GROUP 37

POWER STEERING

CONTENTS

GENERAL INFORMATION

M1372000100445

A hydraulic power steering system has been adopted to all models.

FEATURES

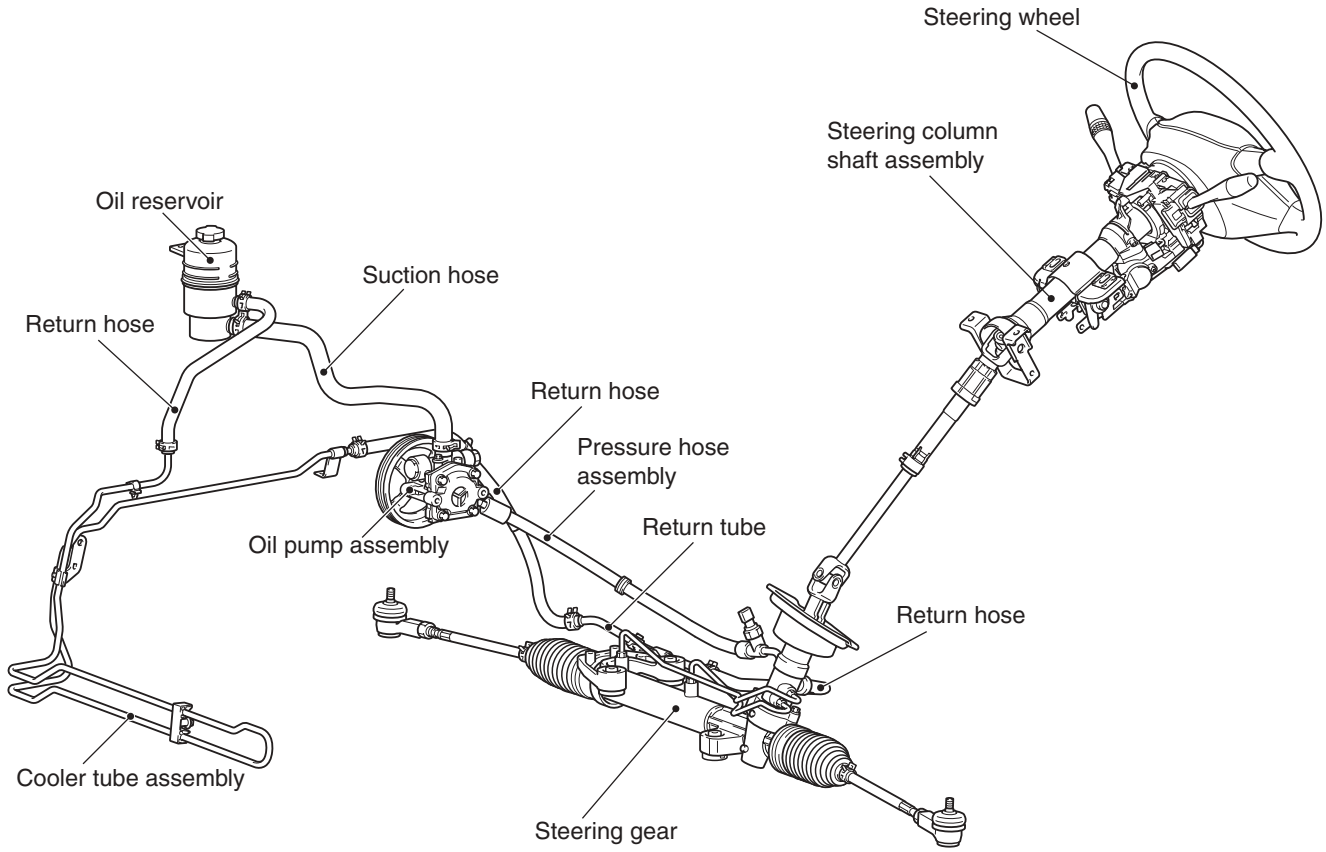
- An elastic mounting structure for the steering gear has improved steering stability significantly.
- The hydraulic characteristics and the friction characteristics of the steering gear have been optimized to improve steering ability and to reduce shimmy sensitivity.
- The oil pump is of a non-return control valve, and improves steering feeling.
- The pressure hoses are of a high-expansion ratio type and reduce vibration and noise.
- The oil pressure sensor allows the system to perform idle-up control linearly and without delay as the power steering fluid pressure deviates.
- On vehicles with 16-inch wheels, a class-top minimum steering radius (5.5 m) has been established due to larger wheel steering angle (The steering radius for 17-inch wheels is 5.8 m).

SPECIFICATIONS

Item		**Vehicles with 16-inch wheels**	**Vehicles with 17-inch wheels**
Steering wheel	Type	4-spoke type	
	Outside diameter mm	380	
	Maximum number of turns	3.4	3.1
Steering column	Column mechanism	Shock absorbing mechanism and tilt steering mechanism	
Power steering type		Integral type	
Oil pump	Type	Vane pump	
	Basic delivery rate cm^3/rev.	9.6	
	Relief pressure MPa	9.8	
	Reservoir type	Separate type (plastic)	
	Hydraulic sensor	Equipped	
Steering gear	Type	Rack and pinion	
	Stroke ratio (Rack stroke/Steering wheel maximum turning number)	44.1	
	Rack stroke mm	152	144

CONSTRUCTION DIAGRAM

LH drive vehicles



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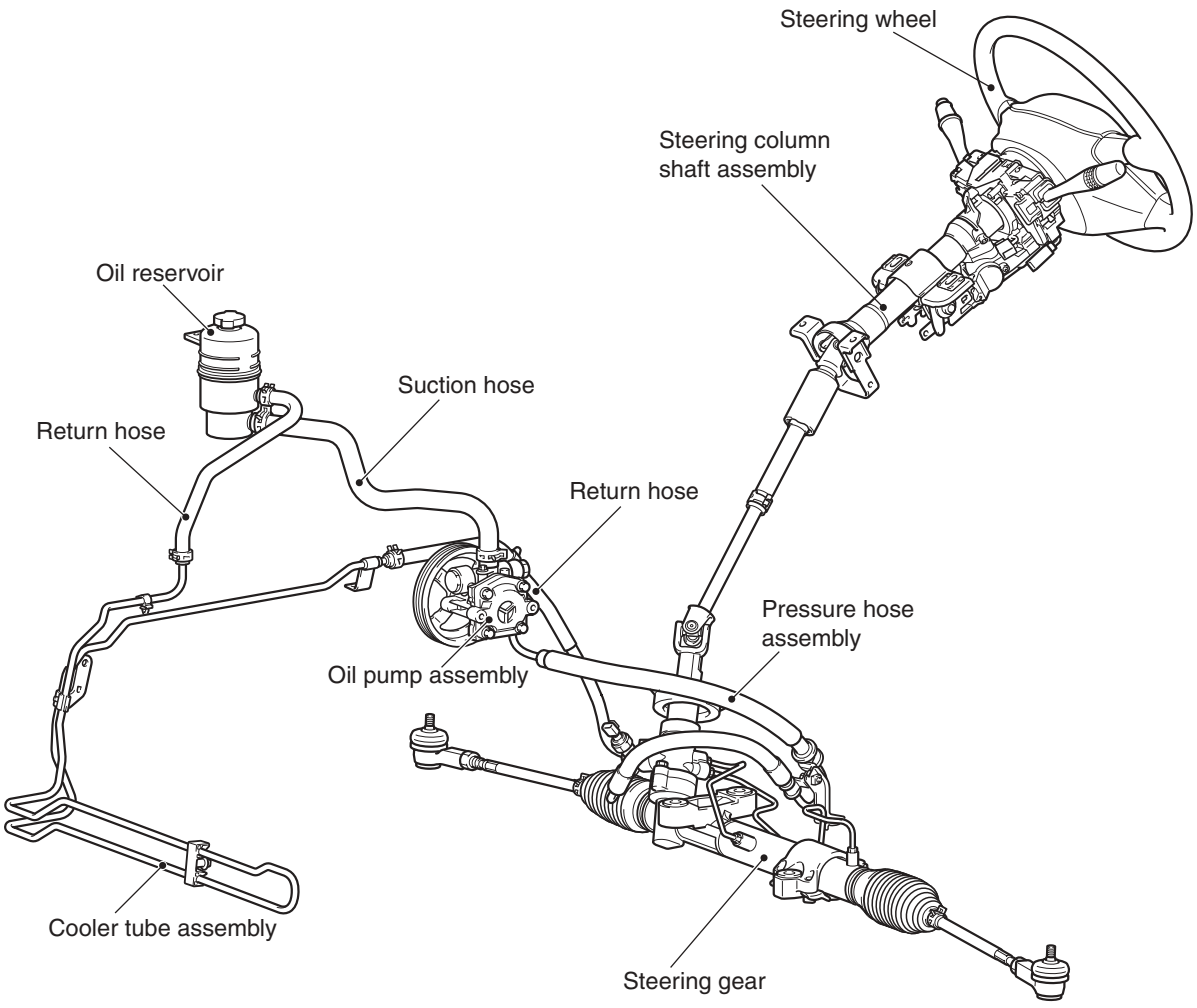
RH drive vehicles



SERVICE SPECIFICATIONS

M1372000300513

Item			Standard value	Limit
Steering wheel free play mm	With engine running		–	30
	With engine stopped		10 or less	–
Steering angle	Inner wheel	Vehicles with 16 inch wheel	39°30' ± 2°	–
		Vehicles with 17 inch wheel	36°30' ± 2°	–
	Outer wheel (reference)	Vehicles with 16 inch wheel	32°30'	–
		Vehicles with 17 inch wheel	30°50'	–
Toe-in	At the centre of tyre tread mm		0 ± 3	–
	Toe-angle (per wheel)		0°00' ± 08'	–
Tie rod end ball joint turning torque N·m			3.9 or less	–
Tie rod swing resistance N [Tie rod swing torque N·m]			6 – 19 [1.5 – 4.9]	–
Stationary steering effort N [Fluctuation allowance N]			25 or less [6.0 or less]	–

Item		Standard value	Limit
Oil pump pressure MPa (1000 ± 100 r/min.)	Oil pump relief pressure	9.8 – 10.3	–
	Pressure under no-load conditions	0.2 – 0.7	–
	Steering gear retention hydraulic pressure	9.8 – 10.3	–
Steering gear total pinion torque N·m [Change in torque N·m]		0.8 – 2.1 [0.6 or less]	–
Opening dimension of special tool boot band crimping tool (MB991561) mm		2.9	–
Band crimped width mm		2.4 – 2.8	–

LUBRICANTS

M1372000400446

Item		Specified lubricant	Quantity
Power steering fluid		ATF DEXRON III or DEXRON II	Approximately 1.0 L
Steering gear	Bearing	ATF DEXRON III or DEXRON II	As required
	O-ring and seal ring		
	Oil seal		
	Special tool (MB991213)		
	Pinion and valve assembly seal ring part		
	Bellows	Silicon grease	As required
	Tie rod end ball joint	Multipurpose grease SAE J310, NLGI No.2 or equivalent	As required
Oil pump	Friction surface of rotor vane, cam ring and pump cover	ATF DEXRON III or DEXRON II	As required
	O-ring		

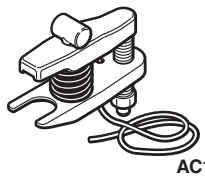
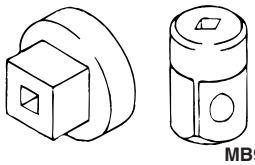
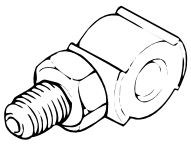
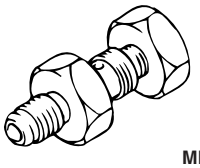
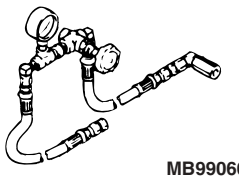
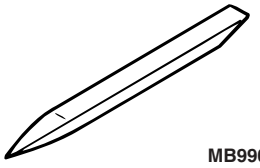
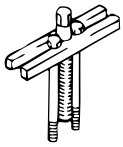
SEALANTS

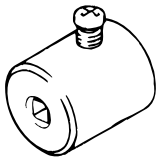
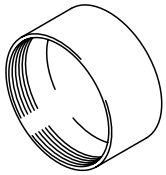
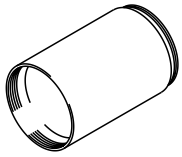
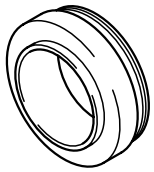
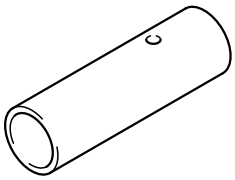
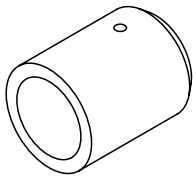
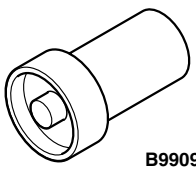
M1372000500443

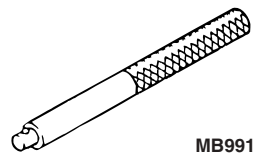
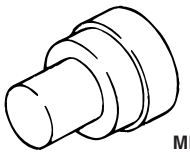
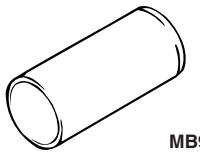
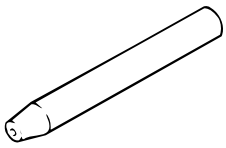
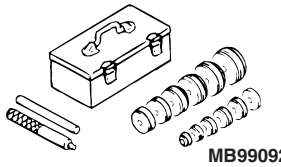
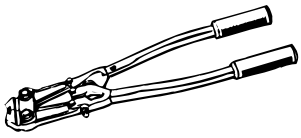
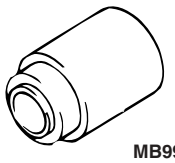
Item		Specified sealant
Steering shaft cover assembly bolt hole on the toeboard		3M ATD Part No.8513 or equivalent
Steering gear	End plug	3M ATD Part No.8661, 8663 or equivalent
	Rack support cover	

SPECIAL TOOLS

M1372000600484

Tool	Number	Name	Use
 AC106827	MB991897	Ball joint remover	Knuckle and tie rod end ball joint disconnection *NOTE: Steering linkage puller (MB990635 or MB991113) is also available to disconnect knuckle and tie rod end ball joint.*
 MB990326	MB990326	Preload socket	Tie rod end ball joint turning torque check
 MB991548	MB991548	Power steering oil pressure gauge adapter (Pump side)	Oil pump pressure test
 MB991549	MB991549	Power steering oil pressure gauge adapter (Hose side)	
 MB990662	MB990662	Power steering oil pressure gauge	
 MB990784	MB990784	Ornament remover	Cover removal
 MB990803	MB990803	Steering wheel puller	Steering wheel removal

Tool	Number	Name	Use
 MB991006	MB991006	Preload socket	Steering gear total pinion torque check and adjustment
 MB991621	MB991621	Piston driver	• Rack support cover removal • Rack support adjustment
	MD998812	Installer cap	Gear housing mount bushing removal
	MD998813	Installer 100	
	MD998822	Installer adopter	
	MD998368	Bearing installer	
	MD999569	Camshaft oil seal installer	Gear housing mount bushing press-fitting
 B990996	MB990996	Lower arm bushing arbor	

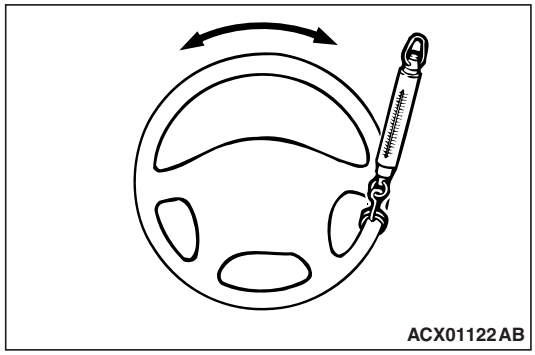
Tool	Number	Name	Use
 MB991197	MB991197	Bar (long type)	Oil seal installation
 MB991199	MB991199	Oil seal and bearing installer	Oil seal installation
 MB991317	MB991317	Seal ring installer	Seal rings installation
 MB991212	MB991213	Oil seal protector	Rack installation
 MB990925	MB990925	Bearing and oil seal installer set	• Oil seal and bearing installation • MB990927, MB990938, MB990939 (For details, refer to GROUP 26, Special Tools P.26-4).
 MB991561	MB991561	Boot band crimping tool	Bellows band installation
 MB990776	MB990776	Front axle base	Tie rod end ball joint dust cover installation

ON-VEHICLE SERVICE

STEERING WHEEL FREE PLAY CHECK

M1372001000418

1. With the engine running (hydraulic operation), set the front wheels straight ahead.



2. Measure the play on the steering wheel circumference before the wheels start to move when slightly moving the steering wheel in both directions.

