General Information

Specifications

Transaxle model		A4CF1
Engine model		Gasoline 1.6L
T/con		3 elements 2 phases 1 stage
T/con size (Φ)		236
O/PUMP type		Parachoid
T/M CASE type		Separated
Friction elements		Clutch: 3EA
		Brake: 2EA
		OWC : 1EA
Planetary gear		2EA
Gear ratio	1st	2.919
	2nd	1.551
	3rd	1.000
	4th	0.713
	Reverse	2.480
Final gear ratio		4.375
Fluid pressure balance piston		2EA
Stall speed		2,000~2,700 rpm
Accumulator		4EA
Solenoid valve		6EA (PWM:5EA, VFS:1EA)
Shift lever position		7 range (P,R,N,D,3,2,L)
Oil filter		1EA

- PWM : Pulse Width Modulation
- VFS : Variable Force Solenoid

Tightening Torques

Item	N.m	kgf.m	lb-ft
Shift cable bracket	15~22	1.5~2.2	10.8~15.9
Input shaft speed sensor	10~12	1.0~1.2	7.2~8.6
Output shaft speed sensor	10~12	1.0~1.2	7.2~8.6
Manual control lever	17~21	1.7~2.1	12.3~15.2
Inhibitor switch	10~12	1.0~1.2	7.2~8.6
Oil pan	10~12	1.0~1.2	7.2~8.6
Valve body mounting bolt	10~12	1.0~1.2	7.2~8.6
Oil drain plug	40~50	4.0~5.0	28.9~36.1
Pressure check plug	8~10	0.8~1.0	5.8~7.2
Transaxle support bracket bolt	88.3~107.9	9.0~11.0	65.1~79.6

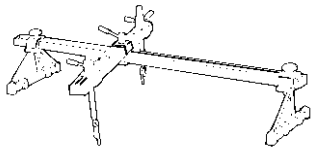
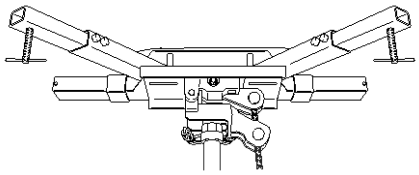
Lubricants

Item	Specified lubricant	Quantity
Transaxle fluid liter (US qt, Imp.qt)	GENUINE DIAMOND ATF SP-III or SK ATF SP -III	6.8 (7.2, 5.98)

Sealant

Item	Specified sealant
Rear cover Torque converter housing Oil pan	LOCTITE FMD-546

Special Service Tools

Tool (Number and name)	Illustration	Use
09200-38001 Engine support fixture	 AKGF020A	Removal and installation of the transaxle.
09624-38000 Crossmember supporter	 EKBF005A	Supporting of the crossmember.

Automatic Transaxle System

Description

The new small sized automatic transaxle (A4CF1) is for Gamma 1.6 gasoline engine.
The transaxle (A4CF1) is improved on the durability, fuel consumption and efficiency by the new main features as followed.

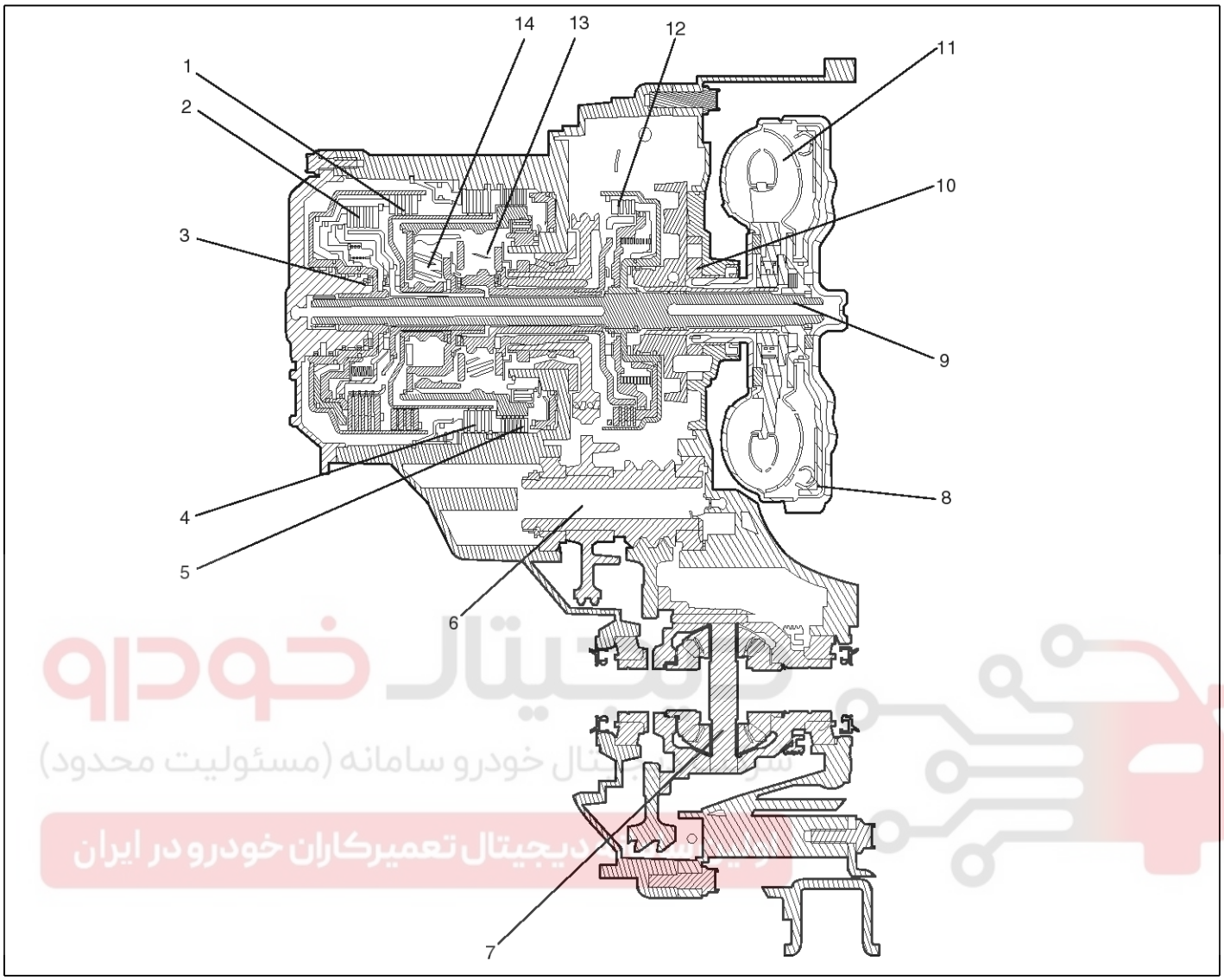
The new main features

1. The hydraulic centrifugal oil pressure balance piston.
2. The full line pressure variable control system.
3. The long travel damper clutch.
4. The disc type return spring.
5. The ultra flat torque converter.

Functions

Item	Contents
Components	The full line pressure variable control operates in the valve body to improve the fuel consumption.
	The long travel damper clutch is applied to the torque converter to improve the engine revolution change reduction capability and the fuel consumption. (17~20˚)
	The oil pump of the trochocentric type is changed to parachoid type to improve the processing and the capacity efficiency at the low RPM range.
	The disc type return spring is applied to the low & reverse brake to improve the durability and reduce the length.
	The hydraulic centrifugal oil pressure balance piston is applied to the inside of clutch to improve the durability and the shift control capability.
	The low noise gear and the gear teeth face grinding are applied to the transfer driven gear to improve the noise and the durability.
Electronic control system	The oil pressure value set by TCM is coupled with the engine torque so that the stable shift feeling can be improved.
	The engine torque reduction control operates effectively to improve the shift feeling and the durability.
	It can be the skip shift of 1↔3 and 2↔4 when shifting.
	The reverse clutch, not L/R brake is controlled when controlling the N→R shift so that the N→R shift feeling can be improved.
	The range of the damper clutch direct control expands to improve the fuel consumption.
	The current control chip is installed into the TCM to regulate the solenoid control current and control the oil pressure securely according to the change of the temperature and voltage.
	The FPC(Flexible Printed Circuit) harness is composed of the thin and flat copper in the insulating film like electric wire.
	The tachometer is operated by the change of the frequency forwarded from the TCM to the instrument cluster, not vehicle speed sensor.

Transaxle structure



SFDAT9001N

1. Reverse clutch
2. Overdrive clutch
3. Rear cover
4. Second brake
5. Low and reverse brake
6. Output shaft
7. Differential
8. Damper clutch
9. Input shaft
10. Oil pump assembly
11. Torque converter assembly
12. Underdrive clutch
13. Output planetary carrier
14. Overdrive planetary carrier

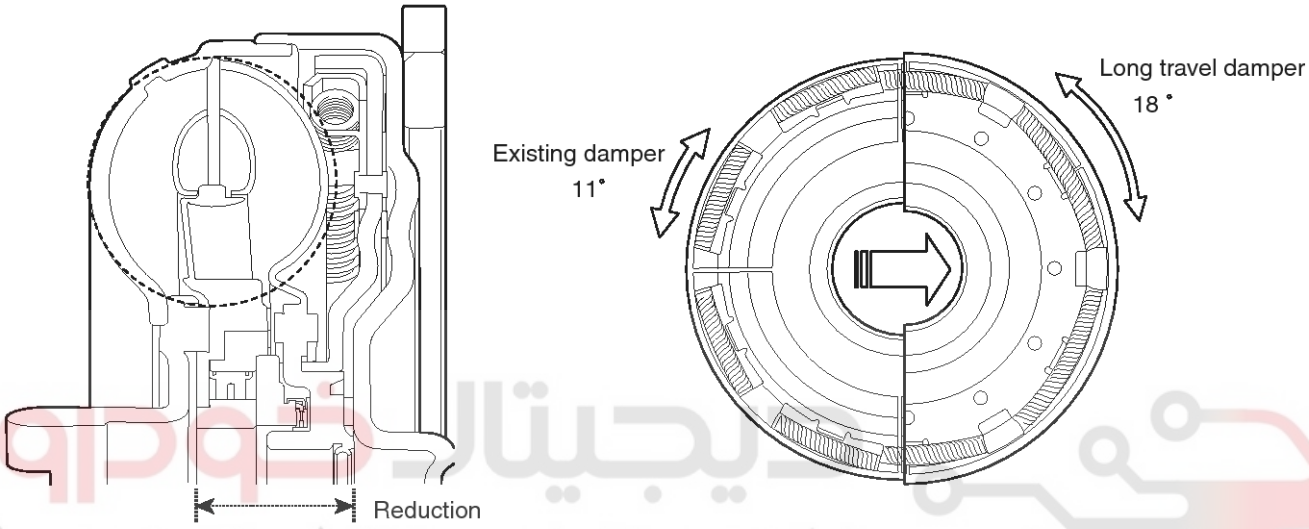
Mechanical system

Function

Torque Converter

The torque converter, as the power plant which delivers the power of engine to the automatic transaxle, consists of 3 elements, 2 phases and 1 stage type.

- The flowing section form of the torque converter changes the round type to the flat type to reduce the length of the torque converter.
- The maximum operating degree of the damper clutch installed inside the transaxle increases from 11˚ to 18˚ to improve the engine revolution change reduction capability and the fuel consumption.



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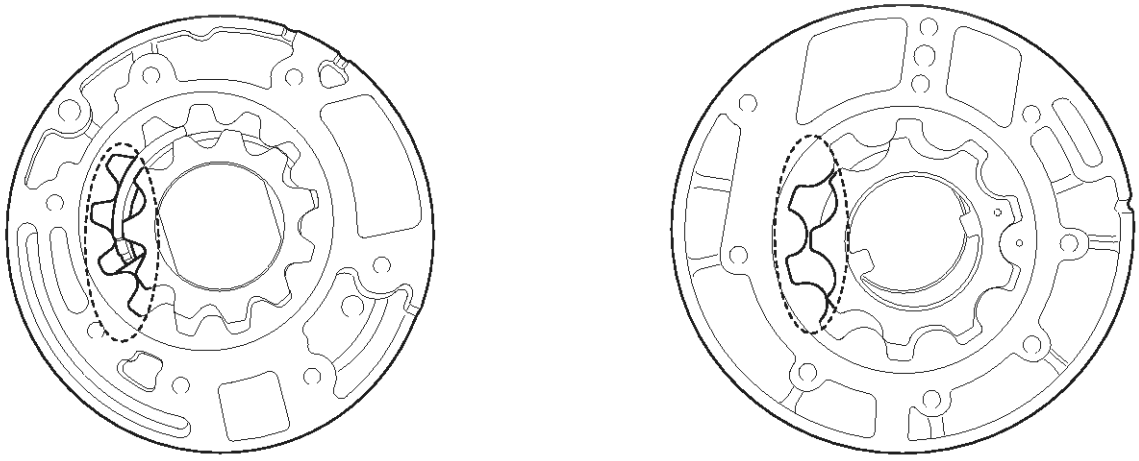
Oil pump

The oil pump is made of the aluminum (the reaction shaft support) to loose the weight and selects the parachoid type to improve the processing and the capacity efficiency at the low RPM range.



<Trocoid> <Pharacoid>

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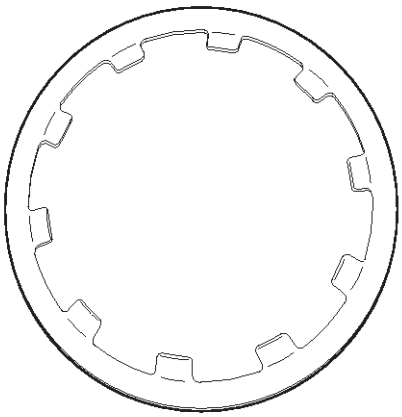
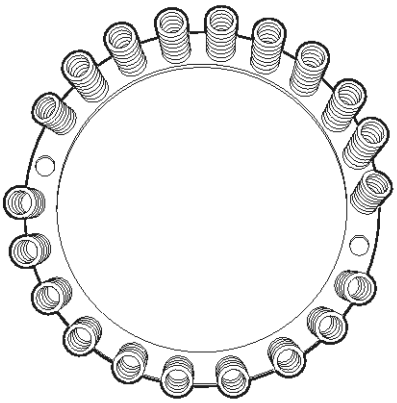
Brakes

The automatic transaxle (A4CF1) uses the low and reverse brake and the second brake. The low and reverse brake is fixed by the low and reverse annulus gear and overdrive planetary carrier.

- The disc type return spring is applied to the low and reverse brake and it minimizes the slip of the friction material from the uniform spring operation power to improve the durability and reduce the length.

The reverse sun gear is held on the transaxle case by the second brake.





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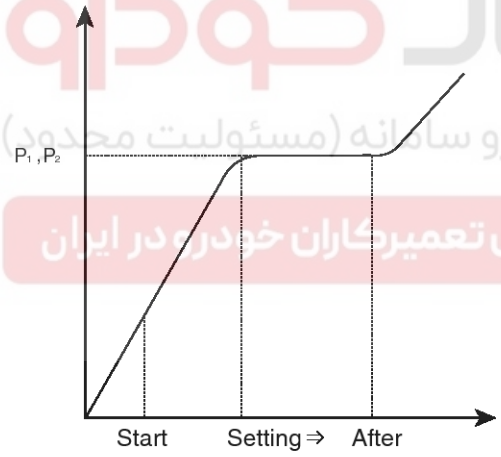
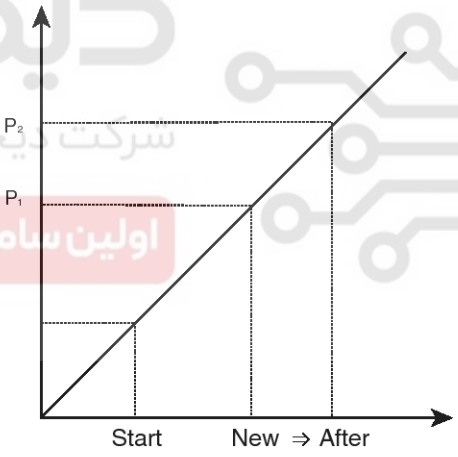


<Disc type return spring>



<Coil type return spring>

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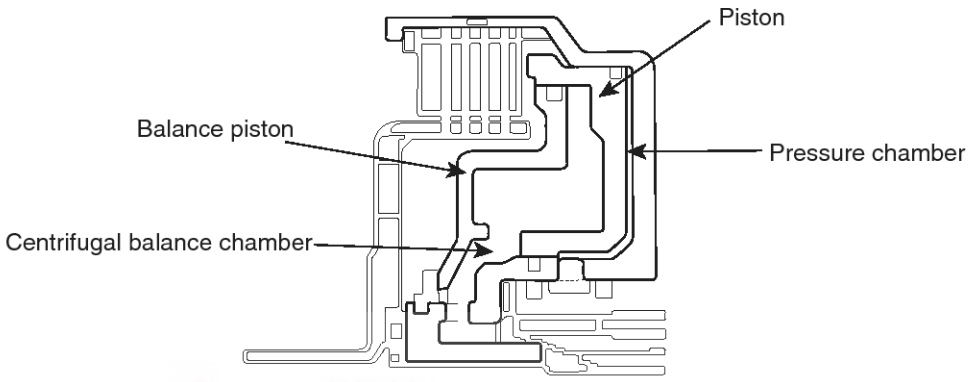
Clutch

The multiple clutches and the one way clutch are used as the transaxle device.
The retainer of each clutch is composed of the precision sheet metal parts to realize the productivity and the light weight .
The hydraulic centrifugal oil pressure balance device places inside the clutch assembly.
Generally the oil remained in the piston oil pressure chamber pushes the piston by the centrifugal force. But to prevent t he piston from being pushed, the oil filled in between the piston and the return spring retainer occurs the centrifugal force and both of the power is offset so that the piston don't move. In result, it improves the durability and the shift control ability.



<Centrifugal balance device>

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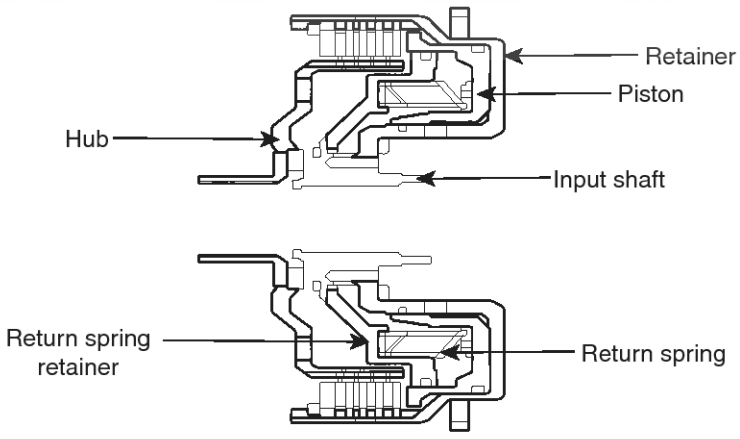
1. Underdrive Clutch

The driving force of input shaft is delivered to the underdrive sun gear.
The operating oil pressure in the underdrive clutch components operates between the piston and the retainer and pushes the piston to the clutch discs to deliver the driving force from the retainer to the hub.



