

# Steering System

## **GENERAL**

## **STEERING COLUMN AND SHAFT**

STEERING COLUMN / SHAFT

## **MECHANICAL POWER STEERING SYSTEM**

POWER STEERING GEAR BOX

POWER STEERING HOSES

POWER STEERING OIL PUMP

## **VARIABLE RACK STROKE**

VRS CONTROL MODULE

VRS OPERATING UNIT

VRS SWITCH

## GENERAL

### SPECIFICATIONS E467FD0C

| Items                     |             |                 | Specifications         |
|---------------------------|-------------|-----------------|------------------------|
| Steering column/<br>shaft | Type        |                 | Tilt                   |
|                           | Tilt stroke |                 | +7° / -11.7°           |
| Steering gear             | Type        |                 | Rack & pinion          |
|                           | Rack stroke | VRS On          | 148 mm (5.827 in)      |
|                           |             | VRS Off         | 156 mm (6.142 in)      |
| Power steering pump       | Type        |                 | Vane                   |
|                           | Diesel      | Relief pressure | 90 kgf/cm <sup>2</sup> |
|                           |             | Discharge       | 9.6 cc/rev             |
|                           | Gasoline    | Relief pressure | 90 kgf/cm <sup>2</sup> |
|                           |             | Discharge       | 10.5 cc/rev            |

### SERVICE STANDARD

| Items                    |         |       | Specifications  |
|--------------------------|---------|-------|-----------------|
| Steering wheel free play |         |       | 30 mm (1.12 in) |
| Steering angle           | VRS on  | Inner | 38.64°          |
|                          |         | Outer | 31.78°          |
|                          | VRS off | Inner | 41.91°          |
|                          |         | Outer | 33.54°          |

## GENERAL

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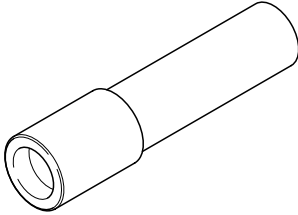
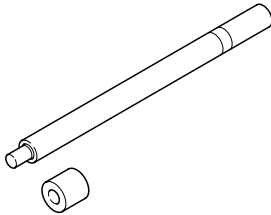
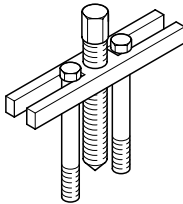
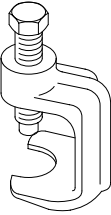
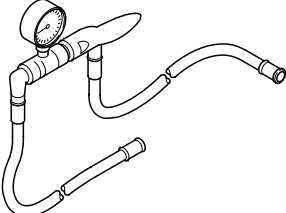
### TIGHTENING TORQUE EDDCEBB3

| Items                                              | Nm        | Kgf.m       | Lb-ft       |
|----------------------------------------------------|-----------|-------------|-------------|
| Steering wheel lock nut                            | 40 ~ 50   | 4.0 ~ 5.0   | 29 ~ 36     |
| Steering column mounting bolts and nut             | 13 ~ 18   | 1.3 ~ 1.8   | 9.4 ~ 13.0  |
| Bolt connecting steering column to universal joint | 13 ~ 18   | 1.3 ~ 1.8   | 9.4 ~ 13.0  |
| Bolt connecting universal joint to steering gear   | 15 ~ 20   | 1.5 ~ 2.0   | 10.8 ~ 14.5 |
| Steering column mounting bolts and nut             | 13 ~ 18   | 1.3 ~ 1.8   | 9.4 ~ 13.0  |
| Tie rod end castle nut                             | 35 ~ 45   | 3.5 ~ 4.5   | 25 ~ 33     |
| Front lower arm ball joint assembly bolts          | 90 ~ 120  | 9.0 ~ 12.0  | 65 ~ 87     |
| Stabilizer link to strut assembly nut              | 100 ~ 120 | 10.0 ~ 12.0 | 72 ~ 87     |
| Rear roll stopper to sub-frame bolts               | 50 ~ 60   | 5.0 ~ 6.0   | 36 ~ 43     |
| Pressure tube to valve body housing nut            | 12 ~ 18   | 1.2 ~ 1.8   | 9 ~ 13      |
| Pressure tube to oil pump eye bolt                 | 65 ~ 75   | 6.5 ~ 7.5   | 47 ~ 54     |
| Return tube to valve body housing nut              | 12 ~ 18   | 1.2 ~ 1.8   | 9 ~ 13      |
| Power steering gear box to sub-frame bolts         | 90 ~ 110  | 9.0 ~ 11.0  | 65 ~ 80     |

### LUBRICANT

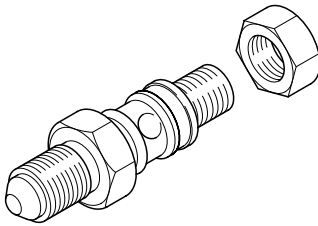
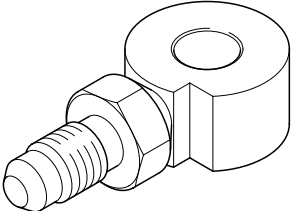
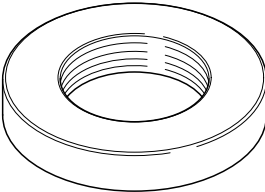
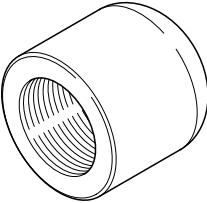
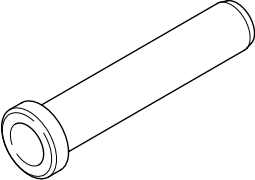
| Item                 | Lubricant | Quantity |
|----------------------|-----------|----------|
| Power steering fluid | PSF-3     | 1.1 L    |

**SPECIAL TOOLS** E6FE6FAC

| Tool (Number and Name)                       | Illustration                                                                                    | Use                                                                                          |
|----------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| 09222-32100<br>Valve stem oil seal installer | <br>EPRF001B   | Installation of the oil pump oil seal                                                        |
| 09555-21000<br>Bar                           | <br>EPRF001D   | Removal and installation of the oil seal<br>(Use with 09573-33100, 09573-33000, 09573-21000) |
| 09561-11001<br>Steering wheel puller         | <br>EPRF001E | Removal of steering wheel                                                                    |
| 09568-4A000<br>Tie rod end puller            | <br>KPRE103I | Separation of the tie rod end bail joint                                                     |
| 09572-21000<br>Oil pressure gauge            | <br>EPRF001F | Measurement of the oil pressure<br>(Use with 09572-22100, 09572-21200)                       |

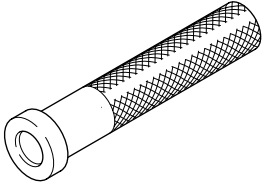
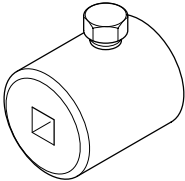
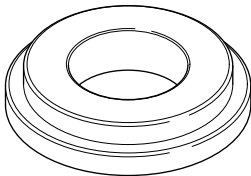
GENERAL

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|                                           |                                                                                                 |                                                                                                     |
|-------------------------------------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| 09572-21200<br>Oil pressure gauge adapter | <br>EPRF001G   | Measurement of the oil pressure<br>(Use with 09572-21000, 09572-22100)                              |
| 09572-22100<br>Oil pressure gauge adapter | <br>EPRF001H   | Measurement of the oil pressure<br>(Use with 09572-21000, 09572-21200)                              |
| 09573-21100<br>Oil seal installer         | <br>EPRF001I  | Installation of the back up washer and oil seal<br>(Use with 09753-21000, 09573-33100, 09555-21000) |
| 09573-33100<br>Oil seal guide             | <br>EPRF001K | Removal and installation of the oil seal<br>(Use with 09573-21000, 09573-33000, 09555-21000)        |
| 09432-21600<br>Bearing installer          | <br>APJF001K | Installing the pinion gear bearing                                                                  |

ST -6

STEERING SYSTEM

|                                                |                                                                                                |                                    |
|------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------|
| 09434-14200<br>Counter shaft bearing installer | <br>APJF001M  | Installing the gear box oil seal   |
| 09565-11100<br>Preload socket                  | <br>APJF001A  | Measuring the pinion shaft preload |
| 09573-21000<br>Oil seal installer guide        | <br>APJF001I | Installation of oil seal           |

TROUBLESHOOTING

ECDE13C9

| Symptom                                                            | Probable cause                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Remedy                            |
|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| Excessive play in steering                                         | Loose yoke plug                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Retighten                         |
|                                                                    | Loose steering gear mounting bolts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Retighten                         |
|                                                                    | Loose or worn tie rod end                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Retighten or replace as necessary |
| Steering wheel operation is not smooth (Insufficient power assist) | V-belt slippage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Readjust                          |
|                                                                    | Damaged V-belt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Replace                           |
|                                                                    | Low fluid level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Replenish                         |
|                                                                    | Air in the fluid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Bleed air                         |
|                                                                    | Twisted or damaged hoses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Correct the routing or replace    |
|                                                                    | Insufficient oil pump pressure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Repair or replace the oil pump    |
|                                                                    | Sticky flow control valve                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Replace                           |
|                                                                    | Excessive internal oil pump leakage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Replace the damaged parts         |
|                                                                    | Excessive oil leaks from rack and pinion in gear box                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Replace the damaged parts         |
|                                                                    | Distorted or damaged gear box or valve body seals                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Replace                           |
| Steering wheel does not return properly                            | Excessive turning resistance of tierod end                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Replace                           |
|                                                                    | Yoke plug excessively tight                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Adjust                            |
|                                                                    | Tie rod and/or ball joint cannot turn smoothly                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Replace                           |
|                                                                    | Loose mounting of gear box mounting bracket<br>Worn steering shaft joint and/or                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Retighten                         |
|                                                                    | Worn steering shaft joint and/or body grommet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Correct or replace                |
|                                                                    | Distorted rack                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Replace                           |
|                                                                    | Damaged pinion bearing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Replace                           |
|                                                                    | Twisted or damaged hoses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Reposition or replace             |
|                                                                    | Damaged oil pressure control valve                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Replace                           |
|                                                                    | Damaged oil pump input shaft bearing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Replace                           |
| Noise                                                              | Hissing Noise in Steering Gear<br>There is some noise with all power steering systems. One of the most common is a hissing sound when the steering wheel is turned and the car is not moving. This noise will be most evident when turning the wheel while the brakes are being applied. There is no relationship between this noise and steering performance. Do not replace the valve unless the "hissing" noise becomes extreme. A replaced valve will also make a slight noise, and is not always a solution for the condition. |                                   |
| Rattling or chucking noise in the rack and pinion                  | Interference with hoses from vehicle body                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Reposition                        |
|                                                                    | Loose gear box bracket                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Retighten                         |
|                                                                    | Loose tie rod end and/or ball joint                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Retighten                         |
|                                                                    | Worn tie rod and/or ball joint                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Replace                           |
| Noise in the oil pump                                              | Low fluid level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Replenish                         |
|                                                                    | Air in the fluid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Bleed air                         |
|                                                                    | Loose pump mounting bolts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Retighten                         |

## SERVICE ADJUSTMENT

### PROCEDURE

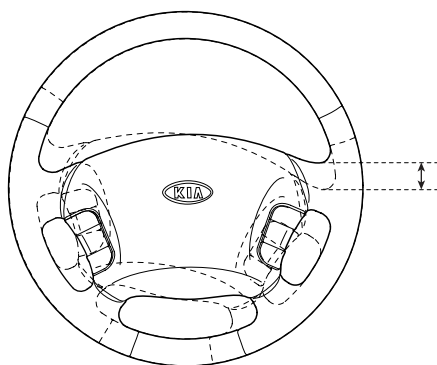
E17FB3C6

#### CHECKING STEERING WHEEL FREE PLAY

1. Start the engine and with the steering wheel in the straight ahead position.
2. Measure the play while turning the steering wheel to the left and right.

#### Standard value :

Steering wheel free play : 30 mm (1.1 in)



BPKG500K

3. If the play exceeds the standard value, inspect the connection between the steering shaft and tie rod ends.

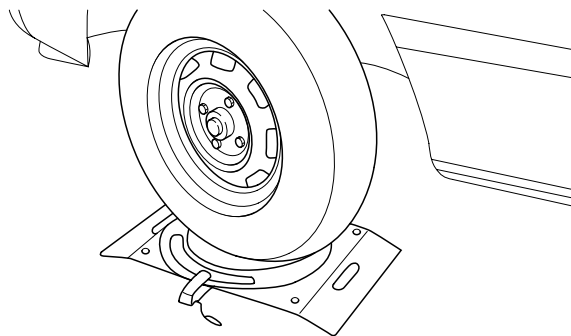
#### CHECKING STEERING ANGLE

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

#### Standard value

|         |       |         |
|---------|-------|---------|
| VRS ON  | Inner | 38.64 ° |
|         | Outer | 31.78 ° |
| VRS OFF | Inner | 41.91 ° |
|         | Outer | 33.54 ° |

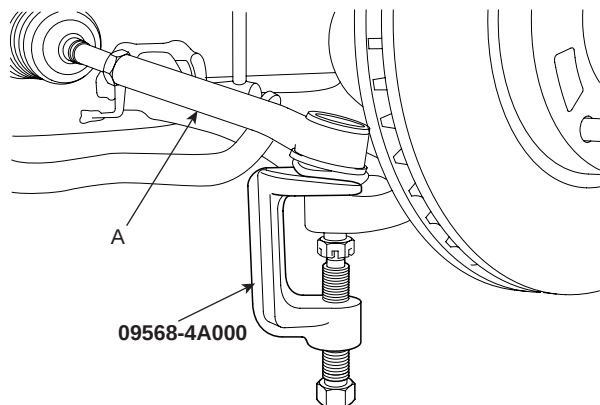
2. If the measured value is not within the standard value, adjust the toe and inspect again.



EPRF010A

### CHECKING THE TIE ROD END BALL JOINT STARTING TORQUE

1. Disconnect tie rod and knuckle with the special tool (09568-4A000).



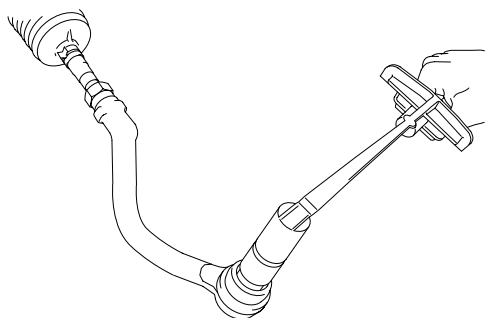
APKF500E

2. Shake the ball joint stud several times to check for looseness.

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**Tie rod end ball joint starting torque :**  
30 kg·cm or less

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KPBF010F

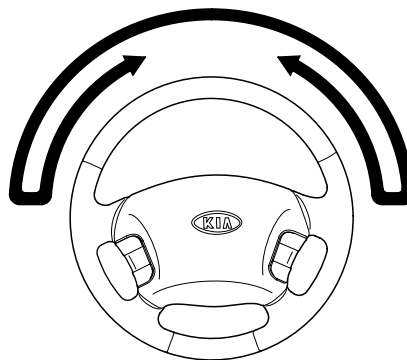
3. If the starting torque exceeds the upper limit of the standard value, replace the tie rod end.
4. Even if the starting torque is below the lower limit of the standard value, check the play of the ball joint and replace if necessary.

### CHECKING STEERING WHEEL RETURN

1. The force required to turn the steering wheel and the wheel return should be the same for both moderate and sharp turns.
2. When the steering wheel is turned 90° and held for a couple of seconds while the vehicle is being driven at 20-30 kph (12-19 mph), the steering wheel should return at least 20° from its central position when it is released.

#### NOTE

*If the steering wheel is turned very quickly, steering may be momentarily difficult. This is not a malfunction because the oil pump output will be somewhat decreased.*



BPKG500L

### CHECKING POWER STEERING BELT TENSION

Refer to EM group(Timing system).

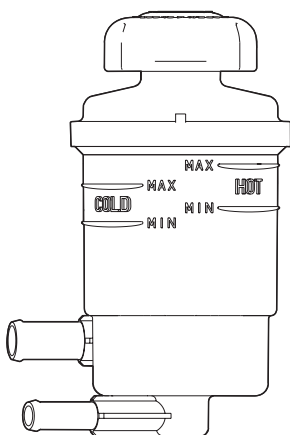
### CHECKING POWER STEERING FLUID LEVEL

1. Position the vehicle on a level surface.
2. Start the engine. With the vehicle kept stationary, turn the steering wheel several times continuously to raise the fluid temperature to 50-60 (122-140 ).
3. With the engine at idle, turn the steering wheel fully clockwise and counter-clockwise several times.
4. Make sure that there is no foaming or cloudiness in the reservoir fluid.
5. Stop the engine and check for any difference in fluid level between a stationary and a running engine.



#### NOTE

1. If the fluid level varies 5 mm (0.2 in) or more, bleed the system again.
2. If the fluid level suddenly rises after stopping the engine, further bleeding is required.
3. Incomplete bleeding will produce a chattering sound in the pump and noise in the flow control valve, and lead to decreased durability of the pump.



BPKG800A

### REPLACING POWER STEERING FLUID

1. Jack up the front wheels and support them with jack-stands.
2. Disconnect the return hose from the oil reservoir and plug the oil reservoir.
3. Connect a vinyl hose to the disconnected return hose, and drain the oil into a container.
4. Remove the fuel pump fuse, then start the engine and wait for the engine to stall. Next, while operating the starting motor intermittently, turn the steering wheel all the way to the left and then to the right several times to drain the fluid.
5. Connect the return hoses, then fill the oil reservoir with the specified fluid.
6. Reinstall the fuel pump fuse.
7. Start the engine. Check for oil leakage.
8. Stop the engine.
9. Bleed the system.

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**Power steering fluid type : PSF-3**

Total quantity : Approx 1.1 liter

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## AIR BLEEDING

1. Remove the fuel pump fuse, then start the engine and wait for the engine to stall. Next, while operating the starting motor intermittently (for 15 ~ 20 seconds), turn the steering wheel all the way to the left and then to the right five or six times.