   Limit: 30 mm

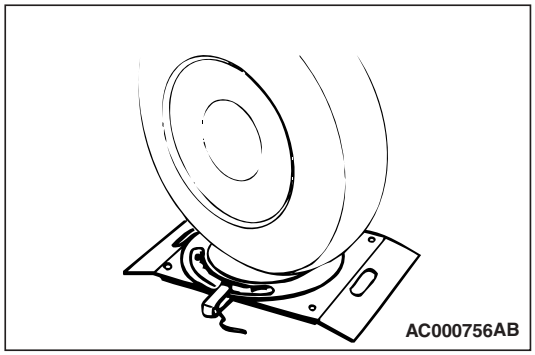
3. When the play exceeds the limit, check for the play on the steering shaft and steering linkage connection. Correct or replace.
4. If the free play still exceeds the limit value, set the steering wheel straight ahead with the engine stopped. Load 5 N towards the steering wheel circumference and check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

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

5. If the play exceeds the standard value, remove the steering gear (Refer to P.37-19) and check the total pinion torque (Refer to P.37-24).

STEERING ANGLE CHECK

M1372001100471



1. Place the front wheel on a turning radius gauge and measure the steering angle.

   Standard value:

   <Vehicles with 16 inch wheel>

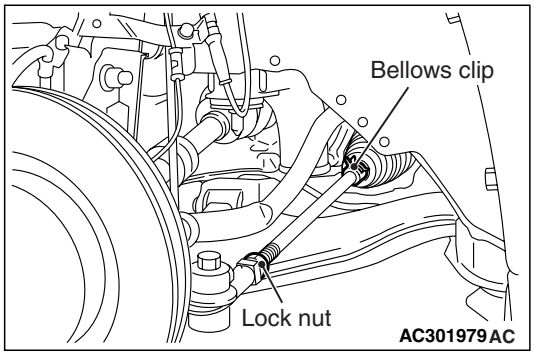
Item	Specification
Inner wheels	39°30' ± 2°
Outer wheels (reference)	32°30'

   <Vehicles with 17 inch wheel>

Item	Specification
Inner wheels	36°30' ± 2°
Outer wheels (reference)	30°50'

2. If the steering angle is not within the standard value, adjust the toe-in as follows.

   Standard value:
   at the centre of tyre tread: 0 ± 3 mm
   Toe angle (per wheel): 0°00' ± 08'



3. Loosen the lock nut, and unclip the bellows.
4. Adjust the toe-in by turning the left and right tie rod turnbuckles by the same amount (in opposite directions).

   NOTE: The toe will move out as the left turnbuckle is turned toward the front of the vehicle and the right turnbuckle is turned toward the rear of the vehicle.

5. Tighten the lock nut to the specified torque, and tighten the bellows by the clip.

   Tightening torque: 52 ± 2 N·m

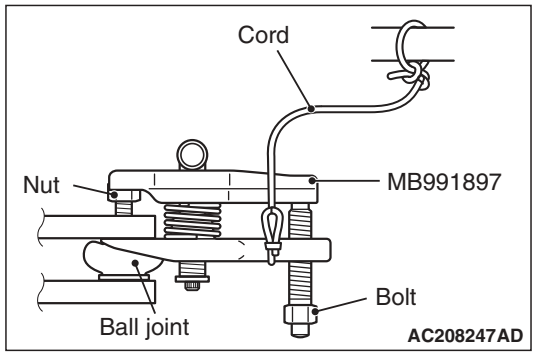
6. Recheck the steering angle.

TIE ROD END BALL JOINT TURNING TORQUE CHECK

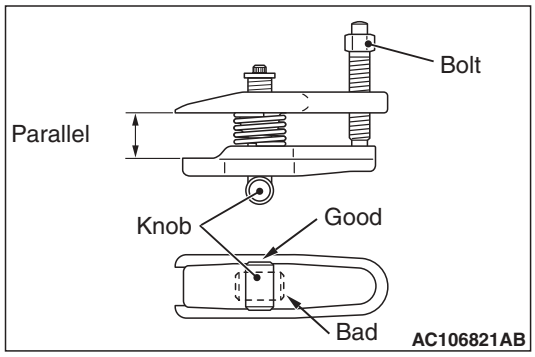
M1372001500402

⚠ CAUTION

- **Do not remove the tie rod end nut from the ball joint. Loosen it and use special tool to avoid possible damage to the ball joint threads.**
- **Hang special tool with cord to prevent it from falling.**



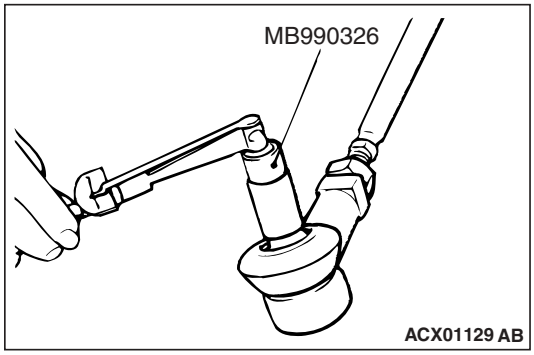
1. Install special tool ball joint remover (MB991897) as shown in the figure.



2. Turn the bolt and knob as necessary to make the jaws of special tool parallel, tighten the bolt by hand and confirm that the jaws are still parallel.

   NOTE: When adjusting the jaws in parallel, make sure the knob is in the position shown in the figure.

3. Tighten the bolt with a wrench to disconnect the tie rod end.



4. Move the ball joint stud several times and install the nut on the stud. Using special tool preload socket (MB990326), measure the ball joint turning torque.

   Standard value: 3.9 N·m or less

5. If the turning torque exceeds the standard value, replace the tie rod end. (Refer to P.37-24)
6. If the turning torque is under the standard value, check the ball joint for axial play or ratcheting. If no axial play or ratcheting, the ball joint can be re-used. (Refer to P.37-24)

⚠ CAUTION

Always use a new ball joint nut as it is a self-locking nut.

7. Install the tie rod end to the knuckle, then tighten a new self-locking nut to the specified torque.

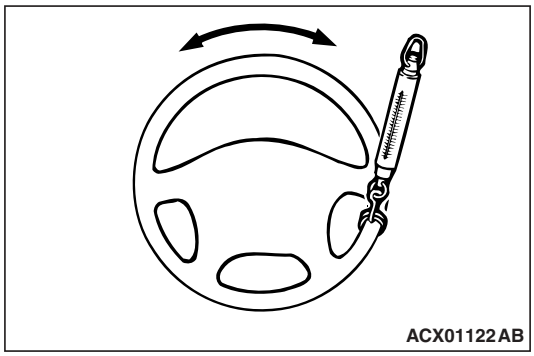
   Tightening torque: 25 ± 5 N·m

STATIONARY STEERING EFFORT CHECK

M1372001700451

1. With the vehicle stopped on a flat and paved surface, turn the steering wheel to the straight ahead position.
2. Start the engine and set the engine idle speed.

   Standard value: 1000 ± 100 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 change in the required steering effort.

   Standard value:
   Steering effort: 25 N or less
   Fluctuation allowance: 6.0 N or less

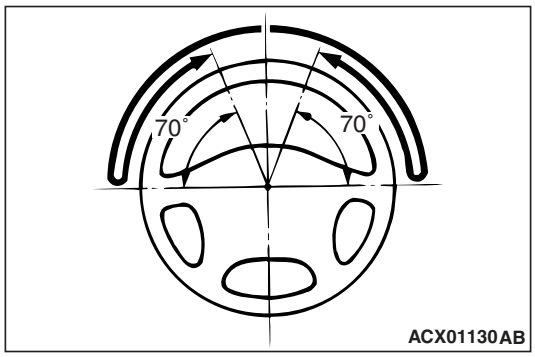
4. If the measured value exceeds the standard value, check and adjust the related parts.

STEERING WHEEL RETURN TO CENTRE CHECK

M1372001800403

Conduct a road test:

1. Make both gradual and sudden turns and check the steering wheel return.



2. At a vehicle speed of approximately 35 km/h, turn the steering wheel 90°, hold a few seconds, then release. If the steering wheel then returns 70° or more, the return can be judged satisfactory.

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

DRIVE BELT TENSION CHECK

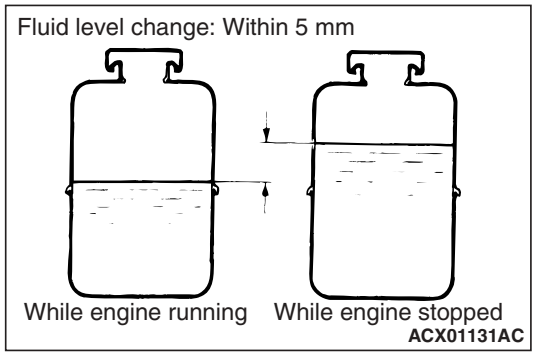
M1372001900369

Refer to GROUP 11A, On-vehicle Service – Drive Belt Tension Check P.11A-7.

FLUID LEVEL CHECK

M1372002000381

1. Park the vehicle on a flat, level surface.
2. Start the engine, and then turn the steering wheel several times to raise the temperature of the fluid to approximately 50 – 60°C.
3. With the engine running, turn the wheel all the way to the left and right several times.

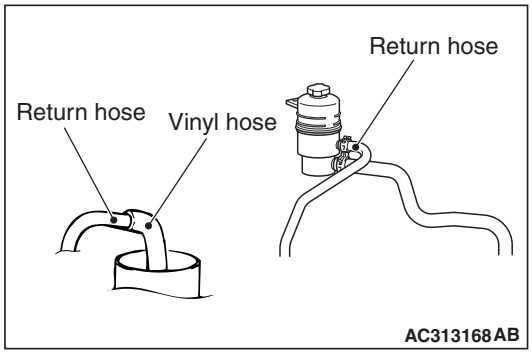


4. Check the fluid in the oil reservoir for foaming or milkiness. Check the difference of the fluid level when the engine is stopped, and while it is running. If the change of the fluid level is 5 mm or more, air bleeding should be done.

FLUID REPLACEMENT

M1372002100441

1. Raise and support the front wheels.



2. Disconnect the return hose connection, and then connect a vinyl hose to the return hose, and drain the fluid into a container.
3. Disconnect the ignition coil connectors (Refer to GROUP 16, Ignition Coil P.16-27).
4. While operating the starter motor intermittently, turn the steering wheel all the way to the left and right several times to drain all of the fluid.
5. Connect the return hose securely, and then secure with the clip.
6. Fill the oil reservoir with specified fluid up to between "MAX" and "MIN" marks, and then bleed the air.

   Specified fluid: ATF DEXRON III or DEXRON II

POWER STEERING SYSTEM AIR BLEEDING

M1372002200437

Perform air bleeding procedure as necessary after replacing the steering gear or the steering fluid lines.

1. Raise and support the front wheels.
2. Disconnect the ignition coil connectors (Refer to GROUP 16, Ignition Coil P.16-27).

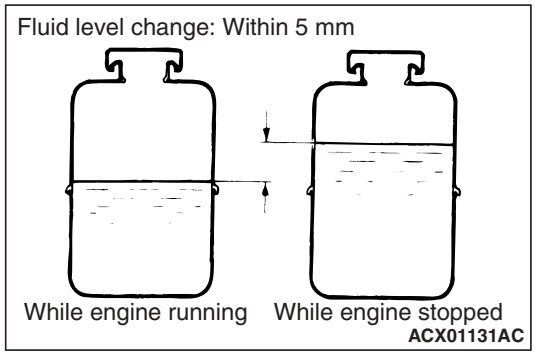
⚠ CAUTION

Perform air bleeding only while cranking the engine. If air bleeding is performed while the engine is running, air could enter the fluid. During air bleeding, refill the steering fluid supply so that the level never falls below the "MIN" mark on the oil reservoir.

3. Turn the steering wheel all the way to the left and right five or six times while using the starter motor to crank the engine intermittently several times (for 15 to 20 seconds).
4. Connect the ignition coil connectors (Refer to GROUP 16, Ignition Coil P.16-27).
5. 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 between "MAX" and "MIN" marks.
8. Confirm that there is very little change in the fluid level when the steering wheel is turned left and right.

⚠ CAUTION

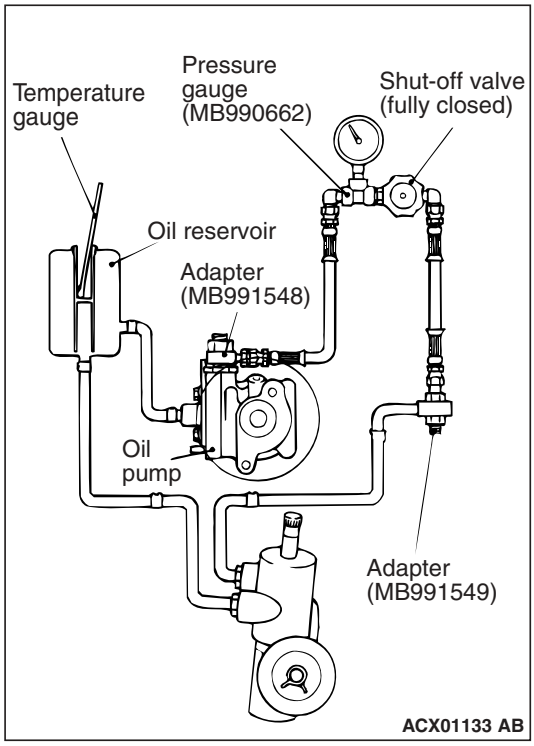
If the fluid level rises suddenly after the engine is stopped, the air has not been completely bled. If air bleeding is not complete, there will be abnormal noises from the pump and the flow-control valve, and this condition could cause reduce the life of the power steering components.



9. Confirm that the change in the fluid level is no more than 5 mm when the engine is stopped and when it is running.
10. If the change of the fluid level is 5 mm or more, the air has not been completely bled from the system. The air bleeding procedure must be repeated.

OIL PUMP PRESSURE TEST

M1372002300412



1. Disconnect the pressure hose from the oil pump, and then connect the following special tools.
   - MB990662: Power Steering Oil Pressure Gauge
   - MB991548: Power Steering Oil Pressure Gauge Adapter (pump side)
   - MB991549: Power Steering Oil Pressure Gauge Adapter (hose side)
2. Bleed air, 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 1000 ± 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. Open it again immediately after checking the pressure.

   Standard value: 9.8 – 10.3 MPa
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: 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, so check these parts and repair as necessary.
8. 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: 9.8 – 10.3 MPa
9. If not the standard value, overhaul the steering gear. Remeasure fluid pressure.
10. Remove the special tools, and then tighten the pressure hose to the specified torque.

    Tightening torque: 57 ± 7 N·m
11. Bleed the system (Refer to P.37-11).

TIE ROD END BALL JOINT DUST COVER CHECK

M1372008600358

1. Press the dust cover with your finger to check whether the dust cover is cracked or damaged.
2. If the dust cover is cracked or damaged, replace the tie rod end.

   NOTE: If the dust cover is cracked or damaged, the ball joint could be damaged.

STEERING COLUMN SHAFT ASSEMBLY SHOCK ABSORBING MECHANISM CHECK

M1372013500250

If a collision accident occurs or severe impact is applied on the steering wheel, the collision energy absorbing mechanism may have operated. Once the mechanism has operated, it will be inoperative even it has suffered no apparent damage. Determine if the steering column shaft can be reused by the following procedure. If the collision energy absorbing mechanism has already operated, replace the steering column shaft assembly.
If any excessive radial free play on the steering wheel is found with the tilt lever in the lock position, always check the steering shaft assembly.

⚠ *WARNING*

- ***If the vehicle continues to be driven after the collision absorbing mechanism has operated, the steering column shaft may be damaged while it is in use.***
- ***If there is a slack in the one-way capsule, do not attempt to repair it but replace the steering column shaft assembly.***

Inspection Procedure

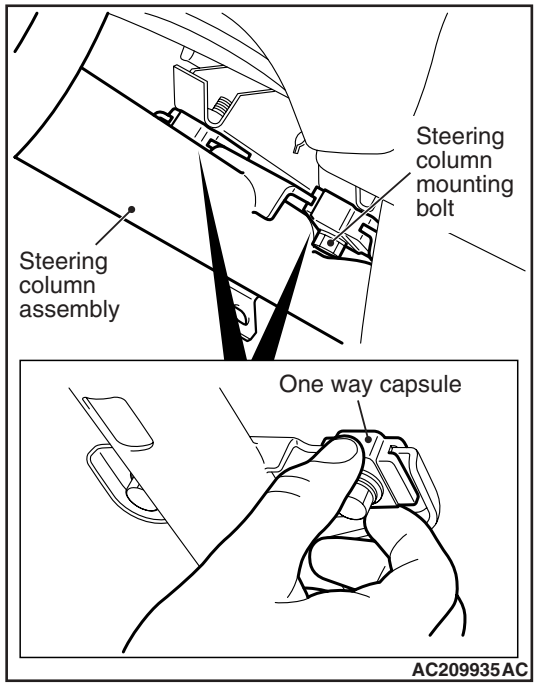
1. Remove the lower and upper column covers.

