2007 TRANSMISSION

Automatic Transaxle (F4A51-3) - Santa Fe

GENERAL

SPECIFICATION

GENERAL SPECIFICATION CHART

Item		F4A51
Torque converter type		3-element, 1-stage, 2-phase type
Transaxle type		4-speed forward, 1-speed reverse
Engine displacement		2.7L GSL
Gear ratio	1st	2.842
	2nd	1.495
	3rd	1.000
	4th	0.731
	Reverse	2.720
Final gear ratio		4.520
Shift pattern	Variable	
Shift range	4range (P-R-N-D) + Sports mode	
Shift range valve	PWM; 5EA (Duty control), VFS	
Planetary gear	2EA (Output planetary/Overdrive planetary)	
Clutch	3EA	
Brake	2EA	
OWC	1EA	

TIGHTENING TORQUE

TIGHTENING TORQUE SPECIFICATION CHART

ITEM	Nm	kgf-m	lb-ft
Control cable nut	8 ~ 12	0.8 ~ 1.2	5.8 ~ 8.6
Input shaft speed sensor	10 ~ 12	1.0 ~ 1.2	7 ~ 8
Output shaft speed sensor	10 ~ 12	1.0 ~ 1.2	7 ~ 8
Manual control lever	18 ~ 25	1.8 ~ 2.5	13 ~ 18
Transaxle range switch	10 ~ 12	1.0 ~ 1.2	7 ~ 8
Valve body cover	10 ~ 12	1.0 ~ 1.2	7 ~ 8
Valve body mounting bolt	10 ~ 12	1.0 ~ 1.2	7 ~ 8
Oil temperature sensor	10 ~ 12	1.0 ~ 1.2	7 ~ 8
Oil filler plug	29 ~ 34	2.9 ~ 3.4	21.4 ~ 25.1
Oil drain plug	40 ~ 50	4.0 ~ 5.0	29 ~ 36
Solenoid valve support	5 ~ 7	0.5 ~ 0.7	4 ~ 5

Pressure check plug	8 ~ 10	0.8 ~ 1.0	6 ~ 7
Transaxle mounting sub bracket nut	60 ~ 80	6.0 ~ 8.0	43 ~ 58
Transaxle mounting bracket bolts	40 ~ 55	4.0 ~ 5.5	29 ~ 40
Transaxle mounting insulator bolt	90 ~ 110	9.0 ~ 11	65 ~ 80
Transaxle and engine mounting bolt	65 ~ 85	6.5 ~ 8.5	47 ~ 61.5
Drive plate bolt	46 ~ 53	4.6 ~ 5.3	33.3 ~ 38.3

LUBRICANT

LUBRICANT SPECIFICATION CHART

Item	Specified lubricant	Quantity
Transmission oil	Diamond ATF SP-III	8.5l (8.98 Us qt 7.48 lmp.qt)

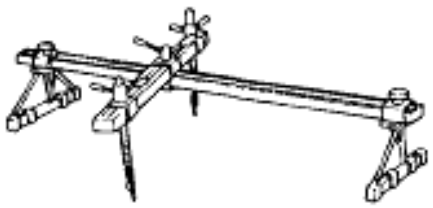
SEALANT

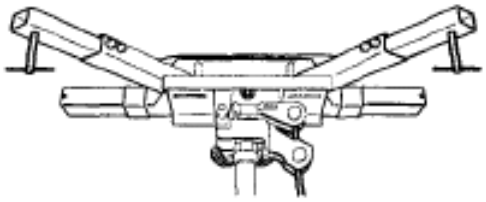
SEALANT SPECIFICATION CHART

Item	Specified Sealant
Rear cover Torque converter housing Valve body cover	Three Bond - TB 1281B or LOCTITE - FMD - 546
Transmission case side cover	Three Bond - TB 1389 or LOCTITE - 518
Side cover	Three Bond - TB 1389 or LOCTITE 518/587

SPECIAL TOOLS

SPECIAL TOOLS CHART

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



AUTOMATIC TRANSAXLE SYSTEM

DESCRIPTION

The automatic transmission is a combination of 3-element 2-phase 1 -stage torque converter and double shaft electrocally-controlled unit which provides 4 speeds forward and 1 reverse. To improve the efficiency of power transmission, the line pressure control was changed applying "Variable Force Solenoid (VFS) valve" on this model. However, adopting VFS on this model, the line pressure is variably changed according to TPS and the vehicle speed, this will enable more improved efficiency of power transmission and fuel consumption.

CHARACTERISTICS

Some of the characteristics include:

- Different power transfer
- Different component layout
- New shift logic (HIVEC) to improve shift feeling
- Position of Valve Body
- Variable shift pattern
- Communication protocol and method
- Step gate type shift lever.

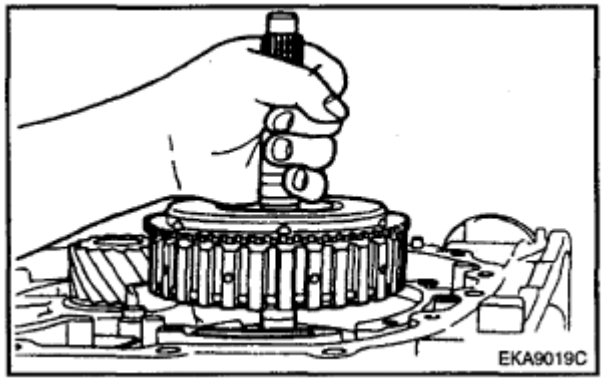
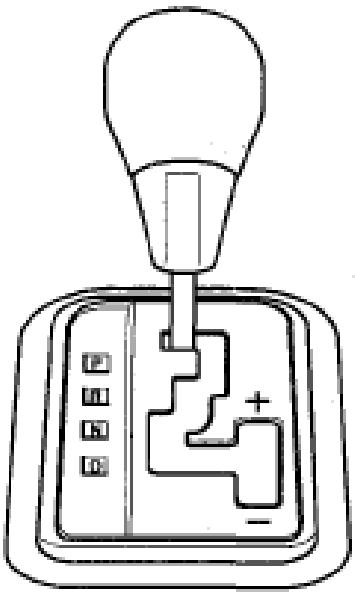


Fig. 1: Identifying Automatic Transaxle System Unit

ITEM DETAIL CHART

Item	Details
Weight Reduction	1. Aluminum oil pump o 2.3kg Approx 2. Pressed parts o Retainer and hub of brakes and clutches o Carrier of planetary gear set
Better shift quality	1. Independent control of clutches and brakes enabled better control of hydraulic pressure and skiped shifts (4 to 2, 3 to 1) 2. During N to D or N to R shift, feedback control adopted. 3. When starting from Creep condition, reduction of shock. (Creep condition is controlled with 1st gear) 4. Solenoid valve frequency is increased for more accurate control. 35Hz to 61.3Hz except DCCSV that is 35Hz and VFS that is 600Hz. 5. HIVEC adoption for better shift feeling. 6. Variable shift pattern.
Increase in Power train efficiency	1. Fully Variable Line Pressure 2. VFS (Variable Force Solenoid)
Dynamic drive by sports mode	o Manual shifting possible o Step gate type shift lever  EKRF072A

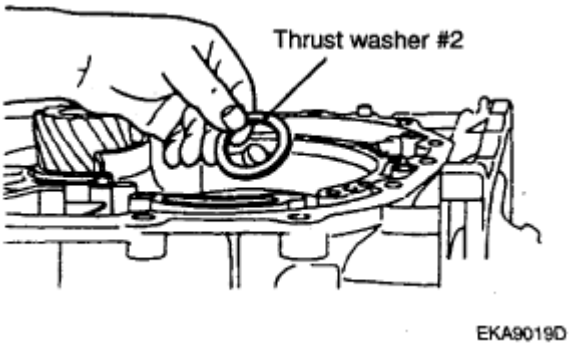


Fig. 2: Identifying Automatic Transaxle System Components Location

MECHANICAL SYSTEM

OPERATION COMPONENTS AND FUNCTION

OPERATION COMPONENTS AND FUNCTION CHART

Operating Element	Symbol	Function
Under drive clutch	UD	Connect input shaft and under drive sun gear
Reverse clutch	REV	Connect input shaft and reverse sun gear
Overdrive clutch	OD	Connect input shaft and over drive carrier
Low & Reverse brake	LR	Hold LR annulus gear and OD carrier
Second brake	2ND	Hold reverse sun gear
One way clutch	OWC	Restrict the rotating direction of low & reverse annulus gear

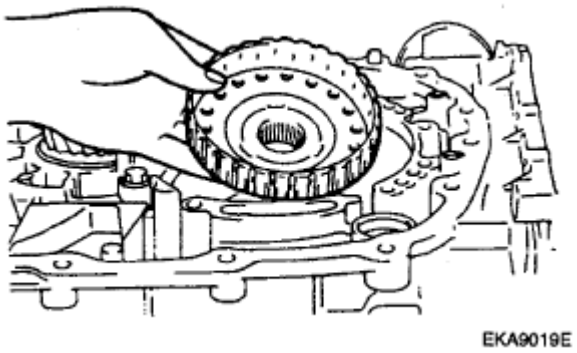


Fig. 3: Identifying Automatic Transaxle System Operating Components

OPERATING ELEMENTS

OPERATING ELEMENTS CHART

	UD/C	OD/C	REV/C	2ND/B	LR/B	OWC
P					•	
R			•		•	
N					•	
D1	•				•	o
D2	•			•		
D3	•	•				
D4		•		•		

1. o : OWC is operated when shifts from 1st gear to 2nd gear.
2. L & R brake is released in 1st gear when the vehicle speed is more than 5KPH approximately.

TORQUE CONVERTER AND SHAFT

The torque converter consists of an impeller (pump), turbine and stator assembly in a single unit. The pump is connected to the engine crankshaft and turns as the engine turns. This drawing force is transmitted to the turbine through the oil which is recycled by the stator.

The transmission has two parallel shafts; the input shaft and the output shaft. Both shafts are in line with the engine crankshaft. The input shaft includes the overdrive clutch, reverse clutch, underdrive clutch, one way clutch, 2ND brake, low & reverse brake, overdrive planetary carrier, output planetary carrier and transfer drive gear. The output shaft includes the transfer driven gear.

CLUTCHES

The gear changing mechanism utilizes three multi-disc clutches. The retainers of these clutches are fabricated from high-precision sheet metal for lightness and ease of production. Also, more responsive gearshifts at high engine speeds are achieved by a pressure-balanced piston mechanism that cancels out centrifugal hydraulic pressure. This mechanism replaces the conventional ball check valve.

UNDERDRIVE CLUTCH

The underdrive clutch operates in 1st, 2nd, and 3rd gears and transmits driving force from the input shaft to the underdrive sun gear (A).

The components comprising the under clutch are as illustrated below.

Hydraulic pressure acts in the piston pressure chamber (B) (between the piston (c) and retainer) and thus pushes the piston (C). In turn, the piston depresses the clutch discs and thereby transmits driving force from the retainer (D) to the hub (E) side.

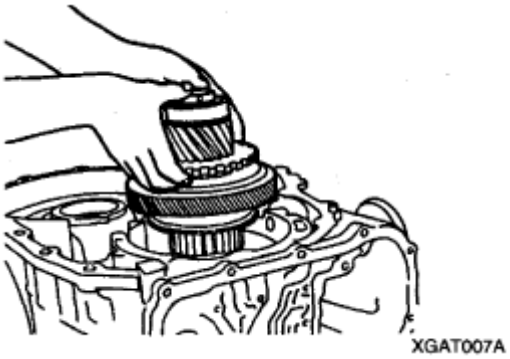


Fig. 4: Identifying Underdrive Clutch Operating Components

At high speed, fluid remaining in the piston pressure chamber is subjected to centrifugal force and attempts to push the piston.

However, fluid in the balance fluid chamber (A) (the space between the piston and return spring retainer (B)) is also subjected to centrifugal force.

Thus, the hydraulic pressure on one side of the piston cancels out the hydraulic pressure on the other side, and the piston does not move.

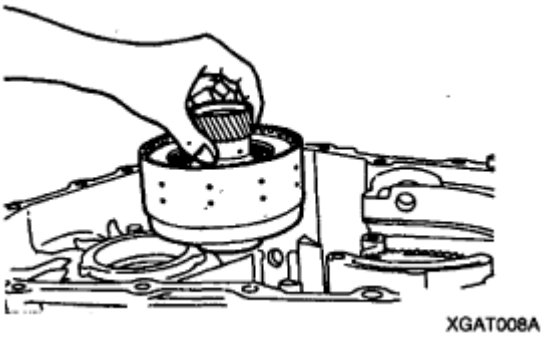
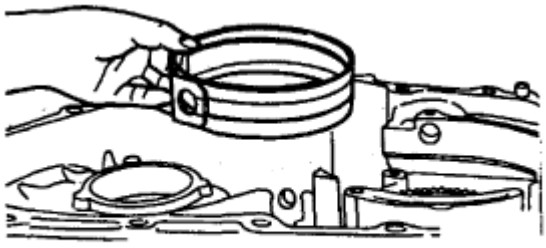


Fig. 5: Identifying Fluid Chamber And Return Spring Retainer

REVERSE CLUTCH AND OVERDRIVE CLUTCH

The reverse clutch (C) operates when the reverse gear is selected and transmits driving force from the input shaft to the reverse sun gear.

The overdrive clutch (D) operates in 3rd and 4th gears and transmits driving force from the input shaft to the overdrive planetary carrier and low-reverse annulus gear.



XGAT009A

Fig. 6: Identifying Reverse Clutch And Overdrive Clutch

BRAKES

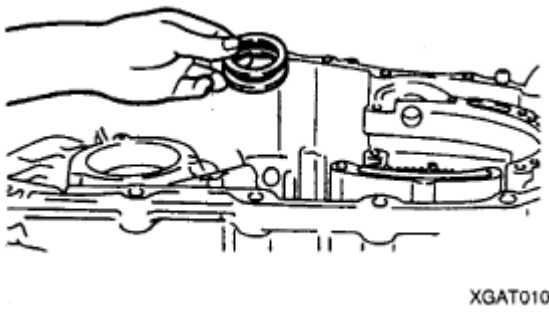
The gear changing mechanism utilizes two multi-disc brakes.

LOW & REVERSE BRAKE AND SECOND BRAKE

The low & reverse brake (A) operates in 1st and reverse gears, when the vehicle is parked, and during manual operation. It locks the low & reverse annulus gear and overdrive planetary carrier to the case.

The second (C) brake (B) operates in 2nd and 4th gears and locks the reverse sun gear (D) to the case. The components comprising the low & reverse brake and second brake are as illustrated below.

As shown, the discs and plates of the two brakes are arranged on either side of the rear cushion plate (E), which is itself secured to the case (F) by a snap ring.



XGAT010A

Fig. 7: [Identifying 2nd And 4Th Gears And Locks Reverse Sun Gear To Case]

OWC

To improve the shift feeling from 1st to 2nd gear, OWC was adopted on the low & reverse brake annulus gear. Instead of hydraulic fixing by Low & reverse brake at the 1st gear, this mechanical fixing device was used. This structure is not a new concept, because this OWC already has been installed on the previous models.

ACCUMULATORS

ACCUMULATORS CHART

Number	Function Name	Color

1	Low & Reverse Brake	None
2	Underdrive Clutch	Yellow
3	Second Brake	Blue
4	Overdrive Clutch	None

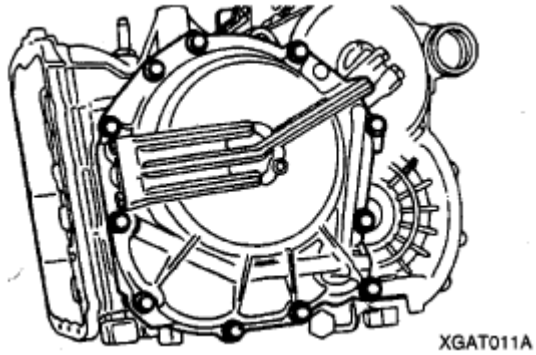


Fig. 8: Identifying Accumulator

OBJECTIVE

- Energy (hydraulic pressure) storage
- Impact and pulsation damping when solenoid valves operating
- Operation as spring element
- Smooth shifting by preventing sudden operation of clutches and brakes

TRANSFER DRIVE GEAR

With the transfer drive gear, increased tooth height and a higher contact ratio have reduced gear noise.

Also, the bearing that supports the drive gear is a preloaded type that eliminates rattle, and the rigidity of the gear mounting has been increased by bolting the bearing directly onto the case.

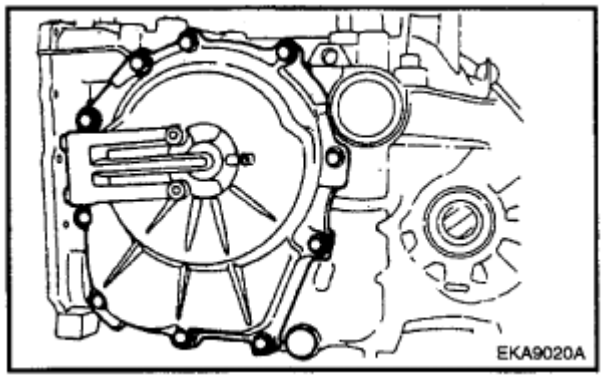


Fig. 9: Identifying Transfer Drive Gear Case And Locking Nut

OUTPUT SHAFT/TRANSFER DRIVEN GEAR

As shown in the illustration below, the transfer driven gear is press-fitted onto the output shaft, and the output shaft is secured by a locking nut and supported by bearings.

The locking nut has a left-handed thread, and a hexagonal hole in the other end of the shaft enables the shaft to be held in position for locking nut removal.

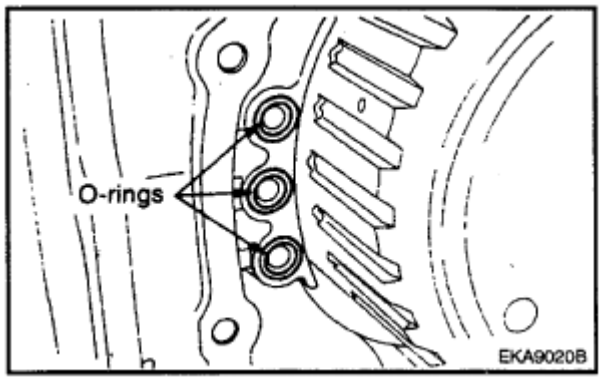


Fig. 10: Identifying Locking Nut And Transfer Driven Gear

MANUAL CONTROL SYSTEM

MANUAL CONTROL LEVER

The manual control lever is fitted to the top of the valve body and is linked to the parking roller rod and manual control valve pin.

A detent mechanism is provided to improve the gear shift feeling during manual selection.

PARKING MECHANISM

When the manual control lever is moved to the parking position, the parking roller rod moves along the parking roller support and pushes up the parking sprag.

As a result, the parking sprag meshes with the transfer driven gear (parking gear), thereby locking the output shaft. To minimize the operating force required, a roller is fitted to the end of the rod.

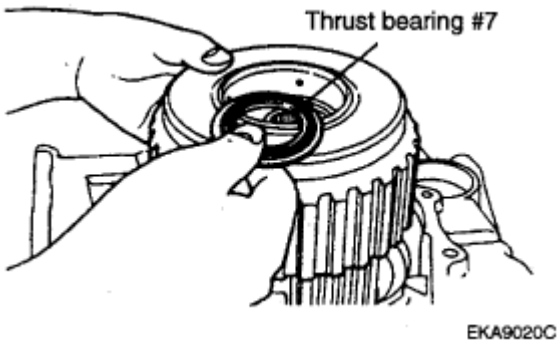


Fig. 11: Identifying Parking Mechanism

POWER TRAIN

P POSITION

Hydraulic pressure is applied to the LR brake and the RED brake, so power is not transmitted from the input shaft to the UD clutch or OD clutch, and the output shaft is locked by the park brake pawl interlocking the park gear.

N POSITION

Hydraulic pressure is applied to the LR brake (A) and the RED brake, so power is not transmitted from the input shaft to the UD clutch or OD clutch.

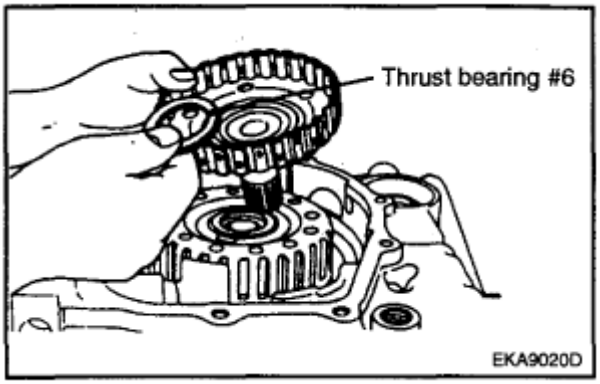


Fig. 12: [Identifying LR Brake Position]

1ST GEAR POWER FLOW

Hydraulic pressure is applied to the UD clutch (B) the LR brake (A) and the one way clutch (OWC), then the UD clutch transmits driving force from the input shaft to the UD sun gear, and the LR brake locks the LR annulus gear to the case. The UD sun gear of the planetary gear drives the output pinion gear, and the LR brake locks the annulus gear, and the output pinion drives the output carriers, and the output carrier drives the transfer drive gear, and the transfer drive gear drives the transfer driven gear of the output shaft, and power is transmitted to the differential gear through the differential drive gear.

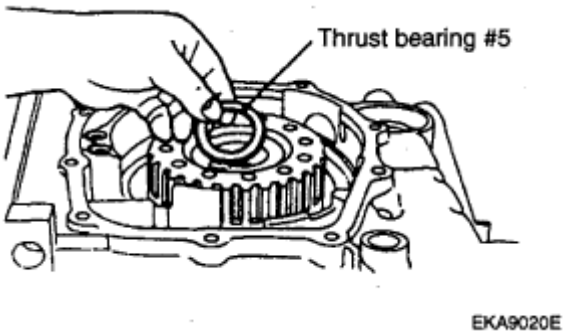


Fig. 13: 1ST Gear Power Flow Diagram

2ND GEAR POWER FLOW

Hydraulic pressure is applied to the UD clutch (A) the 2nd brake (B) and the one way clutch (OWC), then the UD clutch transmits driving force from the input shaft to the UD sun gear, and the 2nd brake locks the reverse sun gear to the case. The UD sun gear of the planetary gear drives the output pinion gear and the LR annulus gear, and the LR annulus gear drives the OD planetary carriers, and OD planetary carriers drives OD pinion gear, and the OD pinion gear drives the output carriers, and the output carrier drives the transfer drive gear, and the transfer drive gear drives the transfer driven gear of the output shaft, and power is transmitted to the differential gear through the differential drive gear.

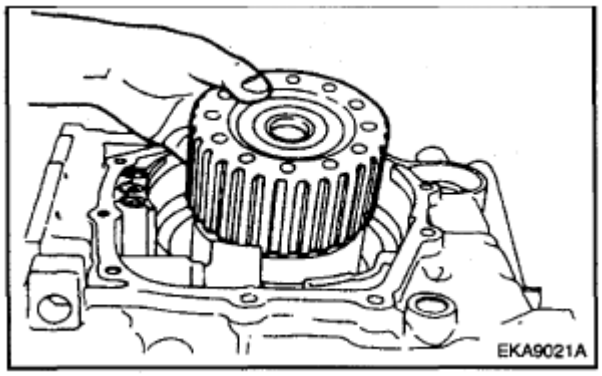


Fig. 14: 2nd Gear Power Flow Diagram

3RD GEAR POWER FLOW

Hydraulic pressure is applied to the UD clutch (A) and the OD clutch (B), then the UD clutch transmits driving force from the input shaft to the UD sun gear, and the OD clutch transmits driving force from the input shaft to the overdrive planetary carrier and low & reverse annulus gear. The UD sun gear of the planetary gear drives the output pinion gear and the LR annulus gear, and the LR annulus gear drives the OD pinion gear through the OD planetary carrier, and the OD pinion gear drives the reverse sun gear and the output carrier. The OD clutch drives the OD carrier, and the OD carrier drives the OD pinion gear, and the OD pinion gear drives the reverse sun gear and the output carrier, and the output carrier drives the transfer drive gear, and the transfer drive gear drives the transfer driven gear of the output shaft, and power is transmitted to the differential gear through the differential drive gear.

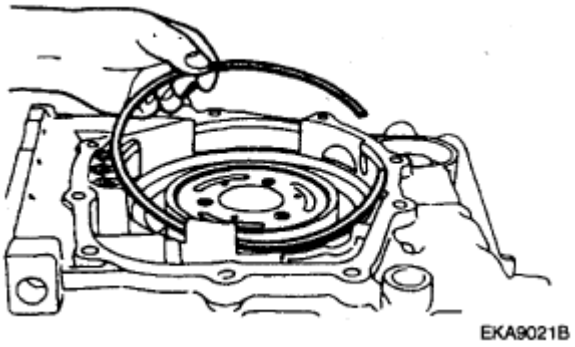


Fig. 15: 2ND Gear Power Flow Diagram

4TH GEAR POWER FLOW

Hydraulic pressure is applied to the OD clutch (A) and the 2nd brake (B), then the OD clutch transmits driving force from the input shaft to the OD planetary carrier and LR annulus gear, and the 2nd brake locks the reverse sun gear to the case. The OD clutch drives the OD carrier, and the OD carrier drives the OD pinion gear and the LR annulus gear, and the OD pinion gear drives the output carrier, and the output carrier drives the transfer drive gear, and the transfer drive gear drives the transfer driven gear of the output shaft, and power is transmitted to the differential gear through the differential drive gear.

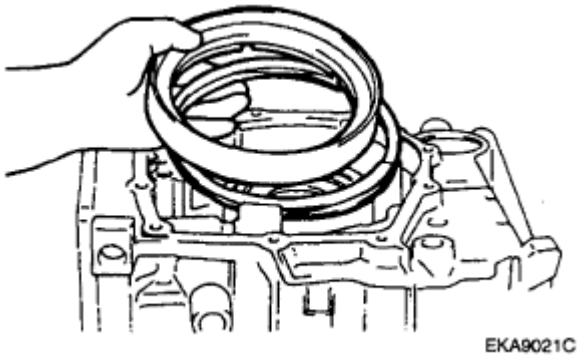


Fig. 16: 4Th Gear Power Flow Diagram

REVERSE GEAR POWER FLOW

Hydraulic pressure is applied to the reverse clutch (A) and the LR brake (B), then the reverse clutch transmits driving force from the input shaft to the reverse sun gear, and the LR brake locks the LR annulus gear and OD planetary carrier to the case. The reverse clutch drives the reverse sun gear, and the reverse sun gear drives the output carrier through the OD pinion gear, and the output carrier drives the transfer drive gear, and the transfer drive gear drives the transfer driven gear of the output shaft, and power is transmitted to the differential gear through the differential drive gear.

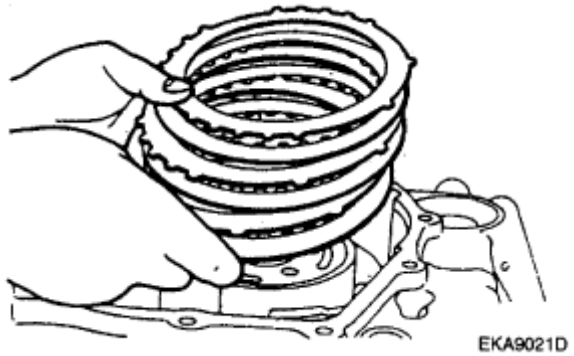


Fig. 17: Reverse Gear Power Flow Diagram

HYDRAULIC CONTROL SYSTEM

DESCRIPTION

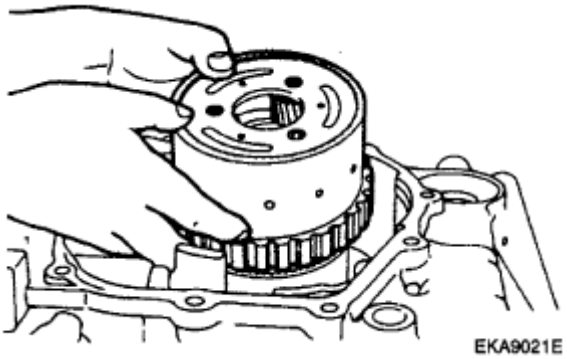


Fig. 18: Hydraulic Control System Block Diagram

- Better and smoother shift quality.
- In order to prevent ATF leakage from the valve body or each elements, the exhaust ports have been grouped into only one with an addition of a check ball.
- If a failure occurs in its electric control, the switch valve and fail safe valve is able to move to enable 3rd speed drive or reverse.
- The hydraulic system consists of oil pump, regulator valve, solenoid valves, pressure control valve and valve body.
- In order to control the optimal line pressure and in-prove the efficiency of power transmission according to maximize the efficiency of the oil pump, VFS (Variable Force Solenoid) valve has been added in the valve body hydraulic circuit.

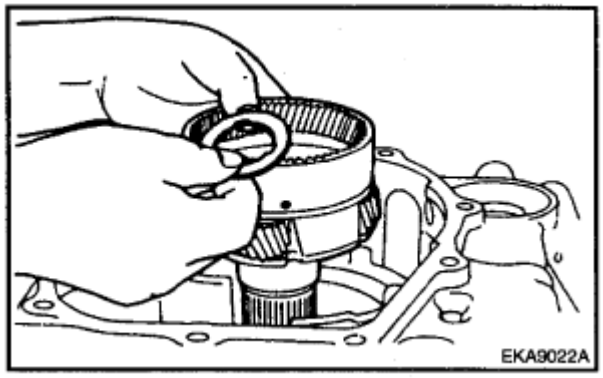


Fig. 19: Identifying Transmission Assembly Components

VFS (VARIABLE FORCE SOLENOID)

VRS Function

The spool rod in VFS is not duty cycled like one of PWM, it minutely vibrates at the range between the control port and exhaust port to control the hydraulic pressure. That is, it uses the equilibrium effect between the spring force and the magnetic force, the spring force is mechanical characteristics decided at the stage of design and the magnetic force is controlled by TCM. This electrical magnetic force is proportional to the current. So TCM will control the current.

In case of VFS valve, the electrical 'time constant' is considered to decide the frequency for the current not to be fluctuated even though turns on or off the input signal. The electrical 'time constant' is much more fast than one of mechanical so the frequency of VFS is extremely higher than the conventional PWM type.

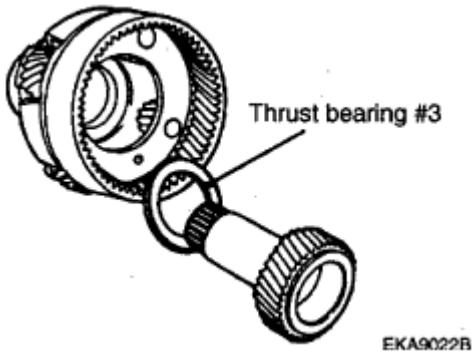


Fig. 20: Locating ATF Sensor And VFS

Characteristics of Bosch VFS:

Supply pressure: 700~1600kPa

Control pressure: typically 600~0 kPa

Current range: typically 0 ~ 1,000 ma

Dither frequency: Up to 600 Hz

Dimension: 32 mm protrusion reach 42 mm

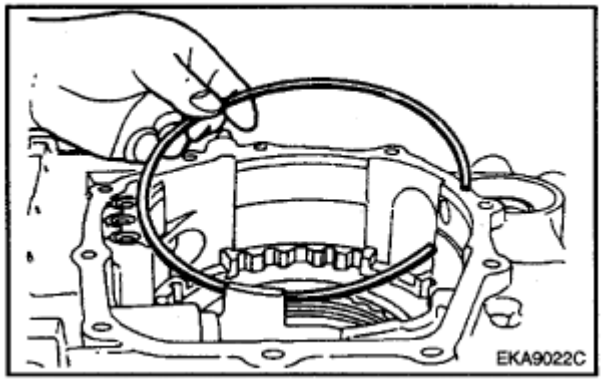


Fig. 21: [Identifying VFS Valve Power Supply]

The reducing pressure will be supplied to the 'Supply' port of the VFS valve on the above illustration to control the line pressure.

REDUCING PRESSURE

FUNCTION

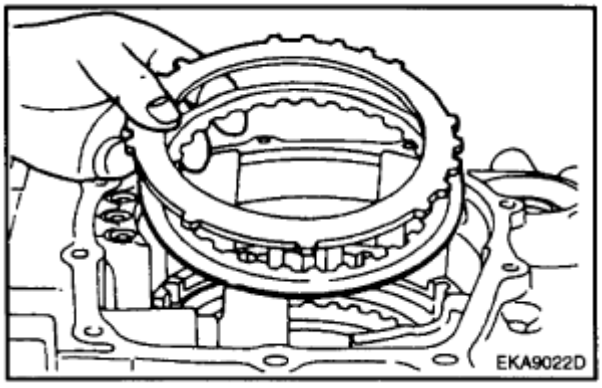


Fig. 22: Locating Adjusting Screw For Reducing Pressure

As same as one of Alpha or Beta automatic transaxle system, this reducing valve length can be adjusted by rotating the screw on the picture. As you rotate the screw toward clockwise by 90°, the reducing pressure will increase about 1.0 bar. However, the reducing pressure is used just as a 'supply pressure' for the solenoid valves (except Low & Reverse, Reduction and Damper Clutch control solenoid), so this may not be handled to rotate in the field service shop. VFS is operated based on the 'supply pressure' and it outputs the 'control pressure' to control the regulator valve indirectly. While developing the VFS system, the line pressure was used as a 'supply pressure' for VFS and other solenoid valves but it has been changed into additional 'reducing pressure' because the line pressure is variably changed by VFS so the control pressure becomes unstable and some hydraulic pressure oscillation occurred. That is why the reducing pressure has been added in the hydraulic circuit of VFS system for both 4th and 5th speed A/T.

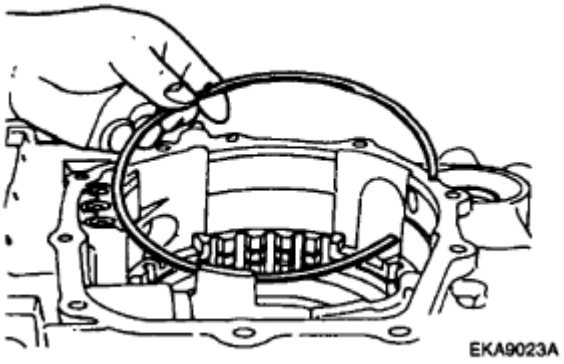


Fig. 23: Locating Reducing Valve

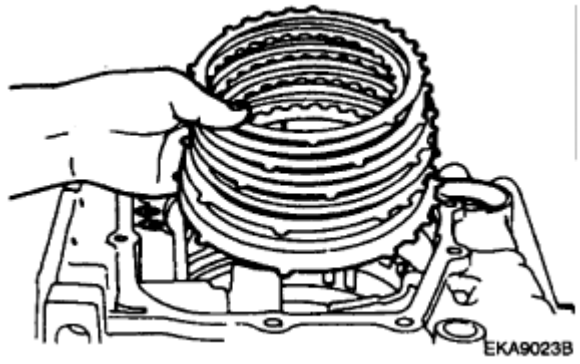


Fig. 24: Oil Flow System Diagram

The reducing pressure is about 6.9 bar and this value does not be changed regardless of the driving or engine load condition. Be sure that the conventional line pressure is used for the 'supply pressure' of Low & Reverse, Reduction solenoid because the variable line pressure is not available at reverse range.

HYDRAULIC PRESSURE TABLE

Under the constant current amount of VFS (200mA), the line pressure will become as below table. Be sure that the following data can be achieved by specific special facility or device to check the performance of A/T assembly (not on the vehicle), however we can refer the maximum pressure value according to each element.

HYDRAULIC PRESSURE CHART

Solenoid valve Duty (%)					Measured Element	Pressure kPa (Psi)
LR	2ND	UD	OD	RED*		
0	100	0	100	0	LR	1030±20 (149±3)
60	?	?	?	?		520±40 (75±6)
75	?	?	?	?		230±40 (33±6)
100	?	?	?	?		0
100	0	0	100	0	2ND	1030±20 (149±3)
?	60	?	?	?		550±40 (80±6)
?	75	?	?	?		220±40 (32±6)
?	100	?	?	?		0
100	100	0	0	0	OD	1030±20 (149±3)
?	?	?	60	?		520±40 (75±6)
?	?	?	75	?		210±40 (30±6)
?	?	?	100	?		0
100	100	0	0	0	UD	1030±20 (149±3)
?	?	60	?	?		470±40 (68±6)
?	?	75	?	?		170±40 (25±6)

?	?	100	?	?		0
100	0	100	0	100	DIR*	0
75	?	?	?	?		270±40 (39±6)
60	?	?	?	?		540±40 (78±6)
0	?	?	?	?		1030±20 (149±3)

Measuring condition:

1. PG-A (Input speed): 2,500rpm
2. Manual valve position: D
3. DCC Solenoid duty: 0%

N-P

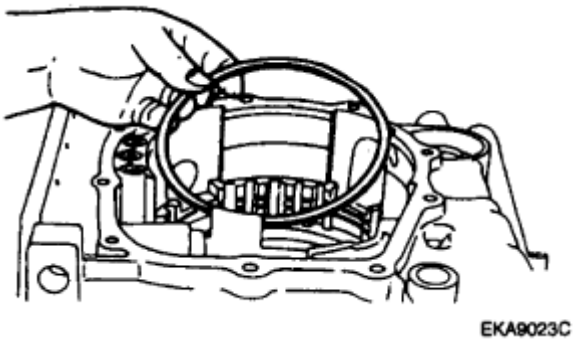


Fig. 25: Oil Flow System Diagram - N-P

D 1ST GEAR

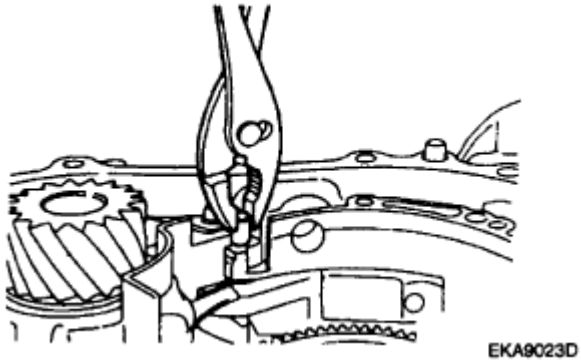


Fig. 26: Oil Flow System Diagram - D 1ST Gears

D 2ND GEAR

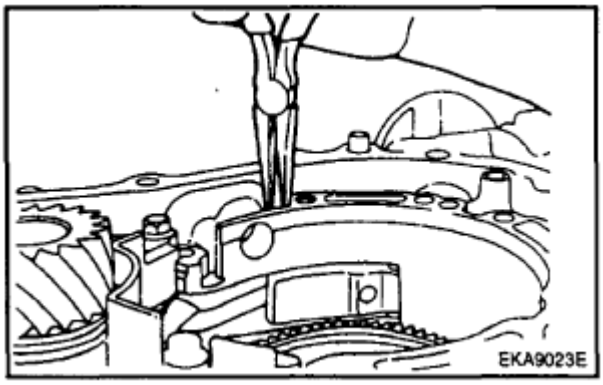


Fig. 27: Oil Flow System Diagram - D 2ND Gear

D 3RD GEAR

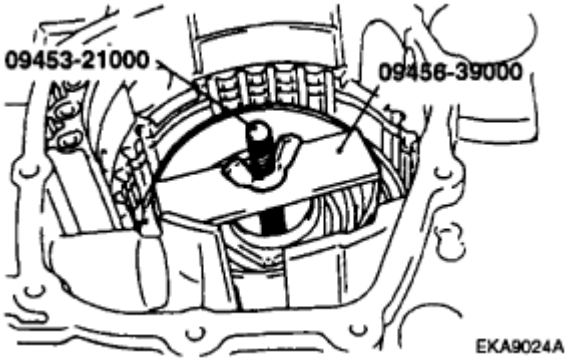


Fig. 28: Oil Flow System Diagram - D 3RD Gear

D 4TH GEAR

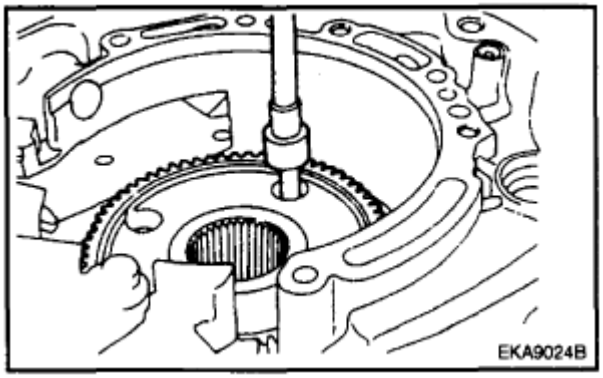


Fig. 29: Oil Flow System Diagram - D 4TH Gear

REVERSE

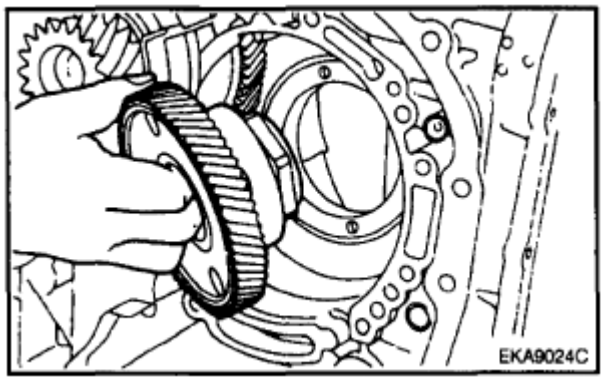


Fig. 30: Oil Flow System Diagram - Reverse

ELECTRONIC CONTROL SYSTEM

DESCRIPTION

The electronic control system used in the new generation auto transaxle is far superior to the previous systems. This system is able to adopt a variable shift pattern for smooth and problem free shifting.

A solenoid valve is applied to each of the clutches and brakes and is independently controlled. Feedback control and correction control is performed in all gears as well as utilization of mutual control system to increase shift feeling. The torque converter damper clutch uses a partial lock up and full lock-up system. An additional control method called the HIVEC system (neural network) is adopted to increase shift feeling.

BLOCK DIAGRAM (CAN)

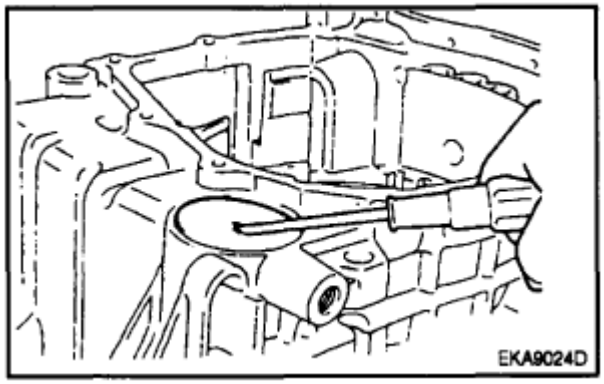


Fig. 31: TCM Block Diagram (CAN)

ELECTRIC CONTROL LOCATION

The TCM (PCM) is located on the intake manifold in the engine room.

