Steering System

GENERAL

SPECIFICATIONS E52E8BEB

Item			Specifications
Column and shaft		Shaft and joint type	Collapsible, crossjoint with tilt column
		Steering gear type	Rack and pinion
		Rack stroke mm	146
		Tilt stroke(Manual/Power)	±7°
		Tele stroke(Manual/Power)	30mm
Oil pump	3.3L/3.8L	Type	Vane type
		Displacement	9.6 cc/rev
		Relief pressure	100 ± 4 kgf/㎠
Steering angle		Inner	37.68° ± 2°
		Outer	30.71°
		Tie rod end ball joint starting torque	30kg·cm or less

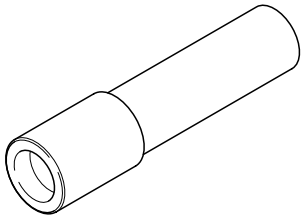
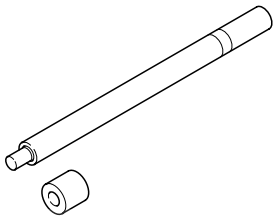
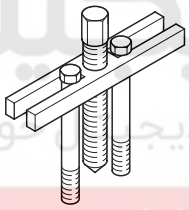
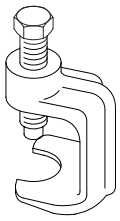
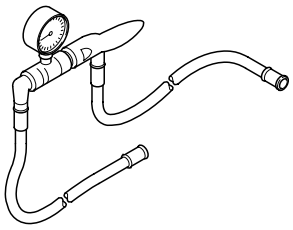
TIGHTENING TORQUE EC7E7013

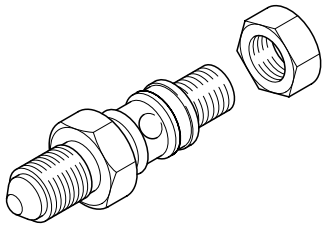
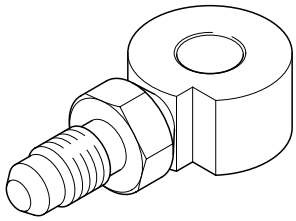
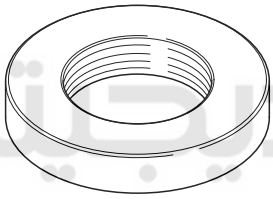
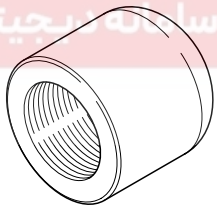
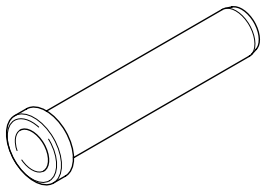
Items		Nm	kgf·m	lb-ft
Steering column and shaft	Steering column to column member mounting (upper)	13 ~ 18	1.3 ~ 1.8	9.4 ~ 13
	Steering column to column member mounting (lower)	13 ~ 18	1.3 ~ 1.8	9.4 ~ 13
	Steering column dust cover mounting bolt	13 ~ 18	1.3 ~ 1.8	9.4 ~ 13
	Steering wheel lock nut	40 ~ 50	4 ~ 5	28.9 ~ 36.1
	Joint assembly(upper)	15 ~ 20	1.5 ~ 2.0	10.8 ~ 14.4
	Joint assembly(lower)	18 ~ 25	1.8 ~ 2.5	13 ~ 18
Steering gear box	Wheel nut	90 ~ 110	9 ~ 11	66 ~ 81
	Pressure hose to gear box	12 ~ 18	1.2 ~ 1.8	8.6 ~ 13
	Return tube to gear box	12 ~ 18	1.2 ~ 1.8	8.6 ~ 13
	Tie rod end lock nut	50 ~ 55	5.0 ~ 5.5	36.1 ~ 39.7
	Pinion and valve assembly to self locking nut	20 ~ 30	2 ~ 3	14.4 ~ 21.6
	Yoke plug lock nut	50 ~ 70	5 ~ 7	36.1 ~ 50.6
	Tie rod end self locking nut	24 ~ 34	2.4 ~ 3.4	17.3 ~ 24.5
	Mounting bracket to crossmember	140 ~ 160	14 ~ 16	101 ~ 118
	Steering gear box Mounting	45 ~ 55	4.5 ~ 5.5	33 ~ 39.7
Oil pump	Pressure hose to oil pump	55 ~ 65	5.5 ~ 6.5	39.7 ~ 47
	Oil pump mounting bolt [3.3L],[3.8L]	35 ~ 55	3.5 ~ 5.5	25.3 ~ 39.7
	Pump cover to pump body	18 ~ 22	1.8 ~ 2.2	13 ~ 15.9
	Suction connector to oil pump body	6 ~ 10	0.6 ~ 1	4.3 ~ 7.2
	Flow control valve connector to pump body	55 ~ 65	5.5 ~ 6.5	39.7 ~ 47
Steering hoses and oil reservoir	Oil reservoir bracket mounting bolt	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3
	Cooler tube clamp mounting bolt	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3
	Tube clip and tube bracket	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3
	Pressure hose bracket mounting bolt	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3
	Hose clamp	4 ~ 6	0.4 ~ 0.6	2.8 ~ 4.3

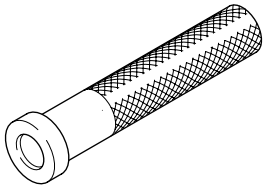
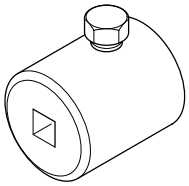
LUBRICANTS

Items	Specified lubircant	Quantity
Steering column bearing	Multipurpose grease SAE J310a, NLGI No.2	As required
Steering gear box rack, pinion gear part	Multipurpose grease SAE J310a, NLGI No.2	As required
Bellows	Silicone grease	As required
Oil pump	Power steering fluid (PSF-3)	As required
Power steering fluid	Power steering fluid (PSF-3)	1.0 lit
Tie rod end ball joint	SUNLIGHT MB-2	4g

SPECIAL TOOLS E215AE3F

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

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

09434-14200 Counter shaft bearing installer	 APJF001M	Installing the gear box oil seal
09565-11100 Preload socket	 APJF001A	Measuring the pinion shaft preload

TROUBLESHOOTING E80E87DD

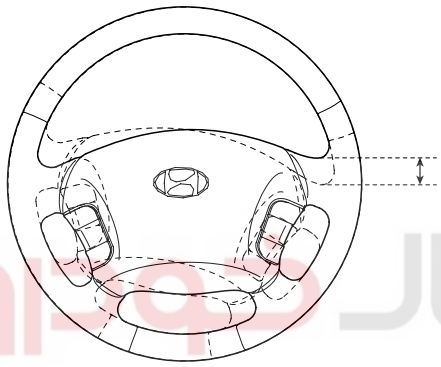
Symptom	Probable cause	Remedy
Excessive play in steering	Loose yoke plug	Retighten
	Loose steering gear mounting bolts	Retighten
	Loose or worn tie rod end	Retighten or replace as necessary
Steering wheel operation is not smooth (Insufficient power assist)	V-belt slippage	Readjust
	Damaged V-belt	Replace
	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 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 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 EF4B5EEB

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)



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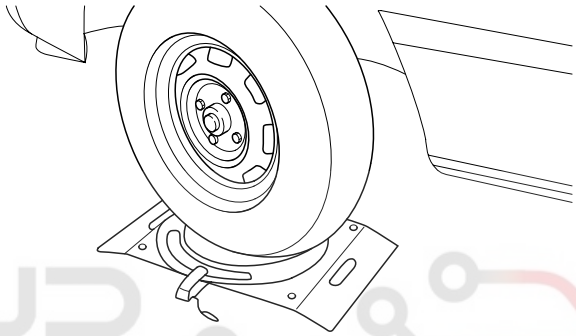
3. If the play exceeds the standard value, inspect the connection between the steering shaft and tie rod ends.

CHECKING STEERING ANGLE

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

Standard value :
Wheel angle
Inside wheel 39.17° ±2°
Outside wheel 31.56°

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



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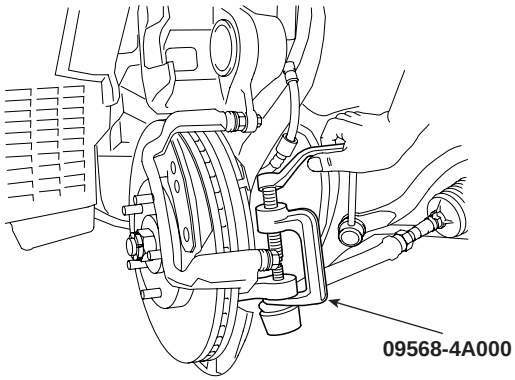
CHECKING THE TIE ROD END BALL JOINT STARTING TORQUE

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



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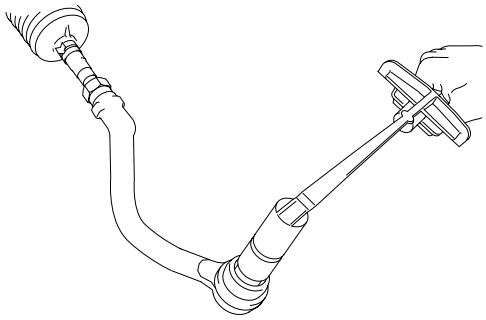
2. Shake the ball joint stud several times to check for looseness.

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



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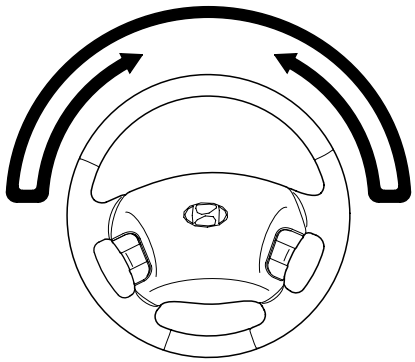
3. If the starting torque exceeds the upper limit of the standard value, replace the tie rod end.
4. Even if the starting torque is below the lower limit of the standard value, check the play of the ball joint and replace if necessary.

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.



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CHECKING POWER STEERING BELT TENSION

Refer to EM group(Timing system).

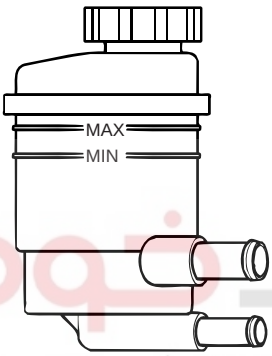
CHECKING POWER STEERING FLUID LEVEL

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˚F).
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.*



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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. Disconnect the high-tension cable at the ignition coil side. While operating the starter 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. Start the engine. Check for oil leakage.
7. Stop the engine.
8. Bleed the system.

Power steering fluid type : PSF-3
Total quantity : Approx 1.0 liter

AIR BLEEDING

1. Disconnect the high tension cable, and 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. *Connect the high tension cable, 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.*

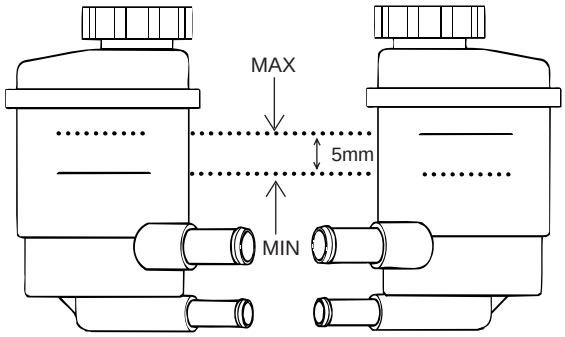
CAUTION

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 isup to the position specified on the level gauge.*
6. *Confirm that there is little change in the surface o 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.***



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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˚F).

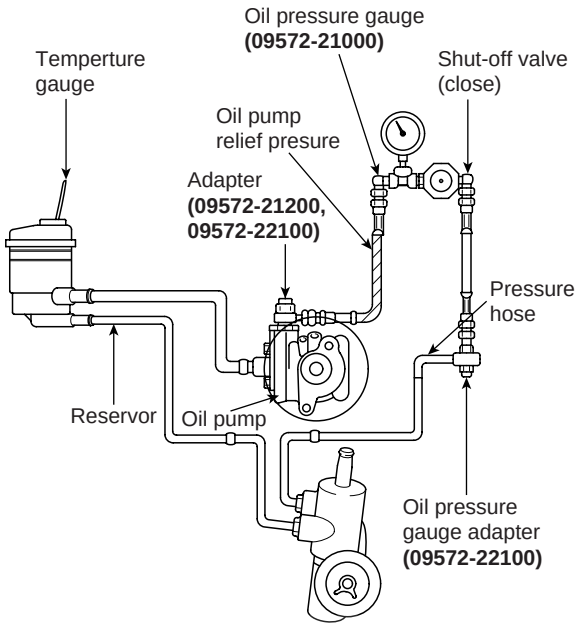
3. Set the engine speed to 1,000 rpm.

4. Close the shut-off valve of the special tool and measure the fluid pressure to confirm that it is within the range.

standard vaule :
Relief pressure: 90 +3/-2 kgf/㎠

CAUTION

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



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

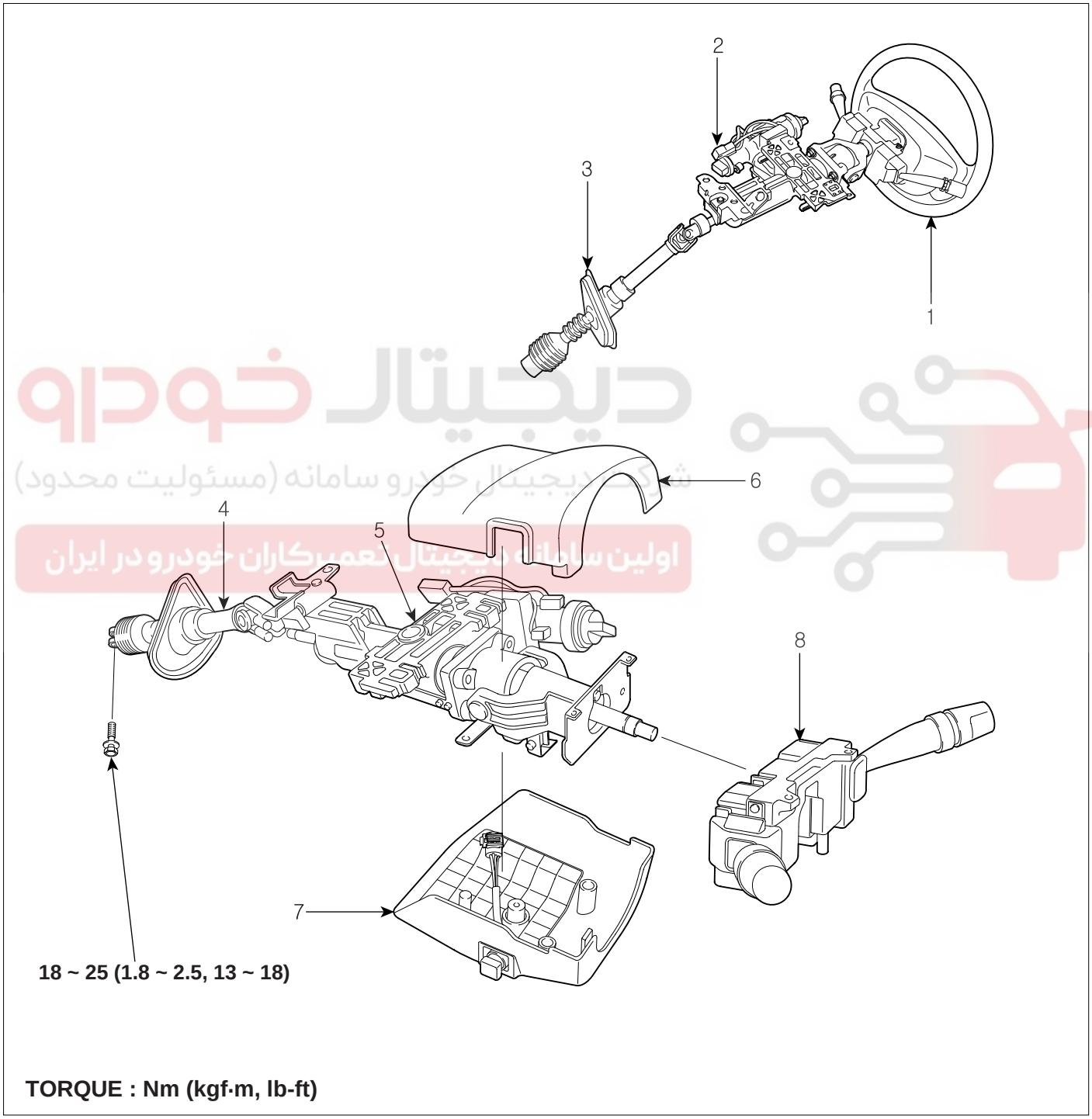
Tightening Torque Nm(kgf·m, lb-ft) :
55 ~ 65(5.5 ~ 6.5, 39.7 ~ 47)

6. Bleed the system.

STEERING COLUMN & SHAFT

STEERING COLUMN / SHAFT

COMPONENTS EE8A2FB4



1. Steering wheel
2. Key lock assembly
3. Dust cover assembly
4. Universal joint assembly
5. Steering colum shaft assembly
6. Steering column upper shroud
7. Steering column lower shroud
8. Multifunction switch

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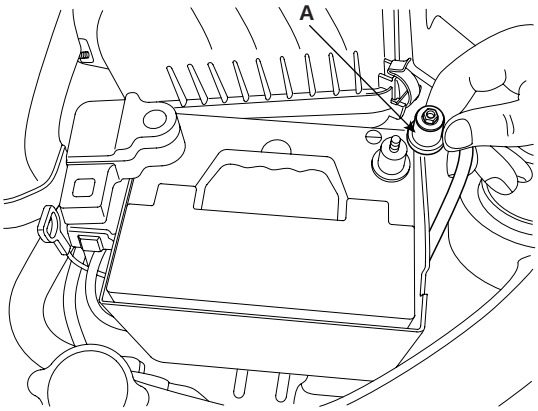
REMOVAL E8272C54

1. Disconnect the negative (-) terminal(A) from the battery.



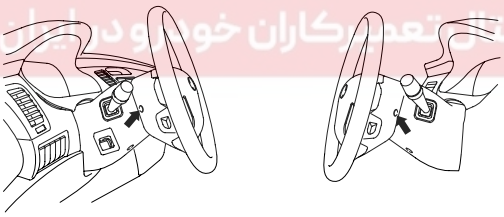
APIE102B

2. Loosen the tapping screws and lift up the horn pad and remove it.

3. Remove the lock nut and the washer.

CAUTION

Before doing these procedures, see the SRS section (RT Group. Only for vehicle equipped with SRS).



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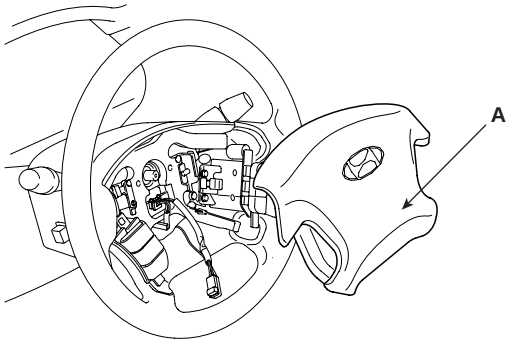

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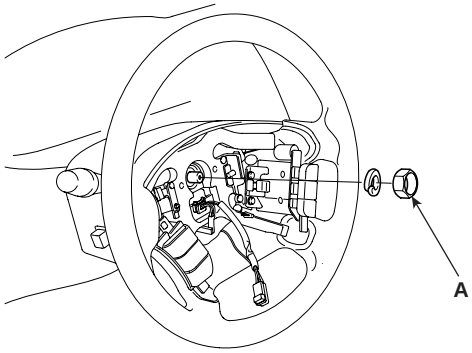
4. Remove the steering wheel with (09561-11001).

CAUTION

Do not hammer on the steering wheel to remove it may cause the damage to the collapsible mechanism.



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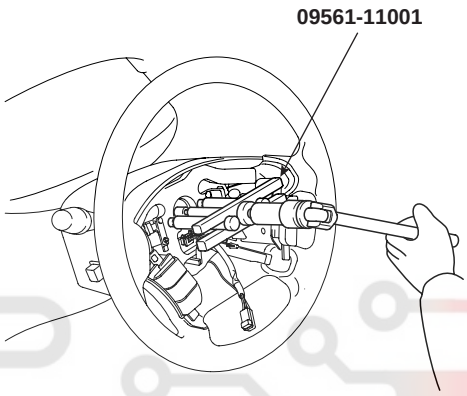

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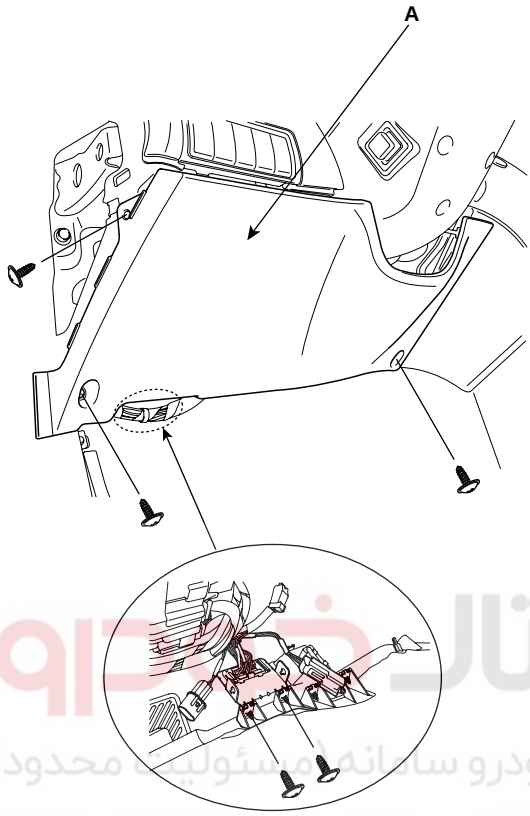
5. Remove the lower cover(A).

[LHD]



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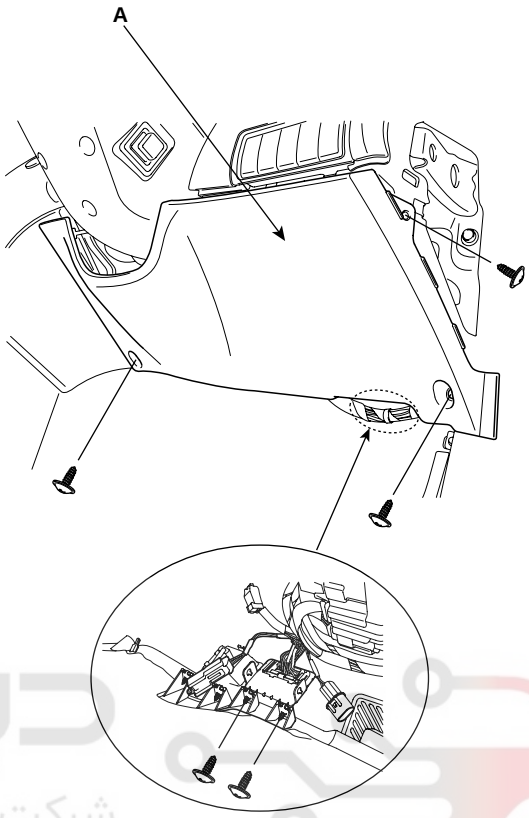

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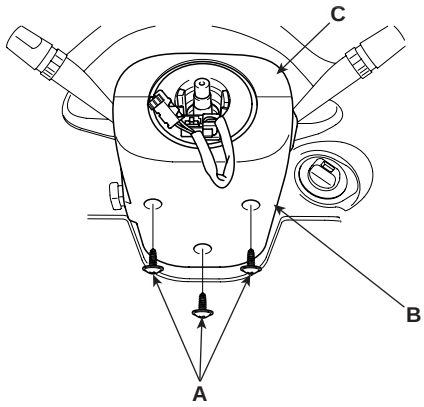
6. Remove the steering column lower and upper shrouds.