⚠ CAUTION

Do not release the tilt lever until the steering column has been installed to complete this inspection procedure.

2. Ensure that the tilt lever is in the lock position.

   NOTE: If not, place the tilt lever in the lock position.
3. Loosen the two upper steering column mounting bolts by two turns.



4. Hold the one-way capsules as shown, and then try to lock them. If there is a slack in either of the capsules, replace the steering column shaft assembly.

   NOTE: When installing a new steering column shaft assembly, place the tilt lever in the lock position, if it is not in place.

⚠ CAUTION

- **Be careful that nothing is pinched between the one-way capsules and the body.**
- **Do not release the tilt lever until the steering column has been installed to complete this inspection procedure.**

5. If no problem is found during the inspection, tighten the steering column mounting bolts to the specified torque.

   Tightening torque: 12 ± 2 N·m

STEERING WHEEL

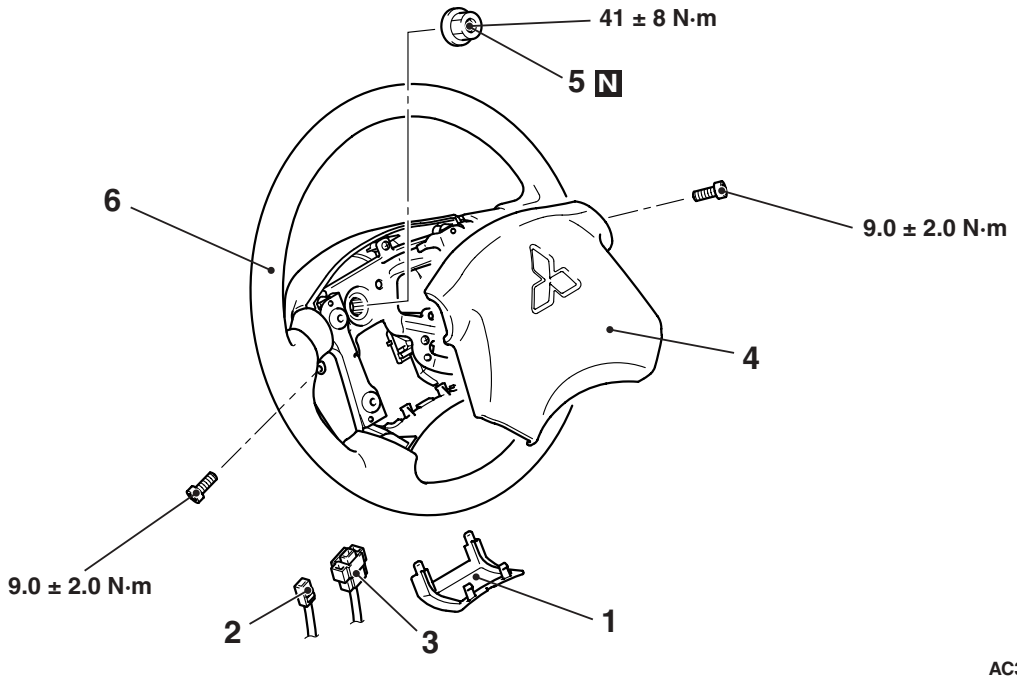
REMOVAL AND INSTALLATION

M1372011400309

⚠ ***WARNING***

- ***Before removing the steering wheel and air bag module assembly, refer to GROUP 52B, Service Precautions (P.52B-7) and Driver's, Front Passenger's Air Bag Module(s) and Clock Spring (P.52B-225).***
- ***When removing and installing the steering wheel, do not let it bump against the air bag module.***

Post-installation Operation
- Confirm that the steering wheel is at the straight-ahead position.
- Steering wheel shake check



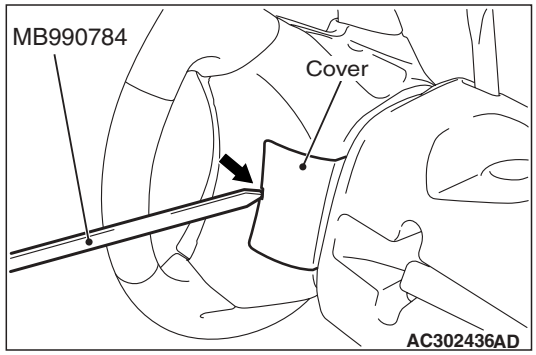
AC312094AB

Removal steps

<<A>>		1.	Cover
	>>B<<	2.	Horn connector connection
<<B>>	>>B<<	3.	Air bag module connector connection
<<C>>		4.	Air bag module
		5.	Self-locking nut
<<D>>	>>A<<	6.	Steering wheel assembly

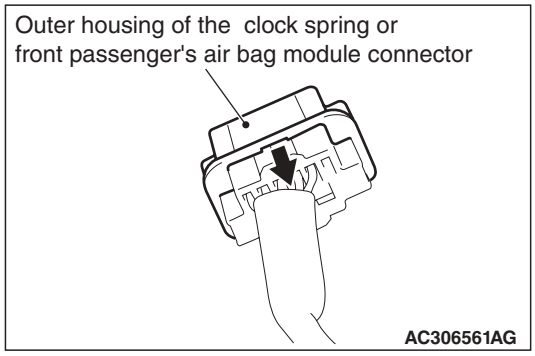
REMOVAL SERVICE POINTS

<<A>> COVER REMOVAL



Insert the special tool ornament remover (MB990784) as shown in the illustration to remove the cover.

<<B>> STEERING WHEEL AND AIR BAG MODULE ASSEMBLY REMOVAL



Slide the outer housing of the clock spring or front passenger's air bag module connector in the arrow direction shown, and disconnect the connector.

<<C>> AIR BAG MODULE REMOVAL

⚠ CAUTION

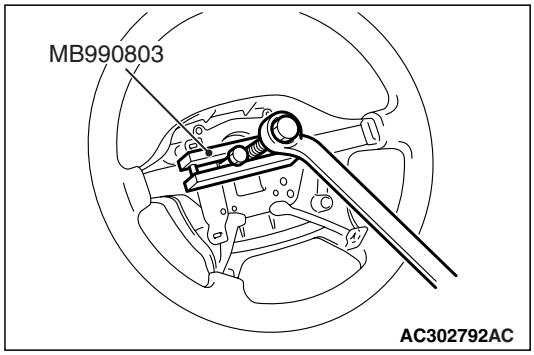
- **Never use an electric tester to diagnose the air bag module circuit. Never attempt to disassemble the air bag module.**
- **The removed air bag module should be stored in a clean, dry place with the deployment surface facing up.**

<<D>> STEERING WHEEL ASSEMBLY REMOVAL

1. Set the steering wheel at the straight-ahead position.

⚠ CAUTION

Use the special tool to remove the steering wheel since the steering column collision absorbing mechanism may be damaged.



2. Use special tool MB990803 (steering linkage puller) to remove the steering wheel assembly as shown.

INSTALLATION SERVICE POINTS

>>A<< STEERING WHEEL ASSEMBLY INSTALLATION

Align the clock spring mating marks and install the steering wheel assembly. (Refer to GROUP 52B, Driver's, Front passenger's air bag module(s) and clock spring P.52B-225)

>>B<< AIR BAG MODULE CONNECTOR CONNECTION / HORN CONNECTOR CONNECTION

Connect the connector securely and route the harnesses not to lie off the cover hole.

STEERING SHAFT

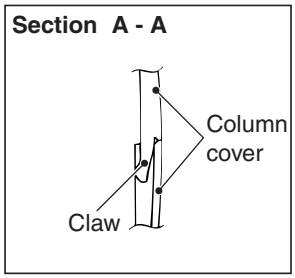
REMOVAL AND INSTALLATION

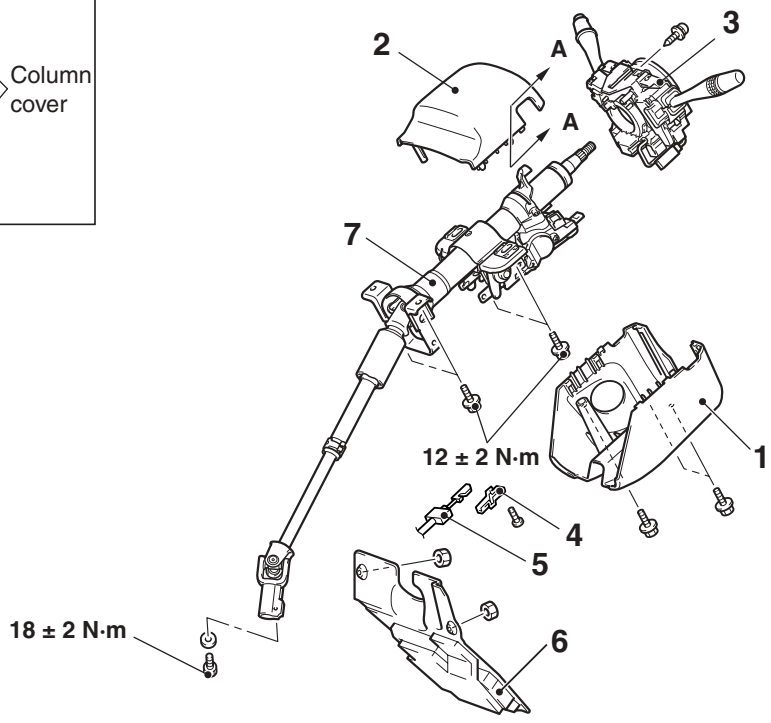
M1372011500221

⚠ WARNING

Before removing the steering wheel and air bag module assembly, refer to GROUP 52B, Service Precautions (P.52B-7) and Driver's, Front Passenger's Air Bag Module(s) and Clock Spring (P.52B-225).

Pre-removal Operation	Post-installation Operation
• Steering Wheel Assembly Removal (Refer to P.37-14.) • Lower panel and console side cover removal (Refer to GROUP 52A, Instrumental Panel P.52A-2.) • Front scuff plate inner and cowl side trim removal (Refer to GROUP 52A, Interior Trim P.52A-10.) • Footrest removal • Accelerator pedal arm stopper removal (Refer to GROUP 17, Accelerator pedal P.17-3.) • Floor carpet removal	• Floor carpet installation • Accelerator pedal arm stopper installation (Refer to GROUP 17, Accelerator pedal P.17-3.) • Footrest installation • Front scuff plate inner and cowl side trim Installation (Refer to GROUP 52A, Interior Trim P.52A-10.) • Lower panel and console side cover removal (Refer to GROUP 52A, Instrumental Panel P.52A-2.) • Steering Wheel Assembly Installation (Refer to P.37-14.) • Confirm that the steering wheel is at the straight-ahead position.





AC302938AC

Removal steps

1. Steering column cover lower
2. Steering column cover upper
3. Clock spring and column switch assembly
4. Cover <A/T>

<<A>> >>A<<

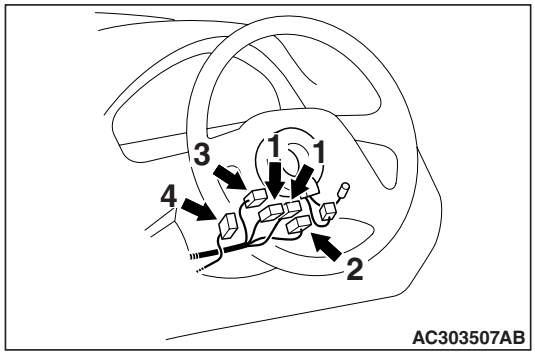
Removal steps (Continued)

5. Key interlock cable <A/T> (Refer to GROUP 23A, A/T Key Interlock and Shift Lock Mechanism P.23A-145.)
6. Steering dust cover
7. Steering column shaft assembly

REMOVAL SERVICE POINTS

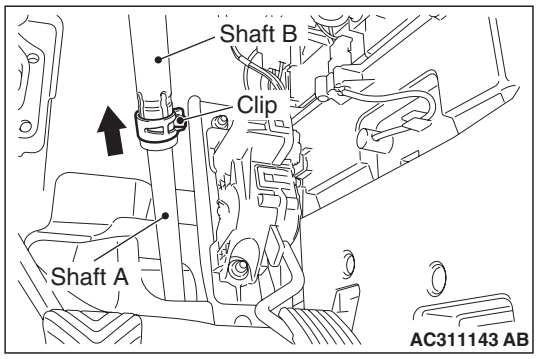
<<A>> CLOCK SPRING AND COLUMN SWITCH ASSEMBLY REMOVAL

Remove the clock spring and column switch assembly after disconnecting the following connectors.



1. Clock spring harness connector
2. Column switch harness connector
3. Key reminder switch connector
4. Ignition switch harness connector

<<B>> STEERING COLUMN SHAFT ASSY REMOVAL



1. Pinch the steering column shaft clip with pliers, and pull up the shaft towards the direction shown to disengage the steering column shaft.

⚠ CAUTION

The tilt lever should be held in the lock position until the steering column shaft is installed to the vehicle. If the steering column is removed with the tilt lever released, or the tilt lever is released after the steering column shaft was removed from the vehicle, the steering column can not be reinstalled correctly. If the steering column is installed incorrectly, the collision energy absorbing mechanism may be damaged.

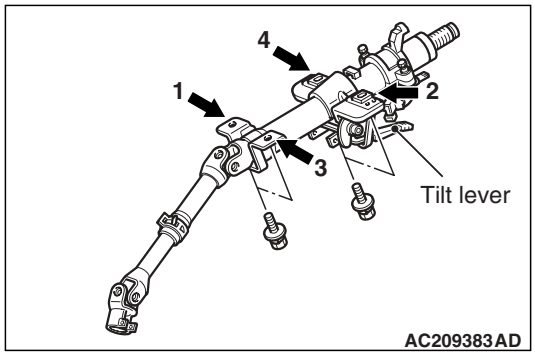
2. Ensure that the tilt lever is in the lock position, and remove the steering column mounting bolts.

INSTALLATION SERVICE POINT

>>A<< STEERING COLUMN SHAFT ASSEMBLY INSTALLATION

⚠ CAUTION

- **When reusing the steering column, do not release the tilt lever until the steering column shaft has been installed.**
- **When the steering column is replaced, do not release the tilt lever until it has been installed. Do not remove the tilt lever fixing band until the installation has completed.**
- **When installing the steering column, do not leave it fixed temporarily at only one point and make sure the column shaft is not shaken strongly. If you fail to do, the collision absorbing mechanism at the column shaft mounting location may be damaged.**

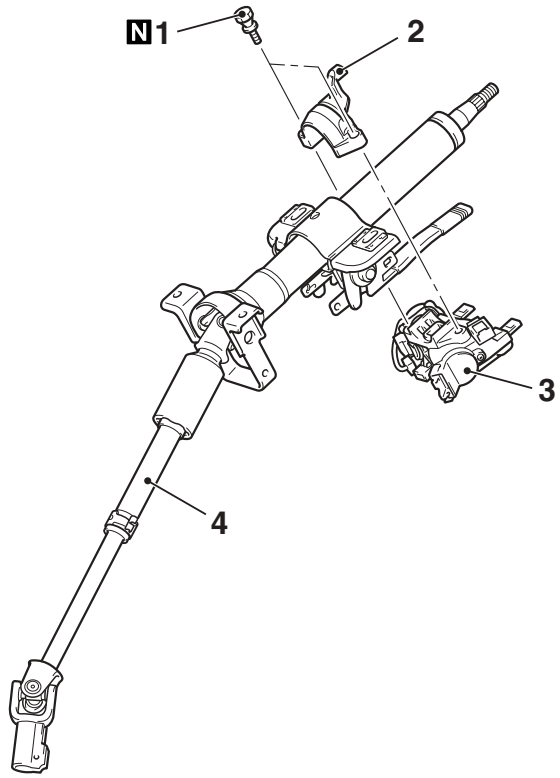


Ensure that the tilt lever is in the lock position, and install the steering column. Tighten the four bolts in the order shown by hand, and then tighten them to the specified torque in the order shown.

