

# STEERING SYSTEM - POWER RACK & PINION

1998 Mitsubishi Galant

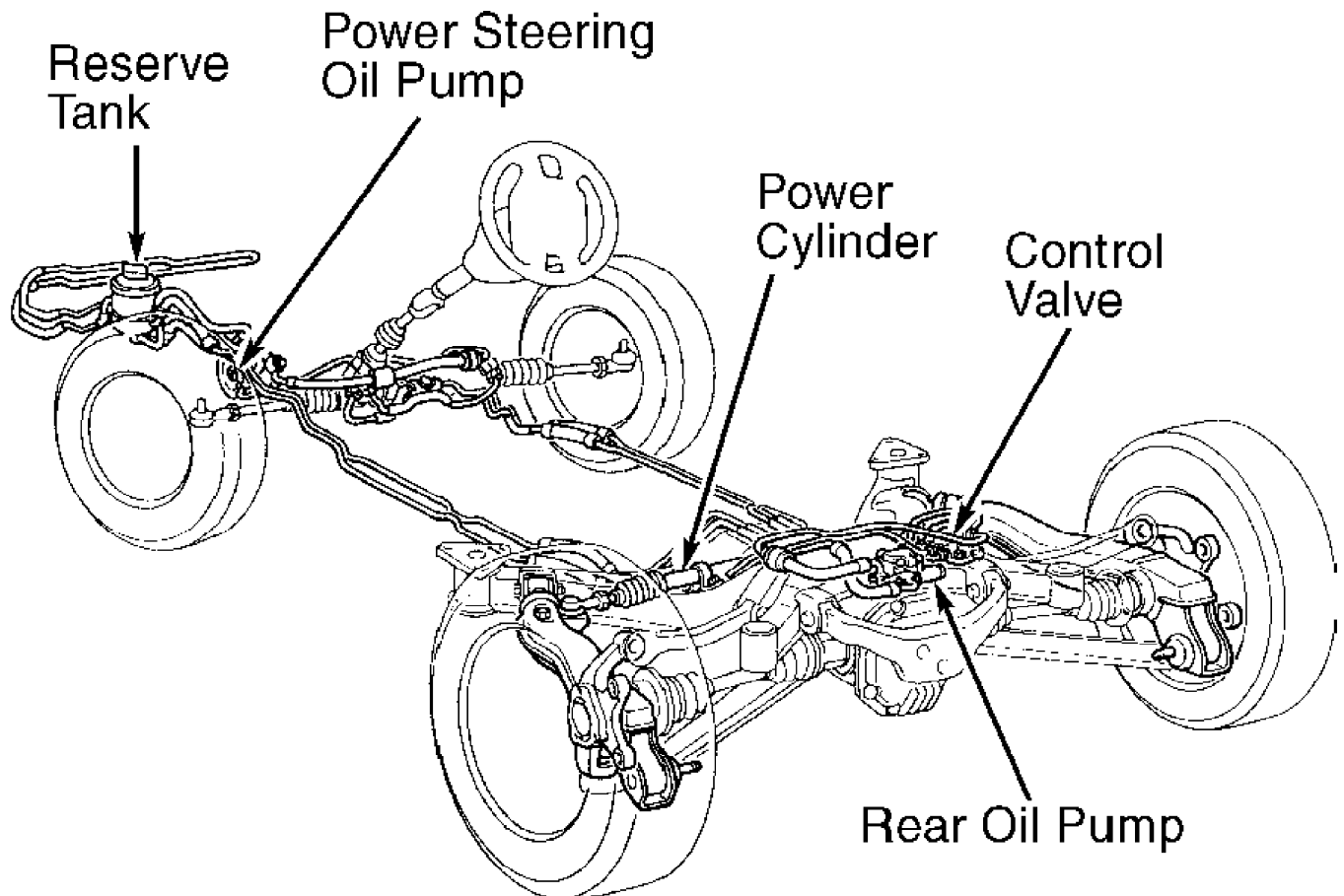
1997-98 STEERING  
Mitsubishi - Power Rack & Pinion

Diamante, Eclipse, Galant, Mirage, 3000GT

## DESCRIPTION & OPERATION

Power-assisted rack and pinion steering system consists of a vane pump, flow control valve and an oil reservoir. Belt-driven vane pump supplies fluid through hoses to flow control valve. Flow control valve regulates fluid pressure to assist rack and pinion steering gear.

