## **General Information**

AT-3

### **General Information**

**Specifications** 

Item		Specifications	
Transmission type		A6LF2	
Engine mode	I	Diesel 2.0	
Torque converter	type	3-element, 1-stage, 2-phase type	
Torque converter	size	Ø260 mm (10.2362 in.)	
Oil pump syste	m	Parachoid	
		Clutch: 2EA	
Friction elemen	ıts	Brake: 3EA	
		OWC : 1EA	
Planetary gea	r	3EA	
	1st	4.252	
	2nd	2.654	
	3rd	1.804	
Gear ration	4th	1.386	
	5th	1.000	
نه (مسئولىت محدود)	6th	0.772	
نه (مسئولیت محدود)	Reverse	3.393	
Final gear rati	0	3.041	
Fluid pressure balance piston		2EA	
Accumulator		4EA	
Solenoid valve		8EA (VFS:6EA, ON/OFF:2EA)	
Shift lever position		4 Range (P,R,N,D)	
Oil filter		1EA	

VFS: Variable Force Solenoid

## **Automatic Transaxle System**

#### **Sensors**

Input Speed Sensor

□ Type: Hall effect sensor

▷ Specifications

Operation condition (°C)°F		((-)40~150)) -40~302	
Air gap(mm)in.		(0.95~1.55)0.950~1.55	
Output valtage(\(\lambda\)	High	1.18~1.68	
Output voltage(V) Low		0.59~0.84	

#### Output Speed Sensor

□ Type: Hall effect sensor

▷ Specifications

Operation condition (°C)°F		((-)40~150)) -40~302	
Air gap(mm)in.		(0.55~1)0.0217~0.0394	
Output valtage	High	1.18~1.68	
Output voltage Low		0.59~0.84	

# Oil Temperature Sensor

Specifications

Temp.[(°C)°F]	Resistance (kΩ)
(-40)-40	48.1
(-20)-4.0	15.6
(0)32.0	5.88
(20)68.0	2.51
(40)104.0	1.11
(60)140.0	0.61
(80)176.0	0.32
(100)212.0	0.18
(120)248.0	0.10
(140)284.0	0.06
(150)302	0.05

#### **Inhibitor Switch**

▷ Specifications

Power supply (V)	12
Output type	Pin to Pin

#### **Solenoid Valves**

Direct control VFS[26/B, T/CON]

Control type : Normal low type

Control Pressure kpa(kgf/	9.81~500.14(0.1~5.1,1.42 ~72.54)	
Current value(mA)	50~850	
Internal resistance(Ω)	5.1	

#### Direct control VFS[UD/B, OD/C, 35R/C]

Control Type : Normal high type

Control Pressure kpa(kgf/	500.14~9.81(5.1~0.1,72.5 4~1.42)	
Current value(mA)	50~850	
Internal resistance( $\Omega$ )	5.1	

## **General Information**

AT-5

Line Pressure Control VFS

Control type : Normal high type

Control Pressure kpa(kgf/	500.14~9.81(5.1~0.1,72.5 4~1.42)	
Current value(mA)	50~850	
Internal resistance(Ω)	5.1	

ON/OFF Solenoid Valve(SS-A, SS-B)

Control type : Normal low type

Control pressure kpa(kgf/	490.33(5.0, 71.12)	
Internal resistance(Ω)	10~11	

#### **Solenoid Valve Operation Table**

	SS A	ee n	UD/B-VFS	OD/C-VFS	35R/C-VFS	26/B-VFS
	SS-A	SS-B	N/H	N/H	N/H	N/L
N, P	•		•		•	
1	$\triangle$			$\triangle$	•	
2				•	•	•
3		•		•		
4					•	
5		• = 00	•			
6					•	
L	•				_•	
R	ه (ه سرع ما س	ن در و ساوان	II ::	·.<		

Connected status

△ : Connected at vehicle speed above 8km/h

# **Automatic Transaxle System**

### **Tightening Torques**

Item	N.m	Kgf.m	lb-ft	
TCM installation mounting bolt	9.8~11.8	1.0~1.2	7.2~8.7	
Shift cable bracket mounting bolt	17.7~24.5	1.8~2.5	13.0~18.1	
Input shaft speed sensor mounting bolt	9.8~11.8	1.0~1.2	7.2~8.7	
Output shaft speed sensor mounting bolt	9.8~11.8	1.0~1.2	7.2~8.7	
Shift lever assembly bolt	8.8~13.7	0.9~1.4	9.4~10.8	
Inhibitor switch mounting bolt	9.8~11.8	1.0~1.2	7.2~8.7	
Valve body cover mounting bolt	13.8~14.7	1.3~1.5	9.4~10.8	
Eyebolt	34.3~44.1	3.5~4.5	25.3~32.6	
Oil drain plug	34.3~44.1	3.5~4.5	25.3~32.6	
Oil level plug	34.3~44.1	3.5~4.5	25.3~32.6	
Torque converter mounting bolt	45.1~52.0	4.6~5.3	33.3~38.3	
Starter motor mounting bolt	49.0~63.7	5.0~6.5	36.2~47.0	
Automatic transaxle upper mounting bolt (TM=>Eng)	42.2~53.9	4.3~5.5	31.1~39.8	
Automatic transcula lower mounting helt (Fing-\TM\)	39.2~46.1	4.0~4.7	28.9~34.0	
Automatic transaxle lower mounting bolt (Eng=>TM)	42.2~53.9	4.3~5.5	31.1~39.8	
Automatic transaxle support bracket bolt	88.3~107.9	9.0~11.0	65.1~79.6	
سرکت دیجیتال خودرو سامانه (مسئولیت ملاکت دیجیتال خودرو سامانه (مسئولیت Lubricants				

Item	Specified lubricant	Quantity	
Transaxle fluid	SK ATF SP-IV, MICHANG ATF SP-IV, NOCA ATF SP-IV, Kia Genuine ATF SP-IV	7.8L (2.06 U.S gal., 8.24 U.S.qt., 6.86 Imp.qt.)	

#### Sealant

Item	Specified sealant	
Rear cover		
Torque converter housing	LOCTITE FMD-546 or THREE-BOND TB1281B	
Valve body cover		

# **General Information**

**AT-7** 

### **Special Service Tools**

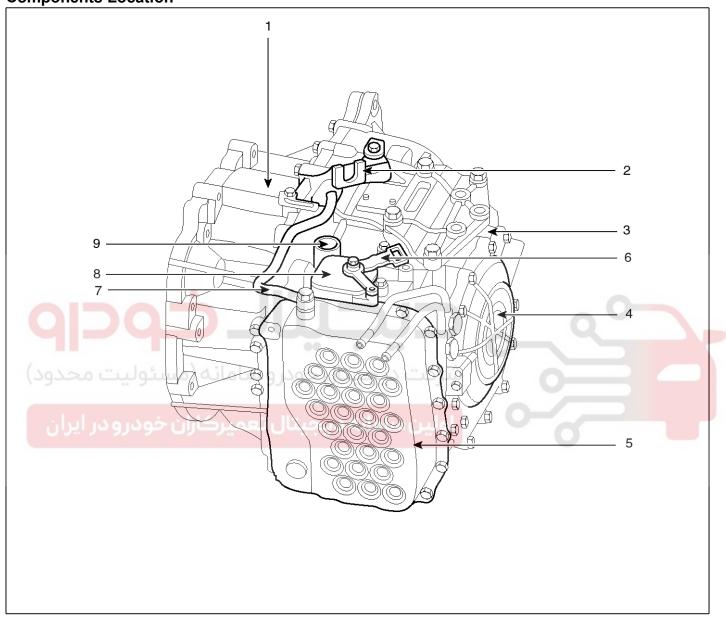
Tools (Number and name)	Illustration	Use
09200-38001 Engine support fixture (Beam)		Removal and installation of the transaxle.  Except lower supporter, use beam only with new engine support fixture supporter(SST No.:0 9200-2S000)
	KKBF030A	
09200-2S000 Engine support fixture (Supporter)		Removal and installation of the transaxle. Use this supporter with the upper beam of the engine support fixture(SST No.:09200-38001)
	SXMAT9080D	
09453-3L240 Oil seal installer		Installation of transaxle case oil seal. [Using with handle (SST No.:09231-H1100)]
	S97AT9116D	
09 <b>231-H1100</b> Bar		Installation of transaxle case oil seal. [Using with oil seal installer (SST No.:09453-3 L240)]
	SLD766035D	

# **Automatic Transaxle System**

### **Automatic Transaxle System**

### **Automatic Transaxle**

**Components Location** 



SYFAT0008D

- 1. Converter housing
- 2. Shift cable bracket
- 3. Automatic transaxle case
- 4. Rear cover
- 5. Valve body cover

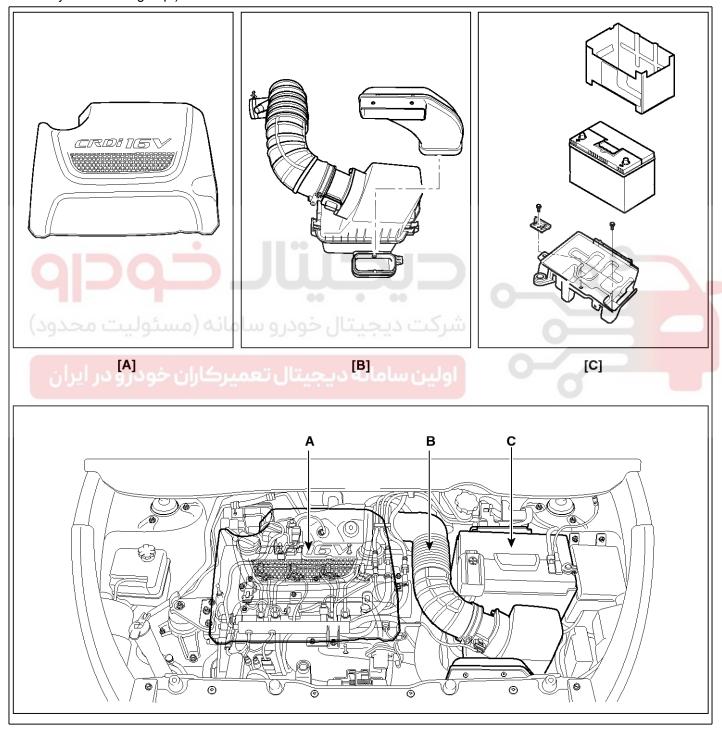
- 6. Manual control lever
- 7. Air breather hose
- 8. Inhibitor switch
- 9. Solenoid valve connector

# **Automatic Transaxle System**

**AT-9** 

#### Removal

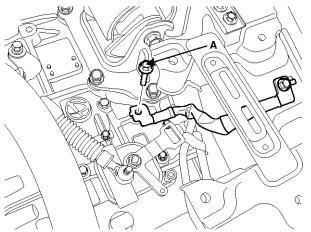
- 1. Remove the following items;
  - Engine cover (A).
  - Air cleaner assembly and air duct (B). (Refer to "Intake and Exhaust system" in EM group.)
  - Battery and battery tray (C). (Refer to "Charging system" in EE group.)



SSLAT0025D

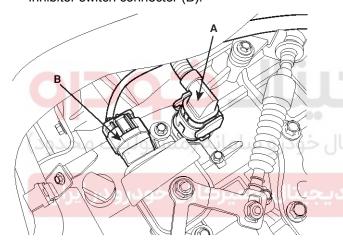
## **Automatic Transaxle System**

2. Remove the ground line after removing the bolt (A).



SXMAT9003D

3. Dissconnect the solenoid valve connector (A) and inhibitor switch connector (B).

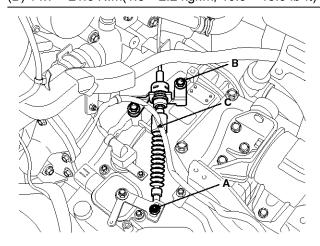


SVGAB0004D

4. Remove the control cable (C) after removing the nut (A) and the bolt (B).

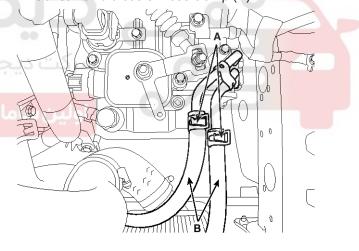
#### Tightening torque:

(A) 7.8  $\sim$  11.8 N.m (0.8  $\sim$  1.2 kgf.m, 5.8  $\sim$  8.7 lb-ft) (B) 14.7  $\sim$ 21.6 N.m(1.5  $\sim$ 2.2 kgf.m, 10.9  $\sim$ 15.9 lb-ft)



SLMAT0005D

5. Disconnect the hose (B) after removing the automatic transaxle fluid cooler hose clamp (A).

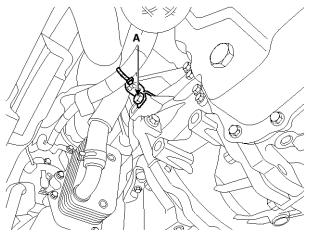


SSLAT0042D

## **Automatic Transaxle System**

**AT-11** 

6. Remove the wiring bracket installation bolt (A).

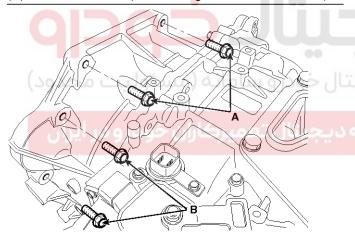


SSLAT0040D

7. Remove the automatic transaxle upper mounting bolt (A-2ea) and the starter motor mounting bolt (B-2ea).

#### **Tightening torque:**

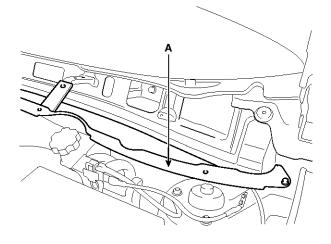
(A)  $42.2 \sim 54.0$  N.m  $(4.3 \sim 5.5$  kgf.m,  $31.1 \sim 39.8$  lb-ft) (B)  $49.0 \sim 63.7$  N.m  $(5.0 \sim 6.5$  kgf.m,  $36.2 \sim 47.0$  lb-ft)



SCMAT0001D

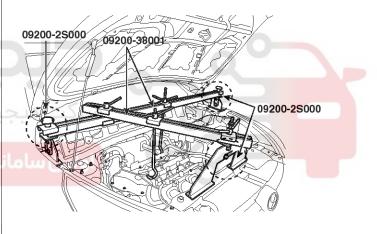
8. Remove the cowl top cover or wiper motor. (Refer to "Windshield Wiper/Washer" in BE group.)

9. Remove the cowl complete assembly panel (A).



SLMAT0013D

10. Using the engine support fixture (Support SST No.: 09200-2S000, Beam SST No.: 09200-38001), hold the engine and transaxle assembly safely.



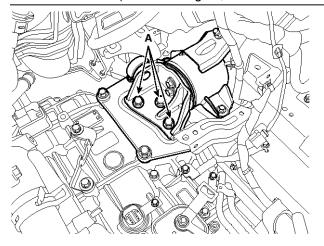
SXMAT9082D

### **Automatic Transaxle System**

11. Remove the automatic transaxle mounting support bracket bolt (A).

#### **Tightening torque:**

 $88.3 \sim 107.9 \text{ N.m} (9.0 \sim 11.0 \text{ kgf.m}, 65.1 \sim 79.8 \text{ lb-ft})$ 



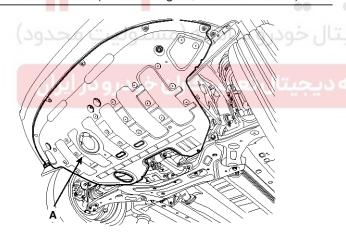
SLMAT0021D

12. Lift the vehicle with a jack.

13. Remove the under cover (A).

#### Tightening torque:

 $19.6 \sim 24.5 \text{ N.m} (2.0 \sim 2.5 \text{ kgf.m}, 14.5 \sim 18.1 \text{ lb-ft})$ 



SSLAT0021D

14. Remove the following items;

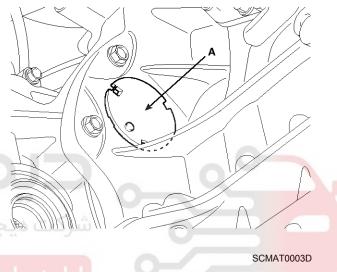
#### 2WD

 Remove the drive shaft assembly. (Refer to "Drive shaft assembly" in DS group.)

#### 4WD

- Sub frame assembly. (Refer to "Front suspension system" in SS group.)
- Drive shaft assembly. (Refer to "Drive shaft assembly" in DS group.)
- Transfer assembly. (Refer to "Transfer assembly" in WD group)

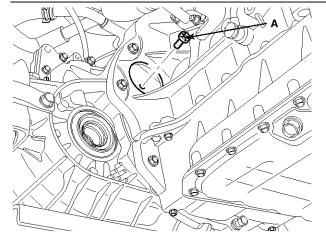
#### 15. Remove the dust cover(A).