Tightening torque: 12 ± 2 N·m

DISASSEMBLY AND ASSEMBLY

M1372011700151

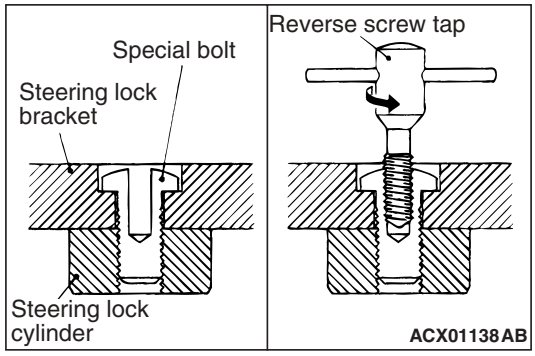


AC302639AC

Disassembly steps

<<A>> >>A<< 1. Steering locking bolt
>>A<< 2. Engine starting switch bracket
>>A<< 3. Engine starting switch assembly
4. Steering column shaft assembly

DISASSEMBLY SERVICE POINT
<<A>> STEERING LOCK REMOVAL



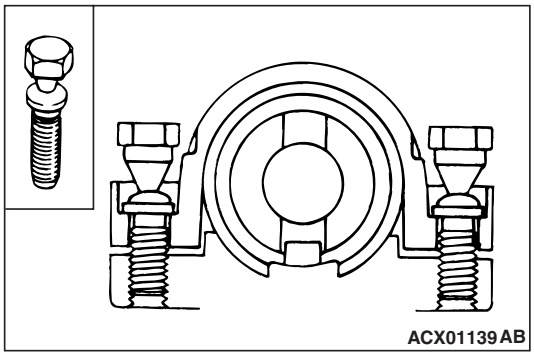
1. Drill in the special bolt a hole deep enough for the tap to stand.
2. Remove the special bolt with a left-hand tap.

REASSEMBLY SERVICE POINT
>>A<< ENGINE STARTING SWITCH ASSEMBLY / ENGINE STARTING SWITCH BRACKET / STEERING LOCK INSTALLATION

⚠ CAUTION

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

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.

POWER STEERING GEAR BOX AND LINKAGE

REMOVAL AND INSTALLATION

M1372010900345

⚠ ***WARNING***

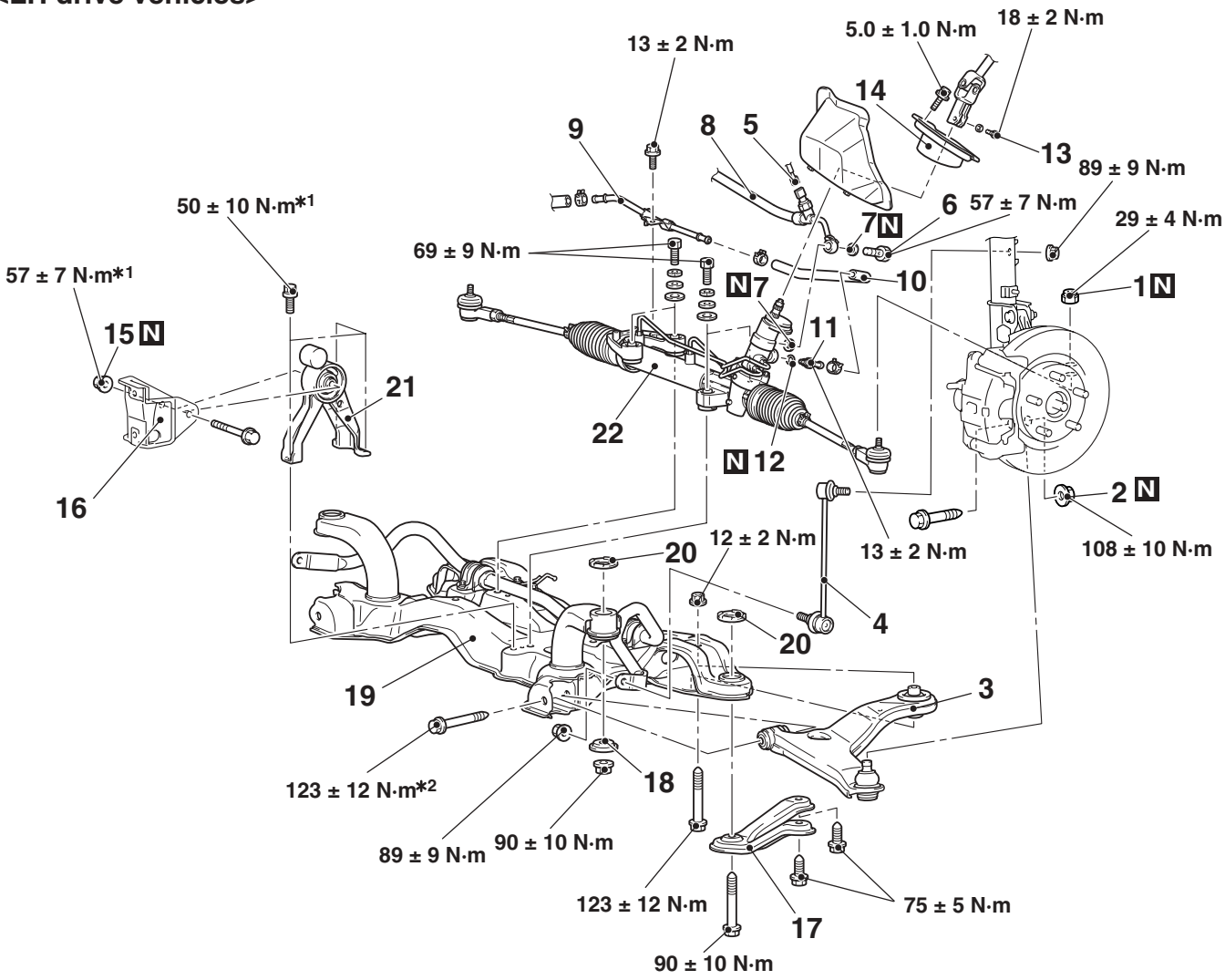
Before removing the steering gear, refer to GROUP 52B, Service Precautions (P.52B-7) and Driver's, Front Passenger's Air Bag Module(s) and Clock Spring (P.52B-225). Centre the front wheels. Failure to do so may damage the SRS clock spring and render the SRS system inoperative, risking serious injury.

⚠ **CAUTION**

- ***1 indicates parts which should be temporarily tightened, and then fully tightened with the engine and transmission assembly weight applied on the vehicle body.**
- ***2 indicates parts which should be temporarily tightened, and then fully tightened with the vehicle standing on the ground and the curb weight condition.**

Pre-removal Operation	Post-installation Operation
• Power Steering Fluid Draining (Refer to P.37-11.) • Centre member removal (Refer to GROUP 32, Engine roll stopper and centre member P.32-6.) • Exhaust pre-muffler removal (Refer to GROUP 15, Exhaust pipe and main muffler P.15-9.) • Steering wheel assembly and air bag module assembly removal (Refer to P.37-14).	• Centre member installation (Refer to GROUP 32, Engine roll stopper and centre member P.32-6.) • Exhaust pre-muffler installation (Refer to GROUP 15, Exhaust pipe and main muffler P.15-9.) • Steering wheel assembly and air bag module assembly installation (Refer to P.37-14). • Power steering fluid refilling and air bleeding (Refer to P.37-11). • Check the dust cover for crack or damage by pressing your finger. • Checking Steering Wheel Position with Wheels Straight Ahead. • Front Wheel Alignment Adjustment (Refer to GROUP 33, On-vehicle Service – Front Wheel Alignment Check and Adjustment P.33-4.)

<LH drive vehicles>



AC312227AB

Removal steps

<<A>>
1. Self-locking nut (tie rod end and knuckle connection)
2. Self-locking nut (lower arm and knuckle connection)
3. Lower arm assembly
4. Stabilizer link
5. Power steering oil pressure sensor connector connection and harness clamp
6. Eye bolt
7. Gasket
8. Pressure hose connection

>>C<<
9. Return tube connection

>>B<<
10. Return hose connection

Removal steps (Continued)

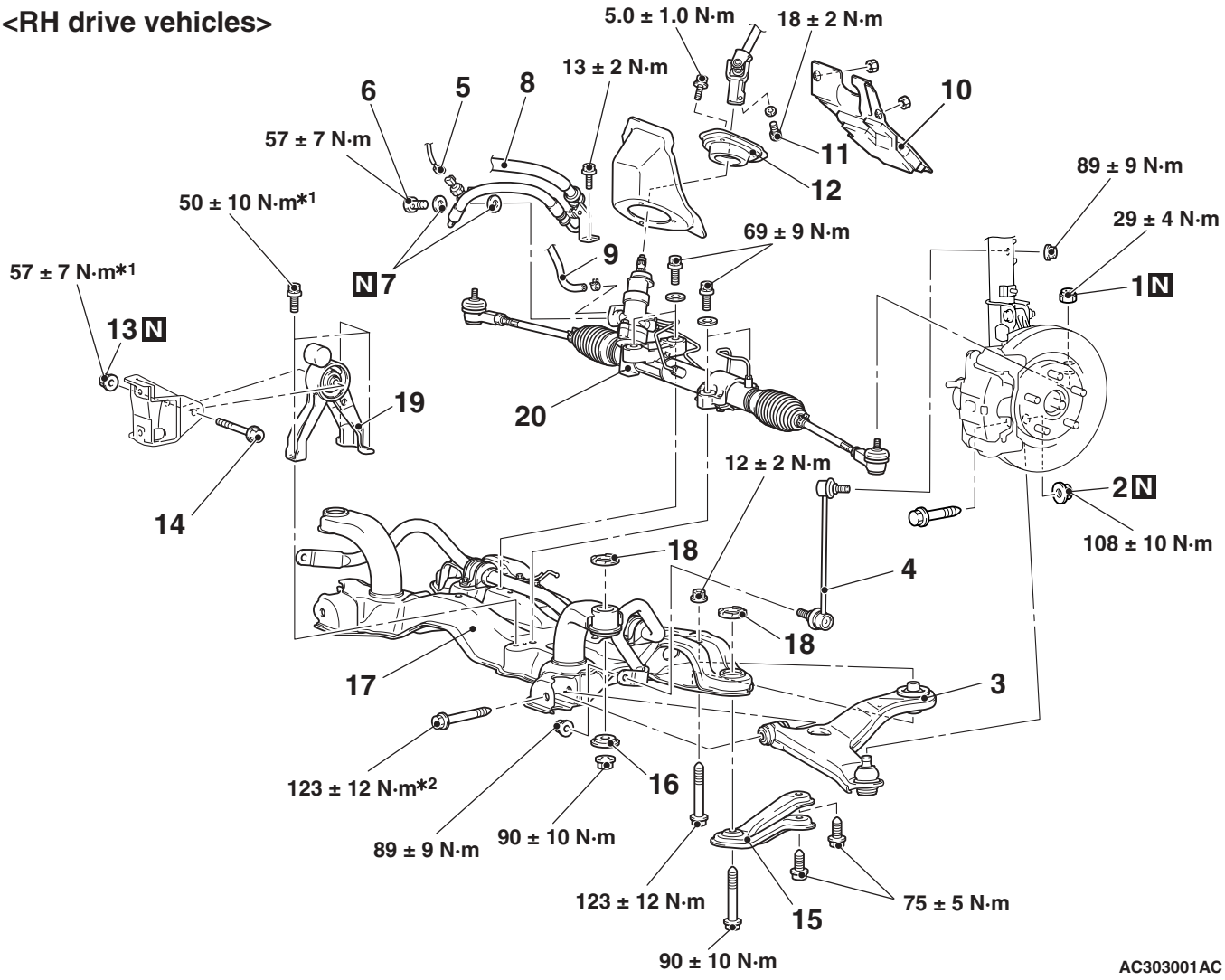
11. Return tube connection
12. O-ring
13. Steering gear and joint connecting bolt

>>A<<
14. Steering column grommet

15. Selflock nut
16. Engine rear roll stopper bracket connecting bolt
17. Crossmember rear stay
18. Lower stopper

<<B>>
19. Front axle No.1 crossmember assembly
20. Stopper
21. Engine roll stopper
21. Steering gear and linkage

<RH drive vehicles>



Removal steps

<<A>>
1. Self-locking nut (tie rod end and knuckle connection)
2. Self-locking nut (lower arm and knuckle connection)
3. Lower arm assembly
4. Stabilizer link
5. Power steering oil pressure sensor connector connection and harness clamp
6. Eye bolt
7. Gasket
8. Pressure hose connection

>>B<<
9. Return hose connection
10. Steering dust cover

Removal steps (Continued)

11. Steering gear and joint connecting bolt

>>A<<
12. Steering column grommet
13. Selflock nut
14. Engine rear roll stopper bracket connecting bolt
15. Crossmember rear stay
16. Lower stopper

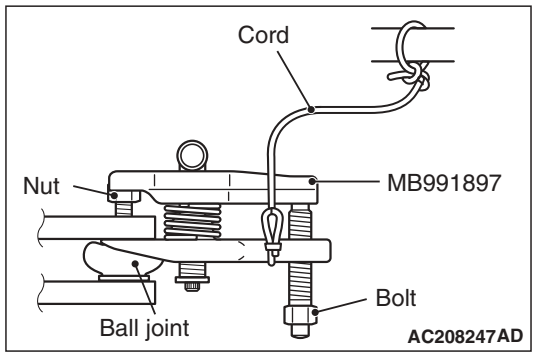
<<B>>
17. Front axle No.1 crossmember assembly
18. Stopper
19. Engine roll stopper
20. Steering gear and linkage

REMOVAL SERVICE POINTS

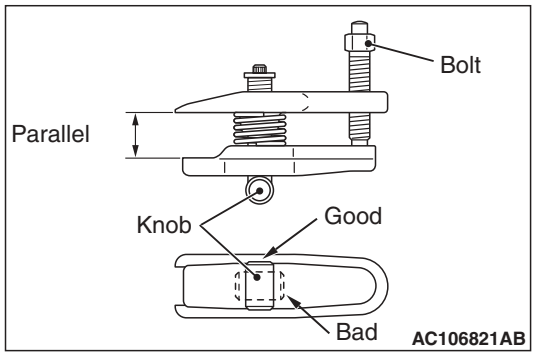
<<A>> TIE ROD END AND KNUCKLE DISCONNECTION

⚠ CAUTION

- **Do not remove the nut from ball joint. Loosen it and use special tool ball joint remover (MB991897) to avoid possible damage to ball joint threads.**
- **Hang special tool ball joint remover (MB991897) with a cord to prevent it from falling.**



1. Install the special tool ball joint remover (MB991897) as shown in the figure.

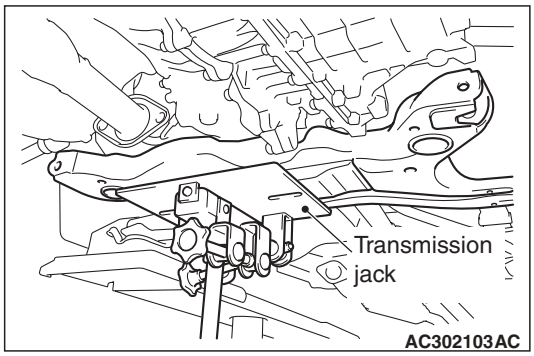


2. Turn the bolt and knob as necessary to make the jaws of the special tool ball joint remover (MB991897) parallel, tighten the bolt by hand and confirm that the jaws are still parallel.

   NOTE: When adjusting the jaws in parallel, make sure the knob is in the position shown in the figure.
3. Tighten the bolt with a wrench to disconnect the tie rod end.

>>B<< RETURN HOSE INSTALLATION

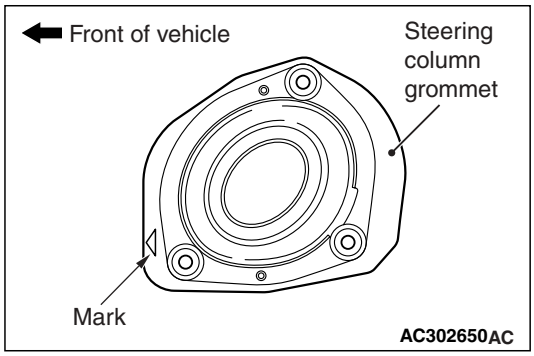
<<B>> FRONT AXLE No.1 CROSSMEMBER ASSEMBLY REMOVAL



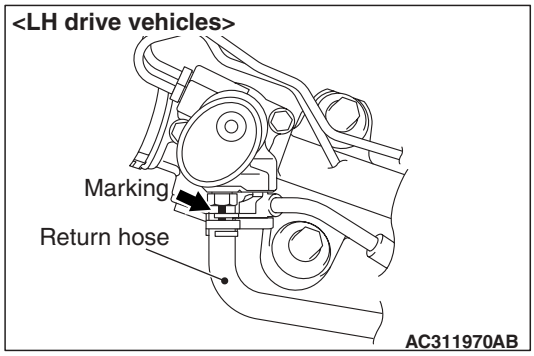
1. Jack up and support the crossmember, and remove it.
2. Check the hoses and harnesses for roughness, and then remove the front axle No.1 crossmember assembly with the rear roll stopper and the steering gear and linkage.

