

# STEERING

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37209000286

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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: SRS-ECU, SRS warning lamp, air bag module, clock spring, side impact sensors 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 (\*).

## GENERAL INFORMATION

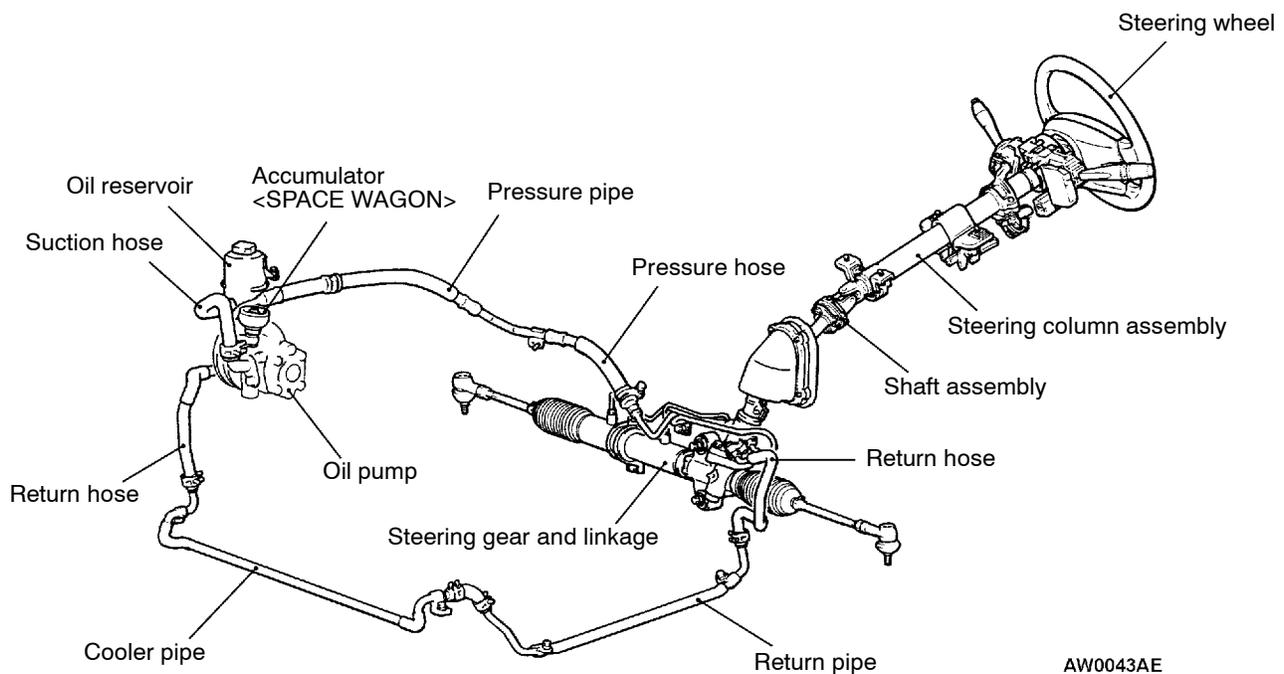
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Three-spoke and four-spoke steering wheels are used, and a supplemental restraint system (SRS) air bag can be fitted in all models. (An air bag is standard in some models and optional in others.) The steering column is equipped with tilt steering mechanism.

The power steering is an integral rack and pinion type that combines the steering gear and linkage into one light-weight and compact assembly. The steering system uses a vane oil pump with a fluid flow control system, so that steering effort varies with engine speed.

Items		SPACE RUNNER	SPACE WAGON
Steering gear and linkage	Type	Integral type	Integral type
	Gear type	Rack and pinion	Rack and pinion
Oil pump	Type	Vane type	Vane type
	Displacement mL/rev.	8.5	9.6
	Relief set pressure MPa	8.8	9.8

## CONSTRUCTION DIAGRAM



## SERVICE SPECIFICATIONS

37200030277

Items		Standard value	Limit
Steering wheel free play mm	when hydraulic operation	-	30 or less
	with engine stopped	0 - 10	-
Steering angle	Inner wheel	SPACE RUNNER	38°00' ± 2°
		SPACE WAGON	39°00' ± 2°
	Outer wheel	SPACE RUNNER	31°00'
		SPACE WAGON	32°00'
Tie rod end ball joint turning torque Nm		0.5 - 2.5	-
Stationary steering effort N	Steering effort	28 or less	-
	Fluctuation allowance	5.9 or less	-
Oil pump relief pressure MPa	SPACE RUNNER	8.8	-
	SPACE WAGON	9.8	-
Pressure under no-load conditions MPa		0.2 - 0.7	-
Steering gear retention hydraulic pressure MPa	SPACE RUNNER	8.8	-
	SPACE WAGON	9.8	-
Oil pressure switch operating pressure MPa	OFF→ON	SPACE RUNNER	1.8 - 2.4
		SPACE WAGON	1.5 - 2.0
	ON→OFF	SPACE RUNNER	0.8 - 2.3
		SPACE WAGON	0.7 - 2.0
Total pinion torque Nm	Total rotation torque	0.7 - 1.4	-
	Torque variation	0.4 or less	-
Tie rod joint swing resistance N (Tie rod joint swing torque Nm)		8 - 27 (1.5 - 4.9)	-
Opening dimension of special tool (MB991561) mm <R.H. drive vehicles>		2.9	-
Band crimped width mm <R.H. drive vehicles>		2.4 - 2.8	-

## LUBRICANTS

37200040171

Items	Specified lubricant	Quantity
Power steering fluid	Automatic transmission fluid DEXRON or DEXRON II	Approx. 0.6 L
Bellows	Silicone grease	As required
Pinion and valve assembly	Repair kit grease	As required
Rack assembly		
Oil seal, seal ring, pinion and valve assembly, needle roller bearing, bushing assembly, ball bearing, rack support, rack bushing, O-ring, rack, special tool (MB991213)	Automatic transmission fluid DEXRON or DEXRON II	As required
O-ring, spool assembly, cam ring, rotor, oil seal		

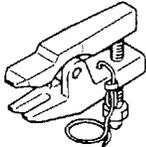
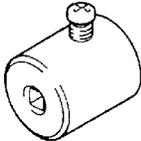
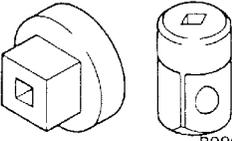
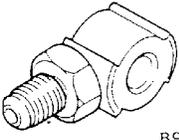
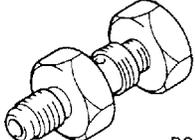
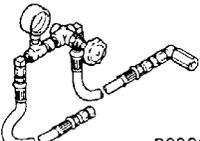
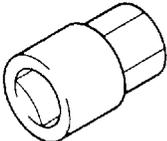
## SEALANT

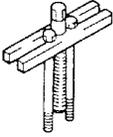
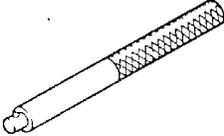
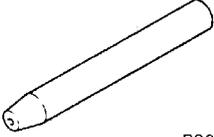
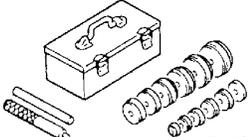
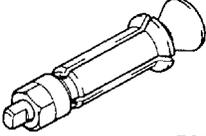
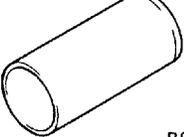
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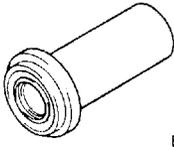
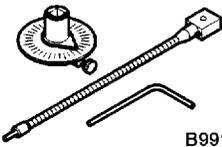
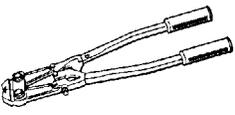
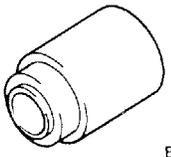
Items	Specified sealant	Remarks
End plug screw	3M ATD Part No. 8661 or equivalent	Semi-drying sealant
Power steering rack support cover screw		
Dust cover lip for tie rod end ball joint		

## SPECIAL TOOLS

37200060177

Tool	Number	Name	Use
 B991113	MB990635, MB991113 or MB991406	Steering linkage puller	Disconnection of tie rod end
 B991006	MB991006	Preload socket	Measurement of the total pinion torque
 B990326	MB990326	Preload socket	Measurement of the ball joint turning torque
 B990993	MB990993	Power steering oil pressure gauge adapter (pump side)	Measurement of oil pressure
 B990994	MB990994	Power steering oil pressure gauge adapter (hose side)	
 B990662	MB990662	Oil pressure gauge assembly	
 B991204	MB991204	Torque wrench socket	<ul style="list-style-type: none"> <li>● Adjustment of rack support</li> <li>● Removal of rack support cover</li> </ul>

Tool	Number	Name	Use
 <p>B990803</p>	MB990803	Steering wheel puller	Disconnection of the steering wheel
 <p>B991202</p>	MB991202	Oil seal and bearing installer	Press fitting of rack housing bearing
 <p>B991197</p>	MB991197	Bar (long type)	To press in the oil seal for the rack
 <p>B991198</p>	MB991199	Oil seal installer	
 <p>B991212</p>	MB991213	Rack installer	Rack installation
 <p>B990925</p>	MB990925	Bearing and oil seal installer set	Installation of the oil seal and bearing (Refer to GROUP 26 - Special Tools.)
 <p>B991120</p>	MB991120	Needle bearing puller	Removal of rack housing needle bearing
 <p>B991203</p>	MB991203	Oil seal and bearing installer	To press in the valve housing oil seal and bearing
 <p>B991317</p>	MB991317	Seal ring installer	Compression of the seal rings after replacement of the pinion seal rings

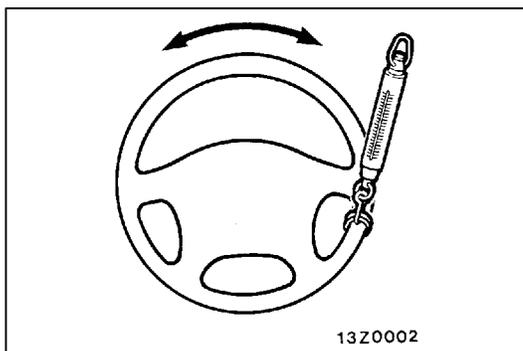
Tool	Number	Name	Use
 B990941	MB990941	Torque tube bearing installer	Installation of valve housing oil seal
 B991614	MB991614	Angle gauge	Installation of rack support cover
	MB991561	Boot band crimping tool	Installation of bellows band
 B990776	MB990776	Front axle base	Installation of dust cover for tie rod end ball joint

## ON-VEHICLE SERVICE

37200100138

### 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 or less**

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 towards steering wheel circumference and check play.

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

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

**STEERING ANGLE CHECK**

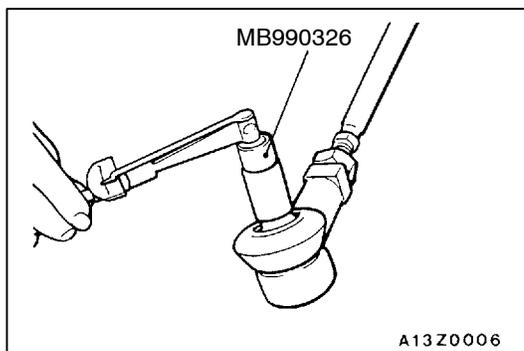
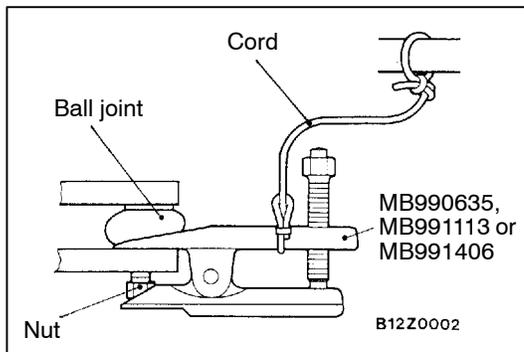
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1. Locate front wheels on turning radius gauge and measure steering angle.

**Standard value:**

Item	SPACE RUNNER	SPACE WAGON
Inner wheel	38°00' ± 2°	39°00' ± 2°
Outer wheel	31°00'	32°00'

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

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

37200150188

1. Disconnect tie rod and knuckle with special tool.

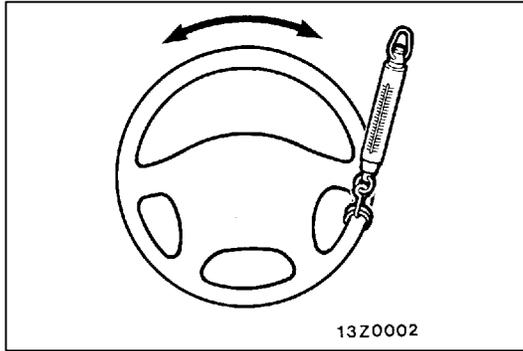
**Caution**

- (1) Loosen the nut of the special tool, but do not remove it. If it is removed, the ball joint thread may be damaged.
- (2) Tie the special tool with a cord not to let it fall off.

2. Move ball joint stud several times and install nut on stud. Measure ball joint turning torque with special tools.

**Standard value: 0.5 - 2.5 Nm**

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

37200170238

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

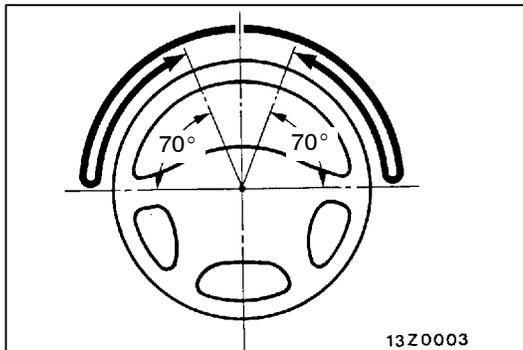
**After checking the engine r/min must return to the standard idling r/min.**

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: 28 N or less**

**Fluctuation allowance: 5.9 N or less**



## CHECKING STEERING WHEEL RETURN TO CENTRE

37200180156

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 not difference in the steering force required and the wheel return between left and right turns.
2. At a speed of 35 km/h, turn the steering wheel  $90^\circ$  and release the steering wheel after 1 or 2 seconds. If the steering wheel then returns  $70^\circ$  or more, the return can be judged to be satisfactory.

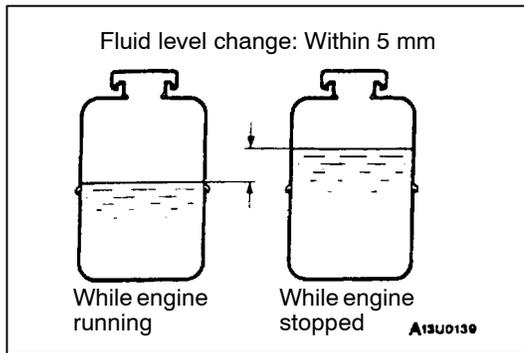
### NOTE

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.)

