6 SPEED AUTO TRANSAXLE

3690-01/3691-07/3691-11/3691-14/3691-22/3691-28/ 3693-15/3693-21/3693-38/3724-01/3724-03/3724-05/

GENERAL INFORMATION

OVERVIEW AND OPERATING PROCESS

CONFIGURATION AND FUNCTIONS

REMOVAL AND INSTALLATION

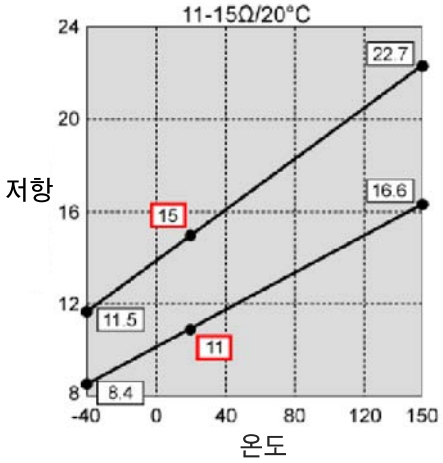
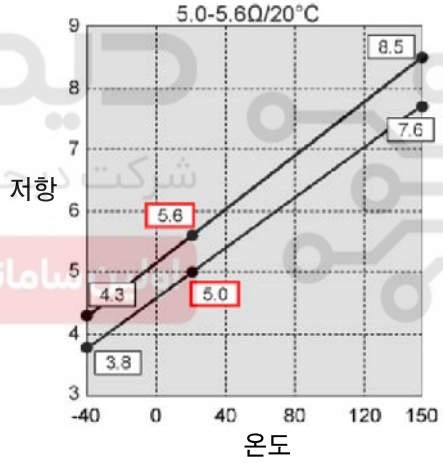
6 SPEED AUTO TRANSAXLE 3690-01

GENERAL INFORMATION

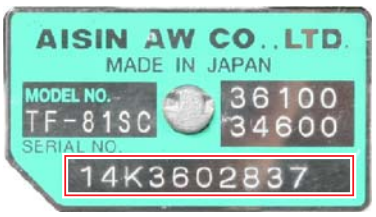
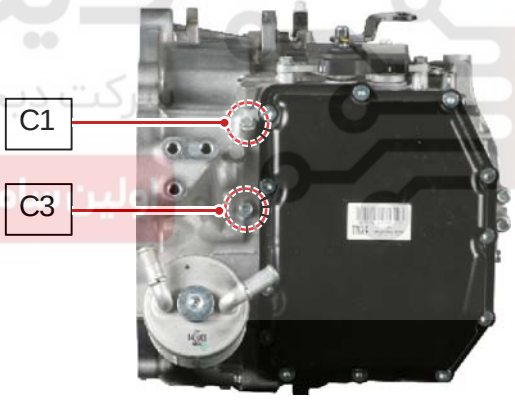
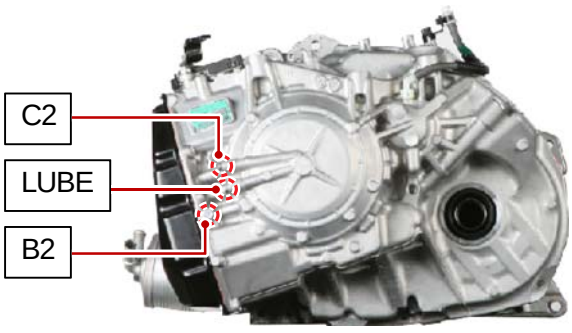
1. SPECIFICATIONS

Item		Specification			
Max. torque		400 Nm			
Weight (including ATF)		Approx. 95.0 kg			
Oil level		Overflow type			
Manual shift control		Yes			
Stall rpm		2,800 rpm±150 rpm			
Oil	Type	AW-1			
	Capacity	6.6 L			
	Change interval	Inspect every 50,000 km or 36 month (But change every 100,000 km under severe condition)			
Gear ratio	1st	4.148			
	2nd	2.370			
	3rd	1.556			
	4th	1.155			
	5th	0.859			
	6th	0.686			
	Reverse	3.394			
	Counter	0.980			
	Differential	3.533			
Configuration of disc clutch	Specific name	Flange	Disc	Plate	Band
	C1	2 EA	7 EA	6 EA	-
	C2	1 EA	4 EA	4 EA	-
	C3	1 EA	4 EA	4 EA	-
Configuration of disc brake	B1	-	-	-	1 EA
	B2	2 EA	6 EA	5 EA	-
Configuration of one-way clutch	F1	Roller type			

Modification basis	
Application basis	
Affected VIN	

Item			Specification
Planetary gear unit			2 EA
Solenoid	Shift solenoid		2 EA (S1 and S2)
	Linear solenoid		6 EA (SLC1, SLC2, SLC3, SLB1, SLT and SLU)
Shift solenoid [S1, S2]			
Linear solenoid [SLC1, SLC2, SLC3, SLB1, SLT, SLU			
Line pressure	Idle	D	350~520 (kPa)
Input speed sensor Output speed sensor	High		12 mA ~ 16 mA
	Low		4 mA ~ 8 mA
Oil temperature sensor resistance	−40°C		Max. 161 kΩ
	−30°C		36.3 kΩ to 52.1 KΩ
	10°C		5.626 kΩ to 7.303 KΩ
	25°C		3.5 kΩ
	110°C		0.224 kΩ to 0.271 KΩ
	145°C		0.102 kΩ to 0.121 KΩ
	150°C		Min. 0.087 kΩ

Modification basis	
Application basis	
Affected VIN	

A/T serial number		
TCU serial number		
Test plug		
		

Modification basis	
Application basis	
Affected VIN	

1) Oil Seal

Item	Specification (oil seal depth)
Auto transaxle housing	19.2 to 20.2 mm
Auto transaxle case	2.0 to 3.0 mm
Manual shaft	-0.3 to -0.4 mm
Oil pump	-0.2 to 0.2 mm

2) Distance Between A/T Housing And Torque Converter

Item	Specification
Distance between A/T housing and torque converter	13.5 mm or longer

3) Acronyms And Abbreviations

Abbreviations	Description
C1	Clutch1
C2	Clutch2
C3	Clutch3
B1	Brake1
B2	Brake2
F1	One-way clutch
S1	Shift solenoid1
S2	Shift solenoid2
SLC	Shift control solenoid (clutch)
SLB	Shift control solenoid (brake)
SLT	Line pressure control solenoid
SLU	Lock-up control solenoid

Modification basis	
Application basis	
Affected VIN	

2. ESSENTIAL TIGHTENING TORQUES

Item	Tightening torque (Nm)	Size x Number
Oil drain plug	34.0 ~ 60.0	Hexagon 17 mm X 1 ea
Oil overflow tube	5.9 ~ 8.8	T-40 mm X 1 ea
Oil filler plug	23.5 ~ 54.9	T-55mm X 1 ea
A/T side cover	17.0 ~ 20.0	T-40 mm X 11 ea
Valve body assembly	8.0 ~ 12.0	10 mm X 3 ea
		10 mm X 5 ea
Oil temperature sensor	6.0 ~ 8.0	8 mm X 1 ea
Valve body wire clamp	6.0 ~ 8.0	8 mm X 1 ea
Input speed sensor	3.9 ~ 6.9	10 mm X 1 ea
Oil cooler	33.3 ~ 39.2	Hexagon 10 mm X 1 ea
TCU	19.6 ~ 29.4	12 mm X 3 ea
Test plug	5.9 ~ 8.8	12 mm X 6 ea
Torque converter	44 ~ 51	13 mm X 6 ea

3. SPECIAL TOOLS

PN & Name	Special Tool	Use
PN: X9936 0080A **Name:** AISIN 6 A/T housing bottom oil filler adapter **Use:** Oil filler adapter for filling with oil at AISIN 6 A/T housing bottom		
PN: X9936 0120A **Name:** AISIN 6 A/T oil seal installer (manual shaft) **Use:** For fitting A/T manual shaft oil seal		
PN: X9936 0130A **Name:** AISIN 6A/T oil seal puller (LH & RH side) **Use:** For removing A/T LH & RH oil seal		
PN: X9936 0140A **Name:** AISIN 6 A/T oil seal puller (oil pump) **Use:** For removing A/T oil pump oil seal		

4. DIAGNOSIS ITEMS FOR EACH SYMPTOM

	Symptoms / Possible cause	Poor shift/slip			Shift time lag		Engine stall					Poor up/down shift									
		D position	R position	Slip when accelerating	N to D	D to N	N to D	D to N	Slow down	Starting difficulty	Poor acceleration	1st, 2nd poor gear shift	2nd, 3rd poor gear shift	3rd, 4th poor gear shift	4th, 5th poor gear shift	5th, 6th poor gear shift	Poor lock-up	Poor engine brake	Poor kick-down	Poor shift	Poor manual shift
ENGINE	Engine fault			O			O	O	O	O	O	O	O	O	O	O					
	Drive plate vibration																				
	Engine/transmission mounting																				
	Exhaust system resonance																				
CHASSIS	Drive shaft vibration																				
	Tire imbalance																				
	Drive train interference																				
	Faulty suspension system																				
ELECTRICAL DEVICE	Battery voltage low/high									O		O	O	O	O	O	O	O			
	Input speed sensor[NIN]											O	O	O	O	O	O			O	
	Output speed sensor[SP]											O	O	O	O	O	O				
	Oil temperature sensor[OT]											O	O	O	O	O	O				
	Shift solenoid[S1]		O									O	O	O				O			
	Shift solenoid[S2]		O											O				O			
	Shift control solenoid[SLC1]	O													O	O					
	Shift control solenoid[SLC2]										O			O							
	Shift control solenoid[SLC3]		O								O		O	O	O	O					
	Shift control solenoid[SLB1]										O	O	O	O	O	O					
	Line pressure control solenoid[SLT]			O																	
	Lock-up control solenoid[SLU]						O	O	O								O				
	Manual mode switch																				O
	Brake switch																				
	TCU	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
CAN COMM	Accelerator pedal position signal																				
	Engine torque signal																				
	Engine rpm signal																				
	Engine coolant temperature signal																				
	Brake pedal signal																				
	Wheel speed signal																				
	Brake pressure signal																				
RELEVANT PARTS	Shift cable fault	O	O	O	O	O				O											
A/T	Torque converter	O	O	O			O	O	O		O										
	Oil seal	O	O	O	O	O															
	O-ring	O	O	O	O	O															
	FIPG(Sealant)	O	O	O	O	O															
	Oil cooler(A/T cooler)	O	O	O	O	O															
	Valve body	O	O	O	O	O	O	O	O		O	O	O	O	O	O	O	O			
	Transmission internal failure	O	O	O	O	O					O	O	O	O	O	O	O	O			
OIL	Overheated oil	O	O	O	O	O					O	O	O	O	O	O	O				
	Insufficient oil	O	O	O	O	O					O	O	O	O	O	O	O	O			
	Inadequate transmission oil	O	O	O	O	O					O	O	O	O	O	O	O				

Modification basis	
Application basis	
Affected VIN	

	Symptoms / Possible cause	Oil leakage									Poor shift						Vacuum/noise				
		Intermittent	Between engine and housing	Between transmission case and housing	Oil pump oil seal	To differential oil seal housing	To differential oil seal case	Manual shift oil seal	O-ring	Oil cooler	N to D	N to R	Up shift	Down shift	Kick-down	Poor acceleration	Idling	Parking	Driving	Up/Down shift	Poor acceleration
ENGINE	Engine fault		O													O	O	O	O	O	O
	Drive plate vibration																				
	Engine/transmission mounting																O	O	O	O	O
	Exhaust system resonance																O	O	O	O	O
CHASSIS	Drive shaft vibration																		O	O	O
	Tire imbalance																		O		O
	Drive train interference																O		O	O	O
	Faulty suspension system																O		O	O	O
ELECTRICAL DEVICE	Battery voltage low/high										O	O	O	O	O						
	Input speed sensor[NIN]																				
	Output speed sensor[SP]																				
	Oil temperature sensor[OT]										O	O	O	O	O						
	Shift solenoid[S1]																				
	Shift solenoid[S2]																				
	Shift control solenoid[SLC1]										O		O	O	O						
	Shift control solenoid[SLC2]												O	O	O						
	Shift control solenoid[SLC3]											O	O	O	O						
	Shift control solenoid[SLB1]										O	O	O	O	O						
	Line pressure control solenoid[SLT]													O							
	Lock-up control solenoid[SLU]																				
	Manual mode switch																				
	Brake switch																				
	TCU										O	O	O	O	O						
CAN COMM	Accelerator pedal position signal																				
	Engine torque signal																				
	Engine rpm signal																				
	Engine coolant temperature signal																				
	Brake pedal signal																				
	Wheel speed signal																				
	Brake pressure signal																				
RELEVANT PARTS	Shift cable fault																				
A/T	Torque converter		O																		
	Oil seal		O		O	O	O	O													
	O-ring								O	O											
	FIPG(Sealant)			O																	
	Oil cooler(A/T cooler)									O											
	Valve body										O	O	O	O	O						
	Transmission internal failure	O									O	O	O	O	O			O	O	O	O
OIL	Overheated oil										O	O	O	O	O		O	O		O	
	Insufficient oil										O	O	O	O	O						
	Inadequate transmission oil										O	O	O	O	O			O		O	

Modification basis	
Application basis	
Affected VIN	

5. CAUTIONS FOR OPERATION & HANDLING

CAUTION

1) Cautions For Working On Electronic Parts

- Before replacing the electronic parts, turn the ignition off and remove the negative (-) terminal from the battery.
- Release the lock part first, and remove the connector. (prevent wiring from being pulled)
- Make sure that the connector is locked fully until a click is heard.
- Do not subject the electronic parts to impact. If it is dropped or subjected to impact, you must replace it with a new one.

2) Handling Component With Care

- Do not store the A/T under the poor surroundings for a long time. (Long-term storage at high humidity causes the corrosion of the internal parts)
- Before installation, remove the shipping cap. Do not store the components for a long time, with the shipping cap removed.
- Do not put the A/T directly on the floor.

3) Dirt-protecting

- When removing the relevant components from the A/T, remove any dirt, sand and etc. completely.
- Place the components into the plastic bag or similar.
- When performing the work, do not use a cotton gloves or cloth, instead bare hands or plastic gloves should be used.

4) To Protect Components From Damage

- When using the plastic hammer to remove the components, tap lightly it. (Do not use the screwdriver as a leverage.)
- Do not pull the components such as the valve with an excessive force.
- Ensure refit the components without being damaged.

5) Cleaning

- All the components should be thoroughly cleaned, dried with a compressed air and applied the oil only for A/T.
- Do not use an alkaline based cleaner to clean the aluminum and rubber parts.
- Do not use the waxing oil (unleaded gasoline) to clean the rubber part.

6) Cautions For Handling ATF

- Do not discharge the ATF when it is hot. (wait until it has cooled down)
- Wipe off any spilled AFT immediately since the floor is slippery and dangerous.
- Make sure to use the oil only for AW-1.

Modification basis	
Application basis	
Affected VIN	

OVERVIEW AND OPERATING PROCESS

1. SPECIFICATIONS

The auto transaxle used for this vehicle is FF type 6 speed auto transaxle, which performs the lock-up control self-learning control and manual shift control. The TCU is integrated into the non-contact type shift position sensor, fitted to top of the A/T and uses a external oil cooler.

▶ Lock-up control

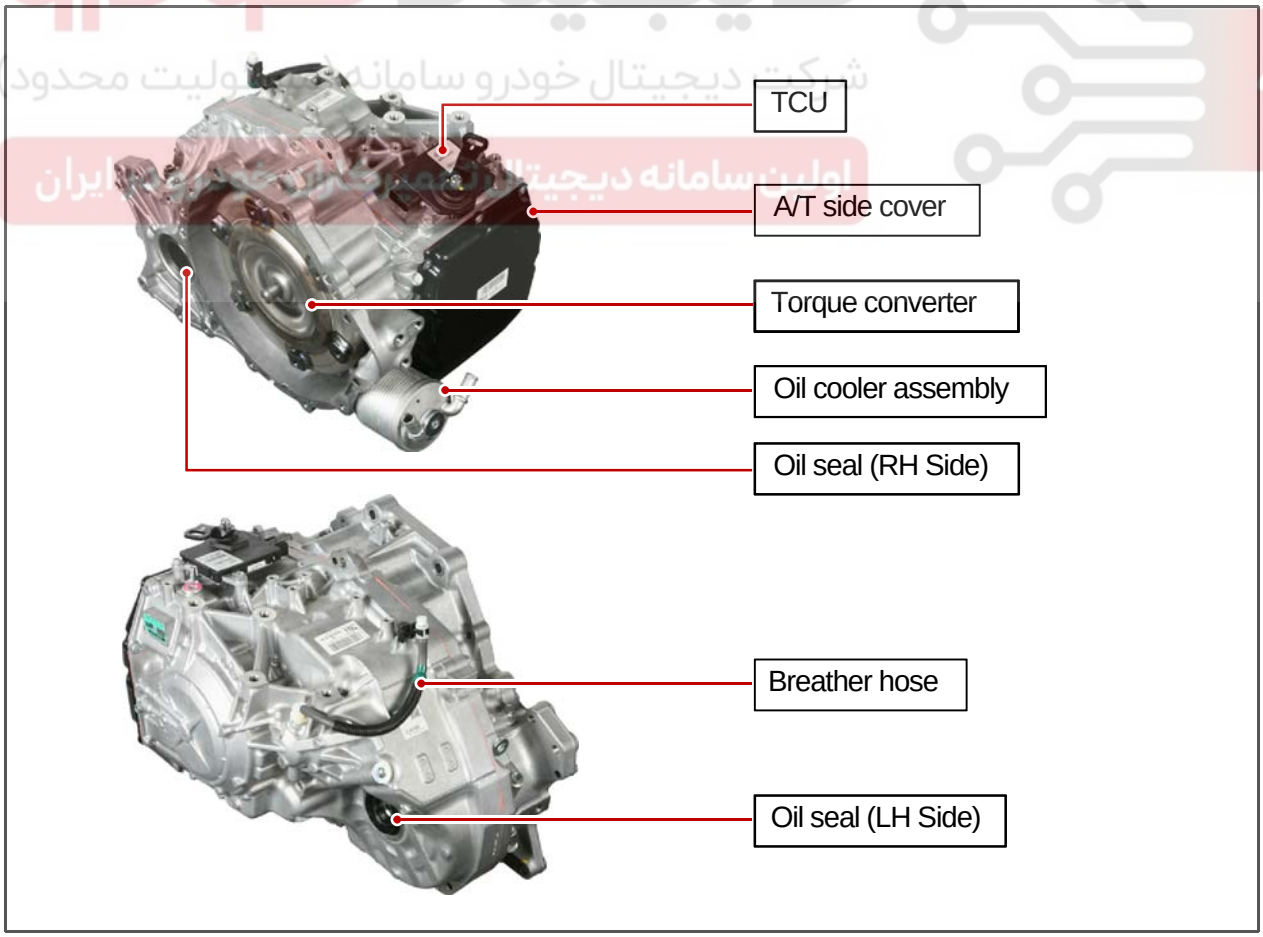
The output rpm signal, engine ECU (engine rpm and throttle opening) signals and vehicle speed are used for smooth lock-up control.

▶ Self-learning control

The TCU performs the shift control learning and stationary-vehicle control learning to provide the smooth clutch engagement during gear shift and the smooth and delicate shift during driving.

▶ Manual shift control

The driver can choose the desired gear by moving the shift lever from "D" range to manual shift position and operating the tip switch + (up shift) or - (down shift) and feel the sportiness as in the manual transmission.



Modification basis	
Application basis	
Affected VIN	

2. TCU CONTROL FUNCTION

1) Automatic Gear Change Control

The automatic gear change control turns S1 and S2 on or off and operates the SLC1, SLC2, SLC3 and SLB1 linearly according to the vehicle speed, throttle opening, information on brake signal, based on the each gear pattern.

▶ **Gear & solenoid operation**

O: On (current on) / - : OFF (current off)

Item	Linear solenoid				Shift solenoid	
Gear	SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)
P, N	-	O	O	-	O	-
R	-	O	-	-	O	-
1st	O	O	O	-	O	-
1st engine brake	O	-	O	-	-	O
2nd	O	O	O	O	O	-
3rd	O	O	-	-	O	-
4th	O	-	O	-	O	-
5th	-	-	-	-	O	-
6th	-	-	O	O	O	-

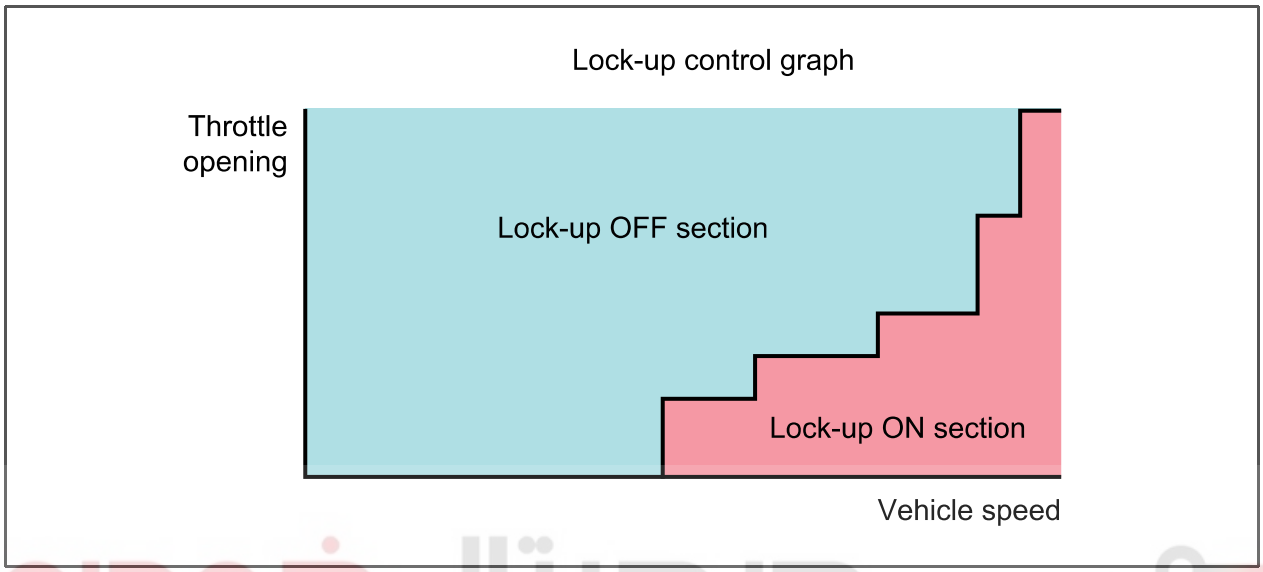
N.O: Normal Open
N.C: Normal Close

2) Manual Shift Control

Moving the shift lever from "D" position to manual shift position and changing to + (up shift) or - (down shift) allows the driver to choose the required gear and feel the sportiness as in the manual transmission. However, the TCU performs the lock-up control by up-shifting automatically and by down-shifting during deceleration, in order to prevent the excessive rpm increase.

3) Lock-up Control

The smooth lock-up control is carried out through the linear control by the lock-up control solenoid [SLU], based on the signals from engine ECU (engine rpm and throttle opening) and vehicle speed signals



Control	Description
Lock-up control	The control is carried out by lock-up control solenoid [SLU]. It turns on or off the lock-up control solenoid valve [SLU] linearly. The lock-up clutch in the torque converter is operated and pump impeller is connected to the turbine runner. This connects the engine to the auto transaxle. The engine output is connected directly to the auto transaxle, reducing the loss of output and improving the fuel economy.

4) Stationary-Vehicle Control

When the shift lever is moved from "N" to "D" or "R" position after the engine is started, the shift control solenoids (SLC1, SLC2 and SLC3) delivers the oil pressure required by the C1 and C3 clutches and properly predefined oil pressure for smooth engagement to the clutch.

NOTE

The shift time lag occurs since the first piston stoke resistance increases at cold engine. In this case, the control is not performed to reduce the time lag. The impactless and smooth engagement is achieved by controlling the oil pressure according to the piston stoke.

5) Reverse Control

When the shift lever is moved from "D" to "R" position and the auto transmission is shifted to reverse during driving, the vehicle is extremely hazardous and the wheels become stuck. Therefore, the TCU prevents the transmission from shifting to reverse during driving.

NOTE

If the vehicle drives at higher speed of 11 km/h, the automatic transmission will not shift to reverse when the shift lever is moved "D" to "R" position. When this control is activated, the C3 clutch is released without operation of the shift control solenoid (SLC3) to prevent the automatic transmission from shifting to reverse. The reverse control has a higher priority than the shift control from "D" to "R" position.

6) Self-Diagnosis Function

The TCU monitors the status of communication on the electronic components including each sensor and ECU. In the event of malfunction, the TCU activates the warning lamp to warn the driver this and stores the fault as a diagnostic trouble code (DTC).

On-board diagnosis	If any fault occurs in the A/T, the TCU activates the warning lamp to inform the driver of this.
Off-board diagnosis	The TCU stores a DTC. The DTC and TCU data can be reviewed by connecting the diagnostic device.

7) Fail-Safe Function

If any fault occurs at the A/T system, the fail-safe function will be activated and the TCU outputs the control signal in order to get the vehicle to the nearest service center. If the shift solenoid is malfunctioning, the TCU will no longer output the control signal If this happens, the gear change will be controlled by the hydraulic circuit and the gear shifted from "R" position to reverse or from "D" position to 3rd.

Shift position	Gear position
"R"	Reverse
"D"	3rd gear

8) "N" Position Learning

If the automatic transmission or TCU has been replaced, you should initialize the learned value and perform the "N" position learning.

NOTE

Refer to [INITIALIZING/LEARNING PROCESS] for detailed information.

9) Initializing Learning

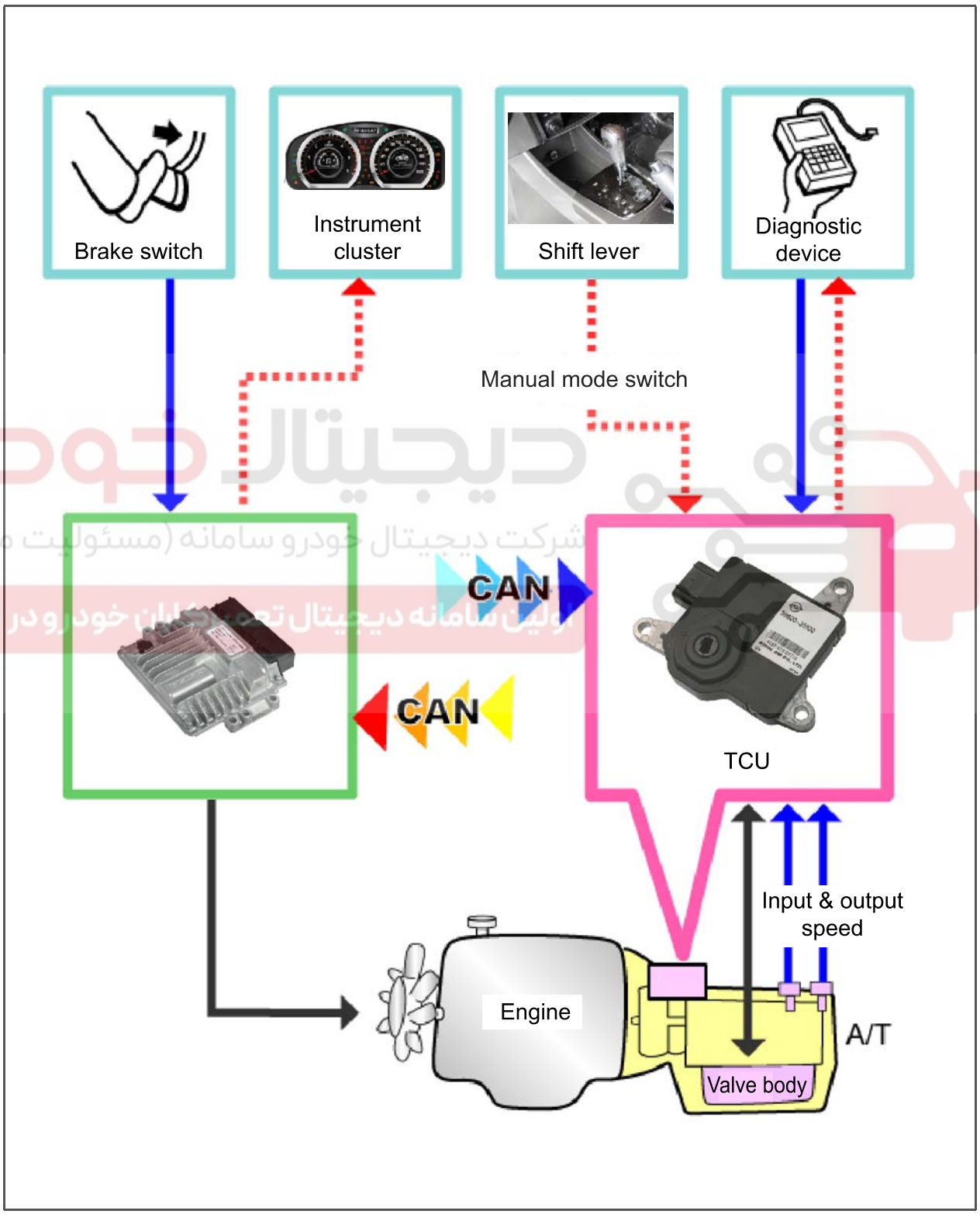
If the automatic transmission, TCU or ECU has been replaced or reprogrammed, you should initialize the TCU learned value and perform the initializing learning.

NOTE

Refer to [INITIALIZING/LEARNING PROCESS] for detailed information.

3. OPERATING COMPONENTS

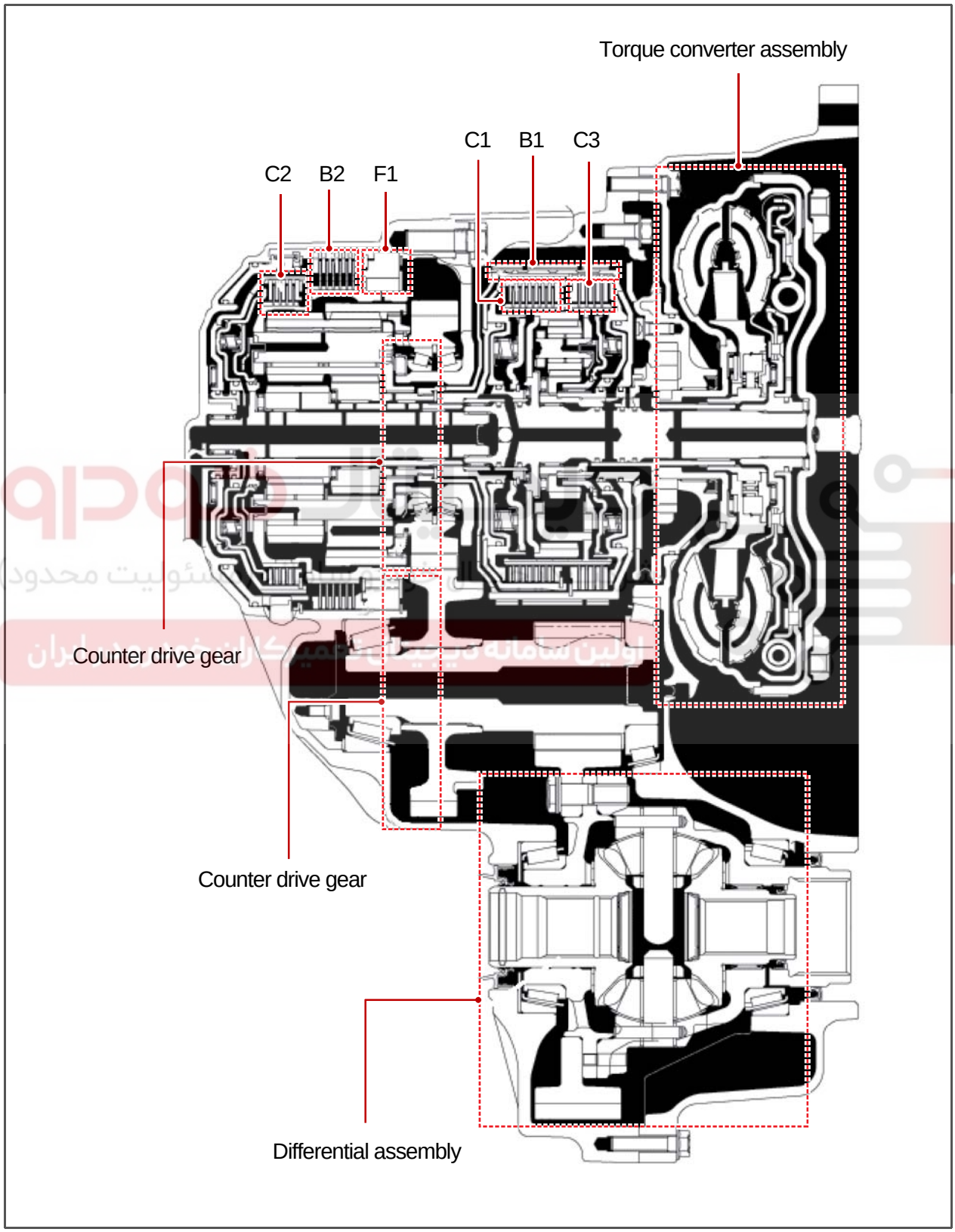
It is consisted of various sensors that retrieve the information required to determine the shift, the ECU that provides those values, the shift lever that inputs the driver's command to the TCU, the TCU that finally sends a shift command through the hydraulic control and etc.



Modification basis	
Application basis	
Affected VIN	

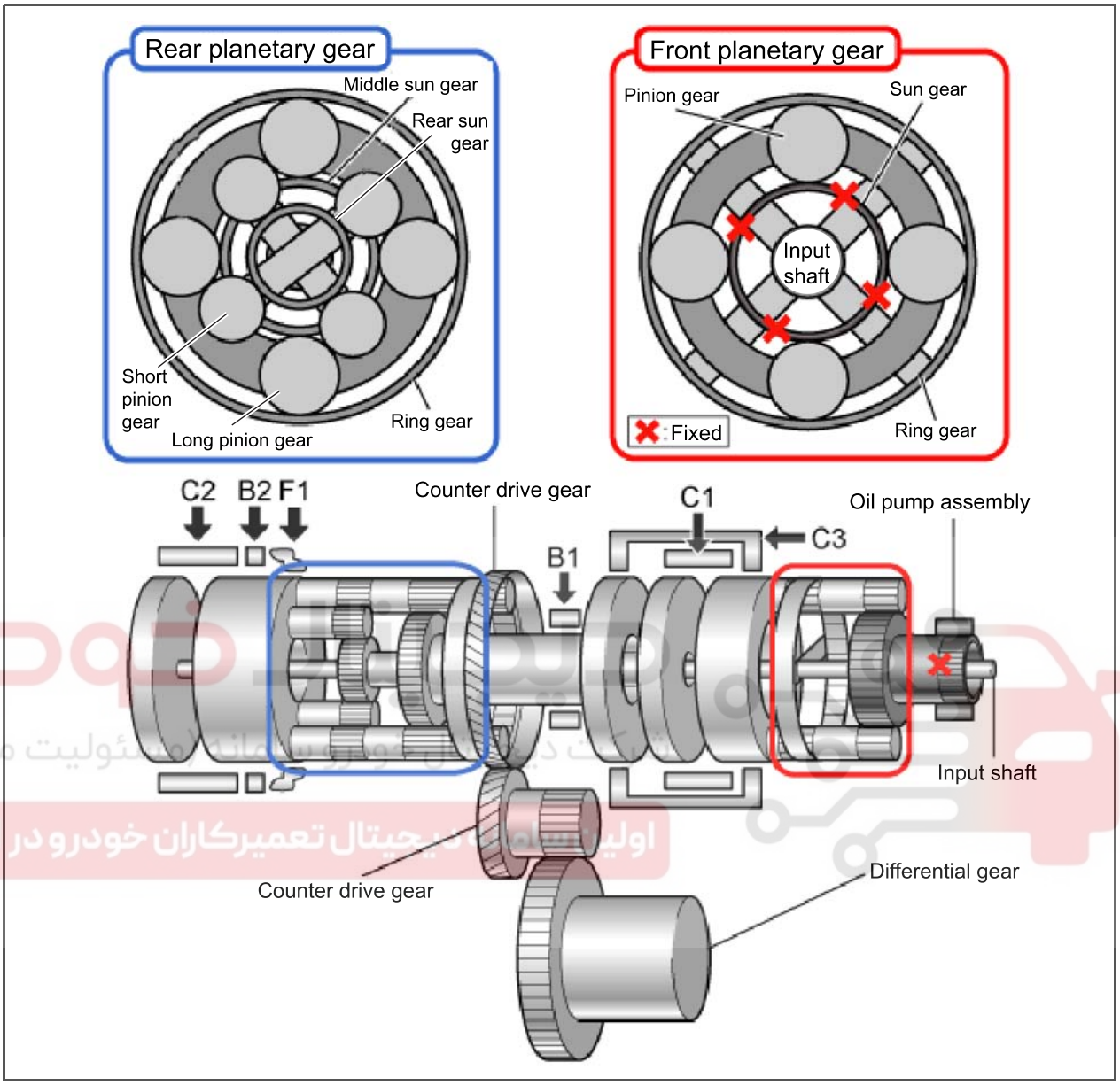
4. OPERATING PROCESS

1) Component Parts



Modification basis	
Application basis	
Affected VIN	

2) Configuration and Designation of Planetary Gear



Designation		Operation
Clutch	C1	Connects front planetary gear carrier to rear planetary gear sun gear
	C2	Connects input shaft to rear planetary gear carrier
	C3	Connects front planetary gear carrier to rear planetary gear middle sun gear
Brake	B1	Fix rear planetary gear middle sun gear
	B2	Fix rear planetary gear carrier
One-way clutch	F1	Prevents rear planetary gear carrier from rotating anti-clockwise

3) Operation Element Chart

단수		솔레노이드 밸브						클러치			브레이크		원-웨이 클러치
		SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	F1
"P"		-	O	O	-	O	-	-	-	-	-	-	-
후진	V ≤ 11km/h	-	O	-	-	O	-	-	-	O	-	O	-
	V > 11km/h	-	O	O	-	O	O	-	-	-	-	-	-
"N"		-	O	O	-	O	-	-	-	-	-	-	-
1단		O	O	O	-	O	-	O	-	-	-	-	O
1단 엔진 브레이크		O	-	O	-	-	O	O	-	-	-	O	O
2단		O	O	O	O	O	-	O	-	-	O	-	-
3단		O	O	-	-	O	-	O	-	O	-	-	-
4단		O	-	O	-	O	-	O	O	-	-	-	-
5단		-	-	-	-	O	-	-	O	O	-	-	-
6단		-	-	O	O	O	-	-	O	-	O	-	-

NOTE

ck-up applies to from 2nd gear to 6th gear.

NOTE

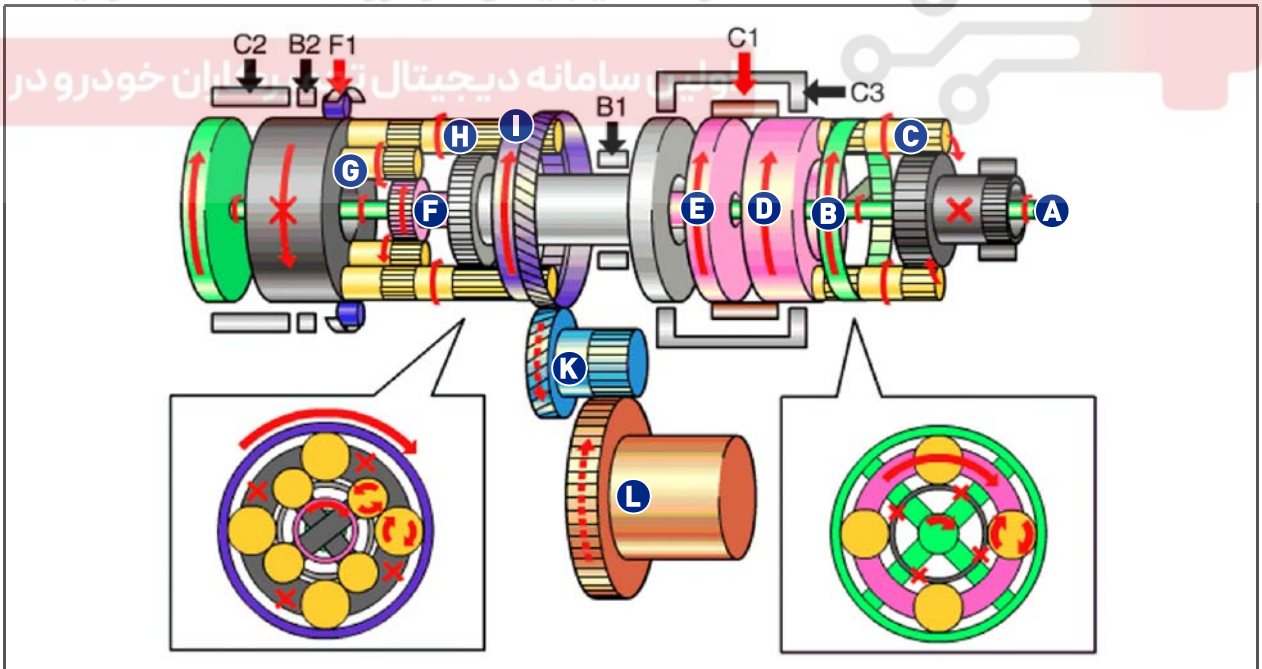
brake is operated only by the shift lever and the SLB2 solenoid does not exist.

