

# AISIN 6 SPEED AUTO TRANSAXLE

3690-01/3691-07/3691-11/3691-14/3691-22/3691-28/  
3693-15/3693-21/3693-38/3724-01/3724-03/8510-07/9210-02/

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## 6 SPEED AUTO TRANSAXLE

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# دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران





**6 SPEED AUTO TRANSAXLE****3690-01****GENERAL INFORMATION****1. SPECIFICATIONS**

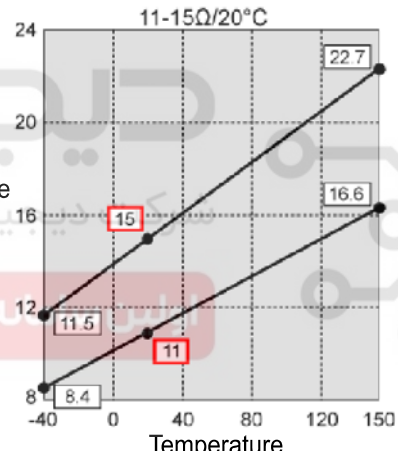
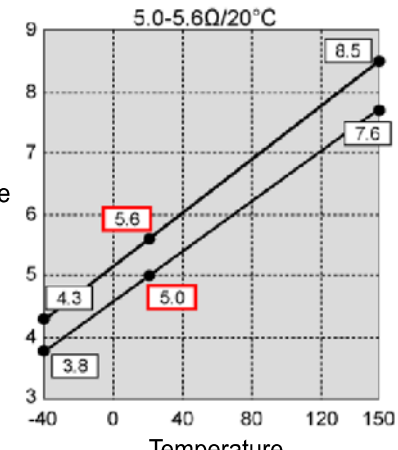
Items		Specifications	
Classification		G16DF	D16DTF
Max. torque		220 Nm	400 Nm
Oil level		Overflow type	
Manual shift control		Yes	
Stall rpm		2800rpm±150rpm	
Fluid	Type	AW-1	
	Capacity	6.1L	7.0L
	Change interval	Maintenance-free, change-free (However, check and change at every 100,000 km of driving under demanding conditions)	
Gear ratio	1st gear	4.044	4.148
	2nd gear	2.371	2.370
	3rd gear	1.556	1.556
	4th gear	1.159	1.155
	5th gear	0.852	0.859
	6th gear	0.672	0.686
	Reverse	3.193	3.394
	Counter	1.061	0.942
	Differential	3.867	3.533

Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

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Items		Specifications				
Configuration of disc clutch *( ) D16DTF		Specific name	Flange	Disc	Plate	Band
		C1	1 (2) ea	5 (7) ea	5 (6) ea	-
		C2	1 (1) ea	4 (4) ea	4 (4) ea	-
		C3	1 (1) ea	3 (4) ea	3 (4) ea	-
Configuration of disc brake *( ) D16DTF		B1	-	-	-	1 (1) ea
		B2	2 (2) ea	5 (6) ea	4 (5) ea	-
Configuration of one-way clutch		F1	Roller type			
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]						



Item			Specification
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

# دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

AISIN 6  
SPEED6-SPEED  
M/T

CLUTCH

PROPELLER

DRIVE  
SHAFT

AWD

SUSPENSION

BRAKE  
SYSTEM

ESP

ABS

ELECTRIC  
POWERWHEEL  
AND TIRE

TPMS

SUB  
FRAME

Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

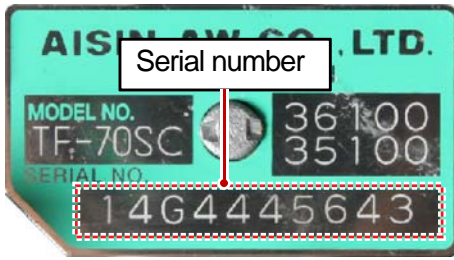
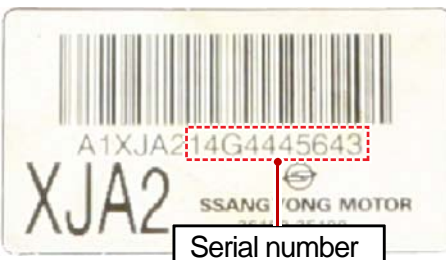

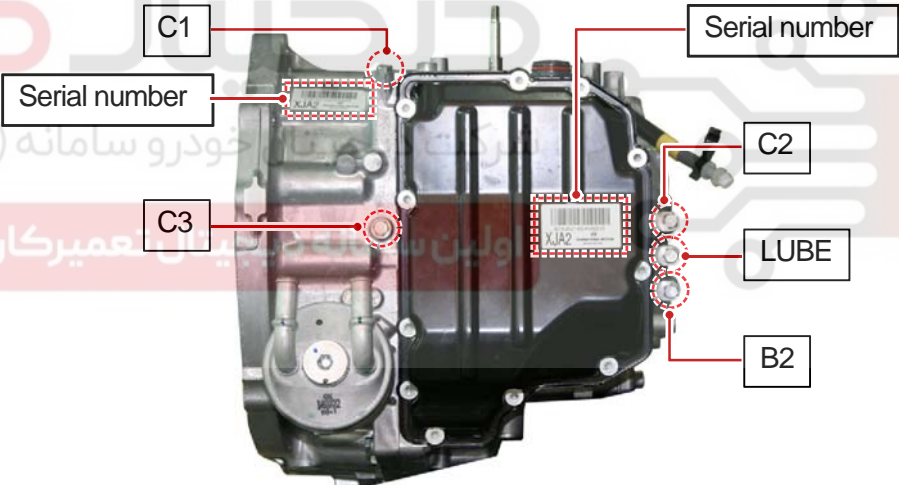
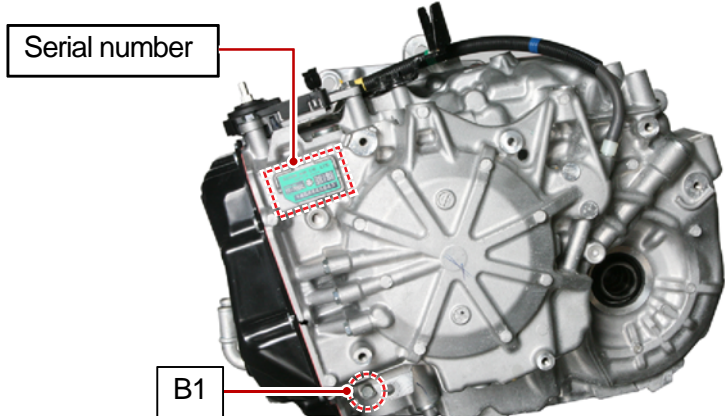
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01-6

3690-01

T I V O L I

A/T serial number	 
TCU serial number	
Serial number positions for test plug and A/T	
	

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 (9.8 ~ 15.7)	T-40 mm X 11 ea
Valve body assembly	8.0 ~ 12.0	10 mm X 3 ea (5 ea)
		10 mm X 5 ea (1 ea)
Suction cover(D16DTF only)	(8.0 ~ 12.0)	(10mm X 2 ea)
Oil temperature sensor	6.0 ~ 8.0	8 mm X 1 ea
Valve body wire clamp (G16DF only)	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 (39.2 ~ 45.1)	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 (5 ea)
Torque converter	44 ~ 51	13 mm X 6 ea

\* ( ) D16DTF

Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

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## 1) Oil Seal

Item	Specification (oil seal depth)
Manual shaft	- 0.3 to 0.4 mm
Oil pump	- 0.2 ~ 0.2 mm

### ► Transmission diff. oil seal

Engine	T/C	Specification (oil seal depth)	
		Housing	Case
G16DF	2WD	$3.9 \pm 0.5$ mm	$2.7 \pm 0.5$ mm
	AWD	$6.4 \pm 0.5$ mm	
D16DTF	2WD	$15.3 \pm 0.5$ mm	$3.5 \pm 0.5$ mm
	AWD	$5.5 \pm 0.5$ mm	

## 2) Distance Between A/T Housing And Torque Converter

Item	Specification
Distance between A/T housing and torque converter	12.15 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



### 3. SPECIAL TOOLS




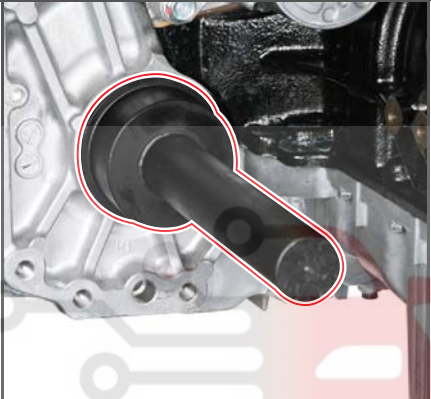


PN & Name	Special Tool	Use
<b>PN:</b> X9936 0080A  <b>Name:</b> AISIN 6 A/T housing bottom oil filler adapter  <b>Use:</b> Oil filler adapter for filling with oil at AISIN 6 A/T housing bottom		
<b>PN:</b> X9936 0090A  <b>Name:</b> AISIN 6A/T oil seal installer (RH side)  <b>Use:</b> For fitting G16DF-2WD A/T RH oil seal		
<b>PN:</b> X9936 0100A  <b>Name:</b> AISIN 6A/T oil seal installer (LH side)  <b>Use:</b> For fitting G16DF-2WD/AWD A/T LH oil seal		
<b>PN:</b> X9936 0110A  <b>Name:</b> AISIN 6A/T oil seal installer (oil pump)  <b>Use:</b> For fitting A/T oil pump oil seal		

Modification basis	
Application basis	
Affected VIN	



PN & Name	Special Tool	Use
<b>PN:</b> X9936 0120A  <b>Name:</b> AISIN 6 A/T oil seal installer (manual shaft)  <b>Use:</b> For fitting A/T manual shaft oil seal		
<b>PN:</b> X9936 0130A  <b>Name:</b> AISIN 6A/T oil seal puller (LH & RH side)  <b>Use:</b> For removing A/T LH & RH oil seal		
<b>PN:</b> X9936 0140A  <b>Name:</b> AISIN 6 A/T oil seal puller (oil pump)  <b>Use:</b> For removing A/T oil pump oil seal		
<b>Name:</b> AWD-A/T deep oil seal installer (RH) (G16DF-AWD A/T only)  <b>Use:</b> For fitting G16DF-AWD A/T RH oil seal  <b>Selling:</b> <a href="http://www.toolntech.com">http://www.toolntech.com</a>		



PN & Name	Special Tool	Use
<b>Name:</b> 2WD-A/T deep oil seal installer (RH) (D16DTF-2WD A/T only)  <b>Use:</b> For fitting D16DTF-2WD A/T RH oil seal  <b>Selling:</b> <a href="http://www.toolIntech.com">http://www.toolIntech.com</a>		
<b>Name:</b> AWD-A/T deep oil seal installer (RH) (D16DTF-AWD A/T only)  <b>Use:</b> For fitting D16DTF-AWD A/T RH oil seal  <b>Selling:</b> <a href="http://www.toolIntech.com">http://www.toolIntech.com</a>		
<b>Name:</b> 2WD/AWD-A/T deep oil seal installer (LH) (D16DTF-2WD/AWD A/T only)  <b>Use:</b> For fitting D16DTF-2WD/AWD A/T LH oil seal  <b>Selling:</b> <a href="http://www.toolIntech.com">http://www.toolIntech.com</a>		

Modification basis	
Application basis	
Affected VIN	



## 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			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
ENGINE	Engine fault			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
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			



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.



## 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

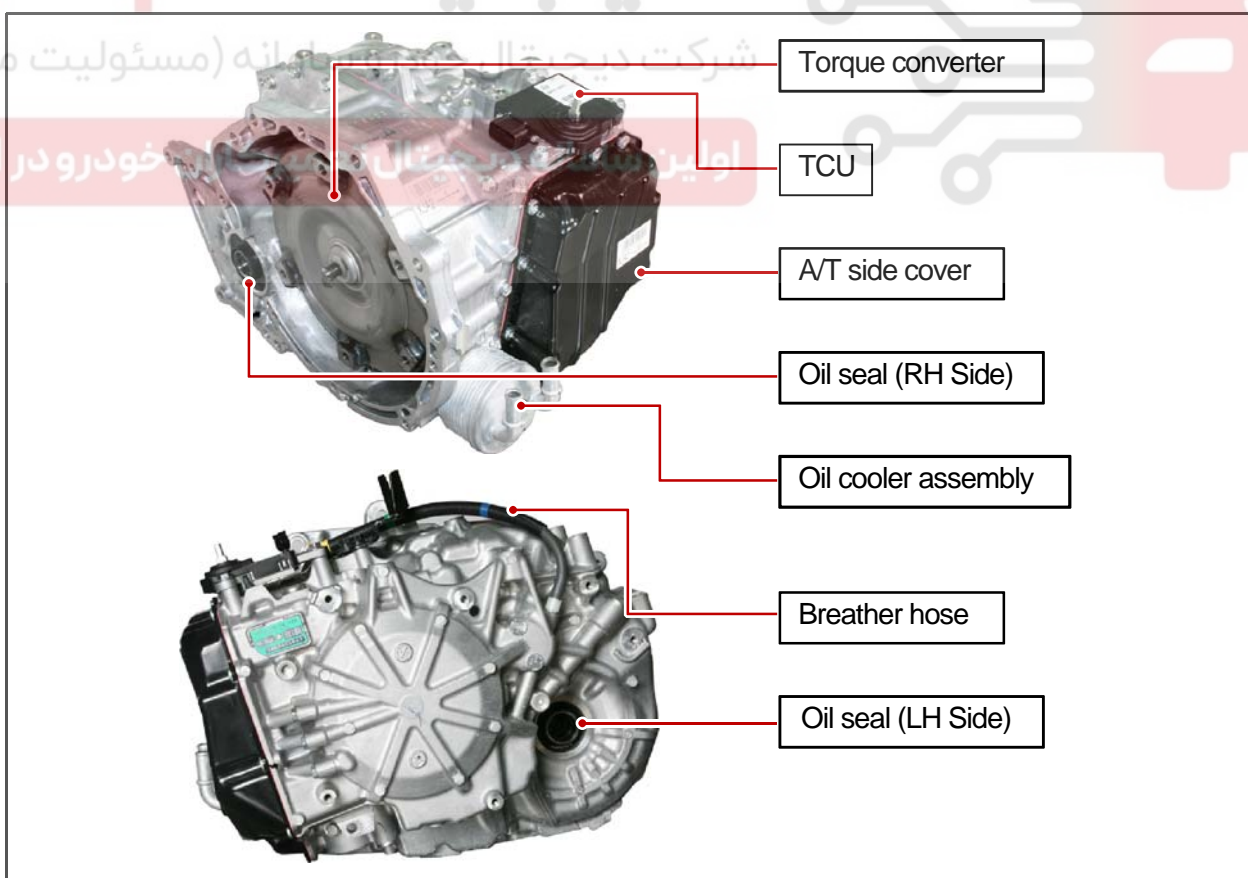
The output rpm signal, engine ECU (engine rpm and throttle opening) signals and vehicle speed are used for smooth lock-up control.

#### ► 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) Neutral Control (N control)

If the vehicle stands to still with the selector lever in D, the transmission enters neutral by releasing the clutch. This helps to reduce the engine load, improve fuel economy and reduce the vibration during idling by reducing the drag loss of the torque converter.

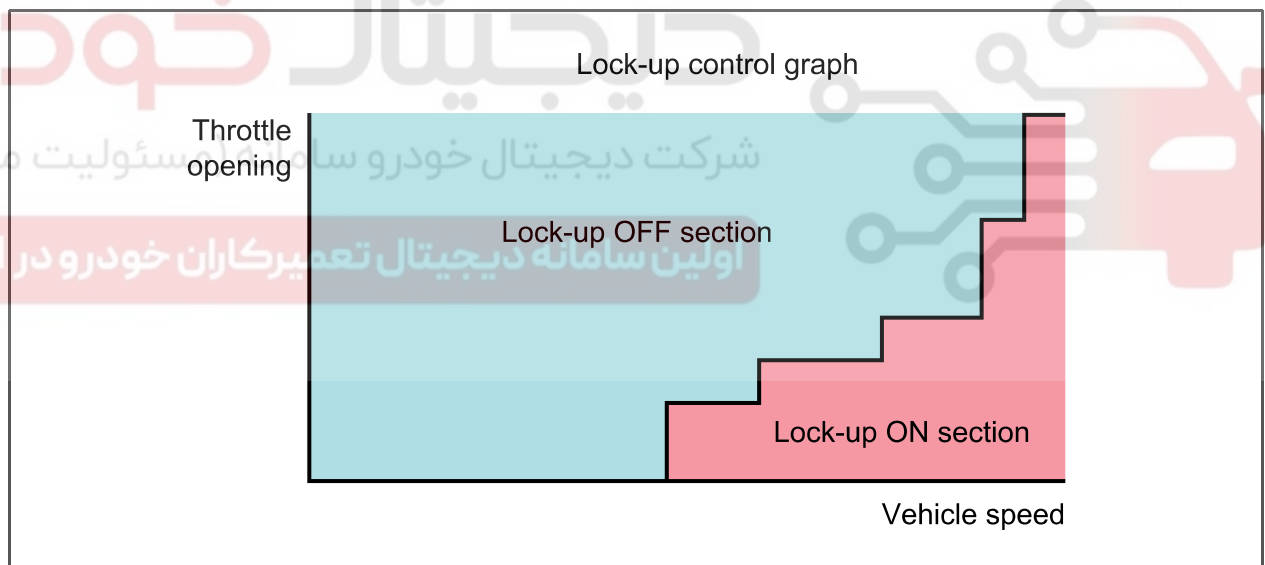


#### NOTE

- During neutral control, the C1 clutch is controlled by the linear solenoid independently.
- During neutral control on an uphill climb, the creep force is not generated and the B1 brake is applied in order to prevent the vehicle from being pushed back and for safe vehicle start.
- The neutral control system operates when the engine is warmed up.
- The neutral control does not operate on a steep slope.

### 4) 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	<p>The control is carried out by lock-up control solenoid [SLU]. It turns on or off the lock-up control solenoid valve [SLU] linearly.</p> <p>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.</p>

Modification basis	
Application basis	
Affected VIN	



## 5) 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 stroke 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 stroke.

## 6) 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.

## 7) 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).

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



## 8) 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

## 9) "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.

## 10) 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

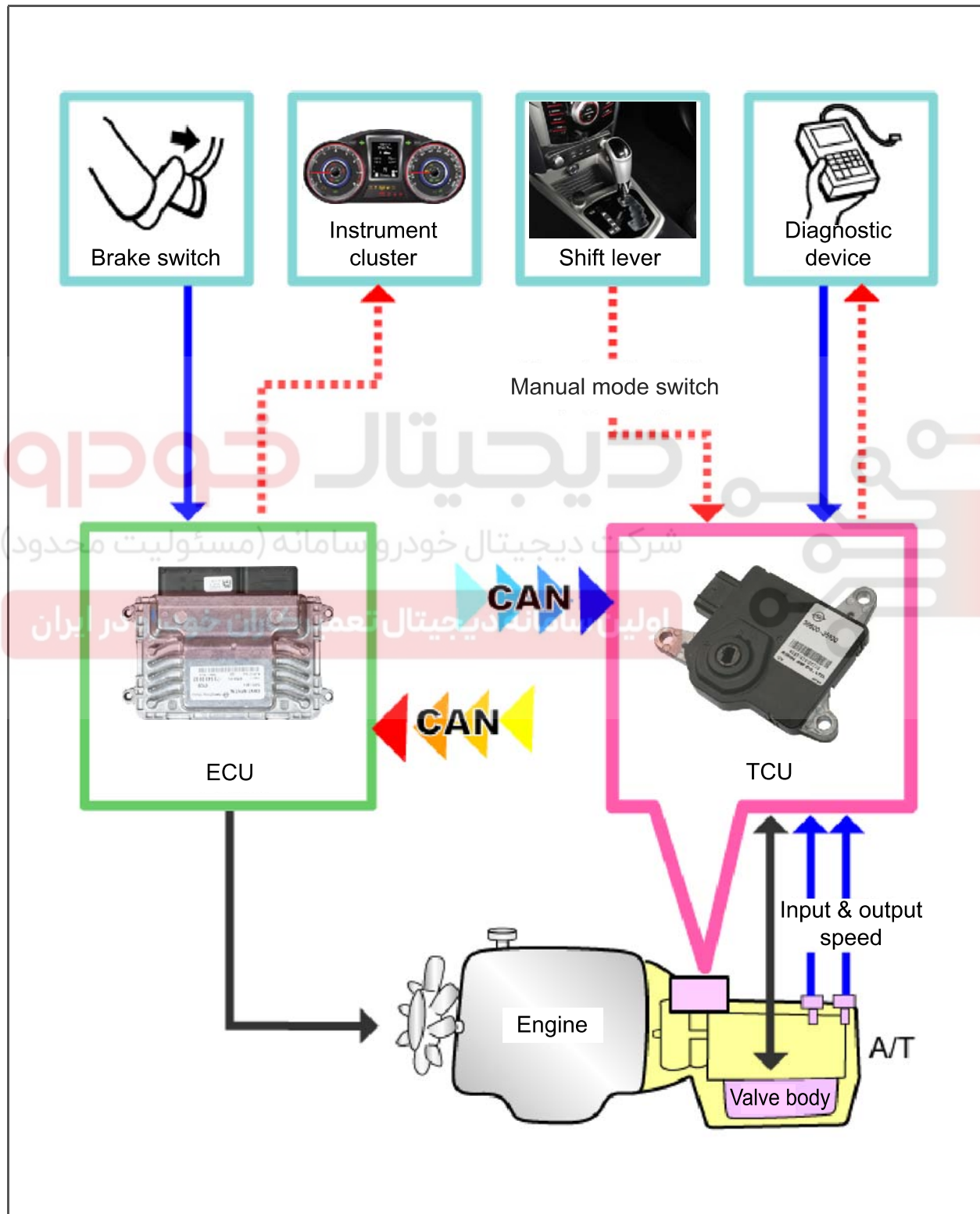
Refer to [INITIALIZING/LEARNING PROCESS] for detailed information.

Modification basis	
Application basis	
Affected VIN	



### 3. OPERATING COMPONENTS

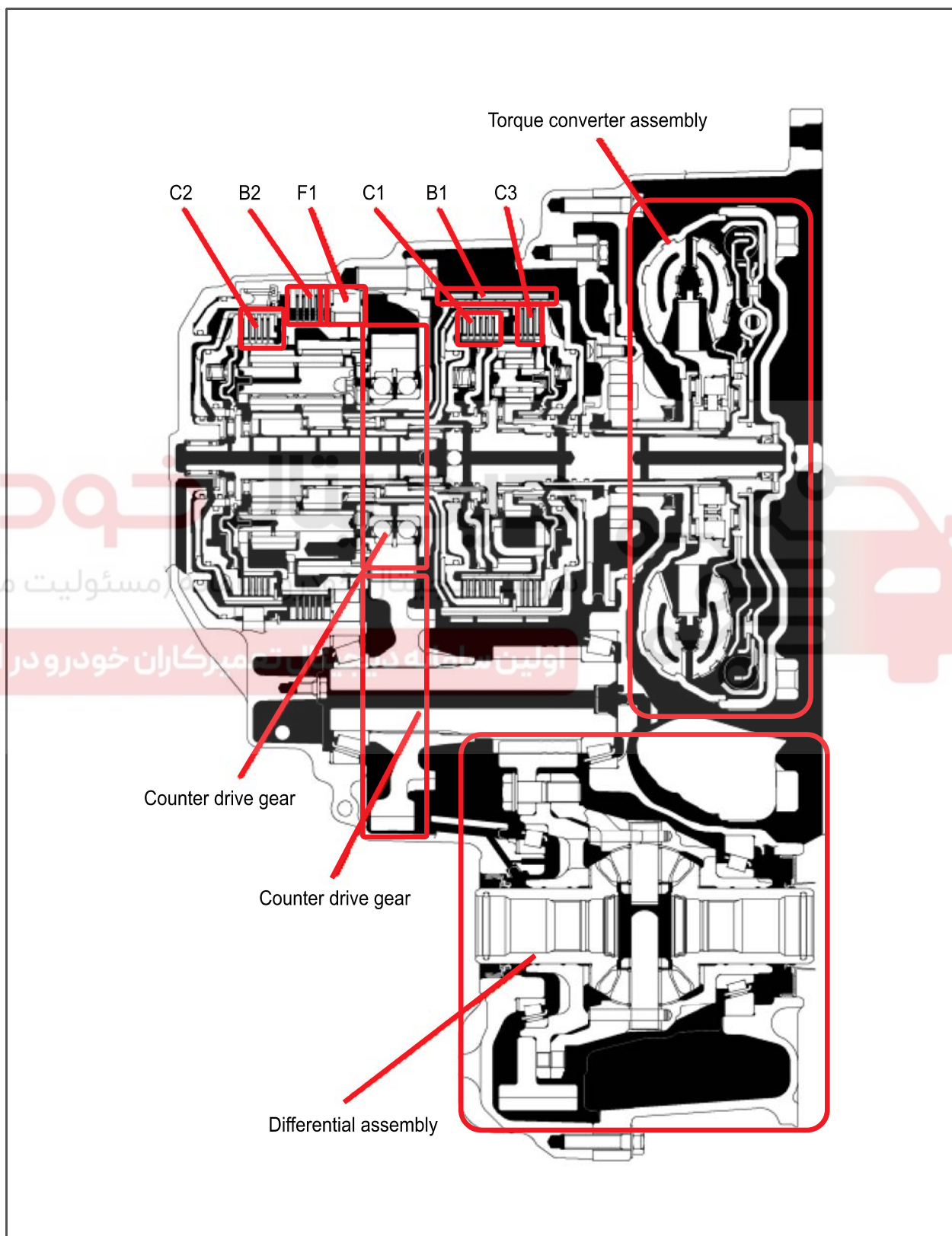
It is consisted of various sensors that retrieve the information required to determine the shift, the ECU that provides those values, the shift lever that inputs the driver's command to the TCU, the TCU that finally sends a shift command through the hydraulic control and etc.





## 4. OPERATING PROCESS

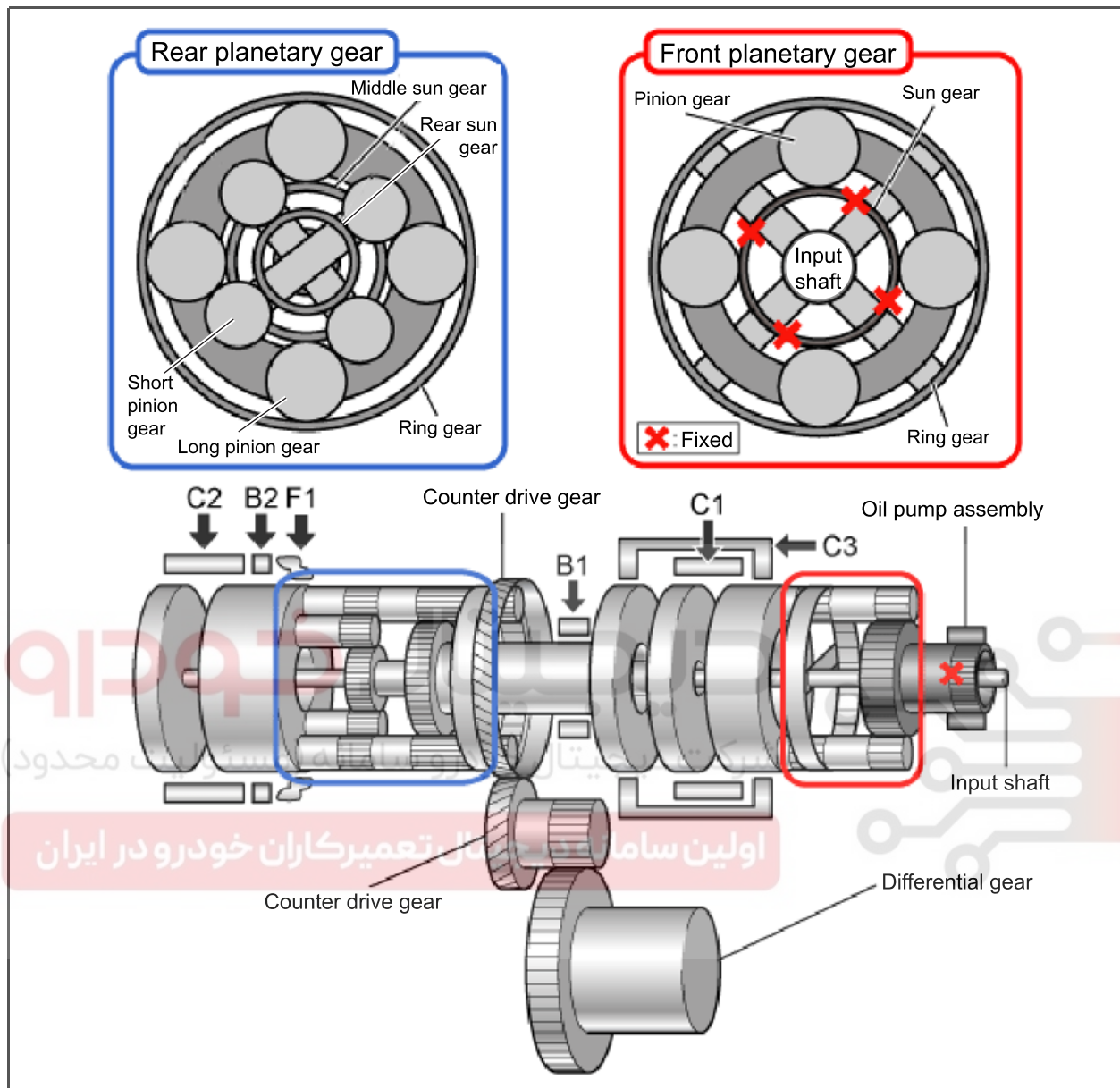
### 1) Component Parts



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

Gear position		Solenoid valve						Clutch			Brake		One-way clutch
		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	-	-	-	-	-	-	-
Reverse	V ≤ 11km/h	-	O	-	-	O	-	-	-	O	-	O	-
	V > 11km/h	-	O	O	-	O	O	-	-	-	-	-	-
"N"		-	O	O	-	O	-	-	-	-	-	-	-
1st		O	O	O	-	O	-	O	-	-	-	-	O
1st engine brake		O	-	O	-	-	O	O	-	-	-	O	O
2nd		O	O	O	O	O	-	O	-	-	O	-	-
3rd		O	O	-	-	O	-	O	-	O	-	-	-
4th		O	-	O	-	O	-	O	O	-	-	-	-
5th		-	-	-	-	O	-	-	O	O	-	-	-
6th		-	-	O	O	O	-	-	O	-	O	-	-



#### NOTE

The lock-up applies to from 2nd gear to 6th gear.



#### NOTE

The B2 brake is operated only by the shift lever and the SLB2 solenoid does not exist.

Modification basis	
Application basis	
Affected VIN	

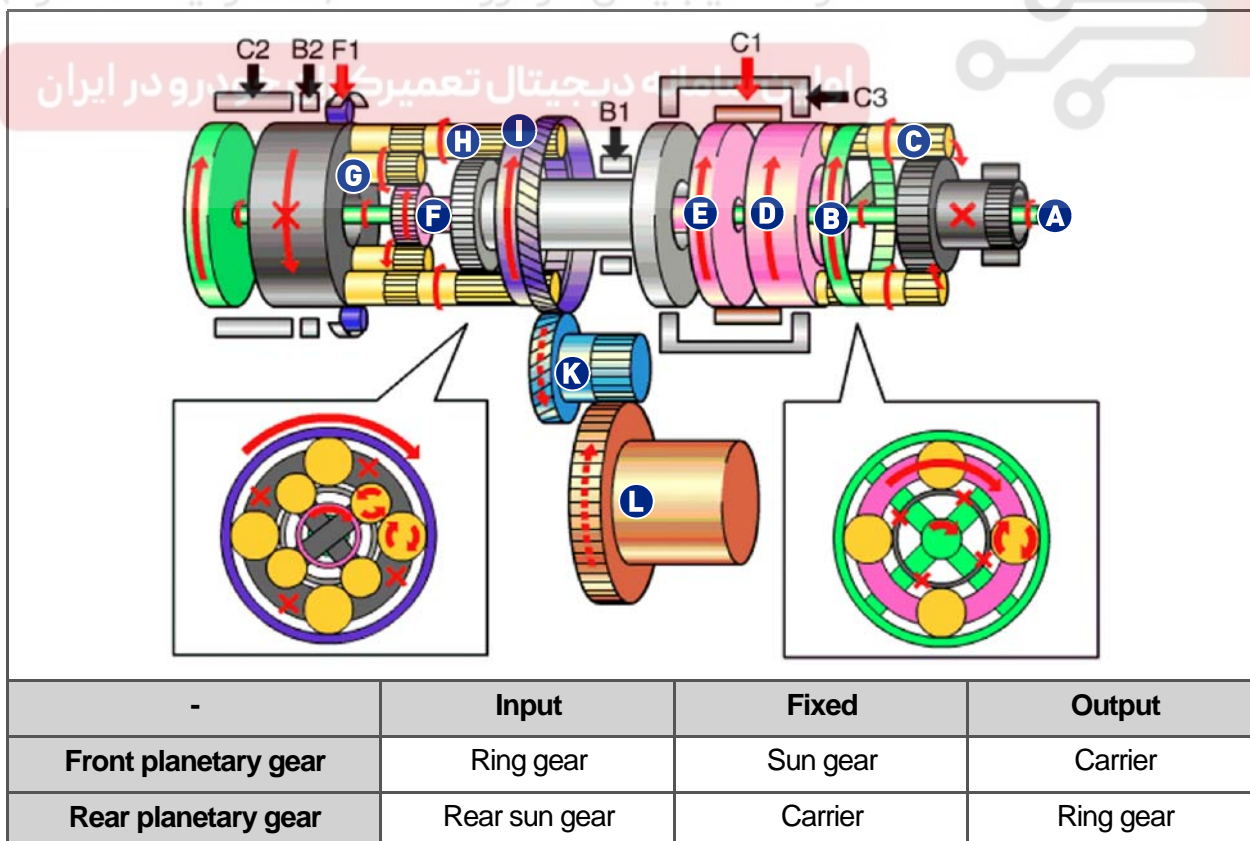


## 5. POWER TRANSFER PROCESS

### ► 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

Gear position	Solenoid valve						Clutch			Brake		One-way clutch
	SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	
1st	0	0	0	-	0	-	0	-	-	-	-	0



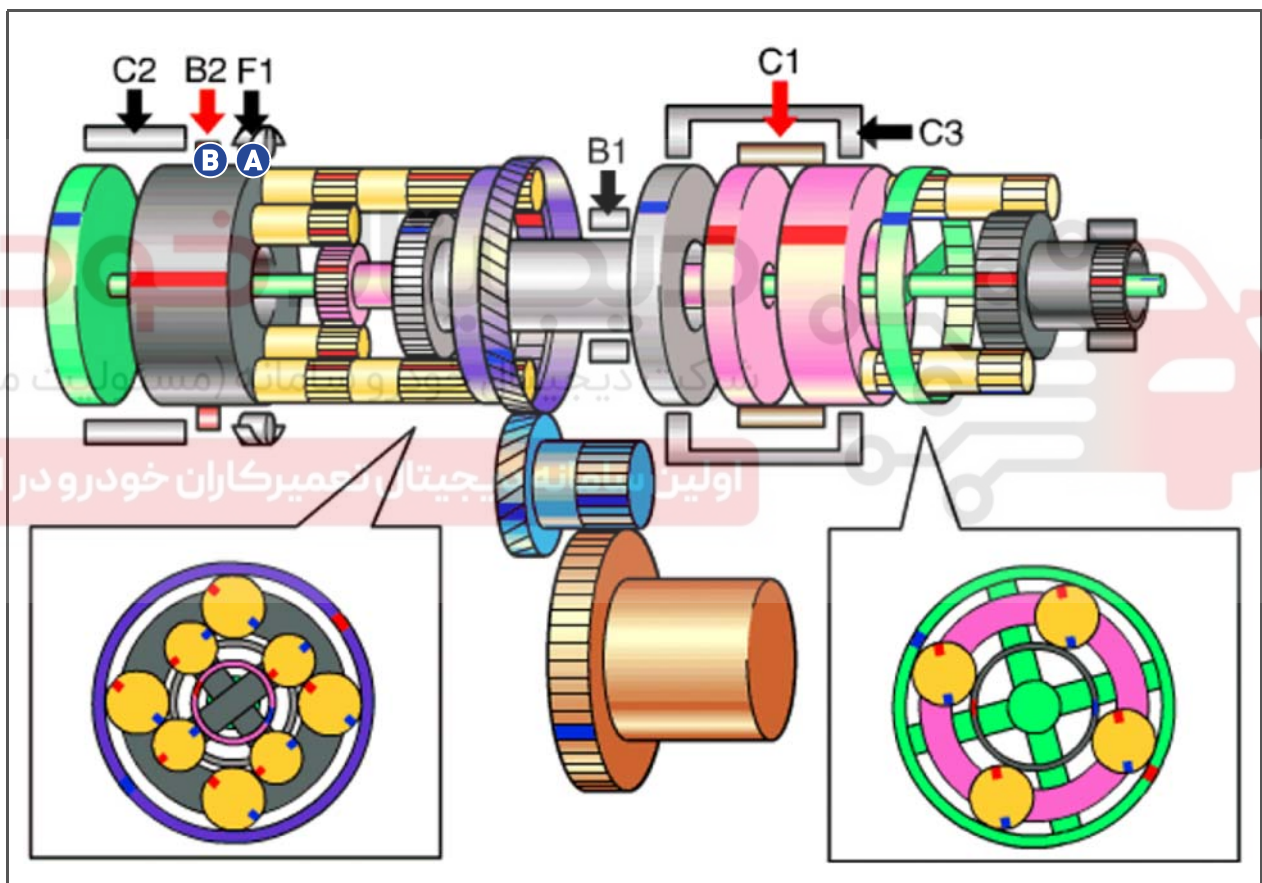


### ► 1st engine brake power transfer

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)

Gear position	Solenoid valve						Clutch			Brake		One-way clutch
	SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	F1
1st engine brake	0	-	0	-	-	0	0	-	-	-	0	0



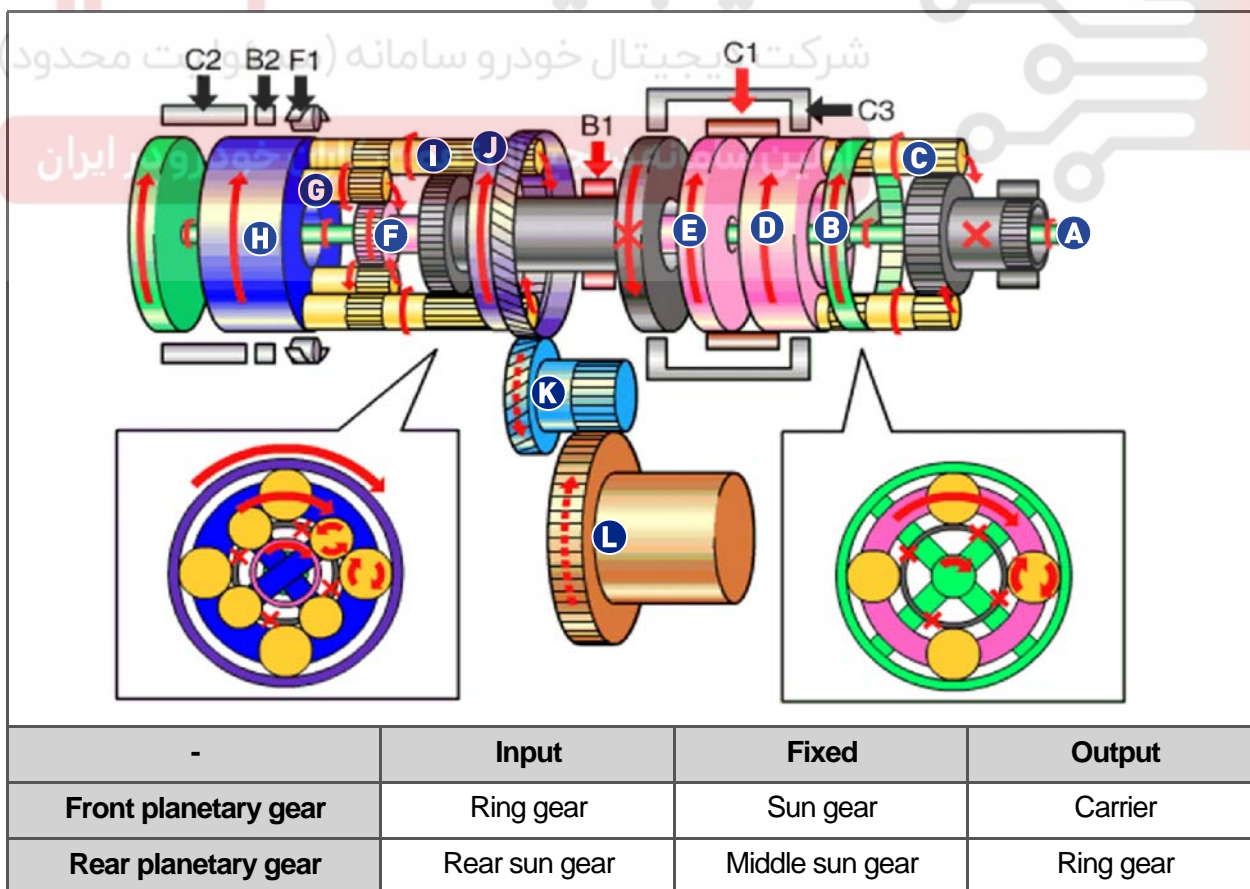
Modification basis	
Application basis	
Affected VIN	



## ► 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

Gear position	Solenoid valve						Clutch			Brake		One-way clutch
	SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	
2nd	0	0	0	0	0	-	0	-	-	0	-	-

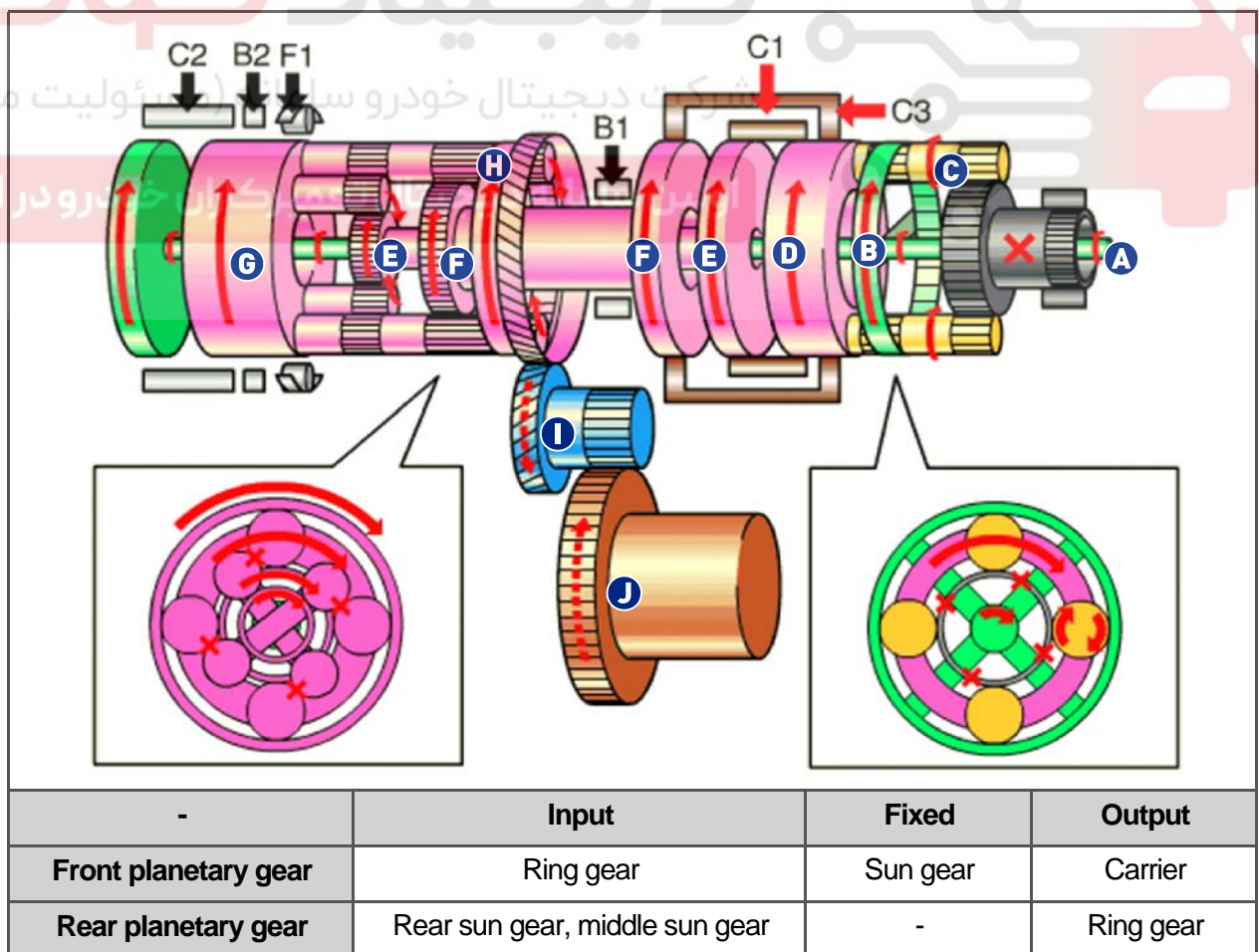




### ► 3rd gear power transfer

- 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 sun gear)
- 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.

