Automatic Transmission (FR) - AISIN -

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INTRODUCTION

This training guidebook is an “Automatic transmission FR (Front engine Rear driving) – AISIN – “ as a series of a self-study text booklet to understand the A/T system of AISIN.

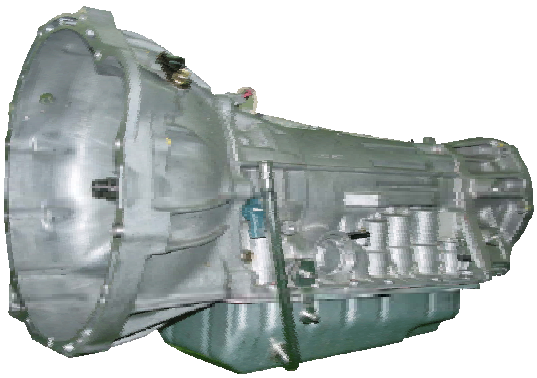
The purpose of this publication, as in the case with other technician’s guides, is to provide complete information on the theoretical operating characteristics of AISIN transmission. Operational theories of the mechanical, hydraulic and electrical components are presented in a sequential and functional order to better explain their operation as part of the system.

AISIN rear driving transmission has been adopted in worldwide vehicles. There are several models that are equipped in Hyundai vehicles.

The basic concept and knowledge for the automatic transaxle please refer the “Transaxle Basic Theory” guidebook and the fundamental explanation will be skipped in this training guidebook. This guidebook is a series of “Automatic Transaxle (FF) and (FR)”, it can be classified as follows.

- Automatic Transaxle (FF) – HIVEC
- Automatic Transaxle (FF) – Alpha & Beta
- Automatic Transaxle (FF) – JATCO & AISIN
- **Automatic Transaxle (FR) – AISIN**

As the new model is developed in the future, additional training guide will be published for each model and system.



Contents

1. AISIN General

1.1 Introduction

This book will cover following AISIN models.

AW03 series: AW03-72L (Mechanical type), AW03-72LE, and AW03-II

AW30 series: AW30-43LE, AW30-40LE

Above transmission models have been installed on following vehicles,

AW03 series:

Townace, Liteace, Dina, Toyoace, Kijang, Tuv (Toyota), Pajero, Delica, Freeca (Mitsubishi), Panther (Isuzu), Escudo, Grand Escudo (Suzuki), Roadster (Mazda), Porter, Starex, Terracan (Hyundai), Grace, Sportage, Pregio, Wide Bongo, Retona (Kia)

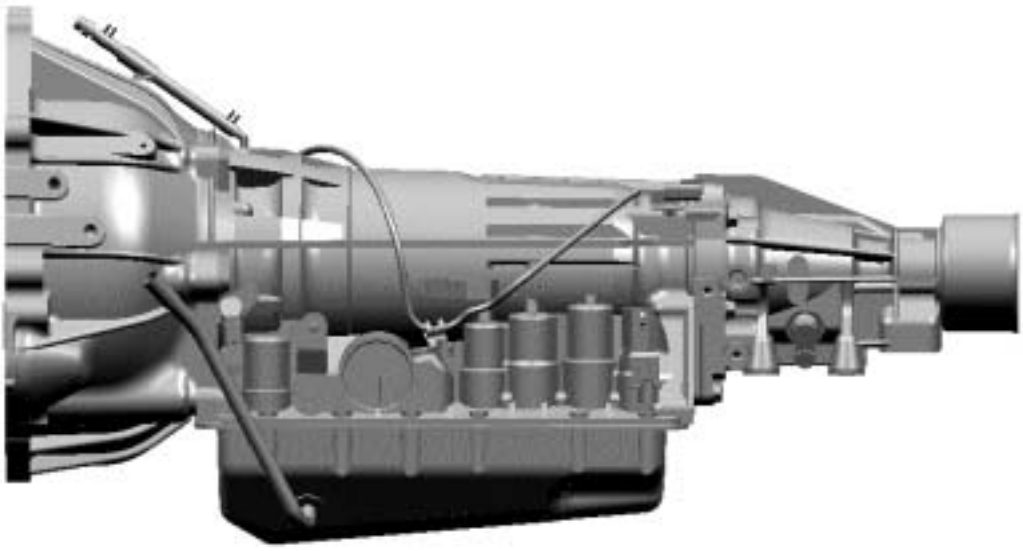
→ A microcomputer was used to optimize the shift schedule and lock-up clutch engagement, for advanced drivability and improved fuel economy.

AW30 series:

Century, Aristo, Crown, Markii, Verossa, Supra, Hiace, Hilux, Tandra, Sequoia, Tuv (Toyota), Pajero, Forte, Challenger (Mitsubishi), Pup, Elf, Bighorn, Mu (Isuzu), Escude (Suzuki), Starex, Terracan Libero (SR) (Hyundai), Sorrento, Enterprise (Kia)

→ Torque capacity increased by 1.5 times than AW03 series A/T to meet improved engine power.

→ Use of a total control system integrated with the engine for intelligent control of engine torque and clutch hydraulic pressure when changing gears, this results in significant improvement of shift quality.



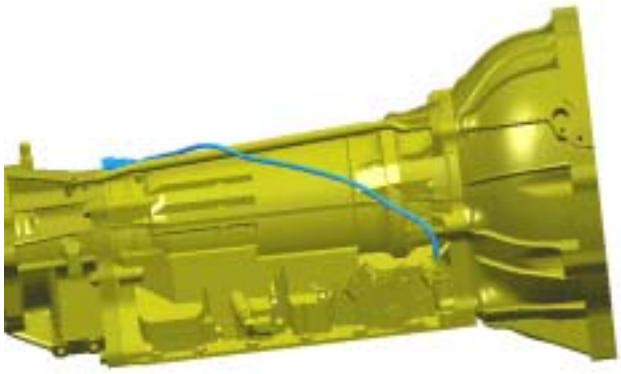
1.2 Application on Hyundai vehicles.

Model	Max. Torque (kgfm)	Vehicle	Engine	Gear Ratio (1/2/3/4/R)	ATF(Liter)	Remarks
AW03-72L	24	Galloper	3.0 V6 MPI	2.826/1.493/1.000/0.730/2.703	SPIII,7.2L	
			2.5DSL ALL	2.826/1.493/1.000/0.688/2.703		
AW03-72LE	24	H-100 (Bus)	4D56 T-2 NA	2.826/1.493/1.000/0.730/2.703	D-II, 7.2L	DOM. Only
		H-100 (Truck)	4D56 T-2 NA	2.826/1.493/1.000/0.730/2.703		DOM. Only
		H-1	4D56 T-2 NA	2.826/1.493/1.000/0.730/2.703		
			Sirius 2.4S	2.826/1.493/1.000/0.730/2.703		
AW03-II	24	Terracan	4D56 2.5L TCI	2.826/1.493/1.000/0.688/2.703	D-II, 8.73L	
		H-1	Sirius-II 2.4D	2.826/1.493/1.000/0.730/2.703		
AW30-43LE	35	SR	ALL	2.804/1.531/1.000/0.753/2.393	D-II, 8.5L	DOM. Only
		H-1	4D56 2.5L TCI	2.804/1.531/1.000/0.753/2.393		
			A-2.5 C/R	2.804/1.531/1.000/0.753/2.393		
			4D56 T-2 NA	2.804/1.531/1.000/0.753/2.393		VAN only
AW30-40LE	35	Terracan	J-2.9 C/R	2.804/1.531/1.000/0.705/2.393	D-II, 9.2L	
			Sigma 3.5D			

2. AW03-72L Model

2.1 Introduction

AW03-72L model is belong to 03 series and this model has no TCM, that is a mechanically controlled transmission. Governor was adopted for the gear shifting, electrical overdrive switch and solenoid valve are supported for 4th gear driving. However its mechanical structure and operating principle(power flow) is same as one of electronic type (AW03-72LE, AW03-II).



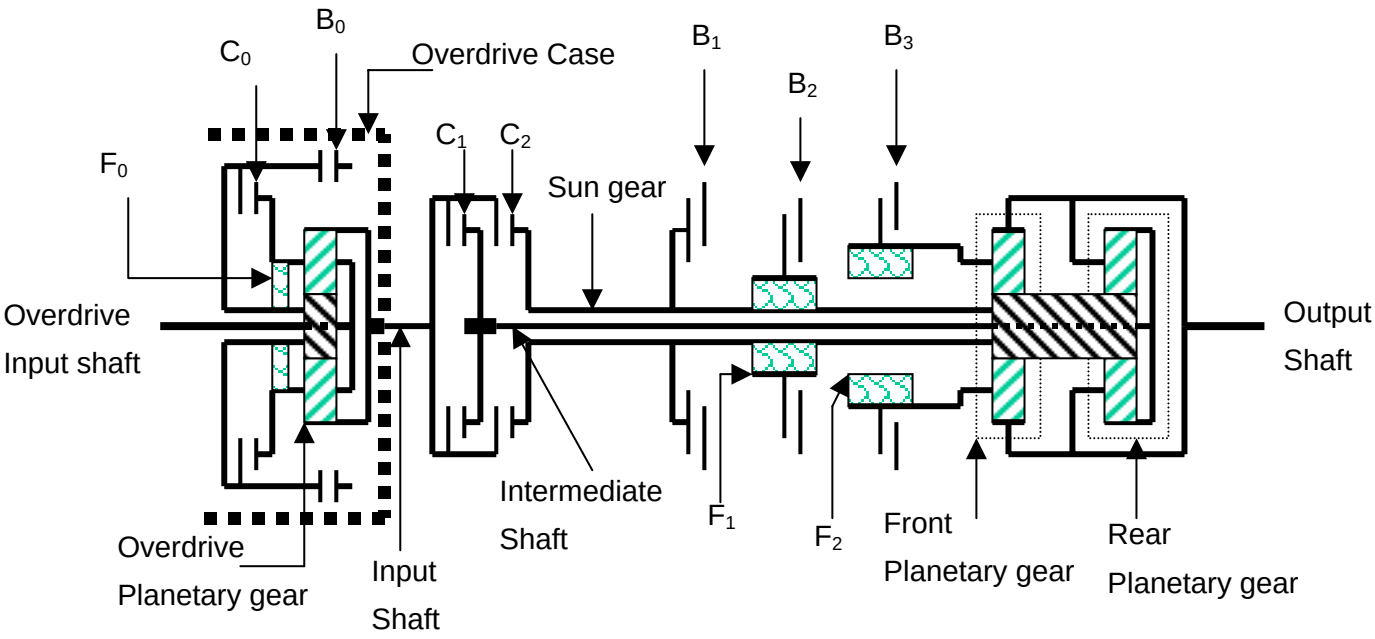
2.2 Application

Galloper, H-100(Mini Bus)

2.3 Components

2.3.1. Structure

The whole structure of this transmission is as below picture. Below diagram is valid not only for AW03-72L(Mechanical type) but also 03 series.(AW03-72LE, AW03-II model)

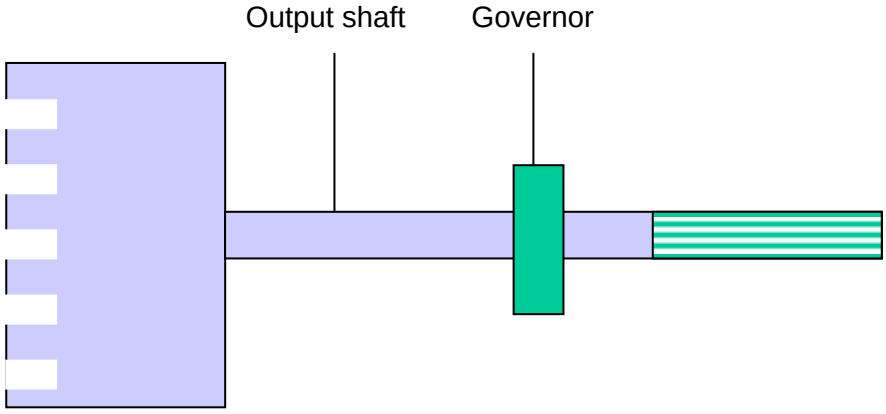


C_0 : overdrive clutch
C_1 : front clutch
C_2 : rear clutch
F_0 : overdrive one-way clutch
F_1 : one-way clutch no.1
F_2 : one-way clutch no.2

B_0 : overdrive brake
B_1 : brake no.1
B_2 : brake no.2
B_3 : brake no.3

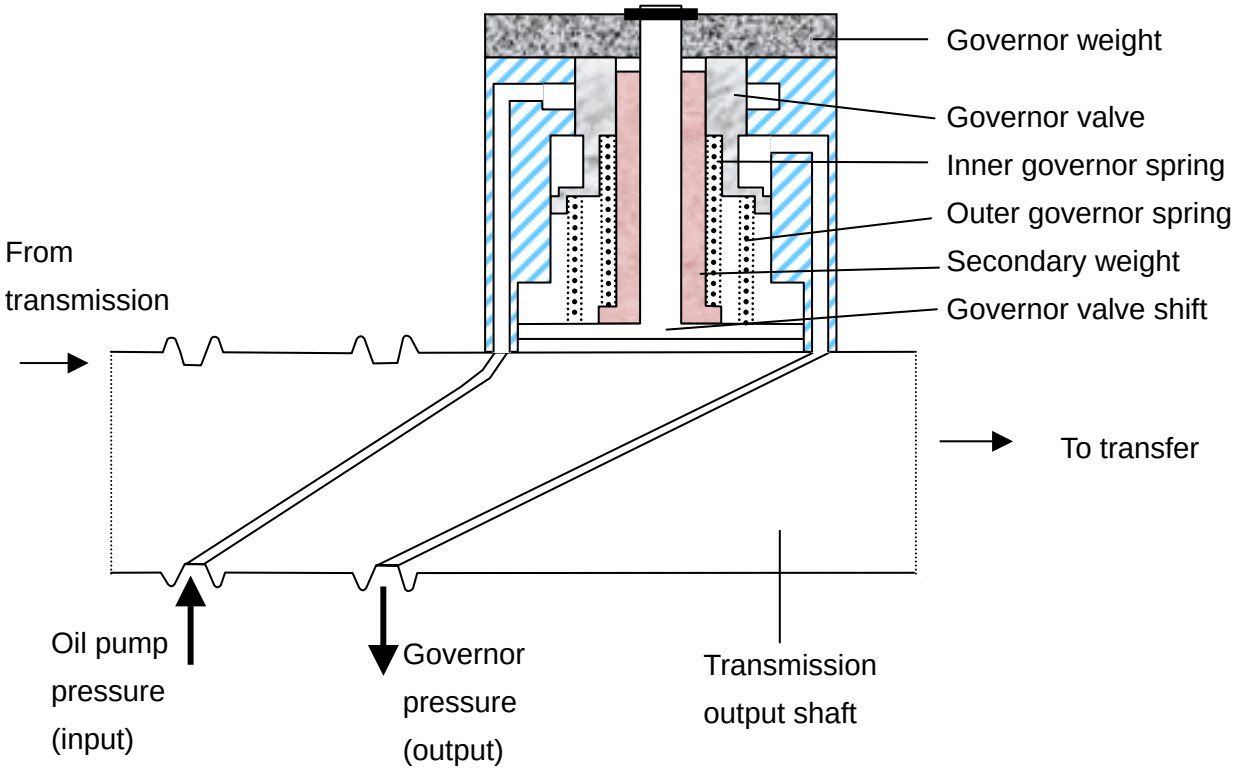
2.3.2. Mechanical governor

As in case of conventional mechanical-hydraulic controlled type automatic transmission, the governor was applied in this transmission.

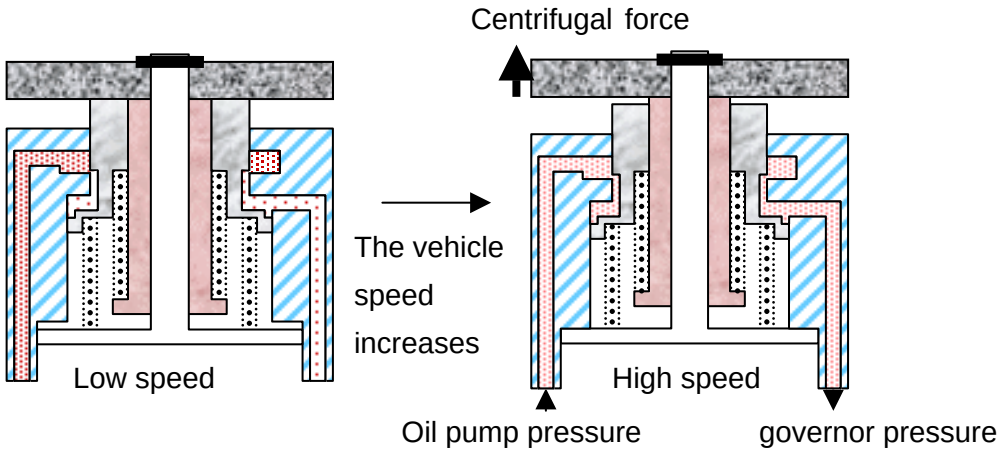


The governor is a hydraulic speedometer that is driven by the output shaft of the transmission. It receives fluid from the mainline pressure and produces a regulated governor pressure signal that is proportional to vehicle speed.

Below section view of governor shows the detail structure and hydraulic pressure passage to be operated depends on the rotational speed of output shaft, which is a vehicle speed for gear shifting.

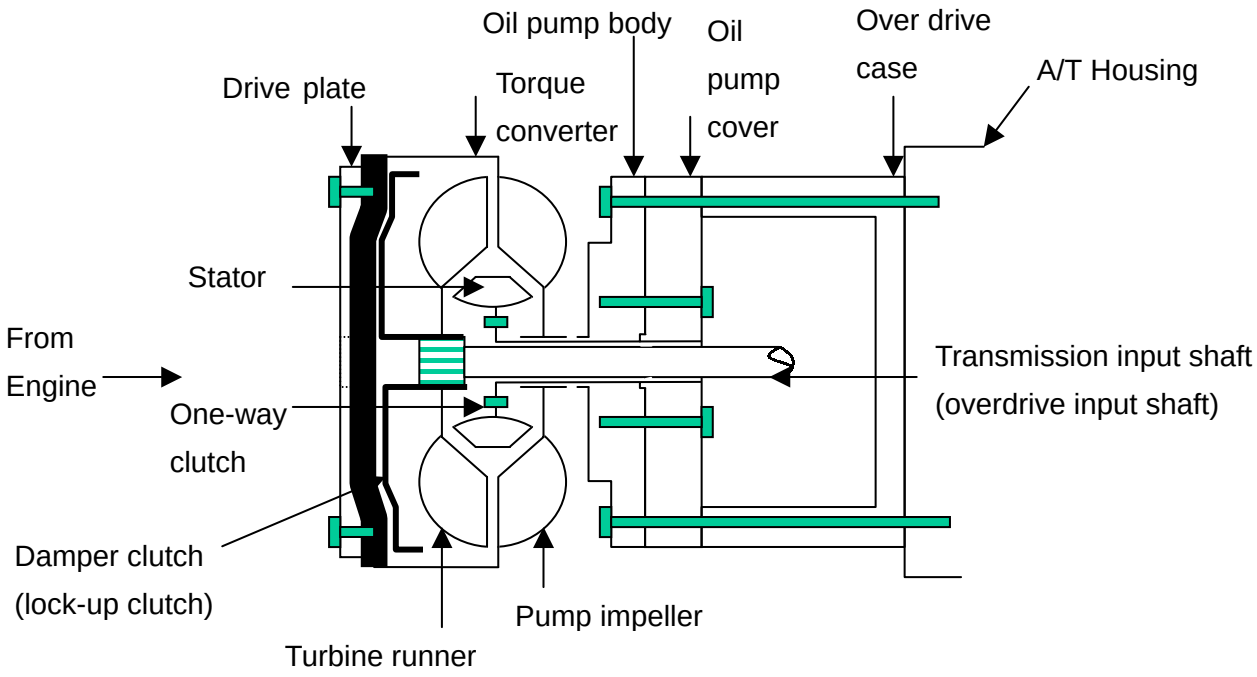


As the vehicle speed increases, the centrifugal force of the weights also increases, hence the greater governor pressure necessary to balance the centrifugal force. Eventually, vehicle speed reaches a point at which the governor valve cannot balance itself against the centrifugal force of the weight. The governor valve is permanently in the open position and governor pressure equals the mainline supply pressure.



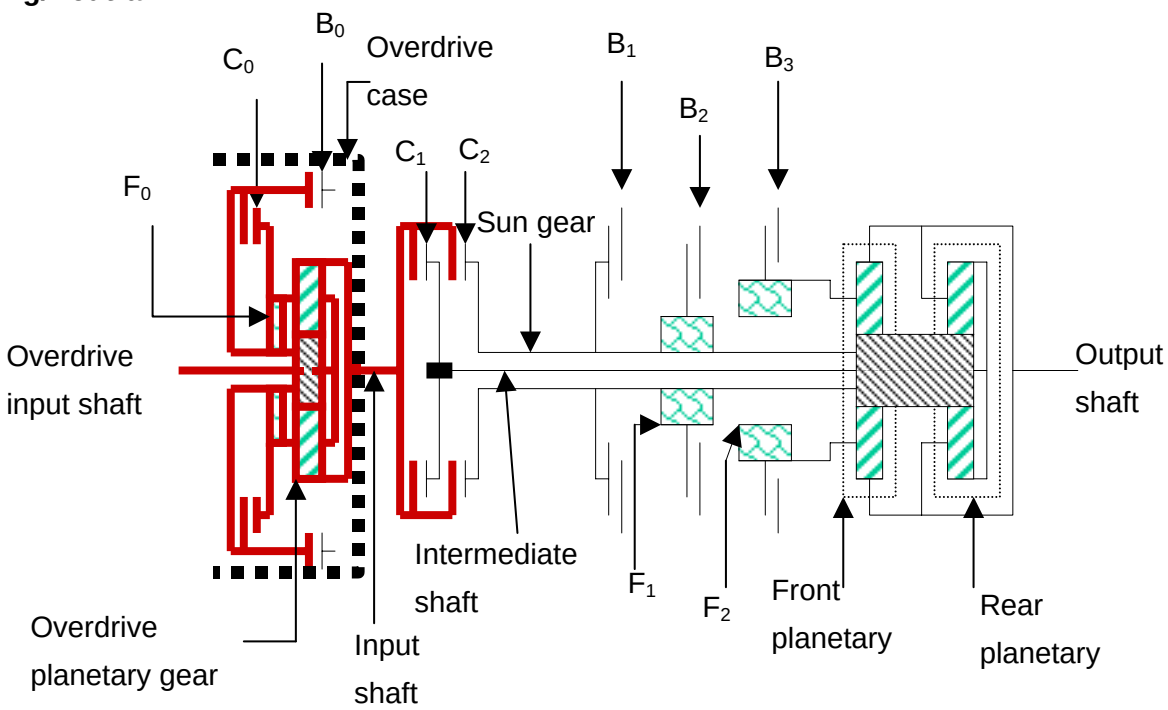
2.3.3. Overdrive case

Refer the connection of overdrive case and oil pump. Service special tools such as oil pump puller should be used while disassembly of transmission.

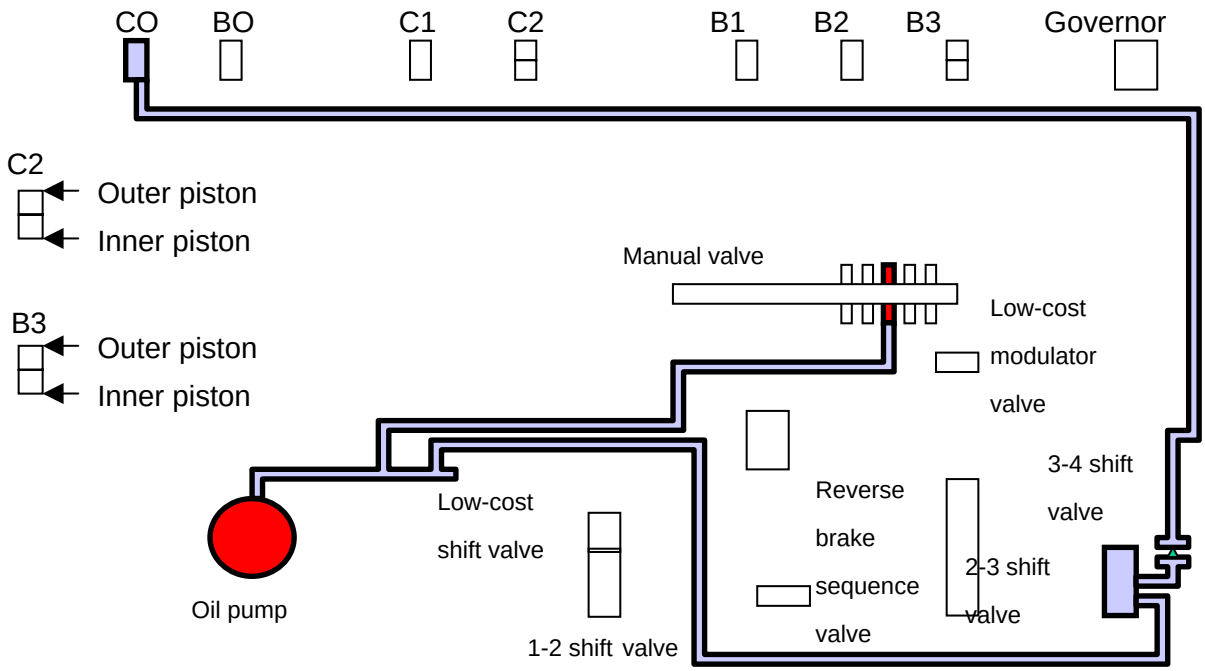


2.3.4. Operating elements

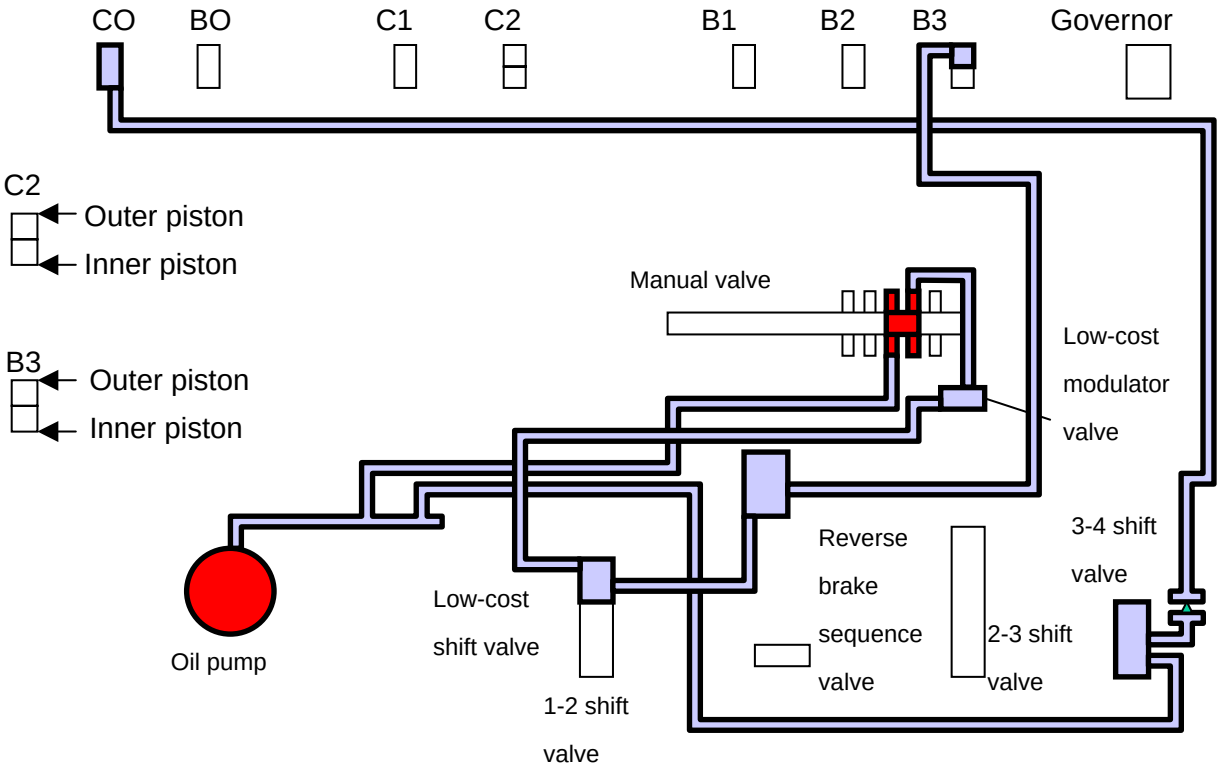
- Parking/Neutral



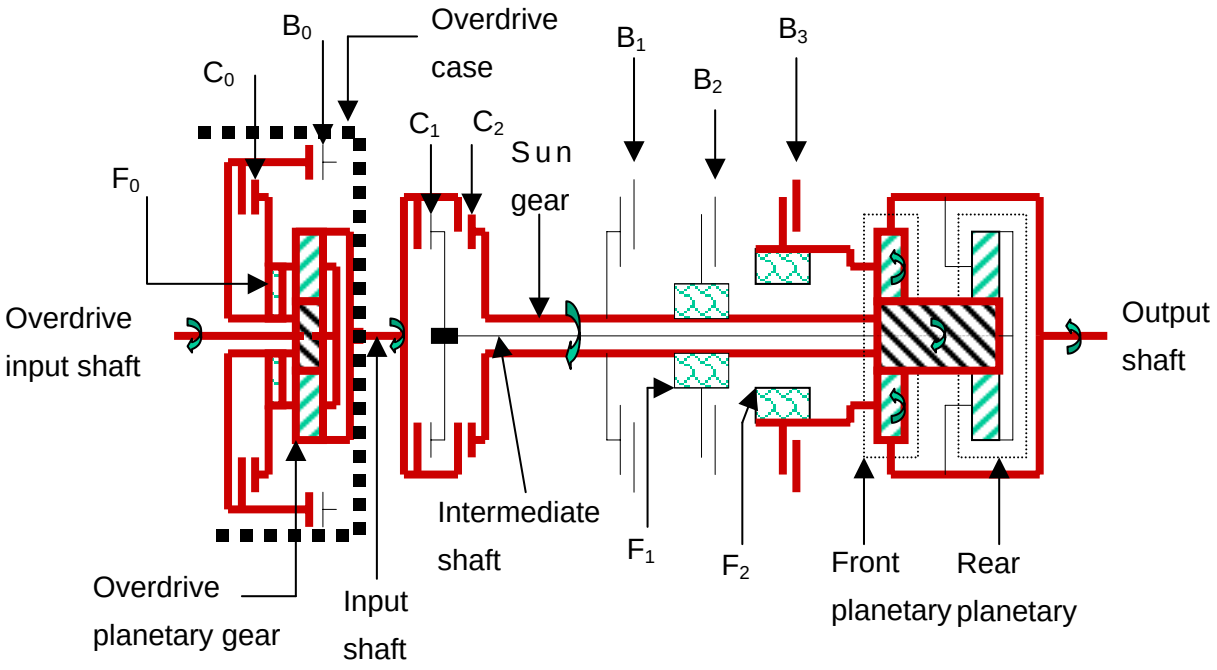
- Neutral Fluid Flow



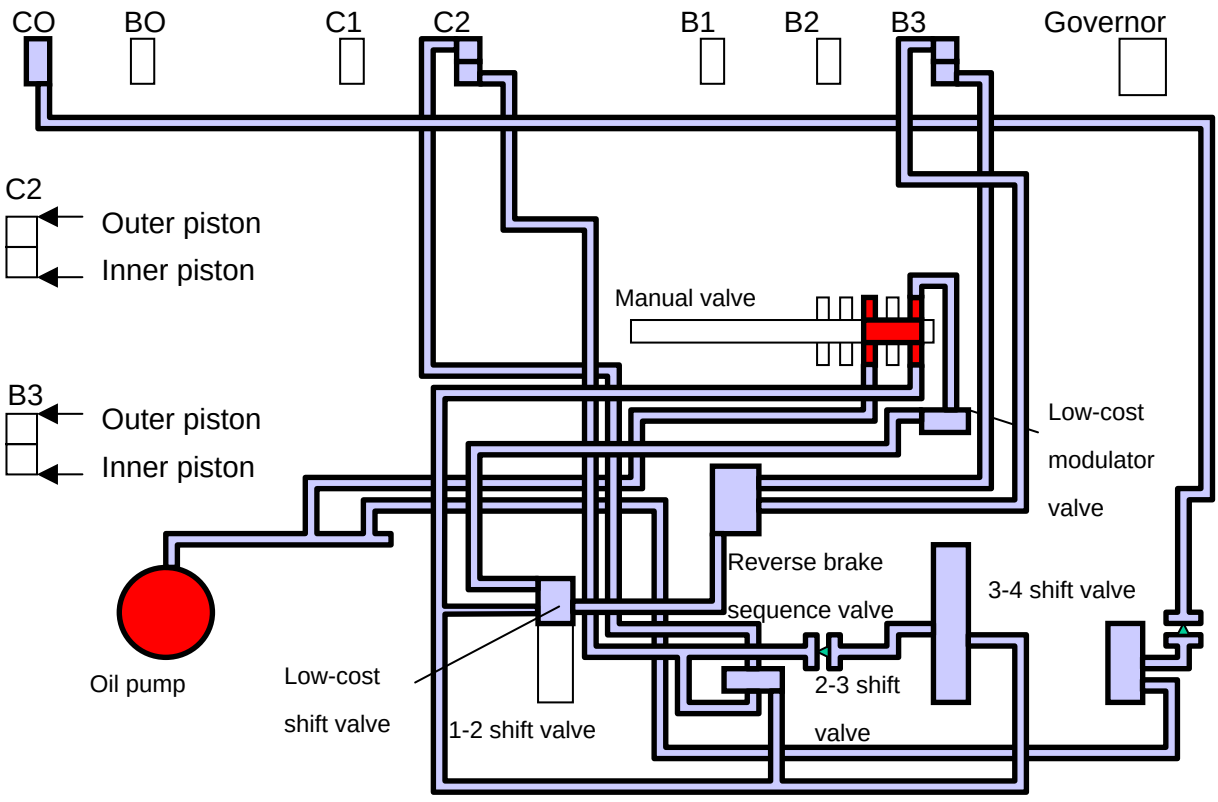
- Parking Fluid Flow



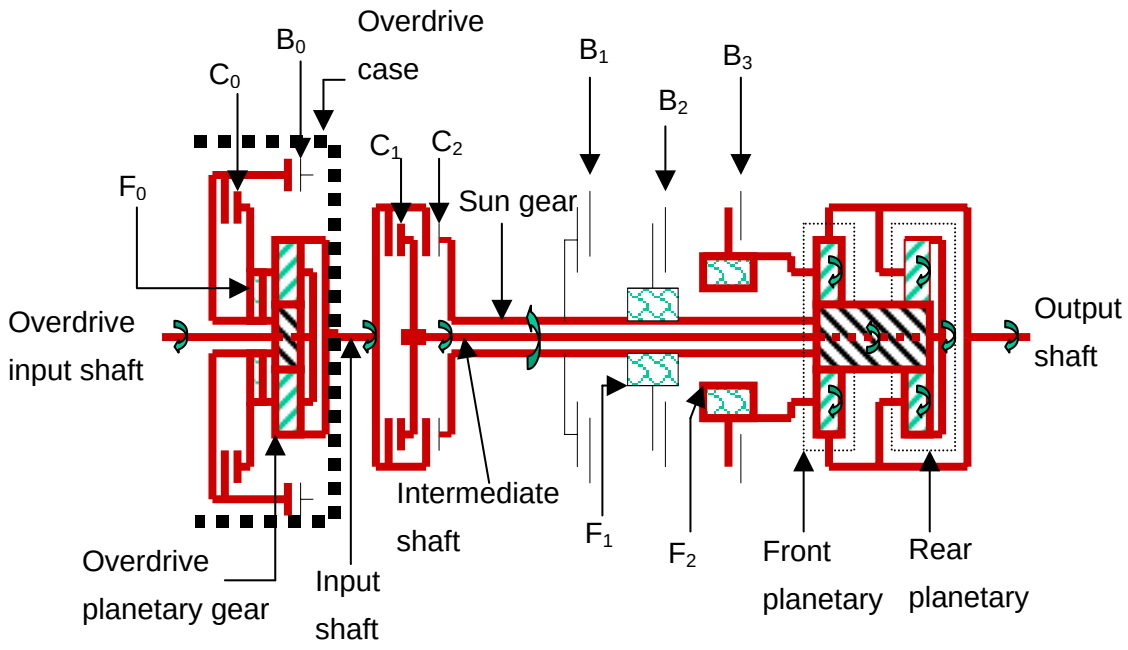
- Reverse Gear



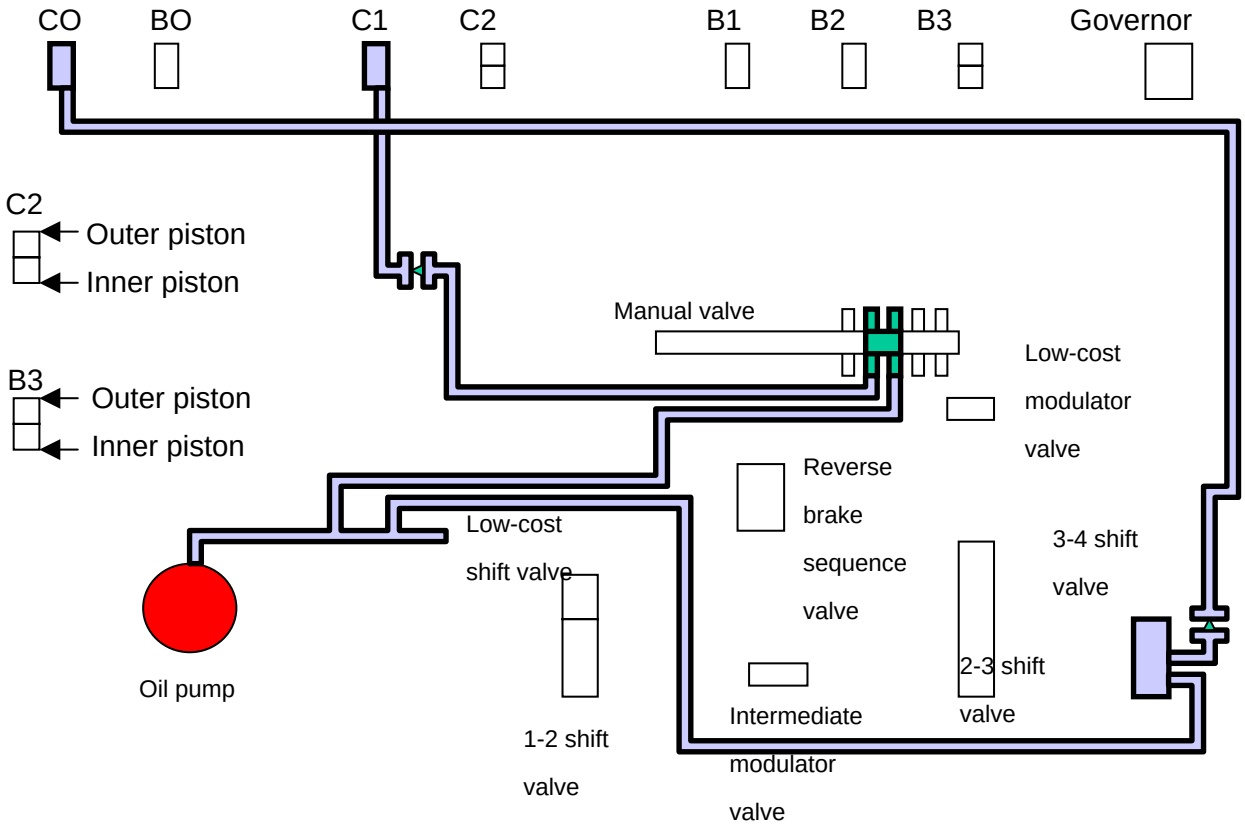
- Reverse Gear Fluid Flow



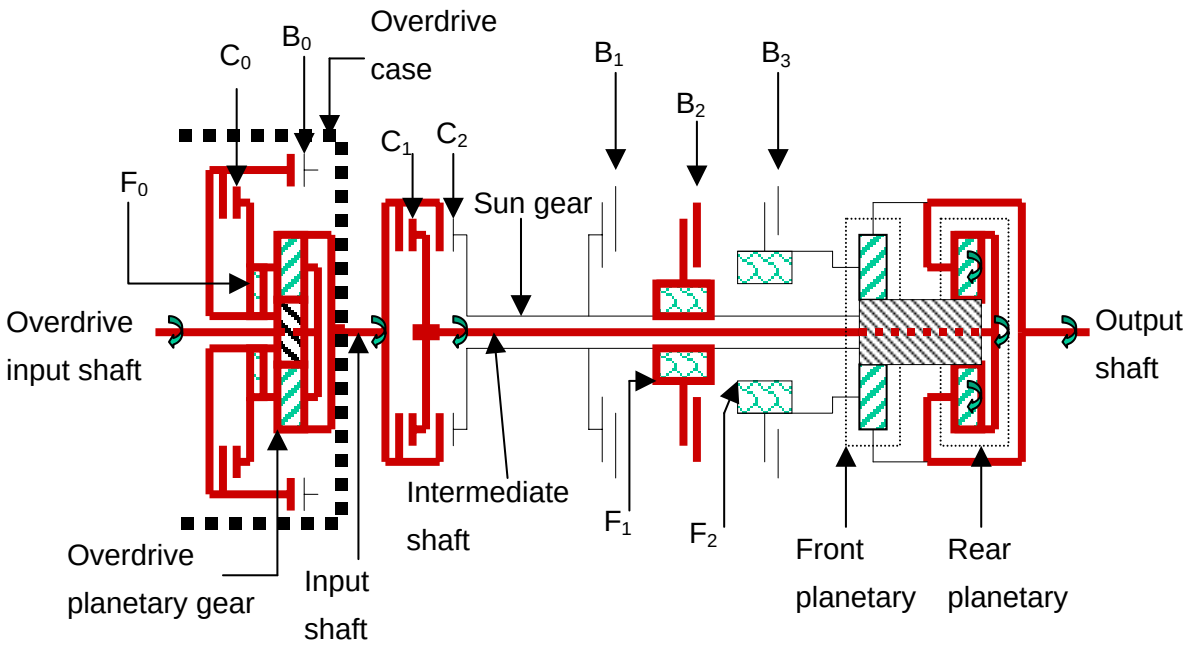
- 1st Gear



- 1st Gear Fluid Flow

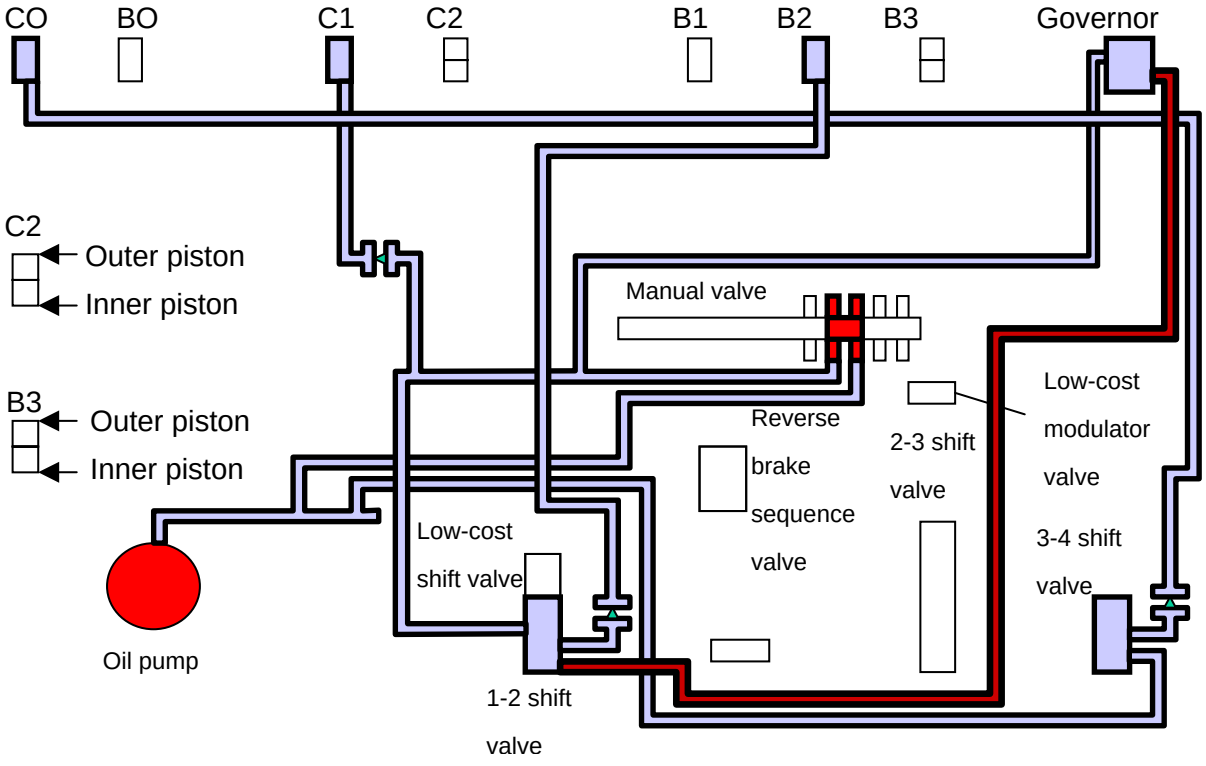


- 2nd Gear

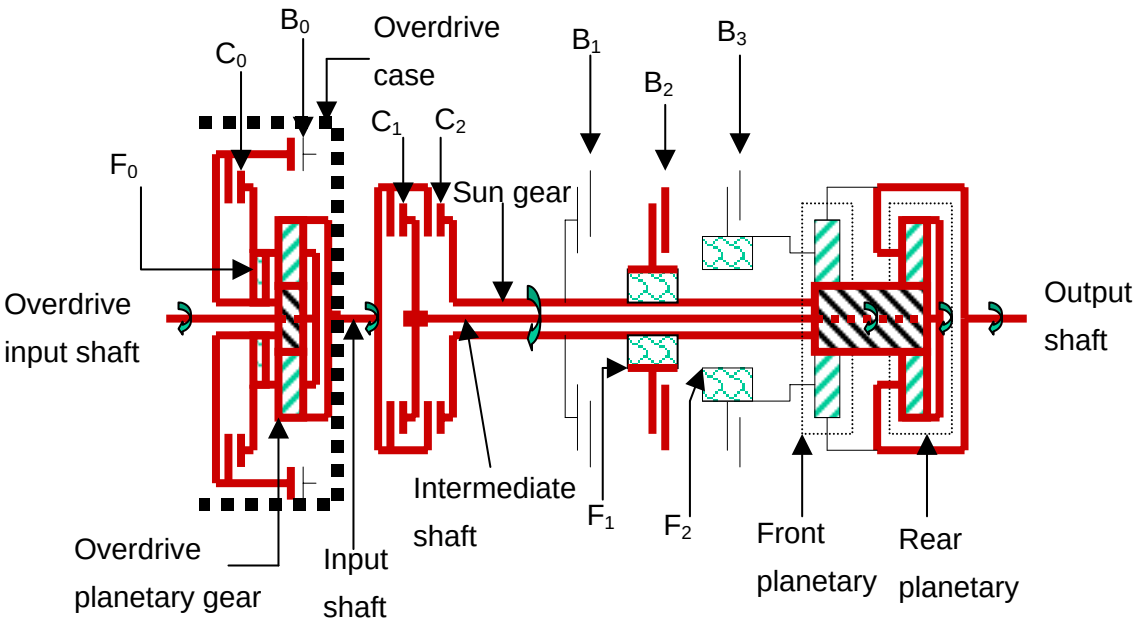


*B1 applies (when engine braking is applied at “2” range

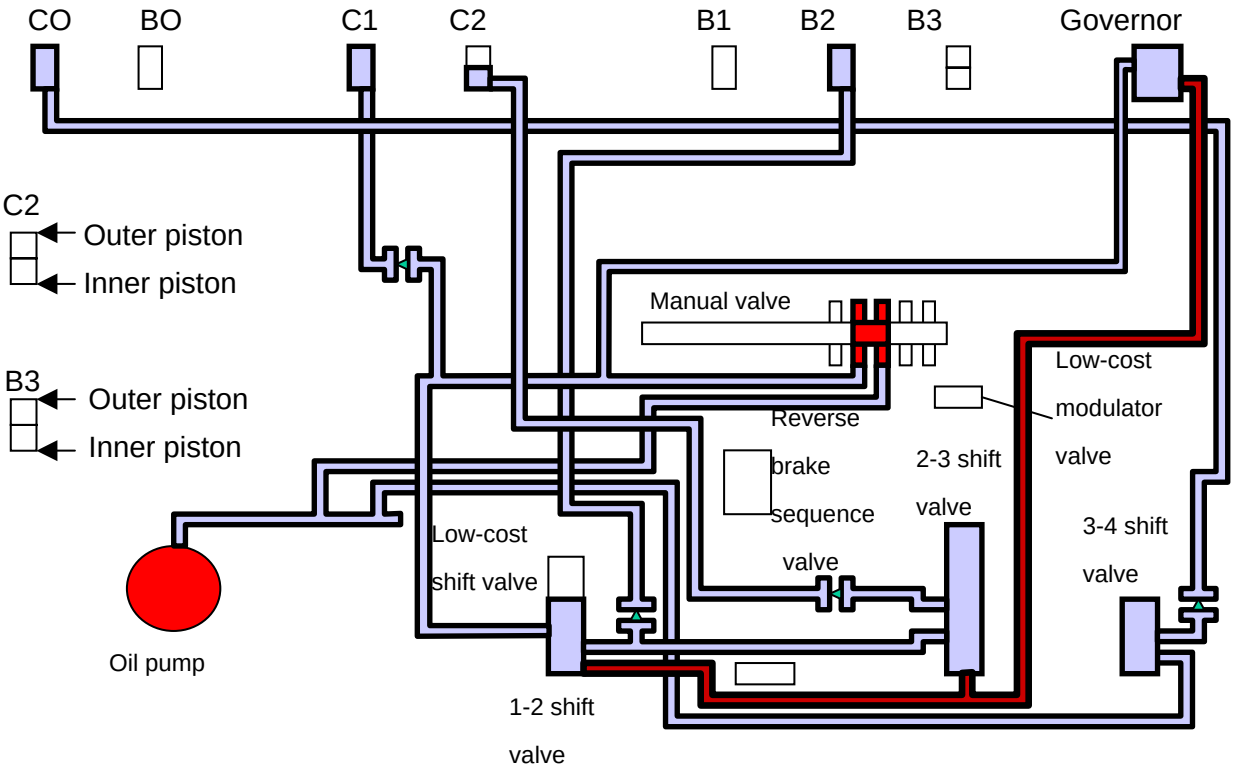
- 2nd Gear Fluid Flow



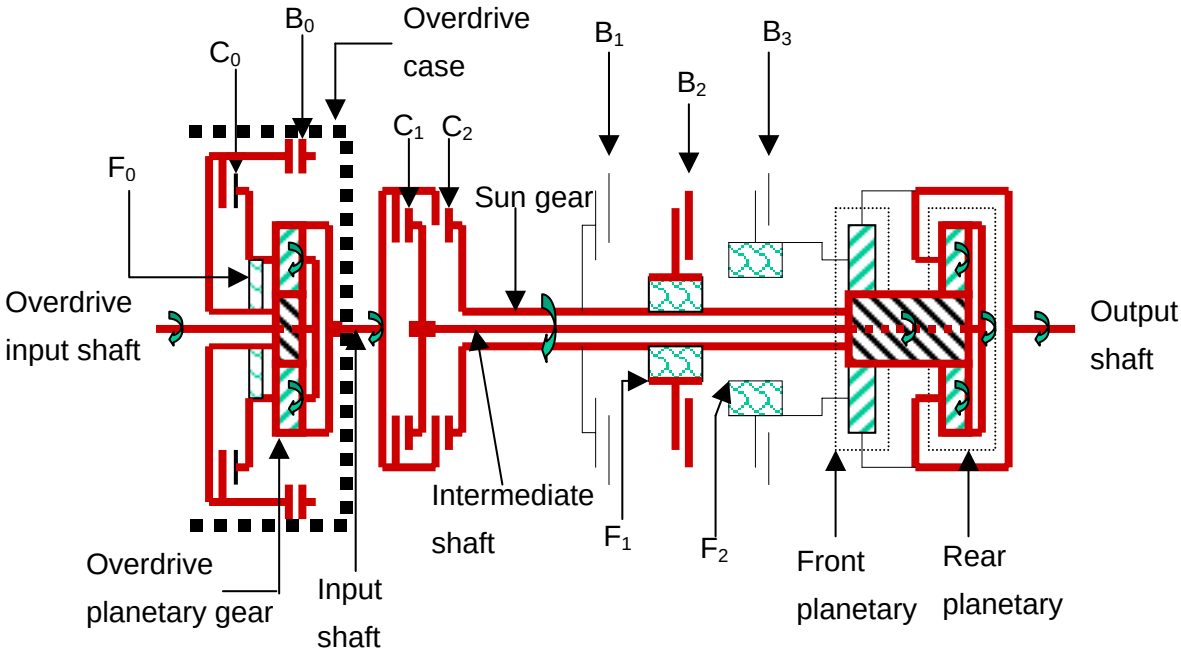
- 3rd Gear



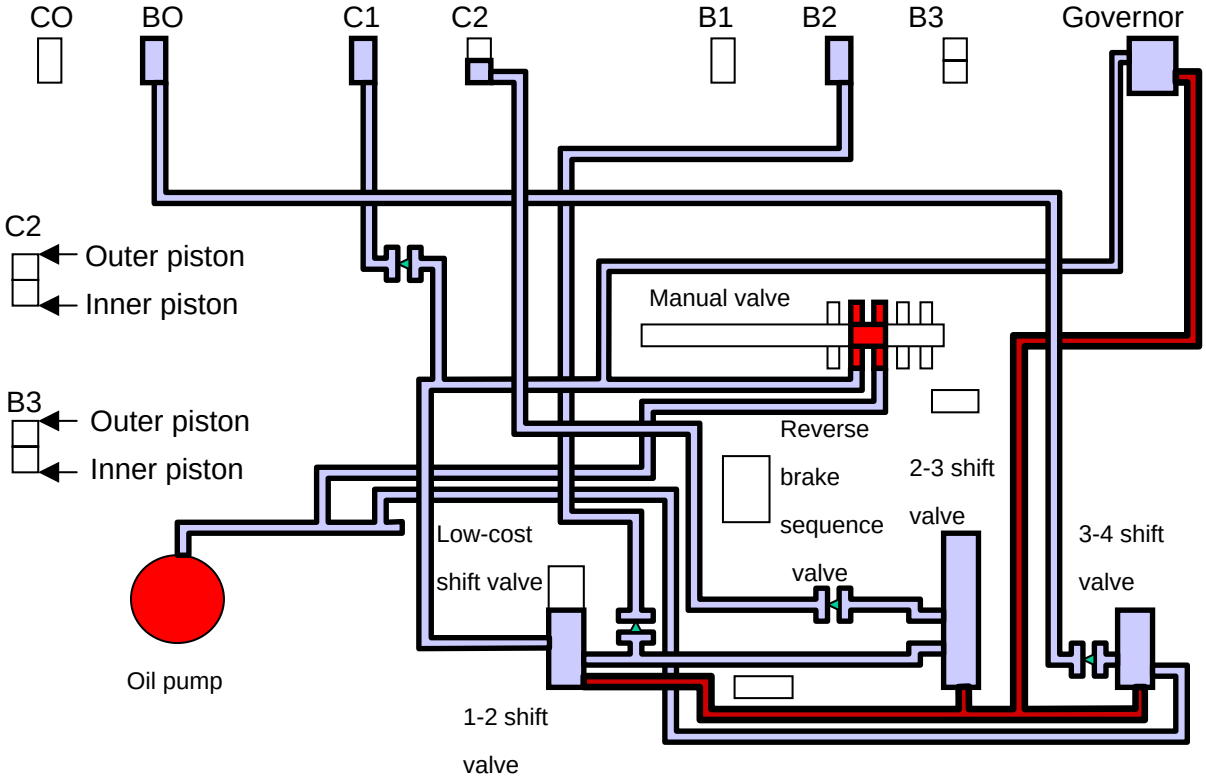
- 3rd Gear Fluid Flow



- OD(4th gear)