### NOTE

1. During air bleeding, replenish the fluid supply so that the level never falls below the lower position of the filter.
2. If air bleeding is done while the vehicle is idling, the air will be broken up and absorbed into the fluid. Be sure to do the bleeding only while cranking.
3. Reinstall the fuel pump fuse, and start the engine(idling).
4. Turn the steering wheel to the left and the right until there are no air bubbles in the oil reservoir.

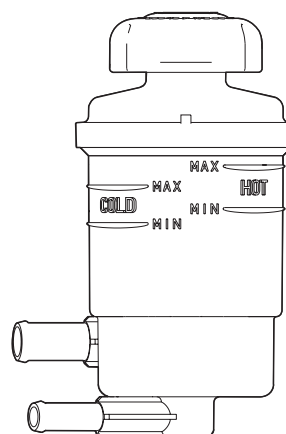
### CAUTION

**Do not hold the steering wheel turned all the way to either side for more than ten seconds.**

5. Confirm that the fluid is not milky, and that the level is up to the position specified on the level gauge.
6. Confirm that there is little change in the surface of the fluid when the steering wheel is turned left and right.

### CAUTION

1. If the surface of the fluid changes considerably, air bleeding should be done again.
2. If the fluid level rises suddenly when the engine is stopped, it indicates that there is still air in the system.
3. If there is air in the system, a jingling noise may be heard from the pump and the control valve may also produce unusual noises. Air in the system will shorten the life of the pump and other parts.



BPKG800A

### OIL PUMP PRESSURE TEST (OIL PUMP RELIEF PRESSURE)

1. Disconnect the pressure hose from the oil pump. Connect the special tool between the oil pump and pressure hose as illustrated.
2. Bleed the air, and then start the engine and turn the steering wheel several times so that the fluid temperature rises to approximately 50 (122 ).
3. Set the engine speed to 1,000 rpm.
4. Close the shut-off valve of the special tool and measure the fluid pressure to confirm that it is within the range.

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**standard vaule :**

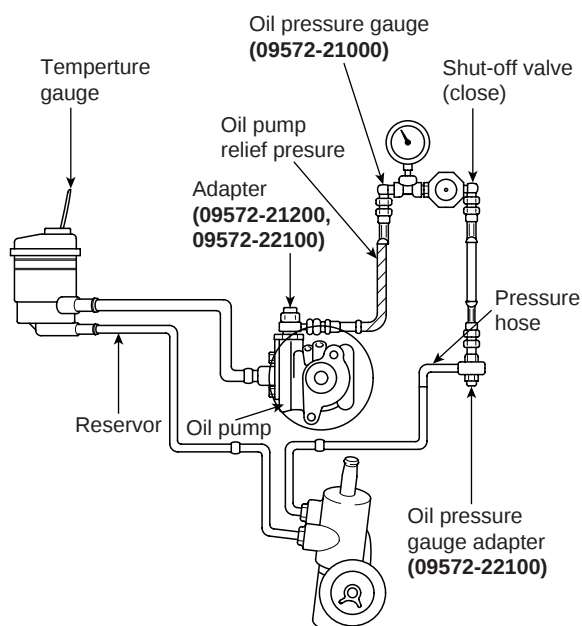
Relief pressure: 90 +3/-2 kgf/cm<sup>2</sup>

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**CAUTION**

***Don' t keep the shut-off valve on the pressure gauge closed for longer than seconds.***



EPRF002B

5. Remove the special tools, and tighten the pressure hose to the specified torque.

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**Tightening Torque Nm(kgf-m, lb-ft) :**

65 ~ 75(6.5 ~ 7.5, 47 ~ 54)

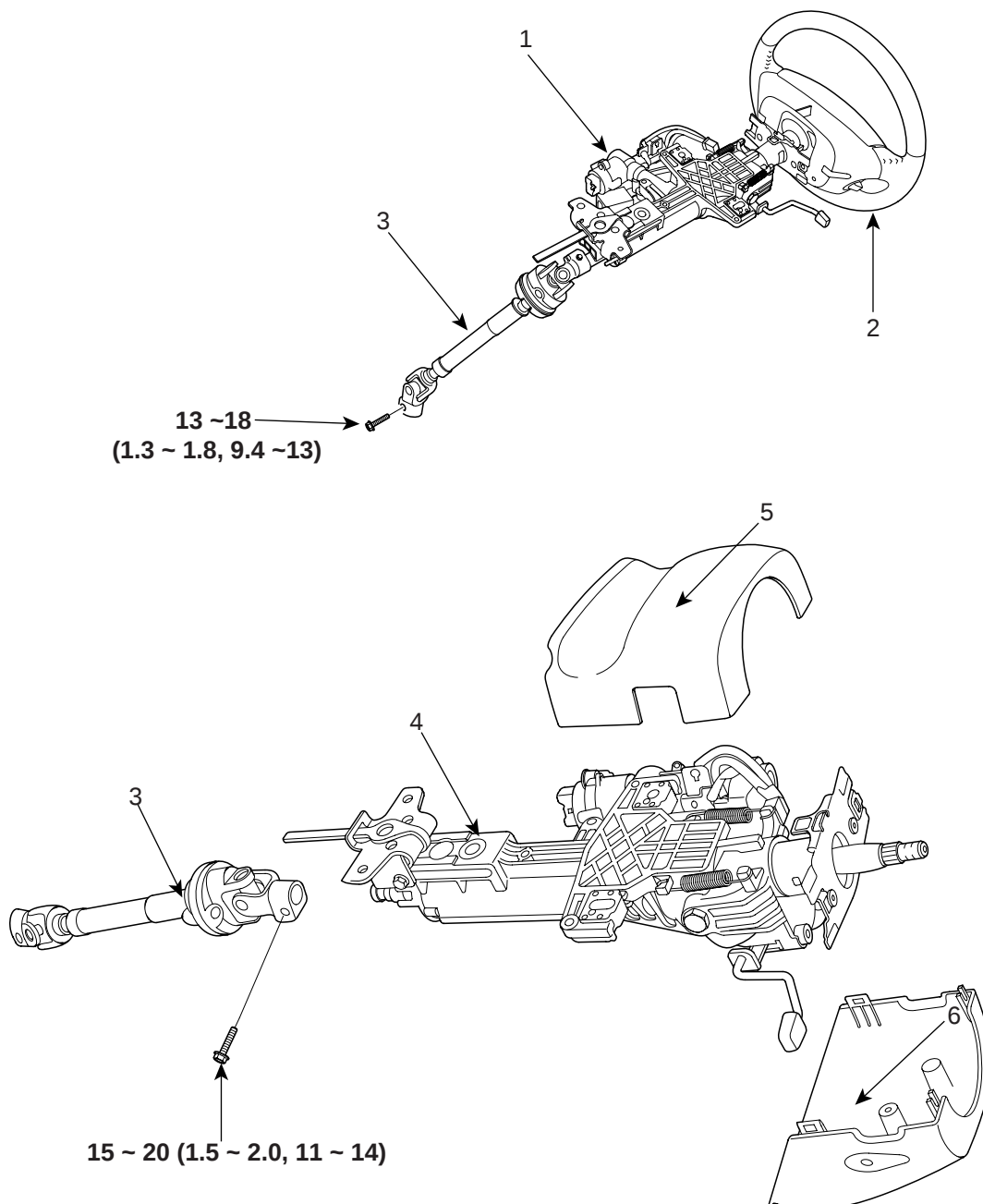
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6. Bleed the system.

## STEERING COLUMN AND SHAFT

### STEERING COLUMN / SHAFT

#### COMPONENTS EB2031B4



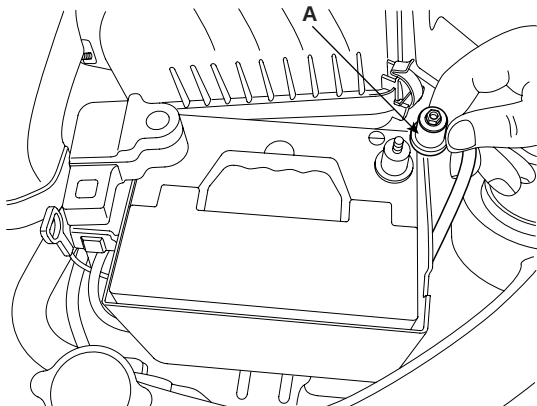
TORQUE : Nm (kgf.m, lb-ft)

- 1. Key lock assembly
- 2. Steering wheel
- 3. Universal joint assembly

- 4. Steering column assembly
- 5. Steering column upper shroud
- 6. Steering column lower shroud

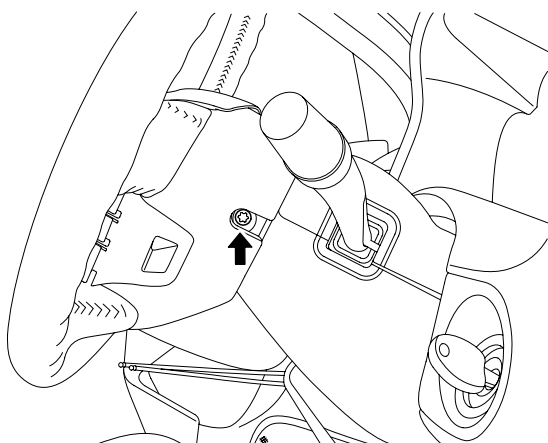
REMOVAL EB855CFD

1. Disconnect the negative terminal (A) from the battery and then wait for 30 seconds.

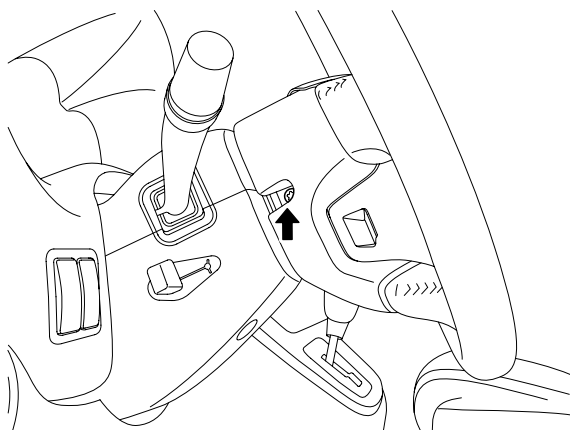


APIE102B

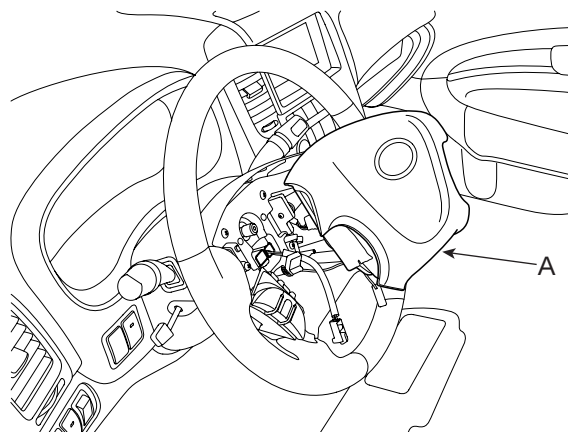
2. Loosen the bolts in the illustration and then remove the horn pad (A).



APKF003A



APKF004A



APKF005A

3. Disconnect the connectors and remove the steering wheel lock nut.

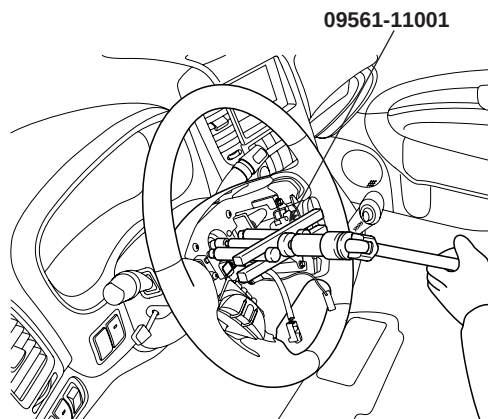
**Tightening torque Nm (kgf.m, lb-ft):**  
40 ~ 50 (4.0 ~ 5.0, 29 ~ 36)

4. After making the marks on the steering wheel and shaft for reinstallation, remove the steering wheel using a SST (09561-11002).



**CAUTION**

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

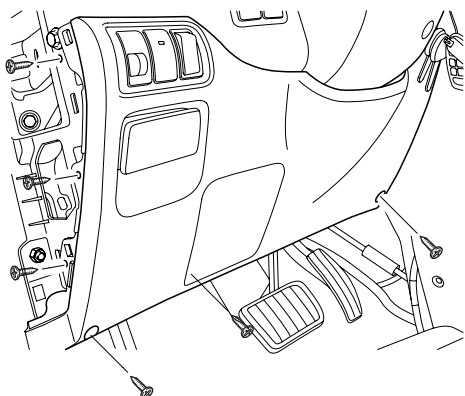


APKF006A

## STEERING COLUMN AND SHAFT

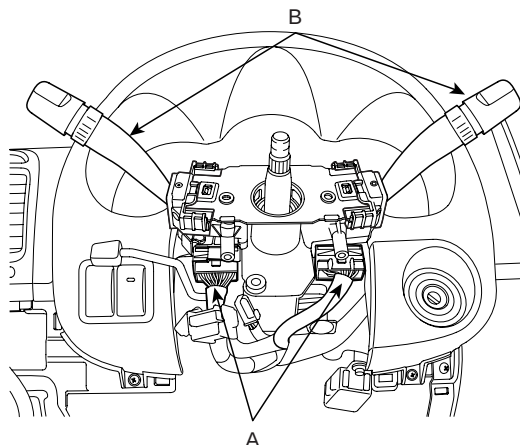
ST -15

5. Loosen the screws, and then remove the lower crash pad (A).



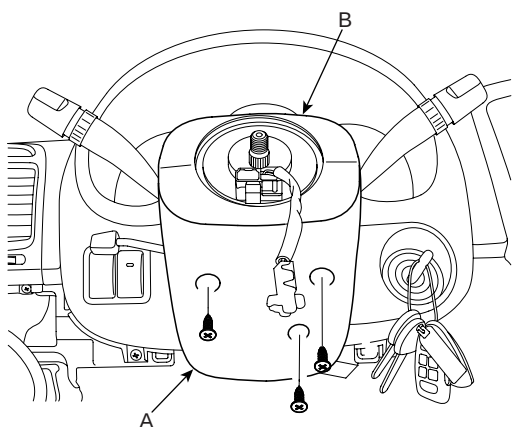
BPKG500B

8. Disconnect the connectors (A) and remove the multi-function switch (B).



APKF010A

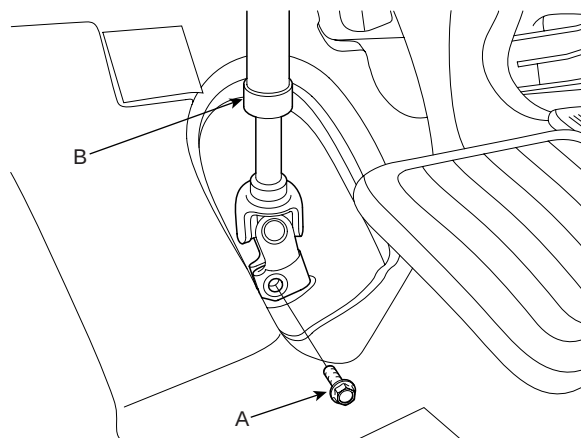
6. Loosen the screws, and then remove the steering column upper (B) and lower shrouds (A).



APKF008A

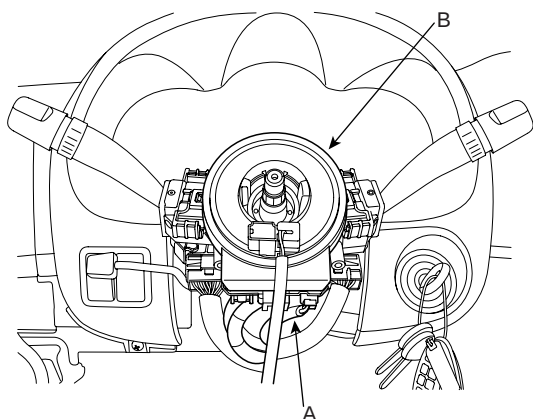
9. Loosen the bolt (A) and then disconnect the universal joint assembly (B) from the steering gear assembly.

**Tightening torque Nm (kgf.m, lb-ft):**  
13 ~ 18 (1.3 ~ 1.8, 9.4 ~ 13.0)



APKF011A

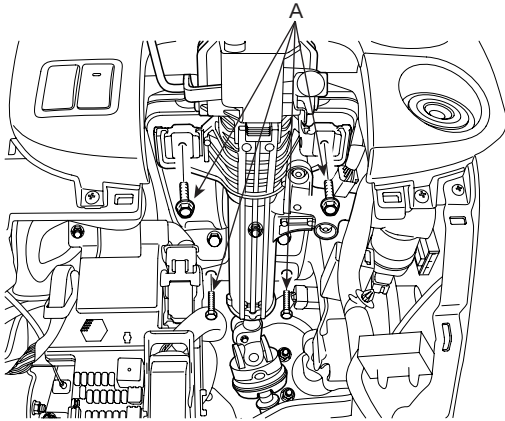
7. Disconnect the connectors (A) and then remove the clock spring (B).