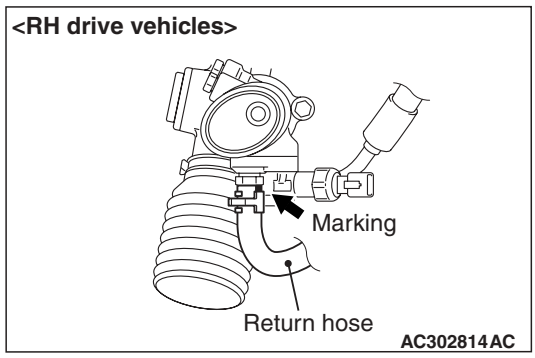
INSTALLATION SERVICE POINTS

>>A<< STEERING COLUMN GROMMET INSTALLATION

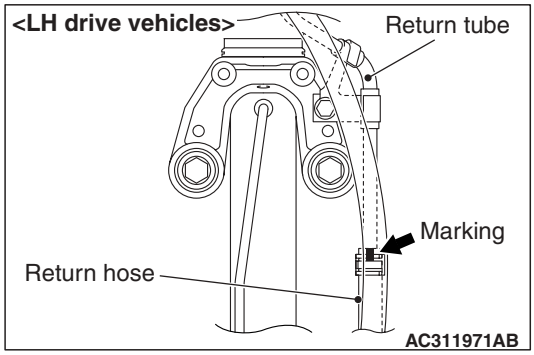


Install the steering column grommet with its mark facing the front of the vehicle.



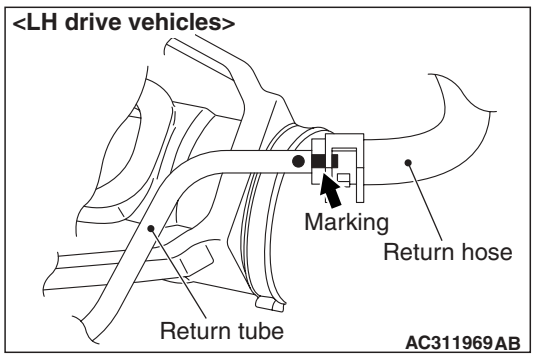


1. Align the marking (white) as shown and connect the return hose.



2. Align the marking (yellow) as shown and connect the return hose.

>>C<< RETURN TUBE INSTALLATION <LH drive vehicles>



Align the return tube marking (green) as shown and connect the return tube.

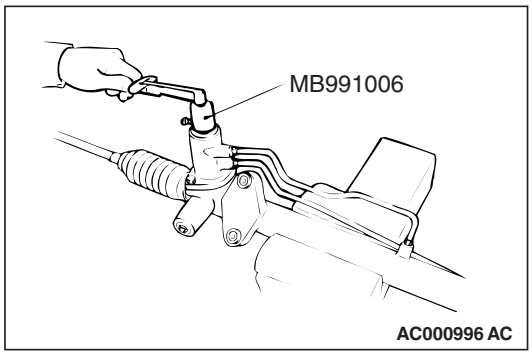
INSPECTION

M1372011000334

STEERING GEAR TOTAL PINION TORQUE CHECK

⚠ CAUTION

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



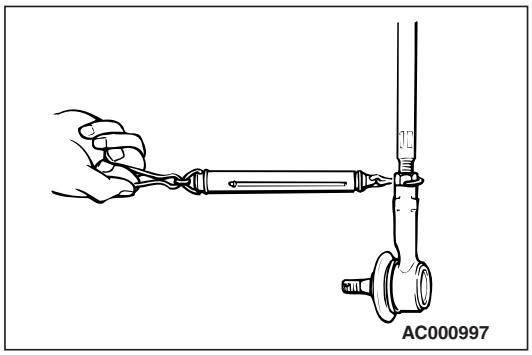
Using special tool preload socket (MB991006), rotate the pinion gear at the rate of one rotation in approximately 4 to 6 seconds to check the total pinion torque.

Standard value: 0.8 – 2.1 N·m
[Change in torque: 0.6 N·m or less]

NOTE: When measuring, remove the bellows from the rack housing. Measure the pinion torque 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 torque again.
If the total pinion 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. Measure the tie rod swing resistance [tie rod swing torque] with a spring balance.

Standard value: 6 – 19 N [1.5 – 4.9 N·m]

3. If the measured value exceeds the standard value, replace the tie rod.
4. If the measured value is below the standard value, the tie rod can be re-used if it swings smoothly without excessive play.

TIE ROD END BALL JOINT DUST COVER CHECK

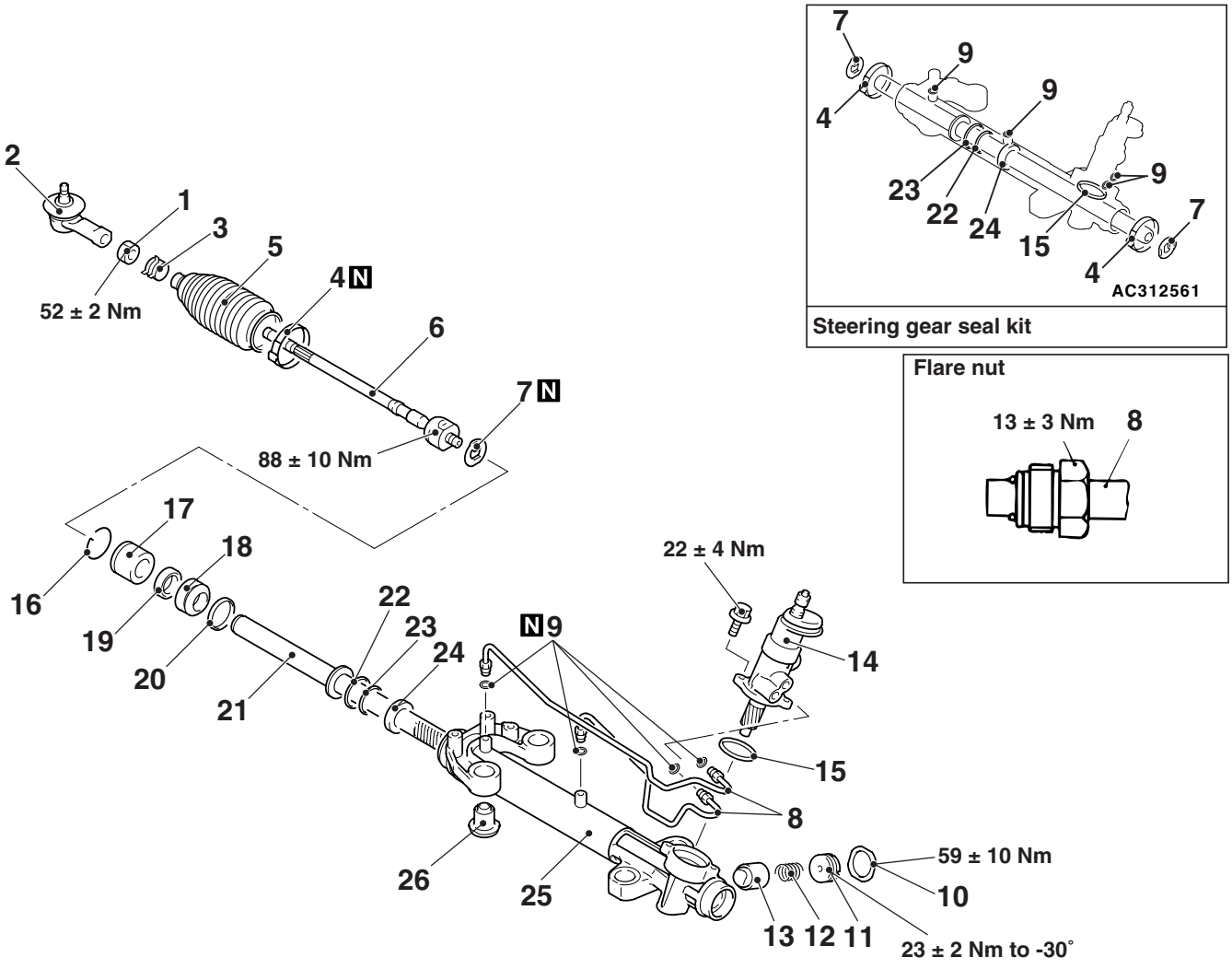
1. Check the dust cover for cracks or damage by pushing it with your finger.
2. If the dust cover is cracked or damaged, replace the tie rod end (Refer to P.37-24).

NOTE: Cracks or damage of the dust cover may damage the ball joint. If it is damaged during service work, replace the dust cover (Refer to P.37-31).

DISASSEMBLY AND ASSEMBLY

M1372011100308

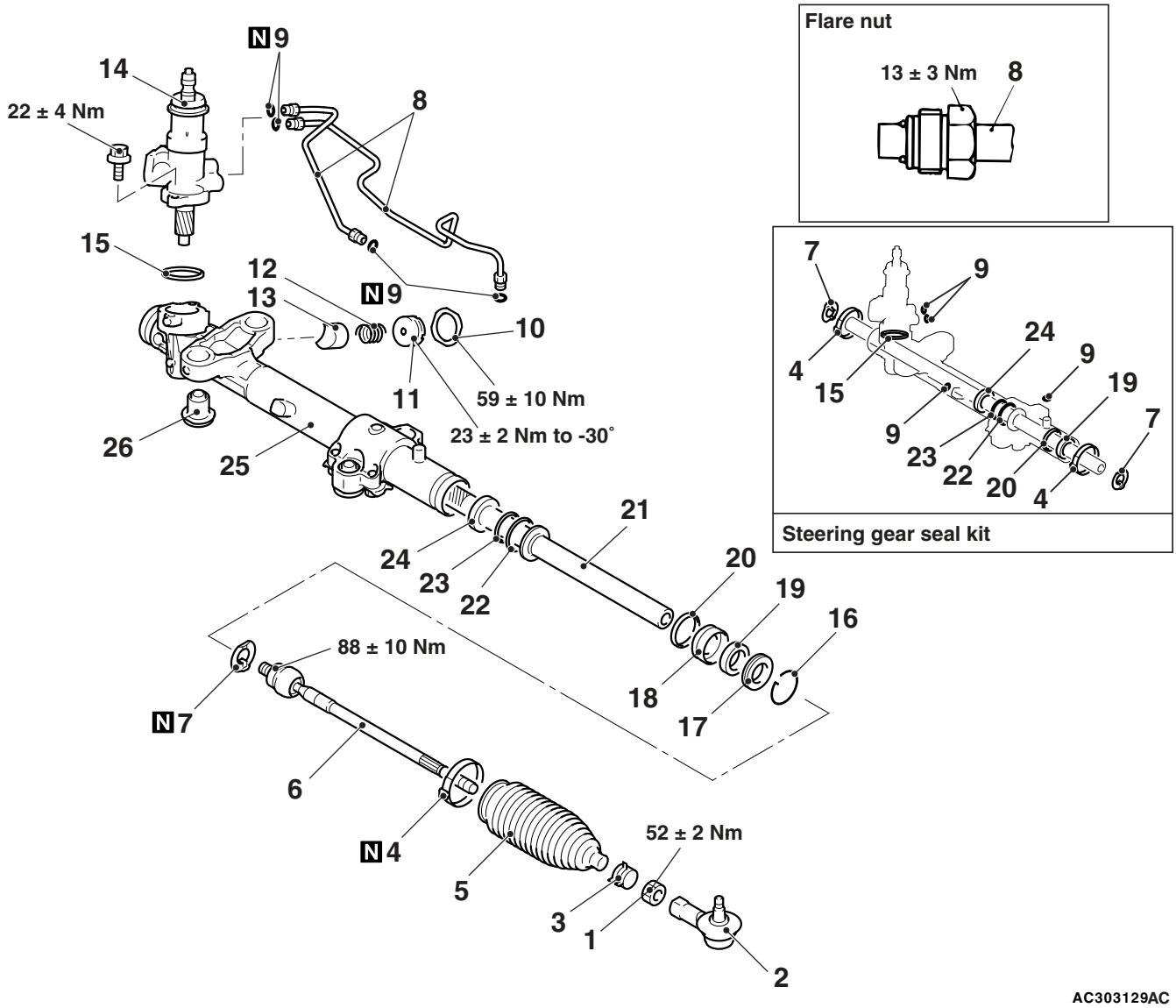
<L.H. drive vehicles>



Steering gear seal kit

AC313192AB

<R.H. drive vehicles>



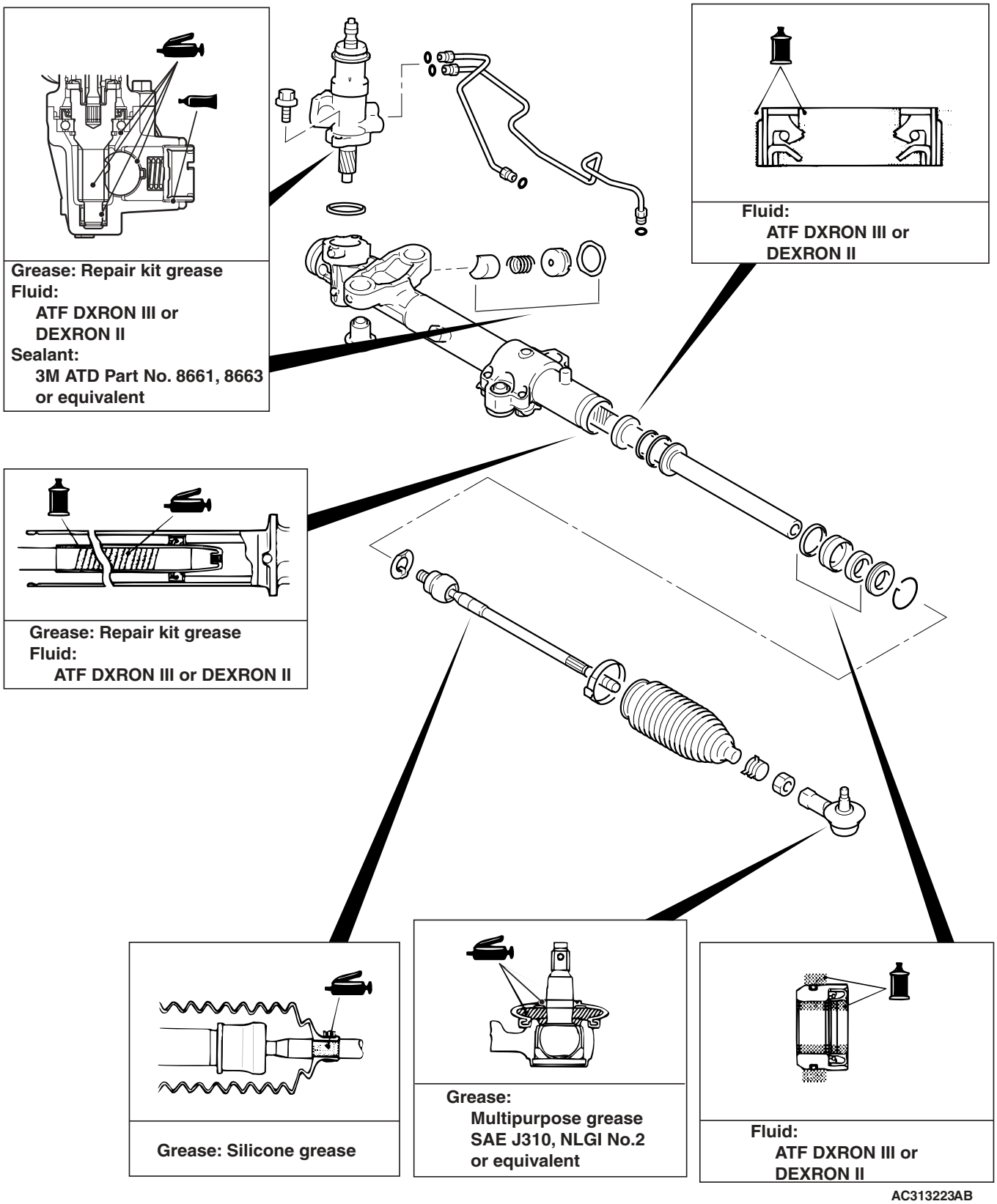
Disassembly steps

	>>K<<	1.	Lock nut
	>>K<<	2.	Tie rod end
		3.	Clip
	>>J<<	4.	Bellows band
		5.	Bellows
	>>I<<	6.	Tie rod
	>>I<<	7.	Tab washer
		8.	Feed pipe
		9.	O-ring
	>>H<<	•	Total pinion torque adjustment
	>>G<<	10.	Lock nut
<<A>>	>>G<<	11.	Rack support cover
		12.	Support spring

Disassembly steps (Continued)

		13.	Rack support
		14.	Valve housing assembly
		15.	O-ring
<<B>>	>>F<<	16.	Circlip
<<C>>		17.	Rack stopper
<<C>>	>>E<<	18.	Rack bushing
<<C>>	>>E<<	19.	Oil seal
<<C>>		20.	O-ring
<<C>>	>>D<<	21.	Rack assembly
<<D>>	>>C<<	22.	Seal ring
		23.	O-ring
<<E>>	>>B<<	24.	Oil seal
		25.	Gear housing
<<F>>	>>A<<	26.	Gear housing mounting bushing

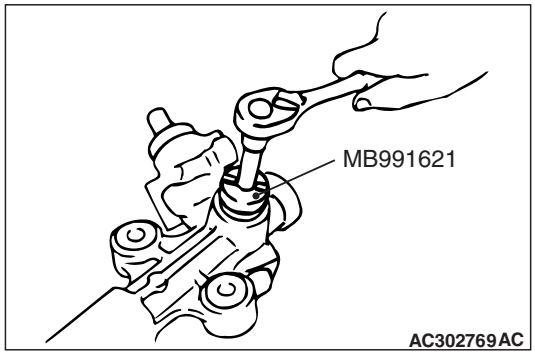
LUBRICATION AND SEALING POINTS



AC313223AB

DISASSEMBLY SERVICE POINTS

<<A>> RACK SUPPORT COVER REMOVAL

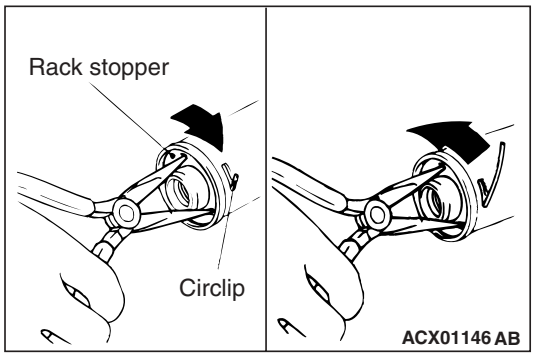


Use special tool MB991621 (rack support cover wrench) to remove the rack support cover.

