

SECTION **ST**

STEERING SYSTEM

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NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

< SYMPTOM DIAGNOSIS >

SYMPTOM DIAGNOSIS

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

NVH Troubleshooting Chart

INFOID:000000004470896

Use the chart below to find the cause of the symptom. If necessary, repair or replace these parts.

Symptom			Possible cause and SUSPECTED PARTS															Reference
Steering	Noise	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	ST-7, "Inspection"
	Shake																	ST-7, "Inspection"
	Vibration																	ST-24, "Inspection"
	Shimmy																	ST-24, "Inspection"
	Judder																	ST-24, "Inspection"
																		ST-24, "Inspection"
																		ST-9, "Inspection"
																		ST-9, "Inspection"
																		EM-13, "Checking"
																		ST-9, "Inspection"
																		—
																		ST-18, "Exploded View"
																		ST-14, "Inspection"
																		ST-13, "Exploded View"
																		ST-18, "Exploded View"
																		NVH in DLN section.
																		NVH in DLN section.
																		NVH in FAX, RAX, FSU, RSU section.
																		NVH in WT section.
																		NVH in WT section.
																		NVH in FAX section.
																		NVH in BR section.

×: Applicable

PRECAUTIONS

< PRECAUTION >

PRECAUTION

PRECAUTIONS

Precaution for Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER"

INFOID:000000004694629

The Supplemental Restraint System such as "AIR BAG" and "SEAT BELT PRE-TENSIONER", used along with a front seat belt, helps to reduce the risk or severity of injury to the driver and front passenger for certain types of collision. This system includes seat belt switch inputs and dual stage front air bag modules. The SRS system uses the seat belt switches to determine the front air bag deployment, and may only deploy one front air bag, depending on the severity of a collision and whether the front occupants are belted or unbelted. Information necessary to service the system safely is included in the "SRS AIRBAG" and "SEAT BELT" of this Service Manual.

WARNING:

- To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision which would result in air bag inflation, all maintenance must be performed by an authorized NISSAN/INFINITI dealer.
- Improper maintenance, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see the "SRS AIRBAG".
- Never use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. SRS wiring harnesses can be identified by yellow and/or orange harnesses or harness connectors.

PRECAUTIONS WHEN USING POWER TOOLS (AIR OR ELECTRIC) AND HAMMERS

When working near the Airbag Diagnosis Sensor Unit or other Airbag System sensors while ignition switch is ON or engine is running, never use air or electric power tools or strike near the sensor(s) with a hammer. Heavy vibration may activate the sensor(s), deploy the airbag(s), possibly cause serious injury. When using air or electric power tools or hammers, always turn OFF ignition switch, disconnect the battery, and wait 3 minutes or more before performing any service.

Precaution Necessary for Steering Wheel Rotation after Battery Disconnect

INFOID:000000004495126

NOTE:

- Before removing and installing any control units, first turn the push-button ignition switch to the LOCK position, then disconnect both battery cables.
- After finishing work, confirm that all control unit connectors are connected properly, then re-connect both battery cables.
- Always use CONSULT-III to perform self-diagnosis as a part of each function inspection after finishing work. If a DTC is detected, perform trouble diagnosis according to self-diagnosis results.

This vehicle is equipped with a push-button ignition switch and a steering lock unit.

If the battery is disconnected or discharged, the steering wheel will lock and cannot be turned.

If turning the steering wheel is required with the battery disconnected or discharged, follow the procedure below before starting the repair operation.

OPERATION PROCEDURE

1. Connect both battery cables.

NOTE:

Supply power using jumper cables if battery is discharged.

2. Turn the push-button ignition switch to ACC position.
(At this time, the steering lock will be released.)
3. Disconnect both battery cables. The steering lock will remain released with both battery cables disconnected and the steering wheel can be turned.
4. Perform the necessary repair operation.
5. When the repair work is completed, re-connect both battery cables. With the brake pedal released, turn the push-button ignition switch from ACC position to ON position, then to LOCK position. (The steering wheel will lock when the push-button ignition switch is turned to LOCK position.)
6. Perform self-diagnosis check of all control units using CONSULT-III.

PRECAUTIONS

< PRECAUTION >

Service Notice or Precautions for Steering System

INFOID:000000004470899

- In case of removing steering gear assembly, make the final tightening with grounded and unloaded vehicle condition, and then check wheel alignment.
- Observe the following precautions when disassembling.
 - Before disassembly, thoroughly clean the outside of the unit.
 - Disassembly should be done in a clean work area. It is important to prevent the internal parts from becoming contaminated by dirt or other foreign matter.
 - For easier and proper assembly, place disassembled parts in order on a parts rack.
 - Use nylon cloth or paper towels to clean the parts; common shop rags can leave lint that might interfere with their operation.
 - Never reuse non-reusable parts.
 - Before assembling, apply the specified grease to the directed parts.

PREPARATION

< PREPARATION >

PREPARATION

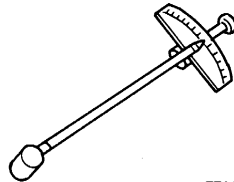
PREPARATION

Special Service Tools

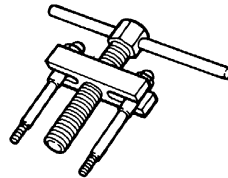
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The actual shapes of Kent-Moore tools may differ from those of special service tools illustrated here.

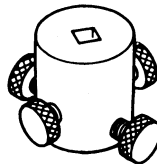
Tool number (Kent-Moore No.) Tool name	Description
ST3127S000 (J-25765-A) Preload gauge	<ul style="list-style-type: none"> Inspecting steering wheel turning torque Pinion rotating torque Ball joint rotating torque
ST27180001 (J-25726-A) Steering wheel puller	Removing steering wheel
KV48103400 (—) Preload adapter	Inspecting rotating torque
ST35300000 (—) Drift a: 45.1 mm (1.776 in) dia. b: 59.0 mm (2.323 in) dia.	Installing oil pump oil seal
KV48103500 (J-26357) Oil pressure gauge	Measuring oil pump relief pressure
KV48102500 (J-33914) Oil pressure gauge adapter	Measuring oil pump relief pressure



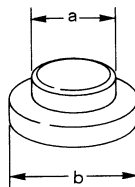
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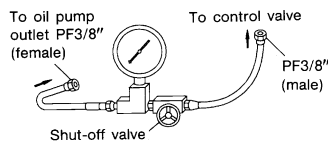
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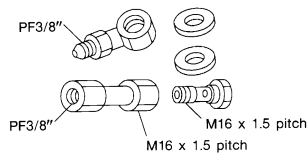
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S-NT547



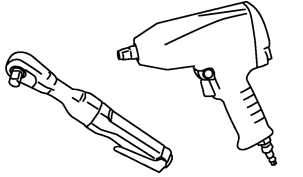
S-NT542

PREPARATION

< PREPARATION >

Commercial Service Tool

INFOID:000000004470903

Tool name	Description
Power tool	Loosening bolts and nuts
 <p>PBIC0190E</p>	

POWER STEERING FLUID

< ON-VEHICLE MAINTENANCE >

ON-VEHICLE MAINTENANCE

POWER STEERING FLUID

Inspection

INFOID:000000004494715

FLUID LEVEL

1. Check fluid level with engine stopped.
2. Ensure that fluid level is between MIN and MAX.
3. Fluid levels at HOT and COLD are different. Do not confuse them.

HOT : Fluid temperature 50 – 80°C (122 – 176°F)

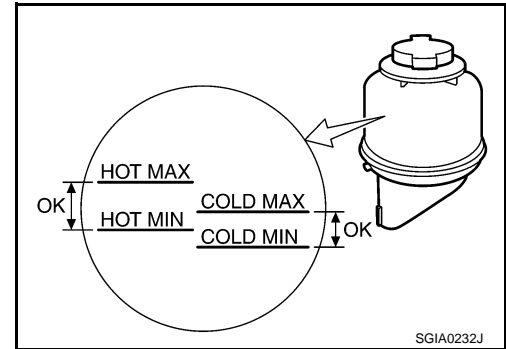
COLD : Fluid temperature 0 – 30°C (32 – 86°F)

Recommended fluid

: Refer to [MA-14, "FOR NORTH AMERICA : Fluids and Lubricants"](#) (For North America), [MA-15, "EXCEPT FOR NORTH AMERICA : Fluids and Lubricants"](#) (Except for North America).

Fluid capacity

: Refer to [ST-33, "General Specifications"](#).



CAUTION:

- The fluid level should not exceed the MAX line. Excessive fluid causes fluid leakage from the cap.
- Never reuse drained power steering fluid.

FLUID LEAKAGE

Check hydraulic connections for fluid leakage, cracks, damage, looseness, or wear.

1. Run the engine until the fluid temperature reaches 50 to 80°C (122 to 176°F) in reservoir tank, and keep engine speed idle.
2. Turn steering wheel several times from full left stop to full right stop.
3. Hold steering wheel at each lock position for five seconds and carefully check for fluid leakage.

CAUTION:

Never hold the steering wheel in a locked position for more than 10 seconds. (There is the possibility that power steering oil pump assembly may be damaged.)

4. If fluid leakage at connections is noticed, then loosen flare nut and then retighten. Do not overtighten connector as this can damage O-ring, washer and connector.
5. If fluid leakage from oil pump is noticed, check oil pump.
6. Check steering gear boots for accumulation of fluid leaked from steering gear.

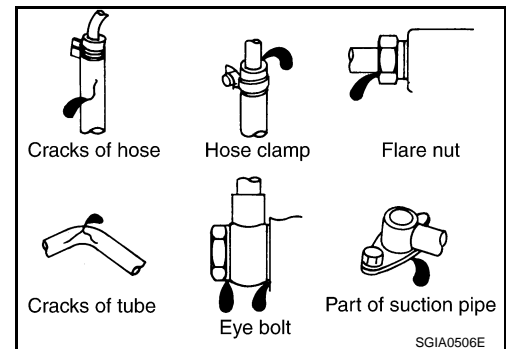
AIR BLEEDING HYDRAULIC SYSTEM

If air bleeding is not complete, the following symptoms can be observed.

- Bubbles are created in reservoir tank.
- Clicking noise can be heard from oil pump.
- Excessive buzzing in the oil pump.

NOTE:

Fluid noise may occur in the steering gear or oil pump. This does not affect performance or durability of the system.



POWER STEERING FLUID

< ON-VEHICLE MAINTENANCE >

1. Turn steering wheel several times from full left stop to full right stop with engine off.
CAUTION:
Fill reservoir tank with a sufficient amount of fluid so that fluid level is not below the MIN line while turning steering wheel.
2. Start the engine and hold steering wheel at each lock position for 3 second at idle to check for fluid leakage.
3. Repeat step 2 above several times at approximately 3 second intervals.
CAUTION:
Never hold the steering wheel in a locked position for more than 10 seconds. (There is the possibility that oil pump may be damaged.)
4. Check fluid for bubbles and white contamination.
5. Stop the engine if bubbles and white contamination do not drain out. Perform step 2 and 3 above after waiting until bubbles and white contamination drain out.
6. Stop the engine, and then check fluid level.

STEERING WHEEL

< ON-VEHICLE MAINTENANCE >

STEERING WHEEL

Inspection

INFOID:000000004470906

STEERING WHEEL AXIAL END PLAY

1. Check installation conditions of steering gear assembly, front suspension assembly, axle and steering column assembly.
2. Check if movement exists when steering wheel is moved up and down, to the left and right and to the axial direction.

Standard

Steering wheel axial end play : Refer to [ST-33, "Steering Wheel Axial End Play and Play"](#).

3. Check the following items if steering wheel axial end play is out of the standard.
 - Check the steering column assembly mounting condition. Refer to [ST-13, "Exploded View"](#).
 - Check steering gear assembly mounting condition for looseness. Refer to [ST-18, "Exploded View"](#).

STEERING WHEEL PLAY

1. Turn steering wheel so that front wheels come to the straight-ahead position.
2. Start the engine and lightly turn steering wheel to the left and right until front wheels start to move.
3. Measure steering wheel movement on the outer circumference.

