SECTION ST
STEERING SYSTEM

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PRECAUTION

PRECAUTIONS

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

INFOID:0000000013557423

Risk of injury

There is a risk of injury caused by parts becoming projectiles if uncontrolled deployment of air bag or seat belt pre-tensioner occurs, or by storing air bag with the deployment side facing downwards. When scrapping air bag or seat belt pre-tensioner by means of controlled deployment, there is also a danger present if a sufficiently safe distance is not maintained, or if opening using cutting torches or other cutting tools, or due to smelting or if parts that are not yet triggered are exposed to a blaze or a smoldering fire at landfills.

Safety instructions/precautions

- Removed air bag must always be stored with deployment side facing up.
- Acquisition, transportation, storage, testing and assembly work should only be performed or supervised by properly trained personnel.
- Install air bag or seat belt pre-tensioner immediately following retrieval from storage.
- Air bag and seat belt pre-tensioner must be protected from flying sparks, open fires and temperature exceeding 100°C (212°F).
- Never transport air bag and seat belt pre-tensioner in the passenger compartment. Store them securely in the luggage room of the vehicle in their original replacement part packaging and secure them so that they cannot slip around.
- Never allow air bag and seat belt pre-tensioner to come into contact with grease, oil, or cleaning agents.
- Perform system tests using approved testing equipment only, and only when the units are properly installed and the vehicle is unoccupied.
- Before the initial hookup of the battery or an external power supply, the ignition must be switched on and the vehicle unoccupied.
- Air bag and seat belt pre-tensioner that fall from a height of more than 0.5 m must be replaced.
- When scrapping by means of controlled deployment of air bag and seat belt pre-tensioner, a safe distance of at least 10 m must be maintained.
- Before starting work on air bag and seat belt pre-tensioner and work on components that are connected to air bag and seat belt pre-tensioner or require and intervention in their electric circuit (e.g. when removing the steering wheel):

- Disconnect any external power sources (e.g. charger).
- Disconnect and insulate ground line of battery

- Before starting bodywork in combination with welding or retrofitting, during which work is performed on uninsulated, current-carrying lines or require an intervention in their electric circuit (e.g. when removing the steering wheel):

- Disconnect any external power sources (e.g. charger).
- Disconnect and insulate ground line of battery.
- During welding, disconnect plug connection and from control unit of air bag.

- When the air bag deploys, the pyrofuse activates and the power source from the battery is disconnected. This prevents possible fires caused by electric leakage after an accident occurs.

Precautions for Removing Battery Terminal

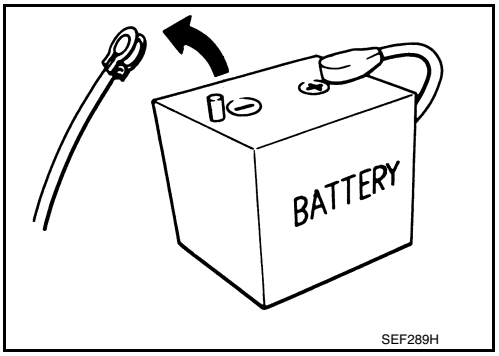
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When disconnecting the battery terminal, pay attention to the following.

- Always use a 12V battery as power source.
- Never disconnect battery terminal while engine is running.

- When removing the 12V battery terminal, turn OFF the ignition switch and wait at least 30 seconds.
- For vehicles with the engine listed below, remove the battery terminal after a lapse of the specified time:

BR08DE	: 4 minutes	YD25DDTi	: 2 minutes
D4D engine	: 20 minutes	YS23DDT	: 4 minutes
HRA2DDT	: 12 minutes	YS23DDTT	: 4 minutes
K9K engine	: 4 minutes	ZD30DDTi	: 60 seconds
M9R engine	: 4 minutes	ZD30DDTT	: 60 seconds
R9M engine	: 4 minutes		
V9X engine	: 4 minutes		



SEF289H

NOTE:
ECU may be active for several tens of seconds after the ignition switch is turned OFF. If the battery terminal is removed before ECU stops, then a DTC detection error or ECU data corruption may occur.

- After high-load driving, if the vehicle is equipped with the V9X engine, turn the ignition switch OFF and wait for at least 15 minutes to remove the battery terminal.

NOTE:
- Turbocharger cooling pump may operate in a few minutes after the ignition switch is turned OFF.
- Example of high-load driving
  - Driving for 30 minutes or more at 140 km/h (86 MPH) or more.
  - Driving for 30 minutes or more on a steep slope.

- For vehicles with the 2-batteries, be sure to connect the main battery and the sub battery before turning ON the ignition switch.

NOTE:
If the ignition switch is turned ON with any one of the terminals of main battery and sub battery disconnected, then DTC may be detected.

- After installing the 12V battery, always check "Self Diagnosis Result" of all ECUs and erase DTC.

NOTE:
The removal of 12V battery may cause a DTC detection error.

Service Notice or Precautions for Steering System

INFOID:0000000013557425

- 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.

Evaluating Steering Gear Assembly When Repairing Accident Vehicles

INFOID:0000000013557426

ACCIDENTS WITH DAMAGE TO BODY

In the event of accidents involving body damage (e.g. deformed fender, longitudinal member, side paneling, rear end etc.) the steering gear assembly can be used again on condition that parts of the front axle, the steering gear assembly are not damaged.