<<B>> CIRCLIP REMOVAL

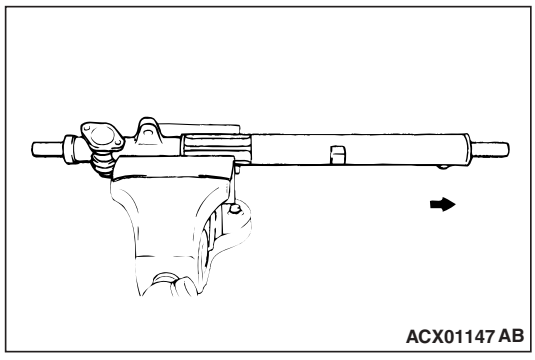
⚠ CAUTION

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.



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.

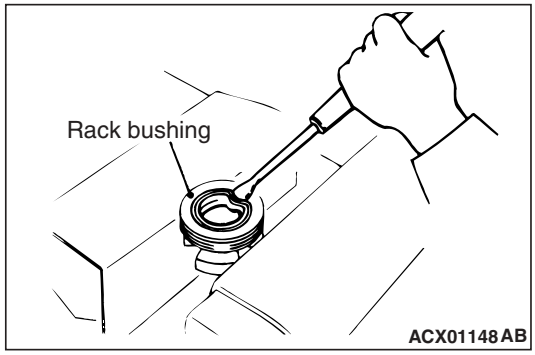
<<C>> RACK STOPPER/RACK BUSHING/OIL SEAL/O-RING/RACK ASSEMBLY REMOVAL



1. Pull out the rack slowly. Take out the rack stopper and the rack bushing at the same time.

⚠ CAUTION

Do not damage the oil seal press fitting surface.



2. Partially bend the oil seal and remove it from the rack bushing.

<<D>> SEAL RING REMOVAL

⚠ CAUTION

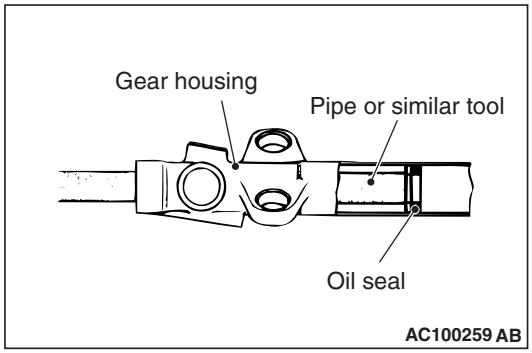
When cutting the seal ring, be careful not to damage the pinion and valve assembly or the rack.

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

<<E>> OIL SEAL REMOVAL

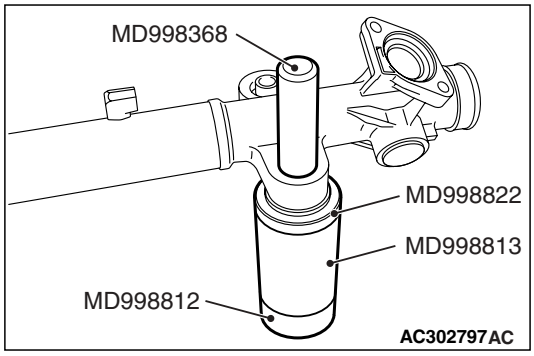
⚠ CAUTION

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



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

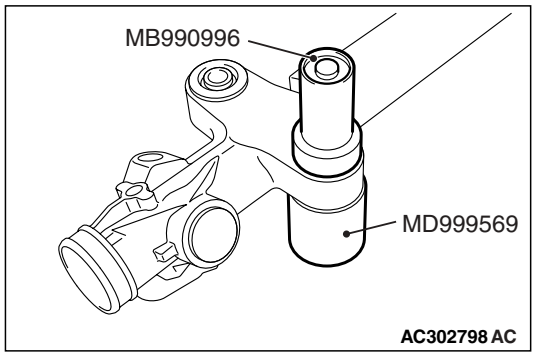
<<F>> GEAR HOUSING MOUNTING BUSHING REMOVAL



Use the following special tools to remove the gear housing mount bushing.
- Installer cap (MD998812)
- Installer 100 (MD998813)
- Installer adopter (MD998822)
- Bearing installer (MD998368)

ASSEMBLY SERVICE POINTS

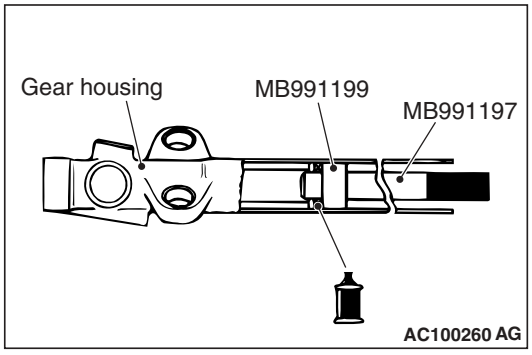
>>A<< GEAR HOUSING MOUNTING BUSHING INSTALLATION



Use the following special tools to press-fit the gear housing mount bushing.
- Camshaft oil seal installer (MD999569)
- Lower arm bushing arbor (MB990996)

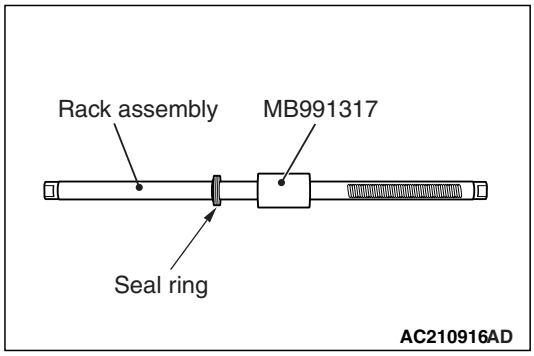
>>B<< OIL SEAL INSTALLATION

1. Apply a coating of ATF DEXRON III or DEXRON II to the both sides of the oil seal.



2. Using the following special tools, press the oil seal into the rack housing.
   - MB991197: Bar (long type)
   - MB991199: Oil Seal Installer

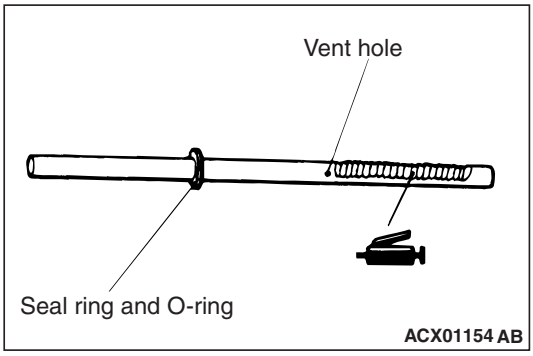
>>C<< SEAL RING INSTALLATION



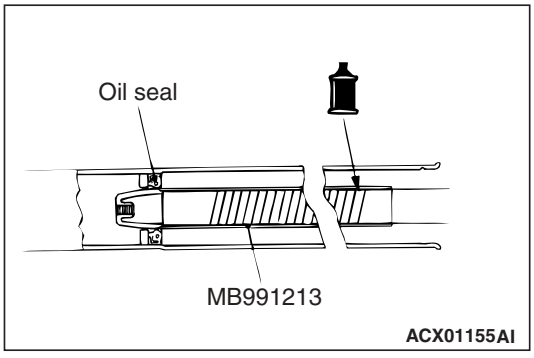
As the seal ring extends after installing, compress the seal ring with special tool MB991317 (seal ring installer) or your hand.

>>D<< RACK ASSEMBLY INSTALLATION

⚠ CAUTION
Do not close the vent hole in the rack with grease.



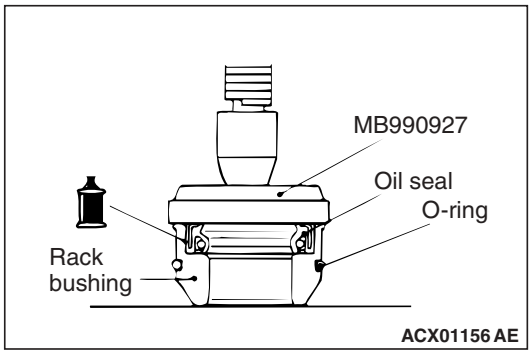
1. Apply a coating of repair kit grease to the rack teeth face.



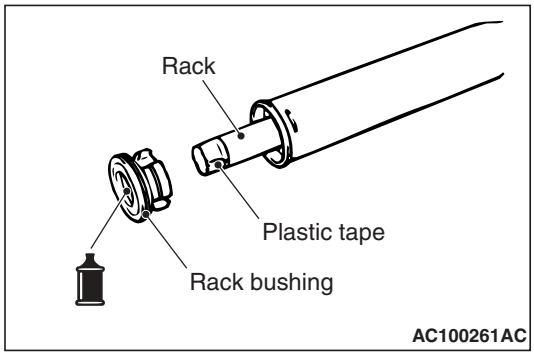
2. Cover the teeth side of rack assembly with special tool MB991213 (oil seal protector).

3. Apply ATF DEXRON III or DEXRON II to special tool, and to the outer surface of the seal ring and the O-ring.
4. Align the centre of the oil seal with the rack to prevent the retainer spring from slipping. Slowly insert the rack from power cylinder side.

>>E<< OIL SEAL/RACK BUSHING INSTALLATION



1. Apply the specified fluid to the outside of the oil seal and use special tool MB990927 (installer adopter) to press-fit the oil seal into the bushing end.

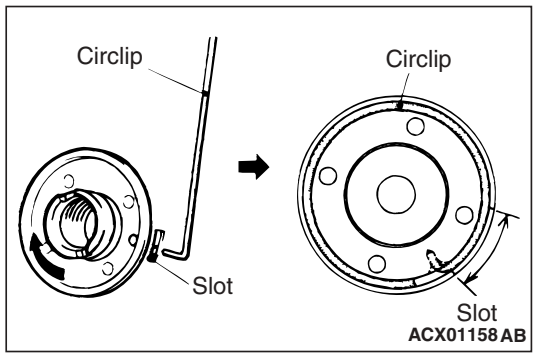


2. Apply ATF DEXRON III or DEXRON II to the oil seal inner surface and the O-ring.
3. Wrap the rack end with plastic tape, and push the rack bushing onto the rack.

>>F<< CIRCLIP INSTALLATION

⚠ CAUTION

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

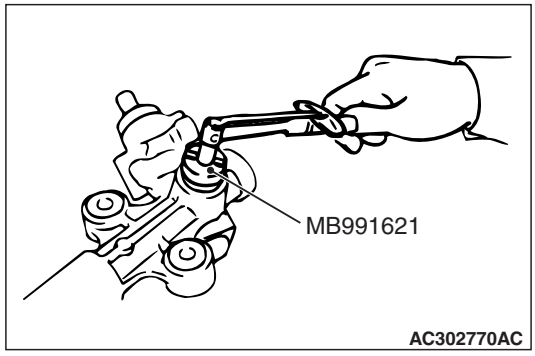


Insert the circlip to the rack stopper hole through cylinder hole. Turn the rack stopper clockwise and insert the circlip firmly.

>>G<< RACK SUPPORT COVER/LOCK NUT INSTALLATION

1. Position the rack at its centre.
2. Apply specified sealant to the threaded part of the rack support cover.

   Specified sealant:
   3M ATD Part No.8661, 8663 or equivalent

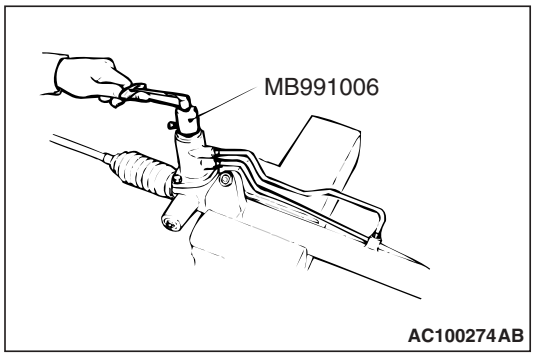


3. Use special tool MB991621 (rack support cover wrench) to tighten the rack support cover to 23 ±2N·m.
4. Turn the rack support cover 30° anticlockwise.
5. Use the special tool to hold the rack support cover, and then tighten the lock nut to 59 ± 10 N·m.

>>H<< TOTAL PINION TORQUE ADJUSTMENT

⚠ CAUTION

- **Be sure there is no ratcheting or catching when operating the rack towards the shaft.**
- **Measure the total pinion torque through the whole stroke of the rack.**



1. Using special tool preload socket (MB991006), 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: 0.8 – 2.1 N·m [Change in torque: 0.6 N·m or less]

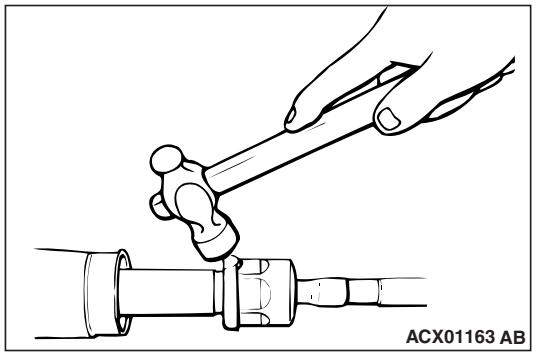
⚠ CAUTION

When adjusting, set at the highest value of the standard value range.

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

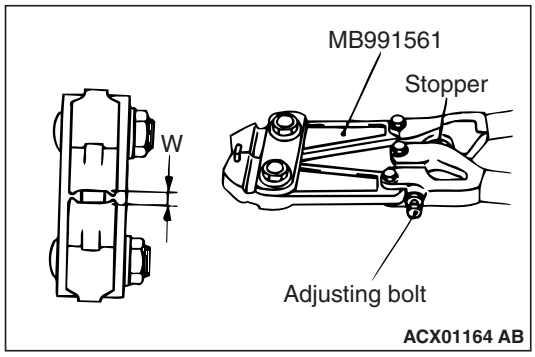
2. If the total pinion torque or the change in torque is outside the standard value, move the rack support cover 0 – 30°, and adjust the pinion torque again.

>>I<< TAB WASHER/TIE ROD INSTALLATION



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

>>J<< BELLOWS BAND INSTALLATION



1. Turn the adjusting bolt of special tool boot band crimping tool (MB991561) to adjust the opening dimension (W) to the standard value.

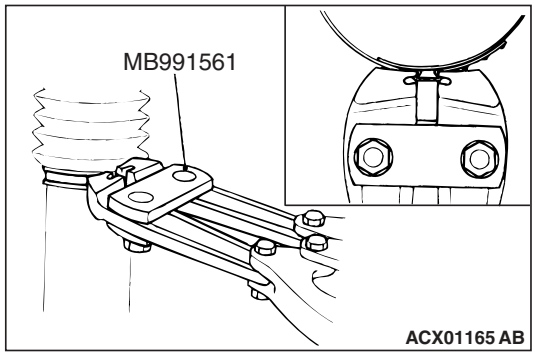
   NOTE: The dimension (W) is adjusted by approximately 0.7 mm per one turn.

   NOTE: Do not turn the adjusting bolt more than one turn.