Standard

Steering wheel play : Refer to [ST-33, "Steering Wheel Axial End Play and Play"](#).

4. Check the following items if steering wheel play is out of the standard.
 - Check backlash for each joint of steering column assembly.
 - Check installation condition of steering gear assembly.

NEUTRAL POSITION STEERING WHEEL

1. Check that steering gear assembly, steering column assembly and steering wheel are installed in the correct position.
2. Perform neutral position inspection after wheel alignment. Refer to [FSU-7, "Inspection"](#).
3. Set the vehicle to the straight-ahead position and check that the steering wheel is in the neutral position.
4. Loosen outer socket lock nut and turn inner socket to left and right equally to make fine adjustments if steering wheel is not in the neutral position.

STEERING WHEEL TURNING TORQUE

1. Park the vehicle on a level and dry surface, apply parking brake.
2. Tires need to be inflated to the specified pressure. Refer to [WT-99, "Tire Air Pressure"](#).
3. Remove driver air bag module. Refer to [SR-5, "Exploded View"](#).
4. Start the engine.
5. Check that the power steering fluid is at the operating temperature.

Fluid temperature : 50 – 80°C (122 – 176°F)

STEERING WHEEL

< ON-VEHICLE MAINTENANCE >

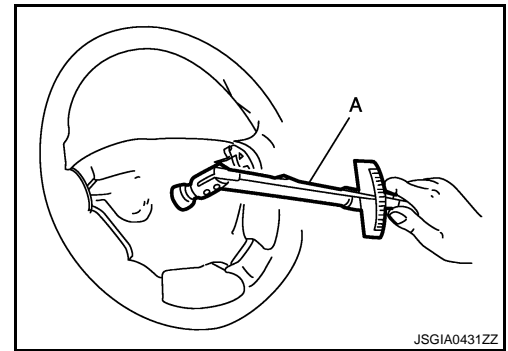
6. Make sure that the reading is within the following specified range using preload gauge (A) [SST: ST3127S000 (J-25765-A)].

Standard

Steering wheel turning torque

: Refer to [ST-33, "Steering Wheel Turning Torque"](#).

7. If steering wheel turning force is out of the specification, check rack sliding force and relief hydraulic pressure of oil pump. Regarding relief hydraulic pressure of oil pump, refer to [ST-30, "Inspection"](#).



RACK SLIDING FORCE

1. Disconnect lower joint and steering knuckle from steering gear assembly. Refer to [ST-18, "Exploded View"](#).
2. Start and run the engine at idle to make sure steering fluid reaches normal operating temperature.

Fluid temperature

: 50 – 80°C (122 – 176°F)

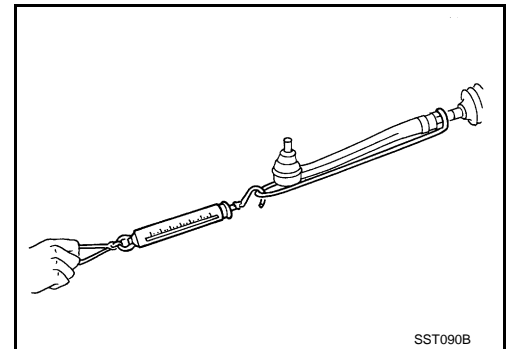
3. While pulling outer socket slowly in ± 11.5 mm (± 0.453 in) range from neutral position, check that rack sliding force is within specification.

Standard

Rack sliding force

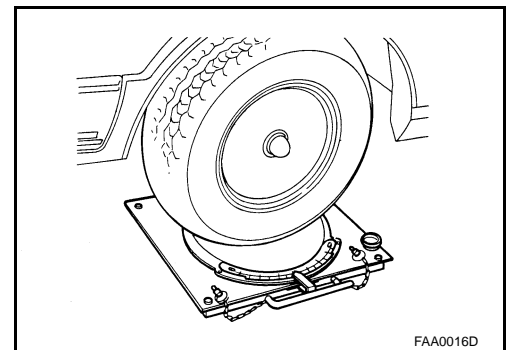
: Refer to [ST-34, "Rack Sliding Force"](#).

4. If rack sliding force is not within specification, overhaul steering gear assembly.



FRONT WHEEL TURNING ANGLE

1. Check front wheel turning angle after toe-in inspection. Refer to [FSU-7, "Inspection"](#).
2. Place front wheels on turning radius gauges and rear wheels on stands, so that vehicle can be level.
3. Check the maximum inner and outer wheel turning angles for LH and RH road wheels.



4. With the engine at idle, turn steering wheel from full left stop to full right stop and measure the turning angles.

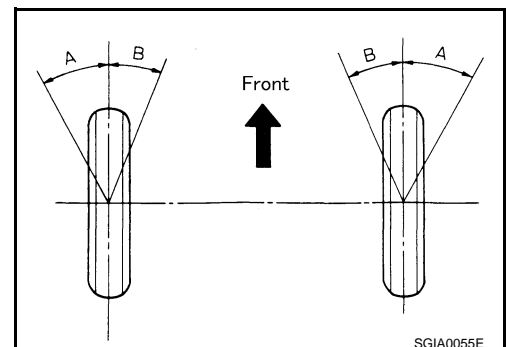
Standard

Inner wheel (Angle: A)

: Refer to [ST-33, "Steering Angle"](#).

Outer wheel (Angle: B)

: Refer to [ST-33, "Steering Angle"](#).



STEERING WHEEL

< ON-VEHICLE MAINTENANCE >

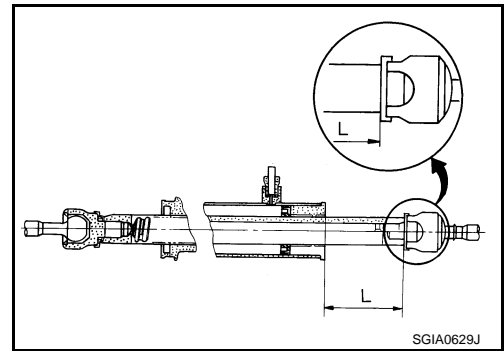
5. Check the following items if turning angle is out of the specified value.
 - a. Check the neutral position of the rack stroke (L).

Standard

L

: Refer to [ST-34, "Rack Stroke"](#).

- b. Disassemble steering gear assembly to check the cause that rack stroke is outside of the specified value.
 - Steering angles are not adjustable. Check steering gear assembly, steering column assembly and front suspension components for wear or damage if any of the turning angles are different from the specified value. Replace damaged or malfunctioning parts if necessary.



A

B

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STEERING WHEEL

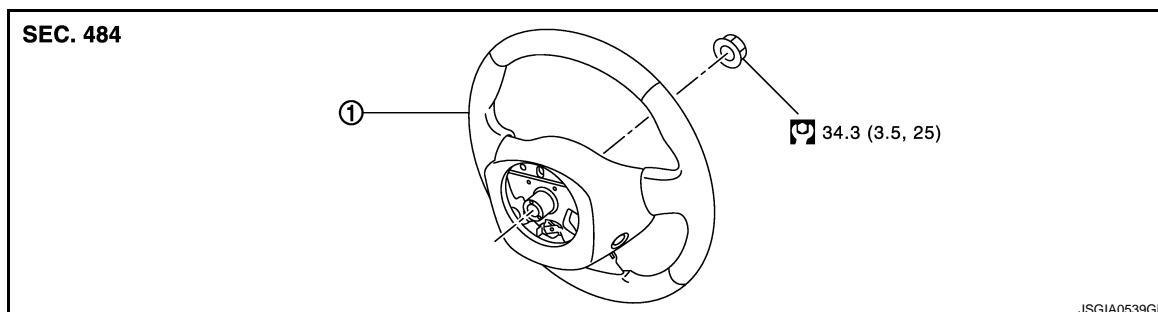
< ON-VEHICLE REPAIR >

ON-VEHICLE REPAIR

STEERING WHEEL

Exploded View

INFOID:000000004470907



1. Steering wheel

Refer to [GI-4, "Components"](#) for symbols in the figure.

Removal and Installation

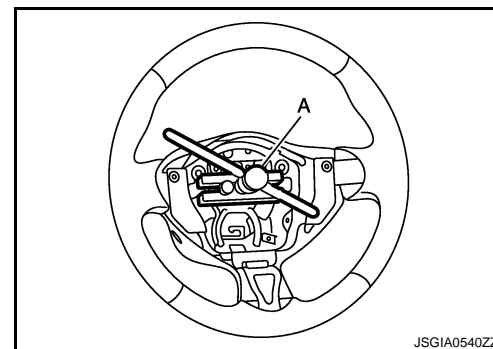
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REMOVAL

NOTE:

When reconnecting spiral cable, fix cable with a tape so that fixing case and rotating part keep aligned. This omits neutral position alignment procedure during spiral cable installation.

1. Set the vehicle to the straight-ahead position.
2. Remove driver air bag module. Refer to [SR-5, "Exploded View"](#).
3. Remove steering wheel lock nut after steering is locked.
4. Remove steering wheel with the steering wheel puller (A) [SST: ST27180001 (J-25726-A)].



INSTALLATION

Note the following, and install in the reverse order of removal.

CAUTION:

Never twist spiral cable freely on excessively after it becomes tight (doing so may cause the cable to tear off).

NOTE:

Check the spiral cable neutral position after replacing or rotating spiral cable. Refer to [SR-8, "Exploded View"](#).

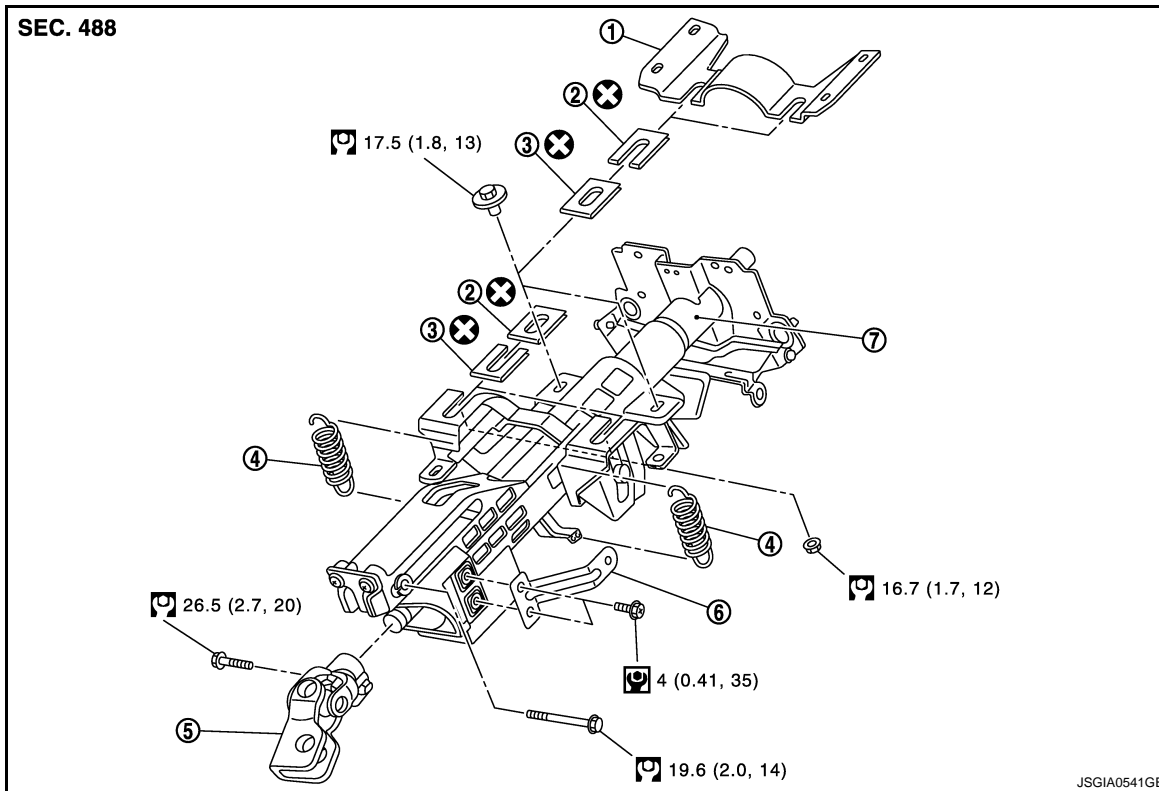
STEERING COLUMN

< ON-VEHICLE REPAIR >

STEERING COLUMN

Exploded View

INFOID:000000004470909



- | | | |
|-----------------------------|----------------|----------------|
| 1. Bracket | 2. Slide plate | 3. Slide plate |
| 4. Spring | 5. Upper joint | 6. Bracket |
| 7. Steering column assembly | | |

Refer to [GI-4, "Components"](#) for symbols in the figure.