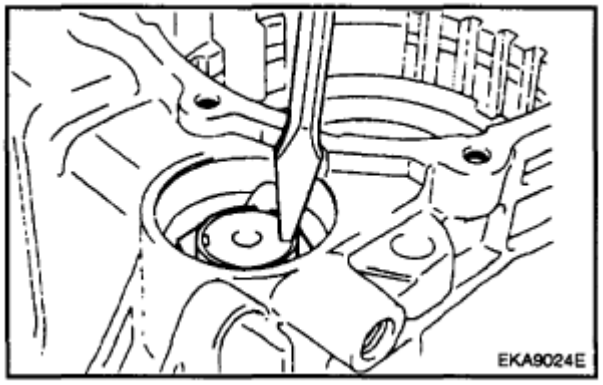


Fig. 32: Locating TCM

OPERATING COMPONENTS AND FUNCTIONS

OPERATING COMPONENTS AND FUNCTIONS CHART

Sensor	Function
Input shaft speed sensor	Detect turbine speed at UD retainer
Output shaft speed sensor	Detect T/F drive gear speed at T/F driven gear (4A/T)
Crank angle sensor	Detect engine speed
TPS (Gasoline)	Throttle opening ratio by potentiometer
Air conditioner switch	A/C load by thermister
Inhibitor switch	Select lever position by contact switch
Brake switch	Brake pedal position
Vehicle speed sensor	Detect vehicle speed by speedometer driven gear
Sport mode switch	Sport mode On/Off signal
Sport mode up-shift switch	Sport mode up-shift signal
Sport mode downshift switch	Sport mode downshift signal
Request of torque reduction	Send the request of torque reduction to ECM
ABS-ECM, Engine ECM	In case of CAN communication

SPORTS MODE

SPORTS MODE SWITCH

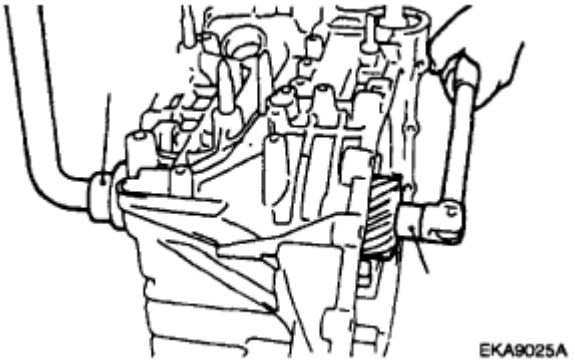


Fig. 33: Identifying Sports Mode Switch

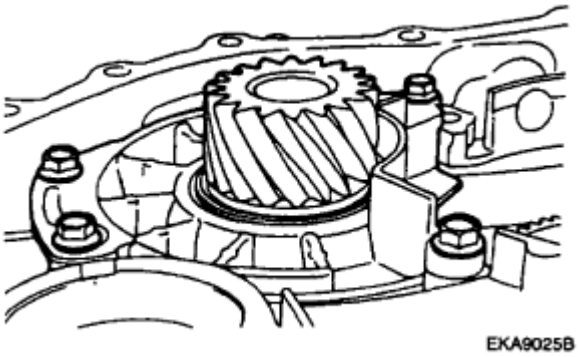


Fig. 34: Driving Power And Time Graph

Sports mode allows the manual up-shift and downshift with the accelerator pedal is depressed. The prompt response and shift would be obtained due to the continuous shifting without cutting of driving power. The shifting time is also decreased about 0.1 sec during up-shift, 0.2sec during downshift. As the selector lever is pushed upward or downward one time, the gear is up shifted or downshifted by one gear.

SIGNALS OF SPORTS MODE SWITCH

SIGNALS OF SPORTS MODE SWITCH CHART

Items	Mode S/W	UP S/W	DOWN S/W
D range selection	OFF	OFF	OFF
Sports mode selection	ON	OFF	OFF
Sports mode up-shift selection	ON	ON	OFF
Sports mode downshift selection	ON	OFF	ON

CONTROLLER AREA NETWORK (CAN)

Previously, for different computers in the vehicle to share the same information, each signal required a different pin and wiring. However, with the introduction of a CAN system, only two lines are required to achieve the same function. The information is in digital format. This method does not use an integrated ECM.

Frequency: 500Kbit/sec

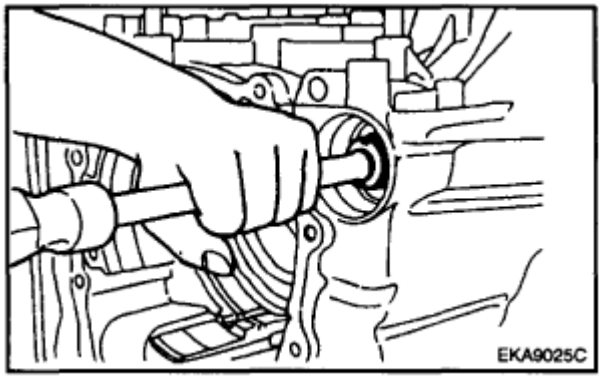


Fig. 35: Controller Area Network Block Diagram (CAN)

Input signals to TCM (PCM) through 'CAN communication'

- Engine rpm, TPS signal
- A/CON signal, Engine coolant temperature
- Quantity of intake airflow, Vehicle speed
- Shift holding signal (FTCS ON)

Output signals from TCM (PCM) through 'CAN communication'

- Request signal for torque reduction
- ATF temperature, TCM (PCM) type, TCM (PCM) error or not
- Damper clutch ON, OFF / Gear position

TCM PIN DESCRIPTION

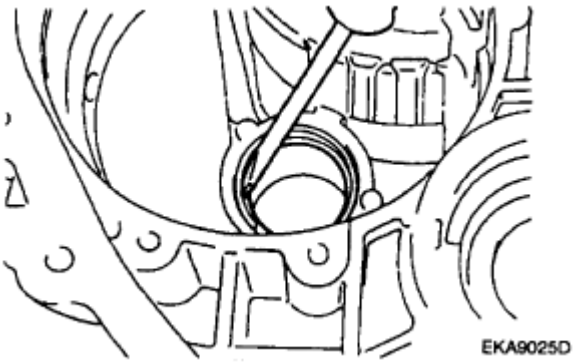


Fig. 36: Identifying TCM Pin Connector Terminal C30-A and C30-B

CONNECTOR PIN TERMINAL REFERENCE CHART

PIN No.	Check item	Condition	Input/Output value		Measurement	Remarks

			Type	Level	Value	
A01	2nd CAN_HI	-	-	-	-	-
A02	2nd CAN_LO	-	-	-	-	-
A03	P Range Selection	P Position Otherwise	DC Voltage	V_BAT Max. 1.0V	12.9V 0V	
A04	R Range Selection	R Position Otherwise	DC Voltage	V_BAT Max. 1.0V	12.3V 0V	
A05	N Range Selection	N Position Otherwise	DC Voltage	V_BAT Max. 1.0V	13.2V 0V	
A06	D Range Selection	D Position Otherwise	DC Voltage	V_BAT Max. 1.0V	13.2V 0V	
A07	Select Position	-	DC Voltage	V_BAT Max. 1.0V	13.2V 0V	
A08	Up Position	-	DC Voltage	V_BAT Max. 1.0V	13.2V 0V	
A09	Down Position	-	DC Voltage	V_BAT Max. 1.0V	13.2V 0V	
A12	N.A	-	-	-	-	
A14	N.A	-	-	-	-	
A19	N.A	-	-	-	-	
A20	A/T Control Relay	Relay On Relay Off	DC Voltage	V_BAT Max. 1.0V Vpeak : Max. 70V Resistance : 680ohms	13.8V 0 V - 0.7V Resistance : 680ohms	
		W/H Open		DTC Spec : P0890	DTC : P0890	
A27	Diagnosis "K"	Communicated with GST	Pulse	At transmitting HI : V_BAT*80%? LO: V_BAT*20%? AT receiving HI : V_BAT*70%? LO : V_BAT*30%?	11.3V 0.14/0.32 V	V_BAT : 13.2V
A31	N.A	-	-	-	-	
A32	A/C Pressure Analog	-	-	-	-	-
A34	N.A	-	-	-	-	
A36	N.A	-	-	-	-	
A37	N.A	-	-	-	-	

A41	CAN_HI	Recessive Dominant	Pulse	2.0 ~ 3.0 V 2.75 ~ 4.5 V	3.85V 2.5V	
A42	CAN_LO	Recessive Dominant	Pulse	2.0 ~ 3.0 V 0.5 ~ 2.25 V	2.55V 1.34V	
A60	A/T PWR Source	IG Off IG On IG. Key On IG. Key Off Idle Key Off from Idle Fuse 1/2/3 Removal Condition	DC Voltage	Max. 0.5 V V_BAT MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND)	0V 11.9V +30V / -10V or less ?	
		W/H Open		DTC Spec : P0888	DTC: P0888	
A73	Shift Position Signal (To Cluster)	Running 1 gear 2 gear 3 gear 4 gear 5 gear	Pulse Duty ? ? ? ?	HI : V_BAT LO : Max. 1.0V Freq.: 50±2Hz (Reference) 12.5±2% 27.5±2% 42.5±2% 57.5±2% 72.5±2%	N.A	Sports mode
B03	UD Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak: Max. 70V	14.4V 0.35V 56.3V	
		W/H Open		DTC Spec : P0755	DTC : P0755	
B05	N.A	-	-	-	-	
B06	Oil temperature sensor_ATM	Idle	Analog	0.5V ~ 4.5V	4.4V 3.1V	16Hz
B09	Output speed sensor	30kph	Pulse	HI : Min. 4.0V LO : Max. 1.0V	5.08V 0.34V	
		W/H Open		DTC Spec : P0722	DTC : P0722	
B10	Input speed sensor	Idle	Pulse	HI : Min. 4.0V LO : Max. 1.0V	5.06V 0.35V	630Hz
		W/H Open		DTC Spec : P0717	DTC : P0717	
B20	N.A	-	-	-	-	

B22	LR Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	13.9V 0.38V 56.1V	
		W/H Open		DTC Spec : P0750	DTC : P0750	
B26	N.A	-	-	-	-	
B27	N.A	-	-	-	-	
B33	GND_Sensor	Idle	DC Voltage	Max. 50 mV	13mV	WTS & OTS_ATM
		W/H Open		DTC Spec: P0118/1115	DTC:P0118/ P1115	
B42	OD Solenoid	Shifting	Pulse	HI : V BAT LO: Max. 1.0V Vpeak : Max. 70V	15.4V 0.45V 56.3V	
		W/H Open		DTC Spec : P0765	DTC : P0765	
B43	DCC solenoid	Lock_Up on	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak: Max. 70V	15.4V 0.45V 56.3V	
		W/H Open		DTC Spec : P0743	DTC : P0743	
B44	RED Solenoid	Shifting	Pulse	HI : V_BAT LO: Max. 1.0V Vpeak : Max. 70V	15.4V 0.45V 56.3V	
		W/H Open		DTC Spec : P0770	DTC : P0770	
B45	2ND Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	15.4V 0.45V 56.3V	
		W/H Open		DTC Spec : P0760	DTC : P0760	
B46	N.A	-	-	-	-	
B47	N.A	-	-	-	-	
B59	Variable Solenoid (-)	Idle	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	1.8/1.2V - N range 0.03V (DC) -D range	600Hz
		W/H Open		DTC Spec : P0748	DTC : P0748	
B65	N.A	-	-	-	-	
B66	N.A	-	-	-	-	

B75	Variable Solenoid (+)	Idle	Pulse	HI : V_BAT LO: Max. 1.0V Vpeak : Max. 70V	13.1V - 0.07V	
		W/H Open		DTC Spec : P0748	DTC : P0748	
B80	N.A	-	-	-	-	

SERVICE ADJUSTMENT PROCEDURE

AUTOMATIC TRANSAXLE FLUID

INSPECTION

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

NOTE: If the fluid smells as if it is burning, it means that the fluid has been contaminated by fine particles from the bushes and friction materials, a transaxle overhaul may be necessary.

5. Check that the fluid level is at the HOT mark on the oil level gauge. If the fluid level is low, add automatic transaxle fluid until the level reaches the "HOT" mark.

   Auto transaxle fluid:

   DIAMOND ATF SP-III, SK ATF SP-III

   Quantity : 8.5*l* (8.98 US qt, 7.48 lmp.qt)

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

6. Insert the oil level gauge (A) securely.

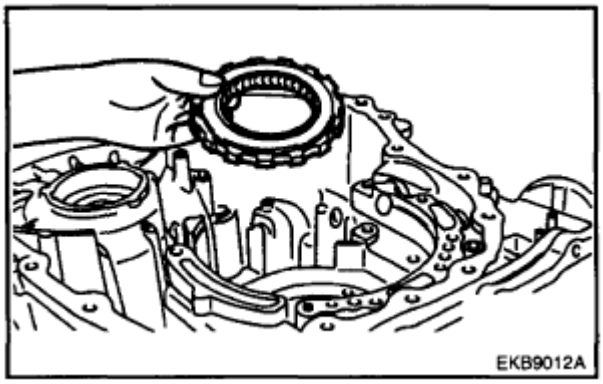


Fig. 37: Identifying Oil Level Gauge

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

REPLACEMENT

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

1. Disconnect the hose which connects the transmission and the oil cooler which is within the radiator only in 2.4L engine (3.3L-the oil cooler is separated).
2. Start the engine and let the fluid drain out.

   Running conditions : "N" range with engine idling.

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

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

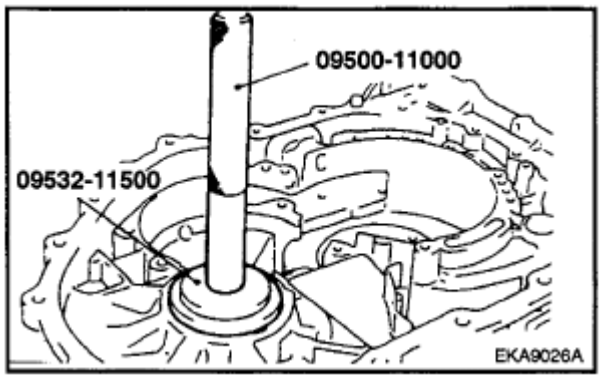


Fig. 38: Identifying Drain Plug

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

   TORQUE :

   40~50Nm (4.0~5.0 kgf.m, 29~36 lb-ft)

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

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

6. Repeat the procedure in step (2).

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

7. Pour the new fluid in through the oil filler tube.
8. Reconnect the hose which was disconnected in step (1) above and firmly replace the oil level gauge.(In case of this "replace", this means after wiping off any dirt around the oil level gauge, insert it into the filler tube.)
9. Start the engine and run it at idle for 1 ~2 minutes.
10. Move the select lever through all positions, and then move it to the "N" position.
11. Drive the vehicle until the fluid temperature rises to the normal temperature (70~80°C), and then check the fluid level again. The fluid level must be at the HOT mark.
12. Firmly insert the oil level gauge (A) into the oil filler tube.

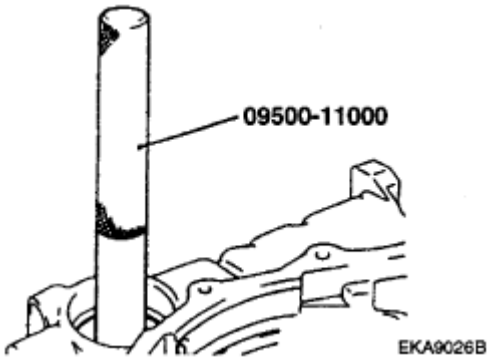


Fig. 39: Identifying Oil Level Gauge Into Oil Filler Tube

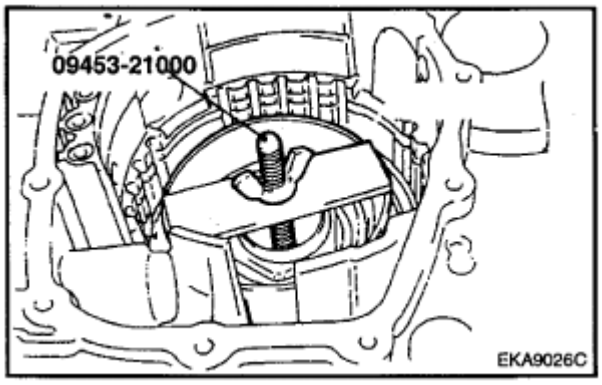


Fig. 40: Identifying Oil Level Gauge

TROUBLESHOOTING

DIAGNOSIS FLOW

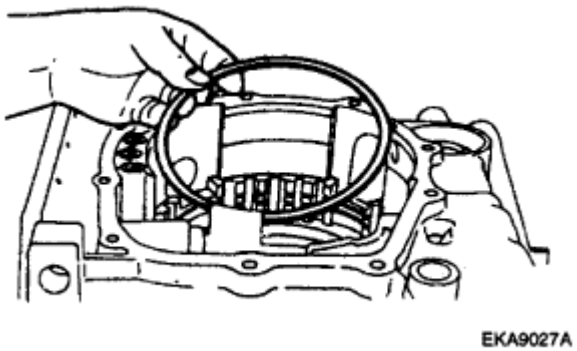


Fig. 41: Troubleshooting Diagnosis Flow Chart

INSPECTION CHART FOR TROUBLE SYMPTOMS

TROUBLE SYMPTOMS CHART

Trouble symptom	Probable cause

Communication with HI-SCAN is not possible If communication with the HI-SCAN is not possible, the cause is probably a defective diagnosis line or the TCM (PCM) is not functioning.		○ Malfunction diagnosis line ○ Malfunction of connector ○ Malfunction of the TCM (PCM)
Driving impossible	**Starting impossible** Starting is not possible when the selector lever is in P or N range. In such cases, the cause is probably a defective engine system, torque converter or oil pump.	○ Malfunction of the engine system ○ Malfunction of the torque converter ○ Malfunction of the oil pump
	Does not move forward If the vehicle does not move forward when the selector lever is shifted from N to D, 3, 2 or L range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the underdrive clutch or valve body.	○ Abnormal line pressure ○ Malfunction of the underdrive solenoid valve ○ Malfunction of the underdrive clutch ○ Malfunction of the valve body
	Does not reverse If the vehicle does not reverse when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal pressure in the reverse clutch or low and reverse brake or a malfunction of the reverse clutch, low and reverse brake or valve body.	○ Abnormal reverse clutch pressure ○ Abnormal low and reverse brake pressure ○ Malfunction of the low and reverse brake solenoid valve ○ Malfunction of the reverse clutch ○ Malfunction of the low and reverse brake ○ Malfunction of the valve body
	Does not move (forward or reverse) If the vehicle does not move forward or reverse when the selector lever is shifted to any position while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the power train, oil pump or valve body.	○ Abnormal line pressure ○ Malfunction of power train ○ Malfunction of the oil pump ○ Malfunction of the valve body
Malfunction when starting	**Engine stalling when shifting** If the engine stalls when the selector lever is shifted from N to	○ Malfunction of the engine system

	D or R range while the engine is idling, the cause is probably a malfunction of the engine system, damper clutch solenoid valve, valve body or torque converter (damper clutch malfunction).	○ Malfunction of the damper clutch control solenoid valve ○ Malfunction of the valve body ○ Malfunction of the torque converter (Malfunction of the damper clutch)
	Shocks when changing from N to D and large time lag If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range while the engine is idling, the cause is probably abnormal underdrive clutch pressure or a malfunction of the underdrive clutch, valve body or idle position switch.	○ Abnormal underdrive clutch pressure ○ Abnormal low and reverse brake pressure ○ Malfunction of the underdrive solenoid valve ○ Malfunction of the valve body ○ Malfunction of the idle position switch
	Shocks when changing from N to R and large time lag If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal reverse clutch pressure or low and reverse brake pressure, or a malfunction of the reverse clutch, low and reverse brake, valve body or idle position switch.	○ Abnormal reverse clutch pressure ○ Abnormal low and reverse brake pressure ○ Malfunction of the low and reverse solenoid valve ○ Malfunction of the reverse clutch ○ Malfunction of the low and reverse brake ○ Malfunction of the valve body ○ Malfunction of the idle position switch
	Shocks when changing from N to D, N to R and large time lag If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range and from N to R range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the oil pump or valve body.	○ Abnormal line pressure ○ Malfunction of the oil pump ○ Malfunction of the valve body
Malfunction when shifting	**Shocks and running up** If shocks occur when driving due	○ Abnormal line pressure

	to up shifting or down shifting and the transmission speed becomes higher than the engine speed, the cause is probably abnormal line pressure or a malfunction of a solenoid valve, oil pump, valve body or of a brake or clutch.	○ Malfunction of each solenoid valve ○ Malfunction of the oil pump ○ Malfunction of the valve body ○ Malfunction of each brake or each clutch
Displaced shifting points	**All points** If all shift points are displaced while driving, the cause is probably a malfunction of the output shaft speed sensor, TPS or of a solenoid valve.	○ Malfunction of the output shaft speed sensor ○ Malfunction of the throttle position sensor ○ Malfunction of each solenoid valve ○ Abnormal line pressure ○ Malfunction of the valve body ○ Malfunction of the TCM (PCM)
	Some points If some of the shift points are displaced while driving, the cause is probably a malfunction of the valve body, or it is related to control and is not an abnormality.	○ Malfunction of the valve body
Does not shift	**No diagnosis codes** If shifting does not occur while driving and no diagnosis codes are output, the cause is probably a malfunction of the transaxle range switch, or TCM (PCM)	○ Malfunction of the transaxle range ○ Malfunction of the TCM (PCM)
Malfunction while driving	**Poor acceleration** If acceleration is poor even if down shifting occurs while driving, the cause is probably a malfunction of the engine system or of a brake or clutch.	○ Malfunction of the engine system ○ Malfunction of the brake or clutch
Malfunction while driving	**Vibration** If vibration occurs when driving at constant speed or when accelerating and deceleration in top range, the cause is probably abnormal damper clutch pressure or a malfunction of the engine system, damper clutch control	○ Abnormal damper clutch pressure ○ Malfunction of the engine system ○ Malfunction of the damper clutch control solenoid valve ○ Malfunction of the torque

	solenoid valve, torque converter or valve body.	converter o Malfunction of the valve body
Transaxle range switch system The cause is probably a malfunction of the inhibitor switch circuit, ignition switch circuit or a defective TCM (PCM).		o Malfunction of the transaxle range switch o Malfunction of the ignition switch o Malfunction of connector o Malfunction of the TCM (PCM)
Idle position switch system The cause is probably a defective idle position switch circuit, or a defective TCM (PCM).		o Malfunction of the triple pressure switch o Malfunction of connector o Malfunction of the TCM (PCM)
Triple pressure switch system The cause is probably a defective dual pressure switch circuit or a defective TCM (PCM).		o Malfunction of the triple pressure switch o Malfunction of connector Malfunction of A/C system o Malfunction of the TCM (PCM)
Vehicle speed sensor system The cause is probably a defective vehicle speed sensor circuit or a defective TCM (PCM).		o Malfunction of the vehicle speed sensor o Malfunction of connector o Malfunction of the TCM (PCM)

DTC TROUBLESHOOTING INDEX

DTC TROUBLESHOOTING INDEX

No.	Code	Item	MIL	Remark
1	**P0707**	TRANSAXLE RANGE SWITCH CIRCUIT LOW INPUT	ON	
2	**P0708**	TRANSAXLE RANGE SWITCH CIRCUIT HIGH INPUT	ON	
3	**P0711**	TRANSAXLE FLUID TEMPERATURE SENSOR	ON	

		RATIONALITY		
4	**P0712**	TRANSAXLE FLUID TEMPERATURE SENSOR CIRCUIT LOW INPUT	ON	
5	**P0713**	TRANSAXLE FLUID TEMPERATURE SENSOR CIRCUIT HIGH INPUT	ON	
6	**P0717**	A/T INPUT SPEED SENSOR CIRCUIT - OPEN or SHORT (GND)	ON	
7	**P0722**	AT OUTPUT SPEED SENSOR CIRCUIT - OPEN or SHORT (GND)	ON	
8	**P0731**	GEAR 1 INCORRECT RATIO	ON	
9	**P0732**	GEAR 2 INCORRECT RATIO	ON	
10	**P0733**	GEAR 3 INCORRECT RATIO	ON	
11	**P0734**	GEAR 4 INCORRECT RATIO	ON	
12	**P0741**	TORQUE CONVERTER CLUTCH STUCK OFF	ON	
13	**P0742**	TORQUE CONVERTER CLUTCH STUCK ON	ON	
14	**P0743**	TORQUE CONVERTER CLUTCH CONTROL SOLENOID VALVE - OPEN or SHORT (GND)	ON	
15	**P0748**	VFS SOLENOID	OFF	
16	**P0750**	LOW and REVERSE SOLENOID VALVE CIRCUIT - OPEN or SHORT (GND)	ON	
17	**P0755**	UNDER DRIVE SOLENOID VALVE CIRCUIT - OPEN or	ON	

		SHORT (GND)		
18	**P0760**	SECOND SOLENOID VALVE CIRCUIT - OPEN or SHORT (GND)	ON	
19	**P0765**	OVERDRIVE SOLENOID VALVE CIRCUIT - OPEN or SHORT (GND)	ON	
20	**P0885**	A/T CONTROL RELAY - OPEN or SHORT (GND)	ON	
21	**P0890**	TCM power Relay sense circuit low	ON	
22	**P0891**	TCM power Relay sense circuit High	ON	

FAILSAFE

Activation and deactivation of error failsafe is coordinated

Error failsafe Management.

Once Error failsafe is activated, it will be kept until ignition key OFF.

In every new TCM start, TCM start with No Error failsafe and No Error present.

0. Mechanical Limp Home Mode
   - Switch off A/T relay
1. Electrical Limp Home Mode
   - Keep 2nd / 3rd gear
2. Prohibit Intelligent Shift
   - Fuzzy SAT (Siemens Adaptive Transmission) shift pattern (Medium Driver, Sporty Driver) will not be used
3. Prohibit Adaptive Control
   - No learning is done
6. Prohibit Torque Reduction Request
   - No torque reduction is sent to ECU
7. Prohibit Lockup Control
   - Stay in non-lockup control state
8. Substitute Input Value Oil Temperature
   - Set oil temperature (tf) to 80° C (192°F)
9. Substitute Value Speed Ratio

- Set speed ratio to 0.7

10. Substitute CAN Input Value
    - Set engine torque to 42%
    - Set throttle position to 50%
    - Set accelerator pedal signal to 50%
    - Set engine speed (Ne) to 3000 rpm
    - Set vehicle speed to 0 km/h
    - Set status of air condition relay to OFF
11. Prohibit VFS control
    - Stop the Line Pressure Control till IG Off

FAILSAFE ACCORDING TO THE DTC

NOTE:

- **Refer the detail description in the previous page for the indicated number on the Failsafe column.**

DTC CHART

Items	Type of error	Failsafe	OBD-II relevant DTC	DTC
Oil temperature sensor	Short to ground	2,3,7,8, 11	P0712	P0712
	Open or short to B+		P0713	P0713
	Stuck signal		P0711	P0711
	Sensor fail		P0711	P0711
PG-A	Short to ground	1,11	P0717	P0717
	Open or short to B+			
PG-B	Short to ground		P0722	P0722
	Open or short to B+			
	Sensor fail		P0721	P0721
Brake switch	Open	2	-	P0713
	Short to B+			
LR Solenoid valve	Short to B+	0,11	P0750	P0750
	Open or short to ground			
2nd Solenoid valve	Short to B+		P0760	P0760
	Open or short to ground			
UD Solenoid valve	Short to B+		P0755	P0755
	Open or short to ground			
OD Solenoid valve	Short to B+		P0765	P0765
	Open or short to			

	ground			
	Open or short to B+		P0765	P0765
DCC Solenoid valve	Short to B+		P0743	P0743
	Open or short to ground			
1st speed asynchronous	Synchronous error	0,11	P0731	P0731
2nd speed asynchronous	Synchronous error		P0732	P0732
3rd speed asynchronous	Synchronous error		P0733	P0733
4th speed asynchronous	Synchronous error		P0734	P0734
Reverse speed asynchronous	Synchronous error		-	-
CAN	No ID from ECM	2,3,6,7,9,10,11	-	P1604
	CAN BUS off		-	P1603
Damper clutch	Abnormal system	7	P0741	P0741
A/T relay	Short to ground or open	0,11	P0885	P0885
Inhibitor switch	Short to ground or open	-	P0707	P0707
	Short to B+ or short between switches		P0708	P0708
VFS	Short to B+	11	-	P0748
	Short to ground	0,11		
	Open	11		
CKP sensor	Sensor error	Ne=3,000rpm 7,9	-	-
TPS sensor	Sensor error	TPS=50%	-	-

SERVICE DATA LIST (WITH SCAN TOOL)

SERVICE DATA LIST

No.	ITEM NAME	UNIT	DATA	Data Description	Failure
1	ENGINE RPM	rpm	700 rpm	Current Engine rpm	0 rpm
2	VEHICLE SPEED	km/h	0km/h	Current Vehicle speed	0km/h
3	THROTTLE P.SENSOR	%	12.5%	Current TPS open angle	0%
4	INPUT SPEED (PG-A)	rpm	700 rpm	Input speed rpm. Always output rpm when	0 rpm

				turning start ON	
5	OUTPUT SPEED (PG-B)	rpm	0 rpm	Output speed rpm. Always output rpm when driving	0 rpm
6	DCC (TCC) SOLENOID DUTY	%	0%	Control 0% --> 100% when operating Damper Clutch	
7	DAMPER CLUTCH SLIP	rpm	260 rpm	Current Damper clutch slip ratio	0 rpm
8	LR SOLENOID DUTY	%	100%	Control 100% --> 0% when operating brake	0%
9	UD SOLENOID DUTY	%	100%	Control 100% --> 0% when operating clutch	0%
10	2ND SOLENOID DUTY	%	100%	Control 100% --> 0% when operating clutch	0%
11	OD SOLENOID DUTY	%	100%	Control 100% --> 0% when operating clutch	0%
12	VFS SOLENOID DUTY	%	0/400%	-	
13	OIL TEMPERATURE	°C	40°C	Current Oil temperature	80°C
14	SHIFT POSITION	N,P,REV/1stG/-/5thG	D	Current shift position	P, N
15	SELECT LEVEL	P,N/R/D/SPORTS	D	Current shift lever position	P, N
16	A/CON SWITCH	OFF/ON/-/NOT SUPP	OFF	-	
17	IDLE STATUS	OFF/ON/-/NOT SUPP	ON	When idling, ON	
18	BRAKE SWITCH	OFF/ON/-/NOT SUPP	ON	When braking, ON	
19	AUTO CRUISE SWITCH	OFF/ON/-/NOT SUPP			
20	AUTO CRUISE RELEASE	-	-		
21	SPORT MODE SELECT SW	OFF/ON/-/NOT SUPP	ON	When selecting sport mode, ON	
22	SPORT MODE UP SW	OFF/ON/-/NOT SUPP	ON	When Selecting Sport mode up, ON	

23	SPORT MODE DOWN SW	OFF/ON/-/NOT SUPP	ON	When selecting sport mode down, ON	
24	A/T CONTROL RELAY VOLT	V	12.9V		0V
25	ENGINE TORQUE	%	20%		
26	HIVEC MODE	A/B/C/D/E/F/G/H/I/J/K	F	A/B/C/D is control mode, F is release mode	F

HIVEC - SAT (SIEMENS ADAPTIVE TRANSMISSION CONTROL) MODE (SHIFT PATTERN)

SHIFT PATTERN CHART

Shift patten	Description (Help)	SCAN DISPLAY
ECONOMY	Economy Driver shift patten for flat road	A
MEDIUM	Shift patten for medium road	B
SPORTS	Shift patten for sport road	C
LOAD 1	Shift patten for low land, slow grade and slope	D
LOAD 2	Shift patten for low land, steep grade and slope	E
LOAD 3	Shift patten for downhill road	F
LOAD 1 HI ALT	Shift patten for high land, steep grade and slope	G
LOAD 2 HI ALT	Shift patten for low land, steep grade and slope	H
HI TEMP	Shift patten for high temperture ATF	I
WARM UP	Shift patten for exhaust gas decrease	J
HOLD	Shift patten for when hold, switch on	K

ACTUATOR INSPECTION

ACTUATOR INSPECTION CHART

NO	ITEM NAME	Actuator Driving	Condition
1	LR SOLENOID (SCSV A)	Solenoid valve driver for 5sec.	1. IG Key ON 2. Inhibitor SW normal 3. P range 4. Vehicle speed 0km/h
2	UD SOLENOID (SCSV B)		
3	2ND SOLENOID (SCSV C)		
4	OD SOLENOID (SCSV		

	D)		5. Engine stop 6. No failure 7. TPS < 1V
5	TORQUE CONVERTER SOLENOID VALVE		
6	A/T CONTROL RELAY	OFF for 3 sec.	-
7	INTELLIGENT SHIFT PROHIBIT	Prohibit until IG off	-
8	CLEAR LEARNING VALUE	-	-

ROAD TEST

ROAD TEST CHART

No.	Condition	Operation	Judgment value	Check item
1	Ignition switch : OFF	Ignition switch (1) ON	Battery voltage (mV)	Control relay
2	• Ignition switch : ON • Engine: Stopped • Selector lever position : P	Selector lever position (1) P, (2) R, (3) N, (4) D	(1) R (2) R, (3) N, (4) D	Transaxle range switch
		Accelerator pedal 1. Released 2. Half depressed 3. Depressed	1. 400 ~ 1,000 mV 2. Gradually rises from (1) 3. 4,500 ~ 5,000 mV	Throttle position sensor
		Brake pedal 1. Depressed 2. Released	1. ON 2. OFF	Brake switch
3	• Ignition switch : ST • Engine: Stopped	Starting test with lever P or N range	Starting should be possible	Starting possible or impossible
4	Warming up	Drive for 15 minutes or more so that the automatic fluid temperature becomes 70~90°C	Gradually rises to 70~90°C	Oil temperature sensor
	• Engine : Idling • Selector lever position : N	A/C switch 1. ON 2. OFF	1. ON 2. OFF	Triple pressure switch
		Accelerator pedal	1. ON	Idle position switch

5		1. Released 2. Half depressed	2. OFF	
			1. 600-900 rpm 2. Gradually rises from (1)	
			1. Data changes	Communication with engine-ECU
		Selector lever position 1. N-->D 2. N-->R	Should be no abnormal shifting shocks Time lag should be within 2 seconds	Malfunction when starting
6	Selector lever position : N (Carry out on a flat and straight road)	Selector lever position and vehicle speed	(2) 1st, (4) 3rd, (3) 2nd, (5) 4th	Shift condition
		1. Idling in 1st gear (Vehicle stopped)	(2)0%, (4) 100%, (3) 100%, (5) 100%	Low and reverse solenoid valve
		2. Driving at constant speed of 20 km/h in 1st gear	(2) 0%, (4) 0%, (3) 0%	Underdrive solenoid valve
		3. Driving at constant speed of 30 km/h in 2nd gear	(1) 100%, (2)0%, (3) 100%	Second solenoid valve
		4. Driving at 50 km/h in 3rd gear with accelerator fully closed	(2) 100%, (3)100%, (4) 0%	Overdrive solenoid valve
			(1) 0km/h (4) 50km/h	Vehicle speed sensor
			(4) 1,800 ~ 2,100rpm	Input shaft speed sensor
		5. Driving at constant speed of 50 km/h in 4th gear	(4) 1,800 ~ 2,100rpm	Output shaft speed sensor
	Selector lever position : D (Carry out on a flat and straight road)	• Accelerate to 4th gear at a throttle position sensor output of 1.5V (accelerator opening angle of 30 %). • Gently decelerate to a standstill.	For (1), (2) and (3), the reading should be the same as the specified output shaft torque, and no abnormal shocks should occur. For (4), (5) and (6), downshifting should occur immediately after the shifting	Malfunction when shifting
				Displaced shift points

7		• Accelerate to 4th gear at a throttle position sensor output of 2.5 V (accelerator opening angle of 50%). • While driving at 60 km/h in 4th gear, shift down to 3rd gear. • While driving at 40 km/h in 3rd gear, shift down to 2nd gear. • While driving at 20 km/h in 2nd gear, shift down to 1st gear.	operation is made.	Does not shift Does not shift from 1 to 2 or 2 to 1 Does not shift from 2 to 3 or 3 to 2 Does not shift from 3 to 4 or 4 to 3
8	Selector lever position : N (Carry out on a flat and straight road)	Move selector lever to R range drive at constant speed of 10km/h	The ratio between input and output shaft speed sensor data should be the same as the gear ratio when reversing.	Does not shift

TORQUE CONVERTER STALL TEST

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

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

1. Check the automatic transmission fluid level and temperature, and the engine coolant temperature.
   - Fluid level : At the HOT mark on the oil level gauge
   - Fluid temperature : 80~100°C (176~212°F)
   - Engine coolant temperature : 80~100°C (176~212°F)
2. Prevent all the wheels from moving during the test.

3. Pull the parking brake lever up, with the brake pedal fully depressed.
4. Start the engine.
5. Move the selector lever to the "D" position, fully depress the accelerator pedal and take a reading of the maximum engine speed at this time.

   Stall speed : 2,100~2,900rpm

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

6. Move the selector lever to the "R" position and carry out the same test again.

TORQUE CONVERTER STALL TEST CONCLUSION

1. Stall speed is too high in both "D" and "R" ranges
   - Low line pressure
   - Low & reverse brake (B) slippage
2. Stall speed is to high in "D" range only
   - Underdrive clutch (C) slippage
3. Stall speed is too high in "R" range only
   - Reverse clutch (A) slippage
4. Stall speed too low in both "D" and "R" ranges
   - Malfunction of torque converter (D)
   - Insufficient engine output

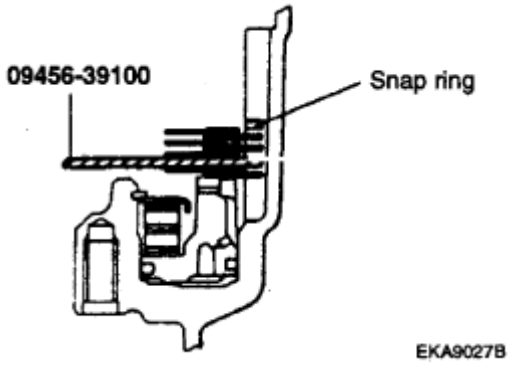


Fig. 42: Torque Converter Stall Test Terminal

HYDRAULIC PRESSURE TEST

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

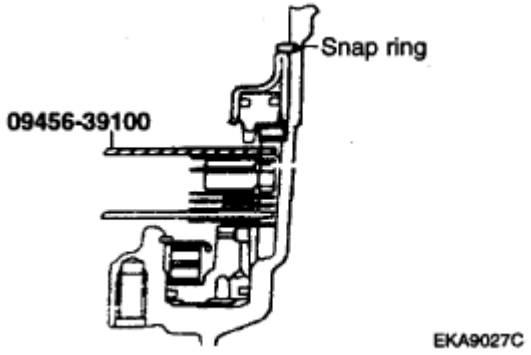


Fig. 43: Connecting Special Tool (Oil Pressure Gauge) To Pressure Discharge Port

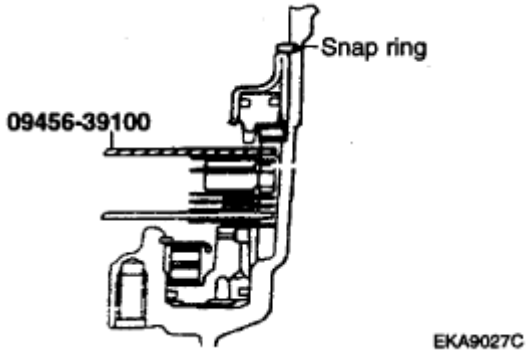


Fig. 44: Connecting Special Tool (Oil Pressure Gauge) To Pressure Discharge Port

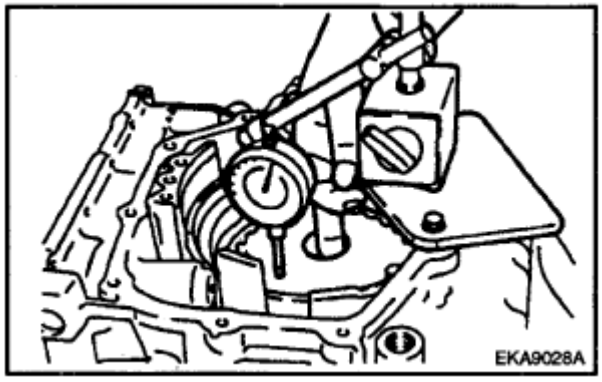


Fig. 45: Connecting Special Tool (Oil Pressure Gauge) To Pressure Discharge Port

STANDARD HYDRAULIC PRESSURE TEST

STANDARD HYDRAULIC PRESSURE TEST CHART

Measurement condition			Standard hydraulic pressure kPa (psi)						
Selector lever position	Shift position	Engine speed (rpm)	Under drive clutch pressure	Reverse clutch pressure	Overdrive clutch pressure	Low & reverse brake pressure	Second brake pressure	Damper clutch Apply pressure (DA)	Damper clutch Release pressure (DR)
P	-	2,500	-	-	-	260-340 (38-50)	-	-	-
R	Reverse	2,500	-	1,270 ~ 1,770 (185-256)	-	1,270 ~ 1,770 (185-256)	-	-	-
N	-	2,500	-	-	-	260-340 (38-50)	-	-	-
D	1st gear	2,500	430-510 (62-74)	-	-	1,010-1,050 (146-152)	-	-	-
	2nd gear	2,500	430-510 (62-74)	-	-	-	430-510 (62-74)	-	-
	3rd gear	2,500	430-510 (62-74)	-	430-510 (62-74)	-	-	More than 730 (100)	0-10 (0-1)
	4th gear	2,500	-	-	430-510 (62-74)	-	780-880 (110-130)	More than 730 (100)	0-10 (0-1)

* The values are subject to change according to vehicle model or condition

* Depress the acceleration pedal "GENTLY" under no load when measuring the hydraulic pressure.

DTC P0707 TRANSAXLE RANGE SWITCH - LOW INPUT

COMPONENT LOCATION

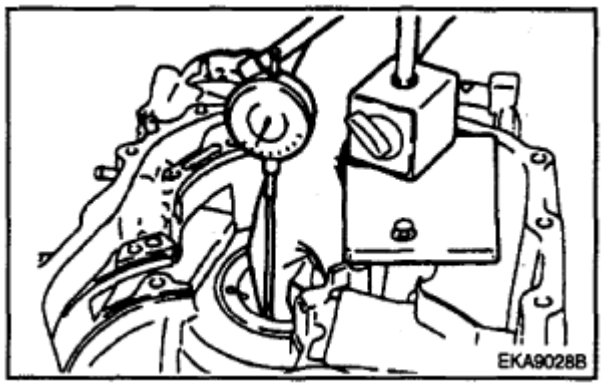


Fig. 46: Identifying Transaxle Range Switch - Low Input

GENERAL DESCRIPTION

The Transaxle Range Switch sends the shift lever position information to the TCM (PCM) using a 12V (battery voltage) signal. When the shift lever is in the D (Drive) position the output signal of Transaxle Range Switch Is 12V and in all other positions the voltage is 0V. The TCM (PCM) judges the shift lever position by reading all signals, for the Transaxle Range Switch, simultaneously.

DTC DESCRIPTION

The TCM (PCM) sets this code when the Transaxle Range Switch has no output signal for more than 30 seconds.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Check for no signal	• Open or short in circuit • Faulty Shift cable adjustment • Faulty Inhibitor switch and Manual control lever position adjustment • Faulty TRANSAXLE RANGE SWITCH • Faulty TCM (PCM)
Enable Conditions	• Engine state = "RUN" • 11V < or = Battery Voltage < or = 16V • TPS > or = 3%	
Threshold value	• No signal detected	
Diagnostic Time	• More than 30seconds	
Fail Safe	• Recognition as previous signal. o When P-D or R-D or D-R SHIFT is detected, it is regarded as N-D or N-R though "N" signal is not detected	

	o When sports mode S/W is ON without P,R,N, D-RANGE signals, it is regarded sports mode. (DTC is not set)	

SIGNAL WAVEFORM

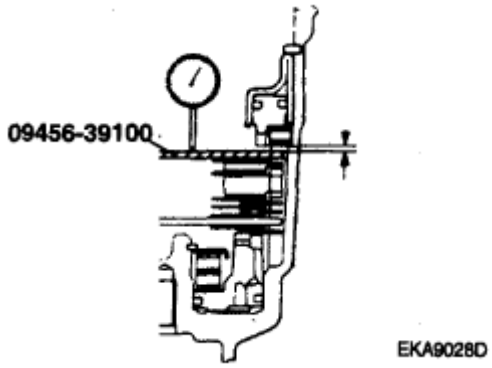


Fig. 47: Scan Tool Display - Transaxle Range Switch

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Ignition "ON" & Engine "OFF".
3. Monitor the "TRANSAXLE RANGE SWITCH" parameter on the scantool.
4. Shift selector lever from "P" range to "D" range.

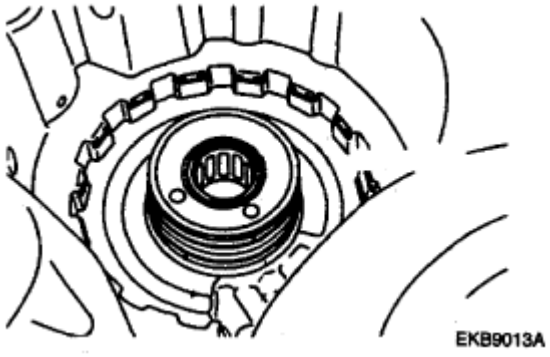


Fig. 48: Scan Tool Display - Select Lever Switch

5. Does "TRANSAXLE RANGE SWITCH" follow the reference data?

   YES

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

* Most of fault that happen about inhibitor switch, result from faulty shift cable adjustment or incorrect location of manual control lever and inhibitor switch. So, when DTC which related Inhibitor switch or engine start defectiveness at "P" range happen, After check the shift cable adjustment or location of manual control lever and inhibitor switch, repair or replace as necessary.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Go to "**POWER CIRCUIT INSPECTION**" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. CHECK POWER TO RANGE SWITCH
    1. Disconnect "TRANSAXLE RANGE SWITCH" connector.
    2. Ignition "ON" & Engine "OFF".
    3. Measure voltage between terminal "8" of the sensor harness connector and chassis ground.

