4-WHEEL STEERING SYSTEM (4WS)

CONTENTS

E37AA-1

SPECIFICATIONS

GENERAL SPECIFICATIONS

E37CA-1

Items		Specifications
Power steering gear box		
Type		Rack and pinion
Oil pump		
Type		Vane type
Displacement	cm^3/rev. (cu.in./rev.)	9.6 (0.59)
Relief set pressure	MPa (kg/cm^2, psi)	8 (80, 1,138)
Rear oil pump		
Type		Vane type
Displacement	cm^3/rev. (cu.in./rev.)	3.3 (0.20)
Relief set pressure	MPa (kg/cm^2, psi)	4 (40, 569)
Power cylinder		
Type		Hydraulic double action type
Stroke	mm (in.)	10 (0.39) [one side 0.5 (0.20)]

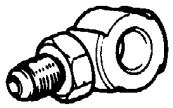
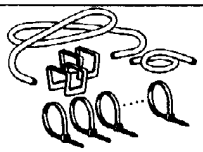
SERVICE SPECIFICATIONS

E37CB-1

Items	Specifications
Standard value	
Rear oil pump displacement [at speedometer reading of 50 km/h (31 mph) for 30 seconds] lit. (U.S.qts., Imp.qts.)	Approx. 1.0 (1.06, 0.88)
Power cylinder ball joint rotation starting torque Nm (kgcm, in.lbs.)	0.5 (5, 4) or less
Power cylinder tie rod swing torque N (kg, lbs.) [Nm (kgcm, in.lbs.)]	9–55 (0.9–5.5, 2–12) [0.5–3.0 (5–30, 4–26)]

SPECIAL TOOLS

E37DA-1

Tool	Number	Name	Use
	MB990993	Power steering oil pressure gauge adaptor	Measurement of fluid flow volume
	MB991230	Air bleeder set	Air bleed
	MB990685 MB991151	Torque wrench	Measurement of the ball joint starting torque
	MB990326	Preload socket	Measurement of the power cylinder ball joint rotation-starting torque

TROUBLESHOOTING

E37EAAK

Before inspecting, check the following items:

- Ensure that the suspension has not been modified
- Tyre and wheel size, specifications, air pressure, balance and amount of wear
- Steering wheel type
- Wheel alignment
- Oil pump drive belt tension
- Power steering fluid level, and air in the system
- Engine idle speed and even idle
- Oil leakage

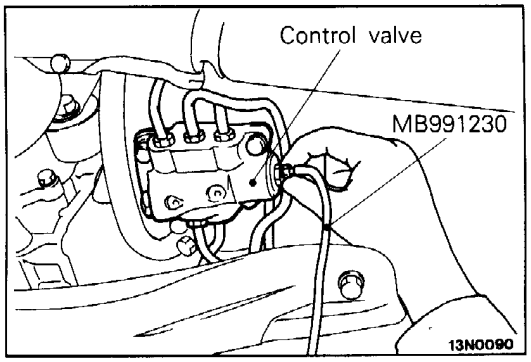
Malfunction symptom	Malfunctioning system	Inspection item
4WS does not operate	Power cylinder	Tie rod swing torque
		Power cylinder slide resistance
	Rear oil pump	Flow volume check
	Control valve	–
Poor steering feeling Feeling of friction in steering Poor steering return	Steering gears and linkage	Rack cracks or deformation
Steering wheel efforts excessive	Control valve	Oil leakage from control valve joint
	Power cylinder	Oil leakage from piston rod
	Oil line	Pressure hose breakage
	Oil reservoir	Oil reservoir deformation or oil leakage
Rear wheels cannot be steered Poor rear wheels return Hydraulic pressure for rear wheel is constantly high	Control valve	Stuck control valve spool
	Power cylinder	Stuck power cylinder
	Rear oil pump	Relief valve remains open
Long rear wheel steering delay Poor steering response Poor steering return	Power cylinder	Excessive power cylinder friction
		Looseness in power cylinder tie rod ball joint
		Ball joint dust cover cracks
Poor rear wheel steering response Poor rear wheel steering range	Control valve	Oil leakage from control valve spool
	Power cylinder	Oil leakage from power cylinder
	Rear oil pump	Extreme oil pump internal wear
Poor steerability (extreme tyre wear)	Power cylinder	Tie rod length improperly adjusted after toe-in adjustment