5. POWER TRANSFER PROCESS

▶ **1st gear power transfer**

A. Input shaft rotates clockwise (same revolutions as turbine runner in torque converter)
B. Front ring gear rotates clockwise (same revolutions as input shaft)
C. Front pinion gear rotates clockwise
D. Front sun gear is fixed and front planetary gear carrier rotates clockwise
E. C1 clutch engaged (front planetary gear carrier and rear sun gear are connected together and rotate clockwise)
F. Rear sun gear rotates clockwise
G. Rear short pinion gear rotates anti-clockwise
(Rear planetary gear carrier locks anti-clockwise by one-way clutch F1)
H. Rear long pinion gear rotates clockwise
I. Rear ring gear rotates clockwise by rear long pinion gear
K. Counter drive gear rotates anti-clockwise
L. Differential gear rotates clockwise

단수	솔레노이드 밸브						클러치			브레이크		원-웨이 클러치
	SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	F1
1단	O	O	O	-	O	-	O	-	-	-	-	O



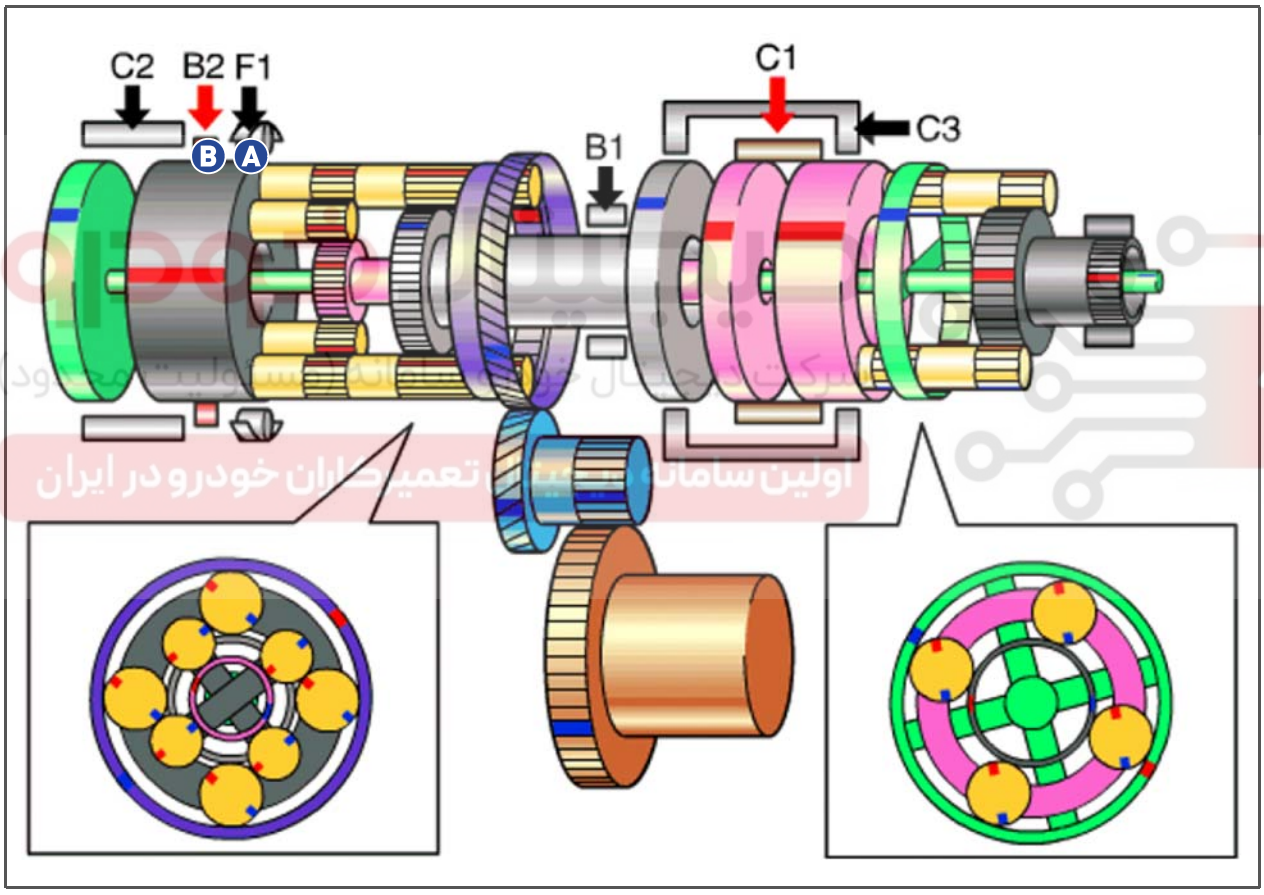
-	Input	Fixed	Output
Front planetary gear	Ring gear	Sun gear	Carrier
Rear planetary gear	Rear sun gear	Carrier	Ring gear

▶ 1st engine brake power transfer

When the engine brake is operated, the drive power is transmitted from the tires.
The rear planetary gear carrier is fixed as follows:

A. F1 (one-way clutch): offsets anti-clockwise rotation power
B. B2 (brake): Operates (fix rear planetary gear carrier)

단수	솔레노이드 밸브						클러치			브레이크		원-웨이 클러치
	SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	F1
1단 E/B 브레이크	O	-	O	-	-	O	O	-	-	-	O	O

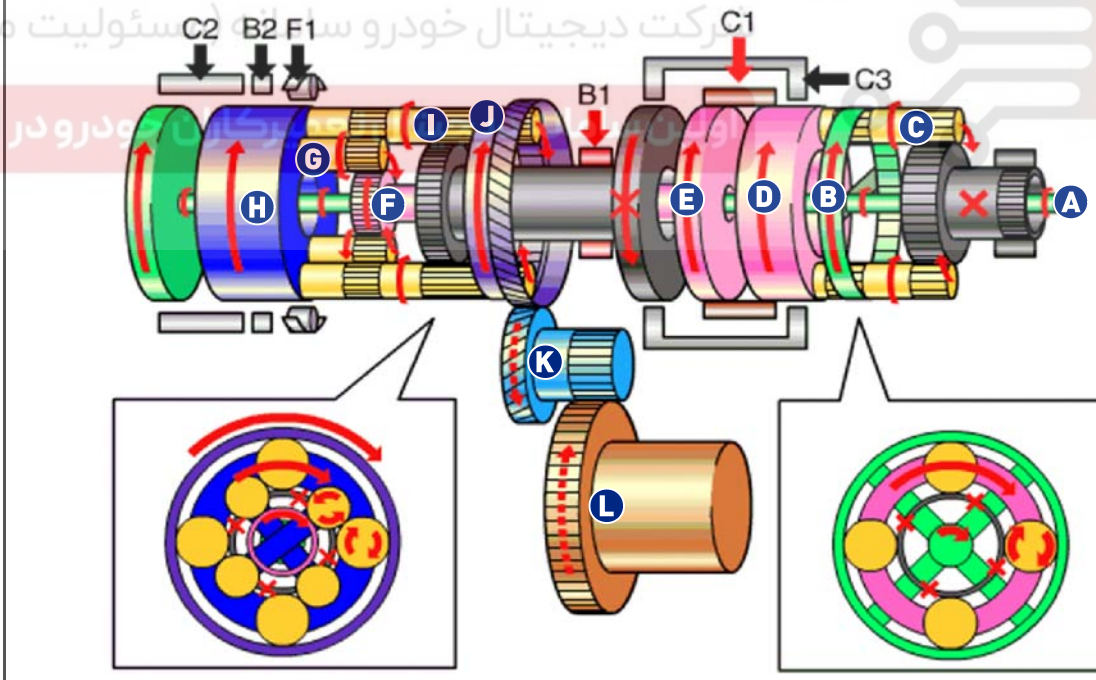


Modification basis	
Application basis	
Affected VIN	

▶ 2nd gear power transfer

A. Input shaft rotates clockwise
B. Front ring gear rotates clockwise
C. Front pinion gear rotates clockwise
D. Front sun gear is fixed and front planetary gear carrier rotates clockwise
E. C1 clutch engaged (front planetary gear carrier and rear sun gear are connected together and rotate clockwise)
F. Rear sun gear rotates clockwise
G. Rear short pinion gear rotates anti-clockwise
H. Middle sun gear is fixed by B1 brake and rear planetary gear carrier rotates clockwise
I. Rear long pinion gear rotates clockwise
J. Rear ring gear rotates clockwise by rear long pinion gear
K. Counter drive gear rotates anti-clockwise
L. Differential gear rotates clockwise

단수	솔레노이드 밸브						클러치			브레이크		원-웨이 클러치
	SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	F1
2단	O	O	O	O	O	-	O	-	-	O	-	-



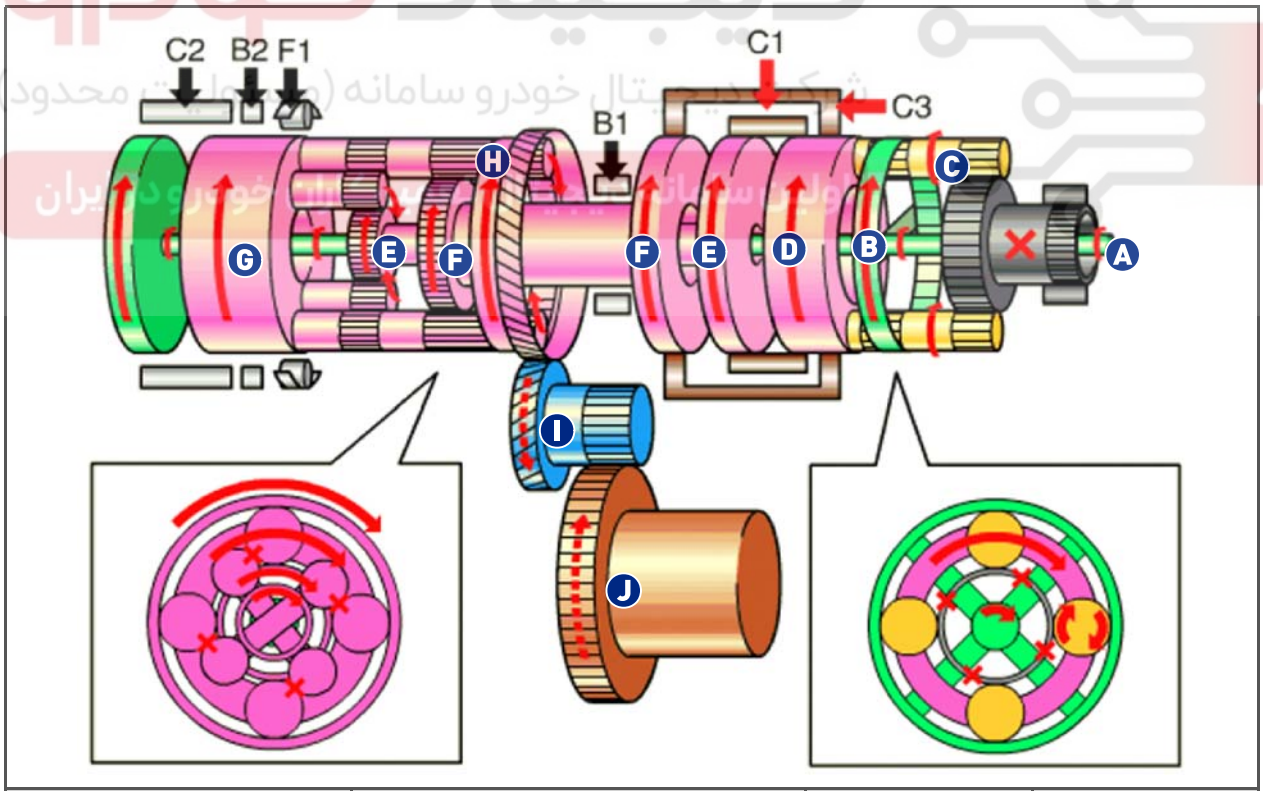
-	Input	Fixed	Output
Front planetary gear	Ring gear	Sun gear	Carrier
Rear planetary gear	Rear sun gear	Middle sun gear	Ring gear

Modification basis	
Application basis	
Affected VIN	

▶ 3rd gear power transfer

A. Input shaft rotates clockwise
B. Front ring gear rotates clockwise
C. Front pinion gear rotates clockwise
D. Front sun gear is fixed and front planetary gear carrier rotates clockwise
E. C1 clutch engaged (front planetary gear carrier and rear sun gear are connected together)
F. C3 clutch engaged (front planetary gear carrier and rear middle sun gear are connected together)
Rear short pinion and long pinion gears are fixed to body of revolution (rear sun gear and rear middle
G. sun gear) and rear planetary gear carrier rotates clockwise
Rear ring gear rotates clockwise by rear long pinion gear
H. Counter drive gear rotates anti-clockwise
I. Differential gear rotates clockwise
J.

단수	솔레노이드 밸브						클러치			브레이크		원-웨이 클러치
	SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	F1
3단	O	O	-	-	O	-	O	-	O	-	-	-



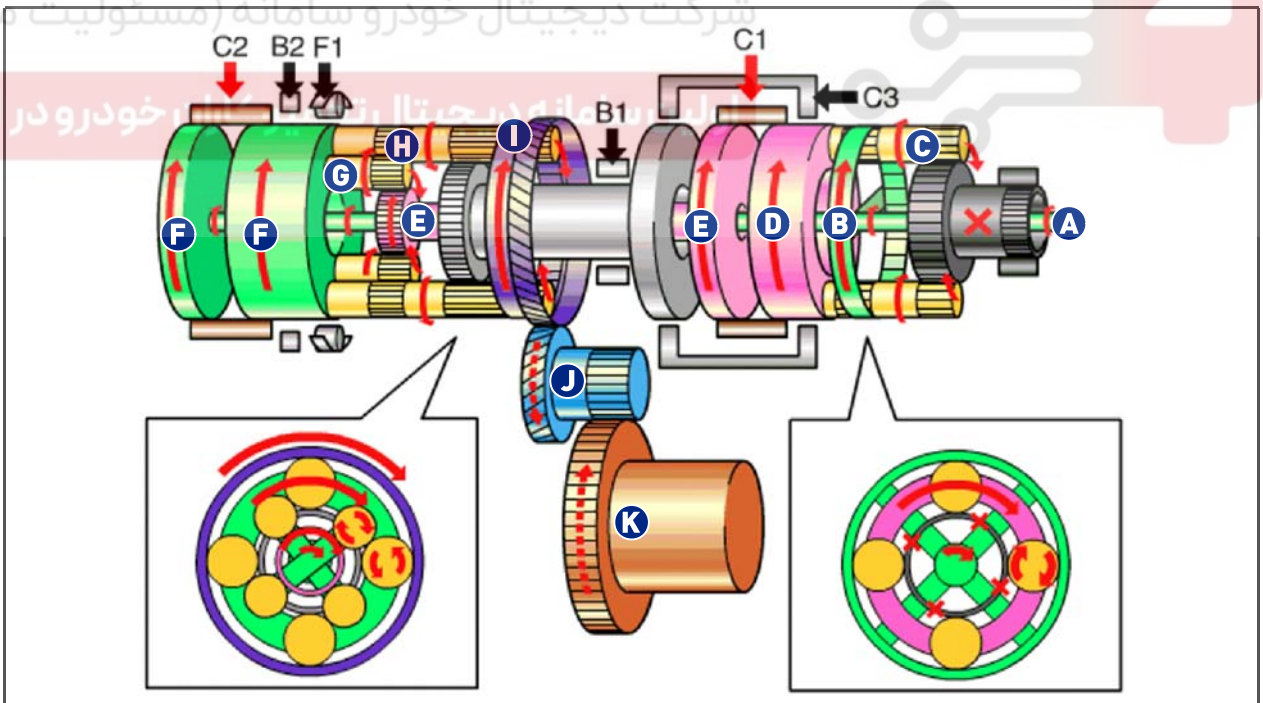
-	Input	Fixed	Output
Front planetary gear	Ring gear	Sun gear	Carrier
Rear planetary gear	Rear sun gear, middle sun gear	-	Ring gear

Modification basis	
Application basis	
Affected VIN	

▶ 4th gear power transfer

A. Input shaft rotates clockwise
B. Front ring gear rotates clockwise
C. Front pinion gear rotates clockwise
D. Front sun gear is fixed and front planetary gear carrier rotates clockwise
E. C1 clutch engaged (front planetary gear carrier and rear sun gear are connected together and rotate clockwise)
F. C2 clutch engaged (rear planetary gear carrier rotates clockwise (same revolutions as input shaft))
Rear short pinion gear rotates clockwise by rear sun gear
G. Rear long pinion gear rotates anti-clockwise
H. Rear ring gear rotates clockwise and its rotation speed is lower than rear planetary gear carrier due
I. to rear long pinion gear.
Counter drive gear rotates anti-clockwise
J. Differential gear rotates clockwise
K.

단수	솔레노이드 밸브						클러치			브레이크		원-웨이 클러치
	SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	F1
4단	O	-	O	-	O	-	O	O	-	-	-	-



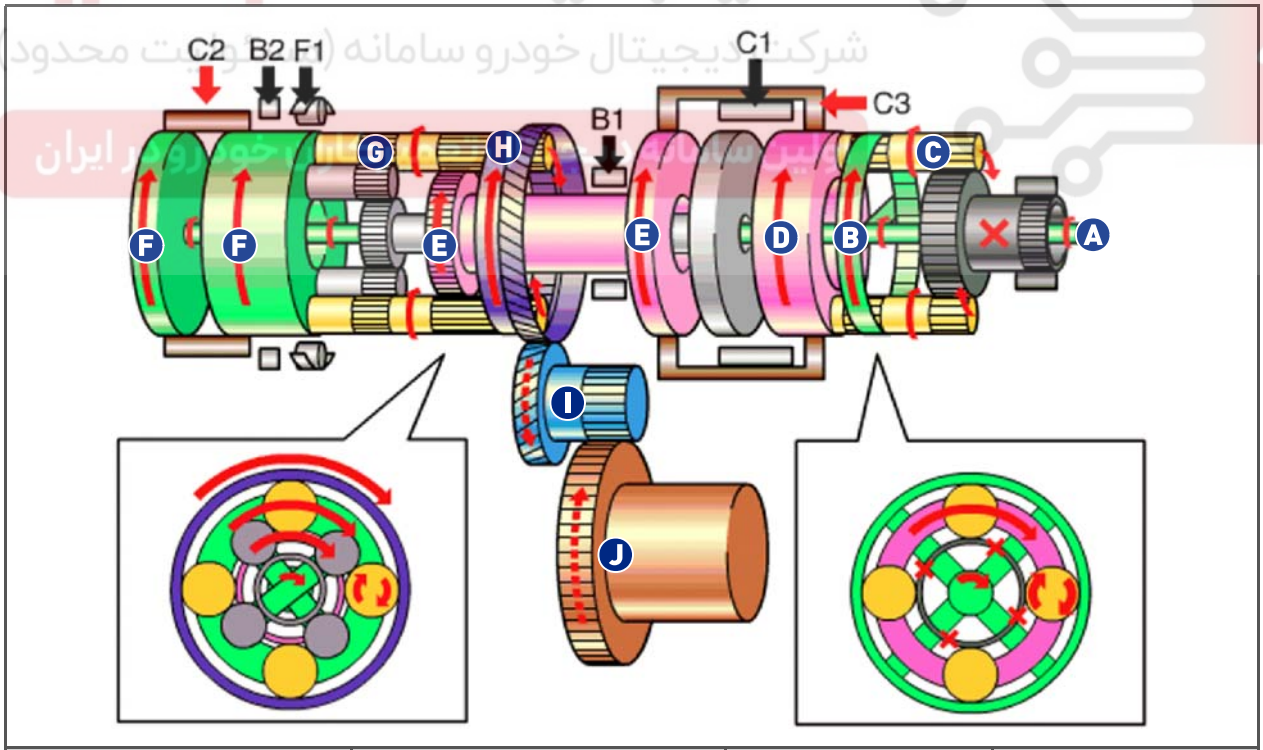
-	Input	Fixed	Output
Front planetary gear	Ring gear	Sun gear	Carrier
Rear planetary gear	Rear sun gear, carrier	-	Ring gear

Modification basis	
Application basis	
Affected VIN	

▶ 5th gear power transfer

A. Input shaft rotates clockwise
B. Front ring gear rotates clockwise
C. Front pinion gear rotates clockwise
D. Front sun gear is fixed and front planetary gear carrier rotates clockwise
E. C3 clutch engaged (front planetary gear carrier and rear middle sun gear are connected together and rotate clockwise)
F. C2 clutch engaged (rear planetary gear carrier rotates clockwise (same revolutions as input shaft))
Rear long pinion gear rotates clockwise
G. Rear ring gear rotates clockwise and its rotation speed is higher than rear planetary gear carrier due
H. to rear long pinion gear.
Counter drive gear rotates anti-clockwise
I. Differential gear rotates clockwise
J.

단수	솔레노이드 밸브						클러치			브레이크		원-웨이 클러치
	SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	F1
5단	-	-	-	-	O	-	-	O	O	-	-	-



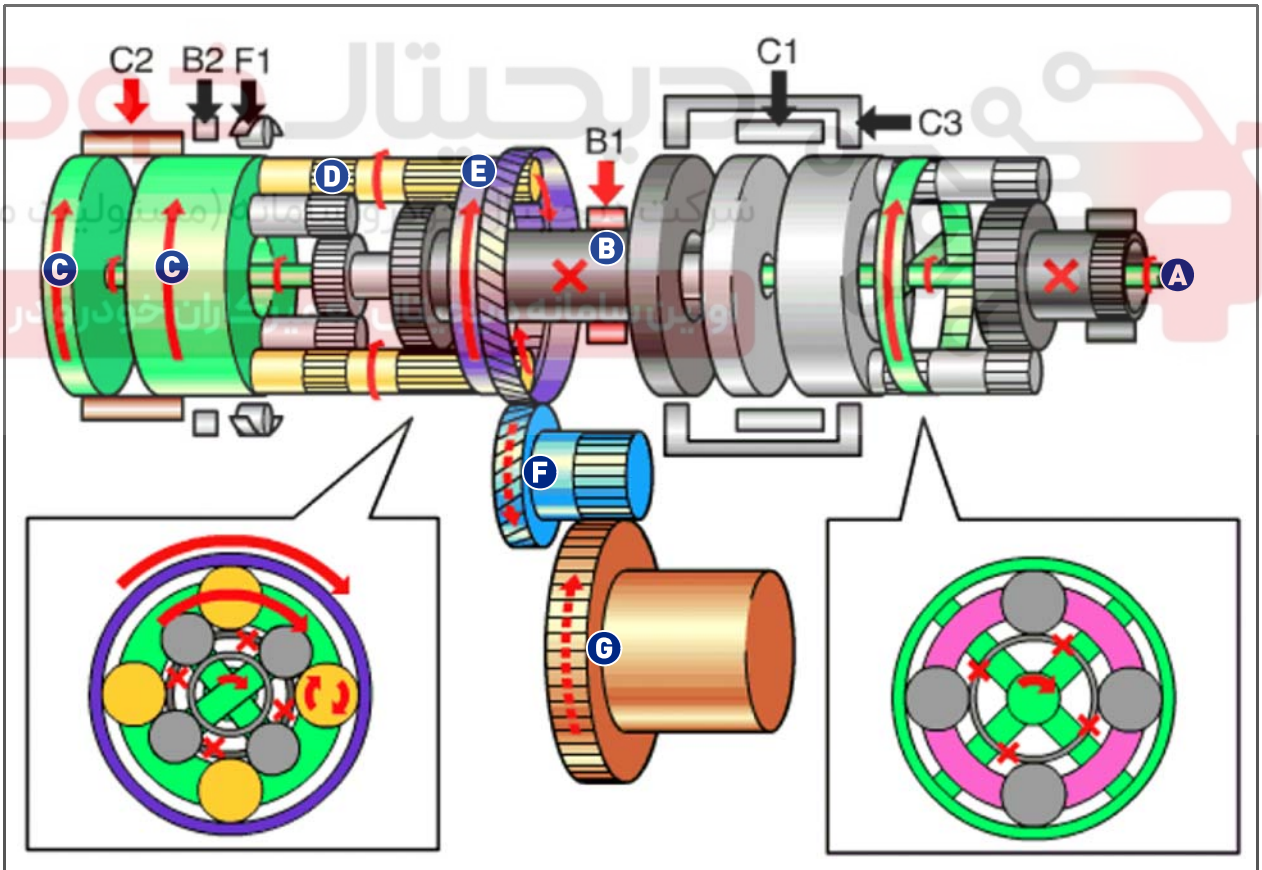
-	Input	Fixed	Output
Front planetary gear	Ring gear	Sun gear	Carrier
Rear planetary gear	Carrier, middle sun gear	-	Ring gear

Modification basis	
Application basis	
Affected VIN	

▶ 6th gear power transfer

A. Input shaft rotates clockwise
B. Rear middle sun gear fixed as B1 brake operates
C. C2 clutch engaged (rear planetary gear carrier rotates clockwise (same revolutions as input shaft))
Rear short pinion gear is fixed due to fixed rear middle sun gear and rear long pinion gear rotates
D. clockwise
Rear ring gear rotates clockwise
E. Counter drive gear rotates anti-clockwise
F. Differential gear rotates clockwise
G.

단수	솔레노이드 밸브						클러치			브레이크		원-웨이 클러치
	SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	F1
6단	-	-	O	O	O	-	-	O	-	O	-	-



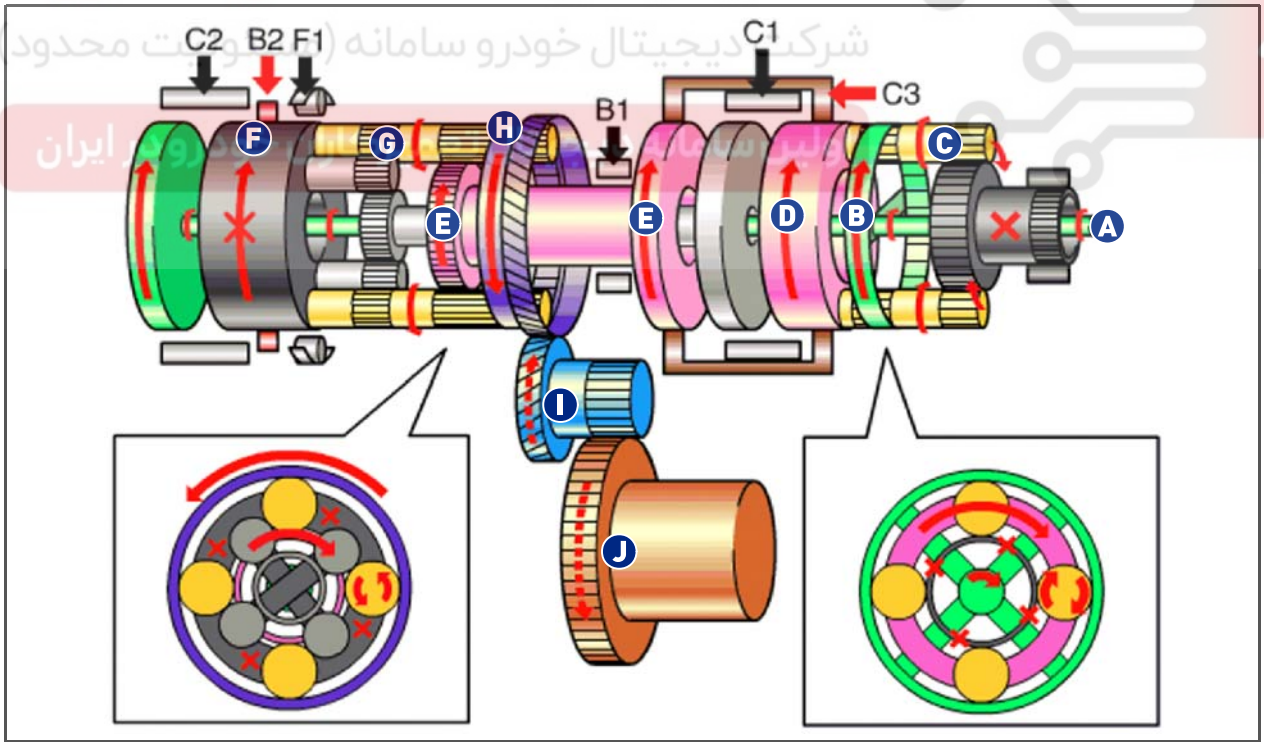
-	Input	Fixed	Output
Front planetary gear	-	-	-
Rear planetary gear	Carrier	Middle sun gear	Ring gear

Modification basis	
Application basis	
Affected VIN	

▶ Reverse power transfer

A. Input shaft rotates clockwise
B. Front ring gear rotates clockwise
C. Front pinion gear rotates clockwise
D. Front sun gear is fixed and front planetary gear carrier rotates clockwise
E. C3 clutch engaged (front planetary gear carrier and rear middle sun gear are connected together and rotate clockwise)
F. Rear planetary gear carrier is fixed as B2 brake operates
G. Rear long pinion gear rotates anti-clockwise due to fixed rear planetary gear carrier
H. Rear ring gear rotates anti-clockwise
I. Counter drive gear rotates clockwise
J. Differential gear rotates anti-clockwise

단수		솔레노이드 밸브						클러치			브레이크		원-웨이 클러치
		SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	F1
후진	V ≤ 11km/h	-	O	-	-	O	-	-	-	O	-	O	-
	V > 11km/h	-	O	O	-	O	O	-	-	-	-	-	-



-	Input	Fixed	Output
Front planetary gear	Ring gear	Sun gear	Carrier
Rear planetary gear	Middle sun gear	Carrier	Ring gear

Modification basis	
Application basis	
Affected VIN	

6. EMERGENCY MODE

If the A/T has a failure while driving, the self-learning control, lock-up control and gear change adaptation control will be deactivated. The TCU stores the DTC if it can diagnose which fault has occurred and sometimes the system enters the emergency mode.

▶ Emergency mode 1

If the linear solenoids (SLC1, SLC2, SLC3 and SLB1) are open or short circuit to B+ or ground, the gear will be stuck at 3rd gear.

▶ Emergency mode 2

If there is a gear ratio error (1st ~ 6th), an abnormal gear change due to the linear solenoids (SLC1, SLC2, SLC3 and SLB1) maximum pressure, or no signal from the output rotation sensor, the gear will be stuck at 5th gear.

▶ Emergency mode 3

If the S1, linear solenoid (SLT) is open or short circuit to B+ or ground, the input rotation sensor has a electrical problem or sends no signal, in the event of high supply voltage to the battery, CAN communication error or CAN bus off, the gear will be stuck at 3rd gear.

▶ Emergency mode 4

If the lever position sensor has a electrical problem, the gear will be stuck at 3rd gear.

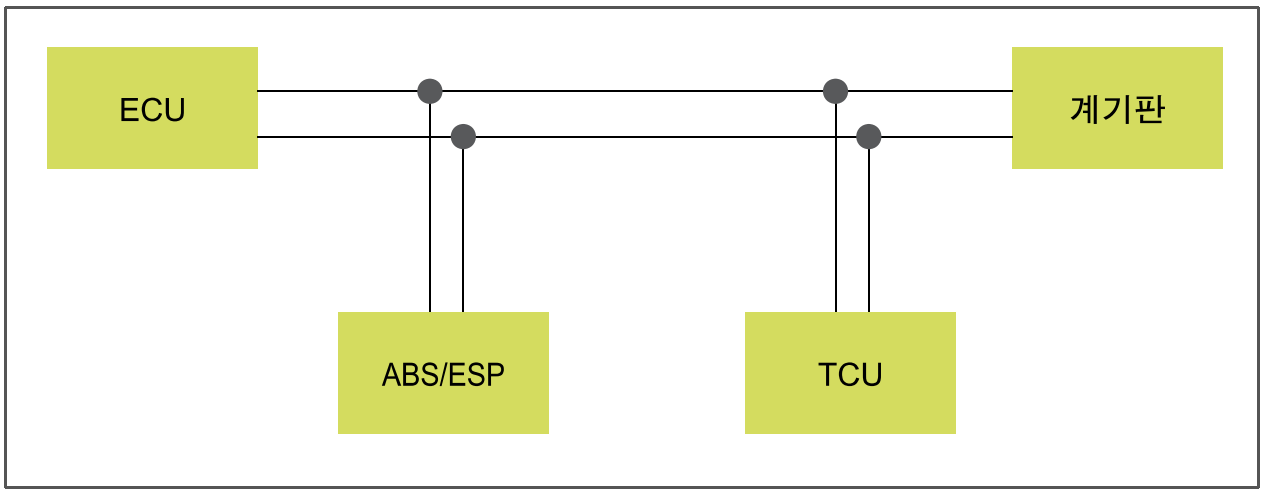
▶ Emergency mode 5

In the event of low supply voltage to the battery, the gear will be stuck at 3rd gear for 1st to 3rd and at 5th gear for 4th to 6th.

Modification basis	
Application basis	
Affected VIN	

7. CONFIGURATION OF CAN RELATED TO TCU

▶ **CAN network communication**



The TCU transmits the following signals via the CAN bus.

- Selector lever position
- Selected gear condition
- Manual mode activation
- Drive mode state
- Output torque
- ATF temperature
- Torque converter lockup clutch status
- Request for reduced engine torque
- Request for increased engine torque

Modification basis	
Application basis	
Affected VIN	

CONFIGURATION AND FUNCTIONS

S.G.N. 3690-01 AUTOMATIC TRANSMISSION ASSEMBLY

1) Component Parts

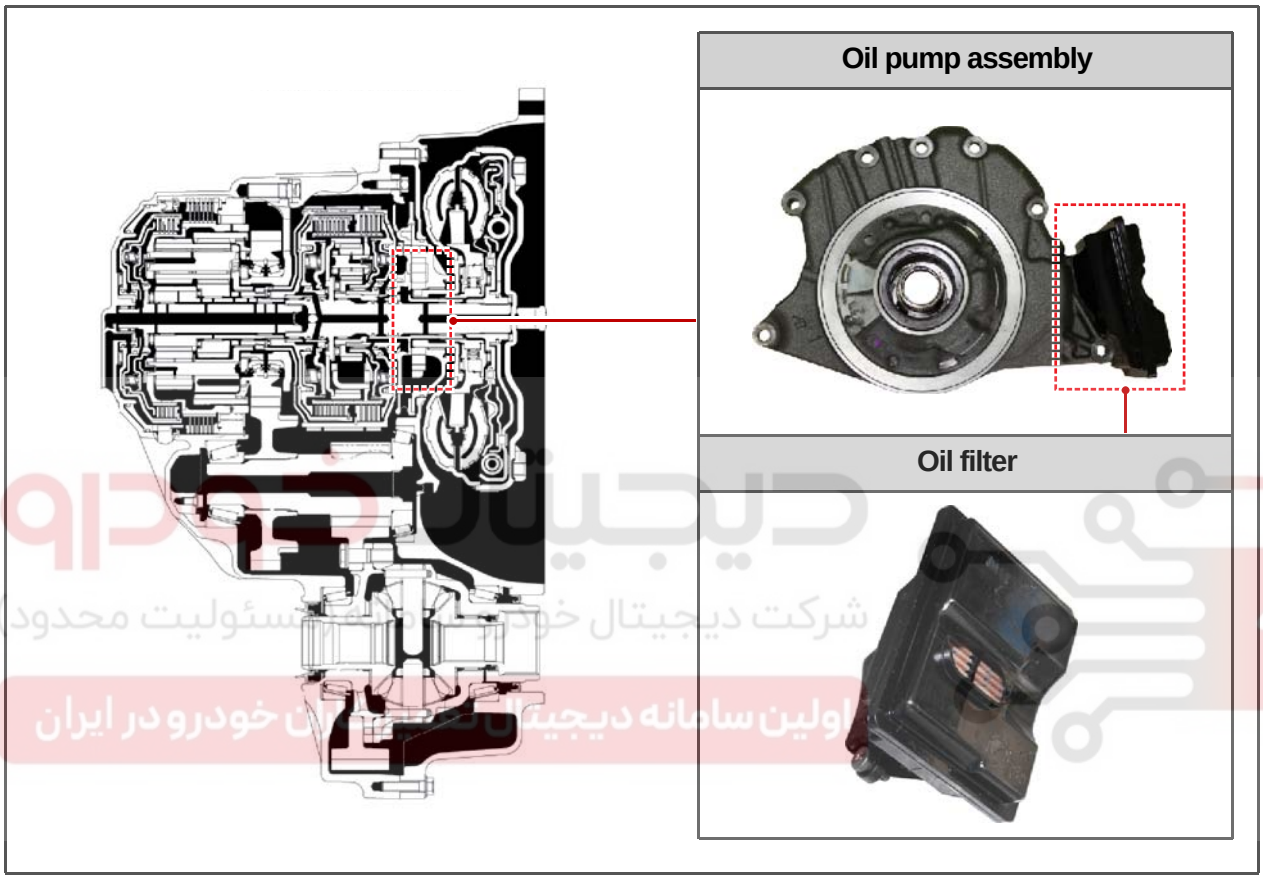
▶ **Mounting location**

A/T assembly

Modification basis	
Application basis	
Affected VIN	

2) Oil Pump

The oil pump is of paracoid type which delivers ATF for each rotation. It is fitted between the torque converter and A/T housing. The torque converter is supported to the oil pump by the plain bush bearing. The oil pump is driven directly by the engine through the torque converter cover and delivers ATF directly to the auto transmission and valve body. In addition, the oil pump draws in ATF through the filter and delivers it to the valve body with high pressure.



Modification basis	
Application basis	
Affected VIN	

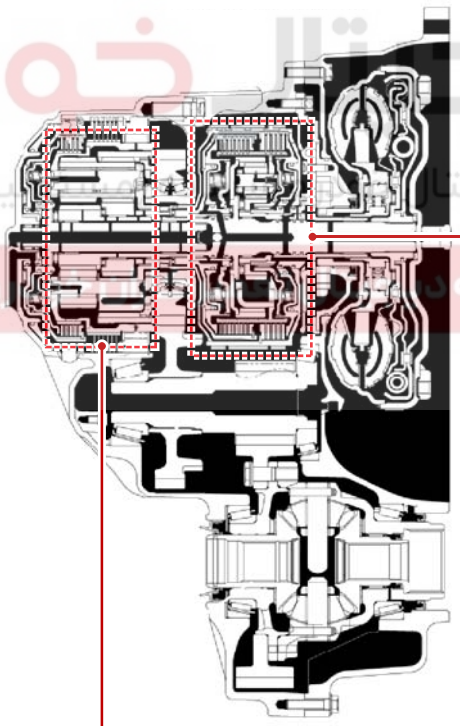
3) Front / Rear Planetary Gear Set

(1) Front planetary gear set

The front planetary gear set is driven by the input shaft and consists of the following components:
- 1 sun gear
- 4 pinion gears meshing with sun gear
- 1 carrier
- 1 ring gear

(2) Rear planetary gear set

The rear planetary gear set is driven by the input shaft and consists of the following components:
- 1 sun gear
- 4 short pinion gears meshing with sun gear, 4 long pinion gears meshing with ring gear
- 1 carrier
- 1 ring gear

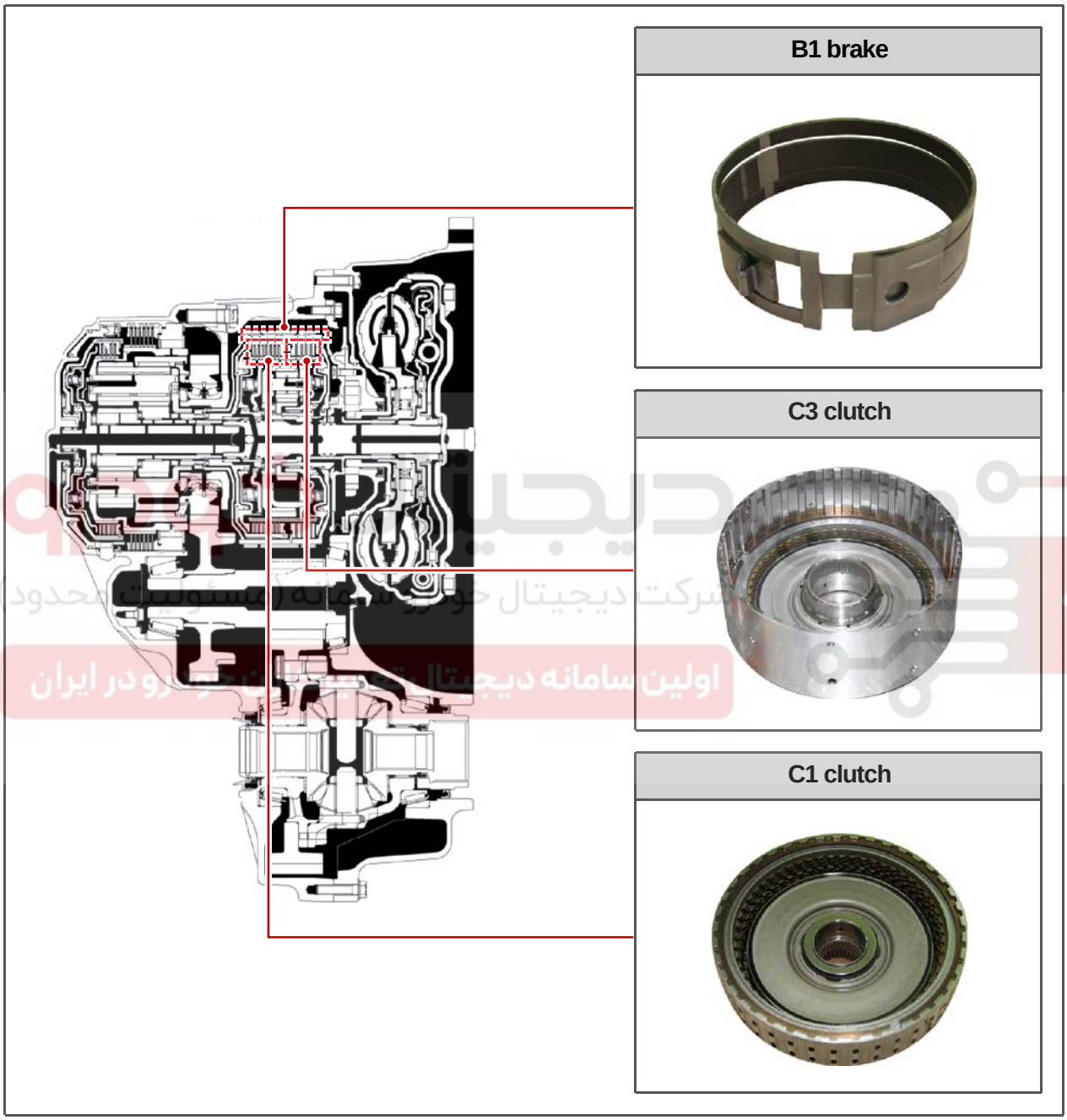


Front planetary gear

Rear planetary gear

4) C1 and C3 Clutches, B1 Brake

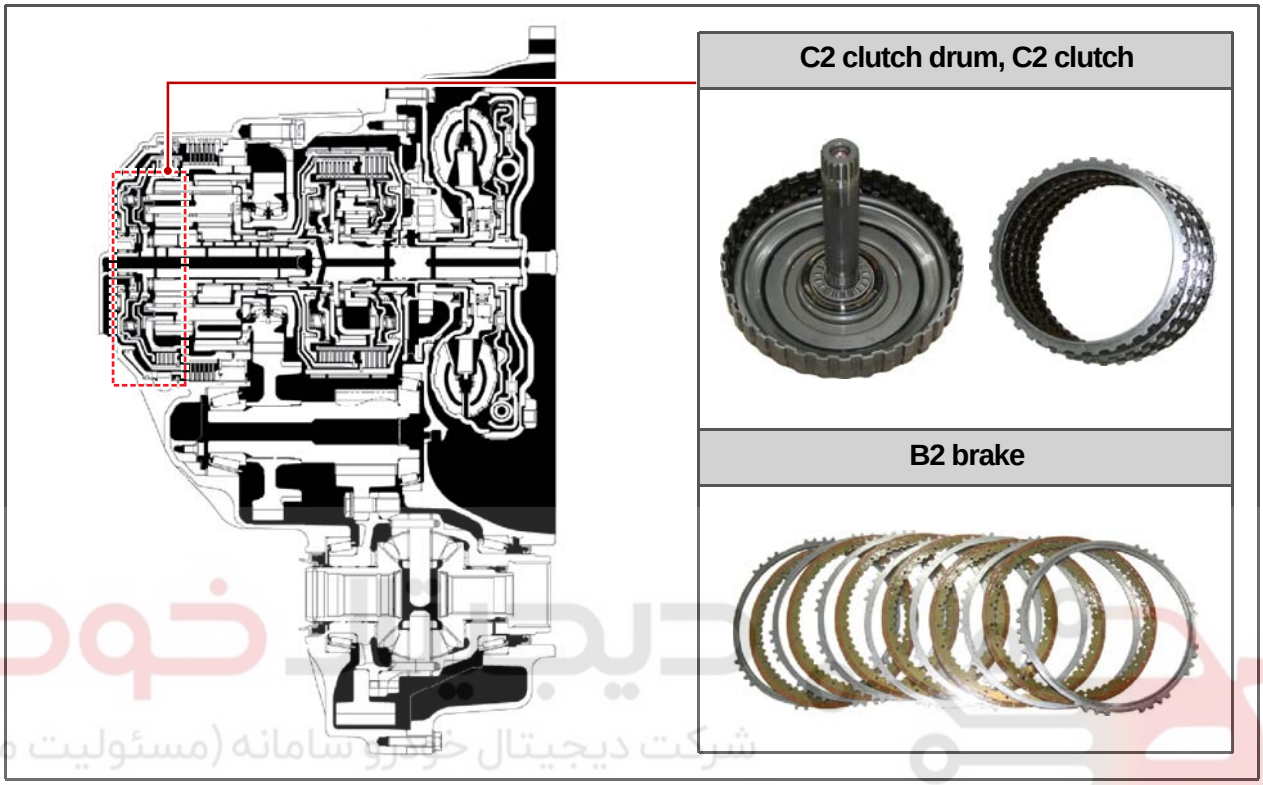
- C1 clutch: Connects the front planetary gear carrier to the rear planetary gear sun gear.
- C3 clutch: Connects the front planetary gear carrier to the rear planetary gear middle sun gear.
- B1 brake: Holds the rear planetary gear middle sun gear.



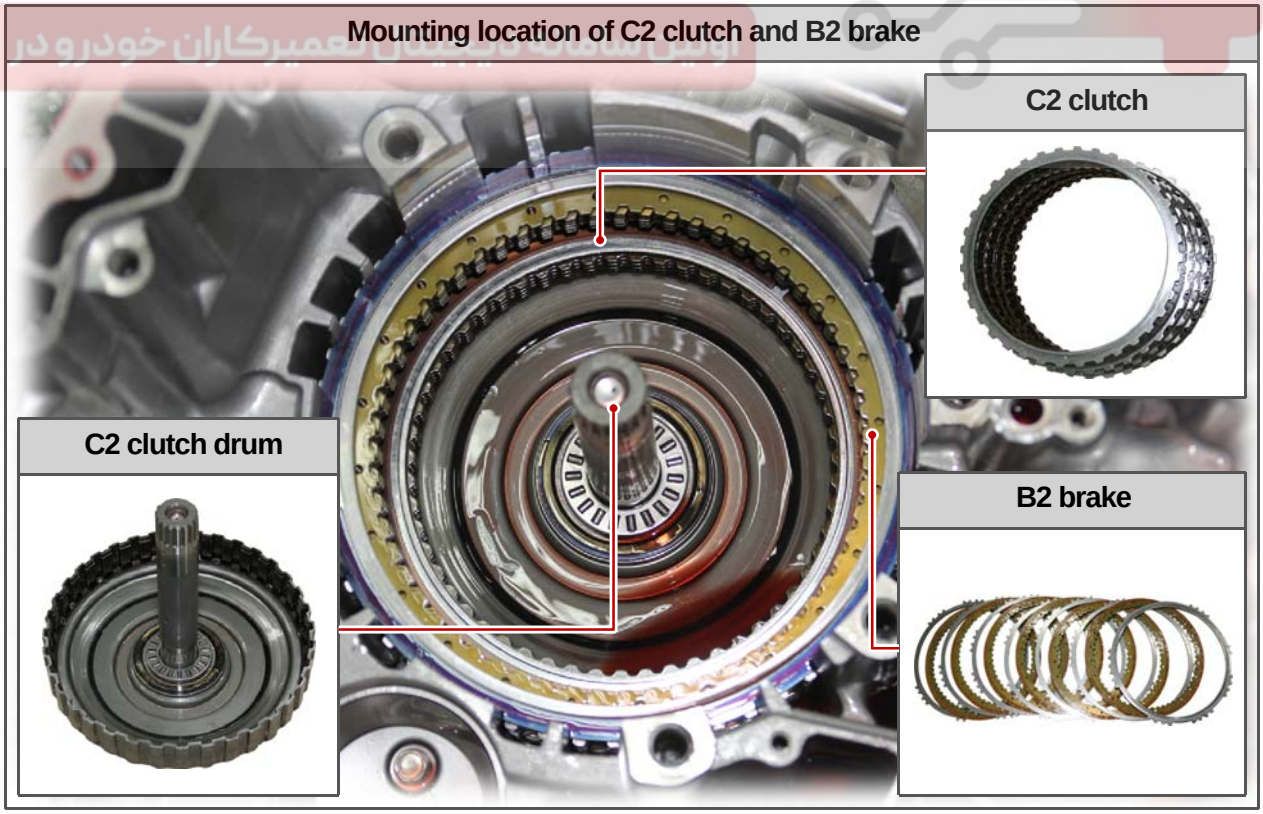
Modification basis	
Application basis	
Affected VIN	

5) C2 clutch, B2 brake

- C2 clutch: Connects the input shaft to the rear planetary gear carrier.
- B2 brake: Holds the rear planetary gear carrier.



