

## SPORTAGE(SL) &gt; 2013 &gt; G 2.0 T-GDI &gt; Steering System

## Steering System &gt; General Information &gt; Specifications

## Specifications

| Item                 |             | Specification               |
|----------------------|-------------|-----------------------------|
| Type                 |             | Motor Driven Power Steering |
| Steering gear        | Type        | Rack & Pinion               |
|                      | Rack stroke | 153mm                       |
| Steering angle(Max.) | Inner       | 39.5°±1.30'                 |
|                      | Outer       | 31.9°                       |

## Tightening Torques

| Item                                       | Tightening torque (kgf.m) |             |               |
|--------------------------------------------|---------------------------|-------------|---------------|
|                                            | Nm                        | kgf.m       | lb-ft         |
| Hub nuts                                   | 88.3 ~ 107.9              | 9.0 ~ 11.0  | 65.1 ~ 79.6   |
| Steering wheel lock nut                    | 39.2 ~ 49.0               | 4.0 ~ 5.0   | 28.9 ~ 36.2   |
| Steering column mounting bolts and nuts    | 12.7 ~ 17.7               | 1.3 ~ 1.8   | 9.4 ~ 13.0    |
| Universal joint to pinion of steering gear | 32.4 ~ 37.3               | 3.3 ~ 3.8   | 23.9 ~ 27.5   |
| Tie rod end castle nut                     | 23.5 ~ 33.3               | 2.4 ~ 3.4   | 17.4 ~ 24.6   |
| Lower arm ball joint bolt and nut          | 98.1 ~ 117.7              | 10.0 ~ 12.0 | 72.3 ~ 86.8   |
| Steering gear box mounting bolts           | 58.8 ~ 78.5               | 6.0 ~ 8.0   | 43.4 ~ 57.9   |
| Stabilizer link nut                        | 98.1 ~ 117.7              | 10.0 ~ 12.0 | 72.3 ~ 86.8   |
| Sub frame mounting bolts & nuts            | 176.5 ~ 196.1             | 18.0 ~ 20.0 | 130.2 ~ 144.7 |
| Roll rod mounting bolt & nut               | 107.9 ~ 127.5             | 11.0 ~ 13.0 | 79.6 ~ 94.0   |

## Steering System &gt; Electric Power Steering &gt; Description and Operation

## Description

EPS (Electric power steering, Column assist type) system uses an electric motor to assist the steering force and it is an engine operation independent steering system.

EPS control module controls the motor operation according to information received from the each sensor and CAN (Controller Area Network),

resulting in a more precise and timely control of steering assist than conventional engine-driven hydraulic systems.

Components (Steering Angle Sensor, Torque Sensor, Fail-safe relay, etc.) of the EPS system are located inside the steering column & EPS unit assembly.

The steering column & EPS unit assembly must not be disassemble to inspect.

The replace them.

**Note With Regard to diagnosis**

| Trouble factor               | Check item    | Trouble symptom                                                        | Explanation                                                                                                                                                                                                             | Note                                                                                                                                                                        |
|------------------------------|---------------|------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Drop, impact, and overload   | Motor         | Abnormal noise                                                         | - Visible or unvisible damage can occur. The steering wheel could pull to one side by using the dropped parts.- Precise parts of motor/ECU are sensitive to vibration and impact.- Overload can cause unexpected damage | - Do not use the impacted EPS.- Do not overload each parts.                                                                                                                 |
|                              | ECU           | Circuit damage- Wrong welding point- Broken PCB- Damaged precise parts |                                                                                                                                                                                                                         |                                                                                                                                                                             |
|                              | Torque sensor | Insufficient steering effort                                           | Overload to INPUT shaft can cause malfunction of the torque sensor                                                                                                                                                      | - Do not impact the connecting parts (When inserting and torquing)- Use the specified tool to remove the steering wheel. (Do not hammer on it)- Do not use the impacted EPS |
|                              | Shaft         | Insufficient steering effort (Uneven between LH and RH)                |                                                                                                                                                                                                                         | Do not use the impacted EPS                                                                                                                                                 |
| Pull/Dent                    | Harness       | - Malfunction- impossible power operation- Malfunction of EPS          | Disconnection between harness connecting portion and harness                                                                                                                                                            | Do not overload the harness                                                                                                                                                 |
| Abnormal storage temperature | Motor/ECU     | Abnormal steering effort by improper operation of the motor/ECU        | - Waterproof at the normal condition- Even a little moisture can cause malfunction of the precise parts of the motor/ECU                                                                                                | - Keep the normal temperature and proper moisture, while storing- Avoid drowning                                                                                            |

1. Do not impact the electronic parts, if they are dropped or impacted, replace them with new ones.
2. Avoid heat and moisture to the electronic parts.
3. Do not contact the connect terminal to avoid deformation and static electricity.
4. Do not impact the motor and torque sensor parts, if they are dropped or impacted, replace them with new ones.
5. The connector should be disconnected or connected with IG OFF.

**Steering System > Electric Power Steering > Repair procedures****General Inspection**

After or before servicing the EPS system, perform the troubleshooting and test procedure as follows. Compare the

system condition with normal condition in the table below and if abnormal symptom is detected, perform necessary remedy and inspection.

| Test condition | Normal condition: Motor must not supply steering assist. |                        |                                                |
|----------------|----------------------------------------------------------|------------------------|------------------------------------------------|
|                | Symptom                                                  | Possible cause         | Remedy                                         |
| IG Off         | Motor supplies steering assist.                          | ASP is not calibrated. | Perform the ASP calibration using a scan tool. |
|                |                                                          | IG power supplies      | Inspect the IG power supply line.              |

| Test condition   | Normal condition: Motor must not supply steering assist, Warning lamp is illuminated. |                                 |                                                |
|------------------|---------------------------------------------------------------------------------------|---------------------------------|------------------------------------------------|
|                  | Symptom                                                                               | Possible cause                  | Remedy                                         |
| IG On/Engine Off | Motor supplies steering assist.                                                       | ASP is not calibrated.          | Perform the ASP calibration using a scan tool. |
|                  |                                                                                       | EMS CAN signal is not received. | Inspect the CAN line.                          |
|                  | Warning lamp is not illuminated.                                                      | Cluster fault                   | Inspect the cluster and cluster harness        |

| Test condition  | Normal condition: Motor supplies steering assist, Warning lamp is not illuminated. |                                                     |                                                                                        |
|-----------------|------------------------------------------------------------------------------------|-----------------------------------------------------|----------------------------------------------------------------------------------------|
|                 | Symptom                                                                            | Possible cause                                      | Remedy                                                                                 |
| IG On/Engine On | Warning lamp is illuminated and Motor does not supply steering assist.             | EPS (Hot at all times) and IG power supply fault    | Inspect the connector and harness for EPS (Hot at all times) and IG power supply line. |
|                 |                                                                                    | DTC is detected by system.                          | Perform the self test using a scan tool and repair or replace.                         |
|                 | Warning lamp is illuminated and Motor supplies steering assist.                    | ASP is not calibrated.                              | Perform the ASP calibration using a scan tool.                                         |
|                 |                                                                                    | CAN communication between EPS and cluster is fault. | Inspect the CAN line.                                                                  |

ASP: Absolute Steering Position

CAN: Controller Area Network

EMS: Engine Management System

#### CAUTION

If there is no EPS warning light illumination, then there is not malfunction of EPS system.

The following symptoms may occur during normal vehicle operation.

- After turning the ignition switch on, the steering wheel becomes stiffer while it performs EPS system diagnostics for about 2 seconds, then it becomes normal steering condition.
- After turning the ignition switch on or off, EPS relay noise may occur but it is normal.
- While steered, when the vehicle is stopped or in low driving speed, motor noise may occur but it is normal operation.

Caution when ASP (Absolute Steering Position) calibration or EPS type recognition

- Check if the battery is fully charged before ASP calibration or EPS type recognition.

- Be careful not to disconnect any cables connected to the vehicle or scan tool during ASP calibration or EPS type recognition.
- When the ASP calibration or EPS type recognition is completed, turn the ignition switch off and wait for several seconds, then start the engine to confirm normal operation of the vehicle.

#### Scan tool (Hi-Scan Pro) installation

1. Attach the CAN interface module to the Hi-Scan Pro main body and securely tighten the two bolts.
2. Install the CAN interface module to the Data Link Cable and securely tighten the two bolts.