ACCIDENTS WITH DEFORMATION AT THE FRONT AXLE OR STTEERING GEAR ASSEMBLY

For safety reasons, the steering gear assembly must be replaced if components of the front axle or steering gear assembly are permanently deformed.

NOTE:
A shock transmitted to the steering gear through the front axle or steering linkage may have caused damage which not externally visible. A pressure test or crack test required for this is not possible in the workshops, therefore the steering gear is to be replaced in cases of doubt.

ACCIDENTS WITH TRIGGERED DRIVER AIR BAG

In the event of accidents with a driver air bag which has been triggered the steering wheel and steering column assembly must always be replaced.

NOTE:

Due to the driver air bag being triggered damage can occur to the steering wheel and the steering column assembly which is not visible externally.

ACCIDENTS WITH DAMAGED ENGINE COMPARTMENT PANELING

In the event of visible damage to the engine compartment paneling or the steering plate, the steering gear assembly must then be checked for damage. In particular, the steering gear assembly must be visually inspected for signs of external damage and cracks.

NOTE:

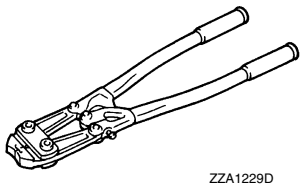
The steering gear assembly has to be removed to enable inspection to be performed. This is the only way of ensuring an integrated assessment. In case of doubt, the steering gear assembly must be replaced.

PREPARATION

PREPARATION

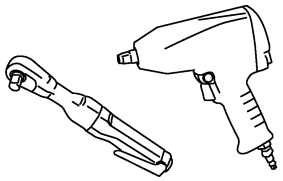
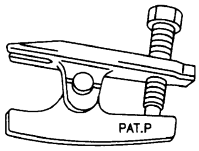
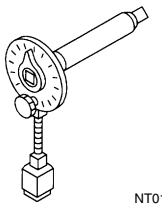
Special Service Tools

INFOID:0000000013557403

Tool number Tool name	Description
KV40107300 Boot band crimping tool  ZZA1229D	Installing boot clamp (large diameter)

Commercial Service Tools

INFOID:0000000013557404

Tool name	Description
Power tool  PBIC0190E	Loosening bolts and nuts
Ball joint remover  NT146	Removing outer socket
Angle wrench  NT014	• Tightening for steering gear assembly mounting bolts • Tightening for outer socket mounting nuts

BASIC INSPECTION

STEERING WHEEL

Inspection

INFOID:0000000013557405

NEUTRAL POSITION STEERING WHEEL

1. Check that steering gear assembly, steering column assembly and steering wheel are installed in the correct position.
2. Check wheel alignment within specification. Refer to FSU-8, "Inspection".
3. Set vehicle to the straight-ahead position and confirm steering wheel is in the neutral position.
   - 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.

   CAUTION:

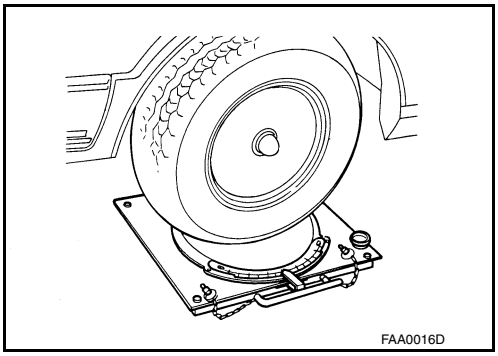
   If the adjustment is performed by using the inner socket, check wheel alignment after the adjustment. Refer to FSU-8, "Inspection".

FRONT WHEEL TURNING ANGLE

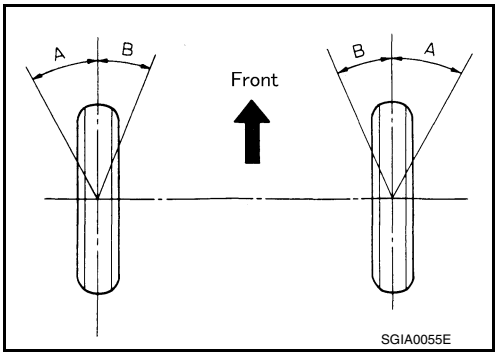
1. Perform toe-in inspection. Refer to FSU-8, "Inspection".

   CAUTION:

   Perform front wheel turning angle inspection, after toe-in 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.



A : Inner wheel angle

B : Outer wheel angle

Steering angle : Refer to ST-18, "Steering Angle".

NOTE:

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.

SYMPTOM DIAGNOSIS

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

NVH Troubleshooting Chart

INFOID:0000000013557406

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

			Reference	ST-8	—	ST-13	ST-10	ST-9	ST-13	NVH in FAX, RAX, FSU, RSU section.	NVH in WT section.	NVH in WT section.	NVH in FAX section.	NVH in BR section.
			Possible cause and SUSPECTED PARTS	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	AXLE and SUSPENSION	TIRE	ROAD WHEEL	DRIVE SHAFT	BRAKE
Symptom	Steering	Noise		—	—	—	×	×	—	×	×	×	×	×
		Shake		×	×	×	—	—	—	×	×	×	×	×
		Vibration		×	×	×	×	×	—	×	×	—	×	—
		Shimmy		×	—	×	—	—	×	×	×	×	—	×
		Judder		—	×	×	—	—	×	×	×	×	—	×