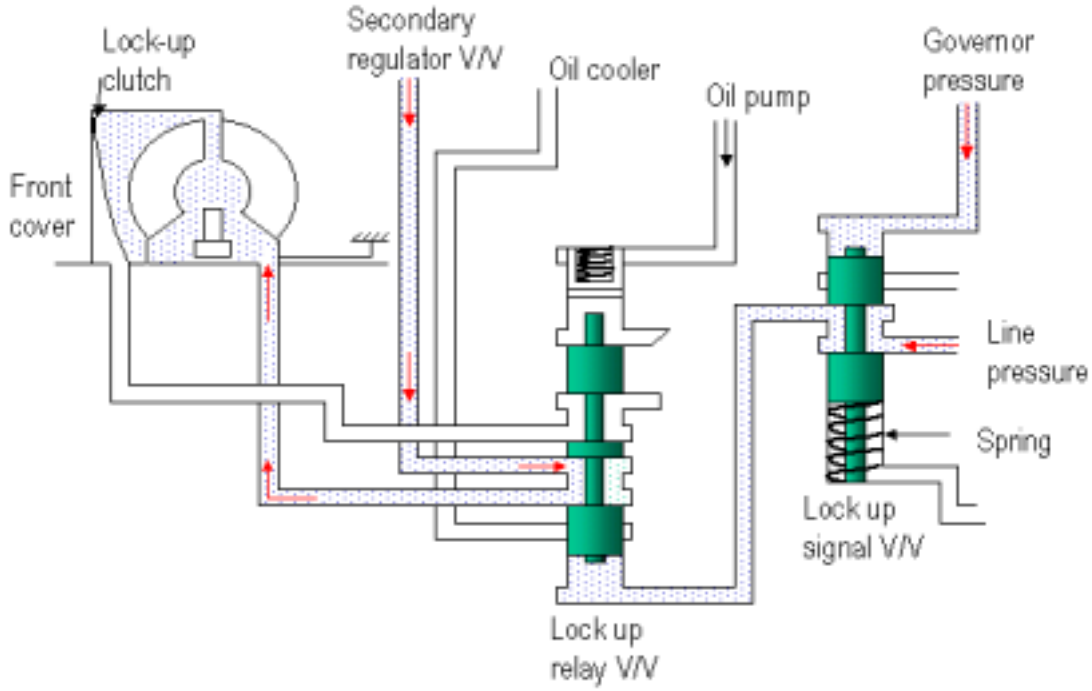


- OD(4th gear) Fluid Flow

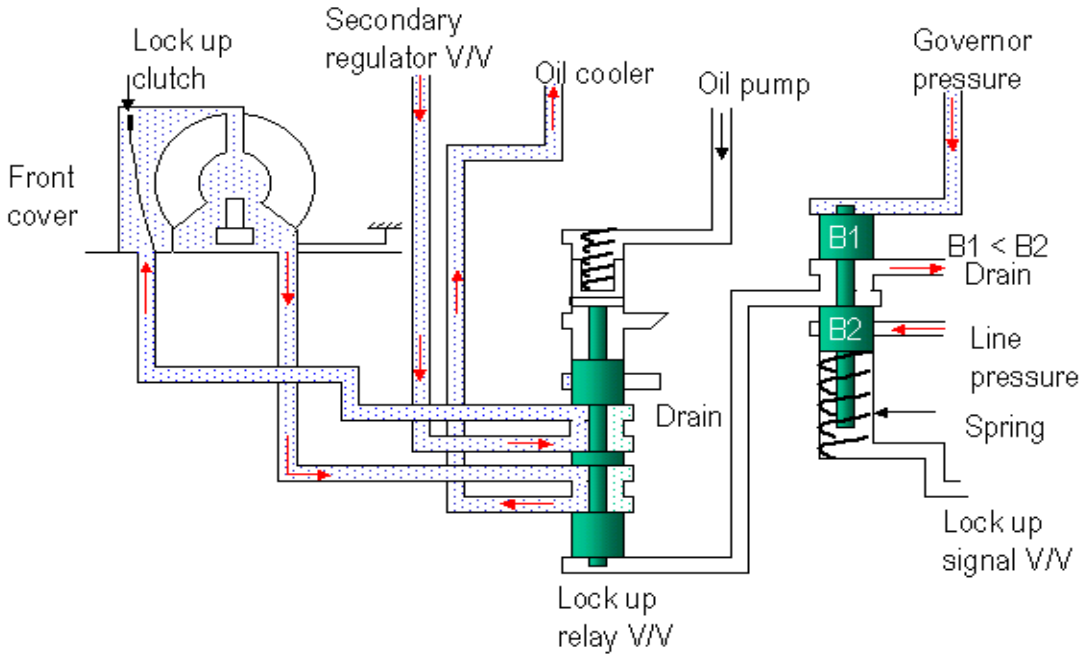


2.3.5. Lock-up clutch

- **Engaged**

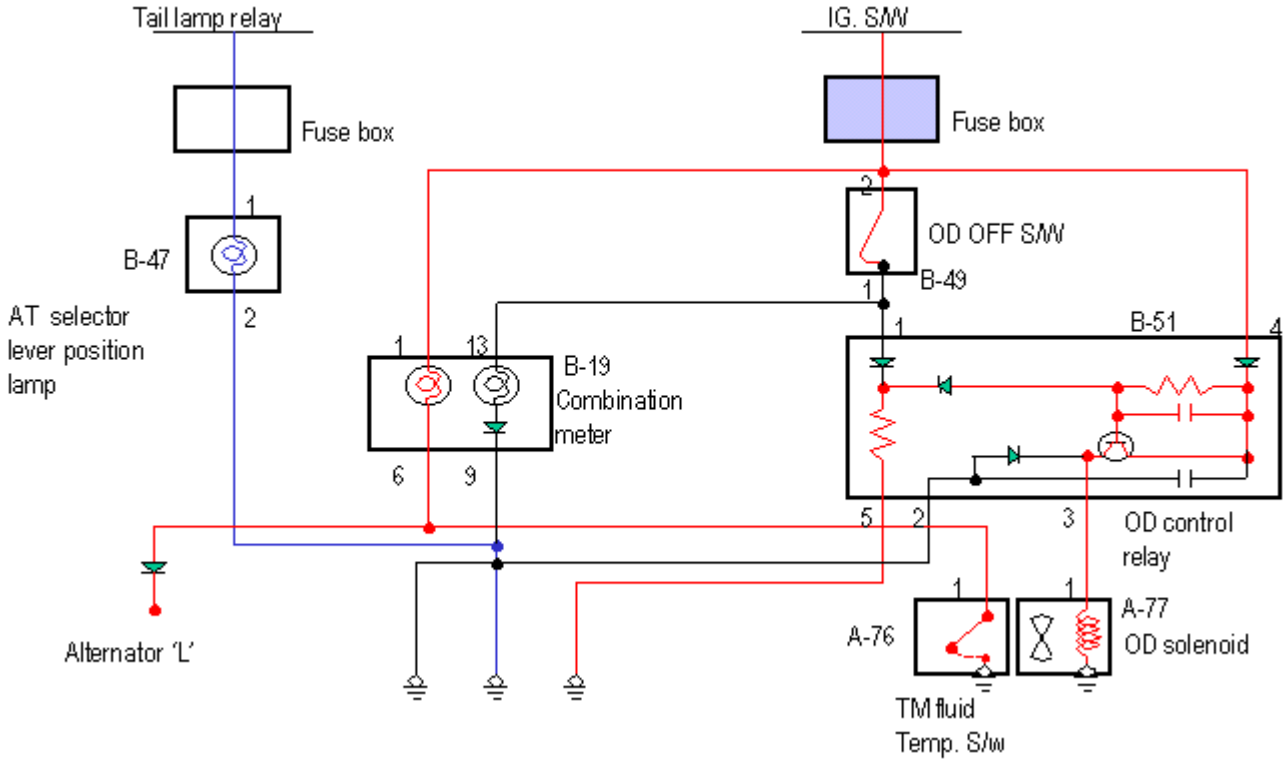


- **Disengaged**

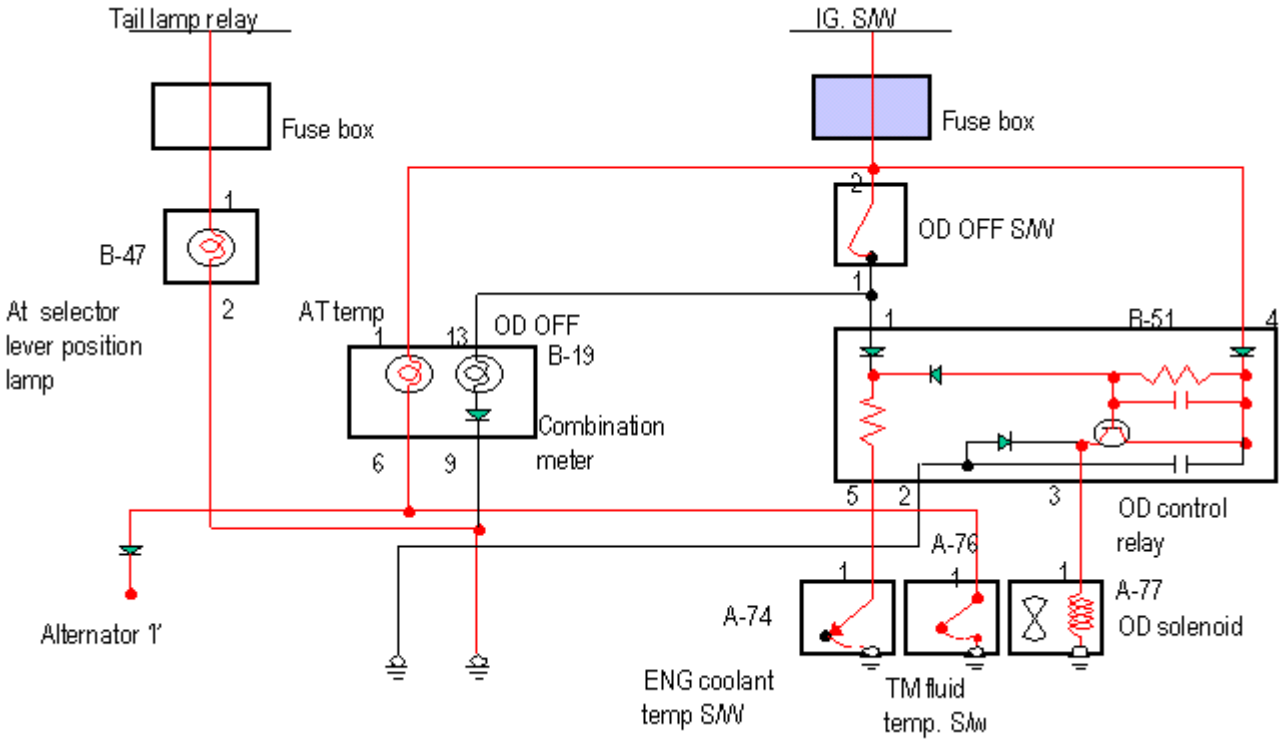


2.3.6. Over Drive Circuit Diagram

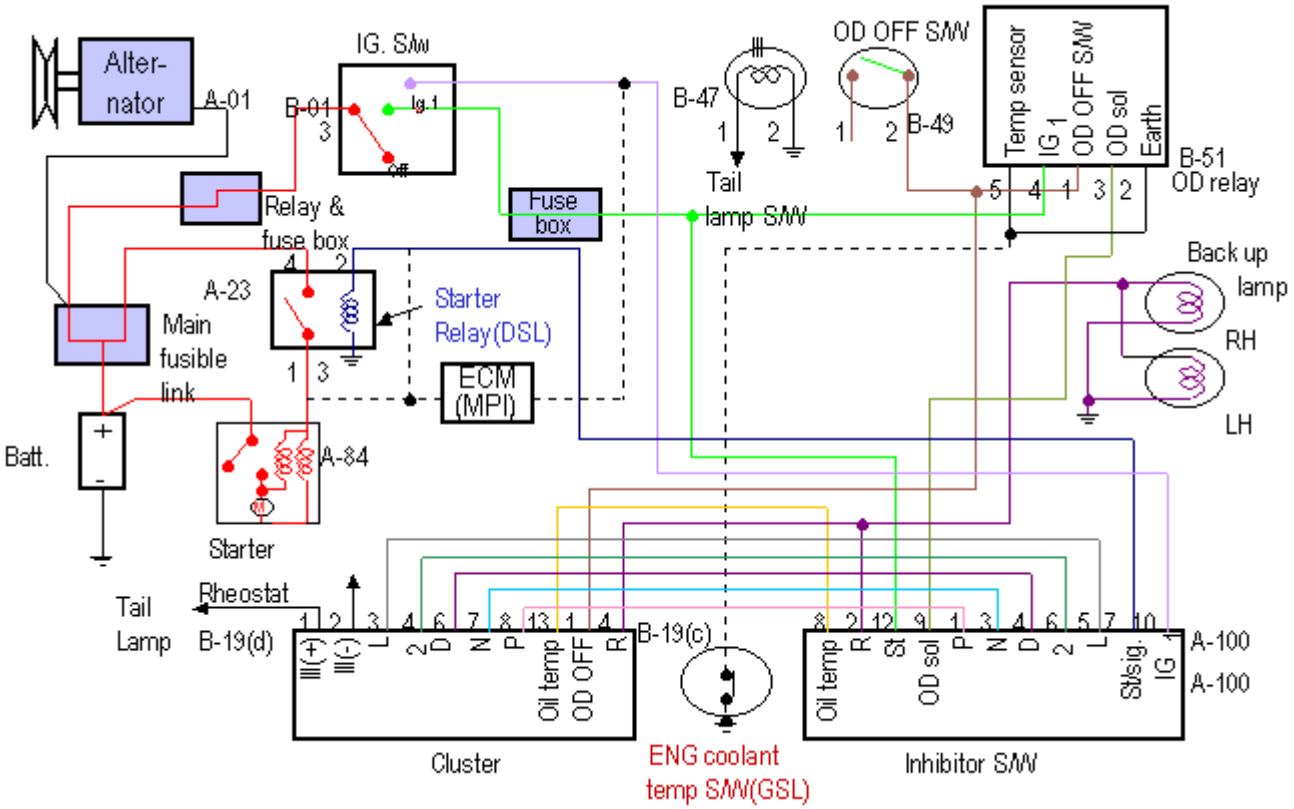
- Diesel



- Gasoline



2.3.7. Electrical Circuit Diagram (Galloper, Since 1997)



Memo

3. AW0372LE Model

3.1 Introduction

The "AW0372LE" automatic transmission is a 4-speed electronically controlled transmission with lock-up function. The "AW0372" is mainly composed of the torque with lock-up clutch; planetary gear set unit, the hydraulic control system and electronic control system. The electronic control system provides extremely precise control of the gearshift timing and lock-up timing in the response to driving conditions as sensed condition.

1) Progress of fuel consumption rate

The precision and flexibility of shifting point improved to control with a computer. And setting of shifting point that the best fuel consumption rate was always provided and expansion of the L-up operation area to low speed became possible to control with a computer, progress of fuel consumption rate came true.

2) Progress of shift quality

The computer always detects a engine condition and a driving condition with electricity signal, and controls a timing of shifting and L-up clutch operation with high precision. And reduction of shift shock came true because of computer adapted in a characteristic of engine torque.

3) Possibility of selection 3 driving mode

The driver can select the driving mode that best suits the existing driving condition by simply pushing the driving mode select switch.

4) Addition of self-diagnosis function

Because self-diagnosis function was added, the driver got possible to detect abnormality such as electronic part or electricity system simply, and service system improved.

3.1.1. The comparison of "AW03-72L" and "AW03-72LE"

	ECT	Oil pressure control
Vehicle Speed	Speed sensor	Governor valve produces oil pressure (Governor pressure), which was proportional to vehicle speed, and do it with vehicle speed signal.
Throttle Opening	TP sensor	Throttle valve produces oil pressure (Throttle pressure) which was proportional to throttle opening.
Shifting L-UP operation	TCM detects electricity signal of vehicle speed and throttle opening etc. And TCM decides in any gear and	Oil pressure signal of governor pressure and throttle pressure acts on each shift valve, and does shifting of 1st., 2nd, 3rd. and 4th. and

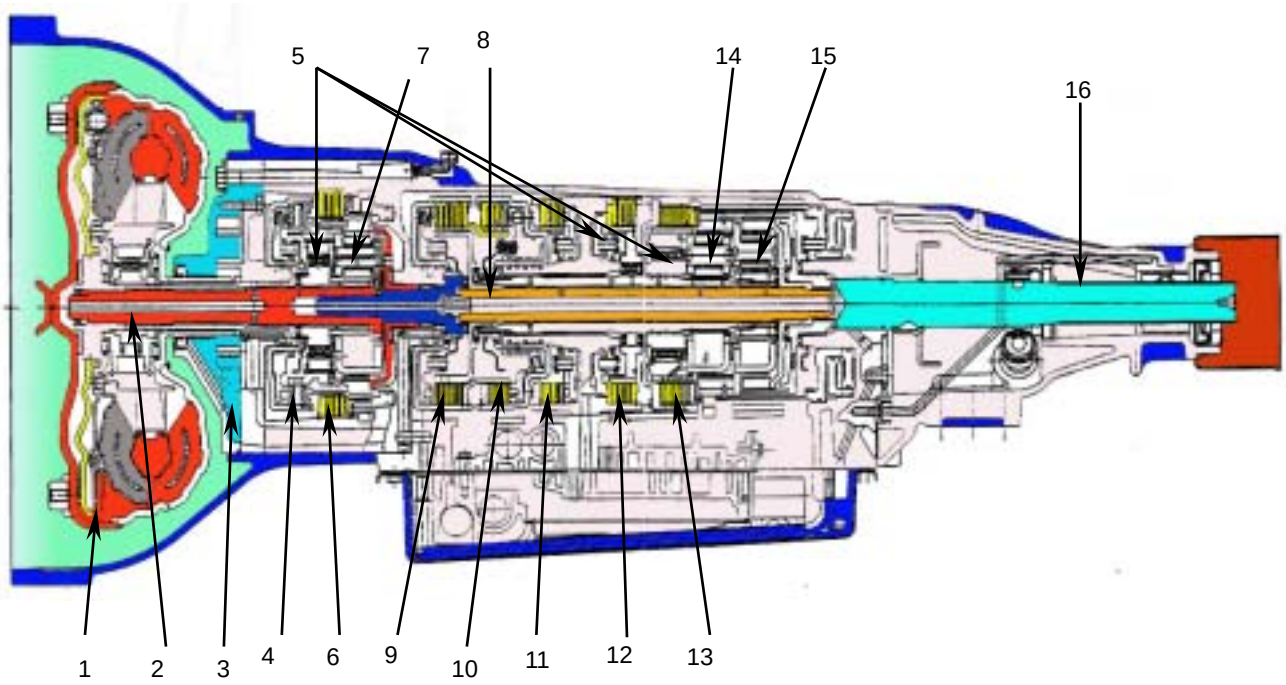
	when On/Off can point at L-UP on the basis of those signals, and sends electricity signal to SOL.-1/2 and L-UP SOL., so operates each shift valve and A/T does shifting and lock up operation.	the lock up operation by letting shift valve operate by both hydraulic big things and small things.

3.2 Application

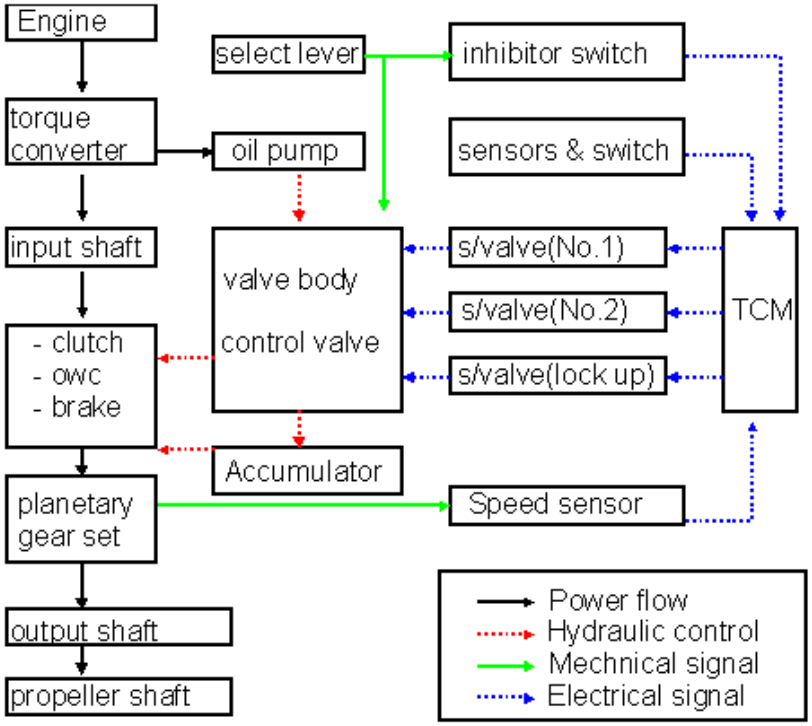
H-100 (Truck), H-1 (N/A, T/C)

3.3 Components

3.3.1. Structure



1. Torque converter
2. Overdrive input shaft
3. Oil pump
4. Overdrive direct clutch
5. One way clutch (O/D, No1, No2)
6. Overdrive brake
7. Overdrive planetary gear
8. Intermediate shaft
9. Forward clutch
10. Direct clutch
11. Second coast brake
12. Second brake
13. 1st & Reverse brake
14. Front planetary gear
15. Rear planetary gear
16. Output shaft



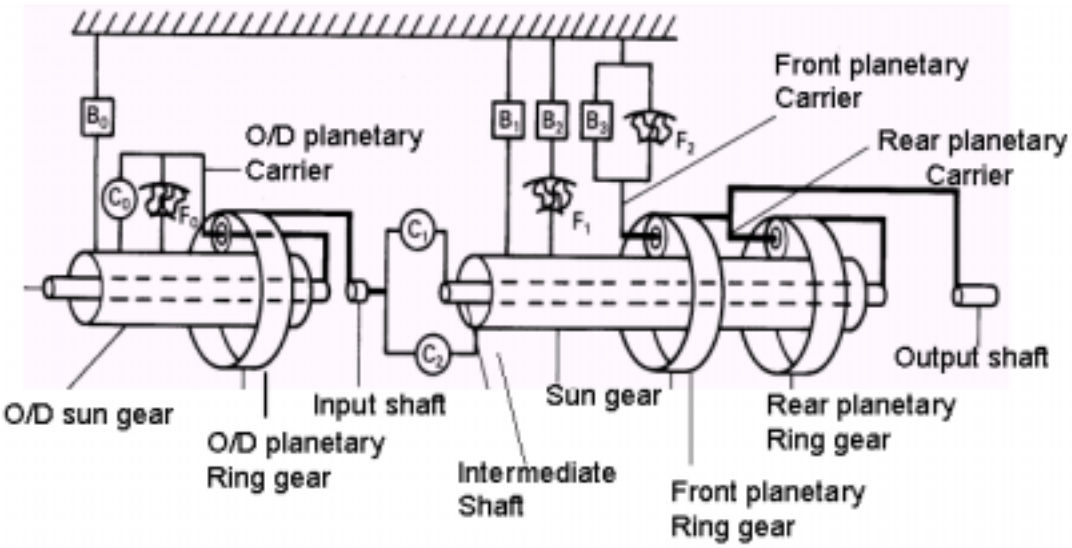
3.3.2. Specifications

Type Of Transmission		AW0372LE
Torque Converter	Type	3 Elements 1 Stage 2 Phases
	Stall Torque Ratio	2.1
Lock-Up Mechanism		Equipped
Gear Ratio	1st. Gear	2.826
	2nd. Gear	1.493
	3rd. Gear	1.000
	4th. Gear	0.730
	Reverse	2.703
	Final Gear	3.700

Number Of Drive Plates	Clutch	Overdrive Direct	2
		Forward	5
		Direct	3
	Brake	Overdrive	3
		Second Coast	2
		Second	3
		1st. & Reverse	4

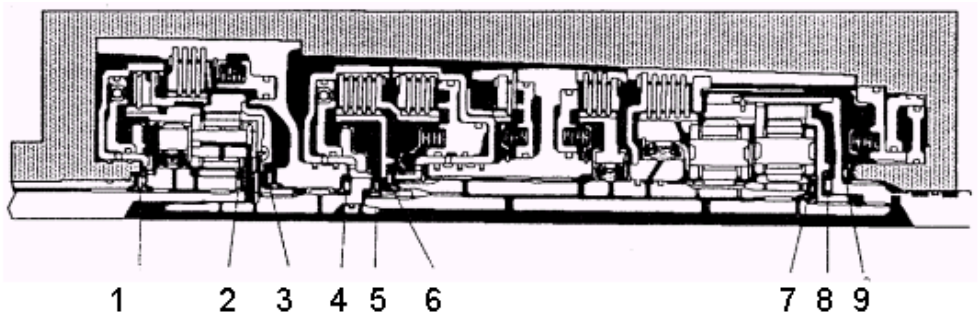
	One Way Clutch	Overdrive	20
		No.1	18
		No.2	26
Fluid	Type	Diamond ATF SP-II Or Autran MMSP-II	
	Capacity	7.0 Liter	

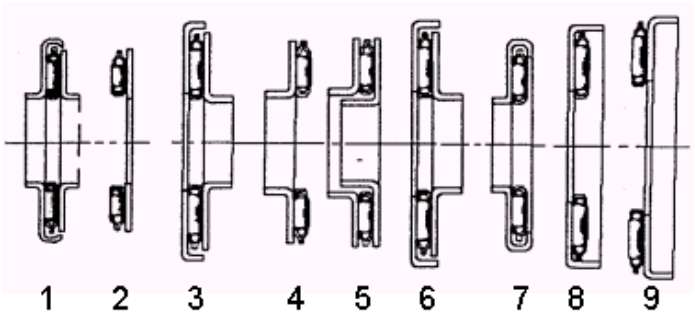
3.3.3. Operating Elements



1. Overdrive direct clutch
2. Overdrive brake
3. Forward clutch
4. Direct clutch
5. Second coast brake
6. Second brake
7. 1st.& Reverse brake
8. No. 1 One way clutch
9. No.2 One way clutch
10. Overdrive One way clutch
11. Overdrive input shaft
12. Forward One way clutch
13. Intermediate shaft

3.3.4. Thrust Bearing & Race





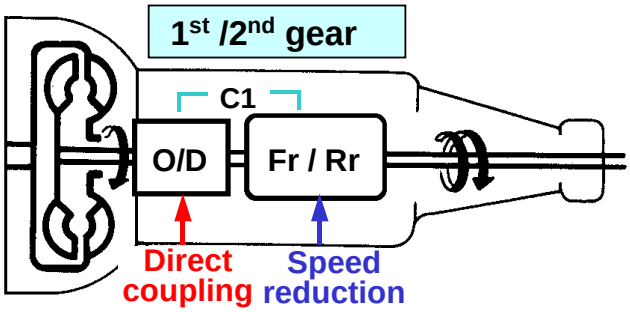
3.3.5. Operating chart for each gear

Range		C0	C1	C2		B0	B1	B2	B3		F0	F1	F2
				IP	OP				IP	OP			
P(parking)		O											
R(reverse)		O		O	O				O	O	O		
N(neutral)		O											
D	1st.	O	O								O		OX
	2nd.	O	O					O			O	OX	
	3rd.	O	O	O				O			O		
	O/D		O	O		O		O					
2	1st.	O	O								O		OX
	2nd.	O	O				O	O			O	O	
	3rd.	O	O	O				O			O		
L	1st.	O	O						O	O	O		O
	2nd.	O	O				O	O			O	O	

Lock-up solenoid valve "on"; operating at the "overdrive" range

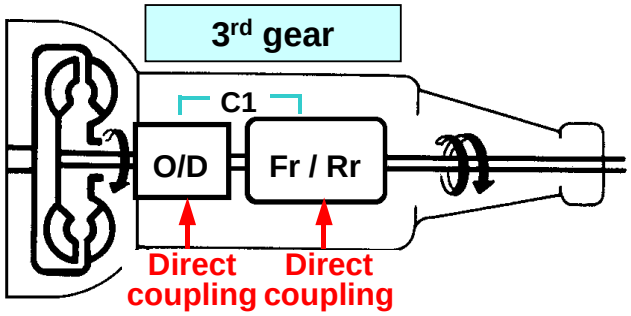
** OX ; O (Driving), X(Coast down)

- Principle of Each Range



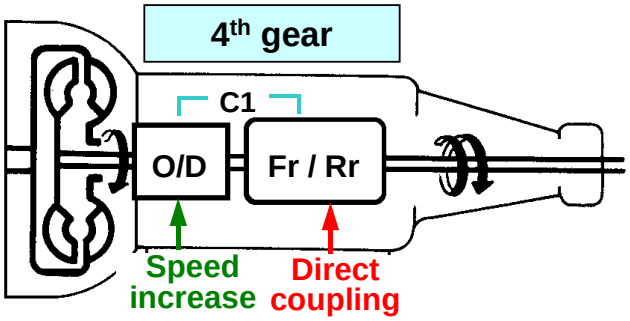
1. Power flow
OD input shaft →OD gear set(coupling by C0) →Fr/Rr (speed reduction by F2(1st gear), by B2&F1(2nd gear))

2. Engine brake
- D range 1st,2nd gear: non(F2,F1 free to clockwise)
- 2 range: 1st gear(non), 2nd gear(operated by B1)
- L range 1st,2nd gear: operated by B1, B3



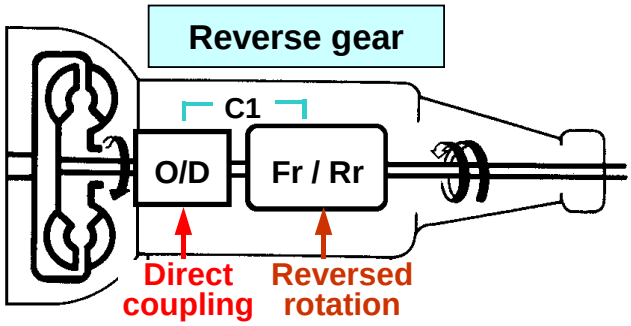
1. Power flow
OD input shaft → OD gear set(coupling by C0) →Fr/Rr (coupling by C1 & C2)

2. Engine brake
- D & 2 range: operates



1. Power flow
OD input shaft → OD gear set (speed increase by B0) → Fr/Rr (coupling by C1&C2)

2. Engine brake
- D range: operates



1. Power flow
OD input shaft → OD gear set (coupling by C0) → Fr/Rr (reverse rotation by B3)

2. Reverse inhibition control: C2

3.3.6. Function of components

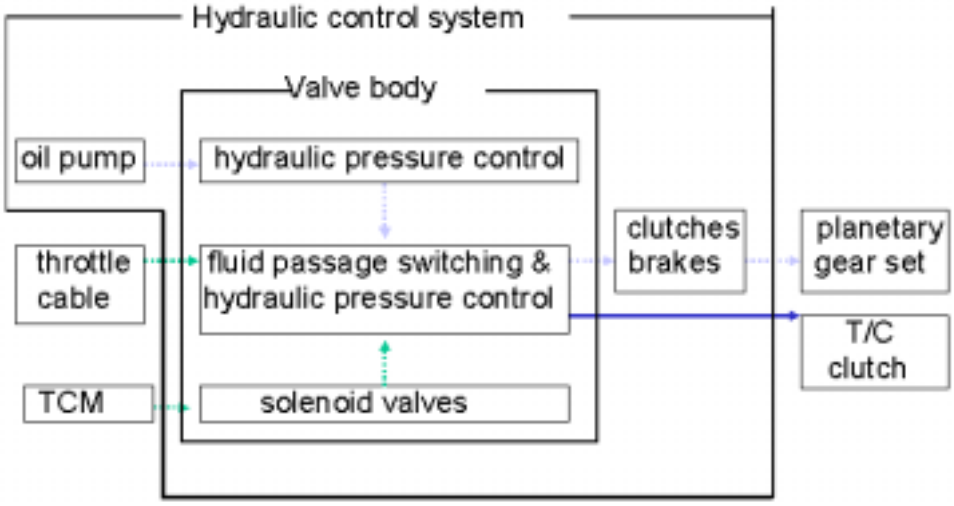
Clutch	C0	Connects overdrive sun gear and overdrive planetary carrier
	C1	Connects input shaft and front planetary ring gear
	C2	Connects input shaft and front & rear planetary sun gear
Brake	B0	Prevents overdrive sun gear from turning either clockwise or counterclockwise
	B1	Prevents front & rear planetary sun gear from turning either clockwise or counterclockwise
	B2	Prevents outer race of F1 from turning either clockwise or counterclockwise thus

		preventing the front & rear planetary sun gear from turning counterclockwise
	B3	Prevents rear planetary carrier from turning either clockwise or counterclockwise.
OWC	F0	When the transmission is being driven by the engine, this clutch connects the overdrive sun gear and overdrive planetary carrier.
	F1	When B2 is operating, this clutch prevents the front & rear planetary sun gear from turning counterclockwise
	F2	Prevents rear planetary carrier from turning counterclockwise.

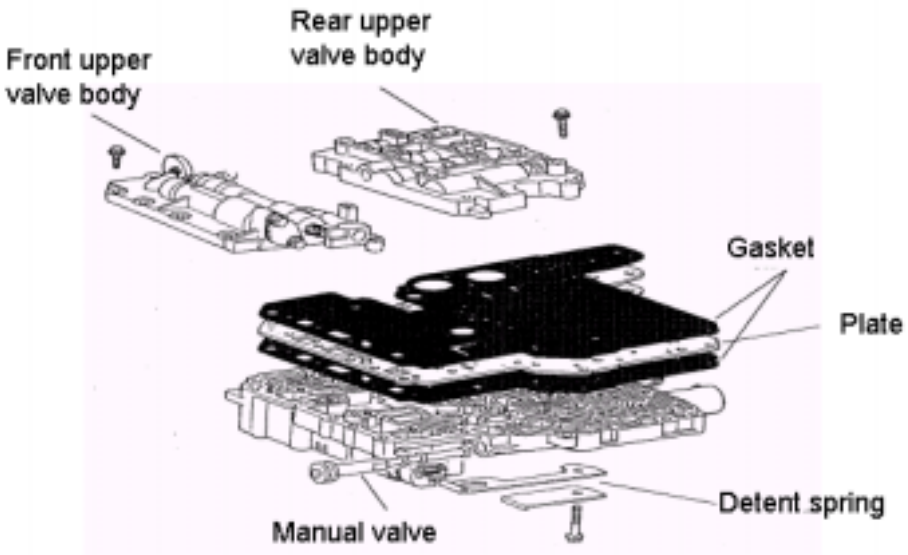
3.4 Hydraulic Control System

3.4.1. General

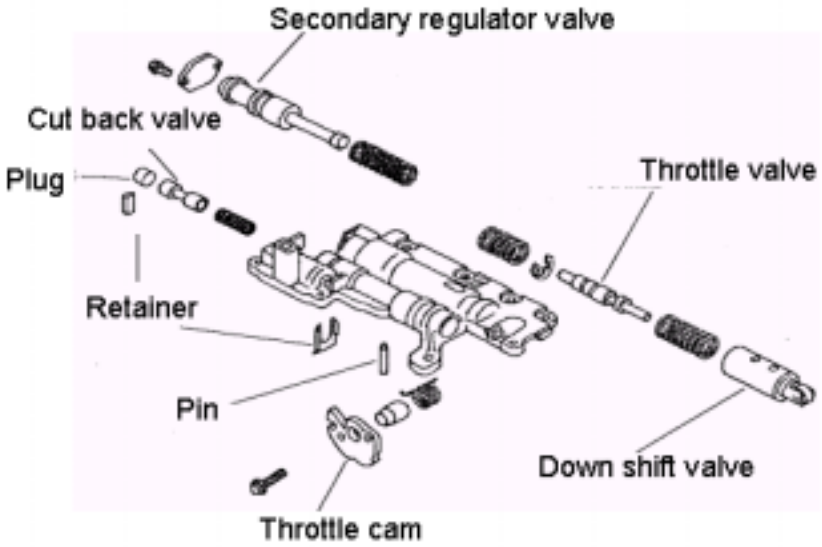
The hydraulic control system is composed of the oil pump, the valve body, the solenoid valves, the accumulators, the clutches and brakes as well as the fluid passages, which connect all of these components. Based on the hydraulic pressure created by the oil pump, the hydraulic control system governs the hydraulic pressure acting on the torque converter clutch, clutches and brakes in accordance with the vehicle driving conditions. There are 3 solenoid valves on the valve body. The NO.1 And NO.2 solenoid valves are tuned on and off by signals from the TCM to operate the shift valves, and change the gear shift position. The NO.3 solenoid valve is operated by signals from the TCM to engage or disengage the lock-up clutch of the torque converter clutch.



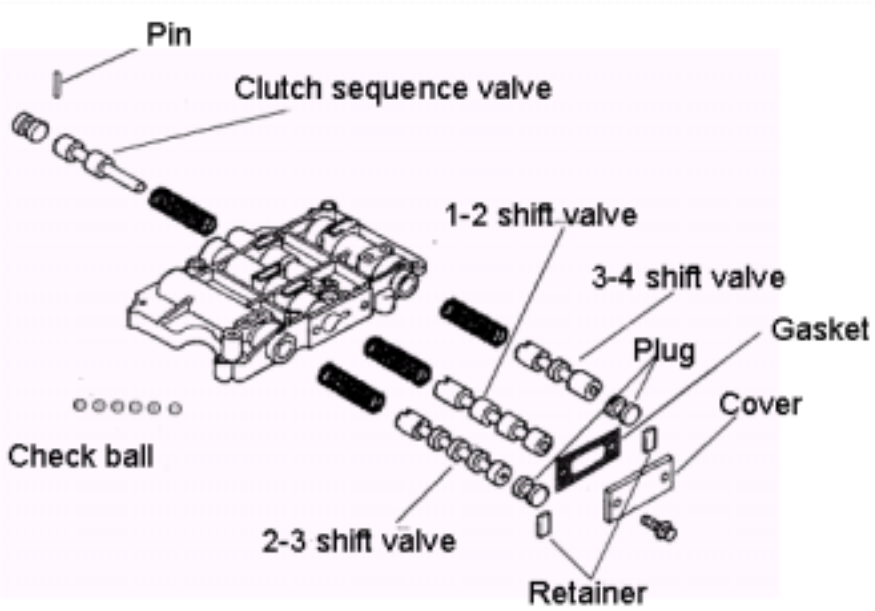
3.4.2. Valve Body



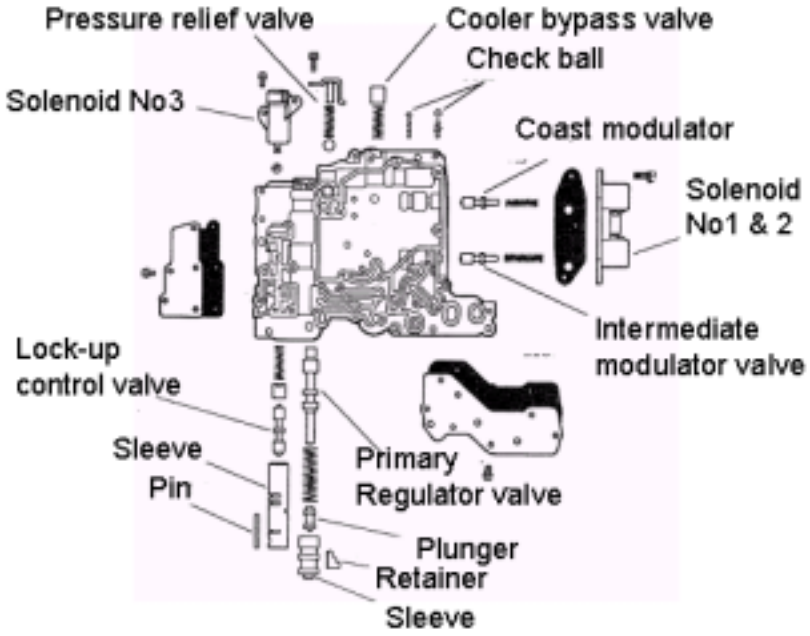
- Front Upper Valve Body



- Front Rear Valve Body



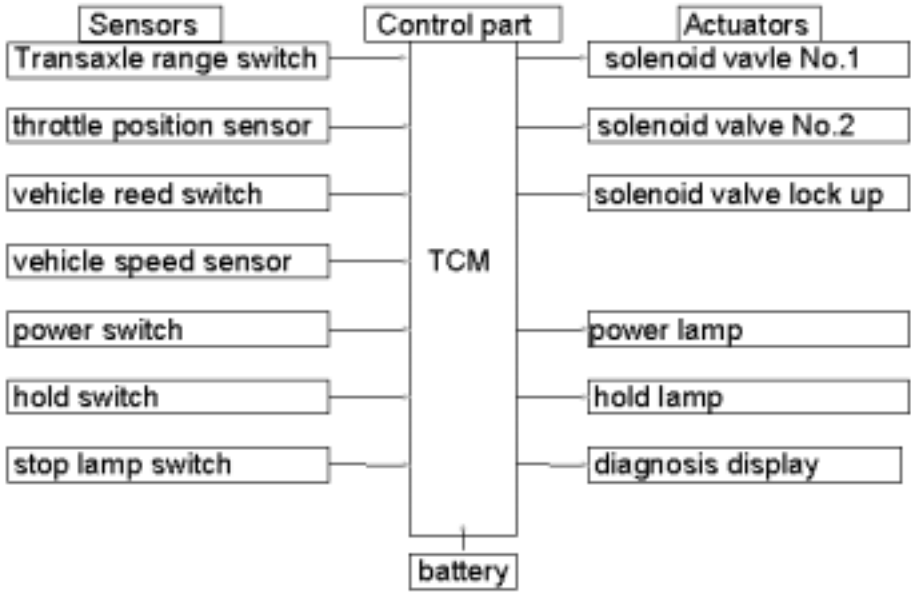
- Lower Valve Body



3.5 Electronic Control System

3.5.1. General

The electronic control system for the 03-72LE automatic transmission provides extremely precise control of the gearshift timing and lock up timing in response to driving conditions as sensed condition. At the same time, the TCM reduces vehicle squat when the vehicle starts out and gear shift shock. The electronic control system is also equipped with a self-diagnosis system which diagnosis malfunctions for the vehicle to continue functioning when a malfunction occurs. The electronic control system can be broadly divided into three groups; the sensors, TCM, actuators.



3.5.2. Shift control

Getting a signal from each sensor, TCM determines the target gear and activates solenoid valve No.1 and/or No.2.

Range			Gear	S/valve No.1	S/valve No.2	Remarks
P, R, N			-	ON	OFF	
D	2	L	1st.	ON	OFF	
			2nd.	ON	ON	
			3rd.	OFF	ON	
			O/D	OFF	OFF	

3.5.3. Lock-up control

From sensor input signals, the TCM determines whether to turn the lock up ON and OFF.

The lock up clutch does not operate in the conditions below.

1) Brake switch ON
2) Idle RPM
3) Transmission range switch; 1st, 2nd, or 3rd.
4) Engine water temperature S/W *On*

3.5.4. O/D cut control

The area that does not shift to 4th. gear

1) Engine water temperature S/W ON.

3.5.5. Drive mode selection control

This control is possible to change shift pattern by the situation or driving purpose of a road, and selects 3 kinds modes of Normal, Power, Hold by power-hold switch. Each has shift pattern L-up pattern of independence. : (Priority: 1. Hold - 2. Power - 3.Normal)

- Normal mode

This mode is usual driving mode, and shifting point and the L-up operation point is established a little by the low speed side, so do engine revolution a little low. When drivers wants to do better economic driving, they use.

- Power mode

This mode is powerful driving and mountains conditions, shifting point and the L-up operation point is established a little by the high speed side, so do engine revolution a little high.

- Hold mode

This control fixes a gear and it is hard to gear, and do a run near by manual transmission. And this control uses for departure on the road surface that is easy to slide.

- Drive mode of each vehicle

	Normal	Power	Hold	Remarks
D Range	1⇔2⇔3⇔4(L)		2⇔3←4	
2 Range	1⇔2⇔3			
L Range	1⇔2			A1(2.6Diesel.), AU(2.6Diesel.,2.4LPG)
	1←2←3			A1 (2.4 LPG & GAS), AU (2.5 Diesel), AH (2.6 Diesel)

⇔ : Shift up & down, ←: shift down, (L): L-up operation

3.5.6. Kick down mode control

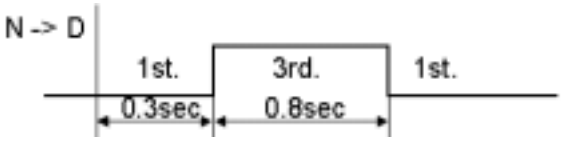
This control is to do KICK-DOWN when throttle opening is more than 93%.

3.5.7. Squat control (**Except AU)

When the shift lever is shifted from “N” to “D”, the Squat Control operation that temporarily shifts to 3rd. gear to reduce shift shock and squat vehicle.

< Condition >

- Vehicle speed * 7Km/h
- Throttle opening = 0%
- Inhibitor S/W is not in N, 2 & L.
- Water temperature S/W Off
- Brake S/W *Off*

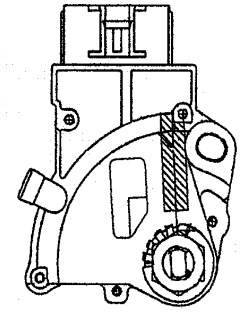


3.5.8. Sensors & Actuators

- Neutral start switch

Neutral start switch communicates the information that which range includes shift lever of A\T to TCM by combination of a terminal.

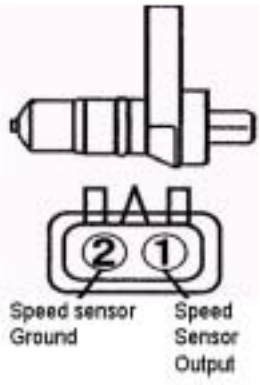
	Starter		Position						
Range	B	N	C	P	R	N	D	2	L
P	○	○	○	○					
R			○		○				
N	○	○	○			○			
D			○				○		
2			○					○	
L			○						○
Polarity	+	-	+	-	-	-	-	-	-



- Speed sensor

Speed sensor detects a turn number of magnet of rotor sensor installed in output shaft, and communicates to TCM as a signal.

Resistance: 560 680w (20℃)



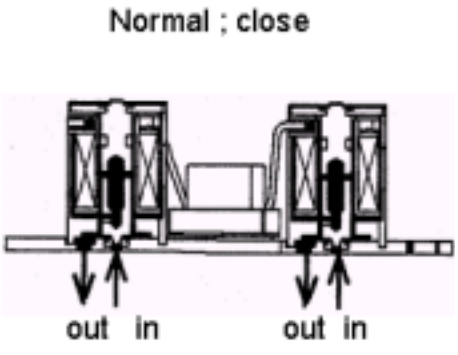
- Speedometer driven gear

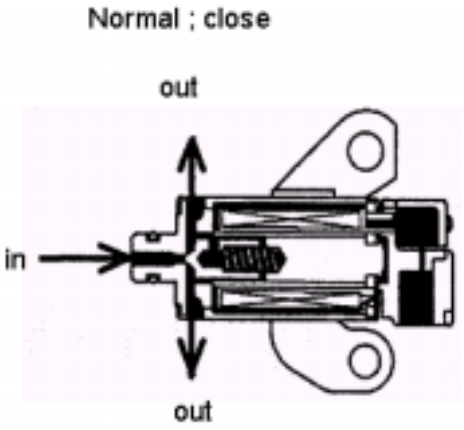
When output shaft (drive gear) rotates once time, driven gear rotates 6\20 (different by model of a car), and speedometer driven gear communicates the signal to TCM as assistance speed sensor signal

- Shift solenoid valve 1 and 2

Shift solenoid No.1 & 2 is united with each, and it is installed valve body of A/T directly. And shift solenoid No.1 & 2 does the operation of ON/OFF by the control signal from TCM, and changes a position of shift valve by combination with shift solenoid No.1 & 2, and changes gear

Resistance: 11 15Ω(20℃)



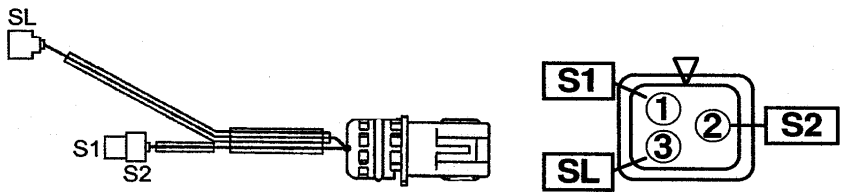


- Lock up solenoid valve

L/up solenoid does the operation of ON \ OFF of L-UP clutch inside T\C by the control signal from TCM. (When L-UP SOLENOID is on, L-UP clutch operates.) Resistance: 11 15Ω(20℃)

- Wire to solenoid

Wire to solenoid puts wining of shift solenoid. No.1 & 2 and l-up solenoid together in one connector, and it is installed to a\t case.



- Control Circuit

O/DS/W	Type I	Type II
With O/D S/W	- A1 (2.6 Diesel, 03A350)* - AH (2.6 Diesel, 03A420)	- A1 (2.4 Gasoline, 03A360) - AH (2.4 LPG, 03A430)
Without O/D S/W	- AU (2.5 Diesel, 03A291) - AU (2.6 Diesel, 034A420)	- AU (2.4 LPG, 03A410)

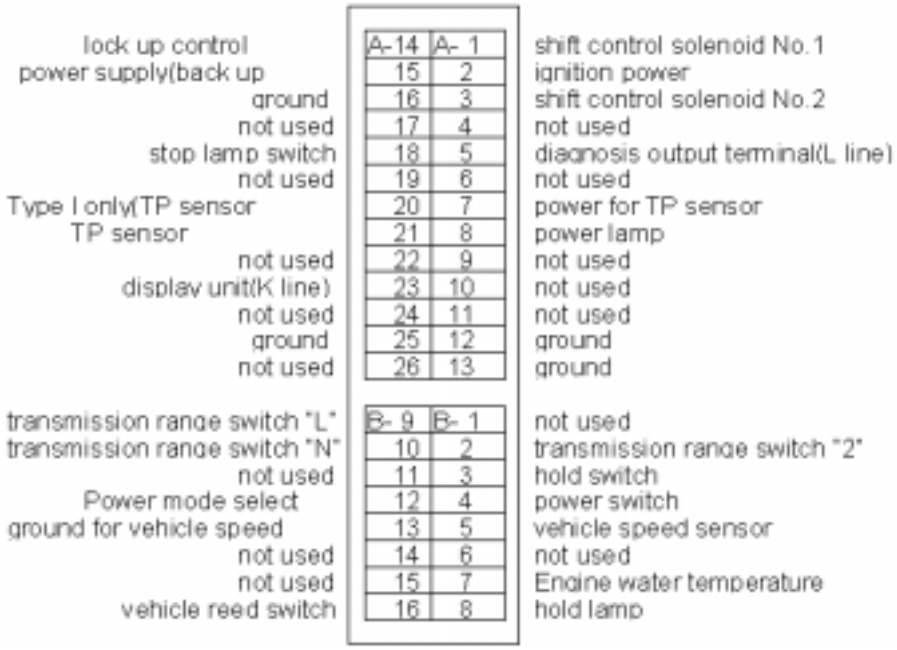
* Notation (Engine Type, TCM ID.)

Difference between Type I and Type II: Ground of TP Sensor

Type I: Sensor ground itself

Type II: TCM control

3.5.9. TCM Terminals



3.5.10. Output value from TCM

Terminal	Check item	Check condition	Normal condition
A - 1	Solenoid valve No.1	“On”	Battery voltage
		“Off”	0V
A - 2	Ignition power	Ignition switch “on”	Battery voltage
A - 3	Solenoid valve No.2	“On”	Battery voltage
		“Off”	0V
A - 5	Diagnosis output	When normal	0 → 5V flashing
A - 7	Power for TP sensor		5V
A - 8	Power lamp (RAM)	Power mode	1.5V or more less
		Out of power mode	Battery voltage
A -12	Ground	Engine: idling	0V
A -13	Ground	Engine: idling	0V
A -14	Lock up solenoid	“On”	Battery voltage
	Valve	“Off”	0V

A -15	Power supply	At all times	Battery voltage
A -16	Ground	Engine: idling	0V
A -18	Stop lamp switch	Brake pedal depressed	Battery voltage
		Brake pedal released	0V
A -20	TP Sensor ground (*Diesel only)		0V
A -21	Throttle position sensor signal	Accelerator closed fully	0.15 - 0.65V
		Accelerator open fully	3.2 - 3.7V
A -23	Display unit (K-Line)	-	-
A -25	Ground	Engine: idling	0V
B - 2	Transmission range switch “2”	2 range	Battery voltage
		Out of 2 range	0V
B - 3	Hold switch	Hold mode	Battery voltage
		Out of hole mode	1V or more less
B - 4	Power switch	Power mode	Battery voltage
		Out of power mode	1V or more less
B - 5	Vehicle speed sensor	Slowly moving forward	0 → 5V flashing
B - 8	Hold lamp	Hold mode	1.5V or more less
		Out of hold mode	Battery voltage
B - 9	Transmission range switch “L”	L range	Battery voltage
		Out of L range	0V
B -10	Transmission range switch “N”	N range	Battery voltage
		Out of N range	0V
B -13	Ground of VSS	Slowly moving forward	0 → 5V flashing
B -16	Vehicle speed sensor	Slowly moving forward	0 → 5V flashing

3.5.11. Diagnosis

Transmission control system malfunction; *Hold lamp* blinks

- Flash code output

1. Executing condition
   1) IG. *ON*
   2) Vehicle speed * 2Km/h
   3) Diagnostic tester not connected
   4) *L* line is grounded for more than 2 seconds.
2. Output format and Timing
   1) ROM ID. Output format at no trouble code
      Start signal --- ROM ID Output (2times) --- End signal
   2) DTC Output format at the trouble code
      Start signal --- ROM ID Output (2times) --- 4 digits of DTC (Consecutively)

- Diagnostic trouble code

Code No.	Description	Fail safe control (Hold lamp flashing)
P0500	Speed sensor (speed meter)	X
P0720	Speed sensor (T/M)	O
P0740	L-up solenoid SL.	O
P0750	Shift solenoid S1	O
P0755	Shift solenoid S2	O
P1701	Throttle position sensor	O

3.5.12. Fail-safe control

- DTC 0720 (No signal from speed sensor (Pulse generator))

< Control > Change ‘speed signal’ to ‘speedometer signal’

< Cancellation > IG. Off, On

< Note > “1st gear” in the D, 2 range & “2nd. Gear” in the L when a signal doesn’t come from both “Speed sensor” and “Speedometer sensor”

- DTC 0740 (Open or short L-up solenoid)

< Control > No lock-up

< Cancellation > IG. Off * On Normal condition

- DTC 0750/0755 (Open or short solenoid No.1 & 2)

When either of solenoid No. 1& 2 is not good, TCM controls normal solenoid, as for A/T, manual shift is possible. When neither of solenoid No. 1& 2 is not good, TCM does not control the shifting,

as for shifting, only manual shift is possible.