## DRIVE BELT TENSION CHECK

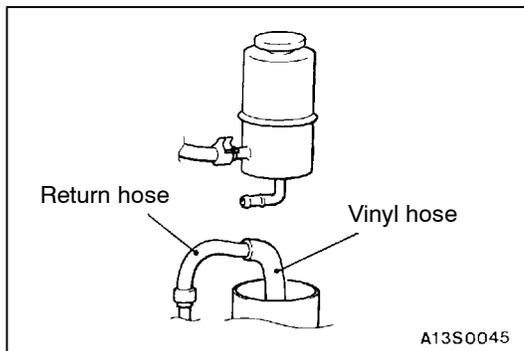
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Refer to GROUP 11 - On-vehicle Service.

**FLUID LEVEL CHECK**

37200200043

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.
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 change of the fluid level is 5 mm or more, air bleeding should be done.

**FLUID REPLACEMENT**

37200210169

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.

**Caution**

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

5. 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.
6. Connect the return hoses securely, and then secure it with the clip.
7. 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**

37200220155

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. On vehicles with a petrol engine, disconnect the high-tension cable. On vehicles with a diesel engine, remove the fuel cut valve connector attached to the injection pump.

**Caution**

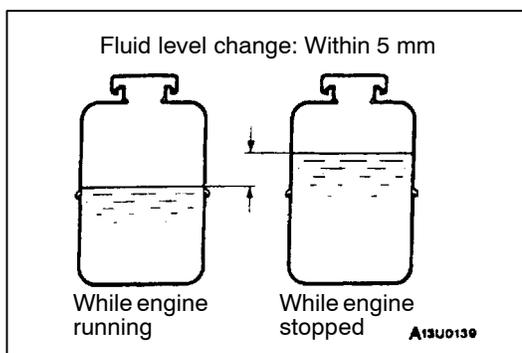
**Be careful not to position the high-tension cable near the delivery pipe.**

5. 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, refill the fluid 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.**

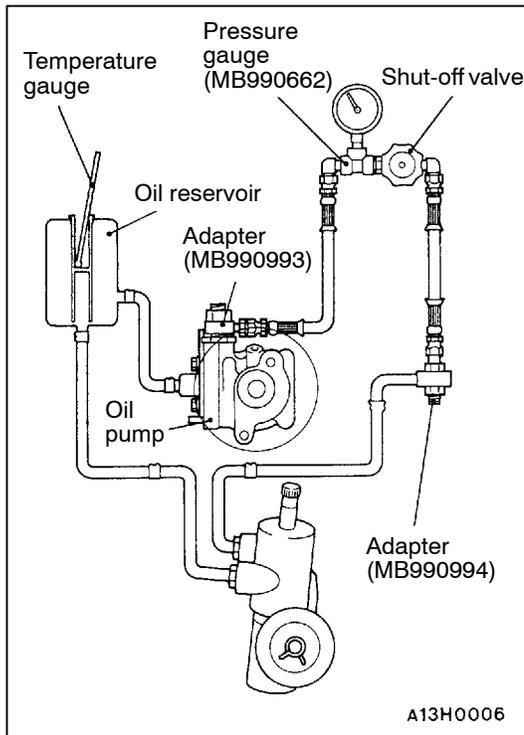
6. On vehicles with a petrol engine, connect the high-tension cable. On vehicles with a diesel engine, connect the fuel cut valve connector attached to the injection pump. Start the engine (idling).
7. Turn the steering wheel to the left and right until there are no air bubbles in the oil reservoir.
8. Confirm that the fluid is not milky, and that the level is up to the specified position on the level gauge.
9. Confirm that there is very little change in the fluid level when the steering wheel is turned left and right.



10. Check whether or not the change in the fluid level is within 5 mm when the engine is stopped and when it is running.
11. If the change of the fluid level is 5 mm or more, the air has not been completely bled from the system, and thus must be bled completely.

**Caution**

- (1) **If the fluid level rises suddenly after the engine is stopped, the air has not been completely bled.**
- (2) **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

37200230240

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.
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:

<SPACE RUNNER> 8.8 MPa

<SPACE WAGON> 9.8 MPa

### Caution

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

5. If it is not within the standard value, replace the oil pump.
6. 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:

<SPACE RUNNER> 0.2 - 0.7 MPa

<SPACE WAGON> 0.2 - 0.7 MPa

7. 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.
8. Fully open the shut-off valve of the pressure gauge.
9. 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:

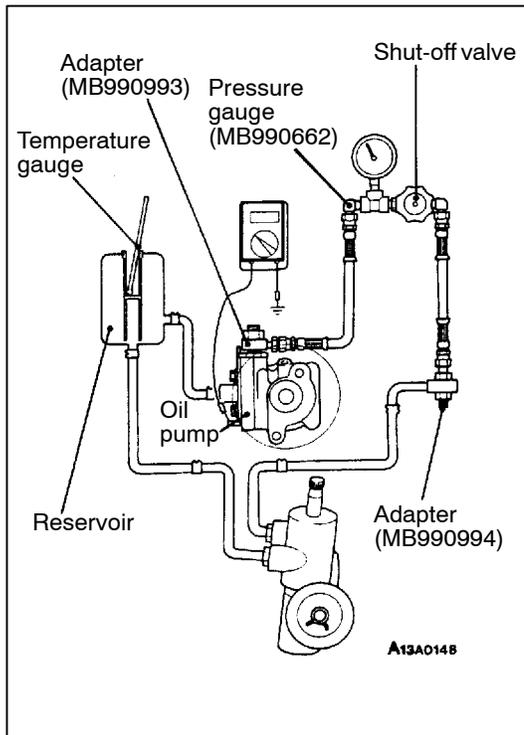
<SPACE RUNNER> 8.8 MPa

<SPACE WAGON> 9.8 MPa

10. When not within the standard value, replace the power steering gear box.  
Remeasure fluid pressure.
11. Remove the special tools, and then tighten the pressure hose to the specified torque.

### Tightening torque: 57 Nm

12. Bleed the system.



## POWER STEERING OIL PRESSURE SWITCH CHECK

37200720228

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.
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:

<SPACE RUNNER> 1.8 - 2.4 MPa

<SPACE WAGON> 1.5 - 2.0 MPa

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:

<SPACE RUNNER> 0.8 - 2.3 MPa

<SPACE WAGON> 0.7 - 2.0 MPa

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

**Tightening torque: 57 Nm**

8. Bleed the system.

## BALL JOINT DUST COVER CHECK

37200860012

1. Check the dust cover for cracks or damage by pushing it with finger.
2. If the dust cover is cracked or damaged, replace the tie rod end.

### NOTE

Cracks or damage of the dust cover may cause damage of the ball joint.

# STEERING WHEEL AND SHAFT

37200260454

## REMOVAL AND INSTALLATION

**Caution:**

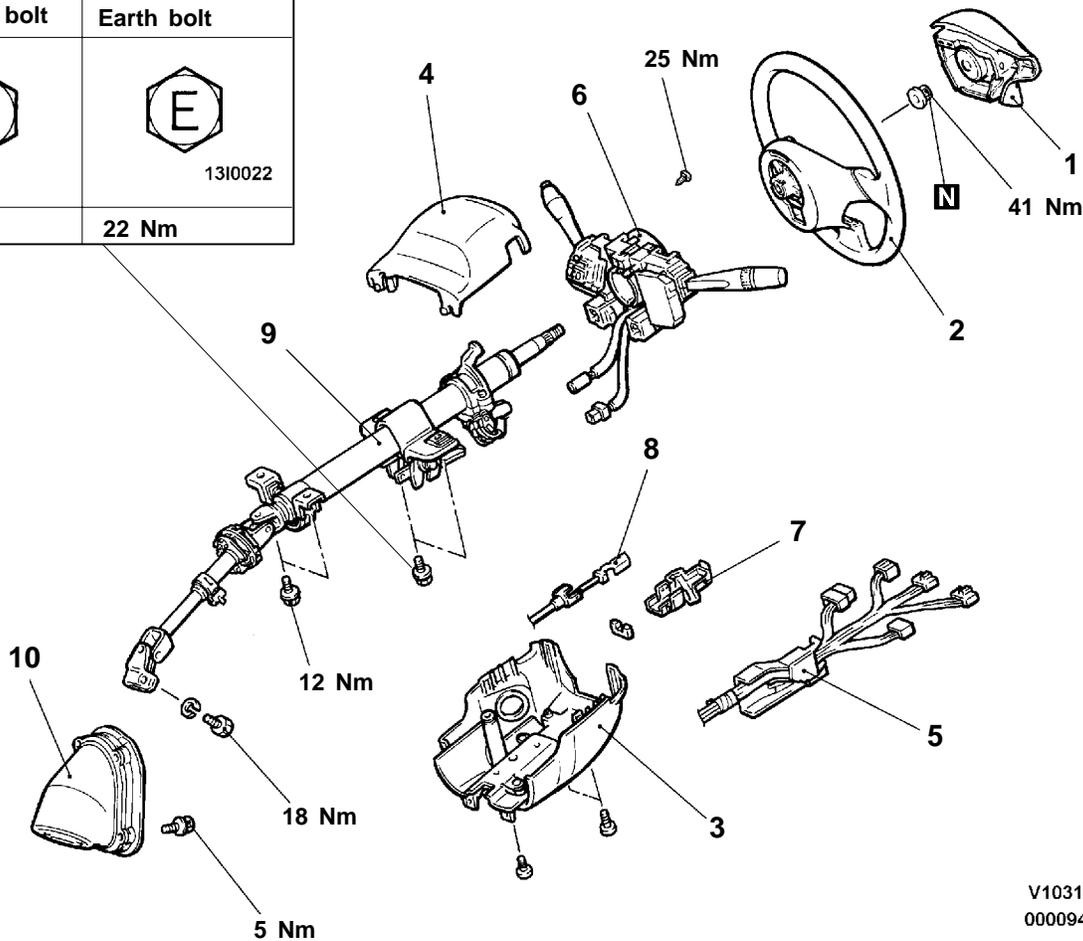
1. Before removal of air bag module, refer to GROUP 52B - Service Precautions and Air Bag Module and Clock Spring.
2. One of the steering shaft assembly mounting bolts must be the earth bolt. The earth bolt has a "E" mark on its head.

**Pre-removal Operation**  
 Instrument Lower Panel Assembly Removal  
 (Refer to GROUP 52A - Instrument Panel.)

**Post-installation Operation**

- Instrument Lower Panel Assembly Installation (Refer to GROUP 52A - Instrument Panel.)
- Checking Steering Wheel Position with Wheels Straight Ahead

Standard bolt	Earth bolt
	 13I0022
12 Nm	22 Nm

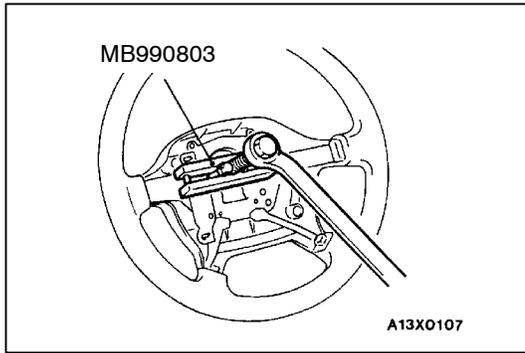


V1031AE  
00009426

**Removal steps**

- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. Horn pad assembly &lt;vehicles without SRS&gt; or air bag module &lt;vehicles with SRS&gt; (Refer to GROUP 52B - Air Bag Module and Clock Spring.)</li> <li>2. Steering wheel</li> <li>3. Lower column cover</li> <li>4. Upper column cover</li> <li>5. Protector</li> </ol> | <ol style="list-style-type: none"> <li>6. Column switch &lt;vehicles without SRS&gt; or clock spring and column switch &lt;vehicles with SRS&gt; (Refer to GROUP 52B - Air Bag Module and Clock Spring.)</li> <li>7. Cover</li> <li>8. Key interlock cable</li> <li>9. Steering column shaft assembly</li> <li>10. Cover assembly</li> </ol> |
|--|--|



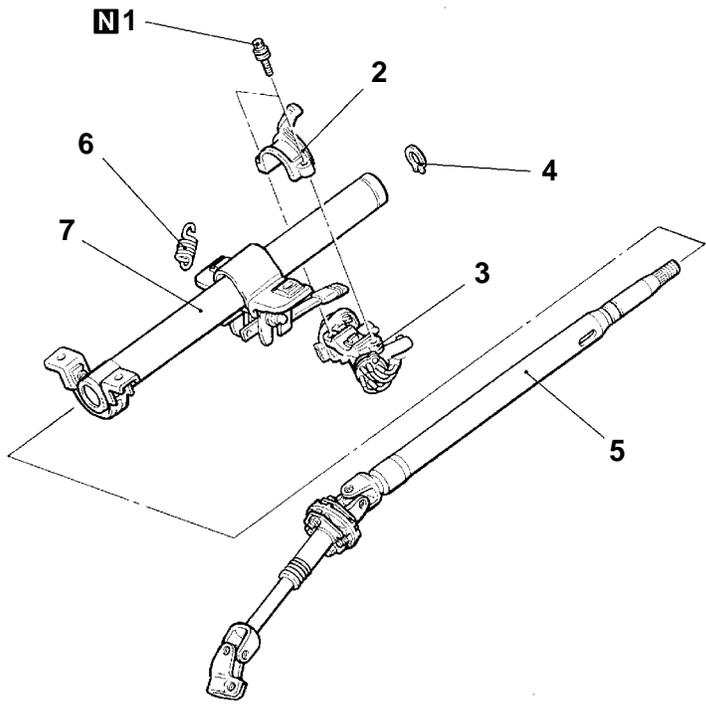


**REMOVAL SERVICE POINT**

**◀A▶ STEERING WHEEL REMOVAL**

**DISASSEMBLY AND REASSEMBLY**

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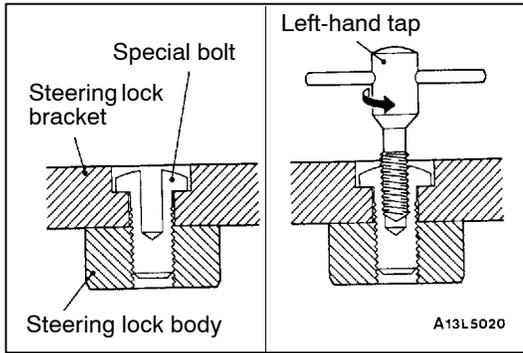
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**Disassembly steps**