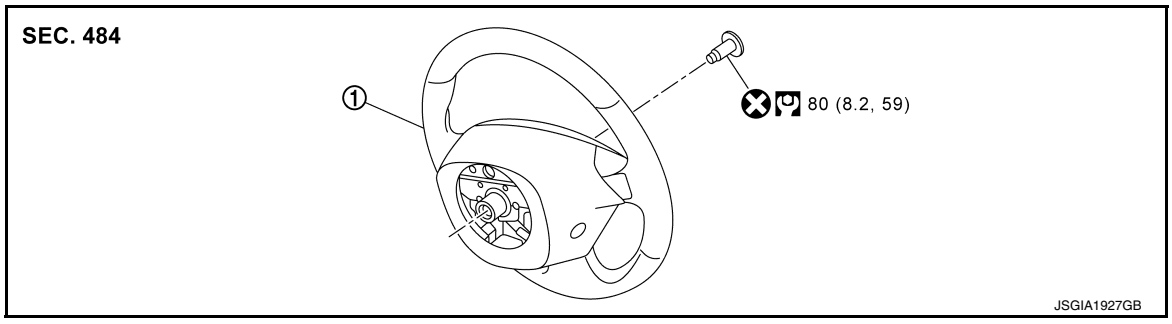
×: Applicable, —: Not applicable

REMOVAL AND INSTALLATION

STEERING WHEEL

Exploded View

INFOID:0000000013557407



① Steering wheel

: Always replace after every disassembly.

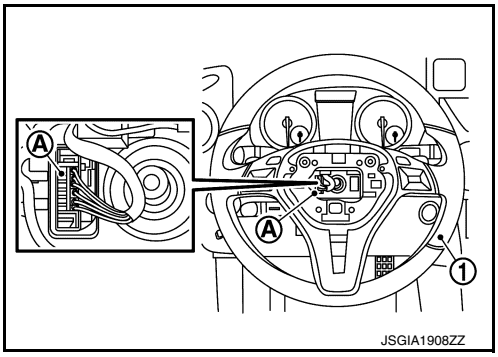
: N·m (kg-m, ft-lb)

Removal and Installation

INFOID:0000000013557408

REMOVAL

1. Set vehicle to the straight-ahead position.
2. Remove driver air bag module. Refer to SR-20, "Removal and Installation".
3. Remove steering wheel lock bolt after steering wheel is locked.
4. Disconnect steering wheel harness connector Ⓐ from steering wheel ①.
5. Remove steering wheel.
   NOTE:
   Put paint marks on the steering wheel and the column shaft head for supporting accurate positioning during the installation procedure.



INSTALLATION

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

CAUTION:

Never reuse steering wheel mounting bolt.

- Perform inspection after installation. Refer to ST-8, "Inspection".

Inspection

INFOID:0000000013557409

INSPECTION AFTER INSTALLATION

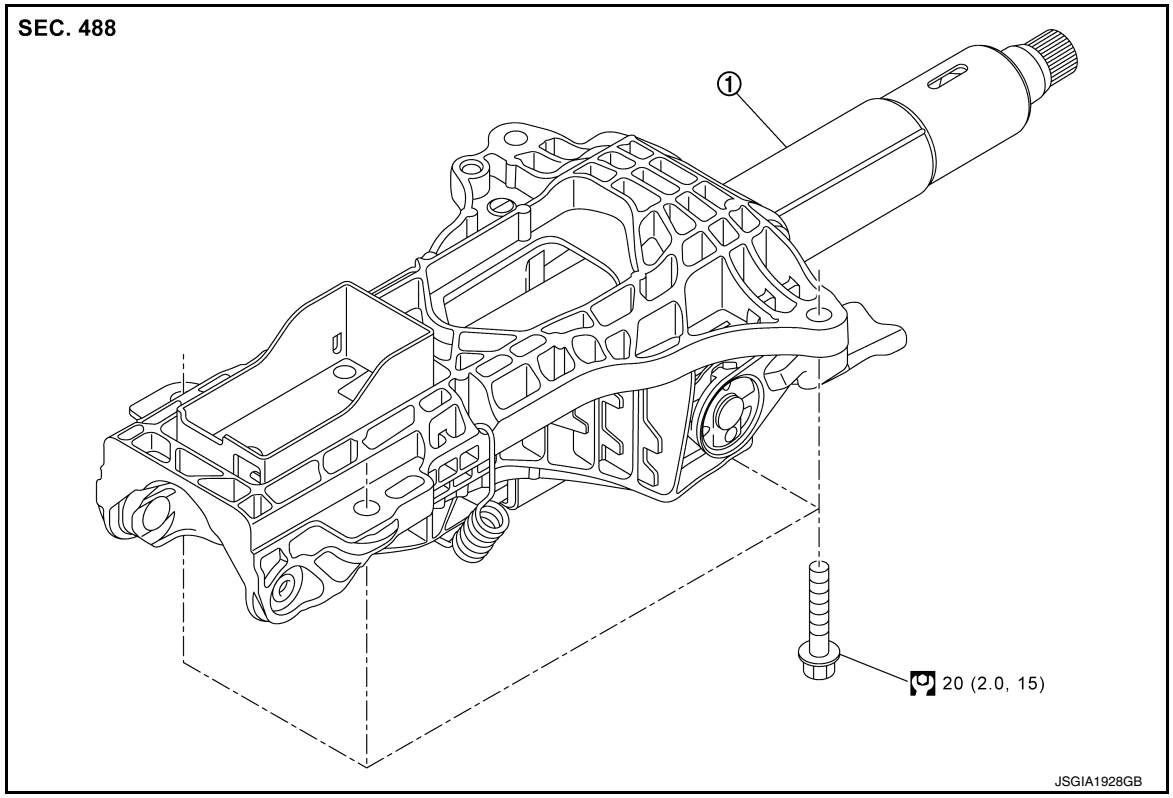
- Conduct a road test.