#### ASP Calibration Using GDS

1. Select "Steering Angle Sensor".
2. Proceed with the test according to the screen introductions.



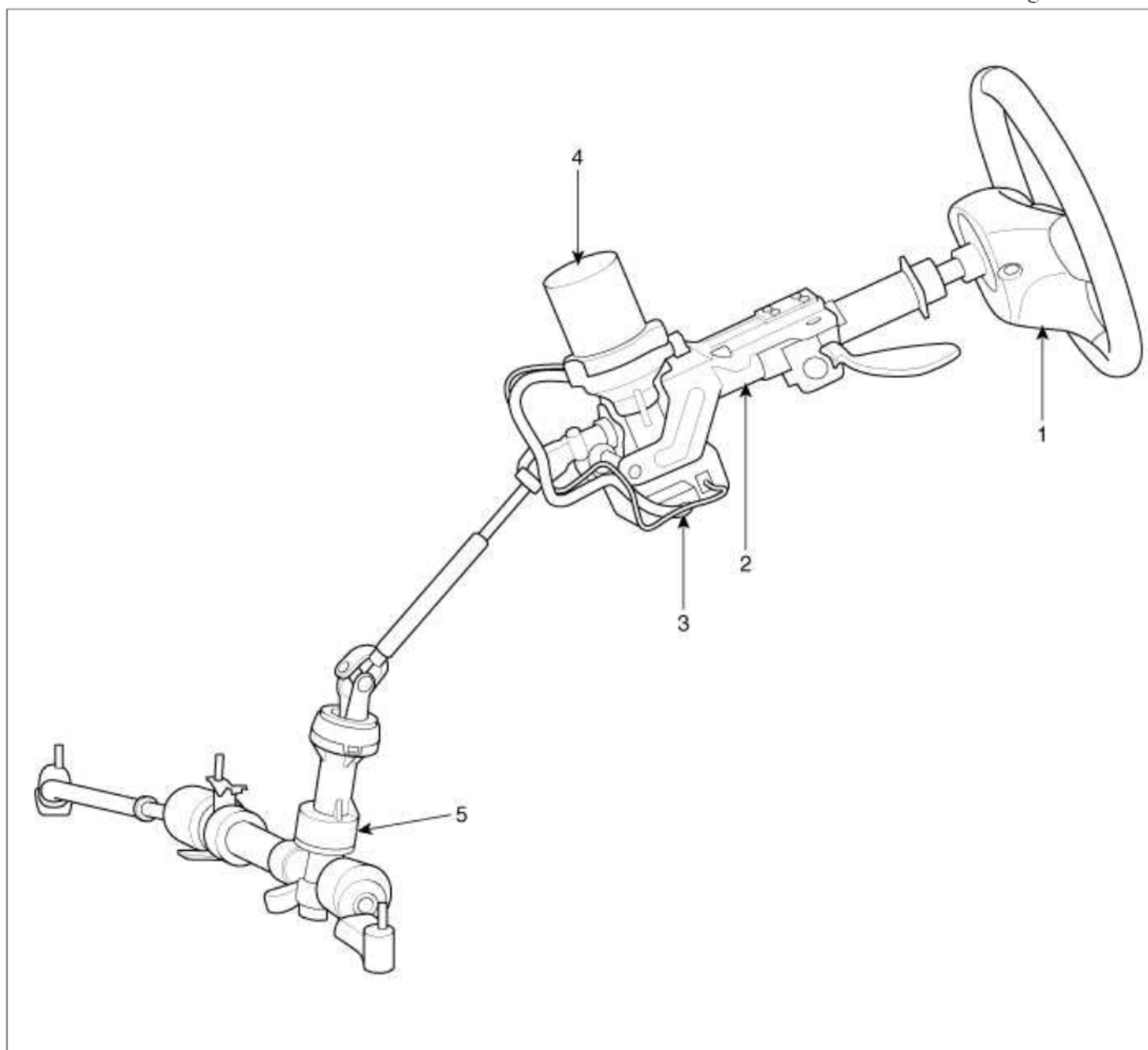
#### EPS Type Recognition Procedure

1. Select "EPS Variant Coding".
2. Proceed with the test according to the screen introductions.



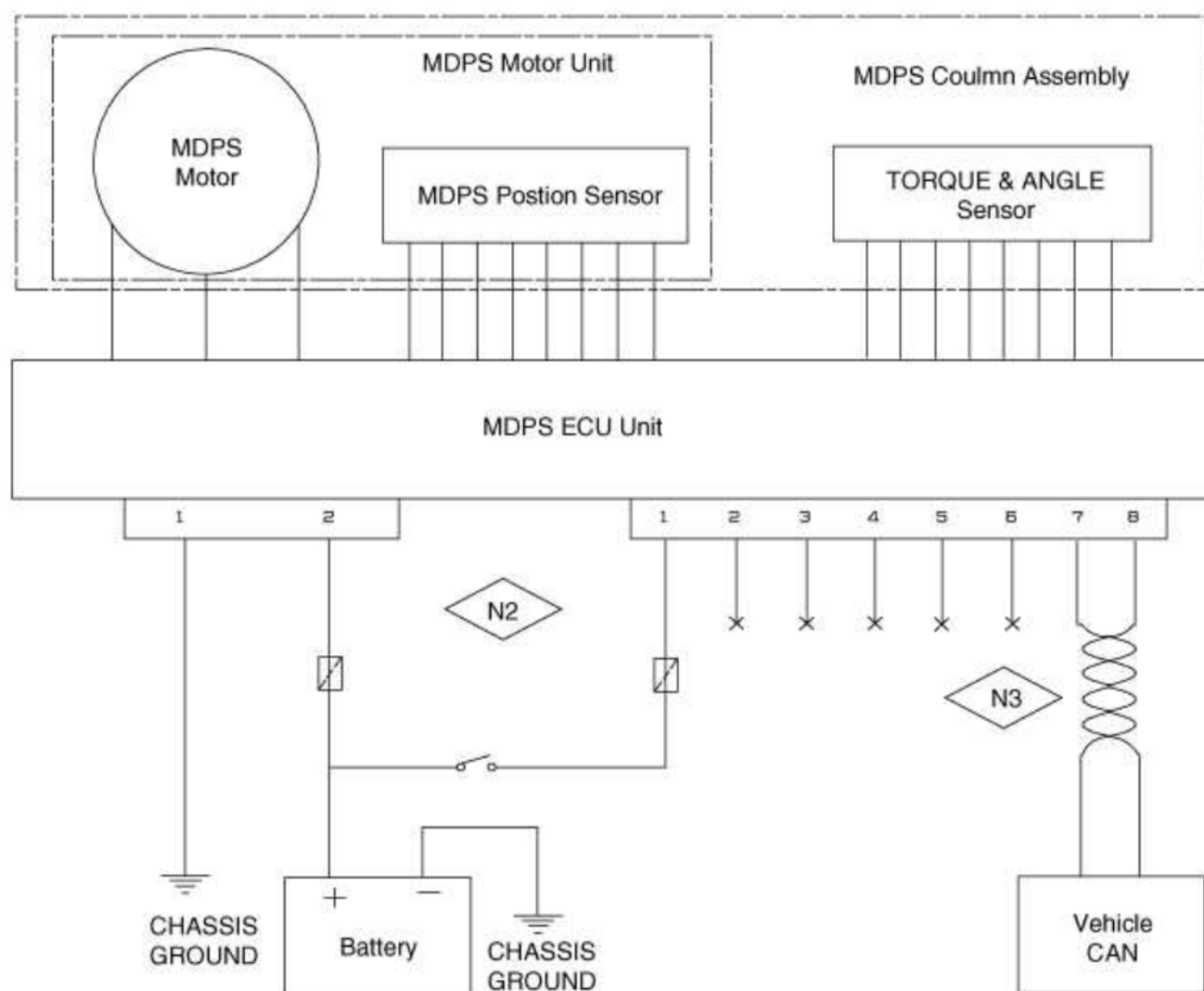
### Steering System > Electric Power Steering > Components and Components Location

#### Components

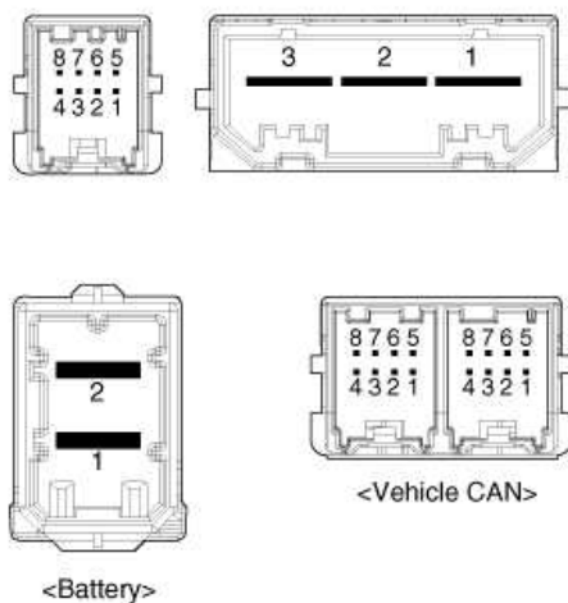


- |                    |                      |
|--------------------|----------------------|
| 1. Steering wheel  | 4. Motor             |
| 2. Steering column | 5. Steering gear box |
| 3. ECU             |                      |

### MDPS Circuit Diagram



## Harness Connector

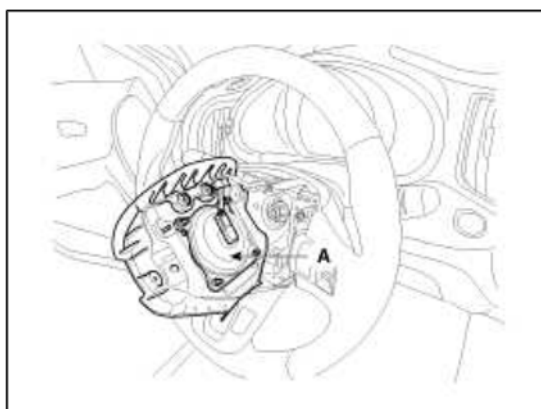


| Type    | Pin No | Description |
|---------|--------|-------------|
| Battery | 1      | Battery -   |
|         | 2      | Battery +   |
| Vehicle | 1      | IGN         |
|         | 2      | -           |
|         | 3      | -           |
|         | 4      | -           |
|         | 5      | -           |
|         | 6      | -           |
|         | 7      | High_CAN    |
|         | 8      | Low_CAN     |

