GROUP

3

Powertrain

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3.2 Automatic Transmission/Transaxle

2012 EADO

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3.2.1 Automatic transmission

Specifications

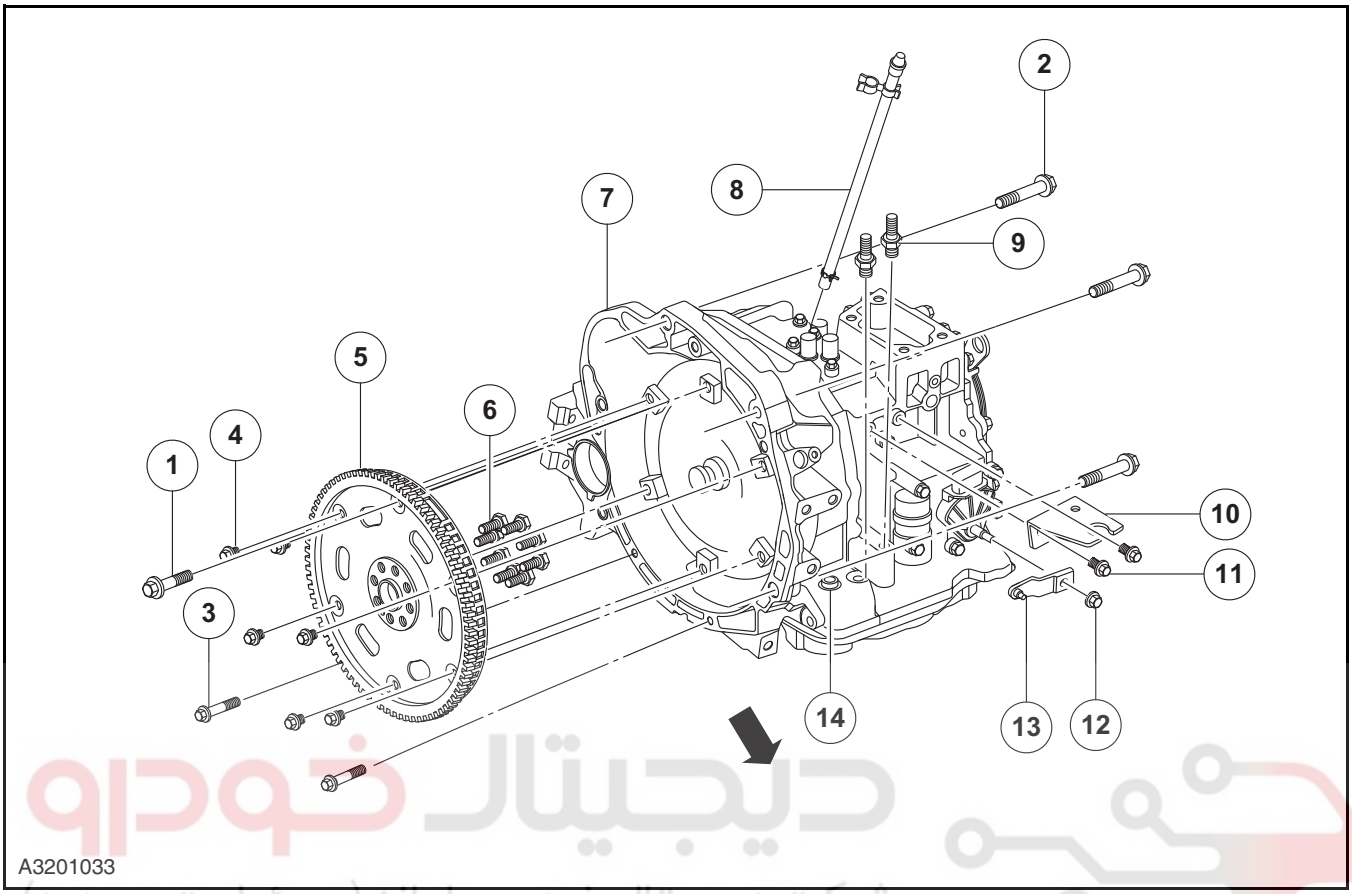
General Specifications

Name	Specification
Model	TS - 40 SN
Transmission ratio-first gear	2.875 :1
Transmission ratio-second gear	1.568 :1
Transmission ratio-third gear	1.000 :1
Transmission ratio-fourth gear	0.697 :1
Reverse	2.300 :1
Differential	4.277 :1
Intermediate shaft	1.023 :1
Planetary gear group	1
Weight	Approx. 54 kg
Max. torque	130 Nm

Component Specifications

Name	Specification
Automatic transmission fluid-specification	AW - 1
Automatic transmission fluid - total volume (including cooler and tube)	4.4 ~ 4.8L
Level adjustment	Overflow type

Torque Specifications



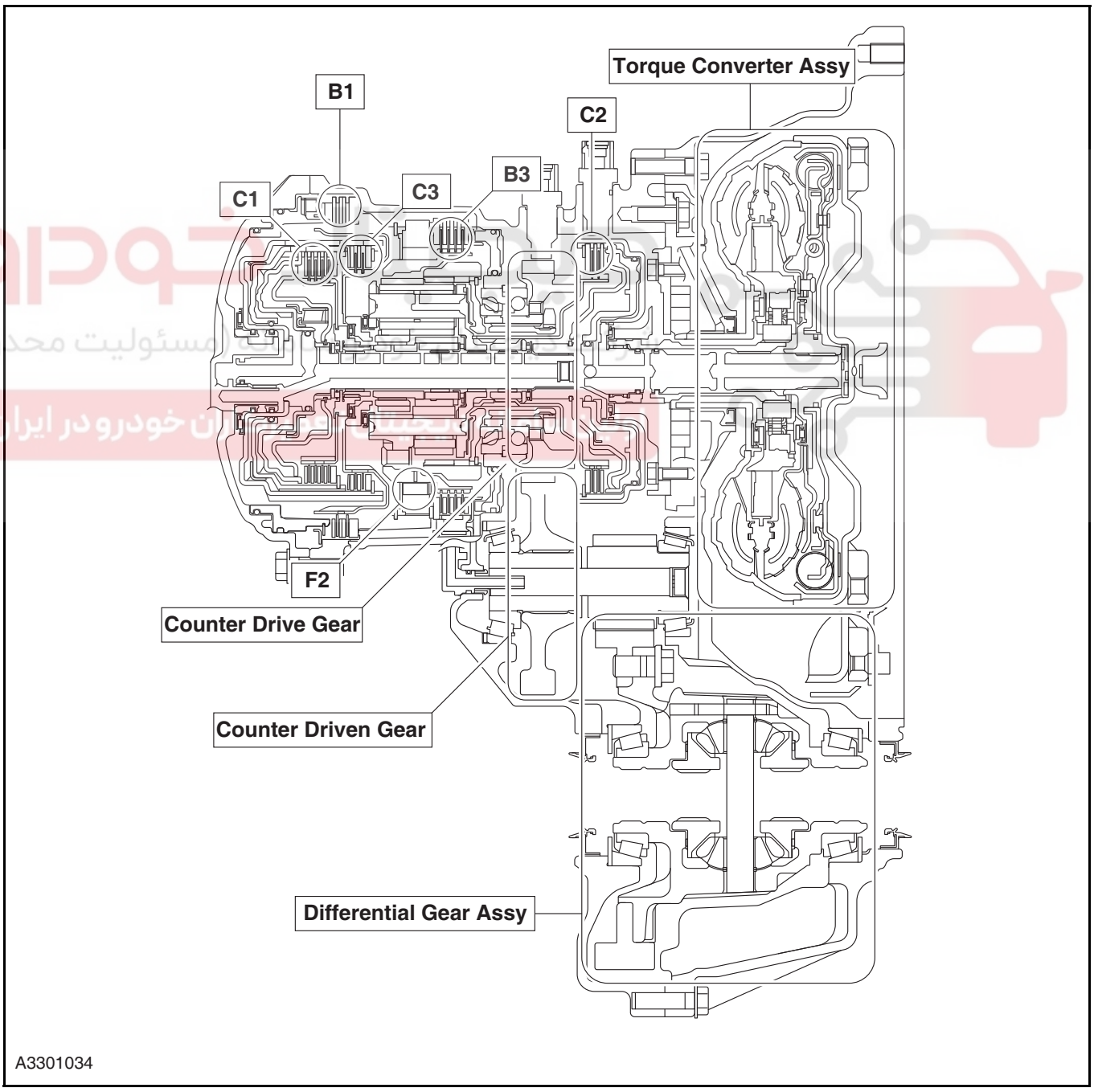
No.	Name: Specification	Nm	lb-ft	lb-in
1	Transmission mounting bolt	85	63	-
2	Transmission mounting bolt	85	63	-
3	Transmission mounting bolt	23	17	-
4	Drive plate mounting bolt	23	17	-
5	Drive plate assembly	-	-	-
6	Flywheel bolt	60	44	-
7	Transmission assembly (4AT)	-	-	-
8	Vent pipe assembly	-	-	-
9	Pipe fitting assembly	24	18	-
10	Gearshift cable support	-	-	-
11	Gearshift cable support installing bolt	23	17	-
12	Gearshift arm installing nut	23	17	-
13	Gearshift arm	-	-	-
14	Oil filling plug	35	26	-

Description and Operation

System General Information

CAUTION: In the process of diagnosis, a lack of basic knowledge would lead to wrong performance diagnosis or damage in components of power system. Don't try to diagnose any faults of power system without basic knowledge.

Automatic transmission TS-40 SN is a 4-speed manual & automatic transmission with lockup clutch. The automatic transmission mainly consists of hydraulic torque converter with lockup clutch, planetary gear, hydraulic control system and electronic control system. The hydraulic control system is based on hydraulic pressure generated by oil pump, the automatic transmission control module sends signal to solenoid valve and the hydraulic control system controls hydraulic pressure acting on hydraulic torque converter, clutches and brakes according to the vehicle driving condition. There are three clutches, two brakes and one one-way clutch controlling the planetary gear set. The control units are shown below.



Clutches and Brake		Purpose
C1	Forward clutch	Connecting intermediate shaft to front sun gear
C2	Direct-drive clutch	Connecting intermediate shaft to front sun gear
C3	Reverse gear clutch	Connecting intermediate shaft to rear sun gear
B1	2nd coasting and 4th brake	Locking rear sun gear
B3	First gear and reverse brake	Brake planet carrier
F2	One-way clutch 2	Prevent planet carrier reversal

Execution Components Worksheet

Location		Solenoid valve					Clutch			Brakes		One-way clutch
		SLC1	SLC2	SLB1	SLU	S1	C1	C2	C3	B1	B3	F2
		N/O	N/O	N/C	N/C	N/C						
“P”		○	□	×	×	○	×	×	×	×	×	×
R	V ≦ 7	○	□	×	×	○	×	×	○	×	×	×
	V ＞ 7	○	○	×	○	○	×	×	○	×	×	×
“N”		○	□	×	×	○	×	×	×	×	×	×
D	1st	△ (□)	○	×	×	*1	○	×	×	×	×	○
	1st E/B	△ (□)	△	×	○	○	○	×	×	×	○	○
	2nd	△ (□)	○	△	⊙	*1	○	×	×	○	×	×
	2nd↔3rd	△ (□)	○→ △	△→ ×	⊙	×	○	× → ○	×	○ → ×	×	×
	3rd	△	△ (□)	×	⊙	×	○	○	×	×	×	×
	3rd↔4th	△→ ○	△ (□)	× → △	⊙	×	○ → ×	○	×	× → ○	×	×
	4th	○	△ (□)	△	⊙	×	×	○	×	○	×	×
Remarks		○	ON (N/O : Close， N/C : Open)				Applied					
		×	OFF(N/O : Open， N/C : Close)				Release					
		⊙	ON : Lock-up ON				-					
			OFF : Lock-up OFF									
		△	CONTROLED				Neutral control					
		□	CONTROLED (Line pressure)				-					

Lock-up operation exists : 2nd to 4th gears

*1: ○ :(V ≦ 14 km/h) / ×:(V ＞ 14 km/h)

TCM Control Function

Automatic Shift Control

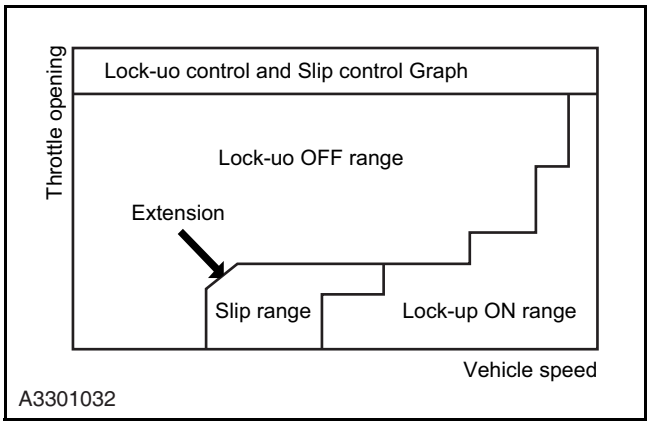
In each gear shift mode, TCM controls the gear shift solenoid (S1) to open or close according to the engine RPM signal, input shaft speed signal, vehicle speed signal, throttle position signal and brake pedal position signal, and also linearly operates the pressure control solenoids SLC1, SLC2 and SLB1 so as to control hydraulic pressure in the hydraulic control system, realizing automatic shift of the transmission among gear positions.

Driver Self-adaptive Mode Control

During the vehicle driving, automatic transmission is always in the self-adaptive mode. There is no switch for the driver to select a drive mode. Once particular conditions occur, TCM will choose an appropriate gear shift mode for the driving status and automatically change the mode to improve smooth gear shift.

Lockup Control and Slip Control

TCM linearly controls the solenoid to smoothly perform lockup control according to input shaft speed signal, ECM signal (engine speed and throttle position) and vehicle speed signal. In addition, the lockup clutch slip ratio is monitored through monitoring of input shaft speed sensor signal. Once the solenoid is closed, the lockup clutch is allowed to slip and the slip control expands the lockup range at low speed. This control reduces the engine speed, increase drive efficiency of transmission and improves fuel economy. Meanwhile, with the slip of lockup clutch, the engine speed fluctuation could be absorbed by torque converter.



Reverse gear Control

If the shift lever is moved from the N position to the R position while the vehicle is moving, the transmission will be reversed and wheels may be locked instantly, this is very dangerous. To avoid this, TCM will prohibit shifting the transmission into the reverse gear while the vehicle is moving.

Self-diagnostic Function

By monitoring communications of sensors and electronic elements (including with ECM), the self-diagnostic function of TCM will illuminate MIL on the instrument cluster to inform the driver of timely repair and store it in the TCM memory in the form of DTC if TCM detects a transmission related fault.

Fault protect function

If automatic transmission system develops a fault, TCM will output a control signal to realize fault protection function and this control allows the vehicle to move in the minimum distance. If a gearshift solenoid develops a fault, TCM will cancel the control signal to this solenoid to realize fault protection function and at this time the gear is in the R or 3rd position.

TCU Initialization Learning

In case of automatic transmission or TCM replacement or TCM software overflow, the learning value must be initialized and the initialization learning carried out.

1. Preheat

Make ATF temperature increase by keeping the engine working at idle speed or carrying out urban road test, check ATF temperature and confirm the temperature is between 65 ℃ and 80 ℃ . Do not attempt to raise ATF temperature by stalling the engine. If ATF temperature is not between 65 ℃ and 80 ℃ , the initialization learning can not be performed.

2. Static gearshift self-learning

With the vehicle stopped, press the brake pedal and engage the shift lever into the N position and hold it in this position for 3s. Then move the shift lever from the N position to the D position and hold it in the D position for 3s. Repeat the procedure above 5 times. Again, move the shift lever

from the N position to the R position and repeat this step 5 times.

3. Dynamic gearshift self-learning

Engage the shift lever into the D position and make the vehicle moving by keeping the throttle opening 25% ~ 35% until the automatic transmission is upshift to the 4th gear and the vehicle speed reaches 80km/h or higher. Then release the accelerator pedal to allow the vehicle to coast and stop the vehicle within 60s. Repeat the procedure above for 10 times.

4. Check the result of initialization learning

Check if the gearshift shock reduces as compared with that before the initialization learning.

Components Description

Transmission Control Module (TCM)

Transmission control module (TCM) mainly controls relevant actions of gear shift point and lockup solenoid. It is located at the front of central console under the instrument panel at driver's side.

The transmission is controlled by electronic gear shift system. TCM processes input signals. The transmission module uses signals to control the transmission hydraulic system by exploiting information received.

The electronic gear shift system consists of the components below.

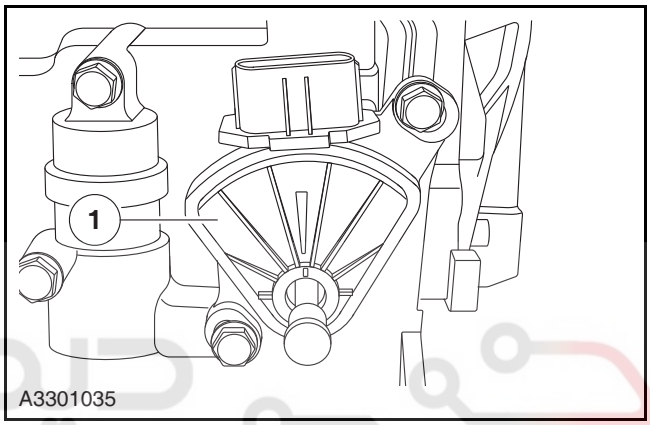
- Transmission Control Module (TCM)
- Park/Neutral Position Switch (NSW)
- Gearshift solenoid (S1)
- Linear pressure Control Solenoid (SLC1,SLC2,SLB1)
- Lock-up Solenoid (SLU)
- Input shaft speed sensor (NC2)
- Output Shaft Speed Sensor (SP)
- Transmission oil Temperature Sensor (OT).

Park/Neutral Position Switch (NSW)

The park/neutral position switch sends information of gear position, including that of Automatic Transmission (A/T) gearshift lever, to the starter and transmission control module.

- To prevent reckless driving, the park/neutral position switch (NSW) could start an engine only in Park and Neutral.
- When reversing, park/neutral position switch (NSW)be switched to reversing lamps.
- This action regulates the park/neutral position switch (NSW) to control gear shifting.

The park/neutral position switch (NSW) sends information combining lines of both start and reverse directly to the vehicle without going through the transmission control module.



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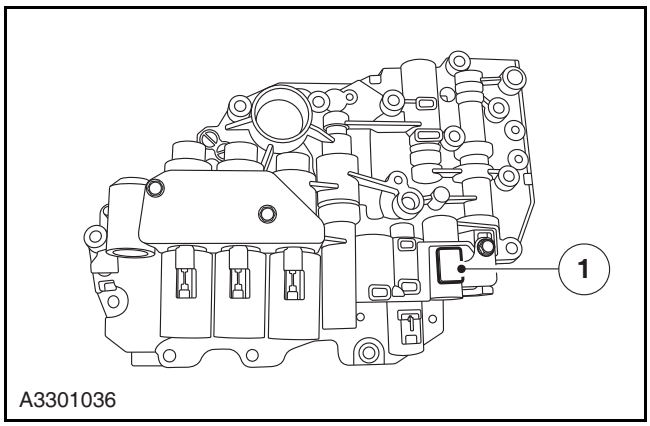
Gearshift solenoid (S1)

The shift solenoid S1(1) is installed in the solenoid valve body directly. The solenoid carries out "On/Off" operation through control signal from TCM. Depending on S1 On or Off status, the oil gallery is switched to realize the fuel efficiency. In case of abnormality of solenoid S1 in the fail-safe mode, TCM will cut off the current to the solenoid.



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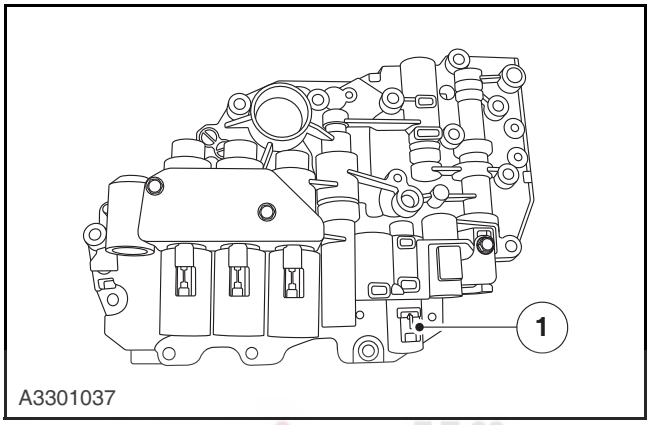
Lock-up Solenoid (SLU)

The lock-up solenoid is installed in the valve body. It receives control signals from the transmission control module. The lockup solenoid manipulates the lockup valve in the valve body and controls hydraulic pressure to lockup clutch, realizing lockup and slip of the lockup clutch. In case of abnormality of solenoid SLU in the fail-safe mode, TCM will cut off the current to the solenoid.



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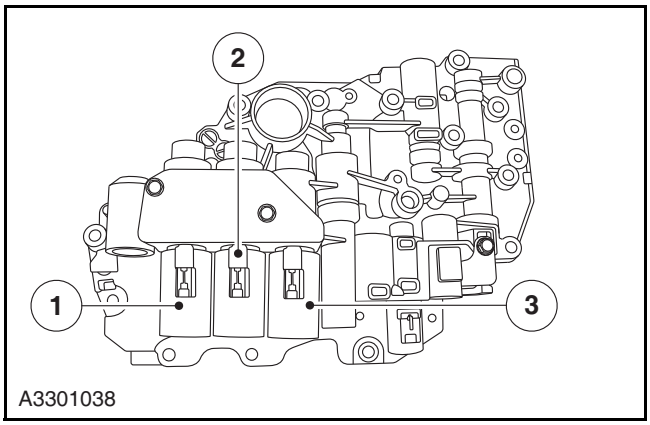
Linear pressure Control Solenoid (SLC1,SLC2,SLB1)

Linear pressure control solenoids(SLC1)(1), (SLC2)(2) and (SLB1)(3) are in the valve bodies and linearly controlled, their hydraulic pressure depends on output signal of TCM. In this case, hydraulic pressure to the clutches (C1, C2 and C3) and brakes (B1 and B3) are linearly controlled for smooth gear shift. Each solenoid performs the gear shift from 1st gear to 4th gear to realize pipeline pressure control at the same time. In case of abnormality of a solenoid in the fail-safe mode, TCM will cut off relevant linear pressure control solenoid.



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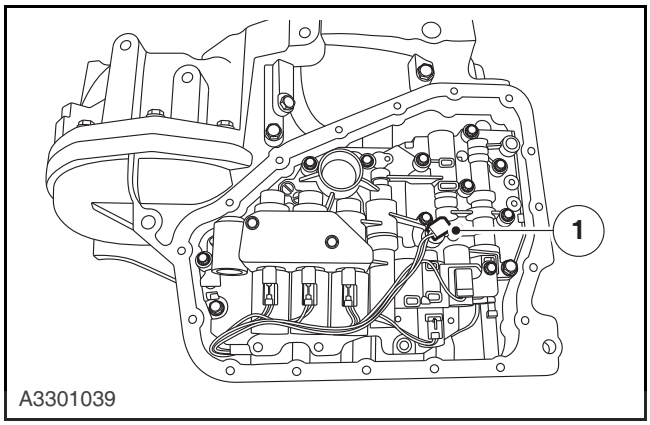
Transmission oil Temperature Sensor (OT)

The transmission fluid temperature sensor (OT) (1) directly mounted on the transmission valve body converts the transmission fluid signal into electric signal and transmits it to TCM which control the gear shift according to the temperature change.



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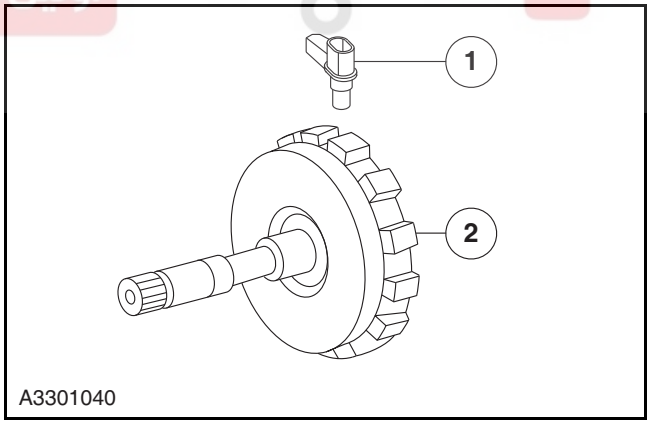
Input shaft speed sensor (NC2)

The input shaft speed sensor (NC2)(1) is located at the upper end of automatic transmission. It detects input speed of automatic transmission according to rotational speed of intermediate shaft C2 hub(2) and then send it as signal to the transmission control module.



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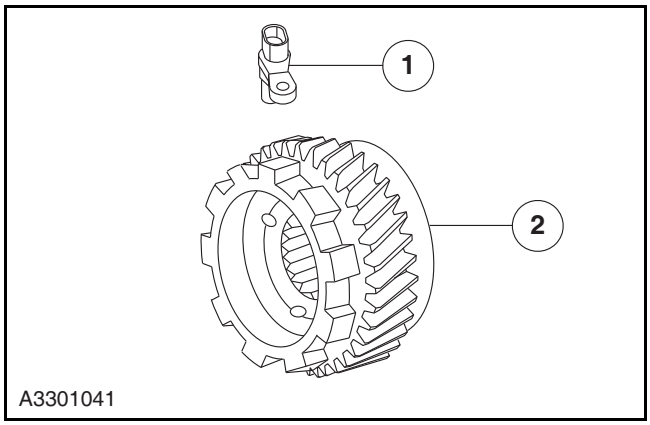
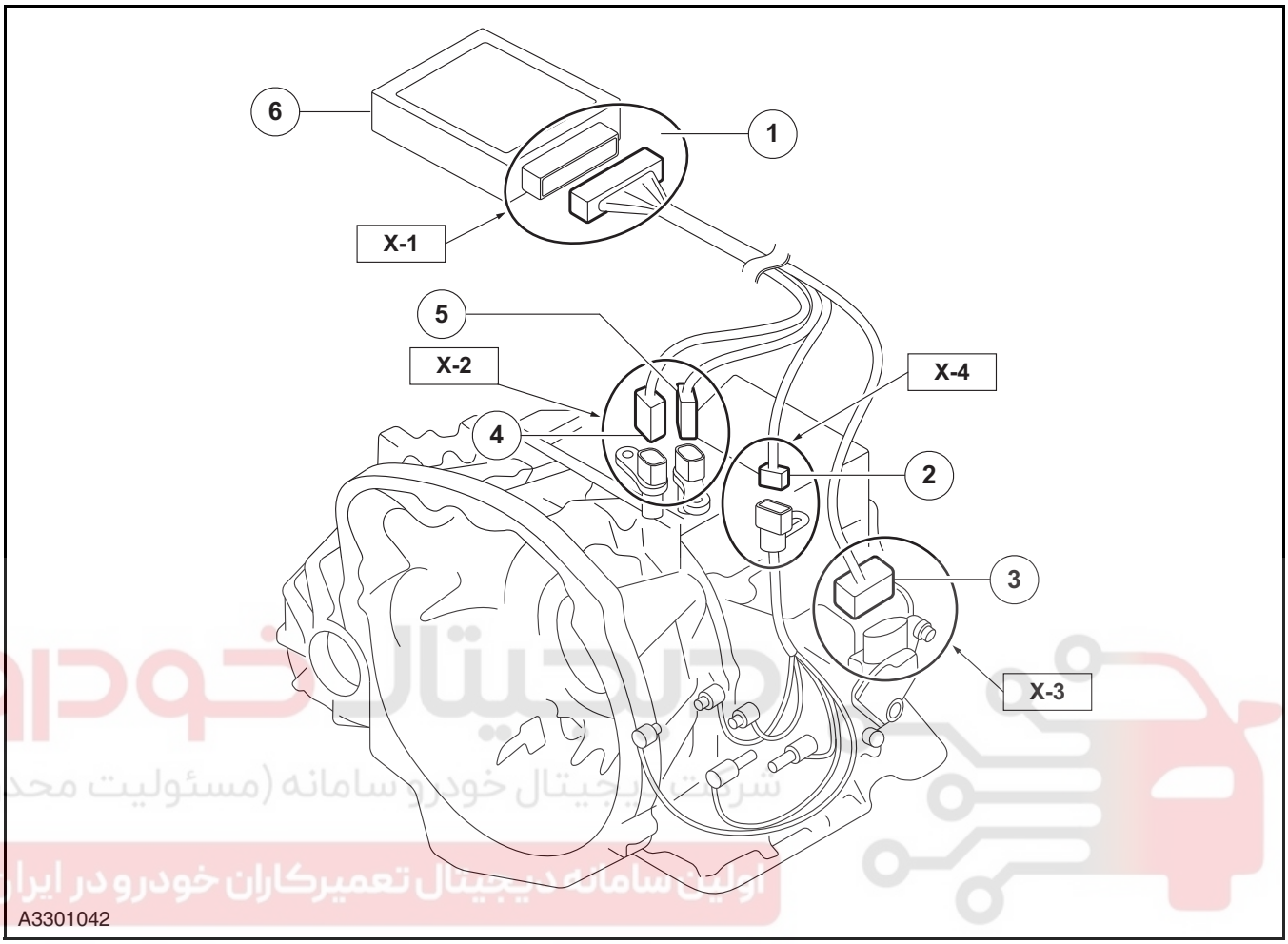
Output Shaft Speed Sensor (SP)

The output shaft speed sensor (SP)(1) is located at the upper end of automatic transmission. It detects the vehicle speed according to the speed of counter shaft drive gear(2) and then send it as signal to the transmission control module.



Component position chart

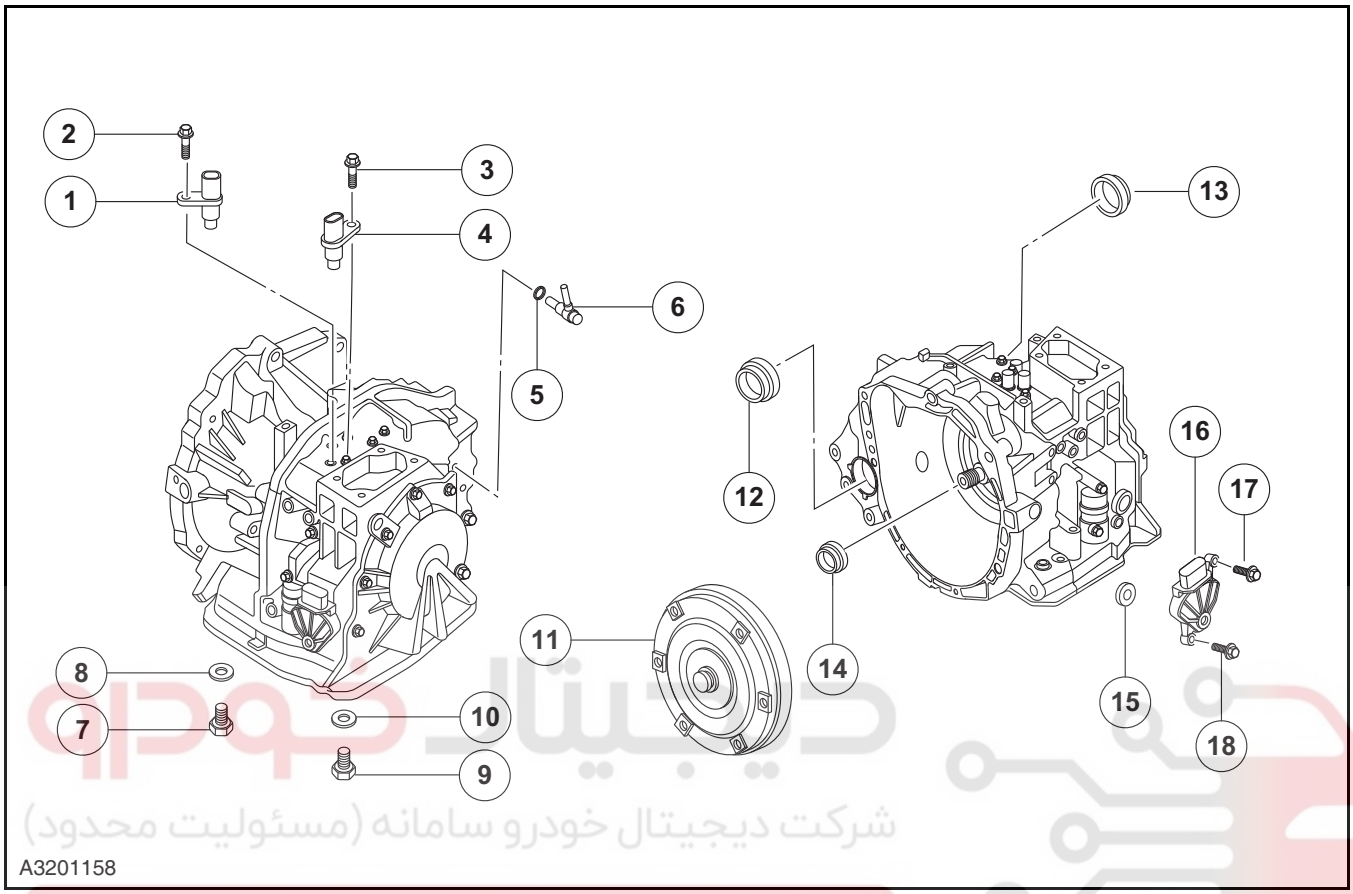
Control Unit Chart



No.	Part	No.	Part
1	TCM wiring harness connector	4	Input shaft speed sensor (NC2)
2	Transmission wiring harness connector (including fluid temperature sensor wiring harness)	5	Output Shaft Speed Sensor (SP)
3	Park/neutral position switch (NSW)	6	Transmission Control Module (TCM)

Component Exploded View

Peripheral Component Exploded View



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No.	Part	No.	Part
1	Output Shaft Speed Sensor	10	Sealing gasket
2	Bolt gasket	11	Torque Converter
3	Input shaft speed sensor	12	Right differential grease seal
4	Bolt, gasket	13	Left differential grease seal
5	O ring	14	Input shaft grease seal
6	Vent tube nipple	15	Sealing gasket
7	Overflow plug	16	Neutral position switch
8	Sealing gasket	17	Bolt gasket
9	Oil drain plug	18	Bolt gasket

General Procedure

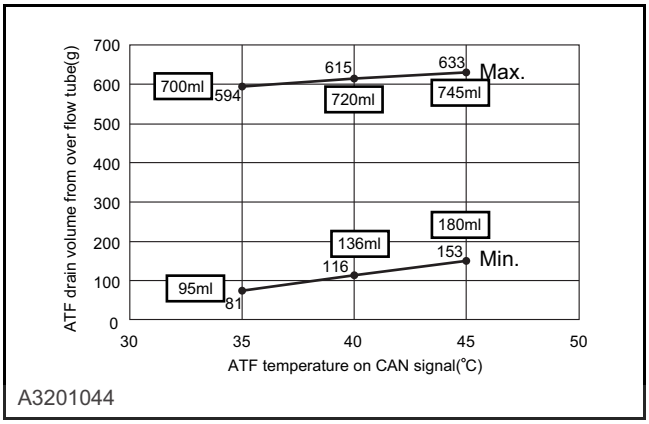
Inspect the transmission oil level and quality

CAUTION: When filling or refilling the oil, use specified automatic transmission oil only.

CAUTION: Inspect the oil level when the auto transmission oil temperature is 35 ~ 45 ℃

CAUTION: When inspecting the oil level, the selection lever must be in Park (P).

1. Park the vehicle on a horizontal ground (lifter or trench) and secure wheels.
2. Apply the parking brake and the wheel brake block to prevent slipping.
3. Confirm the shift lever remains in the P position.
4. Unscrew the transmission fluid filler plug.
5. Add 4kg (approx. 4700ml) AW-1 transmission fluid via the filler hole.
6. Tighten the transmission filler plug (torque 30 ~ 40N.m).
7. With A/C turned off, start the engine and keep it running at a speed below 2000RPM to heat the transmission fluid.
8. Shift the transmission shift lever in the order of P/R/N/D and hold the lever in each position for 3s, then shift the lever in the order of D/N/R/P and finally set the lever in the P position. This process is intended to allow ATF to enter into each actuator thoroughly and make the fluid level inspection more accurate.
9. At idle speed, when fluid temperature raises to 35 ℃ , keep the shift lever in the P position for 1 min.
10. When the temperature is stable between 35 ℃ and 45 ℃ , place a clean container under the transmission and unscrew the transmission overflow plug and carry out observations.
11. If the transmission fluid dripping changes from thread-like pattern to the drop pattern, then immediately tighten the transmission overflow plug (torque 23 ~ 25N, the overflow plug gasket cannot be reused and should be replaced at the time of each level check).
12. Weigh the transmission fluid in the container. If the curve requirements below are met, then the transmission fluid level is normal, if not, then repeat the procedure below from Step 4 until the requirements are met.