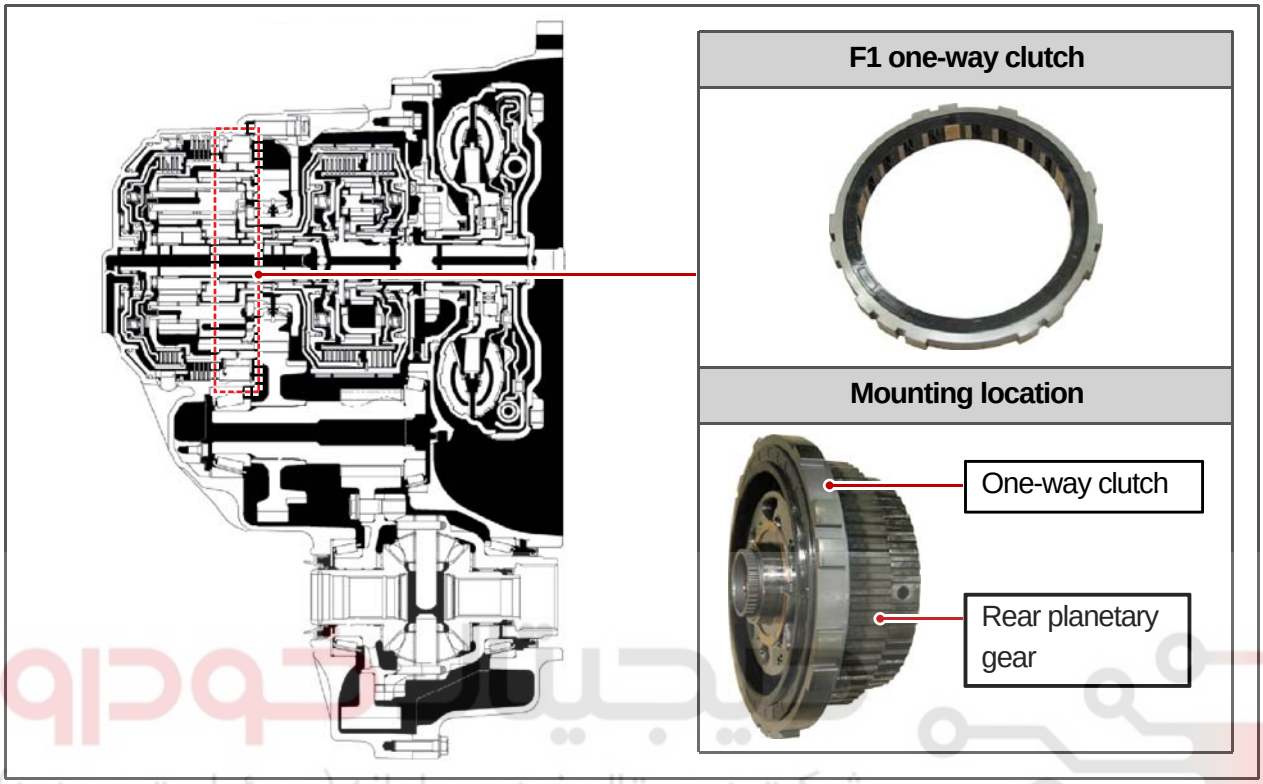
Mounting location of C2 clutch and B2 brake



Modification basis	
Application basis	
Affected VIN	

6) F1 One-way Clutch

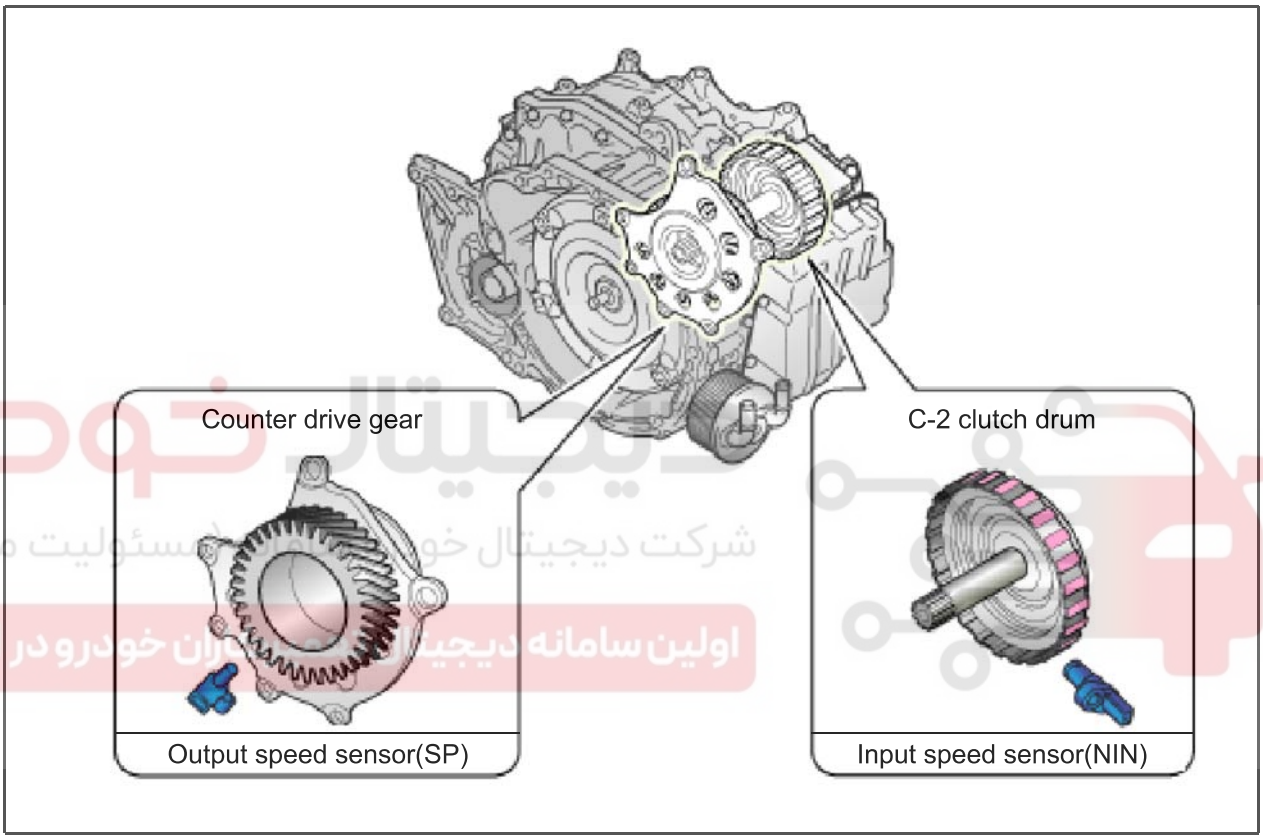
- F1 one-way clutch: Prevents rear planetary gear carrier from rotating anti-clockwise.



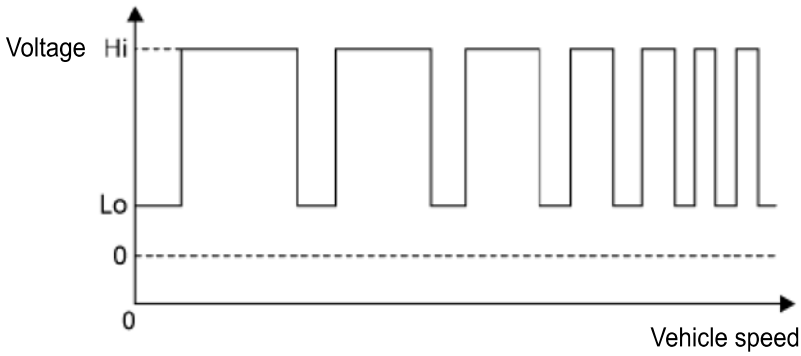
Modification basis	
Application basis	
Affected VIN	

7) Input/Output Speed Sensor

The input/output speed sensor is located in the transmission case and outputs the waveform signal according to the rpm. The TCU calculates the waveform signal frequency to determine the input/output speed.
The input speed sensor [NIN] detects the C2 drum rpm of the intermediate shaft as a input shaft speed.
The output speed sensor [SP] detects the counter drive gear rpm as a output shaft speed.
These signals are transmitted to the TCU, which controls the engine torque, shift timing and lock-up based on them.



▶ **Input/output shaft speed sensor specifications**



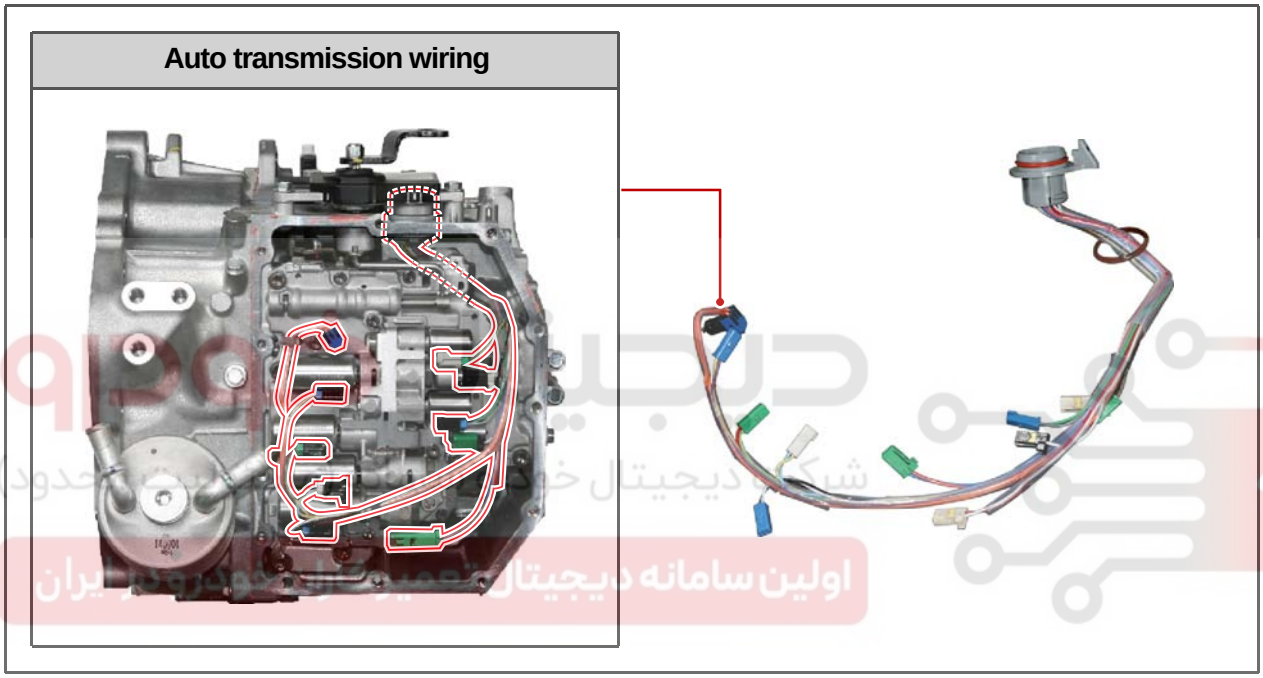
Signal	Specified value
High	12 to 16 mA
Low	4 to 8 mA

8) Auto Transmission Wiring

(1) Auto transmission wiring

The auto transmission wiring is a grouped connector of the oil temperature sensor, speed sensor and solenoid and fitted to the auto transmission case.
The oil temperature sensor integrated into the auto transmission wiring is fitted to the front valve body. The oil temperature sensor detects the oil temperature directly at the hydraulic control circuit and sends the signal based on that value. The TCU controls the gear shift at all temperature zones according to the oil temperature change for smooth shift.

Auto transmission wiring

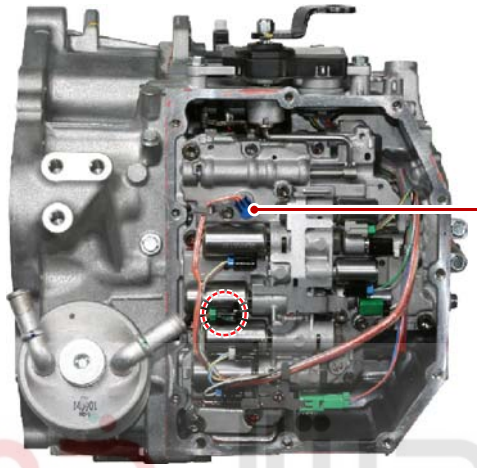


Modification basis	
Application basis	
Affected VIN	

(2) Oil temperature sensor

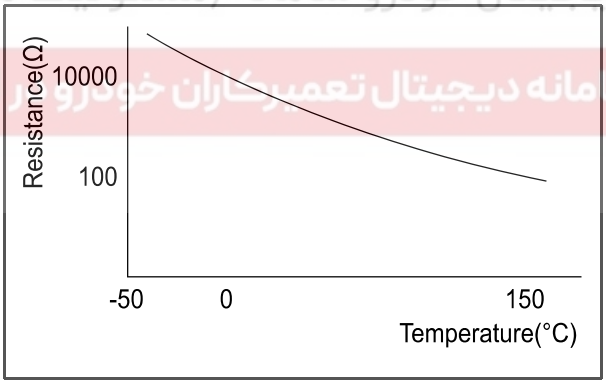
The oil temperature sensor integrated with the auto transmission wiring is fitted in the front section of the valve body. The ATF temperature sensor measures directly the oil temperature in the hydraulic control circuit and sends the value to the TCU which controls the gear shift according to the oil temperature change for smooth shift.

Mounting location



Oil temperature sensor

▶ **Oil temperature sensor specifications**



Item	Temperature	Specified value
Oil temperature sensor resistance	-40°C	161 kΩ (MAX)
	-30°C	36.3 kΩ to 52.1 KΩ
	10°C	5.626 kΩ to 7.303 KΩ
	25°C	3.5 kΩ
	110°C	0.224 kΩ to 0.271 KΩ
	145°C	0.102 kΩ to 0.121 KΩ
	150°C	0.087kΩ (MIN)

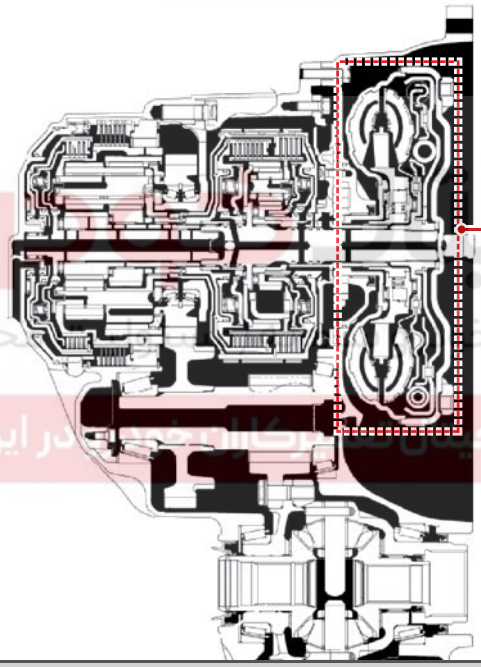
Modification basis	
Application basis	
Affected VIN	

S.G.N.
3691-22 TORQUE CONVERTER

1) Overview

The torque converter is fitted between the engine and auto transmission. It consist of the pump impeller, turbine runner, stator, one-way clutch and lock-up clutch.
The torque converter contains a single plate lock-up clutch.
The lock-up clutch is controlled and engaged by the forward gears (2nd to 6th). The torque converter transmits and amplifies the torque formed by the oil within it. The lock-up clutch connects the engine directly to the auto transmission in order to improve the fuel economy.

2) Mounting Location & Views



Mounting location

Views

Front view	Rear view
	

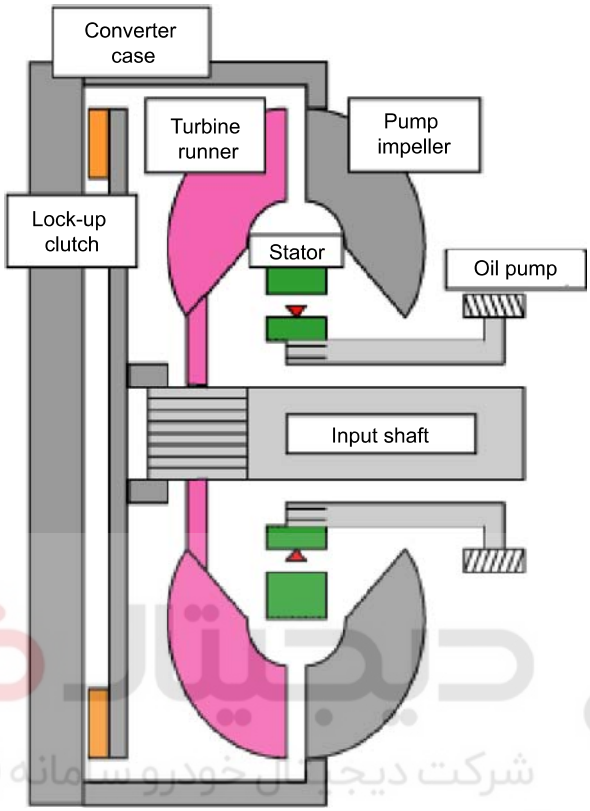
Modification basis	
Application basis	
Affected VIN	

3) Operation Principle

- The impeller, which is driven by the engine, imparts a circular flow to the oil in the converter.
- This oil strikes the turbine wheel, which causes the flow to change its direction.
- The oil flows out of the turbine wheel close to the hub and strikes the stator, where its direction is changed again to a direction suitable for re-entering the impeller.
- The change in direction at the stator generates a torque reaction that increases the torque reaching the turbine.
- The ratio between turbine and impeller torque is referred to as torque multiplication or conversion.
- The greater the difference in speeds of rotation at the impeller and turbine, the greater the increase in torque; The maximum increase is obtained when the turbine wheel is stationary. As turbine wheel speed increases, the amount of torque multiplication gradually drops.
- When the turbine wheel is rotating at about 85 % of the impeller speed, torque at the turbine wheel is no higher than at the impeller.
- The stator, which is prevented from rotating backwards by a one-way clutch and the shaft in the auto transmission housing, runs freely in the oil flow and overruns the one-way clutch. From this point on, the converter acts only as a fluid coupling.
- During the torque conversion process, the stator ceases to rotate and bears against the housing via the one-way clutch.

4) Torque Converter Lock-up Clutch

Internal components



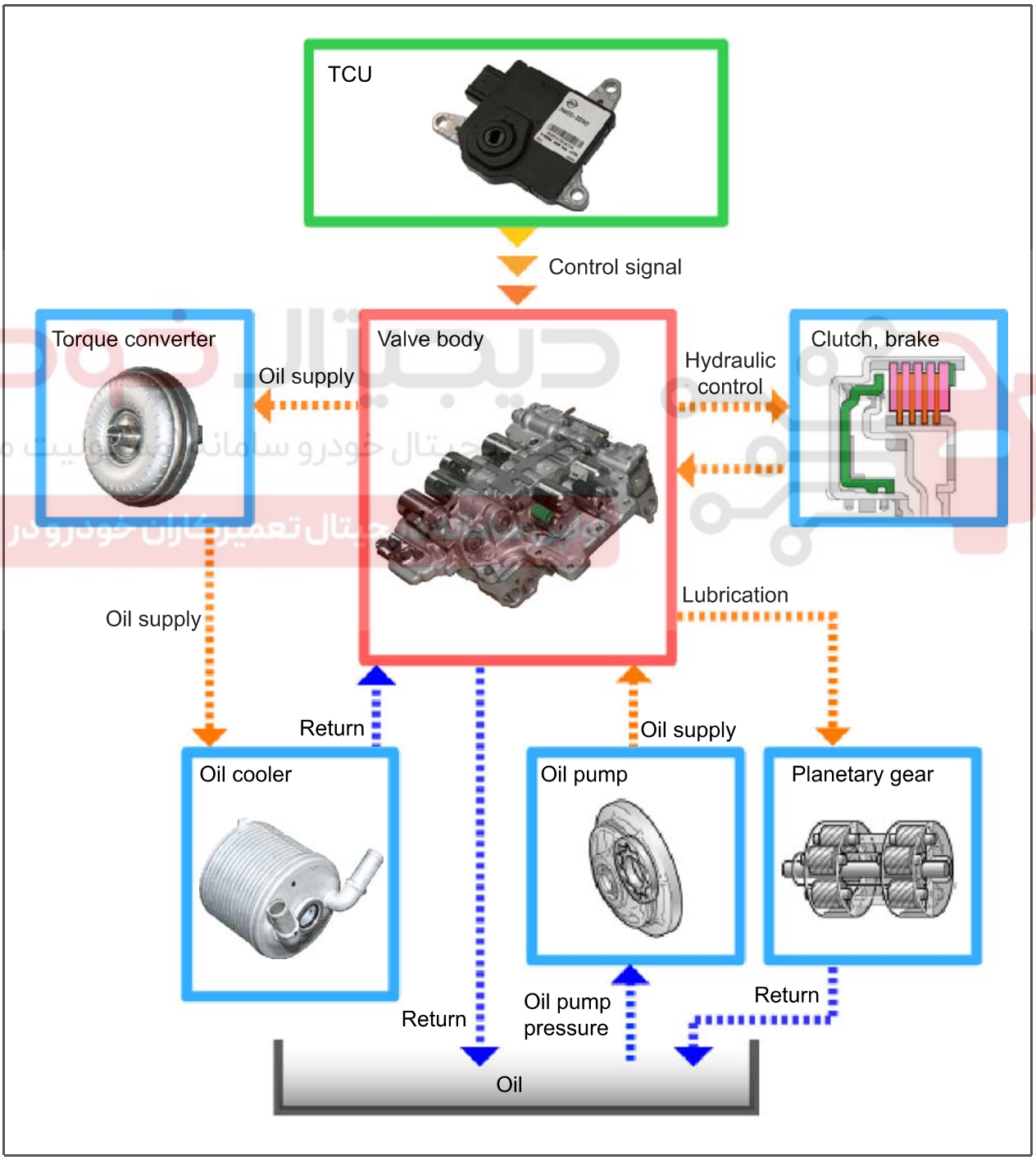
- The torque converter lock-up clutch is a device that eliminates slip in the torque converter and therefore helps to keep fuel consumption to a minimum.
- The torque converter lock-up clutch has a cooling nozzle which enables torque converter slip control. This provides a partial torque converter lock-up mode at the lower speed than normal engine rpm, which improves fuel economy.
- The torque converter lock-up clutch is engaged and released by the lock-up control system in the TCU.
- Pressure at the torque converter lock-up clutch piston is determined by the lock-up control solenoid (SLU) fitted to the valve body, based on the engine rpm, throttle opening signal, input speed sensor (NIN) signal and output speed sensor signal (SP).
- The torque converter lock-up clutch can be controlled and engaged in any gear from 2st to 6th. When the torque converter lock-up clutch is released, the pressure of the AFT behind the lock-up clutch piston at the turbine part will become equal.
- In order to engage the torque converter lock-up clutch, the ATF flow direction should be changed by the valve in the auto transmission pump. At the same time, the ATF at an area behind the torque converter lock-up clutch piston will be drained. The oil pressure increases from the turbine part to the torque converter lock-up clutch piston, ensuring that the piston is in contact with the torque converter cover. This allows the turbine wheel between the piston and cover to be locked and slip with restricted drive power can be transmitted to the planetary gear train under the normal operating conditions.

Modification basis	
Application basis	
Affected VIN	

S.G.N.
3693-15 VALVE BODY ASSEMBLY

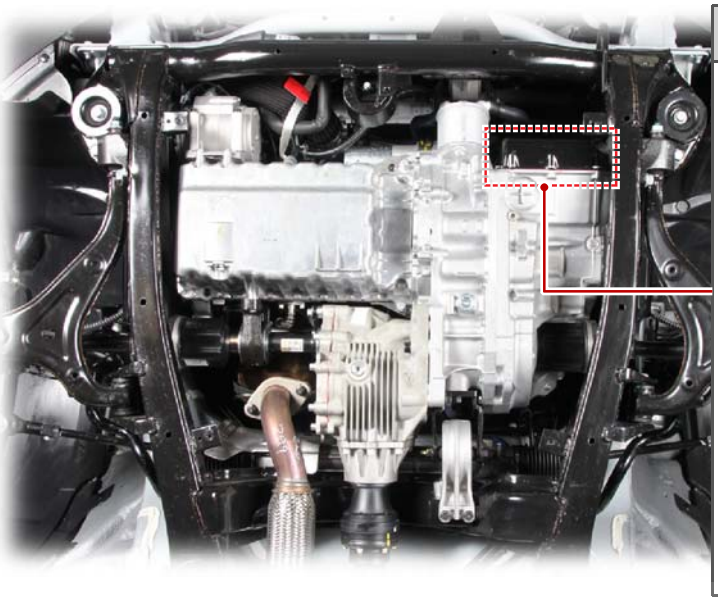
1) Overview

The valve body supply oil by switching the oil circuit for the hydraulic pressure generated by the oil pump. Based on the control signal from the TCU, the 8 solenoid valves in the valve body are activated to control the hydraulic pressure to the clutch and brakes, performing gear shift and lock-up. In addition, an appropriate amount of oil is supplied to the torque converter, planetary gears and each lubricating parts.

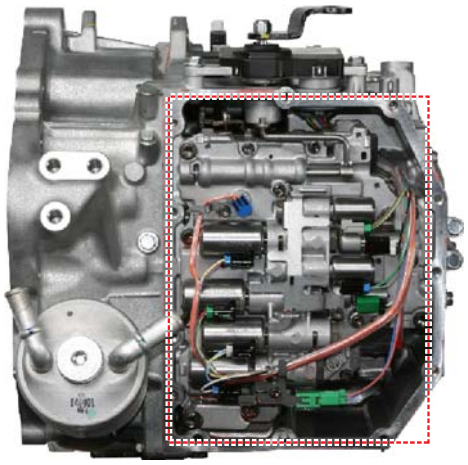


Modification basis	
Application basis	
Affected VIN	

2) Mounting Location



Mounting location of valve body



Valve body assembly

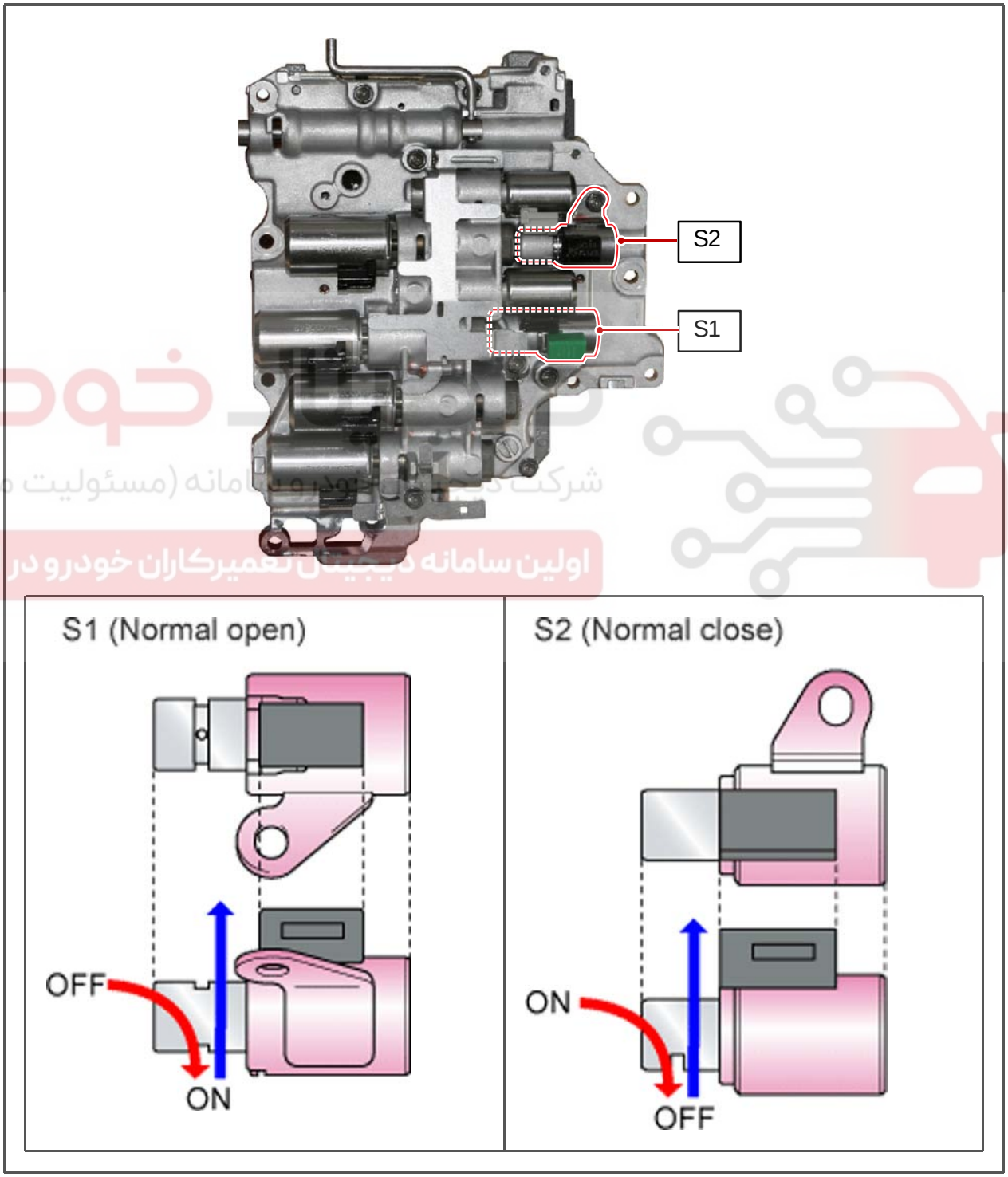
Front view	Rear view
	

Modification basis	
Application basis	
Affected VIN	

3) Mounting Location of Solenoid

▶ **Shift solenoids [S1, S2]**

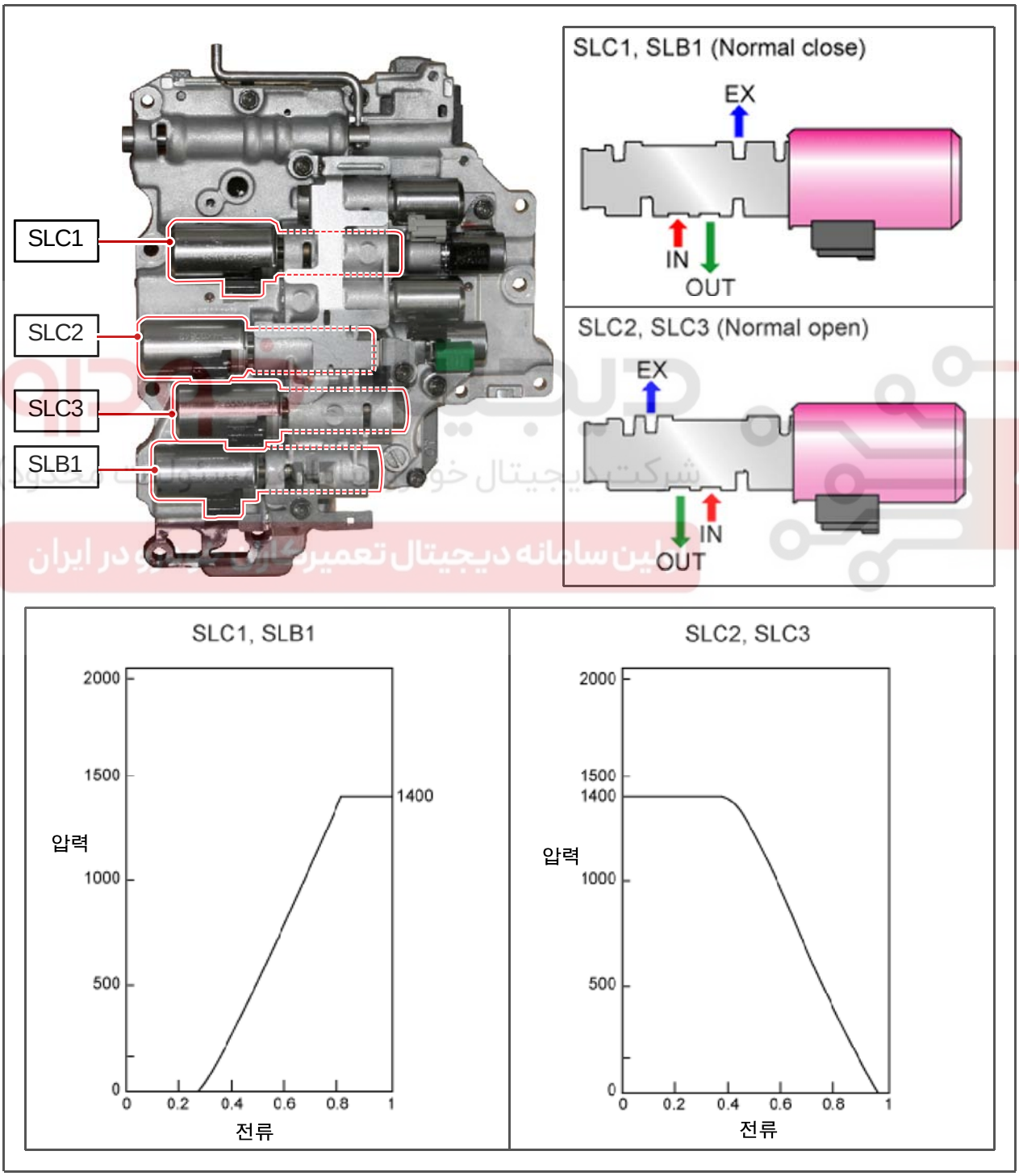
The shift solenoids [S1, S2] are fitted to the front valve body and turn on and off based on the output signal from the TCU. The 1st gear engine brake is activated or the gear shift occurs depending on the S1 or S2 ON/OFF. In the event of the shift solenoid failure, the TCU does not perform the current control for the solenoid as a fail safe function.



Modification basis	
Application basis	
Affected VIN	

▶ Shift control solenoids [SLC1, SLC2, SLC3 and SLB1]

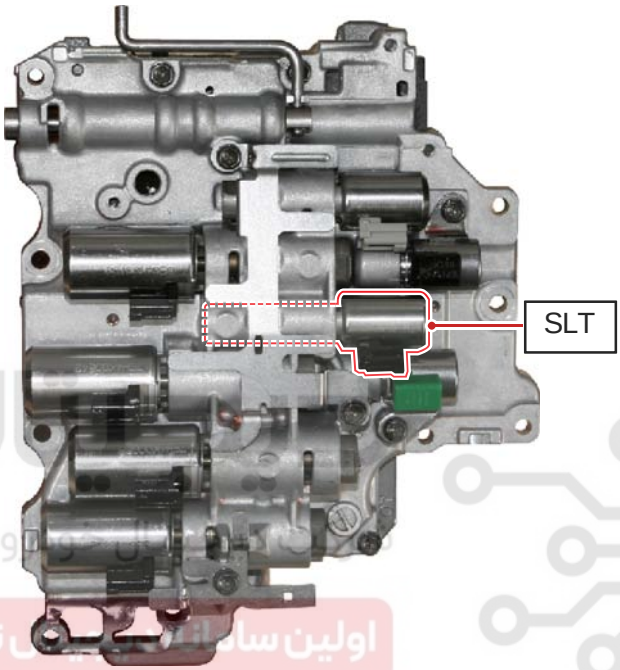
The shift control solenoids [SLC1, SLC2, SLC3, SLB1] are mounted to the front valve body. The solenoid controls the hydraulic pressure linearly, based on the output signal from the TCU. In this way, it controls the clutches [C1, C2 and C3] and brakes [B1 and B2] using a hydraulic pressure for smooth shift. The auto transmission shifts up or down from 1st to 6th, depending on the combination of ON/OFF status of the shift control solenoids In the event of the shift solenoid failure, the TCU does not perform the current control for the solenoid as a fail safe function.

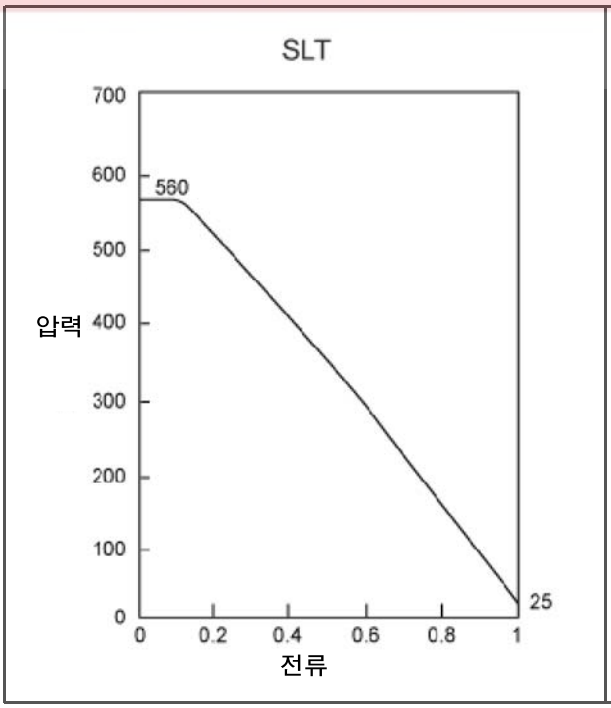


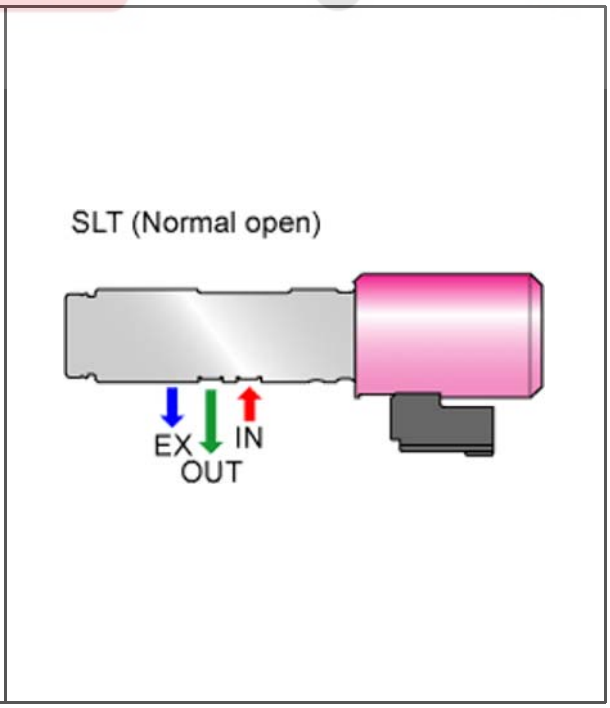
Modification basis	
Application basis	
Affected VIN	

▶ Line pressure control solenoid [SLT]

The line pressure control solenoid [SLT] is fitted to the front valve body. The solenoid controls the line pressure linearly according to the duty ratio predefined by the TCU, based on the throttle opening and engine torque signal. In this way, it controls the clutch and brake using a hydraulic pressure for smooth shift. In the event of the line pressure solenoid failure, the TCU does not perform the current control for the line pressure solenoid as a fail safe function. (The line pressure will be maximized when it is impossible to control the current to the shift control solenoid in the event of failure excepting "stuck")



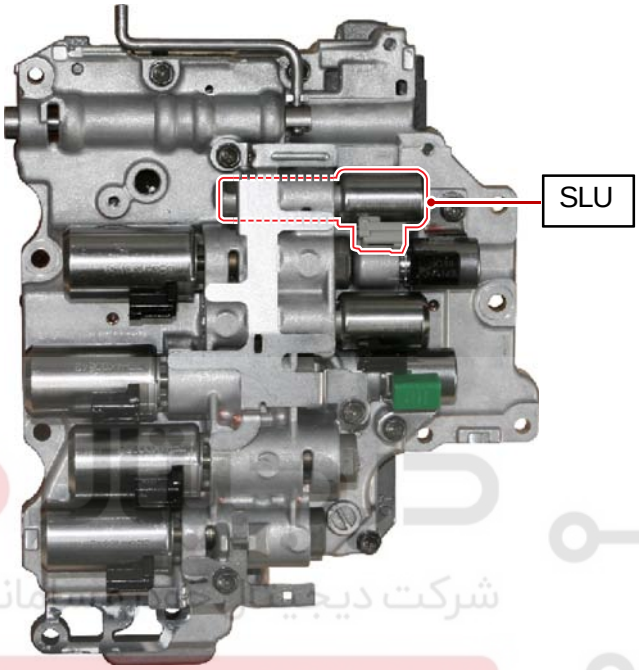


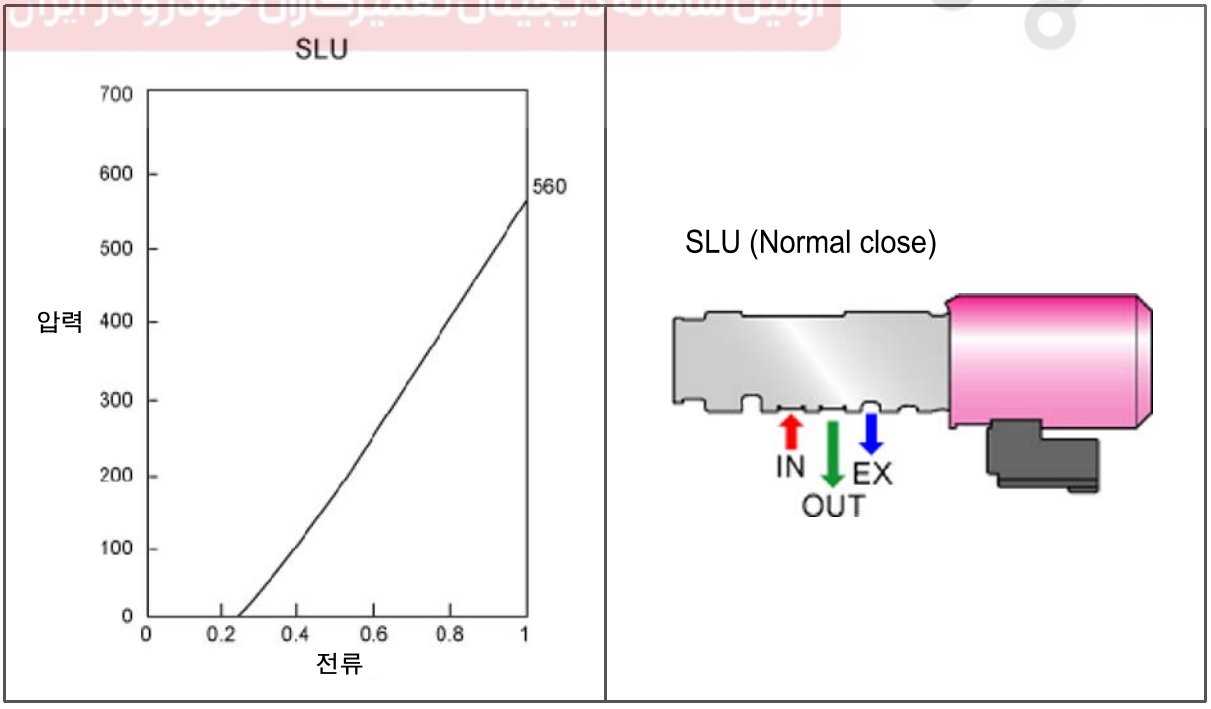


Modification basis	
Application basis	
Affected VIN	

▶ Lock-up control solenoid [SLU]

The lock-up control solenoid [SLU] is fitted to the front valve body.
It controls the lock-up clutch hydraulic pressure linearly, based on the engine rpm, throttle opening signal, input speed sensor [NIN] signal and output speed sensor [SP] signal.
In this way, it controls the lock-up. In the event of the lock-up control solenoid [SLU] failure, the TCU will shut off the current to the solenoid as a fail safe function.





Modification basis	
Application basis	
Affected VIN	

S.G.N. 3691-07

TCU (SHIFT POSITION SENSOR)

1) Overview

The TCU controls the gear groups according to the driving conditions. It receives the driving data from many sensors and switches as input signals. It is also connected with ECU, ESP HECU and instrument panel.
Function of the shift position sensor is fitted as a part of the TCU. A/T shift position is calculated by the TCU.