Removal and Installation

INFOID:000000004494772

REMOVAL

1. Set the vehicle to the straight-ahead position.
2. Place the tilt to the highest level.
3. Remove driver air bag module. Refer to [SR-5, "Exploded View"](#).
4. Remove steering wheel. Refer to [ST-12, "Exploded View"](#).
5. Remove the instrument lower panel LH. Refer to [IP-11, "Exploded View"](#).
6. Remove combination meter. Refer to [IP-11, "Exploded View"](#).
7. Remove the steering column cover. Refer to [IP-11, "Exploded View"](#).
8. Remove spiral cable. Refer to [SR-8, "Exploded View"](#).
9. Remove combination switch. Refer to [BCS-85, "Exploded View"](#).
10. Remove knee protector.
11. Disconnect each harness connectors installed to steering column assembly.
12. Remove the upper joint mounting bolt and nut (lower shaft side), and separate the joint from lower shaft.
13. Remove steering column assembly.

CAUTION:

- Never give axial impact to steering column assembly during removal.
- Never move steering gear assembly when removing steering column assembly.

STEERING COLUMN

< ON-VEHICLE REPAIR >

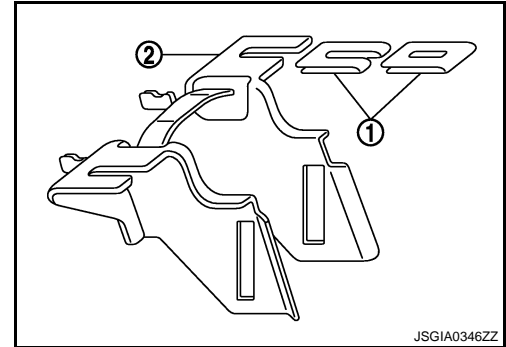
INSTALLATION

Note the following, and install in the reverse order of removal.

- Make sure there is no space between slide plate (1) and steering column assembly (2).

CAUTION:

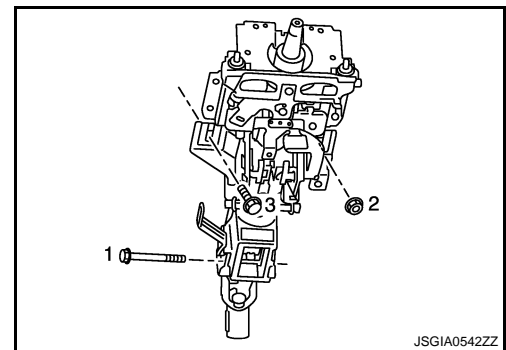
Never reuse the slide plate.



- Tighten the mounting nuts in the order shown in the figure steering member, when installing the steering column assembly.
- Be careful of the following points when installing the steering column assembly.

CAUTION:

- **Never give axial impact to steering column assembly during installation.**
- **Never move steering gear assembly.**
- **Never reuse the joint mounting nut (lower shaft side).**
- Adjust neutral position of steering angle sensor. Refer to [BRC-8, "ADJUSTMENT OF STEERING ANGLE SENSOR NEUTRAL POSITION : Special Repair Requirement"](#) (VDC models).



Inspection

INFOID:000000004494773

INSPECTION AFTER REMOVAL

- Check each part of steering column assembly for damage or other malfunctions. Replace if necessary.
- Measure steering column assembly rotating torque using a preload gauge [SST: ST3127S000 (J-25765-A)]. Replace steering column assembly if outside the standard.

Standard

Rotating torque

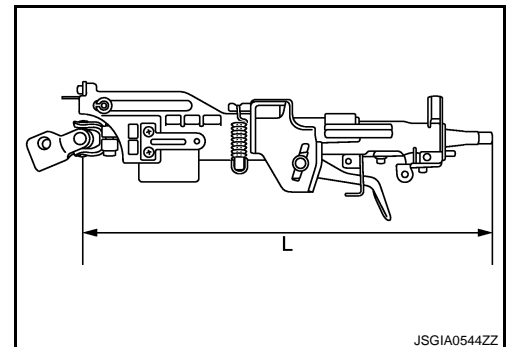
: Refer to [ST-33, "Steering Column Operating Range"](#).

- Measure the length (L) as shown, if vehicle has been involved in a minor collision. Replace steering column assembly if out side the standard.

Standard

L

: Refer to [ST-33, "Steering Column Length"](#).



STEERING COLUMN

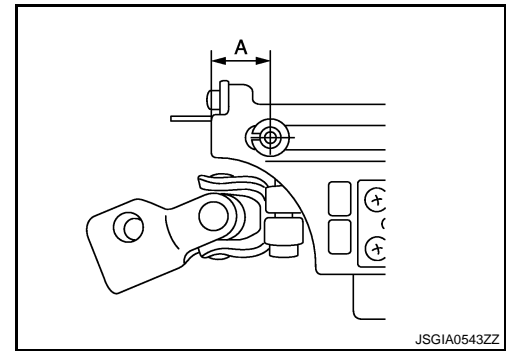
< ON-VEHICLE REPAIR >

- Install the bracket (1) and steering column housing (2) so that the clearance (A) is within the specified range as described below. Replace steering column assembly if out side the standard.

Standard

A

: Refer to [ST-33, "Steering Column Mounting Dimensions"](#).



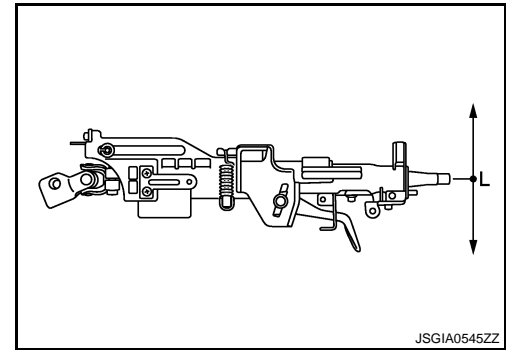
INSPECTION AFTER INSTALLATION

- Check each part of steering column assembly for damage or other malfunctions. Replace if necessary.
- Check the steering wheel play, neutral position steering wheel, steering wheel turning force, and front wheel turning angle. Refer to [ST-9, "Inspection"](#).
- Check tilt mechanism operating range (L), as shown in the figure.

Standard

L

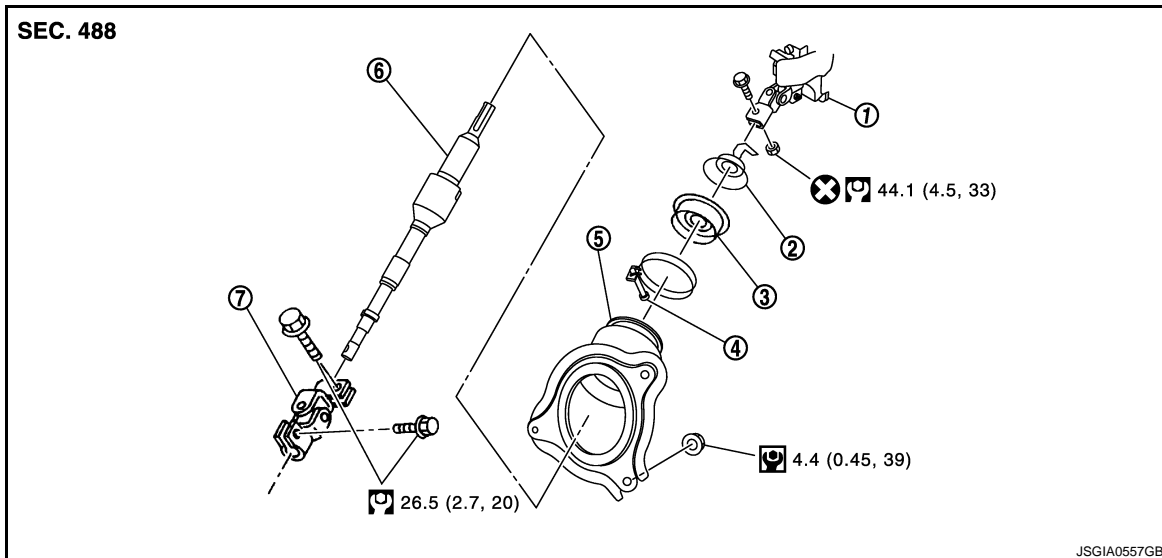
: Refer to [ST-33, "Steering Column Operating Range"](#).



LOWER SHAFT

Exploded View

INFOID:0000000004470912



- | | | |
|-----------------------------|---------------|--------------------|
| 1. Steering column assembly | 2. Collar | 3. Hole cover seal |
| 4. Clamp | 5. Hole cover | 6. Lower shaft |
| 7. Lower joint | | |

Refer to GI-4, "Components" for symbols in the figure.

Removal and Installation

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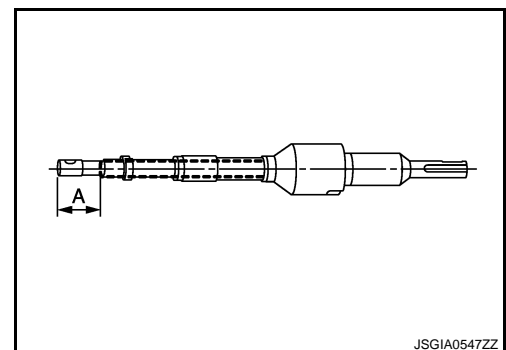
REMOVAL

1. Set the vehicle to the straight-ahead position.
2. Fix the steering wheel.
3. Remove lower joint fixing bolt (steering gear side).
4. Separate the lower shaft from the steering gear assembly by sliding the slide shaft (A: sliding range).

CAUTION:

Spiral cable may be cut if steering wheel turns while separating steering column assembly and steering gear assembly. Always fix the steering wheel using string to avoid turning.

5. Remove the accelerator pedal assembly. Refer to [ACC-3. "Exploded View"](#).
6. Remove the hole cover mounting nuts.
7. Remove the upper joint fixing bolt and nut (lower shaft side).
8. Remove the lower shaft and hole cover.
9. Remove collar, hole cover seal, clamp and hole cover.



INSTALLATION

Note the following, and install in the reverse order of removal.

CAUTION:

Spiral cable may be cut if steering wheel rotates while separating steering column assembly and steering gear assembly. Always fix the steering wheel using string to avoid turning.

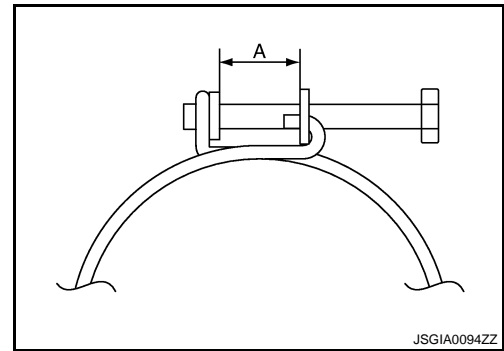
LOWER SHAFT

< ON-VEHICLE REPAIR >

- Tighten the clamp to the specified torque and check the clamp length (A).