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13. If the level is too low, then add automatic transmission fluid via the filler hole and check if automatic transmission leaks.
14. If the level is too high, then the automatic transmission fluid is overfilled. Discharge part of fluid through oil drain plug of oil pan. Check that automatic transmission fluid level returns to the normal level.
15. Drip the transmission oil on a piece of clean white paper and watch its color. The natural color of transmission oil is lighter dark red. If it's getting lighter or darker, replacement is needed.
16. Check the transmission fluid via its odor. A scorched smell indicates the slipping of clutch or brake. Service the transmission as well as replace the transmission fluid.

Preparation for Mechanical System Testing

1. Start the parking brake and using wheel brake blocks on both front and rear wheels.
2. Checking engine coolant level.

   Refer to: Coolant Level Inspection (3.1.4 Cooling System, General Procedure).
3. Inspect the engine oil level.

   Refer to: Oil Level Inspection (3.1.3 Lubrication System, General Procedures).
4. Inspect ATF level

   Refer to: Fluid Level and Quality Inspection (3.2.1 Automatic Transmission/Transaxle, General Procedures).
5. Inspect idle speed
6. Inspect the ignition timing.

   Refer to: Timing Inspection (3.1.2 Mechanical System, General Procedure)

Transmission Oil Pressure Test

Special tool

Automatic transmission oil pressure gauge

Be sure to carry out fluid pressure test under the following conditions:

- The engine has been inspected and adjusted.
- A/C and headlight are turned off.

1. Prepare for mechanical execution system test

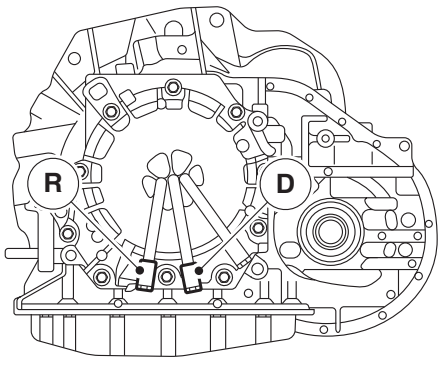
   Refer to: Preparation for Mechanical System Test (3.2.1Automatic Transmission, General Procedure).

WARNING: It may be dangerous to remove the plug when ATF is of high temperature. Hi-temp ATF would jet out from the outlet and thus lead to serious scalding. Please cool down the ATF before the removal of square head screw plug.

2. Connect the auto transmission oil pressure guage to the pressure inspection hole.
3. Warm up the engine until the temperature of ATF reaches 60 to 70 ℃ .
4. Shift the lever to D.
5. When the engine runs at idle speed in D, read the pipe pressure.
6. Read the pipe pressure when the engine runs at idle speed as it shows in step 4 and 5.
7. Depress the brake pedal hardly with your left foot.
8. Shift the lever to D.

CAUTION: The auto transmission may be damaged if accelerator pedal is depressed down for more than 5 seconds when the brake pedal is depressed at the same time. Therefore, execute step 9 and step 10 in 5 seconds.

9. Depress the accelerator pedal gradually with your right foot.
10. When the engine speed does not increase any longer, read the pipe pressure quickly and release the accelerator pedal.
11. Shift the lever to N and make the engine run at idle speed for 1 minute or longer so as to cool ATF.
12. Read the pipe pressure when the engine runs on stalling speed at R gear as it shows from step 7 to 11.
13. Remove the automatic transmission oil gauge.
14. Install test nipple screw plug.



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Pipe Pressure (MPa)	D-gear	R-gear

Engine idle speed	SLC1: 0.625 ~ 0.775	SLC2: 0.449 ~ 0.539
Engine stalling	SLC1: 1.450 ~ 1.630	SLC2 1.725 ~ 2.085

Pipe Pressure Test Assessment

Pipe Pressure Test Results	Possible Causes
Higher than standard pressure at both D and R	Pressure control solenoid (SLC1 or SLC2) malfunction
	Main pressure valve malfunction
Lower than standard pressure in both D and R	Pressure control solenoid (SLC1 or SLC2) malfunction
	Main pressure valve malfunction
	Oil pump fault
	Oil leakage in hydraulic system with transmission in P or R
Lower than standard pressure only in D	Hydraulic system malfunction with transmission in D
	C1 clutch fault
Lower than standard pressure only in R	Hydraulic system malfunction with transmission at R
	C3 clutch fault
	B2 brake fault
Higher than standard pressure only in D	Pressure control solenoid (SLC1 or SLC2) malfunction
Higher than standard pressure only in R	Pressure control solenoid (SLC1 or SLC2) malfunction
	Solenoid fault

Stalling Test

Be sure to carry out the stalling test under the following conditions.

- The engine has been inspected and adjusted.
- A/C and headlight are turned off.

1. Prepare for mechanical execution system test.

   Refer to: Preparation for Mechanical System Test (3.2.1Automatic Transmission, General Procedure).

2. Starting the Engine

CAUTION: Apply the parking brake and the wheel brake block to prevent slipping.

3. Depress the brake pedal hardly with your left foot.
4. Shift the lever to D.

CAUTION: The auto transmission may be damaged if accelerator pedal is depressed down for more than 5 seconds when the brake pedal is depressed at the same time. Therefore, execute step 5 and step 6 in 5 seconds.

5. Depress the accelerator pedal lightly with your right foot.
6. When the engine speed does not increase any longer, read the speed quickly and release the accelerator pedal.
7. Shift the lever into N and make the engine run at idle speed for 1 minute or longer so as to cool ATF.
8. Execute the operation in R again as it shows from step 3 to step 7.
9. Turn off the engine.

Standard value: 2564 ~2864 rpm

Stall Testing Assessment

Stall Testing Result	Possible Causes
Lower than standard speed at both D and R	Engine power is insufficient
	T/C lockup clutch malfunction
Higher than standard speed only in D	Solenoid pressure low (pressure control solenoid (SLC1) malfunction, main pressure valve malfunction)
	Valve body fault (C1 solenoid hydraulic system)
	F2 one-way clutch slippage
	C1 Clutch slippage
Higher than standard speed only in R	Solenoid pressure low (pressure control solenoid (SLC2) malfunction, main pressure valve malfunction)
	Valve body fault (C2 solenoid hydraulic system)
	B3 Brake slippage
	C3 Clutch slippage
Higher than standard espeed in both D and R	Solenoid pressure low (pressure control solenoid (SLC1 or SLC2) malfunction, main pressure valve malfunction)
	Oil pump fault
	Oil pump screen blocked

Road Test

⚠ **CAUTION: The temperature of engine oil is between 50 to 80 ℃ before the road test.**

Be sure to carry out the road test under the following conditions.

- The engine has been inspected and adjusted.
- Transmission fluid is within normal working range: 50 ~ 80 ℃ .
- A/C and headlight are turned off.

1. Gear shift function (D):
   - During the normal driving, check if the transmission can be shifted from the 1st gear into the 2nd gear, from 2nd gear into the 3rd and from the 3rd into the 4 gear.
2. Gear shift shock during the driving:
   - Check if the gear shift is smooth during the driving.
3. Kick-down function:
   - Perform kick-down shift in each gear range.
   - Check if there is shock during the kick-down shift.
4. Engine brake :
   - With transmission in the 1st gear in the manual mode, check for engine brake.
5. Gear shift point when accelerator pedal is pressed all the way down:
   - With shift lever in D position, press the accelerator pedal all the way down and check if the transmission can be upshifted from the 1st gear to the 2nd gear to meet specific gearshift point.
6. Manual gear shift control:
   - Check if any position can be shifted into in manual mode.
7. Control Lock Function
   - With lockup function active on the flat surface, check that engine speed will change significantly when accelerator pedal is gently pressed.
8. Working condition while in P position:
   - Park at a slope (5% or 3°or steeper), move into the P position and then release the brake, check if the vehicle can move.
9. Oil leakage:
   - At the end of road test, check each part for oil leakage.

Time Lag Test

Be sure to carry out the time lag test under the following conditions.

- The engine has been inspected and adjusted.
- A/C and headlight are turned off.

1. Prepare for mechanical execution system test.

   Refer to: Preparation for Mechanical System Test (3.2.1 Automatic Transmission, General Procedure).

2. Starting the Engine.
3. Warm up the engine until the temperature of ATF reaches 60 to 70 ℃ .
4. Apply the brake and allow the engine to run at idle. Move the shift lever from the N position to the D position or from the N position to the R position and use a timer to record the time required from commencement of gear shift to the vibration feel.

   Formula: Average Time Lag= (Time 1+ Time 2+ Time 3)/3
5. Execute the following shifting test as it shows in step 5.
   - N → R

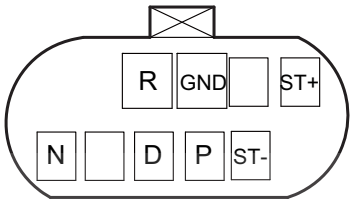
Gear Shifting	Time
From N position to R position	1.5s or shorter
From N position to D position	1.5s or shorter

Time Lag Test Assessment

Time Lag Test Result	Possible Causes
The time of shifting from N to D is longer than standard time	Valve body fault (C1 or C2 hydraulic system)
	C1 Clutch slippage
	F2 one-way clutch fault
	Oil pump fault
The time of shifting from N to R is longer than standard time	Valve body fault (C1 or C2 or S1 solenoid hydraulic system)
	C3 Clutch slippage
	B3 brake fault
	Oil pump fault
	Oil filter blocked

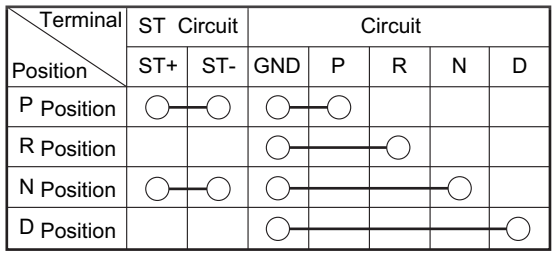
Park/Neutral Position Switch Inspection

1. Switch off the Park/Neutral switch (NSW).



A3201046

2. Use multimeter to inspect if every gear range could conduct electricity according to polarity and indicator line table.

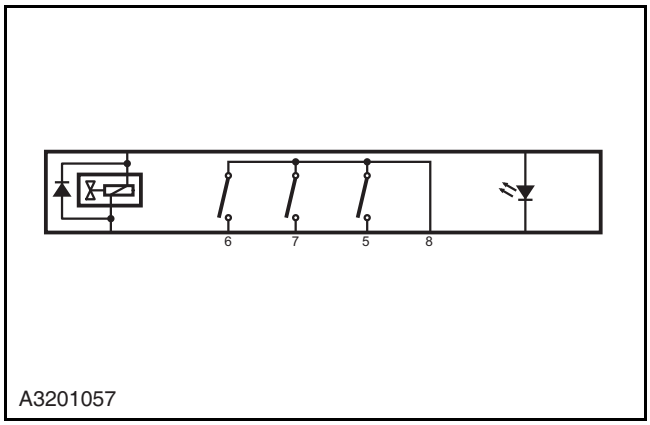


A3301047

3. If a wrong gear range is displayed during the test, replace the Park/Neutral switch.

Manual mode switch inspection

1. Set the gear lever in the manual mode position.
2. Disconnect the gear lever wiring harness connector.



3. Operate the gear lever in corresponding gear range.
4. Carry out tests as per the table below using a multimeter.

Standard:

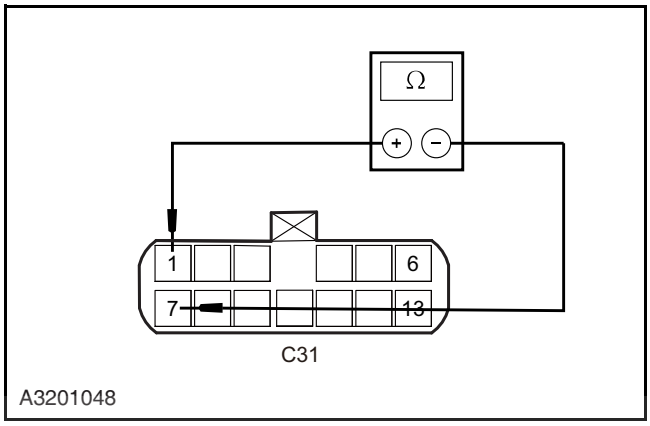
Terminal	Terminal definition
6 [MS-]	Manual downshift switch
7 [MS+]	Manual upshift switch
5 [MS]	Manual shift mode switch
8 [GND]	Shift lever grounding

Accelerator pedal signal inspection

Refer to: DTC Diagnosis Chart (3.1.3 Electronic Control System -MT22.1, DTC Diagnosis and Testing).

Inspect oil temperature sensor

1. Remove the transmission oil temperature sensor.
2. At certain transmission fluid temperature, measure the resistance value between Terminals 1 and 7 of transmission fluid temperature sensor.



3. If the value measured at certain temperature does not fall within standard resistance value range, then replace the transmission fluid temperature sensor. Refer to the table below for standard resistances in different temperature.

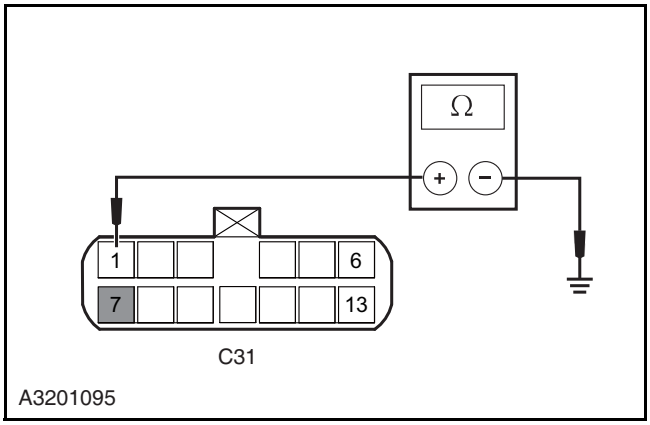
CAUTION: Do not damage the sensor and its terminals.

Name	Temperature	Resistance
Oil temperature sensor	-40 ℃	161 kΩ(Max)
	-30 ℃	36.3 ~ 52.1 kΩ
	-10 ℃	5.626 ～ 7.303 kΩ
	25 ℃	3.5 ~ 0 kΩ
	110 ℃	0.224 ～ 0.271 kΩ
	145 ℃	0.102 ~ 0.121 kΩ
	150 ℃	0.087 kΩ(Min)

4. Test if Terminals 1 and 7 of transmission fluid temperature sensor are shorted to ground.

Standard Resistance Value: 10 MΩ or higher

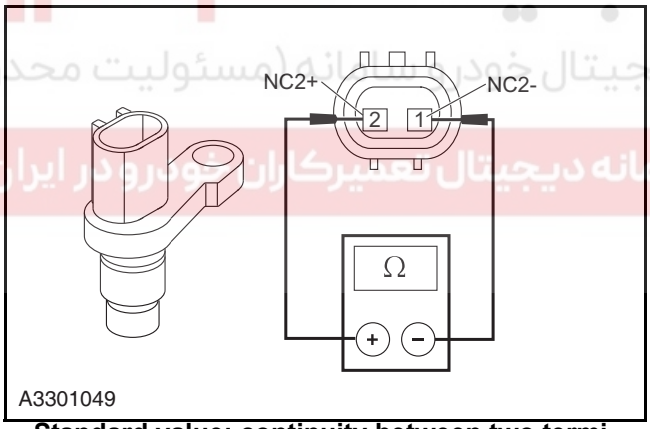
CAUTION: Do not damage terminals of the sensor.



5. If the measurements are accurate, then repair failed circuit of transmission fluid temperature sensor.

Input shaft speed sensor (NC2) inspection

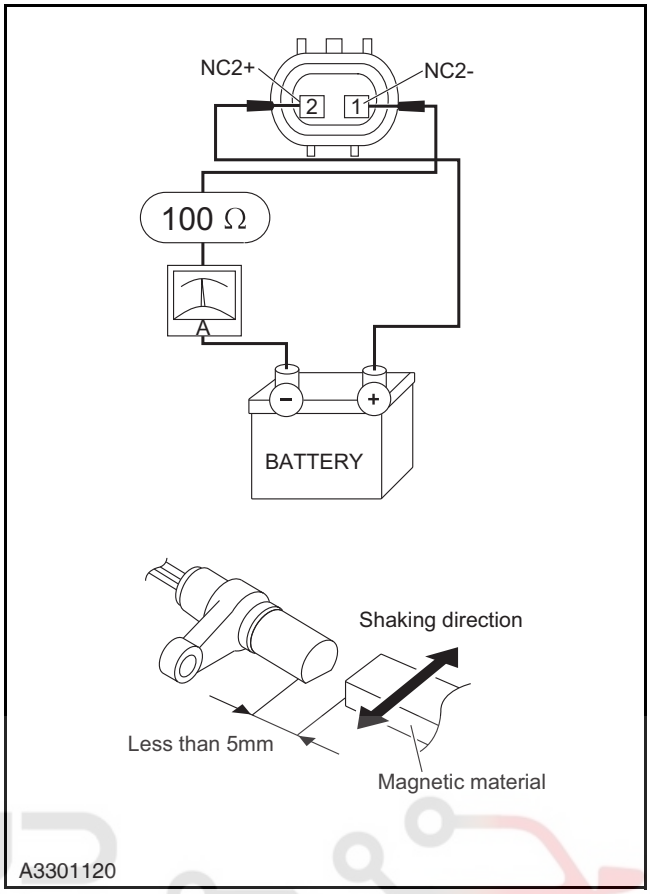
1. The input shaft speed sensor is an electromagnetic induction speed sensor. Its inspection can be done by measuring continuity between its terminals and can determine on the health of the sensor.



Standard value: continuity between two terminals

CAUTION: Do not damage the sensor and its terminals.

CAUTION: In the measurement of resistance at both ends of the sensor, the resistance value measured may be 100 kΩ or greater, but it can not serve as the basis for fault determination.



2. Remove the input shaft speed sensor.
3. As shown above, energize the sensor and connect a resistor of 100Ω and an ammeter in series.

CAUTION: Do not damage the sensor and its terminals.

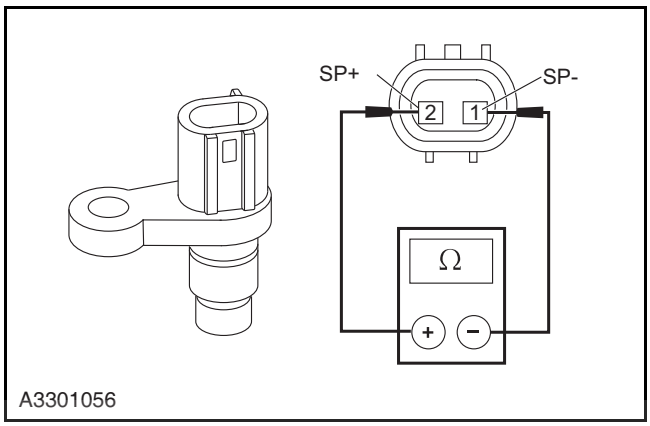
4. Move left and right a magnet below with a distance of 5mm from the speed sensor, and check the ammeter readings. Refer to the table below for standard current values.

Signal	Current
High	12.0 ~ 16.0 mA
Low	4.0 ~ 8.0 mA

5. If current values measured in two attempts are not between min. and max. current values, replace the sensor measured.

Output shaft speed sensor (SP) inspection

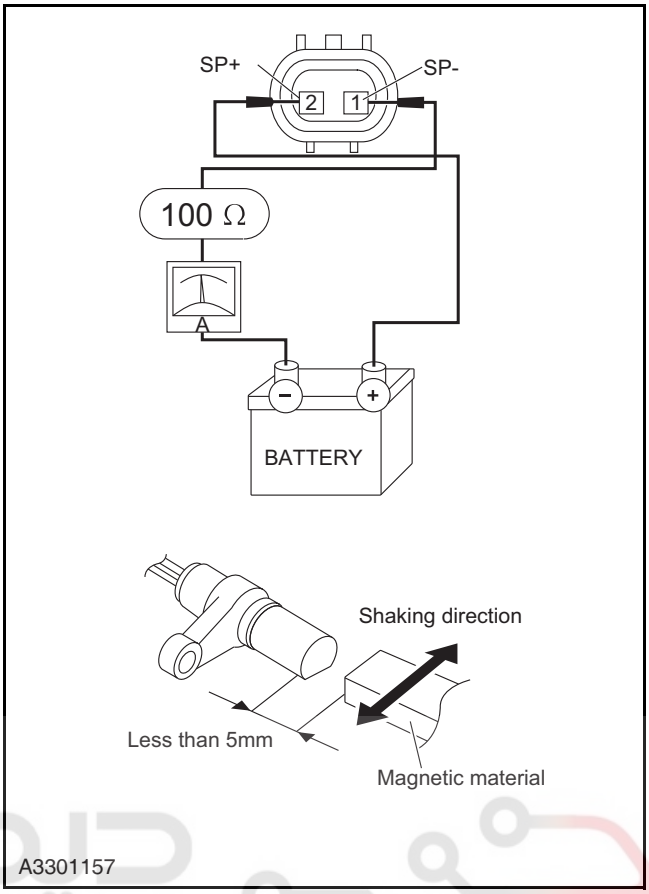
1. The output shaft speed sensor is an electromagnetic induction speed sensor. Its inspection can be done by measuring continuity between its terminals and can determine on the health of the sensor.



Standard value: continuity between two terminals

CAUTION: Do not damage the sensor and its terminals.

CAUTION: In the measurement of resistance at both ends of the sensor, the resistance value measured may be 100 kΩ or greater, but it can not serve as the basis for fault determination.



2. Remove the output shaft speed sensor.
3. As shown above, energize the sensor and connect a resistor of 100Ω and an ammeter in series.

CAUTION: Do not damage the sensor and its terminals.

4. Move left and right a magnet below with a distance of 5mm from the speed sensor, and check the ammeter readings. Refer to the table below for standard current values.

Signal	Current
High	12.0 ~ 16.0 mA
Low	4.0 ~ 8.0 mA

5. If current values measured in two attempts are not between min. and max. current values, replace the sensor measured.

Shift Solenoid (S1) Inspection

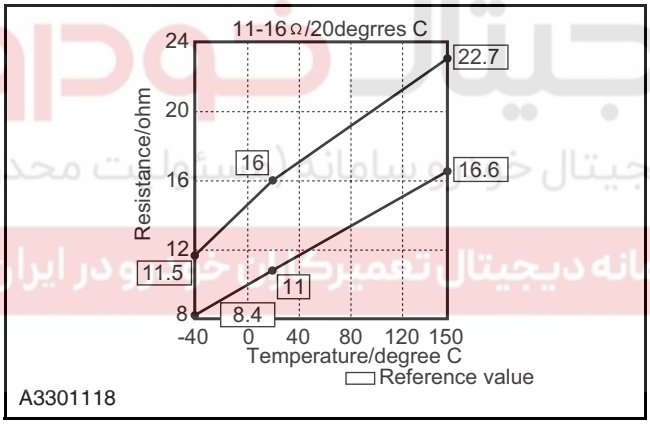
1. Remove the oil pan.
2. Remove the shift solenoid.
3. Use a multimeter to measure the resistance between solenoid terminal and ground terminal.

CAUTION: When measuring the solenoid resistance in high temperature, the value would become infinite.

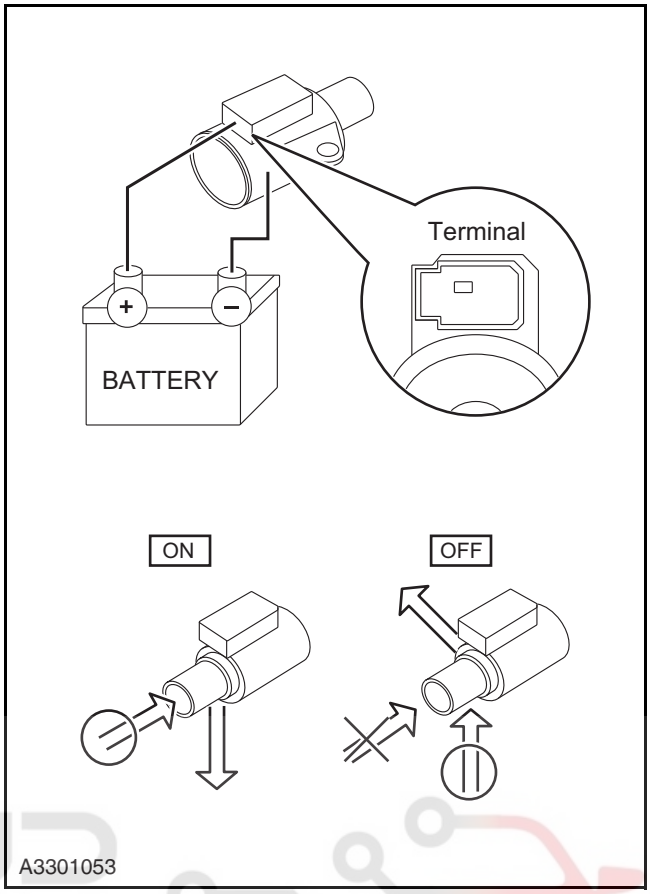
CAUTION: Do not damage the shift solenoid and its terminals.

4. If the value is not between the maximum and minimum resistance curve, measure the solenoid resistance in 20℃. Refer to the table below for the resistance in different temperatures.

Standard resistance value: 11 ～ 15 Ω (20 ℃)



5. Connect battery's anode with solenoid terminal and cathode with solenoid ground, check if the solenoid works. Connect battery's anode with solenoid terminal and cathode with solenoid ground. The shift solenoid (S1) is a 3-way valve. Check if the air flow direction is correct, refer to the figure below.



Linear Pressure Control Solenoid (SLC1, SLC2 and SLB1) Inspection

1. Remove the oil pan.
2. Remove the valve body.

CAUTION: Do not remove a solenoid from the body.

CAUTION: Do not damage a solenoid.

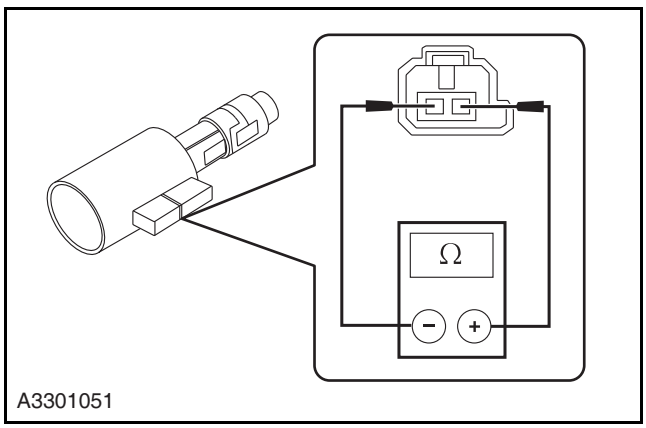
3. Measure the resistance between terminals of pressure control solenoid with a multimeter.

CAUTION: Do not damage a solenoid and its terminals.

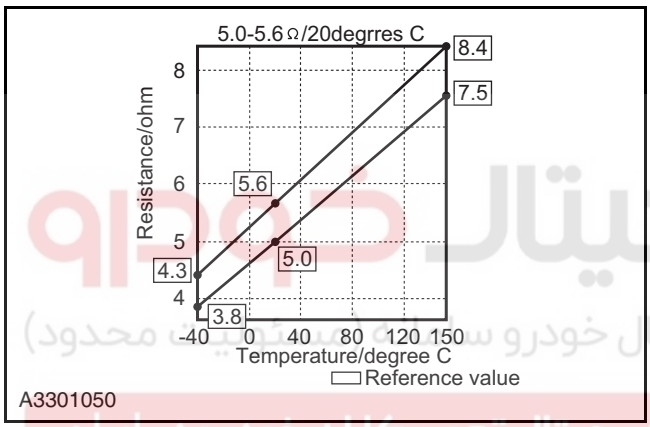
4. If the value is not between the maximum and minimum resistance curve, measure the solenoid resistance in 20 ℃.

Standard resistance value: 5.0 ～ 5.6 Ω(20 ℃).

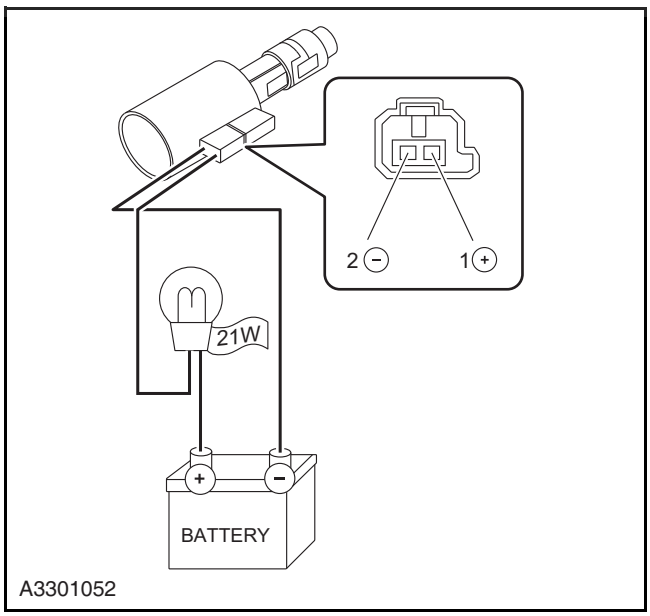
CAUTION: When measuring the sensor resistance in high temperature, the value would become infinite.



5. Replace the measured solenoid if both of the values are not between the maximum and minimum resistance curve. Refer to the table below for resistances in different temperature.



6. Connect as shown and test if every solenoid works. (lamp bulb 12V-21W)



Lockup Solenoid (SLU) Inspection

1. Remove the oil pan.
2. Remove the valve body.

CAUTION: Do not remove the solenoid from the body.

CAUTION: Do not damage a solenoid.

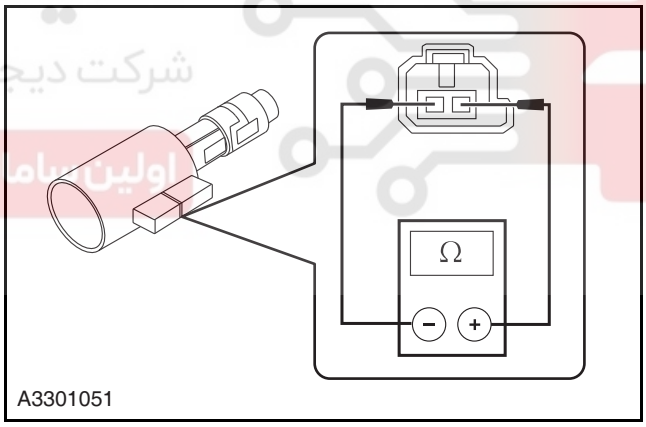
3. Measure the resistance between terminals of pressure control solenoid with a multimeter.

CAUTION: Do not damage the shift solenoid and its terminals.

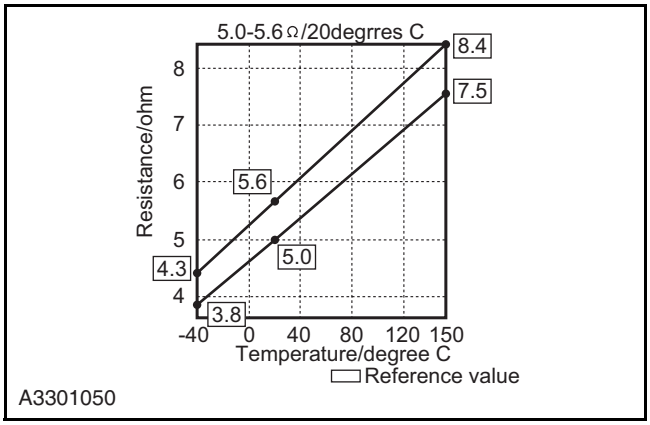
4. If the value is not between the maximum and minimum resistance curve, measure the solenoid resistance in 20 ℃ .

Standard resistance value: 5.0 ～ 5.6 Ω(20 ℃).

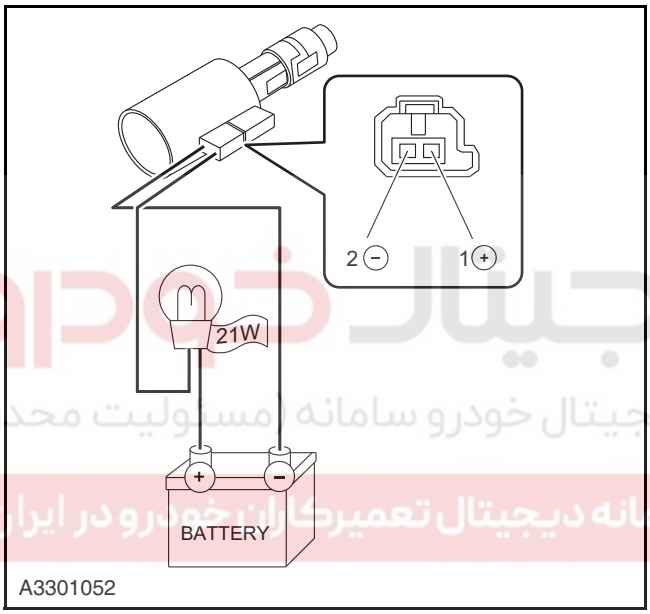
CAUTION: When measuring the sensor resistance in high temperature, the value would become infinite.



5. Replace the measured solenoid if both of the values are not between the maximum and minimum resistance curve. Refer to the table below for resistances in different temperature.

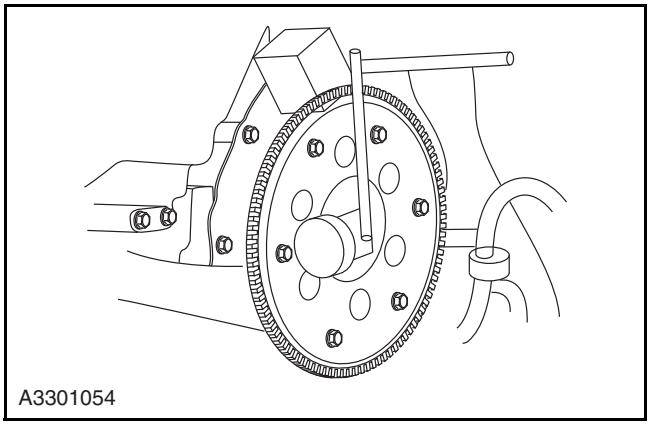


6. Connect as shown and test if every solenoid works (lamp bulb 12V-21W).



Flywheel Face Runout Check

1. Check if the drive plate runout falls within the reference value range.



Standard value: smaller or equal to 0.2 mm

CAUTION: If not within the range, replace the drive plate.

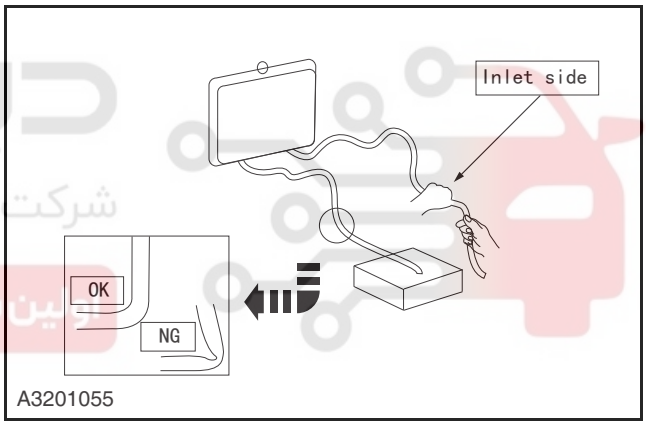
CAUTION: If an "abnormal wear" or "spot erosion" is detected on T/C or oil pump, replace A/T assembly.

Cooler Tube Bending and Clogging Check

1. Check the chamfer R section of cooler tube, distorted part and small-section area of the tube for abnormal bend.

CAUTION: If there is any problem, replace the failed parts.

2. Blow 2 kg/cm^2 compressed air into the tube from its inlet and check if the tube is clogged by identifying smoothness of air flow.



CAUTION: Cooler tube bending and clogging

3. A bent or clogged cooler tube will result in reduced flow of transmission fluid through the cooler, giving rise to increased fluid temperature and fluid overflow through the vent pipe, the lockup clutch of T/C can not respond due to lack of pressure and the engine at idle will shut down due to continued engagement of lockup clutch. Remove impurities in the tube and clean the inside or replace the tube.

Symptom Diagnosis and Testing

General Equipment

Digital Multimeter
Changan Auto special diagnostic tool

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage or electric damage.

Visual Inspection Chart

Mechanical	Electrical
•Leak •Gear shifting cables	•Fuse •Circuit •Electrical wiring harness connector

3. If an obvious cause for an observed or reported concern is found, correct the cause before proceeding to the next step.
4. If the cause is not evident, verify the symptom and refer to the Fault Symptom Chart.