       Specification : approx. B+

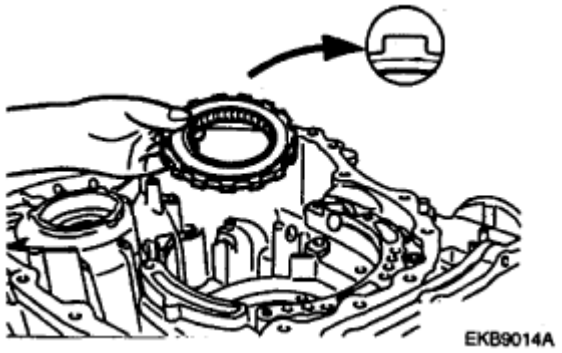


Fig. 49: Measuring Voltage Between Terminal 8 Of Sensor Harness Connector And Chassis Ground

4. Is voltage within specifications?

YES

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

NO

- Check that Fuse 10A is installed or not blown.
- Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect "TRANSAXLE RANGE SWITCH" and "TCM (PCM)" connector.
3. Measure resistance between each terminal of the sensor harness connector and TCM (PCM) harness connector as below.

Specification :

RESISTANCE SPECIFICATION CHART

Pin No of "TRANSAXLE RANGE SWITCH"	C08 No.1	C08 No.3	C08 No.4	C08 No.7
Pin No of "PCM" harness	C30-A No.6	C30-A No.3	C30-A No.5	C30-A No.4
Specification	0ohms	0ohms	0ohms	0ohms

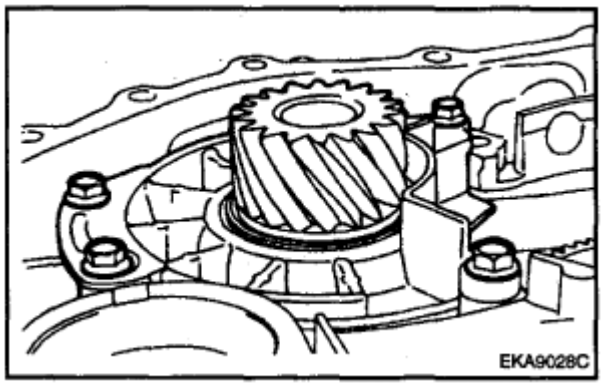


Fig. 50: Measuring Resistance Between Terminal Of Sensor Harness Connector And TCM (PCM) Harness Connector

4. Is resistance within specifications?

   YES

   - Go to "**COMPONENT INSPECTION**" procedure.

   NO

   - Check for Open in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Remove "TRANSAXLE RANGE SWITCH".
3. Measure the resistance between each terminal of the sensor.

   Specification : Approx. 0 ohms

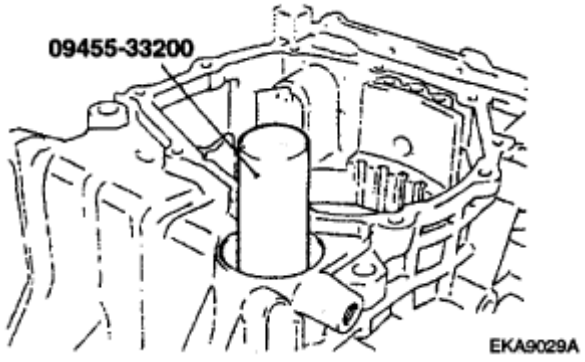


Fig. 51: Measuring Resistance Between Terminal Of Sensor

4. Is resistance within specifications?

YES

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Replace "TRANSAXLE RANGE SWITCH" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO

- System performing to specification at this time.

DTC P0708 TRANSAXLE RANGE SWITCH - HIGH INPUT

COMPONENT LOCATION

Refer to **DTC P0707**.

GENERAL DESCRIPTION

Refer to **DTC P0707**.

DTC DESCRIPTION

The TCM sets this code when the Transaxle Range Switch outputs multiple signals for more than 30 seconds.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Check for multiple signals	• Open or short in TRANSAXLE RANGE SWITCH • Faulty Shift cable adjustment • Faulty Inhibitor switch and Manual control lever position adjustment • Faulty TRANSAXLE RANGE SWITCH • Faulty PCM
Enable Conditions	• Engine state = "RUN" • 11V < or = Battery Voltage < or = 16V • TPS > or = 3%	
Threshold value	• Multiple signal	
Diagnostic Time	• More than 30sec	
Fail Safe	• Recognition as previous signal o When signal is input "D" and "N" at the same time, TCM regards it as "N" RANGE o After PCM/TCM Reset, If the if the PCM/TCM detects multiple signal or no signal, then it holds the 3rd gear position	

SIGNAL WAVEFORM

Refer to **DTC P0707**.

MONITOR SCANTOOL DATA

Refer to **DTC P0707**.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0707**.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "TRANSAXLE RANGE SWITCH" connector.
2. Ignition "ON" & Engine "OFF".
3. Measure voltage between each terminal of the sensor harness connector and chassis ground.

   Specification :

VOLTAGE SPECIFICATION CHART

TERMINAL	No.1	No.3	No.4	No.7	No.8	No.9	No. 10

(C08)							
SPECIFICATION	0V	0V	0V	0V	0V	0V	0V

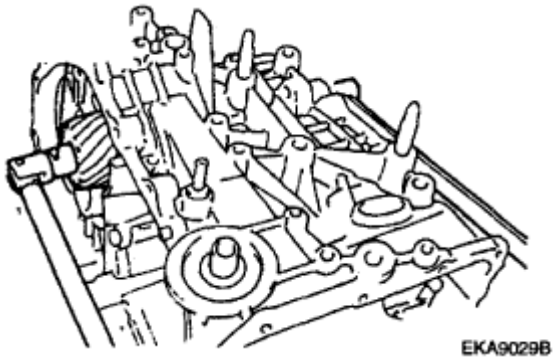


Fig. 52: Measuring Voltage Between Each Terminal Of Sensor Harness Connector And Chassis Ground

4. Is voltage within specifications?

   YES

   - Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

   NO

   - Check for Short in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect "TRANSAXLE RANGE SWITCH" and "TCM (PCM)" connector.
3. Measure resistance between each terminals of the sensor harness to check for Short.

   Specification : Infinite

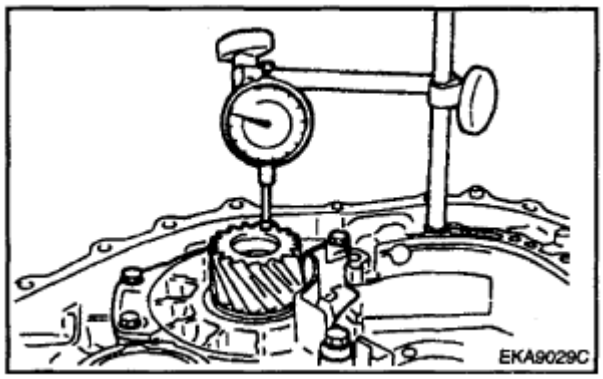


Fig. 53: Measuring Resistance Between Terminals Of Sensor Harness To Check For Short

4. Is resistance within specifications?

   YES

   - Go to "**COMPONENT INSPECTION**" procedure.

   NO

   - Check for Short in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

Refer to **DTC P0707**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0707**.

DTC P0711 TRANSAXLE FLUID TEMPERATURE SENSOR RATIONALITY

COMPONENT LOCATION

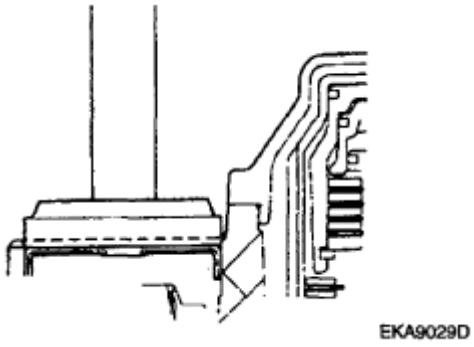


Fig. 54: Identifying Transaxle Fluid Temperature Sensor Components Location With Voltage Graph

GENERAL DESCRIPTION

The automatic TRANSAXLE fluid (ATF) temperature sensor is installed in the Valve Body. This sensor uses a thermistor whose resistance changes according to the temperature changes. The TCM supplies a 5V reference voltage to the sensor, and the output voltage of the sensor changes when the ATF temperature varies. The automatic TRANSAXLE fluid (ATF) temperature provides very important data for the TCM's control of the Torque Converter Clutch, and is also used for many other purposes.

DTC DESCRIPTION

This DTC code is set when the ATF temperature output voltage is lower than a value generated by thermistor resistance, in a normal operating range, for approximately 1 second or longer. The TCM regards the ATF temperature as fixed at a value of 80°C (176°F).

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Check rationality	• Sensor signal circuit is short to ground • Faulty sensor • Faulty PCM
Enable Conditions 1)	• Intake air temperature > or = -25°C (-13°F) • Engine state = RUN • No error with relations other sensors • Engine be cooled sufficiently	
Enable Conditions 2)	• Engine state = RUN • Average start up temperature of TM stuck diagnostic < or = 55°C (131°F)	
Threshold Value 1)	• ATF Temp - Coolant Temp > or = 20°C (68°F)	
Threshold Value 2)	• ATF Temp - TM start up Temp < or = 0.5°C (32.9°F)	
Diagnostic Time 1)	• more than 1 second	
Diagnostic Time 2)	• more than 900 seconds	
Fail Safe	• Learning control and Intelligent shift are inhibited • Fluid temperature is regarded as 80°C (176°F)	

SPECIFICATION

TEMPERATURE AND RESISTANCE SPECIFICATION CHART

TEMP.[°C (°F)]	Resistance (kohms)	TEMP.[°C (°F)]	Resistance)
-40 (-40°F)	139.5	80 (176°F)	1.08
-20 (-4°F)	47.7	100 (212°F)	0.63
0 (32°F)	18.6	120 (248°F)	0.38
20 (68°F)	8.1	140 (284°F)	0.25
40 (104°F)	3.8	160 (320°F)	0.16
60 (140°F)	1.98		

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "TRANSAXLE FLUID TEMPERATURE SENSOR" parameter on the scan tool.

   Specification : Increasing Gradually

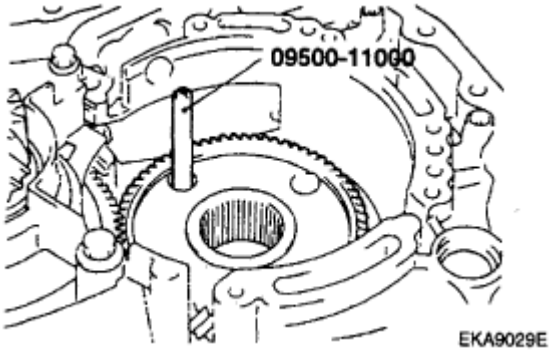


Fig. 55: Scan Tool Display - Fluid Temp Sensor

4. Does "TRANSAXLE FLUID TEMPERATURE SENSOR" follow the reference data?

   YES

   - Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

   NO

   - Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Go to "**COMPONENT INSPECTION**" procedure.

COMPONENT INSPECTION

1. CHECK "TRANSAXLE FLUID TEMPERATURE SENSOR"
    1. Ignition "OFF".
    2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
    3. Measure the resistance between terminals "1" and "2" of the "TRANSAXLE FLUID TEMPERATURE SENSOR".

    Specification : Refer to "**REFERENCE DATA**"

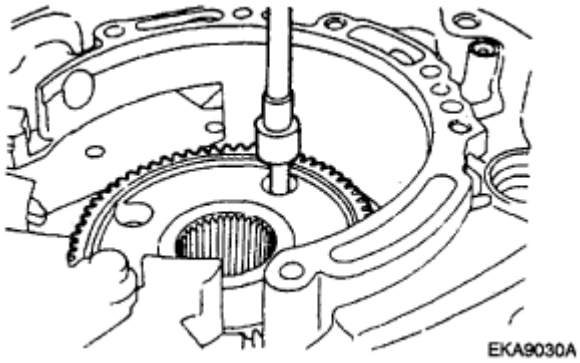


Fig. 56: Measuring Resistance Between Terminals 1 And 2 Of Transaxle Fluid Temperature Sensor

[REFERENCE DATA]

RESISTANCE SPECIFICATION CHART

TEMP.[°C (°F)]	Resistance (kohms)	TEMP.[°C (°F)]	Resistance (kohms)
-40 (-40°F)	139.5	80 (176°F)	1.08
-20 (-4°F)	47.7	100 (212°F)	0.63
0 (32°F)	18.6	120 (248°F)	0.38
20 (68°F)	8.1	140 (284°F)	0.25
40 (104°F)	3.8	160 (320°F)	0.16

60 (140°F)	1.98		

4. Is resistance within specifications?

YES

- Go to "2CHECK PCM/TCM" as below.

NO

- Replace "TRANSAXLE FLUID TEMPERATURE SENSOR" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. CHECK TCM
   1. Ignition "ON" & Engine "OFF".
   2. Connect "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
   3. Install scan tool and select a SIMU-SCAN.
   4. Simulate voltage (0-->5V) to "TRANSAXLE FLUID TEMPERATURE SENSOR" signal circuit.

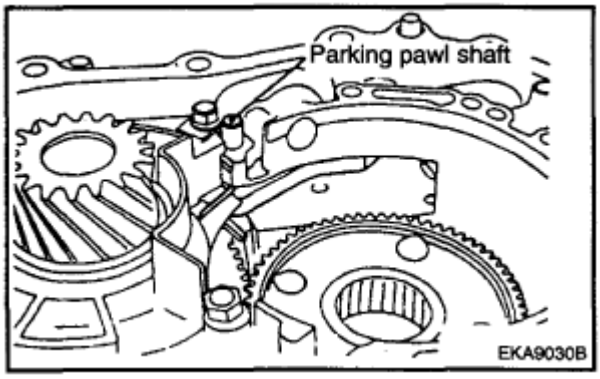


Fig. 57: Scan Tool Display - Oil Temperature

5. Is FLUID TEMP. SENSOR signal value changed according to simulation voltage?

YES

- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO

- System performing to specification at this time.

DTC P0712 FLUID (OIL) TEMPERATURE SENSOR CIRCUIT - LOW

COMPONENT LOCATION

Refer to **DTC P0711**.

GENERAL DESCRIPTION

Refer to **DTC P0711**.

DTC DESCRIPTION

Refer to **DTC P0711**.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Check for Voltage range	• Sensor signal circuit is short to ground • Faulty sensor • Faulty PCM
Enable Conditions	• Engine state = RUN	
Threshold Value	• voltage < 0.07V	
Diagnostic Time	• more than 1sec	
Fail Safe	• Learning control and Intelligent shift are inhibited • Fluid temperature is regarded as 80°C (176°F)	

SPECIFICATION

Refer to **DTC P0711**.

MONITOR SCANTOOL DATA

Refer to **DTC P0711**.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0711**.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Measure the voltage between terminal "1" of the "TRANSAXLE FLUID TEMPERATURE SENSOR" harness connector and chassis ground.

   Specification : Approx. 5 V

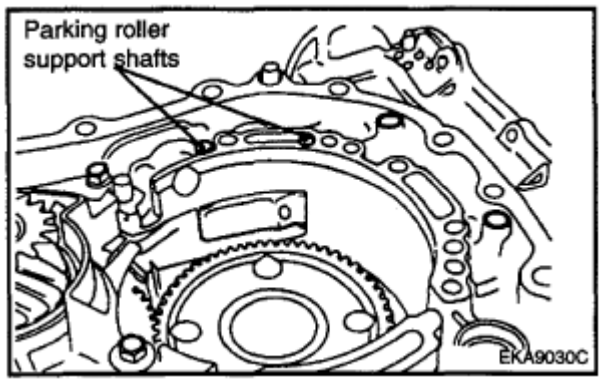


Fig. 58: Measuring Voltage Between Terminal 1 Of Transaxle Fluid Temperature Sensor Harness Connector And Chassis Ground

4. Is voltage within specifications?

   YES

   - Go to "**COMPONENT INSPECTION**" procedure.

   NO

   - Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

Refer to **DTC P0711**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0711**.

DTC P0713 FLUID (OIL) TEMPERATURE SENSOR CIRCUIT - HIGH

COMPONENT LOCATION

Refer to **DTC P0711**.

GENERAL DESCRIPTION

Refer to **DTC P0711**.

DTC DESCRIPTION

This DTC code is set when the ATF temperature output voltage is higher than a value generated by thermistor resistance, in a normal operating range, for an extended period of time. The TCM regards the ATF temperature as fixed at a value of 80°C (176°F).

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Check for Voltage range	• Sensor signal circuit is short to ground • Faulty sensor • Faulty PCM
Enable Conditions	• Intake air temperature > -23.5°C (-10.3°F) • Engine state = RUN	
Threshold Value	• Voltage > or = 4.9V	
Diagnostic Time	• more than 1sec	
Fail Safe	• Learning control and Intelligent shift are inhibited • Fluid temperature is regarded as 80°C (176°F)	

SPECIFICATION

Refer to **DTC P0711**.

MONITOR SCANTOOL DATA

Refer to **DTC P0711**.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0711**.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Measure the voltage between terminal "1" of the "TRANSAXLE FLUID TEMPERATURE SENSOR" harness connector and chassis ground.

   Specification : Approx. 5 V

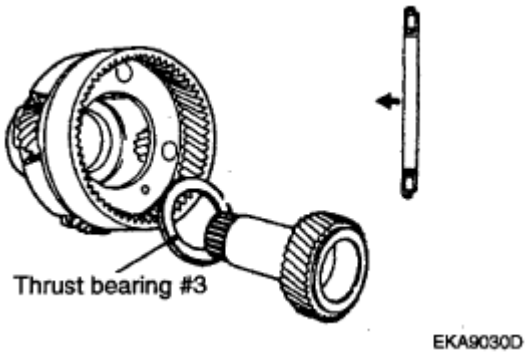


Fig. 59: Measuring Voltage Between Terminal 1 Of Transaxle Fluid Temperature Sensor Harness Connector And Chassis Ground

4. Is voltage within specifications ?

   YES

   - Go to "**GROUND CIRCUIT INSPECTION**" procedure.

   NO

   - Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Measure the resistance between terminal "2" of the "TRANSAXLE FLUID TEMPERATURE SENSOR" harness connector and chassis ground.

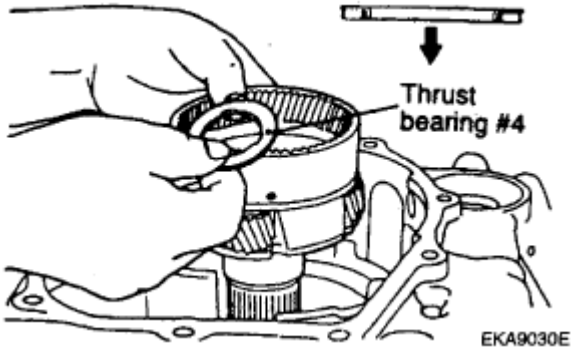


Fig. 60: Measuring Resistance Between Terminal 2 Of Transaxle Fluid Temperature Sensor Harness Connector And Chassis Ground

4. Is resistance within specifications?

   YES

   - Go to "**COMPONENT INSPECTION**" procedure.

   NO

   - Check for open in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure

COMPONENT INSPECTION

Refer to **DTC P0711**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0711**.

DTC P0717 INPUT SPEED SENSOR CIRCUIT - NO SIGNAL

COMPONENT LOCATION

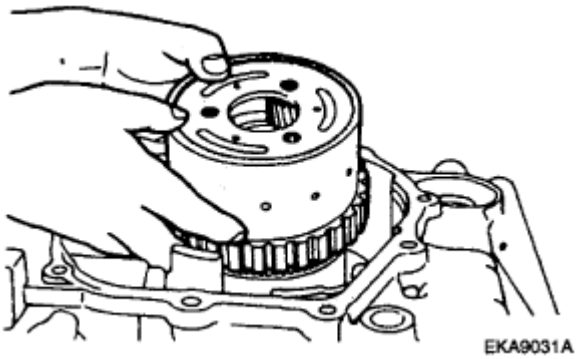


Fig. 61: Identifying Input Speed Sensor

GENERAL DESCRIPTION

The input (turbine) speed sensor outputs pulse-signals according to the revolutions of the input shaft of the transmission. The TCM determines the input shaft speed by counting the frequency of the pulses. This value is mainly used to control the optimum fluid pressure during shifting.

DTC DESCRIPTION

The TCM sets this code if an output pulse-signal is not detected, from the input speed sensor, when the vehicle is running faster than 30 km/h. The Fail-Safe function will be set by the TCM if this code is detected.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Speed rationality check	• Signal circuit is open or short. • Sensor power circuit is open • Sensor ground circuit is open • Faulty INPUT SPEED SENSOR • Faulty PCM/TCM
Enable Conditions	• Vehicle speed is over 19 Mile/h (30 Km/h) and Ne > or = 1000rpm in D,3,2,L (A/T range switch) and SP (SPORTS MODE) • 11V < or = Battery Voltage < or = 16V • TM oil temperature < or = -23°C (-9.4°F)	
Threshold value	• No signal	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd or 2nd gear • Manual shifting is possible (2nd --> 3 rd, 3 rd --> 2nd)	

SPECIFICATION

Input shaft & Output shaft speed sensor

- Type : Hall sensor
- Current consumption : 22mA (MAX)
- Sensor body and sensor connector have been unified as one.

SIGNAL WAVEFORM

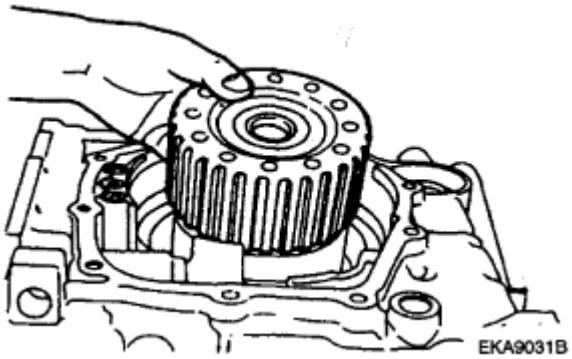


Fig. 62: Signal Waveform Graph

MONITOR SCANTOOL DATA

1. Connect scan tool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "INPUT SPEED SENSOR" parameter on the scantool.
4. Driving at speed of over 19 Mile/h (30 Km/h).

   Specification : Increasing Gradually

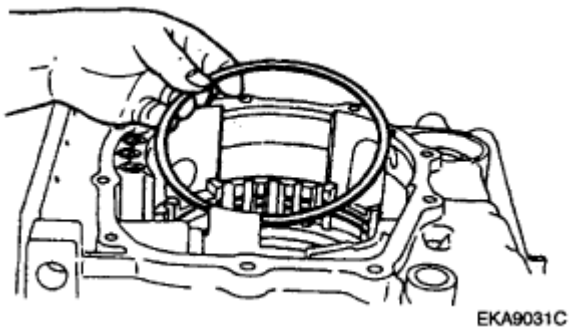


Fig. 63: Scan Tool Display - Input Speed Sensor

5. Does "Input speed sensor" follow the reference data?

   YES

   - Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

   NO

   - Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system may be caused from poor harness and terminals. These faults can be caused by interference from other electrical systems and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   - Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

   NO

   - Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "INPUT SPEED SENSOR" connector.
3. Measure voltage between terminal "2" of the INPUT SPEED SENSOR harness connector and chassis ground.

   Specification : approx. 5V

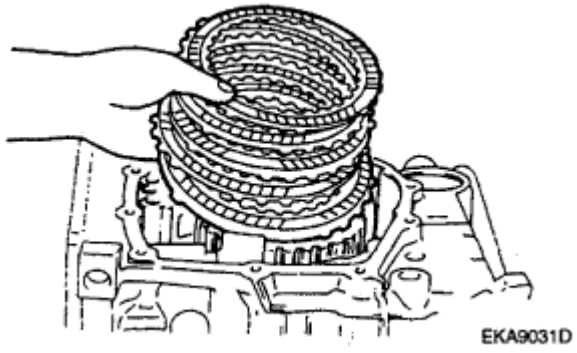


Fig. 64: Measuring Voltage Between Terminal 2 Of Input Speed Sensor Harness Connector And Chassis Ground

4. Is voltage within specification?

   YES

   - Go to "**POWER CIRCUIT INSPECTION**" procedure.

   NO

- Check for open or short in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.
- If signal circuit in harness is OK, Go to "2Check PCM/TCM" of the "Component Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "INPUT SPEED SENSOR" connector.
3. Measure voltage between terminal "3" of the INPUT SPEED SENSOR harness connector and chassis ground.

   Specification : approx. B+

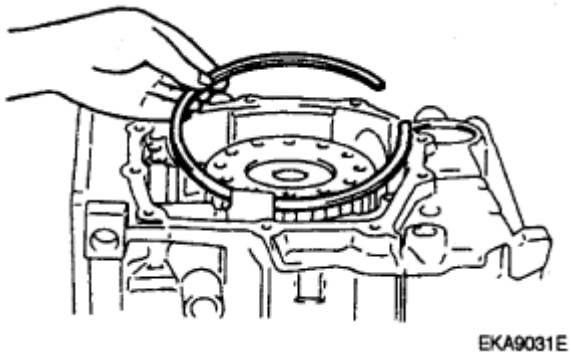


Fig. 65: Measuring Voltage Between Terminal 3 Of Input Speed Sensor Harness Connector And Chassis Ground

4. Is voltage within specification?

   YES

   - Go to "**GROUND CIRCUIT INSPECTION**" procedure.

   NO

   - Check for open in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "INPUT SPEED SENSOR" connector.
3. Measure resistance between terminal "1" of the INPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 0 ohms

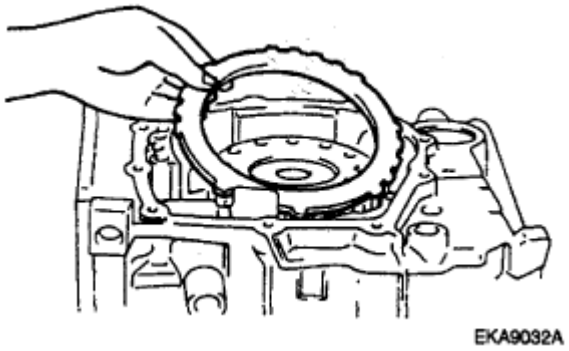


Fig. 66: Measuring Resistance Between Terminal 1 Of Input Speed Sensor Harness Connector And Chassis Ground

4. Is resistance within specification ?

   YES

   - Go to "**COMPONENT INSPECTION**" procedure.

   NO

   - Check for open in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.
   - If ground circuit in harness is OK, Go to "2Check PCM/TCM" of the "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check "INPUT SPEED SENSOR"
   1. Ignition "OFF".
   2. Disconnect the "INPUT SPEED SENSOR" connector.
   3. Measure resistance between terminal "1", "2" and "2", "3" and "1", "3" of the "INPUT SPEED SENSOR" connector.

      Specification : Refer to "**REFERENCE DATA**"

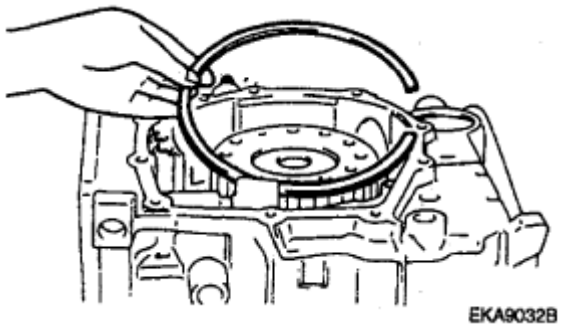


Fig. 67: Measuring Resistance Between Terminal Input Speed Sensor Connector

4. Is resistance within specifications? [REFERENCE DATA]

RESISTANCE SPECIFICATIONS CHART

Data	Reference Data	
Current	22 mA	
Air Gap	Input sensor	1.3 mm
	Output sensor	0.85 mm
Resistance	Input sensor	Above 4 Mohms
	Output sensor	Above 4 Mohms
Voltage	High	4.8 ~ 5.2V
	Low	Below 0.8V

YES

- Go to "2CHECK PCM" as below.

NO

- Replace "INPUT SPEED SENSOR" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. CHECK PCM/TCM
    1. Ignition "ON" & Engine "OFF".
    2. Connect "INPUT SPEED SENSOR" connector.
    3. Install scantool and select a SIMU-SCAN.
    4. Simulate frequency to INPUT SPEED SENSOR signal circuit.

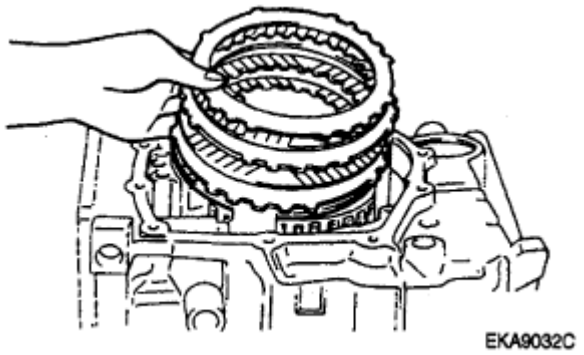


Fig. 68: Scan Tool Display - Input Speed Sensor

* The values are subject to change according to vehicle model or conditions

5. Is "INPUT SPEED SENSOR" signal value changed according to simulation frequency?

   YES

   - Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

   NO

   - Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scan tool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Is resistance within specification ?

   YES

   - Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

   NO

   - System performing to specification at this time.

DTC P0722 OUTPUT SPEED SENSOR CIRCUIT - NO SIGNAL

COMPONENT LOCATION

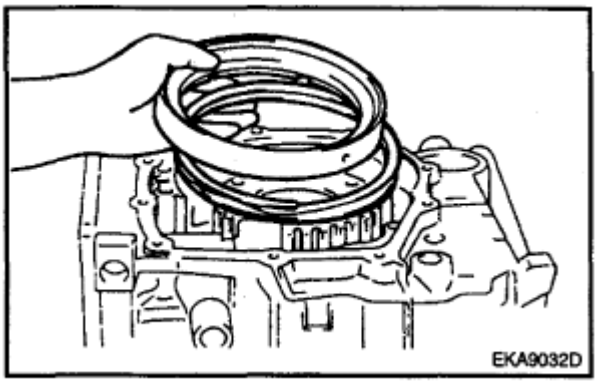


Fig. 69: Identifying Output Speed Sensor Circuit

GENERAL DESCRIPTION

The Output Speed Sensor outputs pulse-signals according to the revolutions of the output shaft of the transmission. The Output Speed Sensor is installed in front of the Transfer Drive Gear to determine the Transfer Drive Gear rpms by counting the frequency of the pulses. This value, together with the throttle position data, is mainly used to decide the optimum gear position.

DTC DESCRIPTION

The TCM sets this code if the calculated value of the pulse-signal is noticeably different from the value calculated, using the Vehicle Speed Sensor output, when the vehicle is running faster than 30 km/h. The TCM will initiate the fail safe function if this code is detected.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Speed rationality check	• Signal circuit is open or short • Sensor power circuit is open • Sensor ground circuit is open • Faulty OUTPUT SPEED SENSOR • Faulty PCM
Enable Conditions	• Vehicle speed is over 19 Mile/h (30 Km/h) and Ne < or = 1000rpm in D,3,2,L (A/T range switch) and SP (SPORTS MODE) • 11V < or = Battery Voltage < or = 16V • TM oil temperature > or = -23°C (-9.4°F)	
Threshold value	• Vehicle speed calculated from output speed < or = 10%(the vehicle speed from	

	vehicle speed sensor)	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd or 2nd gear. • Apply an electric current to solenoid valve • Manual shifting is possible (2nd --> 3 rd, 3 rd --> 2nd)	

SPECIFICATION

Input shaft & Output shaft speed sensor

- Type : Hall sensor
- Current consumption : 22mA (MAX)
- Sensor body and sensor connector have been unified as one.

SIGNAL WAVEFORM

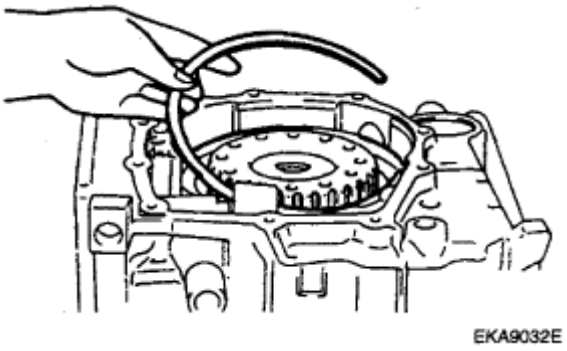


Fig. 70: Signal Waveform Graph

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "OUTPUT SPEED SENSOR" parameter on the scantool.
4. Driving at speed of over 19 Mile/h (30 Km/h).

   Specification : Increasing Gradually

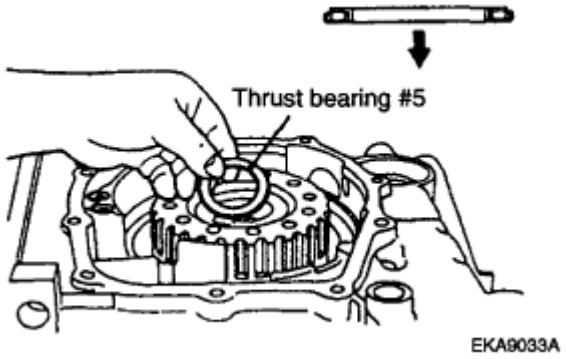


Fig. 71: Scan Tool Display - Output Speed Sensor

5. Does "Output speed sensor" follow the reference data?

   YES

   - Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

   NO

   - Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0717**.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR" connector.
3. Measure voltage between terminal "2" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

   Specification : approx. 5V

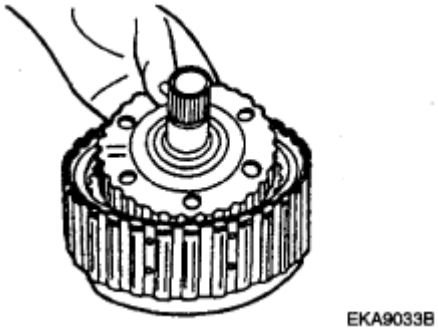


Fig. 72: Measuring Voltage Between Terminal 2 Of Output Speed Sensor Harness Connector And Chassis Ground

4. Is voltage within specification?

   YES

   - Go to "**POWER CIRCUIT INSPECTION**" procedure.

   NO

   - Check for open or short in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.
   - If signal circuit in harness is OK, Go to "2Check PCM/TCM" of the "Component Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR" connector.
3. Measure voltage between terminal "3" of the "OUTPUT SPEED SENSOR" harness connector and chassis ground.

   Specification : approx. B+

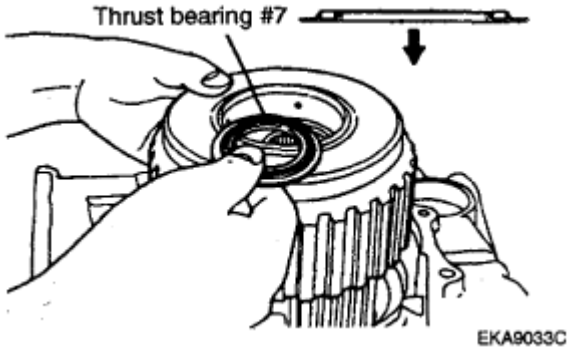


Fig. 73: Measuring Voltage Between Terminal 3 Of Output Speed Sensor Harness Connector And

Chassis Ground

4. Is voltage within specification?

YES

- Go to "**GROUND CIRCUIT INSPECTION**" procedure.

NO

- Check for open in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR" connector.
3. Measure resistance between terminal "1" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

   Specification : Approx. 0ohms

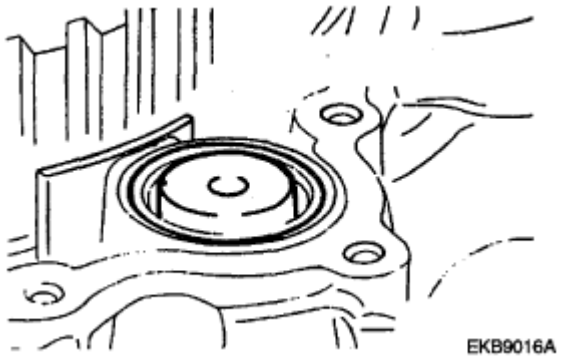


Fig. 74: Measuring Resistance Between Terminal 1 Of Output Speed Sensor Harness Connector And Chassis Ground

4. Is resistance within specifications?

YES

- Go to "**COMPONENT INSPECTION**" procedure.

NO

- Check for open in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.
- If ground circuit is OK, Go to "2Check PCM/TCM" of the "Component Inspection" procedure.

COMPONENT INSPECTION

1. Check "OUTPUT SPEED SENSOR"
    1. Ignition "OFF".
    2. Disconnect the "OUTPUT SPEED SENSOR" connector.
    3. Measure resistance between terminal "1", "2" and "2", "3" and "1", "3" of the "OUTPUT SPEED SENSOR" connector.

       Specification : Refer to "**REFERENCE DATA**"

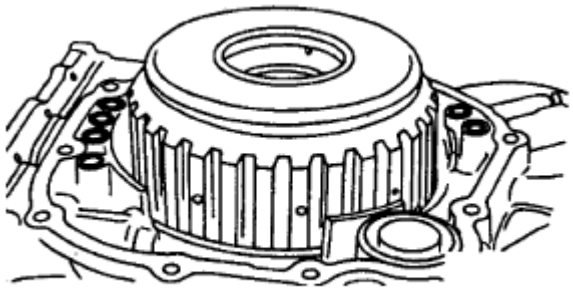

EKB9016B

Fig. 75: Measuring Resistance Between Terminal Output Speed Sensor Connector

    4. Is resistance within specifications?

       [REFERENCE DATA]

       RESISTANCE SPECIFICATIONS CHART

Data	Reference Data	
Current	22 mA	
Air Gap	Input sensor	1.3 mm
	Output sensor	0.85 mm
Resistance	Input sensor	Above 4 Mohms
	Output sensor	Above 4 Mohms
Voltage	High	4.8 ~ 5.2V
	Low	Below 0.8V

       YES

       - Go to "2CHECK PCM/TCM" as below.

       NO

       - Replace "OUTPUT SPEED SENSOR" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.
2. CHECK PCM/TCM

1. Ignition "ON" & Engine "OFF".
2. Connect "OUTPUT SPEED SENSOR" connector.
3. Install scantool and select a SIMU-SCAN.
4. Simulate frequency to OUTPUT SPEED SENSOR signal circuit.

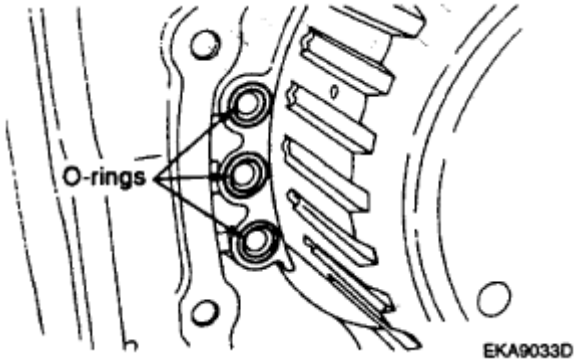


Fig. 76: Scan Tool Display - Output Speed Sensor

5. Is "OUTPUT SPEED SENSOR" signal value changed according to simulation frequency?

YES

- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0707**.

DTC P0731 GEAR 1 INCORRECT RATIO

COMPONENT LOCATION

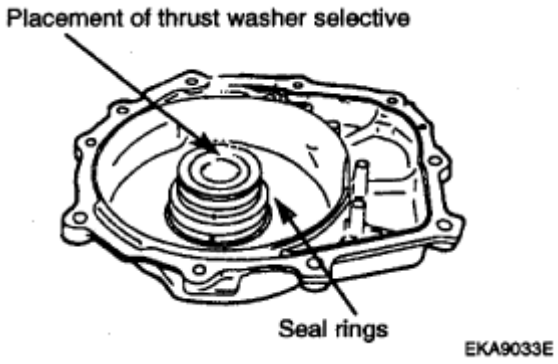


Fig. 77: Identifying UD Clutch And L And R Brake

GENERAL DESCRIPTION

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 1st gear ratio, while the transaxle is engaged in the 1st gear. For example, if the output speed is 1000 rpm and the 1st gear ratio is 2.842, then the input speed is 2,842 rpm.

DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 1st gear ratio, while the transaxle is engaged in 1st gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfunctioning rather than an electrical issue.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• 1st gear incorrect ratio	• Faulty Input speed sensor • Faulty output speed sensor • Faulty UD clutch or LR brake or Oneway clutch
Enable Conditions	• Engine speed > 450rpm • Output speed > 350rpm • Shift stage 1st. gear • Input speed > 0rpm • A/T oil temp sensor voltage < 4.5V • Voltage of Battery > 10V • TRANSAXLE RANGE SWITCH is normal and after 2sec is passed from IG ON	
Threshold value	• | Input speed - output speed x 1st gear ratio | > or = 200rpm	
Diagnostic Time	• More than 1sec	
	• Locked into 3rd gear.	

Fail Safe	(If diagnosis code P0731 is output four times, the transaxle is locked into 3rd gear)	

SIGNAL WAVEFORM

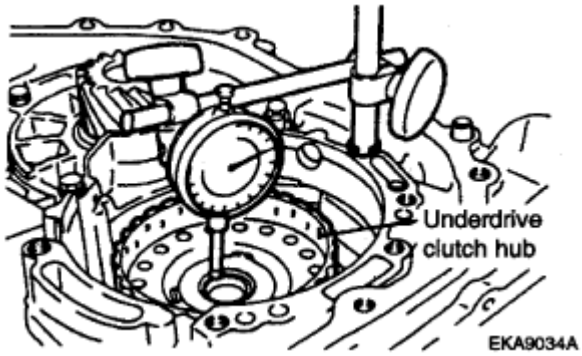


Fig. 78: Signal Wave Form Graph

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scantool.
4. Perform the "STALL TEST" with gear position "1"

   Specification : 2000~2700 engine rpm

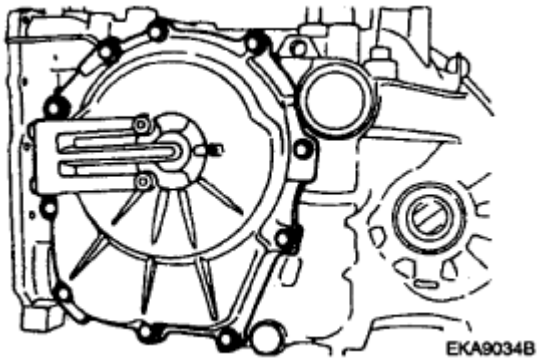


Fig. 79: Scan Tool Display - Shift Position

OPERATING ELEMENT OF EACH SHIFTING RANGE

OPERATING ELEMENT OF SHIFTING RANGE CHART

	UD/C	OD/C	REV/C	2ND/B	LR/B	OWC
P					•	
R			•		•	
N					•	
D1	•				•	o
D2	•			•		
D3	•	•				
D4		•		•		

* Low & Reverse Brake is released when the vehicle speed is over 7Km/h (5 MPH).

Stall test procedure in D1 and reason

Procedure

1. Warm up the engine
2. After positioning the select lever in "D", depress the foot brake pedal fully. After that, depress the accelerator pedal to the maximum

   * The slippage of 1st gear operating parts can be detected by stall test in D

Reason for stall test

1. If there is no mechanical defaults in A/T, all slippage occurs in the torque converter.
2. Therefore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
3. If 1st gear operating part has faults, input speed revolution will be out of specification.
4. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.

5. Is "STALL TEST" within specification?

YES

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

NO

- Go to "**COMPONENT INSPECTION**" procedure.

CAUTION:
- **Do not let anybody stand in front of or behind the vehicle while this test is being carried out.**
- **Check the A/T fluid level and temperature and the engine coolant temperature.**

- **Fluid level: At the hot mark on the oil level gauge.**
- **Fluid temperature : 176 °F~ 212 °F (80 ~ 100 °C).**
- **Engine coolant temperature : 176 °F~ 212 °F (80 ~ 100 °C).**

- **Chock both rear wheels (left and right).**
- **Pull the parking brake lever on with the brake pedal fully depressed.**
- **The throttle should not be left fully open for more than eight seconds.**
- **If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent tests.**

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 1st gear.