### Steering System > Electric Power Steering > Steering Column and Shaft > Repair procedures

#### Replacement

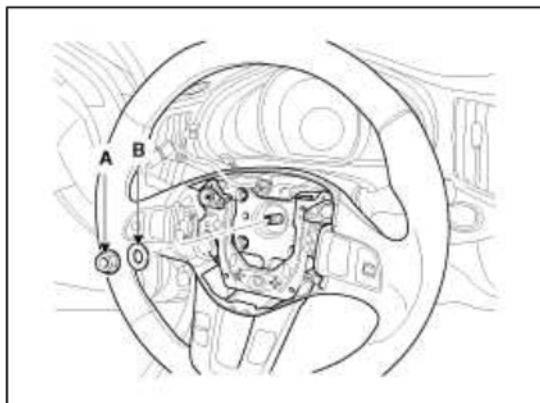
1. Disconnect the battery negative cable from the battery and then wait for at least 30 seconds.
2. Turn the steering wheel so that the front wheels can face straight ahead.
3. Remove the airbag module (A).  
(Refer to "Airbag Module" in RT group)



4. Disconnect the locknut (A) & washer (B) and then remove the steering wheel from the steering column shaft.

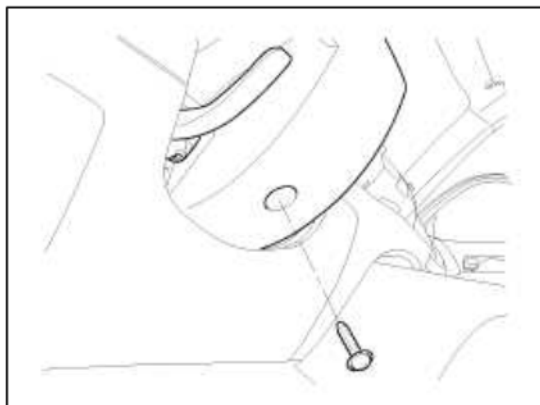
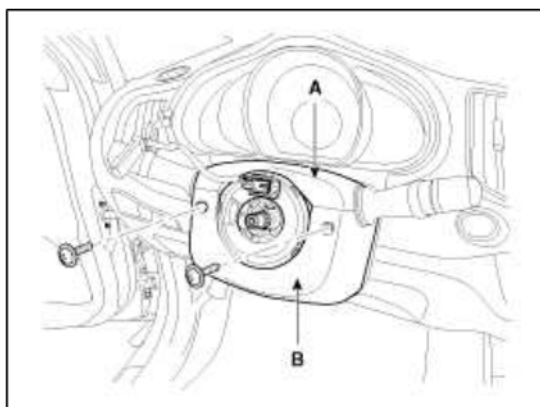
**Tightening torque :**

39.2 ~ 49.0N.m (4.0 ~ 5.0kgf.m, 28.9 ~ 36.2lb-ft)

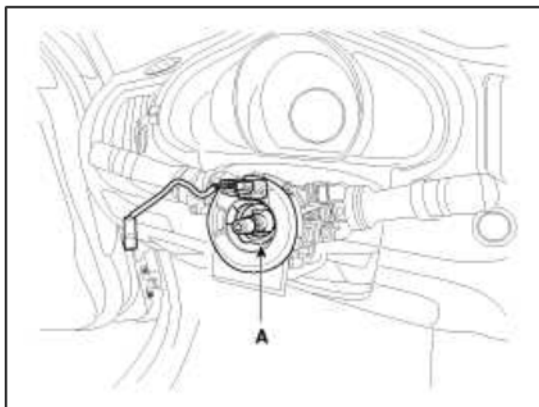
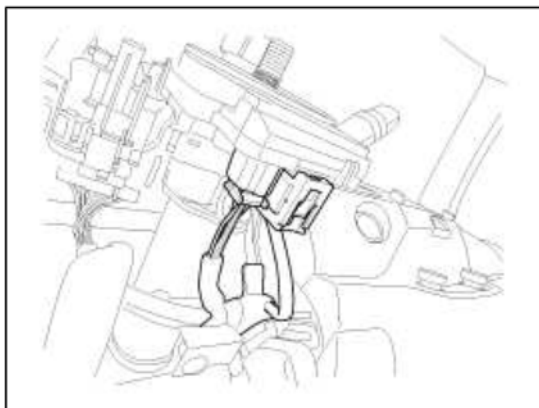
**CAUTION**

Do not hammer on the steering wheel to remove it may damage the steering column.

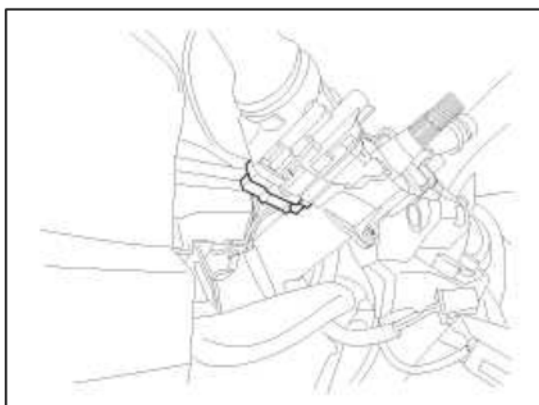
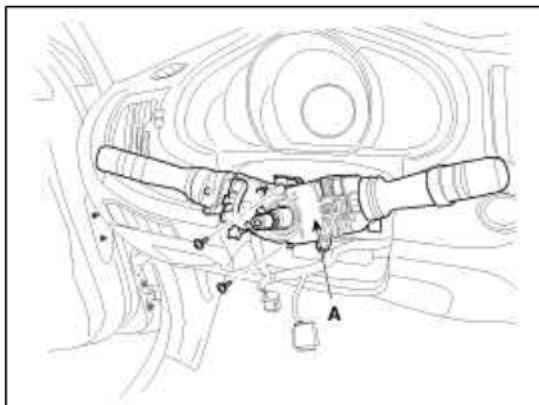
5. Remove the steering column upper (A) and lower (B) shroud.

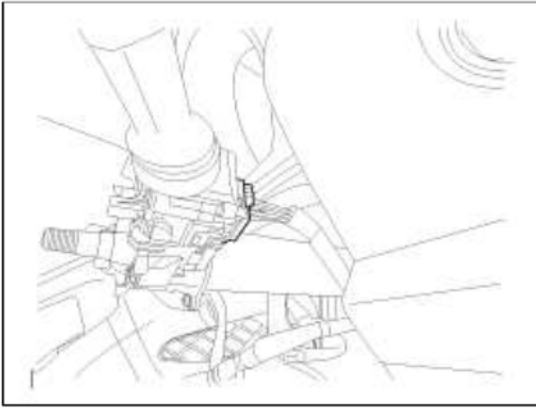


6. Remove the clock spring (A).

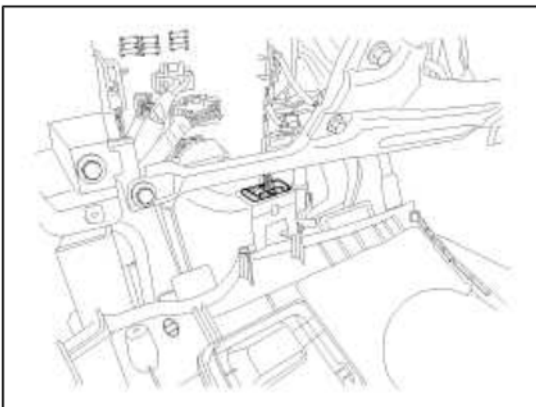
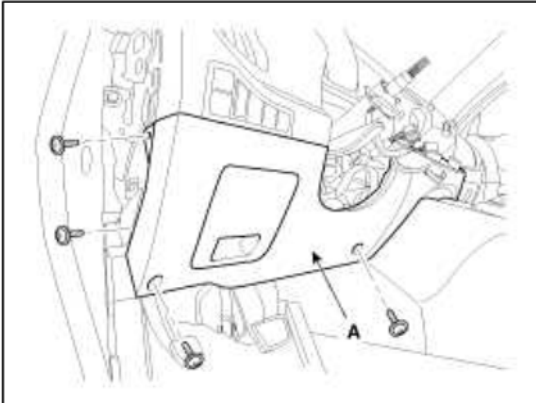
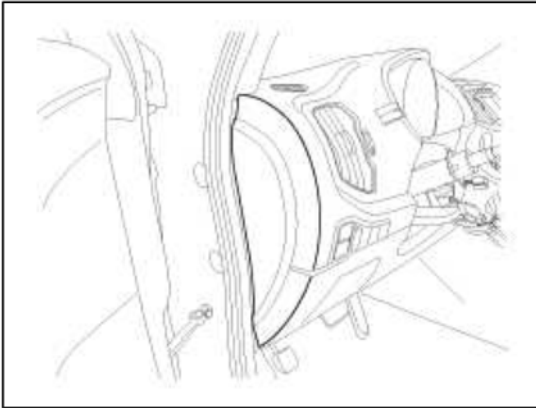


7. Remove the multifunction switches (A).

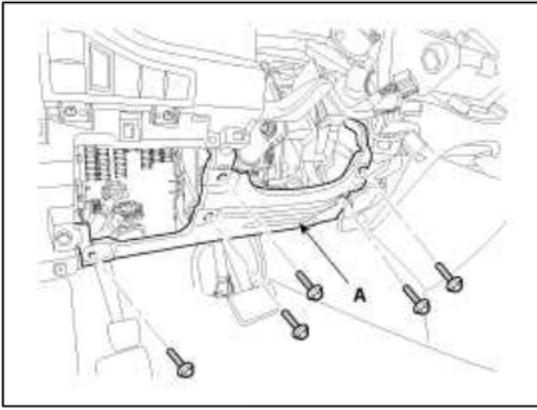




8. Remove the crash lower panel (A).



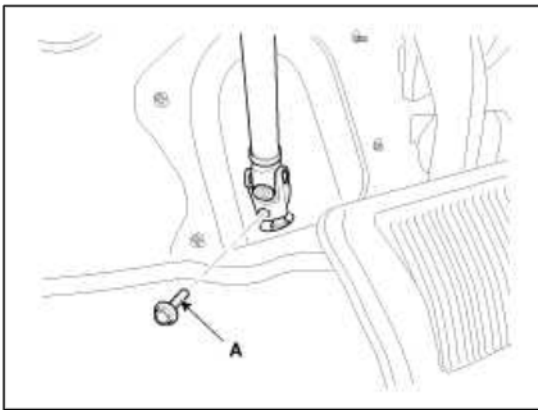
9. Loosen the bolt & nut and then remove the panel (A).