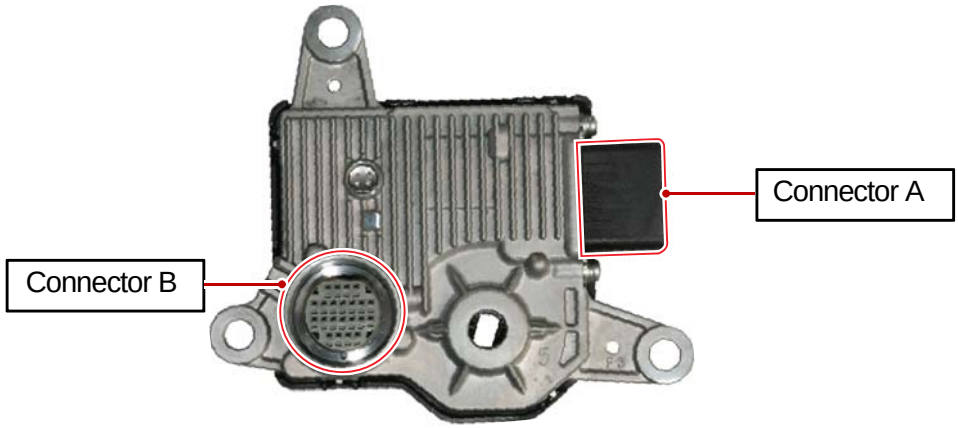
2) Mounting Location

TCU (integrated to shift position sensor)

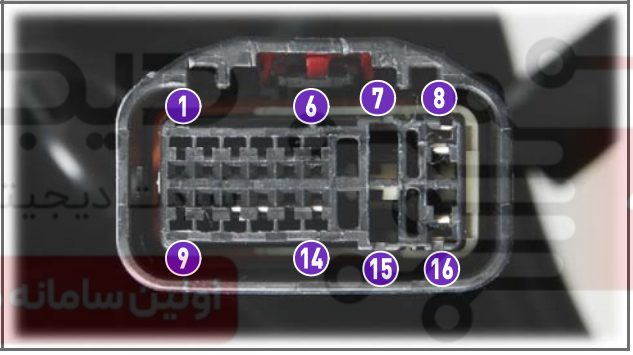

TCU	
Front view	Rear view
	

Modification basis	
Application basis	
Affected VIN	

3) Connector Description



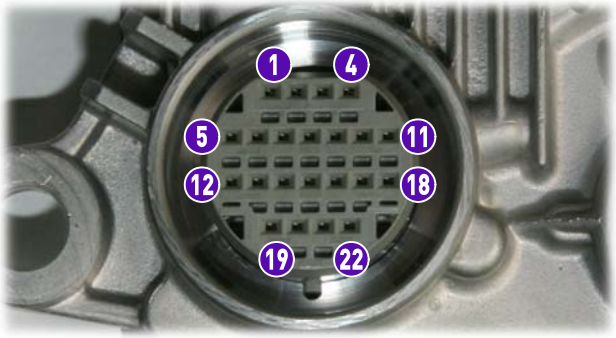
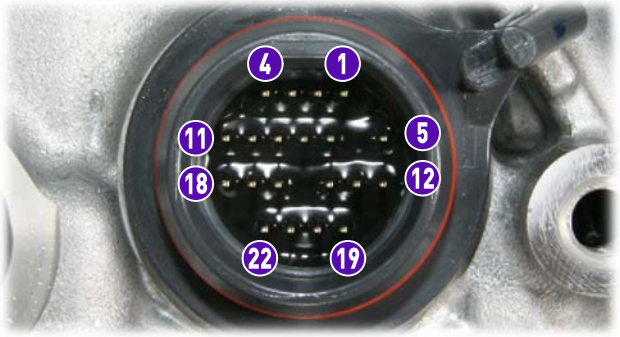
▶ **Connector A**

Component side	Wiring side
	

Pin No.	Function	Pin No.	Function
A1	-	A9	-
A2	Manual mode switch (+)	A10	-
A3	P-CAN LO	A11	P-CAN HI
A4	Start relay signal input	A12	Shift lock solenoid control (+)
A5	Tip switch (-)	A13	-
A6	Tip switch (+)	A14	IGN1
A7	-	A15	-
A8	B+	A16	TCU ground

Modification basis	
Application basis	
Affected VIN	

▶ **Connector B**

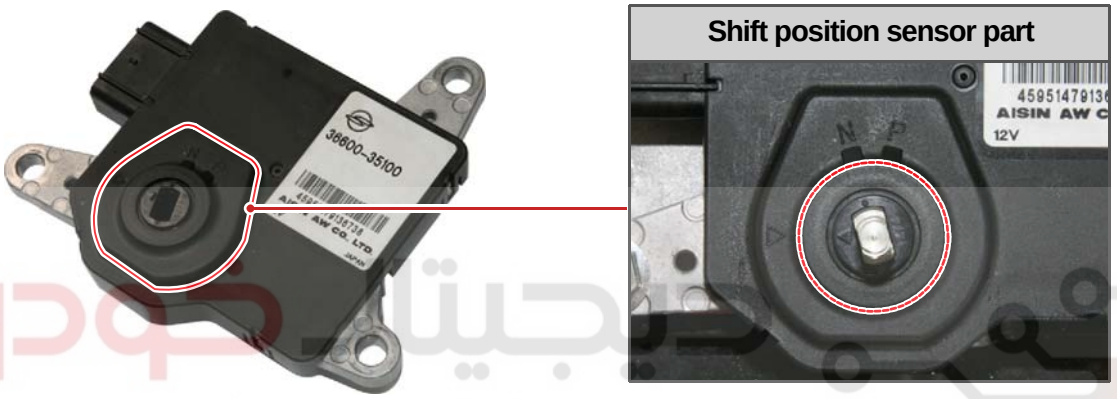
Component side	Wiring side
	

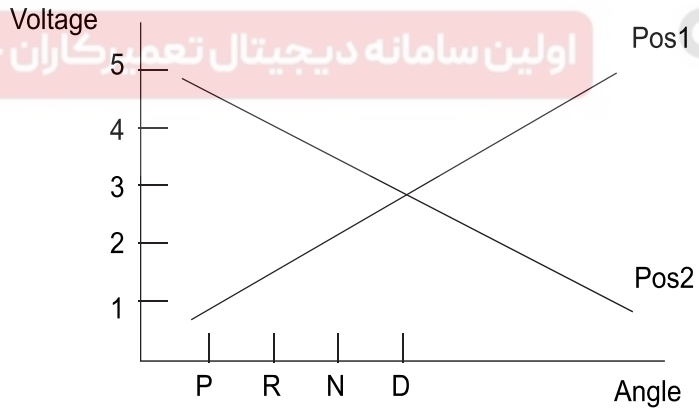
Pin No.	Function	Pin No.	Function
B1	Line pressure solenoid (SLT-)	B12	Input speed sensor [NIN+]
B2	Shift solenoid No. 2 [S2]	B13	Input speed sensor [NIN-]
B3	Line pressure solenoid (SLT+)	B14	Shift control solenoid (SLC3+)
B4	Lock-up solenoid (SLU-)	B15	-
B5	Shift solenoid No. 1 [S1]	B16	B1 solenoid (SLB1-)
B6	-	B17	C2 solenoid (SLC2+)
B7	Oil temperature sensor [OT-]	B18	C2 solenoid (SLC2-)
B8	Oil temperature sensor [OT+]	B19	Output speed sensor [SP+]
B9	Lock-up solenoid (SLU+)	B20	Output speed sensor [SP-]
B10	C1 solenoid (SLC1-)	B21	B1 solenoid (SLB1+)
B11	C1 solenoid (SLC1+)	B22	C3 solenoid (SLC3-)

4) Shift Position Sensor (Integrated with TCU)

The 6 speed auto transmission fitted to this vehicle has a non-contact type shift position sensor integrated with the TCU. The sensor detects the shift position using the hall effect which outputs voltage depending on the position of the magnet at the shift positions (P, R, N and D).
The shift position sensor integrated into the TCU has the advantages as follows:

- A compact and lightweight unit can be achieved since the parts has been simplified (simplified wiring).
- There is no wiring circuit between the TCU and shift position sensor, resulting improved reliability.





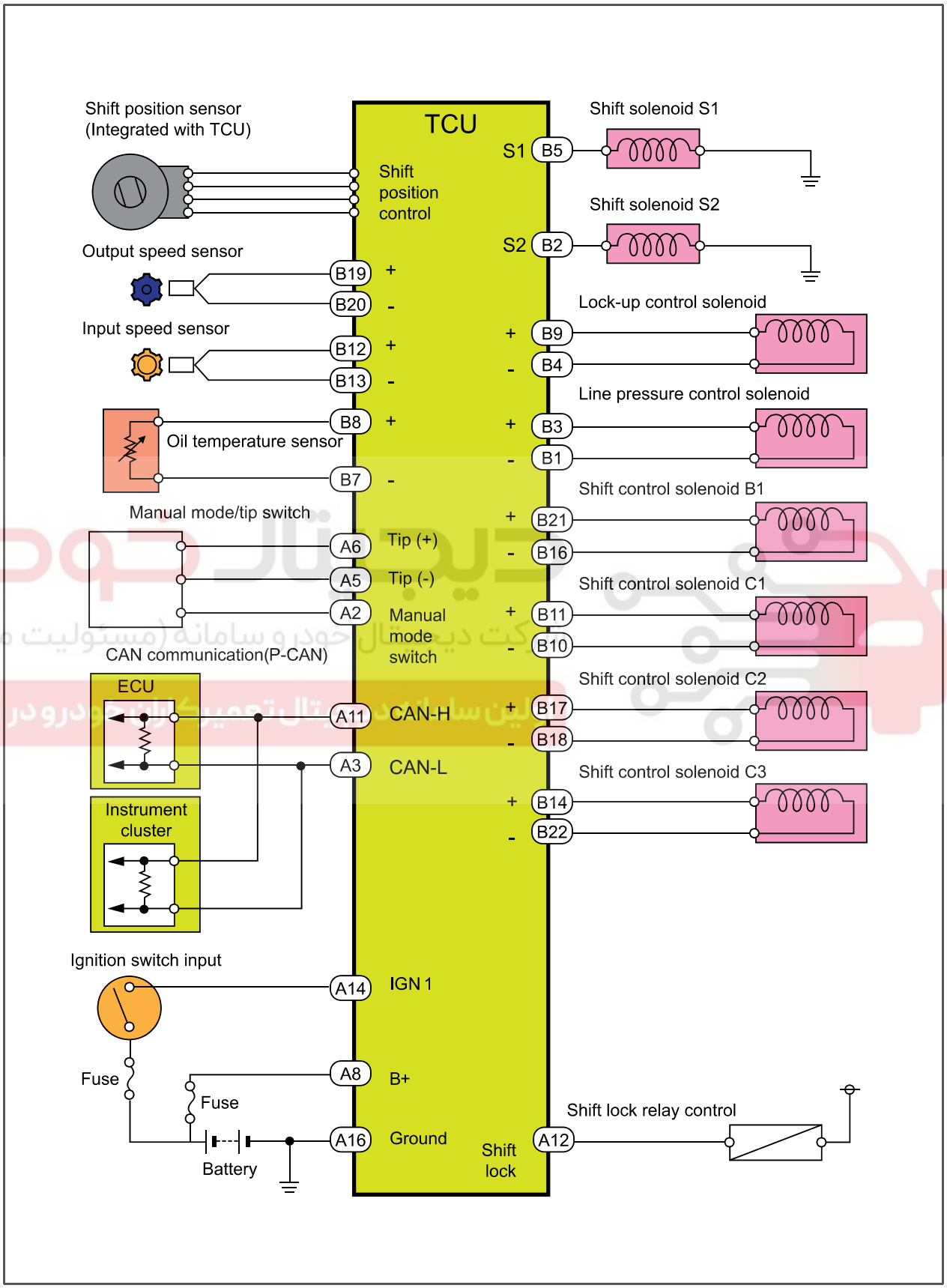
How to determine position

NOTE

When the TCU has been replaced or removed and fitted, "N" position learning should be performed.

Modification basis	
Application basis	
Affected VIN	

5) TCU Block Diagram



Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

KORANDO 2015.01

S.G.N. 3724-01

DRIVING MODE SWITCH

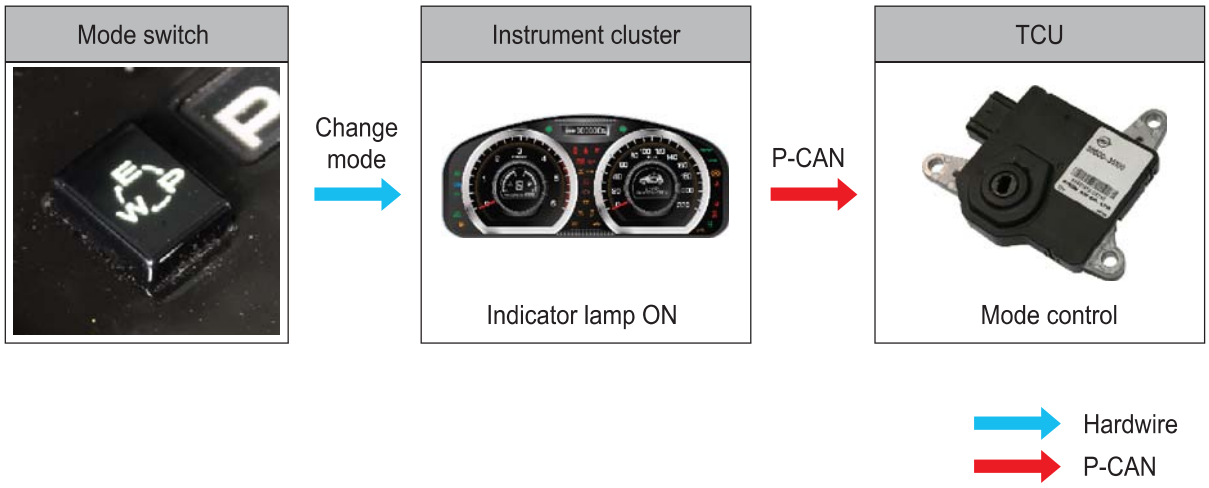
1) Overview

The driving mode switch is located on the driver's lower panel: E (ECO standard mode), P (Power mode) and W (Winter mode).
The driver can switch the driving mode to desired mode simply by operating the switch depending on the driving conditions.
The driving mode cycles from E (ECO standard mode) → P (Power mode) → W (Winter mode) → E (ECO standard mode) each time the mode switch is pressed. The indicator on the instrument cluster also comes on when the mode is changed.
The driving mode switch recognition is carried out by sending the mode signal to the TCU through the hardwire from the instrument cluster via the CAN communication signal.

2) Mounting Location

Modification basis	
Application basis	
Affected VIN	

Signal flow diagram



E (ECO) mode

This fuel-saving mode is used for normal driving and does not trigger any warning light on the instrument cluster.

P (Power) mode

This mode facilitates the driving performance by improving the driving force for passing.
Pressing the mode switch once in E (ECO) mode changes the driving mode to power mode and turns on the power mode indicator (green) on the instrument cluster.

W (Winter) mode

When starting off the vehicle in this mode on roads that are icy, the 2nd gear is selected to prevent slipping.
Pressing the mode switch once in power mode changes the driving mode to winter mode and turns on the winter mode indicator (green) on the instrument cluster.

NOTE

After the ignition switch is cycled OFF and ON the mode is switched back to E (ECO standard mode) whatever the previous mode was.

S.G.N. 3724-05

TGS LEVER

1) Overview

The driver can use the TGS lever to maintain the auto transmission to desired driving mode (parking, reverse, neutral or forward). In addition, the TGS lever knob is equipped with a tip switch so that the driver can select the gear positions (1st to 6th) manually when the TGS lever is in "M" position.
Two safety functions have been installed; P Lock function which allows the driver to shift gears only when the brake pedal is depressed with the lever in "P" position and R Lock function which the driver can not shift the lever from "N" position to "R" position.

NOTE

When you shift lever from "D" to "P" position abruptly with R Lock activated, an intermittent sticking may be occurred, which is quite normal.

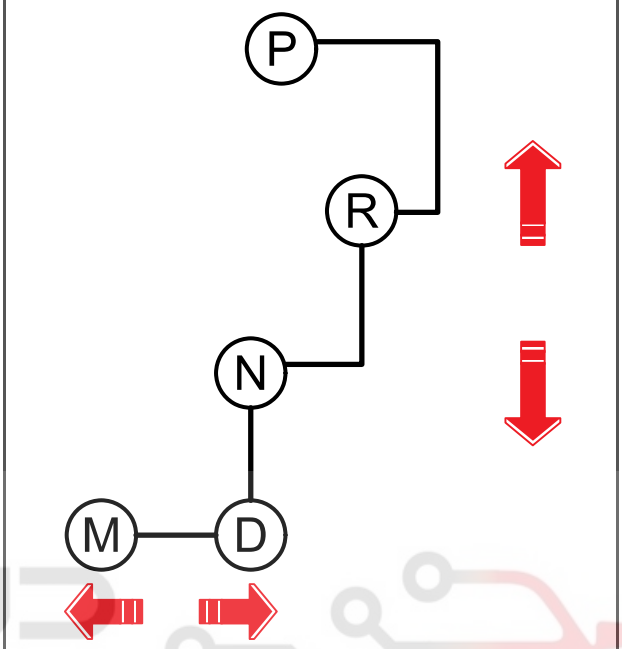
2) Mounting Location & Components

Modification basis	
Application basis	
Affected VIN	

3) How TGS Lever Works

(1) Change TGS lever position

Operating pattern



P The position in which engine can start and vehicle is parked.
In order to move the lever from P position to other positions, always depress the brake pedal with the ignition on.

R The position used for reversing the vehicle. The gear ratio is 3.193 : 1 for reverse.

N This position in which the engine does not transfer power to the wheels is for temporary stopping or towing of the vehicle. The engine can be started in this position. When towing the vehicle, the vehicle speed should be below 50 km/h and the towing distance should be within 50 km.

D Use this position in normal driving conditions. The transmission is automatically shifted from 1st gear through 6th gear according to the vehicle speed and how far the accelerator pedal is depressed.

M At this position, the driver can shift the gear manually using the tip switch on top of the shift lever by moving the lever from D to M position while driving.

4) Manual Shift in M Position

Since the system recognizes the switch signal when you move the TGS lever from D to M position and push (+) or pull (-) the tip switch on the TGS lever knob, the driver can change the gear position and use the engine brake.

This indicates the most appropriate timing for shifting to the 4th gear (target) when the vehicle is driven in 3rd gear.

NOTE

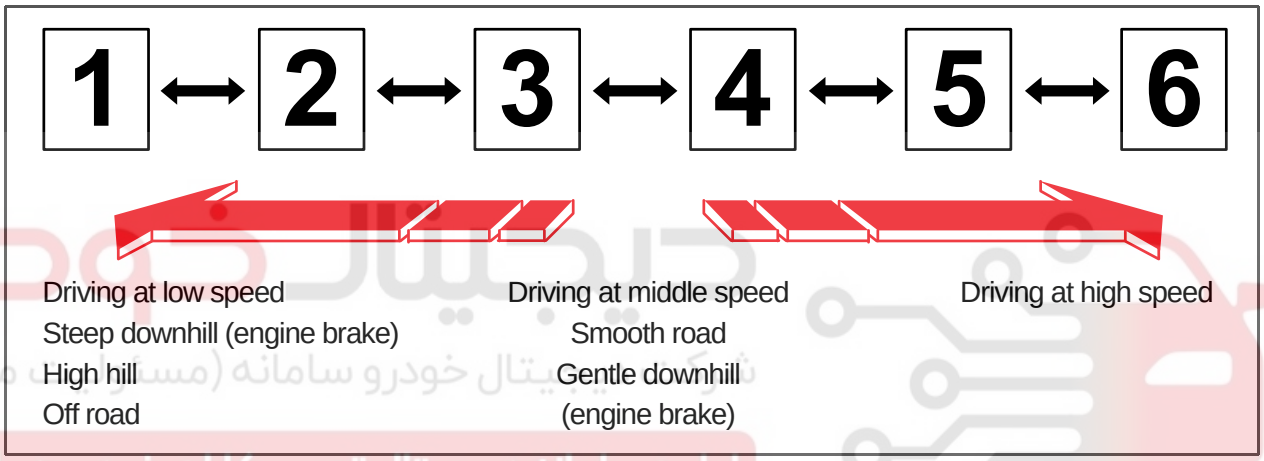
When the engine rpm is high, upshift can occur to avoid any damage to the system without changing the gear in time, with forward gears such as 1st, 2nd and 3rd engaged.

▶ Activate manual mode

Changing the shift lever from D to M position and knob switch on the TGS lever to + (up shift) or - (down shift) allows the driver to choose the required gear and feel the sportiness as in the manual transmission. However, the TCU performs the lock-up control by up-shifting automatically and by down-shifting during deceleration, in order to prevent the excessive rpm increase.

- When the vehicle is stationary (0 km/h), the driver can engage up to 2nd gear and the vehicle can start from 2nd gear on an icy road or a slippery road (for Winter mode).
- When you move the lever to "M" position while driving, generally 1 or 2 gear downshift will be performed from the current gear. However, the current gear can be maintained to avoid the shift shock or damage to the system.

▶ Selecting suitable gear



5) Shift Lock Function

(1) P Lock function

Unless the ignition switch is turned to "ON" or the brake pedal is pressed, the TGS lever does not activate the locking solenoid and the selector lever stays locked.
In order for the TGS lever to be able to move, always turn the ignition switch to "ON" position and depress the brake pedal.

(2) R Lock function

Unless depressing the brake pedal with the selector lever in "N" position, the locking solenoid can't be activated which causes the TGS lever not to move to "R" position.
In order for the TGS lever to be able to move, always turn the ignition switch to "ON" position and depress the brake pedal.

(3) Shift lock solenoid operation logic

Input				Lock position	Solenoid	Other
Lever position	Ignition	Brake pedal actuation	Speed			
-	OFF	-	-	-	OFF	-
P	ON	OFF	-	LOCK	OFF	P Lock
P	ON	ON	-	UNLOCK	ON	P Lock released
P, R	ON	-	-	-	OFF	Use last available position
R	ON	-	-	-	OFF	
R, N	ON	-	-	-	OFF	Use last available position
N	ON	OFF	Below 8~11 km/h	LOCK	OFF	R Lock
N	ON	ON	Below 8~11 km/h	UNLOCK	ON	R Lock released
N	ON	-	Above 8~11 km/h	LOCK	OFF	R Lock
N, D	ON	-	-	-	OFF	Use last available position
D	ON	-	-	-	OFF	-

(4) Deactivate shift lock

If you cannot shift out of the position "P" or "N" with the ignition key ON and the brake pedal depressed, move the lever manually as shown in the figure below.

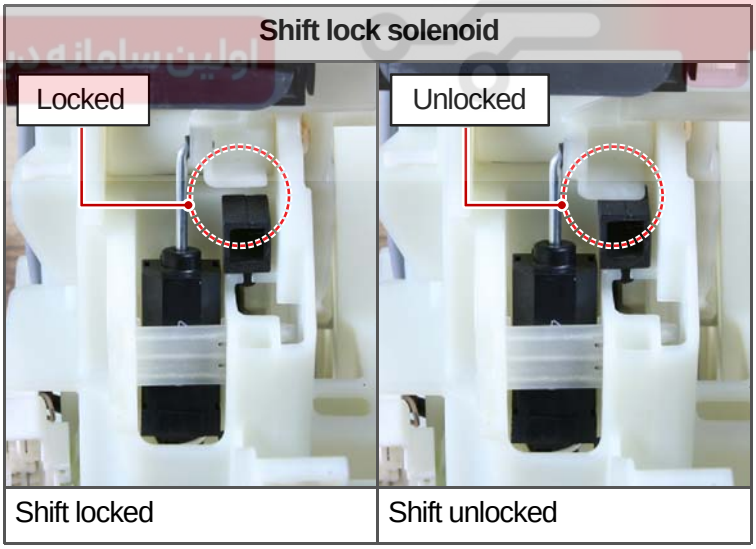
1. Turn off the engine and apply the parking
2. brake.
   Depress the brake pedal, move the TGS lever to another position with the activation part (lock release button) of the solenoid valve pressed with your finger.

CAUTION

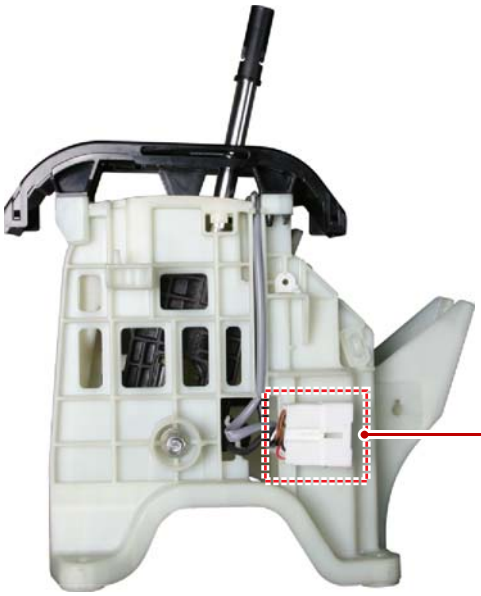
Make sure that the internal parts are not broken by the pressing with an excessive force.

▶ Shift lock solenoid function

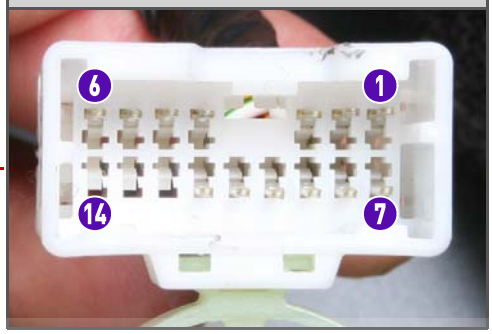
The shift lock solenoid is unlocked by the signal from the brake pedal. You can also release the lock manually by pressing the lock release button with finger.



6) TGS Lever Connector



TGS lever connector



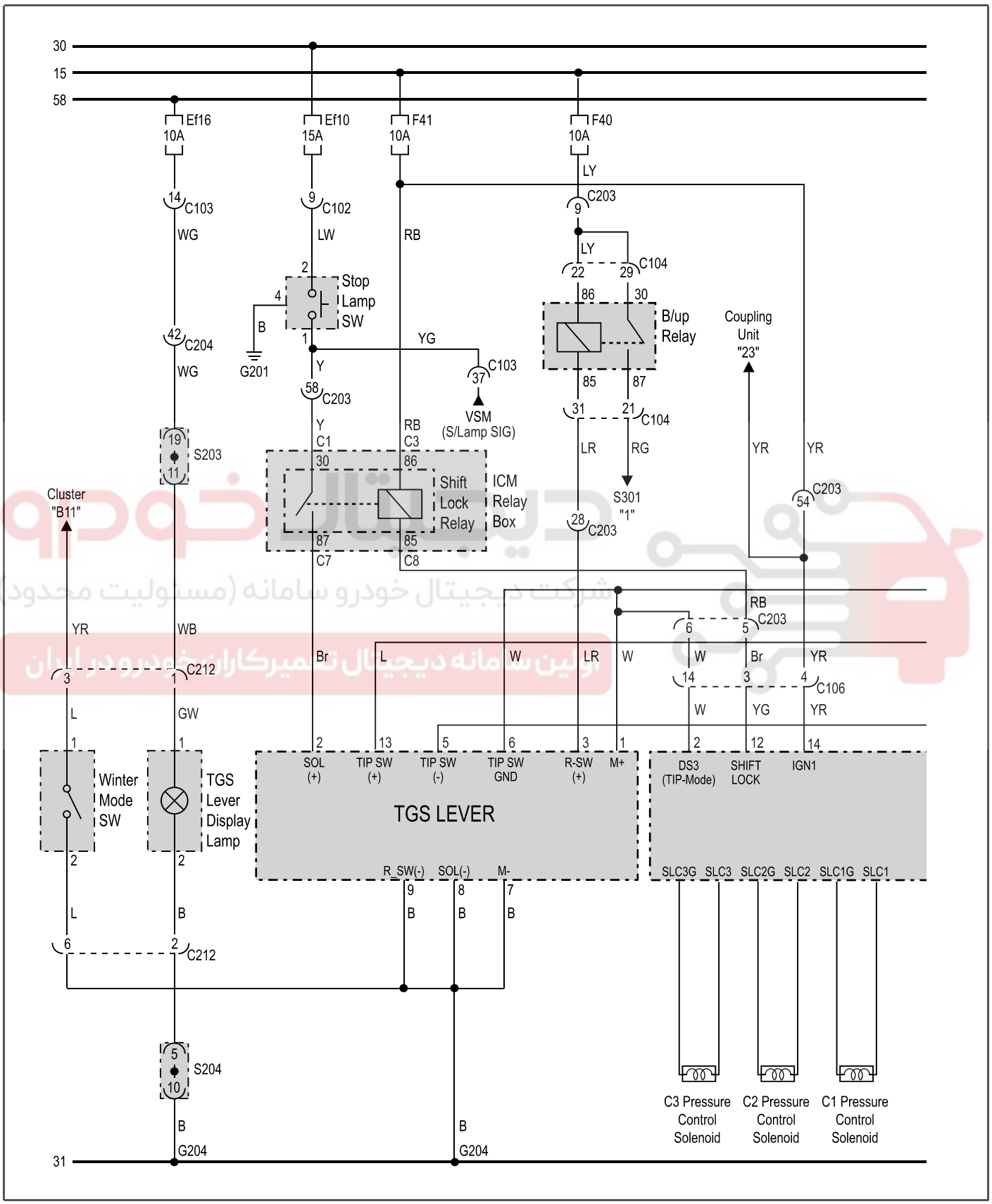
Pin No.	Function	Remarks
1	Manual mode switch (+)	Transmits to TCU (A2)
2	Shift lock solenoid	Shift lock relay
3	Reverse position switch	Backup lamp relay
4	-	-
5	Tip switch (+)	Transmits to TCU (A6)
6	Tip switch ground	Ground
7	Manual mode switch ground	Ground
8	Shift lock solenoid ground	Ground
9	Reverse position switch ground	Ground
10	-	-
11	-	-
12	-	-
13	Tip switch (-)	Transmits to TCU (A5)
14	-	-

Modification basis	
Application basis	
Affected VIN	

Memo

S.G.N. 3691-07

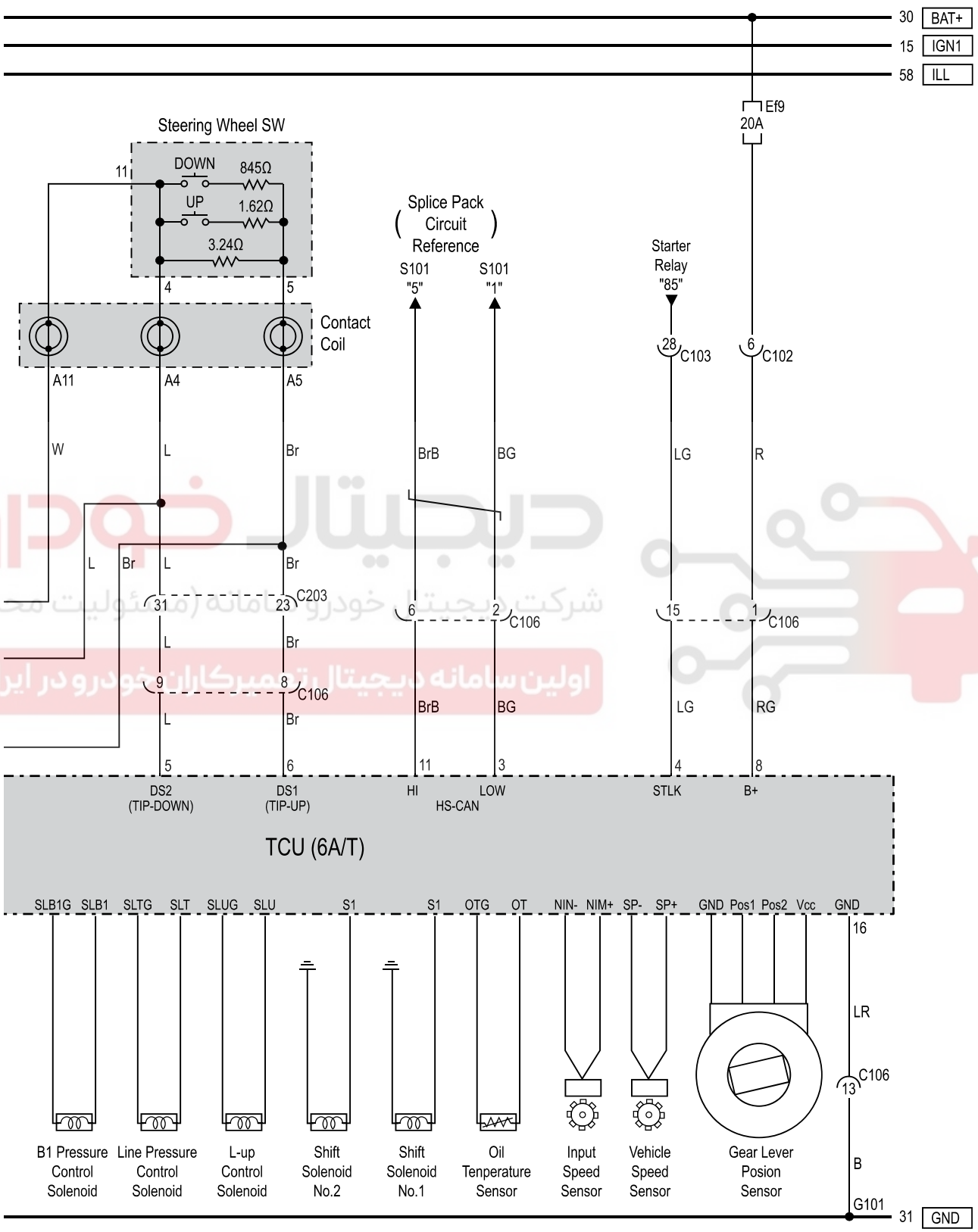
TCU/TGS LEVER CIRCUIT DIAGRAM



AISIN 6 SPEED AUTO TRANSAXLE

KORANDO 2015.01

Modification basis	
Application basis	
Affected VIN	



Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

KORANDO 2015.01

REMOVAL AND INSTALLATION

S.G.N. 3690-00 FUNCITONAL TEST

1) Shift Time Lag Test

NOTE

- Perform the test about 3 times and take the average.
- Carry out the test at intervals of 1 minute.

- Apply the parking brake and place the wheel chocks under each tyres.
- Start the engine. (engine coolant temperature of 80℃ to 100℃)
- Depress the brake pedal.
- Measure the time until you feel the shift shock while changing the shift lever from "N" position to "D" or "R" position.

Selector lever position	Duration
From "N" to "D" position	Less than 1.0 sec.
From "N" to "R" position	Less than 1.5 sec.

▶ **Test result**

Test result	Possible cause
From "N" to "D" position: longer than standard	- Defective valve body (SLC1 hydraulic system) - C1 clutch slippage - One-way clutch [F1] failure - Oil pump failure - Blocked oil strainer
From "N" to "R" position: longer than standard	- Defective valve body (SLC3 hydraulic system) - C3 clutch slippage - B2 brake slippage - Oil pump failure - Blocked oil strainer

2) Stall Test

This test can be used to check if the shift clutch can hold the maximum engine torque without slip. Since the stall test causes considerable harm to the automatic transmission, it should be completed within 5 seconds and carried out only when it's absolutely necessary.
Perform the stall test about 3 times and take the average.

CAUTION

- Make sure that no one is in the vicinity of the vehicle since the vehicle may move suddenly during test.
- Before carrying out the test, check the AFT level and temperature and engine coolant temperature.

NOTE

Refer to the sensor data items "Engine RPM, input shaft speed sensor, output shaft speed sensor" in the diagnostic program for measuring.

- Apply the parking brake and place the wheel chocks under each tyres.
- Start the engine. (engine coolant temperature of 80℃ to 100℃)
- Depress the brake pedal.
- Move the shift lever to "D" position.
- Depress the brake pedal fully and measure the engine's maximum rpm.
- Move the shift lever to "R" position.
- Perform the stall test at "D" position. Always wait for at least 2~3 minutes with lever in "N" position before carrying the stall test at "R" position.
- Depress the brake pedal fully and measure the engine's maximum rpm.

If the engine speed is above 2,800 ± 150 rpm, there may be a fault in the auto transmission.

Test result	Possible cause
Values at both "D" and "R" position are less than standard.	Insufficient engine power One-way clutch slippage
Value at "D" position is higher than standard.	High line pressure (Line pressure solenoid valve [SLT] failure) - Defective valve body (SLC1 hydraulic system) - C1 clutch slippage - One-way clutch [F1] failure
Value at "R" position is higher than standard.	High line pressure (Line pressure solenoid valve [SLT] failure) - Defective valve body (SLC3 hydraulic system) - C3 clutch slippage - B2 brake slippage
Values at both "D" and "R" position are higher than standard.	High line pressure (Shift control solenoid valve failure) - Oil pump failure - Blocked oil strainer

3) Line Pressure Test

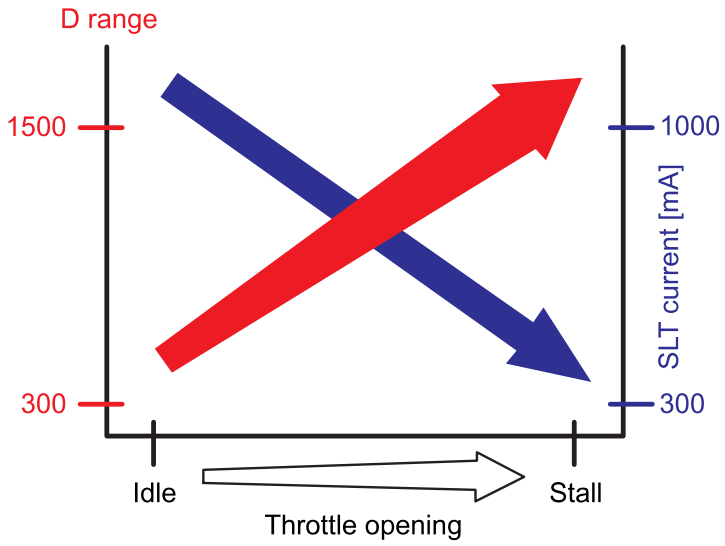
- Apply the parking brake and place the wheel chocks under each tyres.
- Refer to the sensor data items "Line pressure solenoid valve current, feedback current" in the diagnostic program for measuring.
- Remove the test plug as shown in the figure and install the pressure gauge.

- Start the engine and measure the oil pressure with the lever in "D" position and engine at idle.

reference Fluid temperature: 50℃~70℃

Engine rpm	Selector lever position	Lie pressure (kPa)
Idle	"D" position	345 ~ 515

- The oil pressure and oil pressure solenoid [SLT] current value are as shown in the graph below. The maximum oil pressure is adjusted according to the vehicle status. (except for idle)



NOTE

- Since the stall test causes considerable harm to the automatic transmission, it should be completed within 5 seconds and carried out only when it's absolutely necessary.
- Perform the stall test about 3 times and take the average.

Modification basis	
Application basis	
Affected VIN	

4) Road Test

The purpose of this test is to determine the failure symptoms correctly and to check for correct functioning after the service has been finished.
The conditions for road test are:

- Run the engine under normal driving conditions. (engine coolant temperature of 80℃ to 100℃)
- ATF temperature of 50~80℃
- A/C, electric unit, lights off
- Cruise control system off

CAUTION
Check the road for safety when testing on a normal road.

(1) Road test

Refer to the table below to perform the road test.

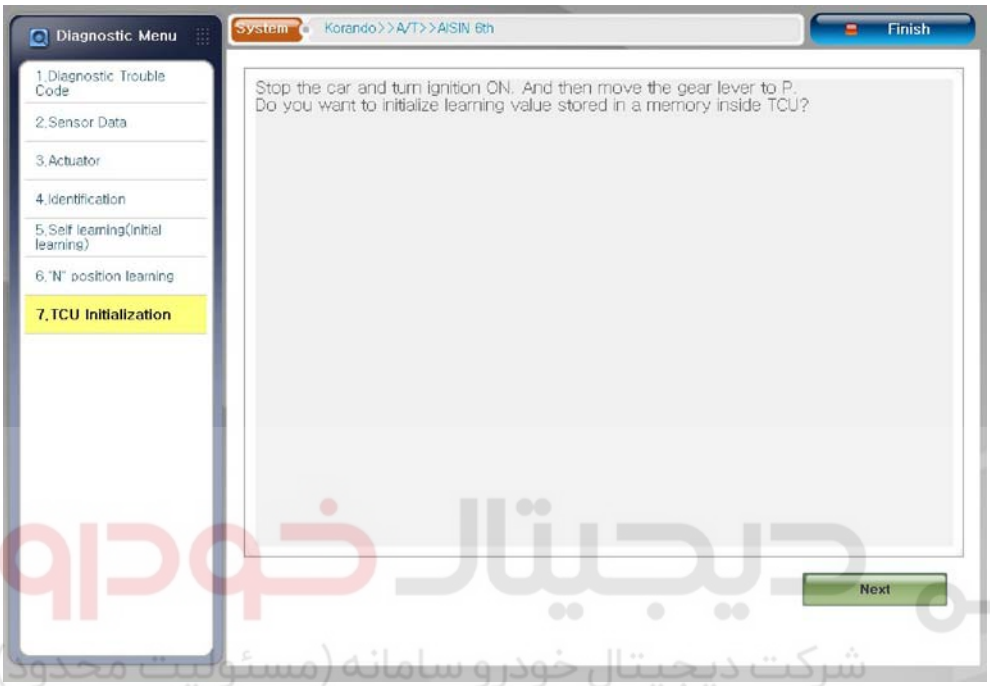
Item	Procedure
"D" position shift function	Carry out the gear change from 1st to 6th under a normal driving conditions. (You may not shift to 5th and 6th in some cases)
Shift shock level while driving	Check that the upshift is smooth at normal drive mode.
Kick-down function	- Check downshift by activating the kick-down at every gear shift. - Check the shift shock level during kick-down.
Activate engine brake	Check the engine brake operating at the manual mode, 1st gear.
Shift timing by accelerator pedal	Check if the upshift by the accelerator pedal matches with specified shift point.
Manual shift control	Check that the shift gear operates manually after changing to manual mode.
Lock-up control	When driving on a smooth road at lock-up control section, check when engine rpm does not change significantly after depressing the accelerator pedal lightly.
Movement at "P" position	Park the vehicle on a incline greater than about 5% or 3° with the shift lever in "P" position and check if the vehicle does not move when the park brake is released.
Oil leakage	Check that there is no external oil leakage after road test.

S.G.N. 3690-00

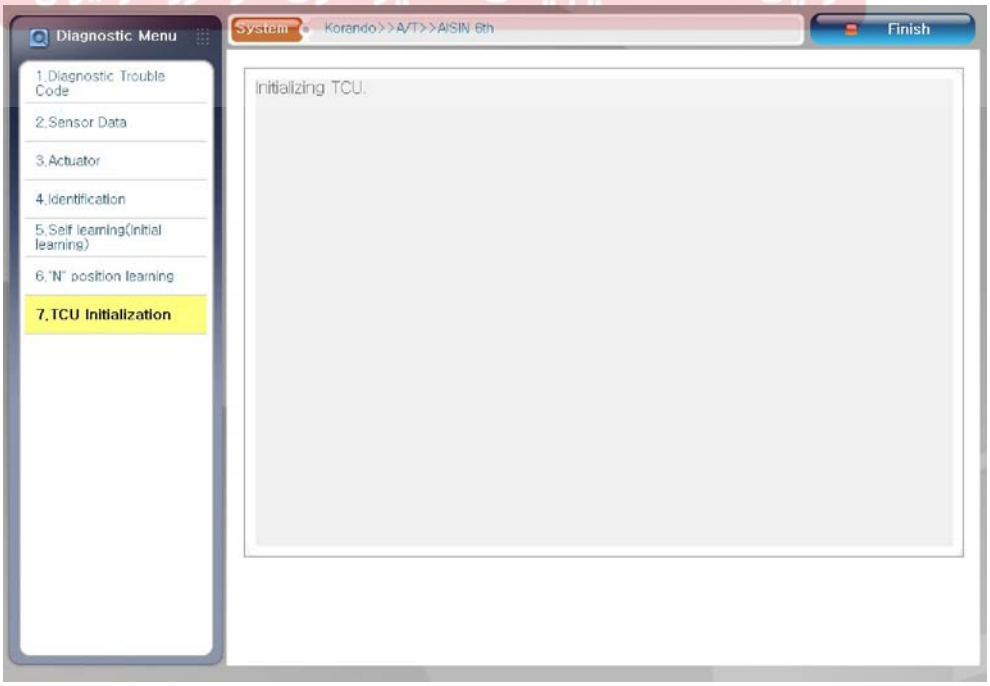
INITIALIZING/LEARNING PROCESS

1) TCU Initialization

1. Select "TCU Initialization" on the diagnosis menu and press "Next" button as instructed on the screens.

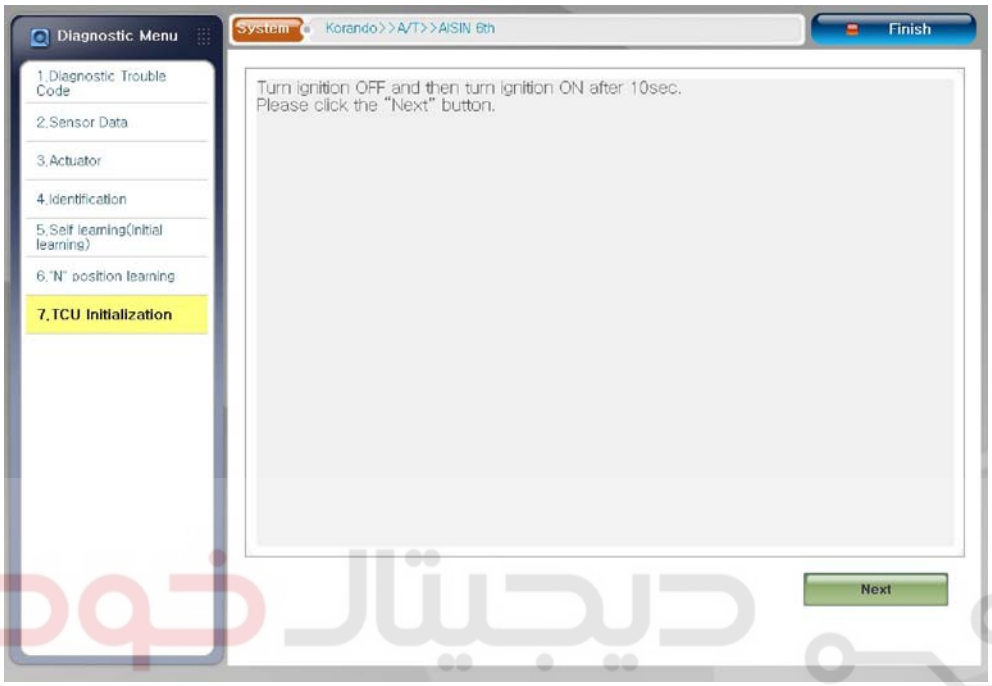


2. Click on the [Done] button when the initialization is completed.

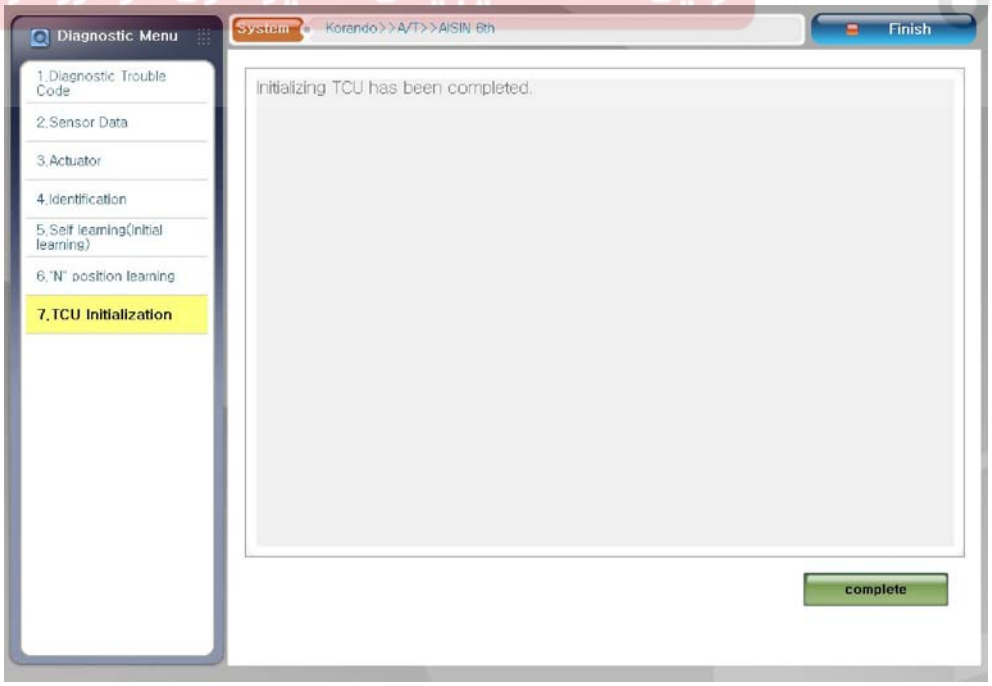


Modification basis	
Application basis	
Affected VIN	

3. Turn the ignition switch to OFF position as instructed on the screen, wait for 10 seconds, turn the ignition switch to ON position and click on [Next] button.