  NOTE:
  - Check turn signal cancellation: If displacement is more than one tooth, problem-free canceling of flashers is not guaranteed.
  - Check SRS air bag warning lamp: The SRS air bag warning lamp should not light up when the steering wheel is turned to its full-lock position in either direction.
  - Check position of the steering wheel: If the steering wheel is crooked, adjust it by max. one tooth.

STEERING COLUMN

Exploded View

INFOID:0000000013557410



① Steering column assembly

: N·m (kg-m, ft-lb)

Removal and Installation

INFOID:0000000013557411

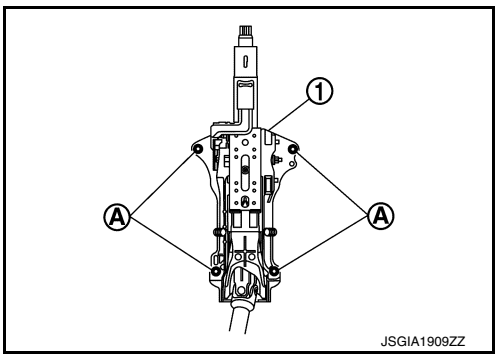
REMOVAL

CAUTION:

- **Be careful when removing steering column assembly from the vehicle because it is heavy.**
- **While removing the steering column assembly, never move the steering gear.**
- **When removing the steering column assembly, be careful not to allow the steering shaft to turn.**
- **Place a matching mark on both steering shaft and steering column assembly when removing steering shaft.**

1. Set vehicle to the straight-ahead position.
2. Move the steering column assembly forward and up.
3. Remove driver air bag module. Refer to SR-20, "Removal and Installation".
4. Remove steering wheel. Refer to ST-8, "Removal and Installation".
5. Remove steering column control module. Refer to BCS-250, "Removal and Installation".
6. Remove instrument panel assembly. Refer to IP-13, "Removal and Installation".
7. Remove front foot duct. Refer to VTL-11, "FRONT FOOT DUCT : Removal and Installation".
8. Remove steering shaft mounting bolt (steering gear side). Refer to ST-11, "Removal and Installation".

9. Remove the steering column assembly mounting bolts Ⓐ, and then remove steering column assembly ①.
   CAUTION:
   - **When removing the mounting bolt, be careful not to drop the steering column assembly.**
   - **When removing the steering column assembly, be careful not to damage the surrounding panel.**
10. Remove steering shaft if necessary. Refer to ST-11, "Removal and Installation".
11. Perform inspection after removal. Refer to ST-10, "Inspection".



INSTALLATION

Note the following, and install in the reverse order of removal.
- Check steering column assembly is correctly seated.
- Perform inspection after installation. Refer to ST-10, "Inspection".

Inspection

INFOID:0000000013557412

INSPECTION AFTER REMOVAL

Check the following items and replace, if necessary.
- Check each part of steering column assembly for damage or other malfunctions. Replace if there are any abnormal conditions.