SERVICE ADJUSTMENT PROCEDURES

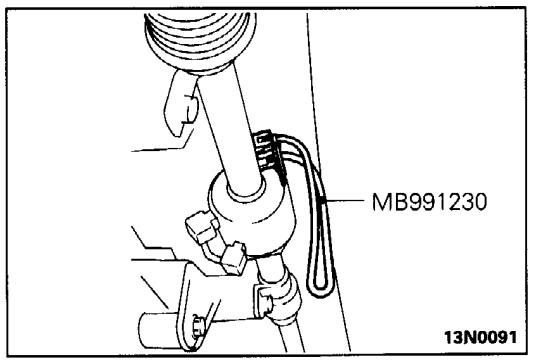
BLEEDING

37FKA-Ja

(1) Bleed air from power steering system (Refer to GROUP 37A – Service Adjustment Procedures.)
(2) Lift up the vehicle.
(3) Start the engine and let it idle.



(4) Loosen the bleeder screw on the front of the control valve and set the special tool to the bleeder screw.
(5) Turn the steering wheel all the wey to the left, immediately returning it half way back.
At this time confirm that air is dischanged with the fluid.
(6) Repeat step (5) two or three times, then check to ensure that all air has been bled from the system.
Tighten the bleeder screw and remove the special tool.
(7) Repeat steps (4) through (6) for the rear bleeder screw, turning the steering wheel to the right this time.



(8) Loosen the power cylinder bleeder screw and set the special tool to the bleeder screw.

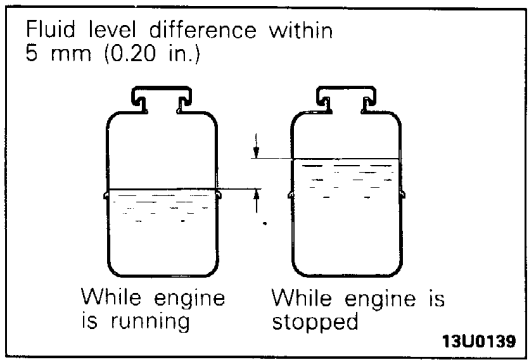
Caution
Loosen the bleeder screw about 30 to 45 degrees, and secure it with the special tool (rotation prevention metal fixtures) so as not to be loosened more.

(9) Start the engine, hold the front wheels in the straight-forward position, and increase the engine speed so that the speedometer reading is 70–80km/h (43–50mph) to make the rear wheel oil pump operate.

Caution
When replenishing the fluid, take special care as all four wheels will be rotating.

NOTE
If the engine speed is increased, the fluid in the oil pump for the rear wheels will be recirculated, but the oil inside the tube (special tool) will not be recirculated.

(10) Maintain an indicated speed of about 30–40 km/h (19–25 mph), turning the steering wheel all the way to both left and right.
When the wheel is steered all the way in either direction, pressure will rise and air will circulate inside the tube (special tool). Check to ensure that this air is discharged into the oil reservoir.
(11) Repeat step (10) several times until that all air in the system has been bled.
Tighten the bleeder screw and remove the special tool.

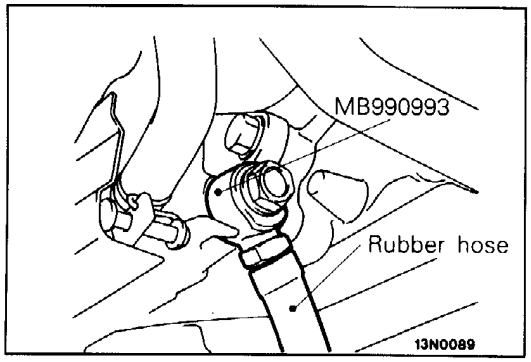


(12)Ensure that the difference in the fluid levels when the engine is running and when it is stopped are within 5 mm (0.20 in.).
If the difference exceeds 5 mm (0.20 in.), there is still air in the system and it must be bled again.

Caution
If air has not been completely bled from the system, the pump will make a humming sound or an unusual noise will come from the flow control valve; this also contributes to shortened pump life.