16. Remove the torque converter mounting bolt (A-4ea) with rotating the crankshaft.

#### Tightening torque:

45.1  $\sim$  52.0 N.m (4.6  $\sim$  5.3 kgf.m, 33.3  $\sim$  38.3 lb-ft)

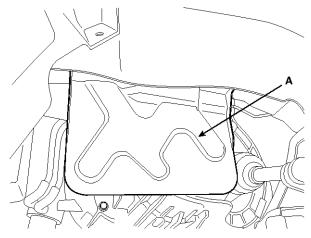


SCMAT0004D

## **Automatic Transaxle System**

**AT-13** 

17. Remove the side cover (A).

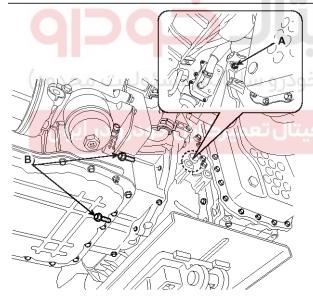


SSLMT1006D

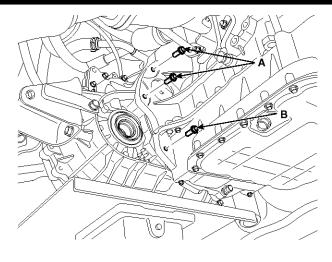
18. Remove the automatic transaxle with a jack after removing the mounting bolt (A-4ea, B-2ea).

#### **Tightening torque:**

(A)  $42.2 \sim 53.9$  N.m  $(4.3 \sim 5.5$  kgf.m,  $31.1 \sim 39.8$  lb-ft) (B)  $39.2 \sim 46.1$  N.m  $(4.0 \sim 4.7$  kgf.m,  $28.9 \sim 34.0$  lb-ft)



SSLAT0100D



SSLAT0114D

#### Installation

1. Installation is the reverse of removal.

#### **⚠**CAUTION

If the oil seal on the transaxle case side is damaged and fluid is leaking, replace the oil seal with a new unit. When installing the new oil seal, use the specialized tool (oil seal installer, 09453-3L240).

#### MNOTICE

After replacement or reinstallation procedure of the automatic transaxle assembly, must perform procedures below.

- Power steering fluid replacement and air bleeding.
   (Refer to "General information" in ST group)
- Adding automatic transaxle fluid. (Refer to "Hydraulic system (Fluid)" in this group)
- After servicing the automatic transaxle or TCM, clear the diagnostic trouble codes (DTC) using the GDS tool.
  - Diagnostic trouble codes (DTC) cannot be cleared by disconnecting the battery.
- When replacing the automatic transaxle and TCM, reset the diagnostic trouble code by using GDS.
- When deleting diagnostic trouble code, use the GDS as possible.
- When replacing the automatic transaxle, reset the automatic transaxle's values by using the GDS.
- Perform TCM learning after replacing the transaxle to prevent slow transaxle response, jerky acceleration and jerky startup. (Refer to "Automatic transaxle control system (Repair procedures)" in this group)

# **Automatic Transaxle System**

### **Hydraulic System**

#### **Description**

The hydraulic system consists of oil, an oil filter, an oil pump, and a valve body (valves and solenoid valves). The oil pump is powered by the engine. ATF passes through the oil filter and gets distributed along the oil channels. The oil becomes highly pressurized as it exits the oil pump and passes through the line pressure valve before being fed to the clutch & brake control valve, clutch, and brakes. TCM controls the hydraulic pressure using solenoid valves and controls clutch and brake operations.

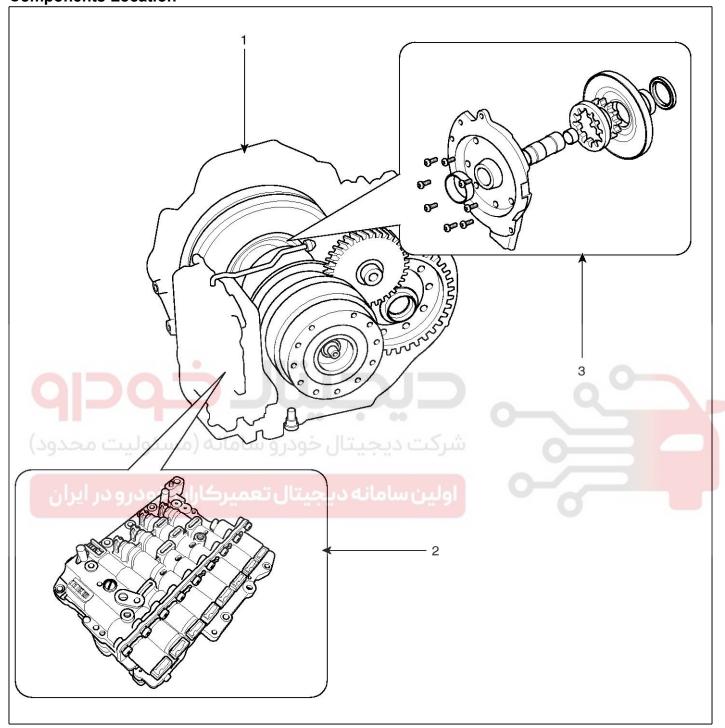




# **Hydraulic System**

**AT-15** 

**Components Location** 



SSLAT0001D

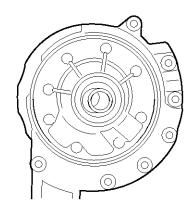
- 1. Automatic transaxle
- 2. Valve body assembly
- 3. Oil pump assembly

# **Automatic Transaxle System**

### **Oil Pump**

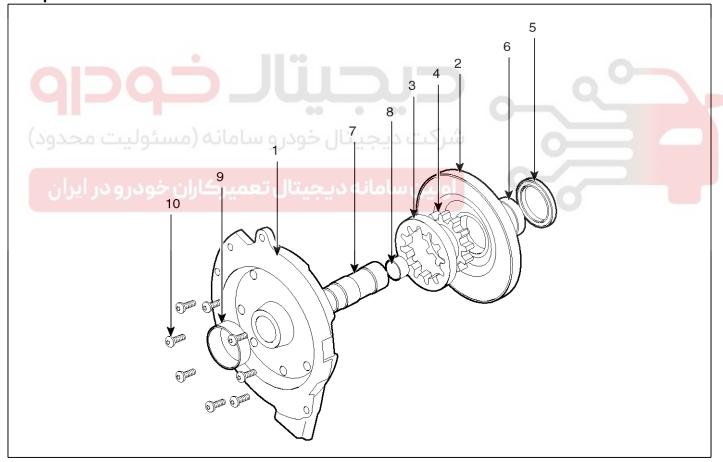
#### **Description**

The oil pump is built-in as a single unit with the 26 brake chamber. Rotation of the pump builds the hydraulic pressure needed for the lubrication of the various parts of the transaxle and operation of the clutch and brakes. The oil also circulates through the torque converter and the cooler.



SSLAT0101D

#### Components



SSLAT0002D

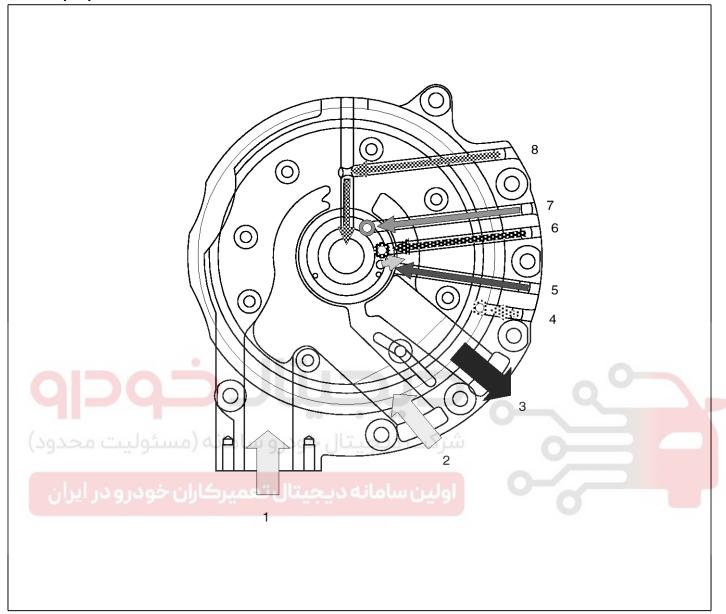
- 1. Reaction shaft support assembly
- 2. Oil pump housing
- 3. Driven gear
- 4. Drive gear
- 5. Oil seal

- 6. Bush-Housing
- 7. Reaction shaft
- 8. Bush- Reaction shaft
- 9. Sleeve
- 10. Bolt

# **Hydraulic System**

**AT-17** 

### **Oil Pump Operation Flow**



SSLAT0003D

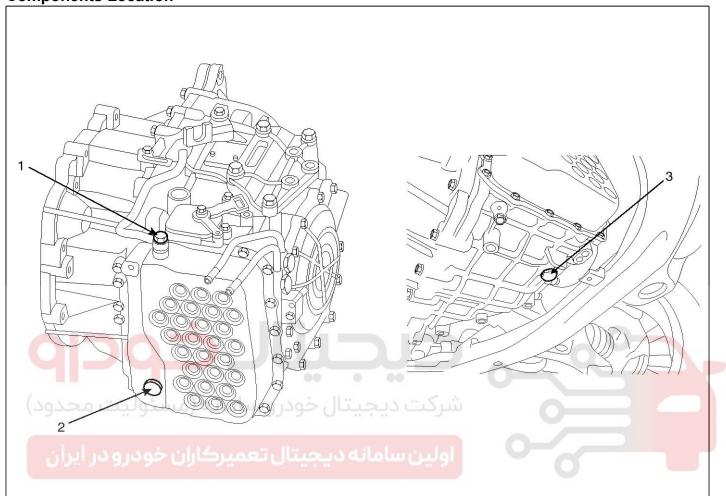
- 1. Inhale(Oil filter)
- 2. Inhale(Valve body)
- 3. Outlet
- 4. 26/B operation pressure

- 5. 35R/C operation pressure
- 6. Lubrication
- 7. Line up clutch operation pressure
- 8. Line up clutch cancellation

# **Automatic Transaxle System**

### Fluid

**Components Location** 



SSLAT0102D

- 1. Injection hole(eyebolt)
- 2. Oil level plug
- 3. Oil drain plug

### **Hydraulic System**

### **AT-19**

# Service Adjustment Procedure Oil level Check

#### MOTICE

A check of ATF level is not normally required during scheduled services. If an oil leak is found, perform the oil level check procedure after repairs are completed.

#### **A**CAUTION

When checking the oil level, be careful not to enter dust, foreign matters, etc. from fill hole.

1. Remove the eyebolt (A).

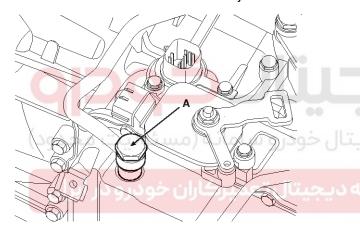
#### **Eyebolt tightening torque:**

 $34.3 \sim 44.1 \text{ N.m} (3.5 \sim 4.5 \text{ kgf.m}, 25.3 \sim 32.6 \text{ lb-ft})$ 

#### **⚠**CAUTION

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.

2. Add ATF SP-IV 700cc to the ATF injection hole.



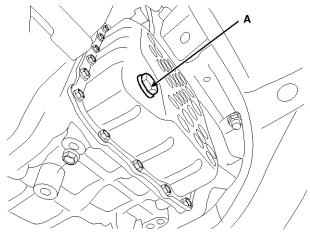
SLMAT0008D

- 3. Start the engine. (Don't step on brake and accelerator simultaneously.
- 4. Confirm that the temperature of the A/T oil temperature sensor is 50~60°C(122~140°F) with the GDS.
- 5. Shift the select lever slowly from "P" to "D", then "D" to "P" and repeat one more at idle.

#### **A**CAUTION

Keep on each speed position more than 2 sec.

6. Lift the vehicle, then remove the oil level plug (A) from the valve body cover.



SVGAT0002D

#### **⚠**CAUTION

At this time, the vehicle must be at a level state.

7. If the oil flows out of the overflow plug in thin steady stream, the oil level is correct.

Then finish the procedure and tighten the oil plug.

#### UNOTICE

Oil level check (excess or shortage) method

- Excess: Oil flows out in thick stream.
- Shortage: No oil flows out of the overflow plug.

#### **ACAUTION**

If there is no damage at the automatic transaxle and the oil cooler, the oil cooler hose, transaxle case, valve body tightening state are normal, ATF must drip out after performing above 1 to 7 procedures. After performing above 1 to 7 procedures, if the oil doesn't drip out, inspect the automatic transaxle assembly.

#### CAUTION

Replace the gasket of the oil level plug and use new one whenever loosening the oil level plug.

#### Oil level plug tightening torque:

 $34.3 \sim 44.1 \text{ N.m} (3.5 \sim 4.5 \text{ kgf.m}, 25.3 \sim 32.6 \text{ lb-ft})$ 

8. Put down the vehicle with the lift and then tighten the eyebolt.

# **Automatic Transaxle System**

#### Replacement

#### **MNOTICE**

ATF of 6 speed automatic transaxle doesn't need to be replaced. If the vehicle is used severely in business or personal use, replace ATF every 60,000 miles.

#### Severe usage is defined as

- Driving in rough road (Bumpy, Gravel, Snowy, Unpaved road, etc)
- · Driving in mountain road, ascent/descent
- · Repetition of short distance driving
- More than 50% operation in heavy city traffic during hot weather above 32° C(89.6° F).
- Police, Taxi, Commercial type operation or trailer towing, etc
- 1. Remove the drain plug (A) and reinstall the drain plug after draining ATF totally.





SYFAT0003D

#### Drain plug tightening torque:

34.3 ~ 44.1 N.m (3.5 ~ 4.5 kgf.m, 25.3 ~32.6 lb-ft)

### **ACAUTION**

The gasket of the drain plug use new one.

- 2. Fill the oil about 5 liters through eyebolt.
- 3. Check the oil level. (Refer to "Hydraulic system (Fluid)" in this group)

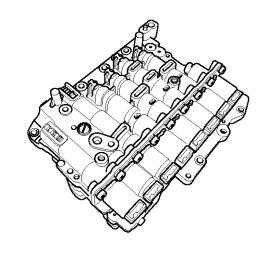
# **Hydraulic System**

### **AT-21**

### Valve Body

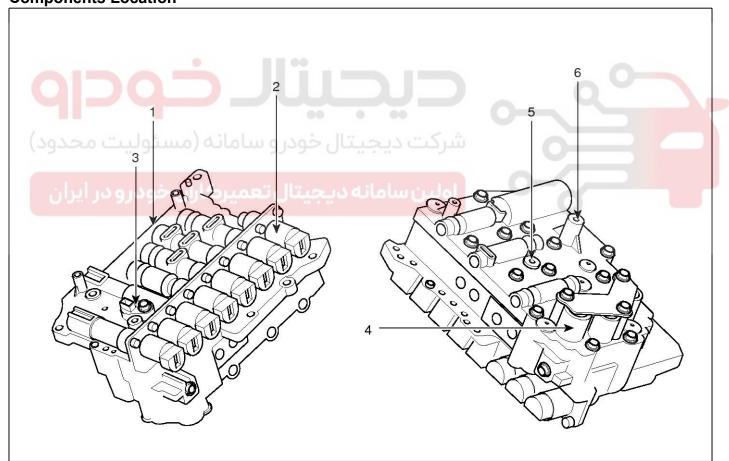
#### **Description**

The valve body is essential to automatic transaxle control and consists of various valves used to control the oil feed from the oil pump. Specifically, these valves consist of pressure regulator valves, oil redirection valves, shift valves, and manual valves. The body also features electronic solenoid valves that ensure smooth gear changes.