A

: 14.0 – 18.0 mm (0.551 – 0.709 in)



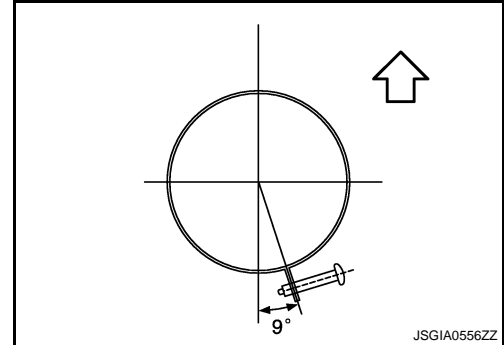
- Install clamp as shown in the figure.

↩ : Vehicle front

- When installing lower joint to steering gear assembly, follow the procedure listed below.
- Set rack of steering gear in the neutral position.

NOTE:

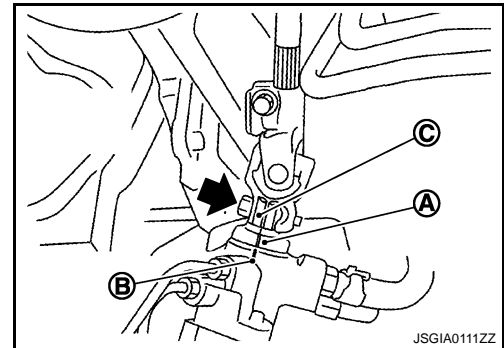
To get the neutral position of rack, turn gear-sub assembly and measure the distance of inner socket, and then measure the intermediate position of the distance.



- Align rear cover cap projection (A) with the marking position of gear housing assembly (B).

← : Bolt

- Install slit part of lower joint (C) aligning with the rear cover cap projection (A). Check that the slit part of lower joint (C) is aligned with rear cover cap projection (A) and the marking position of gear housing assembly (B).
- Make sure there is no clearance between the lower joint, gear housing assembly and mounting bolt.
- Adjust neutral position of steering angle sensor. Refer to [BRC-8, "ADJUSTMENT OF STEERING ANGLE SENSOR NEUTRAL POSITION : Special Repair Requirement"](#).
- Check the following after installation:
 - Check if steering wheel turns smoothly when it is turned several times fully to the end of the left and right.
 - Check the steering wheel play, neutral position steering wheel, steering wheel turning force, and front wheel turning angle. Refer to [ST-9, "Inspection"](#).



Inspection

INFOID:000000004470914

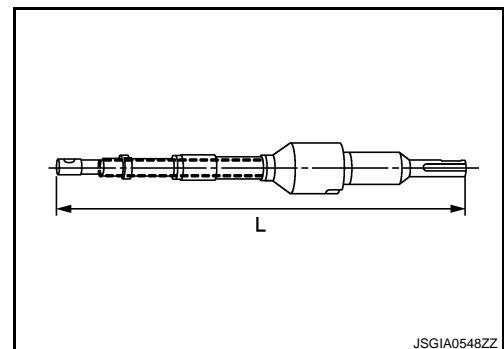
- Check the length (L) (extended position) of the lower shaft.

Standard

L

: Refer to [ST-34, "Lower Shaft"](#).

- Check each part of lower shaft for damage or other malfunctions. Replace if there are.



STEERING GEAR AND LINKAGE

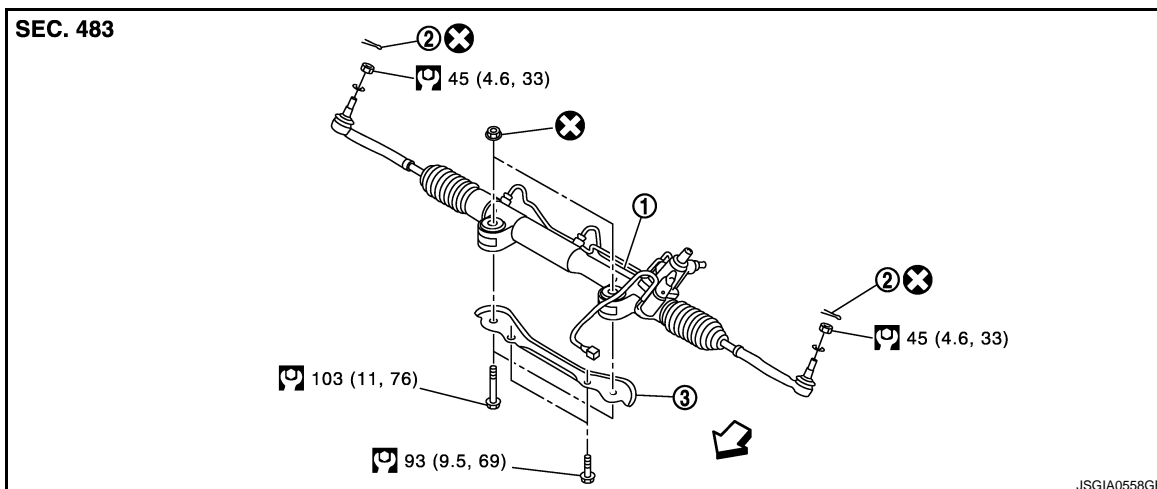
< ON-VEHICLE REPAIR >

STEERING GEAR AND LINKAGE

Exploded View

INFOID:000000004470915

REMOVAL



1. Steering gear assembly

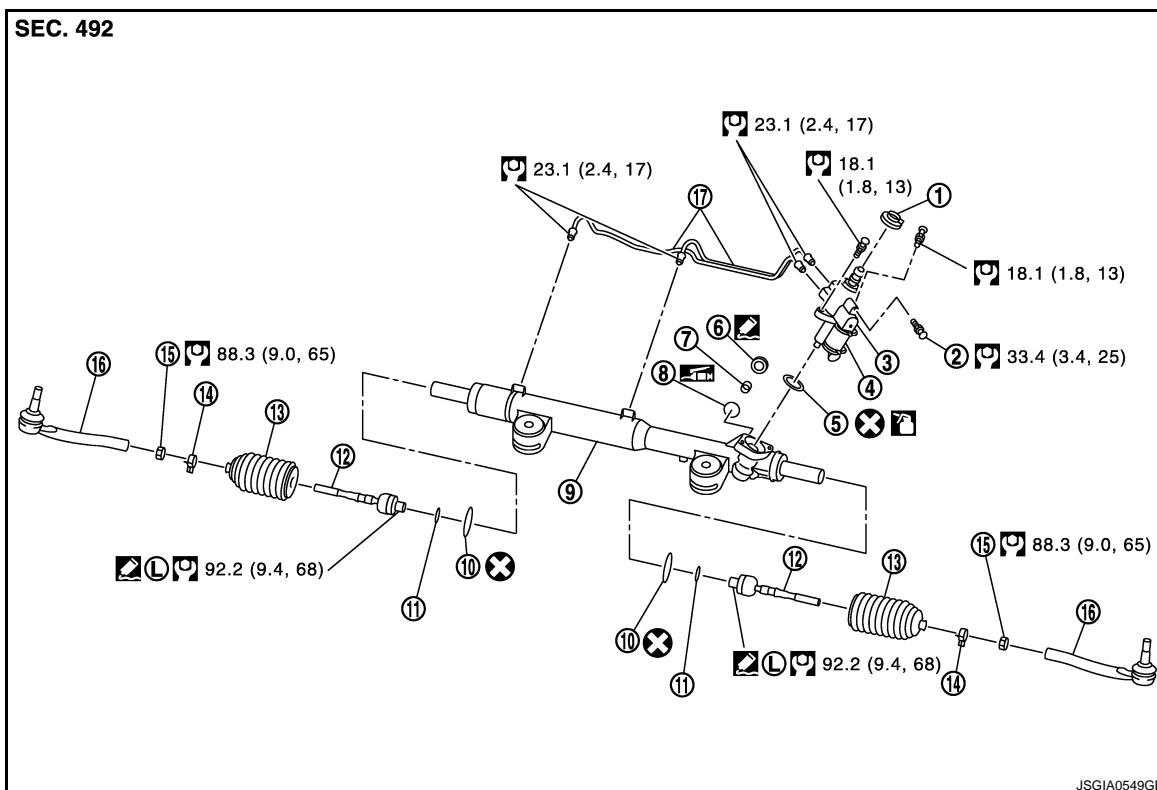
2. Cotter pin

3. Rack stay

←: Vehicle front

Refer to [GI-4, "Components"](#) for symbols in the figure.

DISASSEMBLY



1. Rear cover cap

2. Low pressure piping

3. Gear-sub assembly

4. Power steering solenoid valve

5. O-ring

6. Adjusting screw

7. Spring

8. Retainer


9. Gear housing assembly


STEERING GEAR AND LINKAGE


< ON-VEHICLE REPAIR >

- | | | |
|---------------------------------|--------------------|---------------------------|
| 10. Boot clamp (stainless wire) | 11. Spacer | 12. Inner socket |
| 13. Boot | 14. Boot clamp | 15. Outer socket lock nut |
| 16. Outer socket | 17. Cylinder tubes | |

: Apply power steering fluid.

: Apply Genuine High Performance Thread Sealant or equivalent. Refer to [GI-17, "Recommended Chemical Products and Sealants"](#).

: Apply Genuine Medium Strength Thread Locking Sealant or equivalent. Refer to [GI-17, "Recommended Chemical Products and Sealants"](#).

: Apply multi-purpose grease.

Refer to [GI-4, "Components"](#) for symbols not described on the above.

Removal and Installation

INFOID:000000004470916

REMOVAL

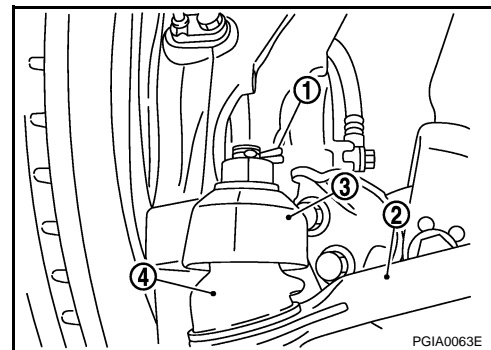
1. Set the vehicle to the straight-ahead position.
2. Remove tires with a power tool.
3. Remove front suspension member stay. Refer to [FSU-18, "Exploded View"](#).
4. Remove cotter pin (1), and then loosen the nut.

5. Remove steering outer socket (2) from steering knuckle (3) so as not to damage ball joint boot (4) using suitable ball joint remover.

CAUTION:

Temporarily tighten the nut to prevent damage to threads and to prevent the ball joint remover from sudden drop.

6. Remove high pressure piping and low pressure piping of hydraulic piping, and then drain power steering fluid.



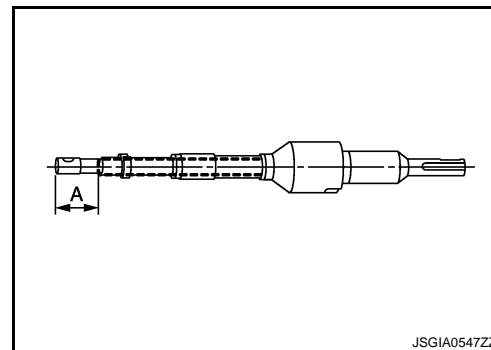
7. Remove power steering solenoid valve harness connector.
8. Remove rack stay. Refer to [ST-18, "Exploded View"](#).
9. Remove lower joint fixing bolt (steering gear side).

10. Separate the lower shaft from the steering gear assembly by sliding the slide shaft (A: sliding range).

CAUTION:

Spiral cable may be cut if steering wheel turns while separating steering column assembly and steering gear assembly. Always fix the steering wheel using string to avoid turning.

11. Remove the mounting bolts and nuts of steering gear assembly.
12. Remove steering gear assembly.



INSTALLATION

Note the following, and install in the reverse order of removal.

CAUTION:

Spiral cable may be cut if steering wheel turns while separating steering column assembly and steering gear assembly. Always fix the steering wheel using string to avoid turning.

