

**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:000000003305890

#### 2WD MODELS

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	
			Reference	Reference
Steering	Noise	Fluid level	ST-10, "Inspection"	ST-10, "Inspection"
	Shake	Air in hydraulic system	ST-10, "Inspection"	ST-10, "Inspection"
	Vibration	Outer/inner socket ball joint swinging torque	ST-34, "Inspection"	ST-34, "Inspection"
	Shimmy	Outer/inner socket ball joint rotating torque	ST-34, "Inspection"	ST-34, "Inspection"
	Judder	Outer/inner socket ball joint end play	ST-34, "Inspection"	ST-10, "Inspection"
		Steering fluid leakage	ST-10, "Inspection"	ST-12, "Inspection"
		Steering wheel play	ST-12, "Inspection"	ST-12, "Inspection"
		Steering gear rack sliding force	EM-13, "Checking"	ST-12, "Inspection"
		Drive belt looseness	ST-12, "Inspection"	—
		Improper steering wheel	ST-24, "Exploded View"	ST-17, "WITHOUT ELECTRIC MOTOR : Inspection"
		Improper installation or looseness of tilt lock lever	ST-17, "WITHOUT ELECTRIC MOTOR : Inspection"	ST-16, "WITHOUT ELECTRIC MOTOR : Exploded View"
		Mounting looseness	ST-24, "Exploded View"	ST-24, "Exploded View"
		Steering column deformation or damage	NVH in DLN section.	NVH in DLN section.
		Improper installation or looseness of steering column	NVH in DLN section.	NVH in DLN section.
		Steering linkage looseness	NVH in FAX, RAX, FSU, RSU section.	NVH in WT section.
		PROPELLER SHAFT	NVH in WT section.	NVH in WT section.
		DIFFERENTIAL	NVH in FAX section.	NVH in FAX section.
		AXLE and SUSPENSION	NVH in BR section.	NVH in BR section.
		TIRE		
		ROAD WHEEL		
		DRIVE SHAFT		
		BRAKE		

x: Applicable

#### AWD MODELS (WITHOUT ELECTRIC MOTOR)

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

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# NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

< SYMPTOM DIAGNOSIS >

Symptom	Steering	Possible cause and SUSPECTED PARTS		Reference
		Fluid level	Air in hydraulic system	
	Noise	×	×	ST-10. "Inspection"
	Shake	×	×	ST-10. "Inspection"
	Vibration	×	×	ST-34. "Inspection"
	Shimmy	×	×	ST-34. "Inspection"
	Judder	×	×	ST-34. "Inspection"
		×	×	ST-10. "Inspection"
		×	×	ST-12. "Inspection"
		×	×	ST-12. "Inspection"
		×	×	EM-13. "Checking"
		×	×	ST-12. "Inspection"
				—
				ST-24. "Exploded View"
		×	×	ST-17. "WITHOUT ELECTRIC MOTOR : Inspection"
		×	×	ST-16. "WITHOUT ELECTRIC MOTOR : Exploded View"
		×	×	ST-24. "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, RAX section.
		×	×	NVH in BR section.

×: Applicable

## AWD MODELS (WITH ELECTRIC MOTOR)

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

# NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

< SYMPTOM DIAGNOSIS >

Symptom	Steering	Possible cause and SUSPECTED PARTS														Reference																	
		Noise	Shake	Vibration	Shimmy	Judder	Fluid level	Air in hydraulic system	Outer/inner socket ball joint swinging torque	Outer/inner socket ball joint rotating torque	Outer/inner socket ball joint end play	Steering fluid leakage	Steering wheel play	Steering gear rack sliding force	Drive belt looseness		Improper steering wheel	Improper installation or looseness of tilt lock lever	Mounting looseness	Steering column deformation or damage	Improper installation or looseness of steering column	Steering linkage looseness	PROPELLER SHAFT	DIFFERENTIAL	AXLE and SUSPENSION	TIRE	ROAD WHEEL	DRIVE SHAFT	BRAKE				
		x					x																										ST-10. "Inspection"
		x																														ST-10. "Inspection"	
		x																														ST-34. "Inspection"	
		x																														ST-34. "Inspection"	
		x																														ST-34. "Inspection"	
		x																														ST-10. "Inspection"	
		x																														ST-12. "Inspection"	
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			x																													ST-24. "Exploded View"	
		x																														ST-20. "WITH ELECTRIC MOTOR : Inspection"	
		x																														ST-19. "WITH ELECTRIC MOTOR : Exploded View"	
							x																									ST-24. "Exploded View"	
		x																														NVH in DLN section.	
		x																														NVH in DLN section.	
		x																														NVH in FAX, RAX, FSU, RSU section.	
		x																														NVH in WT section.	
		x																														NVH in WT section.	
		x																														NVH in FAX, RAX section.	
		x																														NVH in BR section.	

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# PRECAUTIONS

< PRECAUTION >

## PRECAUTION

### PRECAUTIONS

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

INFOID:000000003464623

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:000000003305892

#### **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. Carry the Intelligent Key or insert it to the key slot and 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:000000003305893

- 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.

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# PREPARATION

< PREPARATION >

## PREPARATION

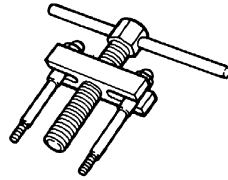
### PREPARATION

#### Special Service Tools

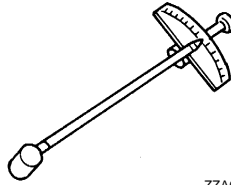
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The actual shapes of Kent-Moore tools may differ from those of special service tools illustrated here.

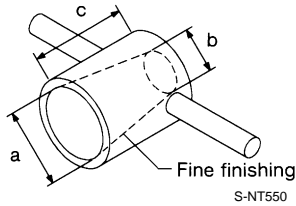
Tool number (Kent-Moore No.) Tool name	Description
ST27180001 (J-25726-A) Steering wheel puller	Removing steering wheel
ST3127S000 (J-25765-A) Preload gauge	Inspecting sliding torque, steering torque, and rotating torque for ball joint
KV48104400 ( — ) Teflon ring correcting tool a: 50 mm (1.97 in) dia. b: 36 mm (1.42 in) dia. c: 100 mm (3.94 in)	Installing rack Teflon ring
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



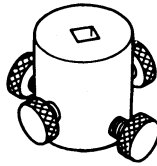
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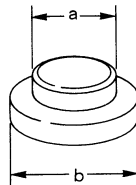
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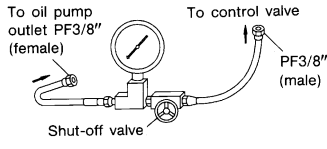
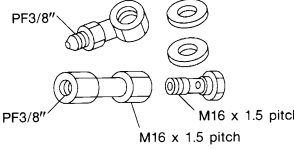


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# PREPARATION

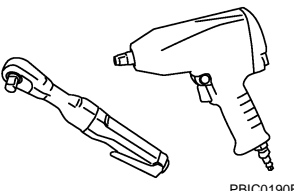
## < PREPARATION >

Tool number (Kent-Moore No.) Tool name	Description	
KV48103500 (J-26357) Oil pressure gauge	 <p style="text-align: center;">S-NT547</p>	A B C
KV48102500 (J-33914) Oil pressure gauge adapter	 <p style="text-align: center;">S-NT542</p>	D E F

## Commercial Service Tool

INFOID:000000003305895

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Tool number Tool name	Description	
Power tool	 <p style="text-align: center;">PBIC0190E</p>	H I J K L M N O P

# POWER STEERING FLUID

< ON-VEHICLE MAINTENANCE >

## ON-VEHICLE MAINTENANCE

### POWER STEERING FLUID

#### Inspection

INFOID:000000003305896

#### FLUID LEVEL

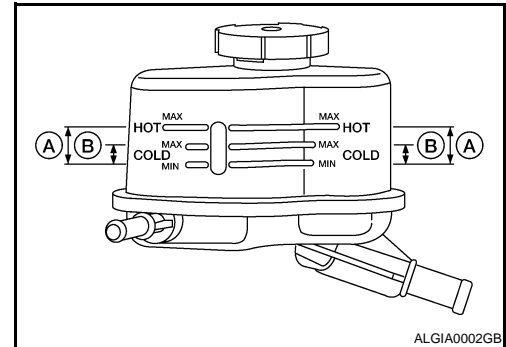
1. Check fluid level with engine stopped.
2. Ensure that fluid level is between MIN and MAX.
3. Fluid levels at HOT and COLD are different. Do not confuse them.

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

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

**Recommended fluid** : Refer to [MA-15, "FOR NORTH AMERICA : Fluids and Lubricants"](#).

**Fluid capacity** : Refer to [ST-44, "General Specifications"](#).



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#### 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

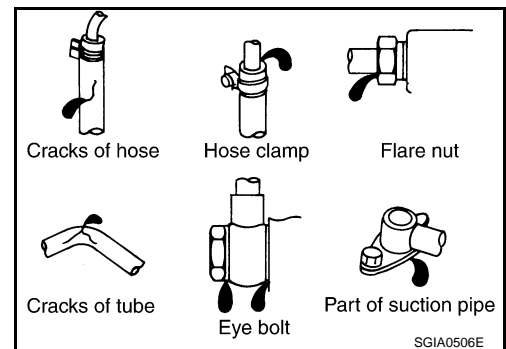
Check hydraulic connections for fluid leakage, cracks, damage, looseness, or wear.

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.



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#### 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.

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.**

## POWER STEERING FLUID

### < ON-VEHICLE MAINTENANCE >

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2. Start the engine and hold steering wheel at each lock position for 3 second at idle to check for fluid leakage. A
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.)** B
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. C
6. Stop the engine, and then check fluid level. D

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# STEERING WHEEL

< ON-VEHICLE MAINTENANCE >

## STEERING WHEEL

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### Inspection

INFOID:000000003305897

#### 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-44, "Steering Wheel Axial End Play and Play"](#).

3. Check the following items when steering wheel axial end play is out of the standard.
  - Check the steering column assembly mounting condition. Refer to [ST-16, "WITHOUT ELECTRIC MOTOR : Exploded View"](#) (Without electric motor), [ST-19, "WITH ELECTRIC MOTOR : Exploded View"](#) (with electric motor).
  - Check steering gear assembly mounting condition for looseness. Refer to [ST-24, "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-44, "Steering Wheel Axial End Play and Play"](#).

4. Check the following items when 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-9, "Inspection"](#).
3. Set the vehicle to the straight-ahead position and confirm 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 FORCE

1. Park the vehicle on a level and dry surface, set parking brake.
2. Tires need to be inflated normal pressure. Refer to [WT-111, "Tire Air Pressure"](#).
3. Start the engine.
4. Bring power steering fluid up to adequate operating temperature.

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

# STEERING WHEEL

## < ON-VEHICLE MAINTENANCE >

5. Check steering wheel turning force when steering wheel has been turned 540° from neutral position.

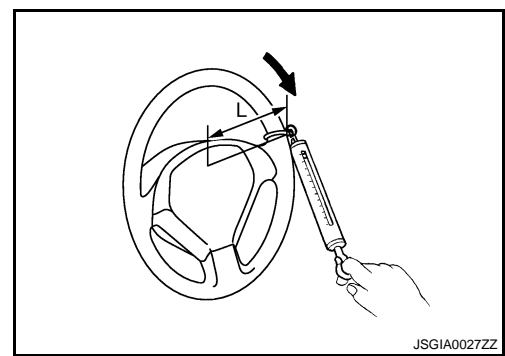
### Standard

**Steering wheel turning force** : Refer to [ST-44, "Steering Wheel Turning Force"](#).

### NOTE:

Multiply the distance (L) from the hook of spring balance to the center of steering wheel by the measurement value with a spring balance.

6. 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-40, "Inspection"](#).



## RACK SLIDING FORCE

1. Disconnect lower joint and steering knuckle from steering gear assembly. Refer to [ST-22, "Exploded View"](#).
2. Start and run the engine at idle to make sure steering fluid has reached normal operating temperature.

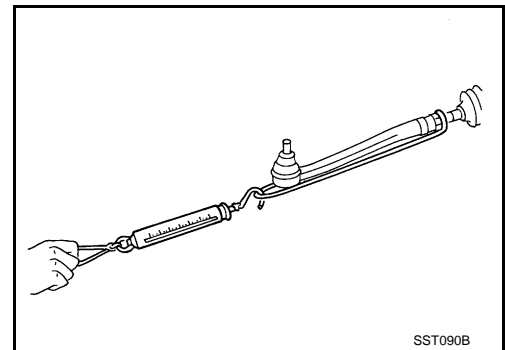
**Fluid temperature** : 50 – 80°C (122 – 176°F)

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

### Standard

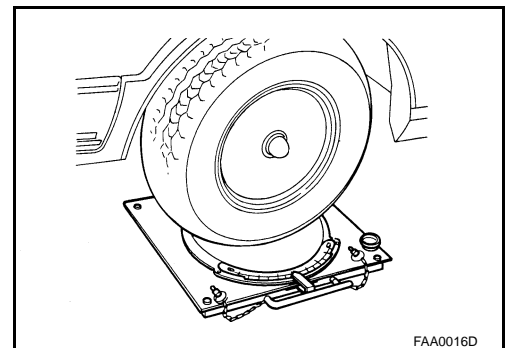
**Rack sliding force** : Refer to [ST-45, "Rack Sliding Force"](#).

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-9, "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.

