

# STEERING

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E37AA--

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### WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

#### WARNING!

- (1) **Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver and passenger (from rendering the SRS inoperative).**
- (2) **Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.**
- (3) **MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B - Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.**

#### NOTE

The SRS includes the following components: impact sensors, SRS diagnosis unit, SRS warning lamp, air bag module, clock spring, and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (\*).

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NOTES

## SPECIFICATIONS

## GENERAL SPECIFICATIONS

E37CA--

Items	Specifications
Gear box	
Steering gear type	Rack and pinion
Oil pump	
Oil pump type	Vane type
Displacement	9.6 (0.59) cm <sup>3</sup> /rev. (cu.in./rev.)
Relief set pressure	8 (80, 1,138) MPa (kg/cm <sup>2</sup> , psi.)

## SERVICE SPECIFICATIONS

E37CB--

Items	Specifications
Standard value	
Steering wheel free play (with engine stopped)	mm (in.) 10 (0.43) or less
Steering angle	
Inner wheel	37°00' ± 2°
Outer wheel	30°30'
Tie rod end ball joint starting torque	Nm (kgcm, in.lbs.) 0.5–2.5 (5–25, 4–22)
Stationary steering effort	N (kg, lbs.)
<Vehicles built up to October, 1992>	
Conventional power steering	31 (3.1, 6.8) or less
E.P.S. (Vehicles without 4WS)	23 (2.3, 5.1) or less
E.P.S. (Vehicles with 4WS)	33 (3.3, 7.2) or less
<Vehicles built from November, 1992>	
Conventional power steering	
L.H. drive vehicles	34 (3.4, 7.5) or less
R.H. drive vehicles	31 (3.1, 6.8) or less
E.P.S.	
L.H. drive vehicles	28 (2.8, 6.2) or less
R.H. drive vehicles	23 (2.3, 5.1) or less
Solenoid current	A 0.9–1.1
V-belt tension	mm (in.)
SOHC Engine	
When belt tension is inspected	6–9 (0.24–0.35)
When belt tension is readjusted	7 (0.28)
When new belt is installed	4–5 (0.16–0.20)
DOHC Engine	
<Vehicles built up to October, 1991>	
When belt tension is inspected or readjusted	9–11 (0.35–0.43)
When new belt is installed	7–8.5 (0.28–0.33)
<Vehicles built from November, 1991>	
When belt tension is inspected	9.5–13.5 (0.37–0.53)
When belt tension is readjusted	10.5–12.5 (0.41–0.49)
When new belt is installed	7.5–9.0 (0.30–0.35)

Items	Specifications
Oil pump pressure	MPa (kg/cm <sup>2</sup> , psi)
Oil pump relief pressure	7.5–8.2 (75–82, 1.067–1.166)
Pressure under no-load conditions	0.8–1.0 (8–10, 114–142)
Steering gear retention hydraulic pressure	7.5–8.2 (75–82, 1.067–1.166)
Oil pressure switch operating pressure	MPa (kg/cm <sup>2</sup> , psi)
OFF → ON	1.5–2.0 (15–20, 213–284)
ON → OFF	0.7–1.2 (7–12, 100–171)
Total pinion preload	Nm (kgcm, in.lbs.)
Conventional power steering	
0° (Neutral position)–60°	1.3–1.8 (13–18, 11–16)
60°–180°	0.7–1.2 (7–12, 6–10)
E.P.S. (Vehicles without 4WS)	1.3 (13, 11)
E.P.S. (Vehicles with 4WS)	0.7–1.6 (7–16, 6–14)
Tie-rod joint swing resistance	N (kg, lbs.)
Tie-rod joint swing torque	Nm (kgcm, in.lbs.)
Limit	
Steering wheel free play (when hydraulic operation)	mm (in.) 30 (1.2)
Tie rod end ball joint variation (shaft direction)	mm (in.) 1.5 (0.059)
Space between vane and rotor	mm (in.) 0.06 (0.0024)

**37A-2-2**

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**NOTES**

**LUBRICANTS**

E37CD--

Items	Specified lubricants	Quantity
Power steering gear box		
Bearing	Automatic transmission fluid DEXRON or DEXRON II	As required
O-ring	Automatic transmission fluid DEXRON or DEXRON II	As required
Oil seal	Automatic transmission fluid DEXRON or DEXRON II	As required
Special tool (MB991213)	Automatic transmission fluid DEXRON or DEXRON II	As required
Pinion and valve assembly seal ring part	Automatic transmission fluid DEXRON or DEXRON II	As required
Bellows	Silicone grease	As required
Oil pump		
Power steering fluid	Automatic transmission fluid DEXRON or DEXRON II	0.9 lit. (0.95 U.S.qt., 0.79 Imp.qt.)
Flow control valve	Automatic transmission fluid DEXRON or DEXRON II	As required
Friction surface of rotor, vane, cam ring and pump cover	Automatic transmission fluid DEXRON or DEXRON II	As required
O-ring	Automatic transmission fluid DEXRON or DEXRON II	As required

**SEALANT AND ADHESIVES**

E37CE--

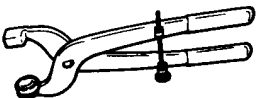
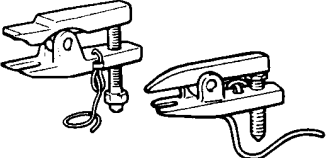

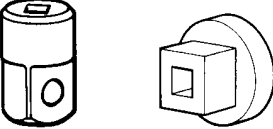

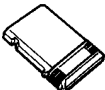
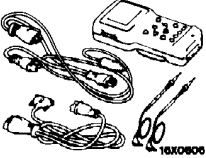

Items	Specified sealant and adhesive	Remarks
Steering column assembly		
Retainer attachment hole	3M ATD Part No. 8661 or equivalent	Semi-drying sealants
Power steering gear box		
End plug screw		
Power steering rack support cover screw		
Dust cover lip for tie rod end ball joint	3M ATD Part No. 8661 or equivalent	Semi-drying sealants

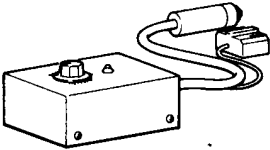

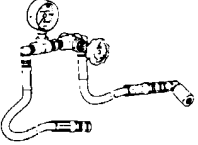
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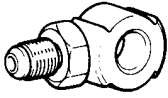
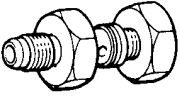
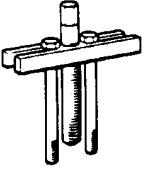

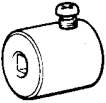
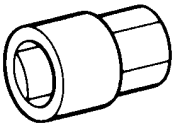
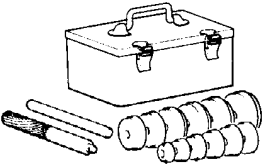
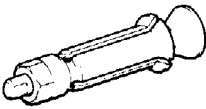










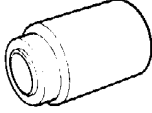
SPECIAL TOOLS

E37DA--

Tool	Number	Name	Use
	MB990948	Linkage joint gauge	Ball joint variation check for shaft direction
	MB991113 or MB990635	Steering linkage puller	Disconnection of tie-rod end
	MB990685	Torque wrench	Measurement of the ball joint starting torque Measurement of the pinion shaft preload
	MB990326 or CT-1046	Preload socket	Measurement of the ball joint starting torque
	MB991341	Multi-use tester subassembly	Up to 1993 models Checking the solenoid valve current control function
	( For the number, refer to GROUP ) 00 – Precautions Before Service. )	ROM pack	
	MB991502	MUT-II	All models Checking the solenoid valve current control function
 <p>16X0607</p>		ROM pack	

Tool	Number	Name	Use
	MB991141	Dummy speed oscillator	Checking the solenoid valve current control function Checking of stationary steering effort during simulated high-speed driving
	MB991167	Harness adapter	
	MB990662	Oil pressure gauge assembly	Measurement of oil pressure

Tool	Number	Name	Use
	MB990993 or MB991217	Power steering oil pressure gauge adapter (pump side)	Measurement of oil pressure
	MB990994	Power steering oil pressure gauge adapter (hose side)	
	MB990803	Steering wheel puller	Disconnection of the steering wheel
	MB990826	Torque wrench	Removal and installation of the tilt bracket or upper bracket
	MB991006	Preload socket	Measurement of the pinion shaft preload
	MB991204	Torque wrench socket	Adjustment of rack support Removal of rack support cover
	MB990925	Bearing and oil seal installer set (Refer to GROUP 26)	Installation of the oil seal and bearing MB990927 MB990938 MB990939
	MB991120	Needle bearing puller	Removal of rack housing needle bearing
	MB991197	Bar (long type)	To press in the oil seal for the rack

Tool	Number	Name	Use
	MB991199	Oil seal installer	To press in the oil seal for the rack
	MB991099	Oil seal installer attachment	Oil seal installer guide
	MB991202	Oil seal & bearing installer	Press fitting of rack housing bearing
	MB991214	Rack installer	Rack installation
	MB991203	Oil seal & bearing installer	To press in the valve housing oil seal and bearing
	MB991317	Seal ring installer	Compression of the seal rings after replacement of the pinion seal rings
	MB991152	Dust cover installer	To press in the column tube lower part bearing
	MB990776	Front axle base	Installation of dust cover for tie rod end ball joint

**TROUBLESHOOTING <E.P.S.>**  
**<VEHICLES BUILT UP TO OCTOBER, 1992>**

E37EAAL

Trouble symptom	Trouble area	Inspection item	Reference page
Steering wheel movement is heavy. (When ignition key is turned to ON, no current flows through the solenoid.)	Steering gear and linkage	Solenoid valve continuity	P.37A-15
		Solenoid or PCV operation is faulty.	P.37A-15, 34
	Harness or fuse	Blown fuse	–
		Remove the control unit connector and check the continuity in the solenoid harness (between terminals No. 2 and No. 3).	P.37A-11
	Control unit	Turn the ignition key momentarily to ACC or LOCK and check if the fail-safe function is operating.	P.37A-9 Refer to the flow-chart type troubleshooting guide "Trouble Symptom 2".
Check for continuity in each harness and for abnormalities in the control unit power circuit.			
While driving at medium or high speed, steering remains light.	Control unit	Use a tester to check the stationary steering effort.	P.37A-13
		Check the solenoid current in relation to changes in vehicle speed.	P.37A-15
	Steering gear and linkage	Solenoid or PCV operation.	P.37A-15, 34

## NOTE

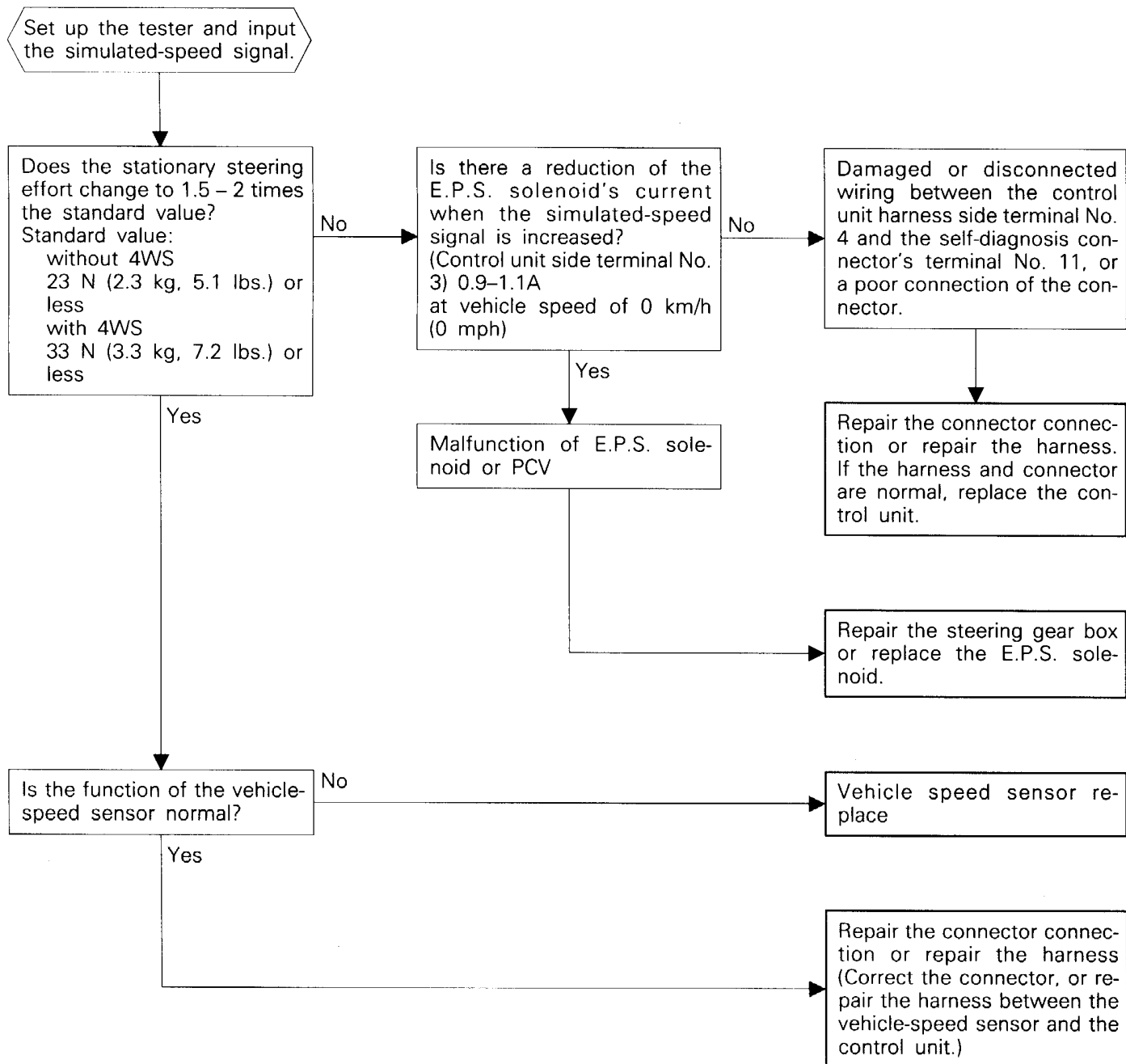
- (1) For checking procedures for each problem, refer to the flow-chart type of troubleshooting guide on the following page.  
 (2) P.C.V. = Proportioning control valve

Trouble Symptom 1

**Steering effort remains light at moderate and high speeds.**

NOTE

- (1) Check to be made by using the special tool; dummy speed oscillator or MUT.
- (2) Refer to the circuit diagram for terminal numbers at the harness side of the E.P.S. control unit.

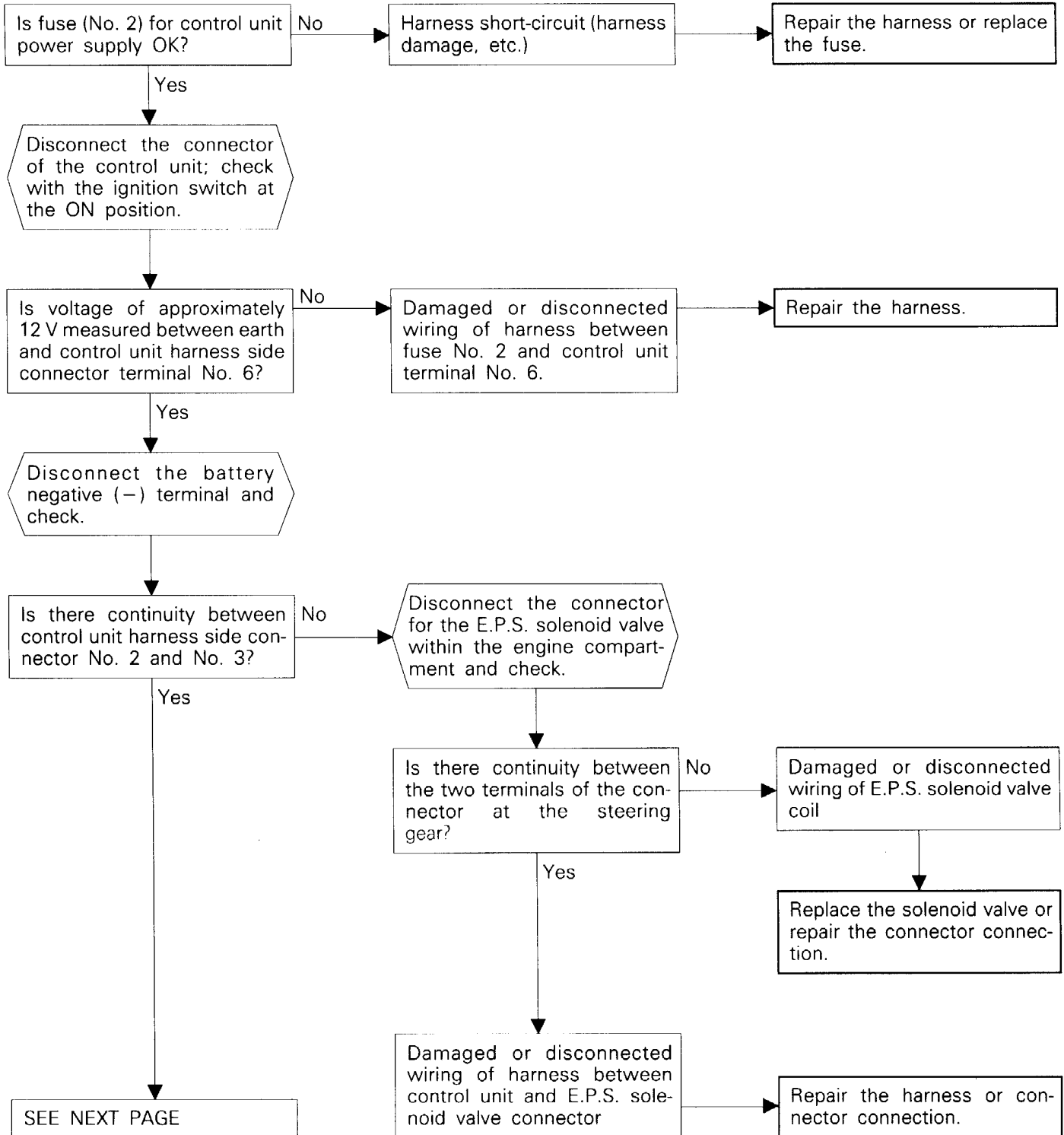


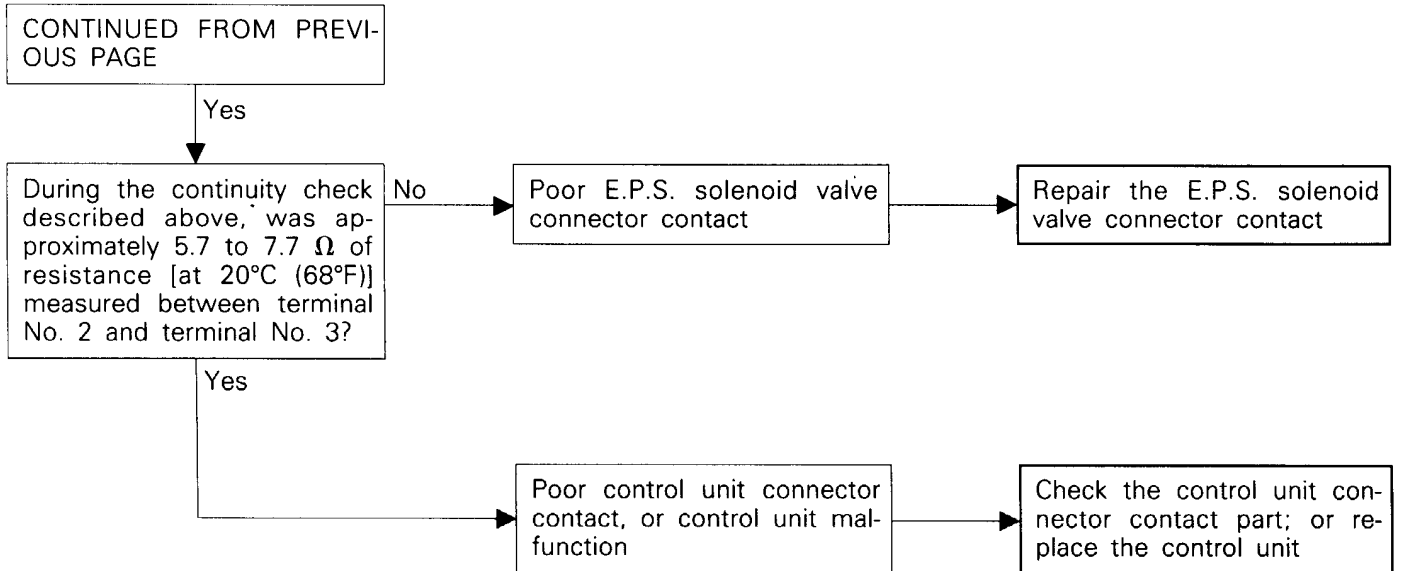
Trouble Symptom 2

**No flow of solenoid current (large steering effort required to turn steering wheel fully) when the ignition switch is at the ON position.**

NOTE

- (1) Before making the checks described below, check to be sure that the failsafe system has not been activated by racing the engine.
- (2) Refer to the circuit diagram for terminal numbers at the harness side of the E.P.S. control unit.



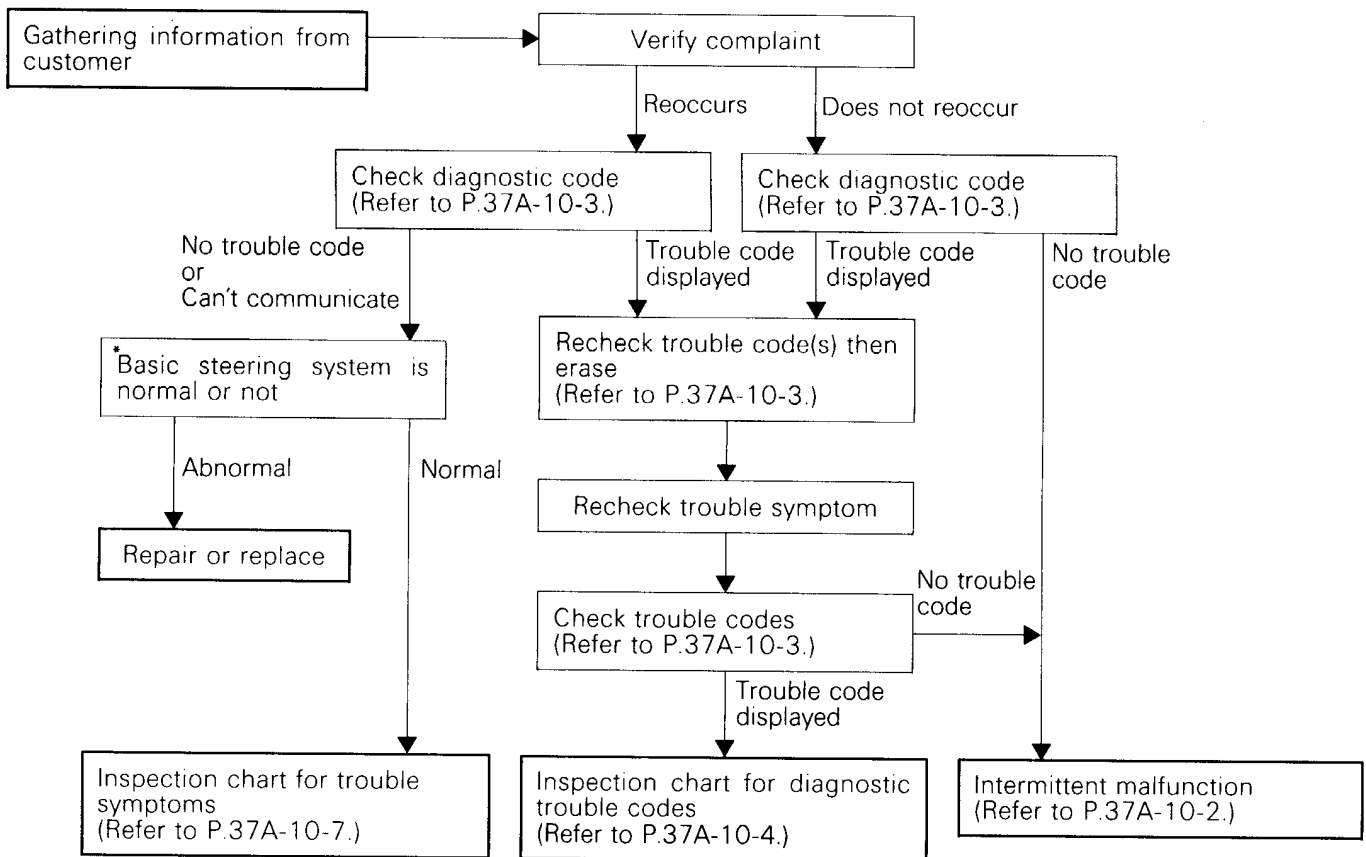




**TROUBLESHOOTING <E.P.S.>  
<VEHICLES BUILT FROM NOVEMBER, 1992>**

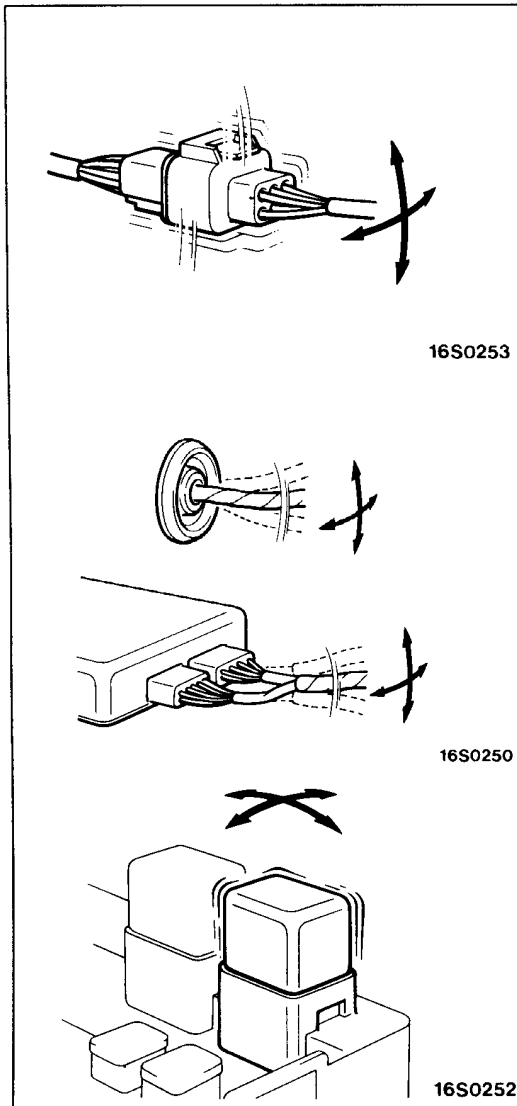
E37EAALa

**STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING**



NOTE

\* : Basic steering system refers to steering system other than the E.P.S. system.

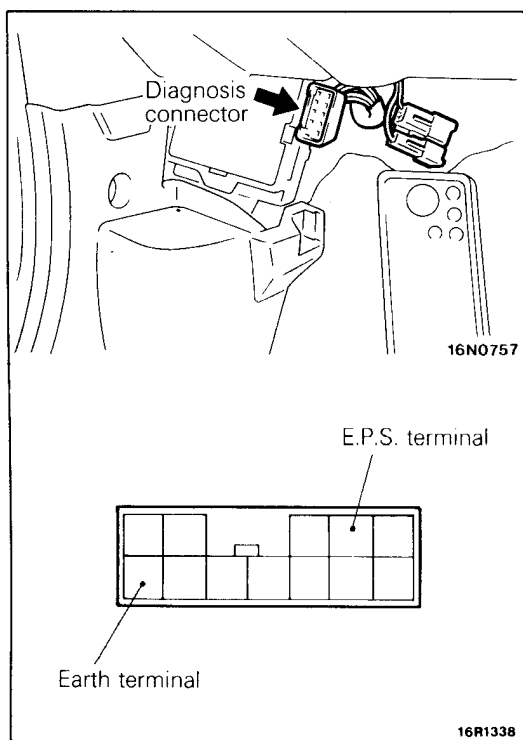


### Points to note for intermittent malfunctions

Intermittent malfunctions often occur under certain conditions, and if these conditions can be ascertained, determining the cause becomes simple. In order to ascertain the conditions under which an intermittent malfunction occurs, first ask the customer for details about the driving conditions, weather conditions, frequency of occurrence and trouble symptoms, and then try to recreate the trouble symptoms. Next, ascertain whether the reason why the trouble symptom occurred under these conditions is due to vibration, temperature or some other factor. If vibration is thought to be the cause, carry out the following checks with the connectors and components to confirm whether the trouble symptom occurs.