< Cancellation > IG. Off * On Normal condition

< Control >

Range		Normal		S1 Short, open		S2 Short, open		S1, S2 Short, open	
		S1	S2	Gear	S2	Gear	S1	Gear	S1, S2
D	1st.	O	X	4th.→3rd.	X → O	1st.	O	4th.	No control
	2nd.	O	O	3rd	O	1st.→4th	O → X	4th.	No control
	3rd.	X	O	3rd.	O	4th.	X	4th.	No control
	4th.	X	X	4th.	X	4th.	X	4th.	No control
2	1st.	O	X	3rd	X → O	1st.	O	3rd	No control
	2nd.	O	O	3rd.	O	1st.→3rd	O → X	3rd.	No control
	3rd.	X	O	3rd	O	3rd	X	3rd	No control
L	1st.	O	X	3rd.	X	1st.	O	3rd.	No control
	2nd.	O	O	3rd	O	1st.	O	3rd	No control

→ : Fail safe operation

- DTC 1701 (Open or short throttle position sensor)

< Control > Fixed throttle opening = 0%

< Cancellation > Normal condition

- Erase method: Battery terminal open during above 10 sec.

3.5.13. Oil Condition & Check

- Park the vehicle on the lever area.
- Check the oil lever at proper oil temperature.
- Move the shift lever slowly from "P" to "L" range and return it to "P" range at idle condition.
- Pull the lever gauge out, wipe off the oil with clean cloth and reinsert. Pull it out again and check if the oil lever is within "Hot" area.
- If out of lever, be sure to adjust again.

4. AW30-43LE Model

4.1 Introduction

"AW30-43LE" model has a lock-up mechanism inside of torque converter and this transaxle is controlled by electronic control module. It consists of lock-up built in torque converter, 4th gear planetary gear set, hydraulic pressure control and electronic control devices. TCM controls the each clutches and brakes according to the basic shift pattern. Line pressure is controlled mechanically (throttle cable and valve).

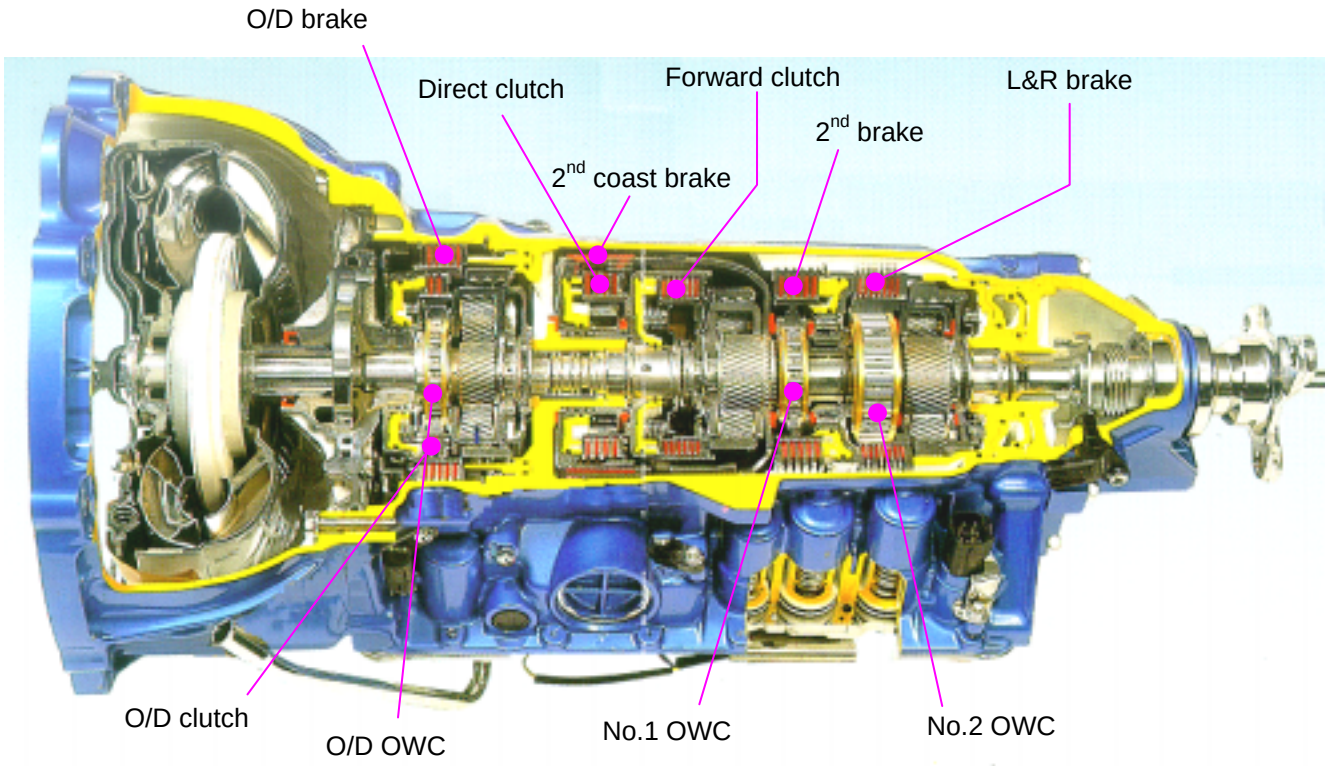
4.2 Application

SR (All engine – domestic only), H-1 (A-2.5 C/R, 4D56 2.5L TCI, 4D56 T2 NA(VAN only))

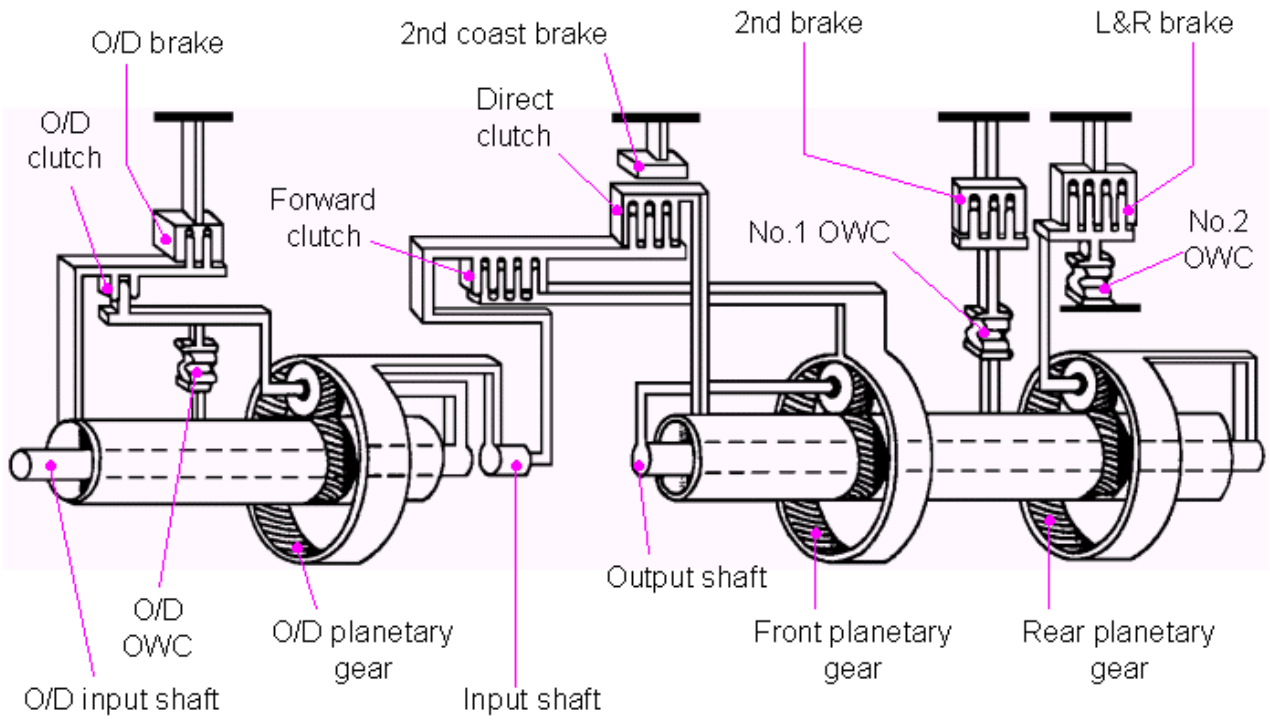
4.3 Components

Friction elements: Clutches: 3EA, Brakes: 4EA, → Multiple disc type 3EA, Band type 1EA, OWC: 3EA
Planetary gear: 3sets(O/D planetary gear, Front planetary gear, Rear planetary gear), Simpson (single) type

4.3.1. Structure



4.3.2. Function



C0: O/D clutch - Connects O/D sun gear and O/D carrier

C1: Forward clutch - Connects input and intermediate shaft

C2: Direct clutch - Connects input shaft and front & rear sun gear

B0: O/D brake - Hold O/D sun gear

B1: 2nd coast brake - Hold front & rear sun gear

B2: 2nd brake - Hold OWC outer race

B3: Low & Reverse brake - Hold front planetary gear

F0: O/D OWC - Restrict O/D sun gear or carrier rotating direction

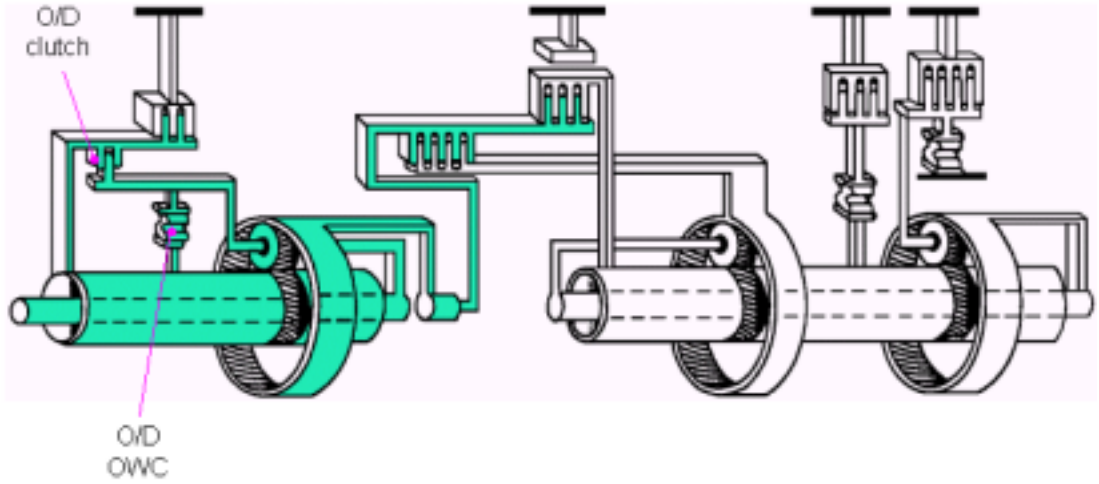
F1: No.1 OWC - Restrict front & rear sun gear rotating direction

F2: No.2 OWC - Restrict front planetary carrier rotating direction

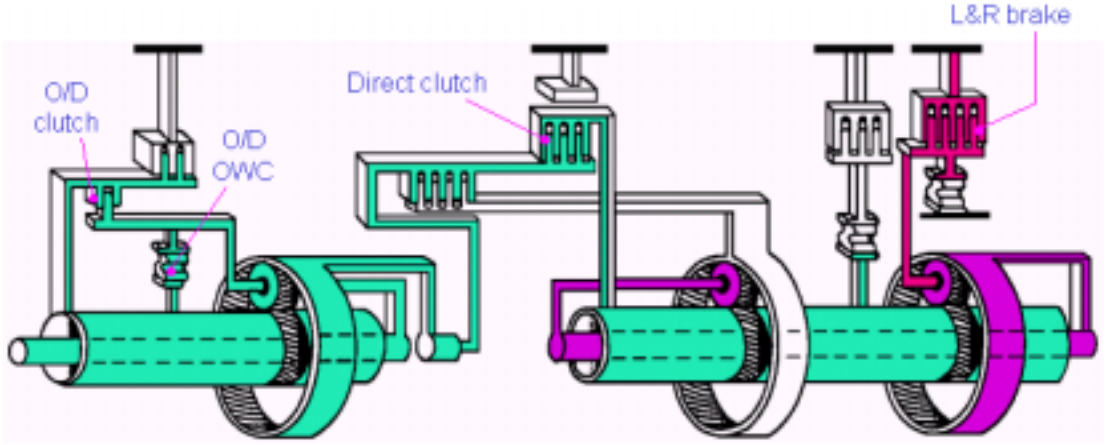
4.3.3. Operating elements chart

Range		OD clutch	Forward clutch	Direct clutch		OD brake	2nd coast brake	2nd brake	L&R brake		OD OWC	OWC No.1	OWC No.2
				Inner	Outer				Inner	Outer			
P		◆									◆		
R		◆		◆	◆				◆	◆	◆		
N		◆									◆		
D	1st	◆	◆								◆		◆
	2nd	◆	◆					◆			◆	◆	
	3rd	◆	◆		◆			◆			◆		
	4th		◆		◆	◆		◆					
2	1st	◆	◆								◆		◆
	2nd	◆	◆				◆	◆			◆	◆	
L	1st	◆	◆						◆	◆	◆		
	2nd	◆	◆				◆	◆			◆		

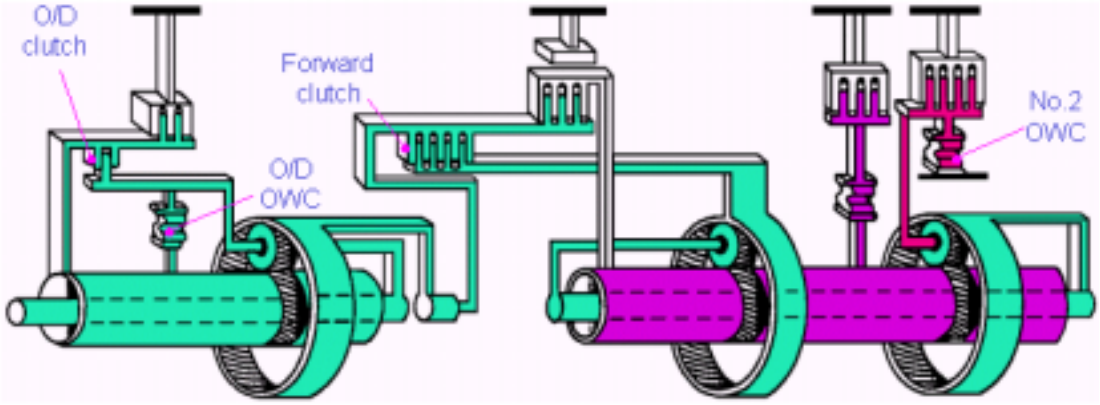
- 'P, N' range - O/D clutch, O/D OWC are engaged.



'R' range - O/D clutch, O/D OWC, Direct clutch, L&R brake are engaged.

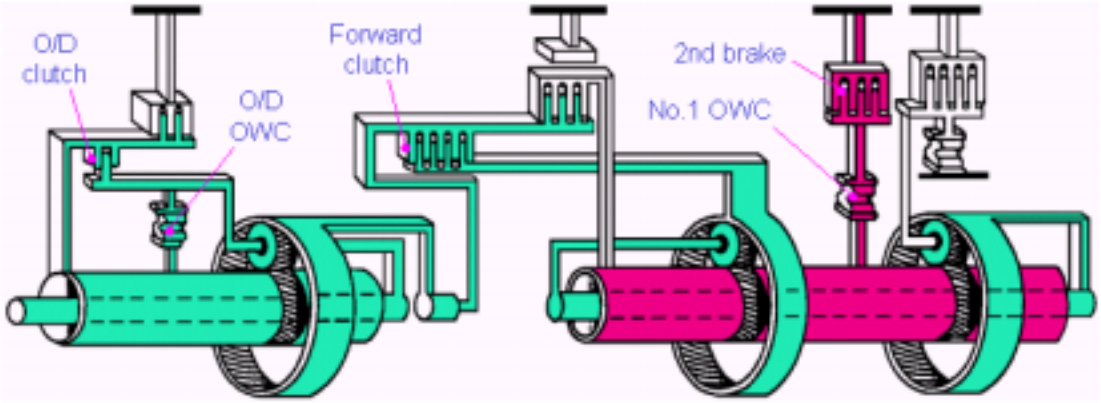


'D' range 1st gear - O/D clutch, O/D OWC, Forward clutch, No.2 OWC are engaged.



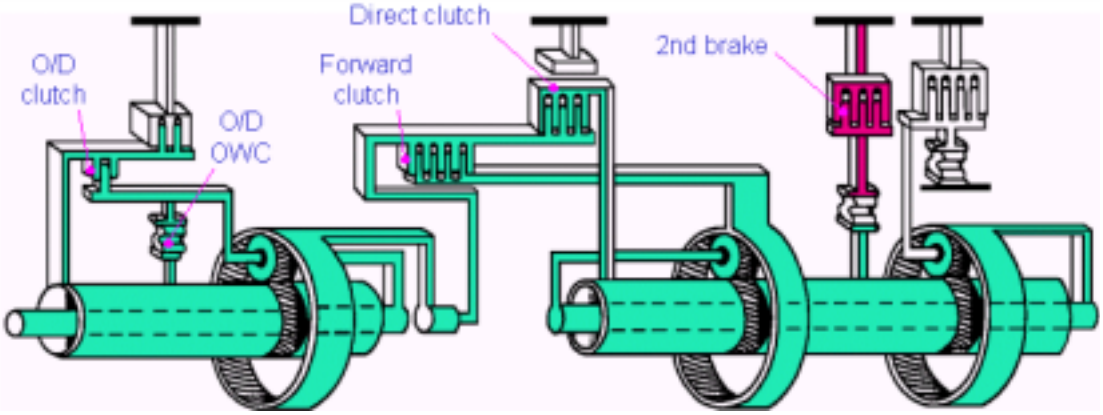
☞ No.2 OWC is operated during vehicle acceleration but not operated in case of deceleration.

'D' range 2nd gear - O/D clutch, O/D OWC, Forward clutch, 2nd brake, No.1 OWC are engaged.

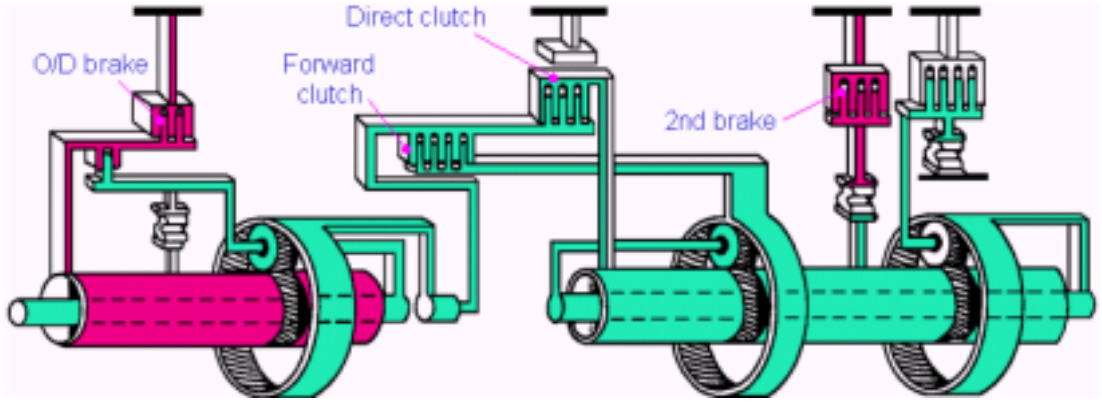


☞ No.2 OWC is operated during vehicle acceleration but not operated in case of deceleration.

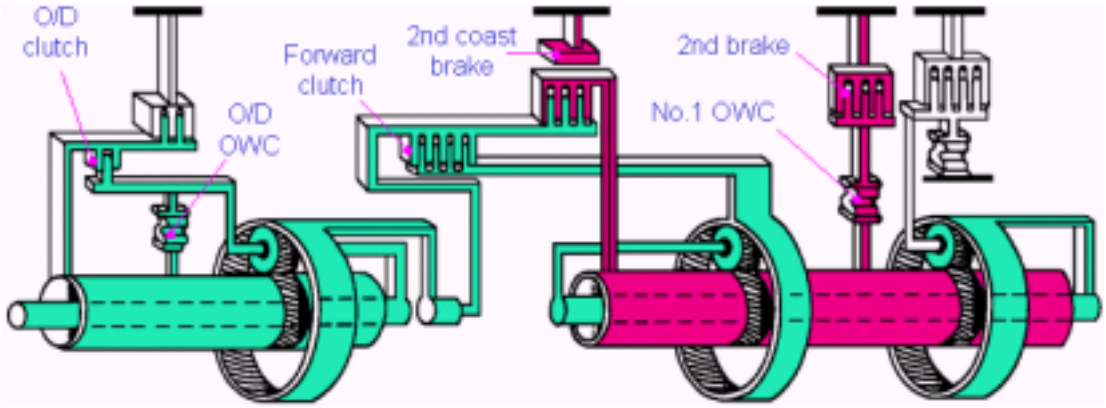
'D' range 3rd gear - O/D clutch, O/D OWC, Forward clutch, Direct clutch, 2nd brake are engaged.



'D' range 4th gear - Forward clutch, Direct clutch, O/D brake, 2nd brake are engaged.



'2' or 'L' range 2nd gear - O/D clutch, O/D OWC, Forward clutch, 2nd brake, 2nd coast brake, No.1 OWC are engaged.



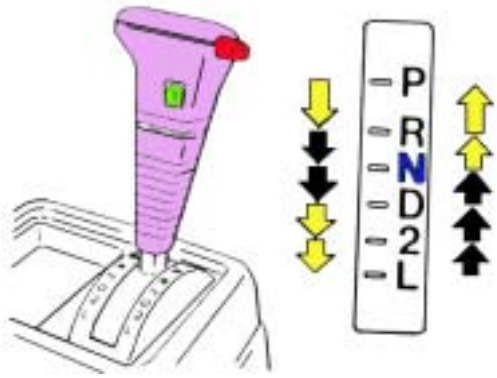
☞ No.1 OWC is always engaged due to the 2nd coast brake regardless of vehicle acceleration or deceleration. → Engine brake is available.

Memo

4.4 Control System

4.4.1. Select pattern

Select pattern displays the current shift range according the driver's selection when driver selects it manually.



- Parking (P)

- No activating elements and engine power is not transmitted.
- Engine start is possible.
- Mechanically fix the parking mechanism.

- Reverse (R)

- Back up lamp is illuminated at the reverse range.
- Engine start is impossible.

- Neutral (N)

- Engine start is possible.
- Engine power is not transmitted.

- Driving (D)

- Automatically shifted by TPS and vehicle speed.
- Vehicle starts with 1st gear and it is hold with 3rd gear at engine idle condition. (This reduces creep effects)
- Kick-down is available when the acceleration is 85% or more for sufficient driving power.
- Engine brake is not available at the 'D' range 1st gear.

- 2nd Range (2)

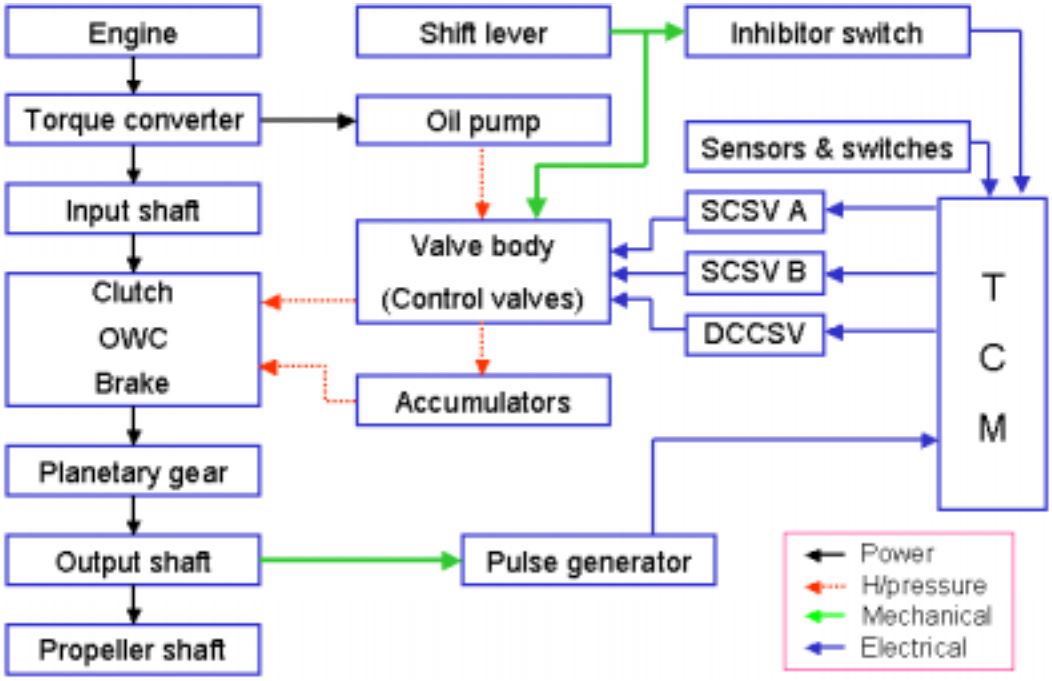
-1st, 2nd, 3rd gear is automatically shifted. 3rd gear is shifted by not opening ratio of TPS but the rotating speed of transfer drive gear.

- 1st gear is selected when the engine is idle or the vehicle starts.
- Engine brake is not available and it is used at the icy road.
- If '2' range is selected during driving with 4th gear, the downshift is performed automatically up to 2nd gear through 3rd gear according to the mapping data.

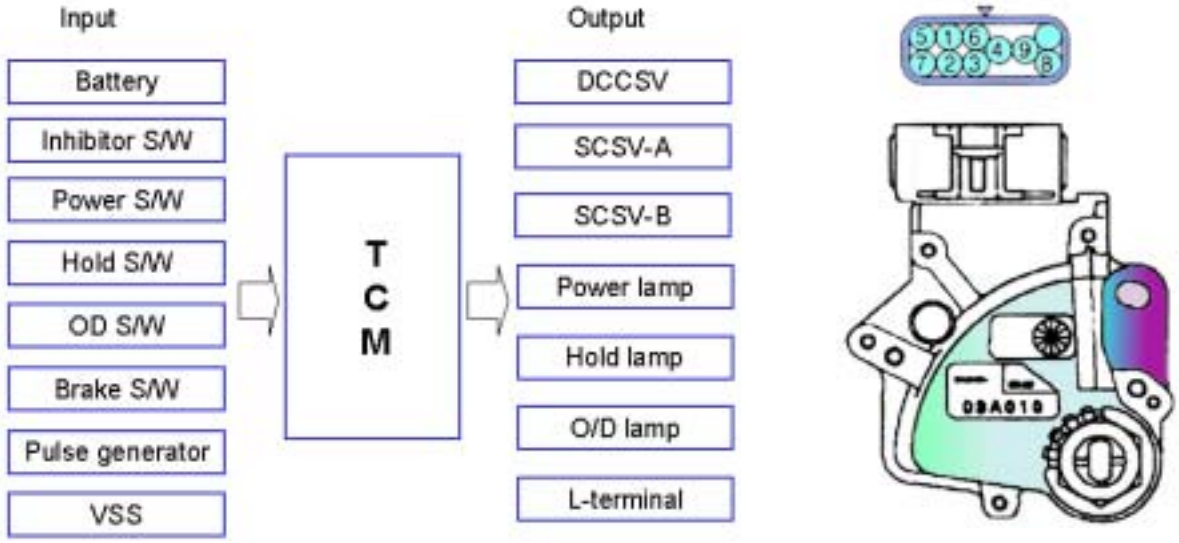
- Lock-up (L)

- Down shifted from 2nd gear to 1st gear and up-shift is prohibited. (1st gear holding)
- Vehicle starts with 1st gear and engine brake is available.
- If 'L' range is selected during driving with 4th gear, the downshift is performed automatically up to 1st gear through 3rd and 2nd gear according to the mapping data.
- It is used at the continuous downhill road.

4.4.2. System schematics



4.4.3. Inputs and Outputs



- Inhibitor switch:

Inspection: Make sure that the engine start is possible at the range of P or N only.

Check the back up lamp is illuminated or not in R range.

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

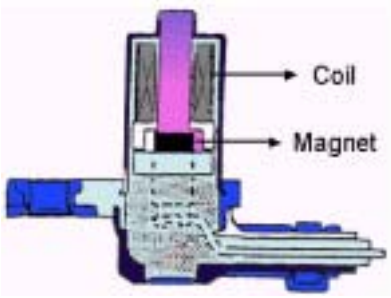
- Pulse generator :

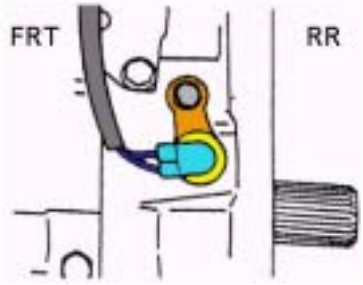
Function: Detects the output shaft rotating speed

Parts inspection: measure the peak-to-peak voltage

Operation principle: Detects the alternative voltage frequency from the sensor rotor.

Specified internal resistance : 560 ~ 680Ω



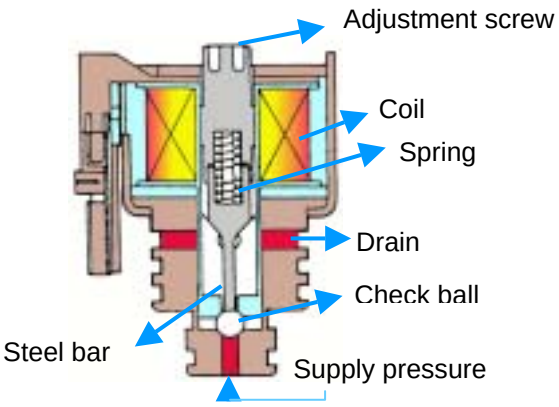


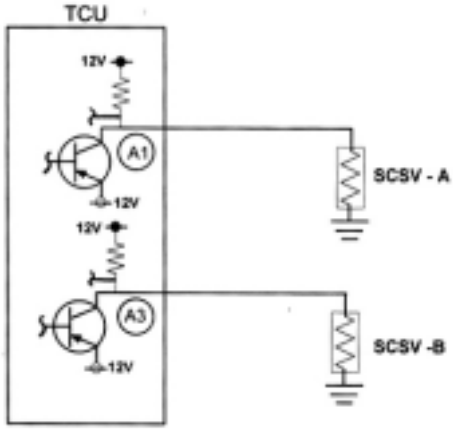
- Shift control solenoid valve A, B

Operating principle: ON - pressure is drained (normal close type), OFF- pressure is supplied

If SCSV is malfunctioned, it is impossible to shift.

Inspection :Listen to the operating sound by applying the battery voltage to No.1 and No.2 terminal of TCM after disconnecting TCM connector. (“Actuator driving test” mode in Hi-scan is not supported in some AISIN model A/T)





DCCSV :
Damper clutch
control solenoid valve
→ It is ON at the 4th gear only.

Range		SCSV-A	SCSV-B
P		ON	OFF
R		ON	OFF
N		ON	OFF
D	1st	ON	OFF
	2nd	ON	ON
	3rd	OFF	ON
	4th	OFF	OFF
2	1st	ON	OFF
	2nd	ON	ON
L	1st	ON	OFF

- The operating sequence of shift control solenoid valve A, B

- Brake switch

Function: The damper clutch will be disengaged if the brake pedal is depressed during damper clutch engagement to reduce brake depressing force and vehicle vibration.

Inspection: Measure the voltage on the terminal No.8 of TCM using multi-meter.

- Vehicle speed sensor

Function: When the pulse generator is failed, this signal is used as a vehicle speed and output shaft speed.

Inspection: With IG ON, rotate the wheel with hands and check the repeated voltage from 0 to 5 volt on the terminal No.13 of TCM using multi-meter.

- Power switch

Function: Change the shift pattern according to the driver's tendency.

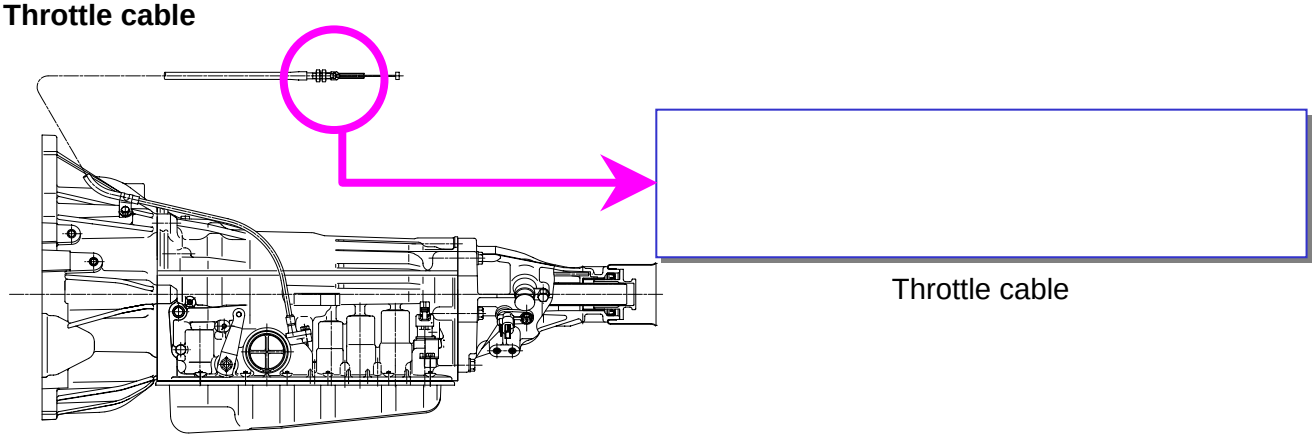
Inspection: Check the voltage on the terminal No.6 of TCM using multi meter. This is digital signal. (4V or less: power off, 8V or more: power on)

- Hold switch

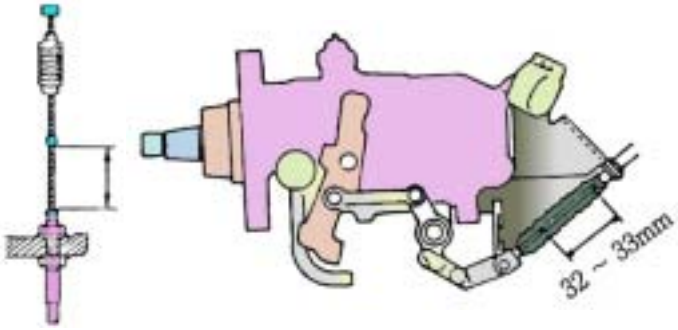
Function: Hold the current gear when drive at the icy road or downhill road.

Inspection : Check the voltage on terminal No.20 of TCM using multi meter. (Hold switch ON 12V, OFF 0V)

- Throttle cable



Due to the line not pressure control by solenoid valve but the throttle cable controls pressure, it is very important to adjust correctly the throttle cable between A/T and fuel injection pump.



Inspection

- Check the damage on cable and complete connection.
- Check the clearance is within the specification.
- If it is out of specification, adjust it after loosening the adjusting screw (14mm).

- OD/OFF switch

Function: The operating principle is same as power/normal switch.

Inspection: Check the voltage on the terminal No.29 of TCM using the multi meter.

(Hold switch ON 0V, OFF 12V)

4.4.4. Diagnostic trouble code

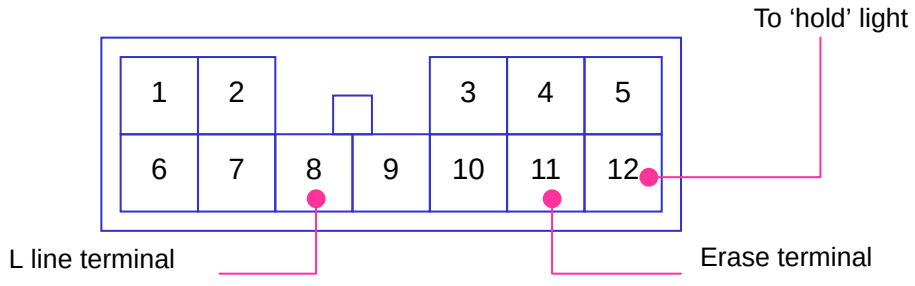
Fail items	SCAN TOOL	OBD
Pulse generator	0720	55
Shift control solenoid valve A	0750	60
Shift control solenoid valve B	0755	61
Damper clutch control solenoid valve	0743	63
Vehicle speed sensor	0500	06

- Fault code erasing procedure

On SR and H-1 vehicles with TCI (Turbo charger inter-cooler) engines and automatic transaxles, the diagnostic trouble codes related to automatic transaxle system failure will not be erased though the battery negative cable has been removed after repairing the defective parts.

1) Install the Hi-scan to the vehicle to conduct self-diagnosis test for the automatic transaxle control system.
2) Turn the ignition key to the ON position or start the engine. Turn on the Hi-scan power. If any failure related to the automatic transaxle control system exists, the following diagnostic trouble codes may be displayed on the Hi-scan when conducting self-diagnosis test with a Hi-scan.
   * P0500: VSS malfunction
   * P0750: SCSV malfunction
   * P0743: DCCSV open circuit
   * P0720: Pulse generator open circuit
   * Etc.

   Additionally, the 'hold' light on the cluster flashes repeatedly as many as detected codes.
3) If you press the 'erase' key on the Hi-scan to delete any trouble codes after repairing the defective parts. Hi-scan directs you disconnect the battery negative terminal.
4) However, the automatic transaxle relating diagnostic trouble codes for SR and H-1 with a TCI engine will not be erased even though the battery negative cable has been disconnected more than 15 seconds. Furthermore the 'hold' light still flashes repeatedly when conducting self-diagnosis test using the Hi-scan.
5) If you encounter a vehicle with the above specification and symptoms, follow the trouble codes erasing procedure as below.
   (1) Turn the ignition key to the ON position.
   (2) Connect one end of wiring to the self-diagnosis terminal No.11 (Erase terminal) in the data link connector and the other end to the vehicle ground point for 5 seconds or more.



   (3) The existing trouble codes will be erased completely after grounding the erase terminal in the data link connector more than 5 seconds.
   (4) Make sure that the trouble codes have been erased by conducting self-diagnosis test using the Hi-scan again.

4.4.5. Fail-safe

Fail items		Cases					
Pulse generator		OK	OK	OK	OK	NG	NG
Vehicle speed sensor		OK	OK	OK	NG	OK	NG
SCSV A		OK	NG	NG	OK	OK	OK
SCSV B		NG	OK	NG	OK	OK	OK
DCCSV		-	-	-	-	-	-
D	1	1	3	4	1	1	1
	2	4	3	4	2	2	1
	3	4	3	4	3	3	1
	4	4	4	4	4	3	1
2	1	1	3	3	1	1	1
	2	3	3	3	2	2	1
	3	3	3	3	3	3	1
L	1	1	1	1	1	1	1
	2	1	2	1	2	2	1

- Specifications of line pressure

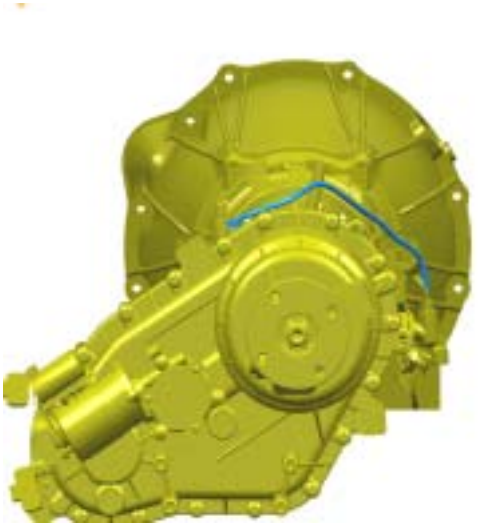
Range	Line pressure (kg/cm^2)	
	Idle	Stall
D	3.7 4.1	10.7 12.2
R	5.1 5.2	13.8 16.3

5. AW30-40LE Model

5.1 Introduction

It is a four (4) speed, Electronically Controlled Automatic Transmission (ECAT) with a Lock-up Torque Converter and a Pressure Control Solenoid valve. Various internal and external changes have been made to improve the transmission's performance. An input Turbine Engine Speed Sensor has been added to confirm to new OBD-II regulations. The Transmission Control Module (TCM) has been changed and the torque converter housing has been redesigned to accommodate the input speed sensor.

TYPE		AUTOMATIC		
		2.5 TCI	2.9 TCI	3.5 V6
GENERAL		4-Speed Transmission with Floor Shift		
MODEL		AISIN 03-II	AISIN 30-40LEi	
GEAR RATIO	1ST	2.826	2.804	
	2ND	1.493	1.531	
	3RD	1.000	1.000	
	4TH	0.688	0.705	
	R	2.703	2.393	
FINAL GEAR RATIO		4.875	4.222	4.625
Maximum torque		24kgfm	35kgfm	
Weight (kg)		72	79.8	
T/C Stall torque ratio		2.1		
Torque converter (DIA)		241mm	254mm	
ATF		DEXRON II		
ATF CAPA. (LITER)		8.73 (L)	9.2 (L)	



Inside transmission the Direct Clutch disc surfaces now have a wavy pattern to improve engagement shock, and the disc facing material on the other clutches has been changed to enhance shift quality. Accumulators with springs have been adapted to improve the shift feel.

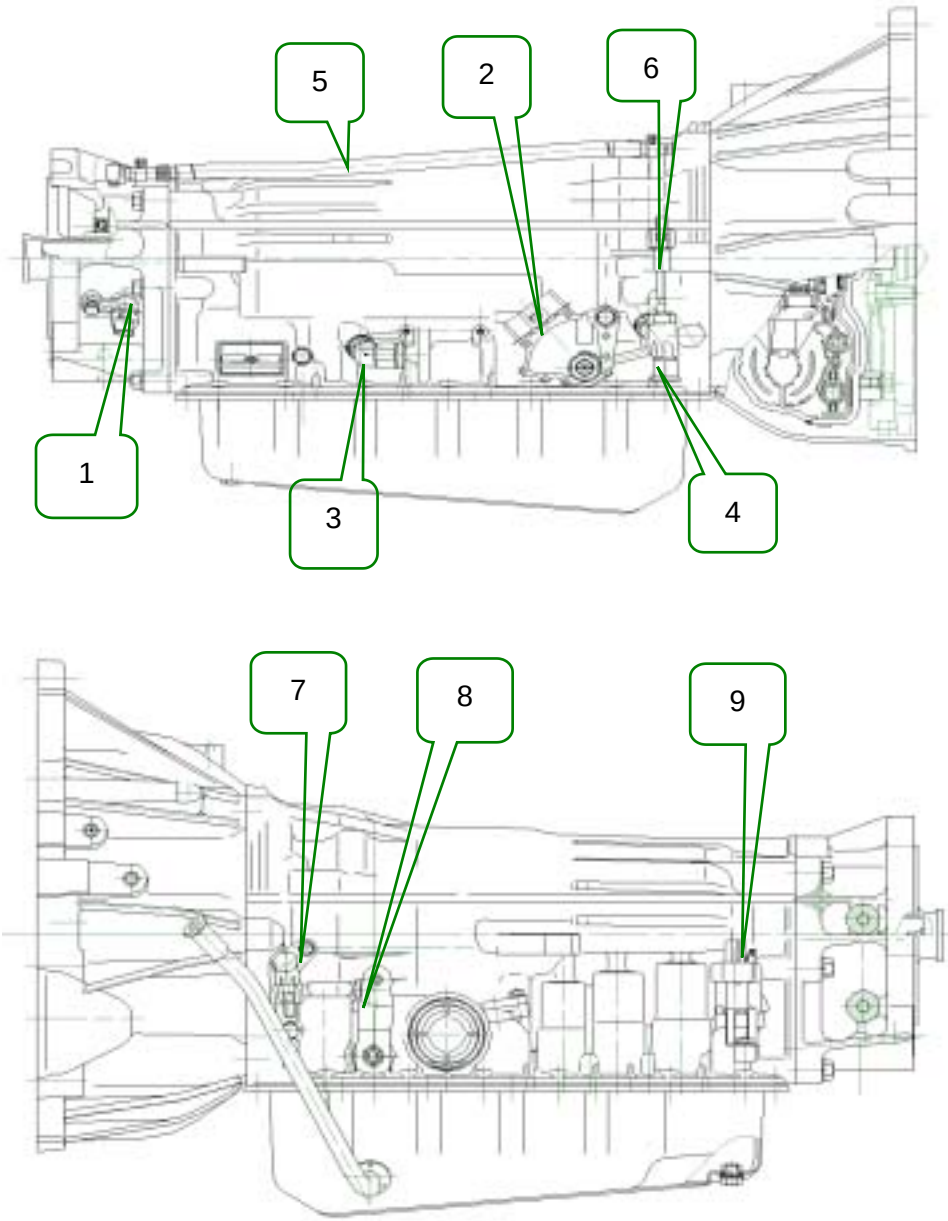
Previously hydraulic pressure control is made by a throttle cable that is connected with an accelerator pedal. According to acceleration amount, line pressure that is applied to the operating components is managed. Differently from the previous cable control type, 30-40LEi has a linear pressure control solenoid valve which does the same job but more preciously controls the line pressure while gear shifts. To control the line pressure, the pressure control solenoid valve was adopted instead of throttle cable. 'A/T' lamp was installed so as to turn on when the temperature of ATF is higher than the specified level to protect transmission. If there are trouble or failure on the sensor or system, 'A/T' lamp is blinked. ('Hold' mode and its lamp were eliminated.) For the smooth shift feeling, various signals between engine ECM and TCM is being communicated. (Torque reduction request, water temperature and so on.) In case of 4-wheel drive low or high ATF temperature, the shift pattern is changed. 4 solenoid valves were adopted to control each gear, line pressure and lock up operation.

5.2 Application

Terracan (J3 2.9L C/R, Sigma 3.5L V6 Gasoline)

5.3 Components

Friction elements: Clutches: 3EA, Brakes: 4EA, → Multiple disc type 3EA, Band type 1EA, OWC: 3EA Planetary gear: 3sets(O/D planetary gear, Front planetary gear, Rear planetary gear), Simpson (single) type basically, the mechanical components, power flow, location and structure is same as one of “AW30-43LE” model.



5.3.1. Mechanical components

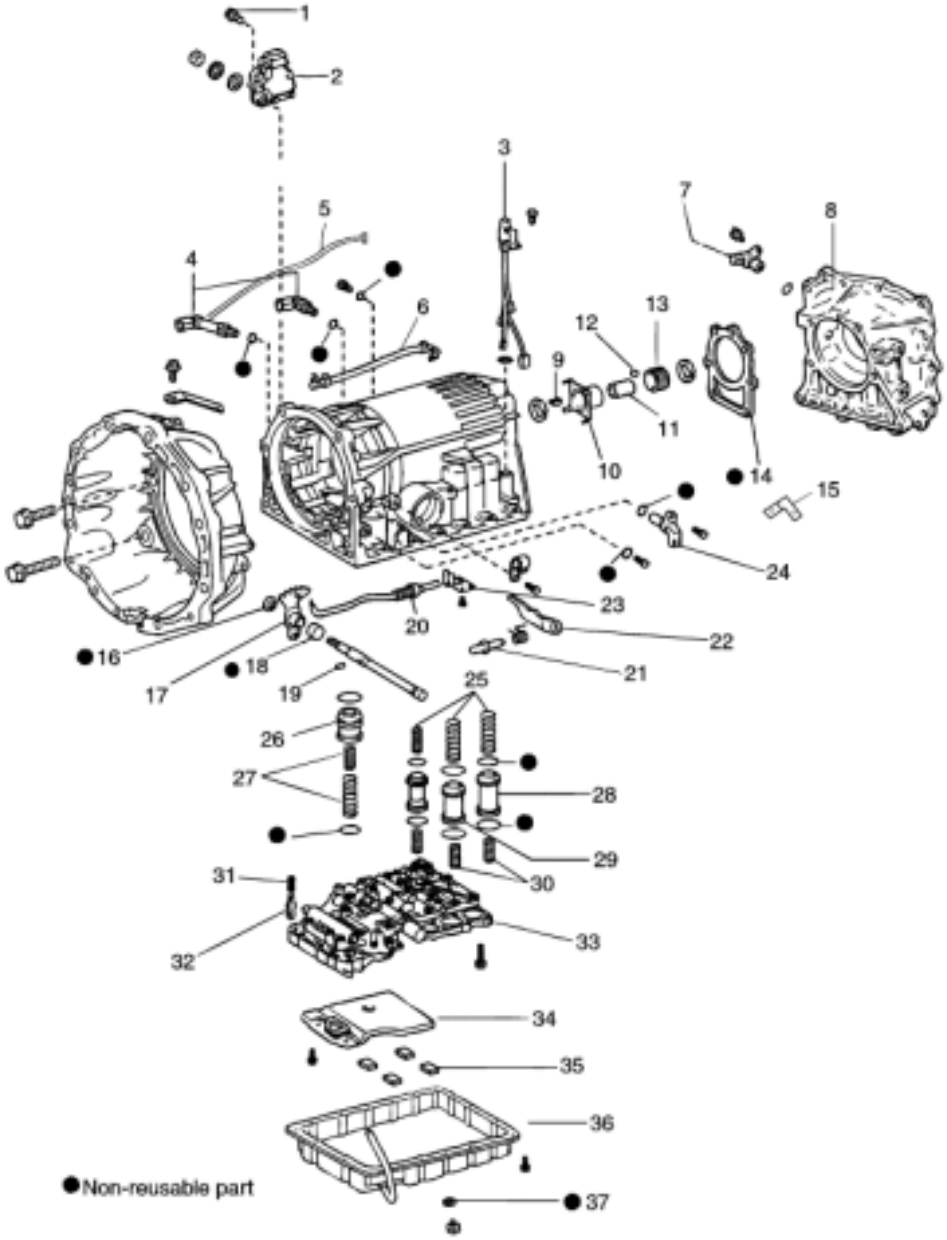
- Parts and function

No.	Parts	Function
1	Output speed sensor	To detect the output shaft speed
2	TR switch	To detect selected or driving range
3	Cooler OUT	From oil cooler to transmission
4	Cooler IN	From transmission to oil cooler
5	Breather hose	For the air bleeding inside of transmission
6	OTS	To detect the ATF temperature
7	Input speed sensor	To detect the input shaft speed
8	Outer lever	Connected to control cable to operate driving range
9	T/M wire	Solenoid valve connector

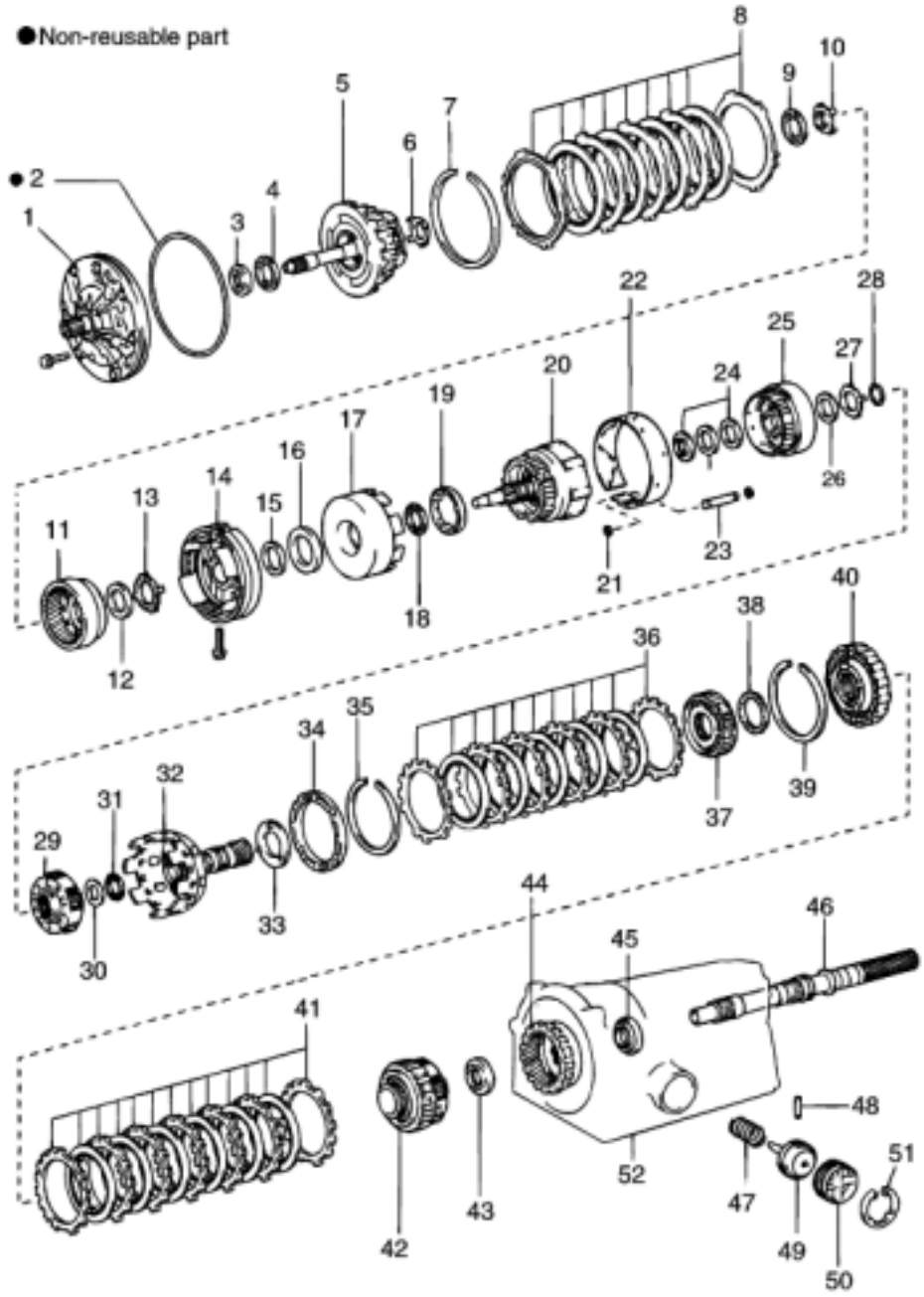
- Coupling's function

Component		Function
C0	O/D Direct Clutch	Connect O/D sun gear and O/D CARIER
C1	Forward Clutch	Connect input shaft and input shaft
C2	Direct Clutch	Connect input shaft and FR/RR planetary sun gear
B0	O/D Brake	Lock O/D sun gear
B1	2nd Coast Brake	Lock FR/RR planetary sun gear
B2	2nd Brake	Lock counterclockwise rotation of FR/RR planetary sun gear (Lock outer race of F1)
B3	1st & Reverse Brake	Lock FR planetary carrier
F0	O/D One-Way Clutch	Connect O/D sun gear and O/D carrier, when O/D Sun gear rotates rapid more than O/D carrier.
F1	No.1 One-Way Clutch	Lock counterclockwise rotation of FR/RR planetary sun gear, when B2 operations.
F2	No.2 One-Way Clutch	Lock counterclockwise rotation of FR planetary carrier.