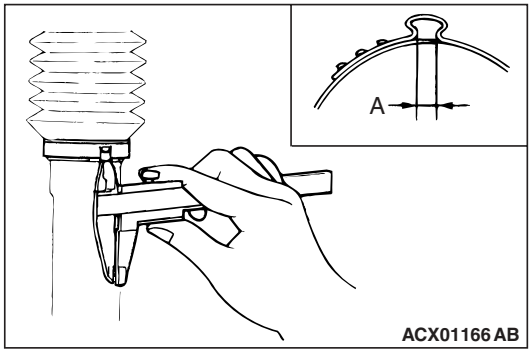
   Standard value (W): 2.9 mm
   <When more than 2.9 mm>: Screw in the adjusting bolt.
   <When less than 2.9 mm>: Loosen the adjusting bolt.

⚠ CAUTION

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



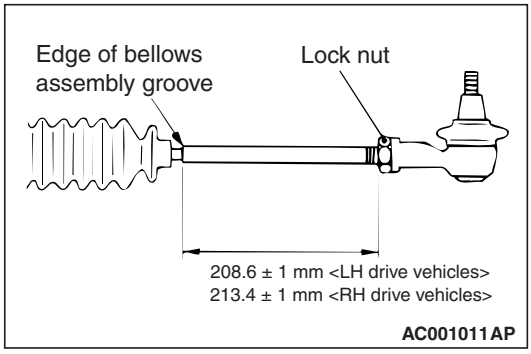
2. Use special tool boot band crimping tool (MB991561) to crimp the bellows band.



3. Check that 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 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 mm – A [Example: if (A) is 2.3 mm, (W) is 3.2 mm.]

>>K<< TIE ROD END/LOCK NUT INSTALLATION



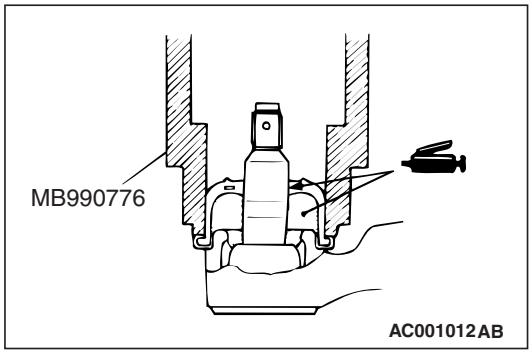
Screw in the tie rod end to achieve the right and left length as illustrated. Lock with the lock nut.

NOTE: The lock nuts must be tightened securely only after the steering gear is installed to the vehicle and toe-in is adjusted.

TIE ROD END BALL JOINT DUST COVER REPLACEMENT

M1372008200402

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



1. Apply specified grease to the lip and inside of the dust cover.

   Specified grease:
   Multipurpose grease SAE J310, NLGI No.2 or equivalent

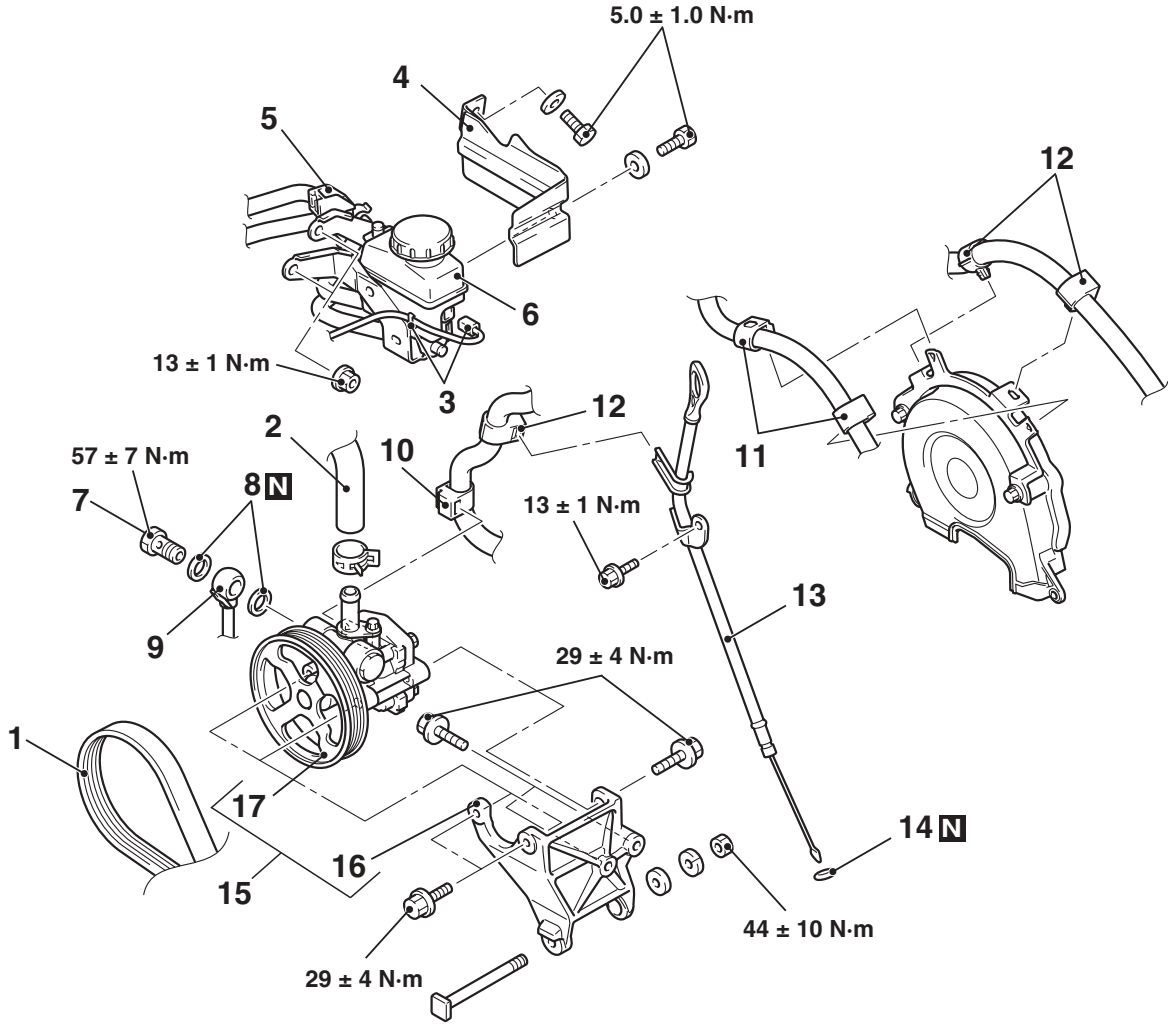
2. Drive in the dust cover with special tool front axle base (MB990776) until it is fully seated.
3. Check the dust cover for cracks or damage by pushing it with your finger.

POWER STEERING OIL PUMP ASSEMBLY

REMOVAL AND INSTALLATION

M1372005200481

Pre-removal Operation	Post-installation Operation
• Power Steering Fluid Draining (Refer to P.37-11.) • Under cover (RH) removal	• Under cover (RH) installation • Power steering fluid refilling and air bleeding (Refer to P.37-11). • Drive belt tension adjustment (Refer to GROUP 11A, Engine adjustment P.11A-7.)



AC303048AC

Removal steps

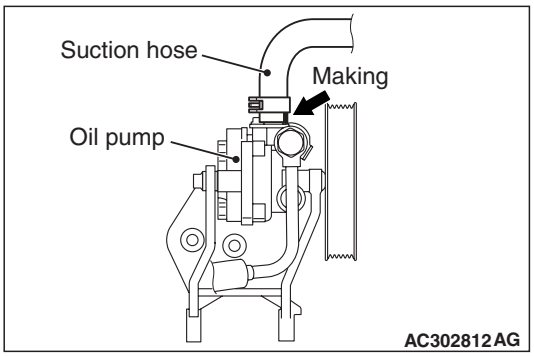
1. Drive belt (Refer to GROUP 11A, Timing belt P.11A-33.)
>>A<< 2. Suction hose connection
3. Brake fluid level switch connector and clamp
4. Heat protector <RH drive vehicles>
5. Hose clip <RH drive vehicles>
6. Brake fluid reservoir assembly <RH drive vehicles>
7. Eye bolt
8. Gasket
9. Pressure hose connection

Removal steps (Continued)

10. Power steering oil pressure sensor harness clamp (Oil pump side)
11. Control harness clamp (2 clamps at engine side)
12. Battery harness clamp (two clamps at engine side, a clamp at level gauge side)
13. Level gauge
14. O-ring
15. Oil pump bracket and oil pump assembly
16. Oil pump bracket
17. Oil pump assembly

INSTALLATION SERVICE POINT

>>A<< SUCTION HOSE INSTALLATION



Align the suction hose marking (yellow) as shown and connect the suction hose.

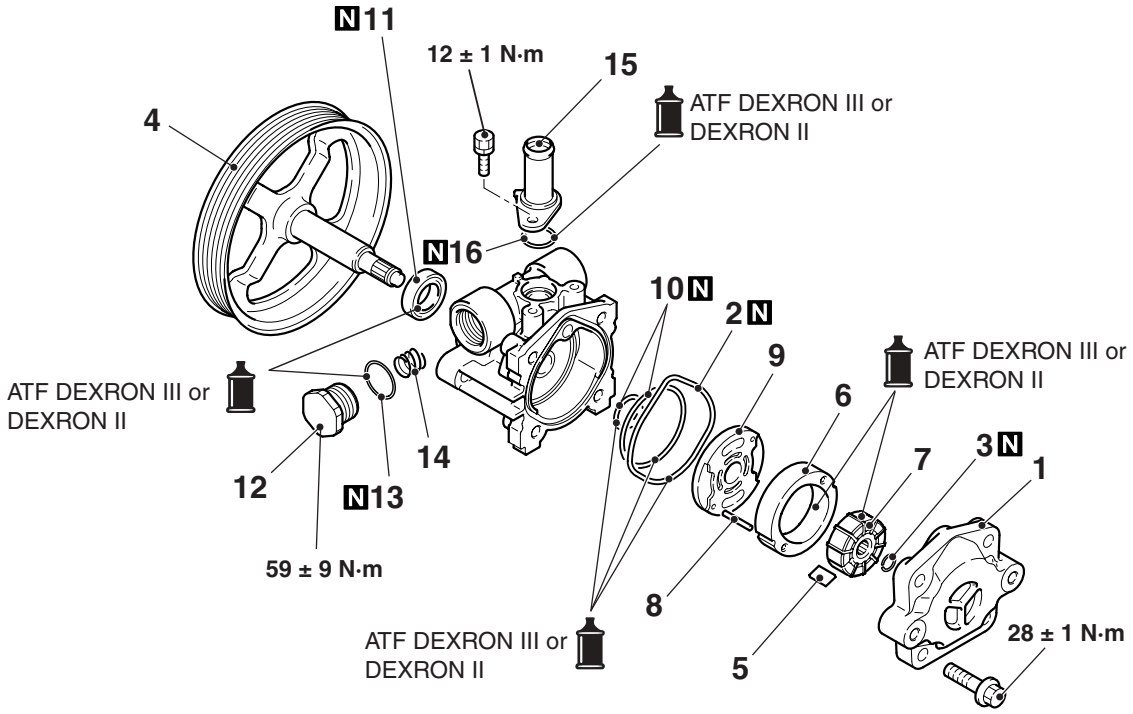
INSPECTION

M1372005300273

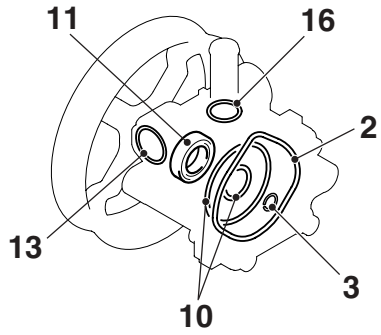
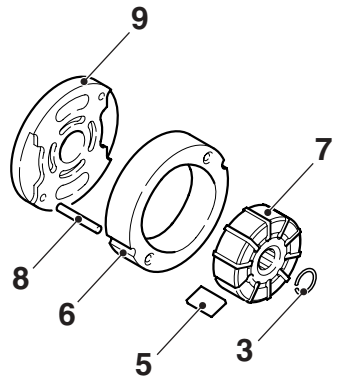
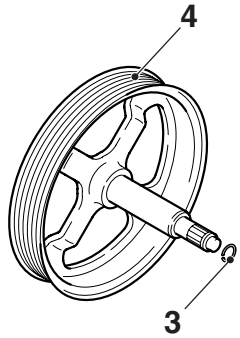
- Check the drive belt for cracks.
- Check the pulley for uneven rotation.

DISASSEMBLY AND ASSEMBLY

M1372005400429



AC303143AC

		
Oil pump seal kit	**Oil pump cartridge kit**	**Oil pump pulley and shaft kit**

Disassembly steps

1. Pump cover
2. O-ring
3. Snap ring
4. Pulley and shaft
5. Vanes

>>C<< 6. Cam ring

7. Rotor
8. Pin
9. Side plate

>>A<< 10. O-ring

>>B<< 11. Oil seal

12. Plug assembly

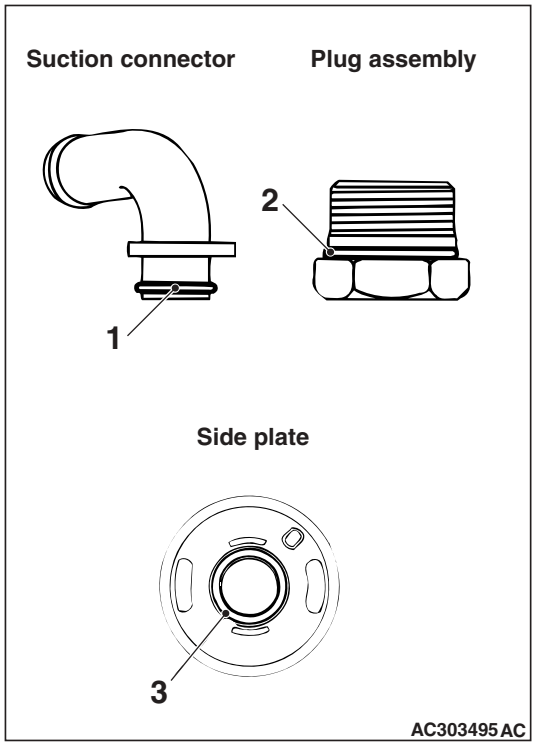
>>A<< 13. O-ring

14. Flow control spring
15. Suction connector

>>A<< 16. O-ring

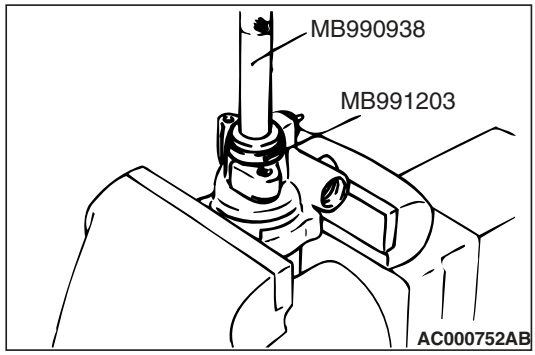
ASSEMBLY SERVICE POINTS

>>A<< O-RING INSTALLATION



No.	ID × Width mm
1	15.8 × 2.4
2	21.0 × 2.4
3	14.8 × 1.9

>>B<< OIL SEAL INSTALLATION



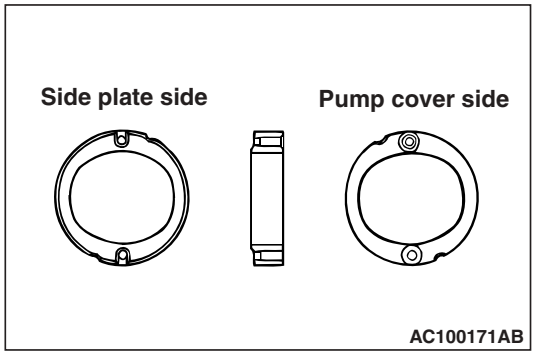
Use following special tool to install the oil seal.

- MB990938: Bar (Snap-in type)
- MB991203: Oil Seal and Bearing Installer

>>C<< CAM RING INSTALLATION

⚠ CAUTION

Be sure to install the cam ring in the correct direction as shown.



Install the cam ring as shown in the illustration.

INSPECTION

M1372005500288

- Check the flow control valve of the pump body for clogging.
- Check the pulley and shaft for wear or damage.
- Check the rotor and vane groove for "stepped" wear.
- Check the contact surface of cam ring and vanes for "stepped" wear.
- Check the vanes for damage.