APKF009A

10. Remove the steering column assembly by loosening the steering column mounting bolts and nut (A).

**Tightening torque Nm (kgf.m, lb-ft):**  
13 ~ 18 (1.3 ~ 1.8, 9.4 ~ 13.0)

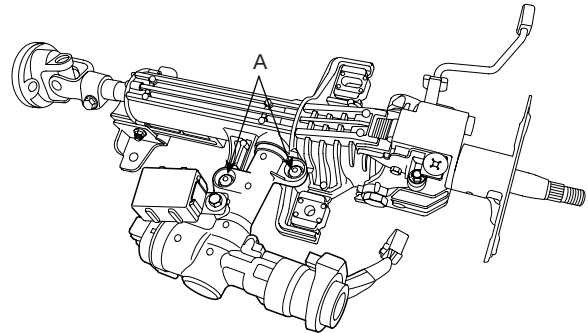


APKF012A

## DISASSEMBLY E51FB4AA

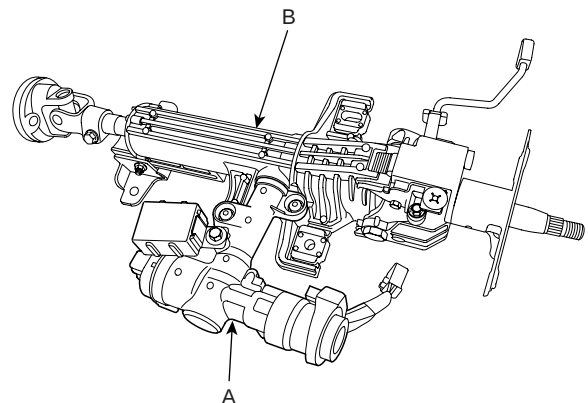
### KEY LOCK ASSEMBLY

1. Make a groove on head of the special bolt (A) by using a punch.



BPKG500C

2. Remove the key lock assembly (A) from the steering column (B) by loosening special bolts.

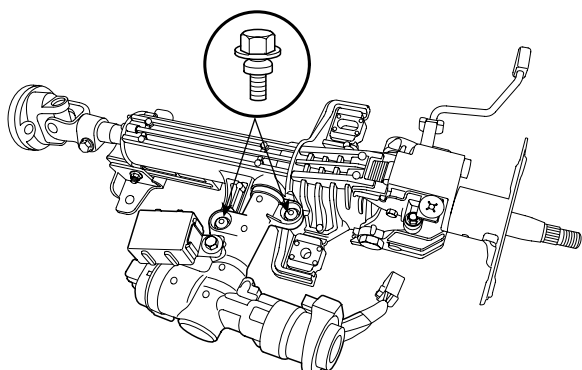


APKF500B

## STEERING COLUMN AND SHAFT

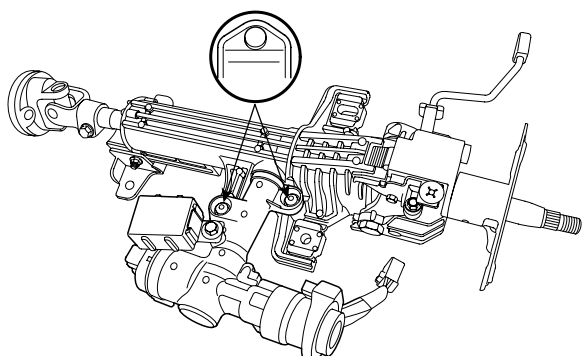
ST -17

3. When reassembling the key lock assembly, loosely install new special bolts to the steering column shaft.



BPKG500D

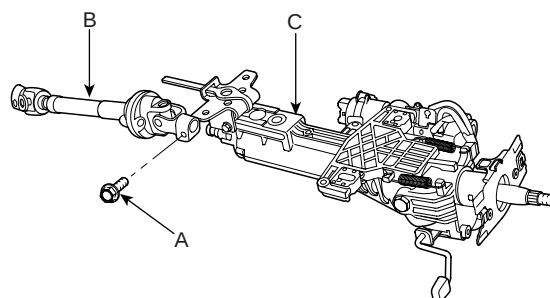
4. Tighten the special bolt until its head is cut off.



BPKG500E

## UNIVERSAL JOINT ASSEMBLY

1. Remove the universal joint (B) assembly from the steering column assembly (C) by loosening the bolt (A).



APKF014A

2. Reassembly is the reverse of disassembly.

## INSPECTION

EEDDA53D

1. Check the steering column shaft for damage and deformation.
2. Check connection for play, damage and smooth operation.
3. Check the joint bearing for wear and damage.

## INSTALLATION

EDA4DBBE

### NOTE

*Before installing, apply multi purpose grease to each moving parts.*

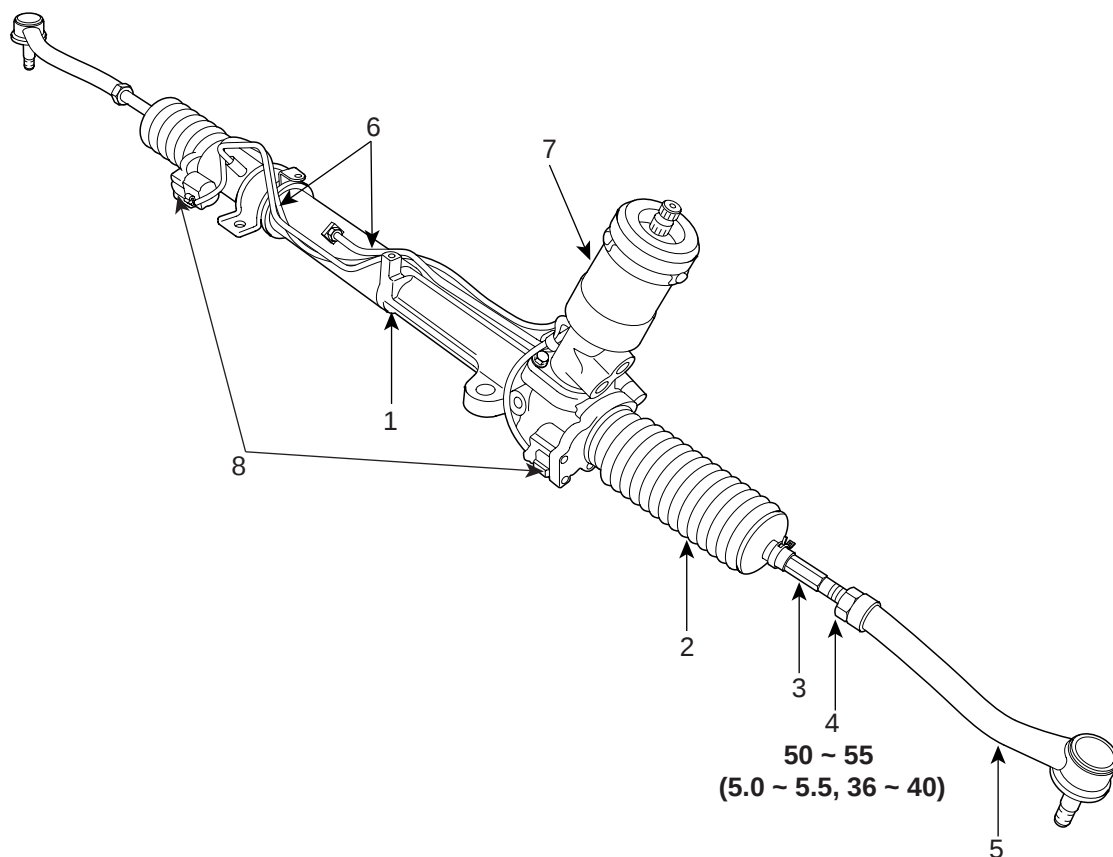
1. Installation is the reverse of removal.

### CAUTION

*Align the marks on the steering wheel and shaft for reinstallation when installing the steering wheel.*

## MECHANICAL POWER STEERING SYSTEM

### COMPONENTS EE5E1AD4

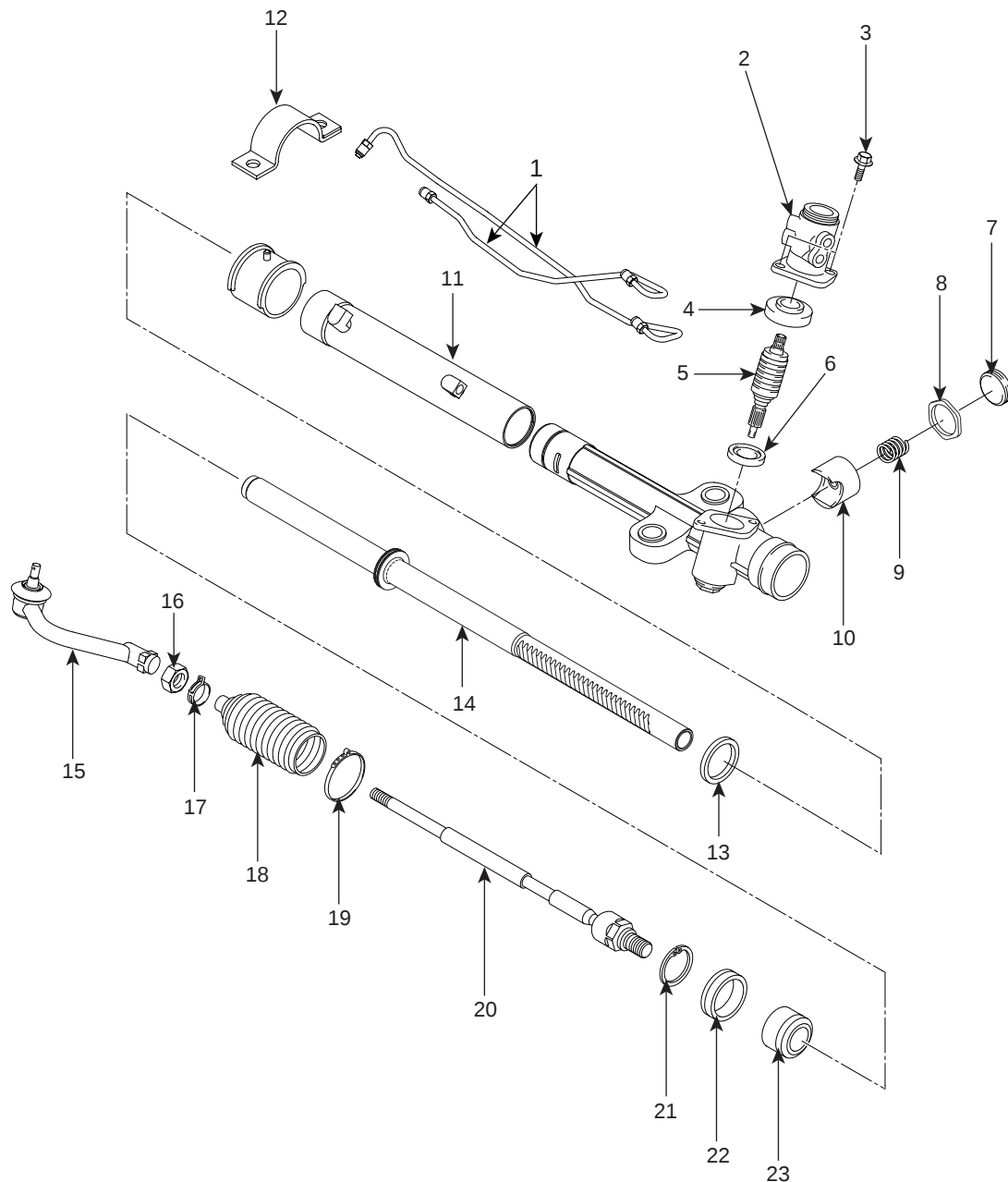


**TORQUE : Nm (kgf.m, lb-ft)**

- |                     |                        |
|---------------------|------------------------|
| 1. Rack housing     | 5. Tie rod end         |
| 2. Bellows          | 6. Feed tube           |
| 3. Tie rod          | 7. Valve body assembly |
| 4. Tie rod lock nut | 8. VRS operating unit  |

## POWER STEERING GEAR BOX

COMPONENT EE7006FA

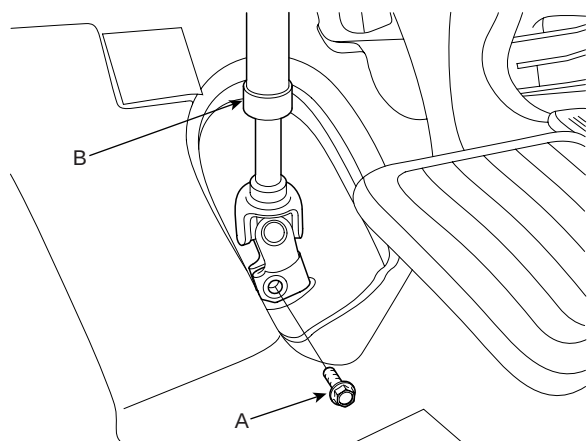


- |                          |                                            |                  |
|--------------------------|--------------------------------------------|------------------|
| 1. Feed tube             | 9. Rack support spring                     | 17. Bellows clip |
| 2. Valve body housing    | 10. Rack support yoke                      | 18. Bellows      |
| 3. Bolt                  | 11. Rack housing                           | 19. Bellows band |
| 4. Oil seal              | 12. Power steering gear box mounting clamp | 20. Tie rod      |
| 5. Pinion valve assembly | 13. Oil seal                               | 21. Circlip      |
| 6. Oil seal              | 14. Rack                                   | 22. Oil seal     |
| 7. Yoke plug             | 15. Tie rod end                            | 23. Rack stopper |
| 8. Lock nut              | 16. Lock nut                               |                  |

**REMOVAL** EDED533F

1. Remove the both front wheel & tire assemblies.
2. Drain the power steering fluid.
3. Remove the bolt (A) connecting steering column to universal joint.

**Tightening torque Nm (kgf.m, lb-ft):**  
13 ~ 18 (1.3 ~ 1.8, 9.4 ~ 13.0)

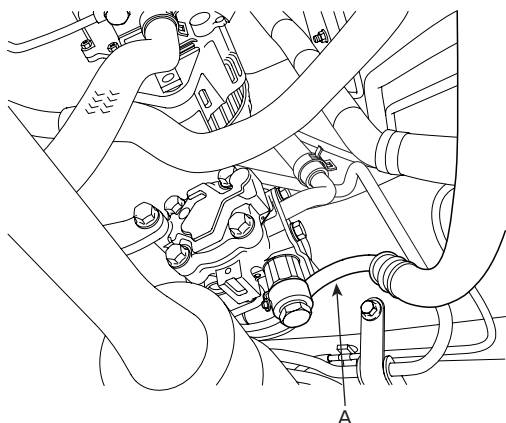


APKF011A

4. Disconnect the pressure tube (A) from the power steering oil pump by loosening eye bolt.

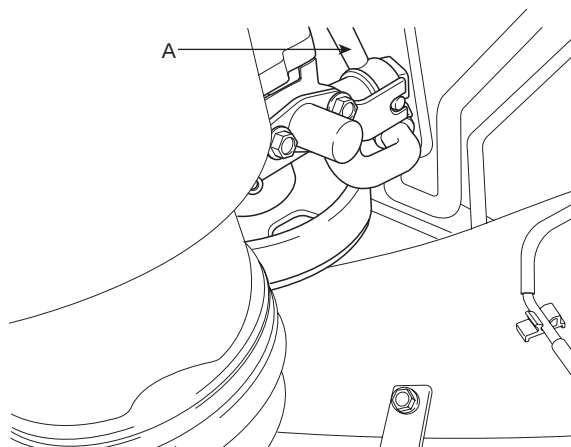
**Tightening torque Nm (kgf.m, lb-ft):**  
65 ~ 75 (6.5 ~ 7.5, 47 ~ 54)

**[DIESEL]**



APKF501D

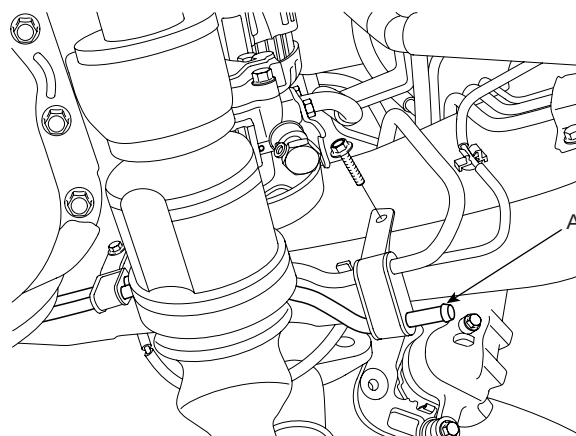
**[GASOLINE]**



LPKG101A

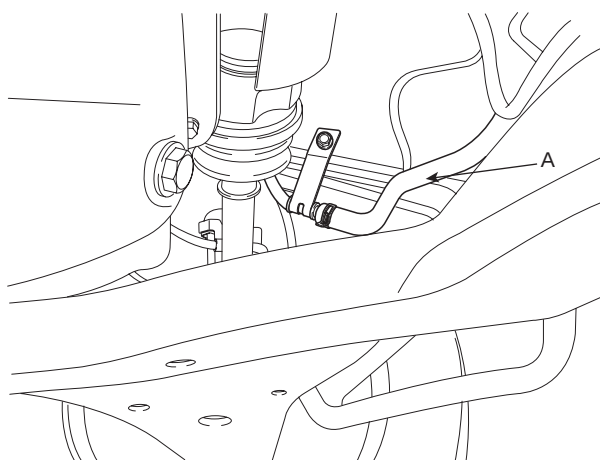
5. Disconnect the return hose (A)

**[DIESEL]**



APKF501E

**[GASOLINE]**



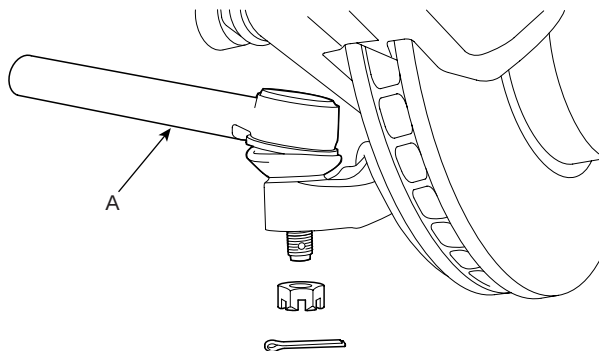
LPKG103A

## MECHANICAL POWER STEERING SYSTEM

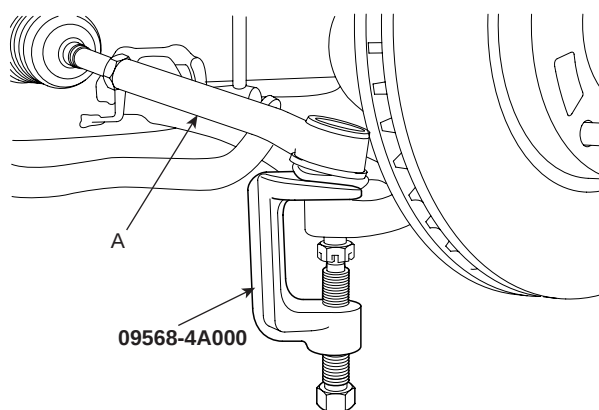
ST -21

6. Loosen the split pin and castle nut, and then remove the tie rod end (A) from the knuckle by using a SST (09568-4A000).