SSLAT0103D

#### **Components Location**



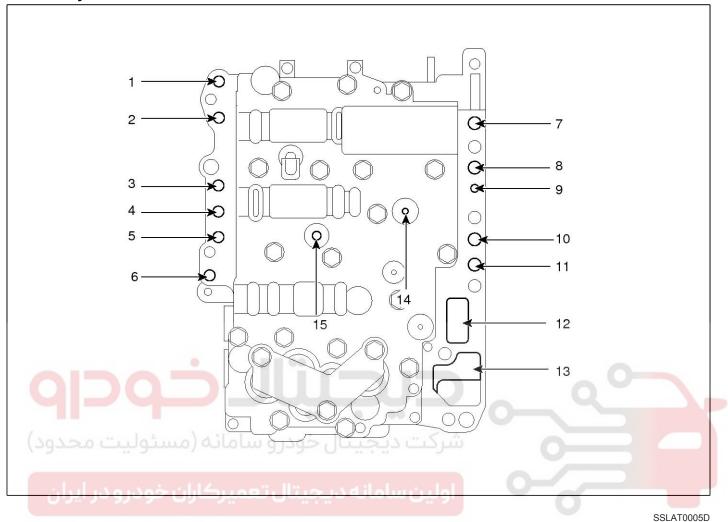
SSLAT0004D

- 1. PCV adjust screw
- 2. Solenoid valve
- 3. Oil temperature sensor

- 4. Accumulator
- 5. Low & reverse brake(LR/B) pressure flow hole
- 6. Under drive brake (UD/B) pressure flow hole

# **Automatic Transaxle System**

### **Valve Body Flow**



- 1. To cooler
- 2. From cooler
- 3. Lubrication(rear)
- 4. Overdrive pressure
- 5. Reducing pressure (red2)
- 6. Reducing pressure (red1)
- 7. From damper pressure
- 8. To damper pressure

- 9. Lubrication(front)
- 10. 35R clutch pressure
- 11. 26 brake pressure
- 12. From oil pump
- 13. To oil pump
- 14. Underdrive pressure
- 15. Low & reverse pressure

## **Hydraulic System**

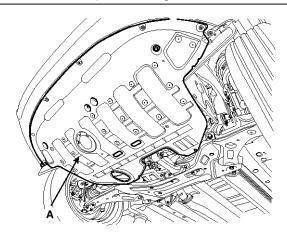
**AT-23** 

#### Removal

- 1. Remove the battery and the battery tray. (Refer to "Charging system" in EE group.)
- 2. Remove the under cover (A).

#### **Tightening torque:**

 $19.6 \sim 24.5 \text{ N.m} (2.0 \sim 2.5 \text{ kgf.m}, 14.5 \sim 18.1 \text{ lb-ft})$ 



SSLAT0021D

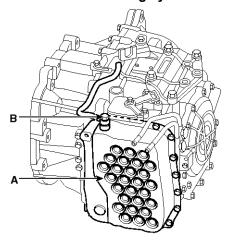
- 3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)
- 4. Remove the valve body cover (A) and eyebolt (B).

#### **Tightening torque:**

- (A)  $13.8 \sim 14.7 \text{ N.m}$  ( $1.3 \sim 1.5 \text{ kgf.m}$ ,  $9.4 \sim 10.8 \text{ lb-ft}$ )
- (B) 34.3 ~ 44.1 N.m (3.5 ~ 4.5 kgf.m, 25.3 ~ 32.6 lb-ft)

#### **⚠**CAUTION

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.

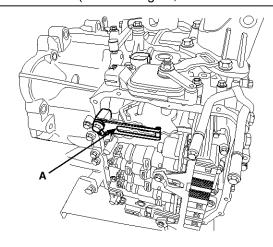


SSLAT1111N

5. Remove the plate and the detent spring (A) after removing the bolt.

#### Tightening torque:

 $24.5 \sim 35.3 \text{ N.m}$  (2.5  $\sim 3.6 \text{ kgf.m}$ ,  $18.1 \sim 26.0 \text{ lb-ft}$ )

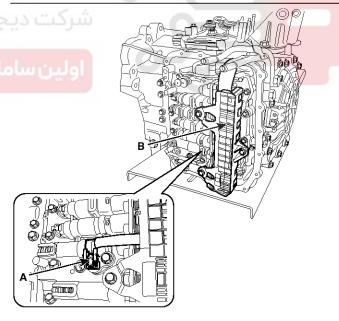


SLMAT0023E

 Remove the bolt (3ea) after disconnecting the solenoid valve (B) connector and the oil temperature sensor connector (A).

#### **Tightening torque:**

 $9.8 \sim 11.8 \text{ N.m} (1.0 \sim 1.2 \text{ kgf.m}, 7.2 \sim 8.7 \text{ lb-ft})$ 



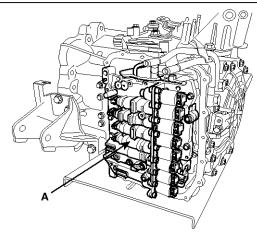
SLMAT0024D

### **Automatic Transaxle System**

7. Remove the valve body assembly (A).

#### **Tightening torque:**

 $9.8 \sim 11.8$  N.m (1.0  $\sim$  1.2 kgf.m, 7.2  $\sim$  8.7 lb-ft)



SCMAT0008L

#### Installation

1. Installation is the reverse of removal.

#### **A**CAUTION

After replacement or reinstallation procedure of the valve body assembly, must perform procedures below.

#### MOTICE

 Continue to apply liquid gasket at application points at the valve body cover with Ø2.5mm (0.0984in.) thickness.

Liquid gasket Part name :

Threebond 1281B or LOCTITE FMD-546

- Adding automatic transaxle fluid. (Refer to "Hydraulic system (Fluid)" in this group)
- Perform TCM learning after replacing the valve body to prevent slow transaxle response, jerky acceleration and jerky startup. (Refer to "Automatic transaxle control system (Repair procedures)" in this group)





### Clutch & Brake

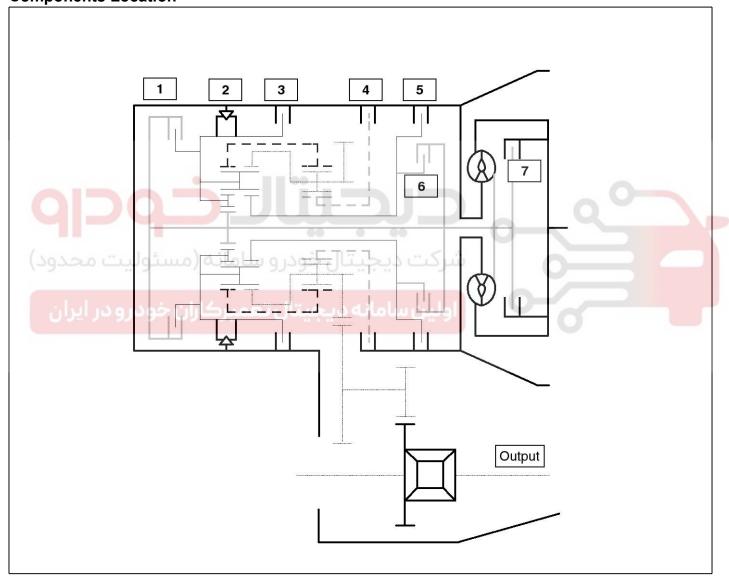
**AT-25** 

### Clutch & Brake

#### **Description**

The 6-spd automatic transaxle consists of an overdrive clutch (OD/C), a one-way clutch (OWC), a lower and reverse brake (LR/B), an underdrive brake (UD/B), a 26 brake (26/B), and a 35R clutch (35R/C). These clutches and brakes are operated by controlling the hydraulic pressure.

**Components Location** 



SSLAT1006N

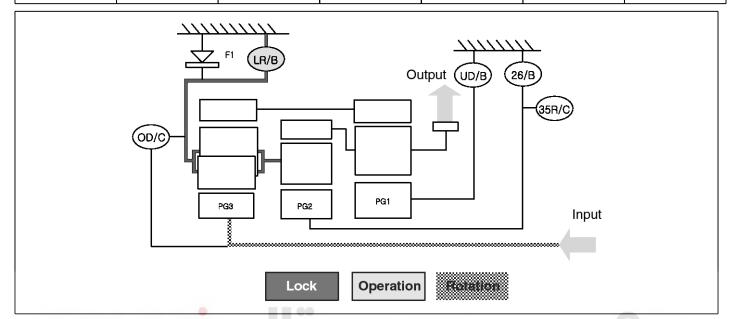
- 1. Overdrive clutch (OD/C)
- 2. One way clutch (OWC)
- 3. Low & Reverse brake (LR/B)
- 4. Underdrive brake (UD/B)

- 5. 26 brake(26/B)
- 6. 35R clutch (35R/C)
- 7. Damper clutch (D/C)

# **Automatic Transaxle System**

#### **Power Flow Chart**

P,N	UD/B	LR/B	26/B	35R/C	OD/C	OWC
F,IN		•				



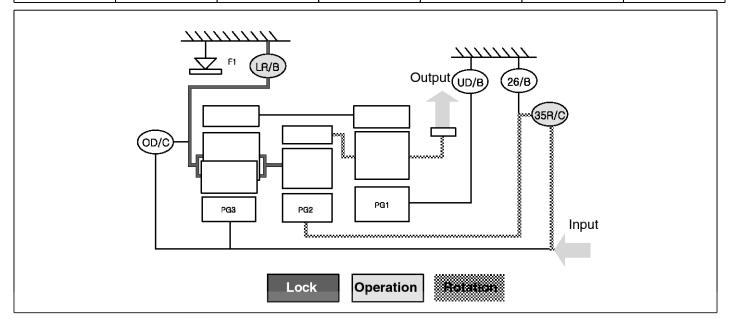
- Direction of Rotation
- ► Lower & Reverse Brake (LR/B) Activation → Overdrive (O/D) Hub Lock → Mid & Rear P/C Lock
- ▶Input Shaft Rotation → Rear Sun Gear Rotation → Rear Inner Pinion Rotation (Reverse) → Rear Outer Pinion Rotation → Rear Annulus Gear Rotation → Front Annulus Gear Rotation → Front Sun Gear Rotation (Reverse) → Underdrive (U/D) Hub Rotation (Reverse)
- ▶Input shaft rotation → Overdrive Clutch (OD/C) Retainer Rotation
- ▶ Input shaft rotation → 35R Clutch Rotation

SSLAT1007N

### Clutch & Brake

**AT-27** 

В	UD/B	LR/B	26/B	35R/C	OD/C	OWC
K		•		•		

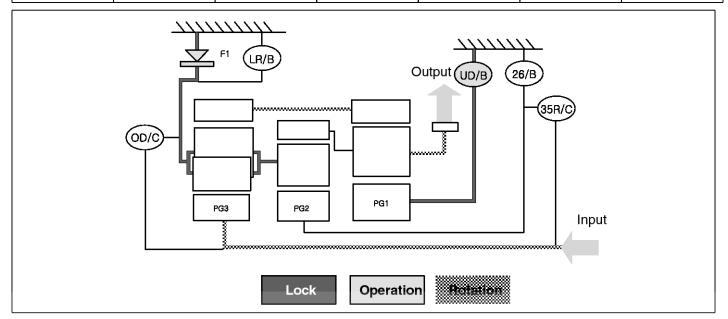


SSLAT1008N

- Power Delivery Route
- ► Middle carrier locked and middle sun gear in rotation
- ▶ Rotating the middle planetary gear's sun gear while its carrier is locked in place slows down and reverse rotates the annulus gear (front carrier), resulting in power transfer to the front carrier.
- ▶ The rear planetary gear's rear and front annulus gears rotate at a reduced rate, resulting in reverse, zero load rotation of the front planetary gear's front sun gear.

## **Automatic Transaxle System**

D1	UD/B	LR/B	26/B	35R/C	OD/C	OWC
	•	(0)				•



■ Power Delivery Route

► Front sun gear and middle & rear carrier locked and rear sun gear in constant rotation

▶ When the rear sun gear is rotated, power is reduced at the rear planetary gear and then delivered to the rear and front annulus gears. The power is then reduced again at the front planetary gear, whose sun gear is locked in place, and then delivered to the front carrier.

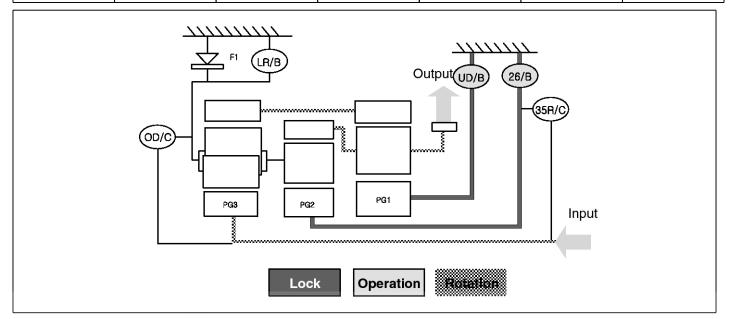
▶ Here, the middle annulus gear, which comprises of a single unit with the front carrier, rotates and results in reverse, zero load rotation of the middle sun gear.

SSLAT1009N

### Clutch & Brake

**AT-29** 

D2	UD/B	LR/B	26/B	35R/C	OD/C	OWC
D2	•		•			

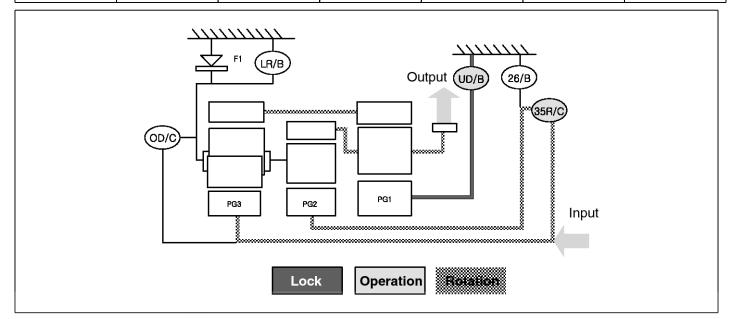


- Power Delivery Route
- ► Front sun gear and middle sun gear locked and rear sun gear in constant rotation
- ▶ Rotating the rear sun gear delivers power to the rear & front annulus gears, and reaction from the front carrier and the middle annulus gear, to which the sun gear is attached, transfers to the middle and rear carriers, resulting in power equilibrium and power transfer to the front carrier.



# **Automatic Transaxle System**

D3	UD/B	LR/B	26/B	35R/C	OD/C	OWC
D3	•			•		



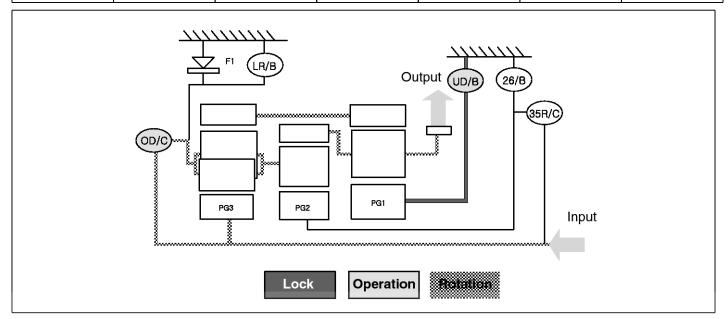
- Power Delivery Route
- ► Front sun gear locked and middle and rear sun gears in rotation
- ▶ Rotating the middle sun gear and the rear sun gear transfers power to the rear and front annulus gears, and reaction from the front carrier and the middle annulus gear, to which the sun gear is attached, transfers to the middle and rear carriers, resulting in power equilibrium and power transfer to the front carrier.

SSLAT1011N

### Clutch & Brake

**AT-31** 

D4	UD/B	LR/B	26/B	35R/C	OD/C	OWC
D4	•				•	

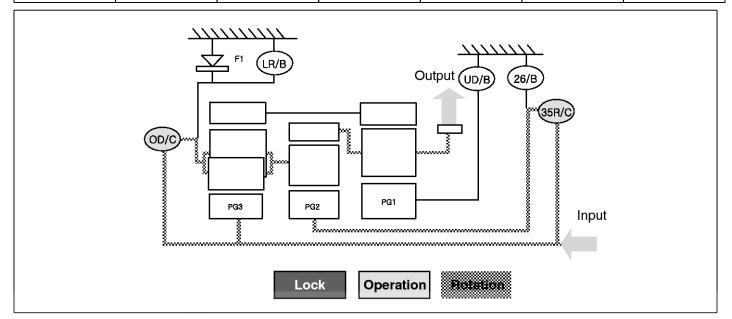


- Power Delivery Route
- Front sun gear locked and rear carrier and rear sun gears in rotation
- ▶ Activation of the overdrive clutch (OD/C) synchronizes the rear planetary gear's carrier and sun gears. The 1:1 rotation ratio passes through the rear and front annulus gears and reaches the front planetary gear's front carrier, to which the sun gear is attached.
- ▶ Here, the middle planetary gear's middle sun gear rotates at a faster rate in the normal direction and at zero load due to the actions of the reduced annulus gear and the carrier having a 1:1 rotation ratio.