- Structure

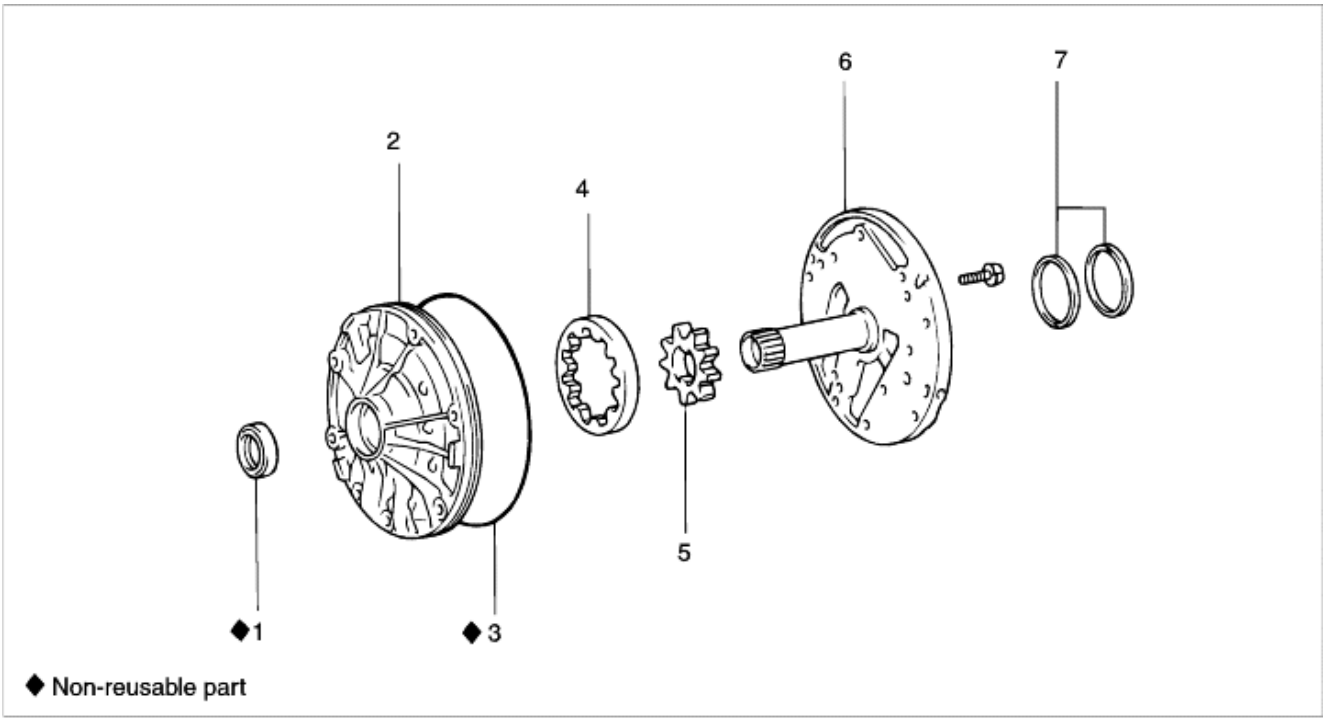


1. Adjusting Bolt
2. Selector Position Switch
3. Solenoid Wiring
4. Elbow
5. Oil temperature Sensor(OTS) Wire
6. Breather hose
7. Output Speed Sensor
8. Adapter
9. Key
10. Sensor Rotor
11. Spacer
12. Ball
13. Speedometer Drive Gear
14. Gasket
15. Oil temperature Sensor Bracket
16. Oil Seal
17. Manual Valve Lever
18. Spacer
19. Pin
20. Parking Lock Rod
21. Parking Lock Pawl Shaft
22. Parking Lock Pawl
23. Parking Lock Pawl Bracket
24. Input Speed Sensor
25. Spring
26. C0 Accumulator Piston
27. Spring
28. B2 Accumulator Piston
29. C2 Accumulator Piston
30. Spring
31. Spring
32. Check Ball Body
33. Valve Body
34. Oil Strainer
35. Magnet
36. Oil Pan
37. Drain plug



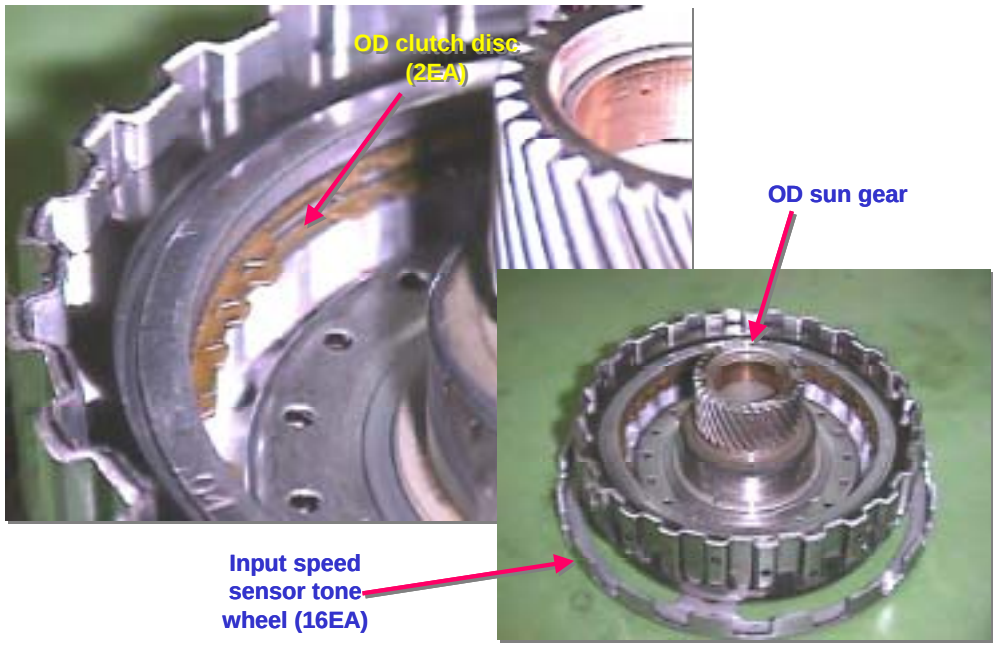
1. Oil Pump
2. O-Ring
3. Race
4. Bearing
5. O/D Planetary Gear, Direct Clutch and One-Way Clutch
6. Race
7. Snap Ring
8. O/D Brake Pack
9. Bearing
10. Race
11. O/D Planetary Ring Gear
12. Race
13. Bearing
14. O/D Support
15. Race
16. Thrust Washer
17. Direct Clutch
18. Bearing
19. Thrust Washer
20. Forward Clutch
21. E-Ring
22. Second Coast Brake Band
23. Pin
24. Race
25. Front Planetary Ring Gear
26. Bearing
27. Race
28. Snap Ring
29. Front Planetary Ring Gear
30. Race
31. Bearing
32. Planetary Sun Gear
33. Thrust Washer
34. Piston Sleeve
35. Snap Ring
36. Second Brake Pack
37. NO.1 One-Way Clutch
38. Thrust Washer
39. Snap Ring
40. Second Brake Drum
41. First and Reverse Brake Pack
42. Rear Planetary Gear and NO.2 OWC
43. Bearing and Race
44. Rear Planetary Ring Gear
45. Assembled Bearing and Race
46. Output Shaft
47. Spring
48. Second Brake Drum Gasket
49. Second Coast Brake Piston
50. Second Coast Brake Cover
51. Snap Ring
52. Transmission Case

- Oil pump

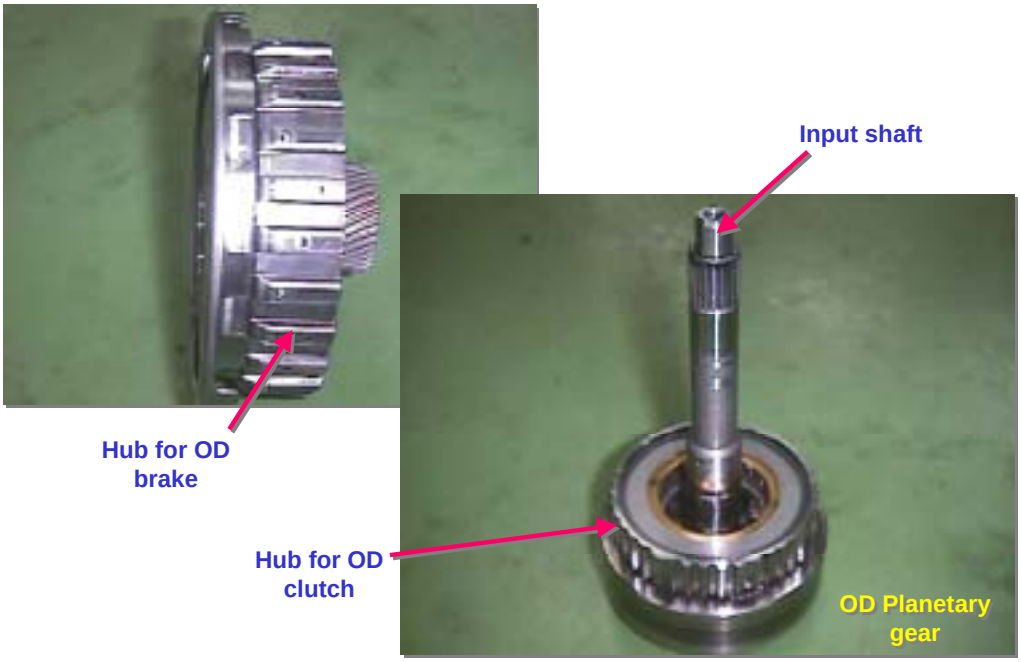


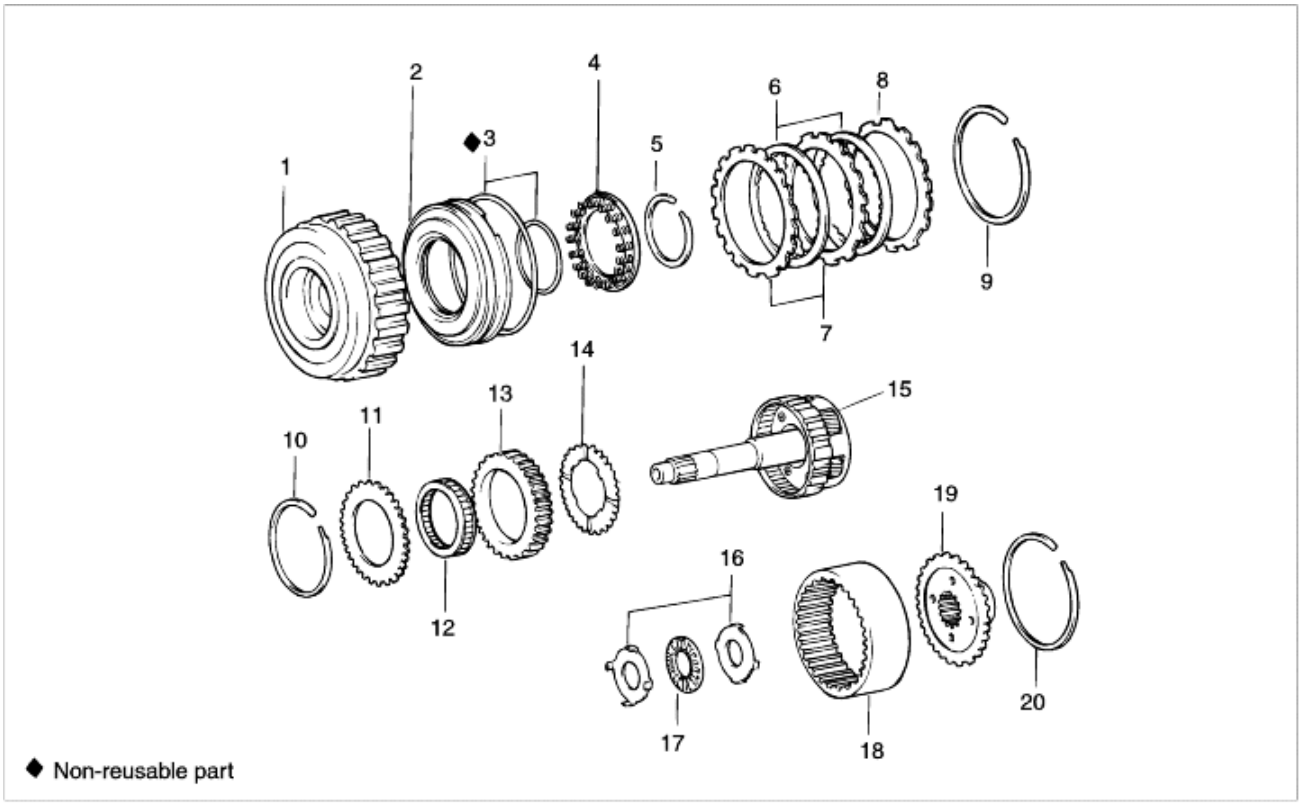
1. Oil seal
2. Oil pump body
3. O-ring
4. Driven gear
5. Drive gear
6. Stator shaft
7. Oil seal ring

- Overdrive clutch



- Input shaft & Overdrive planetary gear

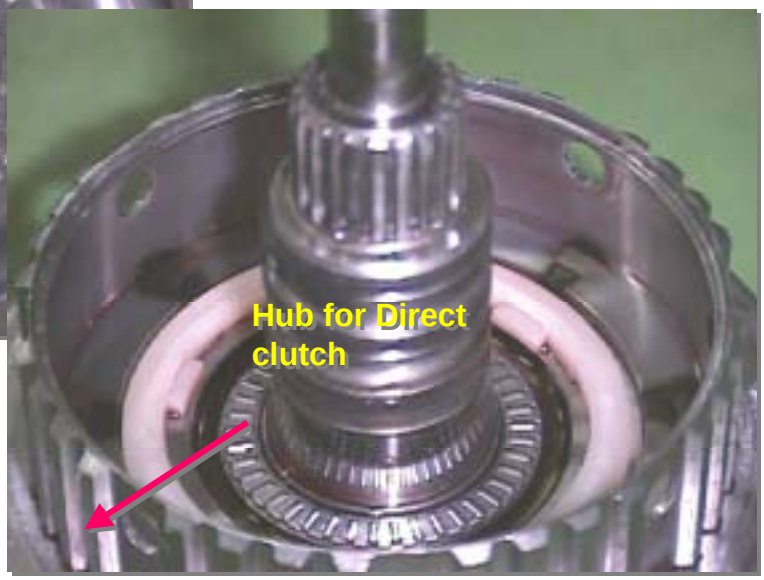


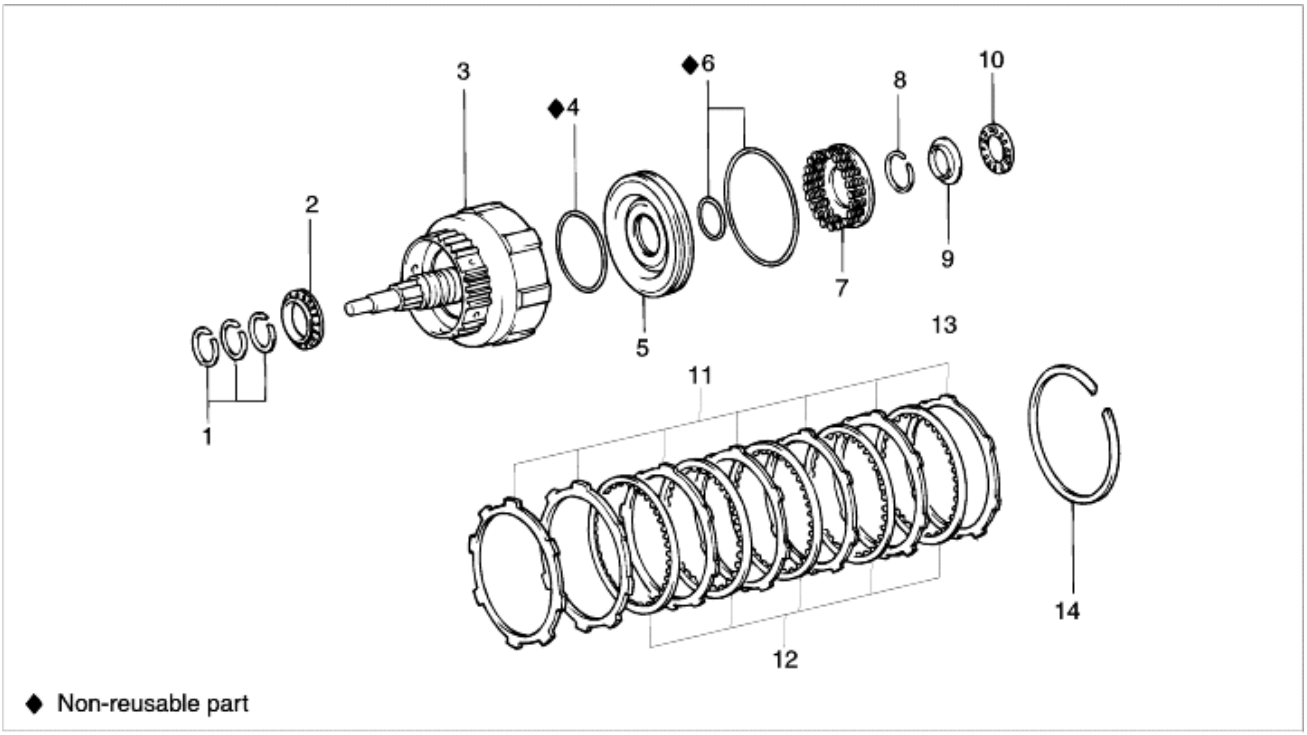


1. O/D direct clutch drum
2. O/D direct clutch piston
3. O-ring
4. Piston return spring
5. Snap ring
6. Disc
7. Plate
8. Flange
9. Snap ring
10. Snap ring
11. Retaining plate
12. O/D one-way clutch
13. One-way clutch outer race
14. Thrust washer
15. O/D Planetary gear
16. Race
17. Bearing
18. O/D planetary ring gear
19. Ring gear flange
20. Snap ring

- Overdrive OWC & Forward clutch

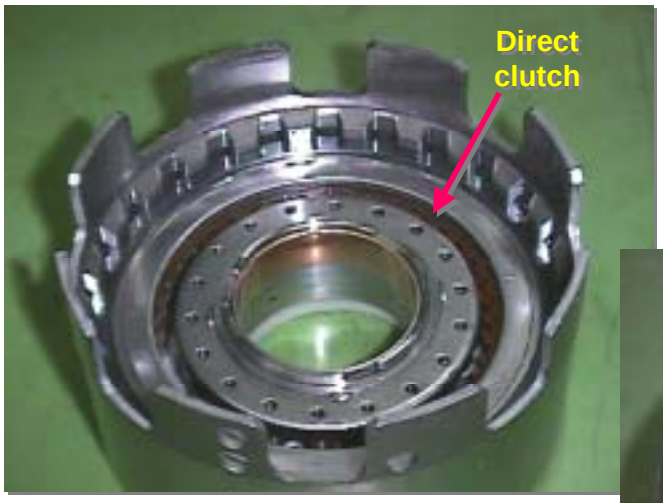
Forward clutch
(5EA)



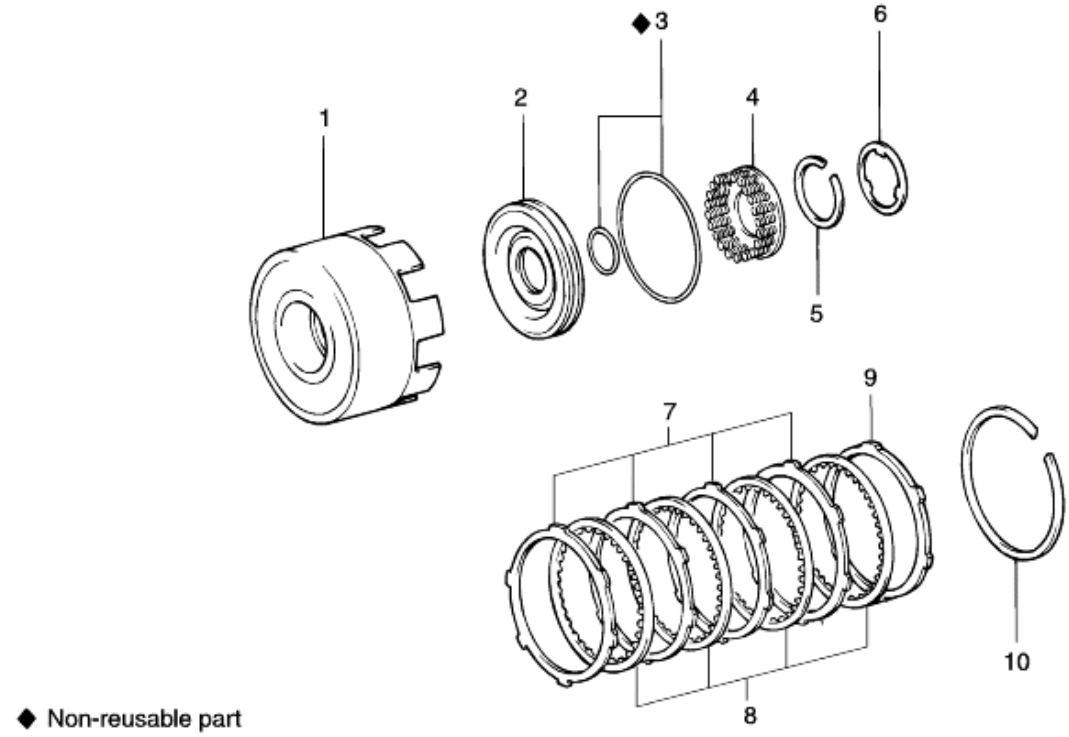


1. Seal ring
2. Bearing
3. Forward clutch drum
4. O-ring
5. Forward clutch piston
6. O-ring
7. Return spring
8. Snap ring
9. Race
10. Bearing
11. Plate
12. Disc
13. Flange
14. Snap ring

- Direct clutch

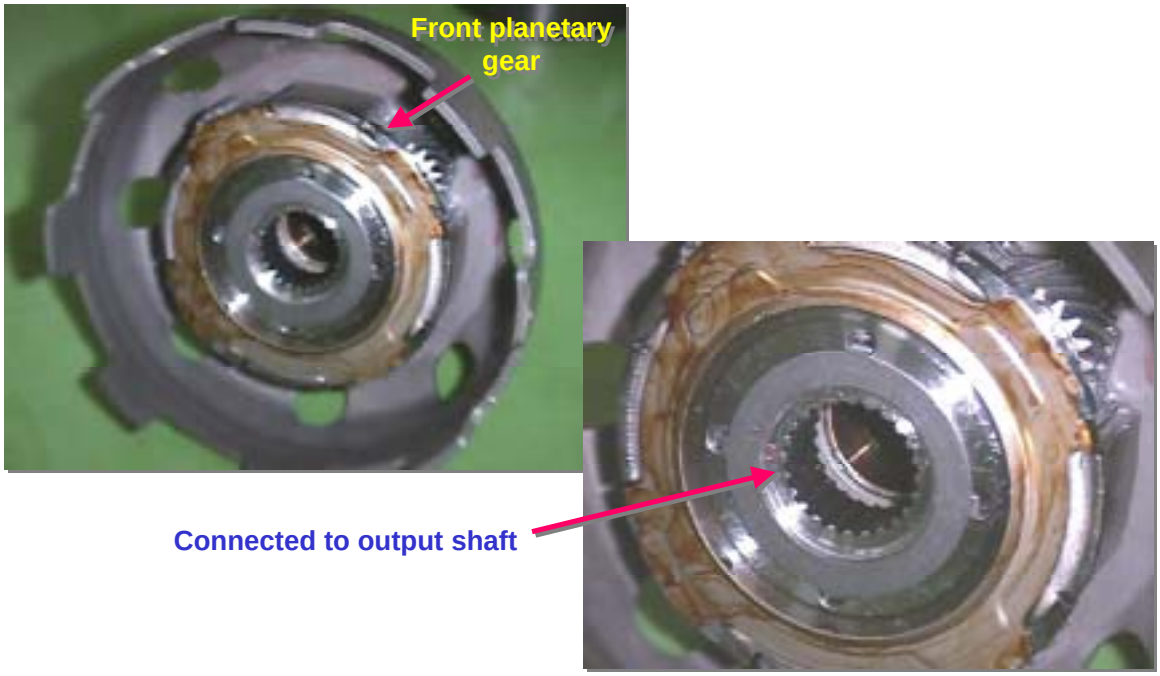


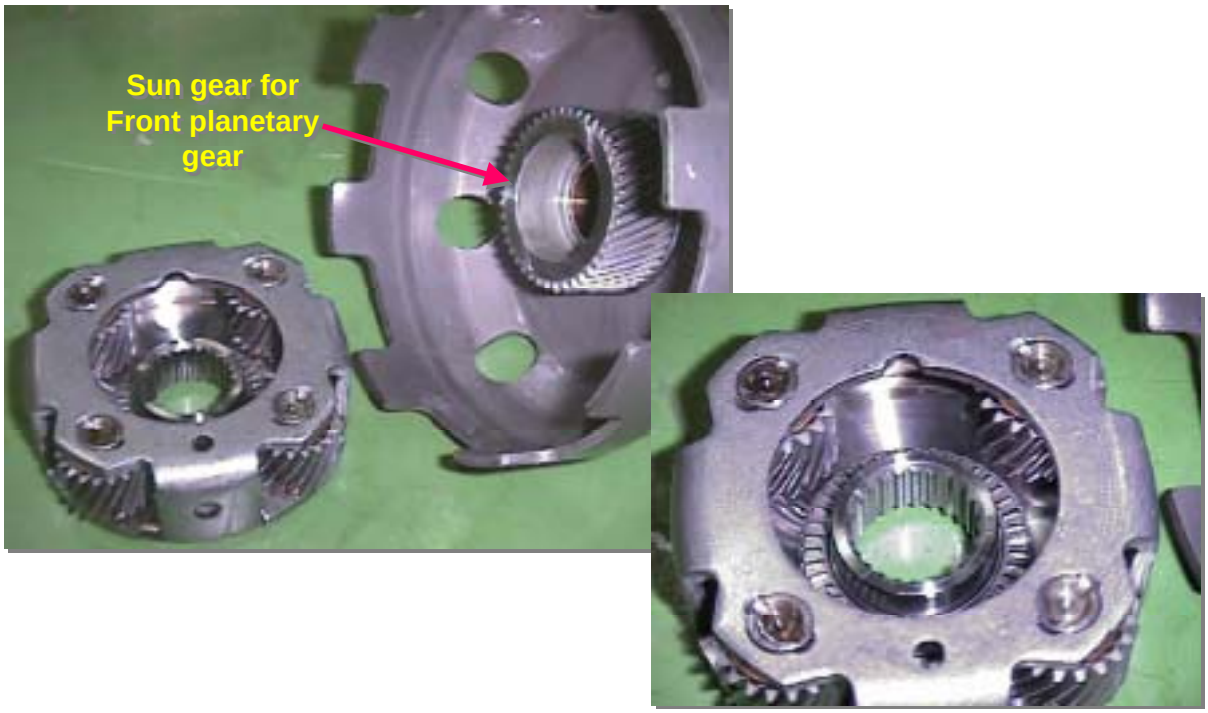
Plastic washer on Direct clutch and OD brake piston

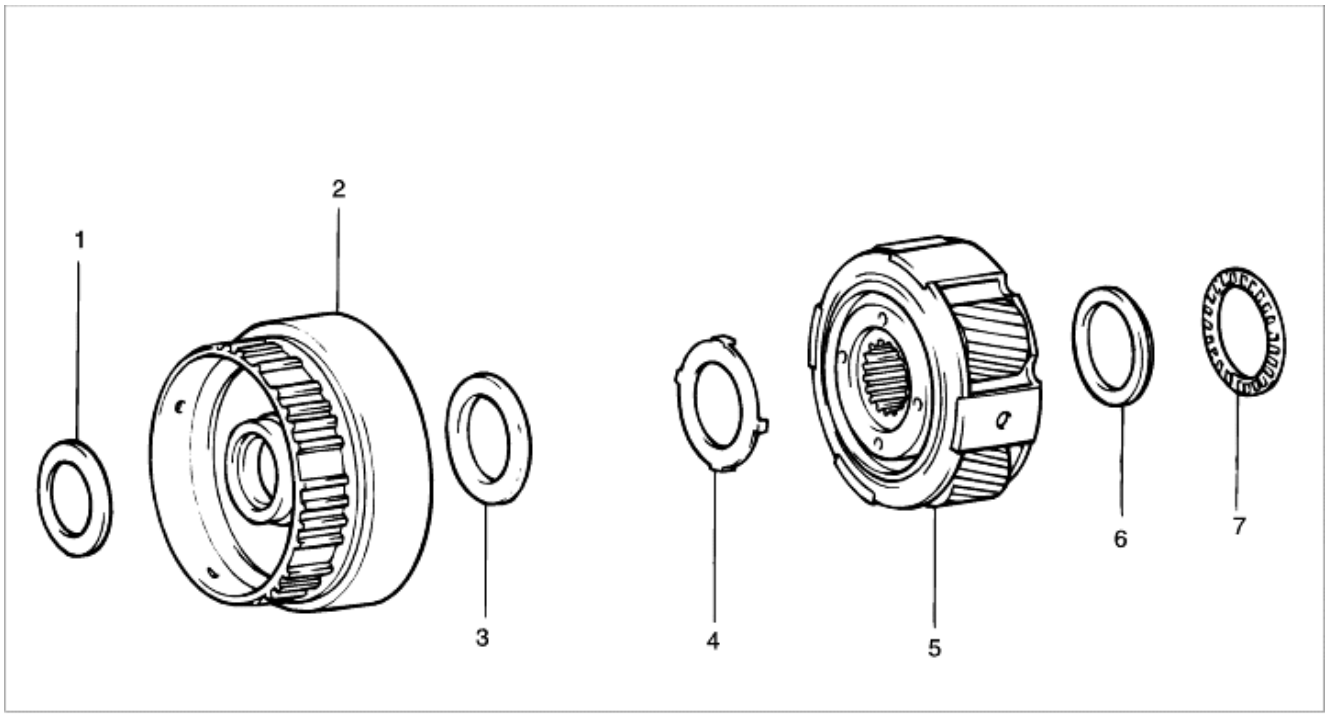


1. Direct clutch drum
2. Piston
3. O-ring
4. Return spring
5. Snap ring
6. Thrust washer
7. Plate
8. Disc
9. Flange
10. Snap ring

- Front planetary gear

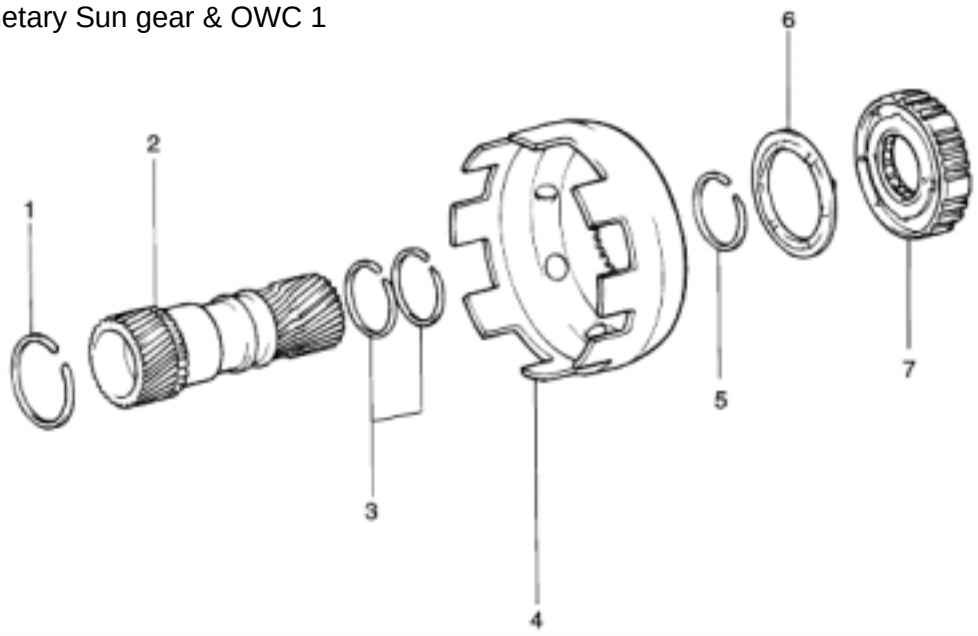






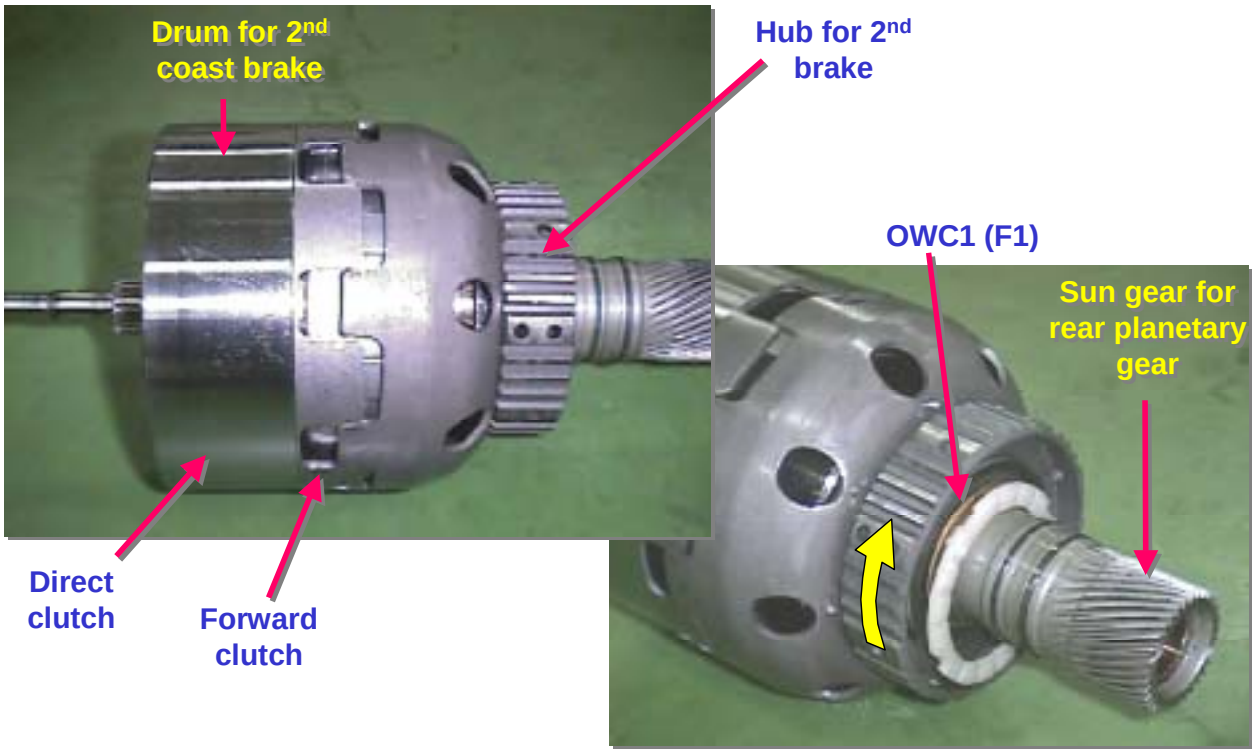
1. Race
2. Front planetary ring gear
3. Race
4. Race
5. Front planetary gear
6. Race
7. Bearing

Front Planetary Sun gear & OWC 1

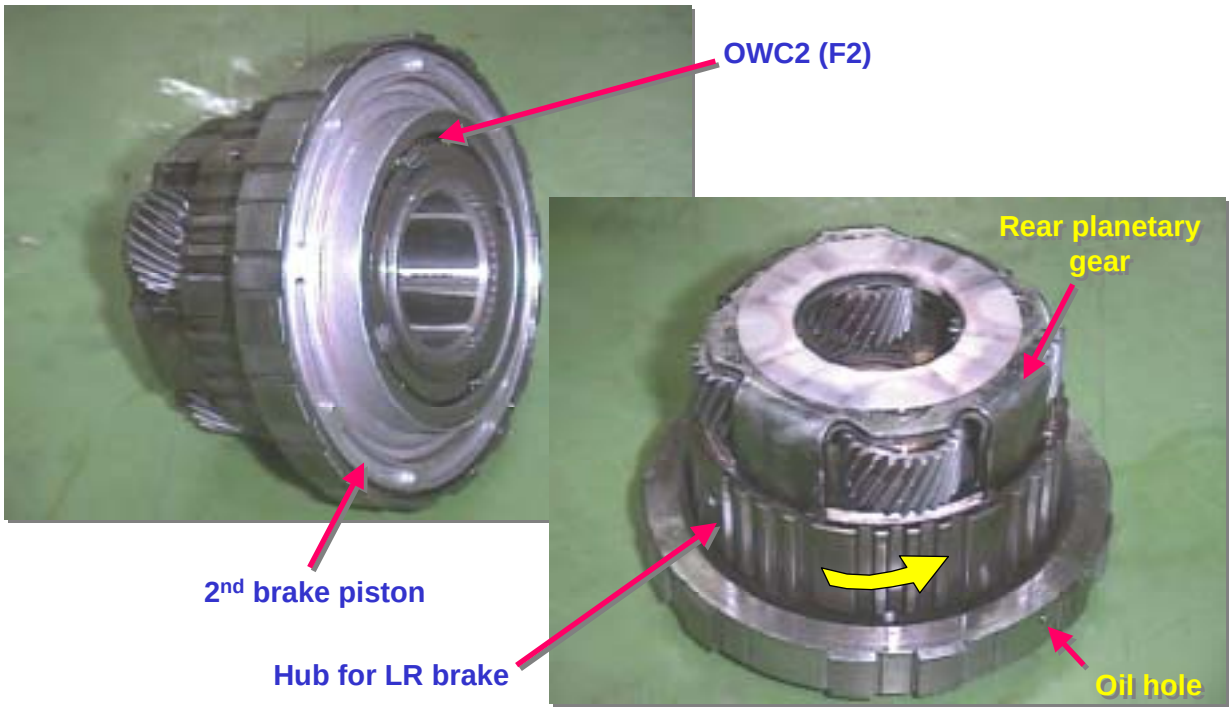


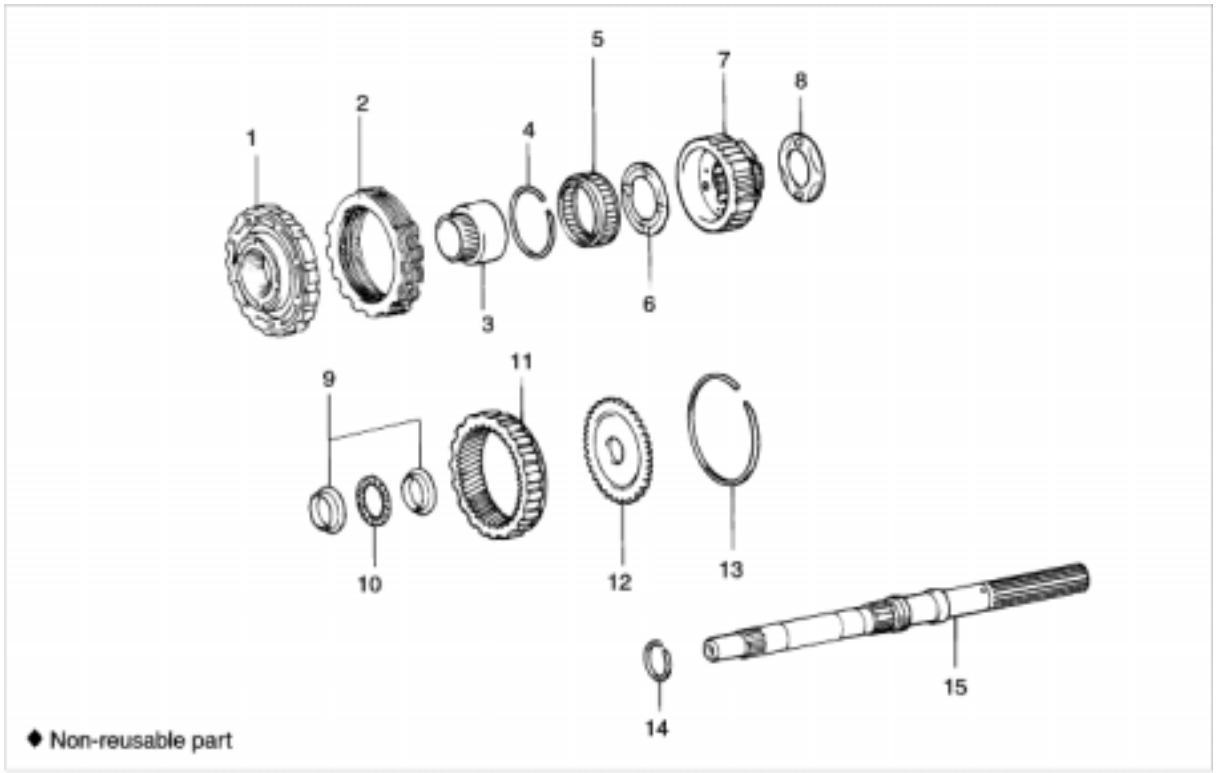
1. Snap ring
2. Planetary sun gear
3. Oil seal ring
4. Sun gear input drum
5. Snap ring
6. Thrust washer
7. One-way clutch & second brake hub

- Direct clutch & Forward clutch



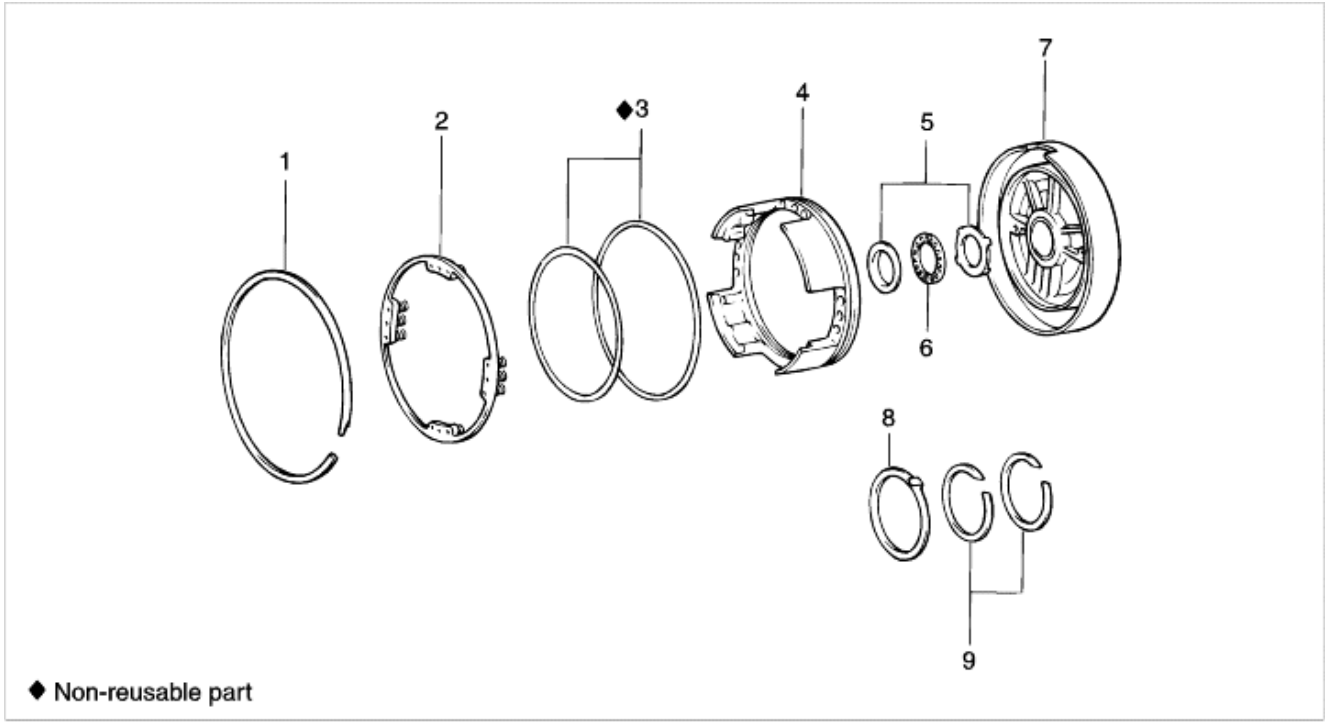
- Rear Planetary gear & 2nd brake piston





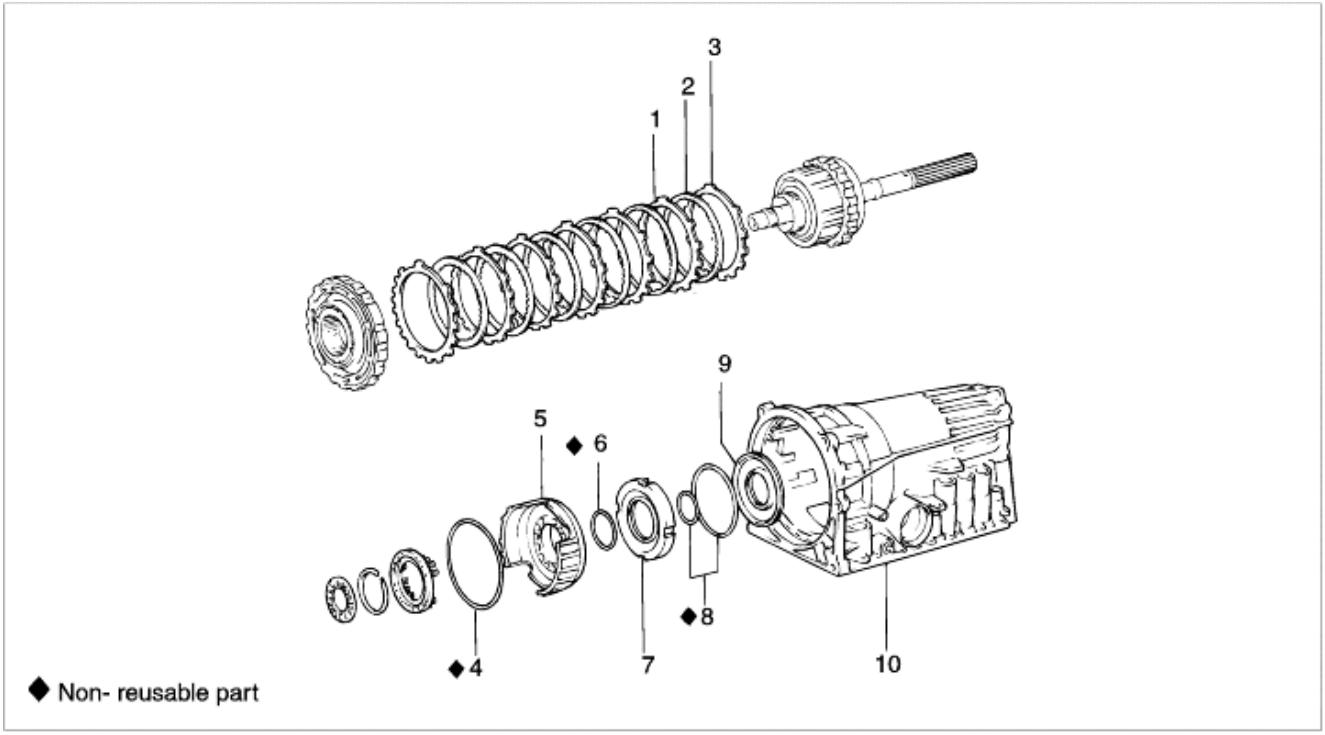
1. Second Brake Assembly
2. 1st & Reverse Brake Pack
3. One-Way Clutch Inner Race
4. Snap Ring
5. NO.2 One-Way Clutch
6. NO.2 Thrust Washer
7. Rear Planetary Gear
8. NO.1 Thrust Washer
9. Race
10. Bearing
11. Rear Planetary Ring Gear
12. Ring Gear Flange
13. Snap Ring
14. Oil Seal Ring
15. Output Shaft

- Overdrive brake



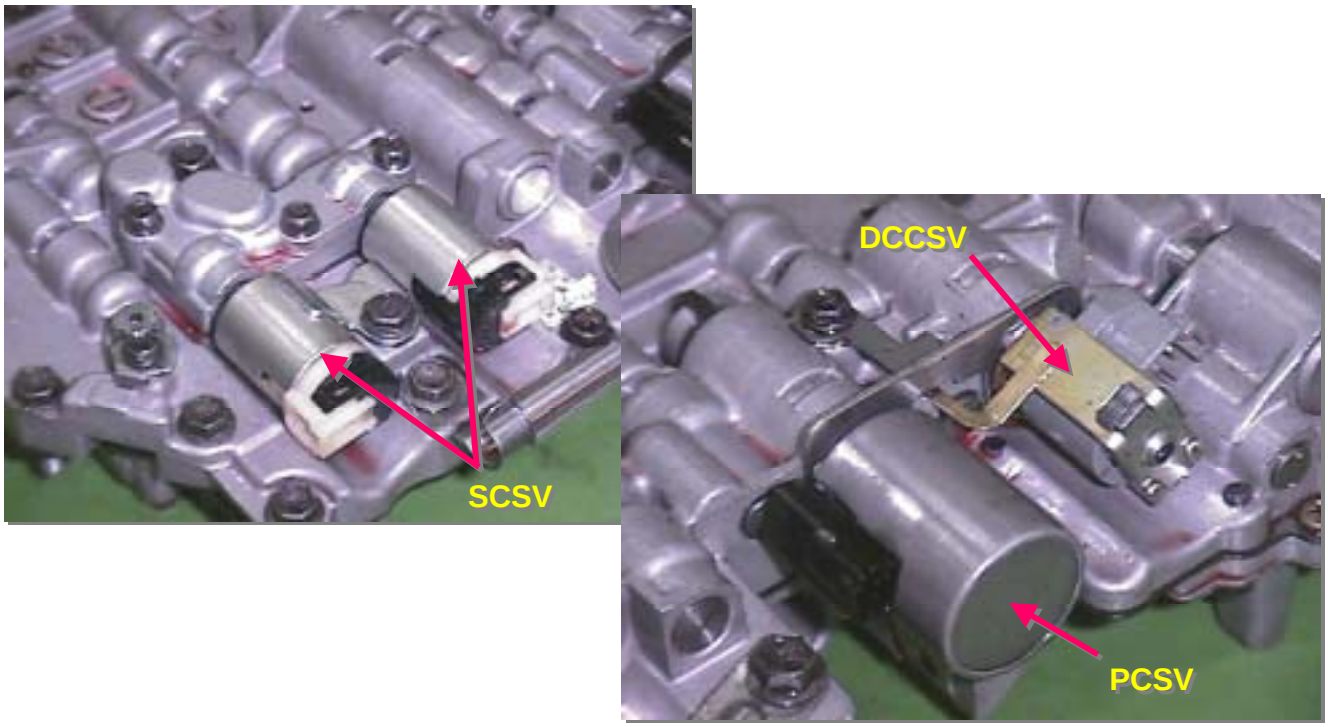
1. Snap ring
2. Piston return spring
3. O-ring
4. OD brake piston
5. Race
6. Bearing
7. OD support
8. Thrust washer
9. Seal ring

- Low & Reverse brake



1. Plate
2. Disc
3. Flange
4. O-ring
5. NO.2 First & reverse brake piston
6. O-ring
7. Reaction sleeve
8. O-ring
9. NO.1 First & reverse brake piston
10. Case

