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General Information

SPECIFICATION

Item		F4A42		
Torque converter type		3-element, 1-stage, 2-phase type		
Transaxle type		4-speed forward, 1-speed reverse		
Engine displacement		2.0 DSL	2.0L GSL	2.7 GSL
Gear ratio	1st	2.842	2.842	2.842
	2nd	1.529	1.529	1.529
	3rd	1.000	1.000	1.000
	4th	0.712	0.712	0.712
	Reverse	2.480	2.480	2.480
Final gear ratio	2WD	4.042	4.626	4.042
	4WD	4.042	4.626	4.407
Shift pattern		Variable		
Shift range		4range (P-R-N-D) + Sports mode		
Shift range valve		PWM ; 5EA(Duty control)		
Planetary gear		2EA(Output planetary/Overdrive planetary)		
Clutch		3EA		
Brake		2EA		
OWC		1EA		

SERVICE SPECIFICATIONS

Items	Standard value
Output shaft preload	0.01-0.09 mm (0.0004-0.0035 in)
Brake reaction plate end play	0-0.16 mm (0-0.0063 in)
Low and reverse brake end play	1.65-2.11mm (0.065-0.083 in)
Second brake end play	0.79-1.25 mm (0.0311-0.0492 in)
Underdrive sun gear end play	0.25-0.45 mm (0.0098-0.0177 in)
Input shaft end play	0.70-1.20 mm (0.0276-0.0472 in)
Differential case preload	0.045-0.105 mm (0.0018-0.0041 in)
Underdrive clutch end play(wave disk)	1.25-1.45 mm (0.0492-0.057 in)
Overdrive clutch return spring retainer end play	0-0.09 mm (0-0.0035 in)
Overdrive clutch end play(wave disk)	1.6-1.8 mm (0.0630-0.0709 in)
Reverse clutch end play	1.5-1.7 mm (0.0590-0.0609 in)
Backlash between differential side gear and pinion	0.025-0.150 mm (0.001-0.006 in)

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TIGHTENING TORQUE

ITEM	N·m	kgf·cm	lbf·ft
Wiring harness bracket	20 ~ 26	200 ~ 260	14 ~ 18
Control cable bracket bolt	20 ~ 26	200 ~ 260	14 ~ 18
Eye bolt	30 ~ 45	300 ~ 450	22 ~ 33
Oil cooler feed tube	10 ~ 12	100 ~120	7 ~ 8
Input shaft speed sensor	10 ~ 12	100 ~ 120	7 ~ 8
Output shaft speed sensor	10 ~ 12	100 ~ 120	7 ~ 8
Manual control lever	18 ~ 25	180 ~ 250	13 ~ 18
Transaxle range switch	10 ~ 12	100 ~ 120	7 ~ 8
Speedometer gear	4 ~ 6	40 ~ 60	3 ~ 4
Valve body cover	8 ~ 10	80 ~ 100	6 ~ 7
Valve body mounting bolt	10 ~ 12	100 ~ 120	7 ~ 8
Oil temperature sensor	10 ~ 12	100 ~ 120	7 ~ 8
Manual control shaft detent	5 ~ 7	50 ~ 70	4 ~ 5
Rear cover	20 ~ 26	200 ~ 260	14 ~ 18
Torque converter housing	42 ~ 54	420 ~ 540	29 ~ 38
Oil pump	20 ~ 26	200 ~ 260	14 ~ 18
Transfer drive gear	16 ~ 22	160 ~ 220	11 ~ 15
Output shaft lock nut	160 ~ 180	1600 ~ 1800	110 ~ 126
Output shaft bearing retainer	20 ~ 26	200 ~ 260	14 ~ 18
Oil filler plug	29 ~ 34	290 ~ 340	21.4 ~ 25.1
Oil drain plug	40 ~ 50	400 ~ 500	29 ~ 36
Transfer drive gear lock nut	180 ~ 210	1800 ~ 2100	126 ~ 147
Differential drive gear to subframe bolts	130 ~ 140	1300 ~ 1400	91 ~ 98
Valve body	10 ~ 12	100 ~ 120	7 ~ 8
Solenoid valve support	5 ~ 7	50 ~ 70	4 ~ 5
Plate	5 ~ 7	50 ~ 70	4 ~ 5
Pressure check plug	8 ~ 10	80 ~ 100	6 ~ 7
Front roll stopper bracket to subframe bolts	40 ~ 55	400 ~ 550	29 ~ 40
Front roll stopper insulator bolt and nut	50 ~ 65	500 ~ 650	36 ~ 47
Front roll stopper bracket to transaxle bolts	60 ~ 80	600 ~ 800	43 ~ 58
Rear roll stopper bracket	40 ~ 55	400 ~ 550	29 ~ 40
Rear roll stopper insulator bolt and nut	50 ~ 65	500 ~ 650	36 ~ 47
Rear roll stopper bracket to transaxle bolts	60 ~ 80	600 ~ 800	43 ~ 58
Transaxle mounting sub bracket nut	60 ~ 80	600 ~ 800	43 ~ 58

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Transaxle mounting bracket bolts	40 ~ 55	400 ~ 550	29 ~ 40
Transaxle mounting insulator bolt	90 ~ 110	900 ~ 1100	65 ~ 80

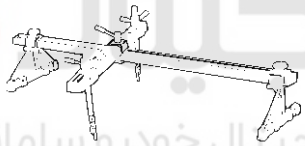
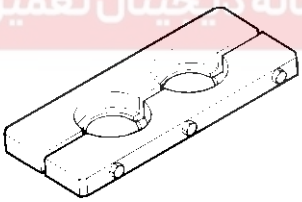
LUBRICANT

Item	Specified lubricant	Quantity
Transmission oil	Diamond ATF SP-III	7.8ℓ(8.2 Us gt, 6.9Imp.gt)

SEALANT

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

TOOL (Number and name)	Illustration	Use
09200 - 38001 Engine support fixture		Removal and installation of transaxle.
09432 - 33200 Bearing removing plate		Removal of 4WD coupling flange oil seal

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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. The entire unit is in line with the engine.

Characteristics

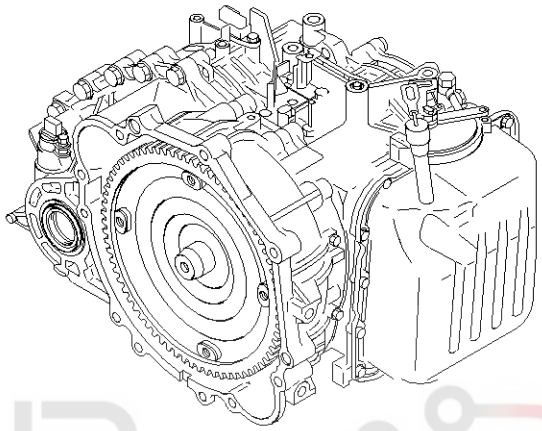
HIVEC: Hyundai Intelligent Vehicle Electronic Control

It differs drastically compared to previous T/M such as alpha, Bcta or KM series automatic transaxles.

Hyundai vehicles adopted with an engine volume of 2.0 liters or more has the HIVEC automatic transaxle developed and produced by Hyundai.

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



LKIF001A

دیجیتال خودرو
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

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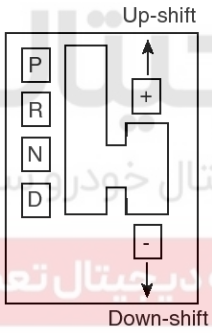
Item	Details
Weight Reduction	1. Aluminum oil pump - 2.3kg Approx 2. Pressed parts - Retainer and hub of brakes and clutches - Carrier of planetary gear set
Better shift quality	1. Independent control of clutches and brakes enabled better control of hydraulic pressure and skip shift possible (4 to 2, 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 61.3 Hz except DCCSV that is 35Hz. 5. HIVEC adoption for better shift feeling. 6. Variable shift pattern.
Increase in Power train efficiency	1. Variable oil level - An oil dam is incorporated in the case to temporarily contain ATF, so the damage of power train is decreased at low temperatures
Dynamic drive by sports mode	- Manual shifting possible 

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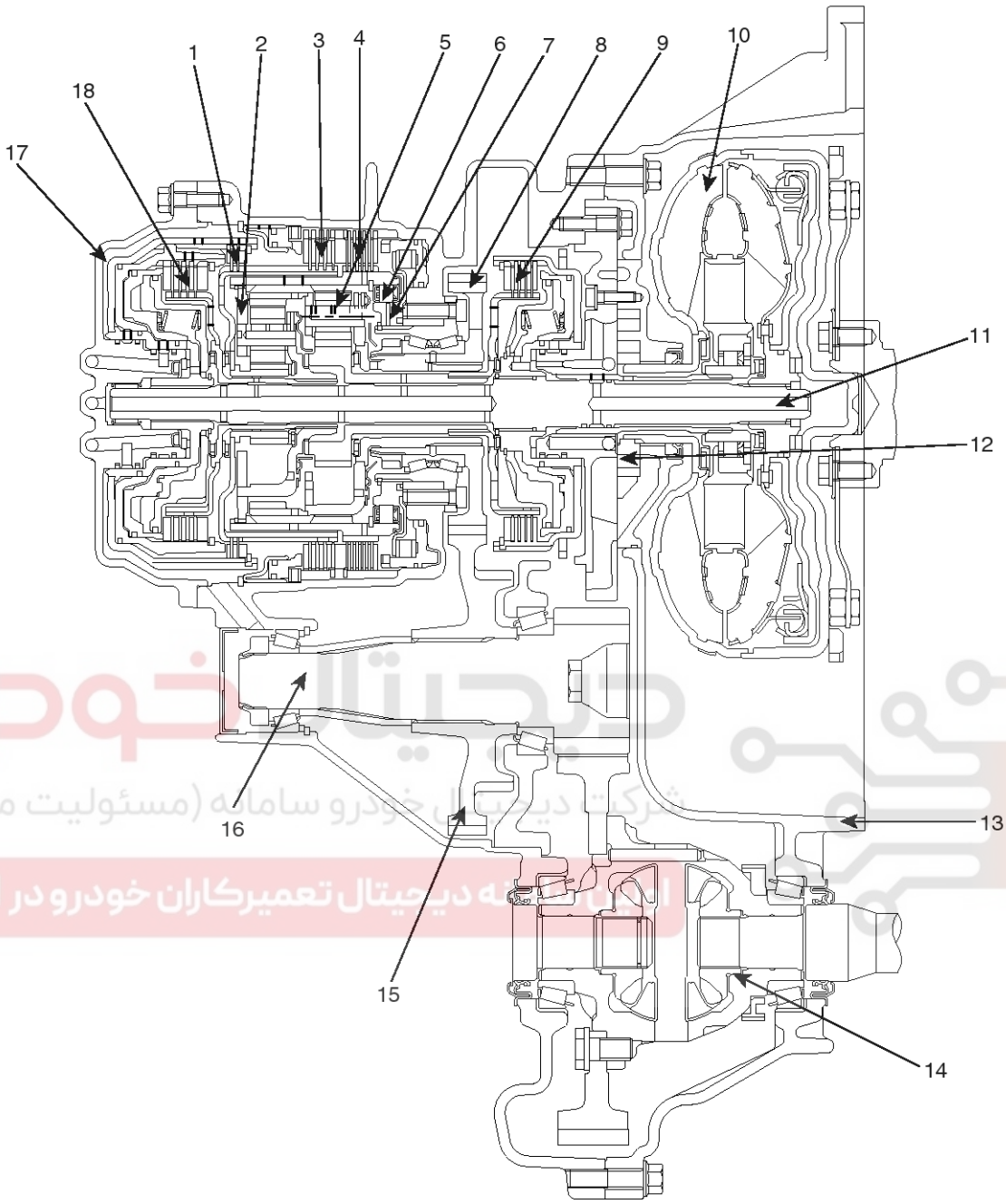

1. Reverse clutch
2. Overdrive planetary gear set
3. Second brake
4. Low-reverse brake
5. Output plantary gear set
6. Oneway clutch
7. Oneway clutch inner race
8. Transfer drive gear
9. Underdrive clutch
10. Torque converter
11. Input shaft
12. Oil pump
13. Converter housing
14. Differential
15. Transfer driven gear
16. Output shaft
17. Rear cover
18. Overdrive clutch

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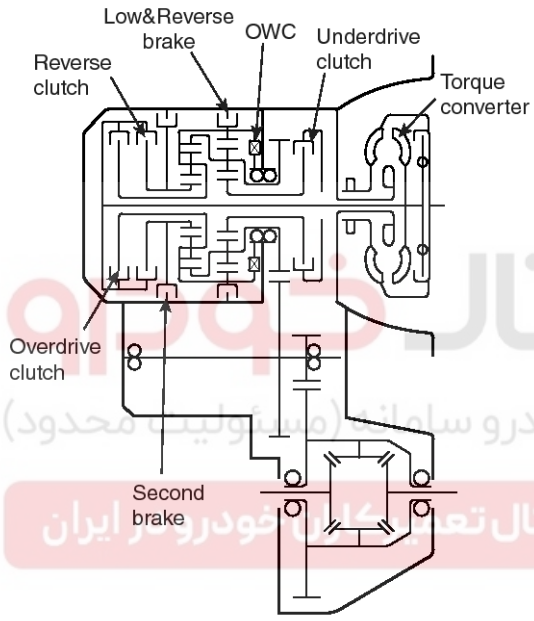
MECHANICAL SYSTEM

OPERATION COMPONENTS AND FUNCTION

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



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Operating elements

	UD/C	OD/C	REV/C	2ND/B	LR/B	OWC
P					●	
R			●		●	
N					●	
D1	●				●	○
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 a impeller(pump), turbine and stator assembly in a single unit. The pump is connected to the engine crankshaft and turns as the

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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

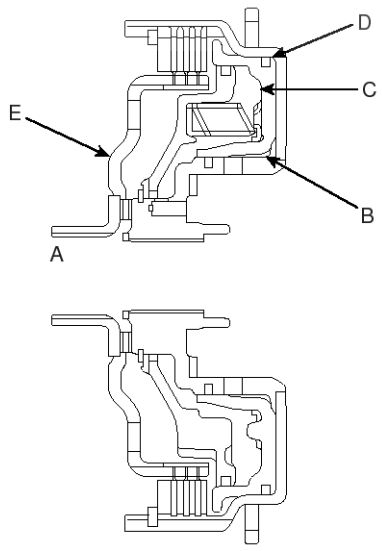
The gear changing mechanism utilizes three multi-disc clutches. The retainers of these clutches are fabricated from high-precision sheet metal for lightness and ease of production. Also, more responsive gearshifts at high engine speeds are achieved by a pressure-balanced piston mechanism that cancels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



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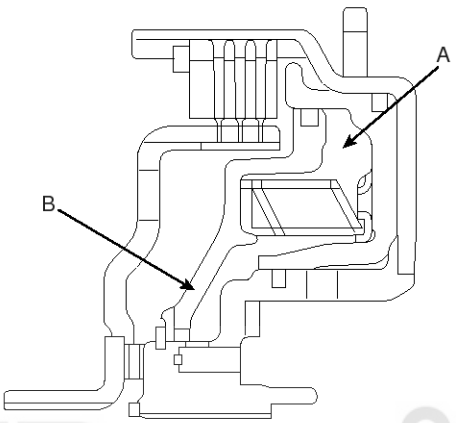
At high speed, fluid remaining in the piston pressure chamber is subjected to centrifugal force and attempts to push the piston.

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.



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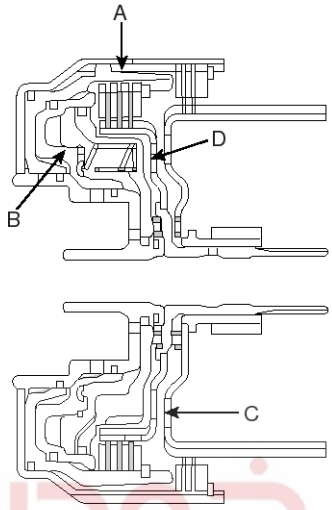
REVERSE CLUTCH AND OVERDRIVE CLUTCH

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.



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BRAKES

The gear changing mechanism utilizes two multi-disc brakes.

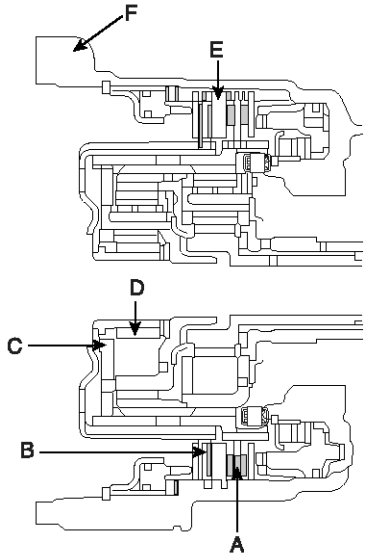
LOW & REVERSE BRAKE AND SECOND BRAKE

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.



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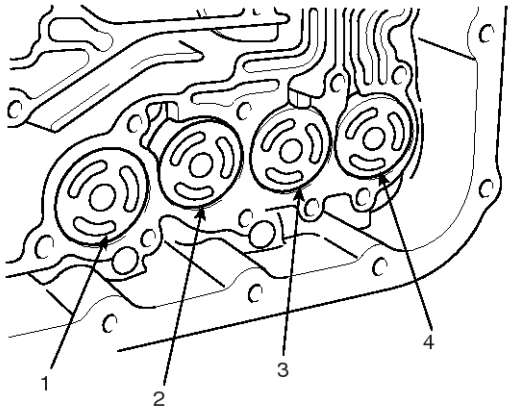
OWC

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 new concept, because this OWC already has been installed on the:

ACCUMULATORS

Number	Function Name	Color
1	Low & Reverse Brake	None
2	Underdrive Clutch	Yellow
3	Second Brake	Blue
4	Overdrive Clutch	None



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Objective

* Energy (hydraulic pressure) storage

* Impact and pulsation damping when solenoid valves operating

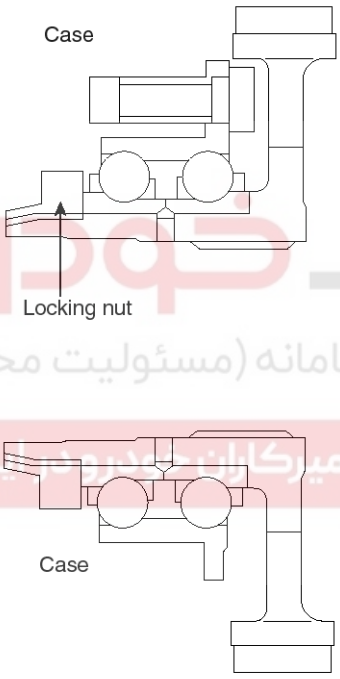
* Operation as spring element

* 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.



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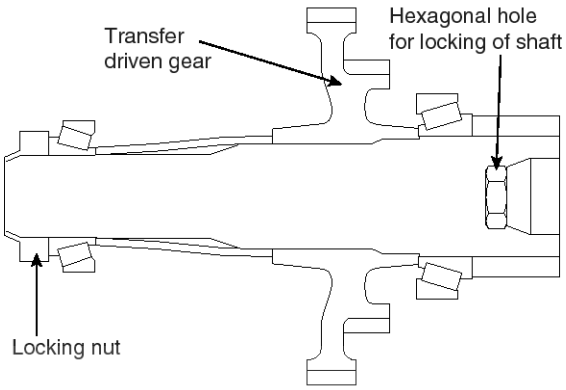
OUTPUT SHAFT/TRANSFER DRIVEN GEAR

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.



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MANUAL CONTROL SYSTEM

MANUAL CONTROL LEVER

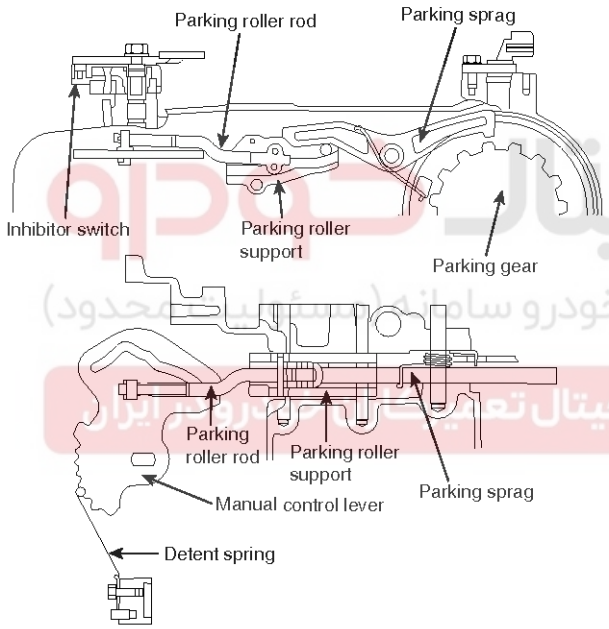
The manual control lever is fitted to the top of the valve body and is linked to the parking roller rod and manual control valve pin.

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.



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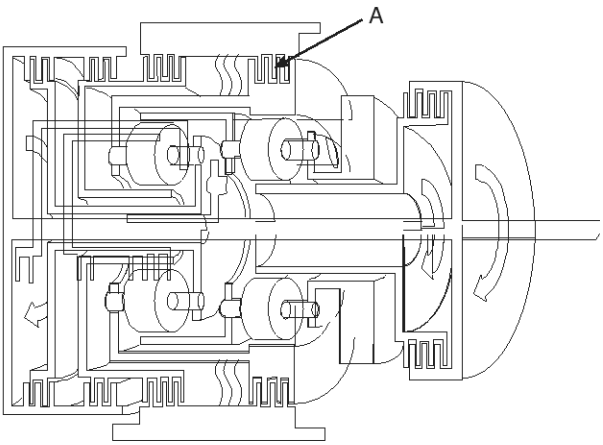
POWER TRAIN

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.



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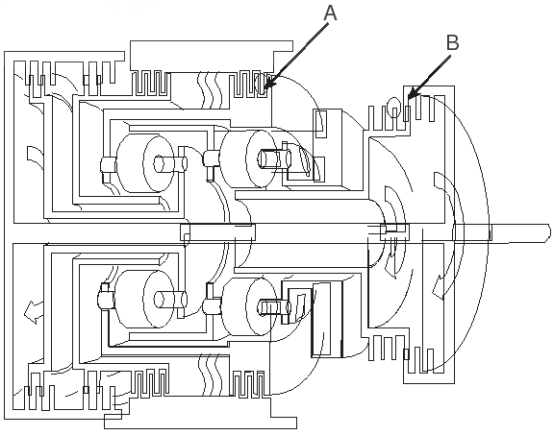
1st GEAR POWER FLOW

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.



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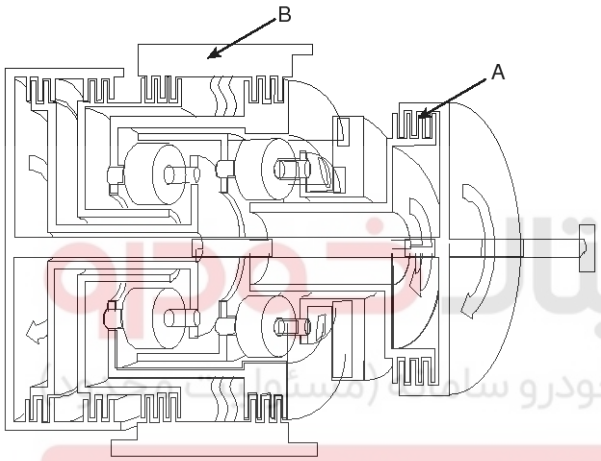
2nd GEAR POWER FLOW

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.



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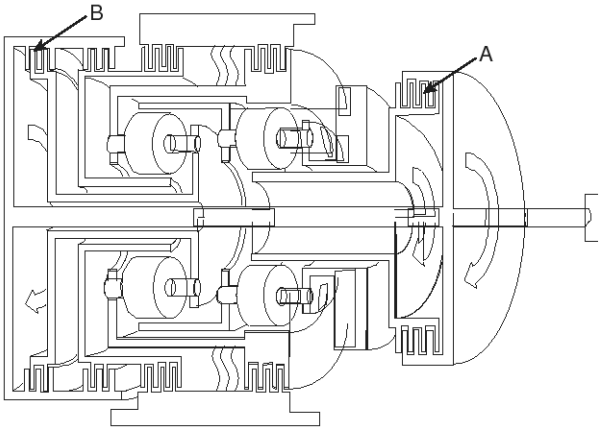
3rd GEAR POWER FLOW

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.



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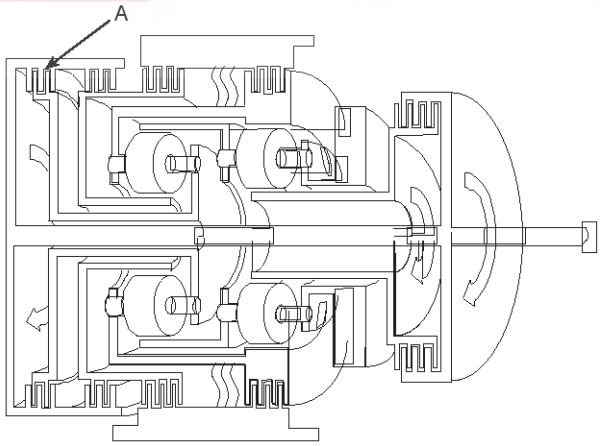
4th GEAR POWER FLOW

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.



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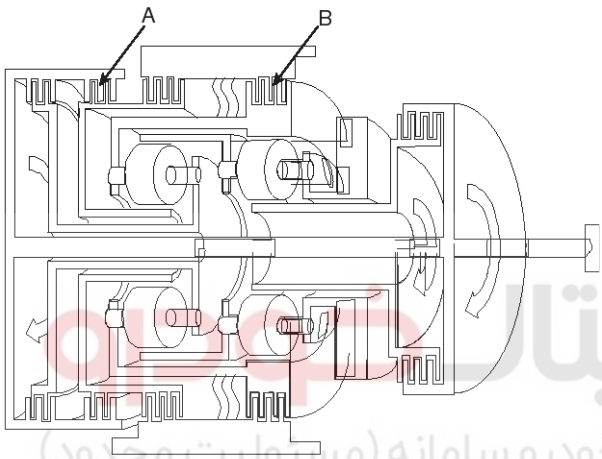
Rev GEAR POWER FLOW

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.



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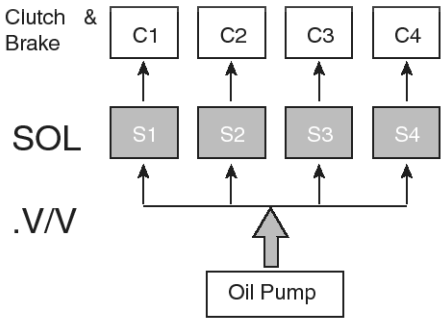
Hydraulic Control System

DESCRIPTION



Each clutch and brake have a Solenoid valve for independent control of hydraulic pressure

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- 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.

OPERATION COMPONENTS AND FUNCTIONS

Oil Pump

The oil pump is made of aluminum to reduce its weight. The oil pump is not a serviceable part; it must be replaced as a pump assembly.

Do not disassemble the pump as improper alignment during assembly will cause pump failure and could cause damage to the transaxle.

When removing the oil pump from the T/M case, the S.S.T. (09452-33100) must be used.

OPERATION OF EACH VALVE

Torque converter pressure control valve : The function of this valve is to maintain a constant pressure within the torque converter.

Damper clutch control valve : Its function is to control the hydraulic pressure that acts on the Damper Clutch. Manual valve :The position of the manual valve is determined by the selector lever and applies or cuts line pressure to different valves.

Pressure control valve & Solenoid valve : The pressure control valve prevents a rapid decrease in hydraulic pressure when the clutch becomes disengaged. It also reduces the sharp increase in input shaft speed during clutch to clutch control.

Switch valve : When the OD clutch is applied, the hydraulic pressure is applied to the regulator valve via the switch valve. Hence, the line pressure is reduced at 3rd and 4th gear.

Fail Safe Valve-A : During fail safe mode, this valve releases the pressure in the LR Brake.

Fail Safe Valve-B : During fail safe mode, this valve cuts the pressure from the 2nd pressure control valve to 2nd brake.

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Hydraulic flow

P and N position

The TCM(PCM) controls the solenoid valves. The conditions of the solenoid valve and positions of the solenoid valve are as follows :

- The LR solenoid valve is turned off, and the LR pressure solenoid valve is moved to the left side.
- The 2nd solenoid valve is turned on, and the 2nd pressure solenoid valve remains in the right side.
- The UD solenoid valve is turned on, and the UD pressure solenoid valve remains in the right side.
- The OD solenoid valve is turned on, and the OD pressure solenoid valve remains in the right side.
- The line pressure is supplied to the regulator valve and the fail-safe valve A.
- The line pressure is supplied to each element (fail-safe valve B, switch valve, DCCV, LR solenoid valve, LR pressure control valve).
- The fail-safe valve B moves to the left side by the line pressure through the manual valve.
- The switch valve moves to the left side by the line pressure.
- The line pressure is supplied to the DCCV, and DCCV moves to the right side.
- The line pressure is supplied to the LR pressure control valve and the LR solenoid valve, and TCM(PCM) turns off the LR solenoid valve, so the line pressure is supplied to the LR brake through the switch valve and the fail-safe valve A.
- The regulator valve moves to the left side by the line pressure through the manual valve, and the line pressure is supplied to the torque converter pressure control valve and the oil pump.

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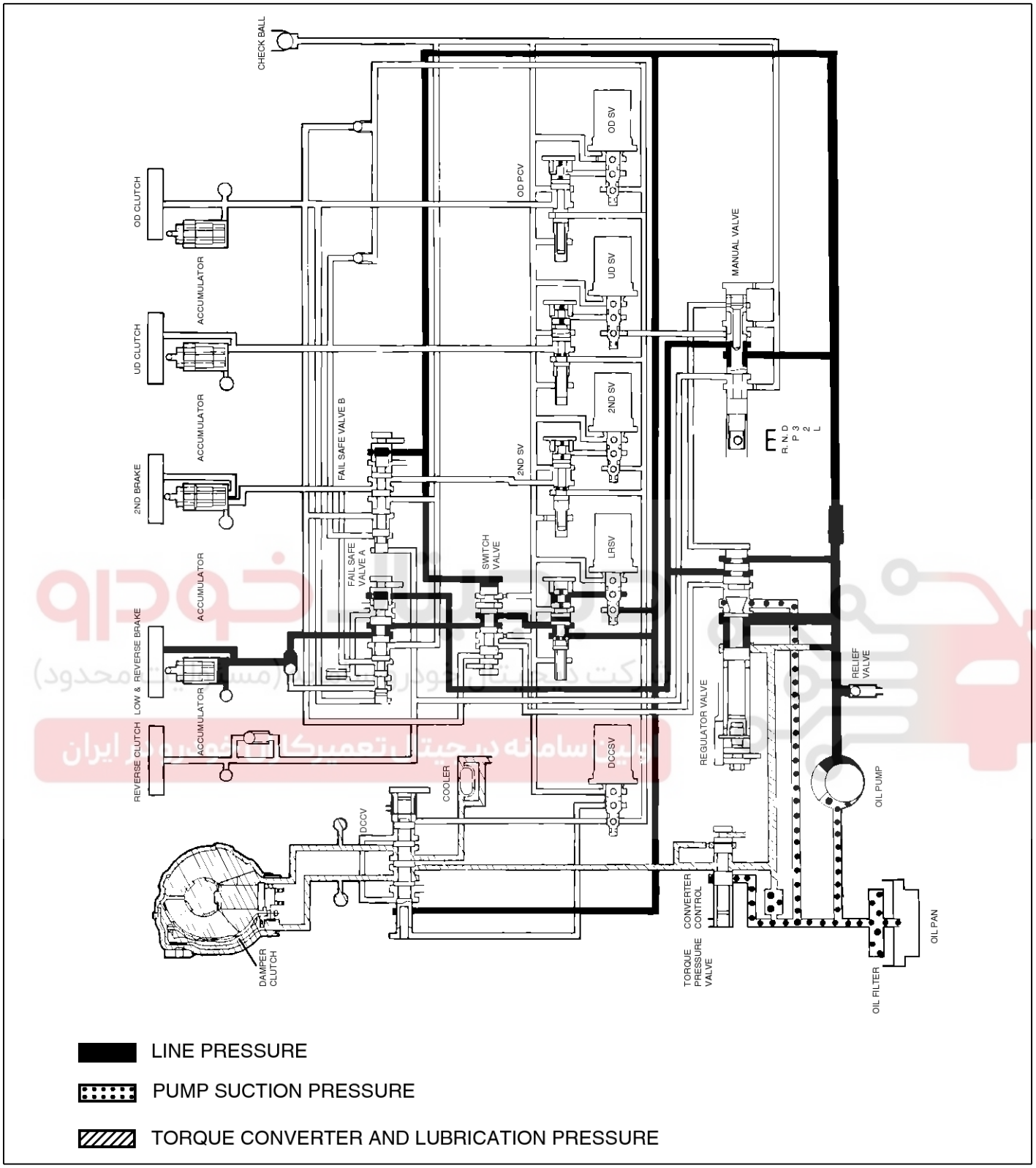

EKA9050A

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D position : 1st gear

The TCM(PCM) controls the solenoid valves. The conditions of the solenoid valve and positions of the solenoid valve are as follows :

- The LR solenoid valve is turned off, and the LR pressure solenoid valve is moved to the left side.
- The 2nd solenoid valve is turned on, and the 2nd pressure solenoid valve remains in the right side.
- The UD solenoid valve is turned off, and the UD pressure solenoid valve is moved to the left side.
- The OD solenoid valve is turned on, and the OD pressure solenoid valve remains in the right side.
- The line pressure is supplied to the regulator valve and the fail-safe valve A.
- The line pressure is supplied to each element (fail-safe valve B, switch valve, damper clutch control valve, LR solenoid valve, LR pressure control valve).
- The line pressure through the manual valve is supplied to each element (DCCV, 2nd solenoid valve, 2nd pressure control valve, OD solenoid valve, OD pressure control valve, UD solenoid valve, UD pressure control valve).
- The fail-safe valve B moves to the left side by the line pressure.
- The switch valve moves to the left side by the line pressure.
- The line pressure is supplied to the DCCV, and TCM(PCM) turns off the DCCSV, so the DCCV remains in the right side
- The line pressure is supplied to the LR pressure control valve and the LR solenoid valve, and TCM(PCM) turns off the LR solenoid valve, so the line pressure is supplied to the LR brake through the switch valve and the fail-safe valve A.
- The line pressure is supplied to the UD pressure control valve and the UD solenoid valve, and TCM(PCM) turns off the UD solenoid valve, so the line pressure is supplied to the UD clutch and the fail-safe valve B.
- The regulator valve moves to the left side by the line pressure through the manual valve, and the line pressure is supplied to the torque converter pressure control valve and the oil pump.

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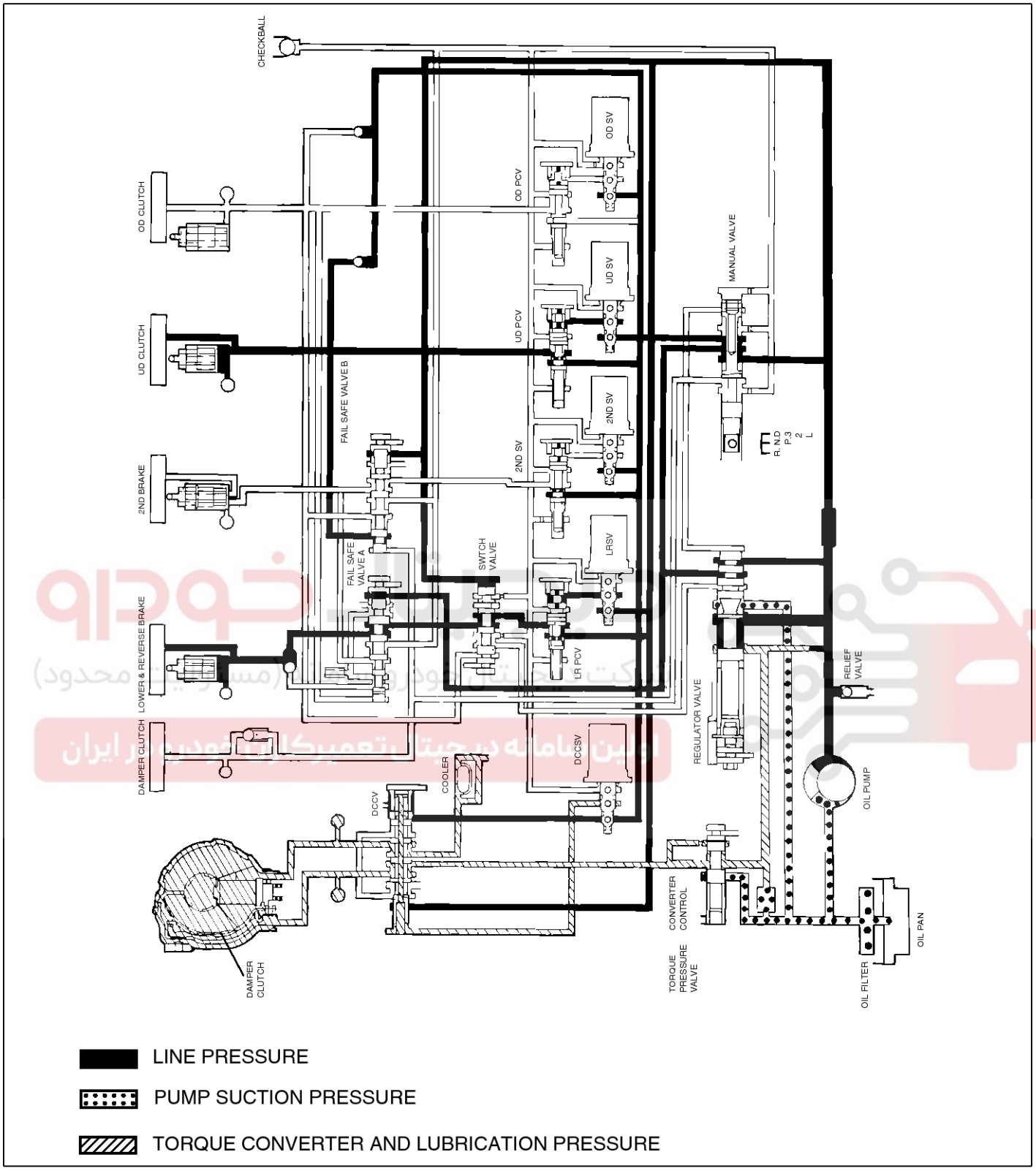

EKA9050B

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D position : 2nd gear

The TCM(PCM) controls the solenoid valves. The conditions of the solenoid valve and positions of the solenoid valve are as follows :

- The LR solenoid valve is turned on, and the LR pressure solenoid valve remains in the right side.
- The 2nd solenoid valve is turned off, and the 2nd pressure solenoid valve is moved to the left side.
- The UD solenoid valve is turned off, and the UD pressure solenoid valve is moved to the left side.
- The OD solenoid valve is turned on, and the OD pressure solenoid valve remains in the right side.
- The line pressure is supplied to the regulator valve and the fail-safe valve A.
- The line pressure is supplied to each element (fail-safe valve B, switch valve, damper clutch control valve, LR solenoid valve, LR pressure control valve).
- The line pressure through the manual valve is supplied to each element (DCCV, 2nd solenoid valve, 2nd pressure control valve, OD solenoid valve, OD pressure control valve, UD solenoid valve, UD pressure control valve).
- The fail-safe valve B moves to the right side by the line pressure through 2nd pressure control valve and the line pressure through the UD pressure control valve.
- The pressure through the manual valve is supplied to the fail-safe valve A, and the fail-safe valve A moves to the left side
- The switch valve moves to the left side by the line pressure.
- The line pressure is supplied to the DCCV and the DCCSV, and TCM(PCM) turns off the DCCSV, so the DCCV remains in the right side
- The line pressure is supplied to the 2nd pressure control valve and the 2nd solenoid valve, and TCM(PCM) turns off the 2nd solenoid valve, so the line pressure is supplied to the 2nd brake and the fail-safe valve A through the fail-safe valve B.
- The line pressure is supplied to the UD pressure control valve and the UD solenoid valve, and TCM(PCM) turns off the UD solenoid valve, so the line pressure is supplied to the UD clutch and the fail-safe valve B.
- The regulator valve moves to the left side by the line pressure through the manual valve, and the line pressure is supplied to the torque converter pressure control valve and the oil pump.

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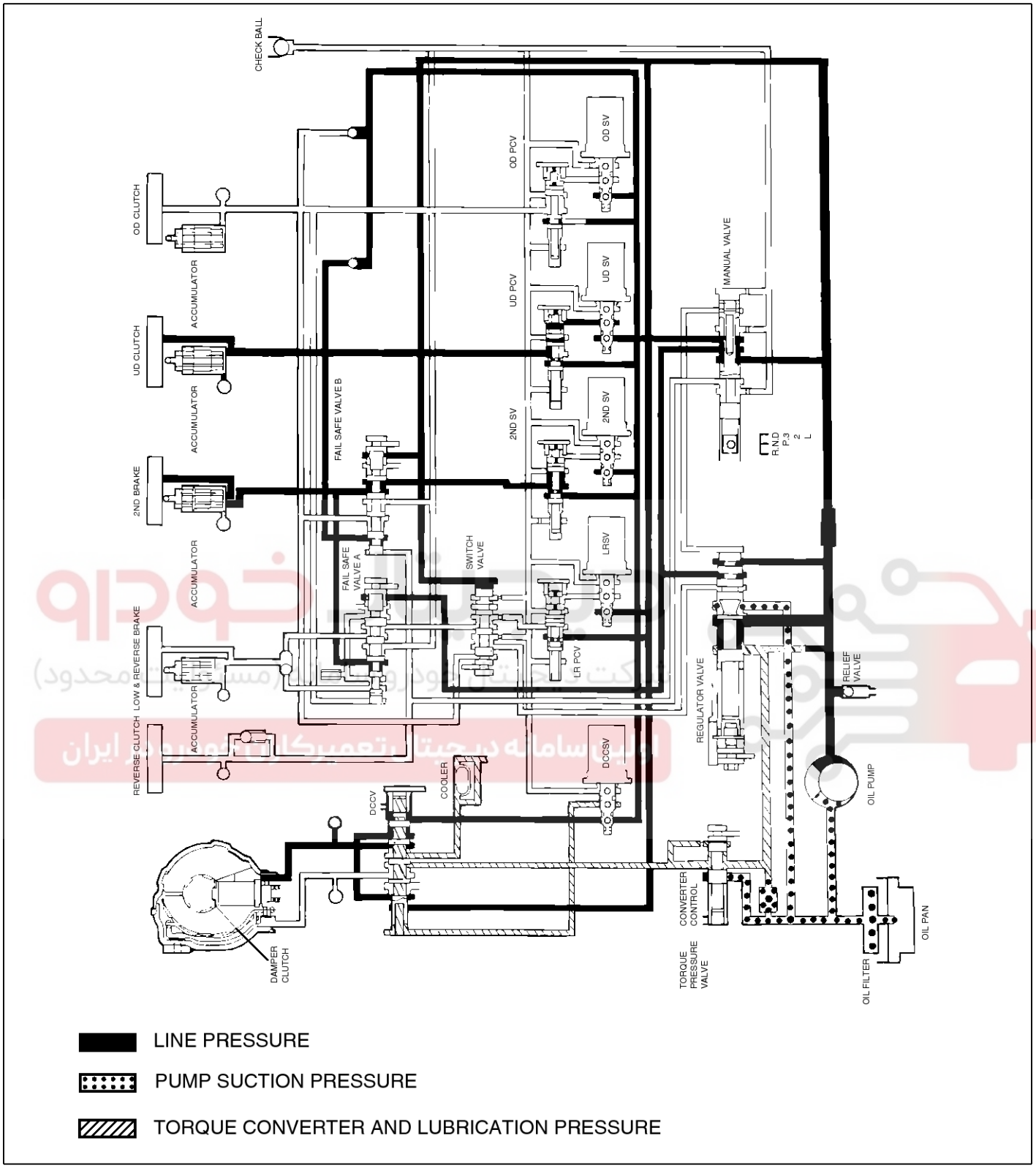

EKA9050C

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D position : 3rd gear

The TCM(PCM) controls the solenoid valves. The conditions of the solenoid valve and positions of the solenoid valve are as follows :

- The LR solenoid valve is turned on, and the LR pressure solenoid valve remains in the right side.
- The 2nd solenoid valve is turned on, and the 2nd pressure solenoid valve remains in the right side.
- The UD solenoid valve is turned off, and the UD pressure solenoid valve is moved to the left side.
- The OD solenoid valve is turned off, and the OD pressure solenoid valve is moved to the left side.
- The line pressure is supplied to the regulator valve and the fail-safe valve A.
- The line pressure is supplied to each element (fail-safe valve B, switch valve, DCCV, LR solenoid valve, LR pressure control valve).
- The line pressure through the manual valve is supplied to each element (DCCSV, 2nd solenoid valve, 2nd pressure control valve, OD solenoid valve, OD pressure control valve, UD solenoid valve, UD pressure control valve).
- The fail-safe valve B moves to the right side by the line pressure through the UD pressure control valve and the line pressure through the OD pressure control valve.
- The pressure is supplied to the fail-safe valve A through the OD pressure control valve, but the fail-safe valve A does not move to the right side
- The line pressure is supplied to the DCCV and the DCCSV, and TCM(PCM) turns on the DCCSV, and the DCCV moves to the left side, and the damper clutch is operated.
- The line pressure is supplied to the UD pressure control valve and the UD solenoid valve, and TCM(PCM) turns off the UD solenoid valve, so the line pressure is supplied to the UD clutch and the fail-safe valve B.
- The line pressure is supplied to the OD pressure control valve and the OD solenoid valve, and TCM(PCM) turns off the OD solenoid valve, so the line pressure is supplied to the OD clutch and the fail-safe valve A/B and the switch valve.
- The switch valve moves to the right side by the line pressure through the OD pressure control valve.
- The regulator valve moves to the left side by the pressure through the manual valve and the pressure through the switch valve, and the line pressure is more supplied to the oil pump.