   Specification : INPUT SPEED - (OUTPUT SPEED x GEAR RATIO) < or = 200 RPM

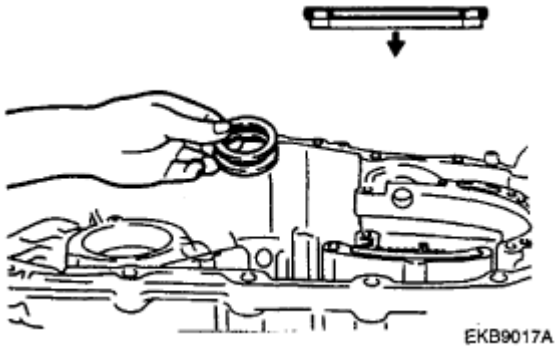


Fig. 80: Scan Tool Display - Shift Position

5. Are "INPUT & OUTPUT SPEED SENSOR" within specifications?

   YES

   - Go to "**COMPONENT INSPECTION**" procedure.

   NO

   - Check for electrical noise of circuit in INPUT & OUTPUT SPEED SENSOR or replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

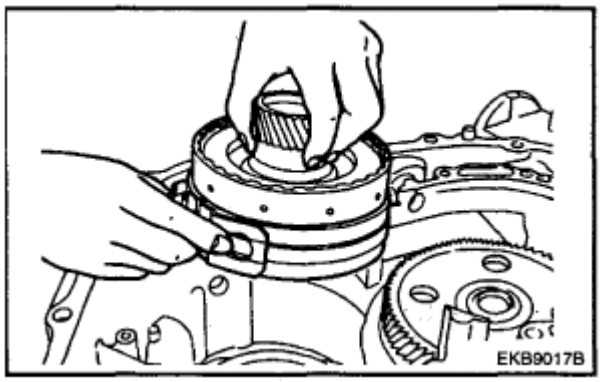


Fig. 81: Identifying LR, UD And 2ND Port

1. Connect oil pressure gauge to "UD" and "L/R" port.
2. Engine "ON".
3. Drive the car with gear position 1 in "SPORTS MODE".
4. Compare it with reference data as below.

Specification : shown below

HYDRAULIC PRESSURE SPECIFICATION CHART

Measurement condition			Standard hydraulic pressure kPa (psi)						
Selector lever position	Shift position	Engine speed (rpm)	Under drive clutch pressure	Reverse clutch pressure	Overdrive clutch pressure	Low & reverse brake pressure	Second brake pressure	Damper clutch Apply pressure (DA)	Damper clutch Release pressure (DR)
P	-	2,500	-	-	-	260-340 (38-50)	-	-	-
R	Reverse	2,500	-	1,270-1,770 (185-256)	-	1,270-1,770 (185-256)	-	-	-
N	-	2,500	-	-	-	260-340 (38-50)	-	-	-
D	1st gear	2,500	430-510 (62-74)	-	-	1,010-1,050 (146-152)	-	-	-
	2nd gear	2,500	430-510 (62-74)	-	-	-	430-510 (62-74)	-	-
	3rd gear	2,500	430-510 (62-74)	-	430-510 (62-74)	-	-	More than 730 (100)	0-10 (0-1)
	4th gear	2,500	-	-	430-510	-	780-880	More	0-10 (0-

					(62-74)		(110-130)	than 730 (100)	1)

* The values are subject to change according to vehicle model or condition

5. Is oil pressure value within specification?

YES

- Repair AUTO TRANSAXLE (Clutch or Brake) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in general information.
4. Are any DTCs present ?

YES

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO

- System performing to specification at this time.

DTC P0732 GEAR 2 INCORRECT RATIO

COMPONENT LOCATION

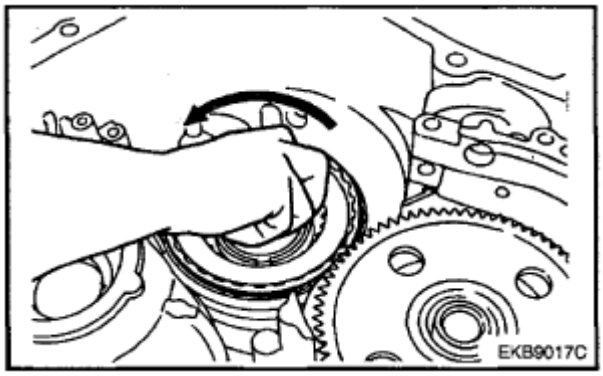


Fig. 82: Identifying 2nd Brake And UD Clutch

GENERAL DESCRIPTION

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 2nd gear ratio, while the transaxle is engaged in the 2nd gear. For example, if the output speed is 1000 rpm and the 2nd gear ratio is 1.529, then the input speed is 1,529 rpm.

DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 2nd gear ratio, while the transaxle is engaged in 2nd gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfunctioning rather than an electrical issue.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• 2nd gear incorrect ratio	• Faulty Input speed sensor • Faulty output speed sensor • Faulty UD clutch or 2nd brake
Enable Conditions	• Engine speed > 450rpm • Output speed > 350rpm • Shift stage 2nd. gear • Input speed > 0rpm • A/T oil temp sensor voltage < 4.5V • Voltage of Battery >10V • TRANSAXLE RANGE SWITCH is normal	
Threshold value	• | Input speed - output speed x 2nd gear ratio | > or = 200rpm	
Diagnostic Time	• More than 1sec	
	• Locked into 3 rd gear.	

Fail Safe	(If diagnosis code P0732 is output four times, the transaxle is locked into 3rd gear)	

SIGNAL WAVEFORM

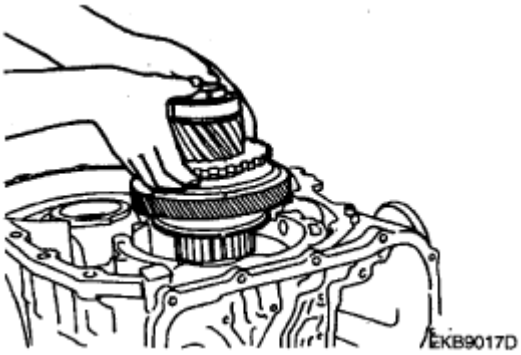


Fig. 83: Signal Waveform Graph

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scantool.
4. Perform the "STALL TEST" with gear position "2".

   Specification : 2000~2700 engine rpm

   * This test is possible only for "HOLD S/W" or "SPORTS MODE" applied vehicles.

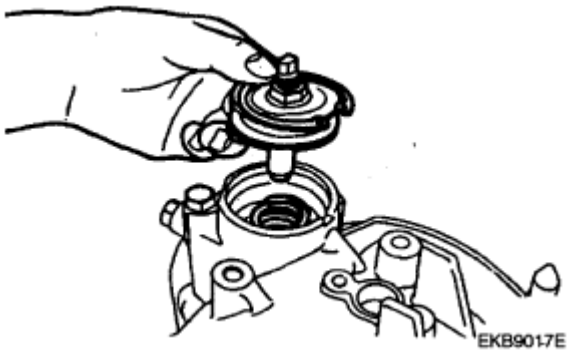


Fig. 84: Scan Tool Display - Shift Position

OPERATING ELEMENT OF EACH SHIFTING RANGE

OPERATING ELEMENT OF SHIFTING RANGE CHART

	UD/C	OD/C	REV/C	2ND/B	LR/B	OWC
P					•	
R			•		•	
N					•	
D1	•				•	o
D2	•			•		
D3	•	•				
D4		•		•		

* Low & Reverse Brake is released when the vehicle speed is over 7Km/h (5 MPH).

Stall test procedure in D2 and reason

Procedure

1. Warm up the engine
2. After positioning the select lever in "D", depress the foot brake pedal fully after that, depress the accelerator pedal to the maximum

   * The slippage of 1st gear operating parts can be detected by stall test in D2.

Reason for stall test

1. If there are mechanical defaults in A/T, all slippage occurs in the torque converter.
2. Therefore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
3. If 2nd brake system (2nd gear operating part) has faults, input speed revolution will be out of specification.
4. If wheel spin occurs, the applied brake force is not adequate. Retry using more brake force.

5. Is "STALL TEST" within specification?

YES

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

NO

- Go to "**COMPONENT INSPECTION**" procedure.

CAUTION:
- **Do not let anybody stand in front of or behind the vehicle while this test is being carried out.**
- **Check the A/T fluid level and temperature and the engine coolant temperature.**

- **Fluid level: At the hot mark on the oil level gauge.**
- **Fluid temperature : 80~100 °C (176 °F~ 212 °F).**
- **Engine coolant temperature : 80~100 °C (176 °F~ 212 °F).**

- **Chock both rear wheels (left and right).**
- **Pull the parking brake lever on with the brake pedal fully depressed.**
- **The throttle should not be left fully open for more than eight seconds.**
- **If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent tests.**

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 2nd gear.

   Specification : INPUT SPEED - (OUTPUT SPEED x GEAR RATIO) < or = 200 RPM

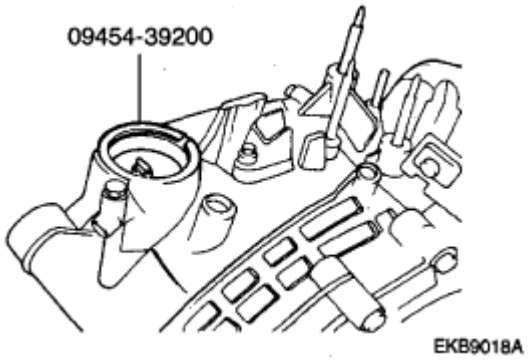


Fig. 85: Scan Tool Display - Shift Position

5. Are "INPUT & OUTPUT SPEED SENSOR" within specifications?

   YES

   - Go to "**COMPONENT INSPECTION**" procedure.

   NO

   - Check for electrical noise of circuit in INPUT & OUTPUT SPEED SENSOR or replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and go to "**VERIFICATION OF VEHICLE**

REPAIR" procedure.

COMPONENT INSPECTION

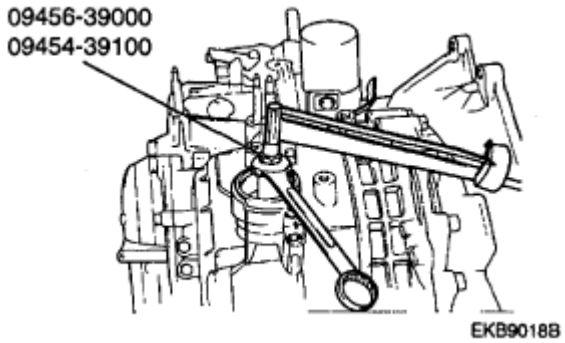


Fig. 86: Identifying LR, UD And 2ND Port

1. Connect Oil pressure gauge to "UD" and "2ND" port.
2. Engine "ON".
3. Drive the car with gear position 2 in "SPORTS MODE"
4. Compare it with reference data as below.

   Specification : Refer to **DTC P0731**.

5. Is oil pressure value within specification?

   YES

   - Repair AUTO TRANSAXLE (Clutch or Brake) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

   NO

   - Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0731**.

DTC P0733 GEAR 3 INCORRECT RATIO

COMPONENT LOCATION

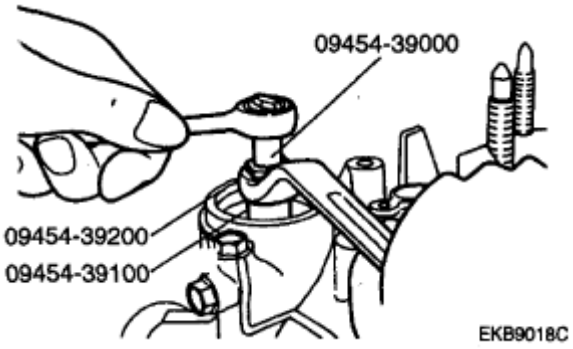


Fig. 87: Identifying OD Clutch And UD Clutch

GENERAL DESCRIPTION

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 3rd gear ratio, while the transaxle is engaged in the 3rd gear. For example, if the output speed is 1,000 rpm and the 3rd gear ratio is 1.000, then the input speed is 1,000 rpm.

DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 3rd gear ratio, while the transaxle is engaged in 3rd gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfunctioning rather than an electrical issue.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• 3rd gear incorrect ratio	• Faulty Input speed sensor • Faulty output speed sensor • Faulty UD clutch or OD clutch
Enable Conditions	• Engine speed > 450rpm • Output speed > 900rpm • Shift stage 3rd. gear • Input speed > 0rpm • A/T oil temp sensor voltage < 4.5V • Voltage of Battery > 10V • TRANSAXLE RANGE SWITCH is normal and after 2sec is passed from IG ON	
Threshold value	• | Input speed - output speed x 3rd gear ratio | > or = 200rpm	
Diagnostic Time	• More than 1sec	
	• Locked into 3rd gear.	

Fail Safe	(If diagnosis code P0733 is output four times, the transaxle is locked into 3rd gear)	

SIGNAL WAVEFORM

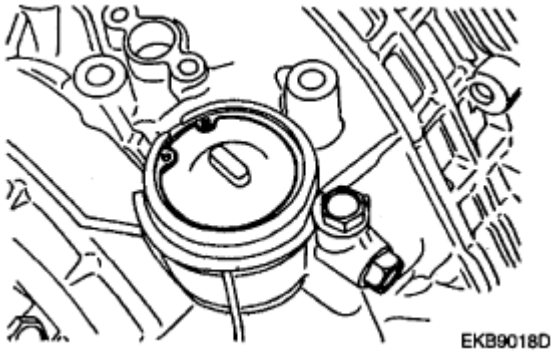


Fig. 88: Signal Waveform Graph

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scantool.
4. Disconnect the solenoid valve connector and perform the "STALL TEST".

   Specification : 2000~2700 engine rpm

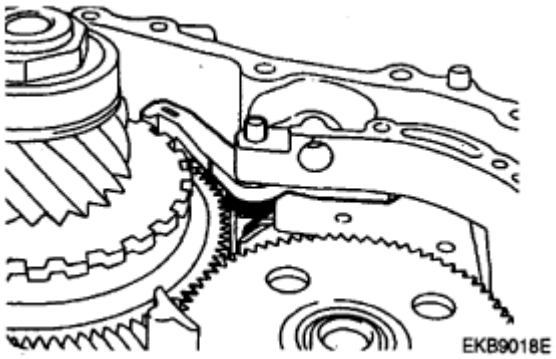


Fig. 89: Scan Tool Display - Shift Position

OPERATING ELEMENT OF EACH SHIFTING RANGE

OPERATING ELEMENT OF SHIFTING RANGE CHART

	UD/C	OD/C	REV/C	2ND/B	LR/B	OWC
P					•	
R			•		•	
N					•	
D1	•				•	o
D2	•			•		
D3	•	•				
D4		•		•		

* Low & Reverse Brake is released when the vehicle speed is over 7Km/h (5 MPH).

Stall test procedure in D3 and reason

Procedure

1. Warm up the engine
2. Set 3rd gear hold by disconnecting the solenoid valve connector. Fully depress the brake pedal, then place the transaxle gear lever into "D" range. Press and hold the accelerator pedal to the floor for no more than eight seconds while observing the engine, input speed, and output speed RPM values.

   * The slippage of 3rd gear operating parts can be detected by stall test in D3

Reason for stall test

1. If there is no mechanical defaults in A/T, all slippage occurs in torque converter.
2. Therefore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
3. If OD clutch system (3rd gear operating part) has faults, input speed revolution will be out of specification.
4. If output speed revolution is output. It means that the foot brake force is not applied fully. Retesting using greater braking force is required.

5. Is "STALL TEST" within specification?

YES

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

NO

- Go to "**COMPONENT INSPECTION**" procedure.

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

- **Check the A/T fluid level and temperature and the engine coolant temperature.**
  - **Fluid level: At the hot mark on the oil level gauge.**
  - **Fluid temperature : 80~100 °C (176 °F~ 212 °F).**
  - **Engine coolant temperature : 80~100 °C (176°F~212°F).**
- **Chock both rear wheels (left and right).**
- **Pull the parking brake lever on with the brake pedal fully depressed.**
- **The throttle should not be left fully open for more than eight seconds.**
- **If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent tests.**

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 3rd gear.

   Specification : INPUT SPEED - (OUTPUT SPEED x GEAR RATIO) < or = 200 RPM

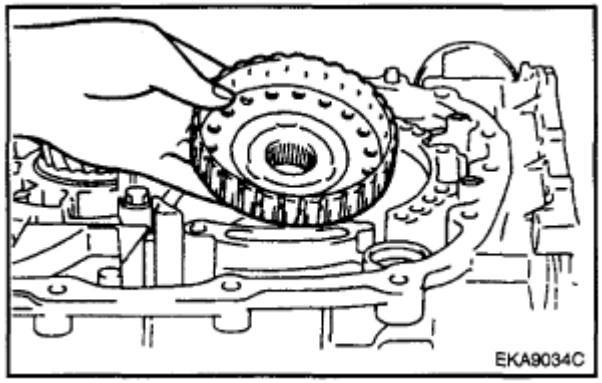


Fig. 90: Scan Tool Display - Shift Position

5. Are "INPUT & OUTPUT SPEED SENSOR" within specifications?

   YES

   - Go to "**COMPONENT INSPECTION**" procedure.

   NO

- Check for electrical noise of circuit in INPUT & OUTPUT SPEED SENSOR or replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

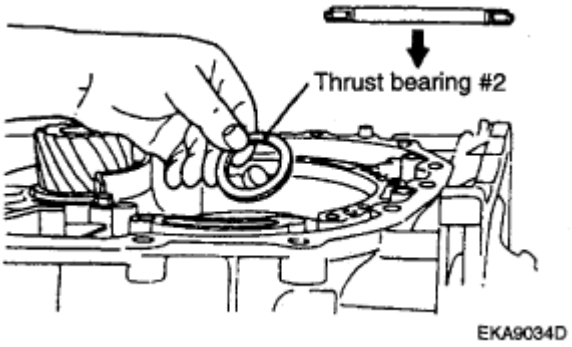


Fig. 91: Identifying LR, UD And 2ND Port

1. Connect Oil pressure gauge to "UD" and "OD" port.
2. Engine "ON".
3. Drive a car with gear position 3 in fail mode.
4. Compare it with reference data as below.

   Specification : Refer to **DTC P0731**.

5. Is oil pressure value within specification?

   YES

   - Repair AUTO TRANSAXLE (Clutch or Brake) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

   NO

   - Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0731**.

DTC P0734 GEAR 4 INCORRECT RATIO

COMPONENT LOCATION

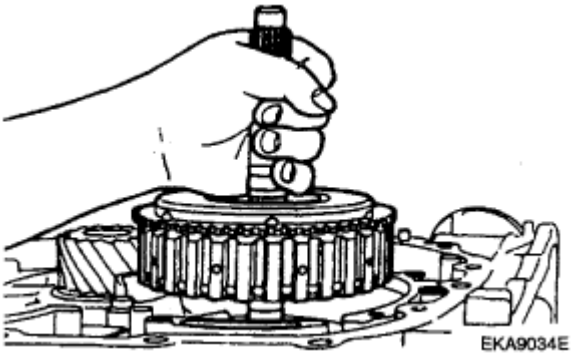


Fig. 92: Identifying 2nd Brake And OD Clutch

GENERAL DESCRIPTION

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 4th gear ratio, while the transaxle is engaged in the 4th gear. For example, if the output speed is 1,000 rpm and the 4th gear ratio is 0.712, then the input speed is 0,712 rpm.

DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 4th gear ratio, while the transaxle is engaged in 4th gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfunctioning rather than an electrical issue.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• 4th gear incorrect ratio	• Faulty Input speed sensor • Faulty output speed sensor • Faulty OD clutch or 2nd brake
Enable Conditions	• Engine speed > 450rpm • Output speed > 900rpm • Shift stage 4th. gear • Input speed > 0rpm • A/T oil temp sensor voltage < 4.5V • Voltage of Battery > 10V • TRANSAXLE RANGE SWITCH is normal and above 2sec is passed from IG ON	
Threshold value	• | Input speed - output speed x 4th gear ratio | > or = 200rpm	
Diagnostic Time	• More than 1sec	
	• Locked into 3rd gear.	

Fail Safe	(If diagnosis code P0734 is output four times, the transaxle is locked into 3rd gear)	

SIGNAL WAVEFORM

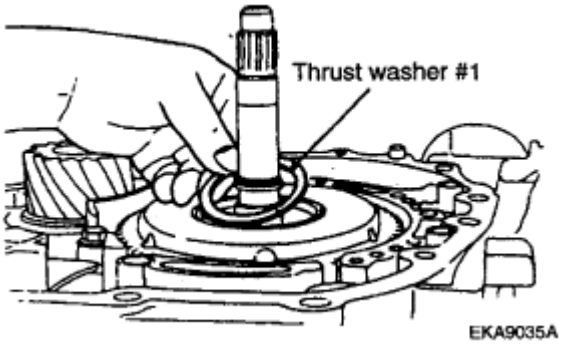


Fig. 93: Signal Waveform

Monitor Scantool Data

* It Is Difficult To "Stall Test" In 4Th Gear, Therefore Go To "**Signal Circuit Inspection**" Procedure.
Operating Element Of Each Shifting Range

SHIFTING RANGE CHART

	Ud/C	Od/C	Rev/C	2Nd/B	Lr/B	Owc
P					•	
R			•		•	
N					•	
D1	•				•	o
D2	•			•		
D3	•	•				
D4		•		•		

* Low & Reverse Brake Is Released When The Vehicle Speed Is Over 7Km/H (5 Mph).

Signal Circuit Inspection

1. Connect Scantool.
2. Engine "On".
3. Monitor The "Input & Output Speed Sensor" Parameter On The Scantool.
4. Accelerate The Engine Speed Until About 2000 Rpm In The 4Th Gear.

   Specification : Input Speed - (Output Speed X Gear Ratio) < or = 200 Rpm

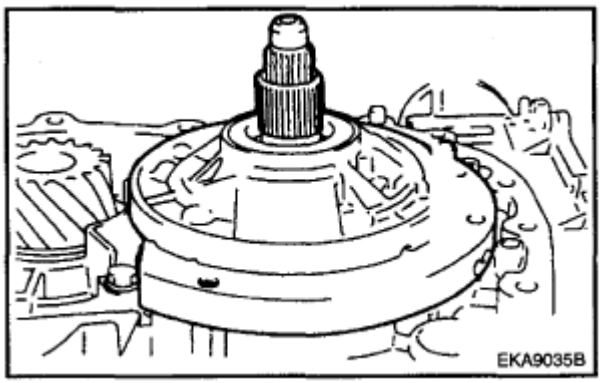


Fig. 94: Scan Tool Display - Shift Position Gear

5. Are "INPUT & OUTPUT SPEED SENSOR" within specifications?

   YES

   - Go to "**COMPONENT INSPECTION**" procedure.

   NO

   - Check for electrical noise of circuit in INPUT & OUTPUT SPEED SENSOR or replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

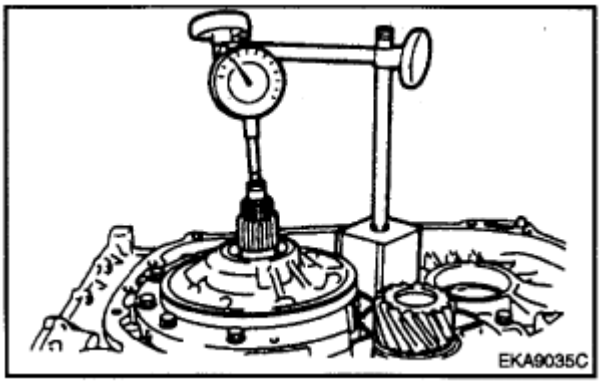


Fig. 95: Identifying Oil Pressure Gauge OD And 2Nd Port

1. Connect Oil pressure gauge to "OD" and "2nd" port.
2. Engine "ON".
3. Drive the car with gear position "4".
4. Compare it with reference data as below.

Specification : Refer to **DTC P0731**.

5. Is oil pressure value within specification?

YES

- Repair AUTO TRANSAXLE (Clutch or Brake) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0731**.

DTC P0741 TORQUE CONVERTER CLUTCH CIRCUIT - STUCK OFF

GENERAL DESCRIPTION

The PCM/TCM controls the locking and unlocking of the Torque Converter Clutch (or Damper Clutch), to the input shaft of the transmission, by applying hydraulic pressure. The main purpose of T/C clutch control is to save fuel by decreasing the hydraulic load inside the T/C. The PCM/TCM outputs duty pulses to control the Damper Clutch Control Solenoid Valve (DCCSV) and hydraulic pressure is applied to the DC according to the DCC duty ratio value. When the duty ratio is high, high pressure is applied and the Damper Clutch is locked. The normal operating range of the Damper Clutch Control duty ratio value is from 30%(unlocked) to 85% (locked).

DTC DESCRIPTION

The PCM/TCM increases the duty ratio to engage the Damper Clutch by monitoring slip rpms (difference value between engine speed and turbine speed). To decrease the slip of the Damper Clutch, the PCM/TCM increases the duty ratio by applying more hyraulic pressure. When slip rpm does not drop under some value with 100% duty ratio, the PCM/TCM determines that the Torque Converter Clutch is stuck OFF and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Stuck "OFF"	*TORQUE CONVERTER (DAMPER) CLUTCH : TCC • Faulty TCC or oil pressure system • Faulty TCC solenoid valve
Enable Conditions	• Always	
Threshold value	• TCC duty > 0% or TCC abnormal slip counter s 4	
Diagnostic Time	• 1 second	

Fail Safe	• Damper clutch abnormal system (If diagnosis code P0741 is output four times, TORQUE CONVERTER (DAMPER) CLUTCH is not controlled by PCM/TCM)	• Faulty body control valve • Faulty PCM/TCM

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Select "D RANGE" and drive vehicle.
4. Monitor the "TORQUE CONVERTER (DAMPER) CLUTCH" parameter on the scantool.

   Specification : TCC SLIP < 160RPM (In condition that TCC SOL. DUTY > 40%)

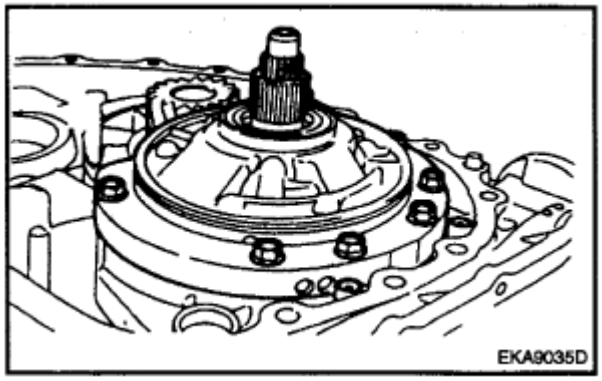


Fig. 96: Scan Tool Display - TCC Solenoid Duty

5. Are "TCC SOLENOID DUTY and TCC SLIP" within specifications?

   YES

   - Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

   NO

   - Go to "**COMPONENT INSPECTION**" procedure.

COMPONENT INSPECTION

1. CHECK TORQUE CONVERTER CLUTCH SOLENOID VALVE
    1. Connect scantool to data link connector (DLC).
    2. Ignition "ON" & Engine "OFF".
    3. Select A/T Solenoid valve Actuator test and Operate Actuator test.
    4. Can you hear operating sound for using TCC SOLENOID VALVE Actuator Testing Function?

    YES

    - Go to "2CHECK OIL PRESSURE" as below.

    NO

    - Replace "TCC SOLENOID VALVE" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.
2. CHECK OIL PRESSURE

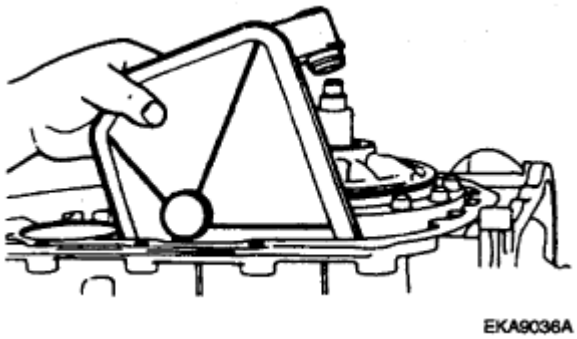


Fig. 97: Identifying DA And DR Port

1. Connect oil pressure gauge to "DA" ports.
2. Engine "ON".
3. After connecting Scantool and monitor the "TCC SOLENOID VALVE DUTY" parameter on the scantool data list.
4. Operate vehicle with 3rd or 4th gear and operate the "TCC SOLENOID VALVE DUTY" more than 85%.
5. Is oil pressure value within specification?

YES

- Repair TORQUE CONVERTER CLUTCH (REPLACE Torque Converter) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Replace A/T assembly (possible to BODY CONTROL VALVE faulty) as necessary and Go

to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO

- System performing to specification at this time.

DTC P0742 TORQUE CONVERTER CLUTCH CIRCUIT - STUCK ON

GENERAL DESCRIPTION

Refer to **DTC P0741**.

DTC DESCRIPTION

The TCM increases the duty ratio to engage the Damper Clutch by monitoring the slip rpms (difference value between engine speed and turbine speed). If a very small amount of slip rpm is maintained though the TCM applies 0% duty ratio value, then the TCM determines that the Torque Converter Clutch is stuck ON and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Stuck "ON"	* TORQUE CONVERTER (DAMPER) CLUTCH : TCC • Faulty TCC or oil pressure system • Faulty TCC solenoid valve • Faulty body control valve • Faulty TCM (PCM)
Enable Conditions	• Throttle position > 20% • Output speed > 500 rpm • Manifold air pressure > 60 kPa • A/T range switch D,SP • TCC stuck on delay timer > 5 sees	
Threshold value		

	• | Engine rpm - Input speed sensor rpm | < or = 20 rpm	
Diagnostic Time	• More than 1sec	
Fail Safe	• Damper clutch abnormal system (If diagnosis code P0742 is output four times, TORQUE CONVERTER (DAMPER) CLUTCH is not controlled by PCM/TCM)	

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Select "D RANGE" and drive vehicle.
4. Monitor the "TORQUE CONVERTER (DAMPER) CLUTCH" parameter on the scantool.

   Specification : TCC SLIP > 5RPM

Fig. 98: Scan Tool Display - TCC Solenoid Duty

5. Is TCC SLIP" within specifications?

   YES

   - Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

   NO

   - Go to "**COMPONENT INSPECTION**" procedure.

COMPONENT INSPECTION

1. CHECK TORQUE CONVERTER CLUTCH SOLENOID VALVE
    1. Connect scantool to data link connector (DLC).
    2. Ignition "ON" & Engine "OFF".
    3. Select A/T solenoid valve actuator test and operate actuator test.
    4. Can you hear operating sound for using TCC SOLENOID VALVE actuator testing function?

    YES

    - Go to "2CHECK OIL PRESSURE" as below.

    NO

    - Repair or replace as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.
2. CHECK OIL PRESSURE

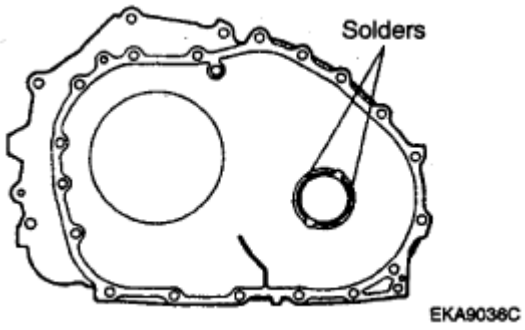


Fig. 99: Identifying DA And DR Port

1. Connect oil pressure gauge to "DR" ports.
2. Ignition "ON" & Engine "OFF".
3. After connecting scantool and monitor the "TCC SOLENOID VALVE DUTY" parameter on the scantool data list.
4. Select 1st gear and accelerate Engine speed to 2500 rpm.
5. Measure oil pressure.
6. Is oil pressure value within specification?

    Specification : approx. 598.2034KPa (6.1 kg/cm^2)

    YES

    - Repair TORQUE CONVERTER CLUTCH (REPLACE Torque Converter) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Replace A/T assembly (possible to BODY CONTROL VALVE faulty) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0741**.

DTC P0743 TORQUE CONVERTER CLUTCH CIRCUIT - ELECTRICAL

COMPONENT LOCATION

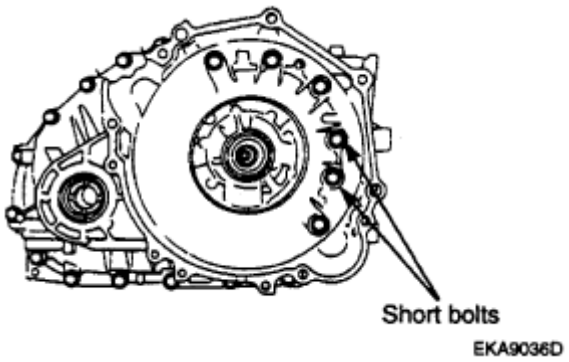


Fig. 100: Identifying Torque Converter Clutch Circuit Components

GENERAL DESCRIPTION

The PCM/TCM controls the locking and unlocking of the Torque Converter Clutch (or Damper Clutch), to the input shaft of the transmission, by applying hydraulic pressure. The main purpose of T/C clutch control is to save fuel by decreasing the hydraulic load inside the T/C. The PCM/TCM outputs duty pulses to control the Damper Clutch Control Solenoid Valve (DCCSV) and hydraulic pressure is applied to the DC according to the DCC duty ratio value. When the duty ratio is high, high pressure is applied and the Damper Clutch is locked. The normal operating range of the Damper Clutch Control duty ratio value is from 30%(unlocked) to 85% (locked).

DTC DESCRIPTION

The PCM/TCM checks the Damper Clutch Control Signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected) the PCM/TCM judges that DCCSV circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy		TORQUE CONVERTER

	• Check voltage range	(DAMPER) CLUTCH : TCC • Open or short in circuit • Faulty TCC SOLENOID VALVE • Faulty PCM/TCM
Enable Conditions	• 16V > Voltage Battery > 11V • In gear state (no gear shifting) 500msec is passed from turn on the relay • A/T Relay = ON • Engine state = RUN	
Threshold value	• Feedback voltage from DCC control solenoid > vb-2V and DCC control duty is 100%	
Diagnostic Time	• More than 2 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F (-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64HZ

    KM series : 35Hz
- Internal resistance :
  - 2.7~3.4ohms (68°F or 20°C)
- Surge voltage : 56 V

SIGNAL WAVEFORM

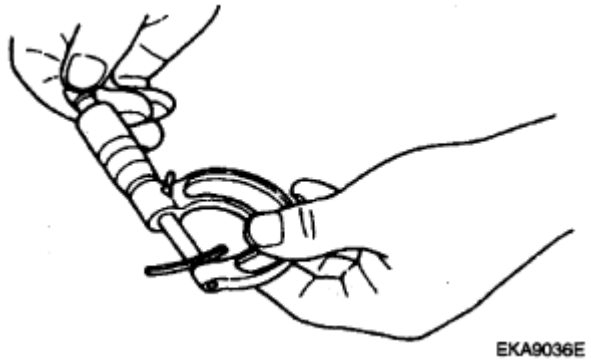


Fig. 101: Signal Waveform Graph

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC)
2. Engine "ON".
3. Monitor the "TCC SOL. VALVE" parameter on the scantool
4. Select "D RANGE" and Operate "TCC SOLENOID DUTY" more than 40%.

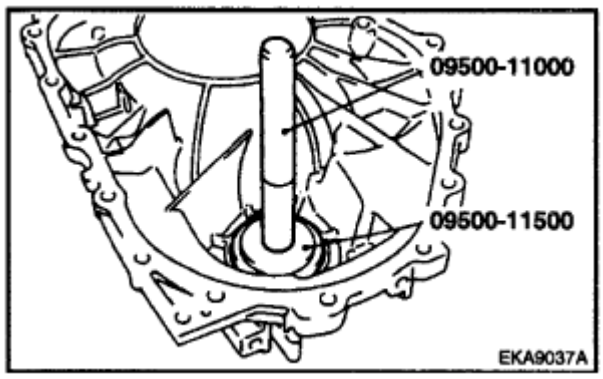


Fig. 102: Scan Tool Display - TCC Solenoid Duty

5. Does "TCC SOLENOID DUTY" follow the reference data?

YES

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   - Repair as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

   NO

   - Go to "**POWER SUPPLY CIRCUIT INSPECTION**" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. Measure voltage between terminal "5" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF --> ON

   Specification: 12V is measured only for approx. 0.5sec

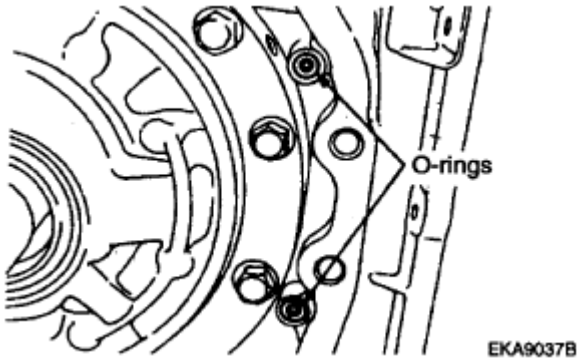


Fig. 103: Measuring Voltage Between Terminal 5 Of Sensor Harness Connector And Chassis Ground

4. Is voltage within specifications?

   YES

   - Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

   NO

   - Check that A/T-20A fuse in engine room junction is installed or not blown.

- Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection.
    1. Ignition "OFF".
    2. Disconnect "A/T SOLENOID VALVE" connector and "PCM/TCM" connector.
    3. Measure resistance between terminal "9" of the ATM SOLENOID VALVE harness connector and terminal "43" of the TCM harness connector.

       Specification: approx. 0 ohms

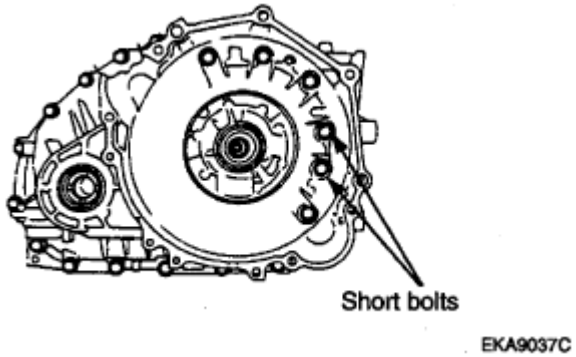


Fig. 104: Measuring Resistance Between Terminal "9 Of ATM Solenoid Valve Harness Connector And Terminal

    4. Is resistance within specifications?

       YES

       - Go to "2Check signal circuit short inspection" procedure.

       NO

       - Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.
2. Check signal circuit short inspection
    1. Ignition "OFF".
    2. Disconnect "A/T SOLENOID VALVE" connector and "PCM/TCM" connector.
    3. Measure resistance between terminal "9" of the ATM SOLENOID VALVE harness and chassis ground.

       Specification: Infinite

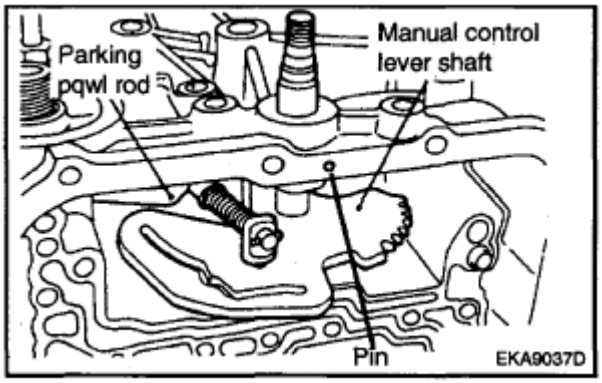


Fig. 105: Measuring Resistance Between Terminal 9 Of ATM Solenoid Valve Harness And Chassis Ground

4. Is resistance within specifications?

YES

- Go to "**COMPONENT INSPECTION**" procedure.

NO

- Check for short to ground in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VALVE
    1. Ignition "OFF".
    2. Disconnect "A/T SOLENOID VALVE" connector.
    3. Measure resistance between terminal "5" and terminal "9" of the ATM SOLENOID VALVE harness connector.

    Specification: Approximately 2.7~3.4 ohms [20°C (68°F)]

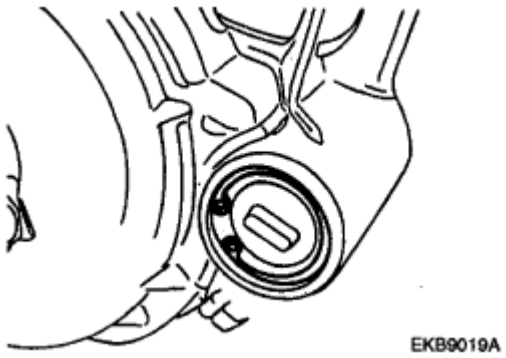


Fig. 106: Measuring Resistance Between Terminal 5 And Terminal 9 Of ATM Solenoid Valve Harness Connector

4. Is resistance within specification?

YES

- Go to "2CHECK PCM/TCM" as below.

NO

- Replace TCC SOLENOID VALVE as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. CHECK PCM/TCM
   1. Connect scantool to data link connector (DLC).
   2. Ignition "ON" & Engine "OFF".
   3. Select A/T solenoid valve actuator test and operate actuator test.
   4. Can you hear operating sound for TCC SOLENOID VALVE actuator testing function?

YES

- Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Replace PCM/TCM as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle Speed 0mph (0km/h)
5. Throttle position sensor < 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic. Trouble Codes (DTCs)" mode.
2. Using a scantool, Clean DTC.

3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO

- System performing to specification at this time.

DTC P0748 PRESSURE CONTROL SOLENOID VALVE A - ELECTRICAL

COMPONENT LOCATION

Refer to **DTC P0743**.

GENERAL DESCRIPTION

Variable Force Solenoid (Linear Solenoid) : With the duty control which uses higher frequency (600Hz), instead of the existing PWM type which adapts low frequency (60Hz) to control, spool valve can be controlled precisely.

In PWM control, the amount of oil flow is determined by the duration of "ON" signal among continuously repeated ON/OFF signals.

In VFS, the amount is decided by how widely spool valve open the passage of going through.

DTC DESCRIPTION

The TCM checks the VFS Control Signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected), the TCM judges that the Low and Reverse control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty VFS SOLENOID VALVE • Faulty PCM/TCM
Enable Conditions	• 16V > Voltage Battery > 11V • In gear state (no gear shifting) 500msec is passed from turn on the relay • A/T Relay = ON	

	• Engine state = RUN	
Threshold value	• Out of available voltage range	
Diagnostic Time	• More than 2 seconds	
Fail Safe	• Locked in 3rd gear (Control relay off)	

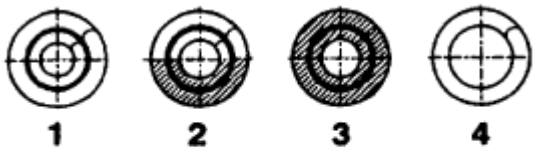
SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F (-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64HZ
  - VFS : 600 ± 20Hz

    KM series : 35Hz
- Internal resistance :
  - 2.7~3.4ohms (68°F or 20°C) - LR, 2ND, UD, OD, DCC
  - 4.35±0.35ohms (68°F or 20°C) - VFS
- Surge voltage : 56 V (except VFS)

SIGNAL WAVEFORM



EKA9037E

Fig. 107: Signal Waveform Graph

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "PRESS CONTROL SOL. VALVE" parameter on the scantool.
4. Shift gear at each position.

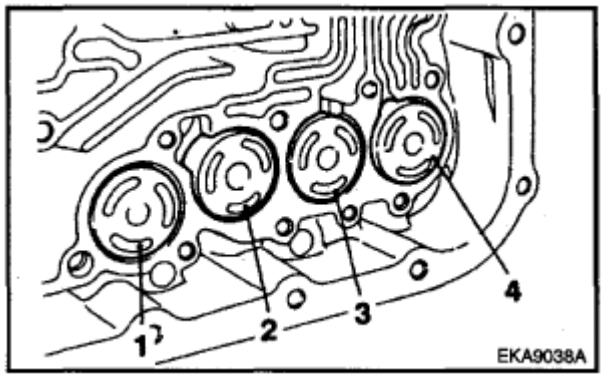


Fig. 108: Scan Tool Display - Pressure Solenoid

5. Does "PRESS CONTROL SOL DUTY" follow the reference data?

   YES

   - Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

   NO

   - Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0743**.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. Measure voltage between terminal "7" of the sensor harness connector and chassis ground.
3. Measure voltage of VFS solenoid valve.