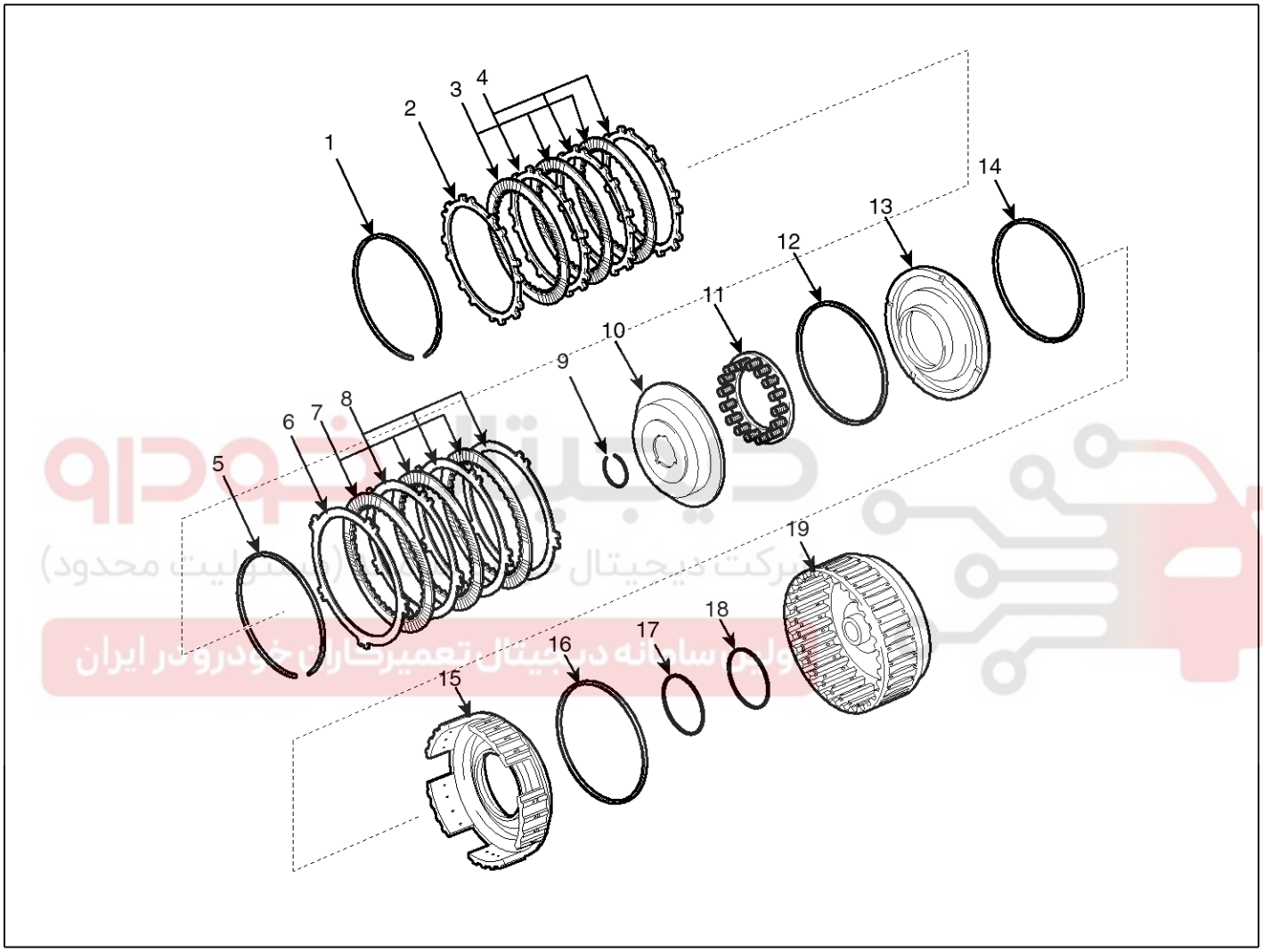
<Underdrive clutch>

BKGF003B

2. Reverse clutch and overdrive clutch

The reverse clutch delivers the driving force of input shaft to the reverse sun gear.
The overdrive clutch delivers the driving force of input shaft to the overdrive planetary carrier and the low and reverse a-nnulus gear.
The operating oil pressure of the reverse clutch operates between the reverse clutch retainer and reverse clutch piston and it has the whole overdrive clutch moved through hub splines.

Structure of the reverse and the overdrive clutch



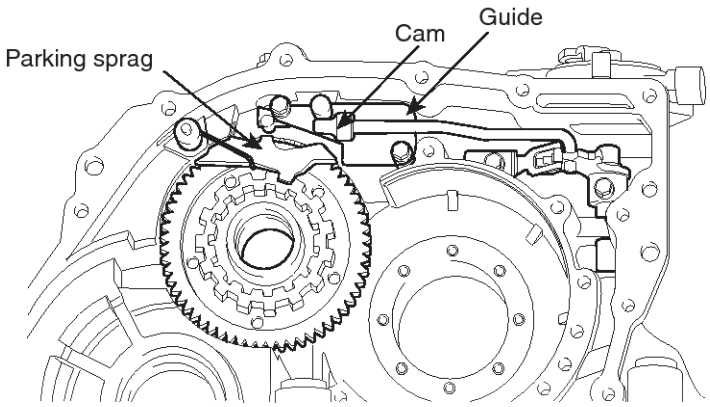
STDAT9001C

1. Snap ring
2. Clutch reaction plate
3. Clutch disc
4. Clutch plate
5. Snap ring
6. Clutch reaction plate
7. Clutch disc
8. Clutch plate
9. Snap ring
10. Spring retainer
11. Return spring
12. D-ring
13. Overdrive clutch piston
14. D-ring
15. Reverse clutch piston
16. D-ring
17. D-ring
18. D-ring
19. Reverse clutch retainer

Parking System

The parking system for A4CF1 model is the cam type.

The roller type installed to the existing new generation AT needs the support to move the roller when operating the parking system and is so complicated. But the cam type for A4CF1 model doesn't need the support and the structure is simply. It only needs the guide to prevent from moving the cam idly.



<Parking system>

BKGF003D

Operation

Hydraulic Control System

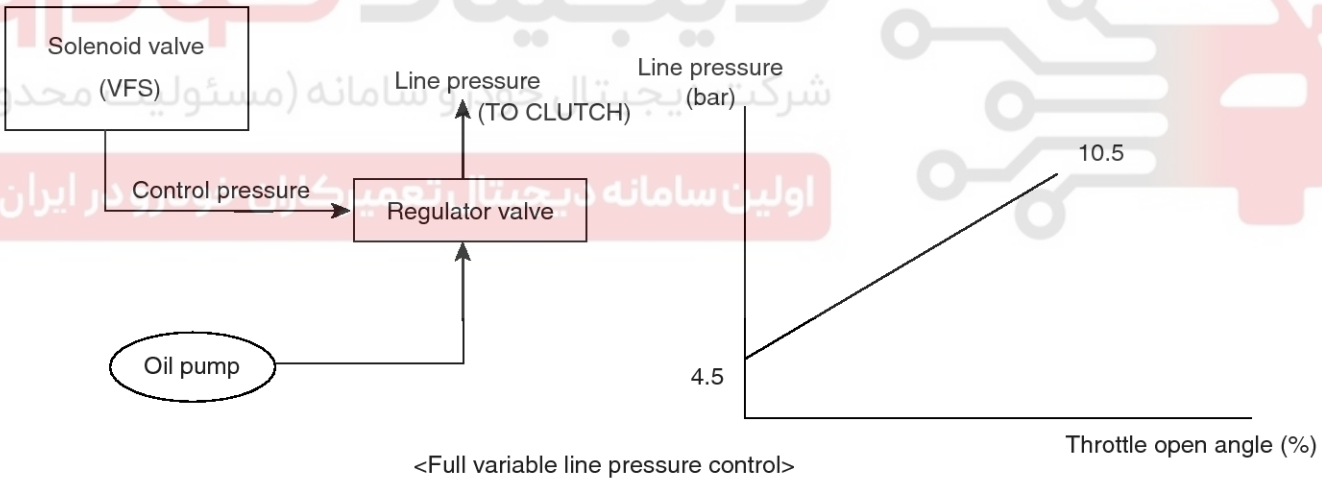
Main Features

The VFS (Variable Force Solenoid) installed in the valve body is applied to transaxle(A4CF1). VFS varies the line pressure from 4.5bar to 10.5bar according to throttle open angle and shift range to improve the fuel consumption and shift ability.

And the reducing valve which is installed in the valve body makes the solenoid control pressure using the reducing pressure instead of the line pressure like the HIVEC transaxle.

The material of spool valve in the valve body is changed from the steel to aluminum to reduce the oil leakage by the thermal expansion between the valve body and spool valve at the high temperature.

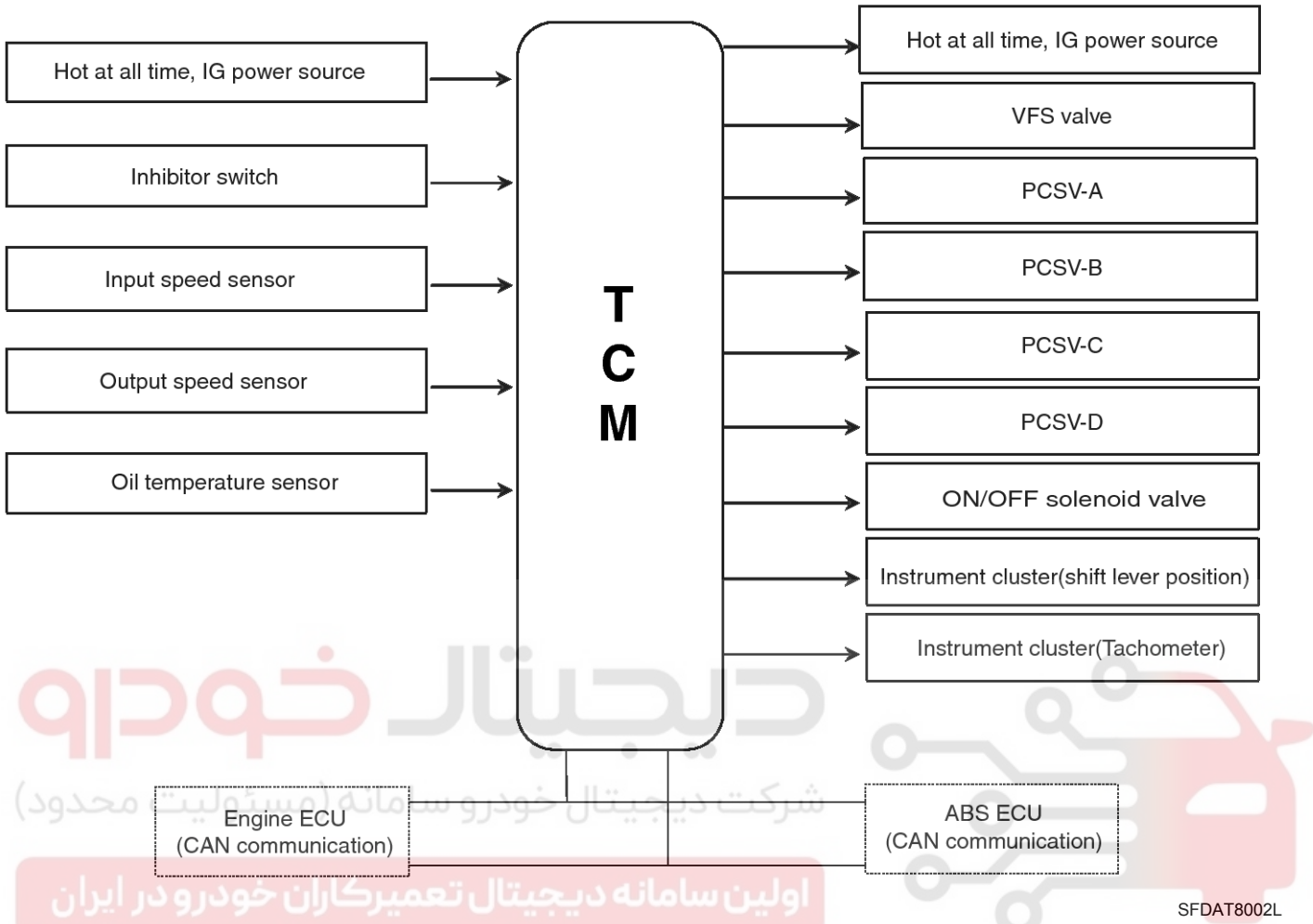
The switch valve, the solenoid valve and the fail safe valve are operated to drive the vehicle at the 3rd speed and reverse even thought the malfunction of the electronic control parts occur.



<Full variable line pressure control>

SHDAT6038L

Electronic Control System

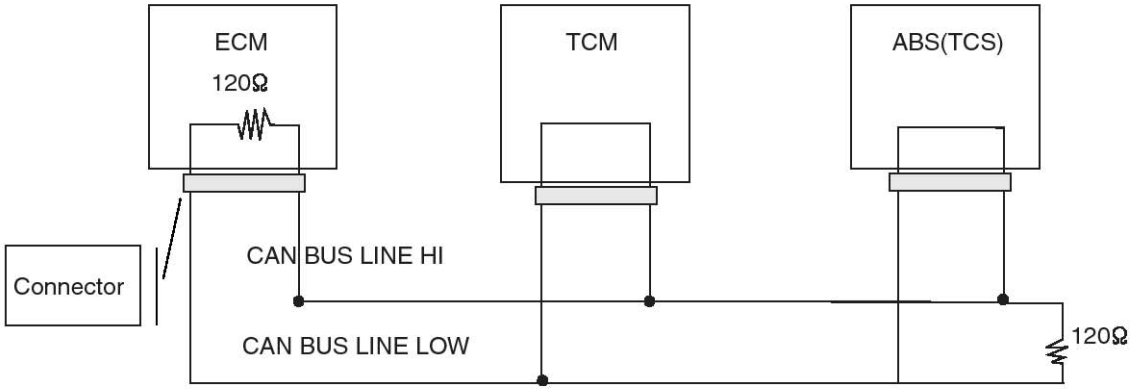


Sensor And Actuator Function

Item	Function
Input speed sensor	Detect the input shaft rpm(TURBINE RPM) at the OD/RVS retainer
Output speed sensor	Detect the output shaft rpm(T/F DRIVEN GEAR RPM) at the T/F driven gear
Engine rpm signal	Receive the engine rpm via CAN communication with ECM
Oil temperature sensor	Detect the temperature of ATF through the thermistor
Inhibitor switch	Detect the position of select lever through the contact switch
ON/OFF solenoid valve (SC-SV-A)	Control the hydraulic passage for the shift control
VFS solenoid valve	Change the line pressure from 4.5 bar to 10.5 bar according to throttle open angle and s-hift ranges
PCSV-A(SCSV-B)	Control the OD or L/R hydraulic pressure to the pressure control valve for shift control
PCSV-B(SCSV-C)	Control the 2/4 or REV hydraulic pressure to the pressure control valve for shift control
PCSV-C(SCSV-D)	Control the UD hydraulic pressure to the pressure control valve for shift control
PCSV-D(TCC)	Control the hydraulic pressure for the damper clutch control
Cluster	Send the signal of the current position of shift lever and vehicle speed

CAN Communication

Layout



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ECM- TCM CAN Communication Error Management

No.	Item	Error management
1	Engine rpm	3,000 RPM
2	Engine torque	80%
3	Vehicle speed	0 km/h
4	A/C Switch	OFF
5	Engine coolant temperature	70°C
6	TPS	50%
7	Shift range hold signal	OFF

Basic Inspection Adjustment

Transaxle Fluid Level

Inspection

1. Drive the vehicle until the fluid reaches normal operating temperature [70~80˚C(158~176˚F)].
2. Place the vehicle on a level surface.
3. Move the gear selector lever through all gear positions. This will fill the torque converter with trans fluid. Set the selector lever to the "N" (Neutral) position.
4. Before removing the oil level gauge, wipe all contaminants from around the oil level gauge. Then take out the oil level gauge and check the condition of the fluid.

   NOTICE

   If the fluid smells as if it is burning, it means that the fluid has been contaminated by fine particles from the bushes and friction materials, a transmission overhaul may be necessary.
5. Check that the fluid level is in the "HOT" mark on the oil level gauge. If fluid level is low, add automatic transaxle fluid until the level reaches the "HOT" mark.

Automatic transaxle fluid :
DIAMOND ATF SP-III, SK ATF SP-III
Automatic transaxle fluid capacity:
6.8liter(7.2 US qt, 5.98Imp.qt)

NOTICE

Low fluid level can cause a variety of abnormal conditions because it allows the pump to take in air along with fluid. Air trapped in the hydraulic system forms bubbles, which are compressible. Therefore, pressures will be erratic, causing delayed shifting, slipping clutches and brakes, etc. Improper filling can also raise fluid level too high. When the transaxle has too much fluid, gears churn up foam and cause the same conditions which occur with low fluid level, resulting in accelerated deterioration of automatic transaxle fluid. In either case, air bubbles can cause overheating, and fluid oxidation, which can interfere with normal valve, clutch, and brake operation. Foaming can also result in fluid escaping from the transaxle vent where it may be mistaken for a leak.

6. Insert the oil level gauge securely.

   NOTICE

   When new, automatic transmission fluid should be red, The red dve is added so the assembly plant can identify it as transmission fluid and distinguish it from engine oil or antifreeze. The red dve, which is not an indicator of fluid quality, is not permanent. As the vehicle is driven the transmission fluid will begin to look darker. The color may eventually appear light brown.

Replacement

If you have a fluid changer, use this changer to replace the fluid. If you do not have a fluid replace the fluid by the following procedure.

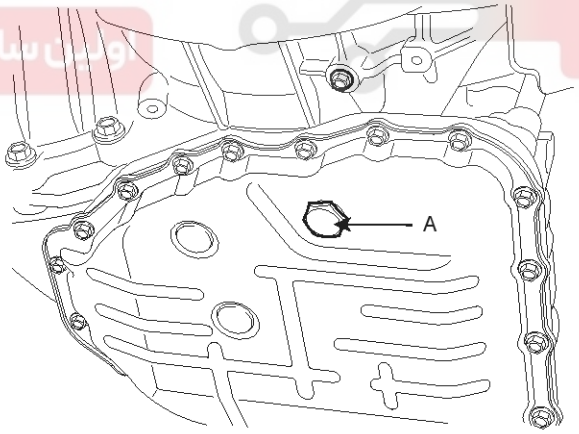
1. Disconnect the hose, which connects the transmission and the oil cooler (inside the radiator).
2. Start the engine and let the fluid drain out.

Running conditions : "N" range with engine idling

CAUTION

The engine should be stopped within one minute after it is started. If the fluid has all drained out before then, the engine should be stopped at that point.

3. Remove the drain plug(A) from the bottom of the transmission case to drain the fluid.



AKGF032W

4. Install the drain plug via the gasket, and tighten it the specified torque.

Tightening torque :
40~50 N.m (4.0~5.0kgf.m, 28.9~36.2lb-ft)

5. Pour the new fluid in through the oil filler tube.

   CAUTION
   Stop pouring if the full volume of fluid cannot be poured in.

6. Repeat the procedure in step (2).

   NOTICE
   Check the old fluid for contamination. If it has been contaminated, repeat the steps (5) and (6).

7. Pour the new fluid in through the oil filler tube.
8. Reconnect the hose, which was disconnected in step (1) above, and firmly replace the oil level gauge.

   (In case of this "replace", this means after wiping off any dirt around the oil level gauge, insert it into the filler tube.)

9. Start the engine and run it at idle for 1~2 minutes.
10. Move the select lever through all positions, and then move it to the "N" or "P" position.
11. Drive the vehicle until the fluid temperature rises to the normal temperature (70~80˚C(158~176˚F)), and then check the fluid level again. The fluid level must be at the HOT mark.
12. Firmly insert the oil level gauge into the oil filler tube.

Torque Converter Stall Test

This test measures the maximum engine speed when the select lever is at the "D" or "R" position and the torque converter stalls to test the operation of the torque converter, starter motor and one-way clutch operation and the holding performance of the clutches and brakes in the transmission.

CAUTION
Do not let anybody stand in front of or behind the vehicle while this test is being carried out.

1. Check the automatic transmission fluid level and temperature and the engine coolant temperature.
   - Fluid level : At the HOT mark on the oil level gauge
   - Fluid temperature : 80~100˚C (176~212˚F)
   - Engine coolant temperature : 80~100˚C (176~212˚F)
2. Check both rear wheels (left and right).
3. Pull the parking brake lever on, with the brake pedal fully depressed.
4. Start the engine.
5. Move the select lever to the "D" position, fully depress the accelerator pedal and take a reading of the maximum engine speed at this time.