4. You'll move to the TCU Initialization screen when the initialization is completed.



2) N Position Learning

If the automatic transmission or TCU has been replaced or the TCU has been reprogrammed, you should initialize the learned value and perform the "N position learning".

NOTE

Conditions for "N" position learning:
- Vehicle speed: Stationary (0 km/h)
- Engine speed: Stop
- Shift lever: N position
- DTC: None

1. How to perform N position learning

- Stop the vehicle, turn the ignition on and place the shift lever to "P" position.
- Place the shift lever to "N" position.
- Check that the "N" position mark of TCU is in the correct position.

OK	NG
	

- Run the menu "N Position Learning" on the diagnostic program.
- If "Done" message is displayed, move the shift lever to the "P" position and turn the ignition off.
- Wait for 10 seconds, turn the ignition on and check that the shift lever position matches with position mark on the instrument cluster when moving the shift lever from "P" to "D" position.

NOTE

- If the "N Position Learning" fails, remove the TCU, check the connector pin for foreign materials, bending, damage and O-ring, fit the TCU correctly and perform the learning procedure again. If learning fails more than 3 times, replace the TCU as a new one.
-

Modification basis	
Application basis	
Affected VIN	

3) Stop & Drive Learning

1. Warm-up

- Heat the auto transmission by allowing the vehicle to idle or drive.
- Check that the ATF temperature is between 65℃ and 110℃ using the diagnostic device. If the oil temperature is out of the range, adjust the temperature properly.

CAUTION

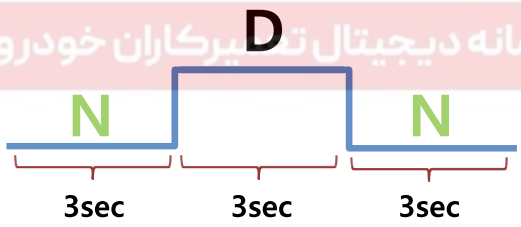
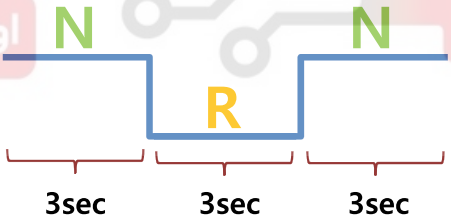
Do not stall the engine to increase oil temperature.

NOTE

- If the oil temperature is not within 65℃ to 110℃, initialization learning is performed and it will not work.
- Check the shift shock at various speed sections before performing the learning.

2. Garage shift learning

- Stop the vehicle, depress the brake pedal and leave the shift lever in "N" position for 3 seconds. Then, move the lever from "N" to "D" position and leave it for 3 seconds.
- Repeat this 5 times and repeat 5 times also for "R" position in the same way.

N-D learning	N-R learning
 ➡ Repeat 5 times	 ➡ Repeat 5 times

S.G.N.
3690-00 LEVEL CHECK AND FILL UP

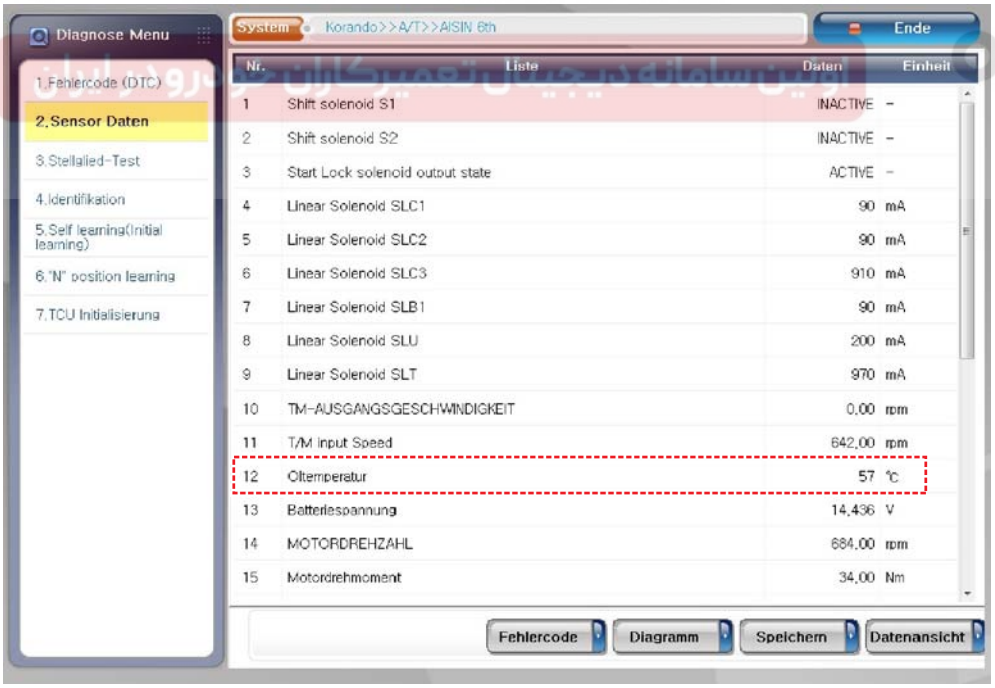
NOTE

- Check & replacement interval: Check-free, change-free
  (However, check and change at every 100,000 km of driving under demanding conditions)
- Before starting oil level check, check that there are no oil leakages.

▶ ATF level check

1. Place the vehicle on a level surface and start the engine.
2. Depress the brake pedal, place and stay the TGS lever at the 'P-R-N-D' positions for 2 seconds or longer, repeat this process twice, then shift the lever to the "P" position.

3. Check if the ATF temperature is between 50 and 60℃.
4. When the ATF temperature reaches 50℃, start oil level check with engine started.

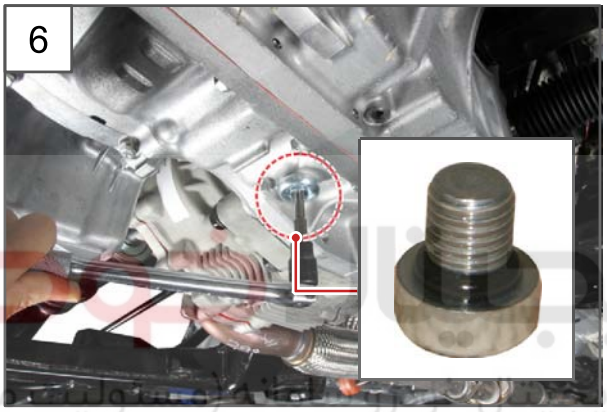


Modification basis	
Application basis	
Affected VIN	

5

5. Raise the vehicle with a lift.

6



6. Remove the oil overflow plug (T-40) under the vehicle.

Tightening torque 5.9 to 8.8 Nm

CAUTION

- Replace the O-ring as a new one.
- Avoid getting oil on the bodywork, workplace floor or skin.

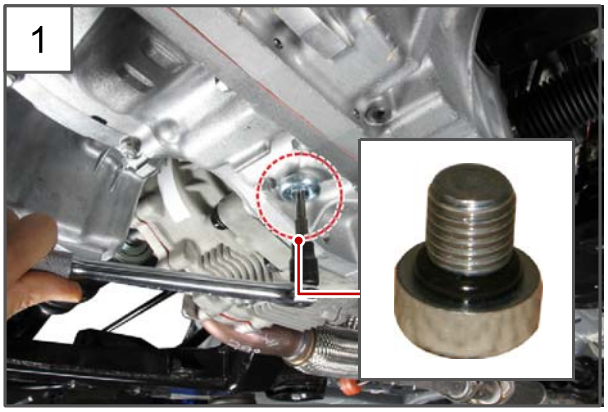
7. Check that the oil comes out of the overflow tube. If not, add ATF.

NOTE

If the ATF flows out of the drain plug (overflow tube) with the overflow tube removed, it is not necessary to add up the fluid.

▶ Topping up ATF

1

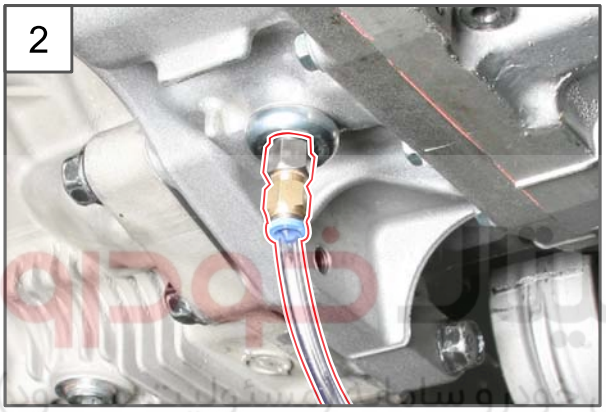


1. Remove the oil overflow plug (T-40) under the vehicle.

Tightening torque 5.9 to 8.8 Nm

CAUTION
- Replace the O-ring as a new one.
- Avoid getting oil on the bodywork, workplace floor or skin.
- Fill with ATF with the engine started.

2



2. Screw on the AISIN 6 A/T housing bottom oil filler adapter (X9936 0080A) to the oil overflow plug hole.

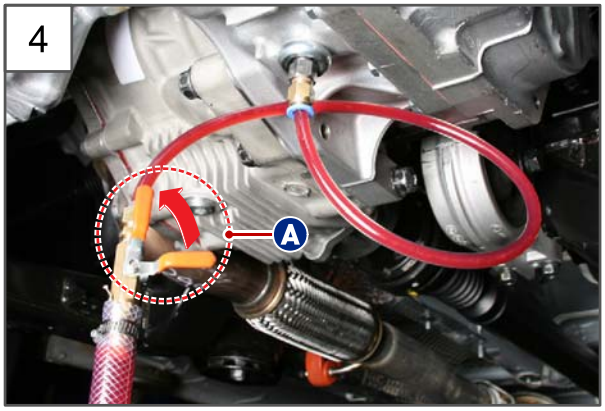
NOTE
If the ATF flows out of the drain plug (overflow tube) with the overflow tube removed, it is not necessary to add up the fluid.

3

3. Set the oil filled pressure to about 1.5 bar.

CAUTION
If the oil filled pressure is above 1.5 bar, the auto transmission internal parts and oil seal may be broken.

4



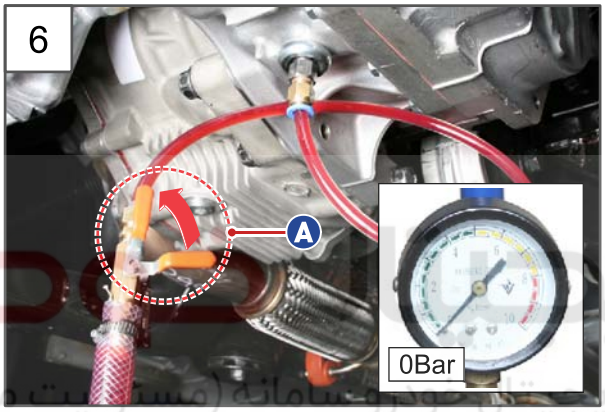
4. Open the oil filler valve (A) to fill with ATF.

NOTE
If the oil must be filled, fill the oil about 0.5 l first, check the oil level and top up as necessary.

5

5. Start the engine, leave the TGS lever in "P-R-N-D" for more than 2 seconds. Repeat this 2 times and set the oil temperature to 50~60°C using a diagnostic device.

6



6. Release the pressure from the oil filler, open the valve in the oil filler adapter and check the oil flow. If the oil level is low, add oil. If the oil level is too high, drain some oil.

CAUTION

- The conditions for oil level check: Leave the engine started, ATF temperature is between 50 and 60°C.
- When fitting the oil overflow plug, replace the O-ring as a new one and apply the oil on the O-ring.

S.G.N. 3690-00 OIL CHANGE

NOTE

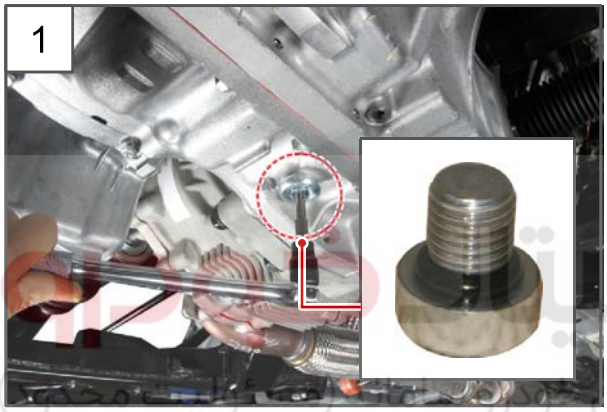
Check & replacement interval: Check-free, change-free
(However, check and change at every 100,000 km of driving under demanding conditions)

Oil capacity	Approx. 6.6 l (initial fill quantity)
Oil specification	AW-1

CAUTION

Avoid mixing the different ATFs. It may cause the corresponding system damage.

1



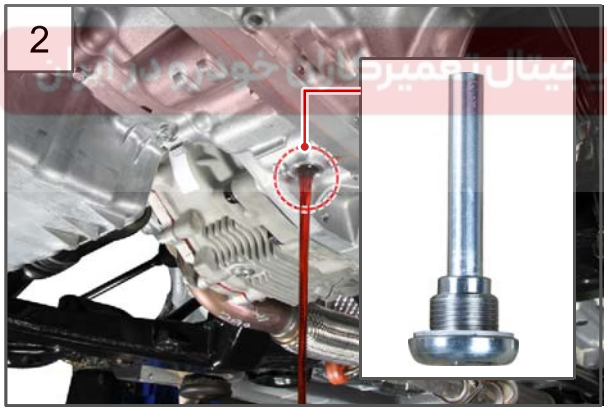
1. Remove the oil overflow plug (T-40) under the vehicle.

Tightening torque 5.9 to 8.8 Nm

CAUTION

- Replace the O-ring as a new one.
- Avoid getting oil on the bodywork, workplace floor or skin.

2



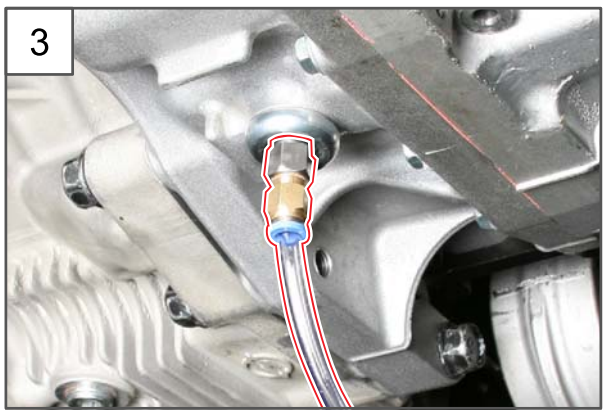
2. Remove the oil drain plug (hexagon-17 mm) and drain the oil completely.
(When oil drainage is completed, screw on the drain plug only.)

Tightening torque 34 to 60 Nm

NOTE

When draining the oil via the drain plug, 40~50% of total oil quantity (initial fill quantity) will be drained.

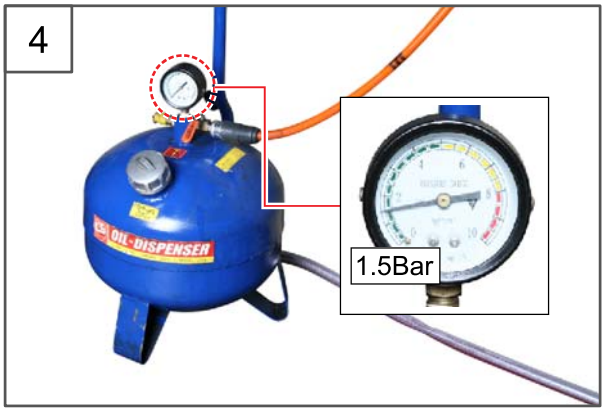
3



3. Screw on the AISIN 6 A/T housing bottom oil filler adapter (X9936 0080A) to the oil overflow plug hole.

Modification basis	
Application basis	
Affected VIN	

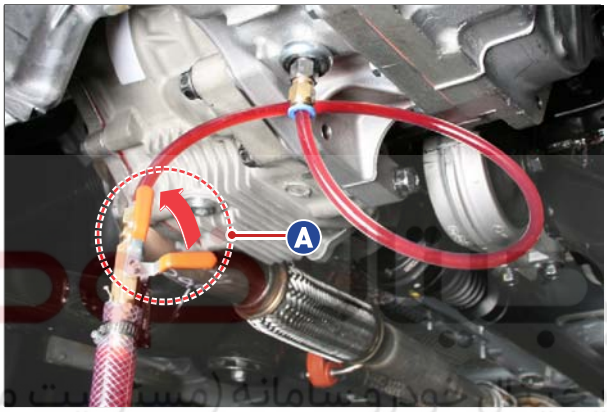
4



4. Set the oil filled pressure to about 1.5 bar.

CAUTION

If the oil filled pressure is above 1.5 bar, the auto transmission internal parts and oil seal may be broken.



5. Open the oil filler valve (A) to fill with ATF.

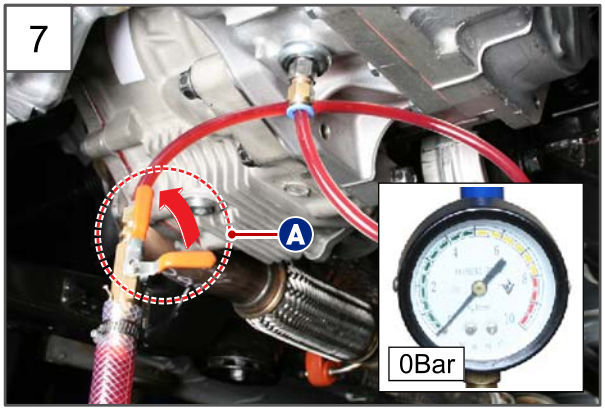
NOTE

- Fill the oil with the same amount as drained first, check the oil level and top up as necessary.
- Proceed the next works without removing the AISIN 6 A/T housing bottom oil filler adapter and oil filler after filling oil.

6

6. Start the engine, leave the TGS lever in "P-R-N-D" for more than 2 seconds. Repeat this 2 times and set the oil temperature to 50~60°C using a diagnostic device.

7



7. Release the pressure from the oil filler, open the valve in the oil filler adapter and check the oil flow. If the oil level is low, add oil. If the oil level is too high, drain some oil.

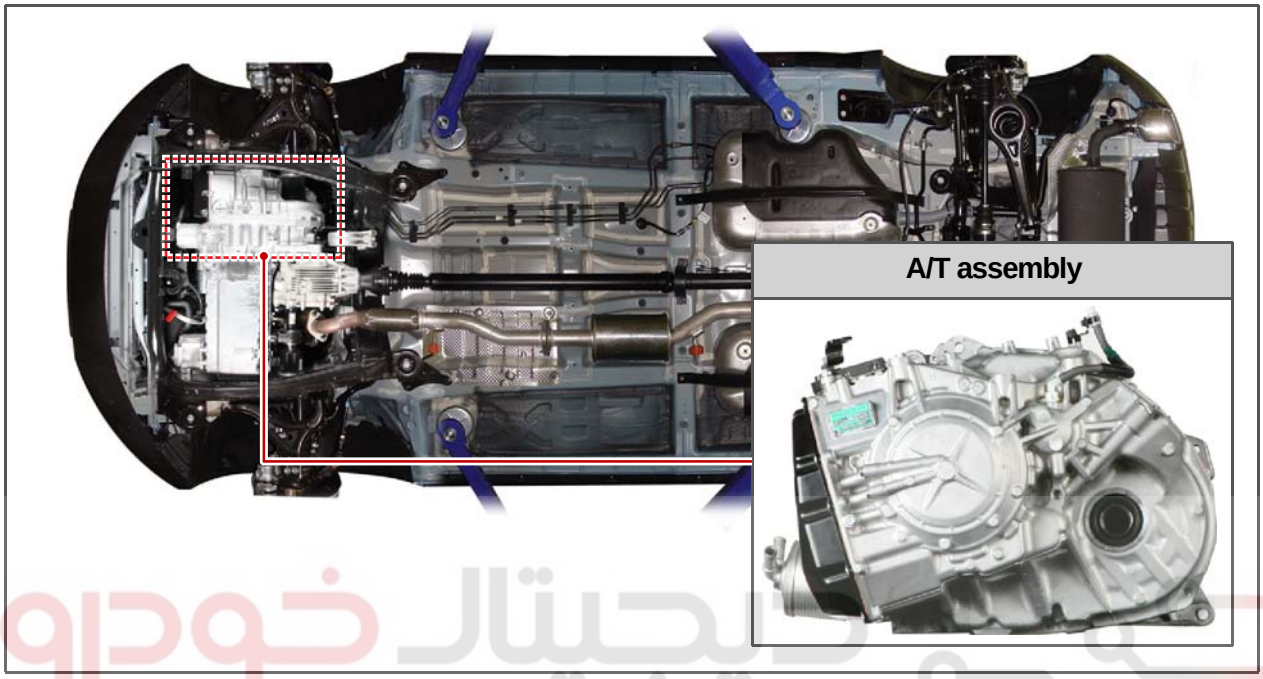
CAUTION

- The conditions for oil level check: Leave the engine started, ATF temperature is between 50 and 60°C.
- When fitting the oil overflow plug, replace the O-ring as a new one and apply the oil on the O-ring.

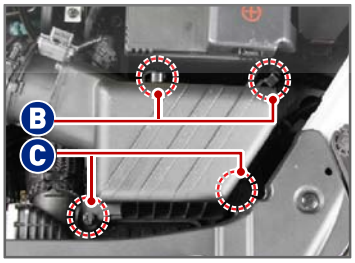
Modification basis	
Application basis	
Affected VIN	

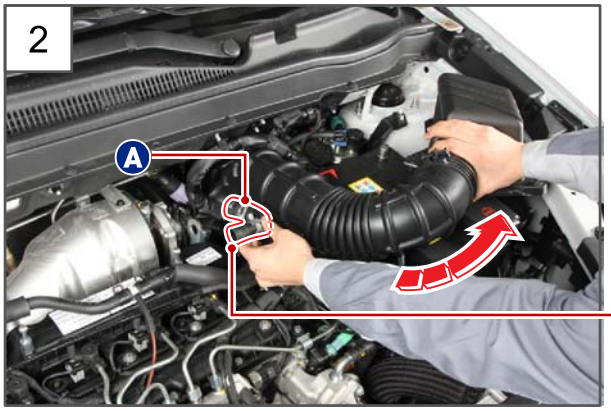
S.G.N.
3690-01 AUTOMATIC TRANSMISSION ASSEMBLY

Preceding work
- Disconnect the negative battery cable.
- Remove the front RH and LH tires.

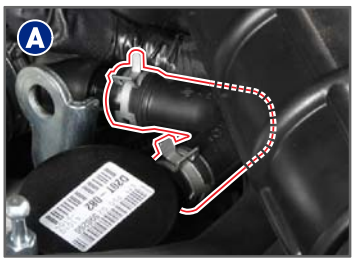


1. Remove the HFM sensor connector (A), prize off the air cleaner top housing mounting clamp (B) and unscrew the 2 mounting bolts (C, 10 mm).





2. Prize off the air cleaner hose assembly (air cleaner → turbocharger) to the arrow direction (anti-clockwise) and remove the blow-by outlet hose (A).

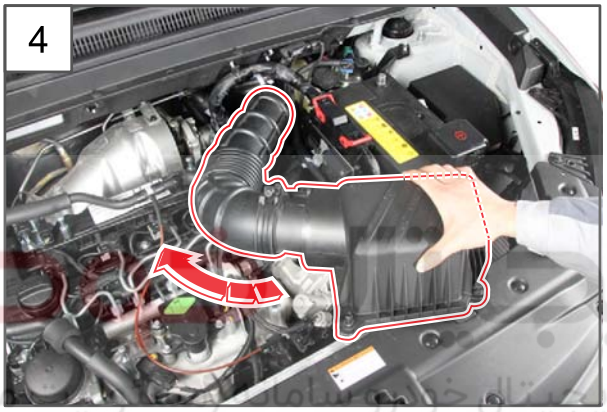


Modification basis	
Application basis	
Affected VIN	

3

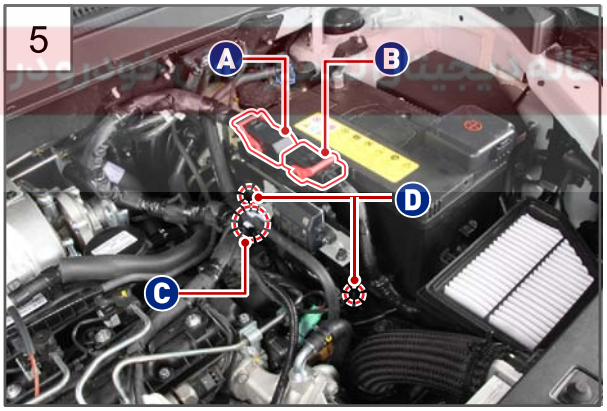
3. Unscrew the mounting clamp on the air cleaner hose assembly (air cleaner → turbocharger).

4



4. Turn the air cleaner hose assembly (air cleaner → turbocharger) to the arrow direction (clockwise) and remove it.

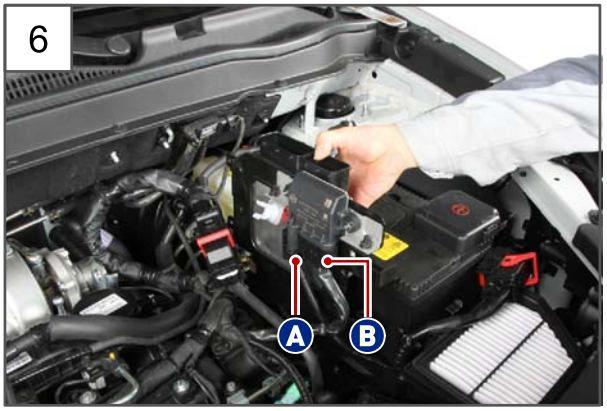
5



5. Disconnect the ECU connectors (A and B), separate the fuel hose from the mounting clip (C) and unscrew the 2 ECU bracket mounting nuts (D, 12 mm).

Tightening torque 3.7 to 7.8 Nm

6



6. Disconnect the connectors (A and B) connected to the GCU and remove the ECU and GCU assembly.

NOTE

The GCU connecting connector (B) has the locking parts on both sides.

Modification basis	
Application basis	
Affected VIN	

7

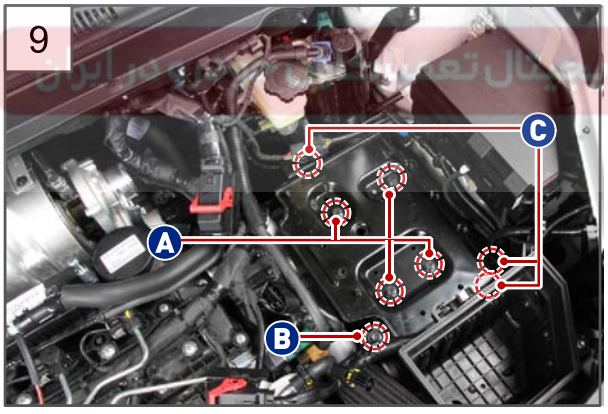
7. Unscrew 2 battery bracket mounting bolts (12 mm).

Tightening torque 10 ± 1.0 Nm

8

8. Unscrew the battery (+) connecting terminal mounting nut (10 mm) and remove the battery.

9

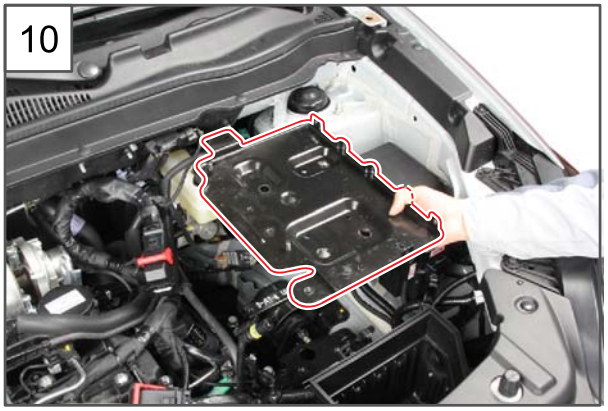


9. Unscrew the battery support mounting bolts (A) (14 mm, 4 off) and (B) (12mm), and separate each cable holding part (C) connected to the support.

Tightening torque (A) 25 ± 2.5 Nm

Tightening torque (B) 3.9 to 7.8 Nm

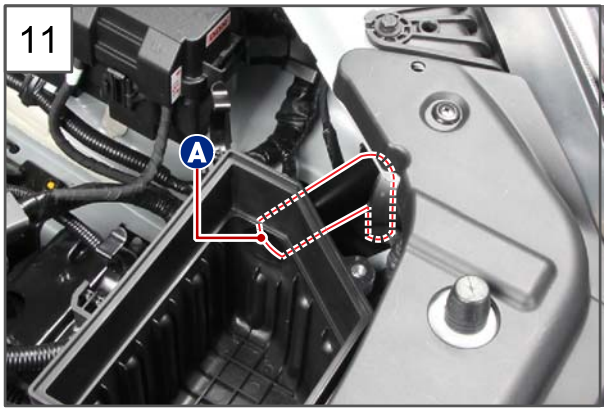
10



10. Remove the battery support.

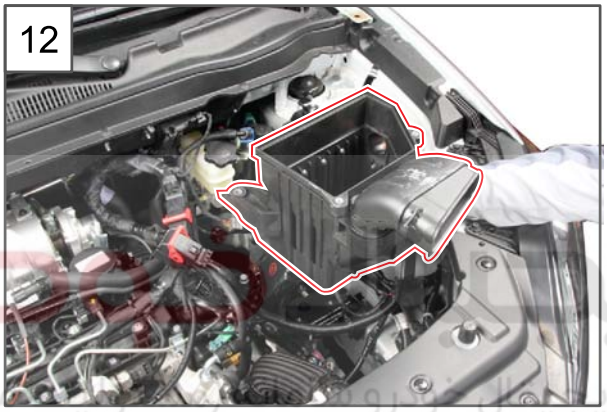
Modification basis	
Application basis	
Affected VIN	

11



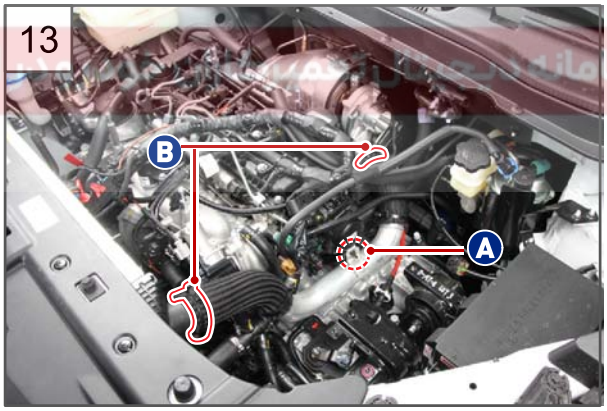
11. Remove the resonance duct (A) from the air cleaner assembly.

12



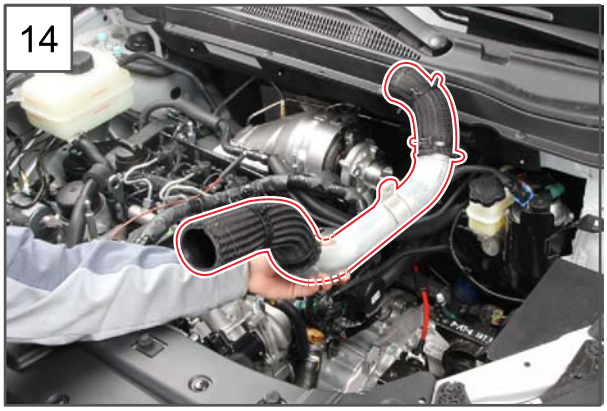
12. Remove the air cleaner assembly bottom housing from the air cleaner assembly bottom housing holding part (A).

13



13. Unscrew the intercooler hose and pipe mounting bolt (A) (10 mm) and mounting clamp (B).

14



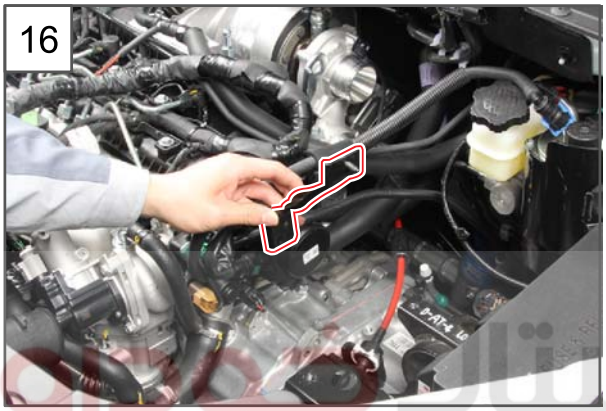
14. Remove the intercooler hose and pipe.

15

15.Unscrew 2 intercooler hose and pipe bracket mounting bolts (10 mm).

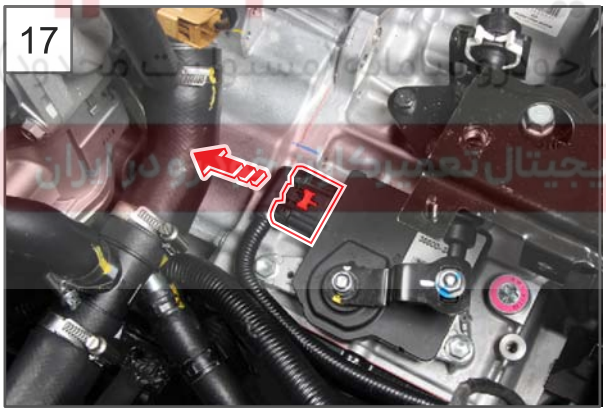
Tightening torque 10 ± 1.0 Nm

16



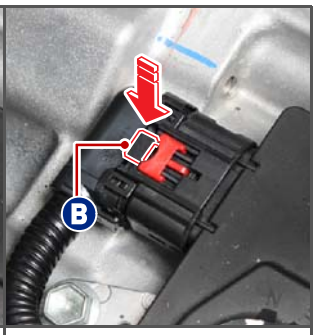
16.Remove the intercooler hose and pipe bracket.

17



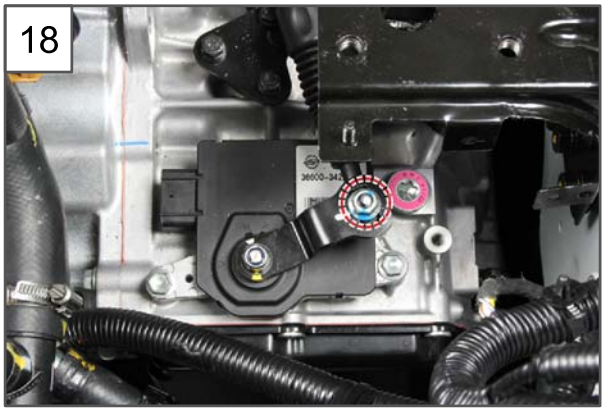
17.Disconnect the TCU wiring connector.

Move the connector locking part (A) to the arrow direction.



Press the connector locking part (B) to the arrow direction and remove it.

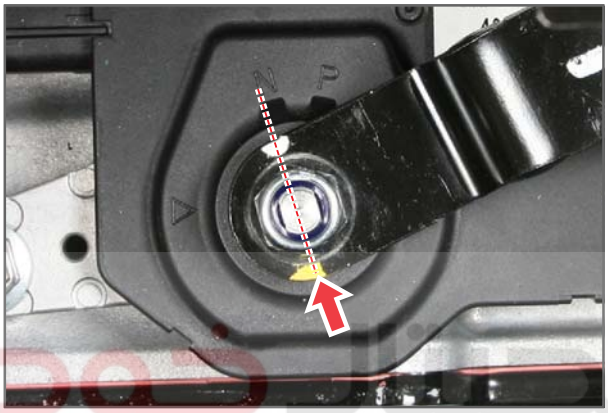
18



18. Unscrew the TGS cable mounting bolt (12 mm) from the manual lever.

Tightening torque 14 to 18 Nm

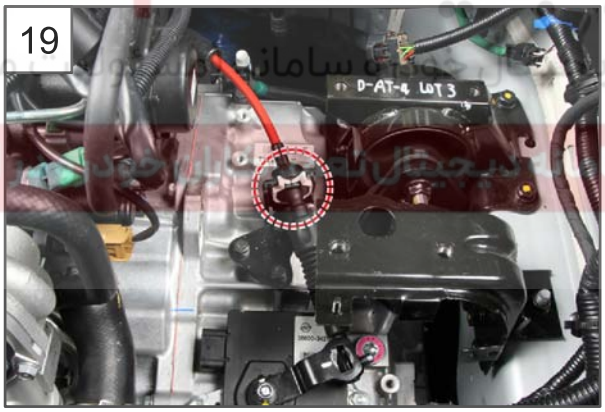
CAUTION
- Avoid using impact when removing or fitting the mounting bolt. Follow the specified torque.
- Be careful not to deform the manual lever.



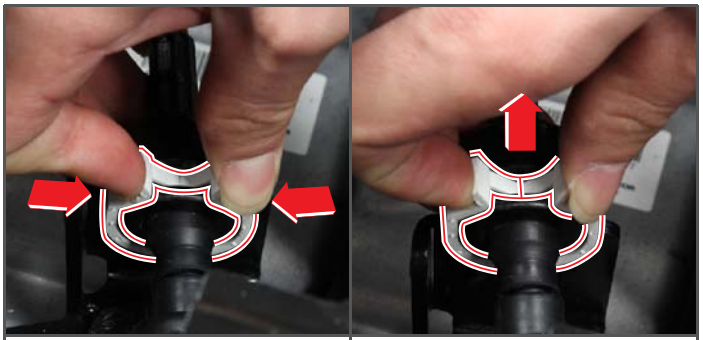
NOTE
Check if the "N" position marks of shift position sensor in the TCU are aligned.

CAUTION
- Make sure that manual lever position marks do not deviate more than 60°.

19

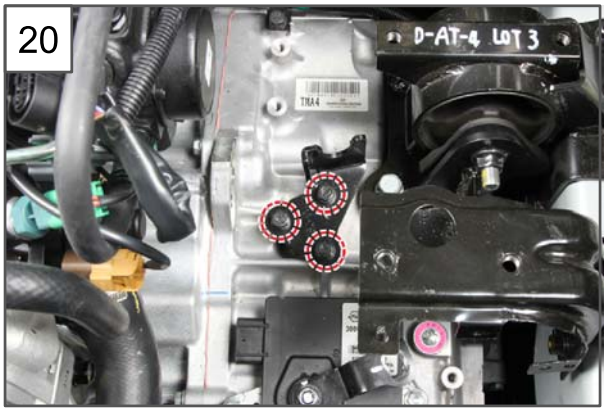


19. Loosen the mounting clip from the TGS cable bracket to the automatic transmission and remove the TGS cable.



Press the mounting clip at both sides to the arrow directions.	Lift off the mounting clip to the arrow direction while pressing it at both sides.

20



20.Unscrew 3 TGS cable bracket mounting bolts (12 mm) to the automatic transmission.

21

21.Remove the TGS cable bracket to the automatic transmission.

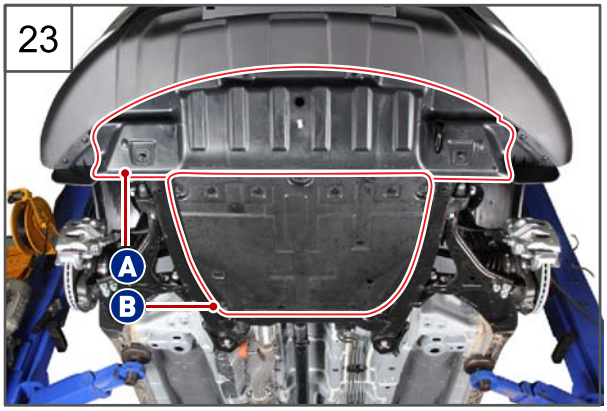
22

22.Place the engine support hanger on the engine hanger bracket and check for safety.

NOTE

Refer to "Fitting engine support hanger" in ENGINE.

23



23.Remove the front under cover (A) and rear under cover (B) under the vehicle.

Modification basis	
Application basis	
Affected VIN	

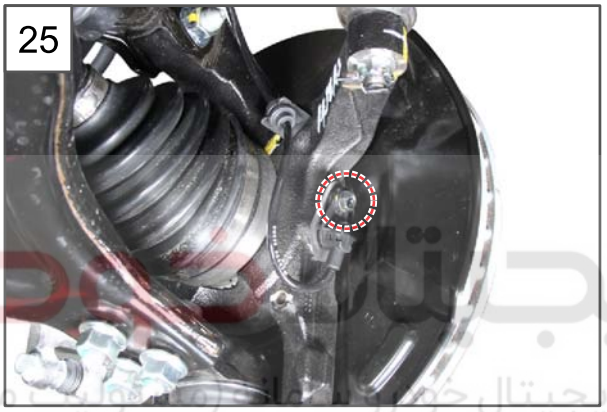
24

24.Remove the front brake caliper assembly. (same procedure for both sides)

NOTE

Refer to "FRONT BRAKE CALIPER ASSEMBLY" in "REMOVAL AND INSTALLATION" under "BRAKE SYSTEM".

25



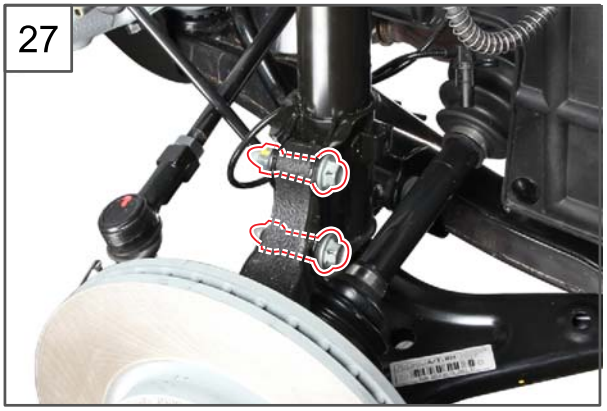
25.Unscrew the wheel speed sensor mounting bolt (10 mm) and separate the wheel speed sensor from the knuckle. (same procedure for both sides)

26

26.Unscrew a stabilizer bar link upper mounting nut (17 mm) and remove the link from the front shock absorber. (same procedure for both sides)

Tightening torque 44.1 to 53.9 Nm

27

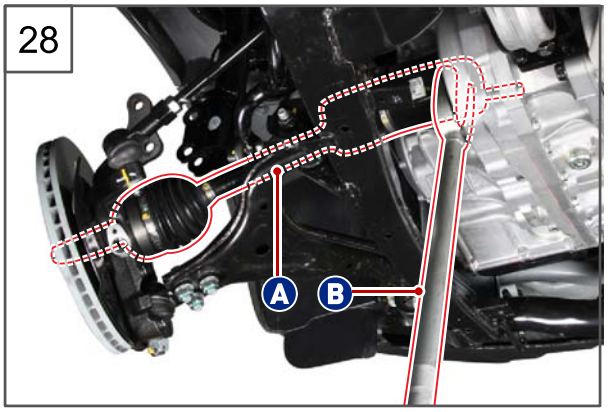


27.Unscrew 2 shock absorber lower mounting bolts (17 mm) and nuts (19 mm). (same procedure for both sides)

Tightening torque 137.2 to 156.8 Nm

Modification basis	
Application basis	
Affected VIN	

28

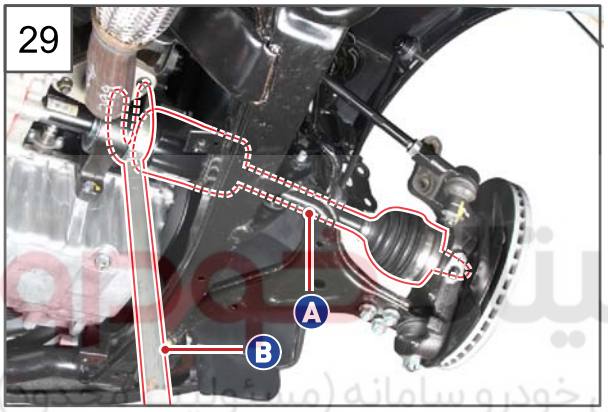


28.Separate the left drive shaft (A) from the automatic transmission using the special tool (B).