   Specification: Approx.12V

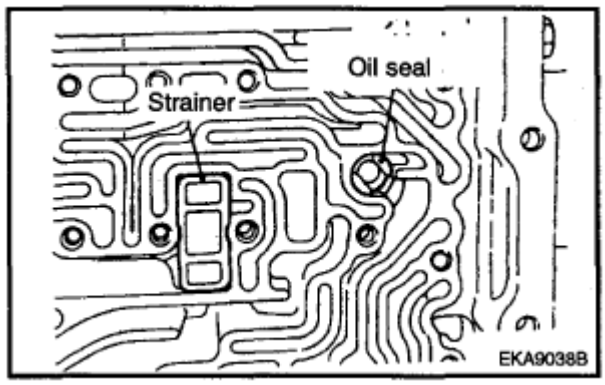


Fig. 109: Measuring Voltage Between Terminal 7 Of Sensor Harness Connector And Chassis Ground

4. Is voltage within specifications?

YES

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

NO

- Check that A/T-20A fuse in engine room junction is installed or not blown.
- Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection.
    1. Ignition "OFF".
    2. Disconnect "A/T SOLENOID VALVE" connector and "PCM/TCM" connector.
    3. Measure resistance between terminal "7" of the ATM SOLENOID VALVE harness connector and terminal "75" of the PCM/TCM harness connector.

       Specification: approx. 0 ohms

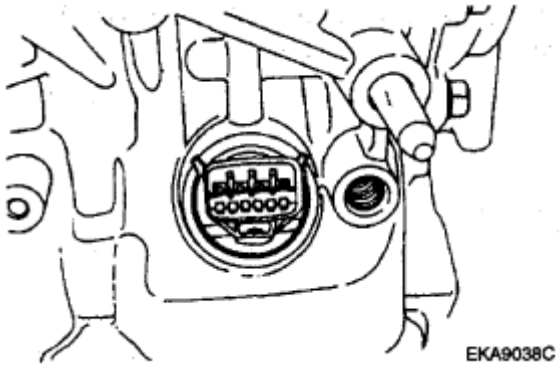


Fig. 110: Measuring Resistance Between Terminal 7 Of ATM Solenoid Valve Harness Connector And Terminal 75 Of PCM/TCM Harness

4. Is resistance within specifications?

   YES

   - Go to "2Check signal circuit short inspection" procedure.

   NO

   - Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. Check signal circuit short inspection
   1. Ignition "OFF".
   2. Disconnect "A/T SOLENOID VALVE" connector and "PCM/TCM" connector
   3. Measure resistance between terminal "7" of the ATM SOLENOID VALVE harness and chassis ground.

      Specification: Infinite

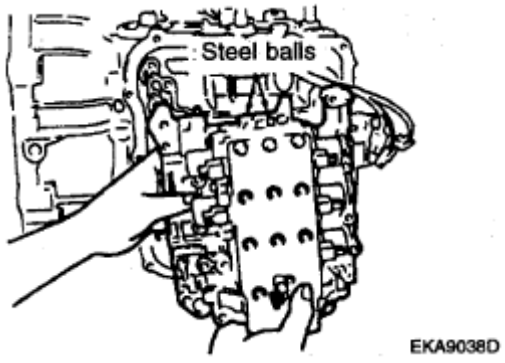


Fig. 111: Measuring Resistance Between Terminal 7 Of ATM Solenoid Valve Harness And Chassis Ground

4. Is resistance within specifications?

YES

- Go to "**COMPONENT INSPECTION**" procedure.

NO

- Check for short to ground in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VALVE
   1. Ignition "OFF".
   2. Disconnect "A/T SOLENOID VALVE" connector.
   3. Measure resistance between terminal "7" and terminal "8" of the ATM SOLENOID VALVE harness connector.

      Specification: Approximately 4.35±0.35ohms [20°C (68°F)]

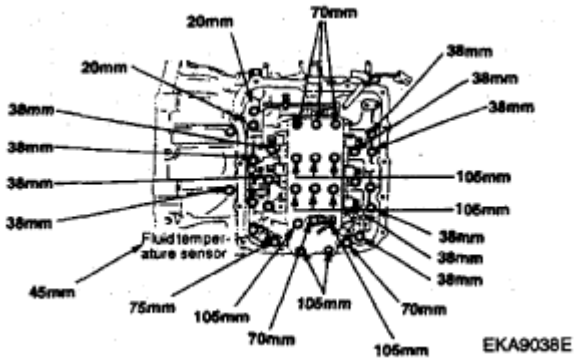


Fig. 112: Measuring Resistance Between Terminal 7 And Terminal 8 Of ATM Solenoid Valve Harness Connector

   4. Is resistance within specification?

YES

- Go to "2CHECK PCM/TCM" as below.

NO

- Replace "PRESS CONTROL SOL VALVE (VFS)" as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. CHECK PCM/TCM

1. Connect scantool to data link connector (DLC).
2. Ignition "ON" & Engine "OFF".
3. Select A/T Solenoid valve Actuator test and Operate Actuator test.
4. Can you hear operating sound for "PRESS CONTROL SOL VALVE (VFS)" Actuator testing function?

YES

- Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Replace PCM/TCM as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle Speed 0mph (0km/h)
5. Throttle position sensor < 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0743**.

DTC P0750 SHIFT CONTROL SOLENOID VALVE A CIRCUIT MALFUNCTION

COMPONENT LOCATION

Refer to **DTC P0743**.

GENERAL DESCRIPTION

The Automatic transmission changes the gear position of the transmission by utilizing a combination of clutches and brakes, which are controlled by solenoid valves. This automatic transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and RED (Reduction Brake, only for 5 speed transmissions). The LR Brake is engaged in the 1st gear and reverse gear positions.

DTC DESCRIPTION

The TCM checks the Low and Reverse Control Signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected), the TCM judges that the Low and Reverse control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty LR SOLENOID VALVE • Faulty PCM/TCM
Enable Conditions	• 16V > Voltage Battery >11V • In gear state (no gear shifting) 500msec is passed from turn on the relay • A/T Relay = ON • Engine state = RUN	
Threshold value	• Out of available voltage range	
Diagnostic Time	• More than 2 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SPECIFICATION

Refer to **DTC P0743**.

SIGNAL WAVEFORM

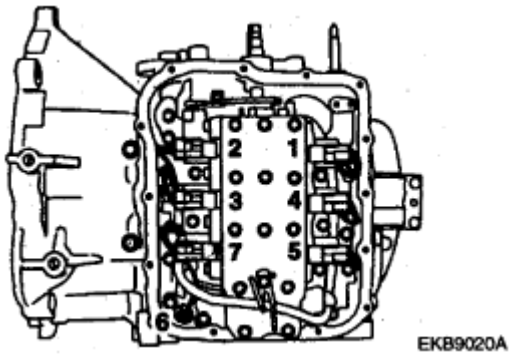


Fig. 113: Signal Waveform Graph

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).

2. Engine "ON".
3. Monitor the "LR SOL. VALVE" parameter on the scantool.
4. Shift gear at each position.

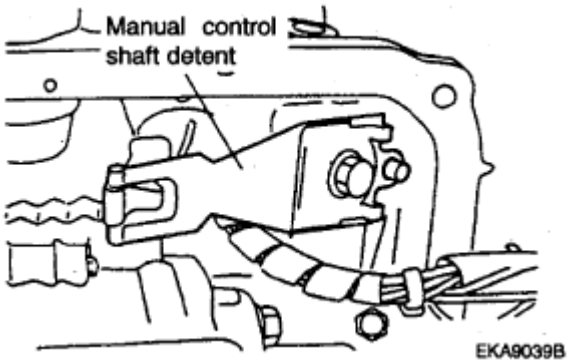


Fig. 114: Scan Tool Display - Pressure Solenoid

5. Does "LR SOLENOID DUTY" follow the reference data?

YES

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0743**.

POWER SUPPLY CIRCUIT INSPECTION

Refer to **DTC P0743**.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection
    1. Ignition "OFF".
    2. Disconnect "A/T SOLENOID VALVE" connector and "PCM/TCM" connector.
    3. Measure resistance between terminal "11" of the ATM SOLENOID VALVE harness connector and terminal "22" of the PCM/TCM harness connector.

Specification: approx. 0 ohms

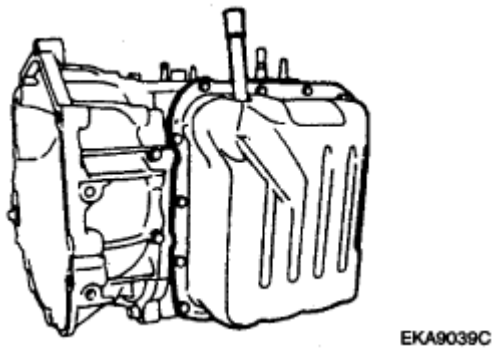


Fig. 115: Measuring Resistance Between Terminal 11 Of ATM Solenoid Valve Harness Connector And Terminal

4. Is resistance within specifications?

   YES

   - Go to "2Check signal circuit short inspection" procedure.

   NO

   - Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. Check signal circuit short inspection
   1. Ignition "OFF".
   2. Disconnect "AH" SOLENOID VALVE" connector and "PCM/TCM" connector.
   3. Measure resistance between terminal "11" of the ATM SOLENOID VALVE harness and chassis ground.

      Specification: Infinite

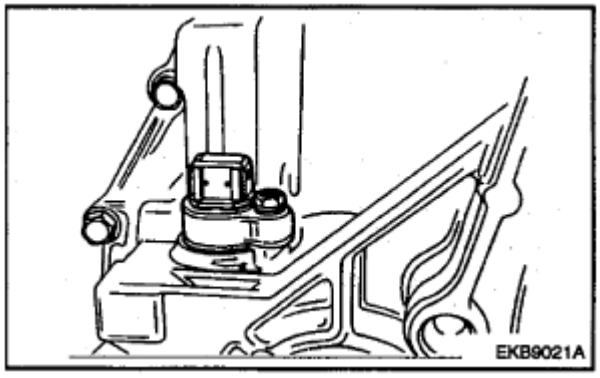


Fig. 116: Measuring Resistance Between Terminal 11 Of ATM Solenoid Valve Harness And

Chassis Ground

4. Is resistance within specifications?

YES

- Go to "**COMPONENT INSPECTION**" procedure.

NO

- Check for short to ground in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VALVE
    1. Ignition "OFF".
    2. Disconnect "A/T SOLENOID VALVE" connector.
    3. Measure resistance between terminal "5" and terminal "11" of the ATM SOLENOID VALVE harness connector.

    Specification: Approximately 2.7~3.4 ohms [20°C (68°F)]

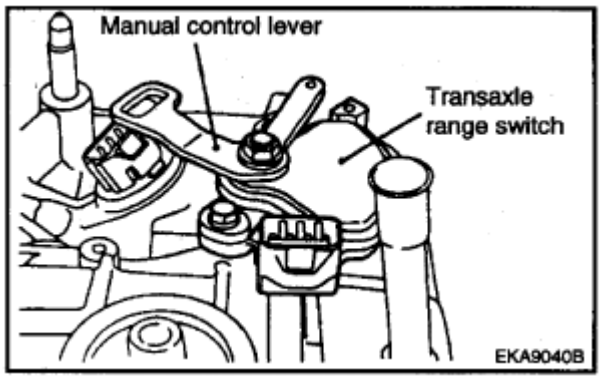


Fig. 117: Measuring Resistance Between Terminal 5 And Terminal 11 Of ATM Solenoid Valve Harness Connector

4. Is resistance within specification?

YES

- Go to "2CHECK PCM/TCM" as below.

NO

- Replace LR SOLENOID VALVE as necessary and go to "**VERIFICATION OF VEHICLE**

REPAIR" procedure.

2. CHECK PCM/TCM
    1. Connect scantool to data link connector (DLC).
    2. Ignition "ON" & Engine "OFF".
    3. Select A/T solenoid valve actuator test and operate actuator test.
    4. Can you hear operating sound for LR SOLENOID VALVE actuator testing function?

    YES

    - Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

    NO

    - Replace PCM/TCM as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle Speed 0mph (0km/h)
5. Throttle position sensor < IV
6. IDLE SWITCH ON
7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0743**.

DTC P0755 SHIFT CONTROL SOLENOID VALVE B CIRCUIT MALFUNCTION

COMPONENT LOCATION

Refer to **DTC P0743**.

GENERAL DESCRIPTION

The Automatic transmission changes the gear position of the transmission by utilizing a combination of clutches and brakes, which are controlled by solenoid valves. This automatic transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and RED (Reduction Brake, only for 5 speed transmissions).

The UD Clutch is engaged in the 1st gear, 2nd gear and 3rd gear positions.

DTC DESCRIPTION

The TCM checks the Under Drive Clutch Control Signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected), the TCM judges that Under Drive control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty UD SOLENOID VALVE • Faulty PCM/TCM
Enable Conditions	• 16V > Voltage Battery >11V • In gear state (no gear shifting) 500msec is passed from turn on the relay • A/T Relay = ON • Engine state = RUN	
Threshold value	• Out of available voltage range	
Diagnostic Time	• More than 2 seconds	
Fail Safe	• Locked in 3rd gear. (Control relay off)	

SPECIFICATION

Refer to **DTC P0743**.

SIGNAL WAVEFORM

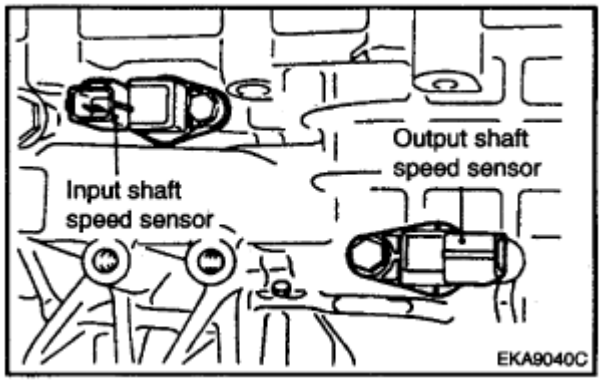


Fig. 118: Signal Waveform Graph

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "UD SOL. VALVE" parameter on the scantool.
4. Shift gear at each position.

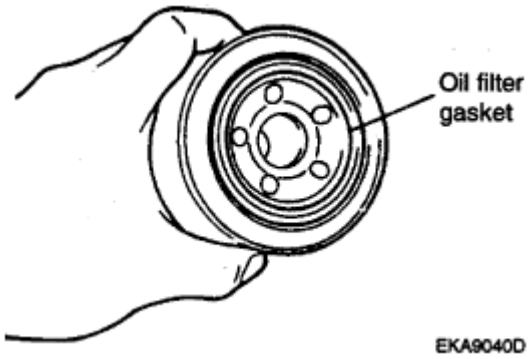


Fig. 119: Scan Tool Display - UD Solenoid Duty

5. Does "UD SOLENOID DUTY" follow the reference data?

YES

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0743**.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. Measure voltage between terminal "6" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF --> ON.

Specification: 12V is measured only for approx. 0.5sec

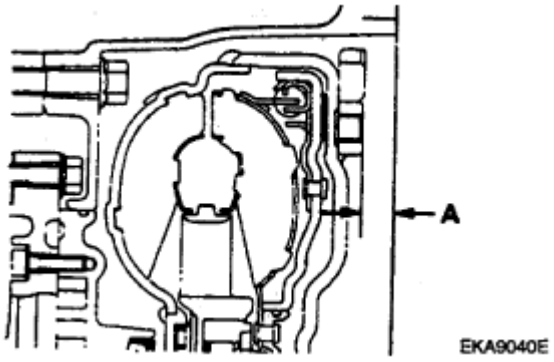


Fig. 120: Measuring Voltage Between Terminal 6 Of Sensor Harness Connector And Chassis Ground

4. Is voltage within specifications?

   YES

   - Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

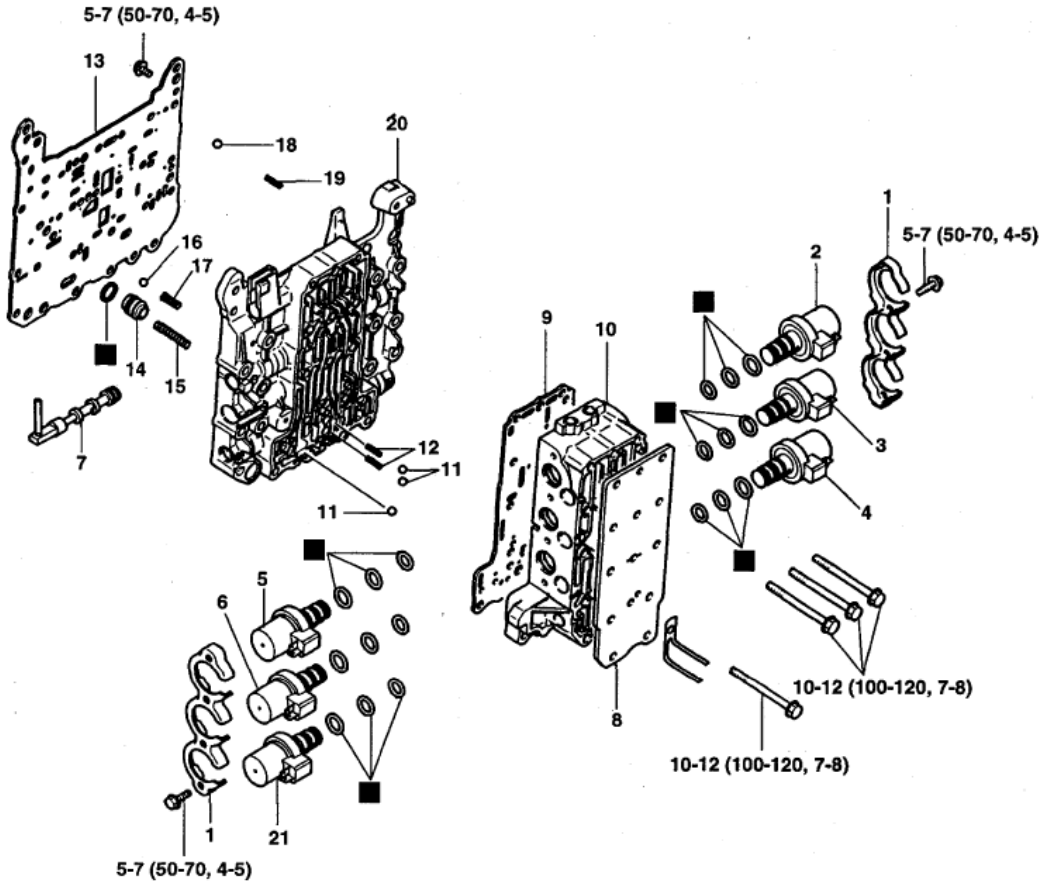
   NO

   - Check that A/T-20A fuse in engine room junction is installed or not blown.
   - Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection
   1. Ignition "OFF".
   2. Disconnect "A/T SOLENOID VALVE" connector and "PCM/TCM" connector.
   3. Measure resistance between terminal "3" of the ATM SOLENOID VALVE harness connector and terminal "3" of the PCM/TCM harness connector.

      Specification: approx. 0 ohms



<Disassembly steps>

1. Solenoid valve support
2. UD clutch solenoid valve
3. 2nd brake solenoid valve
4. Damper clutch control solenoid valve
5. OD clutch solenoid valve
6. L & R brake solenoid valve
7. Manual valve
8. Cover
9. Plate
10. Outside valve body assembly
11. Still ball (Orifice check ball)
12. Spring
13. Plate
14. Damping valve
15. Damping valve spring
16. Steel ball (line relief)
17. Spring
18. Steel ball (orifice check ball)
19. Spring
20. Inside valve body assembly
21. Reduction solenoid valve (F5A51 Model)

TORQUE : Nm (kg·cm, lb·ft)

EKA9041B

Fig. 121: Measuring Resistance Between Terminal 3 Of ATM Solenoid Valve Harness Connector And Terminal

4. Is resistance within specifications?

YES

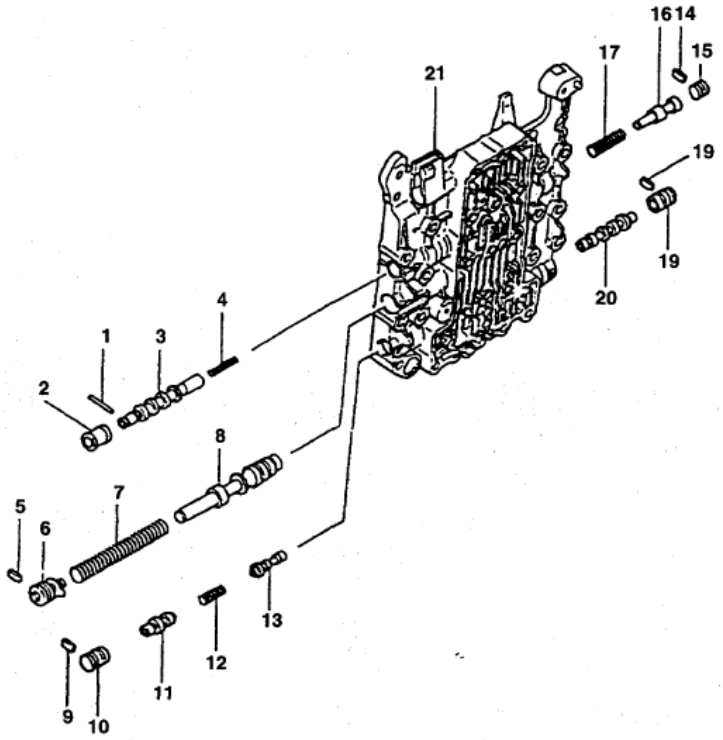
- Go to "2Check signal circuit short inspection" procedure.

NO

- Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. Check signal circuit short inspection
    1. Ignition "OFF".
    2. Disconnect "A/T SOLENOID VALVE" connector and "PCM/TCM" connector.
    3. Measure resistance between terminal "3" of the ATM SOLENOID VALVE harness and chassis ground.

       Specification: Infinite



<Disassembly>

1. Roller
2. Damper clutch control valve sleeve
3. Damper clutch control valve
4. Damper clutch control valve spring
5. Plate
6. Screw
7. Regulator valve spring
8. Regulator valve
9. Plate
10. Fail-safe valve A sleeve
11. Fail-safe valve A2
12. Fail-safe valve A sprint
13. Fail-safe valve A1
14. Plate
15. Plug
16. Torque converter valve
17. Torque converter valve spring
18. Plate
19. Fail-safe valve B sleeve
20. Fail-safe valve
21. Inside valve body

EKA9041A

Fig. 122: Measuring Resistance Between Terminal 3 Of ATM Solenoid Valve Harness And Chassis Ground

4. Is resistance within specifications?

YES

- Go to "**COMPONENT INSPECTION**" procedure.

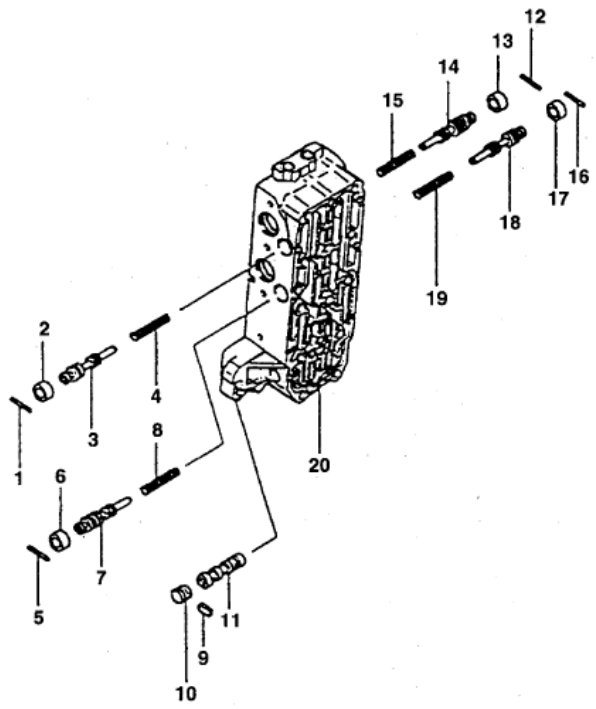
NO

- Check for short to ground in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VALVE
    1. Ignition "OFF".
    2. Disconnect "A/T SOLENOID VALVE" connector.
    3. Measure resistance between terminal "3" and terminal "6" of the ATM SOLENOID VALVE harness connector.

    Specification: Approximately 2.7~3.4 ohms [20°C (68°F)]



<Disassembly>

1. Roller
2. Overdrive pressure control valve sleeve
3. Overdrive pressure control valve
4. Overdrive pressure control valve spring
5. Roller
6. Low-reverse pressure control valve sleeve
7. Low-reverse pressure control valve
8. Low-reverse pressure control valve spring
9. Plate
10. Plug
11. Switching valve
12. Roller
13. Underdrive pressure control valve sleeve
14. Underdrive pressure control valve
15. Underdrive pressure control valve spring
16. Roller
17. Second pressure control valve sleeve
18. Second pressure control valve
19. Second pressure control valve spring
20. Outside valve body

EKA9042A

Fig. 123: Measuring Resistance Between Terminal 3 And Terminal 6 Of ATM Solenoid Valve Harness Connector

4. Is resistance within specification?

YES

- Go to "2CHECK PCM/TCM" as below.

NO

- Replace UD SOLENOID VALVE as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. CHECK PCM/TCM
    1. Connect scantool to data link connector (DLC).
    2. Ignition "ON" & Engine "OFF".
    3. Select ATM solenoid valve actuator test and operate actuator test.
    4. Can you hear operating sound for UD SOLENOID VALVE actuator testing function?

    YES

    - Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

    NO

    - Replace PCM/TCM as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle Speed 0mph (0km/h)
5. Throttle position sensor < 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0743**.

DTC P0760 SHIFT CONTROL SOLENOID VALVE C CIRCUIT MALFUNCTION

COMPONENT LOCATION

Refer to **DTC P0743**.

GENERAL DESCRIPTION

The Automatic transmission changes the gear position of the transmission by utilizing a combination of clutches and brakes, which are controlled by solenoid valves. This automatic transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and RED (Reduction Brake, only for 5 speed transmissions).

The 2ND Brake is engaged in the 2nd gear and 4th gear positions.

DTC DESCRIPTION

The TCM checks the Under Drive Clutch Control Signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored, (For example, high voltage is detected when low voltage is expected or low voltage is detected when high voltage is expected) the TCM judges that 2nd Brake drive control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

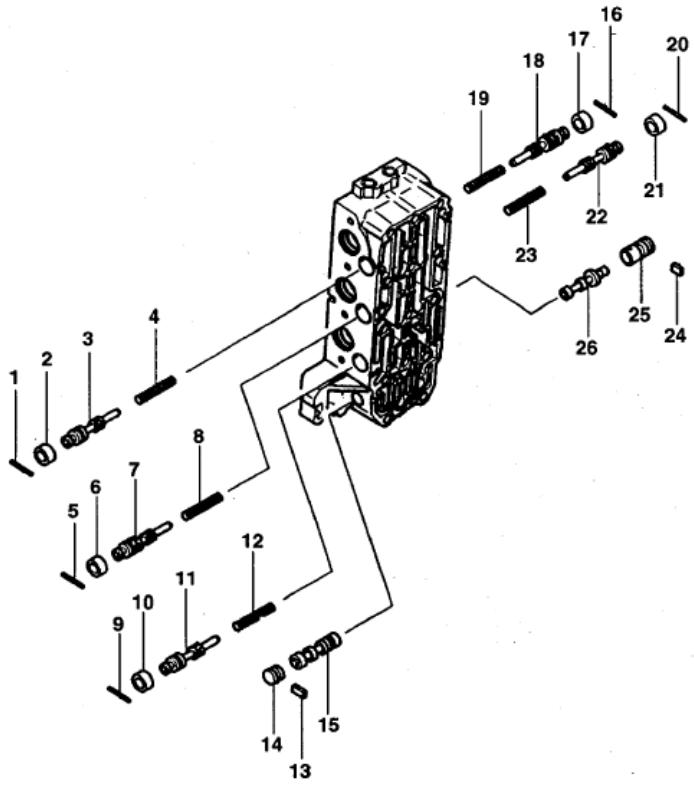
DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty 2ND SOLENOID VALVE • Faulty PCM/TCM
Enable Conditions	• 16V > Voltage Battery > 11V • In gear state (no gear shifting) 500msec is passed from turn on the relay • A/T Relay = ON • Engine state = RUN	
Threshold value	• Out of available voltage range	
Diagnostic Time	• More than 2 seconds	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SPECIFICATION

Refer to **DTC P0743**.

SIGNAL WAVEFORM



<Disassembly steps>

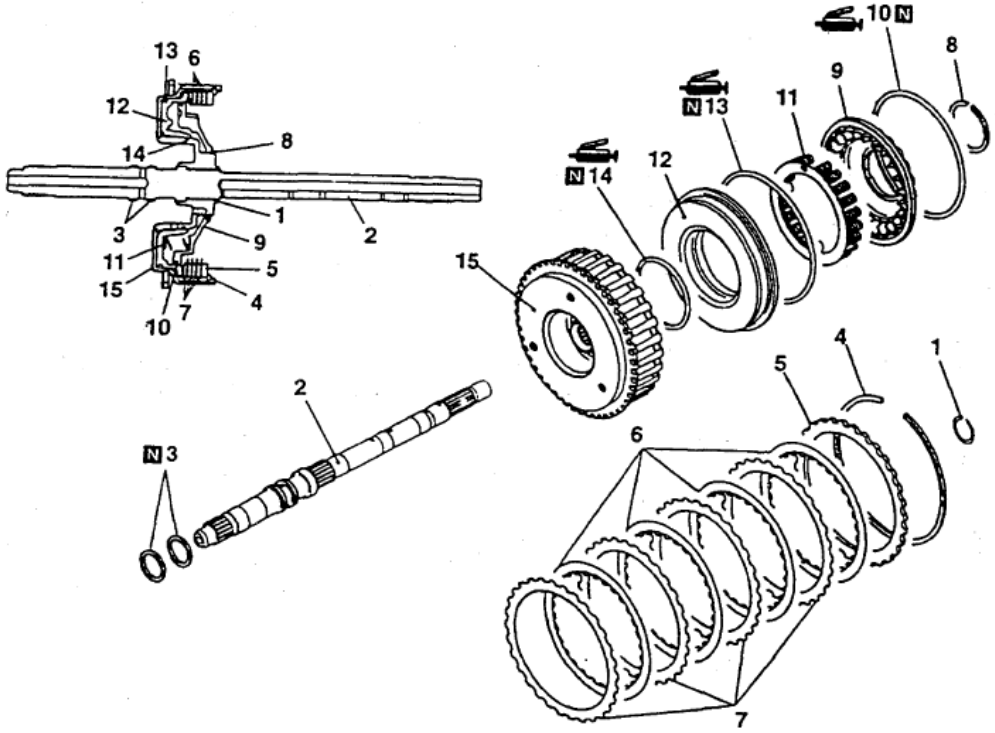
1. Roller
2. Overdrive pressure control valve sleeve
3. Overdrive pressure control valve
4. Overdrive pressure control valve spring
5. Roller
6. Low-reverse pressure control valve sleeve
7. Low-reverse pressure control valve
8. Low-reverse pressure control valve spring
9. Roller
10. Reduction pressure control valve sleeve
11. Reduction pressure control valve
12. Reduction pressure control valve spring
13. Plate
14. Plug
15. Switching valve
16. Roller
17. Underdrive pressure control valve sleeve
18. Underdrive pressure control valve
19. Underdrive pressure control valve spring
20. Roller
21. Second pressure control valve sleeve
22. Second pressure control valve
23. Second pressure control valve spring
24. Plate
25. Fail safe valve "C" sleeve
26. Fail safe valve "C"

EKB9022A

Fig. 124: Signal Waveform Graph

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "2nd SOL. VALVE" parameter on the scantool.
4. Shift gear at each position.



Disassembly steps
1. Snap ring
2. Input shaft
3. Seal ring
4. Snap ring
5. Clutch reaction plate
6. Clutch disc
7. Clutch plate
8. Snap ring
9. Spring retainer
10. D-ring
11. Return spring
12. Underdrive clutch piston
13. D-ring
14. D-ring
15. Underdrive clutch retainer

EKA9043A

Fig. 125: Scan Tool Display - 2nd Solenoid Duty

5. Does "2nd SOLENOID DUTY" follow the reference data?

YES

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0743**.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. Measure voltage between terminal "6" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF --> ON.

   Specification: 12V is measured only for approx. 0.5sec

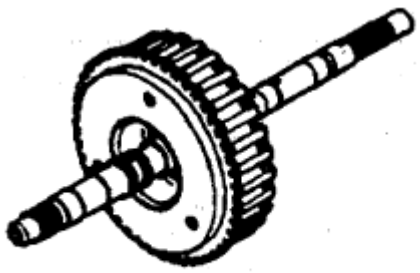


Fig. 126: Measuring Voltage Between Terminal 6 Of Sensor Harness Connector And Chassis Ground

4. Is voltage within specifications?

   YES

   - Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

   NO

   - Check that A/T-20A fuse in engine room junction is installed or not blown.
   - Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection
   1. Ignition "OFF".
   2. Disconnect "A/T SOLENOID VALVE" connector and "PCM" connector.

3. Measure resistance between terminal "4" of the ATM SOLENOID VALVE harness connector and terminal "45" of the PCM/TCM harness connector.

   Specification: approx. 0 ohms

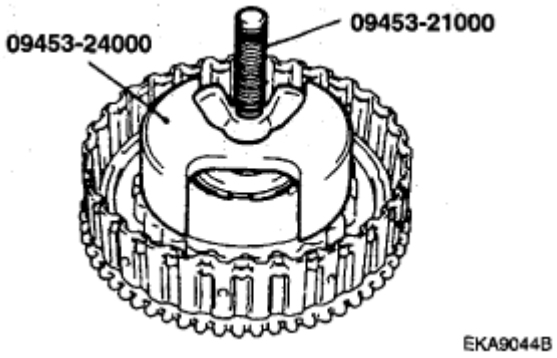


Fig. 127: Measuring Resistance Between Terminal 4 Of ATM Solenoid Valve Harness Connector And Terminal

4. Is resistance within specifications?

   YES

   - Go to "2Check signal circuit short inspection" procedure.

   NO

   - Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. Check signal circuit short inspection
   1. Ignition "OFF".
   2. Disconnect "A/T SOLENOID VALVE" connector and "PCM/TCM" connector.
   3. Measure resistance between terminal "4" of the ATM SOLENOID VALVE harness and chassis ground.

      Specification: Infinite

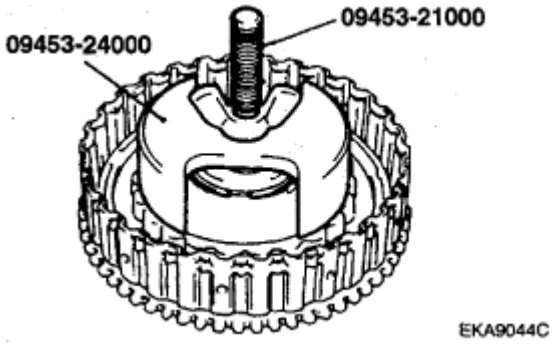


Fig. 128: Measuring Resistance Between Terminal 4 Of ATM Solenoid Valve Harness And Chassis Ground

4. Is resistance within specifications?

   YES

   - Go to "**COMPONENT INSPECTION**" procedure.

   NO

   - Check for short to ground in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VALVE
   1. Ignition "OFF".
   2. Disconnect "A/T SOLENOID VALVE" connector.
   3. Measure resistance between terminal "4" and terminal "6" of the ATM SOLENOID VALVE harness connector.

      Specification: Approximately 2.7~3.4 ohms [20°C (68°F)]

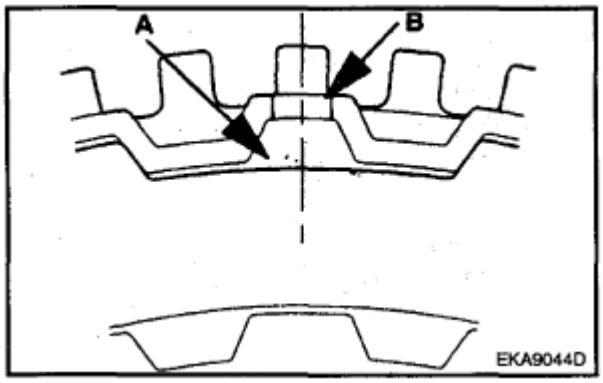


Fig. 129: Measuring Resistance Between Terminal 4 And Terminal 6 Of ATM Solenoid Valve

Harness Connector

4. Is resistance within specification?

YES

- Go to "2CHECK PCM/TCM" as below.

NO

- Replace 2nd SOLENOID VALVE as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. CHECK PCM/TCM
   1. Connect scantool to data link connector (DLC).
   2. Ignition "ON" & Engine "OFF".
   3. Select A/T solenoid valve actuator test and operate actuator test.
   4. Can you hear operating sound for 2nd SOLENOID VALVE actuator testing function?

YES

- Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Replace PCM/TCM as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle Speed 0mph (0km/h)
5. Throttle position sensor < 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0743**.

DTC P0765 SHIFT CONTROL SOLENOID VALVE D CIRCUIT MALFUNCTION

COMPONENT LOCATION

Refer to **DTC P0743**.

GENERAL DESCRIPTION

The Automatic transmission changes the gear position of the transmission by utilizing a combination of clutches and brakes, which are controlled by solenoid valves. This automatic transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and RED (Reduction Brake, only for 5 speed transmissions).

The OD Clutch is engaged in the 3rd gear and 4th gear positions.

DTC DESCRIPTION

The TCM checks the Under Drive Clutch Control Signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected or low voltage is detected when high voltage is expected), the TCM judges that the OVER DRIVE CLUTCH drive control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty OD SOLENOID VALVE • Faulty PCM/TCM
Enable Conditions	• 16V > Voltage Battery > 11V • In gear state (no gear shifting) 500msec is passed from turn on the relay • A/T Relay = ON • Engine state = RUN	
Threshold value	• Out of available voltage range	
Diagnostic Time	• More than 2 seconds	
Fail Safe	• Locked in 3rd gear. (Control relay off)	

SPECIFICATION

Refer to **DTC P0743**.

SIGNAL WAVEFORM

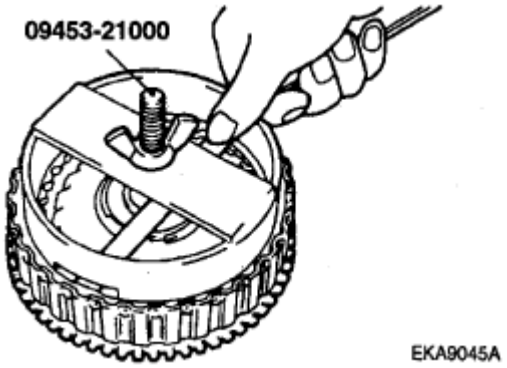


Fig. 130: Signal Waveform Graph

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "OD SOL. VALVE" parameter on the scantool.
4. Shift gear at each position.

   Specification: 2nd gear --> 0.0%, 3nd gear --> 100%

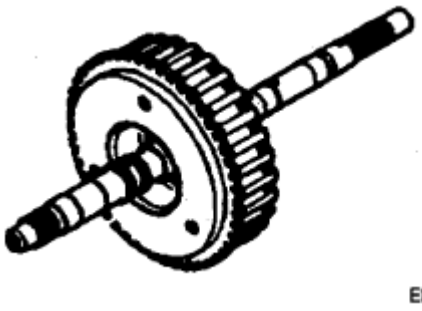


Fig. 131: Scan Tool Display - OD Solenoid Duty

5. Does "OD SOLENOID DUTY" follow the reference data?

   YES

   - Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

   NO

   - Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0743**.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. Measure voltage between terminal "6" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF --> ON.

   Specification: 12V is measured only for approx. 0.5sec

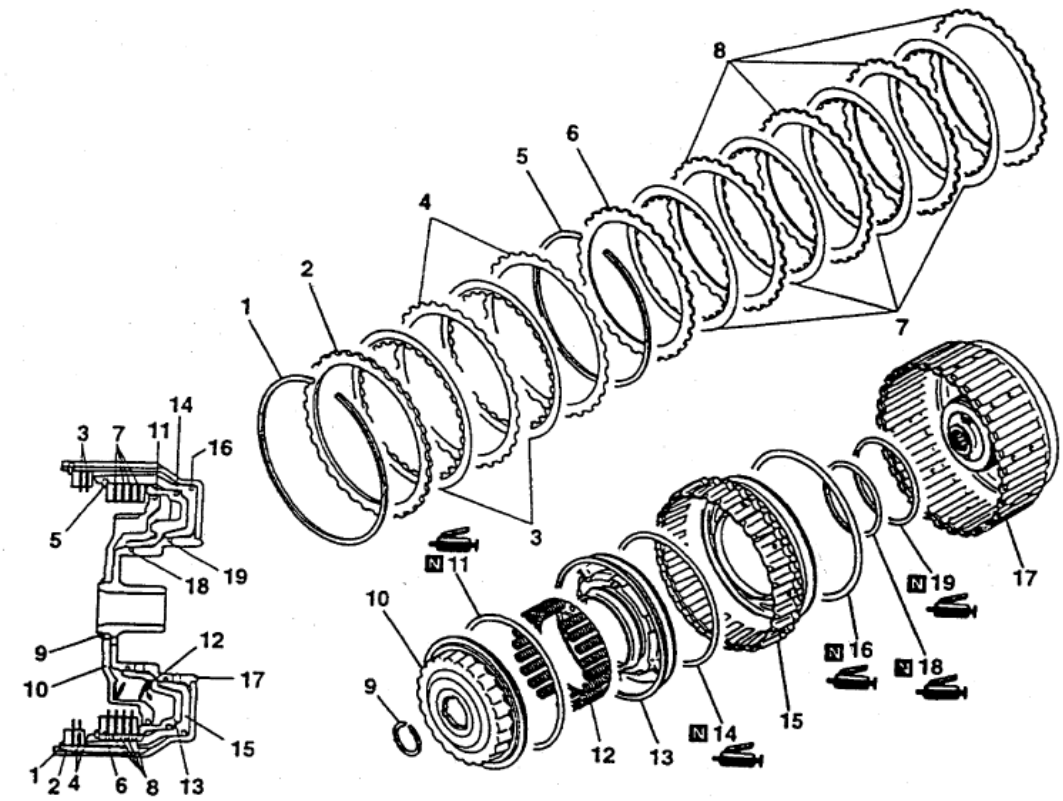


Fig. 132: Measuring Voltage Between Terminal 6 Of Sensor Harness Connector And Chassis Ground

4. Is voltage within specifications?

YES

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

NO

- Check that A/T-20A fuse in engine room junction is installed or not blown.
- Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection
    1. Ignition "OFF"..
    2. Disconnect "A/T SOLENOID VALVE" connector and "PCM/TCM" connector.
    3. Measure resistance between terminal "12" of the ATM SOLENOID VALVE harness connector and terminal "42" of the PCM/TCM harness connector.

       Specification: approx. 0 ohms

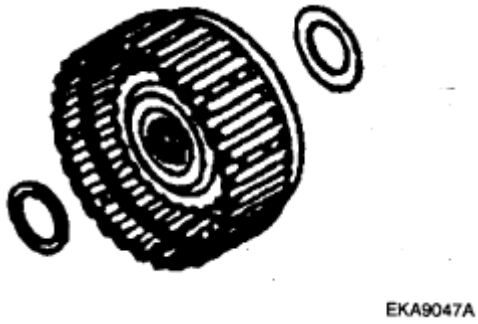


Fig. 133: Measuring Resistance Between Terminal 12 Of ATM Solenoid Valve Harness Connector And Terminal

    4. Is resistance within specifications?

       YES

       - Go to "2Check signal circuit short inspection" procedure.

       NO

       - Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.
2. Check signal circuit short inspection
    1. Ignition "OFF".
    2. Disconnect "A/T SOLENOID VALVE" connector and "PCM/TCM" connector.
    3. Measure resistance between terminal "12" of the ATM SOLENOID VALVE harness and chassis ground.

       Specification: Infinite

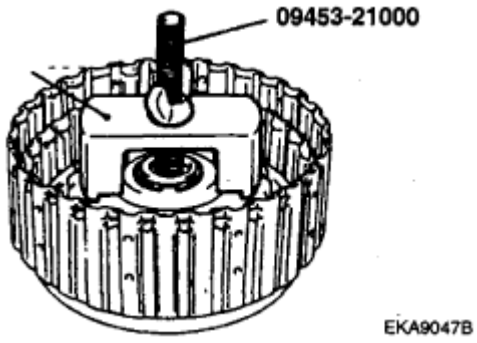


Fig. 134: Measuring Resistance Between Terminal 12 Of ATM Solenoid Valve Harness And Chassis Ground

4. Is resistance within specifications?

YES

- Go to "**COMPONENT INSPECTION**" procedure.