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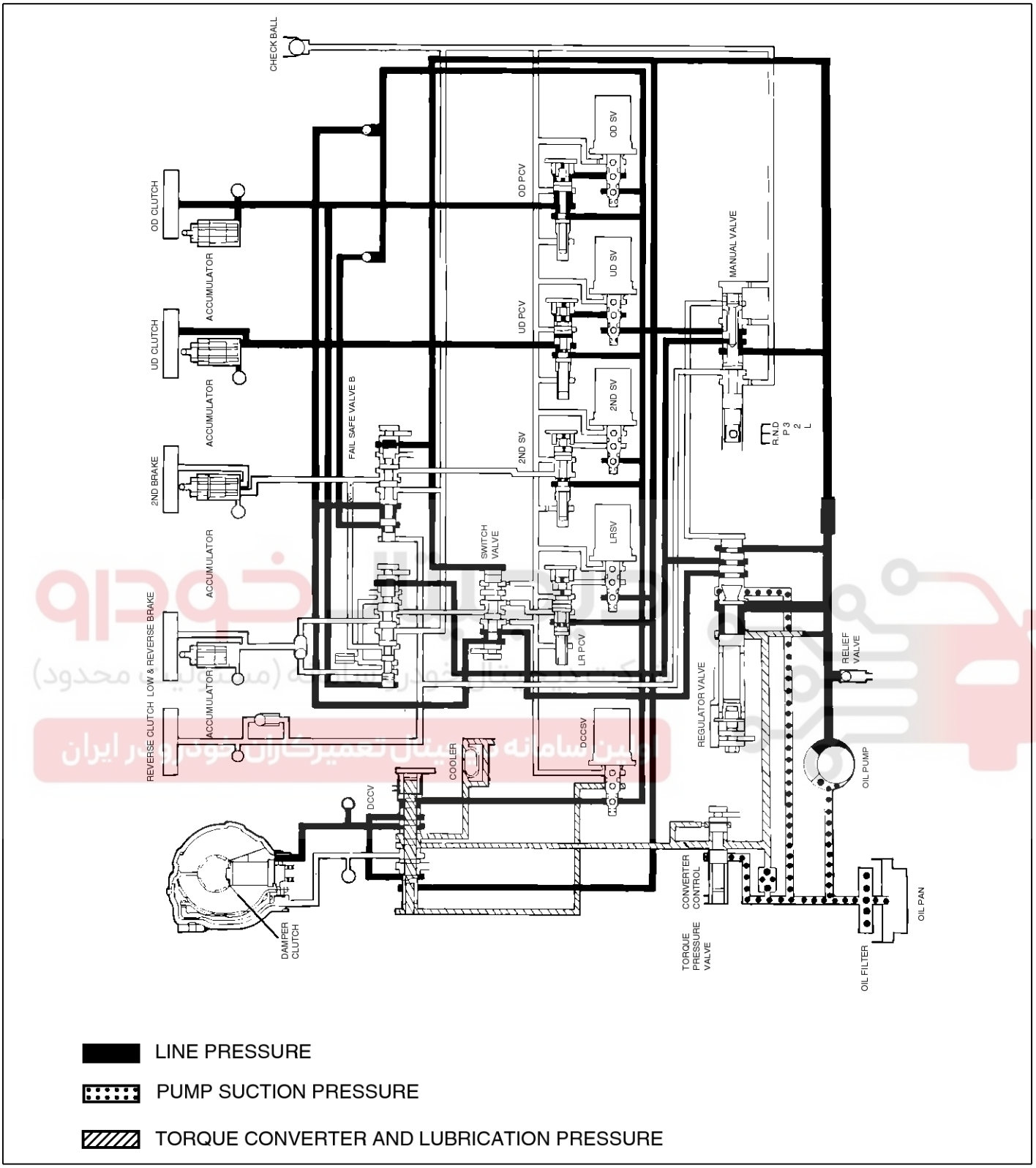

EKA9050D

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D position : 4th gear

The TCM(PCM) controls the solenoid valves. The conditions of the solenoid valve and positions of the solenoid valve are as follows :

- The LR solenoid valve is turned on, and the LR pressure solenoid valve remains in the right side.
- The 2nd solenoid valve is turned off, and the 2nd pressure solenoid valve is moved to the left side.
- The UD solenoid valve is turned on, and the UD pressure solenoid valve remains in the right side.
- The OD solenoid valve is turned off, and the OD pressure solenoid valve is moved to the left side.
- The line pressure through the manual valve is supplied to the regulator valve and the fail-safe valve A.
- The line pressure is supplied to each element (fail-safe valve B, switch valve, DCCV, LR solenoid valve, LR pressure control valve).
- The line pressure through the manual valve is supplied to each element (DCCSV, 2nd solenoid valve, 2nd pressure control valve, OD solenoid valve, OD pressure control valve, UD solenoid valve, UD pressure control valve).
- The fail-safe valve B moves to the right side by the line pressure through the 2nd pressure control valve and the line pressure through the OD pressure control valve.
- The line pressure through the OD pressure control valve is supplied to the fail-safe valve A, and the fail-safe valve A moves to the right side by the line pressure through the fail-safe valve B and the line pressure through the OD pressure control valve.
- The line pressure is supplied to the DCCV and the DCCSV, and TCM(PCM) turns on the DCCSV, so DCCV moves to the right side, and the damper clutch is operated.
- The line pressure is supplied to the OD pressure control valve and the OD solenoid valve, and TCM(PCM) turns off the OD solenoid valve, so the line pressure is supplied to the OD clutch and the fail-safe valve A/B and the switch valve.
- The line pressure is supplied to the 2nd pressure control valve and the 2nd solenoid valve, and TCM(PCM) turns off the 2nd solenoid valve, so the line pressure through the 2nd pressure control valve is supplied to the 2nd brake through the fail-safe valve B.
- The regulator valve moves to the left side by the line pressure through the manual valve and the line pressure through the switch valve, and the line pressure is more supplied to the oil pump.

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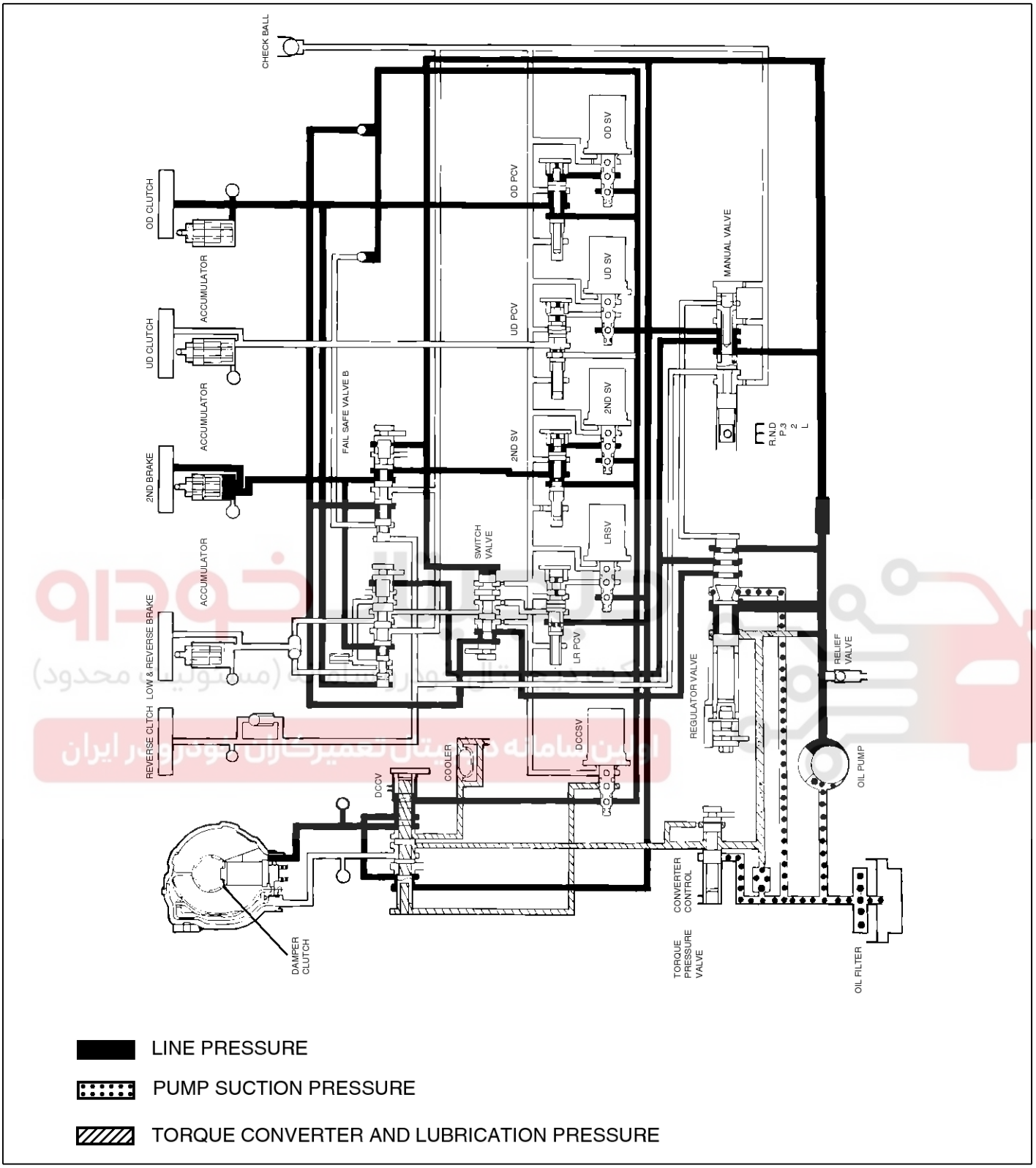

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Reverse position

The TCM(PCM) controls the solenoid valves. The conditions of the solenoid valve and positions of the solenoid valve are as follows :

- The LR solenoid valve is turned off, and the LR pressure solenoid valve is moved to the left side.
- The 2nd solenoid valve is turned on, and the 2nd pressure solenoid valve remains in the right side.
- The UD solenoid valve is turned on, and the UD pressure solenoid valve remains in the right side.
- The OD solenoid valve is turned on, and the OD pressure solenoid valve remains in the right side.
- The line pressure through the manual valve is supplied to the reverse clutch and the fail-safe valve B.
- The line pressure is supplied to each element (fail-safe valve B, switch valve, DCCV, LR solenoid valve, LR pressure control valve).
- The fail-safe valve B moves to the left side by the line pressure.
- The switch valve moves to left side by the line pressure, and the line pressure through the LR pressure control valve is supplied to the LR brake through the fail-safe valve A.
- The line pressure is supplied to the DCCV, so the DCCV remains in the right side.
- The fail-safe valve A moves to the right side by the line pressure through the switch valve.
- The line pressure is supplied to the LR pressure control valve and the LR solenoid valve, and TCM(PCM) turns off the LR solenoid valve, and the line pressure is supplied to the LR brake through the LR pressure control valve and the switch valve and the fail-safe valve A.
- The regulator valve moves to the right side by the no line pressure through the manual valve, and the line pressure is higher than other range.

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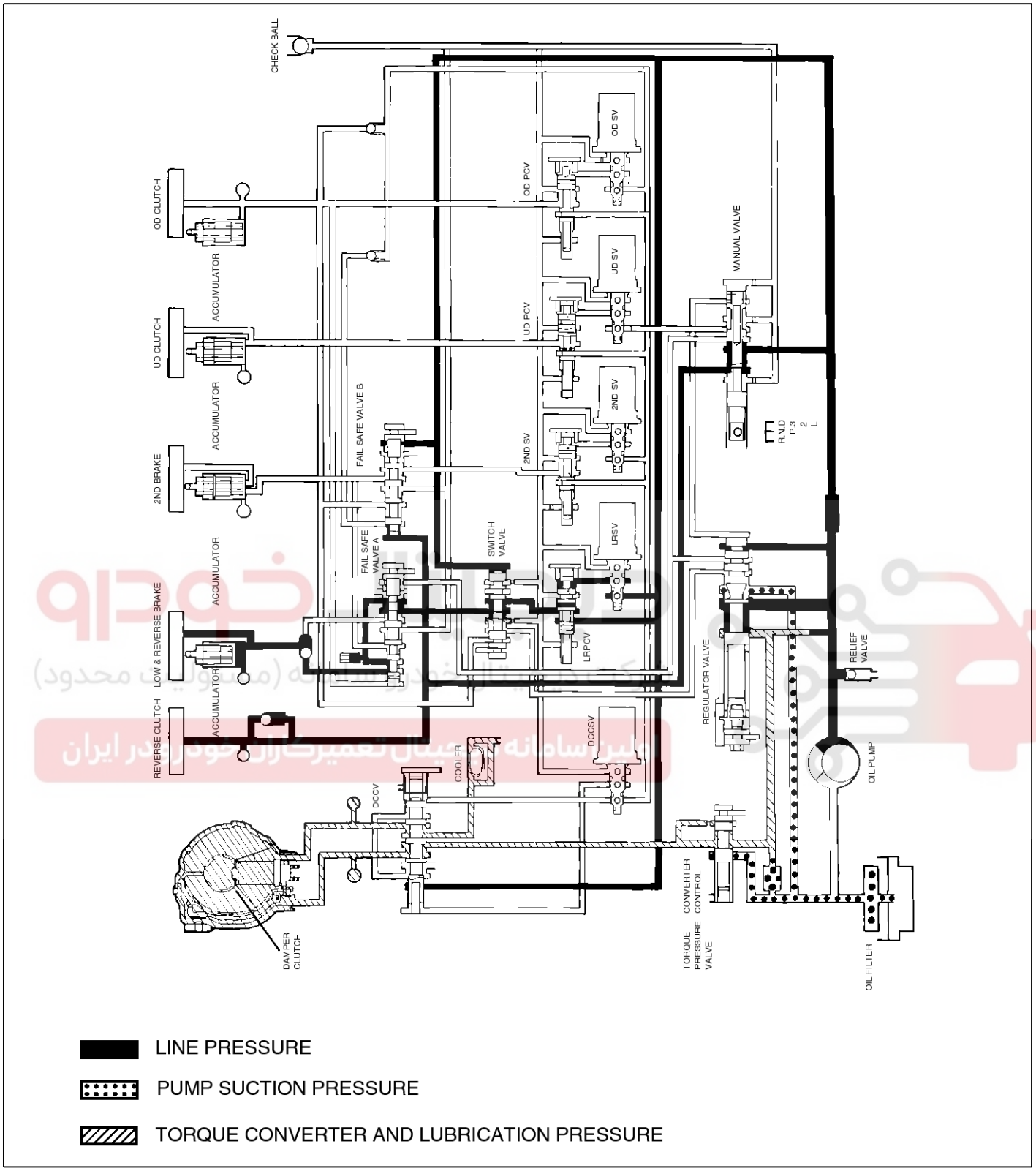

EKA9050F

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Electronic Control System

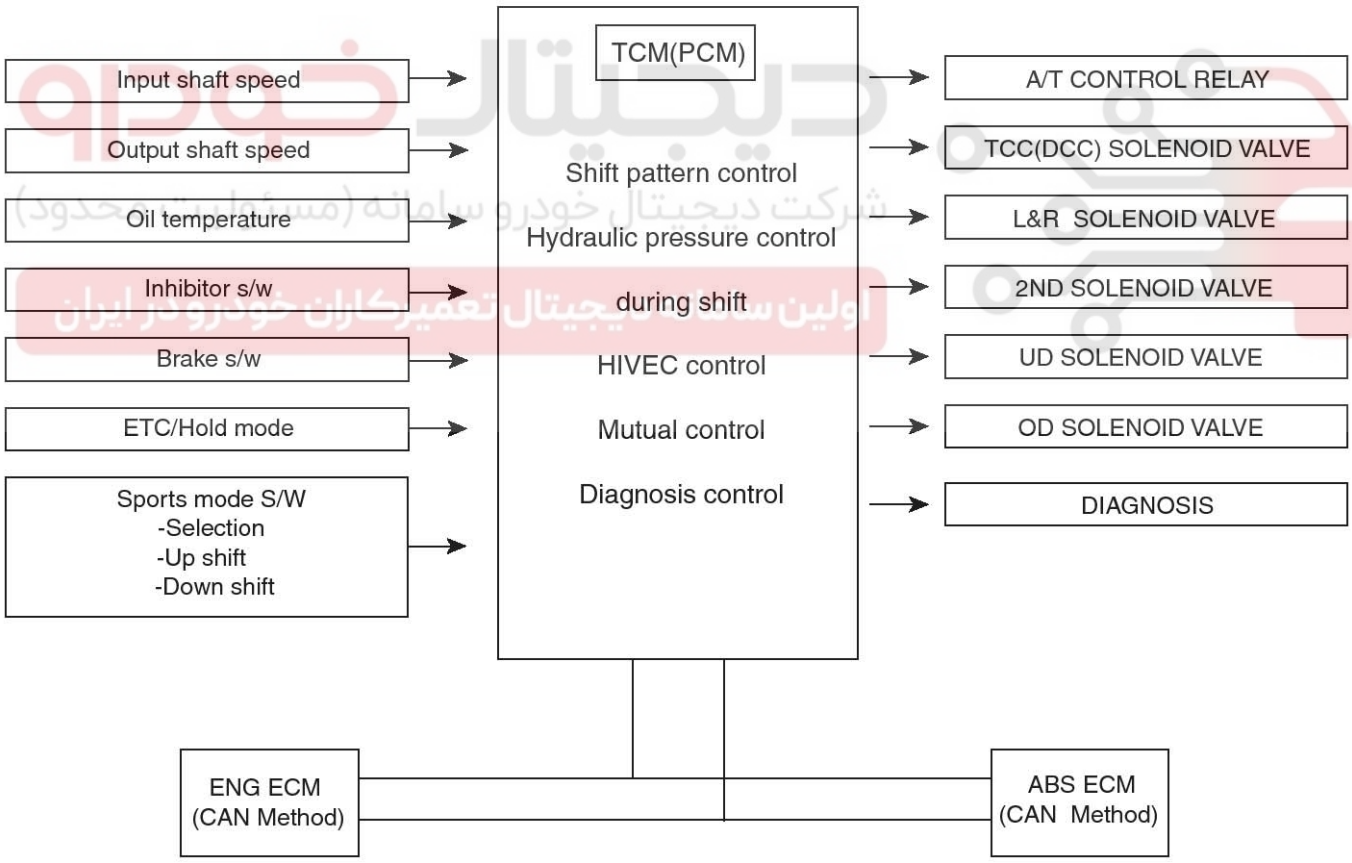
DESCRIPTION

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)



ELQE208A

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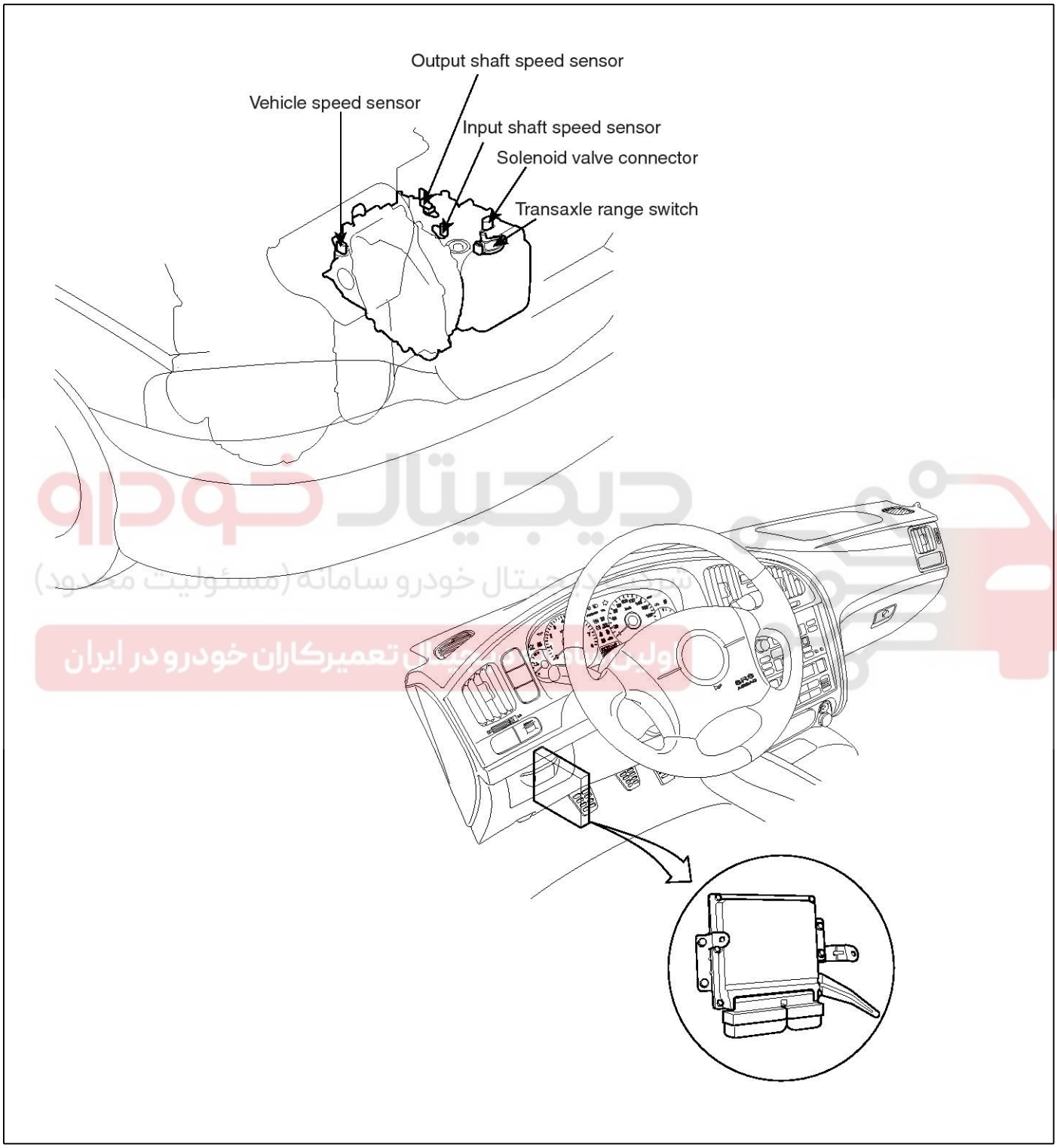
ELECTRIC CONTROL LOCATION

The TCM(PCM) is located below the dashboard. However, in the ß-engine vehicles, there is not TCM(PCM).



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OPERATING COMPONENTS AND FUNCTIONS

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
APS(Diesel)	Accelerator position sensor
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
Kick down servo switch	Kick down piston position
Vehicle speed sensor	Vehicle speed
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

HIVEC

In addition to the variable shift pattern control, the HIVEC system with neural network is also adopted for the first time in HMC. HIVEC uses information from various inputs and feedback adaptation and selects the best appropriate gear position and shift timing under all possible driving conditions.

CONTROL FOR ALL DRIVING CONDITION

This function makes TCM(PCM) decide optimal gear range under all driving condition. The optimal operation of the manual shift lever by several drivers' and various driving condition is pre-set in the TCM(PCM). On the basis of mapping data, TCM(PCM) decides the driving condition from throttle opening, vehicle speed and brake signal. And then TCM(PCM) controls the gear position optimally. Optimal gear position is achieved under various driving condition by HIVEC logic.

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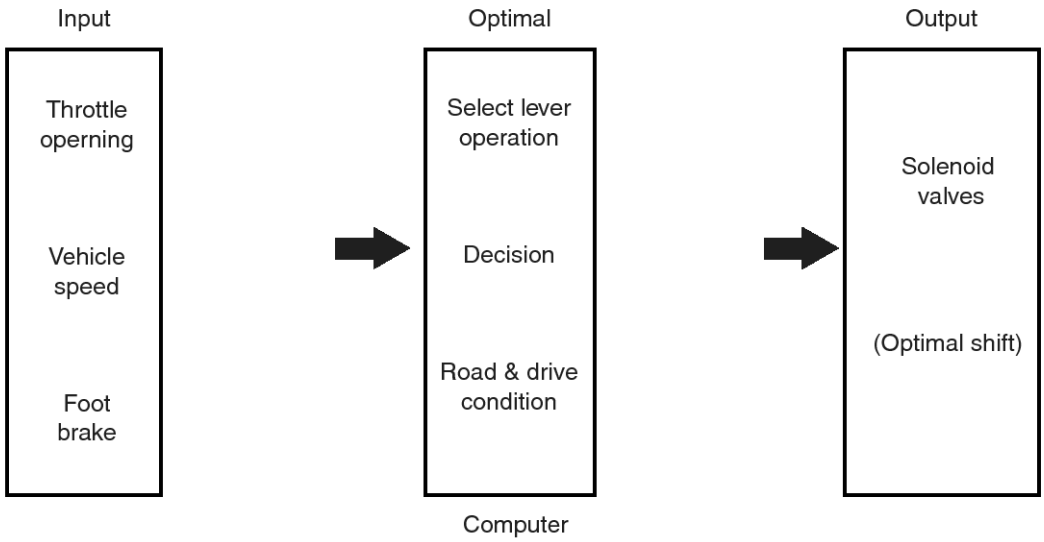
Optimal control for all driving condition



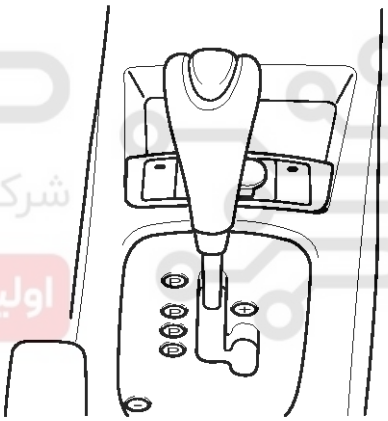
ELQE209A

HIVEC INHIBIT CONDITIONS

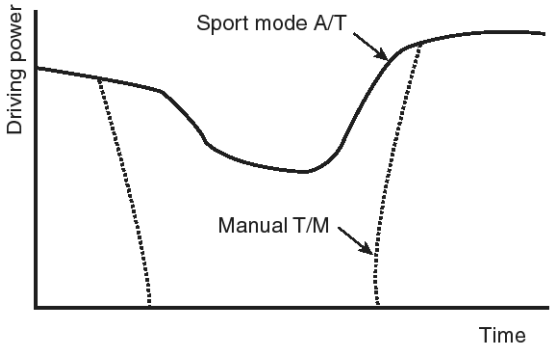
- ATF temperature below 40°C.
- When standard pattern is not used.
  - Inhibitor switch: P, R, N, L
  - Extremely low temperature mode
  - Lower emission shift pattern
  - ATF control variable shift pattern
- During fail safe mode (3rd gear hold)
- In case of prohibition of Intelligent shift
  - TPS faulty (Short: P1702, Open: 1701)
  - ATF Temperature sensor faulty (P1712)
  - Stop lamp s/w faulty (P0703)
- TCM faulty (Check engine lamp ON)
- After IG ON until first time stop lamp S/W comes ON→OFF.

Sports Mode

Sports Mode Switch



AKIE002Q



ELQE210B

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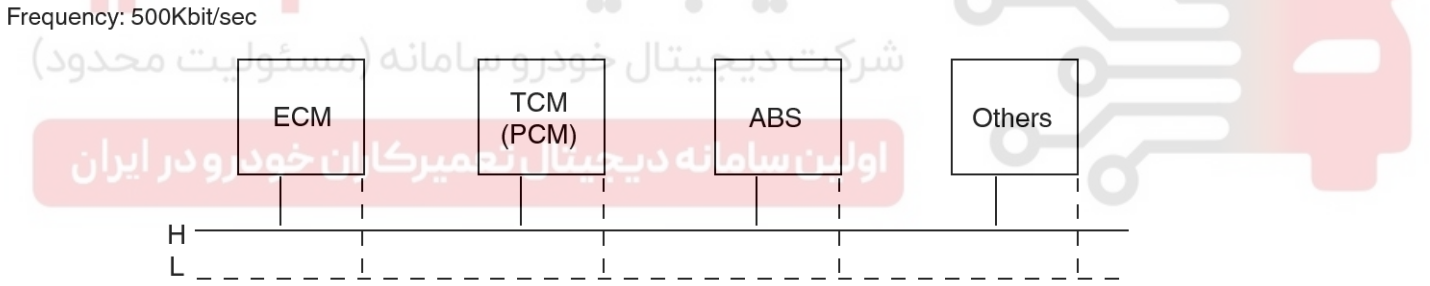
Sports mode allows the manual up-shift and downshift with the accelerator pedal is depressed. The prompt response and shift would be obtained due to the continuous shifting without cutting of driving power. The shifting time is also decreased about 0.1sec during up-shift, 0.2sec during downshift. As 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

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 a integrated ECM.



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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

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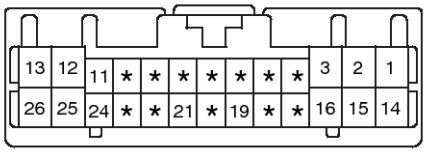
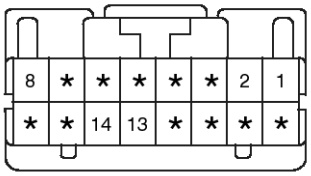
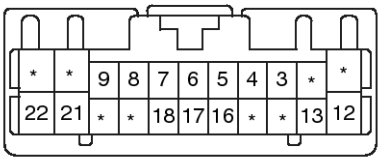
TCM(PCM) PIN DESCRIPITION



C89-1 (2.7 GSL)
C141-1 (2.0 DSL)



C89-2 (2.7 GSL)
C141-2 (2.0 DSL)



C89-3 (2.7 GSL)
C141-3 (2.0 DSL)

LKIF002B

Terminal Number		Description
C89-1 C141-1	1	SOLENOID VALVE(UD)
	2	POWER 1(SOLENOID VALVE)
	3	POWER 2(SOLENOID VALVE)
	4	-
	5	-
	6	-
	7	-
	8	AUTO CRUISE
	9	-
	10	-
	11	POWER(IG.1)
	12	EARTH FOR POWER
	13	EARTH FOR POWER
	14	SOLENOID VALVE(OD)
	15	SOLENOID VALVE(DCC)
	16	SOLENOID VALVE(2ND)
	17	-
	18	-
	19	POWER FOR FLASH ROM
	20	-
	21	SHIFT POSITION SIGNAL
	22	-
	23	-
	24	POWER(IG.1)
	25	EARTH FOR POWER
	26	EARTH FOR POWER

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Terminal Number		Description
C89-2 C141-2	1	SENSOR-INPUT SPEED
	2	SENSOR-OUTPUT SPEED
	3	-
	4	-
	5	-
	6	-
	7	-
	8	POWER FOR S-RAM
	9	-
	10	-
	11	-
	12	-
	13	EARTH FOR SENSOR
	14	OIL TEMPERATURE SENSOR
	15	-
	16	-

دیجیتال خودرو
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

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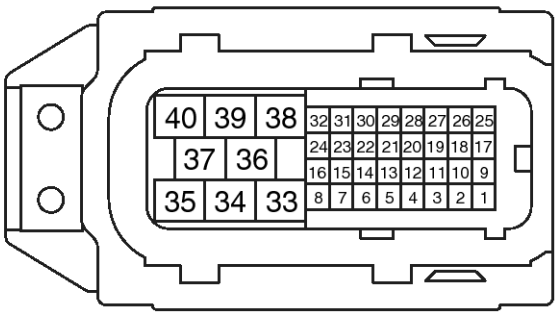
Terminal Number		Description
C89-1 C141-1	1	-
	2	-
	3	CAN-'HIGH'
	4	CAN-'LOW'
	5	INHIBITOR SW.(P)
	6	INHIBITOR SW.(N)
	7	SPT SELECT SW.
	8	SPT DOWN SW.
	9	STOP LAMP SW.
	10	-
	11	-
	12	SOLENOID VALVE(LR/DIR)
	13	K-LINE
	14	-
	15	-
	16	INHIBITOR SW.(R)
	17	INHIBITOR SW.(D)
	18	SPT UP SW.
	19	-
	20	-
	21	A/T CONTROL RELAY
	22	EARTH FOR SIGNAL



C18-2(2.0 GSL)

LKIF002C

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Terminal NO.		PIN Description
C18-2	1	-
	2	-
	3	-
	4	-
	5	Sports down switch
	6	Inhibiter switch(N)
	7	-
	8	-
	9	-
	10	-
	11	Auto cruise
	12	-
	13	Sports up switch
	14	Inhibiter switch(R)
	15	-
	16	-
	17	-
	18	Sensor ground
	19	Stop switch
	20	Output speed sensor
	21	Sports select switch
	22	Inhibiter switch(P)
	23	-
	24	Shift signal(PWM)
	25	-
	26	Oil temperature sensor
	27	-
	28	Input speed sensor

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Terminal NO.		PIN Description
C18-2	29	Inhibiter switch(D)
	30	-
	31	-
	32	A/T relay
	33	Solenoid valve(OD)
	34	-
	35	Solenoid valve(DCC)
	36	Power source(SOL.)
	37	Ground1
	38	Solenoid valve(LR)
	39	Solenoid valve(2ND)
	40	Solenoid valve(UD)

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TCM INPUT/OUTPUT SIGNAL VOLTAGE CHECK SHEET

Gasoline 2.7 Engine (C89-1,2,3) / DIESEL 2.0 ENGINE (C141-1,2,3)

No.		SIGNAL NAME	CONDITION	INPUT/OUTPUT SIGNAL		TEST RESUL-T	REMARK
				TYPE	Level		
C89-1 C141-1	1	UD Solenoid	Shifting	Pulse	HI : V_BAT LO : Max . 1.0V	14.5V 0.31V	
	2 3	A/T PWR Source	IG Off IG On	DC	Max. 1.0V V_BAT	0.0mV 12.7V	"L"
	4	1ST Lamp	1st Speed Otherwise	DC	V_BAT Max. 1.0V	13.8V 8mV	
	5	3rd Lamp	3rd Speed Otherwise	DC	V_BAT Max. 1.0V	13.8V 8mV	
	6	N.A	-	-	-	-	
	7	N.A	-	-	-	-	
	8	ACC Cancel SIG	Non-operating Operating	DC	V_BAT Max. 0.5V		
	9	N.A	-	-	-	-	
	10	N.A	-	-	-	-	
	11 24	V_IG	IG Off IG On	DC	Max. 0.5 V V_BAT	0.0mV 12.4V	TCM(PC-M)
	12	GND_PWR1	Idle	DC	Max. 50 mV	0.0mV	
	13	GND_PWR2	Idle	DC	Max. 50 mV	-2.0mV	
	14	OD Solenoid	Shifting	Pulse			
	15	Damper Clutch Solen-oid	Lock_Up On	Pulse	HI : V_BAT LO : Max. 1.0V	14.5V 0.31V	
	16	2ND Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V	14.4V 0.27V	
	17	2nd Lamp	2nd Speed Otherwise	DC	V_BAT Max. 1.0V	13.8V 8mV	
C89-1 C141-1	18	4th Lamp	4th Speed Otherwise	DC	V_BAT Max. 1.0V	13.8V 8mV	
	19	Flash PWR Source	IG On IG Off	DC	4.0~5.0V Max. 0.5 V	4.5V 0.0mV	Flash R-OM
	20	N.A	-	-	-	-	
	21	N.A	-	-	-	-	
	22	N.A	-	-	-	-	
	23	N.A	-	-	-	-	
	25	GND_PWR3	Idle	DC	Max. 50 mV	-2.0mV	
	26	GND_PWR4	Idle	DC	Max. 50 mV	-2.0mV	

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No.		SIGNAL NAME	CONDITION	INPUT/OUTPUT SIGNAL		TEST RESUL-T	REMARK
				TYPE	Level		
C89-2 C141-2	1	Speed Sensor-Input	Idle	Pulse	HI : Min. 4.0V LO : Max. 1.0V	4.96V 354mV	
	2	Speed Sensor-Output	30kph	Pulse	HI : Min. 4.0V LO : Max. 1.0V	4.95V 359mV	
	3	N.A	-	-	-	-	
	4	N.A	-	-	-	-	
	5	N.A	-	-	-	-	
	6	N.A	-	-	-	-	
	7	N.A	-	-	-	-	
	8	V_BAT	Key removal Always	DC vol. Current	Below 1.0 mA V_BAT	0.41mA 12.6V	TCM(PC-M)
	9	N.A	-	-	-	-	
	10	N.A	-	-	-	-	
	11	N.A	-	-	-	-	
	12	N.A	-	-	-	-	
	13	GND_Sensor	Idle	DC	Max. 50 mV	22mV	OTS/PG-B
	14	Oil Temp. Sensor_AT-M	Idle	Analog	0.5V ~ 4.5V	2.5V	at 60.0˚C
	15	N.A	-	-	-	-	
	16	N.A	-	-	-	-	

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No.		SIGNAL NAME	CONDITION	INPUT/OUTPUT SIGNAL		TEST RESUL-T	REMARK
				TYPE	Level		
C89-3 C141-3	1	N.A	-	-	-	-	
	2	N.A	-	-	-	-	
	3	CAN_HI	Recessive Do-minant	Pulse	2.0 ~ 3.0V 2.75~4.5V	2.51V 3.52V	(Commn-icatio sp-eed : 500 kbps)
	4	CAN_LO	Recessive Do-minant	Pulse	2.0 ~ 3.0V 0.5~2.25V	2.48V 1.49V	(Commn-icatio sp-eed : 500 kbps)
	5	P Range Selection	P Position Otherwise	DC	V_BAT Max. 1.0V	13.8V 21mV	
	6	N Range Selection	N Position Otherwise	DC	V_BAT Max. 1.0V	13.8V 21mV	
	7	SPT Select Selection	Select Position Otherwise	DC	V_BAT Max. 1.0V	14.1V 21mV	
	8	SPT Down Selection	Down Position Otherwise	DC	V_BAT Max. 1.0V	13.9V 26mV	
	9	Brake SW(N.O)	Release Push	DC	Max. 0.5V V_BAT	13.4V 0.0mV	
	10	N.A	-	-	-	-	
	11	N.A	-	-	-	-	

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No.		SIGNAL NAME	CONDITION	INPUT/OUTPUT SIGNAL		TEST RESUL-T	REMARK
				TYPE	Level		
C89-3 C141-3	12	LR Solenoid	Shifting	Pulse	HI : V_BAT LO : Max . 1.0V	14.4V 0.27V	
	13	Diagnosis "K"	GST communication	Pulse	HI : Min V_BAT * 70 % LO : Max. V_BAT * 30%	11.3V 0.21V	(Commn-icatio sp-eed: 10.4 kbps)
	14	N.A	-	-	-	-	
	15	N.A	-	-	-	-	
	16	R Range Selection	R Position Otherwise	DC	V_BAT Max. 1.0V	13.4V 0mV	
	17	D Range Selection	D Position Otherwise	DC	V_BAT Max. 1.0V	13.8V 28mV	
	18	SPT Up Selection	Up Position Otherwise	DC	V_BAT Max. 1.0V	13.9V 21mV	
	19	N.A	-	-	-	-	
	20	N.A	-	-	-	-	
	21	RLY A/T Control	RLY Off RLY On	DC	Max. 1.0V V_BAT	0.0mV 12.8V	"S2"
	22	GND_Sensor	Idle	DC	Max. 50 mV	8mV	TCM(PC-M) Signal

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GASOLINE 2.0 ENGINE (C18-2)

PIN No.	SIGNAL	CONDITION	INPUT. OUTPUT VALUE		TEST RESULT	REMARK
			TYPE	LEVEL		
5	Sport down SW	DOWN ON	Static signal	Vlow < 1.8V Vhigh > 4.2V Active : high	12.37V (Vbatt Level)	Sport mode down SW
		Others			0.2V	
6	N-SW	N ON	Static signal	Vlow < 1.8V Vhigh > 4.2V Active : high	12.37V (Vbatt Level)	Inhibitor SW (N)
		Others			0.2V	
9	V_ATREL	ON	Power		12.4V (Vbatt Level)	Batt. Voltage after A/T RELAY
		OFF			0.2V	
11	Auto cruise	Auto cruise ON	PULL UP INPUT	Vlow < 1.8V Vhigh > 4.2V	12.37V (Vbatt Level)	Auto cruise input from Cruise controller
		Auto cruise OFF			0.2V	
13	Sport up SW	UP ON	Static signal	Vlow < 1.8V Vhigh > 4.2V Active : high	12.37V (Vbatt Level)	Sport mode up SW
		Others			0.2V	
14	R-SW	R ON	Static signal	Vlow < 1.8V Vhigh > 4.2V Active : high	12.37V (Vbatt Level)	Inhibitor SW (R)
		Others			0.2V	
18	Sensor GND	Always	Power		GND level (0V)	
19	BRAKE SW	Brake ON	Sens	Vlow < 1.0V Vhigh > 6V	12.37V (Vbatt Level)	Detect BW input with open status detection function
		Brake OFF			0.2V	
20	Output speed	No signal: 1009 RPM	Pulse	Vlow < 1.8V Vhigh > 4.2V		Duty 50±20%, 1.116k-Hz
21	Sport SEL. SW	SEL. ON	Static signal	Vlow < 1.8V Vhigh > 4.2V Active : high	12.37V (Vbatt Level)	Sport mode Select SW
		Others			0.2V	

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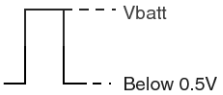
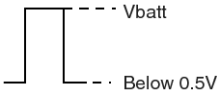
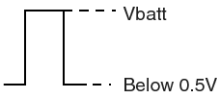
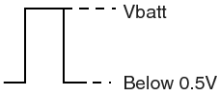
PIN No.	SIGNAL	CONDITION	INPUT. OUTPUT VALUE		TEST RESULT	REMARK
22	P-SW	P ON	Static signal	Vlow < 1.8V Vhigh > 4.2V Active : high	12.37V (Vbatt Level)	Inhibitor SW (P)
		Others			0.2V	
24	Trip computer		PWM	3.0 < I < 5.0 A	50Hz	Sports Mode P,R,N,D range : 100% 1st gear : 12.5% 2nd gear : 27.5% 3rd gear : 42.5 % 4th gear : 57.5 %
26	Oil Temperatu-re sensor		Analog	V = -0.3~VB	85°C → 0.8V	
28	Input speed	Ne signal: 2068 RPM	Pulse	Vlow < 1.8V Vhigh > 4.2V Active : high		Duty 50±20%, 2.049k-Hz
29	D-SW	D ON	Static signal	Vlow < 1.8V Vhigh > 4.2V Active : high	12.37V (Vbatt Level)	Inhibitor SW (D)
		Others			0.2V	
32	A/T Relay	A/T ON	Static signal	Norminal load current 1.1A	11.44V (Vbatt Level)	
		A/T OFF			0.2V	
33	Solenoid valve(OD)	→	PWM	Signal: 3.0 < Isol < 5.0A Supply : V_ATREL.		1st,2nd : 2kHz, 30% Positive duty (VB:12V) 3rd,4th: 100% Positive duty
35	Solenoid valve(DCC)	→	PWM	Signal: 3.0 < Isol < 5.0A Supply : V_ATREL.		1st,2nd : 100% Positi-ve duty 3rd,4th: unknown
37	Power GND	Always	Power		GND level	
38	Solenoid valve(LR)	→	PWM	Signal: 3.0 < Isol < 5.0A Supply : V_ATREL.		1st: 100% Positive du-ty 2nd,3rd,4th:2kHz, 30% Positive duty (VB:12V)
39	Solenoid valve(2ND)	→	PWM	Signal: 3.0 < Isol < 5.0A Supply : V_ATREL.		1st,3rd:2kHz, 30% Positive duty (VB:12V) 2nd,4th : 100% Positi-ve duty