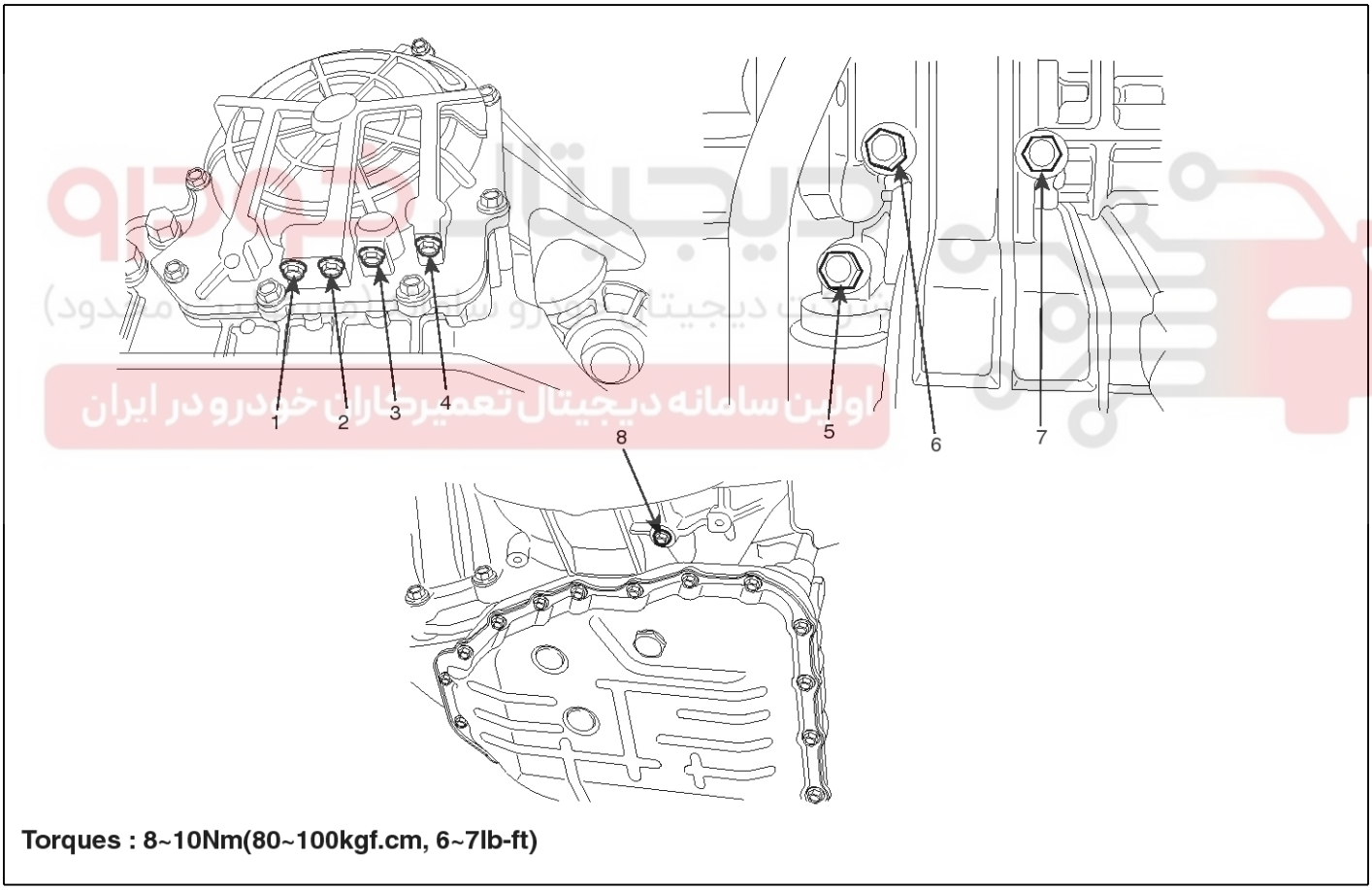
   CAUTION
   - **The throttle should not be left fully open for any more than 5 seconds.**
   - **If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 r/min to let the automatic transaxle fluid cool down before carrying out subsequent tests.**
   - **Move the select lever to the "R" position and carry out the same test again.**

Stall rpm : 2,000~2,700 RPM

Range	Condition	Passable cause
R range slip	Reverse	REV in D range normal L/R in D range abnormal
D1 rang slip	D range 1st/ Sports mode 1st	L/R in reverse range abnormal UD in reverse range normal
D3 range slip	3rd gear hold	OD in 3rd gear slip (1st and 2nd gear normal)
Forwarding, reverse slip	D range, R range	Torque converter Oil pump, Manual valve in the valve Driving device abnormal

Hydraulic Pressure Test

1. Warm up the engine until the automatic transaxle fluid temperature is 80~100˚C(176~212˚F).
2. Jack up the vehicle so that the wheels are free to turn.
3. Connect the special tools(09452-21500, 09452-21000) oil pressure gauge to each pressure discharge port.
4. Measure the hydraulic pressure at each port under the conditions given in the standard hydraulic pressure table, and check that the measured values are within the standard value ranges.
5. If a value is outside the standard range, correct the problem while referring to the hydraulic pressure test diagnosis table.
   a. Bottom side



Torques : 8~10Nm(80~100kgf.cm, 6~7lb-ft)

SFDAT9003N

1. RED pressure port
2. OD pressure port
3. 2/4 pressure port
4. REV pressure port
5. DA pressure port
6. UD pressure port
7. LR pressure port
8. DR pressure port

Standard Hydraulic Pressure Table

No.	Shift range position	Operation					Measuring	Oil pressure (kgf/㎠)				
		PCSV-A	PCSV-B	PCSV-C	PCSV-D	ON/OFF		LR	2-4(2ND)	UD	OD	REV
1	D	0	100	0	0	ON	LR	10.5±0.2	0	10.5±0.2	0	0
2	↑	50	↑	↑	↑	↑	↑	5.6±0.4	↑	↑	↑	↑
3	↑	75	↑	↑	↑	↑	↑	1.0±0.3	↑	↑	↑	↑
4	↑	100	↑	↑	↑	↑	↑	0	↑	↑	↑	↑
5	↑	↑	0	↑	100	OFF	2-4(2ND)	0	10.5±0.2	↑	↑	↑
6	↑	↑	50	↑	↑	↑	↑	↑	5.3±0.4	↑	↑	↑
7	↑	↑	75	↑	↑	↑	↑	↑	0.9±0.3	↑	↑	↑
8	↑	↑	100	↑	↑	↑	↑	↑	0	↑	↑	↑
9	↑	0	↑	↑	↑	↑	OD	↑	↑	↑	10.5±0.2	↑
10	↑	50	↑	↑	↑	↑	↑	↑	↑	↑	5.6±0.4	↑
11	↑	75	↑	↑	↑	↑	↑	↑	↑	↑	1.0±0.3	↑
12	↑	100	↑	↑	↑	↑	↑	↑	↑	↑	0	↑
13	↑	↑	↑	0	0	↑	UD	↑	↑	10.5±0.2	↑	↑
14	↑	↑	↑	50	↑	↑	↑	↑	↑	5.8±0.4	↑	↑
15	↑	↑	↑	75	↑	↑	↑	↑	↑	1.0±0.3	↑	↑
16	↑	0	↑	100	↑	↑	↑	↑	↑	0	↑	↑
17	R	↑	0	↑	↑	ON	REV	17.7±0.8	↑	↑	↑	17.7±0.8
18	↑	↑	50	↑	↑	↑	↑	↑	↑	↑	↑	8.7±0.8
19	↑	↑	75	↑	↑	↑	↑	↑	↑	↑	↑	0.9±0.5
20	↑	↑	100	↑	↑	↑	↑	↑	↑	↑	↑	0

[Measure condition]
- Oil pump revolution : 2500rpm
- LPCSV Duty ratio : 0%

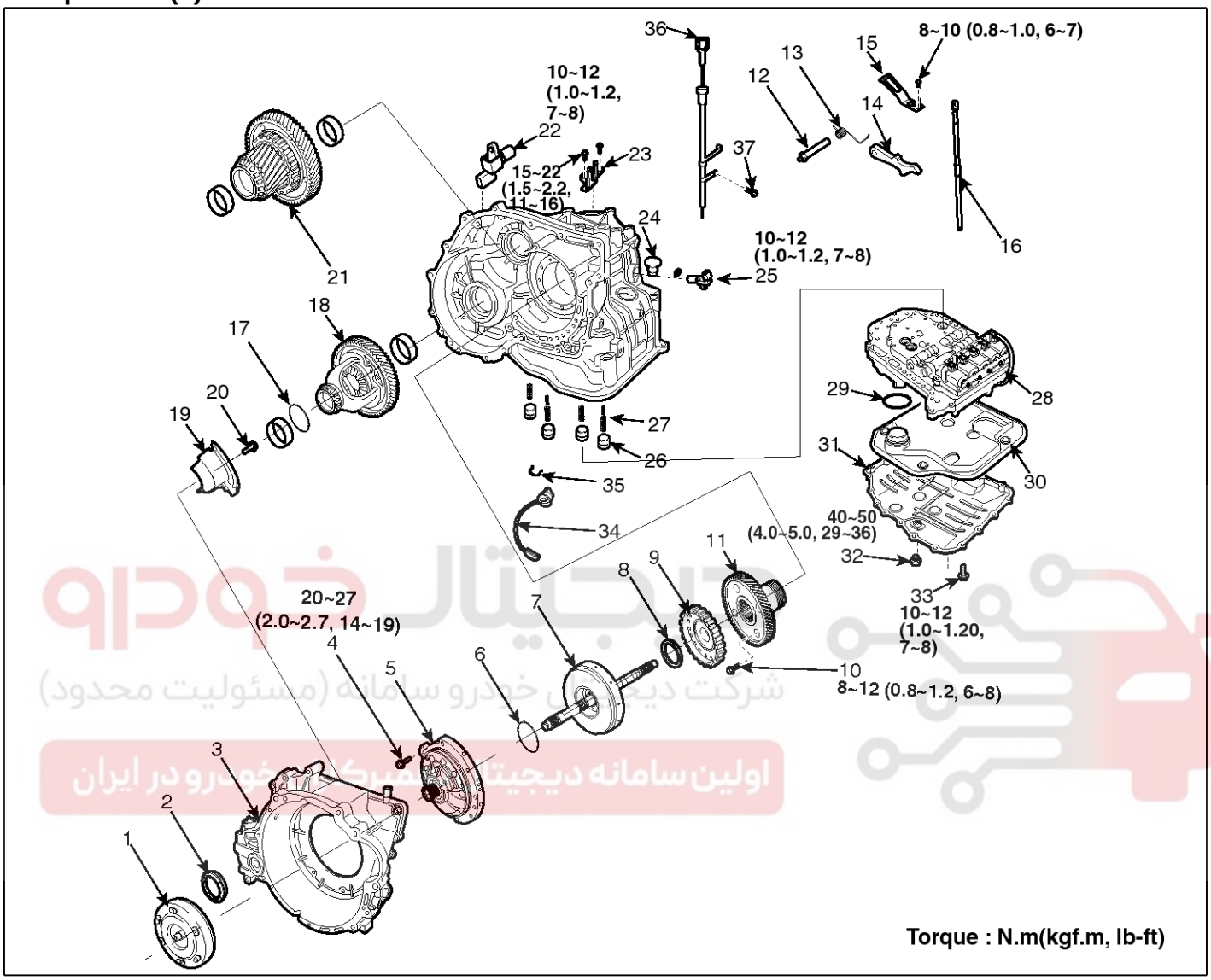
Note) The oil pressure values of "0" marked on the above table must measure less than 0.1kgf/㎠ when testing.

※ The values are subject to change according to vehicle model or condition.

SHDAT6062L

Automatic Transaxle

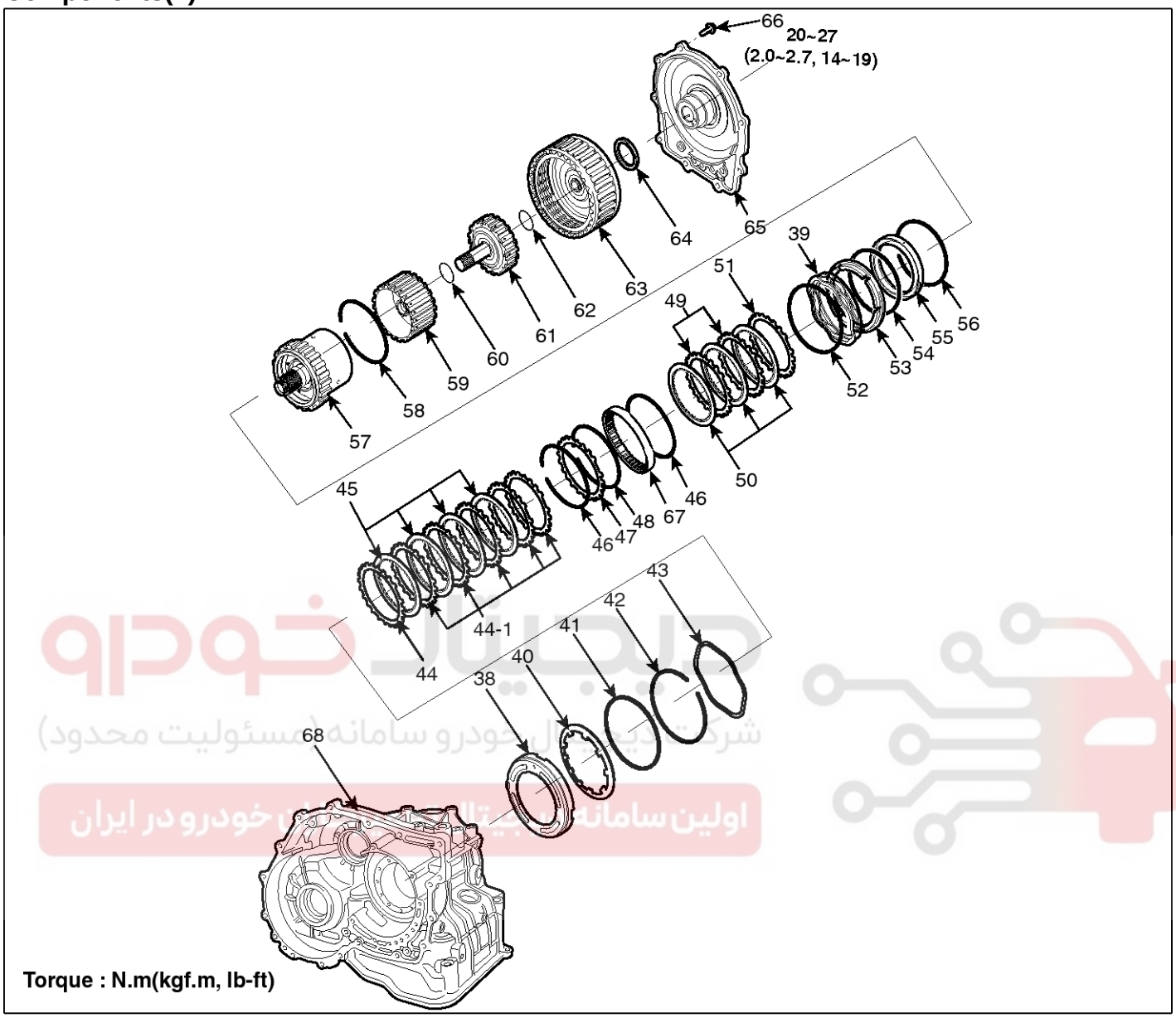
Components(1)



STDAT9002C

1. Torque converter
2. Differential oil seal
3. Converter housing
4. Oil pump bolt
5. Oil pump assembly
6. Thrust washer
7. Underdrive(U/D) clutch
8. Thrust bearing
9. Underdrive(U/D) clutch hub
10. Transfer drive gear mounting bolt
11. Transfer drive gear
12. Parking sprag shaft
13. Sprag spring
14. Parking sprag
15. Detent spring
16. Manual control shaft
17. Spacer
18. Differential
19. Oil separate
20. Oil separate mounting bolt
21. Transfer driven gear
22. Output shaft speed sensor
23. Shift cable bracket
24. Plug
25. Input shaft speed sensor
26. Accumulator piston
27. Coil spring
28. Valve body assembly
29. O-ring
30. Oil filter
31. Oil pan
32. Drain plug
33. Valve body cover bolt
34. Valve body connector
35. Valve body connector mounting clip
36. Oil level gauge
37. Oil level gauge bracket bolt

Components(2)

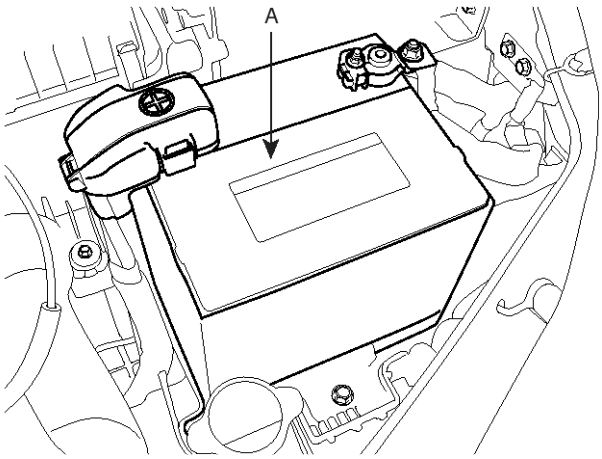


STDAT9003C

38. Low & reverse brake piston
39. 2ND brake return spring
40. Low & reverse brake return spring
41. Low & reverse brake spring retainer
42. Snap ring
43. Wave spring
44. Low & reverse pressure plate
44-1. Low & reverse brake plate
45. Low & reverse brake disc
46. Snap ring
47. Reaction plate
48. Snap ring
49. 2ND brake plate
50. 2ND brake disc
51. 2ND brake pressure plate
52. D-ring
53. 2ND brake piston
54. D-ring
55. 2ND brake retainer
56. Snap ring
57. Low & reverse planetary gear set
58. Snap ring
59. Reverse sun gear
60. Thrust bearing
61. Overdrive(O/D) hub
62. Thrust bearing
63. Reverse & Overdrive(O/D) clutch
64. Thrust bearing
65. Rear cover
66. Rear cover bolt
67. One way clutch inner race
68. Transmission case

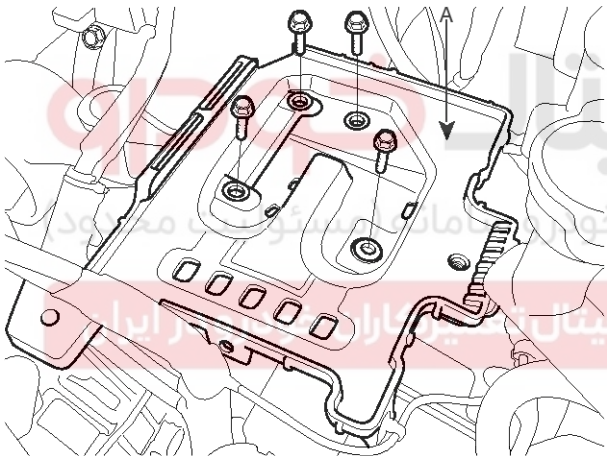
Removal

1. Remove the engine cover.
2. Remove the battery (A).



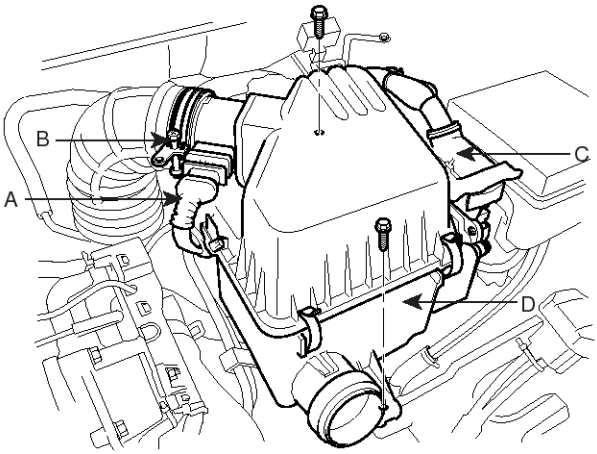
SHDAT6002D

3. Remove the battery tray (A).



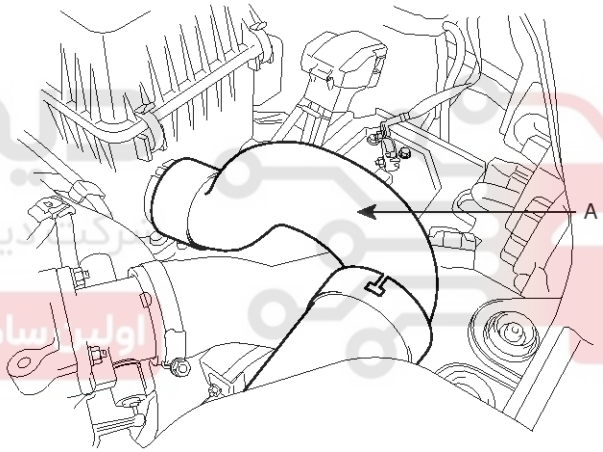
SHDAT6006D

4. Remove the air cleaner assembly (D) by disconnecting the AFS(Air Flow Sensor) connector (A), the clamp (B) and the ECM connector (C).