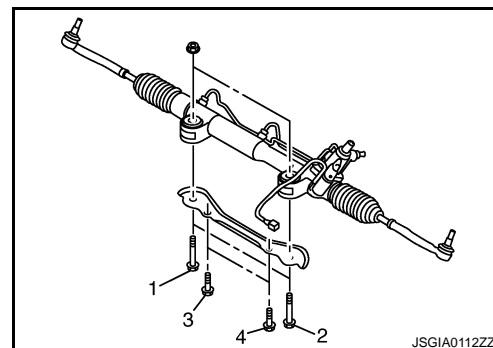
STEERING GEAR AND LINKAGE

< ON-VEHICLE REPAIR >

- Tighten the mounting bolts in the order shown in the figure when installing the steering gear assembly.

Temporary tightening: 1 ⇒ 2 ⇒ 3 ⇒ 4

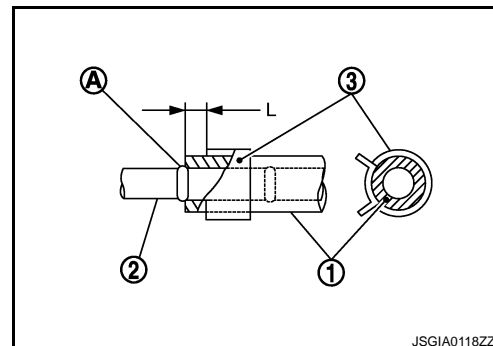
Final tightening: 1 ⇒ 2 ⇒ 3 ⇒ 4



- When installing suction hoses (1), refer to the figure.

CAUTION:

- **Never apply fluid to the hose (1) and tube (2).**
- **Insert hose securely until it contacts spool (A) of tube.**
- **Install clamp (3) to the hose at 3 – 8 mm (0.12 – 0.31 in) (L) from the edge of the hose.**



- When installing lower joint to steering gear assembly, follow the procedure listed below.
- Set rack of steering gear in the neutral position.

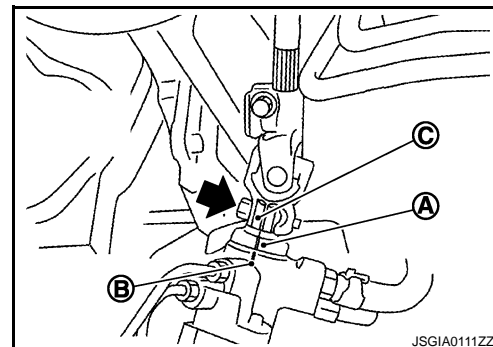
NOTE:

To get the neutral position of rack, turn gear-sub assembly and measure the distance of inner socket, and then measure the intermediate position of the distance.

- Align rear cover cap projection (A) with the marking position of gear housing assembly (B).

← : Bolt

- Install slit part of lower joint (C) aligning with the rear cover cap projection (A). Make sure that the slit part of lower joint (C) is aligned with rear cover cap projection (A) and the marking position of gear housing assembly (B).
- Make sure there is no clearance between the lower joint, gear housing assembly and mounting bolt.
- After installation, bleed air from the steering hydraulic system. Refer to [ST-7, "Inspection"](#).
- Perform final tightening of nuts and bolts on each part under unladen conditions with tires on level ground when removing steering gear assembly. Check wheel alignment. Refer to [FSU-7, "Inspection"](#).
- Adjust neutral position of steering angle sensor after checking wheel alignment. Refer to [BRC-8, "ADJUSTMENT OF STEERING ANGLE SENSOR NEUTRAL POSITION : Special Repair Requirement"](#).



Disassembly and Assembly

INFOID:000000004470917

DISASSEMBLY

1. Remove low pressure piping.

CAUTION:

- **Disassemble and assemble steering gear assembly by fixing the mounting area with a vise using copper plates.**
 - **Clean steering gear assembly with kerosene before disassembling. Be careful to avoid splashing or applying any kerosene over connector of discharge port or return port.**
2. Remove cylinder tubes from gear housing assembly.
 3. Remove rear cover cap from gear-sub assembly.

STEERING GEAR AND LINKAGE

< ON-VEHICLE REPAIR >

4. Measure adjusting screw height "H", and loosen adjusting screw.

CAUTION:

- Never loosen adjusting screw 2 turns or more.
- Replace steering gear assembly if adjusting screw is loosened 2 turns or more and it is removed.

5. Remove gear-sub assembly from gear housing assembly.
6. Remove O-ring from gear housing assembly.
7. Loosen outer socket lock nut, and remove outer socket.
8. Remove boot clamps, and then remove boot from inner socket.

CAUTION:

Never damage inner socket and gear housing assembly when removing boot. Inner socket and gear housing assembly must be replaced if inner socket and gear housing assembly are damaged because it may cause foreign material interfusion.

9. Remove inner socket from gear housing assembly.
10. Remove spacer from gear housing assembly.

ASSEMBLY

1. Apply recommended fluid to O-ring, and then install O-ring to gear housing assembly.

CAUTION:

Never reuse O-ring.

2. Install gear-sub assembly to gear housing assembly.

CAUTION:

In order to protect oil seal from any damage, insert gear-sub assembly straightly.

3. Install inner socket to gear housing assembly with the following procedure.

- a. Install spacer to gear housing assembly.
- b. Apply thread sealant into the thread of inner socket.

Use Genuine Medium Strength Thread Locking Sealant or equivalent. Refer to [GI-17, "Recommended Chemical Products and Sealants"](#).

4. Decide on the neutral position of the rack stroke (L).

Standard

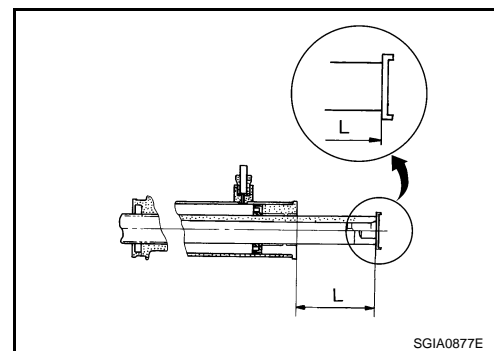
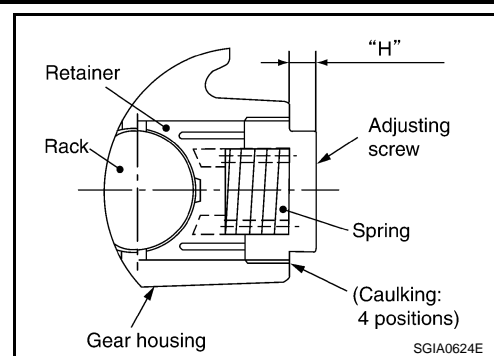
L

: Refer to [ST-34, "Rack Stroke"](#).

5. Install rear cover cap to gear sub-assembly.

CAUTION:

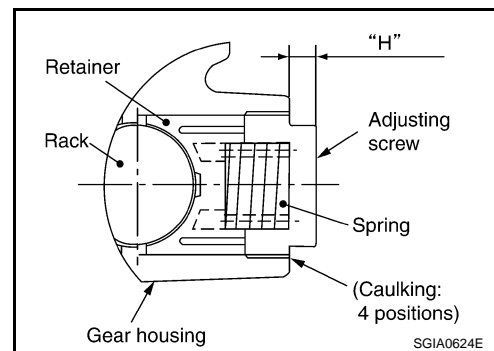
Check that the projection of rear cover cap is aligned with the marking position of gear housing assembly.



6. Apply recommended thread sealant to the thread (2 turns thread), and then screw in the adjusting screw until it reaches height "H" from gear housing assembly measured before disassembling.

Use Genuine High Performance Thread Sealant or equivalent. Refer to [GI-17, "Recommended Chemical Products and Sealants"](#).

7. Move rack assembly 10 strokes throughout the full stroke so that the parts can fit with each other.



8. Adjust pinion rotating torque with the following procedure.

STEERING GEAR AND LINKAGE

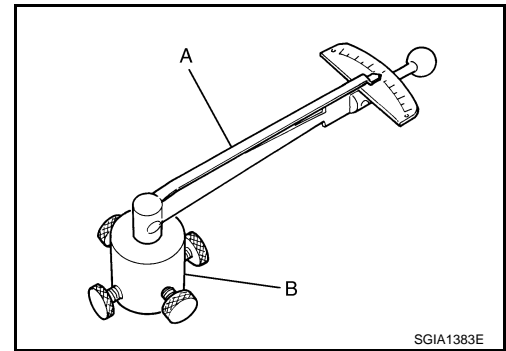
< ON-VEHICLE REPAIR >

- a. Measure pinion rotating torque within $\pm 180^\circ$ of neutral position of the rack assembly using tools. Stop the gear at the point where highest torque is read.

A: Preload gauge [SST: ST3127S000 (J-25765-A)]

B: Preload adapter [SST: KV48103400 (—)]

- b. Loosen adjusting screw and retighten to 5.4 N·m (0.55 kg-m, 48 in-lb), and then loosen by 20 to 40°.



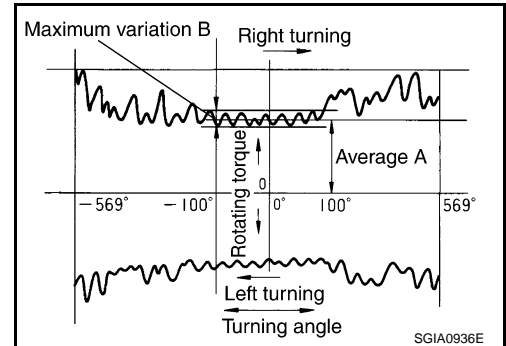
SGIA1383E

- c. Measure pinion rotating torque using tools to check that the measured value is within the specified value. Readjust if the value is outside the standard. Replace steering gear assembly, if the value is out of the specified value after readjusting, or adjusting screw rotating torque is 5 N·m (0.51 kg-m, 44 in-lb) or less.

Pinion rotating torque

Around neutral position (within $\pm 100^\circ$) average (A) : 1.95 – 2.58 N·m (0.20 – 0.26 kg-m, 18 – 22 in-lb)

Maximum variation (B) : 0.98 N·m (0.10 kg-m, 9.0 in-lb)



SGIA0936E

- d. Turn pinion fully to left.
- e. Install dial gauge at 5 mm (0.20 in) (L) from the edge of gear housing assembly (1), and tooth point.
- f. Measure vertical movement of rack assembly when pinion is turned clockwise with torque of 19.6 N·m (2.0 kg-m, 14 ft-lb). Readjust adjusting screw angle if the measured value is out of the specified value.

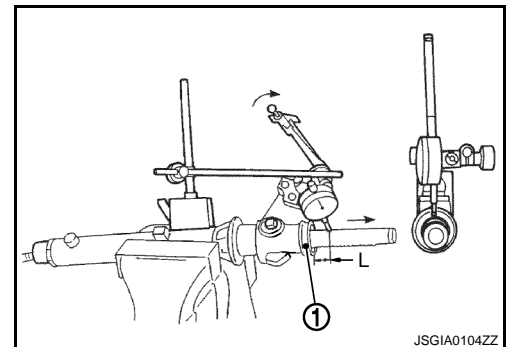
Vertical movement : 0.265 mm (0.0104 in)

- If reading is outside of the specification, readjust screw angle with adjusting screw.

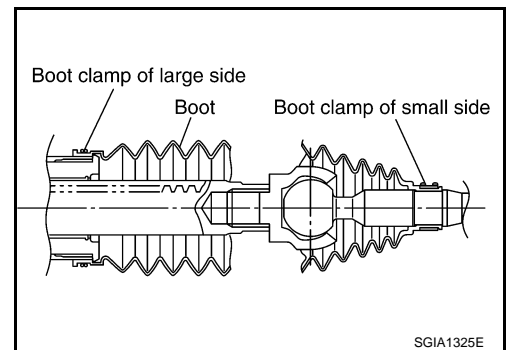
CAUTION:

- If reading is still outside of specification, or if the rotating torque of adjusting screw is less than 5 N·m (0.51 kg-m, 44 in-lb), replace steering gear assembly.
- Never turn adjusting screw more than twice.
- Replace steering gear assembly when adjusting screw is removed or turned more than twice.

9. Install large end of boot to gear housing assembly.
10. Install small end of boot to inner socket boot mounting groove.
11. Install boot clamp to boot small end.