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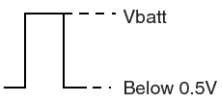
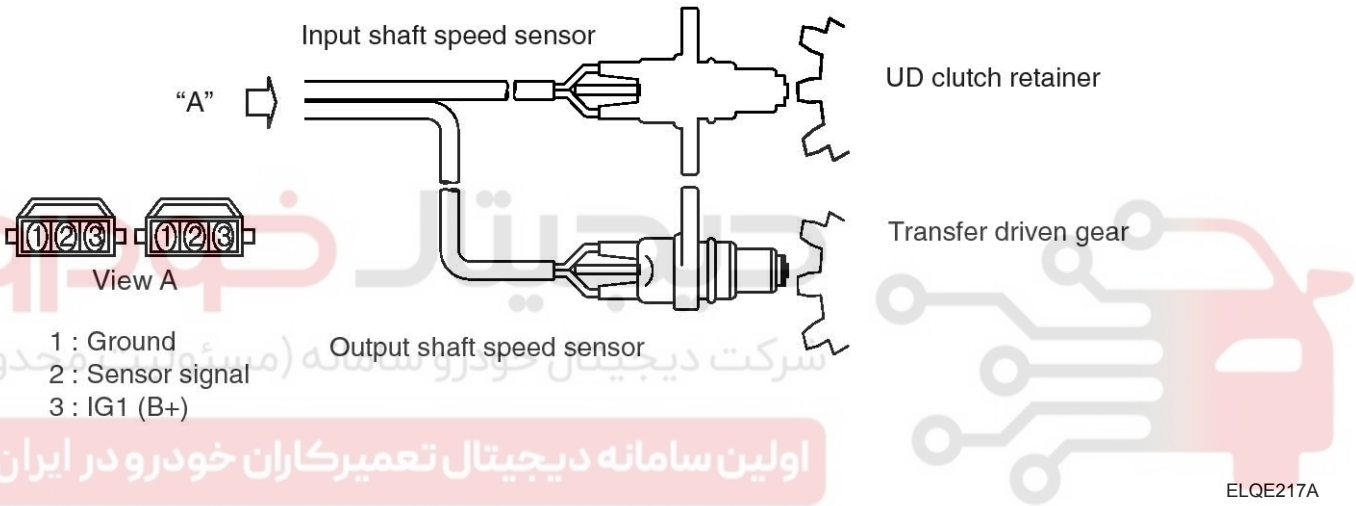
PIN No.	SIGNAL	CONDITION	INPUT. OUTPUT VALUE		TEST RESULT	REMARK
40	Solenoid valve(UD)	→	PWM	Signal: 3.0 < Isol < 5.0A Supply : V_ATREL.		1st,2nd,3rd : 100% Positive duty 4th: 2kHz, 30% Positive duty (VB:12V)

Sensors

Input shaft & Output shaft speed sensor

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



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Hall type sensor: specification

Air gap (mm)	Input shaft speed sensor	1.3
	Output shaft speed sensor	0.85
Coil Resistance	Input shaft speed sensor	over 1MΩ
	Output shaft speed sensor	over 1MΩ
Peak-Peak Voltage	High	4.8~5.2V
	Low	0.8V

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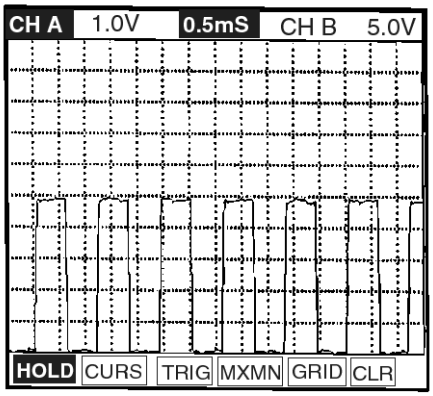
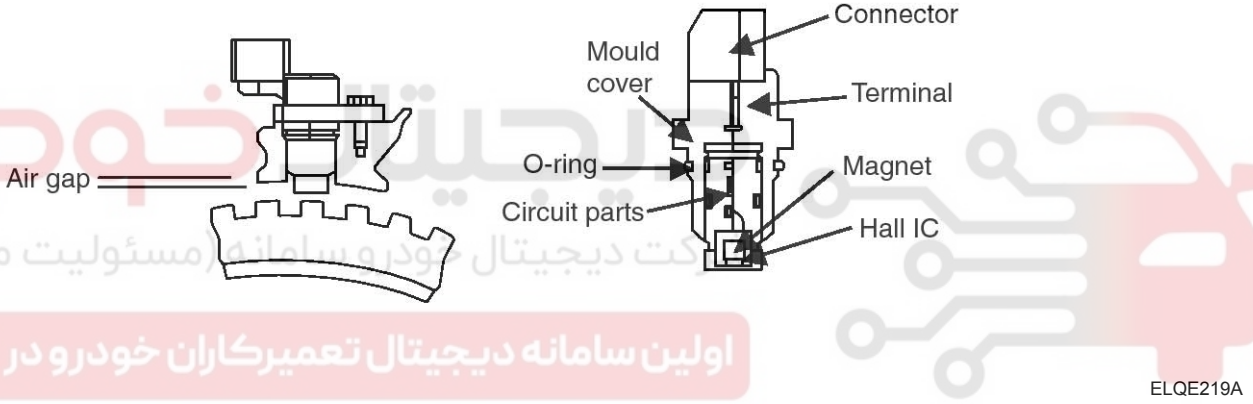
Wave Form With High-scan



ELQE218A

Hall Type Sensor: Structure & Interface



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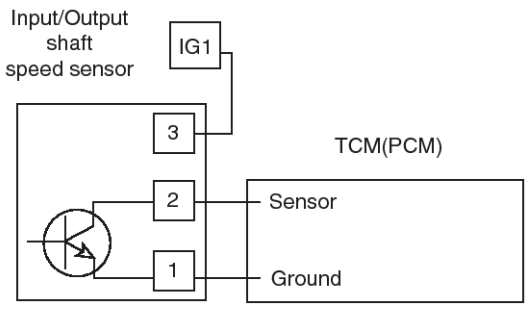
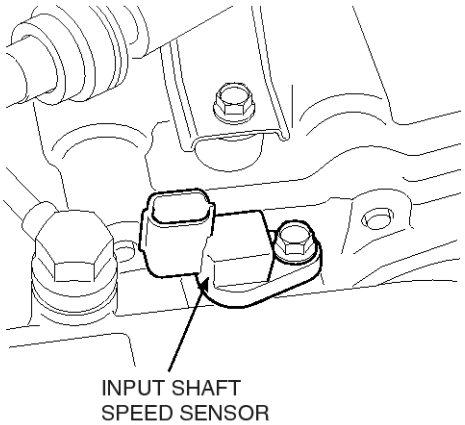


LKIF003A



LKIF003B

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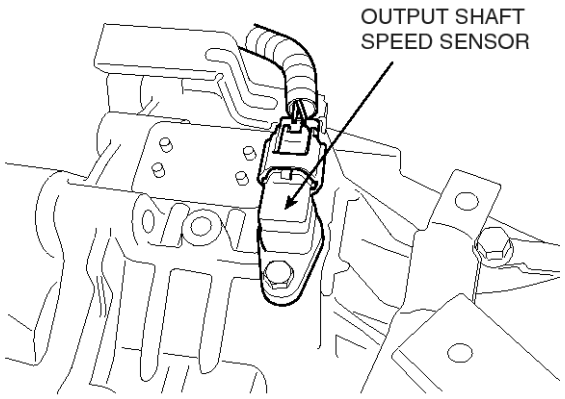

LKIF003C

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

Temp.[˚C(˚F)]	Resistance(kΩ)	Temp.[˚C(˚F)]	Resistance(kΩ)
-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		

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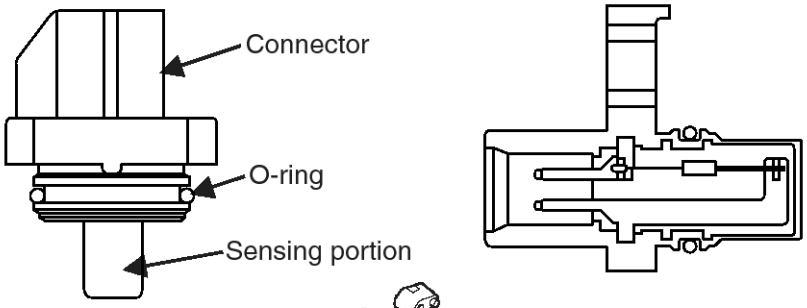
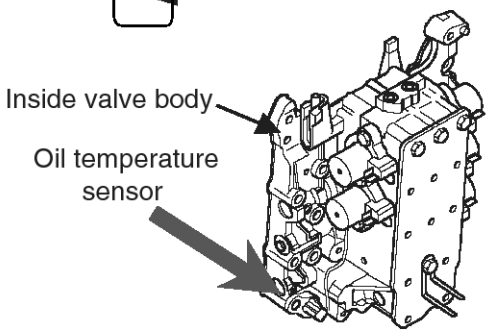
Structure



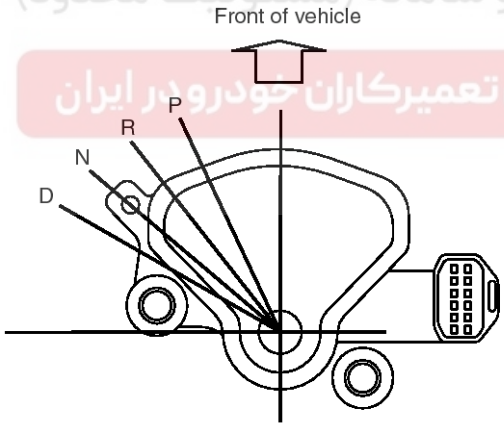
Location



ELQE222A

Inhibitor Switch

- Type: Rotary contact type
- Range of temperature : -40˚C～145˚C



ELQE223A

Inhibitor Switch - Continuity check(Sports mode)

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

Actuators

Solenoid Valve for Pressure Control

- Sensor type: Normal open 3-way
- Operating temperature : -30˚C～130˚C
- Frequency:

LR, 2ND, UD, OD, RED: 61.27Hz (at the ATF temp. -20˚C above)

DCC: 30.64Hz

- Internal resistance: 2.6Ω or more
- Surge voltage: 56 V

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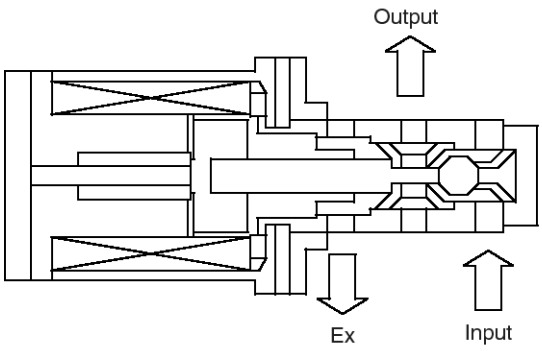

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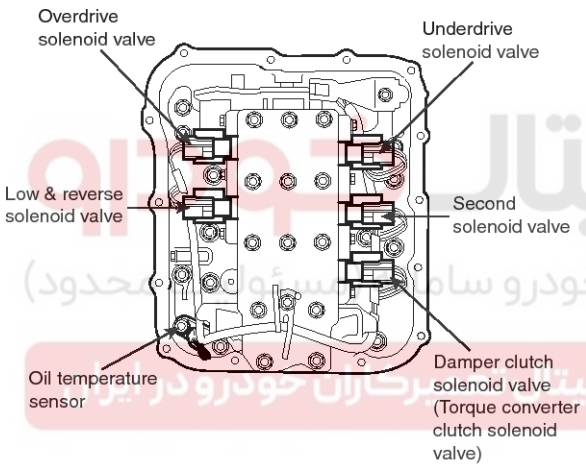
Location



ELQE226A

Identification Color of Each Solenoid Valves

Solenoid valve	Wire color	Housing	Frequency
UD sol. valve	White, Red, Red	Black	61.27 Hz
OD sol. valve	Orange, Red	Black	61.27 Hz
L/R sol. valve	Brown, Yellow	Milky white	61.27 Hz
2nd sol. valve	Green, Red, Red	Milky white	61.27 Hz
DCC sol. valve	Blue, Yellow, Yellow	Black	34.64 Hz
ATF temp. Sensor	Black, Red	Black	

- L/R solenoid valve controls the direct clutch in 5A/T as well as low-reverse brake

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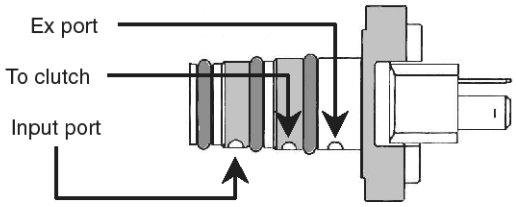


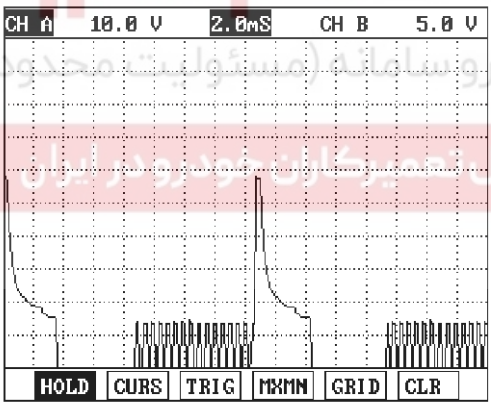
ELQE227A

Wave Form with High-scan

Solenoid valve ON: Hydraulic pressure is released from corresponding clutch or brake.

Solenoid valve OFF: Hydraulic pressure is supplied to corresponding clutch or brake.

Except) DCCSV: When the DCCSV is ON, the damper clutch is operated.



ELQE228A

Controlled Pressure

Solenoid valve	Duty 0%	Duty 50%	Duty 75%	Duty 100%
UD, OD, LR, 2ND	10.5±0.1	6.4±0.25	3.6±0.25	0.1 or less
DCC	10.5±0.1	5.9±0.3	3.2±0.3	0.1 or less

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Solenoid Valves Schedule

Position	Solenoid valves				
Operation	LR	2ND	UD	OD	* 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

*: Reference value.

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

A/T Control Relay

The control relay supplies power to the solenoid valves.

As soon as the A/T control relay is ON, the battery voltage is directly supplied to solenoid valves and each solenoid valve is operated when the TCM grounds the opposite terminal. (-) Control At fail safe condition, the power is cut causing 3 gear hold.

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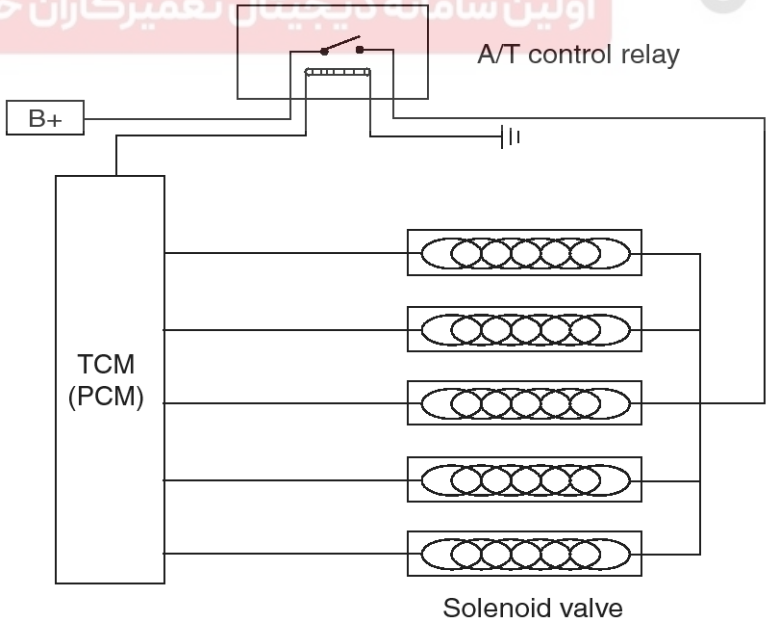

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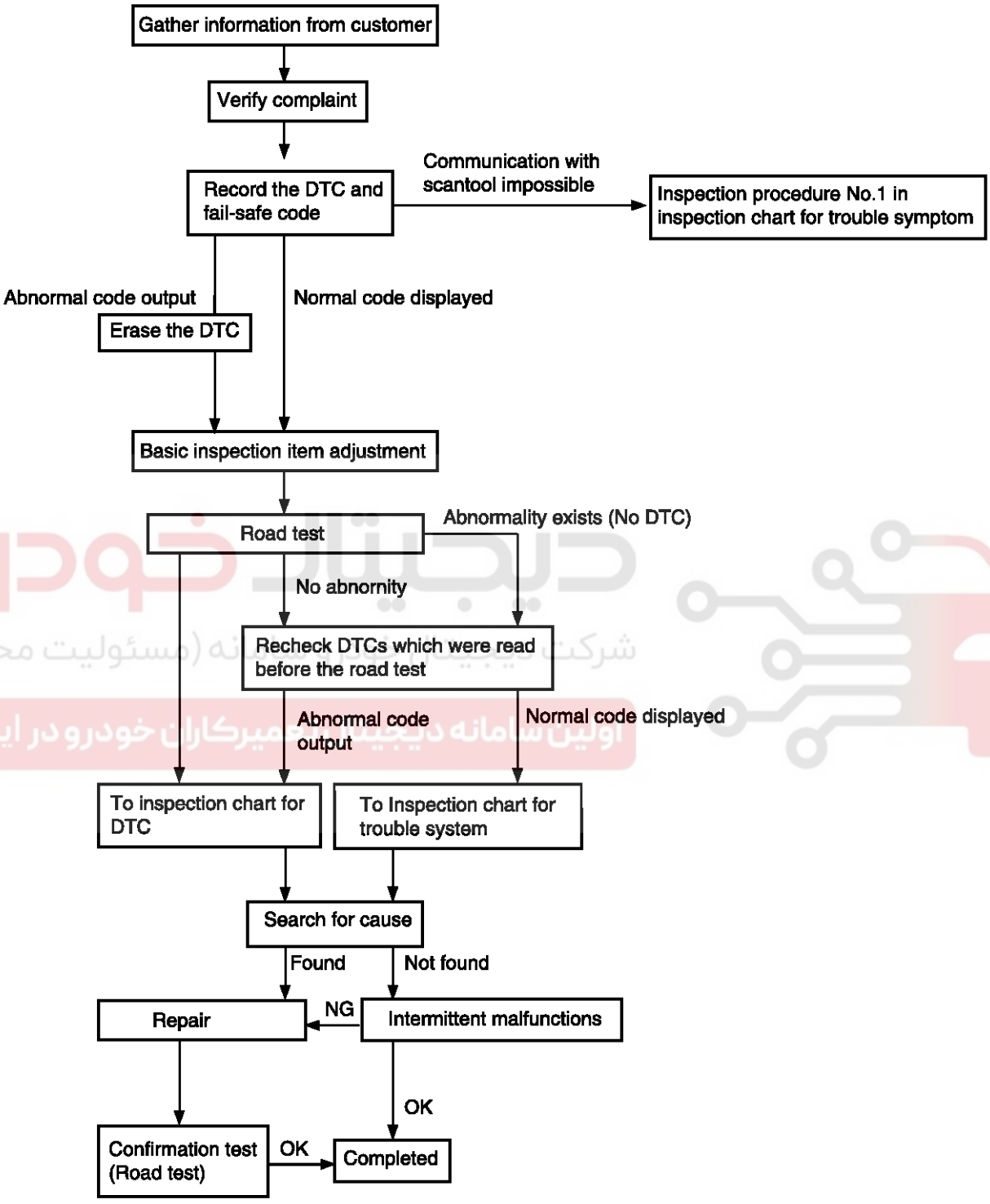
TROUBLESHOOTING

DIAGNOSIS FLOW



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INSPECTION CHART FOR TROUBLE SYMPTOMS

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 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 engine system - 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

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Trouble symptom		Probable cause
Malfunction when starting	**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 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.	- Abnormal line pressure - 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

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Trouble symptom		Probable cause
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 solenoid valve, torque converter or valve body.	- Abnormal damper clutch pressure - Malfunction of the engine system - Malfunction of the damper clutch control solenoid valve - Malfunction of the torque converter - 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).		- Malfunction of the transaxle range switch - Malfunction of the ignition switch - Malfunction of connector - Malfunction of the TCM(PCM)
Idle position switch system The cause is probably a defective idle position switch circuit, or a defective TCM(PCM).		- Malfunction of the triple pressure switch - Malfunction of connector - Malfunction of the TCM(PCM)
Triple pressure switch system The cause is probably a defective dual pressure switch circuit or a defective TCM(PCM).		- Malfunction of the triple pressure switch - Malfunction of connector - Malfunction of A/C system - Malfunction of the TCM(PCM)
Vehicle speed sensor system The cause is probably a defective vehicle speed sensor circuit or a defective TCM(PCM).		- Malfunction of the vehicle speed sensor - Malfunction of connector - Malfunction of the TCM(PCM)

HOW TO USE SCAN TOOL

INSTRUCTION

With the advent of electronic control vehicles, the system efficiency increases with the complexities, as you would realize.

As medical diagnostic devices do, the advanced testers can help identify and fix the problems.

The scan tool can provide you with the versatile and user friendly monitoring capabilities.

SCAN TOOL FUNCTION

Scan tool offers the following functionality:

Diagonstic trouble codes

Freeze frame data

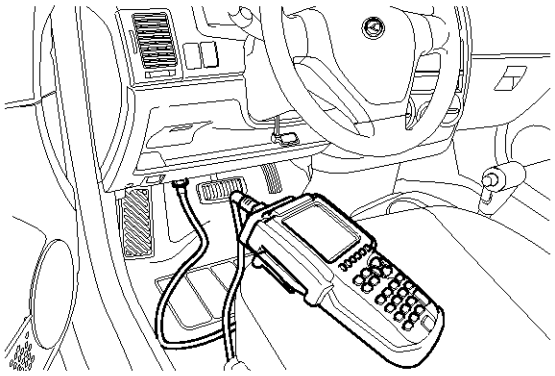
Current data

Actuation test

HOW TO CONNECT

For vehicles with 16 pin Data Link Connector(DLC), power is supplied from the DLC terminal through the DLC CABLE without the need for an additional power supply.

For connections between the Hi-scan and these vehicle data link terminals the DLC CABLE 16 is all that is required.



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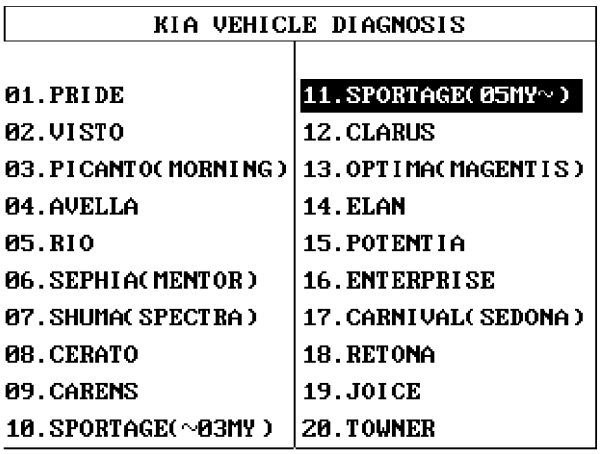
HOW TO SELECT VEHICLE AND SYSTEM

OPERATION FLOW

1. Select "KIA VEHICLE DIAGNOSIS"
2. Select "VEHICLE NAME"



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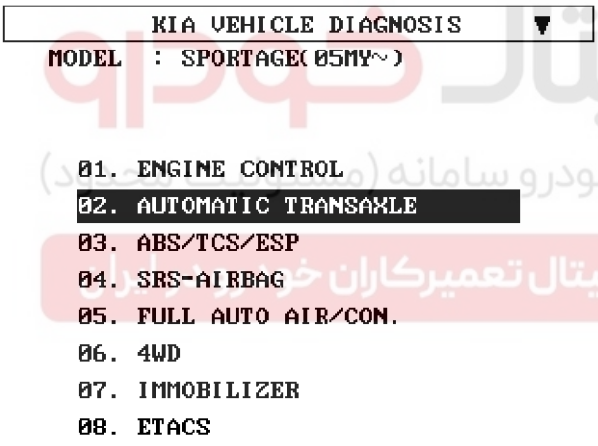
3. Select "AUTOMATIC TRANSAXLE SYSTEM"



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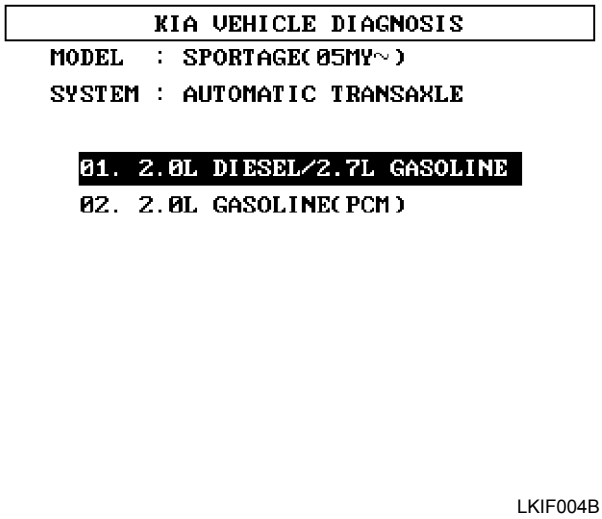
4. Select the engine model.



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BASIC APPLICATION

Having connected and turned on scan tool, the vehicle and system selection must be made from the 1.0 KIA VEHICLE DIAGNOSIS SCREEN.

The support functions vary according to vehicles. Therefore, the correct selection must be made.

Selection may be made by scrolling up or down the screen and pressing ENTER, or by using the numeric keypad to select the appropriate option number and pressing ENTER.

HOW TO READ DTC

OPERATION FLOW

1. Select vehicle and system
   (Refer to How to select vehicle and system)
2. Select 1.1 DIAGNOSTIC TROUBLE CODES

MODE APPLICATION

At this level, Diagnostic trouble codes(DTC) are displayed for the selected TCM.

HOW TO ERASE DTC

OPERATION FLOW

1. Select "1.1 DIAGNOSTIC TROUBLE CODES"
   (Refer to How to read DTC)
2. Select "ERAS" key on the Diagnostic Trouble codes mode.
3. Select "1.2.2. ERASE FAULT CODE"

MODE APPLICATION

"ERAS"

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This soft function key will clear the DTC currently held in the memory of the selected TCM.

If this option is selected, a message requesting confirmation of the ERAS request will be displayed.

The YES or NO key should be used to confirm or cancel the request to clear the current DTC.

DTC TROBLESHOOTING INDEX

TCM(PCM) DTCs (DSL 2.0 & GSL 2.7)

DTC No.	DESCRIPTION
P0560	Back-Up BATTERY LINE OPEN
P0605	EEPROM Abnormal
P0703	BRAKE SWITCH CIRCUIT
P0707	TRANS.RANGE SENSOR-LOW
P0708	TRANS.RANGE SENSOR-HIGH
P0711	FLUID TEMPERATURE.SENSOR RATIONALITY
P0712	FLUID TEMPERATURE.SENSOR CIRCUIT-LOW
P0713	FLUID TEMPERATURE.SENSOR CIRCUIT-HIGH
P0715	INPUT SPEED SENSOR CIRCUIT
P0720	OUTPUT SPEED SENSOR CIRCUIT
P0731	Gear 1 Incorrect Ratio
P0732	Gear 2 Incorrect Ratio
P0733	Gear 3 Incorrect Ratio
P0734	Gear 4 Incorrect Ratio
P0736	REVERSE INCORRECT RATIO
P0741	Torque Converter Clutch Circuit Stuck off
P0742	Torque Converter Clutch Circuit Stuck on
P0743	DCC(TCC) Solenoid - Open or ground short(Torque Converter Clutch Circuit Electrical)
P0750	LR Solenoid - Open or ground short(SCSV "A" CIRCUIT MAL.)
P0755	UD Solenoid - Open or ground short(SCSV "B" CIRCUIT MAL.)
P0760	2ND Solenoid - Open or ground short(SCSV "C" CIRCUIT MAL.)
P0765	OD Solenoid - Open or ground short(SCSV "D" CIRCUIT MAL.)
P0885	A/T RELAY CIRCUIT MAL
P1500	VEHICLE SPEED SENSOR CIRCUIT
U0001	CAN COMMUNICATION BUS OFF
U0100	NO ID From ECU

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TCM(PCM) DTCs (GSL 2.0)

DTC No.	DESCRIPTION
P0703	BRAKE SWITCH CIRCUIT
P0707	TRANS.RANGE SENSOR-LOW
P0708	TRANS.RANGE SENSOR-HIGH
P0711	FLUID TEMPERATURE.SENSOR RATIONALITY
P0712	FLUID TEMPERATURE.SENSOR CIRCUIT-LOW
P0713	FLUID TEMPERATURE.SENSOR CIRCUIT-HIGH
P0717	INPUT SPEED SENSOR CIRCUIT
P0721	OUTPUT SPEED SENSOR
P0722	OUTPUT SPEED SENSOR CIRCUIT
P0731	Gear 1 Incorrect Ratio
P0732	Gear 2 Incorrect Ratio
P0733	Gear 3 Incorrect Ratio
P0734	Gear 4 Incorrect Ratio
P0736	REVERSE INCORRECT RATIO
P0741	Torque Converter Clutch Circuit Stuck off
P0743	DCC(TCC) Solenoid - Open or ground short(Torque Converter Clutch Circuit Electrical)
P0750	LR Solenoid - Open or ground short(SCSV "A" CIRCUIT MAL.)
P0755	UD Solenoid - Open or ground short(SCSV "B" CIRCUIT MAL.)
P0760	2ND Solenoid - Open or ground short(SCSV "C" CIRCUIT MAL.)
P0765	OD Solenoid - Open or ground short(SCSV "D" CIRCUIT MAL.)
P0885	A/T RELAY CIRCUIT MAL
U0001	CAN COMMUNICATION BUS OFF
U0100	NO ID From ECU

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SERVICE DATA LIST(WITH SCAN TOOL)

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 turning start ON	0 rpm
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	OIL TEMPERATURE	˚C	40˚C	Current Oil temperature	80˚C
13	SHIFT POSITION	N,P,REV/1st G/…/5th G	D	Current shift position	P, N
14	TRANSAXLE RANGE S-W	P,N/R/D/SPORTS	D	Current shift lever position	P, N
15	HOLD/STD SWITCH	-/-/HOLD/STD	-		-
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	CRUISE SWITCH	OFF/ON/-/NOT SUPP			
20	SPORT MODE SELECT SW	OFF/ON/-/NOT SUPP	ON	When selecting sport mode, ON	
21	SPORT MODE UP SW	OFF/ON/-/NOT SUPP	ON	When Selecting Sport mode up, ON	
22	SPORT MODE DOWN SW	OFF/ON/-/NOT SUPP	ON	When selecting sport mode down, ON	

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No.	ITEM NAME	UNIT	DATA	Data Description	Failure
23	A/T CONTROL RELAY VOLT	V	12.9V		0V
24	ENGINE TORQUE	%	20%		
25	HIVEC MODE	A/B/C/D/-/F	F	A/B/C/D is control mode, F is release m-ode	F

HIVEC -SAT(SIEMENS ADAPTIVE TRANSMISSION CONTROL) Mode (Shift Patten)

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 3	Shift patten for downhill road	F

Actuator inspection

NO	ITEM NAME	Actuator Driving	Condition
1	LR SOLENOID(SCSV A)	Driving solenoid valve indicated by Scan tool for 5 sec. (Other solenoid valve is not contin-uity) Blinking for 3 sec.	1. IG Key ON 2. Inhibitor SW normal 3. P range 4. Vehicle speed 0km/h 5. Engine stop 6. No failure 7. TPS < 1V
2	UD SOLENOID(SCSV B)		
3	2ND SOLENOID(SCSV C)		
4	OD SOLENOID(SCSV D)		
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	-	-

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ROAD TEST

No.	Condition	Operation	Judgment value	Check item
1	Ignition switch : OFF	Ignition switch (1) ON	Battery voltage (mV)	Control relay
2	• Ignition switch : O-N • Engine : Stopped • Selector lever position : P	Selector lever position (1) P, (2) R, (3) N, (4) D	(1) P, (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
5	• Engine : Idling • Selector lever position : N	A/C switch (1) ON (2) OFF	(1) ON (2) OFF	Triple pressure switch
		Accelerator pedal (1) Released (2) Half depressed	(1) ON (2) OFF	Idle position switch
			(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

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No.	Condition	Operation	Judgment value	Check item
6	Selector lever position : N (Carry out on a flat and straight road)	Selector lever position and vehicle speed 1. Idling in 1st gear (Vehicle stopped) 2. Driving at constant speed of 20 km/h in 1st gear 3. Driving at constant speed of 30 km/h in 2nd gear 4. Driving at 50 km/h in 3rd gear with accelerator fully closed 5. Driving at constant speed of 50 km/h in 4th gear	(2) 1st, (4) 3rd, (3) 2nd , (5) 4th	Shift condition
			(2) 0%, (4) 100%, (3) 100%, (5) 100%	Low and reverse solenoid valve
			(2) 0%, (4) 0%, (3) 0%	Underdrive solenoid valve
			(1) 100%, (2) 0%, (3) 100%	Second solenoid valve
			(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
			(4) 1,800 ~ 2,100rpm	Output shaft speed sensor
7	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. • 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.	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 operation is made.	Malfunction when shifting
				Displaced shift points
				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

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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

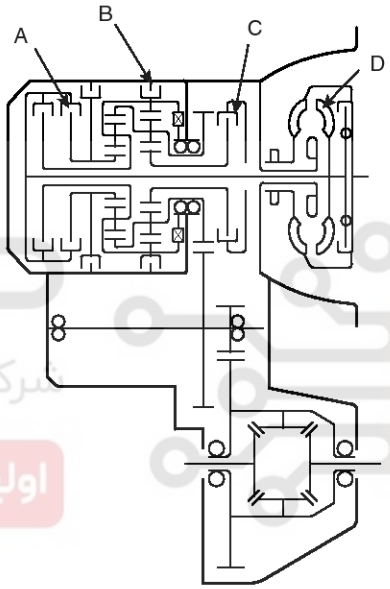
Do not let anybody stand in front of or behind the vehicle while this test is being carried out

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
   - Engine coolant temperature : 80~100˚C
2. Prevent all the wheel 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.

   ⚠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



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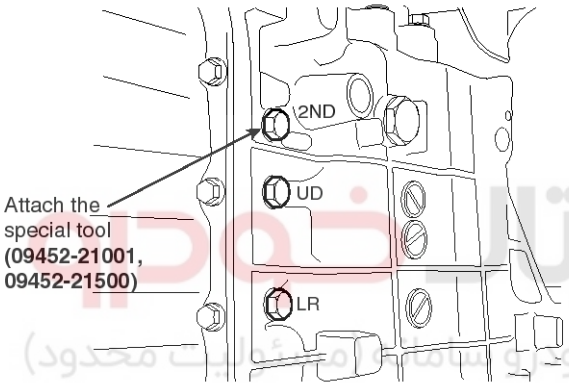
HYDRAULIC PRESSURE TEST

1. Warm up the engine until the automatic transaxle fluid temperature is 80-100˚C.
2. Jack 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.



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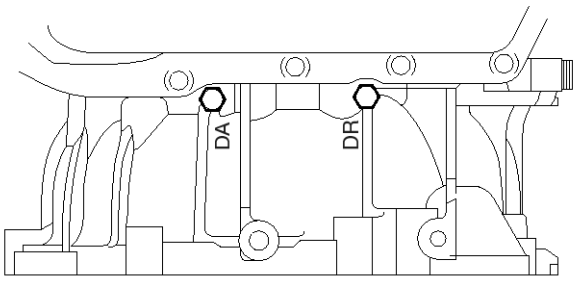

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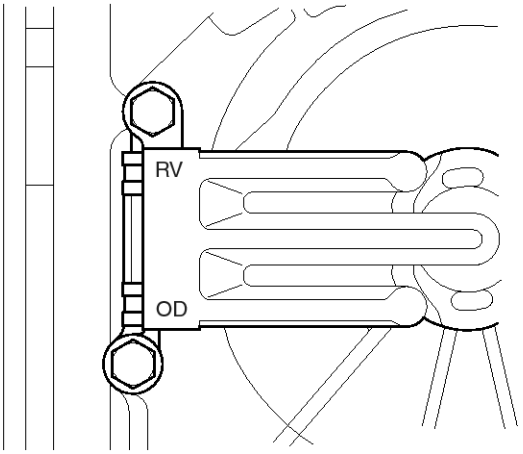

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دیجیتال خودرو
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

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STANDARD HYDRAULIC PRESSURE TEST

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 and reverse brake pressure	Second brake pressure	Torque converter pressure
P	-	2,500	-	-	-	310-390 (45-56)	-	250-350 (36-56)
R	Reverse	2,500	-	1,270-1,770 (185-256)	-	1,270-1,770 (185-256)	-	500-700 (185-256)
N	2,500	-	-	-	-	310-390 (45-56)	-	250-390 (36-56)
D	1st gear	2,500	1,010-1,050 (146-152)	-	-	1,010-1,050 (146-152)	-	500-700 (73-101)
	2nd gear	2,500	1,010-1,050 (146-152)	-	-	-	1,010-1,050 (146-152)	500-700 (73-101)
	3rd gear	2,500	590-690 (85-100)	-	590-690 (85-100)	-	-	450-650 (65-94)
	4th gear	2,500	-	-	590-690 (85-100)	-	590-690 (85-100)	450-650 (65-94)

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

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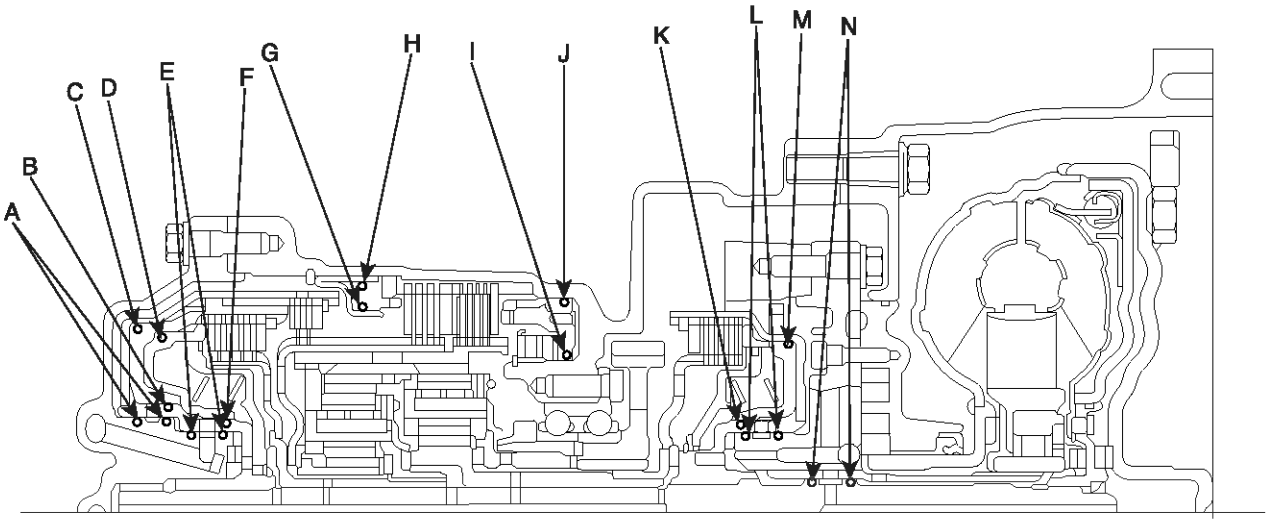
OIL SEAL LOCATION



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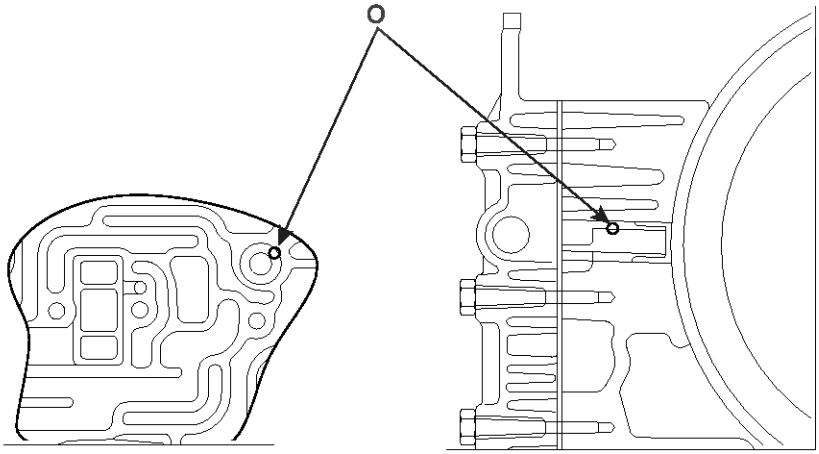
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



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HYDRAULIC PRESSURE TEST DIAGNOSIS TABLE

Trouble symptom	Probable cause
All hydraulic pressures are high	Incorrect transmission control cable adjustment
	Malfunction of the regulator valve
All hydraulic pressures are low	Incorrect transmission control cable adjustment
	Malfunction of the oil pump
	Clogged oil filter
	Clogged oil cooler
	Malfunction of the regulator valve
	Malfunction of the relief valve
	Incorrect valve body installation
Hydraulic pressure is abnormal in "R" range only	Malfunction of the regulator valve
	Clogged orifice
	Incorrect valve body installation
Hydraulic pressure is abnormal in "3" or "4" range only	Malfunction of the regulator valve
	Clogged orifice
	Incorrect valve body installation
	Malfunction of the overdrive solenoid valve
	Malfunction of the overdrive pressure control valve
	Malfunction of the regulator valve
	Malfunction of the switch valve
	Clogged orifice
	Incorrect valve body installation
Only underdrive hydraulic pressure is abnormal	Malfunction of the oil seal K
	Malfunction of the oil seal L
	Malfunction of the oil seal M
	Malfunction of the underdrive solenoid valve
	Malfunction of the underdrive pressure control valve
	Malfunction of check ball
	Clogged orifice
	Incorrect valve body installation
Only reverse clutch hydraulic pressure is abnormal	Malfunction of the oil seal A
	Malfunction of the oil seal B
	Malfunction of the oil seal C
	Clogged orifice
	Incorrect valve body installation

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Trouble symptom	Probable cause
Only overdrive hydraulic pressure is abnormal	Malfunction of the oil seal D
	Malfunction of the oil seal E
	Malfunction of the oil seal F
	Malfunction of the overdrive solenoid valve
	Malfunction of the overdrive pressure control valve
	Malfunction check ball
	Clogged orifice
	Incorrect valve body installation
Only low and reverse hydraulic pressure is abnormal	Malfunction of the oil seal I
	Malfunction of the oil seal J
	Malfunction of the low and reverse solenoid valve
	Malfunction of the low and reverse pressure control valve
	Malfunction of the switch valve
	Malfunction of the fail safe valve A
	Malfunction of check ball
	Clogged orifice
	Incorrect valve body installation
Only second hydraulic pressure is abnormal	Malfunction of the oil seal G
	Malfunction of the oil seal H
	Malfunction of the oil seal O
	Malfunction of the second solenoid valve
	Malfunction of the second pressure control valve
	Malfunction of the fail safe valve B
	Clogged orifice
	Incorrect valve body installation
Only reverse clutch hydraulic pressure is abnormal	Malfunction of the oil cooler
	Malfunction of the oil seal N
	Malfunction of the damper clutch control solenoid valve
	Malfunction of the damper clutch control valve
	Malfunction of the torque converter pressure control valve
	Clogged orifice

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Trouble symptom	Probable cause
Pressure applied to non operating element	Incorrect valve body installation
	Incorrect transmission control cable adjustment
	Malfunction of the manual valve
	Malfunction of check ball
	Incorrect valve body installation

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 position. This will fill the torque converter and the hudraulic 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.

   NOTICE

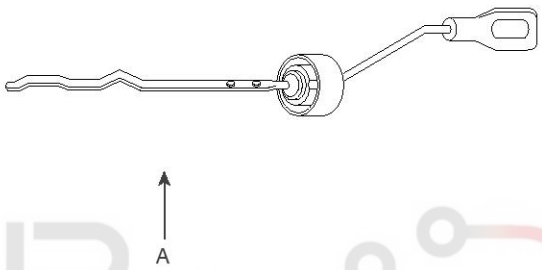
   If the fluid smells as if it is burning, it means that the fluid has been contaminated by fine particles from the bushes and friction materials, a transaxle overhaul may be necessary.
5. Check that the fluid level is at the HOT mark on the oil level gauge. If the fluid level is low, add automatic transaxle fluid until the level reaches the "HOT" mark.

Auto transaxle fluid:
DIAMOND ATF SP-III, SK ATF SP-III
Quantity : 7.8ℓ (8.2 US qt, 6.9 Imp.qt)

NOTICE

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 acuse 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 securely.



KKQE101C

NOTICE

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.

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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 2.0L engine(2.7L-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 after it is started. If the fluid has all drained out before then, the engine should be stopped at that point.

3. Romove the drain plug from the bottom of the transmission case to drain the fluid.
4. Install the drain plug via the gasket, and tighten it to the specified torque.

TORQUE :
40 ~ 50Nm (400 ~ 500 kgf.cm, 29 ~ 36 lbf.ft)

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

⚠CAUTION

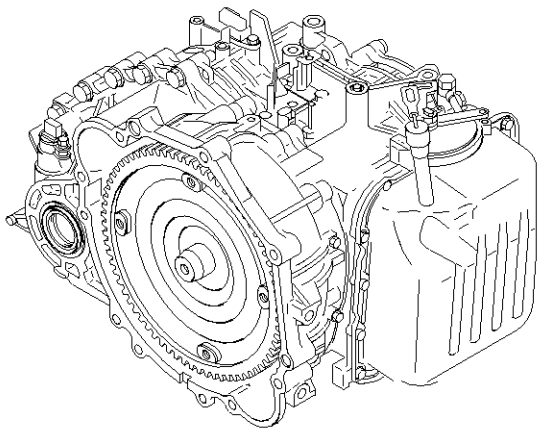
Stop pouring if the full volume of fluid cannot be poured in.

6. Repeat the procedure in step (2).

NOTICE

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"(Neutral) or "P" (Park) position.
11. Drive the vehile 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 into the oil filler tube.