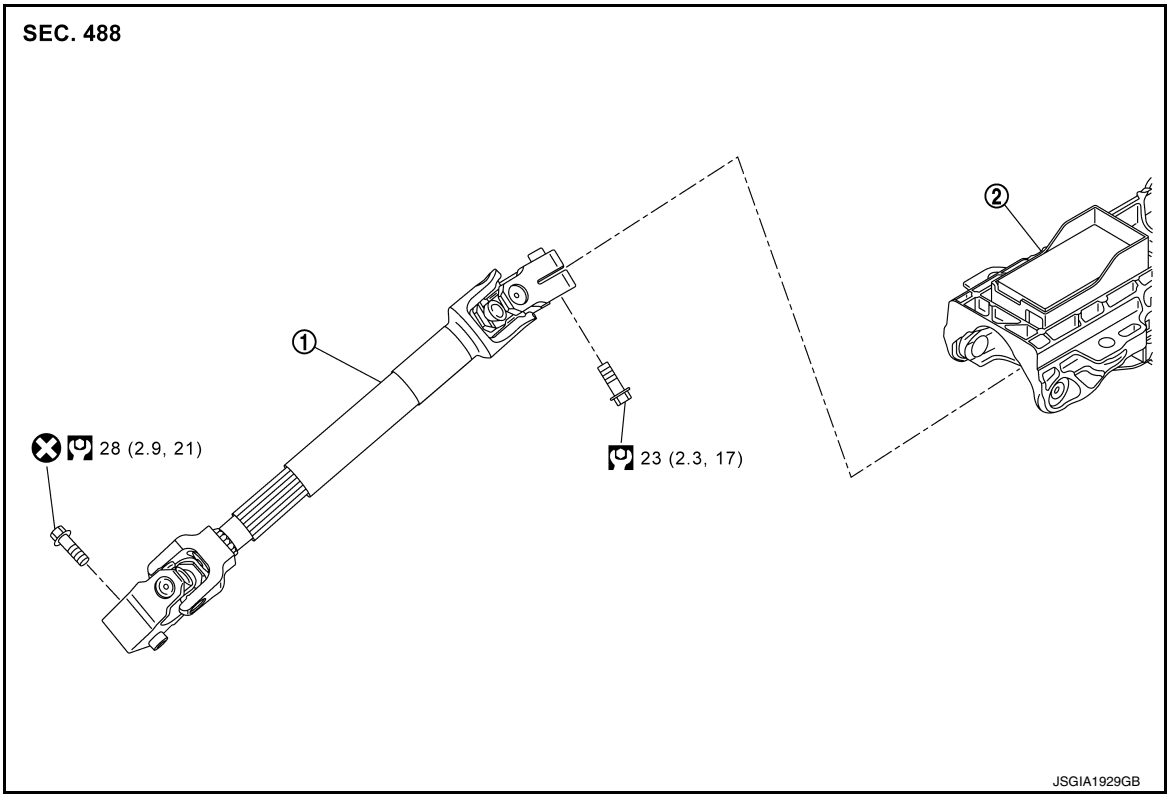
INSPECTION AFTER INSTALLATION

Check the following items and replace, if necessary.
- Check each part of steering column assembly for damage or other malfunctions. Replace if there are any abnormal conditions.
- Rotate steering wheel to check for decentered condition, binding, noise, or excessive steering effort.
- Perform test drive when removing steering column assembly. Refer to STC-26, "Description".

STEERING SHAFT

Exploded View

INFOID:0000000013557413



① Steering shaft ② Steering column assembly

: Always replace after every disassembly.

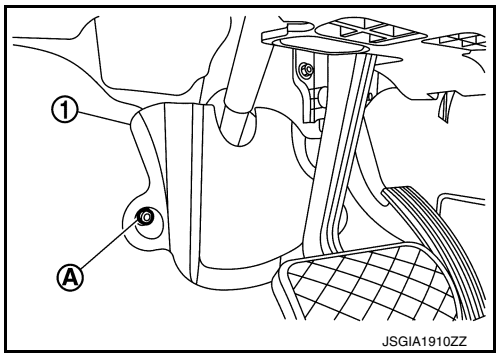
: N·m (kg-m, ft-lb)

Removal and Installation

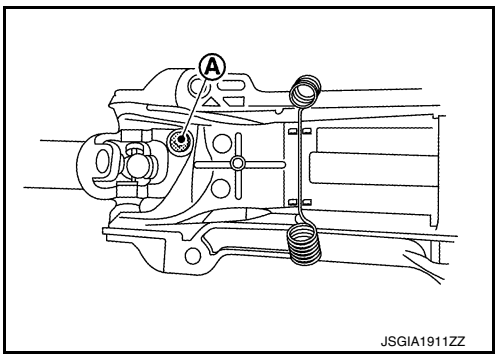
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REMOVAL

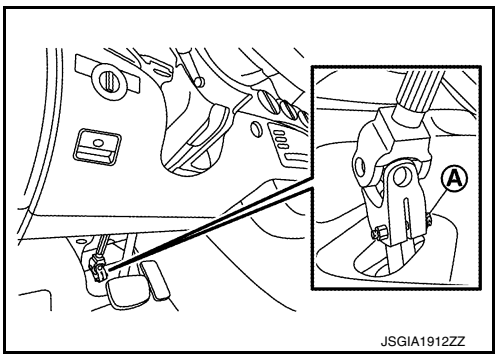
1. Remove cover mounting nut Ⓐ, and remove cover ①.
2. Remove knee air bag module. Refer to SR-27, "Removal and Installation".



3. Turn steering wheel and move steering shaft mounting bolt Ⓐ to assembly position, remove steering shaft mounting bolt (steering column assembly side).



4. Remove steering shaft mounting bolt Ⓐ (steering gear side).
5. Set the front wheels to straight-ahead position and fix steering wheel at center position.
6. Remove steering shaft.
7. Perform inspection after removal. Refer to ST-12, "Inspection".

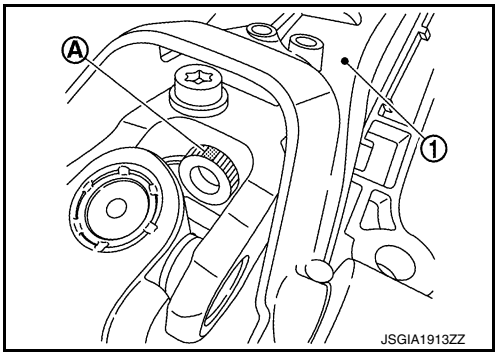


INSTALLATION

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

CAUTION:

- **steering column control module 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.**
- **Never reuse steering shaft mounting bolt (steering gear side).**
- Observe locking splines Ⓐ on steering column ①.
- Perform inspection after installation. Refer to ST-12, "Inspection".



Inspection

INFOID:0000000013557415

INSPECTION AFTER REMOVAL

Check the following items and replace, if necessary.

- Check each part of steering shaft for damage or other malfunctions. Replace if there are any abnormal conditions.

INSPECTION AFTER INSTALLATION

Check the following items and replace, if necessary.