Symptom Chart

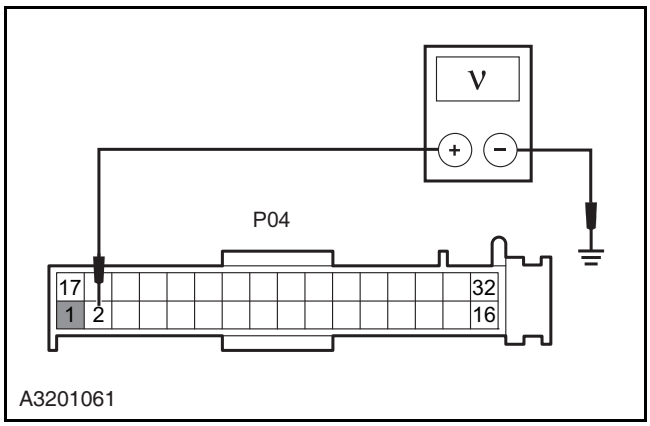
If there is a symptom but no diagnosis trouble code (DTC) is stored in control module and can not confirm symptom reasons in basic inspect, it is necessary to diagnosis and eliminate the symptoms in the following chart.

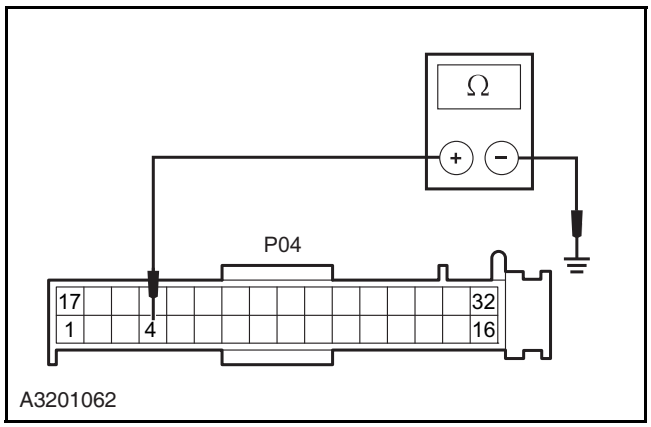
Symptom	Possible Sources	Action
Diagnosis process of Malfunction indicator light malfunction	•Instrument •Circuit •Bulb •Automatic Transmission Control Module	**Refer to: Diagnostic Procedure for Improper MIL Operation (3.2.1 Automatic Transmission, Symptom Diagnosis and Testing)**
The abnormal gearshift (up or down shifting)	•Emergency mode •Throttle position sensor •Input shaft speed sensor •Output shaft speed sensor •Transmission control module •Neutral position switch	**Refer to: Diagnostic Procedure for Abnormal Gear Shift (up shift or down shift) (3.2.1 Automatic Transmission, Symptom Diagnosis and Testing)**
Enter transmission failsafe mode	•S1 shift solenoid valve •Solenoids SLC1, SLC2, SLB1 •ECM •TCM •Circuit	•Replace the solenoid •Repair TCM malfunction •Repair ECM malfunction •Repair the circuit
The engine speed does not change when depressing the accelerator pedal	•Air Intake system •Inlet air pressure sensor •Throttle body •Fuel injector •Spark plug •Ignition timing •Fuel •Exhaust block •Control module circuit	**Refer to: Symptom Chart (3.1.13 Electronic Control System - MT22.1, Symptom Diagnosis and Testing)**

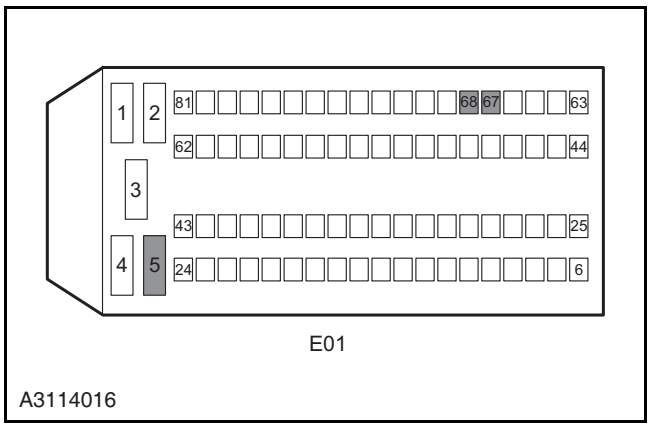
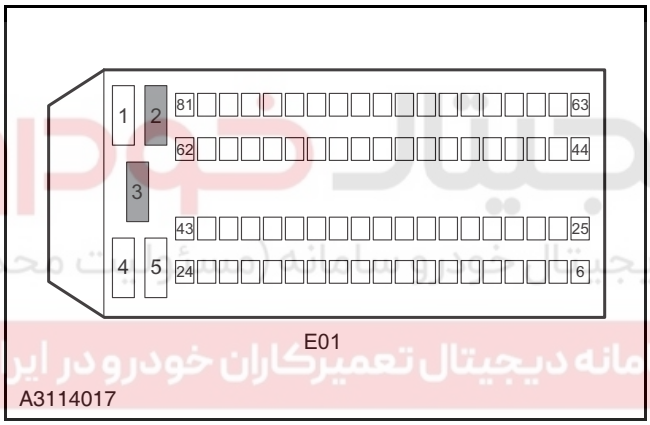
Symptom	Possible Sources	Action
Stationary, abnormal shift shock during driving	•Engine output power •Pressure control solenoid •Output shaft speed sensor •Input shaft speed sensor •Neutral position switch •Automatic transmission	**Refer to: Stationary, Diagnostic Procedure for Abnormal Gear Shift Shock During Driving (3.2.1 Automatic Transmission, Symptom Diagnosis and Testing)**
Manual mode can not be enabled	•Manual mode switch •Circuit •TCM	**Refer to: Diagnostic Procedure for Failure to Enable Manual Mode(3.2.1 Automatic Transmission, Symptom Diagnosis and Testing)**
Fluid leakage	•Automatic transaxle housing or case leakage	•Check bolt torque. If a bolt is loose, replace fasteners and tighten to torque specification. If the torque is correct, inspect the case and sealing. Replace if necessary.
	•O-ring leakage - sensors, transmission cable	•Inspect if the O-ring of the connectors are damaged or lost, then replace them. Replace if necessary.
	•Leak in the oil pan washer area	•Check if the torque of oil pan bolt is proper. Check if the gasket is correctly positioned or curls up. Replace if necessary.
	•Gearshift lever area leakage	•Check if shift lever seals or shift lever is damaged. Repair as necessary
	•Output flange area leakage	•Check if oil slinger seal and output shaft seal are damaged. Visually check output flange surface for damage. Repair as necessary
	•Transmission vent area leakage	•Check if the fluid is overfilled. Adjust as necessary If the level is within specified range, then test on board. Monitor transmission temperature. If working temperature is found too high, then transmission fluid could be contaminated or the cooling system fails, replace the fluid as per the procedures in the service manual.
	•Transmission filler area leakage	•Check if filling port is properly installed. Check Oil-ring seal between housing and filling port for leakage, and repair as necessary.

Symptom	Possible Sources	Action
Transmission noise	•The bolts of torque converter touches the dust boot	•Replace transmission
	•Drive disk damage or crack	
	•Drive shaft or rear axle noise	
	•Transmission output bearing noise	
	•Oil pump	
	•Oil level low	•Inspect and adjust the oil level
	•In emergency mode	•Repair according to the DTC **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission,DTC Diagnosis and Testing).**

Diagnosis process of MIL fault

Test Conditions	Details/Results/Actions
1.Inspect the instrument status and other warning lamps	
	A.Turn the ignition switch to position"ON". B.Inspect the status of all the indicators. Are any indicators on except for MIL? **Y** Go to step 2. **N** Go to step 4.
2.Inspect the instrument cluster power supply circuit	
 A3201061	A.Turn the ignition switch to "LOCK" position. B.Disconnect the instrument cluster wiring harness P04. C.Turn the ignition switch to "ON" position. D.Measure the reliabe voltage of the terminal 1 and 2 of the instrument wiring harness connector P04 to the reliable grounding. **Standard Voltage Value: 11~14V** Is the voltage normal? **Y** Go to step 3. **N** Repair the circuits from Terminals 1 and 2 of instrument cluster wiring harness connector P04 to Terminal 157 of fuse IF25 in the interior electrical center and to Terminal 41 of fuse IF19 respectively.

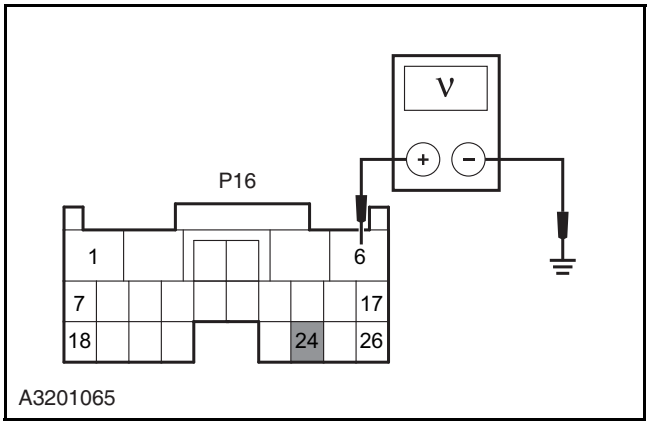
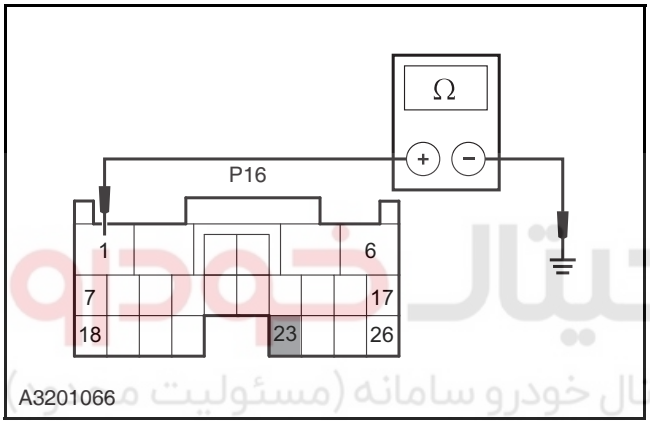
Test Conditions	Details/Results/Actions
3.Inspect the instrument cluster grounding circuit	
 A3201062	A.Turn the ignition switch to "LOCK" position. B.Disconnect the combined instrument wiring harness P04. C.Measure the resistance between terminal 4 of instrument cluster wiring harness connector P04 to the reliable grounding. **Standard Resistance Value: less than 5 Ω** Is the resistance value normal? **Y** Go to step 4. **N** Repair the failed circuit.
4. Implement fault indicator lamp drive test	
	A.Connect fault diagnostic tool. B.Turn the ignition switch to position "ON". C.Select "MIL" "ON" from the "Active Test" menu in the diagnostic tool. MIL can turn on as normal. Is the fault indicator lamp drive test normal? **Y** Go to step 5. **N** Replace the instrument cluster.
5 . Inspect and repair CAN bus	
	A.Inspect and repair CAN bus **Refer to: Can Not Communicate With ECM Diagnostic Tool (4.3.16 Vehicle Network System, Symptom Chart).** Is CAN bus circuit normal? **Y** Go to step 6. **N** Repair the failed circuit.

Test Conditions	Details/Results/Actions
6.Inspect the power circuit of ECM	
 E01 A3114016	A.Turn the ignition switch to position "LOCK". B.Measure from the back of ECM wiring harness connector E01. C.Turn the ignition switch to ON position and use a multimeter to measure the voltage between the terminal 5, 67 and 68 of the ECM wiring harness connector E01 and the power supply. **Standard Voltage Value: 11~14 V** Is the voltage normal? **Y** Go to step 7 **N** Inspect the power circuit of ECM
7. Inspect ECM grounding circuit	
 E01 A3114017	A.Turn the ignition switch to position "LOCK". B.Measure from the back of ECM wiring harness connector E01. C.Measure the resistance between terminal 2 and 3 of the ECM wiring harness connector E01 and the reliable grounding terminal. **Standard Resistance Value: less than 5Ω** Is the resistance value normal? **Y** Replace the engine control module. **Refer to: Engine Control Module (3.1.13 Electronic Control System-MT22.1, Removal and Installation).** **N** Inspect and repair the ECM grounding circuit.

Diagnosis process of the abnormal shift (up or down shifting)

Test Conditions	Details/Results/Actions
1.Inspect DTC	
	A.Connect the diagnosis tool. B.Inspect AT system with the diagnostic tool. Does the automatic transmission system have diagnosis trouble code? **Y** **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission,DTC Diagnosis and Testing)** **N** Go to step 2
2.Inspect whether the transmission is in emergency mode	
	A.Road test vehicles. B.Inspect the transmission up-shift, down-shift, kicking down, engine brake, hydraulic torque converter lock. Is the transmission is emergency mode? **Y** The transmission is in the emergency mode. **N** Go to step 3.
3. Inspect the throttle position sensor	
	A.Inspect the throttle position sensor. **Refer to: DTC Diagnostic Procedure Index (3.1.13 Electrical Control System - MT22.1， DTC Diagnosis and Testing).** Is the throttle position sensor normal? **Y** Go to step 4. **N** Repair or replace the throttle position sensor.

Test Conditions	Details/Results/Actions
4. Inspect neutral position switch	
	A.Replace the neutral position switch. **Refer to: Neutral position Switch Inspection (3.2.1Automatic Transmission, General Procedure).** Is the neutral position switch normal? **Y** Go to step 5. **N** Replace the neutral position switch.
5. Inspect input and output shaft speed sensors	
	A. Inspect the input shaft speed sensor. **Refer to: Inspect the input shaft speed sensor (3.2.1 Automatic Transmission, General Procedure).** B. Inspect the output shaft speed sensor. **Refer to: Inspect the output shaft speed sensor (3.2.1 Automatic Transmission, General Procedure).** Is the sensor normal? **Y** Go to step 6. **N** Replace the failed sensor.

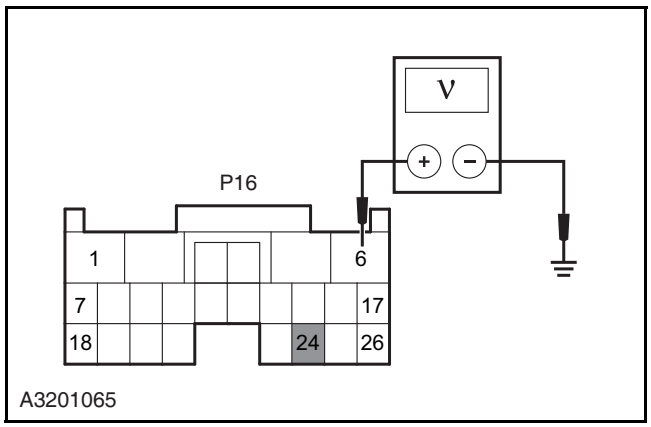
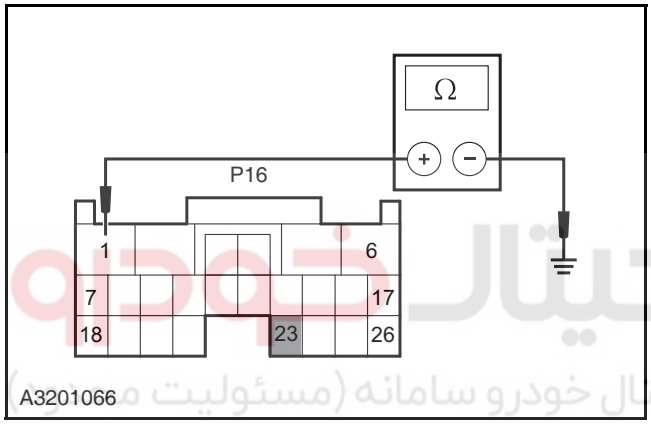
Test Conditions	Details/Results/Actions
6. Inspect the TCM power supply and its grounding circuit	
 A3201065	A.Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B.Disconnect the TCM wiring harness connector P16. C.Turn the ignition switch to position "ON". D.Measure the voltage of the terminal 6 and 24 of TCM wiring harness connector P16 to the ground. **Standard Voltage Value: 11~14 V** E.Measure the resistance of the terminal 1 and 23 of the TCM wiring harness connector P16 and the value and the reliable grounding terminal. **Standard Resistance Value: less than 5 Ω** Is TCM power supply and the grounding circuit normal? **Y** Go to step 7. **N** Repair the open circuit fault of TCM power or ground circuit.
 A3201066	
7. Inspect TCM	
	A.Remove TCM. B.Install TCM on a vehicle in good working order. Is the vehicle normal after installing the TCM? **Y** Replace automatic transmission. **N** Replace TCM.

Diagnosis process of static, driving abnormal shift shock

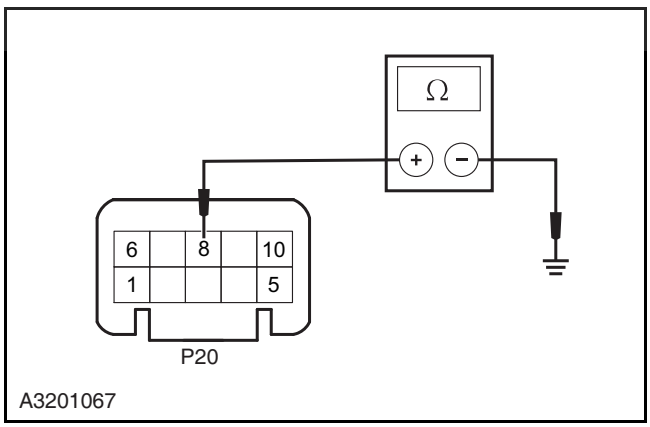
Test Conditions	Details/Results/Actions
1. Inspect DTC	
	A.Connect the diagnosis tool. B.Inspect AT system with the diagnostic tool. Does the automatic transmission system have diagnosis trouble code? **Y** **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission, DTC Diagnosis and Testing)** **N** Go to step 2.
2. Inspect whether the transmission is in emergency mode	
	A. Road test vehicles. B. Inspect the transmission up-shift, down-shift, kicking down, engine brake, hydraulic torque converter lock. Is the transmission is emergency mode? **Y** The transmission is in the emergency mode. **N** Go to step 3.
3.Inspect the wiring harness connector	
	A. Inspect whether the transmission wiring harness connector C31 connection is reliable without loosing, falling, dirt and damage. B. Check if connections of TCM wiring harness connector P16 and P17 are reliable without loose, falling, dirty and damage. Is the wiring harness connector inspected normal? **Y** Go to step 4. **N** Repair or replace transmission wiring harness and TCM harness.

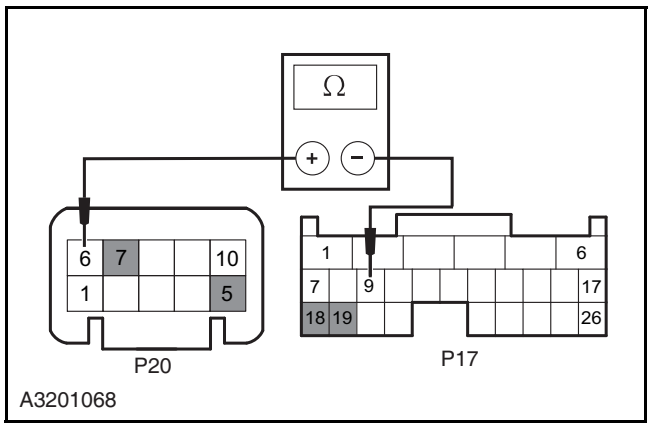
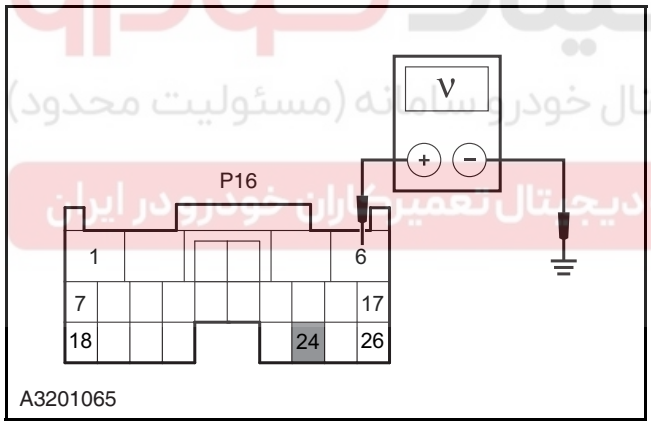
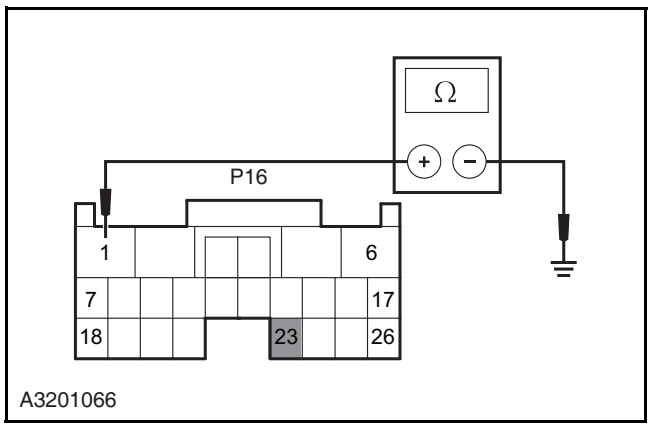
Test Conditions	Details/Results/Actions
4. Inspect the engine	
	A.Inspect the engine for the following. • Air intake pressure temperature sensor • Throttle position sensor • Camshaft Position Sensor • Crankshaft position sensor • High voltage cable • Ignition coil • Spark plug • Ignition timing • Idle speed • Intake leak • Exhaust block Is the engine normal? **Y** Go to step 5. **N** Repair the fault.

Test Conditions	Details/Results/Actions
5. Inspect the automatic transmission sensor	
	A. Inspect the following sensors of the automatic transmission: Input shaft speed sensor **Refer to: Inspect the input shaft speed sensor (3.2.1 Automatic Transmission, General Procedure).** Output Shaft Speed Sensor **Refer to: Inspect the output shaft speed sensor (3.2.1 Automatic Transmission, General Procedure).** Neutral position switch **Refer to: Neutral position Switch Inspection (3.2.1 Automatic Transmission, General Procedure).** Oil temperature sensor **Refer to: Inspect the oil temperature sensor (3.2.1 Automatic Transmission, General Procedure)** Is the sensor normal? **Y** Go to step 6. **N** Replace the failed sensor.

Test Conditions	Details/Results/Actions
6. Inspect the TCM power supply and its grounding circuit	
 A3201065	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Turn the ignition switch to position "ON". D. Measure the voltage of the terminal 6 and 24 of TCM wiring harness connector P16 to the ground. **Standard Voltage Value: 11~14 V** E. Measure the resistance of the terminal 1 and 23 of the TCM wiring harness connector P16 and the value and the reliable grounding terminal. **Standard Resistance Value: less than 5 Ω** Are TCM power and ground connection normal? **Y** Go to step 7. **N** Repair the open circuit fault of TCM power or ground circuit.
 A3201066	
7. Inspect TCM	
	A. Remove TCM. B. Install TCM on a vehicle in good working order. Is the vehicle normal after installing the TCM? **Y** Replace automatic transmission. **N** Replace TCM.

Diagnosis process of malfunction of manual mode

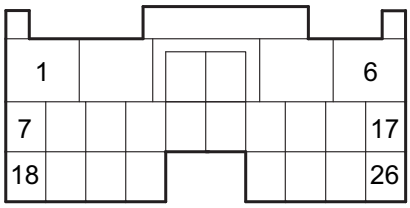
Test Conditions	Details/Results/Actions
1.Inspect DTC	
	A. Connect the diagnosis tool. B. Inspect AT system with the diagnostic tool. Does the automatic transmission system have diagnosis trouble code? **Y** **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission, DTC Diagnosis and Testing)** **N** Go to step 2.
2.Inspect the manual mode switch	
	A. Inspect manual mode switch. **Refer to: Manual Mode Switch Inspection (3.2.1Automatic Transmission, General Procedure).** Is the switch inspected normal? **Y** Go to step 3. **N** Replace the manual mode switch.
3. Inspect the manual mode switch grounding circuit	
 A3201067	A.Turn the ignition switch to position "LOCK". B.Disconnect manual mode switch wiring harness connector P20. C.Measure the resistance between the terminal 8 of the wiring harness connector P20 of the manual mode switch and the reliable grounding. **Standard Resistance Value: less than 5 Ω** Is the resistance value normal? **Y** Go to step 4. **N** Inspect and repair the open circuit between the terminal 8 of the manual mode switch wiring harness connector P20 and the grounding point GD201.

Test Conditions	Details/Results/Actions
4. Inspect the circuit between manual mode switch and TCM	
 A3201068	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect manual mode switch wiring harness connector P20 and TCM wiring harness connector P17. C. Measure the resistance from Terminals 6, 7 & 5 of manual mode switch wiring harness connector P20 to Terminals 18, 19 & 9 of TCM wiring harness connector P17 respectively. **Standard Resistance Value: less than 5 Ω** Is the resistance normal? **Y** Go to step 5. **N** Inspect and repair the open circuit fault from Terminals 6, 7 & 5 of manual mode switch wiring harness connector P20 to Terminals 18, 19 & 9 of TCM wiring harness connector P17 respectively.
5. Inspect the TCM power supply and its grounding circuit	
 A3201065	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Turn the ignition switch to position "ON". D. Measure the voltage of the terminal 6 and 24 of TCM wiring harness connector P16 to the ground. **Standard Voltage Value: 11~14 V** E. Measure the resistance of the terminal 1 and 23 of the TCM wiring harness connector P16 and the value and the reliable grounding terminal. **Standard Resistance Value: less than 5 Ω** Are TCM power and ground connection normal? **Y** Go to step 6. **N** Repair the open circuit fault of TCM power or ground circuit.
 A3201066	

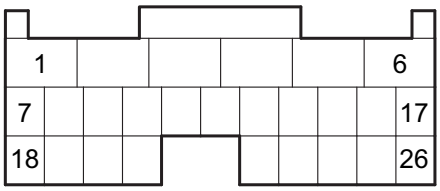
Test Conditions	Details/Results/Actions
6. Inspect TCM	
	A. Remove TCM. B. Install TCM on a vehicle in good working order. Is the vehicle normal after installing the TCM? **Y** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System-MT22.1, Symptom Diagnosis and Testing).** **N** Replace TCM.

DTC Diagnosis and Test

Control module terminal list



P16



P17

A3201074

Terminal No.	Name	Connec-tion	Terminal Description	Status
P16-1	GND	0.5 BK	GND	At all times
P16-2	SLB1G	0.5 BN/BU	B1 shift control valve [SLB1-]	During gear shift
P16-3	SLUG	0.5 VT/WH	Lockup control valve [SLU-]	During gear shift
P16-4	SLB1	0.5 BN/BK	B1 shift control valve [SLB1+]	During gear shift
P16-5	SLU	0.5 VT/BK	SLU lockup control valve [SLU+]	When locking
P16-6	+B	0.5 RD/BU	Battery voltage	At all times
P16-7	CANL	0.3 LG/BK	CAN communication low	At all times
P16-8	-	-	-	-
P16-9	SLC1G	0.3 LG/BK	C1 shift control valve [SLC1-]	During gear shift
P16-10	-	-	-	-
P16-11	OT	0.5 GN/WH	Oil temperature sensor [OT+]	Ignite“on”
P16-12	OTG	0.5 GN/RD	Oil temperature sensor [OT-]	Ignite“on”
P16-13	-	-	-	-
P16-14	-	-	-	-
P16-15	-	-	-	-
P16-16	S1	0.5 GN/BU	Transmission shift solenoid 1	During gear shift
P16-17	CANH	0.3 LG	CAN communication high	At all times
P16-18	-	-	-	-

Terminal No.	Name	Connec-tion	Terminal Description	Status
P16-19	SLC2G	0.5 BN	C2 shift control valve [SLC2-]	During gear shift
P16-20		-	-	-
P16-21	SLC2	0.5 BN/WH	C2 shift control valve [SLC2+]	During gear shift
P16-22	SLC1	0.5 VT/GN	C1 shift control valve [SLC1+]	During gear shift
P16-23	GND	0.5 BK	TCU ground	At all times
P16-24	IG	0.5 BK	Ignition input signal	Ignite“on”
P17-1	R	0.5 YE/GN	Neutral ON switch signal (R)	At gear R
P17-2	-	-	-	-
P17-3	-	-	-	-
P17-4	-	-	-	-
P17-5	SP-	0.5 RD/BU	Vehicle Speed Sensor [SP-]	When driving
P17-6	NC2-	0.5 GY/BU	C2 speed sensor [NC2-]	When engine operates
P17-7	D	0.5 YE/BU	Neutral ON switch signal [D]	At gear D
P17-8	N	0.5 BN/YE	Neutral ON switch signal [N]	At Gear N
P17-9	MS	0.5 BN/YE	Manual shift mode switch	Driver's com-mand
P17-10	-	-	-	-
P17-11	-	-	-	-
P17-12	-	-	-	-
P17-13	-	-	-	-
P17-14	SP+	0.5 BN/YE	Vehicle Speed Sensor [SP+]	When driving
P17-15			-	-
P17-16	NC2+	0.5 BN/YE	C2 speed sensor [NC2+]	When engine operates
P17-17				
P17-18	MS-	0.5 BN/YE	Manual downshift switch	Driver's com-mand
P17-19	MS+	0.5 BN/YE	Manual upshift switch	Driver's com-mand
P17-20	P	0.5 BN/YE	Neutral ON switch signal [P]	In P position
P17-21	-	-	-	-
P17-22	-	-	-	-
P17-23	-	-	-	-
P17-24	-	-	-	-

DTC code list

Fault code	Description		Is the MIL lamp on ?
P0974	Gearshift solenoidS1	Power supply short circuit/ open circuit	ON
P0973		Short circuit to ground	ON
P0980	C1 solenoid valve	Short circuit to power supply	ON
P0979		Grounding short circuit/ open circuit	ON
P0983	C2 Solenoid valve	Short circuit to power supply	ON
P0982		Grounding short circuit/ open circuit	ON
P0999	B1 Solenoid valve	Short circuit to power supply	ON
P0998		Grounding short circuit/ open circuit	ON
P2763	Lock solenoid	Short circuit to power supply	ON
P2764		Grounding short circuit/ open circuit	ON
P0722	Vehicle speed sensor	No pulse	ON
P0720		Electrical malfunction	ON
P0717	Input shaft speed sensor	No pulse	ON
P0715		Electrical malfunction	ON
P0713	Oil temperature sensor	Power supply short circuit/ open circuit	ON
P0712		Short circuit to ground	ON
P0711		Fluid temperature holding	ON
P0601	ROM	Internal check error	ON
P0562	Battery voltage	Low voltage	ON
P0563		High voltage	ON
P0604	RAM	Read / write error	ON
P0978	Solenoid feedback current	C1 solenoid current holding	ON
P0981		C2 solenoid current holding	ON
P0997		B1 solenoid current holding	ON
P2762		Lockup solenoid current holding	ON
P0603	EPROM	Read / write error	ON
P1205	Shifter manual mode problem	Shifter manual mode problem	OFF

Fault code	Description		Is the MIL lamp on ?
P0706	Gear sensor	Short to ground (multi-position signal)	ON
P0705		Open circuit (no signal)	ON
P0766	Gear shifting lock solenoid fault	Max. pressure holding (S1 solenoid pressure highest or C2 solenoid pressure lowest)	ON
P0741		Max. pressure holding(S1 solenoid pressure highest or lockup solenoid pressure lowest)	ON
P0751		Min. pressure holding	ON
P0762	C1 Solenoid fault	Max pressure holding	ON
P0761		Min. pressure holding	ON
P0767	C2 Solenoid fault	Max. pressure holding	ON
P0766		Min. pressure holding (C2 solenoid pressure highest or S1 solenoid pressure lowest)	ON
P2708	B1 Solenoid fault	Max. pressure holding	ON
P2707		Min. pressure holding	ON
P0742	Lockup solenoid failure	Lockup solenoid remains OFF	ON
P0741		Lockup solenoid remains OFF	ON
P0731	No engine brake	C1, C2 or lockup solenoid pressure lowest	OFF
P1229	-	No power in D	OFF
U0001	CAN	LIN bus closure	ON
U0074		No CAN signal (no response)	ON
U0100		Lost communication with ECU	ON
U2081		Lost communication with ESP	OFF
-		Engine speed fault	OFF
-		Throttle position signal	OFF
-		Engine torque fault	OFF
-		Coolant fault	OFF
-		Brake pedal signal fault	OFF
-		Brake pressure fault	OFF
-		Torque control fault	OFF

Failure-protection list

DTC code	Part	Failure protection operation	Prerequisite of releasing failure protection
P0562	Battery voltage (low voltage)	Limp mode 5	Turn the ignition switch to position"ON" from "OFF"
P0563	Battery voltage (high voltage)	Limp mode 3	Turn the ignition switch to position"ON" from "OFF"
P0601	ROM (Interior calibration)	Limp mode 3	Turn the ignition switch to position"ON" from "OFF"
P0603	EPROM (Read/write error)	TCM uses default value as initial value of EPROM	Turn the ignition switch to position"ON" from "OFF"
P0604	RAM (Read/write error)	Limp mode 3	Turn the ignition switch to position"ON" from "OFF"
P0705	Neutral position sensor (short to power/open circuit [no signal])	Limp mode 3	Turn the ignition switch to position"ON" from "OFF"
P0706	Neutral Position Sensor (short to ground [multiple signals])	Limp mode 3	Turn the ignition switch to position"ON" from "OFF"
P0711	Fluid temperature sensor (temperature holding)	No self-learning control No lockup slip difference control No neutral position control Fluid temperature = 80 ℃	Turn the ignition switch to position"ON" from "OFF"
P0712	Oil temperature sensor (short circuit to the ground)	No self-learning control No lockup slip difference control No neutral position control Fluid temperature = 80 ℃	Turn the ignition switch to position"ON" from "OFF"
P0713	Oil temperature sensor (short circuit/open circuit to power supply)	No self-learning control No lockup slip difference control No neutral position control Fluid temperature = 80 ℃	Turn the ignition switch to position"ON" from "OFF"
P0715	Input shaft speed sensor (short to power/to ground/ open circuit)	Limp mode 3 Change input speed calculation source	Turn the ignition switch to position"ON" from "OFF"
P0717	Input shaft speed sensor (No pulse)	Limp mode 3 Change input speed calculation source	Turn the ignition switch to position"ON" from "OFF"

DTC code	Part	Failure protection operation	Prerequisite of releasing failure protection
P0720	Output shaft speed sensor (short circuit to power/to ground/open circuit)	Limp mode 3 Change input speed calculation source	Turn the ignition switch to position"ON" from "OFF"
P0722	Output Shaft Speed Sensor (No pulse)	Limp mode 3 Change input speed calculation source	Turn the ignition switch to position"ON" from "OFF"
P0731	No engine brake	No self-learning control No adaptive shift control	Turn the ignition switch to position"ON" from "OFF"
P0741	Lock control solenoid (Off holding)	No self-learning control No lock-up control No lockup slip difference control	Turn the ignition switch to position"ON" from "OFF"
P0742	Lock control solenoid (Closure holding)	No self-learning control No adaptive shift control Torque limit at max. pressure of C2 solenoid = 40N.M (only in R position)	Turn the ignition switch to position"ON" from "OFF"
P0761	C1 shift control solenoid (Min. pressure holding)	Limp mode 2	Turn the ignition switch to position"ON" from "OFF"
P0762	C1 shift control solenoid (Max. pressure holding)	Limp mode 2	Turn the ignition switch to position"ON" from "OFF"
P0766	C2 shift control solenoid (Min. pressure holding)	Limp mode 2	Turn the ignition switch to position"ON" from "OFF"
P0767	C2 shift control solenoid (Max. pressure holding)	Limp mode 2	Turn the ignition switch to position"ON" from "OFF"
P0741	Gearshift solenoid S1 (Max. pressure holding [S1 pressure highest or SLU pressure lowest])	No self-learning control No lock-up control No lockup slip difference control	Turn the ignition switch to position"ON" from "OFF"
P0751	Gearshift solenoid S1 (Min. pressure holding)	No self-learning control No adaptive shift control Control of engine brake in 1st position is same as that in 2nd position	Turn the ignition switch to position"ON" from "OFF"
P0766	Gearshift solenoid S1 (Max. pressure holding [S1 pressure highest or SLC2 pressure lowest])	Limp mode 2	Turn the ignition switch to position"ON" from "OFF"
P0973	Gearshift solenoid S1 (Short circuit to ground)	Limp mode 4	Turn the ignition switch to position"ON" from "OFF"