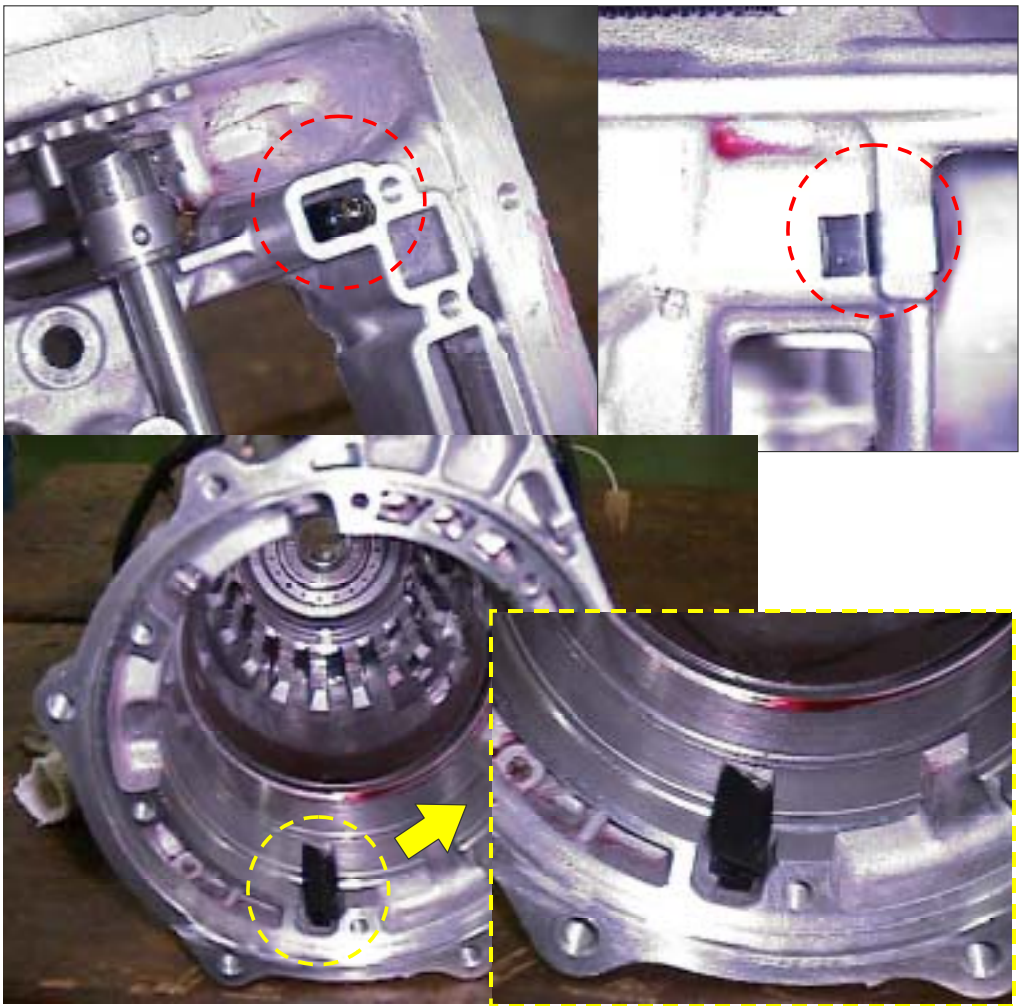
- Valve body



- Accumulators

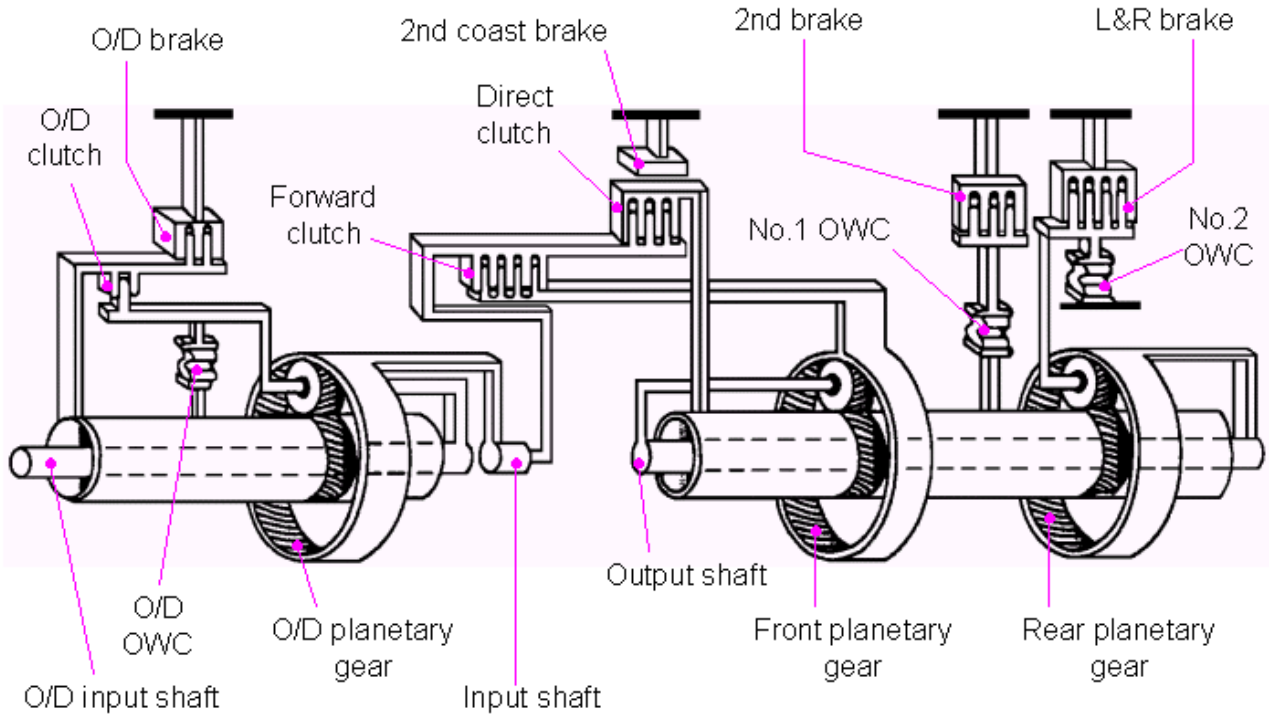
OD direct clutch
Accumulator pistons

- Ball & Clips



5.3.2. Operating Element Chart

POSITION		SOLENOID			CLUTCH			BRAKE				O.W.C.			GEAR RATIO
		S1	S2	SL	C0	C1	C2	B0	B1	B2	B3	F0	F1	F2	
P		ON	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	-
R(V<7)		ON	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	2.393
R(V>=7)		ON	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	-
N		ON	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	-
D	1st	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON OFF	2.804
	2nd	ON	ON	OFF	ON	ON	OFF	OFF	OFF	ON	OFF	ON	ON OFF	OFF	1.531
	3rd	OFF	ON	ON	ON	ON	ON	OFF	OFF	ON	OFF	ON	OFF	OFF	1.000
	4th	OFF	OFF	ON	OFF	ON	ON	ON	OFF	ON	OFF	OFF	OFF	OFF	0.705
2	1st	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON OFF	2.804
	2nd	ON	ON	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	OFF	1.531
	3rd	OFF	ON	OFF	ON	ON	ON	OFF	OFF	ON	OFF	ON	OFF	OFF	1.000
L	1st	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	ON	ON	OFF	ON	2.804
	2nd	ON	ON	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	OFF	1.531

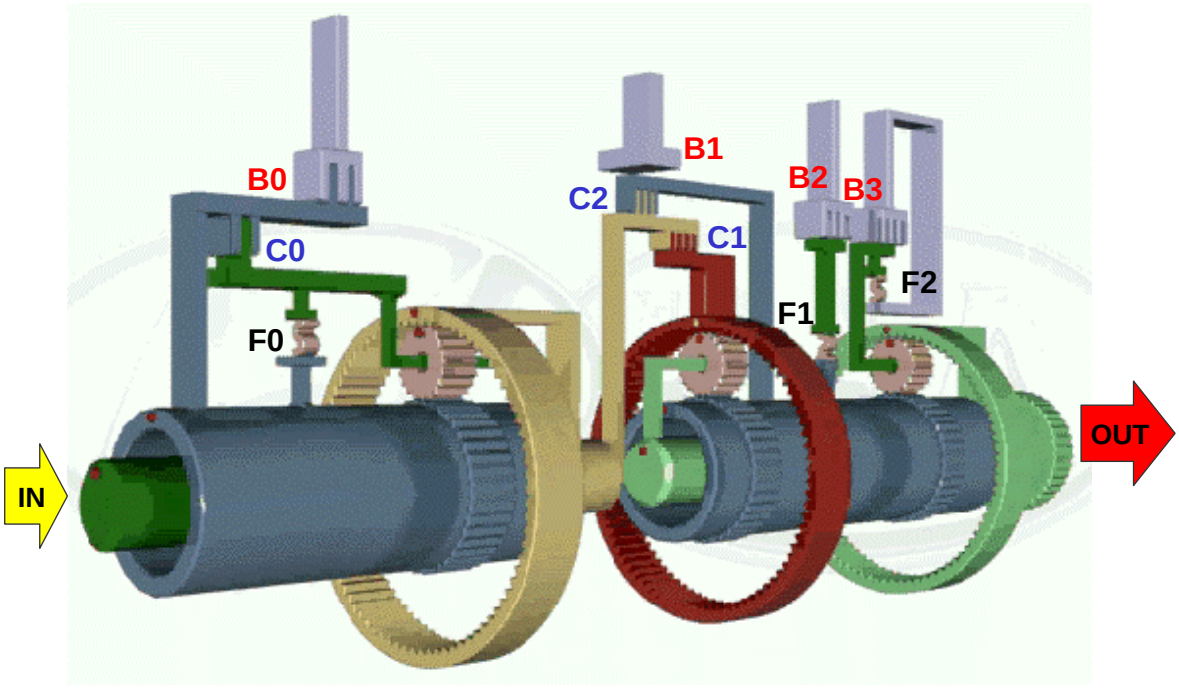


- The usages of each friction plate

Elements	Friction plate		
	03-II	30-40LEi	
Engine	4D56 Tci	KJ2.9	3.5 V6
C-0	n=1	n=2	n=2
B-0	n=3	n=4	n=4
C-1	n=5	n=6	n=6
C-2	n=3	n=4	n=4
B-1	n=2	Band	Band
B-2	n=3	n=5	n=5
B-3	n=5	n=7	n=6

5.3.3. Power flow

Refer the power flow picture in “AW30-43LE” section. (Same as one for AW30-43LE)

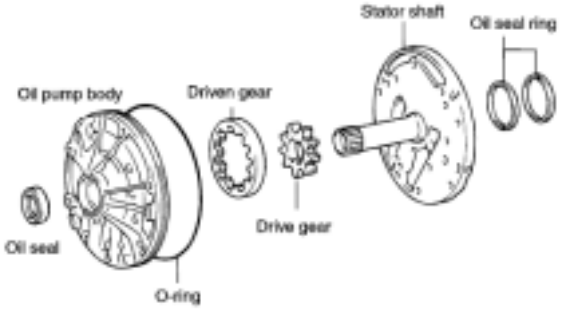


5.4 Hydraulic Control System

Based on the hydraulic pressure created by the oil pump, TCM sends signals to solenoid and hydraulic control system governs the hydraulic pressure acting on the torque converter, planetar y gear, clutches and brakes in accordance with the vehicle driving conditions.

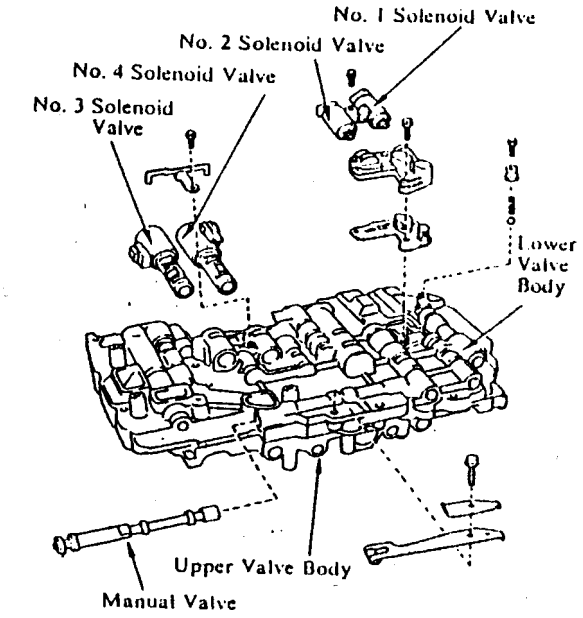
5.4.1. Oil pump

Operated by the impeller hub inside Torque converter, it generates oil pressure for operating components as well as lubricating planetary gear set



5.4.2. Valve body

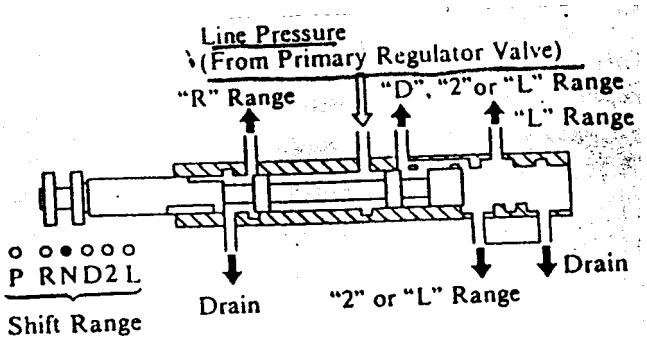
Consists of an upper body and a lower body. It controls hydraulic pressure that applies to operating components as well as changes oil paths inside valve body.



5.4.3. Hydraulic spool valves

- Manual valve

Connected to a shift lever, it changes oil path according to the shift lever position, P-R-N-D-2-L.

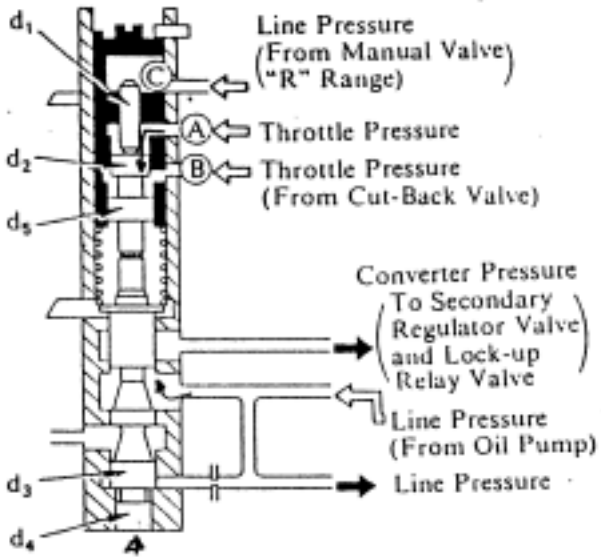


- Primary regulator valve

Using the throttle pressure, Primary regulator valve processes the pressure from the oil pump and generates proper line pressure in accordance with engine load.

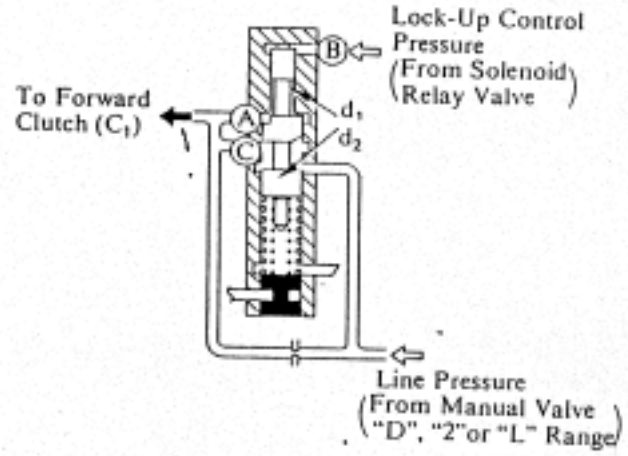
If the primary regulator valve is abnormal, shift shock or disc slip occurs.

* Line pressure: Basic operating pressure to engage all the clutches and brakes.



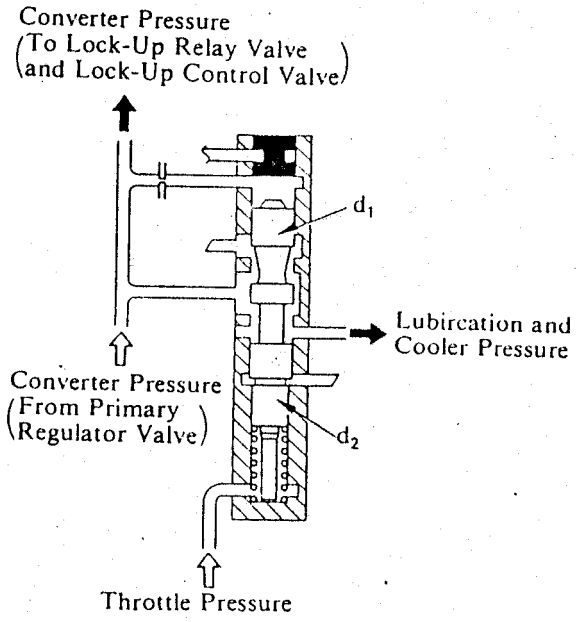
- C1 Orifice control valve

Line pressure from manual valve applies to C_1. At the same time lock-up control pressure also applies to the other side of the spool valve inside it. Therefore the output pressure to forward clutch via this valve changes.



- Secondary regulator valve

Line pressure from manual valve applies to C_1. At the same time lock-up control pressure also applies to the other side of the spool valve inside it. Therefore the output pressure to forward clutch via this valve changes.

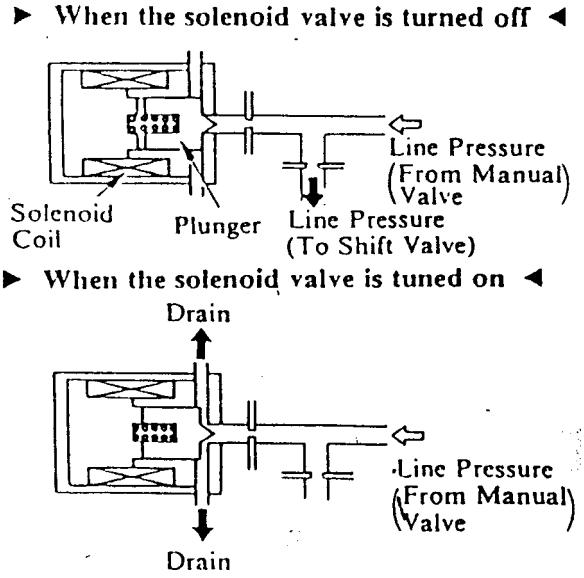


- Shift control solenoid valve NO1, NO2 (S1, S2)

SCSC-A & B controls 1-2, 2-3, 3-4 shift valve by ON or OFF signal from TCM.

Line pressure applies to the SCSV-A at all the forward driving ranges (D,2,L) and to the SCSV-B at all ranges(P,R,N,D,2,L).

SCSV-A / SCSV-B / Shift range	ON / OFF	ON / ON	OFF / ON	OFF / OFF
P	Parking	-	-	-
R	Reverse	-	-	-
N	Neutral	-	-	-
D	1st	2nd	3rd	4th
2	1st	2nd	3rd	3rd
L	1st	2nd	2nd	1st



* Sol. Type: NC (Normal close): When ON, it is open → line pressure to shift valve drains

* Resistance: 11~15 ohm (20℃)

- 1-2 Shift valve

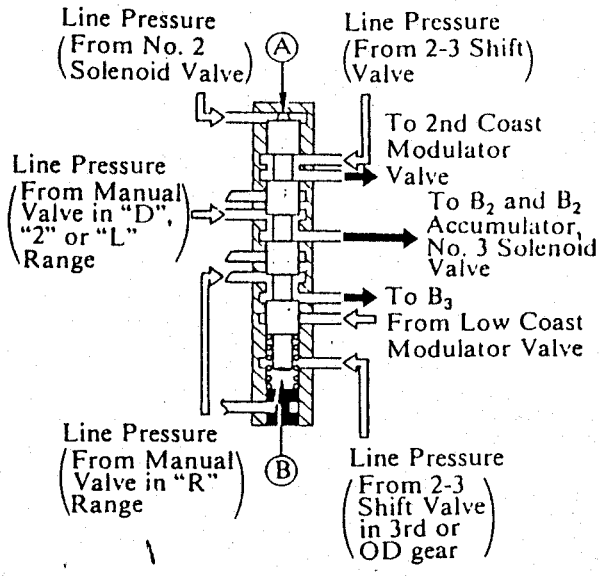
1-2 shift valve performs 1st - 2nd gear shift by SCSV-B ON/OFF.

* SCSV-B ON:

Pressure at 'A' releases → Spool moves upward → Pressure to B_2 is applied → 2nd gear

* SCSV-B OFF:

Hydraulic pressure applied to 'A' → Spool moves downward → B_2 pressure is cut → 1st gear



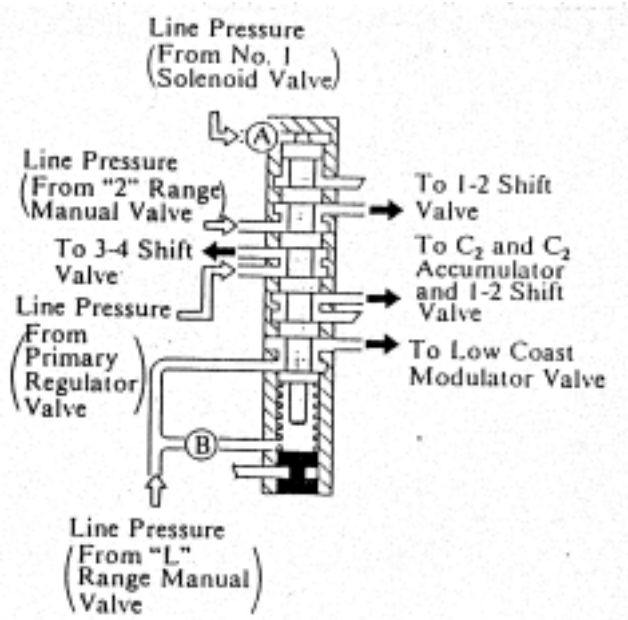
* At 4th gear, even the SCSV-B is OFF, the spool moves upward because of the 2-3 shift valve line pressure: Pressure is applied to B_2

- 2-3 Shift valve

2-3 shift valve performs 2nd - 3rd gear shift by SCSV-A ON/OFF.

* SCSV-A ON:
Pressure at 'A' releases → Spool moves upward → C_2 pressure is cut → 2nd gear

* SCSV-A OFF:
Hydraulic pressure applied to 'A' → Spool moves downward → Pressure to C_2 is applied → 3rd gear



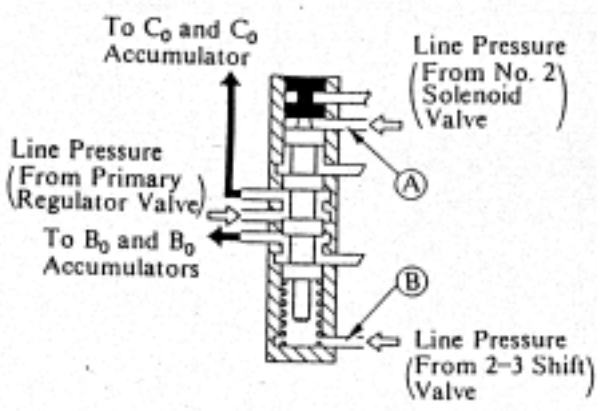
* At 'L' range, the spool moves upward because the line pressure from a manual valve applies to 'B': 3rd gear is impossible

- 3-4 Shift valve

2-3 shift valve performs 2nd - 3rd gear shift by SCSV-A ON/OFF.

* SCSV-A ON:
Pressure at 'A' releases → Spool moves upward → C_2 pressure be cut → 2nd gear

* SCSV-A OFF:
Hydraulic pressure applied to 'A' → Spool moves downward → Pressure to C_2 is applied → 3rd gear



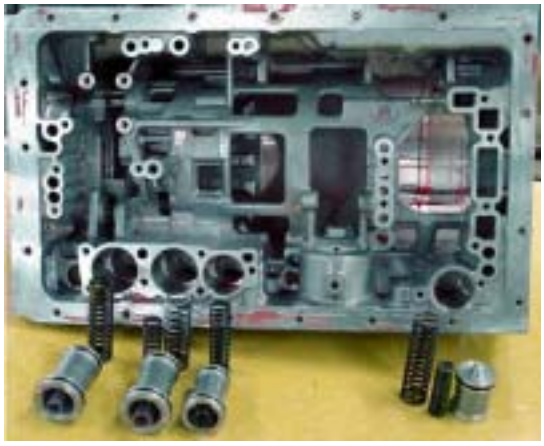
* At '2', 'L' range, the spool moves upward because the line pressure from a 2-3 shift valve applies to 'B': 4th gear is impossible

5.4.4. Accumulators

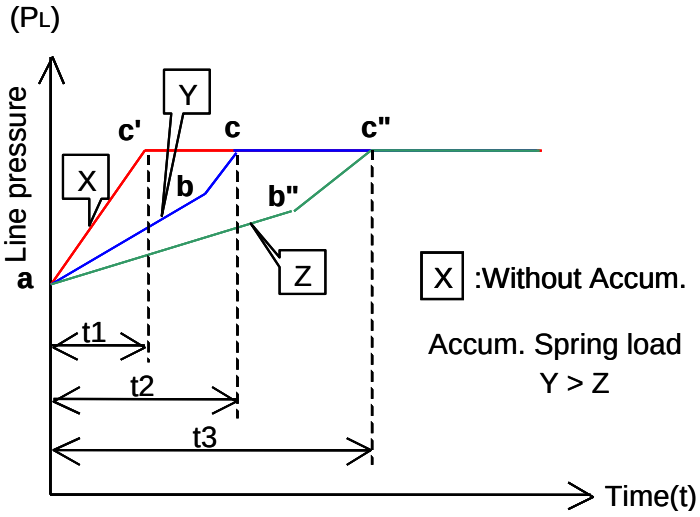
Hydraulic circuit of accumulator, of which one side is installed in the TM case and the other side faces the valve body, is connected with hydraulic circuit to Clutches, Brakes in parallel. It functions as a damper to lessen the engaging shock of Clutches and Brakes.
That is, accumulator functions as a damper until the accumulator back pressure and spring force that applies on the backside of the piston reaches the line pressure of the other side.

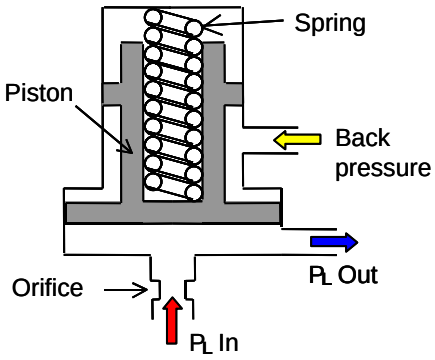
If the line pressure exceeds the accumulator back pressure and spring force, accumulator just functions as oil path.

30-Model has 5 accumulators (C0, C1, C2, B0, B2), one of them is installed inside a valve body and the others are located in the TM case.



Accum.	Operating timing
C0	4 → 3
C1	N → D
C2	2 → 3
B0	3 → 4
B2	1 → 2





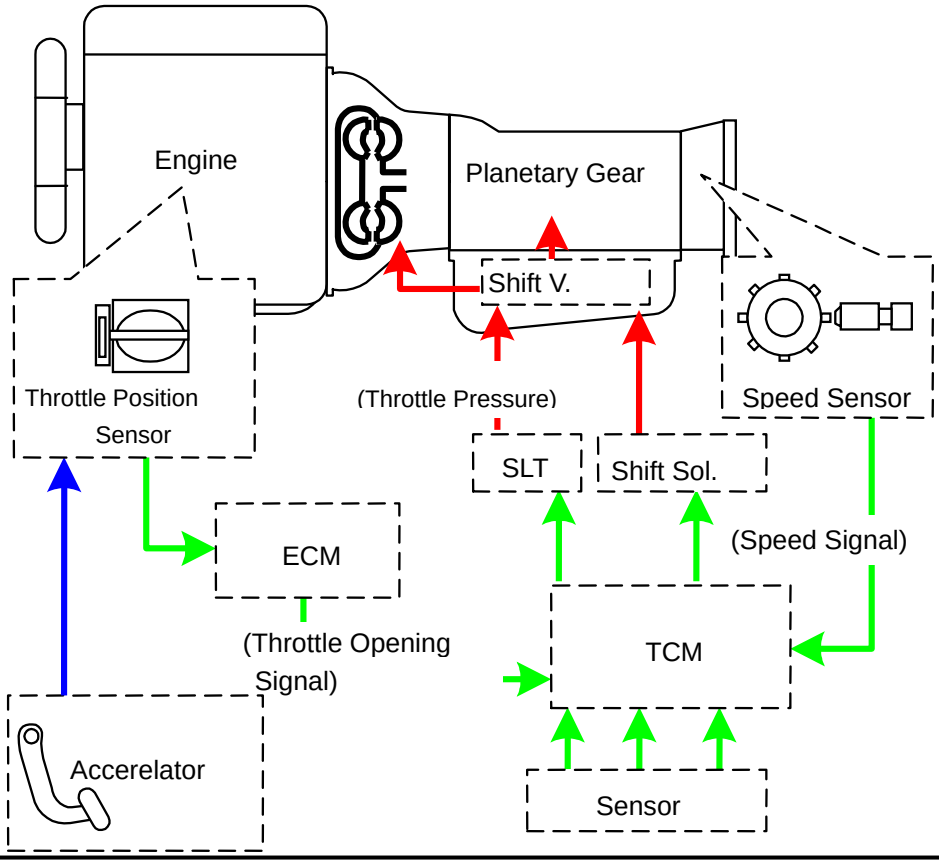
5.5 Electronic Control system

5.5.1. Generals

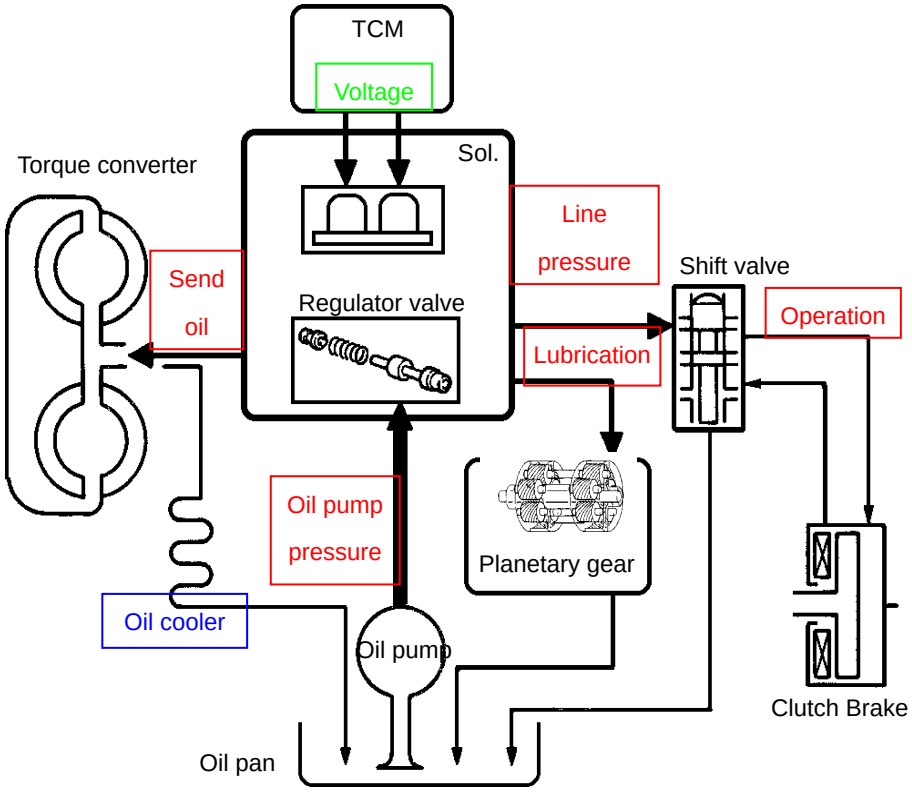
The basic part of all electronic control system is a TCM. TCM is an electronic device that receives information, stores information, and communicates information. All of the information it works with is really nothing more than electricity. To a TCM, certain voltage and current values mean something and based on these values, the TCM becomes informed.

TCM receive information from a variety of input devices that send voltage signals to the TCM. These signals tell the TCM the current condition of a particular part or the conditions that a particular part is opening in. After the TCM receives these signals, it stores them and interprets the signals by comparing the values to data it has in its memory. If an action is required, the TCM will send out a voltage signal to the device that should take the action, causing it to respond and correct the situation. This entire process describes the operation of an electronic system. Information is received by a microprocessor from some input sensors, the TCM processes the information, then sends commands out to output devices. And it monitors its own work and checks to see if its commands resulted in the expected results.

The vehicle speed signal detected by speed sensor and the throttle-opening signal detected by ECM are sent to TCM. Then, TCM sends the electronic signal (ON/OFF) to each solenoid for gears shifting of 1st, 2nd, 3rd and 4th and proper L-up timing. Also, TCM sends the electronic signal to SLT in accordance with the throttle opening to produce oil pressure (throttle pressure).



Based on the hydraulic pressure created by the oil pump, TCM sends signals to solenoid and hydraulic control system governs the hydraulic pressure acting on the torque converter, planetary gear, clutches and brakes in accordance with the vehicle driving conditions.



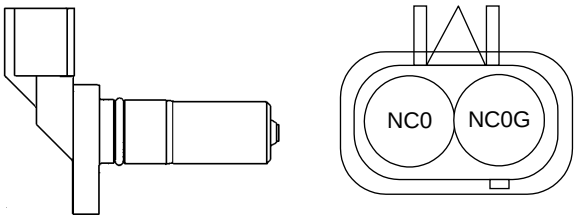
5.5.2. Input speed sensor

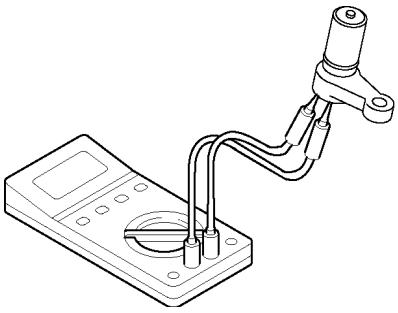
Input Speed Sensor detects A/T input speed from rotation number of C0 (Over drive clutch) drum, and they transmit to TCM as a signal.

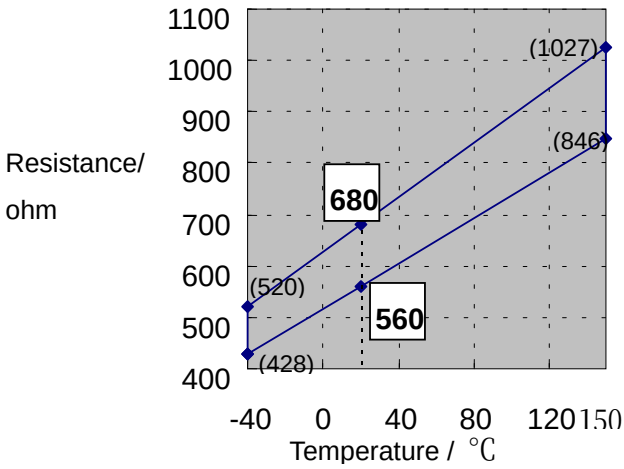
Inspection:

Make sure to inspect resistance again at 20 degree C when resistance differs from standards except 20 degree C. It might become infinity ohm when inspect resistance at higher temperature.

560 – 680 ohm (20℃)





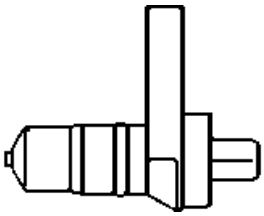


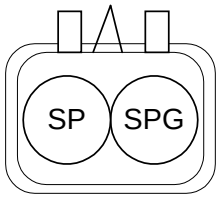
5.5.3. Output speed sensor

Output Speed Sensor detects a turn number of magnet of rotor sensor installed in output shaft, and communicates to TCM as a signal.

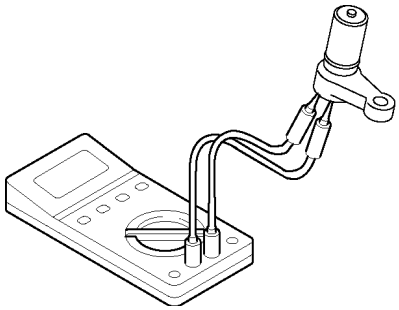
Inspection:

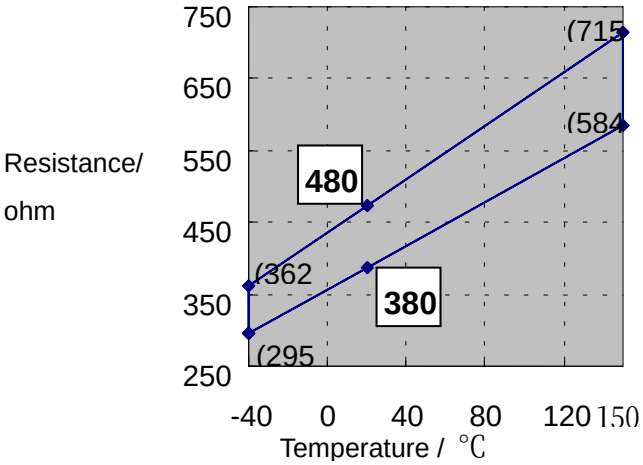
Make sure to inspect resistance again at 20 degree C when resistance differ from standards except 20 degree C. It might become infinity ohm when inspect resistance at higher temperature.





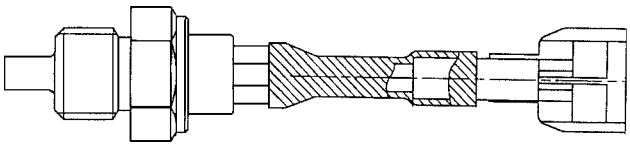
380 – 480 ohm (20℃)

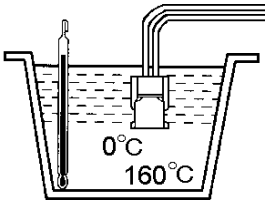


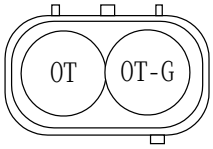


5.5.4. Oil temperature sensor

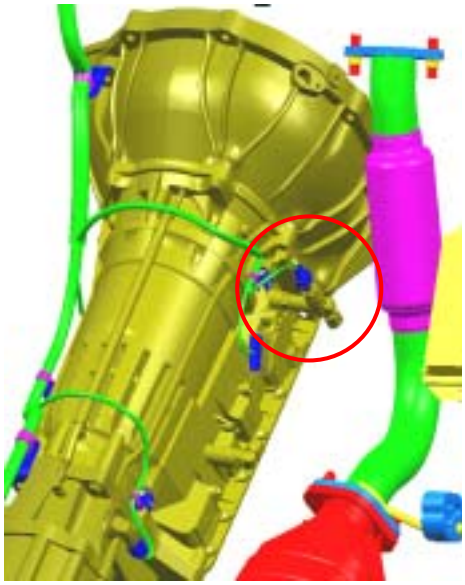
The Oil Temperature Sensor concerts ATF temperature variation into electronic signals to transmit to TCM. This information is necessary for shift control and L-up control, etc.





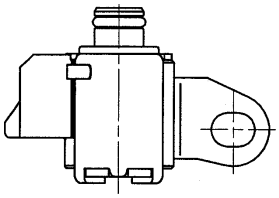


0℃	1,884 - 2,290
160℃	19.2 - 22.2 k ohm

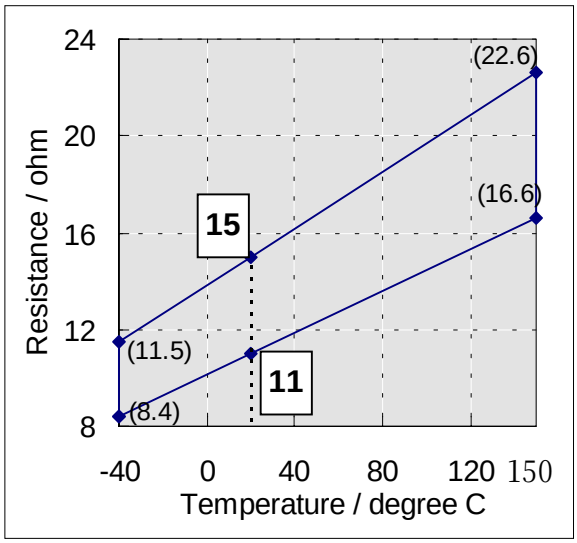


5.5.5. Solenoid valves (Shift solenoid No.1 No.2 (S1, S2), L-up Solenoid)

Shift Solenoid No.1/2 is each, and it is installed Valve body of A/T directly. And Shift Solenoid No.1/2 does the operation of ON / OFF by the control signal from TCM, and changes a position of shift valve by a combination with Shift Solenoid No.1/2, and changes gear. (11 – 15 ohm (20℃))



Normal close type

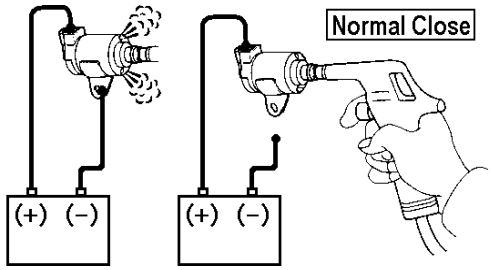


Inspection:

Make sure to inspect resistance again at 20℃ when resistance differs from standards except 20 degree C. It might become infinity ohm when inspect resistance at higher temperature.

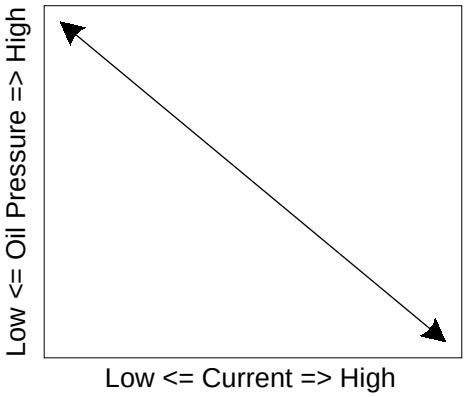
Normal close type:

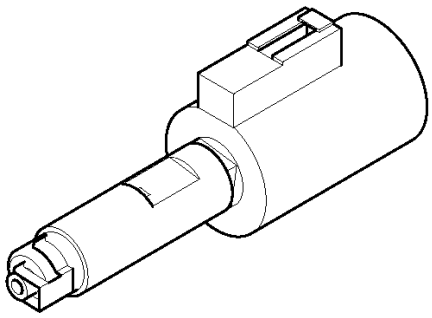
No connect battery	No leak air
Connect battery	Leak air



5.5.6. Line pressure control solenoid valve

SLT controls linear throttle pressure by control signal from TCM and line pressure for clutched and brakes to reduce shift shock.



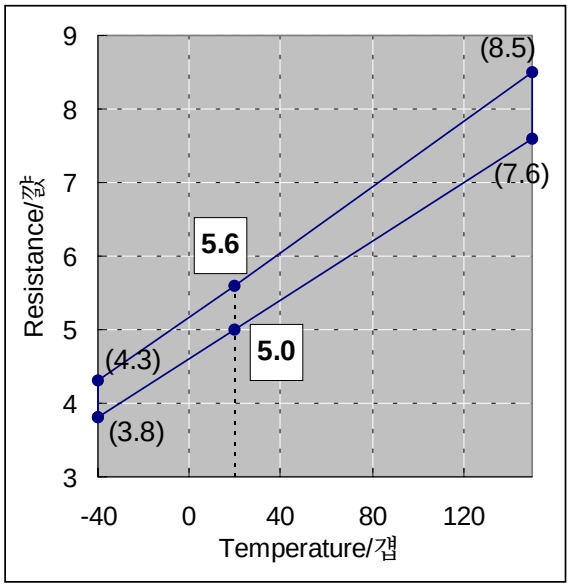


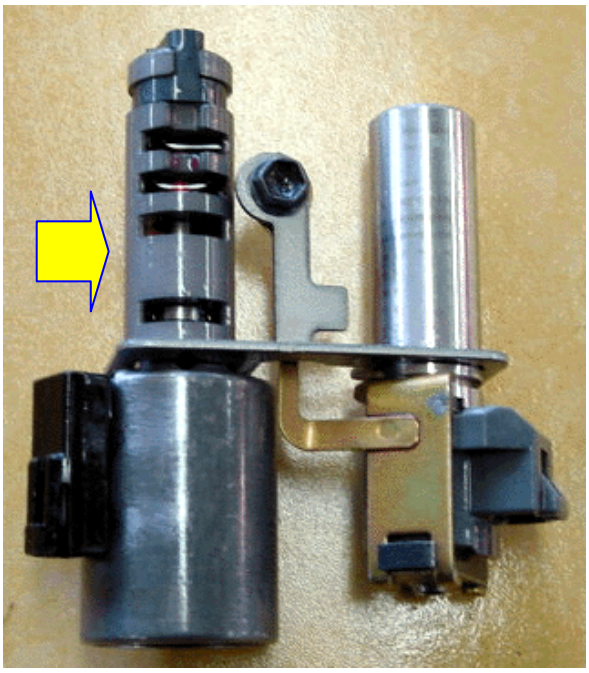
Inspection:

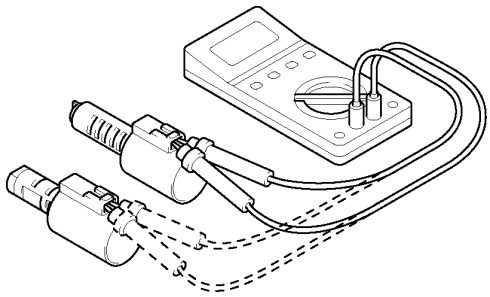
Make sure to inspect resistance again at 20℃ when resistance differs from standards except 20℃.

It might become infinity ohm when inspect resistance at higher temperature.

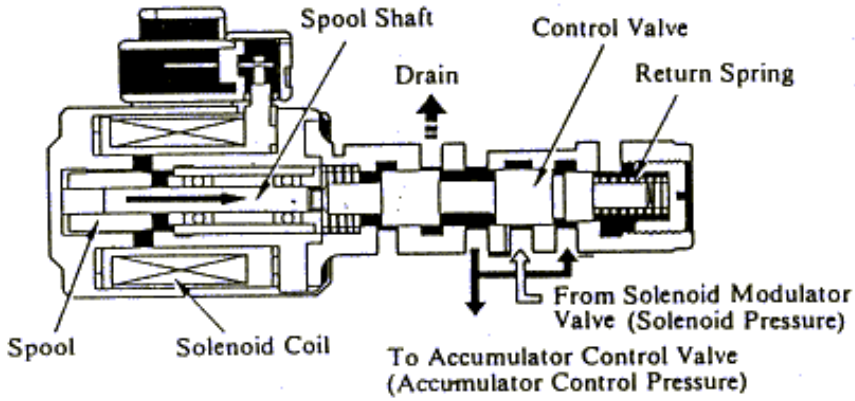
(5.0 – 5.6 ohm (20℃))

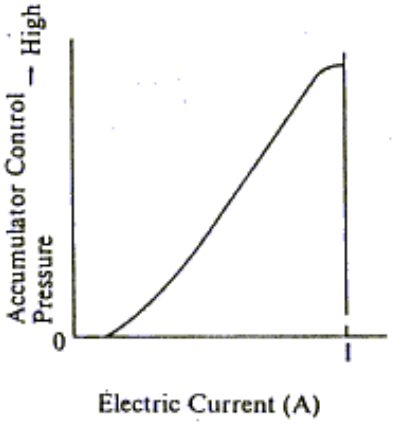






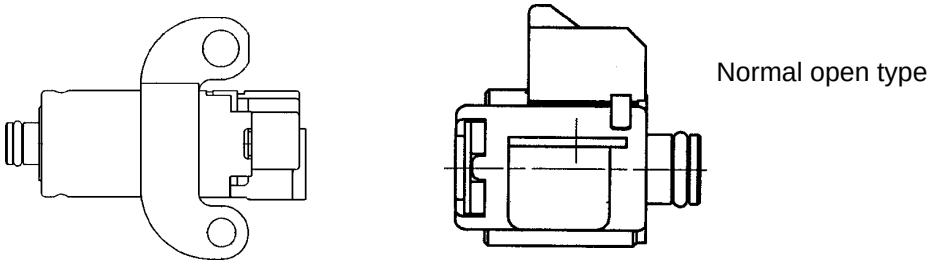
S13-17F





5.5.7. Lock-up solenoid valve

Lock-up solenoid valve operates of ON/OFF by the control signal from TCM and L-up clutch inside T/C.



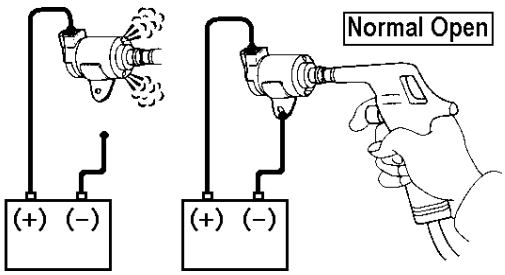
Normal open type

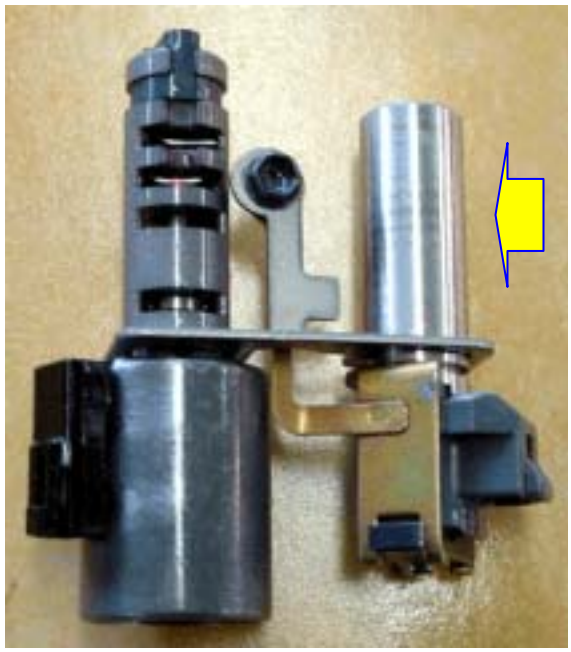
According to each L-up shift schedule, TCM sends signals to the Lock-up solenoid valve that operates ON/OFF control “L-up control” on the basis of the vehicle speed and the throttle opening.

Inspection: Make sure to inspect resistance again at 20-degree C when resistance differs from standards except 20 degree C. It might become infinity ohm when inspect resistance at higher temperature.

Normal open type:

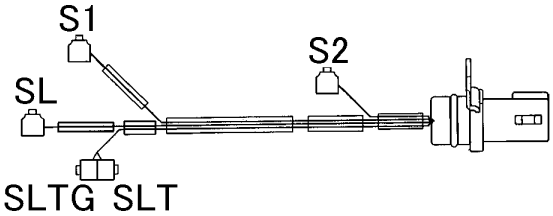
No connect battery	Leak air
Connect battery	No leak air

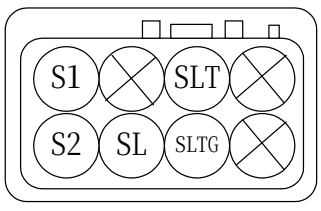




- Wire to solenoid valves

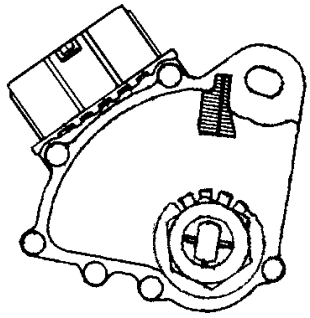
Wire To Solenoid puts wiring of Shift Solenoid No.1, No.2, L-up Solenoid and SLT together in one connector, and it is installed to A/T case.

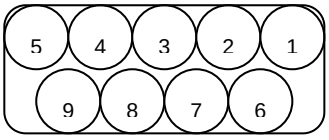




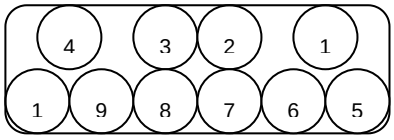
5.5.8. Inhibitor switch (Transaxle range switch)

TR switch transmits the information which range includes shift lever of A/T to TCM by combination of a position circuit terminal. It is possible for TR switch to start an engine in only “P” and “N”. (Prevention of reckless driving) It is used for TR switch to shift control.