The objects to be checked are connectors and components which are indicated by inspection procedures or given as probable causes (which generate diagnosis codes or trouble symptoms).

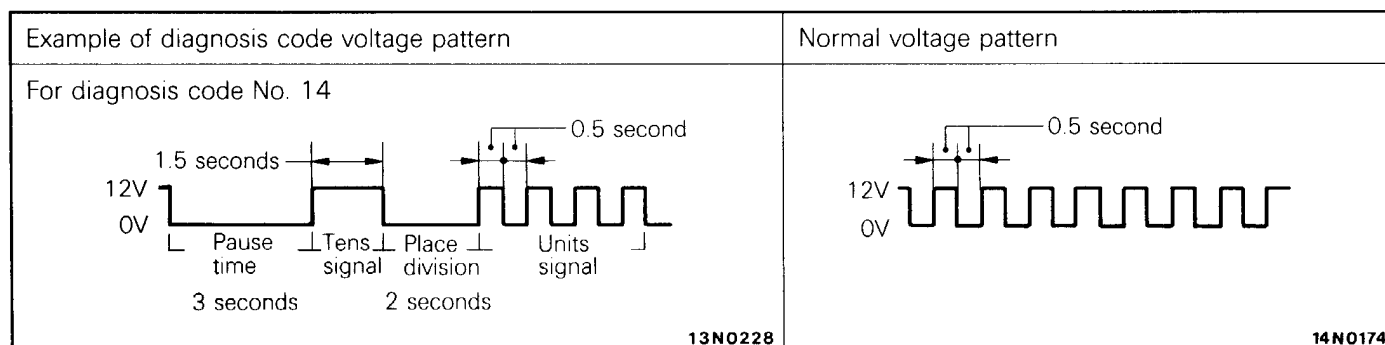
- Gently shake the connector up, down and to the left and right.
- Gently shake the wiring harness up, down and to the left and right.
- Gently rock each sensor and relay, etc. by hand.
- Gently shake the wiring harness at suspensions and other moving parts.



### INSPECTION BY SELF-DIAGNOSIS

- (1) With the vehicle stationary and idling, measure the voltage output pattern between the E.P.S. terminal of the diagnosis connector and the earth, as shown at left, and make a note of this pattern.
- (2) Momentarily erase the diagnosis code memory. (If the ignition switch is turned to OFF, the diagnosis codes will be erased.) Even when the memory is erased, and a problem signal is output, the problem signal currently being displayed will also cause the function to stop. If no signal is output, the problem was only transient, or it is a problem that is only detected while driving.
- (3) When a problem code is output again, or another code is output during a repeated driving test, inspect by following the diagnosis code table.

### Method of diagnosing display results



**NOTE**

Other diagnosis codes also are output as voltage patterns corresponding to the code numbers.

### DIAGNOSIS CODE TABLE

Diagnosis code No.	Probable cause	Inspection chart name or remedy	Reference page
11*1	Abnormal control unit power supply	E-1	P.37A-10-4
12*1	Faulty vehicle speed sensor	E-2	P.37A-10-5
13	Faulty E.P.S. solenoid valve	E-3	P.37A-10-6
14	Faulty control unit inner circuit	Repair the control unit	P.37A-47

**NOTE**

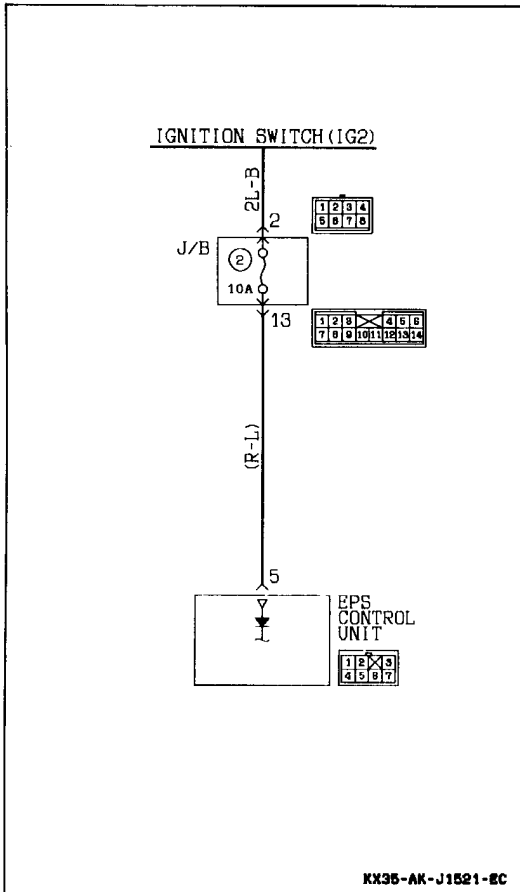
Diagnosis code with \*1 will be erased if the system returns to normal.

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES

**E-1 When diagnosis code No.11 is displayed**

Comment: This diagnosis code is output if the EPS-ECU power supply voltage is outside the specified value.  
Furthermore, if the voltage returns to the specified value, this diagnosis code is not output.

**Caution**  
If the battery voltage drops during inspection, this diagnosis code will be output as a current problem, and correct diagnosis of the problem cannot be made. Before carrying out the following inspection, check the battery condition, and refill it if necessary.



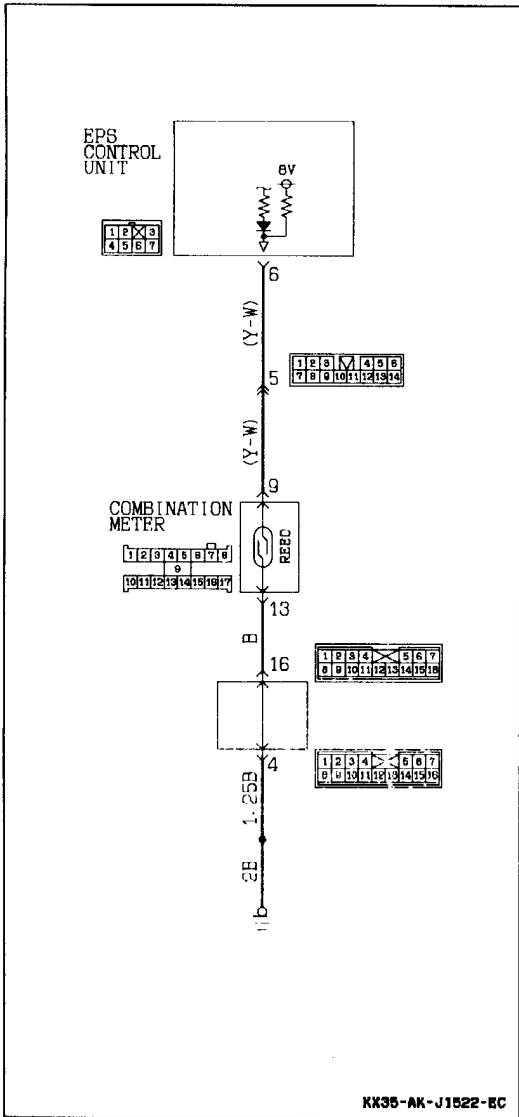
```

    graph TD
      Start([Disconnect the connector of the control unit; check with the ignition switch at the ON position.]) --> Q1{Is voltage of approximately 12 V measured between earth and control unit harness side connector terminal No. 5?}
      Q1 -- No --> A1[Damaged or disconnected wiring of harness between fuse No. 2 and control unit terminal No. 5.]
      A1 --> R1[Repair the connector connection or repair the harness. If the harness and connector are normal, check the battery or the alternator.]
      Q1 -- Yes --> A2[Malfunction of E.P.S. control unit]
      A2 --> R2[Replace the E.P.S. control unit.]
    
```

**E-2 When diagnosis code No.12 is displayed**

Comment: This diagnosis code is output if a signal from the vehicle speed sensor is not input for a period of 1 minute or more while the vehicle is driving (throttle valve

is open). Furthermore, if the vehicle speed signal returns to normal, this diagnosis code is not output.



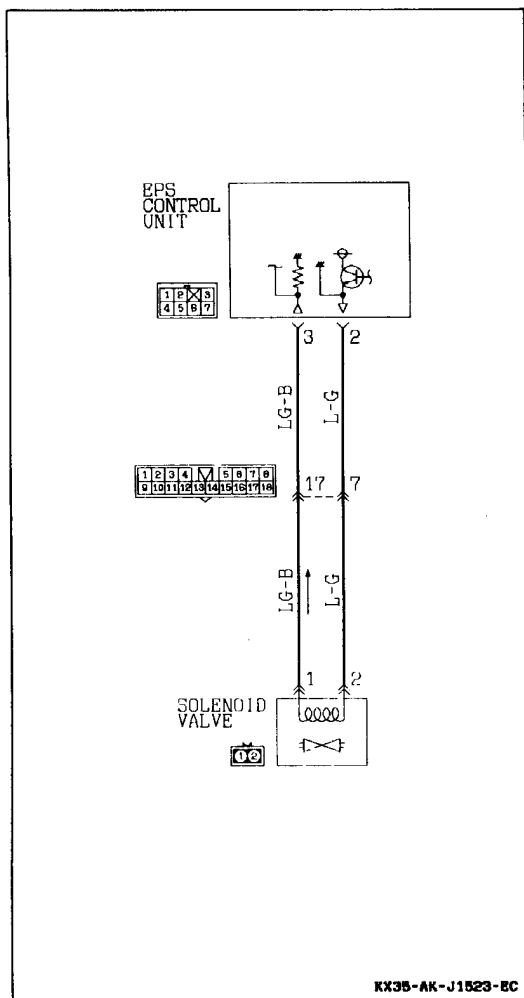
```

    graph TD
        Start([Disconnect the connector of the E.P.S. control unit and check at the harness side.]) --> Q1{Is continuity between the terminal No. 6 and earth normal? If it is normal, it alternates between continuity and no continuity when the vehicle moves forward and backward.}
        Q1 -- Yes --> A1[Malfunction of E.P.S. control unit]
        A1 --> R1[Replace the E.P.S control unit]
        Q1 -- No --> Start2([Disconnect the connector of the combination meter and check at the harness side.])
        Start2 --> Q2{With the ignition switch "ON", does the voltage between the terminal No. 9 and earth indicate 7-9V.}
        Q2 -- No --> A2[Malfunction of the harness between the combination meter and the E.P.S. control unit]
        A2 --> R2[Repair the harness.]
        Q2 -- Yes --> Q3{Is there continuity between the terminal No.13 and earth?}
        Q3 -- No --> A3[Malfunction of the harness between the combination meter and earth]
        A3 --> R3[Repair the harness.]
        Q3 -- Yes --> A4[Malfunction of vehicle speed sensor]
        A4 --> R4[Replace the vehicle speed sensor.]
    
```

**E-3 When diagnosis code No.13 is displayed**

Comment: This diagnosis code is output if current corresponding to the vehicle speed is output from the E.P.S. control unit to

the solenoid valve and the resulting feedback current is outside the standard value.



```

    graph TD
        A[Disconnect the connector for the E.P.S. solenoid valve within the engine compartment and check.] --> B{Does the resistor between the connector terminals of the E.P.S. solenoid valve side indicate 5.7 – 7.7Ω?}
        B -- No --> C[Malfunction of E.P.S. solenoid valve]
        C --> D[Replace the E.P.S. solenoid valve.]
        B -- Yes --> E[Disconnect the connector of the E.P.S. control unit and check at the harness side.]
        E --> F{Does the resistance between the terminals No. 2 and No. 3 indicate 5.7 – 7.7Ω?}
        F -- No --> G[Malfunction of the harness between the E.P.S. control unit and the E.P.S. solenoid valve]
        G --> H[Repair the harness.]
        F -- Yes --> I[Malfunction of E.P.S. control unit]
        I --> J[Replace the E.P.S. control unit.]
    
```

## INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Trouble area	Inspection item	Reference page
Steering wheel movement is heavy. (When ignition key is turned to ON, no current flows through the solenoid.)	Steering gear and linkage	Solenoid valve continuity	P.37A-15
		Solenoid or PCV operation is faulty.	P.37A-15, 34
	Harness or fuse	Blown fuse	–
		Remove the control unit connector and check the continuity in the solenoid harness (between terminals No. 2 and No. 3).	P.37A-10-6 Refer to the circuit diagram.
	Control unit	Turn the ignition key momentarily to ACC or LOCK and check if the fail-safe function is operating.	P.37A-10-9 Refer to the flow-chart type troubleshooting guide "Trouble Symptom 2".
Check for continuity in each harness and for abnormalities in the control unit power circuit.			
While driving at medium or high speed, steering remains light.	Control unit	Use a tester to check the stationary steering effort.	P.37A-13
		Check the solenoid current in relation to changes in vehicle speed.	P.37A-15
	Steering gear and linkage	Solenoid or PCV operation.	P.37A-15, 34

## NOTE

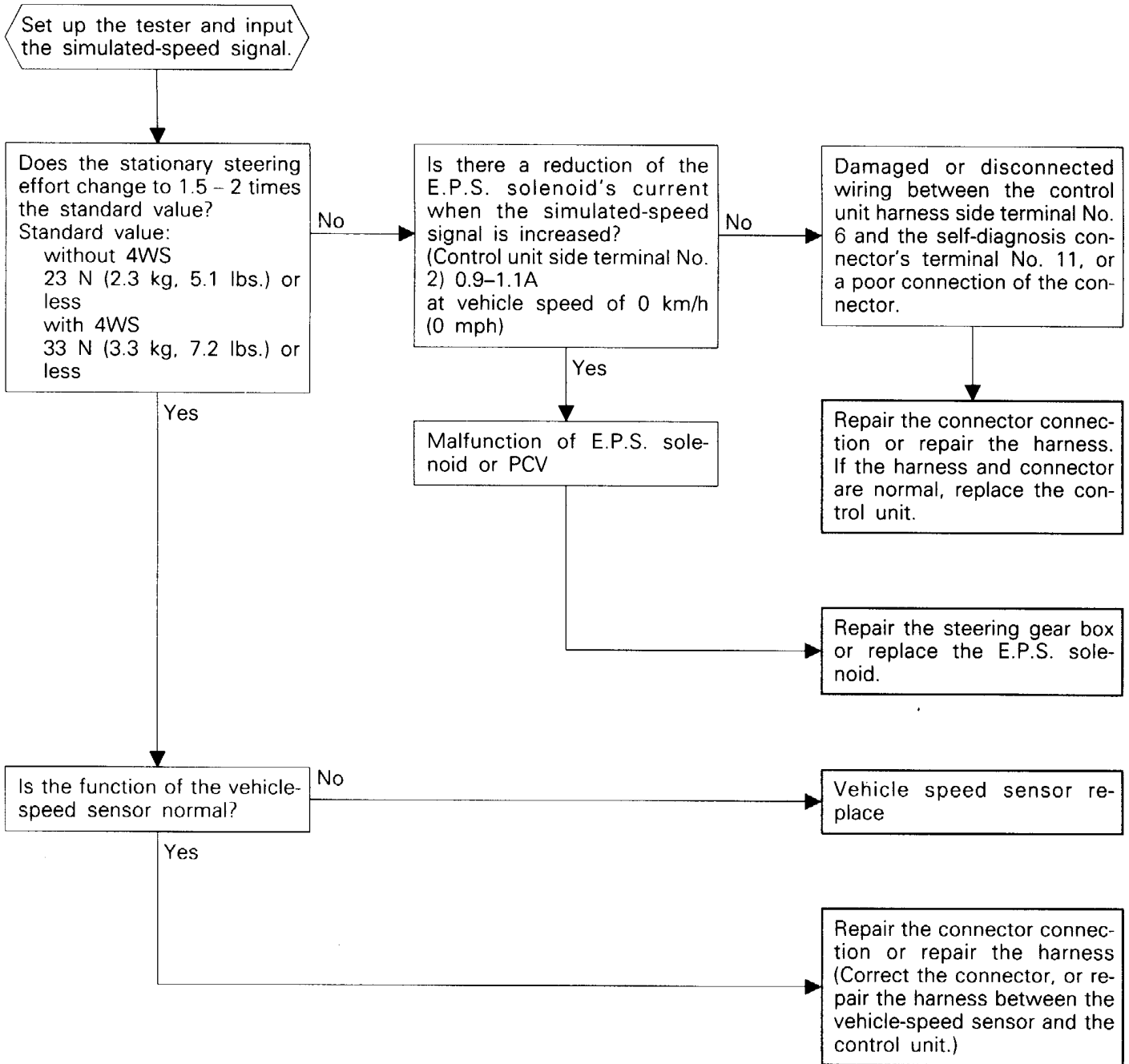
- (1) For checking procedures for each problem, refer to the flow-chart type of troubleshooting guide on the following page.  
(2) P.C.V. = Proportioning control valve

Trouble Symptom 1

**While driving at medium or high speed, steering remains light.**

NOTE

- (1) Check to be made by using the special tool; dummy speed oscillator or MUT.
- (2) Refer to the circuit diagram (P.37A-10-4, 10-5, 10-6) for terminal numbers at the harness side of the E.P.S. control unit.



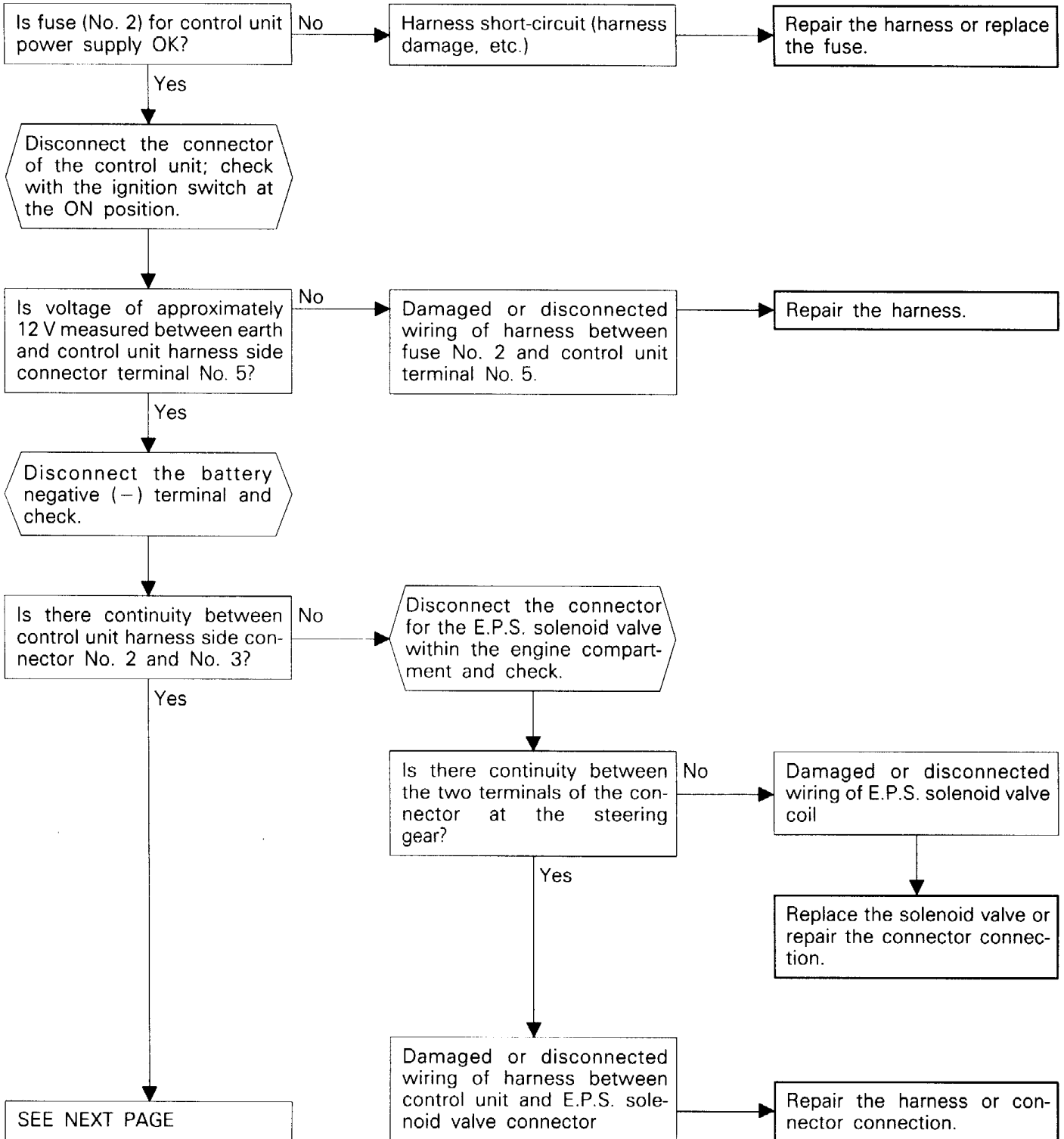


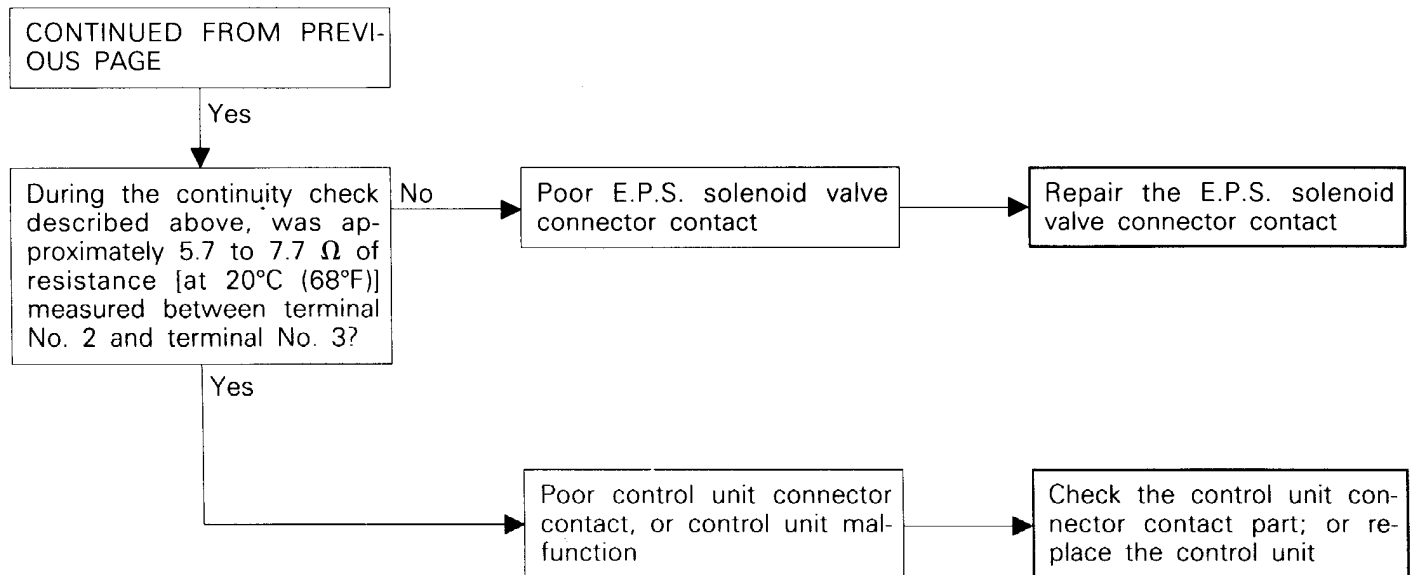
**Trouble Symptom 2**

**Steering wheel movement is heavy. (When ignition key is turned to ON, no current flows through the solenoid.)**

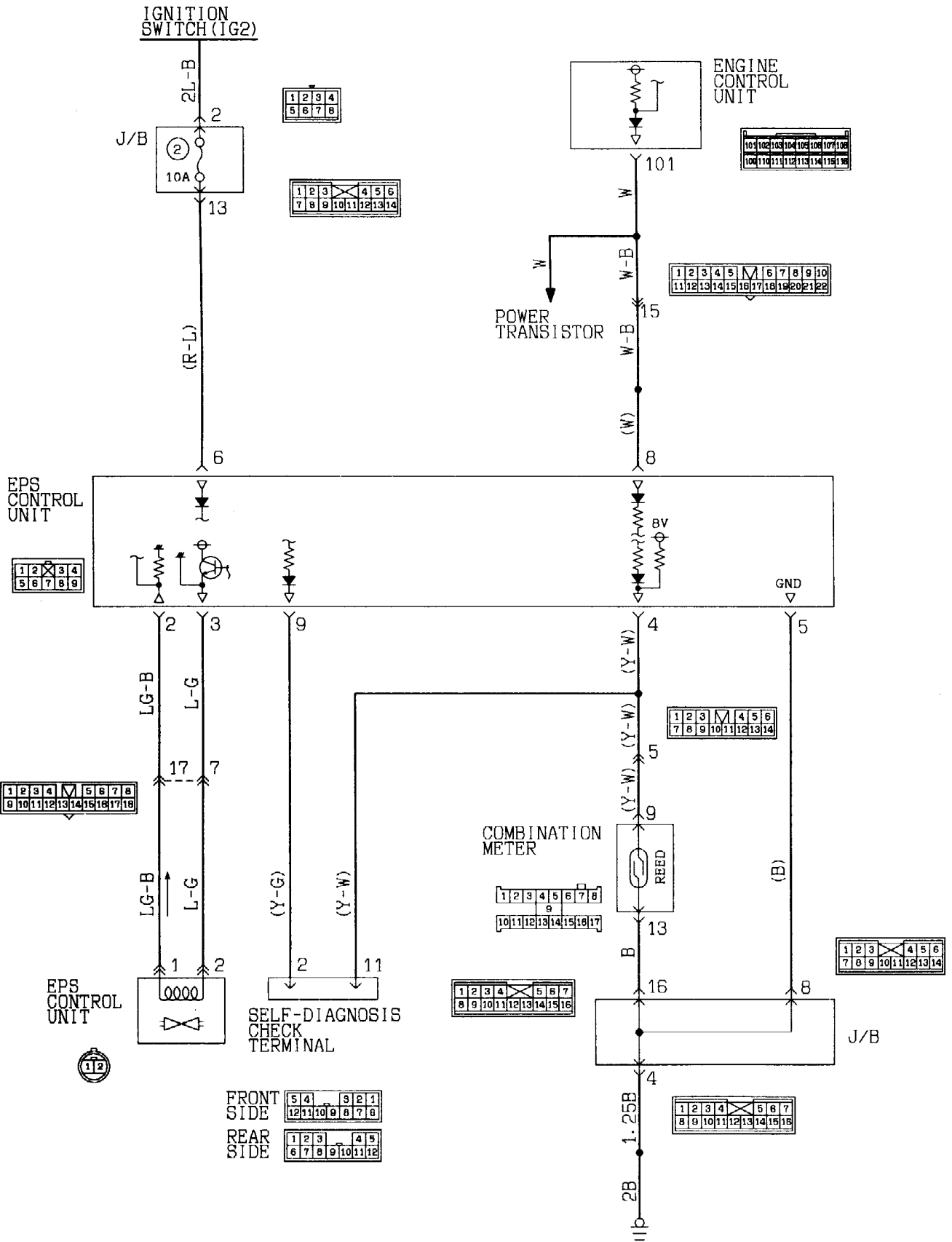
NOTE

- (1) Before making the checks described below, check to be sure that the failsafe system has not been activated by racing the engine.
- (2) Refer to the circuit diagram (P.37A-10-4, 10-5, 10-6) for terminal numbers at the harness side of the E.P.S. control unit.