**Tightening torque Nm (kgf.m, lb-ft):**  
50 ~ 55 (5.0 ~ 5.5, 36 ~ 40)



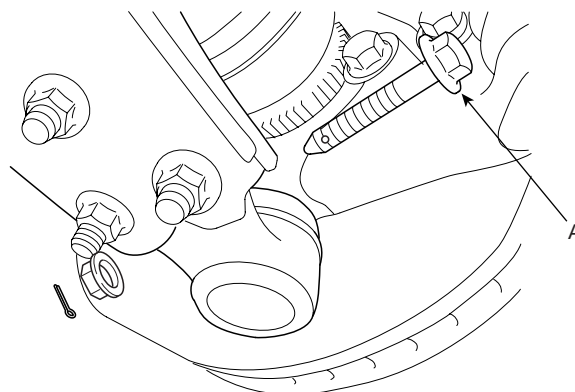
AIKF007A



APKF500E

7. Remove the split pin and lower arm bolts and nut (A).

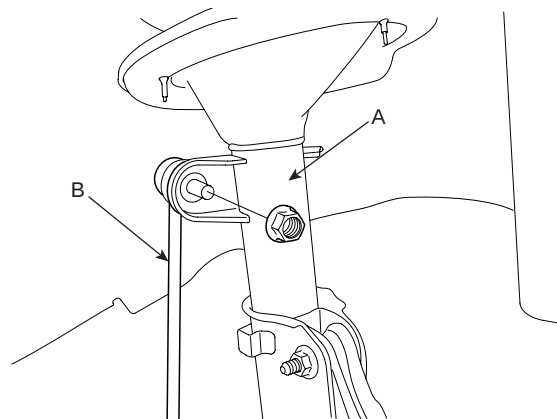
**Tightening torque Nm (kgf.m, lb-ft):**  
90 ~ 120 (9.0 ~ 12.0, 65 ~ 87)



BPKG500G

8. Disconnect the stabilizer link (B) from the strut assembly (A) by loosening nut.

**Tightening torque Nm (kgf.m, lb-ft):**  
100 ~ 120 (10.0 ~ 12.0, 72 ~ 87)



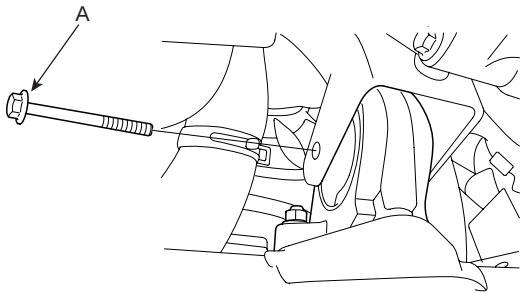
LPKG500A

9. Repeat on the other side.

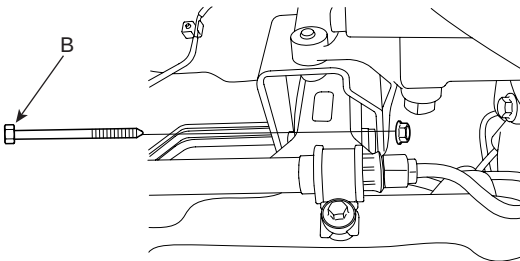
ST -22

STEERING SYSTEM

10. Remove the front and rear roll stopper bolts and nuts (A, B).

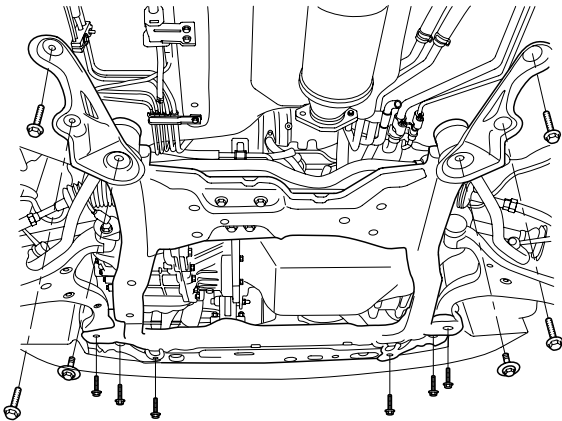


AHKF130F



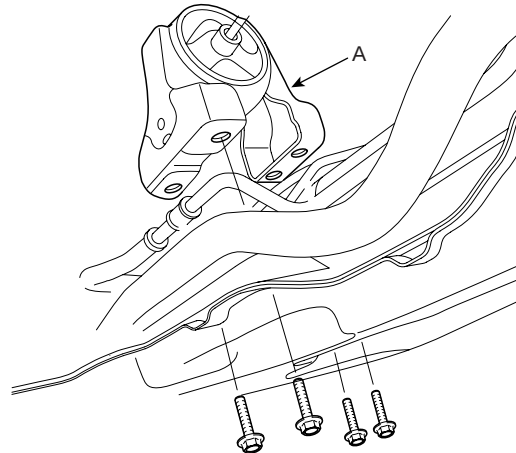
AHKF130G

11. Remove the sub-frame by loosening the bolts and nuts.



AHKF130H

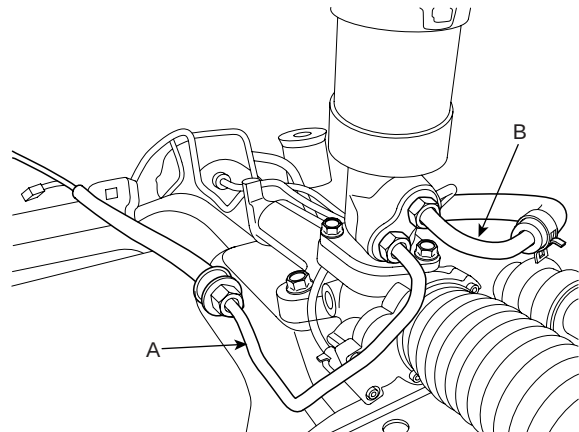
12. Remove the rear roll stopper (A) from the sub-frame.



APKF017A

13. Disconnect the pressure tube (A) and return (B) from the valve body housing.

**Tightening torque Nm (kgf.m, lb-ft):**  
12 ~ 18 (1.2 ~ 1.8, 9 ~ 13)



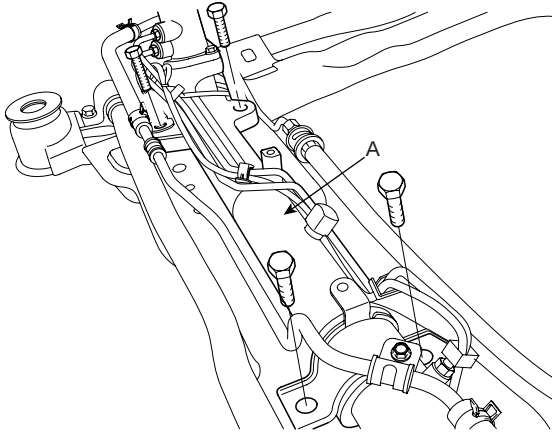
APKF018A

## MECHANICAL POWER STEERING SYSTEM

ST -23

14. Remove the power steering gear box (A) from the sub-frame by loosening the mounting bolts.

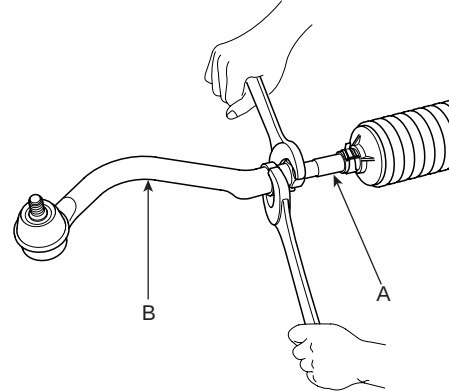
**Tightening torque Nm (kgf.m, lb-ft):**  
60 ~ 80 (6.0 ~ 8.0, 43~58)



BPKG500M

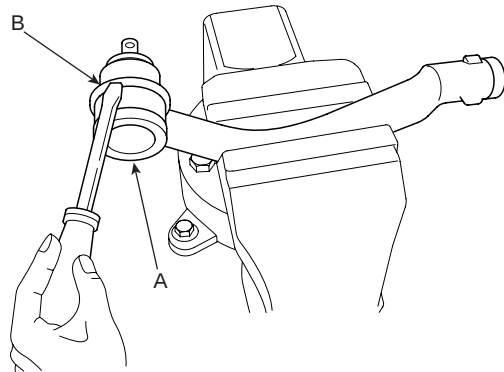
## DISASSEMBLY EDB49EB4

1. Remove the tie rod end (B) from the tie rod (A).



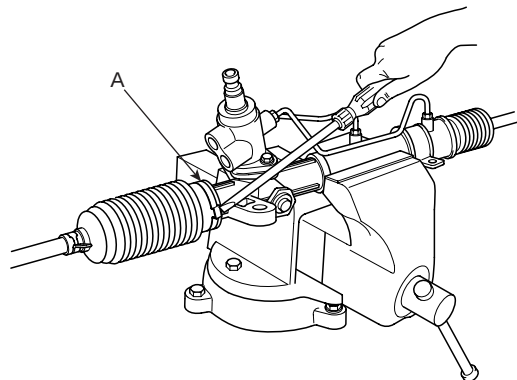
KPBF202A

2. Remove the dust cover (B) from the ball joint (A).



EPBF500H

3. Remove the bellows band (A).

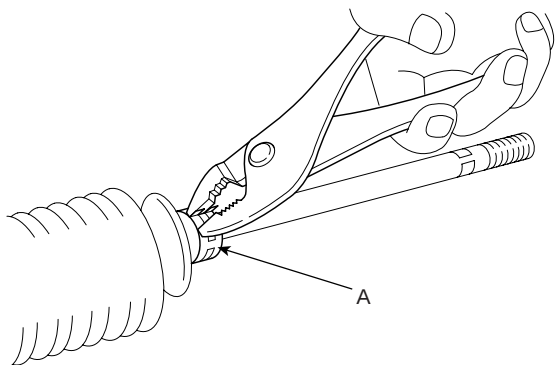


KPBF006F

ST -24

STEERING SYSTEM

4. Remove the bellows clip (A).



EPKE013I

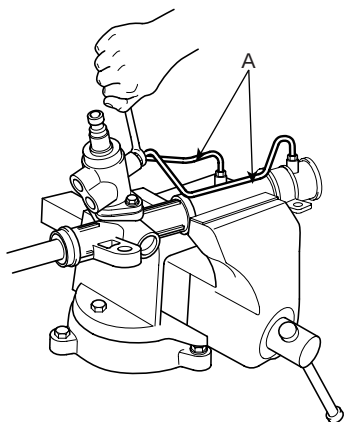
5. Pull the bellows out toward the tie rod.



**NOTE**

Check for rust on the rack when the bellows are re-placed.

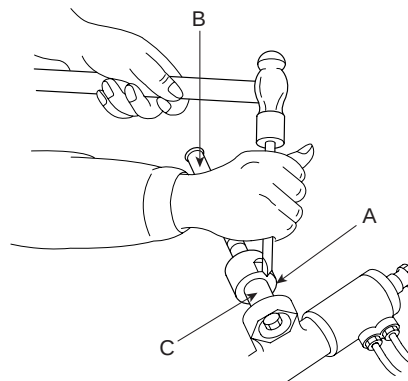
6. Remove the feed tube(A) from the rack housing.



APHE006H

7. While moving the rack slowly, drain the fluid from the rack housing.

8. Unstake the tab washer (A) which fixes the tie rod (B) and rack (C) with a chisel.



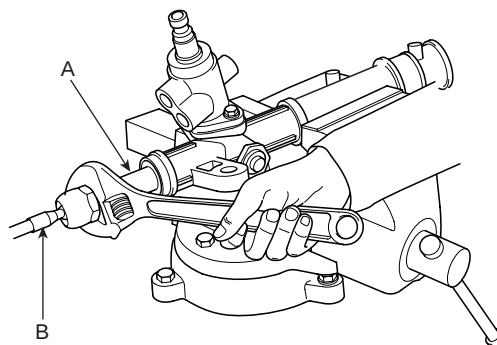
EPKE037A

9. Remove the tie rod (B) from the rack (A).



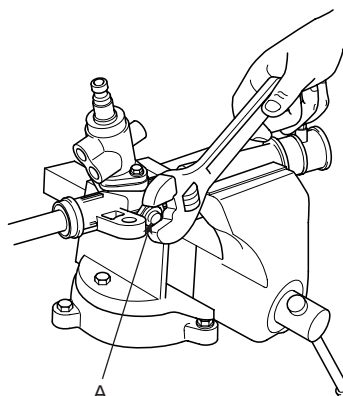
**CAUTION**

Remove the tie rod (B) from the rack (A), taking care not to twist the rack.



KPBF006J

10. Remove the yoke plug locking nut (A).

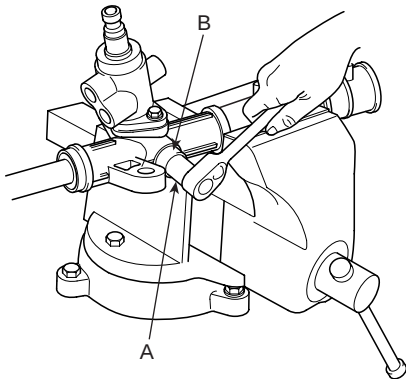


KPBF006K

## MECHANICAL POWER STEERING SYSTEM

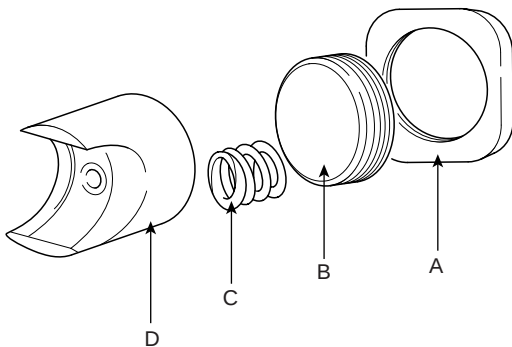
ST -25

11. Remove the yoke plug (B) with a 14mm socket (A).



KPBF006L

12. Remove the lock nut (D), yoke plug (C), rack support spring (B) and rack support yoke (A) from the gear box.



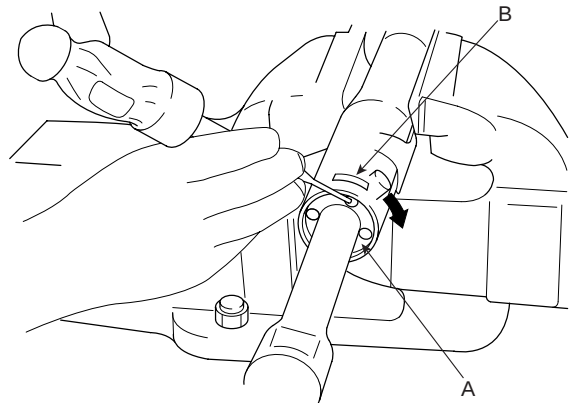
APJF005L

13. When the end of the circlip comes out of the notched-hole of the housing rack cylinder, turn the rack stopper (A) clockwise and remove the circlip.



**CAUTION**

**Be careful not to damage the rack.**



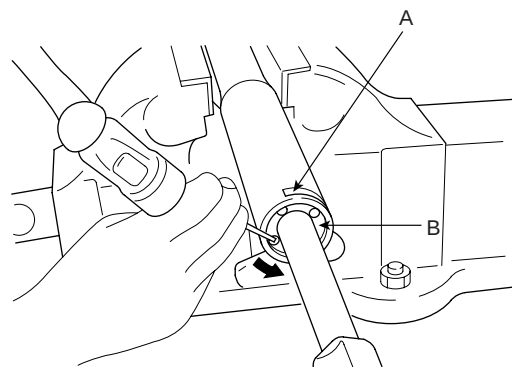
UPBG500K

14. When the end of the circlip comes out of the notched hole (A) of the housing rack cylinder, turn the rack stopper (B) counterclockwise and remove the circlip.



**CAUTION**

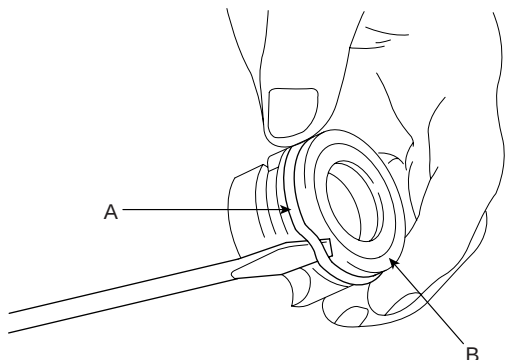
**Be careful not to damage the rack.**



EPKE013R

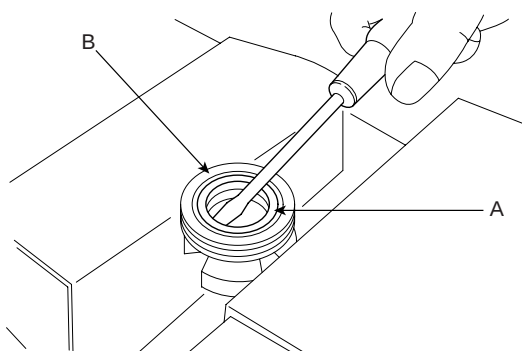
15. Remove the rack bushing and rack from the rack housing.