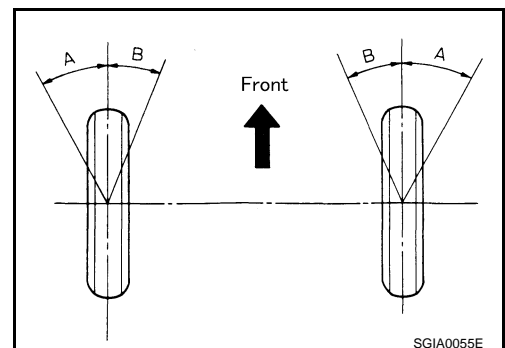


4. With the engine at idle, turn steering wheel from full left stop to full right stop and measure the turning angles.

### Standard

**Inner wheel (Angle: A)** : Refer to [ST-44, "Steering Angle"](#).

**Outer wheel (Angle: B)** : Refer to [ST-44, "Steering Angle"](#).



# STEERING WHEEL

## < ON-VEHICLE MAINTENANCE >

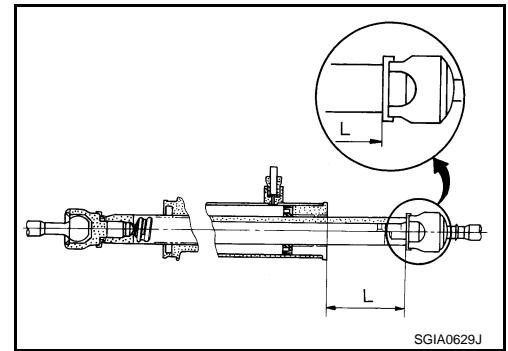
5. Check the following items when turning angle is out of the standard.
  - a. Check the neutral position of the rack stroke (L).

**Standard**

**L**

**: Refer to [ST-45. "Rack Stroke"](#).**

- b. Disassemble steering gear assembly to check the cause that rack stroke is outside of the standard.
  - 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 any of them, if any non-standard condition exists.



# STEERING WHEEL

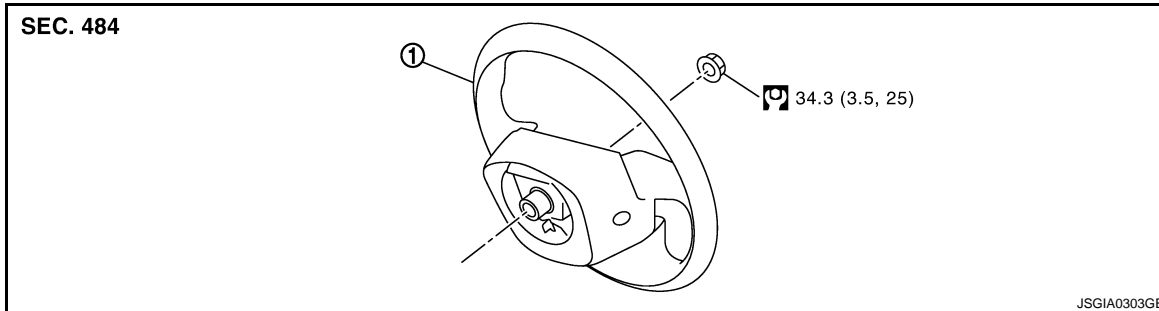
< ON-VEHICLE REPAIR >

## ON-VEHICLE REPAIR

### STEERING WHEEL

#### Exploded View

INFOID:000000003305898



1. Steering wheel

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

#### Removal and Installation

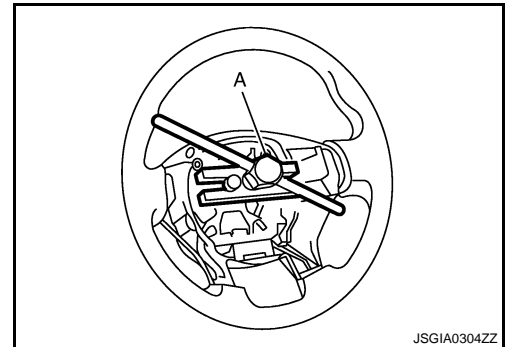
INFOID:000000003305899

##### REMOVAL

###### NOTE:

When reconnecting spiral cable, fix cable with a tape so that fixing case and rotating part keep aligned. This will omit 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"](#).

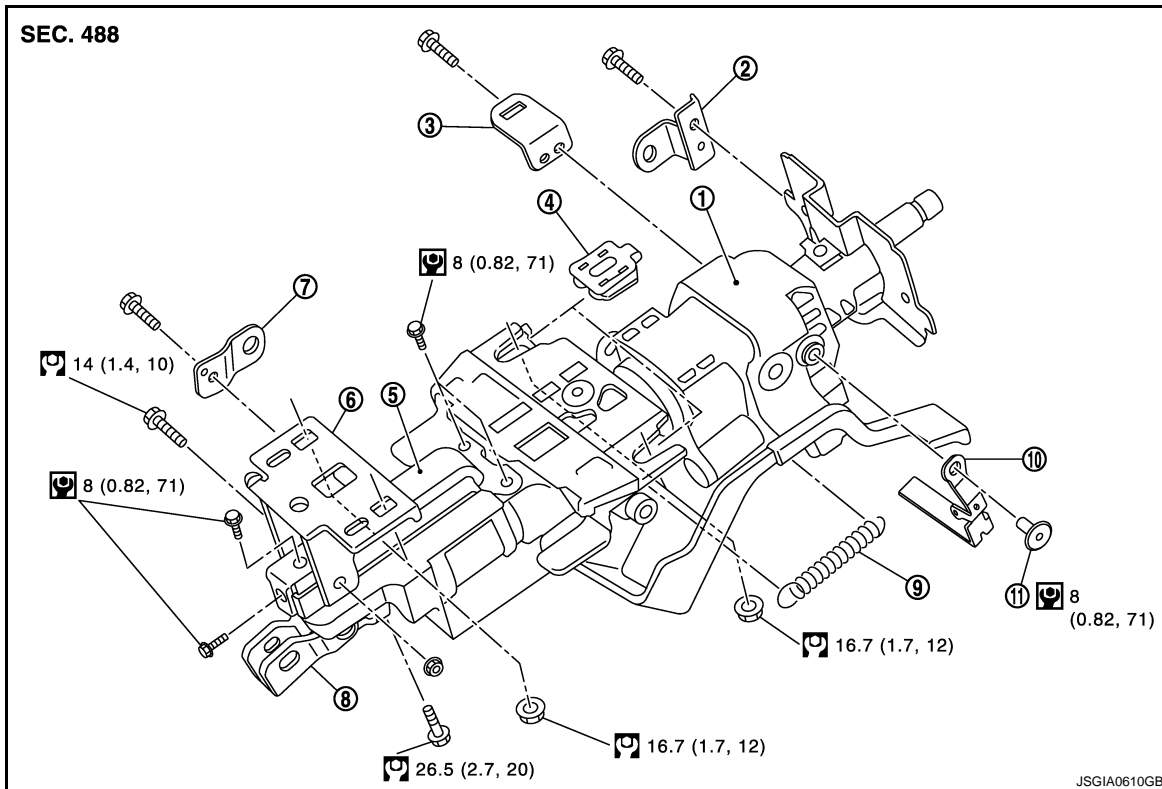
# STEERING COLUMN

< ON-VEHICLE REPAIR >

## STEERING COLUMN WITHOUT ELECTRIC MOTOR

### WITHOUT ELECTRIC MOTOR : Exploded View

INFOID:000000003305900



- |                             |                  |                        |
|-----------------------------|------------------|------------------------|
| 1. Steering column assembly | 2. Bracket       | 3. Bracket             |
| 4. Slide plate              | 5. Slide bracket | 6. Lower mount bracket |
| 7. Bracket                  | 8. Upper joint   | 9. Spring              |
| 10. Tilt lever              | 11. Clip         |                        |

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

### WITHOUT ELECTRIC MOTOR : Removal and Installation

INFOID:000000003305901

#### REMOVAL

1. Set the vehicle to the straight-ahead position.
2. Place the tilt to the highest level. Place the telescopic to the longest level.
3. Remove driver air bag module. Refer to [SR-5, "Exploded View"](#).
4. Remove steering wheel. Refer to [ST-15, "Exploded View"](#).
5. Remove instrument driver lower panel. Refer to [IP-11, "Exploded View"](#).
6. Remove steering column cover. Refer to [IP-11, "Exploded View"](#).
7. Remove spiral cable. Refer to [SR-5, "Exploded View"](#).
8. Remove cluster lid A. Refer to [MWI-145, "Exploded View"](#).



# STEERING COLUMN

## < ON-VEHICLE REPAIR >

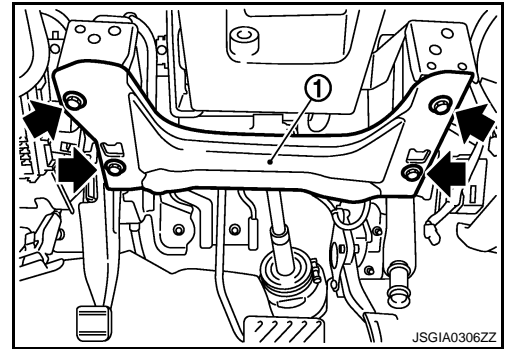
9. Remove knee protector (1).

← : Bolt

10. Disconnect each switch harness connectors installed to steering column assembly.
11. Remove the joint mounting bolt and nut (lower shaft side), and separate the joint from lower shaft.
12. 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.



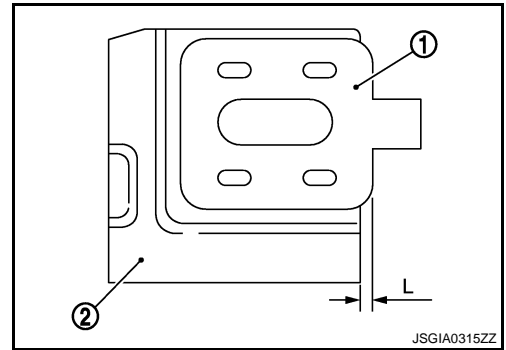
## INSTALLATION

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

- Install the slide plate (1) and steering column housing (2) so that the mounting dimensions (L) is within the specified range as described below.

**Standard**

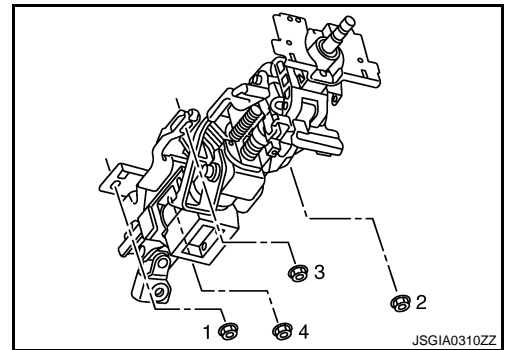
**L : 2.0 mm (0.079 in) or less**



- Tighten the mounting bolts in the order shown in the figure 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-9. "ADJUSTMENT OF STEERING ANGLE SENSOR NEUTRAL POSITION : Special Repair Requirement"](#).



## WITHOUT ELECTRIC MOTOR : Inspection

INFOID:000000003305902

## 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-44. "Steering Column Operating Range"](#).**

## STEERING COLUMN

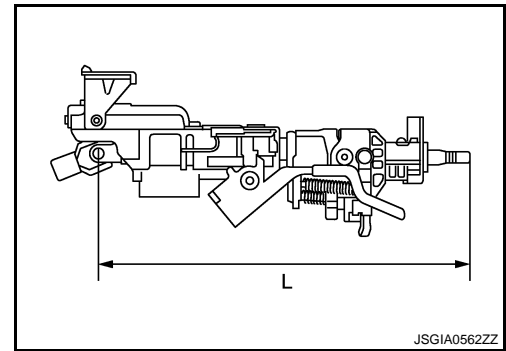
### < ON-VEHICLE REPAIR >

- 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-44, "Steering Column Length"](#).

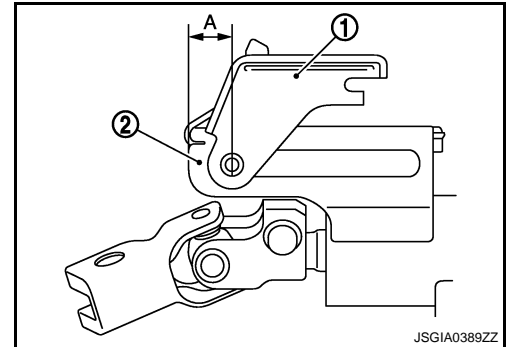


- Install the bracket (1) and steering column housing (2) so that the clearance (A) is within the specified range as described below. Replace steering column assembly if out side the standard.

#### Standard

A

: Refer to [ST-44, "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-12, "Inspection"](#).
- Check tilt and telescopic mechanism operating range tilt operating range (L), telescopic operating range (T) as shown in the figure.

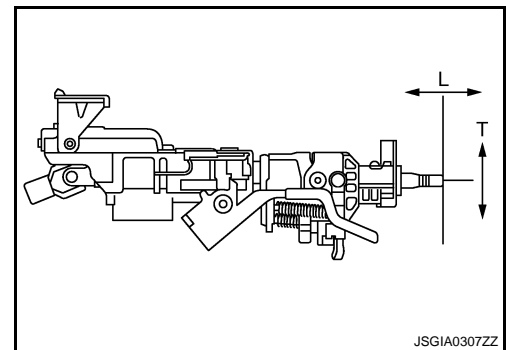
#### Standard

T

: Refer to [ST-44, "Steering Column Operating Range"](#).

L

: Refer to [ST-44, "Steering Column Operating Range"](#).