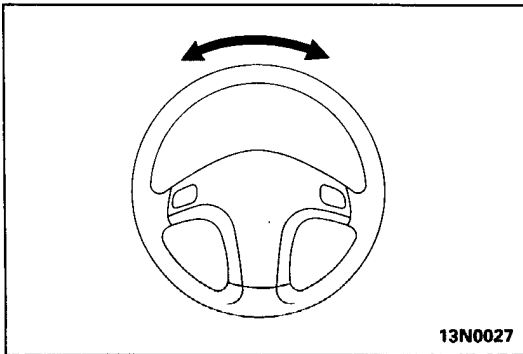




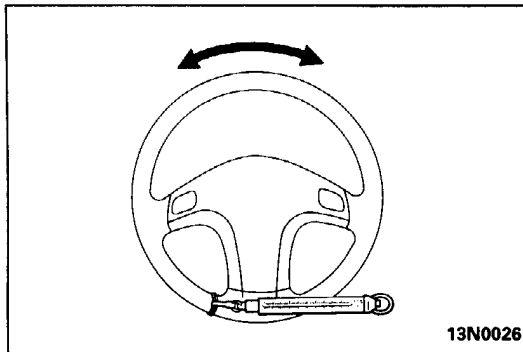
ELECTRONIC CONTROL POWER STEERING CIRCUIT



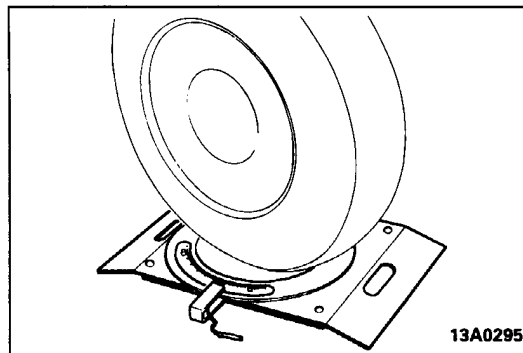
KX35-AC-J1509-EG



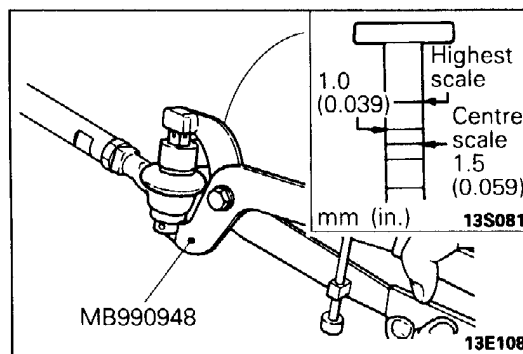
13N0027



13N0026



13A0295



MB990948

13E108

## SERVICE ADJUSTMENT PROCEDURES

E37FABC

### STEERING WHEEL FREE PLAY CHECK

1. With engine running (hydraulic operation), set front wheels straight ahead.
2. Measure the play on steering wheel circumference before wheels start to move when slightly moving steering wheel in both directions.

**Limit: 30 mm (1.2 in.)**

3. When play exceeds the limit, check for play on steering shaft connection and steering linkage. Correct or replace.
4. If the free play still exceeds the limit value, set steering wheel straight ahead with engine stopped. Load 5 N (0.5 kg, 1 lb.) towards steering wheel circumference and check play.

**Standard value (steering wheel play with engine stopped): 10 mm (0.43 in.) or less**

If the play exceeds the standard value, remove steering gear box and check total pinion torque.

### STEERING ANGLE CHECK

E37FDAE

1. Locate front wheels on turning radius gauge and measure steering angle.

**Standard value:**

<b>Inside wheel</b>	<b>37°00' ± 2°</b>
<b>Outside wheel</b>	<b>30°30'</b>

2. When the angle is not within the standard value, the toe is probably incorrect. Adjust toe (Refer to GROUP 33A – Service Adjustment Procedures) and recheck steering angle.

### TIE ROD END BALL JOINT VARIATION CHECK (SHAFT DIRECTION)

E37FVAA

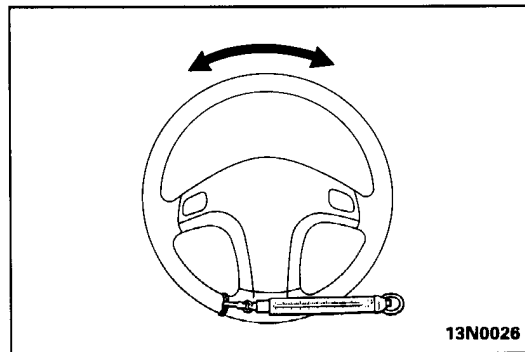
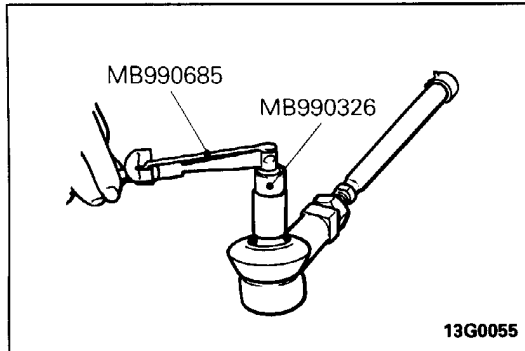
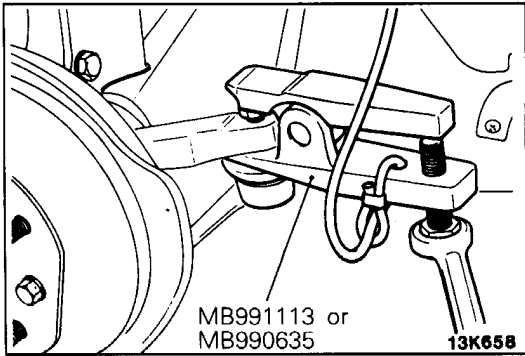
1. Hold ball joint with the special tool.
2. Set special tool scale at its highest and measure variation with ball stud compressed. The variation should locate between the highest and centre scales.

**Limit: 1.5 mm (0.059 in.)**

3. When the variation exceeds the centre scale, replace the tie-rod end.

**Caution**

**Even if the variation is within the limit, check ball joint starting torque.**



**TIE ROD END BALL JOINT STARTING TORQUE CHECK**

E37FMAA

1. Disconnect tie rod and knuckle with special tool.
2. Move ball joint stud several times and install nut on stud. Measure ball joint starting torque with special tools.  
**Standard value: 0.5–2.5 Nm (5–25 kgcm, 4–22 in.lbs.)**
3. When the starting torque exceeds the standard value, replace tie rod end.
4. When the starting torque is under the standard value, check ball joint for end play or ratcheting. If none of these, the joint is still serviceable.

**STATIONARY STEERING EFFORT CHECK**  
**<VEHICLES BUILT UP TO OCTOBER, 1992>**

E37FFAE

1. With the vehicle stopped on a flat, paved surface, turn the steering wheel to the straight ahead position.
2. Start the engine and set it to  $1,000 \pm 100$  r/min.

**Caution**

**After checking the engine r/min., there must be a return to the standard idling r/min.**

3. Attach a spring balance to the outer circumference of the steering wheel and measure the steering force required to turn the steering wheel from the straight ahead position to the left and right (within a range of 1.5 turns). Also check to be sure that there is no significant fluctuation of the required steering force.

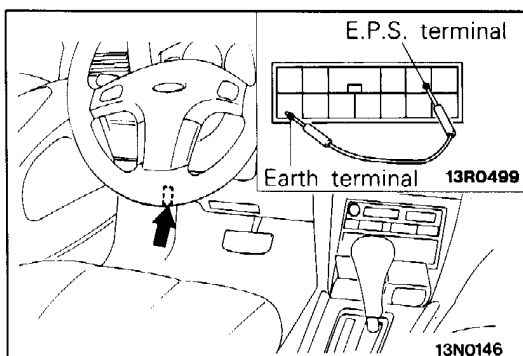
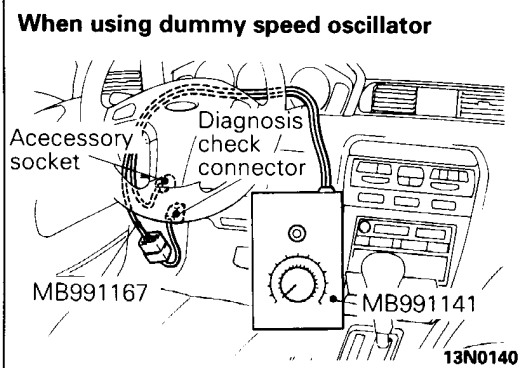
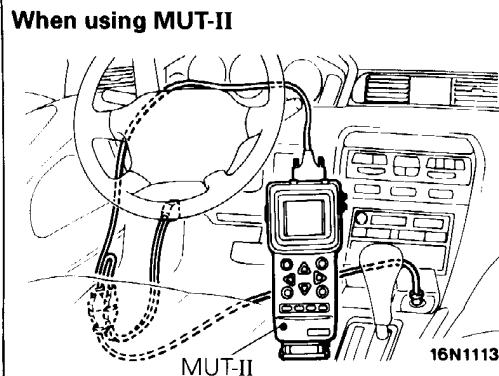
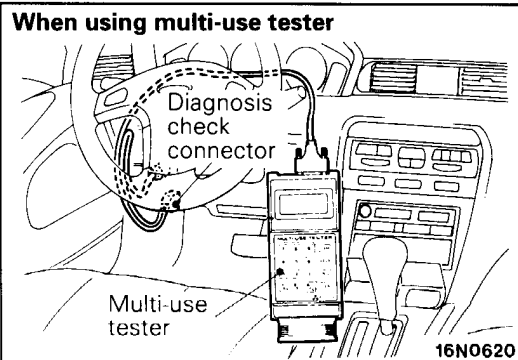
**Standard value:**

**Steering effort**

Conventional Power Steering		31 N (3.1 kg, 6.8 lbs.) or less
E.P.S.	Without 4WS	23 N (2.3 kg, 5.1 lbs.) or less
	4WS	33 N (3.3 kg, 7.2 lbs.) or less

**Fluctuation allowance 6 N (0.6 kg, 1.3 lbs.) or less**

4. If the measured force exceeds the standard value, refer to the troubleshooting and make the checks and adjustments described there.



5. For models equipped with the E.P.S., the vehicle speed is detected by the E.P.S. solenoid, thereby changing the required steering effort, and therefore, after checking the E.P.S. solenoid, a tester should be used to input simulated-speed signals so that the required stationary steering effort during simulated high speed driving can be checked.

For information concerning the checking of the E.P.S. solenoid and the set up of the tester, refer to p.37A-15.

- (1) Check whether or not the required steering effort when the turn is started is 1.5 to two times the standard value shown in item (3) when simulated-speed signals of the values indicated below are input.
- (2) If there is no change of the required steering effort, refer to the troubleshooting guide for the procedures for checking the various components.

#### NOTE

It is also possible to make the check described in step (5), without using the tester, by short-circuiting the E.P.S. terminal and the earth terminal of the self-diagnosis check connector, as shown in the illustration at the left.

- (3) For A/T models, when making the check in step (5), there will be a 3-speed hold by the fail-safe function. Therefore, be sure to disconnect the negative (-) terminal of the battery for ten seconds or longer in order to cancel the 3-speed hold after completion of checks by using the tester.

#### Caution

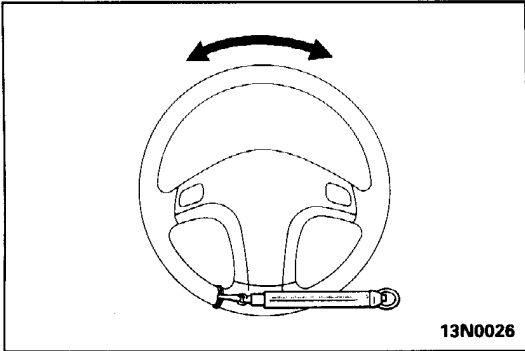
1. **Never drive the vehicle with the tester connected or self-diagnosis check connector short circuit.**
2. **The driving test used for making checks while the vehicle is moving should be done in a safe place.**

**STATIONARY STEERING EFFORT CHECK**  
 <VEHICLES BUILT FROM NOVEMBER, 1992>  
E37FFAEa

1. With the vehicle stopped on a flat, paved surface, turn the steering wheel to the straight ahead position.
2. Start the engine and set it to  $1,000 \pm 100$  r/min.

**Caution**

**After checking the engine r/min., there must be a return to the standard idling r/min.**



3. Attach a spring balance to the outer circumference of the steering wheel and measure the steering force required to turn the steering wheel from the straight ahead position to the left and right (within a range of 1.5 turns). Also check to be sure that there is no significant fluctuation of the required steering force.

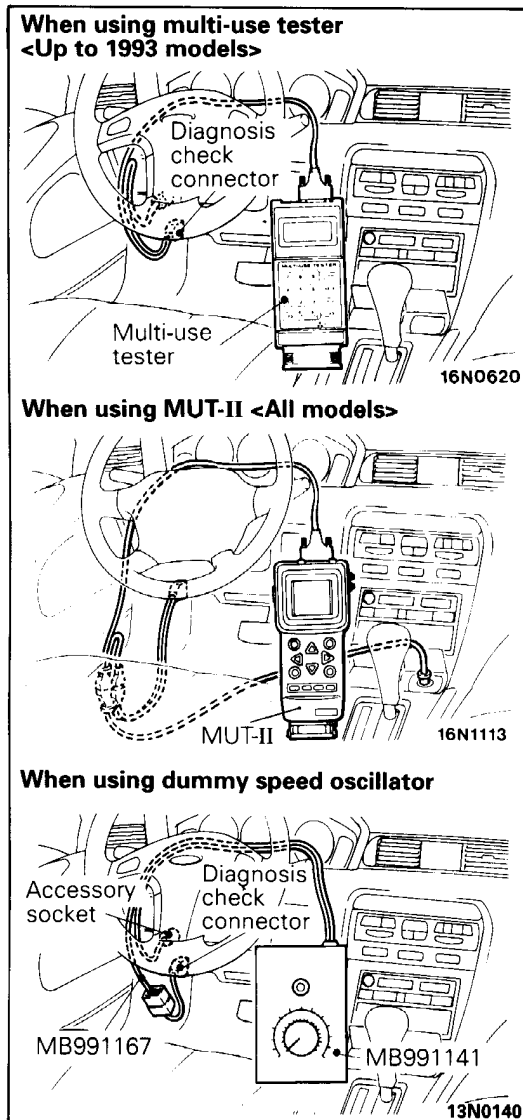
**Standard value:**

**Steering effort**

Conventional Power Steering	L.H. drive vehicles	34 N (3.4 kg, 7.5 lbs.) or less
	R.H. drive vehicles	31 N (3.1 kg, 6.8 lbs.) or less
E.P.S.	L.H. drive vehicles	28 N (2.8 kg, 6.2 lbs.) or less
	R.H. drive vehicles	23 N (2.3 kg, 5.1 lbs.) or less

**Fluctuation allowance 6 N (0.6 kg, 1.3 lbs.) or less**

4. If the measured force exceeds the standard value, refer to the troubleshooting and make the checks and adjustments described there.



5. For models equipped with the E.P.S., the vehicle speed is detected by the E.P.S. solenoid, thereby changing the required steering effort, and therefore, after checking the E.P.S. solenoid, a tester should be used to input simulated-speed signals so that the required stationary steering effort during simulated high speed driving can be checked.

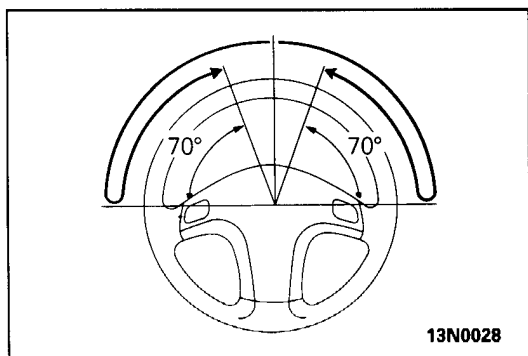
For information concerning the checking of the E.P.S. solenoid and the set up of the tester, refer to P.37A-16-1.

- (1) Check whether or not the required steering effort when the turn is started is 1.5 to two times the standard value shown in item (3) when simulated-speed signals of the values indicated below are input.
- (2) If there is no change of the required steering effort, refer to the troubleshooting guide for the procedures for checking the various components.
- (3) For A/T models, when making the check in step (5), there will be a 3-speed hold by the fail-safe function. Therefore, be sure to disconnect the negative (-) terminal of the battery for ten seconds or longer in order to cancel the 3-speed hold after completion of checks by using the tester.

#### Caution

1. **Never drive the vehicle with the tester connected or self-diagnosis check connector short circuit.**
2. **The driving test used for making checks while the vehicle is moving should be done in a safe place.**





## CHECKING STEERING WHEEL RETURN TO CENTRE

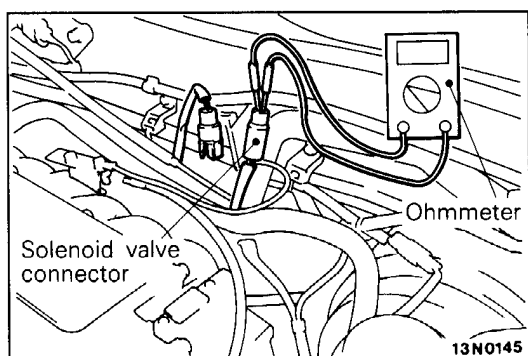
E37FGAA

To make this test, conduct a road test and check as follows.

1. Make both gradual and sudden turns and check the steering "feeling" to be sure that there is no difference in the steering force required and the wheel return between left and right turns.
2. At a speed of 35 km/h (22 mph), turn the steering wheel 90°, and release the steering wheel after 1 or 2 seconds. If the steering wheel then returns 70° or more, the return can be judged to be satisfactory.

### NOTE

There will be a momentary feeling or "heaviness" when the wheel is turned quickly, but this is not abnormal. (This is because the oil pump discharge amount is especially apt to be insufficient during idling.)



## E.P.S. SOLENOID CHECK

E37FPAC

### SOLENOID CONTINUITY CHECK

Check for continuity, by using an ohmmeter, between the solenoid valve terminal and the disconnection of the solenoid valve connector.

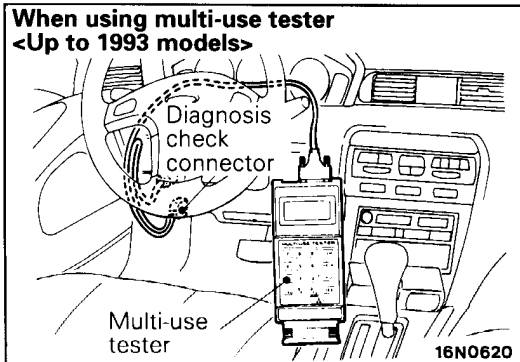
### SOLENOID CURRENT CHECK

#### <VEHICLES BUILT UP TO OCTOBER, 1992>

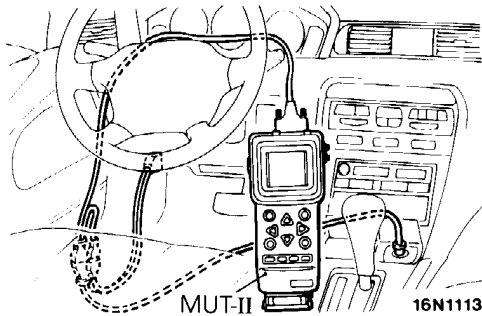
1. Set up the multi-use tester <Up to 1993 models>, MUT-II <All models> or dummy speed oscillator as follows.
  - (1) Turn the ignition switch to ACC or LOCK, and apply the parking brake.

### NOTE

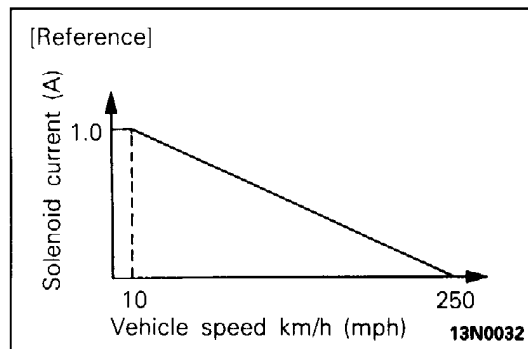
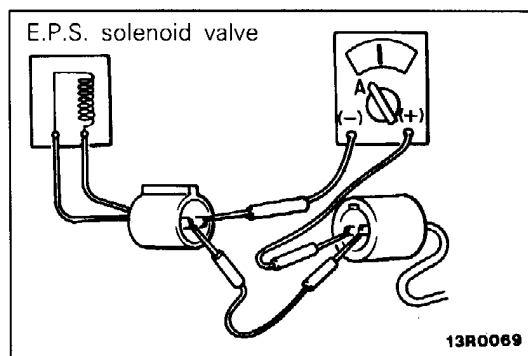
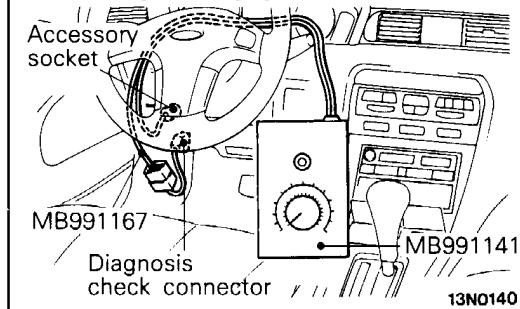
The fail-safe system will be activated when the engine is raced for approximately 50 seconds at an engine speed of 2,300 r/min. or higher, and the solenoid current will be cut, but the fail-safe system can be cancelled by switching OFF the engine and then restarting it.



**When using MUT-II <All models>**



**When using dummy speed oscillator**



- (2) For the dummy speed oscillator (MB991141), set the vehicle-speed selection switch to 0 km/h (0 mph).
- (3) Connect the connector of the tester to the diagnosis check connector at the side part of fuse block, and then connect the connector for the power supply to the cigarette lighter socket (chassis side).

For models equipped with the auto-cruise control system, the main switch must be switched OFF.

**Caution**

**The ignition switch should always be turned OFF when connecting and disconnecting the multi-use tester or MUT-II.**

- (4) Start the engine and let it idle.
- (5) For the multi-use tester or MUT-II, input the simulated vehicle speed, using the vehicle-speed signal function. If the simulated vehicle speed cannot be input, a message will be displayed on the tester's display; move the vehicle ahead 0.3 to 0.4 m (0.98 to 1.31 ft.) if such a message is displayed.
- (6) For the dummy speed oscillator (MB991141), set the vehicle-speed selection switch to 10–20 km/h (6–12 mph), and check to be sure that the monitor lamp is flashing. If it remains steadily illuminated rather than flashing, move the vehicle forward about 0.3–0.4 m (0.98–1.31 ft.) until it begins flashing.

2. Disconnect the wiring harness connector (the waterproof connector in the engine compartment) of the E.P.S. solenoid valve, and then connect an ammeter between the solenoid valve connector and the harness at the body side.

**Caution**

**Do not earth the solenoid terminal.**

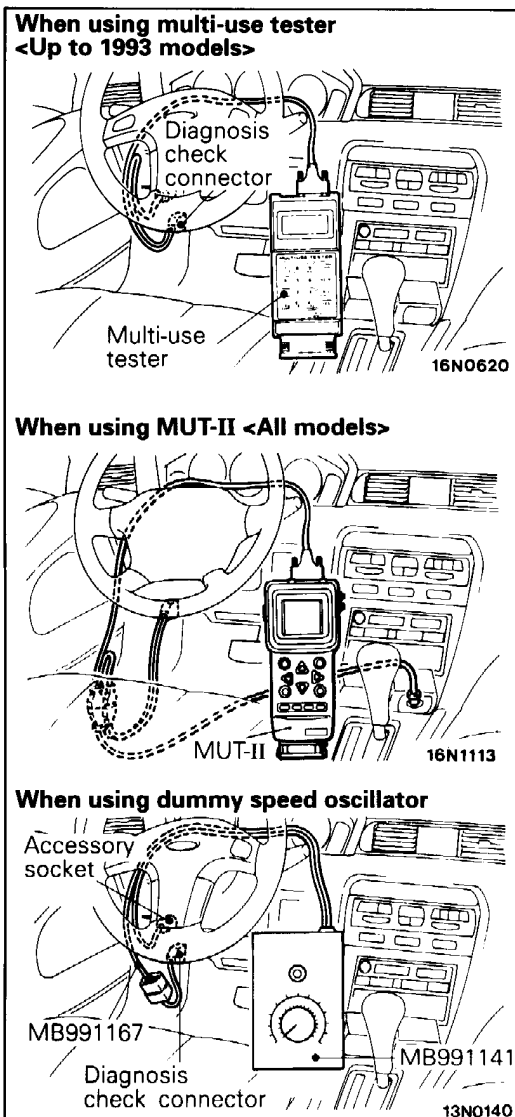
3. Check to be sure that the solenoid current is within the standard value range when the vehicle speed is 0 km/h (0 mph), and that it decreases as the vehicle speed is increased.

**Standard value: 0.9–1.1 A at vehicle speed of 0 km/h (0 mph)**

4. If the solenoid current does not decrease when simulated-speed signals for an increased speed are input, refer to the troubleshooting guide (P.37A-8).
5. For automatic transmission models, when the tester is used, there will be a 3-speed hold by the fail-safe function. Therefore, be sure to disconnect the negative (-) terminal of the battery for ten seconds or longer in order to cancel the 3-speed hold after completion of checks by using the tester.

**Caution**

1. **Never drive the vehicle with the tester connected.**
2. **The driving test used for making checks while the vehicle is moving should be done in a safe place.**



**SOLENOID CURRENT CHECK**  
**<VEHICLES BUILT FROM NOVEMBER, 1992>**

1. Set up the multi-use tester <Up to 1993 models> or MUT-II <All models> or dummy speed oscillator as follows.
  - (1) Turn the ignition switch to ACC or LOCK, and apply the parking brake.

**NOTE**

The fail-safe system will be activated when the engine is raced for approximately 60 seconds at an engine speed of 2,300 r/min. or higher, but the fail-safe system can be cancelled by switching OFF the engine and then restarting it.

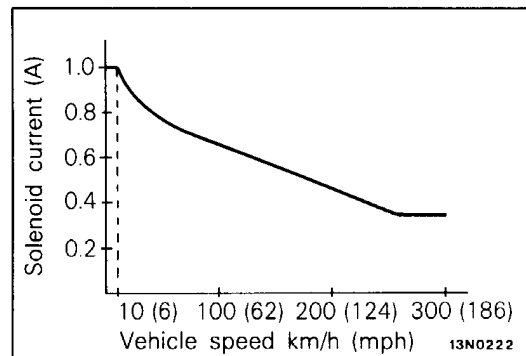
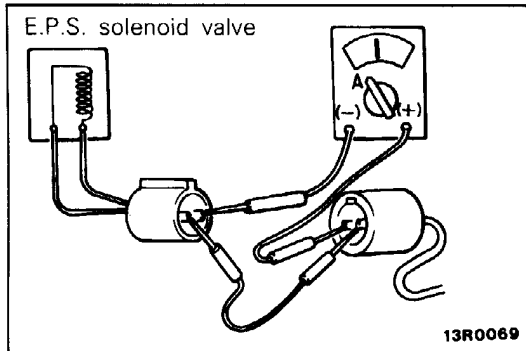
- (2) For the dummy speed oscillator (MB991141), set the vehicle-speed selection switch to 0 km/h (0 mph).
- (3) Connect the connector of the tester to the diagnosis check connector at the side part of fuse block, and then connect the connector for the power supply to the cigarette lighter socket (chassis side).

For models equipped with the auto-cruise control system, the main switch must be switched OFF.

**Caution**

**The ignition switch should always be turned OFF when connecting and disconnecting the multi-use tester or MUT-II.**

- (4) Start the engine and let it idle.
- (5) For the multi-use tester or MUT-II, input the simulated vehicle speed, using the vehicle-speed signal function. If the simulated vehicle speed cannot be input, a message will be displayed on the tester's display; move the vehicle ahead 0.3 to 0.4 m (0.98 to 1.31 ft.) if such a message is displayed.
- (6) For the dummy speed oscillator (MB991141), set the vehicle-speed selection switch to 10–20 km/h (6–12 mph), and check to be sure that the monitor lamp is flashing. If it remains steadily illuminated rather than flashing, move the vehicle forward about 0.3–0.4 m (0.98–1.31 ft.) until it begins flashing.