Gear position	Solenoid valve						Clutch			Brake		One-way clutch
	SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	F1
3rd	O	O	-	-	O	-	O	-	O	-	-	-



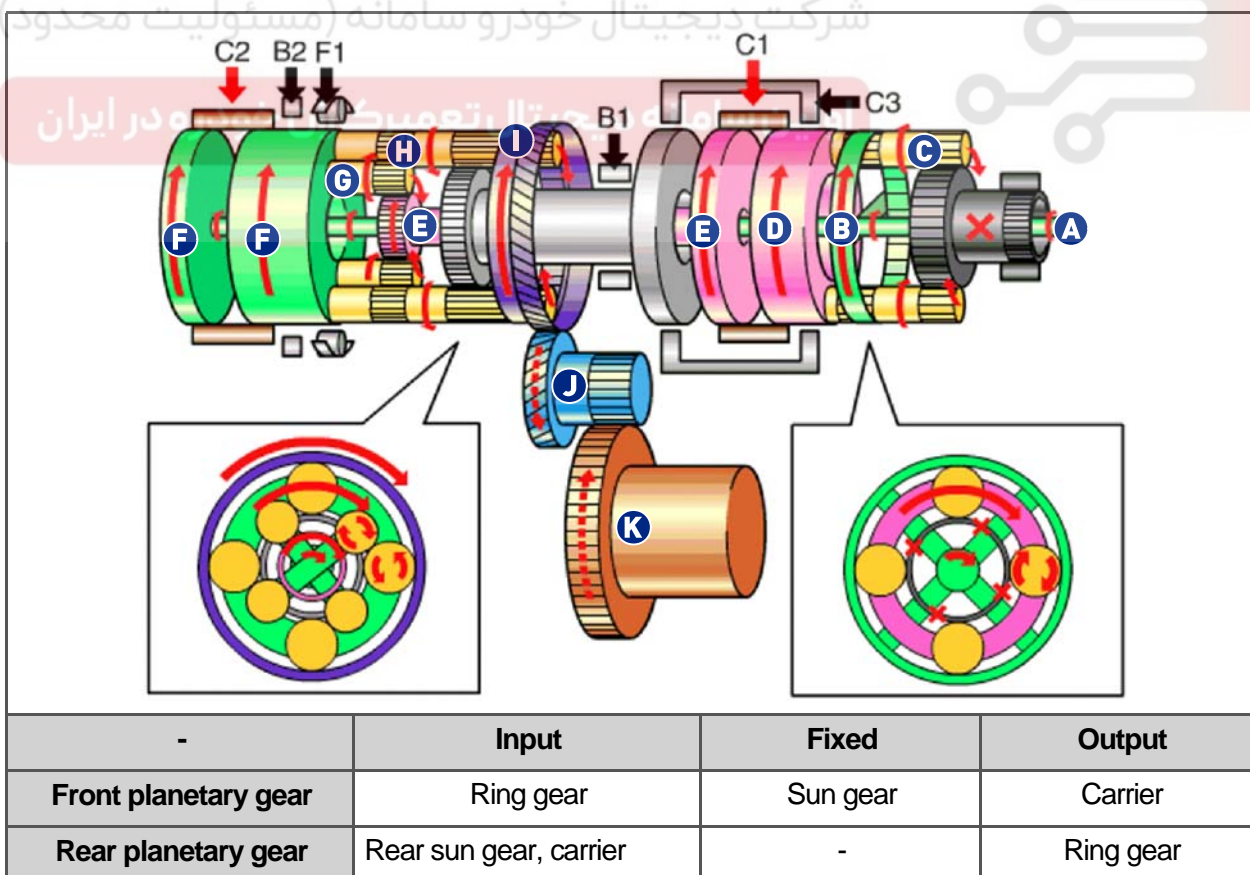
Modification basis	
Application basis	
Affected VIN	



## ► 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.

Gear position	Solenoid valve						Clutch			Brake		One-way clutch
	SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	
4th	0	-	0	-	0	-	0	0	-	-	-	-

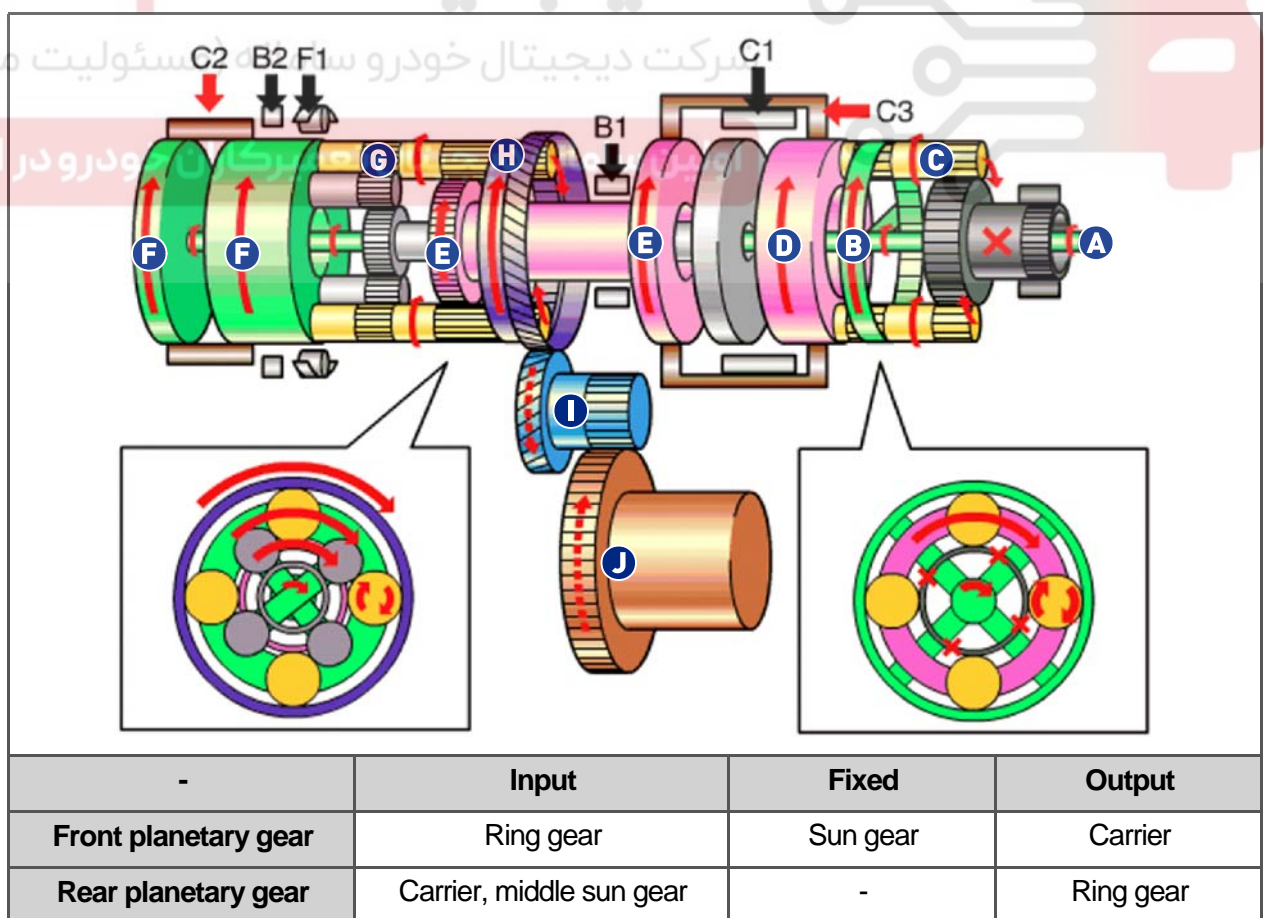




## ► 5th gear power transfer

- 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.

Gear position	Solenoid valve						Clutch			Brake		One-way clutch
	SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	
5th	-	-	-	-	0	-	-	0	0	-	-	-



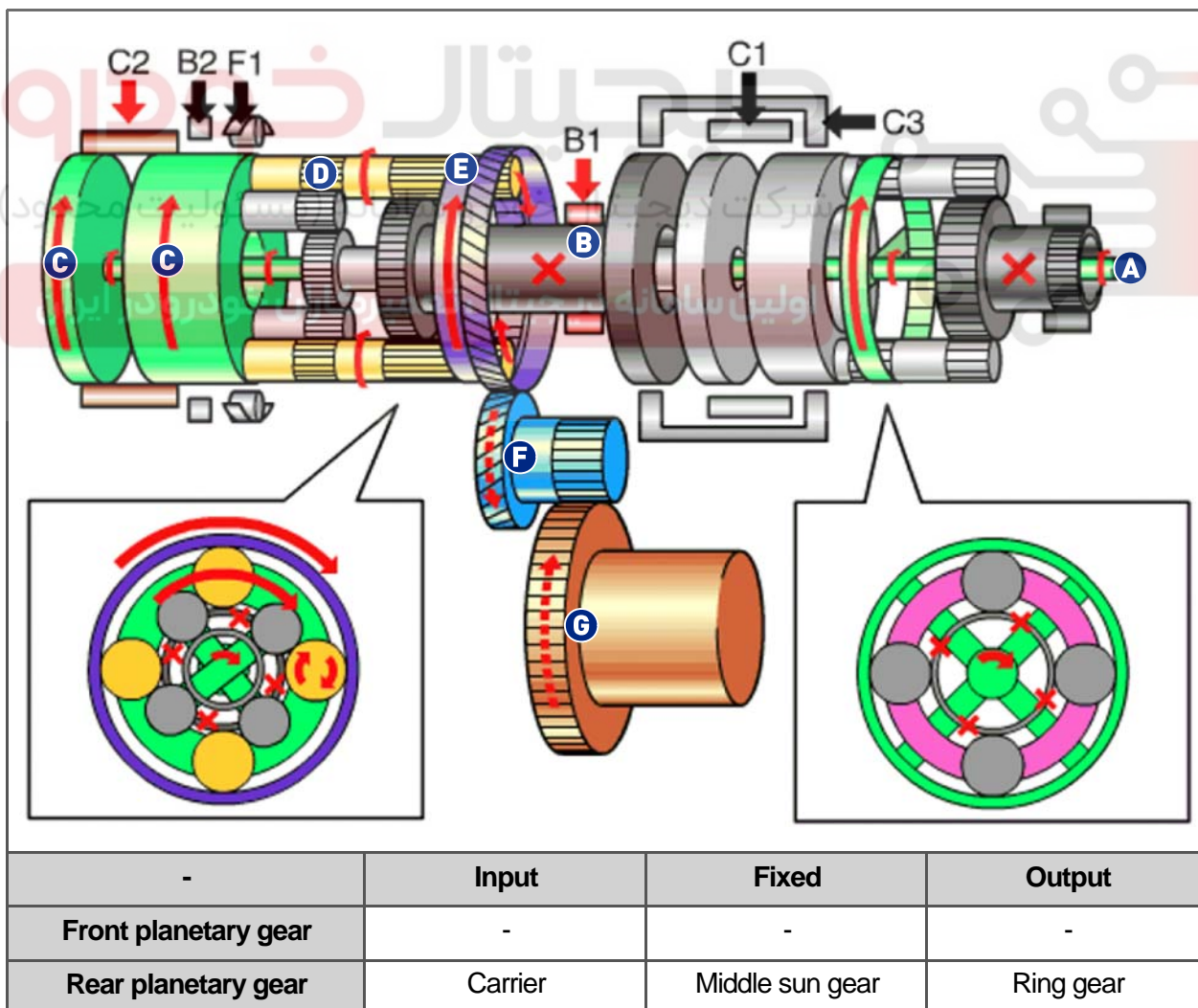
Modification basis	
Application basis	
Affected VIN	



## ► 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.

Gear position	Solenoid valve						Clutch			Brake		One-way clutch
	SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	
6단	-	-	0	0	0	-	-	0	-	0	-	-

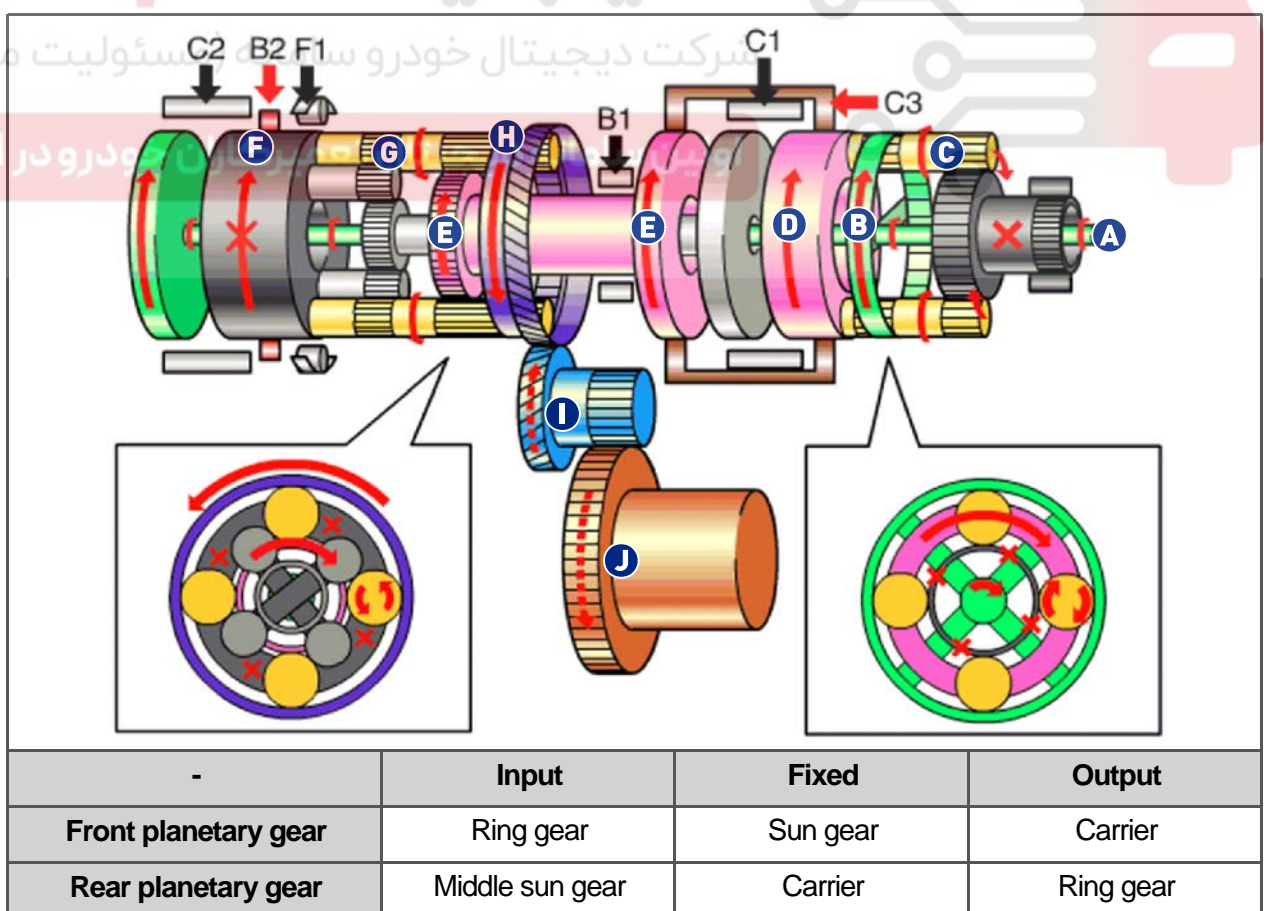




## ► Reverse power transfer

- 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

Gear position		Solenoid valve						Clutch			Brake		One-way clutch
		SLC1 (N.C)	SLC2 (N.O)	SLC3 (N.O)	SLB1 (N.C)	S1 (N.O)	S2 (N.C)	C1	C2	C3	B1	B2	F1
Reverse	$V \leq 11\text{km/h}$	-	0	-	-	0	-	-	-	0	-	0	-
	$V > 11\text{km/h}$	-	0	0	-	0	0	-	-	-	-	-	-



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

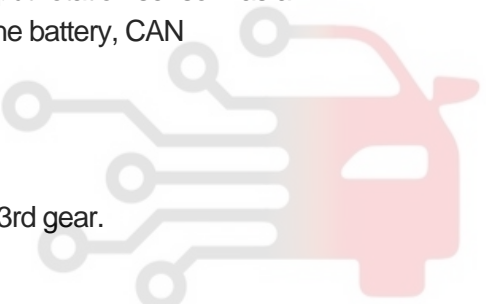
If the S1, linear solenoid (SLT) is open or short circuit to B+ or ground, the input rotation sensor has a electrical problem or sends no signal, in the event of high supply voltage to the battery, CAN communication error or CAN bus off, the gear will be stuck at 3rd gear.

### ► Emergency mode 4

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

### ► Emergency mode 5

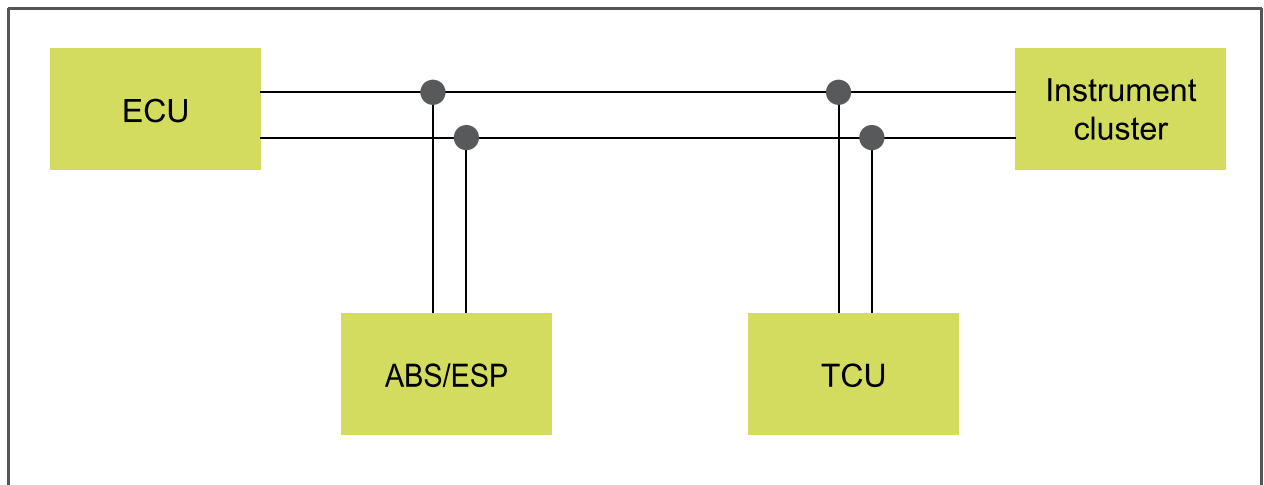
In the event of low supply voltage to the battery, the gear will be stuck at 3rd gear for 1st to 3rd and at 5th gear for 4th to 6th.





## 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	



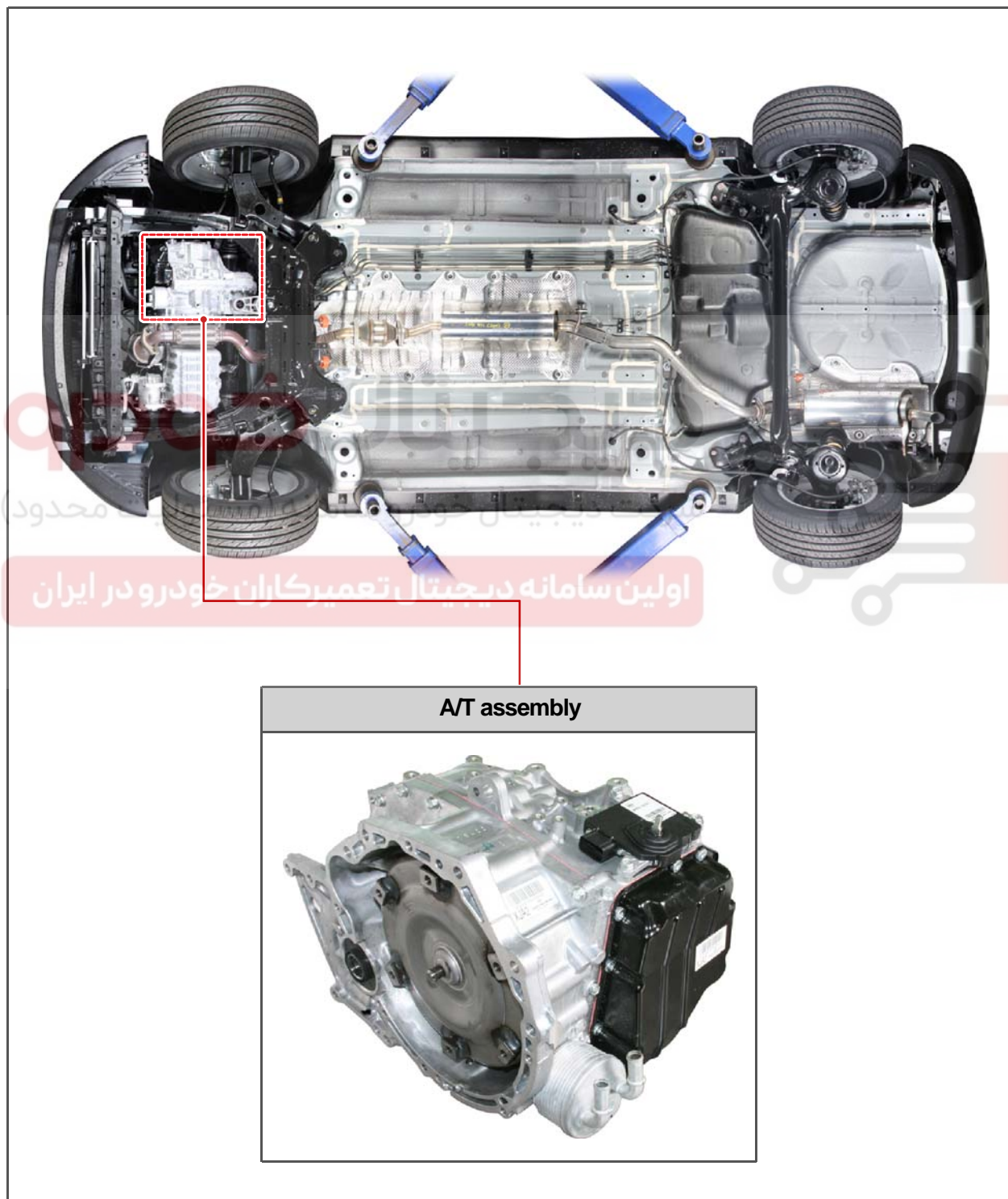
## CONFIGURATION AND FUNCTIONS

S.G.N.

### 3690-01 AUTOMATIC TRANSMISSION ASSEMBLY

#### 1) Component Parts

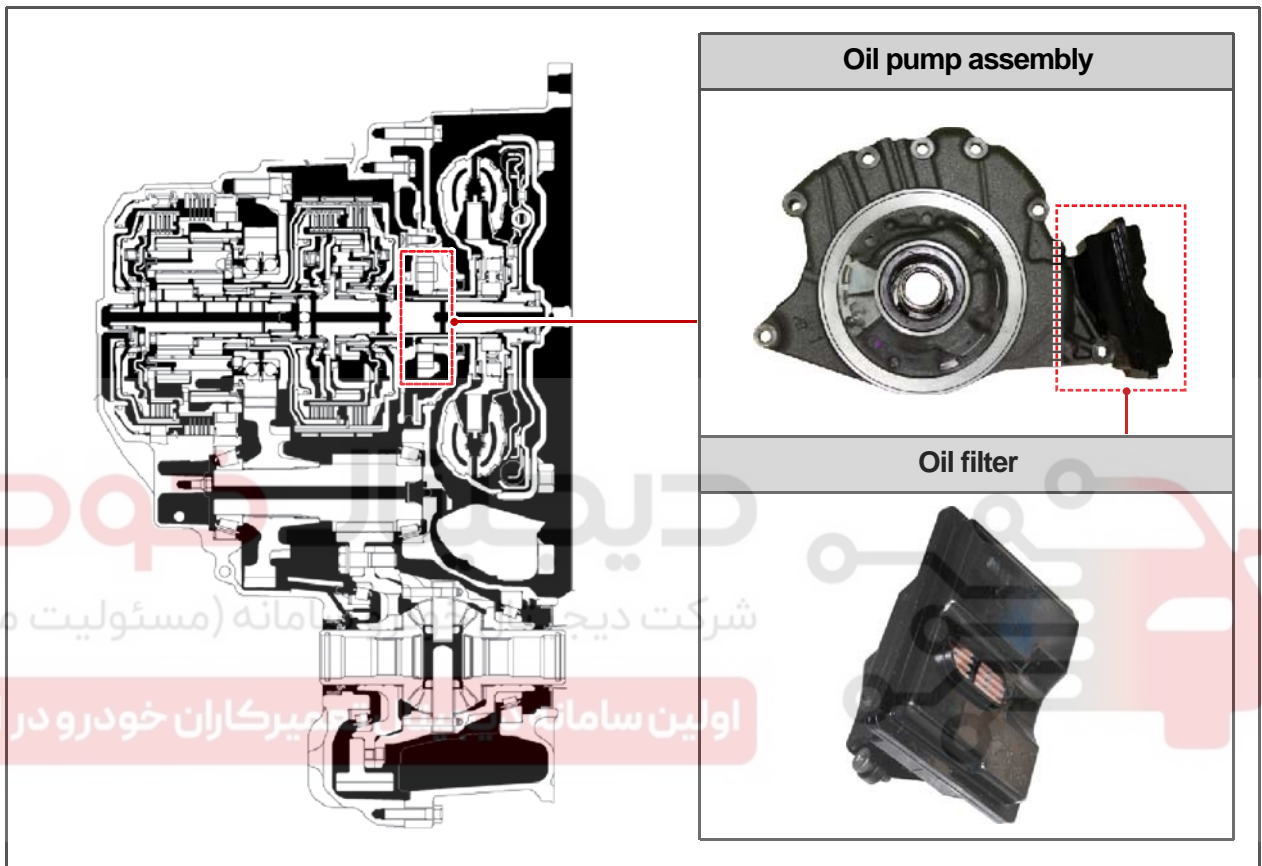
##### ► Mounting location





## 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.

AISIN 6  
SPEED6-SPEED  
M/T

CLUTCH

PROPELLER

DRIVE  
SHAFT

AWD

SUSPENSION

BRAKE  
SYSTEM

ESP

ABS

ELECTRIC  
POWERWHEEL  
AND TIRE

TPMS

SUB  
FRAME

Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

TIVOLI 2015.06



### 3) Front / Rear Planetary Gear Set

#### (1) Front planetary gear set

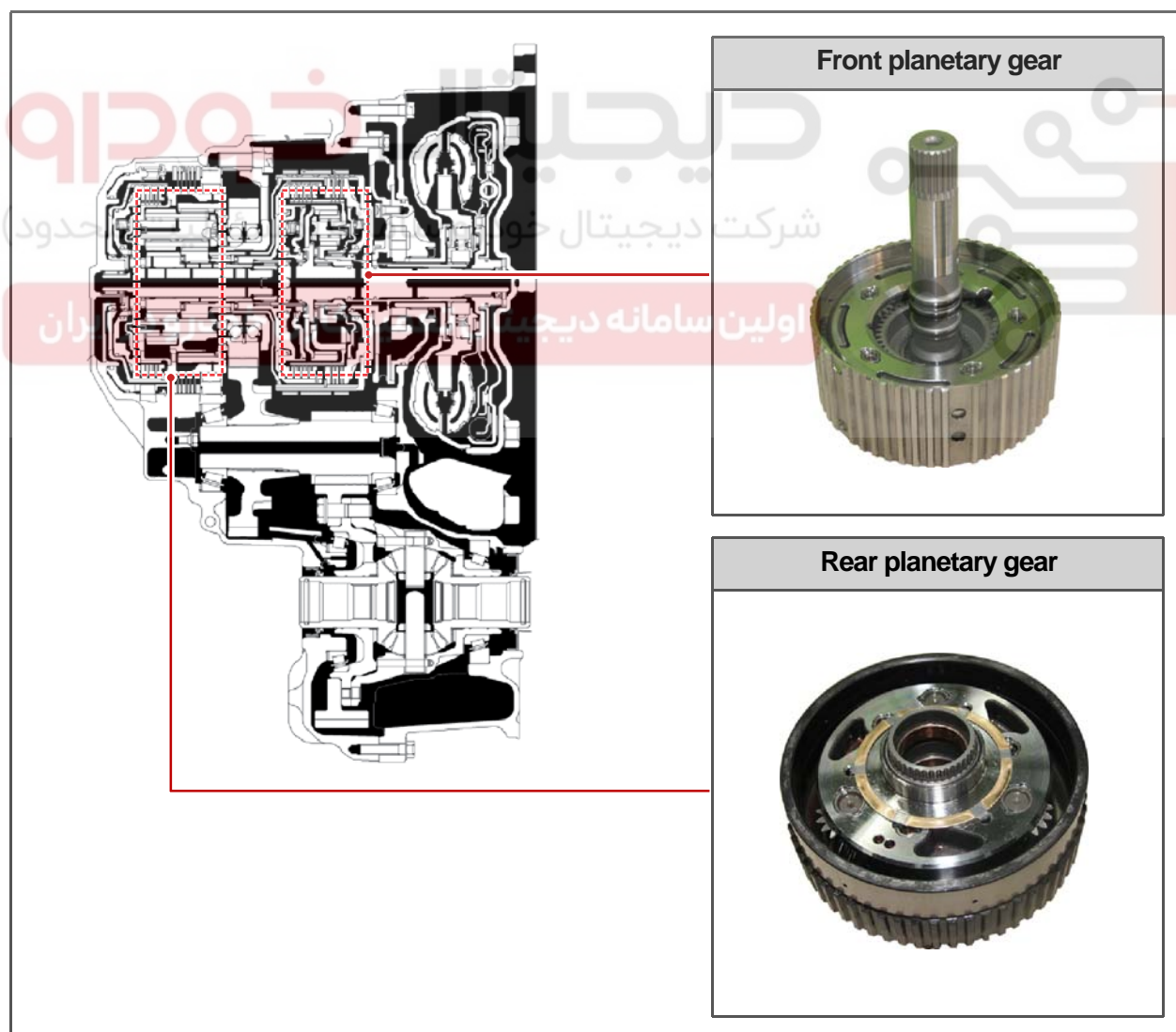
The front planetary gear set is driven by the input shaft and consists of the following components:

- 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:

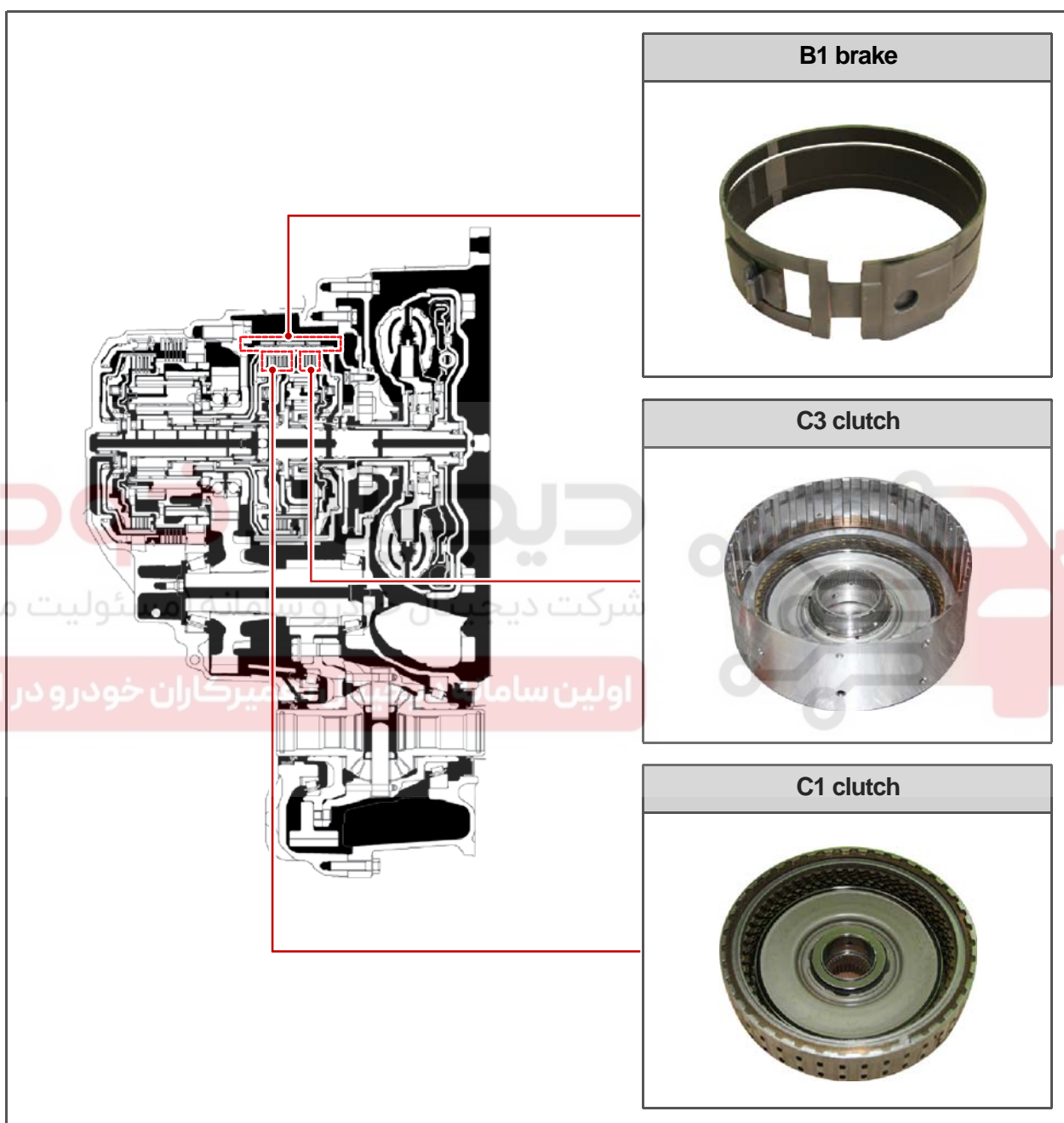
- 1 sun gear
- 4 short pinion gears meshing with sun gear, 4 long pinion gears meshing with ring gear
- 1 carrier
- 1 ring gear





#### 4) C1 and C3 Clutches, B1 Brake

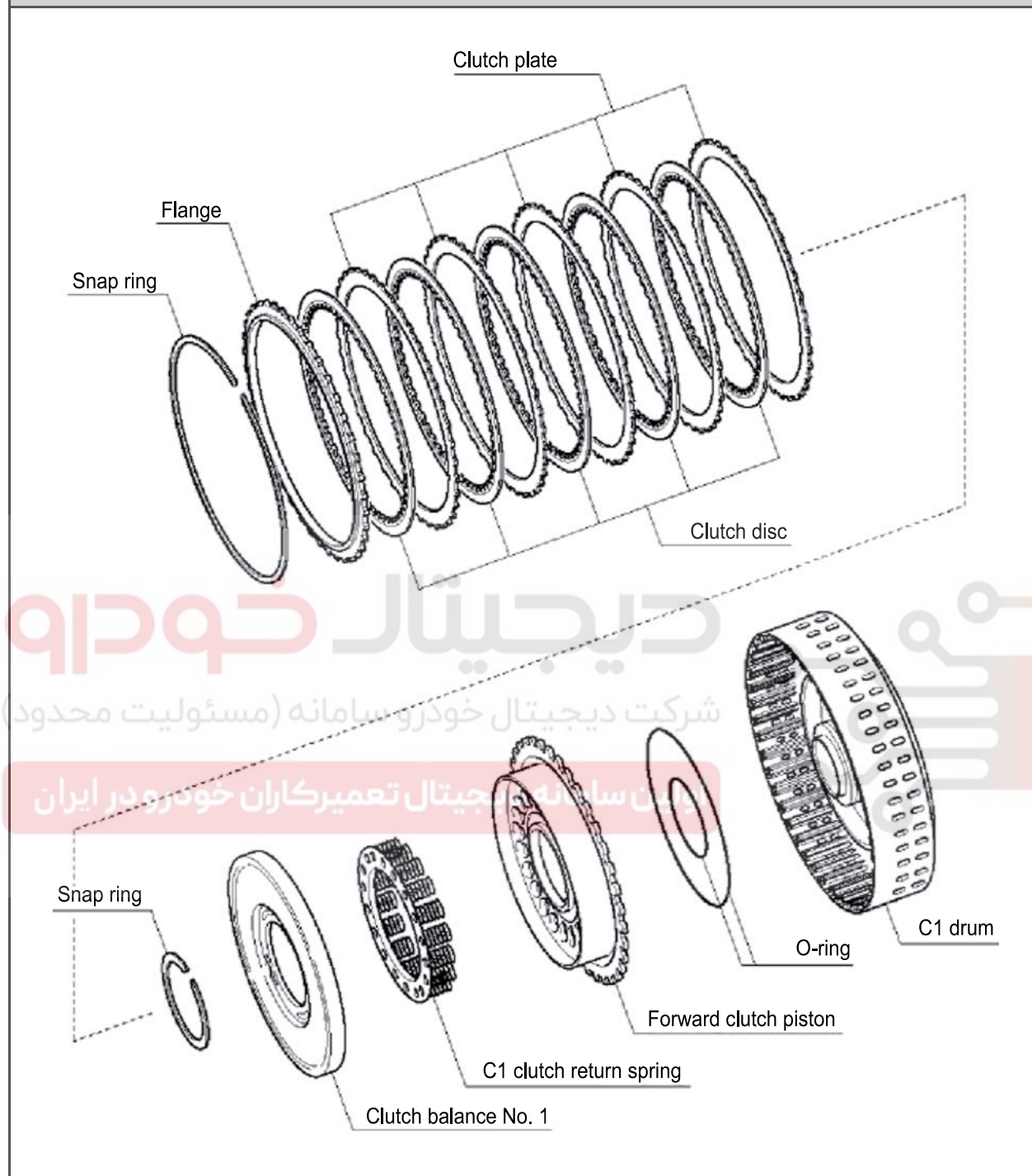
- C1 clutch: Connects the front planetary gear carrier to the rear planetary gear sun gear.
- C3 clutch: Connects the front planetary gear carrier to the rear planetary gear middle sun gear.
- B1 brake: Holds the rear planetary gear middle sun gear.



Modification basis	
Application basis	
Affected VIN	



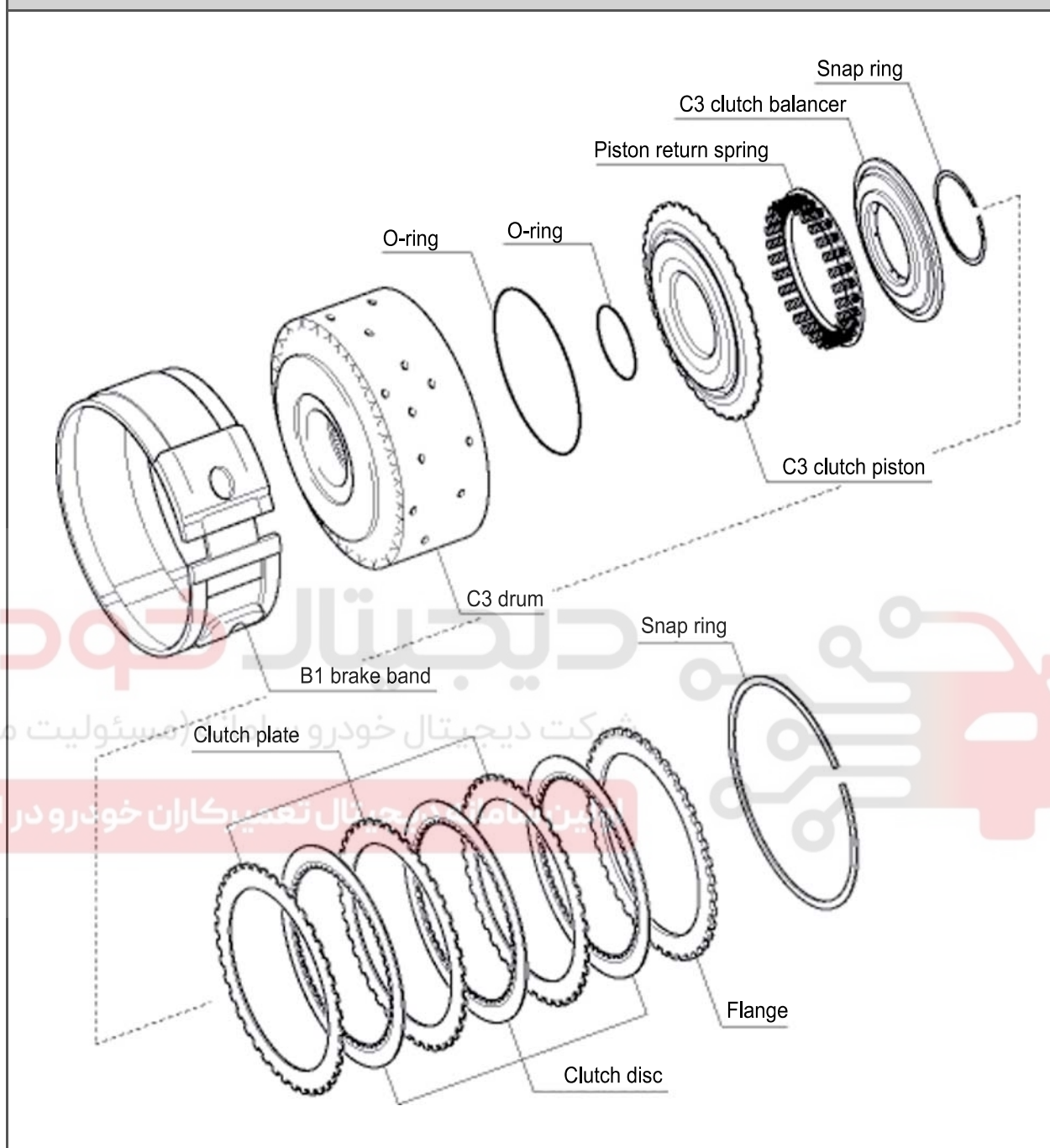
## C1 clutch configuration



Modification basis	
Application basis	
Affected VIN	



## C3 clutch configuration, B1 brake configuration

AISIN 6  
SPEED6-SPEED  
M/T

CLUTCH

PROPELLER

DRIVE  
SHAFT

AWD

SUSPENSION

BRAKE  
SYSTEM

ESP

ABS

ELECTRIC  
POWERWHEEL  
AND TIRE

TPMS

SUB  
FRAME

Modification basis	
Application basis	
Affected VIN	

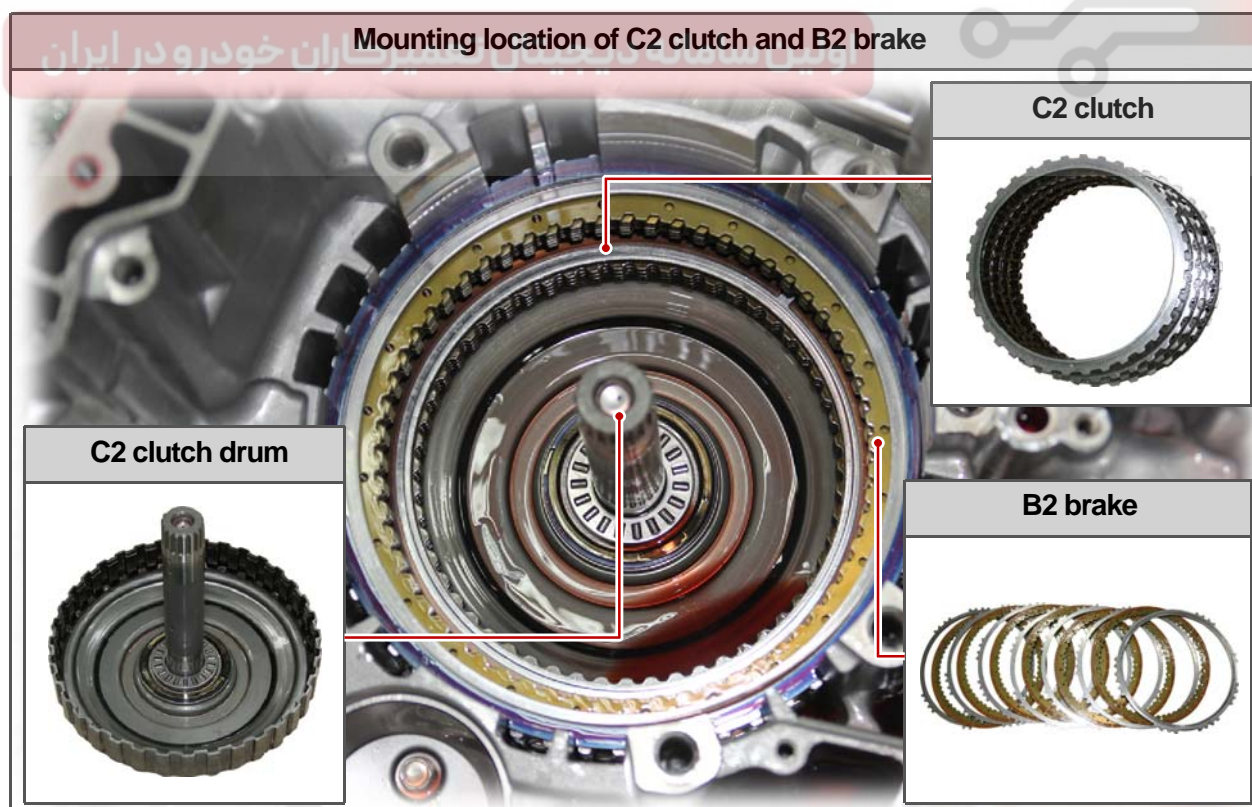
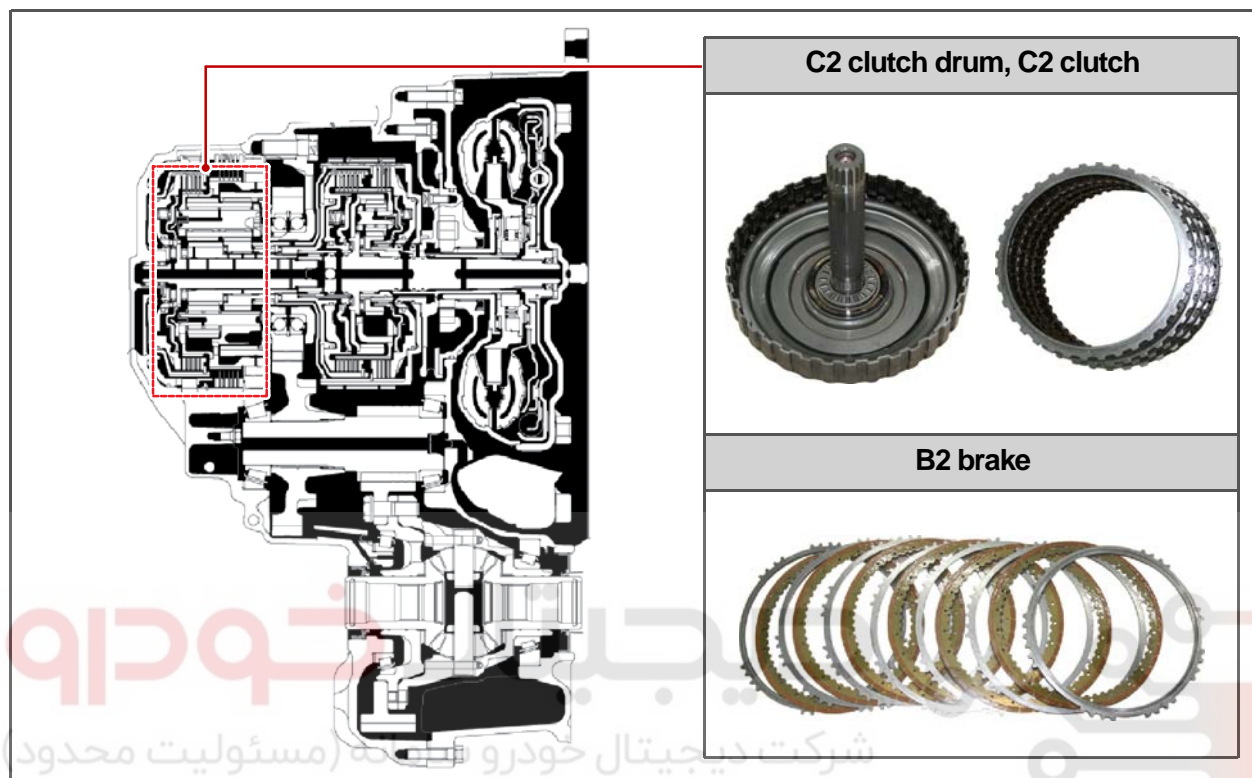
AISIN 6 SPEED AUTO TRANSAXLE

TIVOLI 2015.06



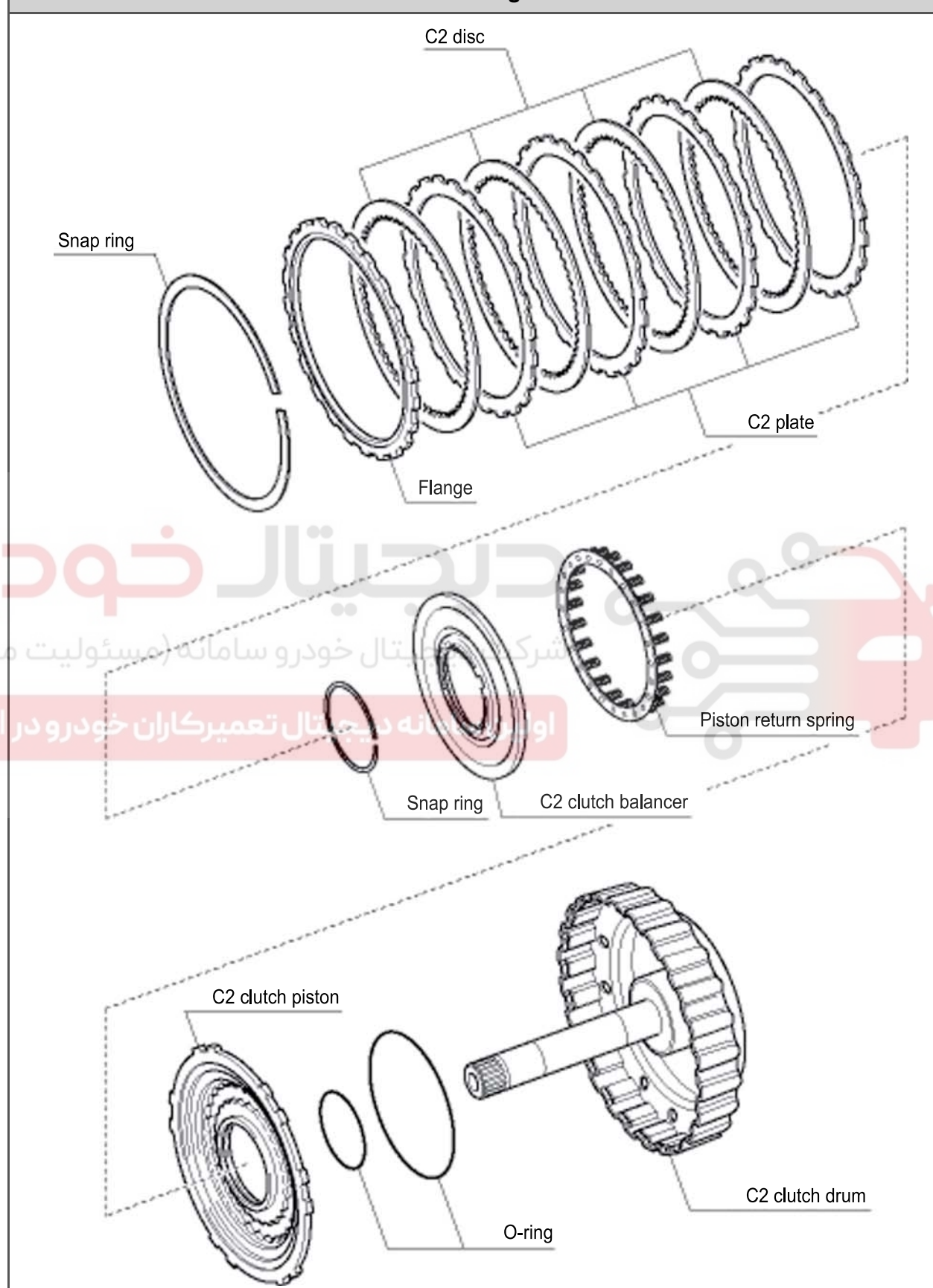
## 5) C2 clutch, B2 brake

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





## C2 clutch configuration



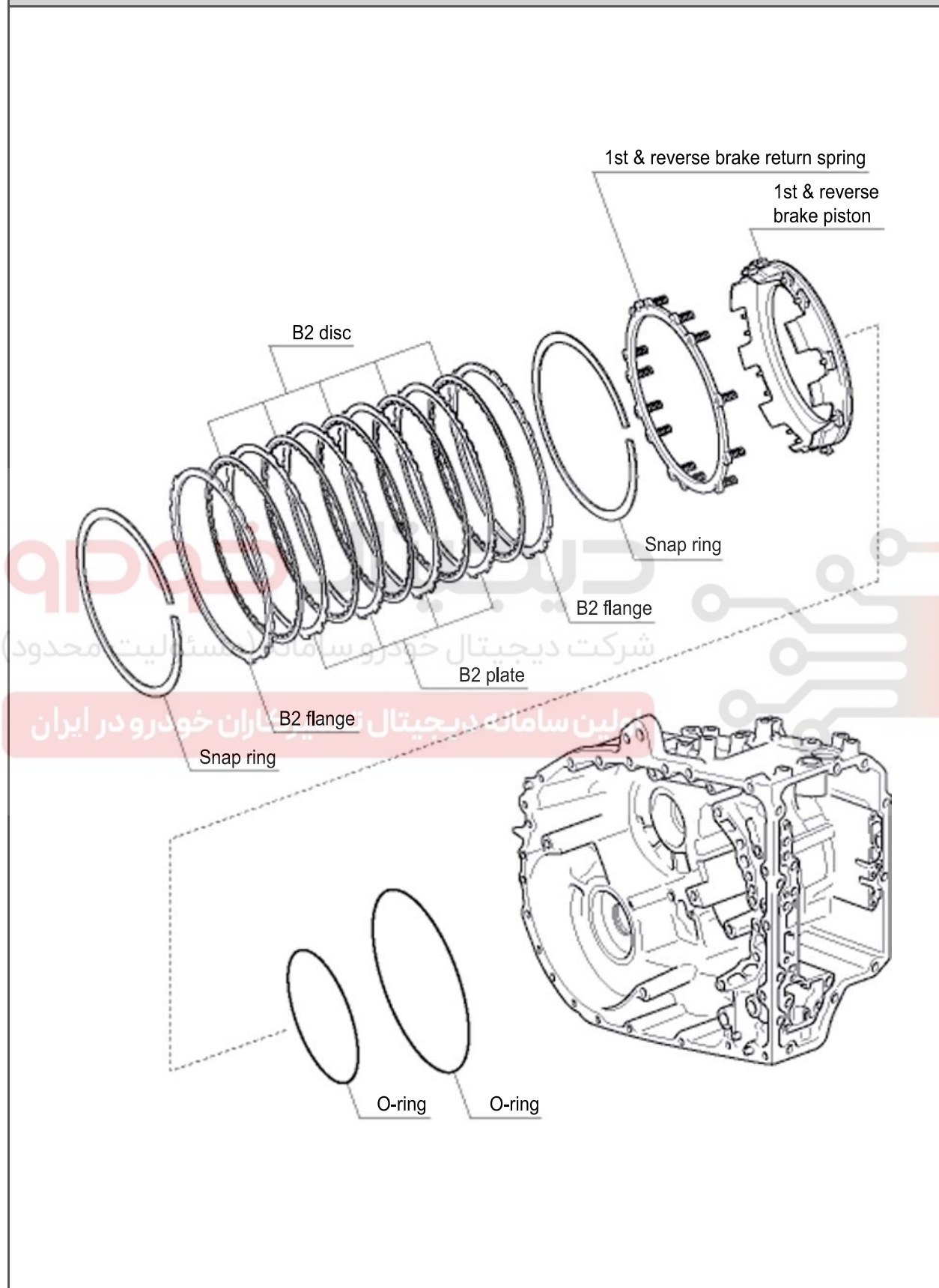
Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