JSGIA0104ZZ



SGIA1325E

12. Install boot clamp to the large side of boot with the following procedure.

CAUTION:

Never reuse boot clamp.

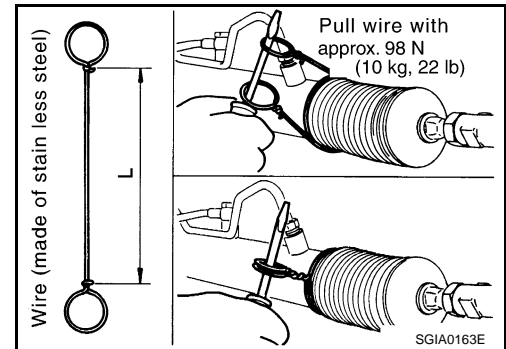
STEERING GEAR AND LINKAGE

< ON-VEHICLE REPAIR >

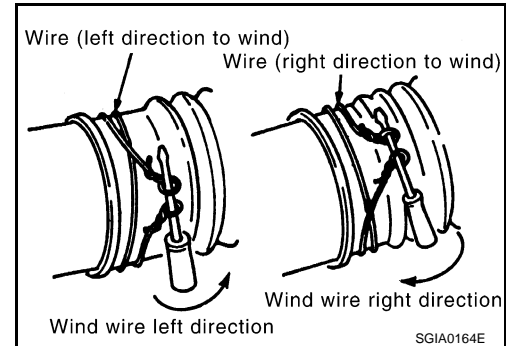
- Tighten large side of boot with boot clamp (stainless wire).

Wire length (L) : 370 mm (14.57 in)

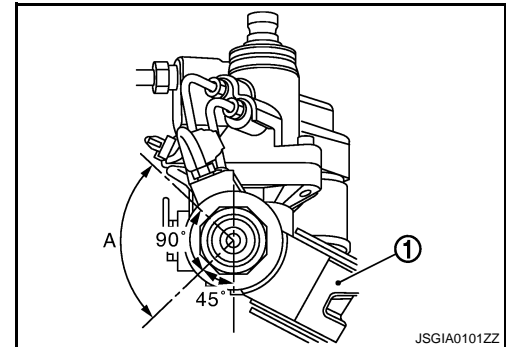
- Wrap clamp around boot groove for two turns. Insert a flat-bladed screwdriver in loops on both ends of wire. Twist 4 to 4.5 turns while pulling them with force of approximately 98 N (10 kg, 22 lb).



- Twist boot clamp as shown. Pay attention to relationship between winding and twisting directions.



- Twisted area (A) of clamp is on the opposite side of adjusting screw (1) as shown in the figure. (To prevent contact with other parts)



- Bend cut end of the wire within the area (A) shown in the figure after twisting the wire 4 to 4.5 turns so that the cut end does not contact with boot.

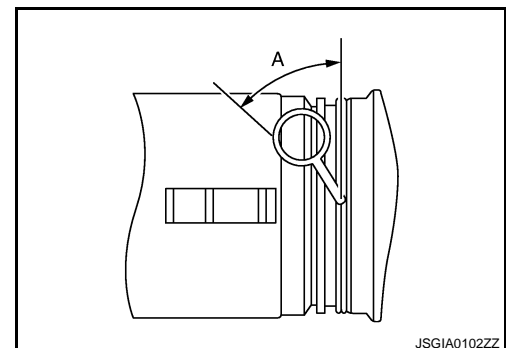
CAUTION:

Keep the clearance from cylinder tube 5.0 mm (0.20 in) or more.

A : 45°

- Install cylinder tubes to gear housing assembly.

- Install low pressure piping.



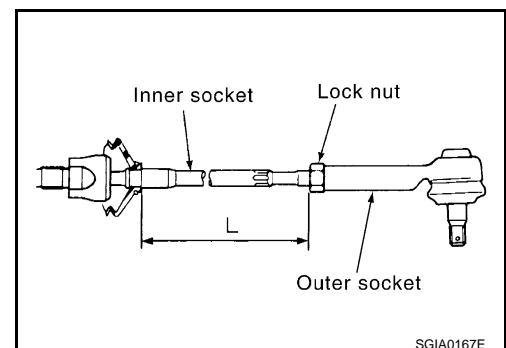
- Adjust inner socket to standard length (L), and then tighten lock nut to the specified torque. Check length again after tightening lock nut.

Standard

L : Refer to ST-34, "Inner Socket Length".

CAUTION:

Adjust toe-in after this procedure. The length achieved after toe-in adjustment is not necessary the above value.



STEERING GEAR AND LINKAGE

< ON-VEHICLE REPAIR >

Inspection

INFOID:000000004470918

INSPECTION AFTER INSTALLATION

- Check if steering wheel turns smoothly when it is turned several times fully to the end of the left and right.
- Check the steering wheel play, neutral position steering wheel, steering wheel turning force, and front wheel turning angle. Refer to [ST-9. "Inspection"](#).
- Check the fluid level, fluid leakage, and air bleeding hydraulic system. Refer to [ST-7. "Inspection"](#).

INSPECTION AFTER DISASSEMBLY

Boot

Check boot for cracks, and replace it if a malfunction is detected.

Rack Assembly

Check rack for damage or wear, and replace it if a malfunction is detected.

Gear-Sub Assembly

- Check gear-sub assembly for damage or wear, and replace it if a malfunction is detected.
- Rotate gear-sub assembly and check for torque variation or rattle, and replace it if a malfunction is detected.

Gear Housing Assembly

Check gear housing assembly for damage and scratches (inner wall). Replace if there are.

Outer Socket and Inner Socket

Check the following items and replace the component if it does not meet the standard.

BALL JOINT SWINGING TORQUE

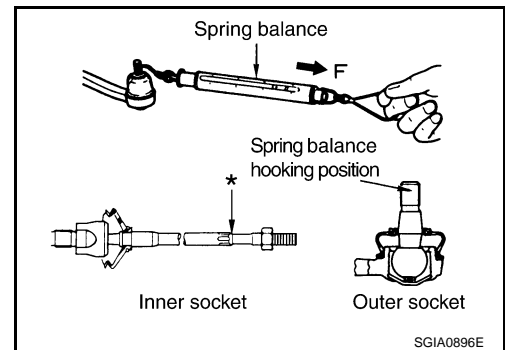
Hook a spring balance at the point shown in the figure and pull the spring balance. Make sure that the spring balance reads the specified value when ball stud and inner socket start to move. Replace outer socket and inner socket if they are outside the standard.

Standard

(Measuring point of outer socket: Stud cotter pin mounting hole)

Outer socket

: Refer to [ST-34. "Socket Swing Force and Rotating Torque"](#).



Standard

(Measuring point of inner socket: "*" mark shown in the figure)

Inner socket

: Refer to [ST-34. "Socket Swing Force and Rotating Torque"](#).

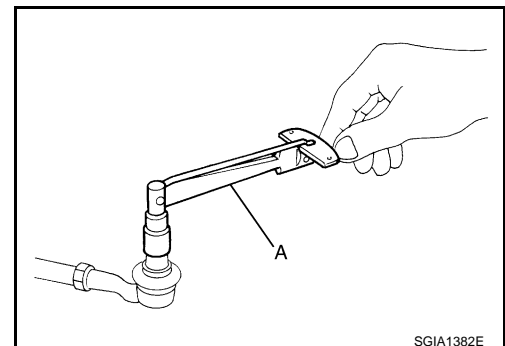
BALL JOINT ROTATING TORQUE

Make sure that the reading is within the following specified range using preload gauge (A) [SST: ST3127S000 (J-25765-A)]. Replace outer socket if the reading is outside the specified value.

Standard

Rotating torque

: Refer to [ST-34. "Socket Swing Force and Rotating Torque"](#).



BALL JOINT AXIAL END PLAY

STEERING GEAR AND LINKAGE

< ON-VEHICLE REPAIR >

Apply an axial load of 490 N (50 kg, 110 lb) to ball stud. Using a dial gauge, measure amount of stud movement, and then make sure that the value is within the following specified range. Replace outer socket (1) and inner socket (2) if the measured value is outside the standard.

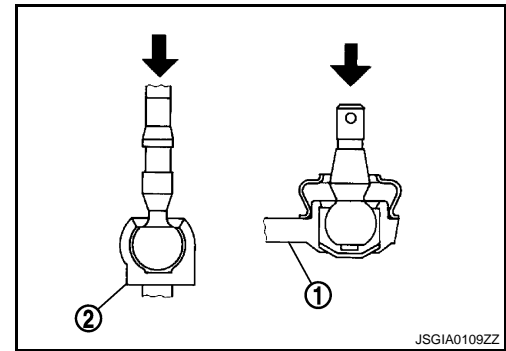
Standard

Outer socket

: Refer to [ST-34, "Socket Axial End Play"](#).

Inner socket

: Refer to [ST-34, "Socket Axial End Play"](#).