On 3000GT models with 4-Wheel Steering (4WS), a rear oil pump, flow control valve and power cylinder are included in power-assisted steering system. See Fig. 1.



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Fig. 1: Identifying 4-Wheel Steering Components  
Courtesy of Mitsubishi Motor Sales of America.

## LUBRICATION

CAPACITY

On 4WS models, fluid capacity is approximately 1.6 qts. (1.5L). On all other models, fluid capacity is approximately .95 qt. (.9L).

## FLUID TYPE

Use Dexron-II ATF type fluid.

## FLUID LEVEL CHECK

Park the vehicle on a level surface. Start engine, and let it idle. Turn steering wheel several times to bring steering fluid to normal operating temperature. Turn steering wheel left and right several times while checking fluid for foaming and clouding. Fluid level should be between MIN and MAX marks on filler cap dipstick. Fill to MAX mark with Dexron-II ATF.

## HYDRAULIC SYSTEM BLEEDING

**CAUTION:** DO NOT hold steering wheel to left or right lock for longer than 10 seconds, or oil pump damage may occur. If air bleeding is performed with engine running, the air will be absorbed into the fluid. Bleed air from system with engine cranking only.

**WARNING:** Use caution when bleeding system on 4WS models. All 4 wheels will be rotating during testing.

All Models (Front Steering)

1) Lift and support vehicle. Manually turn the oil pump pulley a few times. Turn the steering wheel to left and right stops 5 or 6 times. Disconnect coil high tension wire. Crank engine 10-15 seconds while turning steering wheel left and right. Replenish fluid supply if necessary so fluid level does not fall below the lower position of the filler. Connect coil high tension wire. Start engine, and let it idle. Turn steering wheel left and right until no air bubbles appear in oil reservoir.

2) Check fluid level, and ensure fluid is not milky. Turn steering wheel left and right, and ensure fluid level does not change. If fluid level changes more than 0.25" (6.3 mm) or if pump is noisy, fill with fluid to MAX mark on dipstick again. Repeat procedure until air bubbles are no longer present in fluid and fluid level stabilizes. Check fluid level with engine running and stopped. If level changes more than 0.2" (5 mm) bleed air from power steering system again until fluid level is within specifications.

4WS (Rear Steering)

1) Bleed air from power steering system. See ALL MODELS. Have an assistant enter vehicle. Raise and support vehicle. Start engine, and let it idle. Loosen bleed screw on left side of rear control valve, and install a bleed hose to bleed screw.

2) Have assistant turn steering wheel to full left position, and then immediately return wheel halfway. Ensure air and fluid is discharged from hose. Repeat step several times. Ensure all air has been bled from system. Repeat step for right side bleed screw, turning steering wheel to full right position, and then immediately returning wheel halfway.

3) Turn engine off. Loosen bleed screws on power cylinder. Install a bleed hose to power cylinder bleed screws. Have assistant start engine and run vehicle to 43-50 MPH to circulate fluid. Ensure all 4 wheels rotate and fluid does not circulate through bleed hose. Reduce vehicle speed to 19-25 MPH, and maintain speed while turning steering wheel to full left and right positions.

4) When steering wheel is turned to full left or right positions, pressure will rise and air will circulate through bleed hose. Ensure air is discharged into oil reservoir. Repeat step several times until all air has been bled from system.

## ADJUSTMENTS

### POWER STEERING PUMP BELT

#### BELT ADJUSTMENT

Application/ Model	(1) Deflection	
	New Belt - In. (mm)	Used Belt - In. (mm)
Diamante .....	.33-.37 (8.4-9.3)	.46-.52 (11.7-13.4)
Eclipse		
2.0L Non-Turbo .....	.26-.37 (6.5-9.5)	.43-.55 (11.0-14.0)
2.0L Turbo & 2.4L ...	.18-.22 (4.5-5.5)	.24-.28 (6.0-7.0)
Galant .....	.18-.22 (4.5-5.5)	.24-.28 (6.0-7.0)
Mirage		
1.5L .....	.28-.36 (7.2-9.0)	.40-.46 (10.2-11.6)
1.8L .....	.28-.35 (7.0-9.0)	.39-.43 (10.0-11.0)
3000GT		
DOHC .....	.30-.35 (7.5-9.0)	.41-.49 (10.5-12.5)
SOHC .....	.16-.20 (4.0-5.0)	.24-.32 (6.0-8.0)

(1) - With 22 lbs. (98 n) pressure applied midway on longest belt run.