TIVOLI 2015.06



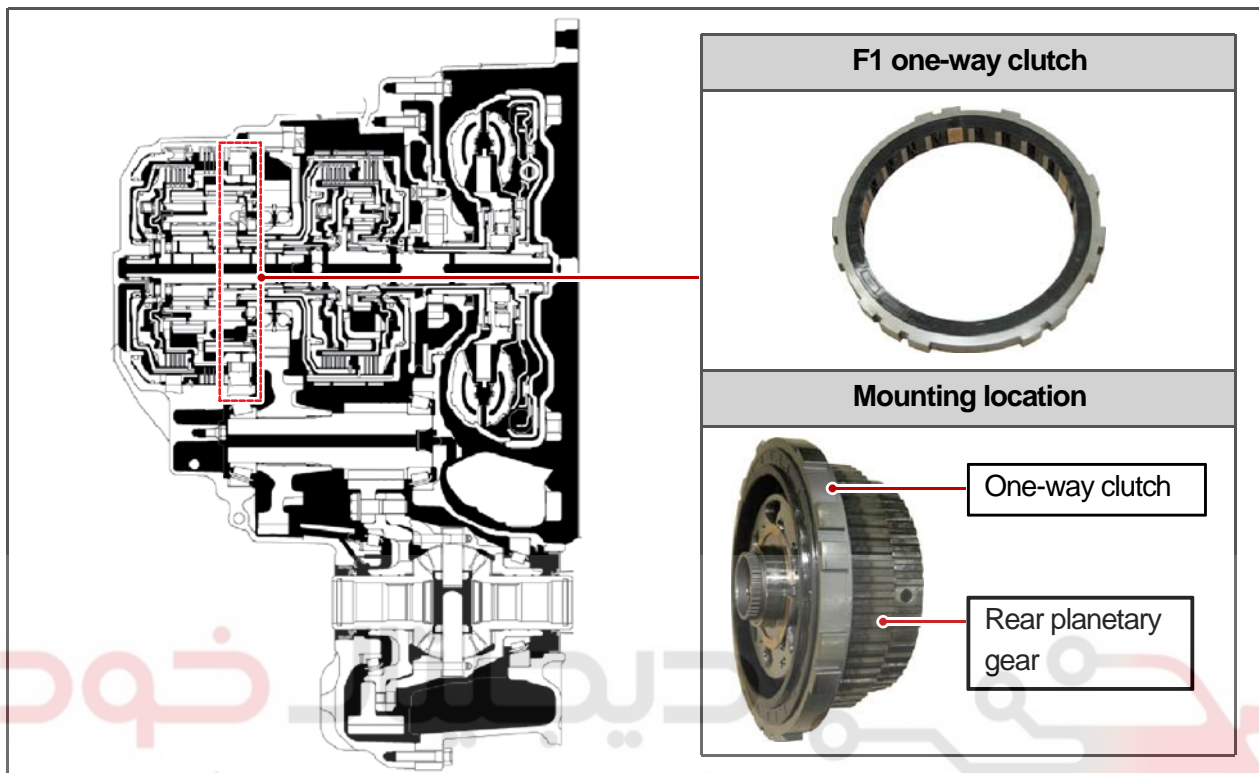
## B2 brake configuration





## 6) F1 One-way Clutch

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



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اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

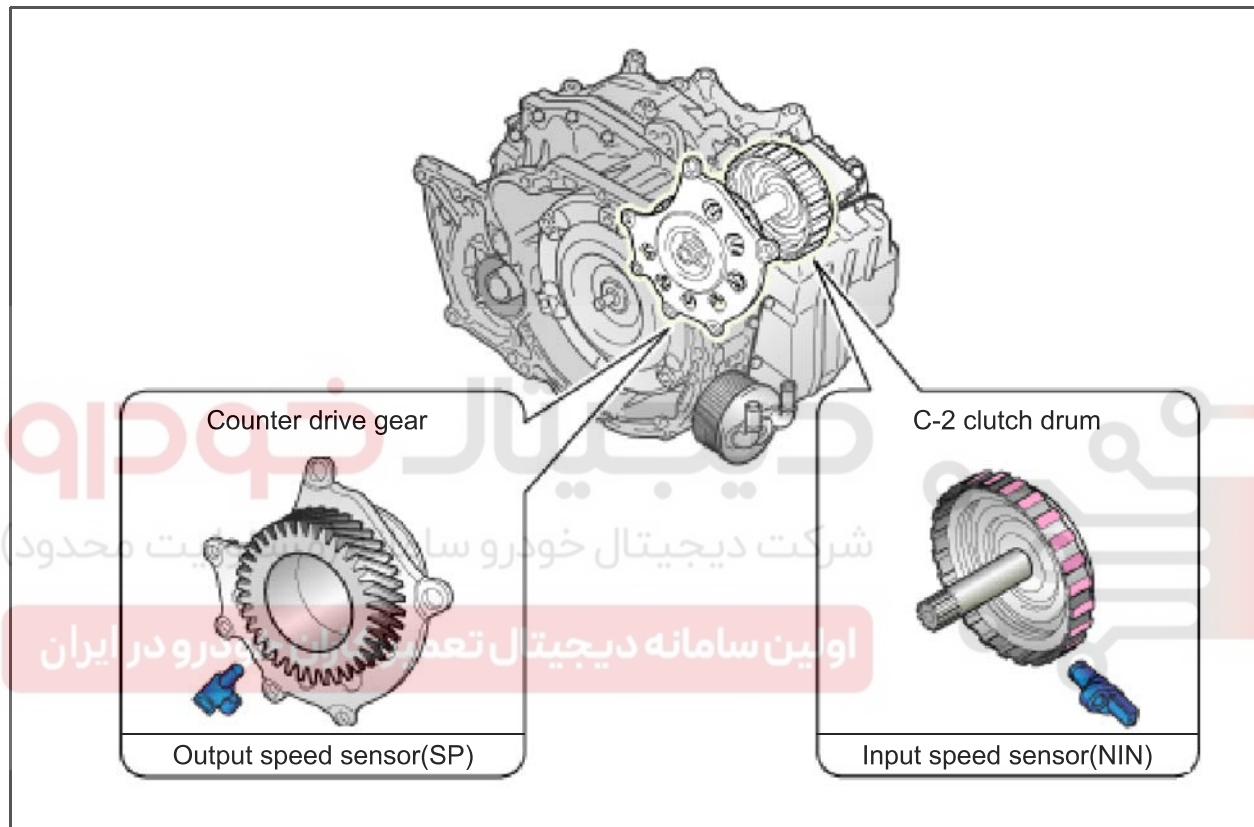
Modification basis	
Application basis	
Affected VIN	



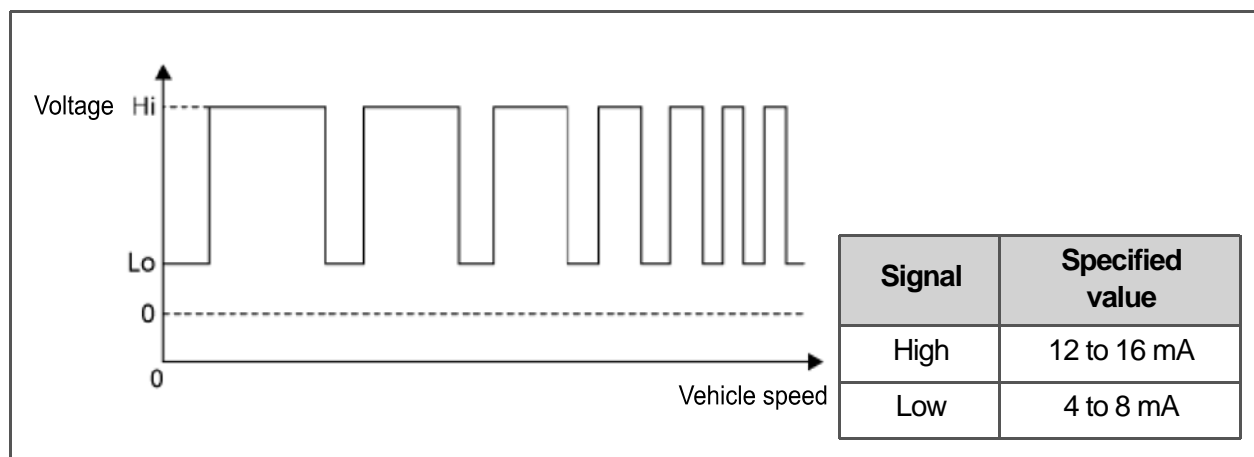
## 7) Input/Output Speed Sensor

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



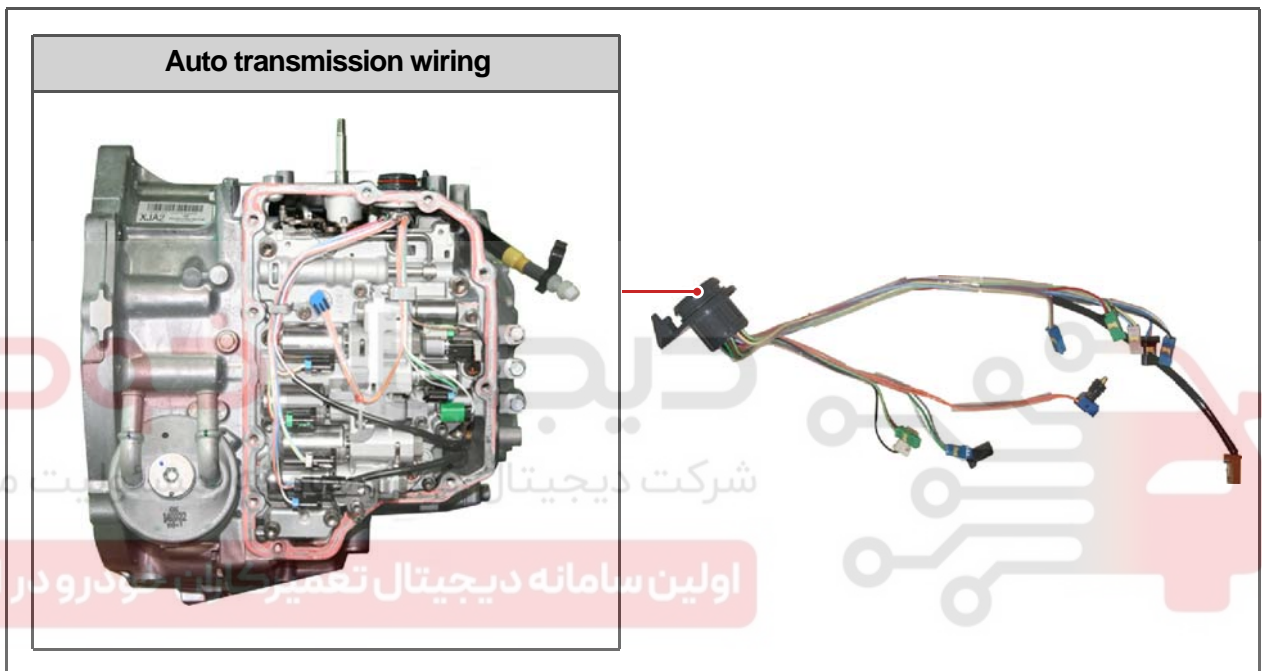


## 8) Auto Transmission Wiring

### (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.

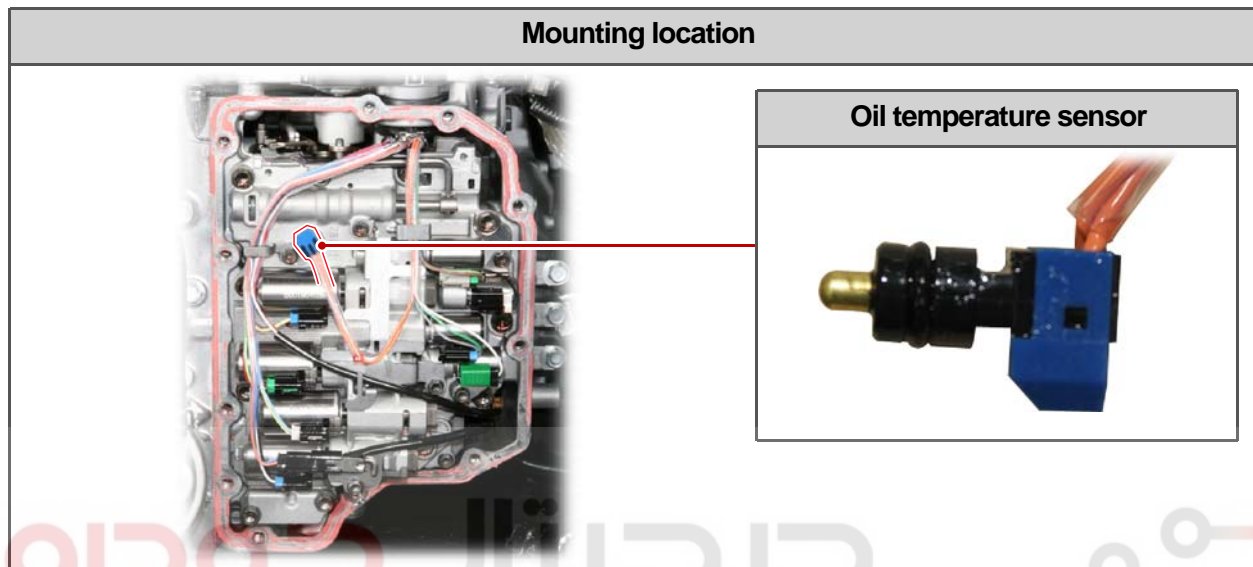


Modification basis	
Application basis	
Affected VIN	

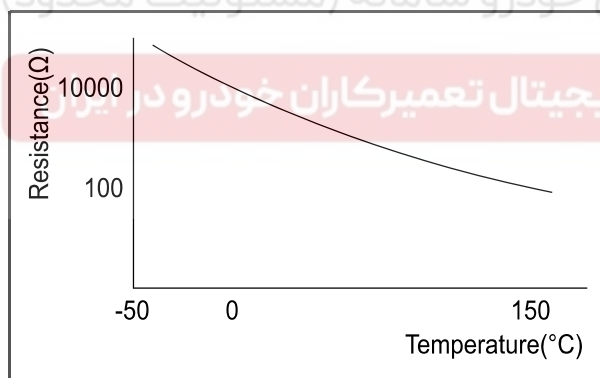


## (2) Oil temperature sensor

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.



### ► 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)



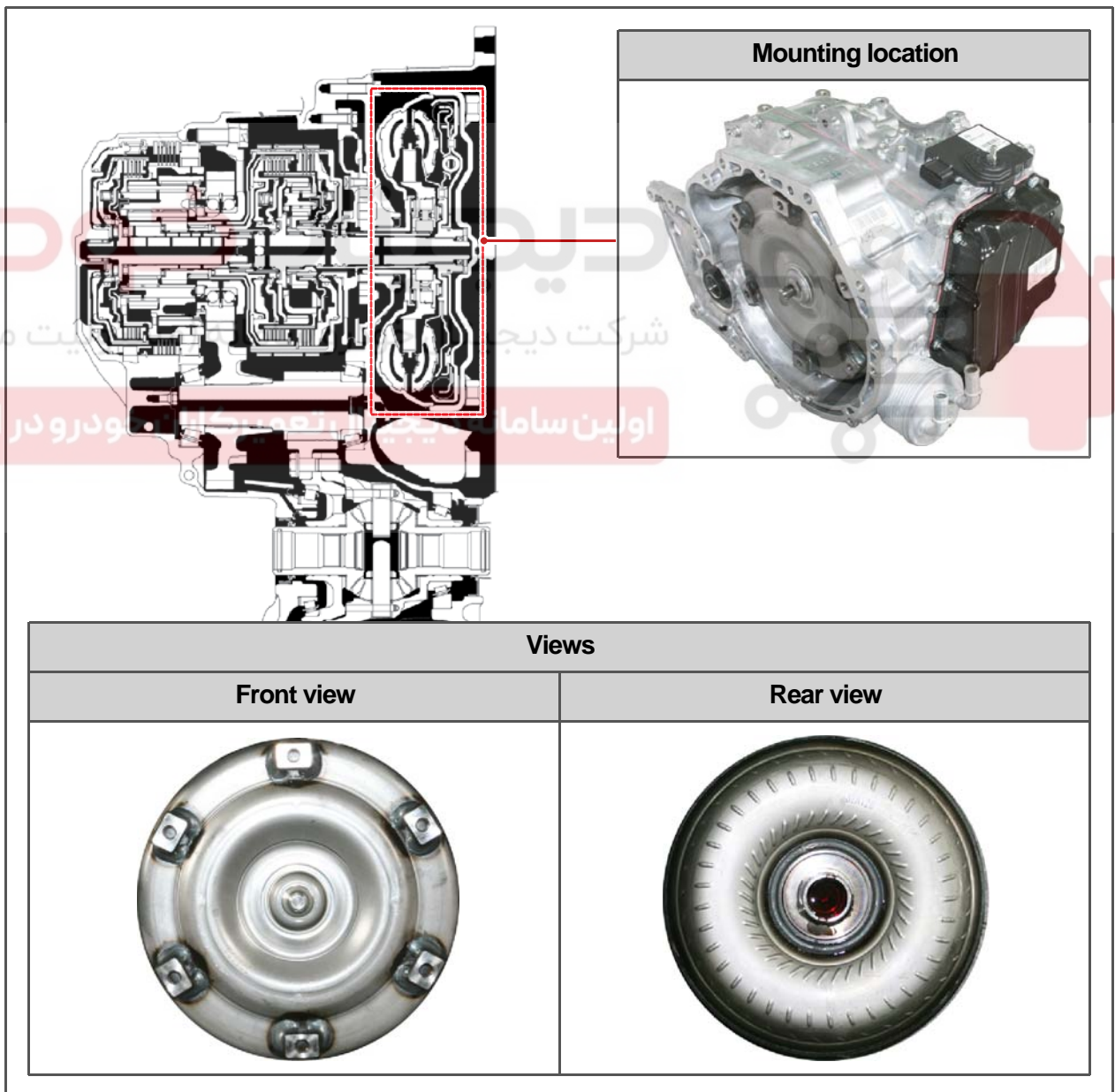
S.G.N.

**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**

Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

TIVOLI 2015.06



### 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.



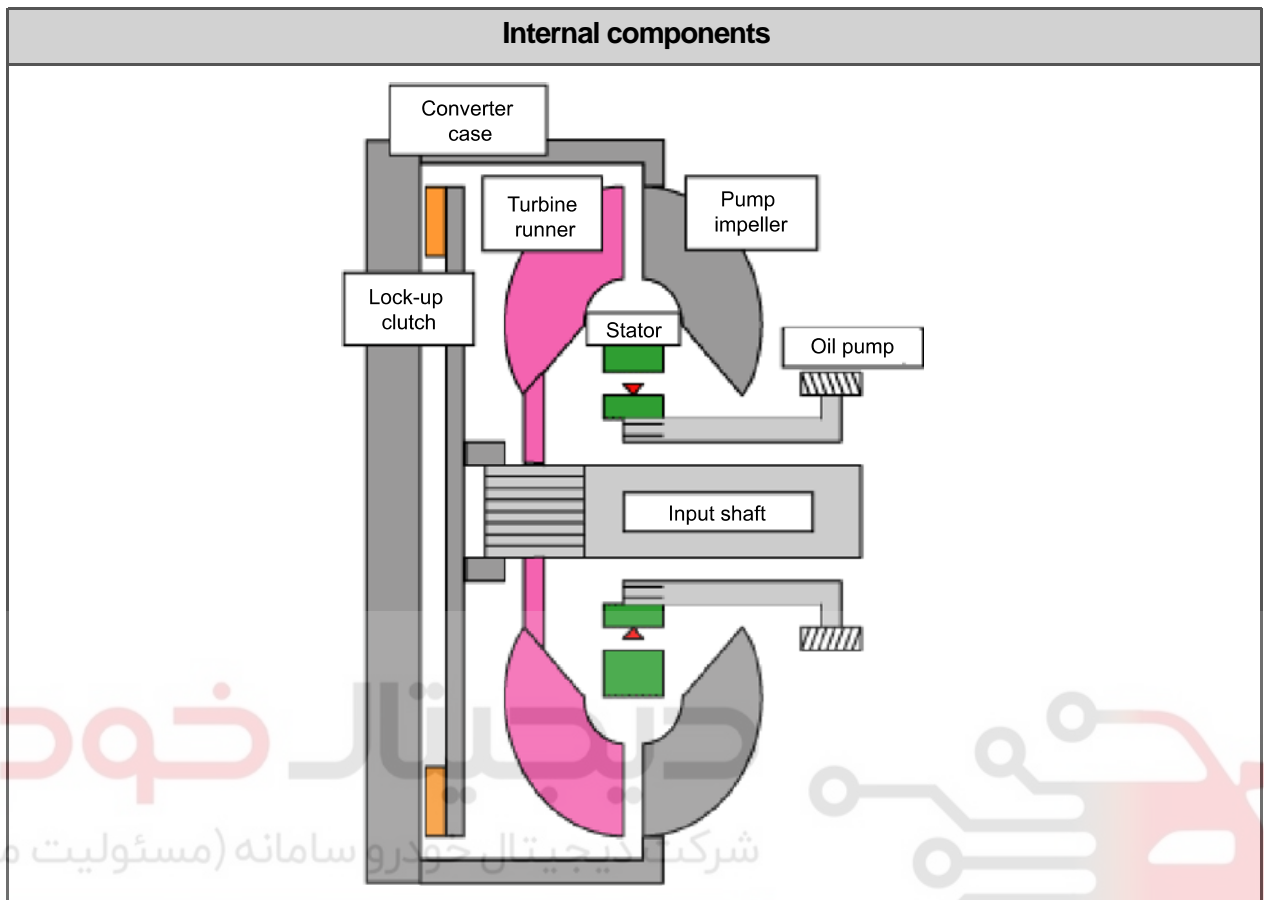
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

Modification basis	
Application basis	
Affected VIN	



#### 4) Torque Converter Lock-up Clutch



- 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.

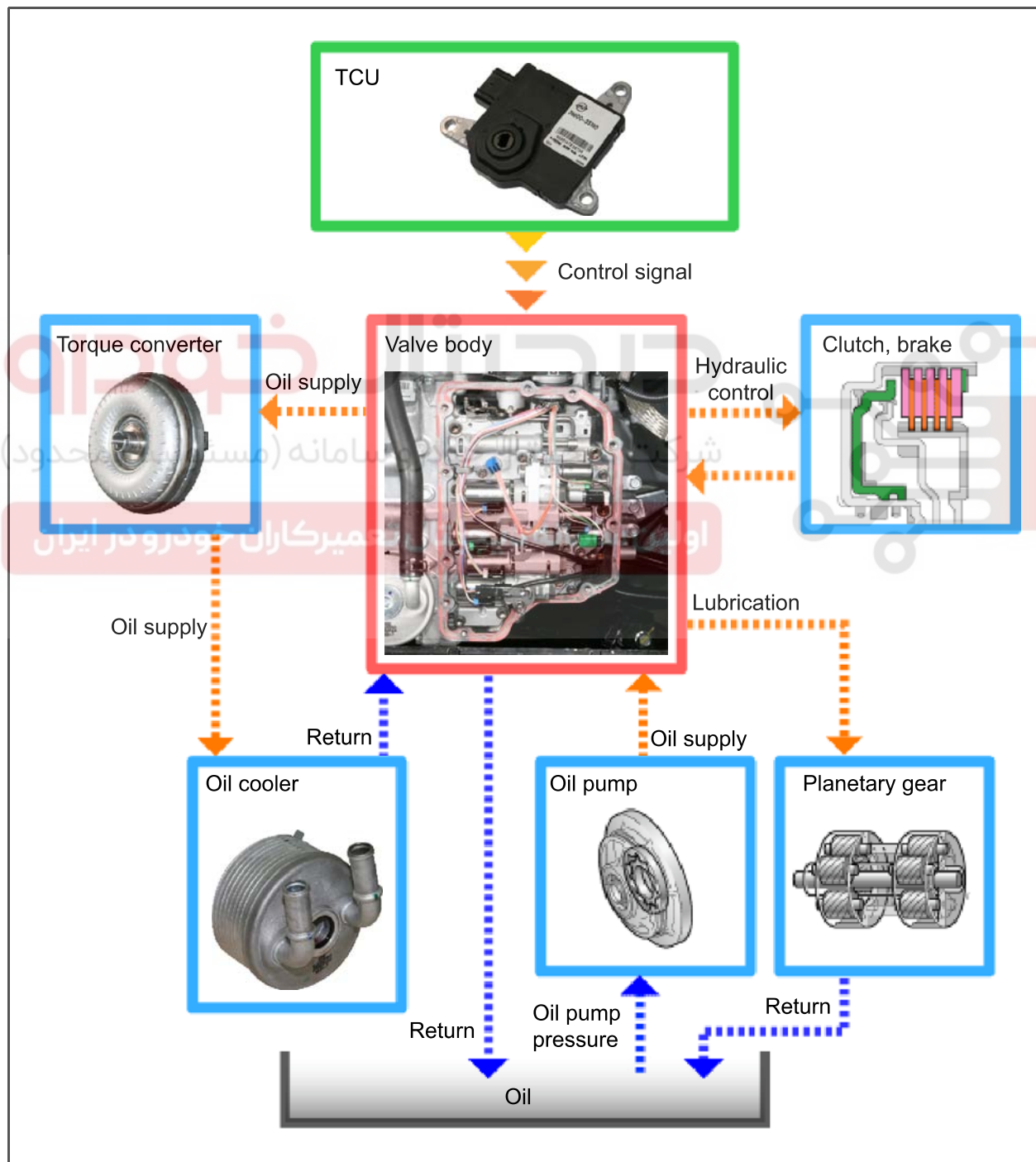
Modification basis	
Application basis	
Affected VIN	



## 3693-15 VALVE BODY ASSEMBLY

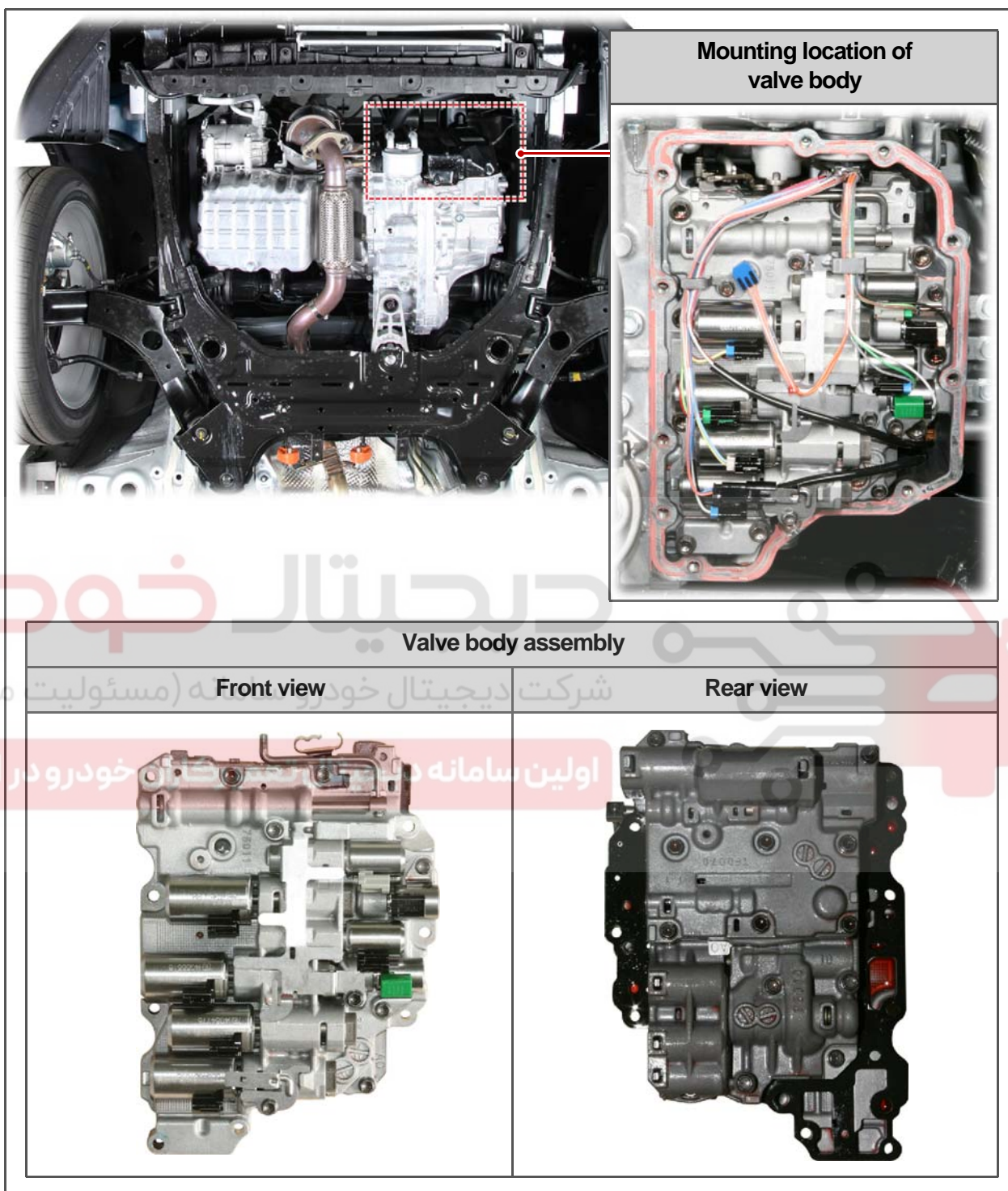
### 1) Overview

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.





## 2) Mounting Location



Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

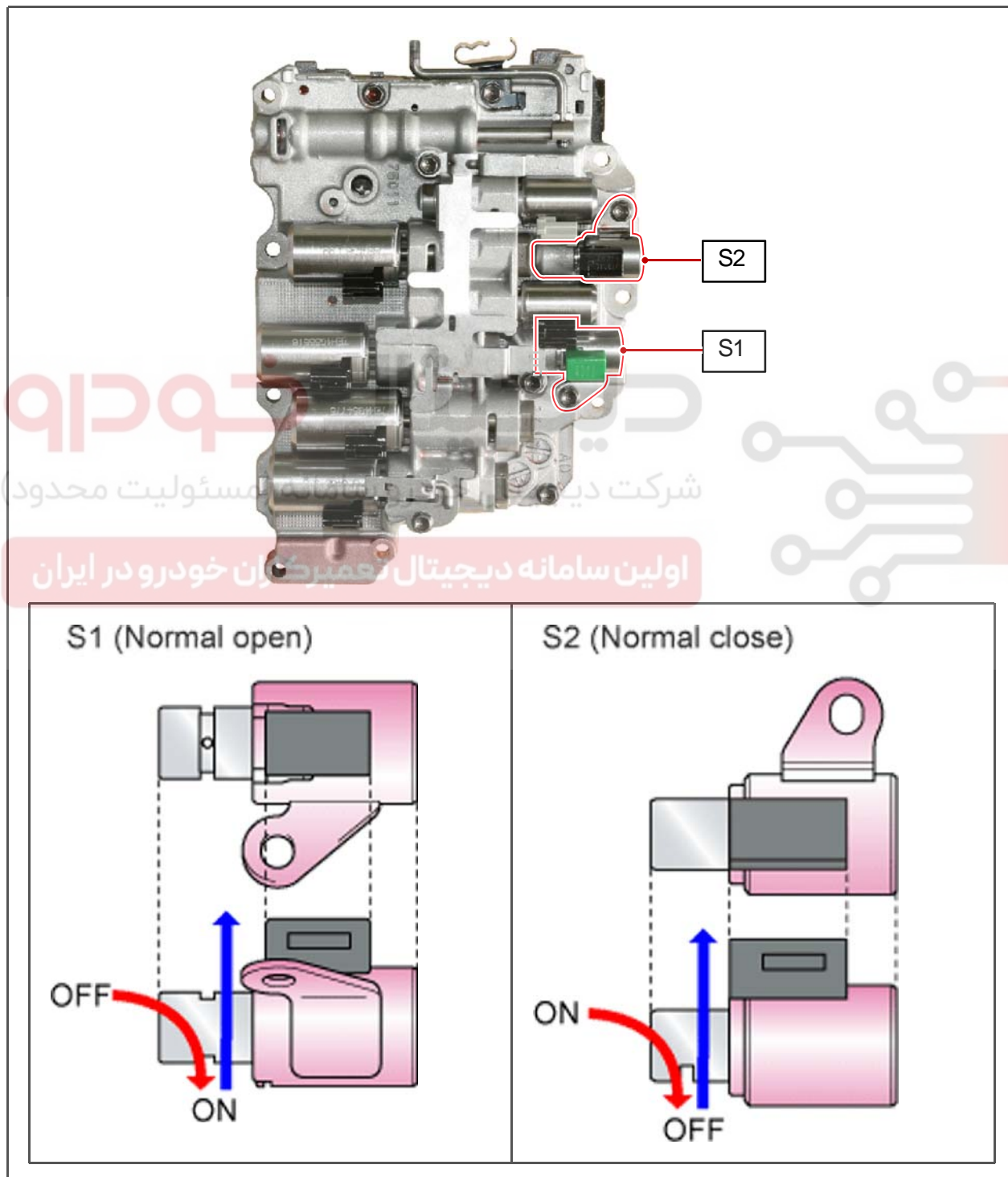
TIVOLI 2015.06



### 3) Mounting Location of Solenoid

#### ► Shift solenoids [S1, S2]

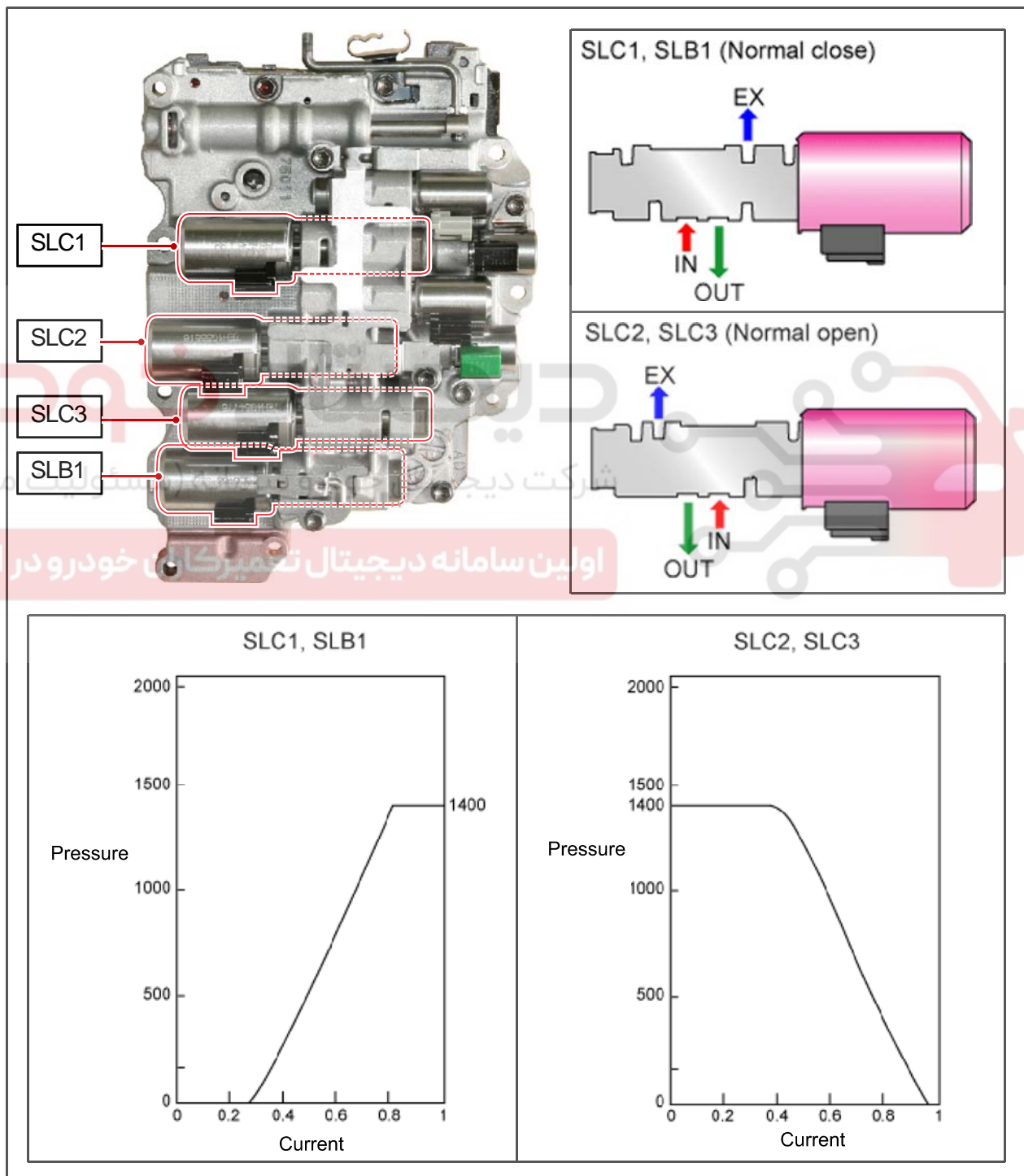
The shift solenoids [S1, S2] are fitted to the front valve body and turn on and off based on the output signal from the TCU. The 1st gear engine brake is activated or the gear shift occurs depending on the S1 or S2 ON/OFF. In the event of the shift solenoid failure, the TCU does not perform the current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





### ► 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.

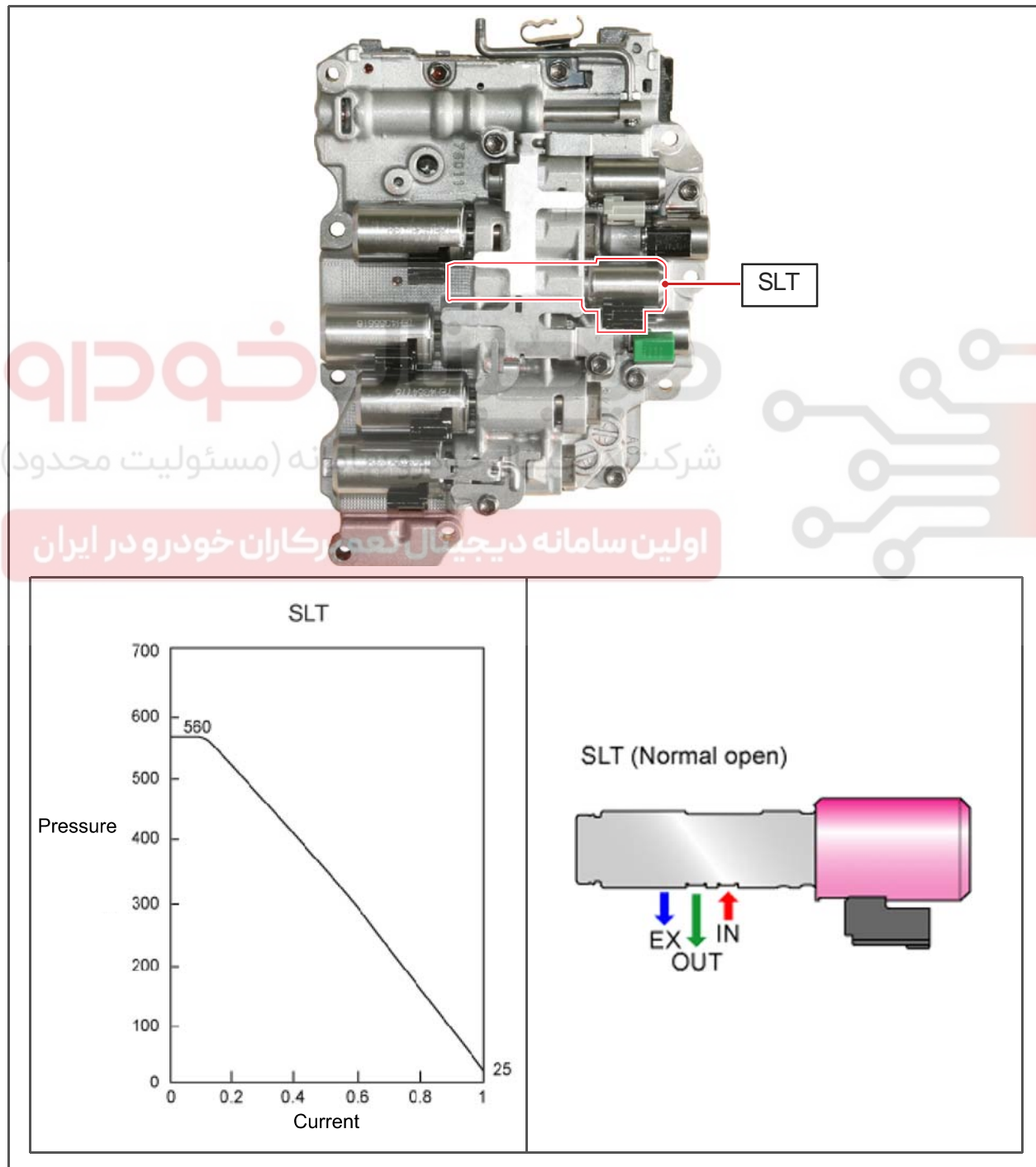


Modification basis	
Application basis	
Affected VIN	



### ► 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")



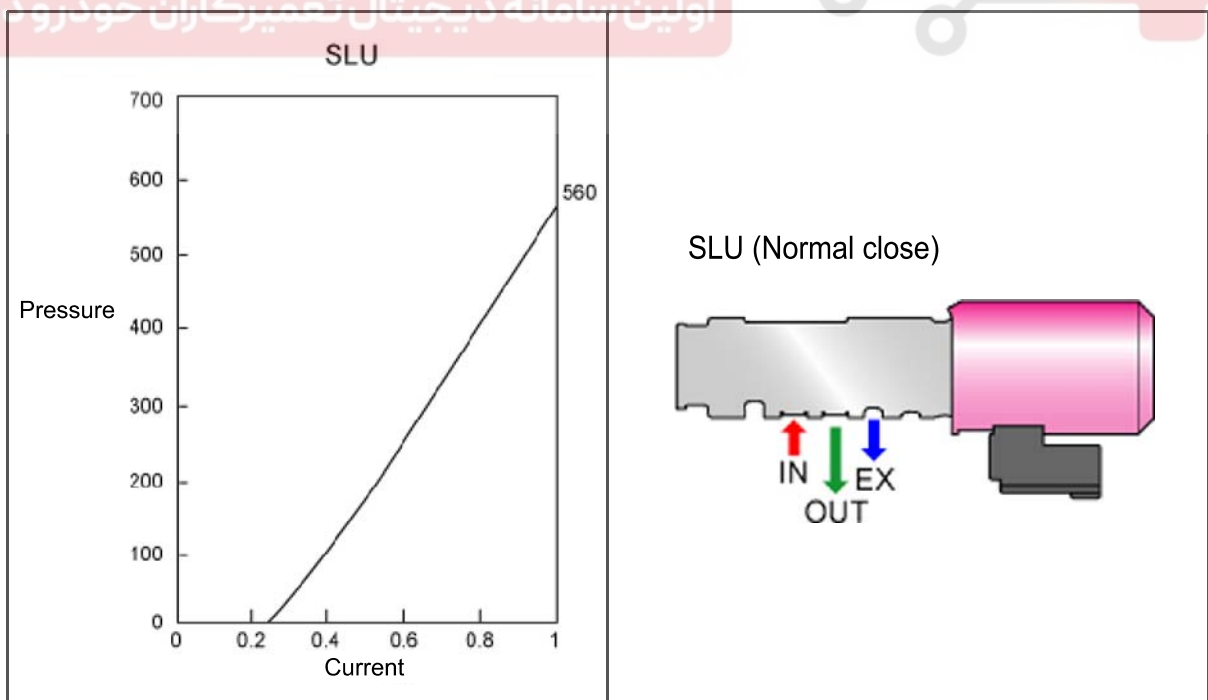
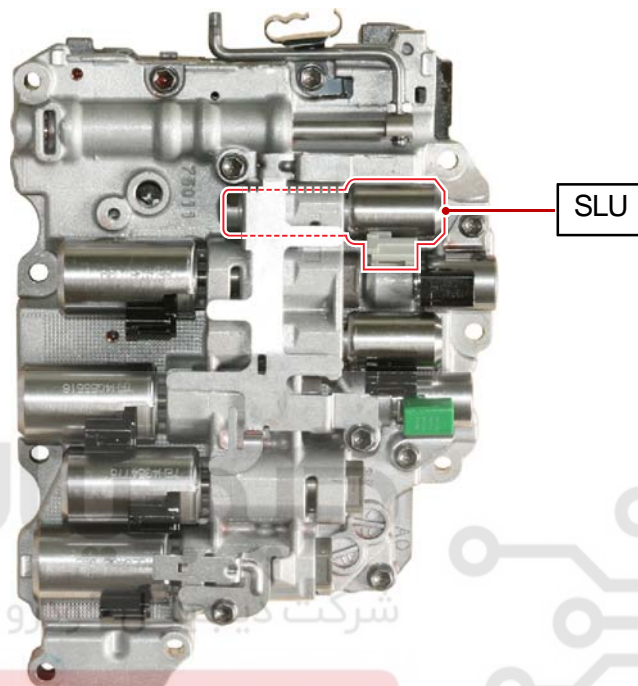


### ► Lock-up control solenoid [SLU]

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	

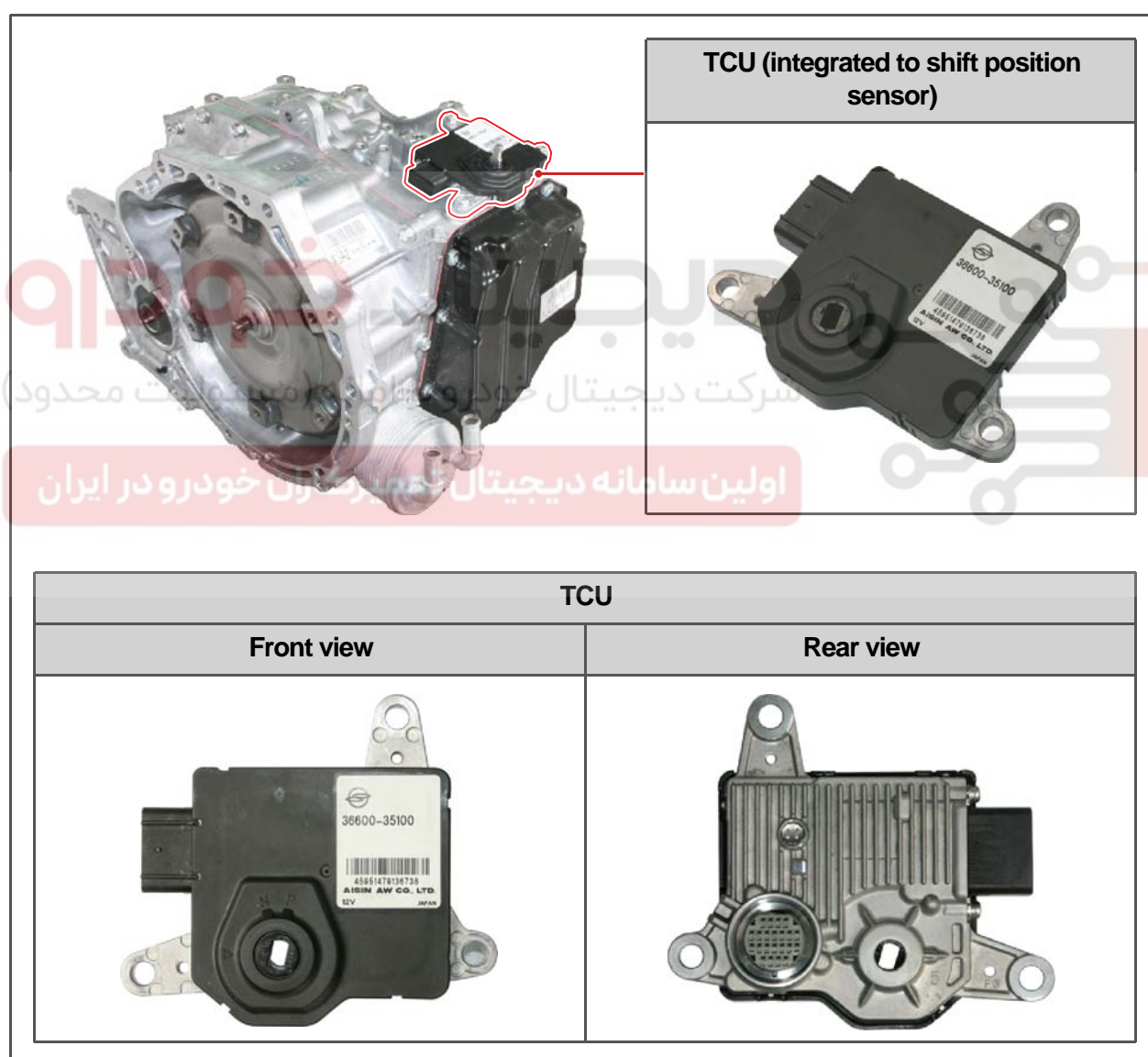


S.G.N.