16. Remove the O-ring(A) from the rack bushing (B).



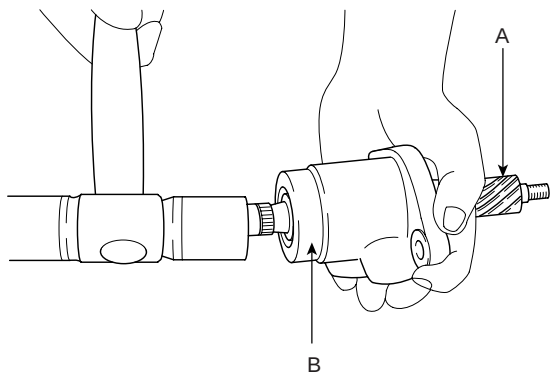
EPKE013T

17. Remove the oil seal (B) from the rack bushing (A).



EPKE013U

18. Remove the valve body (A) from the valve body housing (B) with a soft hammer.



UPBG500L

19. Using the special tool, remove the oil seal and ball-bearing from the valve body housing.

20. Remove the oil seal and O-ring from the rack housing.



**CAUTION**

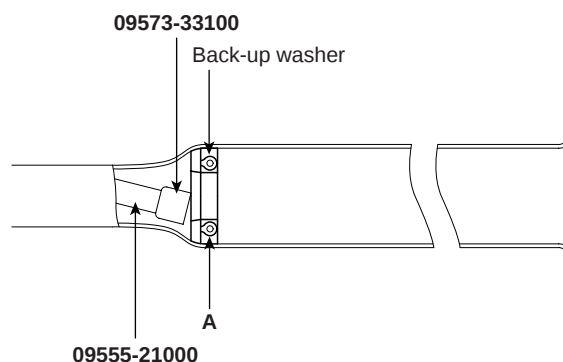
*Be careful not to damage the pinion valve cylinder inside of the rack housing.*

21. Using the special tool (09573-33100, 09555-21000), remove the oil seal (A) from the rack housing.



**CAUTION**

*Be careful not to damage the rack cylinder inside of the rack housing.*



EPRF210B

## MECHANICAL POWER STEERING SYSTEM

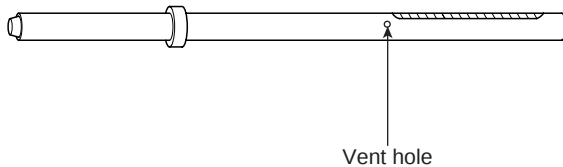
ST -27

### INSPECTION

E390BC17

#### 1. Rack

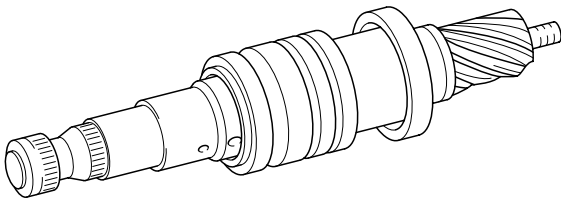
- 1) Check for rack tooth face damage or wear.
- 2) Check for oil seal contact surface damage.
- 3) Check for rack bending or twisting.
- 4) Check for oil seal ring damage or wear.
- 5) Check for oil seal damage or wear.



LPJF006C

#### 2. Pinion valve

- 1) Check for pinion gear tooth face damage or wear.
- 2) Check for oil seal contact surface damage.
- 3) Check for seal ring damage or wear.
- 4) Check for oil seal damage or wear.



APJF013Z

#### 3. Bearing

- 1) Check for seizure or abnormal noise during abearing rotation.
- 2) Check for excessive play.
- 3) Check for missing needle bearing rollers.

#### 4. Others

- 1) Check for damage of the rack housing cylinder bore.
- 2) Check for boot damage, cracking or aging.

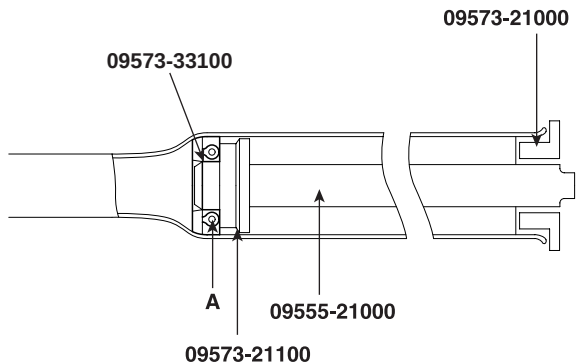
## REASSEMBLY

E6CC0F05

1. Apply the specified fluid to the entire surface of the rack oil seal.

Recommended fluid : PSF-3

2. Install the backup washer and oil seal (A) to the specified position in the rack housing.

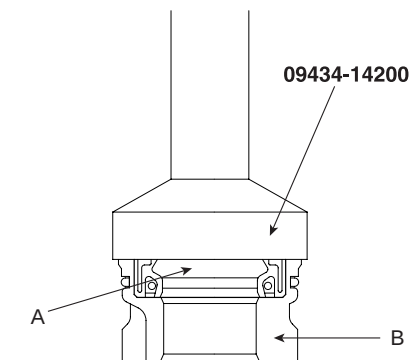


KPBF007F

3. Apply the specified fluid to the entire surface of the rack bushing oil seal.

Recommended fluid : PSF-3

4. Install the oil seal (A) in the rack bushing (B).



EPKE230B

5. Apply the specified fluid to the entire surface of the O-ring and install it in the rack bushing.

6. Apply the specified grease to the rack teeth.

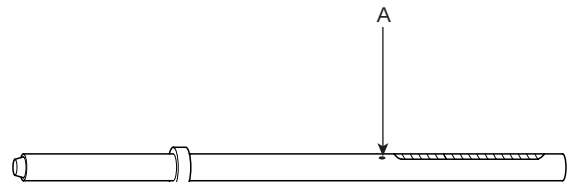
Recommended grease

Multipurpose grease SAE J310a NLGI No.2



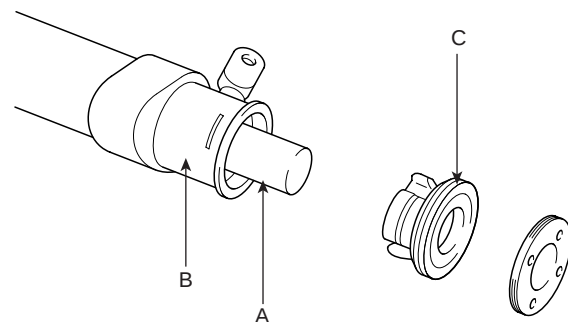
### NOTE

Do not plug the vent hole(A) in the rack with grease.



APJF014E

7. Insert the rack(A) into the rack housing(B) and install the rack bushing(C).



UPBG500M

## MECHANICAL POWER STEERING SYSTEM

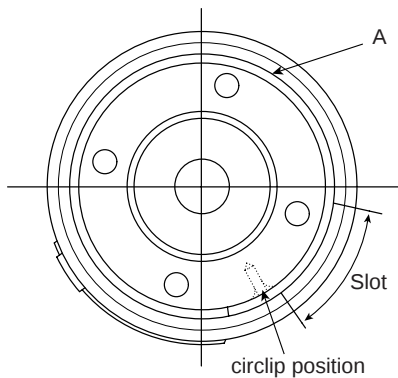
ST -29

8. Push in the rack stopper (A) until the circlip groove of the rack stopper is aligned with the notched hole of the rack housing. Then, install the circlip while turning the rack stopper.



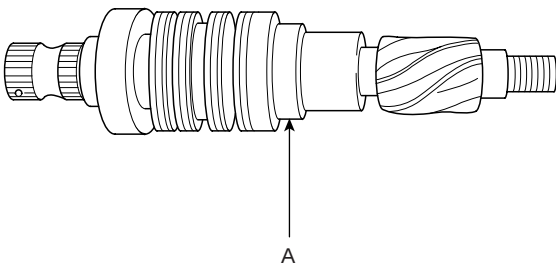
### CAUTION

**The circlip should not be visible through the notched hole of the rack housing.**



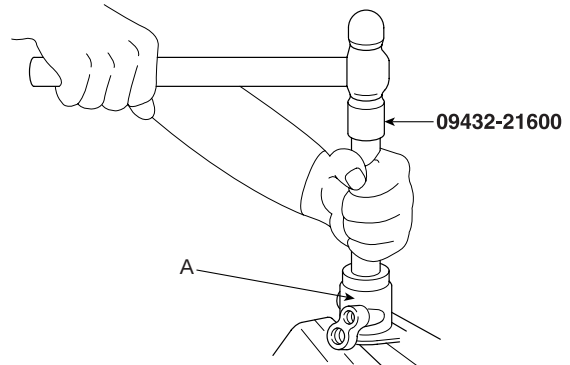
EPBF500C

9. Using special Tool (09432-21600), install the oil seal and the ball bearing in the valve body (A).



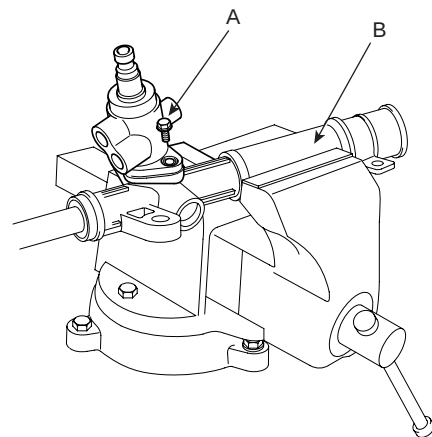
EPKE230E

10. After applying the specified fluid and grease to the pinion valve assembly (A), install it in the rack housing assembly.



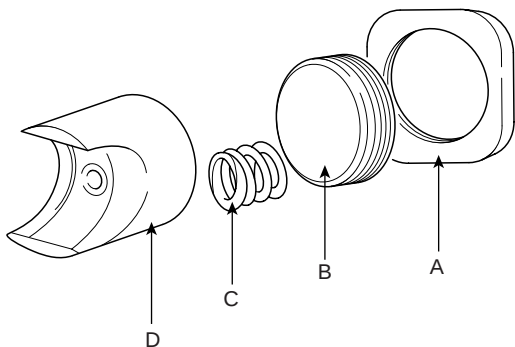
APGE008G

11. After applying the specified fluid to the oil seal, install it in the rack housing and fix the valve body assembly(A) and O-ring in the gear box(B).



APHE007F

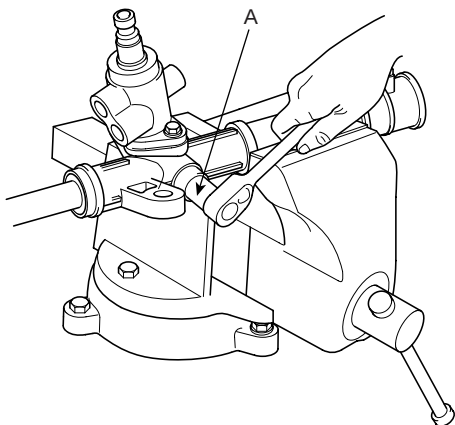
12. Install the rack support yoke (A), rack support spring (B), yoke plug (C) and lock nut (D) in the order shown in the illustration. Apply semi-drying sealant to the threaded section of the yoke plug before installation.



APJF005L

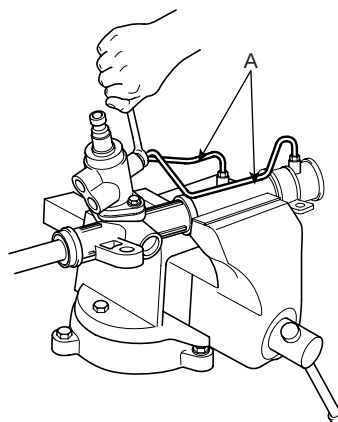
13. With the rack placed in the center position, attach the yoke plug to the rack housing. Tighten the yoke plug to 12 Nm (120 kg·cm, 8.9 lb·ft), with a 14mm socket (A). Loosen the yoke plug approximately from 30° to 60° and tighten the yoke nut to the specified torque.

**Tightening Torque Nm(kgf·m, lb·ft) :**  
50 ~ 70(5 ~ 7, 37 ~ 52)



APHE007I

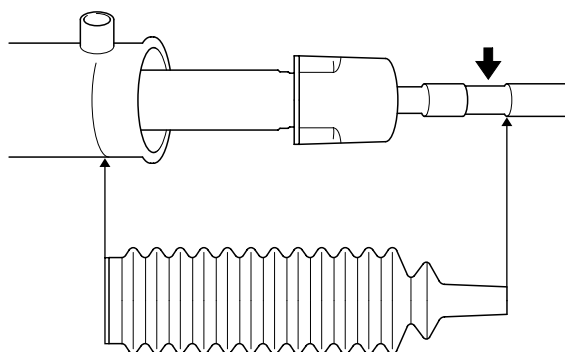
14. Tighten the feed tube (A) to the specified torque and install the mounting rubber using adhesive.



APHE006H

15. Apply the specified grease to the bellows mounting position (fitting groove) of the tie rod.

Recommended grease : Silicone grease



APGE008C

16. Install the new attaching band to the bellows.



**NOTE**

When the bellows are installed, a new band must be used.

17. Install the bellows in position, taking care not to twist it.

## MECHANICAL POWER STEERING SYSTEM

ST -31

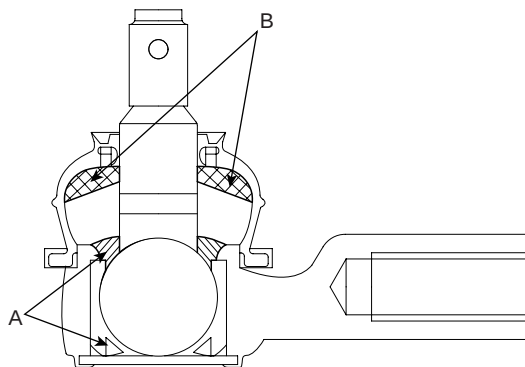
18. Fill the dust cover inner side and lip with the specified grease, and fix the dust cover in position with the clipping attached in the groove of the tie rod end.

Recommended grease

A : POLY LUB GLY 801K or equivalent

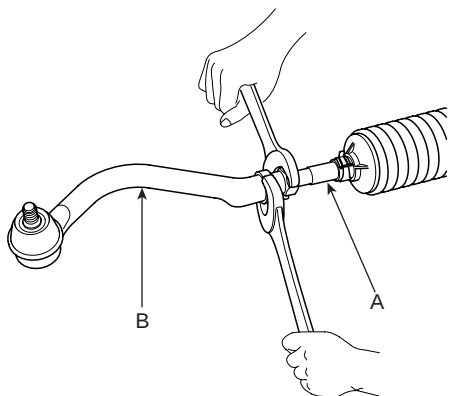
B : SHOWA SUNLIGHT MB2 or equivalent

Dust cover inner side and lip : THREE BOND



EPKE043A

19. Install the tie rod end (B) to the tie rod (A).



KPBF202A

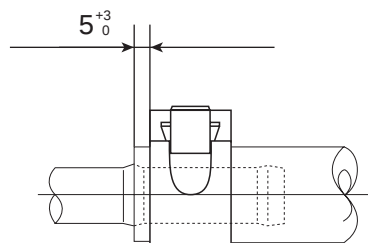
## INSTALLATION

ED2B00D9



### NOTE

Be sure to connect between a tube and a hose as shown in the illustration.