### PINION ROTATING FORCE

NOTE: Pinion rotating force procedure is performed with rack and pinion assembly off vehicle and supported in soft-jawed vise.

Using Adapter (MB991006) and torque wrench, measure rotating force while turning pinion gear through one complete rotation within 4-6 seconds. See PINION ROTATING FORCE SPECIFICATIONS table. If rotating force is not within specification, adjust end plug (rack support cover), and recheck rotating force. See Fig. 5. Tighten locking nut to 36-51 ft. lbs. (49-69 N.m).

#### PINION ROTATING FORCE SPECIFICATIONS

Application	INCH Lbs. (N.m)
Except Diamante, Mirage & 3000GT .....	6-12 (.7-1.4)
Diamante .....	7-14 (.8-1.6)
Mirage .....	5-12 (.6-1.4)
3000GT .....	5-11 (.6-1.3)

## TESTING

### HYDRAULIC SYSTEM PRESSURE TEST

CAUTION: DO NOT leave valve on pressure gauge closed longer than 10 seconds, or damage to oil pump will result.

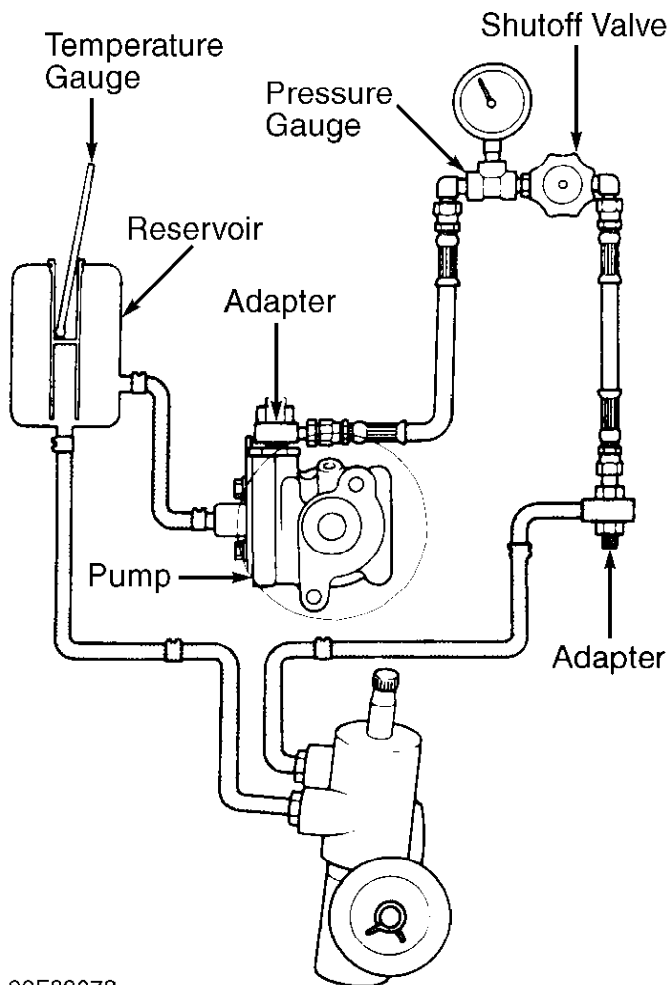
1) Disconnect pressure hose from oil pump. Install Pressure Gauge (MB990662-01). See Fig. 2. Bleed air from system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION. Start engine, and let it idle. Turn

steering wheel several times until temperature reaches 122°F (50°C). Set engine idle speed to 1000 RPM.

2) Close valve to measure oil pump relief pressure. Open valve to measure oil pump no-load pressure. Replace pump if pressure is not within specification. See OIL PUMP PRESSURE SPECIFICATIONS table. Install pressure hose. Bleed system.

OIL PUMP PRESSURE SPECIFICATIONS

Application	psi (kg/cm <sup>2</sup> )
Valve Closed	
Except Galant, Mirage & 3000GT .....	1203-1309 (83-90)
Galant .....	1422 (98)
Mirage .....	1351-1451 (95-102)
3000GT .....	1067-1166 (75-82)
Valve Open	
Except Mirage .....	114-142 (8-10)
Mirage .....	28-71 (2-5)



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

STEERING WHEEL TURNING FORCE

Place vehicle on level surface with steering wheel in straight-ahead position. Attach a spring scale to steering wheel. With engine running at 1000 RPM, measure turning force by turning steering wheel left and right within a range of 1 1/2 turns. See STEERING WHEEL TURNING FORCE table.