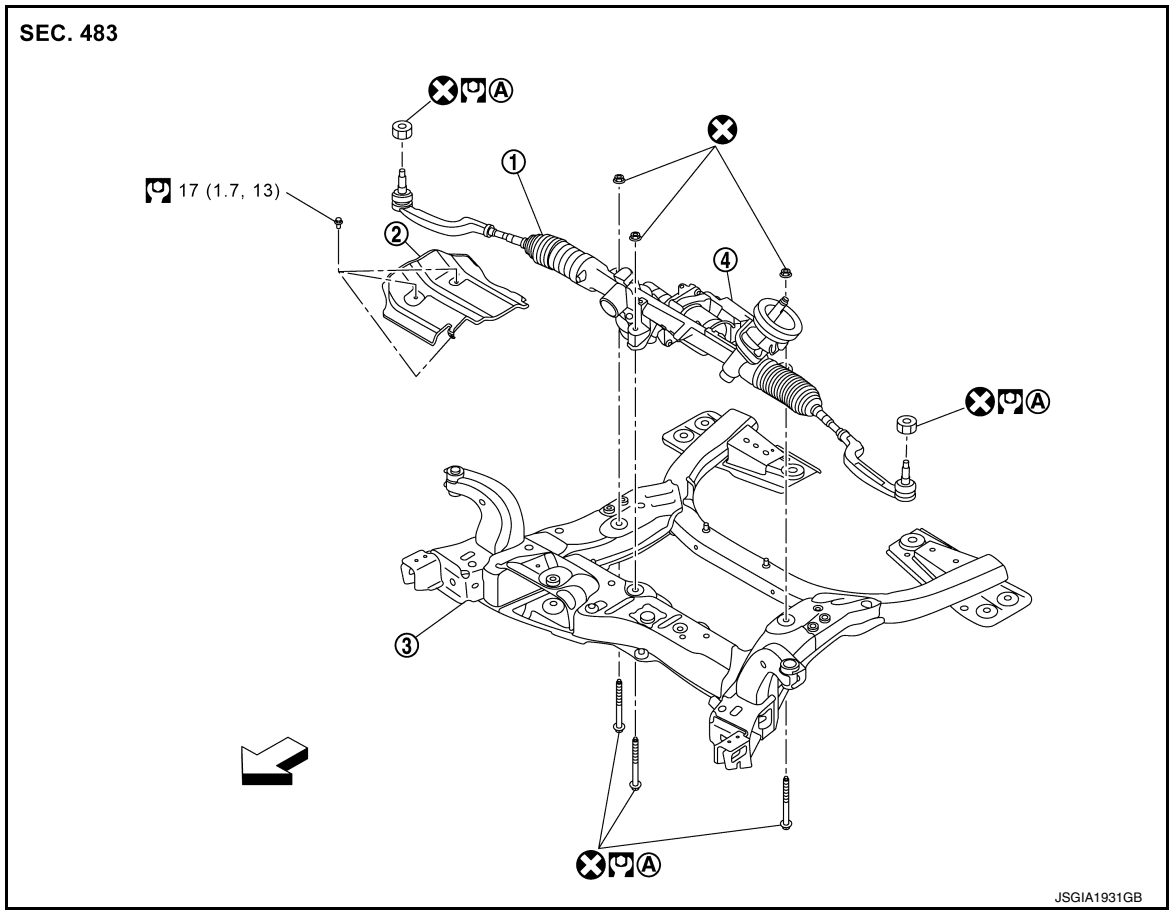
- Check each part of steering shaft for damage or other malfunctions. Replace if there are any abnormal conditions.
- Rotate steering wheel to check for decentered condition, binding, noise, or excessive steering effort.

STEERING GEAR AND LINKAGE

Exploded View

INFOID:0000000013557416

REMOVAL



① Steering gear assembly ② Heat insulator ③ Front suspension member
④ EPS control unit

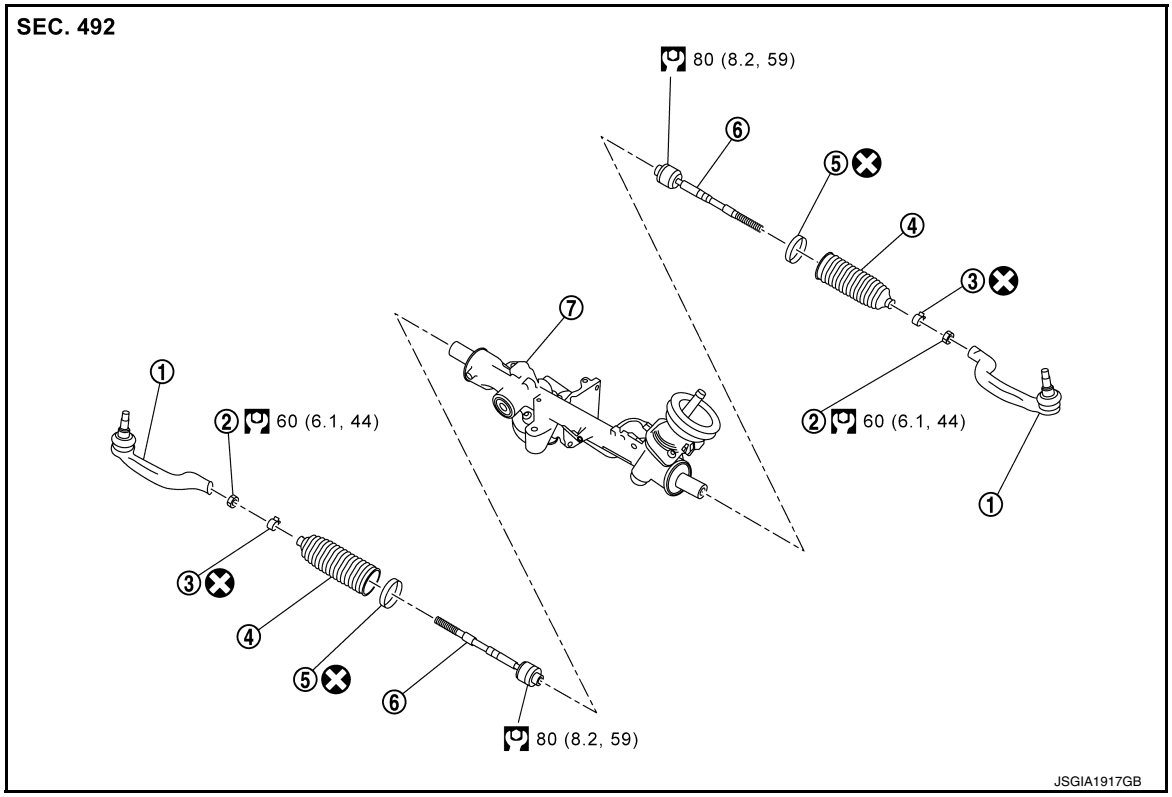
Ⓐ: Tightening must be done following the installation procedure. Refer to ST-14, "Removal and Installation".