- 1. Special bolt
- 2. Steering lock bracket
- 3. Steering lock cylinder assembly
- 4. Snap ring

- 5. Steering shaft assembly
- 6. Tilt spring
- 7. Steering column assembly



**DISASSEMBLY SERVICE POINT**

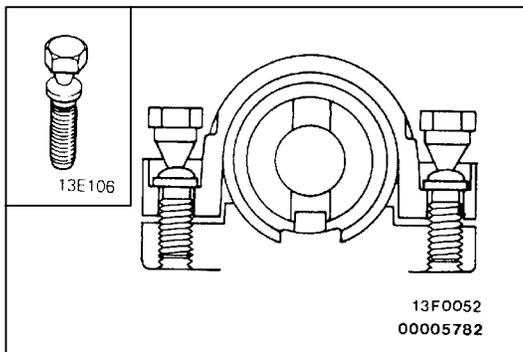
**◀A▶ SPECIAL BOLT REMOVAL**

1. Drill in the special bolt a hole deep enough for the tap to stand.
2. Remove the special bolt with a left-hand tap.

**REASSEMBLY SERVICE POINT**

**▶A◀ STEERING LOCK CYLINDER ASSEMBLY/STEERING LOCK BRACKET/SPECIAL BOLT INSTALLATION**

1. When installing the steering lock cylinder assembly 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.**

## POWER STEERING GEAR BOX

37200390405

## REMOVAL AND INSTALLATION

## Caution: SRS

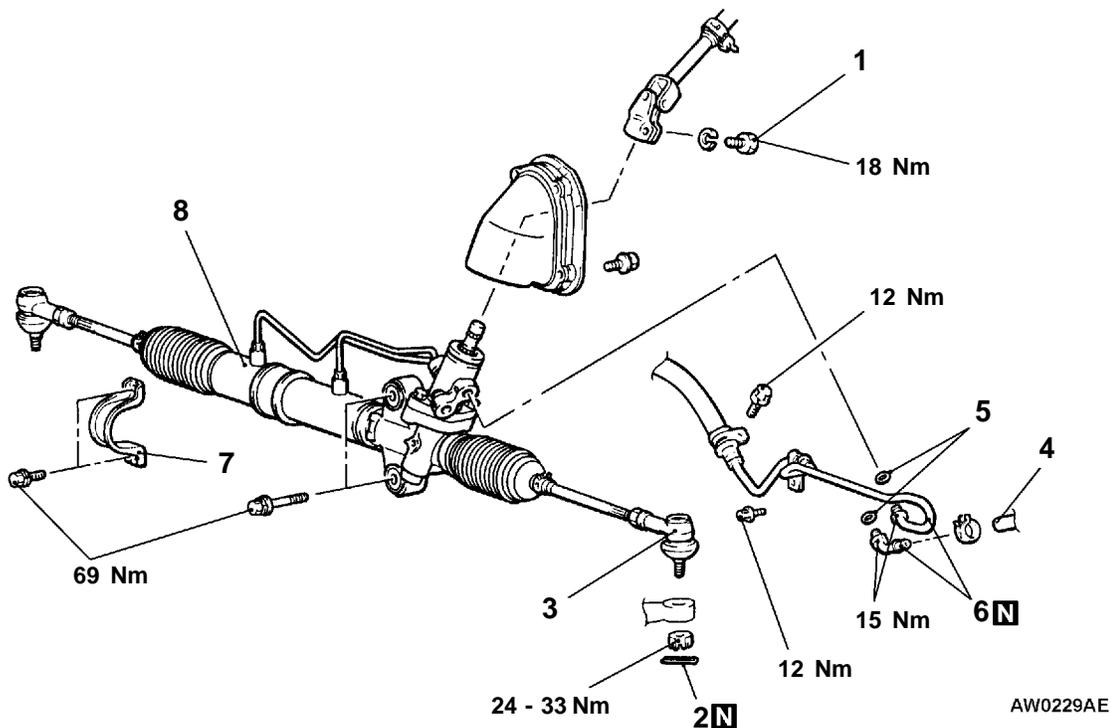
For vehicles with SRS, before removal of steering gear box, refer to GROUP 52B, centre front wheels and remove ignition key. Failure to do so may damage SRS clock spring and render SRS system inoperative, risking serious driver injury.

**Pre-removal Operation**

- Power Steering Fluid Draining (Refer to P.37A-9.)
- Under Cover Removal
- Front Exhaust Pipe Removal (Refer to GROUP 15.)
- Transfer Assembly Removal <4WD> (Refer to GROUP 22.)
- Rear Roll Stopper Removal <L.H. drive vehicles> (Refer to GROUP 32.)

**Post-installation Operation**

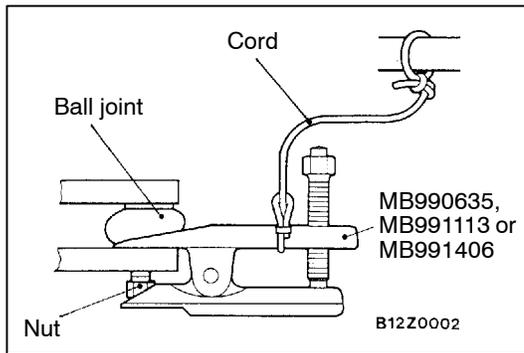
- Check the Dust Cover for Cracks or Damage by Pushing it with Finger.
- Rear Roll Stopper Installation <L.H. drive vehicles> (Refer to GROUP 32.)
- Transfer Assembly Installation <4WD> (Refer to GROUP 22.)
- Front Exhaust Pipe Installation (Refer to GROUP 15.)
- Under Cover Installation
- Power Steering Fluid Supplying (Refer to P.37A-9.)
- Power Steering Fluid Line Bleeding (Refer to P.37A-10.)
- Checking Steering Wheel Position with Wheels Straight Ahead
- Front Wheel Alignment Adjustment (Refer to GROUP 33A.)

**Removal steps**

1. Steering shaft assembly and gear box connecting bolt
2. Split pin
3. Tie rod end and knuckle connection
4. Return hose connection

5. Pressure pipe assembly connection
6. O-ring
7. Clamp
8. Gear box assembly





## REMOVAL SERVICE POINTS

### ◀A▶ TIE ROD END AND KNUCKLE DISCONNECTION

#### Caution

1. Loosen the nut of the special tool, but do not remove it. If it is removed, the ball joint thread may be damaged.
2. Tie the special tool with a cord not to let it fall off.

### ◀B▶ GEAR BOX ASSEMBLY REMOVAL

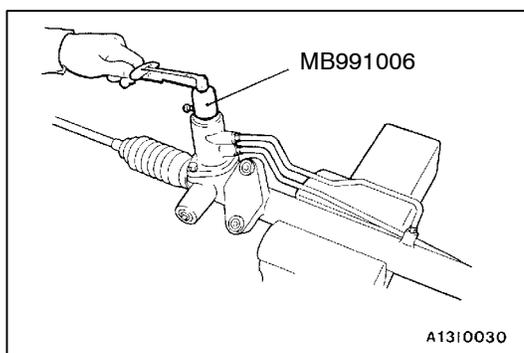
#### Caution

Be careful not to damage the bellows and the tie rod end dust cover when removing the gear box assembly.

## INSPECTION

37200400191

- Check the rubber parts for cracks and breakage.



### GEAR BOX TOTAL PINION TORQUE CHECK

1. 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 torque.

#### Standard value:

Total rotation torque: 0.7 - 1.4 Nm

Torque variation: 0.4 Nm or less

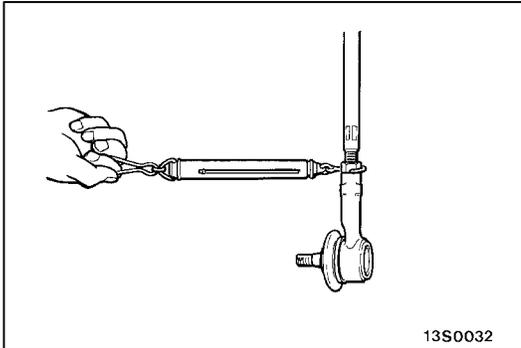
#### Caution

When holding the steering gear box assembly in a vice, secure its mounting positions. If it is secured in any other places, the gear housing may become deformed or damaged.

#### NOTE

- (1) When measuring, remove the bellows from the rack housing.
  - (2) Turn the torque wrench left and right by 180 degree from the neutral position to measure the total rotation torque.
2. 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.

3. If the total pinion turning 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 if necessary.



#### TIE ROD SWING RESISTANCE CHECK

1. Give 10 hard swings to the tie rod.
2. With the tie rod end downwards, use a spring scale to measure swing resistance (swing torque) as shown in the illustration.

#### Standard value:

**Swing resistance: 8 - 27 N**

**Swing torque: 1.5 - 4.9 Nm**

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

#### TIE ROD END BALL JOINT DUST COVER CHECK

1. Check the dust cover for cracks or damage by pushing it with finger.
2. If the dust cover is cracked or damaged, replace the tie rod end. (Refer to P.37A-19.)

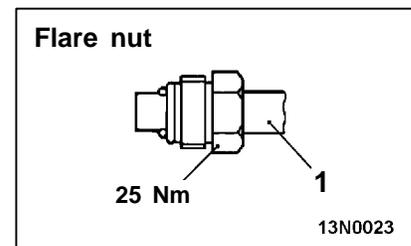
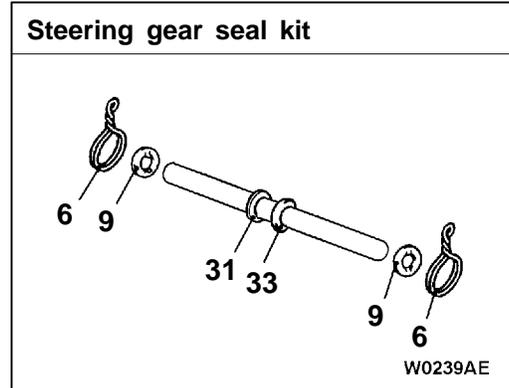
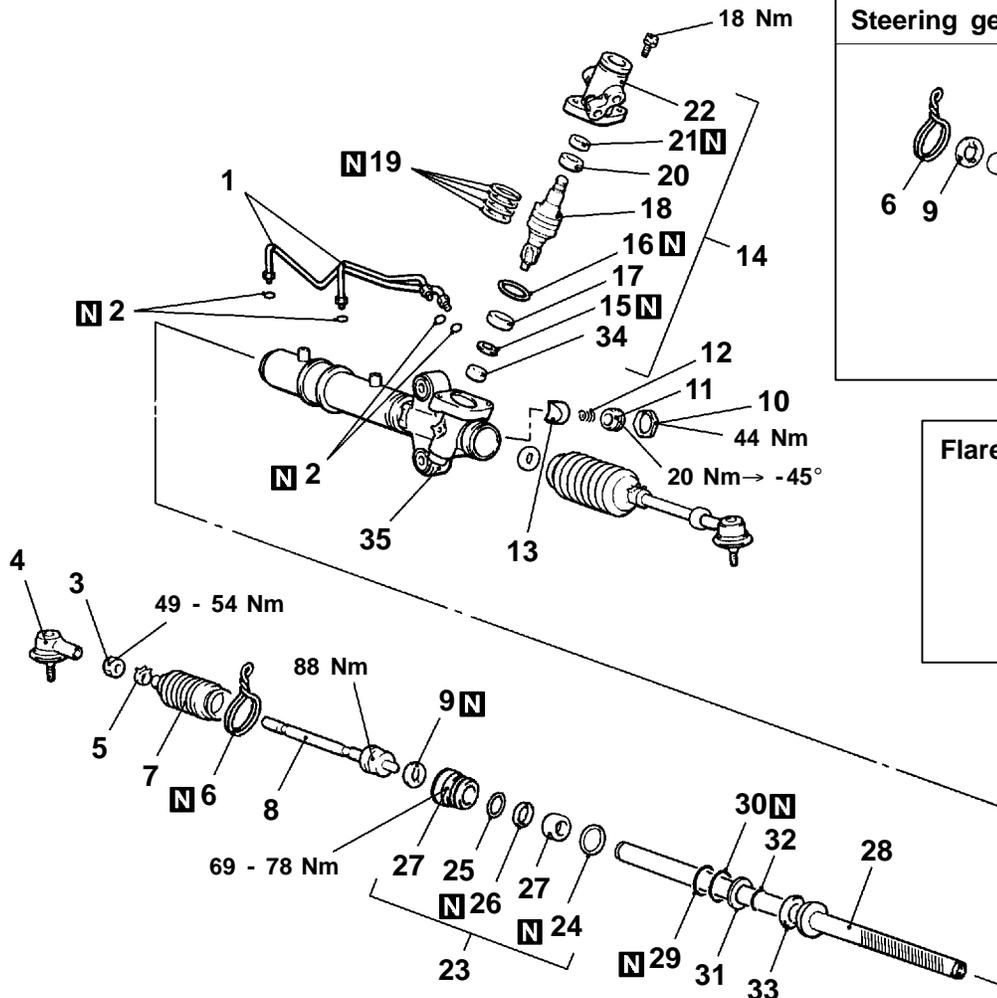
#### NOTE

Cracks or damage of the dust cover may cause damage of the ball joint. When it is damaged during service work, replace the dust cover.