STEERING WHEEL TURNING FORCE

Application	Lbs. (kg)
Except Diamante .....	7.6-8.0 (3.4-3.5)
Diamante .....	6.1 (2.7)

**REMOVAL & INSTALLATION**

**\* PLEASE READ FIRST \***

CAUTION: On vehicles equipped with Supplemental Restraint System (SRS), ensure steering wheel is straight ahead and locked (key removed from ignition switch) before removing steering rack and pinion, to prevent damage to clockspring.

**POWER STEERING PUMP**

Removal & Installation

Disconnect pressure and suction hoses from pump. Drain fluid into container. Remove oil pump mounting bolts, belt and oil pump. Remove reservoir hoses and retaining bolts. Remove reservoir. To install, reverse removal procedure. Fill and bleed system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION.

**POWER RACK & PINION**

Removal & Installation (Diamante & 3000GT)

1) Raise and support vehicle. Remove coupling bolt from pinion shaft joint. Remove hydraulic lines from steering gear. Drain fluid. Remove tie rod end cotter pins and loosen nuts. Using Steering Linkage Puller (MB991113), separate tie rods from steering knuckles and then remove tie rod nuts. Remove left and right crossmember.

2) Remove front exhaust pipe mounting nuts and lower pipe. On AWD vehicles, remove bolts from transfer assembly, and remove transfer assembly from transaxle. Remove and support drive shaft from transfer assembly. Remove stabilizer bar (if necessary).

3) Remove power rack and pinion assembly by moving assembly completely to right and off crossmember. Tilt power rack and pinion assembly downward, and remove from left side.

4) To install, reverse removal procedure. Fill and bleed system. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

Removal & Installation (Eclipse)

1) Raise and support vehicle. Remove windshield washer tank. On 2.0L turbo and 2.4L engines it is necessary to remove the brake fluid reservoir assembly and the A/C compressor. Remove coupling bolt from pinion shaft joint. Remove hydraulic lines from steering gear. Drain fluid.

2) Remove tie rod end cotter pins and loosen nuts. Using Steering Linkage Puller (MB991113), separate tie rods from steering knuckles and remove tie rod nuts. Remove rear mounting bolts from center crossmember. Remove left and right stays. Remove long bolt from engine mount attached to center crossmember.

3) Remove exhaust pipe mounting nuts and lower pipe. On AWD models, remove bolts, and remove transfer assembly from transaxle. Remove and support drive shaft from transfer assembly. Remove stabilizer bar (if necessary).

4) Remove rack housing mounting clamp assemblies. Remove rack and pinion assembly by moving assembly completely to right and off crossmember. Tilt power rack and pinion assembly downward, and remove from left side.

5) To install, reverse removal procedure. Fill and bleed system. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

#### Removal & Installation (Galant)

1) Raise and support vehicle. Remove front wheels. Disconnect stabilizer bar from link. Unbolt frame mount bracket from crossmember. Remove stabilizer bar. Remove coupling bolt from pinion shaft joint. Remove hydraulic lines from steering gear. Drain fluid. On Galant with electronic power steering, disconnect solenoid valve connector.

2) Remove tie rod end cotter pins and loosen nuts. Using Steering Linkage Puller (MB991113), separate tie rods from steering knuckles and remove tie rod nuts. Remove both crossmember stays (crossmember reinforcement brackets). Remove rear mounting bolts from center crossmember. Remove long bolt from engine mount attached to center crossmember.

3) Remove rack housing mounting clamp assemblies. Unbolt compression lower control arm and support with wire. Do not allow arm to be supported by ball joint. Remove rack and pinion assembly by moving assembly completely to left and off crossmember. To install, reverse removal procedure. Ensure steering is straight ahead. Fill and bleed system. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

#### Removal & Installation (Mirage)

1) Raise and support vehicle. Remove center member and front exhaust pipe (if necessary). Pull back dust shield (if equipped), and remove coupling bolt from pinion shaft joint. Disconnect hydraulic lines from steering gear, and remove "O" rings. Drain fluid.

2) Remove tie rod end cotter pins and loosen nuts. Using Steering Linkage Puller (MB991113), separate tie rod ends from steering knuckles and remove tie rod nuts. Remove rack housing mounting clamp assemblies. Remove power rack and pinion assembly. To install, reverse removal procedure. Fill and bleed system. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

## REAR OIL PUMP

#### Removal & Installation (4WS)

1) Raise and support vehicle. Remove muffler. Support differential case using transmission jack. Remove rear strut assembly lower mounting bolts. Remove crossmember brackets at front of suspension.