⇦: Vehicle front

: Always replace after every disassembly.

: N·m (kg-m, ft-lb)

DISASSEMBLY



① Outer socket
② Outer socket lock nut
③ Boot clamp (small diameter)
④ Boot
⑤ Boot clamp (large diameter)
⑥ Inner socket
⑦ Gear housing assembly

: Always replace after every disassembly.

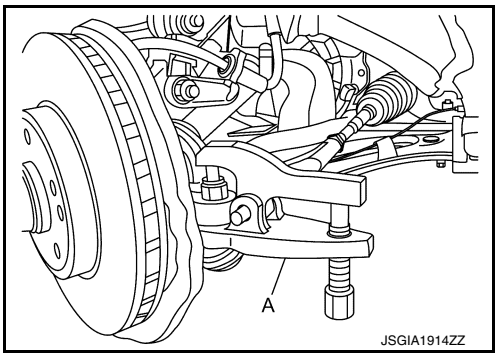
: N·m (kg-m, ft-lb)

Removal and Installation

INFOID:0000000013557417

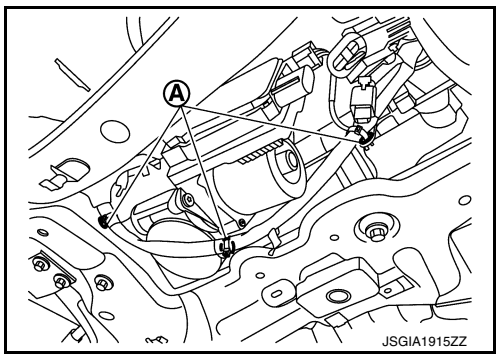
REMOVAL

1. Remove front tires. Refer to WT-70, "Exploded View".
2. Remove engine under cover. Refer to EXT-44, "ENGINE UNDER COVER : Removal and Installation".
3. Loosen outer socket mounting nut, and remove outer socket from steering knuckle so as not to damage ball joint boot using a ball joint remover (commercial service tool) (A).
   CAUTION:
   - **Temporarily tighten the nut to prevent damage to threads and to prevent the ball joint remover from sudden drop turning.**
   - **Never damage the boot of ball joint.**

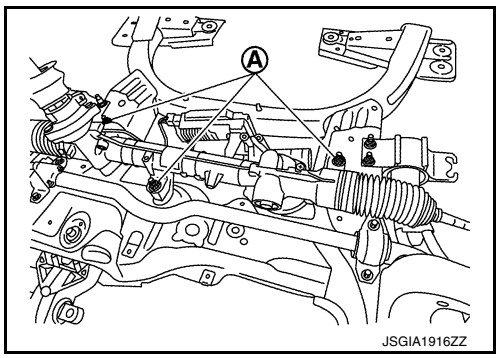


4. Loosen outer socket lock nut, and remove outer socket if necessary.
   NOTE:
   After loosening, do not twist the outer socket lock nut anymore on the inner socket.
5. Remove steering shaft mounting bolt (steering gear side). Refer to ST-11, "Removal and Installation".
6. Separate steering shaft from steering gear assembly. Refer to ST-11, "Removal and Installation".
7. Disconnect EPS control unit harness connectors. Refer to STC-57, "Removal and Installation".

8. Remove clamps Ⓐ of EPS control unit harness.
9. Remove front suspension member assembly. Refer to FSU-19, "Removal and Installation".
10. Remove heat insulator from front suspension member. (1.6L/ 2.0L TURBO ENGINE) Refer to FSU-19, "Exploded View".
11. Remove heat insulators from front suspension member. Refer to ST-13, "Exploded View".



12. Remove steering gear assembly mounting bolts and nuts Ⓐ.
13. Remove steering gear assembly.



INSTALLATION

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

CAUTION:

- **Never interfere with vehicle body or surrounding parts.**
- **Never damage the spline part of steering gear assembly.**
- Install steering gear assembly with the following procedure.
- Install steering gear assembly to suspension member.
- Install steering gear assembly mounting bolts and nuts.

CAUTION:

Never reuse steering gear assembly mounting bolt and nut.

- Tighten steering gear assembly mounting bolts.

: 40 N·m (4.1 kg-m, 30 ft-lb)

- Turn 180 degrees clockwise (angle tightening).