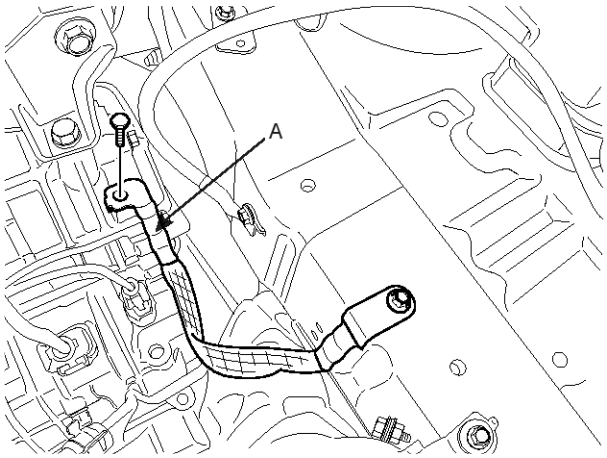
SHDMB6003D

5. Disconnect the air duct (A).



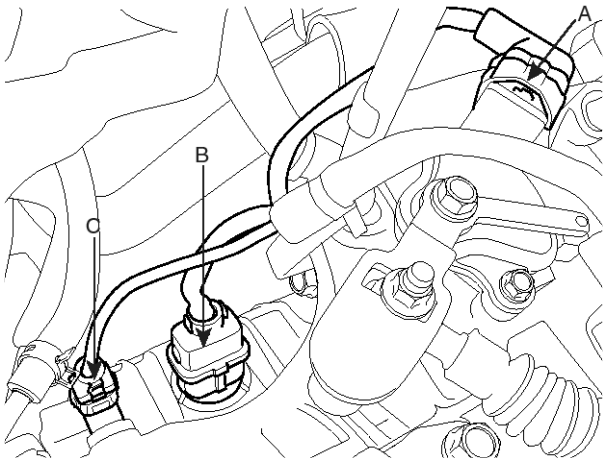
SHDMB6002D

6. Remove the ground cable from transaxle (A).



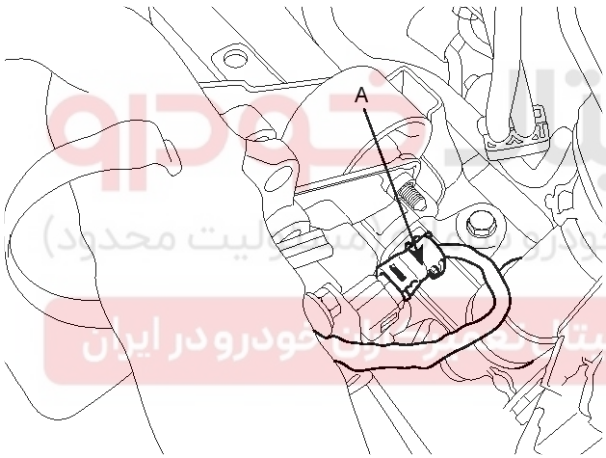
SLDAT7006D

7. Disconnect the inhibiter switch connector (A), solenoid valve connector (B) and the input speed sensor connector (C).



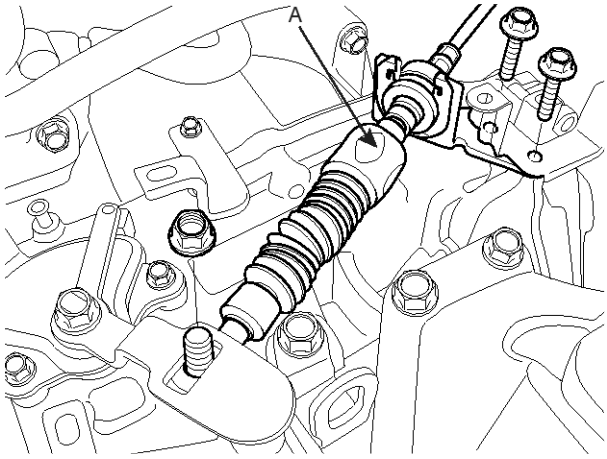
SHDAT6008D

8. Disconnect the output speed sensor connector (A).



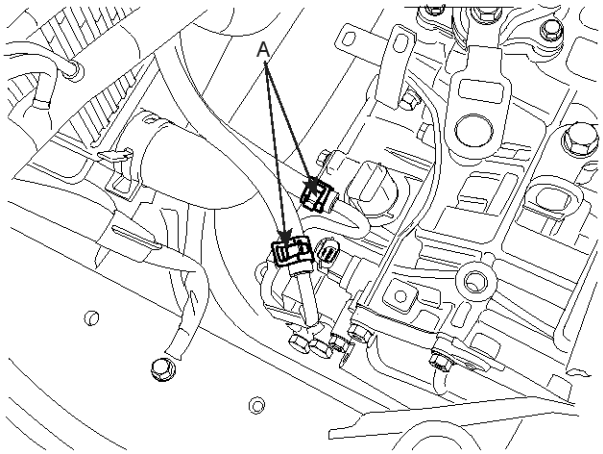
SHDAT6009D

9. Remove the shift cable assembly (A).



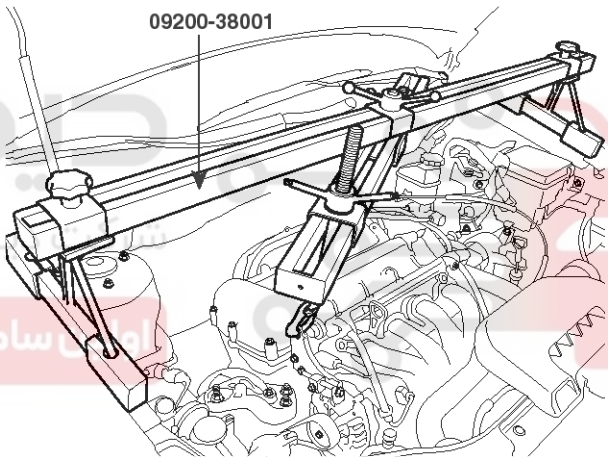
SHDAT6010D

10. Remove the oil cooler hoses (A).



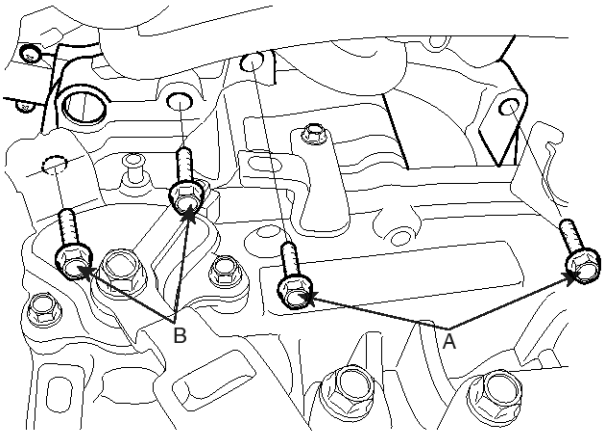
STDAA9001D

11. Install the special tools (09200-38001), the engine support fixture and the adapter on the engine assembly.



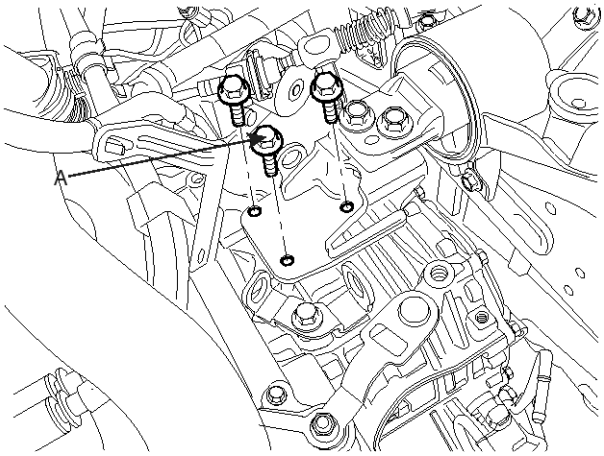
SHDAT6012D

12. Remove the transaxle upper mounting bolts (A-2ea) and the starter motor mounting bolts (B-2ea).



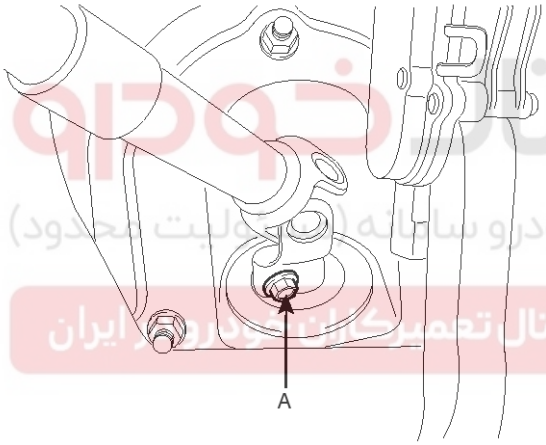
SHDAT6013D

13. After removing the four bolts, take the transaxle insulator mounting bracket (A) off.



STDAA9004D

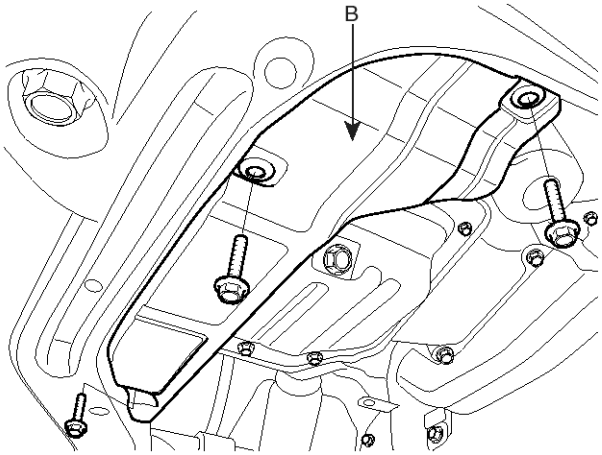
14. Remove the steering joint assembly bolt (A). (refer to Steering column/shaft in ST group)



AKGF032S

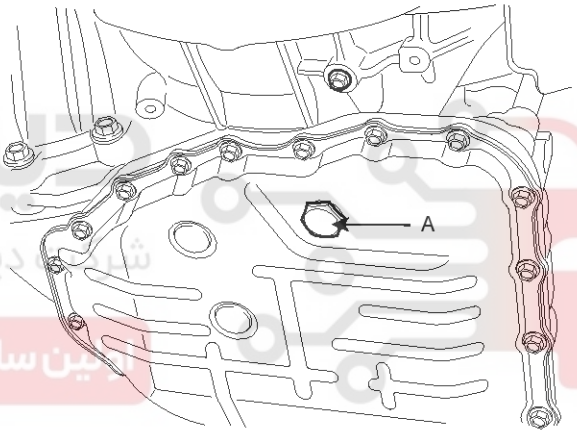
15. Remove the front wheels and tires. (refer to removal in SS group)

16. Remove the under cover (B).



SHDAT6016D

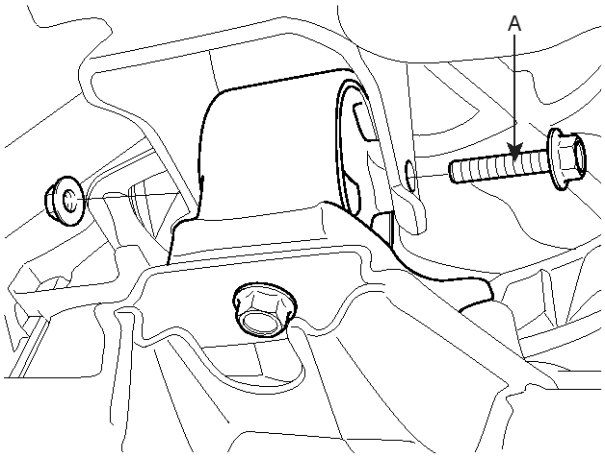
17. Drain the transaxle fluid by removing the oil drain plug(A).



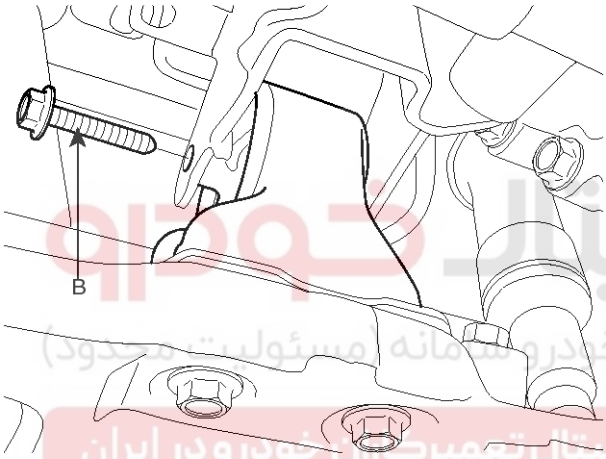
AKGF032W

18. Remove the lower arm ball joint mounting nut, the stabilizer link mounting nut, and the tie rod end mounting nut from the front knuckles. (refer to Front suspesion system in SS group)

19. Remove the roll stopper mounting bolts (A, B).

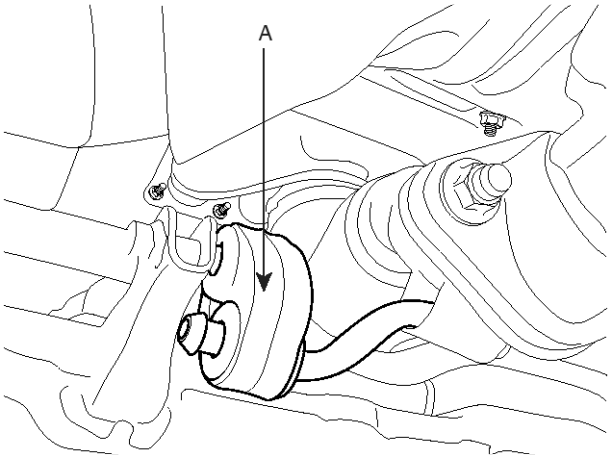


SHDAT6017D



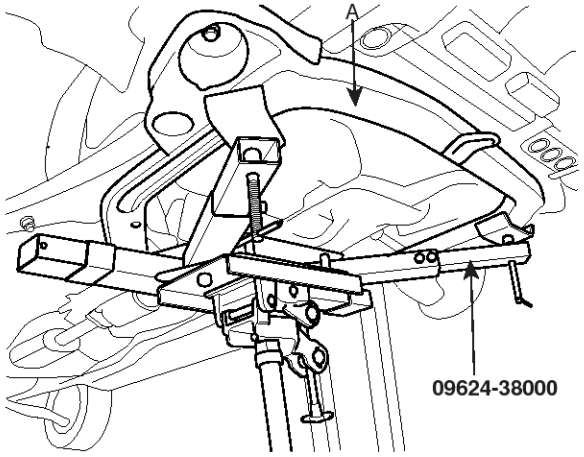
SHDAT6018D

20. Remove the muffler hanger rubber (A).



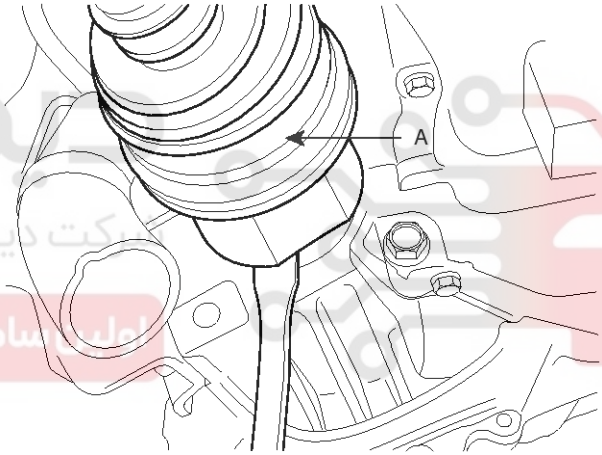
SHDAT6019D

21. Supporting the sub frame (A) with a jack and the Special tool (09624-38000), remove the mounting bolts.(refer to Stabilizer's removal in SS group)

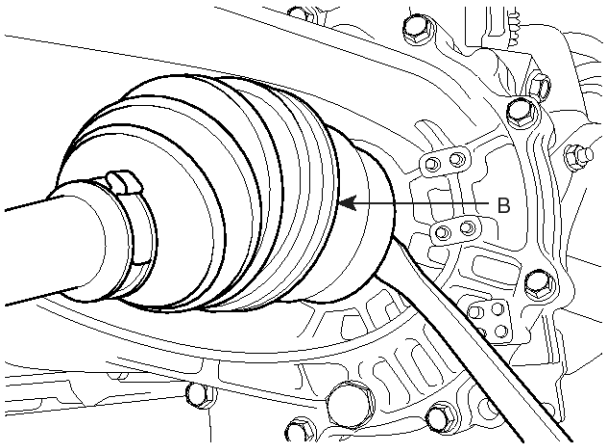


SHDAT6051D

22. Disconnect the drive shafts (A,B) from the transaxle.

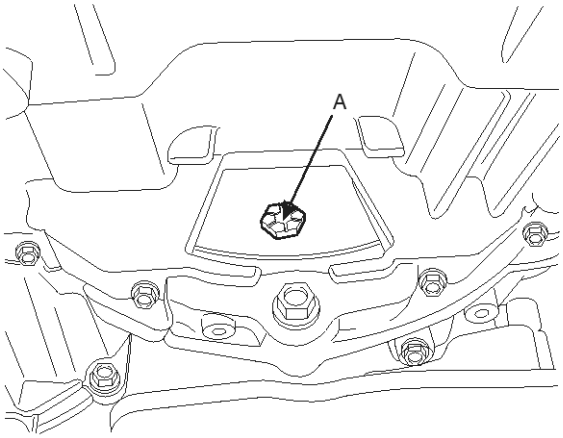


SHDMB6012D



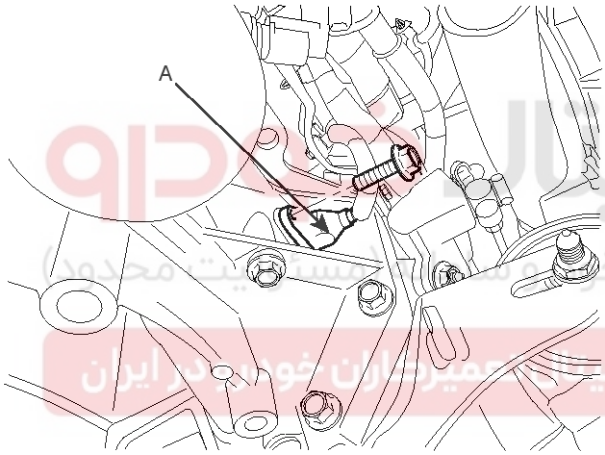
SHDMB6013D

23. Remove the torque converter assembly mounting bolts (A-3ea).



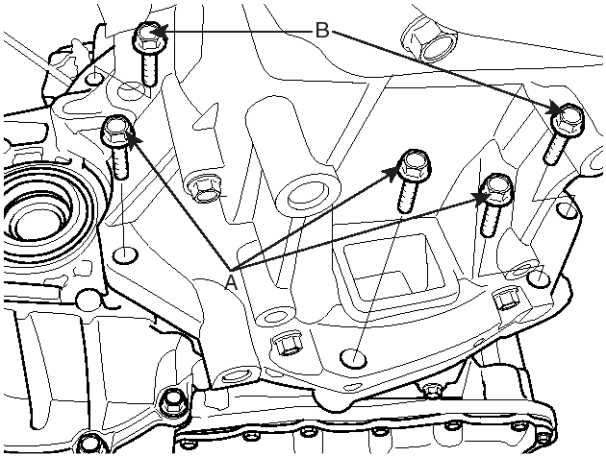
AKGF033H

24. Disconnect the CKP sensor connector(A).



STDMT9011D

25. Supporting the transaxle with a jack, remove the transaxle lower mounting bolts (A-3ea, B-2ea).



SHDAT6024D

26. Lowering the jack slowly, remove the transaxle.

⚠CAUTION

When removing the transaxle assembly, be careful not to damage any surrounding parts or body components.