SSLAT1012N

## **Automatic Transaxle System**

D5	UD/B	LR/B	26/B	35R/C	OD/C	OWC
D5				•	•	



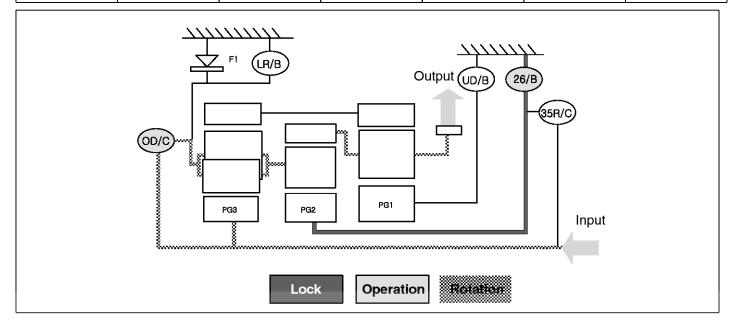
SSLAT1013N

- Power Delivery Route
- ► Middle and rear carriers, middle sun gear, and rear sun gear in rotation
- ▶ The middle planetary gear's middle carrier and sun gear rotate simultaneously, resulting in the 1:1 rotation ratio being transferred to the middle annulus gear (front carrier).
- ▶ Here, the rear planetary gear rotates in a 1:1 rotation ratio, as it would when the 4th gear is engaged; however, the front planetary gear remains unrestrained and the front sun gear rotates in the normal direction, at a zero load, and at a rotation ratio of 1:1.

## Clutch & Brake

**AT-33** 

D6	UD/B	LR/B	26/B	35R/C	OD/C	OWC
D0			•		•	



SSLAT1014N

- Power Delivery Route
- ► Middle carrier in rotation and middle sun gear locked
- ▶ When the middle planetary gear's sun gear is locked in place and the train's carrier's allowed to rotate, the middle annulus gear increases its rate of rotation and transfers power to the front carrier.
- ▶ Here, the rear planetary gear maintains a 1:1 rotation ratio as it would when 4th or 5th gear is engaged; however, the front planetary gear remains unrestrained and the front sun gear rotates at a faster rate in the normal direction and at zero load.

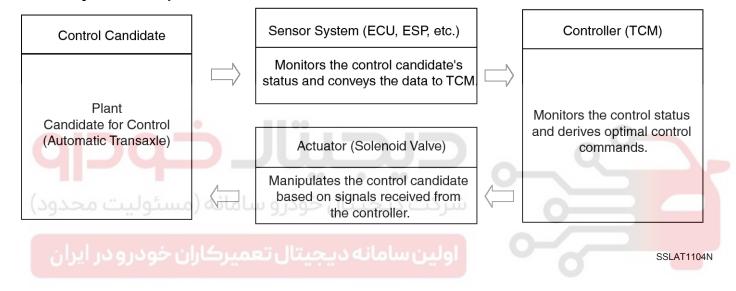
### **Automatic Transaxle System**

### **Automatic Transaxle Control System**

#### **Description**

Automatic transaxle system relies on various measurement data to determine the current control status and extrapolate the necessary compensation values. These values are used to control the actuators and achieve the desired control output. If a problem with the drivetrain, including the transaxle, has been identified, perform self-diagnosis and basic transaxle inspection (oil and fluid inspection) and then check the control system's components using the diagnosis tool.

### **Control System Composition**



### **Automatic Transaxle Control System**

**AT-35** 

#### **Fault Diagnosis**

Features a fail-safe mechanism that prevents dangerous situations from developing in the event of a transaxle failure. The limp home mode engages if the transaxle malfunctions. In this mode, the transaxle operates at a minimal functionality level, making it possible for the vehicle to reach a service center.

Fail-Safe: Prevents dangerous situations from developing in the event of a malfunction.

Limp Home: Maintains minimal functionality (\*) in the event of a malfunction, making it possible for the vehicle to reach a service center.

(\*) Minimal Functionality: Drive (fixed gear setting), Reverse, and Neutral

#### Self-diagnosis

TCM is in constant communication with the control system's components (sensors and solenoids). If an abnormal signal is received for longer than the predefined duration, TCM recognizes a fault, stores the fault code in memory, and then sends out a fault signal through the self-diagnosis terminal. Such fault codes are independently backed up and will not be cleared even if the ignition switch is turned off, the battery is disconnected, or the TCM connector is disconnected.

### فودر و سامانه (مسئولیت مCAUTION

Disconnecting a sensor or an actuator connector while the ignition switch is in the "On" position generates a diagnostic trouble code (DTC) and commits the code to memory. In such event, disconnecting the battery will not clear the fault diagnosis memory. The diagnosis tool must be used to clear the fault diagnosis memory.

#### **A**CAUTION

- Before removing or installing any part, read the diagnostic trouble codes and then disconnect the battery negative (-) terminal.
- Before disconnecting the cable from battery terminal, turn the ignition switch to OFF.
   Removal or connection of the battery cable during engine operation or while the ignition switch is ON could cause damage to the TCM.
- Wchecking the generator for the charging state, do not disconnect the battery '+' terminal to prevent the ECM from damage due to the voltage.
- When charging the battery with the external charger, disconnect the vehicle side battery terminals to prevent damage to the TCM.

#### **Checking Procedure (Self-diagnosis)**

#### CAUTION

- When battery voltage is excessively low, diagnostic trouble codes can not be read. Be sure to check the battery for voltage and the charging system before starting the test
- Diagnosis memory is erased if the battery or the TCM connector is disconnected. Do not disconnect the battery before the diagnostic trouble codes (DTC) are completely read and recorded.

#### Inspection Procedure (Using the GDS)

- 1. Turn OFF the ignition switch.
- 2. Connect the GDS to the data link connector on the lower crash pad.
- 3. Turn ON the ignition switch.
- 4. Use the GDS to check the diagnostic trouble code.
- 5. Repair the faulty part from the diagnosis chart.
- 6. Erase the diagnostic trouble code.
- 7. Disconnect the GDS.

#### **CAUTION**

- Perform TCM learning after replacing the automatic transaxle to prevent slow automatic transaxle response, jerky acceleration and jerky startup. (Refer to "Automatic transaxle control system (Repair procedures)" in this group)
- Adding automatic transaxle fluid. (Refer to "Hydraulic system (Fluid)" in this group)
- After servicing the automatic transaxle or TCM, clear the diagnostic trouble code (DTC) using the GDS tool. Diagnostic trouble codes (DTC) cannot be cleared by disconnecting the battery.

### **Automatic Transaxle System**

#### **Adjustment**

#### **TCM Learning**

When shift shock is occurred or parts related with the transaxle are replaced, TCM learning should be performed.

In the following case, TCM learning is required.

- · Transaxle assembly replacement
- · TCM replacement
- · TCM upgrading
- 1. TCM learning condition
  - ATF temperature: 60~115°C (140~239°F)
- 2. TCM learning procedure
  - A. Stop learning

Repeat the below shift pattern four times or more with stepping on the brake.



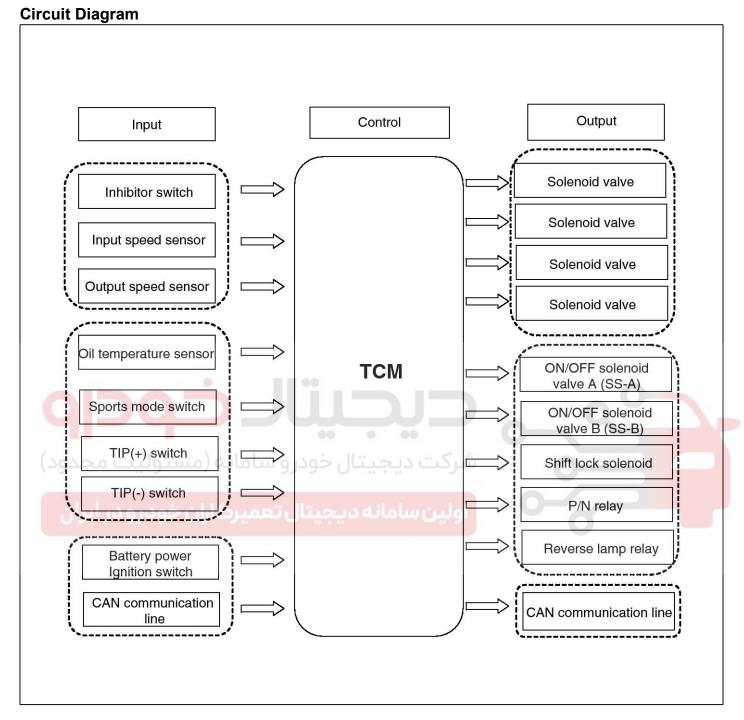
#### B. Driving learning

- Drive the vehicle through all gears at D range.
   Drive from stop to 1st to 2nd to 3rd to 4th to 5th to 6th with keeping fixed throttle open.
- 2. Down shift from 6th to 5th, 5th to 4th, 4th to 3rd, 3rd to 2nd, 2nd to 1st.
- Repeat the above driving pattern four times or more.

Up-shift throttle open: 15~30%

# **Automatic Transaxle Control System**

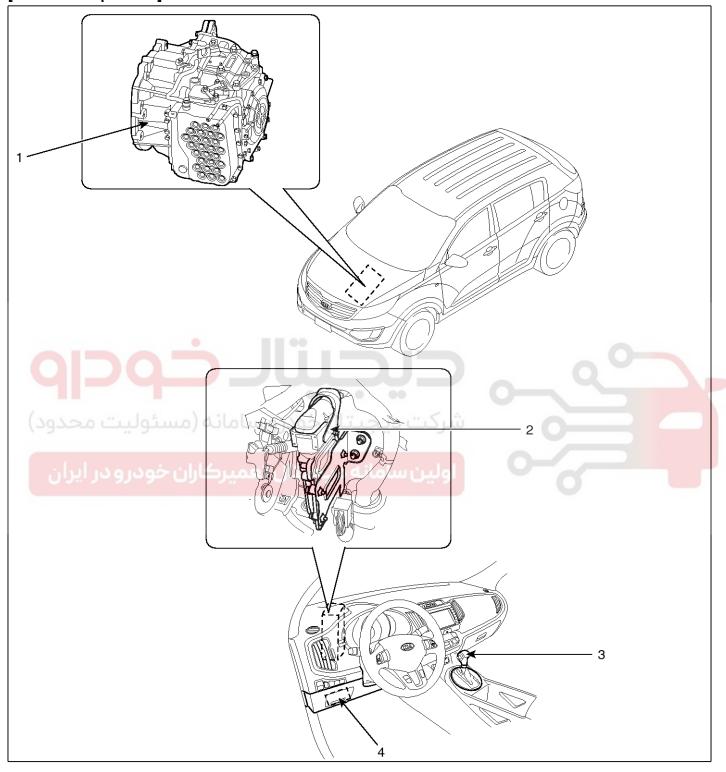
**AT-37** 



SSLAT1106N

# **Automatic Transaxle System**

# Components Location [Vehicle Components]



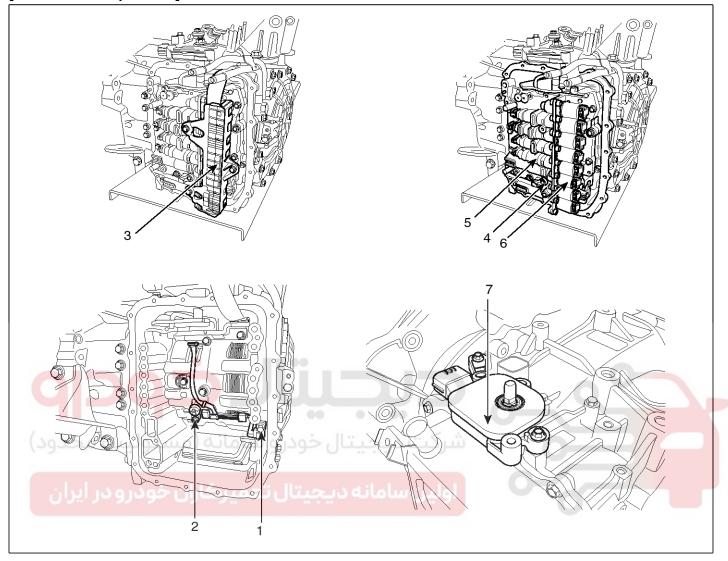
SSLAT0022D

- 1. Automatic transaxle
- 2. Transaxle control module (TCM)

- 3. Shift lever
- 4. (DLC)

**AT-39** 

### [Transaxle Components]



SLMAT0026D

- 1. Input speed sensor
- 2. Output speed sensor
- 3. Solenoid valve connect
- 4. Oil temperature sensor

- 5. Valve body assembly
- 6. Solenoid valve
- 7. Inhibitor switch

## **Automatic Transaxle System**

### **Transaxle Control Module (TCM)**

### **Description**

Transaxle Control Module (TCM) is the automatic transaxle's brain. The module receives and processes signals from various sensors and implements a wide range of transaxle controls to ensure optimal driving conditions for the driver. TCM is programmed for optimal response to any on-road situation. In the event of a transaxle failure or malfunction, TCM stores the fault information in memory so that the technician may reference the code and quickly repair the transaxle.

#### **Functions**

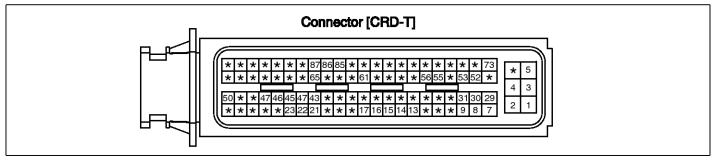
- Monitors the vehicle's operating conditions to determine the optimal gear setting.
- Performs a gear change if the current gear setting differs from the identified optimal gear setting.
- Determines the need for damper clutch (D/C) activation and engages the clutch accordingly.
- Calculates the optimal line pressure level by constantly monitoring the torque level and adjusts the pressure accordingly.
- Diagnoses the automatic transaxle for faults and failures.





**AT-41** 

### **TCM** connector and terminal function



SSLAT1100L

### **TCM Terminal Function**

Pin	Description	Pin	Description
1	Battery power	48	_
2	Battery power	49	_
3	Ignition switch	50	26 brake control solenoid valve (26/B_VFS)
4	Power ground	51	_
5	Power ground	52	ON/OFF solenoid valve A (SS-A)
6	- 11"	53	Reverse lamp relay
7	P/N relay	54	)
8	ON/OFF solenoid valve B(SS-B)	55	Input speed sensor signal
(29,22	Shift lock solenoid	56	Output speed sensor signal
10	_	57	
ایرا ر11	ه دیجیتال تعمی <del>ر</del> کاران خودرو در	58	lgl - lgl
12	_	59	
13	Inhibitor switch signal "S2"	60	_
14	Oil temperature sensor (+)	61	Sports mode select switch
15	Oil temperature sensor (-)	62	_
16	Sports mode up switch	63	_
17	Sports mode down switch	64	_
18	_	65	CAN communication line (LOW)
19	_	66	_
20	_	67	_
21	Inhibitor switch signal "S3"	68	_
22	Inhibitor switch signal "S4"	69	_
23	Inhibitor switch signal "S1"	70	_
24	_	71	_
25	_	72	_
26	_	73	Solenoid power 2

# **Automatic Transaxle System**

Pin	Description	Pin	Description
27	_	74	_
28	_	75	_
29	Solenoid power 1	76	_
30	Output speed sensor power	77	_
31	Input speed sensor power	78	_
32	_	79	_
33	_	80	_
34	_	81	_
35	_	82	_
36	_	83	_
37	_	84	_
38	_	85	_
39	_	86	_
40	_	87	CAN communication line (HIGH)
41		88	- 0-
42		89	
43	Torque converter control solenoid valve (T/C-ON_VFS)	90	شر
44	Overdrive clutch control solenoid valve (OD/C _VFS)	91	
45	35R clutch control solenoid valve (35R/C_VF-S)	92	
46	Line pressure control solenoid valve (LINE_V-FS)	93	_
47	Underdrive brake control solenoid valve (UD/B_VFS)	94	_