DTC code	Part	Failure protection operation	Prerequisite of releasing failure protection
P0974	Gearshift solenoid S1 (Short circuit/open circuit to power supply)	Limp mode 4	Turn the ignition switch to position"ON" from "OFF"
P0978	C1 pressure control solenoid [SLC1] (Feedback current holding)	Limp mode 1	Turn the ignition switch to position"ON" from "OFF"
P0979	C1 pressure control solenoid [SLC1] (Short circuit to ground or open circuit)	Limp mode 1	Turn the ignition switch to position"ON" from "OFF"
P0980	C1 pressure control solenoid [SLC1] (Short to ground or open circuit)	Limp mode 1	Turn the ignition switch to position"ON" from "OFF"
P0981	C2 pressure control solenoid [SLC2] (Feedback current holding)	Limp mode 1	Turn the ignition switch to position"ON" from "OFF"
P0982	C2 pressure control solenoid [SLC2] (Short to ground or open circuit)	Limp mode 1	Turn the ignition switch to position"ON" from "OFF"
P0983	C2 pressure control solenoid [SLC2] (Short circuit to power supply)	Limp mode 1	Turn the ignition switch to position"ON" from "OFF"
P0997	B1 pressure control solenoid [SLB1] (Feedback current holding)	Limp mode 1	Turn the ignition switch to position"ON" from "OFF"
P0998	B1 pressure control solenoid [SLB1] (Short to ground or open circuit)	Limp mode 1	Turn the ignition switch to position"ON" from "OFF"
P0999	B1 pressure control solenoid [SLB1] (Short to ground or open circuit)	Limp mode 1	Turn the ignition switch to position"ON" from "OFF"
P1205	Shifter manual mode problem	No manual mode control	Turn the ignition switch to position"ON" from "OFF"
P1229	No power in D position	-	Turn the ignition switch to position"ON" from "OFF"

DTC code	Part	Failure protection operation	Prerequisite of releasing failure protection
P2707	B1 pressure control solenoid [SLB1] (Min. pressure holding)	Limp mode 2	Turn the ignition switch to position"ON" from "OFF"
P2708	B1 pressure control solenoid [SLB1] (Max. pressure holding)	Limp mode 2	Turn the ignition switch to position"ON" from "OFF"
P2762	Lock solenoid [SLU] (Short circuit to power supply)	Limp mode 1	Turn the ignition switch to position"ON" from "OFF"
P2763	Lock solenoid [SLU] (Short circuit to power supply)	No self-learning control No lock-up control No lockup slip difference control No neutral control function No adaptive shift control SLC2 max. pressure limit = 40N/m (only in R position)	Turn the ignition switch to position"ON" from "OFF"
P2764	Lock solenoid [SLU] (Short circuit or open circuit to grounding)	No self-learning control No lock-up control No lockup slip difference control No neutral control function No adaptive shift control SLC2 max. pressure limit = 40N/m (only in R position)	Turn the ignition switch to position"ON" from "OFF"
U0001	CAN bus interruption	Limp mode 3	Turn the ignition switch to position"ON" from "OFF"
U0074	No CAN signal	Limp mode 3	Turn the ignition switch to position"ON" from "OFF"
U0100	Lost communication with ECU	Limp mode 3	Turn the ignition switch to position"ON" from "OFF"
U2081	Lost communication with ESP/ABS	No self-learning control No neutral position control No adaptive shift control Brake master cylinder pressure = 0	Turn the ignition switch to position"ON" from "OFF"

Data stream list

Data Stream Item	Ignition switch "ON"	Engine speed 2500 rpm	Engine idle speed
Shift solenoid S1 feedback status	On	On	On
C1 solenoid feedback current	180 mA	180 mA	190 mA
C2 solenoid feedback current	900 mA	900 mA	900 mA
B1 solenoid feedback current	100 mA	100 mA	100 mA
Lock solenoid command	200 mA	190 mA	190 mA
Transmission output speed	0.0 rpm	0.0 rpm	0.0 rpm
Transmission turbine speed	0.0 rpm	2497 rpm	700.00 rpm
Transmission oil temperature	65 deg C	77 deg C	65 deg C
Battery voltage	11.99 V	14.07 V	13.88 V
Engine speed	0.0 rpm	2500 rpm	738.00 rpm
Engine torque	0.0 %	10.21 %	10.65 %
Driver request torque	0 %	10 %	11 %
Brake signal	Off	Off	Off
Acceleration pedal position	0 %	4 %	0 %
Gear range	P gear	P gear	P gear
Emergency mode	not in emergency mode	not in emergency mode	not in emergency mode
Vehicle speed	0 km/h	0 km/h	0 km/h
Torque reduction request	100.00 %	100.00 %	100.00 %
Torque limit request	100.00 %	100.00 %	100.00 %
Current lockup status of hydraulic torque converter	Unlocked	Unlocked	Unlocked
Gear shift mode	Sports mode	Sports mode	Sports mode
Current gear	Invalid value	Invalid value	Invalid value
Speed ratio	0.0	7.97	7.97
Sports mode light	Off	Off	Off
Winter mode indicator	Off	Off	Off
Warm-up cycle setup	Off	Off	Off
Driving cycle setup	Off	On	On
MIL request	OFF	OFF	OFF
DTC requests to store freeze fame data	0	0	0
Engine coolant temperature	-40 ℃	-40 ℃	-40 ℃
Engine speed	0.0 rpm	0.0 rpm	0.0 rpm
Vehicle speed sensor	0 km/h	0 km/h	0 km/h
Control mode voltage	0.0 V	0.0 V	0.0 V

Active test list

Diagnostic tool item	Part	Control range	Diagnostic description
Shift solenoid S1 control	Switch on/off gearshift solenoid S1	On/Off	Control the working condition of gearshift solenoid S1
C1 solenoid current	Switch on/off C1 solenoid	On/Off	Control the working condition of C1 solenoid
C2 solenoid current	Switch on/off C2 solenoid	On/Off	Control the working condition of C2 solenoid
B1 solenoid current	Switch on/off B1 solenoid	On/Off	Control the working condition of B1 solenoid
Lock solenoid current	On/Off Lock solenoid	On/Off	Control the working condition of lock solenoid SLU

DTC diagnosis flow index

Fault code	Description	Diagnosis Procedures
P0562	TCM detects system voltage low	Refer to: DTC P0562, P0563
P0563	TCM detects system voltage high	
P0601	Internal ROM malfunction of TCM	Refer to: DTC P0601, P0603, P0604
P0603	Internal EEPROM malfunction of TCM	
P0604	Internal RAM malfunction of TCM	
P0705	Neutral position switch circuit short to power or open	Refer to: DTC P0705, P0706
P0706	Neutral position short circuit short to ground	
P0711	ATF temperature sensor (OT) temperature holding	Refer to: DTC P0711, P0712, P0713
P0712	ATF temperature sensor (OT) short circuit to ground	
P0713	ATF temperature sensor (OT) short circuit to power/open circuit	
P0715	Input shaft speed sensor short circuit to power or ground/open circuit	Refer to: DTC P0715, P0717
P0717	No input shaft speed sensor signal fault	
P0720	Output shaft speed sensor short to power or ground/open circuit	Refer to: DTC P0720, P0722
P0722	No output shaft speed sensor signal	
P0731	No engine brake (C1 solenoid pressure lowest or C2 solenoid pressure lowest or lockup solenoid pressure lowest)	Refer to: DTC P0731

Fault code	Description	Diagnosis Procedures
P0741	Shift solenoid S1 max. pressure holding or SLU min. pressure holding	Refer to: DTC P0741, P0751, P0766, P0973, P0974 Refer to: DTC P0741, P0742, P2762, P2763, P2764
P0742	Lockup solenoid [SLU] closure holding	Refer to: DTC P0741, P0742, P2762, P2763, P2764
P2762	Lockup solenoid [SLU] feedback current holding	
P2763	Lockup solenoid [SLU] short circuit to power	
P2764	Lockup solenoid [SLU] short circuit to ground or open circuit	
P0761	C1 shift control solenoid [SLC1] min. pressure holding	Refer to: DTC P0761, P0762, P0978, P0979, P0980
P0762	C1 shift control solenoid [SLC1] max. pressure holding	
P0978	C1 pressure control solenoid [SLC1] feedback current holding	
P0979	C1 shift control solenoid [SLC1] short to ground/ open circuit	
P0980	C1 shift control solenoid [SLC1] short to power	
P0766	C2 shift control solenoid [SLC2] max. pressure holding or S1 solenoid min. pressure holding	Refer to: DTC P0766, P0767, P0982, P0983 Refer to: DTC P0741, P0751, P0766, P0973, P0974
P0767	C2 shift control solenoid [SLC2] max. pressure holding	Refer to: DTC P0766, P0767, P0981, P0982, P0983
P0981	C2 pressure control solenoid [SLC2] feedback current holding	
P0982	C2 pressure control solenoid [SLC2] short circuit to ground/open circuit	
P0983	C2 pressure control solenoid [SLC2] short circuit to power	
P0751	Shift solenoid (S1) min. pressure holding	Refer to: DTC P0741, P0751, P0766, P0973, P0974
P0766	Shift solenoid (S1) max. pressure holding	
P0973	Shift solenoid (S1) short circuit to power/open circuit	
P0974	Shift solenoid (S1) short circuit to ground	

Fault code	Description	Diagnosis Procedures
P2707	B1 pressure control solenoid [SLB1] min. pressure holding	Refer to: DTC P2707, P2708, P0997, P0998, P0999
P2708	B1 pressure control solenoid [SLB1] max. pressure holding	
P0997	B1 pressure control solenoid [SLB1] feedback current holding	
P0998	B1 pressure control solenoid [SLB1] short to ground/open circuit	
P0999	B1 pressure control solenoid [SLB1] short to power	
P1205	Shifter manual mode problem	Refer to: DTC P1205
P1229	No power in D position	Refer to: DTC P1229
U0001	CAN bus interruption	Refer to: DTC U0001, U0074, U0100, U2081
U0074	No CAN signal	
U0100	Lost communication with ECU	
U2081	Lost communication with ESP/ABS	

DTC P0562, P0563

1. Fault code description

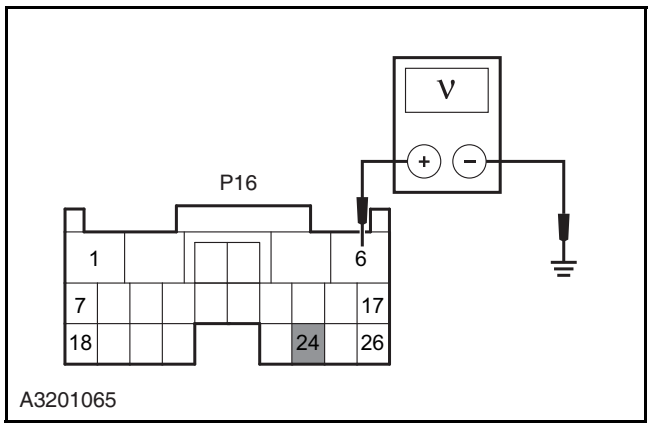
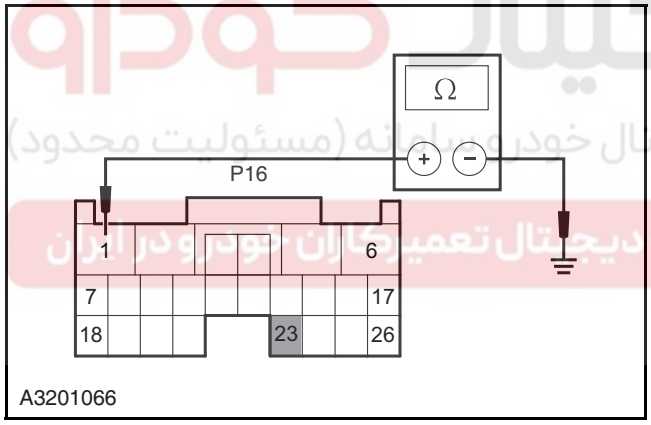
Fault code	Description	Definiton
P0562	TCM detects system voltage low	Battery voltage passes through 10A fuse IF32 of interior electrical center P01 and arrives at Terminal 6 of TCM wiring harness connector P16 directly. When the ignition switch is set to the "ON" position, the battery power passes through 10A fuse IF15 of interior electrical center P01 and arrives at Terminal 24 of TCM wiring harness connector P16 directly.
P0563	TCM detects system voltage high	

2. Possible Sources

Fault code	Test Tactics	Setting conditions (control strategy)	Fault
P0562	Hardware and circuit inspection	•With the engine at idle and the communication with TCM normal, if TCM detects the voltage of ignition switch is below 9V for 1s continuously, then a fault is detected once. DTC will make judgment after 20 fault detections.	•Inspect TCM power supply and grounding circuit. •TCM •Battery •Alternator
P0563		•With the engine at idle and the communication with TCM normal, if TCM detects the voltage of ignition switch is above 18V for 1s continuously, then a fault is detected once. DTC will make judgment after 20 fault detections.	

3. Diagnosis procedure

Test Conditions	Details/Results/Actions
1. Inspect DTC	
	A.Connect the diagnosis tool. B.Diagnose Automatic Transmission with diagnosis tool. Is there any other fault code except for P0562, P0563? **Y** **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission, DTC Diagnosis and Testing).** **N** Go to step 2.
2. Inspect the battery voltage	
	A. Measure the battery voltage. **Standard Voltage Value: 11~14 V** B. Start the engine. C. Measure the voltage at both positive and negative ends of battery. **Standard Voltage Value: 11~16 V** Is the voltage normal? **Y** Go to step 3. **N** Inspect and repair the charging system and battery. Verify the system is normal.
3. Inspect the fuse IF32, IF15	
	A. Inspect the fuse IF32 and IF15. **Rated capacity of the fuse: 10 A** Is the fuse normal? **Y** Go to step 4. **N** Inspect and repair the fuse circuit, replace the fuse in rated capacity.

Test Conditions	Details/Results/Actions
4. Inspect the TCM power supply circuit	
 A3201065	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Connect the battery negative cable. D. Turn the ignition switch to position "ON". E. Measure the voltage between terminal 6 and 24 of TCM wiring harness connector P16 and reliable grounding. **Standard Voltage Value: 11~14 V** Is the circuit normal? **Y** Go to step 5. **N** Inspect and repair the open circuit fault from Terminals 6 and 24 of TCM wiring harness connector P16 to the interior electrical center P01.
5. Inspect the TCM grounding circuit	
 A3201066	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Measure the resistance between terminal 1 and 23 of TCM wiring harness connector P16 and the reliable grounding. **Standard Resistance Value: less than 5 Ω** Is the resistance value normal? **Y** Go to step 6. **N** Inspect and repair the open circuit fault between the TCM wiring harness connector P16 terminal 1 and 23 and the grounding point GD205. Verify the system is normal.

Test Conditions	Details/Results/Actions
6. Inspect TCM	
	A. Remove the transmission control module TCM. B. Install a transmission control module in a vehicle in good condition. Is the vehicle normal after installing the transmission control module? **Y** Replace transmission control module. **Refer to: TCM (3.2.1 Automatic Transmission, Removal and Installation).** **N** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System - M7, Symptom Diagnosis and Testing).**

DTC P0601, P0603, P0604

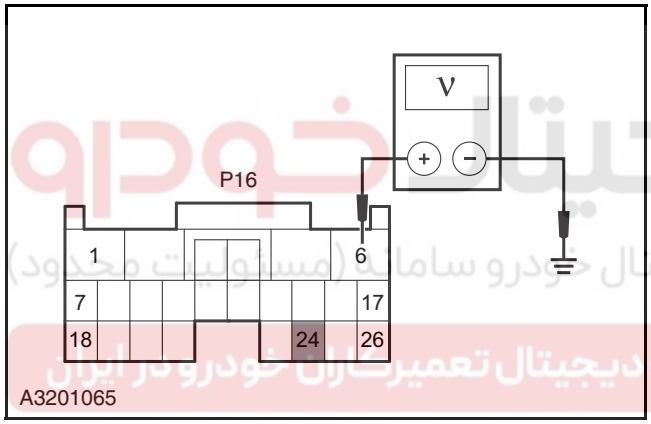
1. Fault code description

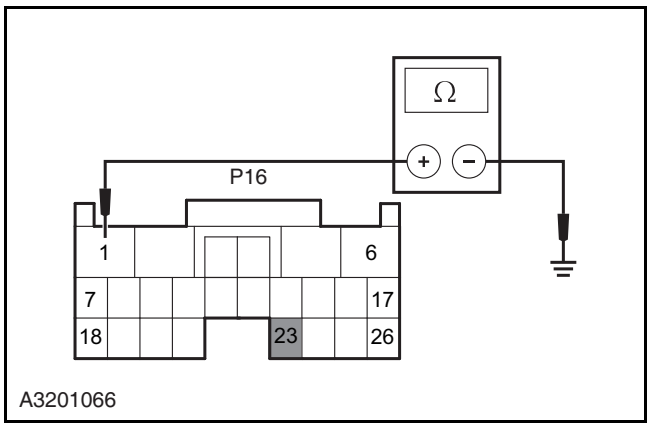
Fault code	Description	Definiton
P0601	Internal ROM malfunction of TCM	Turn the ignition switch to the "ON" position, TCM enters internal self-test procedure to check that all systems are normal internally.
P0603	Internal EEPROM malfunction of TCM	
P0604	Internal RAM malfunction of TCM	

2. Possible Sources

Fault code	Test Tactics	Setting conditions(control strategy)	Fault
P0601 P0603 P0604	TCM hardware and circuit inspection	•Turn the ignition switch to the "ON" position, the module enters self-test procedure and detects hardware malfunction.	•Control module circuit •TCM

3. Diagnosis procedure

Test Conditions	Details/Results/Actions
1. Inspect DTC	
	A. Connect the diagnosis tool. B. Diagnose Automatic Transmission with diagnosis tool. Is there any DTC besides P0601, P0603, P0604 ? **Y** **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission, DTC Diagnosis and Testing)** **N** Go to step 2.
2. Inspect the TCM power supply circuit	
	A.Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B.Disconnect the TCM wiring harness connector P16. C.Connect the battery negative cable. D.Turn the ignition switch to position "ON". E.Measure the voltage between terminal 6 and 24 of TCM wiring harness connector P16 and reliable grounding. **Standard Voltage Value: 11~14 V** Is the circuit normal? **Y** Go to step 3 **N** Inspect and repair the open circuit fault from Terminals 6 and 24 of TCM wiring harness connector P16 to the interior electrical center P01.

Test Conditions	Details/Results/Actions
3. Inspect the TCM grounding circuit	
 A3201066	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Measure the resistance between terminal 1 and 23 of TCM wiring harness connector P16 and the reliable grounding. **Standard Resistance Value: less than 5 Ω** Is the resistance value normal? **Y** Go to step 4. **N** Inspect and repair the open circuit fault between the TCM wiring harness connector P16 terminal 1 and 23 and the grounding point GD205. Verify the system is normal.
4. Inspect TCM	
	A. Remove the transmission control module (TCM). B. Install a transmission control module in a vehicle in good condition. Is the vehicle normal after installing the transmission control module? **Y** Replace transmission control module. **Refer to: TCM (3.2.1 Automatic Transmission, Removal and Installation).** **N** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System - M7, Symptom Diagnosis and Testing).**

DTC P0705, P0706

1. Fault code description

Fault code	Description	Definiton
P0705	Neutral position switch circuit short to power or open	The neutral position switch sends the gear range message to automatic transmission control module via 4 circuits, with Terminals 6, 1, 9 & 7 of neutral position switch wiring harness connector C32 connected to Terminals 20, 1, 8 & 7 of TCM wiring harness connector P17 respectively.
P0706	Neutral position short to the ground	

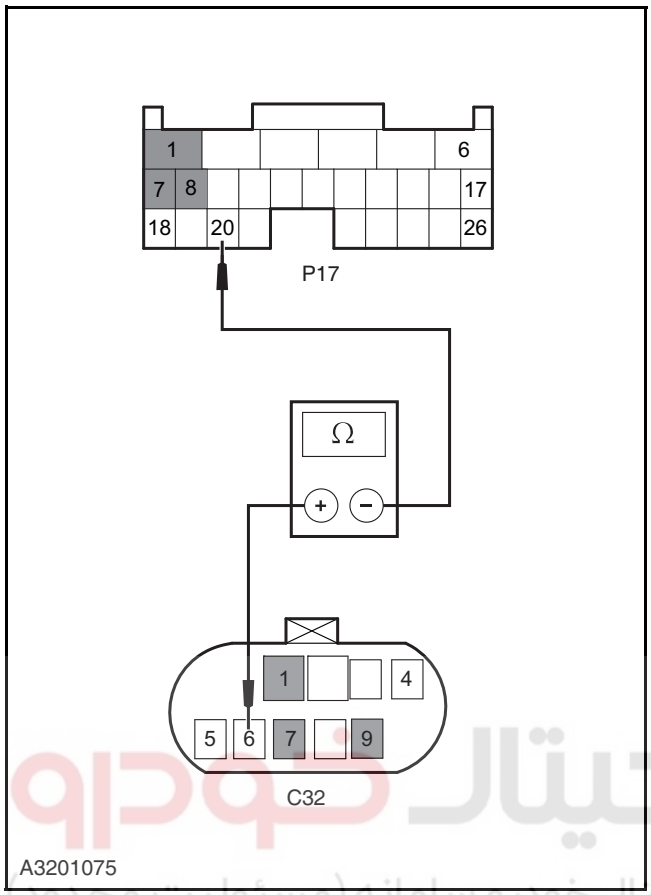
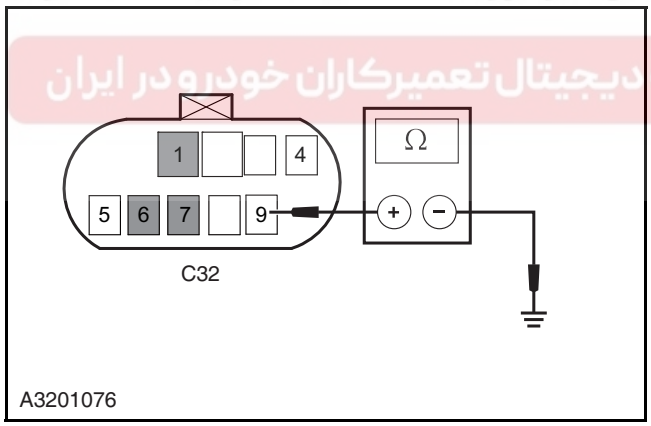
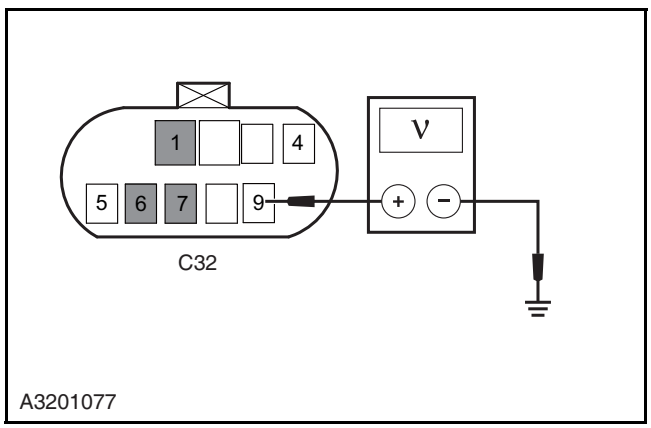
2. Possible Sources

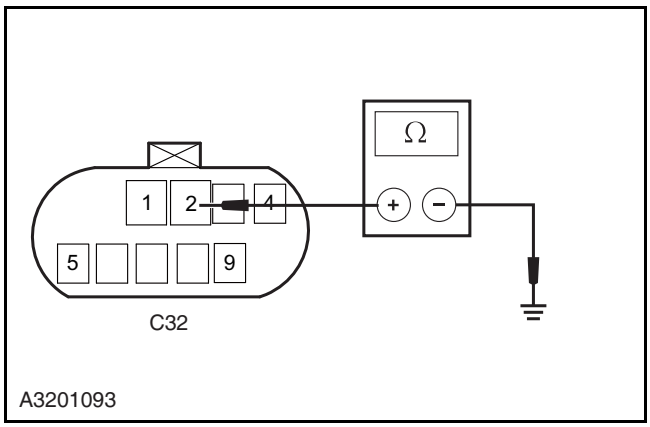
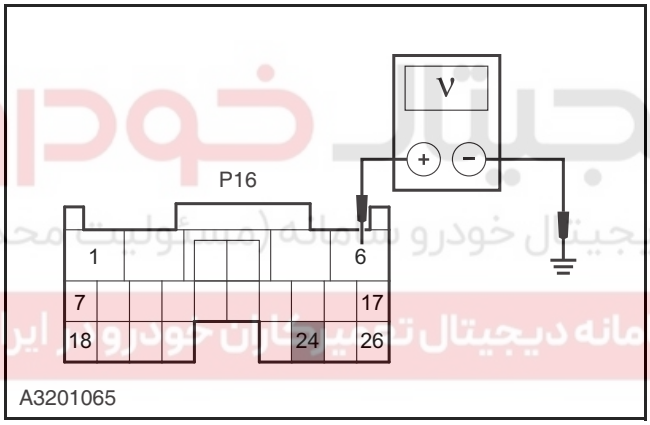
Fault code	Test Tactics	Setting conditions(control strategy)	Fault
P0705	Hardware and circuit inspection	•With the vehicle moving at 30km/h and the communication with TCM normal, TCM detects no neutral position switch signal for 30s or a longer time continuously.	•Neutral position switch circuit •TCM •Neutral position switch
P0706		•With the ignition switch turned to the "ON" position, TCM detects two and more signals from neutral position switch for 1s or a longer time continuously and this symptom occurs 5 times.	

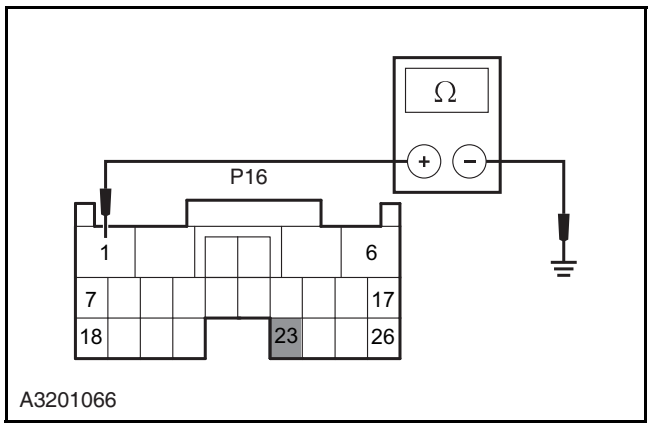
3. Diagnosis procedure

Test Conditions	Details/Results/Actions
1. General Procedures	
	A. Inspect whether the neutral position switch siring harness connector is reliable without dropping and dirt. Is the connection of neutral position switch wiring harness connector normal? **Y** Go to step 2. **N** Repair the fault.

Test Conditions	Details/Results/Actions
2.Inspect DTC	
	A. Connect the diagnosis tool. B. Turn the ignition switch to "ON". C. Diagnose Automatic Transmission with diagnosis tool. Is there any other fault code except for P0705 and P0706? **Y** **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission, DTC Diagnosis and Testing).** **N** Go to step 3.
3. Inspect the neutral position switch data stream	
	A. Read automatic transmission data stream with diagnostic tool: observe data stream of current gear position and corresponding gear position when shift lever is moved into a position. Does the data stream correspond to actual gear? **Y** **Refer to: Intermittent fault diagnosis process (3.1.13 Electrical control System - MT22.1, DTC diagnosis and testing).** **N** Go to step 4.
4. Inspect neutral position switch	
	A. Turn the ignition switch to "LOCK" position. B. Remove the neutral position switch. C. Install the neutral position switch of same type in good working order on the vehicle. D. Vehicle driving test. Is the fault fixed? **Y** Replace the neutral position switch. **N** Go to step 5.
5. Inspect the circuit between neutral position switch and TCM	

Test Conditions	Details/Results/Actions
 A3201075	A. Turn the ignition switch to "LOCK" position and disconnect the battery negative cable. B. Disconnect the neutral position switch wiring harness connector C32. C. Disconnect the TCM wiring harness connector P17. D. Connect the battery negative cable. E. Measure the resistance from terminals 6, 1, 9 & 7 of neutral position switch wiring harness connector C32 to Terminals 20, 1, 8 & 7 of TCM wiring harness connector P17, and check to see if the circuit is open. **Standard Resistance Value: less than 5 Ω** F. Measure the resistance value between the terminal 6, 1. 9. 7 of neutral position switch wiring harness connector C32 and the reliable grounding.Inspect for short circuit to ground. **Standard Resistance Value: 10 MΩ or more** G. Measure the voltage between the terminal 6, 1. 9. 7 of neutral position switch wiring harness connector C32 and the reliable grounding, inspect for short circuit to power supply. **Standard voltage: 0 V** Is the circuit normal? **Y** Go to step 6. **N** Repair the circuit fault from neutral position switch wiring harness connector C32 to TCM wiring harness connector P17.
 A3201076	
 A3201077	

Test Conditions	Details/Results/Actions
6. Inspect the neutral position switch grounding circuit	
	A. Turn the ignition switch to "LOCK" position. B. Disconnect the neutral position switch wiring harness connector C32. C. Measure the resistance between the terminal 2 of the neutral position switch wiring harness connector C32 and the reliable grounding. **Standard Resistance Value: less than 5 Ω** Is the neutral position switch ground circuit normal? **Y** Go to step 7. **N** Repair the open circuit fault between the terminal 2 of the neutral position switch harness connector C32 and the grounding point GD102.
7. Inspect the TCM power supply circuit	
	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Connect the battery negative cable. D. Turn the ignition switch to position "ON". E. Measure the voltage between terminal 6 and 24 of TCM wiring harness connector P16 and the reliable grounding. **Standard Voltage Value: 11~14 V** Is the circuit normal? **Y** Go to step 8. **N** Inspect and repair the open circuit fault from Terminals 6 and 24 of TCM wiring harness connector P16 to the interior electrical center P01.

Test Conditions	Details/Results/Actions
8. Inspect the TCM grounding circuit	
 A3201066	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Measure the resistance between terminal 1 and 23 of TCM wiring harness connector P16 and the reliable grounding. **Standard Resistance Value: less than 5 Ω** Is the resistance value normal? **Y** Go to step 9. **N** Inspect and repair the open circuit fault between the TCM wiring harness connector P16 terminal 1 and 23 and the grounding point GD205. Verify the system is normal.
9. Inspect TCM	
	A. Remove the transmission control module (TCM). B. Install a transmission control module in a vehicle in good condition. Is the vehicle normal after installing the transmission control module? **Y** Replace transmission control module. **Refer to: TCM (3.2.1 Automatic Transmission, Removal and Installation).** **N** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System - MT22.1, Symptom Diagnosis and Testing).**

DTC P0711, P0712, P0713

1. Fault code description

Fault code	Description	Definition
P0711	ATF temperature sensor (OT) holding	ATF temperature sensor is connected with the terminal 1 and 7 of the automatic transmission wiring harness connector C31 by the terminal 11 and 12 of the auto transmission control module wiring harness connector P16, inspect the transmission oil temperature, the oil temperature sensor is a negative temperature coefficient resistor.
P0712	ATF temperature sensor (OT) short to ground	
P0713	ATF temperature sensor (OT) short to power/ open circuit	

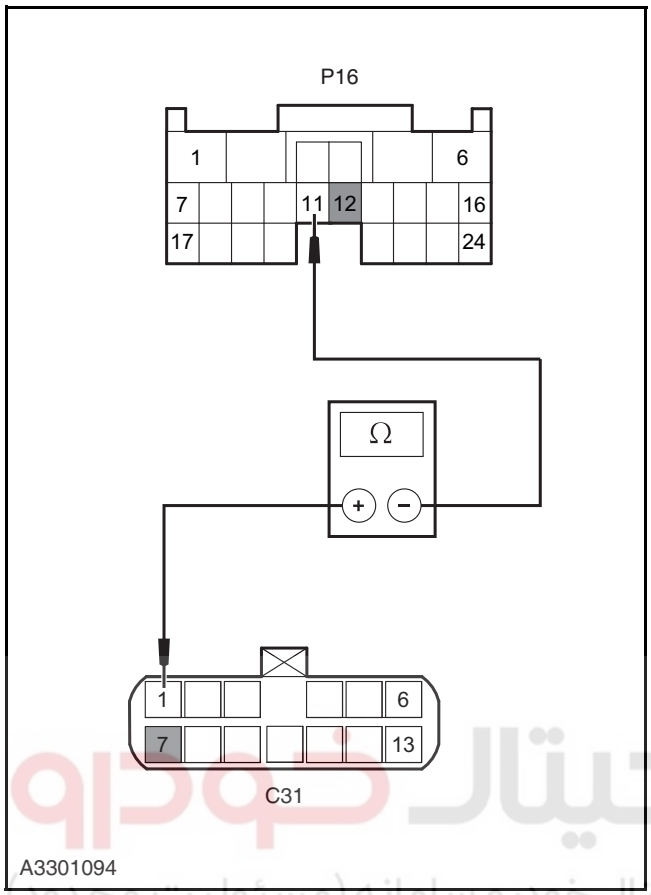
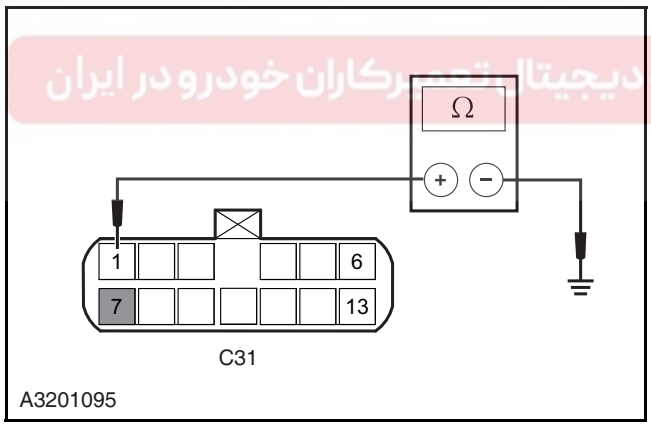
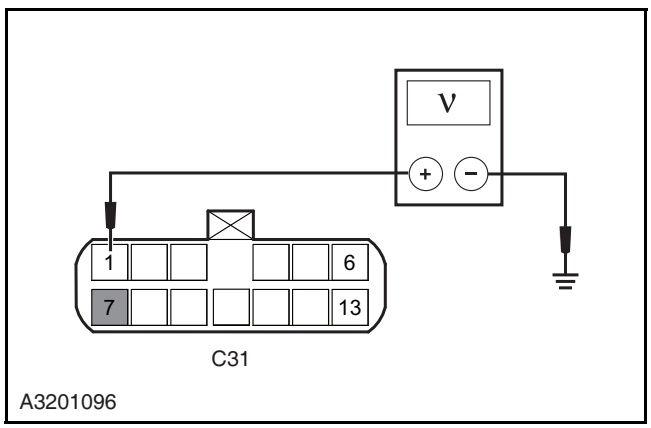
2. Possible Sources

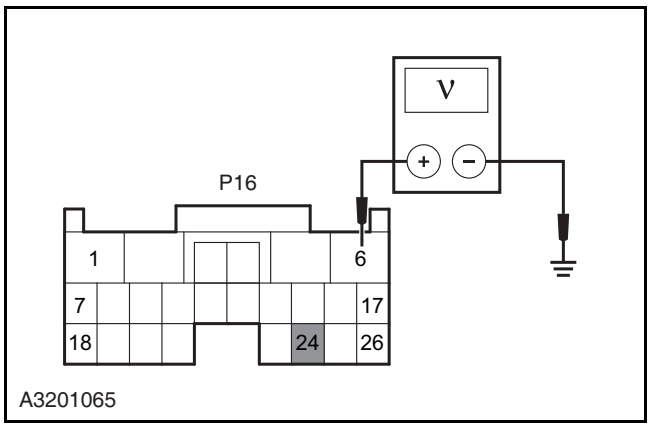
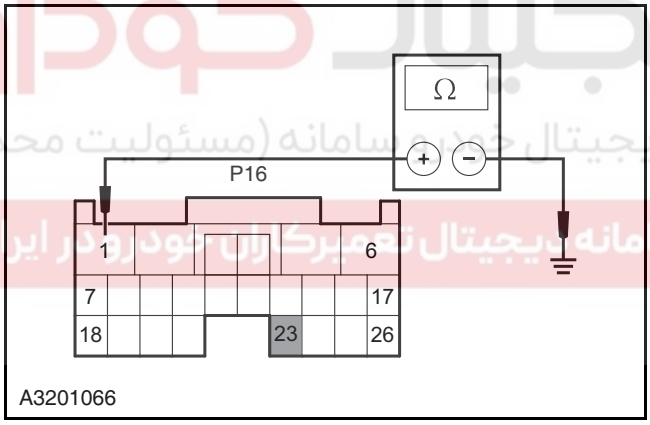
Fault code	Test Tactics	Setting conditions(control strategy)	Fault
P0711	Hardware inspection Circuit inspection	•With the gear lever in D position and the vehicle in operation, if TCM detects no change in transmission fluid temperature data for 10 min or a longer time continuously, then a fault is detected and DTC will make judgment after occurrence of a fault.	•Transmission wiring harness •Oil temperature sensor •TCM
P0712		•With ignition switch turned to the "ON" position, if TCM detects transmission fluid temperature is 200 ℃ or higher for 10s or a longer time continuously, then a fault is detected and DTC will make judgment after 6 detections.	
P0713		•With the gear lever in D or R position and the vehicle moving for 1 min or a longer time, if TCM detects transmission fluid temperature is -55 ℃ or lower for 1s or a longer time continuously, then a fault is detected and DTC will make judgment after 12 detections.	