DISASSEMBLY AND REASSEMBLY

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<L.H. drive vehicles>

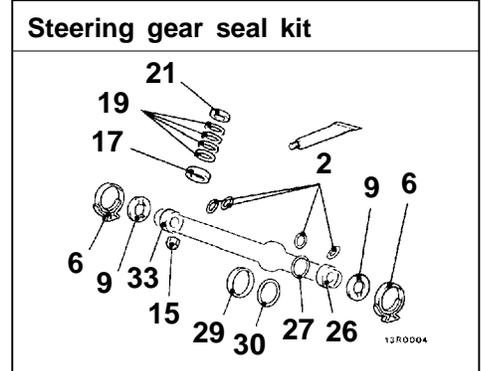
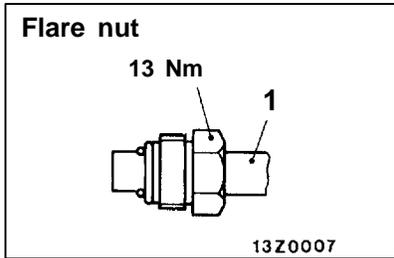
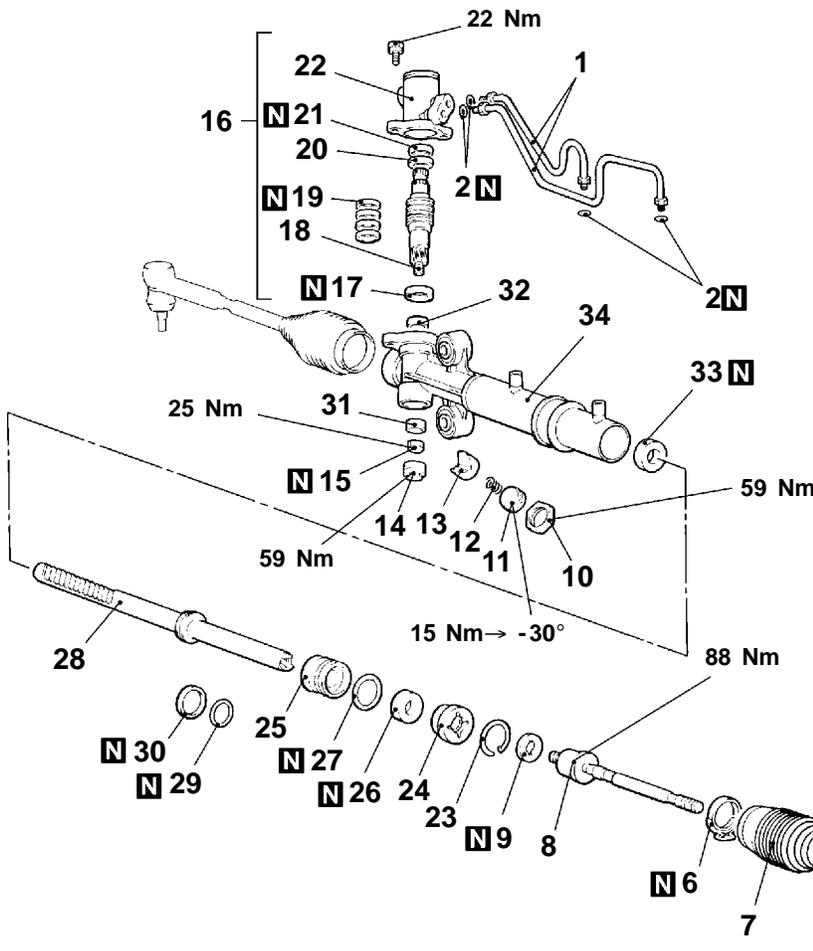


W0232AE  
00009415

Disassembly steps

- |                                      |                               |
|--------------------------------------|-------------------------------|
| 1. Feed pipe                         | 18. Pinion and valve assembly |
| 2. O-ring                            | 19. Seal ring                 |
| ▶N◀ 3. Tie rod end locking nut       | ▶G◀ 20. Bushing assembly      |
| ▶N◀ 4. Tie rod end                   | ▶F◀ 21. Oil seal              |
| 5. Bellows clip                      | 22. Valve housing             |
| 6. Wire cramp                        | 23. Outer box assembly        |
| 7. Bellows                           | 24. O-ring                    |
| ▶L◀ 8. Tie rod                       | 25. Back up ring              |
| ▶L◀ 9. Tab washer                    | 26. U-packing                 |
| ▶K◀ ● Total pinion torque adjustment | 27. Bushing                   |
| ▶J◀ 10. Locking nut                  | 28. Rack                      |
| ◀A▶ ▶J◀ 11. Rack support cover       | 29. Piston ring               |
| 12. Rack support spring              | 30. O-ring                    |
| 13. Rack support                     | 31. Piston                    |
| 14. Valve housing assembly           | 32. Wire ring                 |
| 15. Caulk ring                       | 33. Oil seal                  |
| 16. O-ring                           | 34. Needle roller bearing     |
| 17. Ball bearing                     | 35. Rack housing              |

<R.H. drive vehicles>



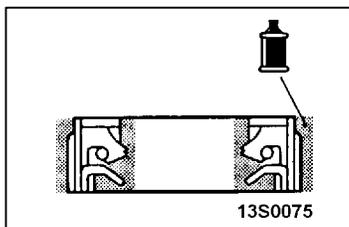
V0157AE

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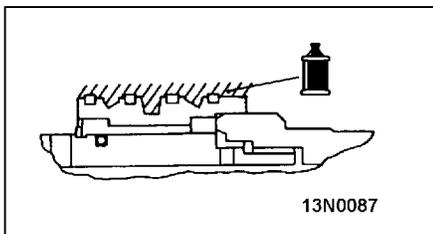
**Disassembly steps**

- |          |                                     |          |                                    |
|----------|-------------------------------------|----------|------------------------------------|
|          | 1. Feed pipe                        | <b>B</b> | 18. Pinion and valve assembly      |
|          | 2. O-ring                           | <b>C</b> | <b>G</b> 19. Seal ring             |
| <b>N</b> | 3. Tie rod end locking nut          | <b>D</b> | <b>F</b> 20. Ball bearing          |
| <b>N</b> | 4. Tie rod end                      | <b>D</b> | <b>F</b> 21. Oil seal              |
|          | 5. Bellows clip                     |          | <b>E</b> 22. Valve housing         |
| <b>M</b> | 6. Bellows band                     |          | <b>E</b> 23. Circlip               |
|          | 7. Bellows                          |          | <b>F</b> 24. Rack stopper          |
| <b>L</b> | 8. Tie rod                          |          | <b>D</b> 25. Rack bushing          |
| <b>L</b> | 9. Tab washer                       |          | <b>D</b> 26. Oil seal              |
| <b>K</b> | • Total pinion torque adjustment    |          | <b>F</b> 27. O-ring                |
| <b>J</b> | 10. Locking nut                     |          | <b>F</b> 28. Rack                  |
| <b>A</b> | <b>J</b> 11. Rack support cover     |          | <b>C</b> 29. Seal ring             |
|          | 12. Rack support spring             |          | 30. O-ring                         |
|          | 13. Rack support                    |          | <b>G</b> <b>B</b> 31. Ball bearing |
| <b>I</b> | 14. End plug                        |          | <b>B</b> 32. Needle roller bearing |
|          | 15. Self-locking nut                |          | <b>A</b> 33. Oil seal              |
| <b>B</b> | <b>H</b> 16. Valve housing assembly |          | 34. Rack housing                   |
|          | 17. Oil seal                        |          |                                    |

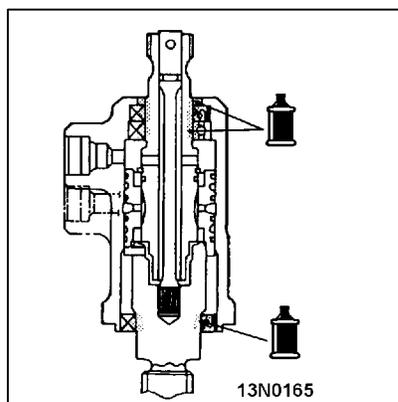
Lubrication and Sealing Points



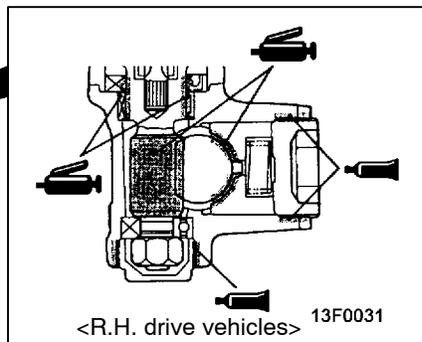
Fluid:  
Automatic transmission  
fluid DEXRON or  
DEXRON II



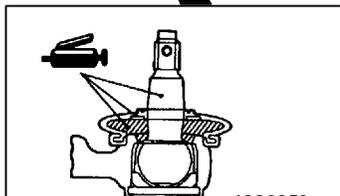
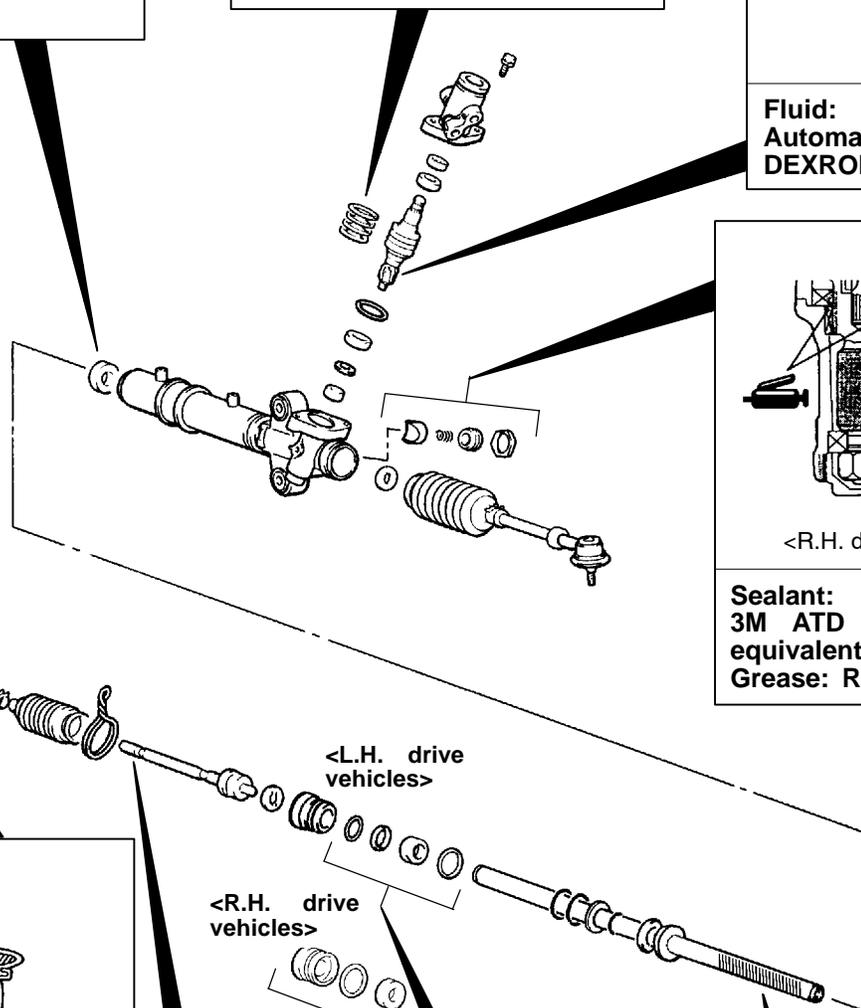
Fluid:  
Automatic transmission fluid  
DEXRON or DEXRON II



Fluid:  
Automatic transmission fluid  
DEXRON or DEXRON II



<R.H. drive vehicles>  
Sealant:  
3M ATD Part No. 8661 or  
equivalent  
Grease: Repair kit grease

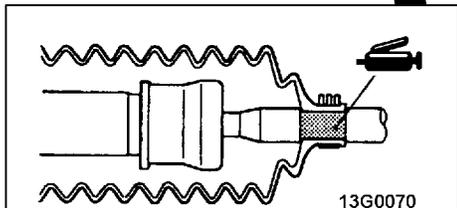


Sealant:  
3M ATD Part No. 8661  
or equivalent

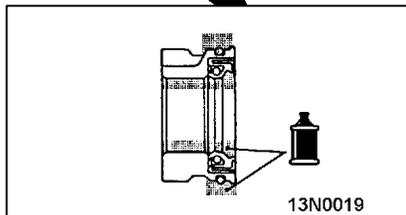
<L.H. drive  
vehicles>

<R.H. drive  
vehicles>

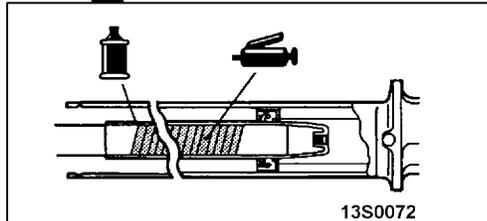
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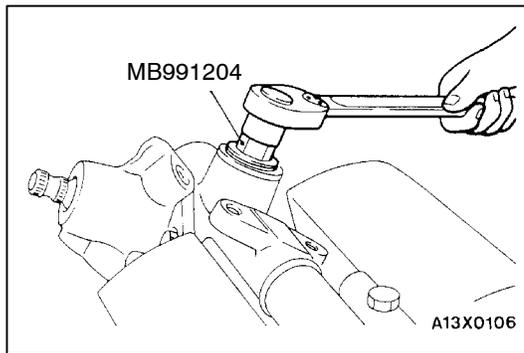
Grease: Silicone grease



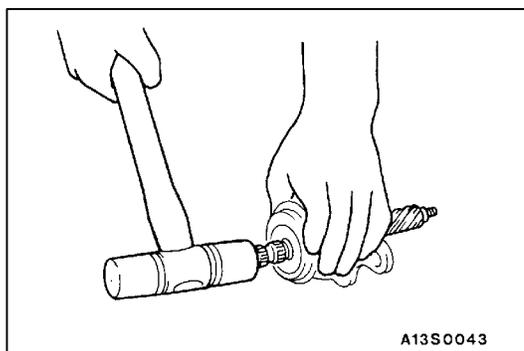
Fluid: Automatic transmission  
fluid DEXRON or DEXRON II



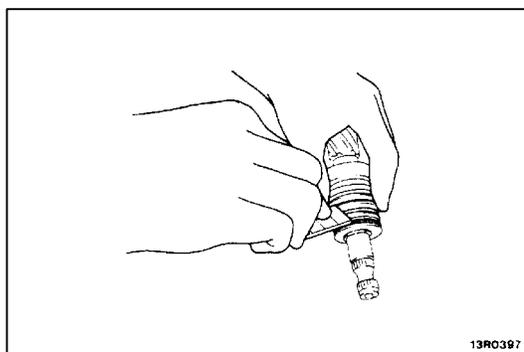
Fluid: Automatic transmission fluid  
DEXRON or DEXRON II  
Grease: Repair kit grease

**DISASSEMBLY SERVICE POINTS****◀A▶ RACK SUPPORT COVER REMOVAL**

Use the special tool to remove the rack support cover from the gear box.

**◀B▶ OIL SEAL/PINION AND VALVE ASSEMBLY REMOVAL**

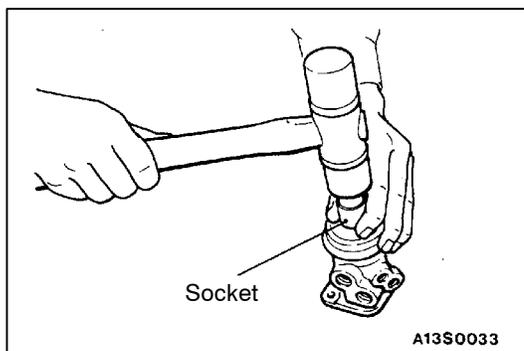
Using a plastic hammer, gently tap the pinion to remove it.