2) Remove crossmember mounting nuts on differential (rear) side of suspension. Disconnect pressure and suction hoses from rear oil pump. Drain fluid. Slightly lower rear suspension. Remove rear oil pump. To install, reverse removal procedure. Fill and bleed system. See HYDRAULIC SYSTEM BLEEDING.

## POWER CYLINDER

#### Removal & Installation (4WS)

1) Raise and support vehicle. Remove muffler. Support differential case using transmission jack. Remove rear strut assembly

lower mounting bolts. Remove crossmember brackets at front of suspension.

2) Remove crossmember mounting nuts on differential (rear) side of suspension. Disconnect pressure hoses and "O" rings from power cylinder. Drain fluid. Slightly lower rear suspension. Remove tie rod nuts and power cylinder mounting bracket bolts. Remove power cylinder. To install, reverse removal procedure. Fill and bleed system. See HYDRAULIC SYSTEM BLEEDING. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

## OVERHAUL

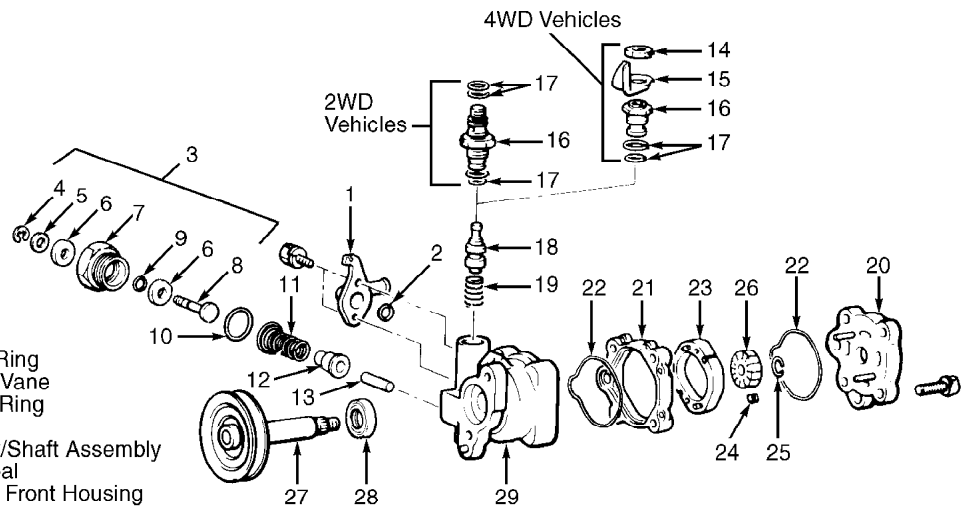
### POWER STEERING PUMP

NOTE: Manufacturer does not supply information on rear oil pump overhaul.

#### Disassembly

1) Remove pump rear cover, cam ring, "O" rings and vanes from rotor. See Fig. 3. Remove snap ring from pulley assembly. Remove rotor.

1. Suction Connector
2. "O" Ring
3. Pressure Switch Assembly
4. Snap Ring
5. Washer
6. Insulator
7. Plug
8. Terminal
9. "O" Ring
10. "O" Ring
11. Spring
12. Piston Rod
13. Plunger
14. Lock Nut (4WD Only)
15. Guide Bracket (4WD Only)
16. Connector
17. "O" Ring
18. Flow Control Valve
19. Spring
20. Pump Rear Cover
21. Cam Case
22. "O" Ring
23. Cam Ring
24. Rotor Vane
25. Snap Ring
26. Rotor
27. Pulley/Shaft Assembly
28. Oil Seal
29. Pump Front Housing



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Fig. 3: Exploded View Of Power Steering Pump (Typical)  
Courtesy of Mitsubishi Motor Sales of America.