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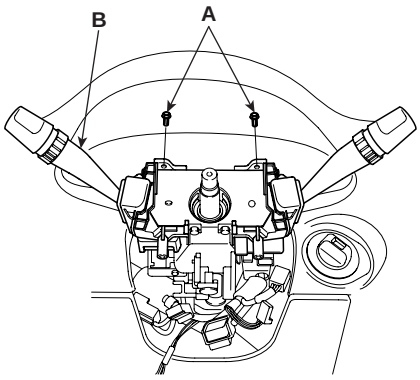
7. Disconnect the connectors and remove the multifunction switch.



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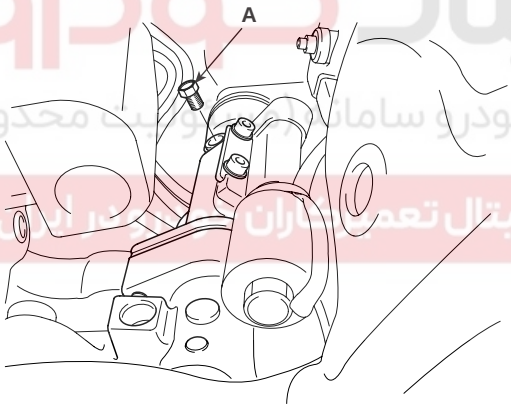
8. Remove the bolts securing the coupling and universal joint. Pull out the universal joint from the gear box.

[LHD]



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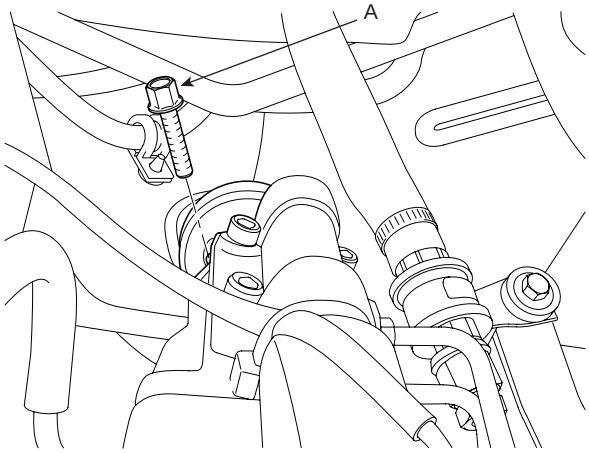
[RHD]



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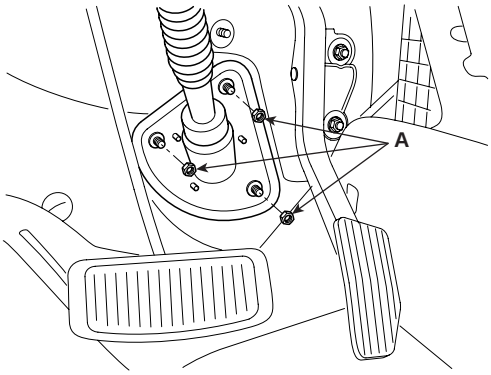
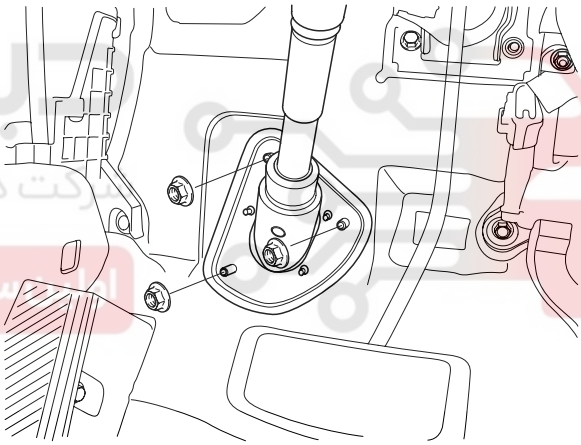
9. Remove the dust cover mounting bolts.

[LHD]



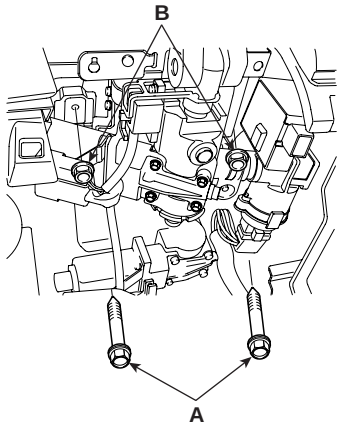
KPBF101H

[RHD]



EPRF700G

10. Remove the steering column mounting bolts (4bolts).



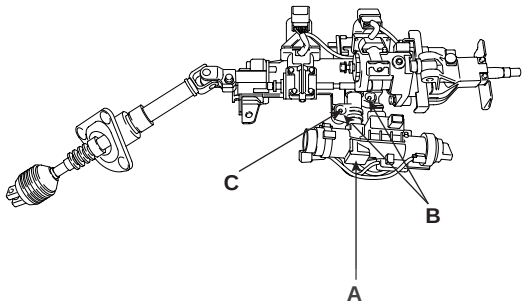
KPBF101I

11. Remove the steering column and shaft with the universal joint and cover.

DISASSEMBLY EB261A91

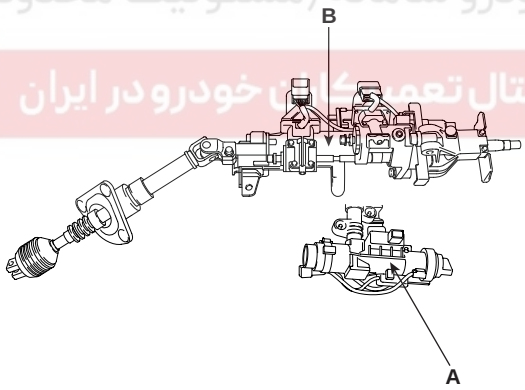
KEY LOCK ASSEMBLY

1. If it is necessary to remove the key lock assembly(A), use a punch to make a groove on the head of the special bolt(B), and then use a screwdriver to remove the key lock assembly mounting bracket(C).



KPBF111A

2. Disassemble the key lock assembly(A) from the steering column and shaft assembly(B).

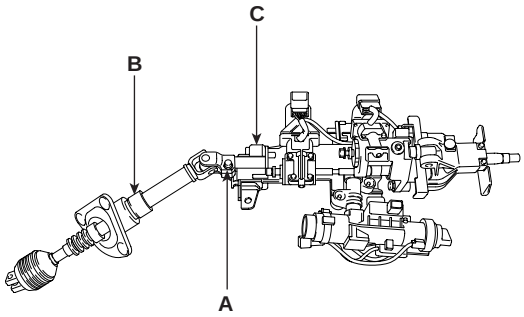


KPBF111B

3. Reassembly is reverse of disassembly.

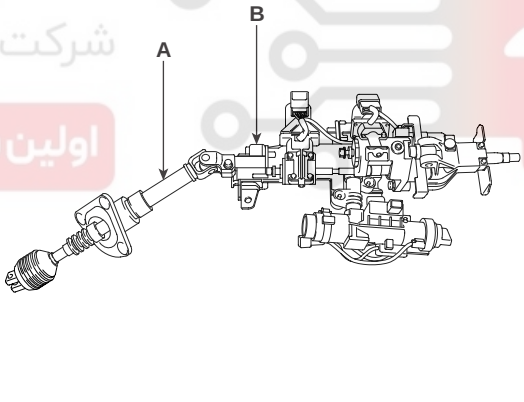
UNIVERSAL JOINT ASSEMBLY

1. Remove the bolt(A) connecting the universal joint assembly(B) and the steering column and shaft assembly(C).



KPBF111C

2. Remove the universal joint assembly(A) from the steering column and shaft assembly(B).



KPBF111D

3. Reassembly is reverse of disassembly.

INSPECTION E1CCD66E

1. Check the steering shaft for damage, play and round-movement.
2. Check the upper and lower bearing for wear or damage.
3. Check the joints for excessive play, damage or rough-movement.
4. Check the tilt bracket for cracks or damage.
5. Check the cover or boot for damage.
6. Check that the steering lock mechanism operate-sproperly. If necessary, replace.

REASSEMBLY EEAA2192

1. Reassembly is reverse of the removal.
2. Make parallel the steering shaft's groove to the hookof the steering lock, when installing the steering lock-assembly.

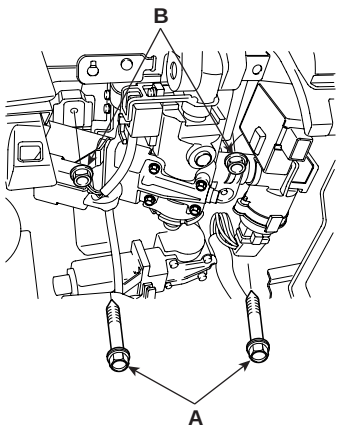
INSTALLATION EFEECD62

1. Before installation, grease the inner side of the bearing, the boot, and the dust cover
2. Install the steering column mounting bolts(A) and nuts(B)

Tightening Torque Nm(kgf·m, lb-ft) :
13 ~ 18(1.3 ~ 1.8, 9.4 ~ 13)

CAUTION

Connect the universal joint to the pinion shaft of the gear box in advance.

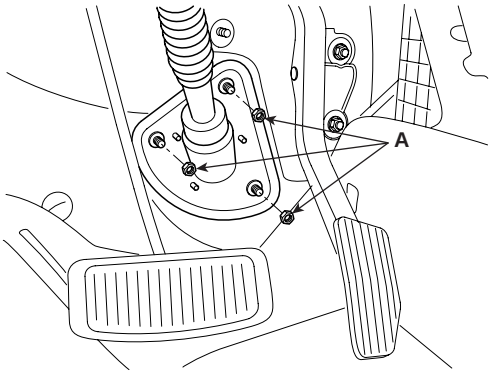


KPBF101I

3. Install the dust cover mounting nuts(A).

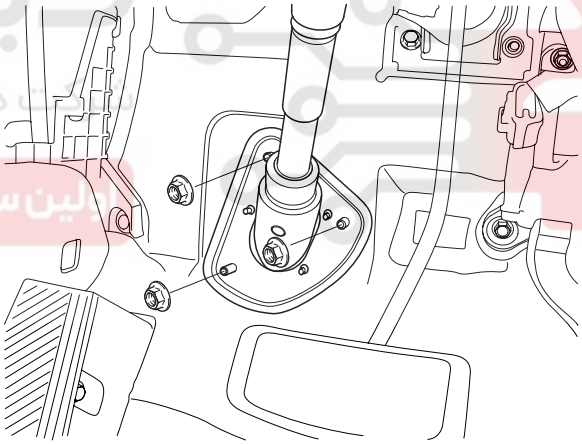
Tightening Torque Nm(kgf·m, lb-ft) :
13 ~ 18(1.3 ~ 1.8, 9.4 ~ 13)

[LHD]



KPBF101H

[RHD]

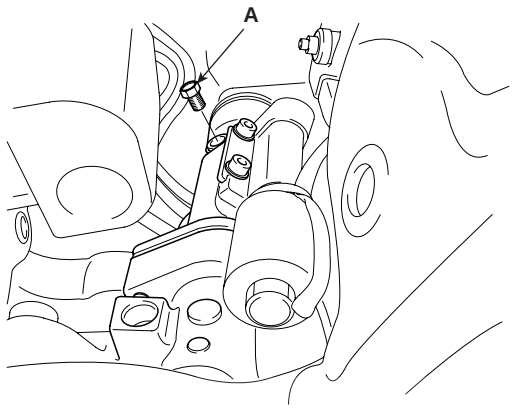


EPRF700G

4. Install the connecting bolt(A) between the universal joint and the pinion shaft.

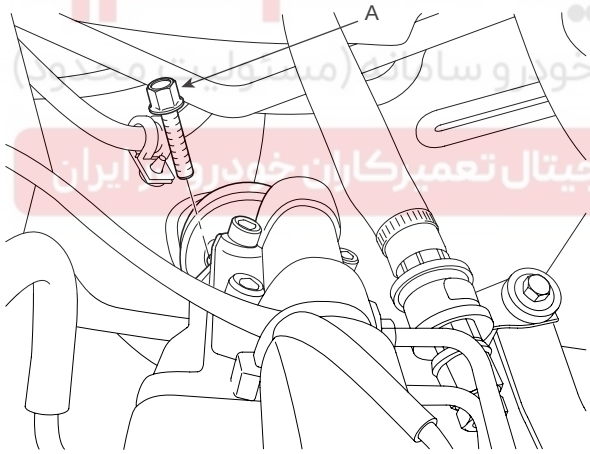
Tightening Torque Nm(kgf·m, lb-ft) :
18 ~ 25(1.8 ~ 2.5, 13 ~ 18)

[LHD]



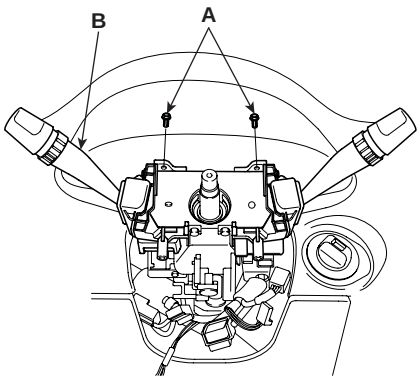
KHBF140F

[RHD]



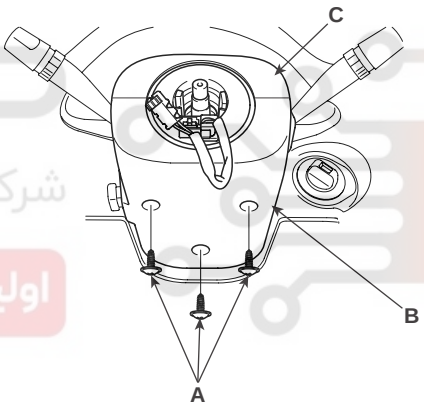
EPBF500Q

5. Install the multifunction switch(B) mounting screws(A) and the connectors.



EPBF500P

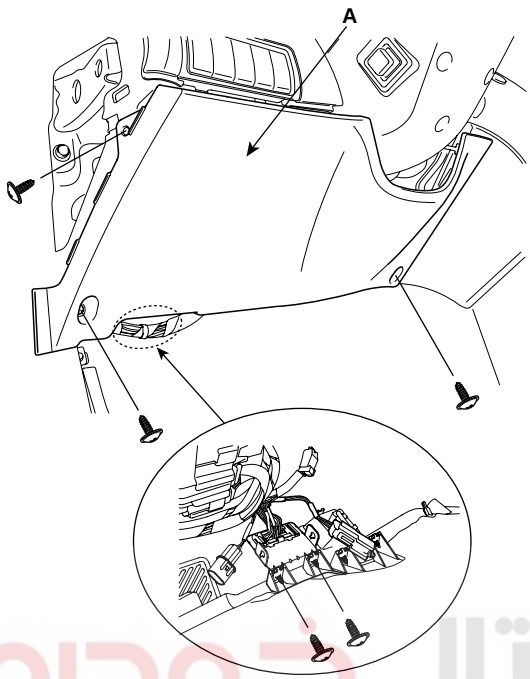
6. Install the steering column lower(A) and upper(B) shrouds.



EPBF500O

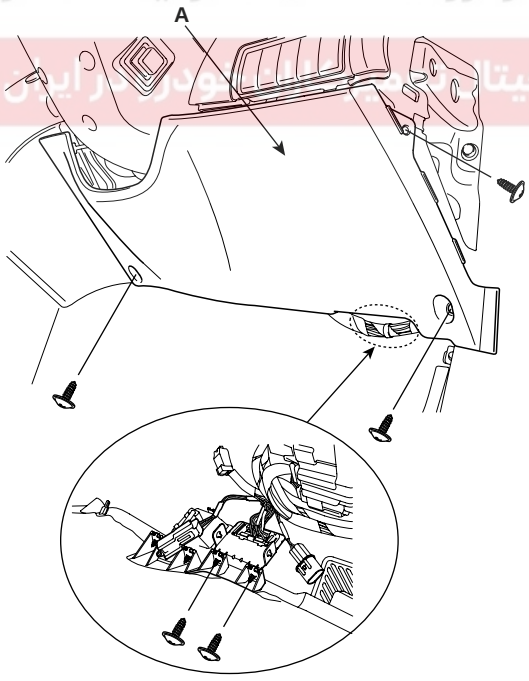
7. Install the crush pad lower cover(A).

[LHD]



EPBF500Y

[RHD]



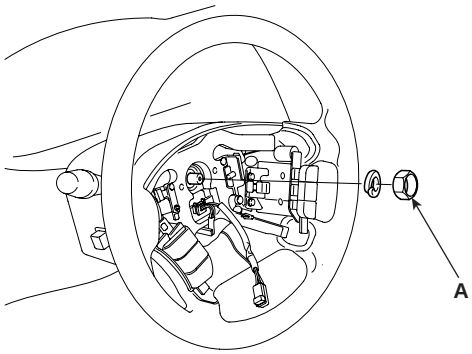
EPBF500Z

8. Install the steering wheel locking nut(A).

Tightening Torque Nm(kgf·m, lb-ft) :
40 ~ 50(4 ~ 5, 28.9 ~ 36.1)

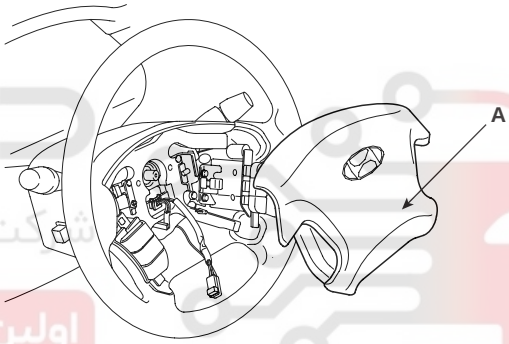
NOTE

Check that the front wheels is in the right direction in advance.

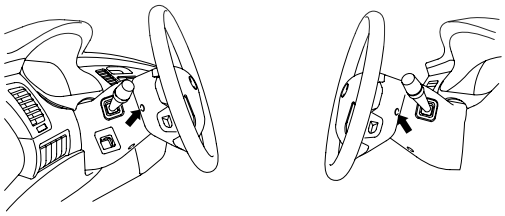


EPBF500K

9. Install the two steering wheel cover(A) bolts by using the hexagon wrench.

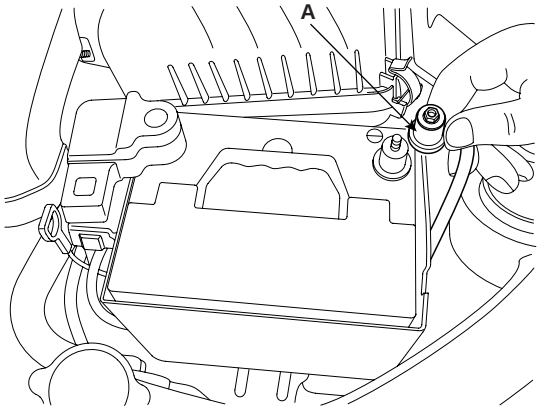


EPBF500X



EPBF500W

10. Connect the negative (-) terminal(A) to the battery.

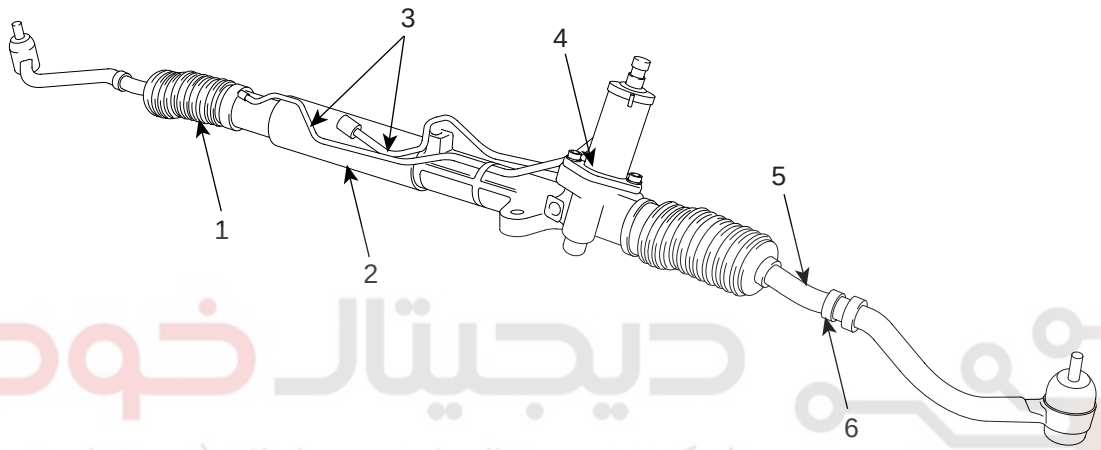


APIE102B

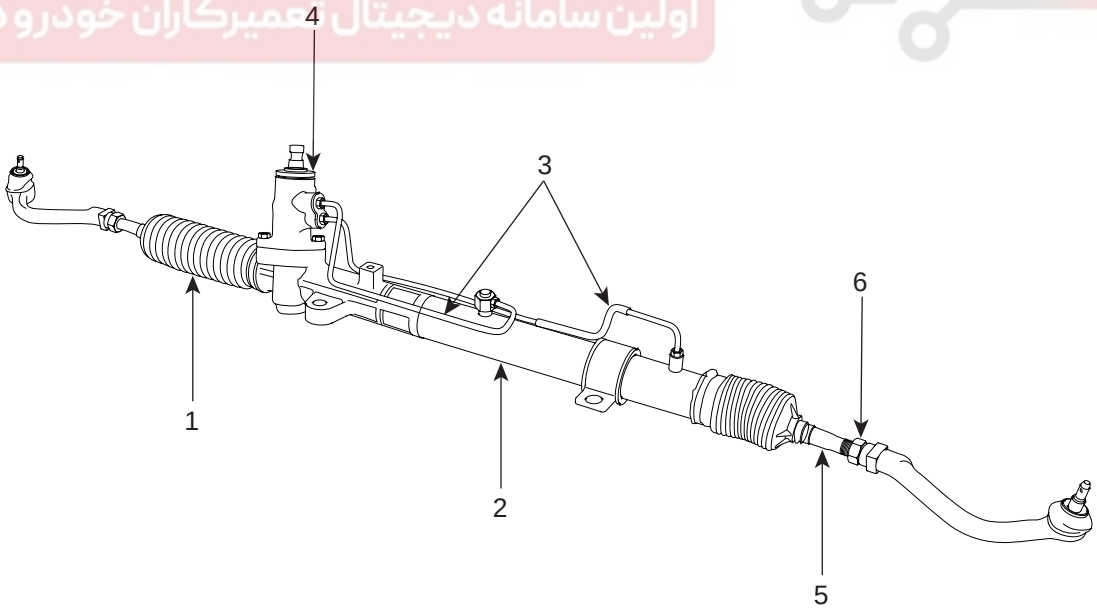
MECHANICAL POWER STEERING SYSTEM

COMPONENTS E401C9A1

[LHD]