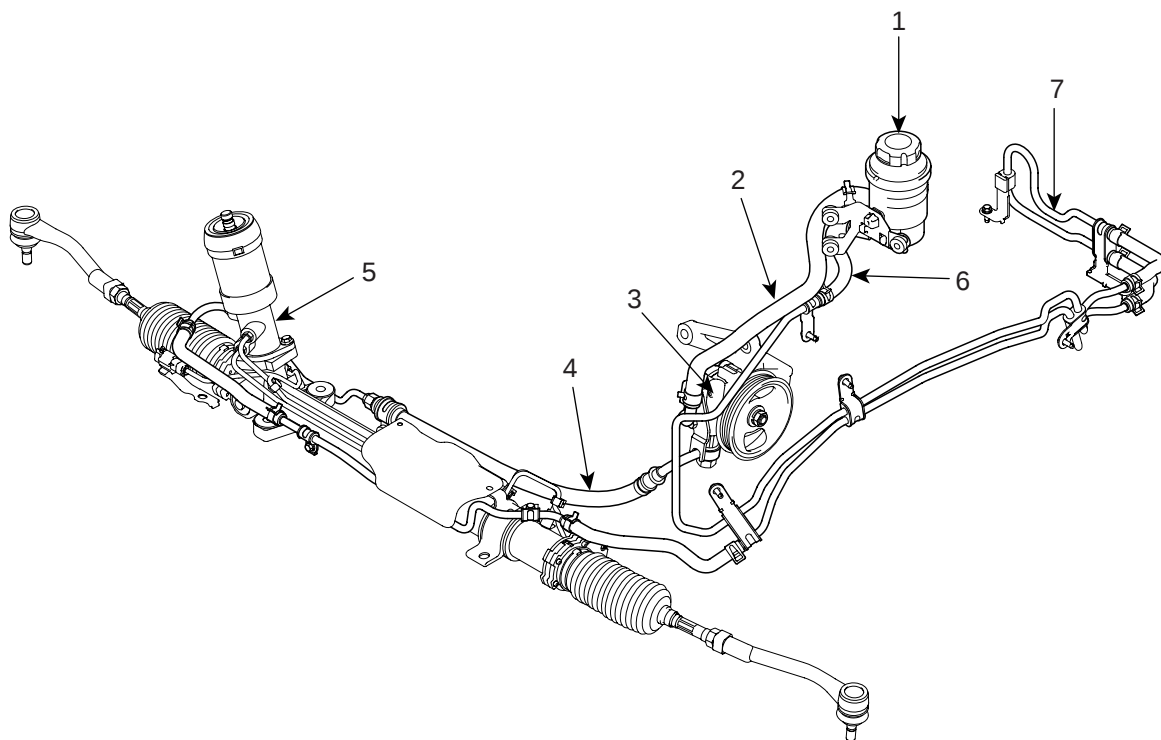
APKF501F

1. Installation is the reverse of removal.
2. After installation, bleed the power steering system. (Refer to the air bleeding in ST group)
3. Adjust the wheel alignment. (Refer to SS group)

## POWER STEERING HOSES

### COMPONENTS EF51A3DD

[DIESEL]

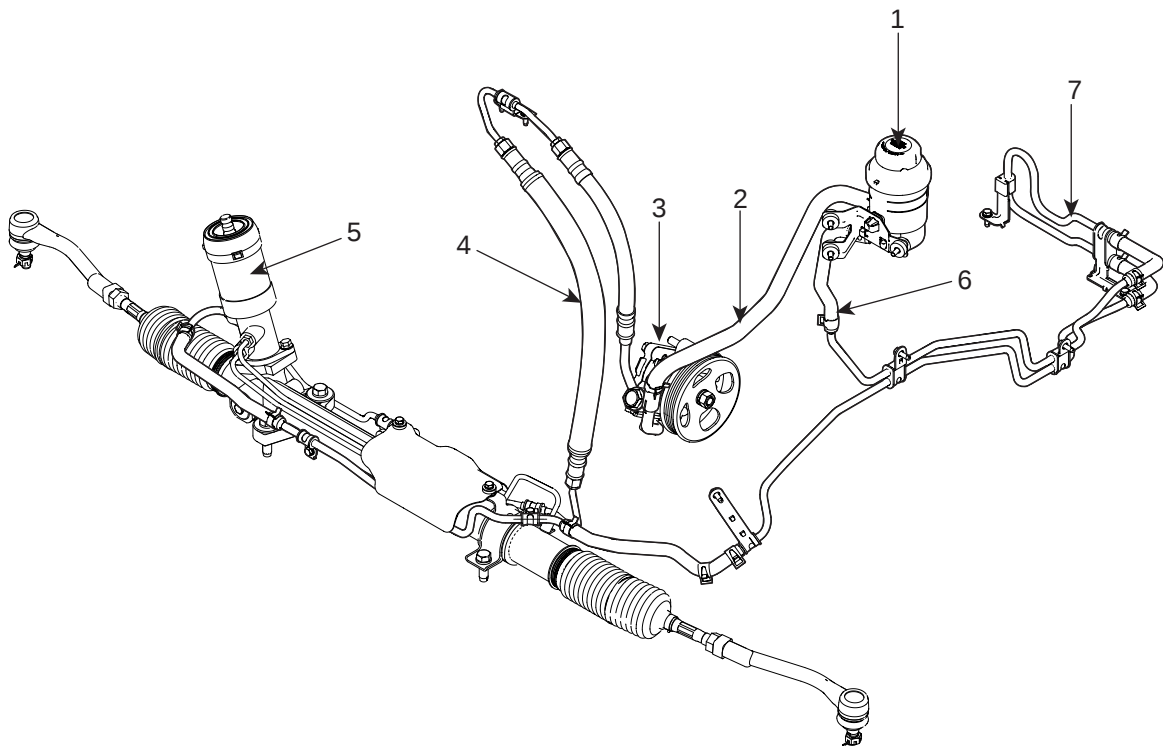


1. Reservoir
2. Suction hose
3. Oil pump
4. Pressure hose

5. Power steering gear box
6. Return tube
7. Cooler tube

LPKG500B

[GASOLINE]



- |                  |                            |
|------------------|----------------------------|
| 1. Reservoir     | 5. Power steering gear box |
| 2. Suction hose  | 6. Return tube             |
| 3. Oil pump      | 7. Cooler tube             |
| 4. Pressure hose |                            |

BPKG500I

ST -34

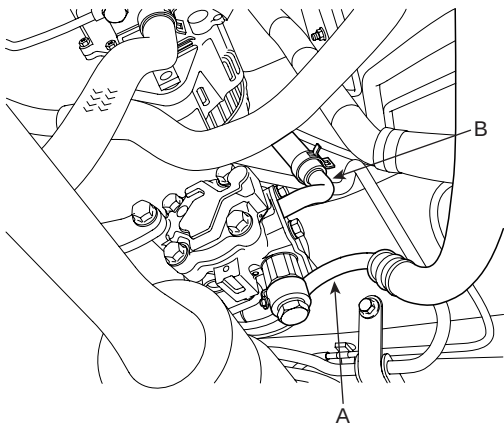
STEERING SYSTEM

REPLACEMENT EB101EEF

1. Drain the power steering fluid.
2. Disconnect the pressure tube (A) and suction tube (B) from the power steering oil pump.

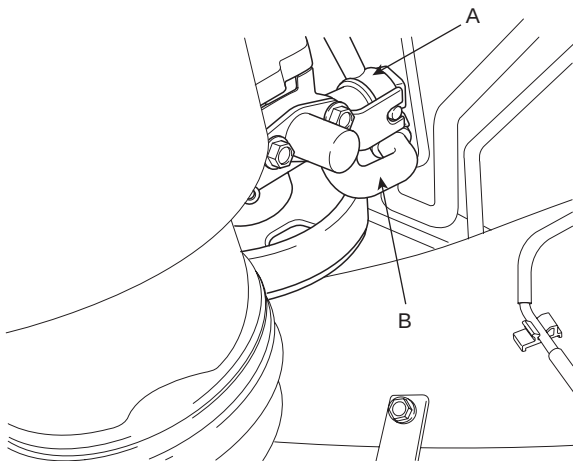
**Tightening torque Nm (kgf.m, lb-ft):**  
55 ~ 65 (4.5 ~ 5.5, 40 ~ 47)

[DIESEL]



APKF016A

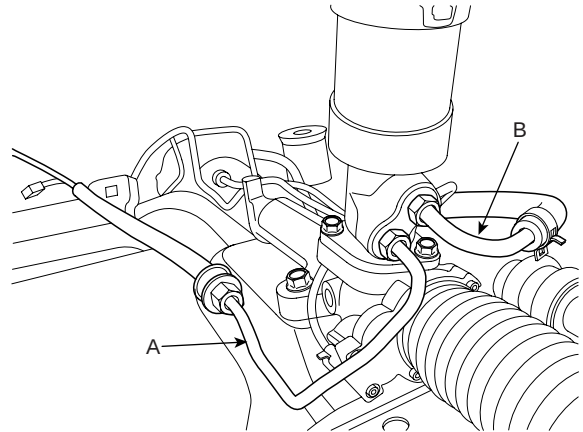
[GASOLINE]



LPKG201A

3. Disconnect the pressure tube (A) and return tube from the valve body housing.

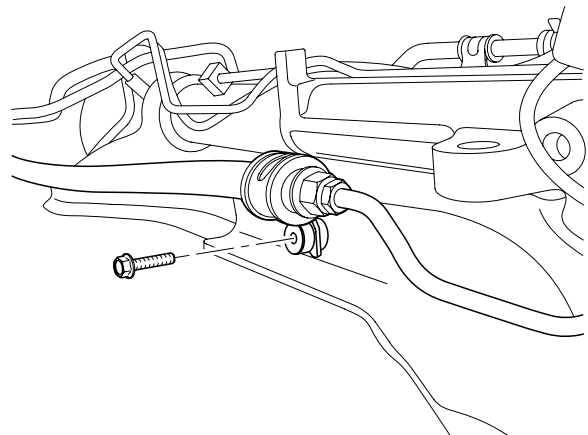
**Tightening torque Nm (kgf.m, lb-ft):**  
12 ~ 18 (1.2 ~ 1.8, 9 ~ 13)



APKF018A

4. Remove the brackets of the pressure tube and hose from the sub-frame.

[DIESEL]

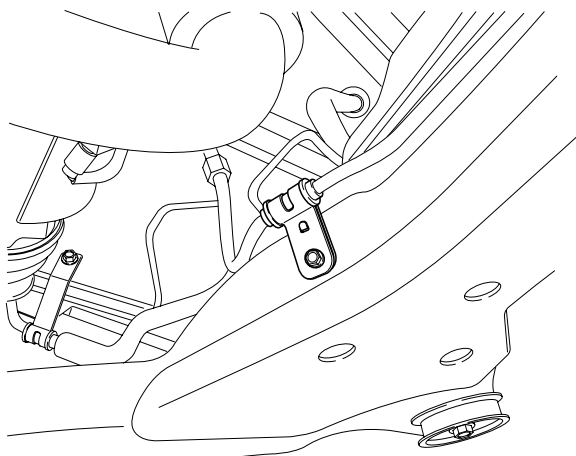


LPKG500C

## MECHANICAL POWER STEERING SYSTEM

ST -35

### [GASOLINE]



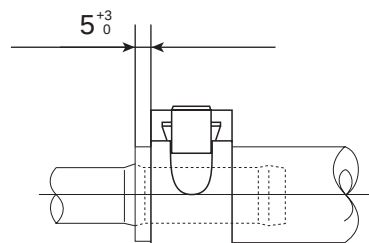
LPKG102A

6. Remove the under cover and then loosen the oil cooler tube bracket bolts. (Refer to BD-group)



### NOTE

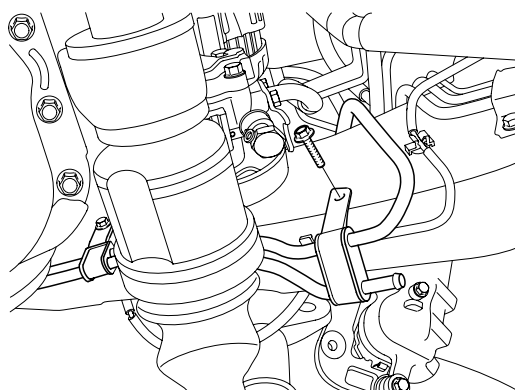
Be sure to connect between a tube and a hose as shown in the illustration.



APKF501F

5. Remove the bracket of the return tube and hose.

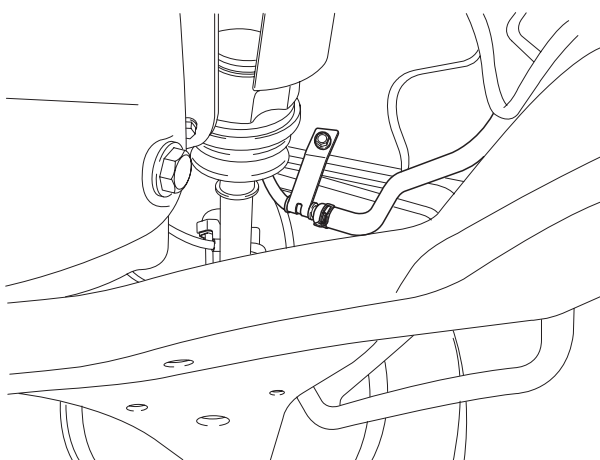
### [DIESEL]



LPKG500D

7. Installation is the reverse of removal.
8. After installation, bleed the power steering system. (Refer to the air bleeding in ST group)

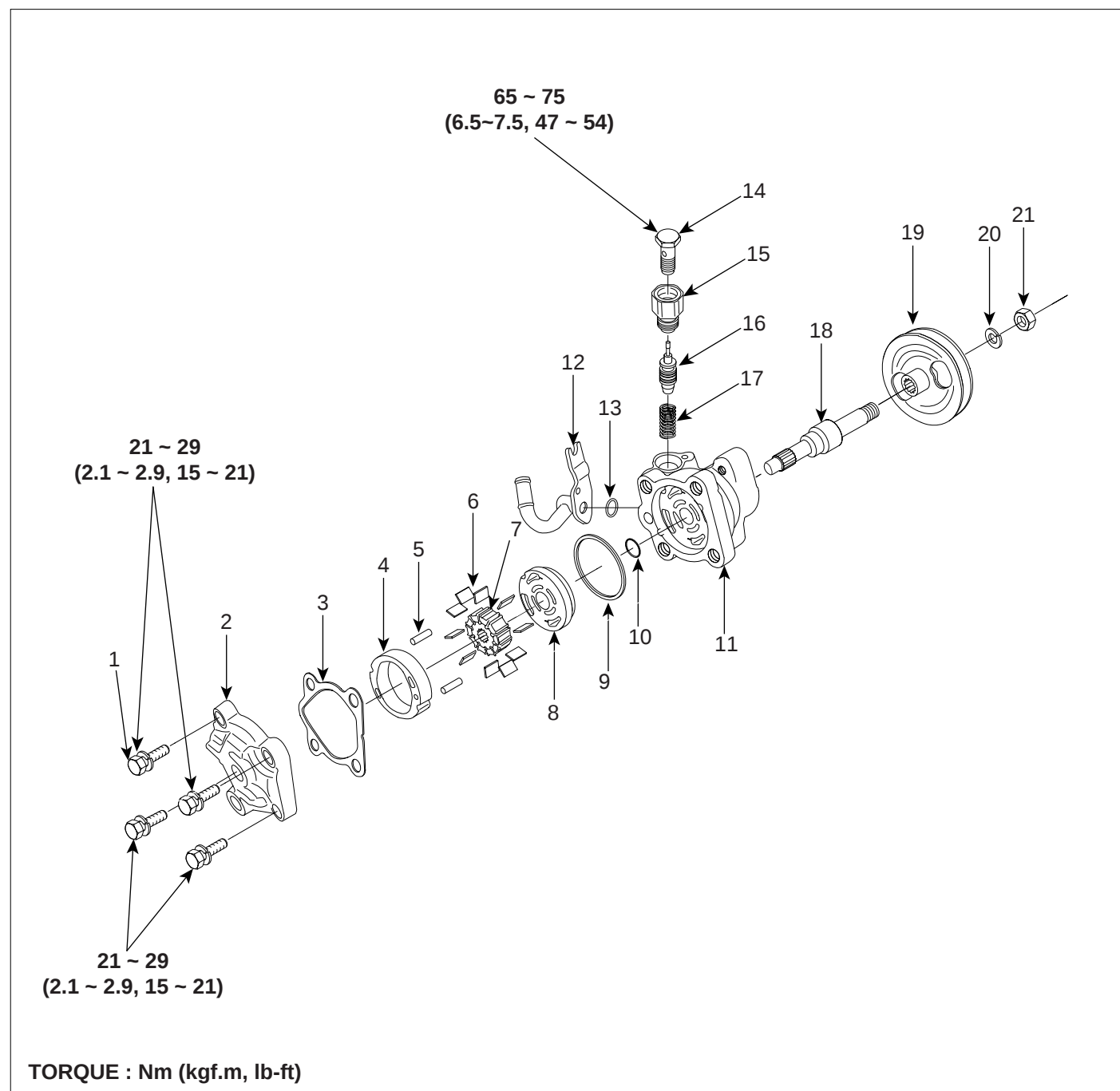
### [GASOLINE]



BPKG501G

## POWER STEERING OIL PUMP

### COMPONENTS E65F9200



1. Bolt
2. Oil pump cover assembly
3. Gasket
4. Cam ring
5. Lock pin
6. Vane
7. Rotor

8. Side plate
9. O-ring(Inner)
10. O-ring(Outer)
11. Front housing
12. Suction pipe
13. O-ring
14. Bolt

15. Connector
16. Flow control valve
17. Flow control spring
18. Shaft
19. Pulley
20. Washer
21. Nut

## MECHANICAL POWER STEERING SYSTEM

ST -37

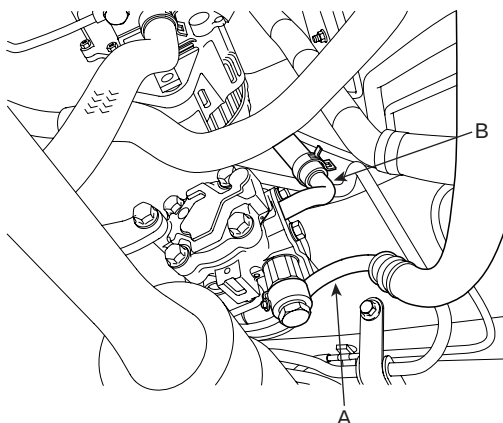
### REMOVAL E8F45457

1. Disconnect the pressure tube (A) from the oil pump by loosening the eye bolt.

**Tightening torque Nm (kgf-m, lb-ft):**  
65 ~ 75 (6.5 ~ 7.5, 47 ~ 54)

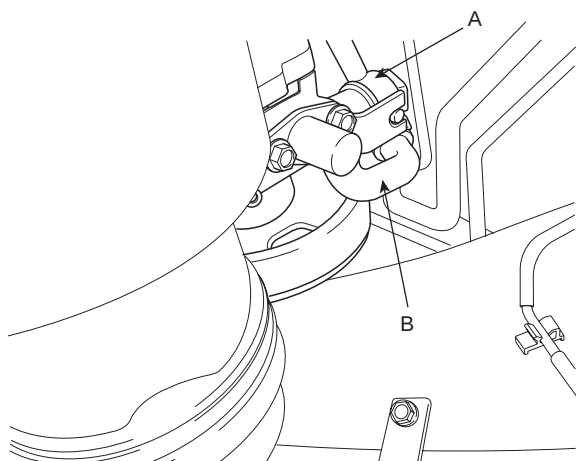
2. Disconnect the suction hose (B) from the suction pipe.

[DIESEL]



APKF016A

[GASOLINE]



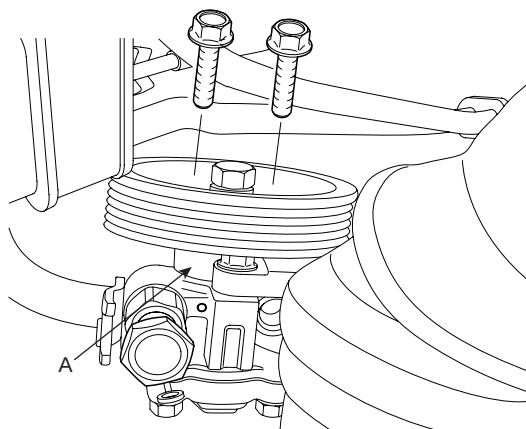
LPKG201A

3. Remove the drive belt.

4. Loosen the power steering pump mounting bolts, and then remove the power steering pump assembly (A) from the pump bracket.