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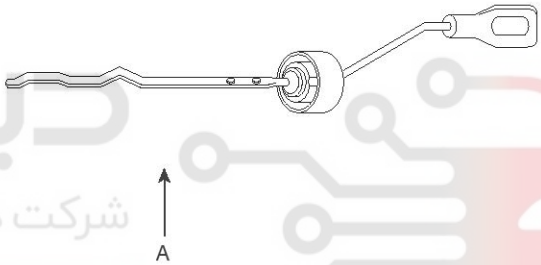

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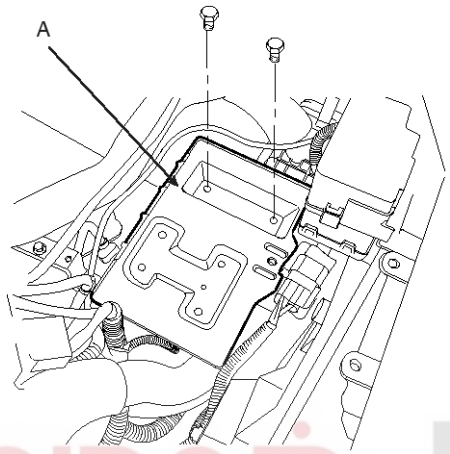
TRANSAXLE RANGE SWITCH (INHIBITOR SWITCH)

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(A).



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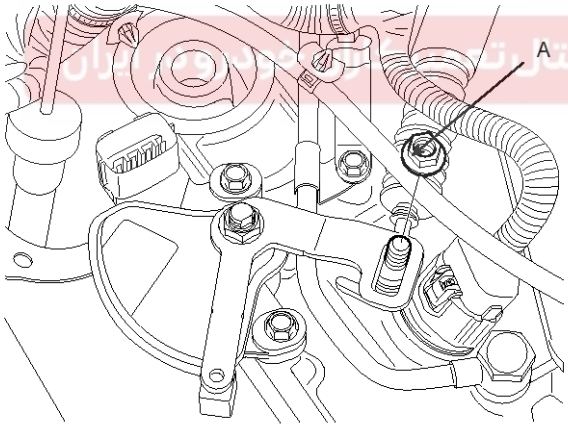
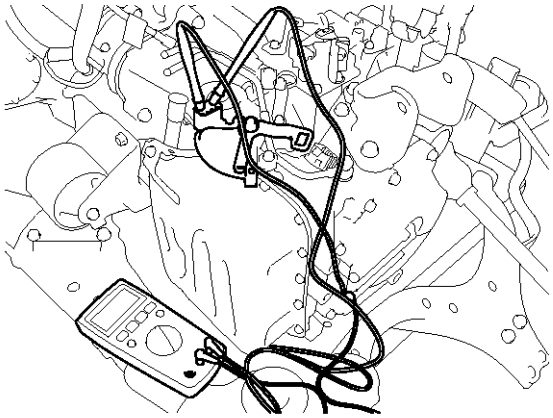
6. Remove the inhibiter switch connector.
7. Remove the shift cable mounting nut(A).



LKIF005B

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



LKIF005C

10. After tightening the shift cable mounting nut, connect the inhibiter 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 inhibiter switch if it does not work properly.
4. If the inhibiter 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 inhibiter switch.

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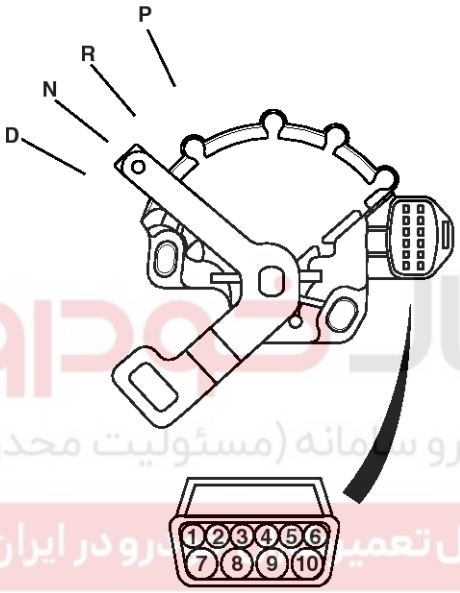
8. Check for continuity between terminals at the switch connector.

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

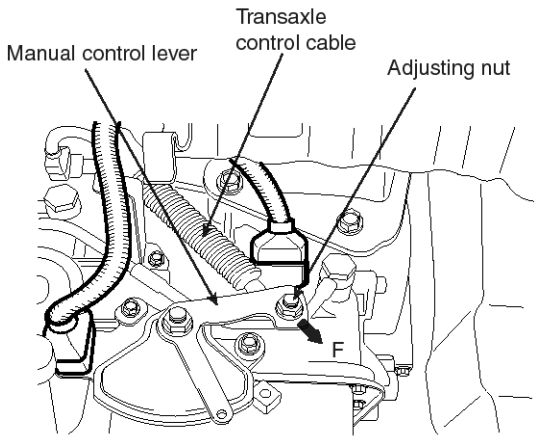


LKIF005D

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

ADJUSTMENT

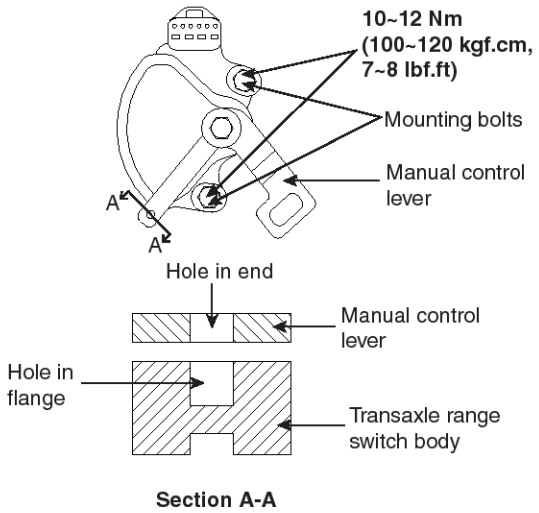
1. Set the select lever to the "N" position.
2. Loosen the control cable to manual control lever coupling nut to free the cable and lever.
3. Set the manual control lever to the neutral position.



LKIF005E

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 :
10～12Nm (100～120kgf.cm, 7～8lbf.ft)



LKIF005F

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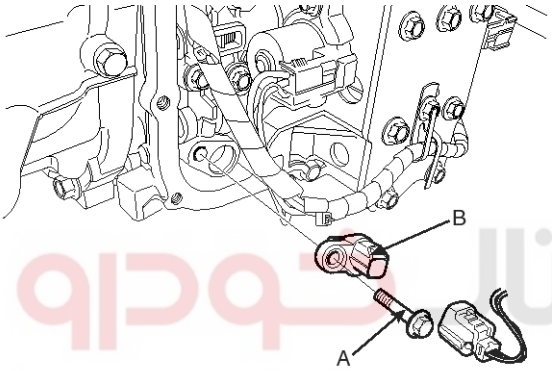
6. Gently pull the transmission control cable in the direction of the arrow, and then tighten the adjusting nut.
7. Check that the select lever is in the "N" position.

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).

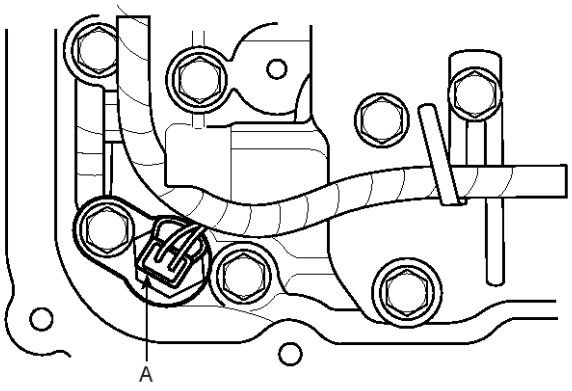


LKIF005G

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

INSPECTION

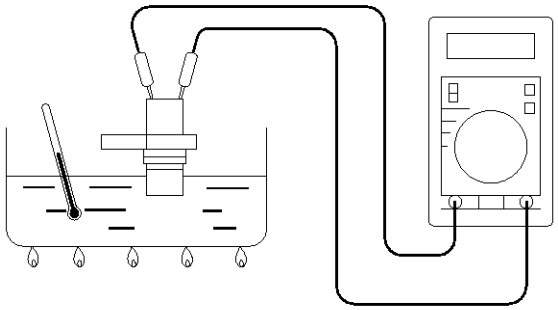
1. Remove the oil temperature sensor(A).



LKIF005H

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

Temp.[˚C(˚F)]	Resistance(KΩ)
0(32) 100(212)	18.6 0.63



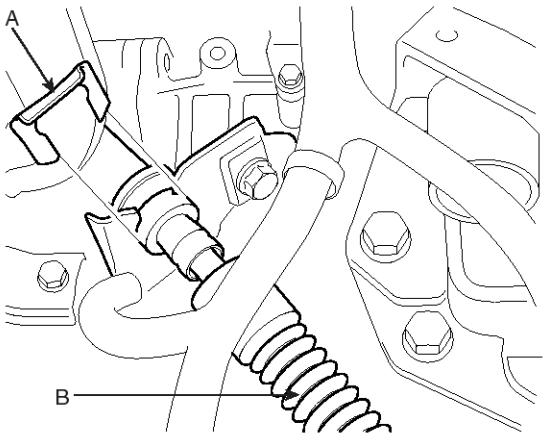
LKIF005I

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

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 clip(A) of the control cable(B).



LKIF005J

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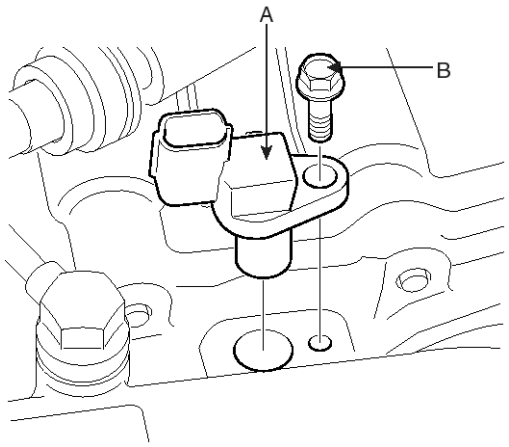
5. Remove the control cable mounting bracket.
6. Remove the input shaft speed sensor(A).
   1) Disconnect the input shaft speed sensor connector.
   2) Remove the bolt(B).

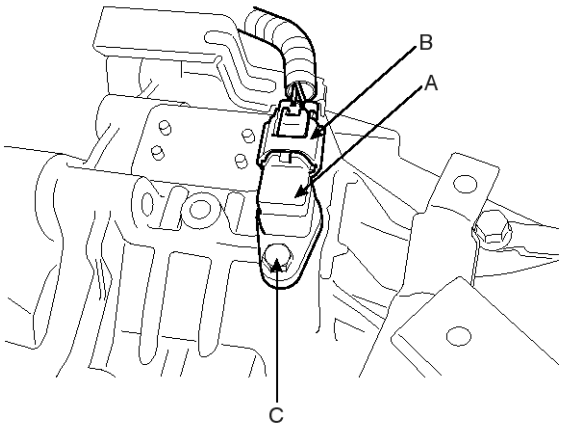


LKIF005K

   3) Inspect the input shaft speed sensor bore.
7. Apply a light coat of automatic transaxle fluid to the O-ring seal before installation.
8. Install the input shaft speed sensor.
9. Install the control cable mounting bracket.
10. Connect the input shaft speed sensor connector.
11. Install the holder of the control cable.
12. 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")
13. Installation is the reverse of removal.

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).



LKIF005L

   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.

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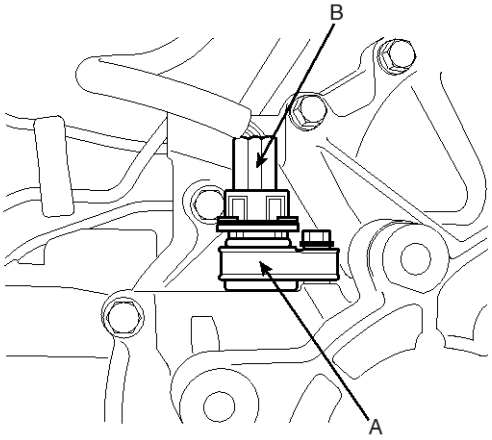
VEHICLE SPEED SENSOR

REPLACEMENT

1. Lift up the vehicle.
2. Remove the vehicle speed sensor(A).



LKIF005M

   1) Disconnect the vehicle speed sensor connector(B).
   2) Remove the bolt (10 mm(0.4 in)).
   3) Inspect the vehicle speed sensor bore.
3. Inspect the O-ring for nicks or cut. Install a new O-ring as necessary.
4. Apply a light coat of automatic transaxle fluid to the O-ring seal before installation.
5. Install the vehicle speed sensor.
6. Connect the vehicle speed sensor connector.
7. Installation is the reverse of removal.

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Automatic Transaxle

COMPONENTS (1)

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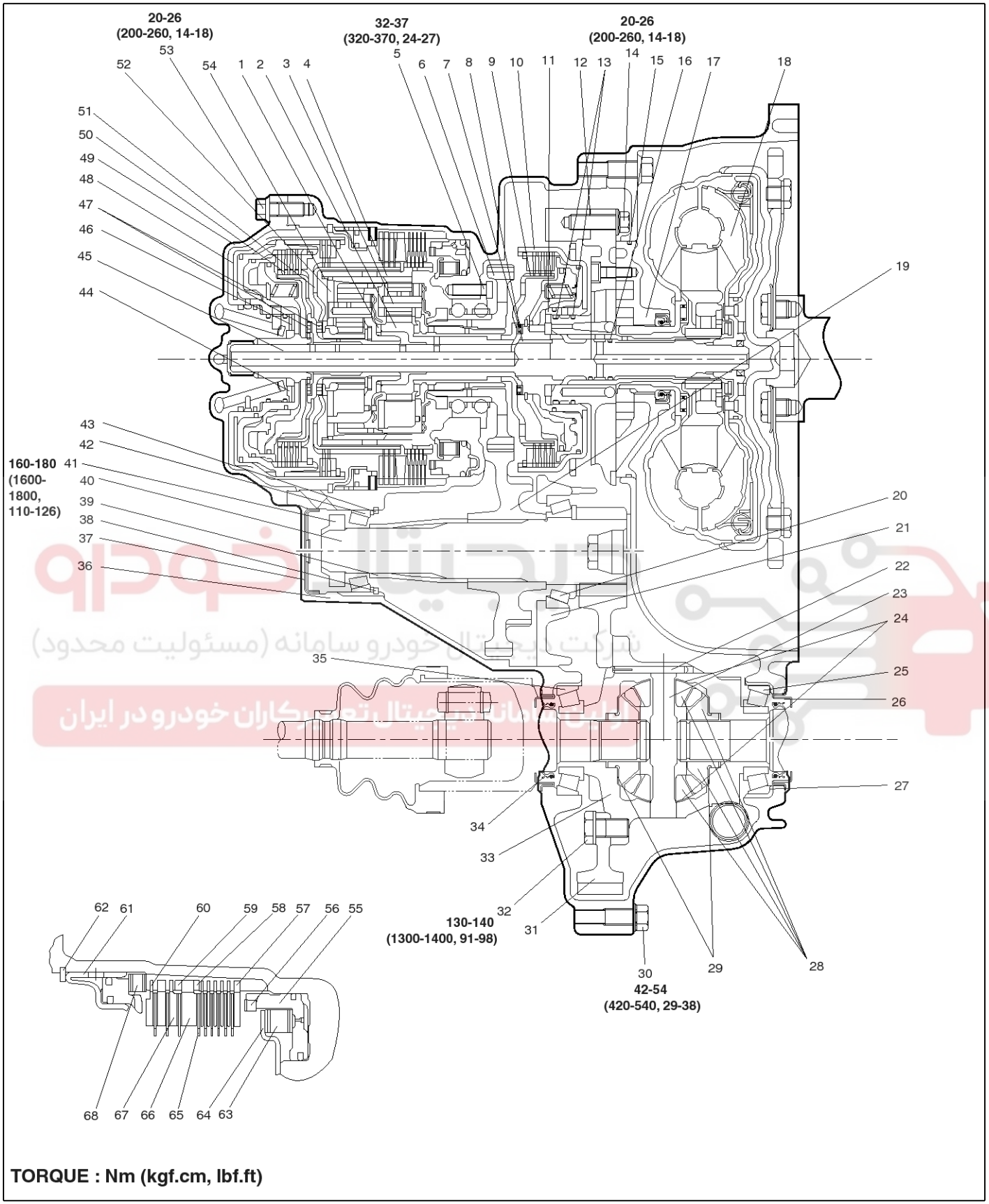

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1. Thrust bearing
2. Underdrive sun gear
3. Output carrier
4. Low and reverse annulus gear
5. Bolt
6. Transfer drive gear
7. Snap ring
8. Thrust bearing
9. Underdrive clutch hub
10 . Underdrive clutch
11. Thrust washer
12. Oil pump gasket
13. Seal ring
14. Flange bolt
15. O-ring
16. Seal ring
17. Oil pump
18. Torque converter
19. Transfer driven gear
20. Taper roller bearing
21. Bearing retainer
22. Lock pin
23. Pinion shaft
24. Washer
25. Taper roller bearing
26. Oil seal
27. Differential spacer
28. Differential gear
29. Differential spacer set
30. Flange bolt
31. Differential drive gear
32. Fly wheel bolt
33. Differential case
34. Oil seal
35. Transmission case
36. One-way Clutch Inner Race
37. Sealing cap
38. Output spacer set
39. Collar
40. Output shaft
41. Locking pin
42. Roller bearing
43. Snap ring
44. Thrust race
45. Input shaft
46. Thrust bearing
47. Thrust bearing
48. Return & O/D clutch
49. Rear cover
50. O/D clutch hub
51. Return sun gear
52. Output carrier
53. Flange bolt
54. Snap ring
55. Low and reverse brake piston
56. Wave spring
57. Brake pressure plate
58. Snap ring
59. Snap ring set
60. Brake pressure plate
61. 2nd brake retainer
62. Snap ring
63. 2nd brake return spring
64. Brake disc
65. Brake reaction plate
66. Brake plate
67. Brake spring retainer
68. Low and reverse return spring

LKIF006B

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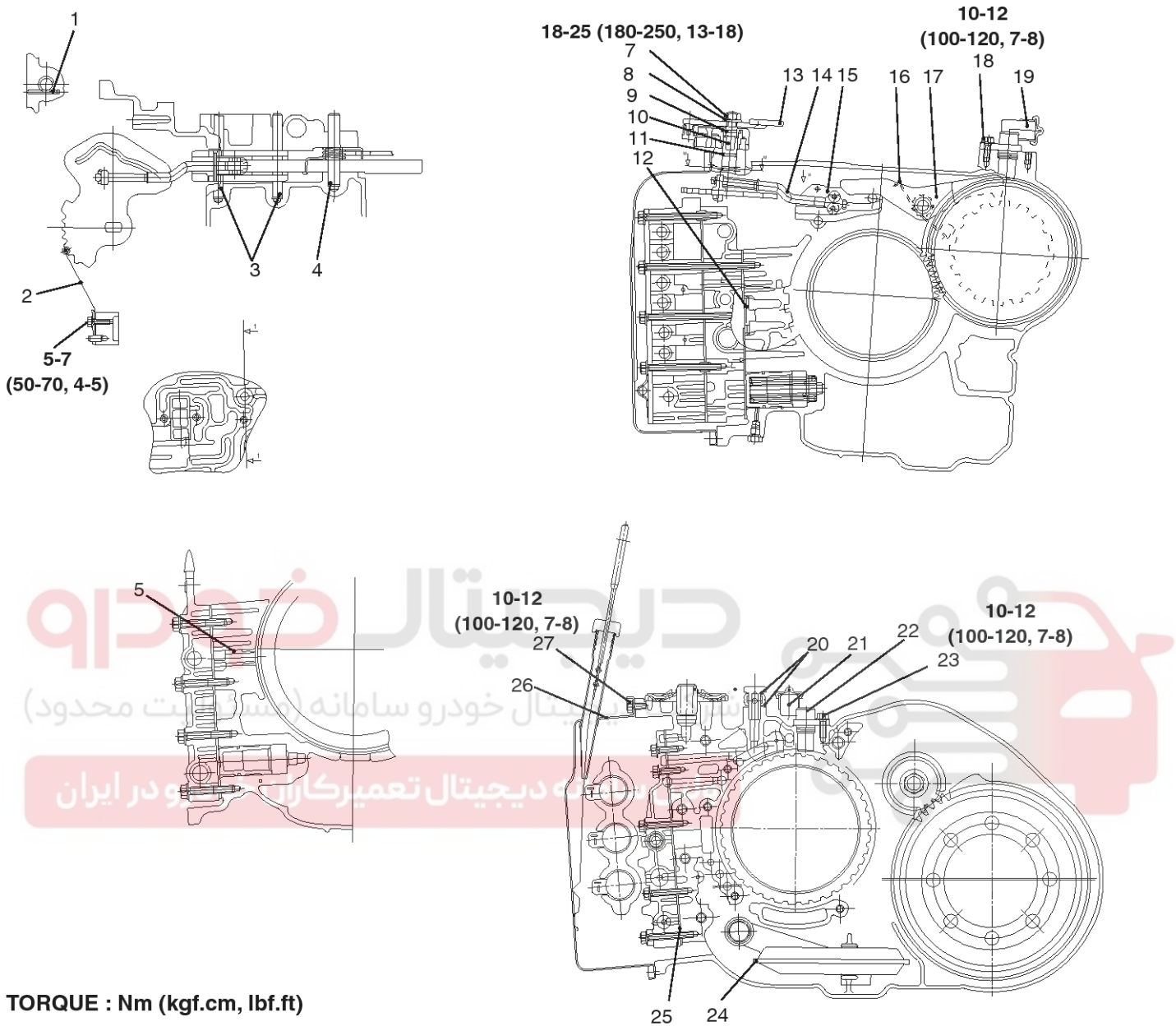
COMPONENTS (2)



TORQUE : Nm (kgf.cm, lbf.ft)

1. Roller
2. Detent spring
3. Parking roller shaft
4. Parking spring shaft
5. Oil seal
6. 2nd brake retainer
7. Flange nut
8. Spring washer
9. Oil ring
10. Manual control shaft
11. Oil ring
12. Oil strainer
13. Manual control lever
14. Parking roller rod
15. Parking roller shaft
16. Parking sprag
17. Parking sprag shaft
18. Flange bolt
19. Output speed sensor
20. Eye bolt
21. Gasket
22. Input speed sensor
23. Flange bolt
24. Oil filter
25. Valve body gasket
26. Valve body
27. Flange bolt

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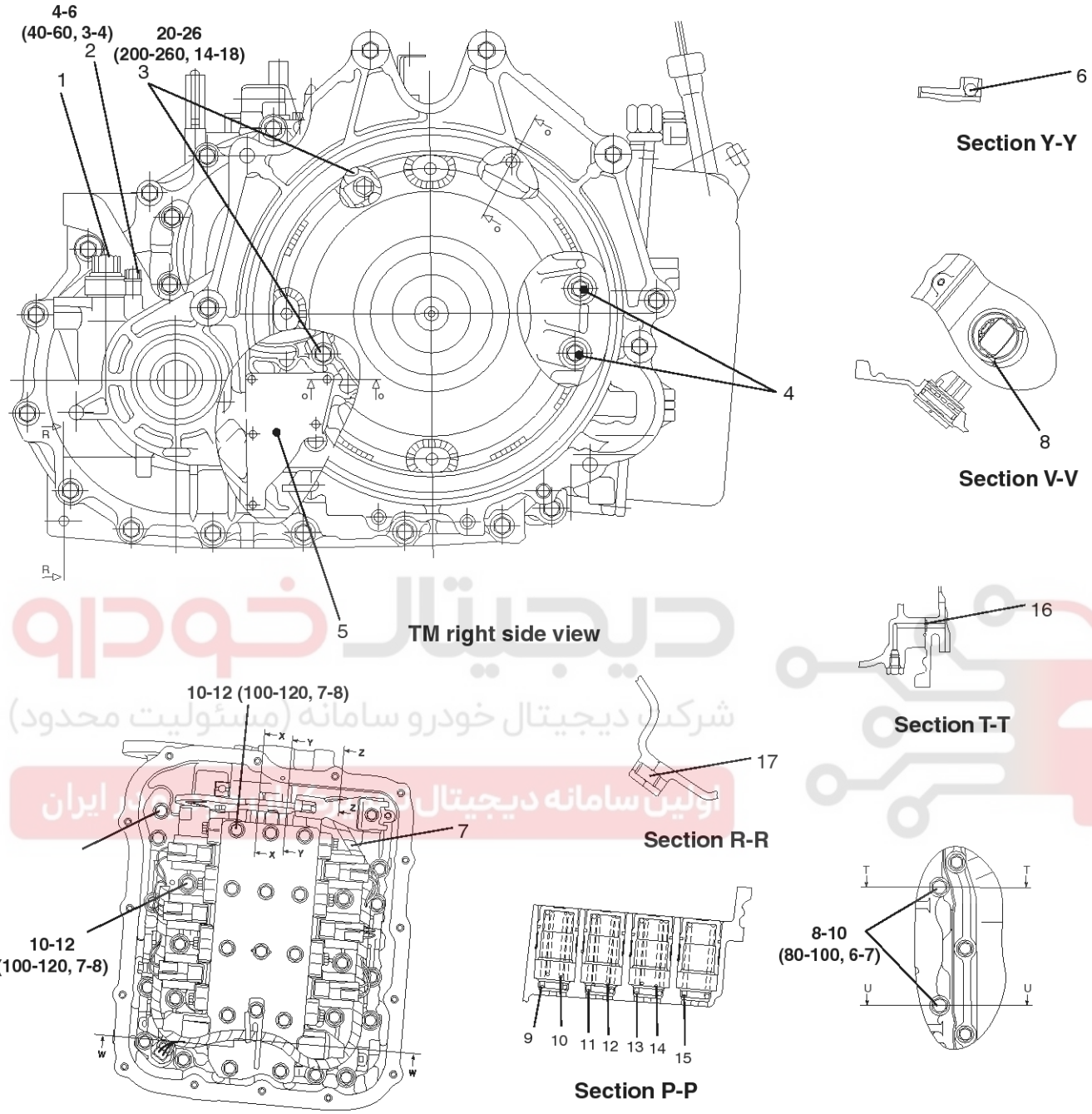
COMPONENTS (3)



TORQUE : Nm (kgf.cm, lbf.ft)

1. Vehicle speed sensor
2. Washer
3. Seal bolt
4. Flange bolt
5. Oil guide
6. Steel ball
7. Harness
8. Snap ring
9. Coil spring
10. Coil spring
11. Coil spring
12. Coil spring
13. Coil spring
14. Coil spring
15. Coil spring
16. O-ring
17. Dowel pin

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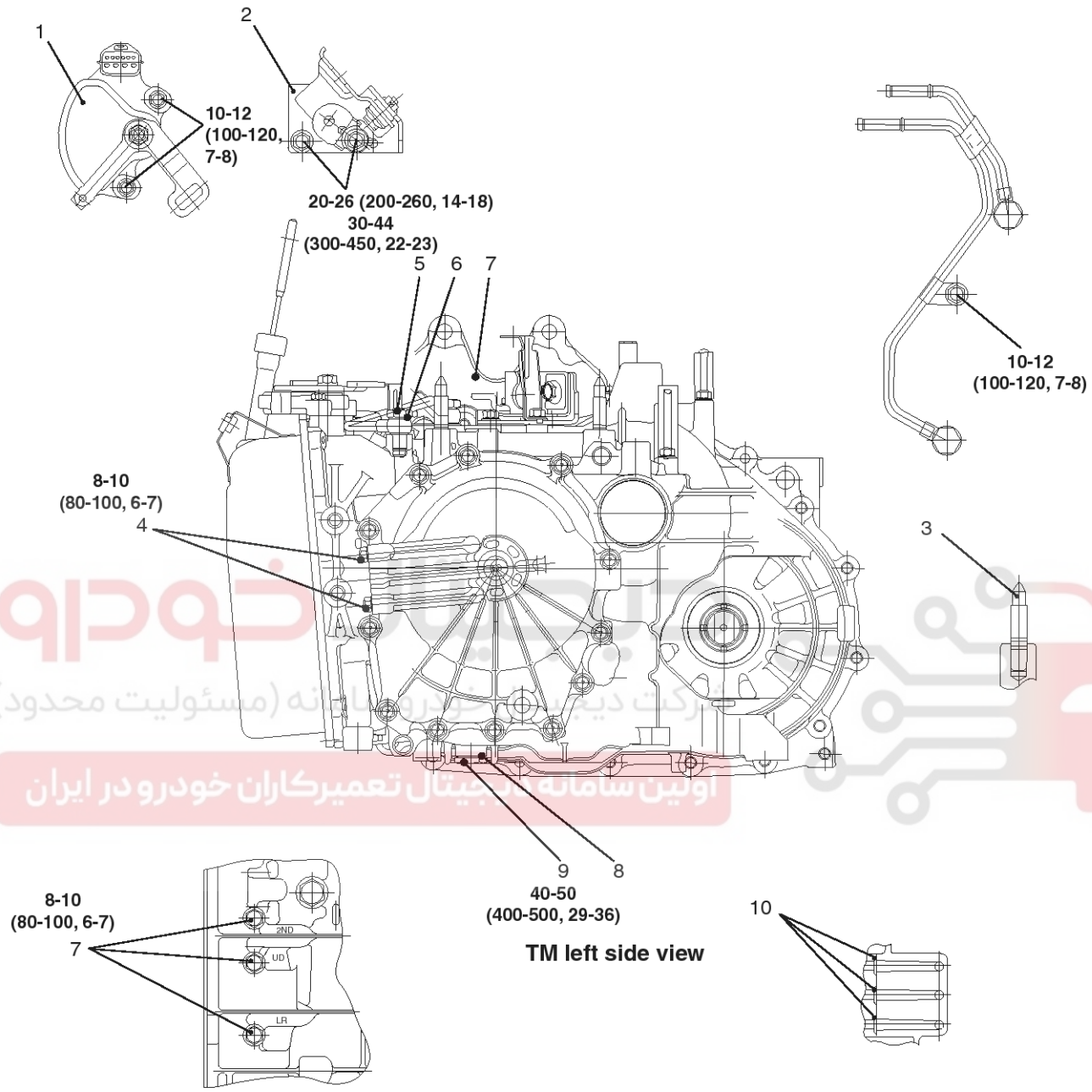
COMPONENTS (4)



TORQUE : Nm (kgf.cm, lbf.ft)

1. Inhibitor switch
2. Control cable bracket
3. Stud
4. Pressure check plug
5. Eye bolt
6. Gasket
7. Converter housing
8. Gasket
9. Magnet plug
10. Accumulator piston

LKIF006E

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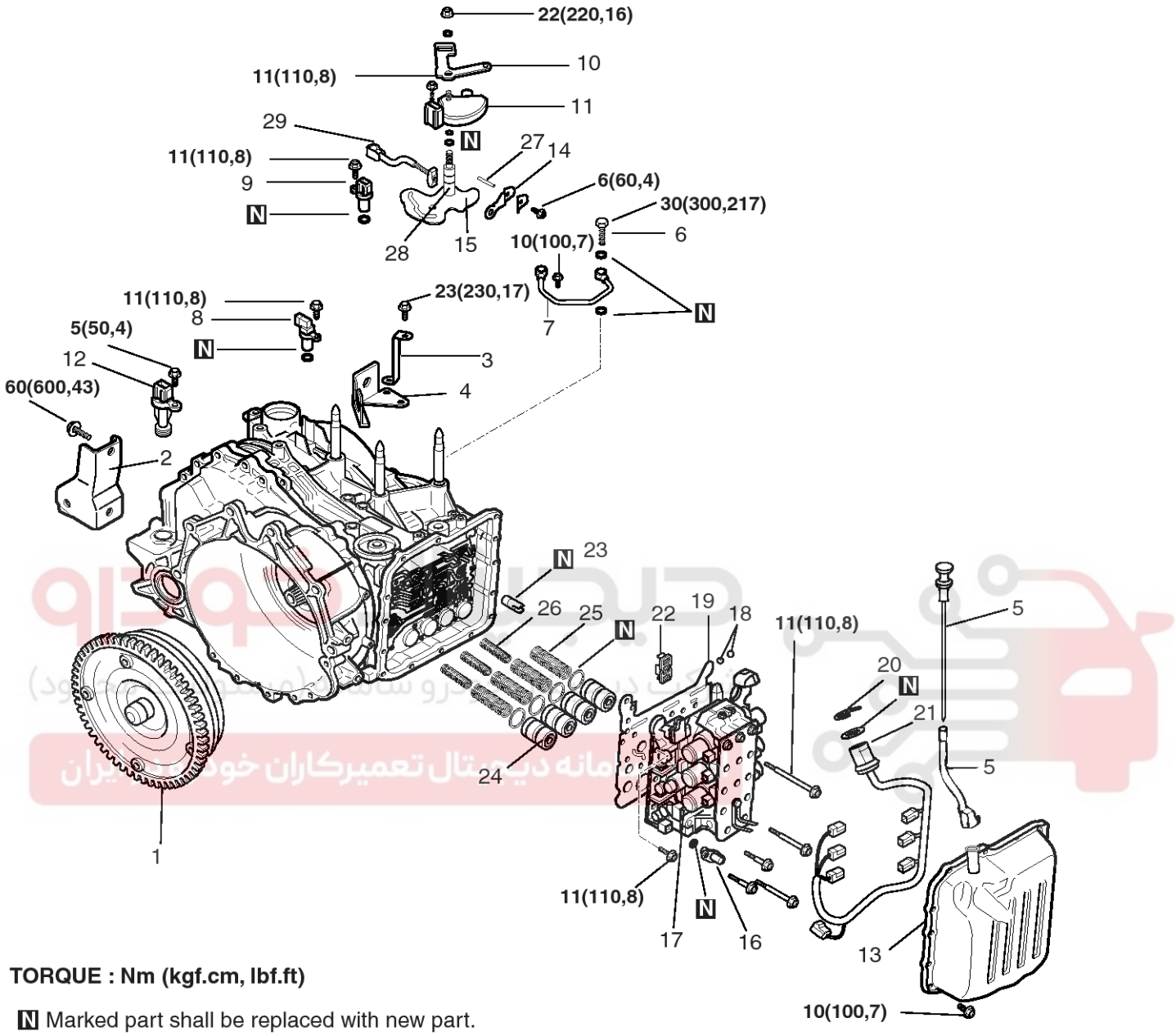
COMPONENTS (5)



TORQUE : Nm (kgf.cm, lbf.ft)

N Marked part shall be replaced with new part.

1. Torque converter
2. Roll stopper bracket
3. Harness bracket
4. Shift cable bracket
5. Oil level gauge
6. Eye bolt
7. Oil cooler feed tube
8. Output speed sensor
9. Input speed sensor
10. Manual control lever
11. Inhibitor switch
12. Speedometer gear
13. Valve body cover
14. Detent spring
15. Manual control shaft assembly
16. Oil temperture sensor
17. Valve body
18. Steel ball
19. Gasket
20. Snap ring
21. Solenoid valve harness
22. Strainer
23. 2nd brake retainer oil seal
24. Accumulator piston
25. Accumulator spring
26. Accumulator spring
27. Manual control lever shaft roller
28. Manual control lever shaft
29. Parking roller rod

LKIF006F

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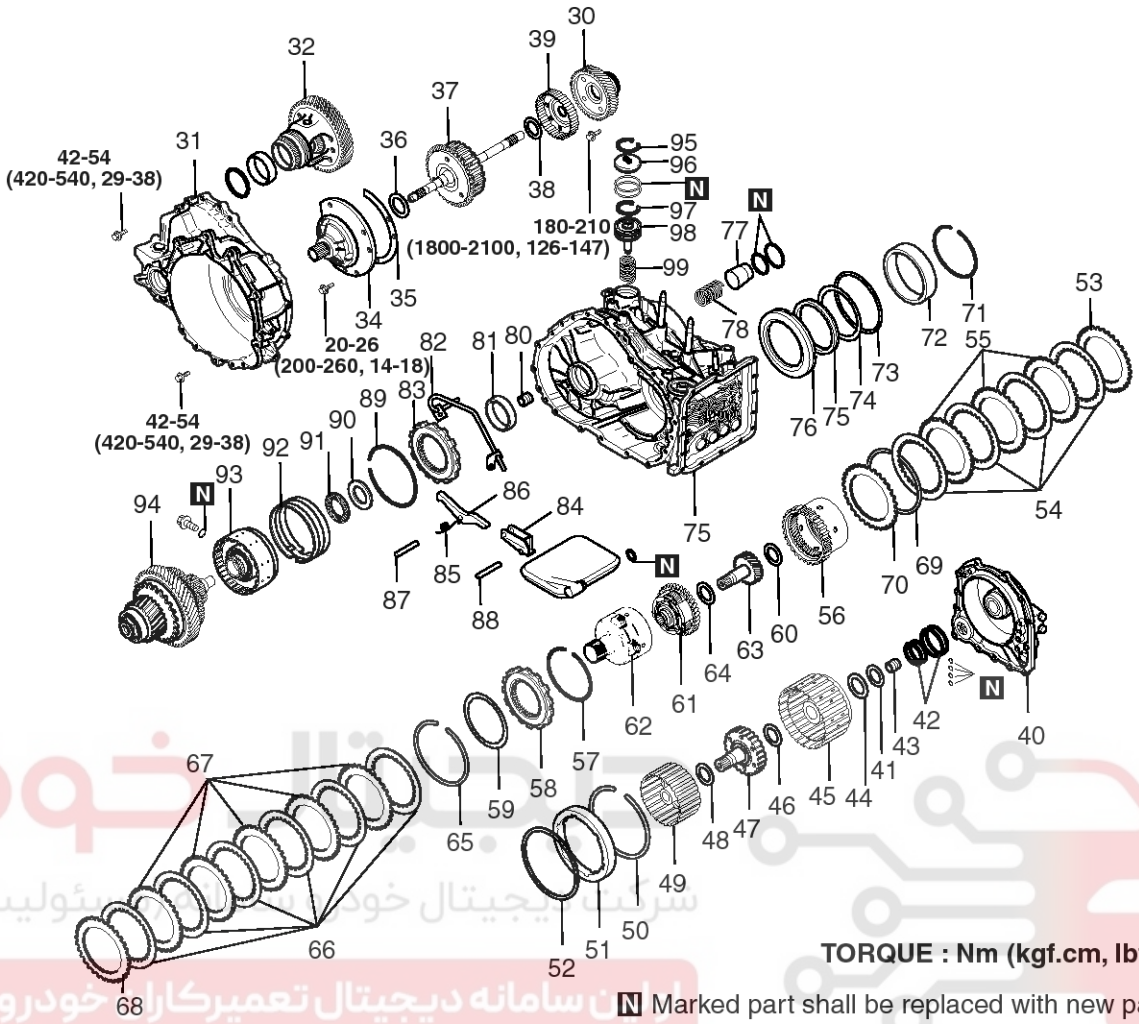

30. Transfer drive gear set
31. Converter housing
32. Differential
33. Oil filter
34. Oil pump
35. Gasket
36. Thrust washer #1
37. Underdrive clutch & input shaft
38. Thrust bearing #2
39. Underdrive clutch hub
40. Rear cover
41. Thrust race #8
42. Seal ring
43. Input shaft rear bearing
44. Thrust bearing #7
45. Reverse & overdrive clutch
46. Thrust bearing #6
47. Overdrive clutch hub
48. Thrust bearing #5
49. Planet carrier reverse sun gear
50. Snap ring
51. 2nd brake piston
52. Return spring
53. Pressure plate
54. 2nd brake disc
55. 2nd brake plate
56. Low & reverse annulus gear
57. Snap ring
58. One-way clutch 1
59. Stopper plate
60. Thrust bearing #4
61. Overdrive planetary carrier
62. Output planetary carrier
63. Underdrive sun gear
64. Thrust bearing #3
65. Snap ring
66. LR brake disc
67. LR brake plate
68. Pressure plate
69. Snap ring
70. Reaction plate
71. Snap ring
72. Inner race
73. Wave spring
74. Spring retainer
75. Return spring
76. LR brake piston
77. Accumulator piston
78. Spring
79. Transaxle case
80. Needle bearing
81. Outer race
82. Pipe
83. One-way clutch 2
84. Parking roller support
85. Hole spring
86. Parking ball spring
87. Parking ball shaft
88. Parking roller support shaft
89. Snap ring
90. Thrust race
91. Thrust bearing
92. Reduction brake band
93. Direct clutch
94. Direct planetary carrier
95. Snap ring
96. Reduction brake band
97. Snap ring
98. Reduction brake piston
99. Reduction brake spring

LKIF006G

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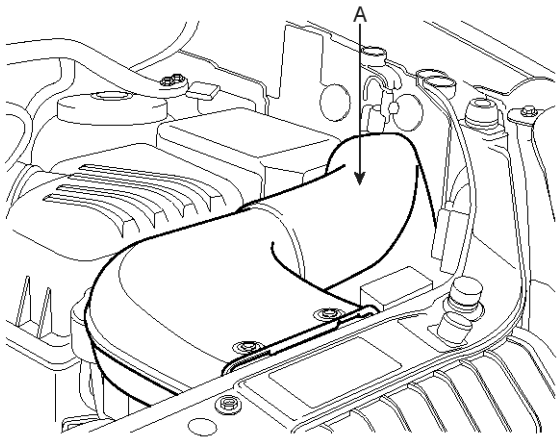
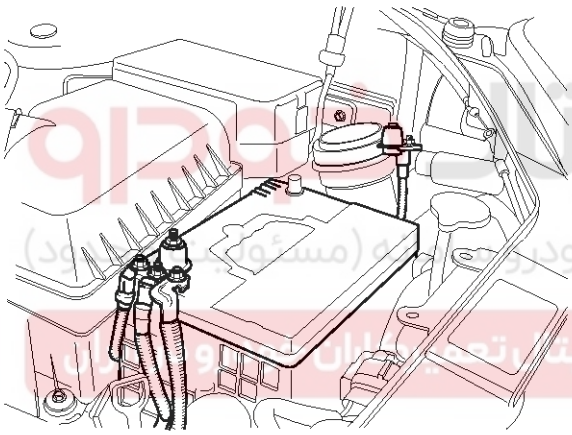
REMOVAL

1. Remove the air duct(A).



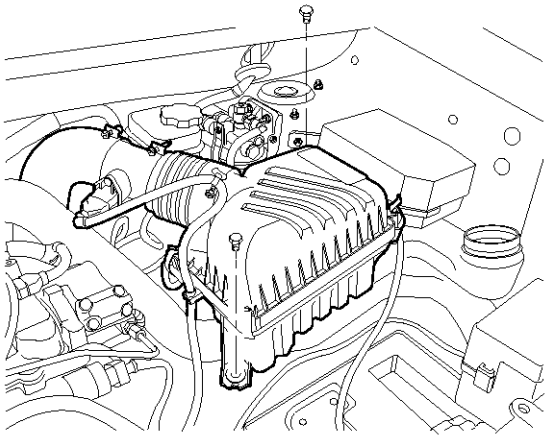
LKIF007A

2. Remove the battery.



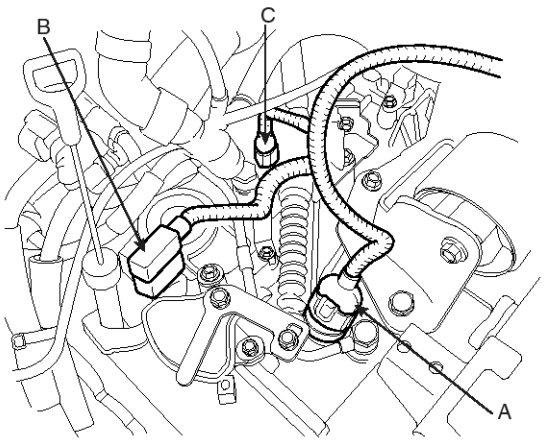
LKIF007B

3. Remove the battery tray.
4. Remove the air cleaner assembly.

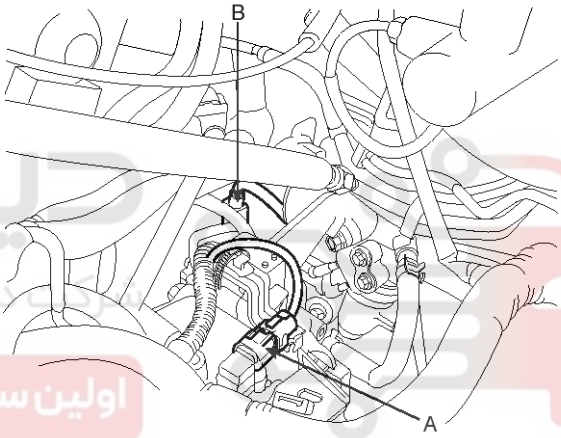


LKIF007C

5. Remove the intercooler inlet pipe.
6. Disconnect the connectors relevant to the transaxle.

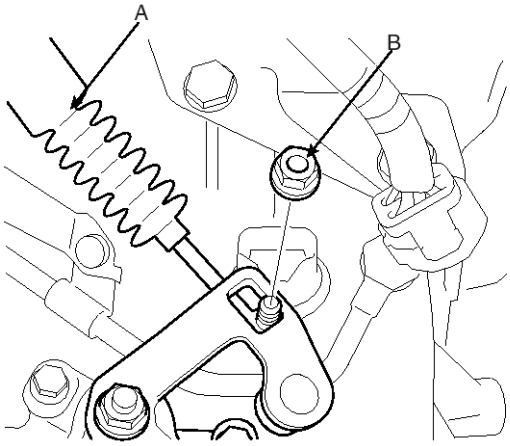


LKIF007D



LKIF007E

7. Disconnect the ground earth wire.
8. Remove the bolt(B) which mounts the clutch release cylinder(A) to the inhibiter switch.