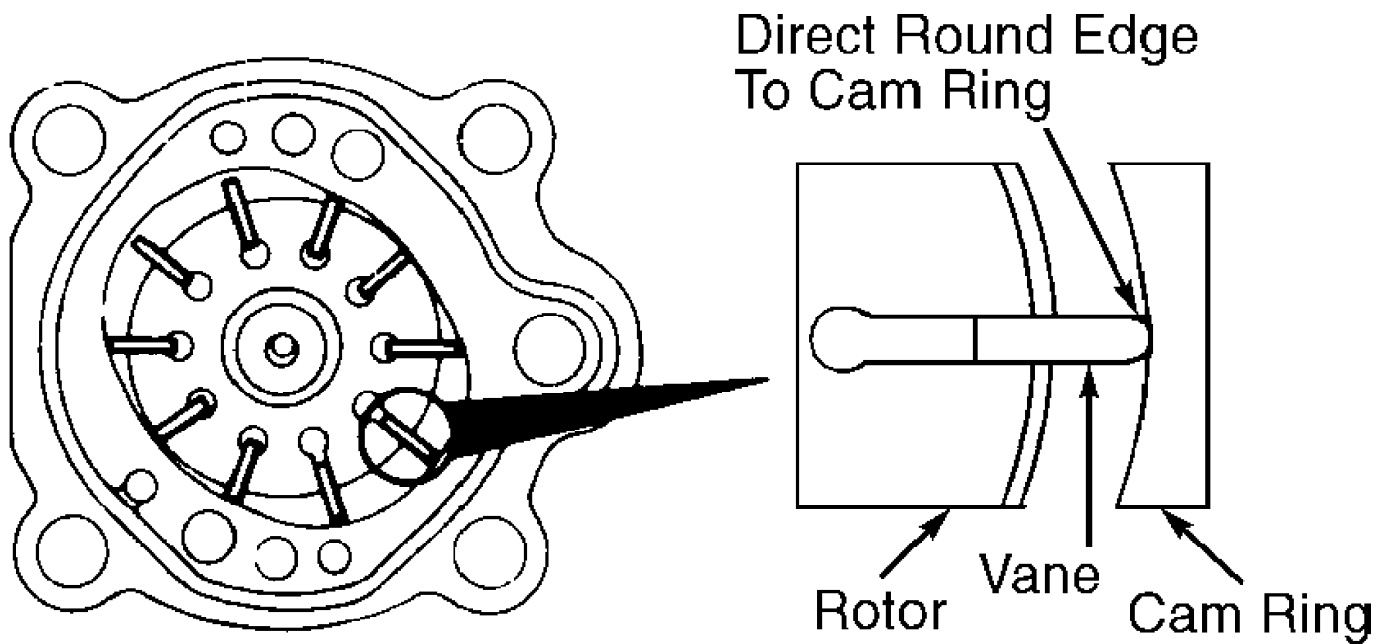
2) Tap pulley assembly using plastic hammer to remove it from pump body. Remove suction connector and oil seal from pump body. Remove connector, flow control valve and spring from pump body.

#### Inspection

Check pulley assembly, cam ring, rotor and vanes for wear. Check pump cover and pump body for abrasion. Check flow control valve for clogging.

#### Reassembly

Apply Dexron-II ATF fluid to "O" rings and vanes. To reassemble, reverse disassembly procedure. Install oil seal into pump body using Installers (MB990925-01 and MB990938-01). Install vanes into rotor in correct direction. See Fig. 4.



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Fig. 4: Installing Power Steering Pump Rotor Vanes  
 Courtesy of Mitsubishi Motor Sales of America.

### POWER RACK & PINION

NOTE: Some Diamante and Galant models are equipped with Electronic Power Steering. For exploded view of electronic power rack and pinion assembly, see ELECTRONIC POWER STEERING article.

#### Disassembly

1) With power rack and pinion assembly mounted in soft-jawed vise, remove tie rod ends, boot clamps and boots. See Fig. 5. Using a chisel, remove tie rod tab washer. Remove tie rod assemblies. Remove steel hydraulic lines. Remove end plug and self-locking nut from pinion/valve assembly.

2) Remove locking nut. Using Socket (MB990607-A), remove rack support cover. Remove rack support spring and rack support. Remove valve housing. Remove oil seals and pinion/valve assembly. Turn end housing in cylinder assembly clockwise to align circlip with slot in cylinder housing for removal.

3) When circlip comes out of housing, turn end housing counterclockwise to remove circlip. Remove end housing, rack bushing and rack from rack housing. Remove "O" ring and oil seal from cylinder housing.

4) Use brass drift to remove ball bearing, needle bearing and oil seal from pinion side of rack housing. Use a pipe to remove oil seal from rear of rack housing.