2. Disconnect the wiring harness connector (the waterproof connector in the engine compartment) of the E.P.S. solenoid valve, and then connect an ammeter between the solenoid valve connector and the harness at the body side.

**Caution**

**Do not earth the solenoid terminal.**

3. Check to be sure that the solenoid current is within the standard value range when the vehicle speed is 0 km/h (0 mph), and that it decreases as the vehicle speed is increased.

**Standard value: 0.9–1.1 A at vehicle speed of 0 km/h (0 mph)**

4. If the solenoid current does not decrease when simulated-speed signals for an increased speed are input, refer to the troubleshooting guide (P.37A-10-1).
5. For automatic transmission models, when the tester is used, there will be a 3-speed hold by the fail-safe function. Therefore, be sure to disconnect the negative (–) terminal of the battery for ten seconds or longer in order to cancel the 3-speed hold after completion of checks by using the tester.

**Caution**

1. **Never drive the vehicle with the tester connected.**
2. **The driving test used for making checks while the vehicle is moving should be done in a safe place.**

**V-BELT TENSION CHECK**

E37FHAH

Check to be sure that the belt is not damaged and that the V-belt is correctly attached to the groove of the pulley.

**NOTE**

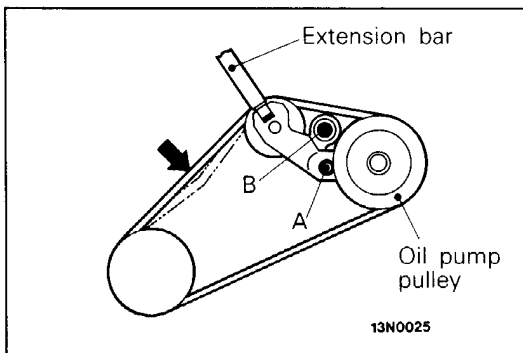
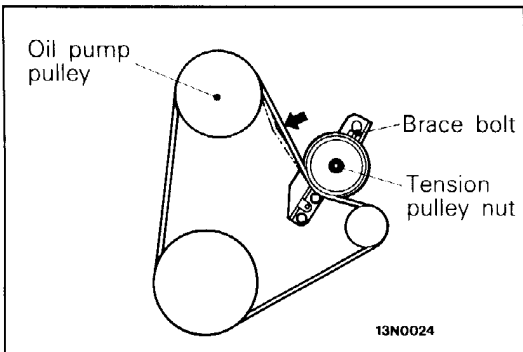
If there is abnormal noise or belt slippage, check the belt tension and check for unusual wear or abrasion, or damage, of the pulley contact surface, and for scars or scratches on the pulley.

**<SOHC Engine>**

1. Press in V-belt at the illustrated position with about 100 N (22 lbs.) and measure deflection.

**Standard value**

When belt tension is inspected	6-9 mm (0.24-0.35 in.)
When belt tension is readjusted	7 mm (0.28 in.)
When new belt is installed	4-5 mm (0.16-0.20 in.)



2. If the deflection is out of the standard values, loosen the tension pulley nut and adjust the belt tension with brace bolt.

**<DOHC Engine>**

1. Press in V-belt at the illustrated position with about 100 N (22 lbs.) and measure deflection.

**Standard value**

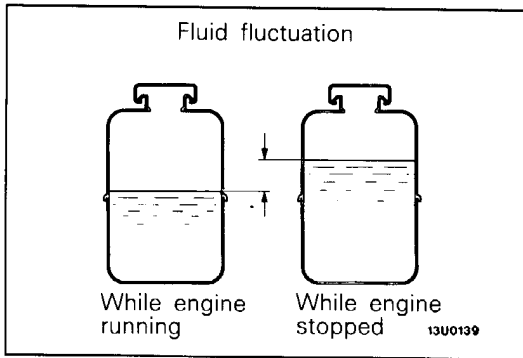
**<Vehicles built up to October, 1991>**

When belt tension is inspected or readjusted	9-11 mm (0.35-0.43 in.)
When new belt is installed	7-8.5 mm (0.28-0.33 in.)

**<Vehicles built from November, 1991>**

When belt tension is inspected	9.5-13.5 mm (0.37-0.53 in.)
When belt tension is readjusted	10.5-12.5 mm (0.41-0.49 in.)
When new belt is installed	7.5-9.0 mm (0.30-0.35 in.)

2. If the deflection is out of the standard values adjust the belt tension using the following procedure.
  - (1) Loosen the tension pulley's securing bolts A and B.
  - (2) Mount the extension bar on the tension pulley.
  - (3) While increasing the tension of the V-belt with the extension bar, retighten the tension pulley's securing bolts A and B in the order mentioned.

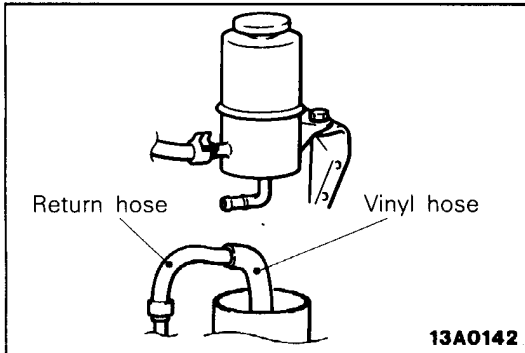


### FLUID LEVEL CHECK

E37FIAD

1. Park the vehicle on a flat, level surface, start the engine, and then turn the steering wheel several times to raise the temperature of the fluid to approximately 50–60°C (122–140°F).
2. With the engine running, turn the wheel all the way to the left and right several times.
3. Check the fluid in the oil reservoir for foaming or milkiness.

Check the difference of the fluid level when the engine is stopped, and while it is running. If the fluid level changes considerably, air bleeding should be done.



## FLUID REPLACEMENT

E37FJAF

1. Raise the front wheels on a jack, and then support them with rigid racks.
2. Disconnect the return hose connection.
3. Connect a vinyl hose to the return hose, and drain the oil into a container.
4. Disconnect the high-tension cable, and then while operating the starting motor intermittently, turn the steering wheel all the way to the left and right several times to drain all of the fluid.

### Caution

**Be careful not to position the high-tension cable near the carburettor or the delivery pipe.**

5. Connect the return hoses securely, and then secure it with the clip.
6. Fill the oil reservoir with the specified fluid up to the lower position of the filter, and then bleed the air.

**Specified fluid: Automatic transmission fluid  
DEXRON or DEXRON II**

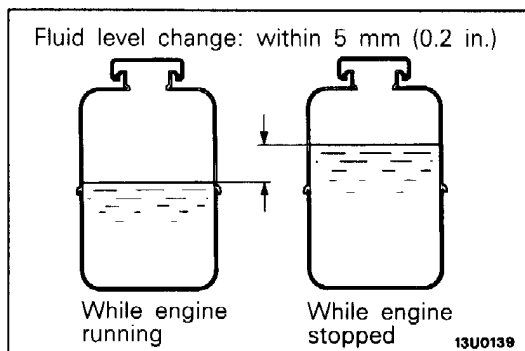
## BLEEDING

E37FKAG

1. Jack up the front wheels and support them by using a rigid rack.
2. Manually turn the oil pump pulley a few times.
3. Turn the steering wheel all the way to the left and to the right five or six times.
4. Disconnect the high-tension cable, and then, while operating the starting motor intermittently, turn the steering wheel all the way to the left and right five or six times (for 15 to 20 seconds).

### Caution

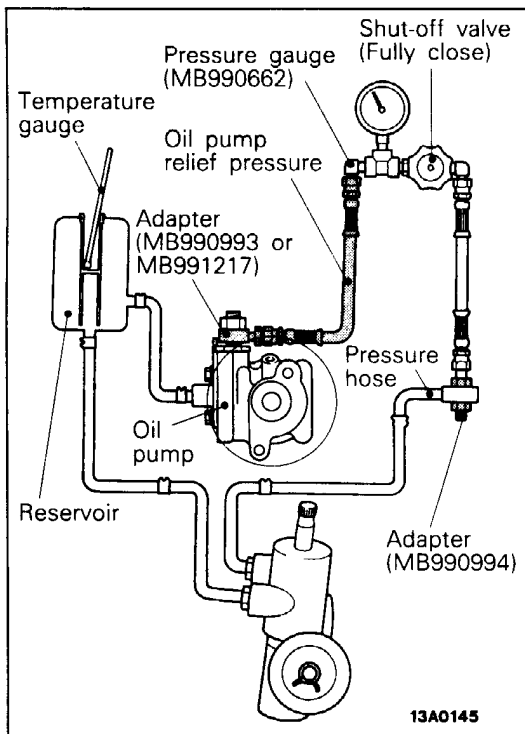
1. **During air bleeding, replenish the fluid supply so that the level never falls below the lower position of the filter.**
2. **If air bleeding is done while engine is running, the air will be broken up and absorbed into the fluid; be sure to do the bleeding only while cranking.**



5. Connect the ignition cable, and then start the engine (idling).
6. Turn the steering wheel to the left and right until there are no air bubbles in the oil reservoir.
7. Confirm that the fluid is not milky, and that the level is up to the specified position on the level gauge.
8. Confirm that there is very little change in the fluid level when the steering wheel is turned left and right.
9. Check whether or not the change in the fluid level is within 5 mm (0.2 in.) when the engine is stopped and when it is running.

**Caution**

1. If the change of the fluid level is 5 mm (0.2 in.) or more, the air has not been completely bled from the system, and thus must be bled completely.
2. If the fluid level rises suddenly after the engine is stopped, the air has not been completely bled.
3. If air bleeding is not complete, there will be abnormal noises from the pump and the flow-control valve, and this condition could cause a lessening of the life of the pump, etc.



**OIL PUMP PRESSURE TEST**

E37FLAE

**CHECKING THE OIL PUMP RELIEF PRESSURE**

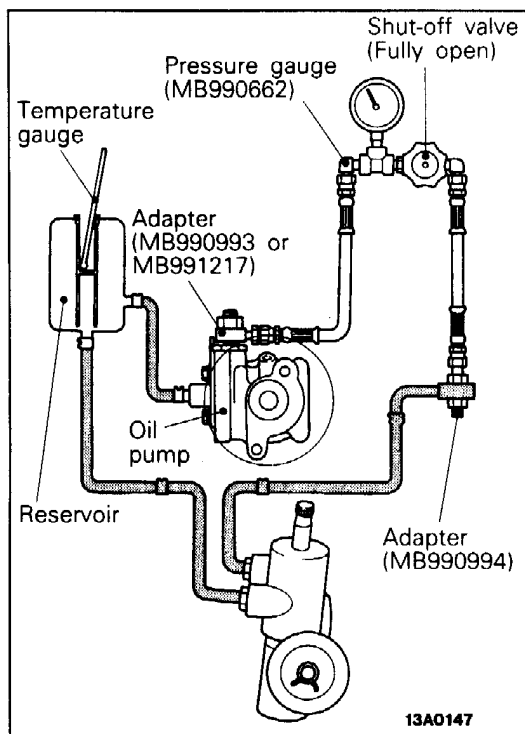
1. Disconnect the pressure hose from the oil pump, and then connect the special tools.
2. Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50–60°C (122–140°F).
3. Start the engine and idle it at 1,000 ± 100 r/min.
4. Fully close the shut-off valve of the pressure gauge and measure the oil pump relief pressure to confirm that it is within the standard value range.

**Standard value: 7.5–8.2 MPa  
(75–82 kg/cm<sup>2</sup>, 1,067–1,166 psi.)**

**Caution**

**Pressure gauge shut off valve must not remain closed for more than 10 seconds.**

5. If it is not within the standard value, overhaul the oil pump.
6. Remove the special tools, and then tighten the pressure hose to the specified torque.
7. Bleed the system.



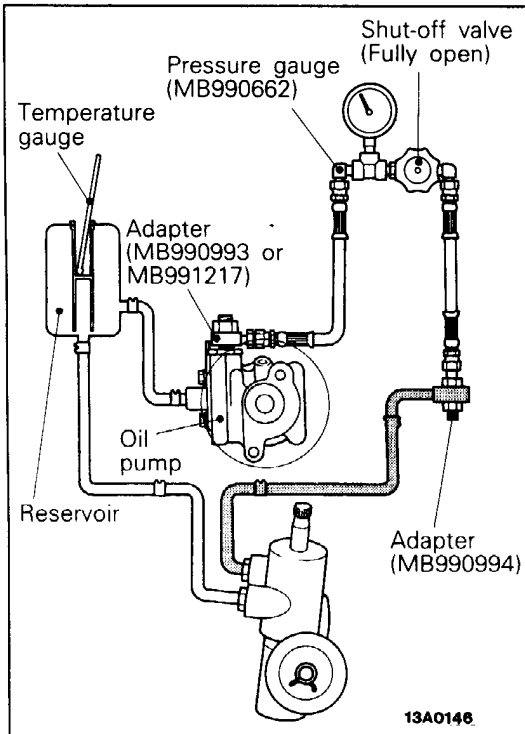
**CHECKING THE PRESSURE UNDER NO-LOAD CONDITIONS**

1. Disconnect the pressure hose from the oil pump, and then connect the special tools.
2. Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50–60°C (122–140°F).
3. Start the engine and idle it at 1,000 ± 100 r/min.
4. Check whether or not the hydraulic pressure is the standard value when no-load conditions are created by fully opening the shut-off valve of the pressure gauge.

**Standard value: 0.8–1.0 MPa  
(8–10 kg/cm<sup>2</sup>, 114–142 psi.)**

5. If it is not within the standard value, the probable cause is a malfunction of the oil line or steering gear box, so check these parts and repair as necessary.
6. Remove the special tools, and then tighten the pressure hose to the specified torque.
7. Bleed the system.





### CHECKING THE STEERING GEAR RETENTION HYDRAULIC PRESSURE

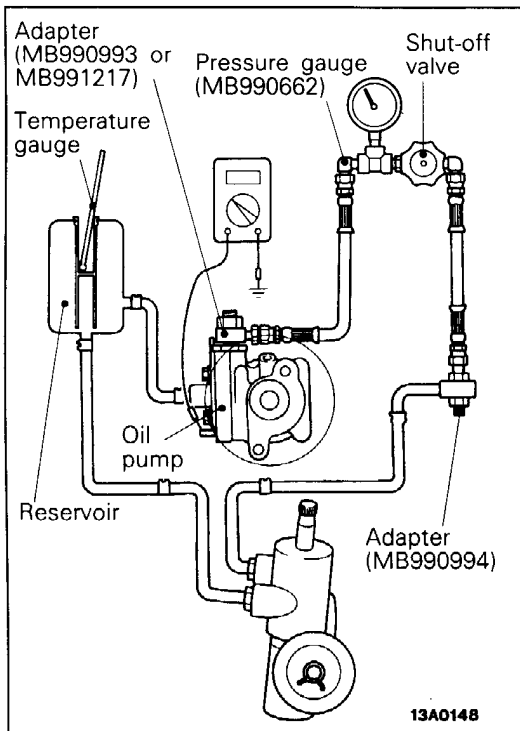
1. Disconnect the pressure hose from the oil pump, and then connect the special tools.
2. Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50–60°C (122–140°F).
3. Start the engine and idle it at  $1,000 \pm 100$  r/min.
4. Fully close and fully open the shut-off valve of the pressure gauge.
5. Turn the steering wheel all the way to the left or right; then check whether or not the retention hydraulic pressure is the standard value.

**Standard value: 7.5–8.2 MPa**  
(75–82 kg/cm<sup>2</sup>, 1,067–1,166 psi.)

6. When not within the standard value, overhaul the steering gear box.  
Remeasure fluid pressure.
7. Remove the special tools, and then tighten the pressure hose to the specified torque.
8. Bleed the system.

### POWER STEERING OIL PRESSURE SWITCH CHECK

E37FQAA



1. Disconnect the pressure hose from the oil pump, and then connect the special tools.
2. Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50–60°C (122–140°F).
3. The engine should be idling.
4. Disconnect the connection of the connector for the oil pressure switch, and place an ohmmeter in position.
5. Gradually close the shut-off valve of the pressure gauge and increase the hydraulic pressure then check whether or not the hydraulic pressure that activates the switch is the standard value.

**Standard value: 1.5–2.0 MPa**  
(15–20 kg/cm<sup>2</sup>, 213–284 psi.)

6. Gradually open the shut-off valve and reduce the hydraulic pressure; then check whether or not the hydraulic pressure that deactivates the switch is the standard value.

**Standard value: 0.7–1.2 MPa**  
(7–12 kg/cm<sup>2</sup>, 100–171 psi.)

7. Remove the special tools, and then tighten the pressure hose to the specified torque.
8. Bleed the system.

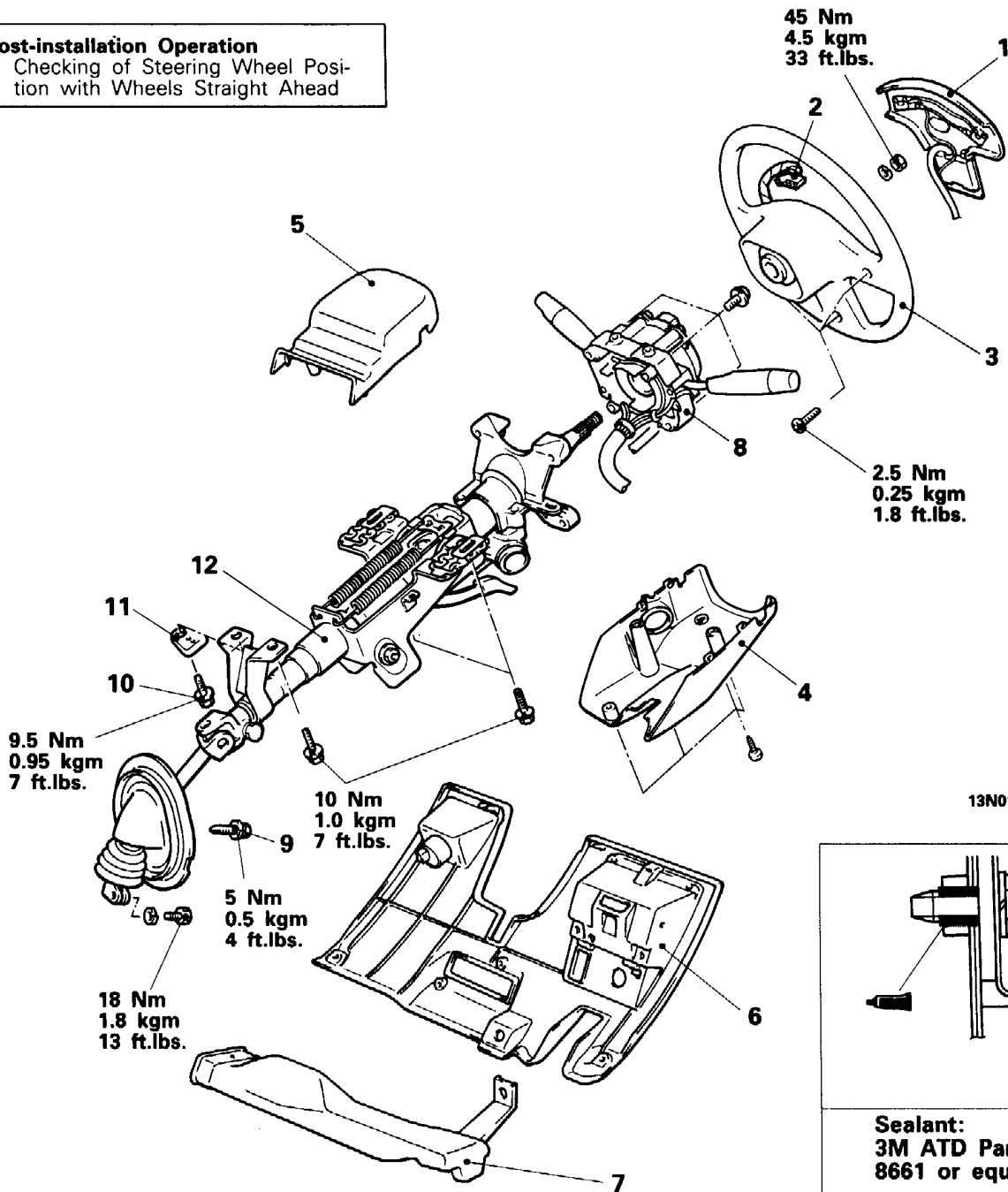
# STEERING WHEEL AND SHAFT

<VEHICLES WITHOUT SRS>

## REMOVAL AND INSTALLATION

E37HA-

**Post-installation Operation**  
 ● Checking of Steering Wheel Position with Wheels Straight Ahead

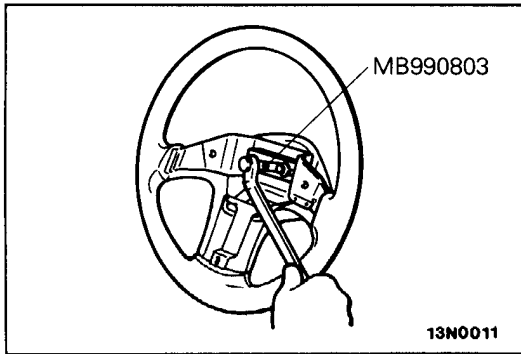


**Sealant:**  
**3M ATD Part No.**  
**8661 or equivalent**

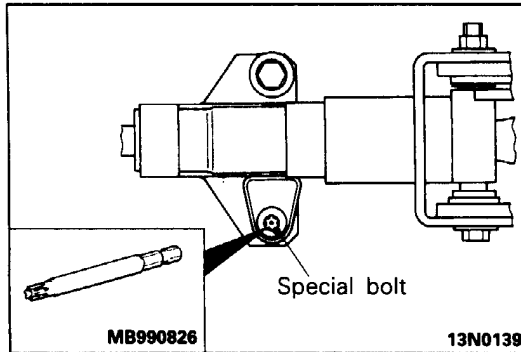
**Removal steps**

- 1. Horn pad
- 2. Harness connector (Vehicle with auto-cruise control)
- 3. Steering wheel
- 4. Lower column cover
- 5. Upper column cover
- 6. Driver side lower panel (Refer to GROUP 52 – Instrument Panel.)

- 7. Lap cooler duct and foot shower duct
- 8. Column switch
- 9. Retainer attachment bolt
- 10. Special screw
- 11. Special washer
- 12. Steering column assembly

**SERVICE POINTS OF REMOVAL**

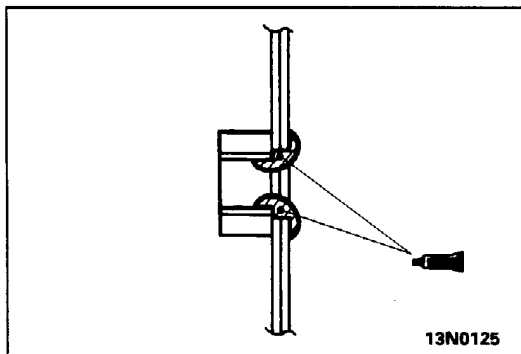
E37HBAS

**3. REMOVAL OF STEERING WHEEL****10. REMOVAL OF SPECIAL SCREW****SERVICE POINTS OF INSTALLATION**

E37HDAH

**10. INSTALLATION OF SPECIAL SCREW**

Tighten the special screw using the special tool.

**9. INSTALLATION OF RETAINER ATTACHMENT BOLT**

Before installing the bolt, apply specified sealant to the retainer attachment hole in the toeboard.

# STEERING WHEEL AND SHAFT

<VEHICLES WITH SRS>

## REMOVAL AND INSTALLATION

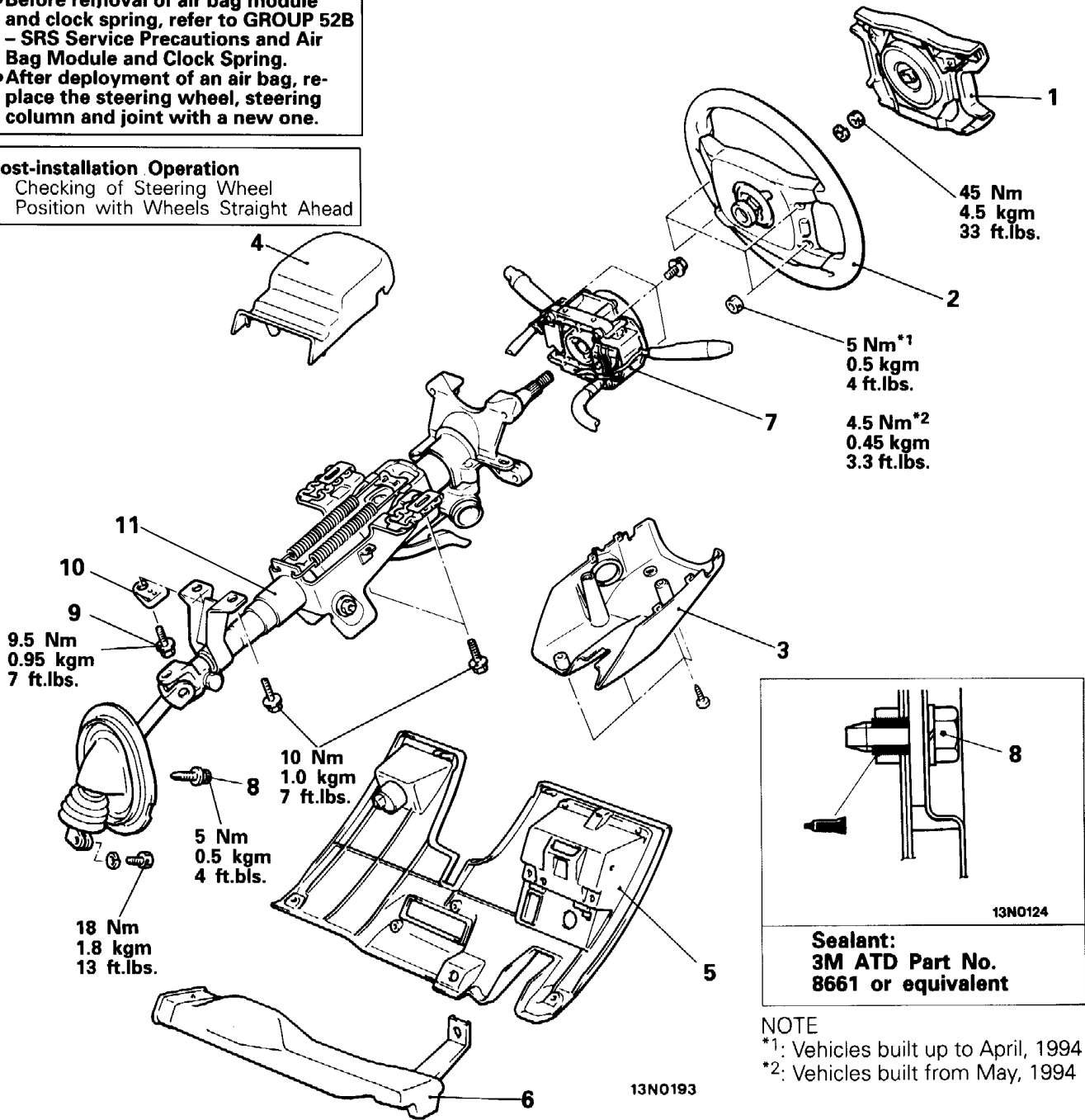
E37HA-A

**CAUTION; SRS**

- Before removal of air bag module and clock spring, refer to GROUP 52B – SRS Service Precautions and Air Bag Module and Clock Spring.
- After deployment of an air bag, replace the steering wheel, steering column and joint with a new one.