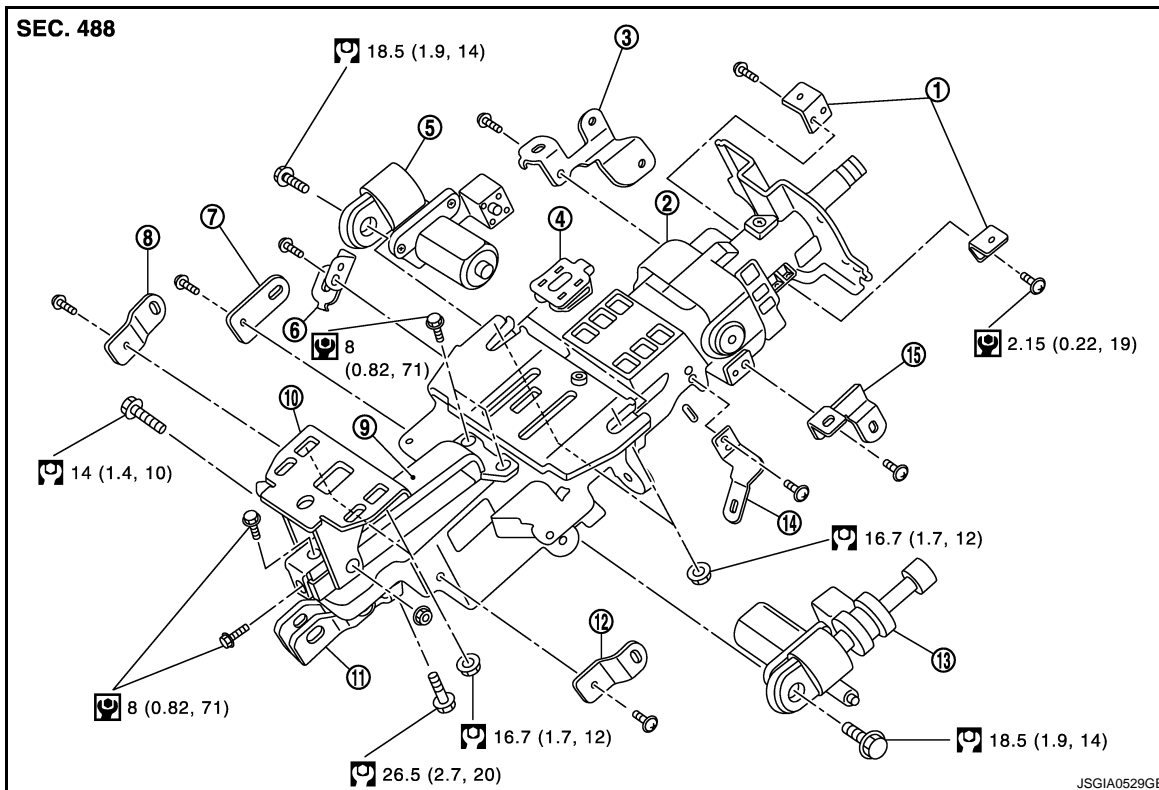
### WITH ELECTRIC MOTOR

# STEERING COLUMN

< ON-VEHICLE REPAIR >

## WITH ELECTRIC MOTOR : Exploded View

INFOID:000000003305903



- |                         |                             |                  |
|-------------------------|-----------------------------|------------------|
| 1. Bracket              | 2. Steering column assembly | 3. Bracket       |
| 4. Clip                 | 5. Tilt motor               | 6. Bracket       |
| 7. Bracket              | 8. Bracket                  | 9. Slide bracket |
| 10. Lower mount bracket | 11. Upper joint             | 12. Bracket      |
| 13. Telescopic motor    | 14. Bracket                 | 15. Bracket      |

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

## WITH ELECTRIC MOTOR : Removal and Installation

INFOID:000000003349525

### REMOVAL

1. Set the vehicle to the straight-ahead position.
2. Place the tilt to the highest level. Place the telescopic to the longest level.
3. Remove driver air bag module. Refer to [SR-5, "Exploded View"](#).
4. Remove steering wheel. Refer to [ST-15, "Exploded View"](#).
5. Remove instrument driver lower panel. Refer to [IP-11, "Exploded View"](#).
6. Remove steering column cover. Refer to [IP-11, "Exploded View"](#).
7. Remove spiral cable. Refer to [SR-8, "Exploded View"](#).
8. Remove cluster lid A. Refer to [MWI-145, "Exploded View"](#).

# STEERING COLUMN

## < ON-VEHICLE REPAIR >

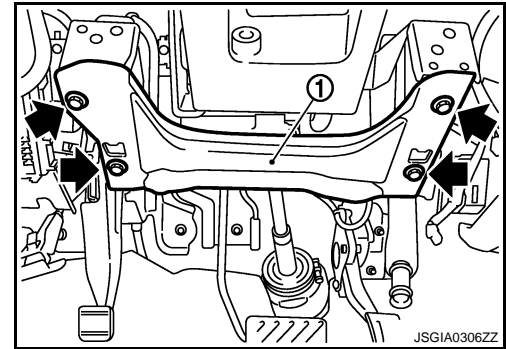
9. Remove knee protector (1).

← : Bolt

10. Disconnect each switch harness connectors installed to steering column assembly.
11. Remove the joint mounting bolt and nut (lower shaft side), and separate the joint from lower shaft.
12. 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.



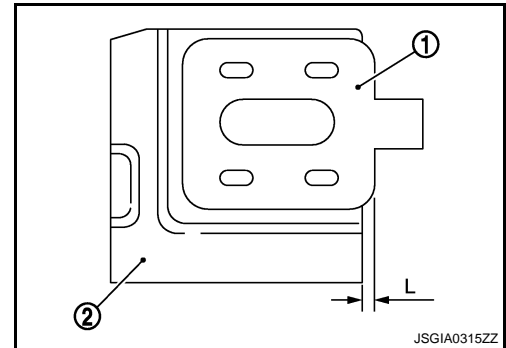
## INSTALLATION

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

- Install the slide plate (1) and steering column housing (2) so that the mounting dimensions (L) is within the specified range as described below.

**Standard**

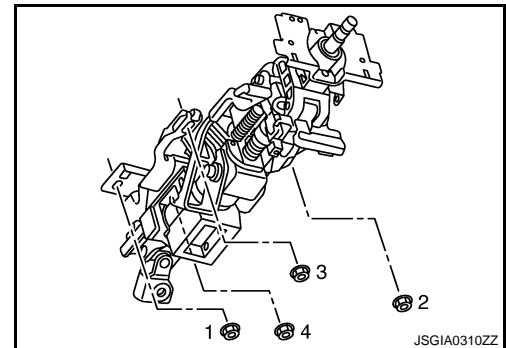
**L : 2.0 mm (0.079 in) or less**



- Tighten the mounting bolts in the order shown in the figure 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-9. "ADJUSTMENT OF STEERING ANGLE SENSOR NEUTRAL POSITION : Special Repair Requirement"](#).



## WITH ELECTRIC MOTOR : Inspection

INFOID:000000003305905

## 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-44. "Steering Column Operating Range"](#).**

# STEERING COLUMN

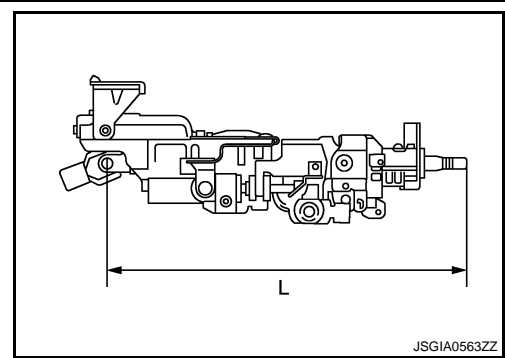
## < ON-VEHICLE REPAIR >

- 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-44, "Steering Column Length"](#).

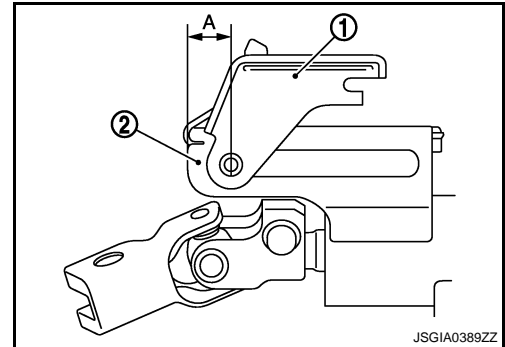


- Install the bracket (1) and steering column housing (2) so that the clearance (A) is within the specified range as described below. Replace steering column assembly if out side the standard.

### Standard

A

: Refer to [ST-44, "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-12, "Inspection"](#).
- Check tilt and telescopic mechanism operating range tilt operating range (L), telescopic operating range (T) as shown in the figure.

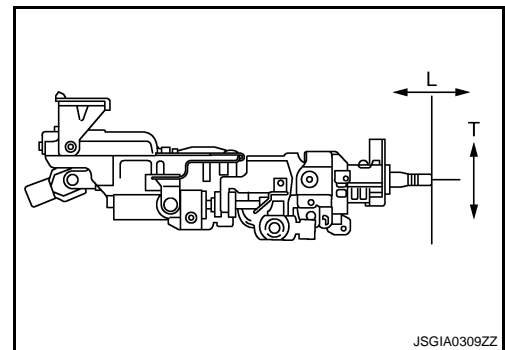
### Standard

T

: Refer to [ST-44, "Steering Column Operating Range"](#).

L

: Refer to [ST-44, "Steering Column Operating Range"](#).



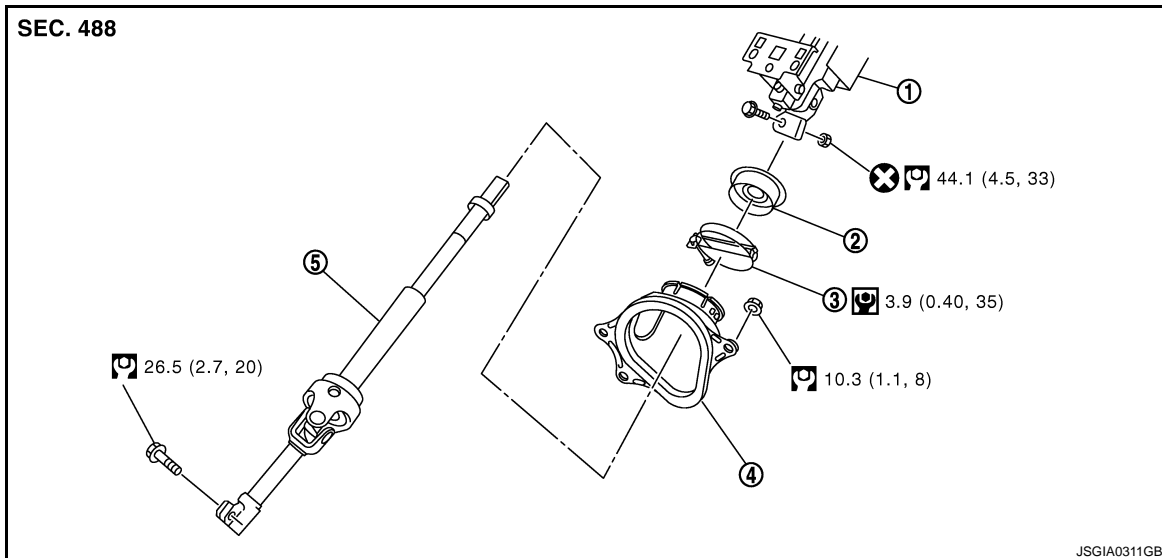
# LOWER SHAFT

< ON-VEHICLE REPAIR >

## LOWER SHAFT

### Exploded View

INFOID:000000003305906



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

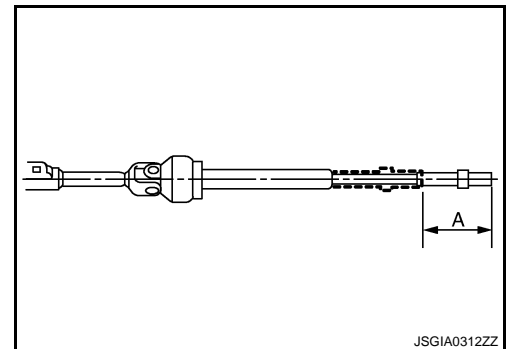
Refer to [GI-4, "Components"](#) for symbols in the figure.

## Removal and Installation

INFOID:000000003305907

### REMOVAL

1. Set the vehicle to the straight-ahead position.
2. Fix the steering wheel.
3. Remove upper joint fixing bolt and nut (lower shaft 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 column assembly. Be sure to secure steering wheel using string to avoid turning.**
5. Remove the accelerator pedal bracket and lever assembly. Refer to [ACC-3, "Exploded View"](#).
6. Remove the side brake pedal bracket and wire clamp stay.
7. Remove the hole cover mounting nuts.
8. Remove the hole cover seal, clamp and hole cover.
9. Remove lower shaft joint fixing bolt (steering gear side).
10. Remove the lower shaft.



### INSTALLATION

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

#### **CAUTION:**

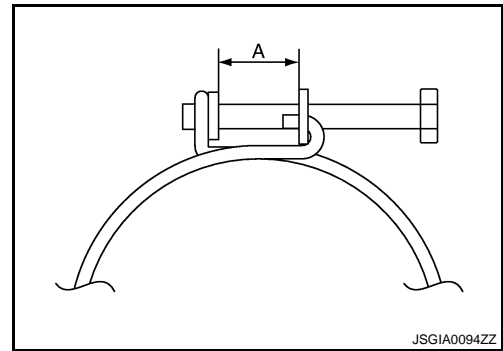
**Spiral cable may be cut if steering wheel turns while separating steering column assembly and steering gear assembly. Be sure to secure steering wheel using string to avoid turning.**

# LOWER SHAFT

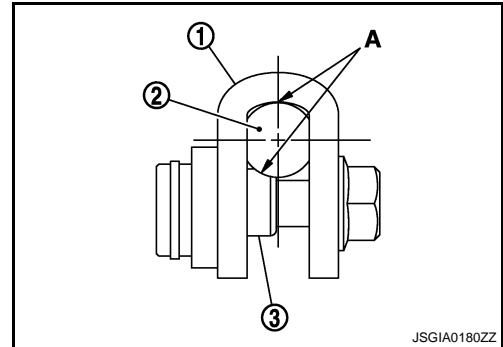
## < ON-VEHICLE REPAIR >

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

**Clamp length "A" : 14.0 – 18.0 mm (0.551 – 0.709 in)**



- After lower shaft (steering gear side) fitted, make sure there is not gap (A) between the yoke (1), lower shaft (2), joint fixing bolt (3).



- 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).

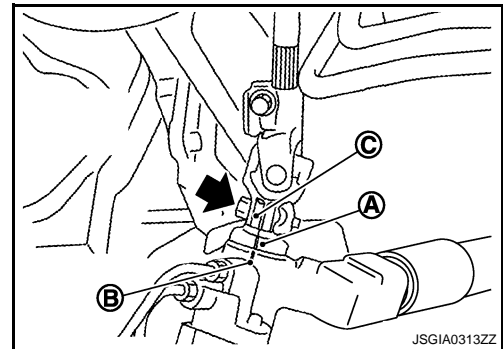
← : Bolt

- 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).