3. Diagnosis procedure

Test Conditions	Details/Results/Actions
1. General Procedures	
	A. Inspect the automatic transmission wiring harness connector C31 is reliable without dropping and damage. Is the automatic transmission wiring harness connector normal? **Y** Go to step 2. **N** Repair the automatic transmission wiring harness connector.
2. Inspect the DTC	
	A. Connect the Diagnosis tool. B. Diagnose the automatic transmission system DTC with diagnosis tool. Any other DTCs expect P0711, P0712, P0713? **Y** **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission, DTC Diagnosis and Testing).** **N** Go to step 3.
3. Inspect oil temperature sensor data stream	
	A. Read the automatic transmission data stream with the diagnostic tool: transmission oil temperature. Is the data stream normal? **Y** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System - MT 22.1, Symptom Diagnosis and Testing).** **N** Go to step 4.

Test Conditions	Details/Results/Actions
4. Inspect oil temperature sensor	
	A. Turn the ignition switch to "LOCK" position. B. Disconnect the automatic transmission wiring harness connector C31. C. Inspect oil temperature sensor. **Refer to: Inspect the oil temperature sensor (3.2.1 Automatic Transmission, General Procedure).** Is the resistance value normal? **Y** Go to step 5. **N** Replace the oil temperature sensor.
5. Inspect the circuit from fluid temperature sensor to TCM	

Test Conditions	Details/Results/Actions
 A3301094	A. Turn the ignition switch to "LOCK" position and disconnect the battery negative cable. B. Disconnect the automatic transmission wiring harness connector C31. C. Disconnect the TCM wiring harness connector P16. D. Measure the resistance between terminal 1 and 7 of the auto transmission harness connector C31 and terminal 11 and 12 of TCM wiring harness connector P16, inspect if there is broken circuit. **Standard Resistance Value: less than 5 Ω** E. Measure the resistance between Terminal 1 and 7 of wiring harness connector C31 of auto transmission and grounding, inspect if there is short circuit to ground. **Standard Resistance Value: 10 MΩ or more** F. Measure the voltage between Terminal 1 and 7 of wiring harness connector C31 of auto transmission and grounding, inspect if there is short circuit to the power. **Standard voltage: 0 V** Is the oil temperature sensor circuit normal? **Y** Go to step 6. **N** Repair circuit faults from Terminals 1 & 7 of auto-matic transmission wiring harness connector C31 to Terminals 11 & 12 of TCM wiring harness connector P16 respectively.
 A3201095	
 A3201096	

Test Conditions	Details/Results/Actions
6. Inspect the TCM power supply circuit	
 A3201065	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Connect the battery negative cable. D. Turn the ignition switch to position "ON". E. Measure the voltage between terminal 6 and 24 of TCM wiring harness connector P16 and reliable grounding. **Standard Voltage Value: 11~14 V** Is the circuit normal? **Y** Go to step 7. **N** Inspect and repair the open circuit fault from Terminals 6 and 24 of TCM wiring harness connector P16 to the interior electrical center P01.
7. Inspect the TCM grounding circuit	
 A3201066	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Measure the resistance between terminal 1 and 23 of TCM wiring harness connector P16 and the reliable grounding. **Standard Resistance Value: less than 5 Ω** Is the resistance value normal? **Y** Go to step 8. **N** Inspect and repair the open circuit fault between the terminal 1 and 23 of TCM wiring harness connector P16 and the grounding point GD205. Verify the system is normal.

Test Conditions	Details/Results/Actions
8. Inspect TCM	
	A. Remove the transmission control module (TCM). B. Install a transmission control module in a vehicle in good condition. Is the vehicle normal after installing the transmission control module? **Y** Replace transmission control module. **Refer to: TCM (3.2.1 Automatic Transmission, Removal and Installation).** **N** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System - MT 22.1, Symptom Diagnosis and Testing).**

DTC P0715, P0717

1. Fault code description

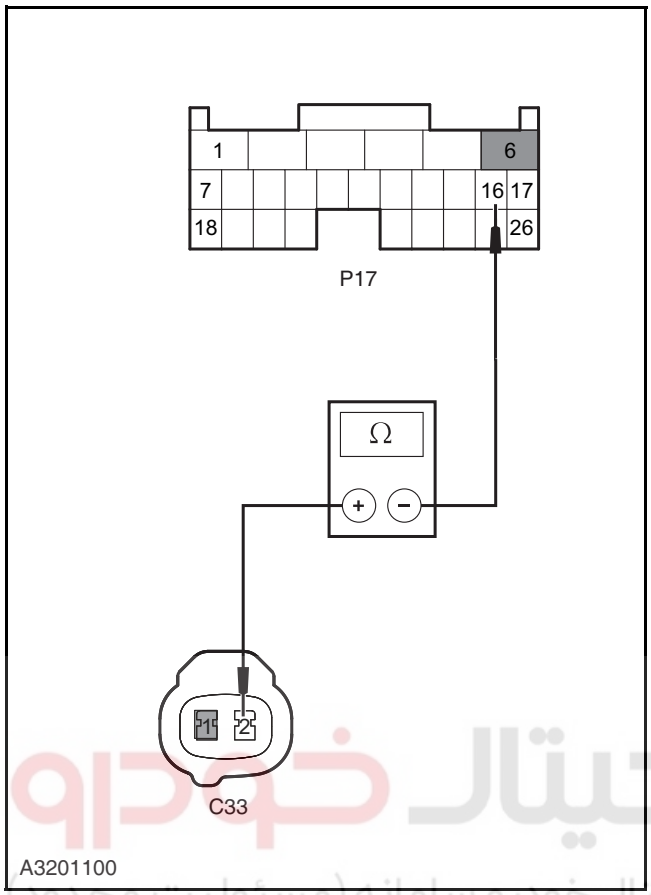
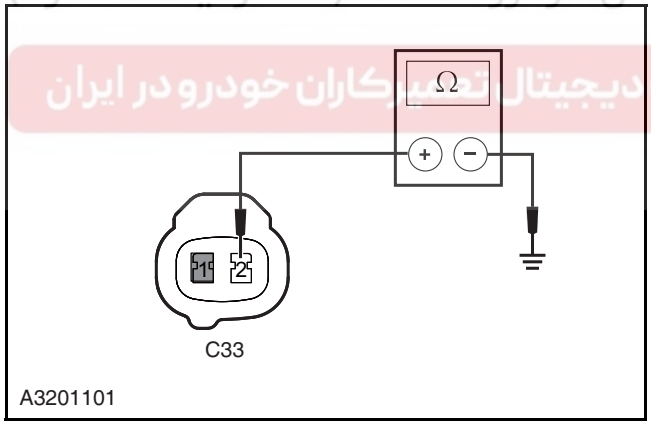
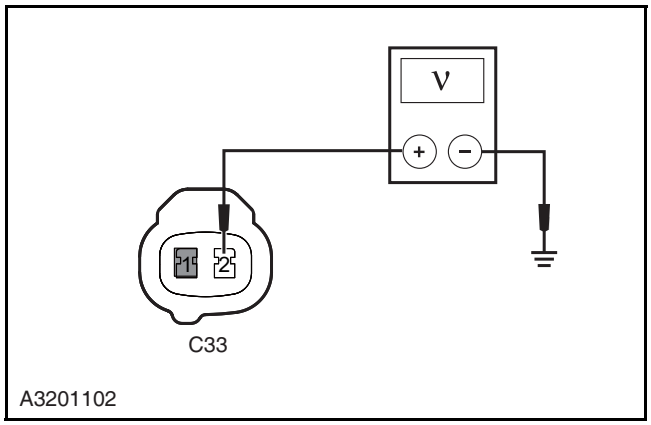
Fault code	Description	Definition
P0715	Input shaft speed sensor short to power or ground/open circuit	Input shaft speed sensor has connections from Terminals 1 & 2 of its wiring harness connector C33 to Terminal 6 & 16 of TCM wiring harness connector P17 respectively.
P0717	No input shaft speed sensor signal fault	

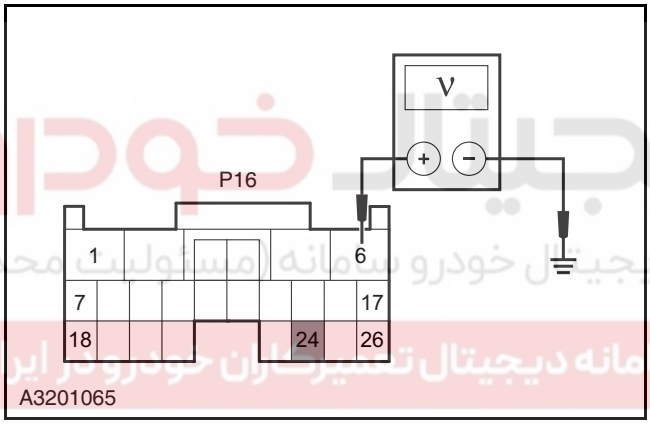
2. Possible Sources

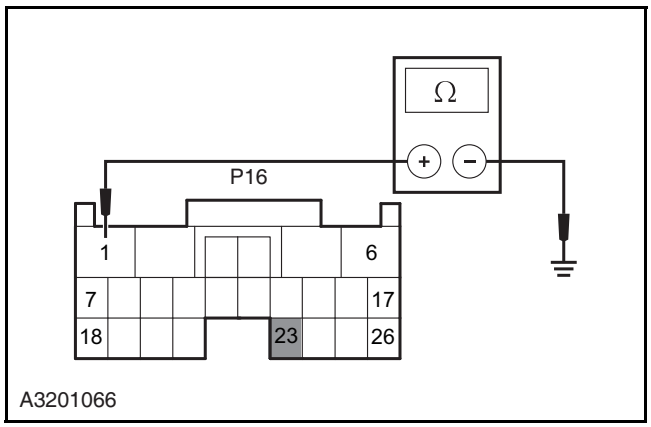
Fault code	Test Tactics	Setting conditions (control strategy)	Fault
P0715	Hardware Circuit Inspection Control signals inspect	• With ignition switch turned to the "ON" position, if TCM receives no pulse signal from input shaft speed sensor for 0.1s or a longer time continuously and this repeats 10 times.	• Input shaft speed sensor • Circuit • TCM
P0717		• With the communication with TCM normal, shift lever in D position and vehicle moving at 20km/h or a higher speed, if TCM receives no input shaft speed sensor signal but can receive output shaft speed sensor signal and this symptom repeats 500 times.	

3. Diagnosis procedure

Test Conditions	Details/Results/Actions
1. General Procedures	
	A. Check if the wiring harness connector C33 of input shaft speed sensor is reliably secured, becomes loose, dirt or damaged. Is the connection of input shaft speed sensor wiring harness connector normal? **Y** Go to step 2. **N** Disconnect the wiring harness connectors of input shaft speed sensor.
2. Inspect the DTC	
	A. Connect the diagnosis tool. B. Turn the ignition switch to "ON" position. C. Inspect AT system with the diagnostic tool. Is there any DTC besides P0715, P0717? **Y** **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission, DTC Diagnosis and Testing).** **N** Go to step 3.
3. Inspect the circuit from input shaft speed sensor to TCM	

Test Conditions	Details/Results/Actions
	A. Turn the ignition switch to "LOCK" position and disconnect the battery negative cable. B. Disconnect the wiring harness connector C33 of input shaft speed sensor. C. Disconnect the TCM wiring harness connector P17. D. Connect the battery negative cable. E. Measure the resistance between Terminals 1 & 2 of input shaft speed sensor connector C33 and Terminals 6 & 16 of TCM wiring harness connector P17 respectively. **Standard Resistance Value: less than 5 Ω** F. Measure the resistance value from Terminals 1 & 2 of input shaft speed sensor connector C33 to reliable ground. **Standard Resistance Value: 10 MΩ or more** G. Measure the voltage between Terminals 1 & 2 of input shaft speed sensor connector C33 and reliable ground. **Standard voltage: 0 V** Are both resistance and voltage values normal? **Y** Go to step 4. **N** Inspect and repair circuit between Terminals 1 & 2 of input shaft speed sensor connector C33 to Terminals 6 & 16 of TCM wiring harness connector P17 respectively.
	
	

Test Conditions	Details/Results/Actions
4. Inspect the input shaft speed sensor	
	A. Inspect the input shaft speed sensor. **Refer to: Inspect the Input shaft speed sensor (3.2.1 Automatic Transmission, General Procedure).** Is the input shaft speed sensor normal? **Y** Go to step 5. **N** Remove the input shaft speed sensor. **Refer to: Input shaft speed Sensor (3.2.1 Manual Transmission, Removal and Installation).**
5. Inspect the TCM power supply circuit	
	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Connect the battery negative cable. D. Turn the ignition switch to position "ON". E. Measure the voltage between terminal 6 and 24 of TCM wiring harness connector P16 and reliable grounding. **Standard Voltage Value: 11~14 V** Is the circuit normal? **Y** Go to step 6. **N** Inspect and repair the open circuit fault from Terminals 6 and 24 of TCM wiring harness connector P16 to the interior electrical center P01.

Test Conditions	Details/Results/Actions
6. Inspect the TCM grounding circuit	
 A3201066	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Measure the resistance between terminal 1 and 23 of TCM wiring harness connector P16 and the reliable grounding. **Standard Resistance Value: less than 5 Ω** Is the resistance value normal? **Y** Go to step 7. **N** Inspect and repair the open circuit fault between the TCM wiring harness connector P16 terminal 1 and 23 and the grounding point GD205. Verify the system is normal.
7. Inspect TCM	
	A. Remove the transmission control module (TCM). B. Install a transmission control module in a vehicle in good condition. Is the vehicle normal after installing the transmission control module? **Y** Replace transmission control module. **Refer to: TCM (3.2.1 Automatic Transmission, Removal and Installation).** **N** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System-MT 22.1, Symptom Diagnosis and Testing).**

DTC P0720, P0722

1. Fault code description

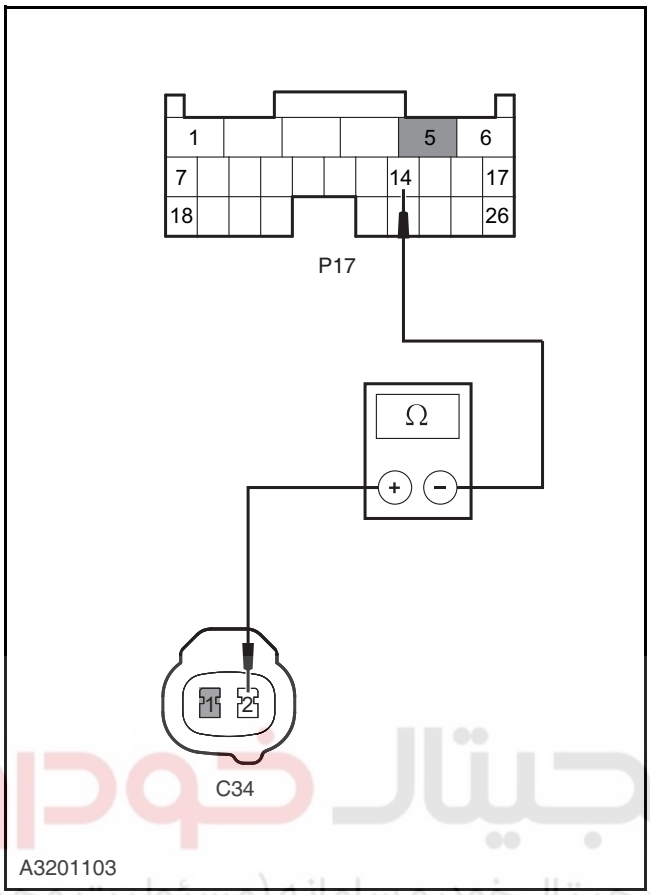
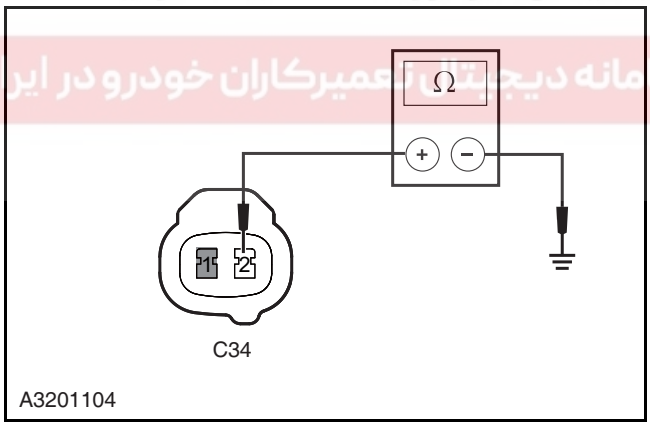
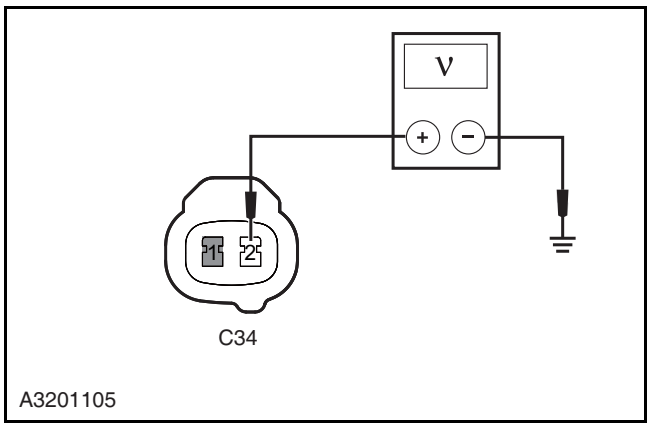
Fault code	Description	Definition
P0720	Output shaft speed sensor short to power or ground/open circuit	Output shaft speed sensor has connections from Terminals 1 & 2 of its wiring harness connector C34 to Terminals 5 & 14 of TCM wiring harness connector P17 respectively.
P0722	No output shaft speed sensor signal fault	

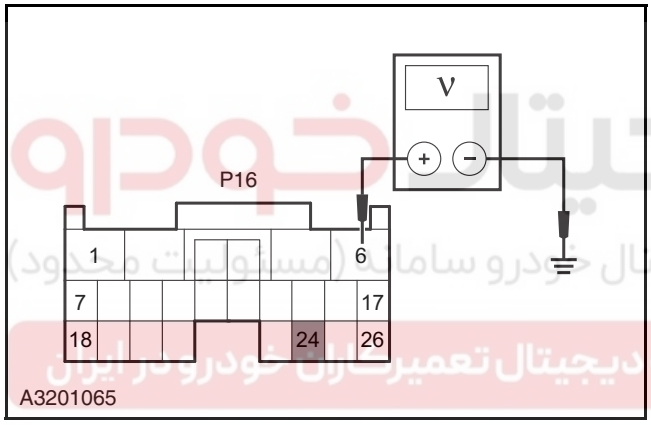
2. Possible Sources

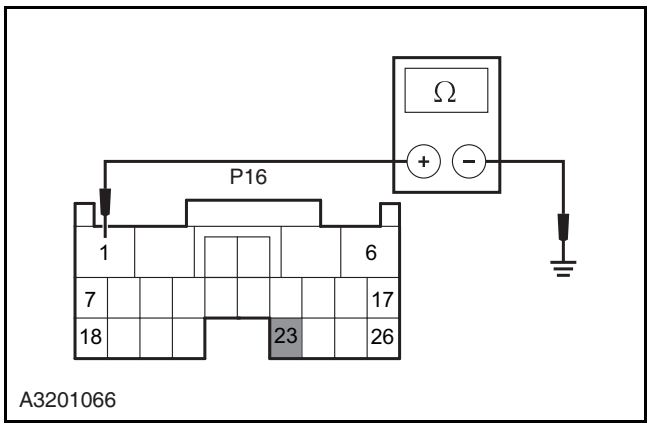
Fault code	Test Tactics	Setting conditions(control strategy)	Fault
P0720	Hardware Circuit Inspection Control signals inspect	• With ignition switch turned to the "ON" position, if TCM receives no pulse signal from output shaft speed sensor for 0.1s or a longer time continuously and this occurred 10 times consecutively.	• Output Shaft Speed Sensor • Circuit • TCM
P0722		• With the communication with TCM normal, shift lever in D position and vehicle moving at 20km/h or a higher speed, if TCM receives no output shaft speed sensor signal but can receive input shaft speed sensor signal, and this symptom occurred 500 times consecutively.	

3. Diagnosis procedure

Test Conditions	Details/Results/Actions
1. General Procedures	
	A. Check if the wiring harness connector C34 of output shaft speed sensor is reliably secured without dropping, dirt or damaged. If the connection of output shaft speed sensor wiring harness connector normal? **Y** Go to step 2. **N** Repair the wiring harness connector of the output shaft speed sensor.
2. Inspect the DTC	
	A. Connect the diagnosis tool. B. Turn the ignition switch to "ON" position. C. Inspect "AT" system with the diagnostic tool. Is there any other fault code except for P0720 and P0722? **Y** **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission, DTC Diagnosis and Testing).** **N** Go to step 3.
3. Inspect the circuit between output shaft speed sensor and TCM	

Test Conditions	Details/Results/Actions
 A3201103	A. Turn the ignition switch to "LOCK" position and disconnect the battery negative cable. B. Disconnect the output shaft speed sensor C34. C. Disconnect the TCM wiring harness connector P17. D. Connect the battery negative cable. E. Measure the resistance value between Terminals 1 & 2 of output shaft speed sensor connector C34 and Terminals 5 & 14 of TCM wiring harness connector P17 respectively. **Standard Resistance Value: less than 5 Ω** F. Measure the resistance between terminal 1 and 2 of output shaft speed sensor C34 and the reliable grounding. **Standard Resistance Value: 10 MΩ or more** G. Measure the voltage value from Terminals 1 & 2 of output shaft speed sensor connector C34 to reliable ground. **Standard voltage: 0 V** Are both resistance and voltage values normal? **Y** Go to step 4. **N** Inspect and repair circuit faults from Terminals 1 & 2 of output shaft speed sensor connector C34 to Terminals 5 & 14 of TCM wiring harness connector P17 respectively.
 A3201104	
 A3201105	

Test Conditions	Details/Results/Actions
4. Inspect output shaft speed sensor	
	A. Inspect the output shaft speed sensor. **Refer to: Inspect the output shaft speed sensor (3.2.1 Automatic Transmission, General Procedure).** Is the output shaft speed sensor normal? **Y** Go to step 5. **N** Replace the output shaft speed sensor. **Refer to: Output shaft speed Sensor (3.2.1 Manual Transmission, Removal and Installation).**
5. Inspect the TCM power supply circuit	
	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Connect the battery negative cable. D. Turn the ignition switch to position "ON". E. Measure the voltage between terminal 6 and 24 of TCM wiring harness connector P16 and reliable grounding. **Standard Voltage Value: 11~14 V** Is the circuit normal? **Y** Go to step 6. **N** Inspect and repair the open circuit fault from Terminals 6 and 24 of TCM wiring harness connector P16 to the interior electrical center P01.

Test Conditions	Details/Results/Actions
6. Inspect the TCM grounding circuit	
 A3201066	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Measure the resistance between terminal 1 and 23 of TCM wiring harness connector P16 and the reliable grounding. **Standard Resistance Value: less than 5 Ω** Is the resistance value normal? **Y** Go to step 7. **N** Inspect and repair the open circuit fault between the TCM wiring harness connector P16 terminal 1 and 23 and the grounding point GD205. Verify the system is normal.
7. Inspect TCM	
	A. Remove the transmission control module (TCM). B. Install a transmission control module in a vehicle in good condition. Is the vehicle normal after installing the transmission control module? **Y** Replace transmission control module. **Refer to: TCM (3.2.1 Automatic Transmission, Removal and Installation).** **N** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System - MT 22.1, Symptom Diagnosis and Testing).**

DTC P0731

1. Fault code description

Fault code	Description	Definition
P0731	No engine brake	C1 solenoid pressure lowest or C2 solenoid pressure lowest or lockup solenoid pressure lowest

2. Possible Sources

Fault code	Test Tactics	Setting conditions (control strategy)	Fault
P0731	Hardware and circuit inspection	• With the gear lever in D position and the vehicle driving, the engine brake is abnormal in the 1st gear and this symptom occurred 5 times.	• Circuit • Solenoid valve • TCM

3. Diagnosis procedure

Test Conditions	Details/Results/Actions
1. General Procedures	
	A. Inspect the related wiring harness connectors for signs of damage, poor contact, aging or loose. Is it normal? **Y** Go to step 2. **N** Repair the fault.
2. Eliminate the DTC	
	A. Connect the diagnosis tool. B. Use diagnosis tool to delete DTC. C. Swing, pulling and pressing the data link connector (DLC), engine control module (ECM) and vehicle body control module (BCM) wiring harness connector. D. Use diagnosis tool to redo the diagnosis for DTC. Is there DTC P0731? **Y** Go to step 3. **N** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System-MT22.1, Symptom Diagnosis and Testing).**

Test Conditions	Details/Results/Actions
3. Inspect the solenoids and circuits	
	A. Inspect relevant solenoids and circuits **Refer to: DTC P0761 P0762 P0978 P0979 P0980 (3.2.1 Automatic Transmission, DTC Diagnosis and Testing).** **Refer to: DTC P0766 P0767 P0981 P0982 P0983 (3.2.1 Automatic Transmission, DTC Diagnosis and Testing).** **Refer to: DTC P0741 P0742 P2762 P2763 P2764 (3.2.1 Automatic Transmission, DTC Diagnosis and Testing).**

DTC P0741, P0742, P2762, P2763, P2764

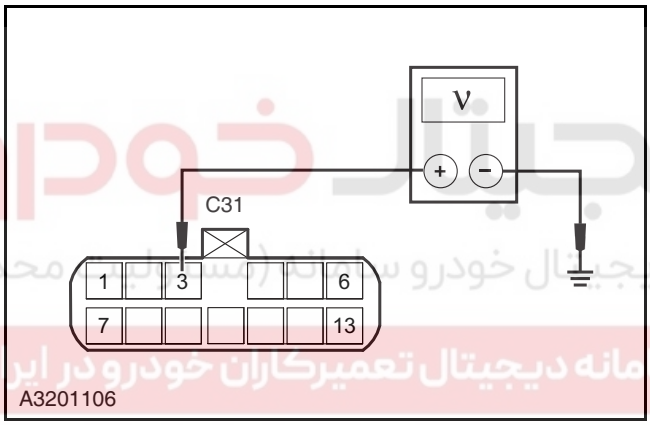
1. Fault code description

Fault code	Description	Definition
P0741	Lockup solenoid [SLU] Off holding	Lockup solenoid has connections from Terminals 3 & 9 of automatic transmission wiring harness connector C31 to Terminals 5 & 3 of TCM wiring harness connector P16 respectively.
P0742	Lockup solenoid [SLU] closure holding	
P2762	Lockup solenoid [SLU] feedback current holding	
P2763	Lockup solenoid [SLU] short to power	
P2764	Lockup solenoid [SLU] short to ground or open circuit	

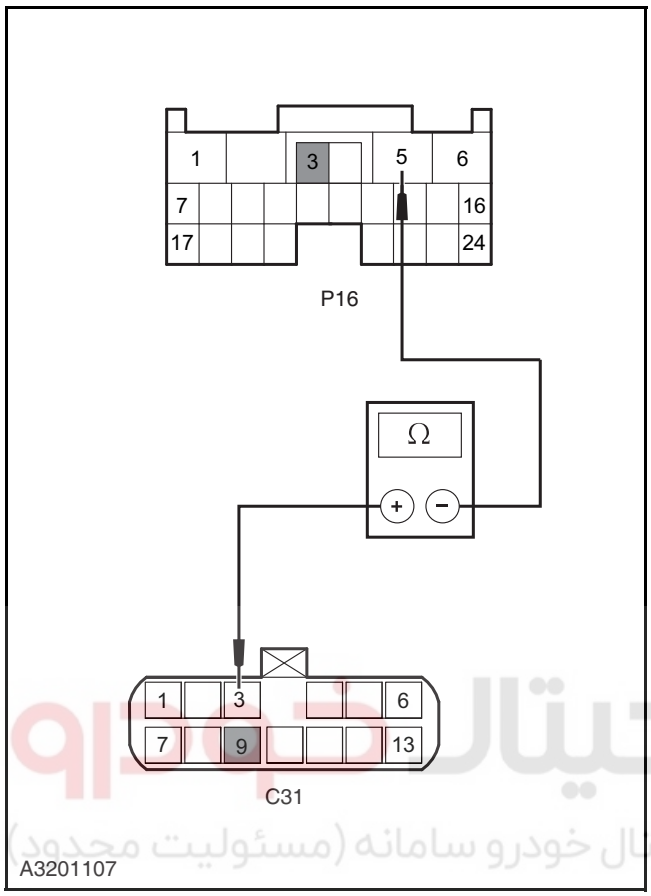
2. Possible Sources

Fault code	Test Tactics	Setting conditions (control strategy)	Fault
P0741	Performance inspection Hardware and circuit inspection	• With the gear lever in D position, the vehicle moving and hydraulic torque converter lockup activated, if TCM detects the difference between engine speed and turbine speed greater than 100RPM and this symptom lasts 2s or longer and occurred 6 times consecutively.	• Circuit • Lock solenoid • TCM
P0742		• With the gear lever in D position, the vehicle moving, hydraulic torque converter lockup and slip difference control inactive, if TCM detects the difference between engine speed and turbine speed less than 100RPM and this symptom lasts 2s or longer and occurred 2 times consecutively.	
P2762		• With the ignition switch turned to the "ON" position, if TCM detects SLU solenoid feedback current error and this symptom lasts 3s or longer.	
P2763		• With the ignition switch turned to the "ON" position, if TCM detects SLU solenoid feedback current error and this symptom lasts 0.1s or longer and occurred 5 times.	
P2764		• With the ignition switch turned to the "ON" position, if TCM detects SLU solenoid feedback current error and this symptom lasts 0.1s or longer and occurred 5 times.	

3. Diagnosis procedure

Test Conditions	Details/Results/Actions
1. Inspect DTC	
	A. Connect the diagnosis tool. B. Diagnose Automatic Transmission with diagnosis tool. Is there any DTC other than P0741, P0742, P2762, P2763 and P2764 ? **Y** **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission,DTC Diagnosis and Testing).** **N** Go to step 2.
2. Inspect the control signal voltage of locking solenoid	
	A. Connect the Diagnosis tool. B. Turn the ignition switch to "ON" position. C. Execute the active test of automatic transmission with diagnosis tool, execute the menu “lock solenoid current - OFF”. D. Measure the voltage between Terminal 3 of wiring harness connector C31 in automatic transmission and reliable grounding with the multimeter. **Standard voltage: 0 V** E. Execute the active test of automatic transmission with diagnosis tool, execute the menu “lock solenoid current - ON”. F. Measure the voltage between Terminal 3 of wiring harness connector C31 in automatic transmission and reliable grounding with the multimeter. **Standard Voltage Value: 11~14 V** Is the voltage normal? **Y** Go to step 4. **N** Go to step 3.

Test Conditions	Details/Results/Actions
3. Inspect the circuit between solenoid and TCM	



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A. Turn the ignition switch to "LOCK" position.

B. Disconnect the automatic transmission wiring harness connector C31.

C. Disconnect the TCM wiring harness connector P16.

D. Measure the resistance of circuits between terminals 3 & 9 of automatic transmission wiring harness connector C31 and terminals 5 & 3 of TCM wiring harness connector P16 respectively.

Standard Resistance Value: less than 5 Ω

E. Measure the resistance between the terminal 3 and 9 of auto transmission wiring harness connector C31 and the reliable grounding.

Standard Resistance Value: 10 MΩ or more

F. Measure the voltage between terminal 3 and 9 of auto transmission wiring harness connector C31 and the reliable grounding.

Standard voltage: 0 V

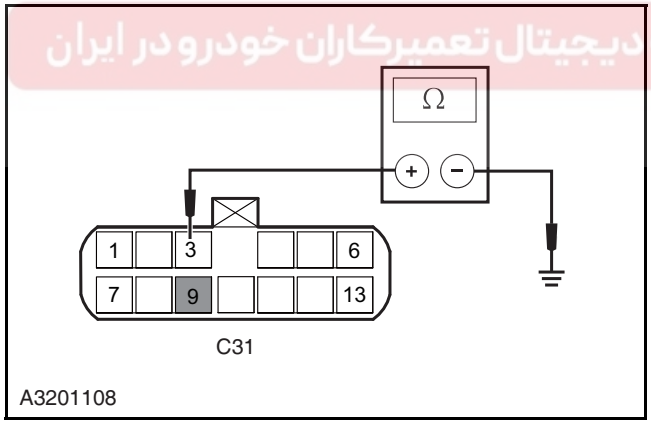
Are both resistance and voltage values normal?

Y

Go to step 4.

N

Inspect and repair circuit faults between Terminals 3 & 9 of automatic transmission wiring harness connector C31 and Terminals 5 & 3 of TCM wiring harness connector P16 respectively.



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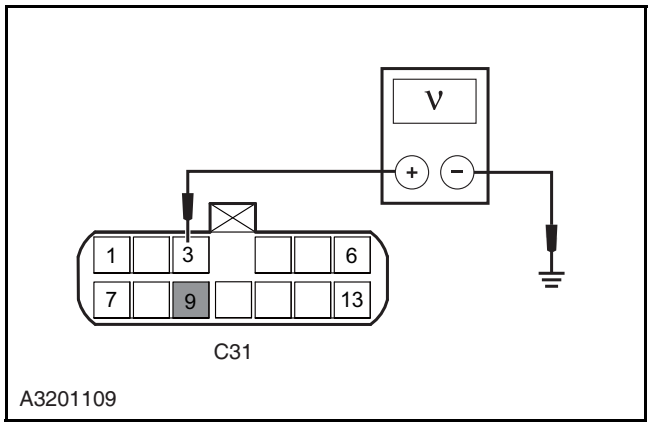

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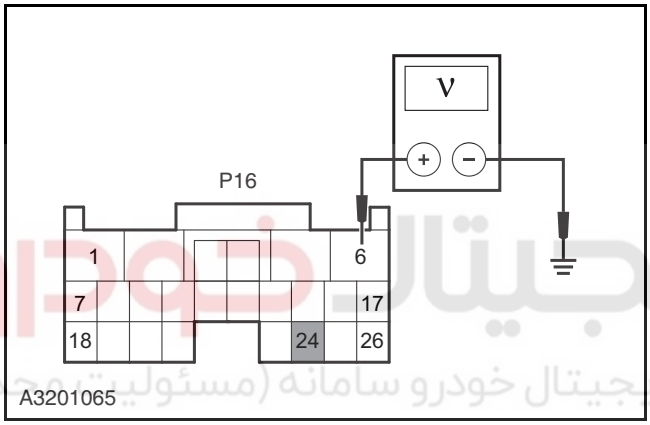
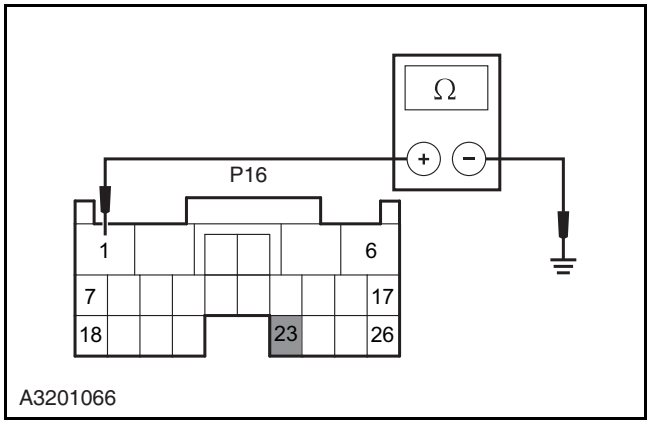
Test Conditions	Details/Results/Actions
4. Inspect the locking solenoid	
	A. Inspect the locking solenoid. **Refer to: Inspect locking solenoid (3.2.1 Automatic Transmission, General Procedure).** Is the lockup solenoid normal? **Y** Go to step 5. **N** Replace locking solenoid.
5. Inspect the TCM power supply circuit	
	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Connect the battery negative cable. D. Turn the ignition switch to position "ON". E. Measure the voltage between terminal 6 and 24 of TCM wiring harness connector P16 and reliable grounding. **Standard Voltage Value: 11~14 V** Is the circuit normal? **Y** Go to step 6. **N** Inspect and repair the open circuit fault from Terminals 6 and 24 of TCM wiring harness connector P16 to the interior electrical center P01.
6. Inspect the TCM grounding circuit	
	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Measure the resistance between terminal 1 and 23 of TCM wiring harness connector P16 and the reliable grounding. **Standard Resistance Value: less than 5 Ω** Is the resistance value normal? **Y** Go to step 7. **N** Inspect and repair the open circuit fault between the TCM wiring harness connector P16 terminal 1 and 23 and the grounding point GD205. Verify the system is normal.