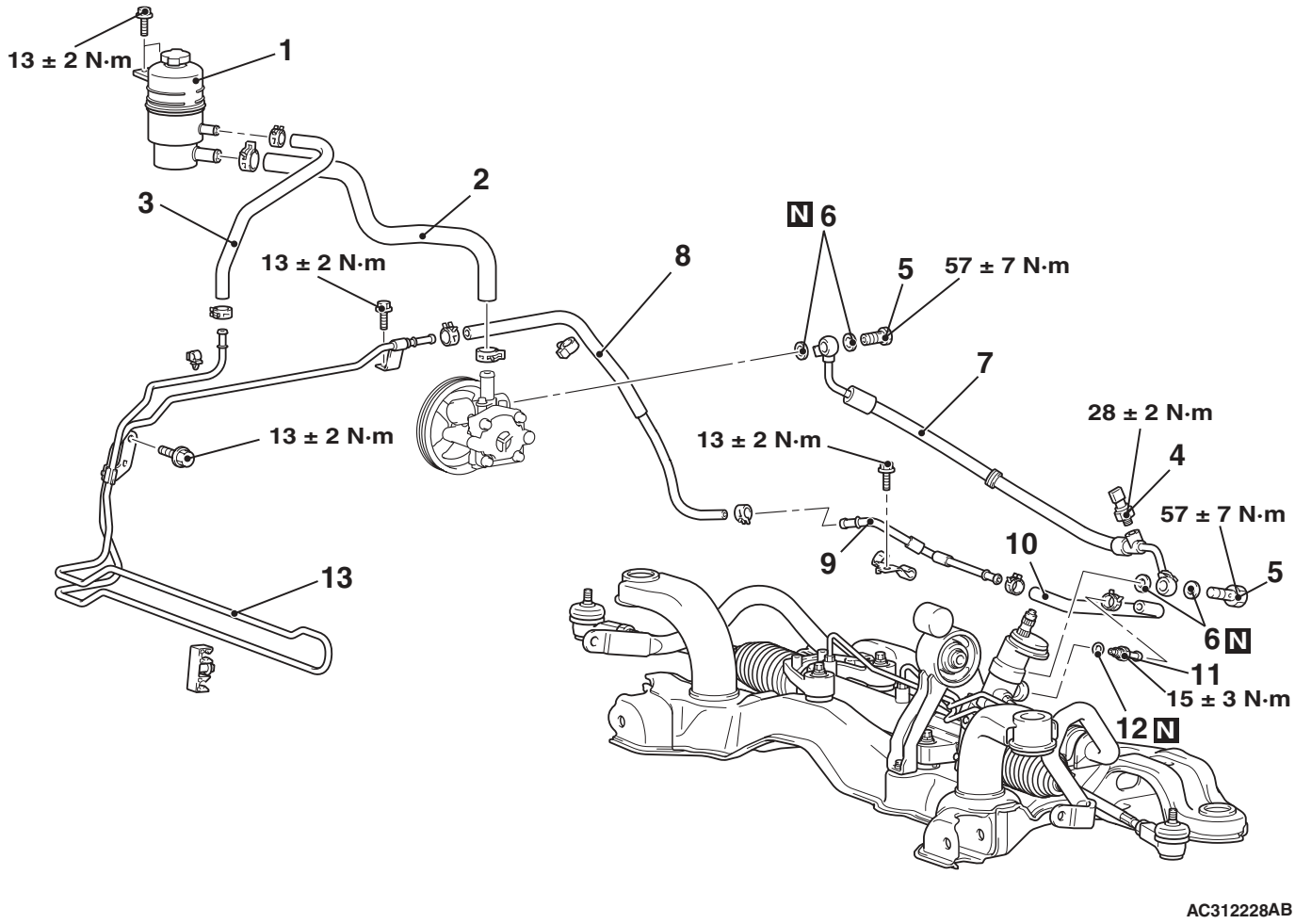
POWER STEERING HOSES

REMOVAL AND INSTALLATION

M1372005700602

Pre-removal and Post-installation Operation
- Power Steering Fluid Draining and Refilling (Refer to P.37-11.) and Bleeding (Refer to P.37-11.)

<LH drive vehicles>

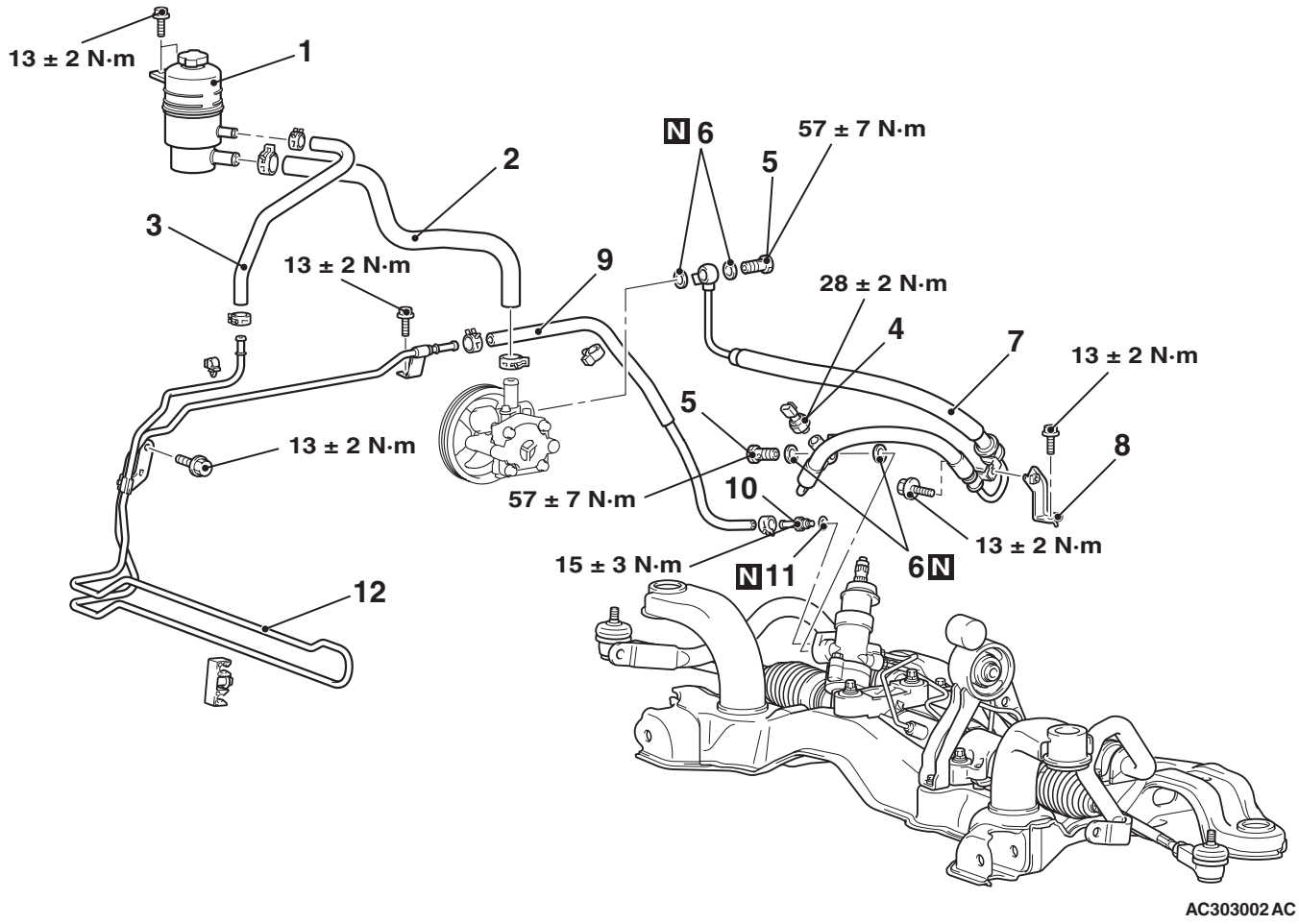


AC312228AB

Removal steps
1. Oil reservoir
>>F<< 2. Suction hose
>>E<< 3. Return hose
- Stabilizer link
4. Power steering oil pressure sensor
5. Eye bolt
6. Gasket
- Brake fluid reservoir assembly mounting nut
>>D<< 7. Pressure hose

Removal steps (Continued)
>>C<< 8. Return hose
>>B<< 9. Return tube
>>A<< 10. Return hose
11. Return tube
12. O-ring
- Front bumper assembly (Refer to GROUP 51, Front bumper assembly P.51-3.)
13. Cooler tube

<RH drive vehicles>



AC303002 AC

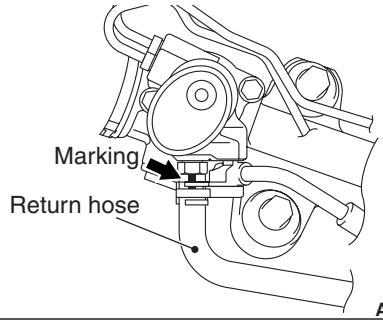
Removal steps

1. Oil reservoir
>>F<< 2. Suction hose
>>E<< 3. Return hose
- Stabilizer link
4. Power steering oil pressure sensor
5. Eye bolt
6. Gasket
- Brake fluid reservoir assembly mounting nut
>>D<< 7. Pressure hose
>>D<< 8. Pressure hose bracket
>>A<< 9. Return hose
10. Return tube
11. O-ring
- Front bumper assembly (Refer to GROUP 51, Front bumper assembly P.51-3.)
12. Cooler tube

INSTALLATION SERVICE POINTS

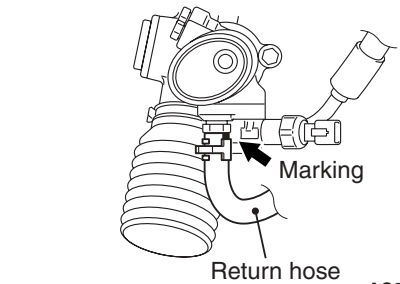
>>A<< RETURN HOSE INSTALLATION

<LH drive vehicles>



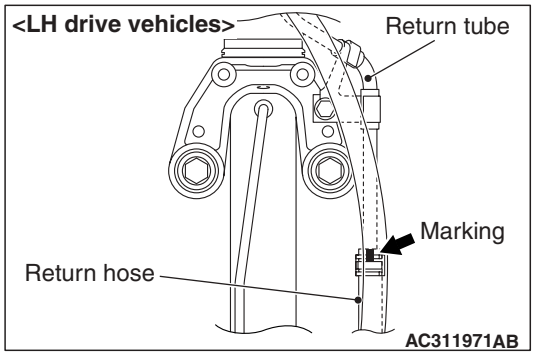
AC311970AB

<RH drive vehicles>



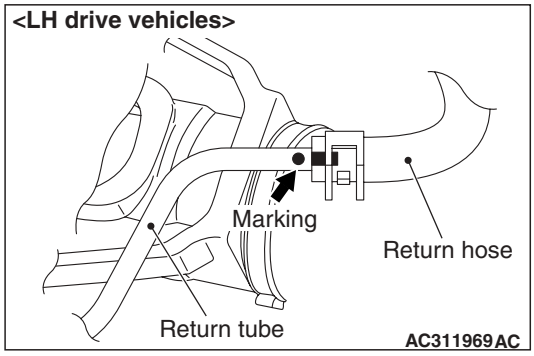
AC302814AC

1. Align the marking (white) as shown and connect the return hose.



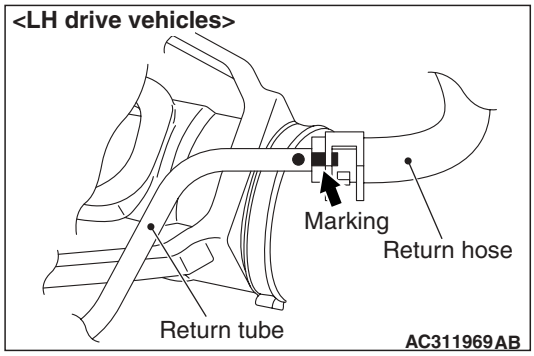
2. Align the marking (yellow) as shown and connect the return hose.

>>B<< RETURN TUBE INSTALLATION <LH drive vehicles>



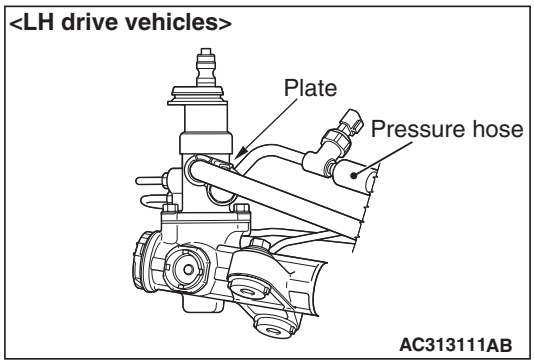
Align the return tube marking (green) as shown and connect the return tube.

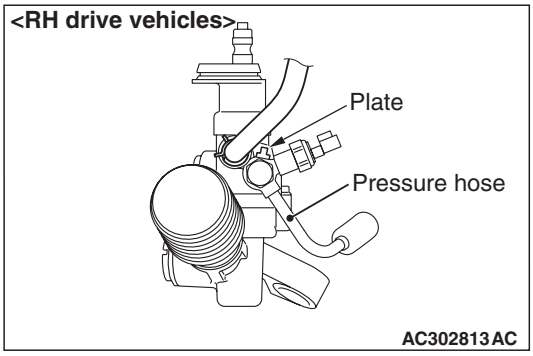
>>C<< RETURN HOSE INSTALLATION <LH drive vehicles>



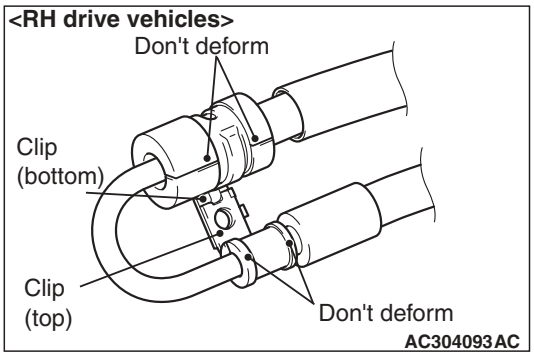
Align the return hose marking (green) as shown and connect the return hose.

>>D<< PRESSURE HOSE INSTALLATION



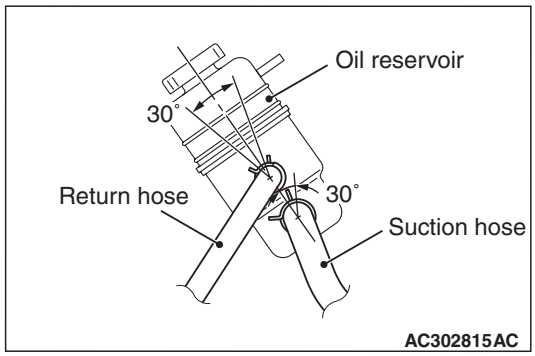


1. Align the pressure hose plate as shown and connect pressure hose.



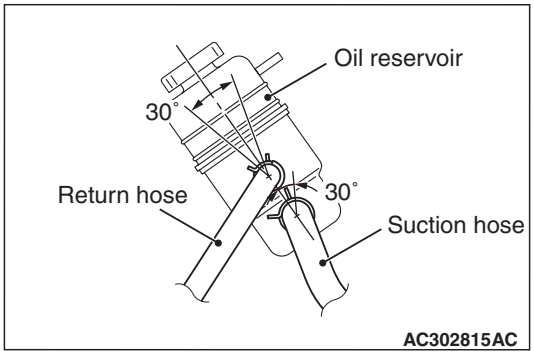
2. When connecting the pressure hose to the pressure hose bracket, be careful not to deform the top and bottom of the clip and the rubber.

>>E<< RETURN HOSE INSTALLATION

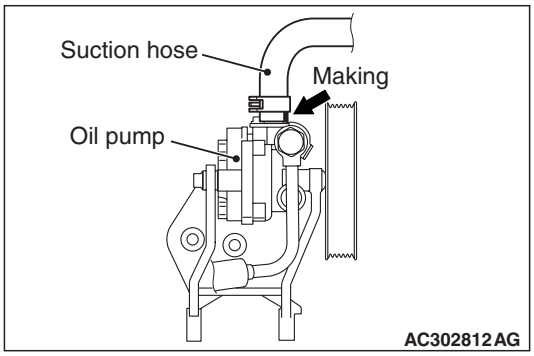


Align the return hose marking (yellow) within the area shown and connect the return hose.

>>F<< SUCTION HOSE INSTALLATION



1. Align the oil reservoir side suction hose marking (white) within the area shown and connect the suction hose.



2. Align the oil pump side suction hose marking (yellow) within the area shown and connect the suction hose.

INSPECTION

M1372005800029

Power steering oil pressure sensor check

Refer to GROUP 13A, Troubleshooting P.13A-20.

NOTE: The engine-ECU <M/T> or the engine-A/T-ECU <A/T> diagnoses the power steering oil pressure sensor. If there is a problem, diagnosis code is set.