FUNCTION CHECK E37FRAA

(1) Raise the vehicle so that all four wheels may turn freely.
(2) Start the engine, running the vehicle at an indicated speed of about 40 km/h (25 mph).
(3) Turn the steering wheel all the way to left and right and turn it swiftly, checking to ensure that the rear wheels steer to the same directions as the front wheels.



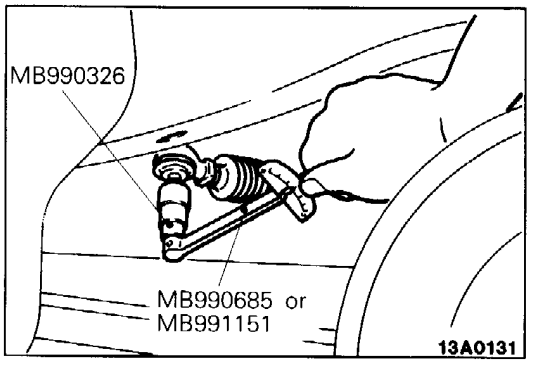
REAR OIL PUMP DISCHARGE FLOW VOLUME CHECK E37FSA-B

(1) Lift up the vehicle
(2) Set the special tool onto the rear oil pump.
(3) Connect a rubber hose about 1.5 m (4.9 ft.) in length to the special tool, then place the other end into a container by which flow volume may be measured [a graduated cylinder of about 2 liters (2.1 U.S.qts., 1.8 Imp.qts.) capacity].
(4) Start the engine. Increase speed slowly, then hold the indicated speed of 50 km/h (31 mph), measuring discharge flow volume for 30 seconds.

Caution
While performing this work, continuously add fluid into the oil reservoir.

Standard value: Approximately 1.0 lit. (1.06 U.S.qts., 0.88 Imp.qts.)

(5) If the discharge flow volume is extremely high or low, the rear oil pump should be replaced.



BALL JOINT ROTATION STARTING TORQUE CHECK E37FTA-B

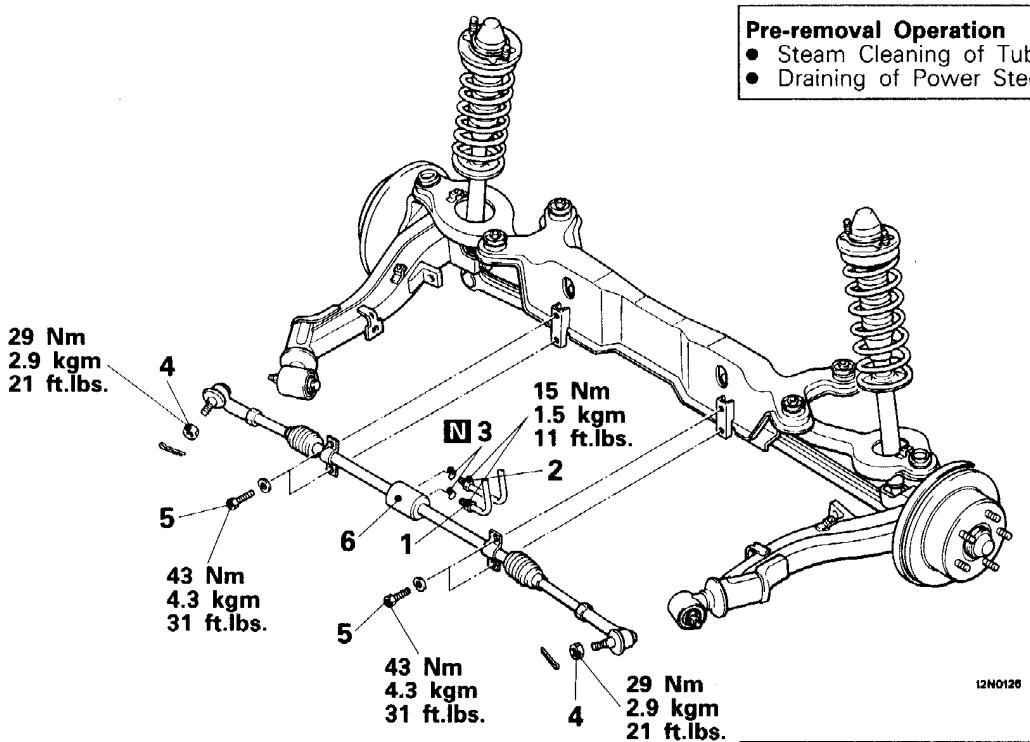
After swinging the ball joint stud several times, install the stud nut, then measure the ball joint rotation starting torque with the special tool.