CAUTION

Do not pull the drive shaft from the outside with an excessive force. It causes the boot to tear or bearing to damage.

29



29.Separate the right drive shaft (A) from the intermediate shaft using the special tool (B).

CAUTION

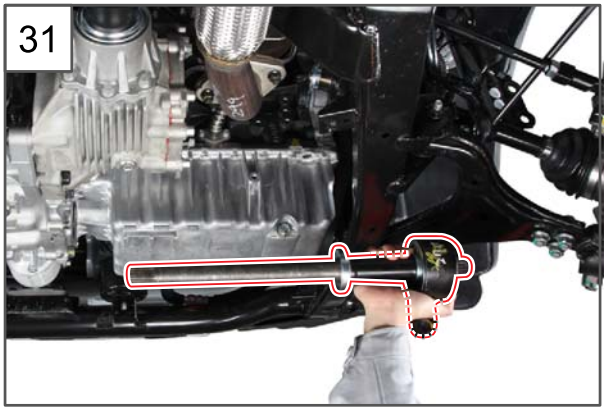
Do not pull the drive shaft from the outside with an excessive force. It causes the boot to tear or bearing to damage.

30

30.Unscrew the 3 intermediate shaft mounting bolts (12 mm).

Tightening torque 24.5 to 29.4 Nm

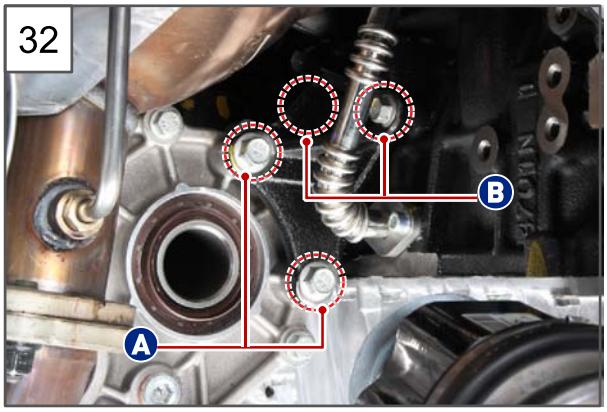
31



31.Remove the intermediate shaft.

Modification basis	
Application basis	
Affected VIN	

32



32.Unscrew the PTU bracket mounting bolts (A) (14 mm, 2 off) and (B) (12 mm, 2 off) and remove the PTU bracket.

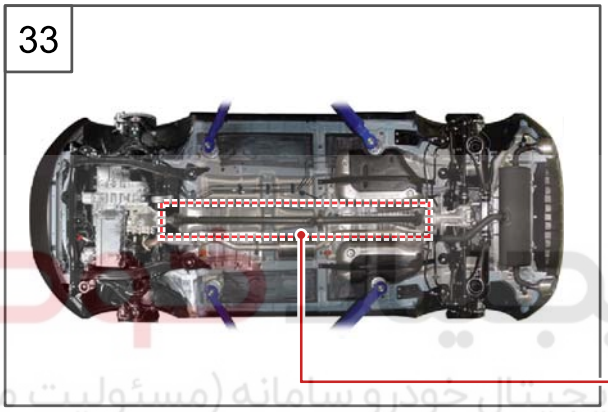
NOTE

This work applies to the 4WD vehicle only.

Tightening torque (A) 24.5 to 34.3 Nm

Tightening torque (B) 8.8 to 11.8 Nm

33

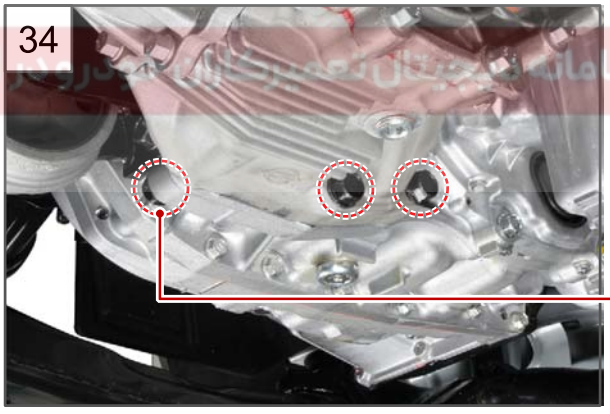


33.Remove the propeller shaft.

NOTE

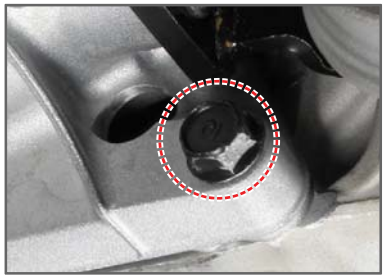
- Refer to "PROPELLER SHAFT" under "REMOVAL AND INSTALLATION" in "PROPELLER SHAFT SYSTEM".
- This work applies to the 4WD vehicle only.

34

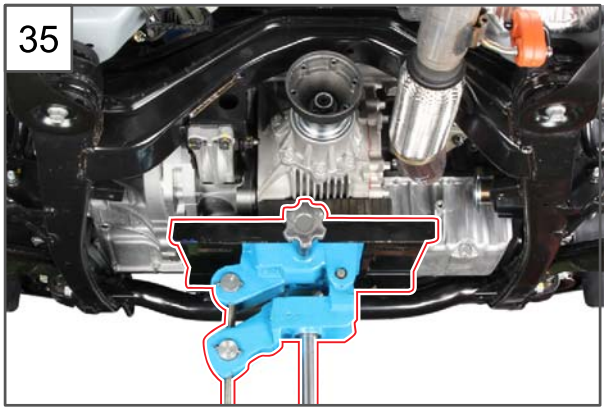


34.Unscrew the 3 PTU lower mounting bolts (19 mm).

Tightening torque 80.4 to 100 Nm

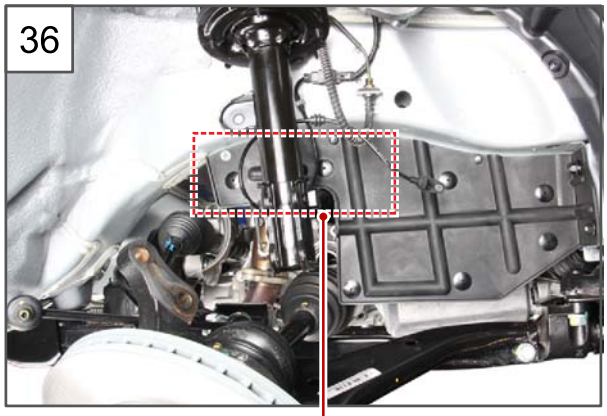


35



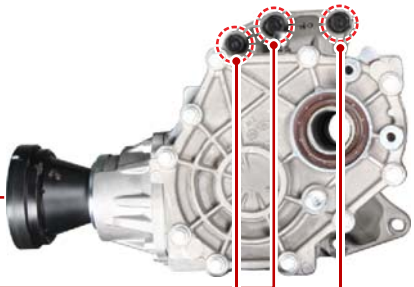
35.Support the mission jack under PTU securely.

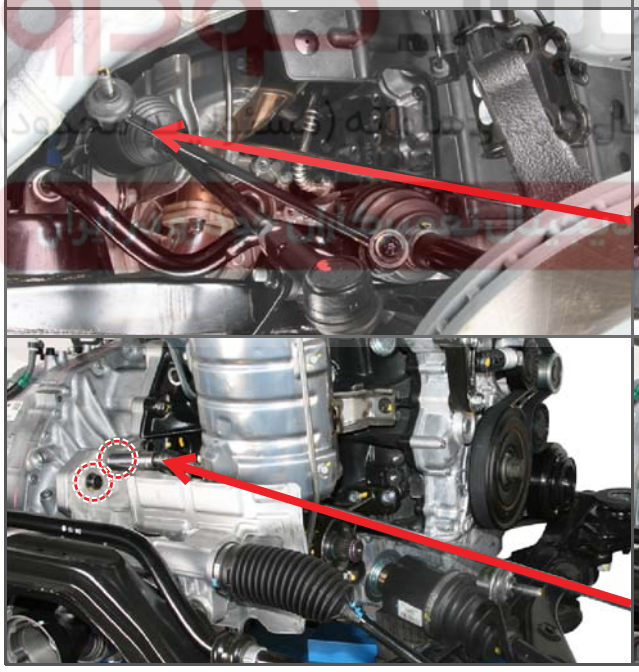
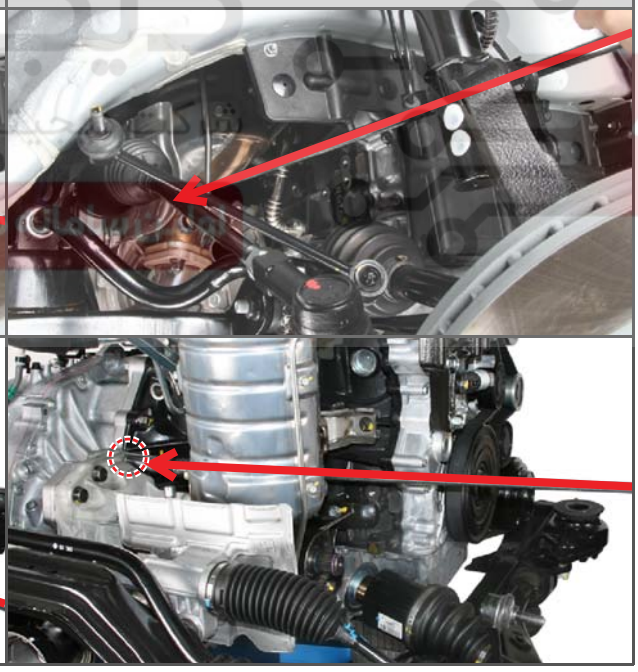
Modification basis	
Application basis	
Affected VIN	



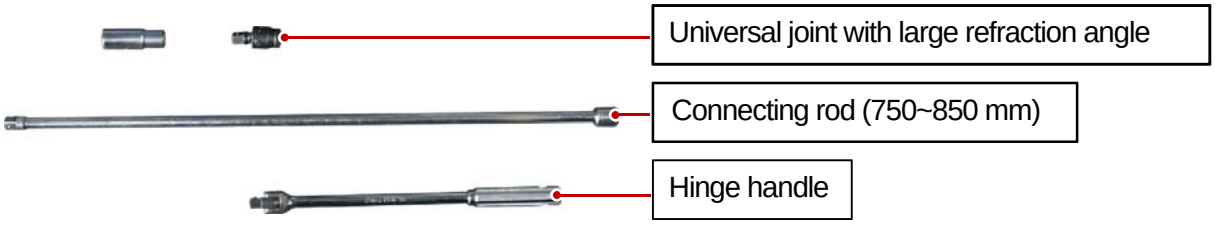
36.Unscrew the 3 PTU upper mounting bolts (19 mm) on the right-hand side as follows:

Tightening torque 80.4 to 100 Nm



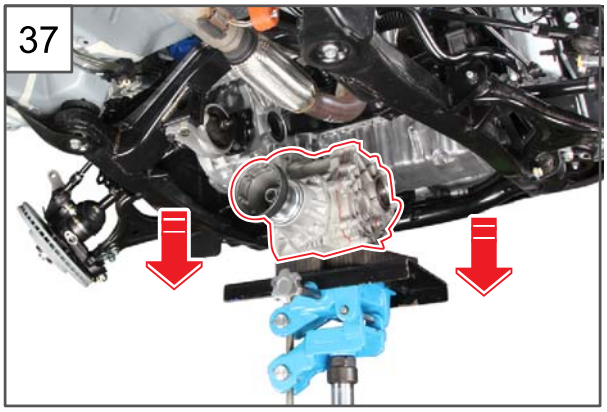
Fitting direction for general tool	Fitting direction for general tool
	

General tools



Modification basis	
Application basis	
Affected VIN	

37

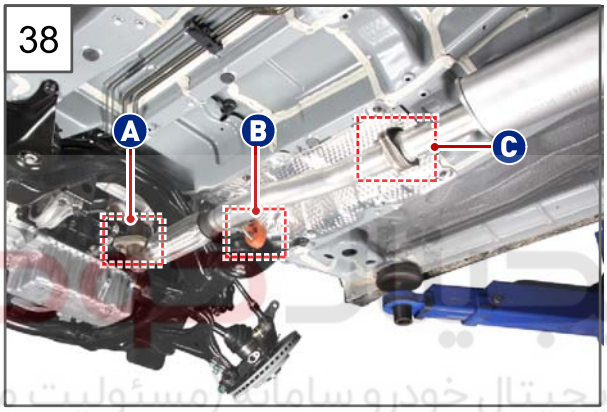


37.Remove the PTU assembly.

CAUTION

Pay attention to the interference to CDPF lower part when removing the PTU.

38

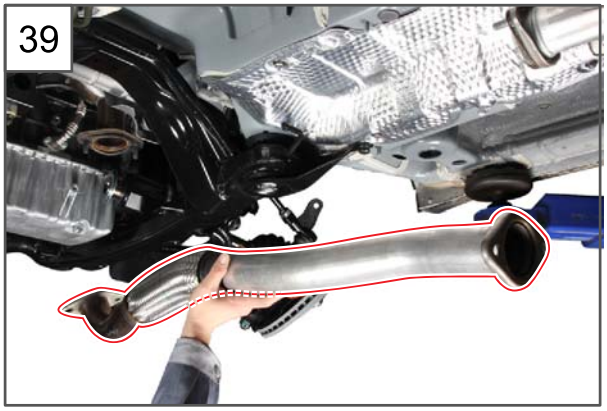


38.Unscrew the No. 1 exhaust pipe mounting nuts (A) (14 mm, 2 off) and (C) (14 mm, 2 off) and remove the mounting hanger (B).

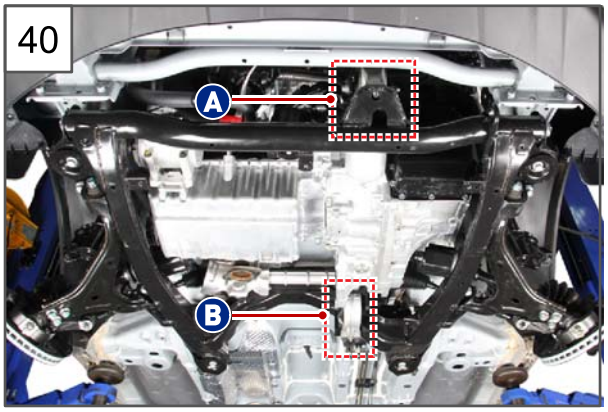
Tightening torque (A) 34 to 37 Nm

Tightening torque (C) 34 to 37 Nm

39



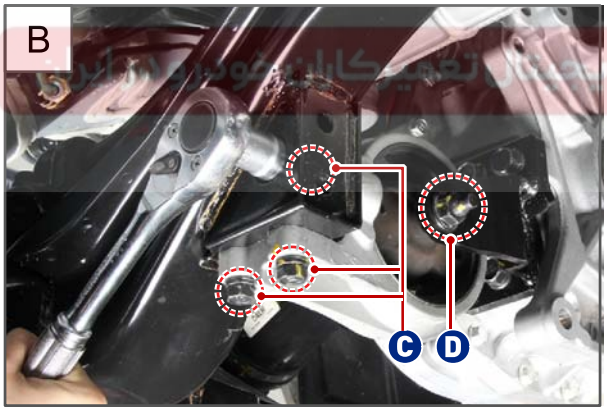
39.Remove the No. 1 exhaust pipe.



40.Remove the front engine mount (A) through bolt and rear engine mount (B) assembly as follows:

A. Unscrew the front engine mount through bolt (17 mm).

Tightening torque 68.6 to 88.2 Nm



B. Unscrew the 3 rear engine mount mounting bolt (C, 17 mm) and rear engine mount through bolt (D, 17 mm).

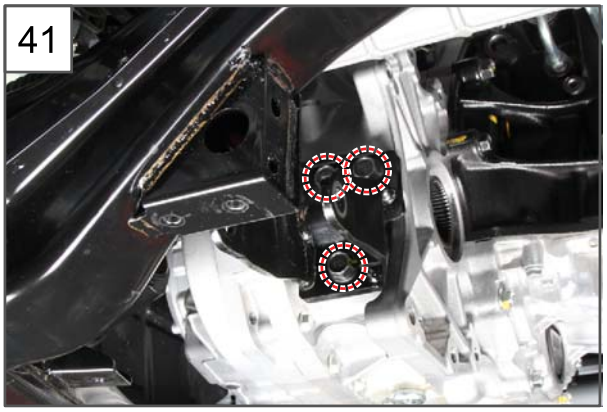
Tightening torque (C) 29.4 to 49.0 Nm

Tightening torque (D) 68.6 to 88.2 Nm

Remove the rear engine mount.

Modification basis	
Application basis	
Affected VIN	

41



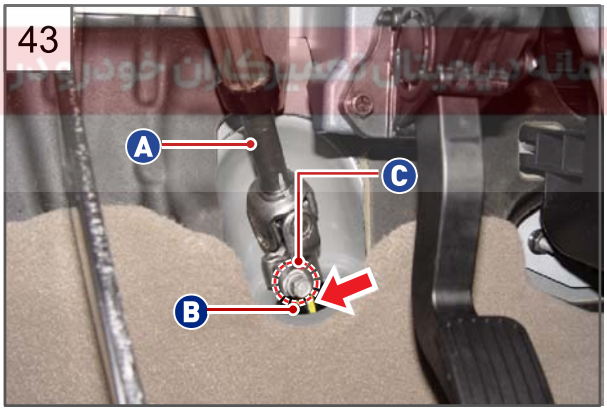
41.Unscrew the 3 rear engine mount bracket mounting bolts (17 mm).

Tightening torque 68.6 to 88.2 Nm

42

42.Remove the rear engine mount bracket.

43



43.Remove the lower shaft (A) on the steering column shaft, and joint (B) and mounting bolt (C, 12 mm) on the gear linkage in the vehicle.

Tightening torque 27.4 to 32.3 Nm

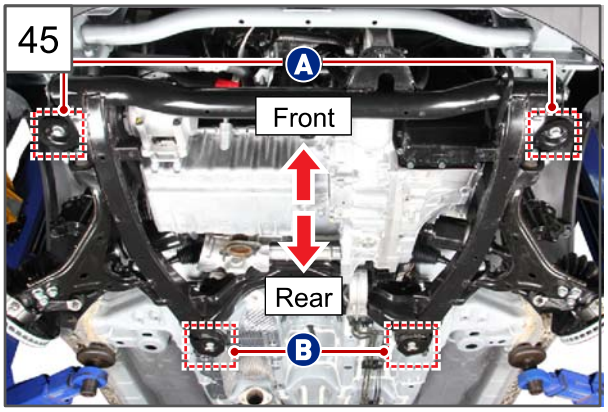
CAUTION

Always mark the assembly marking (arrow) when removing the lower shaft and gear linkage.

44

44.Place the subframe jack under the vehicle.

Modification basis	
Application basis	
Affected VIN	



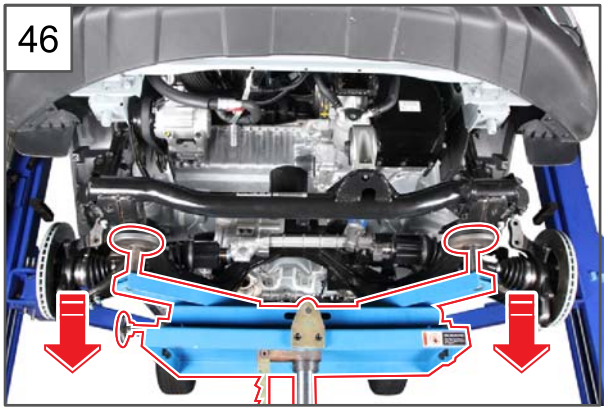
45. Unscrew the front mounting bolt (A) and rear mounting bolt (B) from the front subframe as follows:

A. Unscrew the 2 front LH/RH mounting bolts (17 mm) from the front subframe.

Tightening torque 88.2 to 107.8 Nm

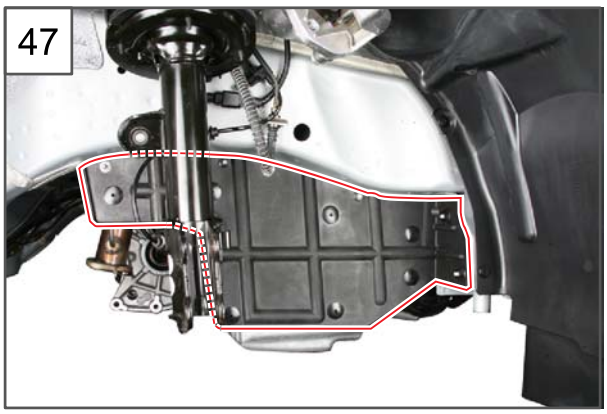
B. Unscrew the 2 rear RH/LH mounting cover bolts (17 mm) from the front subframe and mounting bolt (17 mm).

Tightening torque 88.2 to 107.8 Nm



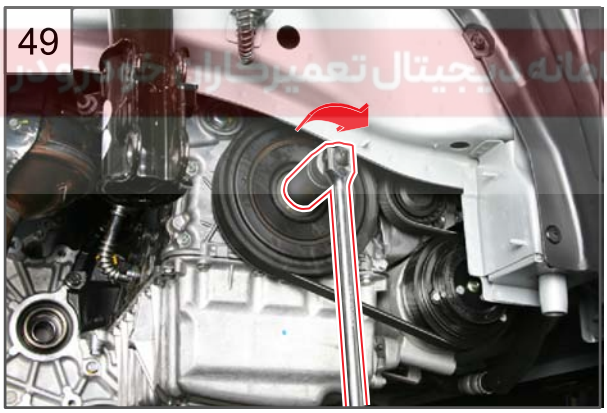
46. Remove the subframe assembly from the vehicle while lowering the subframe jack slowly.

Modification basis	
Application basis	
Affected VIN	



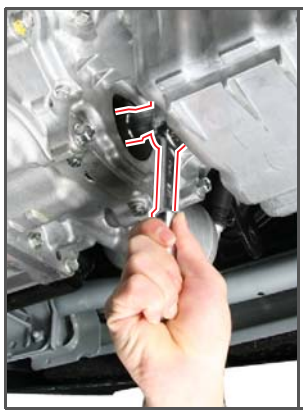
47.Remove the engine compartment side cover (RH).

48.Remove the torque converter service hole cover.



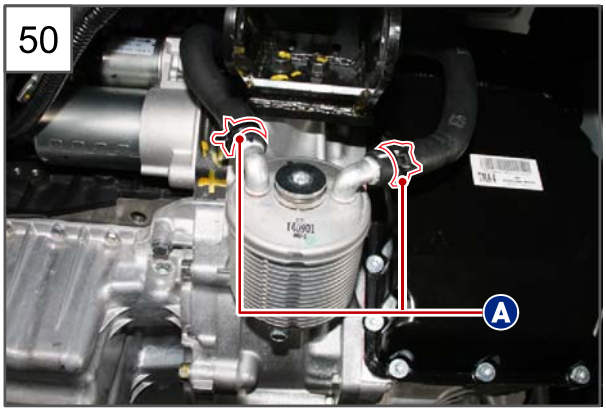
49.Unscrew the 6 torque converter mounting bolts (13 mm) while rotating the crankshaft (27 mm) clockwise.

Tightening torque **44 to 51 Nm**



Modification basis	
Application basis	
Affected VIN	

50



50.Unscrew the ATF cooler hose clamp (A) and remove the coolant hose.

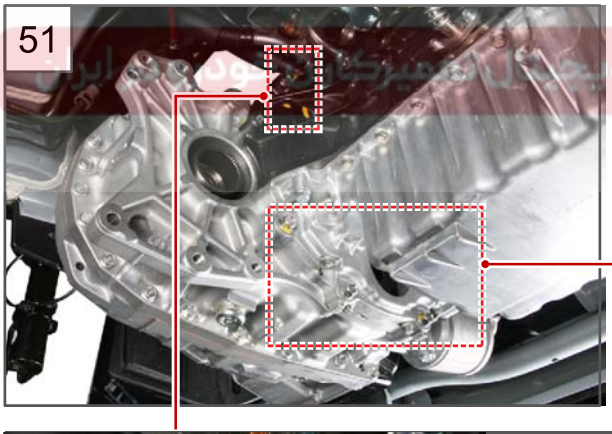
CAUTION

Be careful not to damage the oil cooler and hose connection when removing the oil cooler hose.

NOTE

Drain the engine coolant by removing the ATF cooler hose.

51



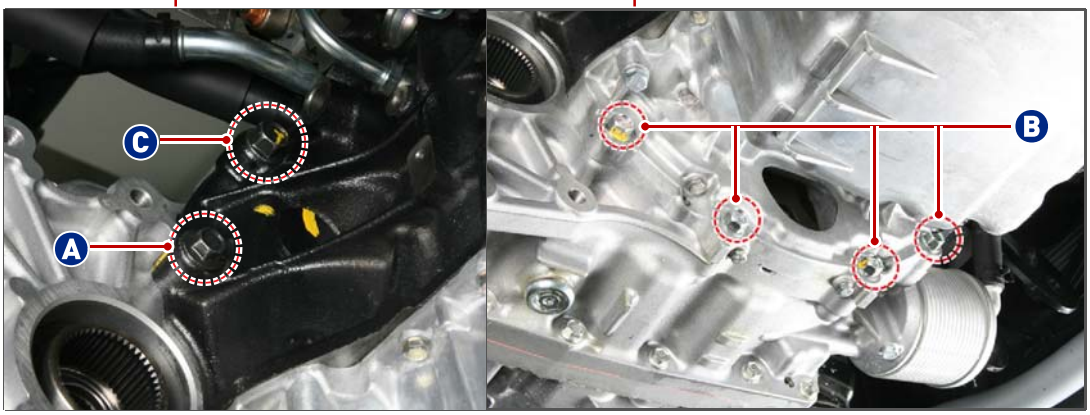
51.Unscrew one automatic transmission side mounting bolt (A, 14 mm) and 4 lower mounting bolts (B, 17 mm).

Tightening torque (A) 85 to 100 Nm

Tightening torque (B) 56 to 62 Nm

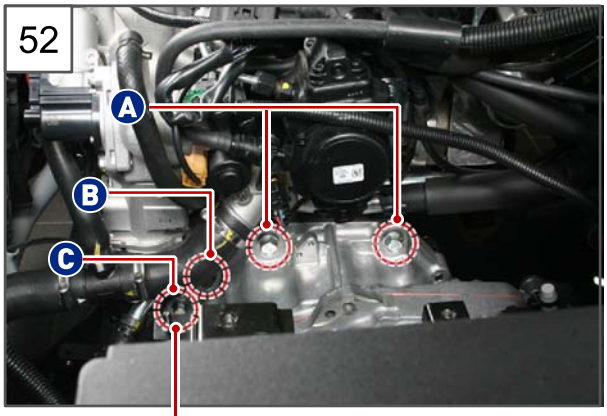
NOTE

In order to prevent the automatic transmission from falling off when removing the automatic transmission upper mounting bolts, install the support before removing it.



Modification basis	
Application basis	
Affected VIN	

52



52. Unscrew the automatic transmission upper mounting bolts (A) (17 mm, 2 off) and (B) (14 mm, 1 off) and starter motor upper mounting bolt (C, 14 mm) from the engine compartment.

Tightening torque (A) 85 to 100 Nm
Tightening torque (B) 54 Nm + 20°
Tightening torque (C) 48 to 58 Nm

NOTE

Since the working space is small, use a spanner to remove the starter motor upper mounting bolt.

CAUTION

Be careful not to damage the radiator pin.

53

53. Unscrew the LH engine mount through bolt/nut (17 mm).

Tightening torque 88.2 to 107.8 Nm

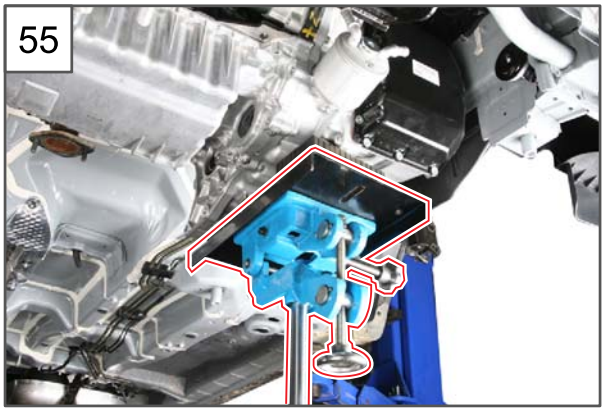
54

54. Unscrew the 3 left engine mount bracket mounting bolts (17 mm) and remove the bracket.

Tightening torque 85 to 100 Nm

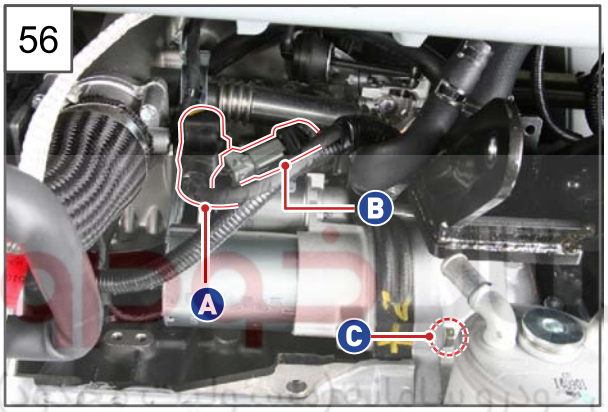
Modification basis	
Application basis	
Affected VIN	

55



55.Place the jack under the automatic transmission securely.

56



56.Remove the B terminal mounting nut (A, 12 mm) and ST connector (B) from the starter motor and unscrew the starter motor lower mounting bolt (C, 14 mm).

Tightening torque (A) 15 ± 1.5 Nm

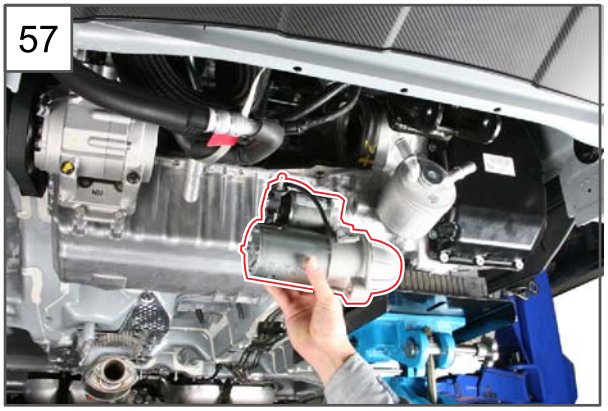
Tightening torque (C) 48 to 58 Nm

Unscrew the starter motor lower mounting bolt (14 mm).

NOTE

Since the working space is small, use a universal joint with large refraction angle (D) to remove the starter motor lower mounting bolt.

57



57.Remove the starter motor.

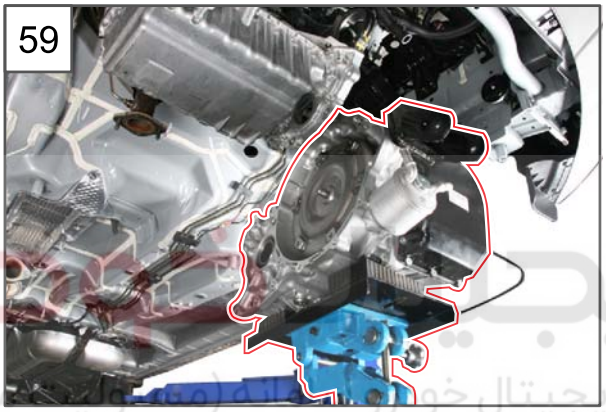
Modification basis	
Application basis	
Affected VIN	

58

58. Securely support the automatic transmission with a jack and unscrew the automatic transmission lower mounting bolt (17 mm).

Tightening torque 85 to 100 Nm

59



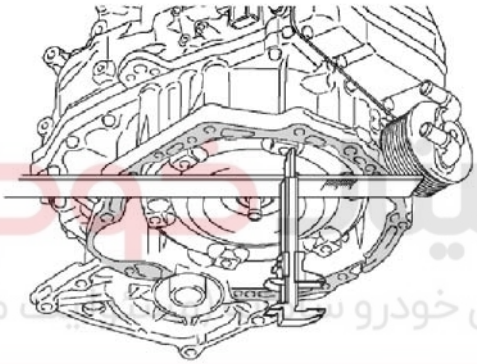
59. Disconnect the automatic transmission assembly.

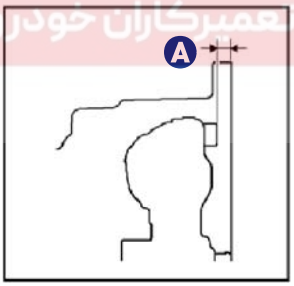
60

60. Install in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

Cautions for fitting automatic transmission assembly





NOTE

- Place the fixing part at direction of 6 o'clock in order to make it easier to fit the torque converter mounting bolt.
- Ensure that no dirt gets into the housing when fitting.

NOTE

Measure the distance from the housing end to torque converter as shown in the figure, and check if the torque converter is fitted correctly.

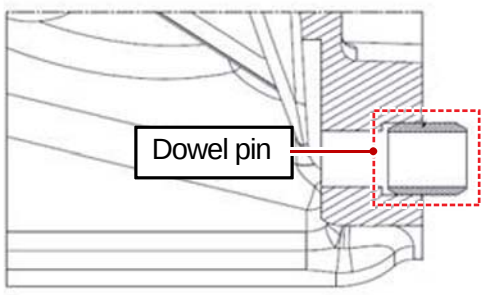
Item	Specification
Distance between transmission housing and torque converter (A)	13.5 mm or longer

- Check how the dowel pin is located to the engine block before fitting the automatic transmission.

CAUTION

The dowel pin may move out of its position when removing the automatic transmission.

Dowel pin fitted

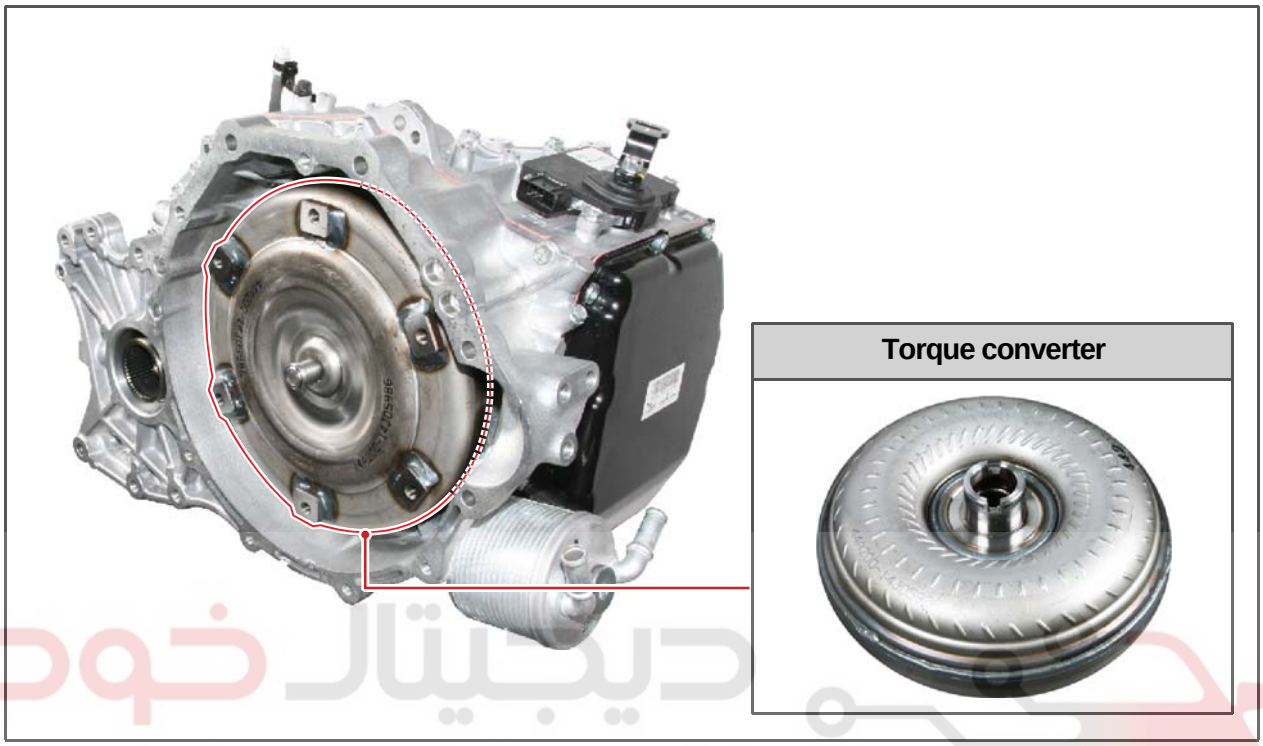


Modification basis	
Application basis	
Affected VIN	

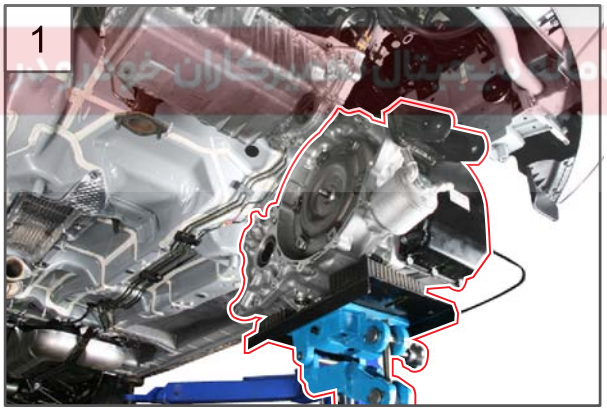
S.G.N. 3691-22

TORQUE CONVERTER

Preceding work - Drain the ATF.



1



1. Disconnect the automatic transmission assembly.

NOTE

Refer to "AUTOMATIC TRANSMISSION" in "REMOVAL AND INSTALLATION" under this section.

2

2. Remove the torque converter from the automatic transmission.

CAUTION

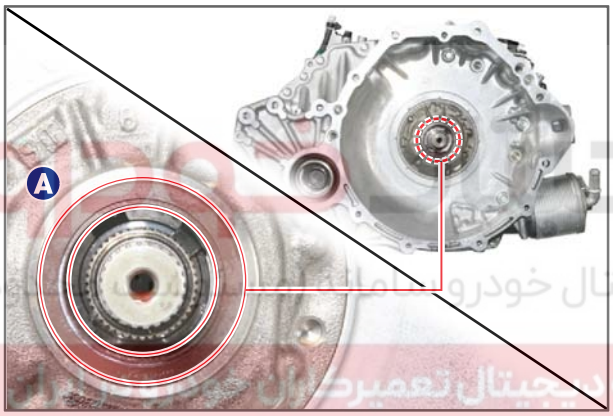
- Be careful not to damage the oil pump oil seal.
- Take care not to drop the torque converter.

Modification basis	
Application basis	
Affected VIN	

3

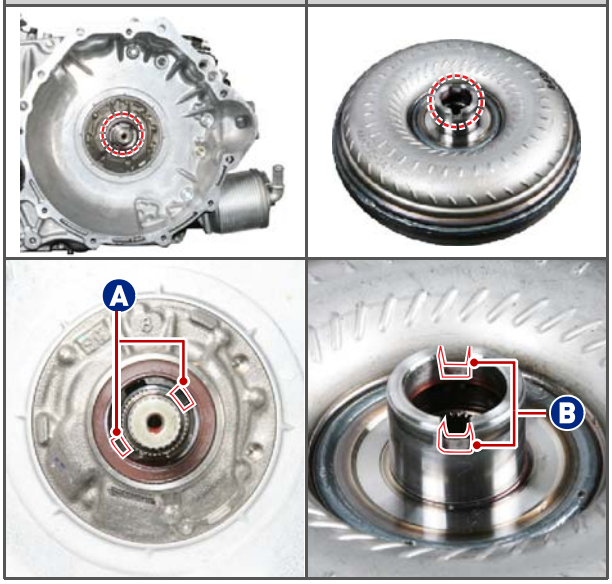
3. Install in the reverse order of removal.

Cautions for fitting torque converter

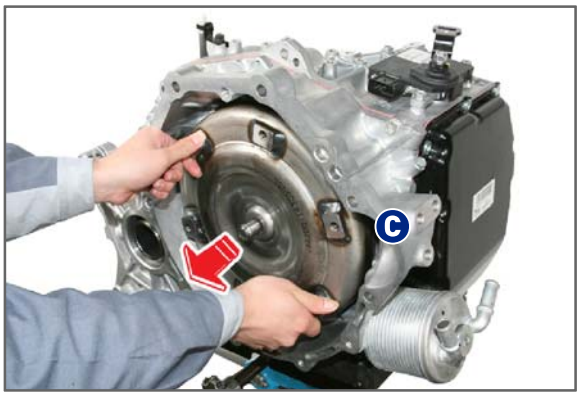


- Be careful not to damage the oil seal (A) when fitting the torque converter.

Fixing part joint	
Oil pump	Torque converter

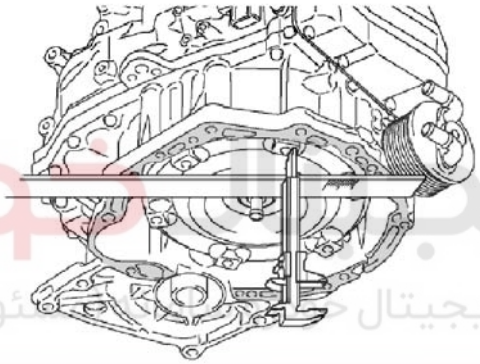


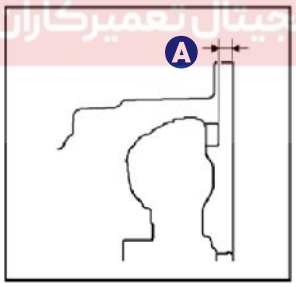
- Align the oil pump fixing part (A) with the torque converter mounting groove (B) and fit the torque converter. Then, check the installation while rotating the torque converter clockwise (C).



Modification basis	
Application basis	
Affected VIN	

Cautions for fitting torque converter





NOTE

- Place the fixing part at direction of 6 o'clock in order to make it easier to fit the torque converter mounting bolt.
- Ensure that no dirt gets into the housing when fitting.

NOTE

Measure the distance from the housing end to torque converter as shown in the figure, and check if the torque converter is fitted correctly.

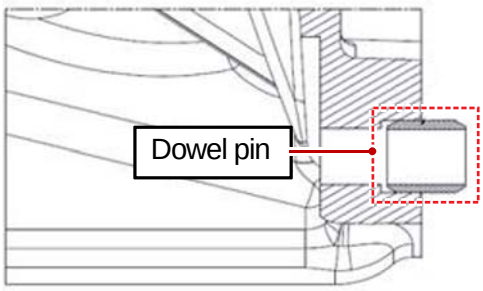
Item	Specification
Distance between A/T housing and torque converter (A)	13.5 mm or longer

- Check how the dowel pin is located to the engine block before fitting the automatic transmission.

CAUTION

The dowel pin may move out of its position when removing the automatic transmission.

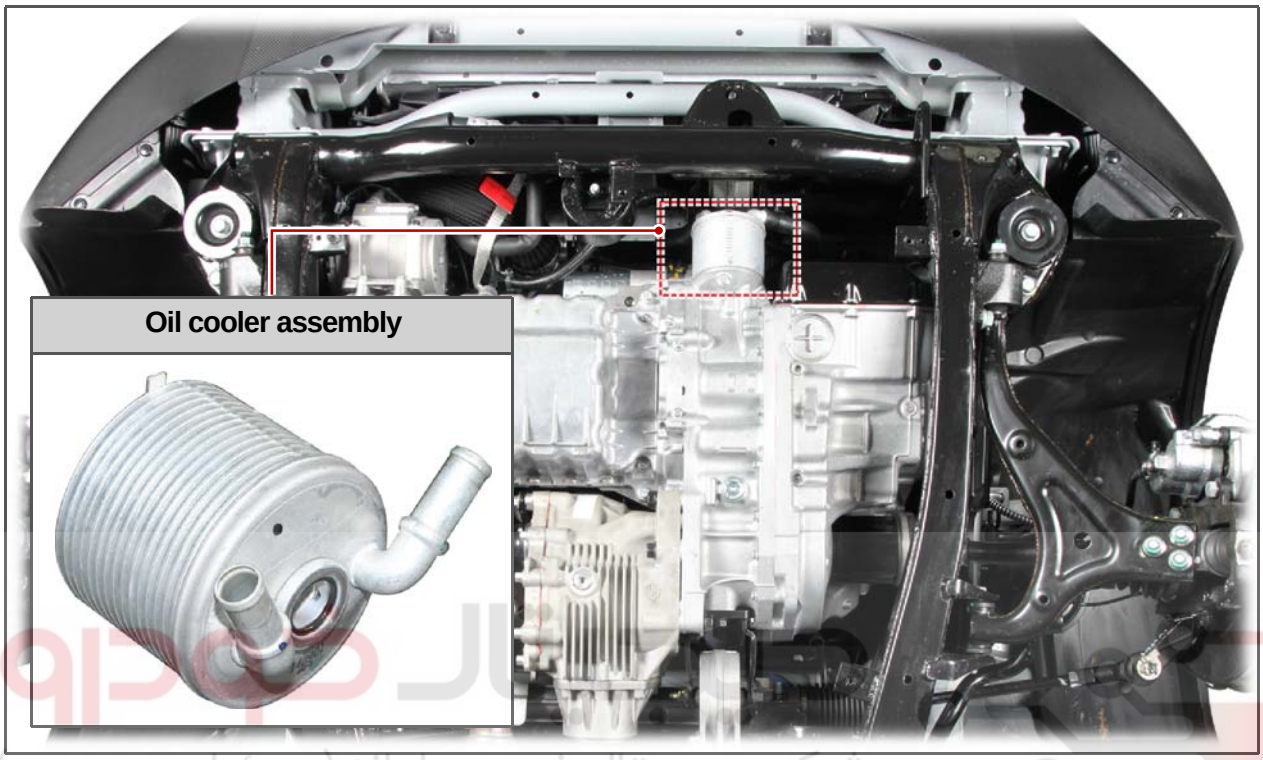
Dowel pin fitted



Modification basis	
Application basis	
Affected VIN	

S.G.N. 3691-28 OIL COOLER ASSEMBLY

Preceding work - Raise the vehicle with a lift and remove the rear under cover under the vehicle.