**Tightening torque Nm (kgf-m lb-ft):**  
17 ~ 26 (1.7 ~ 2.5, 12 ~ 19)

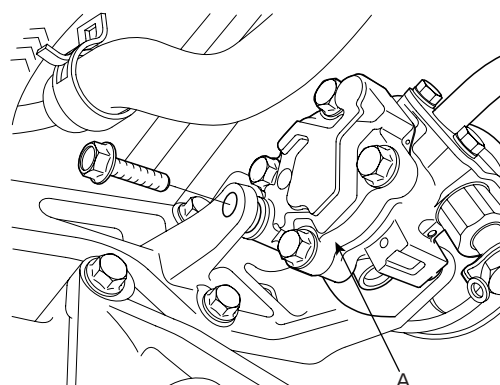
[DIESEL]



LPKG500E

**Tightening torque Nm (kgf-m lb-ft):**  
38 ~ 47 (3.8 ~ 4.7, 27 ~ 34)

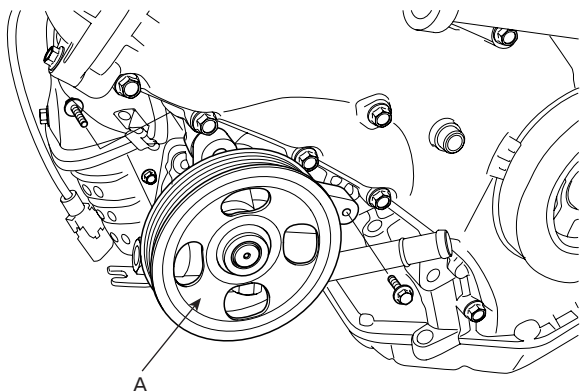
[DIESEL]



LPKG500F

Tightening torque Nm (kgf.m lb-ft):  
35 ~ 50 (3.5 ~ 5.0, 25 ~ 36)

[GASOLINE]



UPBG500Y

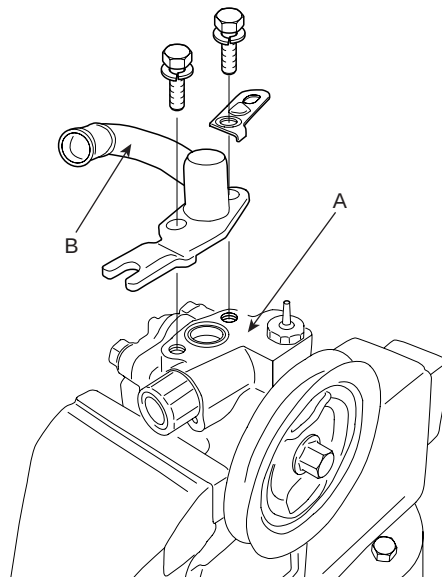


**NOTE**

Be careful not to spill fluid from the power steering oil pump.

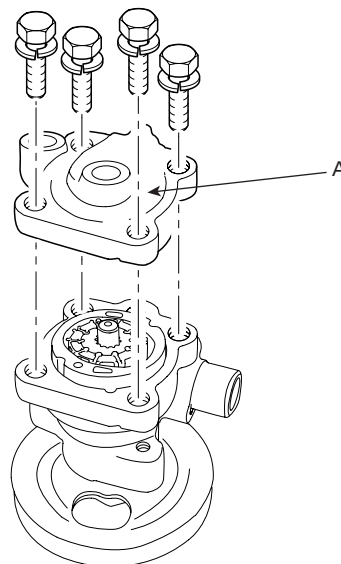
**DISASSEMBLY** EF65F38F

1. Remove two bolts from the oil pump body (A), and then remove the suction pipe (B) and O-ring.

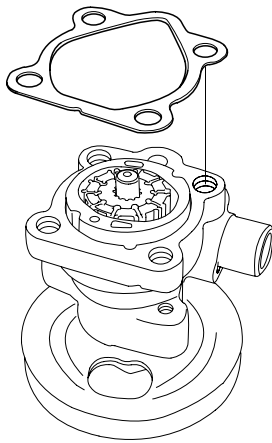


EPNG004A

2. Loosen the four bolts and remove the oil pump cover assembly (A) and the gasket.

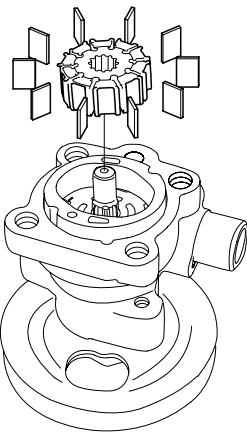


EPNG005A



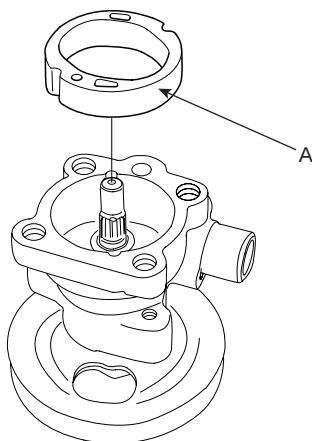
EPNG006A

3. Remove the rotor and vanes.



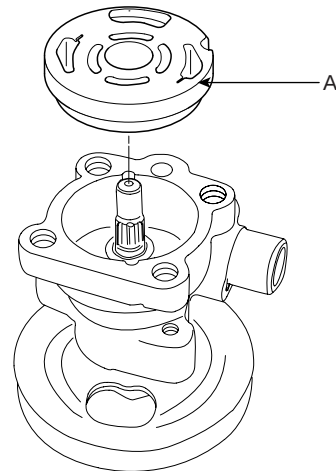
EPNG007A

4. Remove the cam ring.



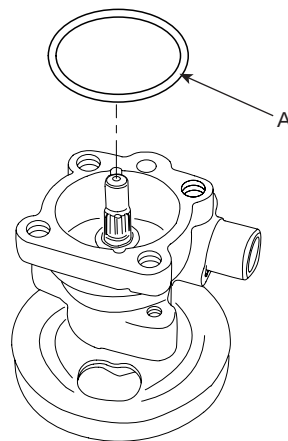
EPNG008A

5. Remove the oil pump side plate (A).



BPKG501E

6. Remove the inner and outer O-ring (A).

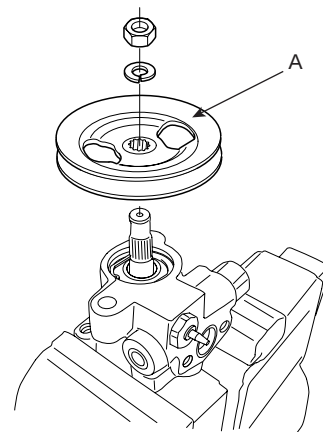


EPNG010A

 **NOTE**

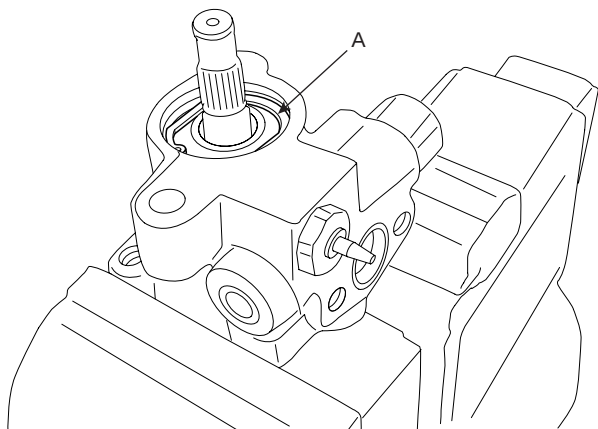
*When assembling, use a new gasket and O-ring.*

7. Mount the pump in a vise and remove the pulley (A) nut and the spring washer.



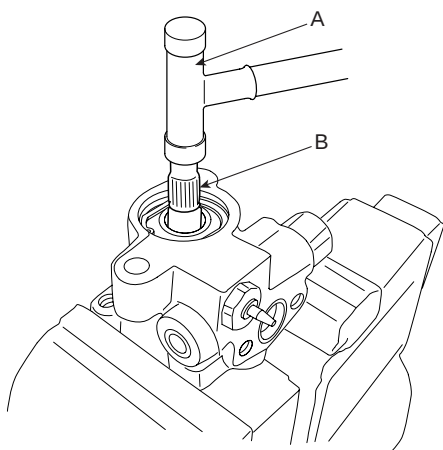
EPNG011A

8. After removing the snap ring (A) of the shaft with snap ring pliers, remove the dust spacer.



EPNG012A

9. Tap the rotor side of the shaft slightly with a plastic hammer (A) to remove the shaft (B).



EPNG500Q

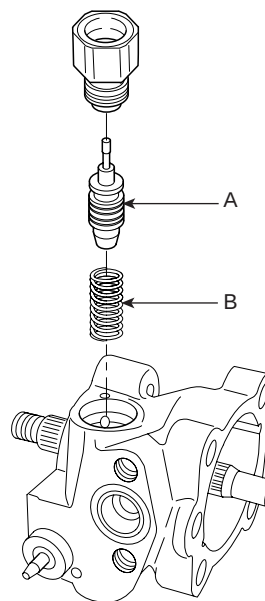
10. Remove the oil seal from the oil pump body.



**NOTE**

When assembling, use a new oil seal.

11. Remove the connector from the oil pump body, and take out the flow control valve (A) and the flow control spring (B).



EPNG013A

12. Remove the O-ring from the connector.



**CAUTION**

**Do not disassemble the flow control valve.**

## MECHANICAL POWER STEERING SYSTEM

ST -41

### INSPECTION

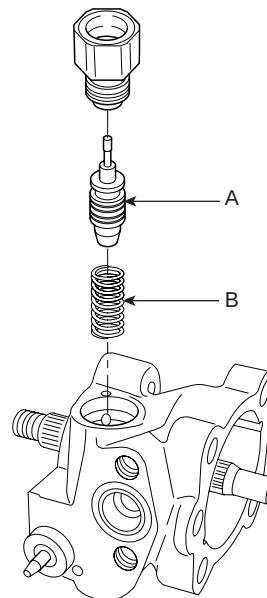
E12AB39A

1. Check that the flow control valve is not bent.
2. Check the shaft for wear and damage.
3. Check the V belt for wear and deterioration.
4. Check the grooves of the rotor and vanes for stratified abrasion.
5. Check the contact surface of the cam ring and vanes for stratified abrasion.
6. Check vanes for damage.
7. Check that there is no striped wear in the side plate or contacting part between the shaft and the pump cover surface.

### REASSEMBLY

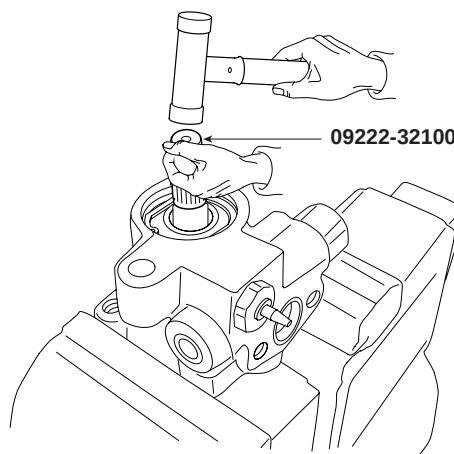
EAE04AEE

1. Install the flow control spring (B), the flow control valve (A) and the connector into the pump body.



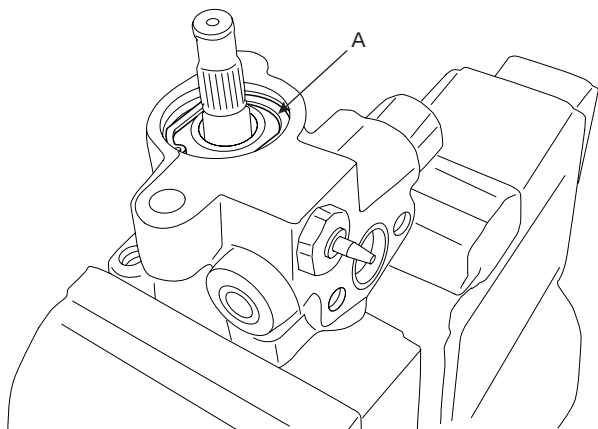
EPNG013A

2. Install the oil seal in the pump body by using the special tool (09222-32100).



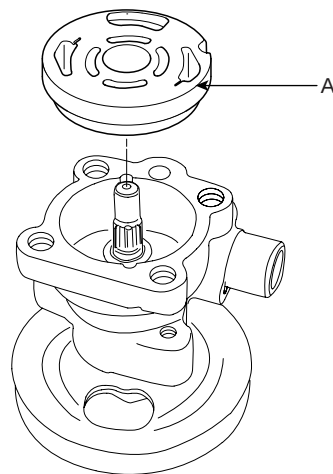
EPNG500R

3. After inserting the shaft assembly into the pump body, install the dust spacer and snap ring (A).



EPNG012A

6. Install the oil pump side plate (A).

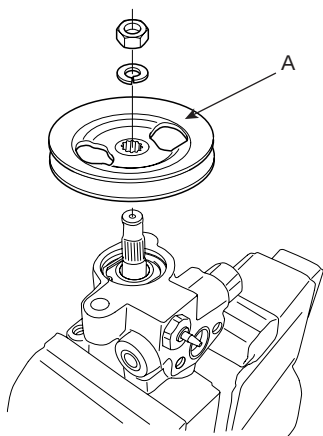


BPKG501E

4. Install the pump pulley(A).

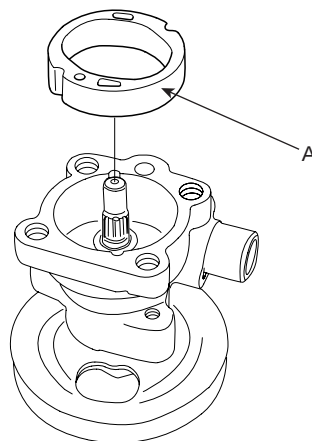
**Tightening torque :**

55 ~ 69 Nm (5.5 ~ 6.9 kgf-m, 39.8 ~ 49.9 lb-ft)



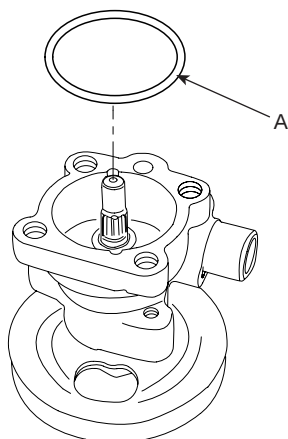
EPNG011A

7. After inserting the lock pin into the groove of the front housing, install the camring (A) attending to the direction.



EPNG008A

5. Install the inner O-ring and outer O-ring (A).

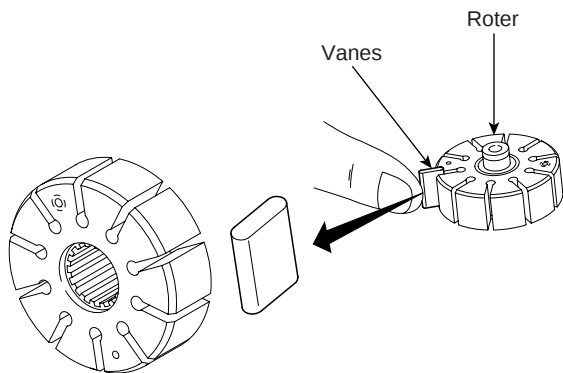


EPNG010A

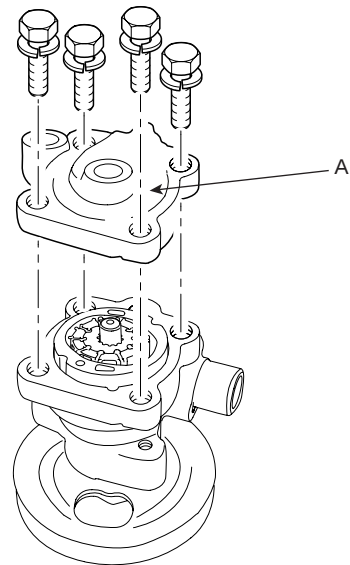
## MECHANICAL POWER STEERING SYSTEM

ST -43

8. Install the rotor and the vanes.



EPRF401D

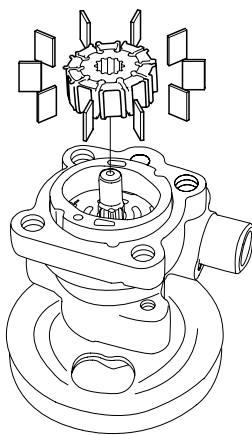


EPNG005A

10. Install the O-ring (A) and the suction pipe mounting bolt.

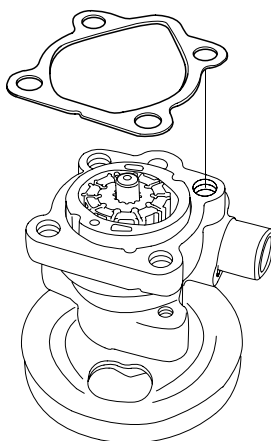
### **Tightening torque :**

13.6 ~ 18.4 Nm (1.36 ~ 1.84 kgf·m, 9.84 ~ 13.3 lb-ft)