10. Remove the dust cover.  
11. Loosen the bolt (A) and then disconnect the universal joint assembly from the pinion of the steering gear box.

**Tightening torque :**

32.4 ~ 37.3N.m (3.3 ~ 3.8kgf.m, 23.9 ~ 27.5lb-ft)



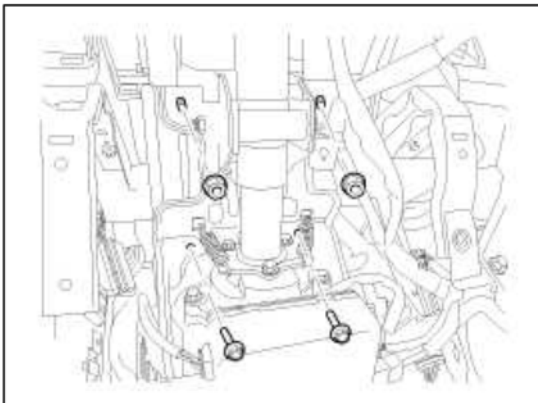
**CAUTION**

- Do not use the bolt again.

12. Disconnect all connectors connected the steering column.  
13. Remove the steering column by loosening the mounting bolts and nuts..

**Tightening torque :**

12.7 ~ 17.7N.m (1.3 ~ 1.8kgf.m, 9.4 ~ 13.0lb-ft)

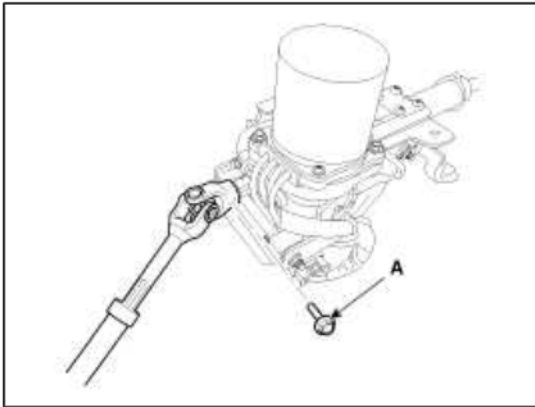


14. Installation is the reverse of the removal.

## Disassembly

### Universal joint assembly

1. Loosen the bolt (A) and then disconnect the universal joint assembly from the steering column assembly.



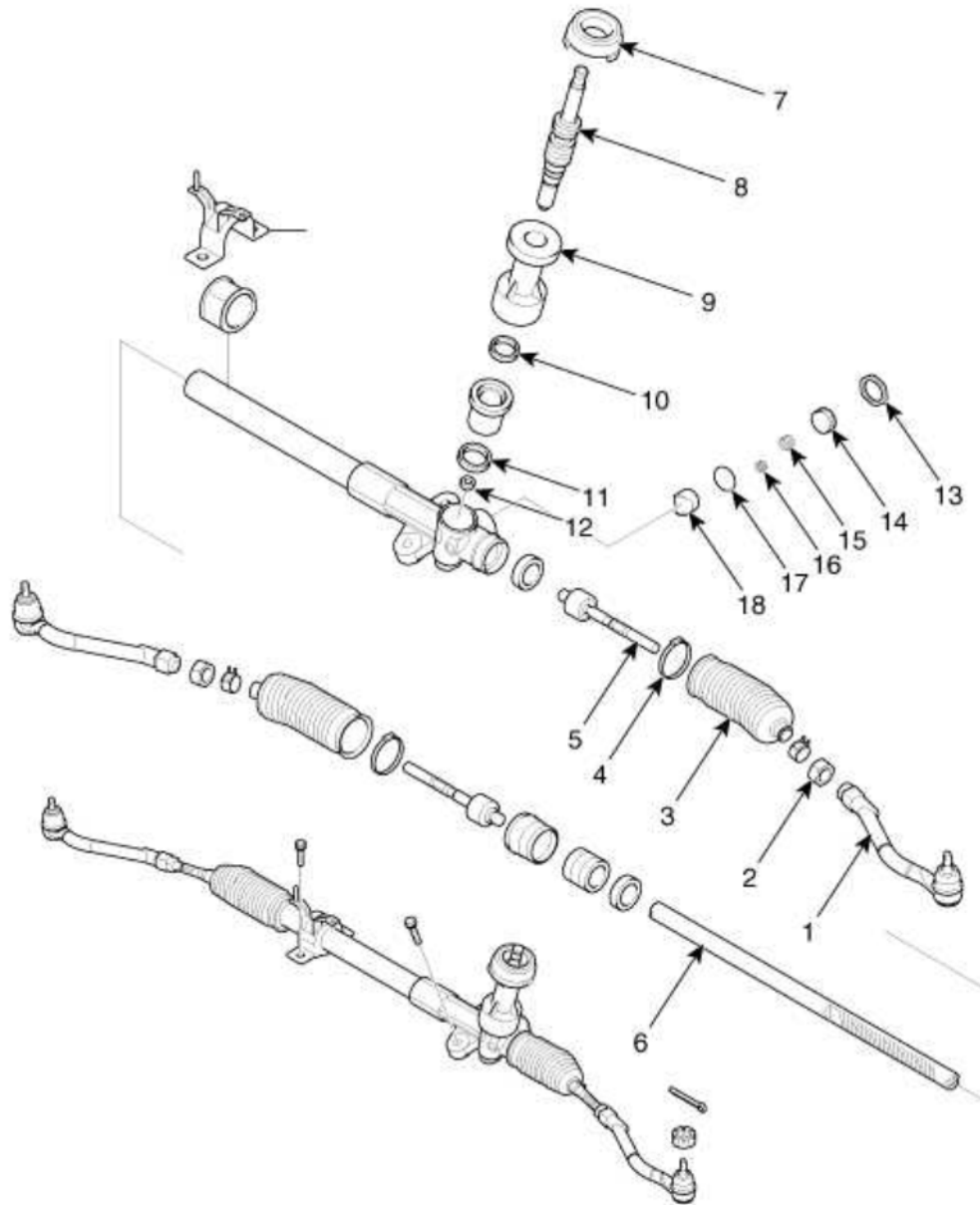
2. Reassembly is the reverse of the disassembly.

## Inspection

1. Check the steering column for damage and deformation.
2. Check the joint bearing for damage and wear.
3. Check the tilt bracket for damage and cracks.
4. Check the key lock assembly for proper operation and replace it if necessary.

**Steering System > Electric Power Steering > Steering Gear box > Components and Components Location**

## Components



|                 |                    |                           |
|-----------------|--------------------|---------------------------|
| 1. Tie rod end  | 7. Dust packing    | 13. Lock nut              |
| 2. Lock nut     | 8. Pinion assembly | 14. Yoke plug             |
| 3. Bellows      | 9. Dust cap        | 15. Yoke spring           |
| 4. Bellows band | 10. Oil seal       | 16. O-ring                |
| 5. Tie rod      | 11. Ball bearing   | 17. Spring                |
| 6. Rack bar     | 12. Needle bearing | 18. Support yoke assembly |

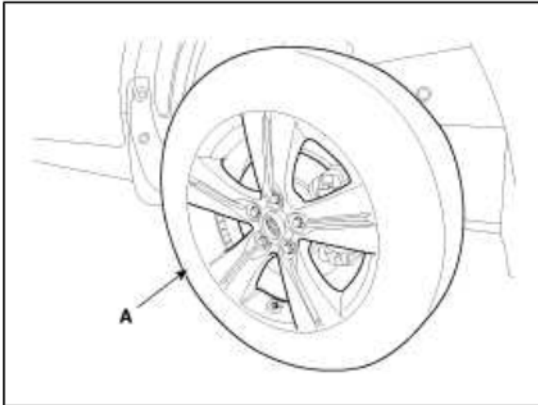
### Steering System > Electric Power Steering > Steering Gear box > Repair procedures

Replacement

1. Remove the front wheel & tire.

**Tightening torque :**

88.3 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)



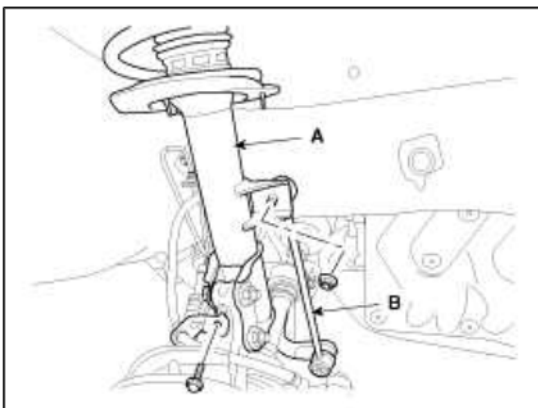
**CAUTION**

Be careful not to damage to the hub bolts when removing the front wheel & tire (A).