**3691-07 TCU (SHIFT POSITION SENSOR)****1) Overview**

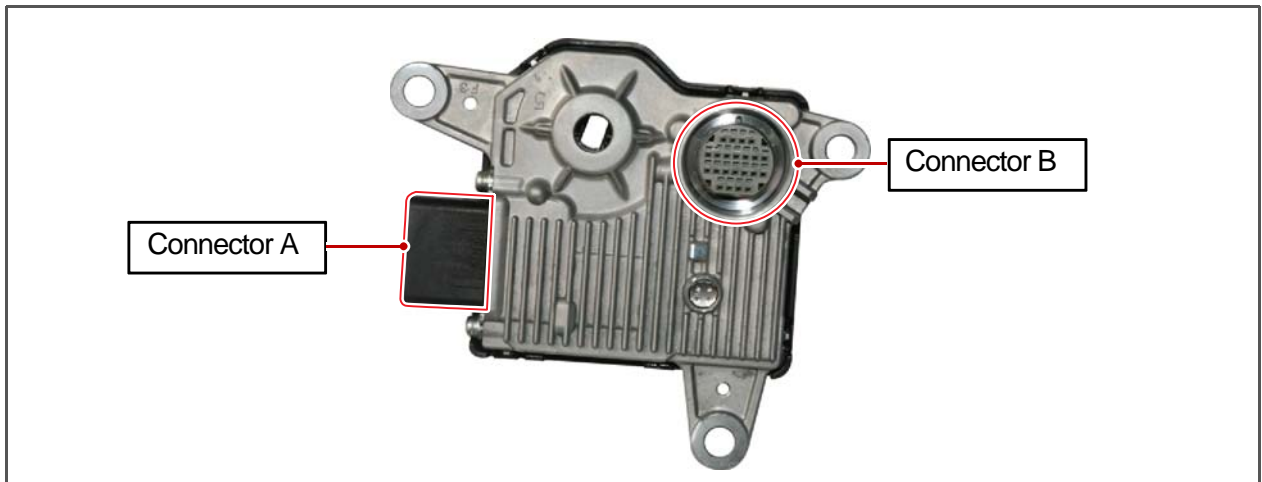
The TCU controls the gear groups according to the driving conditions. It receives the driving data from many sensors and switches as input signals. It is also connected with ECU, ESP HECU and instrument panel.

Function of the shift position sensor is fitted as a part of the TCU. A/T shift position is calculated by the TCU.

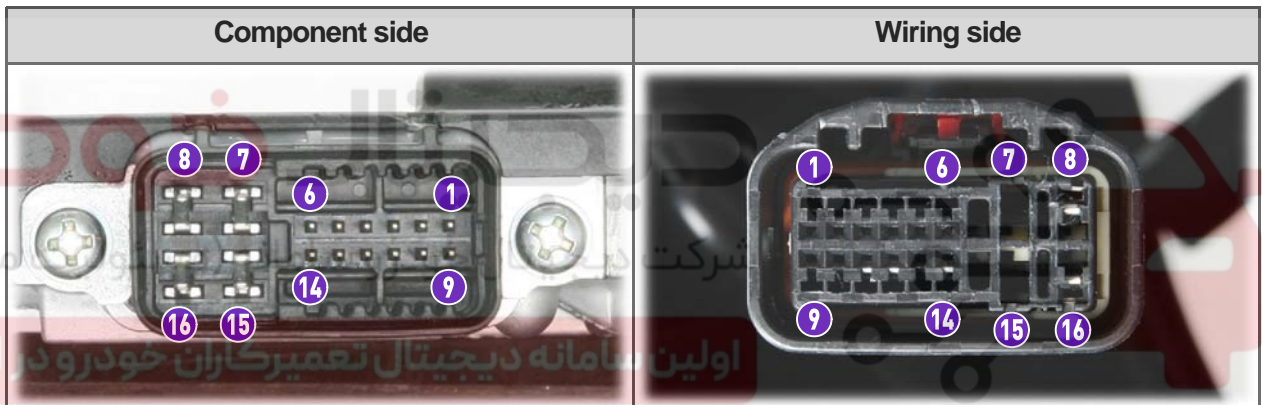
**2) Mounting Location**



### 3) Connector Description



#### ► Connector A

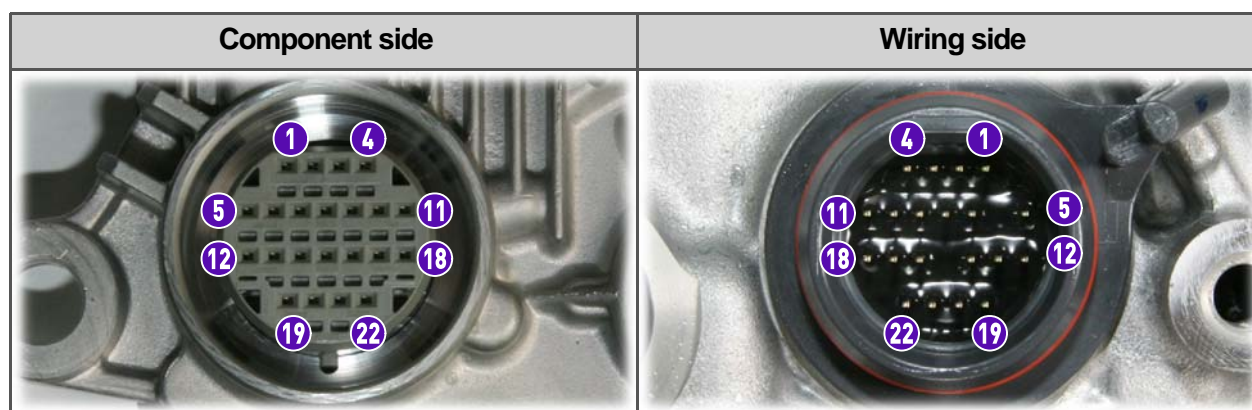


Pin No.	Function	Pin No.	Function
A1	-	A9	-
A2	Manual mode switch	A10	-
A3	P-CAN LOW	A11	P-CAN HI
A4	Start lock control (D16DTF)	A12	Shift lock solenoid control
A5	Tip switch (-)	A13	-
A6	Tip switch (+)	A14	IGN1
A7	-	A15	-
A8	B+	A16	TCU ground

Modification basis	
Application basis	
Affected VIN	



## ► Connector B



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 control solenoid [SLU-]	B15	-
B5	Shift solenoid No. 1 [S1]	B16	Shift control solenoid [SLB1-]
B6	-	B17	Shift control solenoid [SLC2+]
B7	Oil temperature sensor [OT-]	B18	Shift control solenoid [SLC2-]
B8	Oil temperature sensor [OT+]	B19	Output speed sensor [SP+]
B9	Lock-up control solenoid [SLU+]	B20	Output speed sensor [SP-]
B10	Shift control solenoid [SLC1-]	B21	Shift control solenoid [SLB1+]
B11	Shift control solenoid [SLC1+]	B22	Shift control solenoid [SLC3-]

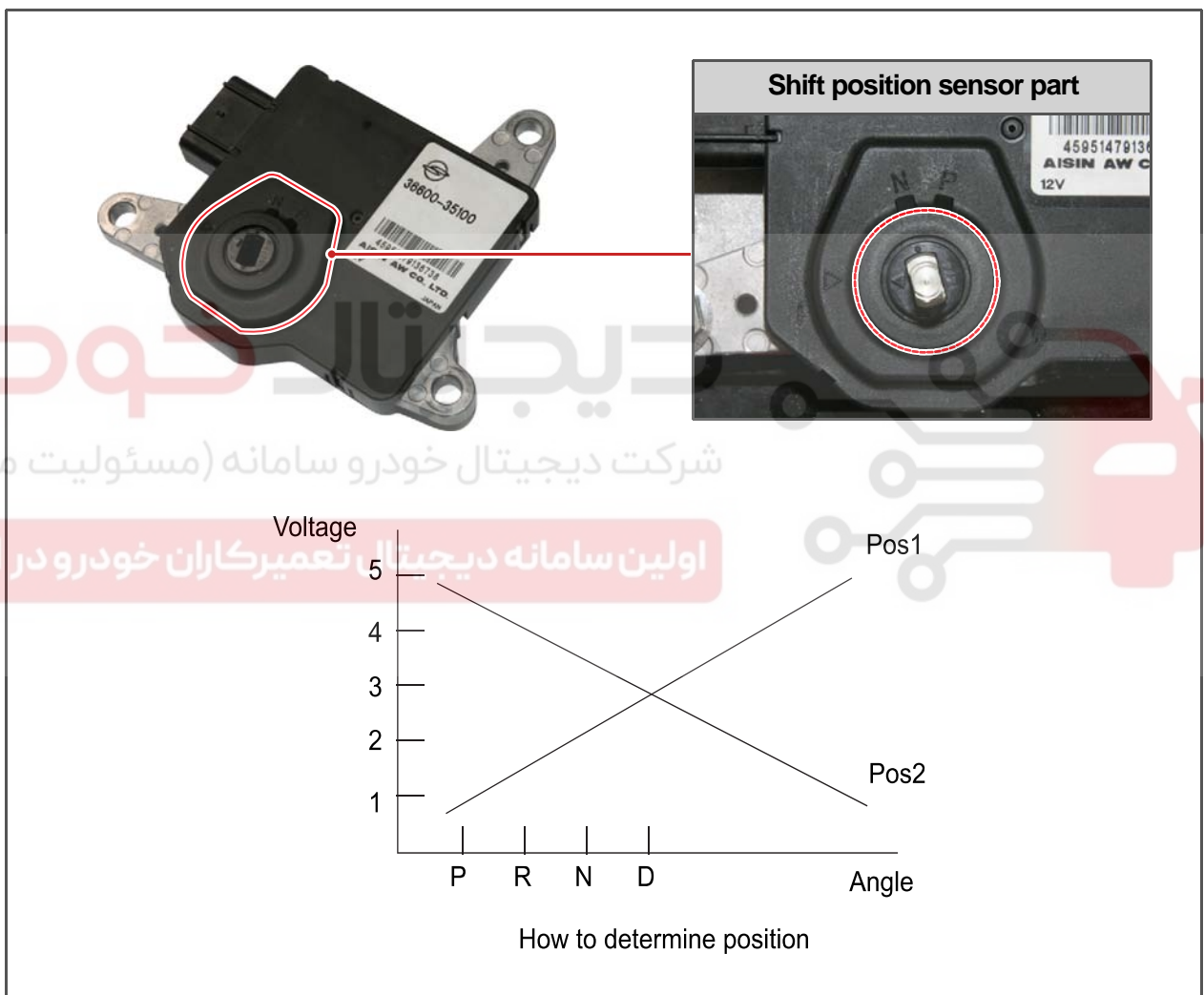


#### 4) Shift Position Sensor (Integrated with TCU)

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.



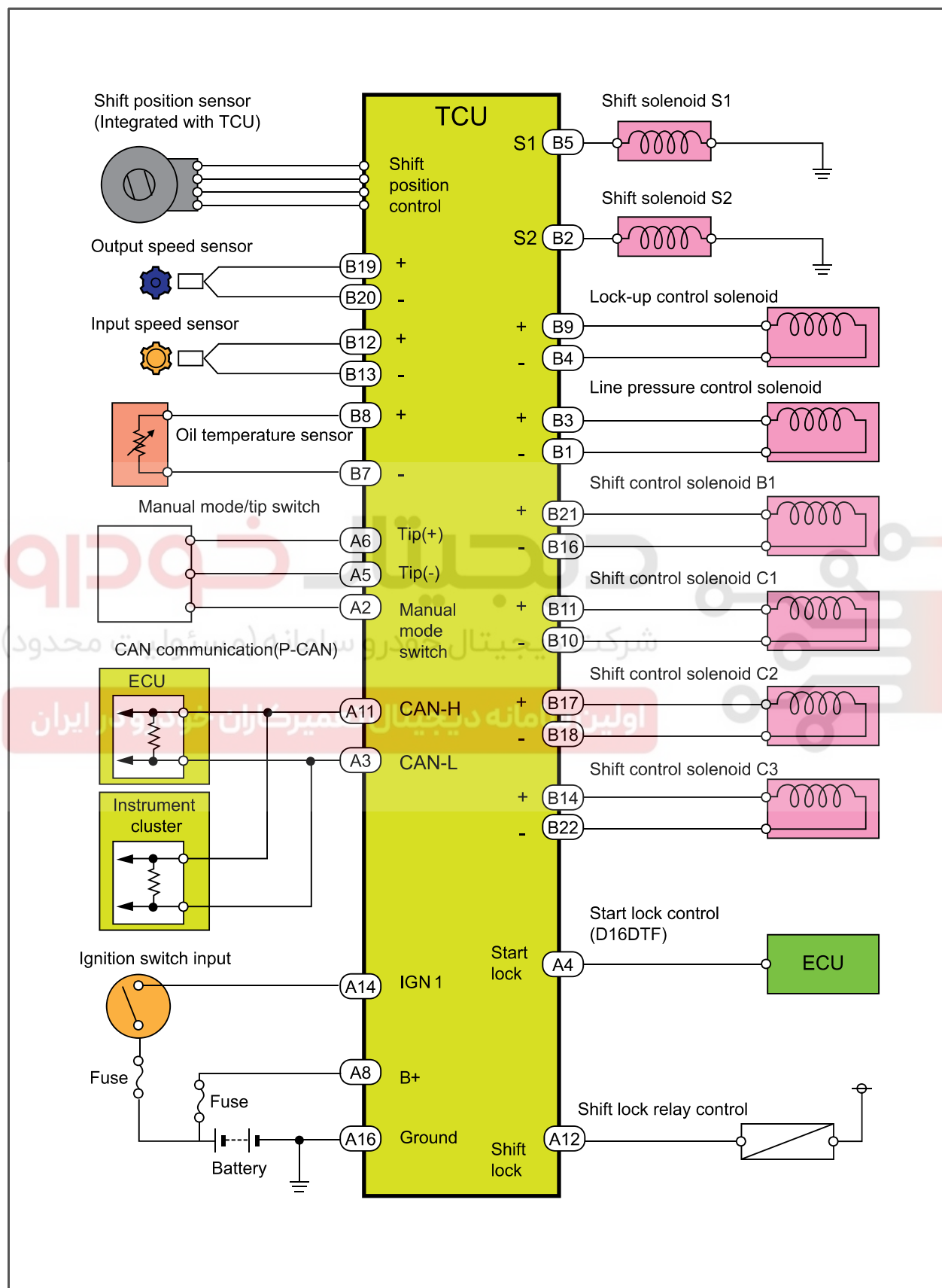
#### NOTE

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	



S.G.N.

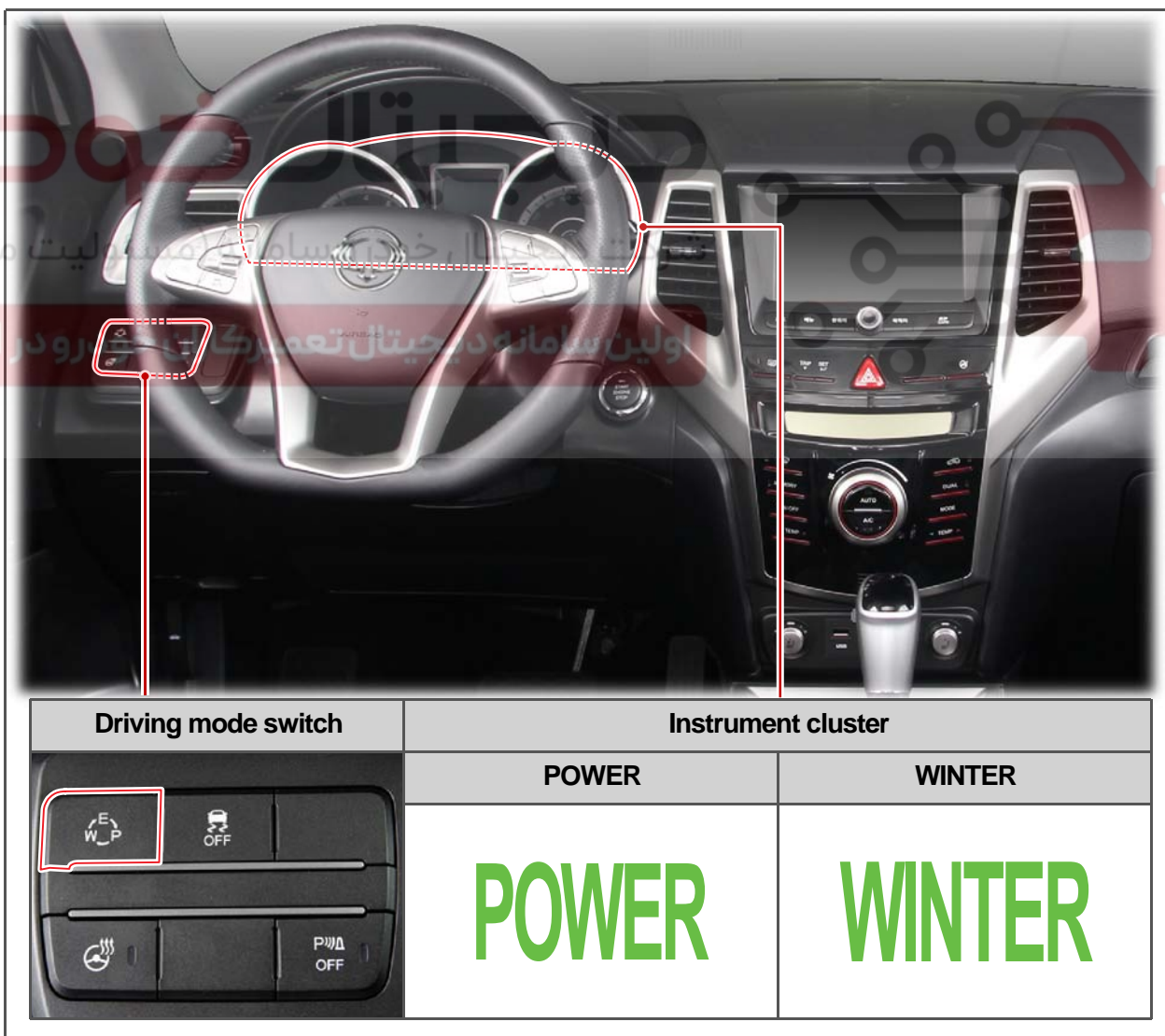
**8510-07 DRIVING MODE SWITCH****1) Overview**

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.

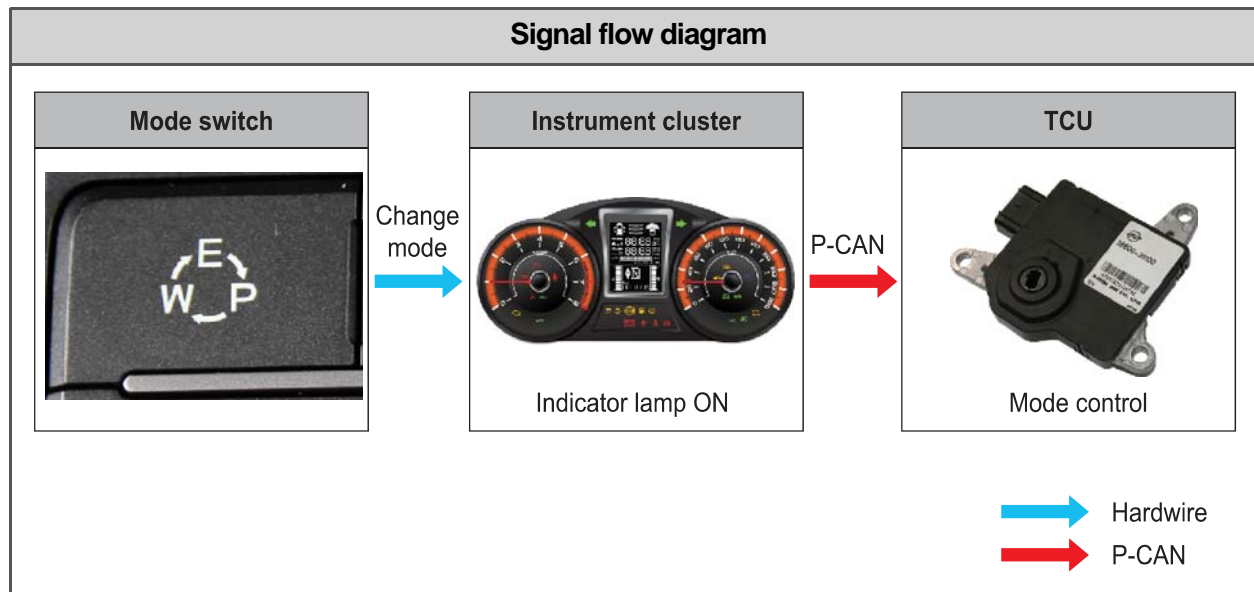
**2) Mounting Location**

Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

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### 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.

Modification basis	
Application basis	
Affected VIN	



S.G.N.

**3724-01 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	

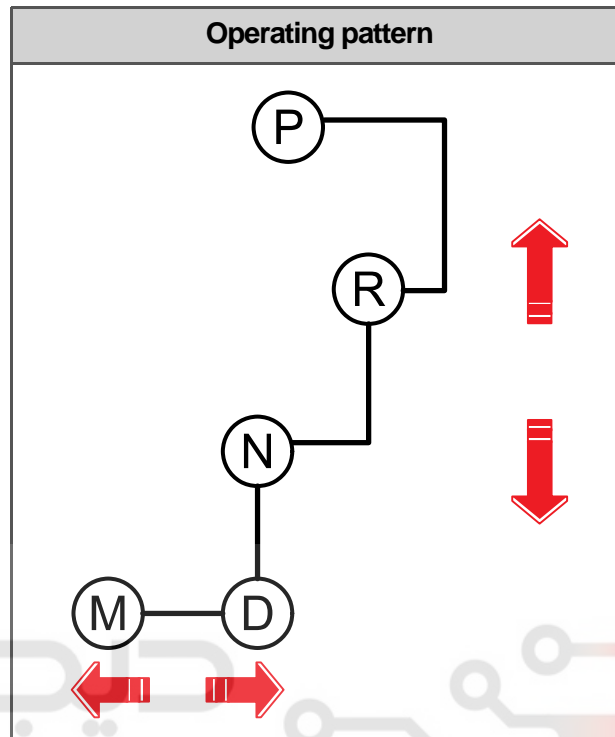
AISIN 6 SPEED AUTO TRANSAXLE

TIVOLI 2015.06



### 3) How TGS Lever Works

#### (1) Change TGS lever position



**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.

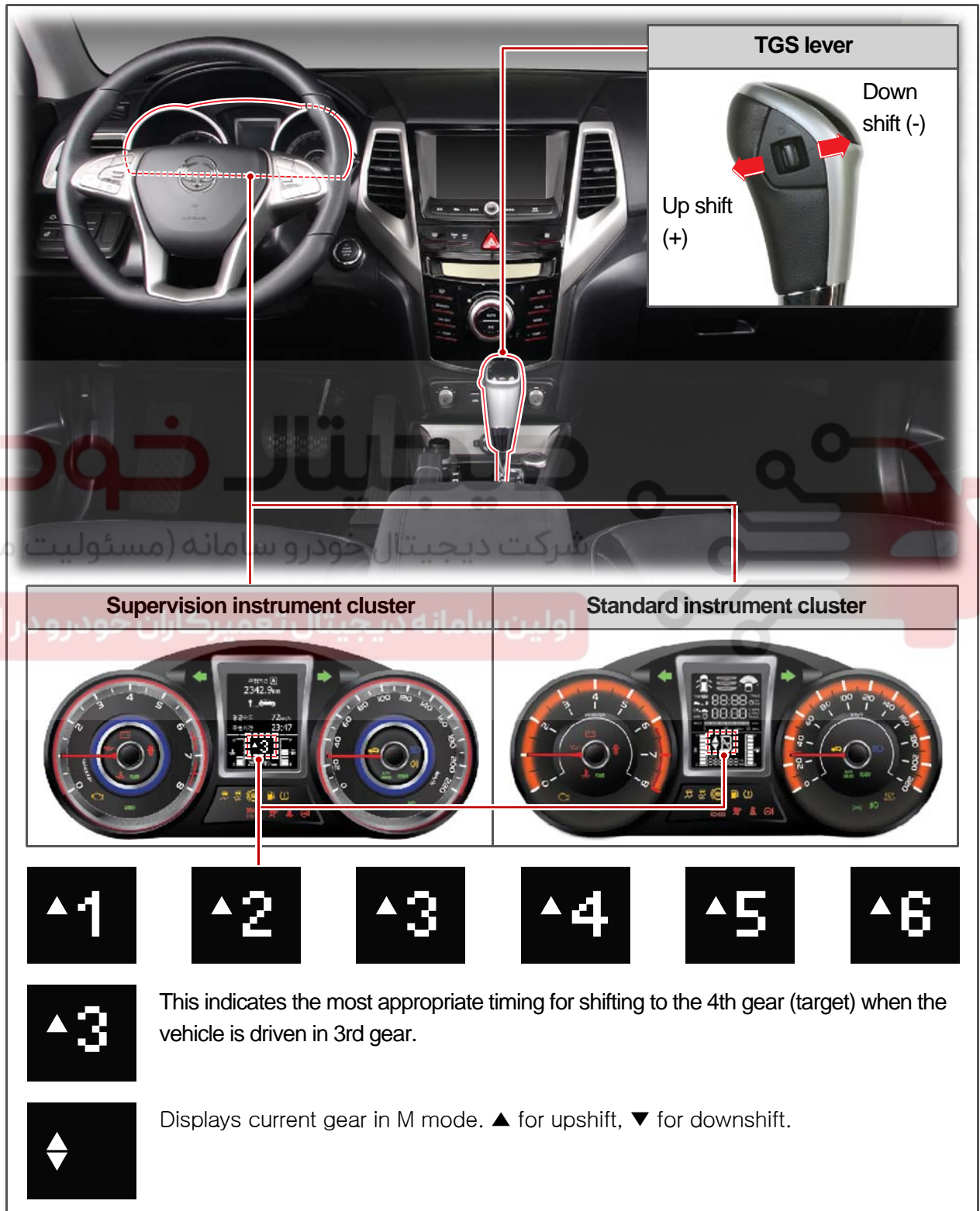
**M**

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.



Modification basis	
Application basis	
Affected VIN	

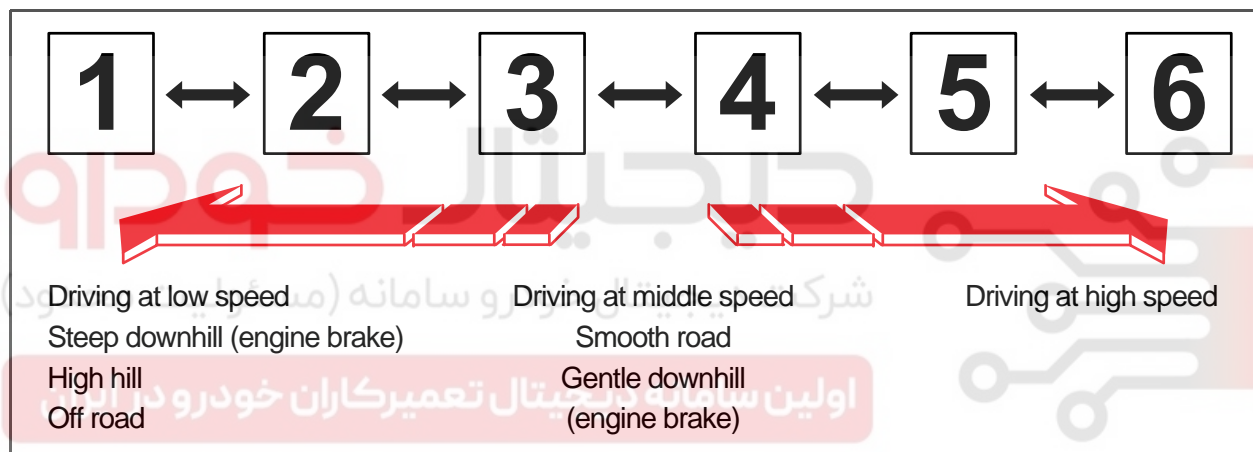


### ► Activate manual mode

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 the shift lever is moved to M position while driving, the current gear position is maintained and you can change the gear position by operating the tip switch.
- In some cases, the gear change may not be made to secure the driving performance when changing up. In addition, it may not be made to prevent the engine from over-revving when the driver shifts down the gear depending on the vehicle speed.

### ► 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	-

Modification basis	
Application basis	
Affected VIN	



#### (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.

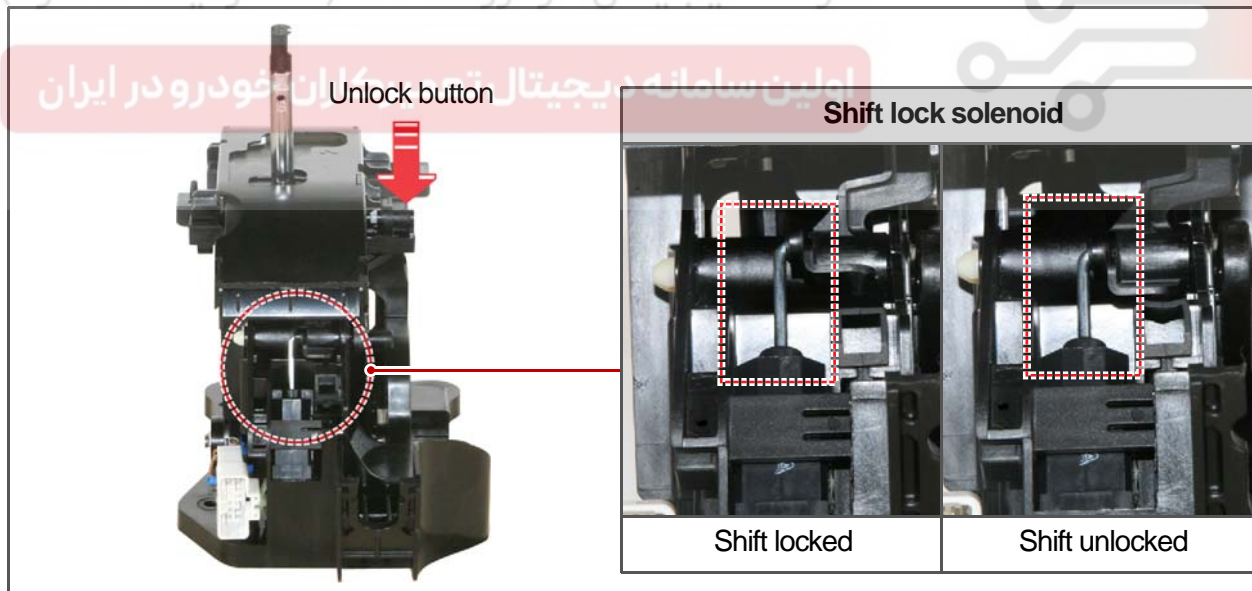
1. Turn off the engine and apply the parking brake.
2. Depress the brake pedal, move the TGS lever to another position with the activation part (lock release button) of the solenoid valve pressed with your finger.

#### CAUTION

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

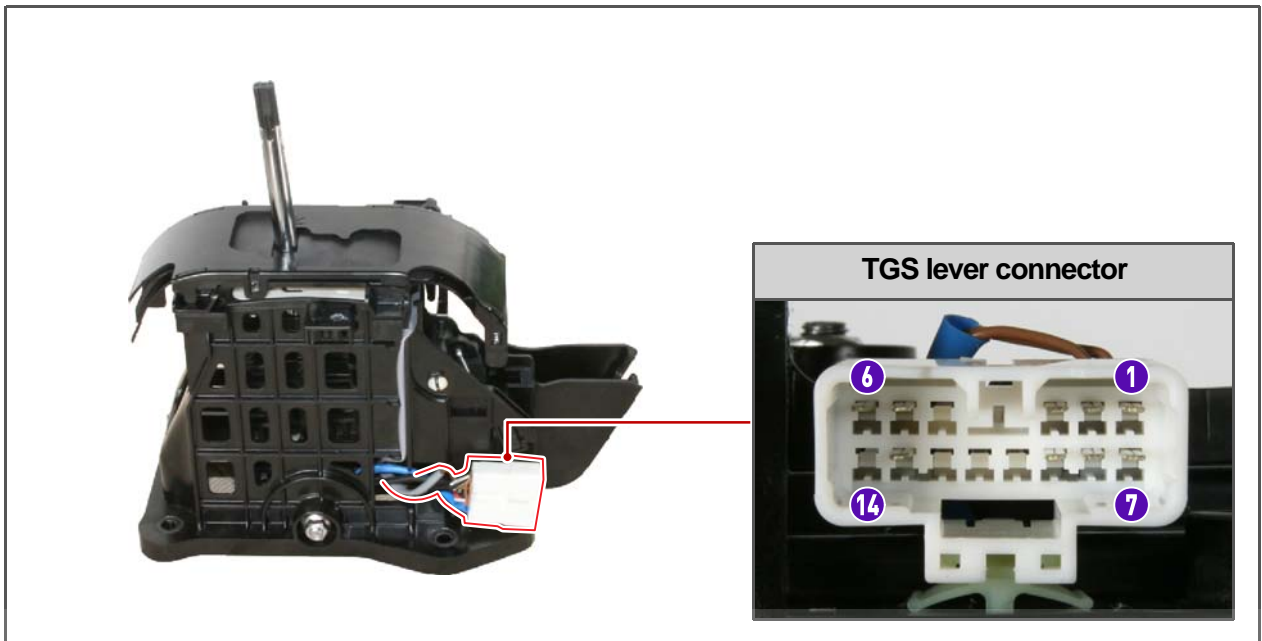
#### ► Shift lock solenoid function

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



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	-	-

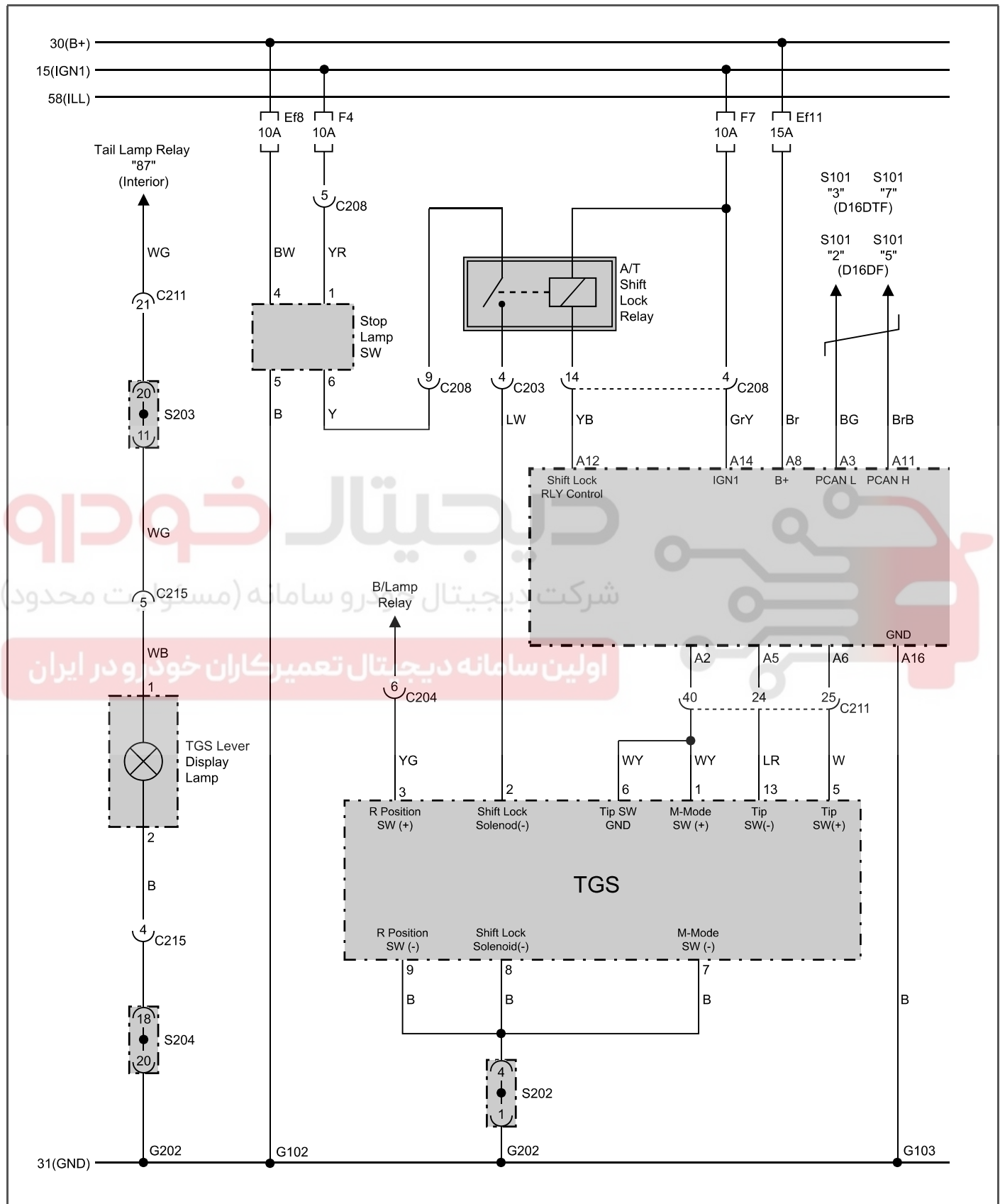
Modification basis	
Application basis	
Affected VIN	



S.G.N.

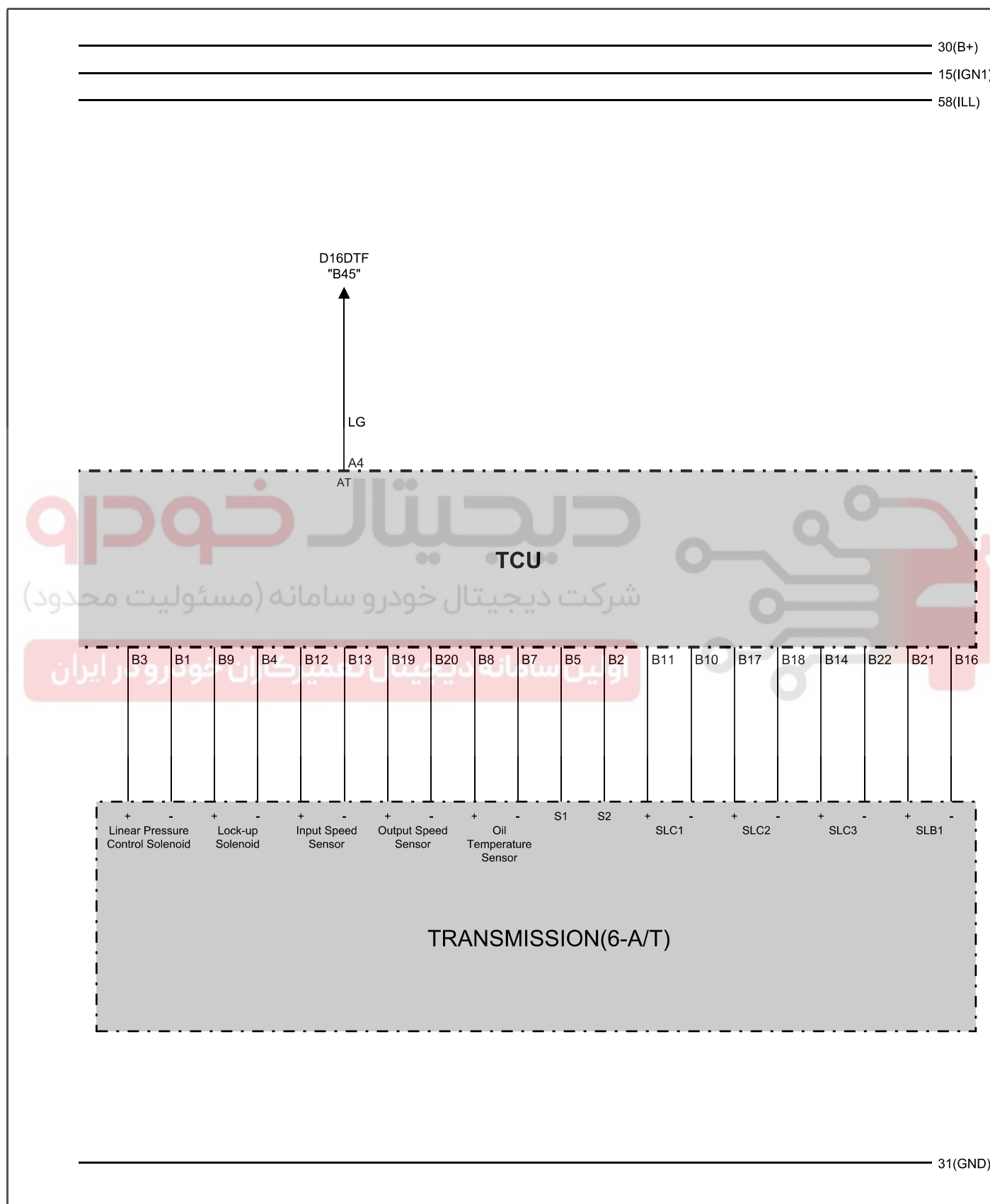
3691-07

## TCU/TGS LEVER CIRCUIT DIAGRAM



Modification basis	
Application basis	
Affected VIN	





Modification basis	
Application basis	
Affected VIN	



## REMOVAL AND INSTALLATION

### S.G.N. 3691-07 FUNCTIONAL 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°C to 100°C)
- 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	<ul style="list-style-type: none"> <li>- Defective valve body (SLC1 hydraulic system)</li> <li>- C1 clutch slippage</li> <li>- One-way clutch [F1] failure</li> <li>- Oil pump failure</li> <li>- Blocked oil strainer</li> </ul>
From "N" to "R" position: longer than standard	<ul style="list-style-type: none"> <li>- Defective valve body (SLC3 hydraulic system)</li> <li>- C3 clutch slippage</li> <li>- B2 brake slippage</li> <li>- Oil pump failure</li> <li>- Blocked oil strainer</li> </ul>



## 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°C to 100°C)
- 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  $2,800 \pm 150$  rpm, there may be a fault in the auto transmission.

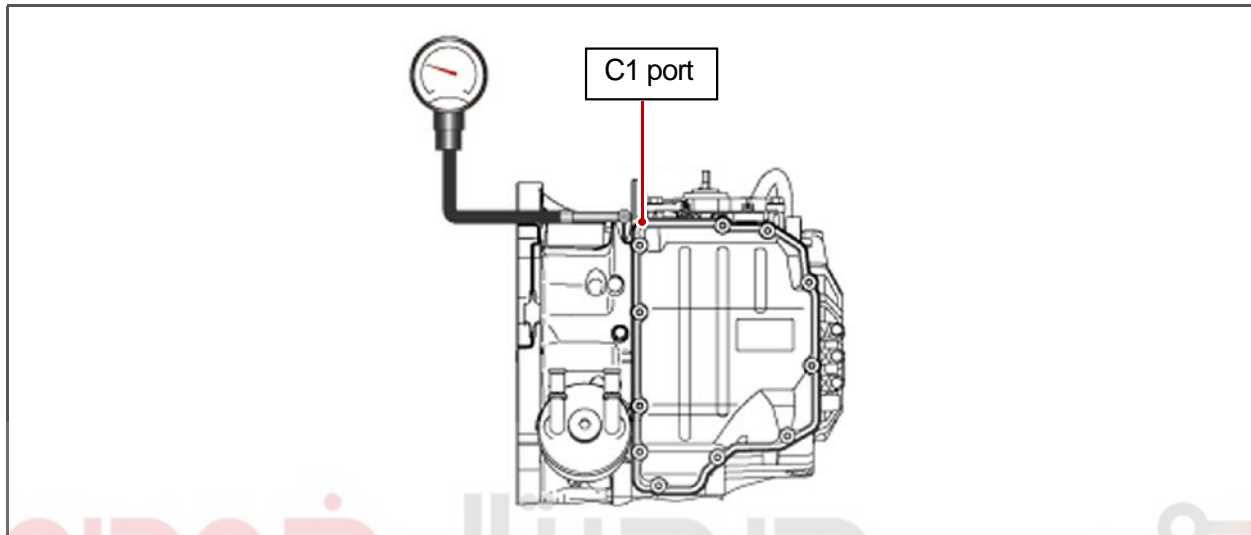
Test result	Possible cause
Values at both "D" and "R" position are less than standard.	Insufficient engine power One-way clutch slippage
Value at "D" position is higher than standard.	High line pressure (Line pressure solenoid valve [SLT] failure) - Defective valve body (SLC1 hydraulic system) - C1 clutch 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

Modification basis	
Application basis	
Affected VIN	



### 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.

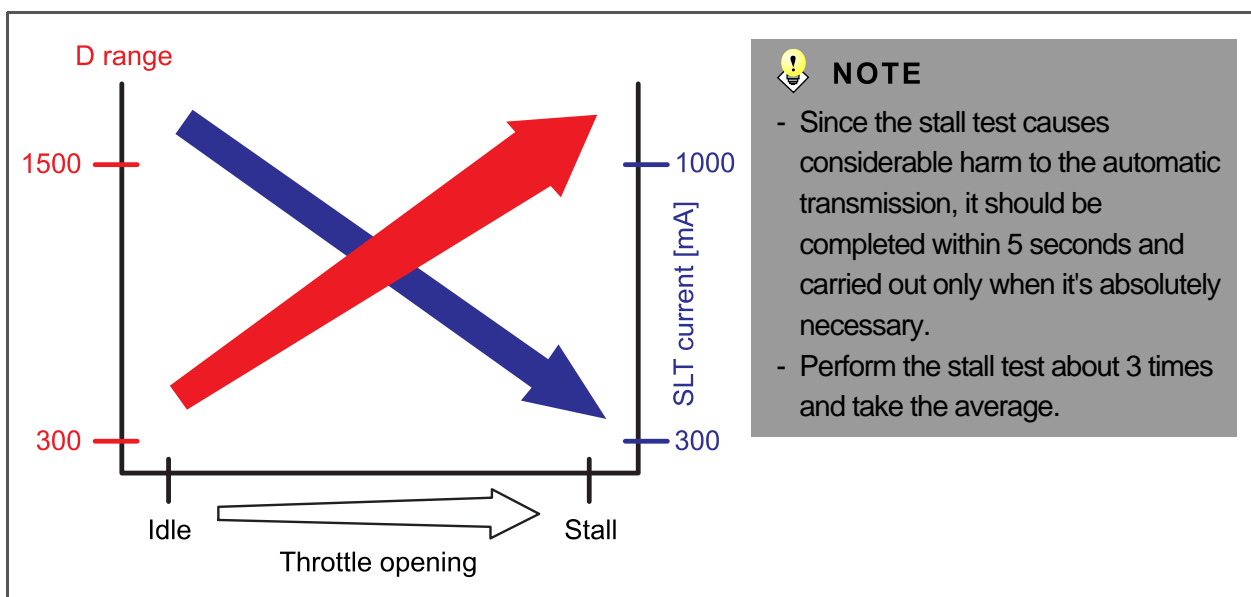


- Start the engine and measure the oil pressure with the lever in "D" position and engine at idle.