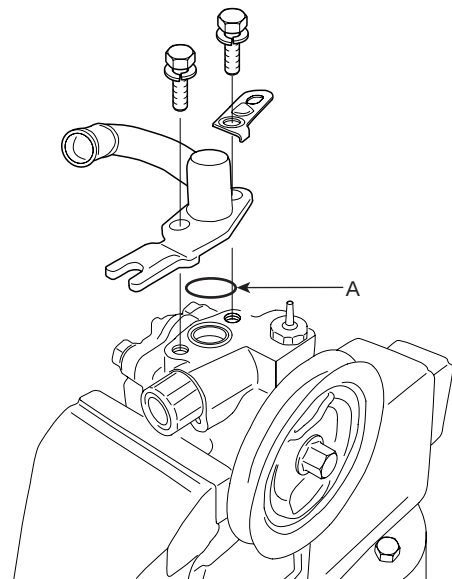


EPNG007A

9. Install the gasket and oil pump cover assembly (A).



EPNG006A



EPNG500S

## INSTALLATION EAE0C0CB

1. Installation is the reverse of removal.



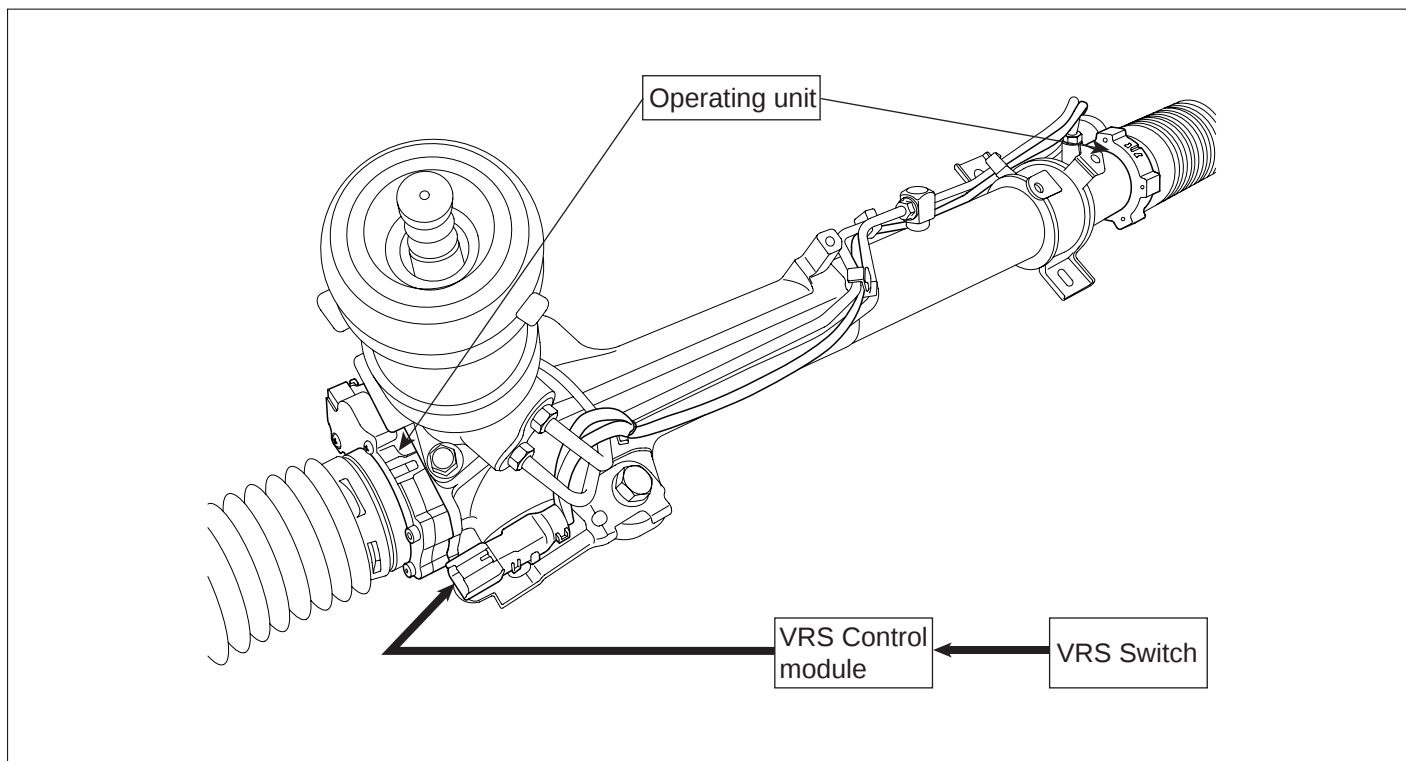
### **CAUTION**

***The pressure tube does not twist and come in contact with other components.***

2. Add power steering fluid
3. Bleed the power steering system. (Refer to the air bleeding in ST group)
4. Check the oil pump pressure.

## VARIOUBLE RACK STROKE

### DESCRIPTION E40EDAA5



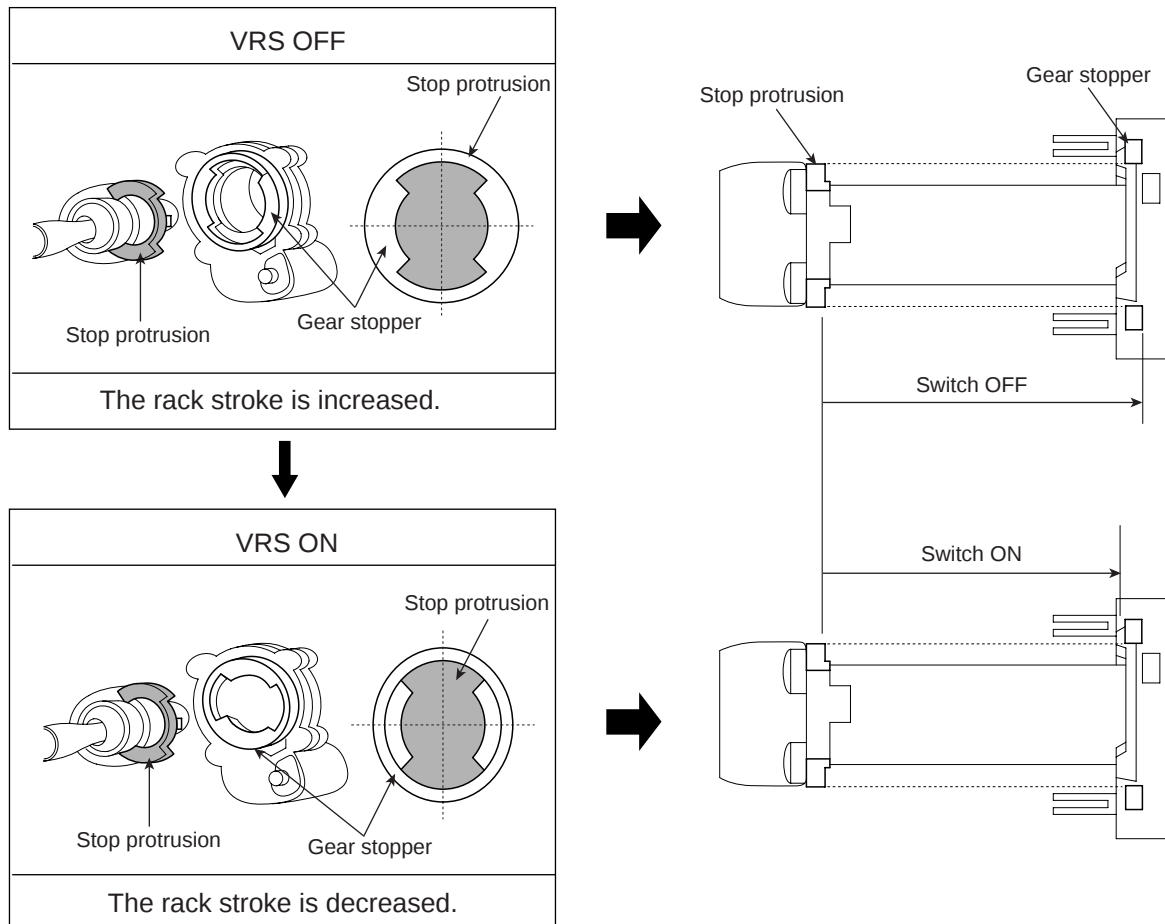
LPKG500G

The VRS (Variable Rack Stroke) is the system that controls the rack stroke using the operating unit installed on both ends of the gear box. Normally the VRS system keeps switching OFF and the rack stroke stays increased, so the vehicle's turning radius becomes reduced. On the other hand, when fitting the snow chains in winter season, the VRS switch must be turned ON and the VRS system will prevent interference between the snow chains and the vehicle by decreasing the rack stroke.

## OPERATING PRINCIPLE EE2B25C7

When switching the VRS system ON, the DC motor in the VRS operating unit rotates the gear stopper by 90 degrees and the gear stopper stops the stop protrusion from entering as shown in the illustration below. This operation reduces the maximum steering angle by decreasing the rack

stroke. When switching the VRS system OFF, the gear stopper returns to original location and the rack stroke also returns to normal.

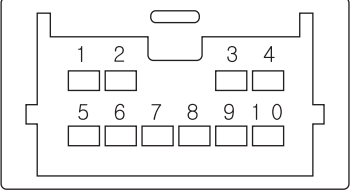
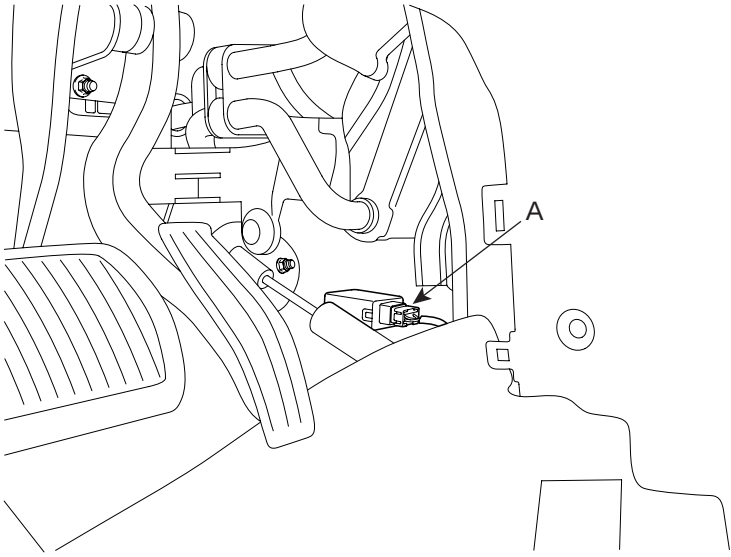


LPKG500H

VRS CONTROL MODULE

DESCRIPTION EF705B24

The VRS control module (A) controls the DC motor in the VRS operating unit according to signal of the VRS switch (ON or OFF) and is mounted behind the center fascia.



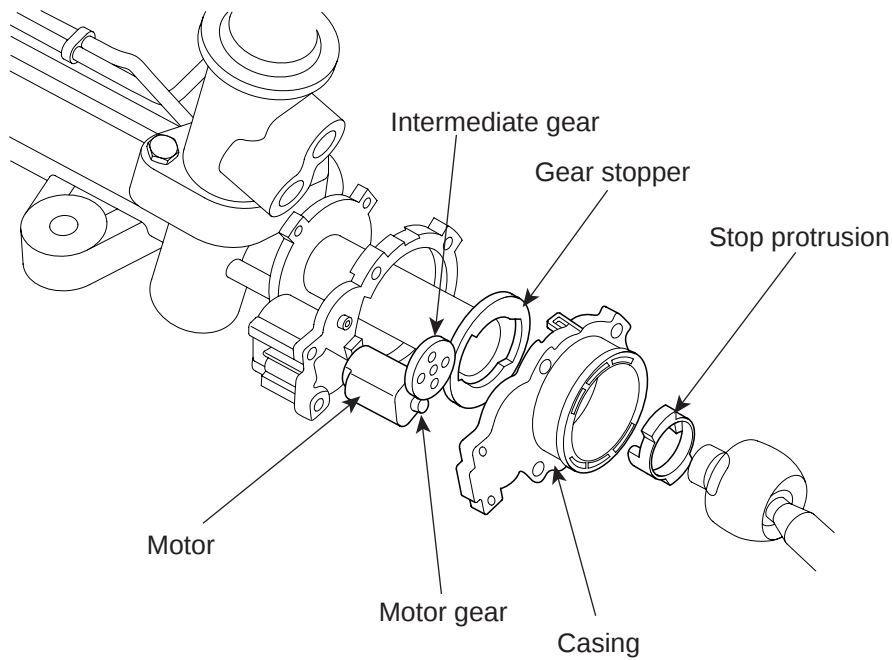
| Pin No. | Function      |
|---------|---------------|
| 1       | Switch signal |
| 2       | -             |
| 3       | IG2 (+)       |
| 4       | IG2 (-)       |
| 5       | Motor LH (-)  |
| 6       | Motor LH (+)  |
| 7       | Motor RH (+)  |
| 8       | Motor RH (-)  |
| 9       | -             |
| 10      | -             |

LPKG5001

## VRS OPERATING UNIT

### DESCRIPTION E5BB4D2E

The VRS operating unit installed on both ends of the steering gear box can change the rack stroke by changing angle of the gear stopper.

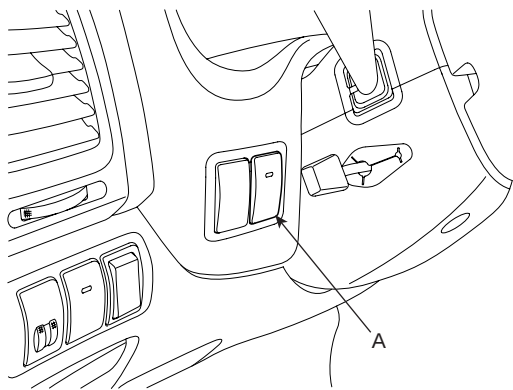


LPKG500J

VRS SWITCH

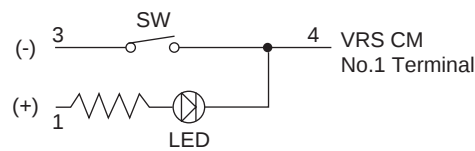
DESCRIPTION EA7150B3

The VRS switch (A) is located on the cluster fascia panel as shown in the illustration and "VRS" is printed on the VRS switch.



SWITCH DIAGRAM

| <div>P<br/>T</div> | ON (Push) | OFF (Free) | REMARK         |
|--------------------|-----------|------------|----------------|
| 3                  |           |            | GND            |
| 4                  |           |            | Control module |
| 1                  |           |            | IGN2           |
| 2                  |           |            | ILL (+)        |
| 5                  |           |            | ILL (-)        |



|                 | Signal (Switch No.4 terminal) | LED |
|-----------------|-------------------------------|-----|
| Switch OFF → ON | High → Low                    | ON  |
| Switch ON → OFF | Low → High                    | OFF |

LPKG500K

TROUBLE SHOOTING

E485456F

| Symptom                                                                              | Probable cause                                                                                                       | Remedy                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| There is no change made in rack stroke even though turning the VRS switch ON or OFF. | <ul style="list-style-type: none"> <li>VRS operating unit</li> <li>VRS control module</li> <li>VRS switch</li> </ul> | <ul style="list-style-type: none"> <li>Inspect the VRS operating unit.</li> <li>Check Input/ output signal of the VRS control module.</li> <li>Inspect connection of the VRS switch.</li> </ul> |
| LED is not illuminated even though turning the VRS switch ON.                        | VRS switch                                                                                                           | <ul style="list-style-type: none"> <li>Inspect connection of the VRS switch.</li> <li>Check the LED for damage.</li> </ul>                                                                      |

There is no change made in rack stroke (the minimum turning radius) even though turning the VRS switch ON or OFF.

LPKG500N

INSPECTION OF THE RACK STROKE

- Is the rack stroke (the maximum steering angle) changed when pressing the VRS switch?

**YES**

The VRS system is in normal condition.

**NO**

Go to step 2.

- Measure the resistance of the VRS operating unit.
  - Disconnect the VRS operating unit connector.
  - Measure the resistance between the terminal No.1 and No.2.

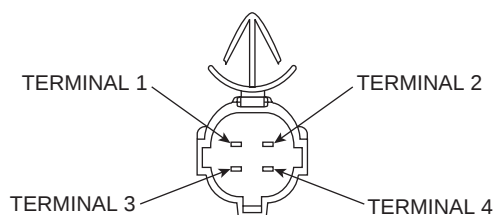
Repeat the terminal No.3 and No.4.

Is the measured resistance within standard value?

4 ~ 20  $\Omega$  → Normal condition (standard value)

1  $\Omega$  or below → Short

100  $\Omega$  or above → Open circuit



LPKG500L

**YES**

Go to step 3.

**NO**

Repair or replace the power steering gear box.

- Measure the output voltage of the VRS control module.
  - Disconnect the VRS control module connector.
  - Connect 9 ~ 15 V power between the terminal No.3 and No.4.
  - Measure the output voltage (to DC motor) between the terminal No.5 ~ 8.

Is the voltage measured within standard value?

| Supplied power | Measured output voltage |                |
|----------------|-------------------------|----------------|
|                | Standard value          | VRS CM failure |
| 9 V            | 8 V or above            | Below 8 V      |
| 12 V           | 11 V or above           | Below 11 V     |
| 15 V           | 14 V or above           | Below 14 V     |

**YES**

Inspect connection of connectors and harness for the VRS system.

**NO**

Replace the VRS control module.

LED is not illuminated even though turning the VRS switch ON.

LPKG5000

4. Is the LED on the VRS switch illuminated when turning the VRS switch ON?

**YES**

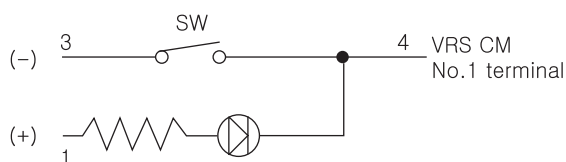
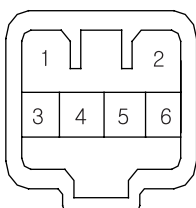
The VRS switch has normal condition.

**NO**

Go to step 2.

5. Inspect the VRS switch connector.

- 1) Disconnect the VRS switch connector.
- 2) Connect 12 V power between terminal No. 1 (+) and No.3 (-).  
Check if the LED is turned ON or OFF by pressing the VRS switch.



LPKG500M

Is the LED turned ON or OFF when pressing the VRS switch?

**YES**

The VRS switch is in normal condition.

**NO**

Repair or replace the VRS switch.