LKIF007F

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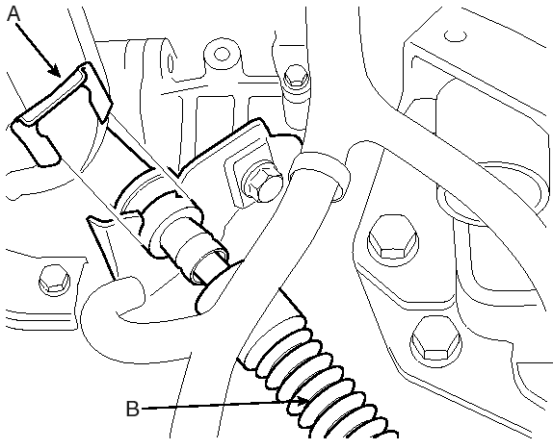
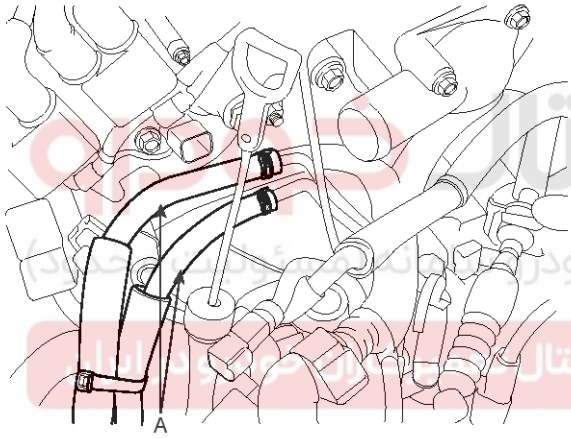
9. Detach the clutch release cylinder(B) clip(A).



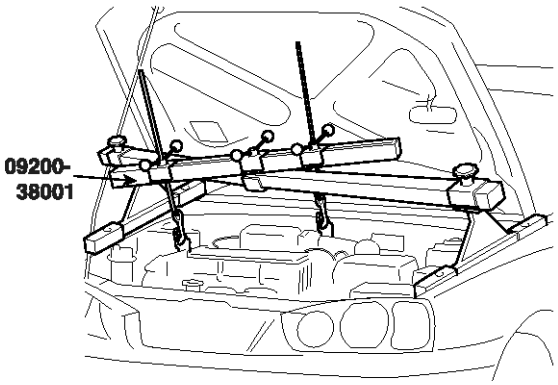
LKIF007G

10. Detach the hoses(A), loosening the oil cooler hose clamps.



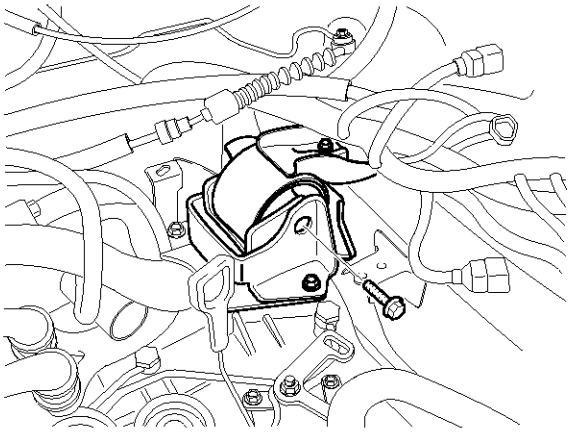
LKIF007H

11. Using SST(09200-38001), support the engine.

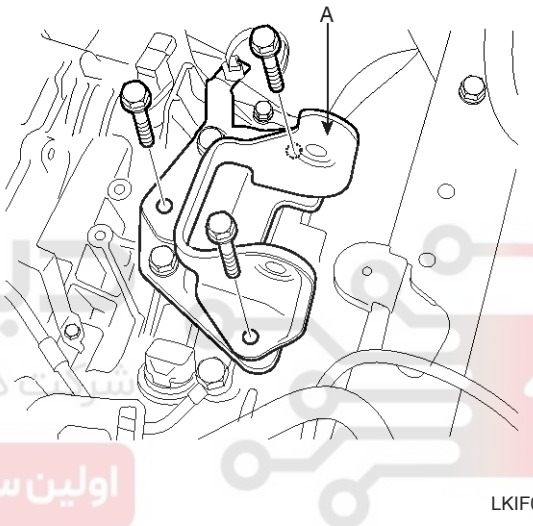


LKIF007I

12. Remove the trasaxle mounting bracket(A) bolts.

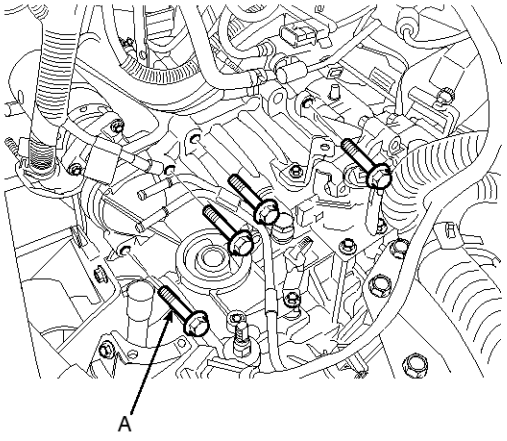


LKIF007J



LKIF007K

13. Remove the transaxle upper mounting bolts(A).



LKIF007L

14. Remove the bolts which mount the transaxle to the front sub frame.
15. Lift up the vehicle.
16. After removing the oil drain plug(A), Drain the fluid.

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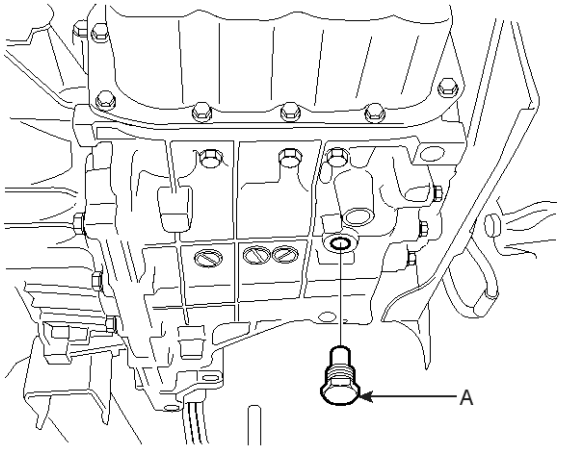
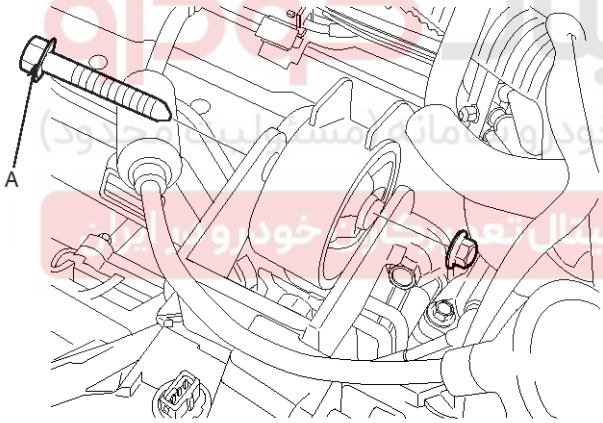


LKIF007M

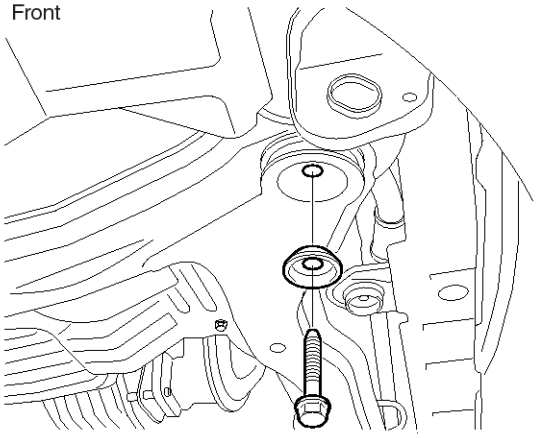
17. Support the transaxle with a jack.
18. Remove the steering column bolt(See 'ST' group).
19. Remove the driveshafts (See 'DS' group-'DRIVESHAFT').
20. Remove the bolt(A) which mounts the transaxle to the rear sub-frame.



LKIF007N

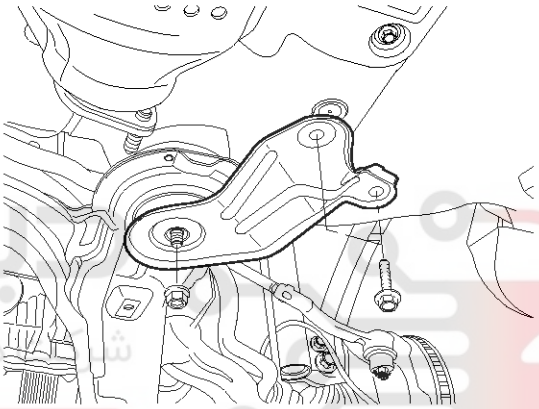
21. Remove the sub-frame. If it is a 4 wheel drive vehicle(4WD), remove the propeller shaft first(See 'DS' group-'PROPELLER SHAFT').

■ Front



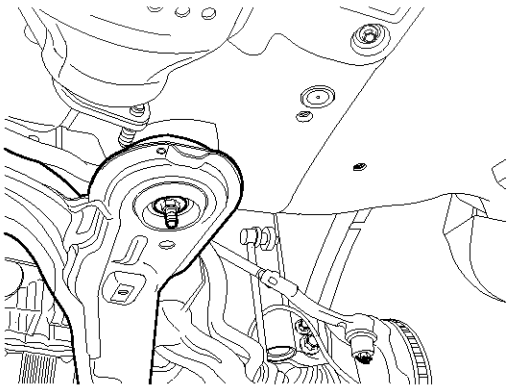
LKIF007O

■ Rear



LKIF007P

■ Rear



LKIF007Q

22. Remove the transaxle lower mounting bolts.
23. Remove the transaxle assembly.

INSTALLATION

1. Attach the torque converter on the transaxle side and mount the transaxle assembly onto the engine.

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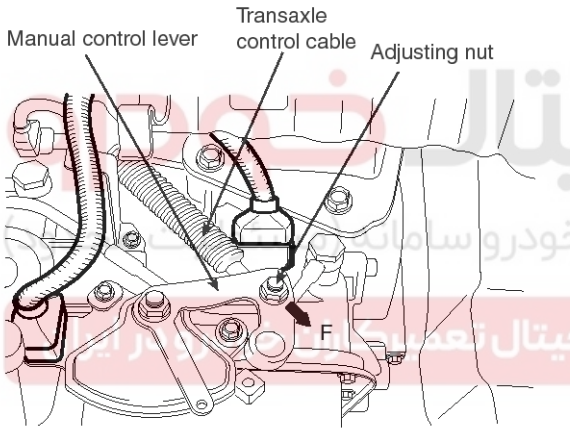
⚠CAUTION

If the torque converter is mounted first on the engine, the oil seal on the transaxle may be damaged. Therefore, be sure to first assemble the torque converter to the transaxle.

2. Install the transaxle control cable and adjust as follows.
   1) Move the shift lever and the transaxle range switch to the "N" position, and install the control cable.
   2) When connecting the control cable to the transaxle mounting bracket, install the clip until it contacts the control cable.
   3) Remove any free-play in the control cable by adjusting nut and then check to see that the selector lever moves smoothly.
   4) Check to see that the control cable has been adjusted correctly.



BKGE001A

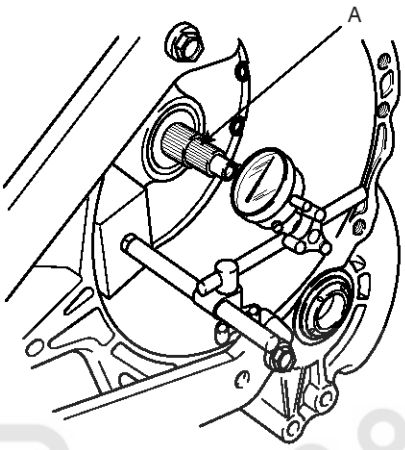
3. Installation is the reverse of removal.

DISASSEMBLY

⚠CAUTION

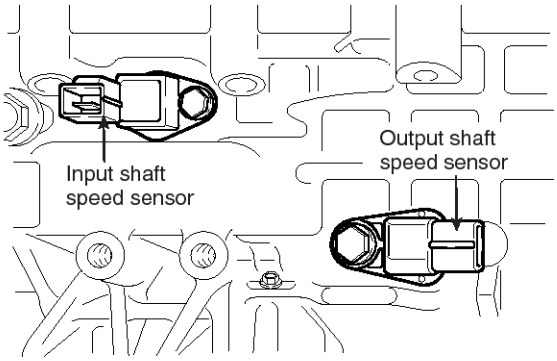
- **Because the automatic transmission is manufactured from high-precision parts, sufficient care must be taken not to scratch or damage these parts during disassembly and reassembly.**
- **The working area should be convered with a rubber mat to keep it clean at all times.**
- **Do not wear any cloth gloves and do not use any rags during disassembly. Use nylon cloth or paper towels if you need to use something.**
- **Parts which have been disassembled should all be cleaned. Metal parts can be cleaned with normal detergent but they should be dried completely using compressed air.**
- **Clutch discs, plastic thrust plates and rubber parts should be cleaned with automatic transmission fluid (ATF) so that they do not become dirty.**
- **If the transmission body has been damaged, disassemble and clean the cooler system also.**

1. Remove the torque converter and set aside.
2. Measure the input shaft(A) end play.



BKGE004A

3. Remove the left and right roll stopper brackets.
4. Remove the wiring harness bracket.
5. Remove the control cable support bracket.
6. Remove the dipstick.
7. Remove the oil cooler feed tube, gasket, and eye bolt.
8. Remove the input shaft speed sensor and the output shaft speed sensor.



BK1A052B

9. Remove the manual control lever, then remove the transaxle range switch.

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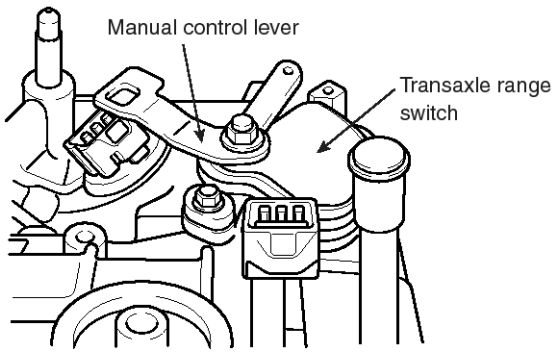
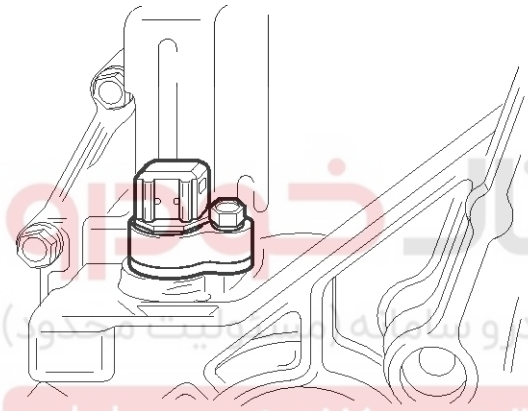


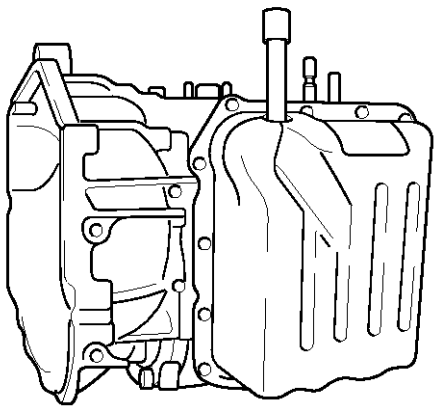
BK1A052C

10. Remove the vehicle speed sensor.



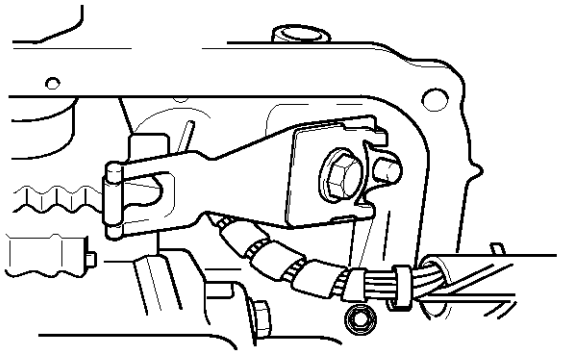
BK1A052D

11. Remove the valve body cover.



BK1A052E

12. Remove the manual control shaft detent.

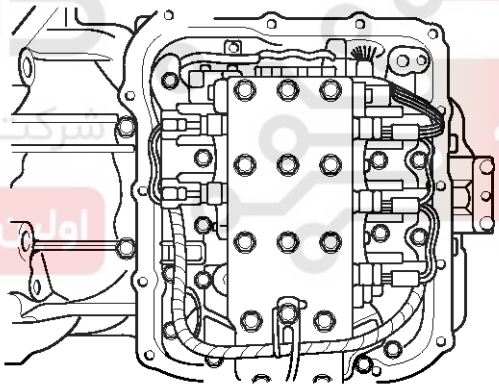


BK1A052F

13. Disconnect the harness connectors of the valve body.

⚠CAUTION

To prevent damage to transaxle components make sure that the manual control lever and the park/neutral switch have been removed before attempting to remove the valve body.



BK1A052G

NOTICE

The valve body mounting bolts are different lengths. Note the locations of the bolts to aid in assembly.

14. Remove 28 of the valve body mounting bolts. Do not remove the bolts shown in the illustration at this time.

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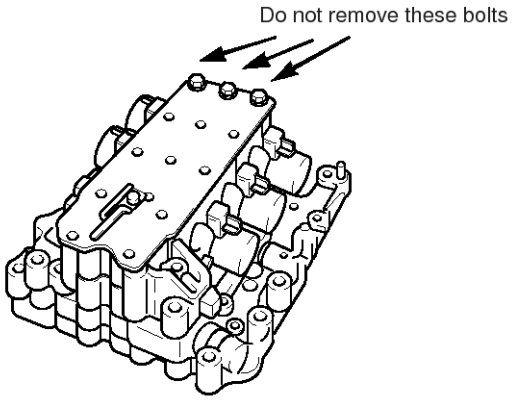
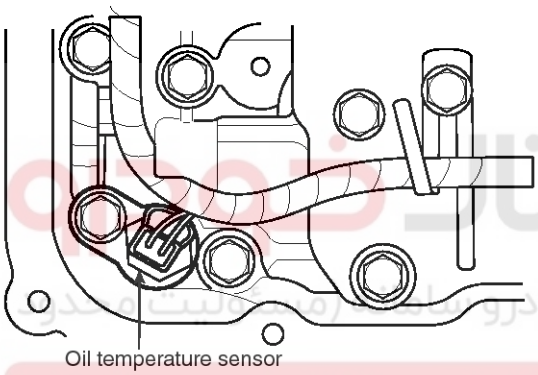


BK1A052H

15. Remove the oil temperature sensor.

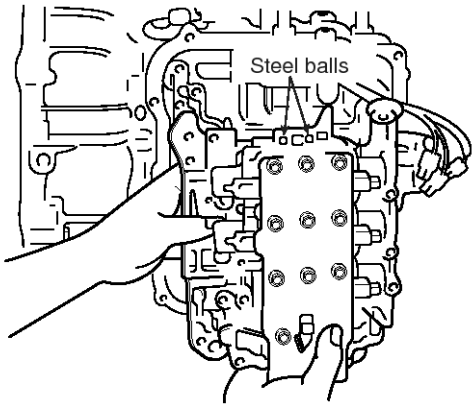


BKGE004C

16. Remove the valve body, gasket, and the 2 steel balls.

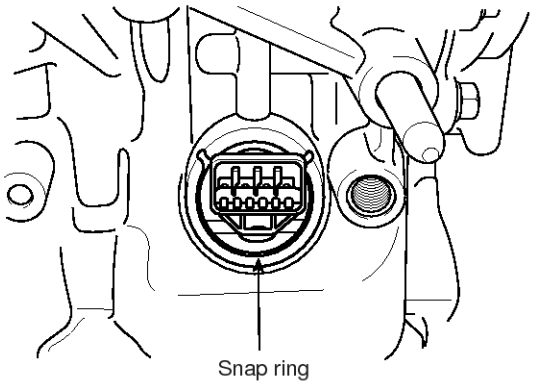
NOTICE

Make sure not to lose the 2 steel balls.



BK1A052I

17. Remove the solenoid valve wiring harness snap ring.

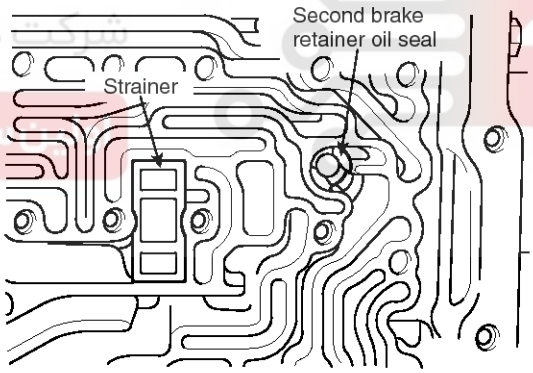


BKGE004B

18. Remove the solenoid valve harness.
19. Remove the strainer.
20. Remove the second brake retainer oil seal.

CAUTION

The second brake retainer oil seal must be removed before removing the transaxle powertrain components from the case or damage to the seal will occur.



BK1A052K

21. Remove the 4 accumulator pistons, the 4 large springs, and the 3 small springs.

Number	Functional Name
1	Low & Reverse Brake
2	Underdrive Clutch
3	Second Brake
4	Overdrive Clutch

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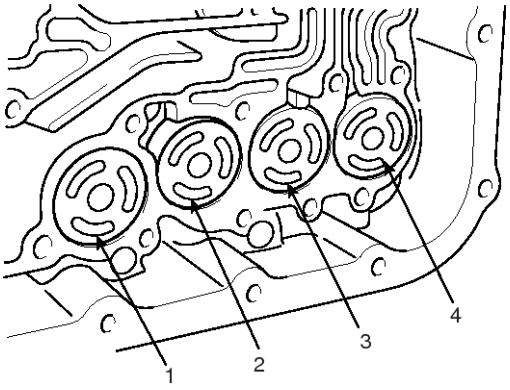
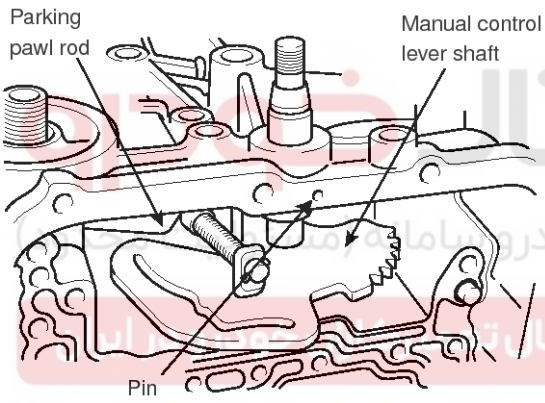


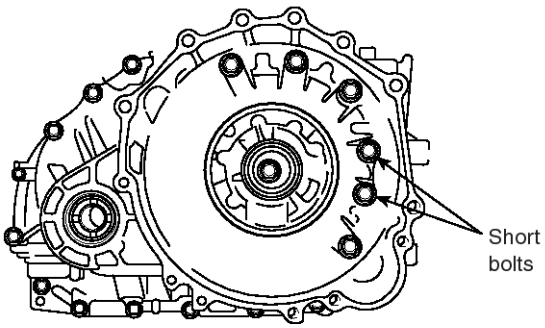
BK1A052L

22. Remove the manual control lever shaft pin (roller).
23. Remove the manual control lever shaft.
24. Remove the parking pawl rod.



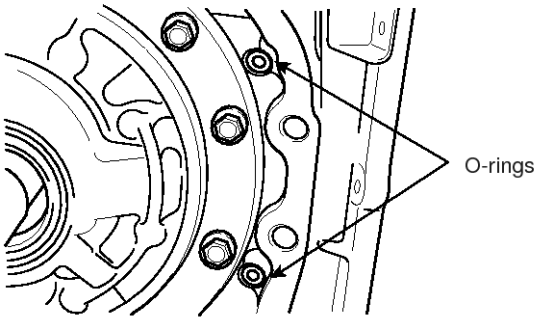
BK1A052M

25. Remove the torque converter housing and 18 mounting bolts. Tap the housing off with a non-metallic hammer.



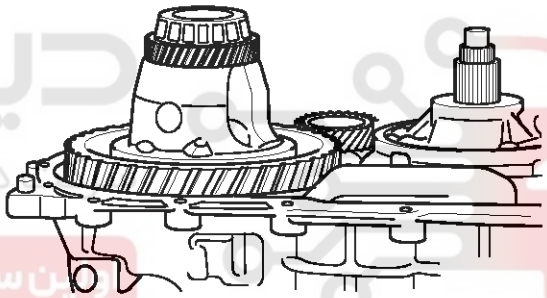
BK1A052N

26. Remove the 2 O-rings from the case.



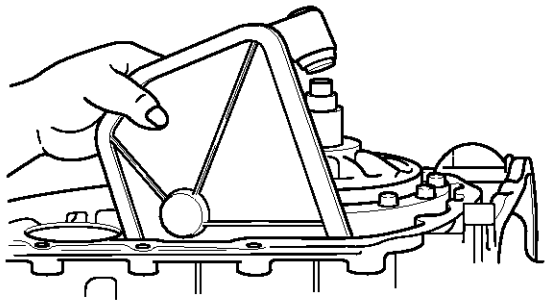
BK1A052O

27. Remove the differential.



BK1A052P

28. Remove the main oil filter.



BK1A052Q

29. Remove oil pump mounting bolts.

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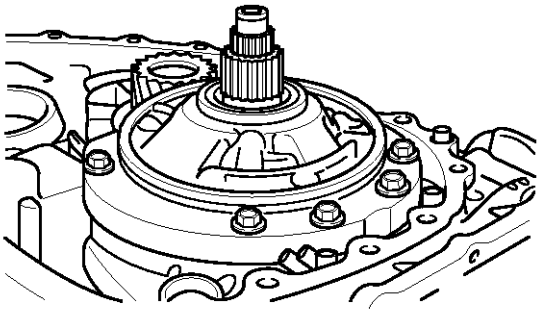
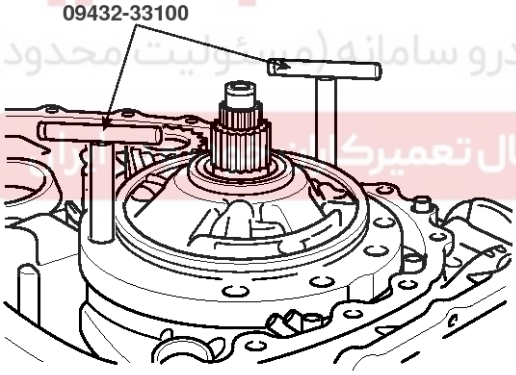
⚠CAUTION
The oil pump is not serviceable, it must be replaced as a pump assembly. Do not disassemble the pump as improper alignment during assembly will cause pump failure and could cause damage to the transaxle.



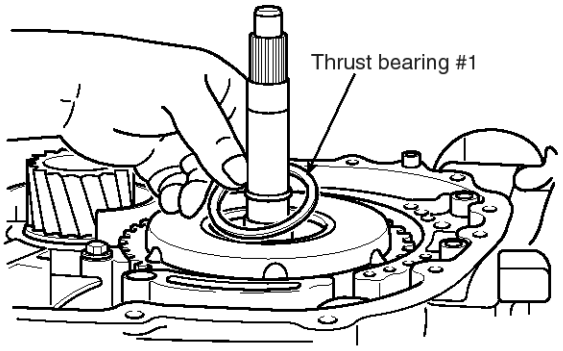
BK1A052R

30. Install the special tool (09452-33100), as shown in the illustration.



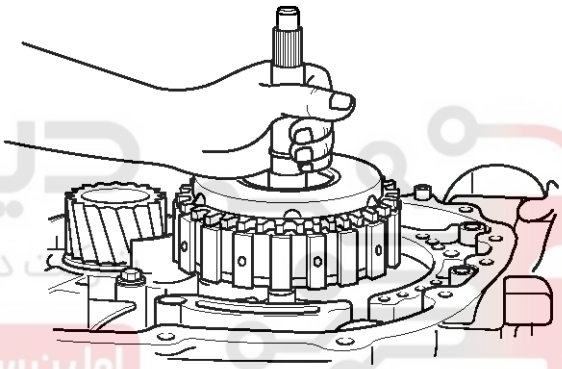
BK1A052S

31. Remove the oil pump by turning special tool screws clockwise.
32. Remove the oil pump gasket.
33. Remove thrust bearing #1.



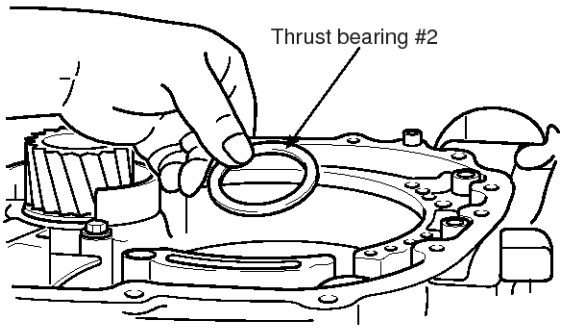
BK1A052T

34. Grasp the input shaft, then pull out the underdrive clutch and input shaft as an assembly.



BK1A052U

35. Remove thrust bearing #2.



BK1A052V

36. Remove the underdrive clutch hub.

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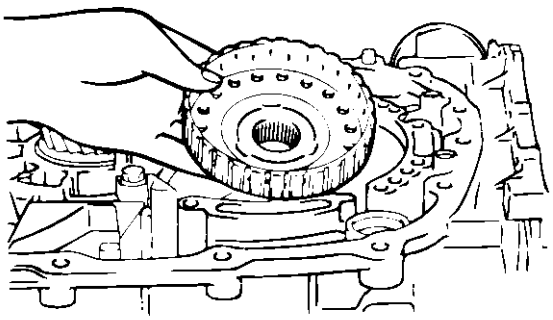
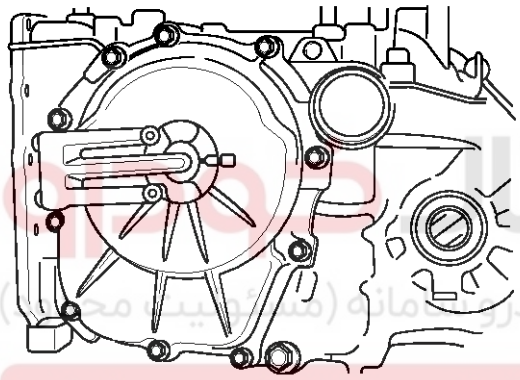


BK1A052W

37. Remove the rear cover and mounting bolts.



BK1A052X

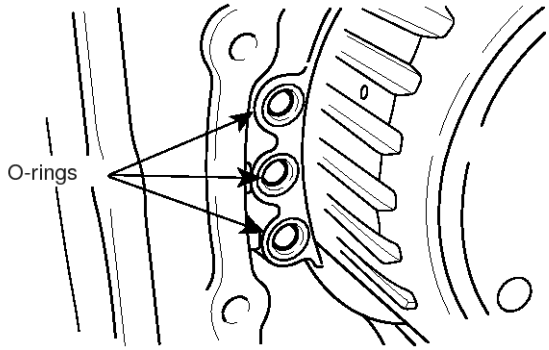
38. Remove the thrust race #8.
39. Remove the 4 seal rings.

NOTICE

Do not remove the input shaft rear bearing unless directed to do so by the instructor.

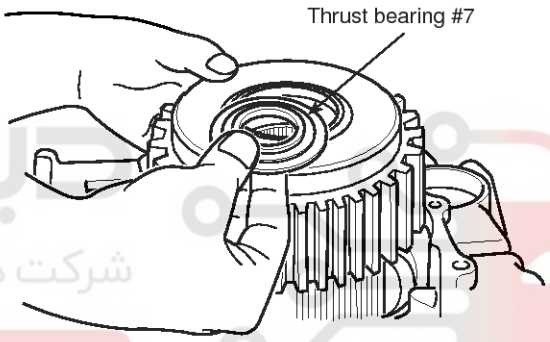
Once this bearing has been removed, it MUST be replaced.

40. Remove the 3 O-rings.



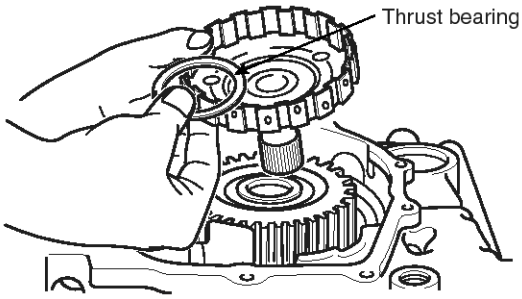
BK1A052Y

41. Remove thrust bearing #7.



BK1A052Z

42. Remove the reverse and overdrive clutch.
43. Remove thrust bearing #6.



LK1D074A

44. Remove the overdrive clutch hub.
45. Remove thrust bearing #5.

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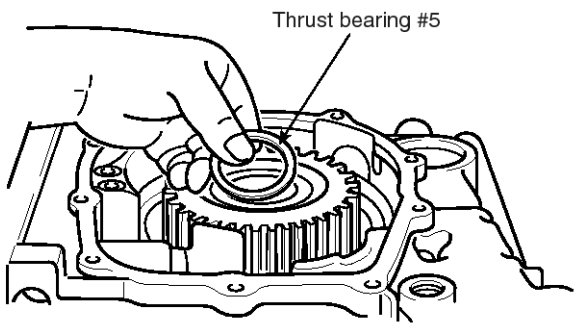
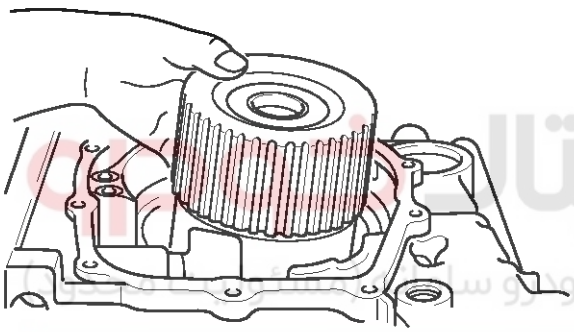


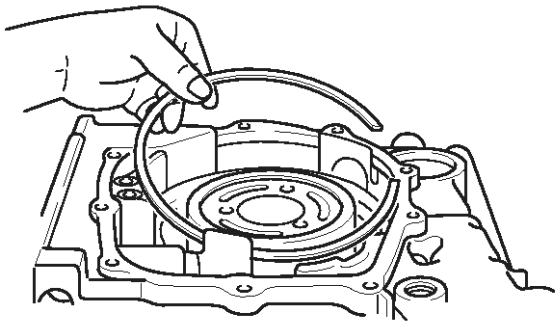
LK1D074B

46. Remove the planetary reverse sun gear.



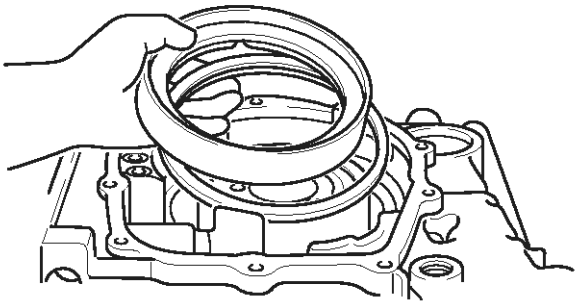
LK1D074C

47. Remove the second brake piston snap ring.



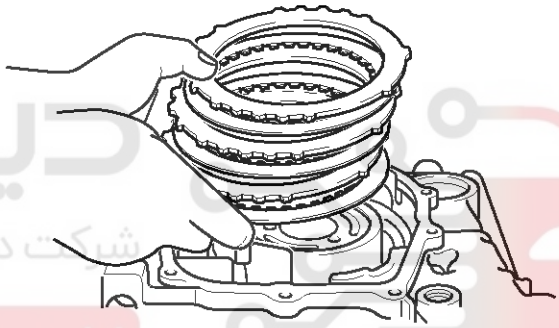
BK1A074D

48. Remove the second brake piston and return spring.



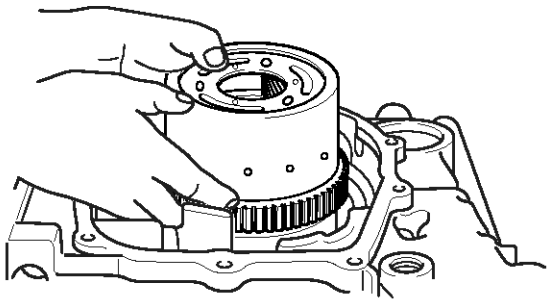
BK1A074E

49. Remove the second brake pressure plate, 3 brake discs, and 2 brake plates.



BK1A074F

50. Remove the overdrive planetary carrier.



BK1A074G

51. Remove thrust bearing #4.

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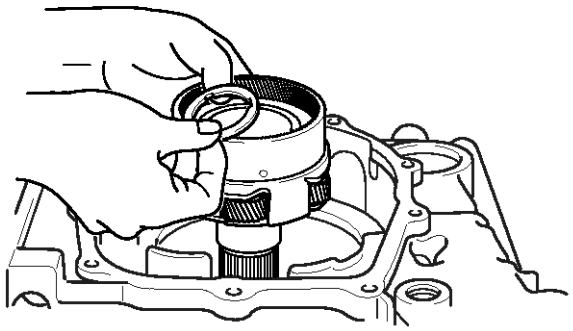
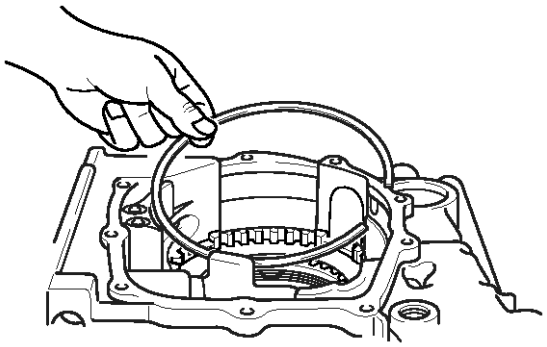


BK1A074H

52. Remove the output planetary carrier.
53. Remove the underdrive sun gear.
54. Remove thrust bearing #3.

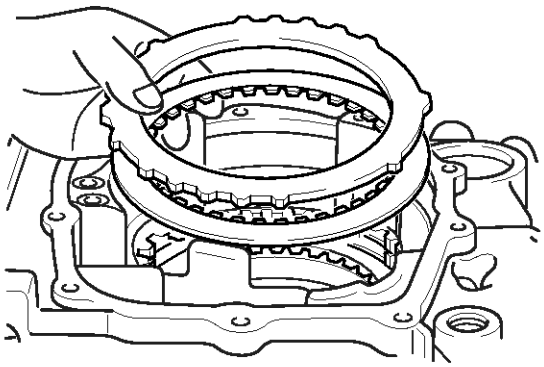
BK1A074I

55. Remove the low and reverse reaction plate snap ring.



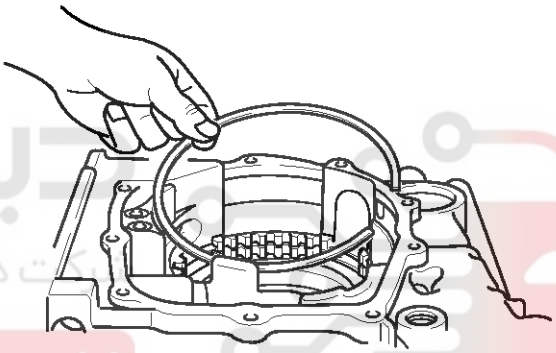
BK1A074J

56. Remove the low and reverse reaction plate and brake disc.



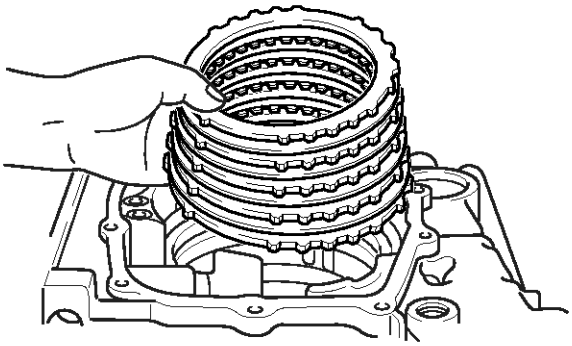
BK1A074K

57. Remove the low and reverse brake snap ring.



BK1A074L

58. Remove the low and reverse 6 brake discs, 5 brake plates, and brake pressure plate.



BK1A074M

59. Remove the wave spring.

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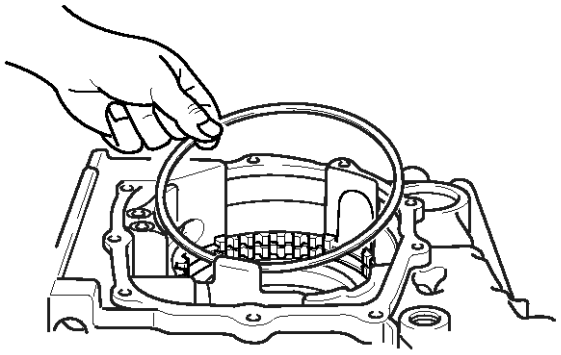
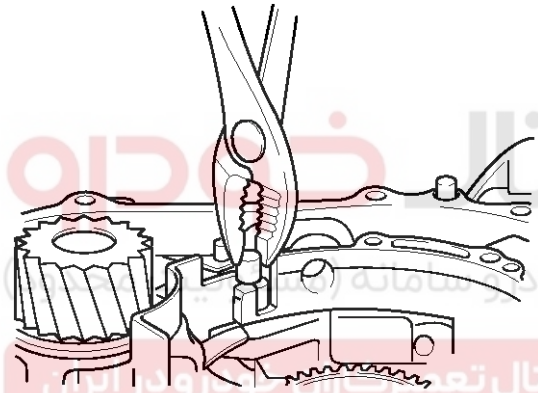


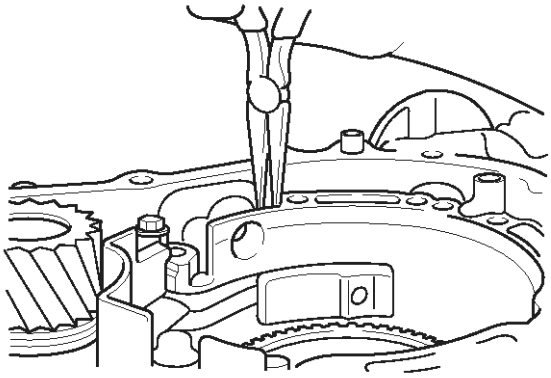
BK1A074N

60. Remove the parking pawl shaft.
61. Remove the spacer.



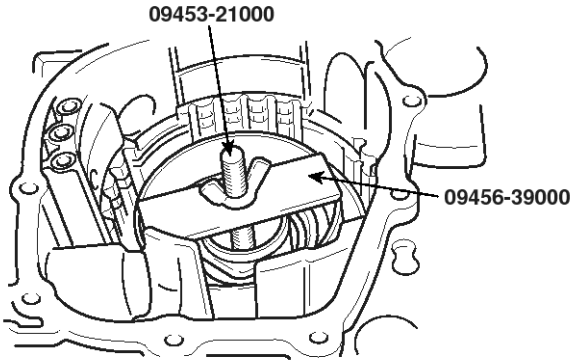
BK1A074O

62. Remove the parking pawl spring. Note the orientation of the spring to aid in reassembly.
63. Remove the 2 parking roller support shafts.



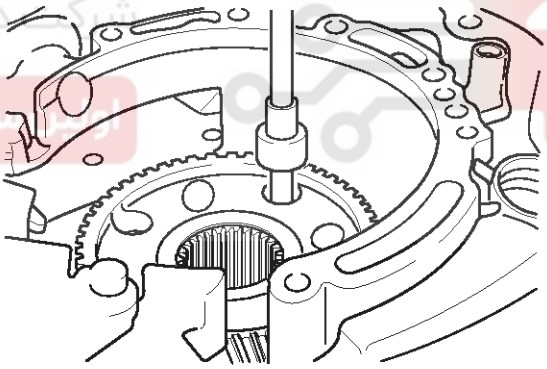
BK1A074P

64. Remove the parking pawl case.
65. Remove the parking roller support.
66. Remove the snap ring.



BK1A074Q

67. Remove the spring retainer.
68. Remove the return spring.
69. Remove the low and reverse brake piston. Use compressed air directed into the valve body passage.
70. Remove the 7 transfer gear mounting bolts.