A

B

C

D

E

F

ST

H

I

J

K

L

M

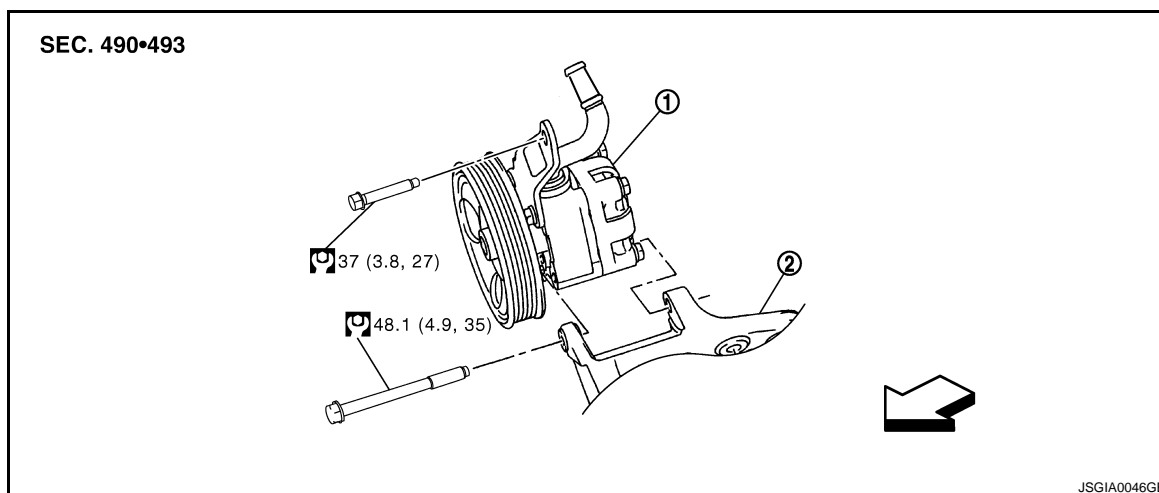
N

O

P

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REMOVAL

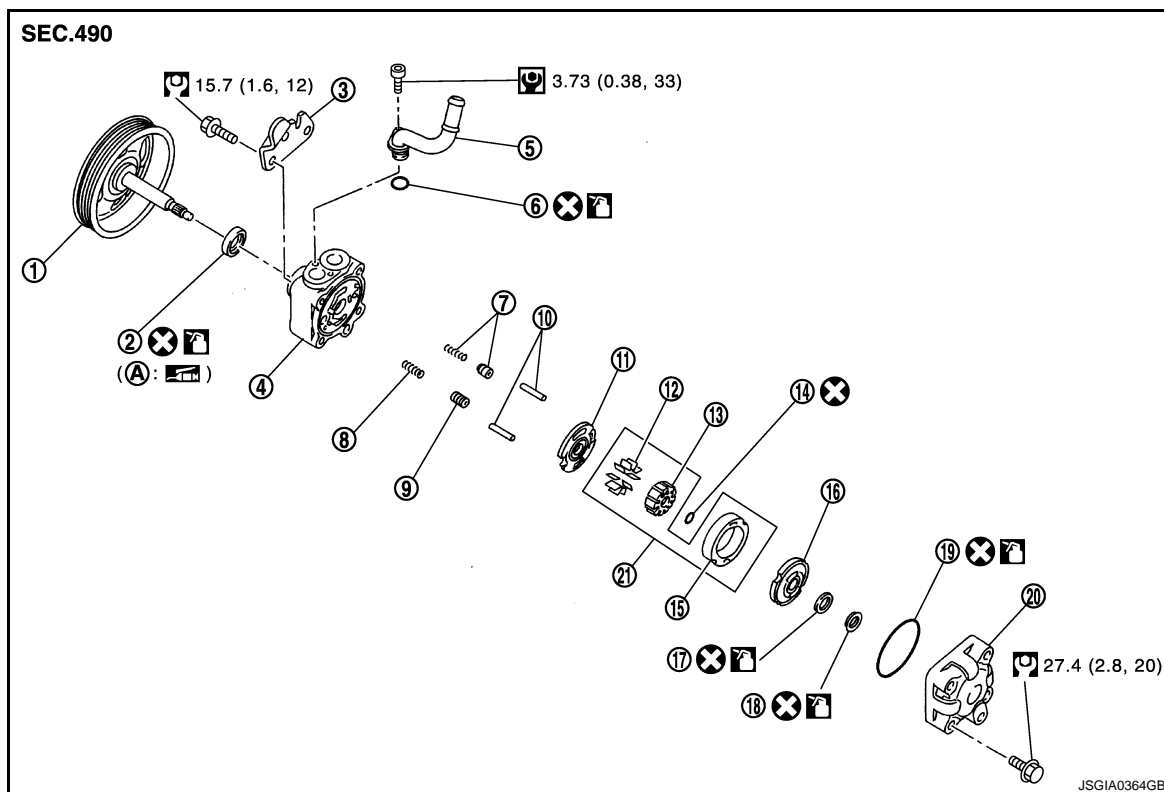


1. Power steering oil pump
2. Bracket

←: Vehicle front

Refer to GI-4, "Components" for symbols in the figure.

DISASSEMBLY



- | | | |
|----------------------------------|------------------------------|-------------------------|
| 1. Pulley | 2. Oil seal | 3. Bracket |
| 4. Body assembly | 5. Suction pipe | 6. O-ring |
| 7. Flow control valve B assembly | 8. Flow control valve spring | 9. Flow control valve A |

POWER STEERING OIL PUMP

< ON-VEHICLE REPAIR >

- | | | |
|---------------------|----------------------|-----------------|
| 10. Dowel pin | 11. Front side plate | 12. Vane |
| 13. Rotor | 14. Rotor snap ring | 15. Cam ring |
| 16. Rear side plate | 17. O-ring | 18. Teflon ring |
| 19. O-ring | 20. Rear cover | 21. Cartridge |
| A. Oil seal lip | | |



: Apply power steering fluid.



: Apply multi-purpose grease.

Refer to [GI-4, "Components"](#) for symbols not described on the above.

Removal and Installation

INFOID:000000004470920

REMOVAL

1. Drain power steering fluid from reservoir tank.
2. Remove the right of the air cleaner and the right of the air duct. Refer to [EM-27, "Exploded View"](#).
3. Loosen drive belt. Refer to [EM-13, "Exploded View"](#).
4. Remove drive belt from oil pump pulley.
5. Remove pressure sensor connector.
6. Remove copper washers and eye bolt (drain fluid from their pipings).
7. Remove suction hose (drain fluid from their pipings).
8. Remove cooling fan assembly. Refer to [CO-16, "Exploded View"](#).
9. Remove oil pump mounting bolts, and then remove oil pump.

INSTALLATION

Note the following, and install in the reverse order of removal.

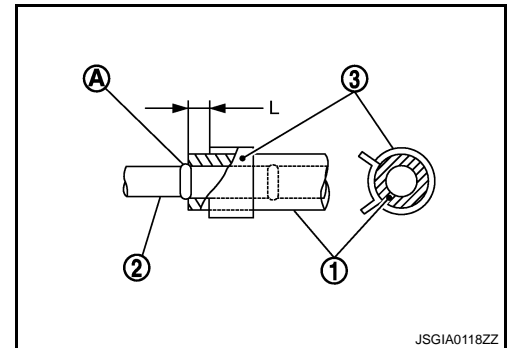
- When installing suction hoses (1), refer to the figure.

CAUTION:

- **Never apply fluid to the hose (1) and tube (2).**
- **Insert hose securely until it contacts spool (A) of tube.**
- **Leave clearance (L) when installing clamp (3).**

Standard

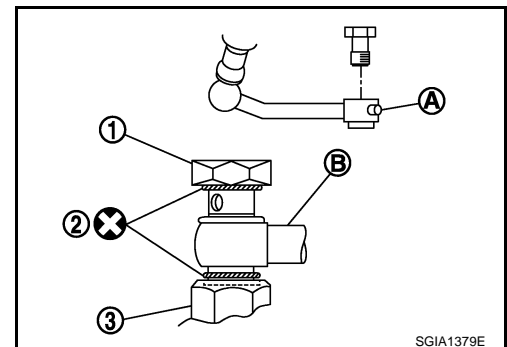
L : 3 – 8 mm (0.12 – 0.31 in)



- When installing eye bolt (1) and copper washer (2) to oil pump (3), refer to the figure.

CAUTION:

- **Never reuse copper washer.**
- **Apply power steering fluid to around copper washers, then install eye bolt.**
- **Install eye bolt with eye joint (assembled to high pressure hose) (B) protrusion (A) facing with pump side cutout, and then tighten it to the specified torque after tightening by hand. Refer to [ST-32, "Exploded View"](#).**
- **Securely insert harness connector to pressure sensor.**
- Adjust belt tension. Refer to [EM-13, "Tension Adjustment"](#).
- Check fluid level, fluid leakage and air bleeding hydraulic system after the installation. Refer to [ST-7, "Inspection"](#).



Disassembly and Assembly

INFOID:000000004470921

DISASSEMBLY

1. Remove rear cover mounting bolts, and then remove rear cover from body assembly.

CAUTION:

POWER STEERING OIL PUMP

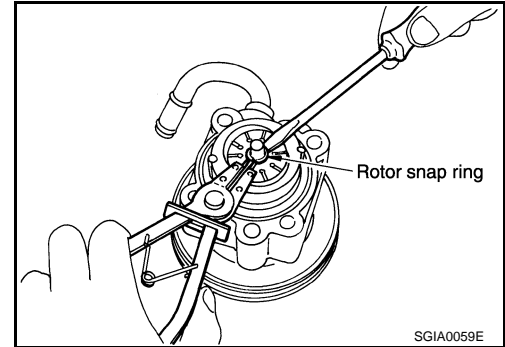
< ON-VEHICLE REPAIR >

- Fix oil pump with a vise if necessary.
- Use copper plates when fixing with a vise.

2. Remove O-ring from body assembly.
3. Remove rear side plate from cartridge, and then remove Teflon ring and O-ring from rear side plate.
4. Remove rotor snap ring using a snap ring pliers, and remove pulley from body assembly.

CAUTION:

Never damage pulley, when removing rotor snap ring.

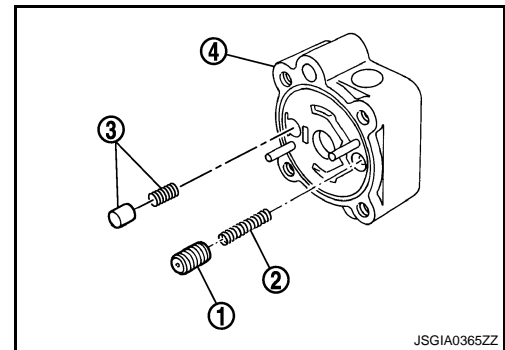


5. Remove cartridge and front side plate.
6. Remove flow control valve A (1), flow control valve spring (2) and flow control valve B assembly (3) from body assembly (4).

CAUTION:

Never drop and damage flow control valve A and flow control valve B assembly when removing.

7. Remove oil seal from body assembly.
8. Remove mounting bolt of suction pipe, and then remove suction pipe from body assembly.
9. Remove O-ring from body assembly.
10. Remove bracket mounting bolts, and then remove bracket from body assembly.



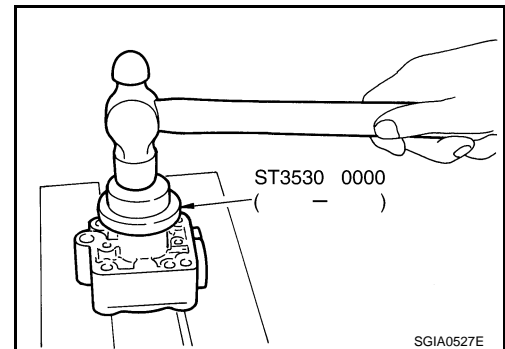
ASSEMBLY

1. Apply recommended grease to oil seal lips. Apply recommended fluid to around oil seal, and then install oil seal to body assembly using a drift [SST: ST35300000 (—)]

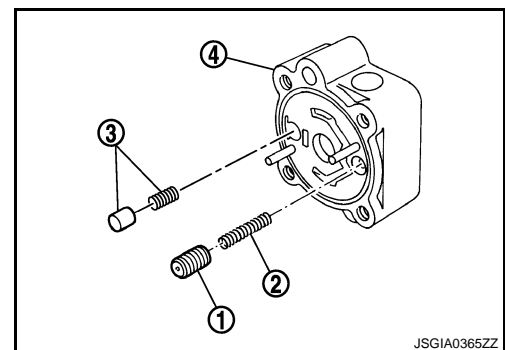
CAUTION:

- Fix oil pump with a vise if necessary.
- Use copper plates when fixing with a vise.

2. Install bracket to body assembly.
3. If dowel pin has been removed, insert it into body assembly by hand. If it cannot be inserted by hand, lightly tap with a hammer.



4. Install flow control valve A (1), flow control valve spring (2) and flow control valve B assembly (3) to body assembly (4).



A
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ST

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-
- Cam ring
- Body assembly
- $D_1 > D_2$
- SGIA0612E

-
- Figure 1 consists of two technical drawings of a circular saw blade. Drawing (A) is a top-down view showing a circular blade with 12 teeth arranged around the perimeter. The teeth are of two types: larger, wider teeth and smaller, narrower teeth. A central mounting hole is visible. Drawing (B) is a side view of the same blade, showing its thickness and the arrangement of the teeth from the side. The teeth are shown in profile, with the larger teeth having a more pronounced shape. The central mounting hole is also visible from the side.

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- Face inside
- Vane
- Rotor
- Cam ring
- Round position
- Flat position
- JSG1A0461GB

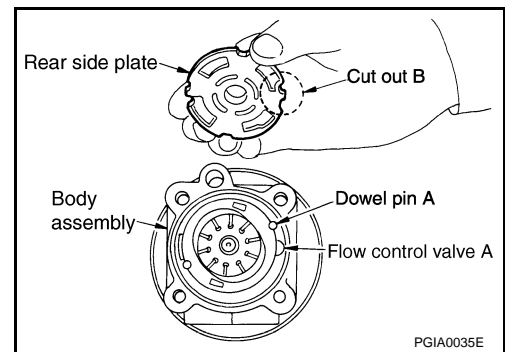
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- Diagram illustrating the assembly of the Box onto the main unit. The Box is being placed onto the top of the main unit, which has a circular opening. The main unit is labeled 'SGIA0063E'.

- O
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- P

POWER STEERING OIL PUMP

< ON-VEHICLE REPAIR >

11. Install rear side plate with dowel pin A on flow control valve A side as shown in the figure aligning with rear side plate cutout B to cartridge.
12. Apply recommended fluid to O-ring, and then install O-ring to body assembly.
13. Apply recommended fluid to O-ring, and then install O-ring to rear side plate.
14. Apply recommended fluid to Teflon ring, and then install Teflon ring to rear side plate.
15. Install rear cover to body assembly.
16. Apply recommended fluid to O-ring, and then install O-ring to body assembly.
17. Install suction pipe to body assembly.