**◀C▶ SEAL RING REMOVAL**

Cut the seal ring and remove it from the pinion and valve assembly and the rack.

**Caution**

When cutting the seal ring, be careful not to damage the pinion and valve assembly or the rack.

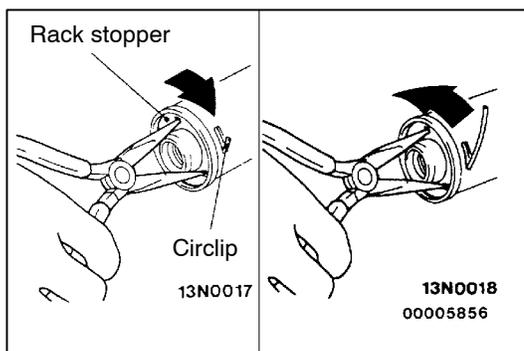
**◀D▶ BUSHING ASSEMBLY/BALL BEARING/OIL SEAL REMOVAL**

<L.H. drive vehicles>

Use a socket, remove the oil seal and the bushing assembly from the valve housing assembly simultaneously.

<R.H. drive vehicles>

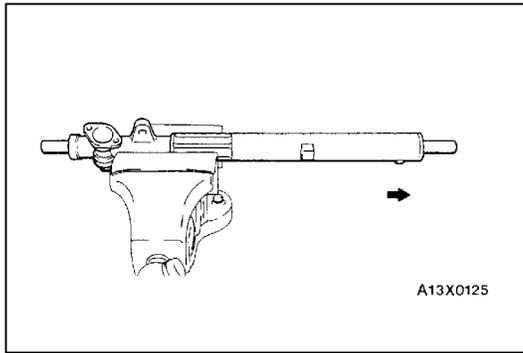
Use a socket, remove the oil seal and the ball bearing from the valve housing assembly simultaneously.

**◀E▶ CIRCLIP REMOVAL**

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.

**Caution**

Note that if the rack stopper is first turned anticlockwise, the circlip will get caught in the slot in the housing and the rack stopper will not turn.

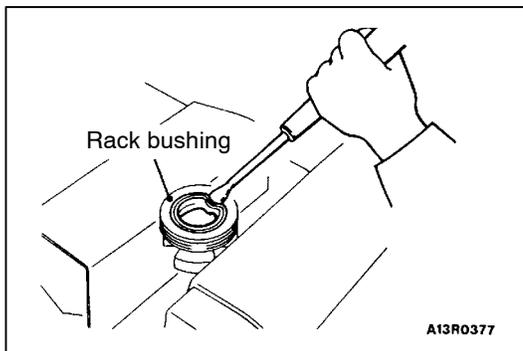


◀F▶ RACK STOPPER/RACK BUSHING/OIL SEAL/O RING/RACK REMOVAL

1. Gently pull out the rack assembly to remove the rack stopper, rack bushing, oil seals and O-rings.
2. Partially bend the oil seals to remove from the rack bushing.

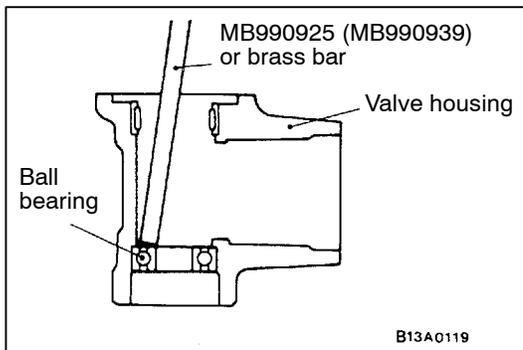
**Caution**

**Do not damage the oil seal press fitting surface of the rack bushing.**



◀G▶ BALL BEARING REMOVAL

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

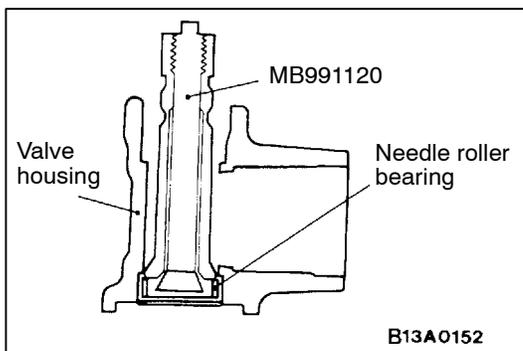


◀H▶ NEEDLE ROLLER BEARING REMOVAL

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

**Caution**

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

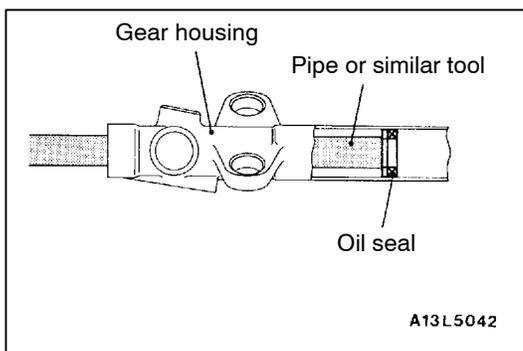


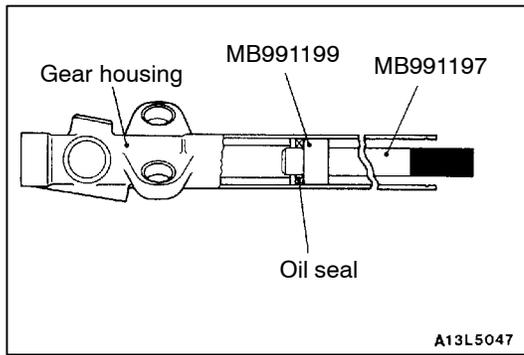
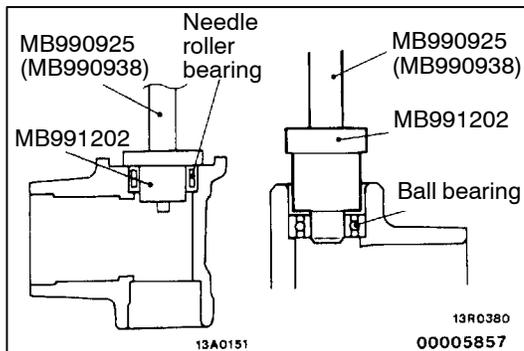
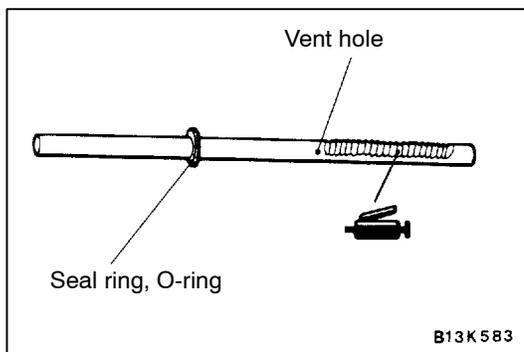
◀I▶ OIL SEAL REMOVAL

Use a piece of pipe or similar tool to remove the oil seal from the gear housing.

**Caution**

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

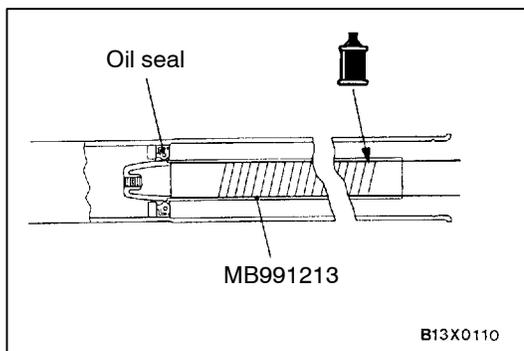


**REASSEMBLY SERVICE POINTS****►A◄ OIL SEAL INSTALLATION****►B◄ NEEDLE ROLLER BEARING/BALL BEARING INSTALLATION****►C◄ RACK INSTALLATION**

1. Apply a coating of repair kit grease to the rack tooth face.

**Caution**

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

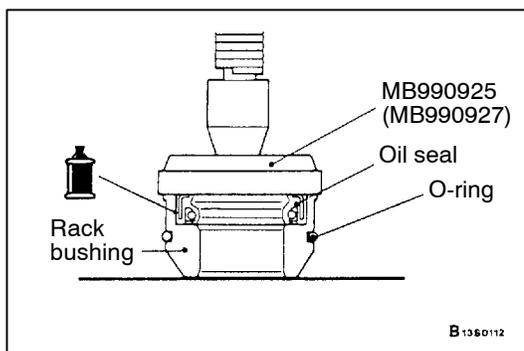


2. Cover rack serrations with special tool.
3. Apply specified fluid to the outer surfaces of the special tool, seal ring and O-ring.

**Specified fluid:**

**Automatic transmission fluid  
DEXRON or DEXRON II**

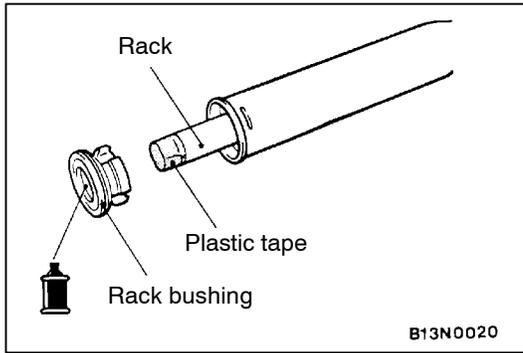
4. Match the oil seal centre with rack to prevent retainer spring from slipping and slowly insert rack from power cylinder side.

**►D◄ OIL SEAL/RACK BUSHING INSTALLATION**

1. Apply the specified fluid to the outer surface of the oil seal. Press-fit the oil seal using the special tool until it is flush with the bushing end face.

**Specified fluid:**

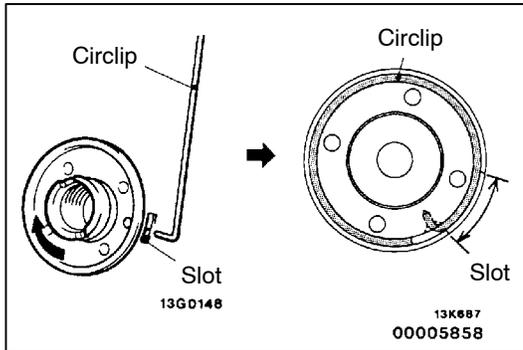
**Automatic transmission fluid  
DEXRON or DEXRON II**



2. Apply the specified fluid to the oil seal inner surface and the O-ring.

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

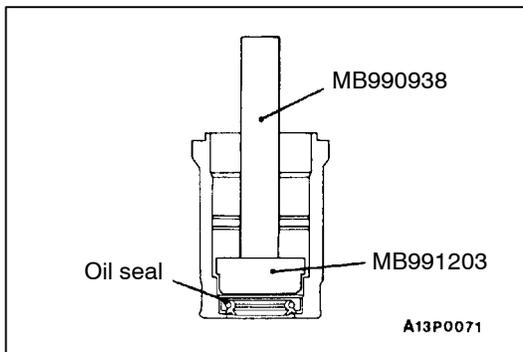
3. Wrap the rack end with plastic tape, and push the rack bushing onto the rack.



►E◄ **CIRCLIP INSTALLATION**

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

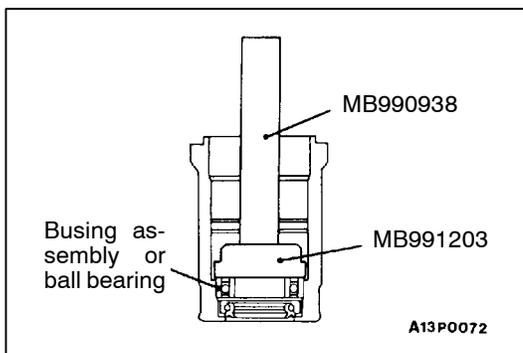
**Caution**  
 Insert the circlip to the rack stopper hole while turning the rack stopper clockwise.



►F◄ **OIL SEAL/BUSHING ASSEMBLY/BALL BEARING INSTALLATION**

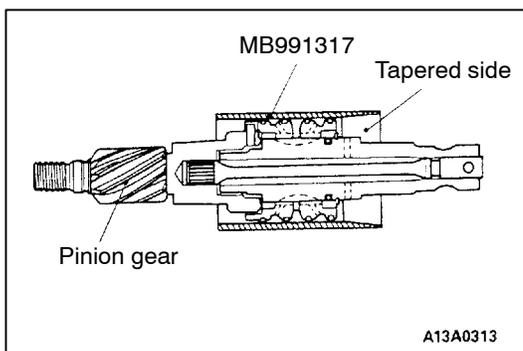
1. Apply a coating of the specified fluid to the outside of the oil seal. Using the special tools, press the oil seal into the valve housing.

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



2. Apply a coating of the specified fluid to the outside of the bushing assembly <L.H. drive vehicles> or the ball bearing <R.H. drive vehicles>. Using the special tools, press the ball bearing into the valve housing.

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

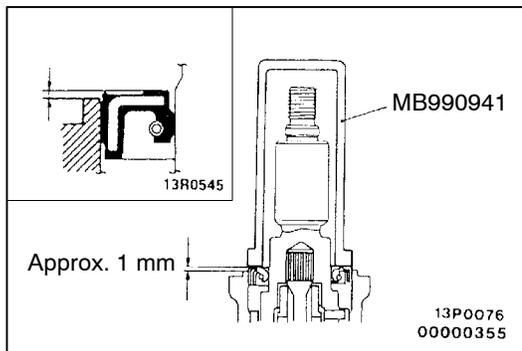


►G◄ **SEAL RING INSTALLATION**

1. Knead the seal ring to soften it.
2. Apply the specified fluid to the seal ring, and install to the rack groove.

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

3. Insert the tapered side of the special tool from the pinion gear side, and compress the seal ring.

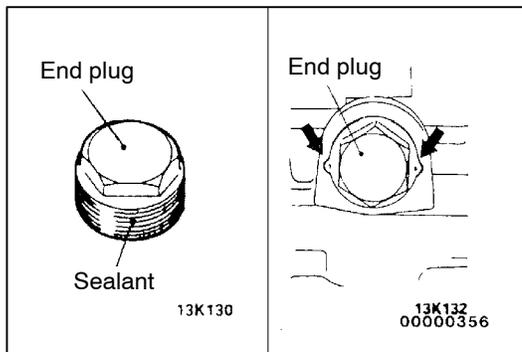


### ►H◄ OIL SEAL INSTALLATION

Use the special tool to press the oil seal into the valve housing. The upper surface of the oil seal should project outwards approx. 1 mm from the housing edge surface.

#### Caution

If the oil seal is flush with or lower than the housing edge, it will cause oil leaks and require reassembly.