- Adjust neutral position of steering angle sensor. Refer to [BRC-9, "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-12, "Inspection"](#).



## Inspection

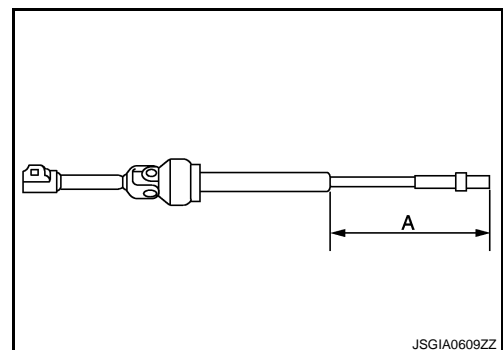
INFOID:000000003305908

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

**Standard**

**A : Refer to [ST-45, "Lower Shaft Length"](#).**

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



# STEERING GEAR AND LINKAGE

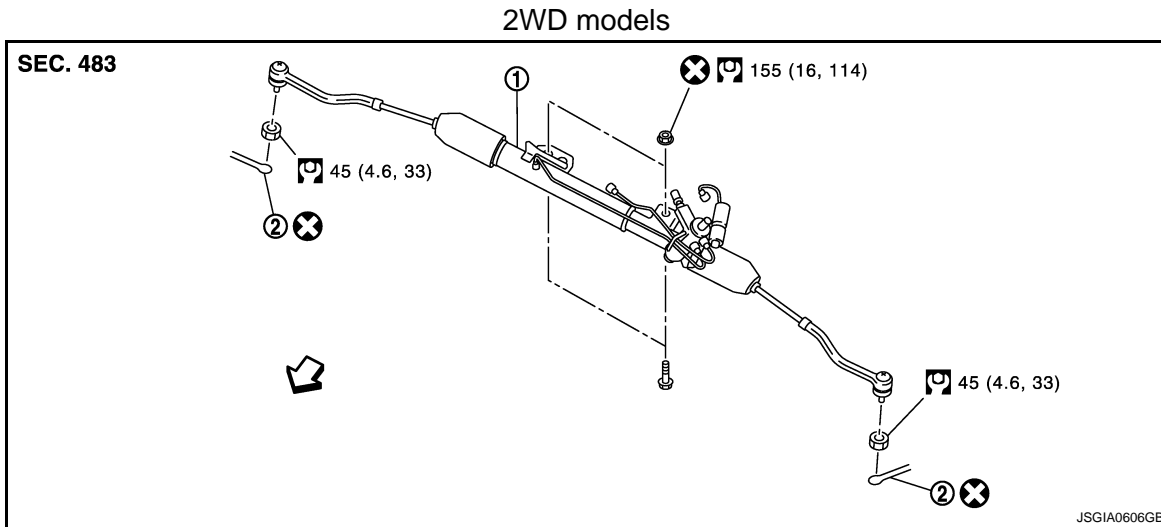
< ON-VEHICLE REPAIR >

## STEERING GEAR AND LINKAGE

Exploded View

INFOID:000000003305917

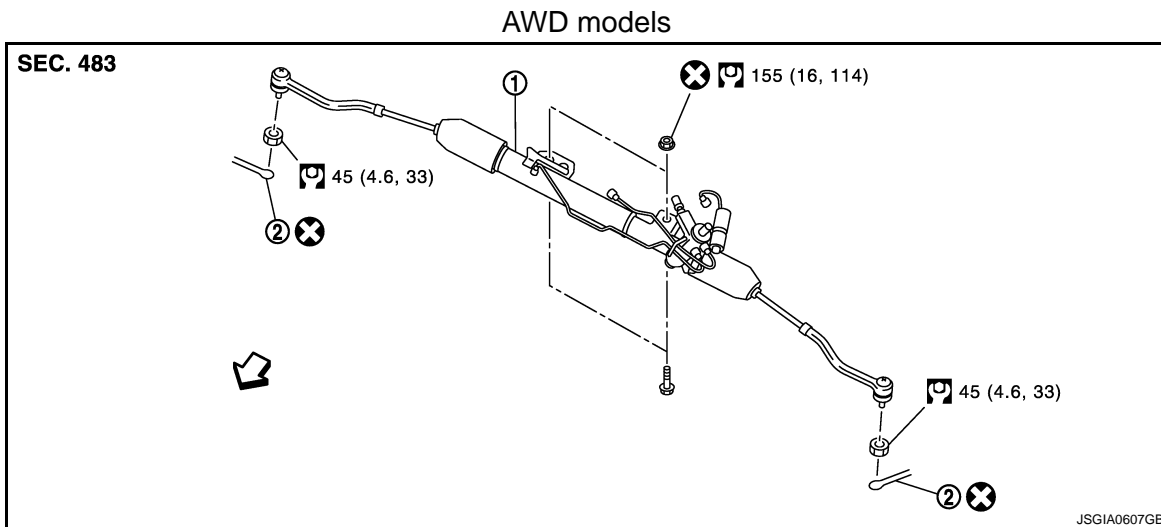
### REMOVAL



1. Steering gear assembly
2. Cotter pin

↔: Vehicle front

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



1. Steering gear assembly
2. Cotter pin

↔: Vehicle front

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

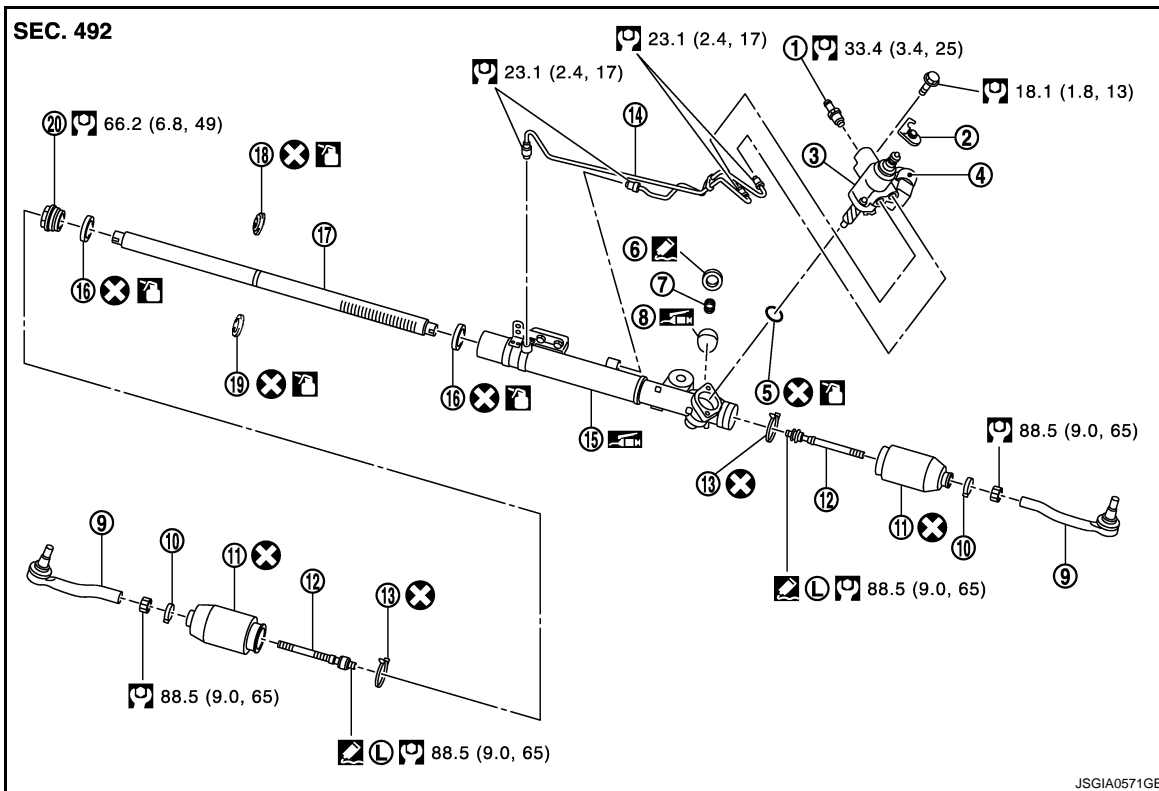
### DISASSEMBLY



# STEERING GEAR AND LINKAGE

< ON-VEHICLE REPAIR >

2WD models



- |                                  |                        |                           |
|----------------------------------|------------------------|---------------------------|
| 1. Low pressure piping           | 2. Rear cover cap      | 3. Gear-sub assembly      |
| 4. Power steering solenoid valve | 5. O-ring              | 6. Adjusting screw        |
| 7. Spring                        | 8. Retainer            | 9. Outer socket           |
| 10. Boot clamp                   | 11. Boot               | 12. Inner socket          |
| 13. Boot clamp (stainless wire)  | 14. Cylinder tube      | 15. Gear housing assembly |
| 16. Rack oil seal                | 17. Rack assembly      | 18. Rack Teflon ring      |
| 19. O-ring                       | 20. End cover assembly |                           |

: Apply power steering fluid.

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

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

: Apply multi-purpose grease.

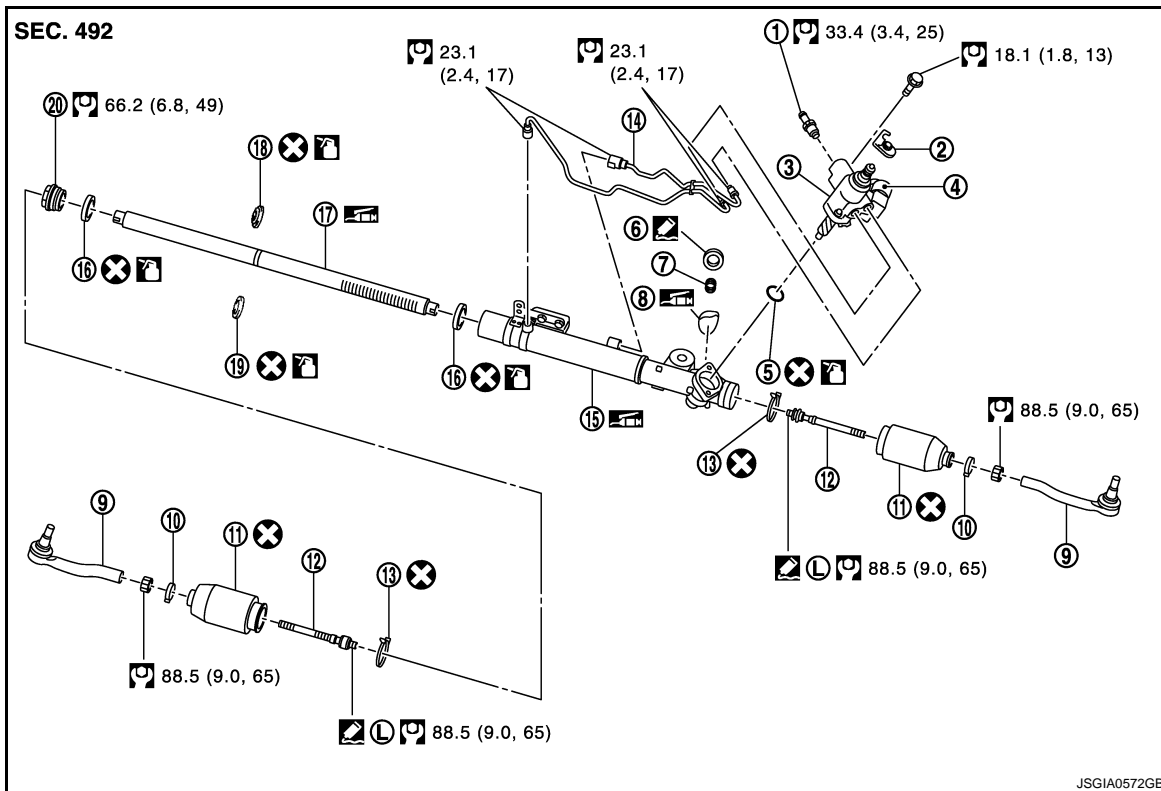
Refer to [GI-4, "Components"](#) for symbols not described on the above.

A  
B  
C  
D  
E  
F  
ST  
H  
I  
J  
K  
L  
M  
N  
O  
P

# STEERING GEAR AND LINKAGE

< ON-VEHICLE REPAIR >

AWD models



- |                                  |                        |                           |
|----------------------------------|------------------------|---------------------------|
| 1. Low pressure piping           | 2. Rear cover cap      | 3. Gear-sub assembly      |
| 4. Power steering solenoid valve | 5. O-ring              | 6. Adjusting screw        |
| 7. Spring                        | 8. Retainer            | 9. Outer socket           |
| 10. Boot clamp                   | 11. Boot               | 12. Inner socket          |
| 13. Boot clamp (stainless wire)  | 14. Cylinder tube      | 15. Gear housing assembly |
| 16. Rack oil seal                | 17. Rack assembly      | 18. Rack Teflon ring      |
| 19. O-ring                       | 20. End cover assembly |                           |

: Apply power steering fluid.

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

: Apply Genuine High Performance Thread 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:000000003305918

### REMOVAL

1. Set the vehicle to the straight-ahead position.
2. Remove front road wheel and tires.
3. Remove splash guards (RH and LH). Refer to [EXT-23, "FENDER PROTECTOR : Exploded View"](#).
4. Remove engine under cover. Refer to [EXT-26, "Exploded View"](#).
5. Remove exhaust front tube. Refer to [EX-5, "Exploded View"](#).
6. Separate the rear propeller shaft (front side). Refer to [DLN-80, "Exploded View"](#) (AWD models).
7. Remove heat insulator from front floor.

# STEERING GEAR AND LINKAGE

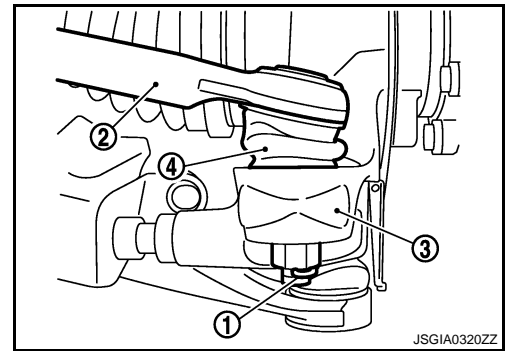
## < ON-VEHICLE REPAIR >

8. Remove cotter pin (1), and then loosen the nuts.
9. Remove steering outer socket (2) from steering knuckle (3) so as not to damage ball joint boot (4) using suitable ball joint remover.