Standard value: 0.5 Nm (5 kgcm, 4 in.lbs.) or less

POWER CYLINDER

REMOVAL AND INSTALLATION

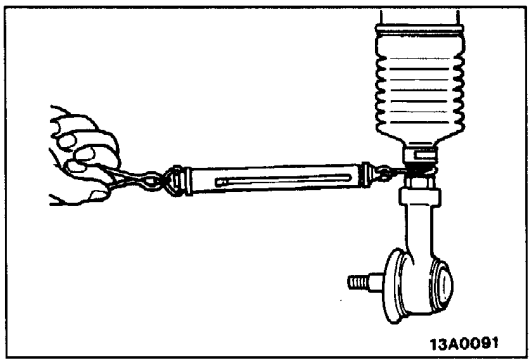
E37KA---



Pre-removal Operation
- Steam Cleaning of Tubing
- Draining of Power Steering Fluid

Removal steps
1. Pressure pipe RR
2. Pressure pipe RL
3. O-ring
◆◆ 4. Tie-rod end nuts
5. Bolts
6. Power cylinder

Post-installation Operation
- Supply of Power Steering Fluid
- Bleeding of Power Steering Fluid Line (Refer to P. 37B-5.)
- 4WS Function Check
- Wheel Alignment Inspection and Adjustment (Refer to GROUP 34 – Service Adjustment Procedures.)



INSPECTION

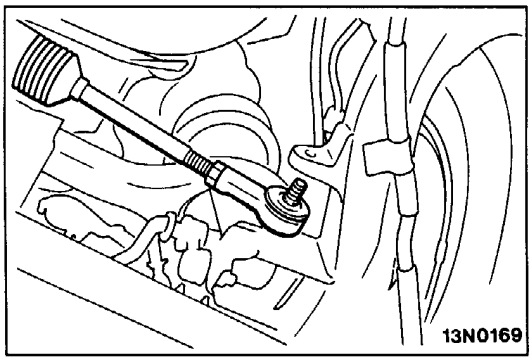
E37KCAA

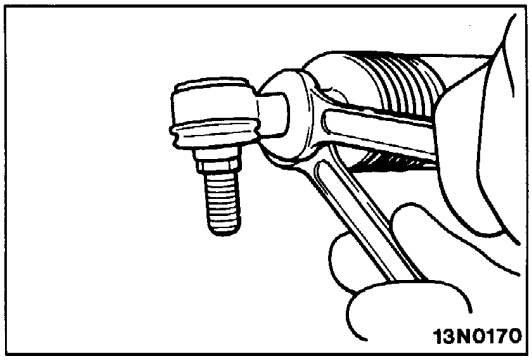
TIR ROD SWING TORQUE INSPECTION

(1) Swing the tie rod ten times, hard.
(2) Point the tie rod end down, then attach a spring balance as shown in the illustration to measure swing resistance (swing torque).

Standard value: 9–55 N (0.9–5.5 kg, 2–12 lbs.) [0.5–3 Nm (5–30 kgcm, 4–26 in.lbs.)]

(3) If the swing resistance exceeds the standard value, replace the tie rod.
(4) If the swing resistance is less than the standard value, the ball joint may be reused as long as it is not loose and operates smoothly.