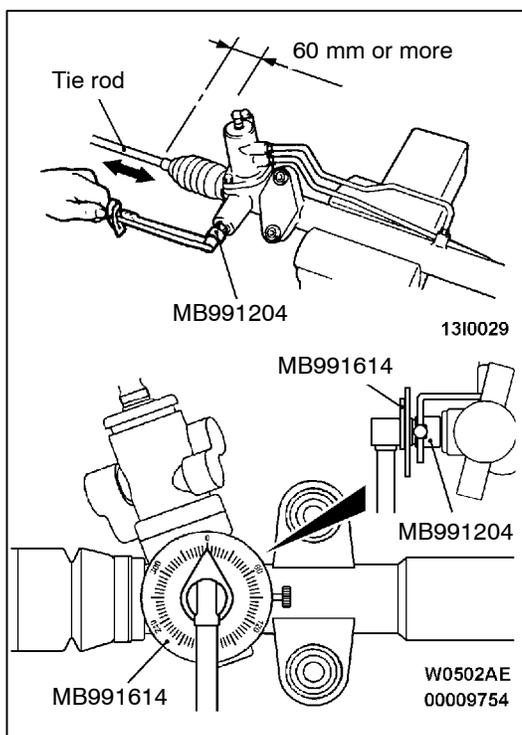
### ►I◄ END PLUG INSTALLATION

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.



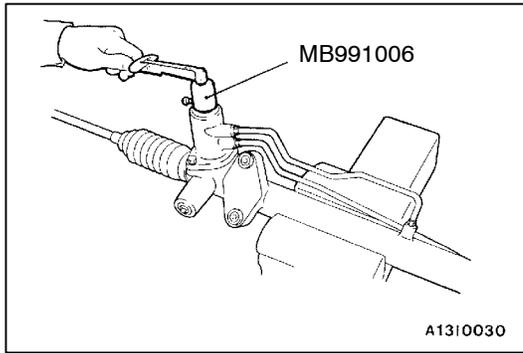
### ►J◄ RACK SUPPORT COVER/LOCKING NUT INSTALLATION

<L.H. drive vehicles>

1. Use the special tool (MB991204) to tighten the rack support cover to 20 Nm.
2. Slide the tie rod to the left and right by 60 mm or more three times, and then re-tighten the rack support cover to 20 Nm.
3. Use the special tools (MB991204, MB991614) to return the rack support cover 45°.
4. Use the special tool (MB991204) to hold the rack support cover and tighten the locking nut to the specified torque 44Nm.

<R.H. drive vehicles>

1. Use the special tool (MB991204) to tighten the rack support cover to 15 Nm.
2. Use the special tools (MB991204, MB991614) to return the rack support cover 30°.
3. Use the special tool (MB991204) to hold the rack support cover and tighten the locking nut to the specified torque 59 Nm.



### ►K◄ TOTAL PINION TORQUE ADJUSTMENT

1. Using the special tool, rotate the pinion shaft at the rate of one rotation in 4 to 6 seconds to check the total pinion torque and the change in torque.

#### Standard value:

**Total pinion torque: 0.7 - 1.4 Nm**

**Change in torque: 0.4 Nm or less**

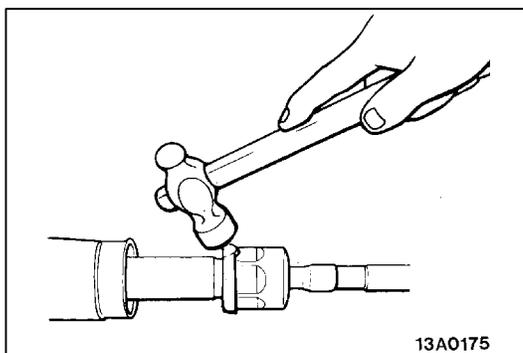
2. If the total pinion torque or the change in torque is outside the standard value, return the rack support cover within 0 to 30°, and adjust again.

#### Caution

- (1) When adjusting, set the standard value at its highest value.
- (2) Assure no ratcheting or catching when operating the rack towards the shaft direction.
- (3) Measure the total pinion torque through the whole stroke of the rack.

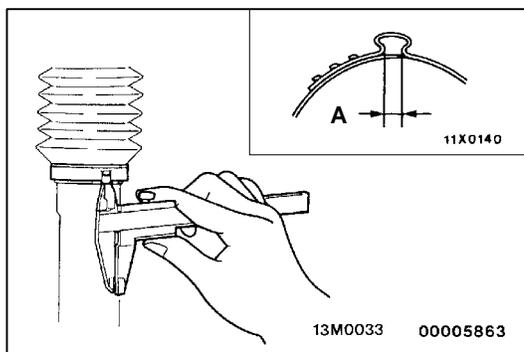
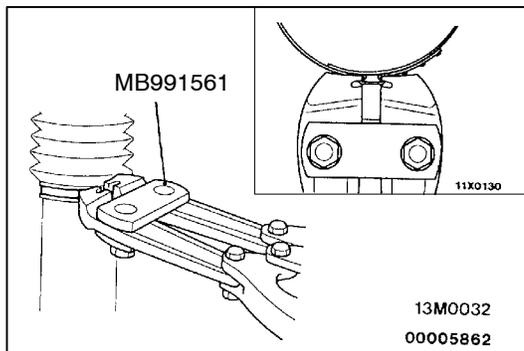
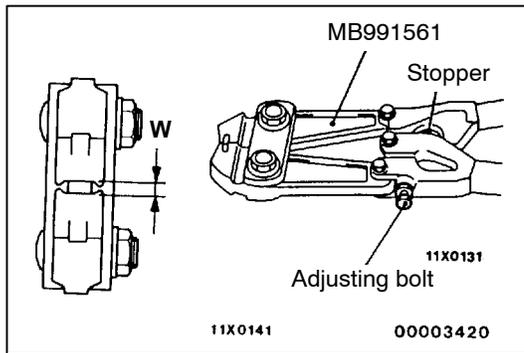
#### NOTE

If the total pinion torque cannot be adjusted to the standard value within the specified return angle, check the rack support cover components and replace any parts if necessary.



### ►L◄ TAB WASHER/TIE ROD INSTALLATION

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



### ►M◄ BELLOWS BAND INSTALLATION

1. Turn the adjusting bolt of the special tool to adjust the opening dimension (W) to the standard value.

**Standard value (W): 2.9 mm**

**<When more than 2.9 mm>**

**Screw in the adjusting bolt.**

**<When less than 2.9 mm>**

**Loosen the adjusting bolt.**

#### NOTE

- (1) The dimension (W) is adjusted by approx. 0.7 mm per one turn.
  - (2) Do not turn the adjusting bolt more than one turn.
2. Use the special tool to crimp the bellows band.

#### Caution

- (1) Hold the rack housing, and use the special tool to crimp the bellows band securely.
- (2) Crimp the bellows band until the special tool touches the stopper.

3. Check that the crimped width (A) is within the standard value.

**Standard value (A): 2.4 - 2.8 mm**

**<When more than 2.8 mm>**

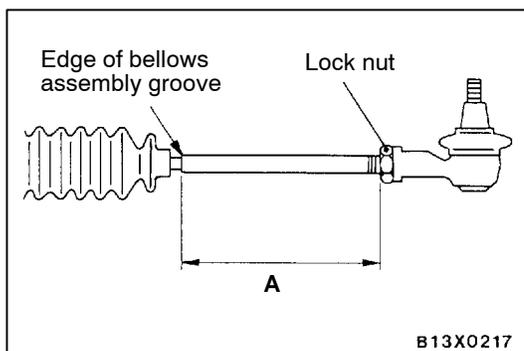
**Readjust the dimension (W) of step (1) to the value calculated by the following equation, and repeat step (2).**

**$W = 5.5 \text{ mm} - A$  [Example: If (A) is 2.9 mm, (W) is 2.6 mm.]**

**<When less than 2.4 mm>**

**Remove the bellows band, readjust the dimension (W) of step (1) to the value calculated by the following equation, and use a new bellows band to repeat steps (2) to (3).**

**$W = 5.5 \text{ mm} - A$  [Example: If (A) is 2.3 mm, (W) is 3.2 mm.]**



### ►N◄ TIE ROD END/TIE ROD END LOCKING NUT INSTALLATION

Screw in the tie rod end to adjust its right and left length (A) illustrated to the value shown in the table below. Lock with lock nut.

Item	L.H. drive vehicles	R.H. drive vehicles
SPACE RUNNER	184 mm	175 mm
SPACE WAGON	199 mm	189 mm

**INSPECTION**

37200440131

**RACK CHECK**

- 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**

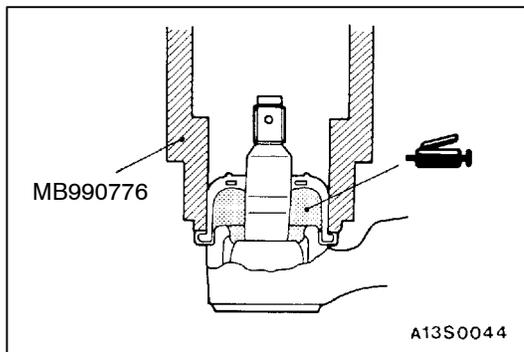
- Check the pinion gear tooth surfaces for damage or wear.
- Check for worn or defective seal ring.

**BEARING CHECK**

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

**OTHER CHECK**

- 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.

**TIE ROD END BALL JOINT DUST COVER REPLACEMENT**

Only when the dust cover is damaged accidentally during service work, replace the dust cover as follows:

1. Apply grease to the inside of the dust cover.
2. Apply the specified sealant to the mounting surface of the dust cover.

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

3. Drive in the dust cover with special tool until it is fully seated.
4. Check the dust cover for cracks or damage by pushing it with finger.

**POWER STEERING OIL PUMP**

37200520446

**REMOVAL AND INSTALLATION**

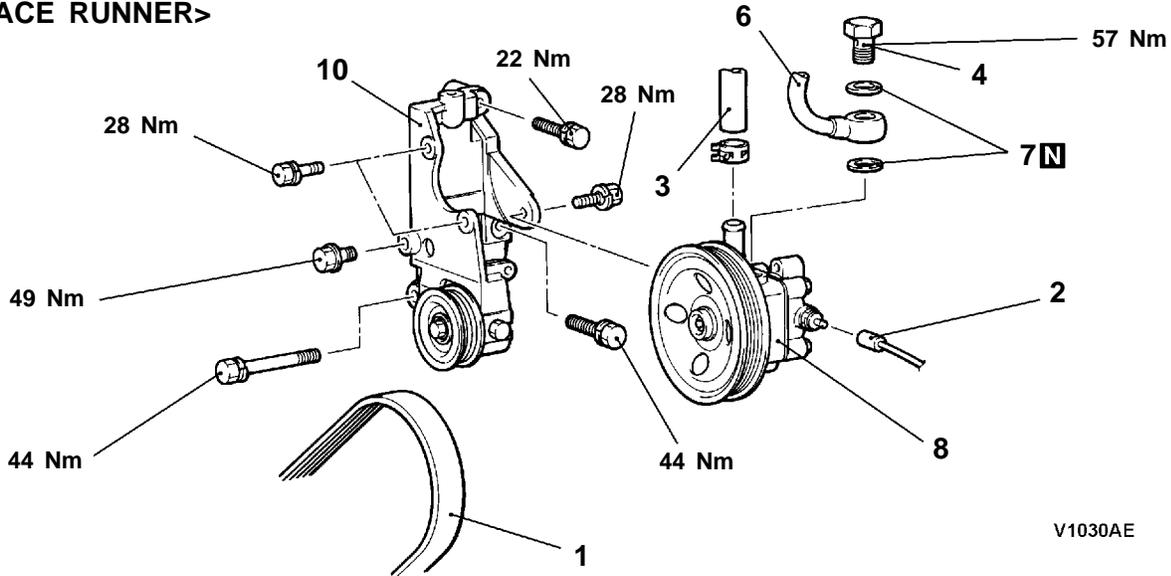
**Pre-removal Operation**

Power Steering Fluid Draining (Refer to P.37A-9.)

**Post-installation Operation**

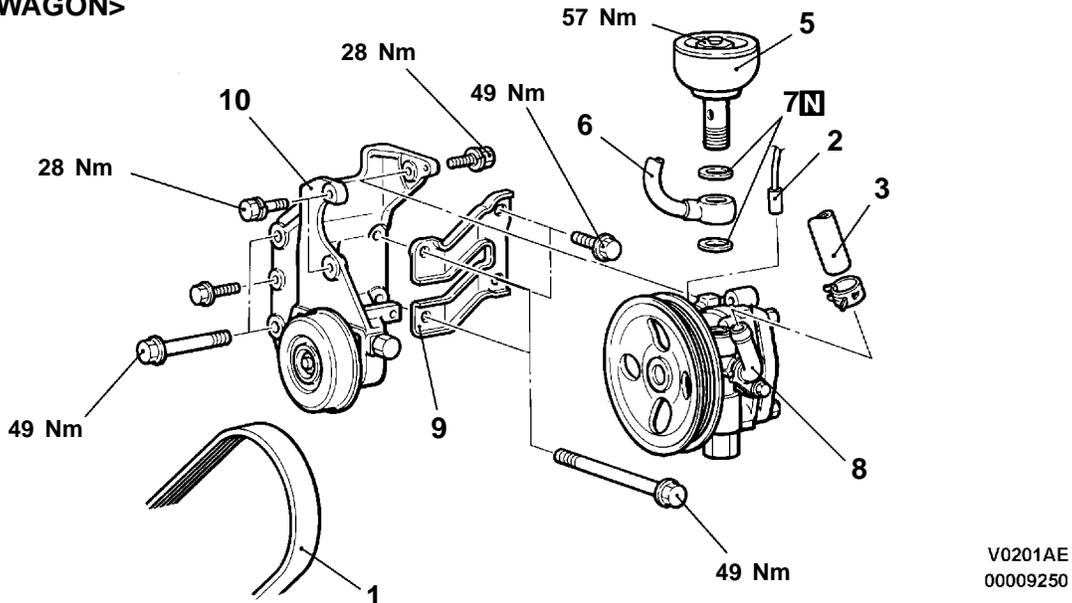
- Power Steering Fluid Supplying (Refer to P.37A-9.)
- Drive Belt Tension Adjusting (Refer to GROUP 11 - On-vehicle Service.)
- Power Steering Fluid Line Bleeding (Refer to P.37A-10.)
- Oil Pump Pressure Check (Refer to P.37A-11.)