NO

- Check for short to ground in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VALVE
    1. Ignition "OFF".
    2. Disconnect "A/T SOLENOID VALVE" connector.
    3. Measure resistance between terminal "6" and terminal "12" of the ATM SOLENOID VALVE harness connector.

    Specification: Approximately 2.7~3.4 ohms [20°C (68°F)]

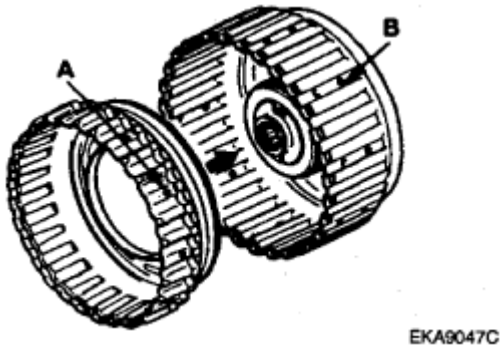


Fig. 135: Measuring Resistance Between Terminal 6 And Terminal 12 Of ATM Solenoid Valve Harness Connector

4. Is resistance within specification?

YES

- Go to "2CHECK PCM/TCM" as below.

NO

- Replace OD SOLENOID VALVE as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. CHECK PCM/TCM
   1. Connect scantool to data link connector (DLC).
   2. Ignition "ON" & Engine "OFF".
   3. Select A/T solenoid valve actuator test and operate actuator test.
   4. Can you hear operating sound for OD SOLENOID VALVE actuator testing function?

YES

- Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Replace PCM/TCM and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle Speed 0mph (0km/h)
5. Throttle position sensor < 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0743**.

DTC P0885 A/T RELAY CIRCUIT MALFUNCTION

COMPONENT LOCATION

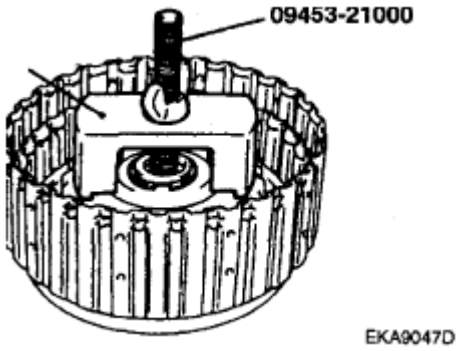


Fig. 136: Identifying A/T Relay

GENERAL DESCRIPTION

The HIVEC Automatic Transmission supplies the power to the solenoid valves by way of a control relay. When the TCM sets the relay to ON, the relay operates and the battery power is supplied to all the solenoid valves. When the TCM sets the relay to OFF, all solenoid valve power is shut off and the transmission is held in the 3rd gear position. (Fail Safe Mode

DTC DESCRIPTION

The TCM checks the A/T control relay signal by monitoring the control signal. If, after the ignition key is turned on, an unexpected voltage value, which is quite a bit lower than battery voltage is detected, the TCM sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty A/T control relay • Faulty PCM/TCM
Enable Conditions	• 16V > Voltage Battery > 11V • Time after TCM turns on > 0.5sec	
Threshold value	• 16V > Voltage Battery >11V	
Diagnostic Time	• more than 1 second	
Fail Safe	• Locked in 3rd gear, (control relay off)	

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Ignition "ON" & Engine "OFF".

3. Monitor the "A/T CON. RELAY VOLT" parameter on the scantool.

   Specification : Approx. B+

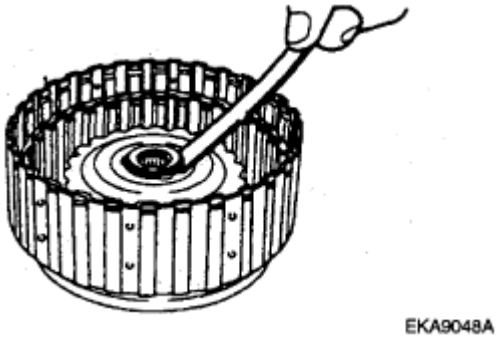


Fig. 137: Scan Tool Display - A/T Con. Relay Volt

4. Is A/T RELAY VOLT within specifications?

   YES

   - Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

   NO

   - Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   - Repair as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

   NO

   - Go to "**POWER CIRCUIT INSPECTION**" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "A/T CONTROL RELAY" connector.
3. Measure the voltage between terminal "1" of the "A/T CONTROL RELAY" harness connector and chassis ground.

   Specification : Approx. B+

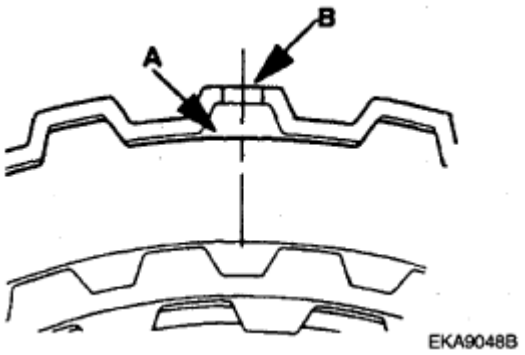


Fig. 138: Measuring Voltage Between Terminal 1 Of A/T Control Relay" Harness Connector And Chassis Ground

4. Is voltage within specifications?

   YES

   - Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

   NO

   - Check that A/T-20A Fuse in engine room junction is installed or not blown.
   - Check for Open in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

SIGNAL CIRCUIT INSPECTION

1. CHECK A/T control relay harness
   1. Ignition "OFF".
   2. Disconnect the "A/T CONTROL RELAY" connector.
   3. Measure the voltage between terminal "4" of the "A/T CONTROL RELAY" harness connector and chassis ground.
   4. Engine OFF --> ON.

      Specification: 12V is measured only for approx. 0.5sec

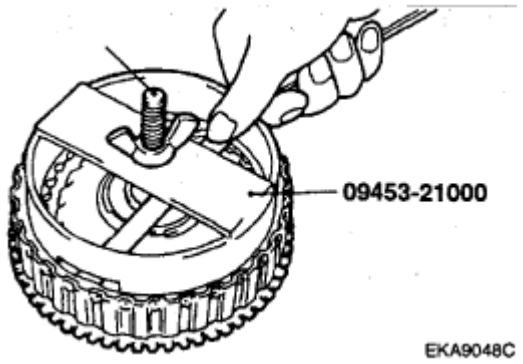


Fig. 139: Measuring Voltage Between Terminal 4 Of A/T Control Relay Harness Connector And Chassis Ground

5. Is voltage within specifications?

   YES

   - Go to "2Check Supplying Power to solenoid valve" procedure.

   NO

   - Check for open in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.
   - If signal circuit is OK, Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. CHECK Supplying Power to solenoid valve harness
   1. Ignition "OFF".
   2. Disconnect the "A/T CONTROL RELAY" and PCM/TCM connector.
   3. Measure the resistance between terminal "3" of the "A/T CONTROL RELAY" harness connector and terminal "60" of the PCM/TCM harness connector.

      Specification : Approx. 0 ohms

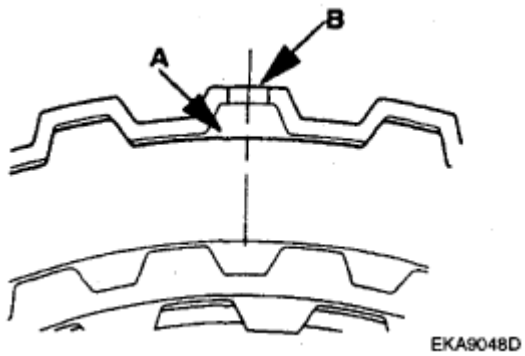


Fig. 140: Measuring Resistance Between Terminal 3 Of A/T Control Relay Harness Connector And Terminal

4. Is resistance within specifications?

YES

- Go to "**GROUND CIRCUIT INSPECTION**" procedure.

NO

- Check that A/T-15A Fuse in engine room junction is installed or not blown.
- Check for open in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Connect the "A/T CONTROL RELAY" connector.
3. Measure the resistance between terminal "2" of the "A/T CONTROL RELAY" harness connector and chassis ground.

   Specification : Approx. 0 ohms

Fig. 141: Measuring Resistance Between Terminal 2 Of A/T Control Relay Harness Connector And Chassis Ground

4. Is resistance within specifications?

YES

- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO

- Replace FRONT AREA MODULE and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO

- System performing to specification at this time.

DTC P0890 AT RELAY - LOW CIRCUIT

COMPONENT LOCATION

Refer to **DTC P0885**.

GENERAL DESCRIPTION

Refer to **DTC P0885**.

DTC DESCRIPTION

Refer to **DTC P0885**.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty A/T control relay • Faulty PCM/TCM
Enable Conditions	• 16V > Voltage Battery > 11V • Time after TCM turns on > 0.5sec	
Threshold value	• Feedback Voltage < or = 0.5V	

Diagnostic Time	• more than 1 second	
Fail Safe	• Locked in 3rd gear.(control relay off)	

MONITOR SCANTOOL DATA

Refer to **DTC P0885**.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0885**.

POWER SUPPLY CIRCUIT INSPECTION

Refer to **DTC P0885**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0885**.

GROUND CIRCUIT INSPECTION

Refer to **DTC P0885**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0885**.

DTC P0891 AT RELAY - OPEN CIRCUIT

COMPONENT LOCATION

Refer to **DTC P0885**.

GENERAL DESCRIPTION

Refer to **DTC P0885**.

DTC DESCRIPTION

Refer to **DTC P0885**.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit

Enable Conditions	• 16V > Voltage Battery > 11V • Time after TCM turns on > 0.5sec	• Faulty A/T control relay • Faulty PCM/TCM
Threshold value	• Feedback Voltage > or = 20V	
Diagnostic Time	• more than 1 second	
Fail Safe	• Locked in 3rd gear, (control relay off)	

MONITOR SCANTOOL DATA

Refer to **DTC P0885**.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0885**.

POWER SUPPLY CIRCUIT INSPECTION

Refer to **DTC P0885**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0885**.

GROUND CIRCUIT INSPECTION

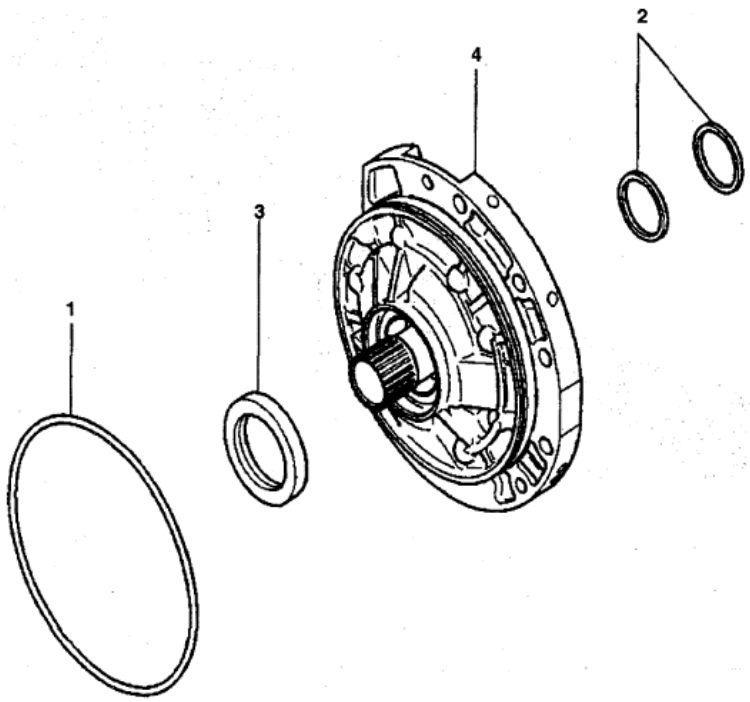
Refer to **DTC P0885**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0885**.

AUTOMATIC TRANSAXLE

COMPONENTS (1)

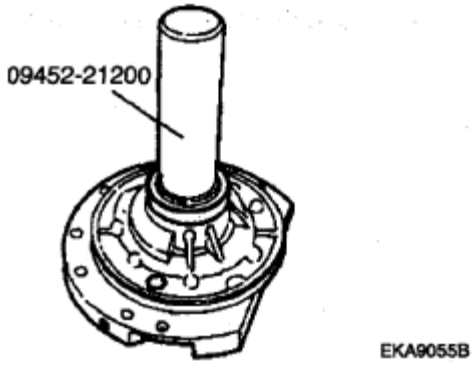


<Disassembly steps>
1.O-ring
2.Seal ring
3.Oil seal
4.Oil pump ass'y

EKA9055A

Fig. 142: Identifying Automatic Transaxle Components (1 Of 4)

COMPONENTS (2)



EKA9055B

Fig. 143: Identifying Automatic Transaxle Components (2 Of 4)

COMPONENTS (3)

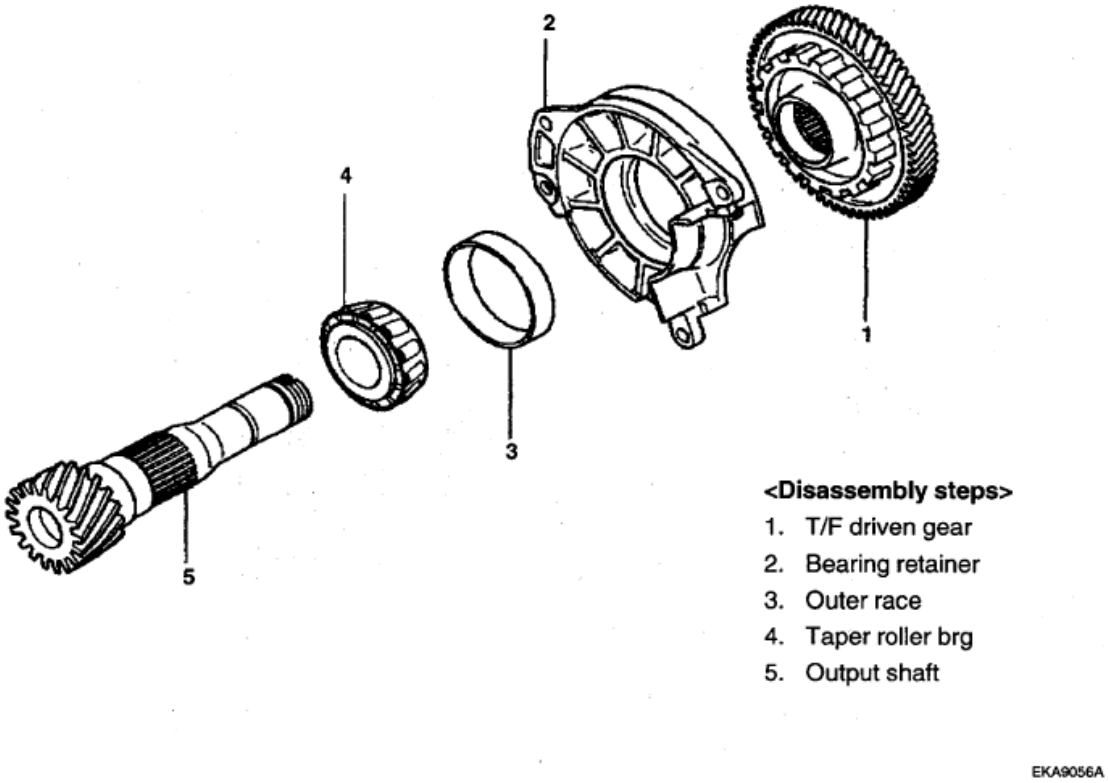


Fig. 144: Identifying Automatic Transaxle Components (3 Of 4)

COMPONENTS (4)

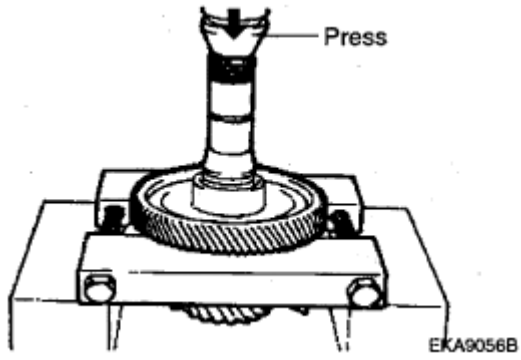


Fig. 145: Identifying Automatic Transaxle Components (4 Of 4)

REMOVAL

CAUTION:
- **Use a cover not to damage the vehicle surface.**
- **Disconnect connectors carefully not to be damaged.**

NOTE:
- **Mark wires or hoses for identification.**

1. Remove the inter cooler and the engine cover, (see **ENGINE MECHANICAL SYSTEM (G6EA-GSL 2.7)**)
2. Remove the battery (A).

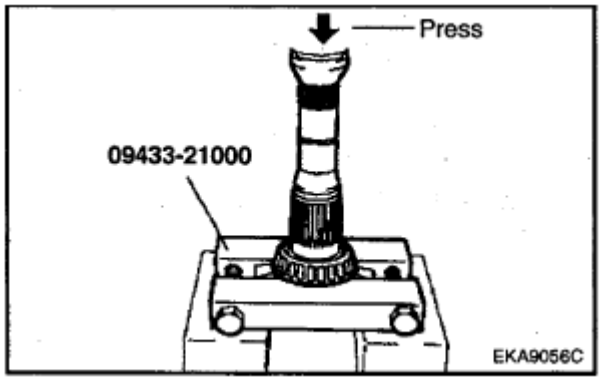


Fig. 146: Identifying Battery

3. Disconnect the AFS connector (A).

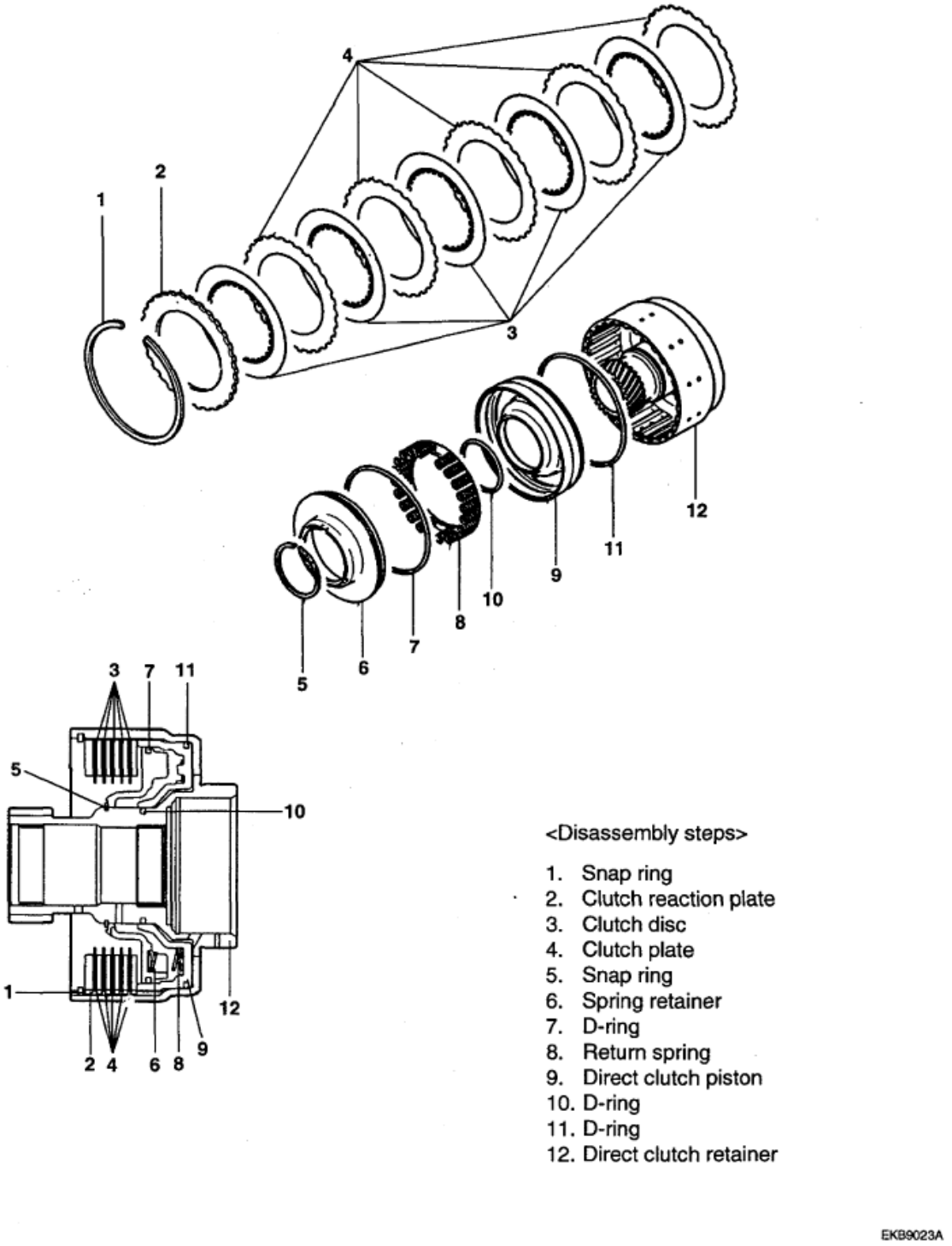


Fig. 147: Locating AFS Connector

4. Loosen the clamp bolt (A) and disconnect the air cleaner hose (B).

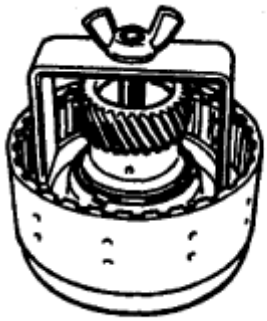
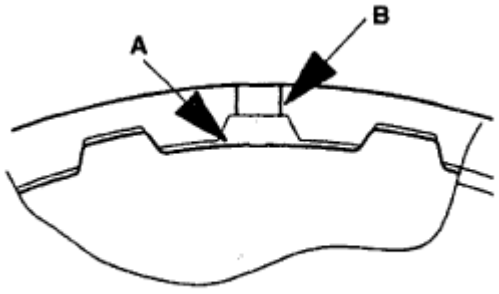

EKB9024A

Fig. 148: Identifying Air Cleaner Hose And Clamp Bolt

5. Remove the air cleaner upper cover (B) by removing the clips (A).



EKB9024B

Fig. 149: Locating Air Cleaner Upper Cover And Clips

6. Remove the air cleaner lower part (A) by removing the two mounting bolts.

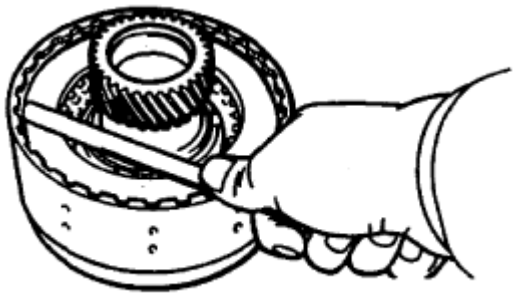
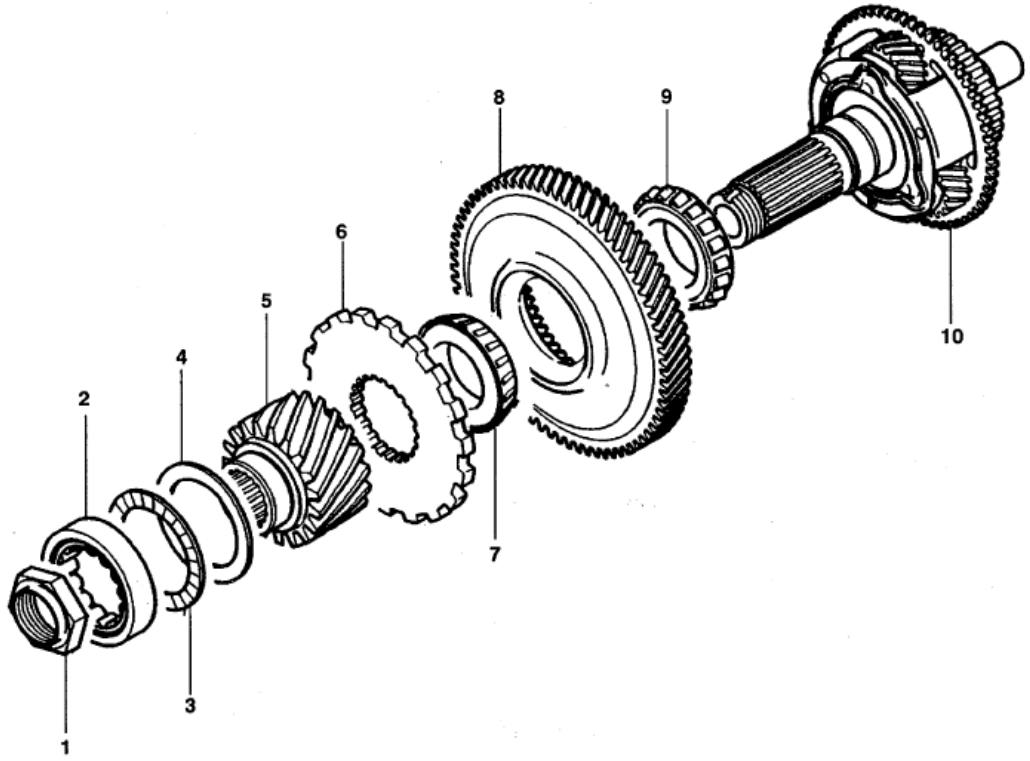

EKB9024C

Fig. 150: Locating Air Cleaner Lower Part With Mounting Bolts

7. Remove the battery tray (B) by removing the four mounting bolts (A).



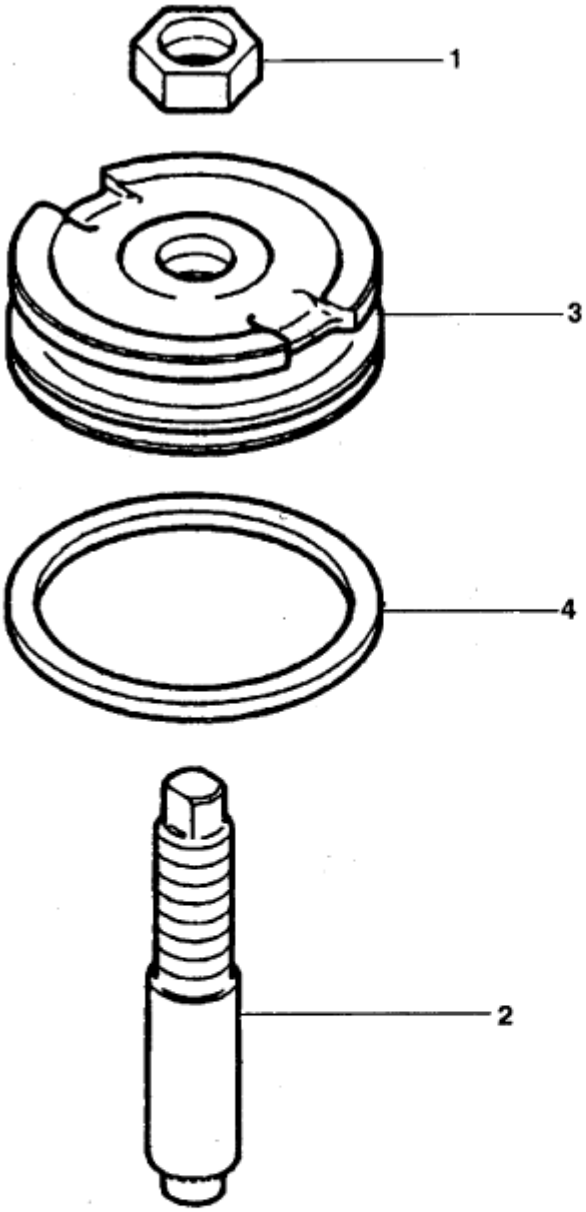
<Disassembly steps>

1. Lock nut
2. Roller bearing
3. Thrust bearing #9
4. Thrust race #10
5. Output gear
6. Parking gear
7. Taper roller bearing
8. Transfer driven gear
9. Taper roller bearing
10. Direct planetary carrier

EKB9025A

Fig. 151: Identifying Battery Tray Mounting Bolts

8. Disconnect the transaxle wire harness connectors.
    1. Remove the inhibitor switch connector (A).



<Disassembly steps>

1. Nut
2. Adjust rod
3. Reduction brake piston
4. Seal-ring

Fig. 152: Identifying Inhibitor Switch Connector

2. Remove the solenoid valve connector (A).

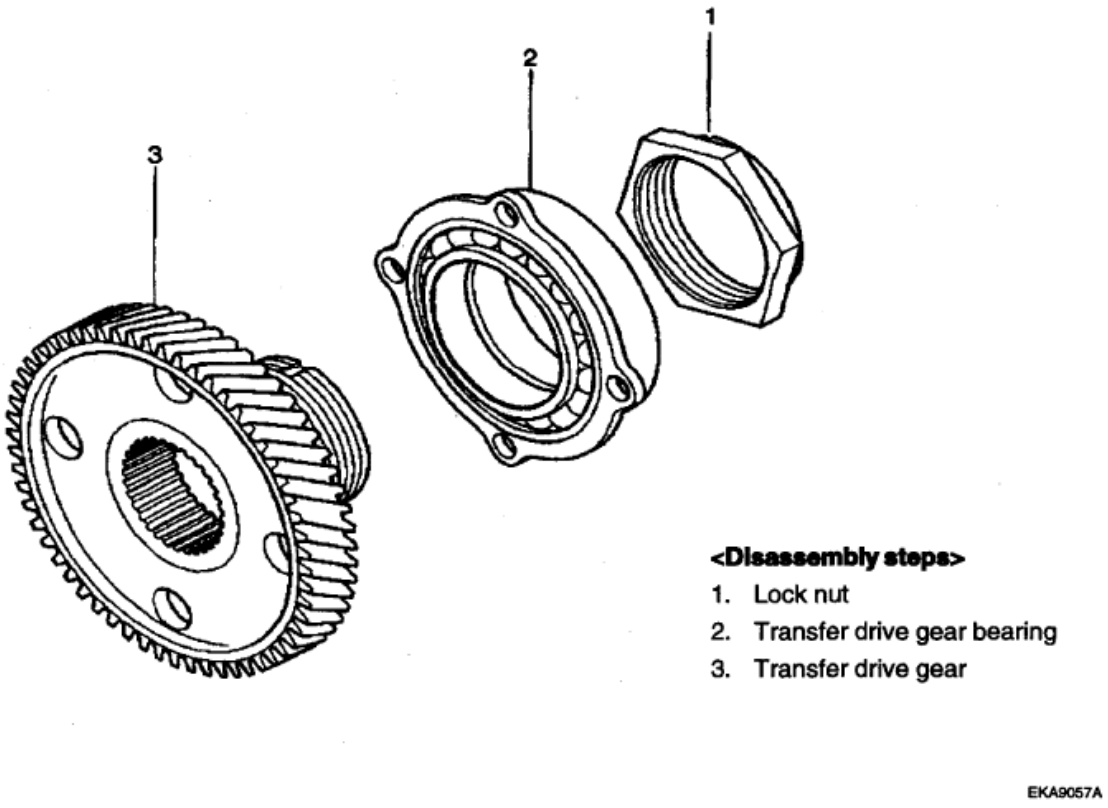


Fig. 153: Identifying Solenoid Valve Connector

3. Remove the input speed sensor connector (A).

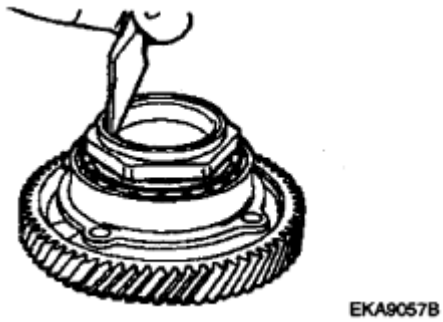


Fig. 154: Identifying Input Speed Sensor Connector

4. Remove the output speed sensor connector (A).

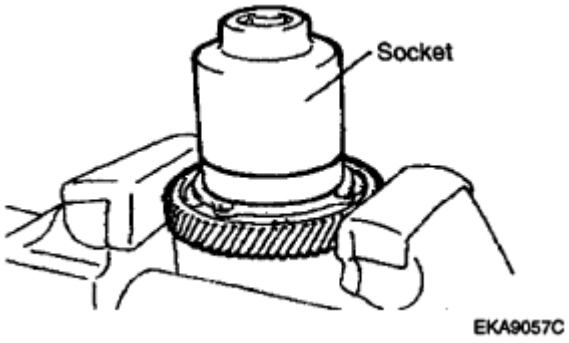


Fig. 155: Identifying Output Speed Sensor Connector

5. Remove the vehicle speed sensor connector (A).

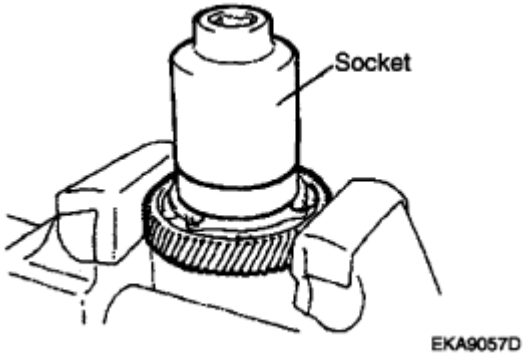


Fig. 156: Identifying Vehicle Speed Sensor Connector

9. Remove the control cable assembly (C) by removing the nut (A) and clip (B).

Fig. 157: Identifying Control Cable Assembly Nut And Clip

10. Disconnect the transaxle oil cooler hoses (B) from the tubes by loosening the clamps (A).

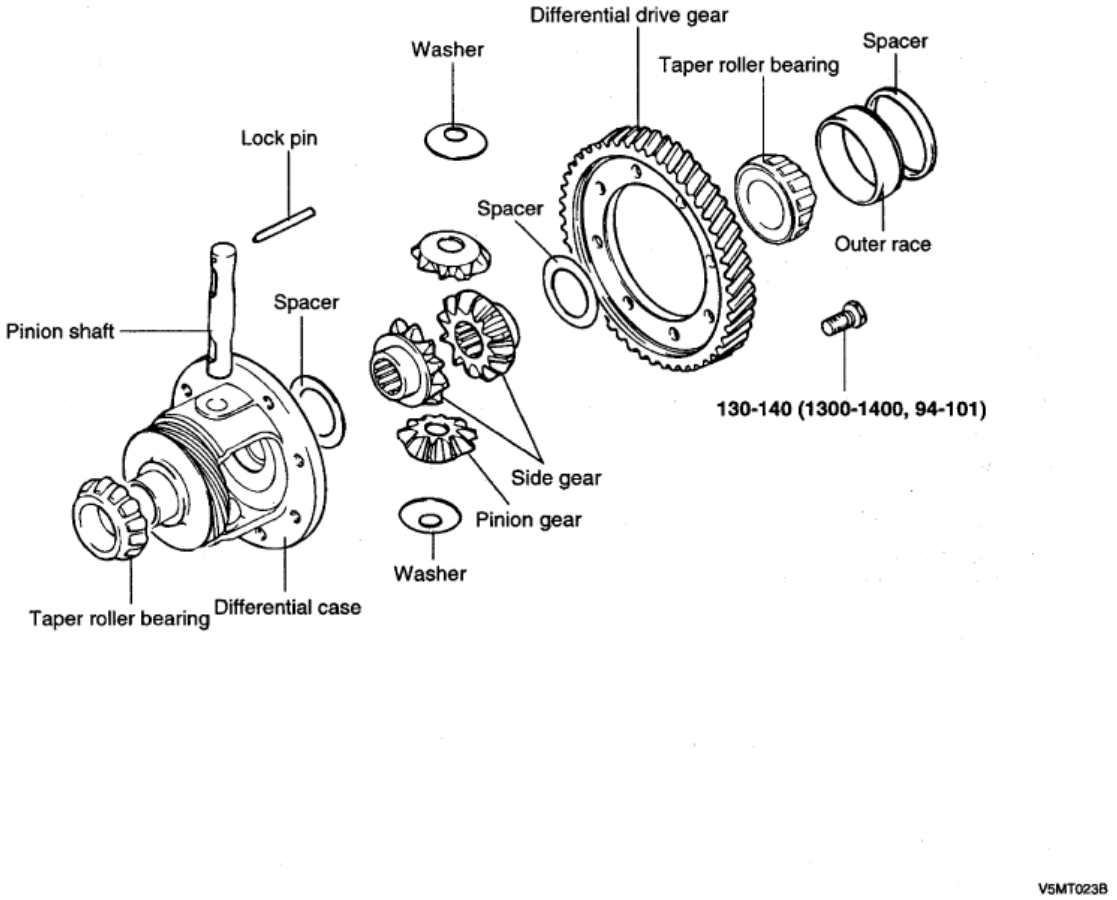


Fig. 158: Identifying Transaxle Oil Cooler Hoses And Clamps

11. Remove the transaxle mounting bolts (A).

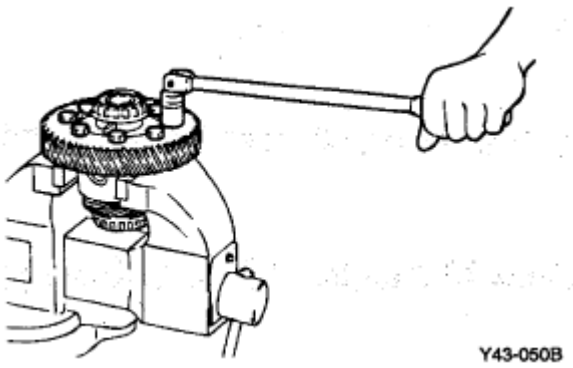


Fig. 159: Identifying Transaxle Mounting Bolts

12. Remove the starter motor by disconnecting the connector, (see **CHARGING SYSTEM (ENGINE ELECTRICAL SYSTEM (G6EA-GSL 2.7))**)
13. Using the SST (09200-38001), hold the engine and transaxle assembly safely.

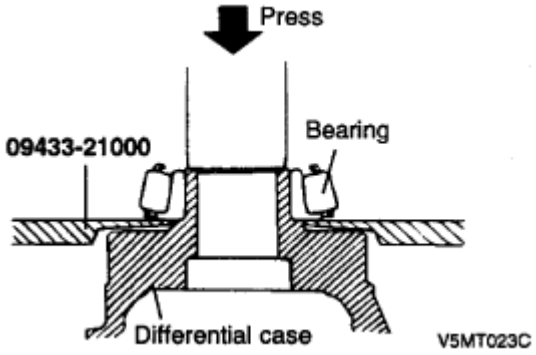


Fig. 160: Identifying SST

14. Remove the transaxle insulator mounting bolts (A).

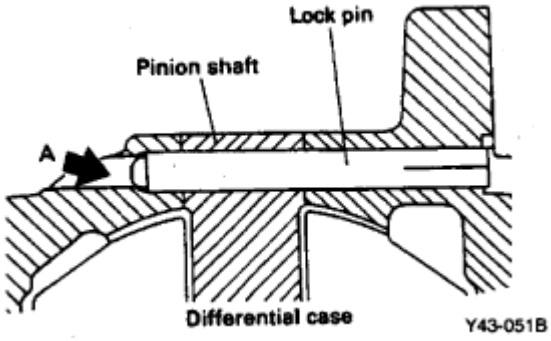


Fig. 161: Identifying Transaxle Insulator Mounting Bolts

15. Remove the front wheels, (see **FRONT SUSPENSION SYSTEM**)
16. Lift up the vehicle.
17. Remove the power steering column joint bolt and the EPS connector, (see **GENERAL (STEERING SYSTEM)**)
18. Remove the under cover (A).

Fig. 162: Identifying Under Cover

19. Drain the transaxle fluid.

20. Drain power steering fluid through the return tube (A). (see **GENERAL (STEERING SYSTEM)**)

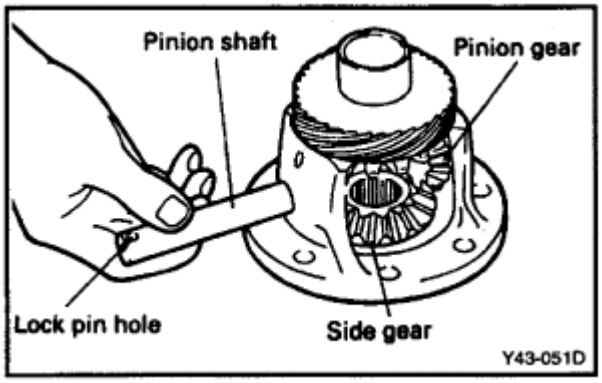


Fig. 163: Identifying Return Tube

21. Disconnect the power steering pressure tube (A) from the power steering oil pump.

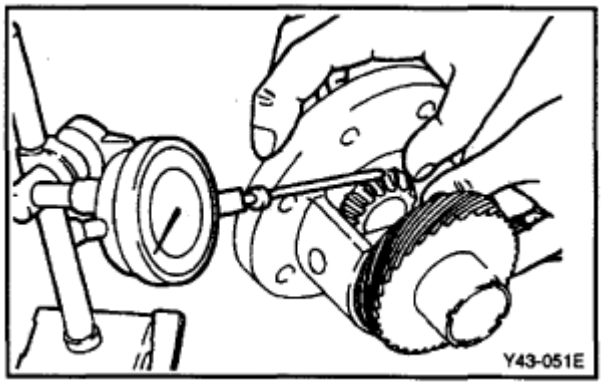


Fig. 164: Identifying Power Steering Pressure Tube

22. Disconnect the lower arm, the tie rod end ball joint, the stabilizer bar link from the front knuckle, (see **FRONT SUSPENSION SYSTEM**)
23. Remove the roll stopper mounting bolts.
24. Remove the mounting bolts from the sub frame by supporting the sub frame with a jack, (see **FRONT SUSPENSION SYSTEM**)
25. Remove drive shaft from transaxle. (see **DRIVESHAFT**).
26. Install a jack for supporting the transaxle assembly.
27. In case of 4WD, remove the transfer case assembly, (see '**TRANSFER CASE** ')
28. Remove the drive plate bolts (A) and the transaxle lower mounting bolts (B-4EA).

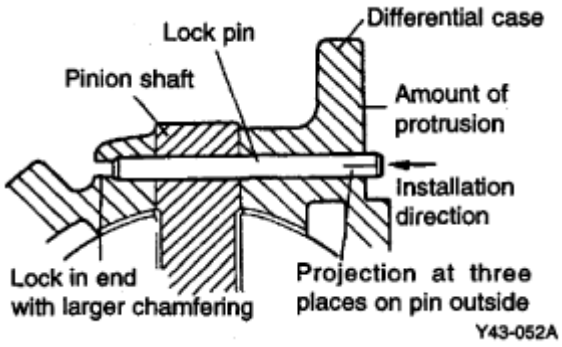


Fig. 165: Identifying Drive Plate Bolts

29. Lifting the vehicle up and lowering the jack slowly, remove the transaxle assembly.

INSTALLATION

Installation is in the reverse order of removal. Perform the following :

- Adjust the shift cable.
- Refill the transaxle with fluid.
- Refill the radiator with engine coolant.
- Bleed air from the cooling system with the heater valve open.
- Clean the battery posts and cable terminals with sandpaper, assemble them, and apply grease to prevent corrosion.

1. Lowering the vehicle or lifting up a jack, install the transaxle assembly.
2. Tighten the transaxle lower mounting bolts (B-4EA).

   TORQUE:

   65~85 Nm (6.5~8.5 kgf.m, 47.0~61.5 lb-ft)

3. Install the drive plate bolts (A) by turning the timing gear.

   TORQUE:

   46~53 Nm (4.6~5.3 kgf.m, 33.3~38.3 lb-ft)

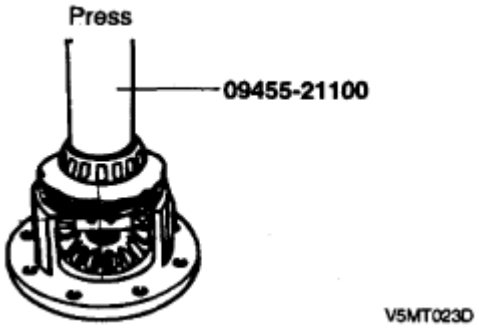


Fig. 166: Identifying Drive Plate Bolts

4. In case of 4WD, install the transfer case assembly, (see '**TRANSFER CASE** ')
5. After removing a jack, insert the drive shafts, (see **DRIVESHAFT**)
6. Install the sub frame, (see **FRONT SUSPENSION SYSTEM**).
7. Tighten the roll stopper mounting bolts.

   TORQUE:

   90~110 Nm (9~11 kgf.m, 65.1~79.5 lb-ft)

8. Connect the lower arm, the tie rod end ball joint, the stabilizer bar link to the front knuckle, (see **FRONT SUSPENSION SYSTEM**)
9. Install the under cover (A).