2. Disconnect the stabilizer link (B) with the front strut assembly (A) after loosening the nut.

**Tightening torque :**

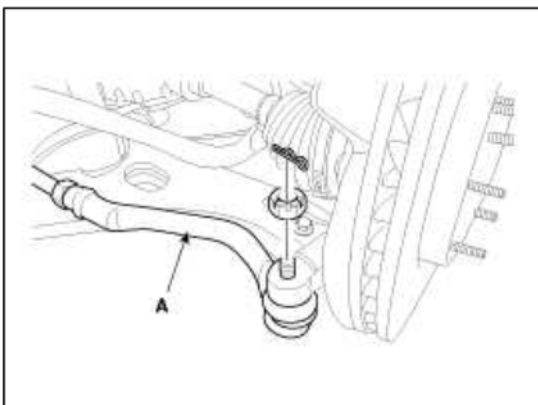
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



3. Remove the split pin and castle nut and then disconnect the tie-rod end (A) from the front knuckle.

**Tightening torque :**

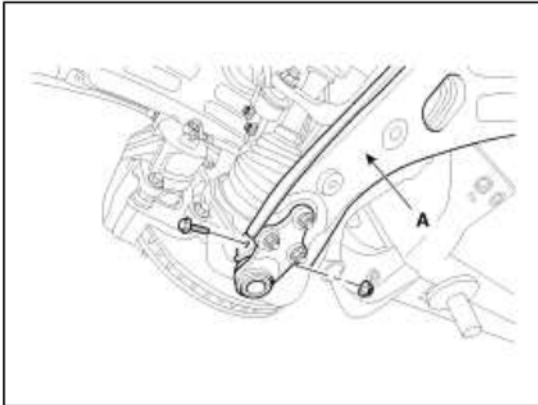
23.5 ~ 33.3N.m(2.4 ~ 3.4kgf.m, 17.4 ~ 24.6lb-ft)



4. Loosen the bolt & nut and then remove the lower arm (A).

**Tightening torque :**

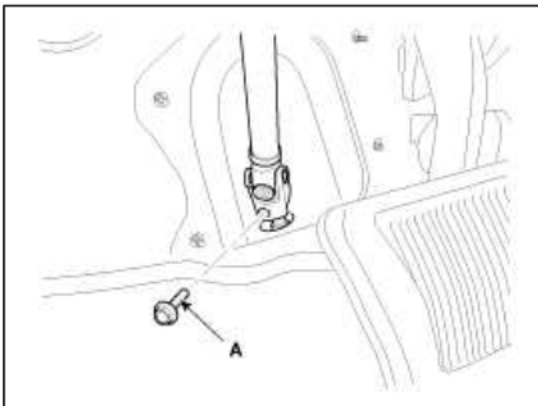
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



5. Remove the dust cover.  
6. Loosen the bolt (A) and then disconnect the universal joint assembly from the pinion of the steering gear box.

**Tightening torque :**

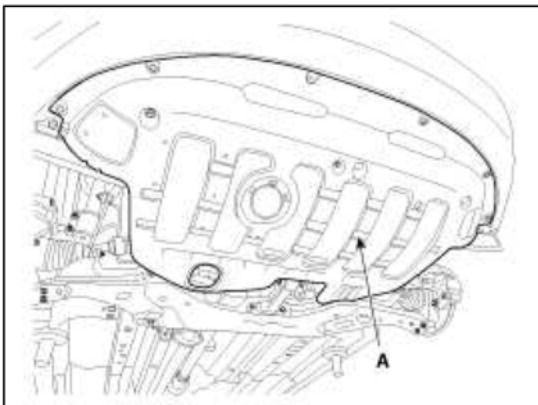
32.4 ~ 37.3N.m (3.3 ~ 3.8kgf.m, 23.9 ~ 27.5lb-ft)



**CAUTION**

- Keep the neutral-range to prevent the damage of the clock spring inner cable when you handle the steering wheel.
- Do not use the bolt again.

7. Remove the under cover (A).



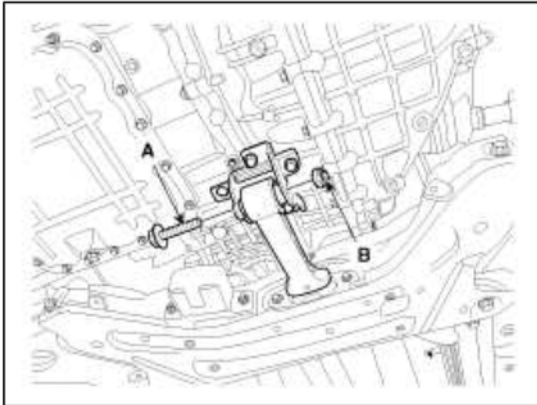
8. Loosen the bolt (A) & nut (B) and then remove the roll rod stopper.

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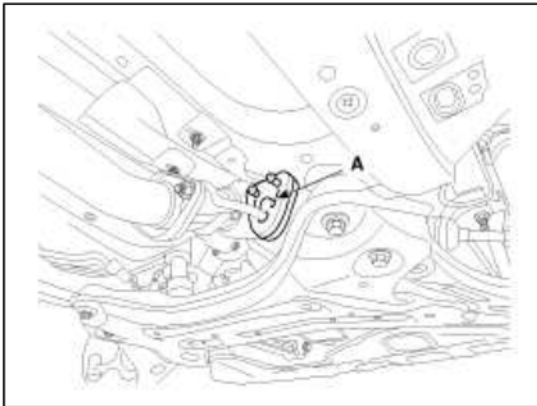
**Tightening torque :**

107.9 ~ 127.5N.m (11.0 ~ 13.0kgf.m, 79.6 ~ 94.0lb-ft)

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9. Disconnect the muffler rubber hanger (A).



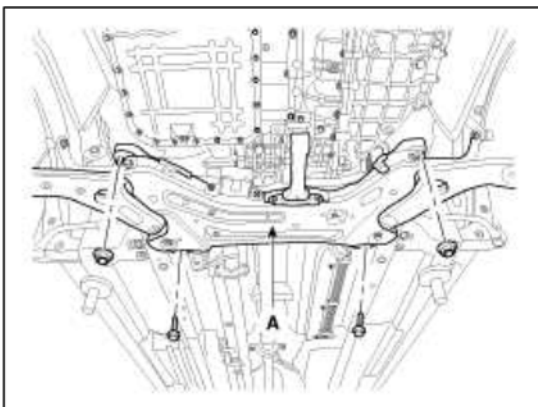
10. Loosen the bolts & nuts and then remove the sub frame.

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**Tightening torque :**

176.5 ~ 196.1N.m (18.0 ~ 20.0kgf.m, 130.2 ~ 144.7lb-ft)

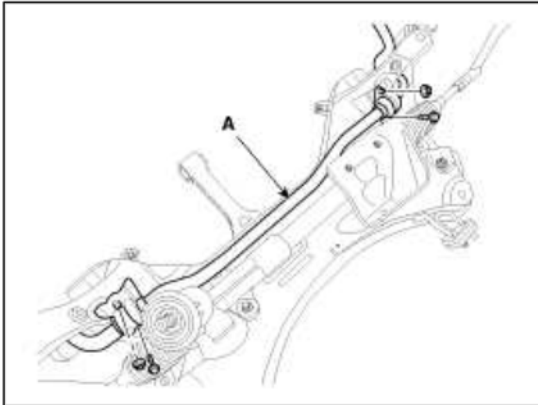
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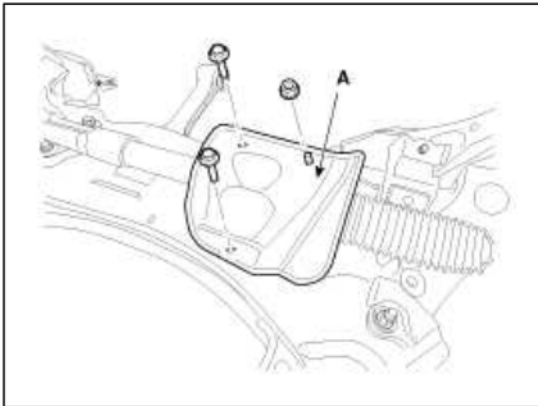
11. Loosen the bolt and then remove the stabilizer (A).

**Tightening torque :**

44.1 ~ 53.9N.m (4.5 ~ 5.5kgf.m, 32.5 ~ 39.8lb-ft)



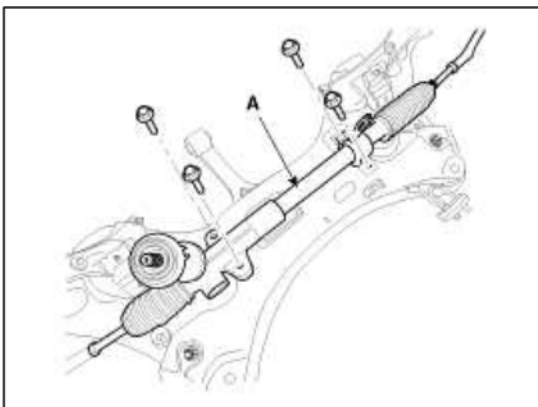
12. Loosen the bolt & nut and then remove the protector (A).