**CAUTION:**

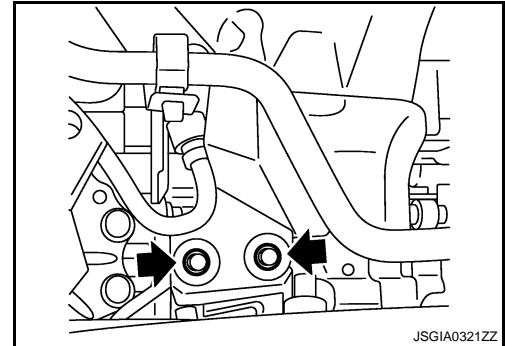
**Temporarily tighten the nut to prevent damage to threads and to prevent the ball joint remover from suddenly coming off.**

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

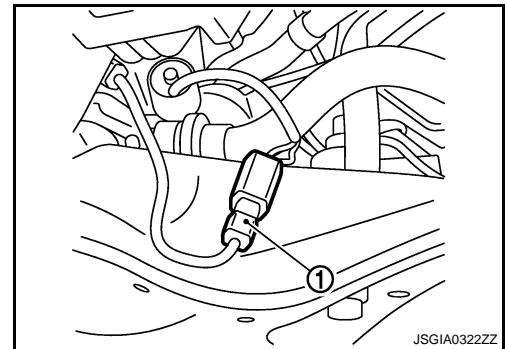


11. Remove steering hydraulic piping bracket from front steering gear assembly.

← : Bolt



12. Remove power steering solenoid valve harness connector (1) and harness clip.
13. Remove lower joint fixing bolt (steering gear side).



14. Separate the lower shaft from the steering gear assembly by sliding the slide shaft.

**CAUTION:**

**Spiral cable may be cut if steering wheel turns while separating steering column assembly and steering gear assembly. Be sure to secure steering wheel using string to avoid turning.**

15. Remove the stabilizer assembly. Refer to [FSU-15, "Exploded View"](#).
16. Support front suspension member with a suitable jack.
17. Remove engine mounting insulator (rear) mounting bolt (lower side). Refer to [EM-68, "2WD : Exploded View"](#) (2WD models), [EM-77, "AWD : Exploded View"](#) (AWD models).
18. Remove engine mounting insulator (LH). Refer to [EM-68, "2WD : Exploded View"](#) (2WD models), [EM-77, "AWD : Exploded View"](#) (AWD models).
19. Remove the mounting bolts and nuts of steering gear assembly.
20. Remove member stay, front suspension member fixing bolts and nuts. Refer to [FSU-17, "Exploded View"](#).
21. Lower the suitable jack for the front suspension member to the steering gear assembly can be removed.

## 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. Be sure to secure steering wheel using string to avoid turning.**

A  
B  
C  
D  
E  
F  
ST  
H  
I  
J  
K  
L  
M  
N  
O  
P

# STEERING GEAR AND LINKAGE

## < ON-VEHICLE REPAIR >

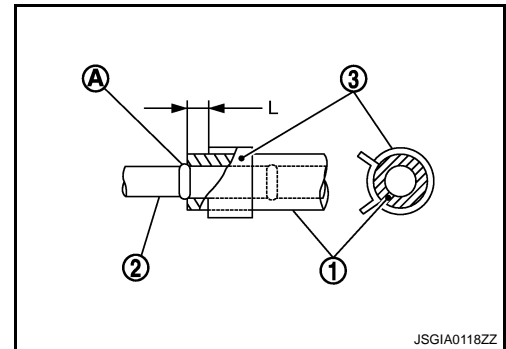
- When installing low pressure hose (1), refer to the figure.

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

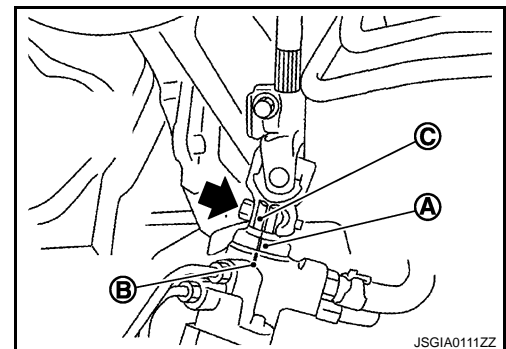
### NOTE:

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).



- After installation, bleed air from the steering hydraulic system. Refer to [ST-10. "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-9. "Inspection"](#).
- Adjust neutral position of steering angle sensor after checking wheel alignment. Refer to [BRC-9. "ADJUSTMENT OF STEERING ANGLE SENSOR NEUTRAL POSITION : Special Repair Requirement"](#).

## Disassembly and Assembly

INFOID:000000003305919

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

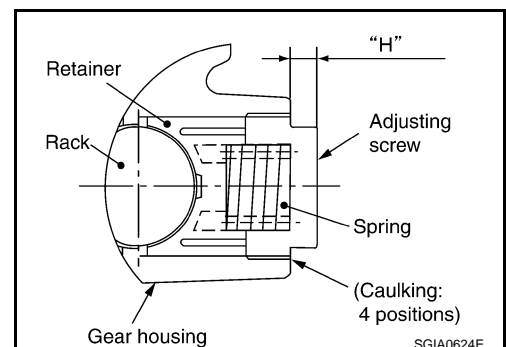
### CAUTION:

- **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:

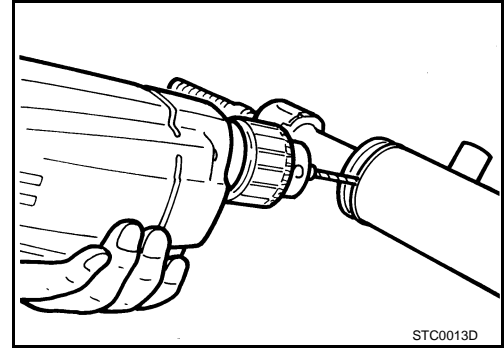
**Never damage inner socket and gear housing assembly when removing boot. Inner socket and gear housing assembly must be replaced if inner socket and gear housing assembly are damaged because it may cause foreign material interfusion.**



# STEERING GEAR AND LINKAGE

## < ON-VEHICLE REPAIR >

- Remove inner socket from gear housing assembly.
- Drill out the clinching part of gear housing assembly (end cover assembly side) outer rim with a 3 mm (0.12 in) drill bit. [Drill for approximately 1.5 mm (0.059 in) depth.]



- Remove end cover assembly with a 36 mm (1.42 in) open head (suitable tool).

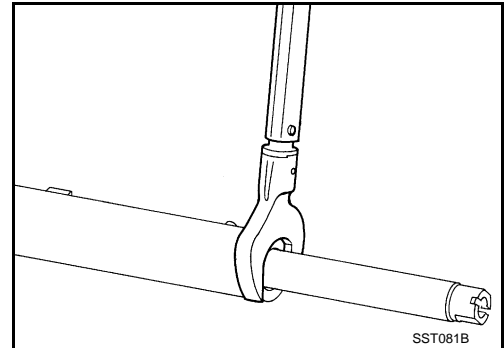
**CAUTION:**

**Never damage rack assembly surface when removing. Rack assembly must be replaced if damaged because it may cause fluid leakage.**

- Pull rack assembly together with rack oil seal (outer side) out from gear housing assembly.

**CAUTION:**

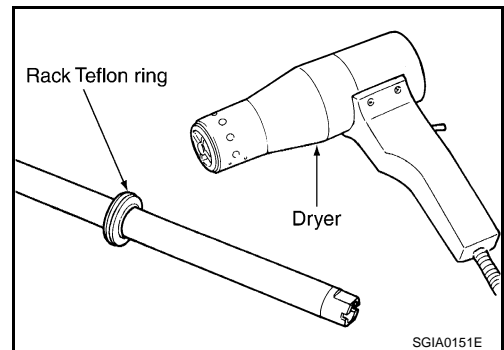
**Never damage cylinder inner wall when remove rack assembly. Gear housing assembly must be replaced if damaged because it may cause fluid leakage.**



- Heat rack Teflon ring to approximately 40°C (104°F) with a dryer, and remove rack Teflon ring and O-ring from rack assembly.

**CAUTION:**

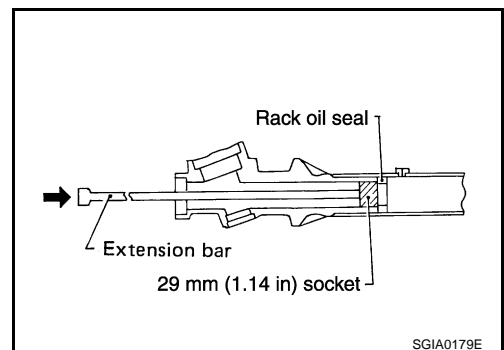
**Never damage rack assembly. Rack assembly must be replaced if damaged because it cause fluid leakage.**



- Push rack oil seal inside with a 29 mm (1.14 in) socket and an extension bar to push out rack oil seal (inner side) from gear housing assembly.

**CAUTION:**

**Never damage gear housing assembly and cylinder inner wall. Gear housing assembly must be replaced if damaged because it may cause fluid leakage.**



## ASSEMBLY

- Apply recommended fluid to O-ring. Put an O-ring into a rack Teflon ring.

**CAUTION:**

**Never reuse O-ring.**

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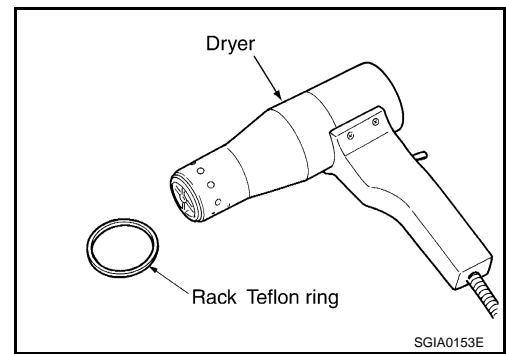
# STEERING GEAR AND LINKAGE

## < ON-VEHICLE REPAIR >

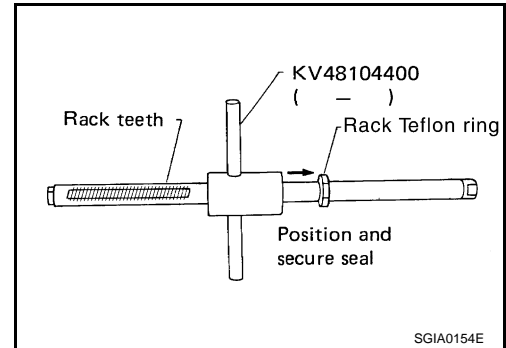
2. Heat rack Teflon ring to approximately 40°C (104°C) with a dryer. Assemble it to mounting groove of rack assembly.

**CAUTION:**

**Never reuse rack Teflon ring.**



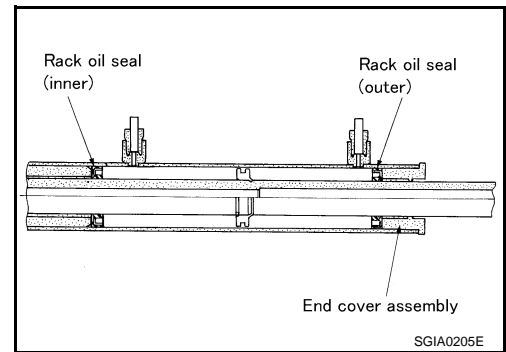
3. Install the rack Teflon ring correcting tool [SST: KV48104400 ( — )] from tooth side of rack fit rack Teflon ring on rack. Compress the with tool.



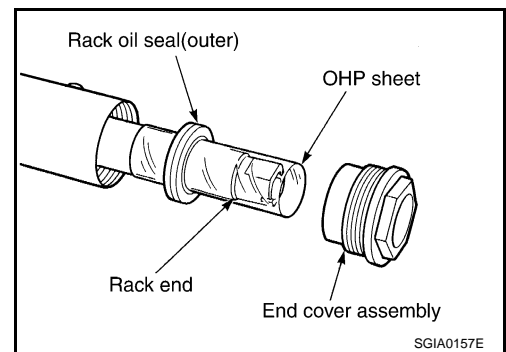
4. Apply recommended grease to rack oil seal, and then install rack oil seal in the following procedure. Then assemble rack assembly to gear housing assembly.

**CAUTION:**

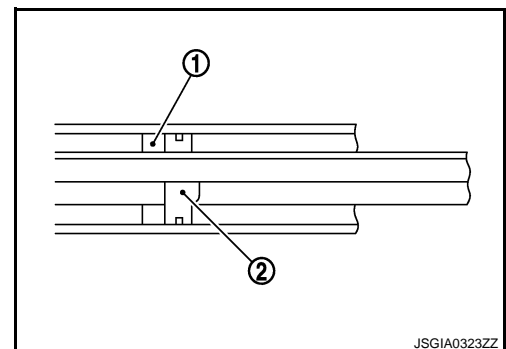
- Install rack oil seal in a direction so that the lip of inner oil seal and the lip of outer oil seal face each other.
- Never damage retainer sliding surface by rack assembly. Replace gear housing assembly if damaged.
- Never damage gear housing assembly inner wall by rack assembly. Gear housing assembly must be replaced if damaged because it may cause fluid leakage.



- a. Wrap an OHP sheet [approximately 70 mm (2.76 in) × 100 mm (3.94 in)]. Around rack assembly teeth to avoid damaging rack oil seal (inner). Install rack oil seal over sheet. Then, pull OHP sheet along with rack oil seal until they pass rack assembly teeth, and remove OHP sheet.



- b. Insert rack oil seal (inner) (1) into rack assembly piston (2).
- c. Push retainer to adjusting screw side by hand, and move the rack assembly inside the gear housing assembly so that the rack oil seal (inner) can be pressed against the gear housing assembly.