[RHD]

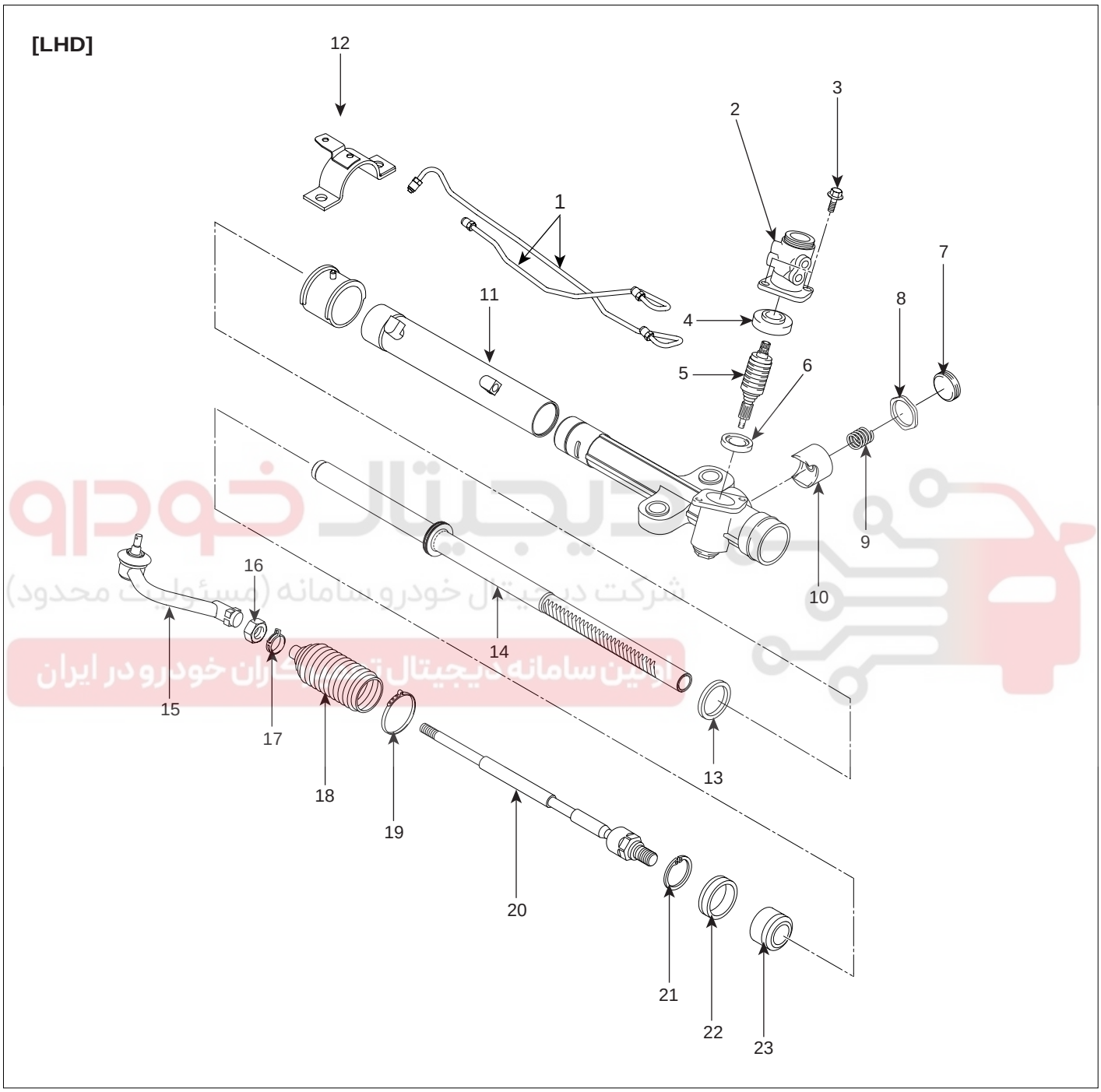


1. Bellows
2. Rack housing
3. Feed tube
4. Valve body assembly
5. Tie rod assembly
6. Lock nut

EPBF500V

POWER STEERING GEAR BOX

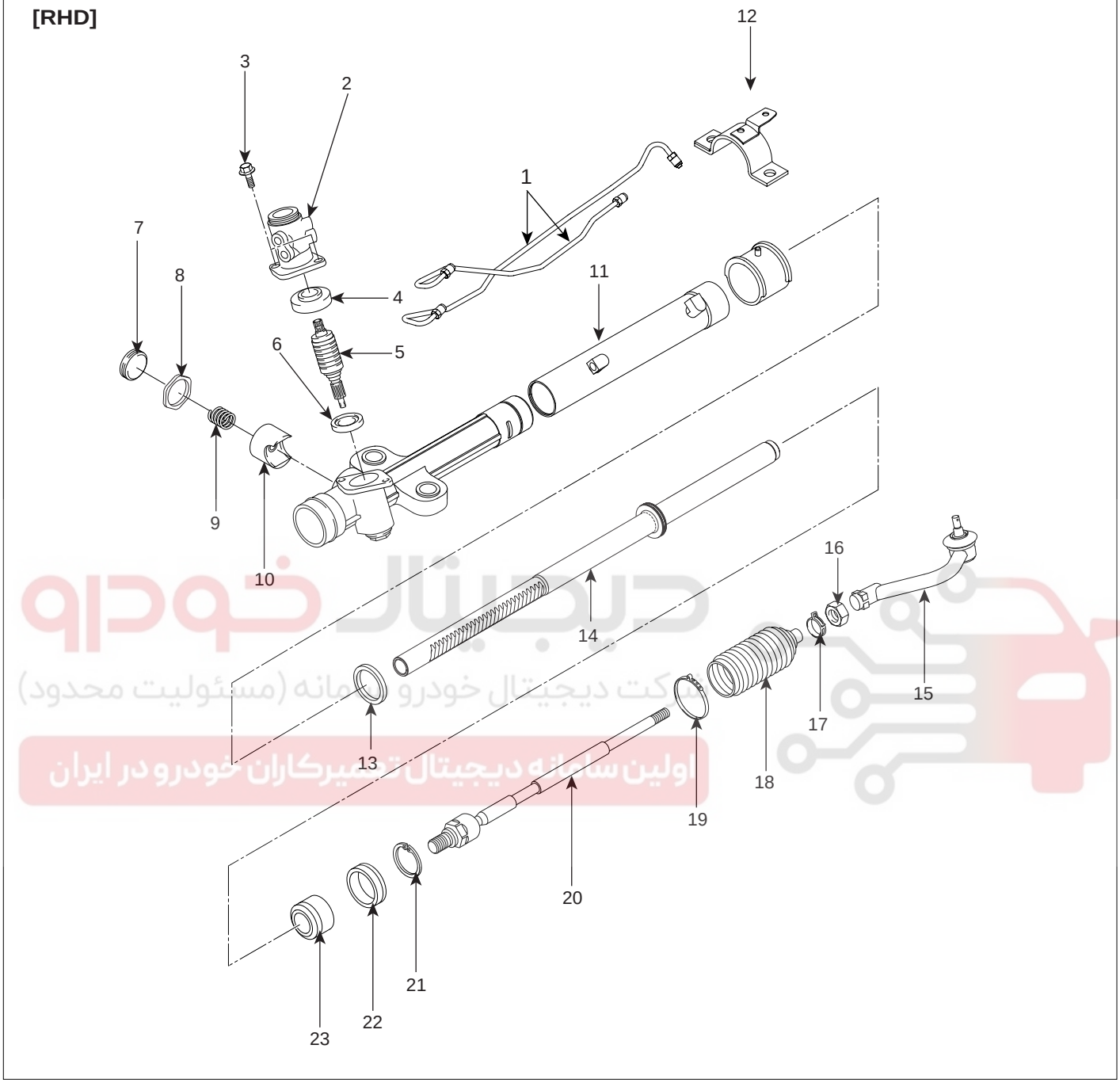
COMPONENTS E15DDC7A



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

EPRF700P

[RHD]



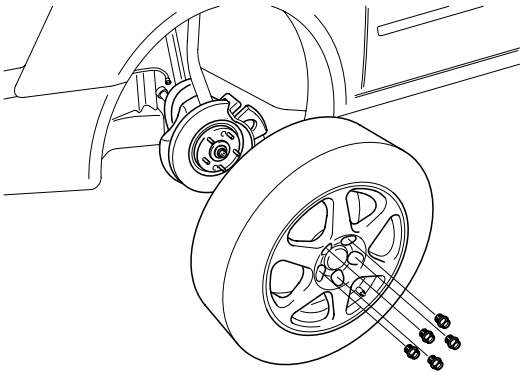
1. Feed tube
2. Valve body housing
3. Bolt
4. Oil seal
5. Pinion valve assembly
6. Oil seal
7. Yoke plug
8. Lock nut
9. Rack support spring
10. Rack support yoke
11. Rack housing
12. Power steering gear box mounting clamp
13. Oil seal
14. Rack
15. Tie rod end
16. Lock nut
17. Bellows clip
18. Bellows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

EPRF700Q

REMOVAL E54305AB

1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.

2. Remove the front wheel and tire(A) from front hub(B).



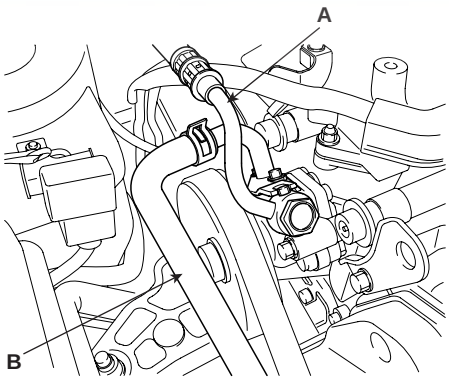
EIRF101A

CAUTION

Be careful not to damage the hub bolts(C) then remove the front wheel and tire(A).

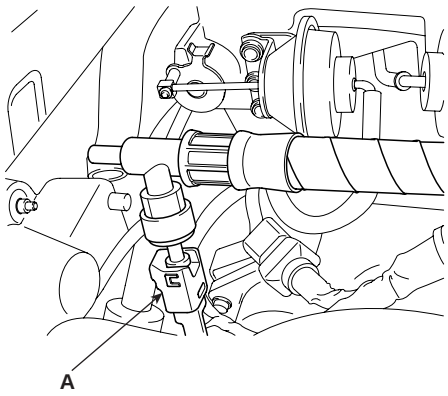
3. Drain the power steering fluid.

4. Disconnect the pressure hose and the retrun tube.



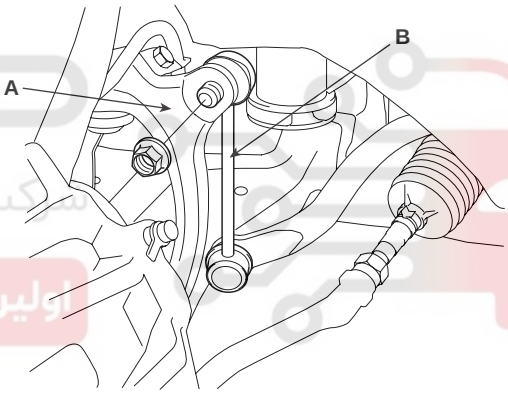
KPBF211A

5. Remove the pressure sensor connector(A) from the pressure hose



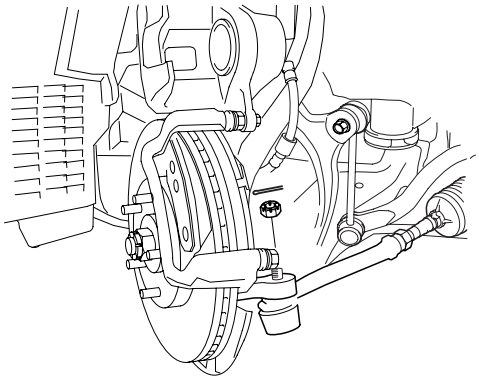
KPBF222A

6. Remove the nut(B) from the stabilizer bar link(A).

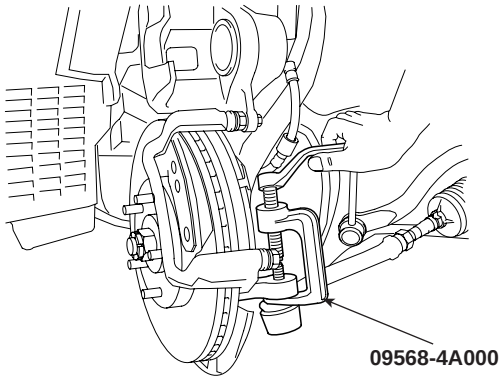


KHRE110B

7. Using the specil tool(09568-4A000) disconnect the tie rod end from the knuckle arm.

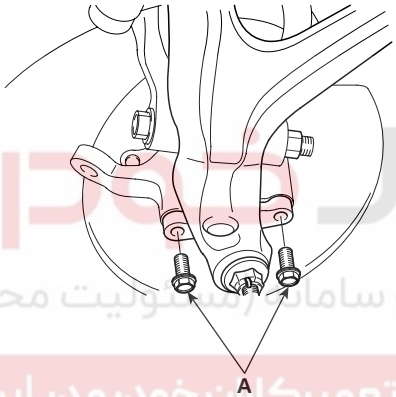


EPBF500G



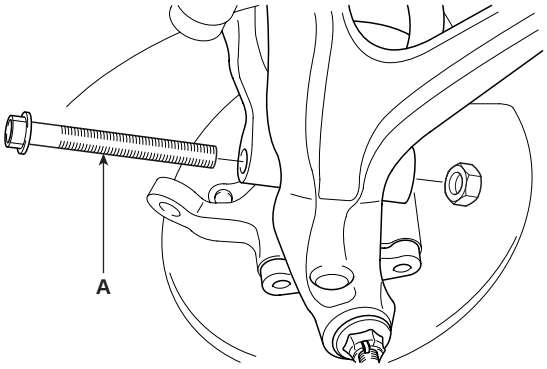
KHBF105B

8. Remove the lower arm mounting bolts(A).



KHBF140D

9. Remove the front fork and the knuckle ball joint from the front lower arm.



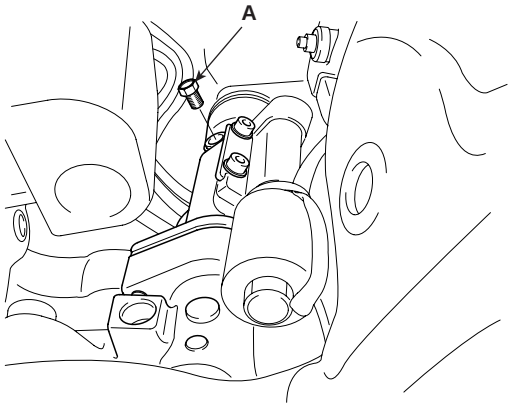
KHBF140E

CAUTION

Be careful not to damage to the aluminium lower arm.

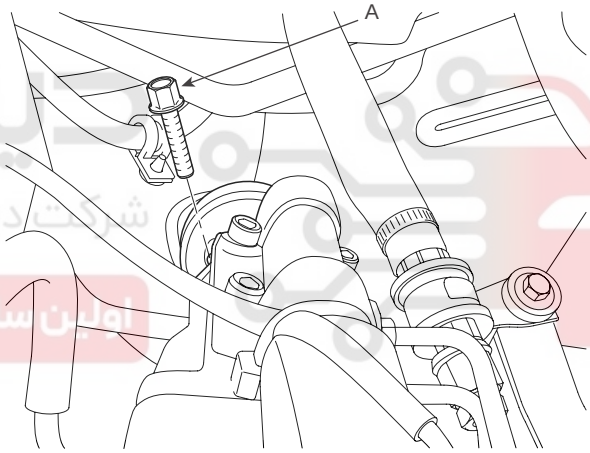
10. Remove the joint assembly connecting bolt.

[LHD]



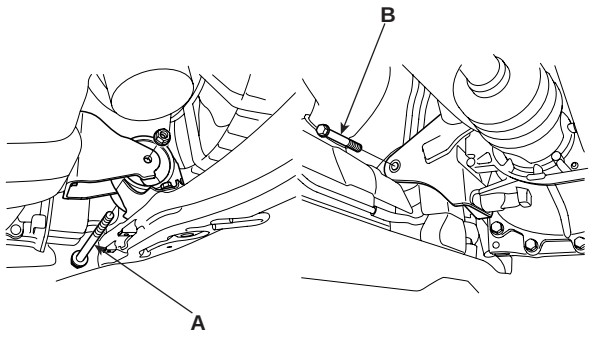
KHBF140F

[RHD]



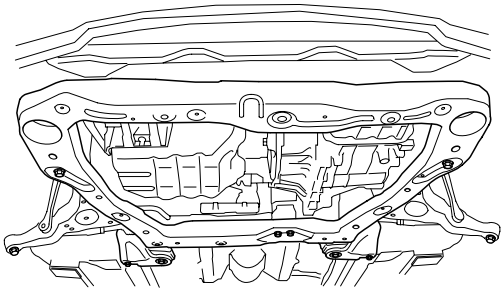
EPBF500Q

11. Remove the connecting bolts of front and rear roll stopper.



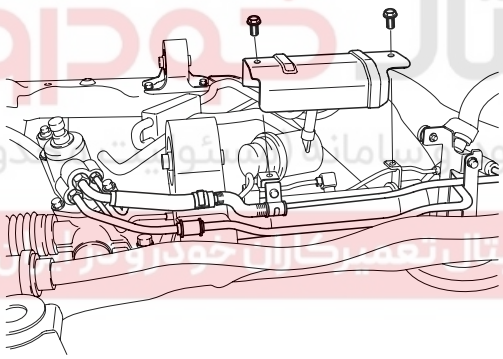
KHBF301A

12. Remove the mounting bolts(10EA) of cross member complete assembly.



KHBF301C

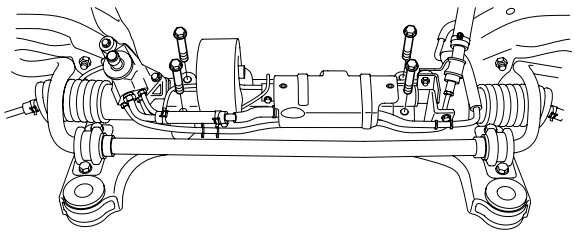
13. Remove the heat protecting cover(A) mounting bolts(B).



KPBF201E

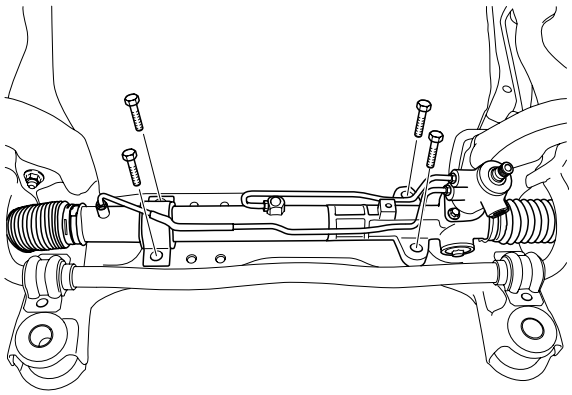
14. Remove the steering gear box mounting bolts and remove the steering gear box assembly and the mounting rubber.

[LHD]



KPRE301E

[RHD]



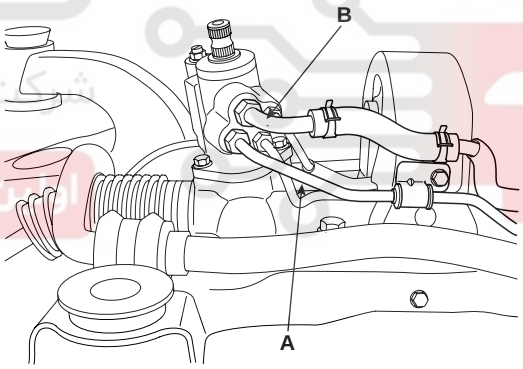
EPRF700L

CAUTION

When removing the gear box, pull it out carefully and slowly to avoid damaging the boots.

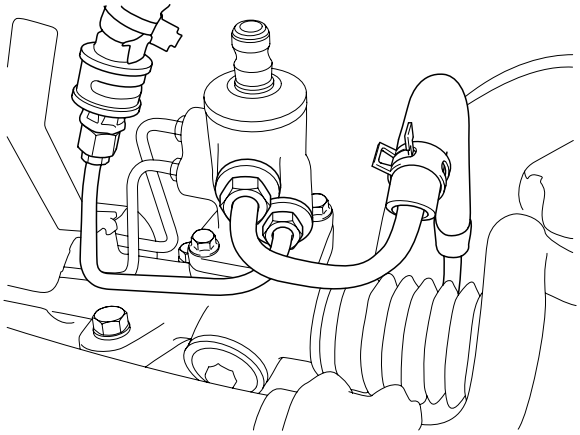
15. Disconnect the pressure hose and the retrun tube.