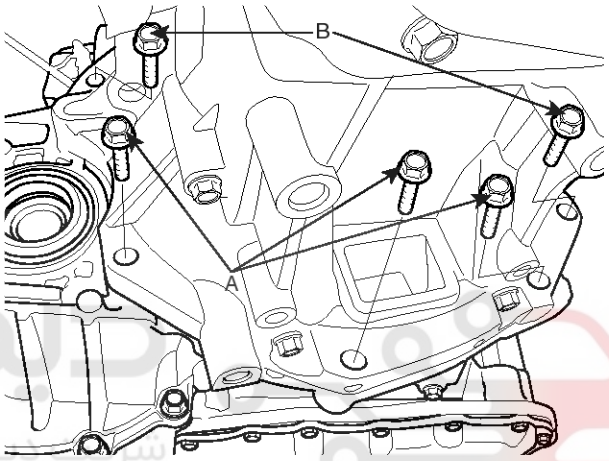
Installation

1. Install the transaxle lower mounting bolts (A-3ea,B-2ea) after fitting the transaxle assembly into the engine assembly.

Tightening torque :

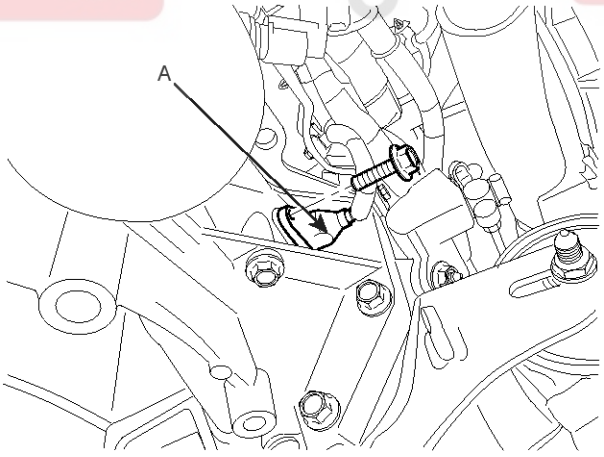
[A] : 43~49N.m (4.3~4.9kgf.m, 31.1~35.4lb-ft)

[B] : 43~55N.m (4.3~5.5kgf.m, 31.1~39.8lb-ft)



SHDAT6024D

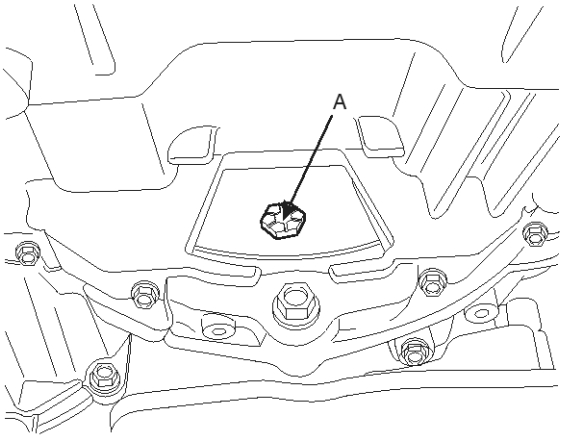
2. Disconnect the CKP sensor connector(A).



STDMT9011D

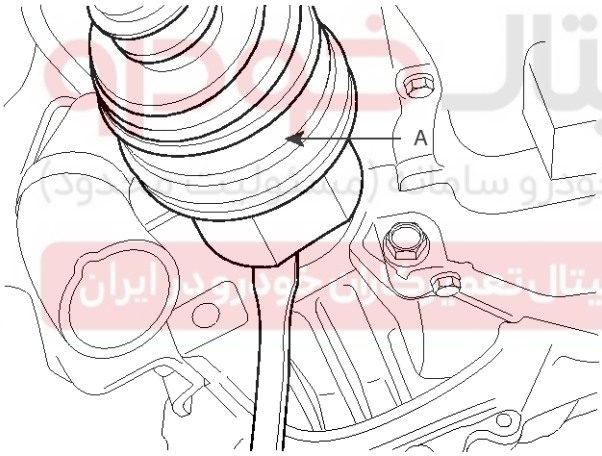
3. Install the torque converter assembly mounting bolts(A-3ea).

Tightening torque :
46~53N.m (4.6~5.3kgf.m, 33.3~38.3lb-ft)

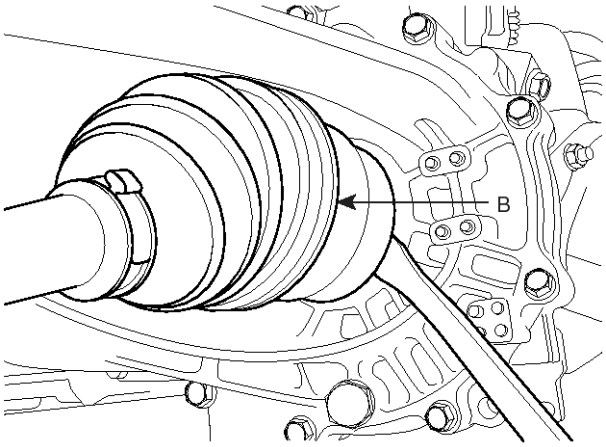


AKGF033H

4. Disconnect the drive shafts (A,B) from the transaxle

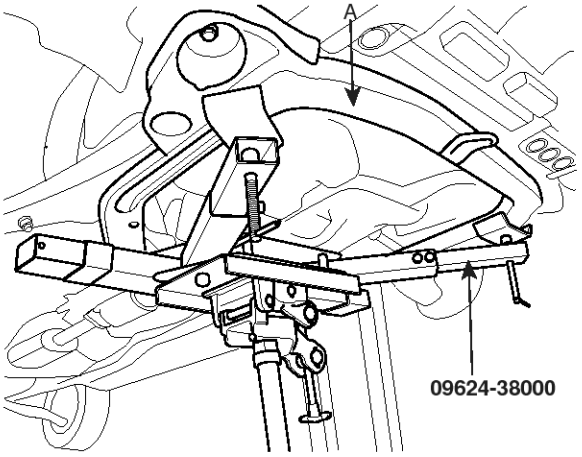


SHDMB6012D



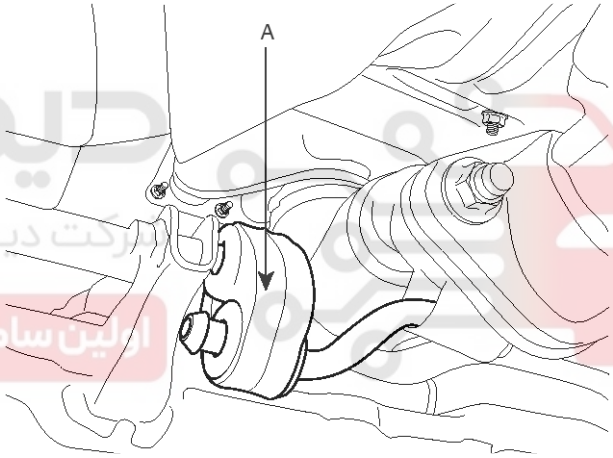
SHDMB6013D

5. Supporting the sub frame (A) with a jack and the Special tool(09624-38000), install themounting bolts. (refer to Stabilizer's installation in SS group).



SHDAT6051D

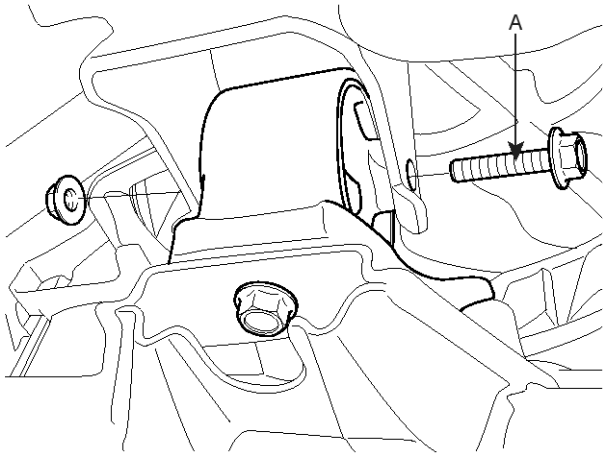
6. Install the muffler hanger rubber (A).



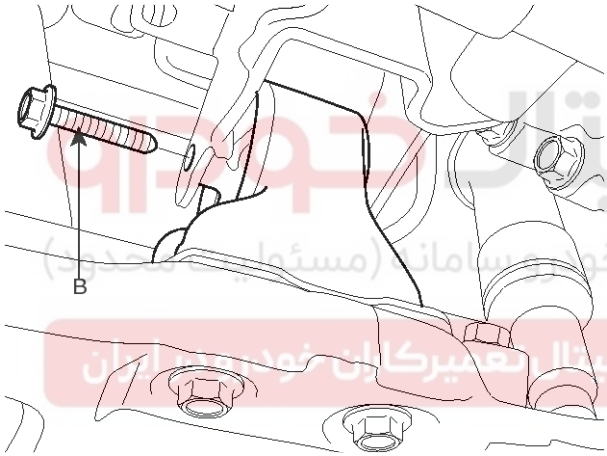
SHDAT6019D

7. Install the roll stopper mounting bolts (A, B).

Tightening torque :
50~65N.m (5~6.5kgf.m, 36.2~47.0lb-ft)



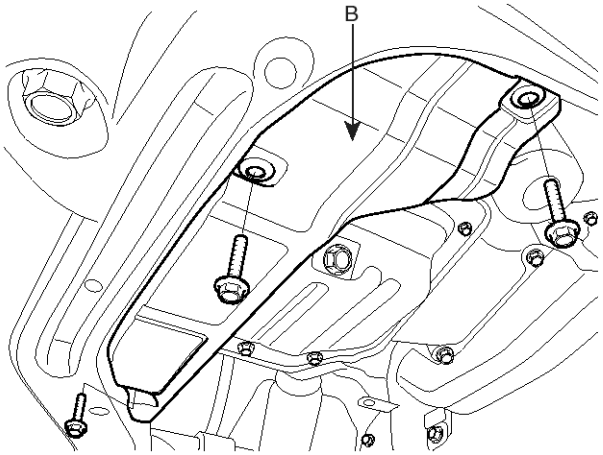
SHDAT6017D



SHDAT6018D

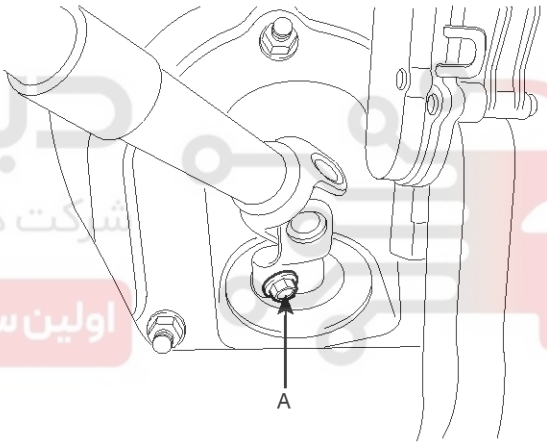
8. Install the lower arm ball joint mounting nut, the stabilizer link mounting nut, and the tie rod end mounting nut to the front knuckles. (refer to Front suspension system in SS group)

9. Install the under cover (B).



SHDAT6016D

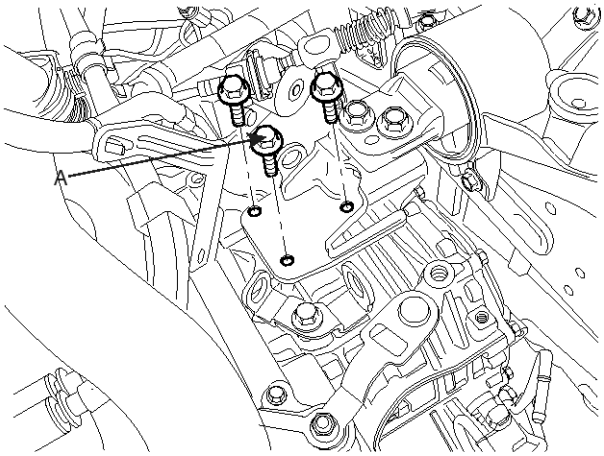
10. Install the front wheels and tires.
11. Install the steering joint assembly bolt (A). (refer to Steering column/shaft in ST group)



AKGF032S

12. Install the transaxle insulator mounting bracket bolts(A).

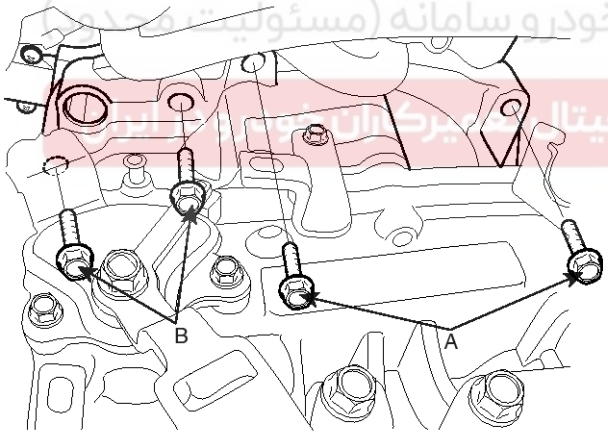
Tightening torque :
90~110N.m (9.0~11.0kgf.m, 65.1~76.6lb-ft)



STDAA9004D

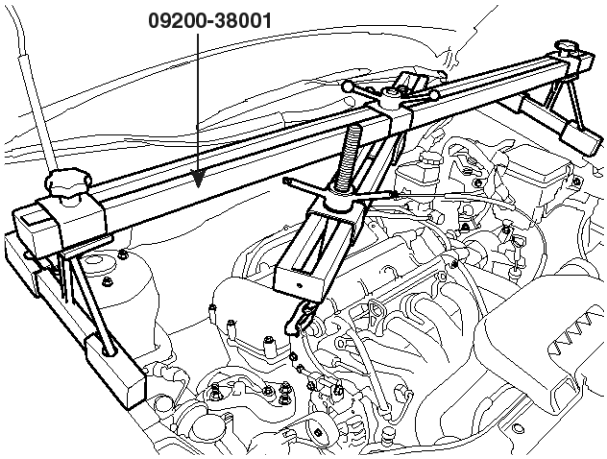
13. Install the transaxle upper mounting bolts (A-2ea) the starter motor mounting bolts (B-2ea).

Tightening torque :
[A] : 60~80N.m (6.0~8.0kgf.m, 43.4~57.7lb-ft)
[B] : 43~55N.m (4.3~5.5kgf.m, 31.1~39.8lb-ft)



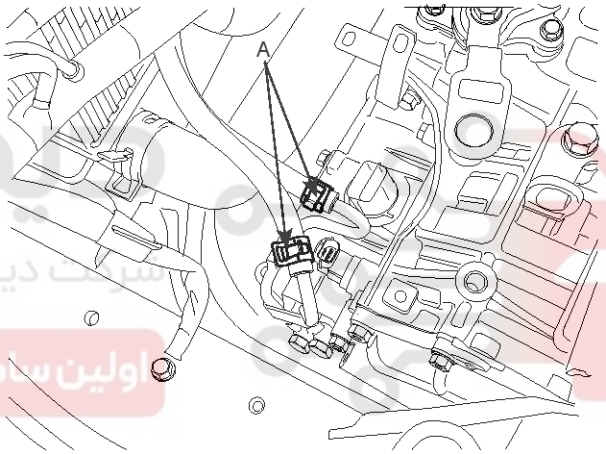
SHDAT6013D

14. Remove the special tool (09200-38001).



SHDAT6012D

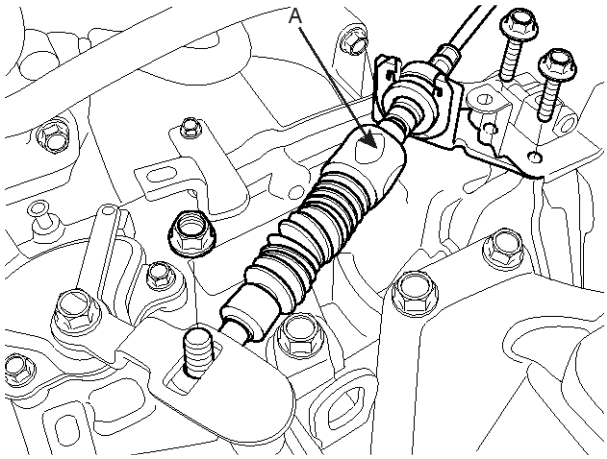
15. Connect the transaxle oil cooler hoses (A) to the tubes by fastening the clamps.



STDAA9001D

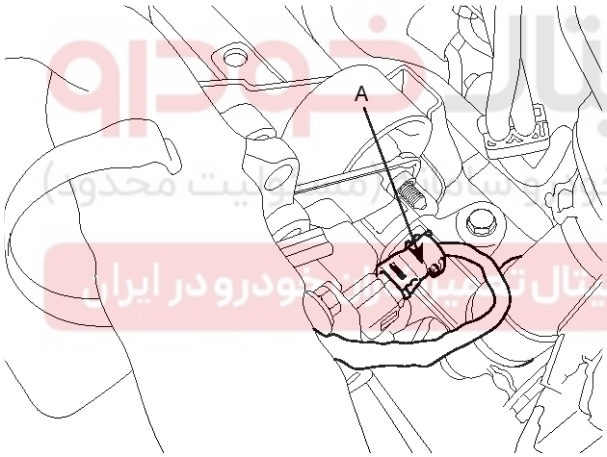
16. Install the shift cable assembly (A).

Tightening torque :
Bracket bolts : 15~22N.m (1.5~2.2kgf.m, 10.8~15.9lb-ft)
Nut : 10~14N.m (1.0~1.4kgf.m, 7.2~10.1lb-ft)



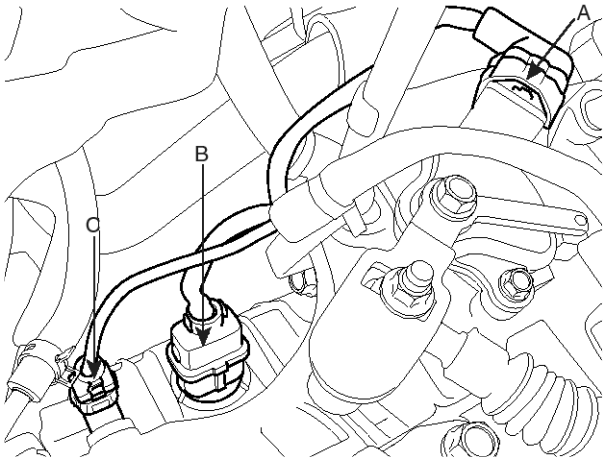
SHDAT6010D

17. Install the output speed sensor connector (A).



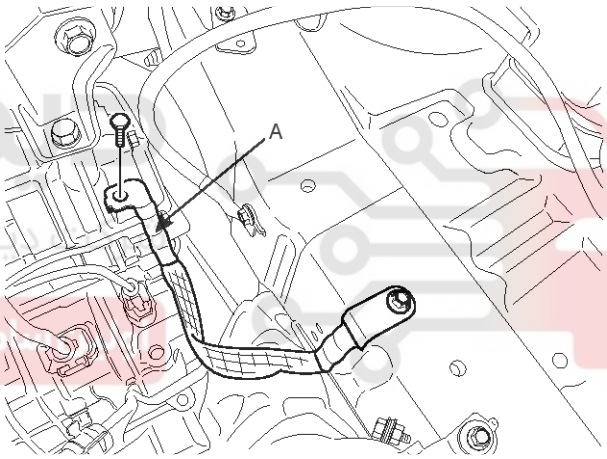
SHDAT6009D

18. Connect the inhibiter switch connector (A), solenoid valve connector (B) and the input speed sensor connector©.



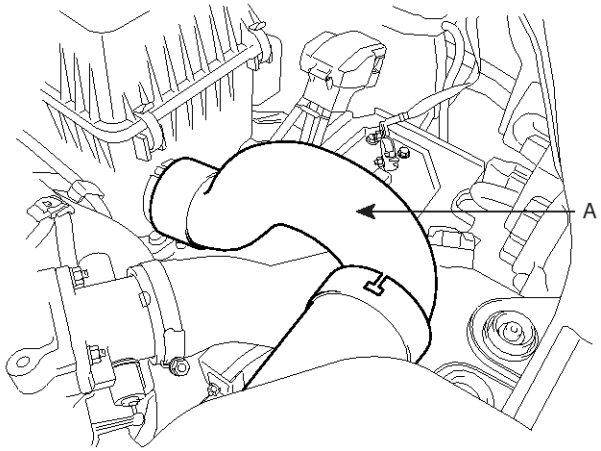
SHDAT6008D

19. Install the ground cable (A) to transaxle.



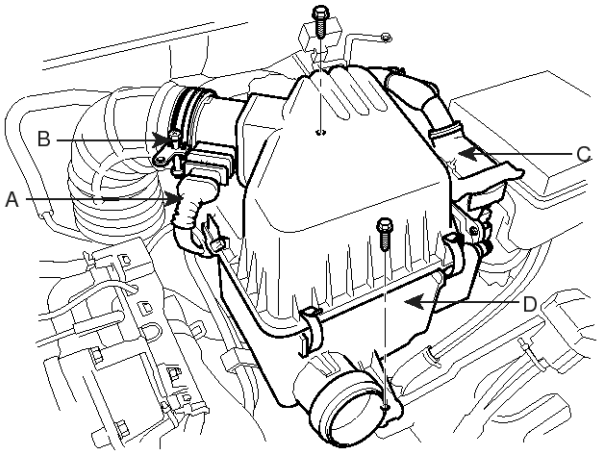
SLDAT7006D

20. Connect the air duct (A).



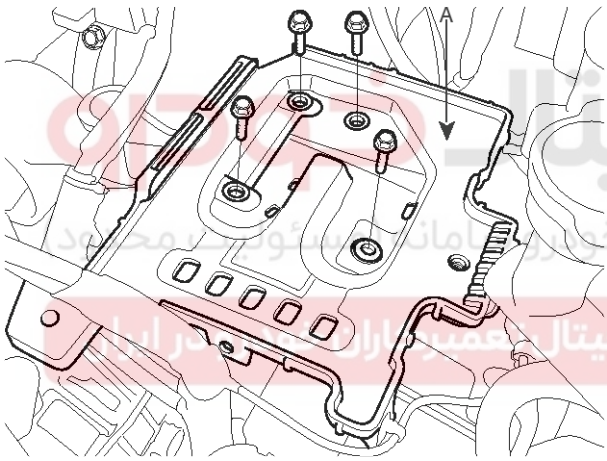
SHDMB6002D

21. Install the air cleaner assembly (D) by connecting the AFS(Air Flow Sensor) connector (A), the clamp (B) and the ECM connector (C).