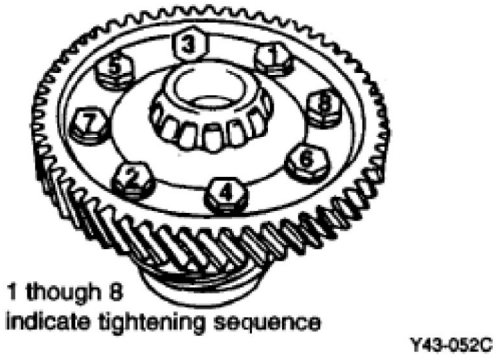
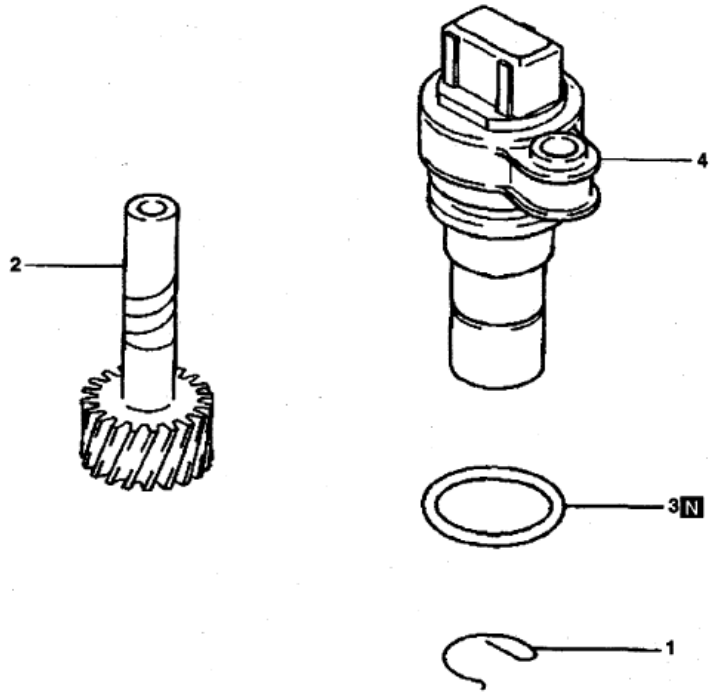


Fig. 167: Identifying Under Cover

10. Install the steering column joint bolt and the EPS connector, (see **GENERAL (STEERING SYSTEM)**)
11. Connect the return tube (A) with a clamp, (see **GENERAL (STEERING SYSTEM)**)



<Disassembly steps>

1. E-clip
2. Speedometer driven gear
3. O-ring
4. Sleeve

EKA9058A

Fig. 168: Identifying Return Tube With Clamp

12. Install the front wheels and tires.
13. Tighten the transaxle insulator mounting bolt (A).

    TORQUE:

    90~110 Nm (9~11 kgf.m, 65.1~79.5 lb-ft)

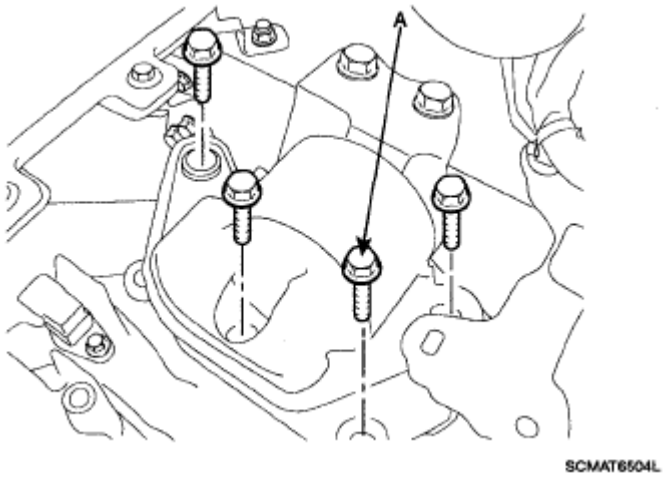


Fig. 169: Identifying Transaxle Insulator Mounting Bolt

14. Tighten the transaxle mounting bolts (A).

    TORQUE:

    65~85 Nm (6.5~8.5 kgf.m, 47.0~61.5 lb-ft)

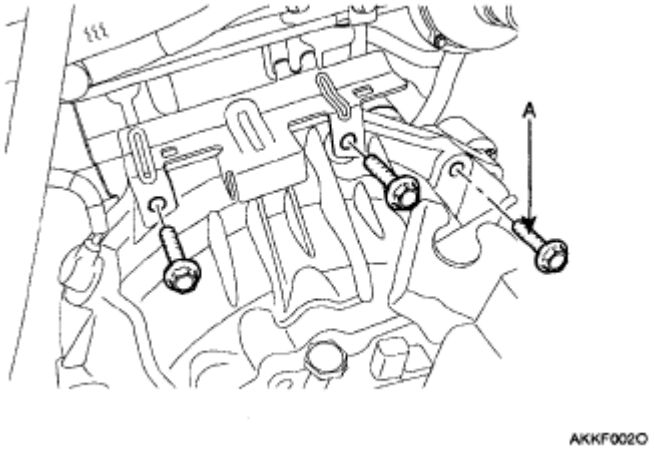


Fig. 170: Identifying Transaxle Mounting Bolts

15. Remove the SST (09200-38001) holding the engine and transaxle assembly.

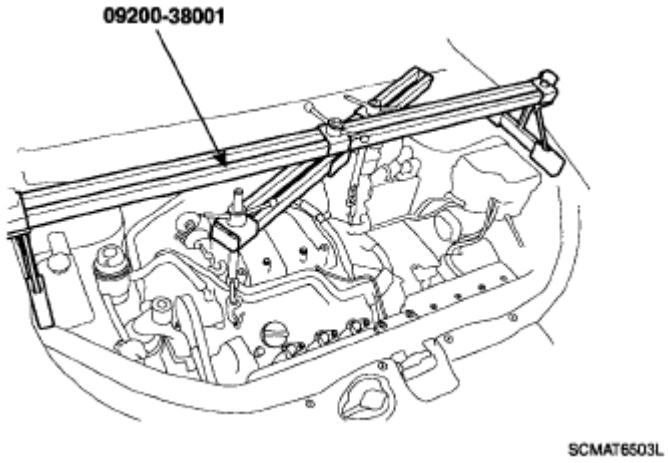


Fig. 171: Identifying SST (09200-38001)

16. Install the starter motor, (see **CHARGING SYSTEM (ENGINE ELECTRICAL SYSTEM (G6EA-GSL 2.7))**).

    TORQUE:

    65~85 Nm (6.5~8.5 kgf.m, 47.0~61.5 lb-ft)

17. Connect the power steering pressure tube (A) to the power steering oil pump.

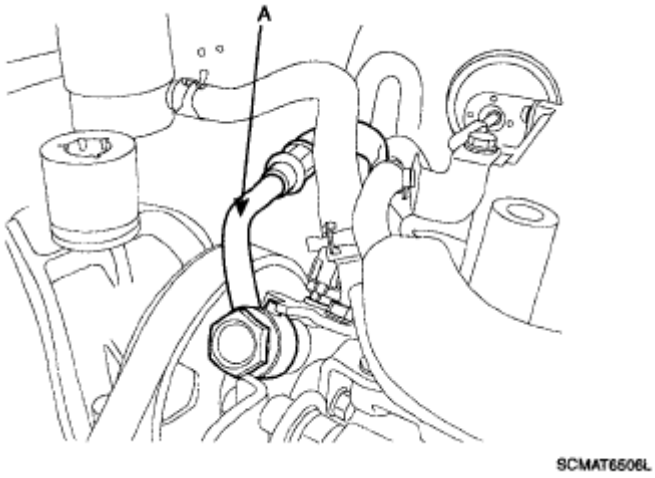


Fig. 172: Identifying Power Steering Pressure Tube

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

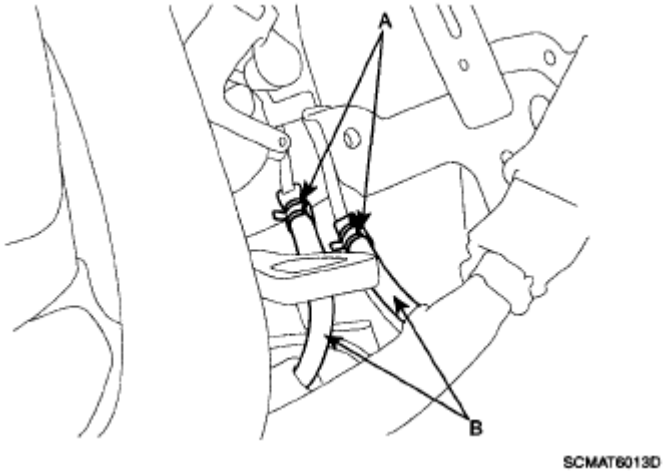


Fig. 173: Identifying Transaxle Oil Cooler Hoses

19. Install the control cable assembly (C) by tightening the nut (A) and clip (B).

    TORQUE:

    8~12 Nm (0.8~1.2 kgf.m, 5.8~8.6 lb-ft)

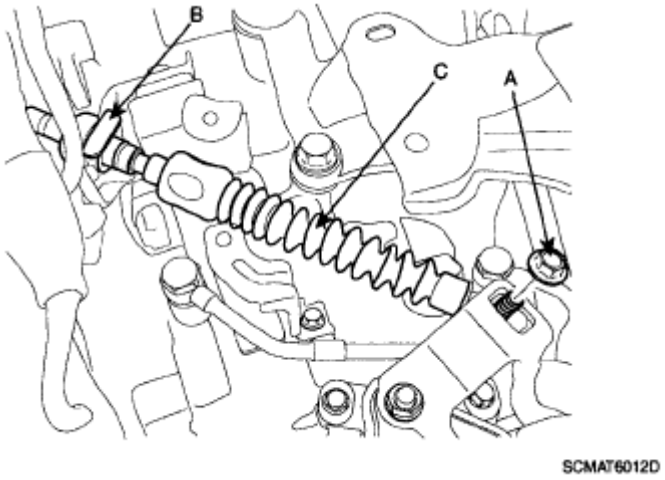


Fig. 174: Identifying Control Cable Assembly Nut And Clip

20. Connect the transaxle wire harness connectors.
    1. Install the inhibitor switch connector (A).

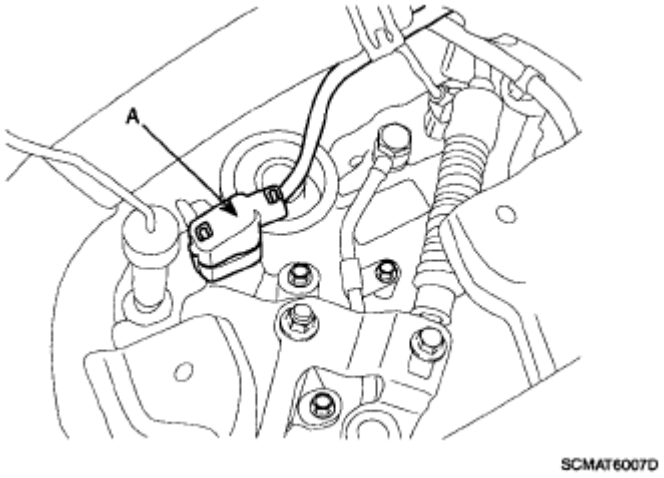


Fig. 175: Identifying Inhibitor Switch Connector

2. Install the solenoid valve connector (A).

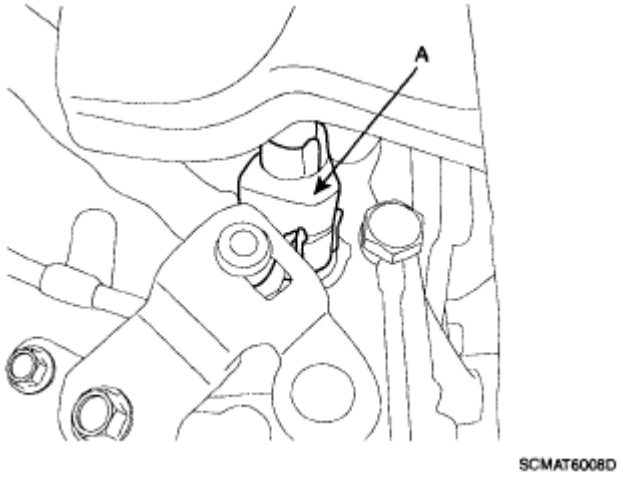


Fig. 176: Identifying Solenoid Valve Connector

3. Install the input speed sensor connector (A).

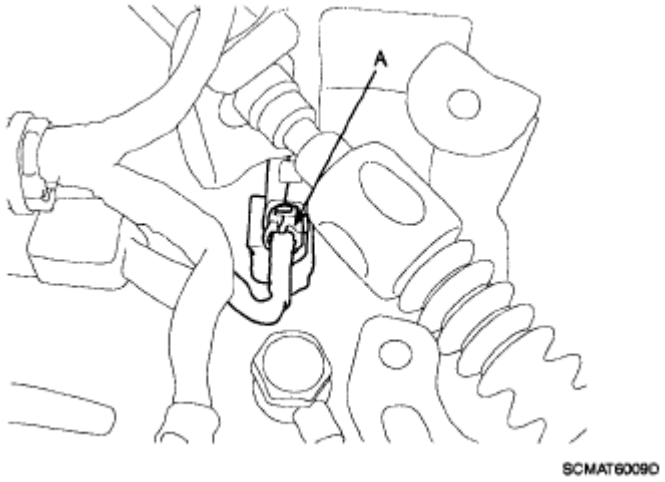


Fig. 177: Identifying Input Speed Sensor Connector

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

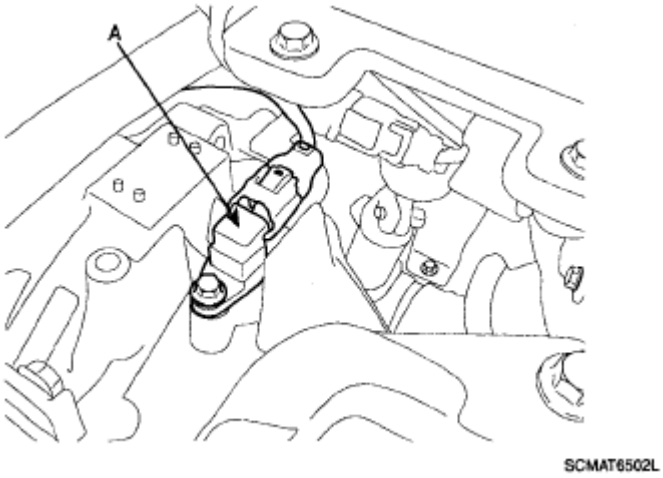


Fig. 178: Identifying Output Speed Sensor Connector

5. Install the vehicle speed sensor connector (A).

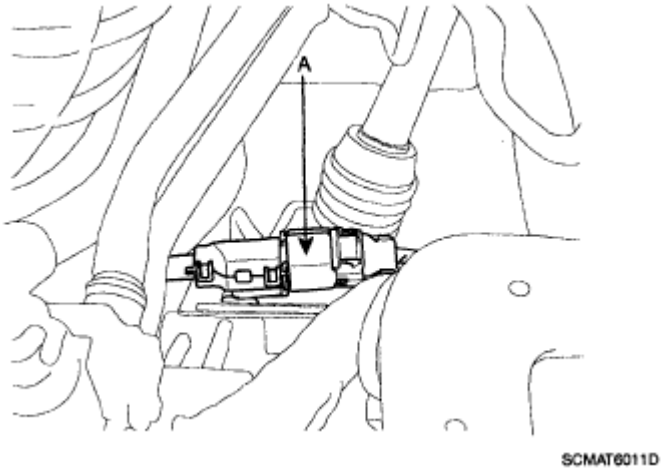


Fig. 179: Identifying Vehicle Speed Sensor Connector

21. Install the battery tray (B) by tightening the four mounting bolts (A).

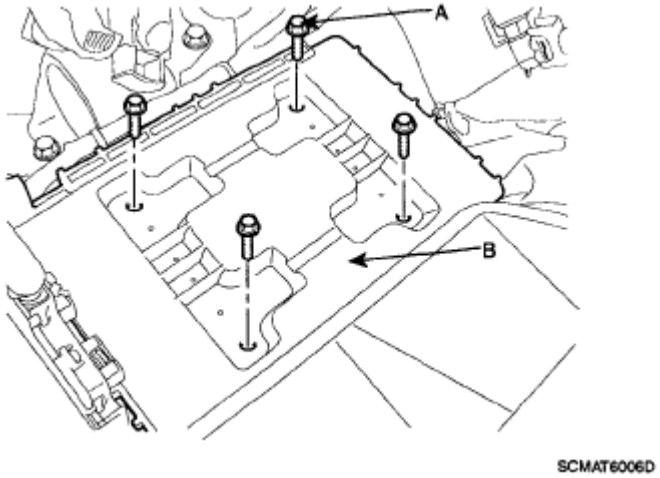


Fig. 180: Identifying Battery Tray Mounting Bolts

22. Install the air cleaner lower part (A) by installing the two mounting bolts.

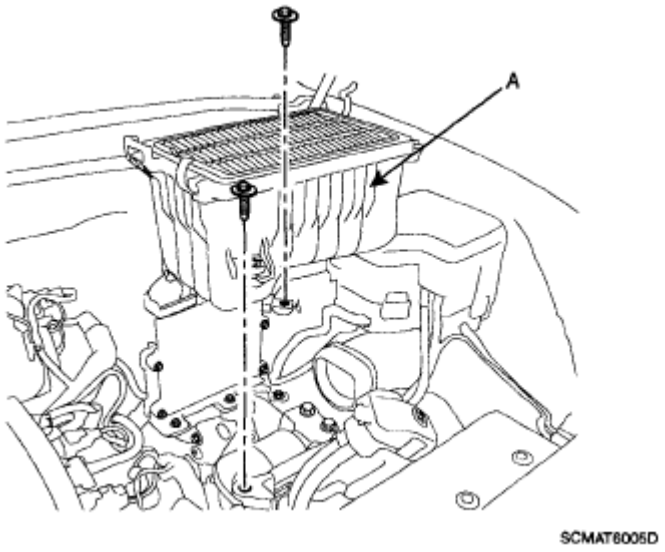


Fig. 181: Identifying Air Cleaner Lower Part With Mounting Bolts

23. Install the air cleaner upper cover (B) by installing the clips (A).

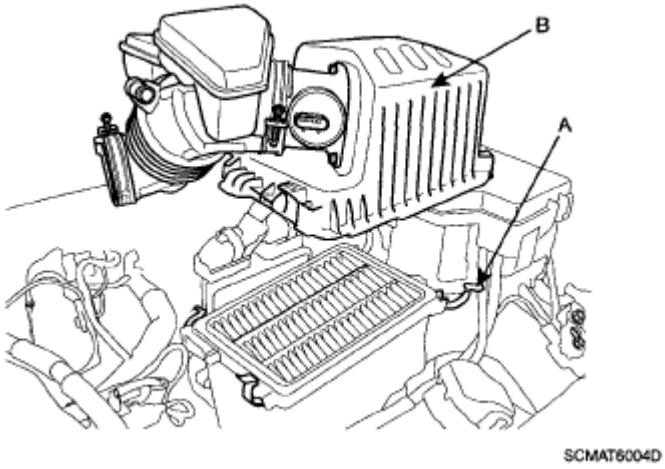


Fig. 182: Identifying Air Cleaner Upper Cover With Clips

24. Connect the air cleaner hose (B) and tighten the clamp bolt (A).

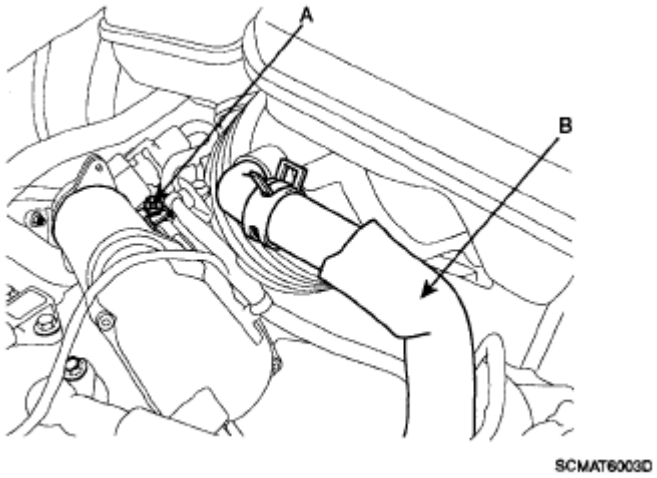


Fig. 183: Identifying Air Cleaner Hose And Clamp Bolt

25. Connect the AFS connector (A).

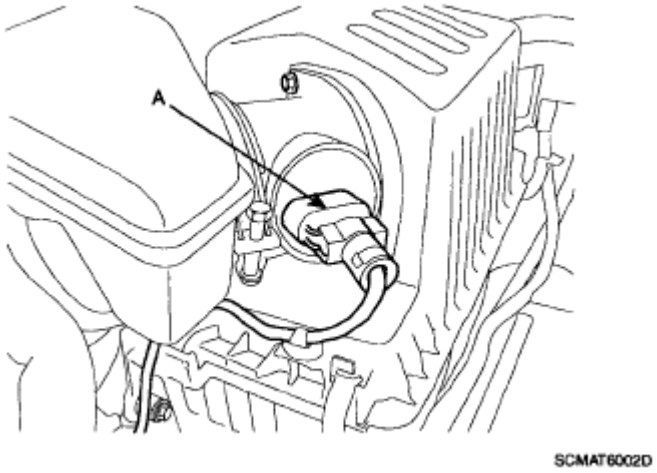


Fig. 184: Identifying AFS Connector

26. Install the battery (A).

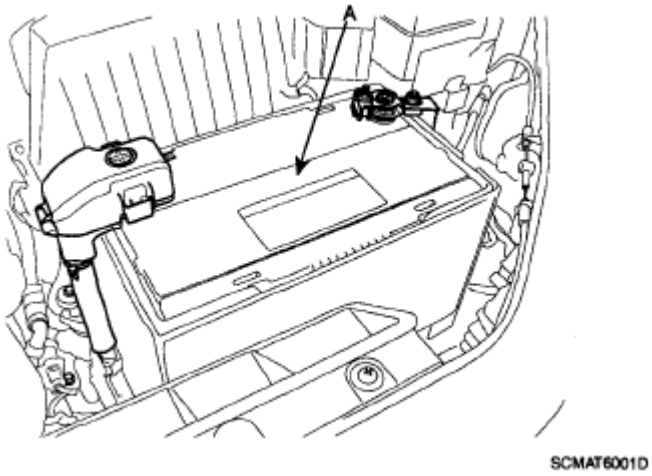


Fig. 185: Identifying Battery

27. Refill the transaxle fluid, (see '**SERVICE ADJUSTMENT PROCEDURE**')
28. Refill the power steering fluid, (see **GENERAL (STEERING SYSTEM)**)

CAUTION: After Installing the inter cooler assembly, bleed the air in the system.

29. Install the engine cover and the inter cooler assembly, (see **ENGINE MECHANICAL SYSTEM (G6EA-GSL 2.7)**)

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

a. Connect the Hi-Scan Pro connector to the data link connector under the crash pad and power cable to the cigar jack under the center facia.
b. Turn the ignition switch on and power on the Hi-Scan Pro.
c. Select the vehicle's name.
d. Select 'AUTOMATIC TRANSAXLE'.

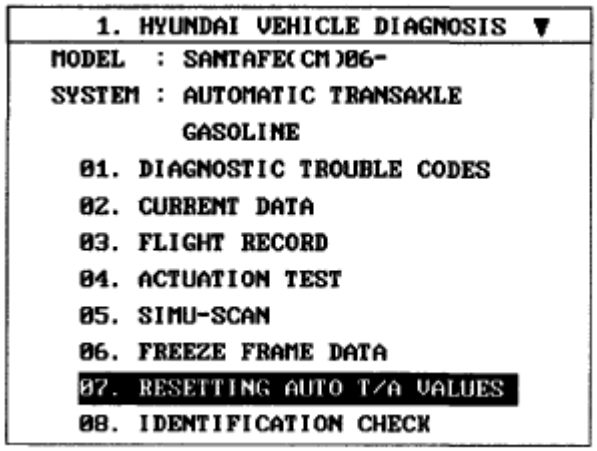


Fig. 186: Display Screen Of - Resetting T/A Values

e. Select 'RESETTING AUTO T/A VALUES' and perform the procedure.

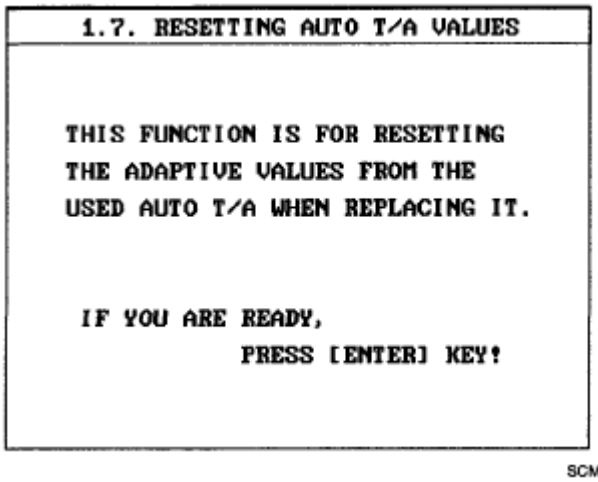


Fig. 187: Display Screen Of - Resetting Auto T/A Values

f. Perform the procedure by pressing F1 (REST).

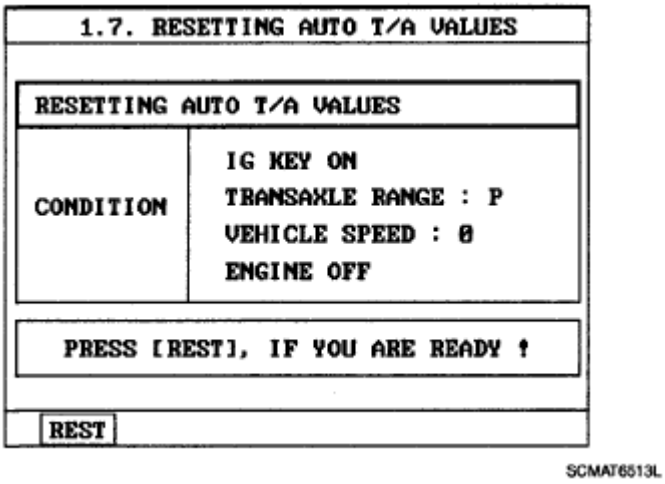


Fig. 188: Display Screen Of - Resetting Auto T/A Values

AUTOMATIC TRANSAXLE CONTROL SYSTEM

SOLENOID VALVE

DESCRIPTION

ACTUATORS

Solenoid Valve for Pressure Control

- Sensor type: Normal open 3-way
- Operating temperature : -30°C~130°C (-22°F~266°F)
- Frequency:

  LR, 2ND, UD, OD: 61.27Hz (at the ATF temp, above -20°C (-4°F))

  DCC: 30.64HZ

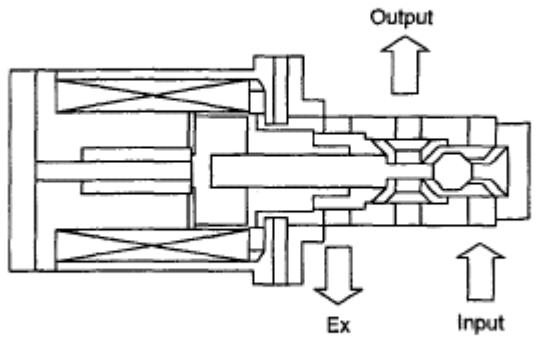
- Internal resistance:

  3.0 ± 0.5 ohms (LR, 2ND, UD, OD, TCC) 4.35 ± 0.5 ohms (VFS)

- Surge voltage: 56 V (Except VFS)

  (LR, 2ND, UD, OD, DCC)

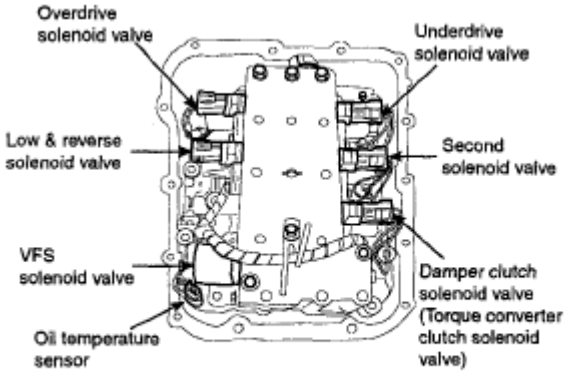
(LR, 2ND, UD, OD, DCC)



EKRF018J

Fig. 189: Identifying Solenoid Valve Port

LOCATION



EKRF018K

Fig. 190: Identifying Automatic Transaxle Control System Components

SOLENOID VALVES SCHEDULE

SOLENOID VALVES SCHEDULE CHART

Position	Solenoid valves				
Operation	LR	2ND	UD	OD	(1) DCC
1st gear	OFF	ON	OFF	ON	OFF
2nd gear	ON	OFF	OFF	ON	OFF
3rd gear	ON	ON	OFF	OFF	ON
4th gear	ON	OFF	ON	OFF	ON
Reverse	OFF	ON	ON	ON	OFF
N, P (STD. mode)	OFF	ON	ON	ON	OFF

N, P (Hold mode)	ON	OFF	ON	ON	OFF
(1) Reference value.					

(DCC solenoid valve will be ON when the operating condition is satisfied)

INSPECTION

1. If the value is out of specification according to the chart below, remove the valve body cover.

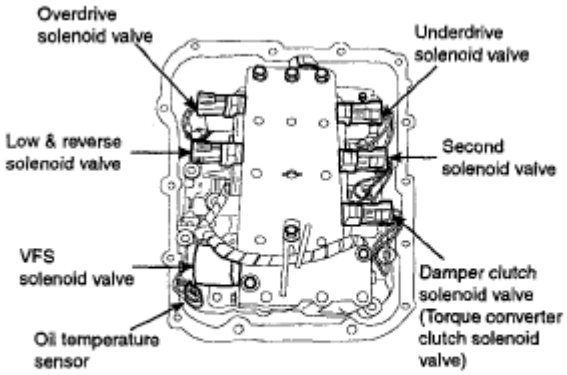


Fig. 191: Identifying Solenoid Valve Body Cover With Components

2. Measure the resistance again after disconnecting solenoid valve connector.

   Specification (20°C):

   2.5 ~ 3.5 ohms (LR, 2ND, UD, OD, TCC)

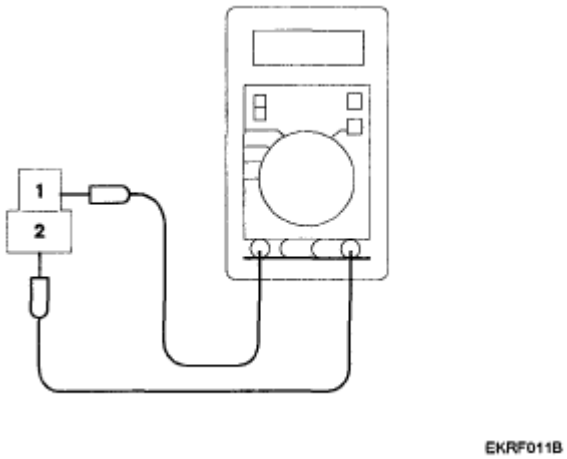


Fig. 192: Measuring Resistance Of Solenoid Valve Connector

3. If the value is out of specification replace the solenoid valve.

RESISTANCE SPECIFICATIONS CHART

Pin No.	Name	Resistance
6&9	DCC (TCC)	2.5~3.5ohms (20°C)
6&11	LR	
4&5	2ND	
3&5	UD	
5&12	OD	

Fig. 193: Identifying Solenoid Valve Connector Terminal

VFS (VARIABLE FORCE SOLENOID) VALVE

DESCRIPTION

ACTUATORS

Solenoid Valve for Pressure Control

- Sensor type: Normal open 3-way
- Operating temperature : -30°C~ 130°C (-22°F~266°F)
- Frequency:

  LR, 2ND, UD, OD: 61.27Hz (at the ATF temp, above -20°C (-4°F))

  DCC: 30.64HZ

- Internal resistance:

  3.0 ± 0.5 ohms (LR, 2ND, UD, OD, TCC) 4.35 ± 0.5 ohms (VFS)

- Surge voltage: 56 V (Except VFS)

(VFS)

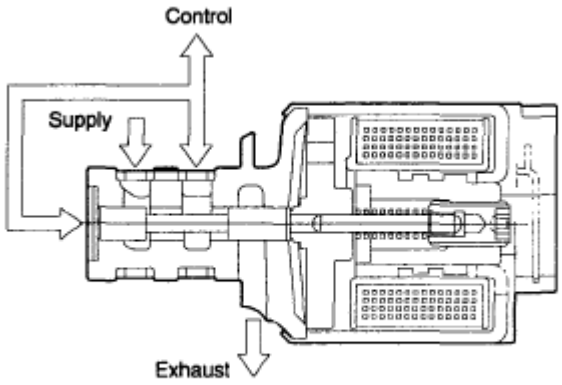


Fig. 194: [Identifying Solenoid Valve Actuators]

LOCATION

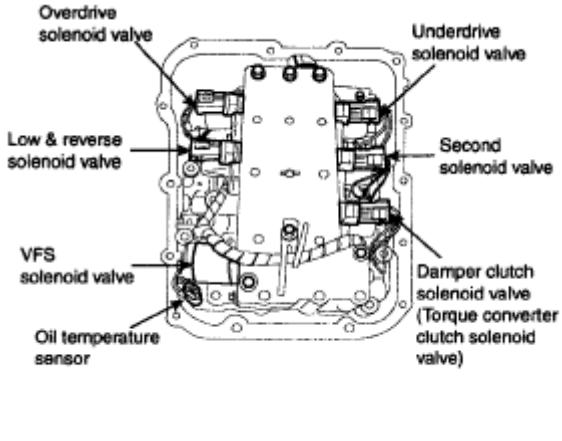


Fig. 195: Identifying Solenoid Valve Components

VFS CONTROL PRESSURE

VFS CONTROL PRESSURE SPECIFICATION CHART

Input Current (mA)	Control Pressure (No line pressure)			
	increasing Current			Decreasing Current
	MAX. (Kgf/cm^2) [Kpa]	MIN. (Kgf/cm^2) [Kpa]	A (Kgf/cm^2) [Kpa]	MIN. (Kgf/cm^2) [Kpa]
100	6.52 [639]	5.87 [575]	[64]	
200	6.23. [611]	5.70 [559]	[52]	5.43 [532]
300	5.76 [564]	5.24 [514]	[50]	4.49 [484]
400	5.08 [498]	4.59 [450]	[48]	4.30 [421]
500	4.24 [416]	3.78 [370]	[46]	3.52 [345]
700	2.29 [224]	1.82 [178]	[46]	1.51 [148]

800	1.41 [138]	0.09 [88]	[50]	0.58 [57]
900	0.65 [64]	0.14 [14]	[50]	0 [0]
1,000	0.24 [24]	0 [0]	[24]	
1,100	0.24 [24]	0 [0]	[24]	

*Test condition:
Ps : Supply Pressure (Ps = 7.1 ± 0.3 KGf/cm^2)
Pc : Control Pressure
Pex : Exhaust Pressure (Atmosphere pressure)
ATF: DIAMOND ATF SP-III
ATF temperature : 30 ± 3°C (86°F)

- Coil resistance : 4.35 ± 35ohms
- Dither Frequency : 600 ± 20Hz

In case of VFS solenoid valve, the relation between Duty and oil pressure can't be expressed.

INSPECTION

1. If the value is out of specification according to the chart below, remove the valve body cover.

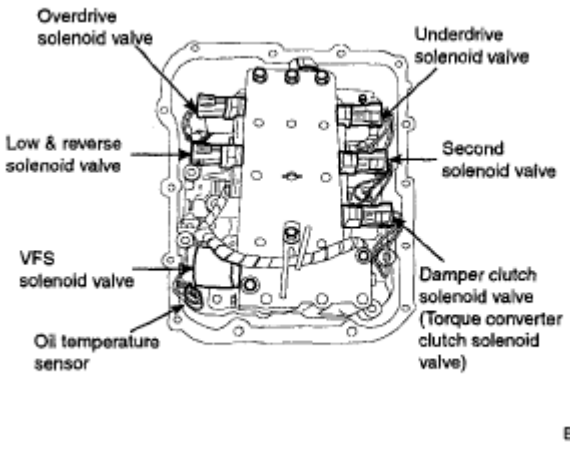
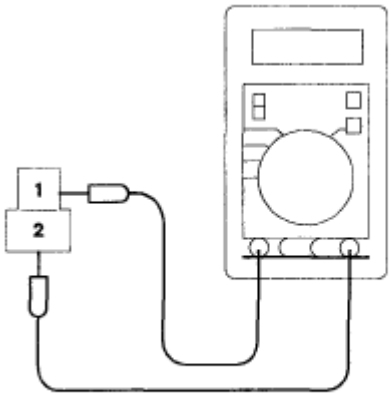


Fig. 196: Identifying Valve Body Cover Components

2. Measure the resistance again after disconnecting solenoid valve connector.

   Specification (20°C):

   4.3 ~ 4.4ohms (VFS)



EKRF011B

Fig. 197: Measuring Resistance Of Solenoid Valve Connector

3. If the value is out of specification replace the solenoid valve.

SOLENOID VALVE SPECIFICATION CHART

Pin No.	Name	Resistance
7&8	VFS	4.3~4.4ohms (20°C)

EKRF011C

Fig. 198: Identifying Solenoid Valve Connector Pin Terminal

INPUT SPEED SENSOR

DESCRIPTION

INPUT SHAFT SPEED SENSOR

- Type: Hall sensor
- Current consumption: 22mA (MAX.)
- Sensor body and sensor connector have been unified as one.

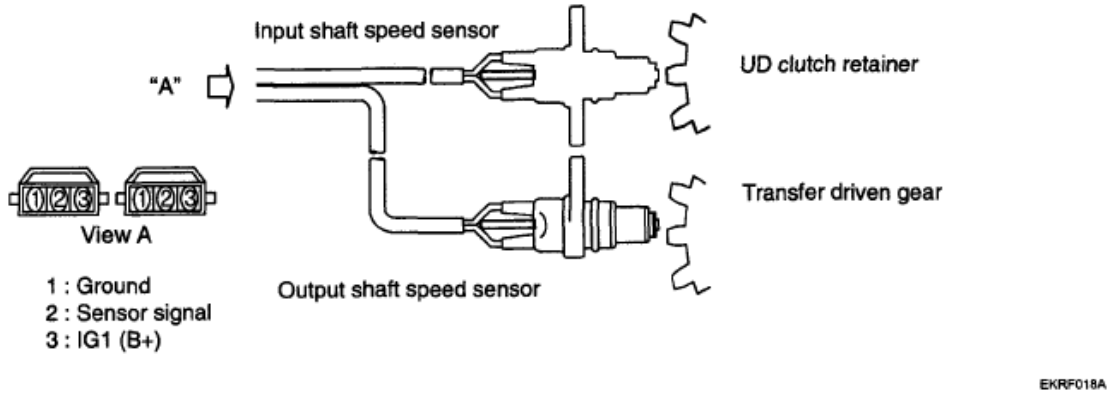


Fig. 199: Identifying Input Shaft Speed Sensor And Output Shaft Speed Sensor

HALL TYPE SENSOR: SPECIFICATION

HALL TYPE SENSOR SPECIFICATION CHART

Air gap (mm)	Input shaft speed sensor	1.3
Coil Resistance	Input shaft speed sensor	over 1Mohms
Peak-Peak Voltage	High	4.8~5.2V
	Low	0.8V

WAVE FORM WITH HIGH-SCAN

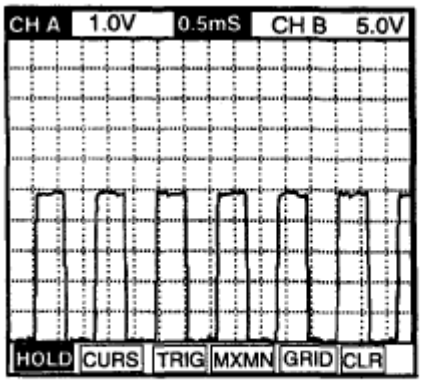


Fig. 200: Wave Form Graph

HALL TYPE SENSOR: STRUCTURE & INTERFACE

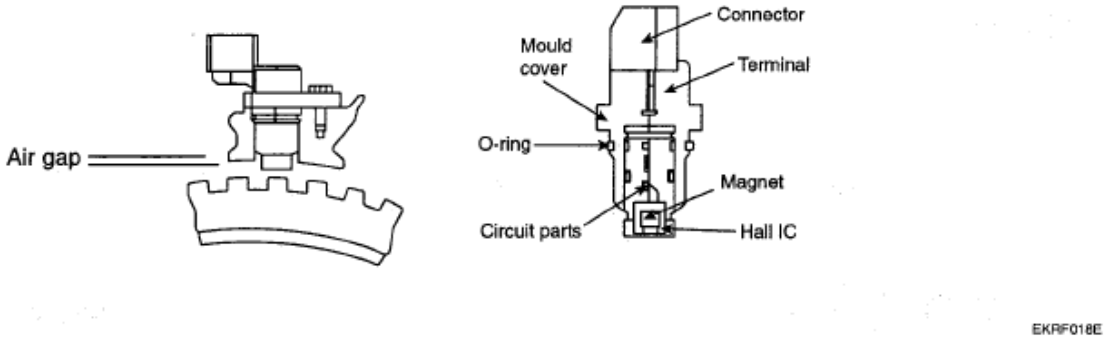


Fig. 201: Identifying Hall Type Sensor Components

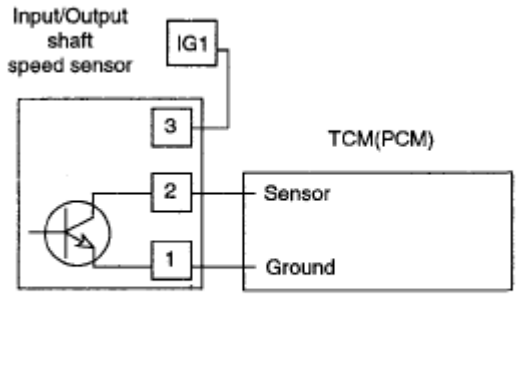


Fig. 202: Input Shaft And Output Shaft Speed Sensor Circuit Diagram

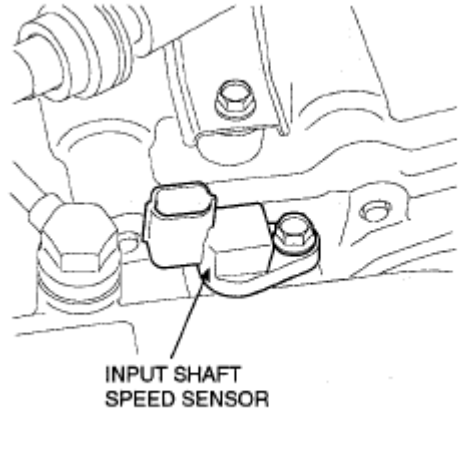


Fig. 203: Identifying Input Shaft Speed Sensor

REPLACEMENT

1. Remove the battery and air cleaner (see "Transaxle range switch replacement").
2. Remove the transaxle range switch connector.
3. Remove the control cable to transaxle range switch mounting nut.

4. Remove the input shaft speed sensor (A).
    1. Disconnect the input shaft speed sensor connector.
    2. Remove the bolt (B).

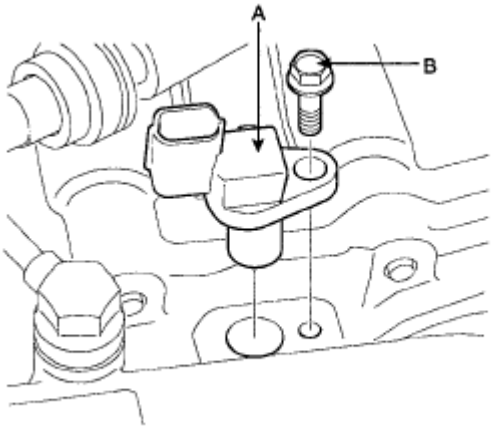


Fig. 204: Identifying Input Shaft Speed Sensor And Bolt

    3. Inspect the input shaft speed sensor bore.
5. Apply a light coat of automatic transaxle fluid to the O-ring seal before installation.
6. Install the input shaft speed sensor.
7. Install the control cable mounting bracket.
8. Connect the input shaft speed sensor connector.
9. Install the holder of the control cable.
10. Adjust the control cable to transaxle range switch and tighten the transaxle manual lever to the control cable mounting nut. (see "Automatic transaxle shift control installation")
11. Installation is the reverse of removal.