SERVICE POINTS OF INSTALLATION E37KDA-A

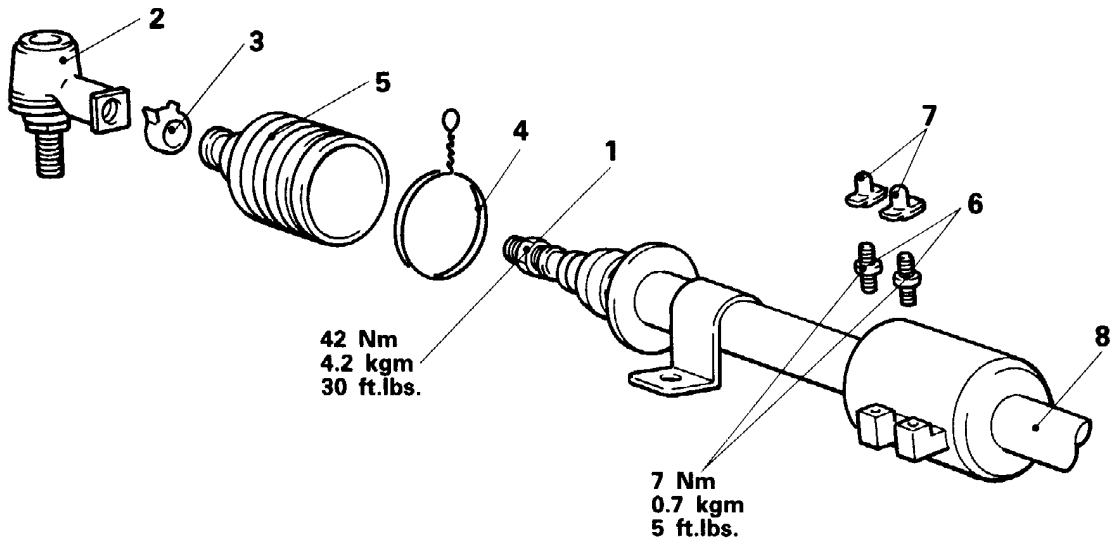
4. INSTALLATION OF TIE-ROD END NUTS

(1) Secure the power cylinder to the crossmember.
(2) Move the power cylinder piston rod over its full stroke to determine its neutral position.
(3) Align tie rod ends and the installation holes at trailing arm.
(4) When the tie rod ends and the installation holes at the trailing arm do not meet, loosen the tie rod end securing nut, then adjust the length. The dust cover fastener clip should be removed for this.
(5) The difference between the lengths of the left and right tie rods should be less than 1 mm (0.039 in.).

NOTE
The threads of the tie rod ends may be used as a guide for this.

DISASSEMBLY AND REASSEMBLY

E37KE---



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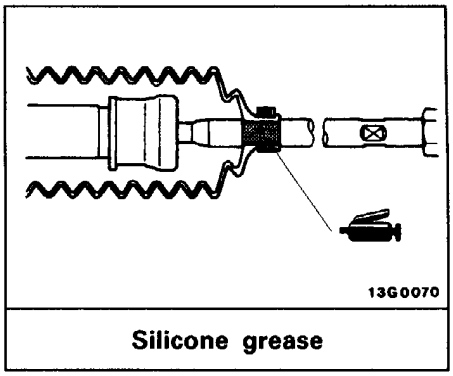
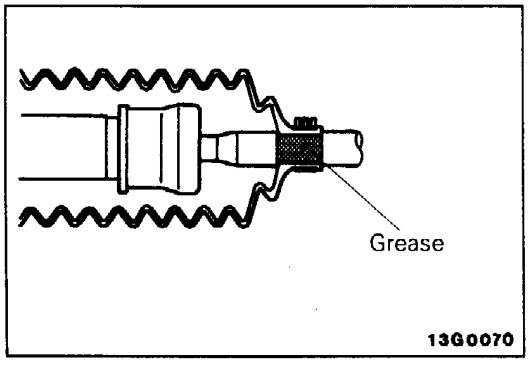


Disassembly steps

1. Nut
2. ◆◆ Tie rod end assembly
3. Clip
4. Wire
5. ◆◆ Dust cover
6. Bleeder caps
7. Bleeder screws
8. Cylinder assembly



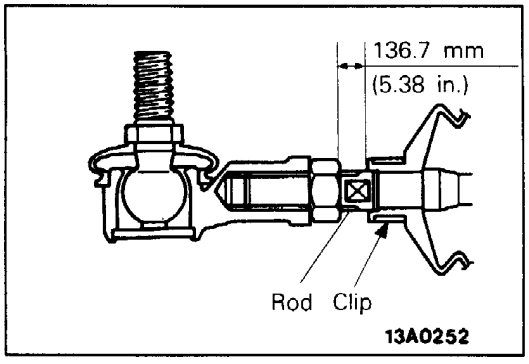
SERVICE POINTS OF REASSEMBLY

E37KHAA

5. INSTALLATION OF DUST COVER

Apply the specified grease to the place indicated in the illustration, then install the dust cover to the cylinder assembly.