#### Inspection

Check bearings, rack bushing and rack teeth for damage and wear. Check pinion/valve assembly for damage to teeth and wear to bearings. Inspect valve housing for damage or wear from sealing rings. Replace all oil seals, "O" rings and sealing rings.

#### Reassembly

1) Apply Dexron-II ATF fluid to all "O" rings. lubricate rack teeth, bearings and teeth on pinion valve assembly with lubricant supplied by manufacturer. Reassemble rack in reverse order of



disassembly.

2) Using Drivers (MB991197 and MB991202), install and oil seal in rack housing. Using Drivers (MB990938 and MB991202), install bearings in rack housing. Using Socket (MB990607-A), install locking nut.

3) Install rack support spring, rack support cover and rack support. Install self-locking nut. Using Drivers (MB990938 and MB991203), install pinion oil seal in rack housing. Using Drivers (C-4637-1 and MB990927), install "O" ring into rack bushing. Adjust pinion rotating force. See PINION ROTATING FORCE under ADJUSTMENTS.

1. Tie Rod End
2. Dust Cover Clip
3. Dust Cover
4. Boot Clamp
5. Boot Clamp
6. Boot
7. Tie Rod End
8. Tab Washer
9. Hydraulic Feed Tube
10. Hydraulic Return Tube
11. End Plug
12. Self-Locking Nut
13. Locking Nut
14. Rack Support Cover
15. Rack Support Spring
16. Rack Support
17. Valve Housing Assembly
18. Valve Housing
19. Pinion/Valve Assembly
20. Seal Rings
21. Bearing
22. Oil Seal
23. Cylinder Assembly
24. End Housing
25. Circlip
26. Oil Seal
27. "O" Ring
28. Cylinder

29. Rack Assembly
30. Steering Rack
31. Piston Ring
32. Oil Seal
33. Circlip
34. Circlip
35. Lower Bearing
36. Upper Bearing
37. Oil Seal
38. Rack Housing

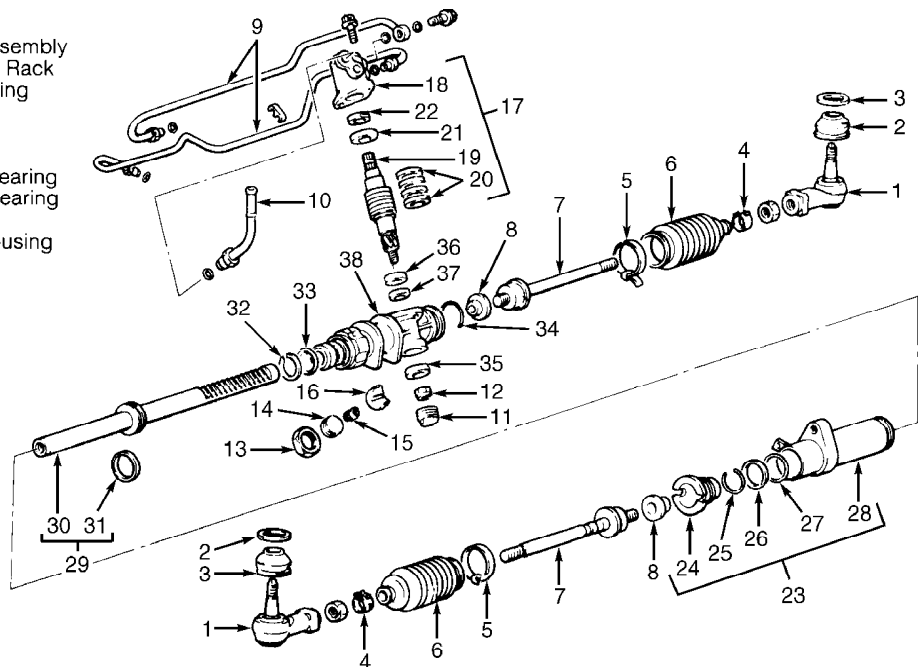


Fig. 5: Exploded View Of Power Rack & Pinion Assembly (Typical)  
Courtesy of Mitsubishi Motor Sales of America.