[LHD]



KPBF301D

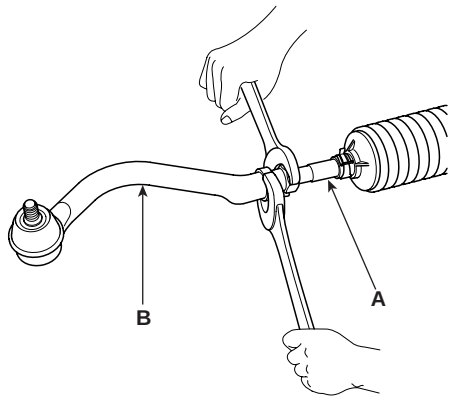
[RHD]



EPRF700K

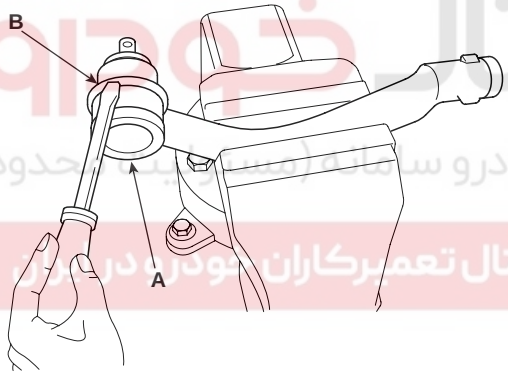
DISASSEMBLY E6CAB1AD

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



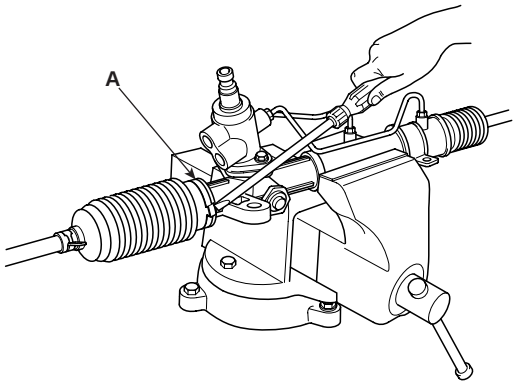
KPBF202A

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



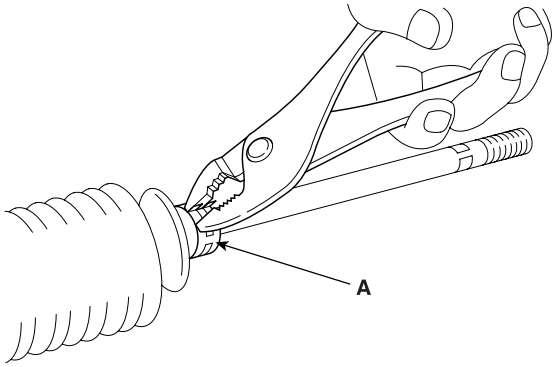
EPBF500H

3. Remove the bellows band(A).



KPBF006F

4. Remove the bellows clip(A).



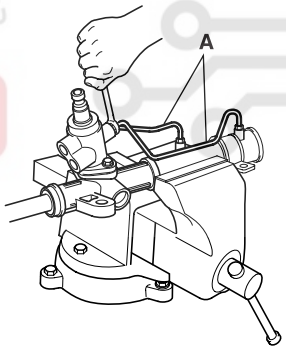
EPKE013I

5. Pull the bellows out toward the tie rod.

NOTE

Check for rust on the rack when the bellows are replaced.

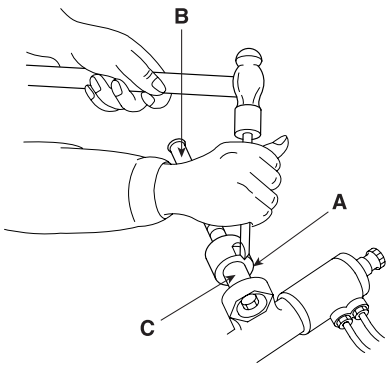
6. Remove the feed tube(A) from the rack housing.



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.

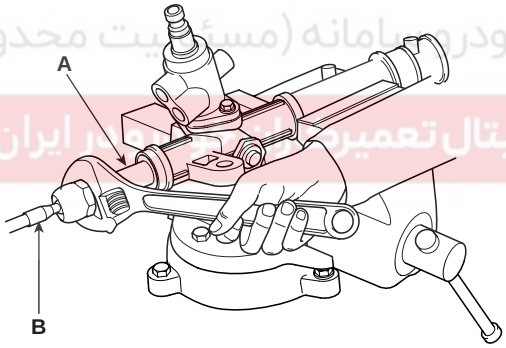


EPKE037A

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

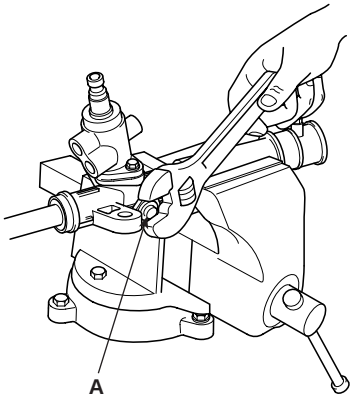
CAUTION

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



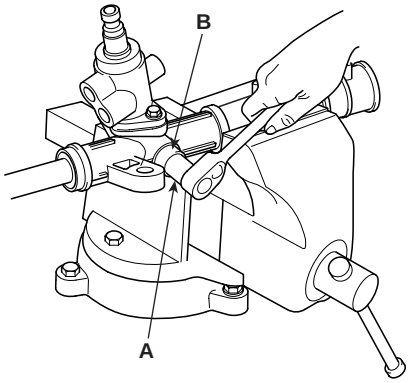
KPBF006J

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



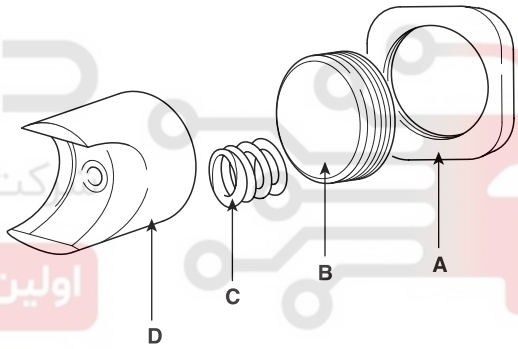
KPBF006K

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.

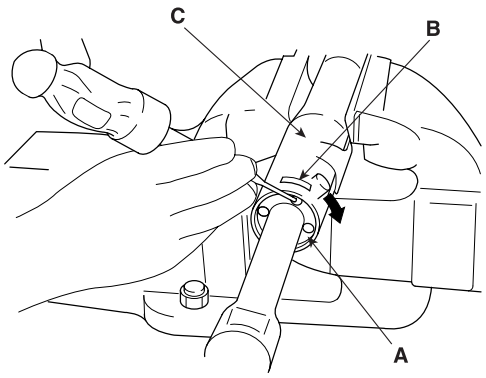


APJF005L

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

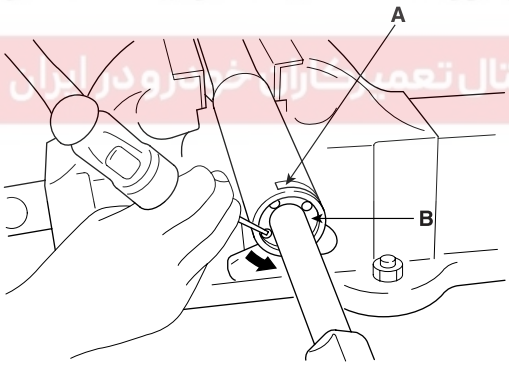
CAUTION

Be careful not to damage the rack.



EPKE013Q

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



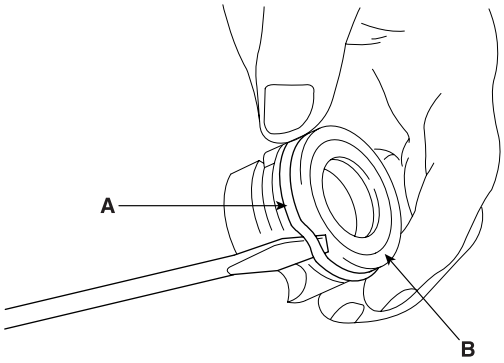
EPKE013R

CAUTION

Be careful not to damage the rack.

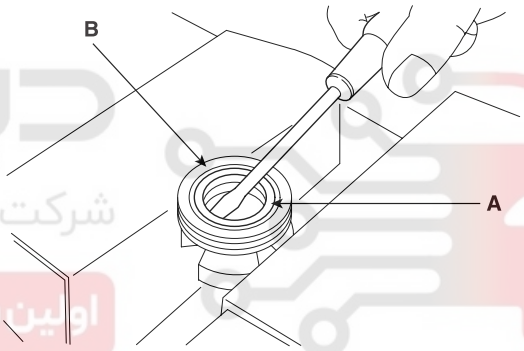
15. Remove the rack bushing and rack from the rack housing.

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



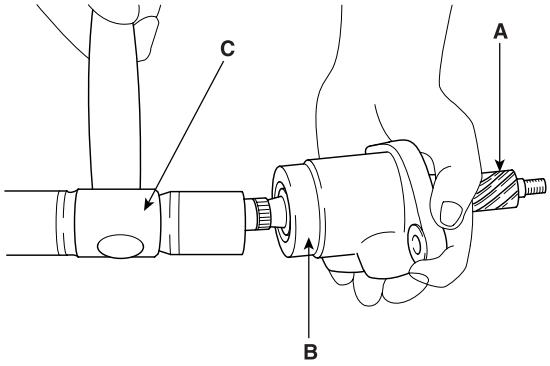
EPKE013T

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



EPKE013U

18. Remove the valve body from the valve body housing with a soft hammer.



EPKE210A

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.

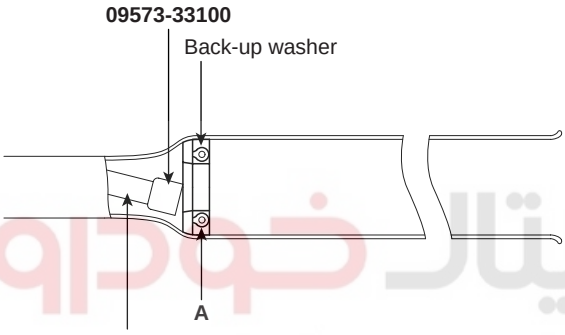
CAUTION

Be careful not to damage the pinion valve cylinderinside of the rack housing.

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

CAUTION

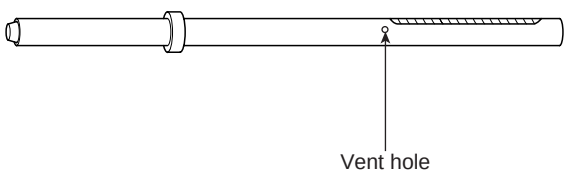
Be careful not to damage the rack cylinder insideof the rack housing.



EPRF210B

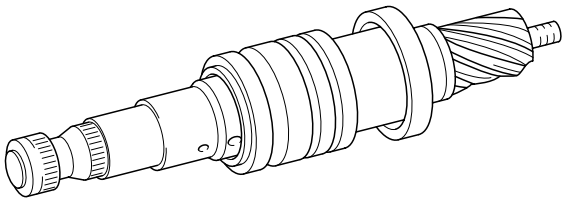
INSPECTION EA7CDA9B

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

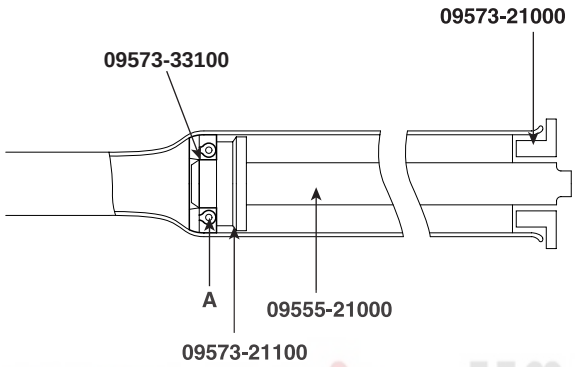
3. Bearing
   1) Check for seizure or abnormal noise during abearing rotation.
   2) Check for excessive play.
   3) Check for missing needle bearing rollers.
4. Others
   1) Check for damage of the rack housing cylinder bore.
   2) Check for boot damage, cracking or aging.

REASSEMBLY EA4ABAC8

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.

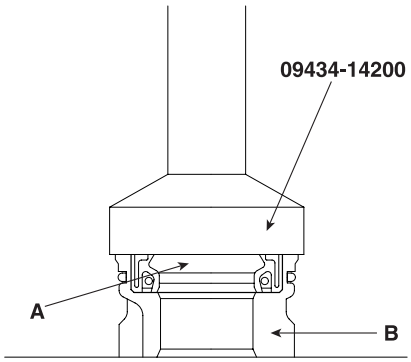


KPBF007F

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

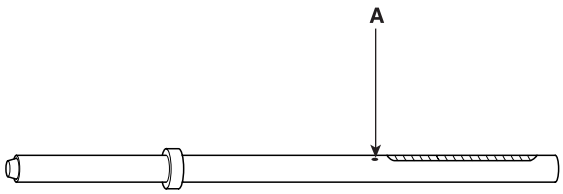
5. Apply the specified fluid to the entire surface of the O-ring and install it in the rack bushing.

6. Apply the specified grease to the rack teeth.

Recommended grease Multipurpose grease SAE J310a NLGI No.2

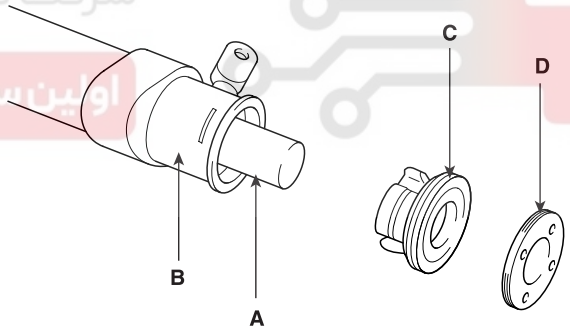
NOTE

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).

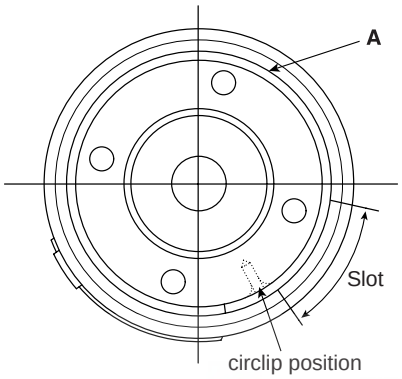


EPKE230I

8. Push in the rack stopper 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.

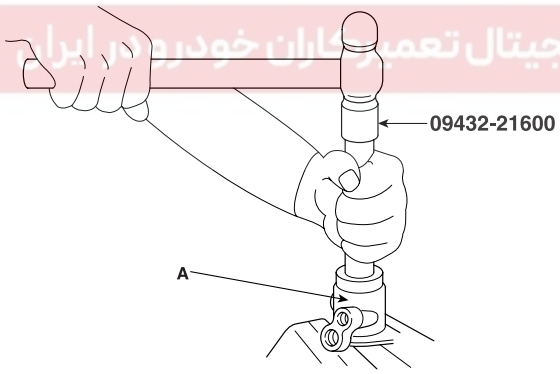
CAUTION

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



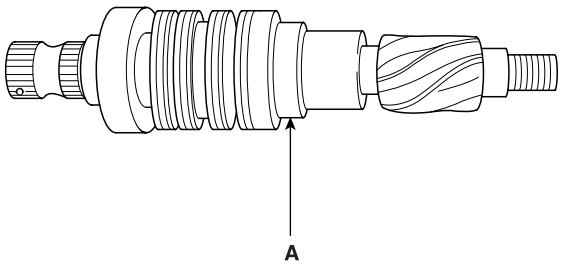
EPBF500C

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



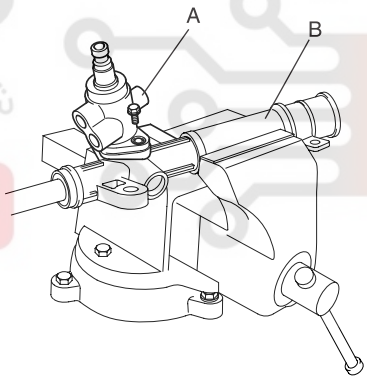
APGE008G

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



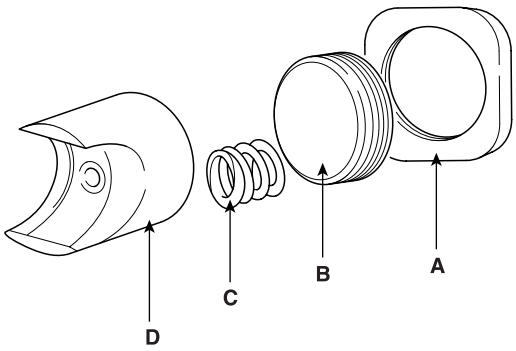
EPKE230E

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



APHE007F

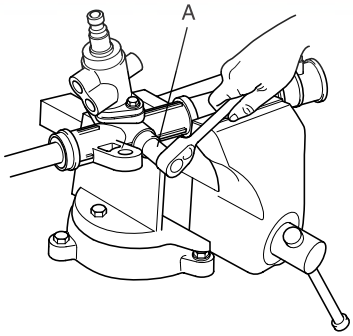
12. Install the rack support yoke(A), rack support spring(B), yoke plug(C) and lock nut(D) in the order-shown in the illustration. Apply semi-drying sealantto the threaded section of the yoke plug before installation.



APJF005L

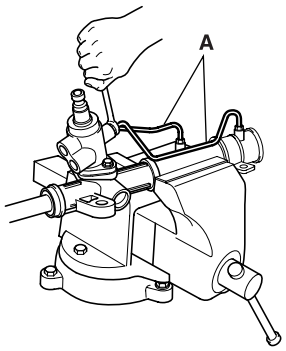
13. With the rack placed in the center position, attach the yoke plug to the rack housing. Tighten the yokeplug to 12 Nm (120 kg·cm, 8.9 lb·ft), with a 14mm socket(A). Loosen the yoke plug approximately from 30° to 60° and tighten the yoke nut to the specified torque.

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



APHE007I

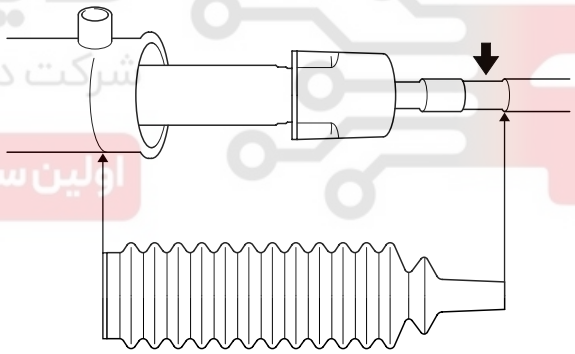
14. Tighten the feed tube(A) to the specified torque and install the mounting rubber using adhesive.



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.

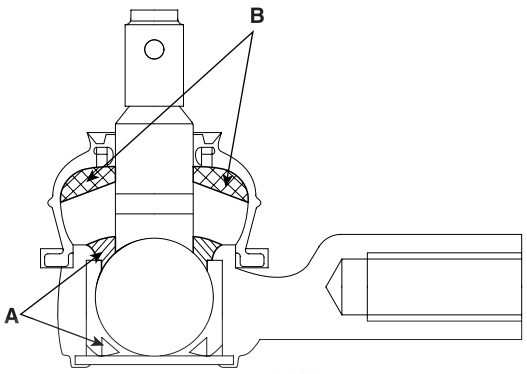
NOTE

When the bellows are installed, a new band must beused.

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

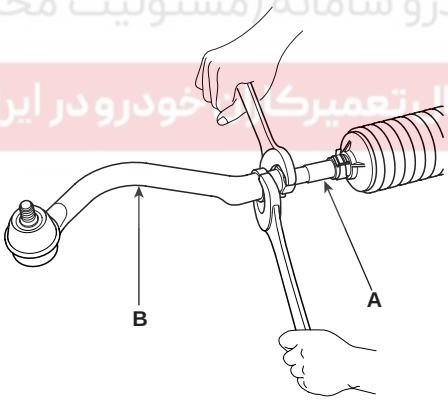
18. Fill the dust cover inner side and lip with the specified grease, and fix the dust cover in position with the clip ring attached in the groove of the tie rod end.

Recommended grease A : POLY LUB GLY 801K or equivalent B : SHOWA SUNLIGHT MB2 or equivalent Dust cover inner side and lip : THREE BOND



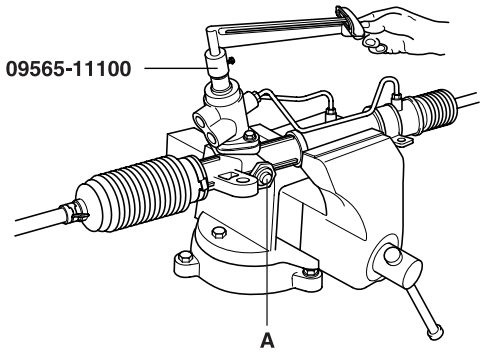
EPKE043A

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



KPBF202A

20. Check for total pinion preload.

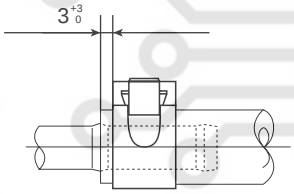


APHE006B

INSTALLATION E5D30F7E

NOTE

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



APJF009A

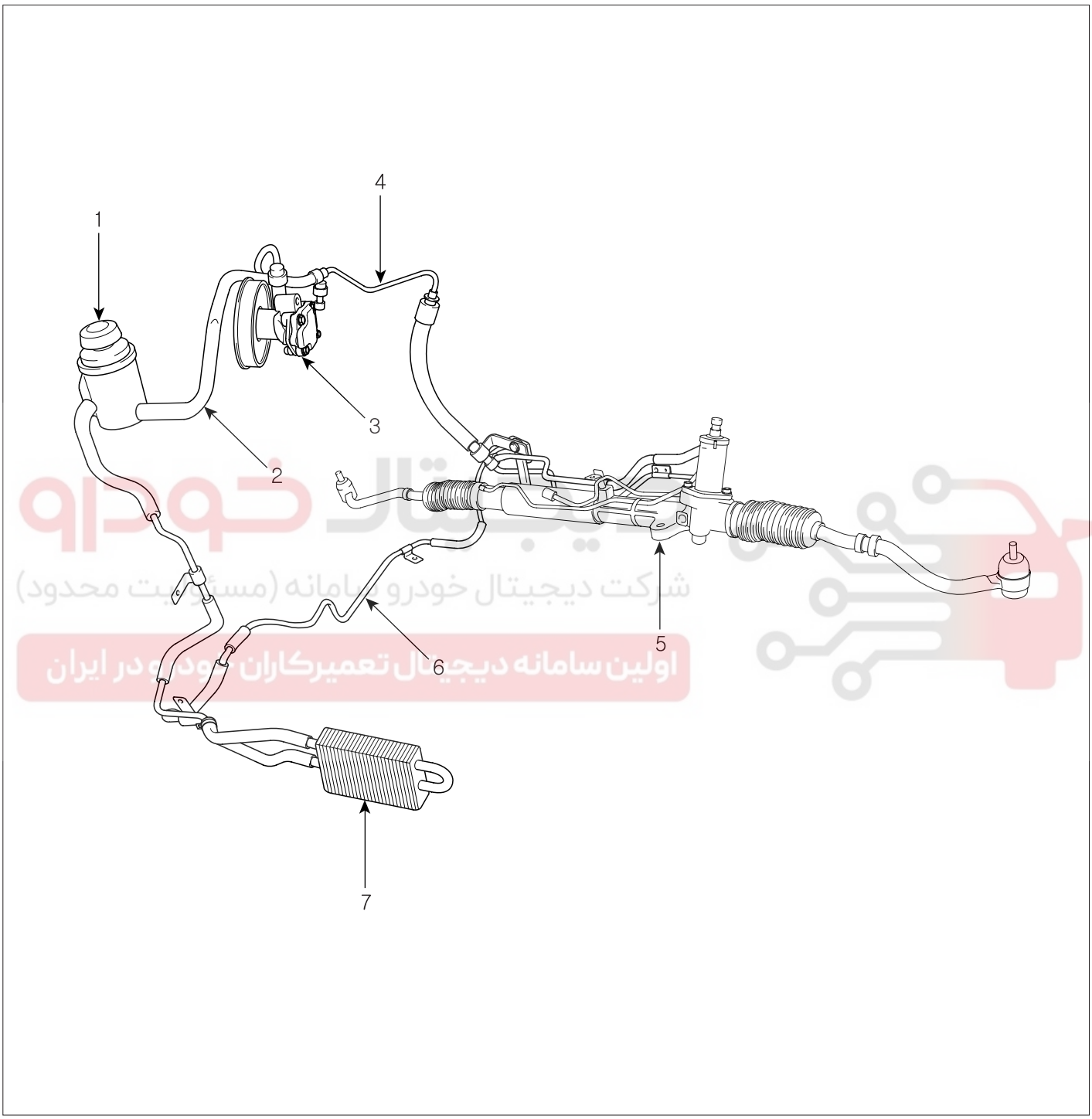
1. Installation is reverse of removal.