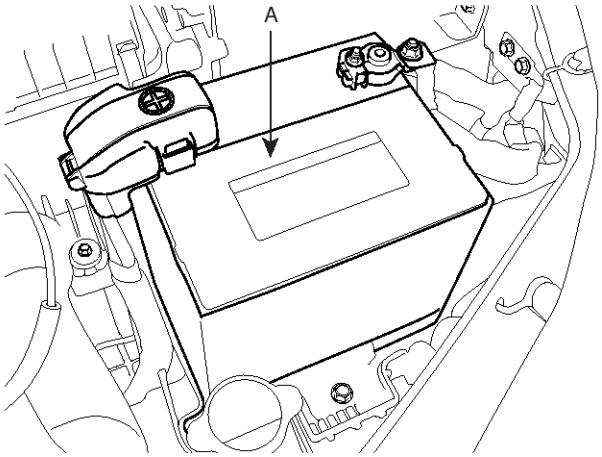
SHDMB6003D

22. Install the battery tray (A).



SHDAT6006D

23. Install the battery (A).



SHDAT6002D

24. Install the engine cover.

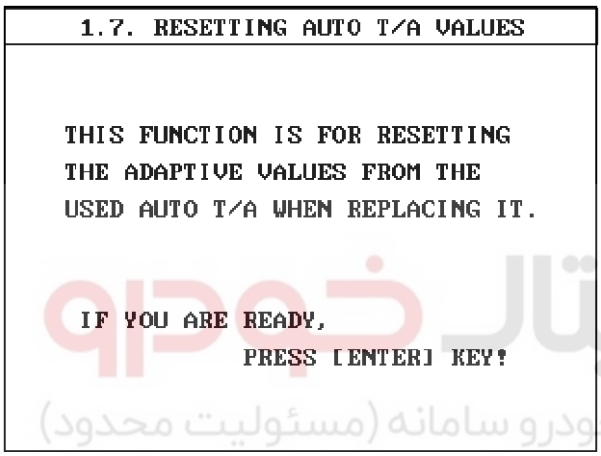
25. After completing the installation perform the following procedure;

- Adjust the shift cable. (Refer to "automatic transaxle control system" in this group.)
- Refill the transaxle fluid. (Refer to "automatic transaxle system" in this group.)
- Clean the battery posts and cable terminals with sandpaper and grease them to prevent corrosion before installing.

NOTICE

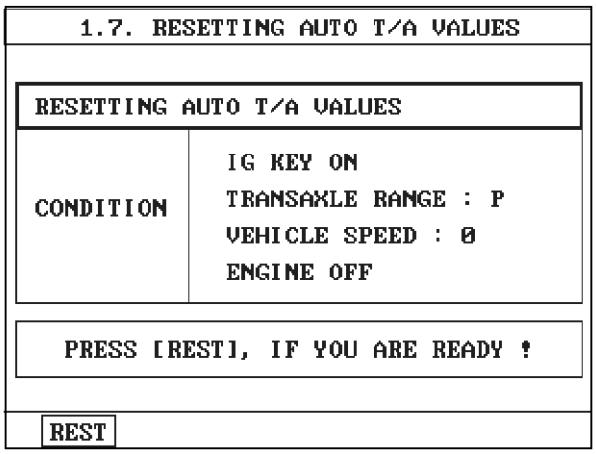
When replacing the automatic transaxle, reset the automatic transaxle's values by using the High- Scan Pro.

1. *Connect the Hi-Scan Pro connector to the data link connector under the crash pad and power cable to the cigar jack under the center facia.*
2. *Turn the ignition switch on and power on the Hi-Scan Pro.*
3. *Select the vehicle's name.*
4. *Select 'AUTOMATIC TRANSAXLE'.*
5. *Select 'RESETTING AUTO T/A VALUES' and perform the procedure*



SCMAT6512L

6. *Perform the procedure by pressing F1 (REST).*



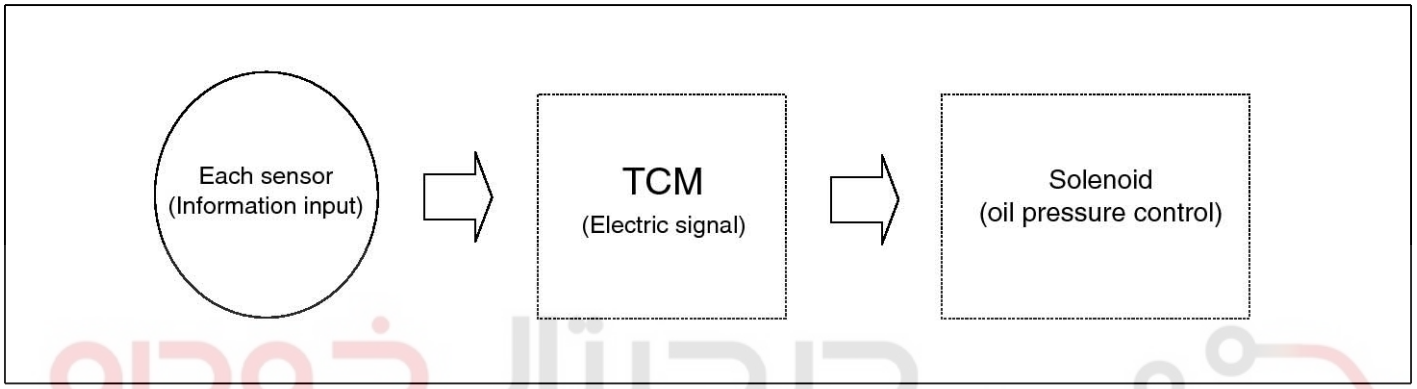
SCMAT6513L

Valve Body System

Solenoid valve

Description

TCM calculates the best condition using the information from all kinds of sensors. If the solenoid valve receives the information on the oil pressure, the solenoid valve actuates according to the driving signal. All kinds of regulators in the valve body are controlled to change the oil passage and also the line pressure is controlled by TCM.

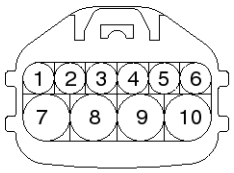


BKGF017A

● **PWM (Pulse Width Modulation) Solenoid Valve**

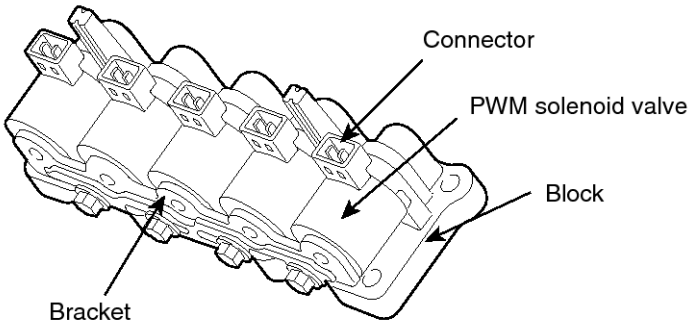
Structure and functions

PWM solenoid valve is composed of five solenoid valves and the oil capacity in the solenoid valve is changed by the electric duty value of TCM. The oil pressure of the valve body and the torque converter engages or disengages the damper clutch. The solenoid valves send the operating oil pressure to the clutches and brakes at the each range and also control the strength and weakness of oil pressure to reduce the shock when shifting the range.



1. PCSV-A (OD & LR)
2. PCSV-B (2-4 brake)
3. ON-OFF solenoid
4. PCSV-D (DCC solenoid)
7. Ground
8. PCSV-C (UD)
9. VFS
10. VFS ground

SHDAT6040L



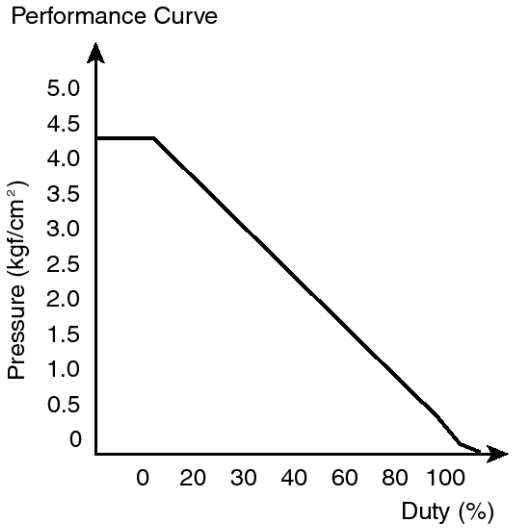
<PWM block assembly>

BKGF017C

PWM (Pulse Width Modulation) solenoid

Range	PWM solenoid valve				
	PCSV-A (SCSV-B)	PCSV-B (SCSV-C)	PCSV-C (SCSV-D)	PCSV-D (TCC SV)	ON, OFF (SCSV-A)
N, P	OFF	ON	ON	OFF	ON
1st	ON	ON	OFF	OFF	ON
2nd	ON	OFF	OFF	ON	OFF
3rd	OFF	ON	OFF	ON	OFF
4th	OFF	OFF	ON	ON	OFF
Reverse	OFF	OFF	ON	OFF	ON
LOW	OFF	ON	OFF	OFF	ON

PWM (Pulse Width Modulation) solenoid valve control feature



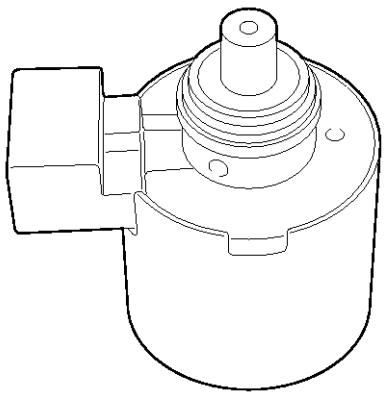
<PWM Solenoid valve performance curve>

BKGF017D

PWM solenoid valve is controlled linearly according to the duty ratio.

Oil pressure range:
0~4.3 kgf/cm² (0~422kpa, 0~61.2psi)

Type	3way & Normal High
Input voltage	12V
Coil resistance	3.2±0.2Ω (at 25°C, 77°F)
Cycle	50Hz

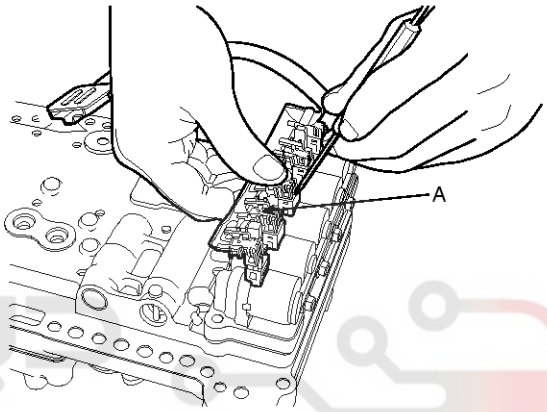


<PWM Solenoid valve form>

BKGF017E

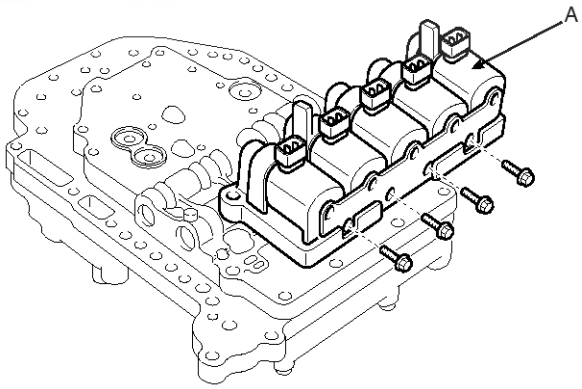
Removal

1. Remove the battery terminal.
2. Lift the vehicle.
3. Remove the under cover.
4. Loosen the drain plug and drain the transaxle oil.
5. Remove the oil pan. (Refer to Automatic transaxle's disassembly in overhaul manual)
6. Remove the oil filter.
7. Remove the valve body. (Refer to Valve body's disassembly in overhaul manual)
8. Disconnect the main harness(A) from valve body.



AKGF014B

9. Remove the PWM solenoid valve assembly(A).



AKGF014C

Installation

1. Install the solenoid valve.

   ⚠CAUTION
   Apply the ATF oil or White Vaseline to the O-ring not to be damaged.

2. Connect the solenoid valve connector to the valve body.

   ⚠CAUTION
   When connecting the solenoid valve connector, check the connector for rust, dirt, or oil, then reconnect it.

3. Install the valve body. (Refer to Valve body's reassembly in overhaul manual)

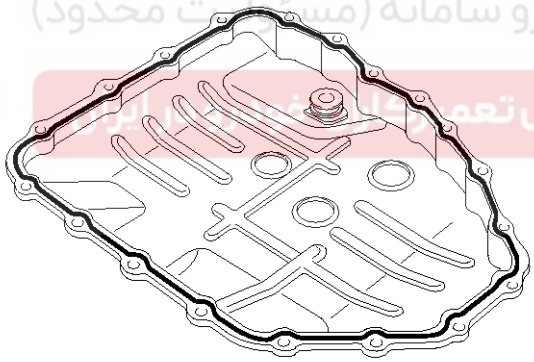
Tightening torque :
10~12N.m(1.0~1.2kgf.m, 7~8lb-ft)

4. Install the oil filter.

Tightening torque :
10~12N.m(1.0~1.2kgf.m, 7~8lb-ft)

5. Continue to apply liquid gasket at application points at the oil pan with Ø2.5mm (0.098in) thickness.

Liquid gasket Part name : Threebond 1281B



AKGF006T

6. Tighten the mounting bolt with the specified torque after installing the oil pan.

Tightening torque :
10~12N.m(1.0~1.2kgf.m, 7~8lb-ft)

7. Install the drain plug.

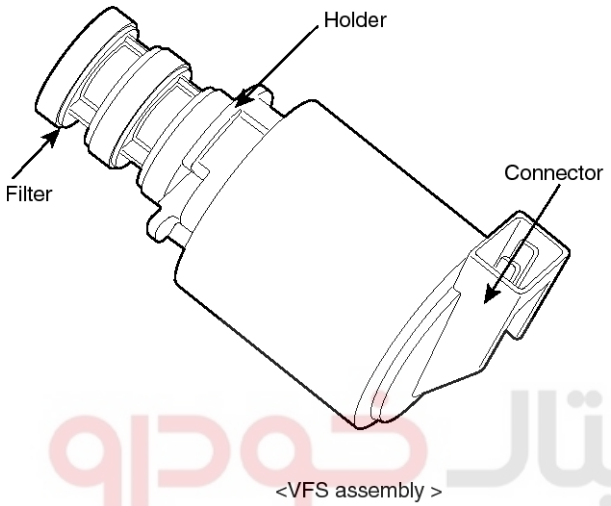
Tightening torque :
40~50N.m(4.0~5.0kgf.m, 28.9~36.2lb-ft)

8. Installation is the reverse of the removal.

VFS(Variable Force Solenoid) Valve

Description

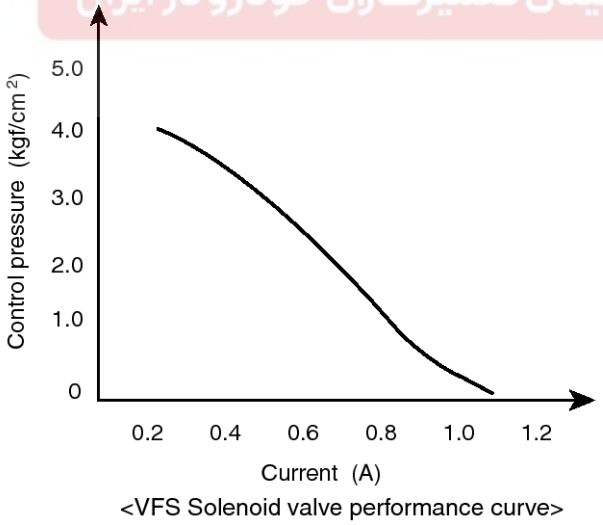
VFS valve controls the regulator valve and varies the line pressure from 4.5bar to 10.5bar according to the throttle open angle and the shift range. The holder is installed on the upper side of the case and the filter is installed to the two places on the holder outside to prevent in the strange material from flowing in the VFS.



<VFS assembly >

BKGF018A

VFS (Variable Force Solenoid) Valve Control Feature



<VFS Solenoid valve performance curve>

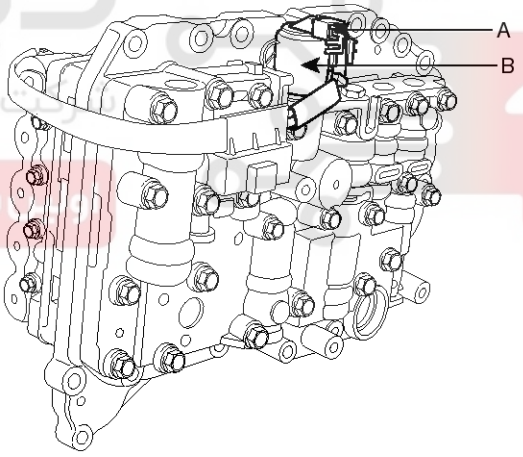
BKGF018B

VFS solenoid valve is controlled linearly according to the current value.

type	3way & Normal High
Input voltage	12V
Coil resistance	3.5±0.2Ω(at 25°C, 77°F)
Operating current	0 ~ 1100 mA

Removal

1. Remove the battery terminal.
2. Lift the vehicle.
3. Remove the under cover.
4. Loosen the drain plug and drain the transaxle oil.
5. Remove the oil pan. (Refer to Automatic transaxle's disassembly in overhaul manual)
6. Remove the oil filter.
7. Remove the valve body. (Refer to Valve body's disassembly in overhaul manual)
8. Disconnect the VFS solenoid valve connector (A).



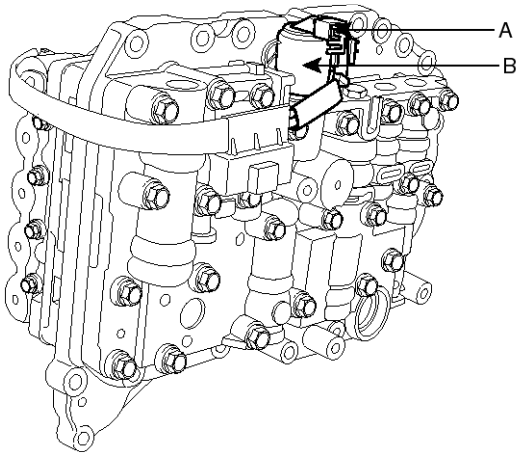
SHDAT6110D

9. Remove the solenoid valve assembly (B).

Installation

1. Install the solenoid valve (B).

⚠CAUTION
Apply the ATF oil or White Vaseline to the O-ring not to be damaged.