**reference** Fluid temperature: 50°C~70°C

Engine rpm	Selector lever position	Lie pressure (kPa)
Idle	"D" position	350 ~ 520

- 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)





## 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°C to 100°C)
- ATF temperature of 50~80°C
- 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	<ul style="list-style-type: none"> <li>- Check downshift by activating the kick-down at every gear shift.</li> <li>- Check the shift shock level during kick-down.</li> </ul>
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.

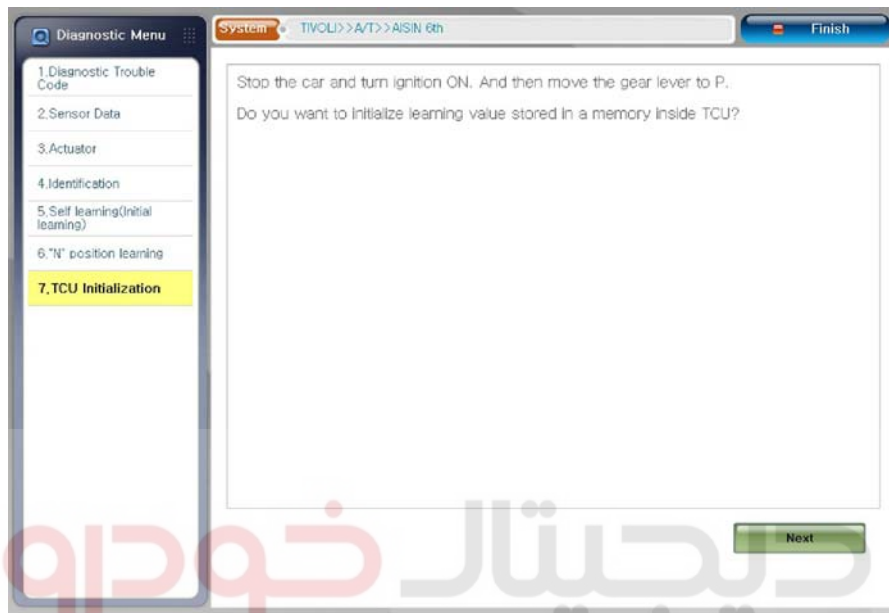
Modification basis	
Application basis	
Affected VIN	



S.G.N.

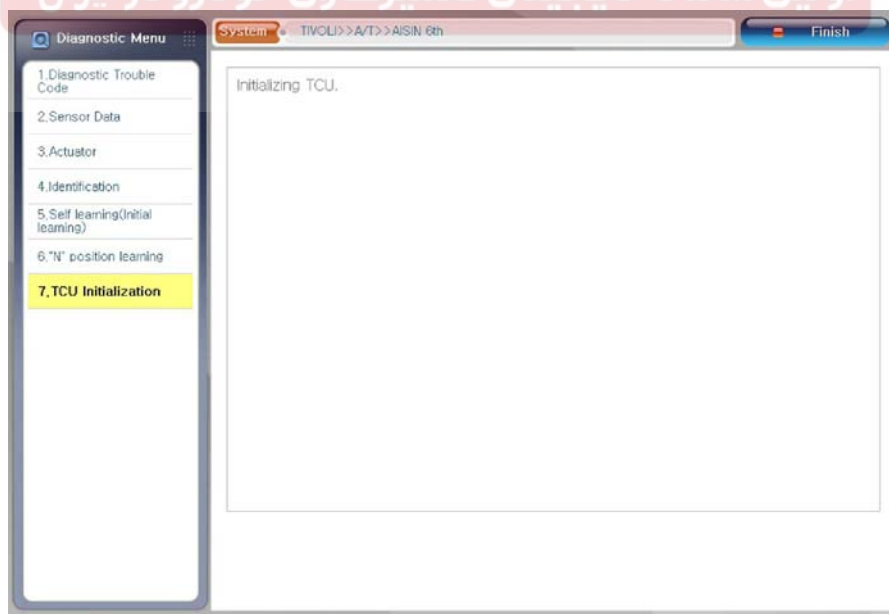
**3691-07 INITIALIZIN/LEARNING PROCESS****1) TCU Initialization**

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



شرکت دیجیتال خودرو (مسئولیت محدود)

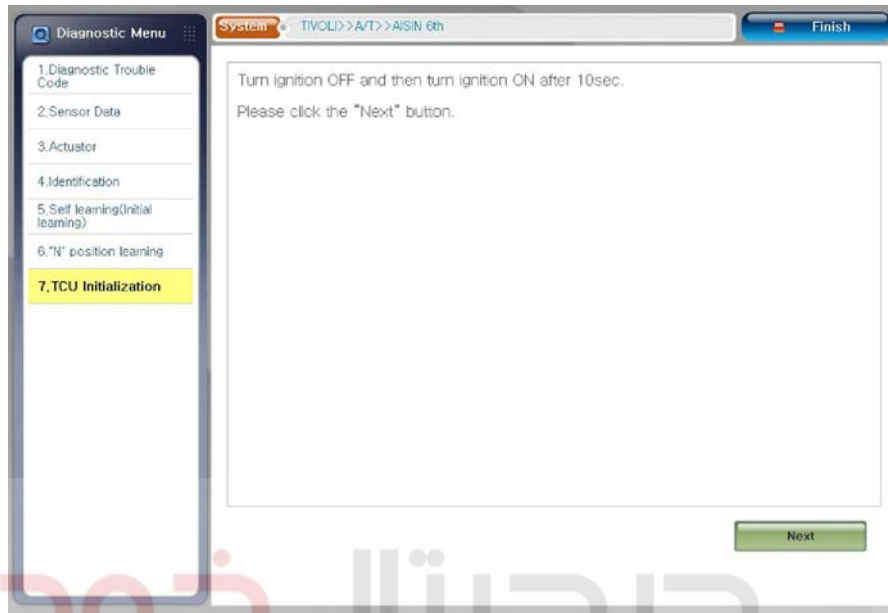
2. Click on the [Done] button when the initialization is completed.



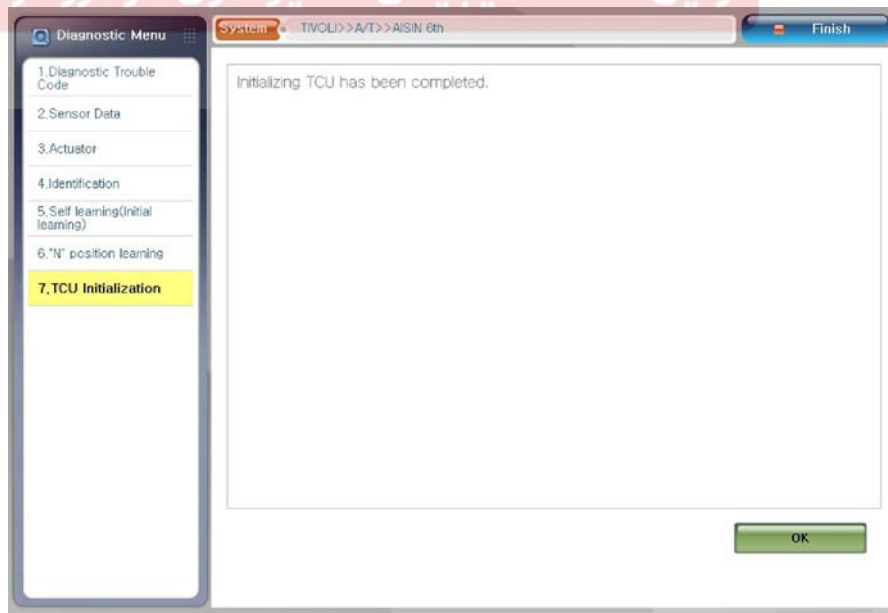
Modification basis	
Application basis	
Affected VIN	



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.



Modification basis	
Application basis	
Affected VIN	



## 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.



- 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.



### 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°C and 110°C using the diagnostic device. If the oil temperature is out of the range, adjust the temperature properly.

#### CAUTION

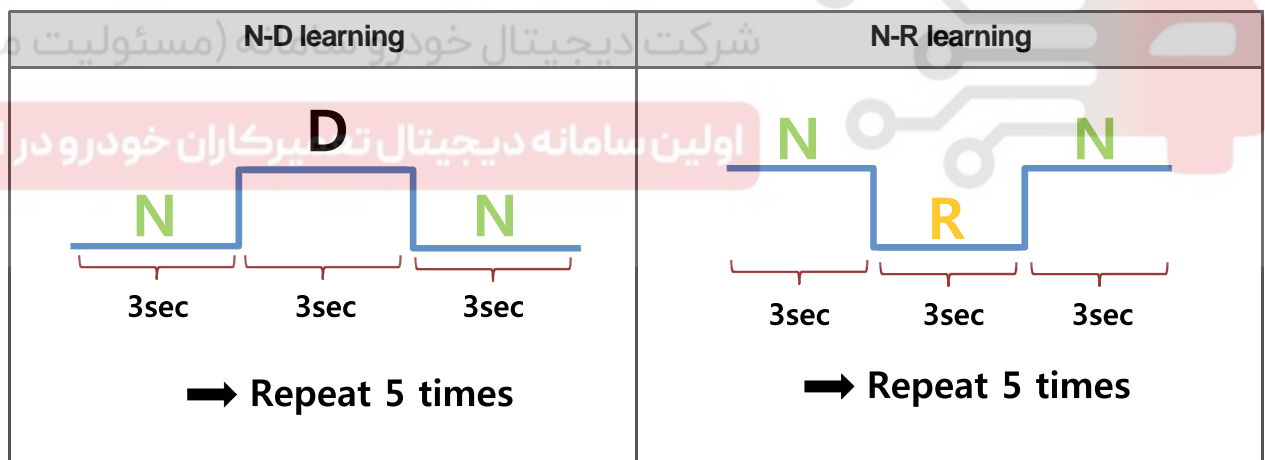
Do not stall the engine to increase oil temperature.

#### NOTE

- If the oil temperature is not within 65°C to 110°C, 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.



Modification basis	
Application basis	
Affected VIN	



### 3. Drive learning (gear shift control learning)

- Run the "Drive Learning" menu on the diagnostic program with the engine started.
- Raise the vehicle speed up to 110 km/h, from 1st to 6th, while maintaining the throttle opening to about 25%~35%.
- After that, release the accelerator pedal and drive the vehicle by inertia so that the vehicle can stop within 60 seconds.
- Repeat the above procedures 10 times and check if "Completed" is displayed on each item under "Drive Learning".
- For item which does not display "Completed", you should concentrate upon the driving at that gear position.



### 4. Check learning results

Compare the shift shocks with ones before learning at the various speeds.



S.G.N.

**9210-02 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)
- Top up the ATF when checking for oil leakage and replacing the automatic transmission assembly.  
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°C.
4. Check the ATF level with the engine started.

**NOTE**

Check if the engine rpm is 650 rpm  $\pm$  10 rpm.

Diagnostic Menu			
System: TIVOLI >> AT >> AISIN 6th			
1. Diagnostic Trouble Code	No.	List	Data Unit
2. Sensor Data	1	Shift solenoid S1	ON -
3. Actuator	2	Shift solenoid S2	OFF -
4. Identification	3	Linear solenoid SLC1	90 mA
5. Self learning (Initial learning)	4	Linear solenoid SLC2	690 mA
6. "N" position learning	5	Linear solenoid SLC3	690 mA
7. TCU Initialization	6	Linear solenoid SLB1	90 mA
	7	Linear solenoid SLU	190 mA
	8	Linear solenoid SLT	690 mA
	9	T/M output speed	0 rpm
	10	T/M input speed	0 rpm
	11	Oil temperature	55 °C
	12	Battery voltage	11.0 V
	13	Engine speed	0 rpm
	14	Engine torque	650 Nm
	15	Driver requested torque	157 Nm

Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

TIVOLI 2015.06

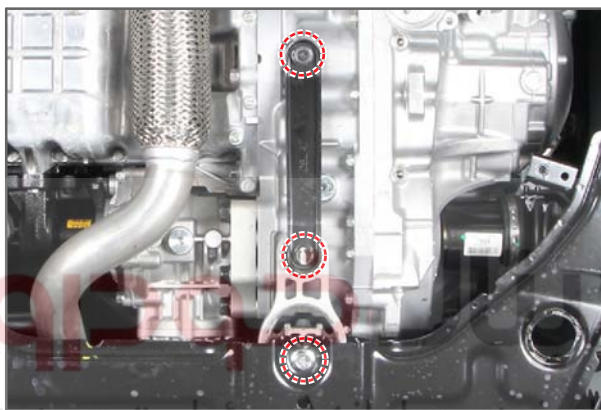


5



5. Raise the vehicle with a lift.

### Preceding works for vehicles with diesel engine



Unscrew the 3 mounting bolts (17 mm) to remove the rear engine mounting insulator.

**Tightening torque** 68.6 ~ 88.2 Nm



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.
- Check the oil level with the rear engine mount fitted.

7



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

### 💡 NOTE

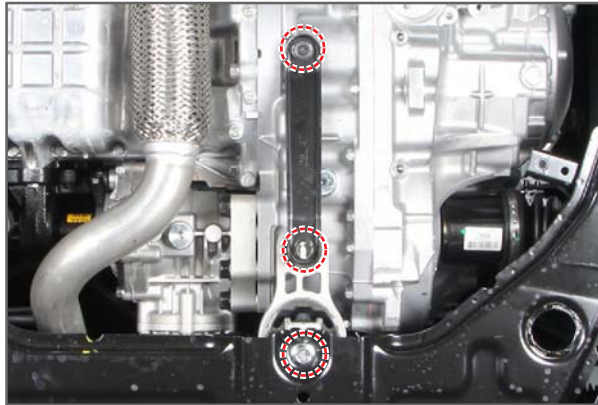
If the ATF flows out of the drain plug (overflow tube) with the overflow tube removed, it is not necessary to add up the fluid.



### ► Topping up ATF

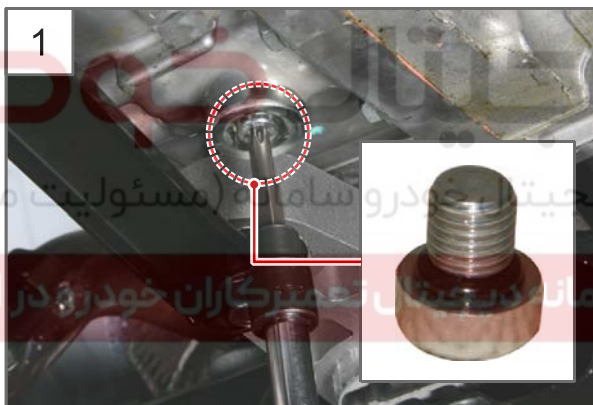
**reference** Top up the ATF when checking for oil leakage and replacing the automatic transmission assembly.

#### Preceding works for vehicles with diesel engine



Unscrew the 3 mounting bolts (17 mm) to remove the rear engine mounting insulator.

**Tightening torque** 68.6 ~ 88.2 Nm



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

**Tightening torque** 5.9 ~ 8.8Nm

#### ⚠ 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.



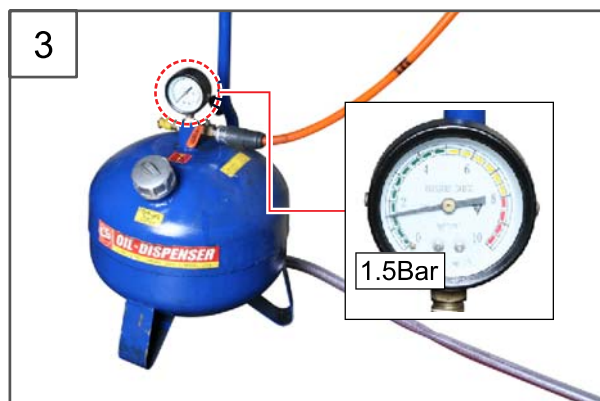
2. Screw on the AISIN 6 A/T housing bottom oil filler adapter (X9936 0080A) to the oil overflow plug hole.

#### ⓘ 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.

Modification basis	
Application basis	
Affected VIN	





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. Add the ATF using a A/T fluid filler tool.

### 💡 NOTE

- If the oil must be filled, fill the oil about 0.5 l 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.



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. 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.
- Check if the engine rpm is 650 rpm  $\pm$  10 rpm.
- Check the oil level with the rear engine mount fitted.
- 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.

**9210-02 OIL CHANGE****NOTE**

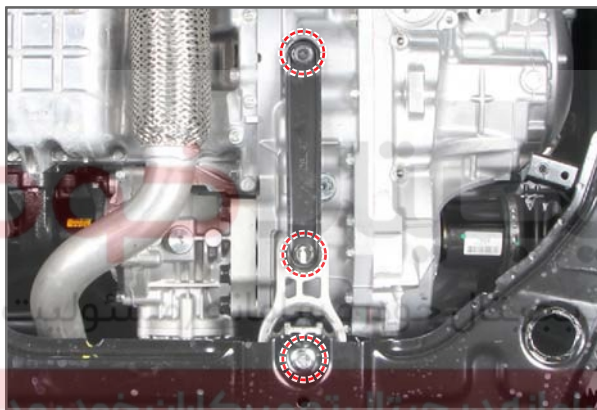
Check & replacement interval: Check-free, change-free

(However, check and change at every 100,000 km of driving under demanding conditions)

<b>Oil capacity</b>	G16DF : Approx. 6.1 L / D16DTF : Approx 7.0 L (initial fill quantity)
<b>Oil specification</b>	AW-1

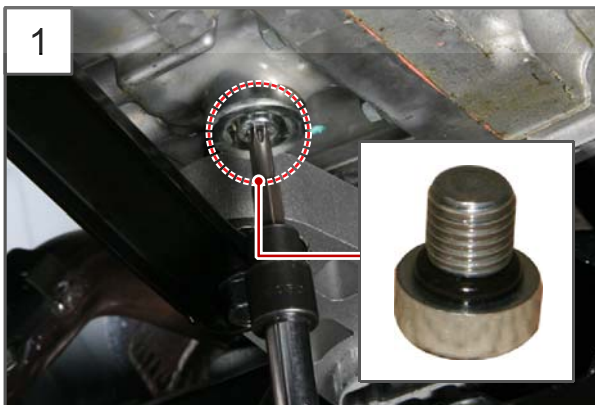
**CAUTION**

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

**Preceding works for vehicles with diesel engine**

Unscrew the 3 mounting bolts (17 mm) to remove the rear engine mounting insulator.

**Tightening torque** 68.6 ~ 88.2 Nm



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.

Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

TIVOLI 2015.06





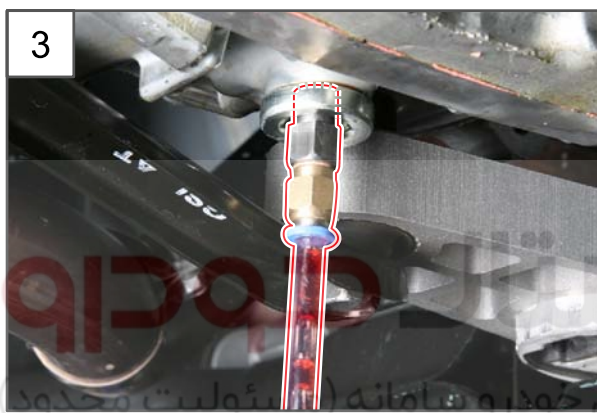
2. Remove the oil drain plug (hexagon-17 mm) and drain the oil completely.  
(When oil drainage is completed, screw on the drain plug only.)

**Tightening torque 34 to 60 Nm**

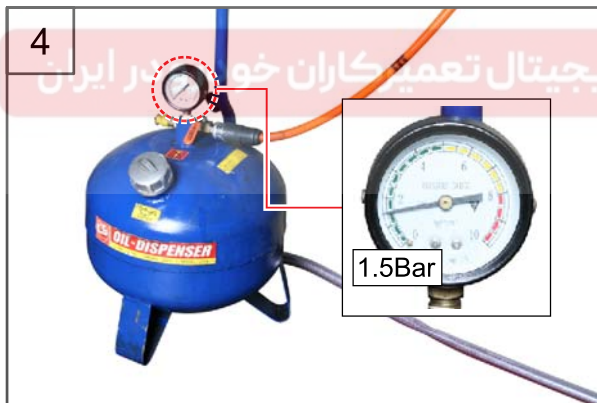


#### NOTE

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



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



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. Add the ATF using a A/T fluid filler tool.



#### 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. 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. 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.
- Check if the engine rpm is 650 rpm  $\pm$  10 rpm.
- Check the oil level with the rear engine mount fitted.
- 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	



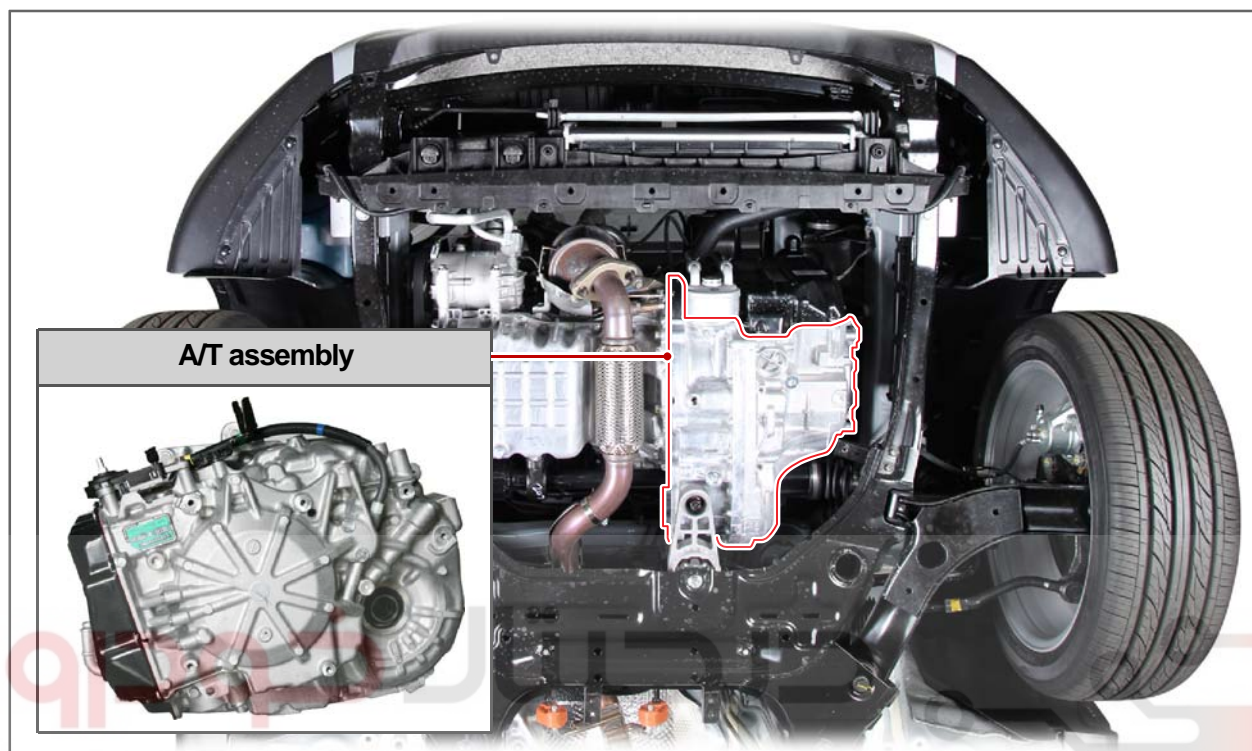
S.G.N.

3690-01

**AUTOMATIC TRANSMISSION ASSEMBLY (G16DF)**

Preceding work

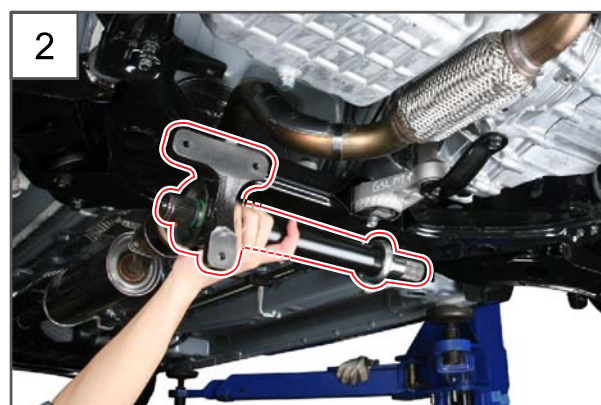
- Disconnect the negative battery cable.



1. Remove the front drive shafts (LH/RH).

**NOTE**

See "FRONT DRIVE SHAFT" in "REMOVAL AND INSTALLATION" under "DRIVE SHAFT AND AXLE SYSTEM".



2. Remove the intermediate shaft.

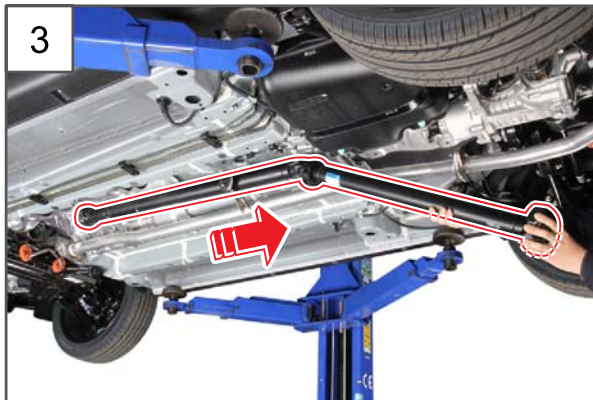
**NOTE**

See "FRONT DRIVE SHAFT" in "REMOVAL AND INSTALLATION" under "DRIVE SHAFT AND AXLE SYSTEM".

Modification basis	
Application basis	
Affected VIN	



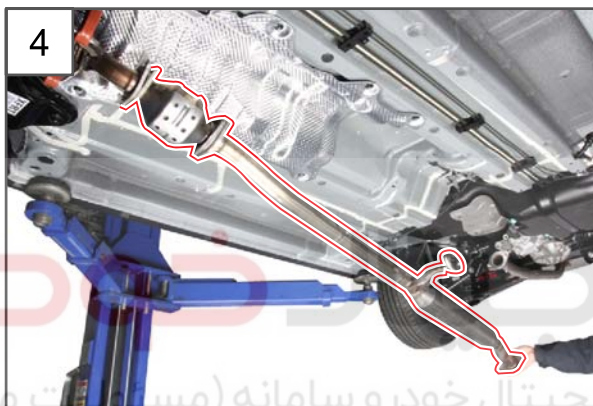
## ► Additional work in AWD vehicle



3. Remove the propeller shaft.

**NOTE**

Refer to "PROPELLER SHAFT" under "REMOVAL AND INSTALLATION" in "PROPELLER SHAFT SYSTEM".

**NOTE**

Refer to "CENTER EXHAUST PIPE" under "REMOVAL AND INSTALLATION" subsection of "EXHAUST SYSTEM" section in "G16DF ENGINE" chapter.

**CAUTION**

Perform the work after the pipe cools down in order to getting burn.



5. Remove the front exhaust pipe.

**NOTE**

Refer to "FRONT EXHAUST PIPE" under "REMOVAL AND INSTALLATION" subsection of "EXHAUST SYSTEM" section in "G16DF ENGINE" chapter.

**CAUTION**

Perform the work after the pipe cools down in order to getting burn.



6. Remove the PTU assembly.

**NOTE**

See "PTU ASSEMBLY" under "REMOVAL AND INSTALLATION" subsection of "AWD SYSTEM" in "CHASSIS" chapter

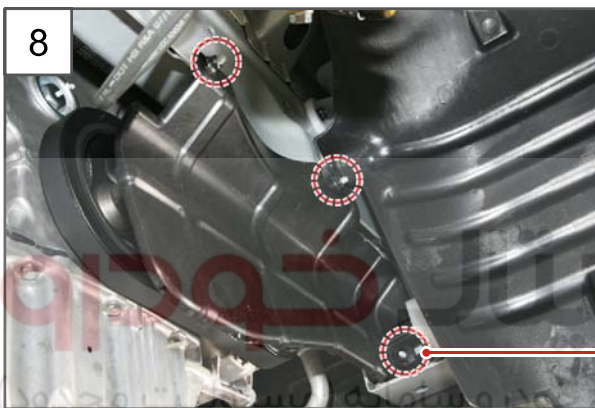
Modification basis	
Application basis	
Affected VIN	



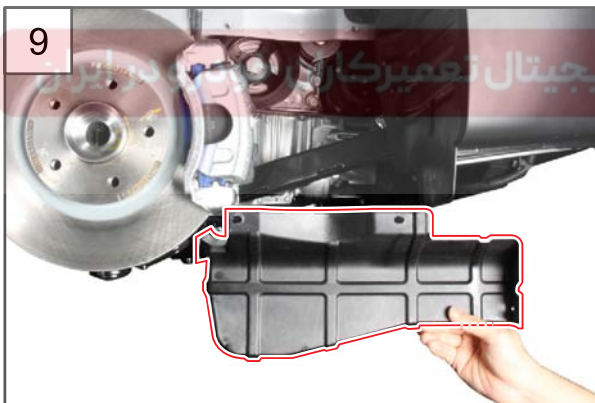
► Common works for both 2WD and AWD vehicles



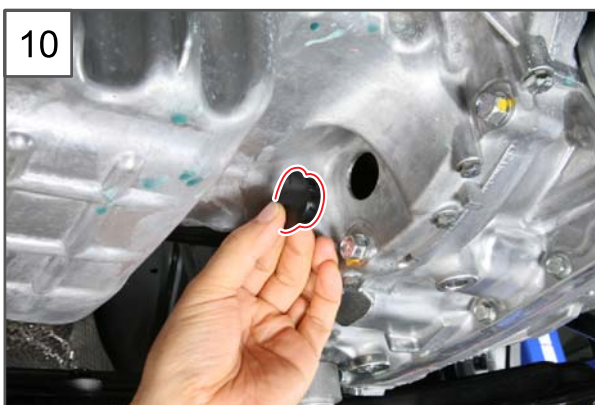
7. Drain the coolant.



8. Unscrew the 2 RH side cover mounting bolts (10 mm) and plastic nut (12 mm).



9. Remove the RH side cover.



10. Remove the torque converter service hole cover.





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

**Tightening torque** 44 ~ 51Nm



12. Undo the oil cooler hose clamp and remove the hose.

**CAUTION**

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



13. Unscrew the 3 A/T lower mounting bolts (14 mm).

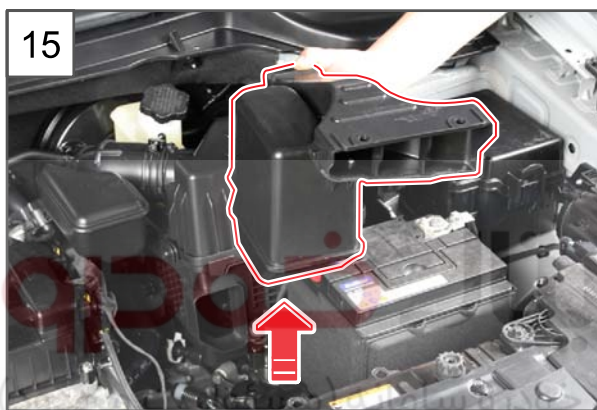
**Tightening torque** 56 ~ 62 Nm

Modification basis	
Application basis	
Affected VIN	

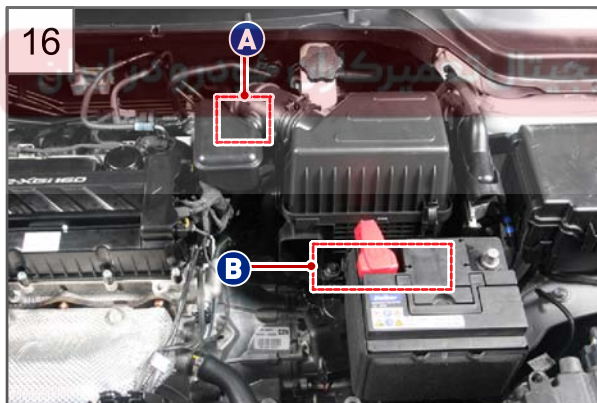




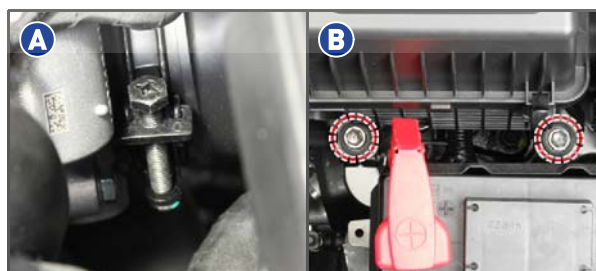
14. Remove the snorkel assembly retaining pins from upper portion of the vehicle.



15. Remove the snorkel assembly.



16. Unscrew the intake hose clamp bolt (A, 10 mm) and the 2 mounting bolts (B, 12 mm) for the air cleaner housing.



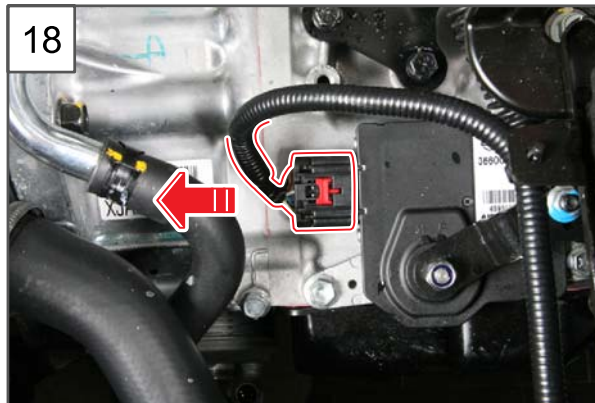
17. Remove the air cleaner assembly.

### **CAUTION**

Cover the throttle body inlet with a cap or cloth so that foreign objects do not enter the throttle body.

Modification basis	
Application basis	
Affected VIN	



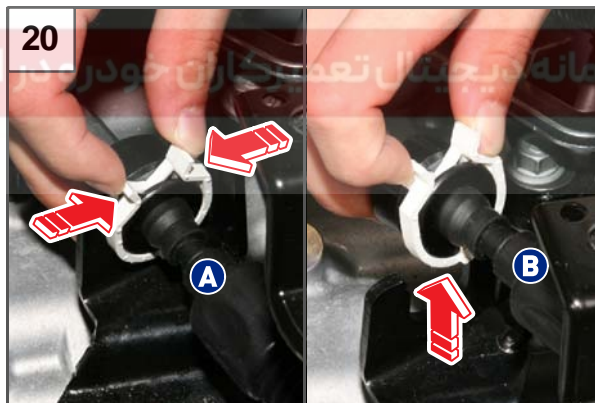


18. Disconnect the TCU wiring connector.



19. Unscrew the shift cable mounting nut (12 mm) from the manual lever.

**Tightening torque** 15.6 ~ 19.6 Nm

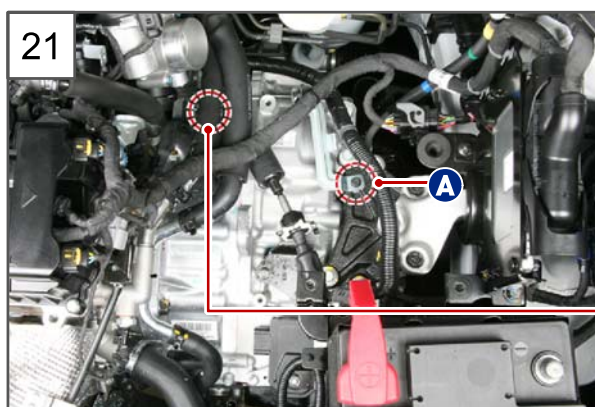


20. Release the retaining clip from the bracket and remove the cable.



#### NOTE

The cable can be disconnected easily from the mounting bracket by pulling the cable with the clip on the cable is pressed.



21. Unscrew the mounting bolt (A, 10 mm) and mounting bolt (B, 10 mm) on the wiring bracket.

**Tightening torque** 5.8 ~ 14.7Nm

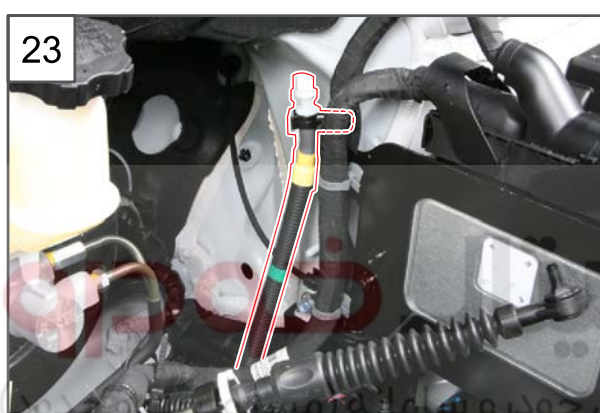


Modification basis	
Application basis	
Affected VIN	





22. Arrange and fix the wirings and cables to facilitate the work when removing the A/T assembly.



23. Disconnect the breather hose.

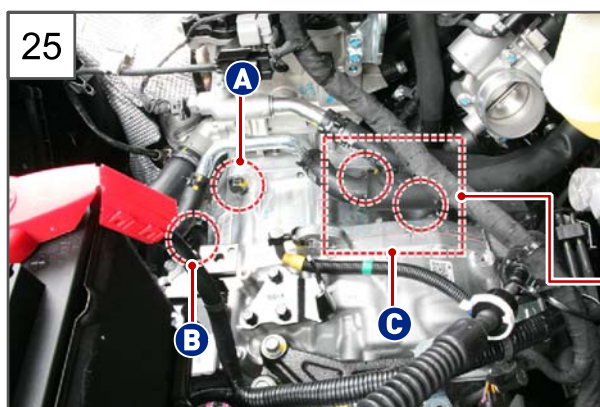
**CAUTION**

Connect the breather hose at the same position in which it was removed.



24. Unscrew the A/T ground wiring mounting bolt (10 mm).

**Tightening torque** 13.7 ~ 19.6Nm

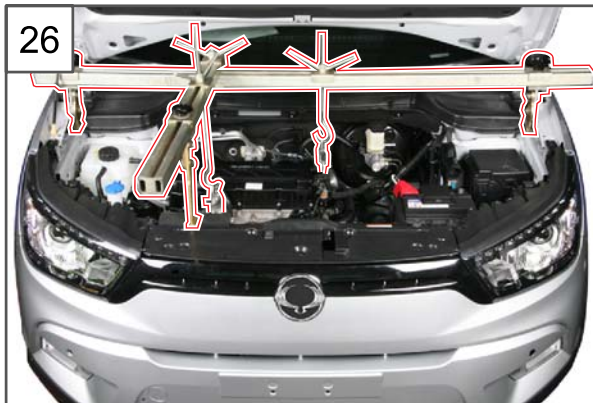


25. Unscrew the 2 upper mounting bolts (A, 17 mm) and mounting bolts (B and C, 14 mm, each) for the automatic transmission.

**Tightening torque** (A) 85 ~ 100 Nm  
(B) 43.2 ~ 64.8 Nm  
(C) 48 ~ 58 Nm





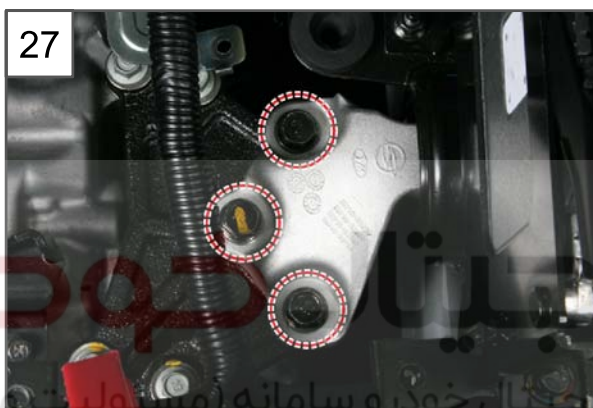


26. Install the engine support hanger.



#### NOTE

Refer to "INSTALLING THE ENGINE SUPPORT HANGER" under "SPECIAL SERVICE TOOLS" subsection of "ENGINE GENERAL" section in "G16DF ENGINE" chapter.



27. Unscrew the 3 A/T mount mounting bolts (17 mm).

**Tightening torque** 85~ 100Nm



#### NOTE

When unscrewing the engine mount mounting bolt, use the hanger to adjust it horizontally. Be careful not to damage the bolt when removing it.



28. Unscrew the 4 A/T mount bracket mounting bolts (17 mm).

**Tightening torque** 75 ~ 85Nm



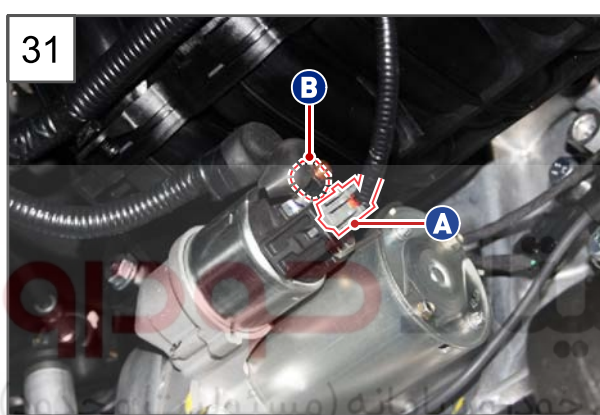
29. Remove the automatic transmission mount bracket.

Modification basis	
Application basis	
Affected VIN	





30. Place the transmission jack under the automatic transmission.



31. Remove the ST terminal connector (A) from the starting motor and unscrew the B+ terminal mounting nut (B, 12 mm).

**Tightening torque**  $15 \pm 1.5\text{Nm}$



32. Unscrew the starting motor lower mounting bolt (14 mm).



33. Remove the starting motor.

**Tightening torque**  $48 \sim 58\text{Nm}$





34. Unscrew the automatic transmission mounting bolt (14mm).

**Tightening torque** 56 ~ 62Nm



35. Lower the jack slowly to remove the automatic transmission assembly from the vehicle.

### CAUTION

Lower the transmission jack slowly while paying attention to interference.



36. Install in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	



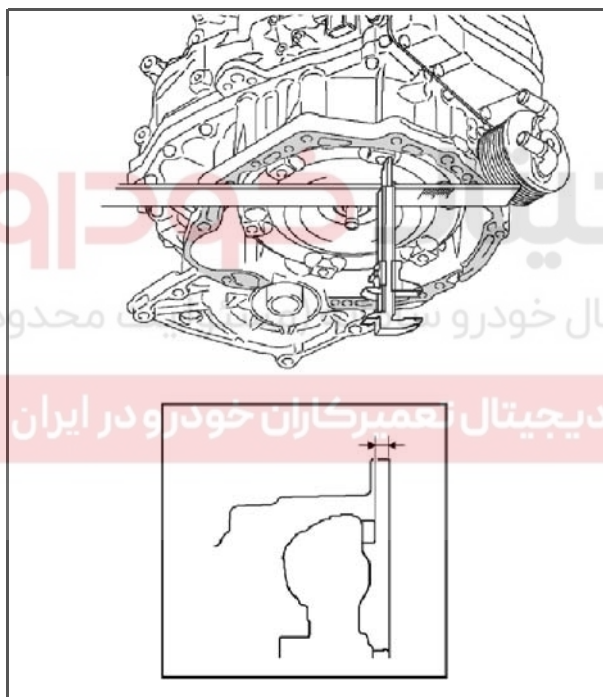
### Cautions for fitting automatic transmission



Place the fixing part at direction of 6 o'clock in order to make it easier to fit the torque converter mounting bolt.

#### **CAUTION**

- Take care not to drop the bolt into the A/T housing when tightening them.
- Ensure that no dirt gets into the housing when fitting.



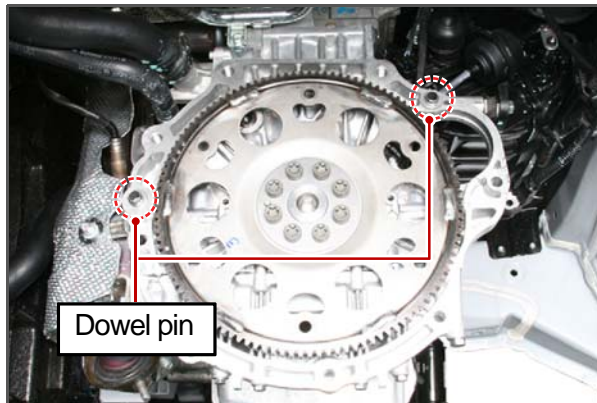
Measure the distance from the housing end to torque converter as shown in the figure, and check if the torque converter is fitted correctly.

Item	Specification
Distance between A/T housing and torque converter	12.15 mm or longer



### Cautions for fitting automatic transmission

#### ► Mounting location of dowel pin

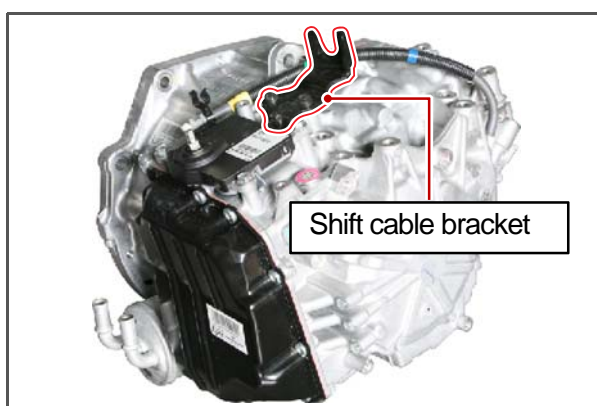
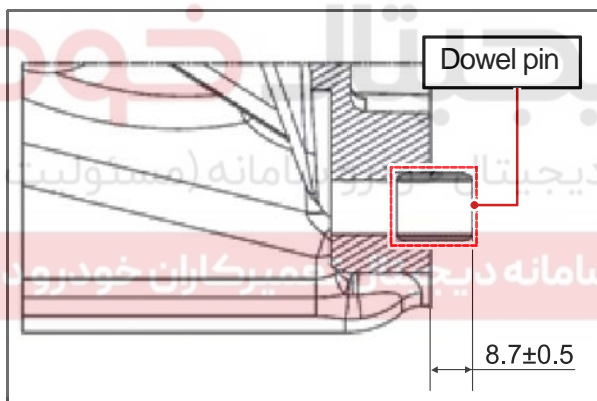


Check how the dowel pin is located to the engine block before fitting the automatic transmission.

#### **CAUTION**

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

#### ► Dowel pin fitted



When replacing the automatic transmission, remove the shift cable bracket and fit it to the new automatic transmission.