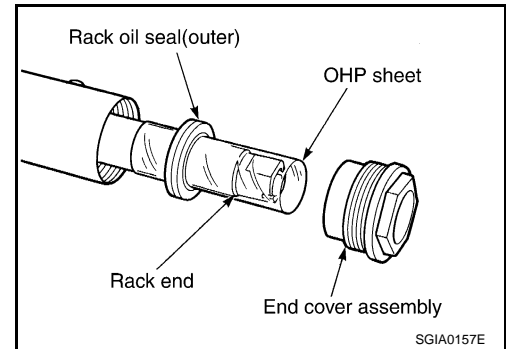


# STEERING GEAR AND LINKAGE

## < ON-VEHICLE REPAIR >

d. Wrap an OHP sheet [approximately 70 mm (2.76 in) × 100 mm (3.94 in)]. Around the edge to avoid damaging rack oil seal (outer). Install rack oil seal over sheet. Then, pull oil seal along with OHP sheet until they pass rack edge, and remove OHP sheet.

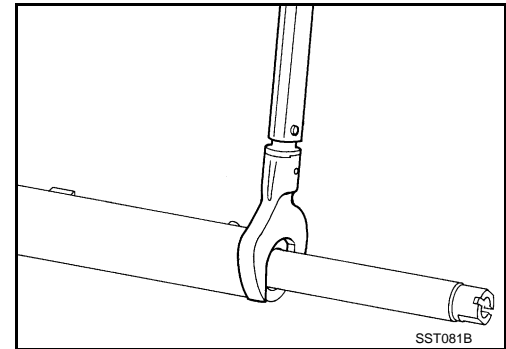
e. Install end cover assembly to rack edge, and move rack oil seal (outer) until it contacts with gear housing assembly.



5. Tighten end cover assembly to specified torque using a 36 mm (1.42 in) open head (suitable tool).

**CAUTION:**

**Never damage rack assembly. Replace it if damaged because it may cause fluid leakage.**



6. Crimp gear housing assembly at one point using a punch as shown in the figure so as to prevent end cover assembly from getting loose after tightening end cover assembly.

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

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

**CAUTION:**

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

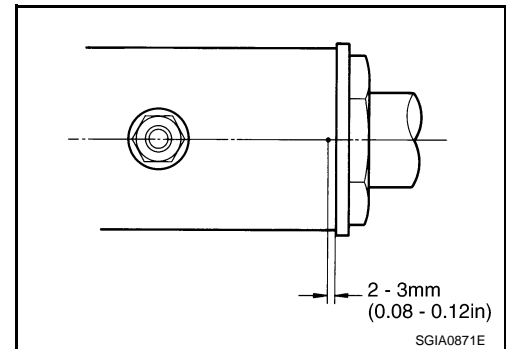
9. Install inner socket to gear housing assembly with the following procedure.

a. 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"](#).**

b. Screw inner socket into rack part and tighten at the specified torque.

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



**Standard**

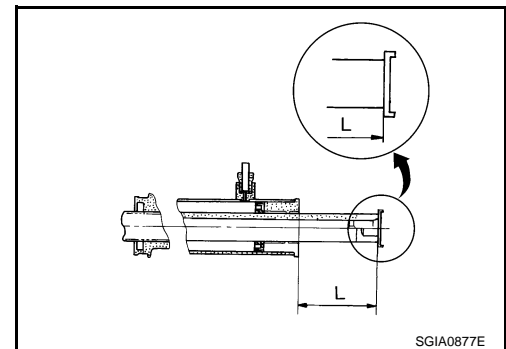
**L**

**: Refer to [ST-45, "Rack Stroke"](#).**

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

**CAUTION:**

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





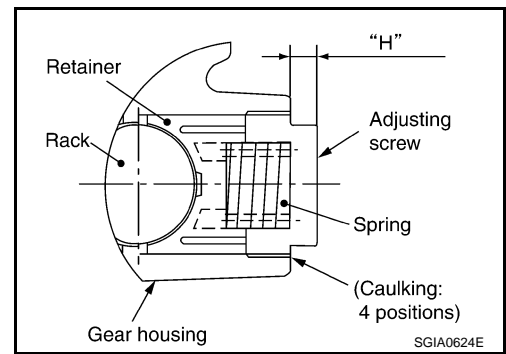
# STEERING GEAR AND LINKAGE

## < ON-VEHICLE REPAIR >

12. Apply recommended thread locking 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".**

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

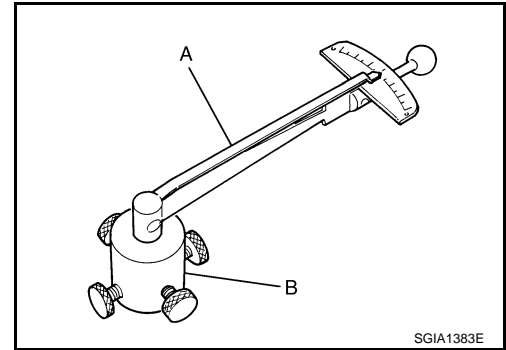


14. Adjust pinion rotating torque with the following procedure.
- Measure pinion rotating torque within  $\pm 180^\circ$  of neutral position of the rack assembly using Tools. Stop the gear at the point where highest torque is read.

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

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

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

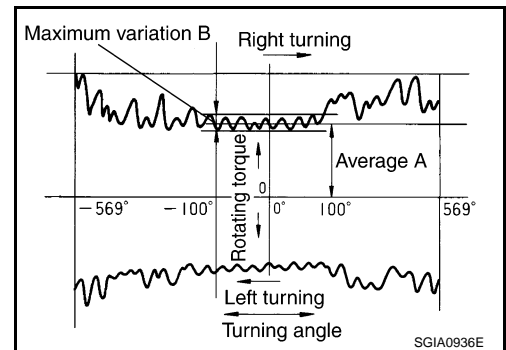


- Measure pinion rotating torque using Tools to make sure that the measured value is within the standard. Readjust if the value is outside the standard. Replace steering gear assembly, if the value is outside the standard after readjusting, or adjusting screw rotating torque is 5 N·m (0.51 kg·m, 44 in·lb)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

### Pinion rotating torque

**Around neutral position (within  $\pm 100^\circ$ ) average (A) : 1.59 – 2.0 N·m (0.17 – 0.20 kg·m, 14 – 17 in·lb)**

**Maximum variation (B) : 0.39 N·m (0.04 kg·m, 3.0 in·lb)**



- Apply recommended liquid gasket to inner socket and turn pinion fully to left with inner socket installed to gear housing assembly.

- Install dial gauge at 5 mm (0.20 in) (L) from the edge of gear housing assembly (1), and tooth point.

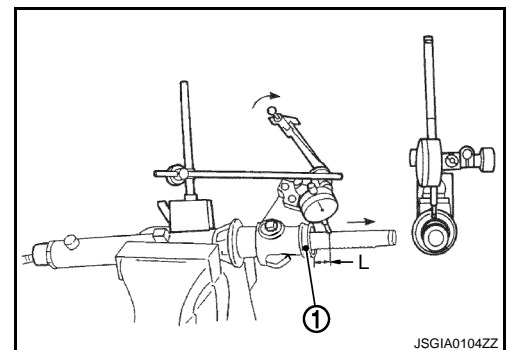
- Measure vertical movement of rack assembly when pinion is turned clockwise with torque of 19.6 N·m (2.0 kg·m, 14 ft·lb). Readjust adjusting screw angle if the measured value is outside the standard.

**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.

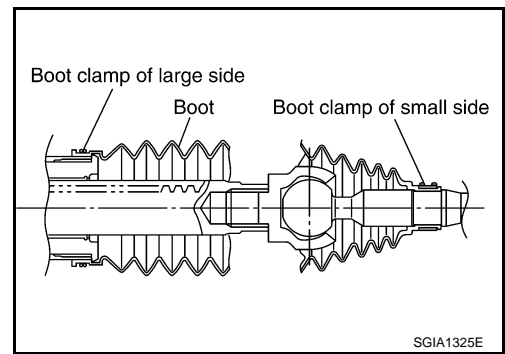




# STEERING GEAR AND LINKAGE

## < ON-VEHICLE REPAIR >

15. Install large end of boot to gear housing assembly.
16. Install small end of boot to inner socket boot mounting groove.
17. Install boot clamp to boot small end.



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

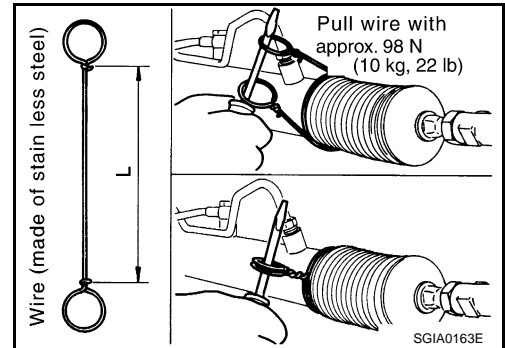
**CAUTION:**

**Never reuse boot clamp.**

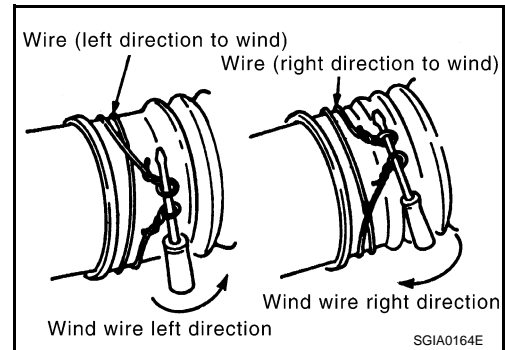
- a. Tighten large side of boot with boot clamp (stainless wire).

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

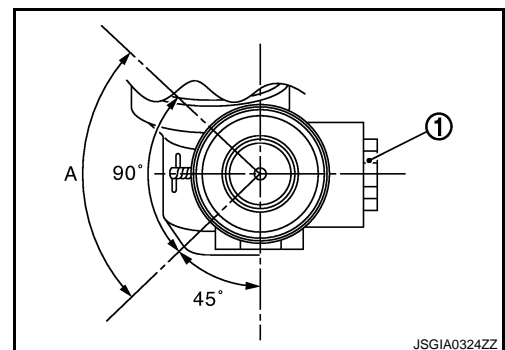
- b. Wrap clamp around boot groove for two turns. Insert a flat-bladed screwdriver in loops on both ends of wire. Twist 4 to 4.5 turns while pulling them with force of approximately 98 N (10 kg, 22 lb).



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



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



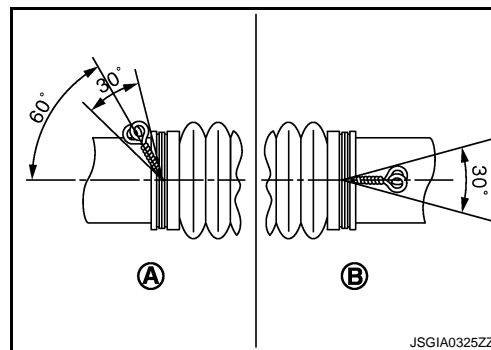
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# STEERING GEAR AND LINKAGE

## < ON-VEHICLE REPAIR >

e. Bent cut end of the wire toward rack axial as shown in the figure after twisting the wire 4 to 4.5 turns so that cut end does not contact with boot.

- A : Gear housing RHD side
- B : Gear housing LHD side



19. Install cylinder tubes to gear housing assembly.
20. Install low pressure piping.
21. Adjust inner socket to standard length (L), and then tighten lock nut to the specified torque. Check length again after tightening lock nut.

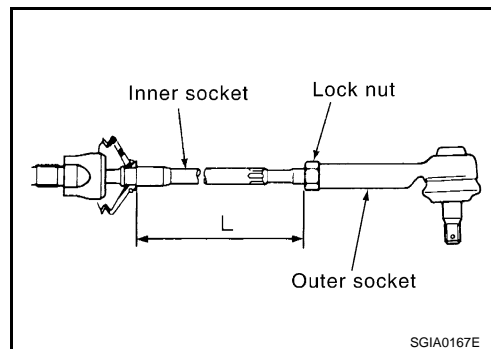
### Standard

L

: Refer to [ST-45, "Inner Socket Length"](#).

### CAUTION:

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



## 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

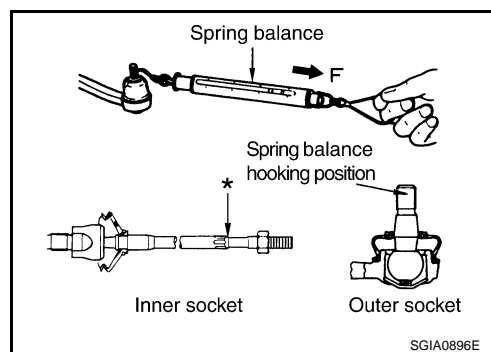
Hook a spring balance at the point shown in the figure and pull the spring balance. Make sure that the spring balance reads the specified value when ball stud and inner socket start to move. Replace outer socket and inner socket if they are outside the standard.

### Standard

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

Outer socket

: Refer to [ST-45, "Socket Swing Force and Rotating Torque"](#).



# STEERING GEAR AND LINKAGE

< ON-VEHICLE REPAIR >

## Standard

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

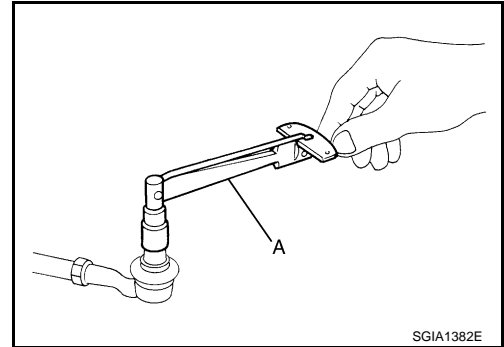
Inner socket : Refer to [ST-45, "Socket Swing Force and Rotating Torque"](#).