CAUTION:

Check the tightening angle by using an angle wrench (commercial service tool) or protractor. Never judge by visual inspection without an angle wrench.

- Install outer socket to inner socket.

NOTE:

Screw on outer socket up to nut.

- Install outer socket to steering knuckle with the following procedure.
- Install outer socket to steering knuckle.
- Install outer socket mounting nut.

CAUTION:

Never reuse outer socket mounting nut.

- Tighten outer socket mounting nut.

: 50 N·m (5.1 kg-m, 37 ft-lb)

- Turn 90 degrees clockwise (angle tightening).

CAUTION:

Check the tightening angle by using an angle wrench (commercial service tool) or protractor. Never judge by visual inspection without an angle wrench.

- Perform inspection after installation. Refer to ST-17, "Inspection".

Disassembly and Assembly

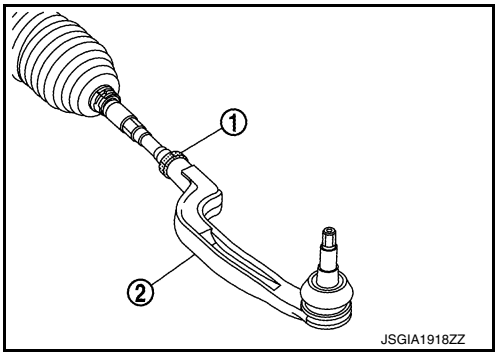
INFOID:0000000013557418

DISASSEMBLY

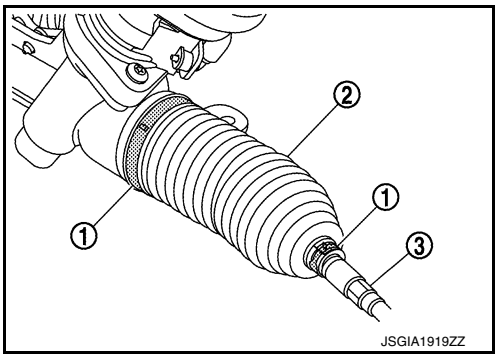
CAUTION:

- **Disassemble and assemble steering gear assembly by fixing the mounting area with a vise using copper plates.**
- **Make sure that the workplace is clean when carrying out the work described below and while performing repairs. Before starting the repair remove any loose soiling from the steering gear assembly without using cleaning agent.**

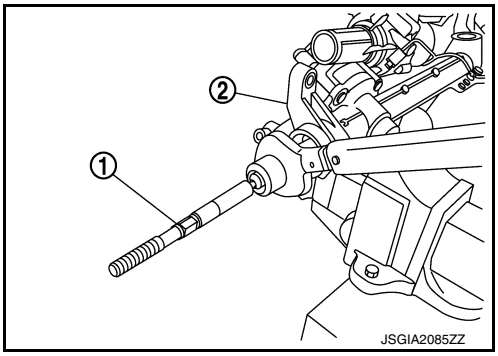
1. Loosen outer socket lock nut ①, and remove outer socket ②.
2. Remove outer socket lock nut.



3. Remove boot clamps ①, and remove boot ② from inner socket ③.



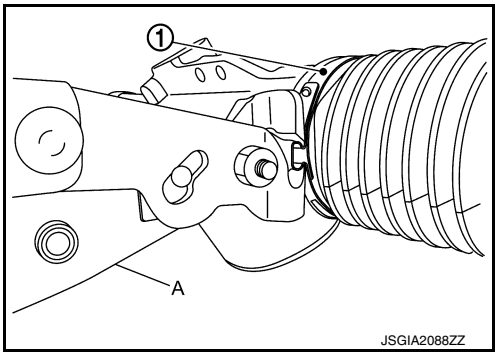
4. Remove inner socket ① from gear housing assembly ②.
5. Perform inspection after disassembly. Refer to ST-17, "Inspection".



ASSEMBLY

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

- Secure the ends of the boot with boot clamp (large diameter) ① using the boot band crimping tool (SST: KV40107300) (A).
  CAUTION:
  Never reuse boot clamp (large diameter).
- Install boot clamp (small diameter).
  CAUTION:
  Never reuse boot clamp (small diameter).



Inspection

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INSPECTION AFTER DISASSEMBLY

Check the following items and replace, if necessary.

Boot

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

Gear Housing Assembly

Check gear housing assembly for damage and scratches. Replace if there are any abnormal conditions.

INSPECTION AFTER INSTALLATION

- Check if steering wheel turns smoothly when it is turned several times fully to the end of the left and right.
- Rotate steering wheel to check for decentered condition, binding, noise, or excessive steering effort.
- Perform test drive when removing steering gear assembly. Refer to STC-26, "Description".
- Check wheel alignment. Refer to FSU-8, "Inspection".

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

Steering Angle

INFOID:0000000013557420

2WD

Item		Standard	
Grade		Except Sport	Sport
Inner wheel	Minimum	33° 45′ (33.75°)	33° 30′ (33.50°)
	Nominal	36° 45′ (36.75°)	36° 30′ (36.50°)
	Maximum	37° 45′ (37.75°)	37° 30′ (37.50°)
Outer wheel		31° 50′ (31.83°)	31° 30′ (31.50°)

AWD

Item		Standard
Inner wheel	Minimum	34° 15′ (34.25°)
	Nominal	37° 15′ (37.25°)
	Maximum	38° 15′ (38.25°)
Outer wheel		32° 15′ (32.25°)