1

1. Place the engine support hanger on the engine hanger bracket and check for safety.

NOTE

Refer to "Fitting engine support hanger" in ENGINE.

2

2. Remove the overflow plug (star wrench-T40).

Tightening torque **5.9 to 8.8 Nm (overflow plug)**
34 ~60 Nm (drain plug)

Modification basis	
Application basis	
Affected VIN	

3

3. Remove the drain plug (hexagon wrench-17 mm) and drain the ATF.

Tightening torque **5.9 to 8.8 Nm (overflow plug)**
34 ~60 Nm (drain plug)

4

4. Unscrew the front engine mount through bolt (17 mm).

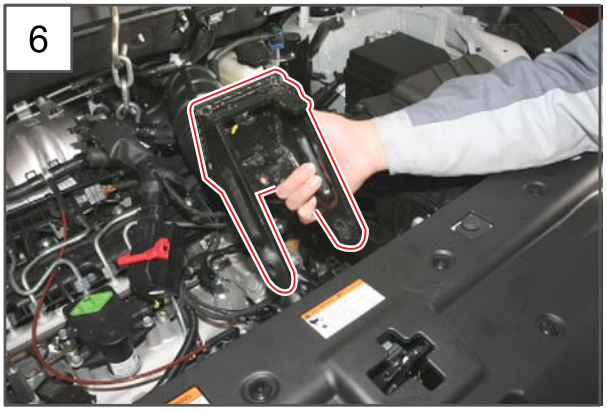
Tightening torque **68.6 to 88.2 Nm**

5

5. Unscrew the 3 front engine mount bracket mounting bolts (17 mm).

Tightening torque **85 to 100 Nm**

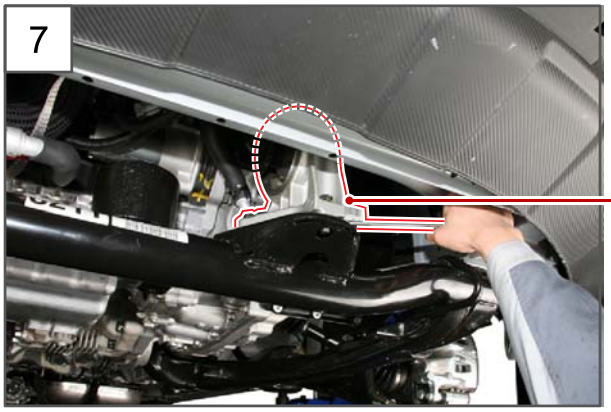
6



6. Remove the front engine mounting bracket.

Modification basis	
Application basis	
Affected VIN	

7

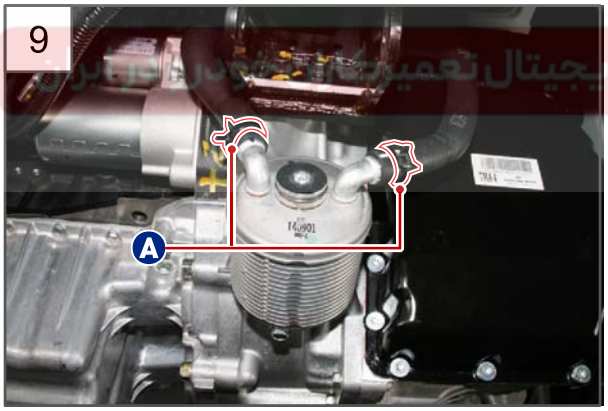


7. Unscrew the 3 front engine mount mounting bolts (14 mm).

8

8. Remove the front engine mount.

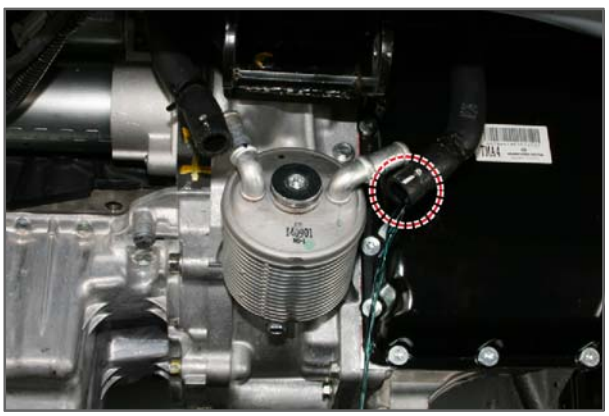
9



9. Unscrew the ATF cooler hose clamp (A) and remove the coolant hose.

CAUTION

Be careful not to damage the oil cooler and hose connection when removing the oil cooler hose.



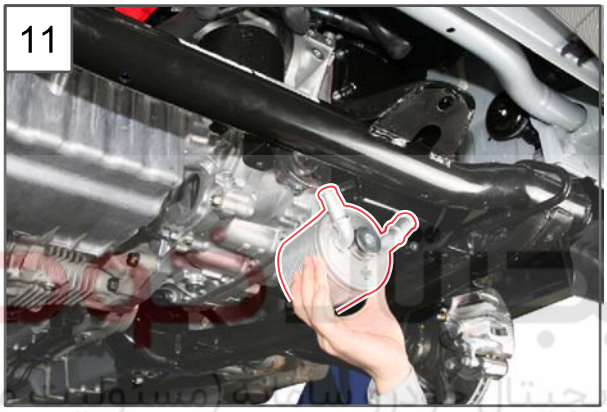
NOTE

Drain the engine coolant by removing the ATF cooler hose.

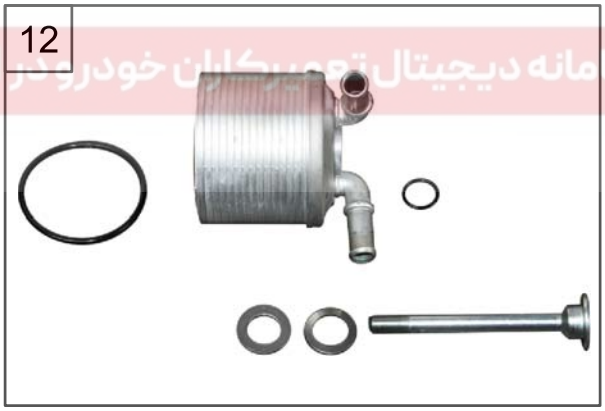
Modification basis	
Application basis	
Affected VIN	

10

11



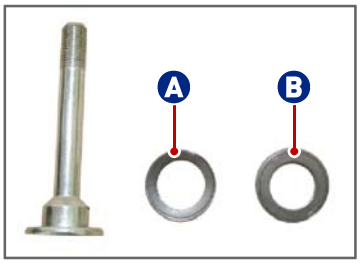
12



13

10. Unscrew the oil cooler assembly mounting bolt (hexagon wrench-10 mm) and remove the mounting bolt, conical spring washer (A) and plate washer (B).

Tightening torque 33.3 to 39.2 Nm



11. Remove the oil cooler assembly.

12. Remove the 2 O-rings from the oil cooler assembly.

NOTE

Do not reuse the removed O-ring.

O-ring size

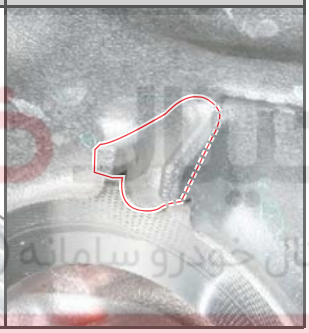
O-ring	Internal diameter	Thickness
1	20.0 mm	2.3 mm
2	74.0 mm	3.5 mm

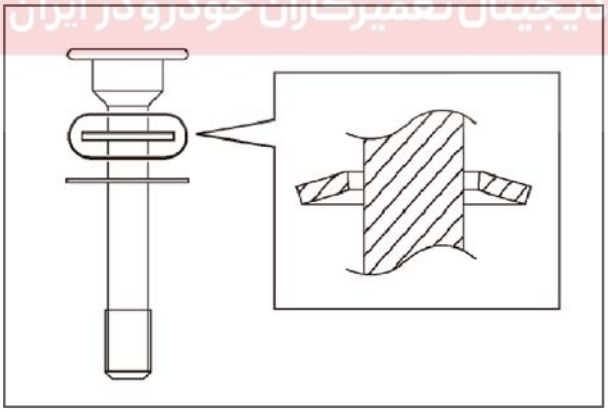
13. Install in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

Cautions for fitting oil cooler assembly

Clean the contact surface between the oil cooler assembly and automatic transmission case and align the automatic transmission case groove with the protrusion when fitting.

To oil cooler	To A/T case
	



Check the sequence and direction of the conical spring washer when assembling the mounting bolt.

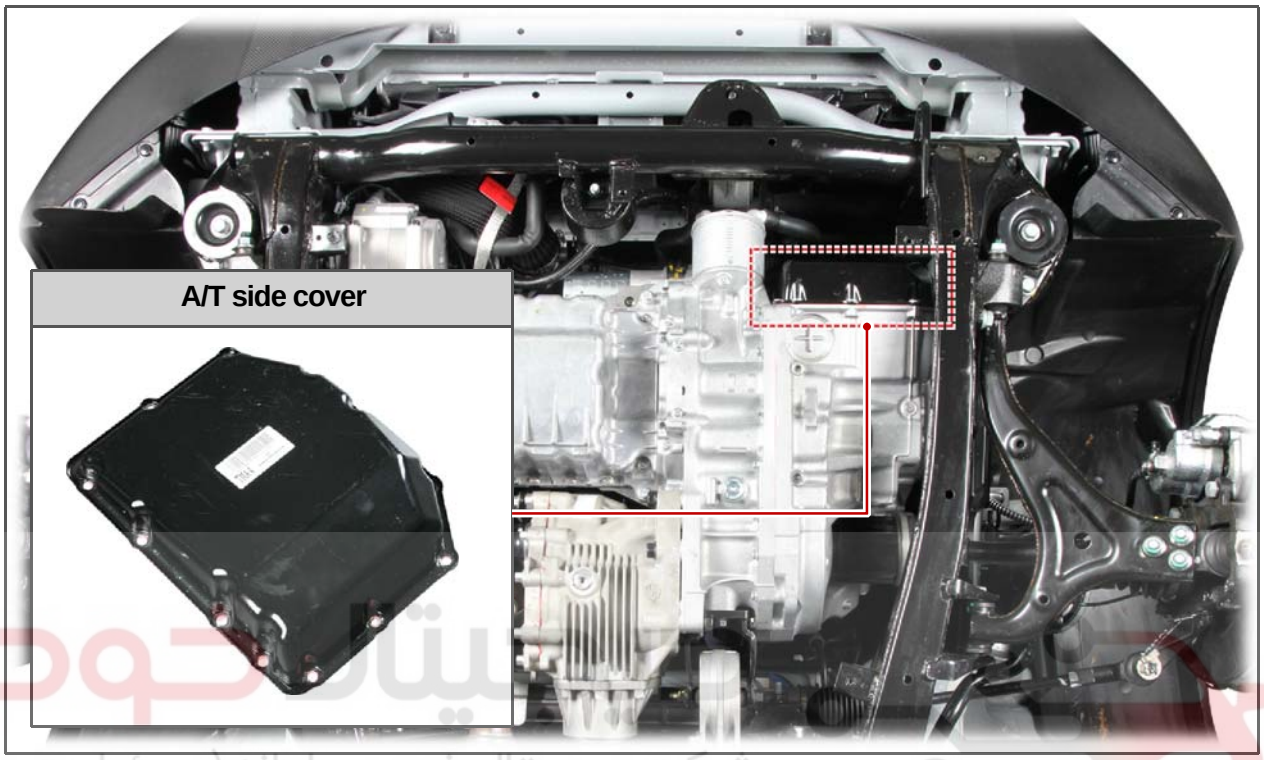
Tightening torque 33.3 to 39.2 Nm

Modification basis	
Application basis	
Affected VIN	

S.G.N. 3693-21

AUTOMATIC TRANSMISSION SIDE COVER

Preceding work - Raise the vehicle with a lift and remove the rear under cover under the vehicle.



1

1. Remove the overflow plug (star wrench-T40).

Tightening torque **5.9 to 8.8 Nm (overflow plug)**
34 ~60 Nm (drain plug)

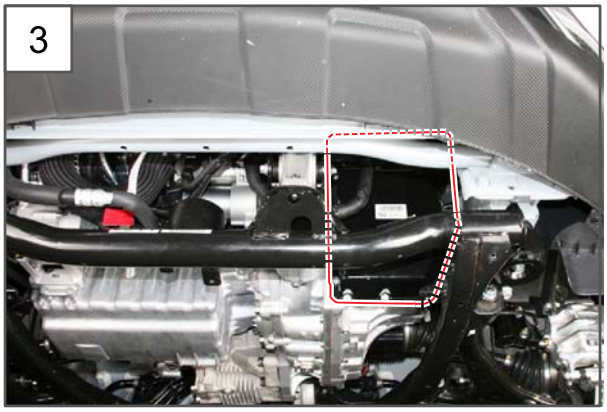
2

2. Remove the drain plug (hexagon wrench-17 mm) and drain the ATF.

Tightening torque **5.9 to 8.8 Nm (overflow plug)**
34 ~60 Nm (drain plug)

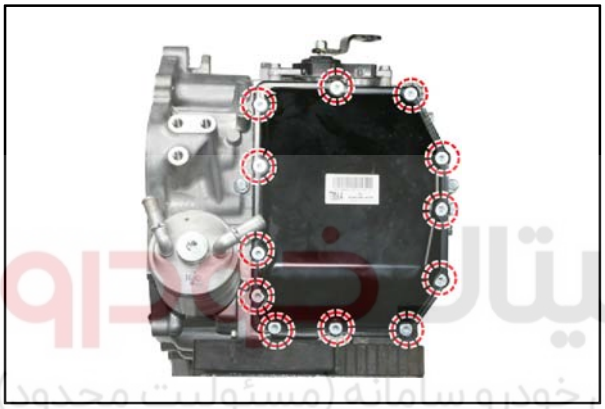
Modification basis	
Application basis	
Affected VIN	

3



3. Unscrew the 12 automatic transmission side cover mounting bolts (star wrench, T40).

Tightening torque 17 to 20 Nm



CAUTION

Do not reuse the removed automatic transmission side cover and mounting bolt.

4

4. Remove the automatic transmission side cover.

CAUTION

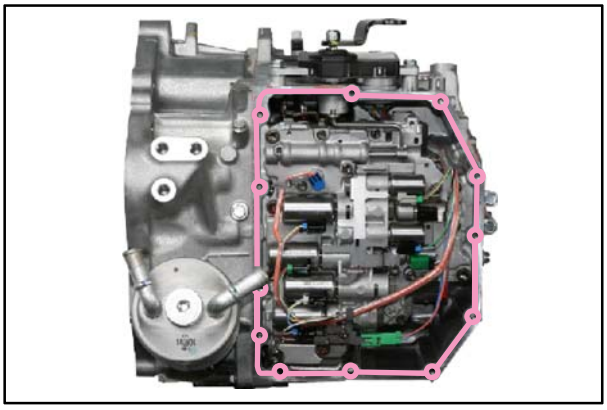
Do not reuse the removed automatic transmission side cover and mounting bolt.

5

5. Install in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

Cautions for fitting automatic transmission side cover



Remove the sealant and oil completely from the mounting bolt hole of the automatic transmission case and side cover contact surface.

CAUTION

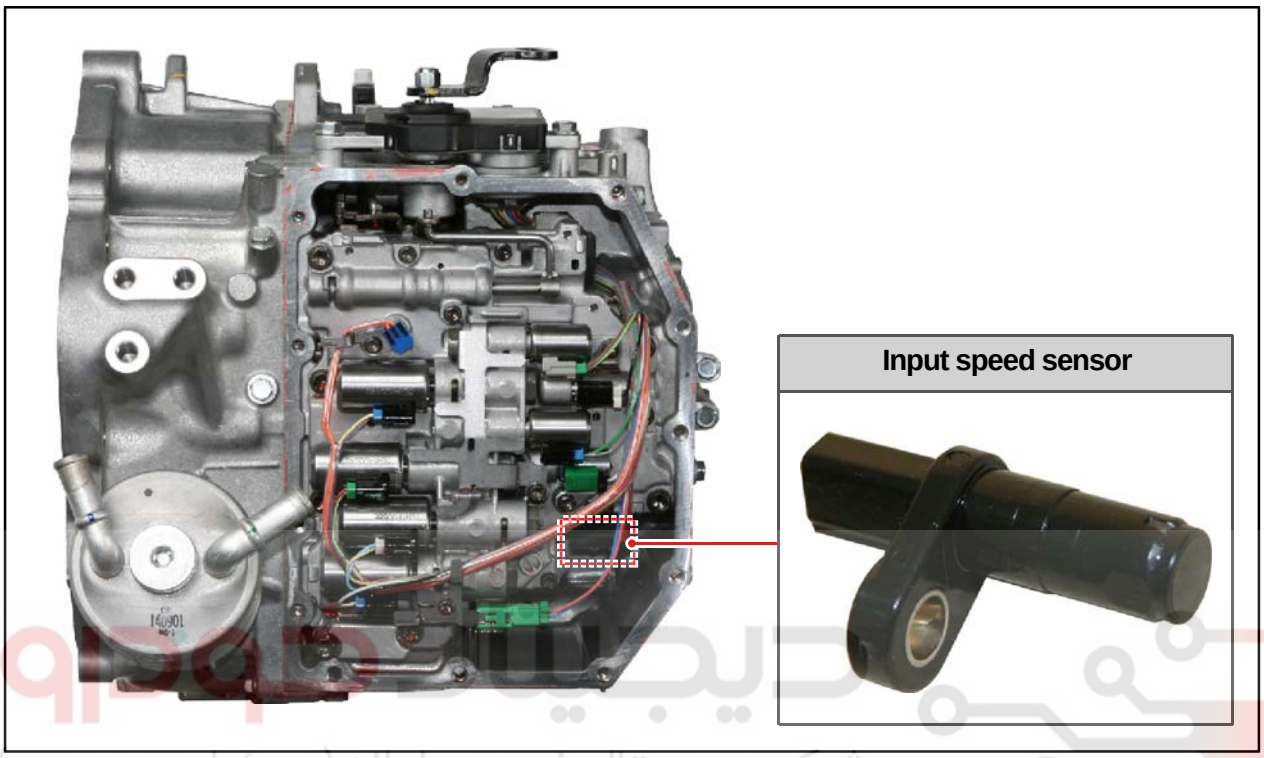
- Take care not to damage the side cover contact surface when removing the sealant and oil.
- Make sure that no sealant gets into the automatic transmission when applying it.
- Take care not to interfere the automatic transmission wiring when fitting the side cover.

Apply the sealant to the new automatic transmission side cover contact surface entirely.

Modification basis	
Application basis	
Affected VIN	

S.G.N. 3693-38 INPUT SPEED SENSOR

Preceding work - Disconnect the negative battery cable.



1

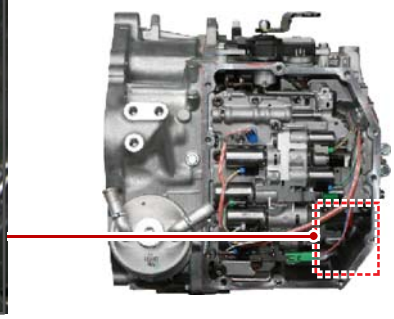
1. Remove the automatic transmission side cover.

NOTE

Refer to "AUTOMATIC TRANSMISSION SIDE COVER" in "REMOVAL AND INSTALLATION" under this section.

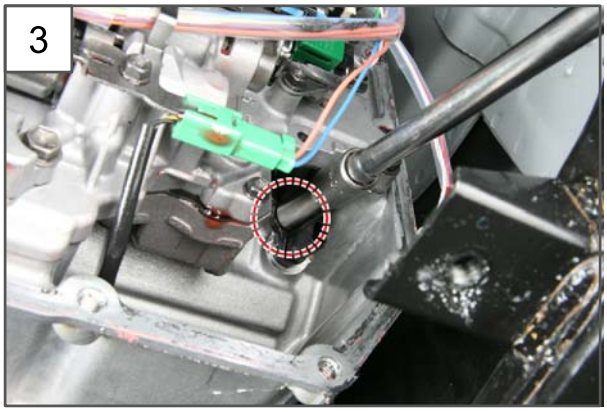
2

2. Disconnect the input speed sensor connector.



Modification basis	
Application basis	
Affected VIN	

3



3. Unscrew the input speed sensor mounting bolt (10 mm).

Tightening torque **3.9 to 6.9 Nm**

4

4. Remove input speed sensor.

5

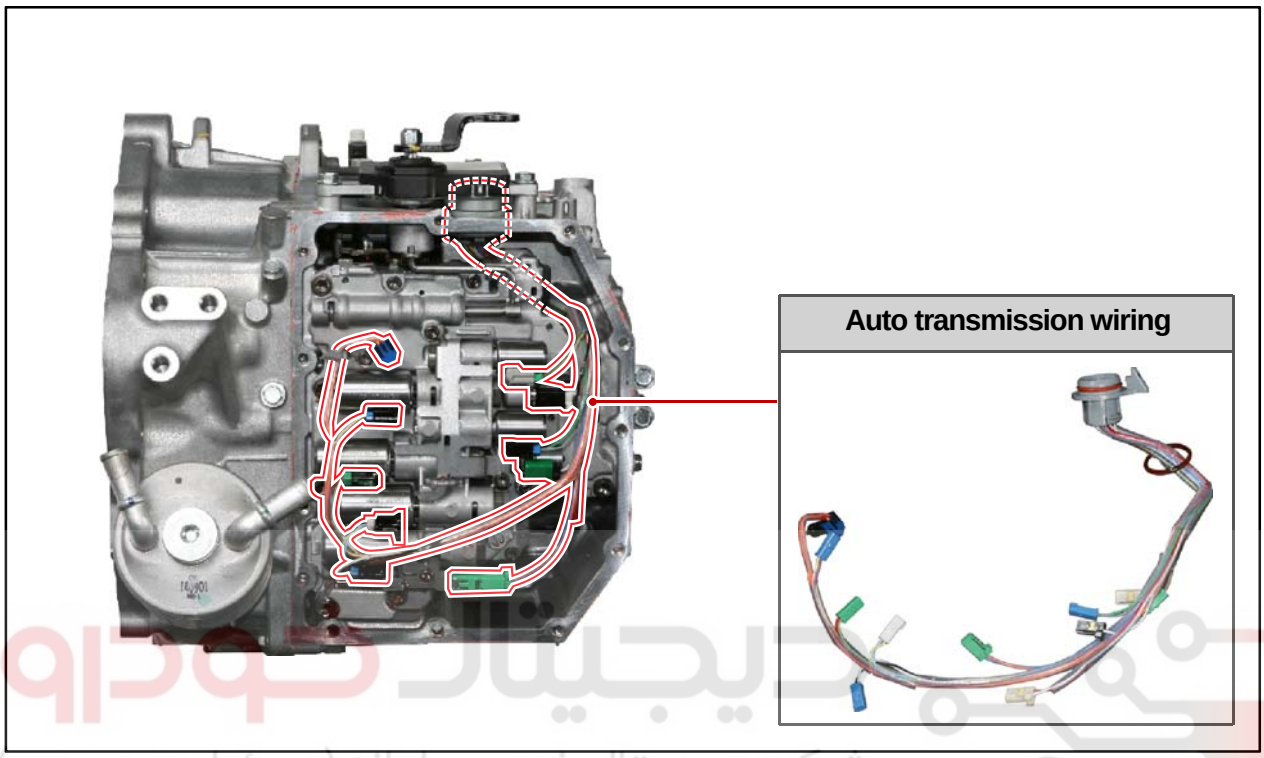
5. Install in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

S.G.N. 3691-11

AUTOMATIC TRANSMISSION WIRING

Preceding work - Disconnect the negative battery cable.



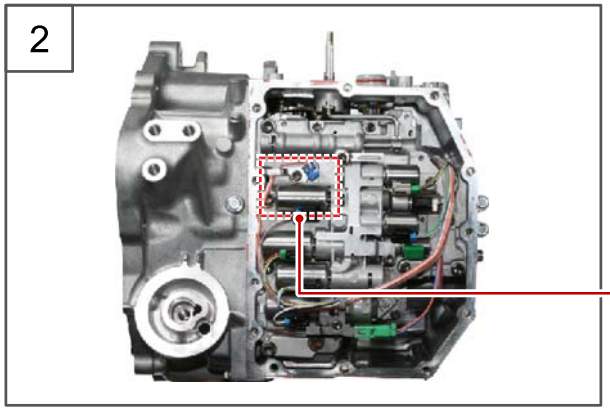
1

1. Remove the automatic transmission side cover.

NOTE

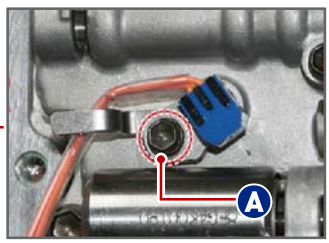
Refer to "AUTOMATIC TRANSMISSION SIDE COVER" in "REMOVAL AND INSTALLATION" under this section.

2



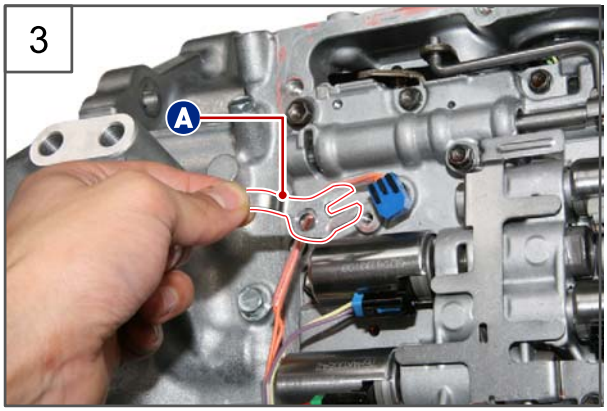
2. Unscrew the oil temperature sensor lock place mounting bolt (A, 8 mm).

Tightening torque 6 to 8 Nm

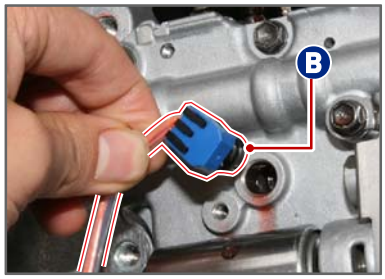


Modification basis	
Application basis	
Affected VIN	

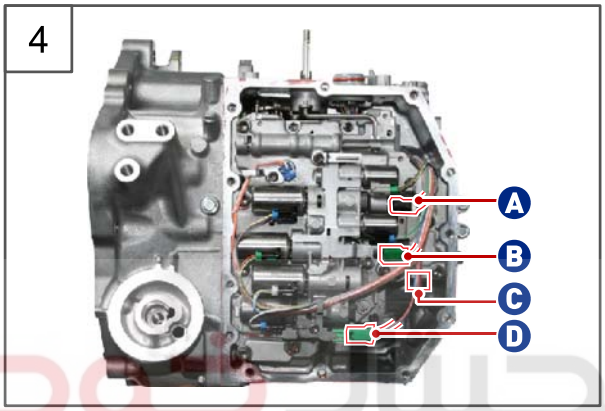
3



3 Remove the lock plate (A) and remove the oil temperature sensor (B).



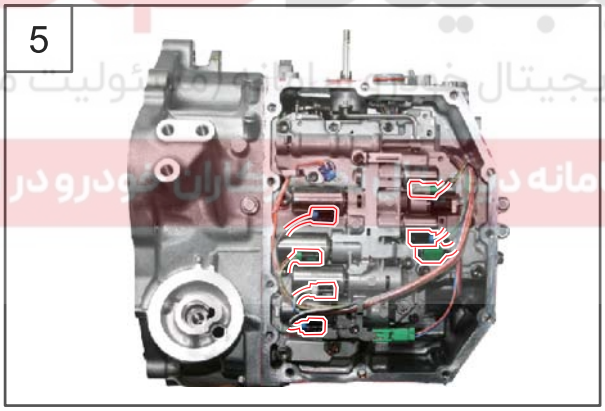
4



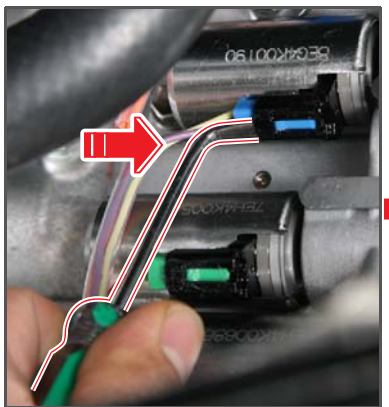
4. Disconnect the connectors (A), (B), (C) and (D).

A. S1 connector
B. S2 connector
C. Input speed sensor connector
D. Output speed sensor connector

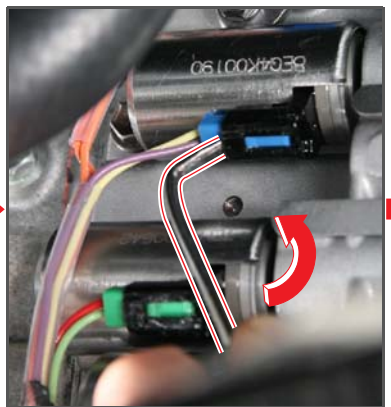
5



5. Disconnect the connectors as follows:



Insert an L-shaped flat screwdriver into the connector locking part.



Turn the flat screwdriver to the arrow direction.

Disconnect the connector.

Modification basis	
Application basis	
Affected VIN	

6

6. Disconnect the output speed sensor connector from the connector holder.

7

7. Unscrew the two suction cover mounting bolts (10 mm).

Tightening torque 8 to 12 Nm

31 mm long

8

8. Remove the suction cover.

CAUTION

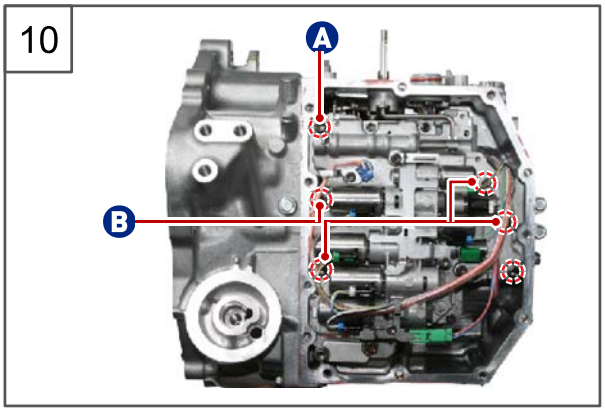
Avoid getting the residual oil in the suction cover on the floor or your body when removing the suction cover.

9

9. Remove the suction cover gasket.

Modification basis	
Application basis	
Affected VIN	

10



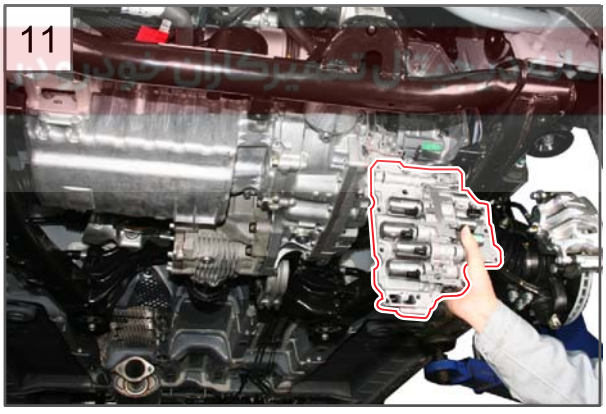
10.Unscrew the 6 valve body mounting bolts (A and B) (10 mm).

Tightening torque 8 to 12 Nm

CAUTION
- Remove the valve body mounting bolts diagonally in two or more stages.
- Be careful not to drop the valve body.

Item	A	B
Appearance		
Length	31 mm	21 mm

11



11.Remove the valve body assembly.

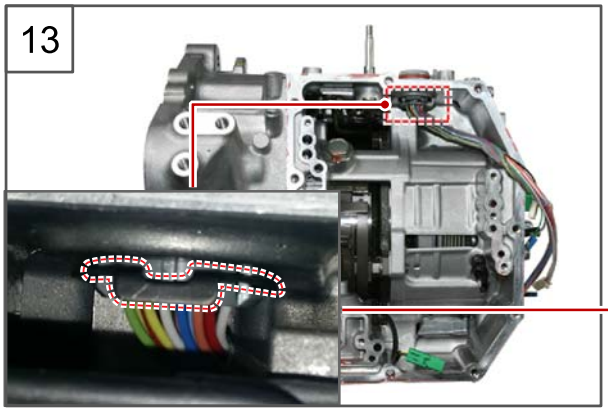
12

12.Remove the TCU.

NOTE
Refer to "TCU" in "REMOVAL AND INSTALLATION" under this section.

Modification basis	
Application basis	
Affected VIN	

13



13.Remove the automatic transmission wiring lock plate from the automatic transmission case.

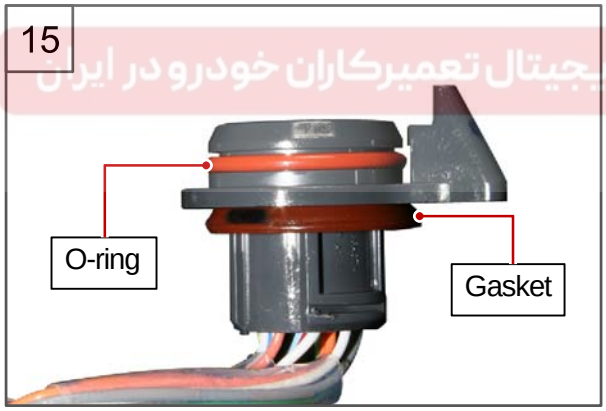
CAUTION

Fit the lock plate with the protrusion pointing downwards.

14

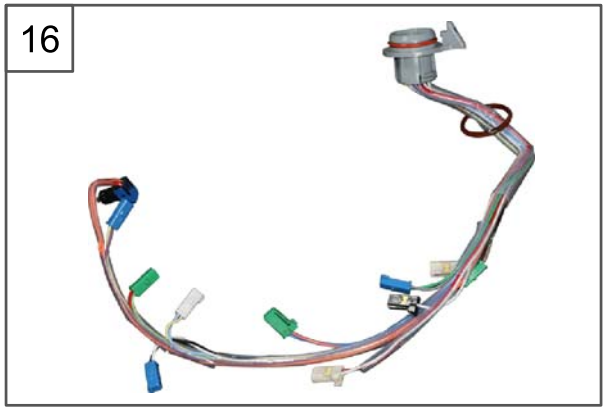
14.Remove the automatic transmission wiring.

15



15.Remove the O-ring and gasket from the automatic transmission wiring.

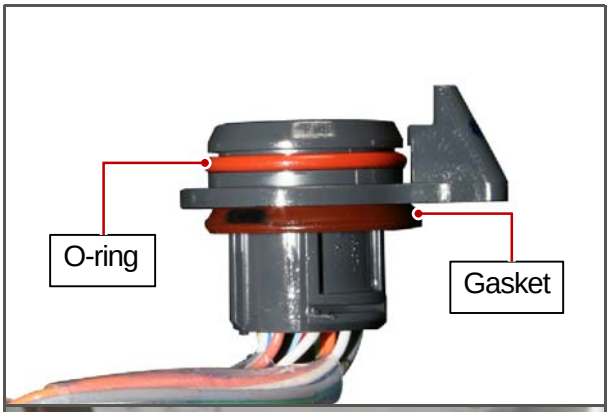
16

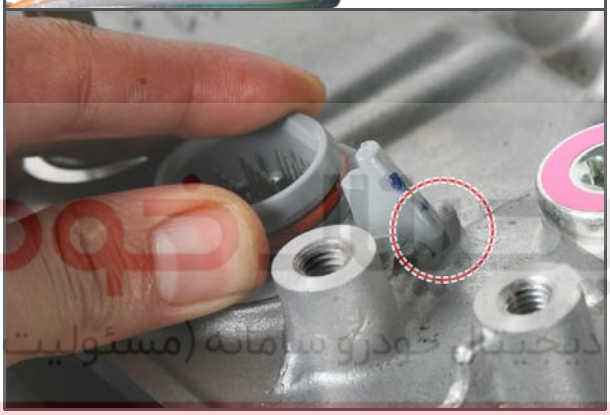


16.Install in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

Cautions for fitting automatic transmission wiring





Use a new O-ring and gasket when fitting them.

O-ring size

Internal diameter	Thickness
27.3 mm	2.4 mm

Align the transmission case groove with the automatic transmission wiring protrusion when fitting.

CAUTION

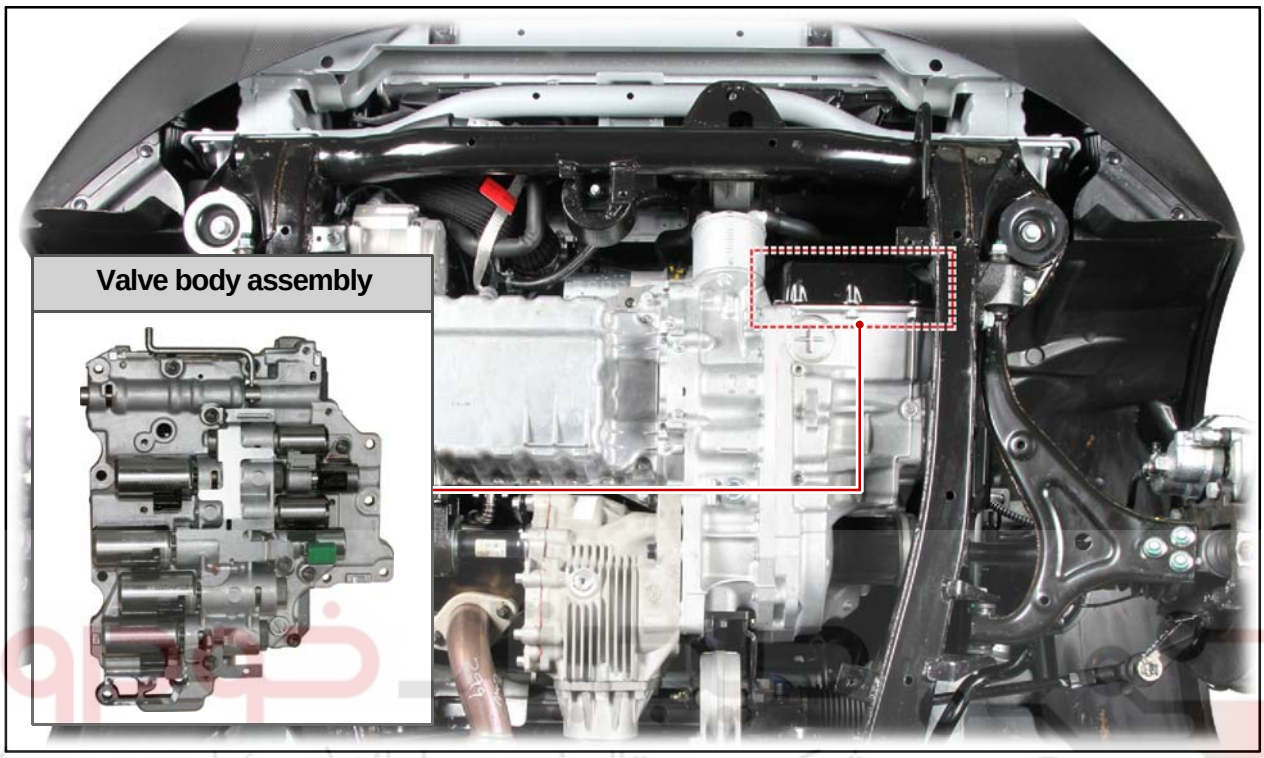
Be careful not to damage the wiring when fitting the automatic transmission wiring.

- Remove the sealant and oil completely from the mounting bolt groove of the automatic transmission case and side cover contact surface and fit the new automatic transmission side cover and mounting bolt.
- Fill with the ATF.

Modification basis	
Application basis	
Affected VIN	

S.G.N.
3693-15 VALVE BODY ASSEMBLY

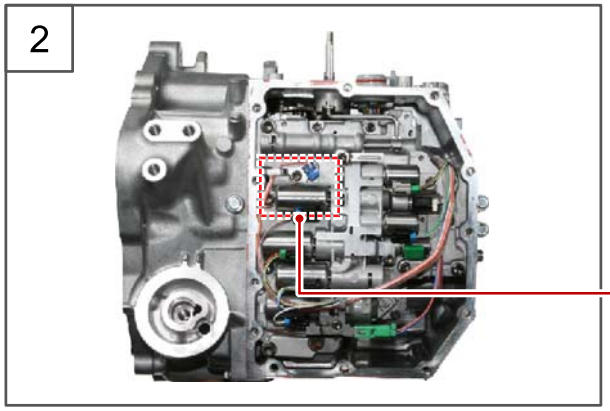
Preceding work - Disconnect the negative battery cable.



1. Remove the automatic transmission side cover.

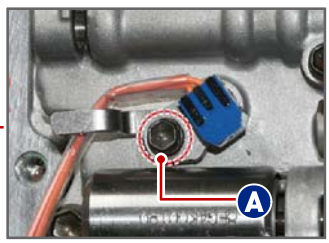
NOTE

Refer to "AUTOMATIC TRANSMISSION SIDE COVER" in "REMOVAL AND INSTALLATION" under this section.



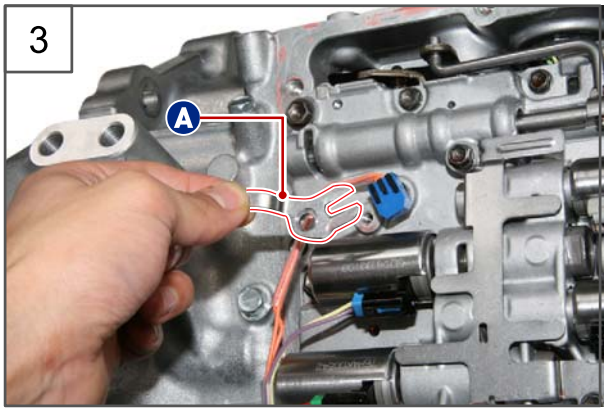
2. Unscrew the oil temperature sensor lock place mounting bolt (A, 8 mm).

Tightening torque 6 to 8 Nm

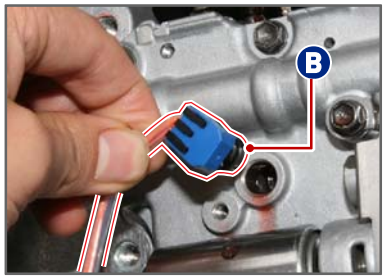


Modification basis	
Application basis	
Affected VIN	

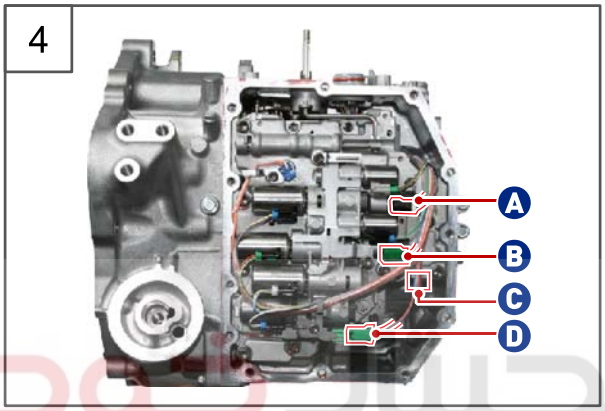
3



3. Remove the lock plate (A) and remove the oil temperature sensor (B).



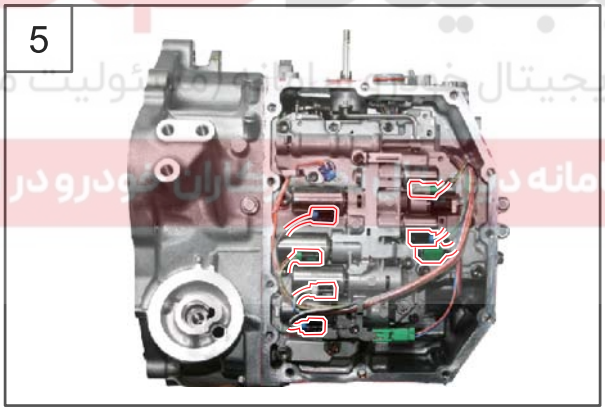
4



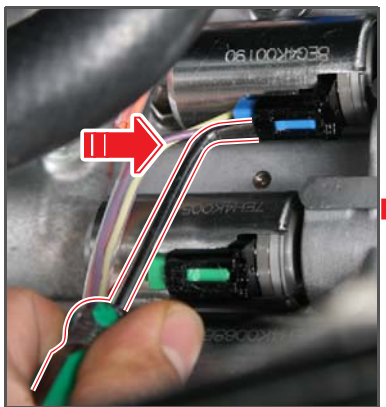
4. Disconnect the connectors (A), (B), (C) and (D).