SHDAT6110D

2. Connect the solenoid valve connector (A).

⚠CAUTION
When connecting the solenoid valve connector, check the connector for rust, dirt, or oil, then reconnect it.

3. Install the valve body. (Refer to Valve body's reassembly in overhaul manual)

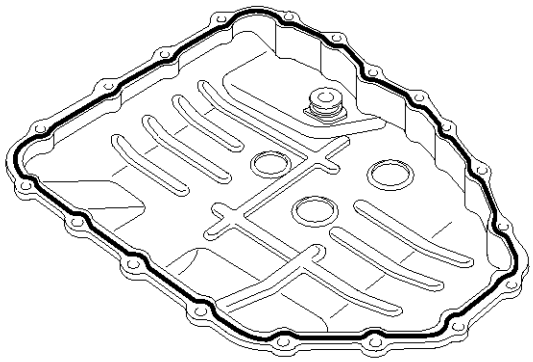
Tightening torque :
10~12N.m(1.0~1.2kgf.m, 7~8lb-ft)

4. Install the oil filter.

Tightening torque :
5~7N.m(0.5~0.7kgf.m, 4~5lb-ft)

5. Continue to apply liquid gasket at application points at the oil pan with Ø2.5mm (0.098in) thickness.

Liquid gasket Part name : Threebond 1281B



AKGF006T

6. Tighten the mounting bolt with the specified torque after installing the oil pan.

Tightening torque :
10~12N.m(1.0~1.2kgf.m, 7~8lb-ft)

7. Install the drain plug.

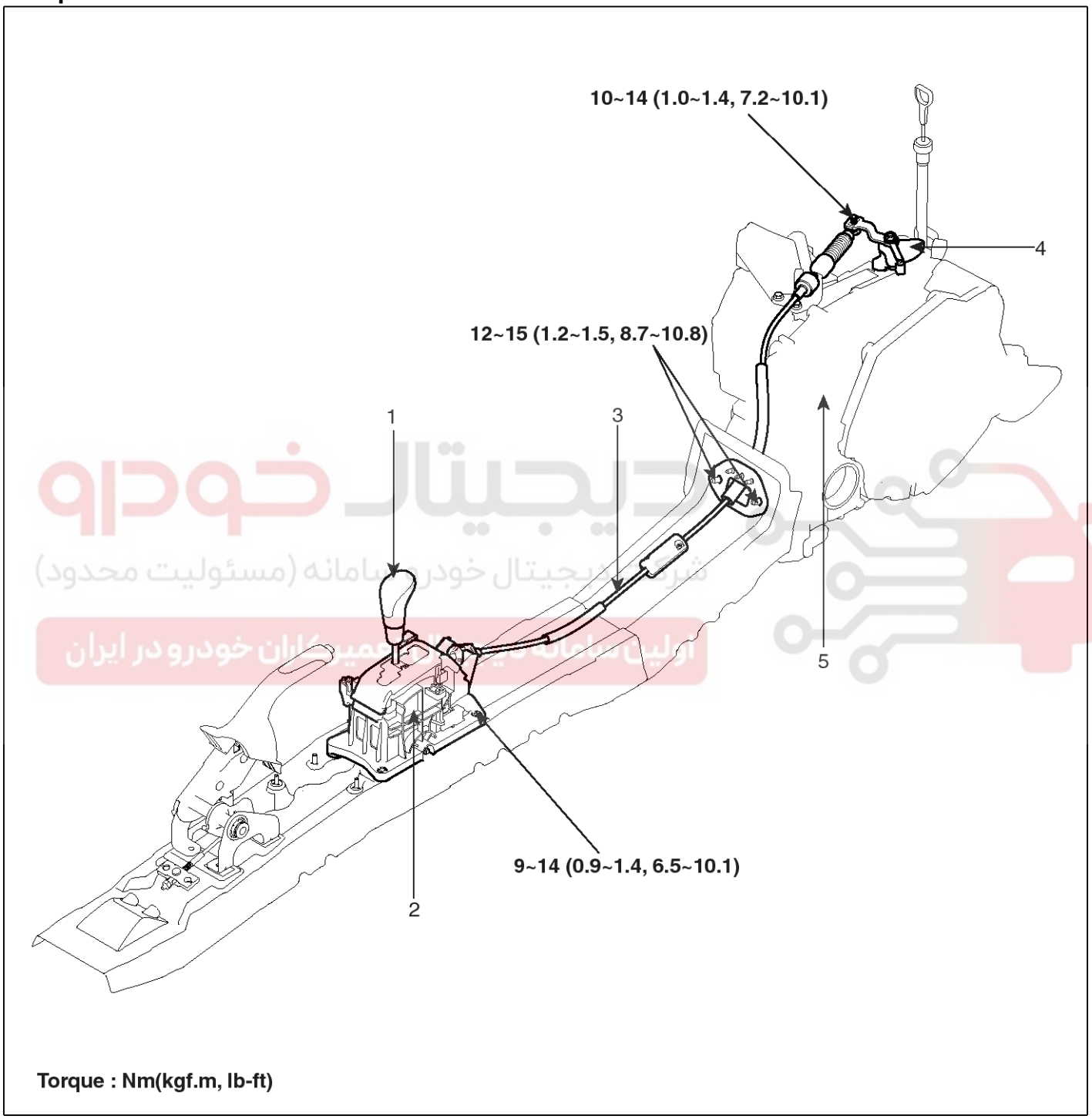
Tightening torque :
40~50N.m(4.0~5.0kgf.m, 28.9~36.2lb-ft)

8. Installation is the reverse of the removal.

Automatic Transaxle Control System

Shift Lever

Components

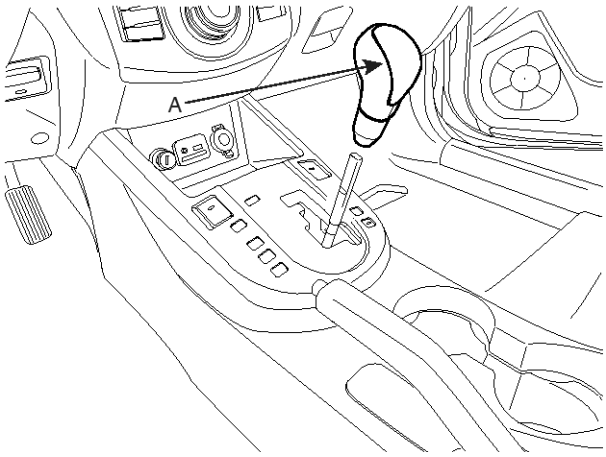


STDAT9032L

1. Shift lever knob
2. Shift lever assembly
3. Control cable assembly
4. Manual lever assembly
5. Automatic transaxle assembly

Removal

1. Remove the shift lever knob (A).

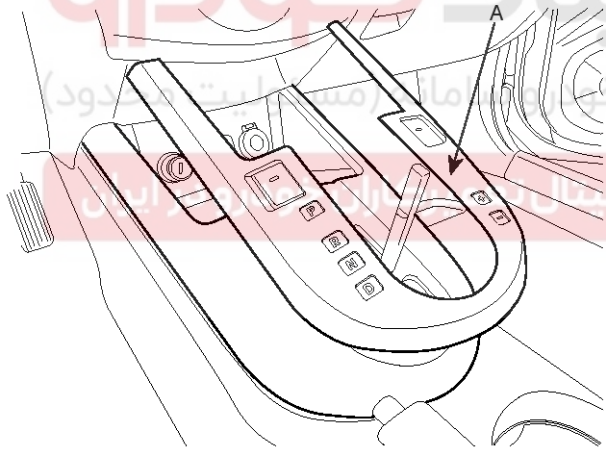


STDAA9005D

* How to remove the knob

1) Turn around the skirt to pull downward.
2) Remove the screw.
3) Remove the knob and skirt.

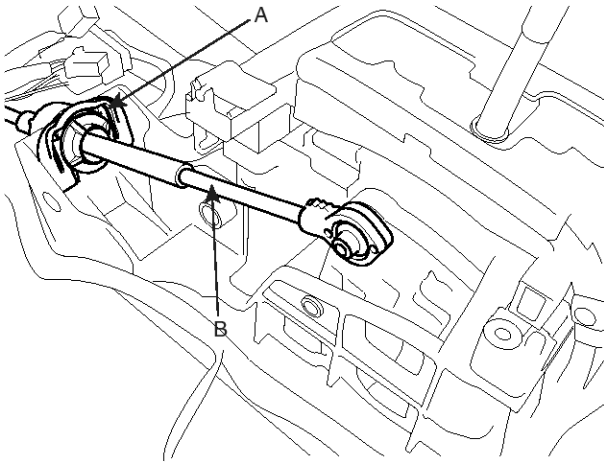
2. Remove the center console cover (A).



STDAA9006D

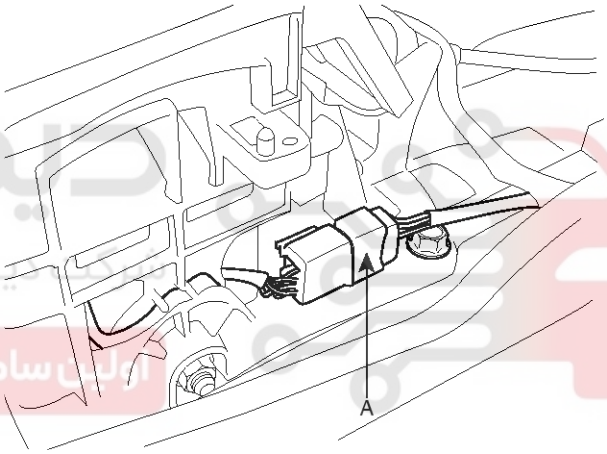
3. Remove the center console. (refer to Console in BD group)

4. Remove the shift cable assembly (B) by removing the clamp (A).



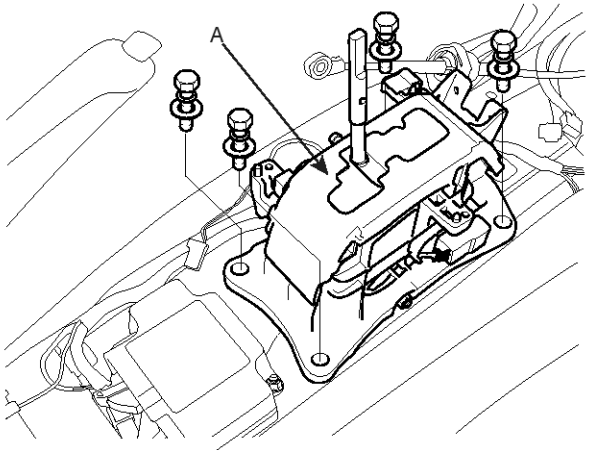
SHDAT6104D

5. Disconnect the interlock switch connector (A).



SHDAT6105D

6. Remove the shift lever assembly (A)

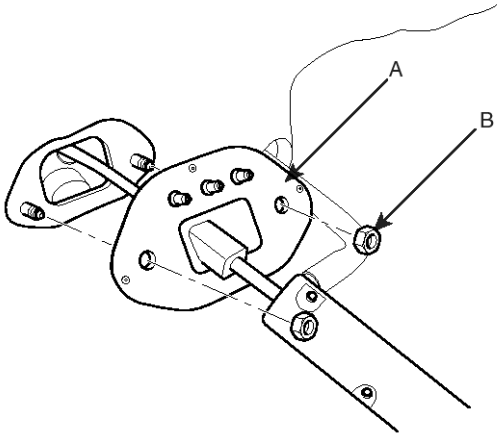


SHDAT6106D

7. Remove the retainer (A) and nuts (B).

NOTICE

In case, remove the crush pad and cowl cross bar. (refer to Crush pad in BD group and Heater unit in HA group)



SHDAT6108D

8. Remove the shift cable assembly from the transaxle. (refer to Automatic transaxle's removal).
9. Remove the shift cable assembly.

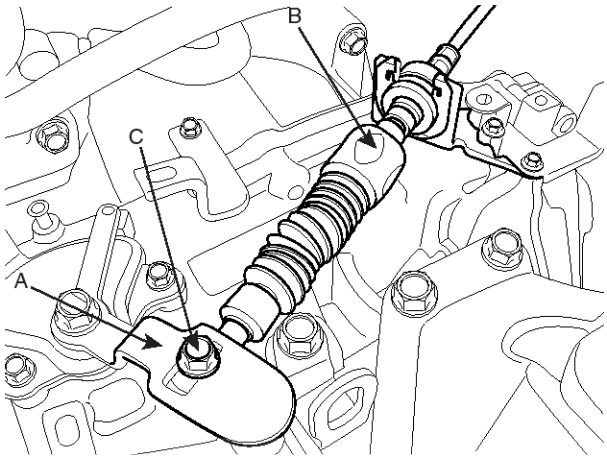
Inspection

1. Check the shift cable for proper operation and for damage.
2. Check the boots for damage.
3. Check the boots for wear, abrasion, sticking, restricted movement or damage.
4. Check for the weak or damaged spring.

Adjustment

Adjusting the shift cable

1. Set the room side lever and the manual lever (A) to N position.
2. Push the shift cable (B) lightly to "F" direction shown to eliminate the free play



SFDAT8007D

3. Tighten the adjusting nut (C).

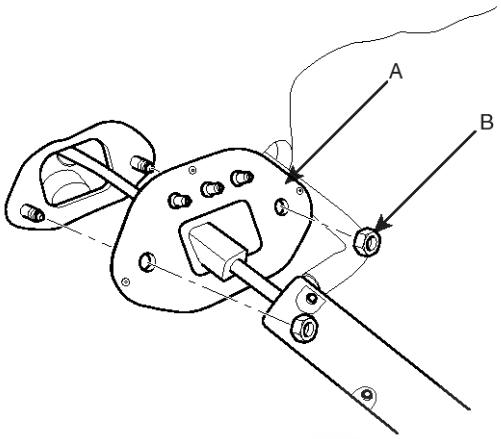
Tightening torque :
10~14N.m (1.0~1.4kgf.m, 7.2~10.1lb-ft)

4. Check that this part operates surely at each range of the manual lever corresponding to each position of the room lever.

Installation

1. Install the shift cable assembly while the manual lever on the transaxle is placed in the neutral position. (refer to Automaic Transaxle Installation)
2. Install the retainer (A) and nuts (B).

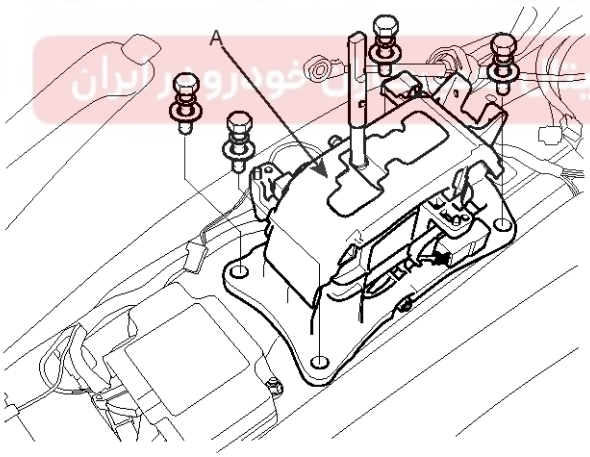
Tightening torque :
12~15N.m (1.2~1.5kgf.m, 8.7~10.8lb-ft)



SHDAT6108D

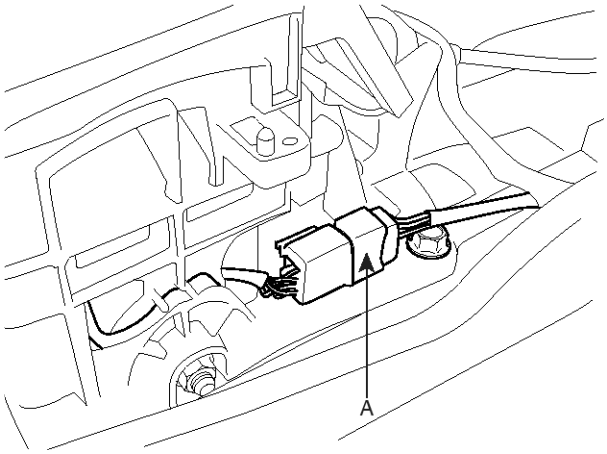
3. Install the shift lever assembly (A).

Tightening torque :
9~14N.m (0.9~1.4kgf.m, 6.5~10.1lb-ft)



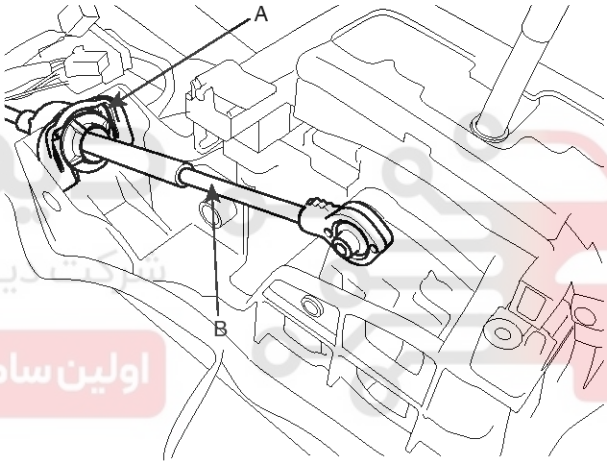
SHDAT6106D

4. Connect the interlock switch connector (A).



SHDAT6105D

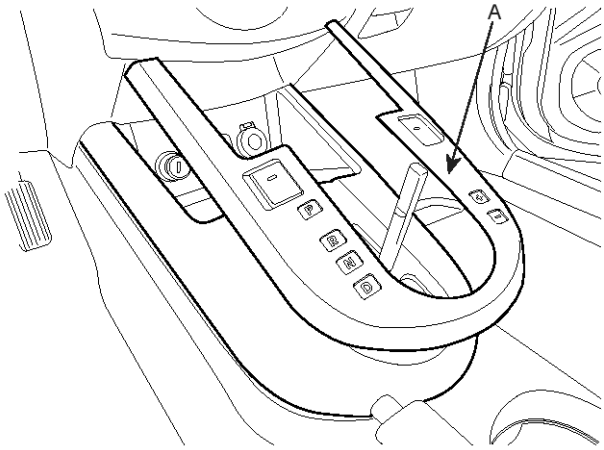
5. Install the shift cable assembly (B) by installing the clamp (A).



SHDAT6104D

6. Install the center console. (refer to Console in BD group)

7. Install the center console cover (A).



STDAA9006D

8. Install the shift lever knob (A).

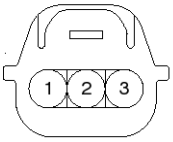
STDAA9005D

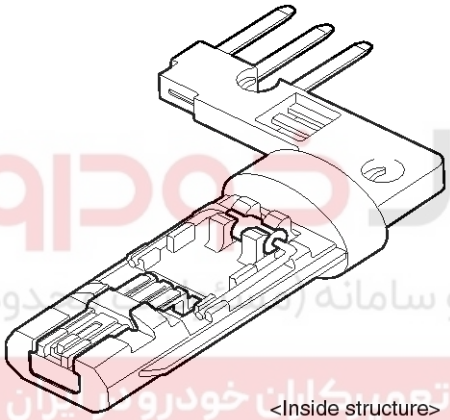
* How to install the knob

1) Install the knob and skirt.
2) Install the screw to fix up the knob.
3) Install the skirt upward.