LK1D074R

71. Remove the transfer drive gear.

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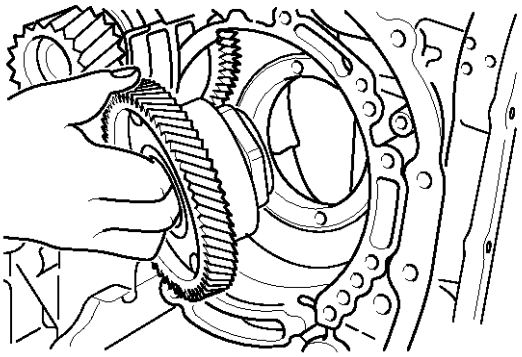
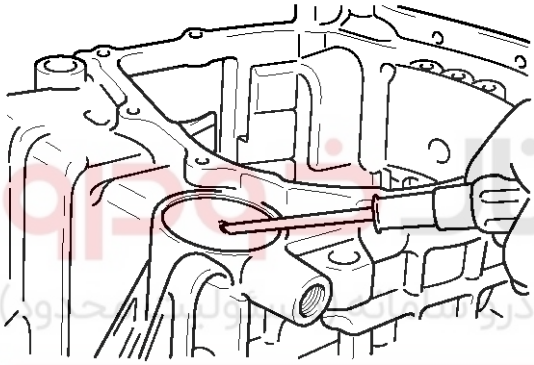


BK1A074S

72. Remove the plastic cap, if present.

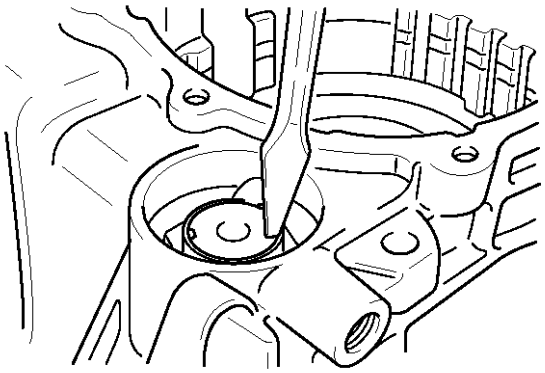


BK1A074T

73. Straighten the locking tab of the output shaft locking nut, if bent.

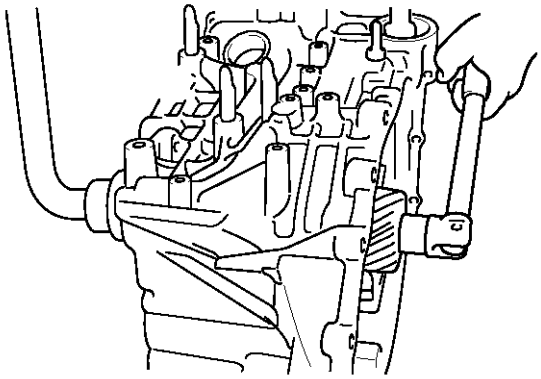
NOTICE

The output shaft locking nut is left-hand thread.



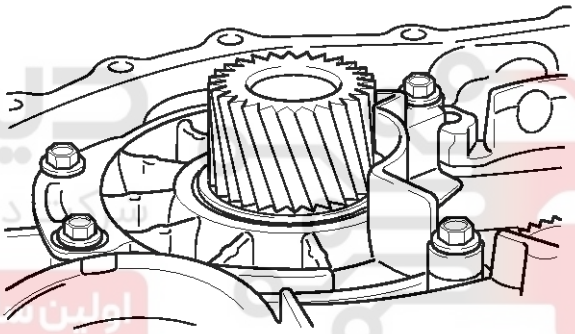
BK1A074U

74. Remove the output shaft locking nut.



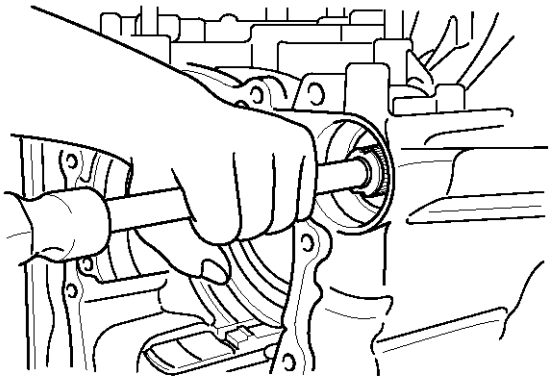
BK1A074V

75. Remove the output shaft bearing retainer mounting bolts.



BK1A074W

76. Tap out the output shaft, tapered roller bearing, and the collar from the back side.



BK1A074X

77. Tap out the bearing outer race and spacer using a

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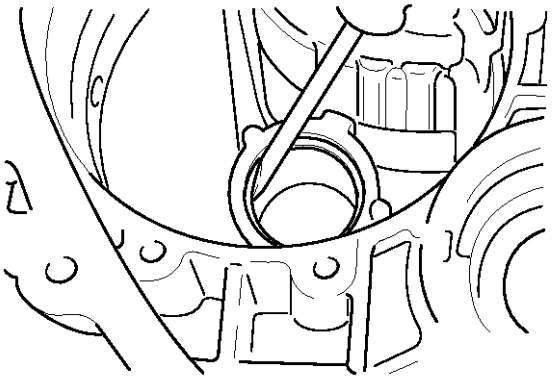
suitable driver.



BK1A074Y

78. Remove the snap ring.
79. Remove the differential bearing outer race and spacer from the torque converter housing.
80. Remove the differential bearing outer race from the transaxle case.

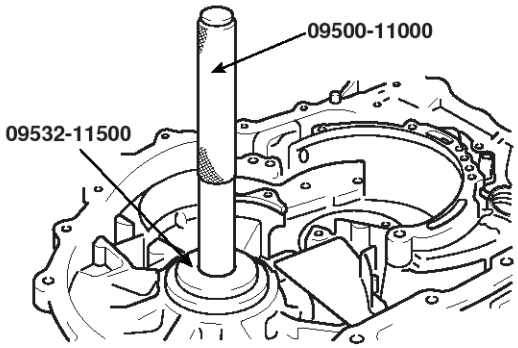
REASSEMBLY

⚠CAUTION

- **Never reuse the gasket, O-ring, oil seal, etc. Always replace with a new one when reassembling.**
- **Never use grease other than blue petrolatum jelly and white Vaseline.**
- **Apply ATF to friction components, rotating parts, and sliding parts before installation. Immerse a new clutch disc or brake disc in ATF for at least two hours before assembling them.**
- **Never apply sealant or adhesive to gaskets.**
- **When replacing a bushing, replace the assembly which it belongs to.**
- **Never use any cloth gloves or any rags during reassembly.**

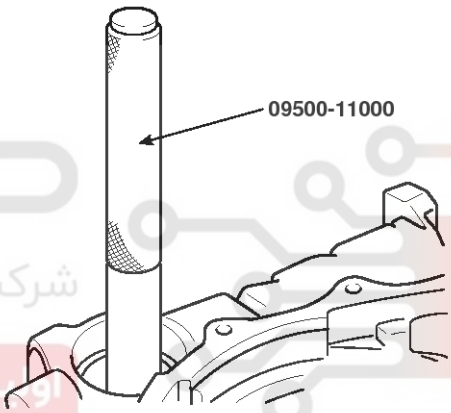
  Use nylon cloth or paper towels if you need to use something. Change the oil in the cooler system.

1. Tap the differential bearing outer race into the transaxle case using special tools tools (09500-11000 and 09532-11500).



BK1A053A

2. Tap the output shaft bearing outer race into the transaxle case using special tool (09500-11000).



BK1A053B

3. Install the spacer and the snap ring.
4. Install the low and reverse brake piston, return spring, and spring retainer.
5. Install the snap ring using special tools (09453-21000). To be sure that you have the correct snap ring, measure the thickness and compare it to the chart in the general parts of the service manual.

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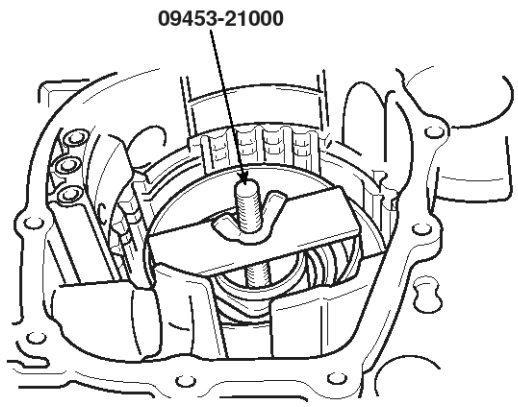
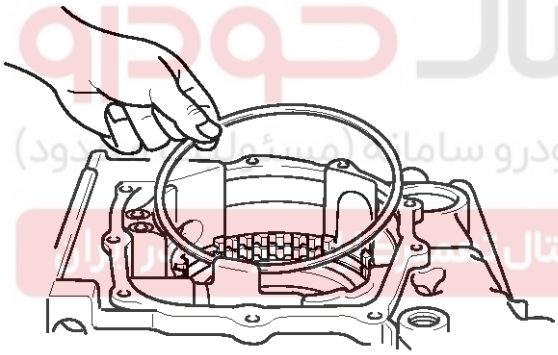


BK1A053C

6. Install the wave spring.

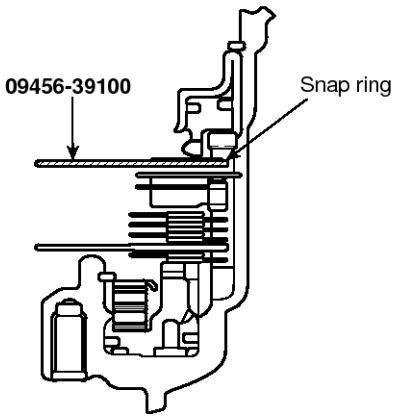
NOTICE

In steps 7 through 9, you will determine the actual clearance between the low and reverse brake discs and plates when the clutch is released.



BK1A074N

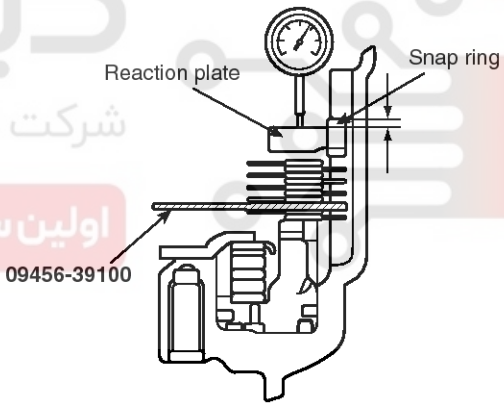
7. Replace the pressure plate of the low and reverse brake, then install the brake discs, 5 brake plates and the snap ring.



BK1A053D

8. Install the low and reverse reaction plate and the old snap ring.
9. With a dial indicator installed, move the special tool up and down to measure the end play.

Standard value :
0-0.16 mm (0-0.0063 in)



BK1A042A

If the end play is incorrect, measure the old snap rig, then select the proper snap rig from the chart shown in the service manual and recheck the clearance.

10. Remove the special tool.

NOTICE

In steps 11 through 16, you will determine the actual clearance between the second brake discs and plates when the clutch is released.

11. Install the 3 second brake discs and 2 plates.
12. Install the second brake return spring, second brake piston, and snap ring.
13. Install a dial indicator as shown in the illustration.

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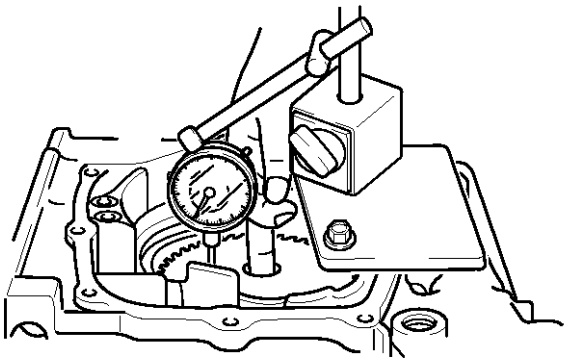


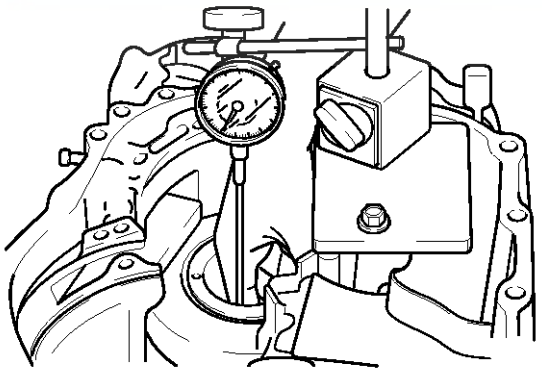
BK1A053F

14. Move up and down, while observing the end play.
15. To determine the proper thickness of the second brake pressure plate.

Standard value :
0.79-1.25 mm (0.0311-0.0492 in)

16. If the standard value is incorrect, select a pressure plate of the proper thickness from the chart in the general parts of the service manual and recheck the clearance.

NOTICE
In steps 18 through 21, you will determine the actual clearance between the low-reverse brake discs and plates when the clutch is released.

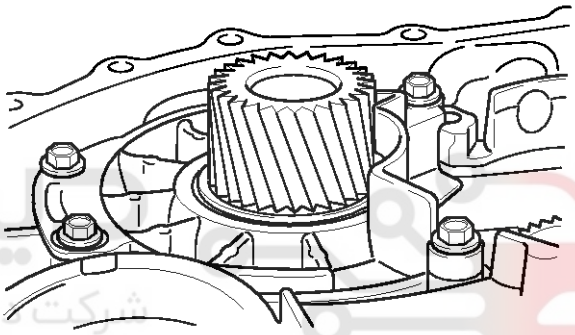


BK1A053G

17. Install the special tool in place of the low/reverse brake pressure plate.
18. Install the 6 brake discs, 5 brake plates and snap ring.
19. Turn the transaxle upside down, install a dial indicator, as shown in the illustration.
20. Move the special tool up and down while observing the end play.
21. To determine the proper thickness of the low/reverse brake pressure plate.

Standard value :
1.65-2.11 mm (0.0650-0.0830 in)

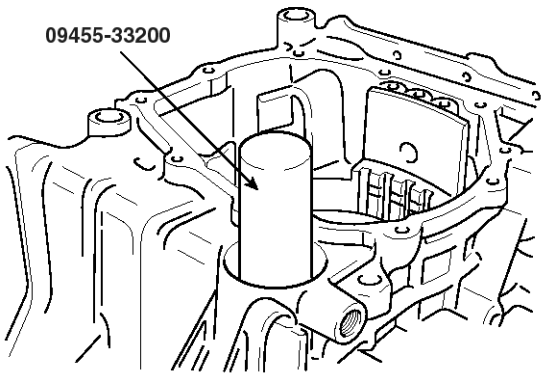
22. If the standard value is incorrect, select a pressure plate of the proper thickness from the chart in the service manual and recheck the clearance.
23. Remove the special tool.
24. Install the output shaft.
25. Install the output bearing retainer mounting bolts. Tighten the bolts to 23 Nm (230 kg·cm, 17 lb·ft) of torque.



BK1A074W

26. Install the output shaft collar and tapered roller bearing using special tool (09455-33200).

NOTICE
The output shaft locking nut is left-hand thread.



BK1A053H

27. Apply ATF and install the locking nut and tighten to

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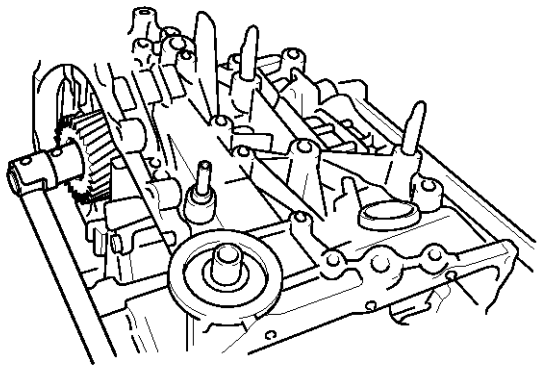
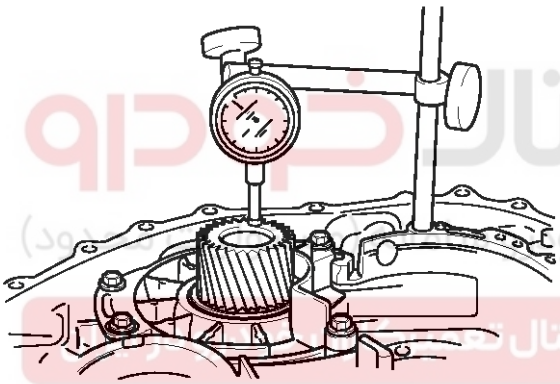
123 lb ft. Loosen the nut one full turn, then retighten the nut to 123 lb ft and stake the nut.



BK1A053I

28. Install a dial indicator as shown in the illustration.

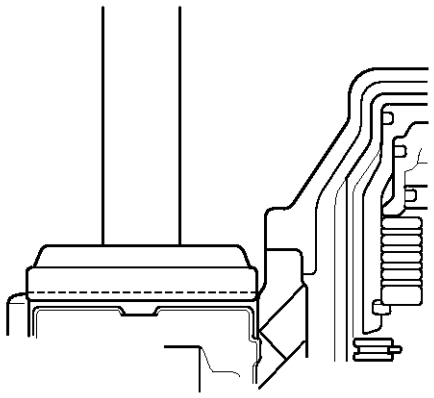


BK1A053J

29. Move the output shaft in and out to measure the end lay.

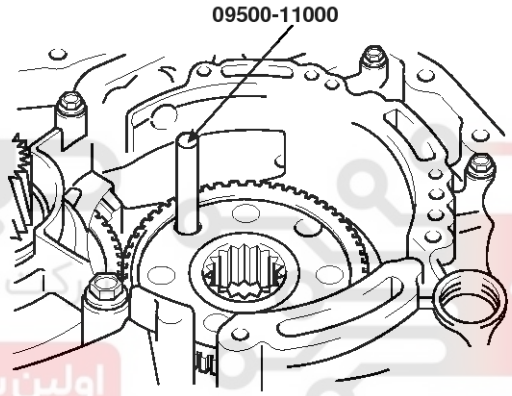
Standard value :
0.01-0.09 mm (0.0004-0.0035 in)

30. If the standard value is incorrect, use this formula to select the correct spacer from the chart in the general parts of the service manual.
31. Install the output shaft protective cap.



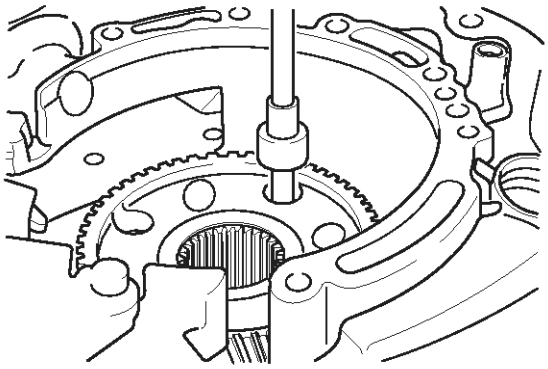
BK1A053K

32. Install the transfer drive gear using special tool (09500-11000).



BK1A053L

33. Install the 7 transfer gear mounting bolts. Tighten the bolts to 19 Nm (190 kgf.cm, 14 lbf.ft).



LK1D074R

34. Install the parking pawl, spacer and spring, then install the parking pawl shaft.

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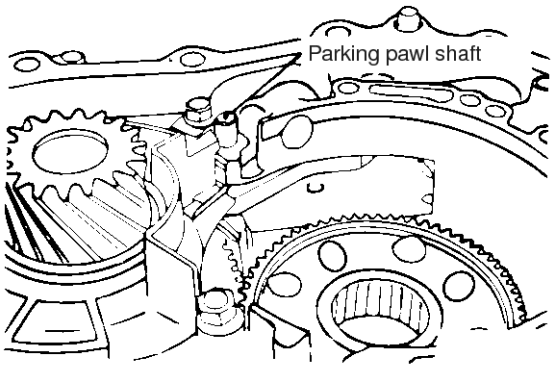
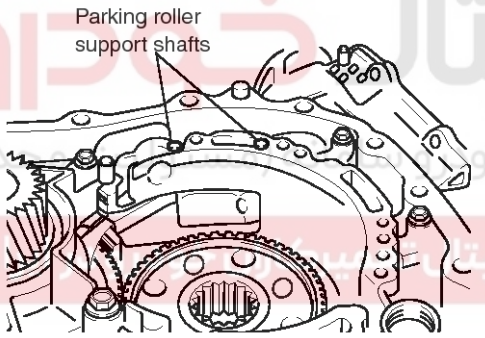


BK1A053M

35. Install the parking roller support, then the two parking roller support shafts.

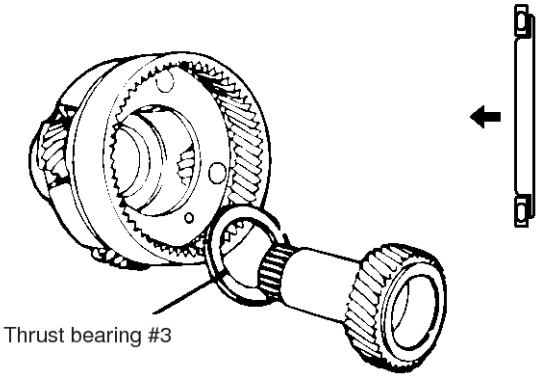
⚠CAUTION
Be sure to install the thrust bearing in the proper direction.



LK1D053N

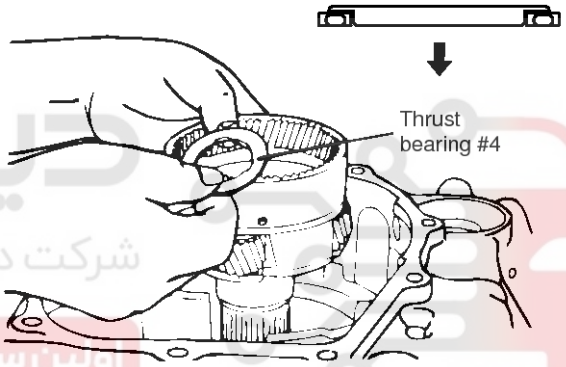
36. Install the underdrive sun gear and thrust bearing #3 to the output planetary carrier.

⚠CAUTION
Be sure to install the thrust bearing in the proper direction.



BK1A053O

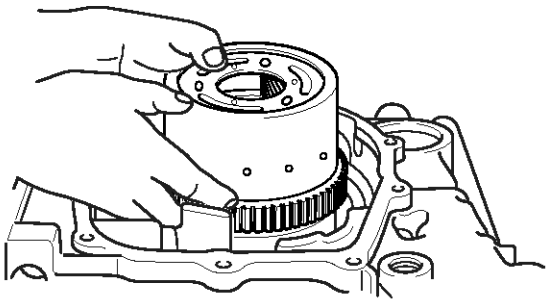
37. Install the output planetary carrier and thrust bearing #4.



BK1A053P

38. Install the overdrive planetary carrier.

NOTICE
Rotating the output shaft will help align the clutch teeth and help the carrier seat.



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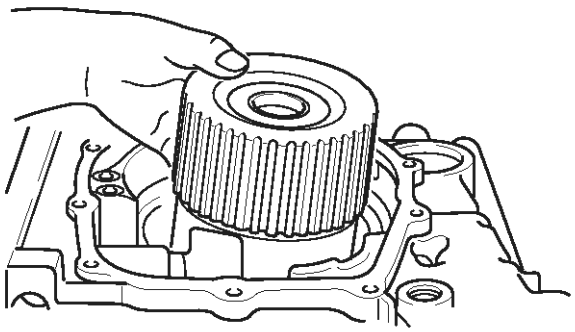
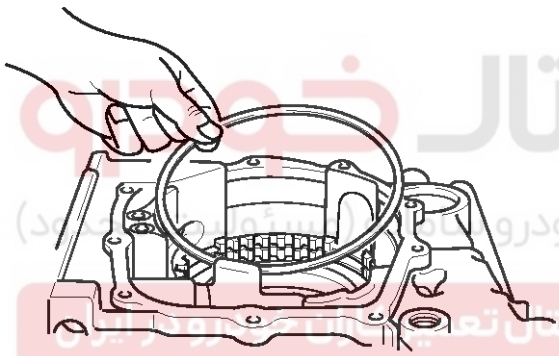
BK1A074G

39. Install the reverse planetary sun gear.



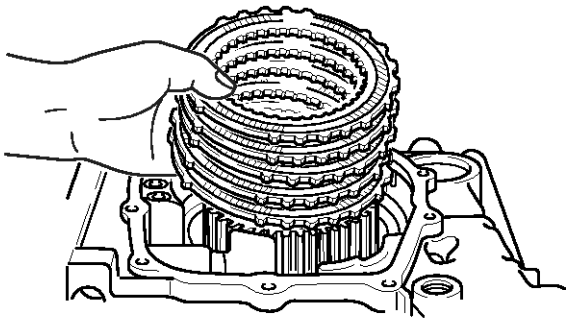
LK1D074C

40. Install the wave spring.



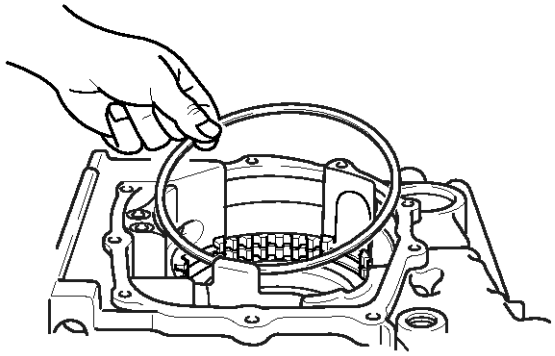
BK1A074N

41. Install the low/reverse pressure plate, 6 brake discs, and 5 brake plates.



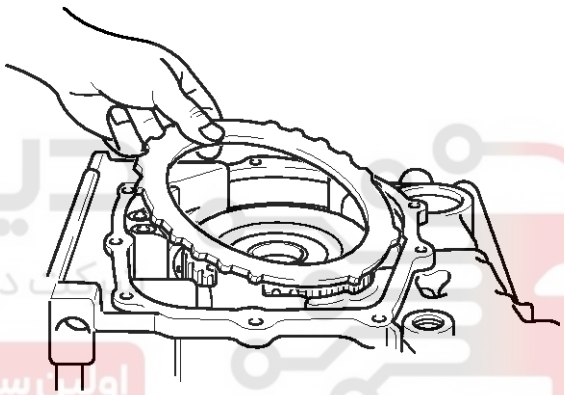
BK1A053Q

42. Install the snap ring.



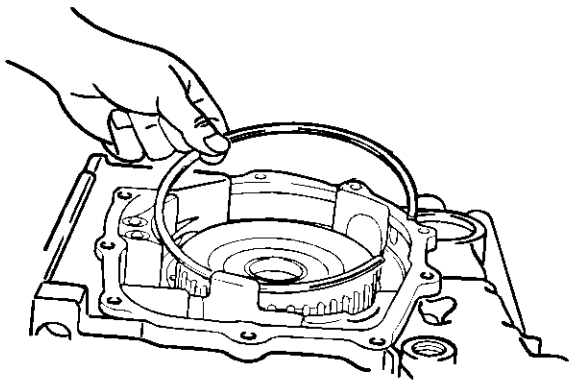
BK1A053R

43. Install the reaction plate.



BK1A053S

44. Install the snap ring.



BK1A053T

45. Install the second brake pressure plate, 3 brake discs, and 2 brake plates.

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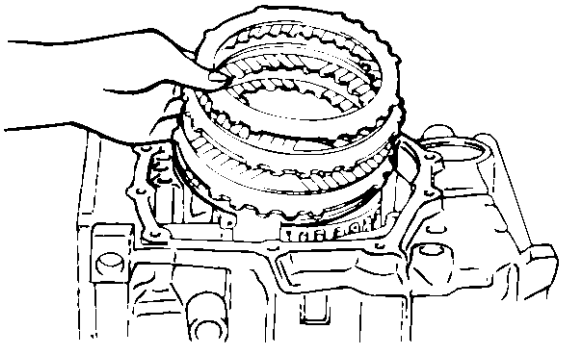
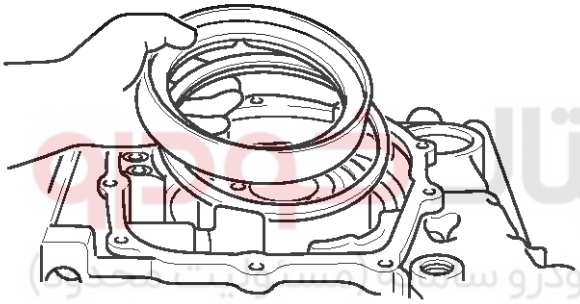


BK1A053U

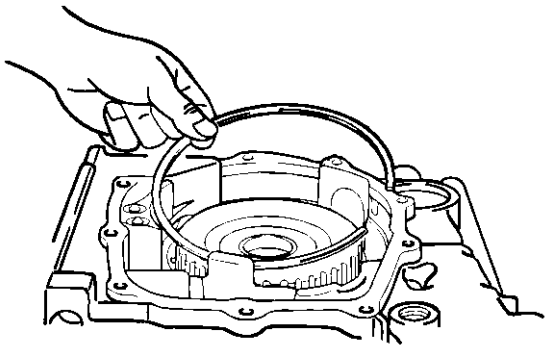
46. Install the return spring and second brake piston.



BK1A074E

47. Install the snap ring.

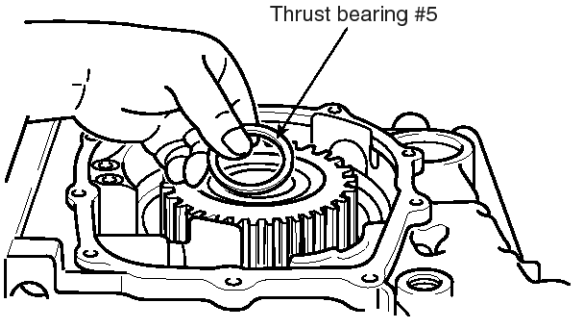
⚠CAUTION
Be sure to install the thrust bearing in the proper direction.



BK1A053V

48. Install thrust bearing #5.

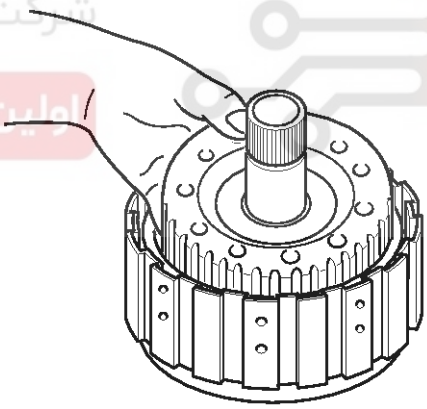
⚠CAUTION
Be sure to install the thrust bearing in the proper direction.



LK1D074B

49. Install the overdrive clutch hub and thrust bearing #6 to the reverse and overdrive clutch.

⚠CAUTION
Be sure to install the thrust bearing in the proper direction.



BK1A053W

50. Install the reverse and overdrive clutch and thrust bearing #7.

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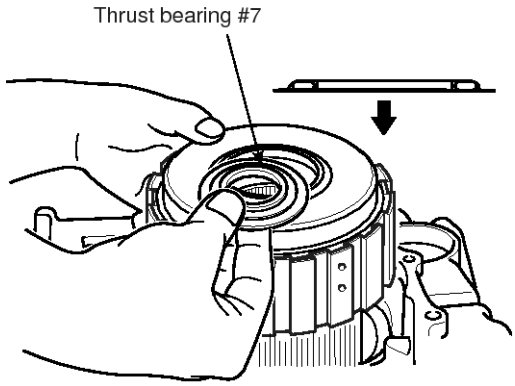
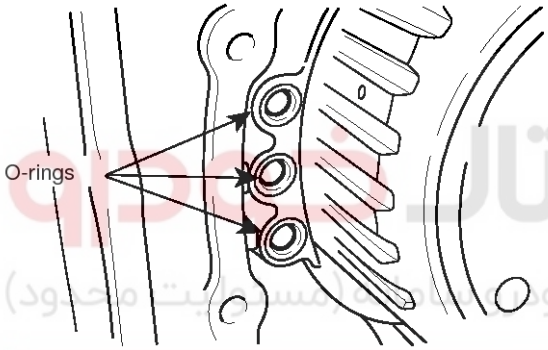


BK1A053X

51. Install the three O-rings.

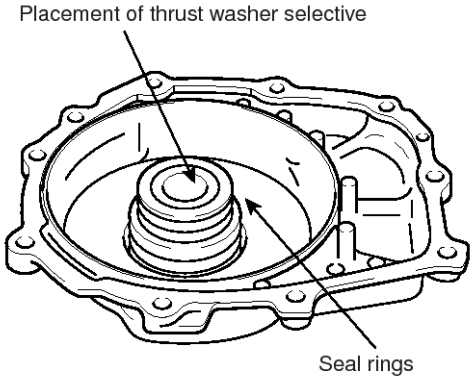


BK1A052Y

52. Install the 3 seal rings into the rear cover.

NOTICE

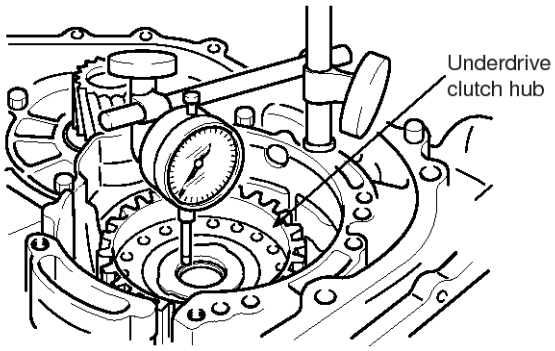
The cover should be clean and dry for step 56. It is only being installed to measure the underdrive sun gear end play.



BK1A053Y

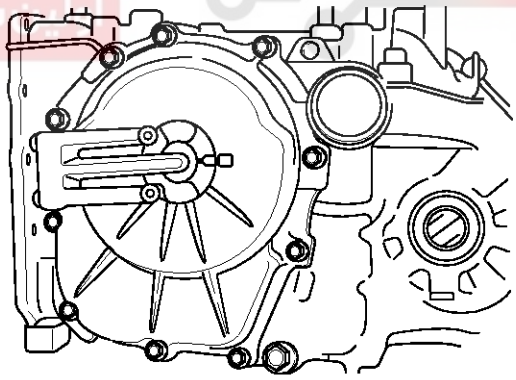
53. Install the used thrust race #8 and rear cover.
54. Using a dial indicator, measure the end play of the underdrive sun gear.

Standard value :
0.25-0.45 mm (0.0098-0.0177 in)



BK1A053Z

55. If the end play exceeds the standard value, measure the used race with a micrometer and select the proper size from the chart in the service manual.
56. Reinstall the rear cover and mounting bolts. Tighten the mounting bolts to 23 Nm (230 kgf.cm, 17 lbf.ft).



BK1A052X

57. Install the underdrive clutch hub.

CAUTION

Be sure to install the thrust bearing in the proper direction.

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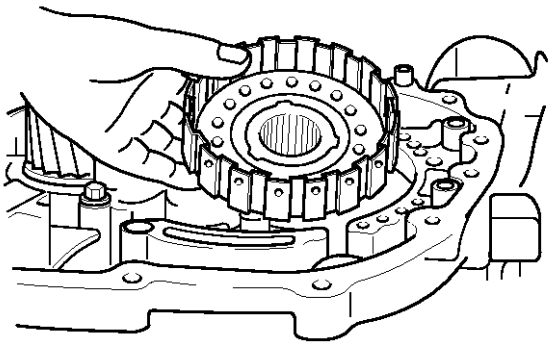
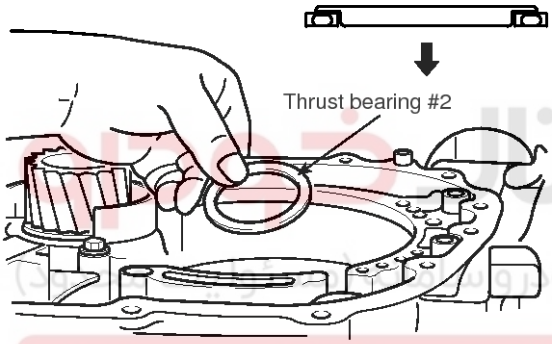


HEW45140

58. Install thrust bearing #2.

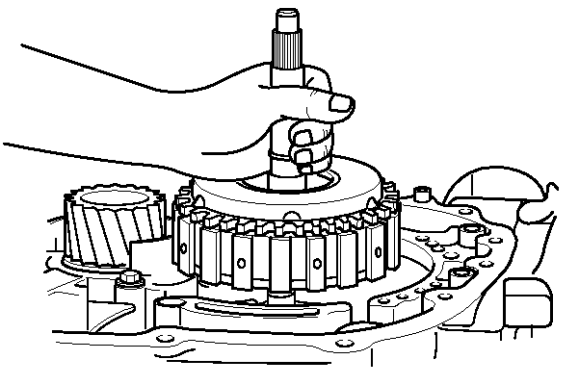


BK1A075A

59. Grasp the input shaft and lower the underdrive clutch into position.

NOTICE

Looking into the hole where the input speed sensor mounts to the case will help you ensure that the underdrive clutch is fully seated.

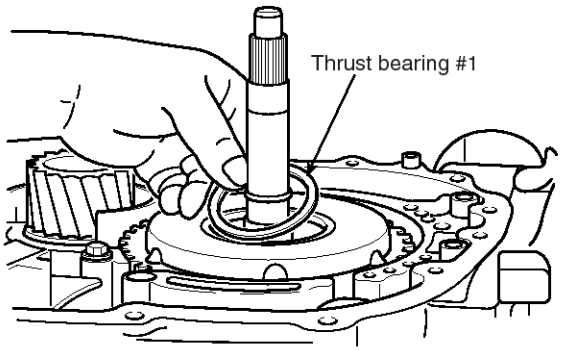


BK1A052U

60. Install the used thrust bearing #1.

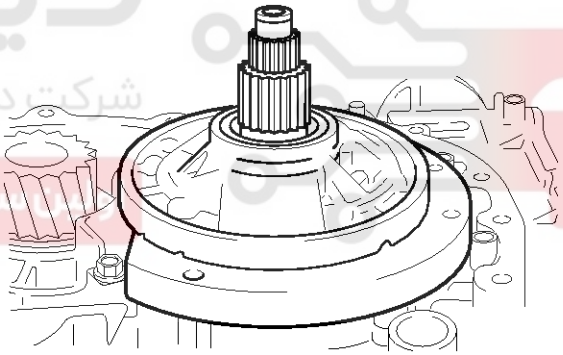
CAUTION

Be sure to use a new oil pump gasket.



BK1A052T

61. Install the oil pump, a new gasket, and the oil pump mounting bolts.



BK1A075B

62. Using a dial indicator, measure the end play of the input shaft.

Standard value :
0.70-1.20 mm (0.0276-0.0472 in)

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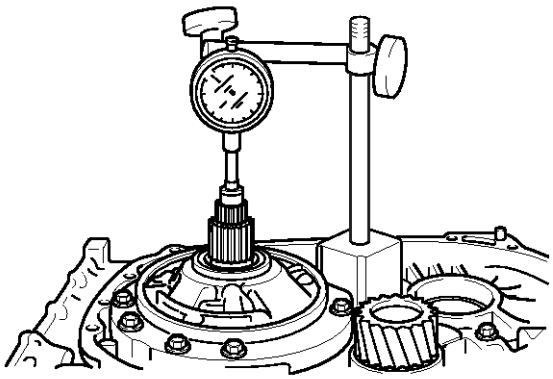
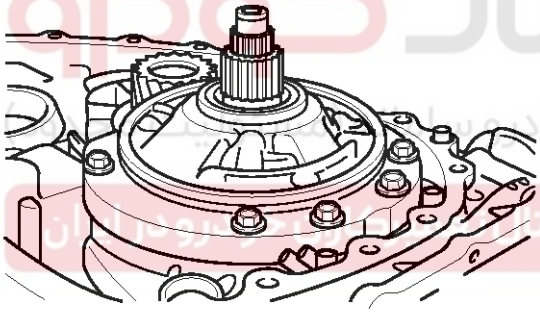


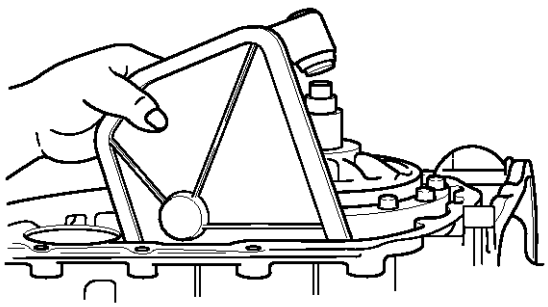
BK1A075C

63. If the end play exceeds the standard value, measure the used race with a micrometer and select the proper size from the chart in the service manual.
64. Reinstall the oil pump and mounting bolts. Tighten the mounting bolts to 23 Nm (230 kgf.cm, 17 lbf.ft).



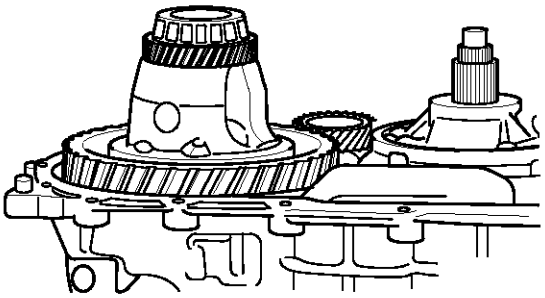
BK1A052R

65. Install the oil internal filter.



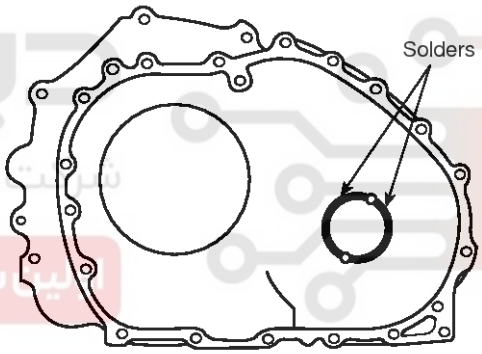
BK1A052Q

66. Install the differential.



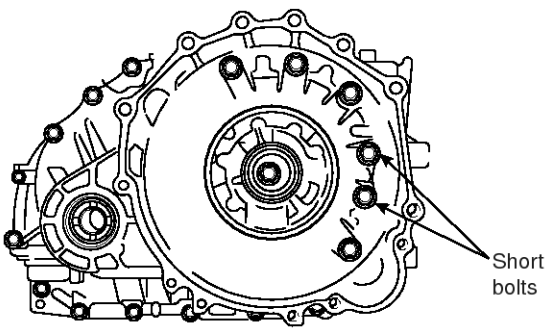
BK1A052P

67. Place two strips of solder, approximately 10 mm (0.39 in) long and 3 mm (0.12 in) thick, on the torque converter housing.



BK1A075D

68. Install the torque converter housing and mounting bolts. Tighten the bolts to 47 Nm (470 kgf.cm, 35 lbf.ft) of torque.



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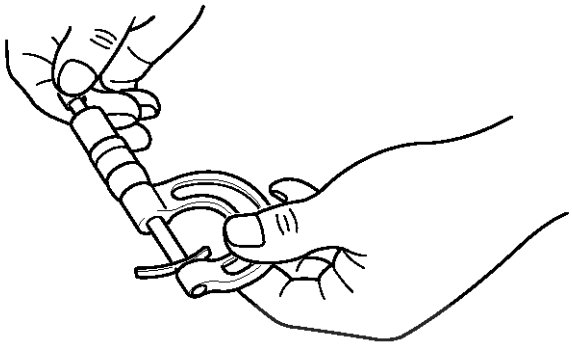
BK1A075E

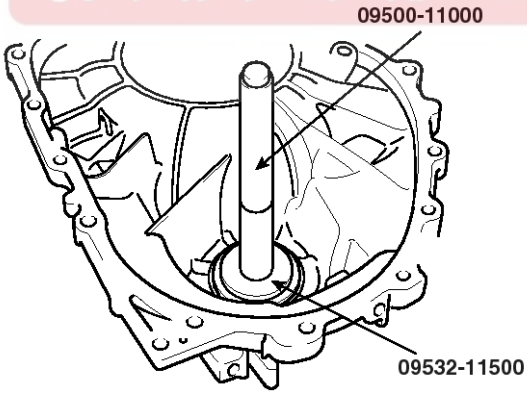
69. Remove the torque converter housing, the bolts and the solder.
70. Using a micrometer, measure the thickness of the pressed solder.
71. Select a spacer that will give the following clearance.

Standard value :
0.045 mm (0.0018 in)-0.105 mm (0.0041 in)



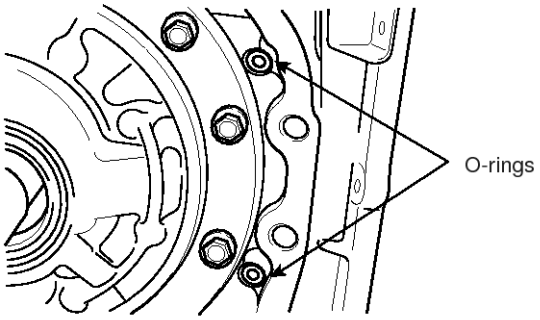
BK1A075F

72. Install the differential spacer selected in the previous step in the torque converter housing.
73. Use special tools 09532-11500 and 09500-11000 to press in the differential bearing outer race.