A. S1 connector
B. S2 connector
C. Input speed sensor connector
D. Output speed sensor connector

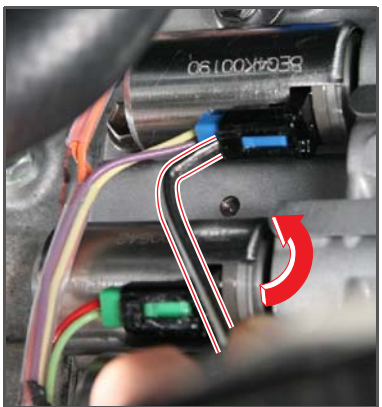
5



5. Disconnect the connectors as follows:



Insert an L-shaped flat screwdriver into the connector locking part.



Turn the flat screwdriver to the arrow direction.

Disconnect the connector.

Modification basis	
Application basis	
Affected VIN	

6

6. Disconnect the output speed sensor connector from the connector holder.

7

7. Unscrew the two suction cover mounting bolts (10 mm).

Tightening torque 8 to 12 Nm

8

8. Remove the suction cover.

CAUTION

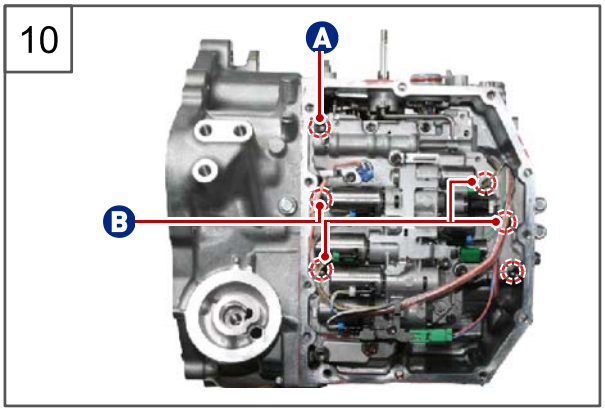
Avoid getting the residual oil in the suction cover on the floor or your body when removing the suction cover.

9

9. Remove the suction cover gasket.

Modification basis	
Application basis	
Affected VIN	

10



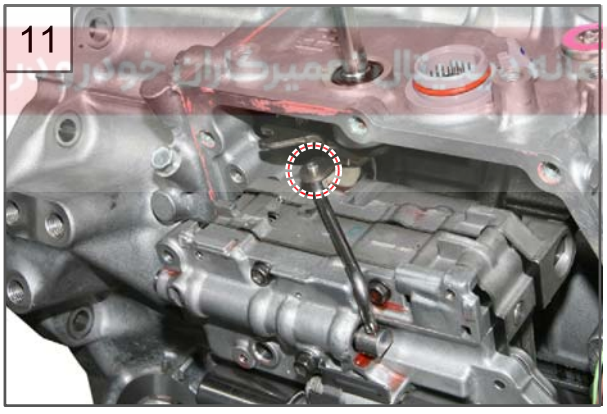
10.Unscrew the 6 valve body mounting bolts (A and B) (10 mm).

Tightening torque 8 to 12 Nm

CAUTION
- Remove the valve body mounting bolts diagonally in two or more stages.
- Be careful not to drop the valve body.

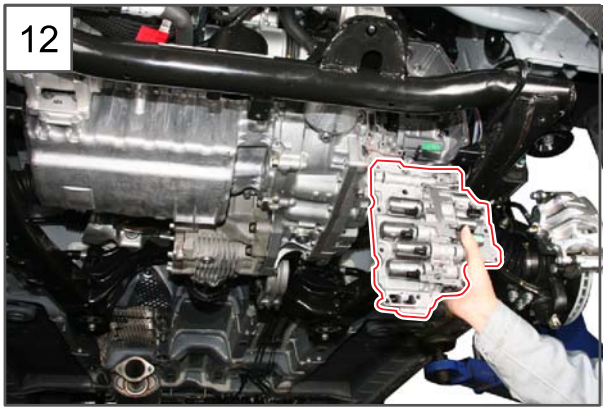
Item	A	B
Appearance		
Length	31 mm	21 mm

11



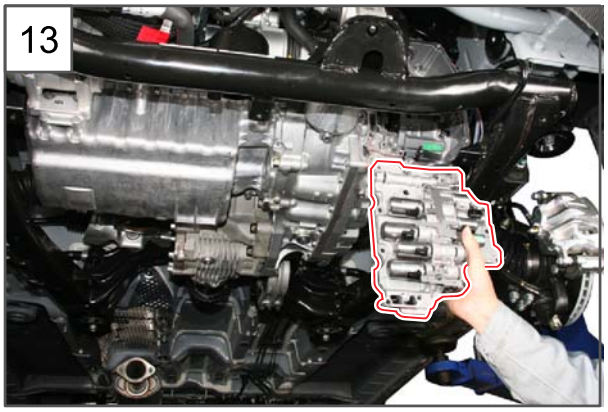
11.Separate the valve body assembly and remove the manual valve link and valve body assembly.

12



12.Remove the valve body assembly.

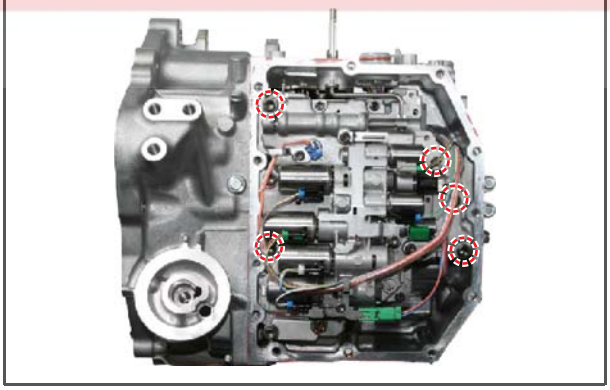
13



13.Install in the reverse order of removal.

Cautions for fitting valve body assembly

Place the shift lever in "N" position to fit the manual valve link.



Align the bolt holes, place the bolts in position roughly, fasten them diagonally in two or more stages with an even force and tighten them to tightening torque when fitting the valve body.

Tightening torque **8 to 12 Nm**

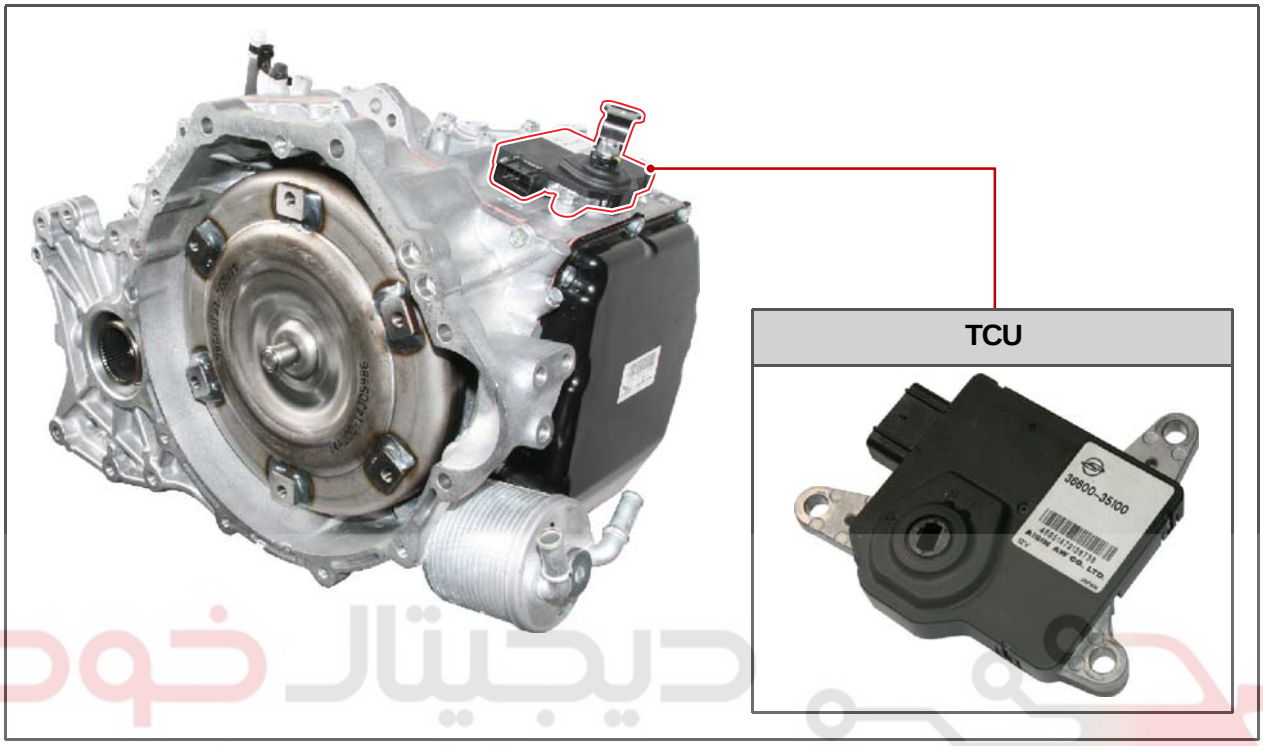
- Remove the sealant and oil completely from the mounting bolt groove of the automatic transmission case and side cover contact surface and fit the new automatic transmission side cover and mounting bolt.
- Fill with the ATF.

Modification basis	
Application basis	
Affected VIN	

S.G.N. 3691-07

TCU

Preceding work - Disconnect the negative battery cable.

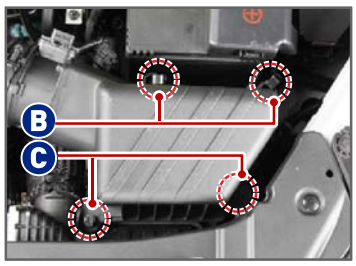


1. Apply the parking brake and place the shift lever to "N" position.

NOTE

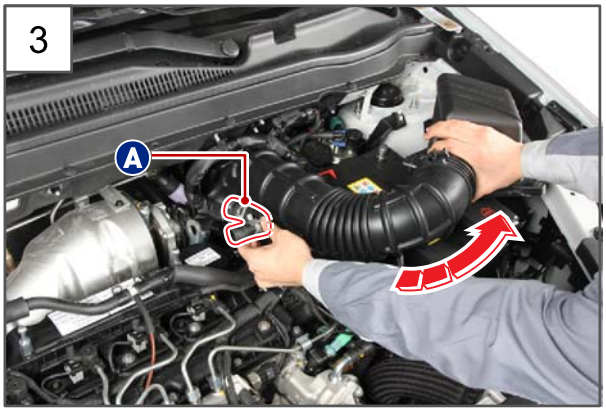
Make sure that the shift lever is in "N" position to align the mark of the shift position sensor when removing and installing the TCU.

2. Remove the HFM sensor connector (A), prize off the air cleaner top housing mounting clamp (B) and unscrew the 2 mounting bolts (C, 10 mm).

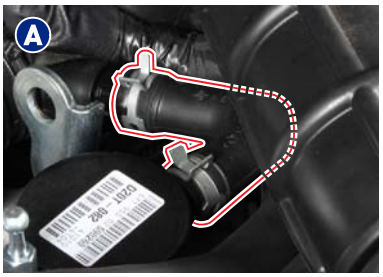


Modification basis	
Application basis	
Affected VIN	

3



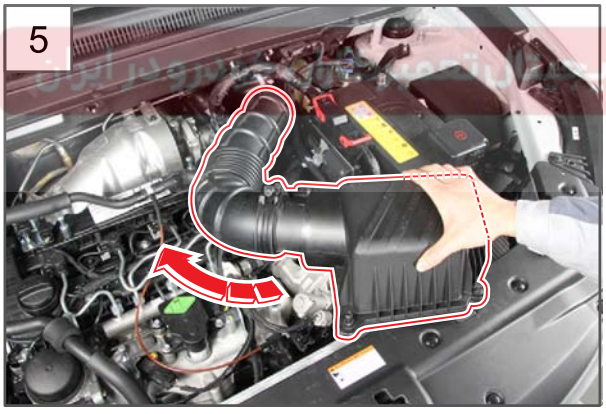
3. Prize off the air cleaner hose assembly (air cleaner → turbocharger) to the arrow direction (anti-clockwise) and remove the blow-by outlet hose (A).



4

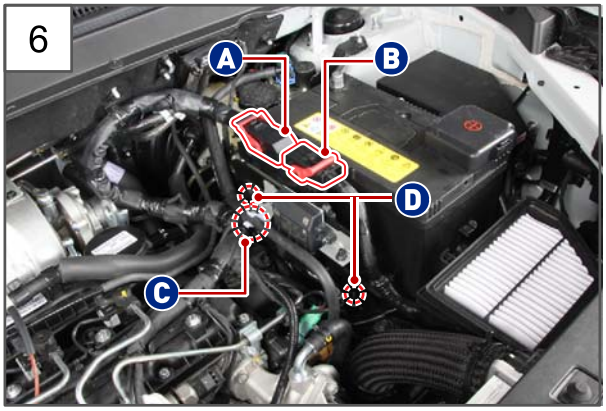
4. Unscrew the mounting clamp on the air cleaner hose assembly (air cleaner → turbocharger).

5



5. Turn the air cleaner hose assembly (air cleaner → turbocharger) to the arrow direction (clockwise) and remove it.

6

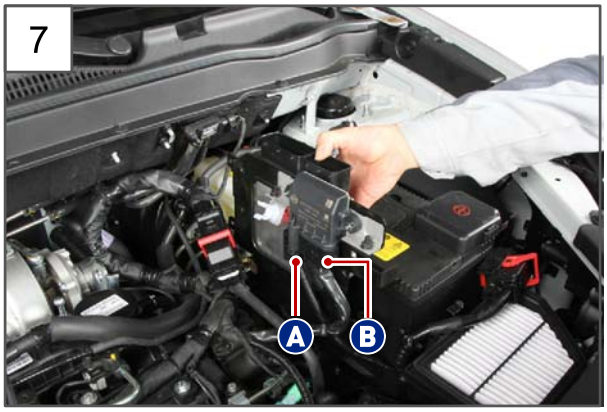


6. Disconnect the ECU connectors (A and B), separate the fuel hose from the mounting clip (C) and unscrew the 2 ECU bracket mounting nuts (D, 12 mm).

Tightening torque 3.7 to 7.8 Nm

Modification basis	
Application basis	
Affected VIN	

7



7. Disconnect the connectors (A and B) connected to the GCU and remove the ECU and GCU assembly.

NOTE
The GCU connecting connector (B) has the locking parts on both sides.

8

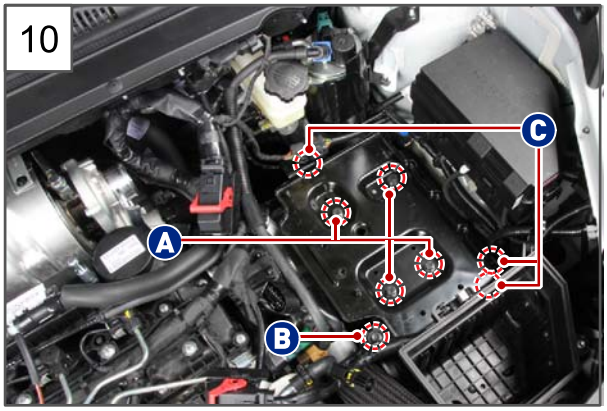
8. Unscrew 2 battery bracket mounting bolts (12 mm).

Tightening torque 10 ± 1.0 Nm

9

9. Unscrew the battery (+) connecting terminal mounting nut (10 mm) and remove the battery.

10

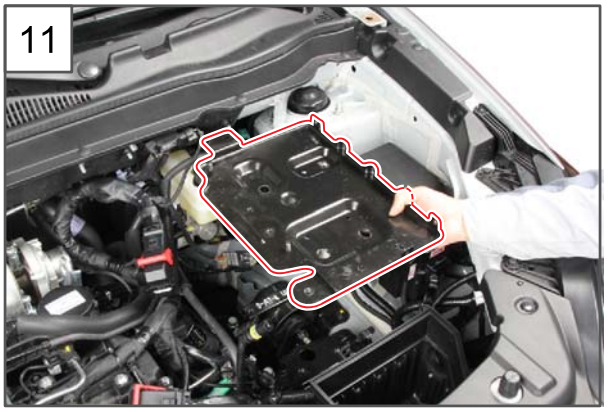


10. Unscrew the battery support mounting bolts (A) (14 mm, 4 off) and (B) (12mm), and separate each cable holding part (C) connected to the support.

Tightening torque (A) 25 ± 2.5 Nm

Tightening torque (B) 3.9 to 7.8 Nm

11



11.Remove the battery support.

12

12.Unscrew the TGS cable mounting bolt (12 mm) from the manual lever.

Tightening torque 14 to 18 Nm

CAUTION

- Avoid using impact when removing or fitting the mounting bolt. Follow the specified torque. Be careful not to deform the manual lever.
-

NOTE

Check if the "N" position marks of shift position sensor in the TCU are aligned.

CAUTION

- Make sure that manual lever position marks do not deviate more than 60˚.

13

13.Loosen the mounting clip from the TGS cable bracket to the automatic transmission and remove the TGS cable.

14

14.Unscrew the manual lever mounting bolt (13 mm).

Tightening torque 14 to 18 Nm

15

15.Remove the manual lever.

Tightening torque 14 to 18 Nm

NOTE

Check if the "N" position marks of shift position sensor in the TCU are aligned.

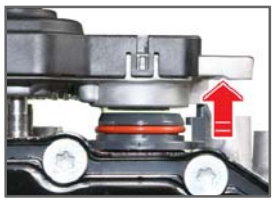
CAUTION

- Make sure that manual lever position marks do not deviate more than 60°.

16

16.Unscrew the 3 TCU mounting bolts (12 mm) to remove the TCU.

Tightening torque 19.6 to 29.4 Nm

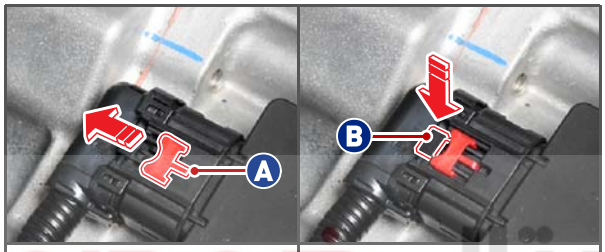


CAUTION

When removing the TCU, take care not to damage the transmission connector and lift it up horizontally.

17

17.Disconnect the TCU wiring connector.



Move the connector locking part (A) to the arrow direction.	Press the connector locking part (B) to the arrow direction and remove it.

18

18.Remove the TCU.

NOTE

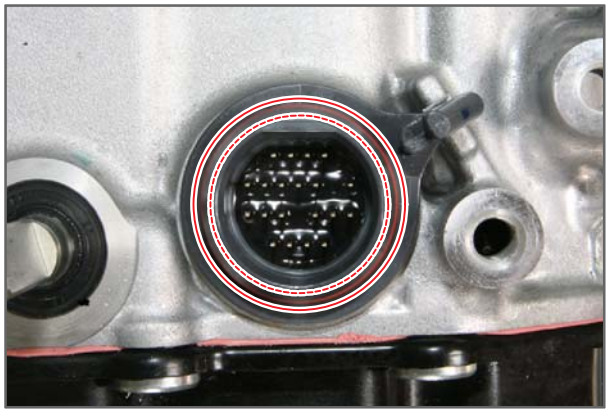
Refer to "TCU" in "REMOVAL AND INSTALLATION" under this section.

19

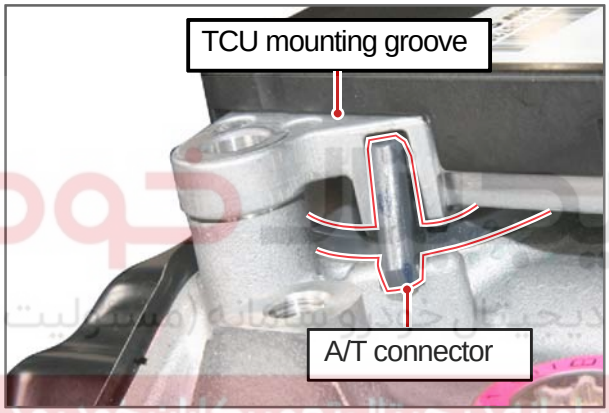
19.Install in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

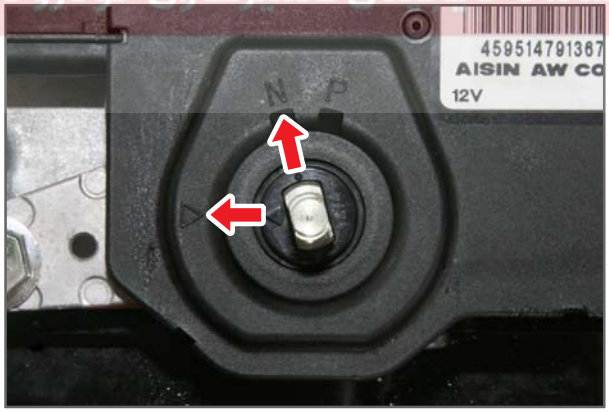
Cautions for fitting TCU



After removing the TCU, check the connector pin for foreign materials, bending, damage and O-ring condition.



Align the automatic transmission housing groove with the automatic transmission connector and TCU's mounting grooves when fitting.



Check if the "N" position marks of shift position sensor in the TCU are aligned after fitting the TCU.

CAUTION

Make sure that manual lever position marks do not deviate more than 60°. (The manual valve in the automatic transmission may come off.)

NOTE

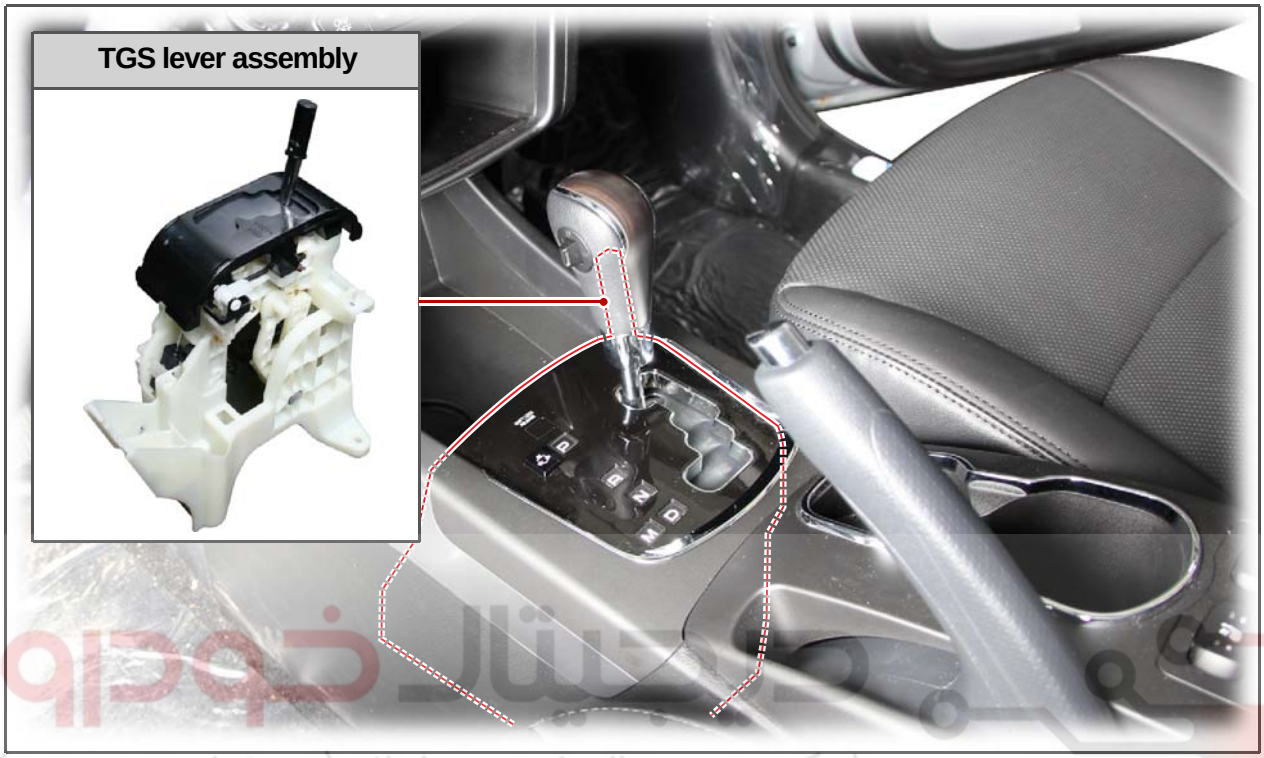
When the TCU has been replaced or refitted, always perform the "N position learning".

Modification basis	
Application basis	
Affected VIN	

S.G.N. 3724-01

TGS LEVER ASSEMBLY

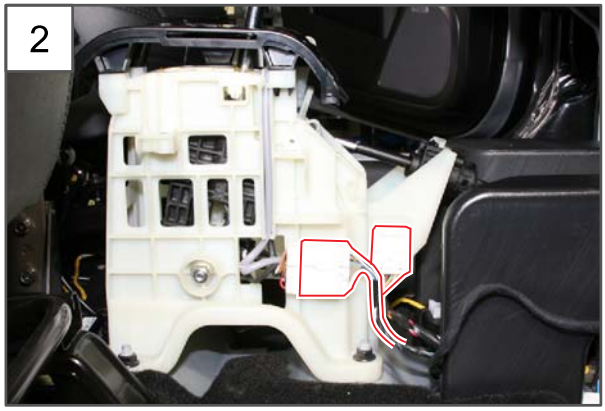
Preceding work - Disconnect the negative battery cable.



1. Remove the front console.

NOTE

Refer to "FRONT CONSOLE" under "REMOVAL AND INSTALLATION" in "BODY INTERIOR" chapter.

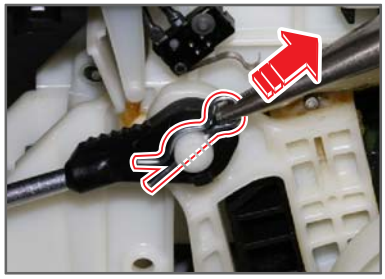


2. Disconnect the 2 connectors connected to the TGS lever.

Modification basis	
Application basis	
Affected VIN	

3

3. Remove the shift cable mounting pin from the TGS lever.



4

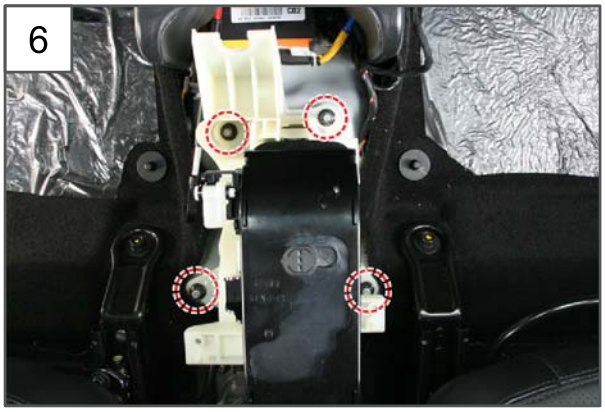
4. Separate the shift cable from the TGS lever.

5

5. Remove the shift cable from the TGS lever fixing part.

 Press the shift cable mounting clip to the arrow direction.	 Lift up the shift cable mounting clip to the arrow direction.

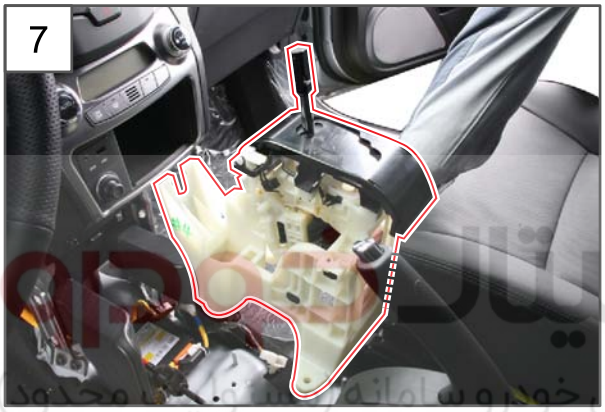
6



6. Unscrew the four mounting nuts (12 mm) on the TGS lever.

Tightening torque 17.6 to 21.6 Nm

7



7. Remove the TGS lever.

8

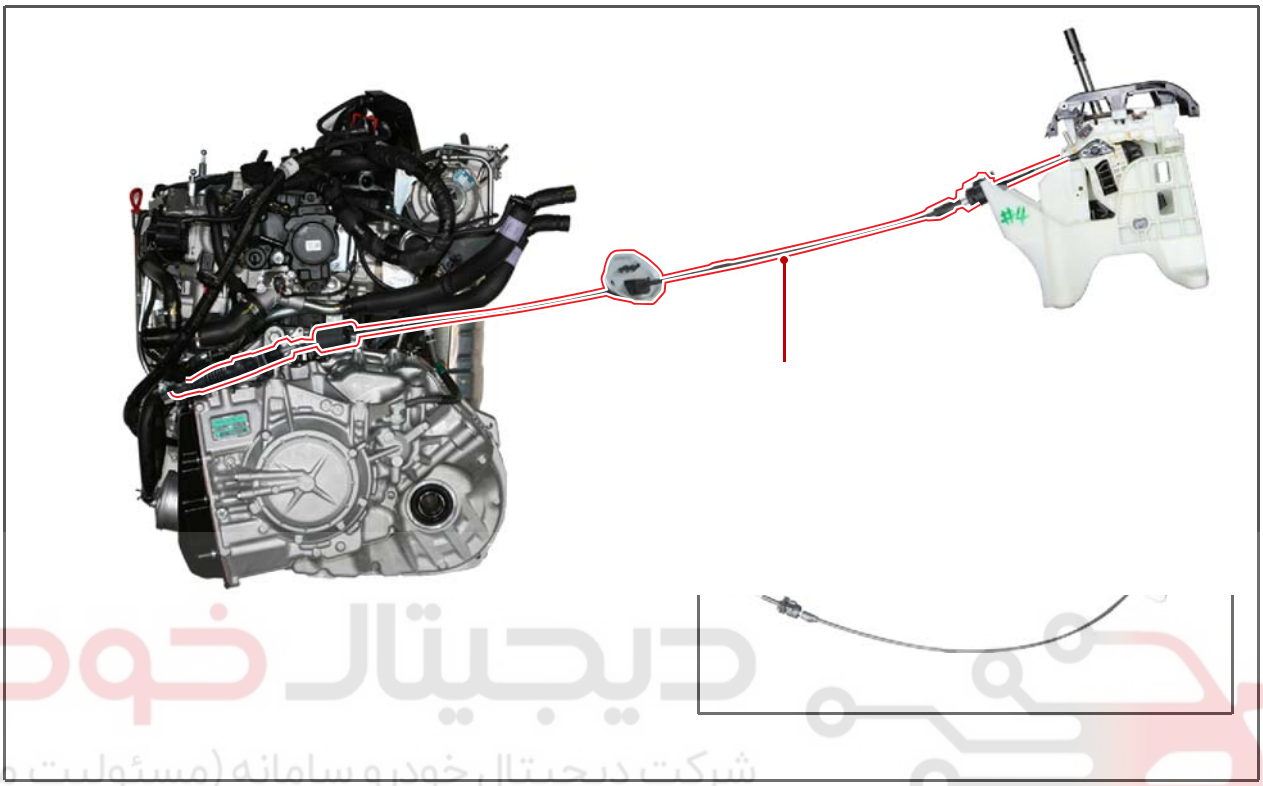
8. Install in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

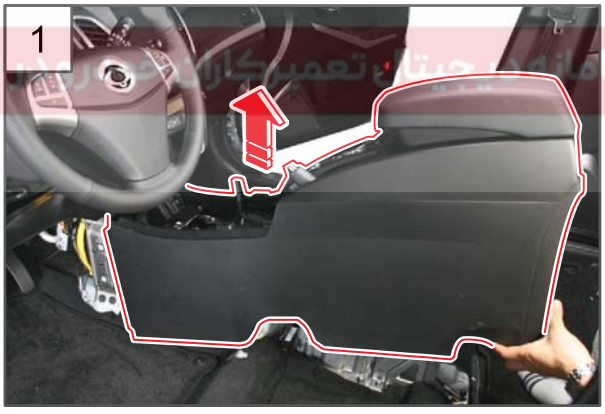
S.G.N. 3724-03

TGS CABLE

Preceding work - Disconnect the negative battery cable.



1



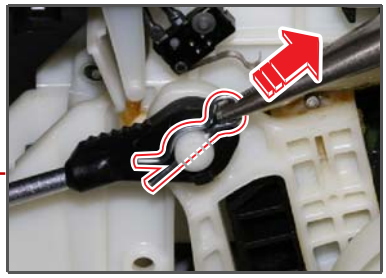
1. Remove the front console.

NOTE

Refer to "FRONT CONSOLE" under "REMOVAL AND INSTALLATION" in "BODY INTERIOR" chapter.

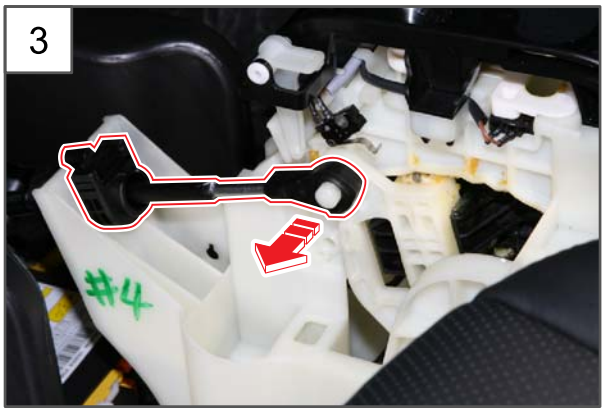
2

2. Remove the shift cable mounting pin from the TGS lever.



Modification basis	
Application basis	
Affected VIN	

3



3. Separate the shift cable from the TGS lever.

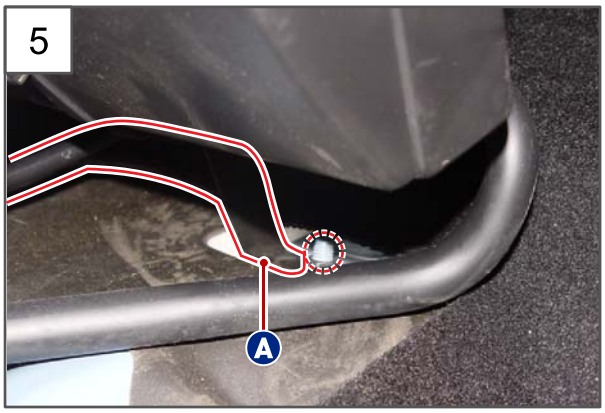
4

4. Remove the shift cable from the TGS lever fixing part.

Press the shift cable mounting clip to the arrow direction.

Lift up the shift cable mounting clip to the arrow direction.

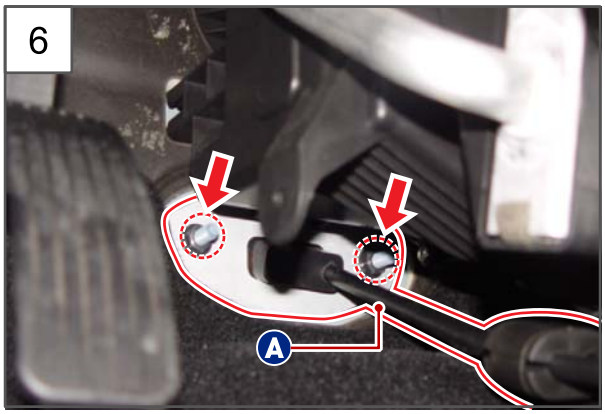
5



5. Unscrew the TGS cable bracket (A) mounting nut (12 mm) from the dash panel.

Tightening torque 17.6 to 21.6 Nm

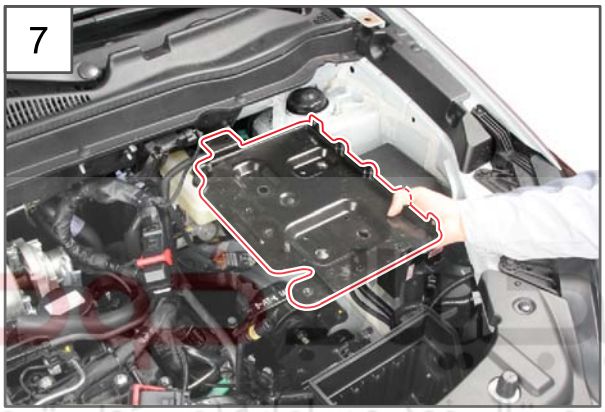
6



6. Unscrew the 2 TGS cable (A) mounting nut (12 mm) from the dash panel.

Tightening torque **17.6 to 21.6 Nm**

7

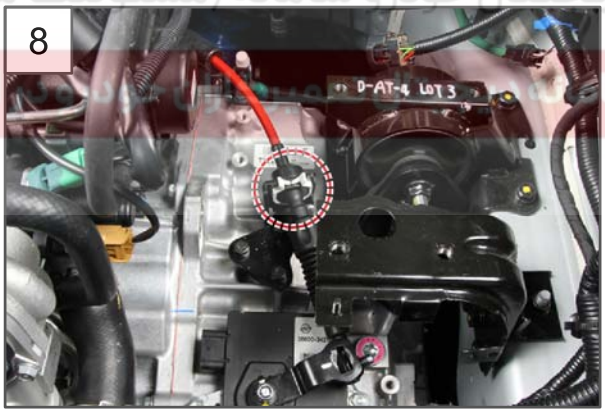


7. Remove the battery support.

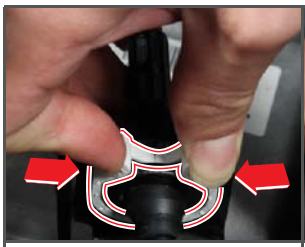
NOTE

Refer to "TCU" in "REMOVAL AND INSTALLATION" under this section.

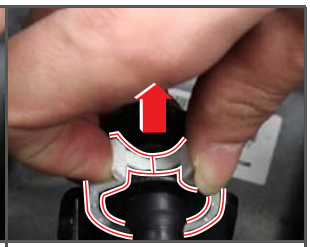
8



8. Loosen the mounting clip from the TGS cable bracket to the automatic transmission and remove the TGS cable.



Press the mounting clip at both sides to the arrow directions.



Lift off the mounting clip to the arrow direction while pressing it at both sides.

Modification basis	
Application basis	
Affected VIN	

9

9. Remove the TGS cable in the vehicle.

10

10.Install in the reverse order of removal.

S.G.N. 3691-14

AUTOMATIC TRANSMISSION OIL SEAL

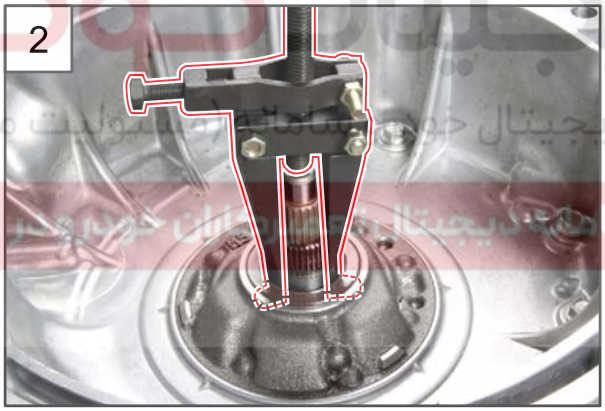
1) Oil Pump Oil Seal

(1) Removal

Preceding work - Remove the automatic transmission assembly. (see "AUTOMATIC TRANSMISSION ASSEMBLY" in "REMOVAL AND INSTALLATION" under "AUTO TRANSAXLE")

1. Remove the torque converter from the automatic transmission.

CAUTION
- Be careful not to damage the oil pump oil seal.
- Take care not to drop the torque converter.



2. Remove the oil seal from the oil pump using the AISIN 6A/T oil seal puller (oil pump) [part no.: X9936 0140A].

CAUTION
Be careful not to damage the busing in the oil pump assembly.

2) Differential Oil Seal (To Housing)

(1) Removal

Preceding work
- Remove the right drive and intermediate shaft. (see "DRIVE SHAFT" in "REMOVAL AND INSTALLATION" under "DRIVE SHAFT & AXLE SYSTEM")
- For a 4WD vehicle, remove the PTU assembly. (see "PTU ASSEMBLY" in "REMOVAL AND INSTALLATION" under "AWD SYSTEM")

1. Remove the oil seal to housing using the AISIN 6A/T oil seal puller (LH and RH Side) [part no.: X9936 0130A] between the differential housing and oil seal.

CAUTION
Be careful not to damage the oil seal and contact surface.

(2) Installation

1. Fit the new oil seal to the automatic transmission housing using the AISIN 6A/T oil seal installer (RH side) and a hammer.

NOTE
Oil seal specification: 19.7 ± 0.5 mm (from housing end)

CAUTION
Be careful not to damage the oil seal.

2. Fit the right drive shaft, intermediate shaft and PTU (4WD).

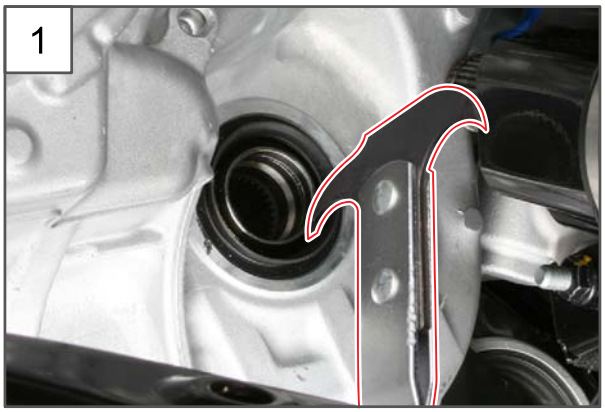
NOTE
- See "DRIVE SHAFT" in "REMOVAL AND INSTALLATION" under "DRIVE SHAFT AND AXLE SYSTEM"
- See "PTU ASSEMBLY" in "REMOVAL AND INSTALLATION" under "AWD SYSTEM"

Modification basis	
Application basis	
Affected VIN	

3) Differential Oil Seal (To Case)

(1) Removal

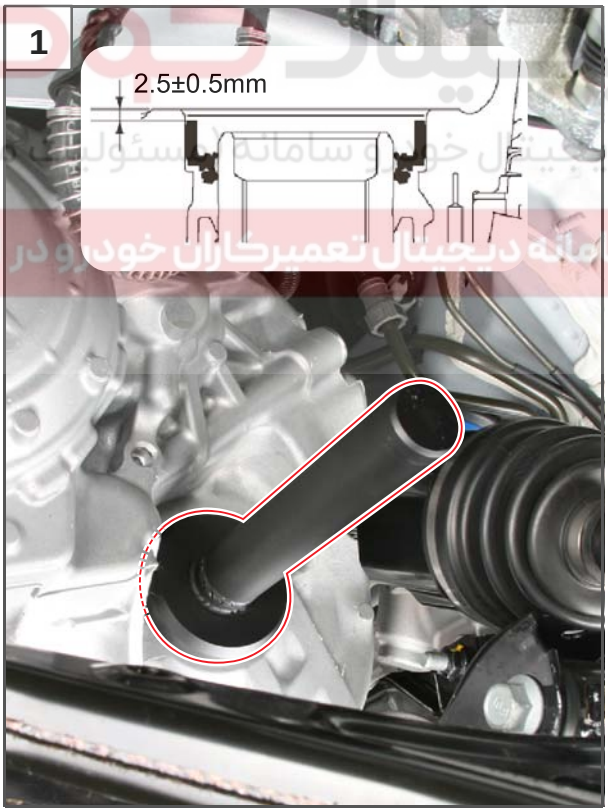
Preceding work - Remove the left drive shaft. (see "DRIVE SHAFT" in "REMOVAL AND INSTALLATION" under "DRIVE SHAFT & AXLE SYSTEM")



1. Remove the oil seal to case using the AISIN 6A/T oil seal puller (LH and RH Side) [part no.: X9936 0130A] between the differential housing and oil seal.

CAUTION
Be careful not to damage the oil seal and contact surface.

(2) Installation



1. Fit the new oil seal to the automatic transmission case using the AISIN 6A/T oil seal installer (RH side) and a hammer.

NOTE
Oil seal specification: 2.5 ± 0.5 mm (from case end)

CAUTION
Be careful not to damage the oil seal.

2. Fit the drive shaft.

NOTE
See "DRIVE SHAFT" in "REMOVAL AND INSTALLATION" under "DRIVE SHAFT AND AXLE SYSTEM"

4) Manual Shaft Oil Seal

(1) Removal

Preceding work - Remove the TCU. (see "TCU" in "REMOVAL AND INSTALLATION" under "AUTO TRANSAXLE")

1. Remove the manual shaft oil seal using the screwdriver.

CAUTION
- Tape the screwdriver tip before use.
- Be careful not to damage the automatic transmission case.
- Be careful not to damage the manual shaft.

(2) Installation

1. Fit the new oil seal using AISIN 6A/T oil seal installer (manual shaft)[part no.: X9936 0120A] and a hammer.

NOTE
Oil seal specification: -0.3 to +0.4 mm (from case end)

CAUTION
Be careful not to damage the oil seal.

2. Fit the TCU.

NOTE
See "TCU" in "REMOVAL AND INSTALLATION" under "AUTO TRANSAXLE"

Modification basis	
Application basis	
Affected VIN	