**AT-43** 

TCM Terminal input/ output signal

Pin Post in		0 1141	Inoutput value	
Pin	Description	Condition	Туре	Level
23	P range position switch 1	ON		Max. ≤ 16.0V
13	P range position switch 2	OFF	Digital	IVIAX. → 10.0V
22	P range position switch 3	ON	Digital	Min. ≥ 7.0V
21	P range position switch 4	ON		IVIIII. = 7.0V
23	R range position switch 1	OFF		Max. ≤ 16.0V
13	R range position switch 2	OFF	Digital	IVIAX. = 10.0V
22	R range position switch 3	OFF	Digital	Min. ≥ 7.0V
21	R range position switch 4	ON		IVIII1. = 7.0V
23	N range position switch 1	ON		Max. ≤ 16.0V
13	N range position switch 2	OFF	- Digital	IVIAA. = 10.0V
22	N range position switch 3	OFF	Digital	Min. ≥ 7.0V
21	N range position switch 4	ON		IVIIII. = 7.0V
23	D range position switch 1	ON		Max. ≤ 16.0V
13	D range position switch 2	OFF	Digital	Wax. = 10.0V
22	D range position switch 3	OFF ••	Digital	Min. ≥ 7.0V
21	D range position switch 4	ت دیـOFF	شركت	Wiii1. ≥ 7.0V
14	Oil temperature sensor signal (+)	-	Analog	Min.: 0 V
15	Oil temperature sensor signal (-)	ر سامانه دیج	Allalog	Max.: 5.1 V
61	Sports mode select switch	ON		Max. Low level threshold value ≤ 2.0 V
16	Sports mode up switch	OFF	Digital	Min. High level threshold value $\geq$ 4.0 V
17	Sports mode down switch	OFF		
56	Output anod concer signal	Revolution		Max. frequency : 9 kHz
50	Output speed sensor signal	Revolution	Pulse	Min. frequency: > 0 Hz
55	Input speed sensor signal	Revolution	Puise	Min. High Pulse: ≥ 25 μs
55	input speed sensor signar	Revolution		Min. Low Pulse: ≥ 25 μs
		P-R change		Min. Operation voltage: Battery voltage ≥ 6.0V
7	P/N relay		Output	Max. Operation voltage: Battery voltage e ≤ 16.0V
				P/N range position
	Chift look poloneid	ON	Outout	Max. current: 1A
9	Shift lock solenoid		Output	Output current: 1,0A
29	Solenoid power 1	-	Output	

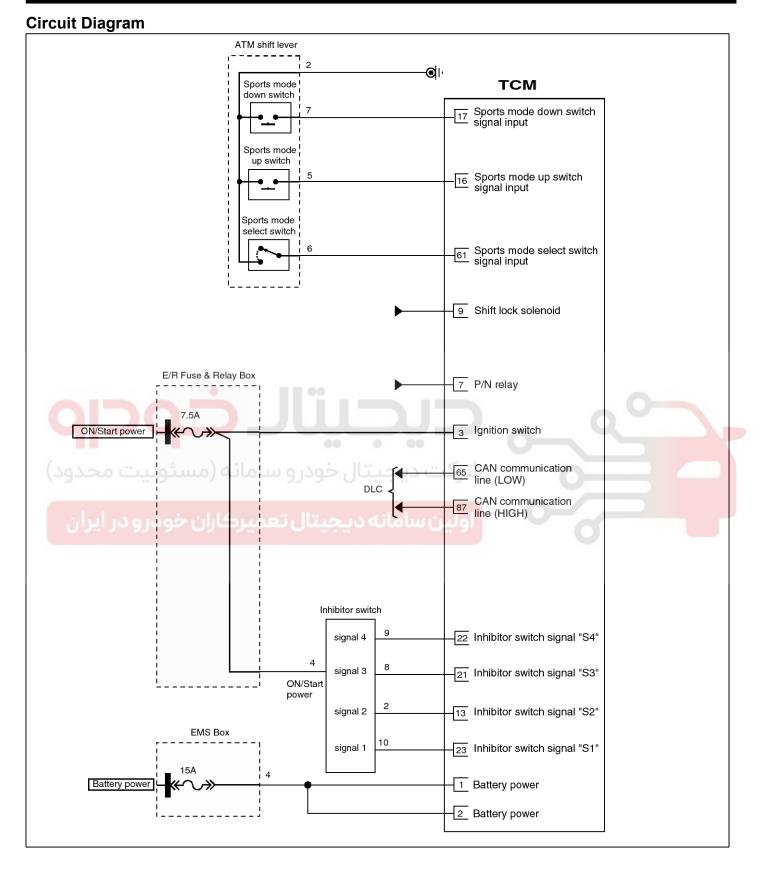
# **Automatic Transaxle System**

Pin	Description	Condition		Inoutput value	
Pilli	Description	Condition	Type	Level	
46	Line pressure control solenoid valve (LINE_VFS)	Variable duty		Max. Output current (TCM): 850 mA	
47	Underdrive brake control solenoid valve (UD/B_VFS)	Variable duty	VFS	Min. Output current (TCM): 50 Ma	
50	26 brake control solenoid valve (26/B_VFS)	Variable duty			
73	Solenoid power 2	-	Output		
43	Torque converter control solenoid valve (T/CON_VFS)	Variable duty		Max. Output current (TCM): 850 mA	
44	Overdrive clutch control solenoid valve (OD/C_VFS)	Variable duty	VFS	Min. Output current (TCM): 50 Ma	
45	35R clutch control solenoid valve (35R/C_VFS)	Variable duty			
52	ON/OFF solenoid valve A (SS-A)	ON/OFF	DVVVV	Output ourrent : 0.74	
8	ON/OFF solenoid valve B (SS-B)	ON/OFF	PWM	Output current : 0.7A	
53	Para lawasalaw	ON	Output	Max. Operation current: 0.3 A	
55	Reverse lamp relay		ON	ON	Output

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

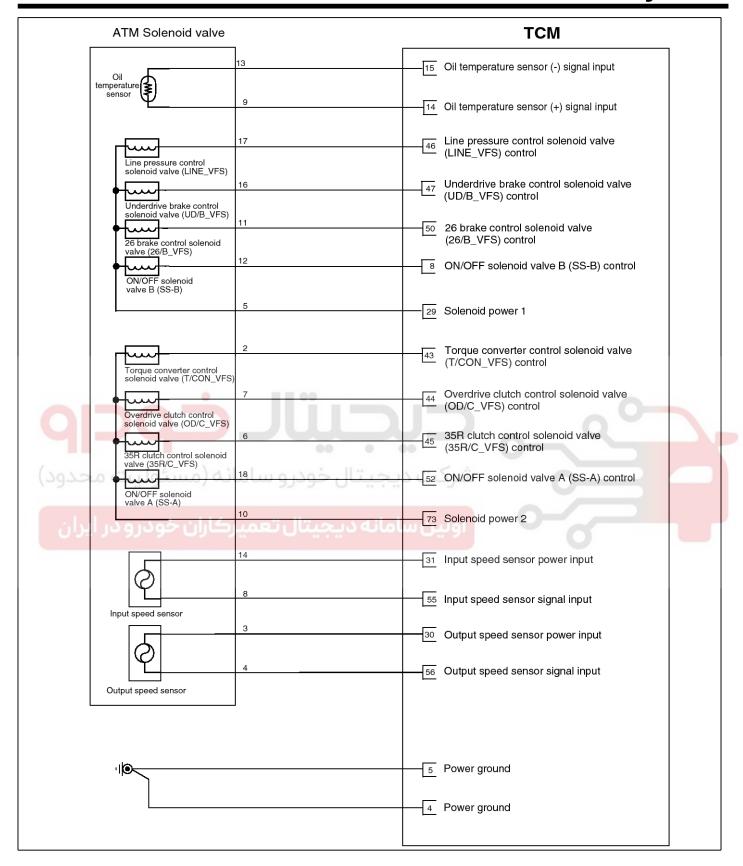
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

**AT-45** 



SSLAT1107L

# **Automatic Transaxle System**



SSLAT1108L

**AT-47** 

### Inspection

### **TCM Problem Inspection Procedure**

 TEST TCM GROUND CIRCUIT: Measure resistance between TCM and chassis ground using the backside of TCM harness connector as TCM side check point. If the problem is found, repair it.

Specification: Below  $1\Omega$ 

- 2. TEST TCM CONNECTOR: Disconnect the TCM connector and visually check the ground terminals on TCM side and harness side for bent pins or poor contact pressure. If the problem is found, repair it.
- 3. If problem is not found in Step 1 and 2, the TCM could be faulty. If so, make sure there were no DTC's before swapping the TCM with a new one, and then check the vehicle again. If DTC's were found, examine this first before swapping TCM.
- 4. RE-TEST THE ORIGINAL TCM: Install the original TCM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original TCM with a new one. If problem does not occur, this is intermittent problem (Refer to "Intermittent Problem Inspection Procedure" in Basic Inspection Procedure).

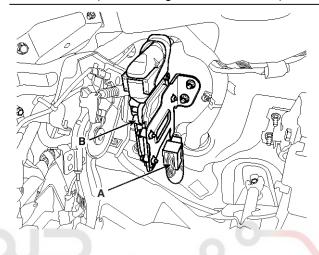
ه دیجیتال تعمیرکاران خودرو در ایران

### Replacement

- 1. Turn ignition switch OFF.
- 2. Disconnect the negative (-) battery cable.
- 3. Disconnect the TCM extension connector (A).
- 4. Remove the TCM (B) after removing the mounting nuts.

#### TCM installation bolt/nut:

 $7.8 \sim 9.8 \text{ N.m} (0.8 \sim 1.0 \text{ kgf.m}, 5.8 \sim 7.2 \text{ lb-ft})$ 



SSLAT0033D

### Installation

1. Installation is reverse of removal.

#### MNOTICE

In the case of the vehicle equipped with immobilizer or button engine start system, perform "Key Teaching" procedure together (Refer to "Immobilizer" or "Button Engine Start System in BE group).

## **Automatic Transaxle System**

### **Transaxle Oil Temperature Sensor**

### **Description**

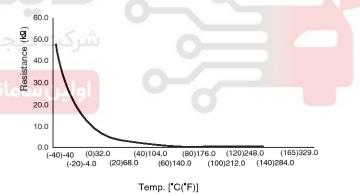
Transaxle oil temperature sensor monitors the automatic transaxle fluid's temperature and conveys the readings to TCM. It is an NTC (Negative Thermal Coefficient) sensor whose resistance has an inversely proportional relationship with the temperature level. Data produced by this sensor is used to identify damper clutch activation and deactivation zones within the low temperature and high temperature range and to compensate hydraulic pressure levels during gear changes.



SSLA10109D

### **Specifications**

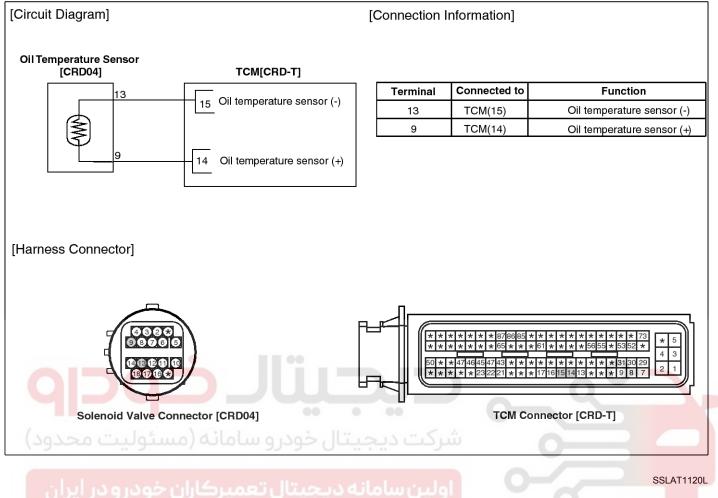
Temp.[(˚C)˚F]	Resistance (kΩ)
(-40)-40	48.1
(-20)-4.0	15.6
(0)32.0	5.88
(20)68.0	2.51
(40)104.0	1.11
(60)140.0	0.61
(80)176.0	0.32
(100)212.0	0.18
(120)248.0	0.10
(140)284.0	0.06
(150)302	0.05



SSLAT1110N

**AT-49** 





## **Automatic Transaxle System**

### Inspection

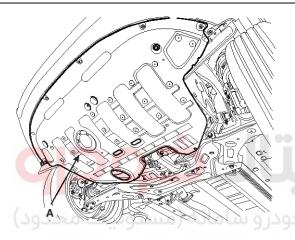
- 1. Turn ignition switch OFF.
- 2. Disconnect the oil temperature sensor connector.
- 3. Measure resistance between sensor signal terminal and sensor ground terminal.
- 4. Check that the resistance is within the specification.

### Removal

- 1. Remove the battery and the battery tray. (Refer to "Charging system" in EE group.)
- 2. Remove the under cover (A).

### **Tightening torque:**

19.6  $\sim$  24.5 N.m (2.0  $\sim$  2.5 kgf.m, 14.5  $\sim$  18.1 lb-ft)



SSLAT0021D

3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)

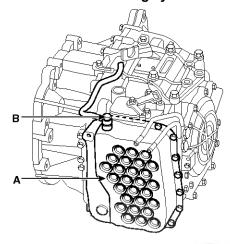
4. Remove the valve body cover (A) and eyebolt (B).

### Tightening torque:

- (A)  $13.8 \sim 14.7 \text{ N.m}$  ( $1.3 \sim 1.5 \text{ kgf.m}$ ,  $9.4 \sim 10.8 \text{ lb-ft}$ )
- (B) 34.3 ~ 44.1 N.m (3.5 ~ 4.5 kgf.m, 25.3 ~ 32.6 lb-ft)

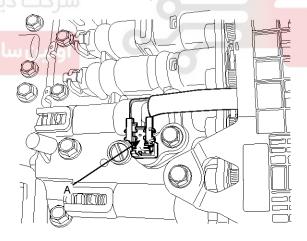
#### CAUTION

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.



SSLAT1111N

5. Disconnect the oil temperature sensor connector (A).



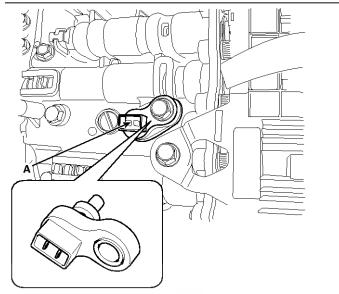
SCMAT0012L

**AT-51** 

6. Remove the oil temperature sensor (A) after removing a bolt.

### Tightening torque:

 $9.8 \sim 11.8 \text{ N.m} (1.0 \sim 1.2 \text{ kgf.m}, 7.2 \sim 8.7 \text{ lb-ft})$ 



#### Installation

1. Installation is the reverse of removal.

### MOTICE

After replacement or reinstallation procedure of the valve body assembly, must perform procedures below.

 Continue to apply liquid gasket at application points at the valve body cover with Ø2.5mm (0.0984in.) thickness.

Liquid gasket Part name : Threebond 1281B or LOCTITE FMD-546

 Adding automatic transaxle fluid. (Refer to "Hydraulic system (Fluid)" in this group)





## **Automatic Transaxle System**

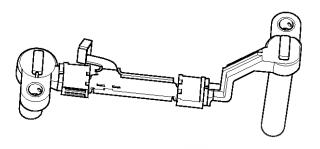
### **Input Speed Sensor**

### **Description**

Input speed sensor is a vital unit that measures the rate of rotation of the input shaft inside the transaxle and delivers the readings to the TCM. The sensor provides critical input data that's used in feedback control, damper clutch control, gear setting control, line pressure control, clutch activation pressure control, and sensor fault analysis.

### **Specifications**

Operation condition	on [°C(°F)]	((-)40~150)) -40~302
Air gap(mm)in.		(0.95~1.55)0.950~1.55
Output valtage (\( \)	High	1.18~1.68
Output voltage(V)	Low	0.59~0.84





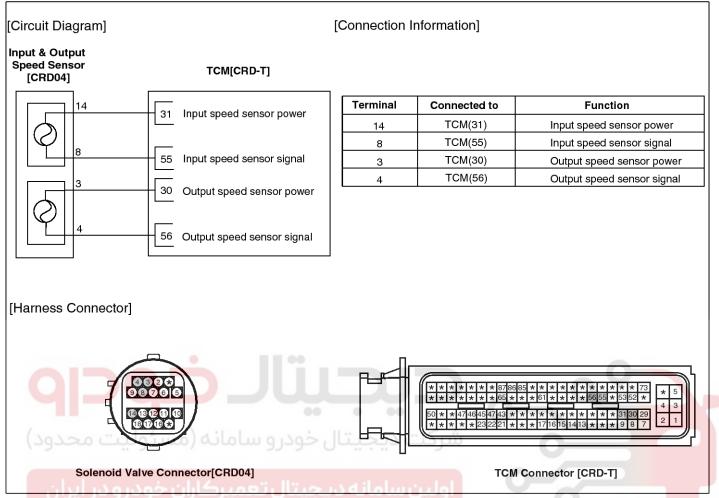
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اولین سامان<mark>ه دیجیتال تعمیرکاران خودرو در ایران</mark>



**AT-53** 

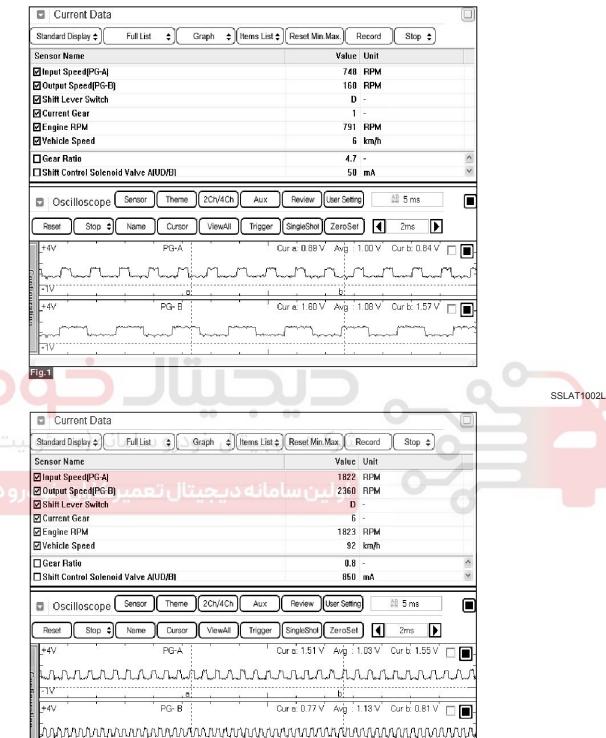




SSLAT1121L

## **Automatic Transaxle System**

### **Signal Waveform**



SSLAT1003L

Fig 1) Input/Output speed sensor at low speed

Fig 2) Input/Output speed sensor at high speed

**AT-55** 

### Inspection

1. Check signal waveform of Input & output speed sensor using the GDS.

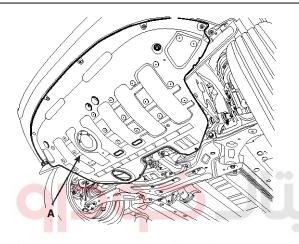
Specification: Refer to "Signal Wave Form" section.