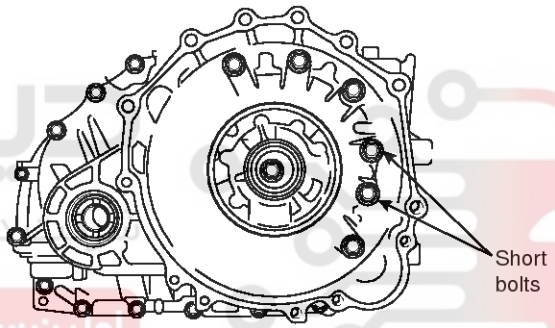
BK1A075G

74. Install the two O-rings.



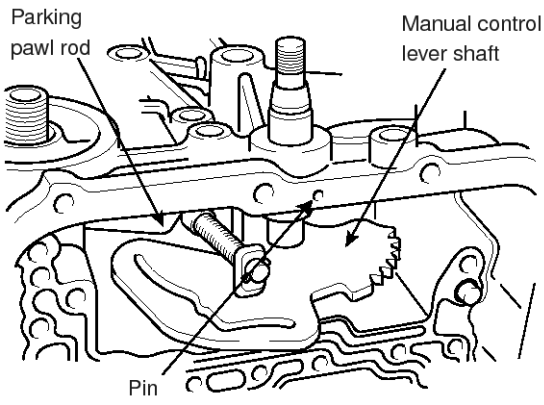
BK1A052O

75. Install the torque converter housing and mounting bolts. Tighten the bolts to 47 Nm (470 kgf.cm, 35 lbf.ft) of torque.



BK1A075E

76. Install the manual control lever shaft and parking pawl.



BK1A052M

77. Install the manual control shaft roller.

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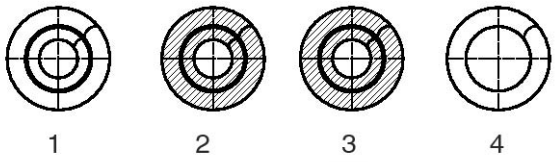
78. Install the three small springs and three larger springs into the accumulator pistons. The accumulator springs are identified in the illustration and in the chart below.

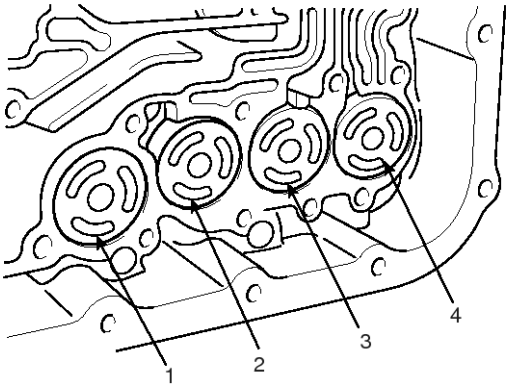
Number	Function Name
1	Low & Reverse Brake
2	Underdrive Clutch
3	Second Brake
4	Overdrive Clutch



BK1A075H

79. Install the accumulators with the springs according to the illustration and the chart below. The accumulators should be flush with the transaxle case.

Number	Function Name	Color
1	Low & Reverse Brake	None
2	Underdrive Clutch	Yellow
3	Second Brake	Blue
4	Overdrive Clutch	None

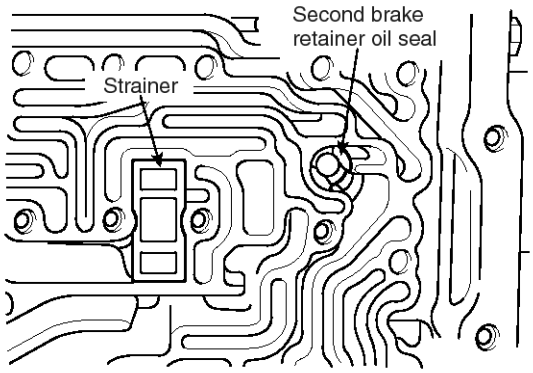


BK1A052L

80. Install the strainer and the second brake retainer oil seal.

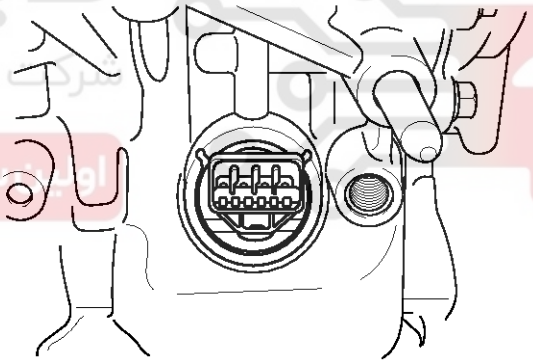
NOTICE

The oil seal orientation in the illustration.



BK1A052K

81. Install the solenoid wiring harness, then install the snap ring in its groove.



BK1A052J

82. Install the valve body, gasket, and two steel balls.

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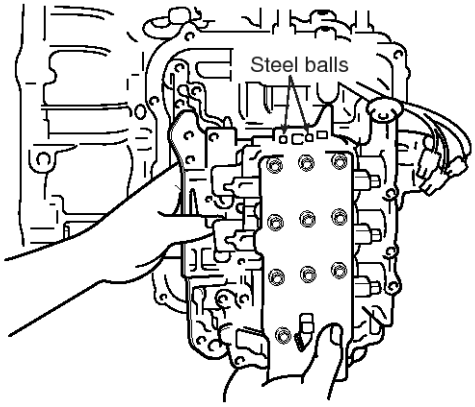
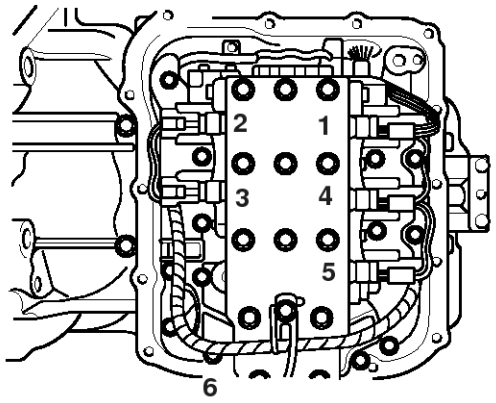


BK1A052I

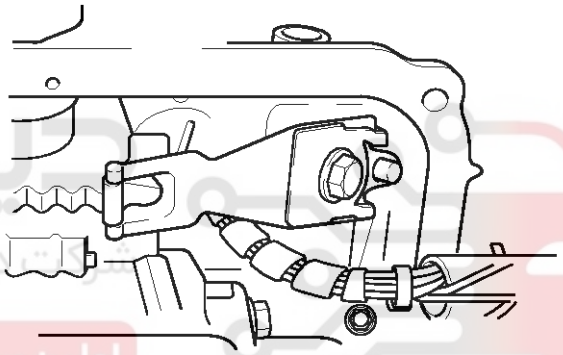
83. Install the oil temperature sensor. Tighten the mounting bolt to 11 Nm (110 kgf.cm, 8 lbf.ft).
84. Install 28 valve body mounting bolts. Tighten all valve body mounting bolts to 11 Nm (110 kgf.cm, 8 lbf.ft).
85. Connect the solenoid wiring and temperature sensor connectors according to the illustration and the chart below.

No.	Part to be connected	Wire color	Connector housing color
1	Underdrive solenoid valve	White, Red, Red	Black
2	Overdrive solenoid valve	Orange, Red	Black
3	Low & Reverse solenoid valve	Brown, Yellow	Milky White
4	Second solenoid valve	Green, Red, Red	Milky White
5	Damper clutch control solenoid valve	Blue, Yellow, Yellow	Black
6	Oil temp. sensor	Black, Red	Black



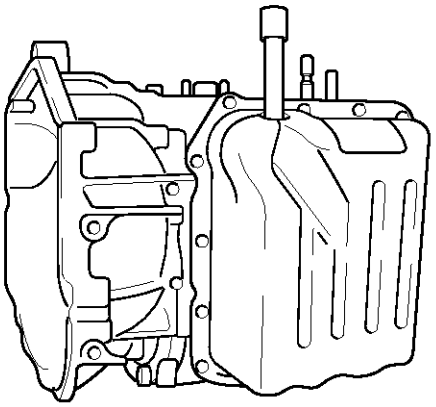
BK1C650A

86. Install the manual control shaft detent. Tighten the nut to 6 Nm (60 kgf.cm, 4.4 lbf.ft) of torque.



BK1A052F

87. Install the valve body cover and mounting bolts. Tighten the mounting bolts to 9 Nm (90 kgf.cm, 7 lbf.ft) of torque.



BK1A052E

88. Install the vehicle speed sensor and mounting bolt.

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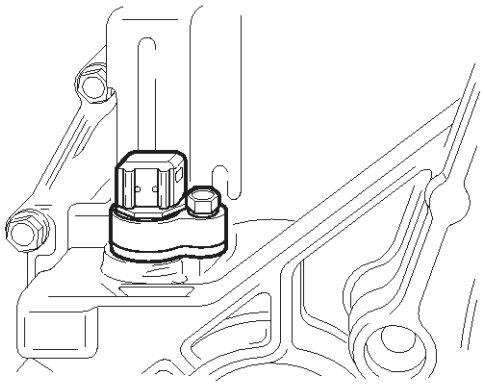
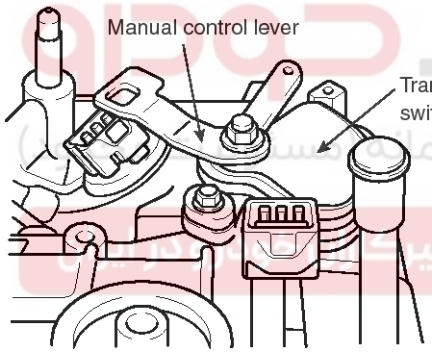
Tighten the mounting bolt to 5 Nm (50 kgf.cm, 4 lbf.ft) of torque.



BK1C650B

89. Install the park/neutral position switch. Tighten the mounting bolt to 11 Nm (110 kgf.cm, 8 lbf.ft) of torque.

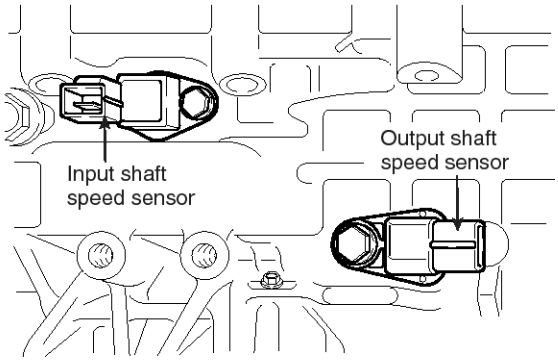


BK1A052C

90. Install the manual control lever. Tighten the mounting nut to 22 Nm (220 kgf.cm, 16 lbf.ft) of torque.
91. Install the input and output shaft speed sensors. Tighten the mounting bolts to 11 Nm (110 kgf.cm, 8 lbf.ft) of torque.

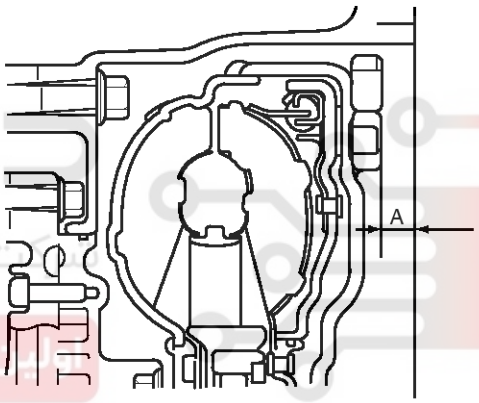
⚠CAUTION

Make sure that you are installing the correct oil filter. While the engine oil filter and the transaxle oil filter locksimilar, their filtering action is different. Installing the wrong oil filter could cause damage to the transaxle. Transaxle oil filters are identified as A/T ONLY.



BK1A052B

92. Install the cooler feed tube with a new gasket and the eye bolt. Tighten the eye bolt to 30 Nm (300 kgf.cm, 22 lbf.ft) of torque.



BK1C650C

93. Install the dipstick.
94. Install the control cable bracket. Tighten the mounting bolt to 23 Nm (230 kgf.cm, 17 lbf.ft).
95. Install the wiring harness bracket. Tighten the mounting bolt to 23 Nm (230 kgf.cm, 17 lbf.ft).
96. Install the two roll stopper brackets. Tighten the mounting bolts to 69 Nm (690 kgf.cm, 51 lbf.ft).
97. Install the torque convertor and secure it so that dimension A.

    Meets the reference value.

Reference value :
approx. 12.2 mm (0.480 in)

⚠CAUTION

Apply ATF to the oil pump drive hub before installing the torque converter. Be careful not to damage the oil pump seal.

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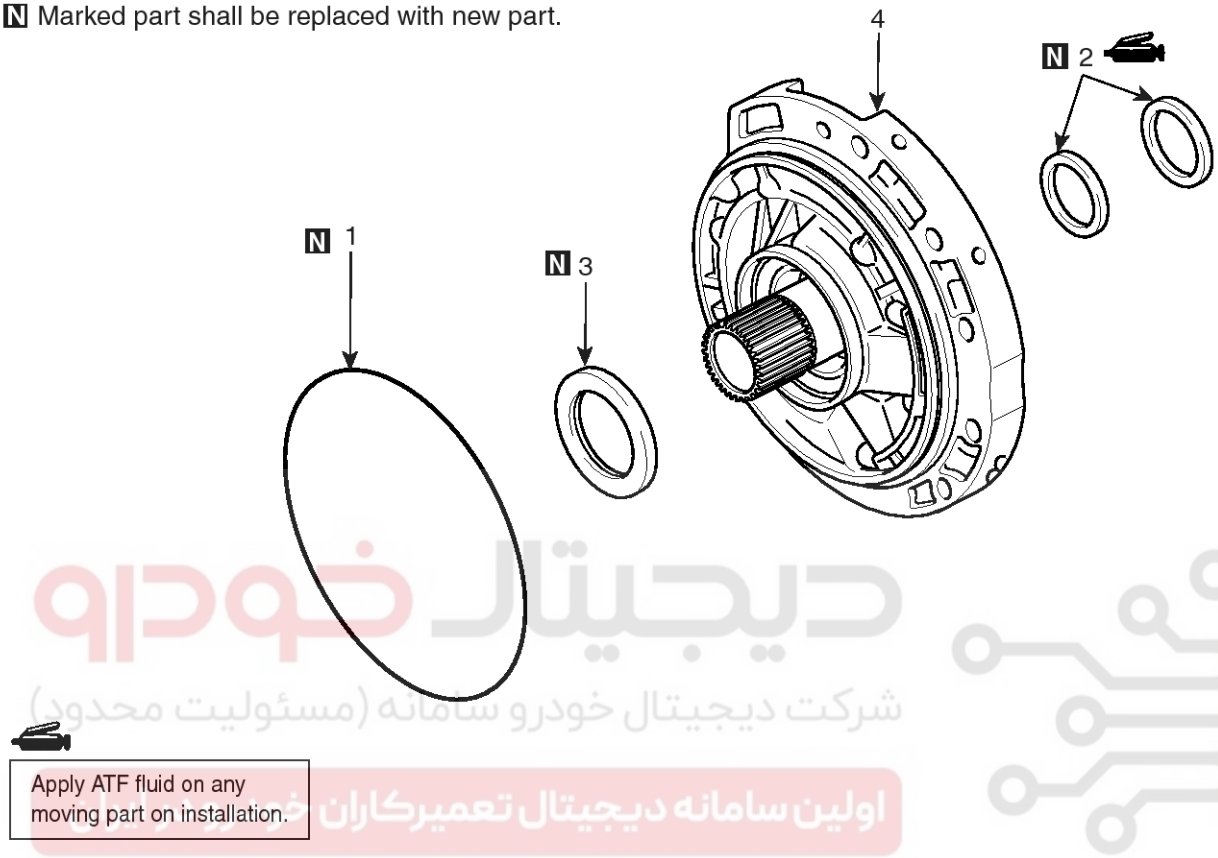
Hydraulic System

Oil Pump

COMPONENTS

N Marked part shall be replaced with new part.



Disassembly steps

1. O-ring
2. Seal ring
3. Oil seal
4. Oil pump assembly

BKGE005B

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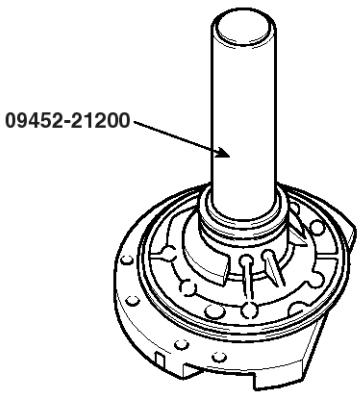
REASSEMBLY

Oil seal replacement

1. Using the special tool (09452-21200), install the oil seal to the pump housing.



BK1A064A

2. Apply a thin coat of automatic transaxle fluid to the lip of the oil seal before installation.

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اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

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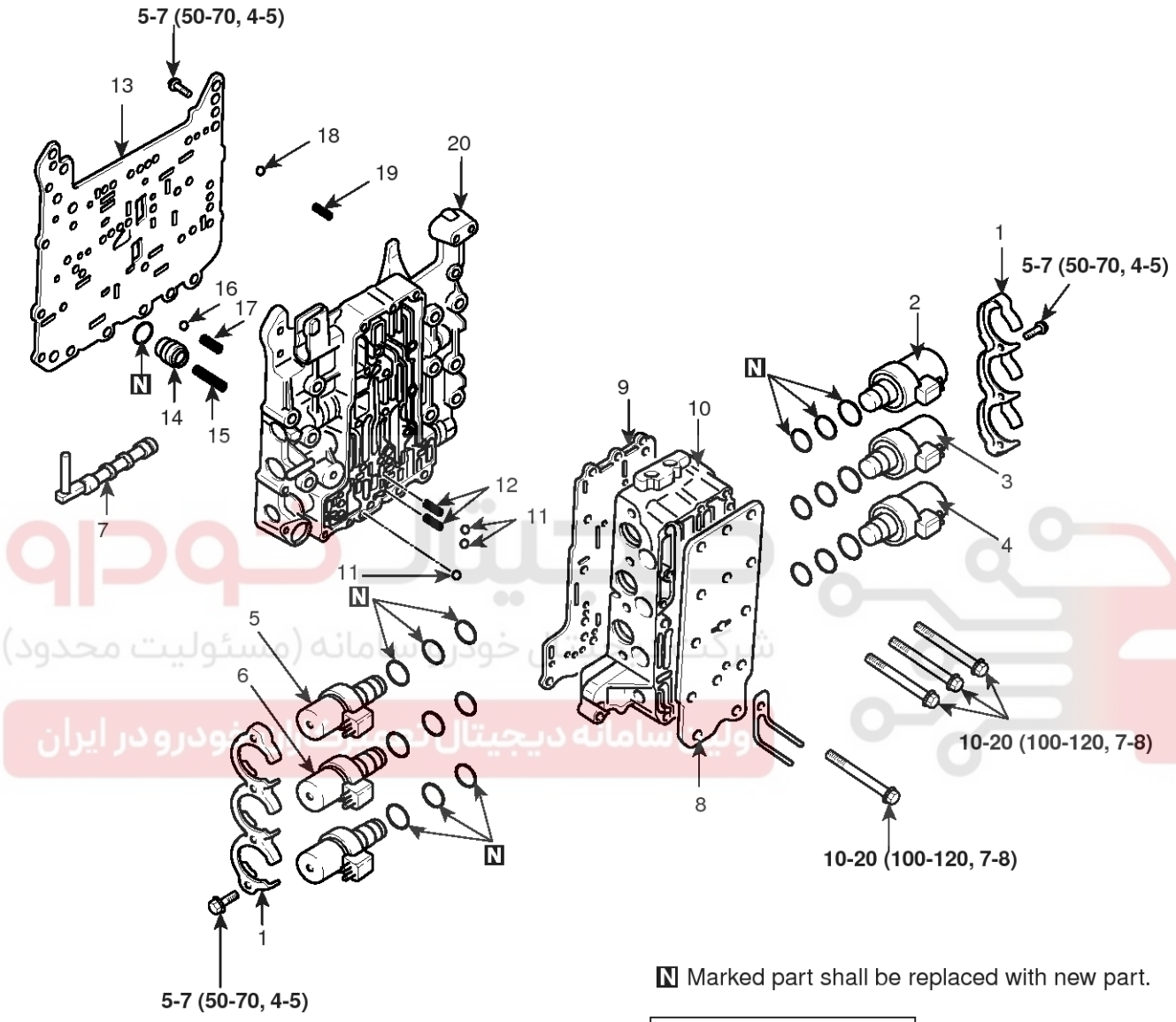
Valve Body System

Valve Body System

Valve Body

COMPONENTS



N Marked part shall be replaced with new part.

Apply ATF fluid on any moving part on installation.

TORQUE : Nm (kgf.cm, lbf.ft)

Disassembly steps

1. Solenoid valve support
2. UD clutch solenoid valve
3. 2nd brke solenoid valve
4. Damper clutch control solenoid valve
5. OD clutch solenoid valve
6. Low and reverse brake solenoid valve
7. Manual valve
8. Cover
9. Plate
10. Outside valve body assembly
11. Still ball (Orfice check ball)
12. Spring
13. Plate
14. Damping valve
15. Damping valve spring
16. Steel ball (line relief)
17. Spring
18. Steel ball (Orfice check ball)
19. Spring
20. Inside valve body assembly

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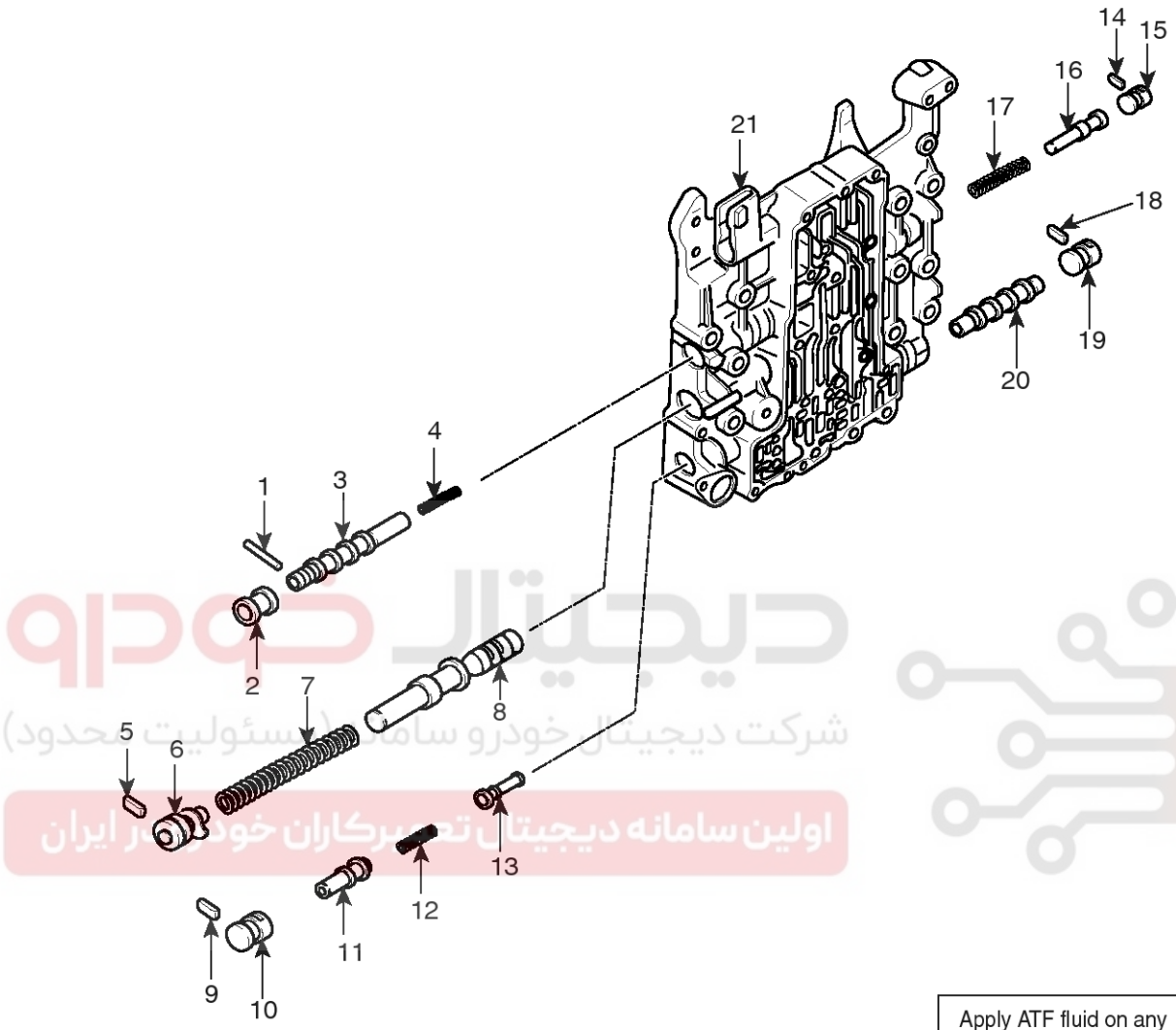
INSIDE VALVE BODY



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

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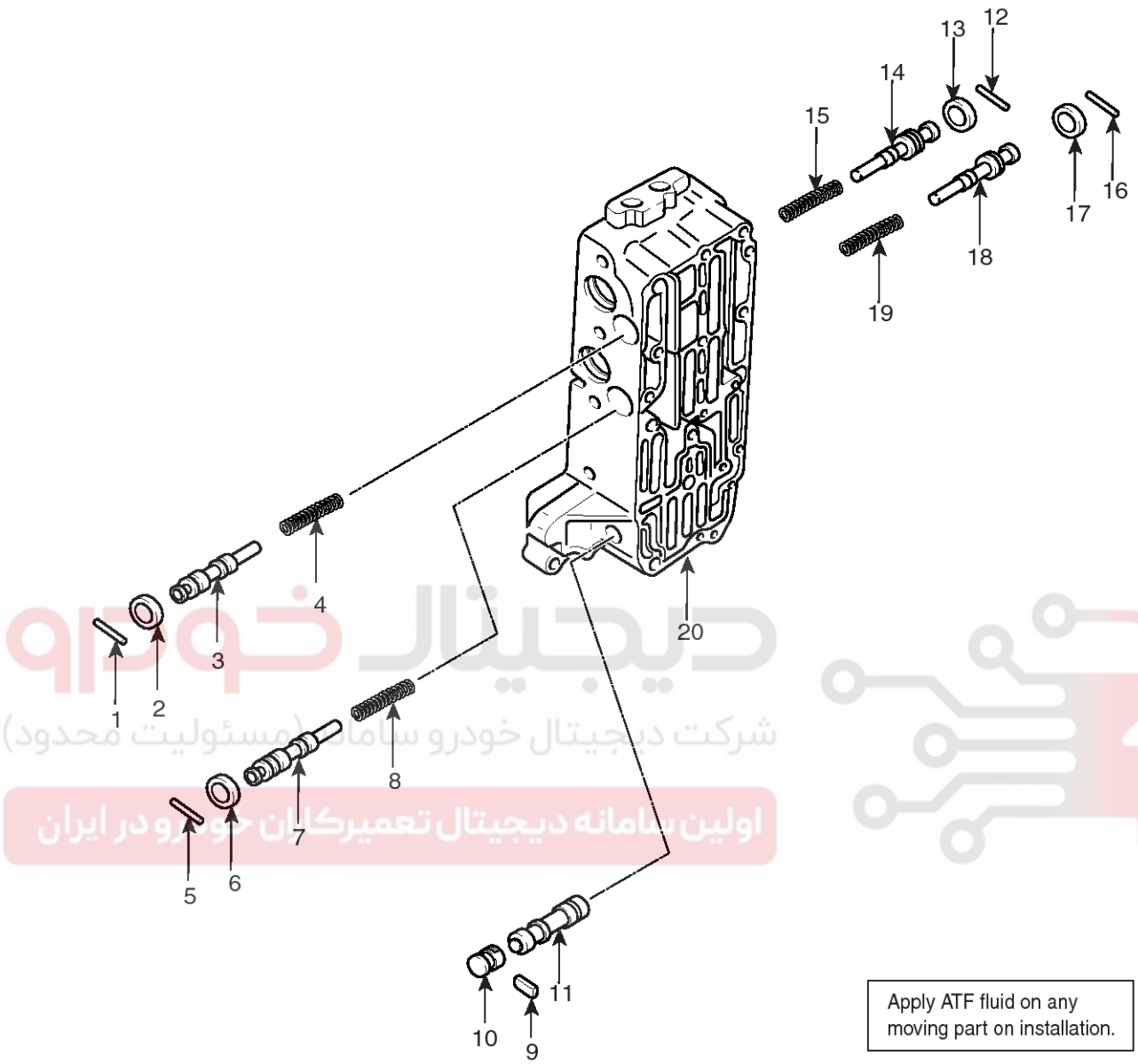
OUTSIDE VALVE BODY



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

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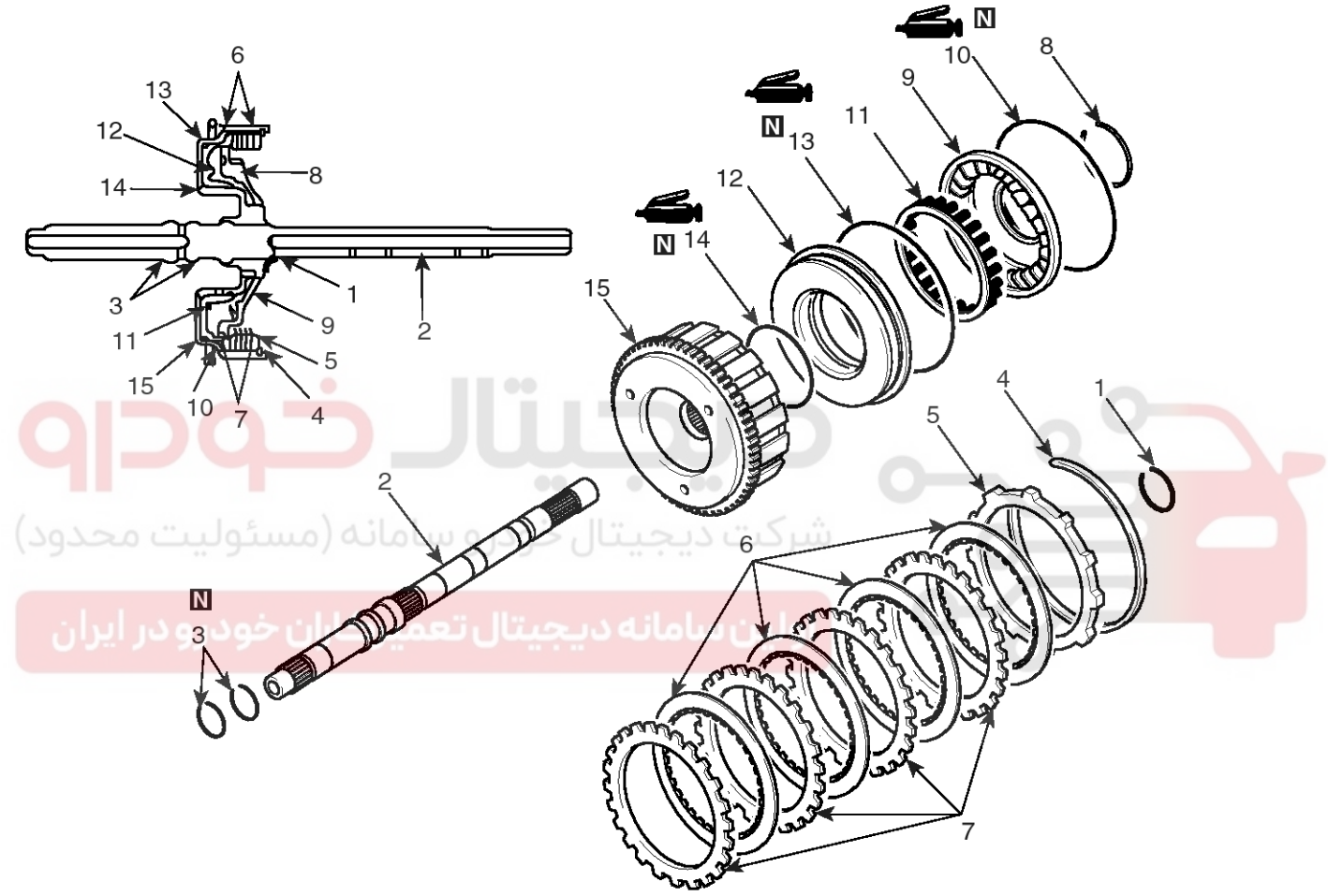
Clutch & Brake

Underdrive Clutch

COMPONENTS

N Marked part shall be replaced with new part.



Apply ATF fluid on any moving part on installation.

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

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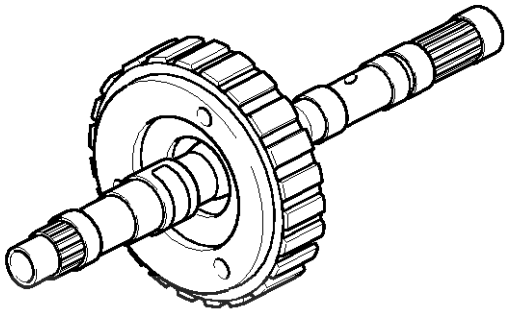
BKGE005J

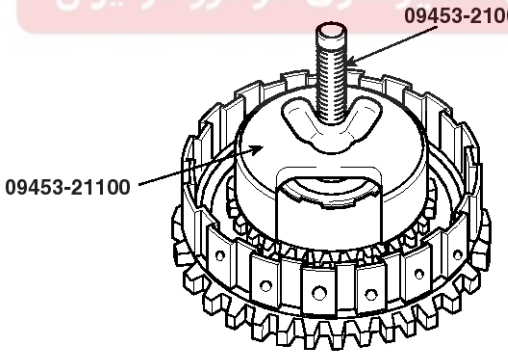
DISASSEMBLY

1. Remove the input shaft snap ring.
2. Remove the input shaft.
3. Remove the 2 seal rings.
4. Remove the clutch reaction plate snap ring.
5. Remove the clutch reaction plate.
6. Remove the 4 clutch discs and 4 clutch plates.



BK1A058A

7. Compress the clutch return springs using special tools, 09453-24000 and 09453-21000 then remove the clutch spring retainer snap ring.

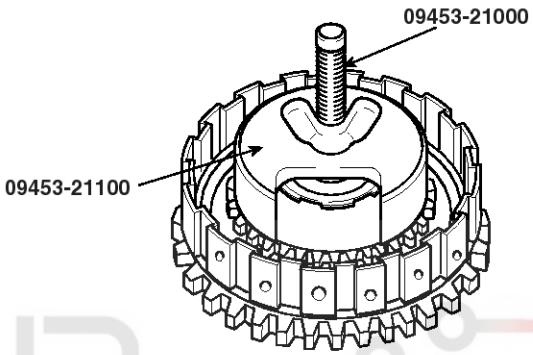


BK1A058B

8. Remove the clutch spring retainer.
9. Remove the D-ring seal.
10. Remove the clutch return spring.
11. Remove the underdrive clutch piston using compressed air.
12. Remove the 2 D-ring seals.

REASSEMBLY

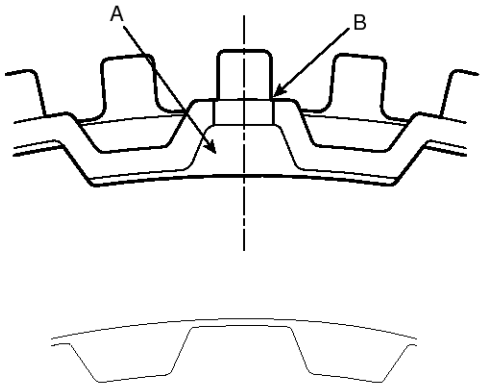
1. Install the 2 D-ring seals.
2. Install the underdrive clutch piston.
3. Install the clutch return spring.
4. Install the D-ring seal.
5. Install the clutch spring retainer.
6. Compress the clutch return springs using special tools, 09453-21100 and 09453-21000, then install the clutch spring retainer snap ring.



BK1A058B

⚠CAUTION
Dip each clutch disc in ATF before assembling.

7. Align the spaces between the teeth (A) on the clutch plates, clutch discs, and reaction plate to the outer circumference hole (B) in the underdrive clutch retainer.



BK1A059A

8. Install the 4 clutch discs and the 4 clutch plates.
9. Install the clutch reaction plate with the shear droop toward the clutch disc.

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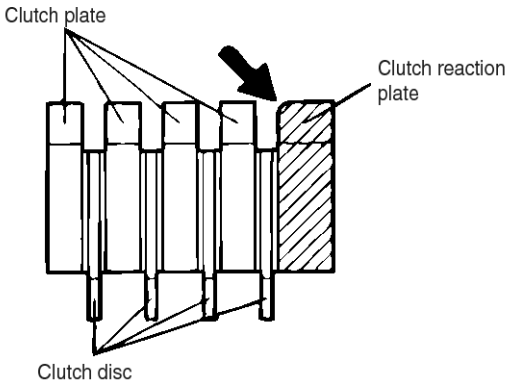
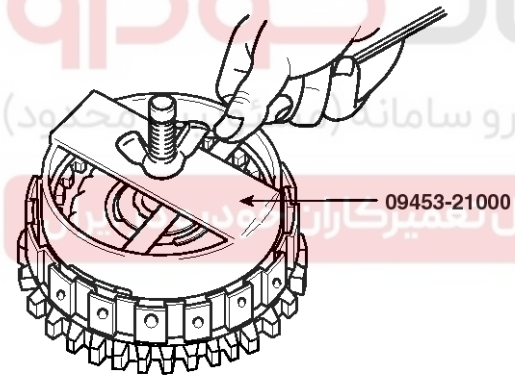
10. Install the clutch reaction plate snap ring.



BKGE005K

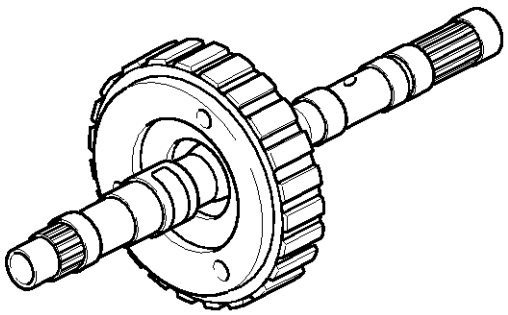
11. Install special tools, MD998924 and MB991628, as shown, then check the clearance between the snap ring and the reaction plate using a feeler gauge.

Standard value :
1.6-1.8 mm (0.0630-0.0709 in)



BK1A059B

12. If the clearance is correct, measure the old snap ring, then select the correct size from the chart in the service manual.
13. Install the seal rings.
14. Install the input shaft.



BK1A058A

15. Install the input shaft snap ring.

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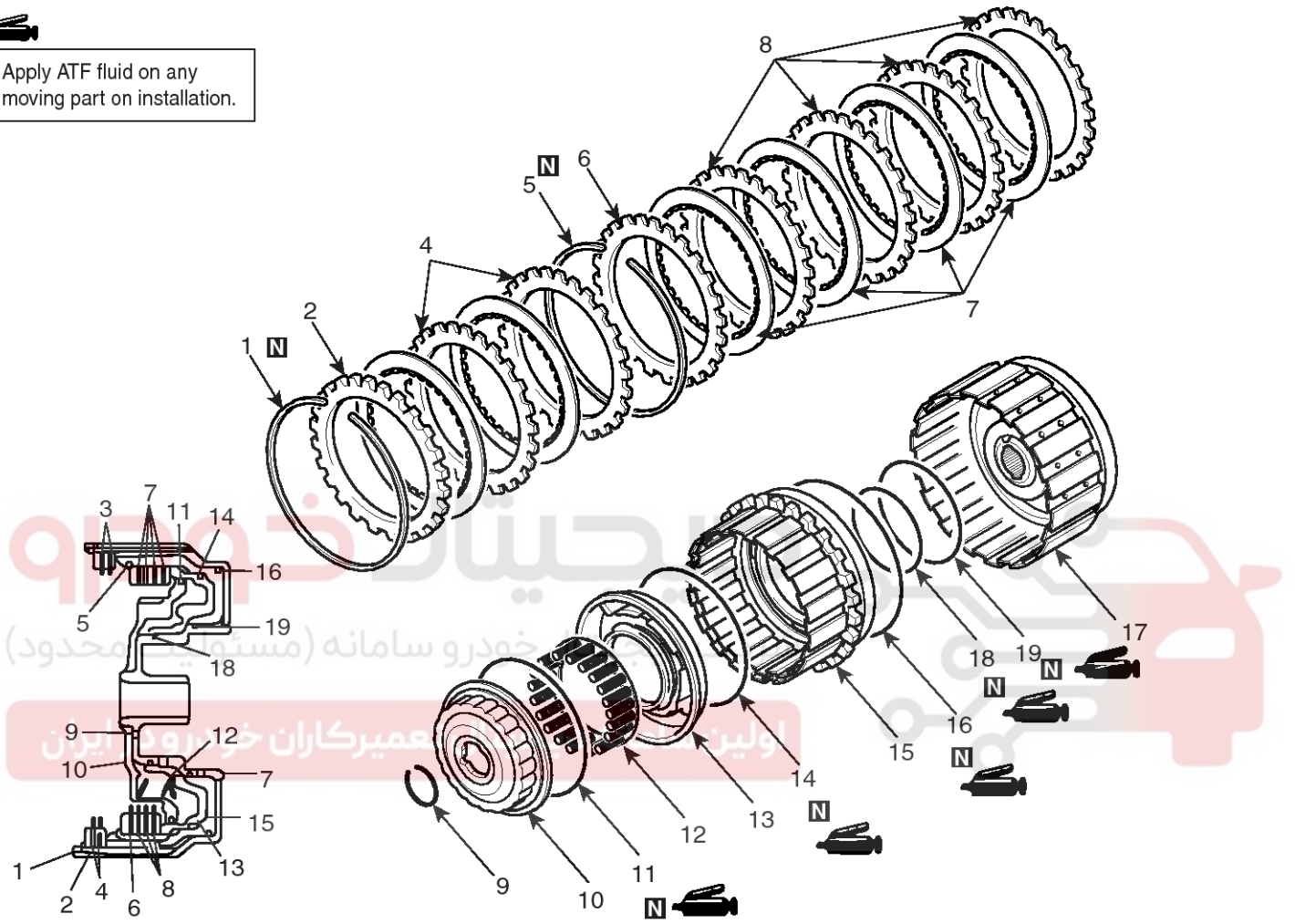
Reverse and Overdrive Clutch

COMPONENTS

N Marked part shall be replaced with new part.

Apply ATF fluid on any moving part on installation.



Disassembly steps

1. Snap ring
2. Clutch reaction plate
3. Clutch disc
4. Clutch plate
5. Snap ring
6. Clutch reaction plate
7. Clutch disc
8. Clutch plate
9. Snap ring
10. Spring retainer
11. D-ring
12. Return spring
13. Overdrive clutch piston
14. D-ring
15. Reverse clutch piston
16. D-ring
17. Reverse clutch retainer
18. D-ring
19. D-ring

BKGE005L

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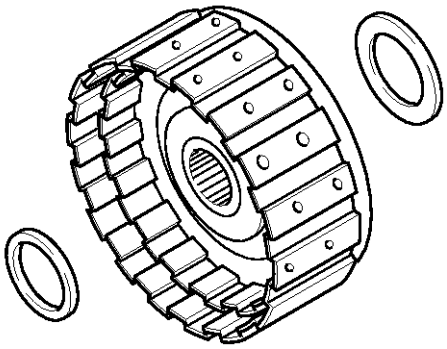
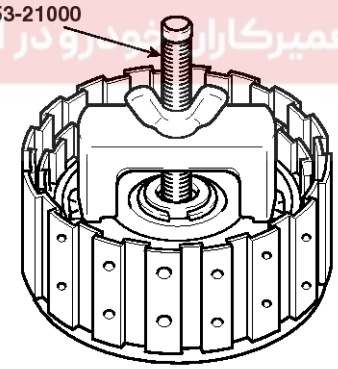
DISASSEMBLY

1. Remove the overdrive clutch reaction plate snap ring.



BK1A061A

2. Remove the overdrive clutch reaction plate.
3. Remove the 2 overdrive clutch discs and 2 plates.
4. Remove the reverse clutch reaction plate snap ring.
5. Remove the reverse clutch reaction plate.
6. Remove the 4 reverse clutch discs and 4 plates.
7. Compress the clutch return springs using special tools, 09453-21000 then remove the clutch spring retainer snap ring.

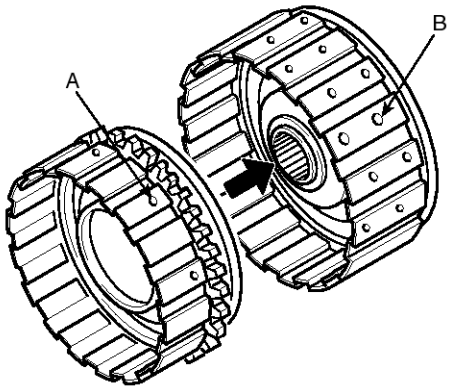


BK1A061B

8. Remove the clutch spring retainer.
9. Remove the D-ring seal.
10. Remove the clutch return spring.
11. Remove the overdrive clutch piston using compressed air.
12. Remove the D-ring seal.
13. Remove the Reverse clutch piston.
14. Remove the 3 D-ring seals.

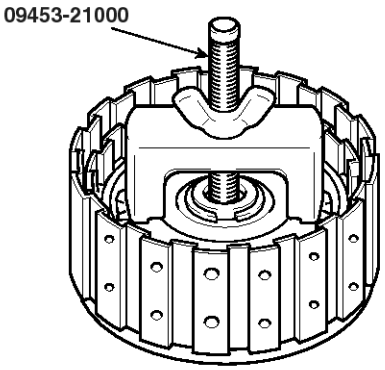
REASSEMBLY

1. Install the 3 D-ring seals.
2. Align the outer circumference holes (A and B) on the reverse piston and the reverse piston retainer before assembly.