## TORQUE SPECIFICATIONS

### TORQUE SPECIFICATIONS (DIAMANTE)

Application	Ft. Lbs. (N.m)
Centermember Mounting Bolt (Front)	58-65 (78-88)
Centermember Mounting Bolt (Rear)	51-58 (69-78)
Crossmember Bracket Bolt	33 (44)
Coupling-To-Pinion Shaft Joint Bolt	13 (18)
Exhaust Pipe Nuts	36 (49)
Power Steering Pump Cover Bolts	15 (20)
Power Steering Pump Mounting Bolt And Nut	29 (39)
Power Steering Pump Pulley Bolt	29 (39)
Pressure Hose-To-Pump Nut	18 (24)
Rack Mounting Bolt	51 (69)
Tie Rod End-To-Steering Knuckle	20 (27)
Tie Rod Lock Nut	36-40 (49-54)
Tie Rod-To-Rack Bolt/Nut	65 (88)

### TORQUE SPECIFICATIONS (ECLIPSE)

Application	Ft. Lbs. (N.m)
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Centermember Mounting Bolt	58-65	(78-88)
Crossmember Bracket Bolt	51-58	(69-78)
Coupling-To-Pinion Shaft Joint Bolt	13	(18)
Power Steering Pump Cover Bolt (Long)	32	(43)
Power Steering Pump Pulley Nut	32	(43)
Power Steering Pump Cover Bolts (Short)	12	(17)
Power Steering Pump Mounting Bolts	29	(39)
Pressure Hose-To-Pump Bolt	42	(57)
Rack Mounting Bolt	51	(69)
Tie Rod End-To-Steering Knuckle	18-24	(24-33)
Tie Rod Lock Nut	36-40	(49-54)
Tie Rod-To-Rack Bolt/Nut	65	(88)

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#### TORQUE SPECIFICATIONS (GALANT)

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Application	Ft. Lbs. (N.m)	
Centermember Mounting Bolt	58-65	(78-88)
Crossmember Bracket Bolt	51-58	(69-78)
Coupling-To-Pinion Shaft Joint Bolt	13	(18)
Exhaust Pipe Nuts	13	(18)
Power Steering Pump Cover Bolts	13	(18)
Power Steering Pump Mounting Bolts	21	(28)
Pressure Hose-To-Pump Nut	13	(18)
Rack Mounting Bolts	51	(69)
Tie Rod End-To-Steering Knuckle	18-24	(24-33)
Tie Rod Lock Nut	36-40	(49-54)
Tie Rod-To-Rack Bolt/Nut	65	(88)

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#### TORQUE SPECIFICATIONS (MIRAGE)

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Application	Ft. Lbs. (N.m)	
Centermember Mounting Bolt	51	(69)
Crossmember Bracket Bolt	25	(34)
Coupling-To-Pinion Shaft Joint Bolt	13	(18)
Exhaust Pipe Nuts	13	(18)
Power Steering Pump Cover Bolts	14	(20)
Power Steering Pump Mounting Bolts	29	(39)
Pressure Hose-To-Pump Nut	13	(18)
Rack Mounting Bolt	51	(69)
Tie Rod End-To-Steering Knuckle	11-25	(15-33)
Tie Rod Lock Nut	30	(41)
Tie Rod-To-Rack Bolt/Nut	65	(88)

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#### TORQUE SPECIFICATIONS (3000GT)

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Application	Ft. Lbs. (N.m)	
Front Steering		
Centermember Mounting Bolt	43-51	(60-70)
Coupling-To-Pinion Shaft Joint Bolt	13	(18)
Exhaust Pipe Nuts	36	(50)
Power Steering Pump Bracket Mounting Bolts	16	(22)
Power Steering Pump Mounting Bolt (Long)	16	(22)
Power Steering Pump Mounting Bolt (Short)	129	(40)
Pressure Hose-To-Pump Nut	17	(24)
Rack Mounting Bolt	51	(70)
Strut Assembly Lower Mounting Bolt	72	(100)

Tie Rod End-To-Steering Knuckle	
AWD .....	36 (50)
FWD .....	21 (29)
Tie Rod Lock Nut .....	36-40 (50-55)
Tie Rod-To-Rack Bolt/Nut .....	65 (90)
Rear Steering (AWD)	
Bleeder Screws .....	5 (7)
Front Line Fittings-To-Control Valve Lines .....	25 (35)
Power Cylinder Mounting Bracket Bolts .....	30 (42)
Rear Crossmember Mounting Nuts .....	80-94 (110-130)
Rear Pump Mounting Bolts .....	17 (24)
Rear Pump-To-Control Valve Line Fittings .....	25 (35)
Strut Assembly Lower Mounting Bolt .....	72 (100)
Tie Rod End-To-Control Arm .....	42 (52)
Tie Rod Lock Nut .....	30 (42)

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