### Removal

- 1. Remove the battery and the battery tray. (Refer to "Charging system" in EE group.)
- 2. Remove the under cover (A).

### **Tightening torque:**

19.6  $\sim$  24.5 N.m (2.0  $\sim$  2.5 kgf.m, 14.5  $\sim$  18.1 lb-ft)



SSLAT0021D

3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)

4. Remove the valve body cover (A) and eyebolt (B).

### Tightening torque:

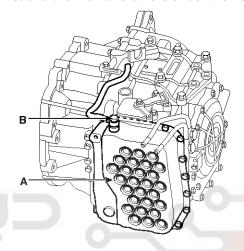
- (A)  $13.8 \sim 14.7 \text{ N.m}$  ( $1.3 \sim 1.5 \text{ kgf.m}$ ,  $9.4 \sim 10.8 \text{ lb-ft}$ )
- (B) 34.3 ~ 44.1 N.m (3.5 ~ 4.5 kgf.m, 25.3 ~ 32.6 lb-ft)

### **ACAUTION**

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.

#### MNOTICE

Remove installation bolts in the engine compartment first and then remove others under the vehicle.

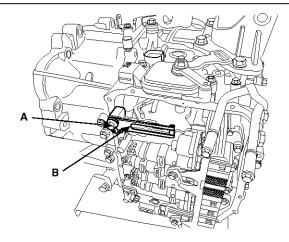


SSLAT1111N

Remove the plate and the detent spring (A) after removing the bolt.

### **Tightening torque:**

 $24.5 \sim 35.3 \text{ N.m}$  ( $2.5 \sim 3.6 \text{ kgf.m}$ ,  $18.1 \sim 26.0 \text{ lb-ft}$ )



SVGAA0006D

## **Automatic Transaxle System**

6. Remove the bolt (3ea) after disconnecting the solenoid valve connector (B) and the oil temperature sensor connector (A).

### **Tightening torque:**

 $9.8 \sim 11.8 \text{ N.m} (1.0 \sim 1.2 \text{ kgf.m}, 7.2 \sim 8.7 \text{ lb-ft})$ 

### **⚠**CAUTION

Be careful not to damage the harness lock connector.

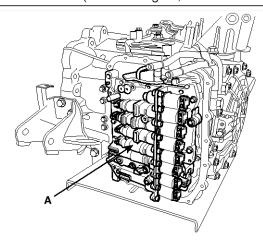


SLMAT0024D

7. Remove the valve body assembly (A).

#### **Tightening torque:**

 $9.8 \sim 11.8 \text{ N.m} (1.0 \sim 1.2 \text{ kgf.m}, 7.2 \sim 8.7 \text{ lb-ft})$ 

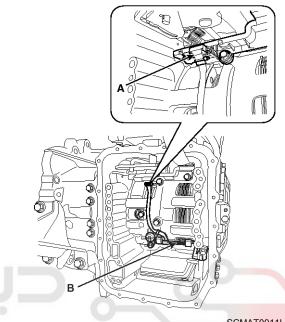


SCMAT0008L

- 8. Disconnect the input & output speed sensor connector(A).
- 9. Remove the input & output speed sensor (B) after removing the bolts(2ea).

### Tightening torque:

 $9.8 \sim 11.8 \text{ N.m} (1.0 \sim 1.2 \text{ kgf.m}, 7.2 \sim 8.7 \text{ lb-ft})$ 



SCMAT0011L

#### Installation

1. Installation is the reverse of removal.

#### MOTICE

After replacement or reinstallation procedure of the valve body assembly, must perform procedures below.

Continue to apply liquid gasket at application points at the valve body cover with Ø2.5mm (0.0984in.) thickness.

Liquid gasket Part name: Threebond 1281B or LOCTITE FMD-546

Adding automatic transaxle fluid. (Refer to "Hydraulic system (Fluid)" in this group)

**AT-57** 

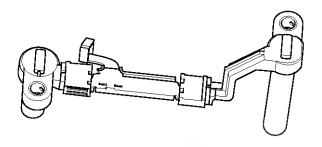
### **Output Speed Sensor**

### **Description**

The output speed sensor is a vital unit that measures the rate of rotation of the transaxle's turbine shaft and output shaft, and delivers the readings to the TCM. The sensor provides critical input data that's used in feedback control, damper clutch control, gear setting control, line pressure control, clutch activation pressure control, and sensor fault analysis.

### **Specifications**

Operation condition [°C(°F)]		((-)40~150)) -40~302
Air gap(mm)in.		(0.55~1)0.0217~0.0394
Output voltage	High	1.18~1.68
	Low	0.59~0.84





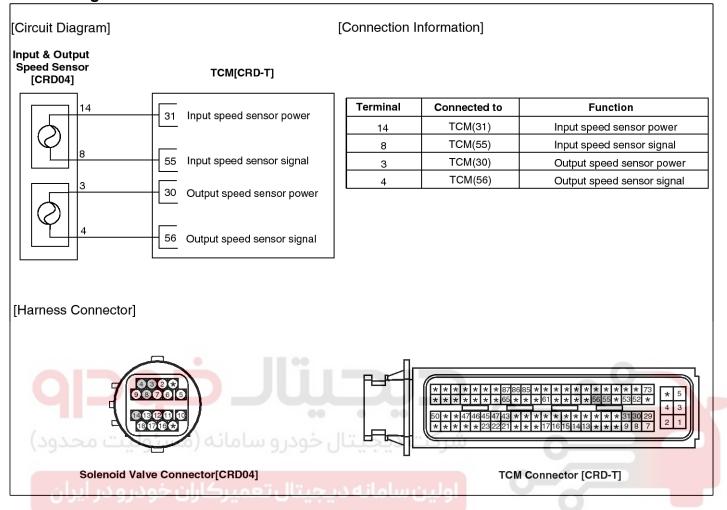
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اولین سامان<mark>ه دیجیتال تعمیرکاران خودرو در ایران</mark>



## **Automatic Transaxle System**

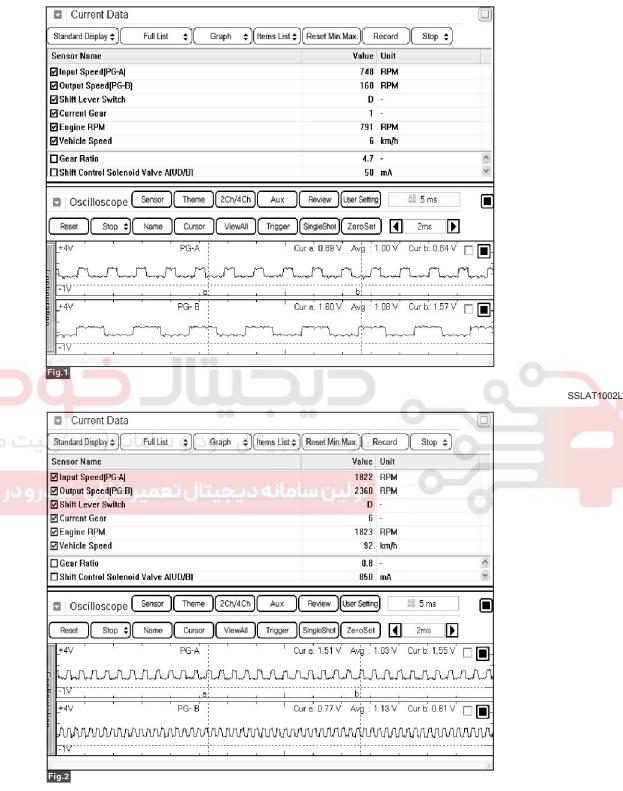
### **Circuit Diagram**



SSLAT1121L

**AT-59** 

### **Signal Waveform**



SSLAT1003L

Fig 1) Input/Output speed sensor at low speed

Fig 2) Input/Output speed sensor at high speed

## **Automatic Transaxle System**

### Inspection

1. Check signal waveform of Input & output speed sensor using the GDS.

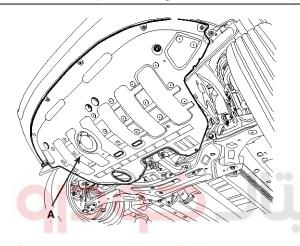
Specification: Refer to "Signal Wave Form" section.

### Removal

- 1. Remove the battery and the battery tray. (Refer to "Charging system" in EE group.)
- 2. Remove the under cover (A).

### **Tightening torque:**

19.6 ~ 24.5 N.m (2.0 ~ 2.5 kgf.m, 14.5 ~ 18.1 lb-ft)



SSLAT0021D

3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)

4. Remove the valve body cover (A) and eyebolt (B).

#### **Tightening torque:**

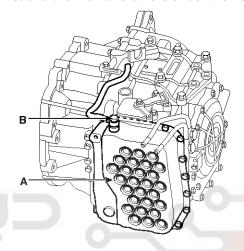
- (A)  $13.8 \sim 14.7 \text{ N.m}$  ( $1.3 \sim 1.5 \text{ kgf.m}$ ,  $9.4 \sim 10.8 \text{ lb-ft}$ )
- (B) 34.3 ~ 44.1 N.m (3.5 ~ 4.5 kgf.m, 25.3 ~ 32.6 lb-ft)

### **ACAUTION**

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.

#### MOTICE

Remove installation bolts in the engine compartment first and then remove others under the vehicle.

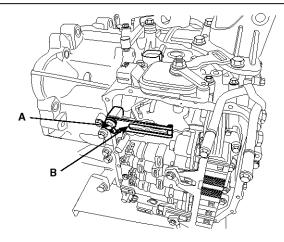


SSLAT1111N

5. Remove the plate and the detent spring (A) after removing the bolt.

#### **Tightening torque:**

 $24.5 \sim 35.3 \text{ N.m}$  (2.5  $\sim 3.6 \text{ kgf.m}$ ,  $18.1 \sim 26.0 \text{ lb-ft}$ )



SVGAA0006D

**AT-61** 

6. Remove the bolt (3ea) after disconnecting the solenoid valve connector (B) and the oil temperature sensor connector (A).

### **Tightening torque:**

 $9.8 \sim 11.8 \text{ N.m} (1.0 \sim 1.2 \text{ kgf.m}, 7.2 \sim 8.7 \text{ lb-ft})$ 

### **⚠**CAUTION

Be careful not to damage the harness lock connector.

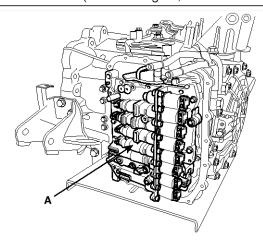


SLMAT0024D

7. Remove the valve body assembly (A).

#### **Tightening torque:**

 $9.8 \sim 11.8 \text{ N.m} (1.0 \sim 1.2 \text{ kgf.m}, 7.2 \sim 8.7 \text{ lb-ft})$ 

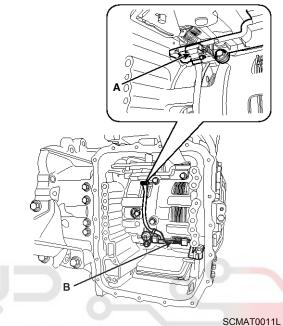


SCMAT0008L

- 8. Disconnect the input & output speed sensor connector(A).
- 9. Remove the input & output speed sensor (B) after removing the bolts(2ea).

### Tightening torque:

 $9.8 \sim 11.8 \text{ N.m} (1.0 \sim 1.2 \text{ kgf.m}, 7.2 \sim 8.7 \text{ lb-ft})$ 



#### Installation

1. Installation is the reverse of removal.

#### MOTICE

After replacement or reinstallation procedure of the valve body assembly, must perform procedures below.

Continue to apply liquid gasket at application points at the valve body cover with Ø2.5mm (0.0984in.) thickness.

Liquid gasket Part name: Threebond 1281B or LOCTITE FMD-546

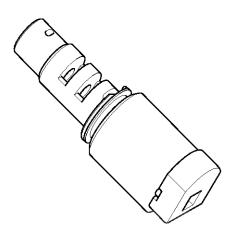
Adding automatic transaxle fluid. (Refer to "Hydraulic system (Fluid)" in this group)

## **Automatic Transaxle System**

### Torque Converter Control Solenoid Valve (T/CON\_VFS)

### **Description**

Torque converter control solenoid valve (T/CON\_VFS) is attached to the valve body. This variable force solenoid valve directly controls the hydraulic pressure inside the torque converter.



### **Specifications**

Direct control VFS[T/CON]

Control type : Normal low type

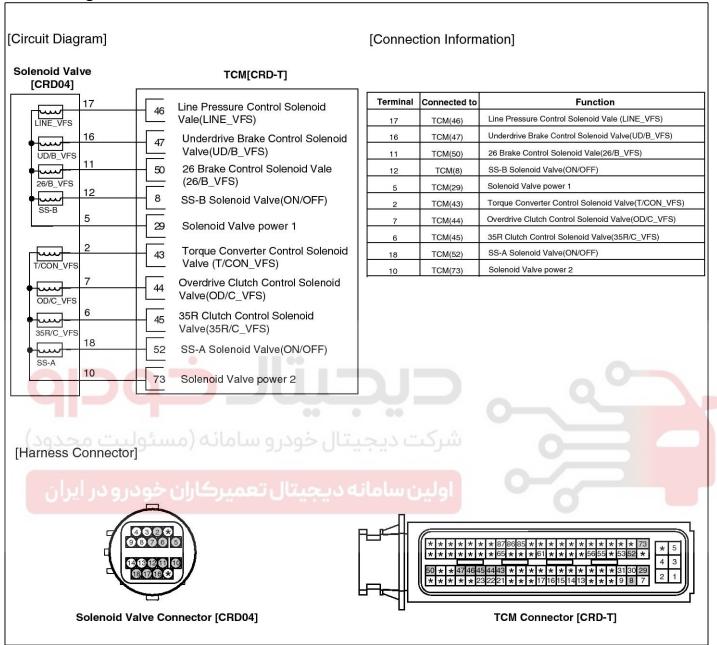
Control Pressure kpa(kgf/	9.81~500.14(0.1~5.1,1.42 ~72.54)
Current value(mA)	50~850
Internal resistance(Ω)	5.1





**AT-63** 





SSLAT1124L

## **Automatic Transaxle System**

### Inspection

- 1. Turn ignition switch OFF.
- 2. Disconnect the oil temperature sensor connector.
- 3. Measure resistance between sensor signal terminal and sensor ground terminal.
- 4. Check that the resistance is within the specification.

### Removal

#### MNOTICE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)



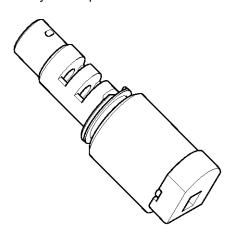


**AT-65** 

### 26 Brake Control Solenoid Valve(26/B\_VFS)

### **Description**

26 brake control solenoid valve(26/B\_VFS) is attached to the valve body. This variable force solenoid valve directly controls the hydraulic pressure inside the 26 brake.