Specified grease: Silicone grease



2. INSTALLATION OF TIE ROD END ASSEMBLY

Temporarily attach the tie rod end assembly to the cylinder assembly at the place of dimension as illustrated.

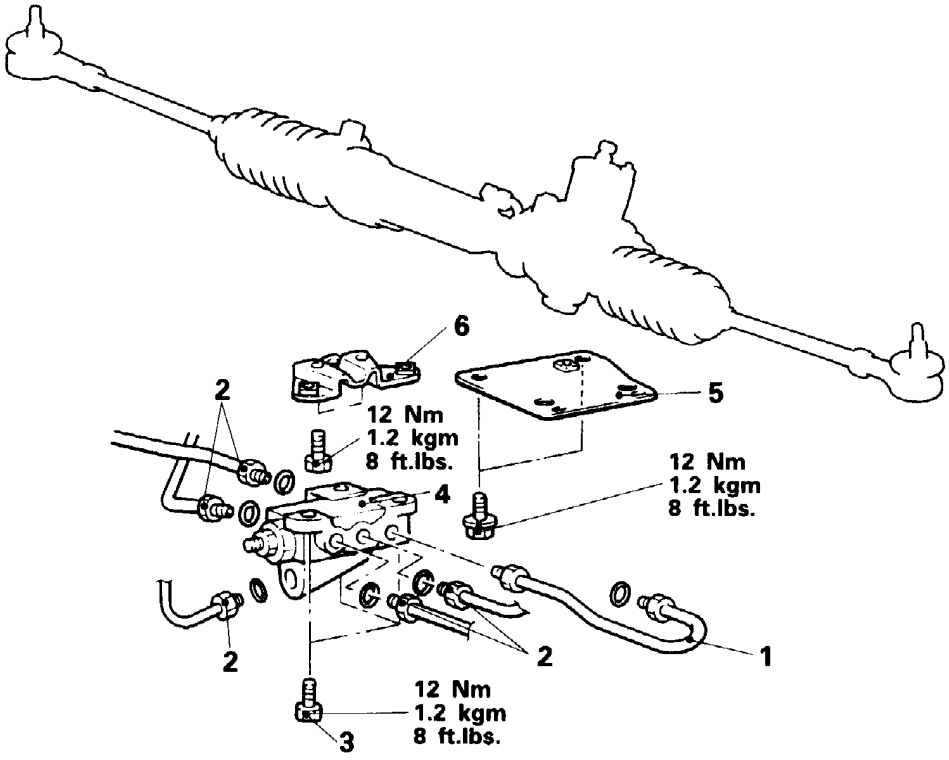
NOTE
To adjust the assembly dimensions of the tie rod end assembly, remove the dust cover clip and rotate the rod.

CONTROL VALVE

37MA—

REMOVAL AND INSTALLATION

Pre-removal Operation
- Removal of Left Member (Refer to GROUP 32 – Crossmember.)



Fluid line flared nut
15 Nm
1.5 kgm
11 ft.lbs.

14F038

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Post-installation operation
- Installation of Left Member (Refer to GROUP 32 – Crossmember.)
- Supplying of Power Steering Fluid
- Bleeding of Power Steering Fluid Line (Refer to P.37B-5.)
- 4WS Function Check

Removal steps
1. Pressure pipe (front, left)
2. Connection for feed pipe and control valve
- ◆◆ 3. Bolts
4. Control valve
5. Control valve bracket <L.H. drive vehicles>
6. Control valve brake bracket <R.H. drive vehicles>