Test Conditions	Details/Results/Actions
7. Inspect TCM	
	A. Remove the transmission control module (TCM). B. Install a transmission control module in a vehicle in good condition. Is the vehicle normal after installing the transmission control module? **Y** Replace transmission control module. **Refer to: TCM (3.2.1 Automatic Transmission, Removal and Installation).** **N** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System - MT22.1, Symptom Diagnosis and Testing).**

DTC P0741, P0751, P0766, P0973, P0974

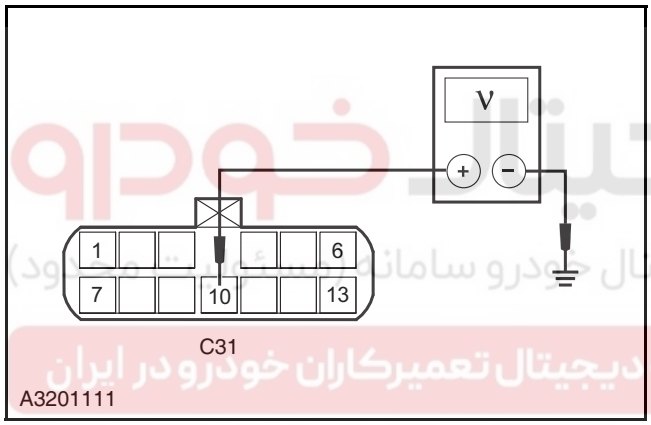
1. Fault code description

Fault code	Description	Definition
P0741	Shift solenoid (S1) max. pressure holding	Solenoid connects with terminal 16 on transmission control module wiring harness connector C16 through terminal 10 on automatic transmission wiring harness connector C31. The solenoid can ground by itself.
P0751	Shift solenoid (S1) min. pressure holding	
P0766	Shift solenoid (S1) max. pressure holding	
P0973	Shift solenoid(S1) short to power/open circuit	
P0974	Shift solenoid (S1) short to ground	

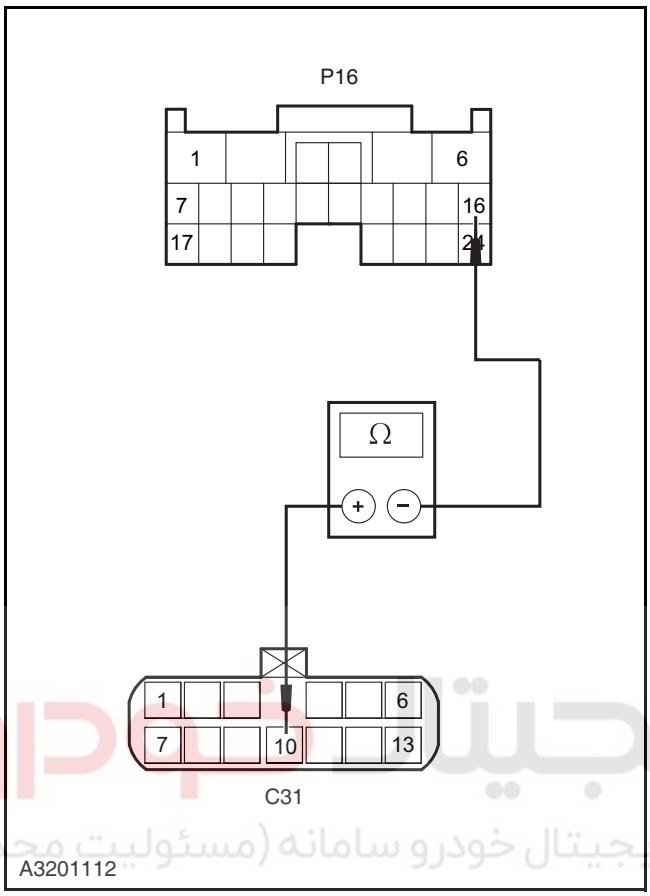
2. Possible Sources

Fault code	Test Tactics	Setting conditions (control strategy)	Fault
P0741	Performance inspection Hardware and circuit inspection	• With the gear lever in D position, the vehicle moving and hydraulic torque converter lockup activated, if TCM detects the difference between engine speed and turbine speed less than 100RPM and this symptom lasts 2s or longer and occurred 6 times consecutively.	•Solenoid valve circuit •Solenoid valve •Transmission assembly
P0751		• With the gear lever in D position and the vehicle moving, if TCM detects the engine brake in the 1st gear abnormal and this symptom occurred 5 times.	
P0766		• With the gear lever in D position and the vehicle moving, if TCM detects the gear ratio in the 3rd or 4th gear abnormal and this symptom occurred 5 times.	
P0973		• With the ignition switch turned to "ON" and the vehicle stopped, if TCM detects S1 short to ground and this symptom lasts 0.1s or longer and occurred 5 times.	
P0974		•With the ignition switch turned to "ON" and the vehicle running, if TCM detects S1 open circuit or short to +B and this symptom lasts 0.1s or longer and occurred 5 times.	

3. Diagnosis procedure

Test Conditions	Details/Results/Actions
1. Inspect DTC	
	A. Connect the diagnosis tool. B.Diagnose Automatic Transmission with diagnosis tool. Is there any DTC other than P0741, P0751, P0766, P0973 and P0974 ? **Y** **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission,DTC Diagnosis and Testing).** **N** Go to step 2.
2. Inspect the control signal voltage of gear shift solenoid	
	A. Connect the Diagnosis tool. B. Turn the ignition switch to "ON" position. C. Use diagnosis tool to execute initiative automatic transmission testing, execute“Gearshift solenoid S1-off”. D. Measure the voltage between Terminal 10 of wiring harness connector C31 in automatic transmission and reliable grounding with the multimeter. **Standard voltage: 0 V** E. Execute the active test of automatic transmission with diagnosis tool, execute the menu “Gearshift solenoid S1-ON”. F. Measure the voltage between terminal 10 of wiring harness connector C31 in automatic transmission and reliable grounding with the multimeter. **Standard Voltage Value: 11~14 V** Is the voltage normal? **Y** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System - MT22.1, Symptom Diagnosis and Testing).** **N** Go to step 3.

Test Conditions	Details/Results/Actions
3. Inspect the circuit of the gear shift solenoid	



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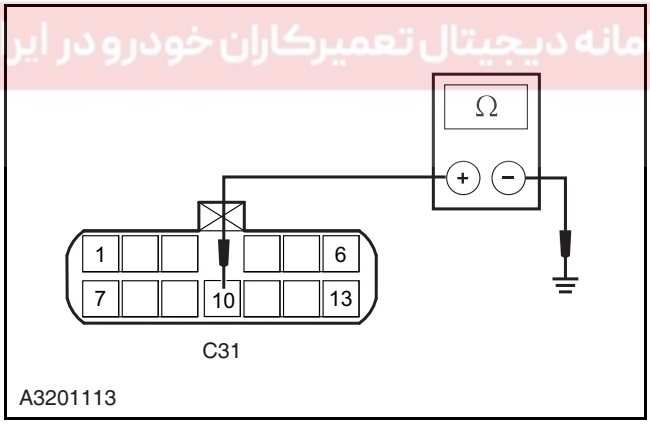
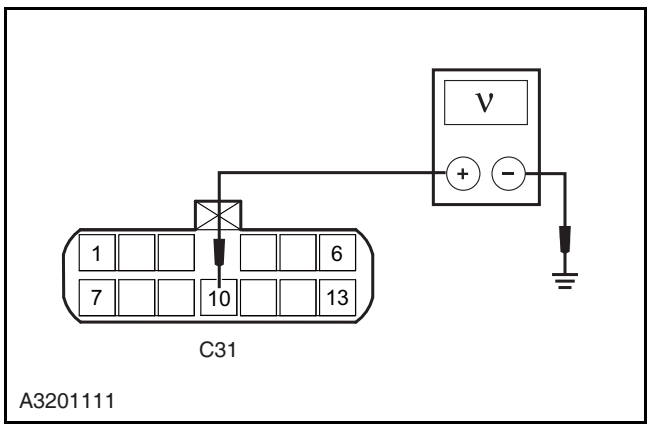


A3201113



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A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable.

B. Disconnect the automatic transmission wiring harness connector C31.

C. Disconnect the TCM wiring harness connector P16.

D. Connect the battery negative cable.

E. Measure the resistance between terminal 10 of wiring harness connector C31 in automatic transmission and the wiring harness connector P16 of the TCM, Inspect if there is broken circuit.

Standard Resistance Value: less than 5 Ω

F. Measure the resistance between terminal 10 of wiring harness connector C31 in automatic transmission and grounding, inspect if there is short circuit to ground.

Standard Resistance Value: 10 MΩ or more

G. Measure the voltage between Terminal 10 of wiring harness connector C31 in automatic transmission and grounding, inspect if there is short circuit to the power.

Standard voltage: 0 V

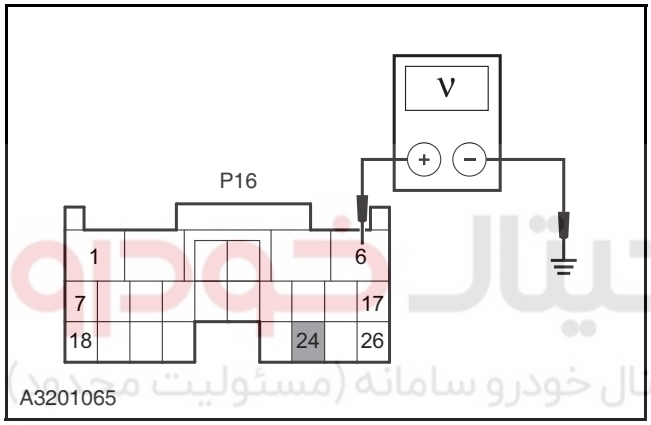
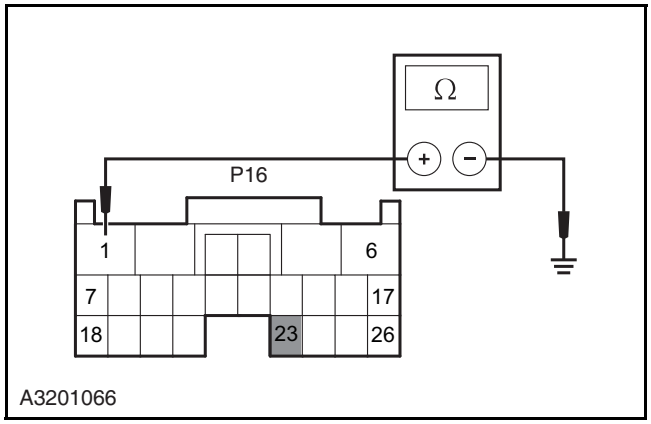
Is the circuit normal?

Y

Go to step 4.

N

Repair circuit faults from terminal 10 of automatic transmission wiring harness connector C31 to terminal 16 of TCM wiring harness connector P16.

Test Conditions	Details/Results/Actions
4. Inspect gearshift solenoid	
	A. Inspect gearshift solenoid **Refer to: Inspect gear shift solenoid (3.2.1 Automatic Transmission, General Procedure).** Is the shift solenoid normal? **Y** Go to step 5. **N** Replace the gear shifting solenoid.
5. Inspect the TCM power supply circuit	
	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Connect the battery negative cable. D. Turn the ignition switch to position "ON". E. Measure the voltage between terminal 6 and 24 of TCM wiring harness connector P16 and reliable grounding. **Standard Voltage Value: 11~14 V** Is the circuit normal? **Y** Go to step 6. **N** Inspect and repair the open circuit fault from terminals 6 and 24 of TCM wiring harness connector P16 to the interior electrical center P01.
6. Inspect the TCM grounding circuit	
	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Measure the resistance between terminal 1 and 23 of TCM wiring harness connector P16 and the reliable grounding. **Standard Resistance Value: less than 5 Ω** Is the resistance value normal? **Y** Go to step 7. **N** Inspect and repair the open circuit fault between the TCM wiring harness connector P16 terminal 1 and 23 and the grounding point GD205. Verify the system is normal.

Test Conditions	Details/Results/Actions
7. Inspect TCM	
	A. Remove the transmission control module (TCM). B. Install a transmission control module in a vehicle in good condition. Is the vehicle normal after installing the transmission control module? **Y** Replace transmission control module. **Refer to: TCM (3.2.1 Automatic Transmission, Removal and Installation).** **N** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System - MT 22.1, Symptom Diagnosis and Testing).**

DTC P0761, P0762, P0978, P0979, P0980

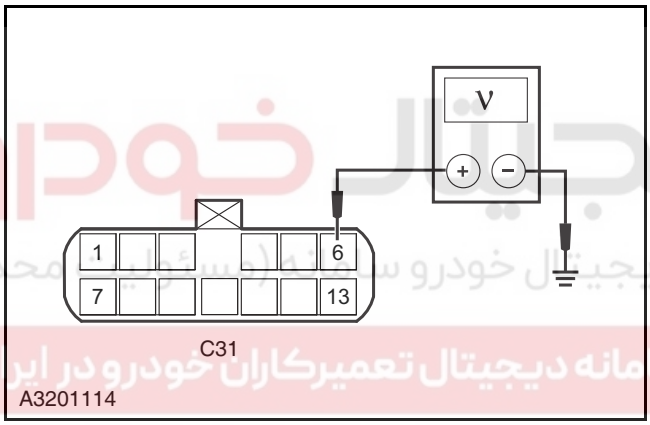
1. Fault code description

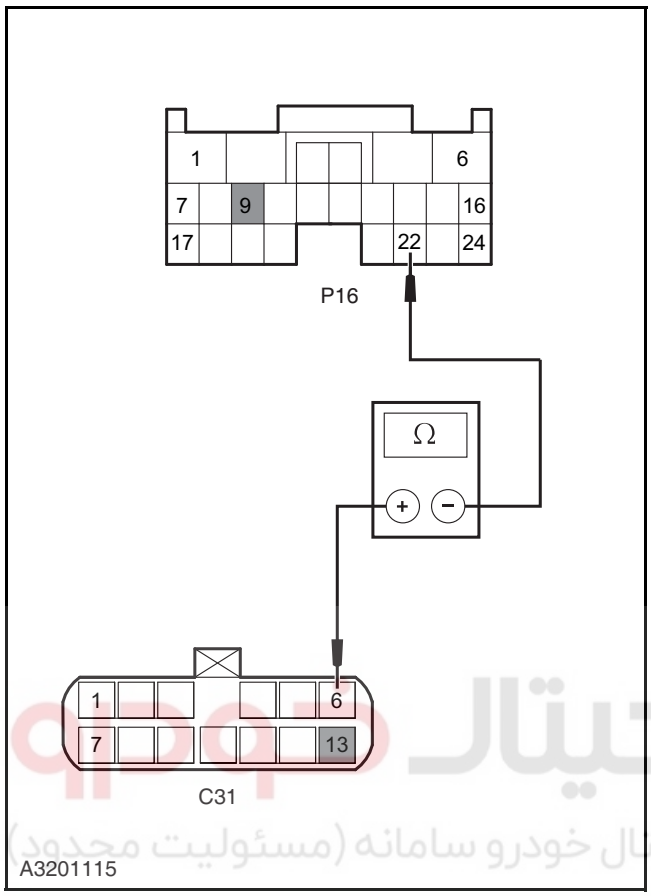
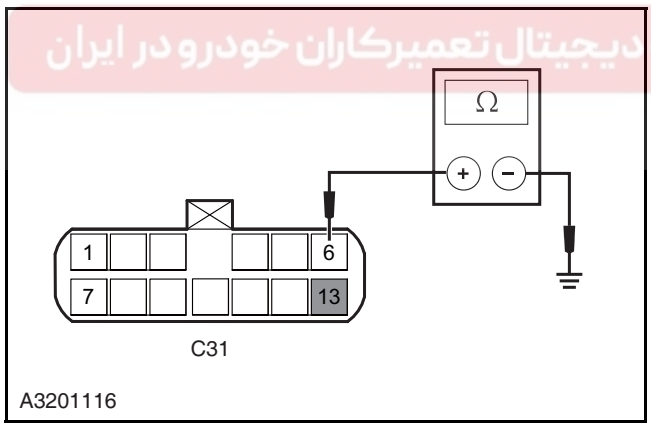
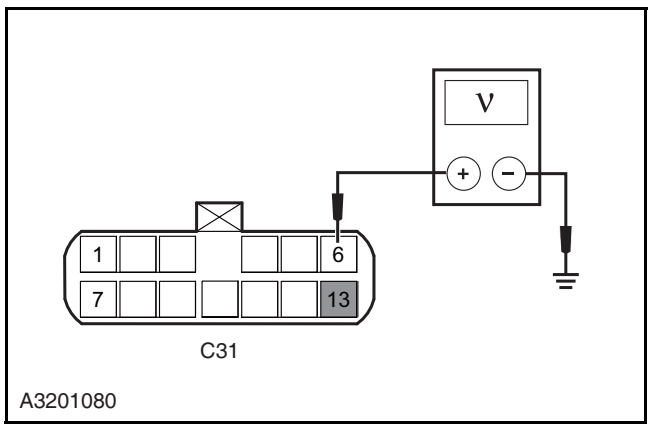
Fault code	Description	Definition
P0761	C1 shift control solenoid [SLC1] min. pressure holding	C1 gear shift control solenoid connects with terminals 22 and 9 of auto transmission control module wiring harness connector P16 through terminal 6 and 13 of automatic transmission wiring harness connector C31.
P0762	C1 shift control solenoid [SLC1] max. pressure holding	
P0978	C1 pressure control solenoid [SLC1] feedback current holding	
P0979	C1 shift control solenoid [SLC1] short to ground/ open circuit	
P0980	C1 shift control solenoid [SLC1] short to power	

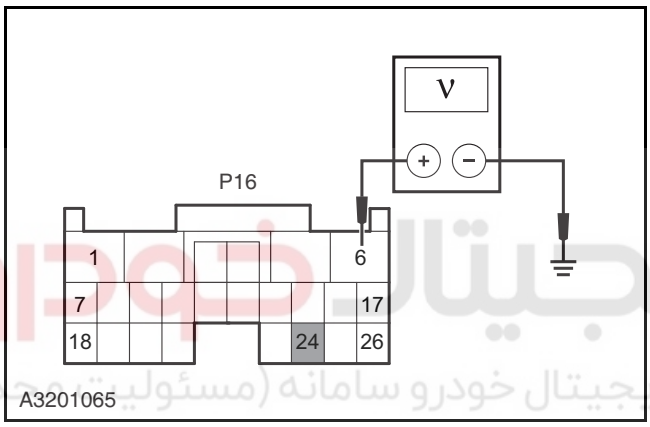
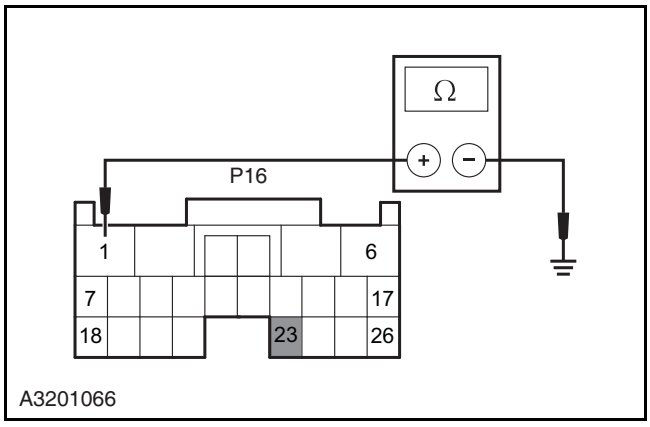
2. Possible Sources

Fault code	Test Tactics	Setting conditions (control strategy)	Fault
P0761	Performance inspection Hardware and circuit inspection	• With the gear lever in D position, accelerator pedal not pressed and the vehicle stopped, the vehicle does not can not be driven (the 1st gear ratio is improper) and this symptom lasts 3.3s or longer and occurred twice. • With the gear lever in D position and the vehicle moving, the 2nd or 3rd gear ratio is improper and this symptom lasts 1s or longer and occurred 5 times.	•Solenoid valve circuit •Solenoid valve •Transmission assembly
P0762		• With the gear lever in D position and the vehicle moving, the gear shift from 2nd to 4th or from 2nd to 3rd is abnormal or the 4th gear ratio is improper and this symptom occurred 5 times.	
P0978		• With the ignition switch turned to the "ON" position, a solenoid feedback current error is detected and this symptom lasts 3s or longer.	
P0979		• With the ignition switch turned to the "ON" position, a solenoid feedback current error is detected and this symptom lasts 0.1s or longer and occurred 5 times.	
P0980		• With the ignition switch turned to the "ON" position, a solenoid feedback current error is detected and this symptom lasts 0.1s or longer and occurred 5 times.	

3. Diagnosis procedure

Test Conditions	Details/Results/Actions
1. Inspect DTC	
	A. Connect the diagnosis tool. B. Diagnose automatic transmission with diagnosis tool. Is there any DTC other than P0761, P0762, P0978, P0979 and P0980 ? **Y** **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission, DTC Diagnosis and Testing).** **N** Go to step 2.
2. Inspect the control signal voltage of gearshift solenoid C1	
	A. Connect the Diagnosis tool. B. Turn the ignition switch to "ON" position. C. Execute the active test of automatic transmission with diagnosis tool, execute the menu “C1 solenoid current-OFF”. D. Measure the voltage between terminal 6 of wiring harness connector C31 in automatic transmission and reliable grounding with the multimeter. **Standard voltage: 0 V** E. Execute the active test of automatic transmission with diagnosis tool, execute the menu “C1 solenoid current-ON” F. Measure the voltage between terminal 6 of wiring harness connector C31 in automatic transmission and reliable grounding with the multimeter. **Standard Voltage Value: 11~14 V** Is the voltage normal? **Y** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System-MT22.1, Symptom Diagnosis and Testing).** **N** Go to step 3.

Test Conditions	Details/Results/Actions
3. Inspect the circuit from C1 shift control solenoid to TCM	
 A3201115	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the automatic transmission wiring harness connector C31. C. Disconnect the TCM wiring harness connector P16. D. Connect the battery negative cable. E. Measure the resistance between terminal 6 and 13 of wiring harness connector C31 in automatic transmission and terminal 22 and 9 of the wiring harness connector P16 of the TCM, inspect if there is broken circuit. **Standard Resistance Value: less than 5 Ω** F. Measure the resistance between terminal 6 and 13 of wiring harness connector C31 in automatic transmission and grounding, inspect if there is short circuit to ground. **Standard Resistance Value: 10 MΩ or more** G. Measure the voltage between terminal 6 and 13 of wiring harness connector C31 in automatic transmission and grounding, inspect if there is short circuit to the power. **Standard voltage: 0 V** Is the circuit normal? **Y** Go to step 4. **N** Repair circuit faults from terminals 6 & 13 of automatic transmission wiring harness connector C31 to terminals 22 & 9 of TCM wiring harness connector P16 respectively.
 A3201116	
 A3201080	

Test Conditions	Details/Results/Actions
4. Inspect C1 gearshift control solenoid	
	A. Inspect C1 shift control solenoid. **Refer to: Inspect linear pressure control solenoid (SLC1, SLC2, SLB1) (3.2.1 Automatic Transmission, General Procedure).** If C1 gearshift control solenoid normal? **Y** Go to step 5. **N** Replace C1 shift control solenoid.
5. Inspect the TCM power supply circuit	
 A3201065	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Connect the battery negative cable. D. Turn the ignition switch to position "ON". E. Measure the voltage between terminal 6 and 24 of TCM wiring harness connector P16 and reliable grounding. **Standard Voltage Value: 11~14 V** Is the circuit normal? **Y** Go to step 6. **N** Inspect and repair the open circuit fault from terminals 6 and 24 of TCM wiring harness connector P16 to the interior electrical center P01.
6. Inspect the TCM grounding circuit	
 A3201066	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Measure the resistance between terminal 1 and 23 of TCM wiring harness connector P16 and the reliable grounding. **Standard Resistance Value: less than 5 Ω** Is the resistance value normal? **Y** Go to step 7. **N** Inspect and repair the open circuit fault between the TCM wiring harness connector P16 terminal 1 and 23 and the grounding point GD205. Verify the system is normal.

Test Conditions	Details/Results/Actions
7. Inspect TCM	
	A. Remove the transmission control module (TCM). B. Install a transmission control module in a vehicle in good condition. Is the vehicle normal after installing the transmission control module? **Y** Replace transmission control module. **Refer to: TCM (3.2.1 Automatic Transmission, Removal and Installation).** **N** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System - MT 22.1, Symptom Diagnosis and Testing).**

DTC P0766, P0767, P0981 P0982, P0983

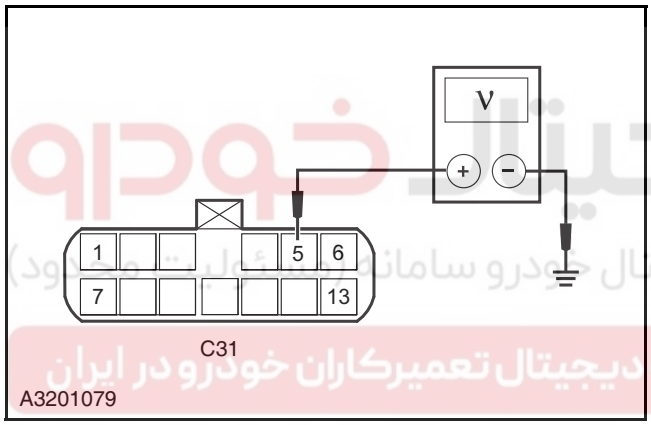
1. Fault code description

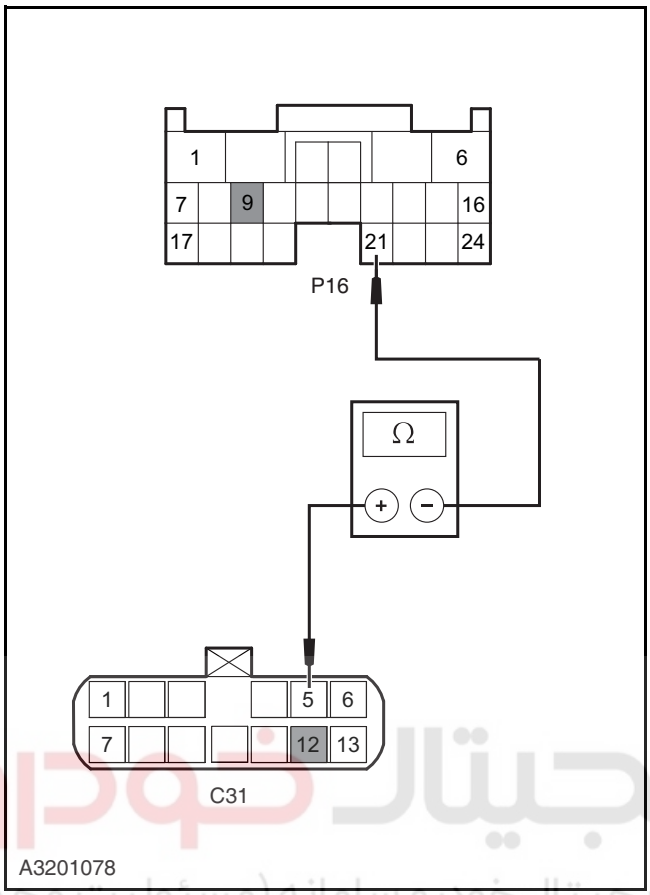
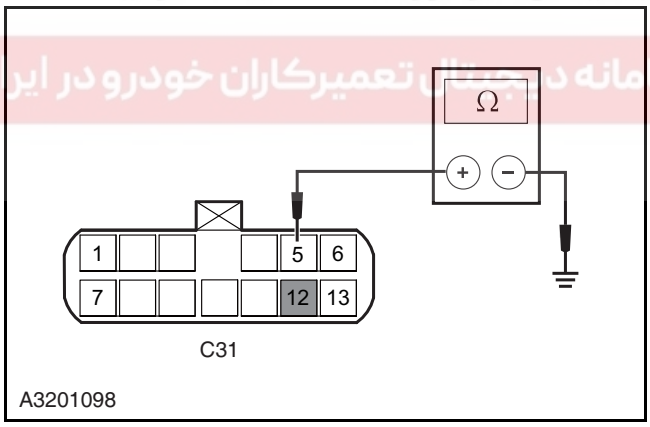
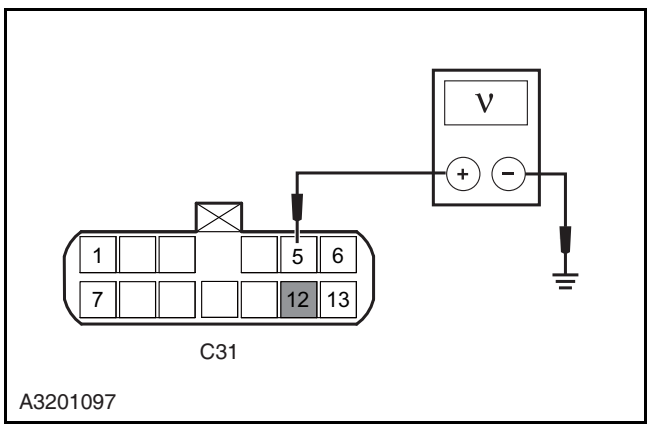
Fault code	Description	Definition
P0766	C2 shift control solenoid [SLC2] min. pressure holding	Gearshift solenoid 1 is connected with terminal 16 of wiring harness connector P35 in Transmission Control Module by terminal 1 of wiring harness connector C20 in automatic transmission,Solenoid can ground by itself.
P0767	C2 shift control solenoid [SLC2] max. pressure holding	
P0981	C2 shift control solenoid [SLC2] feedback current holding	
P0982	C2 pressure control solenoid [SLC2] short to ground/open circuit	
P0983	C2 pressure control solenoid [SLC2] short to power	

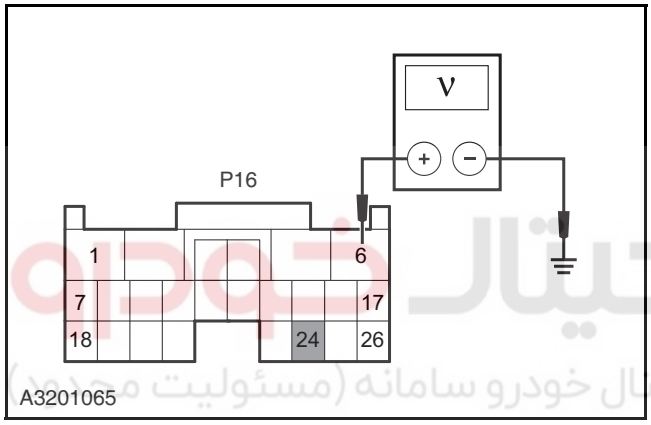
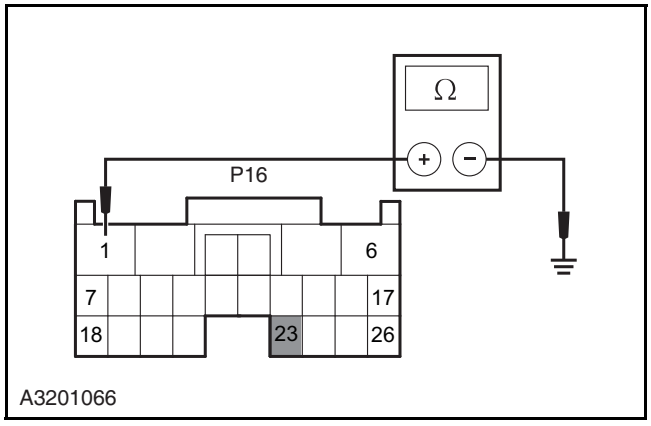
2. Possible Sources

Fault code	Test Tactics	Setting conditions(control strategy)	Fault
P0766	Performance inspection Hardware and circuit inspection	• With the gear lever in D position and the vehicle moving, the 3rd or 4th gear ratio is improper and this symptom lasts 1s or longer and occurred 5 times.	• Circuit • TCM • C2 shift control solenoid • Automatic transmission
P0767		• With the gear lever in D position and the vehicle moving, the gear shift from 1st to 2nd, from 3rd to 2nd or from 4th to 2nd is abnormal or the 2nd gear ratio is improper and this symptom occurred 5 times.	
P0981		• With the ignition switch turned to "ON" , a solenoid feedback current error is detected and this symptom lasts 3s or longer.	
P0982		• With the ignition switch turned to "ON", a solenoid feedback current meters error is detected. This symptom lasts 0.1s or longer and occurred 5 times.	
P0983		•With the ignition switch turned to "ON", a solenoid feedback current error is detected and this symptom lasts 0.1s or longer and occurred 5 times.	

3. Diagnosis procedure

Test Conditions	Details/Results/Actions
1. Inspect DTC	
	A. Connect the diagnosis tool. B. Diagnose Automatic Transmission with diagnosis tool. Is there any DTC other than P0766, P0767, P0981,P0982 and P0983 ? **Y** **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission, DTC Diagnosis and Testing).** **N** Go to step 2.
2. Inspect the control signal voltage of gearshift solenoid C2	
	A. Connect the Diagnosis tool. B. Turn the ignition switch to "ON" position. C. Execute the active test of automatic transmission with diagnosis tool, execute the menu “C2 solenoid current-OFF”. D. Measure the voltage between terminal 5 of wiring harness connector C31 in automatic transmission and reliable grounding with the multimeter. **Standard voltage: 0 V** E. Execute the active test of automatic transmission with diagnosis tool, execute the menu “C2 solenoid current-ON” F. Measure the voltage between terminal 5 of wiring harness connector C31 in automatic transmission and reliable grounding with the multimeter. **Standard Voltage Value: 11~14 V** Is the voltage normal? **Y** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System - MT22.1, Symptom Diagnosis and Testing).** **N** Go to step 3.
3. Inspect the circuit from C2 shift control solenoid to TCM	

Test Conditions	Details/Results/Actions
 A3201078	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Connect the battery negative cable. D. Turn the ignition switch to position "ON". E. Measure the resistance between terminal 5 and 12 of wiring harness connector C31 in automatic transmission and terminal 21 and 9 in the wiring harness connector P16 of the TCM, inspect if there is broken circuit. **Standard Resistance Value: less than 5 Ω** F. Measure the resistance between terminal 5 and 12 of wiring harness connector C31 in automatic transmission and grounding, inspect if there is short circuit to ground. **Standard Resistance Value: 10 MΩ or more** G. Measure the voltage between terminal 5 and 12 of wiring harness connector C31 in automatic transmission and grounding, inspect if there is short circuit to the power. **Standard voltage: 0 V** Is the circuit normal? **Y** Go to step 4. **N** Repair circuit faults from terminals 5 & 12 of automatic transmission wiring harness connector C31 to Terminals 21 & 9 of TCM wiring harness connector P16 respectively.
 A3201098	
 A3201097	

Test Conditions	Details/Results/Actions
4. Inspect C2 shift control solenoid	
	A. Inspect C2 shift control solenoid. **Refer to: Inspect linear pressure control solenoid(SLC1, SLC2, SLB1) (3.2.1 Automatic Transmission, General Procedure).** Is C2 shift control solenoid normal? **Y** Go to step 5. **N** Replace C2 shift control solenoid.
5. Inspect the TCM power supply circuit	
	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Connect the battery negative cable. D. Turn the ignition switch to position "ON". E. Measure the voltage between terminal 6 and 24 of TCM wiring harness connector P16 and reliable grounding. **Standard Voltage Value: 11~14 V** Is the circuit normal? **Y** Go to step 6 **N** Inspect and repair the open circuit fault from terminals 6 and 24 of TCM wiring harness connector P16 to the interior electrical center P01.
6. Inspect the TCM grounding circuit	
	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Measure the resistance between terminal 1 and 23 of TCM wiring harness connector P16 and the reliable grounding. **Standard Resistance Value: less than 5 Ω** Is the resistance value normal? **Y** Go to step 7. **N** Inspect and repair the open circuit fault between the TCM wiring harness connector P16 terminal 1 and 23 and the grounding point GD205. Verify the system is normal.