## 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-45, "Socket Swing Force and Rotating Torque"](#).



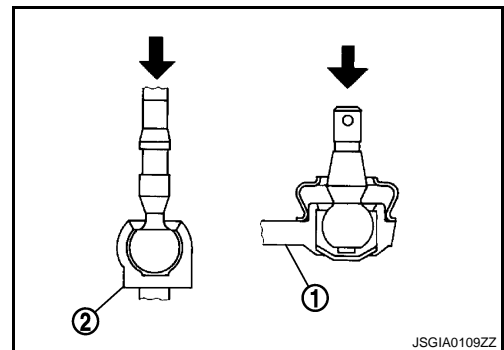
## BALL JOINT AXIAL END PLAY

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-45, "Socket Axial End Play"](#).

Inner socket : Refer to [ST-45, "Socket Axial End Play"](#).



## 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-12, "Inspection"](#).
- Check the fluid level, fluid leakage, and air bleeding hydraulic system. Refer to [ST-10, "Inspection"](#).

# POWER STEERING OIL PUMP

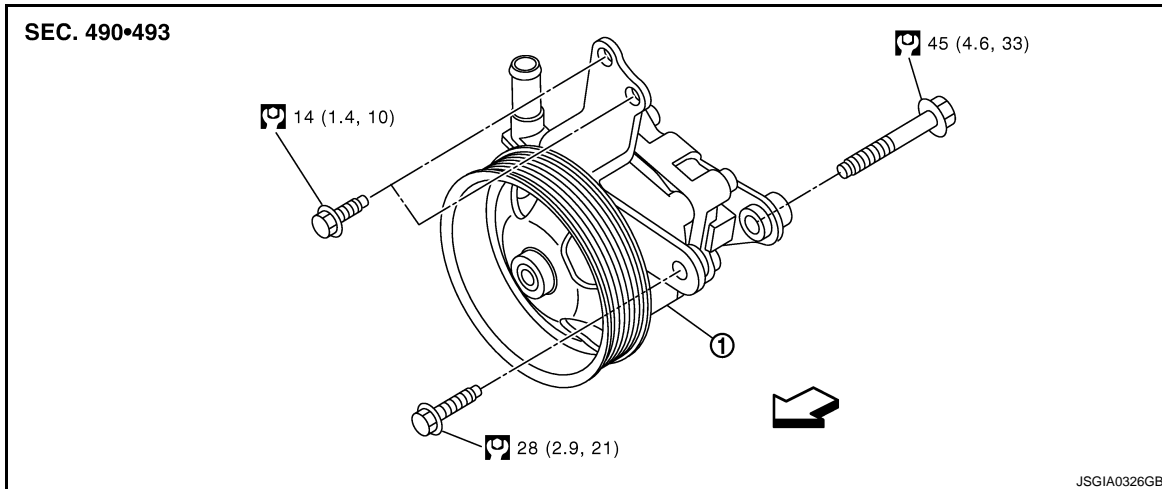
< ON-VEHICLE REPAIR >

## POWER STEERING OIL PUMP

Exploded View

INFOID:000000003305921

### REMOVAL

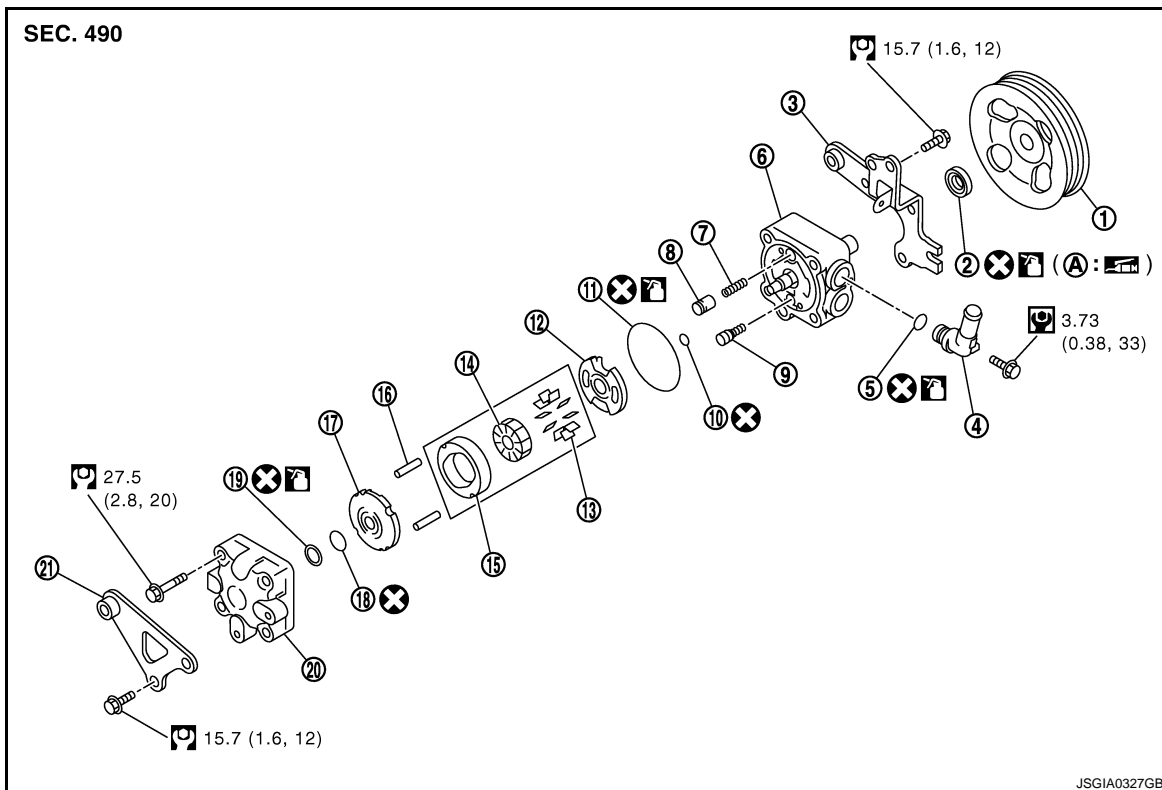


1. Power steering oil pump

↶: Vehicle front

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

### DISASSEMBLY




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

# POWER STEERING OIL PUMP

## < ON-VEHICLE REPAIR >

- |                 |                     |                      |
|-----------------|---------------------|----------------------|
| 10. O-ring      | 11. O-ring          | 12. Front side plate |
| 13. Vane        | 14. Rotor           | 15. Cam ring         |
| 16. Dowel pin   | 17. Rear side plate | 18. O-ring           |
| 19. Teflon ring | 20. Rear cover      | 21. Rear bracket     |
| 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:000000003305922

### REMOVAL

1. Drain power steering fluid from reservoir tank.
2. Remove front road wheel and tires.
3. Remove splash guard. Refer to [EXT-23, "FENDER PROTECTOR : Exploded View"](#).
4. Loosen drive belt. Refer to [EM-13, "Removal and Installation"](#).
5. Remove drive belt from oil pump pulley.
6. Remove copper washers and eye bolt (drain fluid from their pipings).
7. Remove suction hose (drain fluid from their pipings).
8. Remove oil pump mounting bolts, and then remove oil pump.

#### CAUTION:

**Never damage drive shaft boot.**

### INSTALLATION

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

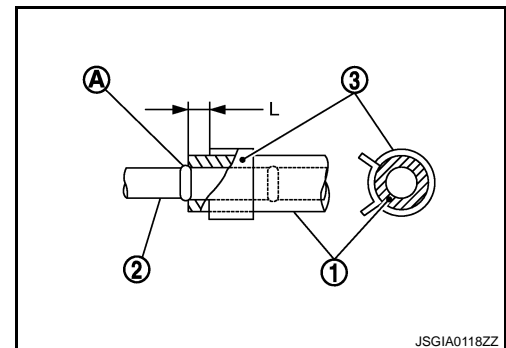
- When installing suction hoses (1), refer to the figure.

#### 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

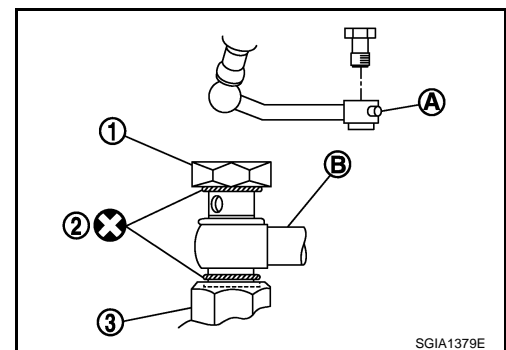
L : 3 – 8 mm (0.12 – 0.31 in)



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

#### CAUTION:

- **Never reuse copper washer.**
  - **Apply power steering fluid 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-42, "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-10, "Inspection"](#).



## Disassembly and Assembly

INFOID:000000003305923

### DISASSEMBLY

1. Remove rear bracket.

# POWER STEERING OIL PUMP

## < ON-VEHICLE REPAIR >

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

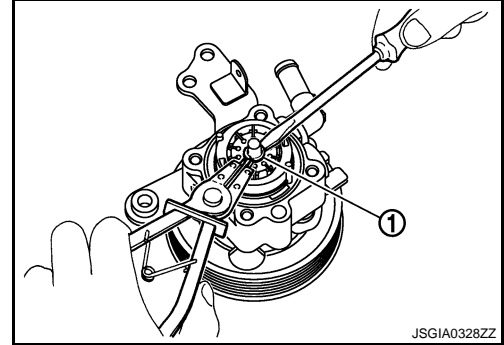
**CAUTION:**

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

3. Remove O-ring from body assembly.
4. Remove rear side plate from cartridge, and then remove Teflon ring and O-ring from rear side plate.
5. Remove rotor snap ring (1) using a snap ring pliers, and remove cam ring, rotor and vane from body assembly.

**CAUTION:**

When removing the snap ring, never damage the pulley shaft.



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

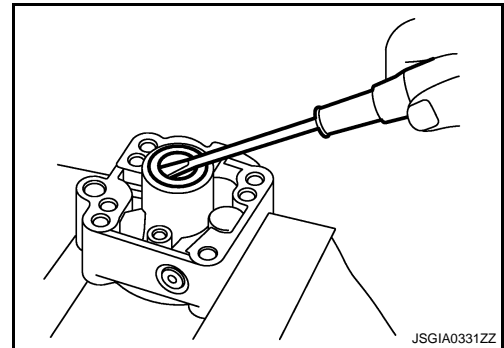
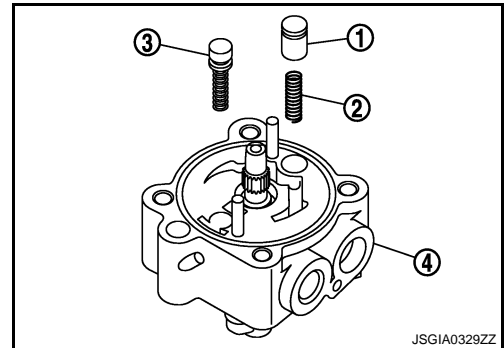
**CAUTION:**

Never drop and damage flow control valve and flow control valve sub assembly when removing.

8. Remove oil seal from body assembly.
9. Remove mounting bolt of suction pipe, and then remove suction pipe from body assembly.
10. Remove pulley from body assembly.
11. Remove front bracket from body assembly.
12. Remove oil seal from body assembly using a flat-bladed screwdriver.

**CAUTION:**

Never damage the body assembly.



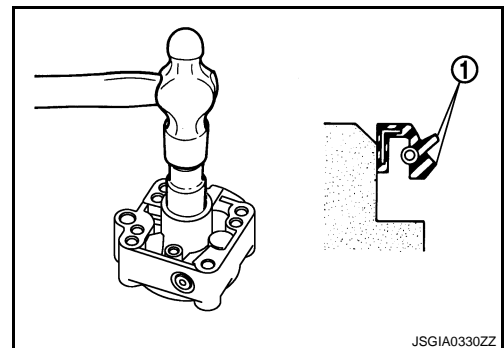
## ASSEMBLY

1. Apply recommended grease to oil seal lips (1). Apply recommended fluid to around oil seal. Install oil seal to body assembly using proper tool.

**CAUTION:**

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

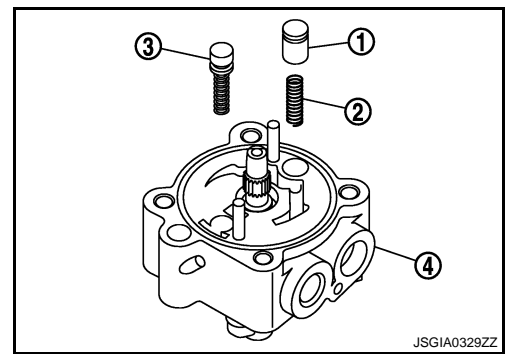
2. Install front bracket to body assembly.
3. Install pulley to body assembly.
4. If dowel pin has been removed, insert it into body assembly by hand. If it cannot be inserted by hand, lightly tap with a hammer.



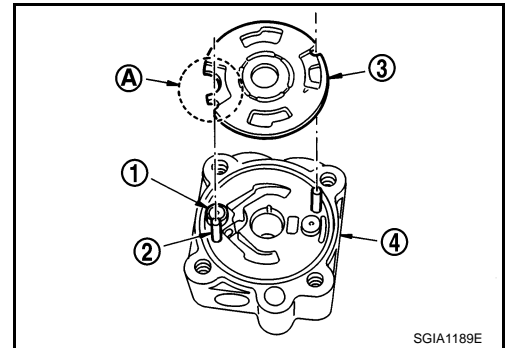
# POWER STEERING OIL PUMP

## < ON-VEHICLE REPAIR >

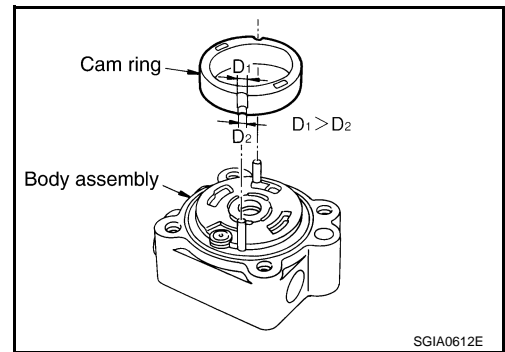
5. Install flow control valve (1), flow control valve spring (2) and flow control valve sub assembly (3) as shown in the figure to body assembly (4).