### **Specifications**

Direct control VFS[26/B]

Control type : Normal low type

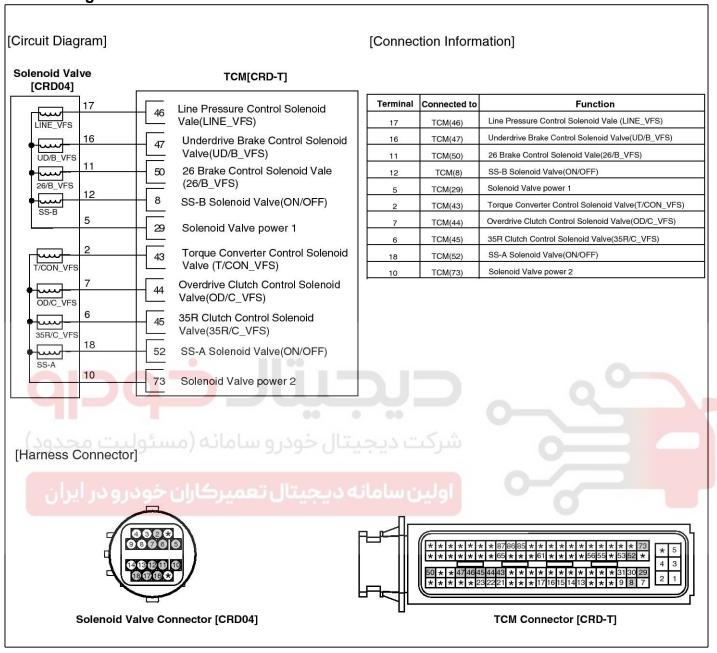
Control Pressure kpa(kgf/	9.81~500.14(0.1~5.1, 1.4 2~72.54)
Current value(mA)	50~850
Internal resistance(Ω)	5.1





## **Automatic Transaxle System**

### **Circuit Diagram**



SSLAT1124L

**AT-67** 

### Inspection

- 1. Turn ignition switch OFF.
- 2. Disconnect the oil temperature sensor connector.
- 3. Measure resistance between sensor signal terminal and sensor ground terminal.
- 4. Check that the resistance is within the specification.

### Removal

#### MOTICE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)



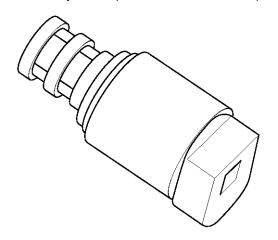


## **Automatic Transaxle System**

### **Line Pressure Control Solenoid Valve**

### **Description**

line pressure control solenoid valve is attached to the valve body. This variable force solenoid valve directly controls the hydraulic pressure inside the line pressure.



### **Specifications**

Direct control VFS[LINE Pressure]

Control type : Normal low type

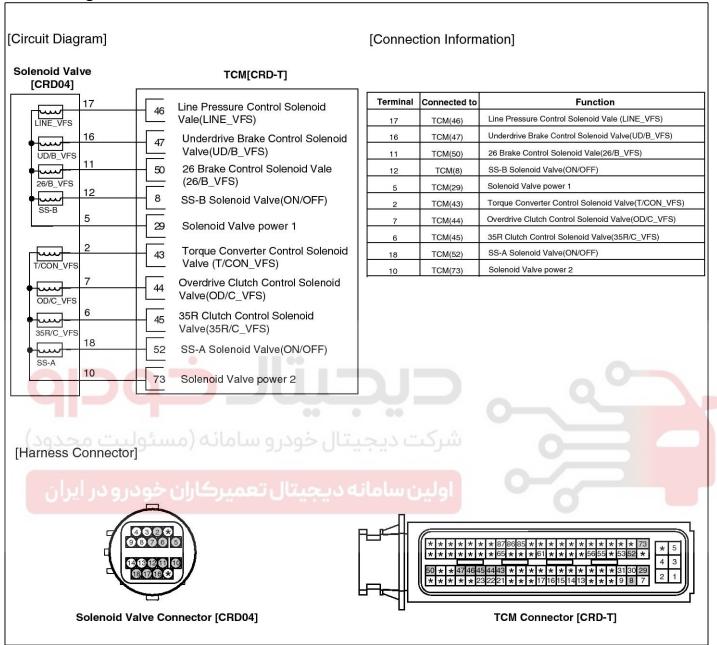
Control Pressure kpa(kgf/	500.14~9.81(5.1~0.1,72.5 4~1.42)
Current value(mA)	50~850
Internal resistance(Ω)	5.1





**AT-69** 





SSLAT1124L

## **Automatic Transaxle System**

### Inspection

- 1. Turn ignition switch OFF.
- 2. Disconnect the oil temperature sensor connector.
- 3. Measure resistance between sensor signal terminal and sensor ground terminal.
- 4. Check that the resistance is within the specification.

### Removal

#### MNOTICE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)



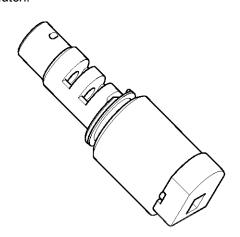


**AT-71** 

### 35R Clutch Control Solenoid Valve(35R/C\_VFS)

### **Description**

35R clutch control solenoid valve(35R/C\_VFS) is attached to the valve body. This variable force solenoid valve directly controls the hydraulic pressure inside the 35R clutch.



### **Specifications**

Direct control VFS[35R/C]

Control type : Normal low type

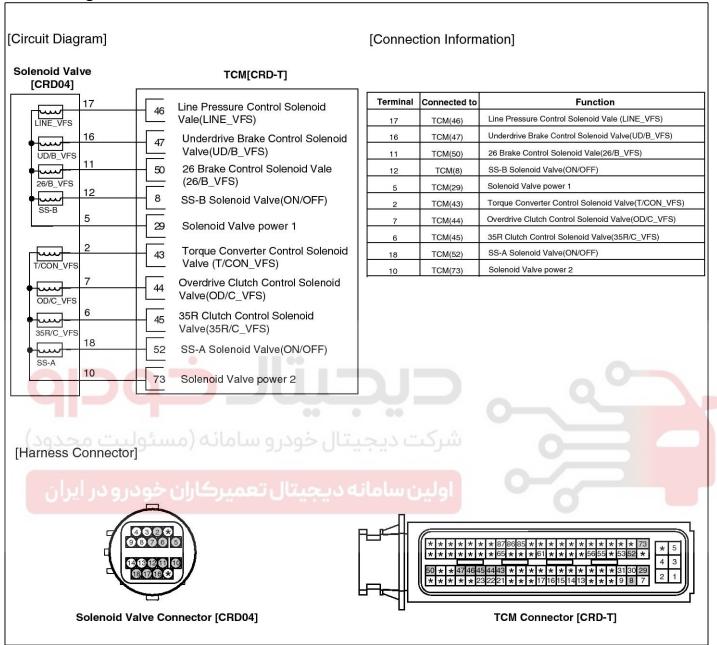
Control Pressure kpa(kgf/	500.14~9.81(5.1~0.1,72.5 4~1.42)
Current value(mA)	50~850
Internal resistance(Ω)	5.1





## **Automatic Transaxle System**

### **Circuit Diagram**



SSLAT1124L

**AT-73** 

### Inspection

- 1. Turn ignition switch OFF.
- 2. Disconnect the oil temperature sensor connector.
- 3. Measure resistance between sensor signal terminal and sensor ground terminal.
- 4. Check that the resistance is within the specification.

### Removal

MOTICE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)



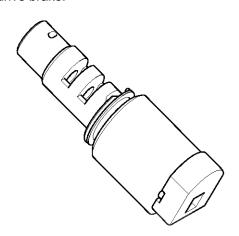


## **Automatic Transaxle System**

### **Underdrive Brake Control Solenoid Valve(UD/B\_VFS)**

### **Description**

Underdrive brake control solenoid valve(UD/B\_VFS) is attached to the valve body. This variable force solenoid valve directly controls the hydraulic pressure inside the underdrive brake.



### **Specifications**

Direct control VFS[35R/C]

Control type : Normal low type

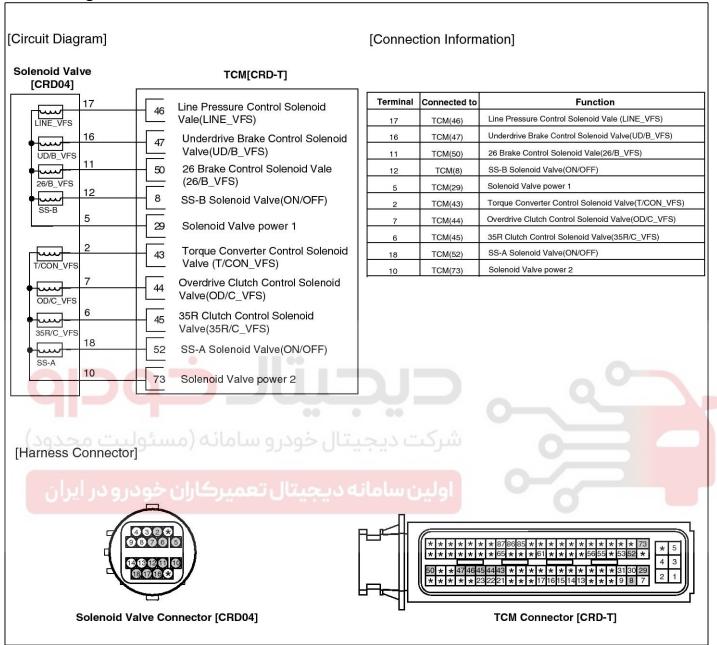
Control Pressure kpa(kgf/	500.14~9.81(5.1~0.1,72.5 4~1.42)
Current value(mA)	50~850
Internal resistance(Ω)	5.1





**AT-75** 





# **Automatic Transaxle System**

### Inspection

- 1. Turn ignition switch OFF.
- 2. Disconnect the oil temperature sensor connector.
- 3. Measure resistance between sensor signal terminal and sensor ground terminal.
- 4. Check that the resistance is within the specification.

#### Removal

#### MOTICE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)



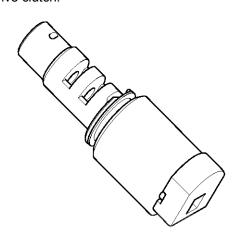


**AT-77** 

## Overdrive Clutch Control Solenoid Valve(OD/C\_VFS)

## **Description**

Overdrive clutch control solenoid valve(OD/C\_VFS) is attached to the valve body. This variable force solenoid valve directly controls the hydraulic pressure inside the overdrive clutch.



## **Specifications**

Direct control VFS[35R/C]

Control type : Normal low type

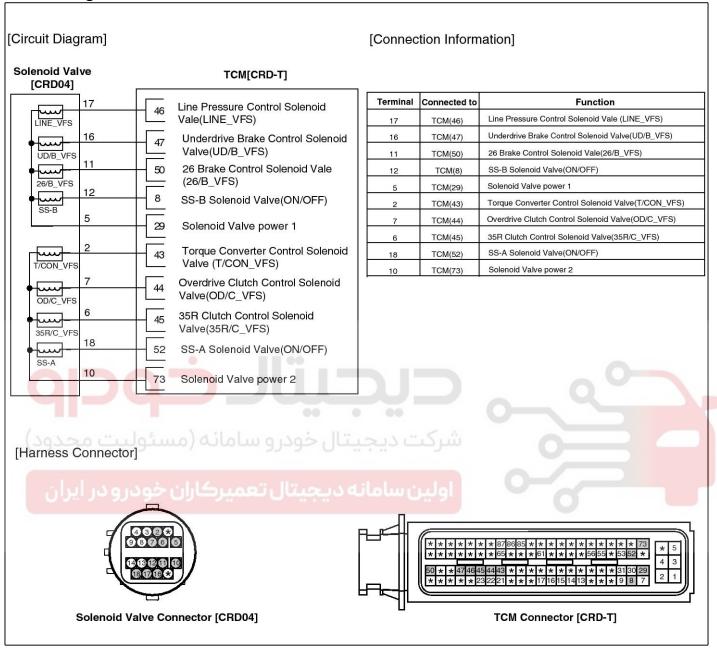
Control Pressure kpa(kgf/	500.14~9.81(5.1~0.1,72.5 4~1.42)			
Current value(mA)	50~850			
Internal resistance(Ω)	5.1			





# **Automatic Transaxle System**

### **Circuit Diagram**



**AT-79** 

### Inspection

- 1. Turn ignition switch OFF.
- 2. Disconnect the oil temperature sensor connector.
- 3. Measure resistance between sensor signal terminal and sensor ground terminal.
- 4. Check that the resistance is within the specification.

#### Removal

#### MOTICE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)



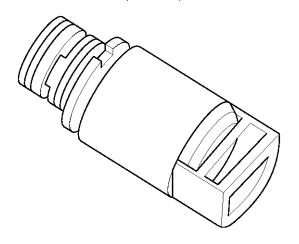


# **Automatic Transaxle System**

## SS-A Solenoid Valve(ON/OFF)

## **Description**

SS-A solenoid valve is attached to the valve body and is an on/off solenoid valve that is used to change gears. SS-A Solenoid valve(ON/OFF) is installed at valve body.



## **Specifications**

ON/OFF Solenoid Valve(SS-A, SS-B)

Control type : Normal low type

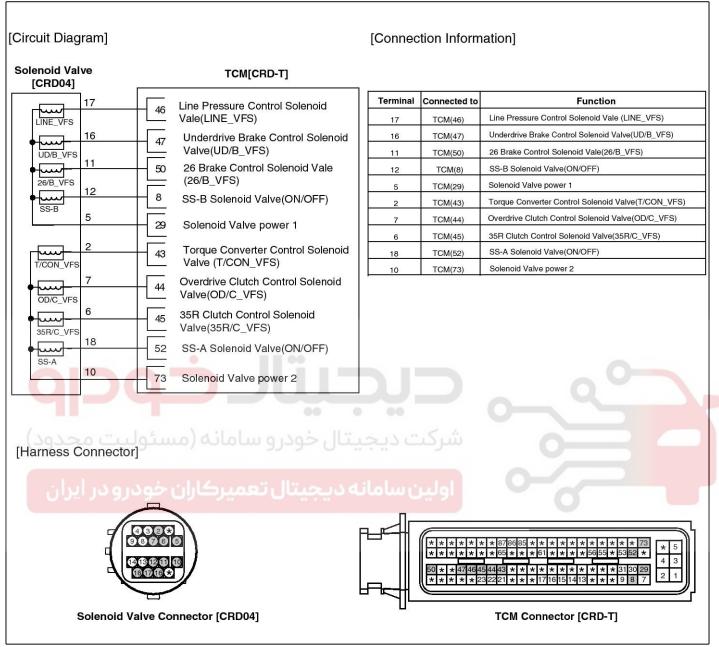
Control pressure kpa(kgf/	490.33(5.0, 71.12)		
Internal resistance(Ω)	10~11		





**AT-81** 





# **Automatic Transaxle System**

#### Inspection

- 1. Turn ignition switch OFF.
- 2. Disconnect the oil temperature sensor connector.
- 3. Measure resistance between sensor signal terminal and sensor ground terminal.
- 4. Check that the resistance is within the specification.

#### Removal

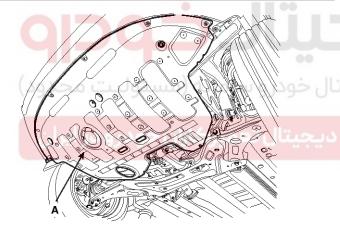
#### MNOTICE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)

- 1. Remove the battery and the battery tray. (Refer to "Charging system" in EE group.)
- 2. Remove the under cover (A).

#### **Tightening torque:**

19.6  $\sim$  24.5 N.m (2.0  $\sim$  2.5 kgf.m, 14.5  $\sim$  18.1 lb-ft)



SSLAT0021D

3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)

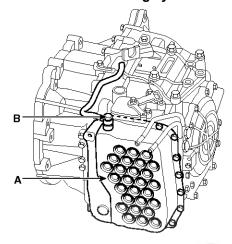
4. Remove the valve body cover (A) and eyebolt (B).

#### **Tightening torque:**

- (A)  $13.8 \sim 14.7 \text{ N.m}$  ( $1.3 \sim 1.5 \text{ kgf.m}$ ,  $9.4 \sim 10.8 \text{ lb-ft}$ )
- (B)  $34.3 \sim 44.1$  N.m  $(3.5 \sim 4.5 \text{ kgf.m}, 25.3 \sim 32.6 \text{ lb-ft})$

#### CAUTION

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.



SSLAT1111N

#### MOTICE

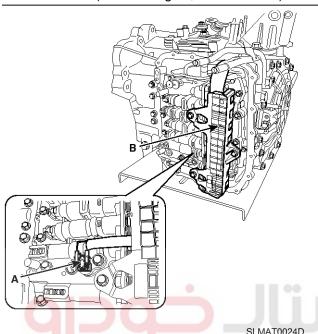
Remove installation bolts in the engin room first and then remove others under the vehicle.

**AT-83** 

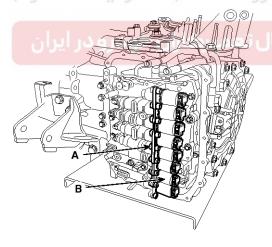
5. Remove the bolt (3ea) after disconnecting the solenoid valve connector (B) and the oil temperature sensor connector (A).