**Post-installation Operation**

- Checking of Steering Wheel Position with Wheels Straight Ahead



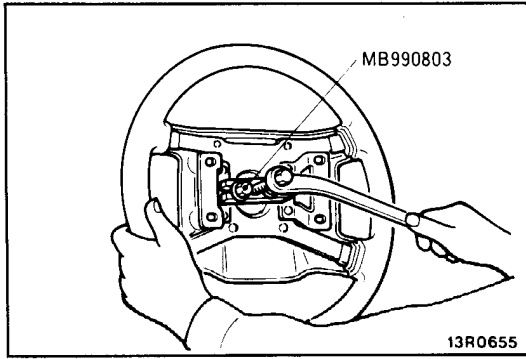
13N0124

**Sealant:**  
3M ATD Part No.  
8661 or equivalent

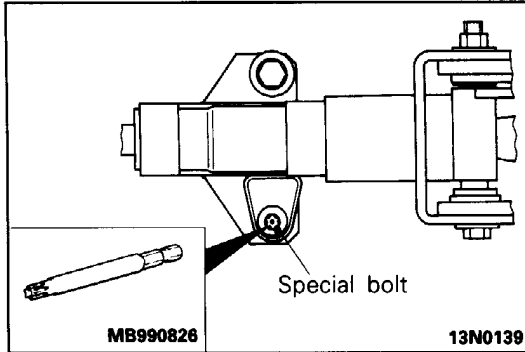
NOTE  
\*1: Vehicles built up to April, 1994  
\*2: Vehicles built from May, 1994

**Removal steps**

1. Air bag module (Refer to GROUP 52B – Air Bag Module and Clock Spring)
2. Steering wheel
3. Lower column cover
4. Upper column cover
5. Driver side lower panel (Refer to GROUP 52 – Instrument Panel.)
6. Lap cooler duct and foot shower duct
7. Column switch and clock spring (Refer to GROUP 52B – Air Bag Module and Clock Spring)
8. Retainer attachment bolt
9. Special screw
10. Special washer
11. Steering column assembly

**SERVICE POINTS OF REMOVAL**

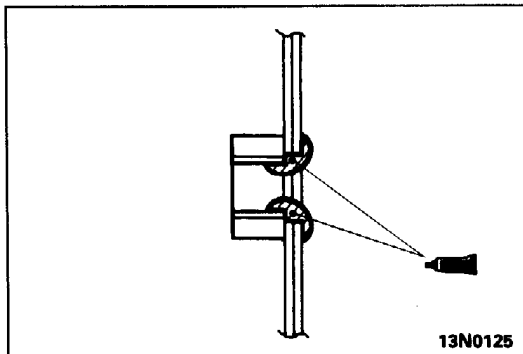
E37HBAS1

**2. REMOVAL OF STEERING WHEEL****9. REMOVAL OF SPECIAL SCREW****SERVICE POINTS OF INSTALLATION**

E37HDAH1

**9. INSTALLATION OF SPECIAL SCREW**

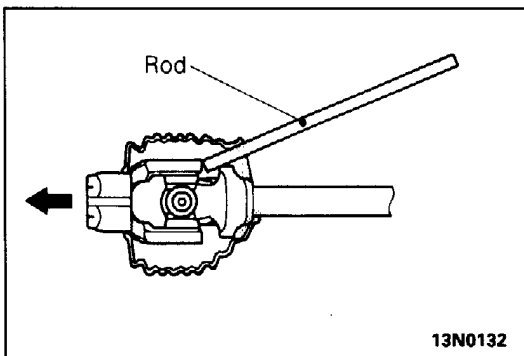
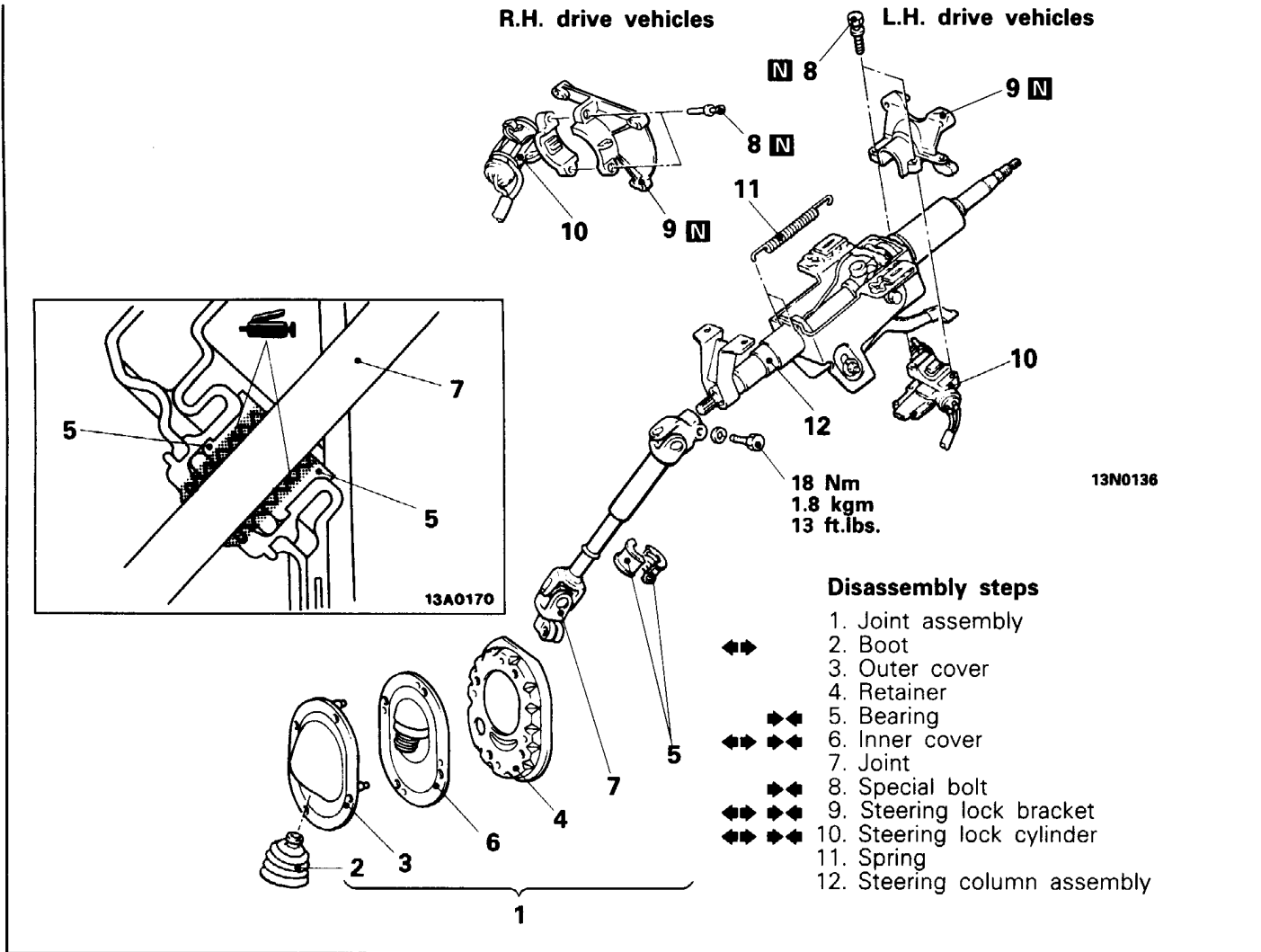
Tighten the special screw using the special tool.

**8. INSTALLATION OF RETAINER ATTACHMENT BOLT**

Before installing the bolt, apply specified sealant to the retainer attachment hole in the toeboard.

DISASSEMBLY AND REASSEMBLY

E37HE--

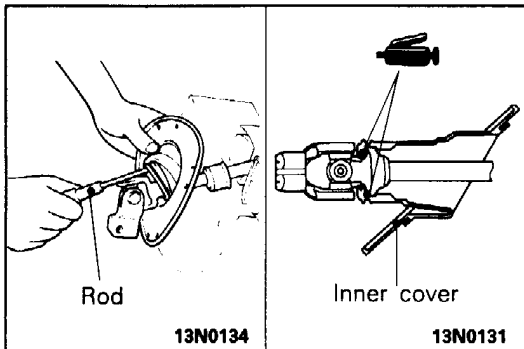


SERVICE POINTS OF DISASSEMBLY

E37HFAQ

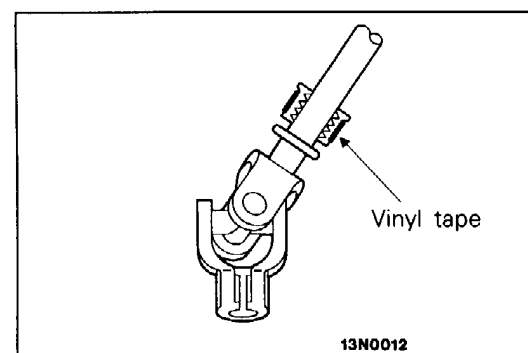
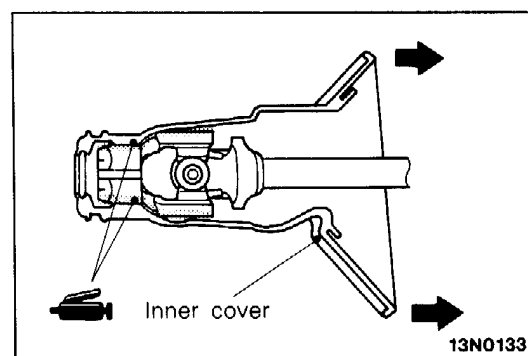
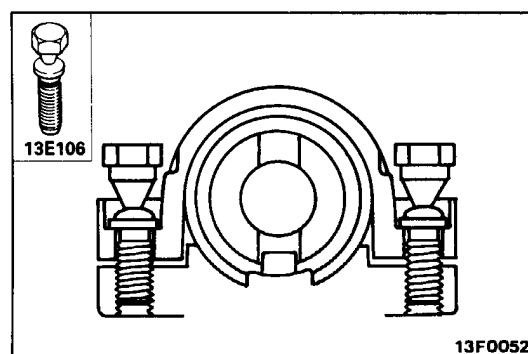
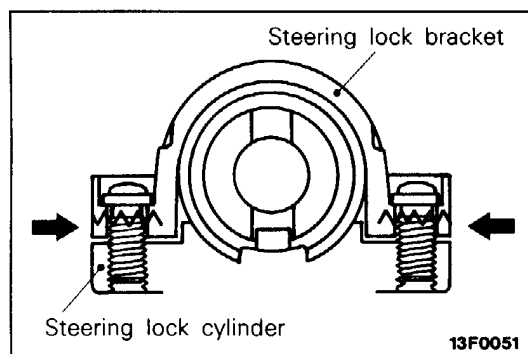
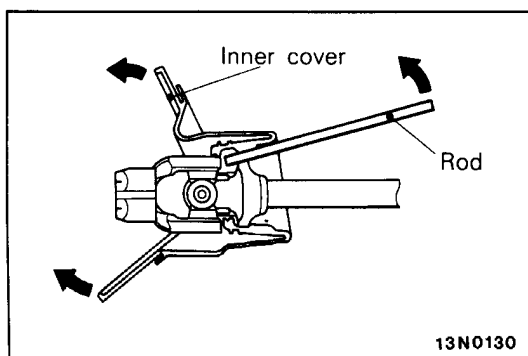
2. REMOVAL OF BOOT

- (1) Apply grease to the inside lip of the boot.
- (2) Remove the boot while using a rod to widen the lip section.



6. REMOVAL OF INNER COVER

- (1) Apply grease to the inside lip of the inner cover.
- (2) Cover the joint while using a rod to widen the lip section.



- (3) While using the rod to widen the inner cover from behind, pull the cover to remove it from the joint.

### 9. REMOVAL OF STEERING LOCK BRACKET/10. STEERING LOCK CYLINDER

If it is necessary to remove the steering lock cylinder, use a hacksaw to cut the special bolts at the steering lock bracket side.

### SERVICE POINTS OF REASSEMBLY

E37HHAK

### 10. INSTALLATION OF STEERING LOCK CYLINDER/9. STEERING LOCK BRACKET/ 8. SPECIAL BOLT

- (1) When installing the steering lock and steering lock bracket to the column tube, temporarily install the steering lock in alignment with the column boss.
- (2) After checking that the lock works properly, tighten the special bolts until the head twists off.

#### Caution

The steering lock bracket and bolts must be replaced with new ones when the steering lock is installed.

### 6. INSTALLATION OF INNER COVER

Cover the inside lip of the inner cover with grease and pull the outside of the cover onto the joint.

### 5. INSTALLATION OF BEARING

- (1) Fill the inside of the bearing with multipurpose grease.
- (2) Install the bearings to the shaft on the joint assembly.
- (3) Wrap vinyl tape approximately one and one-half times around the concave circumferences of the bearings, and then press fit the bearings into the cover assembly.

# POWER STEERING GEAR BOX

## REMOVAL AND INSTALLATION

**CAUTION: SRS**

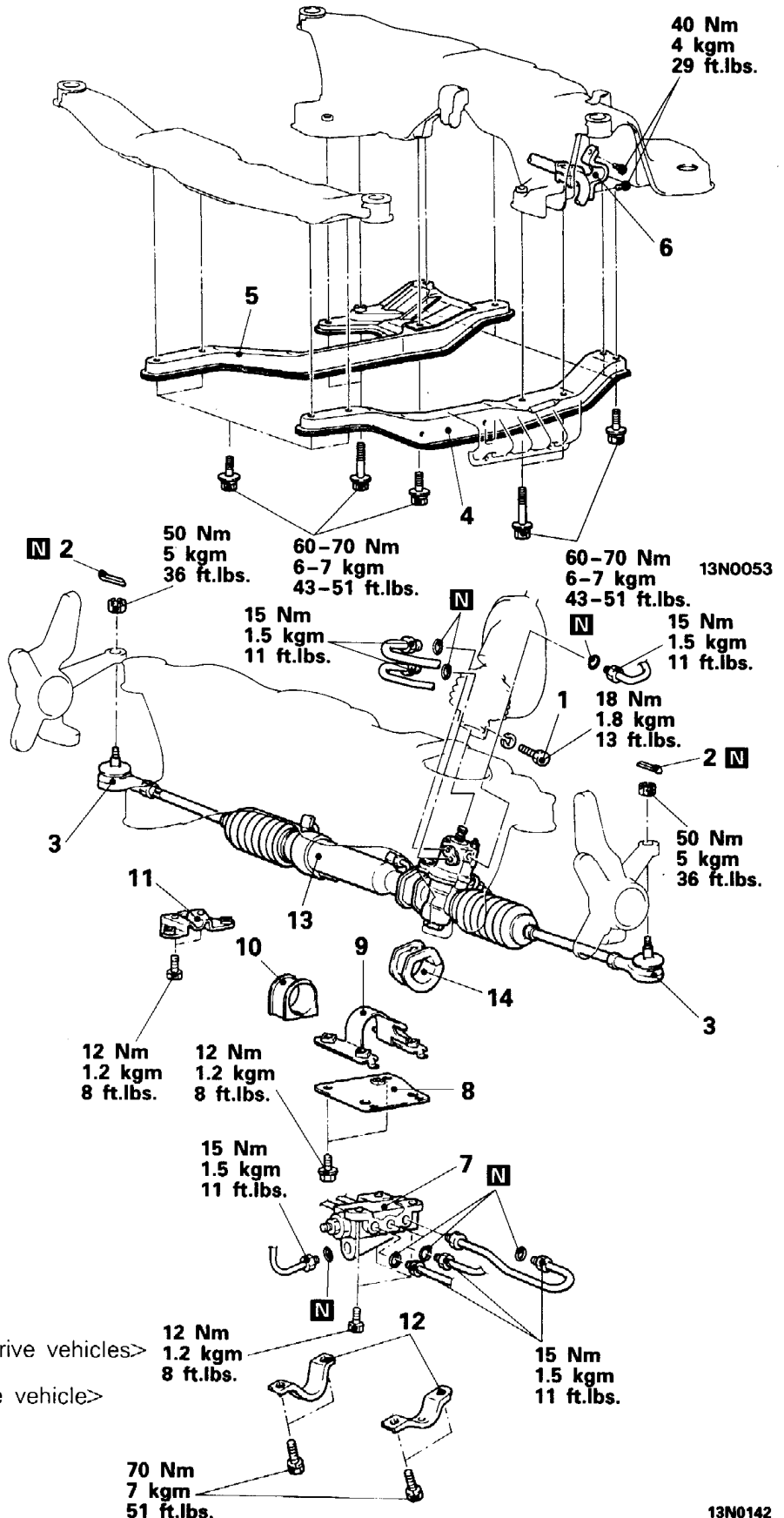
For vehicles with SRS, before removal of steering gear box, refer to GROUP 52B - SRS, center front wheels and remove ignition key. Failure to do so may damage SRS clock spring and render SRS system inoperative, risking serious driver injury.

**Pre-removal Operation**

- Draining of the Power Steering Fluid (Refer to P.37A-18)
- Removal of Front Exhaust Pipe (Refer to GROUP 15 – Exhaust Pipe and Main Muffler.)

**Post-installation Operation**

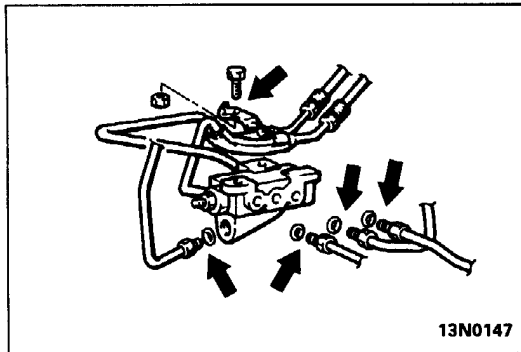
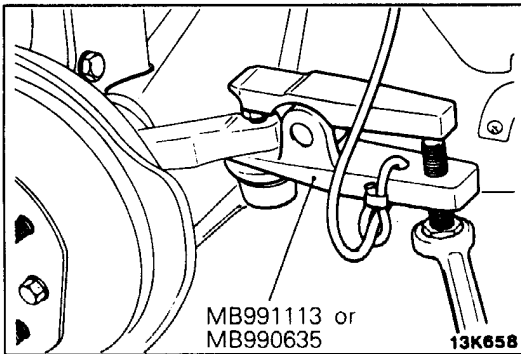
- Installation of Front Exhaust Pipe (Refer to GROUP 15 – Exhaust Pipe and Main Muffler.)
- Supplying of the Power Steering Fluid (Refer to P.37A-18)
- Bleeding of the Power Steering Fluid Line (Refer to P.37A-18)
- Checking of Steering Wheel Position with Wheels Straight Ahead
- Adjustment of the Front Wheel Alignment (Refer to GROUP 33A – Service Adjustment Procedures.)



**Removal steps**

1. Joint assembly and gear box connecting bolt
2. Split pin
3. Tie-rod end and knuckle connecting nut
4. Left member
5. Right member
6. Stabilizer bar bracket
7. Control valve
8. Plate
9. Valve bracket } <L.H. drive vehicles>
10. Cylinder holder } <L.H. drive vehicles>
11. Valve bracket <R.H. drive vehicle>
12. Clamp
13. Gear box assembly
14. Mounting rubber





**SERVICE POINTS OF REMOVAL**

E37PBAF

**3. DISCONNECTION OF TIE-ROD END**

**7. REMOVAL OF CONTROL VALVE**

Remove the connections shown in the diagram and remove the control valve from the gear housing. Secure the control valve to the crossmember with wire, etc.

**13. REMOVAL OF GEAR BOX ASSEMBLY**

- (1) Move the rack completely to the right and pull the left-side tie-rod from the crossmember.
- (2) While tilting the left side of the gear box downward, remove it to the left.

**NOTE**

Remove the gear box to opposite direction for right-hand drive vehicles.

**Caution**

**When removing the gear box, pull it out carefully and slowly to avoid damaging the boots.**

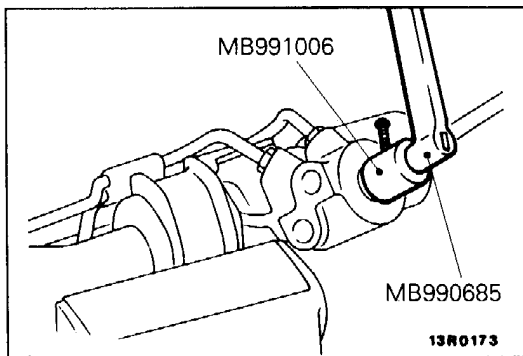
**INSPECTION**

E37PCAG

**GEAR BOX FOR TOTAL PINION PRELOAD**

Using the special tools, rotate the pinion gear at the rate of one rotation in approximately 4 to 6 seconds to check the total pinion preload.

**Standard value:**



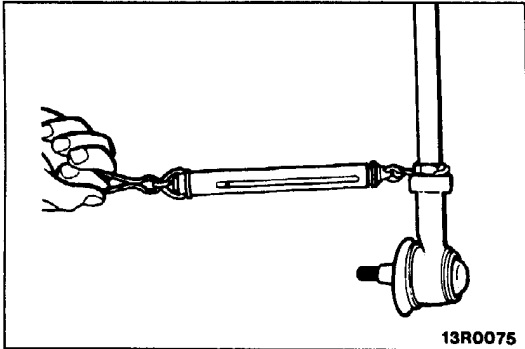
		Total pinion preload	Change in torque
Conventional power steering gear box	0°(Neutral position)–60°	1.3–1.8 Nm (13–18 kgcm, 11 –16 in.lbs.)	0.3 Nm (3 kgcm, 3 in.lbs.)
	60°–180°	0.7–1.2 Nm (7–12 kgcm, 6–10 in.lbs.)	0.3 Nm (3 kgcm, 3 in.lbs.)
E.P.S. gear box	Vehicles without 4WS	1.3 Nm (13 kgcm, 11 in.lbs.)	0.3 Nm (3 kgcm, 3 in.lbs.)
	Vehicles with 4WS	0.7–1.6 Nm (7–16 kgcm, 6–14 in.lbs.)	0.5 Nm (5 kgcm, 4 in.lbs.)

NOTE

Measure the pinion preload through the whole stroke of the rack.

If the measured value is not within the standard range, first adjust the rack support cover, and then check the total pinion starting torque again.

If the total pinion starting torque cannot be adjusted to within the standard range by adjusting the rack support cover, check the rack support cover, rack support spring, rack support and replace any parts necessary.



**CHECK THE TIE ROD FOR SWING RESISTANCE**

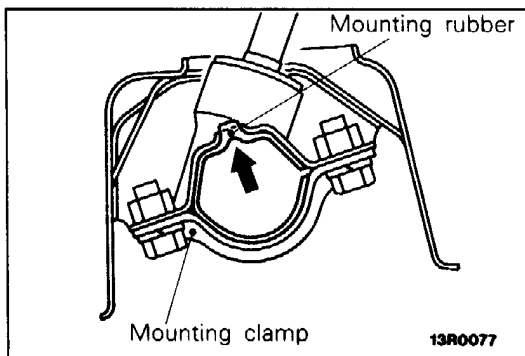
- (1) Give 10 hard swings to the tie rod.
- (2) Measure the tie rod swing resistance with a spring balance.

**Standard value: 8–20 N (0.8–2.0 kg, 1.9–4.6 lbs.)  
[2–5 Nm (20–50 kgcm, 17–43 in.lbs.)]**

- (3) If the measured value exceeds the standard value, replace tie rod assembly.

NOTE

Even if the measured value is below the standard value, the tie rod which swings smoothly without excessive play may be used.



**SERVICE POINTS OF INSTALLATION**

E37PDAB

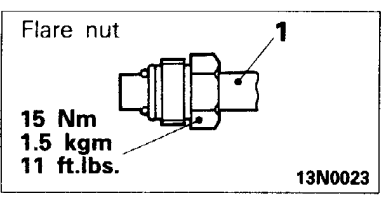
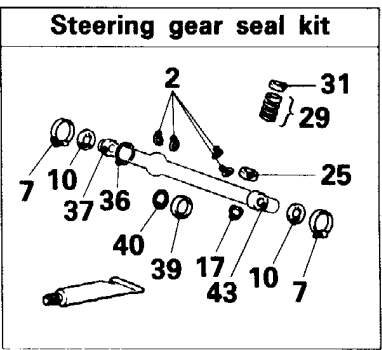
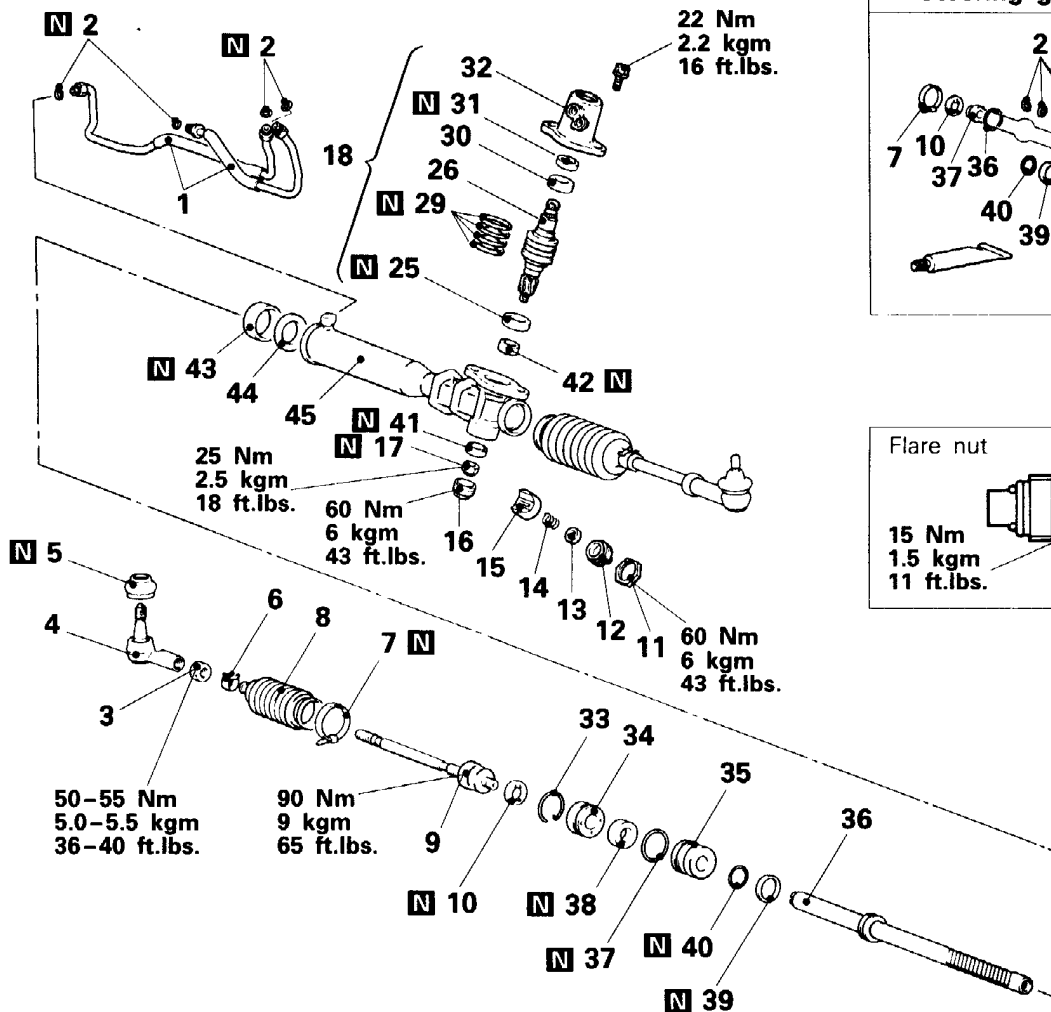
**14. INSTALLATION OF MOUNTING RUBBER/13. GEAR BOX ASSEMBLY**

When installing the mounting rubber, align the projection of the mounting rubber with the indentation in the crossmember to install the gear box.