Test Conditions	Details/Results/Actions
7. Inspect TCM	
	A. Remove the transmission control module (TCM). B. Install a transmission control module in a vehicle in good condition. Is the vehicle normal after installing the transmission control module? **Y** Replace transmission control module. **Refer to: TCM (3.2.1 Automatic Transmission, Removal and Installation).** **N** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System - MT22.1, Symptom Diagnosis and Testing).**

DTC P2707, P2708, P0997, P0998, P0999

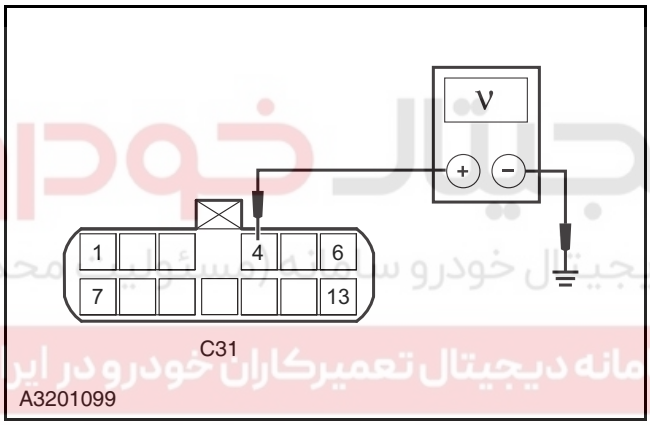
1. Fault code description

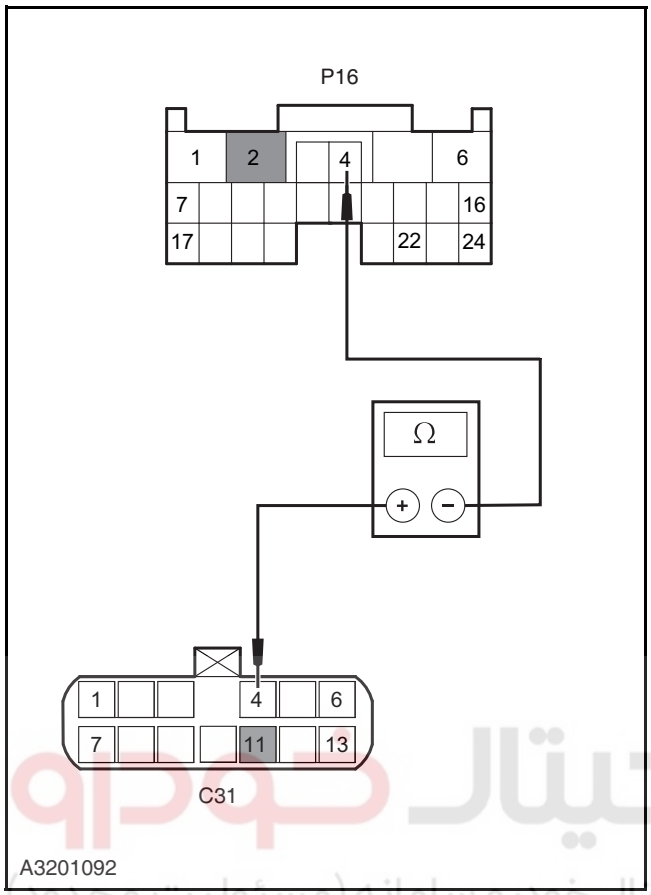
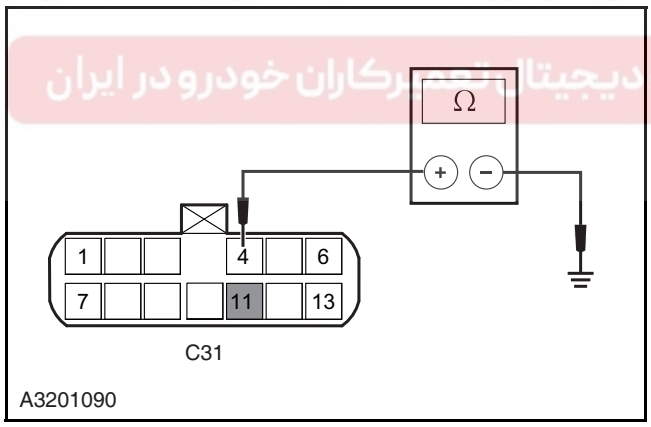
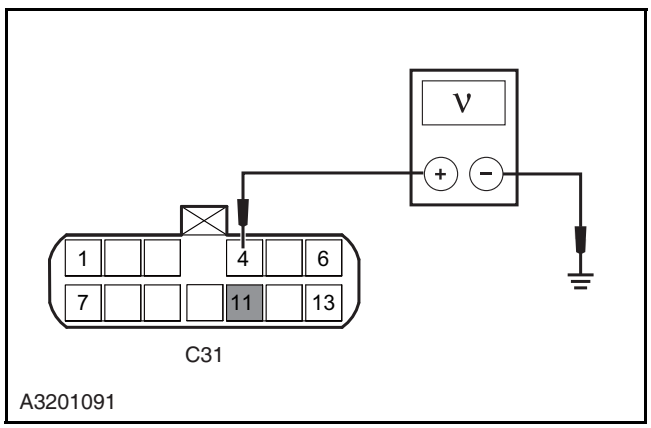
Fault code	Description	Definition
P2707	B1 pressure control solenoid [SLB1] min. pressure holding	B1 pressure control solenoid connects with terminals 4 and 2 of transmission control module wiring harness connector P16 through terminal 4 and 11 of automatic transmission wiring harness connector C31.
P2708	B1 pressure control solenoid [SLB1] max. pressure holding	
P0997	B1 pressure control solenoid [SLB1] feedback current holding	
P0998	B1 pressure control solenoid [SLB1] short to ground/open circuit	
P0999	B1 pressure control solenoid [SLB1] short to power	

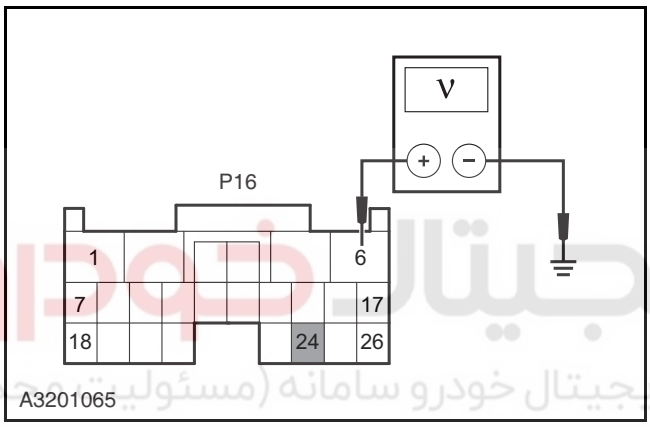
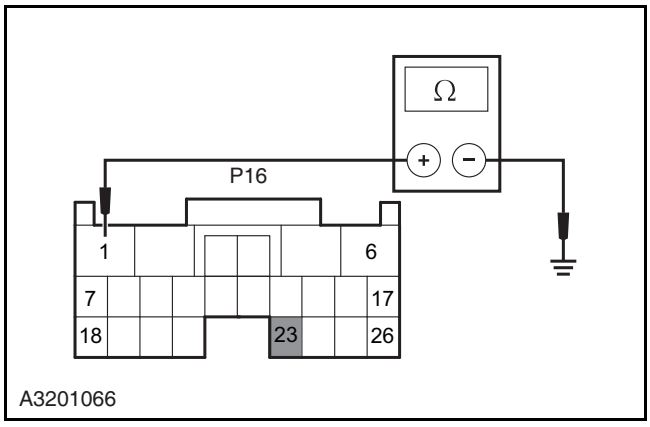
2. Possible Sources

Fault code	Test Tactics	Setting conditions(control strategy)	Fault
P2707	Performance inspection Hardware and circuit inspection	• With the vehicle operating in D position, the gear ratio in 2nd and 4th gear is improper and this symptom occurred 5 times.	• Circuit • TCM • Pressure Control Solenoid B1
P2708		• With the vehicle operating in D gear, the gear shift from 1st to 3rd, from 2nd to 3rd or from 4th to 3rd is abnormal or the 3rd gear ratio is improper, and this symptom occurred 5 times.	
P0997		• With the ignition switch turned to the "ON" position, a solenoid feedback current error is detected and this symptom lasts 3s or longer.	
P0998		• With the ignition switch turned to the "ON" position, a solenoid feedback current error is detected and this symptom lasts 0.1s or longer and occurred 5 times.	
P0999		• With the ignition switch turned to the "ON" position, a solenoid feedback current error is detected and this symptom lasts 0.1s or longer and occurred 5 times.	

3. Diagnosis procedure

Test Conditions	Details/Results/Actions
1. Inspect DTC	
	A. Connect the diagnosis tool. B. Diagnose Automatic Transmission with diagnosis tool. Is there any DTC other than P2707, P2708, P0997, P0998 and P0999 ? **Y** **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission, DTC Diagnosis and Testing).** **N** Go to step 2.
2. B1 pressure control solenoid control signal voltage	
	A. Connect the Diagnosis tool. B. Turn the ignition switch to "ON" position. C. Execute the active test of automatic transmission with diagnosis tool, execute the menu “B1 solenoid current-OFF”. D. Measure the voltage between terminal 4 of wiring harness connector C31 in automatic transmission and reliable grounding with the multimeter. **Standard voltage: 0 V** E. Execute the active test of automatic transmission with diagnosis tool, execute the menu “B1 solenoid current-ON” F. Measure the voltage between terminal 4 of wiring harness connector C31 in automatic transmission and reliable grounding with the multimeter. **Standard Voltage Value: 11~14 V** Is the voltage normal? **Y** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System - MT22.1, Symptom Diagnosis and Testing).** **N** Go to step 3.
3. Inspect the circuit from B1 pressure control solenoid to TCM	

Test Conditions	Details/Results/Actions
 A3201092	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Connect the battery negative cable. D. Turn the ignition switch to position "ON". E. Measure the resistance between terminal 4 and 11 of wiring harness connector C31 in automatic transmission and terminal 4 and 2 in the wiring harness connector P16 of the TCM, inspect if there is broken circuit. **Standard Resistance Value: less than 5 Ω** F. Measure the resistance between terminal 4 and 11 of wiring harness connector C31 in automatic transmission and grounding, inspect if there is short circuit to ground. **Standard Resistance Value: 10 MΩ or more** G. Measure the voltage between terminal 4 and 11 of wiring harness connector C31 in automatic transmission and grounding, inspect if there is short circuit to the power. **Standard voltage: 0 V** Is the circuit normal? **Y** Go to step 4. **N** Repair circuit faults from terminals 4 & 11 of automatic transmission wiring harness connector C31 to terminals 4 & 2 of TCM wiring harness connector P16 respectively.
 A3201090	
 A3201091	

Test Conditions	Details/Results/Actions
4. Inspect B1 pressure control solenoid	
	A. Inspect the B1 pressure control solenoid. **Refer to: Inspect linear pressure control solenoid (SLC1, SLC2, SLB1) (3.2.1 Automatic Transmission, General Procedure).** Is B1 pressure control solenoid normal? **Y** Go to step 5. **N** Replace the B1 pressure control solenoid.
5. Inspect the TCM power supply circuit	
	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Connect the battery negative cable. D. Turn the ignition switch to position "ON". E. Measure the voltage between terminal 6 and 24 of TCM wiring harness connector P16 and reliable grounding. **Standard Voltage Value: 11~14 V** Is the circuit normal? **Y** Go to step 6. **N** Inspect and repair open circuit faults from terminals 6 and 24 of TCM wiring harness connector P16 to the interior electrical center P01.
6. Inspect the TCM grounding circuit	
	A. Turn the ignition switch to position "LOCK" and disconnect the battery negative cable. B. Disconnect the TCM wiring harness connector P16. C. Measure the resistance between terminal 1 and 23 of TCM wiring harness connector P16 and the reliable grounding. **Standard Resistance Value: less than 5 Ω** Is the resistance value normal? **Y** Go to step 7. **N** Inspect and repair the open circuit fault between the TCM wiring harness connector P16 terminal 1 and 23 and the grounding point GD205. Verify the system is normal.

Test Conditions	Details/Results/Actions
7. Inspect TCM	
	A. Remove the transmission control module (TCM). B. Install a transmission control module in a vehicle in good condition. Is the vehicle normal after installing the transmission control module? **Y** Replace transmission control module. **Refer to: TCM (3.2.1 Automatic Transmission, Removal and Installation).** **N** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System-MT22.1, Symptom Diagnosis and Testing).**

DTC P1205

1. Fault code description

Fault code	Description	Definition
P1205	Shifter manual mode problem	The manual mode switch has connections of terminals 6, 7 & 5 of gear lever wiring harness connector P20 with terminals 18, 19 & 9 of TCM wiring harness connector P17 respectively and it connects to the ground through terminal 8 of P20.

2. Possible Sources

Fault code	Test Tactics	Setting conditions (control strategy)	Fault
P1205	Hardware and circuit inspection	• Auto mode detects manual mode signal: with the ignition switch in the "ON" position, manual mode signal is detected while in P, R, N or D gear and this symptom lasts 2s or longer and occurred once. • Manual mode signal detects no signal: with the ignition switch in the "ON" position, manual upshift or downshift signal is not detected in manual mode and this symptom lasts 2s or longer and occurred once.	• Circuit • Manual mode switch • TCM

3. Diagnosis procedure

Test Conditions	Details/Results/Actions
1. General Procedures	
	A. Inspect the related wiring harness connectors for signs of damage, poor contact, aging or loose. Is it normal? **Y** Go to step 2. **N** Repair the fault.
2. Inspect the DTC	
	A. Connect the Diagnosis tool. B. Diagnose automatic transmission with diagnosis tool. Is there any other fault code except for P1205? **Y** **Refer to: Index of DTC Diagnostic Process (3.2.1 Automatic Transmission, DTC Diagnosis and Testing).** **N** Go to step 3.
3. Inspect manual mode circuit	
	A. Inspect manual mode circuit. **Refer to: Diagnostic Procedure for Failure to Enable Manual Mode (3.2.1 Automatic Transmission, Symptom Diagnosis and Testing).**

DTC P1229

1. Fault code description

Fault code	Description	Definition
P1229	No power in D position	-

2. Possible Sources

P1229	Hardware and circuit inspection	• The vehicle fails to move when accelerator pedal is pressed with the gear lever in D position, this symptom lasts 3.3s or longer and occurred twice.	• Valve body • Circuit • Automatic transmission • TCM

3. Diagnosis procedure

Test Conditions	Details/Results/Actions
1. General Procedures	
	A. Inspect the related fuses and wiring harness connectors for signs of damage, poor contact, aging or loose. Is it normal? **Y** Go to step 2. **N** Repair the fault.
2. Eliminate the DTC	
	A. Connect the diagnosis tool. B. Use diagnosis tool to delete DTC. C. Shake, pull and push TCM harness connector, as well as sensor and solenoid wiring harness connectors. D. Use diagnosis tool to redo the diagnosis for DTC. Is there DTC P1299? **Y** Go to step 3. **N** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System-MT22.1, Symptom Diagnosis and Testing).**

Test Conditions	Details/Results/Actions
3. Inspect TCM circuit	
	A. Turn the ignition switch to "LOCK" position and disconnect the battery negative cable. B. Disconnect TCM wiring harness connector P16, as well as sensor and solenoid wiring harness connectors. C. Measure the resistance between each terminal of TCM wiring harness connector P16 and each of corresponding sensor and solenoid wiring harness connectors. **Standard Resistance Value: less than 5 Ω** D. Measure the resistance between terminals of TCM wiring harness connector P16 and the reliable grounding. **Standard Resistance Value: 10 MΩ or higher** Is the resistance value normal? **Y** Replace automatic transmission. **Refer to: Manual Transmission(3.2.1 Manual Transmission, Removal and Installation).** **N** Repair the failed circuit.

DTC U0001, U0074, U0100, U2081

1. Fault code description

Fault code	Description	Definition
U0001	CAN bus interruption	ECM, ESP/ABS, BCM and TCM communicate via CAN network and the diagnostic tool may be used to access ECM, ESP/ABS and TCM through diagnostic interface DLC.
U0074	No CAN signal	
U0100	Lost communication with ECU	
U2081	Lost communication with ESP/ABS	

2. Possible Sources

Fault code	Test Tactics	Setting conditions(control strategy)	Fault
U0001	Hardware and circuit inspection	• With the ignition switch in the "ON" position and TCM communication normal, TCM receives the bus interruption signal and this symptom lasts 0.45s or longer.	• CAN bus malfunction • ESP/ABS malfunction • ECM fault • TCM fault • BCM fault • DLC malfunction
U0074		• With the ignition switch in the "ON" position and TCM communication normal, TCM can not send a signal and this symptom lasts 0.4s or longer.	
U0100		• With the ignition switch in the "ON" position and TCM communication normal, TCM detects no ECU signal and this symptom lasts 0.5s or longer.	
U2081		• With the ignition switch in the "ON" position and TCM communication normal, TCM detects no ESP/ABS signal and this symptom lasts 0.5s or longer.	

3. Diagnosis procedure

Test Conditions	Details/Results/Actions
1. General Procedures	
	A. Inspect the related wiring harness connectors for signs of damage, poor contact, aging or loose. Is it normal? **Y** Go to step 2. **N** Repair the fault.
2. Eliminate the DTC	
	A. Connect the diagnosis tool. B. Use diagnosis tool to delete DTC. C. Shake, pull or press diagnostic plug and wiring harness connectors of ESP/ABS control module, automatic transmission control module, engine control module and body control module. D. Use diagnosis tool to redo the diagnosis for DTC. Is there DTC U0001, U0074, U0100 or U2081 ? **Y** Go to step 3. **N** **Refer to: Intermittent Fault Diagnosis procedure (3.1.13 Electrical Control System-MT22.1, Symptom Diagnosis and Testing).**
3. Inspect and repair CAN bus	
	A. Inspect and repair CAN bus. **Refer to: Diagnostic Tool Can Not Communicate With BCM (4.3.16 Vehicle Network System, Symptom Chart).**

Removal and Installation

TCM

Removal

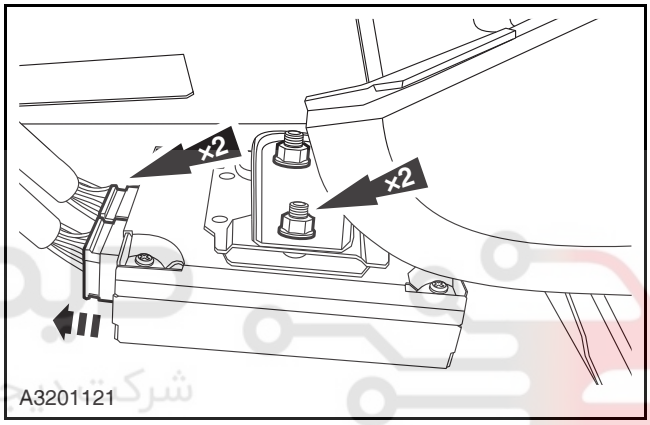
1. Disconnect the battery negative cable.

   Refer to: Battery Inspection (3.1.10 Charging System, General Procedures).

2. Remove the instrument cluster lower cover at the the driver side.

   Refer to: Instrument Cluster (5.1.6 Instrument Cluster and Console, Removal and Installation).

3. Disconnect the TCM wiring harness connector.
4. Remove the TCM retaining nut and take out the TCM.



Installation

1. To install, reverse the removal procedure.

Input Shaft Speed Sensor

Removal

1. Remove the battery.

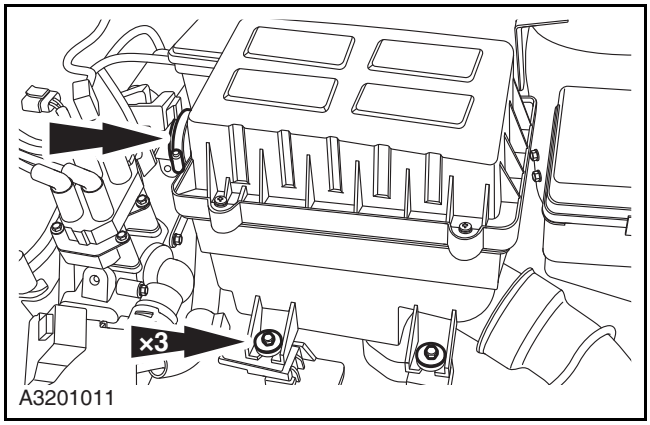
   Refer to: Battery (3.1.10 Charging System, Removal and Installation).

2. Remove the air filter assembly.

   1. Remove the connection of inlet hose and throttle.

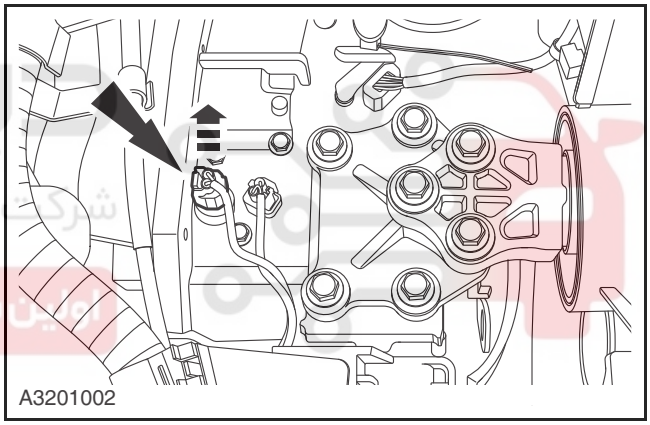
   2. Remove 3 retaining bolts of the air filter case.

   Torque: 9 Nm



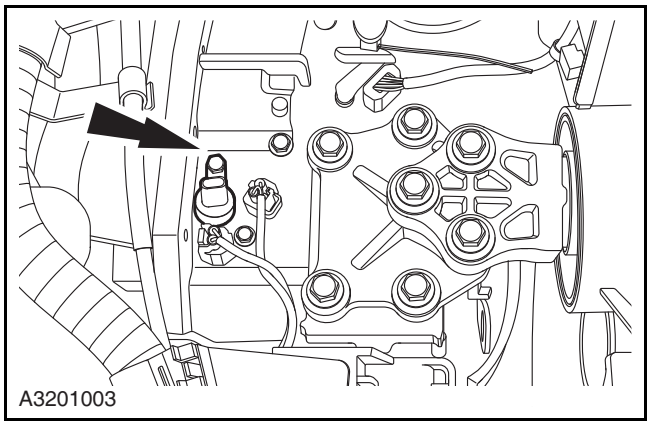
A3201011

3. Disconnect the wiring harness connectors of input shaft speed sensor.


A3201002

4. Remove the input shaft speed sensor.

   Torque: 6 Nm


A3201003

Installation

1. To install, reverse the removal procedure.

CAUTION: Inspect the O-ring and replace it as necessary.

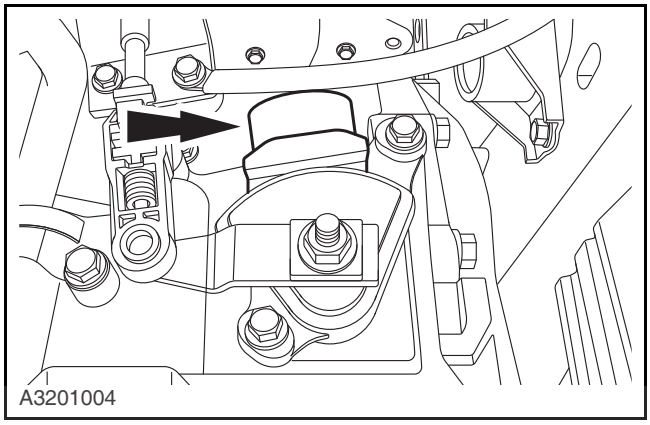
CAUTION: Apply the grease on the O-ring before installing.

Neutral Position Switch

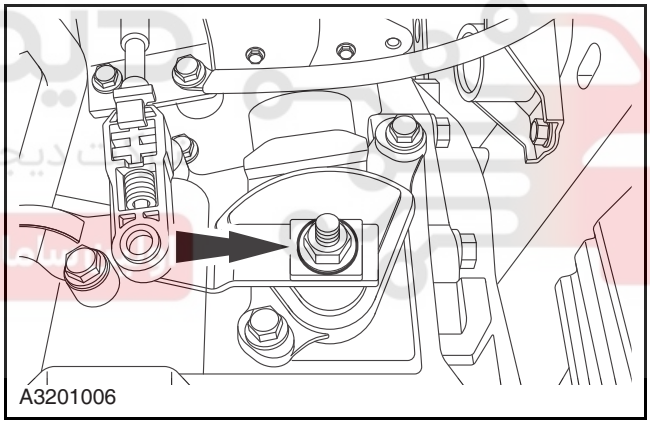
Removal

1. Shift the gearshift lever into the "N" gear.
2. Disconnect the battery negative cable.

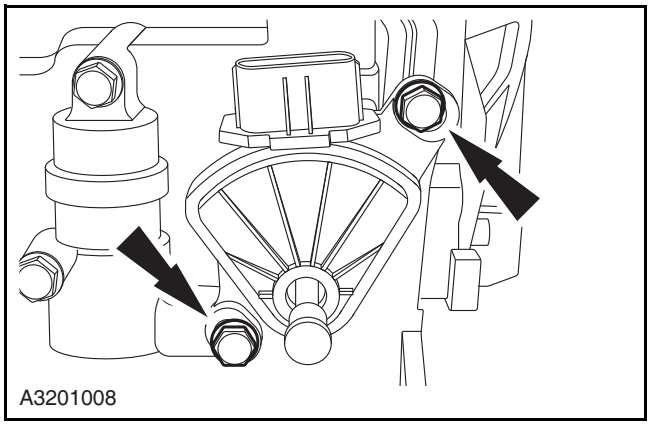
   Refer to: Battery Inspection (3.1.10 Charging System, General Procedures).
3. Disconnect the neutral position switch wiring harness connector.



4. Remove the gearshift arm connecting nut.

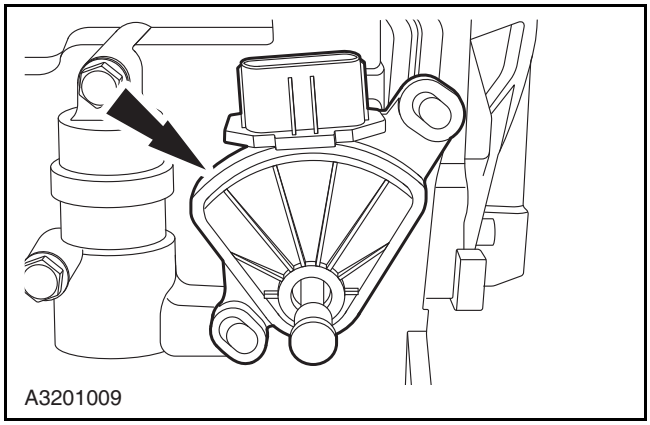


5. Remove the retaining bolt at both sides of neutral position switch.
6. Take out the automatic transmission neutral position switch.



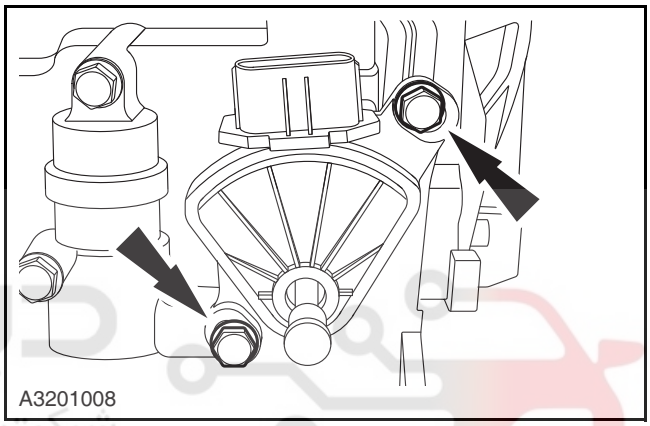
Installation

1. Shift the neutral position switch and the gearshift shaft to "N" gear position.
2. Install the neutral position switch on the automatic transmission gearshift shaft and align the "N" gear baseline of the neutral position switch with the narrow groove of the gearshift shaft.


A3201009

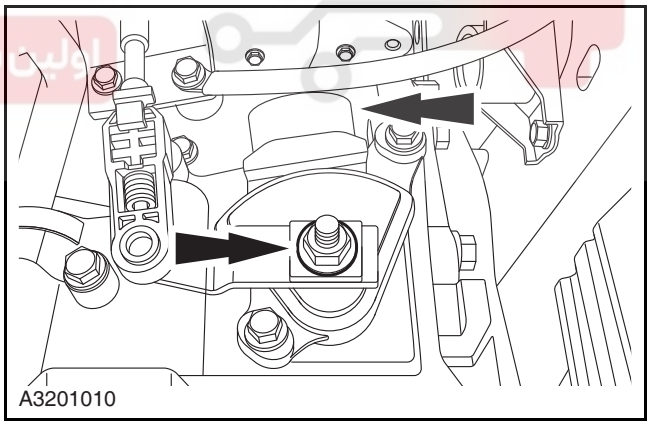
3. Remove the retaining bolt at both sides of neutral position switch.

   Torque: 8 Nm


A3201008

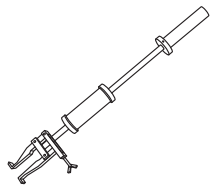
4. Install and fasten the gearshift arm.

   Torque: 8 Nm
5. Connect the neutral position switch wiring harness connector.
6. Install the battery negative cable.
7. Inspect the neutral position switch whether it works well at every gear.


A3201010

Differential Oil Seal

Special Tool

 CA302-001	Remover, Differential Oil Seal CA302-001

Removal

1. Lift and support the vehicle.

   Refer to: Lifting (1.1.3 Traction and Lifting, Description and Operation).

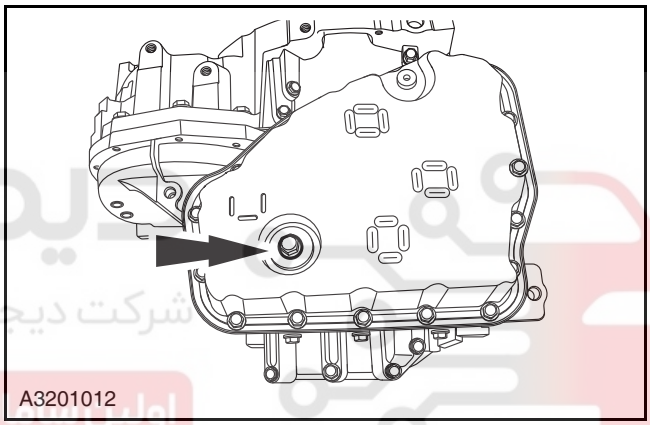
2. Loosen and move the oil drain plug, then drain the oil.

   Torque: 18 Nm

3. Remove the halfshaft assembly.

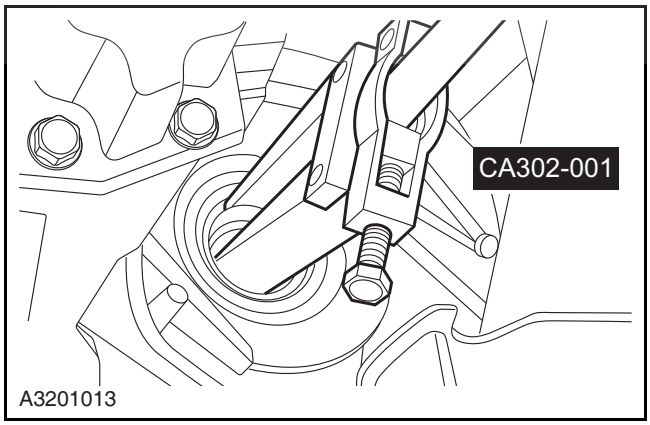
   Refer to: Left-Hand Halfshaft (2.2.2 Half Shaft, Removal and Installation).

   Refer to: Right-Hand Halfshaft (2.2.2 Half Shaft, Removal and Installation).


A3201012

4. Remove the differential oil seal with the special tool.

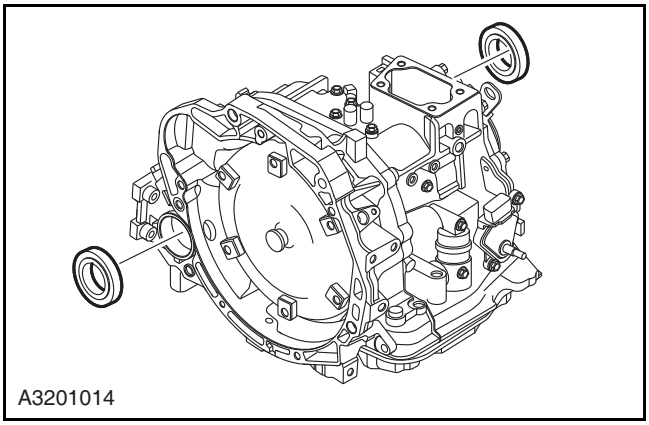
   Special tool: CA302-001



A3201013

Installation

1. Install the differential oil seal with the special tool.
2. Install the halfshaft.
3. Fill up the automatic transmission with the automatic transmission oil and check the oil level.
4. Lower the vehicle.
5. Check the vehicle on road for differential oil seal leakage.


A3201014

Output Shaft Speed Sensor

Removal

1. Disconnect the battery negative cable.

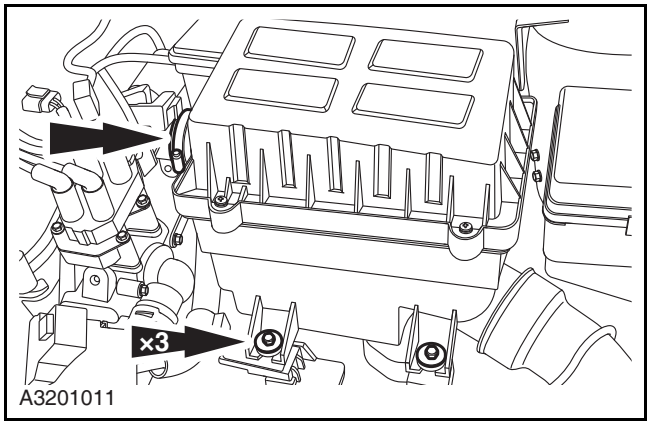
   Refer to: Battery Inspection (3.1.10 Charging System, General Procedures).

2. Remove the air filter assembly.

   1. Remove the connection of inlet hose and throttle.

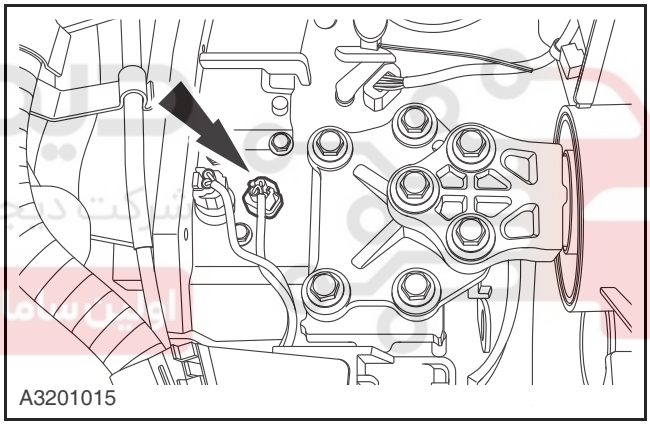
   2. Remove 3 retaining bolts of the air filter case.

   Torque: 9 Nm



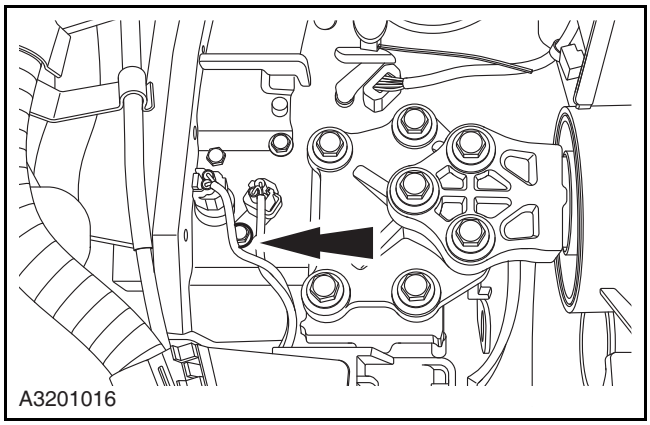
A3201011

3. Disconnect the output shaft speed sensor.


A3201015

4. Remove the output shaft speed sensor.

   Torque: 6 Nm


A3201016

Installation

1. To install, reverse the removal procedure.

CAUTION: Inspect the O-ring and replace it as necessary.

CAUTION: Apply the vaseline on the O-ring before installing.