Input Speed Sensor

Description

Sensor type	1. Type : HALL SENSOR 2. Operating voltage : DC 12V 3. Current consumption : 22mA (Max)
Function	1. Input speed sensor: Detect the input shaft rotation at the OD & REV retainer side to control oil pressure when shifting. 2. Feedback control, clutch-clutch control, damper clutch control, shift range control, incorrect ratio control and sensor trouble detection signal.
Connector	 1. Ground 2. Signal 3. Power source



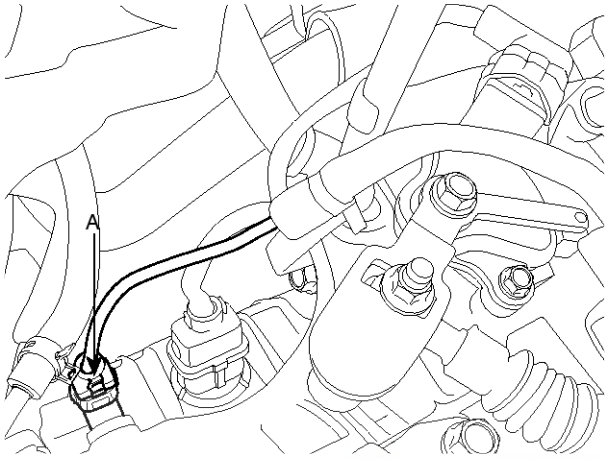
<Inside structure>

BKGF012B

Item	Inspection item	Standard value
Air gap	Input speed sensor	0.05in(1.3mm)
Sensor resistance	Input speed sensor	Over 500V, 1MΩ
Output voltage	HIGH	Over 4.8V
	LOW	Below 0.8V

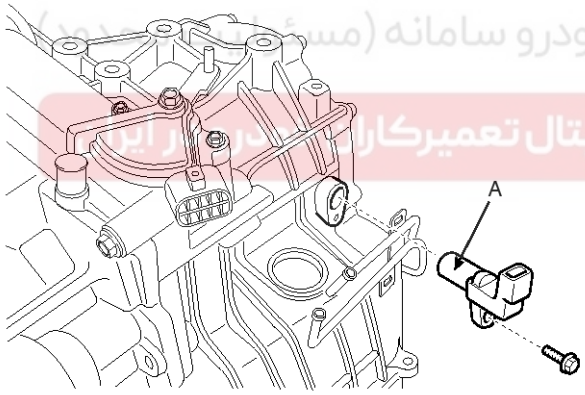
Removal

1. Remove the battery terminal.
2. Remove the battery and battery tray.
3. Remove the air duct.
4. Remove the air cleaner assembly. (Refer to Automatic transaxle's Removal)
5. Remove the input speed sensor connector (A).



SHDAT6111D

6. Remove the input speed sensor(A).



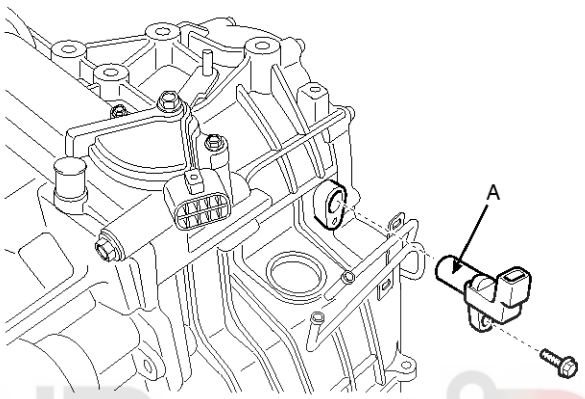
AKGF003L

Installation

1. Install the new O-ring to the input speed sensor.
2. Install the input speed sensor (A).

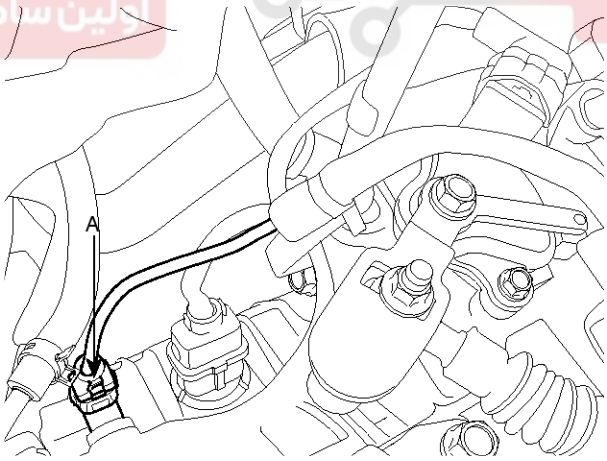
Tightening torque :
10~12N.m(1.0~1.2kgf.m, 7~8lb-ft)

⚠CAUTION
While installing the input shaft speed sensor, do not allow dust or other foreign particles to enter the transaxle.



AKGF003L

3. Check the connector for dust, dirt, or oil, and then connect the input speed sensor connector (A) securely.

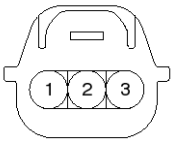


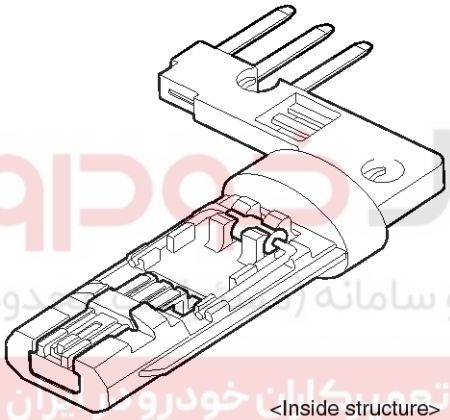
SHDAT6111D

4. Installation is the reverse of removal.

Output Speed Sensor

Description

Sensor type	1. Type : HALL SENSOR 2. Output voltage : DC 12V 3. Current consumption : 22mA (Max)
Function	1. Output speed sensor : Detect the output shaft rpm(T/F DRIVEN GEAR RPM) at the T/F driven gear 2. Feedback control, clutch-clutch control, damper clutch control, shift range control, incorrect ratio control and sensor trouble detection signal.
Connector	 1. Ground 2. Signal 3. Power source



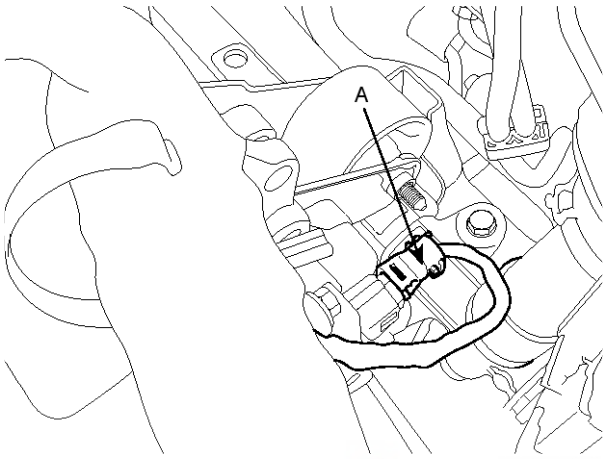
<Inside structure>

BKGF012B

Item	Inspection item	Standard value
Air gap	Output speed sensor	0.033in(0.85mm)
Sensor resistance	Output speed sensor	Over 500V, 1MΩ
Output voltage	HIGH	Over 4.8V
	LOW	Below 0.8V

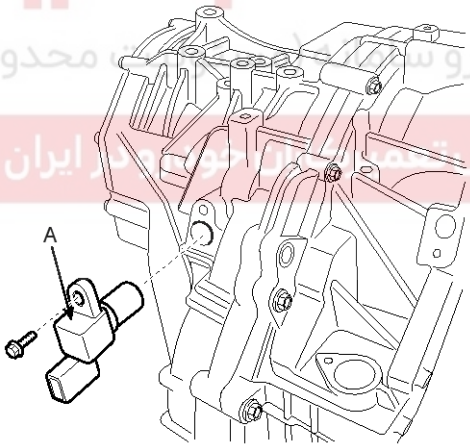
Removal

1. Remove the battery terminal.
2. Remove the battery and battery tray.
3. Remove the air duct.
4. Remove the air cleaner assembly. (Refer to Automatic transaxle's Removal)
5. Remove the output speed sensor connector(A).



SHDAT6009D

6. Remove the output speed sensor(A).



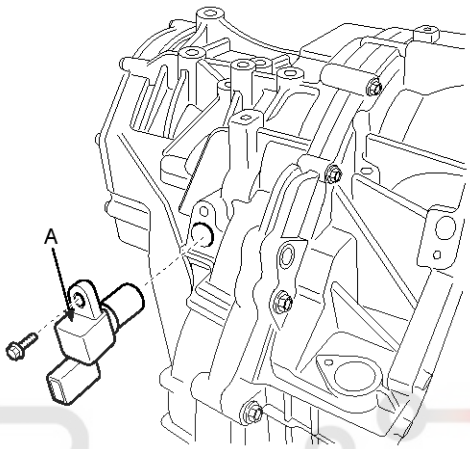
AKGF003K

Installation

1. Install the new O-ring to the output speed sensor.
2. Remove the output speed sensor (A).

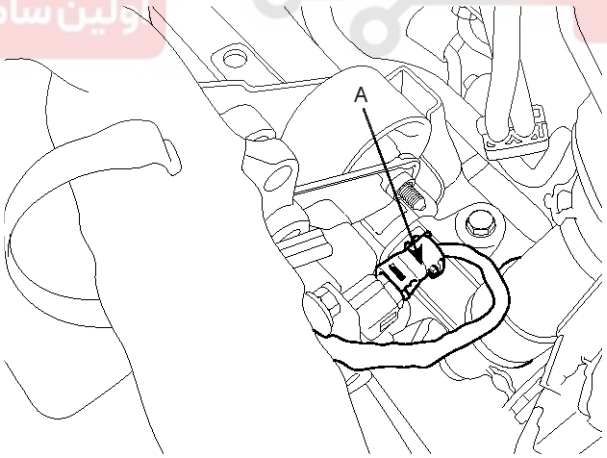
Tightening torque :
10~12N.m(1.0~1.2kgf.m, 7~8lb-ft)

⚠CAUTION
While installing the output speed sensor, do not allow dust or other foreign particles to enter the transaxle.



AKGF003K

3. Check the connector for dust, dirt, or oil, then connect the output speed sensor connector (A) securely.

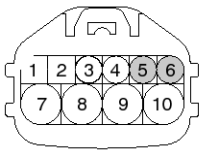


SHDAT6009D

4. Installation is the reverse of removal.

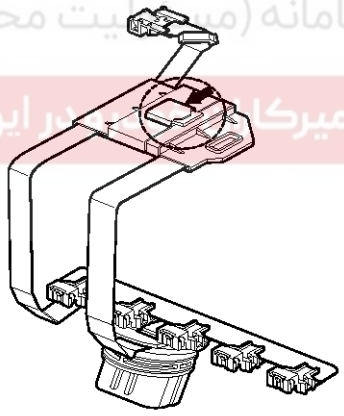
Transaxle Oil Temperature Sensor

Description

Sensor type	1. Type : Thermister 2. Use available temperature :-40~160˚C(-40~320˚F)
Function and feature	1. Detect the temperature of ATF through the thermistor which is exposed outside. 2. When shifting the range, it is used as the oil pressure control information.
Connector	 5. OTS (-) 6. OTS (+)

Temp.[˚C(˚F)]	Resistance (kΩ)	Temp.[˚C(˚F)]	Resistance (kΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.4	100(212)	0.63
0(32)	18.6	120(248)	0.38
20(68)	8.1	140(284)	0.25
40(104)	3.8	160(320)	0.16
60(140)	1.98		

Installation location

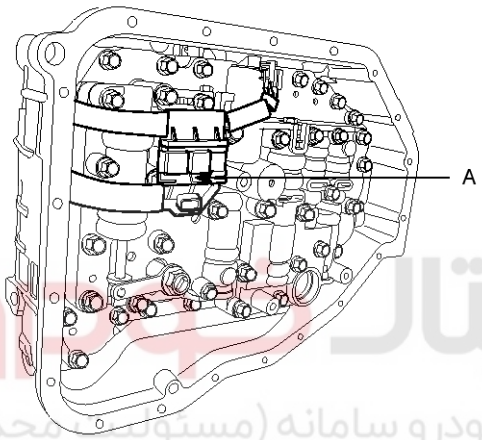


<Oil temperature sensor>

BKGF014B

Removal

1. Remove the battery terminal.
2. Lift the vehicle.
3. Remove the under cover.
4. Loosen the drain plug and drain the transaxle oil.
5. Remove the oil pan. (Refer to Automatic transaxle's disassembly in overhaul manual)
6. Remove the oil filter.
7. Remove the valve body. (Refer to Valve body's disassembly in overhaul manual)
8. Disconnect the main harness connector (A) from the valve body.



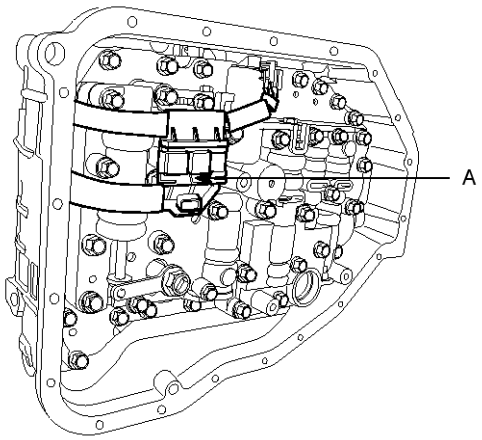
SHDAT6113D

Installation

1. Connect the main harness connector (A) to the valve body.

⚠CAUTION

When connecting the oil temperature connector, check the connector for rust, dirt, or oil, then reconnect it.



SHDAT6113D

2. Install the valve body. (Refer to Valve body's reassembly in overhaul manual)

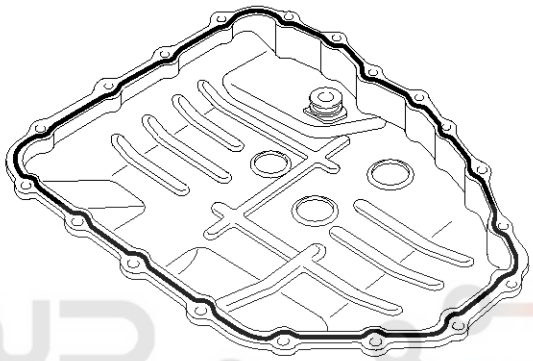
Tightening torque :
10~12N.m(1.0~1.2kgf.m, 7~8lb-ft)

3. Install the oil filter.

Tightening torque :
5~7N.m(0.5~0.7kgf.m, 4~5lb-ft)

4. Continue to apply liquid gasket at application points at the oil pan with Ø0.098in(2.5mm) thickness.

Liquid gasket Part name : Threebond 1281B



AKGF006T

5. Tighten the mounting bolt with the specified TORQUE after installing the oil pan.

Tightening torque :
10~12N.m(1.0~1.2kgf.m, 7~8lb-ft)

6. Install the drain plug.

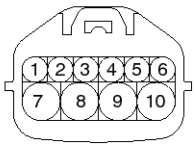
Tightening torque :
40~50N.m(4.0~5.0kgf.m, 28.9~36.2lb-ft)

7. Installation is the reverse of the removal.

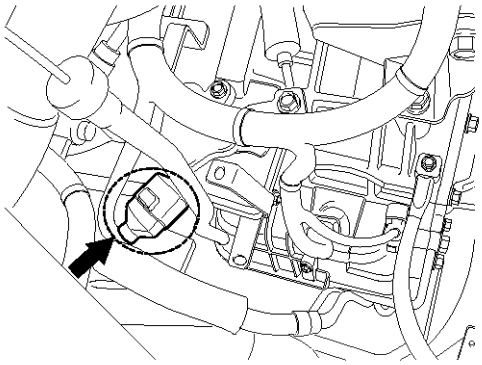
Inhibiter Switch

Description

Sensor type	1. Type : ROTARY 2. Available temperature range : -40~150˚C(-40~320˚F) 3. Tightening torque : : 10~12N.m(1.0~1.2kgf.m, 7~8lb-ft)
Function	Detect the position of select lever through the contact switch. It makes starting possible in "P" and "N" .



1. P range
2. D range
3. L range
5. 2 range
6. N range
7. R range
8. Power supply IG1
9. Start circuit
10. Start circuit



<Installation location>

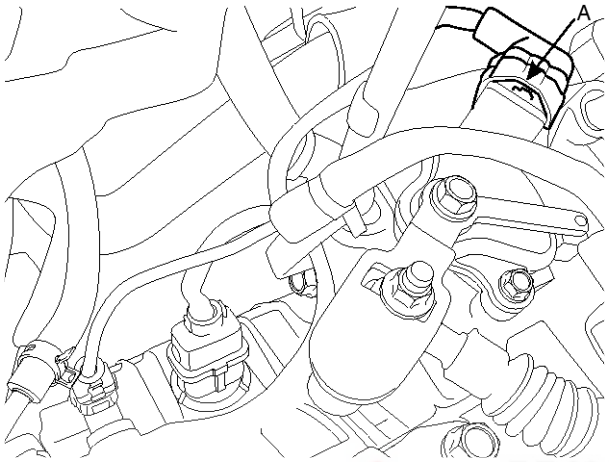
SHDAT6044L

Terminal No. \ Shift lever	P	R	N	D	2	L
1	●					
2				●		
3						●
4						
5					●	
6			●			
7		●				
8	●	●	●	●	●	●
9	●		●			
10	●		●			

SHDAT6066L

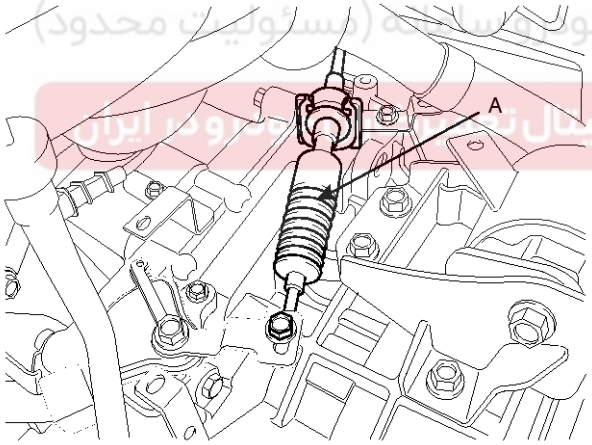
Removal

1. Remove the battery terminal.
2. Remove the battery and battery tray.
3. Remove the air duct.
4. Remove the air cleaner assembly. (Refer to Automatic transaxle's Removal)
5. Disconnect the inhibitor switch connector (A).



SHDAT6112D

6. Remove the control cable(A) from the manual control lever.



AKGF036D

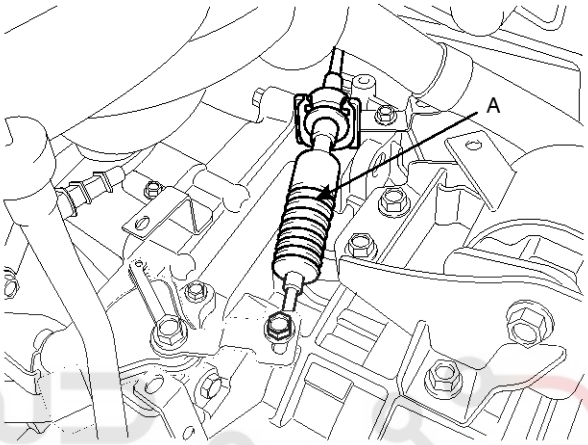
7. Remove the inhibitor switch and manual control lever.

Installation

1. Set the inhibitor switch to the "N" position.
2. Set the inhibitor switch control shaft to the "N" position.
3. Install the inhibitor switch and manual control lever.

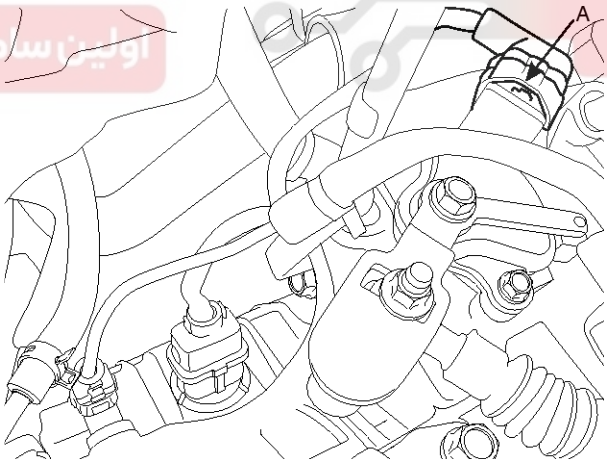
Tightening torque :
Shaft nut: 17~21N.m(1.7~2.1kgf.m, 12~15lb-ft)
Bolt(2EA): 10~12N.m(1.0~1.2kgf.m, 7~8lb-ft)

4. Install the control cable (A) to the manual control lever.



AKGF036D

5. Connect the inhibitor switch connector (A).



SHDAT6112D

6. Installation is the reverse of the removal.
7. Turn the ignition switch ON after installation.

   Move the shift lever from "P" range to "L" range, and verify that the A/T gear position indicator follows the transaxle range switch.