13. Loosen the bolt and then remove the steering gear box (A).

**Tightening torque :**

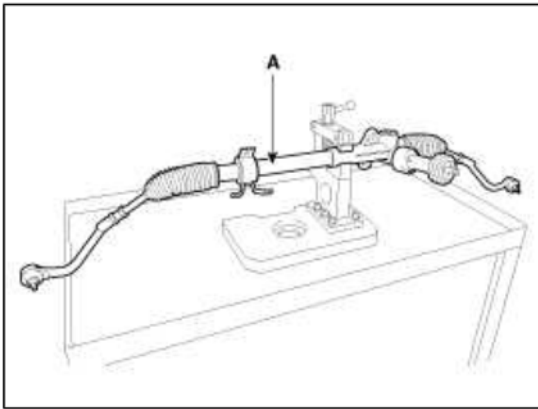
58.8 ~ 78.5N.m (6.0 ~ 8.0kgf.m, 43.4 ~ 57.9lb-ft)



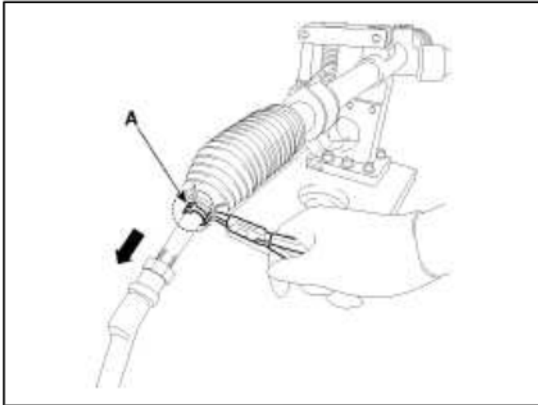
14. Installation is the reverse of the removal.

Disassembly

1. Fix the steering gear box assembly (A) on the vice.

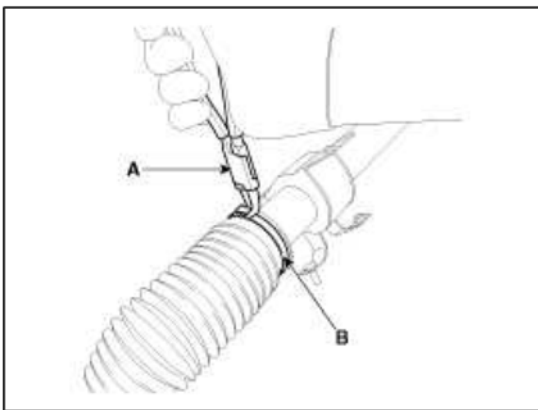


2. Remove the bellows clip (A) in the direction of the arrow. (The left and right same work.)

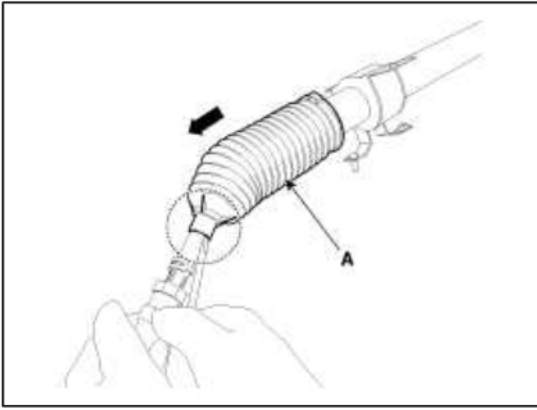


3. Give space to bellows bend (B) by using the ring pliers (A). (The left and right same work)

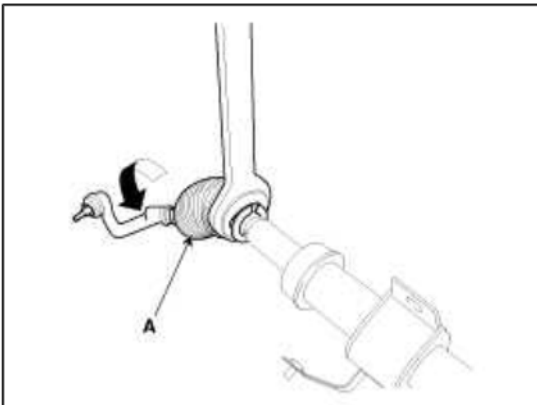
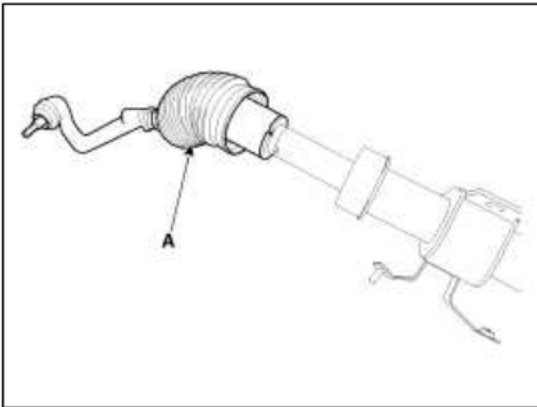
| Ring pliers work                                                                    |                                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Bellows bend<br>(Before shape)                                                      | Bellows bend<br>(After shape)                                                       |
|  |  |



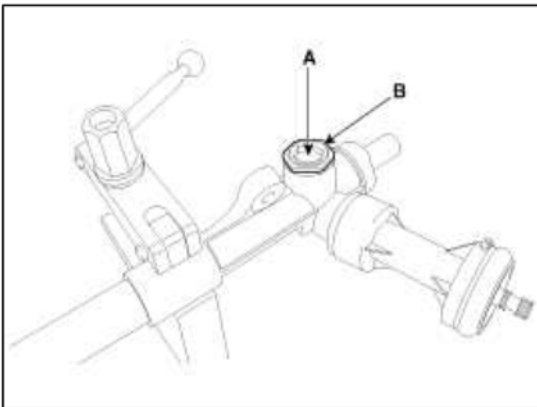
4. After making the space to the bellows and tie-rod end contact part by using the (-) driver, remove the bellows (A) in the direction of the arrow. (The left and right same work)

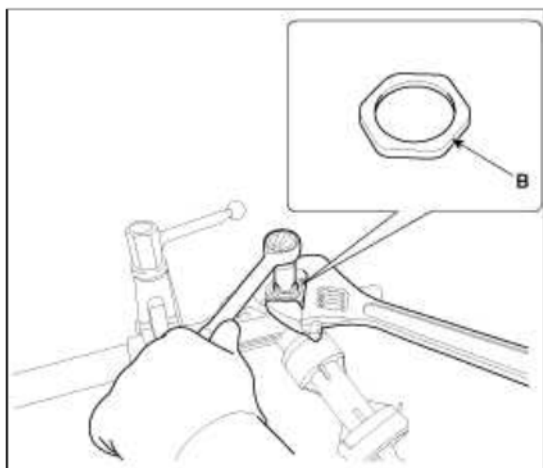


5. Remove the tie-rod & tie-rod end assembly (A). (The left and right same work)

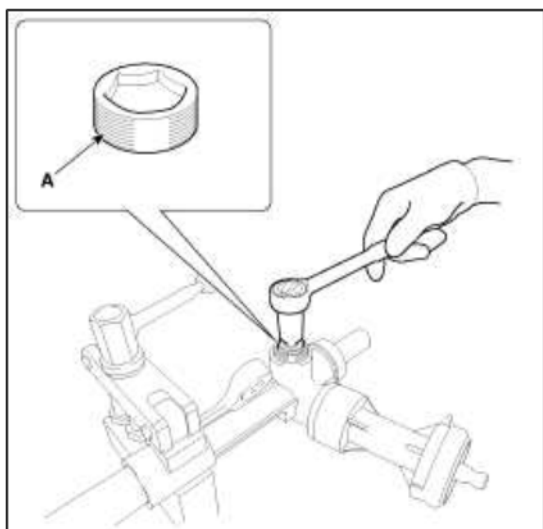


6. After fixing the yoke plug (A), remove the rock nut (B).





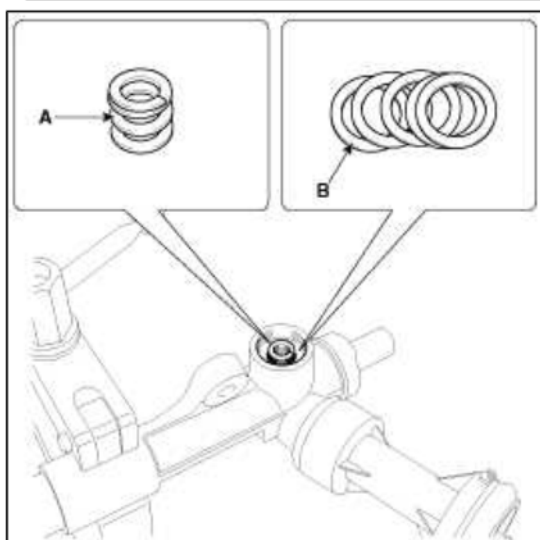
7. Remove the yoke plug (A).



8. Remove the yoke spring (A) and leaf spring (B).

**NOTE**

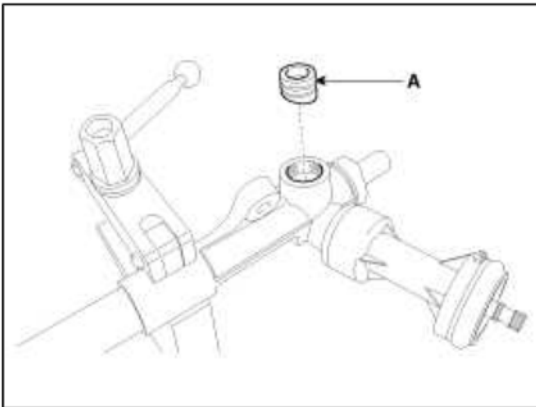
- Note that there may be urethane pads or back side of O-ring in place of leaf spring.
- The number of leaf spring can be differs from depending on vehicle.