**<SPACE RUNNER>**



V1030AE

**<SPACE WAGON>**

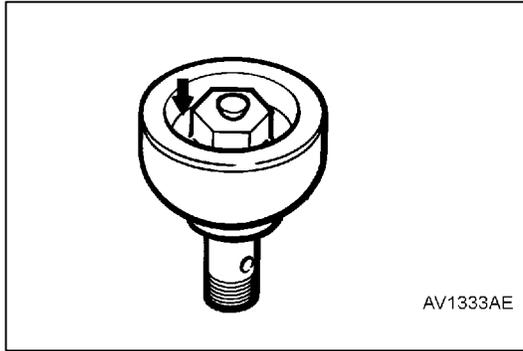


V0201AE  
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**Removal steps**

- |   |   |
|---|---|
| <ol style="list-style-type: none"> <li>1. Drive belt</li> <li>2. Pressure switch connector</li> <li>3. Suction hose</li> <li>4. Eye bolt</li> <li>5. Accumulator</li> </ol> | <ol style="list-style-type: none"> <li>6. Pressure hose assembly</li> <li>7. Gasket</li> <li>8. Oil pump assembly</li> <li>9. Power steering pump bracket stay</li> <li>10. Oil pump bracket</li> </ol> |
|---|---|





## REMOVAL SERVICE POINT

### ◀A▶ ACCUMULATOR REMOVAL

Be sure to drill a hole in the position shown to discharge the packed gas when the accumulator is discarded.

#### Caution

1. Never handle the accumulator in such ways as putting into fire, disassembling, pressing or welding as high-pressure gas is packed inside.
2. When drilling a hole in the accumulator, wear safety glasses against the possible scattering of metal particles by the gas.

## INSPECTION

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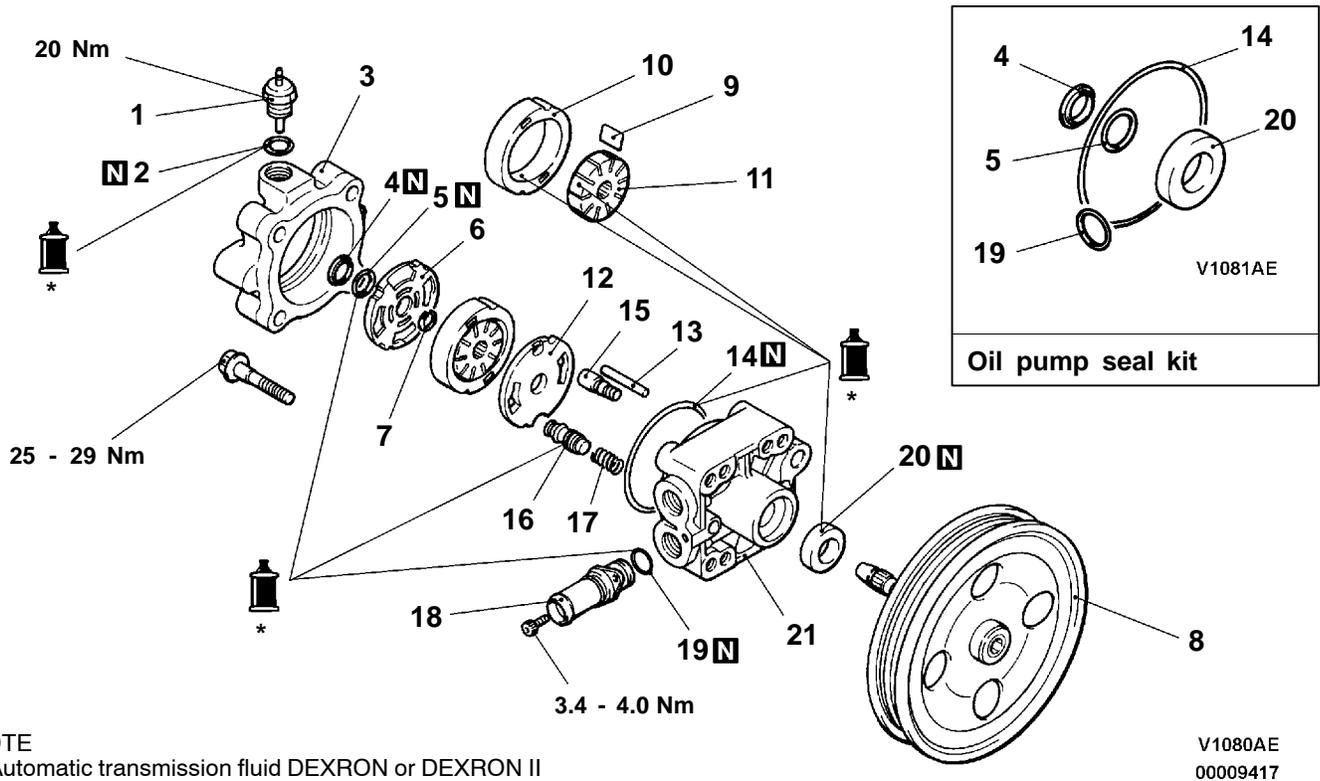
- Check the drive belt for cracks.
- Check the pulley assembly for uneven rotation.
- Check the accumulator for cracks and damage.

DISASSEMBLY AND REASSEMBLY <SPACE RUNNER>

37200540312

Caution

Never disassemble the pressure switch assembly and valve sub assembly.

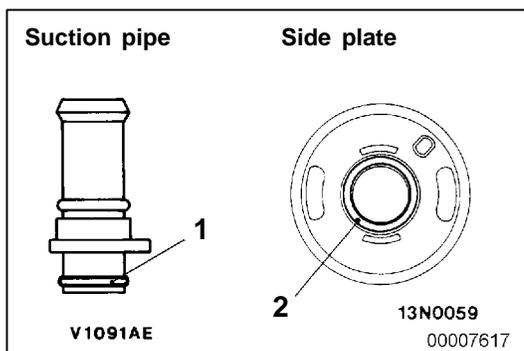


NOTE

\*: Automatic transmission fluid DEXRON or DEXRON II

Disassembly steps

- 1. Pressure switch assembly
- 2. O-ring
- 3. Rear cover
- 4. Back-up ring
- 5. O-ring
- 6. Side plate (R)
- 7. Snap ring
- 8. Oil pump pulley and shaft
- 9. Vanes
- 10. Cam ring
- 11. Rotor
- 12. Side plate (F)
- 13. Lock pin
- 14. O-ring
- 15. Valve sub assembly
- 16. Spool assembly
- 17. Spring
- 18. Suction pipe
- 19. O-ring
- 20. Oil seal
- 21. Oil pump body

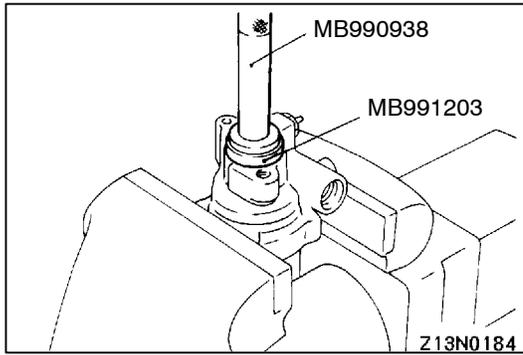


REASSEMBLY SERVICE POINTS

O-RINGS INSTALLATION

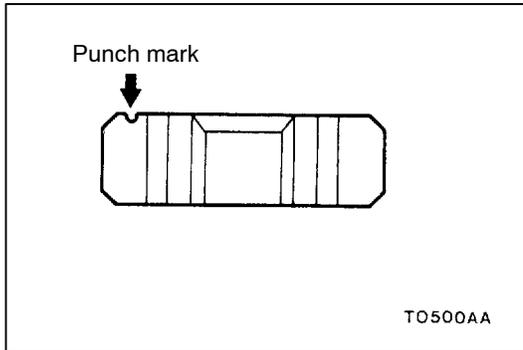
Apply the specified fluid on O-rings to install.

No.	I.D. × Width mm
1	13.3 × 1.6
2	15.0 × 2.0



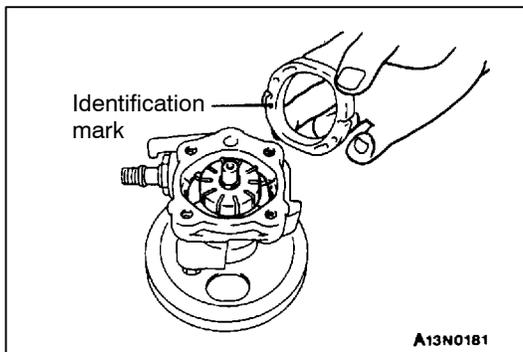
**►B◄ OIL SEAL INSTALLATION**

Install the oil seal to the oil pump body with the special tools.



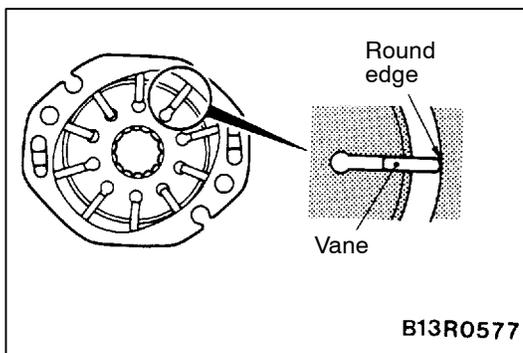
**►C◄ ROTOR INSTALLATION**

Install the rotor with its punch mark towards the side plate (F).



**►D◄ CAM RING INSTALLATION**

Install the cam ring with its identification mark towards the side plate (R).



**►E◄ VANE INSTALLATION**

Install the vane to the rotor with its round edge outwards (towards cam ring).

**INSPECTION**

37200550148

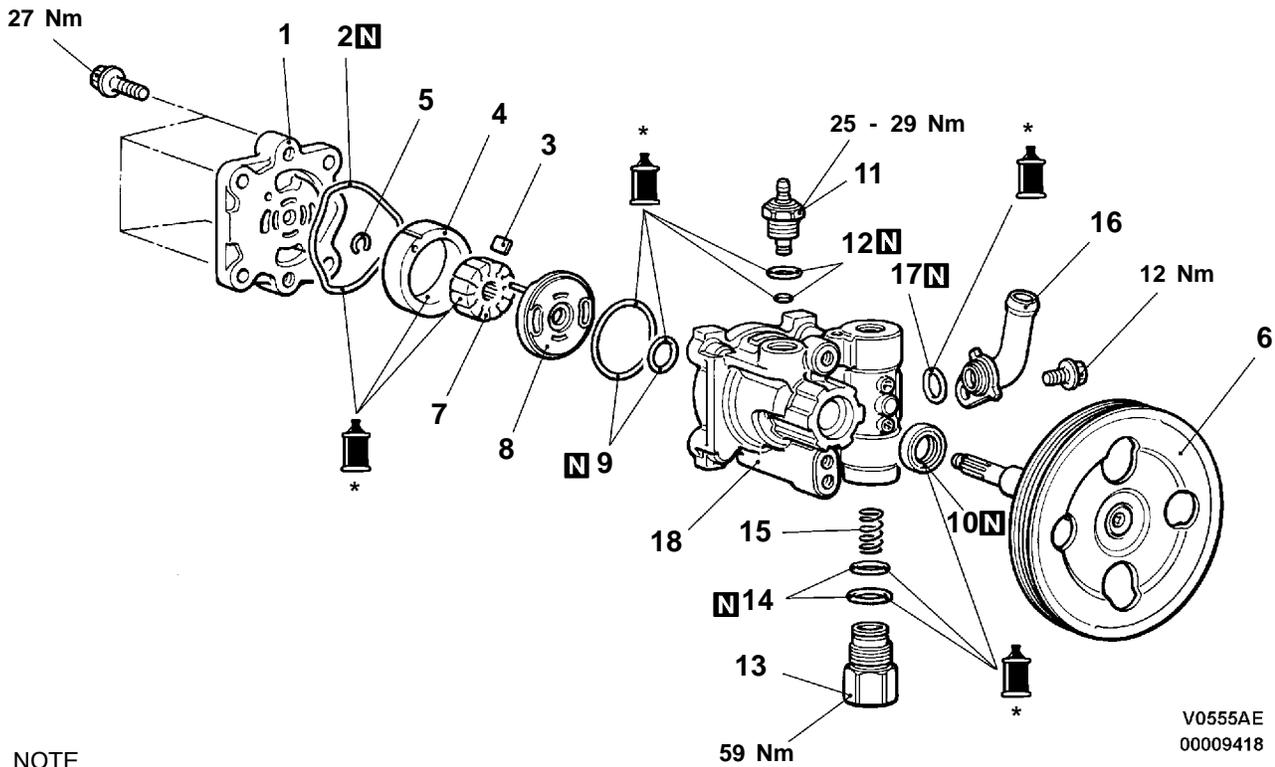
- Check the valve sub assembly for clogging.
- Check the oil pump pulley and shaft for wear or damage.
- Check the groove of rotor and vanes for “stepped” wear.
- Check the contact surface of cam ring and vanes for “stepped” wear.
- Check the vanes for damage.

DISASSEMBLY AND REASSEMBLY <SPACE WAGON>

37200540410

Caution

Never disassemble the terminal assembly and valve assembly.