TIGHTENING TORQUE Nm(kgf·m, lb-ft) Pressure hose to gear box : 12~18(1.2~1.8, 8.6~13) Return tube to gear box : 12~18(1.2~1.8, 8.6~13) Tie rod end lock nut : 50~55(5~5.5, 36.1~39.7) Pinion and valve assembly to self locking nut : 20~30(2~3, 14.4~21.6) lock nut : 50~70(5~7, 36.1~50.6) Tie rod end self locking nut : 24~34(2.4~3.4, 17.3~24.5) Mounting bracket to crossmember : 60~80(6~8, 43.3~57.8)

2. After installation, bleed the air in the power steering system(See page ST-10).

POWER STEERING HOSES

COMPONENTS E1AFD16E

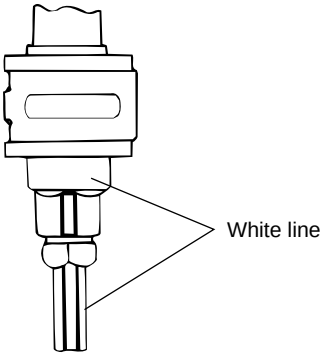


1. Power steering oil reservoir
2. Suction hose
3. Oil pump
4. Pressure hose
5. Power steering gear box
6. Return tube
7. Cooler tube

EPBF500D

REMOVAL E1AFEC1C

While installing the tube and hose assembly, be sure to align white marks on each fitting.

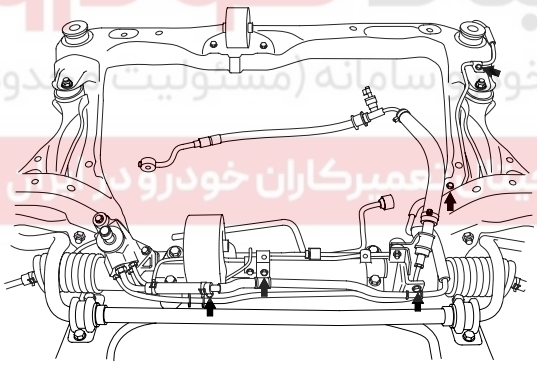


KPBF301A

PRESSURE HOSE, TUBE AND RETURN TUBE, HOSE

1. Remove the mounting clamps from the pressure tube- and the return tube.

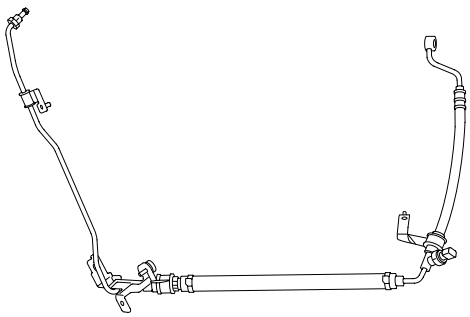
[LHD]



KPBF302B

2. Remove the pitting of both the pressure tube and the return tube from the gear box.

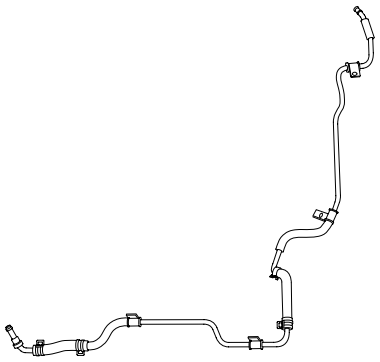
3. Remove the pressure hose and tube.



KPBF303C

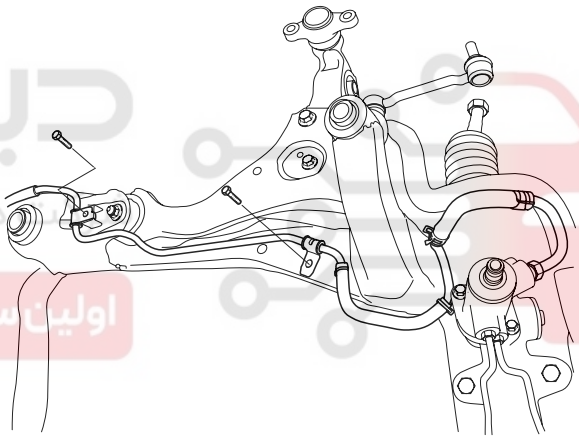
4. Remove the return tube and hose.

[LHD]



KPBF304D

[RHD]



EPRF700O

INSTALLATION E5DC84CE

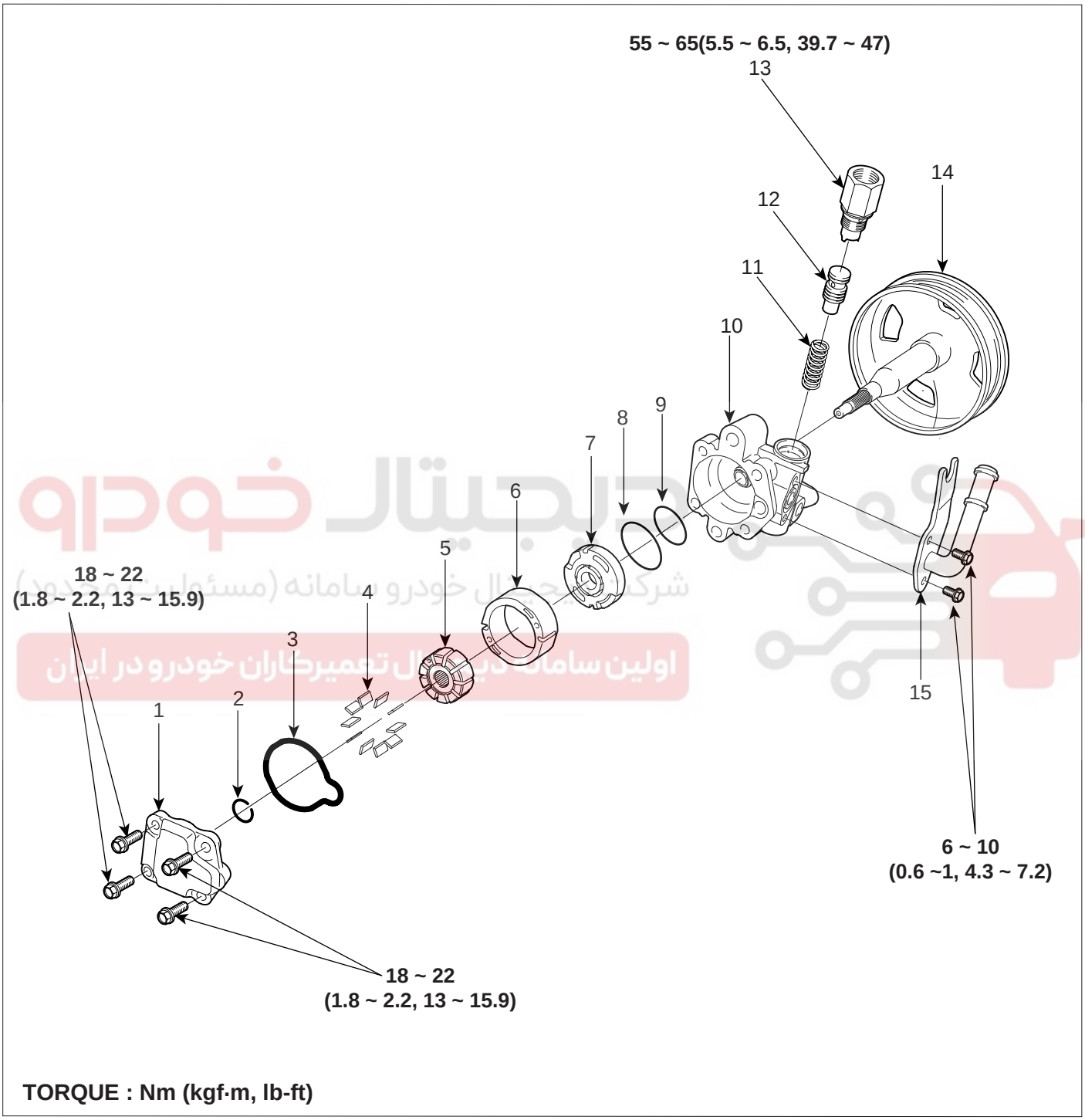
Installation is the reverse of removal.

NOTE

- *Install the return tube and hoses so that they arenot twisted and it does not come in contact withany other parts.*
- *After installation, air bleed the system.*

POWER STEERING OIL PUMP

COMPONENTS EBC21FCC

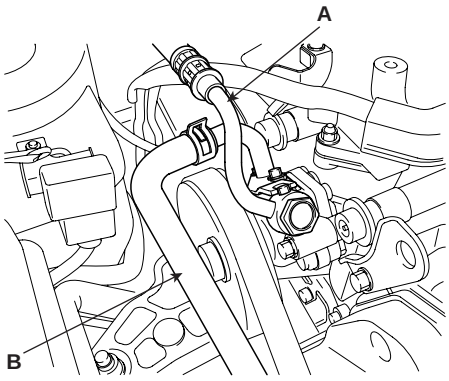


1. Rear cover
2. Snap ring
3. Gasket
4. Vanes
5. Rotor
6. Cam ring
7. Front side plate
8. O-ring (Outer)
9. O-ring (Inner)
10. Front housing
11. Flow control spring
12. Flow control valve
13. Connector
14. Pulley
15. Suction pipe

EPBF500E

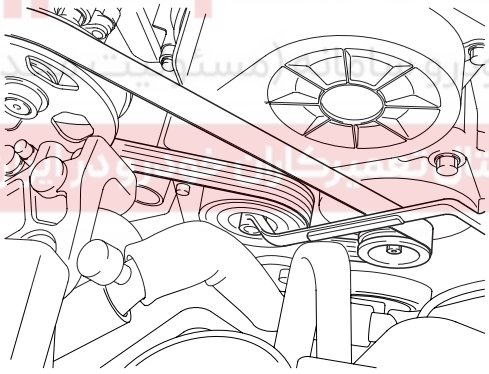
REMOVAL E64E3B0B

1. Remove the pressure hose from the oil pump and the suction hose from the suction pipe, then drain the powersteering oil.



KPBF211A

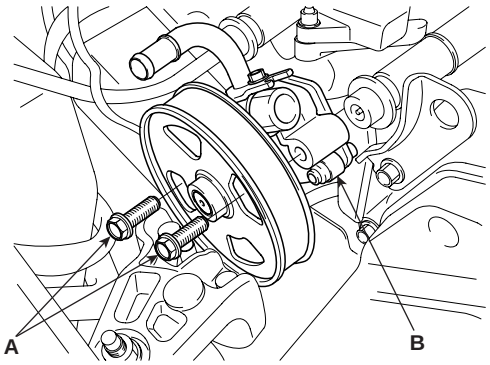
2. Release the tension of the powersteering V-type beltby lifting the auto-tensioner pulley.



KPBF401B

3. Remove the V-type belt from the pulley of the power-steering oil pump.

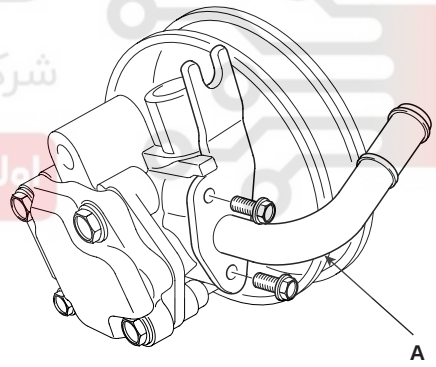
4. Remove the powersteering oil pump assembly by removing the three bolts as shown below.



KPBF401D

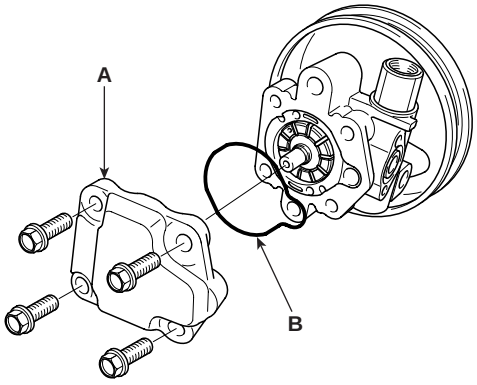
DISASSEMBLY E41A4D99

1. Remove the bolts from the oil pump body, and then remove the suction pipe and O-ring.



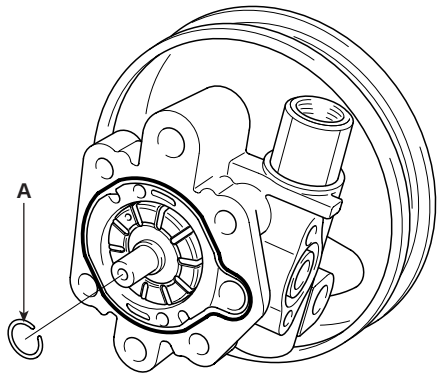
KPBF402A

2. Remove the power steering oil pump rear cover(A) and the O-ring(B) by removing the four bolts.



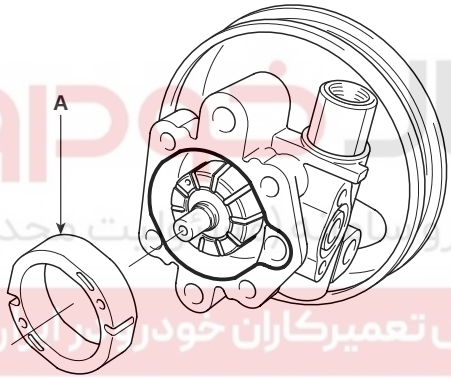
KPBF412A

3. Remove the cam ring.



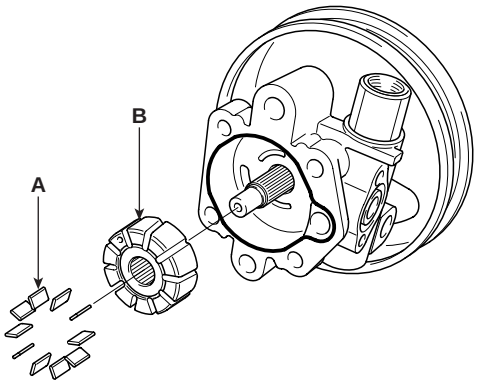
KPBF412D

4. Remove the cam ring.



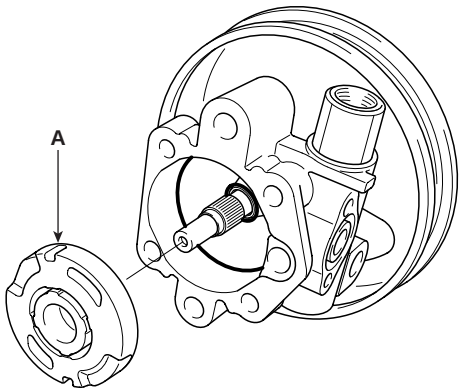
KPBF412B

5. Remove the rotor and vanes.



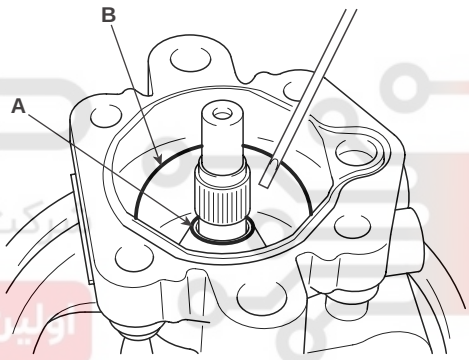
KPBF412C

6. Remove the oil pump side plate.



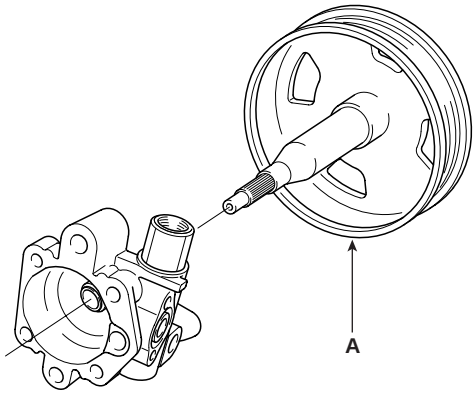
KPBF412E

7. Remove the inner O-ring and outer O-ring.



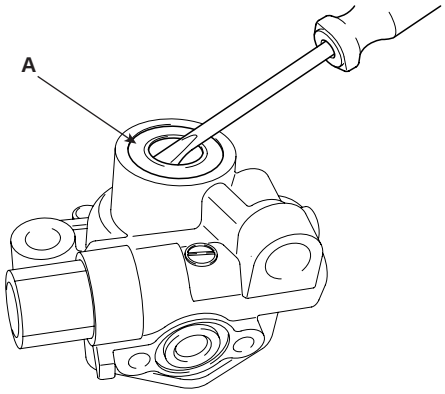
KPBF412F

8. Remove the pulley and the shaft(A).



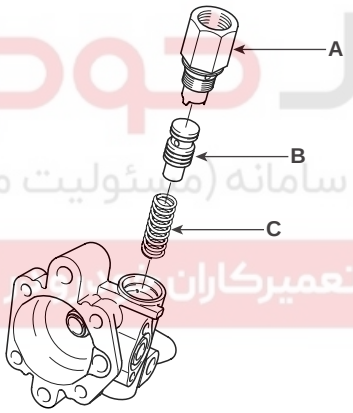
KPBF412G

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



KPBF402D

10. Remove the connector from the oil pump body, and take out the flow control valve and the flow control spring.



KPBF412H

11. Remove the O-ring from the connector.

CAUTION

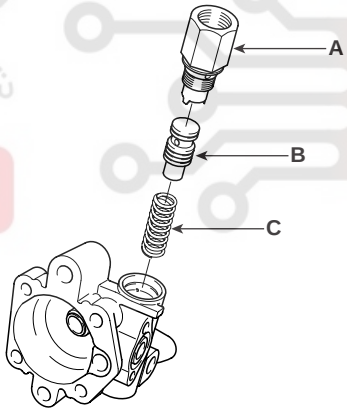
Do not disassemble the flow control valve.

INSPECTION EA05A7C8

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.

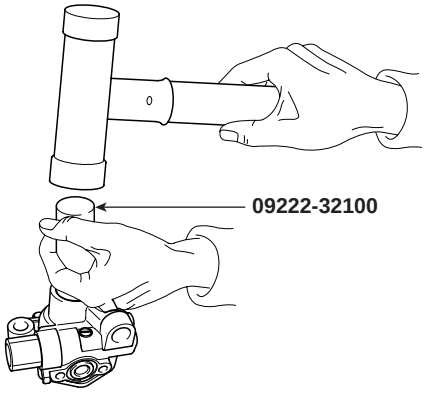
REASSEMBLY EC78610A

1. Install the flow control spring, the flow control valve and the connector in to the pump body.



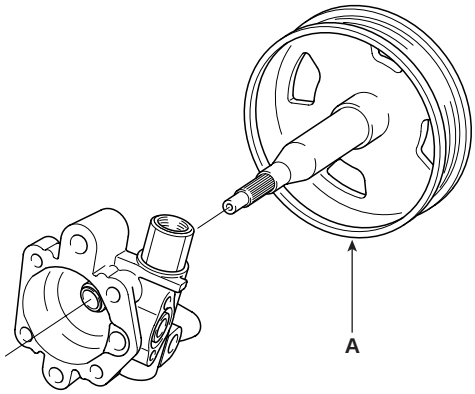
KPBF412H

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



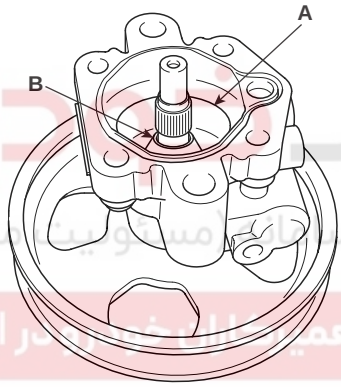
KPBF404B

3. Install the pump pulley.



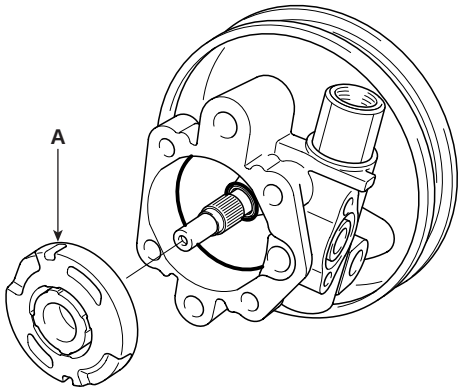
KPBF412G

4. Install the outer(A) and inner(B) O-rings



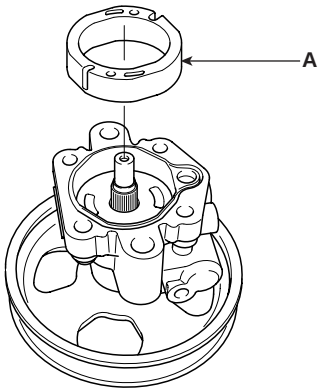
KPBF414D

5. Install the side plate(A).



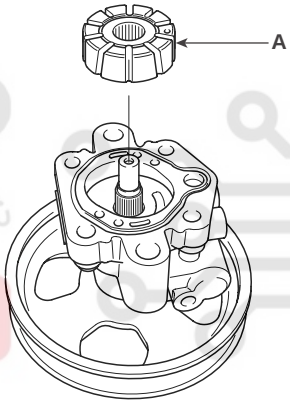
KPBF412E

6. After inserting the lock pin into the groove of the front housing, install the camring attending to the direction.



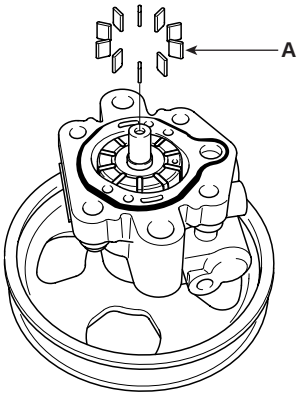
KPBF404F

7. Install the rotor.

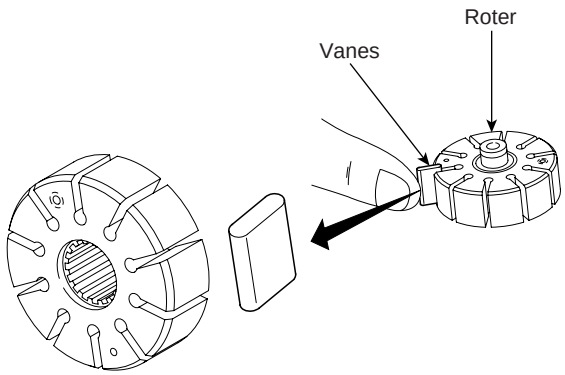


KPBF414E

8. Install the vanes.



KPBF414F

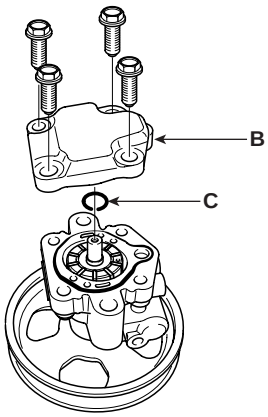


EPRF401D

9. After installing the O-ring(A) and the snap ring(C), install the rear cover assembly(B).

Tightening Torque Nm(kgf·m, lb-ft) :
18 ~ 22(1.8 ~ 2.2, 13 ~ 15.9)

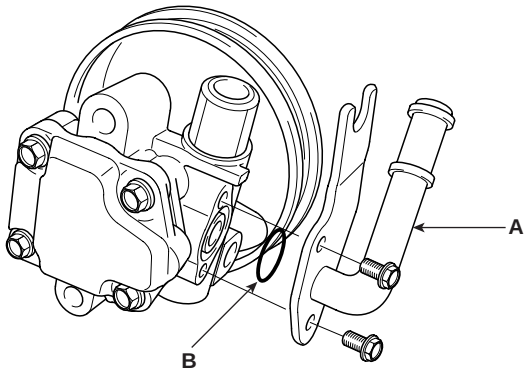
KPBF424G



KPBF414G

10. Install the suction pipe and O-ring.

Tightening Torque Nm(kgf·m, lb-ft) :
6 ~ 10(0.6 ~ 1, 4.3 ~ 7.2)

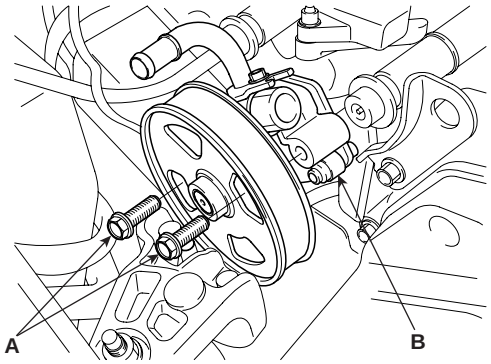


KPBF414H

INSTALLATION EBFE3F36

1. Install the oil pump to the oil pump bracket.

Tightening Torque Nm(kgf·m, lb-ft) :
35 ~ 55(3.5 ~ 5.5, 25.3 ~ 39.7)



KPBF401D

2. Install the "V"-type belt by pulling the auto tensioner.
3. Install the suction hose.

CAUTION

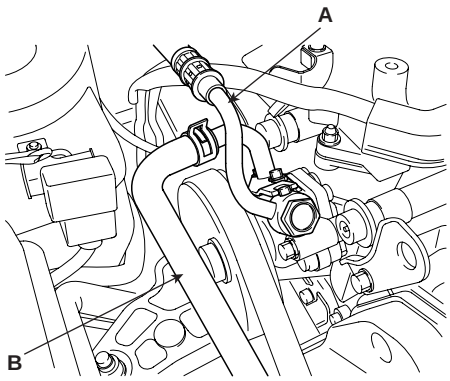
Install the pressure hose to the oil pump.