SERVICE POINTS OF INSTALLATION

E37HDA-B

3. INSTALLATION OF BOLTS

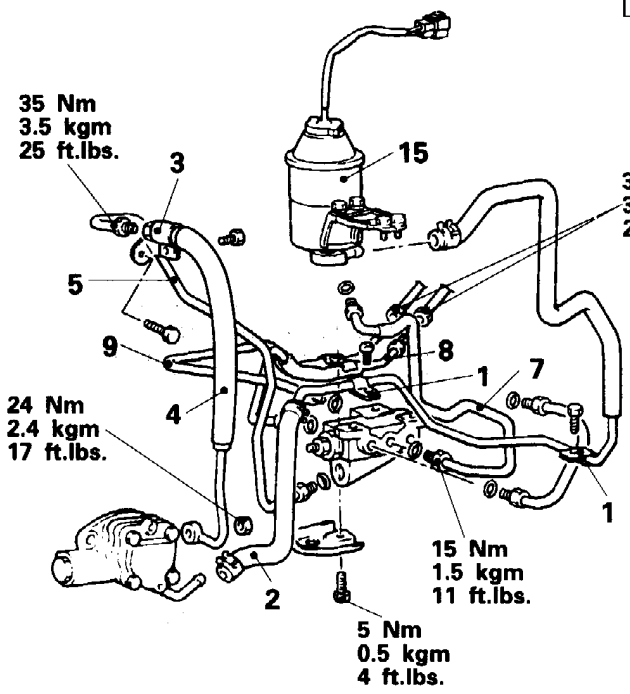
Provisionally tighten the bolt, and after installing the pressure pipe (left, front), tighten the bolt securely.

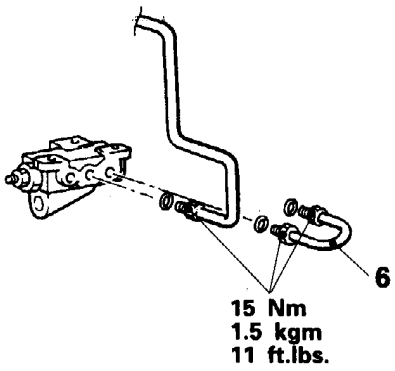
REAR OIL LINE

E37OA---

REMOVAL AND INSTALLATION

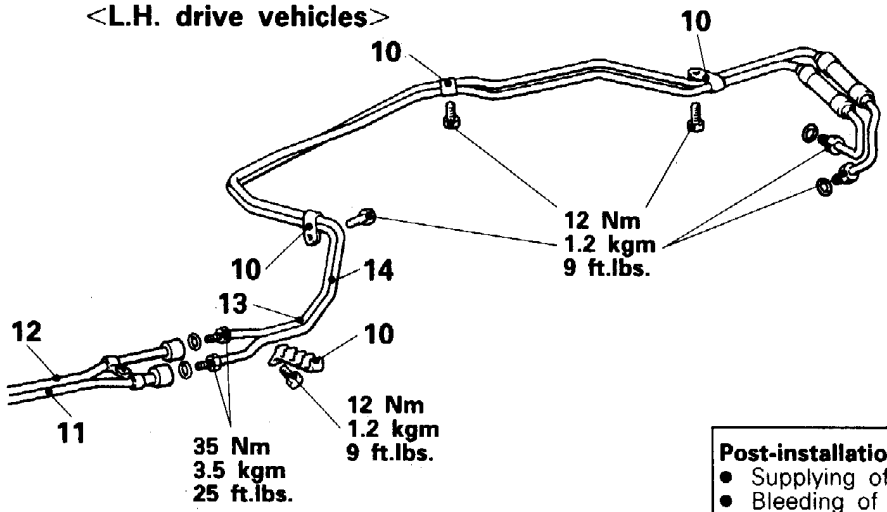
Pre-removal Operation
- Steam Cleaning of Piping
- Draining of Power Steering Fluid





<R.H. drive vehicles>

<L.H. drive vehicles>



13N0172

Post-installation Operation
- Supplying of Power Steering Fluid
- Bleeding of Power Steering Fluid Line (Refer to P. 37B-5.)
- 4WS Function Check

Removal steps

1. Hose clamp
2. Suction hose
3. Hose clamp
4. Pressure hose
5. Pressure pipe
6. Return pipe (Front, Left)
7. Return pipe
8. Pressure pipe (Rear, Left)
9. Pressure pipe (Rear, Right)
10. Pipe clamp
11. Pressure pipe A
12. Pressure pipe B
13. Pressure pipe D
14. Pressure pipe E
15. Reserve tank