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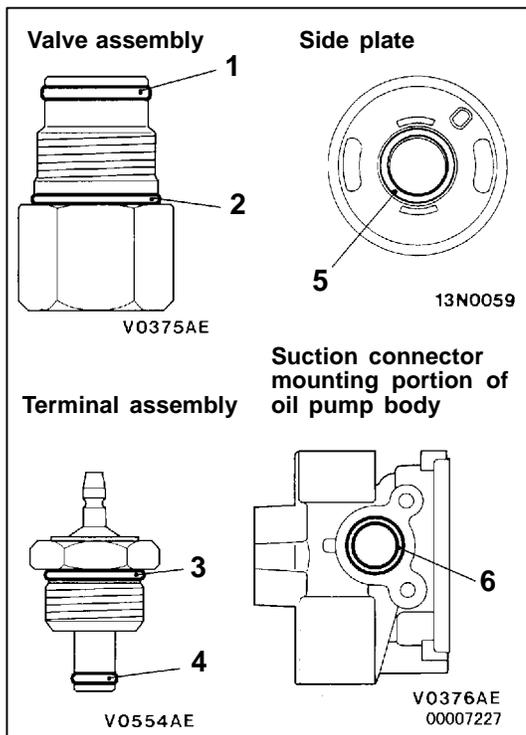
NOTE

\*: Automatic transmission fluid DEXRON or DEXRON II

<p>V0558AE</p>	<p>V0557AE</p>	<p>V0556AE</p>
<p>Oil pump seal kit</p>	<p>Oil pump cartridge kit</p>	<p>Oil pump pulley and shaft kit</p>

Disassembly steps

- 1. Pump cover
- 2. O-ring
- ▶E◀ 3. Vanes
- ▶D◀ 4. Cam ring
- 5. Snap ring
- ▶C◀ 6. Oil pump pulley and shaft
- ▶A◀ 7. Rotor
- ▶A◀ 8. Side plate
- ▶A◀ 9. O-ring
- ▶B◀ 10. Oil seal
- ▶A◀ 11. Terminal assembly
- ▶A◀ 12. O-ring
- ▶A◀ 13. Valve assembly
- ▶A◀ 14. O-ring
- ▶A◀ 15. Flow control spring
- ▶A◀ 16. Suction connector
- ▶A◀ 17. O-ring
- ▶A◀ 18. Oil pump body

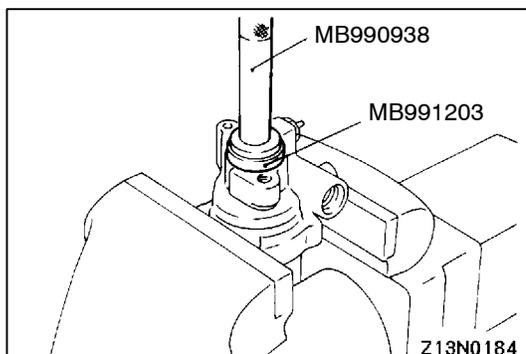


**REASSEMBLY SERVICE POINTS**

**▶A◀ O-RINGS INSTALLATION**

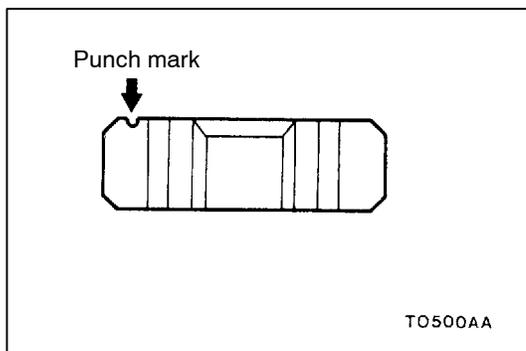
Apply the specified fluid on O-rings to install.

No.	I.D. × Width mm
1	15.8 × 1.9
2	21.0 × 1.9
3	14.8 × 2.4
4	14.8 × 1.9
5	3.8 × 1.9
6	15.8 × 2.4



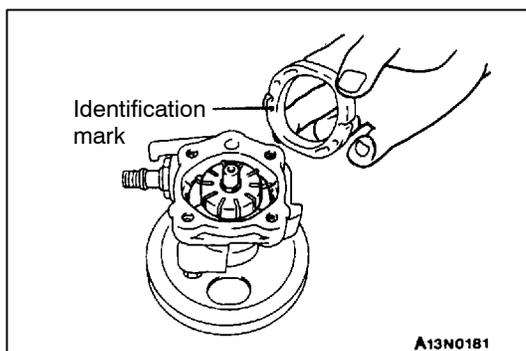
**▶B◀ OIL SEAL INSTALLATION**

Install the oil seal to the oil pump body with the special tools.



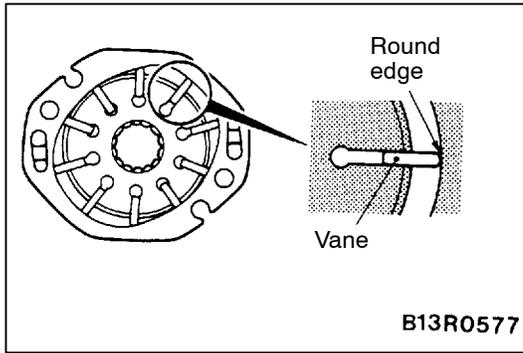
**▶C◀ ROTOR INSTALLATION**

Install the rotor with its punch mark towards the side plate.



**▶D◀ CAM RING INSTALLATION**

Install the cam ring with its identification mark towards the side plate.

**►E◄ VANE INSTALLATION**

Install the vane to the rotor with its round edge outwards (towards cam ring).

**INSPECTION**

37200550148

- Check the valve assembly for clogging.
- Check the oil pump pulley and shaft for wear or damage.
- Check the groove of rotor and vanes for “stepped” wear.
- Check the contact surface of cam ring and vanes for “stepped” wear.
- Check the vanes for damage.

**POWER STEERING HOSES**

37200570410

**REMOVAL AND INSTALLATION**

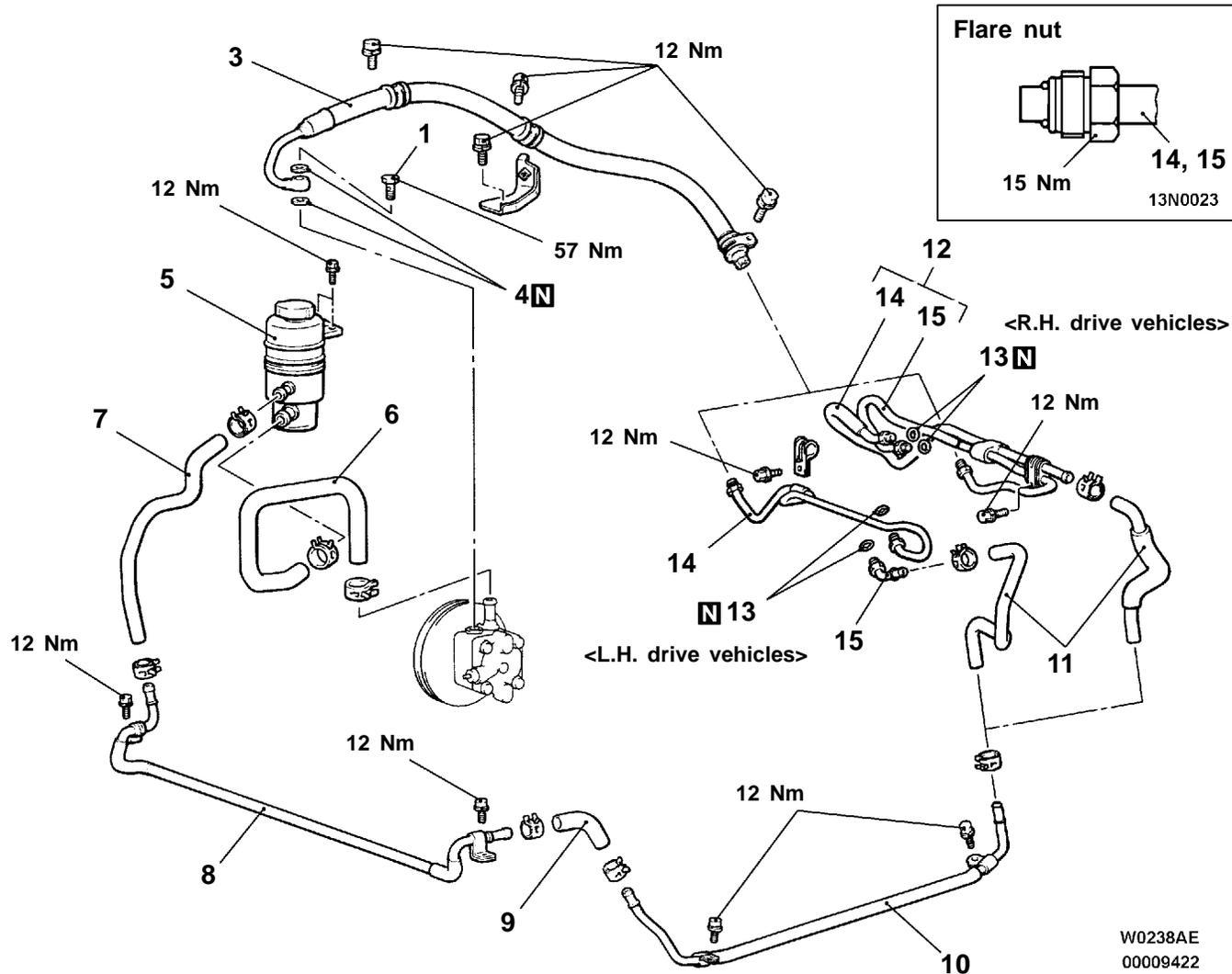
**Pre-removal Operation**

- Power Steering Fluid Draining (Refer to P.37A-9.)
- Under Cover Removal

**Post-installation Operation**

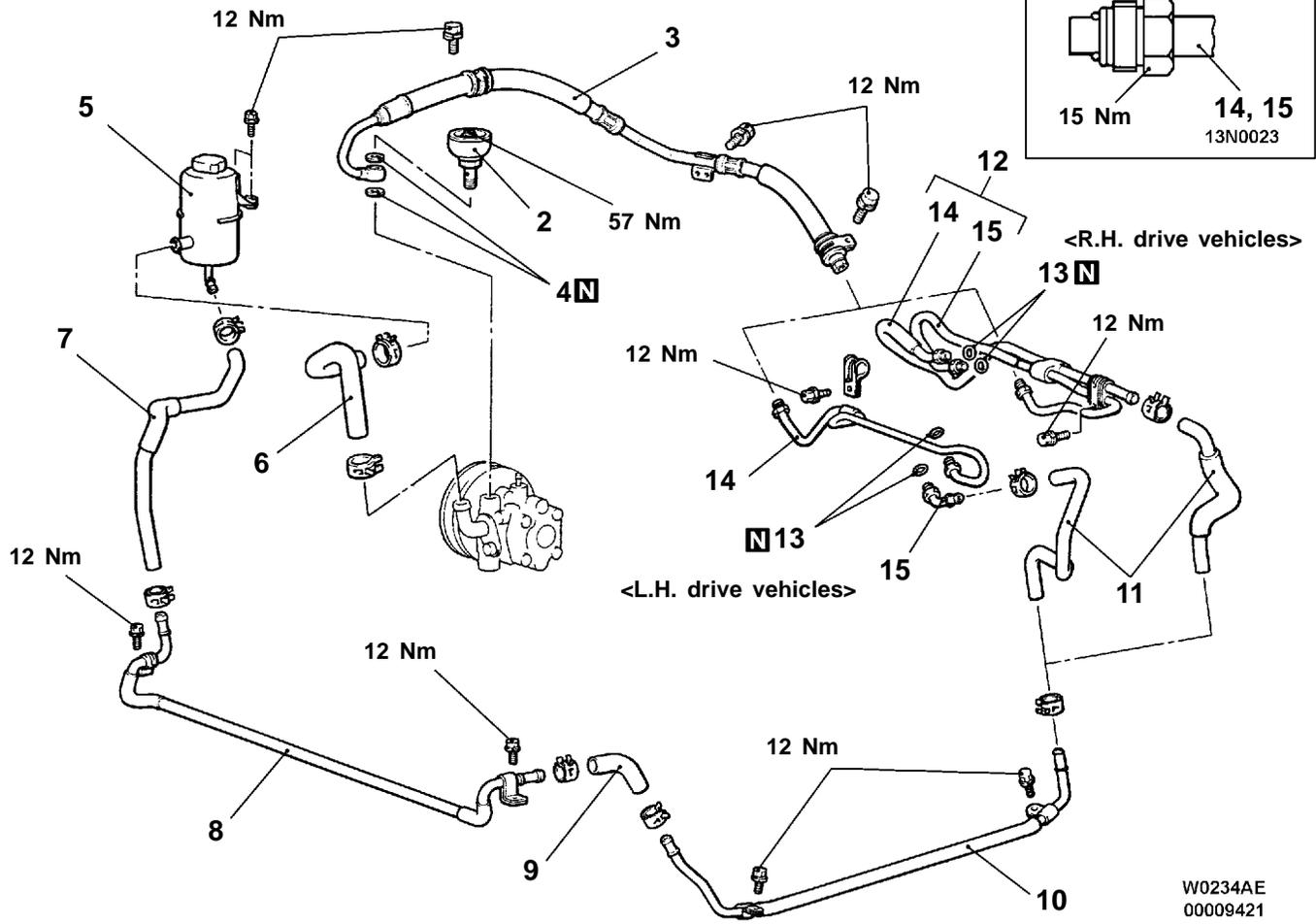
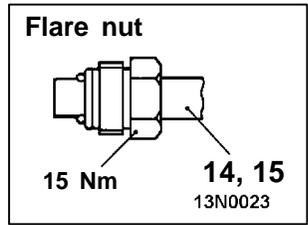
- Under Cover Installation
- Power Steering Fluid Supplying (Refer to P.37A-9.)
- Power Steering Fluid Line Bleeding (Refer to P.37A-10.)

<SPACE RUNNER>



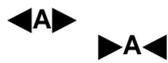
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<SPACE WAGON>



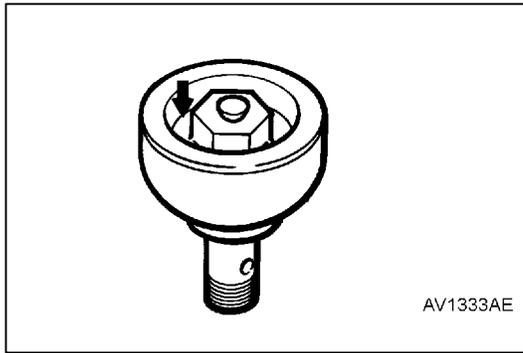
W0234AE  
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**Removal steps**



- 1. Eye bolt
- 2. Accumulator
- 3. Pressure hose
- 4. Gasket
- 5. Oil reservoir
- 6. Suction hose
- 7. Return hose
- 8. Cooler pipe

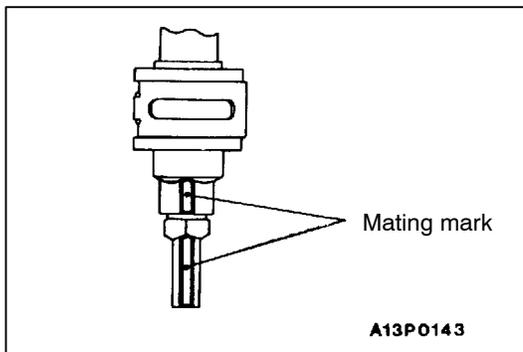
- 9. Return hose
- 10. Return pipe
- 11. Return hose
- 12. Pipe assembly
- 13. O ring
- 14. Pressure pipe assembly
- 15. Return pipe assembly

**REMOVAL SERVICE POINT****◀A▶ ACCUMULATOR REMOVAL <SPACE WAGON>**

Be sure to drill a hole in the position shown to discharge the packed gas when the accumulator is discarded.

**Caution**

1. Never handle the accumulator in such ways as putting into fire, disassembling, pressing or welding as high-pressure gas is packed inside.
2. When drilling a hole in the accumulator, wear safety glasses against the possible scattering of metal particles by the gas.

**INSTALLATION SERVICE POINT****▶A◀ PRESSURE HOSE INSTALLATION**

Align the marks on the pressure hose and pressure pipe, and install the pressure hose.

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## NOTES