DISASSEMBLY AND REASSEMBLY

E37PE--

<Conventional power steering gear box >



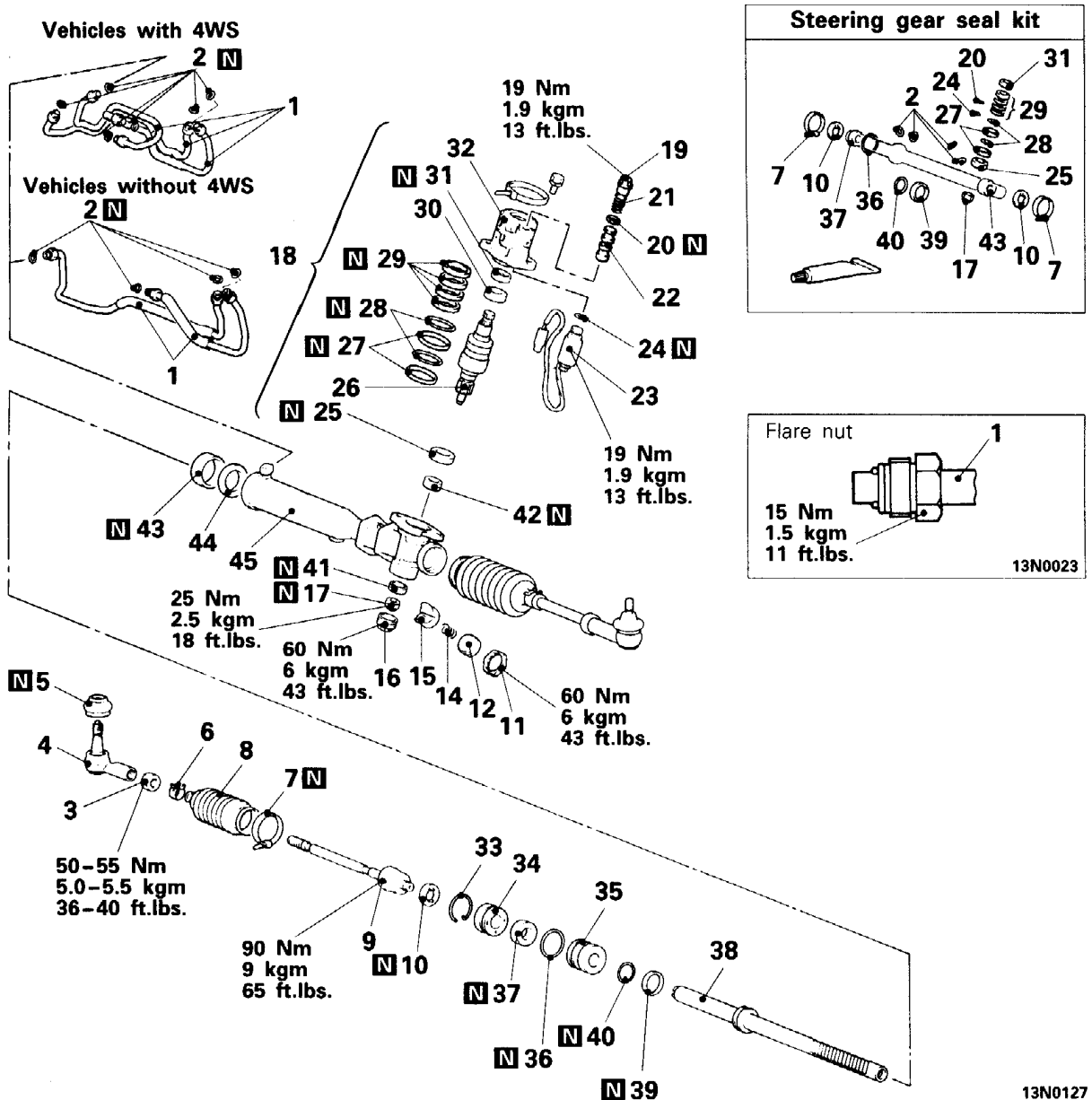
13N0126

Disassembly steps

- 1. Feed tube
- 2. O-ring
- 3. Tie rod end locking nut
- ◆◆ 4. Tie rod end
- ◆◆ 5. Dust cover
- ◆◆ 6. Bellows clip
- ◆◆ 7. Bellows band
- ◆◆ 8. Bellows
- ◆◆ 9. Tie rod
- ◆◆◆ 10. Tab washer
- ◆◆◆ Adjustment of total pinion torque
- ◆◆◆ 11. Locking nut
- ◆◆◆ 12. Rack support cover
- ◆◆◆ 13. Cushion rubber
- ◆◆◆ 14. Rack support spring
- ◆◆◆ 15. Rack support
- ◆◆◆ 16. End plug
- ◆◆◆ 17. Self-locking nut
- ◆◆◆ 18. Valve housing assembly

- ◆◆◆◆ 25. Oil seal
- ◆◆◆◆ 26. Pinion and valve assembly
- ◆◆◆◆ 29. Seal ring
- ◆◆◆◆ 30. Ball bearing
- ◆◆◆◆ 31. Oil seal
- ◆◆◆◆ 32. Valve housing
- ◆◆◆◆ 33. Circlip
- ◆◆◆◆ 34. Rack stopper
- ◆◆◆◆ 35. Rack bushing
- ◆◆◆◆ 36. Rack
- ◆◆◆◆ 37. O-ring
- ◆◆◆◆ 38. Oil seal
- ◆◆◆◆ 39. Seal ring
- ◆◆◆◆ 40. O-ring
- ◆◆◆◆ 41. Ball bearing
- ◆◆◆◆ 42. Needle roller bearing
- ◆◆◆◆ 43. Oil seal
- ◆◆◆◆ 44. Back-up washer
- ◆◆◆◆ 45. Rack housing

<E.P.S. gear box>

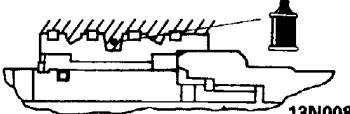


**Disassembly steps**

- |                                     |                               |                           |
|-------------------------------------|-------------------------------|---------------------------|
| 1. Feed tube                        | 15. Rack support              | 30. Ball bearing          |
| 2. O-ring                           | 16. End plug                  | 31. Oil seal              |
| 3. Tie rod end locking nut          | 17. Self-locking nut          | 32. Valve housing         |
| 4. Tie rod end                      | 18. Valve housing assembly    | 33. Circlip               |
| 5. Dust cover                       | 19. P.C.V. cap                | 34. Rack stopper          |
| 6. Bellows clip                     | 20. O-ring                    | 35. Rack bushing          |
| 7. Bellows band                     | 21. P.C.V. spring             | 36. Rack                  |
| 8. Bellows                          | 22. Solenoid valve            | 37. O-ring                |
| 9. Tie rod                          | 23. P.C.V.                    | 38. Oil seal              |
| 10. Tab washer                      | 24. O-ring                    | 39. Seal ring             |
| • Adjustment of total pinion torque | 25. Oil seal                  | 40. O-ring                |
| 11. Locking nut                     | 26. Pinion and valve assembly | 41. Ball bearing          |
| 12. Rack support cover              | 27. Seal ring                 | 42. Needle roller bearing |
| 14. Rack support spring             | 28. O-ring                    | 43. Oil seal              |
|                                     | 29. Seal ring                 | 44. Back-up washer        |
|                                     |                               | 45. Rack housing          |

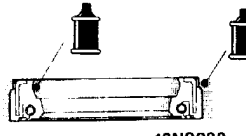
LUBRICATION AND SEALING POINTS

<Conventional power steering gear box>



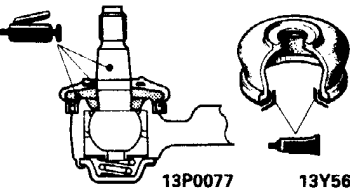
13N0087

Fluid:  
Automatic transmission fluid  
DEXRON or DEXRON II



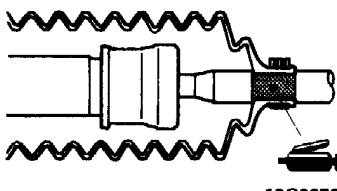
13N0022

Fluid:  
Automatic transmission  
fluid DEXRON or  
DEXRON II



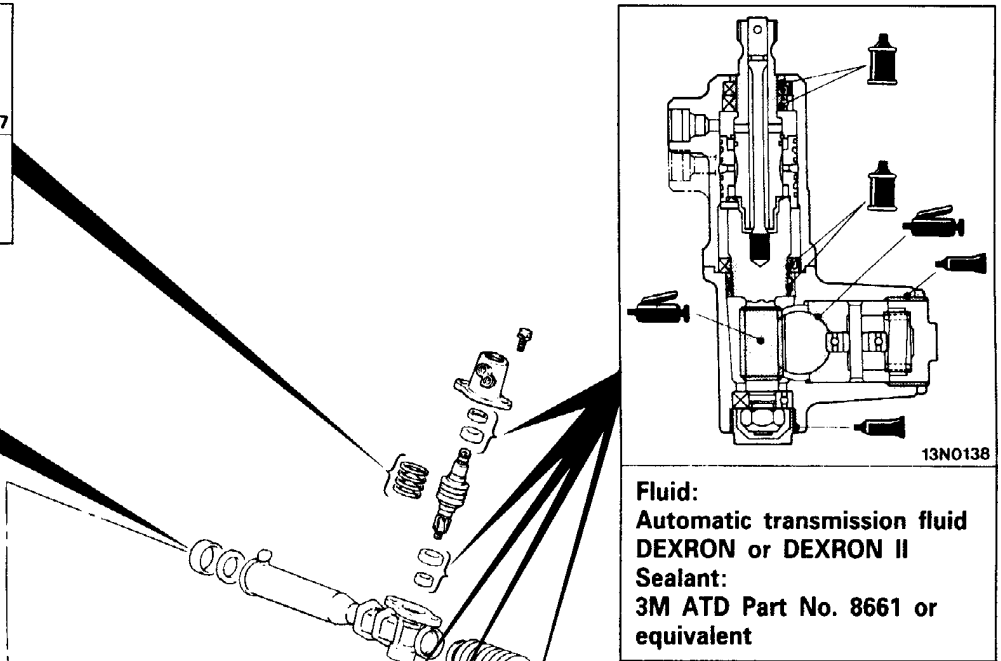
13P0077 13Y564

Sealant:  
3M ATD Part No. 8661 or  
equivalent



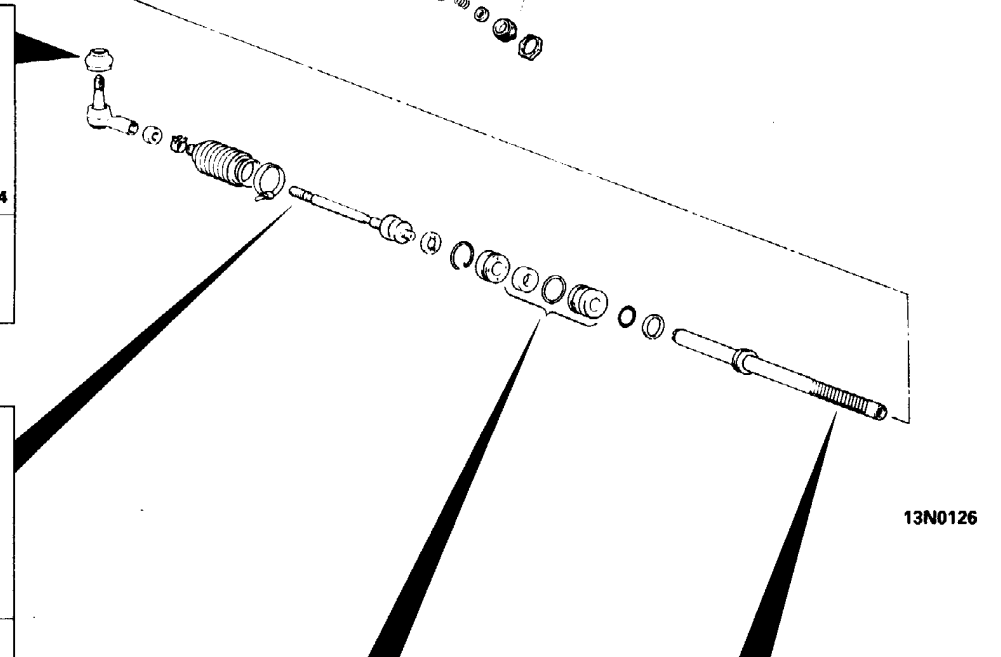
13G0070

Grease: Silicone grease

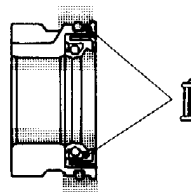


13N0138

Fluid:  
Automatic transmission fluid  
DEXRON or DEXRON II  
Sealant:  
3M ATD Part No. 8661 or  
equivalent

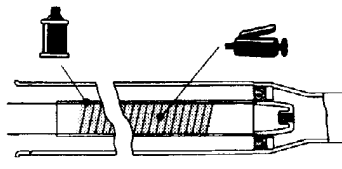


13N0126



13N0019

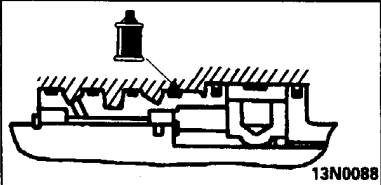
Fluid:  
Automatic transmission fluid  
DEXRON or DEXRON II



13G0186

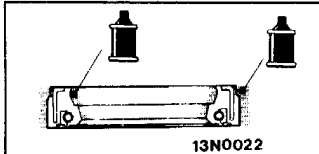
Fluid:  
Automatic transmission fluid  
DEXRON or DEXRON II

<E.P.S. gear box>



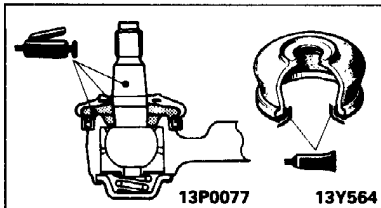
13N0088

Fluid:  
Automatic transmission fluid  
DEXRON or DEXRON II



13N0022

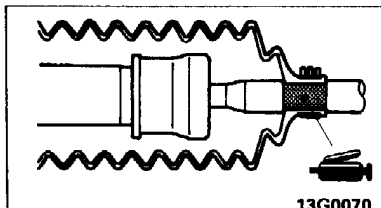
Fluid:  
Automatic transmission fluid  
DEXRON or  
DEXRON II



13P0077

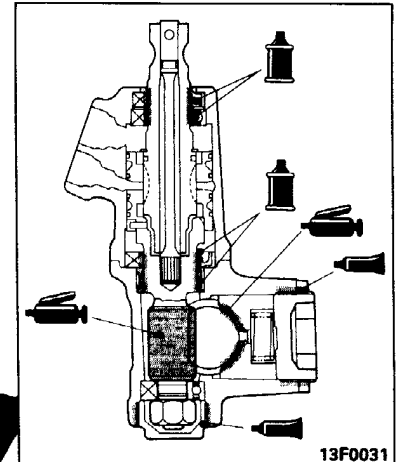
13Y564

Sealant:  
3M ATD Part No. 8661 or  
equivalent



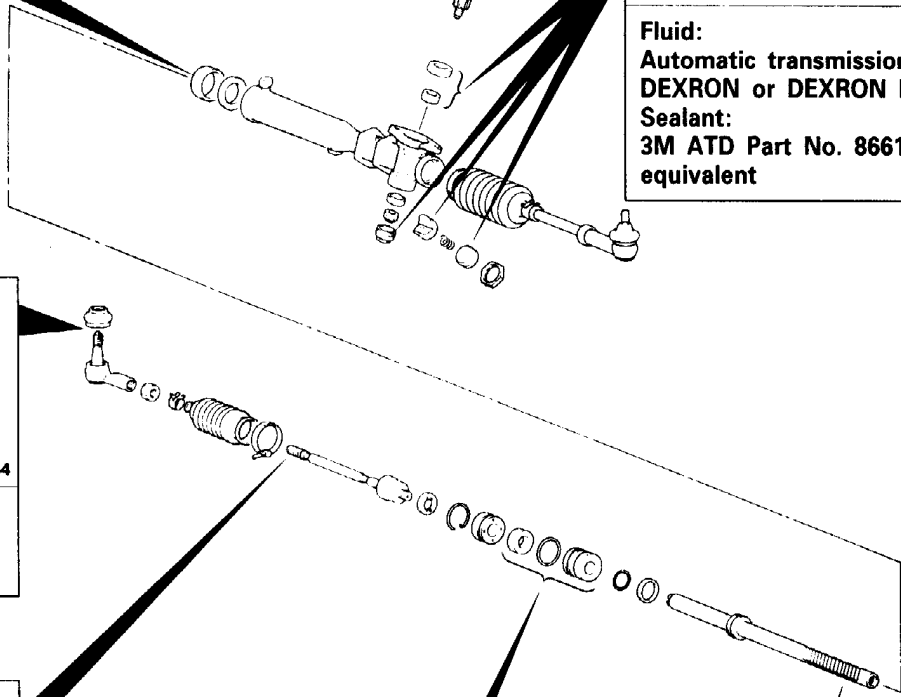
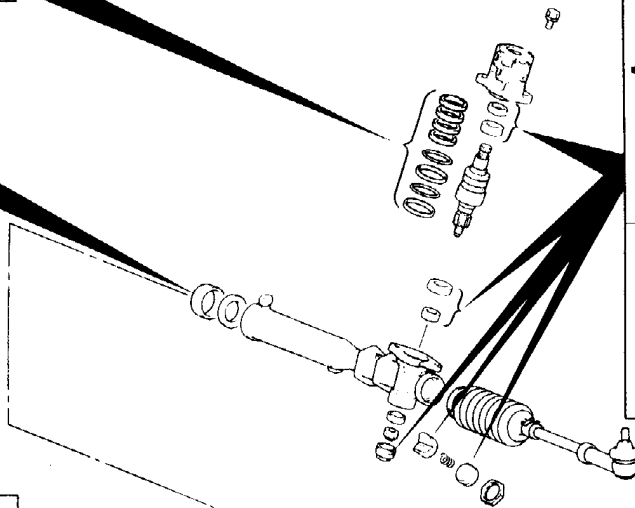
13G0070

Grease: Silicone grease

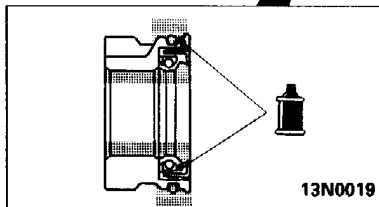


13F0031

Fluid:  
Automatic transmission fluid  
DEXRON or DEXRON II  
Sealant:  
3M ATD Part No. 8661 or  
equivalent

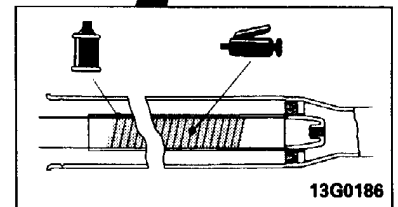


13N0127



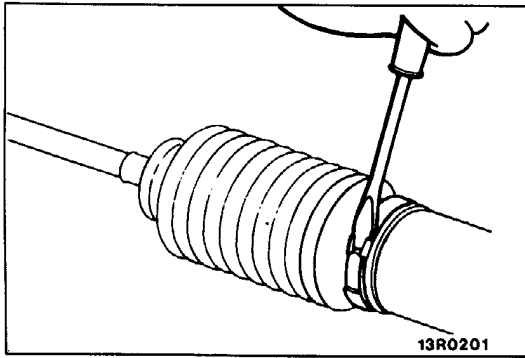
13N0019

Fluid:  
Automatic transmission fluid  
DEXRON or DEXRON II



13G0186

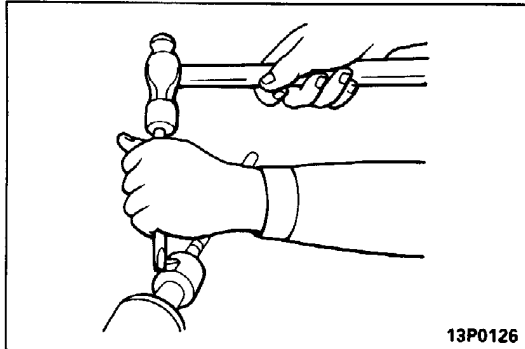
Fluid:  
Automatic transmission fluid  
DEXRON or DEXRON II

**SERVICE POINTS OF DISASSEMBLY**

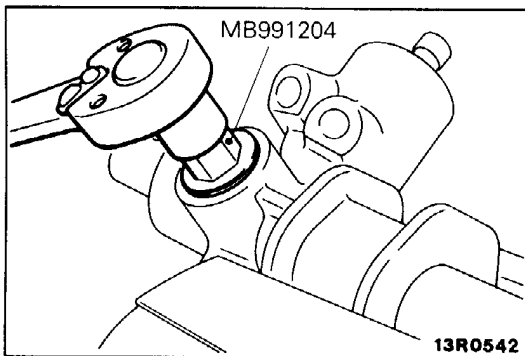
E37PFAK

**7. REMOVAL OF BELLOWS BANDS**

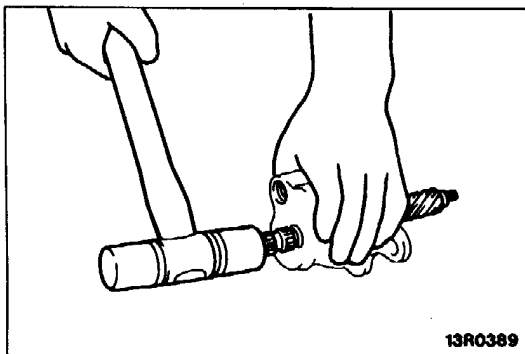
Using a screwdriver or similar tool, loosen and then remove the boot retaining band.

**10. REMOVAL OF TAB WASHER**

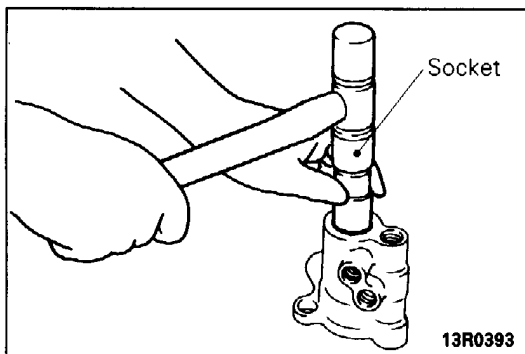
Unstake the tab washer which fixes the tie rod and rack with a chisel.

**12. REMOVAL OF RACK SUPPORT COVER**

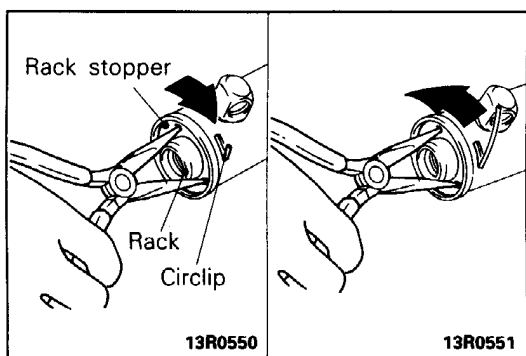
Using the special tool, remove the rack support cover from the gear box.

**25. REMOVAL OF OIL SEAL/26. PINION AND VALVE ASSEMBLY**

Using a plastic hammer, gently tap the pinion to remove it.

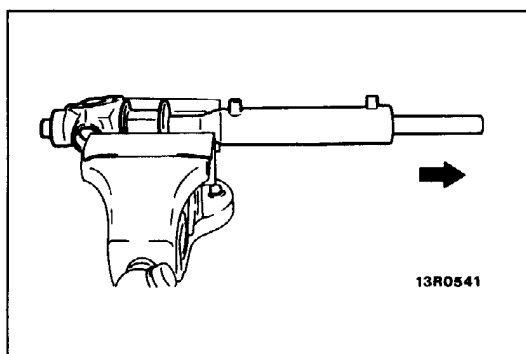
**30. REMOVAL OF BALL BEARING/31. OIL SEAL**

Using a socket, remove the oil seal and the ball bearing from the valve housing simultaneously.



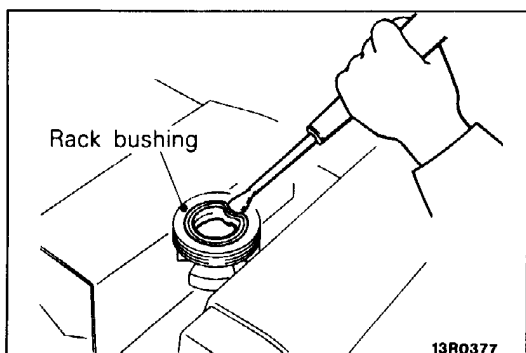
### 33. REMOVAL OF CIRCLIP

- (1) Turn the rack stopper clockwise until the end of the circlip comes out of the slot in the rack housing.
- (2) Turn the rack stopper anticlockwise to remove the circlip.



### 36. REMOVAL OF RACK

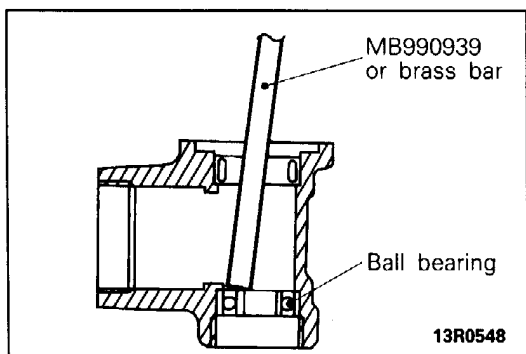
Pull out the rack slowly.  
At this time also take out the rack stopper and the rack bushing simultaneously.



### 38. REMOVAL OF OIL SEAL

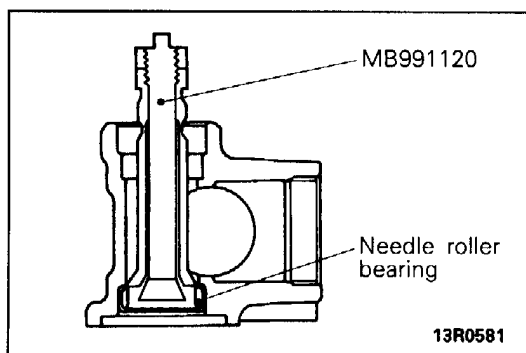
Partially bend oil seal and remove from rack bushing.

**Caution**  
**Do not damage oil seal press fitting surface.**



### 41. REMOVAL OF BALL BEARING

Use a brass bar or special tool to remove the ball bearing from the gear housing.

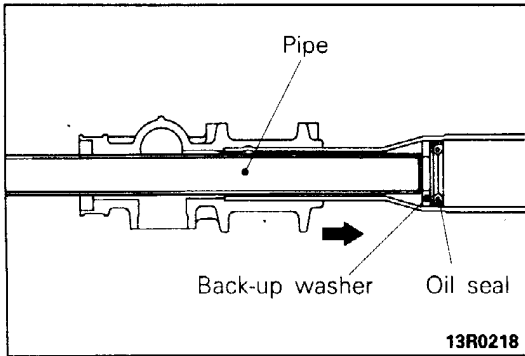


### 42. REMOVAL OF NEEDLE ROLLER BEARING

Use the special tool to remove the needle roller bearing from the rack housing.

**Caution**  
**Do not open special tool excessively to prevent damaging housing interior.**



**43. REMOVAL OF OIL SEAL/44. BACK-UP WASHER**

Use a piece of pipe or similar tool to remove the back-up washer and oil seal from the gear housing.

**Caution**

**Be careful not to damage the inner surface of the rack cylinder of the gear housing.**

**INSPECTION**

E37PGAG

**RACK**

- Check the rack tooth surfaces for damage or wear.
- Check the oil seal contact surfaces for uneven wear.
- Check the rack for bends.

**PINION AND VALVE ASSEMBLY**

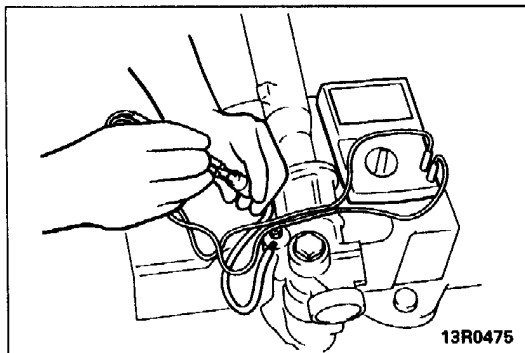
- Check the pinion gear tooth surfaces for damage or wear.
- Check for worn or defective seal ring.

**BEARING**

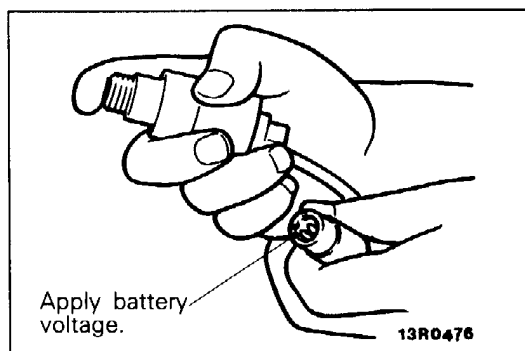
- Check for roughness or abnormal noise during bearing operation.
- Check the bearing for play.
- Check the needle roller bearings for roller slip-off.