**Tightening torque** 17.6 ~ 21.6 Nm

Modification basis	
Application basis	
Affected VIN	



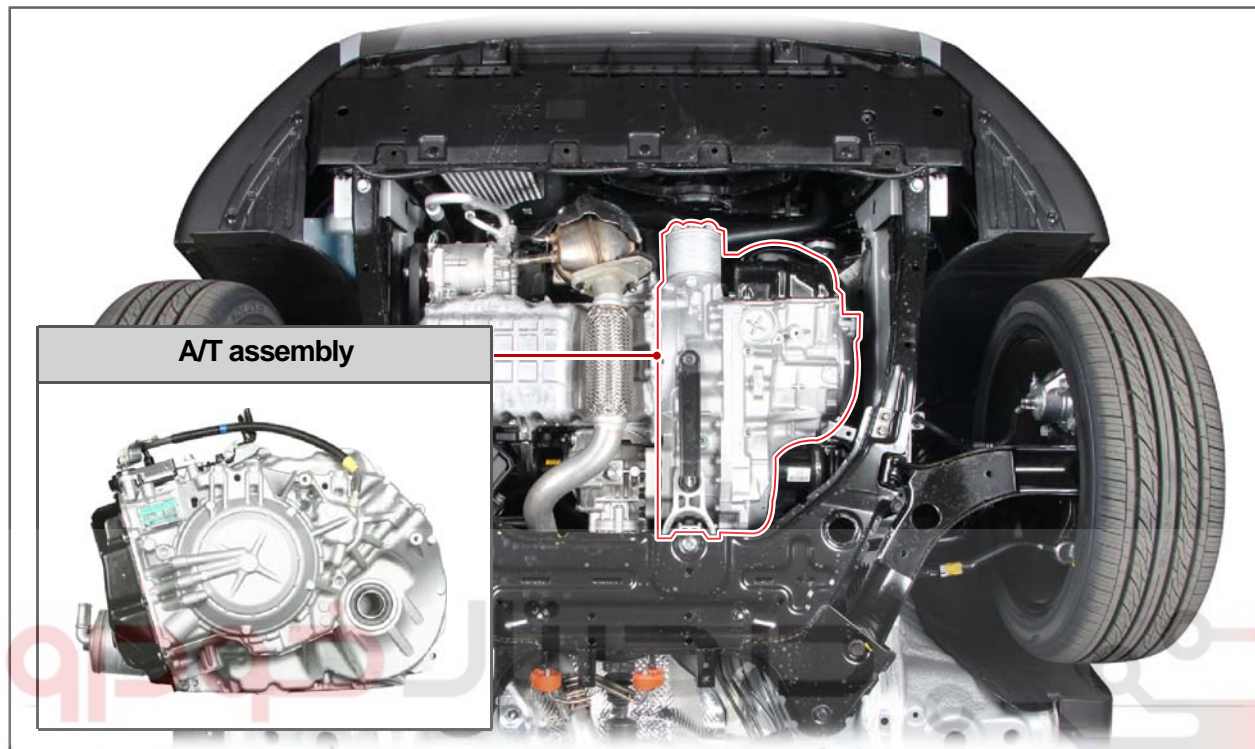
S.G.N.

3690-01

**AUTOMATIC TRANSMISSION ASSEMBLY(D16DTF)**

Preceding work

- Disconnect the negative cable from the battery.



1. Remove the front drive shafts (LH/RH).

**NOTE**

See "FRONT DRIVE SHAFT" in  
"REMOVAL AND INSTALLATION" under  
"DRIVE SHAFT AND AXLE SYSTEM".



2. Remove the intermediate shaft.

**NOTE**

See "FRONT DRIVE SHAFT" in  
"REMOVAL AND INSTALLATION" under  
"DRIVE SHAFT AND AXLE SYSTEM".

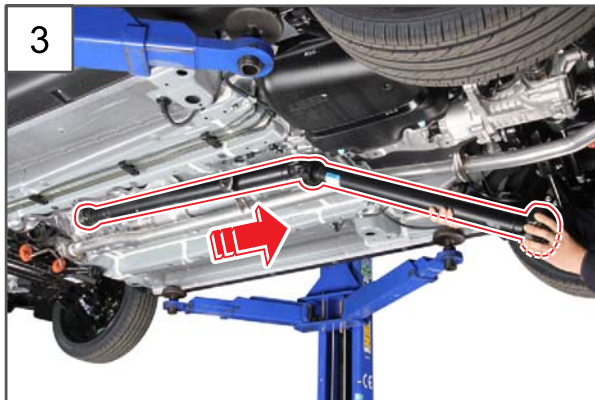
**CAUTION**

The 2WD vehicle does not have the  
intermediate shaft.

Modification basis	
Application basis	
Affected VIN	



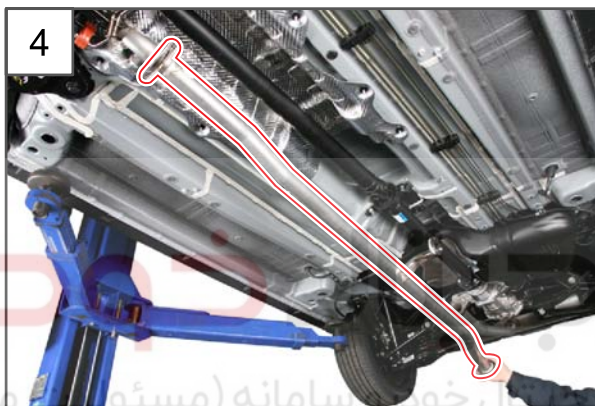
## ► Additional work in AWD vehicle



3. Remove the propeller shaft.

**NOTE**

Refer to "PROPELLER SHAFT" under "REMOVAL AND INSTALLATION" in "PROPELLER SHAFT SYSTEM".



4. Remove the center exhaust pipe from the vehicle.

**NOTE**

Refer to "CENTER EXHAUST PIPE" under "REMOVAL AND INSTALLATION" subsection of "EXHAUST SYSTEM" section in "G16DF ENGINE" chapter.

**CAUTION**

Perform the work after the pipe cools down in order to getting burn.



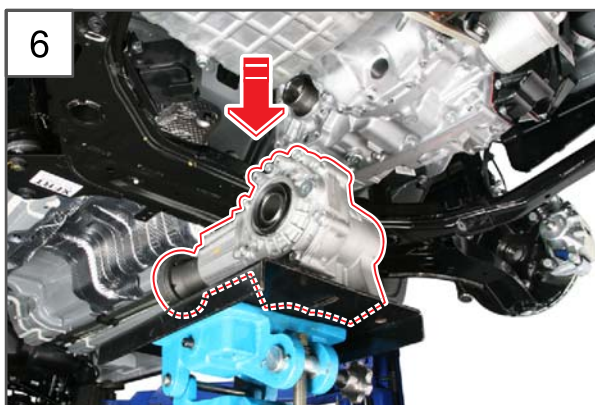
5. Remove the front exhaust pipe.

**NOTE**

Refer to "FRONT EXHAUST PIPE" under "REMOVAL AND INSTALLATION" subsection of "EXHAUST SYSTEM" section in "G16DF ENGINE" chapter.

**CAUTION**

Perform the work after the pipe cools down in order to getting burn.



6. Remove the PTU assembly.

**NOTE**

See "PTU ASSEMBLY" under "REMOVAL AND INSTALLATION" subsection of "AWD SYSTEM" in "CHASSIS" chapter

Modification basis	
Application basis	
Affected VIN	



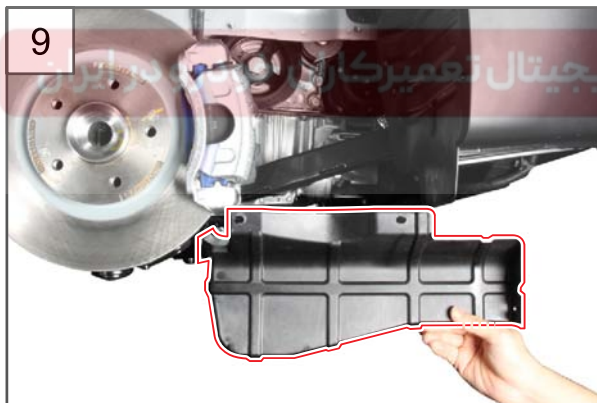
► Common works for both 2WD and AWD vehicles



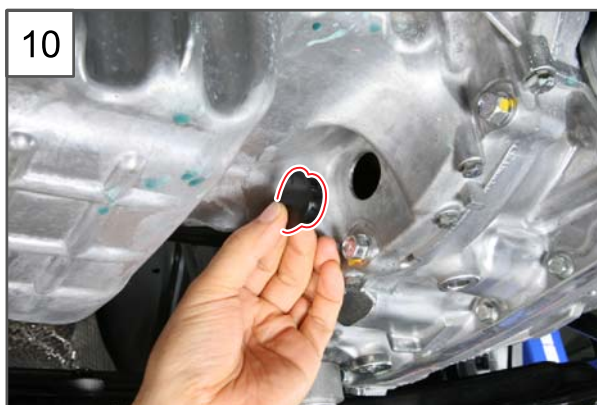
7. Drain the coolant.



8. Unscrew the 2 RH side cover mounting bolts (10 mm) and plastic nut (12 mm).



9. Remove the RH side cover.



10. Remove the torque converter service hole cover.





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

**Tightening torque** 44 ~ 51Nm



12. Undo the oil cooler hose clamp and remove the hose.

#### **CAUTION**

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



13. Unscrew the 3 A/T lower mounting bolts (14 mm).

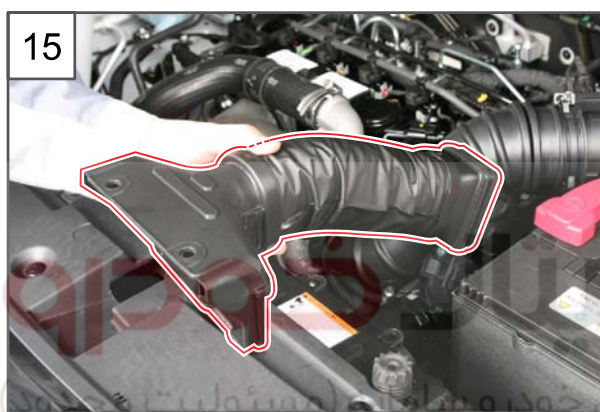
**Tightening torque** 56 ~ 62Nm

Modification basis	
Application basis	
Affected VIN	

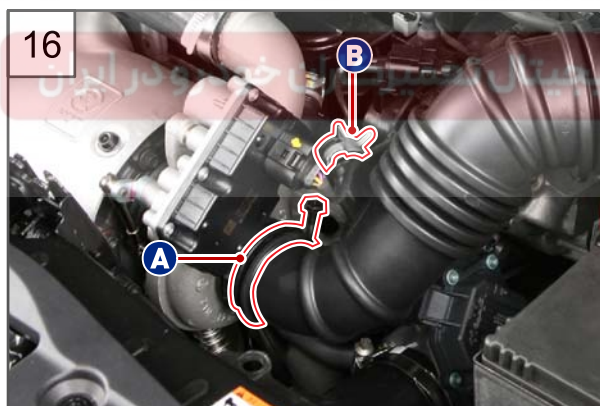




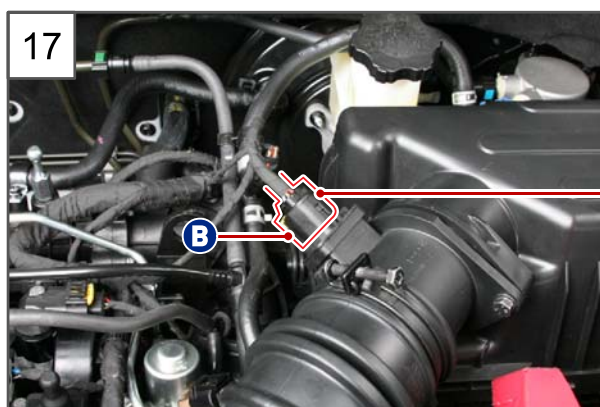
14.Remove the 2 screw rivets securing the snorkel assembly.



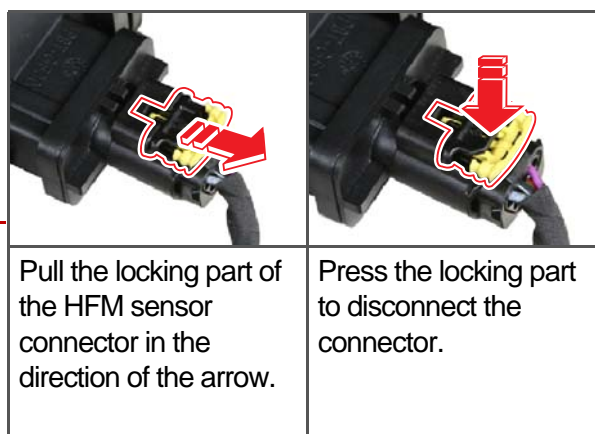
15.Remove the snorkel assembly.



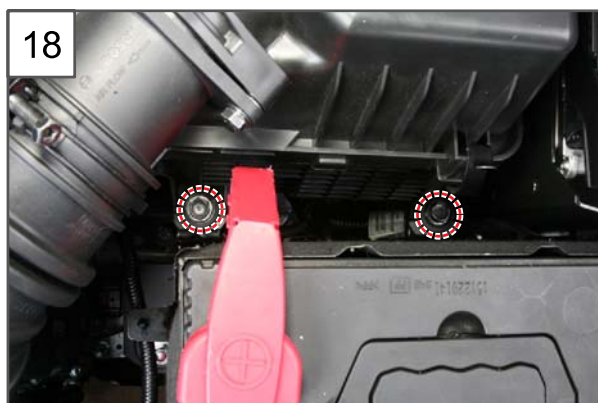
16.Remove the retaining clamp (A) for the hose between the air cleaner and turbocharger and the oil separator hose clamp (B).



17.Disconnect the HFM sensor connector.







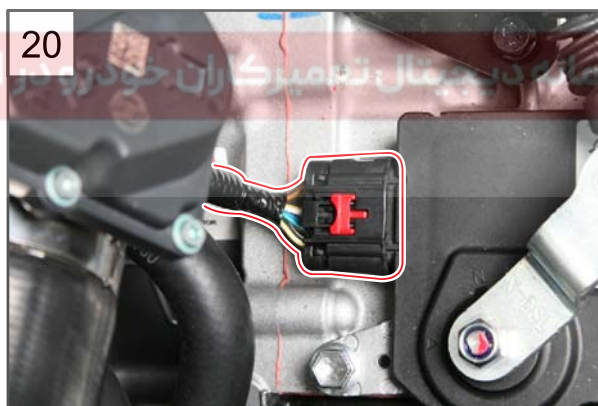
18. Unscrew 2 mounting bolts (12 mm) for the air cleaner housing.



19. Remove the air cleaner housing assembly together with the hose between the air cleaner and turbocharger.

#### CAUTION

Cover the turbocharger inlet with a cap or cloth so that any foreign material does not enter the turbocharger after disconnecting the hose.



20. Disconnect the TCU wiring connector.

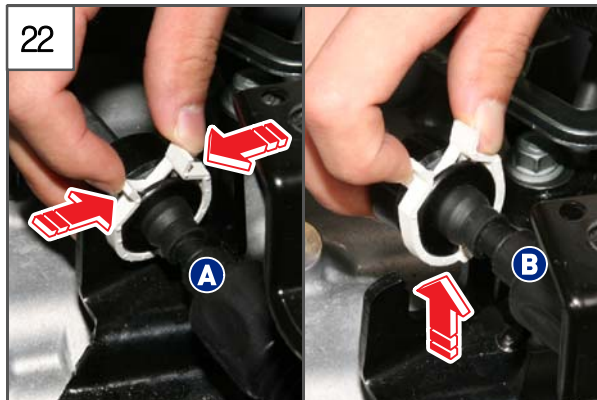


21. Unscrew the shift cable mounting nut (12 mm) from the manual lever.

**Tightening torque** 15.6 ~ 19.6Nm

Modification basis	
Application basis	
Affected VIN	



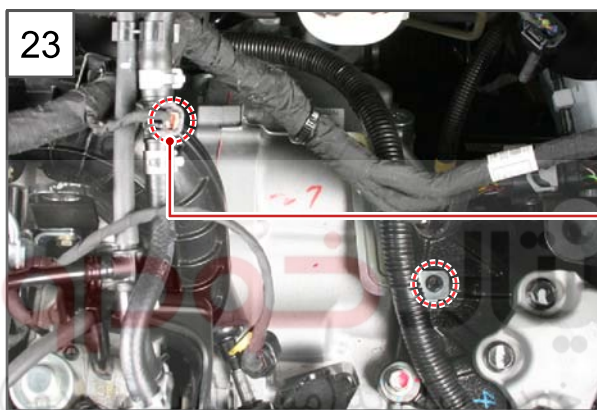


22. Release the retaining clip from the bracket and remove the cable.



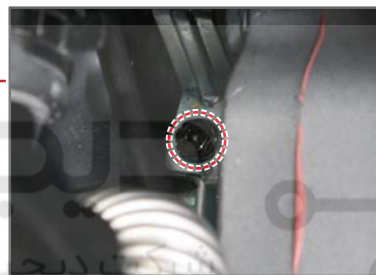
#### NOTE

The cable can be disconnected easily from the mounting bracket by pulling the cable with the clip on the cable is pressed.

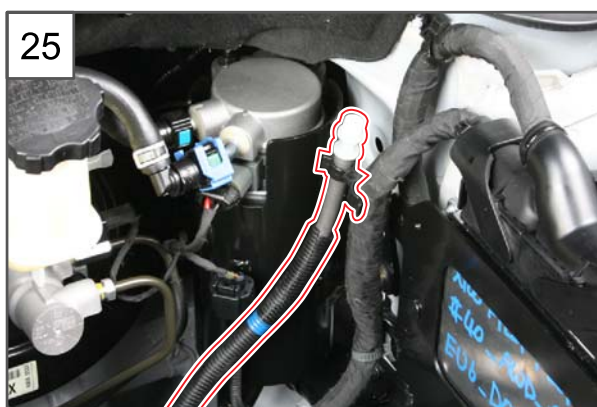


23. Unscrew the 2 wiring mounting bolts (10 mm)

**Tightening torque** 15.6 ~ 19.6Nm



24. Arrange and fix the wirings and cables to facilitate the work when removing the A/T assembly.



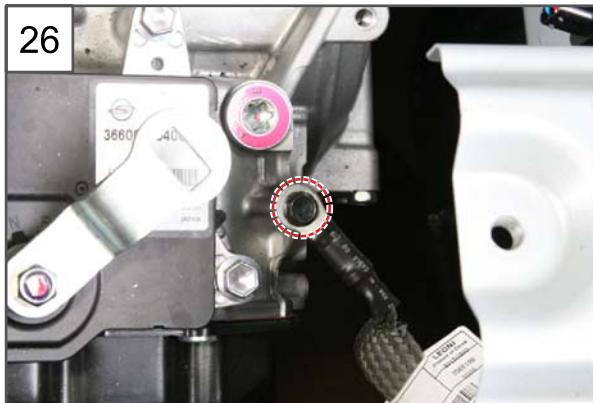
25. Separate the breather hose.



#### CAUTION

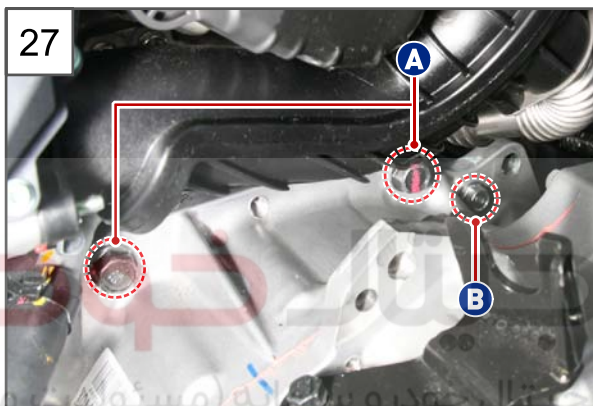
Connect the breather hose at the same position in which it was removed.





26. Unscrew the A/T ground wiring mounting bolt (10 mm).

**Tightening torque** 13.7 ~ 19.6Nm

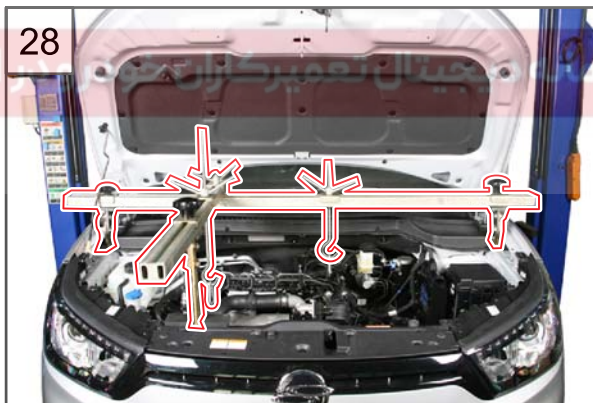


27. Unscrew the 2 upper A/T mounting bolts (A, 17 mm) and the starting motor upper mounting bolt (B, 14 mm).

**Tightening torque** (A) 85 ~ 100Nm  
(B) 48 ~ 58Nm

#### NOTE

It is easy to unscrew the starting motor upper mounting bolt (B) under the vehicle.



28. Install the engine support hanger.

#### NOTE

Refer to "INSTALLING THE ENGINE SUPPORT HANGER" under "SPECIAL SERVICE TOOLS" subsection of "ENGINE GENERAL" section in "G16DF ENGINE" chapter.



29. Unscrew the 3 A/T mount mounting bolts (17 mm).

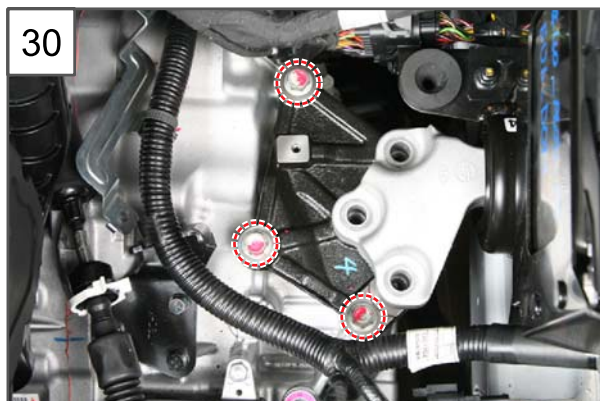
**Tightening torque** 85 ~ 100Nm

#### NOTE

When unscrewing the engine mount mounting bolt, use the hanger to adjust it horizontally. Be careful not to damage the bolt when removing it.

Modification basis	
Application basis	
Affected VIN	





30. Unscrew the 3 A/T mount bracket mounting bolts (14 mm).

**Tightening torque** TBD Nm



31. Remove the automatic transmission mount bracket.



32. Unscrew 3 bracket mounting bolts No. 4 (12 mm) to the CDPF engine.

**Tightening torque** TBD Nm

#### **CAUTION**

Please note that the black bolt is to be fitted to the engine side.



33. Remove the bracket No. 4 to the engine with CDPF.





34. Unscrew 2 bracket mounting bolts No. 3 (12 mm) to the CDPF engine.

**Tightening torque** TBD Nm

### CAUTION

Please note that the black bolt is to be fitted to the engine side.

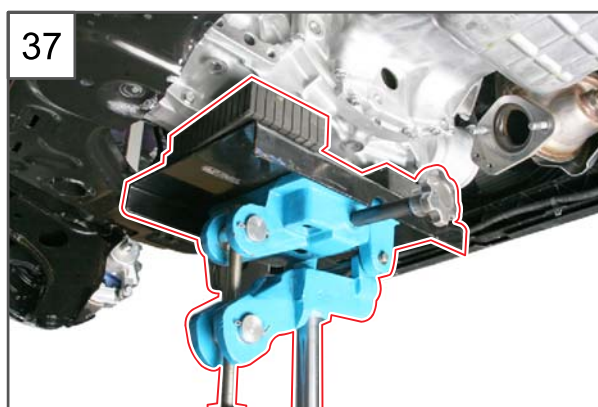


35. Remove the bracket No. 3 to the engine with CDPF.



36. Unscrew the mounting bolt (14 mm) on the bottom of the A/T.

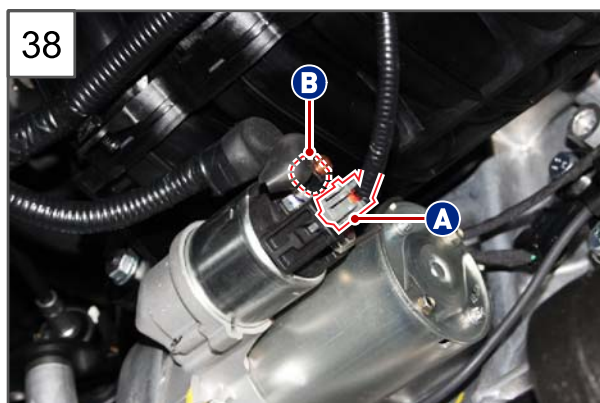
**Tightening torque** TBD Nm



37. Place the transmission jack under the automatic transmission.

Modification basis	
Application basis	
Affected VIN	





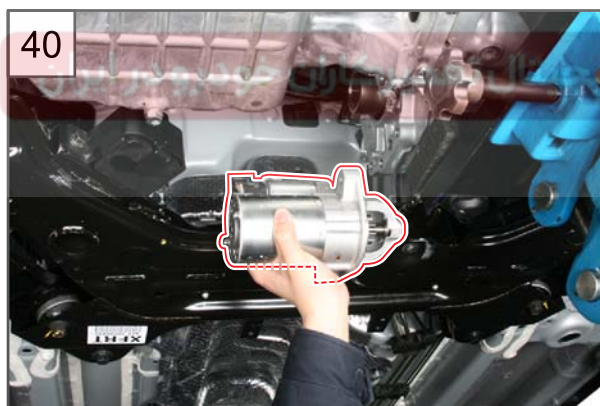
38.Remove the ST terminal connector (A) from the starting motor and unscrew the B+ terminal mounting nut (B, 12 mm).

**Tightening torque**  $15 \pm 1.5\text{Nm}$



39.Unscrew the starting motor lower mounting bolt (14 mm).

**Tightening torque**  $48 \sim 58\text{Nm}$



40.Remove the start motor.



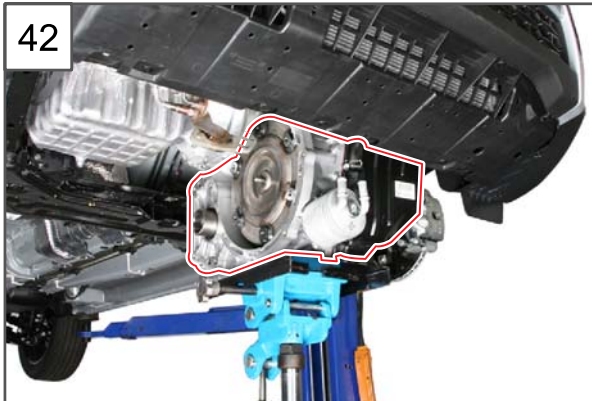
41.Unscrew the upper A/T mounting bolt (14mm).

**Tightening torque**  $48 \pm 58\text{Nm}$





42



42. Lower the jack slowly to remove the automatic transmission assembly from the vehicle.

**CAUTION**

Lower the transmission jack slowly while paying attention to interference.

43



43. Install in the reverse order of removal.

دیجیتال خودرو سامانه (مسئولیت محدود)  
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

TIVOLI 2015.06



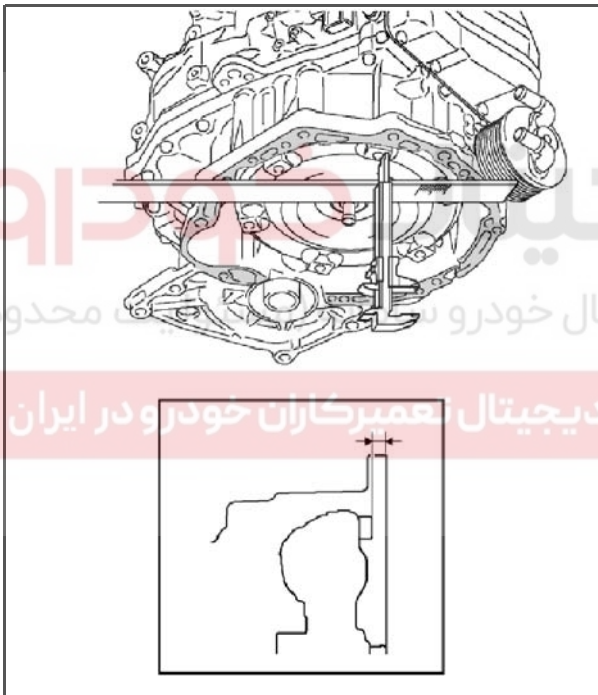
### Cautions for fitting automatic transmission



Place the fixing part at direction of 6 o'clock in order to make it easier to fit the torque converter mounting bolt.

#### **CAUTION**

- Take care not to drop the bolt into the A/T housing when tightening them.
- Ensure that no dirt gets into the housing when fitting.



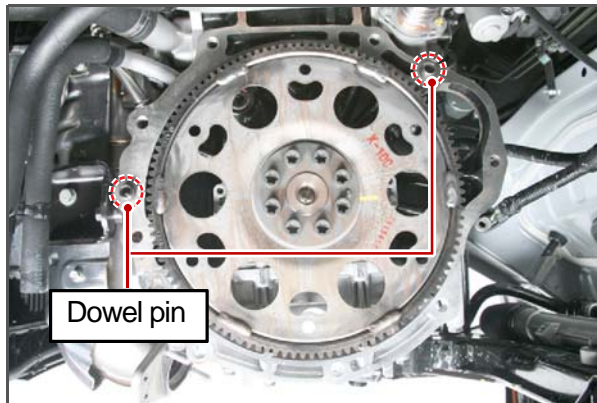
Measure the distance from the housing end to torque converter as shown in the figure, and check if the torque converter is fitted correctly.

Item	Specification
Distance between A/T housing and torque converter	12.15 mm or longer



### Cautions for fitting automatic transmission

#### ► Mounting location of dowel pin

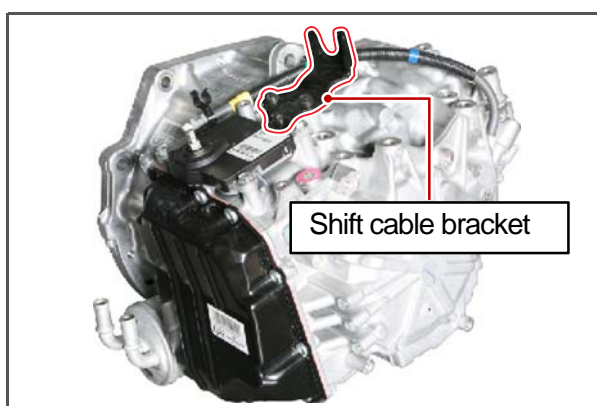
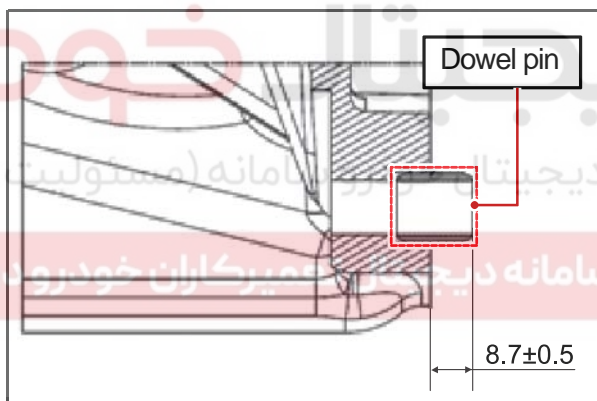


Check how the dowel pin is located to the engine block before fitting the automatic transmission.

#### **CAUTION**

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

#### ► Dowel pin fitted



When replacing the automatic transmission, remove the shift cable bracket and fit it to the new automatic transmission.

**Tightening torque** 17.6 ~ 21.6 Nm

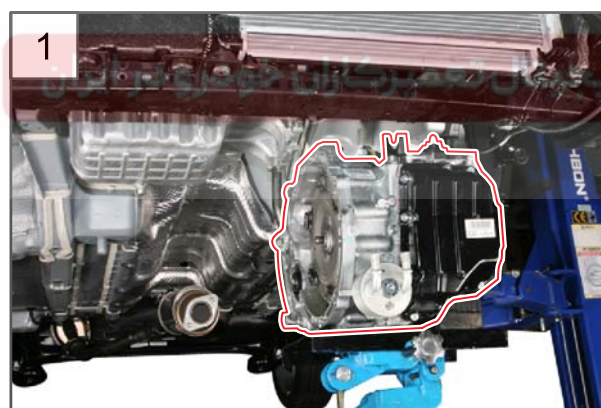
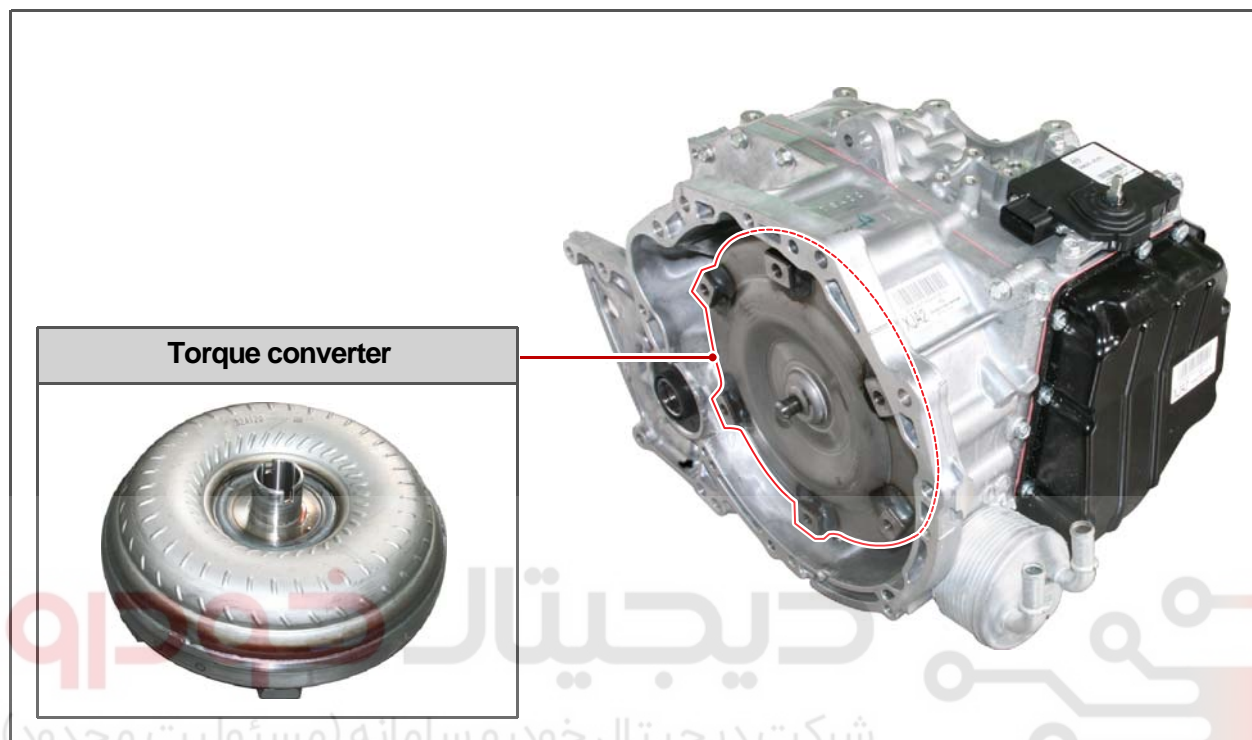
Modification basis	
Application basis	
Affected VIN	



S.G.N.

**3691-22 TORQUE CONVERTER****Preceding work**

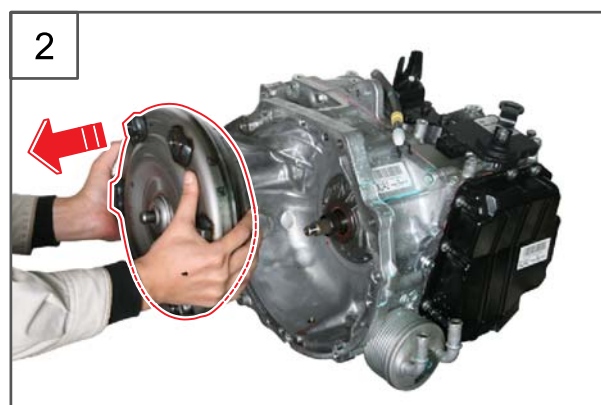
- Drain the ATF.
- Disconnect the automatic transmission assembly.



1. Disconnect the automatic transmission assembly.

**NOTE**

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



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	

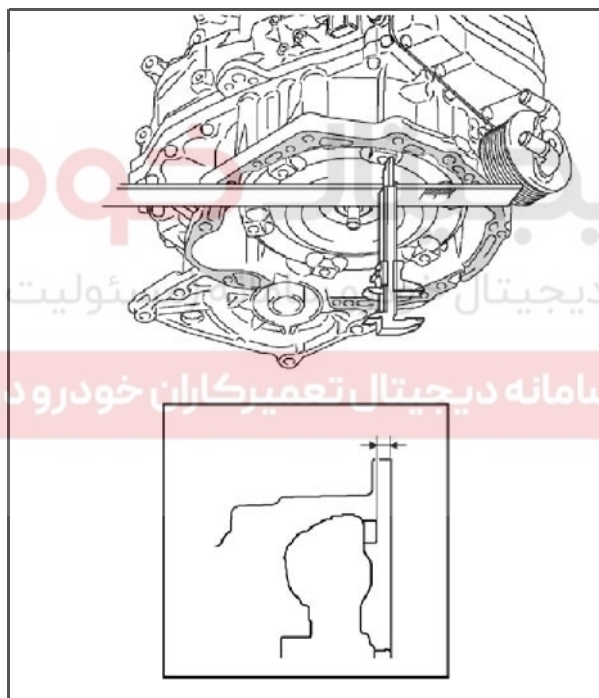


3



3. Install in the reverse order of removal.

#### Cautions for fitting torque converter



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	12.15 mm or longer

Modification basis	
Application basis	
Affected VIN	

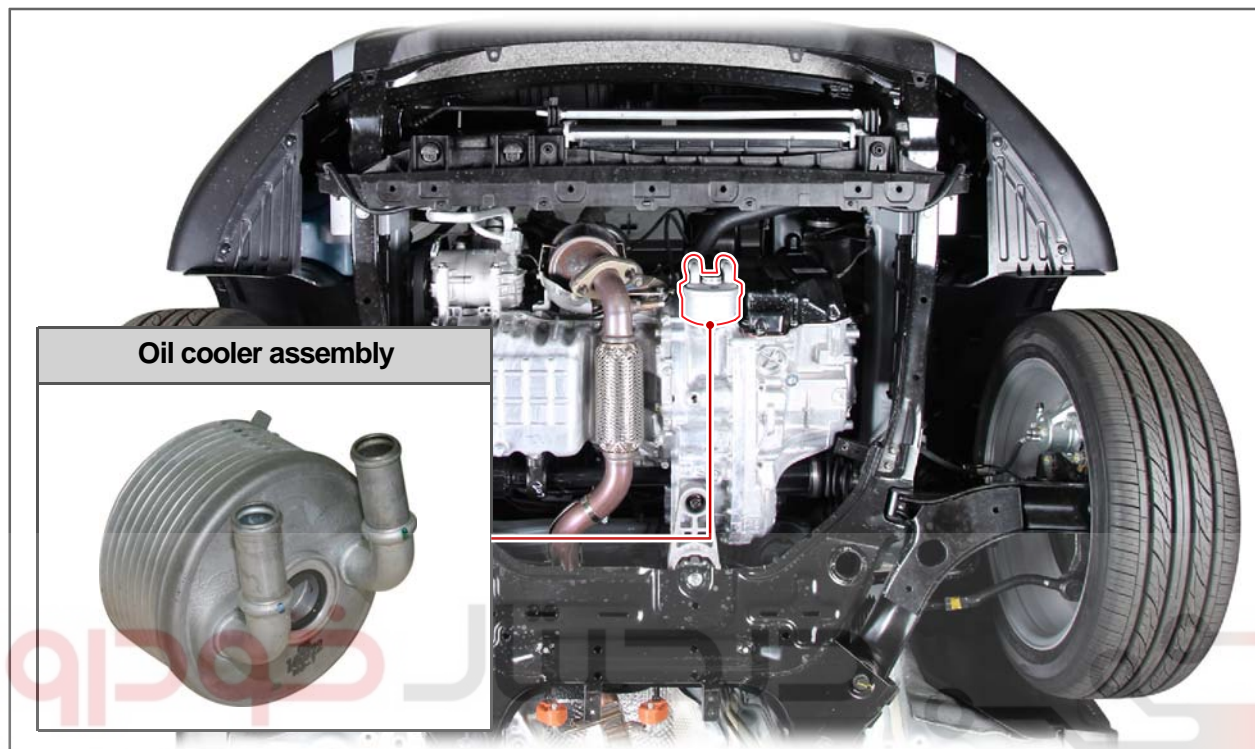
AISIN 6 SPEED AUTO TRANSAXLE

TIVOLI 2015.06



## 3691-28 OIL COOLER ASSEMBLY

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



1. Remove the overflow plug (T40) and drain plug (17 mm) using a hexagon wrench to drain the A/T fluid.

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



2. Drain the coolant.





3. Undo the oil cooler hose clamp and remove the hose.

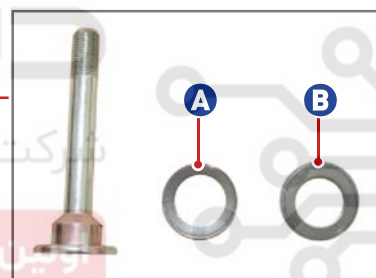
### CAUTION

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

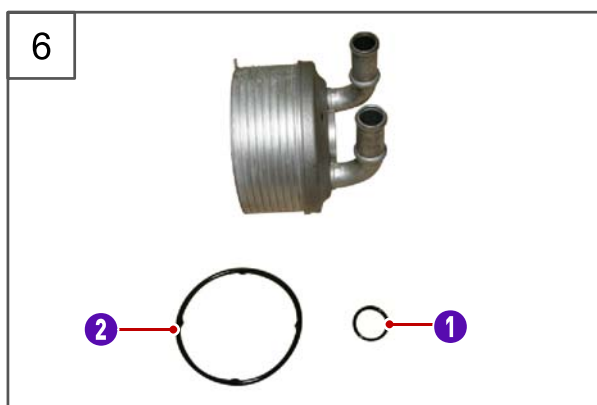


4. Unscrew the oil cooler assembly mounting bolt (hexagon wrench-10 mm) and remove the mounting bolt, conical spring washer (A) and plate washer (B).

**Tightening torque** 33.3 ~ 39.2Nm



5. Remove the oil cooler assembly.



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

### NOTE

Do not reuse the removed O-ring.

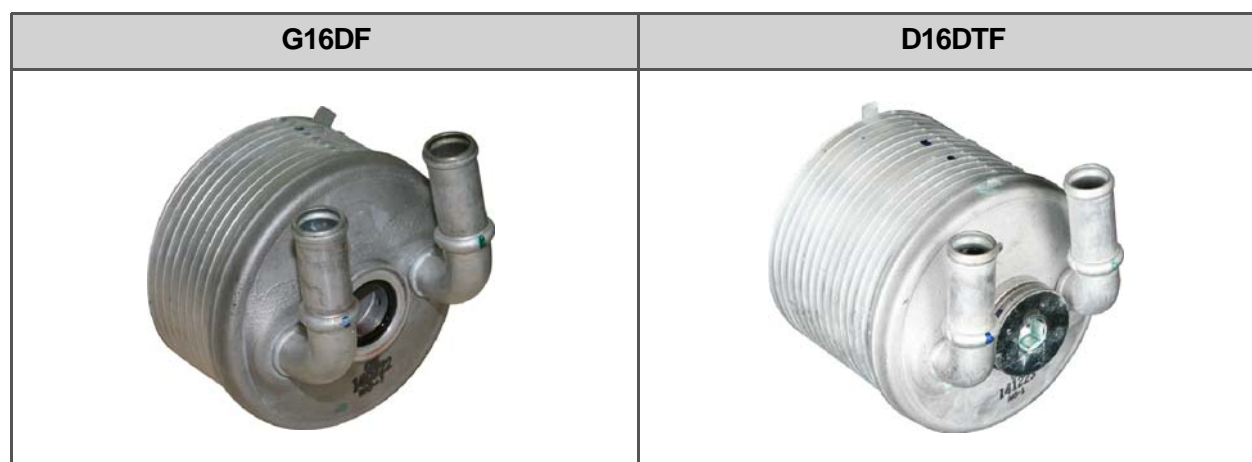
### O-ring size

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

Modification basis	
Application basis	
Affected VIN	



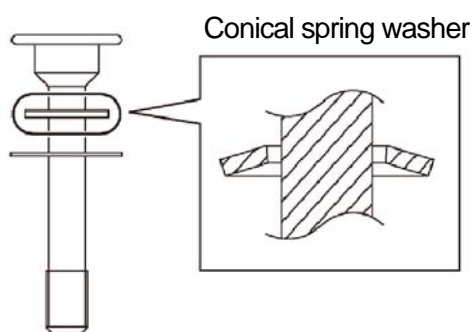
7. Install in the reverse order of removal.



#### 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.



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

**Tightening torque** 33.3 ~ 39.2Nm



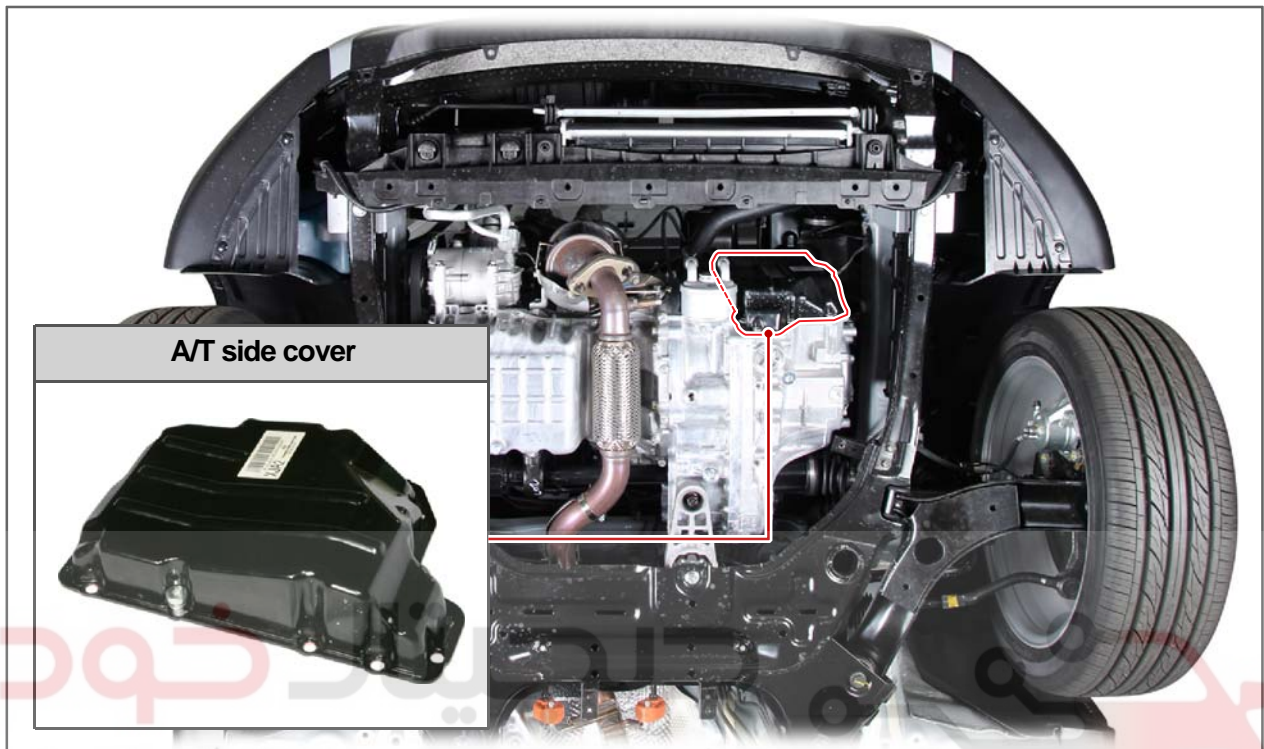
S.G.N.

3693-21

## AUTOMATIC TRANSMISSION SIDE COVER

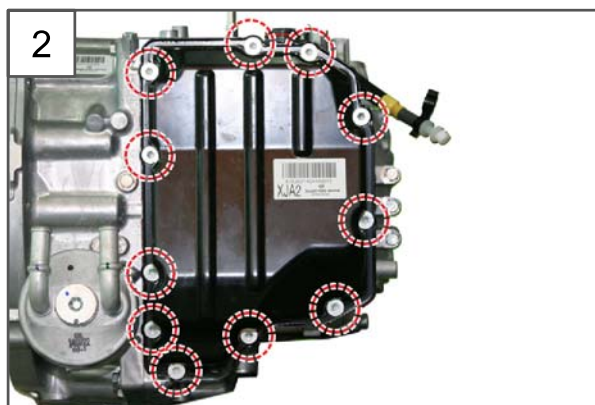
Preceding work

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



1. Remove the overflow plug (T40) and drain plug (17 mm) using a hexagon wrench to drain the A/T fluid.

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



2. Unscrew the 11 automatic transmission side cover mounting bolts (T40) using a star wrench.

**Tightening torque** 17 ~ 20Nm

Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

TIVOLI 2015.06

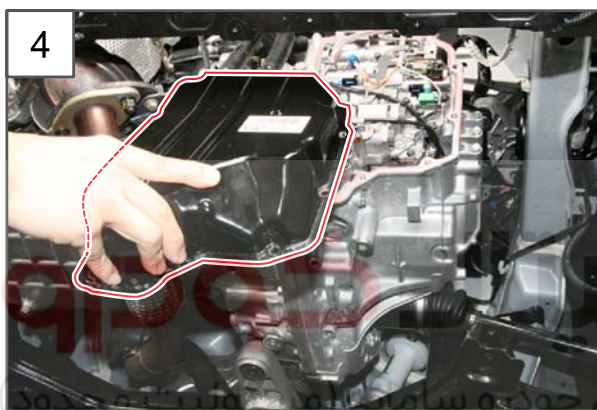




3. Tap out the transmission side cover gently with a plastic hammer.

**CAUTION**

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



4. Remove the automatic transmission side cover.



5. Install in the reverse order of removal.



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



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

#### **CAUTION**

- Use a dedicated sealant (FIPG) product.
- Fit the side cover before the applied sealant (FIPG) is cured
- 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.