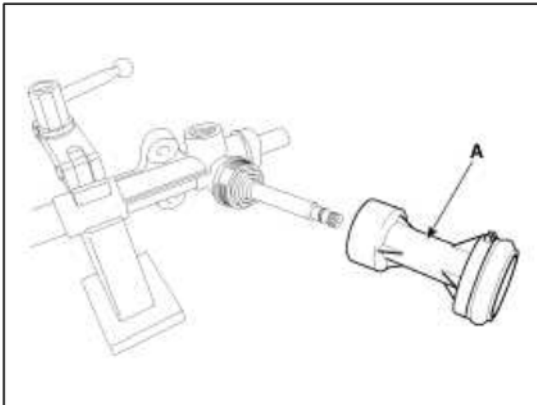
9. Remove the support yoke assembly (A) from the inner lack hosing.

**NOTE**

- In case of support yoke assembly (A), the number and availability of O-ring can differ from depending on vehicle.



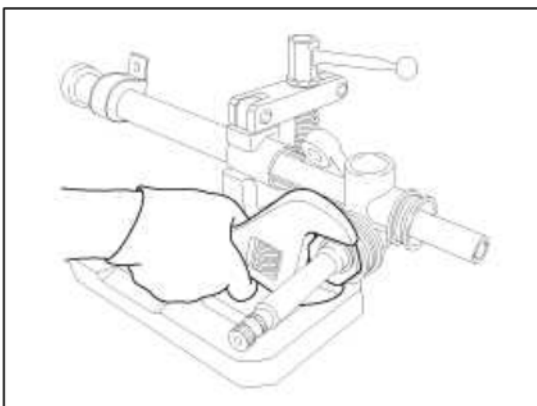
10. Remove the dust packing & cap (A).

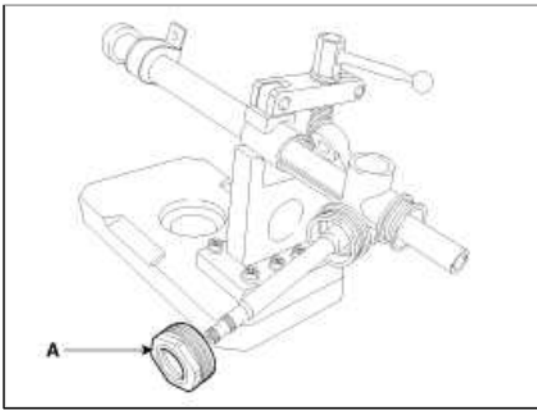


11. Remove the top plug (A) by using the spanner.

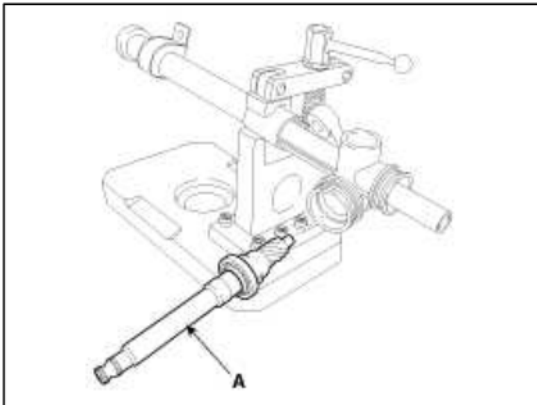
**CAUTION**

- When removing the top plug, top plug is made of aluminum, so be careful to avoid distortion.

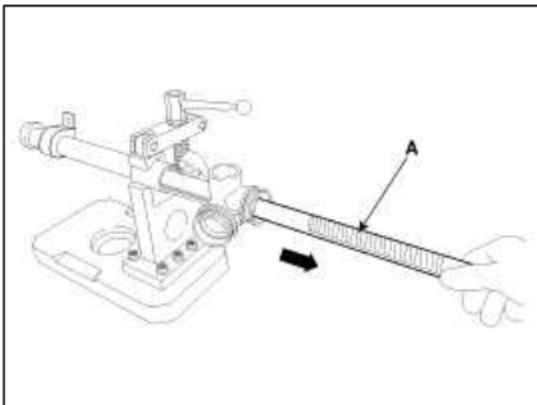




12. Remove the pinion assembly (A).



13. Remove the rack bar (A) in the direction of the arrow.

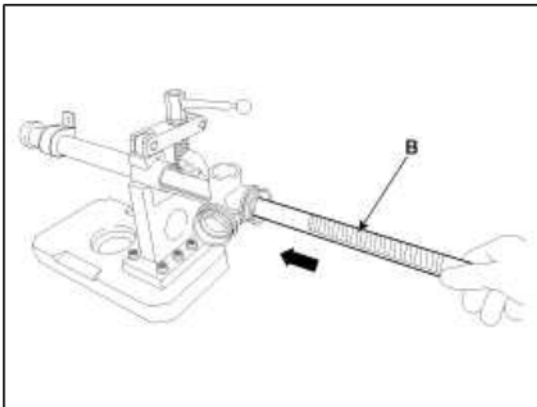
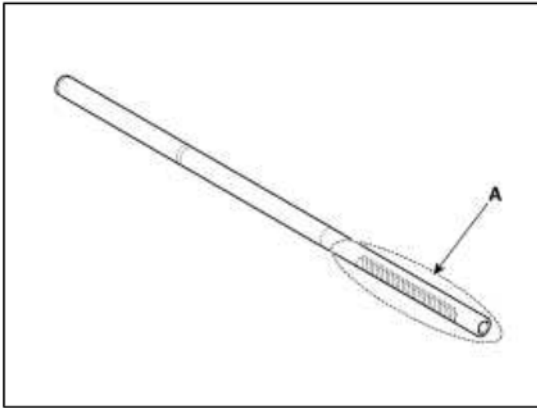


Reassembly

1. After spreading grease on the rack bar gear part (A), install rack bar (B) in the direction of the arrow.

**CAUTION**

- When inserting the rack bar, be careful not to damage to inner rack housing.



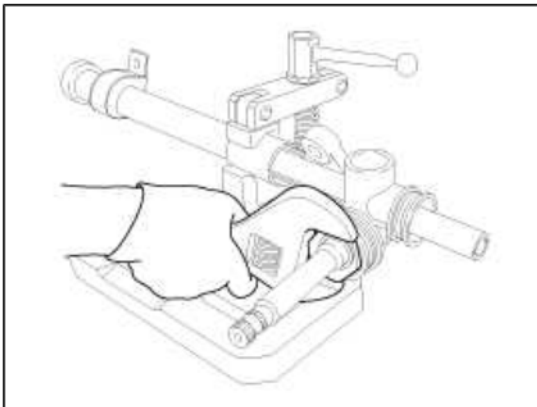
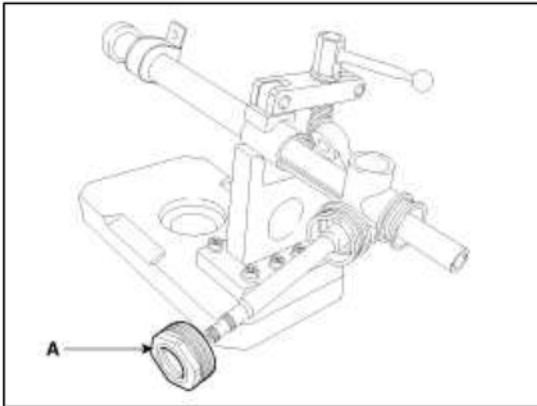
2. After spreading grease on the pinion gear part, install the pinion assembly (A).



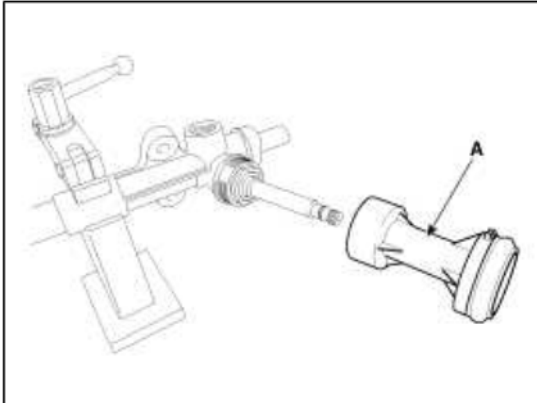
3. After spreading three bond (Loctite) on the top plug (A) thread, install the top plug by using the spanner.

**CAUTION**

- When installing the top plug, top plug is made of aluminum, so be careful to avoid distortion.



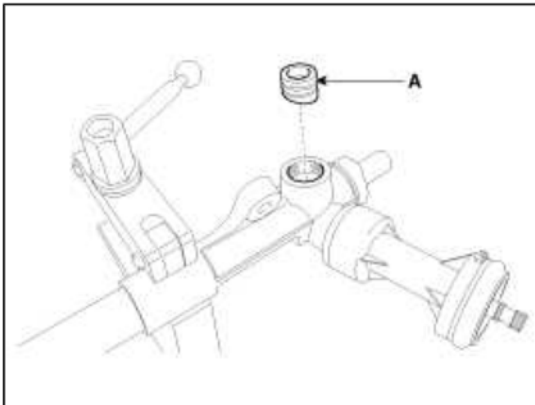
4. Install the dust packing & cap (A).