4. Install the pressure hose to the oil pump.

Tightening Torque Nm(kgf·m, lb-ft) :
55 ~ 65(5.5 ~ 6.5, 39.7 ~ 47)

NOTE

Install the pressure hose being careful so that it does not twist and come in contact with other components.



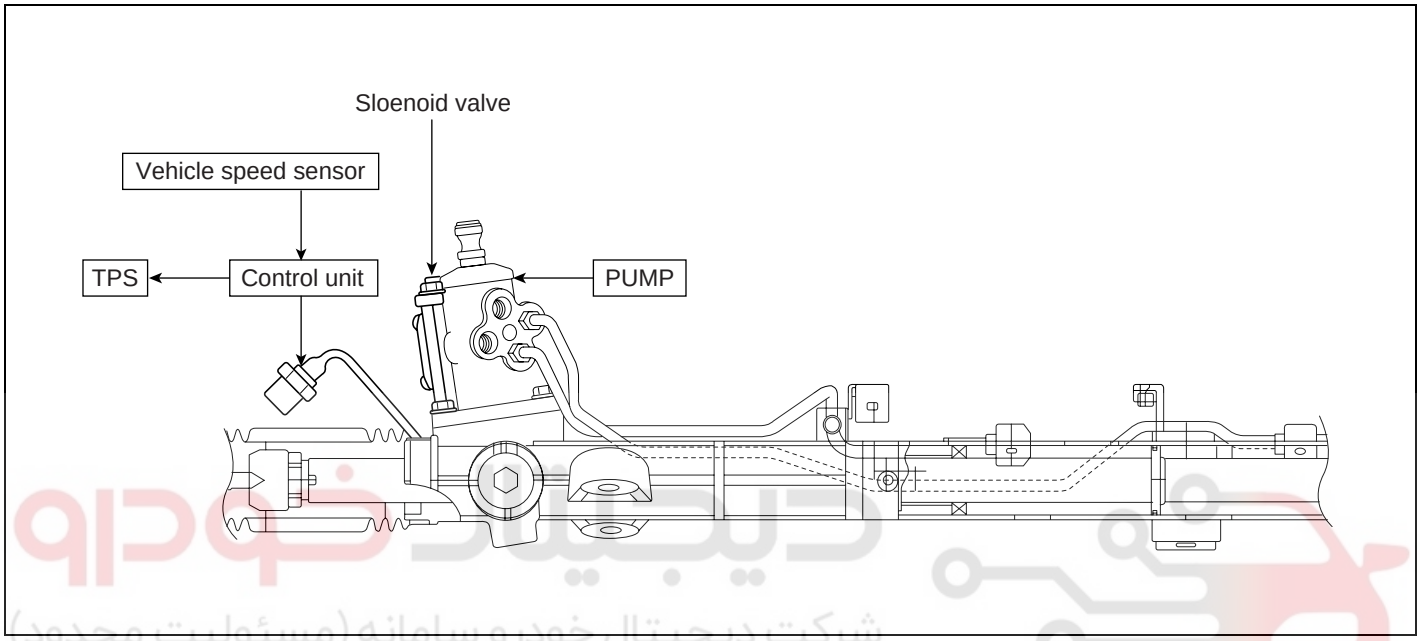
KPBF211A

5. Add power steering fluid (PSF-3).
6. Air bleed the system.
7. Check the oil pump pressure.

EPS (ELECTRONIC POWER STEERING) SYSTEM

GENERAL E7A2FF5F

The electronic power steering (EPS) system includes the same components of conventional power steering system.

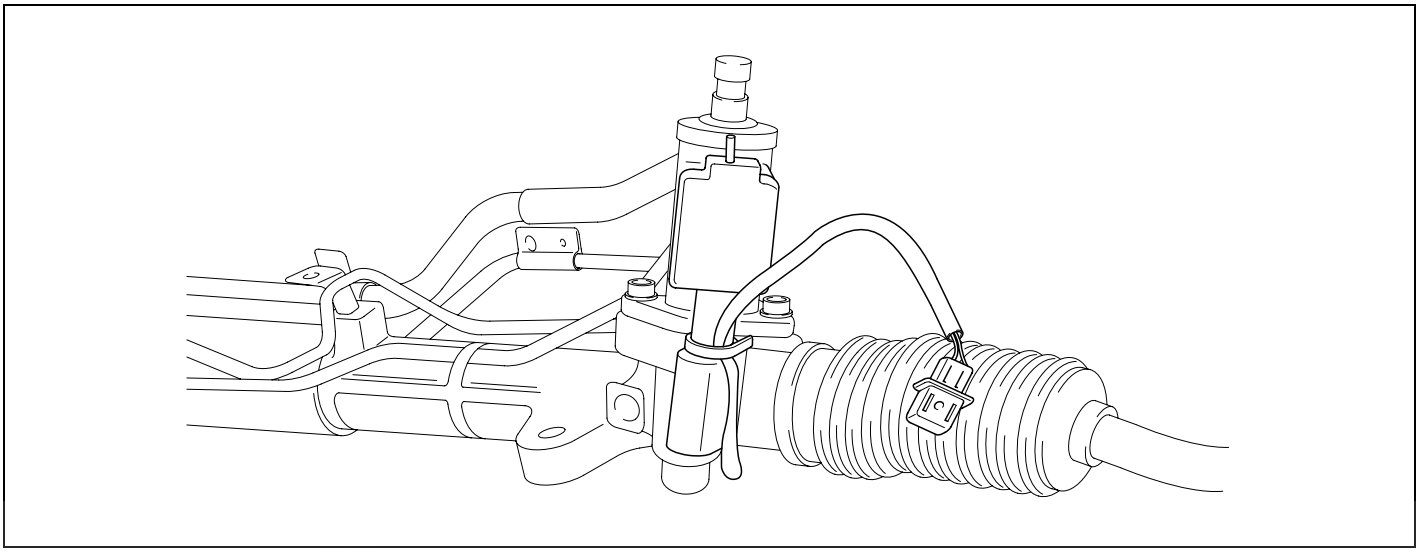


EPRF503A

EPS performs the conventional power steering function in case a failure has occurred in the system. EPS electronically controls the current to the solenoid of by-pass valve by inputting sensor's signals to control the hydraulic amount in cylinder chamber and thereby varying the steering effort versus the hydraulic pressure according to vehicle speed. In addition, it has a solenoid valve on power steering gear box, and a control unit underneath the audio of the center facia. To control the oil flow of steering gear box, a solenoid is provided and it functions by the current from control module which receives signals from VSS (Vehicle Speed Sensor) and TPS.

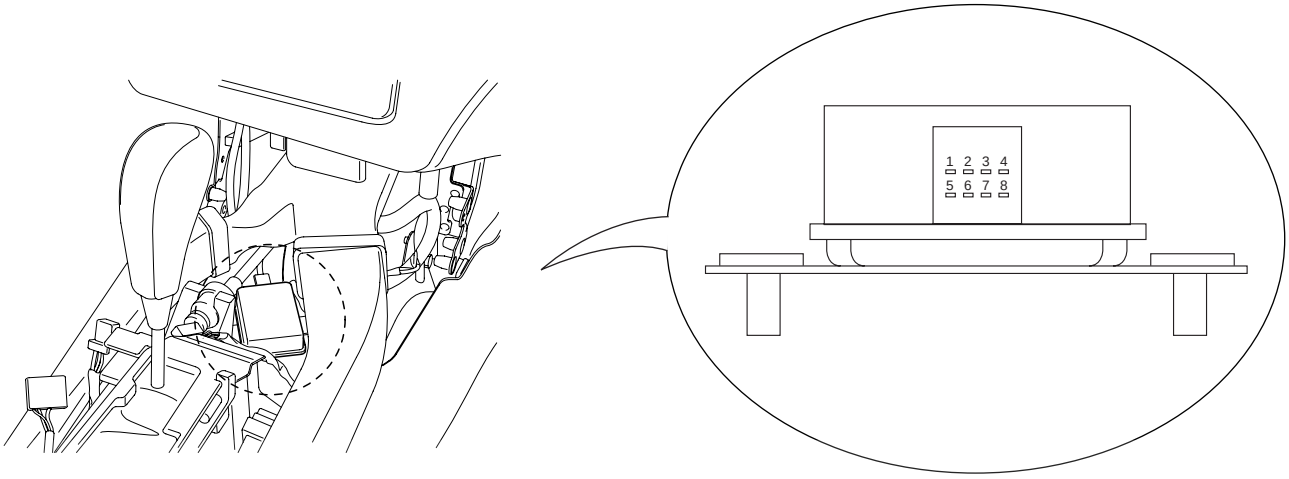
REMOVAL AND INSTALLATION EED98798

The removal and installation procedure is the same as that of conventional power steering system except for the solenoid valve components and EPS control module. Refer to the following figures.



KPBF500D

ELECTRONIC POWER STEERING CONTROL MODULE E8F19C24

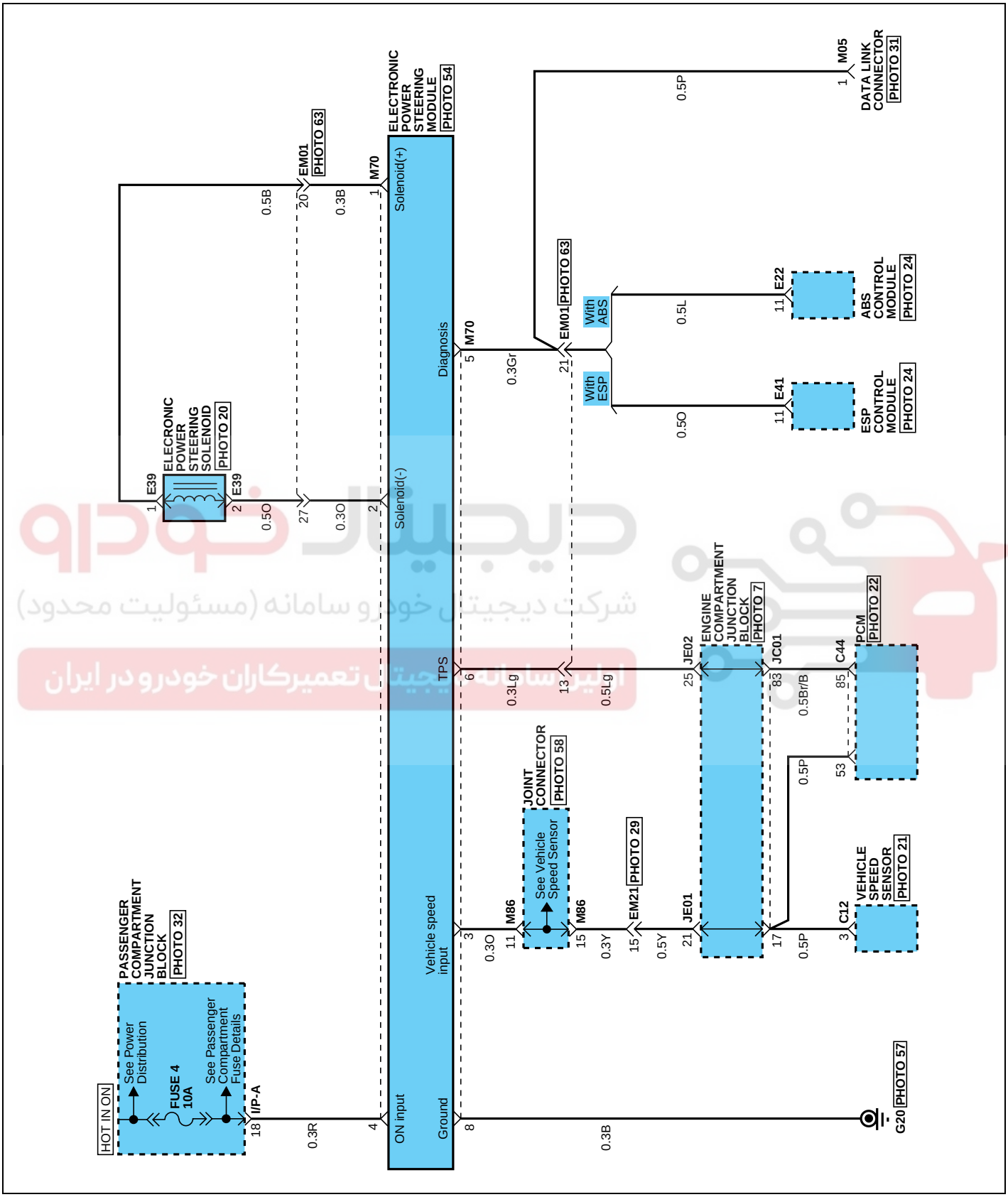


PIN LAYOUT

PIN NO.	DESCRIPTION
1	Solenoid
2	Solenoid
3	Sensor signal from vehicle speed sensor
4	IG2
5	Data link connector
6	Sensor signal from TPS
7	-
8	Ground

EPBF500I

CIRCUIT SIAGRAM EAABCA6A



E2RF057A

TROUBLESHOOTING E7A90FA2

NOTE

For checking procedures for each problem, refer to the flow-chart type of troubleshooting guide on the following page.

Trouble symptom 1

Steering effort remains light at moderate and high speeds

NOTE
1. **Check to be made by using the scan tool or test lamp.**
2. **Refer to the circuit diagram for terminal numbers at the harness side of the E.P.S control module.**

Does the stationary steering effort change within the standard value ?
Standard value :
E.P.S.
2.4 N (2.5 kg, 5.1 lbs) Max.

No → Malfunction of E.P.S. solenoid → Repair the steering gear box or replace the E.P.S. solenoid

Yes ↓

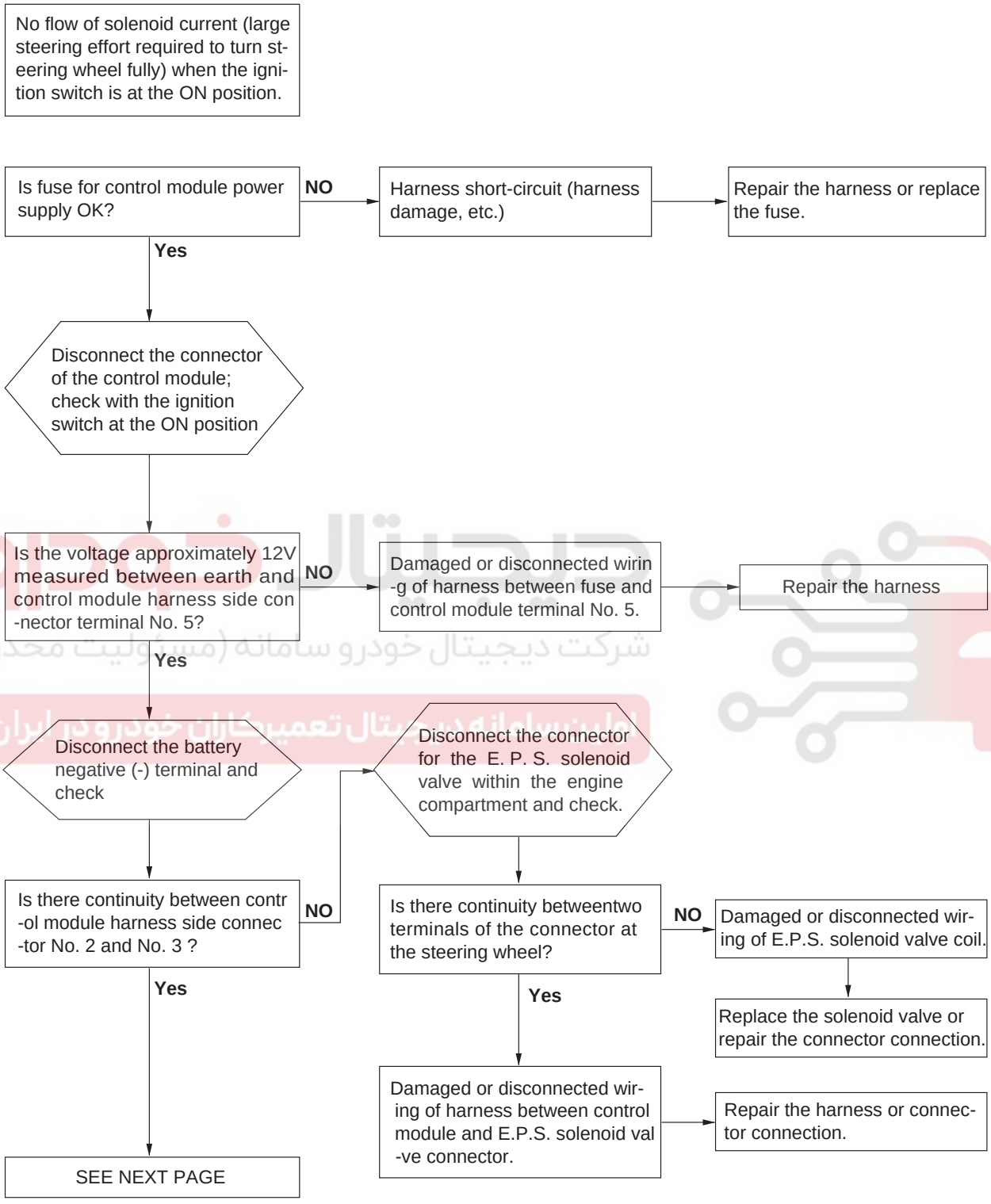
Is the function of the vehicle speed sensor normal?