#### **Tightening torque:**

 $9.8 \sim 11.8 \text{ N.m} (1.0 \sim 1.2 \text{ kgf.m}, 7.2 \sim 8.7 \text{ lb-ft})$ 



6. Remove the solenoid valve (A) after removing the solenoid support.



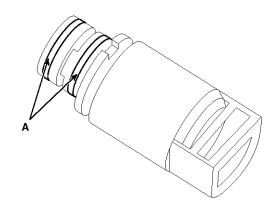
SSLAT0112D

#### Installation

1. Installation is the reverse of removal.

#### MOTICE

 When installing, apply the ATF oil or white vaseline to the O-ring (A) not to be damaged.



SSLAT0113D

 Continue to apply liquid gasket at application points at the valve body cover with Ø2.5mm (0.0984in.) thickness.

Liquid gasket Part name : Threebond 1281B or LOCTITE FMD-546

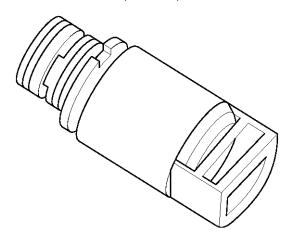
 Adding automatic transaxle fluid. (Refer to "automatic transaxle system" in this group.)

# **Automatic Transaxle System**

## SS-B Solenoid Valve(ON/OFF)

## **Description**

SS-B solenoid valve is attached to the valve body and is an on/off solenoid valve that is used to change gears. SS-B Solenoid valve(ON/OFF) is installed at valve body.



## **Specifications**

ON/OFF Solenoid Valve(SS-A, SS-B)

Control type : Normal low type

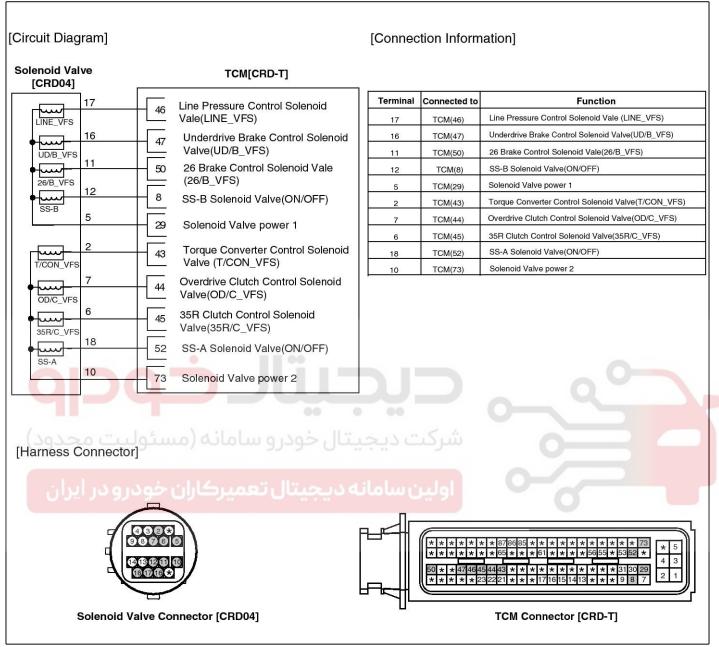
Control pressure kpa(kgf/	490.33(5.0, 71.12)		
Internal resistance(Ω)	10~11		





**AT-85** 





# **Automatic Transaxle System**

#### Inspection

- 1. Turn ignition switch OFF.
- 2. Disconnect the oil temperature sensor connector.
- 3. Measure resistance between sensor signal terminal and sensor ground terminal.
- 4. Check that the resistance is within the specification.

#### Removal

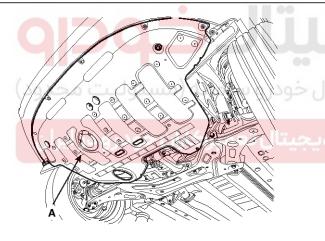
#### MNOTICE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)

- 1. Remove the battery and the battery tray. (Refer to "Charging system" in EE group.)
- 2. Remove the under cover (A).

#### **Tightening torque:**

19.6  $\sim$  24.5 N.m (2.0  $\sim$  2.5 kgf.m, 14.5  $\sim$  18.1 lb-ft)



SSLAT0021D

3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)

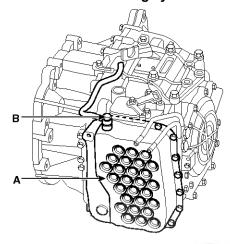
4. Remove the valve body cover (A) and eyebolt (B).

#### **Tightening torque:**

- (A)  $13.8 \sim 14.7 \text{ N.m}$  ( $1.3 \sim 1.5 \text{ kgf.m}$ ,  $9.4 \sim 10.8 \text{ lb-ft}$ )
- (B)  $34.3 \sim 44.1 \text{ N.m}$  (3.5  $\sim 4.5 \text{ kgf.m}$ , 25.3  $\sim 32.6 \text{ lb-ft}$ )

#### CAUTION

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.



SSLAT1111N

#### MOTICE

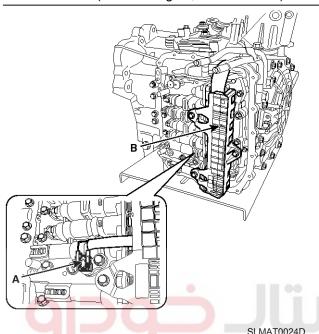
Remove installation bolts in the engin room first and then remove others under the vehicle.

**AT-87** 

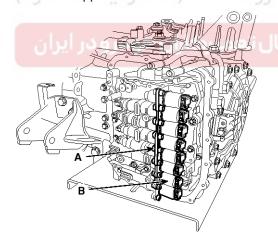
5. Remove the bolt (3ea) after disconnecting the solenoid valve connector (B) and the oil temperature sensor connector (A).

#### **Tightening torque:**

 $9.8 \sim 11.8 \text{ N.m} (1.0 \sim 1.2 \text{ kgf.m}, 7.2 \sim 8.7 \text{ lb-ft})$ 



6. Remove the solenoid valve (A) after removing the solenoid support.



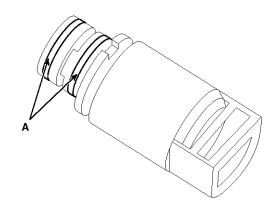
SSLAT0112D

#### Installation

1. Installation is the reverse of removal.

#### MNOTICE

 When installing, apply the ATF oil or white vaseline to the O-ring (A) not to be damaged.



SSLAT0113D

 Continue to apply liquid gasket at application points at the valve body cover with Ø2.5mm (0.0984in.) thickness.

Liquid gasket Part name : Threebond 1281B or LOCTITE FMD-546

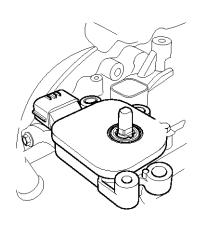
 Adding automatic transaxle fluid. (Refer to "Hydraulic system (Fluid)" in this group)

# **Automatic Transaxle System**

## **Inhibitor Switch**

## Description

Inhibitor Switch monitors the lever's position(PRND) and is used to control gear setting signals.



## **Specifications**

Power supply (V)	11		
Output type	Pin to Pin		

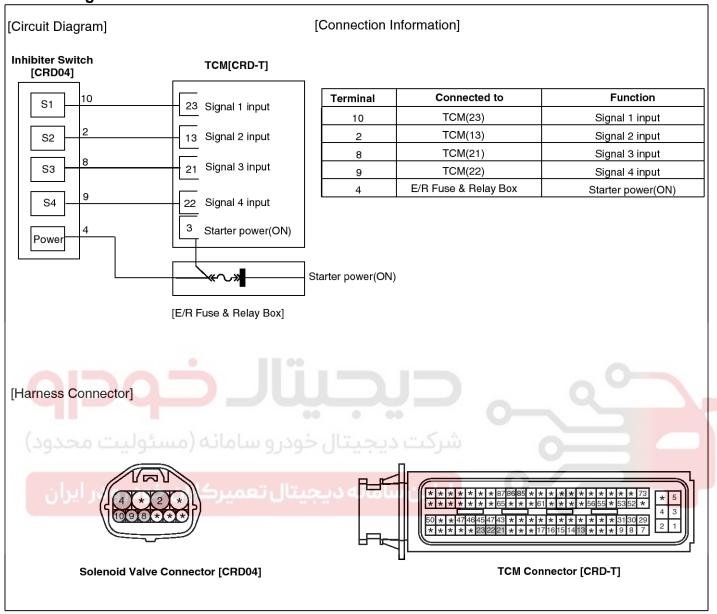
SSLAT1113N

### **Signal Code Table**

	Р	P-R	R	R-N	N	N-D	D
S1	1	0	0	0	1	1	1
S2	0	) a il <sup>0</sup> l c	0	211.5	. 1	0	0
S3	1	1	0	0	0	0	0
S4	10.10	1,14,1,007	117.2d	ملين او ان	1 0-	1	0

**AT-89** 



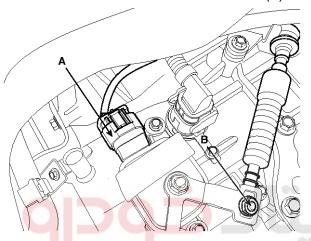


SSLAT1123L

# **Automatic Transaxle System**

#### Removal

- 1. Make sure vehicle does not roll before setting room side shift lever and T/M side manual control lever to "N" position.
- 2. Remove the battery and the battery tray. (Refer to "Charging system" in EE group.)
- 3. Remove the air cleaner assembly. (Refer to "Intake manifold" in EM group.)
- 4. Remove the shift cable mounting nut (B).
- 5. Disconnect the inhibitor switch connector (A).



SLMAT0008N

Remove the manual control lever (A) and the washer(B) after removing a nut (C).



SSLAT1115N

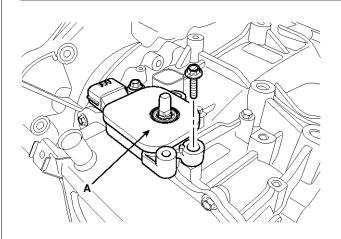
### **A**CAUTION

When installing, affix the manual control lever and the inhibitor switch with Ø5mm (0.1969in.). Then tighten the inhibitor assembly mounting bolts.

7. Remove the inhibitor assembly (A) after removing the bolts (2ea).

#### **Tightening torque:**

 $9.8 \sim 11.8 \text{ N.m} (1.0 \sim 1.2 \text{ kgf.m}, 7.2 \sim 8.7 \text{ lb-ft})$ 



SSLAT1116N

### **ACAUTION**

When installing, tighten the inhibitor assembly mounting bolt lightly, so that necessary adjustments can be made. Tighten to specifications.

#### Installation

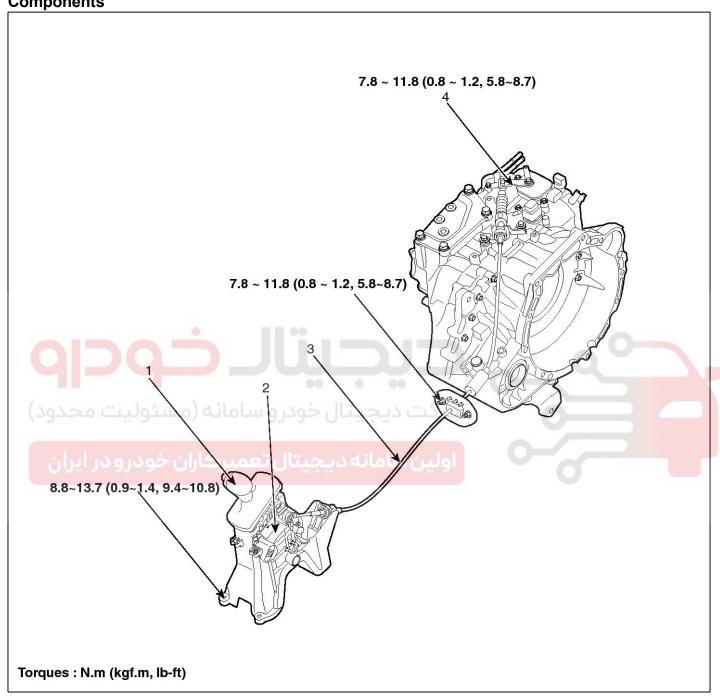
1. Installation is the reverse of removal.

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**AT-91** 

### **Shift Lever**

Components



SSLAT1017N

- 1. Shift lever knob & boots assembly
- 2. Shift lever assembly

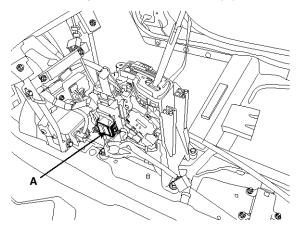
- 3. Control cable assembly
- 4. Manual control lever (T/M side)

# **Automatic Transaxle System**

#### Removal

### **Shift Lever Assembly Replacement**

- 1. Remove the center console assembly. (Refer to "Interior(console)" in BD group.)
- 2. Disconnect sports mode connector (A).

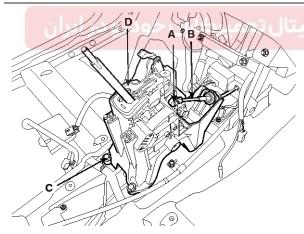


SSLAT0030D

- 3. Take off the clip (A) and then remove the shift cable (B).
- 4. Remove the shift lever assembly (D) by removing the bolts (C-4ea).

## Tightening torque: ودر و سامانه (مسئول)

 $8.8 \sim 13.7$  N.m (0.9  $\sim$  1.4 kgf.m, 6.5  $\sim$  10.1 lb-ft)



SSLAT0031D

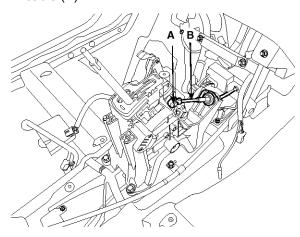
5. Installation is the reverse of removal.

#### MNOTICE

Make sure vehicle does not roll before setting room side shift lever and T/M side manual control lever to "N" position.

#### **Control Cable Replacement**

- 1. Remove the center console assembly. (Refer to "Interior(console)" in BD group.)
- 2. Take off the clip (A) and then remove the control cable (B).

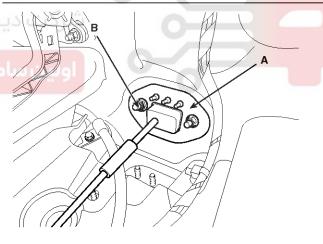


SSLAT0034D

3. Remove the control cable assembly in the vehicle after removing the nuts (B) and the retainer (A).

#### **Tightening torque:**

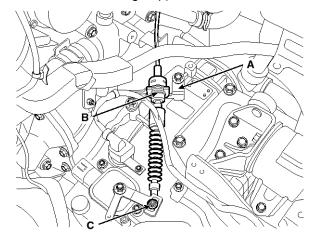
 $7.8 \sim 11.8 \text{ N.m} (0.8 \sim 1.2 \text{ kgf.m}, 5.8 \sim 8.7 \text{ lb-ft})$ 



SSLAT0032D

**AT-93** 

- 4. Remove the nut (C).
- 5. Remove the cable (B) from the bracket (A) at transaxle assembly side (Refer to "Automatic Transaxle" in this group).



SSLAT1004L

6. Remove the control cable inside of cab.

### Inspection

- 1. Check the damage and operation of the control cable.
- 2. Check the damage of the boot.
- 3. Check the damage and corrosion of the bushing.
- 4. Check the damage or weakening of the spring.

#### Installation

1. Installation is the reverse of removal.

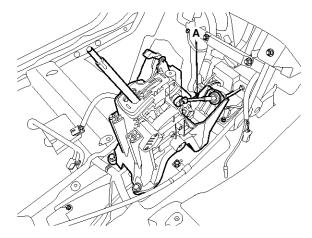
#### MOTICE

Make sure vehicle does not roll before setting room side shift lever and T/M side manual control lever to "N" position.

### **Adjustment**

### Adjusting method for T/M control cable

- Make sure vehicle does not roll before setting room side shift lever and T/M side manual control lever to "N" position.
- 2. Connect room side shift lever and control cable (A).

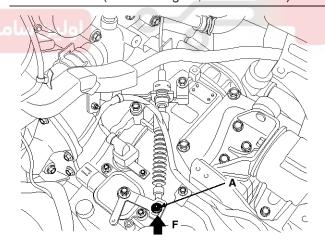


SSLAT1005L

- Push cable to "F" direction shown to eliminate FREE PLAY.
- 4. Tighten adjusting nut (A).

#### Tightening torque:

 $7.8 \sim 11.8 \text{ N.m}$  (0.8  $\sim 1.2 \text{ kgf.m}$ ,  $5.8 \sim 8.7 \text{ lb-ft}$ )



SLMAT0028D

5. After adjusting, check to be sure that this part operates as designed at each range of T/M side corresponding to each position of room lever.