BK1A062A

3. Install the Reverse clutch piston.
4. Install the D-ring seal.
5. Install the overdrive clutch piston.
6. Install the clutch return spring.
7. Install the D-ring seal.
8. Install the clutch spring retainer.
9. Compress the clutch return springs using special tools, 09453-21000 then install the clutch spring retainer snap ring.



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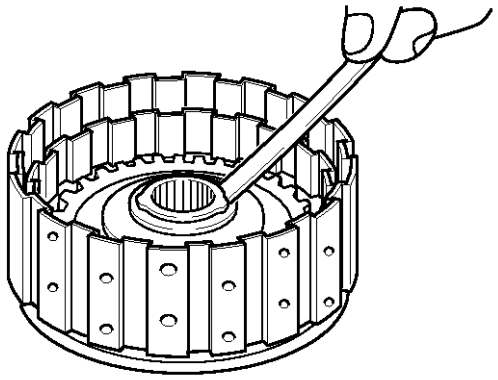
10. Check the clearance between the snap ring and the return spring retainer

Standard value :
0.01-0.09 mm (0.0004-0.0035 in)

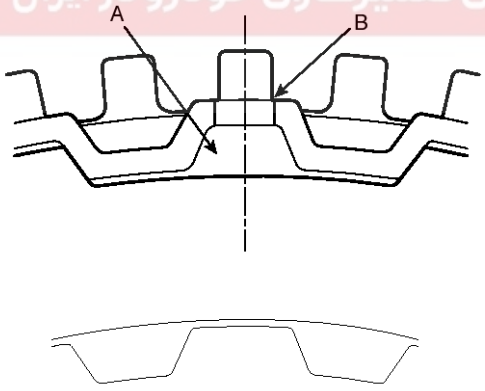


BK1A062B

11. If the clearance is incorrect, measure the old snap ring, then select the correct size from the chart in the service manual.

⚠CAUTION
Dip each clutch disc in ATF before assembling.

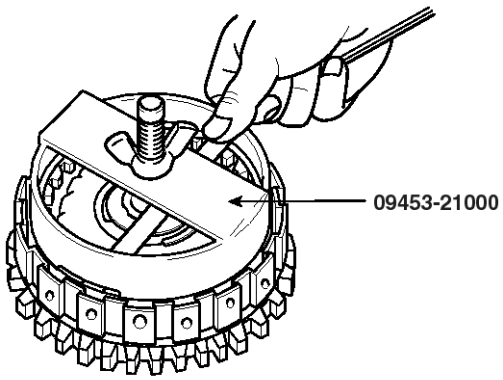
12. Align the spaces between the teeth (A) on the clutch plates, clutch discs, and reaction plate to the outer circumference hole (B) in the reverse clutch retainer.



BK1A062C

13. Install the 4 reverse clutch discs and 4 plates.
14. Install the reverse clutch reaction plate.
15. Install the reverse clutch reaction plate snap ring.
16. Install special tools, 09453-21000 as shown, then check the clearance between the snap ring and the reaction plate using a feeler gauge.

Standard value :
1.6-1.8 mm (0.0630-0.0709 in)

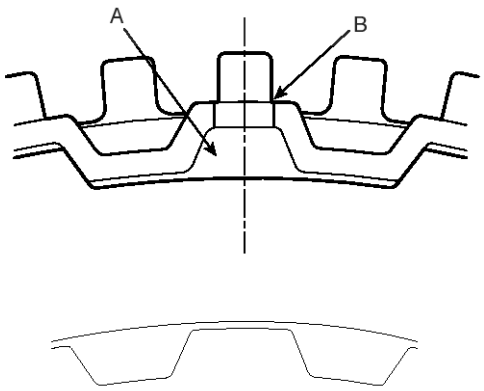


BK1A059B

17. If the clearance is incorrect, measure the old snap ring, then select the correct size from the chart in the service manual.

⊗WARNING
Dip each clutch disc in ATF before assembling.

18. Align the spaces between the teeth (A) on the clutch plates, clutch discs, and reaction plate to the outer circumference hole (B) in the overdrive clutch retainer.



BK1A062C

19. Install the 2 overdrive clutch discs and 2 plates.
20. Install the overdrive clutch reaction plate.
21. Install the overdrive clutch reaction plate snap ring.

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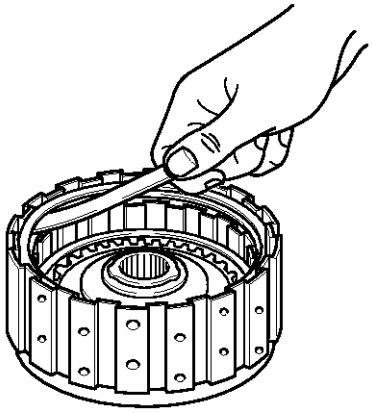
22. Check the clearance between the snap ring and the clutch reaction plate.

Standard value :
1.5-1.7 mm (0.0590-0.0670 in)



BK1A062D

23. If the clearance is incorrect, measure the old snap ring, then select the correct size from the chart in the service manual.

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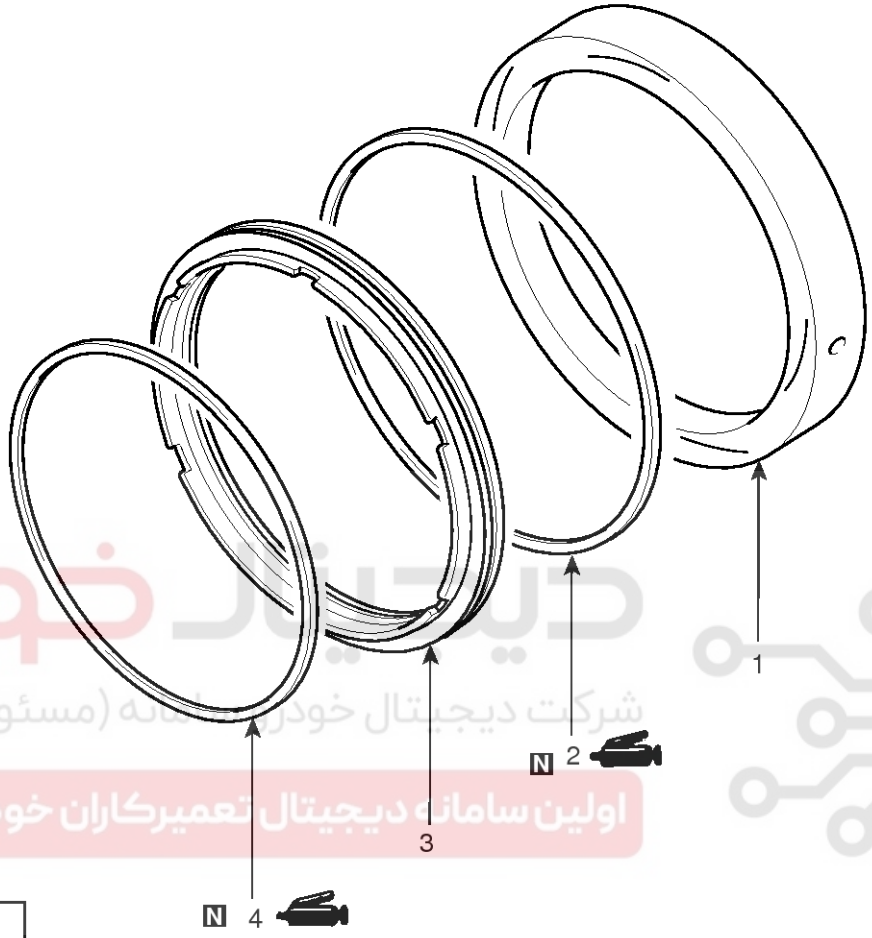
Second Brake

COMPONENTS

N Marked part shall be replaced with new part.



Apply ATF fluid on any moving part on installation.

Disassembly procedure
1. Second brake retainer
2. O-ring
3. Second brake piston
4. O-ring

BKGE005M

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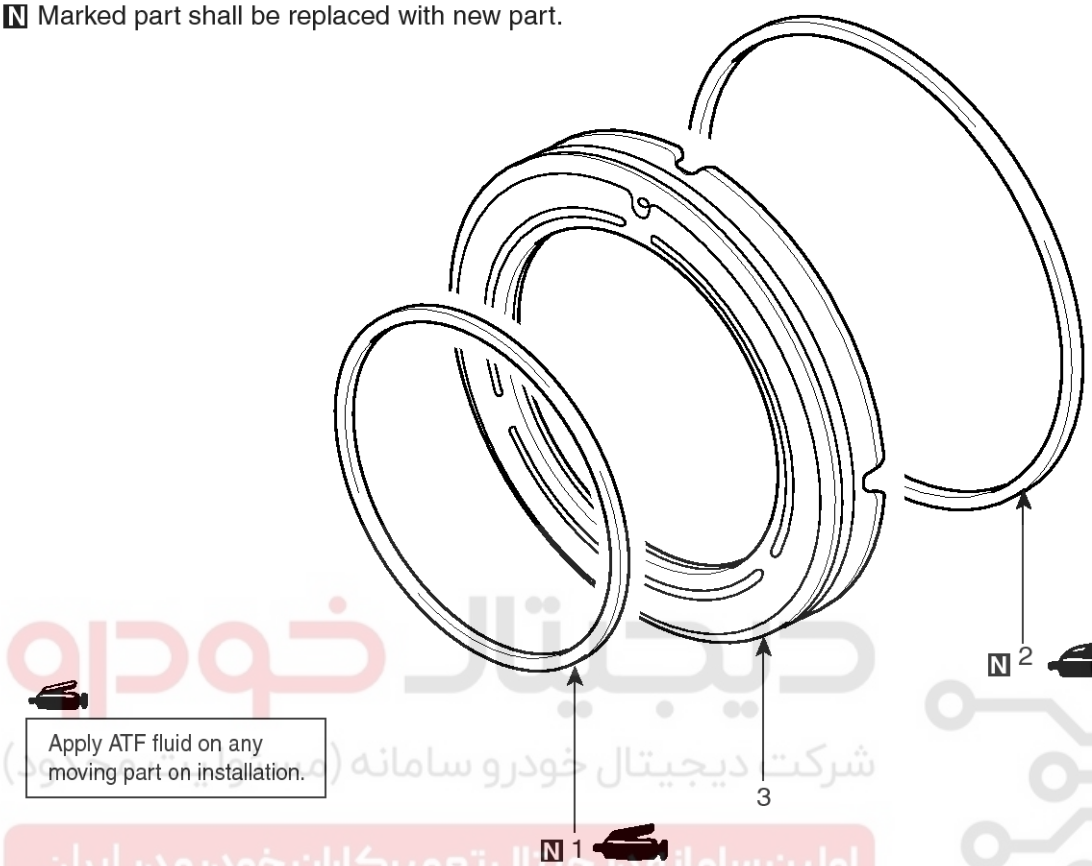
Low and Reverse Brake

COMPONENTS

N Marked part shall be replaced with new part.



Disassembly procedure

1. D-ring
2. D-ring
3. Low and reverse brake piston

BKGE005A

REASSEMBLY

Apply ATF or white Vaseline on the O-ring and install it caring not to damage it.

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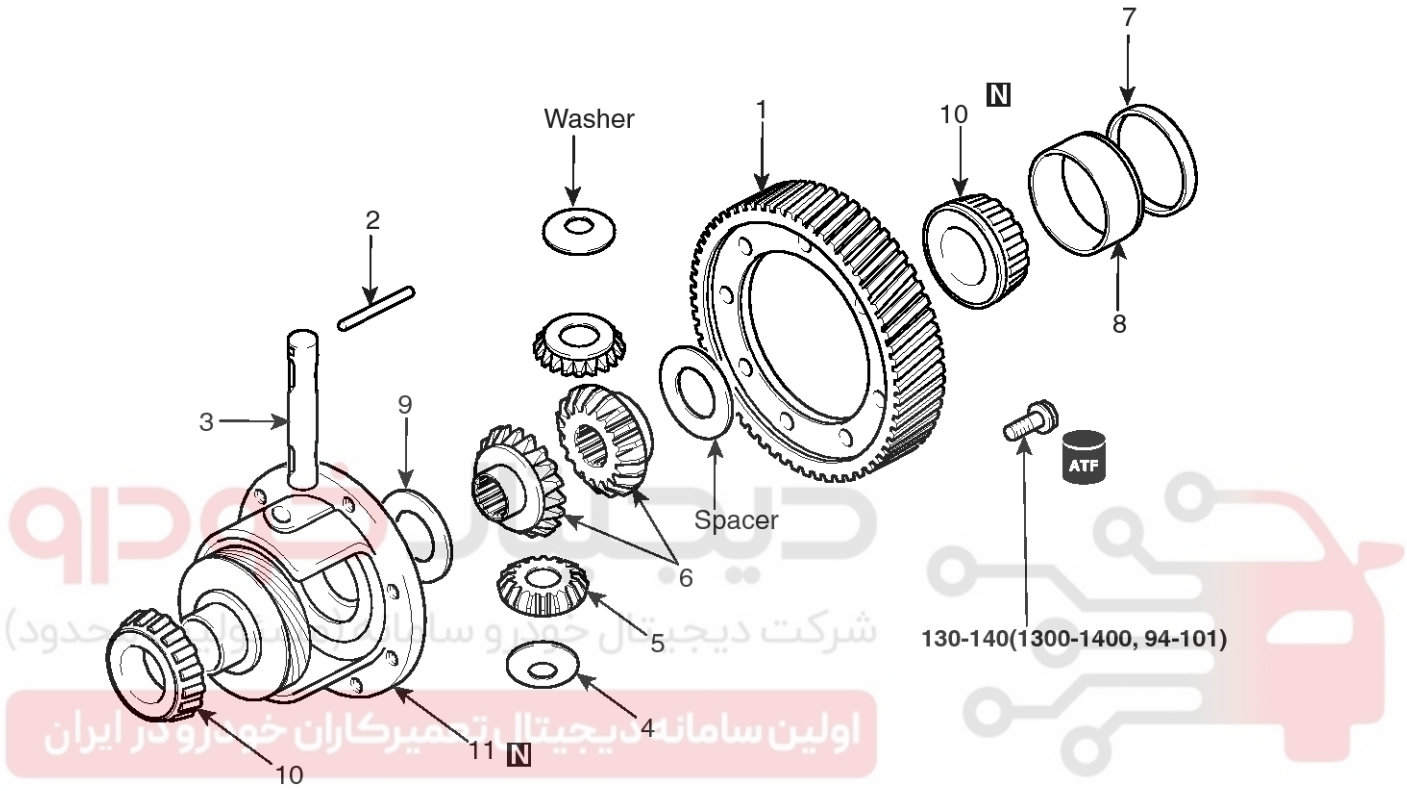
Gear System

Gear System

Differential

COMPONENTS

N Marked part shall be replaced with new part.



TORQUE : Nm (kgf.cm, lbf.ft)

1. Differential drive gear
2. Lock pin
3. Pinion shaft
4. Washer
5. Pinion gear
6. Side gear
7. Spacer
8. Outer race
9. Spacer
10. Taper roller bearing
11. Differential case

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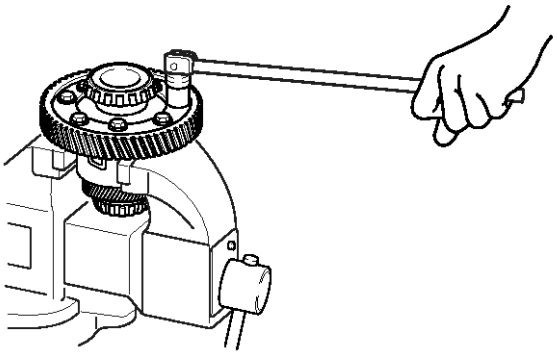
DISASSEMBLY

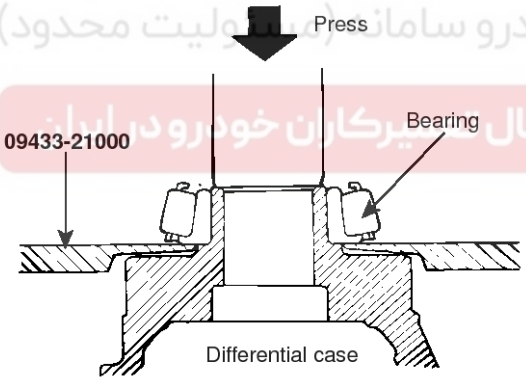
1. Clamp the differential case in a vise.
2. Remove the differential drive retaining bolts and remove the differential drive gea from the case.



BK1A071A

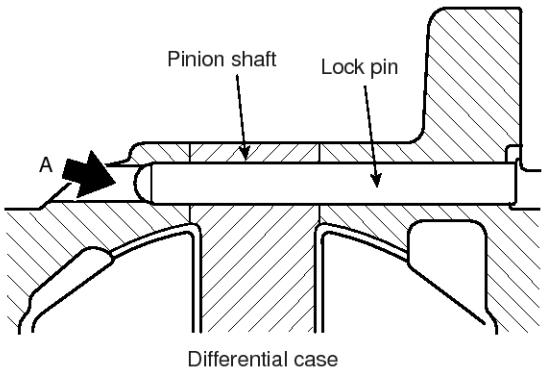
3. Remove the taper bearing using the special tool (09433-21000).

⚠CAUTION
Do not reuse the bearing removed from the shaft.



BK1A071B

4. Drive out the lock pin from the hole A using a punch.

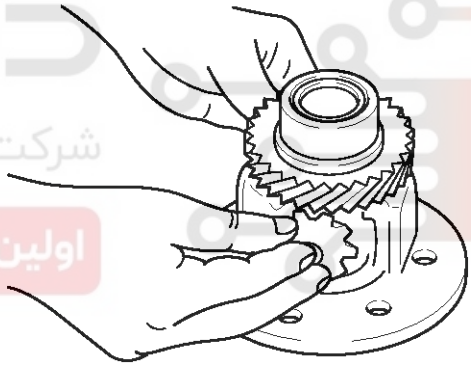


BK1A071C

5. Drive out the pinion shaft.

REASSEMBLY

1. Install the spacer on the back of the side gear and then install the gear in the differential case.



BK1A072A

⚠CAUTION
- **When installing a new side gear, use a spacer of medium thickness [0.83-0.92 mm (0.33-0.036 in)].**
- **Do not reuse the lock pin.**
- **The lock pin head must be sunk below the flange surface of the differential case.**

2. Set the washer on the back of each pinion and insert the two pinions to specified position while engaging them with the side gears by turning them.

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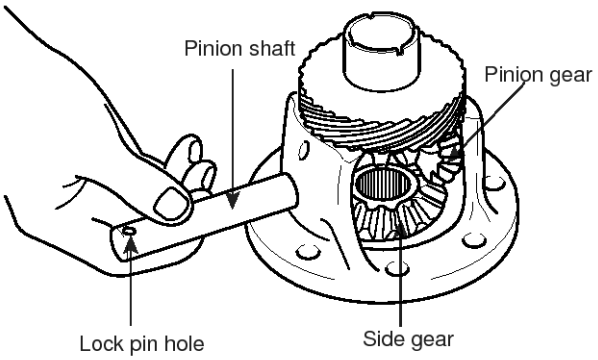
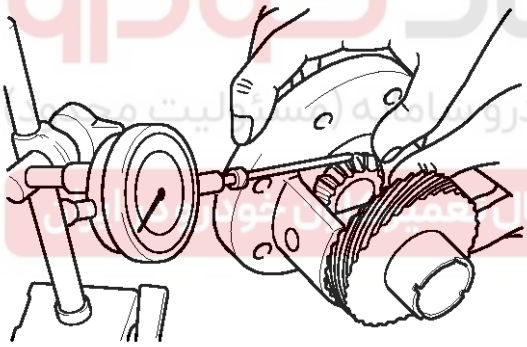
3. Insert the pinion shaft.



BK1A072B

4. Measure the backlash between the side gears and pinions.

Standard value :
0.025-0.150 mm (0.001-0.006 in)
0.025-0.0150 mm (0.001-0.006 in)



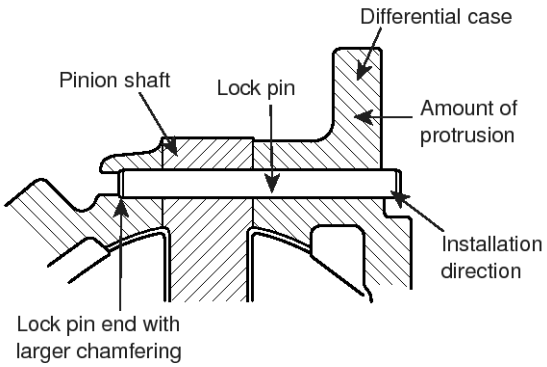
BK1A072C

5. If the backlash is out of specification, disassemble and install the correct spacer, reassemble and remeasure.

⚠CAUTION
Adjust the backlash of both side gears to the same specification.

6. Align the pinion shaft lock pin hole with the case lock pin hole and insert the lock pin.

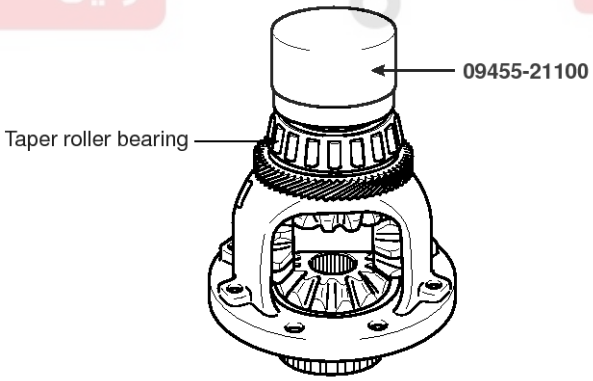
⚠CAUTION
- **Do not reuse the lock pin.**
- **The lock pin head must not protrude more than 3 mm (0.0118 in) gear in the differential case.**



BK1A072D

7. Install the tapered roller bearing on both sides of the differential case using the special tool (09455-21100).

⚠CAUTION
When press-fitting the bearing, press on the inner race only.



BKGE005F

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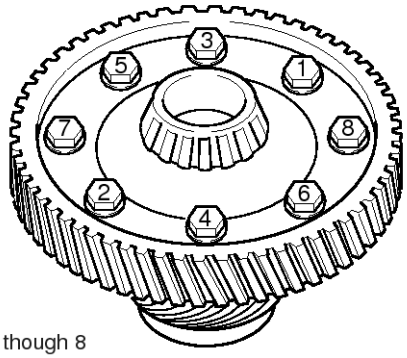
8. Apply specified sealant to the entire threads of the bolts. Tighten to specifications using the sequence shown in the illustration.

⚠CAUTION
If a bolt is reused, remove the old sealant from the threads.



1 though 8
indicate tightening seouence

BK1A072F

دیجیتال خودرو
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

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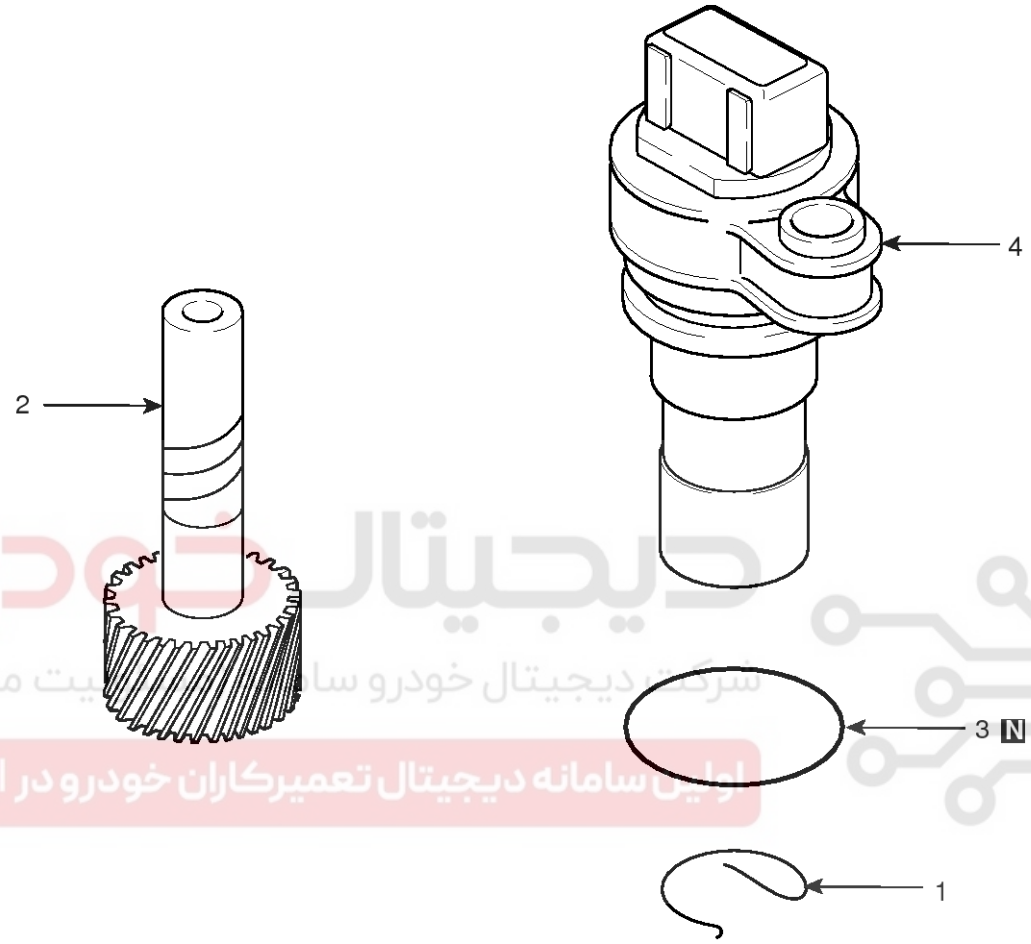
Speedometer Driven Gear Assembly

COMPONENTS

N Marked part shall be replaced with new part.



Apply ATF fluid on any moving part on installation.

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

BKGE005N

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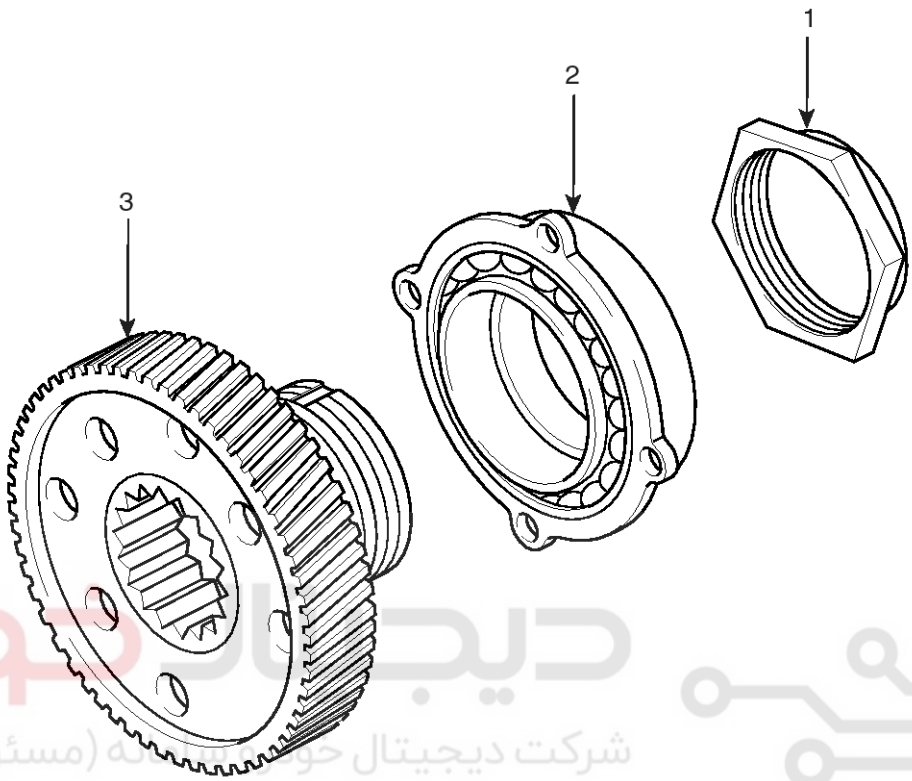
Transfer Drive Gear

COMPONENTS



1. Locking nut
2. Transfer drive gear bearing
3. Transfer drive gear

BKGE005C

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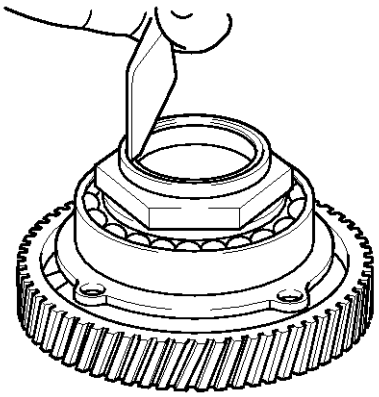
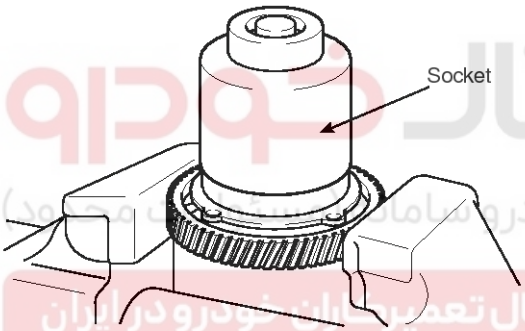
DISASSEMBLY

1. Loosen the locking nut caulking.



BK1A068A

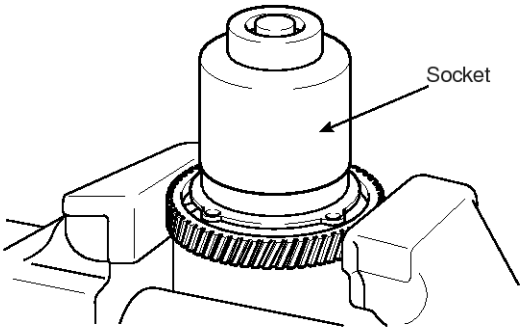
2. Remove the lock by using socket.



BK1A068B

REASSEMBLY

1. Apply ATF to the new locking nut and tighten to the specified torque. And loosen 1 turn and tighten to the specified torque again.



BK1A068B

2. Caulk the locking nut by using punch.

BK1A069A

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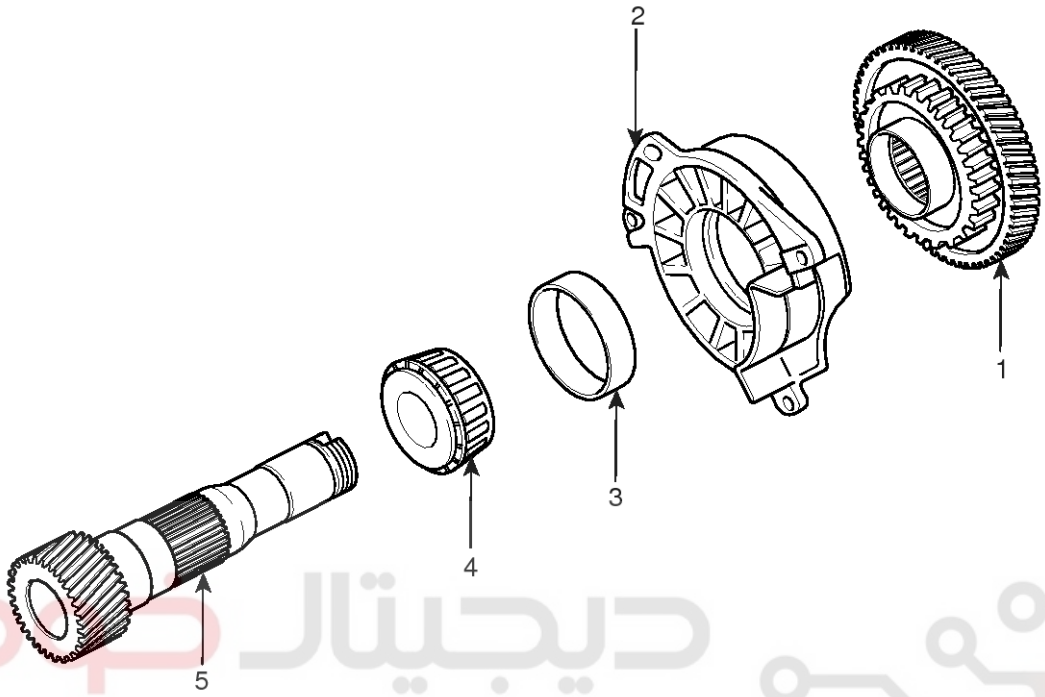
Output Shaft

COMPONENTS



Disassembly steps

1. T/F driven gear
2. Bearing retainer
3. Outer race
4. Taper roller bearing
5. Output shaft

BKGE005D

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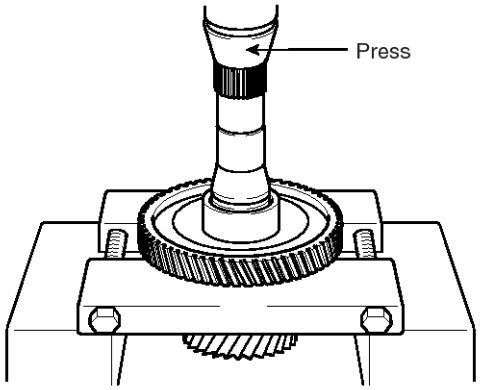
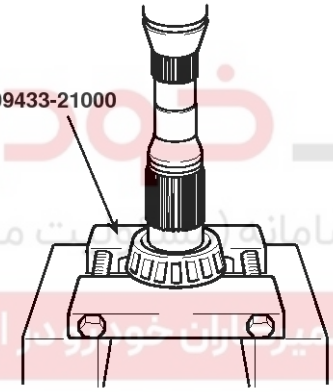
REASSEMBLY

1. Remove the transfer driven gear by press.



BK1A066A

2. Remove the taper roller bearing.



BK1A066B

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Automatic Transaxle Control System

Shift Lever

COMPONENTS

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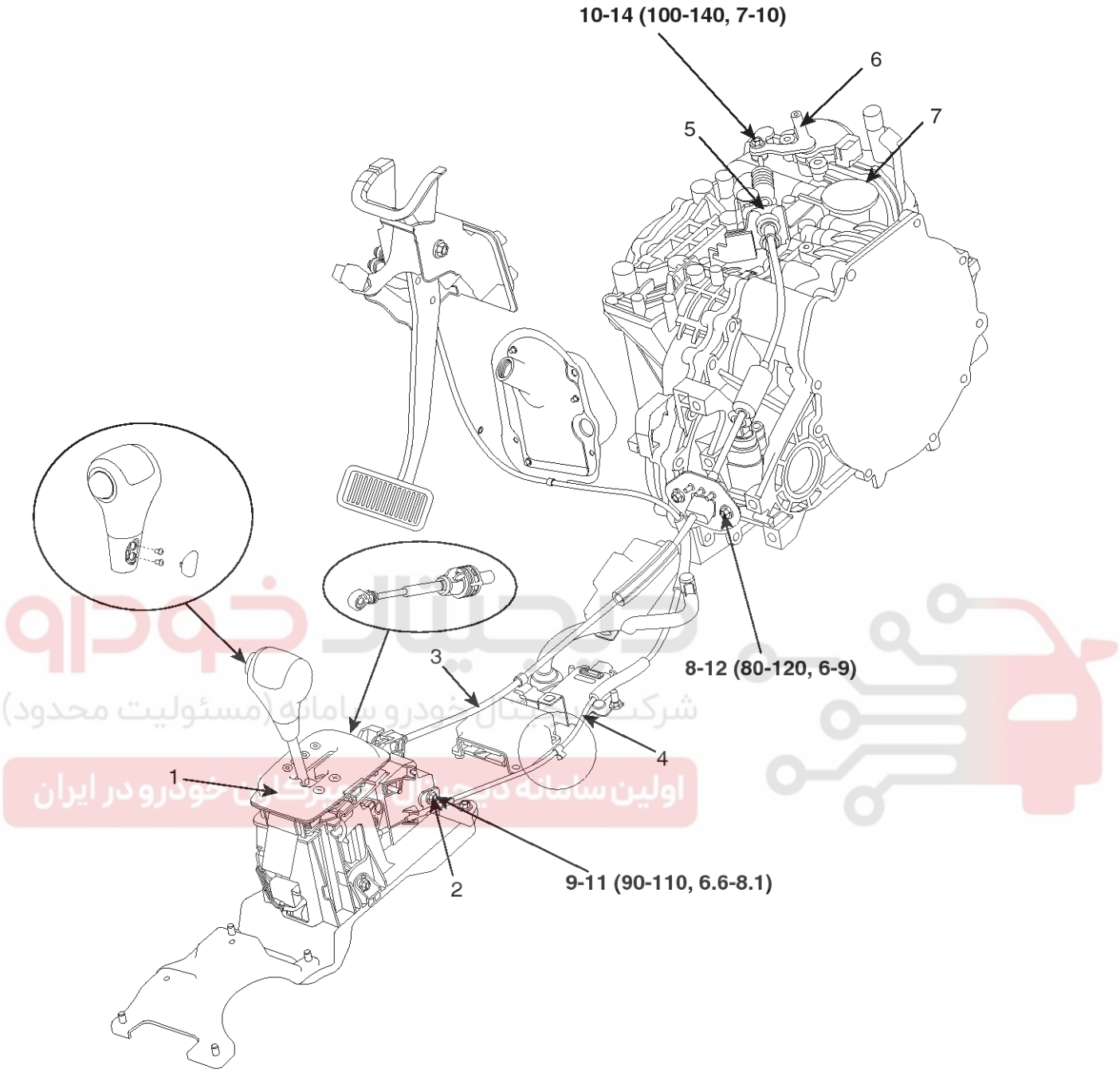

TORQUE : Nm (kgf.cm, lbf.ft)

1. Shift lever assembly
2. Shift lock cable nut
3. AT cable
4. Shift lock cable
5. Pin
6. Shift lever (AT side)
7. Automatic transaxle

LKIF008A

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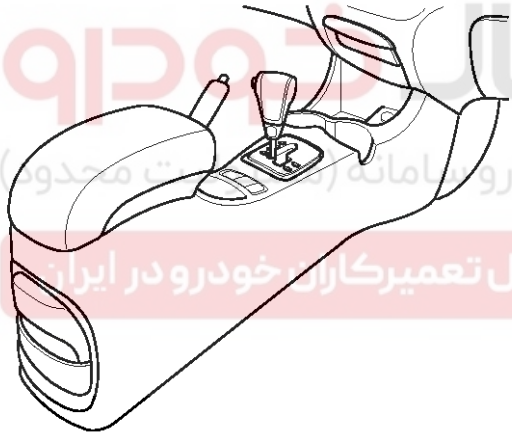
REMOVAL

1. Remove the shift lever knob(A).

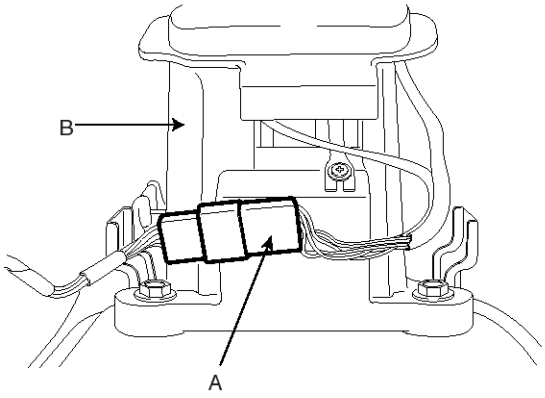
LKIF008B

2. Disconnect the three connectors.
3. Remove the console cover. (Screw:10EA, Fastener:4EA)



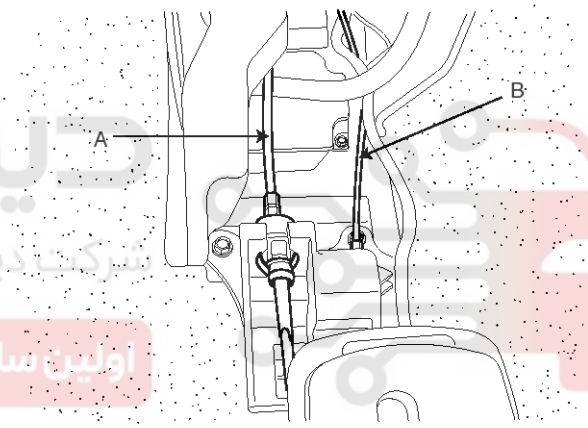
LKIF008C

4. Remove the sports mode connector(A) from the shift lever(B).



LKIF008D

5. Remove the control cable(A) and shift lock cable(B).



LKIF008E

6. Remove the shift lever assembly. (Bolt:4EA)

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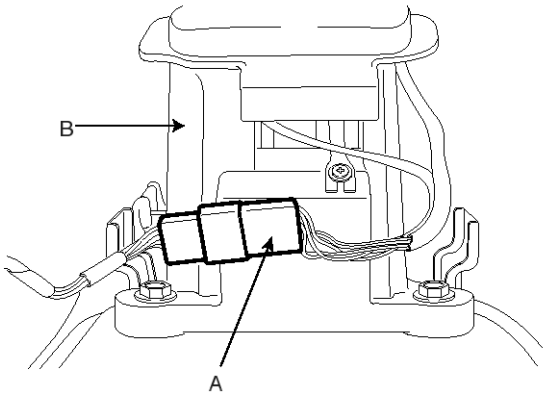
INSTALLATION

1. Install the shift lever assembly. (Bolt:4EA)

TORQUE :
18-25Nm (180-250kgf.cm, 13.3-18.4lbf.ft)

2. Install the cable.
3. Connect the sports mode connector.

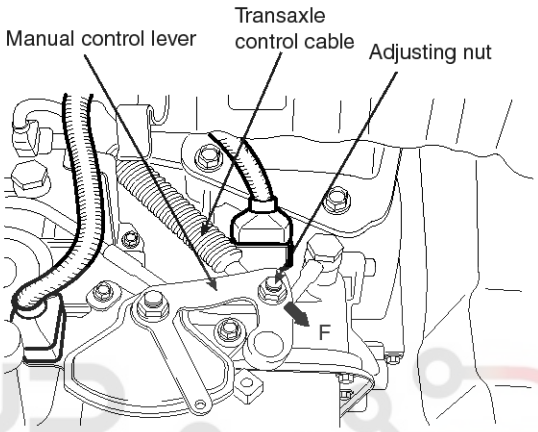


LKIF008D

4. Inspect the shift lock. (Refer to shift lock inspection)
5. Connect the three connectors.
6. Install the console cover. (Screw:10EA, Fastener:4EA)
7. Install the shift lever knob.

INSPECTION

1. Adjusting method for T/M control cable
   1) Set room side lever and T/M side lever to "N" position.
   2) Connect room side lever and shift cable.
   3) Connect T/M side lever to cable in a following orders.
      a. Push cable lightly to "F" direction shown to eliminate FREE PLAY of cable.
      b. Tighten adjusting nut.



BKGE001A

   4) After adjusting 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.

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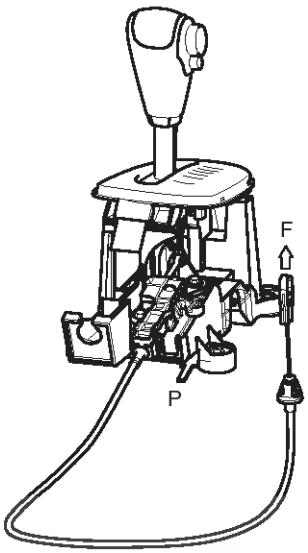
2. Checking item of shift lock
   1) With shift lever at "P" position and brake pedal not depressed. Push button cannot be operated at the positions except "P".

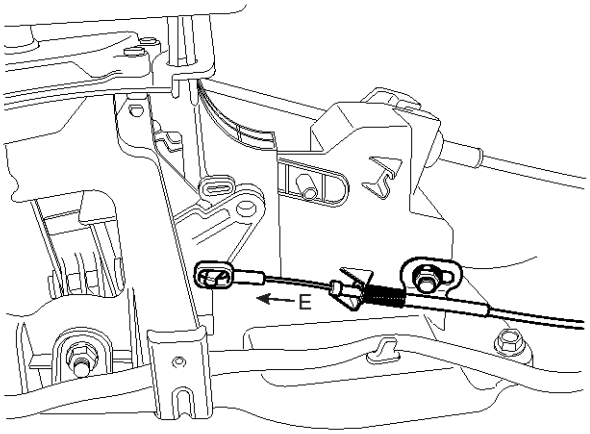


BKGE006C

   2) With IG key at the position other than "LOCK"(may be at "ACC") and brake pedal stroke 15-25mm (0.59-0.98 in) (with shift lever at "P" position). Push button can be operated and shift lever can be shifted smoothly to other from "P".
   3) With brake pedal not depressed. Shift lever can be shifted smoothly to "P" position from other positions.
   4) Brake pedal must be operated smoothly without catching at all positions.

Adjusting procedure for "P" shift lock cable

1. Check that each lock cam is shown below.



AKIE005E

2. Install shift lock cable in position. In this case, shift lock cable must be fixed to brake pedal in position.
3. Temporarily install shift lock cable to A/T lever assy. Securely insert cable end into fixing point of shift lock cam.
4. Doing the work of 3. slightly pull outer casing of shift lock cable to direction "E" to stretch cable. In this case, shift lock cam must not move.
5. After checking portion of cable end touches cable fixing pin of shift lock cam. Fix outer casing with a nut.
6. Check the installation condition of the shift lock cam.

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