OUTPUT SPEED SENSOR

DESCRIPTION

OUTPUT SHAFT SPEED SENSOR

- Type: Hall sensor
- Current consumption: 22mA (MAX.)
- Sensor body and sensor connector have been unified as one.

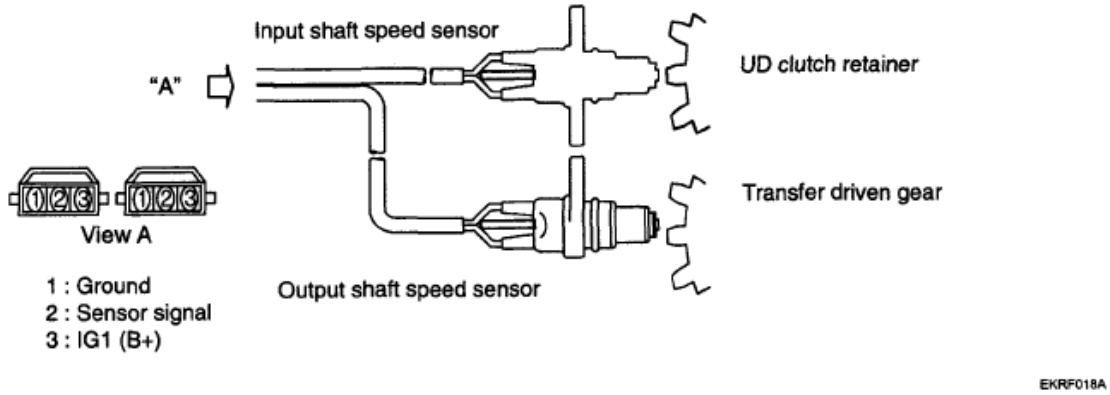


Fig. 205: Identifying Input Shaft Speed Sensor And Output Shaft Speed Sensor

HALL TYPE SENSOR: SPECIFICATION

HALL TYPE SENSOR SPECIFICATION CHART

Air gap (mm)	Output shaft speed sensor	0.85
Coil Resistance	Output shaft speed sensor	over 1M ohms
Peak-Peak Voltage	High	4.8~5.2V
	Low	0.8V

WAVE FORM WITH HIGH-SCAN

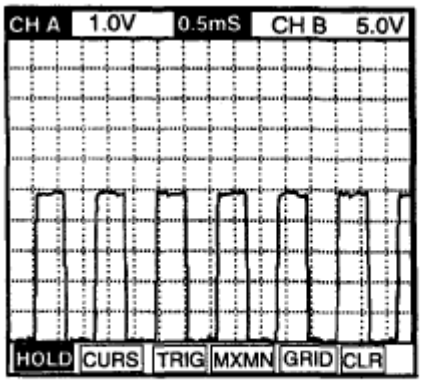


Fig. 206: Wave Form Graph

HALL TYPE SENSOR: STRUCTURE & INTERFACE

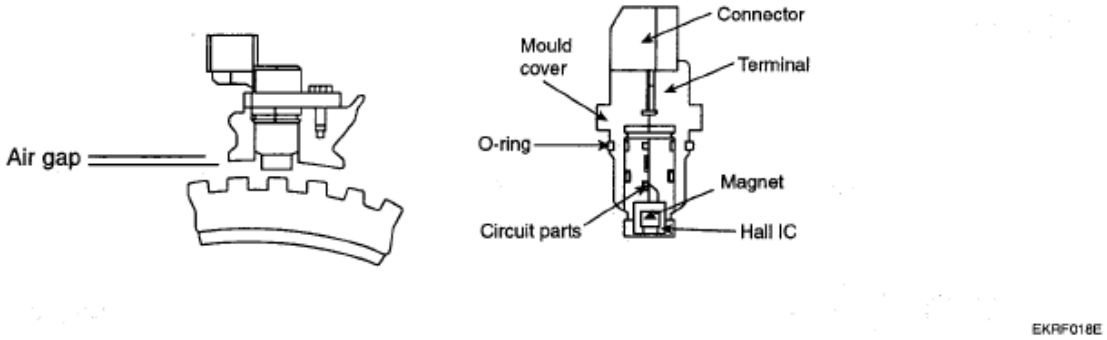


Fig. 207: Identifying Hall Type Sensor Components

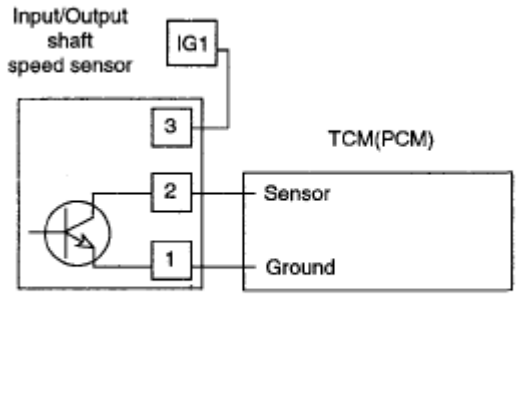


Fig. 208: Input Shaft And Output Shaft Speed Sensor Circuit Diagram

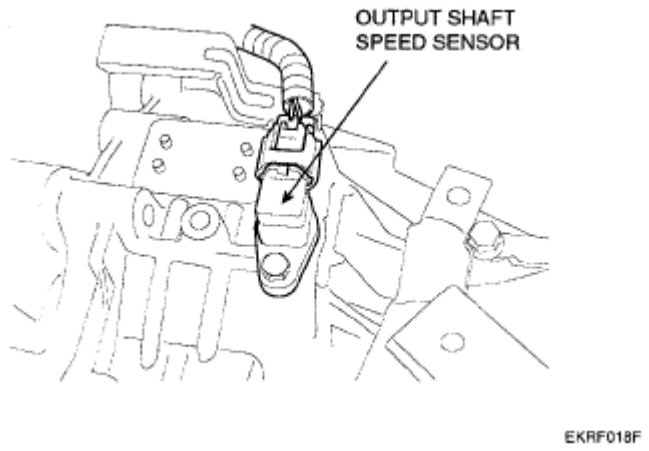


Fig. 209: Identifying Output Shaft Speed Sensor

REPLACEMENT

1. Remove the battery and air cleaner, (see "Transaxle range switch replacement")
2. Remove the output shaft speed sensor (A).

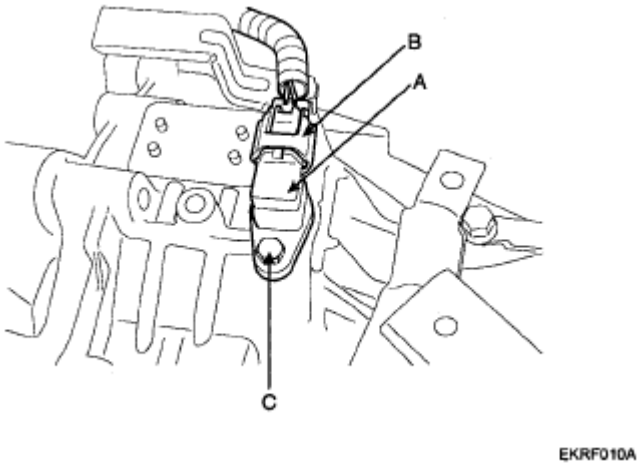


Fig. 210: Identifying Output Shaft Speed Sensor

1. Disconnect the output shaft speed sensor connector (B).
2. Remove the bolt (C).
3. Inspect the output shaft speed sensor bore.

3. Apply a light coat of automatic transaxle fluid to the O-ring seal before installation.
4. Installation is the reverse of removal.

TRANSAXLE OIL TEMPERATURE SENSOR

DESCRIPTION

OIL TEMPERATURE SENSOR

The oil temperature sensor is of the thermistor type, and senses the automatic transaxle fluid temperature. Using the signal from this sensor, TCM (PCM) controls the shift pattern optimally during shift. In order to operate the damper clutch, this signal is also referred.

- Range of temperature : -40°C~145°C
- Type: Separated type (High / Low temperature)
- Standard value of internal resistance

TEMPERATURE SPECIFICATION CHART

Temp.[°C (°F)]	Resistance (kohms)	Temp.[°C (°F)]	Resistance (kohms)
-40 (-40)	139.5	80 (176)	1.08
-20 (-4)	47.7	100 (212)	0.63
0 (32)	18.6	120 (248)	0.38
20 (68)	8.1	140 (284)	0.25
40 (104)	3.8	160 (320)	0.16
60 (140)	1.98		

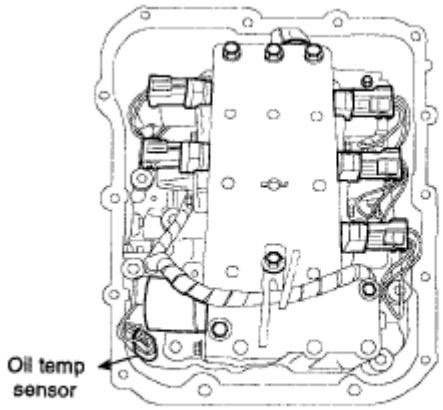


Fig. 211: Identifying Oil Temperature Sensor

REPLACEMENT

1. Remove the automatic transaxle assembly.
2. Remove the valve body cover (refer to the overhaul manual).
3. Disconnect the oil temperature sensor connector.
4. Remove the oil temperature sensor (B), loosening the mounting bolt (A).

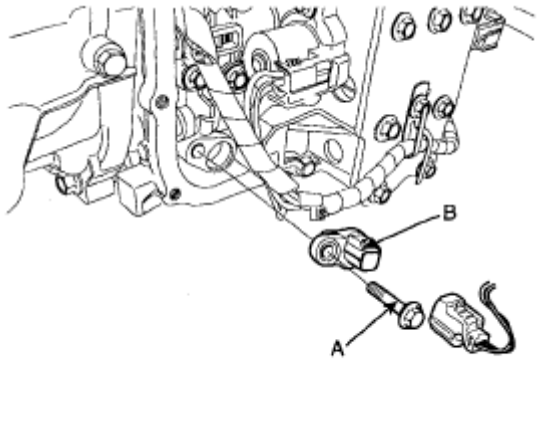
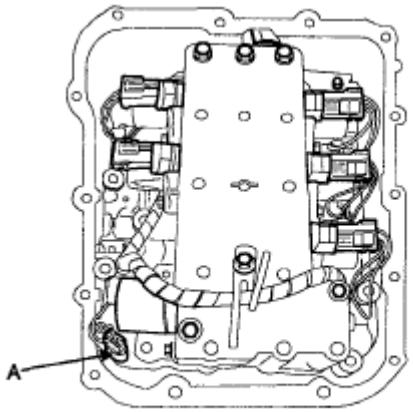


Fig. 212: Identifying Oil Temperature Sensor Mounting Bolt

5. Replace the sensor with the new one and reassemble the rest of the parts.

INSPECTION

1. Remove the oil temperature sensor (A).



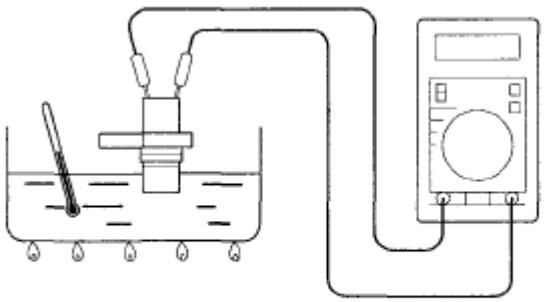
EKRF009D

Fig. 213: Identifying Oil Temperature Sensor

2. Measure the resistance between the terminal 1 and 2 of the sensor connector.

RESISTANCE SPECIFICATION CHART

Temp.[°C (°F)]	Resistance (ohms)
0 (32) 100 (212)	18.6 0.63



EKRF009E

Fig. 214: Measuring Resistance Between Terminal 1 And 2 Of Sensor Connector

3. If the value is out of the specfication, replace the oil temperature sensor.

TRANSAXLE RANGE (TR) SWITCH

DESCRIPTION

INHIBITOR SWITCH

- Type: Rotary contact type
- Range of temperature : -40°C~145°C (-40°F~293°F)

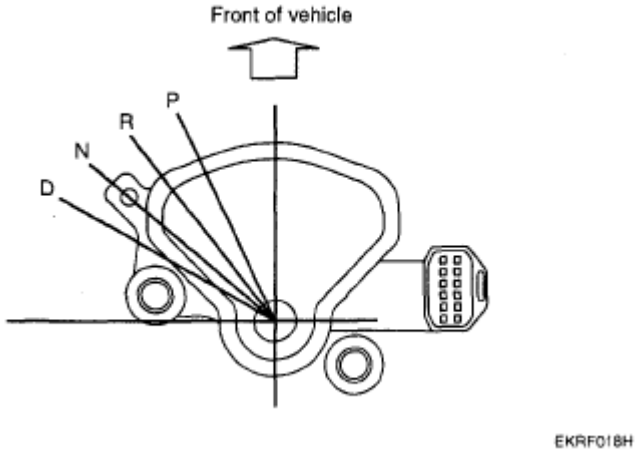


Fig. 215: Identifying Inhibitor Switch Temperature Range

INHIBITOR SWITCH - CONTINUITY CHECK (SPORTS MODE)

Range	Terminal Number									
	1	2	3	4	5	6	7	8	9	10
P			○	—	—	—	—	○	○	○
R							○	○		
N				○	—	—	—	○	○	○
D	○	—	—	—	—	—	—	○		

EKRF018I

Fig. 216: Inhibitor Switch Continuity Chart

REPLACEMENT

1. Pull up the parking brake.
2. Position the shift lever in 'N' range.
3. Remove the air cleaner assembly.
4. Remove the battery.
5. Remove the battery tray.
6. Remove the inhibitor switch connector.
7. Remove the shift cable mounting nut (A).

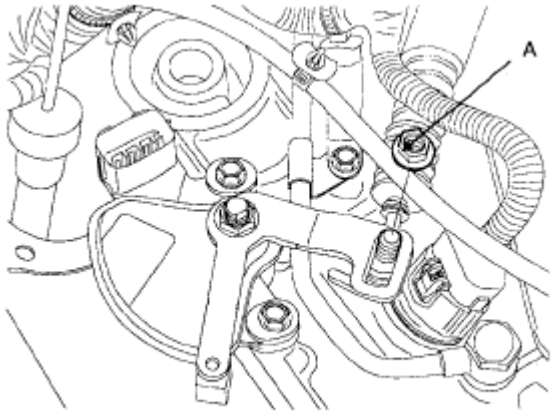


Fig. 217: Identifying Shift Cable Mounting Nut

8. Remove the inhibitor switch loosening the mounting bolts.
9. Referring to 'INSPECTION', check for continuity. If there is an error, replace the inhibitor switch.

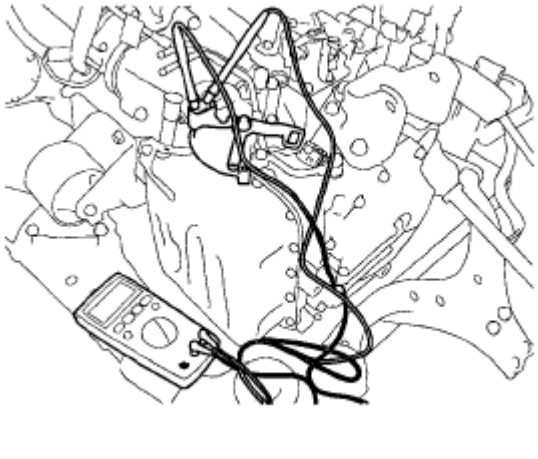


Fig. 218: Checking Inhibitor Switch Continuity

10. After tightening the shift cable mounting nut, connect the inhibitor switch.
11. Install the battery, battery tray and the air cleaner assembly.

INSPECTION

1. Check for the starter motor when the ignition switch is at 'START position and the shift lever at 'P' or 'N' range.
2. Check for the rear lamp when the ignition switch if it does not work properly.
3. Check for the inhibitor switch if it does not work properly.
4. If the inhibitor switch is not fixed in a proper position, reassemble it in the right position.
5. Re-check 1 and 2 procedures.

6. Using a scan tool, confirm the DTCs.
7. Disconnect the battery (-) terminal and the inhibitor switch.
8. Check for continuity between terminals at the switch connector.

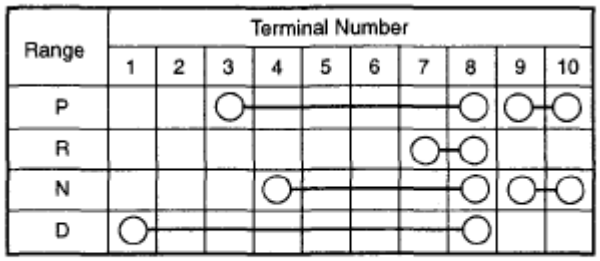


Fig. 219: Continuity Chart

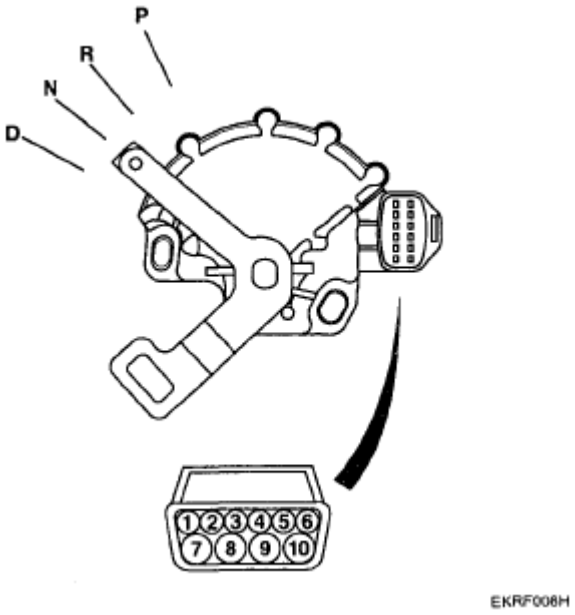


Fig. 220: Identifying Inhibitor Switch Terminal

9. If there is not continuity between the terminals in the table above for each switch position, replace the inhibitor switch.

ADJUSTMENT

1. Set the select lever to the "N" position.
2. Loosen the control cable to manual control lever coupling nut to free the cable and lever.
3. Set the manual control lever to the neutral position.

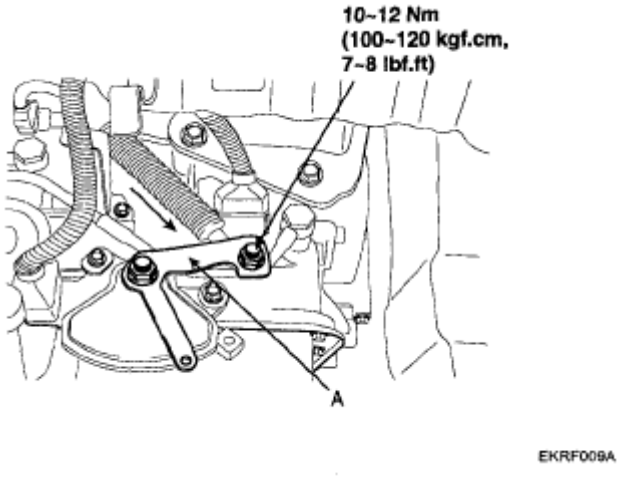


Fig. 221: Identifying Manual Control Lever Coupling Nut

4. Loosen the transaxle range switch body mounting bolts and then turn the transaxle range switch body so the hole in the end of the manual control lever and the hole (cross section A-A in the figure) in the flange of the transaxle range switch body flange are aligned.
5. Tighten the transaxle range switch body mounting bolts to the specified torque. Make sure at this time that the position of the switch body did not move.

   TORQUE :

   10~12 Nm (1.0~1.2kgf.m, 7~8lb-ft)

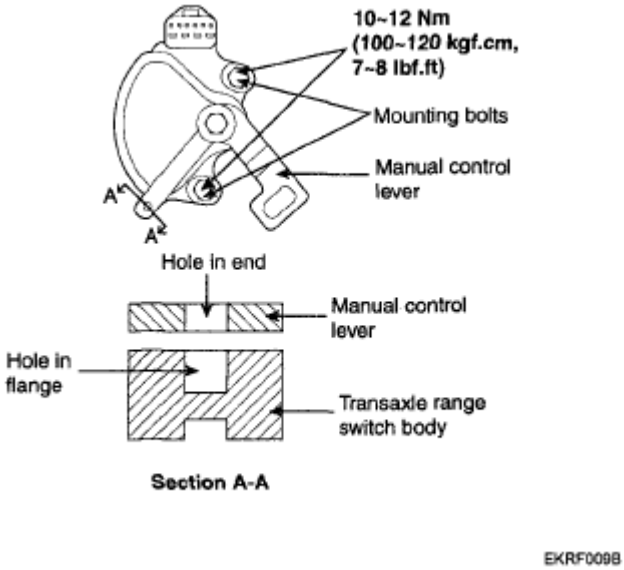


Fig. 222: Identifying Transaxle Range Switch Body Mounting Bolts

6. Gently pull the transmission control cable in the direction of the arrow, and then tighten the adjusting nut.

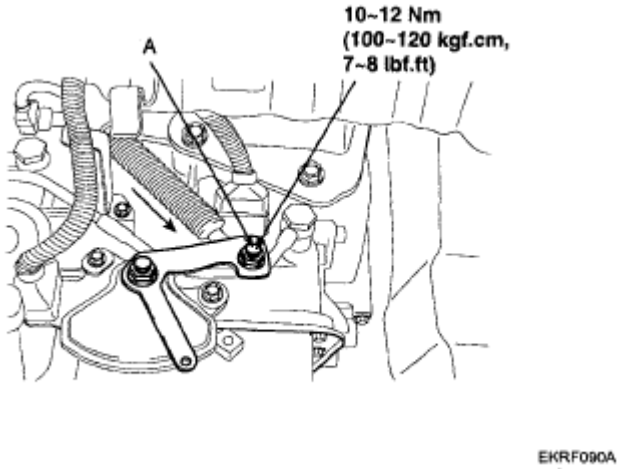
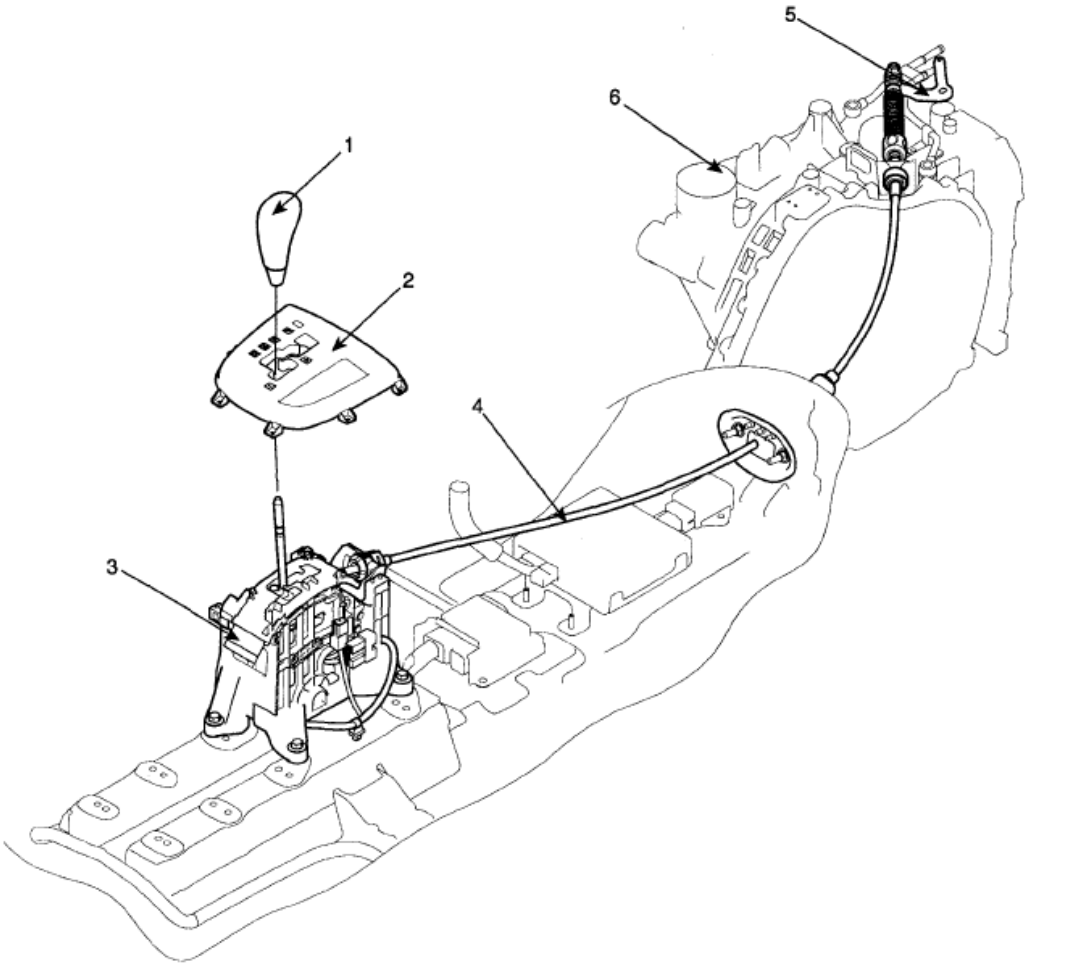


Fig. 223: Identifying Transmission Control Cable Adjusting Nut

7. Check that the select lever is in the "N" position.

1SHIFT LEVER

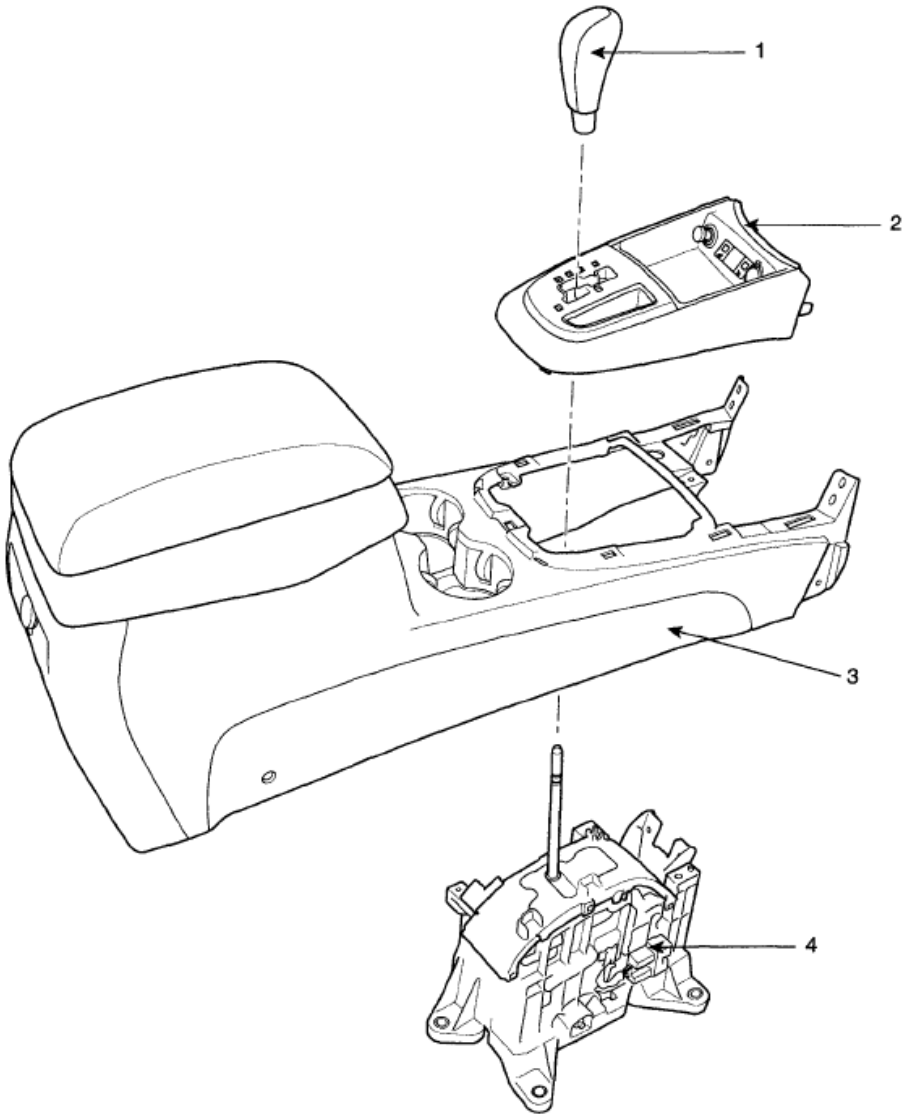
COMPONENTS (1)



1. Shift lever knob
2. Indicator assembly
3. Shift lever assembly
4. Control cable assembly
5. Shift lever assembly (AT side)
6. Automatic transaxle assembly

Fig. 224: Identifying Shift Lever Components (1 Of 2)

COMPONENTS (2)



1. Shift lever knob
2. Center console cover
3. Center console
4. Shift lever

SCMAT6508N

Fig. 225: Identifying Shift Lever Components (2 Of 2)

REMOVAL

1. Remove the shift lever knob (A).

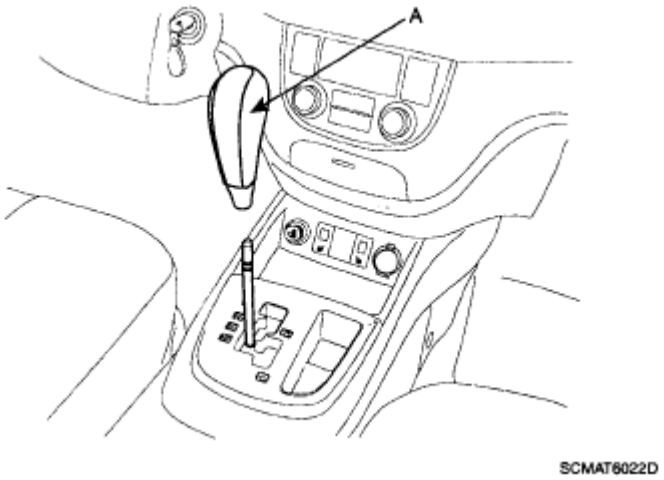


Fig. 226: Identifying Shift Lever Knob

2. Remove the center console cover (A).

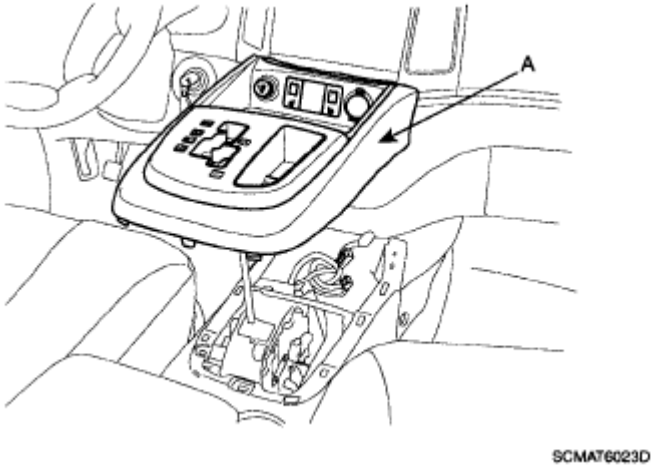


Fig. 227: Identifying Center Console Cover

3. Remove the center console by removing the two screws (A) and the four bolts (B). (See **INTERIOR**)

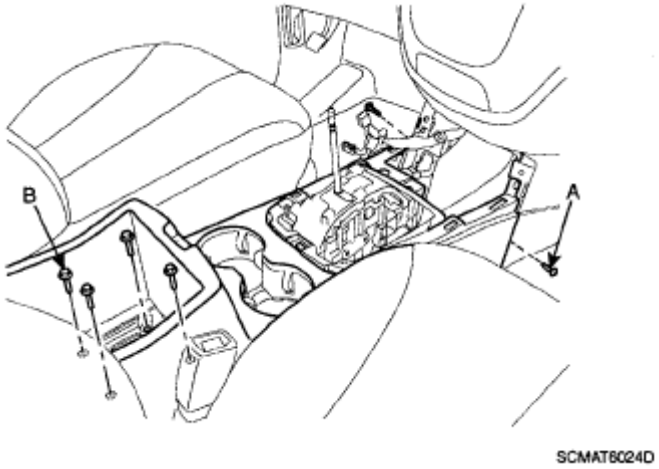


Fig. 228: Identifying Center Console Screws And Bolts

4. Disconnect the interlock switch connector (A).

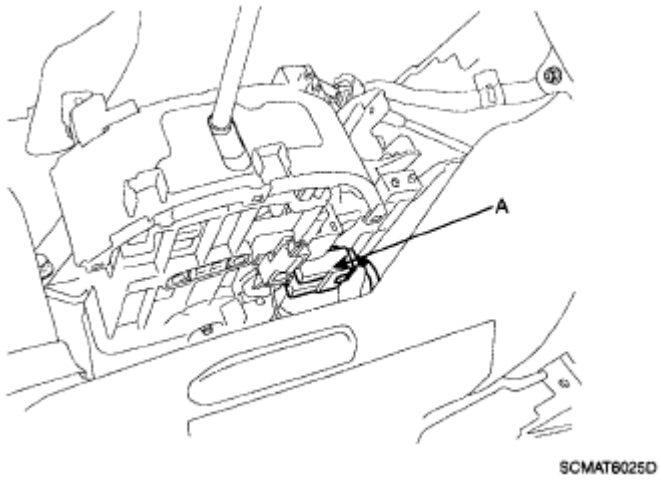


Fig. 229: Identifying Interlock Switch Connector

5. Remove the control cable assembly (C) by removing the snap pin (A) and the clip (B).

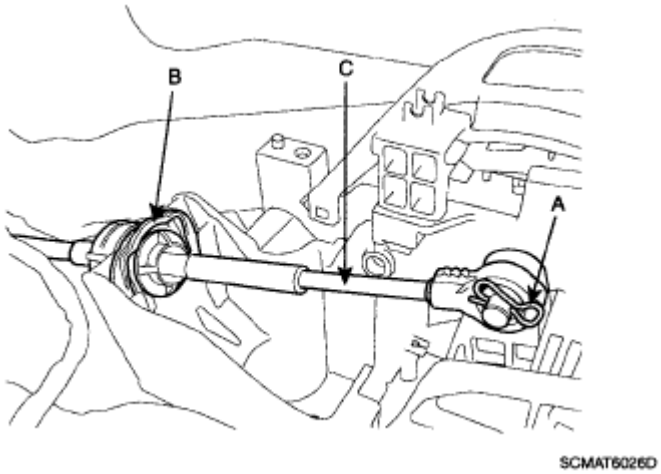


Fig. 230: Identifying Control Cable Assembly Snap Pin And Clip

6. Remove the shift lever bolts (A-4ea).

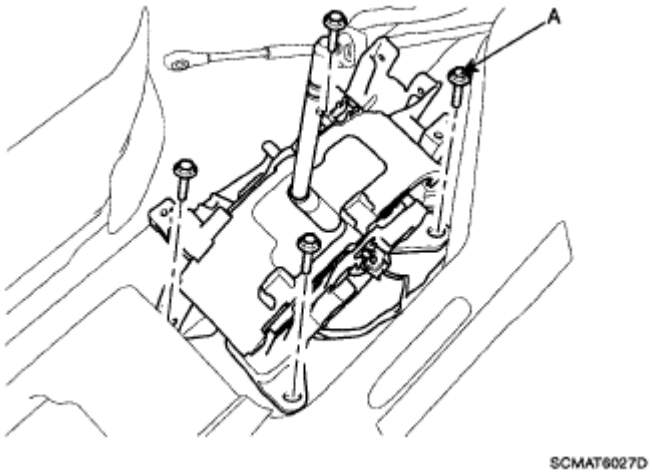


Fig. 231: Identifying Shift Lever Bolts

7. Remove the shift lever assembly.

INSPECTION

Adjusting method for the control cable

1. Set room side lever and T/M side lever (A) to "N" position.
2. Connect the room side lever and shift cable. (See '**INSTALLATION**')
3. Connect the T/M side lever (A) to cable (B) in this following order.
    1. Push the cable (B) lightly to "F" direction shown to eliminate FREE PLAY of the cable (B).
    2. Tighten the adjusting nut (C).

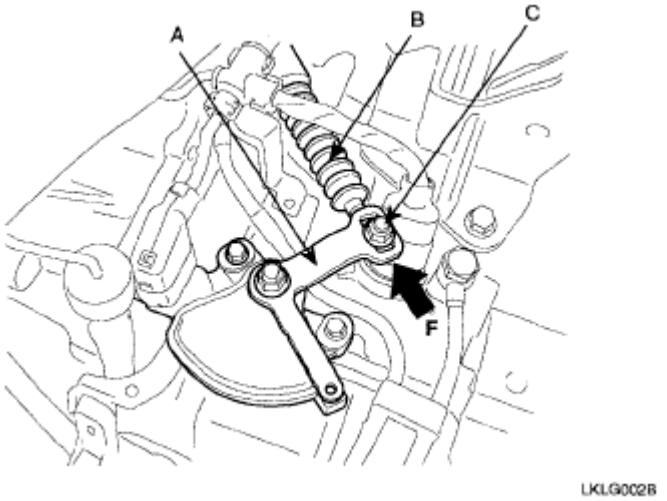


Fig. 232: Identifying Push Cable Adjusting Nut

4. After adjusting the cable (B) according to (2)-(4), check to be sure that this part operates surely at each range of T/M side corresponding to each position of room lever.

INSTALLATION

1. Install the shift lever bolts (A-4ea).

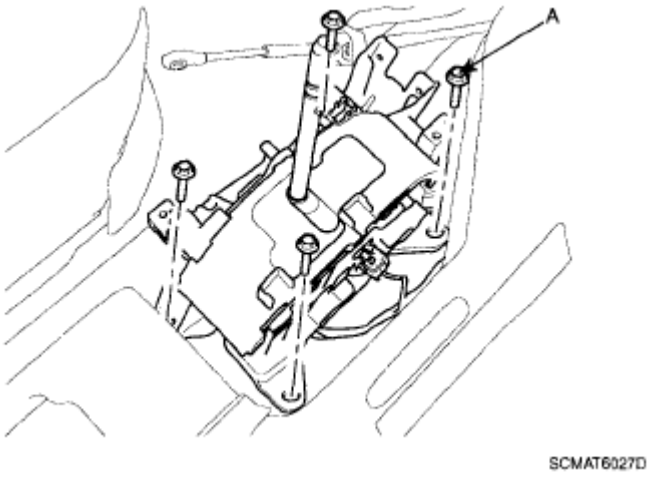


Fig. 233: Identifying Shift Lever Bolts

2. Install the control cable assembly (C) by inserting the snap pin (A) and the clip (B).

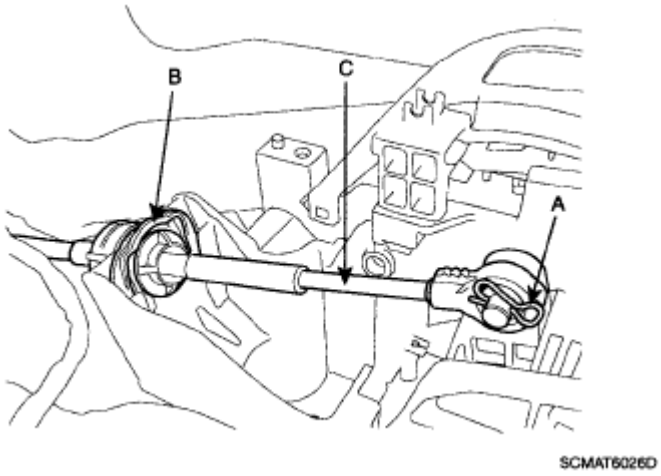


Fig. 234: Identifying Control Cable Assembly Snap Pin And Clip

3. Connect the interlock switch connector (A).

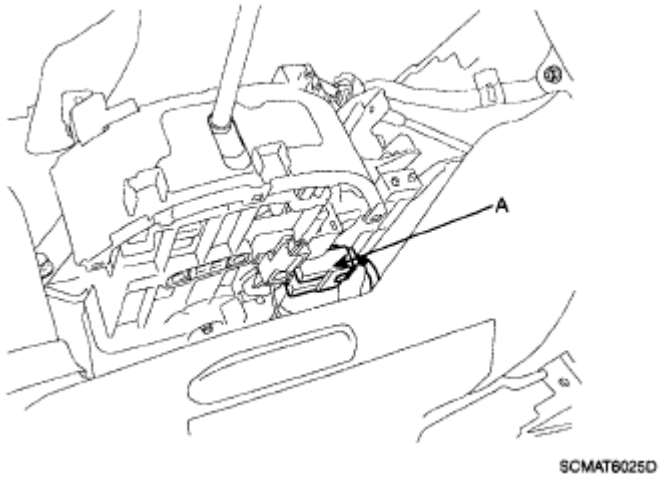


Fig. 235: Identifying Interlock Switch Connector

4. Install the center console by installing the two screws (A) and the four bolts (B). (See **INTERIOR**)

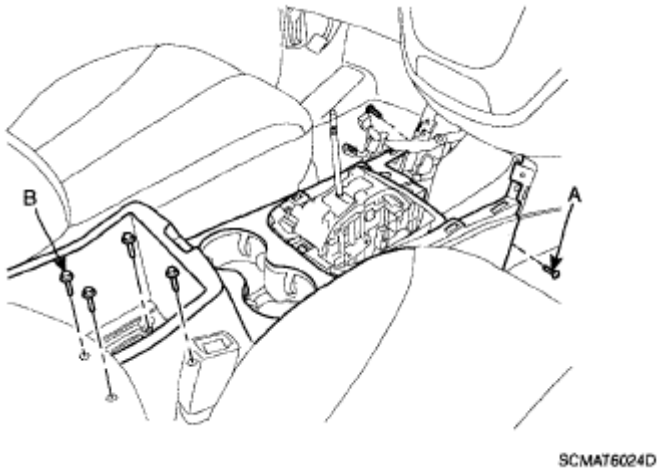


Fig. 236: Identifying Center Console Screws And Bolts

5. Install the center console cover (A).

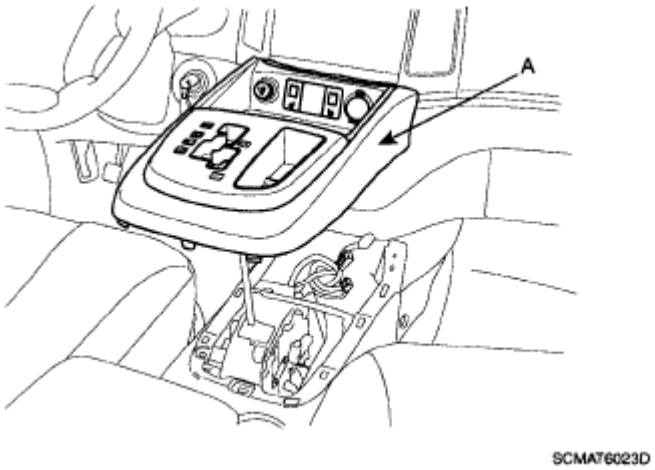


Fig. 237: Identifying Center Console Cover

6. Install the shift lever knob (A).

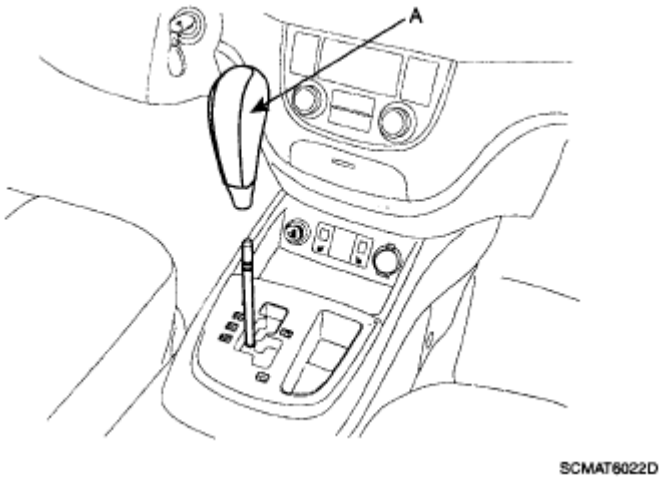


Fig. 238: Identifying Shift Lever Knob