## 5. Install the support yoke (A).

**CAUTION**

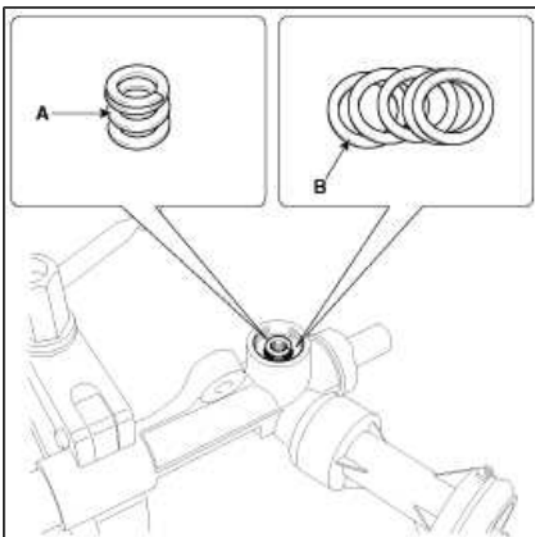
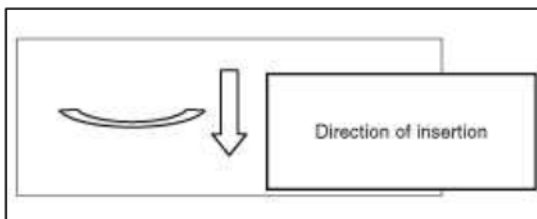
- Before installing the support yoke assembly, make sure to whether the O-ring damage.



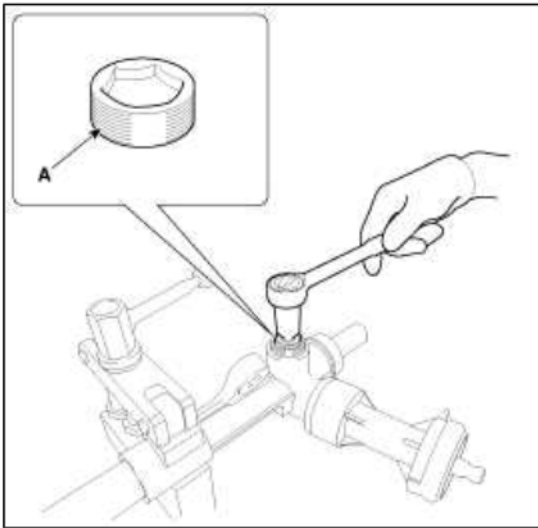
## 6. Install the Yoke plug (A) and leaf spring (B).

**CAUTION**

- The number of leaf spring can differ from depending on vehicle, pay attention to direction.
- Direction of leaf spring

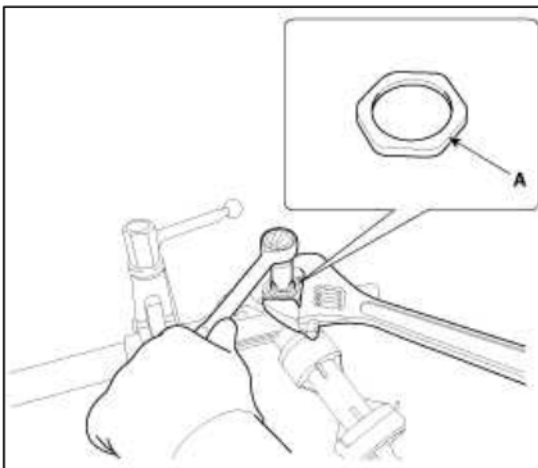


7. After spreading three bond (Loctite) on the Yoke plug (A) thread, install the Yoke plug.

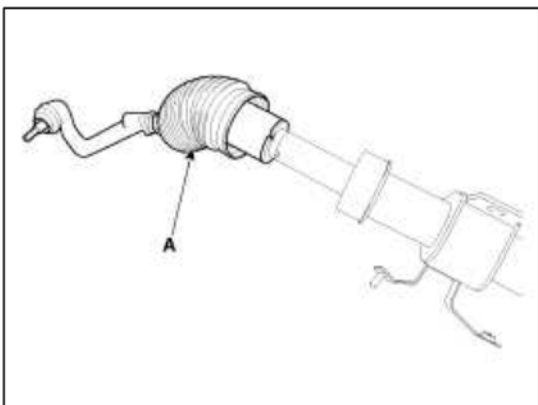
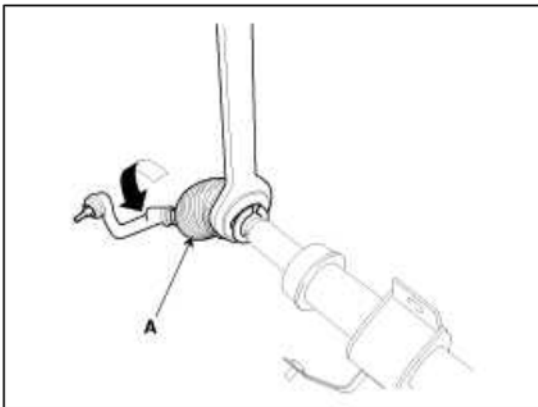


8. Adjust Yoke with reference to the “How to adjust Yoke”. (Refer to "Steering gear box(Adjustment)" in ST group)

9. After fixing the yoke plug, install the rock nut (A).



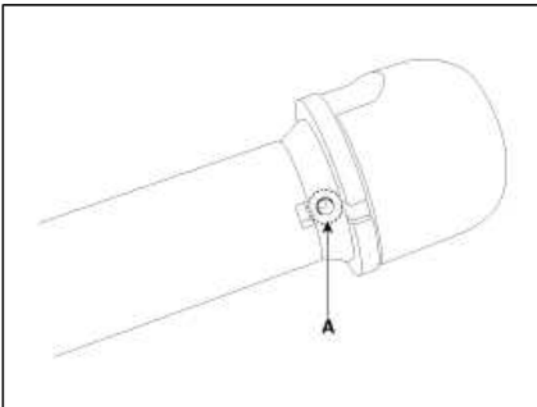
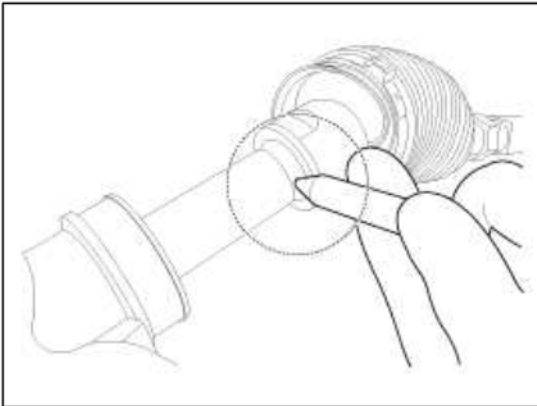
10. Install the tie-rod & tie-rod end assembly (A). (The left and right same work)



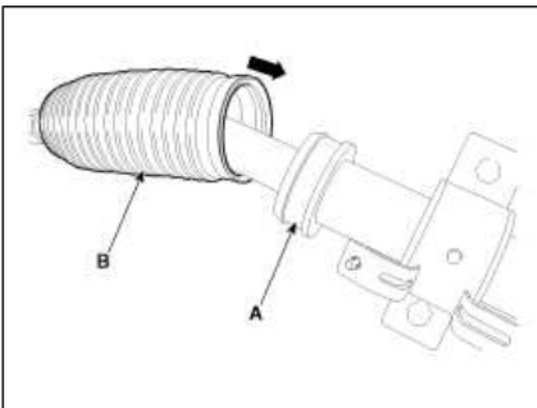
11. Caulk (A) the rack bar and tie-rod assembly joints. (The left and right same work)

**CAUTION**

- When you doing caulking, use the air tool or chisel.



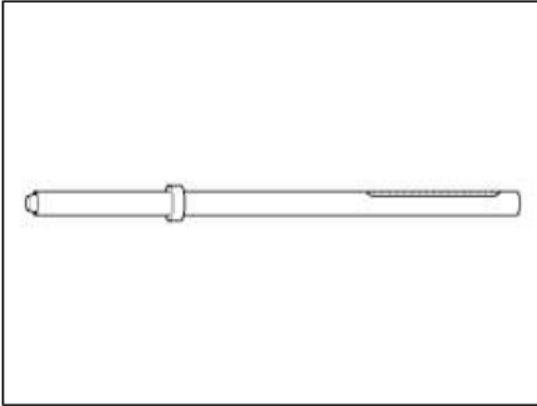
12. After spreading sealant on the rack hosing and the bellow joints (A), install the bellows (B) in the direction of the arrow.



Inspection

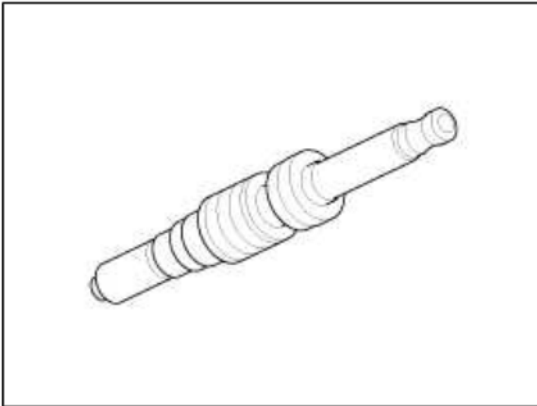
1. Rack bar

- A. Check the rack gear for damage.
- B. Check the rack bar for bend and deformation.



2. Pinion assembly

- A. Check the pinion gear for damage
- B. Check the oil seal for damage.



- 3. Check the inside of rack housing for damage.
- 4. Check the bellows for being torn.