No → Replace vehicle speed sensor

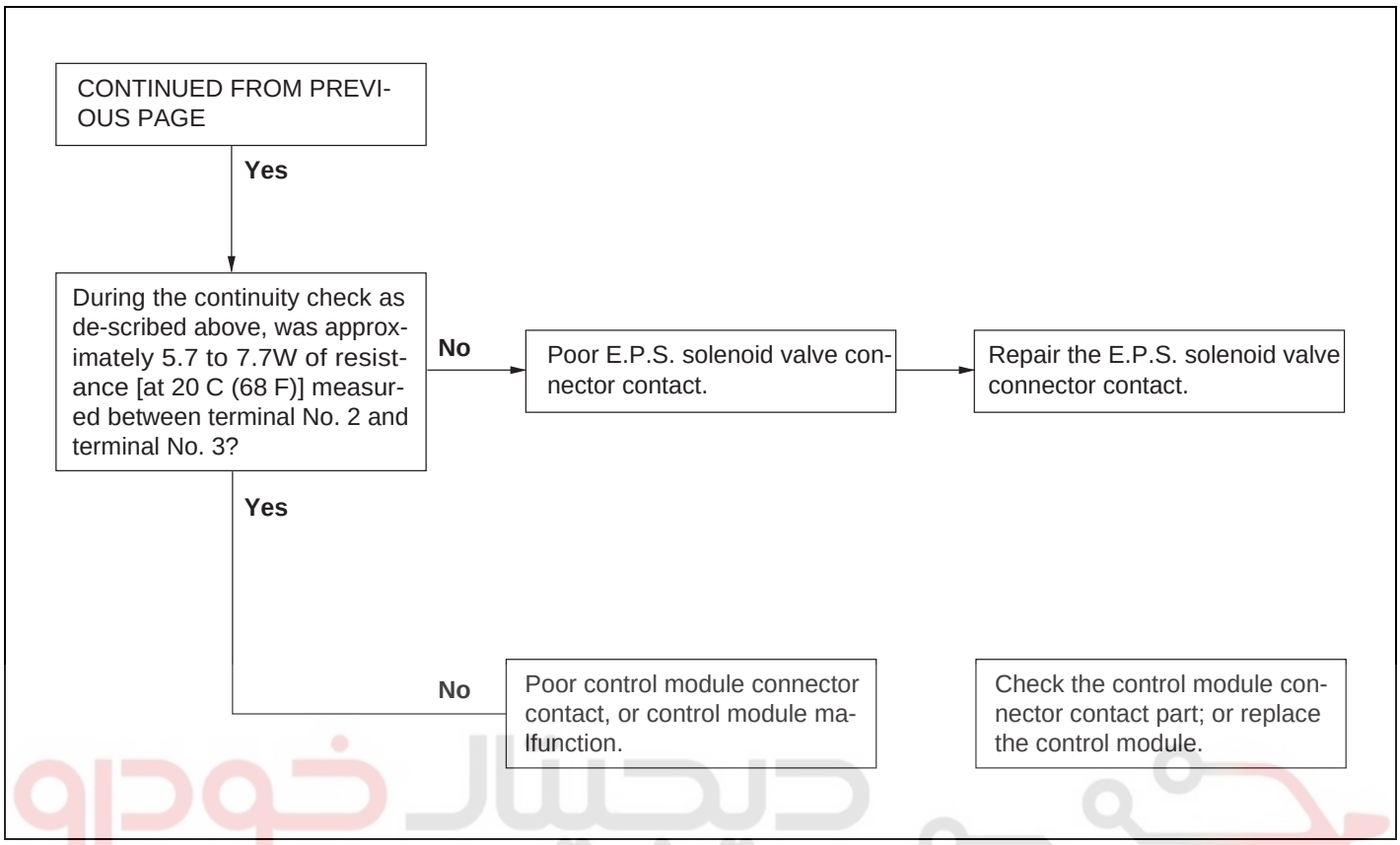
Yes → Repair the connector connection or repair the harness (Connect the connector, or repair the harness between the vehicle speed sensor and the control module

EPRF502A

Trouble symptom 2



EPRF502B

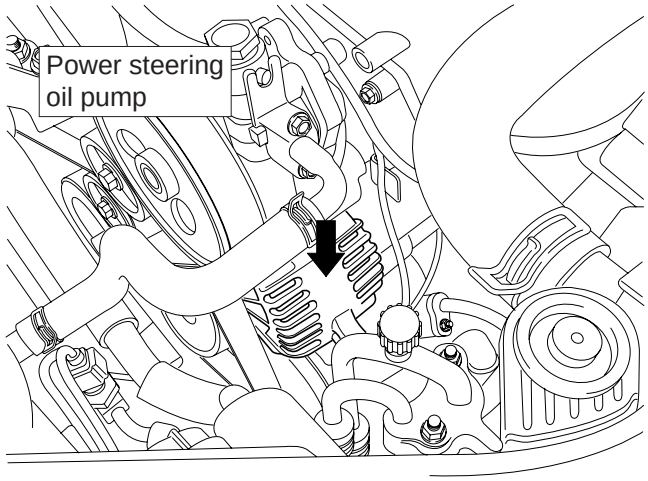


EPRF502C

DTC	Trouble	Condition	Measure time	Disposal	
C1101	Voltage over	IG[V] > 17V	1sec	Solenoid control stop	10V < IG[V] < 16V
C1102	Voltage under	IG[V] > 8V	1sec	Solenoid control stop	10V < IG[V] < 16V
C1212	Vehicle speed sensor	TPS > 30% over and vehiclespeed 0km/h	60sec	Vehicle speed : 80km/h	Vehicle speed > 5km/h
C1604	ECU error	EEPROM Read/Write fail andPWM management error	1sec	Solenoid control stop	IGN ON/OFF
C2230	Solenoid current error	Measure voltage > 1.28A	1sec	Solenoid control stop	Power ON reset
		Solenoid disconnection	1sec		
		Target voltage-Measuervoltage > 0.2A and IG[V] > 13V	2sec		

DTC C1101 BATTERY VOLTAGE HIGH

COMPONENT LOCATION E97277B3



EPRF602A

GENERAL DESCRIPTION EBF87DB7

EPS CM precisely controls the EPS solenoid's current, according to the vehicle speed. The value of the controlled current, according to voltage changes, are minute, and power is provided by IG2. EPS CM does monitor IG2 voltage to monitor excessive rises and drops in voltage. Current control is limited which prevents, damage to the EPS CM due to over-voltage, and operation of the EPS CM at low voltage.

DTC DESCRIPTION EA850CB5

Trouble code occurs when high voltage is caused by a fault in the charging system or IG2 power circuit. EPS CM prohibits solenoid current control by monitoring IG2 battery voltage of EPS CM.

DTC DETECTING CONDITION EEEE98F3

Item	Detecting Condition	Possible cause
DTC strategy	Voltage monitoring	- Open in ground circuit - Contact resistance in connections. - Faulty battery voltage
Enable conditions	IG key "ON"	
Threshold value	IG2 > 17V	
Diagnosis time	1 sec	
Fail safe	Prohibit solenoid 's current control (0 A) Restoration condition : 10V < IG2(V) < 16V ⇒ When the voltage is restored to normal from over voltage, restart solenoid's current control.	

MONITOR SCANTOOL DATA E16E12F3

1. Connect scantool to Data Link Connector(DLC).
2. Start engine and turn the headight and the heatwire on.
3. Monitor the "BATTERY VOLTAGE" parameter on the scantool.
4. Maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.

■ Specification

	IG Key ON	ENG. ON
Bat. Voltage	Approx. 11.8V~12.5V	Approx. 12.5V~14.5V

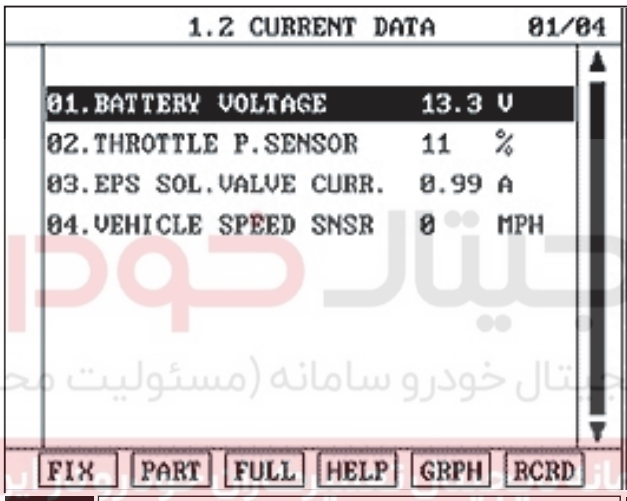


Fig1 Battery voltage current data (normal)

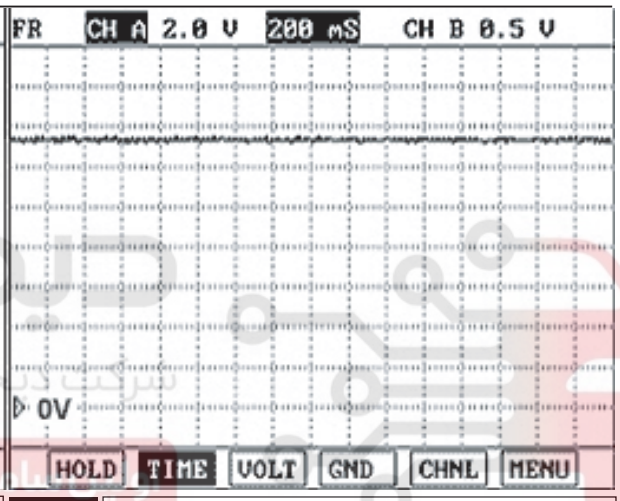


Fig2 Battery voltage signal waveform (normal)

BPCE601B

5. Is parameter within specifications?

YES

⇒ Fault is intermittent and caused either by poor contact in connectors or wiring harness, or it has been repaired and EPS CM memory is not cleared yet. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

⇒ Go to "W/Harness Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EDCEDFBB

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination,deterioration, or damage.
3. Has a problem been found?

YES

⇒ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

⇒ Go to ""Charging System Inspection"" procedure.

CHARGING SYSTEM INSPECTION EA9BFA1A

1. Engine "ON", headight and heatwire "ON".
2. Measure voltage between terminal (+) and (-) of battery maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.

■ Specification

	IG Key ON	ENG. ON
Bat. Voltage	Approx. 11.8V~12.5V	Approx. 12.5V~14.5V

3. Is the measured voltage within specifications?

YES

⇒ Go to "Power Circuit Inspection" procedure.

NO

⇒ Thoroughly check connectors for looseness,poor connection, bending, corrosion, contamination, deterioration, or damage from battery to alternator and fault in charging system.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

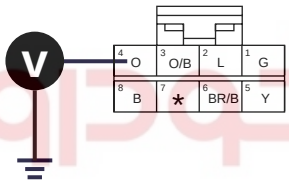
POWER CIRCUIT INSPECTION EBCF3E95

1. Ignition "OFF".
2. Disconnect EPS CM connector.
3. Engine "ON", headight and heatwire "ON".
4. Measure voltage between terminal "4" of EPS CM harness connector and chassis ground maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.

■ Specification

	IG Key ON	ENG. ON
Bat. Voltage	Approx. 11.8V~12.5V	Approx. 12.5V~14.5V

< N-01 >



1. EPS solenoid "+"
2. EPS solenoid "-"
3. Vehicle speed
4. **IG 2**
5. OBD
6. TPS PWM
8. Ground

BPCE601C

5. Is the measured voltage within specifications?

YES

⇒ Go to "Ground Circuit Inspection" procedure.

NO

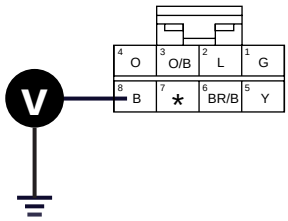
⇒Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E3BAD232

1. Ignition "OFF".
2. Disconnect EPS CM connector.
3. Measure resistance between terminal "8" of EPS CM harness connector and chassis ground.

   ■ Specification : Approx. 0 Ω

< N-01 >



1. EPS solenoid "+"
2. EPS solenoid "-"
3. Vehicle speed
4. IG 2
5. OBD
6. TPS PWM
8. Ground

BPCE601D

4. Is the measured resistance within specifications?

YES

⇒ Substitute with a known-good EPS CM and check for proper operation.
If the problem is corrected,replace EPS CM and then go to "Verification of Vehicle Repair" procedure.

NO

⇒ Check for open or contact resistance in ground harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ED1D3D48

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

⇒ Go to the applicable troubleshooting procedure.

NO

⇒ System performing to specification at this time.

DTC C1102 BATTERY VOLTAGE LOW

COMPONENT LOCATION EFA63D86

Refer to DTC C1101

GENERAL DESCRIPTION EE97FC3D

Refer to DTC C1101

DTC DESCRIPTION E02BBE82

Refer to DTC C1101

DTC DETECTING CONDITION ECF85A0B

Item	Detecting Condition	Possible cause
DTC strategy	Voltage check	- Open/short in power. - Contact resistance in connections. - Poor contact of fail-safe relay. - Faulty charging system. - Low idle rpm. - Loose alternator belt tension.
Enable conditions	IG key "ON"	
Threshold value	IG2 < 8V	
Diagnosis time	1 sec	
Fail safe	Prohibit current control of EPS solenoid (0 A) Restoration condition : 10V < IG2(V) < 16V ⇒ When the voltage is restored to normal from low voltage, restart solenoid's current control "	

MONITOR SCANTOOL DATA E17D2FAC

Refer to DTC C1101

TERMINAL AND CONNECTOR INSPECTION EA41C87A

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.

3. Has a problem been found?

   YES

   ⇒ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   ⇒ Go to "Charging System Inspection" procedure.

CHARGING SYSTEM INSPECTION EA3B2FDC

1. Engine "ON", headight and heatwire "ON".
2. Measure voltage between terminal (+) and (-) of battery maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.

■ Specification

	IG Key ON	ENG. ON
Bat. Voltage	Approx. 11.8V~12.5V	Approx. 12.5V~14.5V

3. Is the measured voltage within specifications?

YES

⇒ Go to "Power Circuit Inspection" procedure.

NO

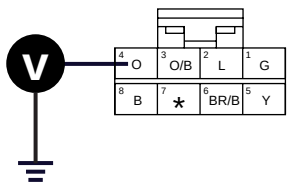
⇒ Check for fault in charging system and check for tension of alternator drive belt, ENG.idle rpm or open/short in harness from battery to alternator.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

POWER CIRCUIT INSPECTION EEAA20E1

1. Ignition "OFF".
2. Disconnect EPS CM connector.
3. Engine "ON", headight and heatwire "ON".
4. Measure voltage between terminal "4" of EPS CM harness connector and chassis ground maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.

■ Specification

	IG Key ON	ENG. ON
Bat. Voltage	Approx. 11.8V~12.5V	Approx. 12.5V~14.5V



1. EPS solenoid "+"
2. EPS solenoid "-"
3. Vehicle speed
4. **IG 2**
5. OBD
6. TPS PWM
8. Ground

BPCE601C

5. Is the measured voltage within specifications?

YES

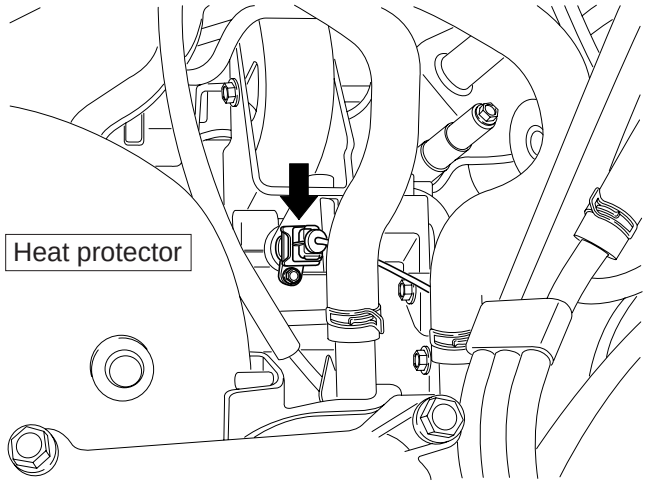
⇒ Substitute with a known-good EPS CM and check for proper operation.
If the problem is corrected, replace EPS CM and then go to "Verification of Vehicle Repair" procedure.

NO

⇒ Check for open/short to ground in power harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

DTC C1212 VEHICLE SPEED SENSOR

COMPONENT LOCATION E2E0C30B



EPRF602E

GENERAL DESCRIPTION ED23CCD1

Speed sensor is a sensor which applies a principal of Hall-effect and is located at speedmeter driven gear of transaxle. If output shaft of transaxle rotates, the rotation of Rotor which has 4 teeth inside the sensor generate a hall effect and outputs the digital pulse. EPS CM detects vehicle speed based on digital pulse signal and controls amount of current t of solenoid valve which controls driving force of steering wheel.

DTC DESCRIPTION EA61B55B

Trouble code occurs when a faulty circuit related to the sensor is detected or when an open/short is detected in the speed sensor circuit. EPS CM detect trouble code and sets solenoid current values according to corresponding 80kph(48mph) values, to reserve driving stability.

DTC DETECTING CONDITION E6F1FDC2

Item	Detecting Condition	Possible cause
DTC strategy	Signal check	- Open/short in power circuit - Open/short in signal circuit - Open in ground circuit - Contact resistance in connections. - Faulty circuit to use VSS - Faulty sensor
Enable conditions	IG key "ON"	
Threshold value	TPS PWM > 30% vehicle speed < 0 kph(0mph)	
Diagnosis time	60 sec	
Fail safe	Fixing solenoid current value corresponding to 80kph(48mph) Restoration : Normal vehicle speed 5kph(0.8mph) of input for 1sec	

SIGNAL WAVEFORM E08D60EC

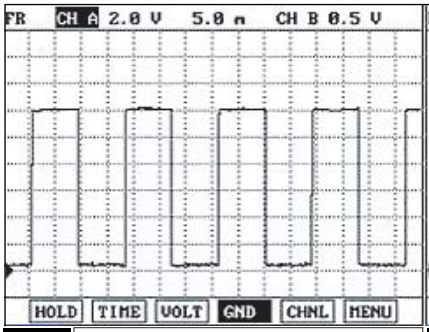


Fig1 Driving (Vehicle speed sensor output)

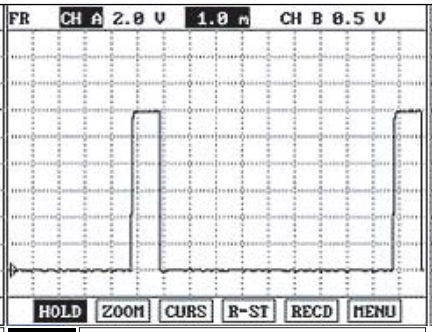


Fig2 TPS PWM (idle)

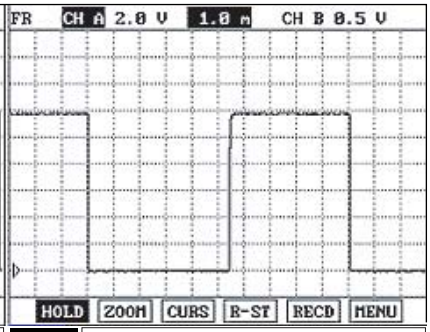


Fig3 TPS PWM (acceleration)

Fig1) Driving : Vehicle speed sensor output 8.0~12.5V(HIGH SIGNAL) or 0.2~0.5V(LOW SIGNAL), as the vehicle moves, the 50% of digital duty wave is ouput. (As vehicle speed increase, Hz increase)

Fig2) Engine RPM signal at idle (TPS PWM duty 10%)

Fig3) Engine RPM signal at acceleration (TPS PWM duty 45%)

BPCE603B

MONITOR SCANTOOL DATA E62D0229

1. Connect scantool to Data Link Connector(DLC).
2. Start engine and monitor the "VEHICLE SPEED SENSOR" parameter on the scantool.
3. Drive the vehicle approx.80kph(48mph) watching the speedometer on the instrument panel.

■ Specification : [Current data value - speedometer value] ≤ [± 10 %]

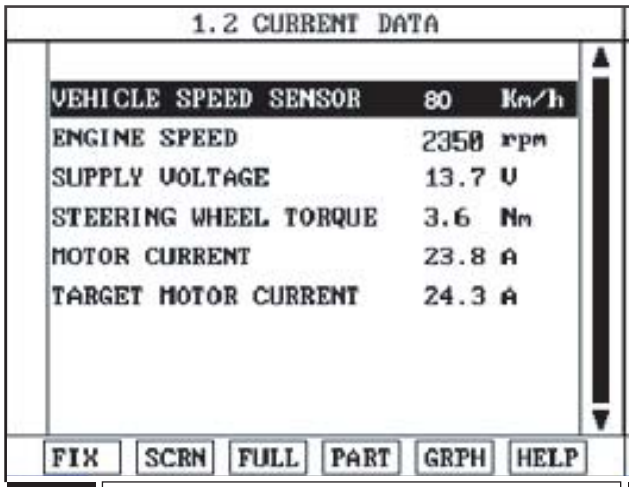


Fig1 Sensor current data (normal)

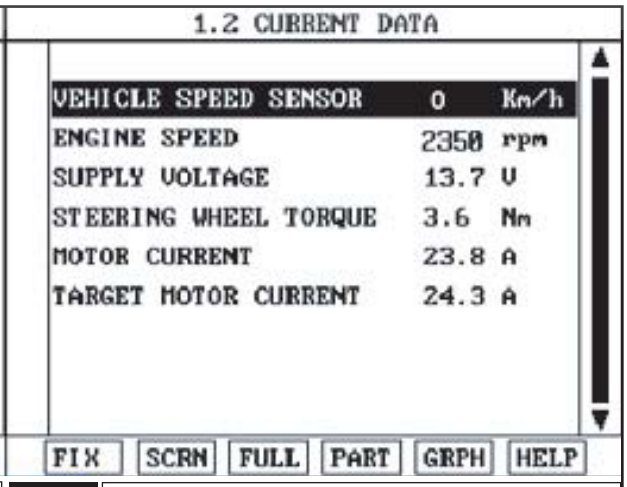


Fig2 Sensor current data (abnormal)

BPCE603C

4. Is parameter within specifications?

YES

⇒ Fault is intermittent and caused either by poor contact in connectors or wiring harness, or it has been repaired and EPS CM memory is not cleared yet. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

⇒ Go to "W/Harness Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EAAC1E11

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

YES

⇒ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

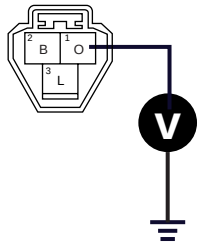
⇒ Check DTC on engine, A/T and other systems which use VSS.
▶ If DTC is detected DTC only in EPS, go to "Signal Circuit Inspection" procedure.
▶ If DTC is detected DTC in other systems also, remove speedometer driven gear and check damage of gear.
→ If Speedometer driven gear is damaged, change it and then go to "Verification of Vehicle Repair" procedure.
→ If Speedometer driven gear is normal, go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION EC9977DA

1. Ignition "OFF".
2. Disconnect vehicle speed sensor connector.
3. Engine "ON".
4. Measure voltage between terminal "1" of vehicle speed sensor harness connector and chassis ground.

■ Specification : Approx. B+

< N-03 >



1. Power supply
2. Sensor Ground
3. Sensor signal

BPCE603D

5. Is the measured voltage within specifications?

YES

⇒ Go to "Ground Circuit Inspection" procedure.

NO

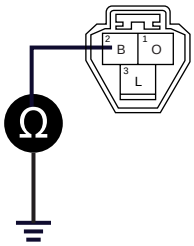
⇒ Check for open/short to ground in power harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EE715553

1. Ignition "OFF".
2. Disconnect vehicle speed sensor connector.
3. Measure resistance between terminal "2" of Vehicle speed sensor harness connector and chassis ground.

■ Specification : Approx. 0 Ω

< N-03 >



1. Power supply
2. Sensor Ground
3. Sensor signal

EPRF603E

4. Is the measured resistance within specifications?

YES

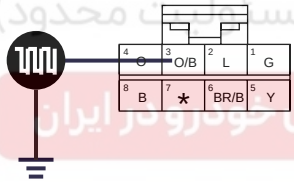
⇒ Go to "Signal Circuit Inspection" procedure.

NO

⇒ Check for open/short to power in ground harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EBDBEE5D

1. Ignition "OFF".
2. Connect Scantool to Data Link Connector(DLC).
3. Start engine and select "SCOPEMETER FUNCTION" on scantool.
4. Drive the vehicle and measure output signal between terminal "3" of EPS CM harness connector and chassis ground.
   ■ Specification : Refer to 'Signal Waveform'



1.EPS solenoid (+)
2.EPS solenoid (-)
3.Vehicle speed
4.IG 2
5.OBD
6.TPS PWM
7.Space
8.Ground

BPCE603F

5. Is vehicle speed sensor output signal within specifications?

YES

⇒ Substitute with a known-good EPS CM and check for proper operation.
If the problem is corrected, replace EPS CM and then go to "Verification of Vehicle Repair" procedure.

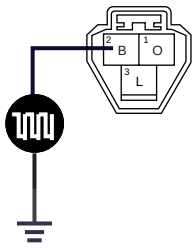
NO

⇒ Check for open/short to ground in signal circuit and other systems which use VSS.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.
If a problem hasn't found, go to "Component Inspection" procedure.

COMPONENT INSPECTION EFEA3BCD

1. Ignition "OFF".
2. Connect Scantool to Data Link Connector(DLC).
3. Start engine and select "SCOPEMETER FUNCTION" on scantool.
4. Drive the vehicle and measure output signal between terminal "3" of Vehicle speed sensor harness connector and chasiss ground.