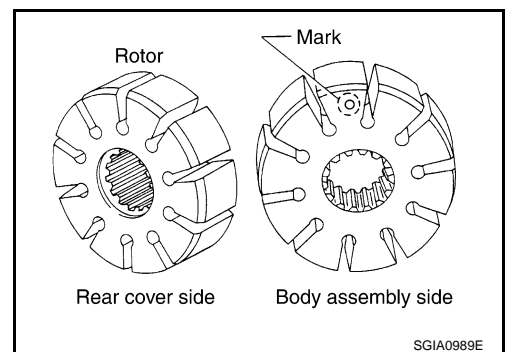
6. Install front side plate (3) with dowel pin (2) on flow control valve A (1) side as shown in the figure aligning with front side plate cutout (A) to body assembly (4).



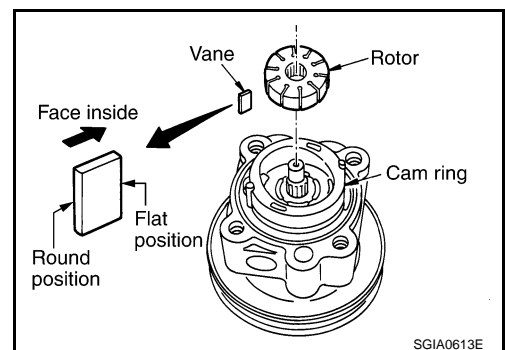
7. Install cam ring as shown in the figure.



8. Install rotor so that mark faces body assembly, and then install it to pulley shaft.



9. Install vane to rotor so that arc of vane faces cam ring side.



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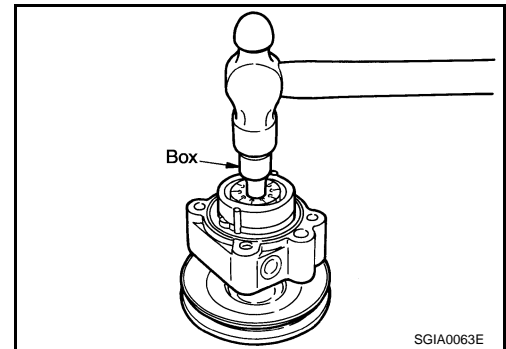
# POWER STEERING OIL PUMP

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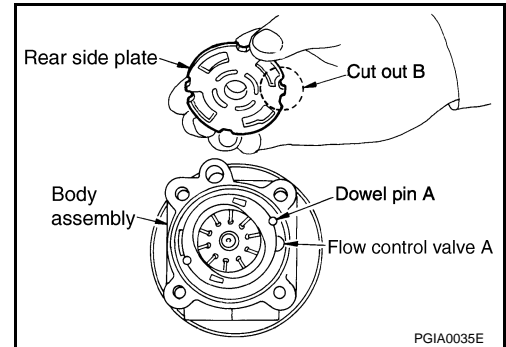
10. Install rotor snap ring to slit of pulley shaft using a hammer and a 10 mm (0.39 in) box.

**CAUTION:**

- Never damage rotor and pulley shaft.
- Oil pump assembly must be replaced if rotor is damaged.



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.
18. Install rear bracket.



## Inspection

INFOID:000000003305924

## RELIEF OIL PRESSURE

**CAUTION:**

**Make sure 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-10, "Inspection"](#).
2. Start the engine. Run the 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 the 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.
- Be sure to 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**

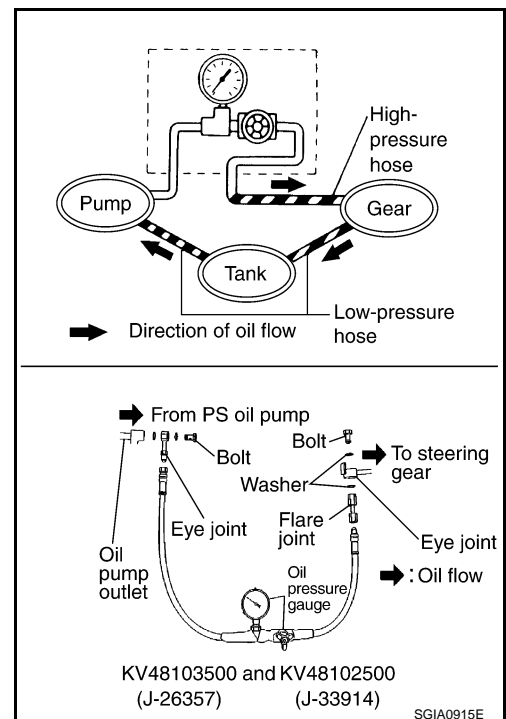
**Relief oil pressure**

**: Refer to [ST-45, "Relief Oil Pressure"](#).**

**CAUTION:**

**Never keep valve 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-37, "Disassembly and Assembly"](#).





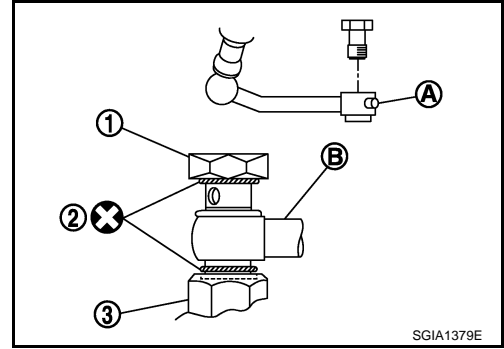
# POWER STEERING OIL PUMP

## < ON-VEHICLE REPAIR >

5. Disconnect the oil pressure gauge from hydraulic circuit.
6. When installing eye bolt (1) and copper washers (2) to oil pump (3), refer to the figure.

### CAUTION:

- Never reuse copper washer.
  - 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-42, "Exploded View"](#).
  - Securely insert harness connector to pressure sensor.
7. Check fluid level, fluid leakage and air bleeding hydraulic system after the installation. Refer to [ST-10, "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 necessary.

### Flow Control Valve Inspection

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

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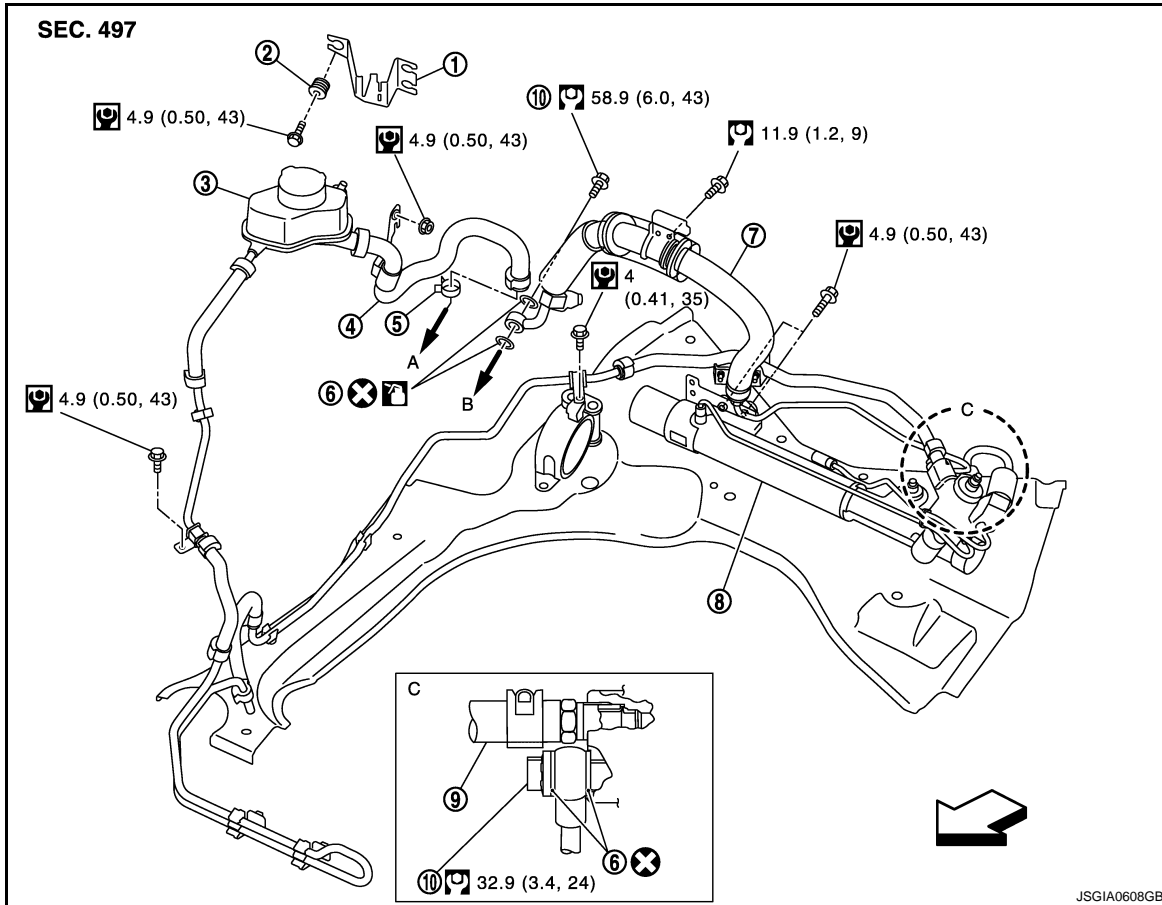
# HYDRAULIC LINE

< ON-VEHICLE REPAIR >

## HYDRAULIC LINE

Exploded View

INFOID:000000003305929



- |   |                                |                      |
|---|--------------------------------|----------------------|
| 1. Reservoir tank bracket                   | 2. Bushing                     | 3. Reservoir tank    |
| 4. Suction hose                             | 5. Clamp                       | 6. Copper washer     |
| 7. High pressure piping                     | 8. Steering gear assembly      | 9. Low pressure hose |
| 10. Eye bolt                                |                                |                      |
| A. To power steering oil pump suction hose. | B. To power steering oil pump. |                      |

⇐: Vehicle front

: Apply power steering fluid.

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

## Removal and Installation

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**CAUTION:**

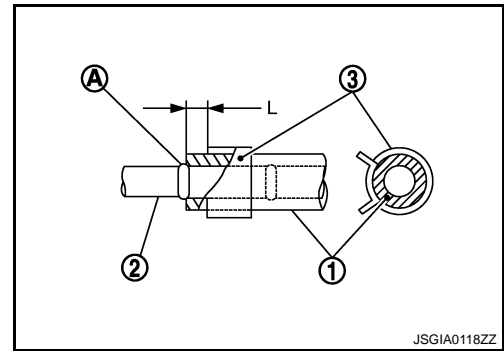
# HYDRAULIC LINE

## < ON-VEHICLE REPAIR >

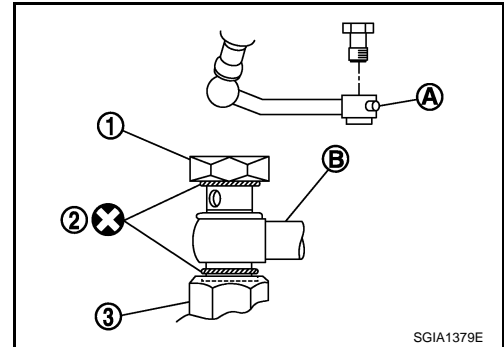
- Never apply fluid to the hose (1) and tube (2).
- Insert hose securely until it contacts spool (A) of tube.
- Leave clearance (L) when installing clamp (3).

Standard

L : 3 – 8 mm (0.12 – 0.31 in)



- 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-42, "Exploded View"](#).
- Securely insert harness connector to pressure sensor.
- Apply power steering fluid to around copper washer, then install eye bolt.
- Never reuse copper washer.



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## SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

# SERVICE DATA AND SPECIFICATIONS (SDS)

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### General Specifications

INFOID:000000003305931

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:000000003305932

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 Force

INFOID:000000003305933

Unit: N·m (kg·m, in·lb)

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

### Steering Angle

INFOID:000000003305934

Unit: Degree minute (Decimal degree)

Item		Standard	
		Wheel size: 18 inch	Wheel size: 20 inch
Inner wheel	Minimum	33°30' (33.5°)	32°00' (32.0°)
	Nominal	36°30' (36.5°)	35°00' (35.0°)
	Maximum	37°30' (37.5°)	36°0' (36.0°)
Outer wheel	Nominal	31°30' (31.5°)	30°30' (30.5°)

### Steering Column Length

INFOID:000000004678296

Unit: mm (in)

Item	Standard
Column length	463 (18.23)

### Steering Column Mounting Dimensions

INFOID:000000004678297

Unit: mm (in)

Item	Standard
Mounting dimension	30 (1.18) or less

### Steering Column Operating Range

INFOID:000000003305935

Item	Standard	
	Without electric motor	With electric motor
Tilt operating range	15°	18°
Telescopic operating range	40 mm (1.57 in)	
Rotating torque	0.49 N·m (0.05 kg·m, 4 in·lb)	

# SERVICE DATA AND SPECIFICATIONS (SDS)

## < SERVICE DATA AND SPECIFICATIONS (SDS)

### Lower Shaft Length

INFOID:000000003305936

Unit: mm (in)

Item	Standard
Lower shaft length	160 (6.3) or more

### Rack Sliding Force

INFOID:000000003305937

Unit: N (kg, lb)

Item	Standard	
	2WD	AWD
Rack sliding force	195 – 258 (19.9 – 26.3, 43.8 – 57.9)	227 – 305 (23.2 – 31.1, 51.1 – 68.5)

### Rack Stroke

INFOID:000000003305938

Unit: mm (in)

Item	Standard	
	Wheel size: 18 inch	Wheel size: 20 inch
Rack neutral position	70.5 (2.776)	68.0 (2.677)

### Socket Swing Force and Rotating Torque

INFOID:000000003305939

#### 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)

### Socket Axial End Play

INFOID:000000003305940

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:000000003305941

Unit: mm (in)

Item	Standard
Rack neutral position	120.3 (4.74)

### Relief Oil Pressure

INFOID:000000003305942

Unit: kPa (kg/cm<sup>2</sup>, psi)

Item	Standard
Relief oil pressure	9,500 – 10,300 (96.9 – 105.1, 1,378 – 1,494)