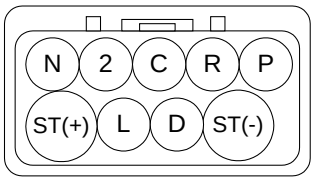




For 4D56 Tci
(for AW03-II model)

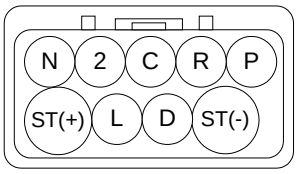


For 2.9 Tci / 3.5V6
(for AW30-43LE model)

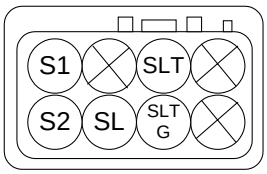


- Connector of vehicle harness (TCM)

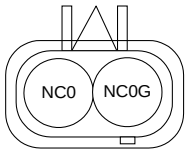
TR switch



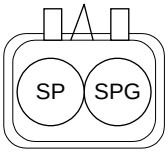
Solenoid



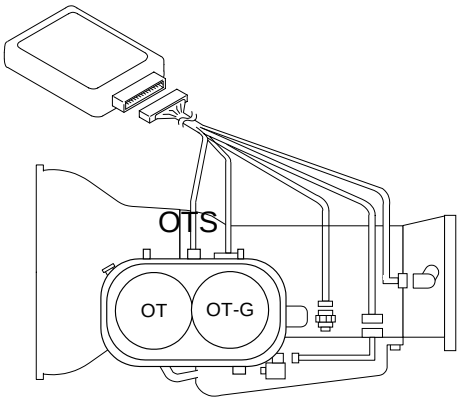
Input speed



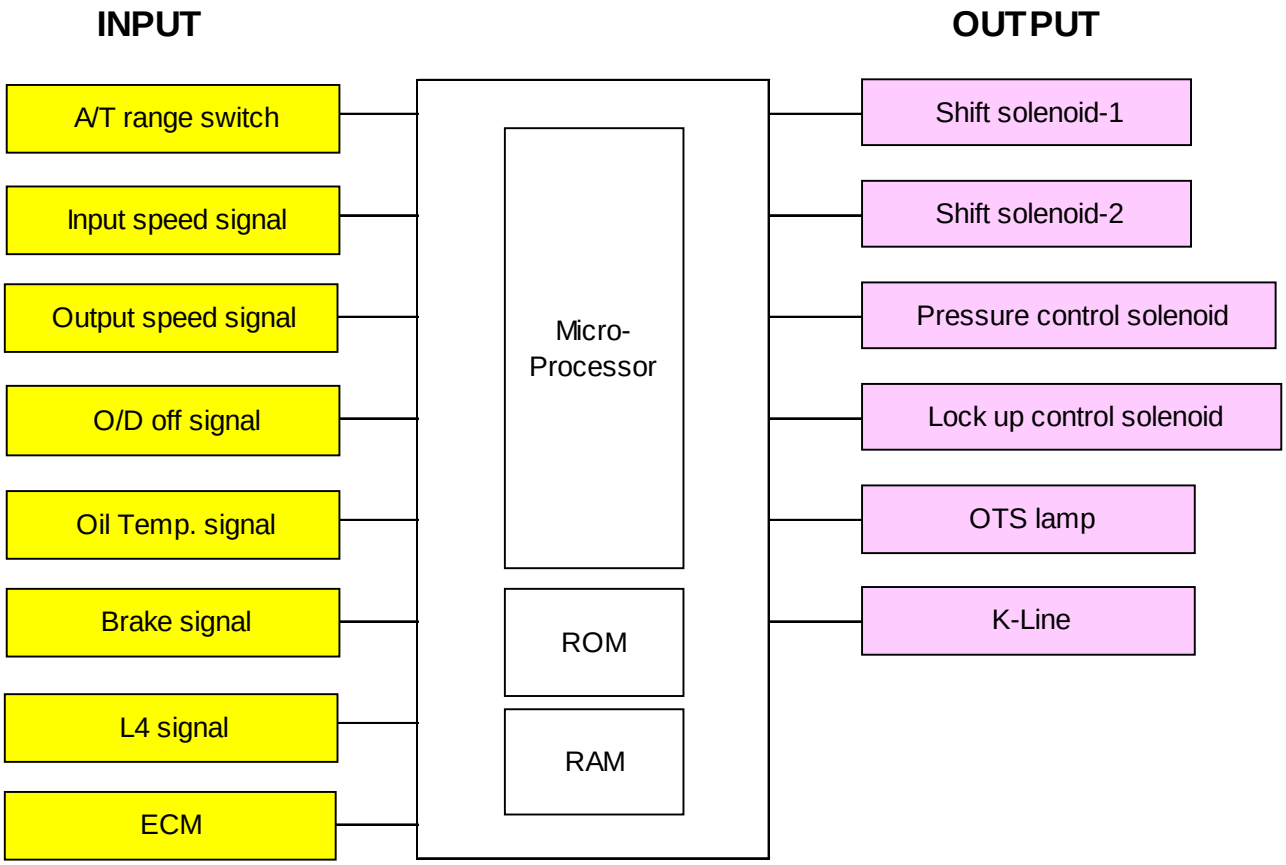
Output speed



OTS



5.5.9. System block diagram

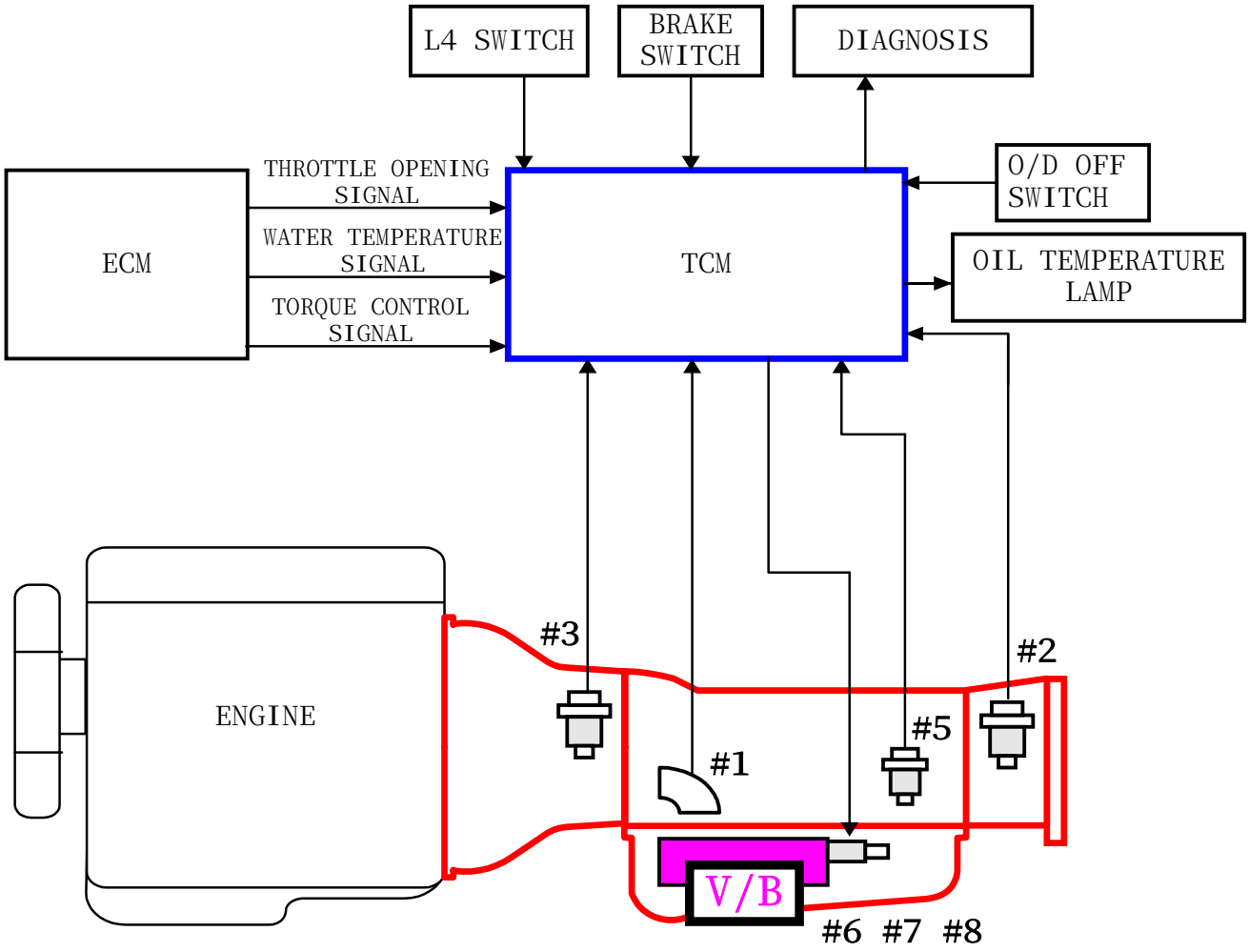


5.5.10. Shift control schedule

In accordance with the vehicle speed and the throttle opening, the TCM sends signal to the shift solenoids (No.1 and No.2) that operate the shift valves.

Gear	No.1	No.2
1st	ON	OFF
2nd	ON	ON
3rd	OFF	ON
4th	OFF	OFF

5.5.11. System schematics



#1 TR SWITCH

#2 OUTPUT SPEED SENSOR (SP)

#3 INPUT SPEED SENSOR (C0)

#4 SPEED METER DRIVEN GEAR (SPM)

#5 OIL TEMPERATURE SENSOR (OT)

#6 SHIFT SORENOID NO.1 NO.2 (S1, S2)

#7 LINE PRESSURE CONTROL SOLENOID (SLT)

#8 LOCK UP SOLENOID (SL)

5.5.12. Lock-up cut control

When the following 3 conditions give approval by 1, TCM cancels L-up.

(1) Brake switch ON

(2) Accelerator opening is full closed. (Engine Rev. is idle speed)

(3) Engine water temperature is low.

5.5.13. Over drive cut control

When the following condition, TCM cancels 4th gear.

(1) Engine water temperature is low.

(2) L4 S/W ON

(3) O/D switch OFF

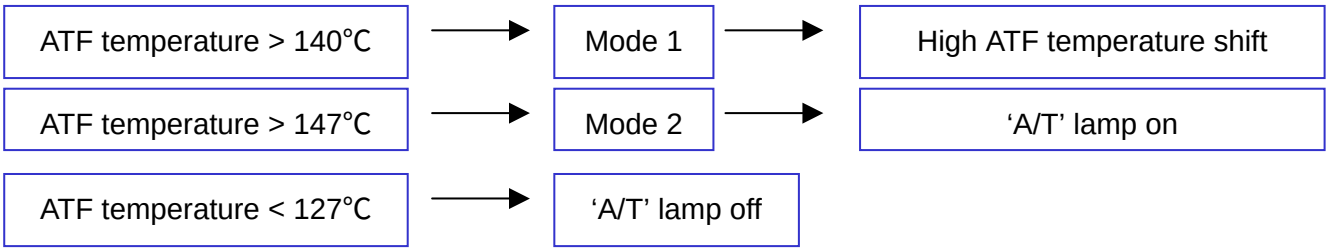
5.5.14. Driving control

<=>: Shift up/down, <=: Only shift down, (L): L-up operation

HP/2.5 TCI	
D	1 <=> 2 <=> 3 <=> 4(L)
2	1 <=> 2 <= 3
L	1 <= 2

5.5.15. ATF temperature control

When ATF temperature abnormally rises (more than 140 degree C), TCM changes shift pattern automatically. As a result, A/T can get bigger driving low gear range, and the rise of ATF temperature by torque converter slip can be prevented. Also, a warning lamp will brink if the oil temperature rises to more than 147 degree C.



- A/T (Automatic Transmission) oil temperature warning light

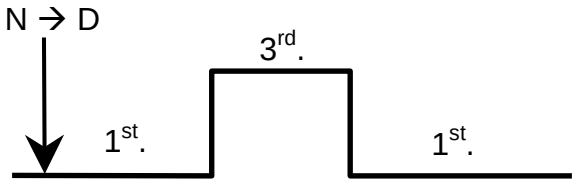
The A/T oil temperature warning light comes on (No blinking) when the automatic transmission oil temperature goes up to the temperature that may result in serious damage of automatic transmission. If the A/T oil temperature warning light comes on while driving, park your vehicle in at a safe place as soon as possible and with the selector lever is shifted into "P" position, and allow the engine to idle un til the warning light goes off. And when the warning light goes off, the vehicle can be driven normally.

- Torque reduction control and line pressure control

Torque reduction control improves the shift quality due to sending torque reduction request signal from TCM to ECM and reducing engine torque increase of shift at N-D, N-R shift and 1 <=> 2 <=> 3 <=> 4. Line pressure control improves the shift quality due to controllable line pressure at N-D, N-R shift, and 1 <=> 2 <=> 3 <=> 4.

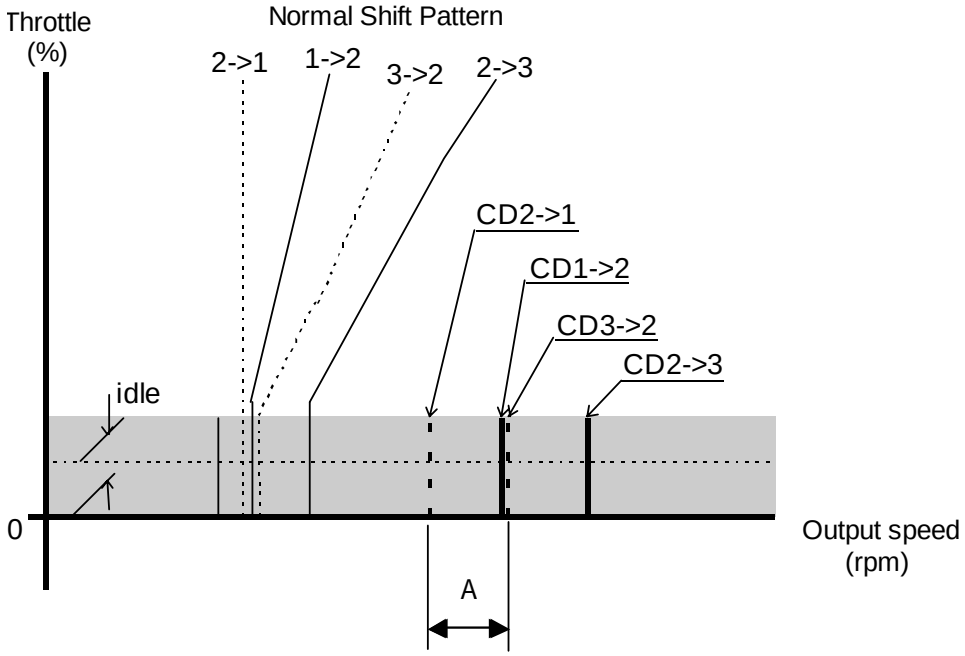
5.5.16 Squat control

When the shift lever is shifted from “N” to “D”, the Squat control operation that temporarily shifts to 3rd gear reduce shifting shock and squatting vehicle.



5.5.17. Coast down control

To prevent the frequent gear shift during short time in the condition of low TPS opening ratio and to improve the shift quality such as 2->1, 3->2 at the coast down road, a special shift pattern was adopted to be operated in case of specified vehicle condition.



- Coast down control beginning condition

1) Brake switch is N (When the foot brake is depressed)
2) Engine is idle (When the accelerator pedal is not depressed)

- Coast down control cancellation condition

1) After 1 second since the brake switch is OFF (To prevent hysteresis)
2) TPS > 0% (When the accelerator pedal is depressed). Comparing with previous shift pattern, the width ‘A’ was enlarged so as to prohibit the shift busy.

5.5.18 Communication

WTS**:
4D56, 3.5 V6
- On/Off switch from ECM to TCM

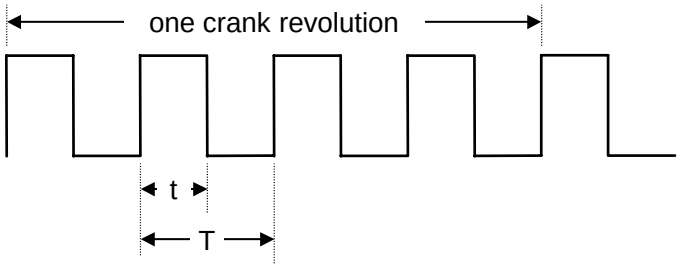
J3-2.9 C/rail
- PWM from ECM to TCM

VSS*: Comes from sensor directly.

Items	4D56 Tci	J3-2.9 Tci (C/Rail)	3.5 V6 (Euro-III)
Torque control	O	O	O
Engine rpm	X	O	O
MIL	X	X	O
VSS*	X	X	O
WTS**	O	O	O

- Engine RPM (ECM->TCM) : Except 4D56TCi

The E_REV is a rectangular signal with 50% +/-10% duty cycle. The number of pulses is 4 pulses per 1 crankshaft revolution.



t / T × 100% = 50 +/- 10

- Accelerator position (ECM->TCM)

The frequency of PWM (Pulse-Width Modulation) signal is 100 Hz.

f = 100 Hz +/- 1%, T_PWM = 10 ms +/- 0.1ms

Specification of duty cycles :

0 % ≤ duty-cycle < 5 % = 0.0 ms ≤ t < 0.5 ms → failure of APS signal

5 % ≤ duty-cycle < 10 % = 0.5 ms ≤ t < 1.0 ms → 0 % APS

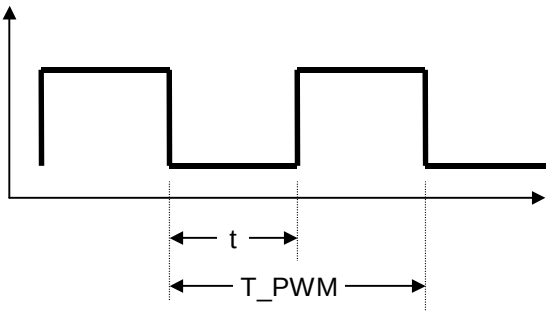
10 % ≤ duty-cycle ≤ 83 % = 1.0 ms ≤ t £ 8.3 ms → valid (0 % APS - 100 % APS)

83 % < duty-cycle ≤ 94 % = 8.3 ms < t ≤ 9.4 ms → 100 % APS

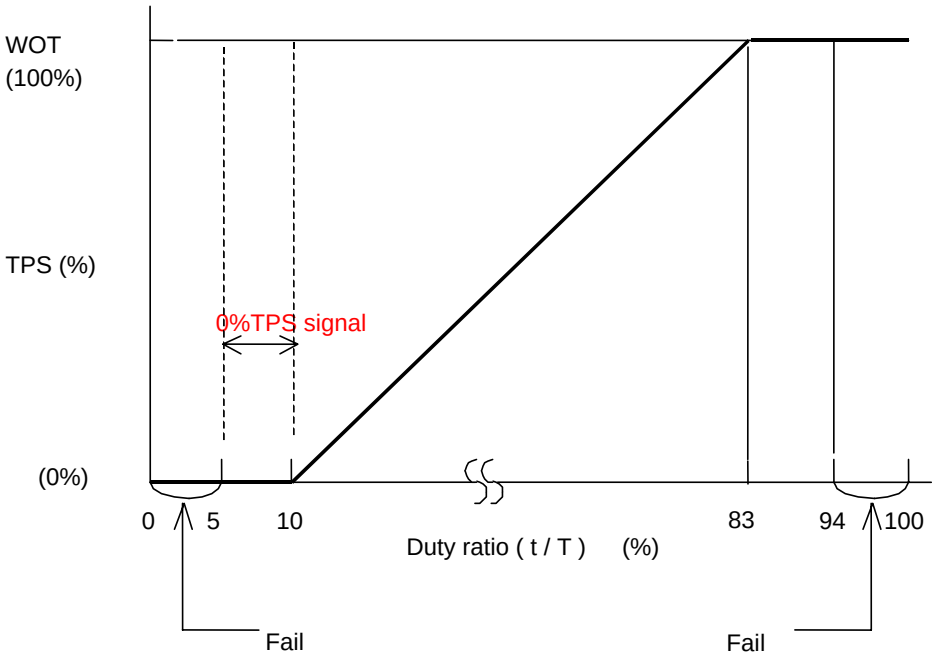
94 % < duty-cycle ≤ 100 % = 9.4 ms < t ≤ 10.0 ms → failure of APS signal

The APS information is always transferred when IG key is 'ON' even during cranking. If acceleration pedal sensor is fail, ECM should transfer 100% PWM.

$$APS = duty\ cycle\,[\%] = \frac{t\,[ms]}{T\_PWM\,[ms]} * 100\ \%$$



PWM Throttle signal (Duty vs. Throttle openings)



- Water temperature (ECM->TCM) for KJ2.9TCi (C/Rail)

f = 100 Hz +/- 1%, T_PWM = 10 ms +/- 0.1ms

WT = duty cycle [%] = (t [ms] / T_PWM [ms]) * 100%

Specification of duty cycles :

0 % ≤ duty-cycle < 5 % = 0.0 ms ≤ t < 0.5 ms → failure of WT signal

5 % ≤ duty-cycle < 10 % = 0.5 ms ≤ t < 1.0 ms → -50degC WT

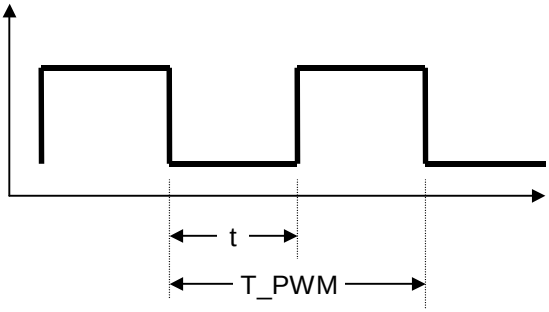
10 % ≤ duty-cycle ≤ 90 % = 1.0 ms ≤ t ≤ 9.0 ms → valid (-50degC WT – 150degC WT)

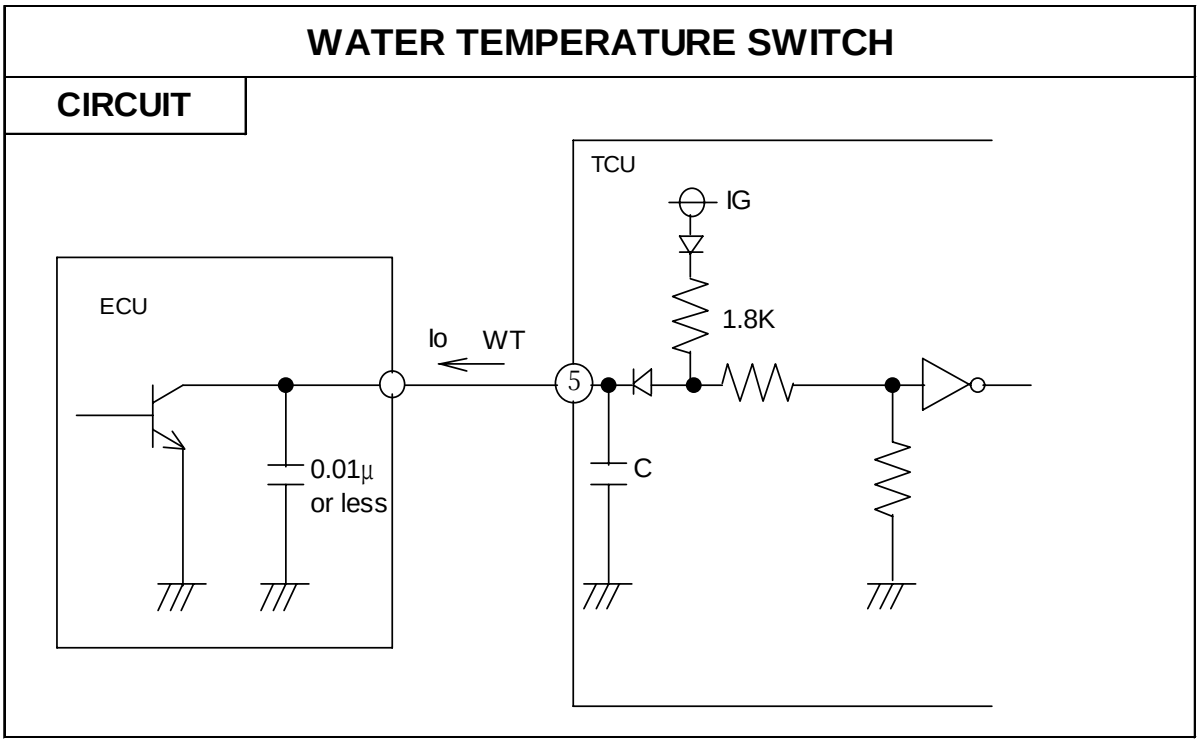
90 % < duty-cycle ≤ 95 % = 9.0 ms < t ≤ 9.5 ms → 150degC WT

95 % < duty-cycle ≤ 100 % = 9.5 ms < t ≤ 10.0 ms → failure of WT signal

The WT information should be always transferred when IG key is 'ON' even during cranking.

If water temperature sensor is fail, ECM should transfer 100% PWM





Io: 10mA max. (at IG = 16V)

Leak resistance: 100K·min.

Chattering time: 10msec. Max.

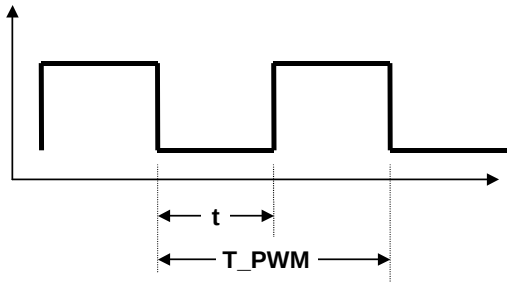
Signal logic: Active low at low temperature. 0V (ECT<37℃), 12V (ECT>40℃)

- Torque reduction request (ECM<-TCM)

The torque request signal is transmitted by the TCM and is used by ECM to reduce the engine torque during gearshift. The active signal is a low state.

f = 100 Hz +/- 1%, T_PWM = 10 ms +/- 0.1ms

$$DT\_PWM = duty\ cycle\,[\%] = \frac{t\,[ms]}{T\_PWM\,[ms]} * 100\ \%$$



Specification of duty cycles:

TCM will monitor continuously the hardware output line for the presence of error so that a `stuck high` or `stuck low` of output can be detected.

Constant high signal when no gear shifting → No reduction required

0 % < duty-cycle < 10 % = 0.0 ms < t < 1.0 ms → ECM ignores this request (invalid signal)

10 % ≤ duty-cycle < 14 % = 1.0 ms ≤ t < 1.4 ms → Maximum torque reduction requested.

14 % ≤ duty-cycle ≤ 96 % = 1.4 ms ≤ t ≤ 9.6 ms → Valid signal

96 % < duty-cycle ≤ 98 % = 9.6 ms < t ≤ 9.8 ms → No reduction requested

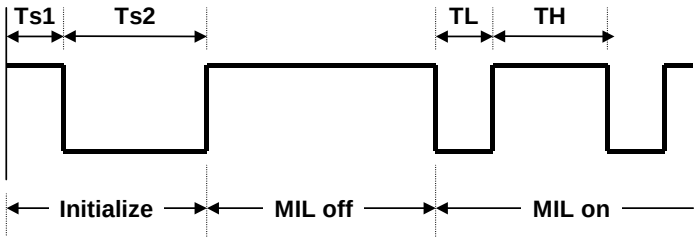
98 % < duty-cycle < 100 % = 9.8 ms < t < 10.0 ms → ECM ignores this request (invalid signal)

constant low signal → Failure of T_RED signal

TCM have no information of real (current) engine torque, but through the calibration work at each condition in the actual vehicle for up- and downshifts, the TCM determines the value by how much the engine torque has to be reduced.

- MIL request (TCM->ECM) – Only for 3.5 V6 with OBD-II or E-OBD

By the MIL-line the TCM demands of the ECM to switch on or off the malfunction indication lamp (MIL).



Specification of MIL request signal:

	Ts1	Ts2	TL	TH
TCM	0.3	2.0se	90ms	1660
ECM	1500<TL+TH<2000msec			

5.5.19. Diagnostic Specification (For Terracan, Except EU & N/A)

CODE	Description	03-II	30LEi
P0705	Transmission Range Sensor Circuit Malfunction(OPEN/SHORT)	C	C
P0722	Output speed Sensor Circuit(No signal)	B	B
P0743	Torque converter Clutch Circuit(SL) Electrical(HIGH/LOW Voltage)	C	C
P0753	Shift Solenoid A(S1) Electrical(HIGH/LOW Voltage)	A	A
P0758	Shift Solenoid B(S2) Electrical(HIGH/LOW Voltage)	A	A
P1121	Throttle sensor Signal Malfunction(PWM Type)	B	B
P0710	Transmission Fluid Temperature Sensor Circuit Malfunction(OPEN/SHOR	C	C
P0715	Input speed Sensor Circuit(No signal)	B	B
P0748	Pressure Solenoid(Sth) Electrical(HIGH/LOW Voltage)	A	A
P1780	Torque reduction signal malfunction(LOW Voltage)	B	B
		4D56TCI	Σ3.5D

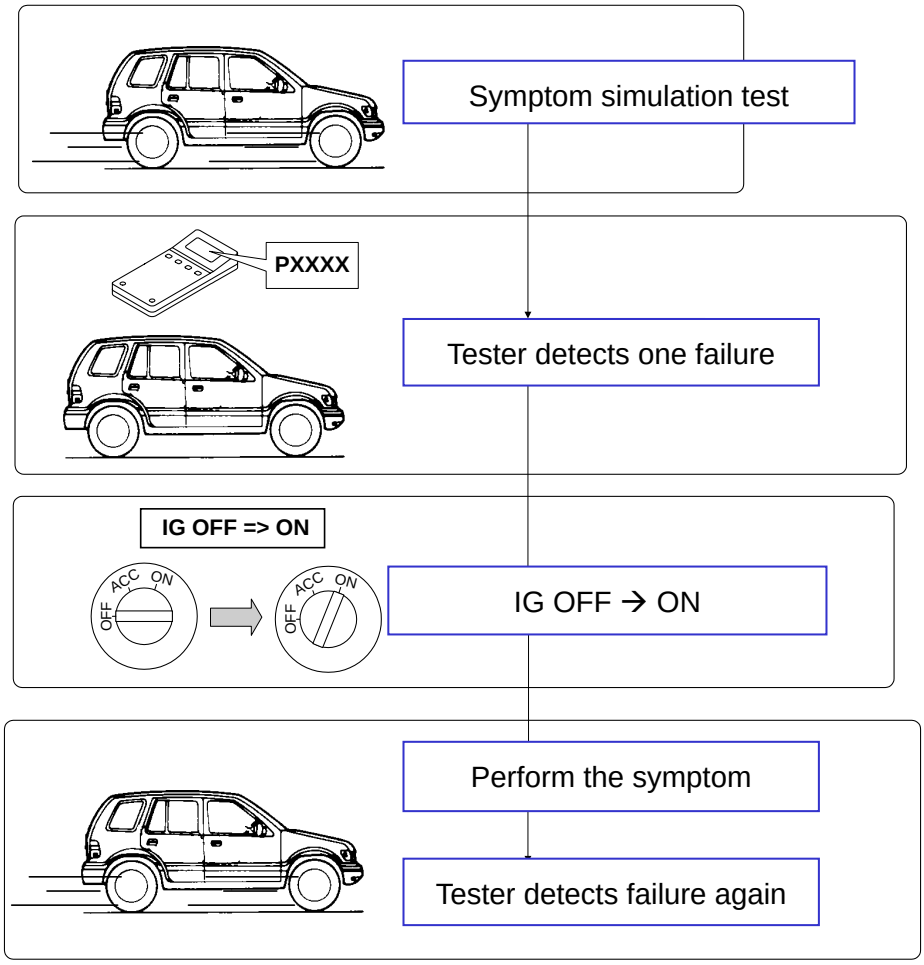
Type A: Failure store DTC on the 1st driving cycle.

Type B: Oil-lamp blinking on the 2nd consecutive driving cycles with a fail store DTC.

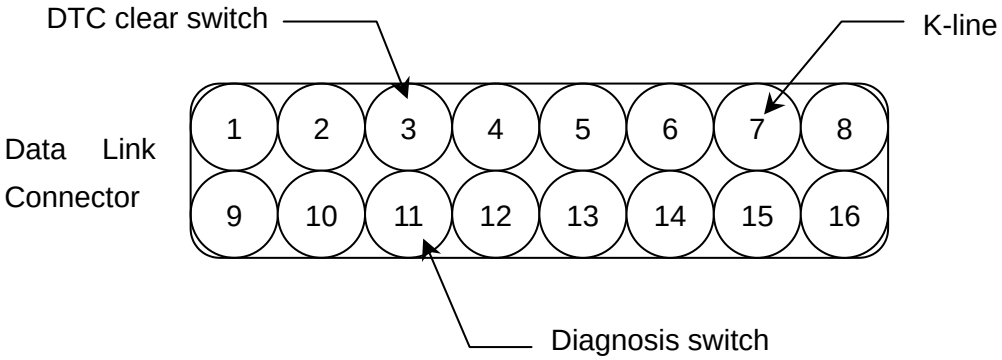
Type C: Oil-lamp not blinking, store DTC on 2nd consecutive driving cycle with a fail.

2nd. Consecutive driving cycle: How to duplicate DTC?

DTC duplicates in case failures are detected at least 2 provided IG OFF => ON



- How to check the Fail-code by means of DGI/DGC



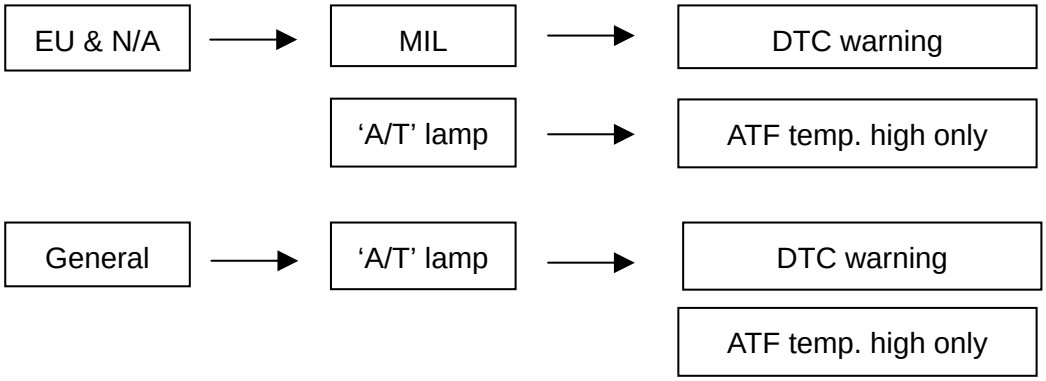
1) Let the PIN No. 11 of DLC ground.

2) Fail-code will be flashed on Oil-lamp after several seconds of Oil-Lamp turned on.

3) For the clear of Fail-code, let the PIN No. 3 of DLC ground over than 5seconds.

- MIL & Oil lamp flush

Caution that MIL and Oil-lamp flashing are not installed simultaneously in a vehicle.



- Diagnostic Trouble Code (DTC)

DTC	Detection item	Detection condition	Lamp	FAILE SAFE	Cancel condition
0753	Shift solenoid No.1	Open circuit GND short cir cuit	OFF	Emergency 2	After IG OFF=> ON
0758	Shift solenoid No.2	Open circuit GND short cir cuit	OFF		
0743	L-up solenoid	Open circuit GND short cir cuit	OFF	No L-up	Gear shifting
0748	Line pressure solenoid	Open circuit GND short cir cuit	OFF	Emergency 2	After IG OFF=> ON, TCM judge normal
0715	Input speed sensor	No signal	ON	No L-up, No line pressure control, No torque reduction control	After TCM judge nor-mal, 0km/h is detected
0722	Output speed sensor	No signal	ON	No change 4th gear, No L-up, No squat control, No line pressure control, No torque reduction control, As for vehicle speed, substitute C0 rotate.	After TCM judge nor-mal, 0km/h is detected
1121	Throttle position sensor	No signal	ON	Full line pressure, Throttle opening =0% fixed No line pressure control, No torque, reduction control, No squat control	After TCM judge nor-mal, 0km/h is detected

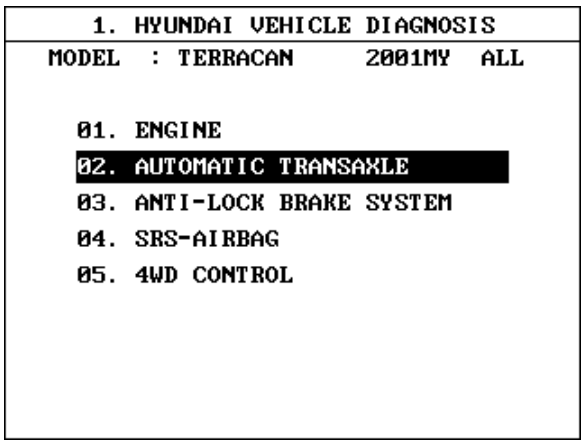
0705	Transaxle Range switch	Open circuit GND short circuit	OFF	Open: All range "D", GND short: TCM judge following priority D>2>L>R>N>P	TCM Judge normal
0710	Oil temperature sensor	Open circuit GND short circuit	OFF	High oil temperature mode No L-up, No squat control, No line pressure control	After TCM judge normal, 0km/h is detected
1780	Torque Control signal	No signal	ON	No torque reduction control	TCM Judge normal

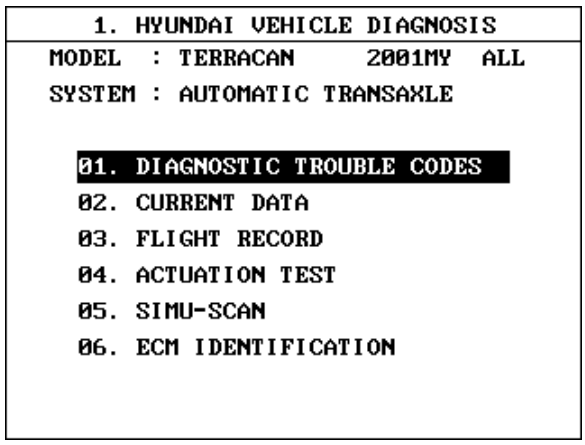
- Emergency mode 2

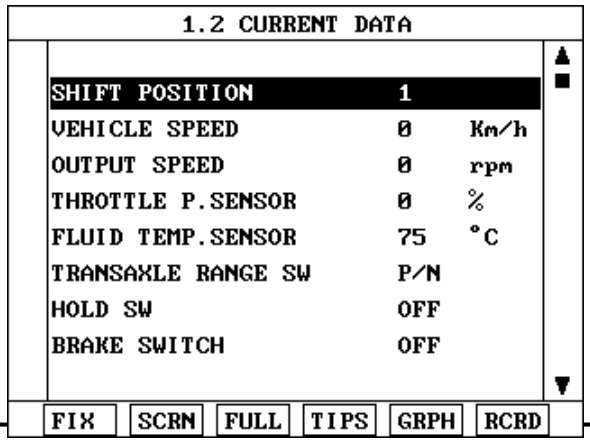
+ Gear shifting is available by turning all the solenoid OFF and manual shift each gear range.

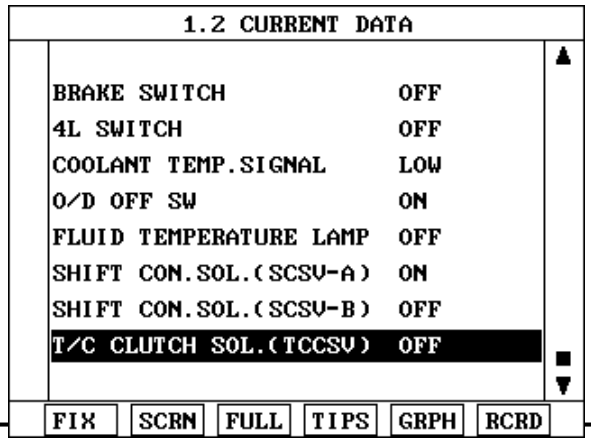
	"D"				"2"			"L"	
Gear	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd
Failure	4th				3rd			1st	

- Hi-scan (2.5 TCI with EST)









5.5.20. Troubleshooting

P0750, P0753 **P0755, P0758** **P0740, P0743**	Solenoid No.1 (S1) Open, Ground short Solenoid No.2 (S2) Open, Ground short

DTC detection condition:

1) Ground short: DTC decides a failure in case any trouble is detected at the other gears at 8 times after trouble detection at a gear for 0.3 sec.
2) Open: DTC decides a failure in case any trouble is detected at the other gears at 8 times after trouble detection at a gear for 0.5 sec. And 2 driving cycles detect.

Cause of failure:

1) Harness or connector between of each shift solenoid and TCM
2) Each shift solenoid
3) TCM

P0748	Pressure control solenoid Open, Ground short

DTC detection condition:

1) Open, GND short: When detected detection condition that the electric current value of less than 20mA has been detected in 12.5 seconds normal value is output from TCM, DTC is decided.
2) (+B) Ground short: When detected detection condition that the output of more than 1.36 A in 0.5 seconds is detected, DTC is decided.

Cause of failure:

1) Harness or connector between pressure control solenoid and TCM.
2) Pressure control solenoid
3) TCM

P0715 **P0720, P0722**	Input speed sensor No signal Output speed sensor No signal

DTC detection condition:

1) No C0 signal: When detected detection condition that no pulse of C0 signals is detected during 12 pulses of SP signals detected, failure is 1 time. When detected more than 1000 times continuously, a temporary failure is decided. When it is detected again after IG OFF => ON, the total of failures become 2 times and DTC is decided.

2) No SP signal: When detected detection condition that no pulse of SP signals is detected during 45 pulses of C0 signals detected, failure is 1 time. When detected more than 500 t imes continuously, a temporary failure is failure is decided. When it is detected again after IG OFF=>ON, the total of failures become 2 times and DTC is decided.

Cause of failure:

1) Harness or connector between each speed sensor and TCM.
2) Each speed sensor
3) TCM

P0705	TR switch No signal, Open

DTC detection condition:

1) No signal: DTC decides a temporary failure in case no signal is transmitted more than 30 sec. at 1130 rpm. When any trouble is detected again after IG OFF =>ON, the number of problems total 2 and DTC decides a failure.
2) Open: DTC decides a temporary failure in case detected 2 or more signals for more than 10 sec. When any trouble is detected again after IG OFF =>ON, the number of problems total 2 and DTC decides a failure.

Cause of failure:

1) Harness or connector between TR switch and TCM.
2) TR switch
3) TCM

P0710	Oil temperature (OT) Open, Ground short

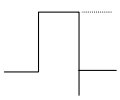
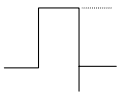
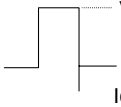
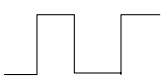
DTC detection condition:

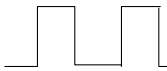
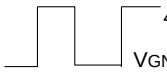
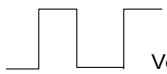
1) Open: When detected detection condition that the abnormal condition of oil temperature after 15 minutes has passed since IG ON, a temporary failure is decided. When it is detected again after IG OFF => ON, the total of failures become 2 times and DTC is decided.
2) Ground short: When detected detection condition that the abnormal condition for 5 minutes since IG ON, a temporary failure is decided. When it is detected again after IG is OFF => ON, the total of failures become 2 times and DTC is decided.

Cause of failure:

1) Harness or connector between oil temperature sensor and TCM.
2) Oil temperature sensor
3) TCM

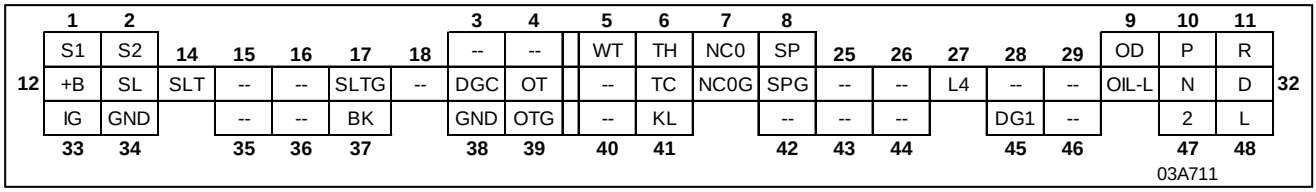
- Standard sheet for TCM signals (3.5V6)

No		Items	Condition	Signals		Description	Remarks
				Type	Level		
1	A1	SCSV 1	IDLE	Hz		1st/2nd : 13.6V/13.2V 3rd/4th : 0V	Current : 0.95A
2	A2	SCSV 2	IDLE	Hz		2nd/3rd : 13V/13.1V 1st/4th : 0V	Current : 0.95A
5	B1	W/TEMP SIG	40℃ or more	DC	Vbatt-2V ~ Vbatt	11.5V	
		(FROM ECU)	37℃ or less	↑	V_{GND}-0.3 ~ 1.5V	0V	
6	B2	TPS SIG(PWM)	ACCEL C.T & W.O.T	PWM	HI : Vbatt-2V ~ Vbatt LO : V_{GND}-0.3 ~ 1.5V FREQ. : 100Hz DUTY(-) : C.T - 10% W.O.T - 83%	HI : 7.24V LO : 0V FREQ. : 100Hz DUTY(-) : C.T - 10.4% W.O.T - 82%	
7	B3	Input speed sensor signal	IDLE	PULSE	 16PULSE/CO CYLINDER REV	Vp-p : 5.68V (IDLE) HI : 5.24V LO : -0.44V FREQ. : 91Hz	3000rpm : Vp-p : 18.1V HI:11.4V/LO:-6.7V FREQ. : 398Hz
8	B4	Output speed sensor signal	Driving	PULSE	 12PULSE/TM REV.	Vp-p : 4.24V(30KPH) HI : 4.58V LO : 0.34V FREQ. : 199Hz	60KPH : Vp-p : 6.12V HI:5.44V/LO:-0.68V FREQ. : 403Hz
9	B5	O/D OFF SW	OFF SW OFF	DC	V_{GND}-0.3 ~ 1V	OFF SW OFF : 0V	
			OFF SW ON	↑	Vbatt-2V ~ Vbatt	OFF SW ON : 13.5V	
10	B6	INHIBITOR SW(P)	P	DC	Vbatt	13.5V	
			R/N/D/2/L	↑	0.8V or less	0V	
11	B7	INHIBITOR SW(R)	R	DC	Vbatt	12.5V	
			P/N/D/2/L	↑	0.8V or less	0V	
12	A5	BATT	IGN OFF	DC	Vbatt	12.3V	
			IGN ON	↑	Vbatt	12.3V	
13	A6	LOCK-UP SOL	Driving	Hz	 Io : 1.9A MAX	HI : 13.1V(I_{HI} : 1.84A) LO : 0V(I_{LO} : 1.15A)	
14	A7	PCSV	IDLE	PULSE	 Io : 1A MAX	HI : 13.1V(I_{HI} : 0.94A) LO : 0V(I_{LO} : 0.65A) FREQ. : 299Hz(-DUTY:44.4%	3000rpm : -DUTY : 53.2% FREQ. : 300Hz
17	A10	EARTH FOR PCSV					G/LVL
18	A11	N.A					

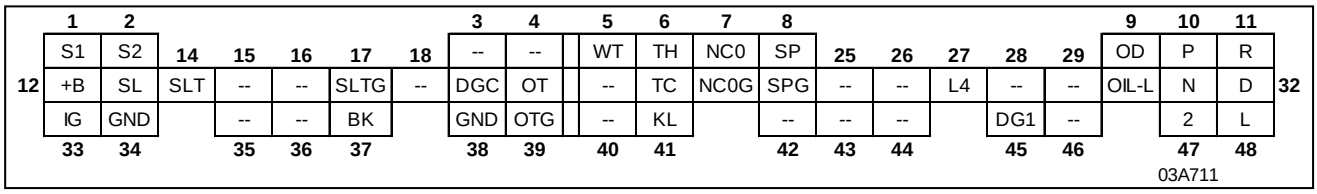
No		Items	Condition	Signals		Description	Remarks
				Type	Level		
19	A12	DTC CLEAR SW	IGN OFF	DC	V_{GND}-0.3 ~ 2V	0V	DTC CLR : GND
			IGN ON	↑	Vbatt	10.4V	
20	A13	OIL TEMP SNSR	IGN OFF	DC	0V	0V	
			IDLE	↑	0 5V	1.15V(After WARM UP)	
22	B9	TORQUE CONTR(	Driving	PULSE	 4V MIN 1.5V MAX FREQ. : 100Hz	HI : 4.2V LO : 0V FREQ. : 100Hz(-DUTY:20%)	
23	B10	EARTH FOR CO CYLINDER					G/LVL
24	B11	EARTH FOR VSS					G/LVL
25	B12	ENG. REVOLUTIO FROM ECU	IDLE	PULSE	 4.0V MIN V_{GND}-0.3 ~ 1V FREQ. : ABOUT 28Hz(850rpm)		
27	B14	L4 SW	SW OFF	DC	V_{GND}-0.3 ~ 1V	SW OFF : 5.8V	
			SW ON	↑	Vbatt-2V ~ Vbatt	SW ON : 0V	
30	B17	OTS LAMP	LAMP OFF	DC	Vbatt	12.1V	
			LAMP ON	↑	1.5V MAX	0V(3.15sec ON)	
31	B18	INHIBITOR SW(N)	N	DC	Vbatt	12.9V	OFF SURGE : -40.4V
			P/R/D/2/L	↑	0.8V or less	0V	
32	B19	INHIBITOR SW(D)	D	DC	Vbatt	13.4V	
			P/R/N/2/L	↑	0.8V or less	0V	
33	A14	POWER(IGN 1)	IGN OFF	DC	0V	0V	
			IGN ON	↑	9V ~ 16V	12V	
34	A15	EARTH FOR POWER					
37	A18	BRAKE SW	SW OFF	DC	V_{GND}-0.3 ~ 2V	0V	
			SW ON	↑	Vbatt-2.0 ~ Vbatt	13V	
38	A19	EARTH FOR POWER					
39	A20	EARTH FOR OTS					G/LVL
41	B21	K-LINE	In comm. (10.4Kbps)	PULSE	LOGIC "0" : Vbatt 20% or less LOGIC "1" : Vbatt 80% or more	0V 12.1V	
44	B24	SPEEDMETER	Driving	Hz	 Vbatt V_{GND}-0.3 ~ 1V FREQ. : 42.5Hz(60KPH)	HI : 11.4V LO : 0V FREQ. : 12Hz(20KPH)	
45	B25	DIAG. SW	IGN OFF	DC	0V	0V	DTC CODE OUTPUT :
			IGN ON	↑	Vbatt	10.7V	GND(VGND-0.3 ~ 1V)

No		Items	Condition	Signals		Description	Remarks
				Type	Level		
47	B27	INHIBITOR SW(2)	2	DC	Vbatt	13V	
			P/R/N/D/L	↑	0.8V or less	0V	
48	B28	INHIBITOR SW(L)	L	DC	Vbatt	13.1V	
			P/R/N/D/2	↑	0.8V or less	0V	

- TCM terminals (AW30-40LE model)



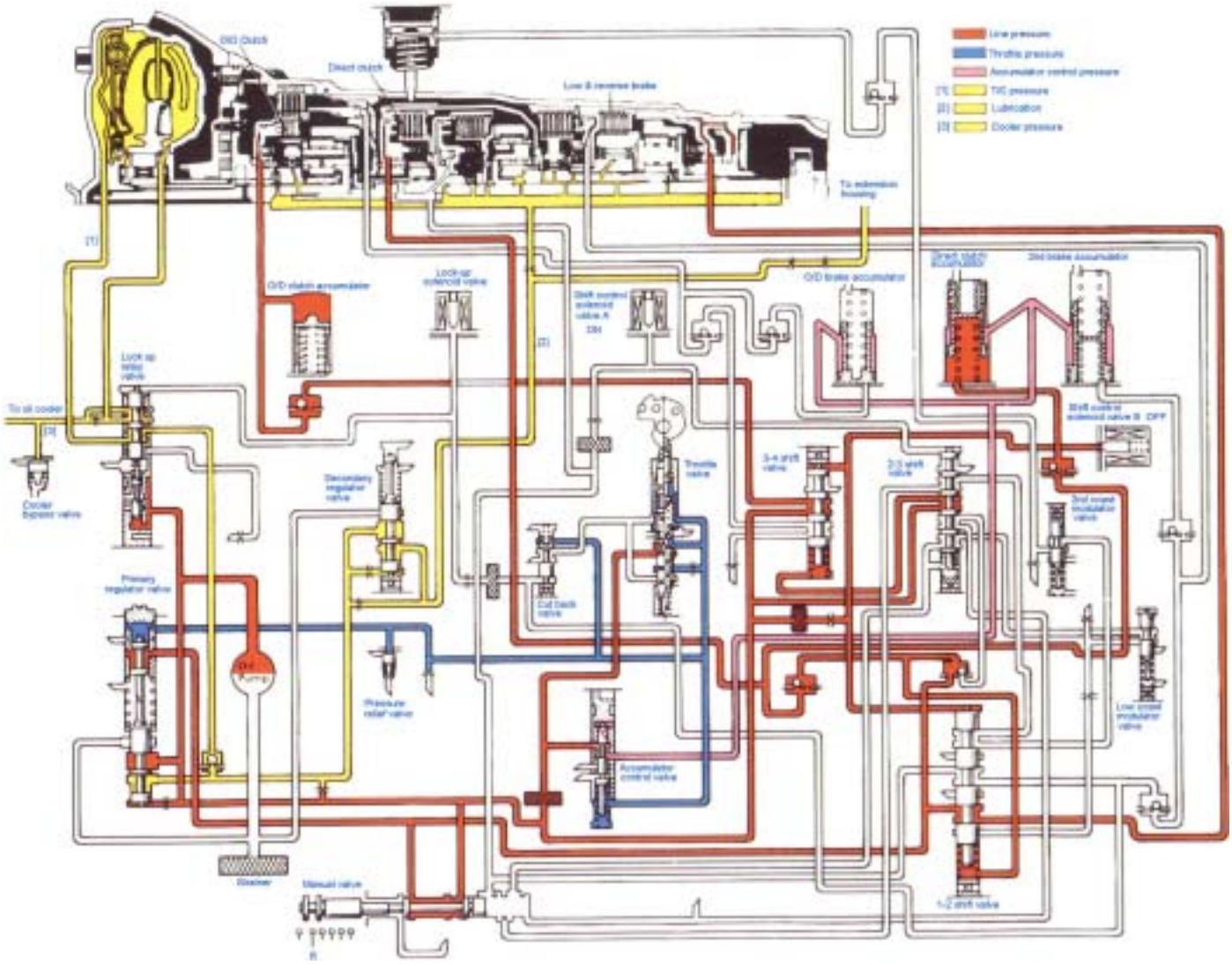
1: Shift solenoid No.1
2: Shift solenoid No.2
3: Open
4: Open
5: Water temperature signal
6: Throttle opening signal
7: Input speed sensor (+)
8: Output speed sensor (+)
9: O/D off switch
10: Position switch “P”
11: Position switch “R”
12: Battery (+)
25: Open
26: Open
27: L4 switch
28: Open
29: Open
30: Oil lamp
31: Position switch ”N”
32: Position switch “D”
33: Ignition switch
34: Ground (-)
35: Open
36: Open



13: L-up control solenoid (+)
14: Line pressure control solenoid (+)
15: Open
16: Open
17: Line pressure control solenoid (-)
18: Open
19: Diagnosis terminal
20: Oil temperature sensor (+)
21: Open
22: Torque control signal
23: Input speed sensor (-)
24: Output speed sensor (-)
37: Brake switch
38: Ground (-)
39: Oil temperature (-)
40: Open
41: Diagnosis signal (K-LINE)
42: Open
43: Open
44: Open
45: Diagnosis terminal
46: Open
47: Position switch “2”
48: Position switch “L”

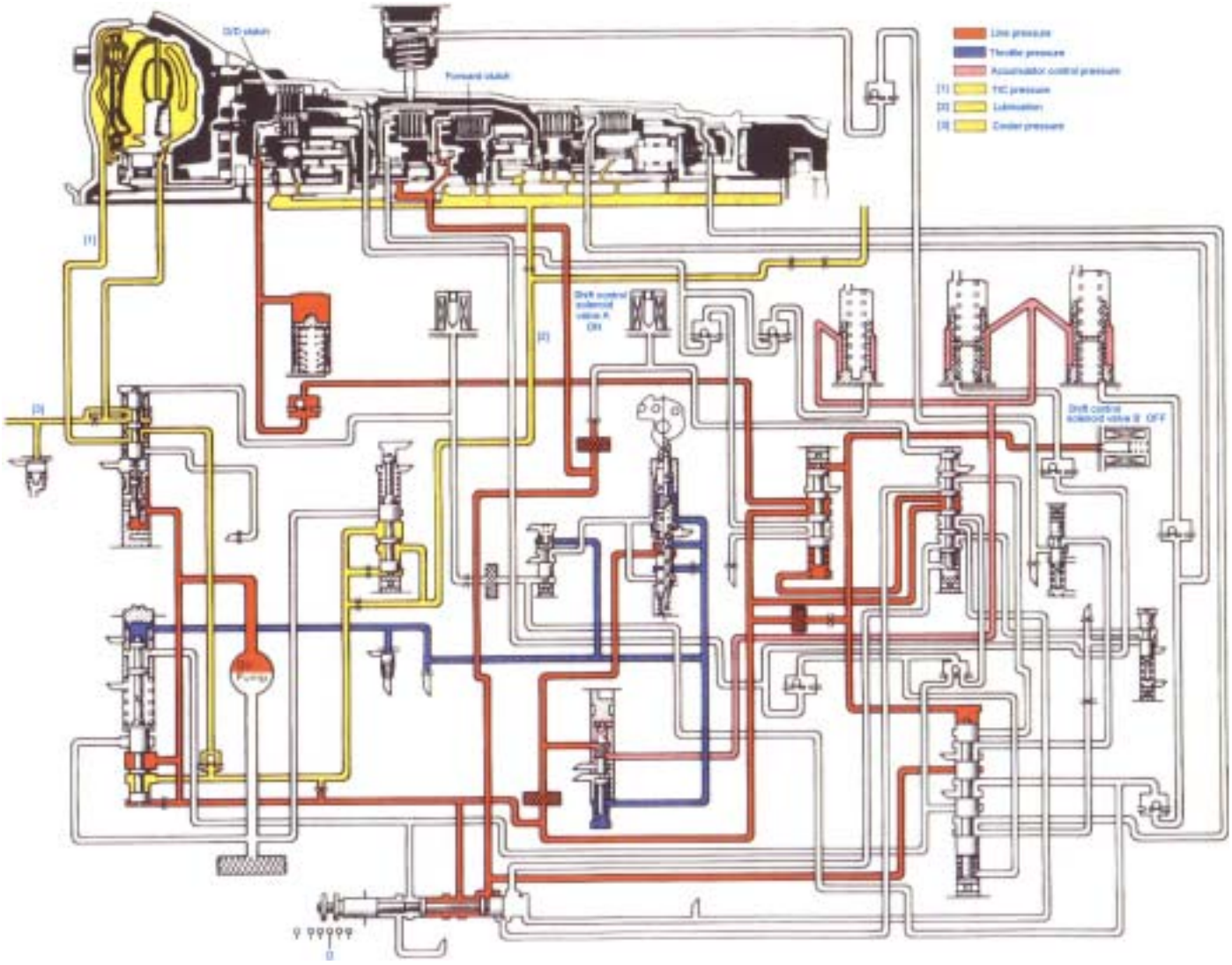
APPENDIX

Hydraulic pressure circuit diagram - Reverse range (AW30-43LE)