< N-03 >



1. Power supply
2. Sensor Ground
3. Sensor signal

BPCE603G

■ Specification : Refer to 'Signal Waveform'

5. Is vehicle speed sensor output signal within specifications?

YES

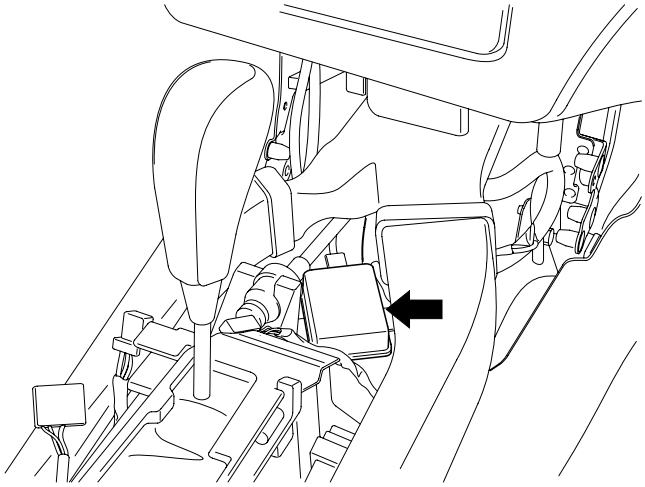
⇒Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

⇒ Check vehicle speed sensor for contamination, deterioration, or damage.
Substitute with a known-good vehicle speed sensor and check for proper operation.
If the problem is corrected, replace vehicle speed sensor and then go to "Verification of Vehicle Repair" procedure.

DTC C1604 ECU HARDWARE ERROR

COMPONENT LOCATION EADC45EC



EPBF500J

GENERAL DESCRIPTION E1F86DC4

EPS has a solenoid valve on power steering gear box, and a EPS CM underneath the audio center facia. EPS CM which receives signals from VSS (Vehicle Speed Sensor) and TPS controls the oil flow of steering gear box.
EPS CM performs the conventional power steering function in case a failure has occurred in the system.
EPS CM electronically controls the current to the solenoid of by-pass valve by inputting sensor's signals to control the hydraulic amount in cylinder chamber and thereby varying the steering effort versus the hydraulic pressure according to vehicle speed.

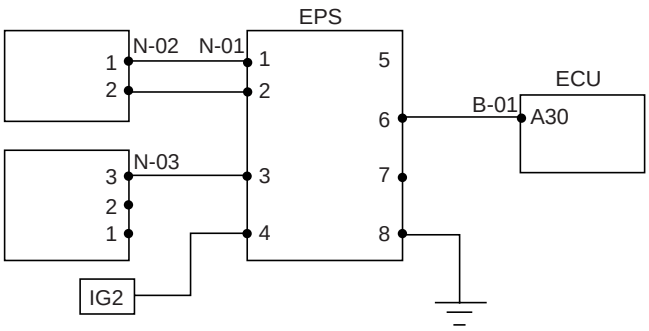
DTC DESCRIPTION E1A7C0D3

This DTC is about general error of inside EPS CM. If this DTC is set, check unstable power or excessive surge influx by faulty power supply and chassis ground.

DTC DETECTING CONDITION EAC60287

Item	Detecting Condition	Possible cause
DTC strategy	Voltage monitoring	- Contact resistance in ground circuit. - Surge in power circuit. - Faulty EPS CM
Enable conditions	IG key "ON"	
Threshold value	EEPROM read/write failPWM managerment error	
Diagnosis time	1 sec	
Fail safe	Prohibit solenoid current control (0 A) IG2 ON/OFF	

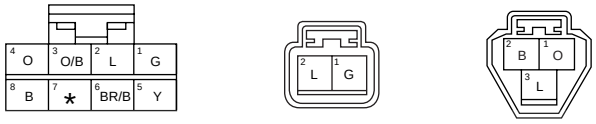
SCHEMATIC DIAGRAM E8DCCF83



[CONNECTION INFORMATION]

M70	Connected to	Fuction
1	N-01 terminal 1	Solenoid(+)
2	N-02 terminal 2	Solenoid(-)
3	N-03 terminal 3	Vehicle speed
4	IG SWITCH	Power(IG2)
5	-	DTC
6	B-01 terminal A30	TPS
8	-	Ground

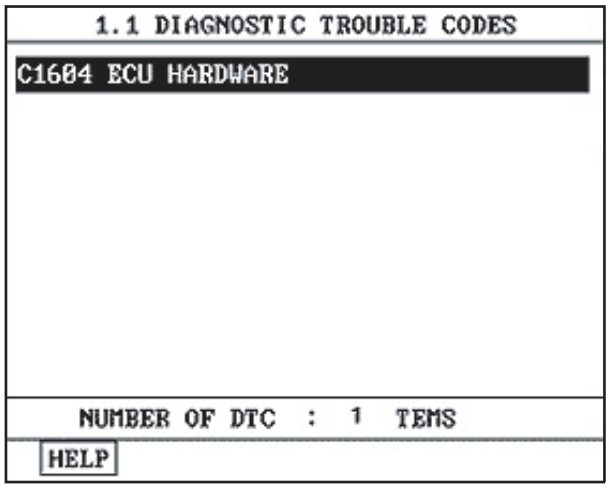
N-01 **N-02** **N-03**



BPCE604B

MONITOR SCANTOOL DATA E5C9C4C4

1. Ignition "OFF" and connect scantool to Data Link Connector(DLC).
2. Ignition "ON" Engine "OFF".
3. Select "DIAGNOSTIC TROUBLE CODES" mode and monitor "Diagnostic Trouble Code".
4. Clear DTC and drive the vehicle within DTC Enable conditions in General Information.



BPCE604C

5. Is "C1604" present ?

YES

⇒ Fault is intermittent and caused either by poor contact in connectors or wiring harness, or it has been repaired and EPS CM memory is not cleared yet. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

⇒ Go to "W/Harness Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E4AFFCBF

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

YES

⇒ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

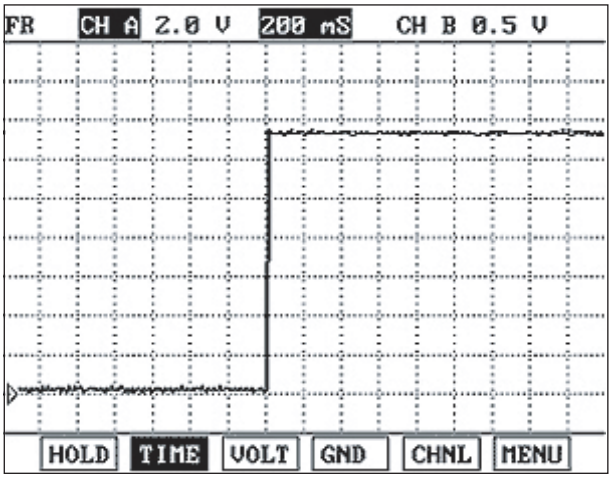
NO

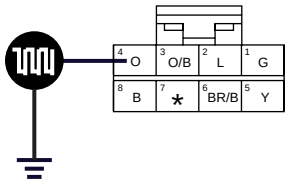
⇒ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION EFB0DC3F

1. Ignition "OFF".
2. Connect Scantool to Data Link Connector(DLC) and start engine.
3. Select "SCOPEMETER FUNCTION" on scantool and accelerate engine.
4. Measure output signal between terminal "4"of EPS CM harness connector and chassis ground with switching (A/C,headlight etc.).

■ Specification : Surge always must not happen when turn IG key ON, OFF with turn the electricity device ON, OFF.





1. EPS solenoid "+"
2. EPS solenoid "-"
3. Vehicle speed
4. IG 2
5. OBD
6. TPS PWM
8. Ground

BPCE604E

5. Is the resistance measured within specifications?

YES

⇒Go to "Ground in power harness" procedure.

NO

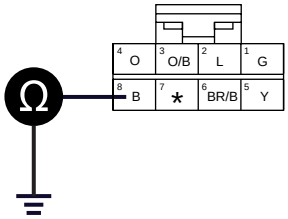
⇒ Check for contact resistance in connections or open in power harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E165624A

1.CHECK FOR OPEN IN GROUND HARNESS

1. Ignition "OFF".
2. Disconnect EPS CM connector.
3. Measure resistance between terminal "8" of EPS CM harness connector and chassis ground.

■ Specification : Approx. 0 Ω



1. EPS solenoid "+"
2. EPS solenoid "-"
3. Vehicle speed
4. IG 2
5. OBD
6. TPS PWM
8. Ground

BPCE604F

4. Is the resistance measured within specifications?

YES

⇒ Go to "Check for earthing in ground harness" as below.

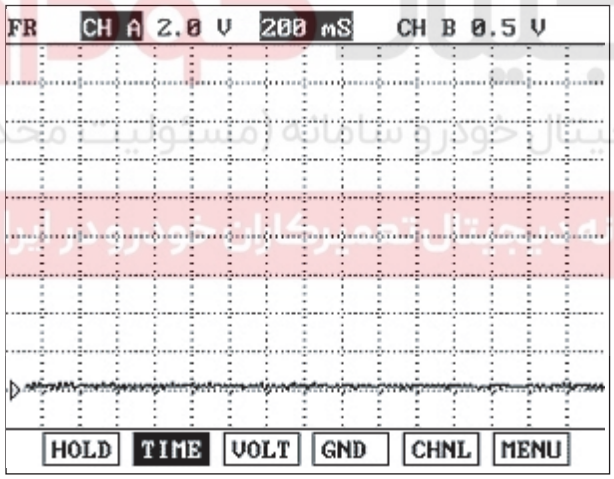
NO

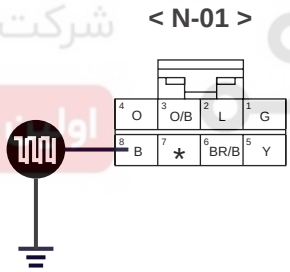
⇒ Check for open or contact resistance in ground harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

2.CHECK FOR EARTHING IN GROUND HARNESS

1. Ignition "OFF".
2. Connect Scantool to Data Link Connector(DLC) and start engine.
3. Select "SCOPEMETER FUNCTION" on scantool and accelerate engine.
4. Measure output signal between terminal "8" of EPS CM harness connector and chassis ground with switching (A/C,headlight etc.).

■ Specification : Surge always must not happen when turn IG key ON, OFF with turn the electricity device ON, OFF.





1. EPS solenoid "+"
2. EPS solenoid "-"
3. Vehicle speed
4. IG 2
5. OBD
6. TPS PWM
8. Ground

BPCE604H

5. Is the output signal within specifications?

YES

⇒ Go to "Component Inspection " procedure.

NO

⇒ Check for open or poor earthing in ground harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EAF9F5FA

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear DTC.
3. Drive the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

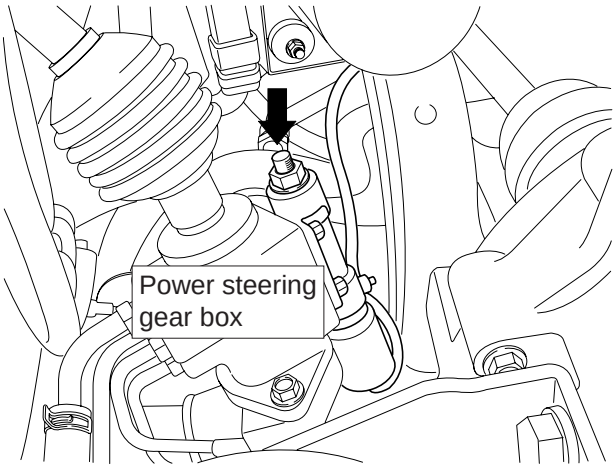
⇒ Check EPS CM for damage or sticking by the naked eye. Substitute with a known-good EPS CM and check for proper operation.
If the problem is corrected, replace EPS CM and then go to "Verification of vehicle Repair" procedure.

NO

⇒ Substitute with a known-good EPS CM and check for proper operation.
If the problem is corrected, replace EPS CM and then go to "Verification of Vehicle Repair" procedure.

DTC C2230 SOLENID

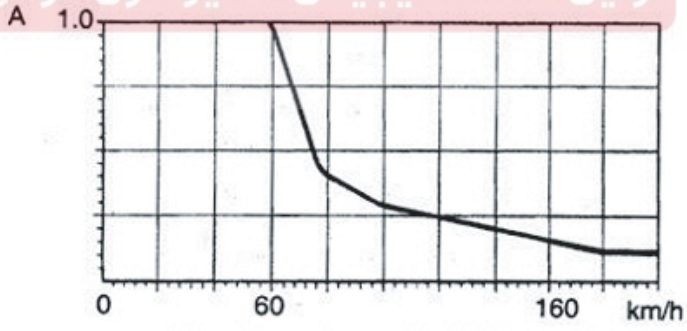
COMPONENT LOCATION E5DDAE5D



EPRF602S

GENERAL DESCRIPTION E8C48A9C

EPS CM controls current amounts to the solenoid valve which adjust driving force of steering wheel, based on vehicle speed information recieved from the vehicle speed sensor. The EPS solenoid maintains proper steering force by adjusting fluid amounts into the EPS valvebody according to current values.



Current value HIGH : Handle light

Currentvalue LOW : Handle heavy

Solenoid control current Vs Vehicle speed
(Vehicle speed increase, solenoid current value is decreased)

BPCE605B

DTC DESCRIPTION EC1B81DD

If an open/short is detected in the solenoid circuit. or current value is under/over, while EPS CM is monitoring solenoid's current, EPS CM sets this trouble and the current value will be controlled "0".

DTC DETECTING CONDITION EE4A56AC

Item	Detecting Condition		Possible Cause
DTC Strategy	Current check		- Open/short in power circuit and control circuit - Contact resistance in connections. - Faulty solenoid
Enable Conditions	IG key "ON"		
Threshold Value		Diagnostic Time	
Measuer current > 1.28A		1 sec	
Solenoid open		1 sec	
[target current-measure current] > 0.2A and IG(V) > 13V		2 sec	
Fail Safe	Prohibit solenoid 's current control (0 A) Restoration condition : Power ON reset		

SPECIFICATION EBAC1F6B

Solenoid resistance	Frequency	Duty
5.7~7.7Ω [at 20℃(68°F)]	125/333 Hz	5~95%

SIGNAL WAVEFORM ED9EF678

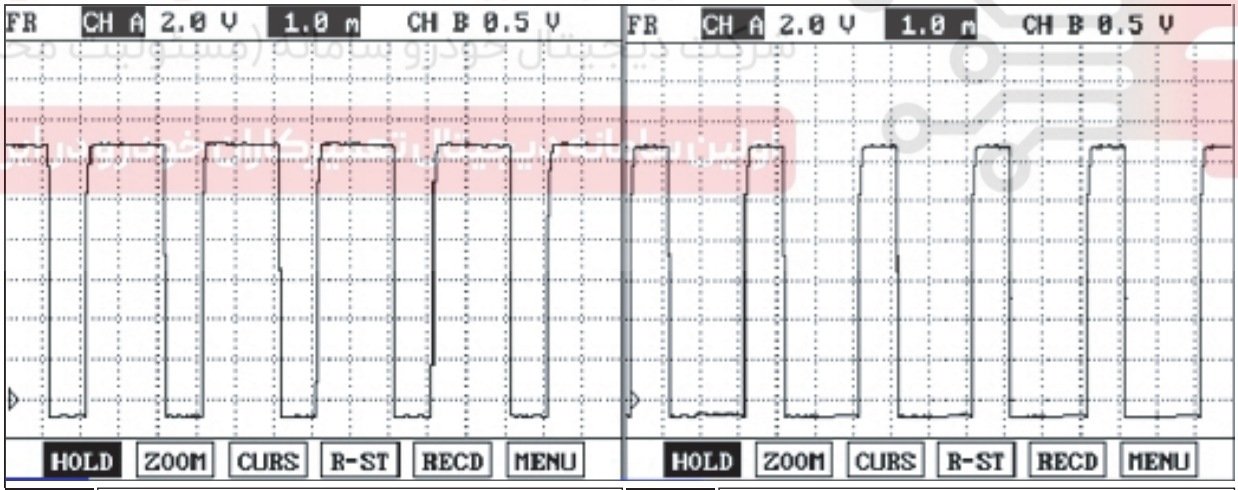


Fig1	Idle	Fig2	Vehicle speed increase

Fig 1) Normal signal waveform which is the current control at idle (1A).
Fig 2) Signal waveform which is the current decrease by vehicle speed increase.

BPCE605C

MONITOR SCANTOOL DATA EF5A65FC

1. Ignition "OFF" and connect scantool to Data Link Connector(DLC).
2. Ignition "ON" Engine "OFF".
3. Select "DIAGNOSTIC TROUBLE CODES" mode and monitor "Diagnostic Trouble Codes(DTCs)".

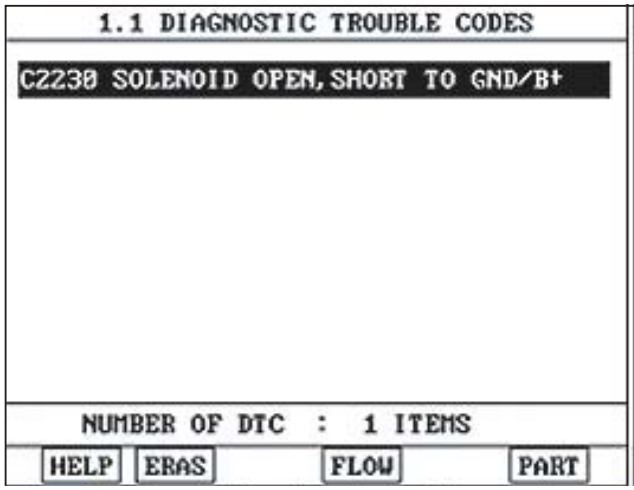


Fig1 Diagnostic Trouble Code (abnormal)

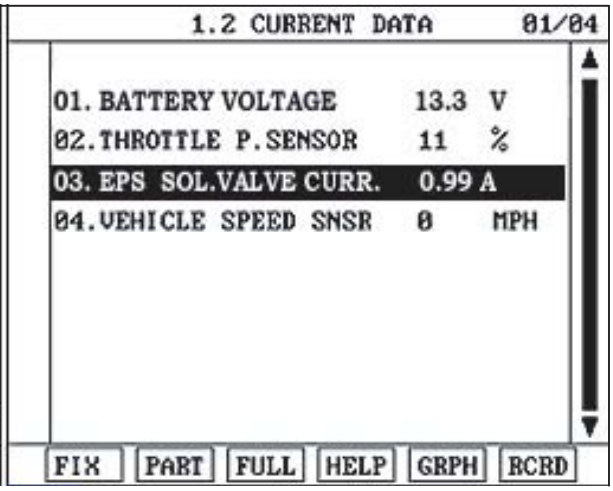


Fig2 Sensor current data (abnormal)

BPCE605D

4. Is parameter within specifications?

YES

⇒ Fault is intermittent and caused either by poor contact in connectors or wiring harness, or it has been repaired and EPS CM memory is not cleared yet. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

⇒ Go to "W/Harness Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EB026EB9

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.

3. Has a problem been found?

YES

⇒ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

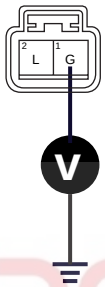
⇒ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E2A9DBA7

1. Ignition "OFF".
2. Disconnect solenoid connector.
3. Engine "ON".
4. Measure voltage between terminal "1" of solenoid harness connector and chassis ground.

■ Specification : Approx. B+

< N-02 >



1.Solenoid (+)
2.Solenoid (-)

BPCE605E

5. Is the voltage measured within specifications?

YES

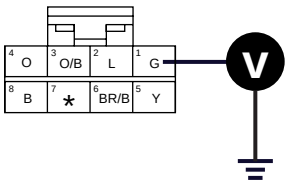
⇒ Go to "Control Circuit Inspection" procedure.

NO

⇒ Measure voltage between terminal "1" of EPS CM harness connector and chassis ground in above condition.

■ Specification : Approx. B+

< N-01 >



1. EPS solenoid "+"
2. EPS solenoid "-"
3. Vehicle speed
4. IG 2
5. OBD
6. TPS PWM
8. Ground

BPCE605F

▶ If it is normal, Check for open/short to ground or control harness in power harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

▶ If it is abnormal, substitute with a known-good EPS CM and check for proper operation. If the problem is corrected, replace EPS CM and then go to "Verification of Vehicle Repair" procedure.

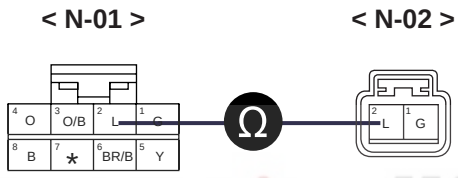
CONTROL CIRCUIT INSPECTION EC16C8C9

1. Ignition "OFF".

2. Disconnect solenoid connector and EPS CM connector.

3. Measure resistance between terminal "2"of solenoid harness connector and terminal "2" of EPS CM harness connector.

■ Specification : Approx. 0 Ω



1.EPS solenoid (+)	5.OBD	1.Solenoid (+)
2.EPS solenoid (-)	6.TPS PWM	**2.Solenoid (-)**
3.Vehicle speed	7.Space	
4.IG 2	8.Ground	

BPCE605G

4. Is the measured resistance within specifications?

YES

⇒ Check for short to ground in control harness.
▶ If it is normal, go to "Component Inspection" procedure.
▶ If it is abnormal, repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

⇒ Check for open/short to ground in control harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5D9BAB3

CHECK EPS SOLENOID

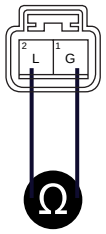
1. Ignition "OFF".

2. Disconnect EPS solenoid connector.

3. Measure resistance between terminal "2" and terminal "1" of solenoid harness connector(To sensor side).

■ Specification : 5.7~7.7Ω [at 20℃(68˚F)]

< N-02 >



1.Solenoid (+)
2.Solenoid (-)

BPCE605H

4. Is the measured resistance within specifications?

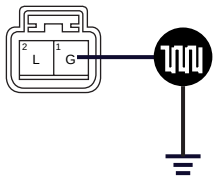
YES

1) Ignition "OFF".
2) Connect Scantool to Data Link Connector(DLC) and then Engine "ON ".
3) Select "SCOPEMETER FUNCTION" on scantool.
4) Measure output signal between terminal "1" of EPS solenoid harness connector and chassis ground.

■ Specification : Refer to 'Signal Waveform'

⇒ If it is normal, substitute with a known-good EPS CM and check for proper operation.
If the problem is corrected, replace EPS CM and then go to ""Verification of Vehicle Repair"" procedure.
⇒ If it is abnormal, check EPS solenoid for contamination, deterioration, or damage.
Substitute with a known-good EPS solenoid and check for proper operation.
If the problem is corrected, replace EPS solenoid and then go to "Verification of Vehicle Repair" procedure.

< N-02 >



1.Solenoid (+)
2.Solenoid (-)

BPCE605I

NO

⇒ Check EPS solenoid for contamination, deterioration, or damage.
Substitute with a known-good EPS solenoid and check for proper operation.
If the problem is corrected, replace EPS solenoid and then go to "Verification of Vehicle Repair" procedure.