Oil Sump

Removal

1. Disconnect the battery negative cable.

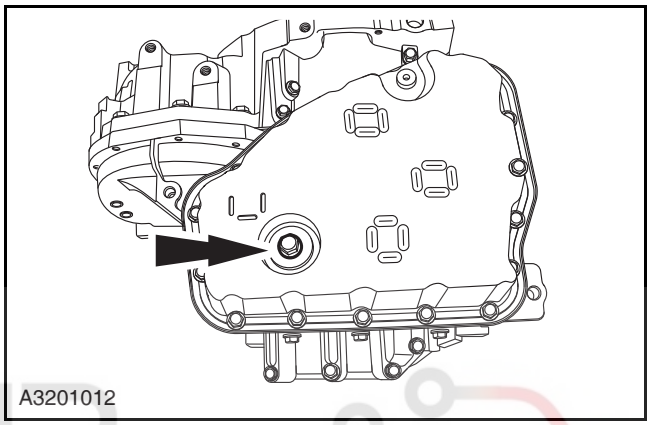
   Refer to: Battery Inspection (3.1.10 Charging System, General Procedures).

2. Lift the vehicle.

   Refer to: Lifting (1.1.3 Traction and Lifting, Description and Operation).

3. Loosen and remove the oil drain bolt, then drain the automatic transmission oil.

   Torque: 18 Nm

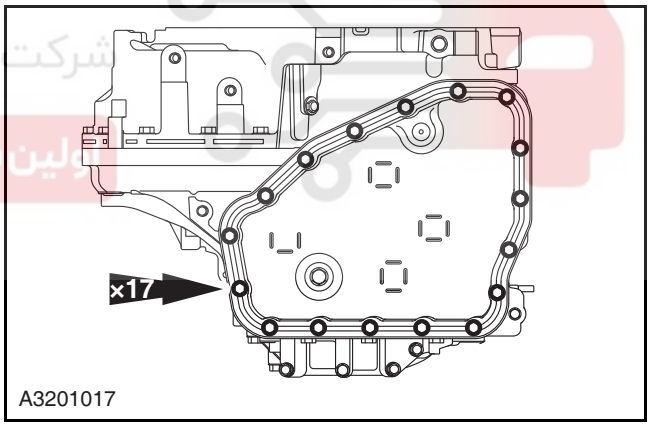

A3201012

4. Remove 17 retaining nuts of the automatic transmission oil sump.

   Torque: 8 Nm

5. Remove the automatic transmission oil sump and discard the seal.

6. Clean the contact surface of the automatic transmission and the oil sump seal.



A3201017

Installation

1. To install, reverse the removal procedure.
2. Use new automatic transmission seal.
3. Check the vehicle on road for oil leakage.

Oil Temperature Sensor

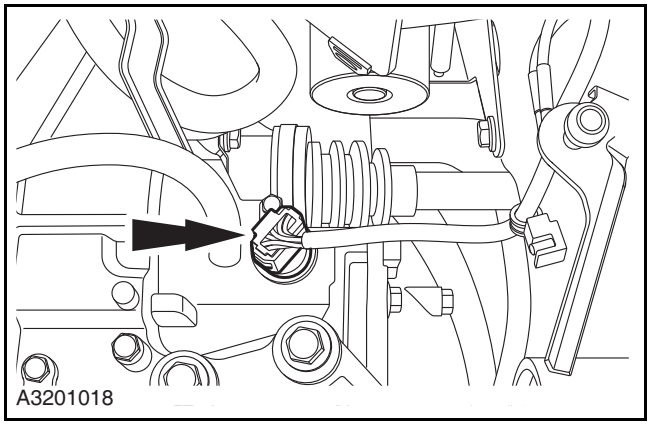
Removal

1. Disconnect the battery negative cable.

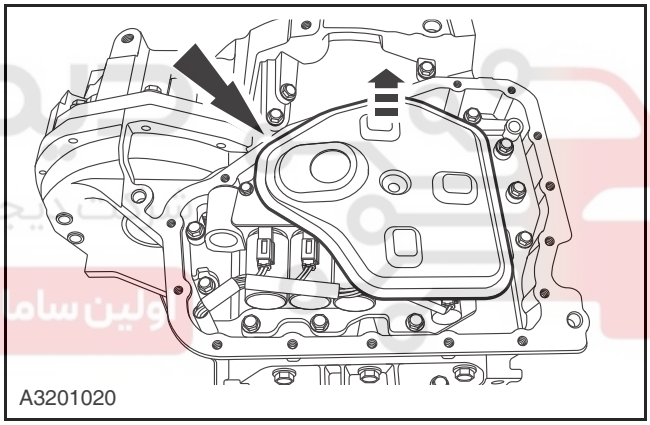
   Refer to: Battery Inspection (3.1.10 Charging System, General Procedures).

2. Disconnect the automatic transmission wiring harness connector.
3. Remove the automatic transmission oil sump.

   Refer to: Oil Sump (3.2.1 Automatic Transmission, Removal and Installation).



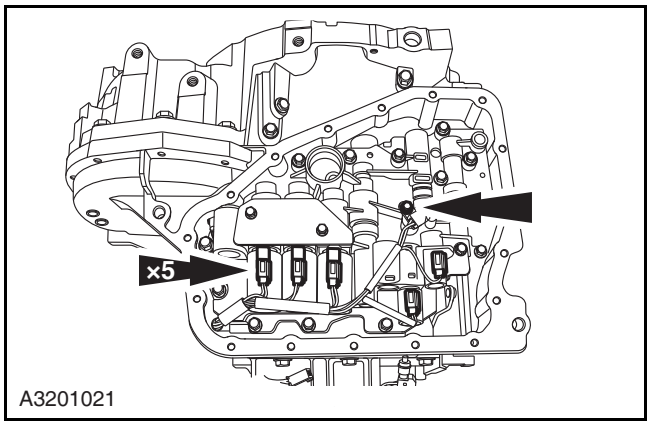
4. Remove the automatic transmission oil filter assembly.



5. Disconnect the gearshift solenoid valve wiring harness connector.
6. Remove the retaining bolt of the oil temperature sensor latch.

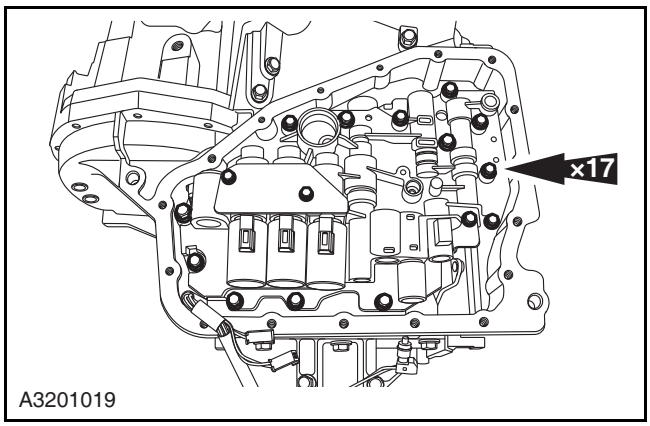
   Torque: 6 Nm

7. Take out the oil temperature sensor.



8. Remove the automatic transmission valve body assembly.

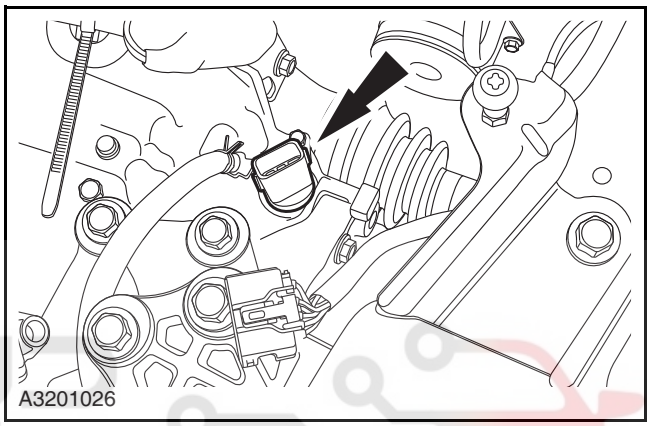
   Torque: 8 Nm



9. Remove the retaining bolt of the automatic transmission wiring harness.

   Torque: 6 Nm

10. Take out the automatic transmission wiring harness.



Installation

1. To install, reverse the removal procedure.

CAUTION: Inspect the O-ring and replace it as necessary.

CAUTION: Apply the vaseline to the O-ring before installing.

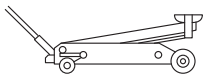
Automatic Transmission Radiator

Removal and Installation

Refer to: Radiator (3.1.4 Cooling System, Removal and Installation).

Automatic Transmission

Special Tool

 CA301-004	Engine Balance Support CA301-004

General Equipment

Flat jack

Removal

1. Remove the battery.

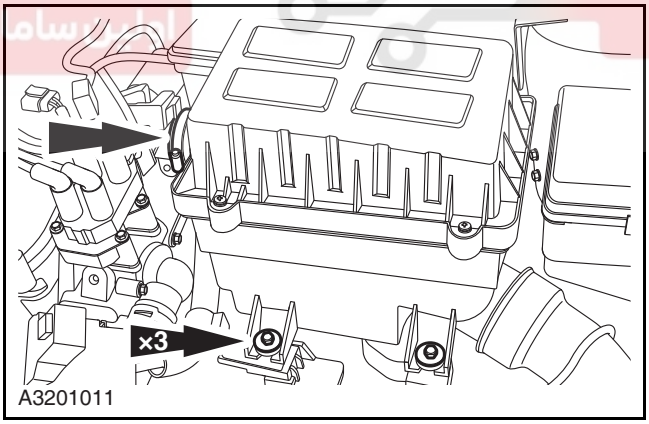
Refer to: Battery (3.1.10 Charging System, Removal and Installation).

2. Remove the air filter assembly.

1. Remove the connection of inlet hose and throttle.

2. Remove 3 retaining bolts of the air filter case.

Torque: 9 Nm



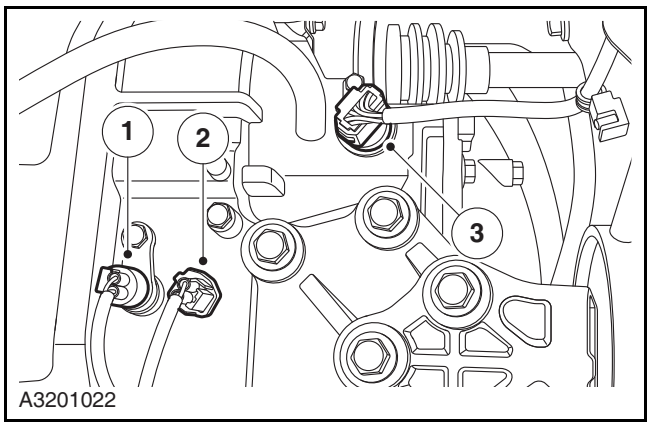
A3201011

3. Remove the wiring harness connector connecting with the automatic transmission.

1. Disconnect the wiring harness connector of the input shaft speed sensor.

2. Disconnect the wiring harness connector of the output shaft speed sensor.

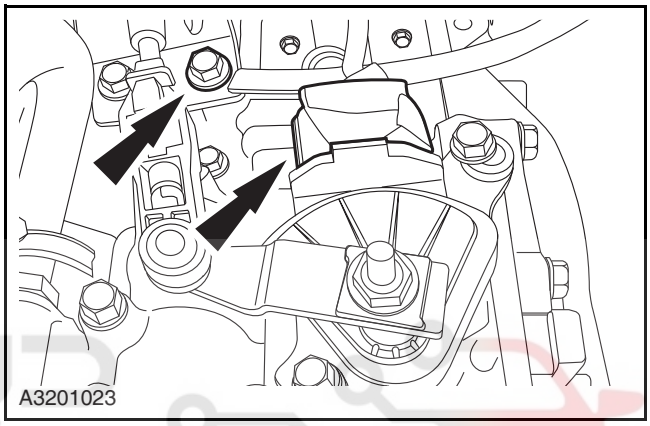
3. Disconnect the wiring harness connector of the automatic transmission.



4. Disconnect the neutral position switch wiring harness connector and the automatic transmission earth wire.

1. Disconnect the neutral position switch wiring harness connector.

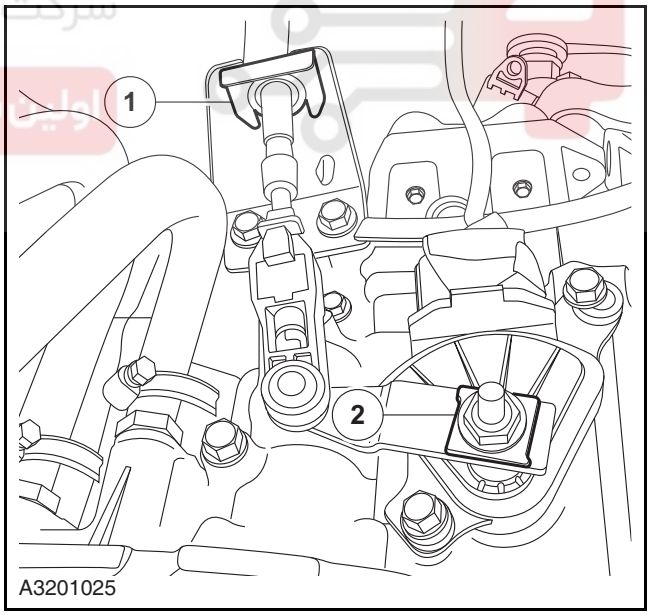
2. Remove the retaining bolt of the automatic transmission earth wire.



5. Disconnect the gearshift lever cable and the automatic transmission.

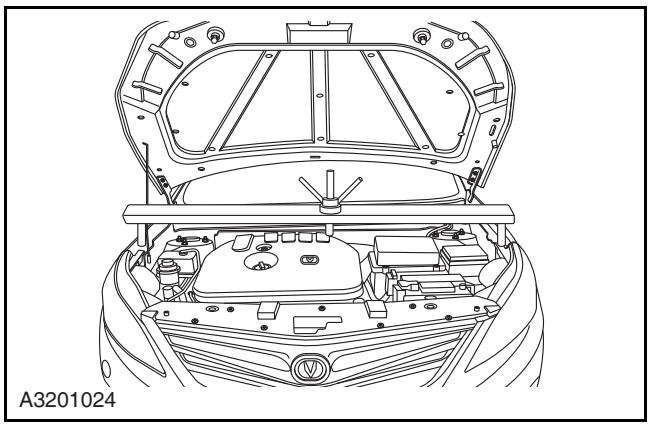
1. Disconnect the gearshift lever cable and the fixing support.

2. Remove the gearshift arm connecting nut.



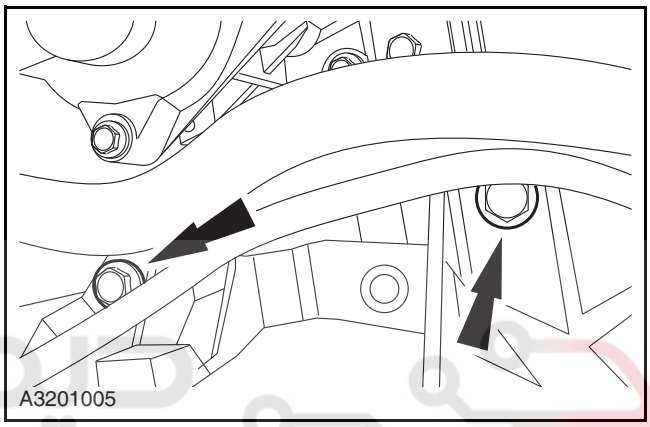
6. Install the engine balance bracket.

   Special tool: CA301-004


A3201024

7. Remove 2 connecting bolts on the upper automatic transmission and the engine.

   Torque: 87 Nm


A3201005

8. Loosen 3 retaining bolts of the left transmission support.

   Torque: 87 Nm

⚠ **CAUTION: Do not remove the bolt.**

9. Lift the vehicle.

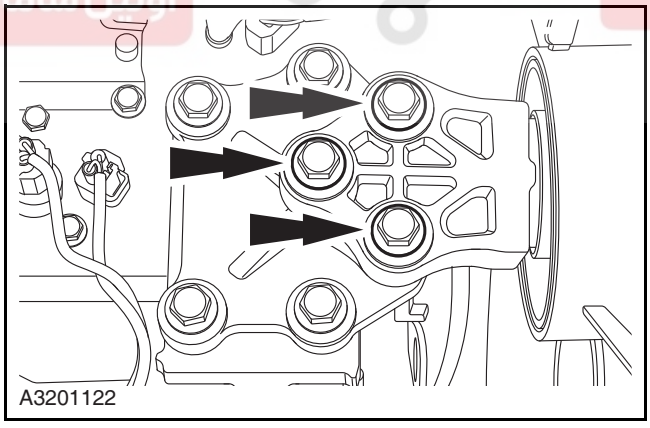
   Refer to: Lifting (1.1.3 Traction and Lifting, Description and Operation).

10. Remove the engine bracket assembly.

    Refer to: Engine Bracket (2.1.2 Front Suspension, Removal and Installation).

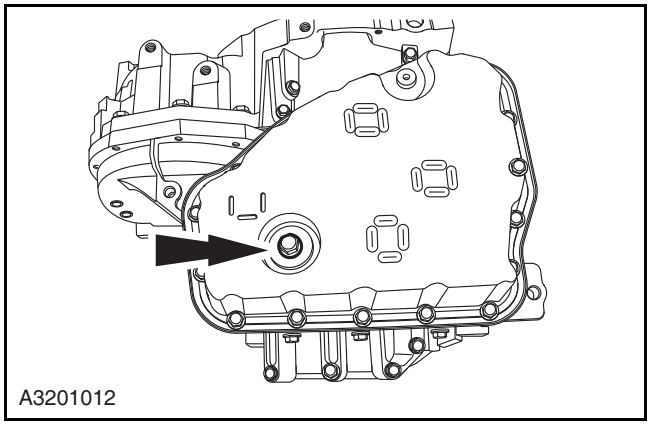
11. Remove the halfshaft on both sides.

    Refer to: Halfshaft (2.2.2 Halfshaft, Removal and installation).


A3201122

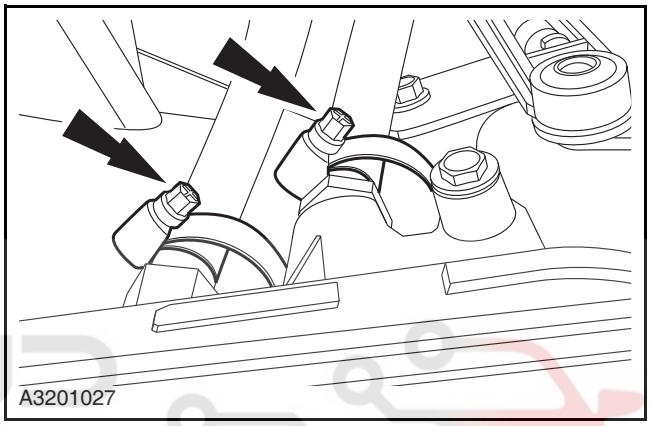
12. Loosen and remove the oil drain bolt, then drain the automatic transmission oil.

    Torque: 18 Nm



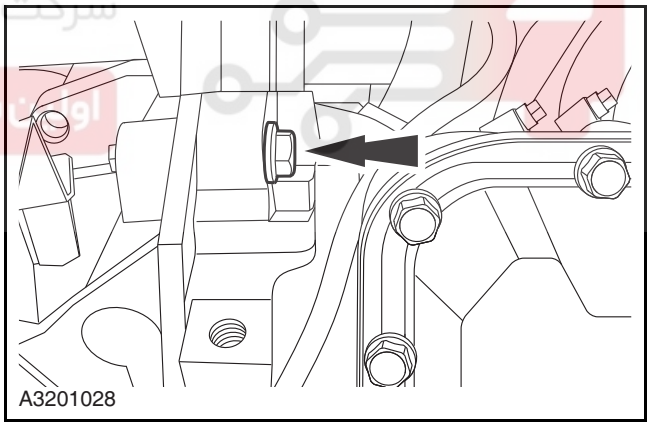
13. Remove the automatic transmission radiation pipe.
14. Support the transmission with the flat jack.

    General tool: Flat jack



15. Remove the connecting bolt connecting the front lower automatic transmission and the engine.

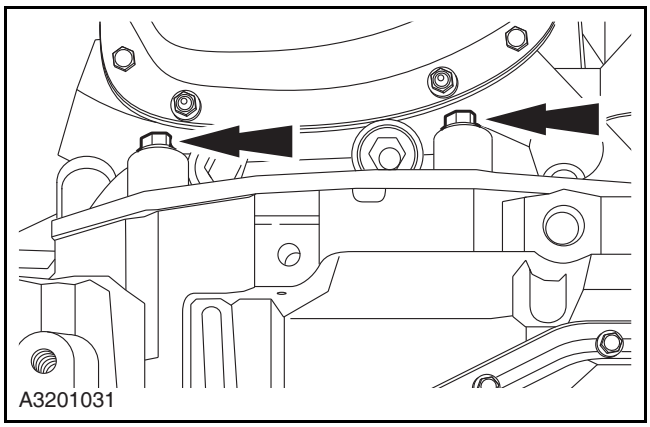
    Torque: 87 Nm



16. Remove the connecting bolt of the lower automatic transmission and the engine.

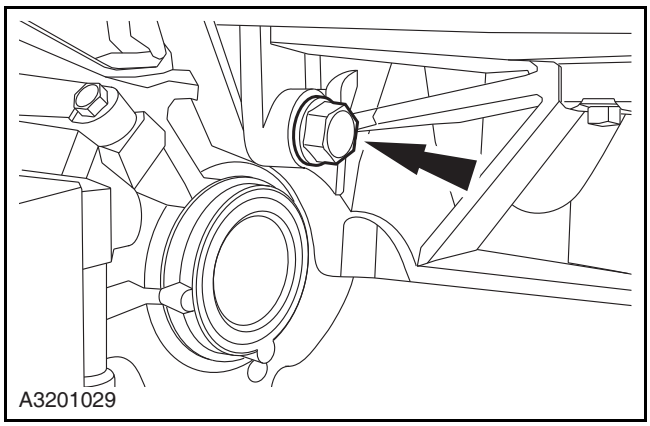
    Torque: 45 Nm
17. Remove the rear support bracket cushion assembly.
18. Remove the starter motor.

    Refer to: Starter Motor (3.1.9 Starting System, Removal and Installation).



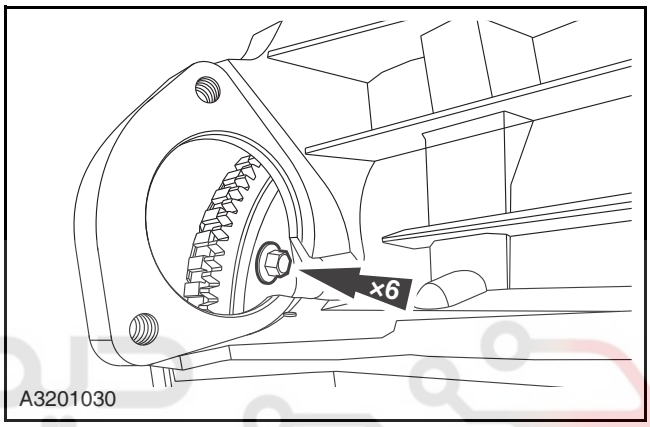
19. Remove the connecting bolt of the lower rear automatic transmission and the engine.

Torque: 87 Nm



20. Remove 6 connecting bolts of the drive disc and the automatic transmission.

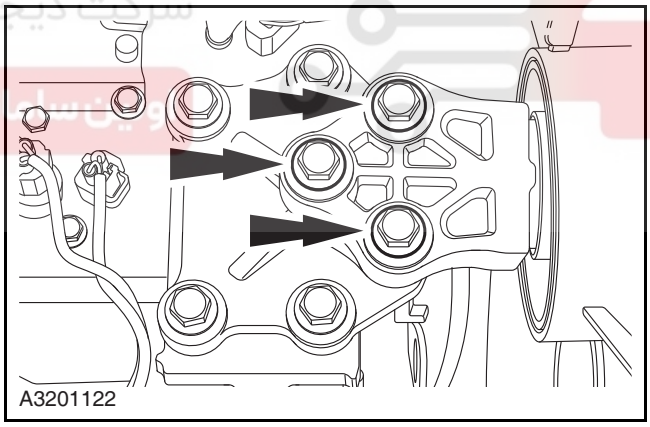
Torque: 39 Nm



21. Remove 3 retaining bolts of the left automatic transmission support.

Torque: 87 Nm

22. Lower the jack slowly and take out the automatic transmission assembly.



Installation

1. To install, reverse the removal procedure.

2. Fill up the automatic transmission with the automatic transmission oil and check the oil level.

Refer to: Automatic Transmission Oil Level and Quality Inspection (3.2.1 Automatic Transmission, General Procedures).

Specifications

Torque Specifications

Name	Nm	lb-ft	lb-in
Gearshift mechanism base installing nut	23	17	-
Gearshift lever handle bolt	5	-	37
Gearshift arm installing nut	8	-	71
Parking/neutral position switch (NSW) installing bolt	8	-	71
Gearshift cable support installing bolt	6	-	37

Description and Operation

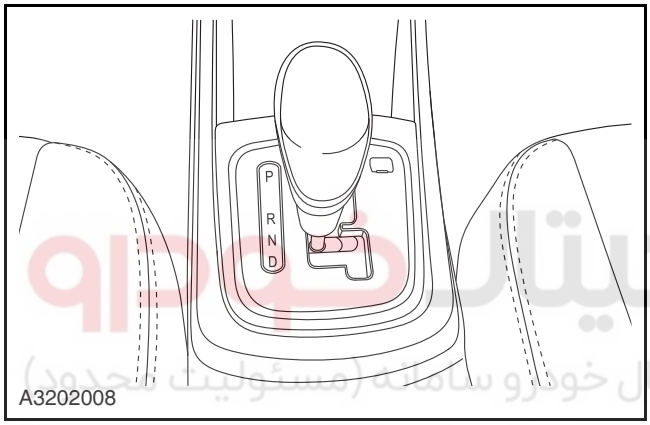
System General Information

Straightline Gearshift Mechanism

Use the straight gearshift mechanism with P, R, N and D four gears.

Gears achieved by each shiftgearare as follows:

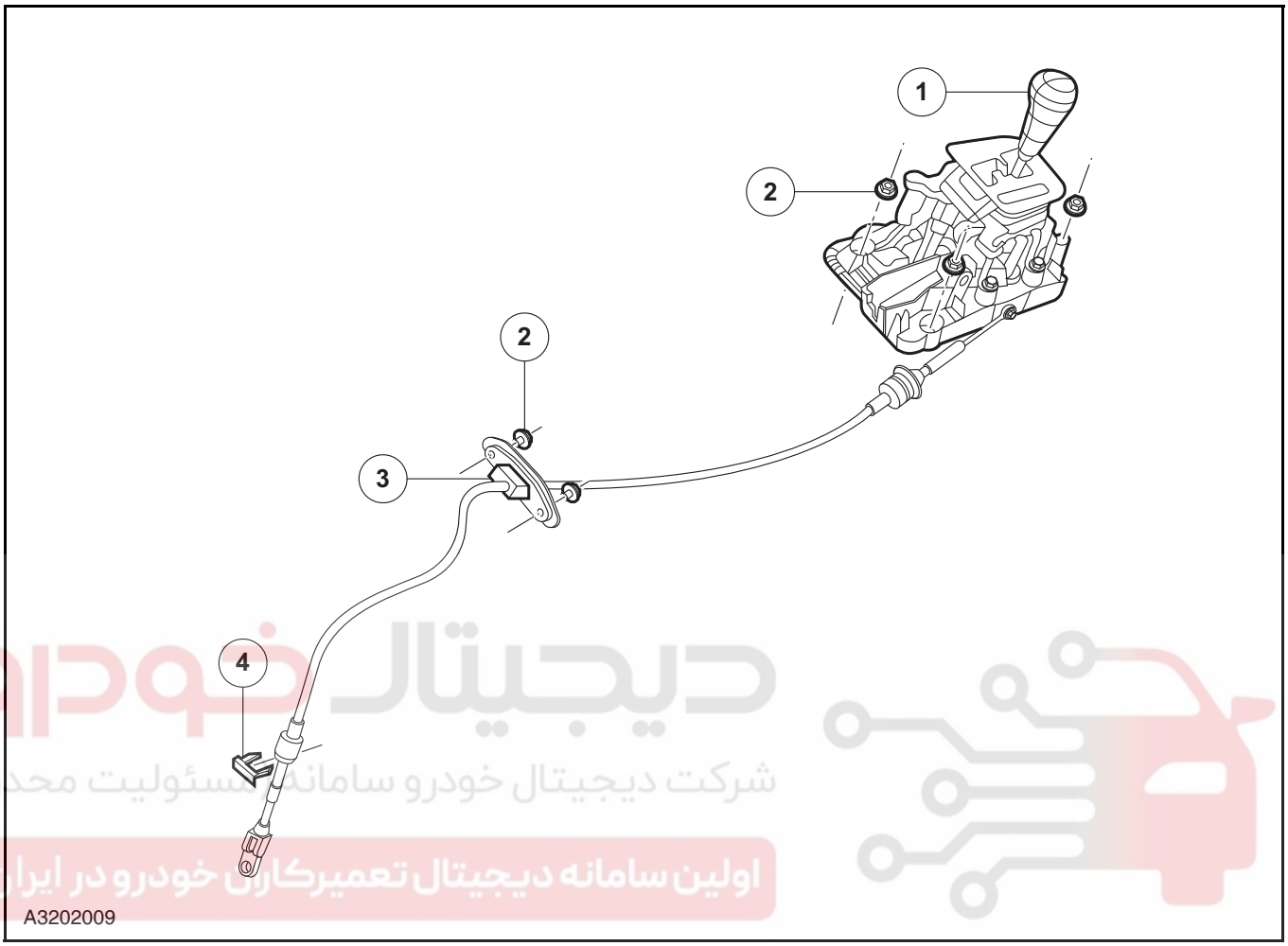
Gearshift lever position	Achieved gears
P	P
R	R
N	N
D	1、2、3、4



A3202008

Component Position Chart

Control Unit Chart



No.	Part	No.	Part
1	Gearshift control mechanism assembly	3	Gearshift control cables assembly
2	Hex flange bearing surface toothed nut	4	E clip

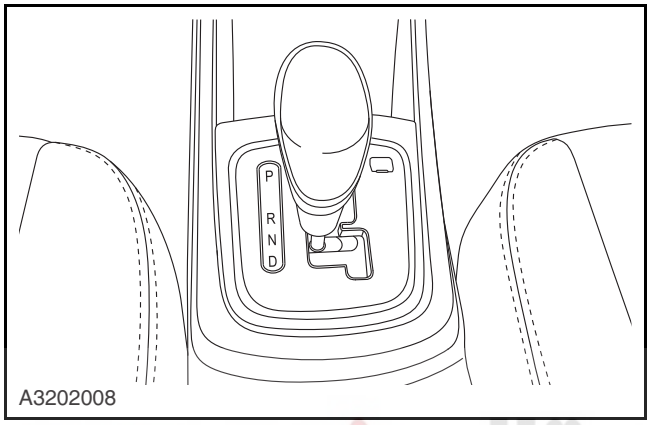
General Procedures

Gearshift Lever Cable Adjustment

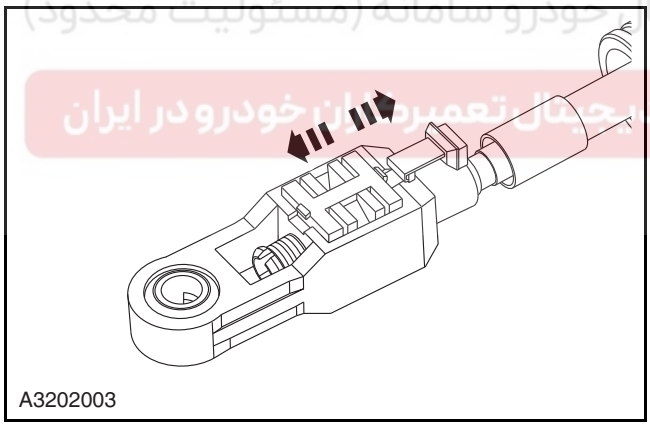
Special Tool

Special Tool SST

1. Shift into the N gear.



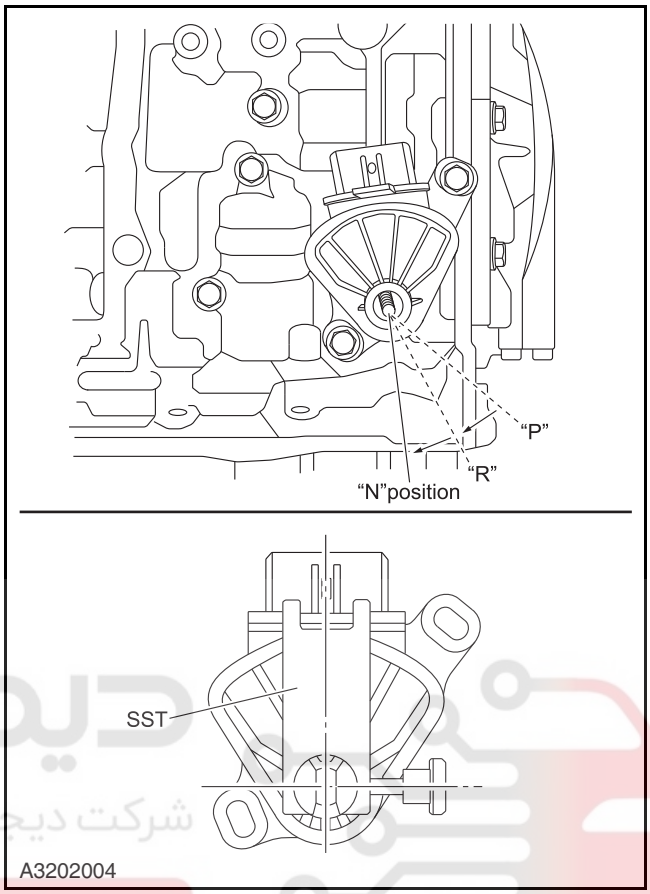
2. Make sure taht the external bushing of the gearshift lever cable can slide freely when not locked in.



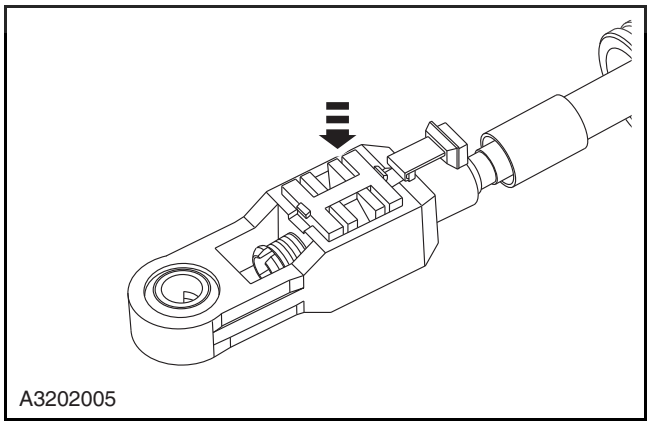
3. Adjust the neutral position switch.
   - Loosen 2 retaining bolts of the neutral position switch for adjustment.
   - Shift the transmission manual valve lever into the "N" gear.
   - Align the SST groove with N gear position baseline by special toolts (SST).
   - Tighten 2 bolts.

CAUTION: Tighten 2 bolts again when the neutral position switch is adjusted to the "N" gear.

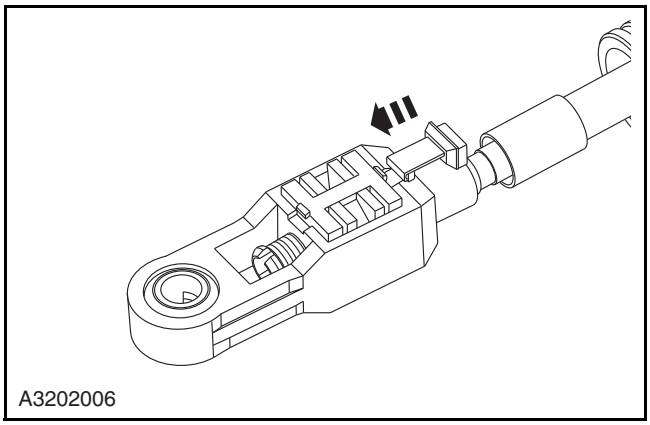
CAUTION: Parts removed can not be reused and use new neutral position switch.



4. Press the fixture block to close the adjustment component.



5. Dial in the locking hook to fasten the fixture block.



6. Inspect the gearshift lever cable adjustment and each gear.

Fault Symptom Diagnosis and Testing

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the obvious mechanical and electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause before proceeding to the next step.
4. If the cause is not evident, verify the symptom and refer to the Fault Symptom Chart.

Visual Inspection Chart

Mechanical
•Gearshift lever •Gearshift cable •Gearshift cable connection

Fault Symptom Chart

Symptom	Possible Sources	Action
Gearshift lever has no response	•Connection drops	•Inspect and repair the gearshift lever connection.
	•Cable	•Repair or repalce the cables
	•Gearshift lever	•Repair or replace the gearshift lever.
	•Neutral position switch	•Replace the neutral position switch.
	•Transmission control module	•Replace the transmission control module.
	•Interior fault of transmission	•Replace the transmission