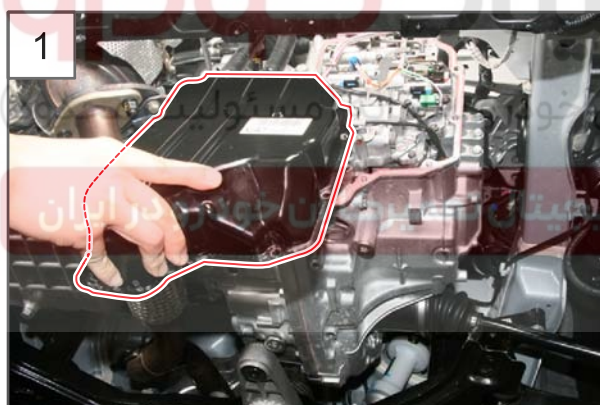
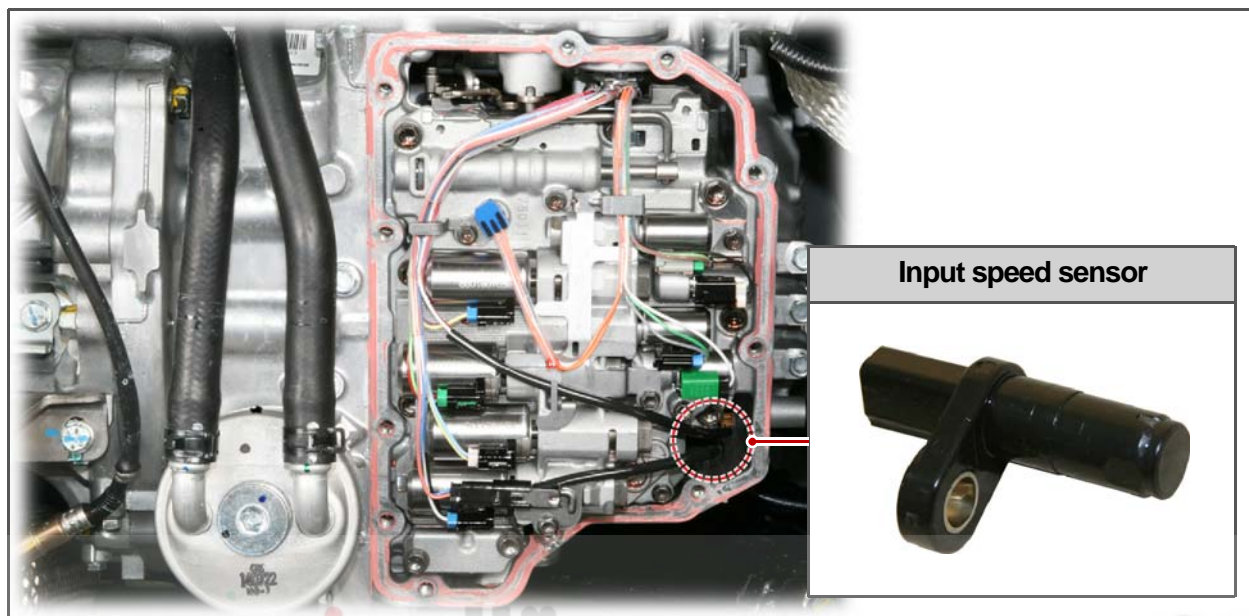
Modification basis	
Application basis	
Affected VIN	



01-122 3693-38

T I V O L I

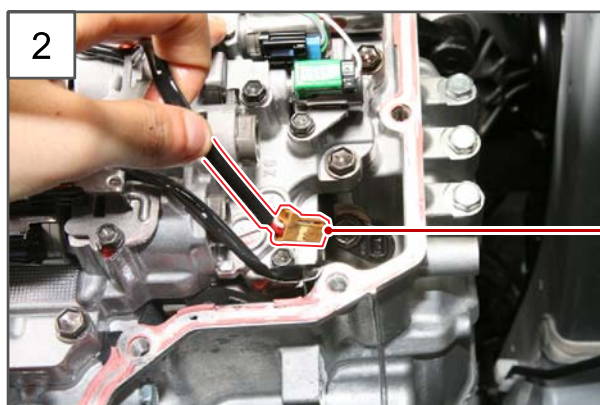
S.G.N.

**3693-38 INPUT SPEED SENSOR****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.

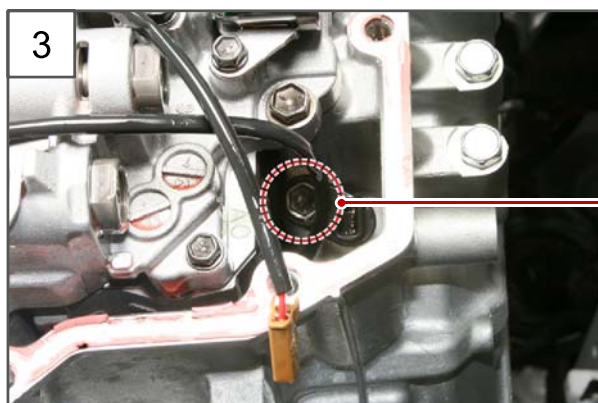


2. Disconnect the input speed sensor connector.



Modification basis	
Application basis	
Affected VIN	



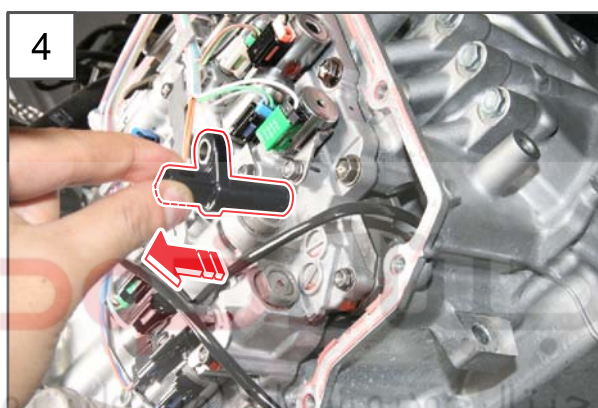


3. Unscrew the input speed sensor mounting bolt (10 mm).

**Tightening torque** 3.9 ~ 6.9Nm



4. Remove input speed sensor.



5. Install in the reverse order of removal.

AISIN 6  
SPEED6-SPEED  
M/T

CLUTCH

PROPELLER

DRIVE  
SHAFT

AWD

SUSPENSION

BRAKE  
SYSTEM

ESP

ABS

ELECTRIC  
POWERWHEEL  
AND TIRE

TPMS

SUB  
FRAME

Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

TIVOLI 2015.06



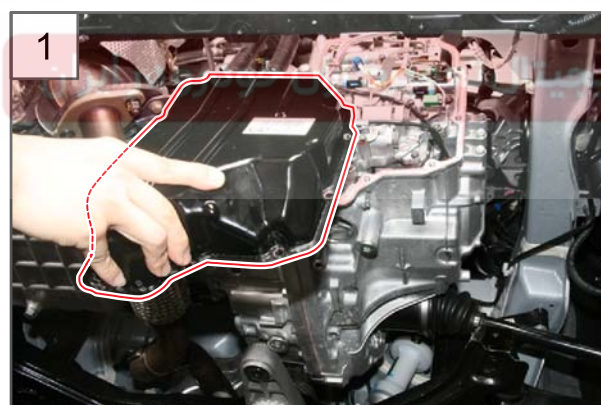
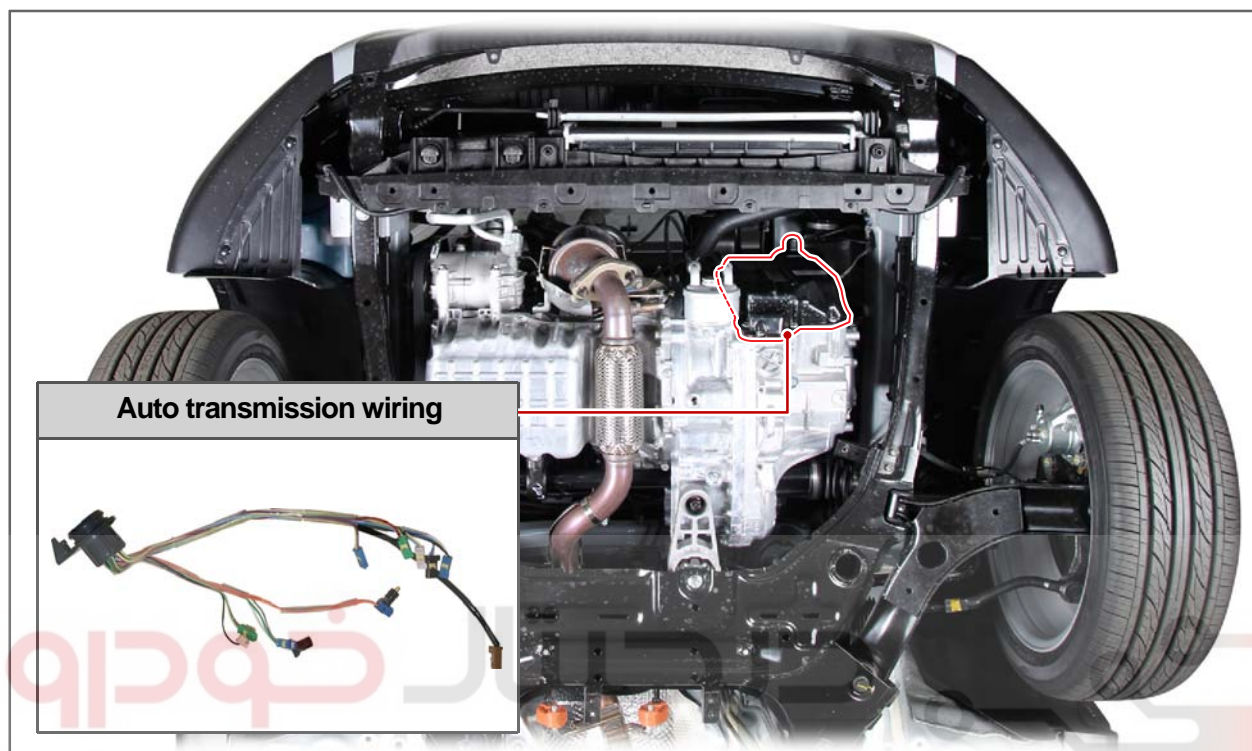
S.G.N.

3691-11

## AUTOMATIC TRANSMISSION WIRING

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.



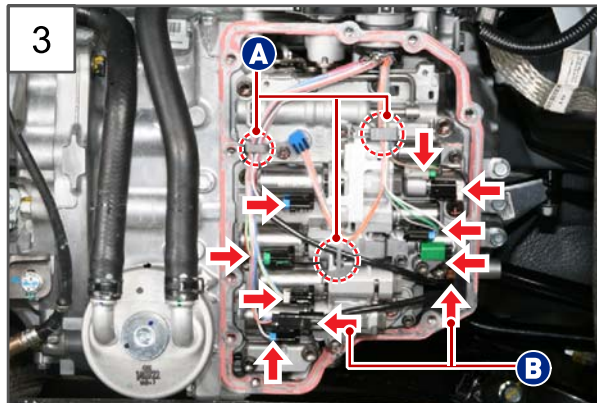
2. Remove the TCU.

**NOTE**

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

Modification basis	
Application basis	
Affected VIN	

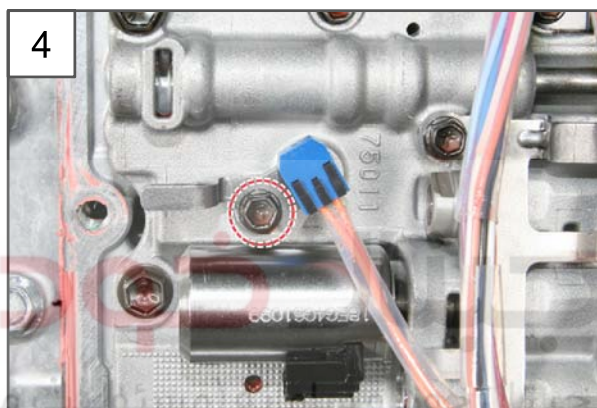




3. Disconnect the automatic transmission wiring from the 3 clamps (A) and remove the 8 solenoid valves and 2 speed sensor (B) connectors.

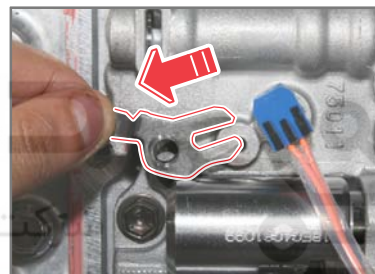
### ⚠ CAUTION

Be careful not to damage the wiring when disconnecting the connector.

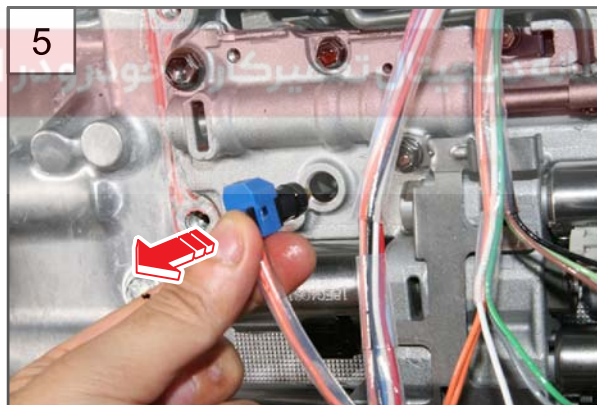


4. Unscrew the lock plate mounting bolt (8 mm) and remove the lock plate.

**Tightening torque** 6 ~ 8Nm

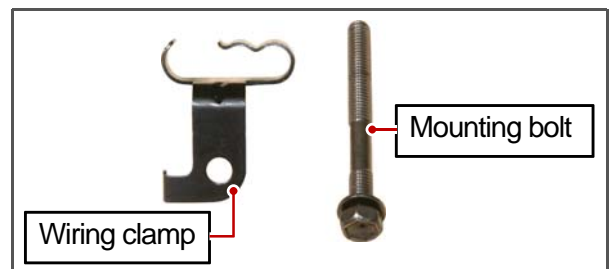


5. Remove the oil temperature sensor.



6. Unscrew the wiring clamp mounting bolt (8 mm) from the valve body assembly and remove the wiring clamp.

**Tightening torque** 6 ~ 8Nm

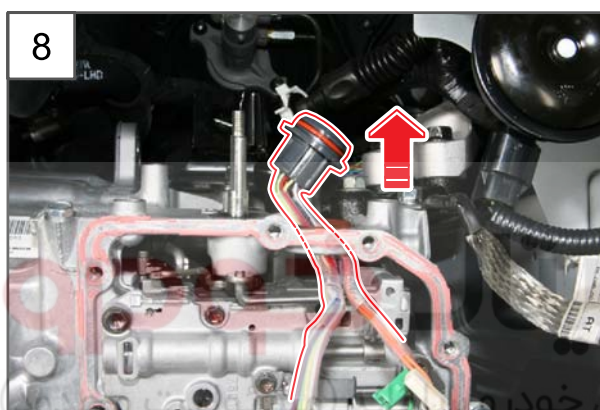


Modification basis	
Application basis	
Affected VIN	





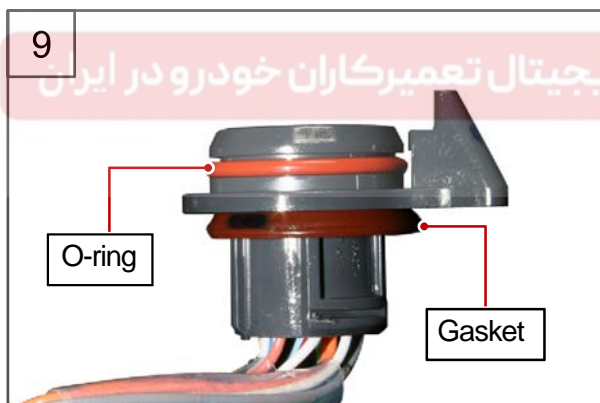
7. Remove the automatic transmission wiring lock plate from the automatic transmission case.



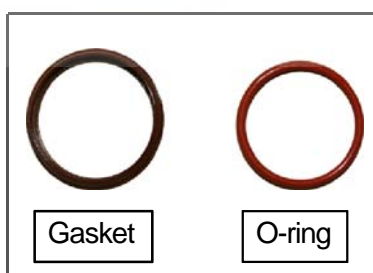
8. Remove the transmission wiring from the automatic transmission case

**⚠ CAUTION**

- Do not pull the wiring forcibly.
- Be careful not to damage the wiring when disconnecting it.



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



**NOTE**

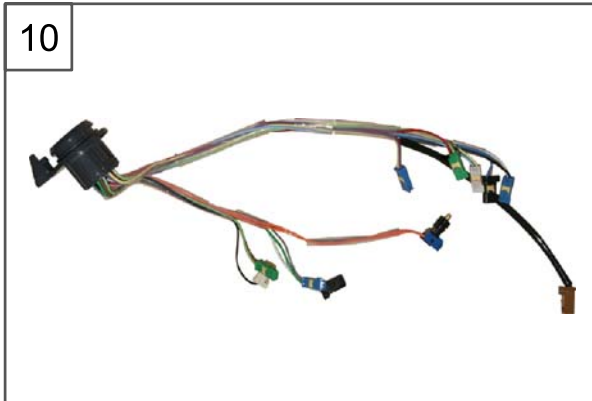
Do not reuse the removed O-ring and gasket.

**O-ring size**

Internal diameter	Thickness
27.3mm	2.4mm

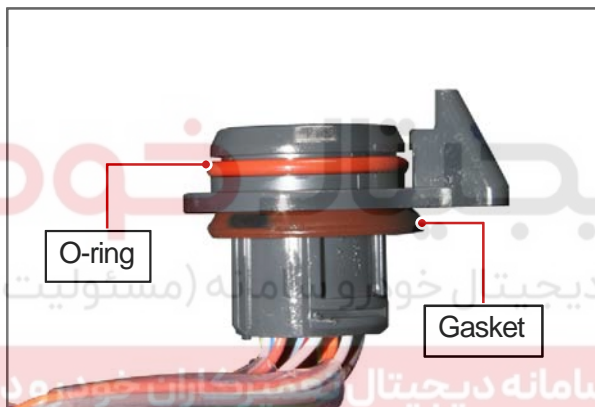


10



10. Install in the reverse order of removal.

### Cautions for fitting automatic transmission wiring



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

#### O-ring size

Internal diameter	Thickness
27.3mm	2.4mm



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.
- Perform "N gear position learning" after fitting the TCU.

Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

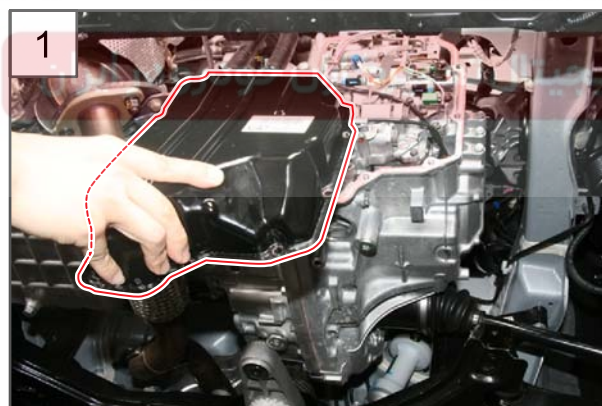
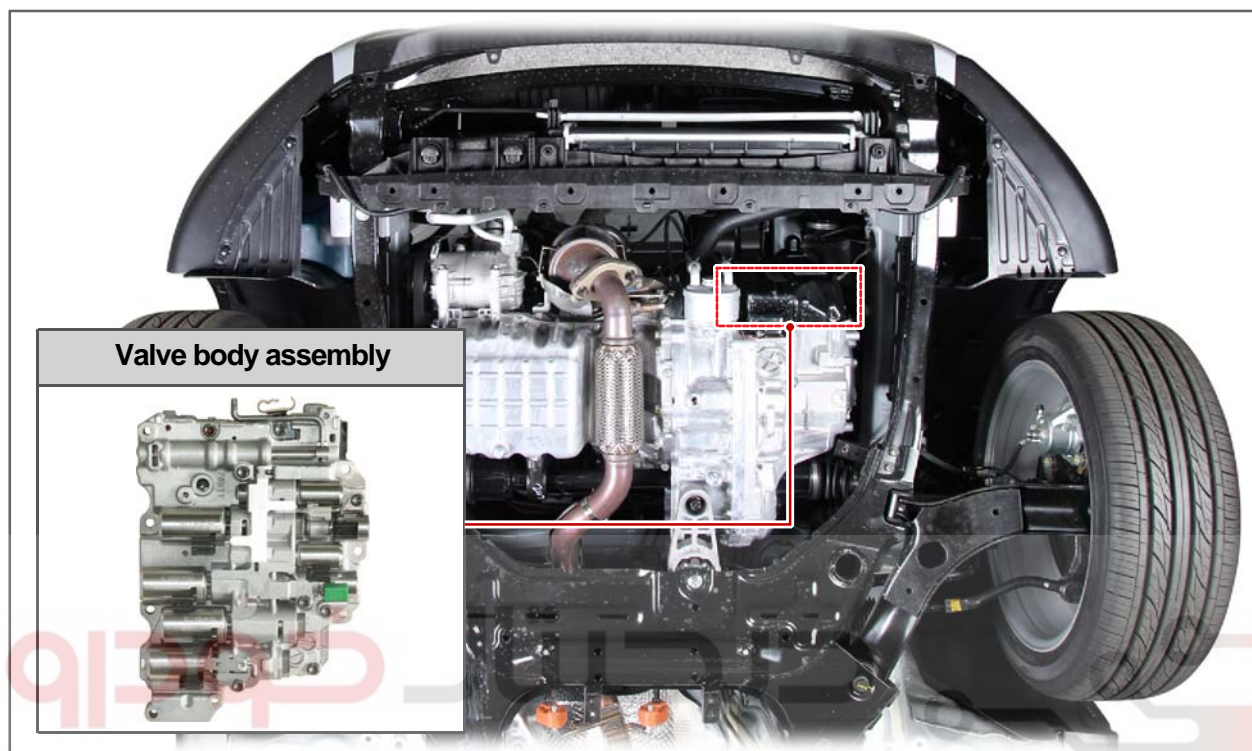
TIVOLI 2015.06



S.G.N.

**3693-15 VALVE BODY ASSEMBLY**

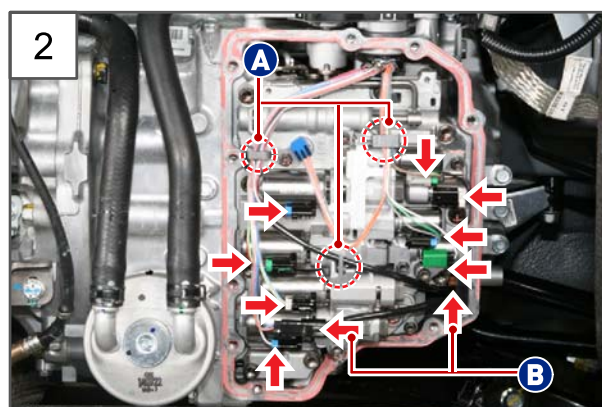
**Preceding work** - Disconnect the negative battery cable.



1. Remove the automatic transmission side cover.

**NOTE**

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



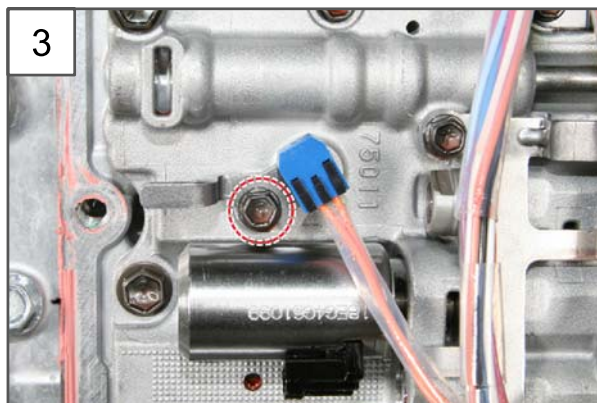
2. Disconnect the transmission wiring from the 3 clamps (A) and remove the 8 solenoid valves and 2 speed sensor (B) connectors.

**CAUTION**

Be careful not to damage the wiring when disconnecting the connector.

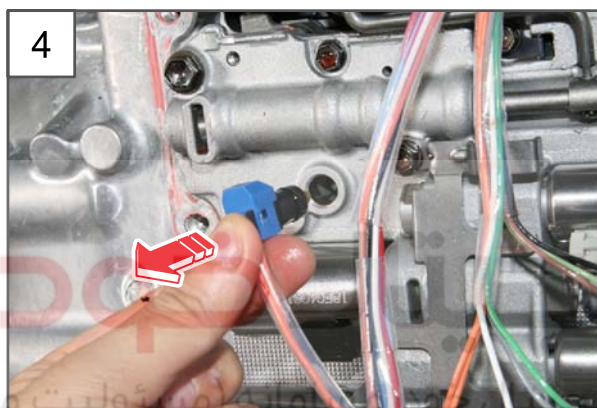
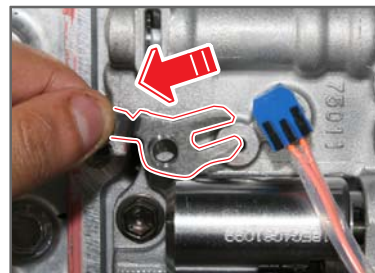
Modification basis	
Application basis	
Affected VIN	



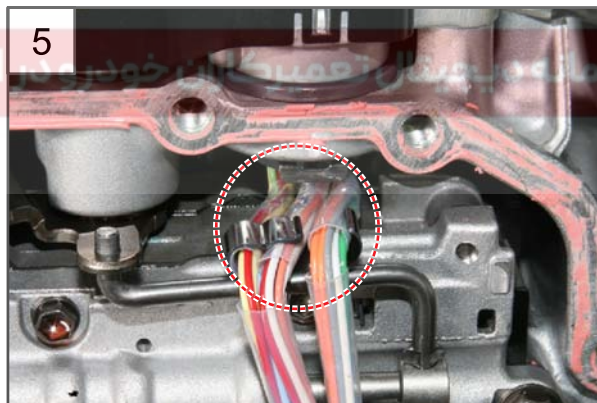


3. Unscrew the lock plate mounting bolt (8 mm) and remove the lock plate.

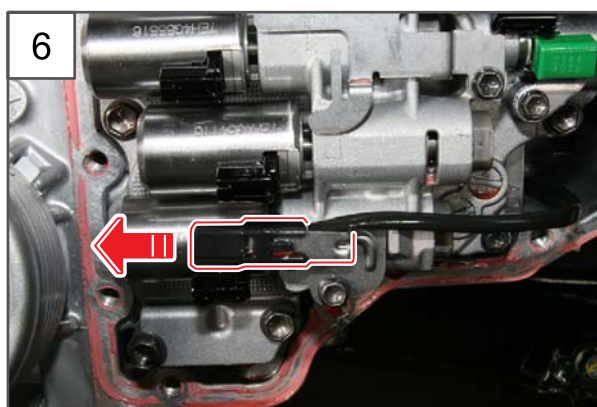
**Tightening torque** 6 ~ 8Nm



4. Remove the oil temperature sensor.



5. Remove the transmission wiring from the wiring clamp.



6. Disconnect the output speed sensor wire connector from the solenoid clamp.

Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

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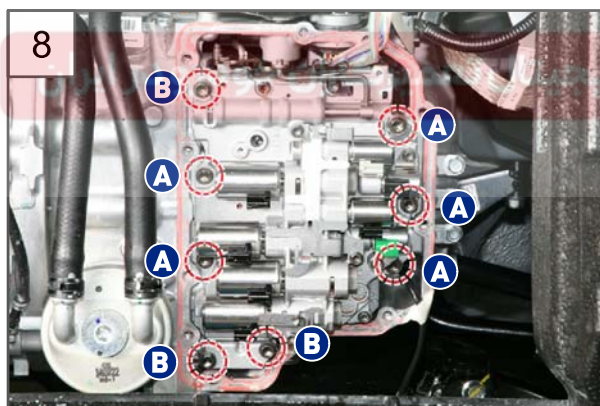
7. Secure the A/T wiring to the A/T case with an adhesive tape.

**NOTE**

It is recommended to secure the wiring to prevent any interference when fitting/removing the valve body.



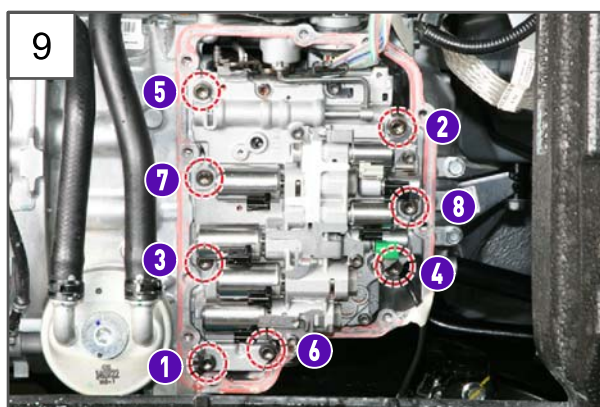
Secure the output speed sensor wiring to the A/T case with an adhesive tape.



8. Unscrew the 8 valve body mounting bolts (10 mm).  
اولير: 10mm

**Tightening torque 8 ~ 12Nm**

Position	Bolt length
A	21mm
B	31mm

**CAUTION**

- Unscrew the valve body mounting bolts evenly, step by step, in the order shown in the figure.
- Be careful not to drop the valve body.

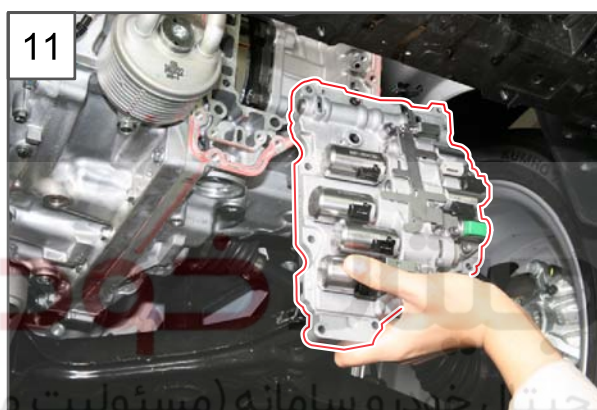




10. Separate the valve body assembly and remove the manual valve link and valve body assembly.

**CAUTION**

- Remove the shift lever from the "N" position.
- Be careful not to drop the valve body.



11. Remove the valve body assembly.



12. Install in the reverse order of removal.

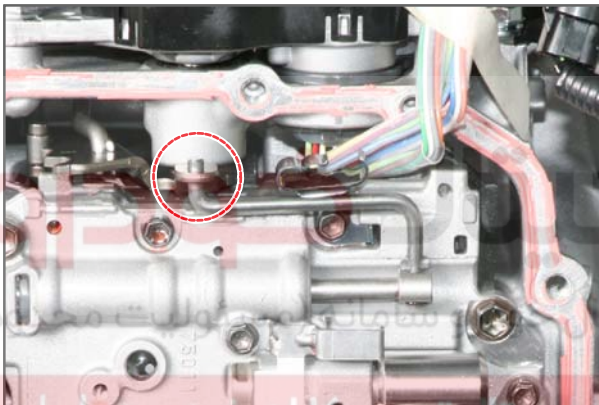
Modification basis	
Application basis	
Affected VIN	



### Cautions for fitting valve body assembly



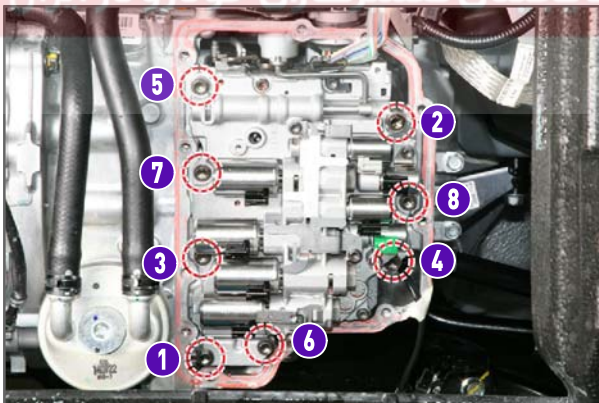
Place the shift lever in "N" position to fit the manual valve link.



Connect the manual valve link and fit the valve body assembly.

#### **CAUTION**

- Check the wiring for damage and twisting when fitting the valve body.
- Connect the transmission wiring connector while checking their positions.



When fitting the valve body, align the bolt holes and place the bolts in it randomly. Then, tighten them evenly in the order shown in the figure.

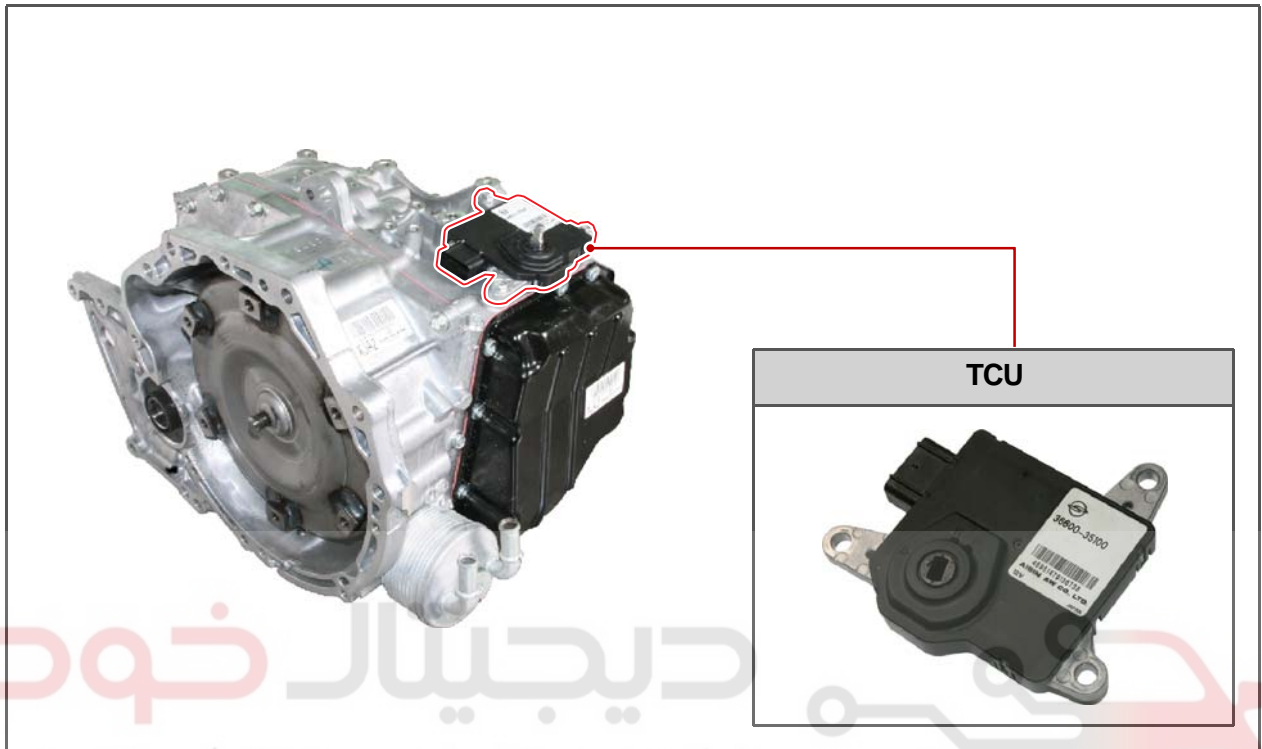
**Tightening torque 8 ~ 12Nm**

- 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.



## 3691-07 TCU

**Preceding work** - Disconnect the negative battery cable.

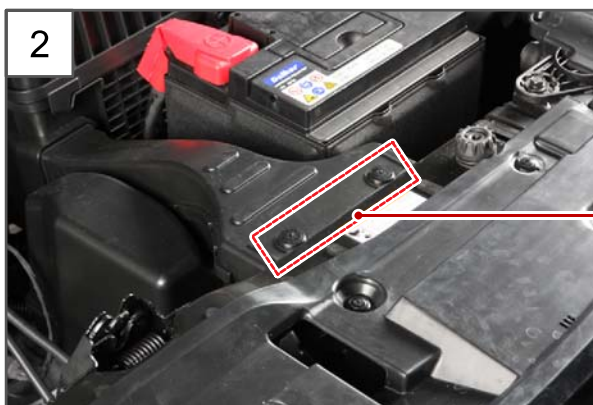


1. Apply the parking brake and place the shift lever to "N" position.



### 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 snorkel assembly retaining pins from upper portion of the vehicle.

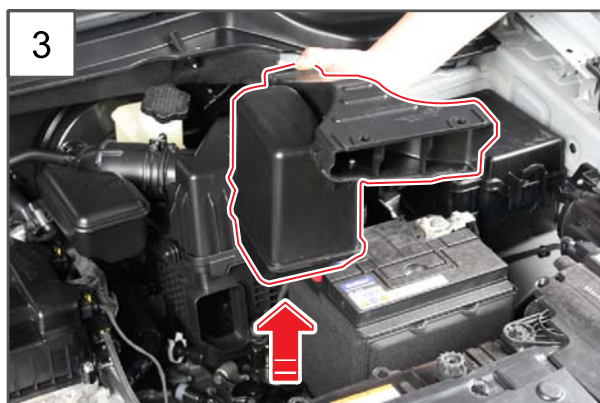


Modification basis	
Application basis	
Affected VIN	

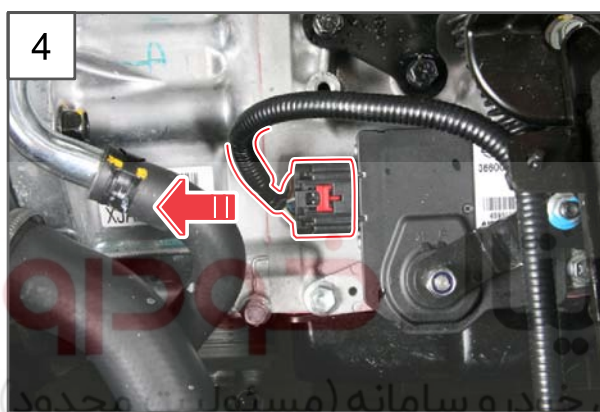
AISIN 6 SPEED AUTO TRANSAXLE

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3. Remove the snorkel assembly.



4. Disconnect the TCU wiring connector.

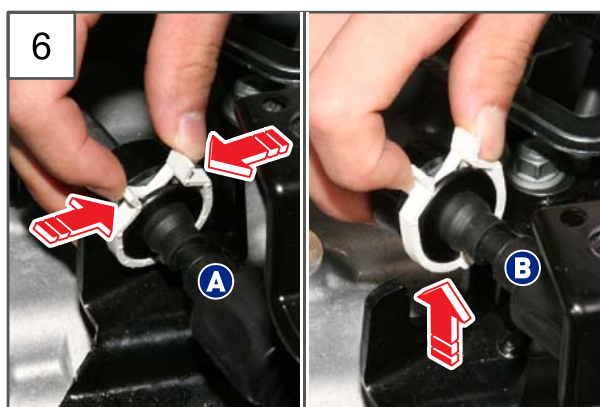


5. Unscrew the manual lever mounting bolt (13 mm).  
اولير: 13mm

**Tightening torque** 13.7 ~ 19.6Nm

#### ⚠ CAUTION

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



6. Release the retaining clip from the bracket and remove the cable.

#### 💡 NOTE

The cable can be disconnected easily from the mounting bracket by pulling the cable with the clip on the cable is pressed.

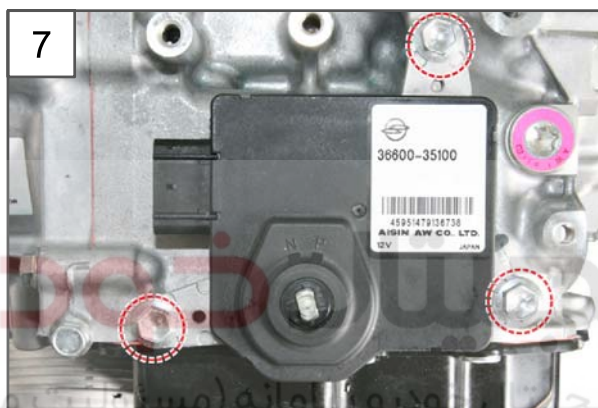


**NOTE**

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°. (The manual valve in the automatic transmission may come off.)

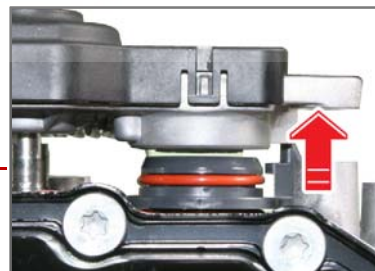


7. Unscrew the 3 TCU mounting bolts (12 mm).

**Tightening torque 19.6 ~ 29.4Nm**



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



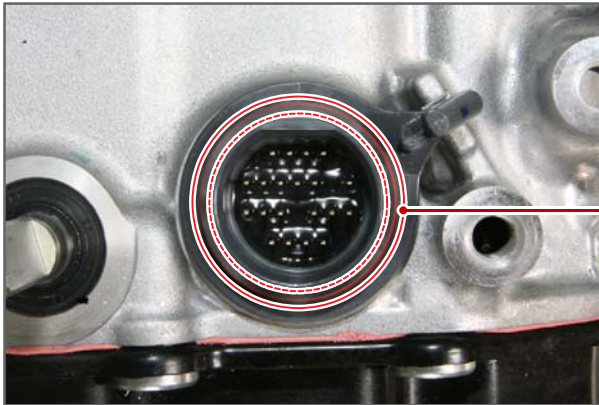
9. Install in the reverse order of removal.



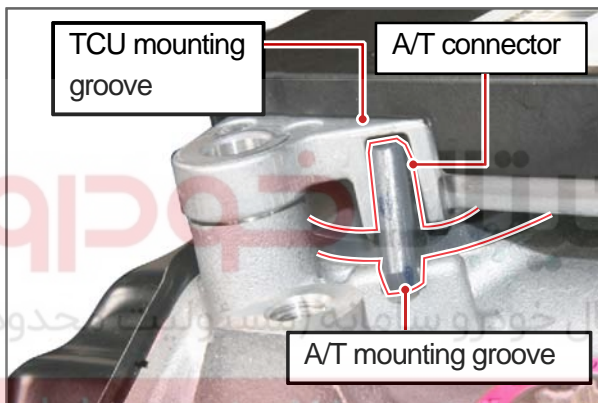
Modification basis	
Application basis	
Affected VIN	



### 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".



S.G.N.

**3724-01 TGS LEVER ASSEMBLY****Preceding work**

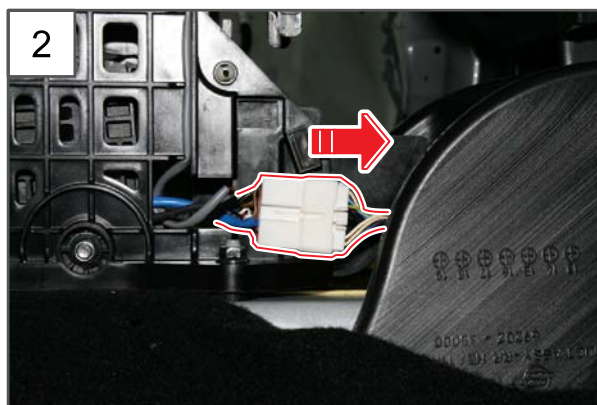
- Disconnect the negative battery cable.



1. Remove the front console.

**NOTE**

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



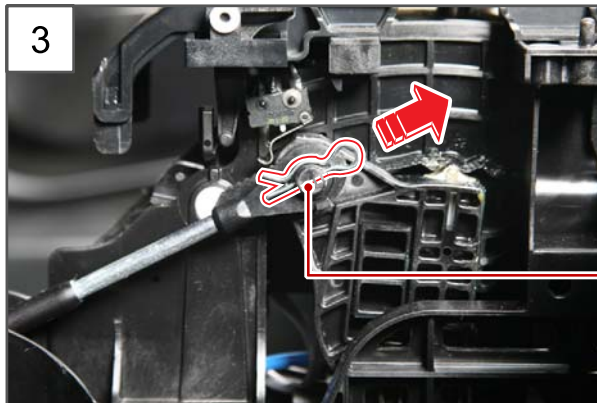
2. Disconnect the connectors connected to the TGS lever.

Modification basis	
Application basis	
Affected VIN	

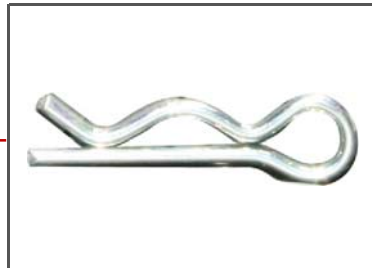
AISIN 6 SPEED AUTO TRANSAXLE

TIVOLI 2015.06





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



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



Hold the retaining clip for the shift cable as below.



Press on the retaining clip for the shift cable with your thumb.



Pull up on the shift cable retaining clip.



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

**Tightening torque 17.6 ~21.6Nm**

Modification basis	
Application basis	
Affected VIN	





6. Remove the 2 air bag wiring fixtures from the TGS lever.



7. Remove the TGS lever.

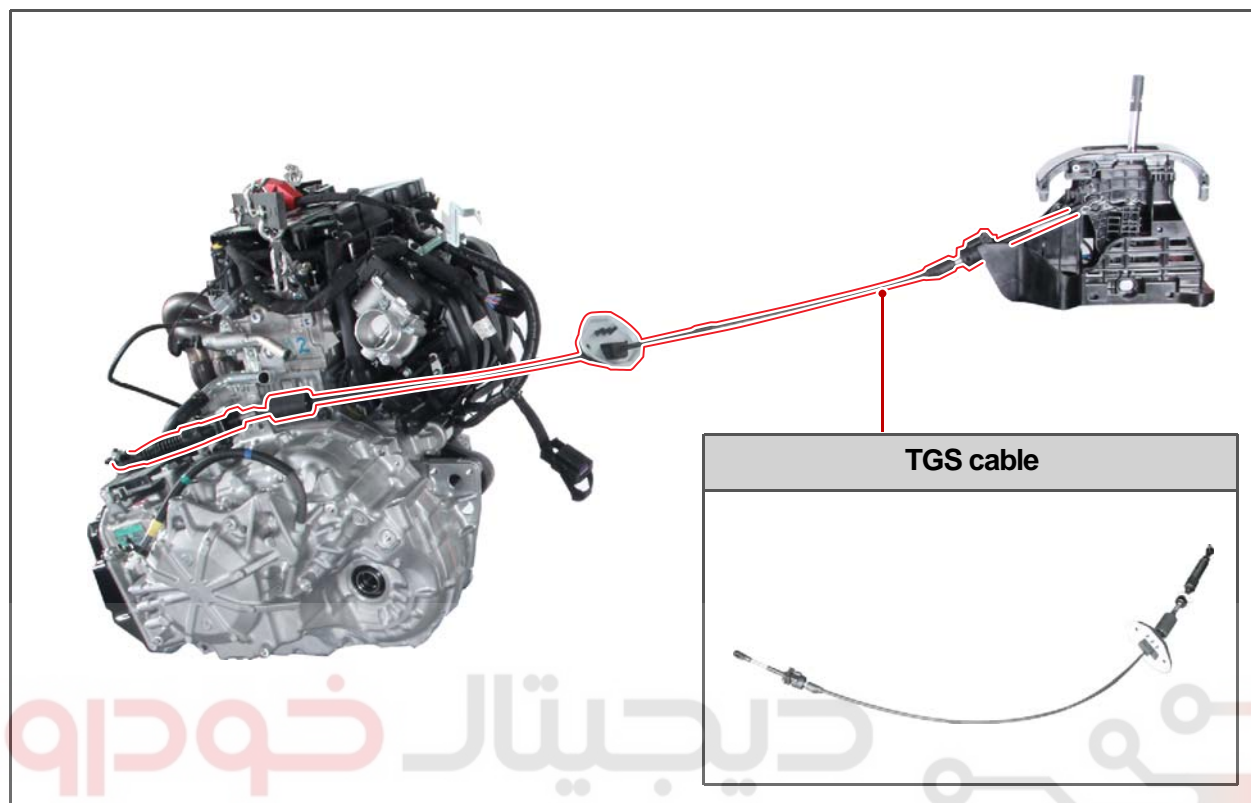


8. Install in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	



S.G.N.