**OTHERS**

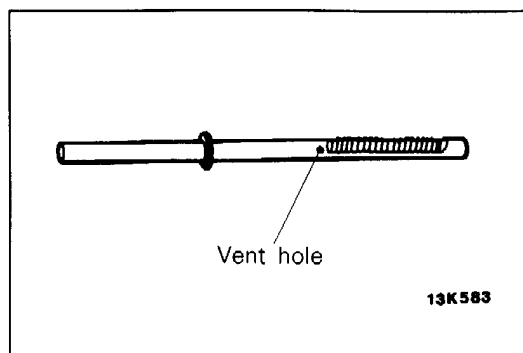
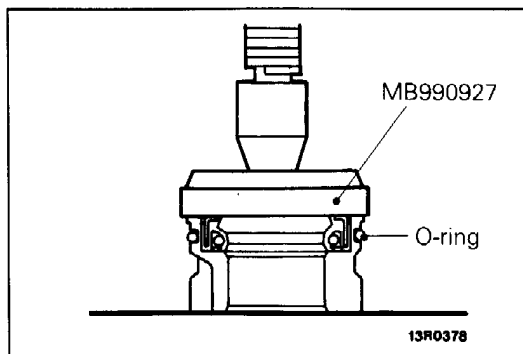
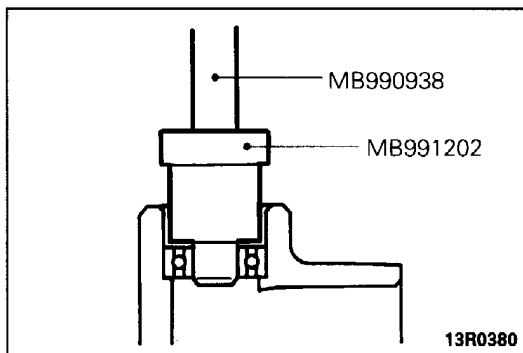
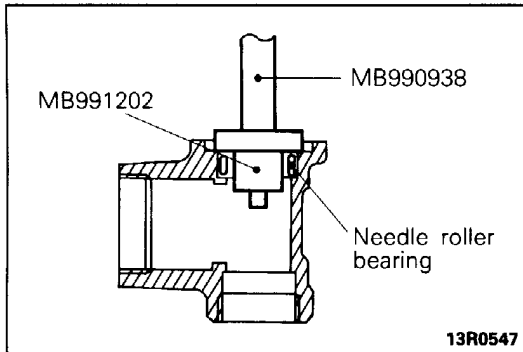
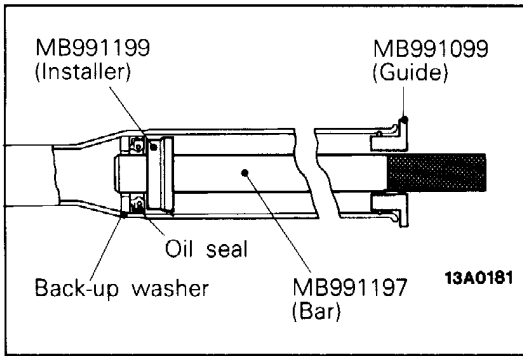
- Check the cylinder inner surface of the rack housing for damage.
- Check the boots for damage, cracking or deterioration.
- Check the rack support for uneven wear or dents.
- Check the rack bushing for uneven wear or damage.

**SOLENOID VALVE**

- (1) Remove the solenoid valve connector, and then check whether or not there is continuity between the two terminals.



- (2) While pressing the solenoid end inward by using a finger, connect to the battery and then check whether or not the solenoid is pushed out.



**SERVICE POINTS OF REASSEMBLY**

E37PHA0

**44. INSTALLATION OF BACK-UP WASHER/43. OIL SEAL**

- (1) Apply a coating of the specified fluid to the outside of the oil seal.

**Specified fluid: Automatic transmission fluid DEXRON or DEXRON II**

- (2) Using the special tools, press the back-up washer and the oil seal into the rack housing to the specified position (where the upper surface of press-in guide coincides with the stepped part of the press-in tool).

**42. INSTALLATION OF NEEDLE ROLLER BEARING**

- (1) Apply specified fluid to housing, bearing and oil seal press fitting surface.

**Specified fluid: Automatic transmission fluid DEXRON or DEXRON II**

- (2) Press fit needle roller bearing with special tools.

**Caution**

**Press fit straight as valve housing is aluminum.**

**41. INSTALLATION OF BALL BEARING**

**38. INSTALLATION OF OIL SEAL/37. O-RING**

- (1) Apply a coating of the specified fluid to the outside of the oil seal and o-ring.

**Specified fluid: Automatic transmission fluid DEXRON or DEXRON II**

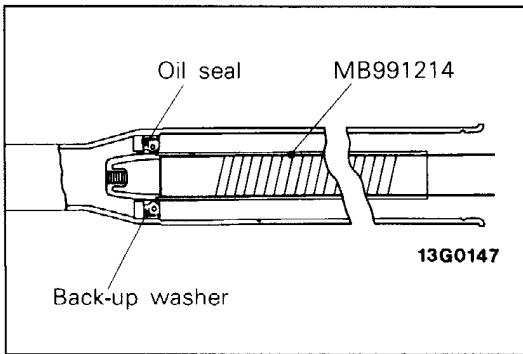
- (2) Use special tool to press fit oil seal until touches rack bush end.

**36. INSTALLATION OF RACK**

- (1) Apply a coating of multipurpose grease to the rack teeth face.

**Caution**

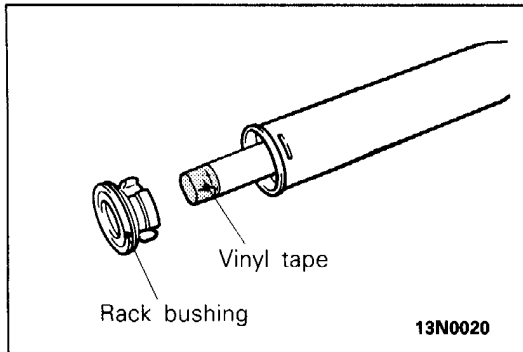
**Do not close the vent hole in the rack with grease.**



- (2) Cover rack serrations with special tool.
- (3) Apply specified fluid on special tool.

**Specified fluid: Automatic transmission fluid DEXRON or DEXRON II**

- (4) Match oil seal centre with rack to prevent retainer spring from slipping and slowly insert rack from power cylinder side.



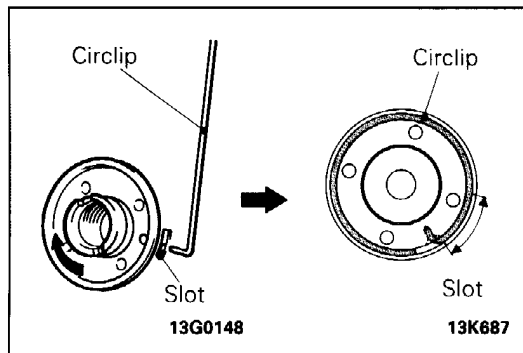
**35. INSTALLATION OF RACK BUSHING ASSEMBLY**

Wrap the rack end with vinyl tape, apply a coating of the specified fluid, and then install the rack bushing and rack stopper.

**Specified fluid: Automatic transmission fluid DEXRON or DEXRON II**

**Caution**

**Do not allow oil seal retainer spring to slip out.**

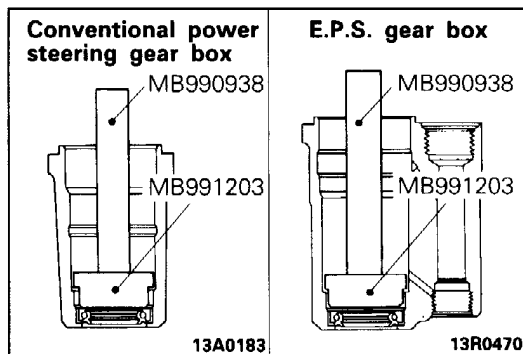


**33. INSTALLATION OF CIRCLIP**

Insert circlip to rack stopper hole through cylinder hole. Turn rack stopper clockwise and insert circlip firmly.

**Caution**

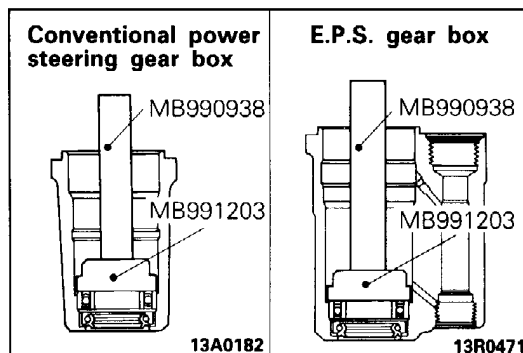
**Insert circlip to rack stopper hole whilst turning rack stopper clockwise.**



**31. INSTALLATION OF OIL SEAL**

Apply a coating of the specified fluid to the outside of the oil seal. Using the special tools, press the oil seal into the valve housing.

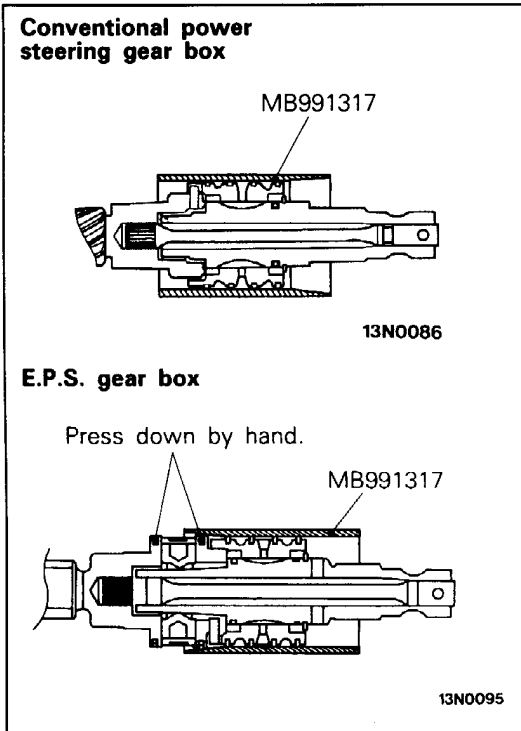
**Specified fluid: Automatic transmission fluid DEXRON or DEXRON II**



**30. INSTALLATION OF BALL BEARING**

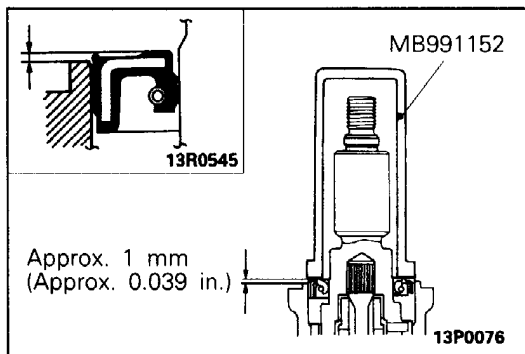
Apply a coating of the specified fluid to the outside of the ball bearing. Using the special tools, press the oil seal into the valve housing.

**Specified fluid: Automatic transmission fluid DEXRON or DEXRON II**



**29./27. INSTALLATION OF SEAL RING**

Because the seal rings expand at the time of installation, tighten after installation by using the special tool to compress the rings, or press down by hand.

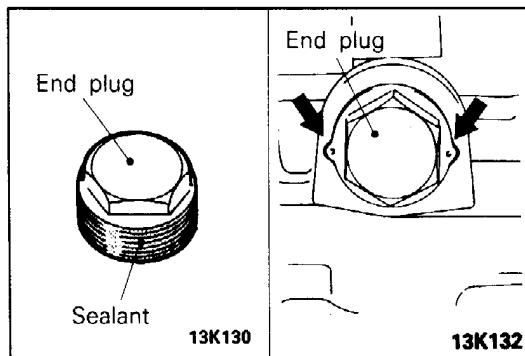


**25. INSTALLATION OF OIL SEAL**

Using the special tool, press the oil seal into the valve housing.

**Caution**

**In order to eliminate a seal malfunction at the valve housing alignment surface, the upper surface of the oil seal should project outward approximately 1 mm (0.039 in.) from the housing edge surface.**



**16. INSTALLATION OF END PLUG**

(1) Apply the specified sealant to the threaded part of the end plug.

**Specified sealant: 3M ATD Part No. 8661 or equivalent**

(2) Secure the threaded portion of the end plug at two places by using a punch.

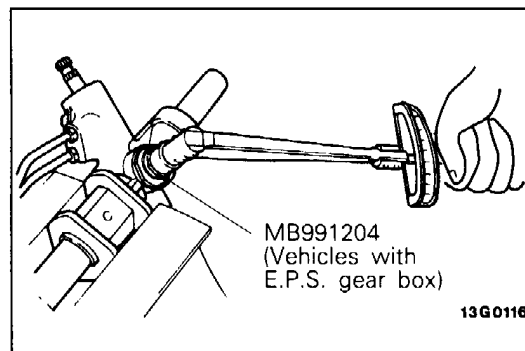
● **ADJUSTMENT OF TOTAL PINION PRELOAD**

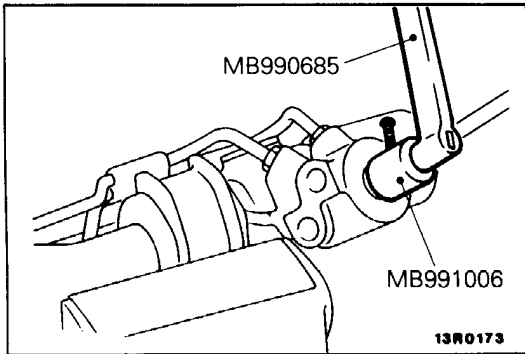
(1) Position rack at its centre. Tighten rack support cover to 15 Nm (1.5 kgm, 11 ft.lbs.).

**NOTE**

For an E.P.S. gear box, use the special tool.

(2) In neutral position, rotate pinion shaft clockwise one turn/4–6 seconds with special tool. Return rack support cover 30°–60° and adjust torque to the standard value.





- (3) Using the special tools, rotate the pinion gear at the rate of one rotation in approximately 4 to 6 seconds to check the total pinion preload.

**Standard value:**

		Total pinion preload	Change in torque
Conventional power steering gear box	0° (Neutral position)–60°	1.3–1.8 Nm (13–18 kgcm, 11–16 in.lbs.)	0.3 Nm (3 kgcm, 3 in.lbs.)
	60°–180°	0.7–1.2 Nm (7–12 kgcm, 6–10 in.lbs.)	0.3 Nm (3 kgcm, 3 in.lbs.)
E.P.S. gear box	Vehicles without 4WS	1.3 Nm (13 kgcm, 11 in.lbs.)	0.3 Nm (3 kgcm, 3 in.lbs.)
	Vehicles with 4WS	0.7–1.6 Nm (7–16 kgcm, 6–14 in.lbs.)	0.5 Nm (5 kgcm, 4 in.lbs.)

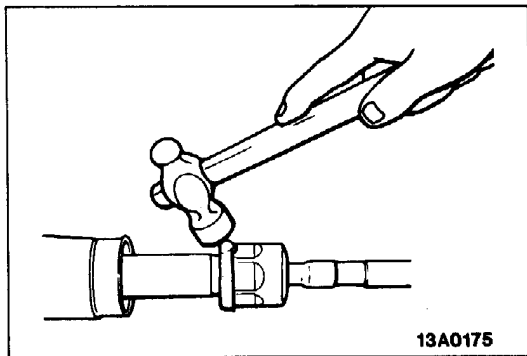
**Caution**

1. When adjusting, set the standard value at its highest value.
2. Assure no ratcheting or catching when operating rack towards the shaft direction.

**NOTE**

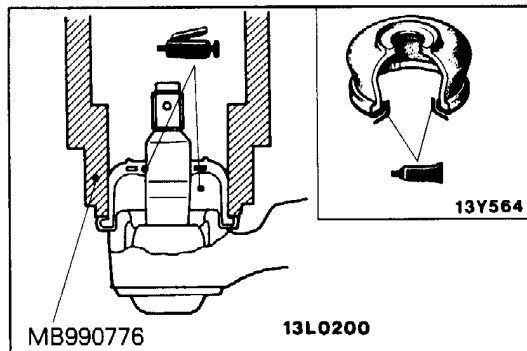
When it cannot be adjusted within the specified return angle, check rack support cover components or replace.

- (4) After adjusting, lock rack support cover with lock nut.



**10. INSTALLATION OF TAB WASHER/9. TIE ROD**

After installing tie-rod to rack, fold tab washer end (2 locations) to tie rod notch.

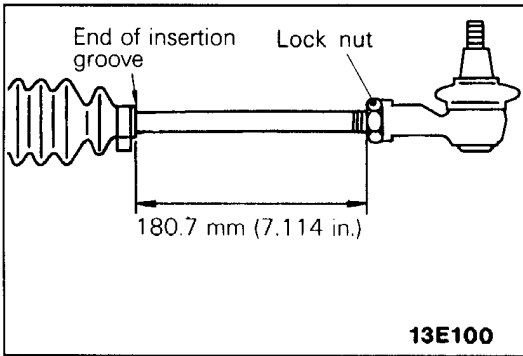


**5. INSTALLATION OF DUST COVER**

- (1) Pack dust cover interior with multipurpose grease.
- (2) Apply specified sealant to dust cover lip.

**Specified sealant: 3M ATD Part No. 8661 or equivalent**

- (3) Using the special tool, install the dust cover to the tie rod end ball joint.



4. INSTALLATION OF TIE ROD END

Screw in tie-rod end to have its right and left length as illustrated. Lock with lock nut.

POWER STEERING OIL PUMP  
REMOVAL AND INSTALLATION

E37RA--

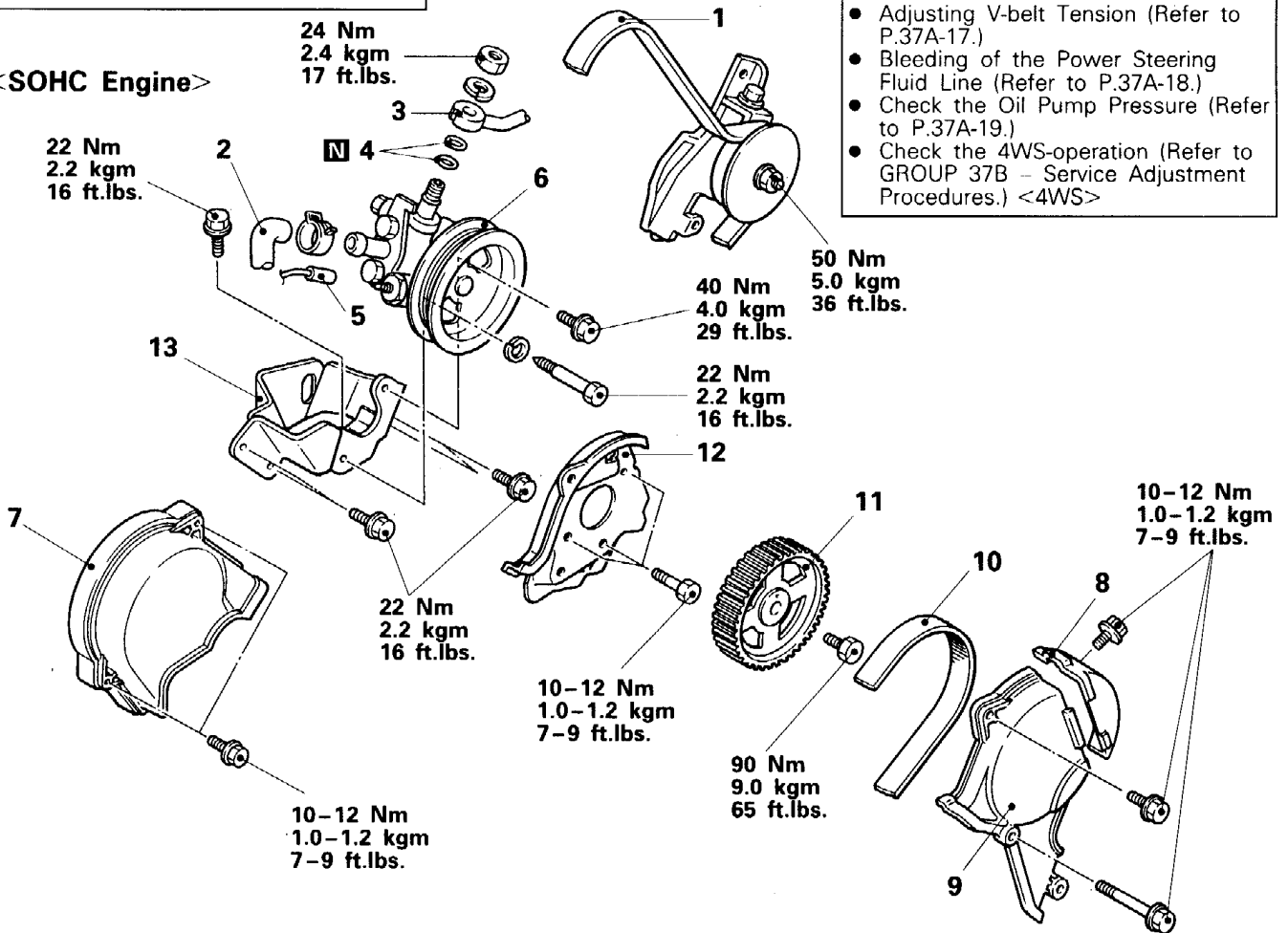
Pre-removal Operation

- Draining of the Power Steering Fluid

Post-installation Operation

- Supplying of the Power Steering Fluid
- Adjusting V-belt Tension (Refer to P.37A-17.)
- Bleeding of the Power Steering Fluid Line (Refer to P.37A-18.)
- Check the Oil Pump Pressure (Refer to P.37A-19.)
- Check the 4WS-operation (Refer to GROUP 37B - Service Adjustment Procedures.) <4WS>

<SOHC Engine>

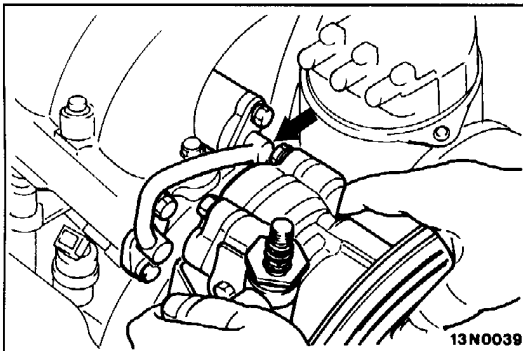
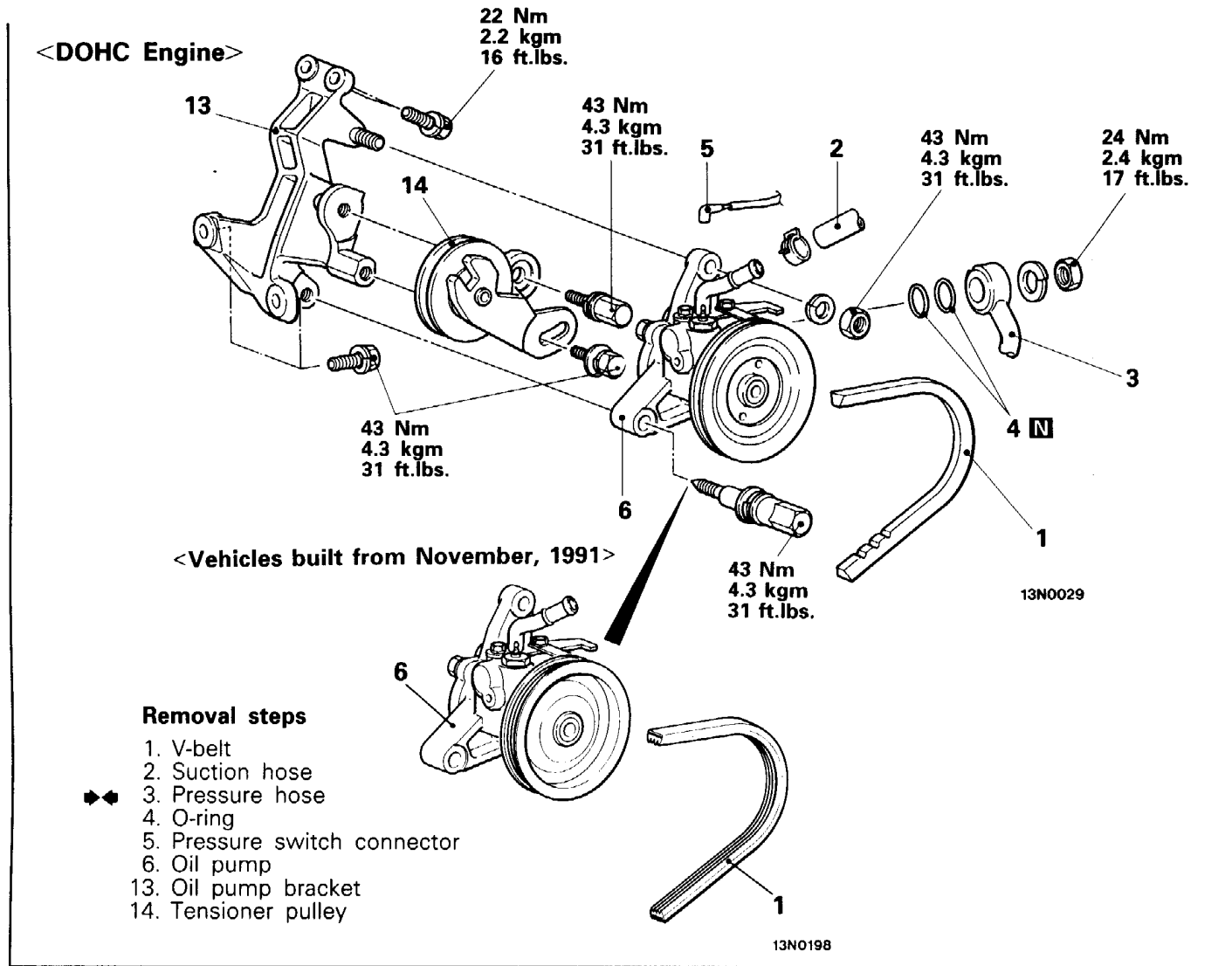


13N0034

Removal steps

1. V-belt
2. Suction hose
3. Pressure hose
4. O-ring
5. Pressure switch connector
6. Oil pump
7. Front timing belt cover, right
8. Timing belt cover cap
9. Front timing belt cover, left
10. Timing belt
11. Camshaft sprocket
12. Rear timing belt cover, left
13. Oil pump bracket

(Refer to GROUP 11 - Timing Belt.)

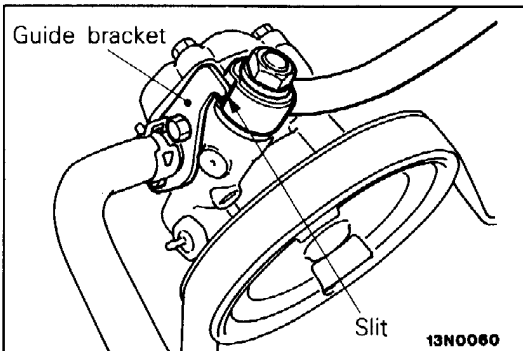


**SERVICE POINTS OF REMOVAL**

E37RBAH

**6. REMOVAL OF OIL PUMP <SOHC Engine>**

- (1) Raise the connector of the oil pressure hose upright and lift it upward.
- (2) Align the concave portion of the pump cover with the fuel pipe, as illustrated, and remove the oil pump.