INSPECTION

E37OCAA

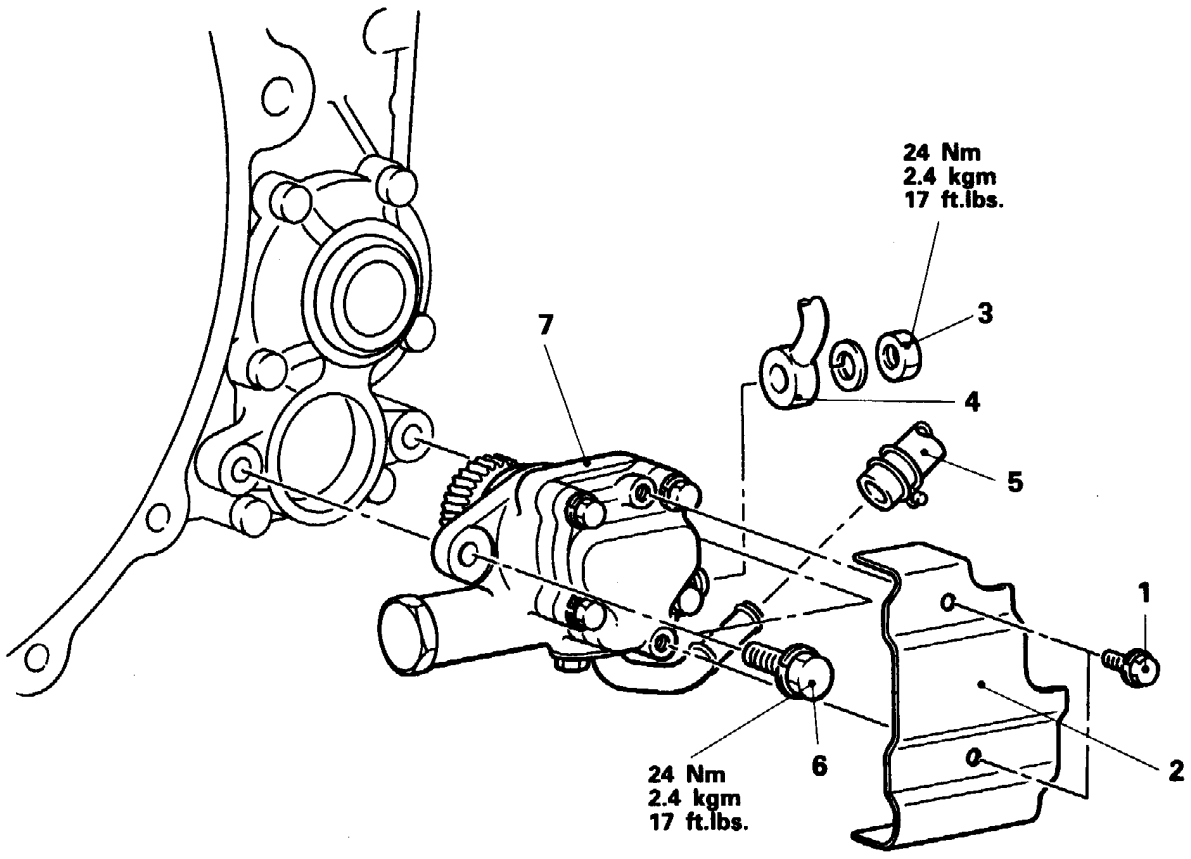
- Check pipes for cracking, damage or corrosion.
- Check hoses for cracking, damage, leakage or fluid seepage.
- Check flare nuts for damage.

REAR OIL PUMP

E37RA—

REMOVAL AND INSTALLATION

Pre-removal Operation
- Draining of Power Steering Fluid



13N0092

Removal steps
1. Bolts
2. Heat protector
3. Nut
4. Pressure hose
5. Suction hose
6. Bolts
7. Rear oil pump

Post-installation Operation
- Supply of Power Steering Fluid
- Bleeding of Power Steering Fluid Line (Refer to P. 37B-5.)
- 4WS Function Check