**3724-03 TGS CABLE**

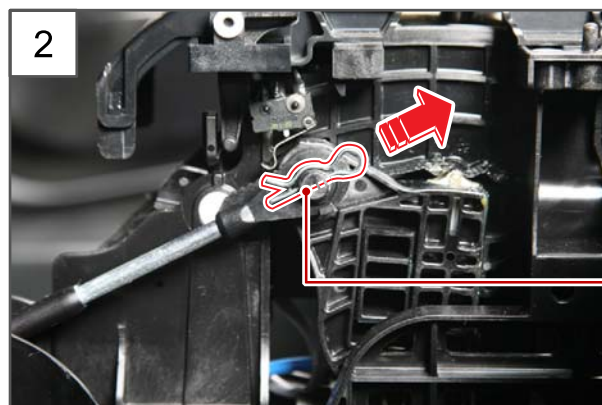
شرکت دیجیتال خودرو (مسئولیت محدود)



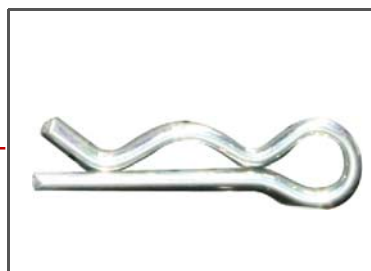
1. Remove the front console.

**NOTE**

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



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



Modification basis	
Application basis	
Affected VIN	





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



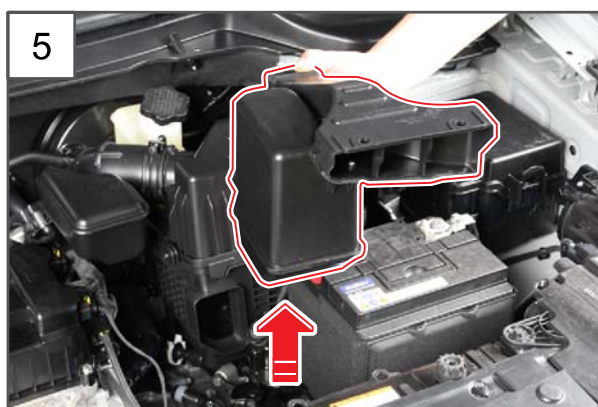
Hold the retaining clip for the shift cable as below.

Press on the retaining clip for the shift cable with your thumb.

Pull up on the shift cable retaining clip.



4. Remove the snorkel assembly retaining pins from upper portion of the vehicle.



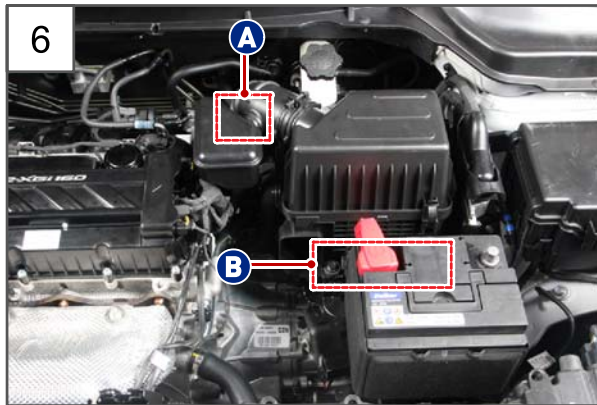
5. Remove the snorkel assembly.



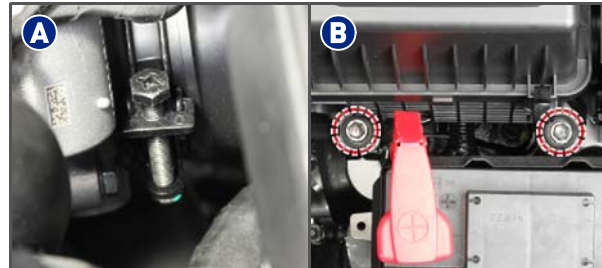
Modification basis	
Application basis	
Affected VIN	



## ► Gasoline engine



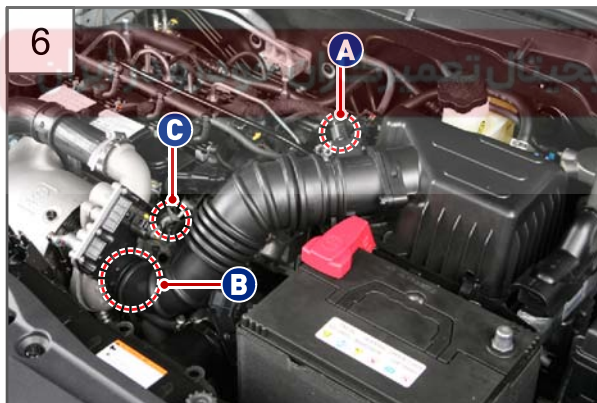
6. Unscrew the intake hose clamp bolt (A, 10 mm) and the 2 mounting bolts (B, 12 mm) for the air cleaner housing.



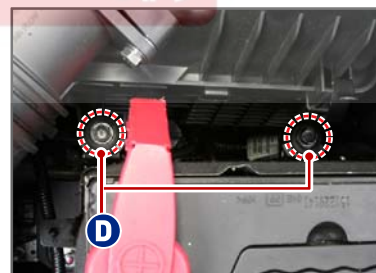
7. Remove the air cleaner housing with the intake hose.



## ► Diesel engine



6. Unhook the mounting clamps on the HFM sensor connector (A) and hose from the air cleaner to the turbocharger and the oil separator hose clamp (C) and then, unscrew the 2 air cleaner housing mounting bolts (D, 12 mm).



7. Unscrew the 2 air cleaner housing mounting bolts (12 mm) and remove the air cleaner housing assembly together with the hose between the air cleaner and turbocharger.



## ⚠ CAUTION

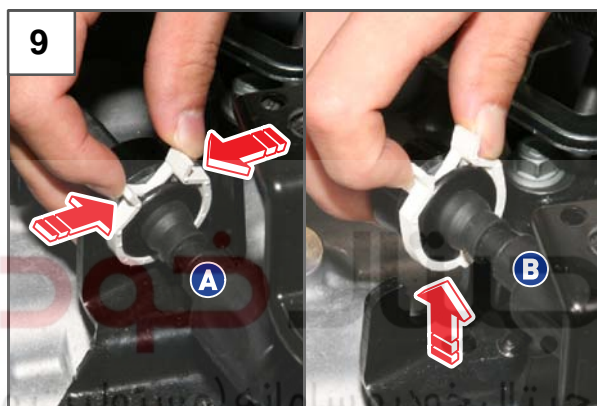
Cover the turbocharger inlet with a cap or cloth so that any foreign material does not enter the turbocharger after disconnecting the hose.





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

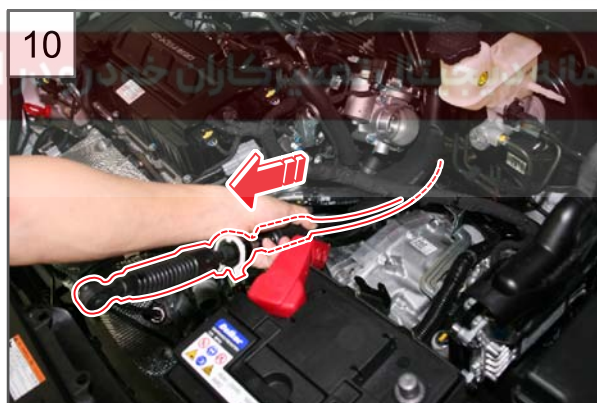
**Tightening torque** 14 ~ 18 Nm



9. Release the retaining clip from the bracket and remove the cable.

#### NOTE

The cable can be disconnected easily from the mounting bracket by pulling the cable with the clip on the cable is pressed.



10. Pull the cable towards the engine compartment for easier work when removing the cable.



11. Unscrew the 2 selector cable mounting nuts (12 mm) from the dash panel.

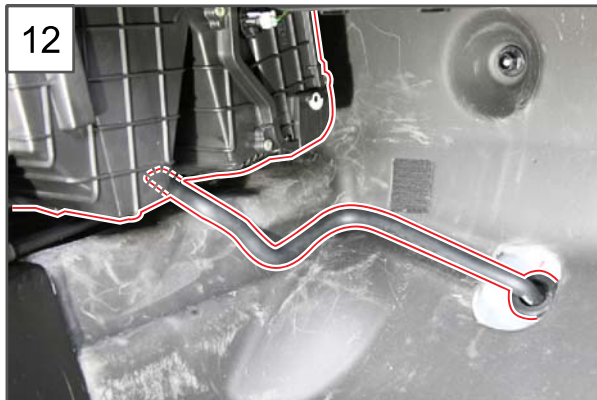
**Tightening torque** 17.6 ~ 21.6 Nm

Modification basis	
Application basis	
Affected VIN	



01-144 3724-03

T I V O L I



12. Disconnect the A/C water drain hose from the front passenger lower evaporator.



13. Pull out the TGS cable to the bottom of the front passenger area.



14. Install in the reverse order of removal.

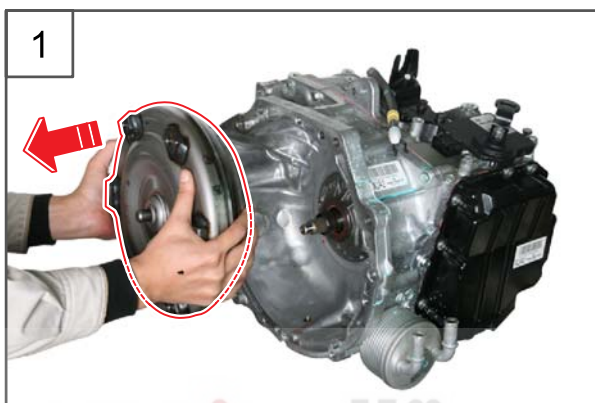
Modification basis	
Application basis	
Affected VIN	



S.G.N.

**3691-14 AUTOMATIC TRANSMISSION OIL SEAL****1) Oil Pump Oil Seal****(1) Removal****Preceding work**

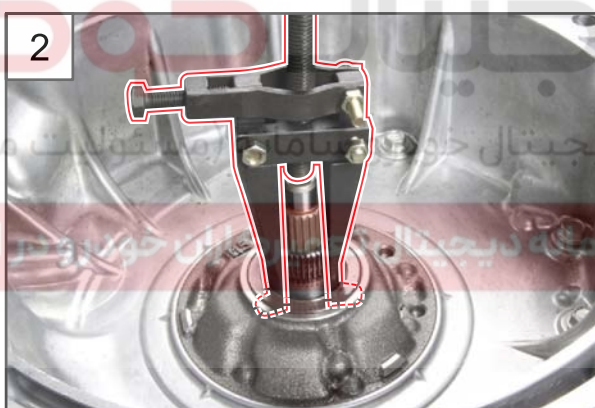
- Drain the A/T fluid. (see "A/T FLUID CHANGE")
- Remove the automatic transmission assembly. (see "AUTOMATIC TRANSMISSION ASSEMBLY" in "REMOVAL AND INSTALLATION" under "AUTO TRANSAXLE")



1. Remove the torque converter from the automatic transmission.

**CAUTION**

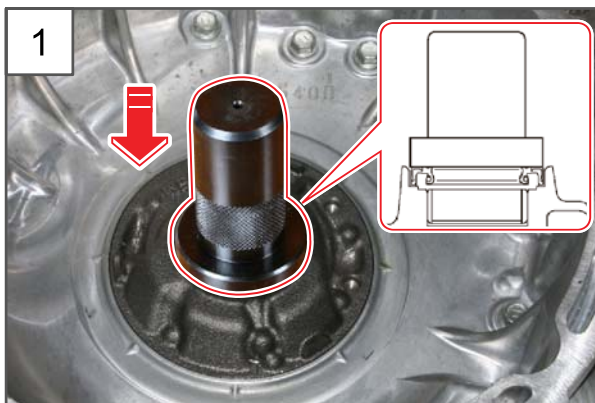
- Be careful not to damage the oil pump oil seal.
- Take care not to drop the torque converter.



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) Installation**

1. Fit the new oil seal to the oil pump assembly using AISIN 6A/T oil seal installer (oil pump) [part no.: X9936 0110A] and a hammer.

**NOTE**

Oil seal specification:  $0 \pm 0.2\text{mm}$  (from housing end)

**CAUTION**

- Be careful not to damage the oil seal.

Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

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AISIN 6  
SPEED6-SPEED  
M/T

CLUTCH

PROPELLER

DRIVE  
SHAFT

AWD

SUSPENSION

BRAKE  
SYSTEM

ESP

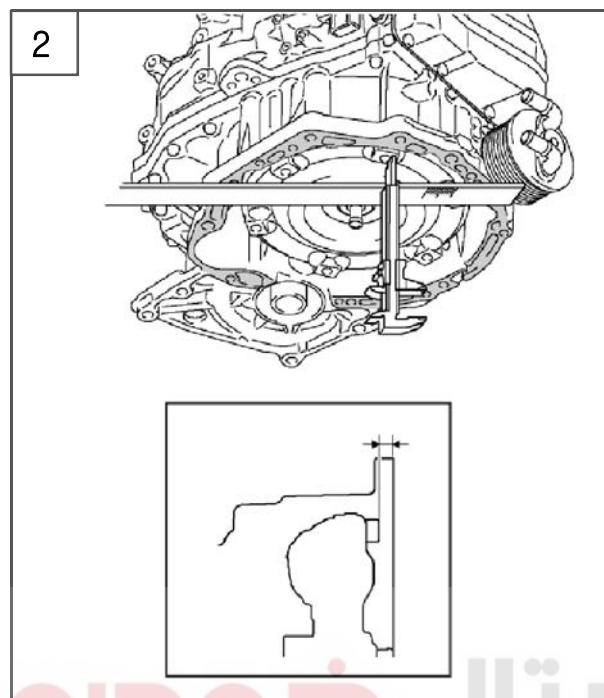
ABS

ELECTRIC  
POWERWHEEL  
AND TIRE

TPMS

SUB  
FRAME





2. 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	12.15 mm or longer

3. Install the automatic transmission. (see "AUTOMATIC TRANSMISSION ASSEMBLY" under "REMOVAL AND INSTALLATION").



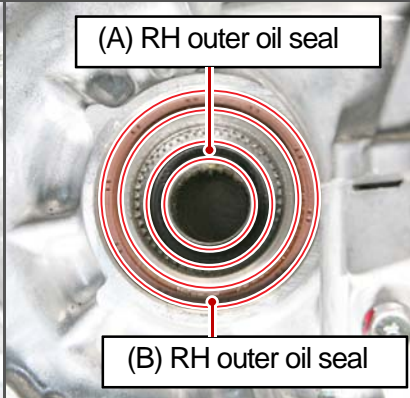



4. Fill the A/T fluid. (see "A/T FLUID CHANGE")




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## 2) G16DF

### (1) Differential Oil Seal & Special Tools

LH oil seal (2WD/AWD)	RH oil seal (2WD)	RH oil seal (AWD)
		
		
[Part no.: 90311 40A020]	[Part no.: 90311 40A026]	(A) [Part no.: 90311 33A006] (B) [Part no.: 90311 62A002]

LH oil seal installer (2WD/AWD)	RH oil seal installer (2WD)	RH oil seal installer (AWD)
		
[Part no.: X9936 0100A]	[Part no.: X9936 0090A]	[Selling: <a href="http://www.toolIntech.com">http://www.toolIntech.com</a> ]

Modification basis	
Application basis	
Affected VIN	

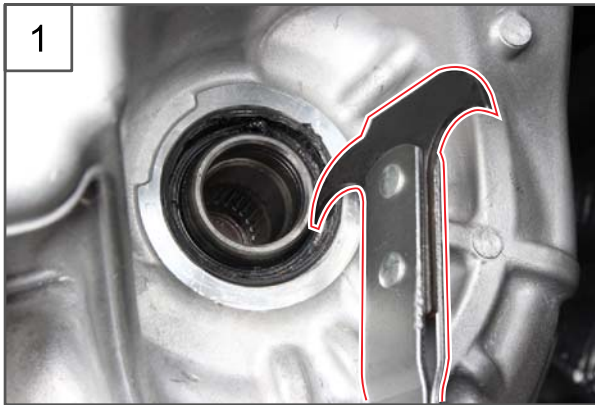


## (2) Differential oil seal (to case)

### ► Removing and fitting LH oil seal (G16DF-2WD/AWD)

#### Preceding work

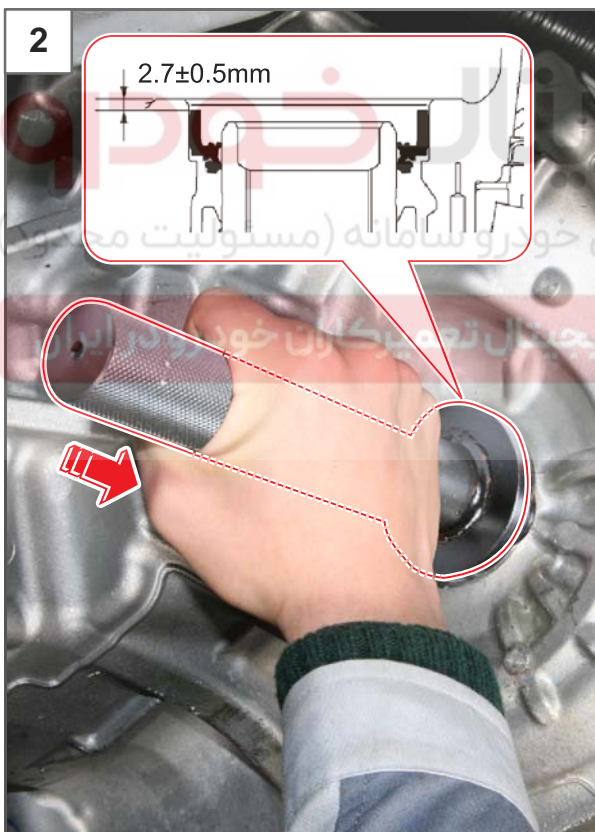
- Drain the A/T fluid. (see "A/T FLUID CHANGE")
- Remove the LH drive shaft. (see "FRONT DRIVE SHAFT" under "REMOVAL AND INSTALLATION" in "DRIVE SHAFT & AXLE SYSTEM")



1. Remove the LH oil seal from using the AISIN 6A/T oil seal puller (both LH and RH sides) [part no.: X9936 0130A].  
- LH oil seal part no.: 90311 40A020

#### ⚠ CAUTION

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



2. Temporarily fit the new oil seal to the correct direction and install it to the transmission case using an AISIN 6A/T oil seal installer (RH side) [part no.: X9936 0100A] and a hammer.

#### ⚠ NOTE

Oil seal assembly standard:  $2.7 \pm 0.5$  mm (from the end of the case)

#### ⚠ CAUTION

Be careful not to damage the oil seal.



3. Install the LH drive shaft. (see "FRONT DRIVE SHAFT" under "REMOVAL AND INSTALLATION" in "DRIVE SHAFT & AXLE SYSTEM")
4. Fill the A/T fluid. (see "A/T FLUID CHANGE")

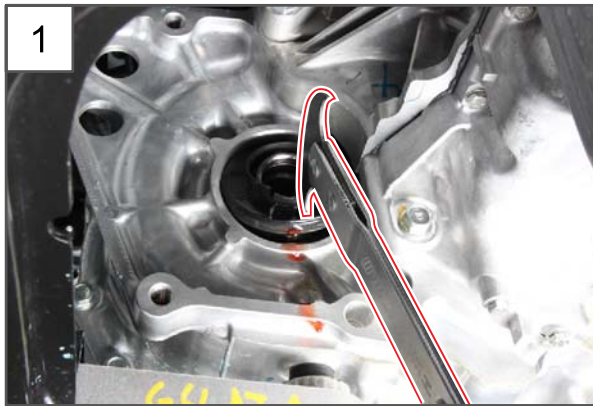


### (3) Differential oil seal (to housing)

#### ► Removing and fitting RH oil seal (G16DF-2WD)

##### Preceding work

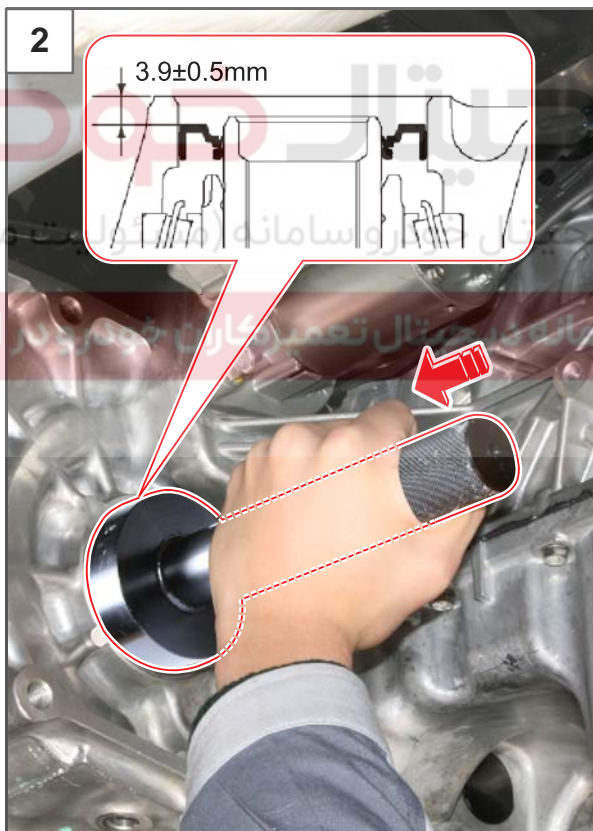
- Drain the A/T fluid. (see "A/T FLUID CHANGE")
- Remove the RH drive shaft and intermediate shaft. (see "FRONT DRIVE SHAFT" under "REMOVAL AND INSTALLATION" in "DRIVE SHAFT & AXLE SYSTEM")



1. Remove the RH oil seal from using the AISIN 6A/T oil seal puller (both LH and RH sides) [part no.: X9936 0130A].  
- RH oil seal part no.: 90311 40A026

#### ⚠ CAUTION

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



2. Temporarily fit the new oil seal to the correct direction and install it to the transmission housing using an AISIN 6A/T oil seal installer (RH side) [part no.: X9936 0100A] and a hammer.

#### ⚠ NOTE

Oil seal assembly standard:  $3.9 \pm 0.5$  mm (from the end of the housing)

#### ⚠ CAUTION

Be careful not to damage the oil seal.



2. Install the LH drive shaft. (see "FRONT DRIVE SHAFT" under "REMOVAL AND INSTALLATION" in "DRIVE SHAFT & AXLE SYSTEM")
3. Fill the A/T fluid. (see "A/T FLUID CHANGE")

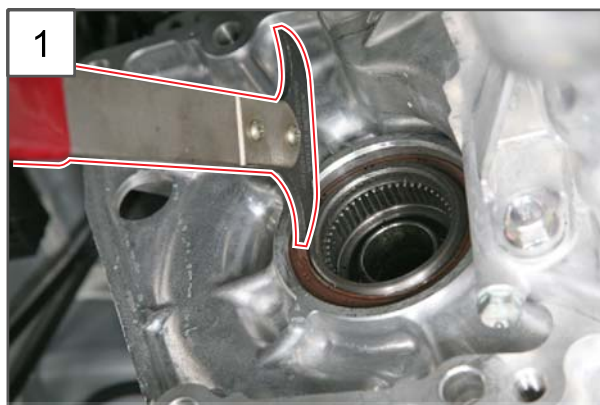
Modification basis	
Application basis	
Affected VIN	



### ► Removing and fitting RH oil seal (G16DF-AWD)

#### Preceding work

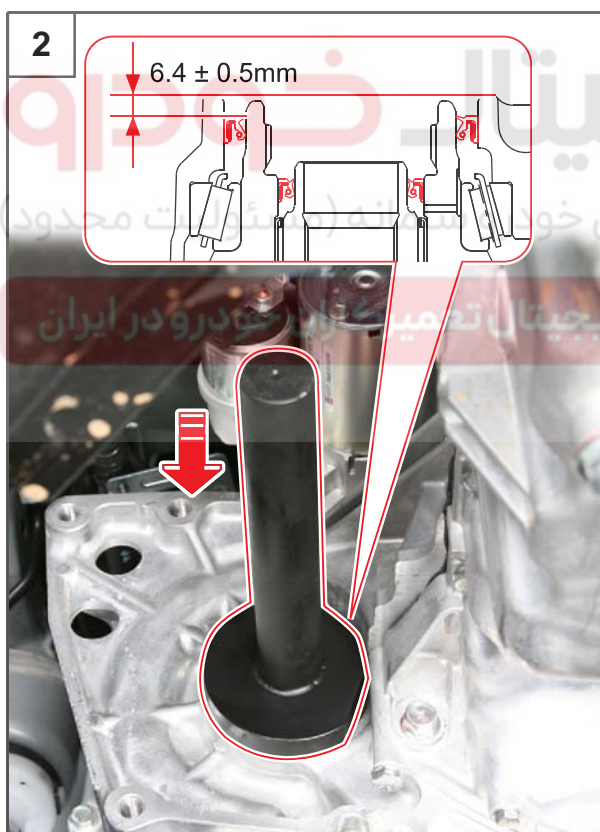
- Drain the A/T fluid. (see "A/T FLUID CHANGE")
- Remove the RH drive shaft and intermediate shaft. (see "FRONT DRIVE SHAFT" under "REMOVAL AND INSTALLATION" in "DRIVE SHAFT & AXLE SYSTEM")
- Remove the PTU. (see "PTU ASSEMBLY" in "REMOVAL AND INSTALLATION" under "AWD SYSTEM")



1. Remove the RH inner oil seal from using the AISIN 6A/T oil seal puller (both LH and RH sides) [part no.: X9936 0130A].  
- RH inner oil seal part no.: 90311 33A006

#### ⚠ CAUTION

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



2. Temporarily fit the new oil seal to the correct direction and install it to the transmission housing using a AWD-A/T deep oil seal installer (RH) and a hammer.

#### ⚠ NOTE

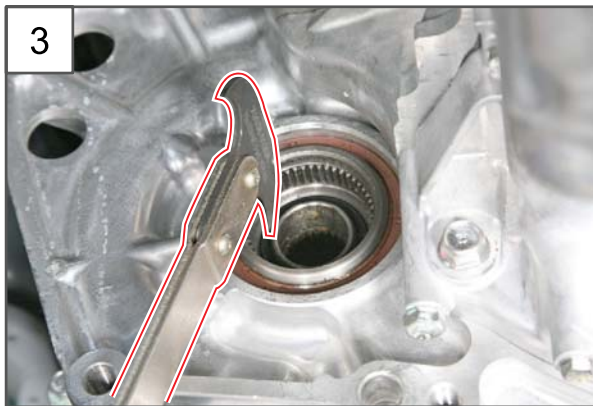
Oil seal assembly standard:  $6.4 \pm 0.5\text{mm}$   
(from the end of the housing)

#### ⚠ CAUTION

Be careful not to damage the oil seal.



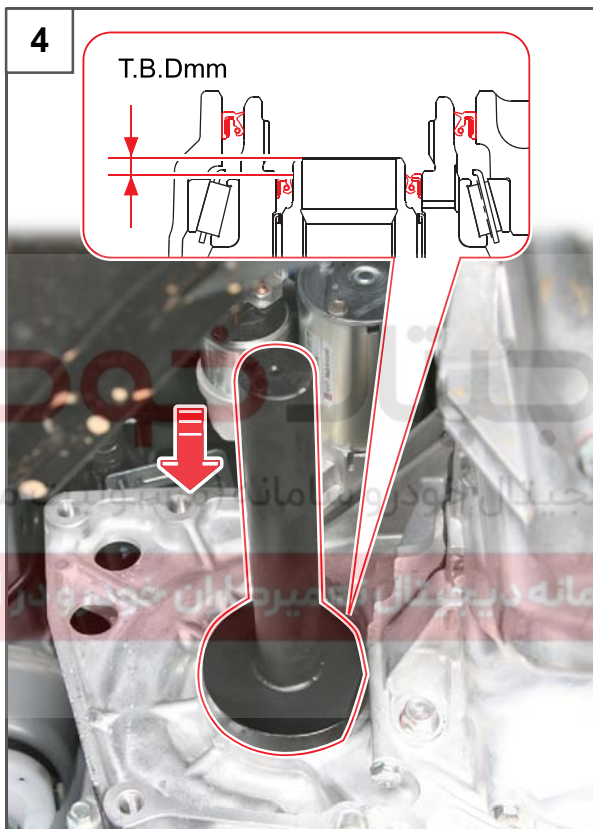




3. Remove the RH outer oil seal from using the AISIN 6A/T oil seal puller (both LH and RH sides) [part no.: X9936 0130A].  
- RH outer oil seal part no.: 90311 62A002

**CAUTION**

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



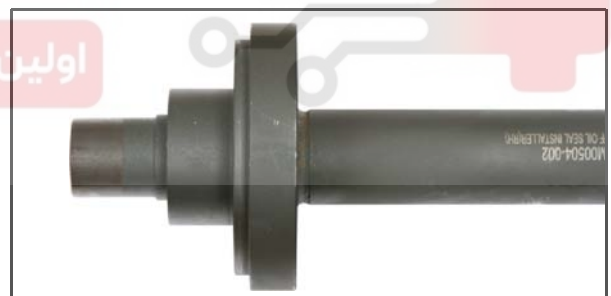
4. Temporarily fit the new oil seal to the correct direction and install it to the transmission housing using a AWD-A/T deep oil seal installer (RH) and a hammer.

**NOTE**

Oil seal assembly standard: T.B.D mm  
(from the end of the inner spline)

**CAUTION**

Be careful not to damage the oil seal.




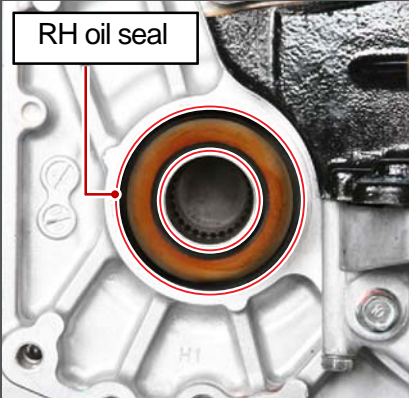
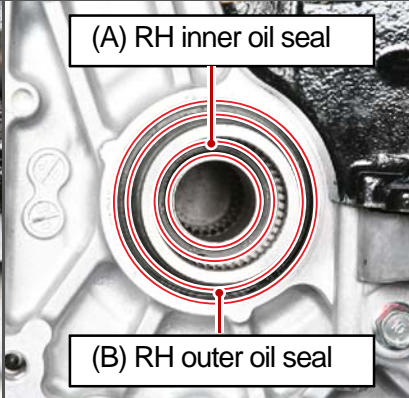



5. Install the PTU. (see "PTU ASSEMBLY" in "REMOVAL AND INSTALLATION" under "AWD SYSTEM")  
6. Install the intermediate shaft and RH drive shaft. (see "FRONT DRIVE SHAFT" under "REMOVAL AND INSTALLATION" in "DRIVE SHAFT & AXLE SYSTEM")  
7. Fill the A/T fluid. (see "A/T FLUID CHANGE")

Modification basis	
Application basis	
Affected VIN	



### 3) D16DTF

#### (1) Differential Oil Seal & Special Tools

LH oil seal (2WD/AWD)	RH oil seal (2WD)	RH oil seal (AWD)
		
		
[Part no.: 90311 43A007]	[Part no.: 90311 40A016]	(A) [Part no.: 90311 34A006] (B) [Part no.: 90311 64A003]

LH oil seal installer (2WD/AWD)	RH oil seal installer (2WD)	RH oil seal installer (AWD)
		
[Selling: <a href="http://www.toolntech.com">http://www.toolntech.com</a> ]		



## (2) Differential oil seal (to case)

### ► Removing and fitting LH oil seal (D16DTF-2WD/AWD)

#### Preceding work

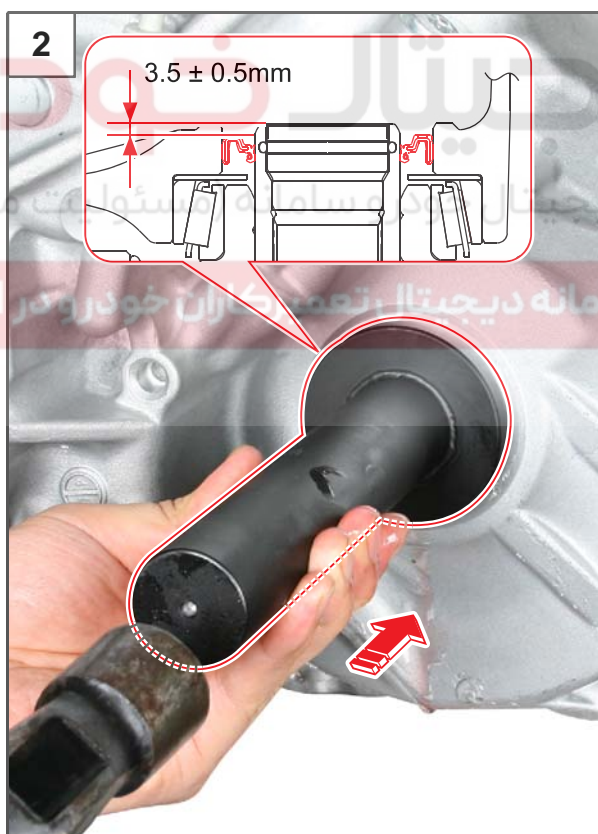
- Drain the A/T fluid. (see "A/T FLUID CHANGE")
- Remove the LH drive shaft. (see "FRONT DRIVE SHAFT" under "REMOVAL AND INSTALLATION" subsection of "DRIVE SHAFT & AXLE SYSTEM" in "CHASSIS" chapter)



1. Remove the LH oil seal from using the AISIN 6A/T oil seal puller (both LH and RH sides) [part no.: X9936 0130A].  
- LH oil seal part no.: 90311 43A007

#### ⚠ CAUTION

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



2. Temporarily fit the new oil seal to the correct direction and install it to the transmission case using a 2WD/AWD-A/T deep oil seal installer (LH) and a hammer.



#### NOTE

Oil seal assembly standard:  $3.5 \pm 0.5\text{mm}$  (from the end of the case)

#### ⚠ CAUTION

Be careful not to damage the oil seal.



3. Install the LH drive shaft. (see "FRONT DRIVE SHAFT" under "REMOVAL AND INSTALLATION" in "DRIVE SHAFT & AXLE SYSTEM")
4. Fill the A/T fluid. (see "A/T FLUID CHANGE")

Modification basis	
Application basis	
Affected VIN	

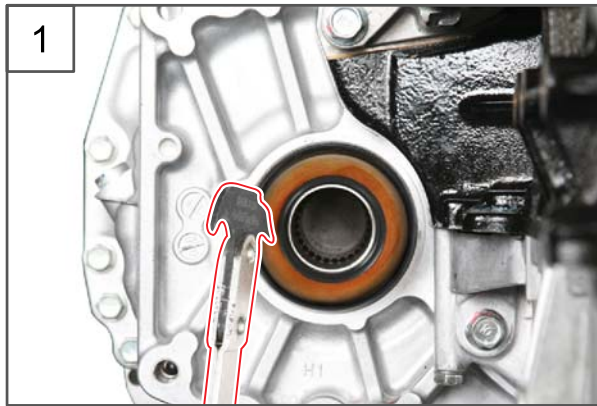


### (3) Differential oil seal (to housing)

#### ► Removing and fitting RH oil seal (D16DTF-2WD)

##### Preceding work

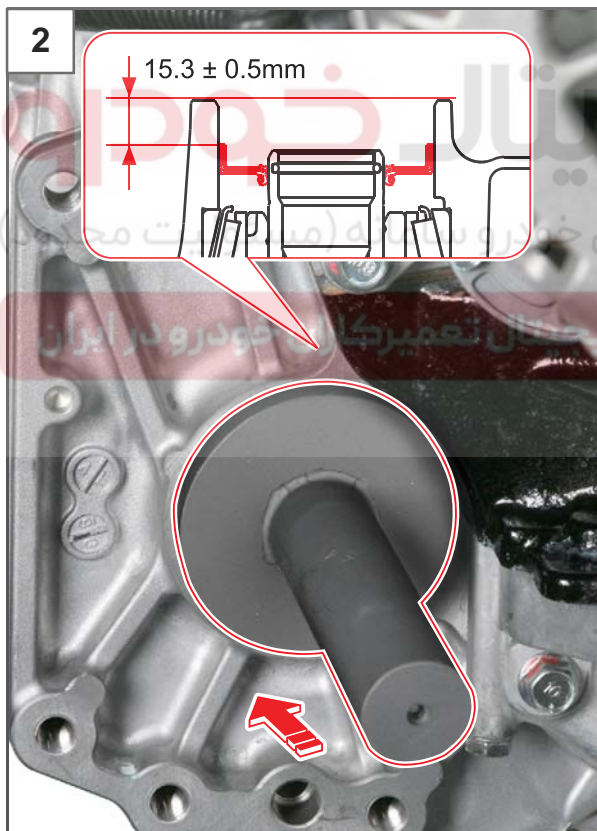
- Drain the A/T fluid. (see "A/T FLUID CHANGE")
- Remove the RH drive shaft. (see "FRONT DRIVE SHAFT" under "REMOVAL AND INSTALLATION" in "DRIVE SHAFT & AXLE SYSTEM")



1. Remove the RH oil seal from using the AISIN 6A/T oil seal puller (both LH and RH sides) [part no.: X9936 0130A].  
- RH oil seal part no.: 90311 40A016

#### ⚠ CAUTION

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



2. Temporarily fit the new oil seal to the correct direction and install it to the transmission housing using a 2WD-A/T deep oil seal installer(RH) and a hammer.

#### 💡 NOTE

Oil seal assembly standard:  $15.3 \pm 0.5\text{mm}$   
(from the end of the housing)

#### ⚠ CAUTION

Be careful not to damage the oil seal.



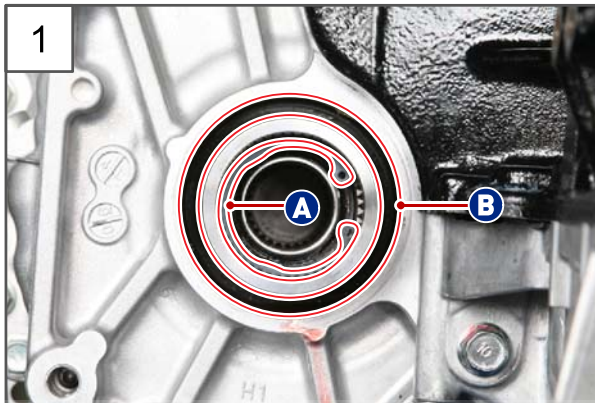
3. Install the LH drive shaft. (see "FRONT DRIVE SHAFT" under "REMOVAL AND INSTALLATION" in "DRIVE SHAFT & AXLE SYSTEM")
4. Fill the A/T fluid. (see "A/T FLUID CHANGE")



### ► Removing and fitting RH oil seal (D16DTF-AWD)

#### Preceding work

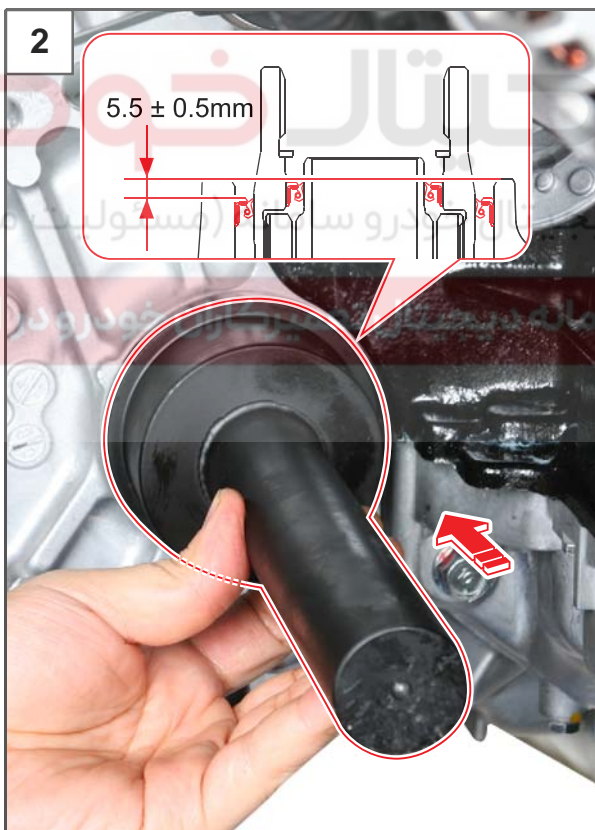
- Drain the A/T fluid. (see "A/T FLUID CHANGE")
- Remove the RH drive shaft and intermediate shaft. (see "FRONT DRIVE SHAFT" under "REMOVAL AND INSTALLATION" in "DRIVE SHAFT & AXLE SYSTEM")
- Remove the PTU. (see "PTU ASSEMBLY" in "REMOVAL AND INSTALLATION" under "AWD SYSTEM")



1. Remove the snap ring (A) using a snap ring plier and remove the RH outer oil seal (B).  
- RH outer oil seal part no.: 90311 64A003

#### ⚠ CAUTION

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



2. Temporarily fit the new oil seal to the correct direction, install it to the transmission housing using a AWD-A/T deep oil seal installer (RH) and a hammer.

#### 💡 NOTE

Oil seal assembly standard:  $5.5 \pm 0.5\text{mm}$   
(from the end of the housing)

#### ⚠ CAUTION

Be careful not to damage the oil seal.



Modification basis	
Application basis	
Affected VIN	

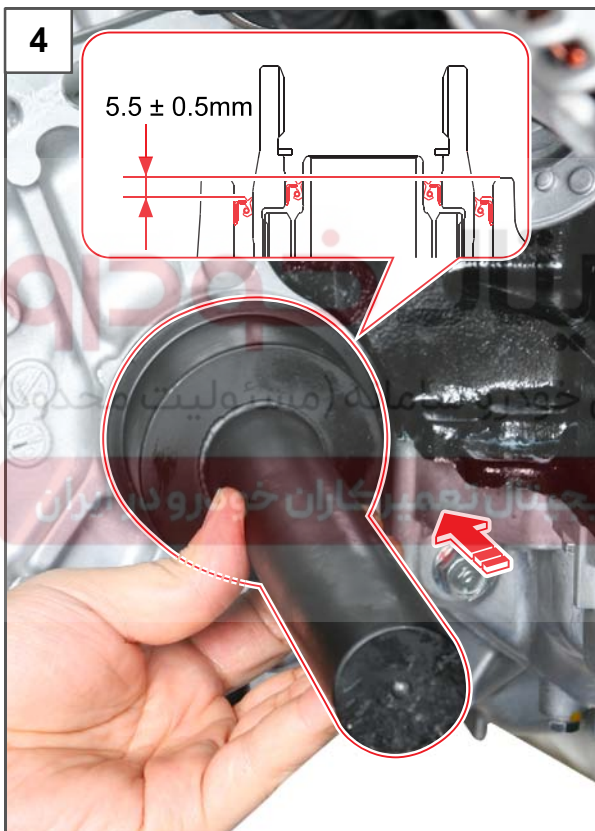




3. Remove the RH inner oil seal.  
- RH inner oil seal part no.: 90311 34A006

**CAUTION**

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



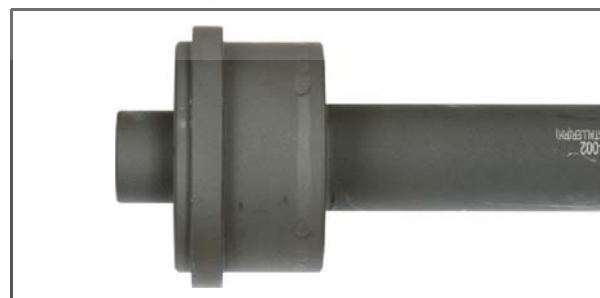
4. Temporarily fit the new oil seal to the correct direction and install it to the transmission housing using a AWD-A/T deep oil seal installer (RH) and a hammer and fit the snap ring to the inner spline.

**NOTE**

Oil seal assembly standard: T.B.D mm  
(from the end of the inner spline)

**CAUTION**

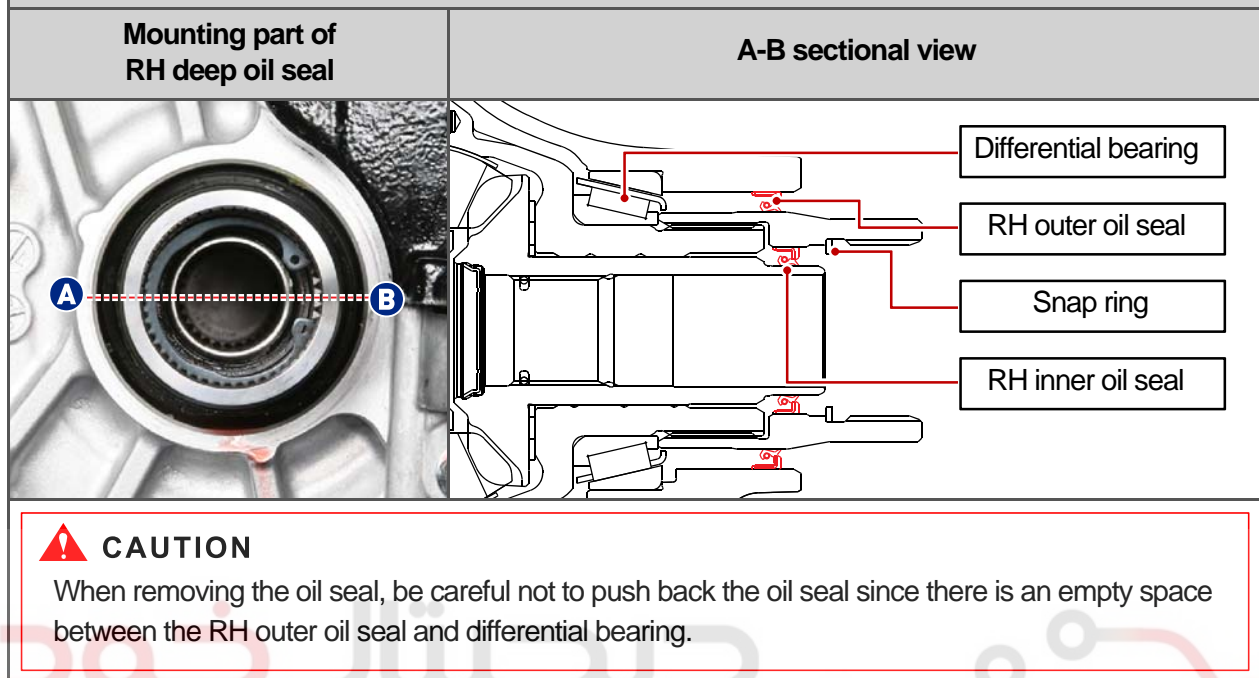
Be careful not to damage the oil seal.



5. Install the PTU. (see "PTU ASSEMBLY" in "REMOVAL AND INSTALLATION" under "AWD SYSTEM")  
6. Install the intermediate shaft and RH drive shaft. (see "FRONT DRIVE SHAFT" under "REMOVAL AND INSTALLATION" in "DRIVE SHAFT & AXLE SYSTEM")  
7. Fill the A/T fluid. (see "A/T FLUID CHANGE")



## Cautions for removing RH outer oil seal



شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

Modification basis	
Application basis	
Affected VIN	

AISIN 6 SPEED AUTO TRANSAXLE

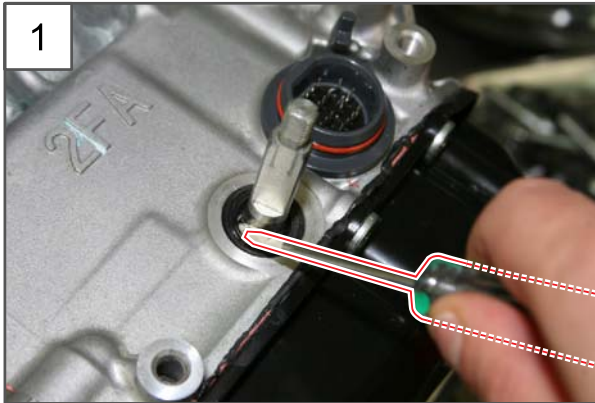
TIVOLI 2015.06



## 4) Manual Shaft Oil Seal

### (1) Removal

**Preceding work** - Remove the TCU. (see "TCU" in "REMOVAL AND INSTALLATION")

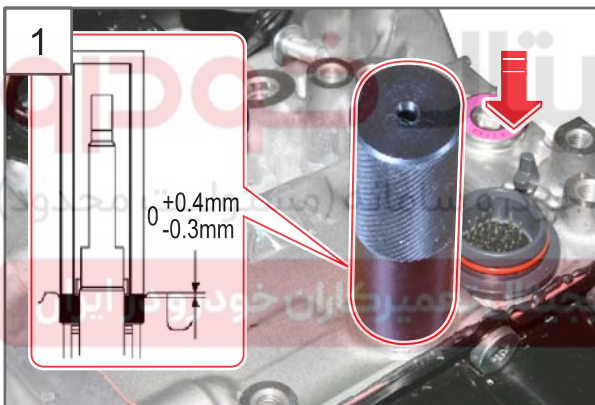


1. Remove the manual shaft oil seal using the screwdriver.

#### **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. (see "TCU" in "REMOVAL AND INSTALLATION")