Inspection

INFOID:000000004470922

RELIEF OIL PRESSURE

CAUTION:

Check that belt tension is normal before starting the following procedure.

1. Connect the oil pressure gauge [SST: KV48103500 (J-26357)] and the oil pressure gauge adapter [SST: KV48102500 (J-33914)] between oil pump discharge connector and high-pressure hose. Bleed air from the hydraulic circuit while opening valve fully. Refer to [ST-7, "Inspection"](#).
2. Start engine. Run engine until oil temperature reaches 50 to 80°C (122 to 176°F).

CAUTION:

- Leave the valve of the oil pressure gauge fully open while starting and running engine. If engine is started with the valve closed, the hydraulic pressure in oil pump goes up to the relief pressure along with unusual increase of oil temperature.
- Always keep hose clear of belts and other parts when engine is started.

3. Fully close the oil pressure gauge valve with engine at idle and measure the relief oil pressure.

Standard

Relief oil pressure

: Refer to [ST-34, "Relief Oil Pressure"](#).

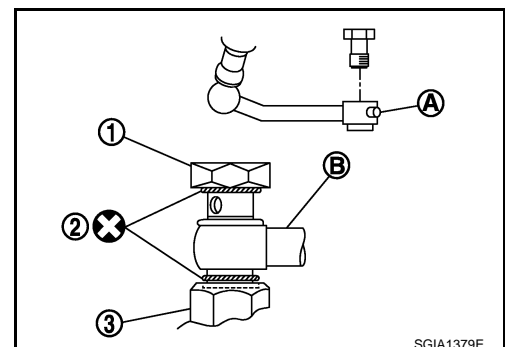
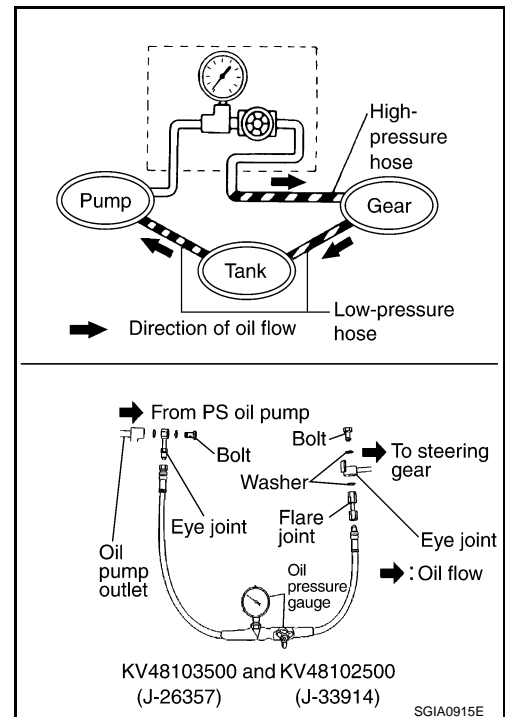
CAUTION:

Never keep valve fully closed for 10 seconds or longer.

4. Open the valve slowly after measuring. Repair oil pump if the relief oil pressure is outside the standard. Refer to [ST-27, "Disassembly and Assembly"](#).
5. Disconnect the oil pressure gauge from hydraulic circuit.
6. When installing eye bolt (1) and copper washer (2) to oil pump (3), refer to the figure.

CAUTION:

- Never reuse copper washers.
- Apply power steering fluid or equivalent to around copper washer, then install eye bolt.
- Install eye bolt with eye joint (assembled to high pressure hose) (B) protrusion (A) facing with pump side cutout, and then tighten it to the specified torque after tightening by hand. Refer to [ST-32, "Exploded View"](#).
- Securely insert harness connector to pressure sensor.



POWER STEERING OIL PUMP

< ON-VEHICLE REPAIR >

7. Check fluid level, fluid leakage and air bleeding hydraulic system after the installation. Refer to [ST-7, "Inspection"](#).

BEFORE DISASSEMBLY

Disassemble oil pump only when the following malfunctions occur.

- If oil leakage is found on oil pump.
- Oil pump pulley is damaged or deformed.
- Performance of oil pump is low.

AFTER DISASSEMBLY

Body Assembly and Rear Cover Inspection

Check body assembly and rear cover for internal damage. Replace rear cover if it is damaged. Replace oil pump assembly if body assembly is damaged.

Cartridge Assembly Inspection

Check cam ring, rotor and vane for damage. Replace cartridge assembly if necessary.

Side Plate Inspection

Check side plate for damage. Replace side plate if there are.

Flow Control Valve Inspection

Check flow control valve and spring for damage. Replace if necessary.

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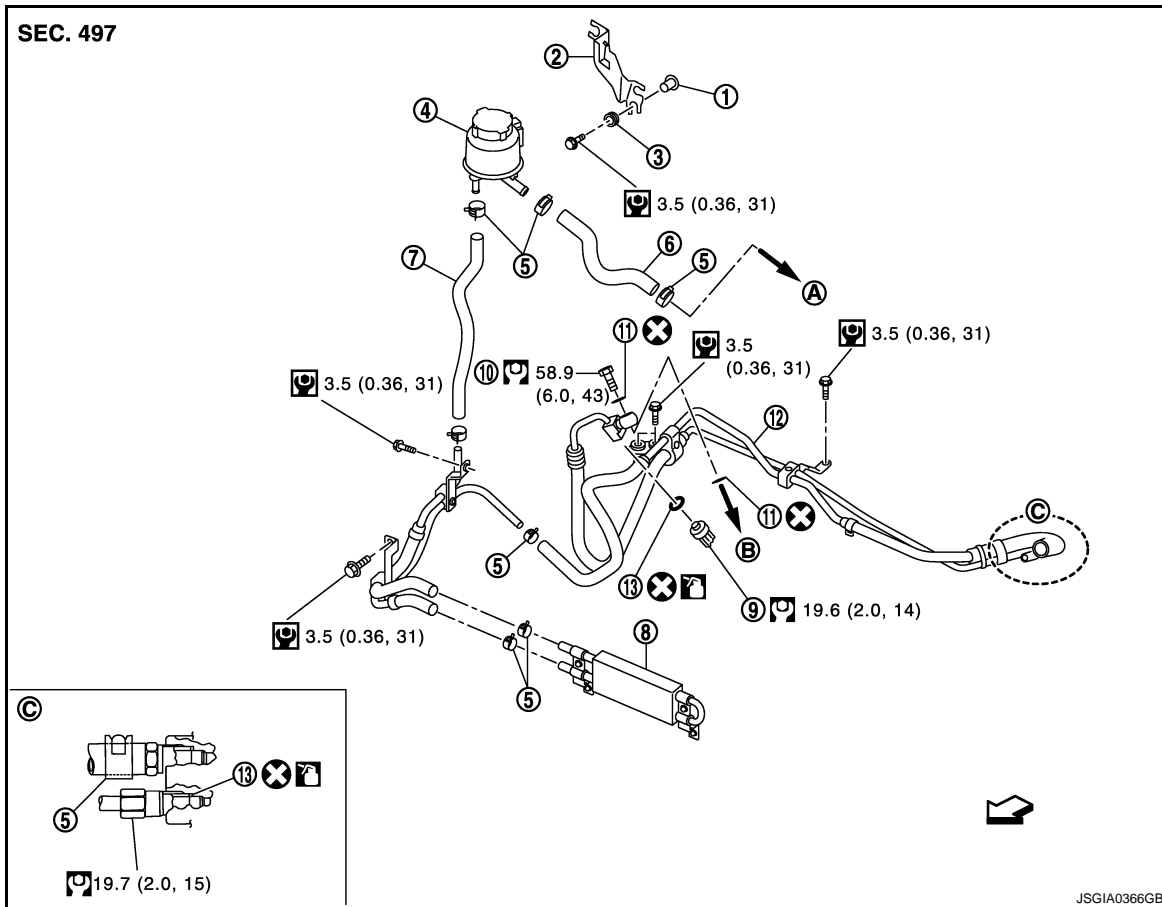
HYDRAULIC LINE

< ON-VEHICLE REPAIR >

HYDRAULIC LINE

Exploded View

INFOID:000000004470923



- | | | |
|---|--|--|
| 1. Collar | 2. Reservoir tank bracket | 3. Bushing |
| 4. Reservoir tank | 5. Clamp | 6. Suction hose |
| 7. Return hose | 8. Oil cooler | 9. Pressure sensor |
| 10. Eye bolt | 11. Copper washer | 12. High pressure piping and low pressure piping |
| 13. O-ring | | |
| A. To power steering oil pump suction piping. | B. To power steering oil pump. piping. | |

⇐: Vehicle front

☞: Apply power steering fluid.

Refer to [GI-4. "Components"](#) for symbols in the figure.

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

General Specifications

INFOID:0000000004470932

Steering gear model	PR26AF
Fluid capacity (Approx.) ℓ (US qt, Imp qt)	1.0 (1-1/8, 7/8)

Steering Wheel Axial End Play and Play

INFOID:0000000004470933

Unit: mm (in)

Item	Standard
Steering wheel axial end play	0 (0)
Steering wheel play on the outer circumference	0 – 35 (0 – 1.38)

Steering Wheel Turning Torque

INFOID:0000000004470934

Unit: N·m (kg-m, in-lb)

Item	Standard
Steering wheel turning force	7.45 (0.76, 66)

Steering Angle

INFOID:0000000004470935

Unit: Degree minute (Decimal degree)

Item		Standard	
		Wheel size: 18 inch	Wheel size: 19 inch
Inner wheel	Minimum	36°40' (36.67°)	34°10' (34.17°)
	Nominal	39°40' (39.67°)	37°10' (37.17°)
	Maximum	40°40' (40.66°)	38°10' (38.16°)
Outer wheel	Minimum	33°20' (30.34°)	31°50' (31.84°)

Steering Column Length

INFOID:0000000004494774

Unit: mm (in)

Item	Standard
Column length	491 – 495 (19.33 – 19.49)

Steering Column Mounting Dimensions

INFOID:0000000004470936

Unit: mm (in)

Item	Standard
Mounting dimension	30.0 – 32.0 (1.18 – 1.26)

Steering Column Operating Range

INFOID:0000000004470937

Item	Standard
Tilt operating range	65 mm (2.56 in)
Rotating torque	0.39 N·m (0.04 kg-m, 3 in-lb)

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

Lower Shaft

INFOID:0000000004470938

Unit: mm (in)

Item	Standard
Lower shaft length	508.8 (20.03) or less

Rack Sliding Force

INFOID:0000000004470939

Unit: N (kg, lb)

Item	Standard
Rack sliding force	217 – 275 (22.2 – 28.0, 48.8 – 61.8)

Rack Stroke

INFOID:0000000004470940

Unit: mm (in)

Item	Standard	
	Wheel size: 18 inch	Wheel size: 19 inch
Rack stroke neutral position	69.0 (2.72)	66.0 (2.60)

Socket Swing Force and Rotating Torque

INFOID:0000000004470941

SWING FORCE

Unit: N (kg, lb)

Item	Standard
Outer socket	4.81 – 45.7 (0.5 – 4.6, 1.1 – 10.2)
Inner socket	8.9 – 64 (0.91 – 6.5, 2.01 – 14.3)

ROTATING TORQUE

Unit: N·m (kg·m, in·lb)

Item	Standard
Outer socket	0.3 – 2.9 (0.03 – 0.29, 3 – 25)
Inner socket	1.0 – 7.8 (0.11 – 0.79, 9 – 69)

Socket Axial End Play

INFOID:0000000004470942

Unit: mm (in)

Item	Standard
Outer socket	0.5 (0.02) or less
Inner socket	0.2 (0.008) or less

Inner Socket Length

INFOID:0000000004470943

Unit: mm (in)

Item	Standard
Rack neutral position, dimension	63.3 (2.492)

Relief Oil Pressure

INFOID:0000000004470944

Unit: kPa (kg/cm², psi)

Item	Standard
Relief oil pressure	8,500 – 9,300 (86.7 – 94.9, 1,233 – 1,349)