**SERVICE POINTS OF INSTALLATION**

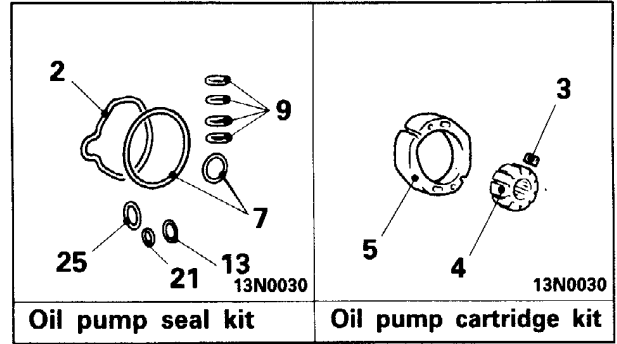
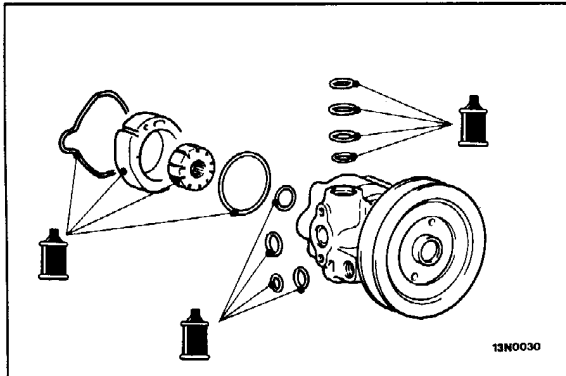
E37RDAJ

**3. INSTALLATION OF PRESSURE HOSE**

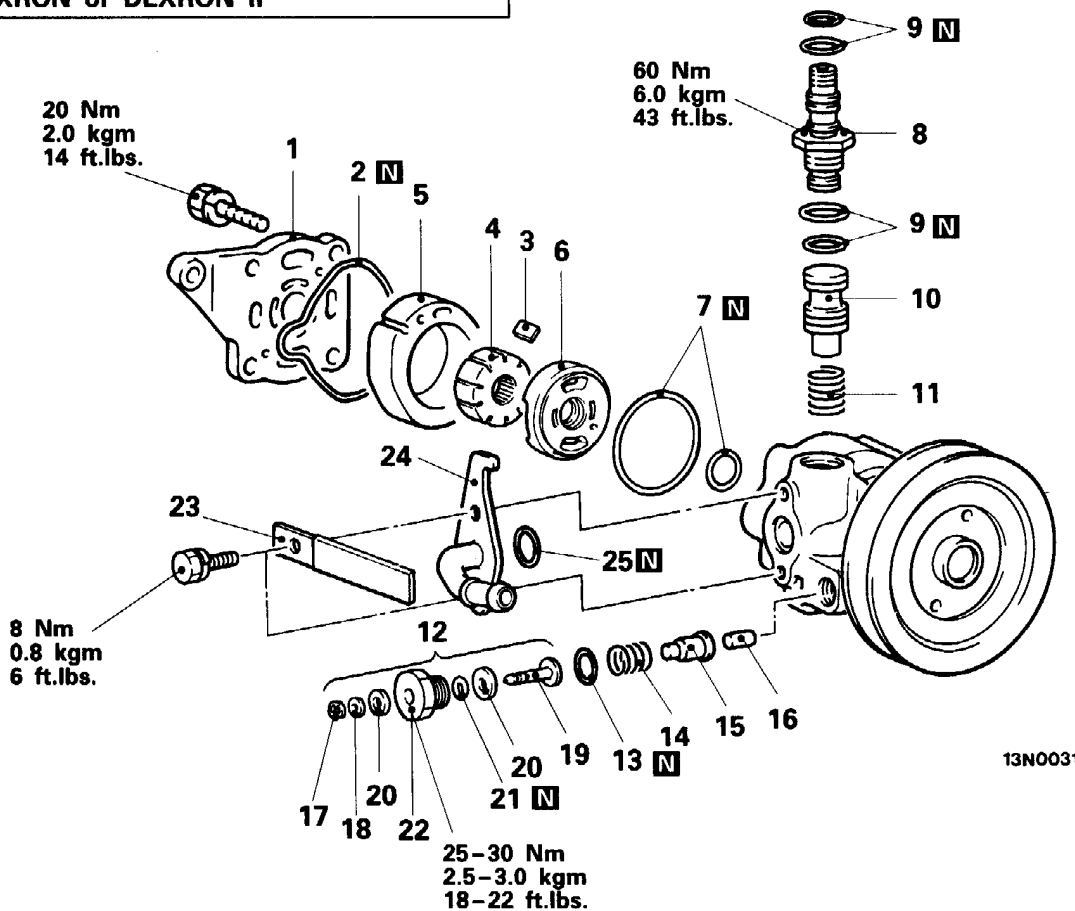
Connect the pressure hose so that its slit part contacts the oil pump's guide bracket.

DISASSEMBLY AND REASSEMBLY

E37RE--



Fluid:  
Automatic transmission fluid  
DEXRON or DEXRON II



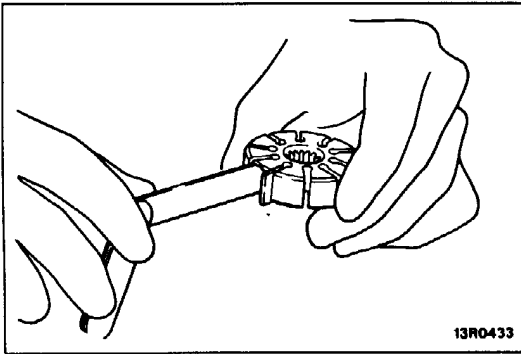
Disassembly steps

- 1. Pump cover
- 2. O-ring
- ◆◆ 3. Vanes
- ◆◆ 4. Rotor
- ◆◆ 5. Cam ring
- ◆◆ 6. Side plate
- ◆◆ 7. O-ring
- ◆◆ 8. Connector
- ◆◆ 9. O-ring
- 10. Flow control valve
- 11. Flow control spring
- 12. Terminal assembly
- ◆◆ 13. O-ring
- ◆◆ 14. Spring

- 15. Plunger
- 16. Piston rod
- 17. Snap ring
- 18. Terminal
- 19. Washer
- 20. Insulator
- ◆◆ 21. O-ring
- ◆◆ 22. Plug
- ◆◆ 23. Clip
- ◆◆ 24. Suction connector
- ◆◆ 25. O-ring
- 26. Oil pump body and Pulley assembly

**Caution**  
Do not disassemble the flow control valve.





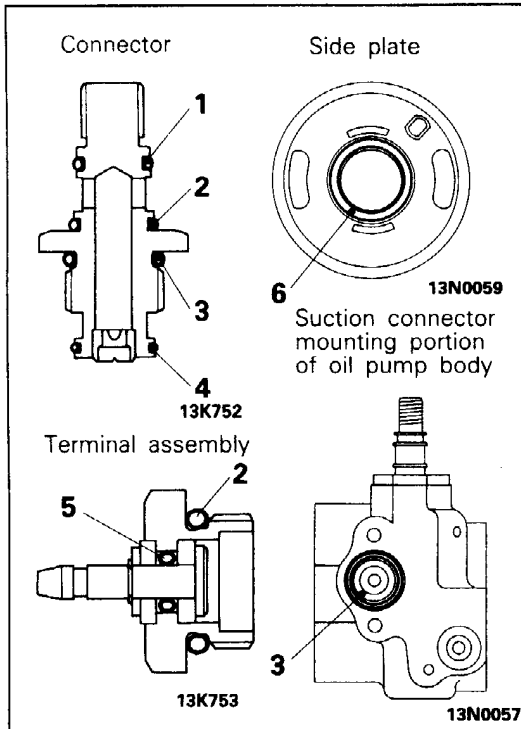
**INSPECTION**

E37RGAG

**CHECK OF GAP BETWEEN VANE AND ROTOR GROOVE**

Install vane to rotor groove as illustrated. Measure the gap between vane and rotor groove with thickness gauge.

**Limit: 0.06 mm (0.0024 in.)**



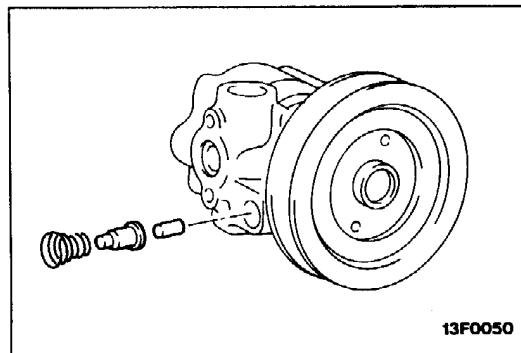
**SERVICE POINTS OF REASSEMBLY**

E37RHAK

**25. 21. 13. 9. 7. INSTALLATION OF O-RINGS**

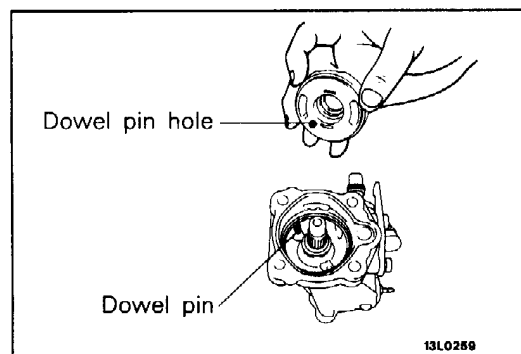
Apply specified fluid on O-rings to install.

No.	I.D. × Width	mm (in.)
1	11 × 1.9	(0.433 × 0.075)
2	13 × 1.9	(0.512 × 0.075)
3	17.8 × 2.4	(0.701 × 0.094)
4	13.5 × 1.5	(0.531 × 0.059)
5	3.8 × 1.9	(0.150 × 0.075)
6	16.8 × 2.4	(0.661 × 0.094)



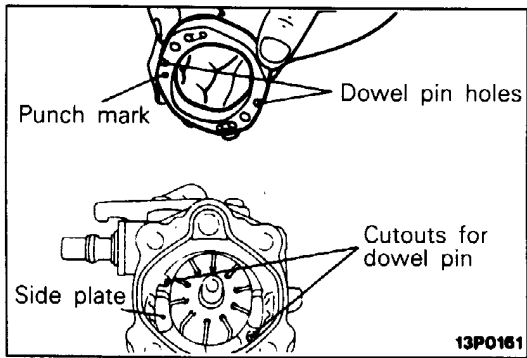
**14. INSTALLATION OF SPRING**

Fit the spring to the oil pump body with the larger-diameter end at the terminal assembly side.



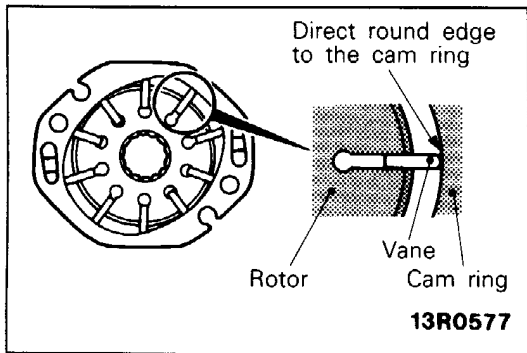
**6. INSTALLATION OF SIDE PLATE**

Line up the dowel pin hole of the side plate with the dowel pin of the pump body when installing the side plate.



**5. INSTALLATION OF CAM RING**

Install the cam ring with the punch mark facing the side plate.



**3. INSTALLATION OF VANES**

Install the vanes on the rotor, paying close attention to the installation direction.

POWER STEERING HOSES

REMOVAL AND INSTALLATION

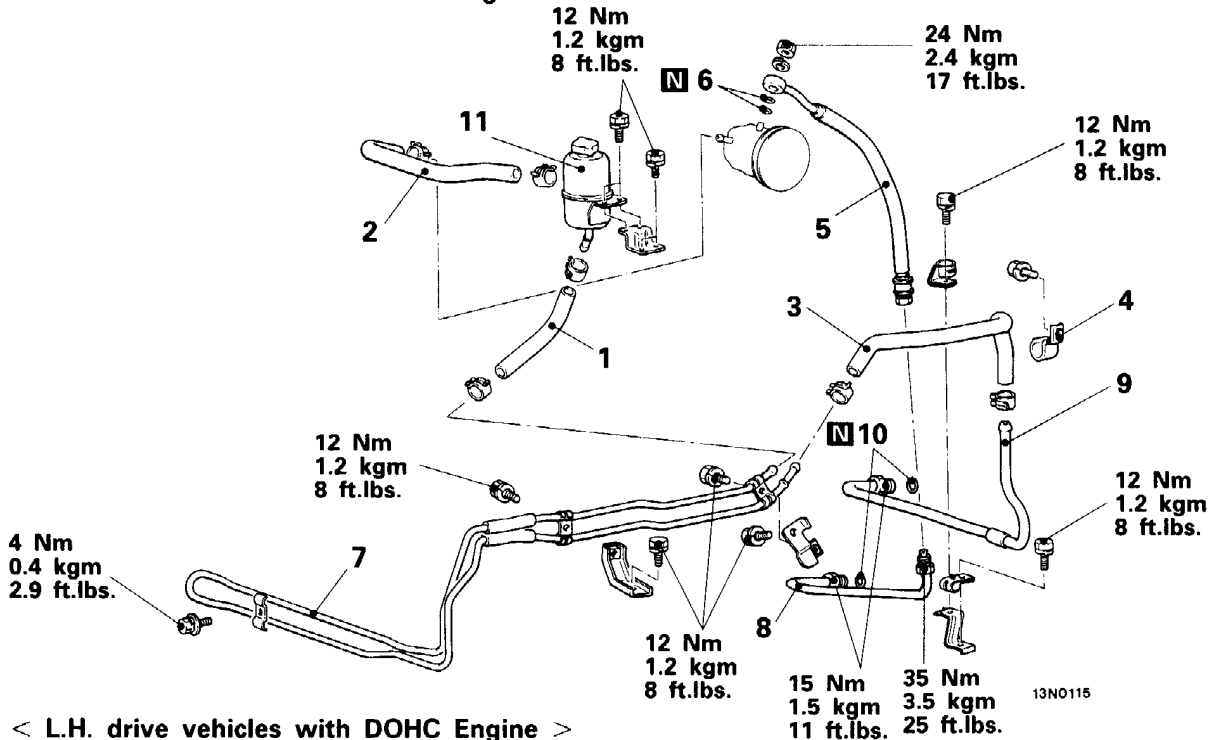
**Pre-removal Operation**

- Draining of the Power Steering Fluid

**Post-installation Operation**

- Supplying of the Power Steering Fluid
- Bleeding of the Power Steering Fluid Line (Refer to P.37A - 18.)

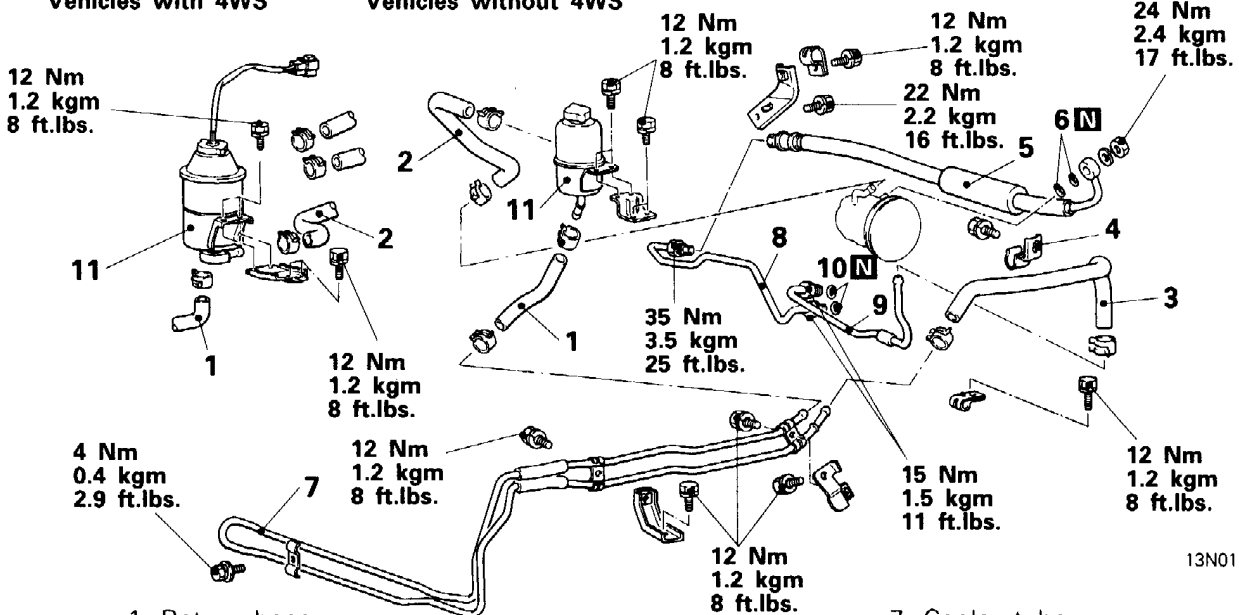
< L.H. drive vehicles with SOHC Engine >



< L.H. drive vehicles with DOHC Engine >

Vehicles with 4WS

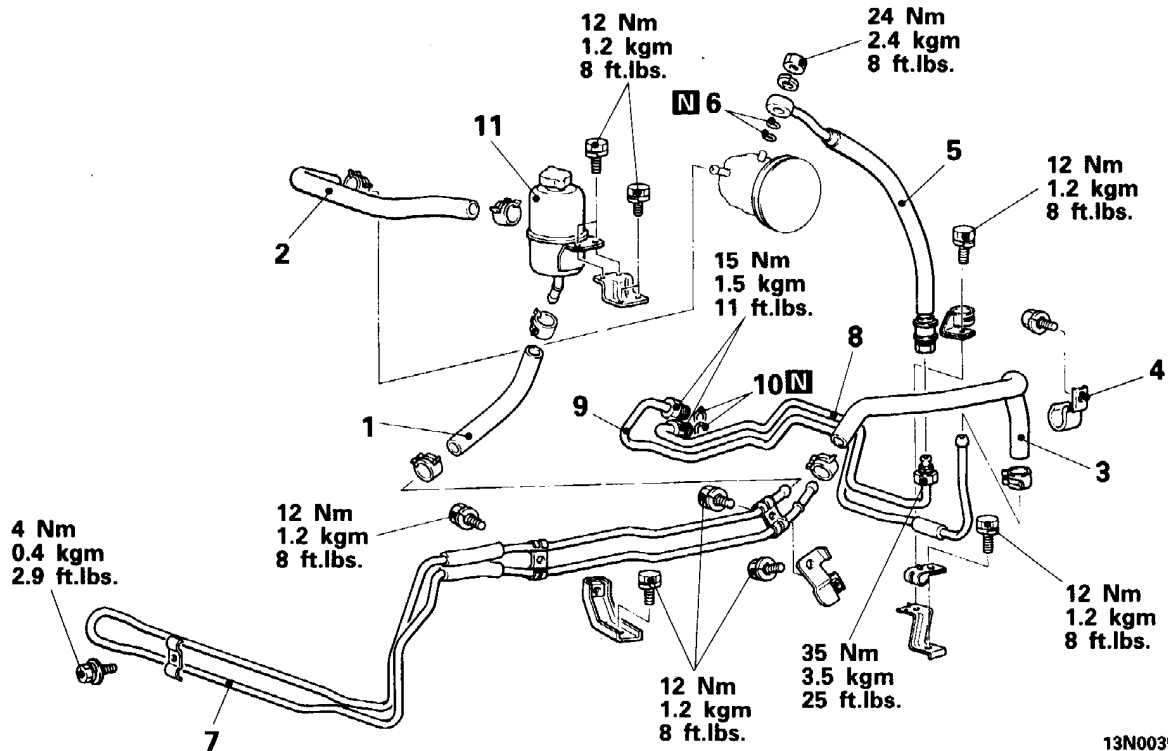
Vehicles without 4WS



- 1. Return hose
- 2. Suction hose
- 3. Return hose
- 4. Hose clip <Vehicles without 4WS>
- 5. Pressure hose
- 6. O-ring

- 7. Cooler tube
- 8. Pressure tube
- 9. Return tube
- 10. O-ring
- 11. Oil reservoir

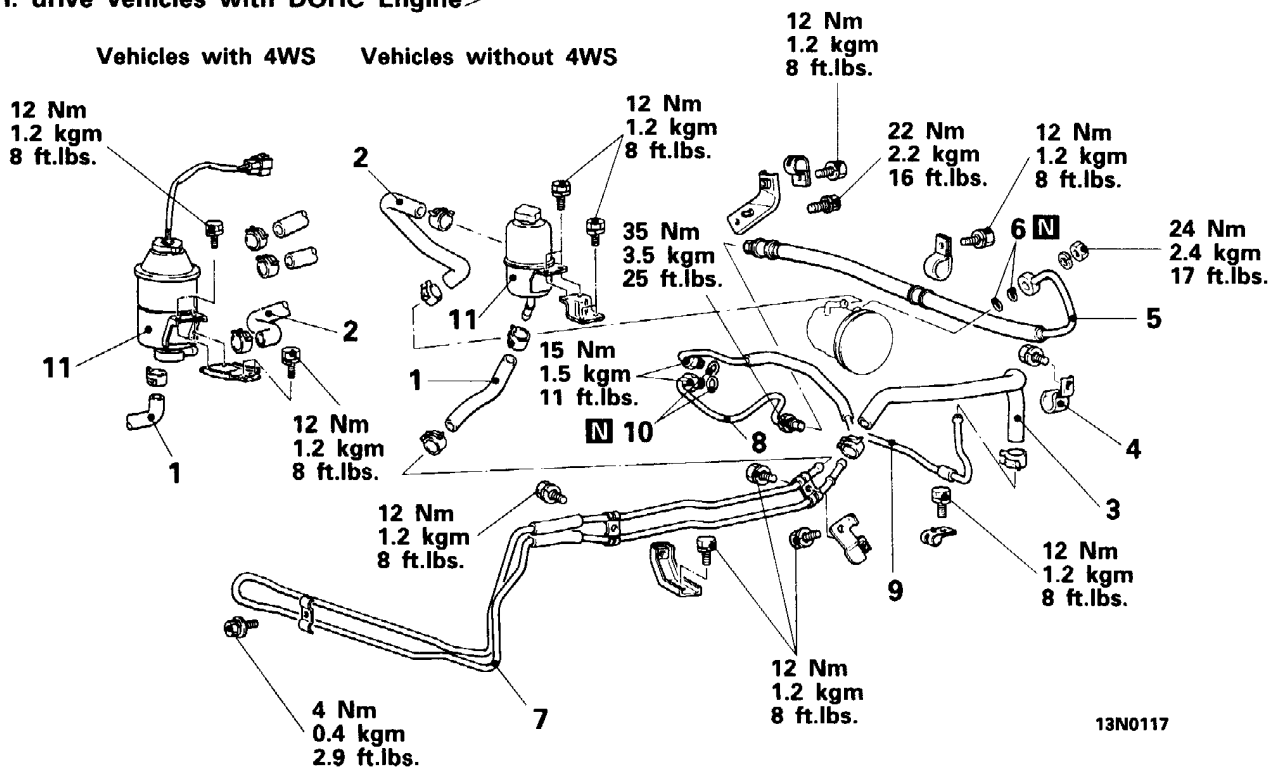
<R.H. drive vehicles with SOHC Engine>



13N0035

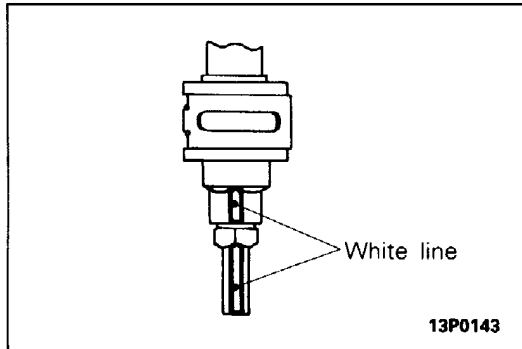
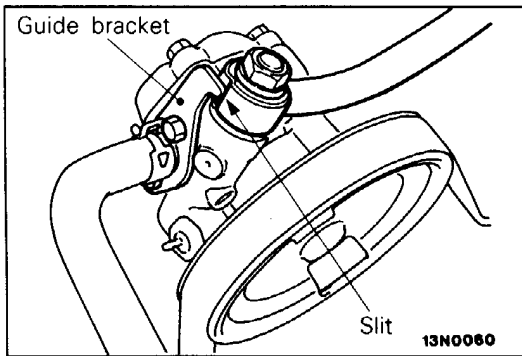
<R.H. drive vehicles with DOHC Engine>

Vehicles with 4WS      Vehicles without 4WS



13N0117

- |                                     |                   |
|-------------------------------------|-------------------|
| 1. Return hose                      | 7. Cooler tube    |
| 2. Suction hose                     | 8. Pressure tube  |
| 3. Return hose                      | 9. Return tube    |
| 4. Hose clip <Vehicles without 4WS> | 10. O-ring        |
| 5. Pressure hose                    | 11. Oil reservoir |
| 6. O-ring                           |                   |

**SERVICE POINT OF INSTALLATION**

E37TDAF

**5. INSTALLATION OF PRESSURE HOSE**

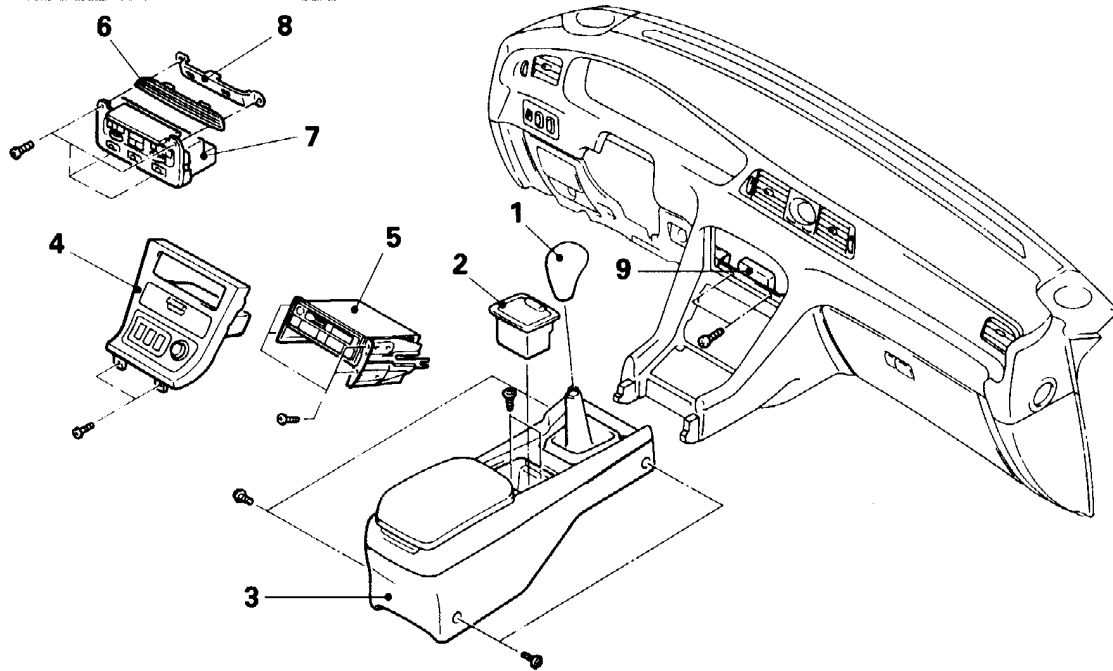
- (1) Connect the pressure hose so that its slit part contacts the oil pump's guide bracket.
  
- (2) When the pressure hose is installed, align the white line on the pressure hose with the white line on the pressure tube so that together they form a straight line.

## E.P.S. CONTROL UNIT REMOVAL AND INSTALLATION

E37XA--

**CAUTION: SRS**

When removing and installing the floor console assembly from vehicles equipped with SRS, do not let it bump against the SRS diagnostic unit or other components.



13N0151

**Removal steps**

1. Shift lever knob <M/T>
2. Ashtray
3. Floor console assembly
4. Audio panel
5. Radio and tape player
6. Heater control garnish
7. Heater control panel assembly
8. Heater control garnish bracket
9. E.P.S. control unit

**INSPECTION**

E37XCAC

To check the control unit, refer to troubleshooting for measurement of the voltage of each terminal and the current in the solenoid.