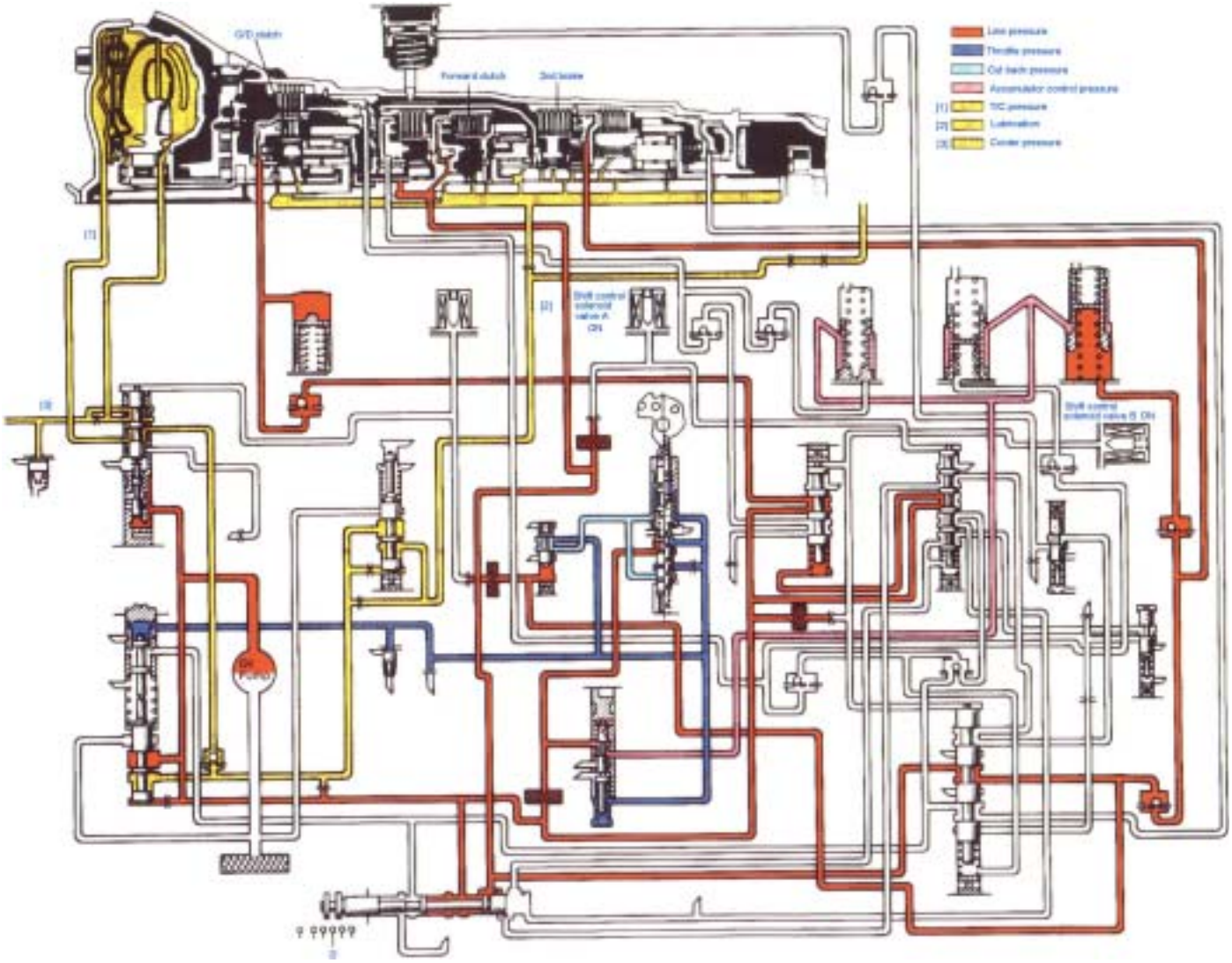
APPENDIX

Hydraulic pressure circuit diagram - D range 1st gear (AW30-43LE)



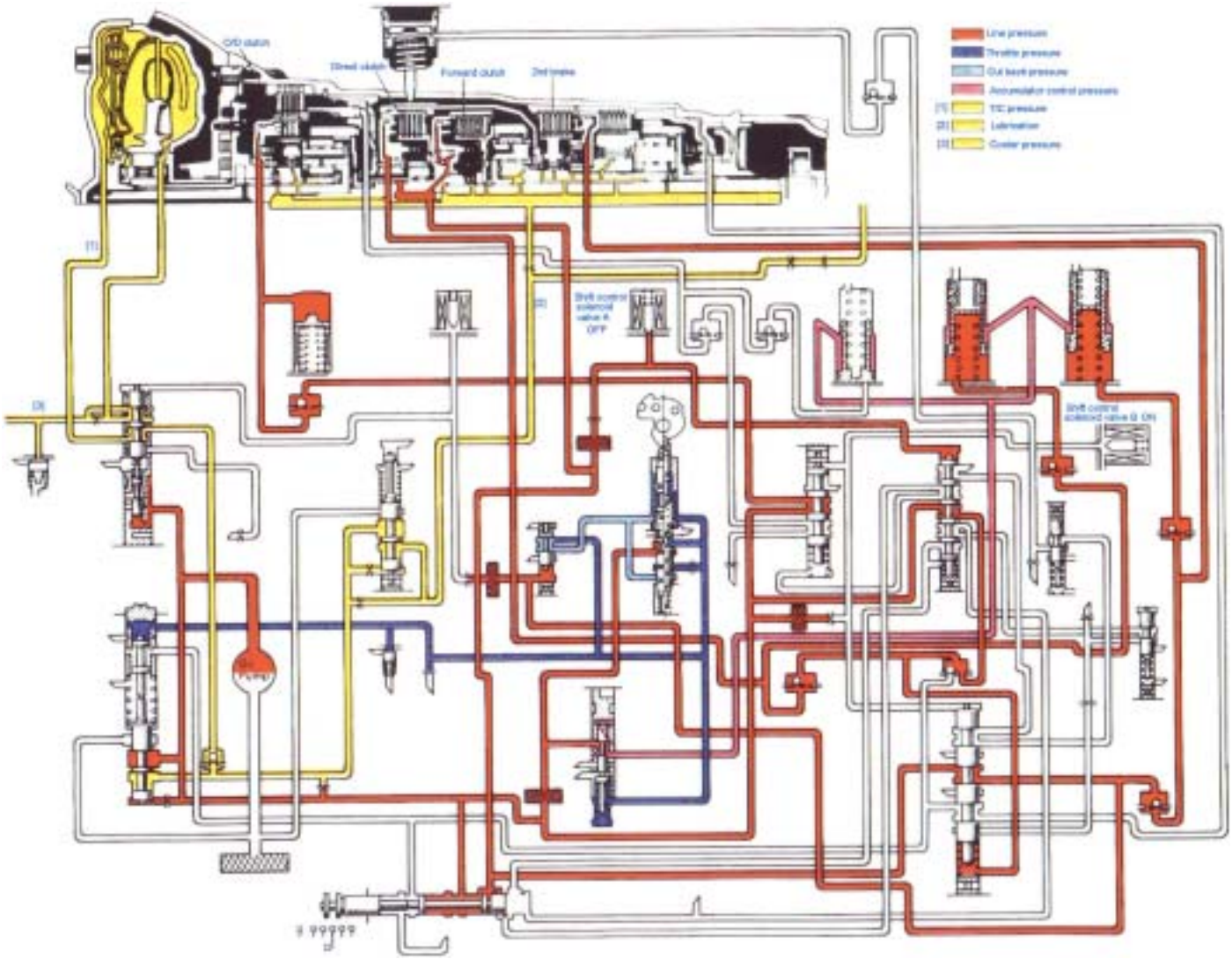
APPENDIX

Hydraulic pressure circuit diagram - D range 2nd gear (AW30-43LE)



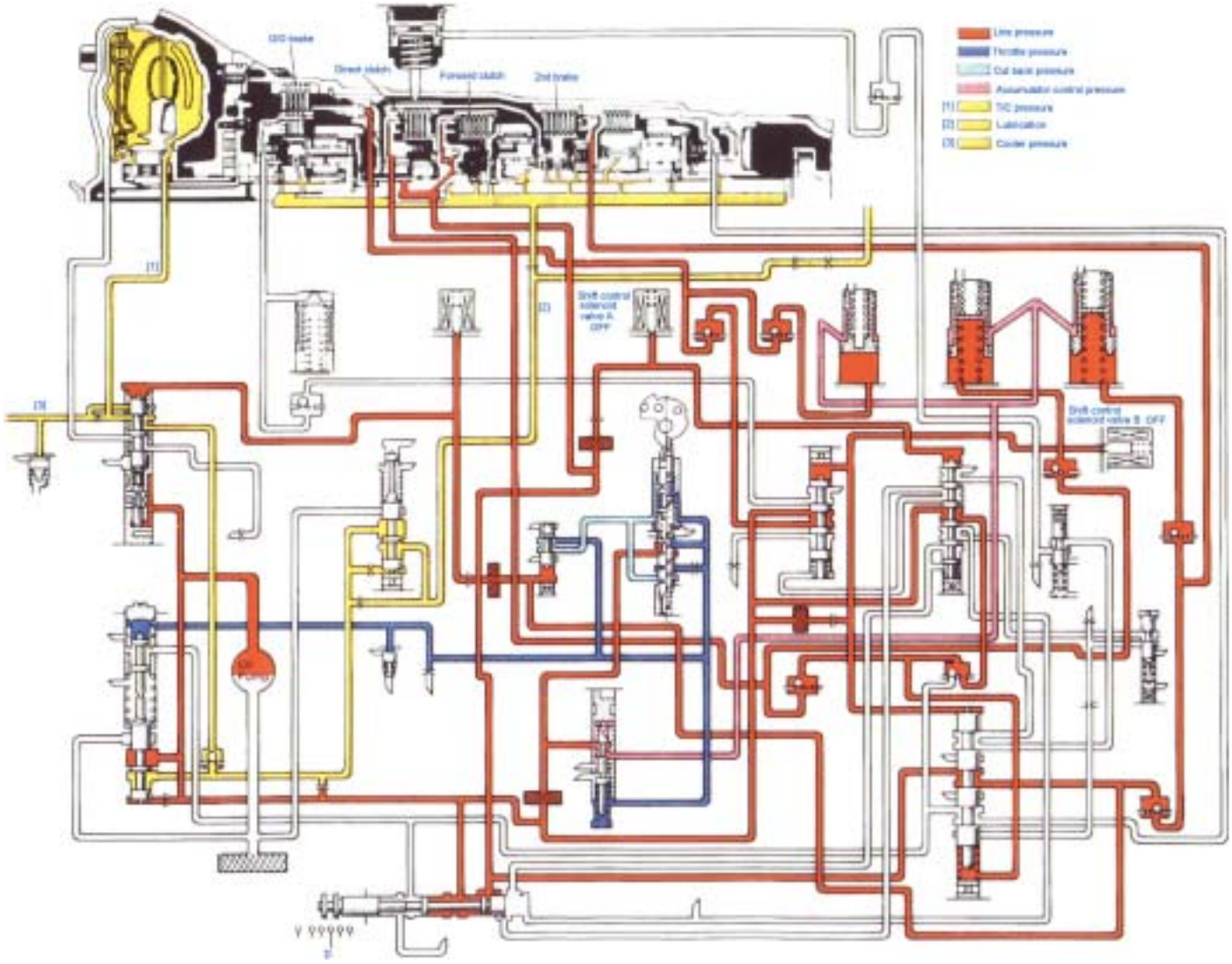
APPENDIX

Hydraulic pressure circuit diagram - D range 3rd gear (AW30-43LE)



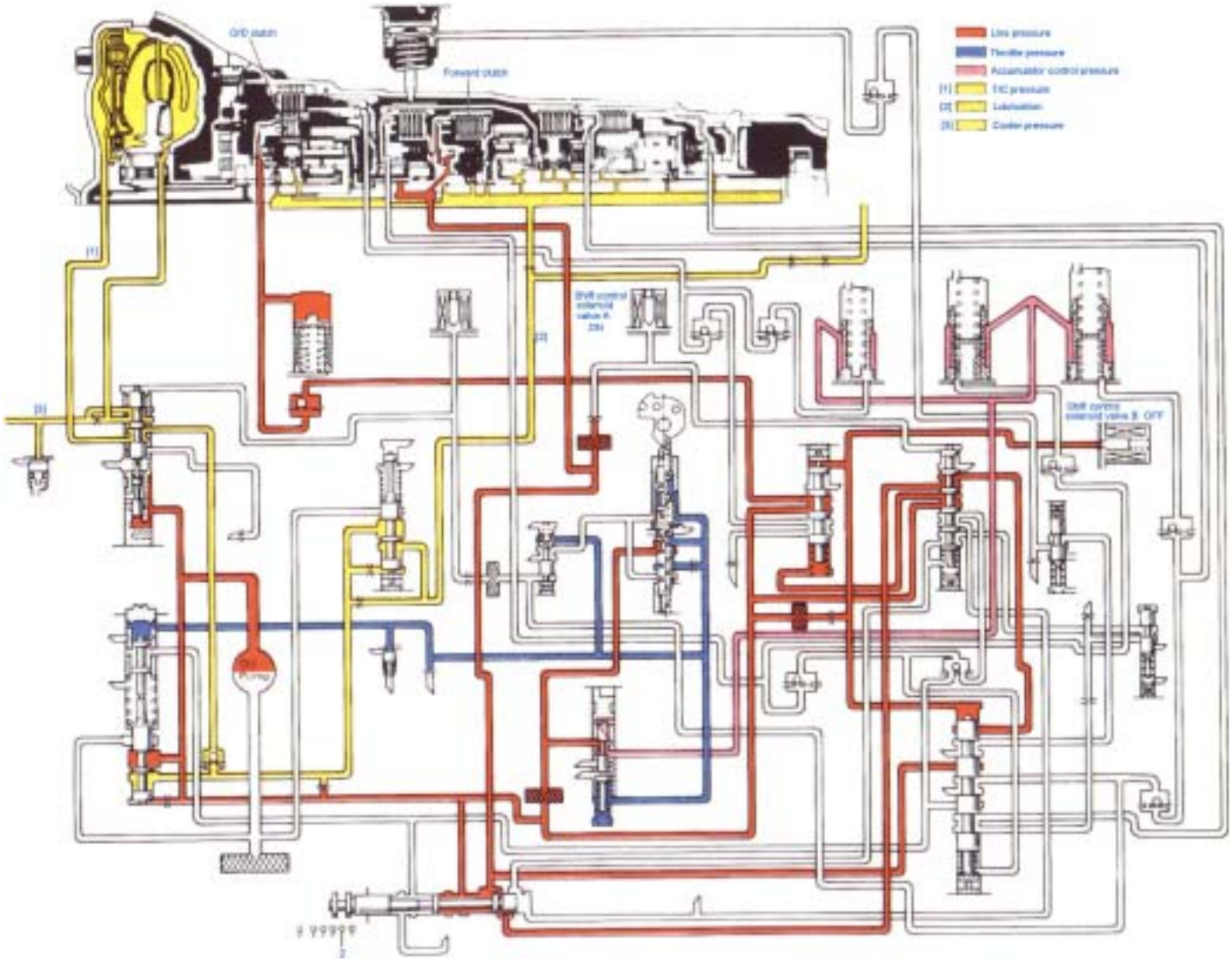
APPENDIX

Hydraulic pressure circuit diagram - D range 4th gear (AW30-43LE)



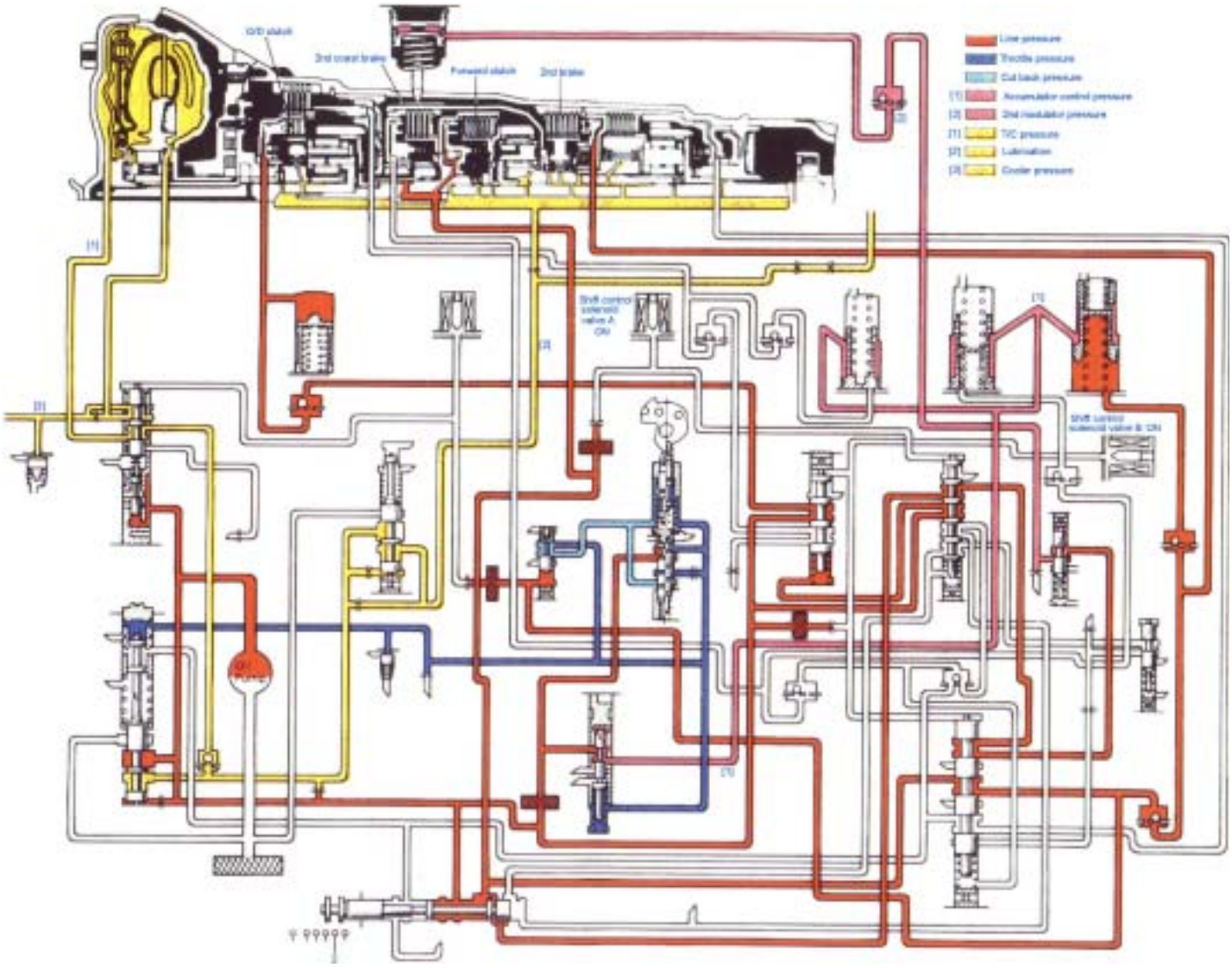
APPENDIX

Hydraulic pressure circuit diagram - 2 range 1st gear (AW30-43LE)



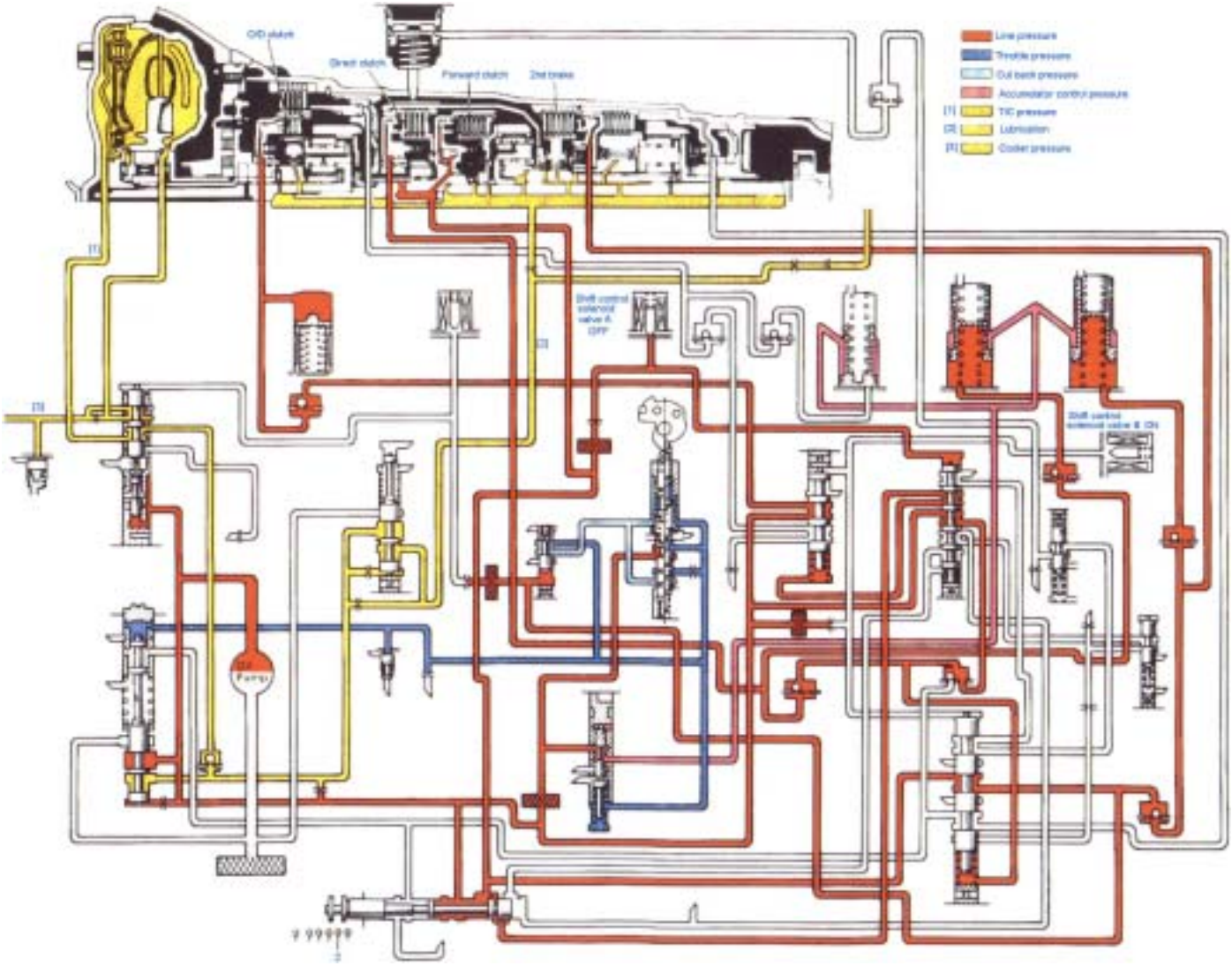
APPENDIX

Hydraulic pressure circuit diagram - 2 range 2nd gear (AW30-43LE)



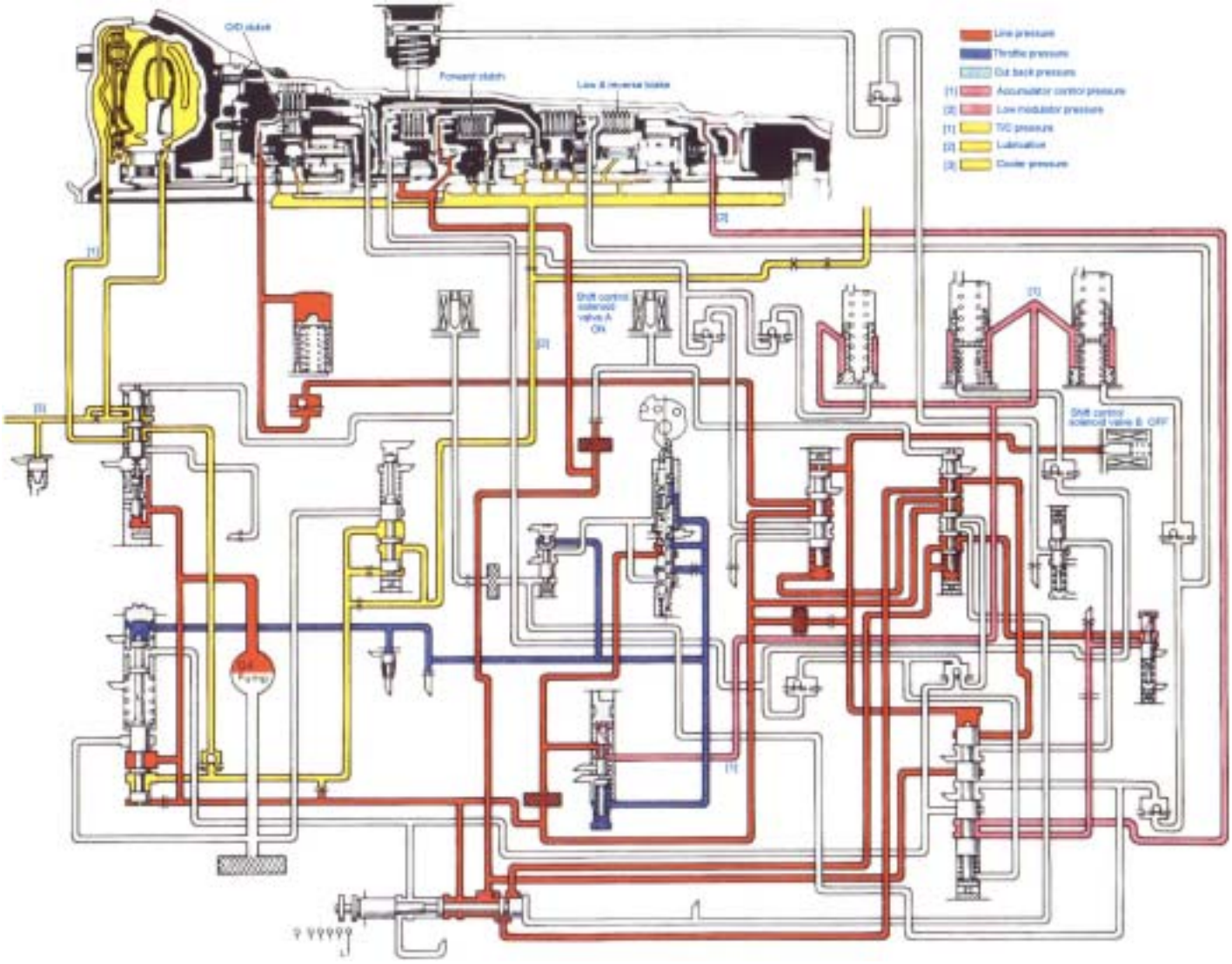
APPENDIX

Hydraulic pressure circuit diagram - 2 range 3rd gear (AW30-43LE)



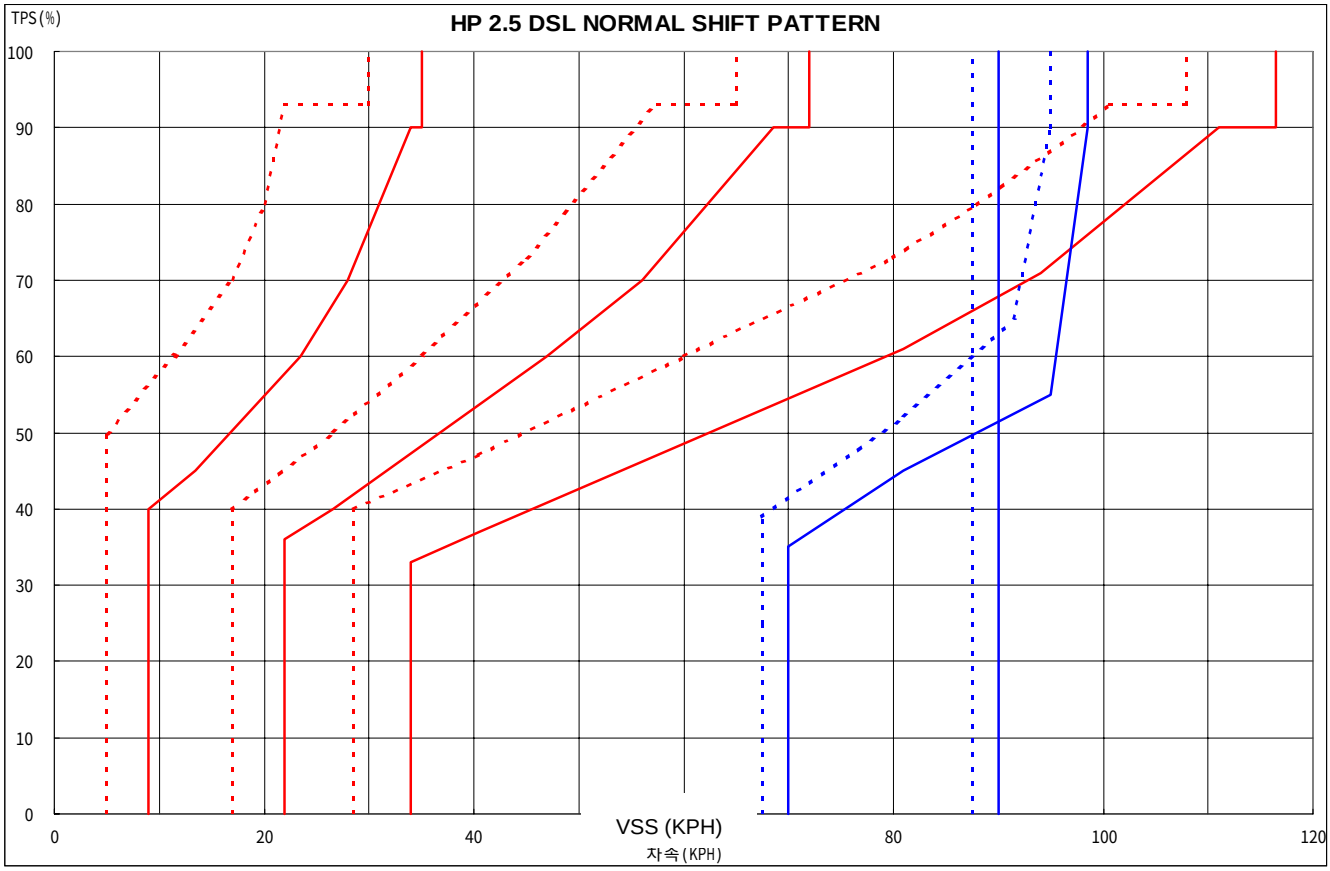
APPENDIX

Hydraulic pressure circuit diagram - L range 1st gear (AW30-43LE)



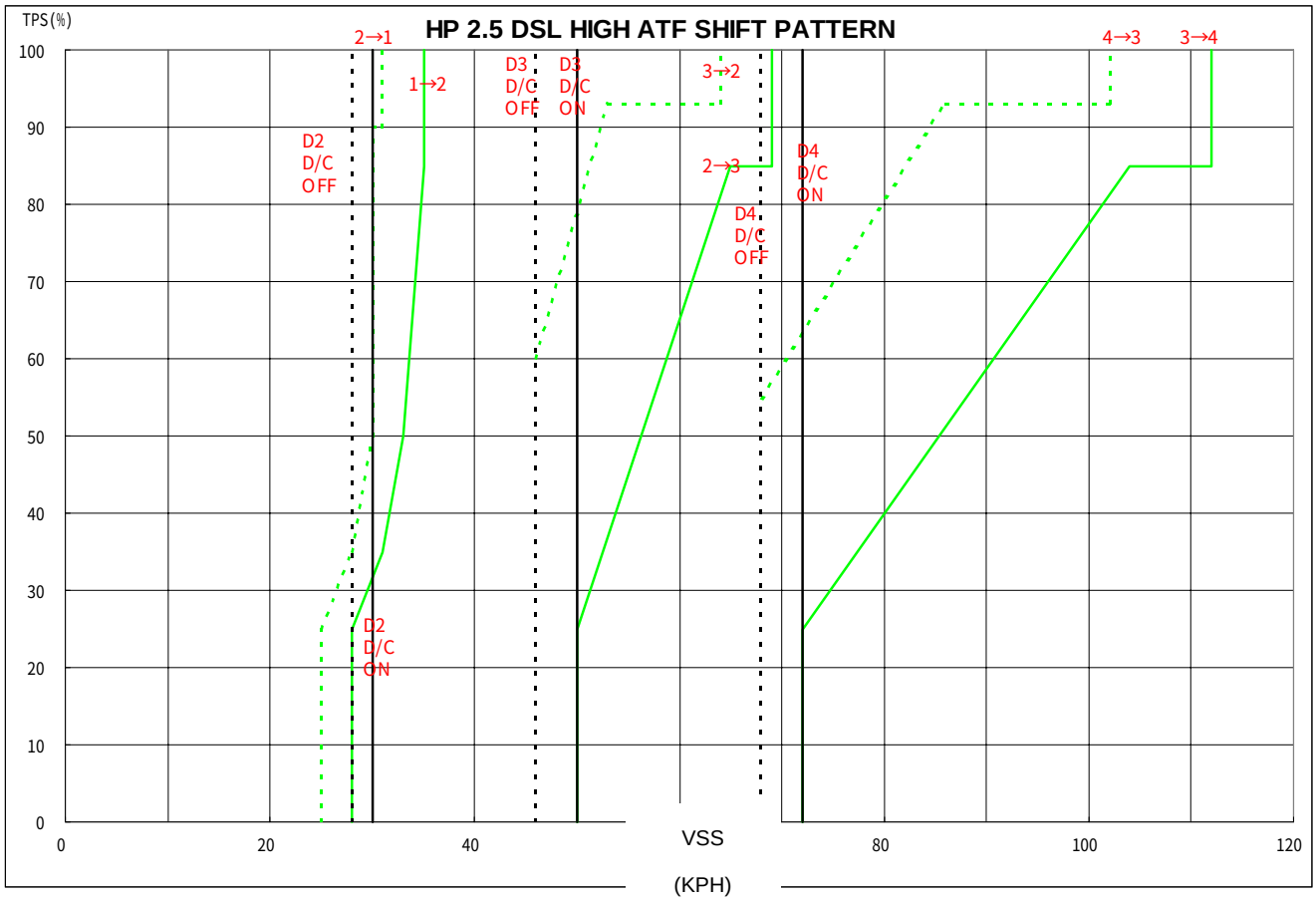
APPENDIX

Shift pattern (AW03-II): Normal shift pattern



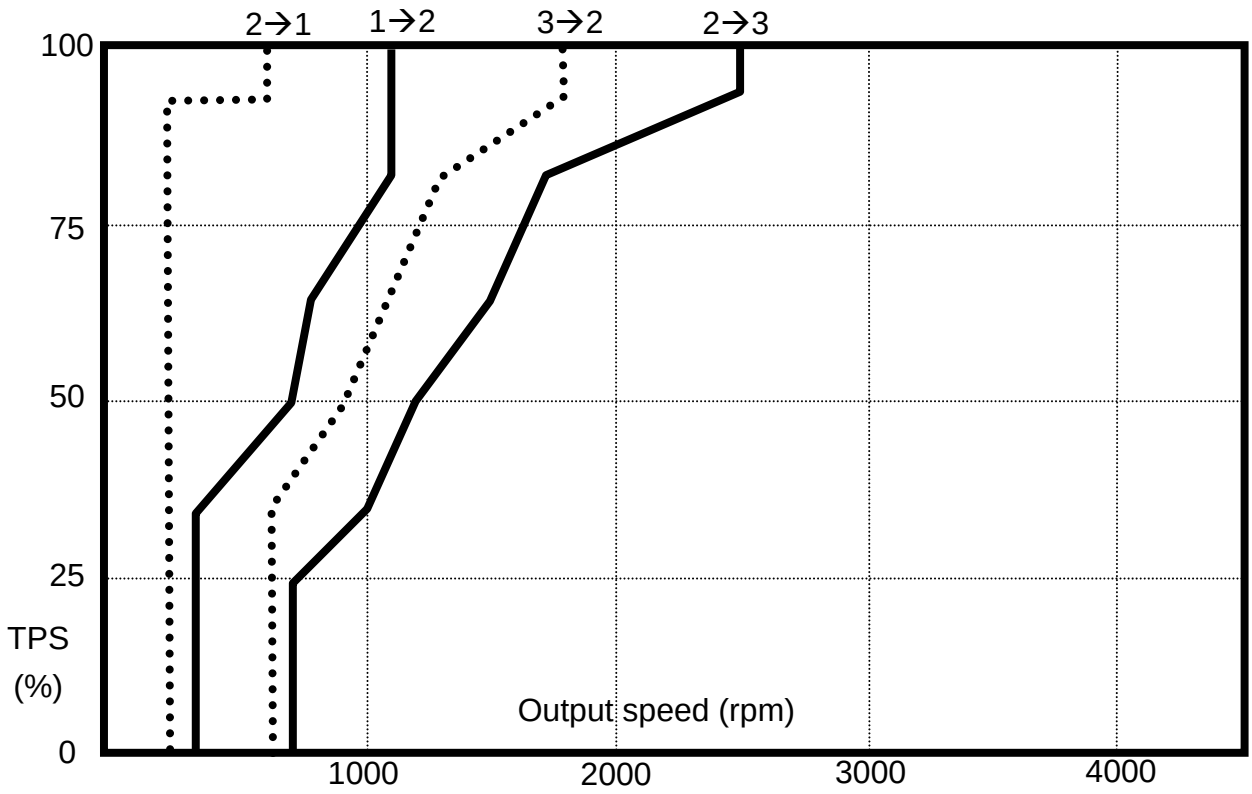
APPENDIX

Shift pattern (AW03-II): High ATF temperature mode

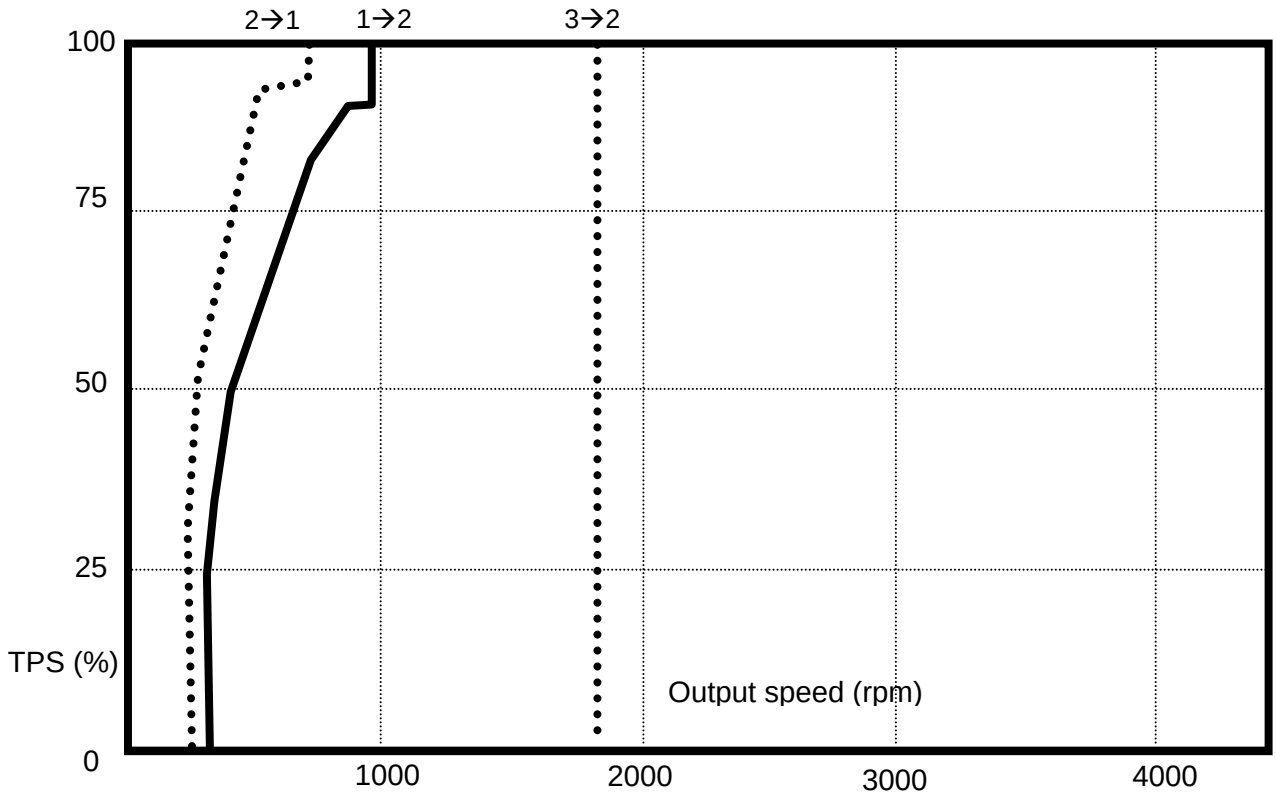


APPENDIX

Shift pattern (AW03-II): HP 2.5 DSL D range 4LOW mode

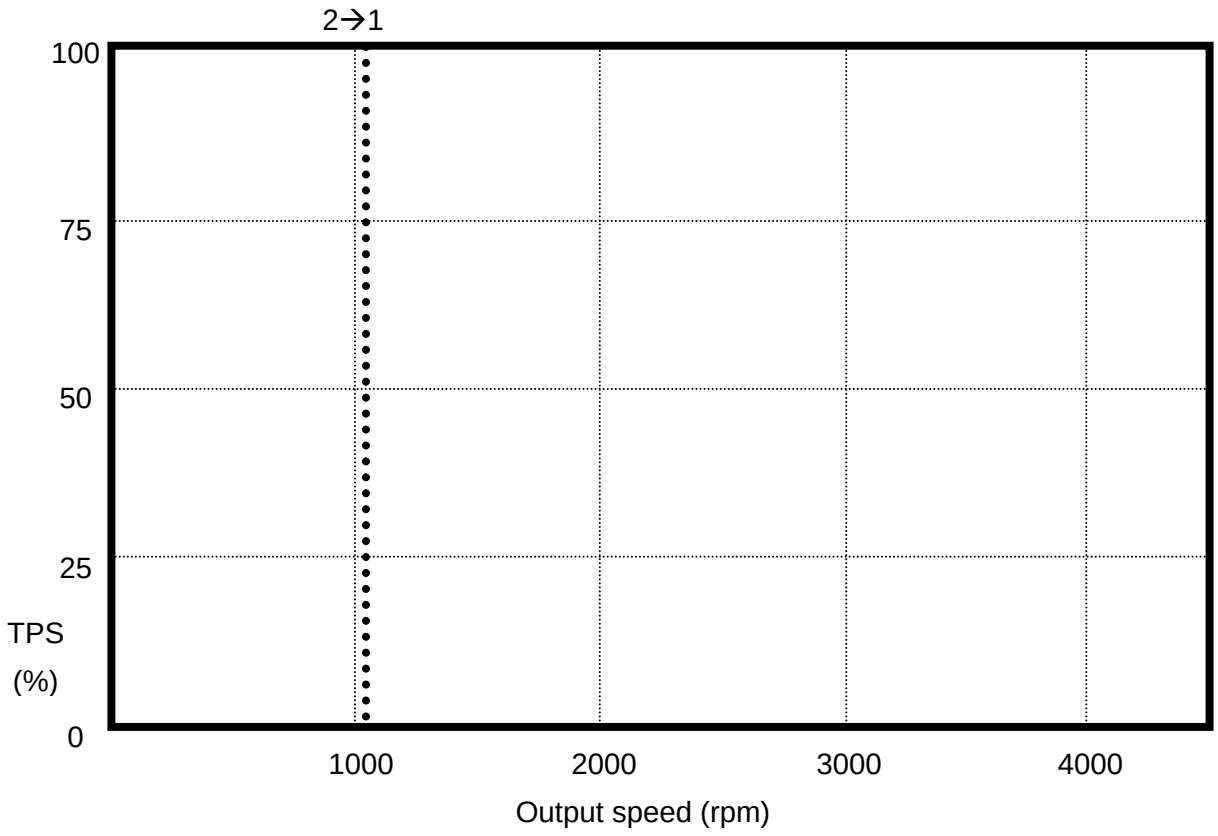


Shift pattern (AW03-II): HP 2.5 DSL 2 range 4LOW mode



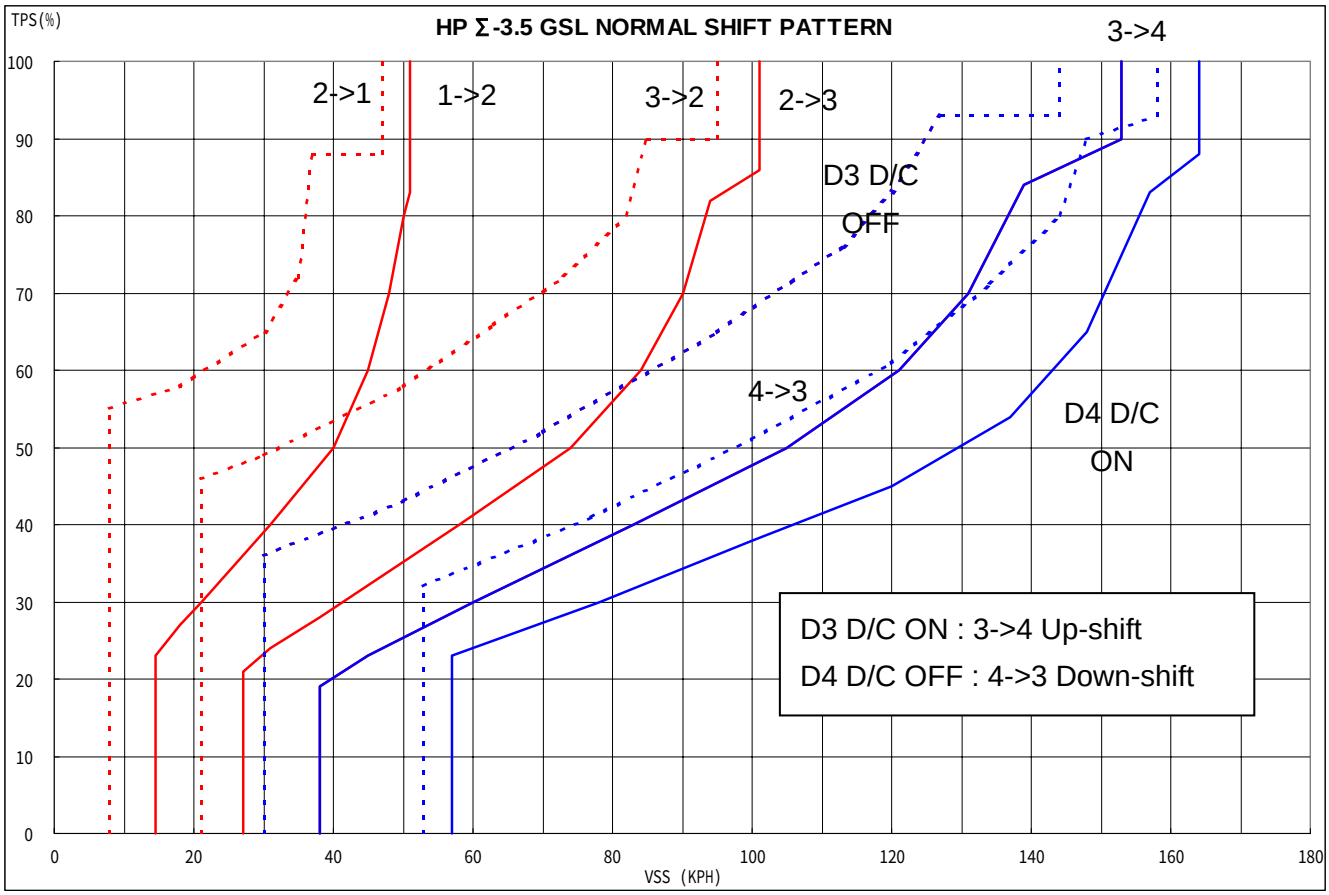
APPENDIX

Shift pattern (AW03-II): HP 2.5 DSL L range 4LOW mode



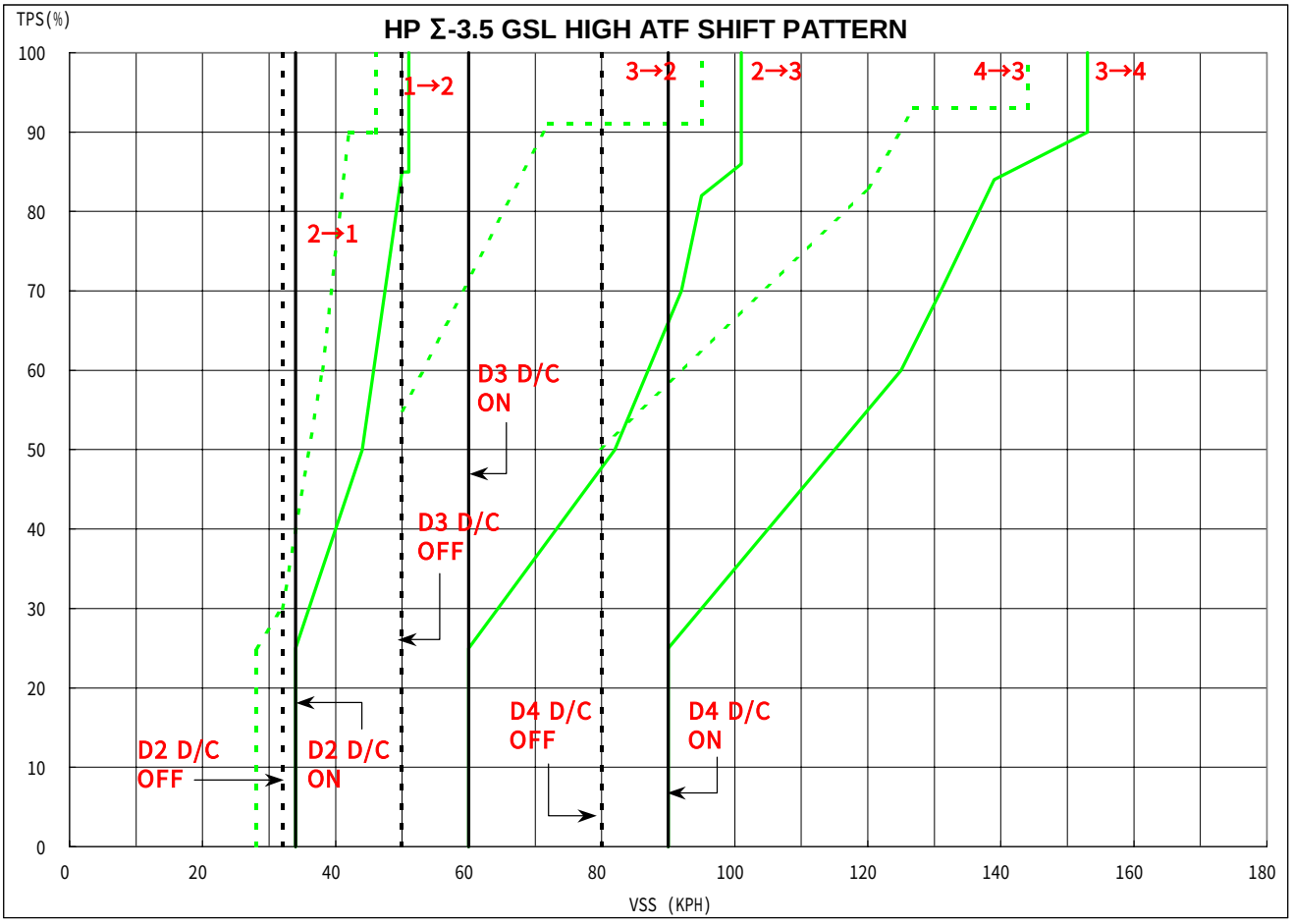
APPENDIX

Shift pattern (AW30-40LEi): HP 3.5 GSL Normal shift pattern



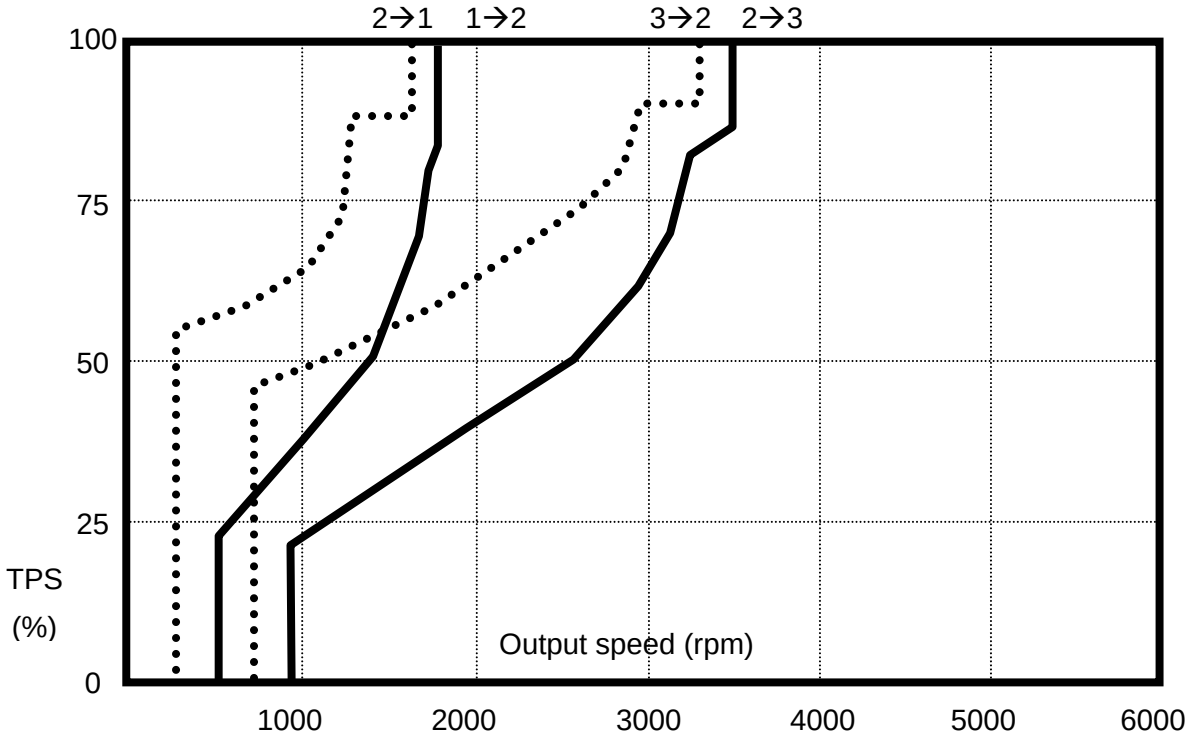
APPENDIX

Shift pattern (AW30-40LEi): HP 3.5 GSL High ATF temperature mode

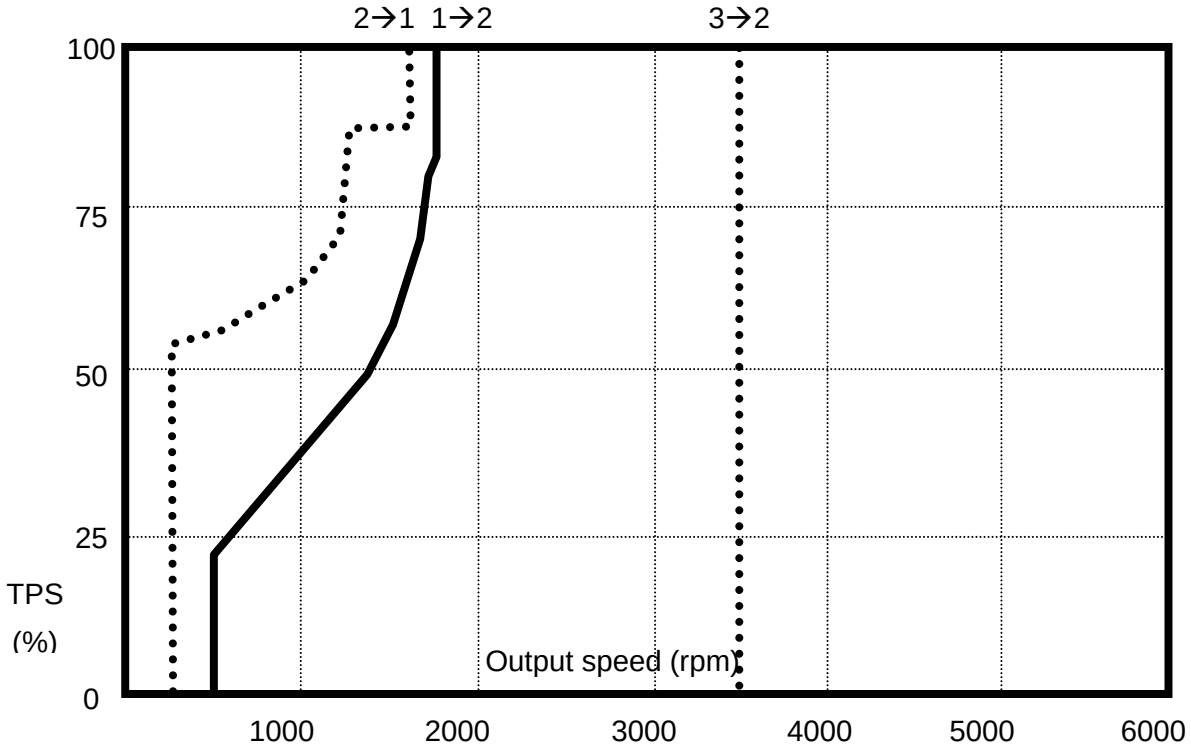


APPENDIX

Shift pattern (AW30-40LEi): HP 3.5 GSL D range 4LOW mode

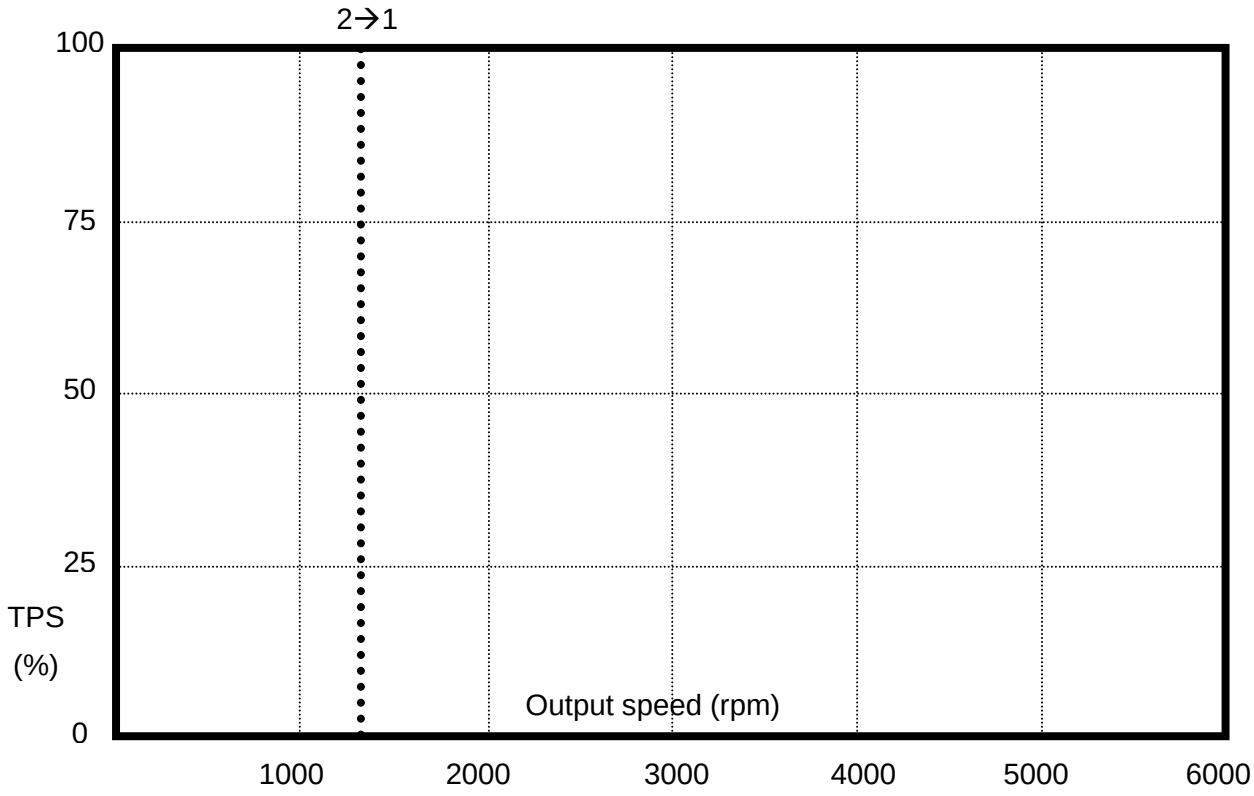


Shift pattern (AW30-40LEi): HP 3.5 GSL 2 range 4LOW mode



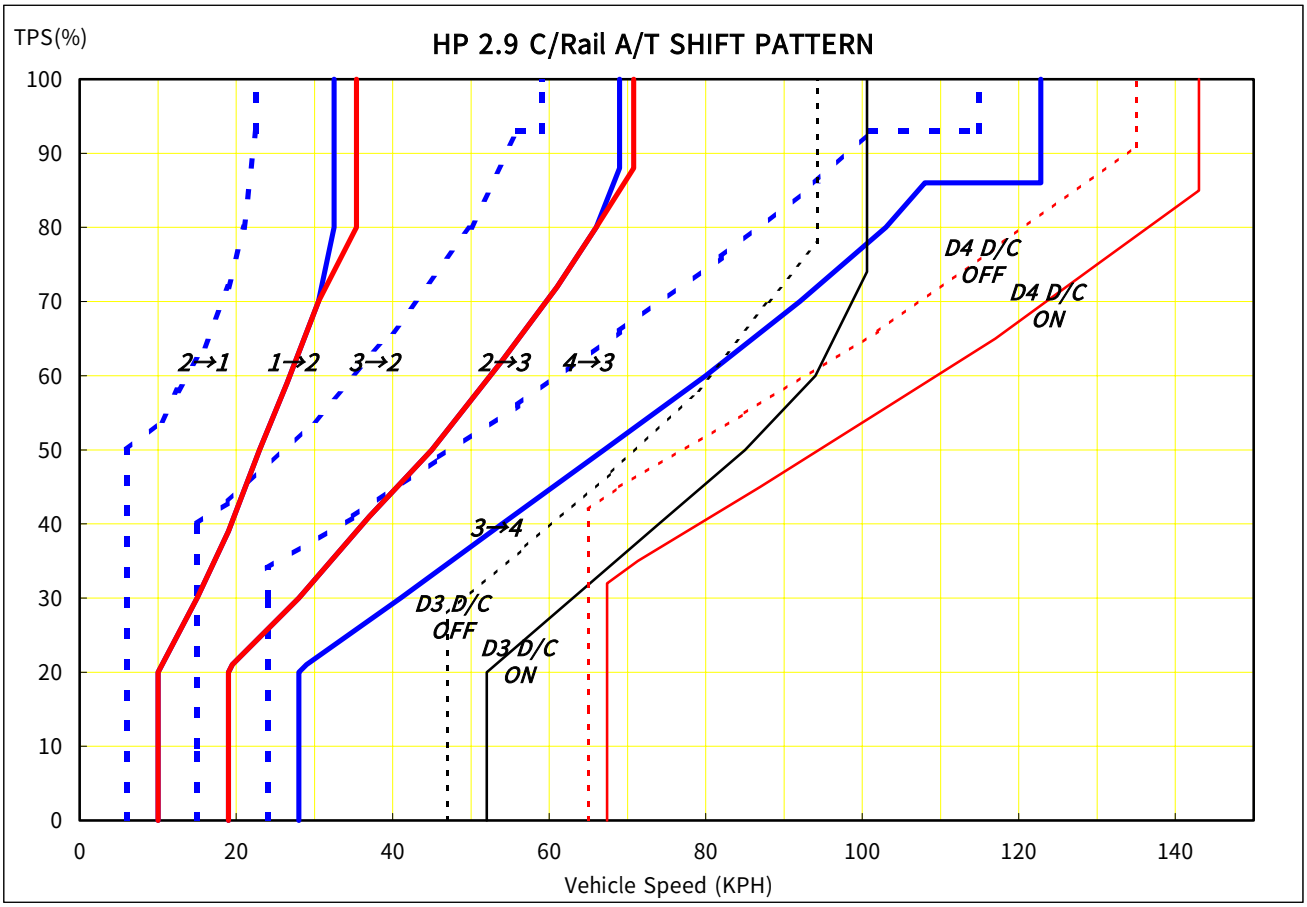
APPENDIX

Shift pattern (AW30-40LEi): HP 3.5 GSL L range 4LOW mode



APPENDIX

Shift pattern (AW30-40LEi): HP 2.9 C/R Normal shift pattern



EXAMINATION

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Section: AW30-40LE (Terracan)

1. Which of the following is not true for the warning lamp (A/T lamp) blinking condition?.
   1) Input speed sensor malfunction
   2) Output speed sensor malfunction
   3) ATF temperature sensor open or short
   4) Throttle position sensor malfunction
   5) CAN communication problem with ECM

2. Write down the name of every clutches and brakes for AW30-40LEi.
   1) C0 –
   2) C1 –
   3) C2 –
   4) B0 –
   5) B1 –
   6) B2 –
   7) B3 –

3. Select wrong statement.
   1) 2nd coasting brake is engaged in D range 2nd gear; therefore engine brake is available in this case.
   2) In case of PG-B fail, over drive will be inhibited.
   3) PG-A speed will be zero in case of 4th gear is engaged.
   4) Even though brake switch is open or short, there is no DTC in Hi-scan Pro.

4. What is the main signal for gear shifting?
   1) PG-A, PG-B
   2) PG-A, TPS.
   3) PG-B, TPS.
   4) TPS, Vehicle speed.

※ Mark 'V' on the "Correct" or "Wrong".

5. If the failsafe function is activated, the 2nd gear is engaged in case of 2 range.

Correct ( ) Wrong ( )

6. If the P0707 (Inhibitor switch open) is detected by TCM, transmission will be controlled by 'D range', therefore the vehicle will move.

Correct ( ) Wrong ( )

7. If TPS is fail, TCM will control the TPS ratio by 50% and the line pressure will be maximum value.

Correct ( ) Wrong ( )

8. As the L4 signal from the 4LOW switch is inputted to TCM, the 4th gear will be inhibited and lock-up also prohibited.

Correct ( ) Wrong ( )

9. In case of ATF temperature sensor is fail, the gear will be fixed by 4th gear (D range), 3rd gear (2nd range), 1st gear (L range)..

Correct ( ) Wrong ( )

10. If the SCSV 1 and SCSV 2 are OFF, the 4th gear is engaged in all ranges (D, 2,L).

Correct ( ) Wrong ( )

11. Even though some DTC is detected by TCM, the PCSV will control the line pressure normally.

Correct ( ) Wrong ( )

12. You can check the signal of SCSV 1 and SCSV 2 in the current data of Hi-scan Pro.

Correct ( ) Wrong ( )

13. The damper clutch control solenoid valve is controlled by duty ratio for better fuel consumption and driving feeling.

Correct ( ) Wrong ( )

14. C0 and B0 cannot be engaged simultaneously.

Correct ( ) Wrong ( )

Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date:

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR01***

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Subject:

Mechanical components & structure

Objectives:

- To know every mechanical elements and components
- To understand the OWC function and direction
- Discussion for power flow, engine brake

Required materials:

- A/T training part (AW30-40LE or AW30-43LE model)
- General tools, relevant SST (Service special tool)
- Training textbook
- Corresponding workshop manual (Terracan/SR/H-1)

Application:

- AW30-43LE (SR, H-1 with D4BH TCI and A-2.5 C/R)
- AW30-40LE (HP J2.9 C/R, 3.5L V6)

The time required:

- Open the gearbox: 40minutes
- Answer the questions on “theme”: 20minutes
- Total: 1hour

Procedure & Cautions:

- Open the gearbox up to Low & reverse brake disc and output shaft assembly referring the w/shop manual.
- Skip to remove the piston and return spring from each clutch or brake.
- Skip to open the valve body (Remove the valve body assembly from the transmission case).
- Be sure to check and memorize the direction and location of each thrust bearing and race.
  (Ask it to instructor if you forgot the location or direction of thrust bearing and race)

Are you ready? Go on next page.

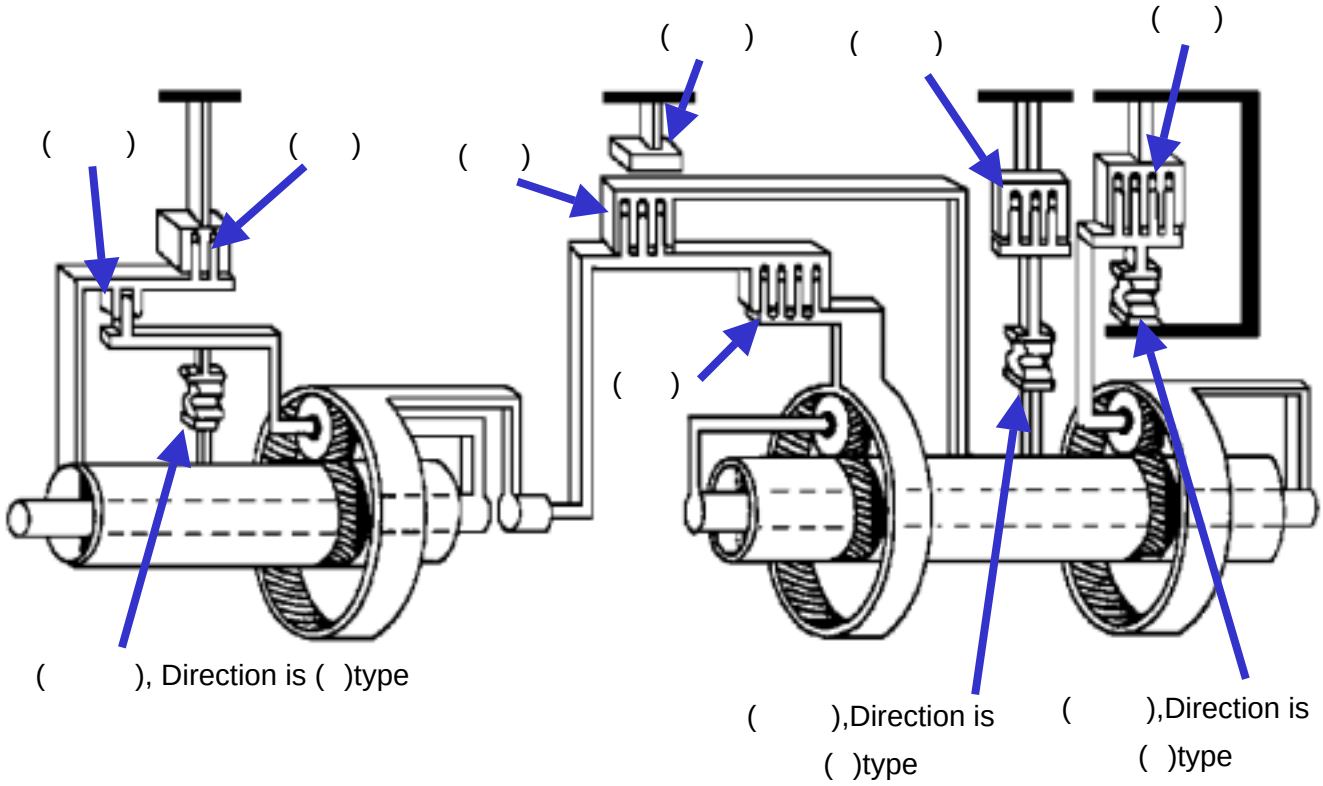
ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR01***

Theme:

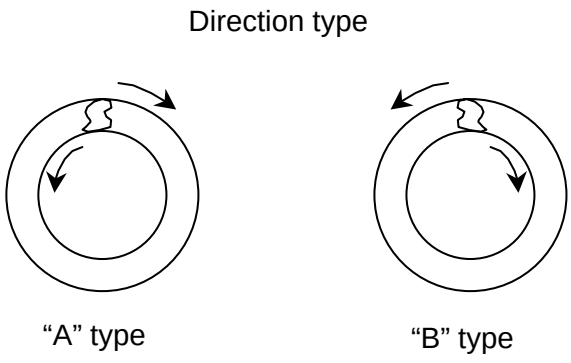
Fill the blanks. (Select the proper number among the examples.)

- The name of each clutch and brake
- The rotating direction of three OWC



Examples:

1. OD OWC	2. OWC No.1
3. OWC No.2	4. Direct clutch
5. LR brake	6. 2nd coast brake
7. OD clutch	8. OD brake
9. 2nd brake	10. Forward clutch



Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date:

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR02***

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Subject:

Mechanical components & structure

Objectives:

- To identify the location of each accumulators
- To understand the function of accumulators
- To know how to remove each accumulators from the transmission case

Required materials:

- A/T training part (AW30-40LE or AW30-43LE model)
- General tools, relevant SST (Service special tool), Air gun
- Training textbook
- Corresponding workshop manual (Terracan/SR/H-1)

Application:

- AW30-43LE (SR, H-1 with D4BH TCI and A-2.5 C/R)
- AW30-40LE (HP J2.9 C/R, 3.5L V6)

The time required:

- Remove the accumulators: 10minutes
- Answer the questions on “theme”: 5minutes
- Total: 15minutes

Procedure & Cautions:

- Open the oil pan and valve body assembly.
- Skip to open the valve body (Remove the valve body assembly from the transmission case).
- Be sure to check and memorize the location of each accumulator piston and springs.
  (Refer the page No. 64 and 71 in this textbook)

Are you ready? Go on next page.

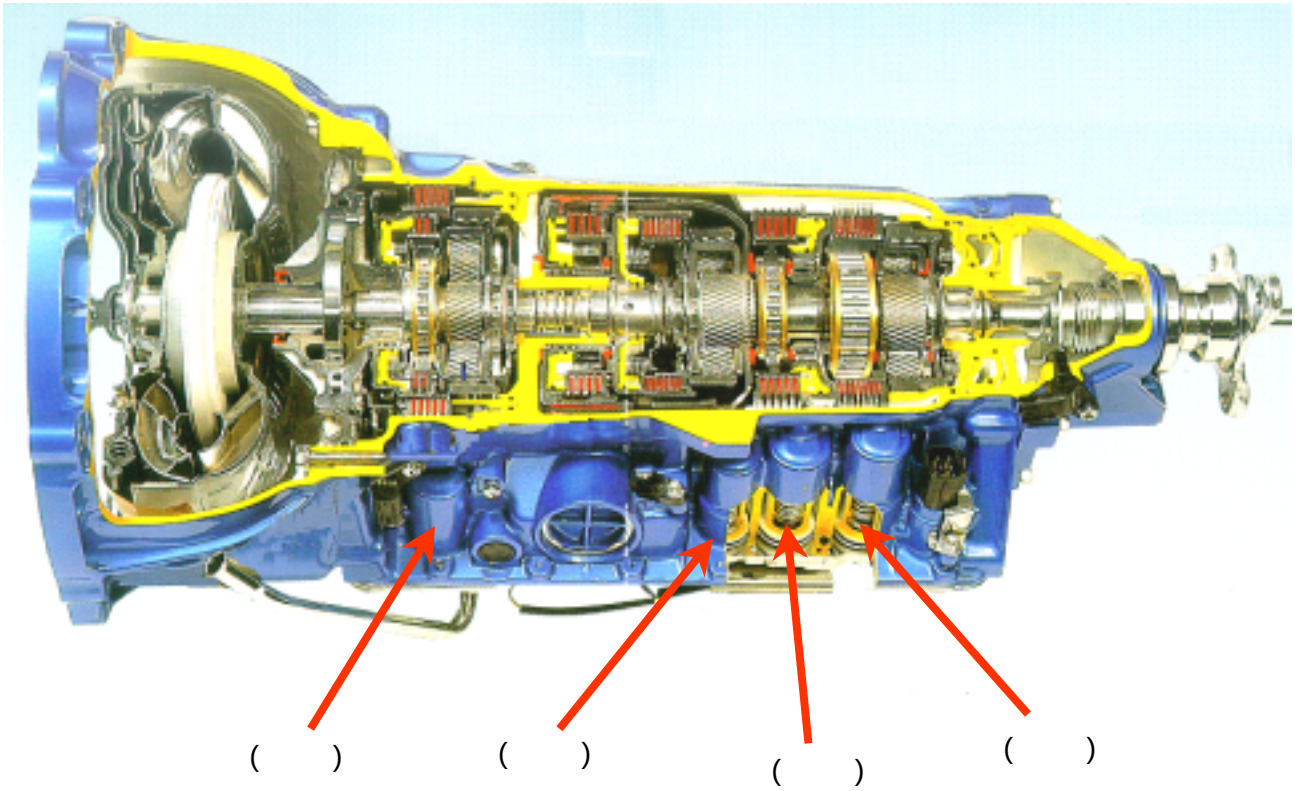
ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR02***

Theme:

Fill the blanks. (Select the proper number among the examples.)

The name of each accumulator



Examples:

1. OD brake
2. OD clutch
3. LR brake
4. 2nd brake
5. Direct clutch
6. Forward clutch
7. 2nd coast brake

Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date:

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR03***

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Subject:

Mechanical service points

Objectives:

- To know how to make decision the replacement of clutch and brake disc
- How to replace the discs while overhauling the clutch and brake
- For deep understanding of internal mechanical structure

Required materials:

- A/T training part (AW30-40LE or AW30-43LE model)
- General tools, relevant SST (Service special tool), Calipers, Micrometer.
- Training textbook
- Corresponding workshop manual (Terracan/SR/H-1)

Application:

- AW30-43LE (SR, H-1 with D4BH TCI and A-2.5 C/R)
- AW30-40LE (HP J2.9 C/R, 3.5L V6)

The time required:

- Remove each clutch and brake: 10minutes
- Answer the questions on “theme”: 10minutes
- Total: 20minutes

Procedure & Cautions:

- Open the gearbox up to Low & reverse brake disc and output shaft assembly referring the w/shop manual..
- Skip to open the valve body (Remove the valve body assembly from the transmission case).
- Be careful not to mix up discs of clutch and brake.
- Be careful not to mix up every snap rings for each clutch and brake

Are you ready? Go on next page.

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR03***

Theme:

- Measure the thickness of disc for all clutch and brake.
- Record the measured value.
- Record the standard value. (Refer the workshop manual)

Name	No.	Measuring value (mm)	Standard value (mm)	Remakrs
OD brake	1			
	2			
	3			
	4			
Forward clutch	1			
	2			
	3			
	4			
	5			
	6			
OD clutch	1			
	2			
LR brake	1			
	2			
	3			
	4			
	5			
	6			
	7			
Second brake	1			
	2			
	3			
	4			
	5			

Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date:

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR04***

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Subject:

Mechanical service points

Objectives:

- To know how to measure the end play of clutch and brake
- To be able to change the proper parts in case of out of specification for normal end play value
- To understand why we have to measure this endplay
- To get a skill to assemble this transmission properly

Required materials:

- A/T training part (AW30-40LE or AW30-43LE model)
- General tools, relevant SST, Air gun, Thickness gauge, Calipers, Dial gauge
- Training textbook
- Corresponding workshop manual (Terracan/SR/H-1)

Application:

- AW30-43LE (SR, H-1 with D4BH TCI and A-2.5 C/R)
- AW30-40LE (HP J2.9 C/R, 3.5L V6)

The time required:

- Assemble every clutch and brake: 60minutes
- Answer the questions on “theme”: 20minutes
- Total: 80minutes

Procedure & Cautions:

- Assemble the training part up to torque converter housing referring the w/shop manual.
- Be careful the location and direction of every thrust bearing and races.
- Be careful not to make damage on the transmission parts.
- Do not apply too much force when you align the teeth of clutch or brake or it will result in damage.

Are you ready? Go on next page.

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR04***

Theme:

- Measure the endplay of indicated on the below box.
- Record the measured value.
- Record the standard value. (Refer the workshop manual)

Name	Measuring value (mm)	Standard value (mm)	Remakrs
The clearance between the 2nd brake snap ring and the flange			
The clearance between the plate and the 2nd brake drum			
The stroke of the 2nd coast brake piston			
The stroke of the OD brake			

Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date:

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR05***

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Subject:

Mechanical structure and Electrical inputs

Objectives:

- To know how TCM detects the input speed in this transmission
- To be able to analyze the waveform of PG-A (Input speed sensor)
- To understand why the input speed drops zero in over drive
- Discuss the function of PG-A (Input speed sensor)

Required materials:

- Overhauled A/T training part (AW30-40LE model)
- A/T (AW30-40LE or AW30-43LE model) training vehicle: HP J2.9 C/R or 3.5L V6
- Training textbook
- Corresponding Electrical troubleshooting manual (Terracan)
- Hi-scan Pro with Software card, SST(T-connector)

Application:

- AW30-40LE (HP J2.9 C/R, 3.5L V6)

※ It is not available in AW30-43LE (SR, H-1 with D4BH TCI and A-2.5 C/R), because PG-A was not applied in these vehicle models.

The time required:

- Installation of the SST(T-connector) on the PG-A sensor: 5minutes
- Answer the questions on “theme”: 10minutes
- Total: 15minutes

Procedure & Cautions:

- After installing the T-connector, go into the ‘Oscilloscope’ menu in Hi-scan Pro to measure the waveform from PG-A sensor while engine starting
- Be careful not to be occurred the shorted circuit in PG-A sensor or TCM while installing the T-connector.

Are you ready? Go on next page.

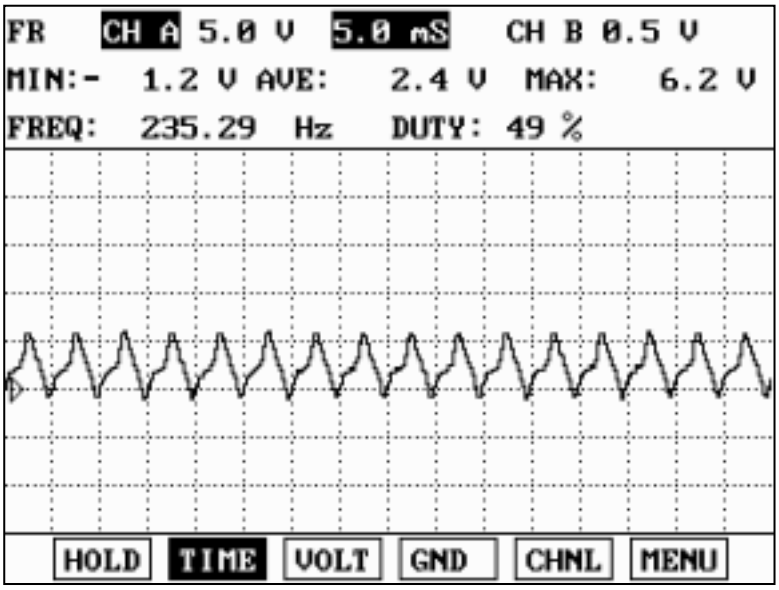
ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR05***

Theme:

- Measure the waveform under the indicated condition as an example.
- Print out the result and attach it on the rectangular blank.
- Verify the result in case of over drive (4th gear).

Example :



1) Measure the waveform of PG-A in 3rd gear.

Print out the result and attach it here

To be continued in next page..

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR05***

2) Measure the waveform of PG-A in 4th gear.

Print out the result and attach it here

Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date:

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR06***

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Subject:

Electrical Outputs

Objectives:

- To verify the schedule of shift control solenoid valve depends on the shift range
- To understand the control of shift while the fail-safe is activated.

Required materials:

- A/T (AW30 or AW03 series model with TCM) training vehicle: Terracan / H-1 / SR and so on.
- Training textbook
- Corresponding Electrical troubleshooting manual
- Hi-scan Pro with Software card, Probe channel for voltage

Application:

- All AISIN Models with TCM: Except Galloper

The time required:

- Installation of the probe on the TCM side harness connector: 5minutes
- Answer the questions on “theme”: 5minutes
- Total: 10minutes

Procedure & Cautions:

- Be careful not to make damage on the TCM harness side connector while installing the probe.
  (Turn the IG key off to protect from the short damage of circuit)
- It is not available to check the shift sequence in the “current data” menu of Hi-scan Pro..
  (Use the “Oscilloscope function to check the signal.)
- Refer the ETM (Electrical troubleshooting manual) to find out the pin number of SCSV 1 and SCSV 2 from the TCM harness side connector
- It is impossible to use T-connector on the solenoid valve connector because there is no space to do it.

Are you ready? Go on next page.

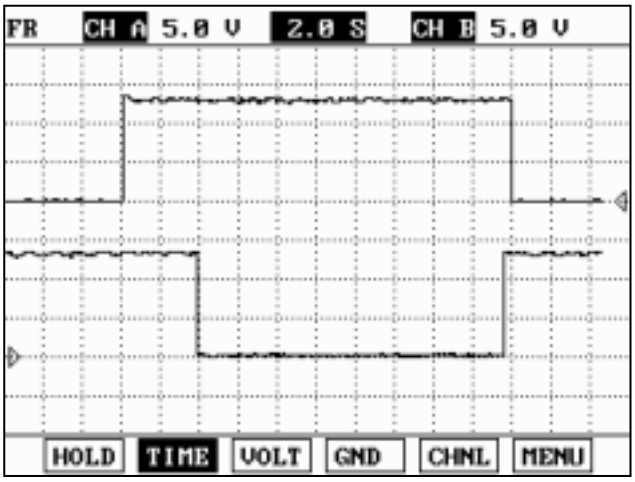
ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR06***

Theme:

- Measure the output voltage from the SCSV1 & 2 under the indicated condition as an example.
- Print out the result and attach it on the rectangular blank.

Example :



1) Measure the output signal of SCSV 1 & 2 (CH-A : SCSV1, CH-B : SCSV2)

Condition: D-range

Print out the result and attach it here

To be continued in next page..

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR06***

2) Measure the output signal of SCSV 1 & 2 (CH-A : SCSV1, CH-B : SCSV2)

Condition: 2-range

Print out the result and attach it here

3) Measure the output signal of SCSV 1 & 2 (CH-A : SCSV1, CH-B : SCSV2)

Condition: L-range

Print out the result and attach it here

4) Check the signal of SCSV1 and SCSV2 at P, R, N range: ON or OFF? : ( )

Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date:

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR07***

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Subject:

Electrical Outputs

Objectives:

- To understand the function of PCSV (Pressure control solenoid valve)
- To know the characteristics of PCSV and how to check it is good or not.

Required materials:

- A/T (AW30-40LE / AW03-II model) training vehicle: Terracan / H-1 .
- Training textbook
- Corresponding Electrical troubleshooting manual
- Hi-scan Pro with Software card, Probe channel for voltage

Application:

- AW30-40LE / AW03-II model without throttle cable

The time required:

- Installation of the probe on the TCM side harness connector: 5minutes
- Answer the questions on “theme”: 5minutes
- Total: 10minutes

Procedure & Cautions:

- Be careful not to make damage on the TCM harness side connector while installing the probe.
  (Turn the IG key off to protect from the short damage of circuit)
- It is impossible to use T-connector on the solenoid valve connector because there is no space to do it.
- Refer the ETM (Electrical troubleshooting manual) to find out the pin number of PCSV from the TCM harness side connector
  (Use the “Oscilloscope function to check the signal.)
  (It is not necessary to use the “Trigger function” of Oscilloscope function in this case)

Are you ready? Go on next page.

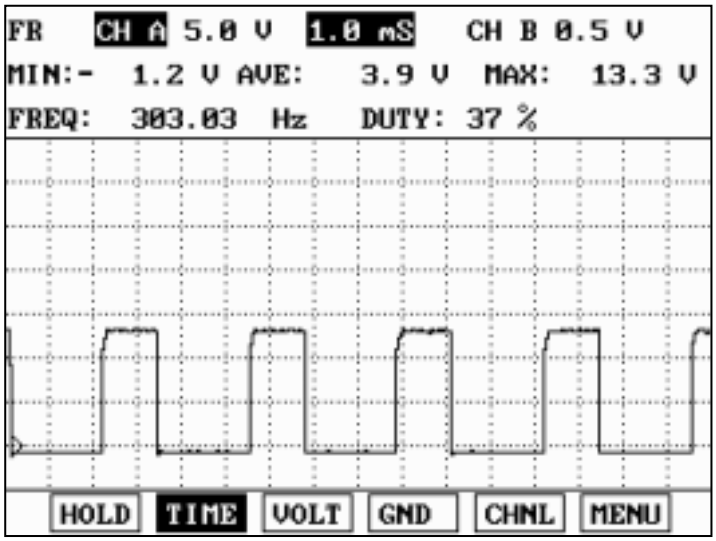
ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR07***

Theme:

- Measure the duty of PCSV under the indicated condition as an example.
- Print out the result and attach it on the rectangular blank.
- Pay attention to the change of duty ratio depends on the vehicle condition.
  (Engine load, vehicle speed, foot brake, current shift range, and current gear position)

Example:



- Measure the duty cycle of PCSV

Condition: N → D-range

Print out the result and attach it here

Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date:

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR08***

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Subject:

Electrical Outputs

Objectives:

- To understand the function of DCCSV (Damper clutch control solenoid valve)
- To verify the damper clutch operating condition.
- To know the characteristics of DCCSV and how to check it is good or not.

Required materials:

- A/T (AW30 or AW03 series model) training vehicle: Terracan / H-1 /SR.
- Training textbook
- Corresponding Electrical troubleshooting manual
- Hi-scan Pro with Software card, Probe channel for voltage

Application:

- All electronic controlled AISIN models with damper clutch (Except Galloper)

The time required:

- Installation of the probe on the TCM side harness connector: 5minutes
- Answer the questions on “theme”: 5minutes
- Total: 10minutes

Procedure & Cautions:

- Be careful not to make damage on the TCM harness side connector while installing the probe.
  (Turn the IG key off to protect from the short damage of circuit)
- It is impossible to use T-connector on the solenoid valve connector because there is no space to do it.
- Refer the ETM (Electrical troubleshooting manual) to find out the pin number of DCCSV from the TCM harness side connector
  (Use the “Oscilloscope function to check the signal.)

Are you ready? Go on next page.

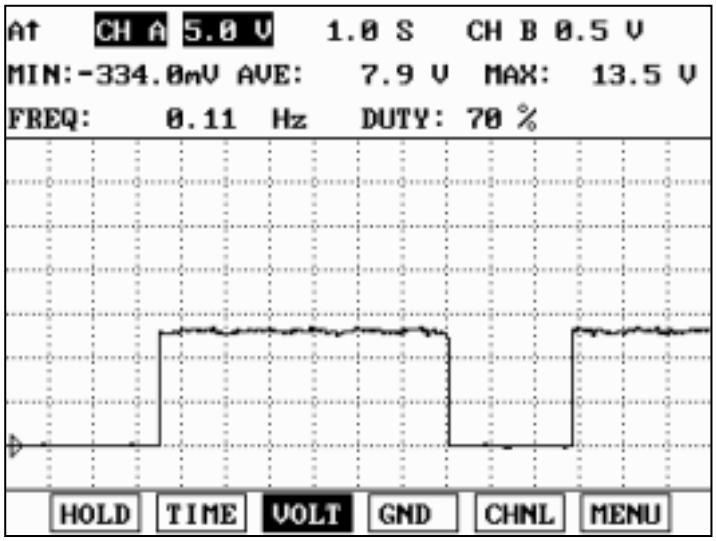
ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR08***

Theme:

- Measure the duty of DCCSV under the indicated condition as an example.
- Print out the result and attach it on the rectangular blank.
- Pay attention to the operating and releasing condition of damper clutch.
  (Current shift range and gear position, foot brake)

Example:



- Measure the on-off signal of DCCSV

Condition: Make up shift 1st→2nd→3rd→4th at D-range

Print out the result and attach it here

Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date:

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR09***

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Subject:

Diagnosis trouble code (Input speed sensor)

Objectives:

- To understand the function of PG-A.
- To verify the symptom when PG-A is failed and failsafe operation by TCM.
- To know the detecting condition of relevant DTC.

Required materials:

- A/T (AW30-40LE, AW03-II model) training vehicle: Terracan.
- Training textbook
- Hi-scan Pro with Software card

Application:

- AW30-40LE, AW03-II model only
- PG-A (Input speed sensor) was not applied in following models.
  (AW03-72LE, AW30-43LE)

The time required:

- Disconnect the PG-A sensor connector: 5minutes
- Answer the questions on “theme”: 10minutes
- Total: 15minutes

Procedure & Cautions:

- Disconnect the PG-A sensor connector
- Lift up the vehicle and drive

Are you ready? Go on next page.

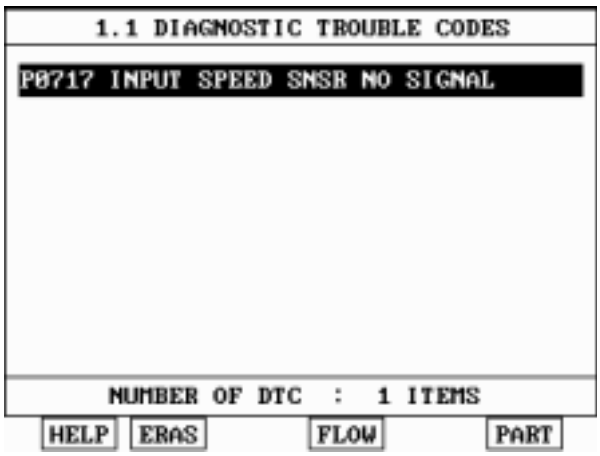
ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR09***

Theme:

- Make the diagnosis trouble code as same as an example.
- Answer the below questions.
- DTC to be detected,
  * PG-B (Output speed) speed should be always higher than 775rpm.
  * Keep the 1st gear for more than 2.5sec at L range (PG-B>775rpm)
  * After 3.5sec or more, go to 2 range and keep the 2nd gear for more than 2.5sec (PG-B>775rpm)
  * After 3.5sec or more, go to D range and keep the 3rd gear for more than 2.5sec (PG-B>775rpm)
  * Keep the 4th gear for more than 2.5sec (PG-B>775rpm) → 1st driving cycle
  * IG key off and on, repeat above procedure (2nd driving cycle)

Example:



1) Automatic shift (1st → 2nd → 3rd → 4th) is possible?

2) How about warning lamp or MIL(Engine check lamp) ?

3) Is there any shift shock?

4) Damper clutch (Lock-up) is operated?

5) Is it possible to erase the DTC even though the input speed sensor is disconnected?

Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date:

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR10***

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Subject:

Diagnosis trouble code (Output speed sensor)

Objectives:

- To understand the function of PG-B.
- To verify the symptom when PG-B is failed and failsafe operation by TCM.
- To know the detecting condition of relevant DTC.

Required materials:

- A/T (AW30-40LE, AW03-II model) training vehicle: Terracan.
- Training textbook
- Hi-scan Pro with Software card

Application:

- AW30, AW03 series models with TCM
- However the DTC detecting condition may be slightly different depends on the vehicle

The time required:

- Disconnect the PG-B sensor connector: 5minutes
- Answer the questions on “theme”: 10minutes
- Total: 15minutes

Procedure & Cautions:

- Disconnect the PG-B sensor connector
- Lift up the vehicle and drive

Are you ready? Go on next page.

ACTIVITY REPORT

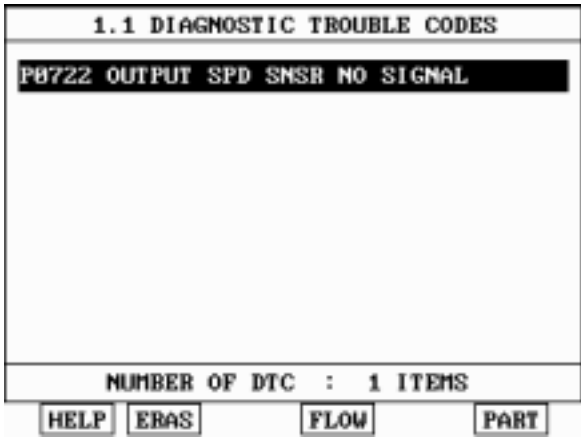
Ref.: ***HAT-FR-AW-AR10***

Theme:

- Make the diagnosis trouble code as same as an example.
- Answer the below questions.
- DTC to be detected,

  * 2nd driving cycle should be satisfied.

Example:



1) Automatic shift (1st → 2nd → 3rd → 4th) is possible?

2) How about warning lamp or MIL(Engine check lamp) ?

3) Is there any shift shock?

4) Damper clutch (Lock-up) is operated?

5) Is it possible to erase the DTC even though the output speed sensor is disconnected?

Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date:

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR11***

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Subject:

Diagnosis trouble code (Shift control solenoid valve 1)

Objectives:

- To verify the fail-safe operation if the shift control solenoid valve is failed.

Required materials:

- A/T (AW30, AW03 series model) training vehicle: Terracan / H-1 / SR
- Training textbook
- Hi-scan Pro with Software card
- Electrical troubleshooting manual

Application:

- AW30, AW03 series models with TCM
- However the DTC detecting condition and fail-safe operation may be slightly different depends on the vehicle

The time required:

- Make related DTC: 5minutes
- Answer the questions on “theme”: 5minutes
- Total: 10minutes

Procedure & Cautions:

- Connect the SCSV 1 terminal of TCM into body to make a short to ground.
- Do make short to ground under the IG key off for protecting the circuit.
- The use of T-connector on solenoid valve connector is improper because there is no space to do it.
- Lift up the vehicle and drive.

Are you ready? Go on next page.

ACTIVITY REPORT

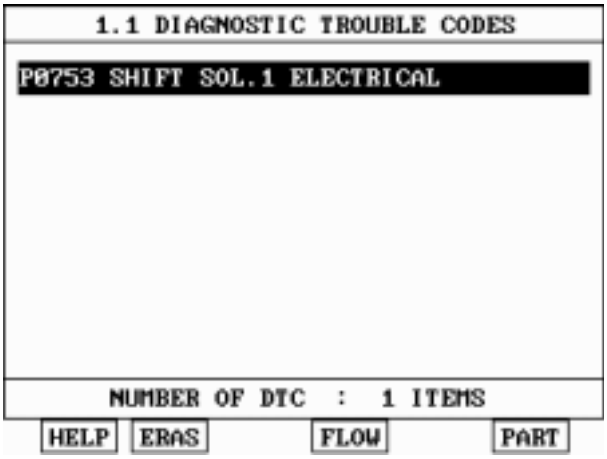
Ref.: ***HAT-FR-AW-AR11***

Theme:

- Make the diagnosis trouble code as same as an example.
- Answer the below questions.
- DTC to be detected,

  * 1st driving cycle is enough the DTC to be displayed.

Example:



1) Automatic shift (1st → 2nd → 3rd → 4th) is possible?

2) How about warning lamp or MIL(Engine check lamp) ?

3) Is there any shift shock?

4) Damper clutch (Lock-up) is operated?

5) Is it possible to erase the DTC even though the SCSV 1 is still grounded to body?

6) Which gear was fixed depends on the range?

D range -

2 range -

L range -

Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date:

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR12***

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Subject:

Diagnosis trouble code (Shift control solenoid valve 2)

Objectives:

- To verify the fail-safe operation if the shift control solenoid valve is failed.

Required materials:

- A/T (AW30, AW03 series model) training vehicle: Terracan / H-1 / SR
- Training textbook
- Hi-scan Pro with Software card
- Electrical troubleshooting manual

Application:

- AW30, AW03 series models with TCM
- However the DTC detecting condition and fail-safe operation may be slightly different depends on the vehicle

The time required:

- Make related DTC: 5minutes
- Answer the questions on “theme”: 5minutes
- Total: 10minutes

Procedure & Cautions:

- Connect the SCSV 2 terminal of TCM into body to make a short to ground.
- Do make short to ground under the IG key off for protecting the circuit.
- The use of T-connector on solenoid valve connector is improper because there is no space to do it.
- Lift up the vehicle and drive.

Are you ready? Go on next page.

ACTIVITY REPORT

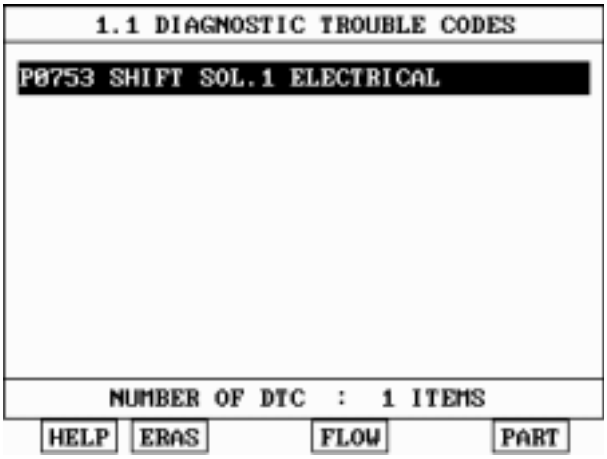
Ref.: ***HAT-FR-AW-AR12***

Theme:

- Make the diagnosis trouble code as same as an example.
- Answer the below questions.
- DTC to be detected,

  * 1st driving cycle is enough the DTC to be displayed.

Example:



1) Automatic shift (1st → 2nd → 3rd → 4th) is possible?

2) How about warning lamp or MIL (Engine check lamp)?

3) Is there any shift shock?

4) Damper clutch (Lock-up) is operated?

5) Is it possible to erase the DTC even though the SCSV 2 is still grounded to body?

6) Which gear was fixed depends on the range?

D range -

2 range -

L range -

Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date:

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR13***

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Subject:

Diagnosis trouble code (Pressure control solenoid valve)

Objectives:

- To verify the fail-safe operation if the pressure control solenoid valve is failed.

Required materials:

- A/T (AW30-40LE / AW03-II model) training vehicle: Terracan / H-1.
- Training textbook
- Corresponding Electrical troubleshooting manual
- Hi-scan Pro with Software card

Application:

- AW30-40LE / AW03-II model without throttle cable

The time required:

- Make related DTC: 5minutes
- Answer the questions on “theme”: 5minutes
- Total: 10minutes

Procedure & Cautions:

- Connect the PCSV terminal of TCM into body to make a short to ground.
- Do make short to ground under the IG key off for protecting the circuit.
- The use of T-connector on solenoid valve connector is improper because there is no space to do it.
- Lift up the vehicle and drive.

Are you ready? Go on next page.

ACTIVITY REPORT

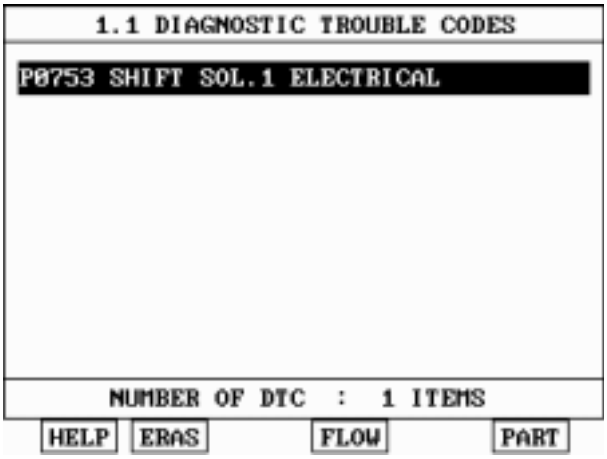
Ref.: ***HAT-FR-AW-AR13***

Theme:

- Make the diagnosis trouble code as same as an example.
- Answer the below questions.
- DTC to be detected,

  * 1st driving cycle is enough the DTC to be displayed.

Example:



1) Automatic shift (1st → 2nd → 3rd → 4th) is possible?

2) How about warning lamp or MIL (Engine check lamp)?

3) Is there any shift shock?

4) Damper clutch (Lock-up) is operated?

5) Is it possible to erase the DTC even though the PCSV is still grounded to body?

6) Which gear was fixed depends on the range?

D range -

2 range -

L range -

Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date:

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR14***

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Subject:

Diagnosis trouble code (Damper clutch control solenoid valve)

Objectives:

- To verify the fail-safe operation if the damper clutch control solenoid valve is failed.
- To understand the symptom if the damper clutch is operated always.

Required materials:

- A/T (AW30, AW03 series model) training vehicle: Terracan / H-1 / SR
- Training textbook
- Hi-scan Pro with Software card
- Electrical troubleshooting manual

Application:

- AW30, AW03 series models with TCM
- However the DTC detecting condition and fail-safe operation may be slightly different depends on the vehicle

The time required:

- Make related DTC: 5minutes
- Answer the questions on “theme”: 5minutes
- Total: 10minutes

Procedure & Cautions:

- Connect the DCCSV terminal of TCM into body to make a short to ground.
- Do make short to ground under the IG key off for protecting the circuit.
- The use of T-connector on solenoid valve connector is improper because there is no space to do it.
- Lift up the vehicle and drive.

Are you ready? Go on next page.

ACTIVITY REPORT

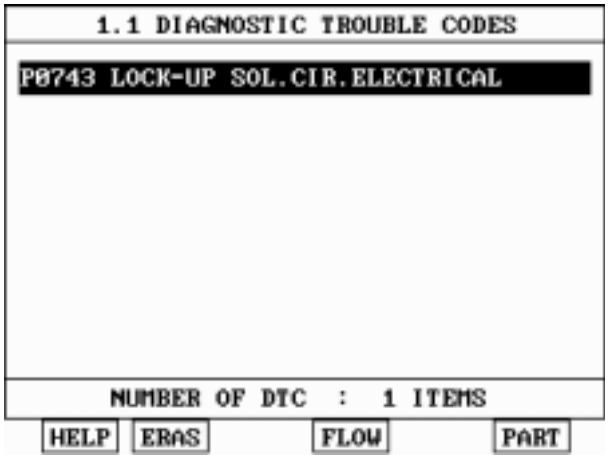
Ref.: ***HAT-FR-AW-AR14***

Theme:

- Make the diagnosis trouble code as same as an example.
- Answer the below questions.
- DTC to be detected,

  * 2nd driving cycle should be satisfied. (More than 2times of automatic shift from 1st gear to 4th gear)

Example:



1) Automatic shift (1st → 2nd → 3rd → 4th) is possible?

2) How about warning lamp or MIL (Engine check lamp)?

3) Is there any shift shock?

4) Damper clutch (Lock-up) is operated?

5) Is it possible to erase the DTC even though the DCCSV is still grounded to body?

Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date:

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR15***

Course:

Automatic Transmission (FR) – AISIN - [CHASSIS_STEP2_IBT_A/T FR (AISIN)] **Code : SCE**

Subject:

Hydraulic line pressure

Objectives:

- To verify the line pressure specification for overdrive clutch.
- To be able to diagnose depends on the measured result.

Required materials:

- A/T (AW30 series model) training vehicle: Terracan / H-1 / SR
- Training textbook
- SST (Pressure gauge adapter), Gauge set

Application:

- AW30 series models with TCM

The time required:

- Installation of SST (Pressure gauge adapter) on the O/D clutch checking port: 15minutes
- Answer the questions on “theme”: 15minutes
- Total: 30minutes

Procedure & Cautions:

- Lift up the vehicle and install the SST(pressure gauge adapter) on the over drive clutch pressure checking port.
- It will be helpful to disconnect the PG-A connector because the space is very poor nearby this pressure checking port.
  (After finishing installing the pressure gauge adapter, don’t forget to reconnect PG-A connector)
- Be careful not to make the gauge hose damage due to the front propeller shaft, catalytic converter or exhaust pipe
- Start the engine and read the gauge.

Are you ready? Go on next page.

ACTIVITY REPORT

Ref.: ***HAT-FR-AW-AR15***

Theme:

- Fill out the below chart.

Range	Eng. Speed (rpm)	Vehicle speed	Measured value (kg_f/cm^2)	Specification (kg_f/cm^2)	Remarks
P, N	Idle	Stop		-	
	WOT	Stop		-	
R	Idle	Stop		6.2 7.2	
	WOT	Driving		-	
	WOT	Stop		15.6 19	Stall test
D	Idle	Stop		4 4.6	
	(1^{st} 3^{rd} gear)	Driving		-	
	(4^{th} gear)	Driving		-	
	WOT	Stop		11.7 13.2	Stall test
2	Idle	Stop		-	
	WOT	Driving		-	
L	Idle	Stop		-	
	WOT	Driving		-	

What is the most probable cause? (Out of specification)

1) Lower than standard in D and R range both:

2) Lower than standard in D range only:

3) Lower than standard in R range only:

4) Excessive line pressure:

Evaluation:

Submit this page only to instructor.

Name: Company:

Country: Date: