# AUTOMATIC TRANSAXLE

# for HP-CAR

## AW 03-II

## AW 30-40LE

## Main points

- To control the line pressure, the pressure control solenoid valve was adopted instead of throttle cable.
- 'A/T' lamp was installed so as to be turned 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 was 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.

## General specifications

| 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 |

## General specifications

| TYPE | AUTOMATIC | | |
|---|---|---|---|
| | 2.5 TCI | 2.9 TCI | 3.5 V6 |
| Maximum torque | 24kgfm | 35kgfm | |
| Weight (kg) | 72 | 79.8 | |
| T/C Stall torque ratio | 2.1 | 2.02 | |
| Torque converter (DIA) | 241mm | 254mm | |
| Stall RPM | | 2,630 | 2,520 |
| ATF | DEXRON II | | |
| ATF CAPA. (LITER) | 8.73 (L) | 9.2 (L) | |

## Variation of AISIN AW Automatic transaxle on HMC vehicles

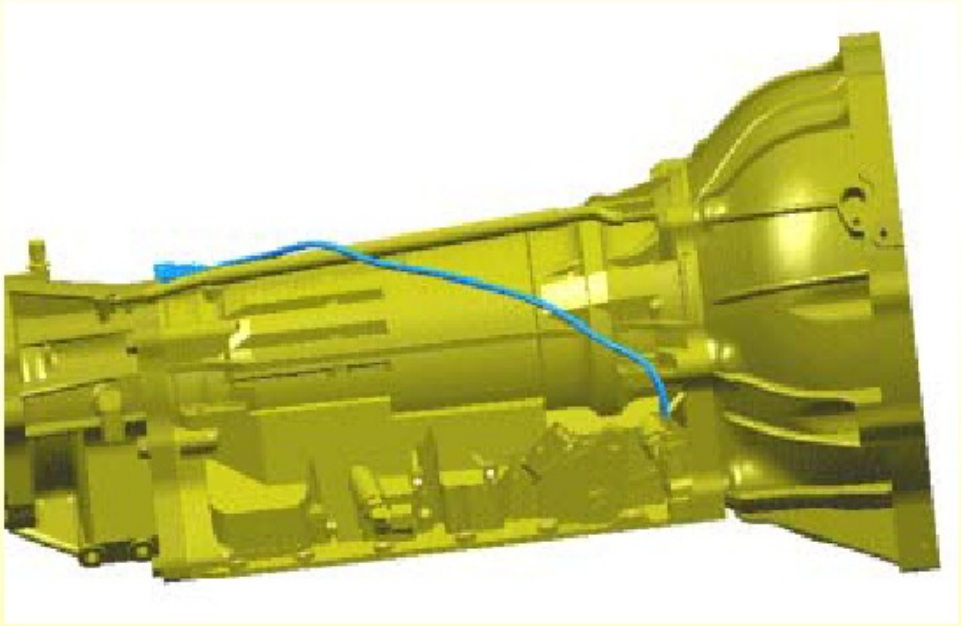
| Model | Application | Remarks |
|---|---|---|
| 03-72L | Galloper, H-100 Bus | Hydraulic type |
| 03-72LE | H-100 Truck, H-1 (N/A) | ECT |
| 03-II | HP (2.5 Tci) | |
| 30-43LE | H-1(Tci), SR | |
| 30-40LEi | HP (2.9C/rail, 3.5 V6) | |

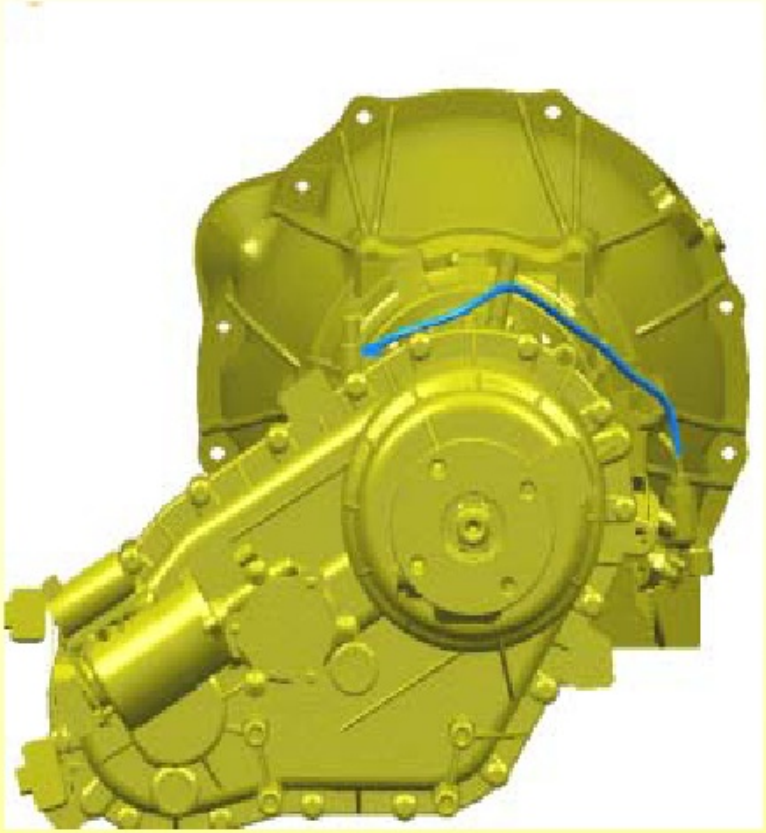
# ATOMATIC TRANSMISSION



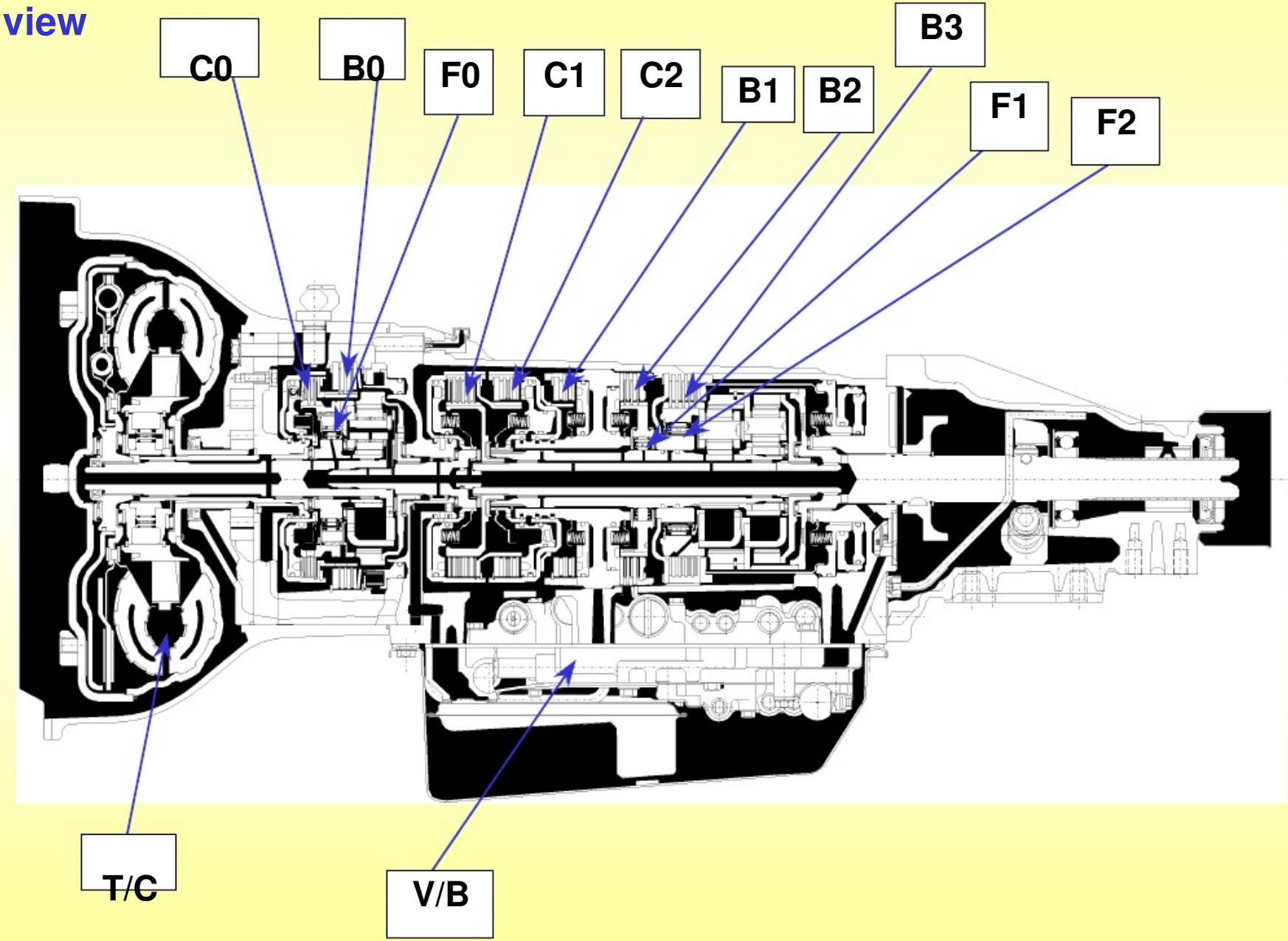


- AISIN AW 03-II (for 4D56 TCi)
- AISIN AW 30-40LEi (for 2.9TCi / 3.5 V6)





## Section view



## Components

| 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 CARIER |
| F0 | O/D ONE-WAY CLUTCH | Connect O/D SUN GEAR and O/D CARIER, when O/D SUN GEAR rotates rapid more than O/D CARIER |
| 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 CARIER |

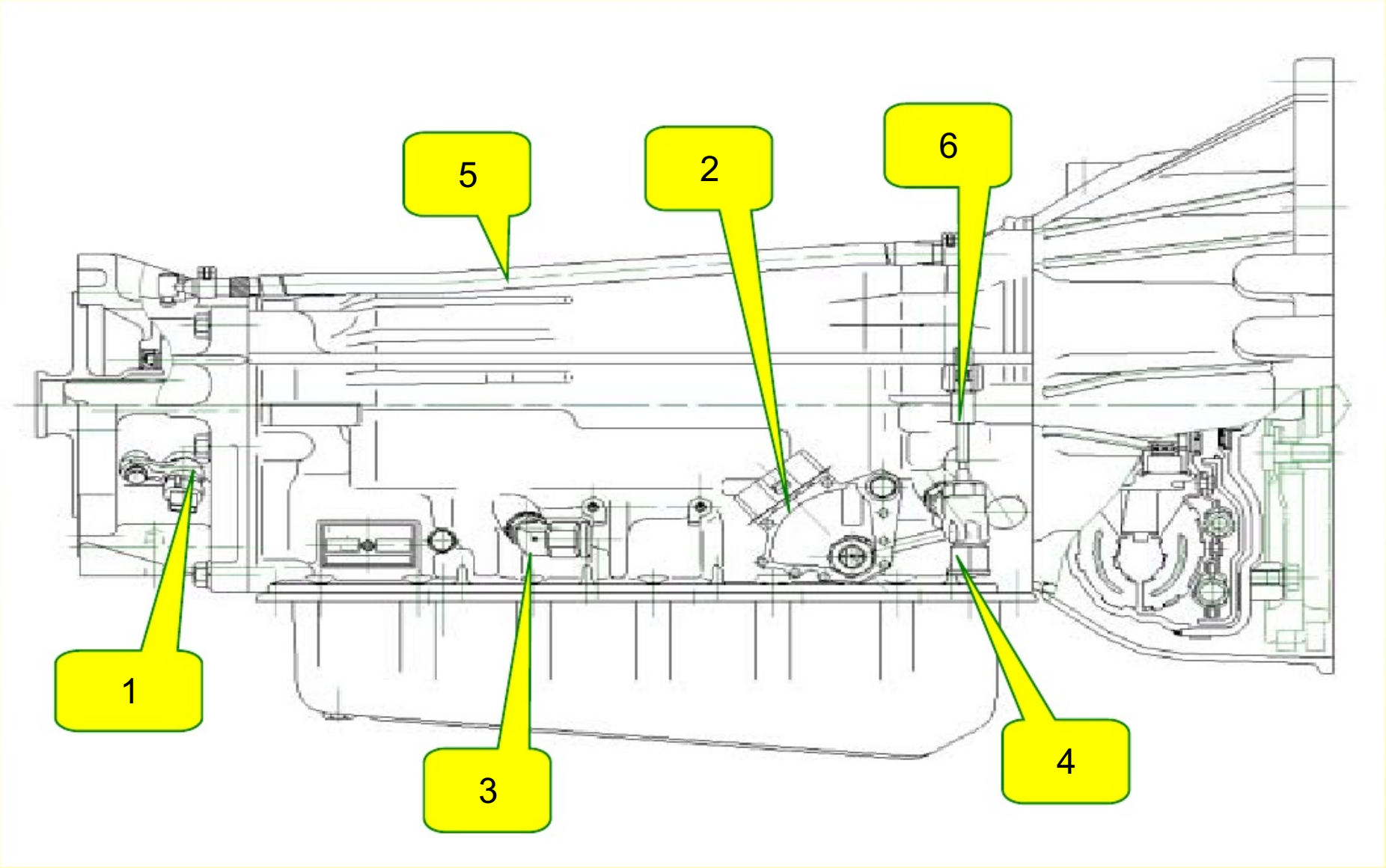
## Operating elements

| POSITION | | SOLENOID | | | CLUTCH | | | | BRAKE | | | | | O.W.C. | | | GEAR RATIO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | S1 | S2 | SL | C0 | C1 | C2 | | B0 | B1 | B2 | B3 | | F0 | F1 | F2 | |
| | | | | | | | I.P. | O.P. | | | | I.P. | O.P. | | | | |
| P | | ON | OFF | OFF | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | - |
| R | | ON | OFF | OFF | ON | OFF | ON | ON | OFF | OFF | OFF | ON | ON | ON | OFF | OFF | 2.703 |
| N | | ON | OFF | OFF | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | - |
| D | 1st | ON | OFF | OFF | ON | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | ON | OFF | ON=>OFF | 2.825 |
| | 2nd | ON | ON | OFF | ON | ON | OFF | OFF | OFF | OFF | ON | OFF | OFF | ON | ON=>OFF | OFF | 1.493 |
| | 3rd | OFF | ON | OFF | ON | ON | OFF | ON | OFF | OFF | ON | OFF | OFF | ON | OFF | OFF | 1.000 |
| | 4th | OFF | OFF | ON | OFF | ON | OFF | ON | ON | OFF | ON | OFF | OFF | OFF | OFF | OFF | 0.730 |
| 2 | 1st | ON | OFF | OFF | ON | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | ON | OFF | ON=>OFF | 2.825 |
| | 2nd | ON | ON | OFF | ON | ON | OFF | OFF | OFF | ON | ON | OFF | OFF | ON | ON | OFF | 1.493 |
| | 3rd | OFF | ON | OFF | ON | ON | OFF | ON | OFF | OFF | ON | OFF | OFF | ON | OFF | OFF | 1.000 |
| L | 1st | ON | OFF | OFF | ON | ON | OFF | OFF | OFF | OFF | OFF | ON | ON | ON | OFF | ON | 2.825 |
| | 2nd | ON | ON | OFF | ON | ON | OFF | OFF | OFF | ON | ON | OFF | OFF | ON | ON | OFF | 1.493 |

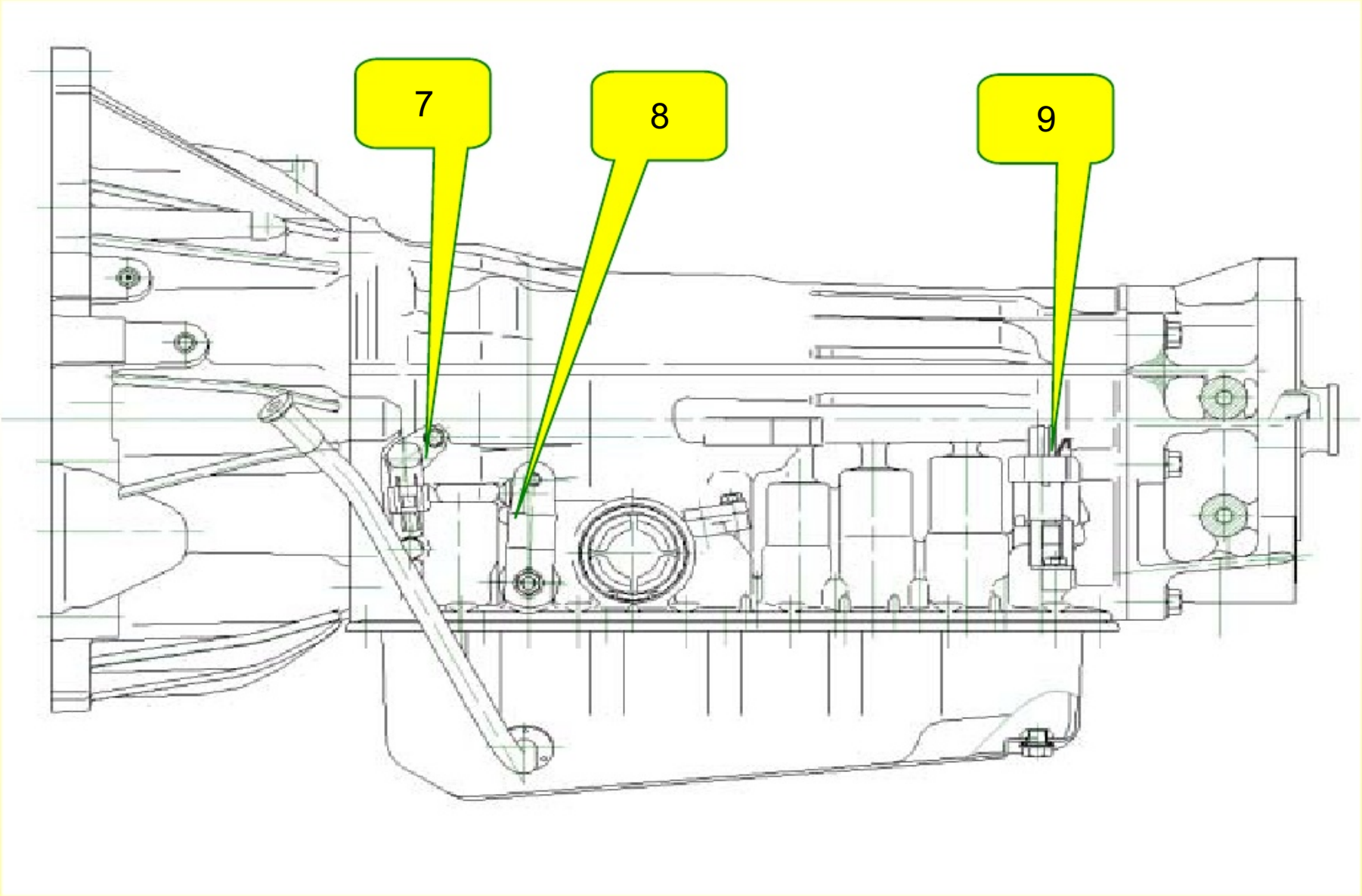
# MECHANICAL (30-40LEi)



## Components



## Components



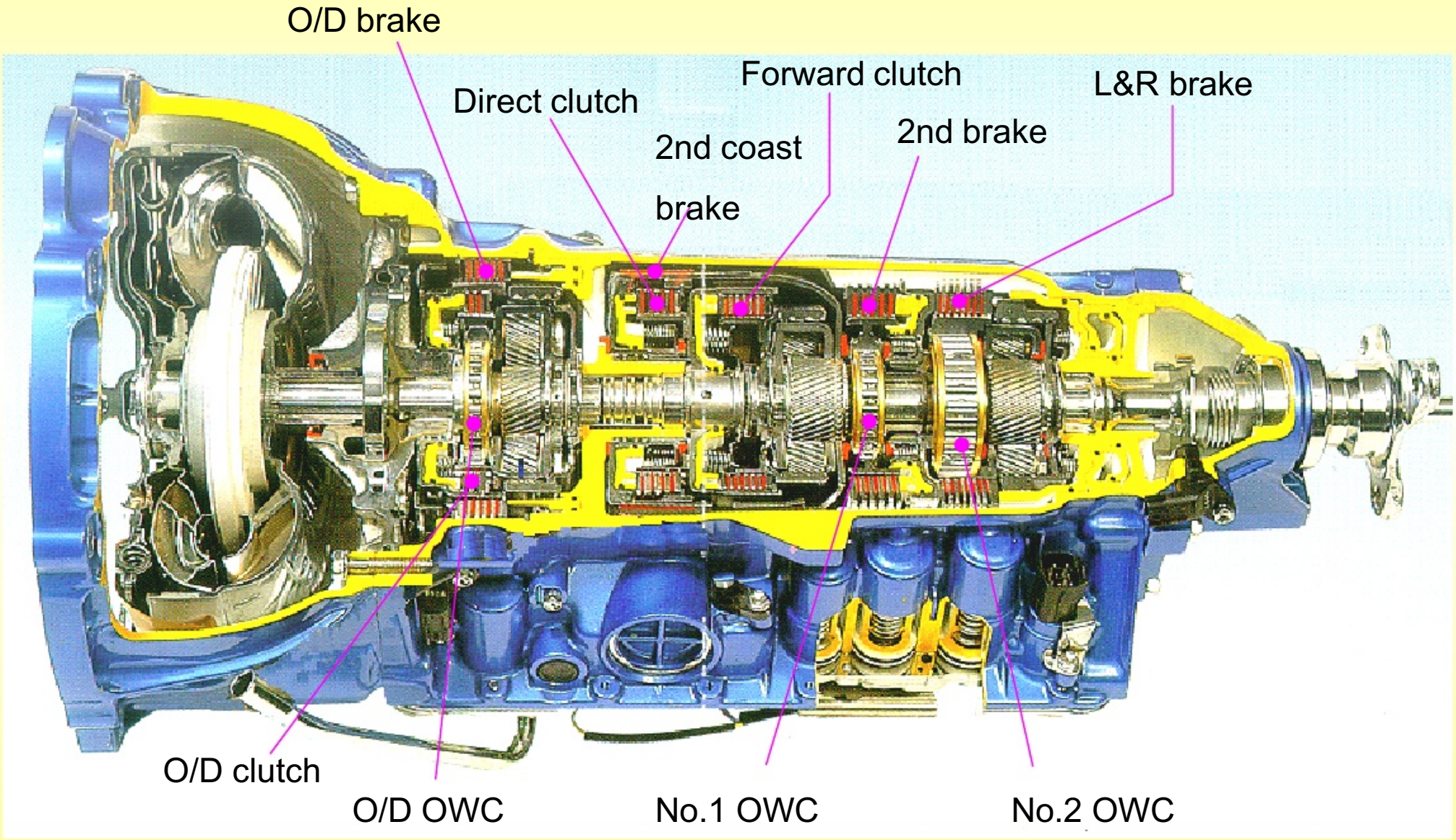
## Components

| 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 |

# MECHANICAL (30-40LEi)



## Section view



## Components

| COMPONENT | | FUNCTION |
|---|---|---|
| C0 | O/D DIRECT CLUTCH | Connect O/D SUN GEAR and O/D CARIER |
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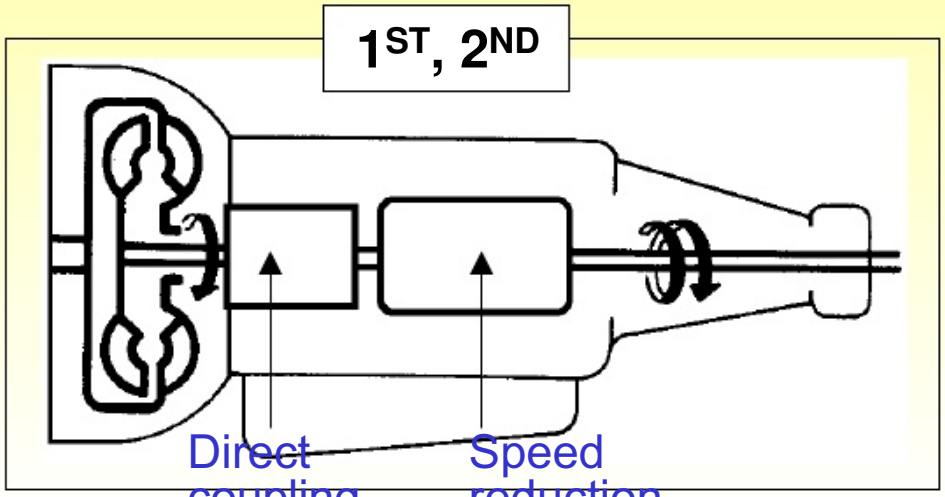
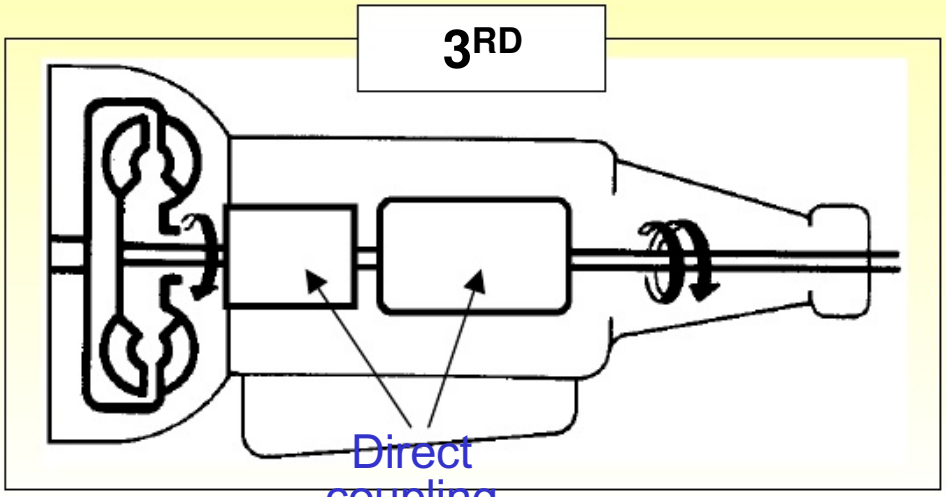
| B3 | 1ST & REVERSE BRAKE | Lock Fr PLANETARY CARIER |
| F0 | O/D ONE-WAY CLUTCH | Connect O/D SUN GEAR and O/D CARIER, when O/D SUN GEAR rotates rapid more than O/D CARIER |
| F1 | NO.1 ONE-WAY CLUTCH | Lock counterclockwise rotation of Fr/Rr PLANETARY SUN GEAR, when B2 operations |
| F2 | NO.2 ONE-WAY CLUTCH | Lock counterclockwise rotation of Fr PLANETARY CARIER |

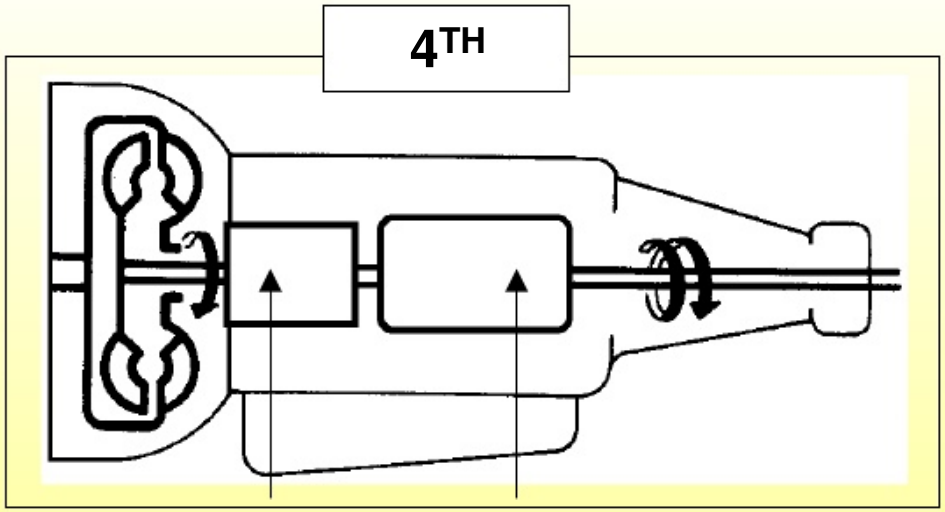
## Operating elements

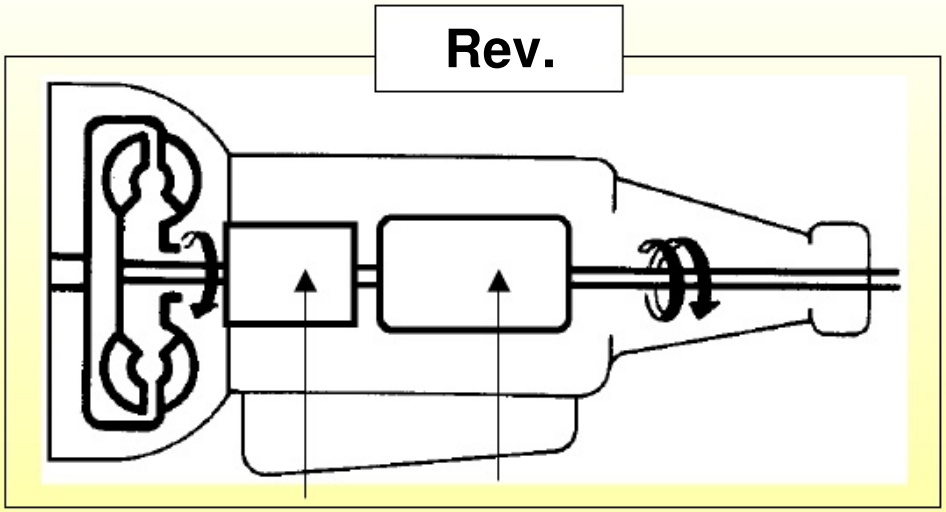
| POSITION | | SOLENOID | | | CLUTCH | | | BRAKE | | | | O.W.C. | | | GEAR RATIO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | S1 | S2 | SL | C0 | C1 | C2 | B0 | B1 | B2 | B3 | F0 | F1 | F2 | |
| P | | ON | OFF | OFF | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | - |
| 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 |

## Principle of each range





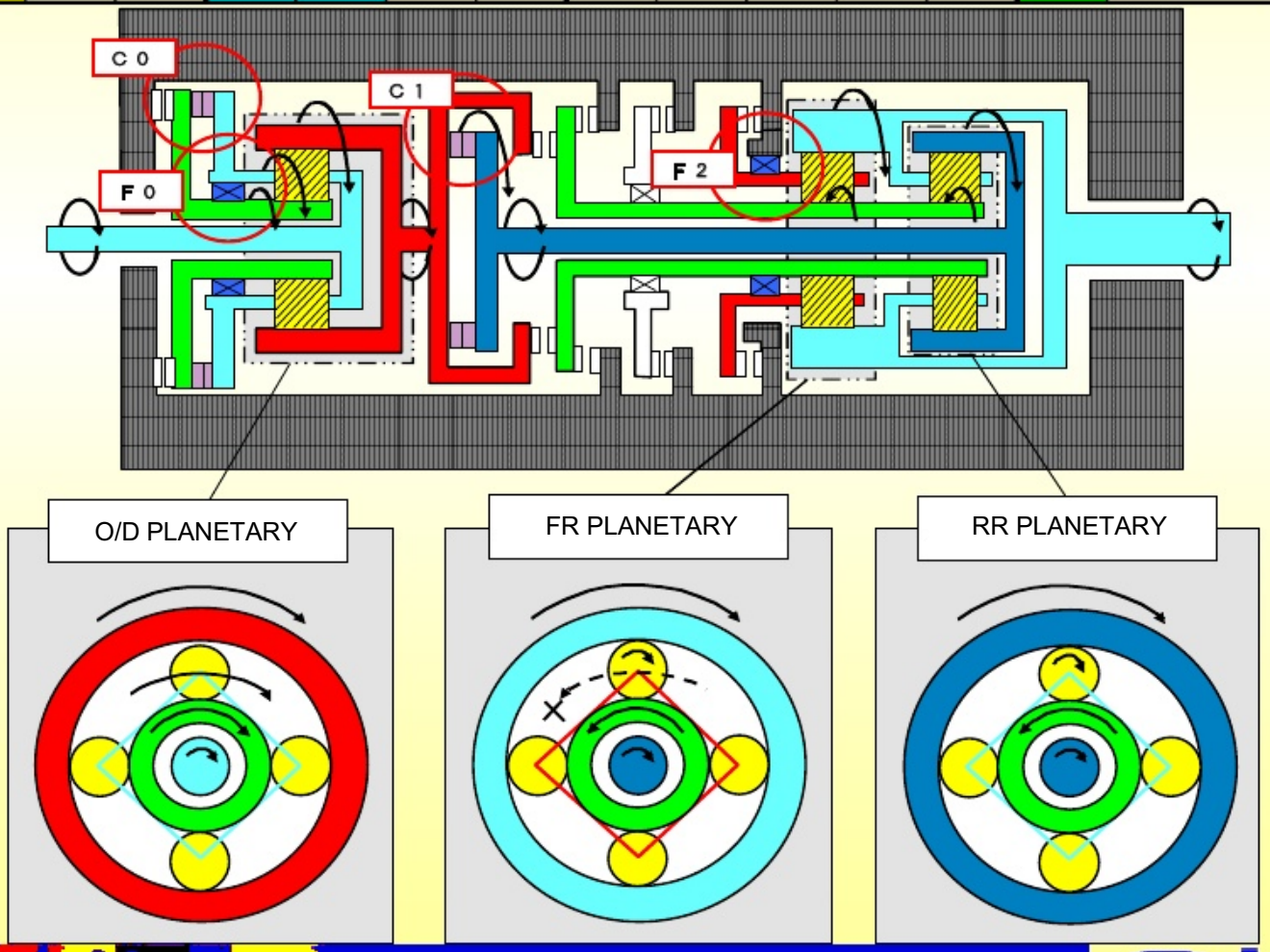

MECHANICAL

## The usages of 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 |

## "D" –1st GEAR

| POSITION | | SOLENOID | | | CLUTCH | | | | BRAKE | | | | | O.W.C. | | | GEAR RATIO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | S1 | S2 | SL | C0 | C1 | C2 | | B0 | B1 | B2 | B3 | | F0 | F1 | F2 | |
| | | | | | | | I.P. | O.P. | | | | I.P. | O.P. | | | | |
| D | 1st | ON | OFF | OFF | ON | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | ON | OFF | ON=>OFF | 2.825 |

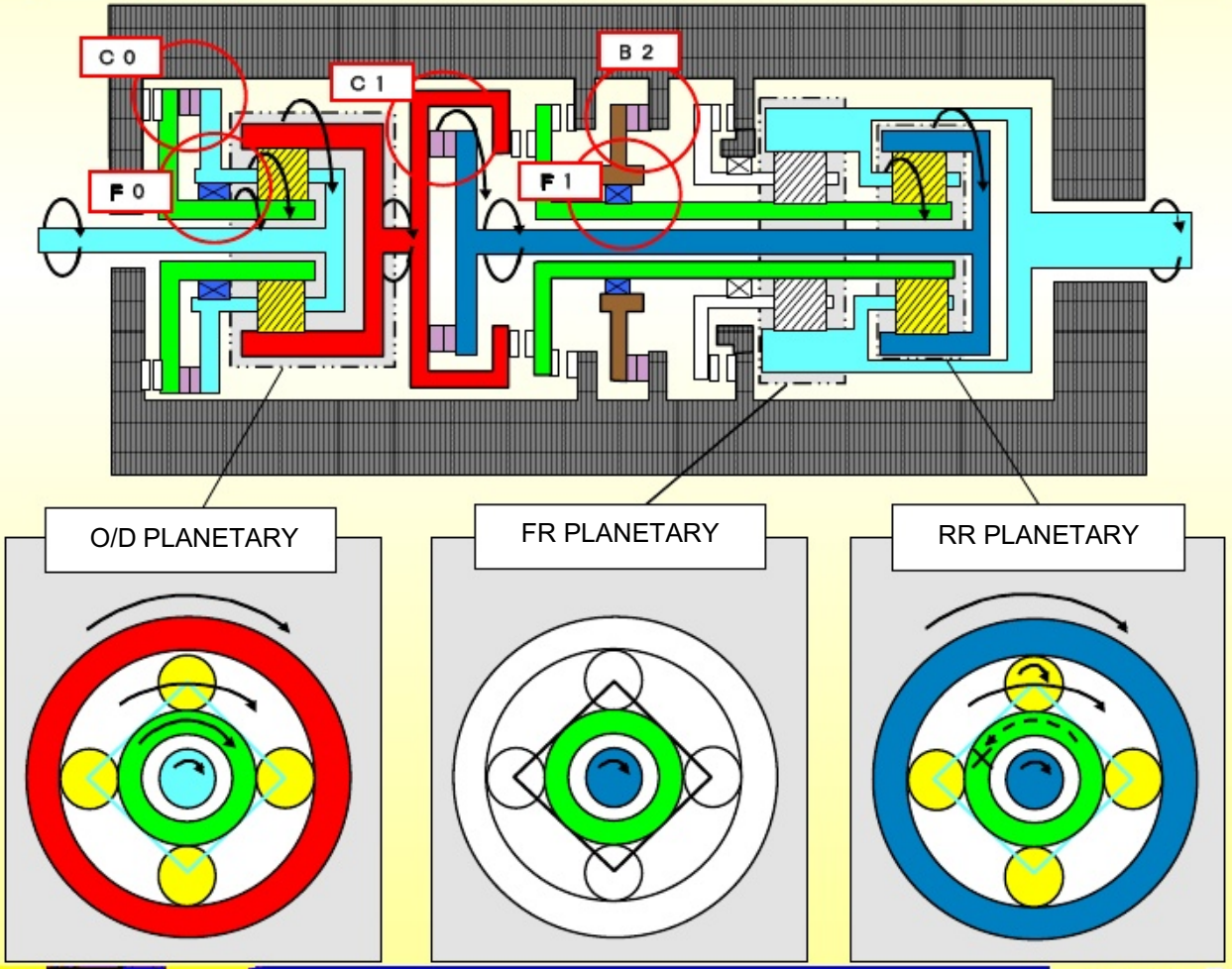


# MECHANICAL (03-II)



## "D" –2nd GEAR

| POSITION | | SOLENOID | | | CLUTCH | | | | BRAKE | | | | | O.W.C. | | | GEAR RATIO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | S1 | S2 | SL | C0 | C1 | C2 | | B0 | B1 | B2 | B3 | | F0 | F1 | F2 | |
| | | | | | | | I.P. | O.P. | | | | I.P. | O.P. | | | | |
| D | 2nd | ON | ON | OFF | ON | ON | OFF | OFF | OFF | OFF | ON | OFF | OFF | ON | ON=>OFF | OFF | 1.493 |

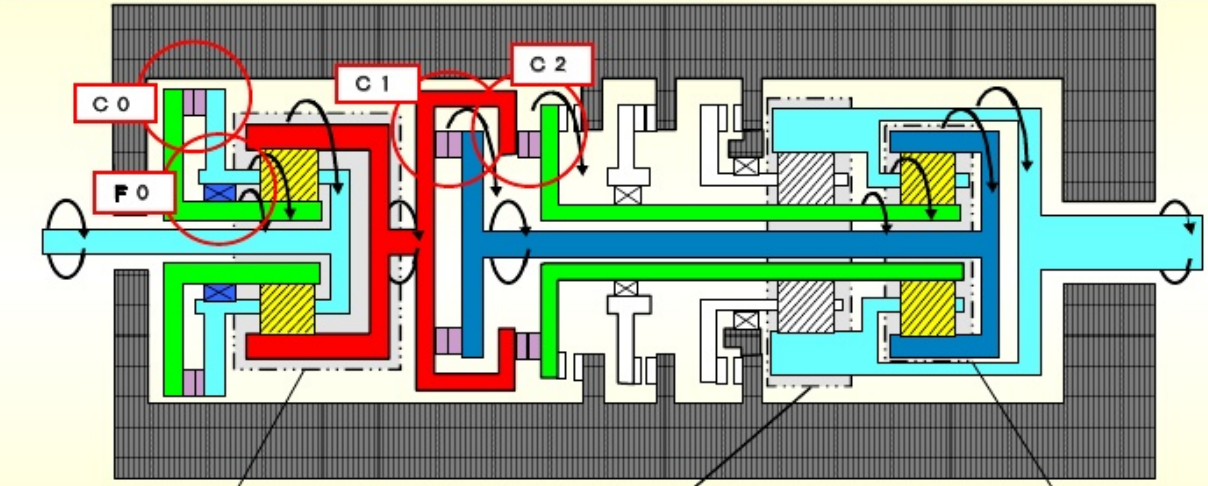


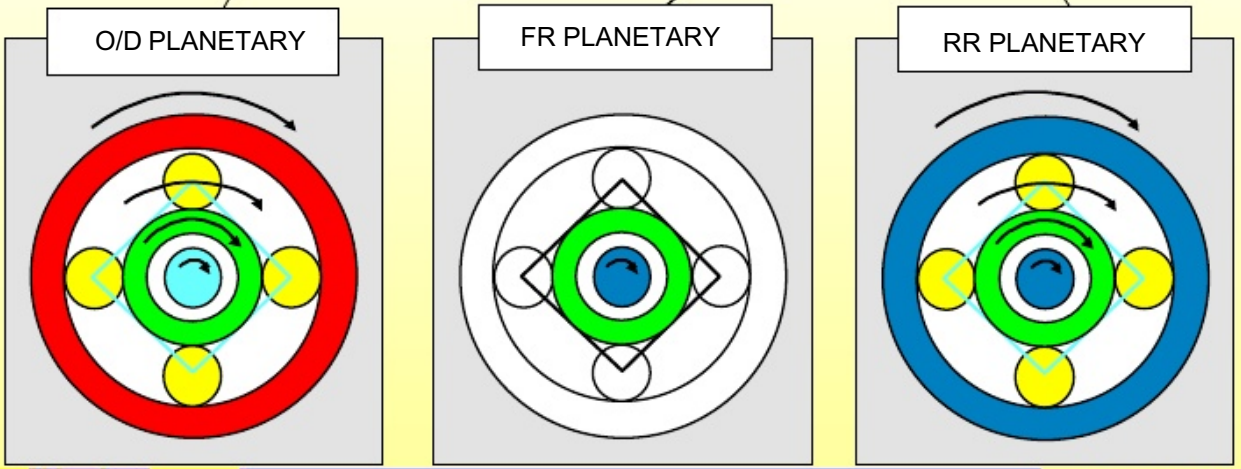
# MECHANICAL (03-II)



## "D" –3rd GEAR

| POSITION | | SOLENOID | | | CLUTCH | | | | BRAKE | | | | | O.W.C. | | | GEAR RATIO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | S1 | S2 | SL | C0 | C1 | C2 | | B0 | B1 | B2 | B3 | | F0 | F1 | F2 | |
| | | | | | | | I.P. | O.P. | | | | I.P. | O.P. | | | | |
| D | 3rd | OFF | ON | OFF | ON | ON | OFF | ON | OFF | OFF | ON | OFF | OFF | ON | OFF | OFF | 1.000 |







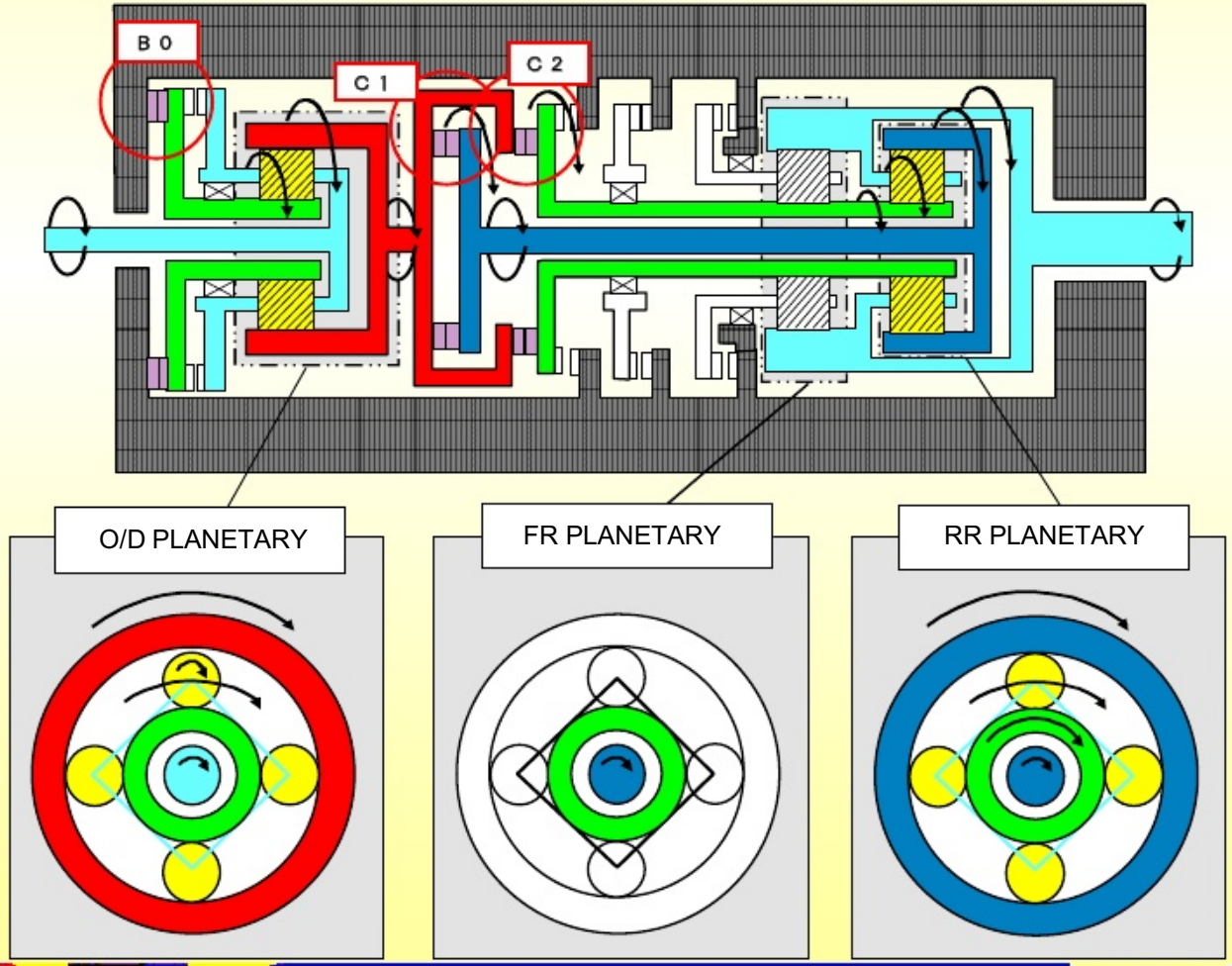

MECHANICAL (03-II)

# MECHANICAL (03-II)



## "D" –4th GEAR

| POSITION | | SOLENOID | | | CLUTCH | | | | BRAKE | | | | | O.W.C. | | | GEAR RATIO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | S1 | S2 | SL | C0 | C1 | C2 | | B0 | B1 | B2 | B3 | | F0 | F1 | F2 | |
| | | | | | | | I.P. | O.P. | | | | I.P. | O.P. | | | | |
| D | 4th | OFF | OFF | ON | OFF | ON | OFF | ON | ON | OFF | ON | OFF | OFF | OFF | OFF | OFF | 0.730 |



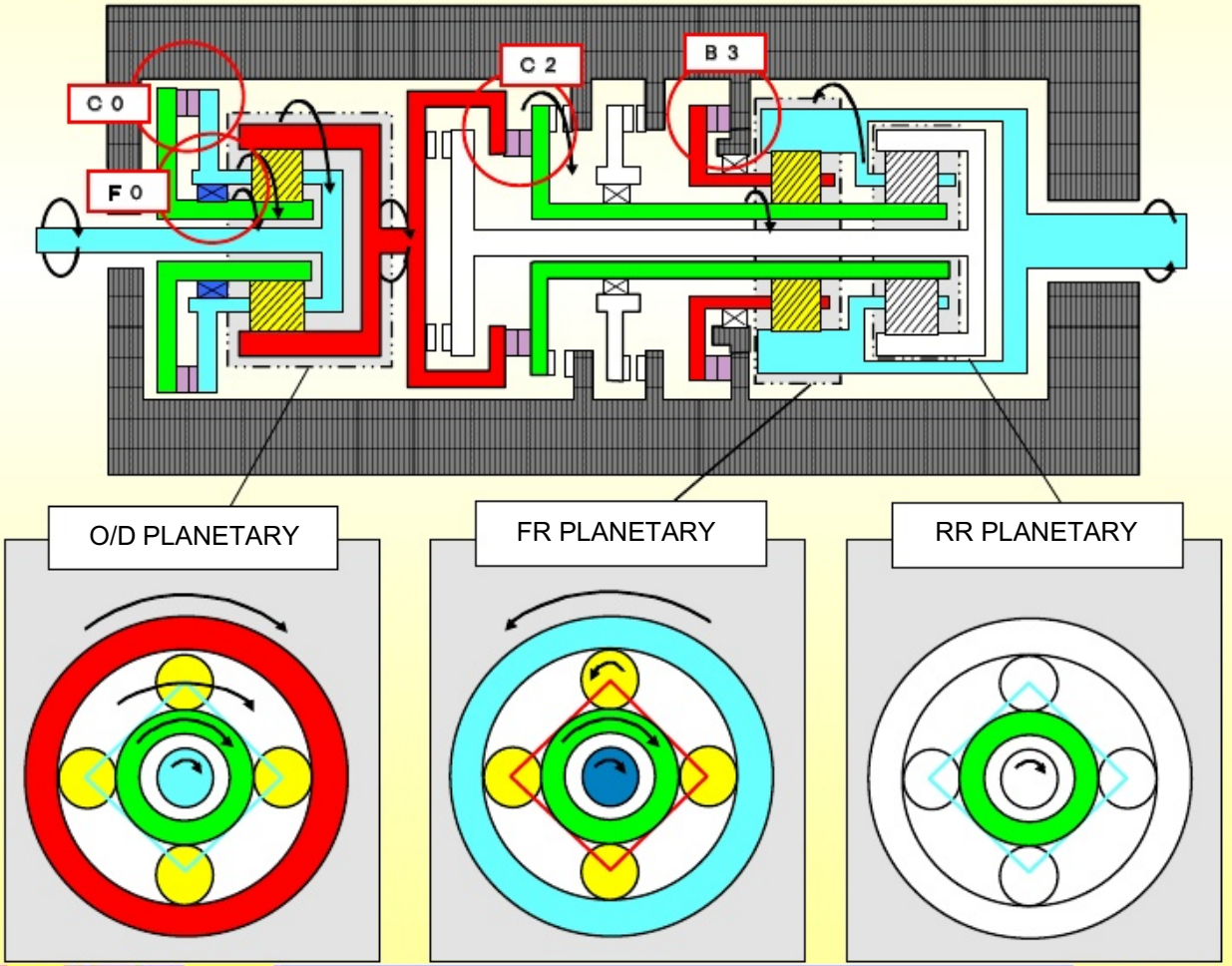





# MECHANICAL (03-II)

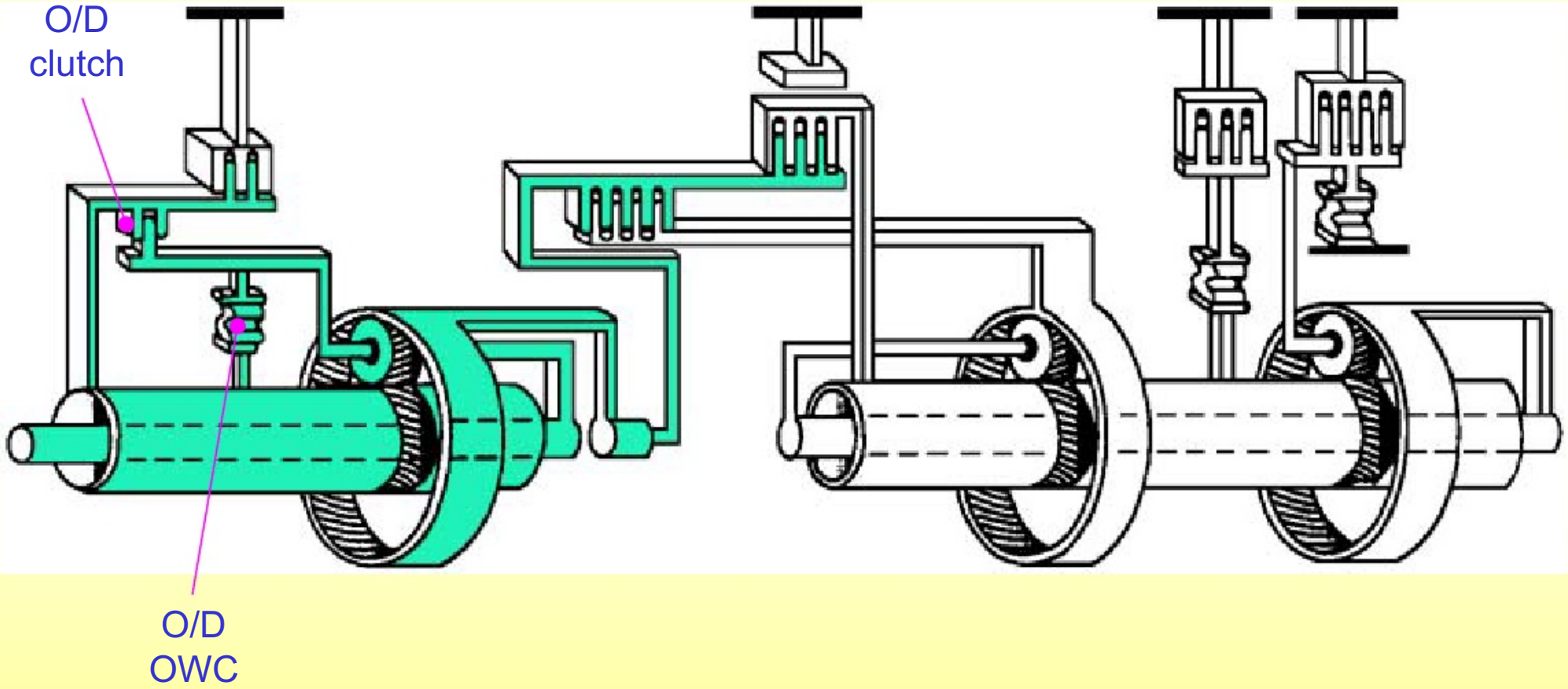
## "R" –Reverse

| POSITION | SOLENOID | | | CLUTCH | | | | BRAKE | | | | | O.W.C. | | | GEAR RATIO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S1 | S2 | SL | C0 | C1 | C2 | | B0 | B1 | B2 | B3 | | F0 | F1 | F2 | |
| | | | | | | I.P. | O.P. | | | | I.P. | O.P. | | | | |
| R | ON | OFF | OFF | ON | OFF | ON | ON | OFF | OFF | OFF | ON | ON | ON | OFF | OFF | 2.703 |



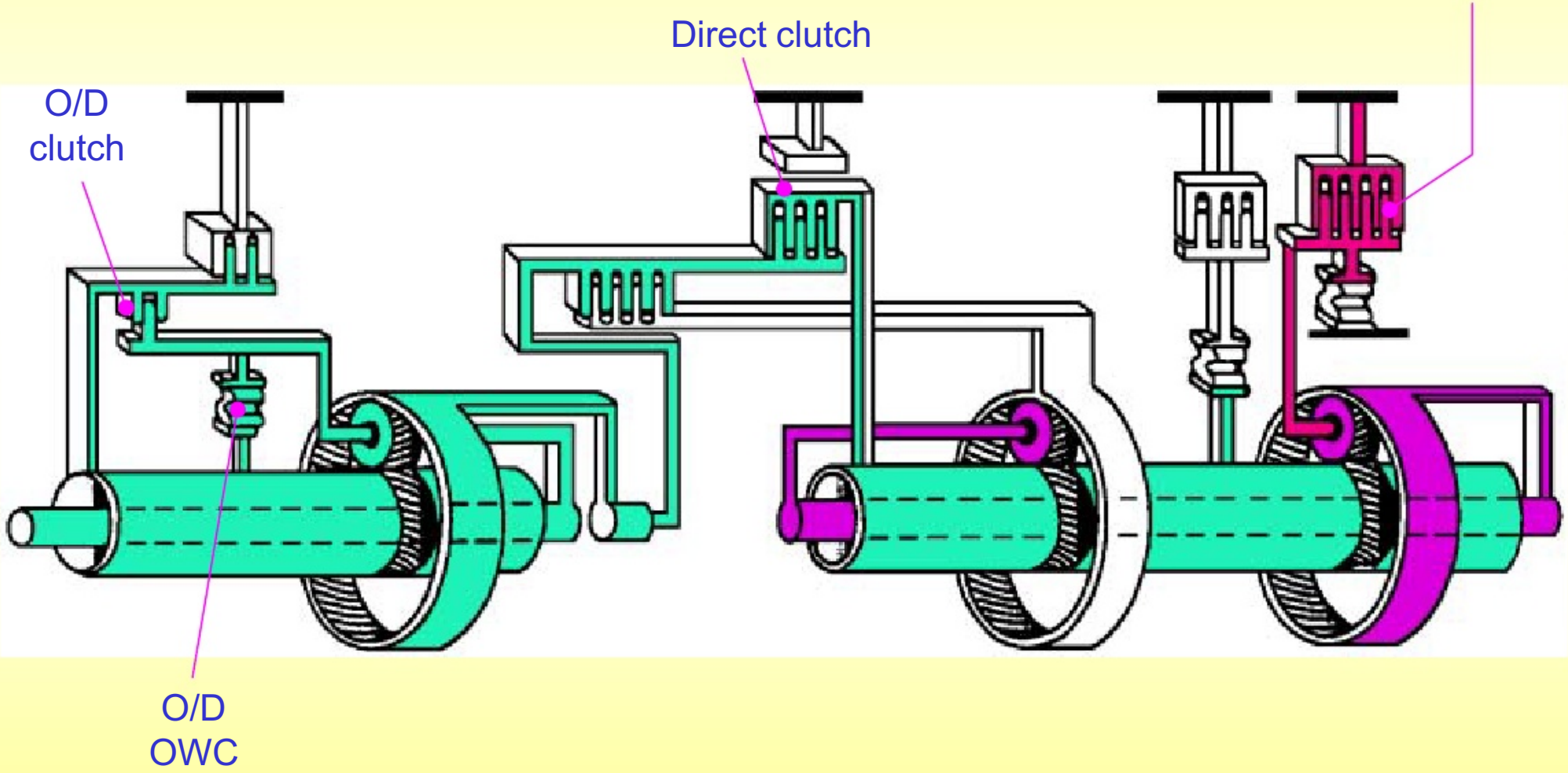
**'P, N' range**

- O/D clutch, O/D OWC are engaged.



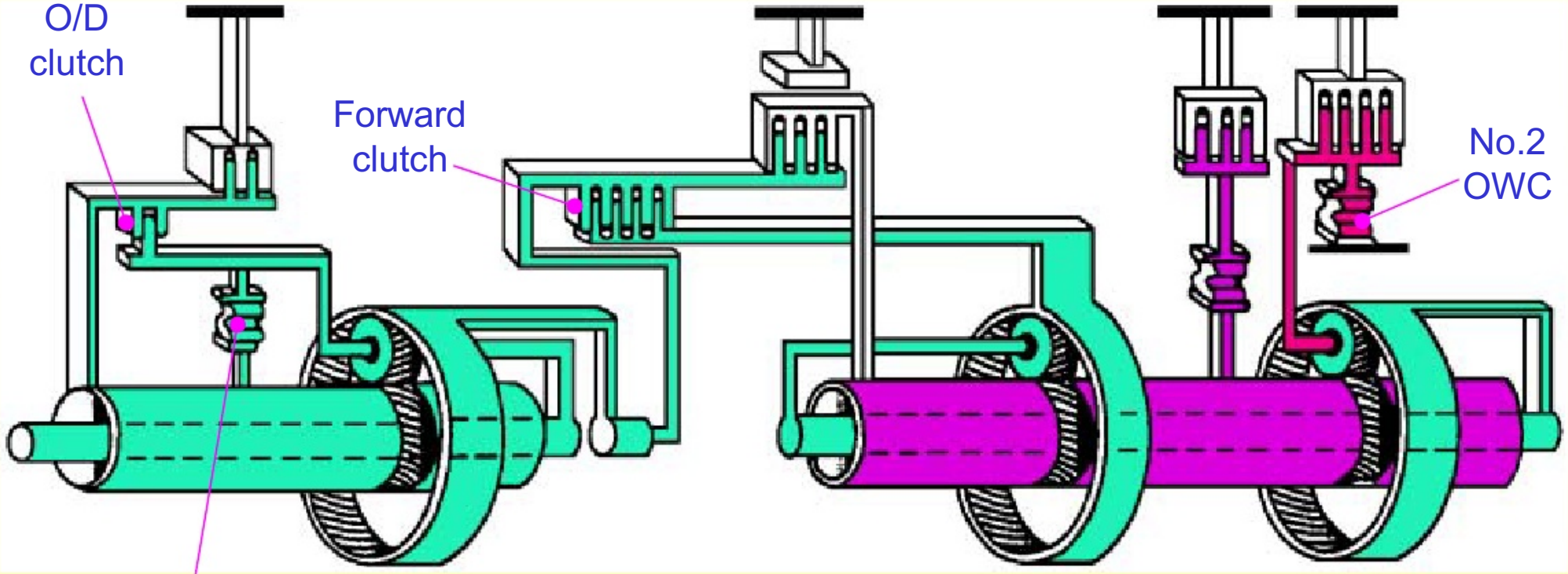
**'R' range**

- 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.

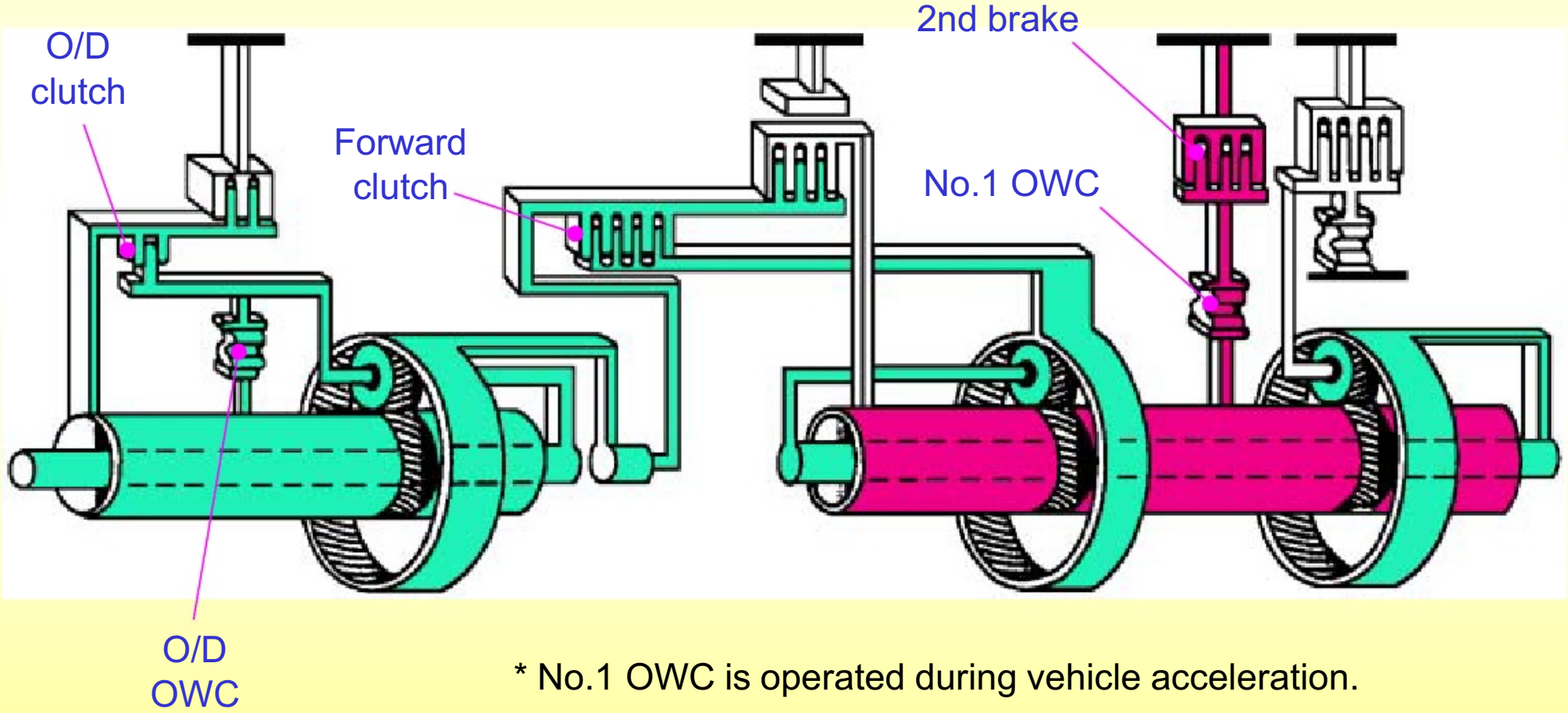



* No.2 OWC is operated during vehicle acceleration.

No.2 OWC is not operated during vehicle deceleration.

**‘D’ range 2nd gear**

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

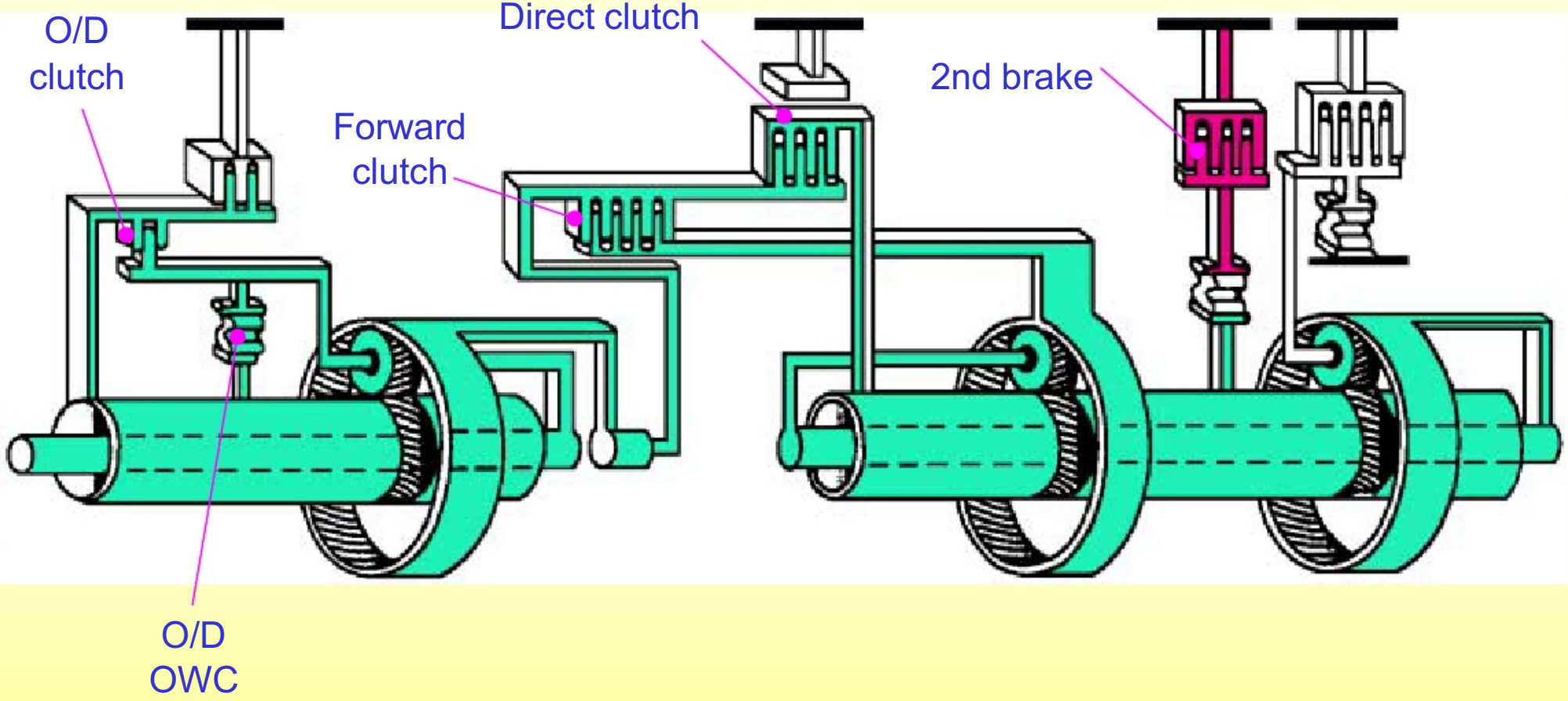



* No.1 OWC is operated during vehicle acceleration.

No.1 OWC is not operated during vehicle deceleration.

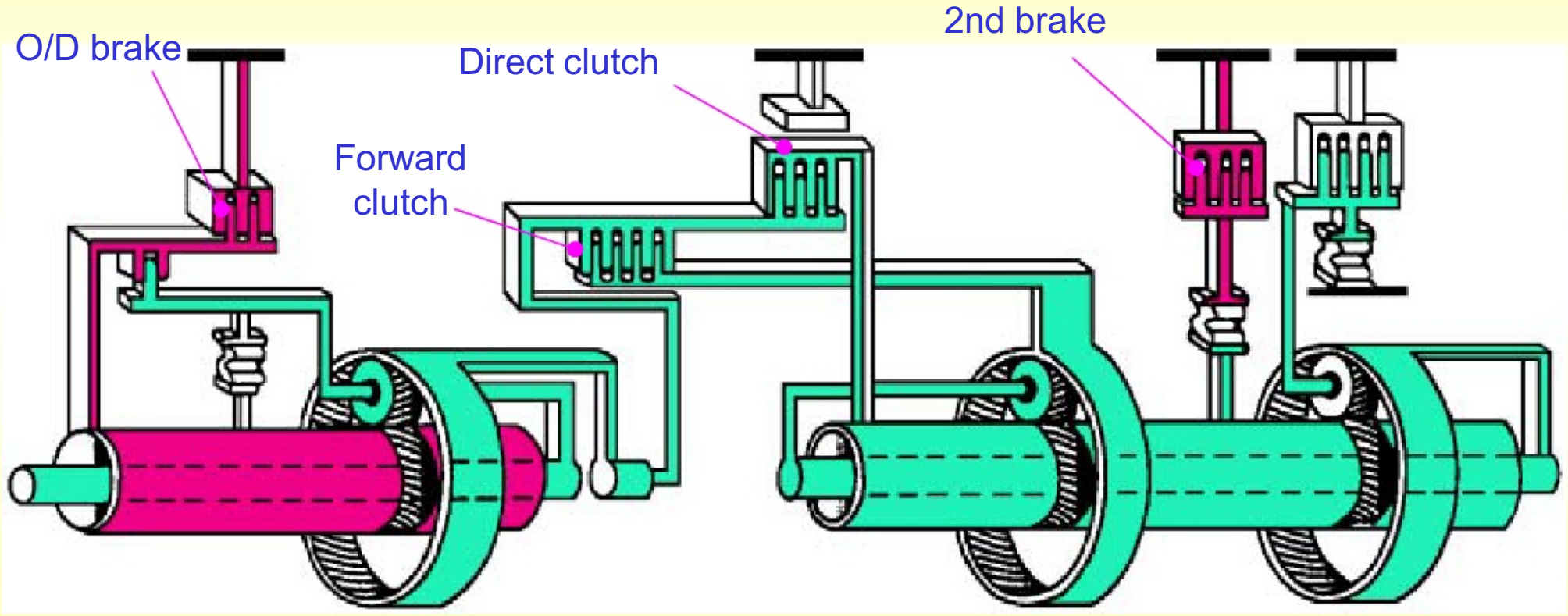
**‘D’ range 3rd gear**

- O/D clutch, O/D OWC, Forward clutch, Direct clutch, 2nd brake are engaged.



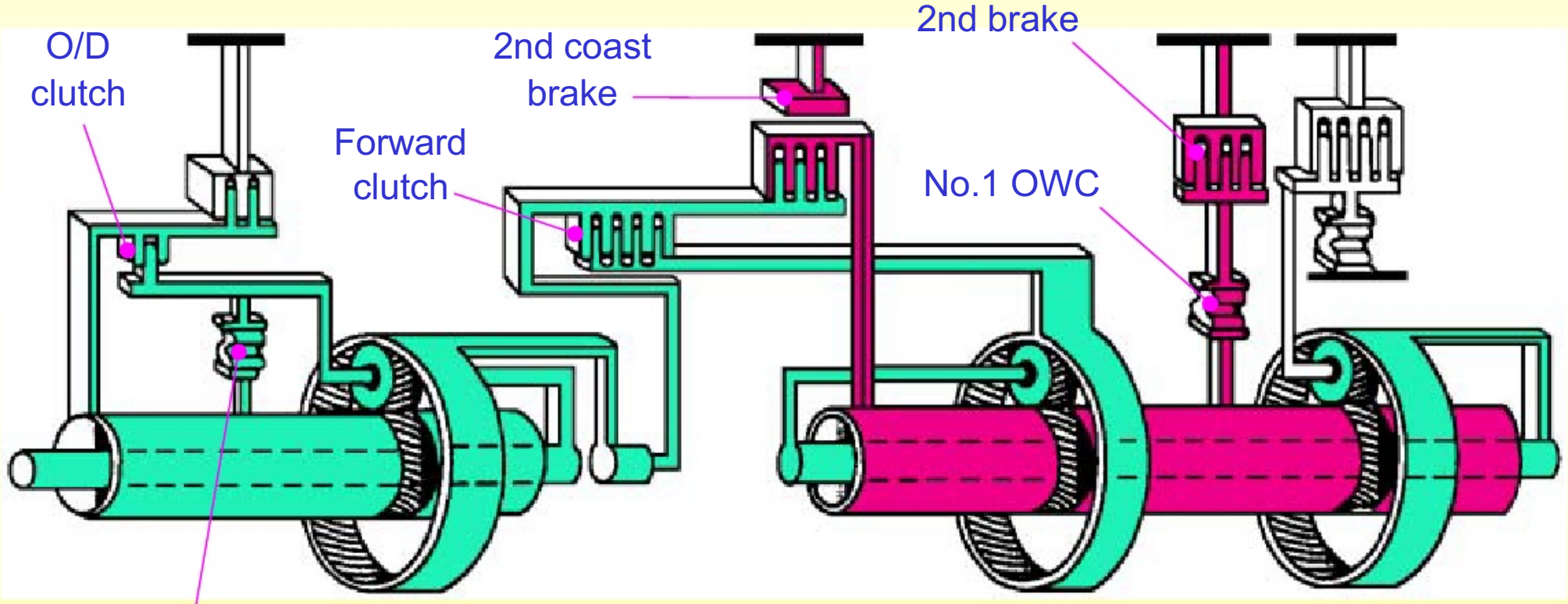
**'D' range 4th gear**

- 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 hold due to the 2nd coast brake regardless of vehicle acceleration or deceleration.

☞ **Engine brake is not available.**



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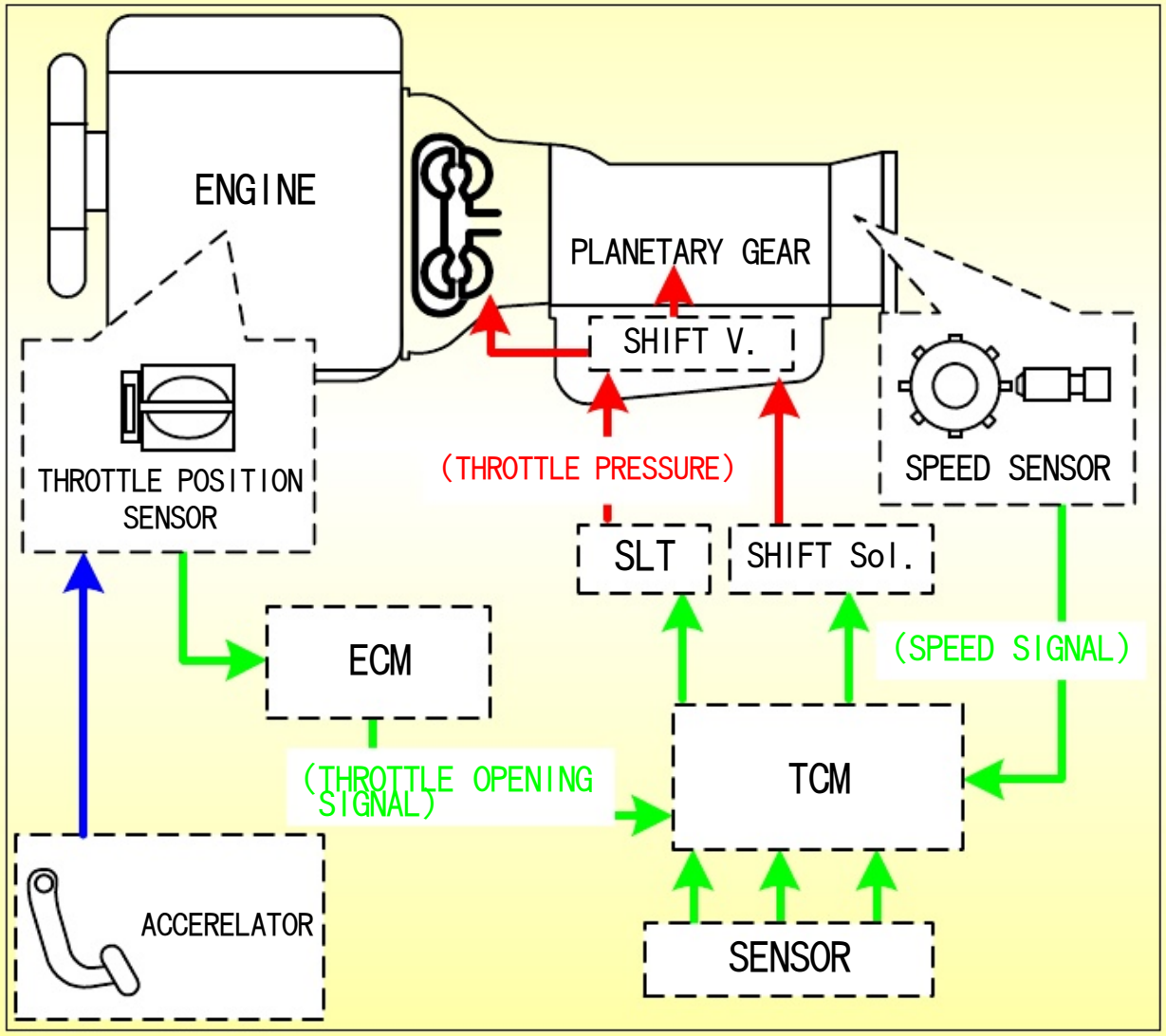
MECHANICAL (03-II)

## Line Pressure MPa (kgf/cm²)

| | IDLE | STALL |
|---|---|---|
| D | 0.32-0.38<br>(3.5-4.2) | 1.15-1.31<br>(12.7-14.5) |
| R | 0.47-0.56<br>(5.2-6.2) | 1.48-1.78<br>(16.3-19.6) |

Line pressure check port

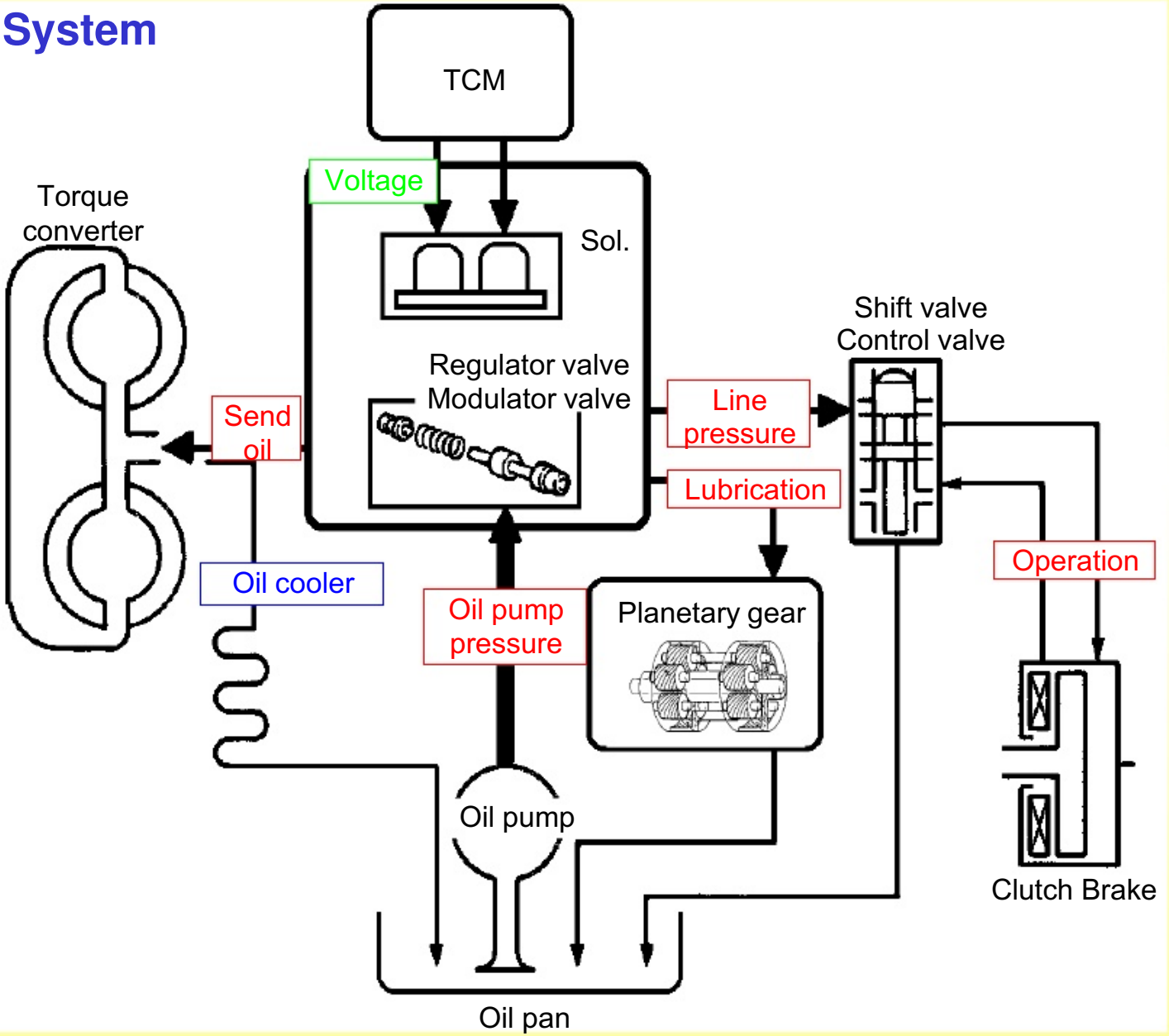
## Control diagram




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).

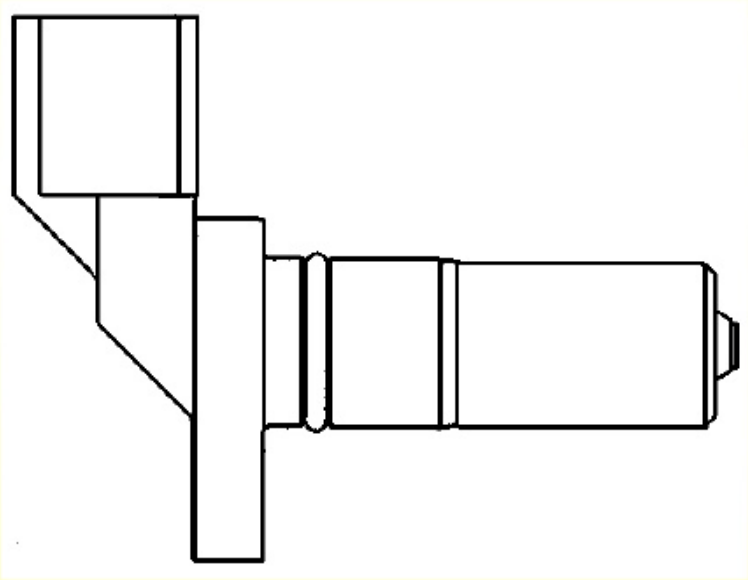
## System

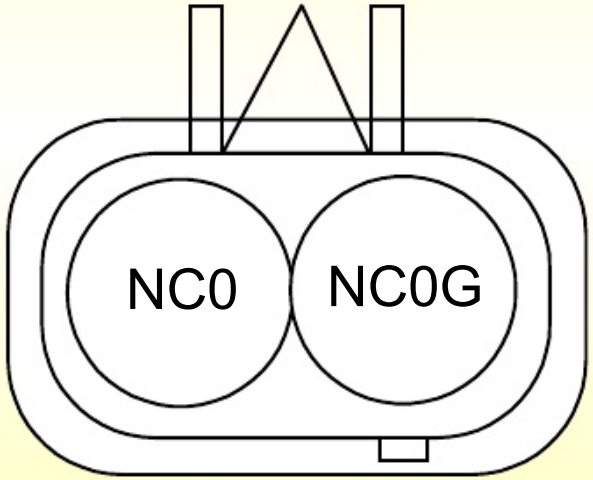



Based on the hydraulic pressure created by the oil pump, TCM sends signals to solenoid and hydraulic control system governs the hydraulic pressure acting on the torque converter, planetary gear, clutches and brakes in accordance with the vehicle driving conditions.

## 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.



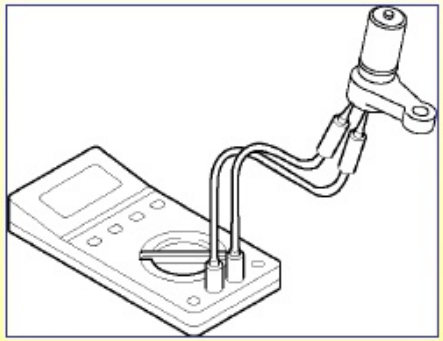


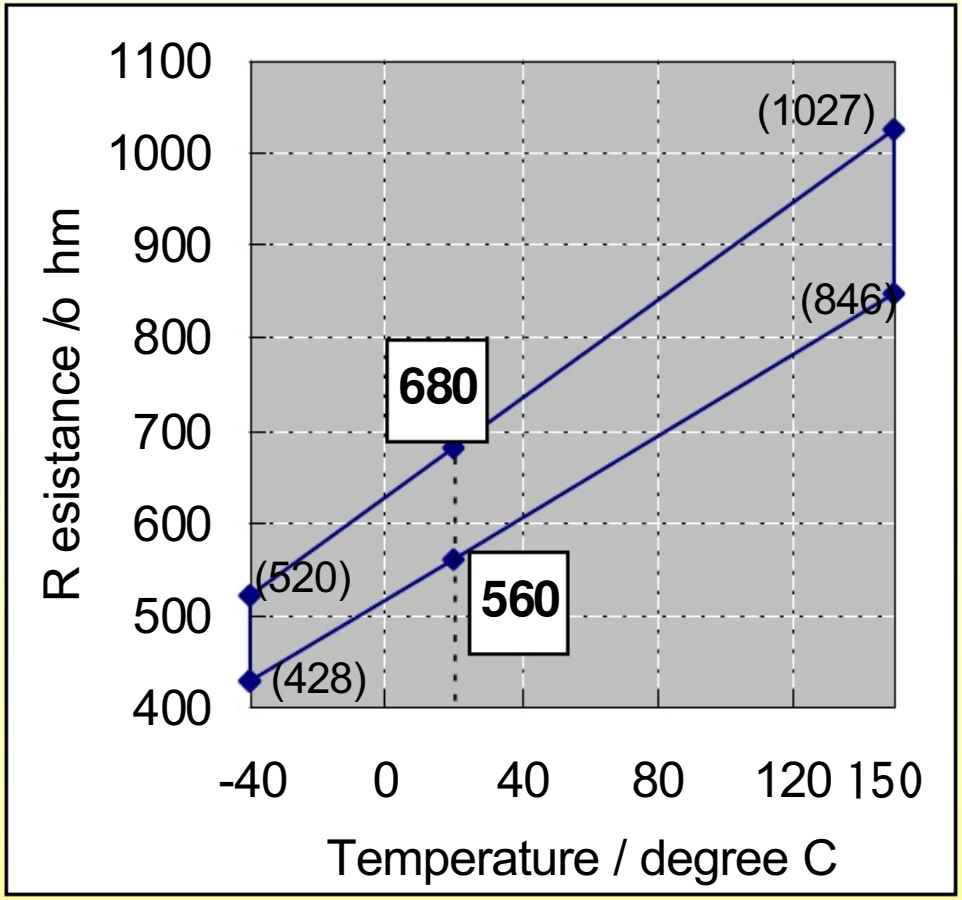
## Input speed sensor

(1) Make sure to inspect resistance again at 20 degree C when resistance differ from standards except 20 degree C.

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

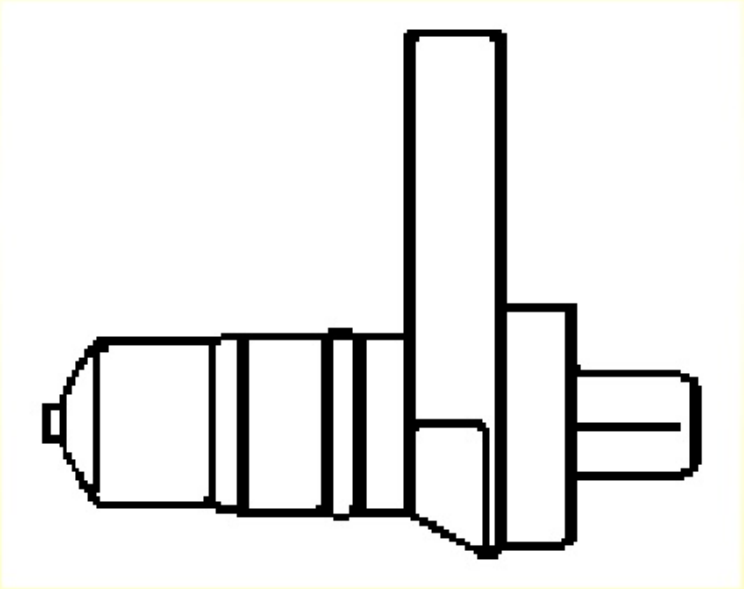
**560 – 680 ohm (20 degree C)**

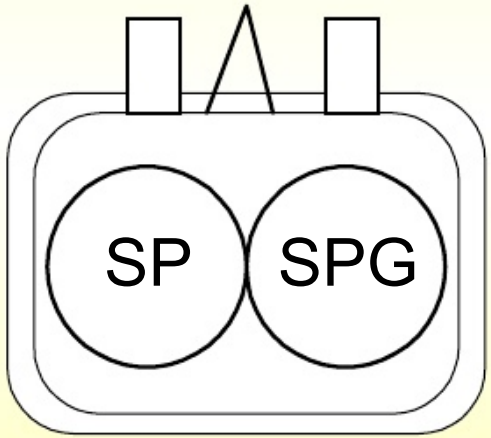




## Output speed sensor

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



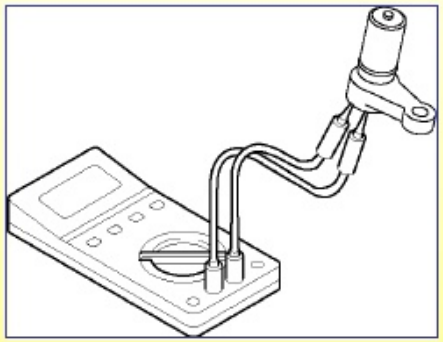


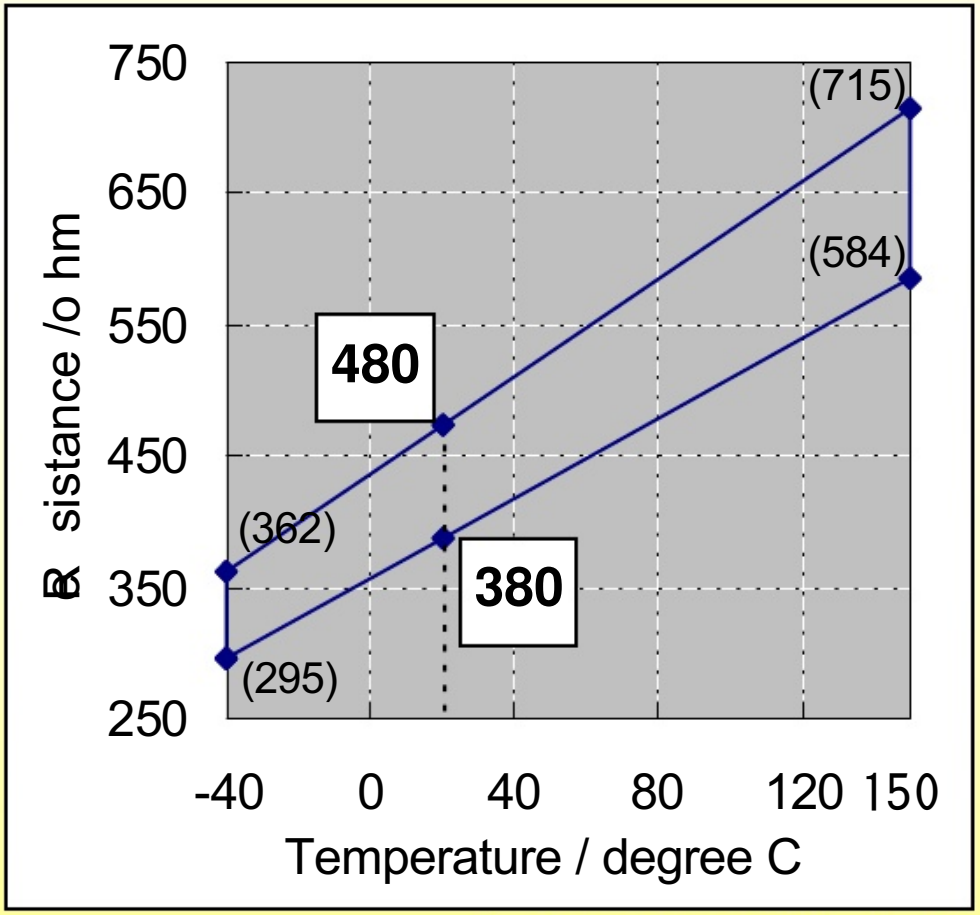
## Output speed sensor

(1) Make sure to inspect resistance again at 20 degree C when resistance differ from standards except 20 degree C.

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

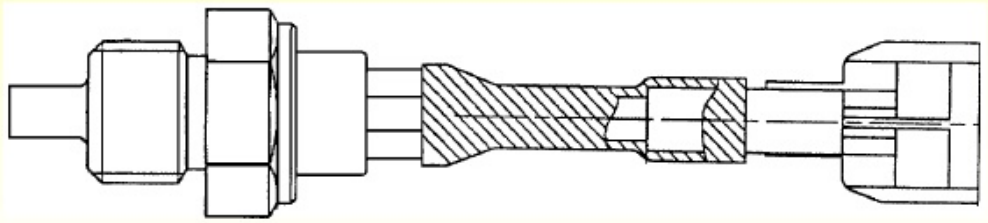
**380 – 480 ohm (20 degree C)**

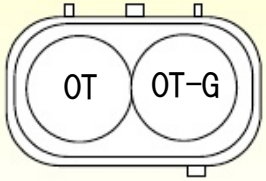


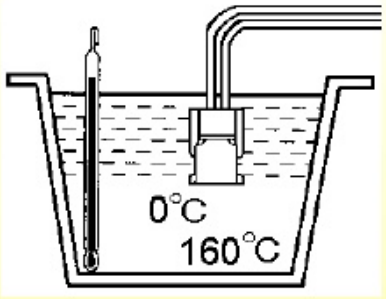


## Oil temperature sensor

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

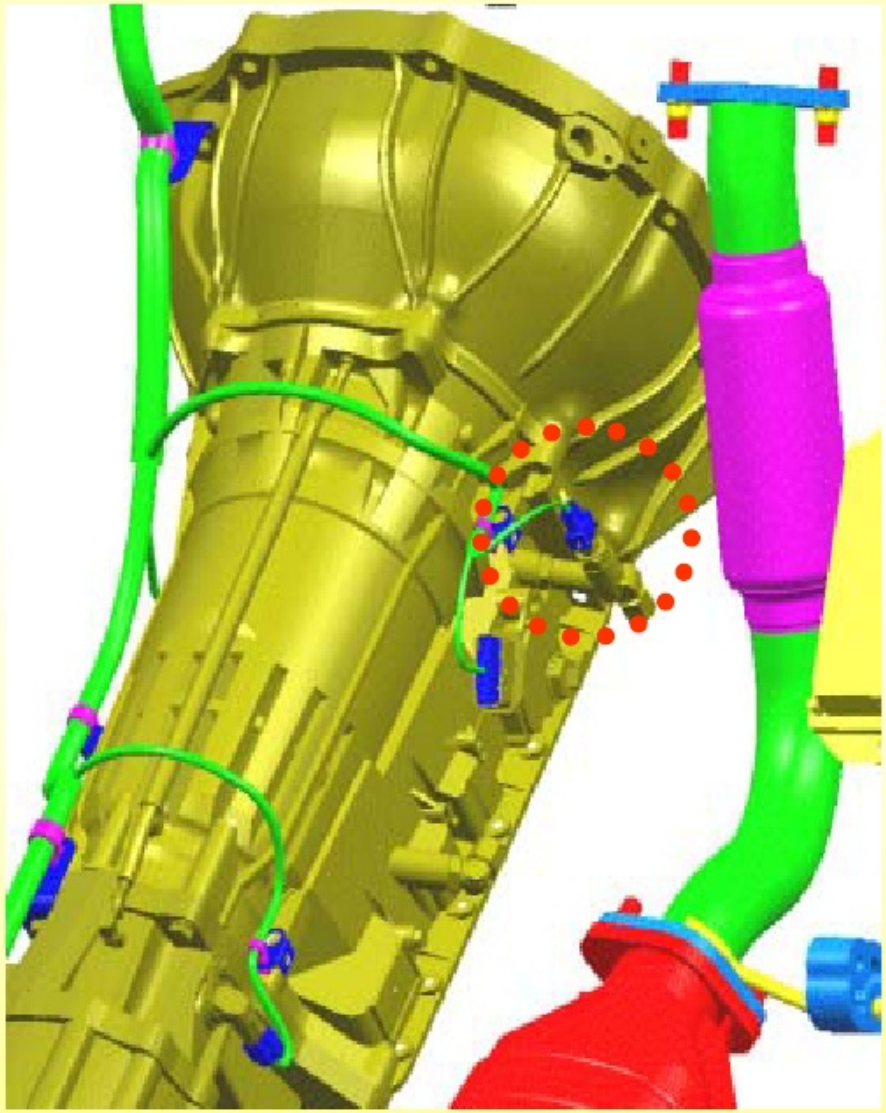




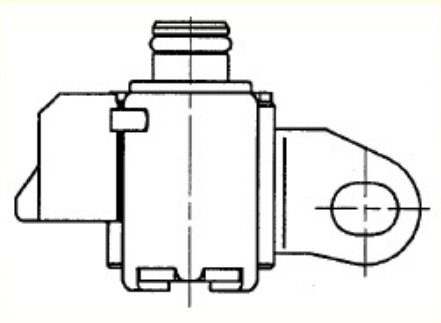

| | |
|---|---|
| 0 degree C | 1,884 - 2,290 ohm |
| 160 degree C | 19.2 - 22.2 k ohm |

## Oil temperature sensor



## Solenoid valves

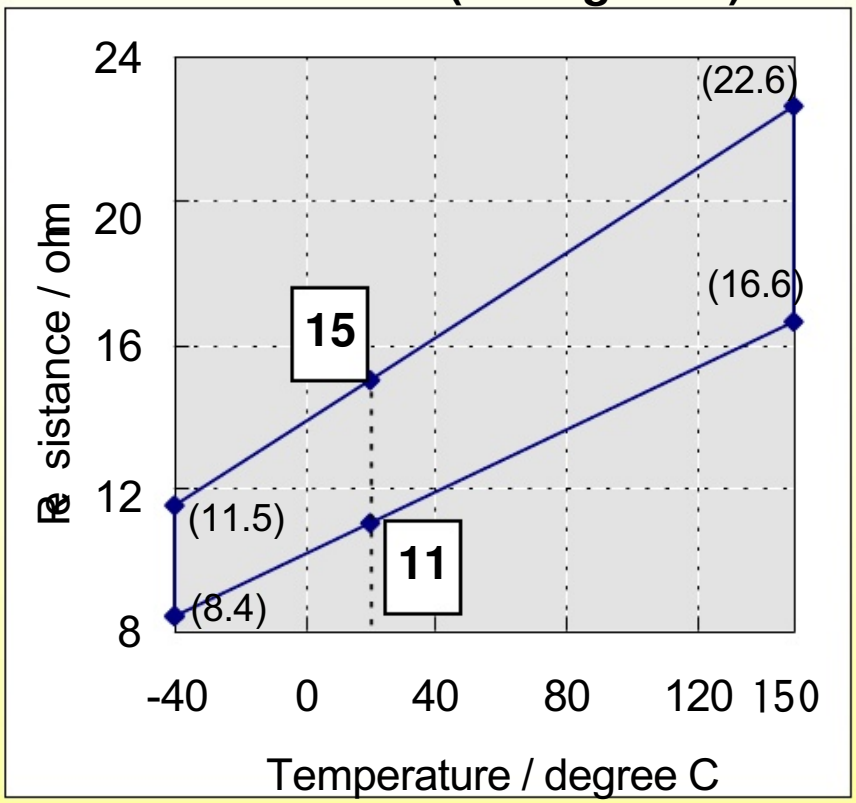
Shift Solenoid No.1/2 is each, and it is installed VALVE BODY of A/T directly. And Shift Solen oid No.1/2 does the operation of ON / OFF by the control signal from TCM, and changes a po sition of shift valve by a combination with Shift Solenoid No.1/2, and changes gear.



Normal close type

Shift solenoid
No.1 No.2
(S1, S2)

L-up Solenoid



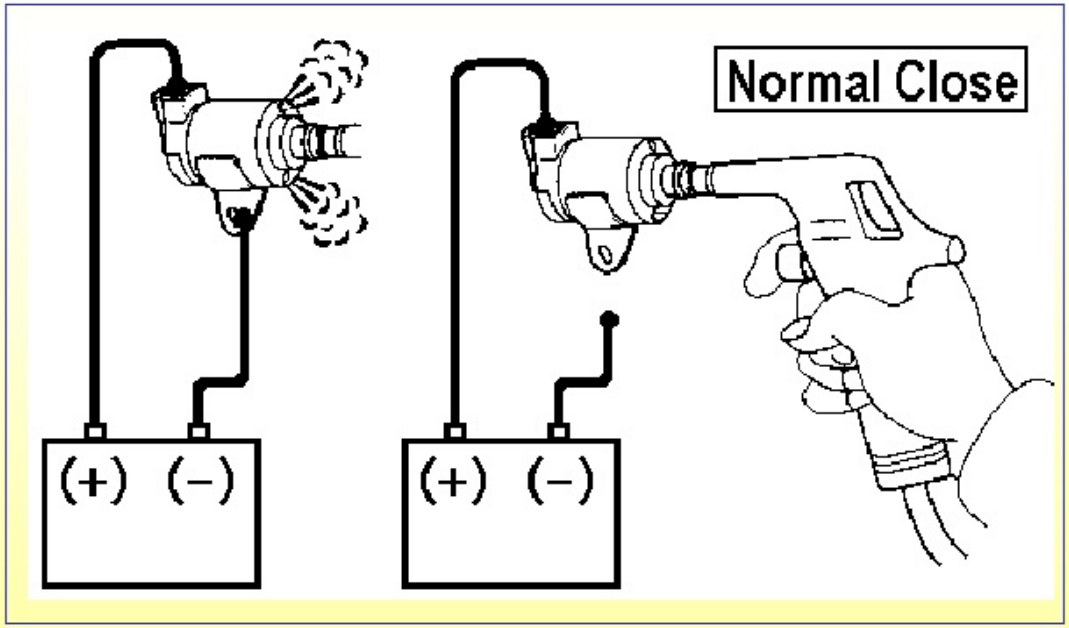
## Solenoid valves

(1) Make sure to inspect resistance again at 20 degree C when resistance differ from standards except 20 degree C.

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

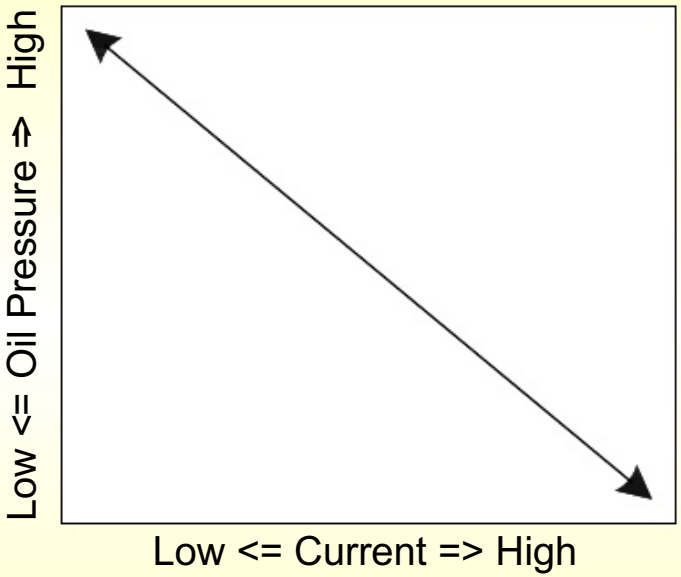
**Normal open type:**

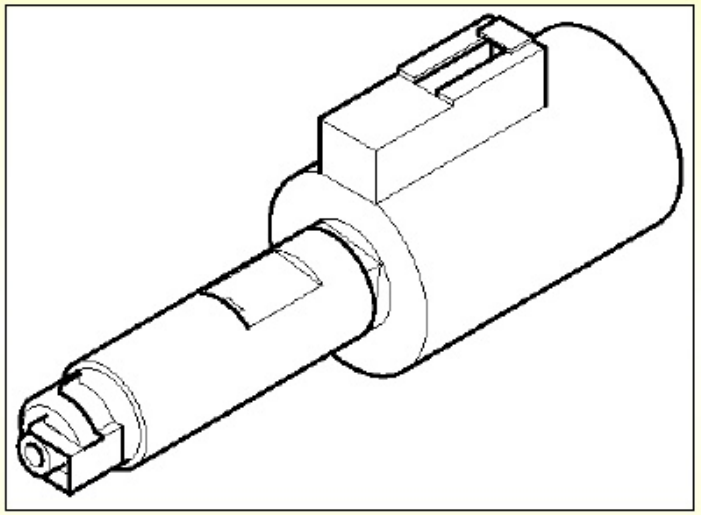
| | |
|---|---|
| No connect battery | No leak air |
| Connect battery | Leak air |

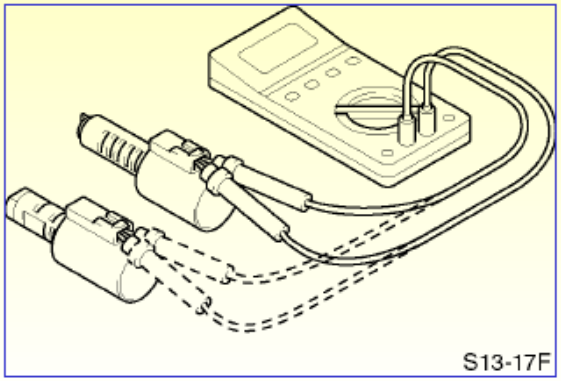


## Line pressure control solenoid valve

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

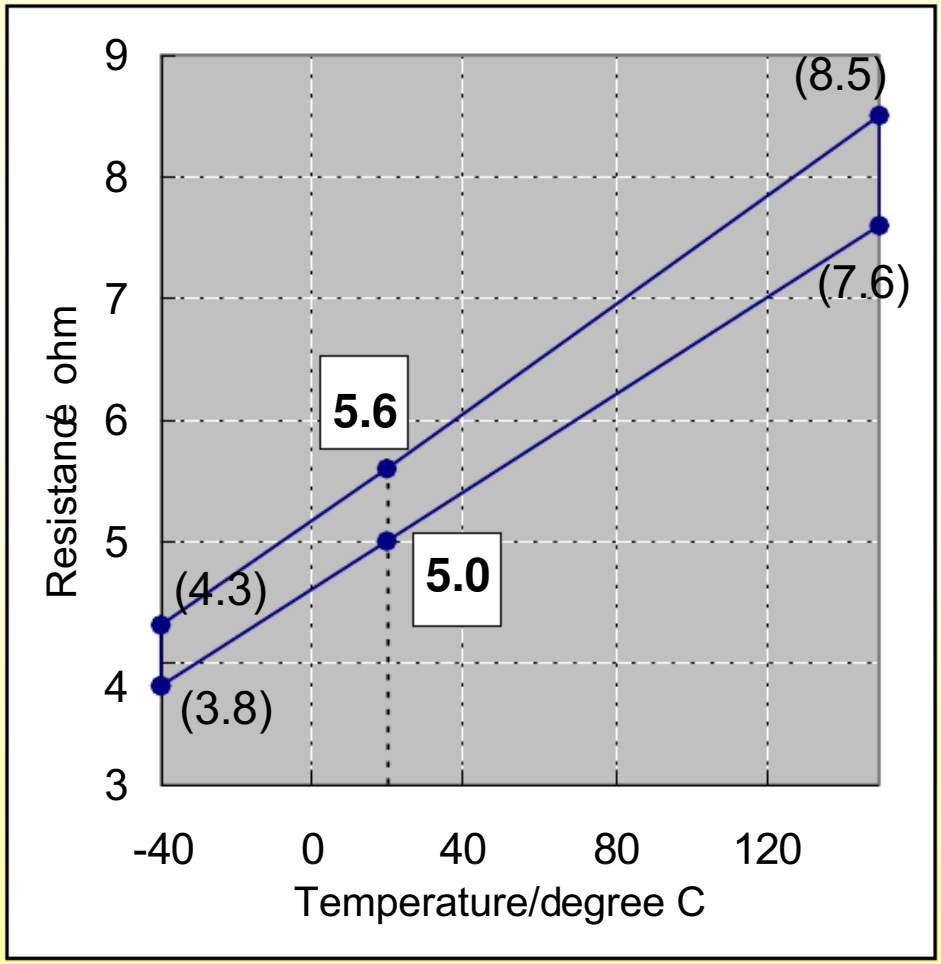




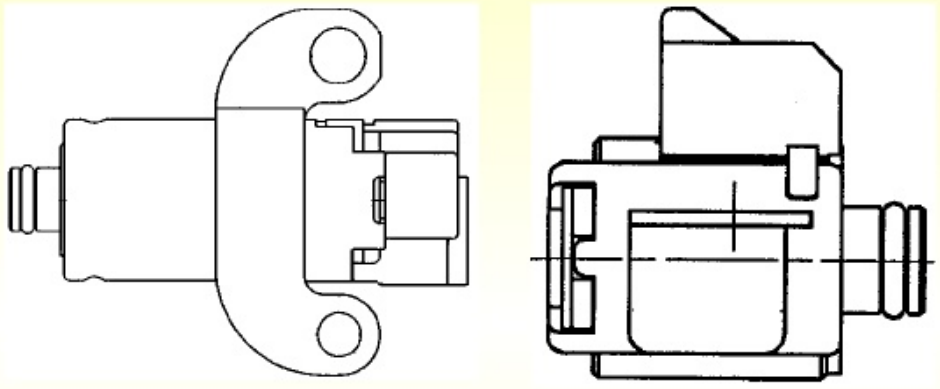

(1) Make sure to inspect resistance again at 20 degree C when resistance differ from standards except 20 degree C.

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



## Lock-up solenoid valve

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



Normal open type

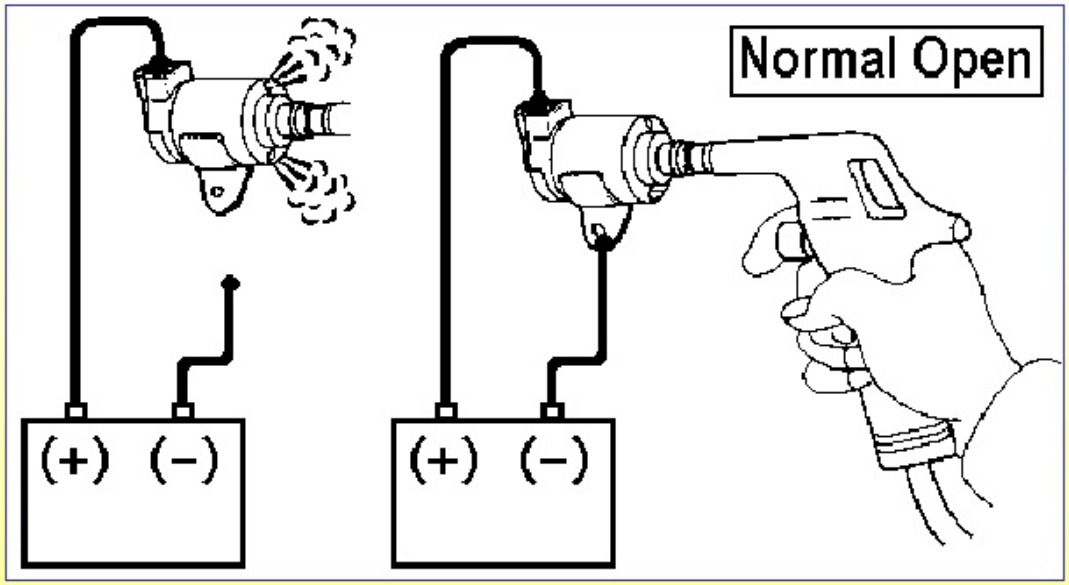
According to each L-up shift schedule, TCM sends signals to the Lock-up solenoid valve which operates ON/OFF control “L-up control” on the basis of the vehicle speed and the throttle ope ning.

(1) Make sure to inspect resistance again at 20 degree C when resistance differ from standards except 20 degree C.

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

**Normal open type:**

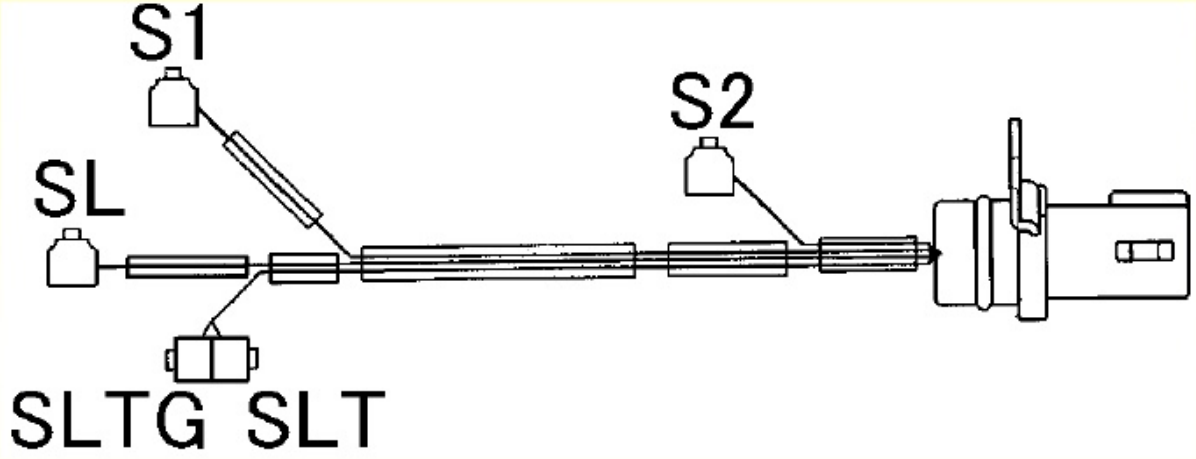
| | |
|---|---|
| No connect battery | Leak air |
| Connect battery | No leak air |

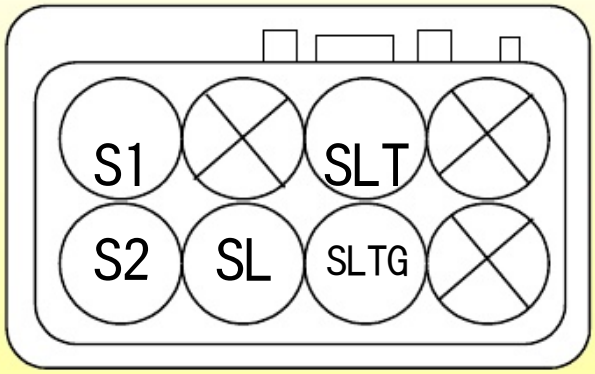


## Wire to solenoid valves



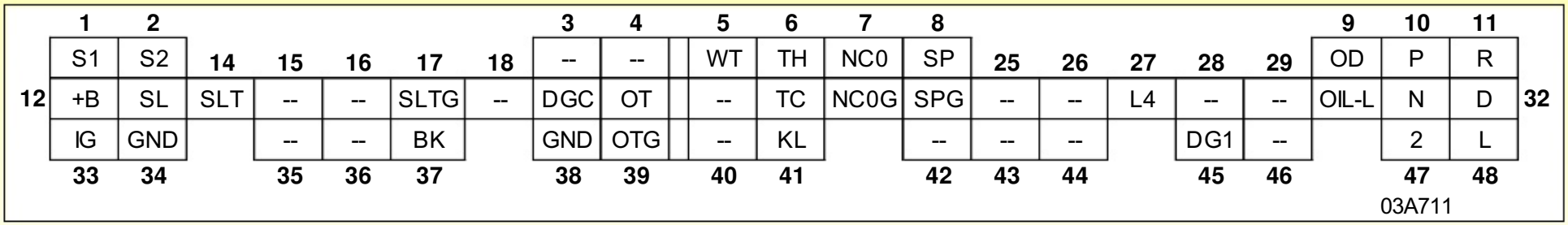
Wire To Solenoid puts wiring of Shift Solenoid No.1, No.2, L-up Solenoid and SLT together in one connector, and it is installed to A/T case.



## TCM terminals





| | 1 | 2 | | | | | | 3 | 4 | | 5 | 6 | 7 | 8 | | | | | | 9 | 10 | 11 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S1 | S2 | 14 | 15 | 16 | 17 | 18 | -- | -- | | WT | TH | NC0 | SP | 25 | 26 | 27 | 28 | 29 | OD | P | R | |
| 12 | +B | SL | SLT | -- | -- | SLTG | -- | DGC | OT | | -- | TC | NC0G | SPG | -- | -- | L4 | -- | -- | OIL-L | N | D | 32 |
| | IG | GND | | -- | -- | BK | | GND | OTG | | -- | KL | | -- | -- | -- | | DG1 | -- | | 2 | L | |
| | 33 | 34 | | 35 | 36 | 37 | | 38 | 39 | | 40 | 41 | | 42 | 43 | 44 | | 45 | 46 | | 47 | 48 | |

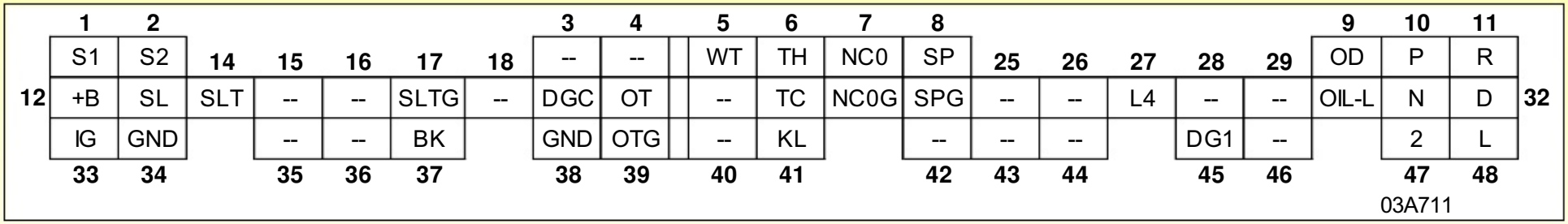
03A711

**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

# TCM terminals





| | 1 | 2 | | | | | | 3 | 4 | | 5 | 6 | 7 | 8 | | | | | | 9 | 10 | 11 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S1 | S2 | 14 | 15 | 16 | 17 | 18 | -- | -- | | WT | TH | NC0 | SP | 25 | 26 | 27 | 28 | 29 | OD | P | R | |
| 12 | +B | SL | SLT | -- | -- | SLTG | -- | DGC | OT | | -- | TC | NC0G | SPG | -- | -- | L4 | -- | -- | OIL-L | N | D | 32 |
| | IG | GND | | -- | -- | BK | | GND | OTG | | -- | KL | | -- | -- | -- | | DG1 | -- | | 2 | L | |
| | 33 | 34 | | 35 | 36 | 37 | | 38 | 39 | | 40 | 41 | | 42 | 43 | 44 | | 45 | 46 | | 47 | 48 | |

03A711

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”

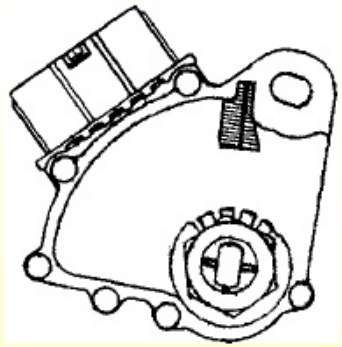
## Inhibitor switch (Transaxle range switch)

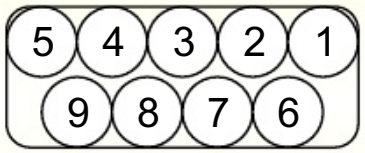


TR switch transmits the information which range includes shift lever of A/T to TCM by combi nation of a position circuit terminal.

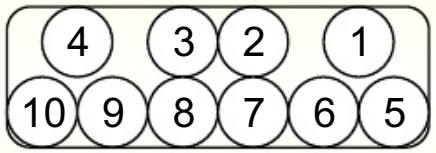
1) It is possible for TR switch to start an engine in only “P” and “N”.
(Prevention of reckless driving)

2) It is used for TR switch to shift control.

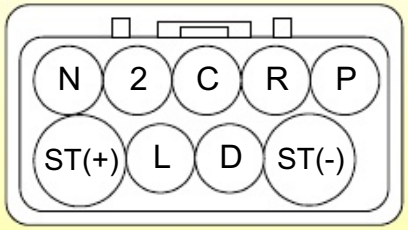





For 4D56 TCi

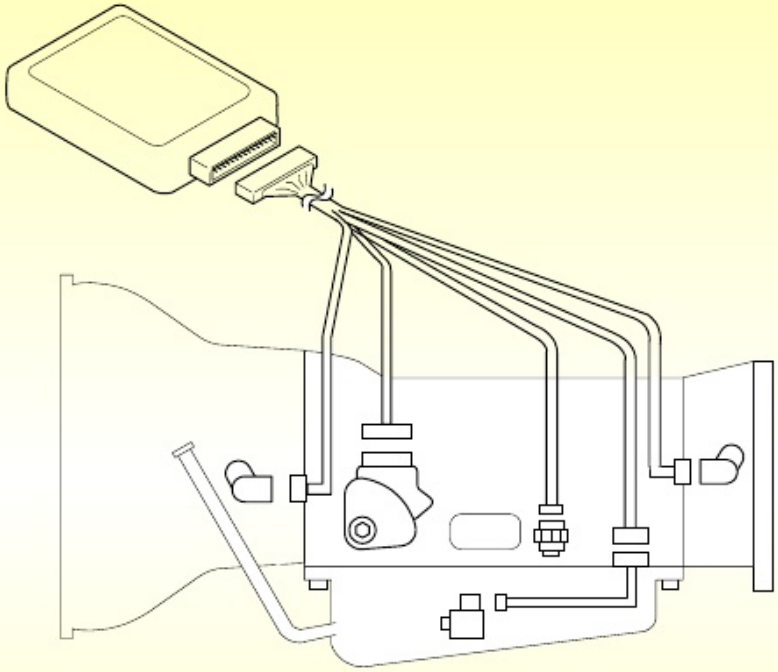



For 2.9 Tci / 3.5V6

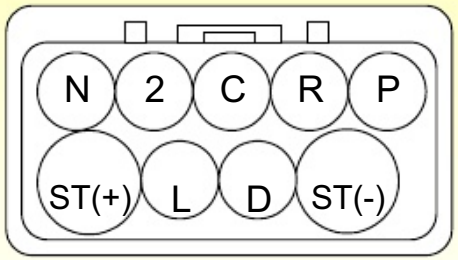


## Connector of vehicle harness (TCM)

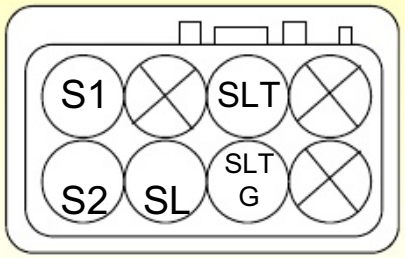




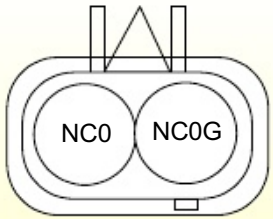
TR switch




Solenoid

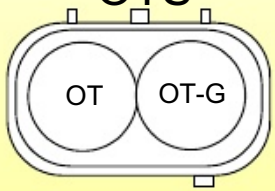


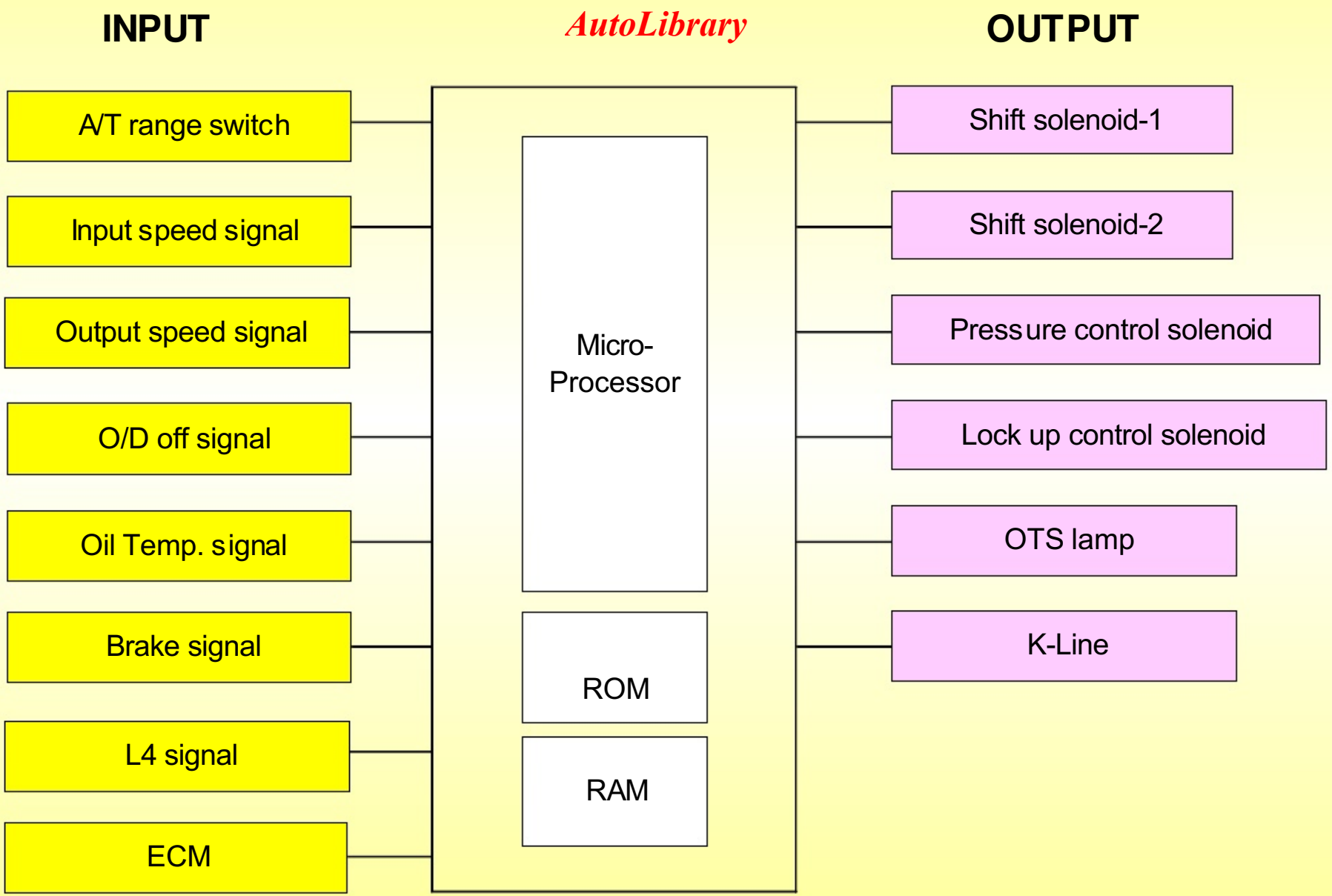

Input speed




Output speed


OTS







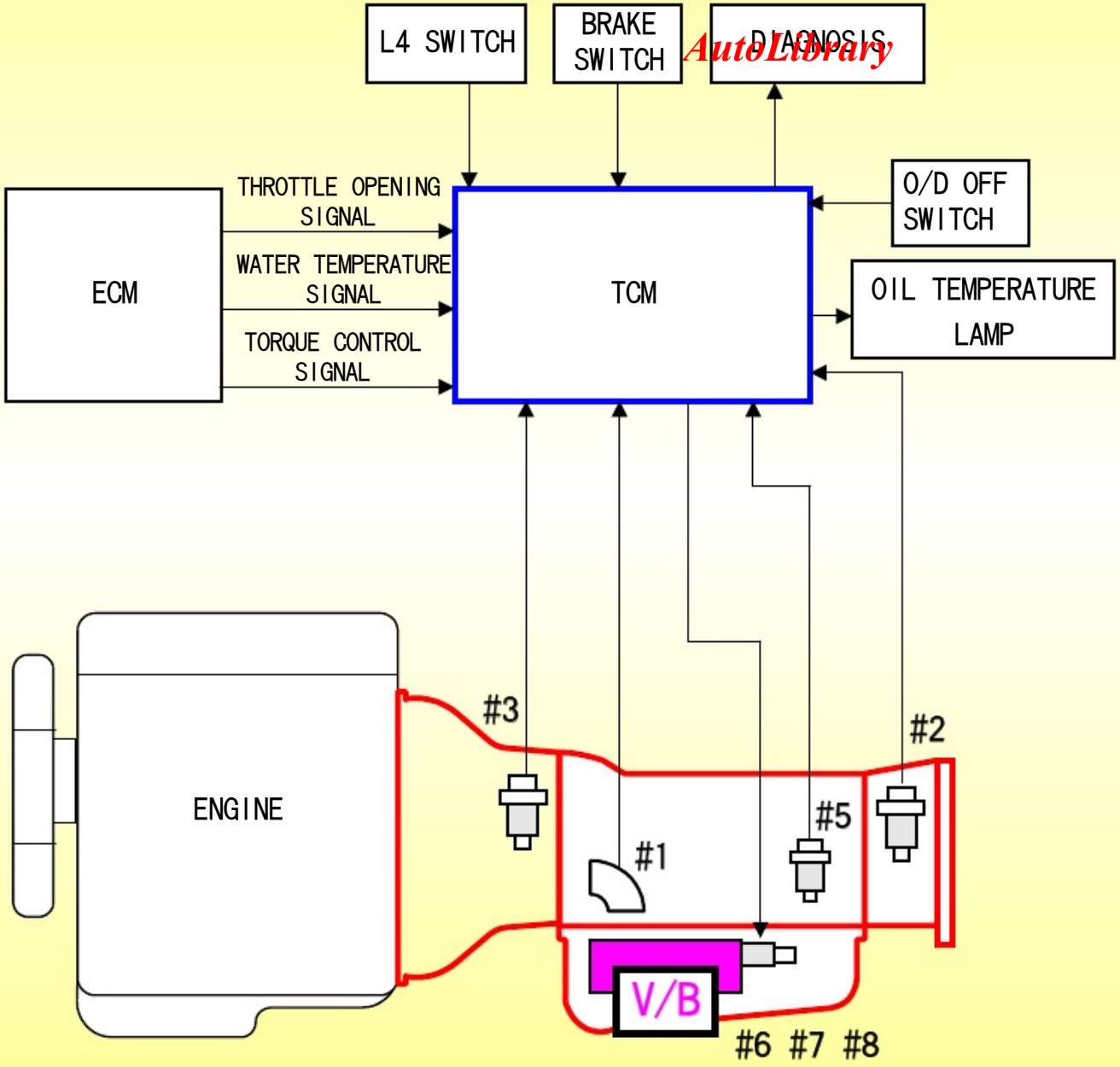

# ELECTRONIC CONTROL

## Shift control schedule



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

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




**#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)**

## 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.

## 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

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

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

## High ATF temperature control



When ATF temperature abnormally rises **(more than 140 degree C)**, TCM changes shift pat tern 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**.

| | | | |
|---|---|---|---|
| ATF temperature > 140 ℃ | → | Mode 1 | → High ATF temperature shift pattern |
| ATF temperature > 147 ℃ | → | Mode 2 | → ‘A/T’ lamp on |
| ATF temperature < 127 ℃ | → | ‘A/T’ lamp off | |

## Torque reduction control and line pressure control



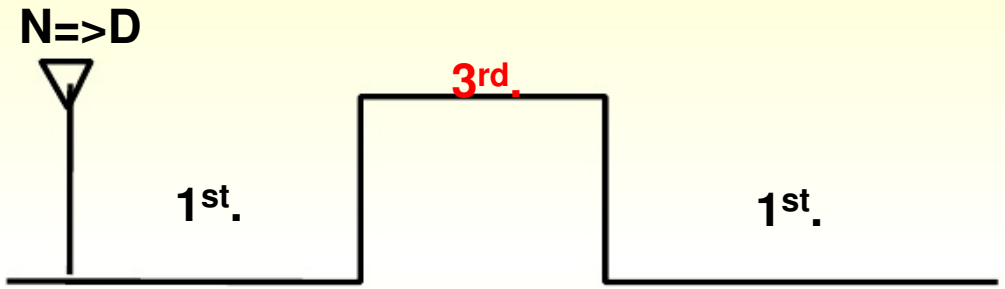
Torque reduction control improves the shift quality due to sending torque reduction request signal from TCM to ECM and reducing engine torque increase of shift at N-D, N-R shift and 1 <=> 2 <=> 3 <=> 4.

Line pressure control improves the shift quality due to controllable line pressure at N-D, N-R shift, and 1 <=> 2 <=> 3 <=> 4.

## Squat control



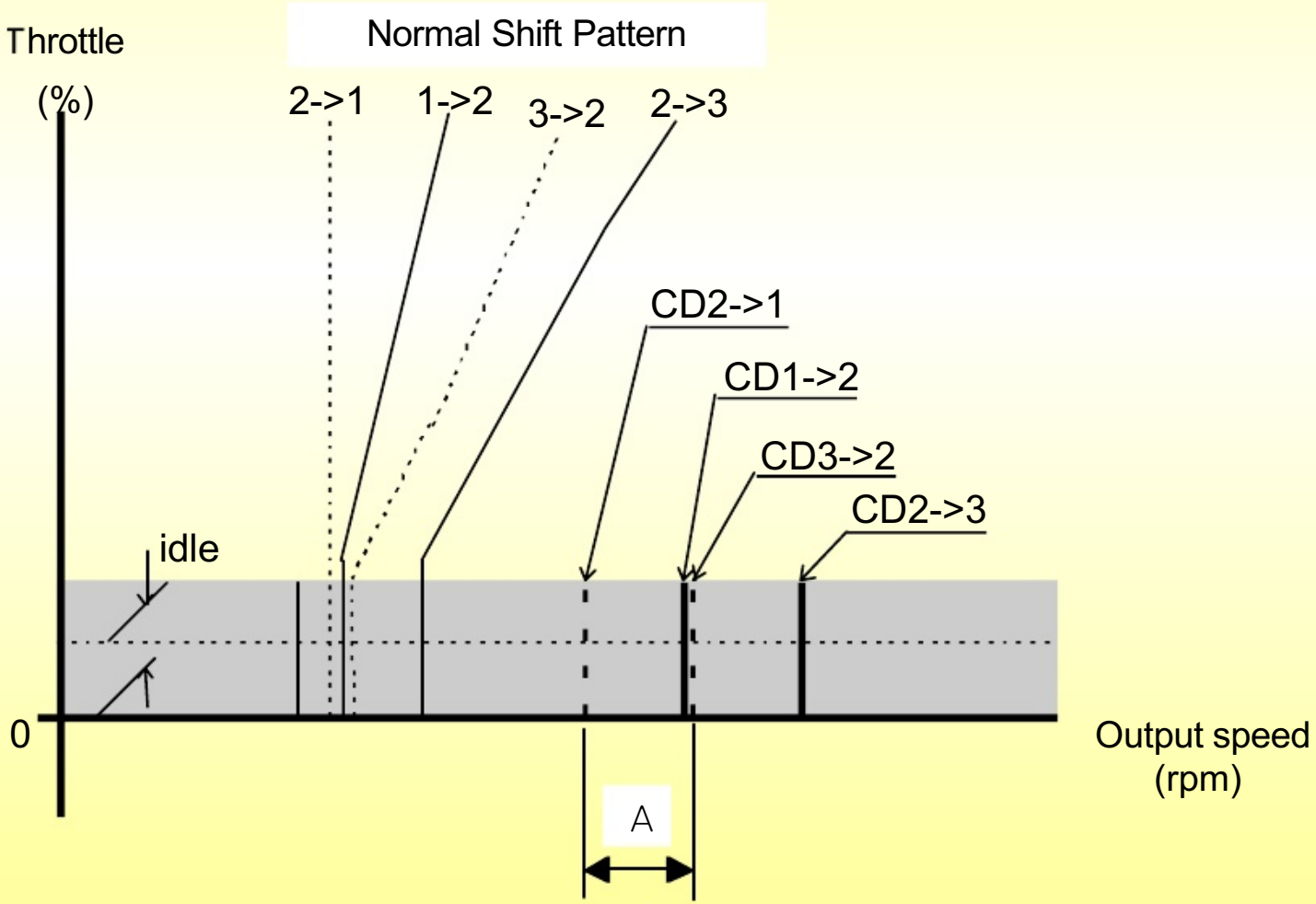
When the shift lever is shifted from “N” to “D”, the Squat control operation which temporarily shifts to 3rd gear reduce shifting shock and squatting vehicle.



## 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 start 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,

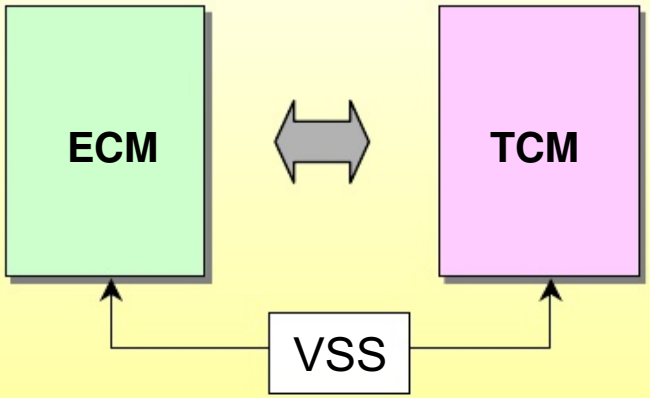
the width ‘A’ was enlarged so as to prohibit the shift busy.

## Pin to pin communication



| 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 |

**VSS***




**WTS****

| 4D56, 3.5 V6 | J3-2.9 C/rail |
|---|---|
| On/Off switch from ECM to TCM | PWM from ECM to TCM |



# ELECTRONIC CONTROL



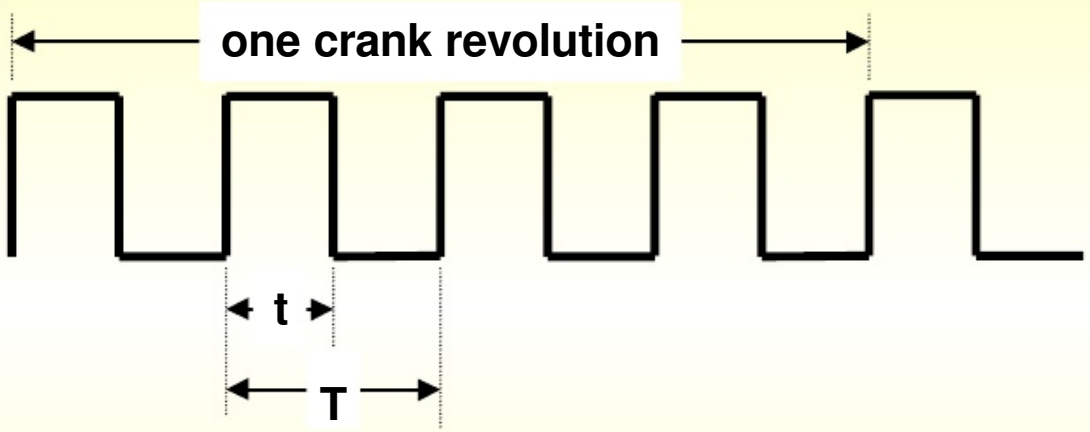


## Engine RPM (ECM -> TCM) : Except 4D56TCi

## Engine RPM (ECM->TCM) : Except 4D56TCI



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




**t / T × 100% = 50 +/- 10**



# ELECTRONIC CONTROL



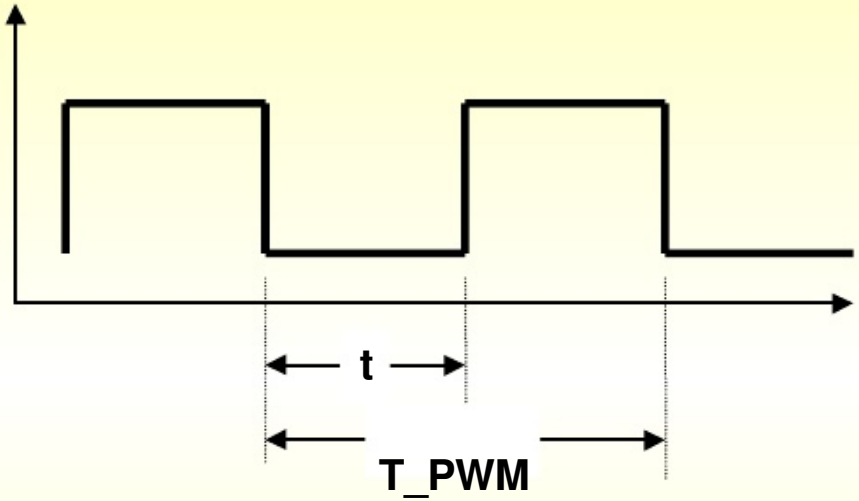


## Accelerator position (ECM->TCM)

## 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

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

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 |

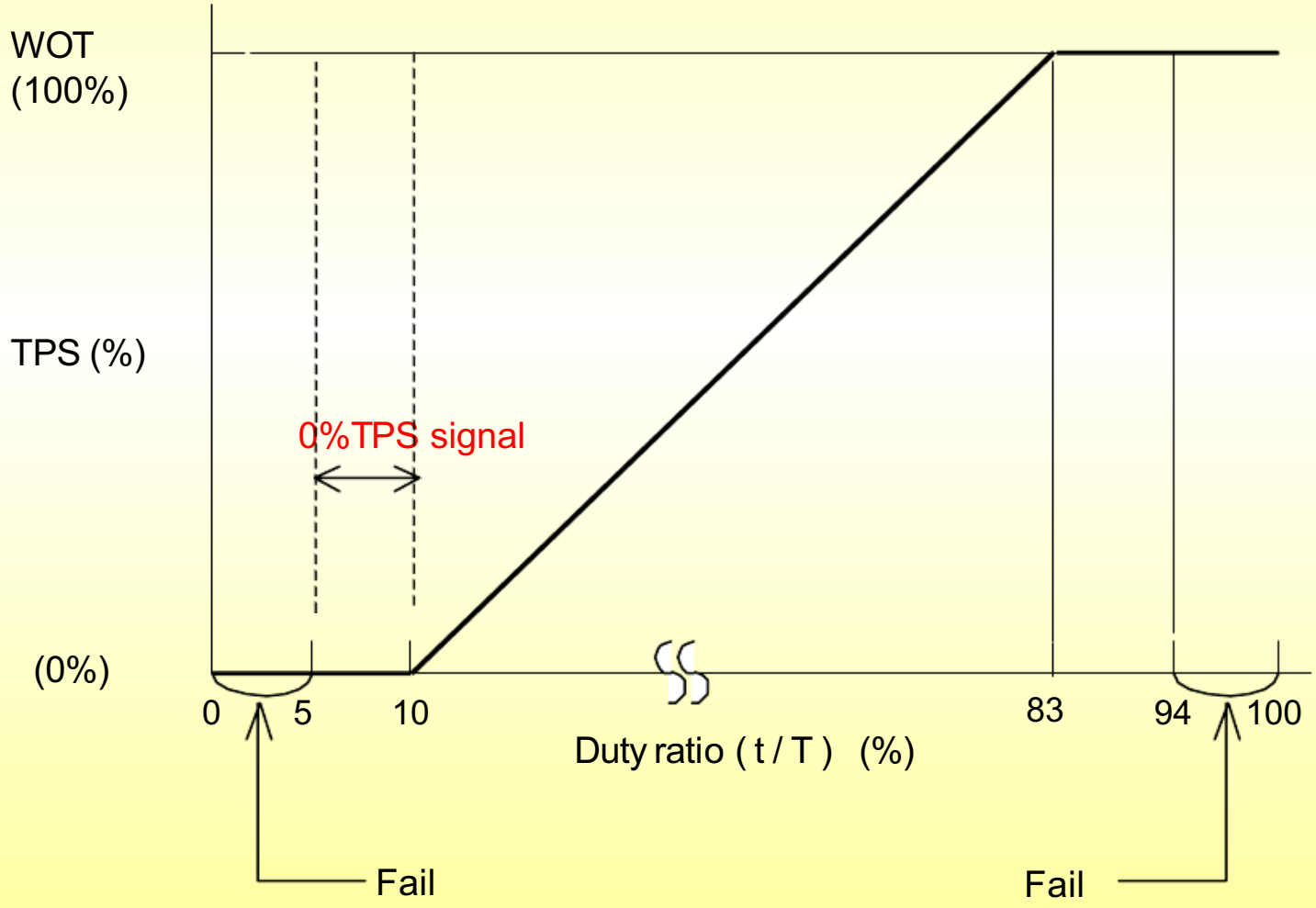
The APS information is always transferred when IG key is 'ON' even during cranking.

If accel pedal sensor is fail, ECM should transfer 100% PWM.

## PWM THROTTLE SIGNAL



### Duty vs Throttle openings





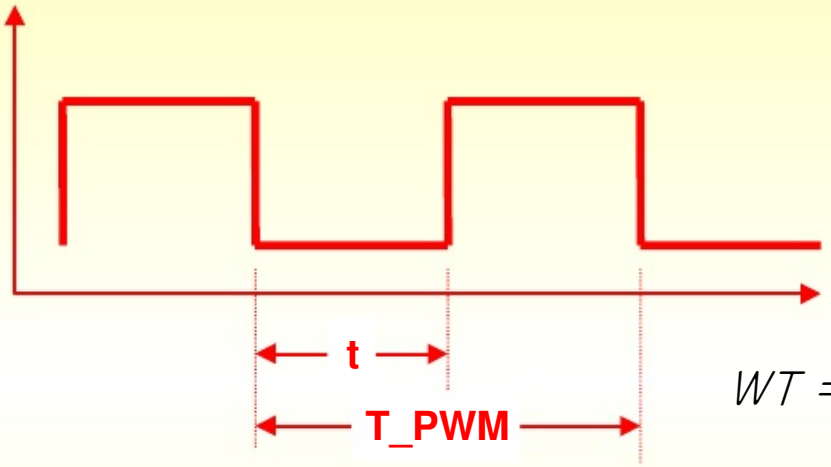

# ELECTRONIC CONTROL





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

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




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

$WT = duty\ cycle[\%] = ( t[ms] / T\_PWM[ms] ) * 100\%$

Specification of duty cycles :

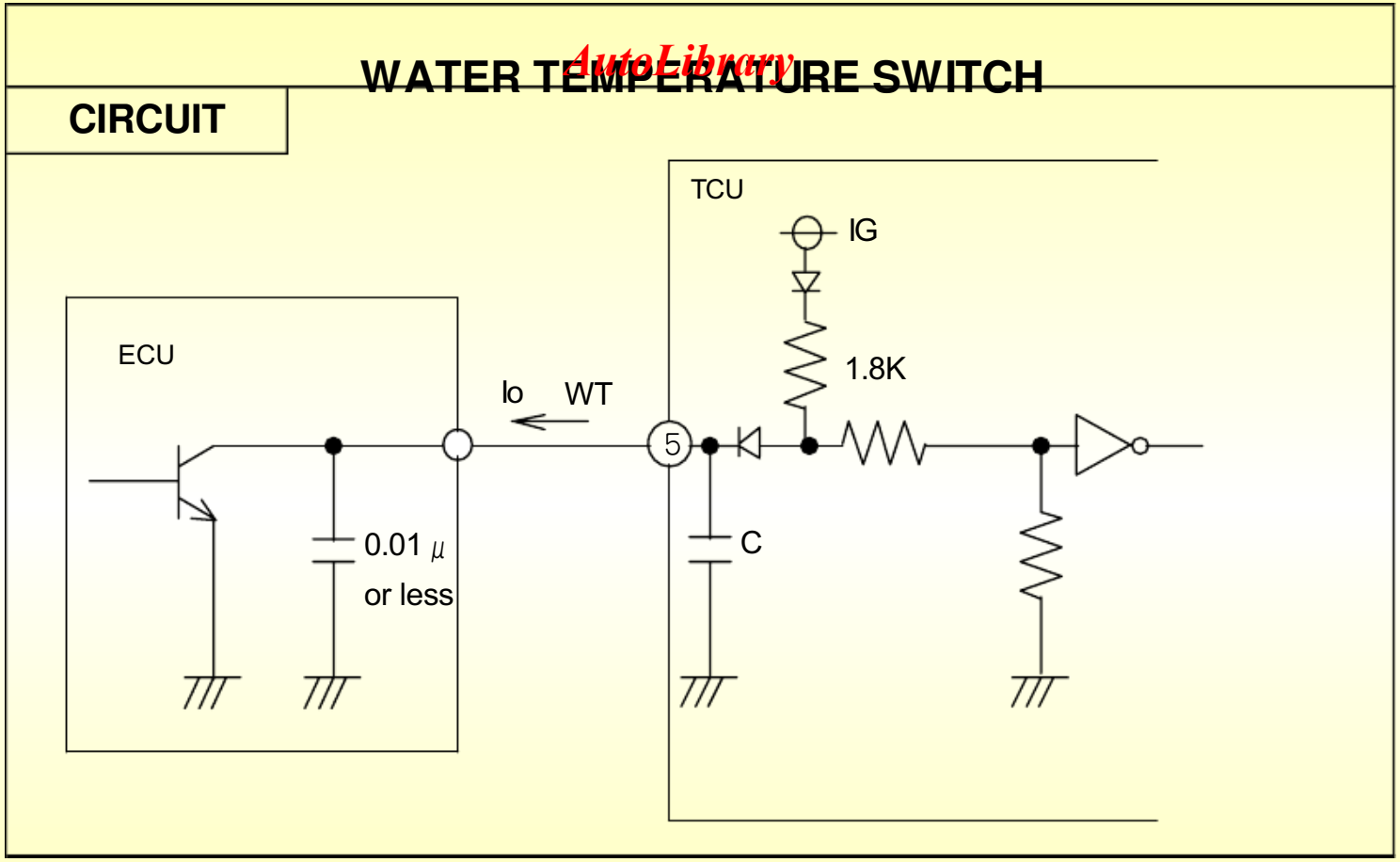
| | | | |
|---|---|---|---|
| 0 % ≤ duty-cycle < 5 % | ≡ | 0.0 ms ≤ t < 0.5 ms | ⇒ failure of WT signal |
| 5 % ≤ duty-cycle < 10 % | ≡ | 0.5 ms ≤ t < 1.0 ms | ⇒ -50degC WT |
| 10 % ≤ duty-cycle ≤ 90 % | ≡ | 1.0 ms ≤ t ≤ 9.0 ms | ⇒ valid ( -50degC WT – 150degC WT) |
| 90 % < duty-cycle ≤ 95 % | ≡ | 9.0 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

## WATER TEMPERATURE SWITCH

### CIRCUIT




| | |
|---|---|
| Io | : 10mA max. **(at IG = 16V)** |
| Leak resistance | : 100K·min. |
| Chattering time | : 10msec. Max. |
| Signal logic | : **Active low at low temperature.** |

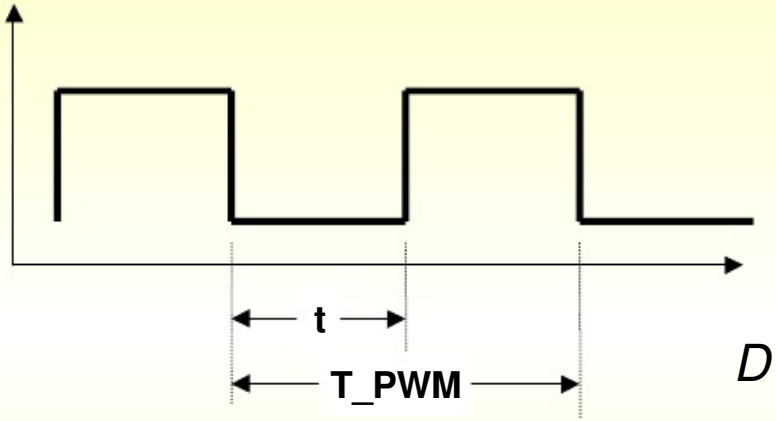
~~0V (ECT<37℃), 12V (ECT>40℃)~~





**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 gear shift. The active signal is a low state.




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

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



# ELECTRONIC CONTROL





## Torque reduction request (ECM<-TCM)

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 down-shifts, the TCM determines the value by how much the engine torque has to be reduced.

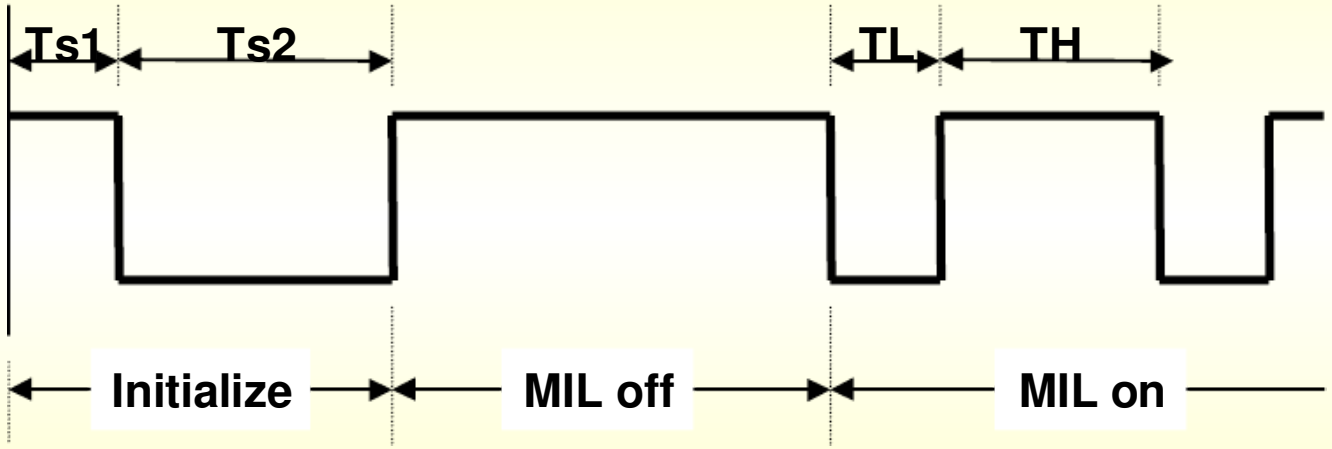




## MIL request (TCM->ECM) – Only for 3.5 V6 with OBD-II or E-OBD

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 sec | 2.0sec | 90ms | 1660ms |
| ECM | 1500<TL+TH<2000msec | | | |





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 until the warning light goes off. And when the warning light goes off, the vehicle can be driven normally.

| CODE | Description | 03-II | 30LFi |
|---|---|---|---|
| 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/SHORT) | 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 cycle with a fail store DTC.**

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



# DIAGNOSIS



## 2nd. consecutive driving

## cycle

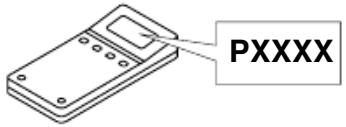
2 Driving cycle detection:
How to duplicate DTC.

DTC duplicates in case

failures are detected at least 2 provided IG OFF => ON

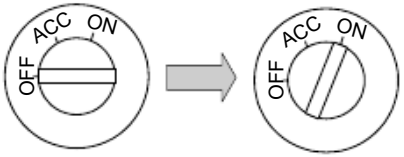


Symptom simulation test

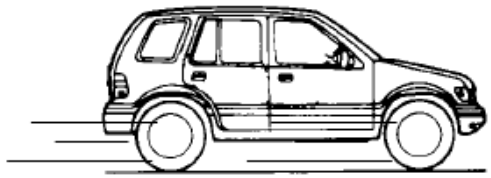



Tester detects one failure
(One driving cycle)

IG OFF => ON




IG OFF → ON



Perform the symptom simulation test again

Tester detects failure again

(Two driving cycle)



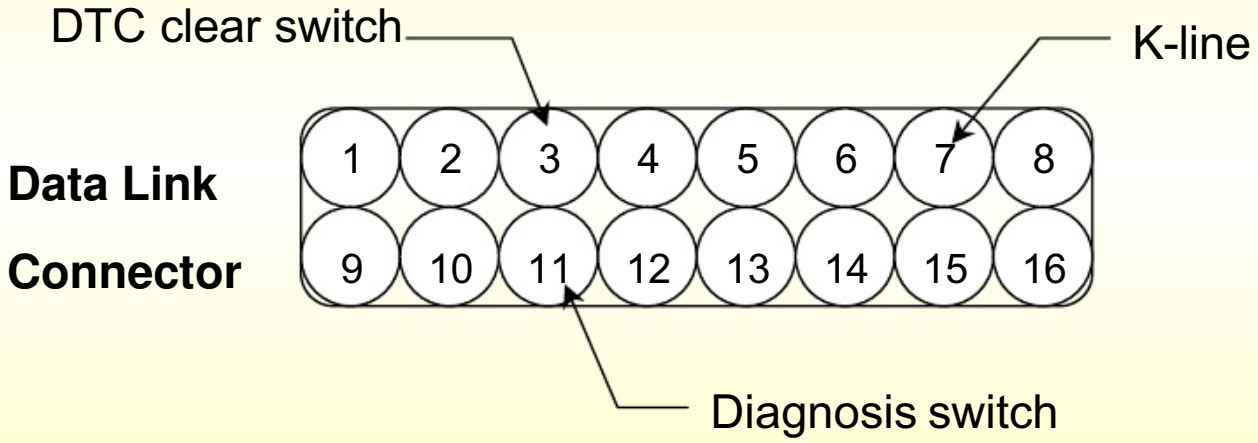
# DIAGNOSIS



## 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.







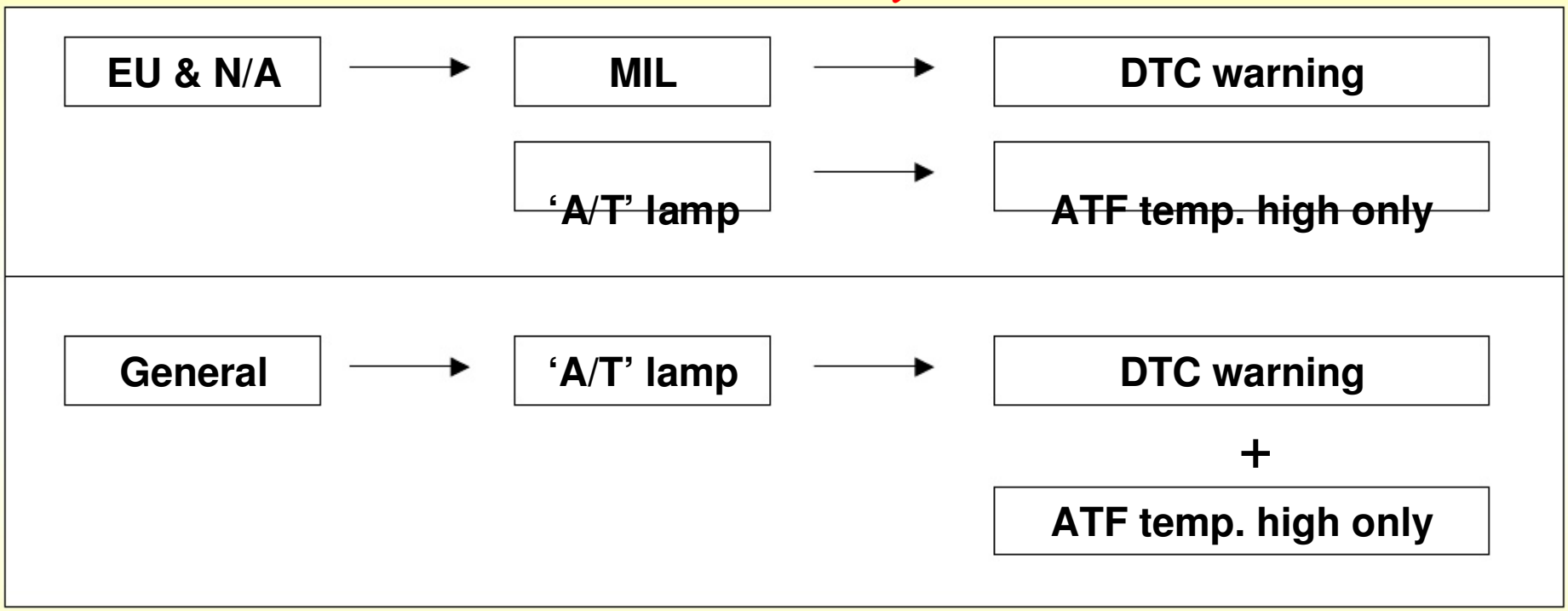

# DIAGNOSIS



## MIL & Oil lamp flush

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







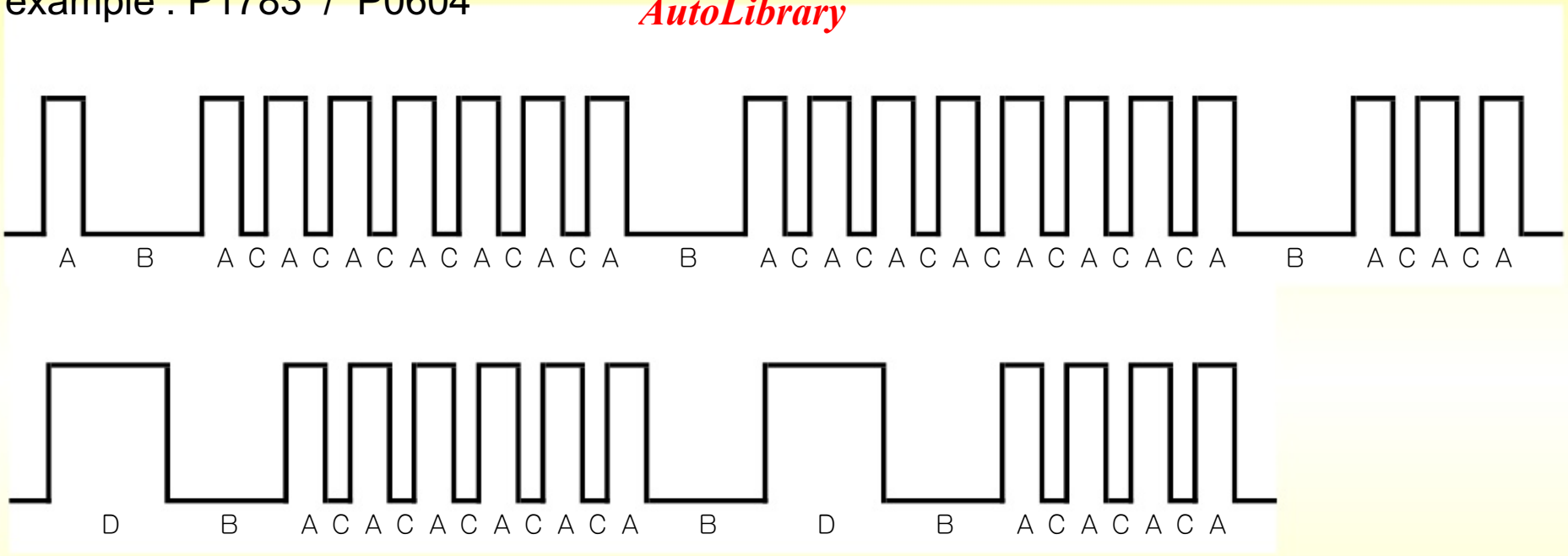

# DIAGNOSIS



## How to count the Oil-lamp blinking

For example : P1783 / P0604






A : 0.5sec. B : 1.5sec. C : 0.3sec. D : 1.5sec.



# DIAGNOSIS



## DTC

| DTC | Detection item | Detection condition | Lamp | FAILE SAFE | Cancel condition |
|---|---|---|---|---|---|
| 0753 | Shift solenoid No.1 | Open circuit | OFF | Emergency 2 | After IG OFF=> ON |
| | | GND short cir cuit | | | |
| 0758 | Shift solenoid No.2 | Open circuit | OFF | | |
| | | GND short cir cuit | | | |
| 0743 | L-up solenoid | Open circuit | OFF | No L-up | Gear shifting |
| | | GND short cir cuit | | | |
| 0748 | Line pressure solenoid | Open circuit | OFF | Emergency 2 | After IG OFF=> ON, TCM judge normal |
| | | GND short cir cuit | | | |





# DIAGNOSIS



## DTC

| DTC | Detection item | Detection condition | Lamp | FAILE SAFE | Cancel condition |
|---|---|---|---|---|---|
| 0715 | Input speed sensor | No signal | ON | No L-up,<br>No line pressure control,<br>No torque reduction control | After TCM judge normal, 0km/h is detected |
| 0722 | Output speed sensor | No signal | ON | No change 4th gear,<br>No L-up,<br>No squat control,<br>No line pressure control,<br>No torque reduction control,<br>As for vehicle speed, substitute C0 rotate. | After TCM judge normal, 0km/h is detected |
| 1121 | Throttle position sensor | No signal | ON | Full line pressure,<br>Throttle opening =0% fixed<br>No line pressure control,<br>No torque, reduction control,<br>No squat control | After TCM judge normal, 0km/h is detected |





# DIAGNOSIS



## DTC

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





# DIAGNOSIS



## DTC



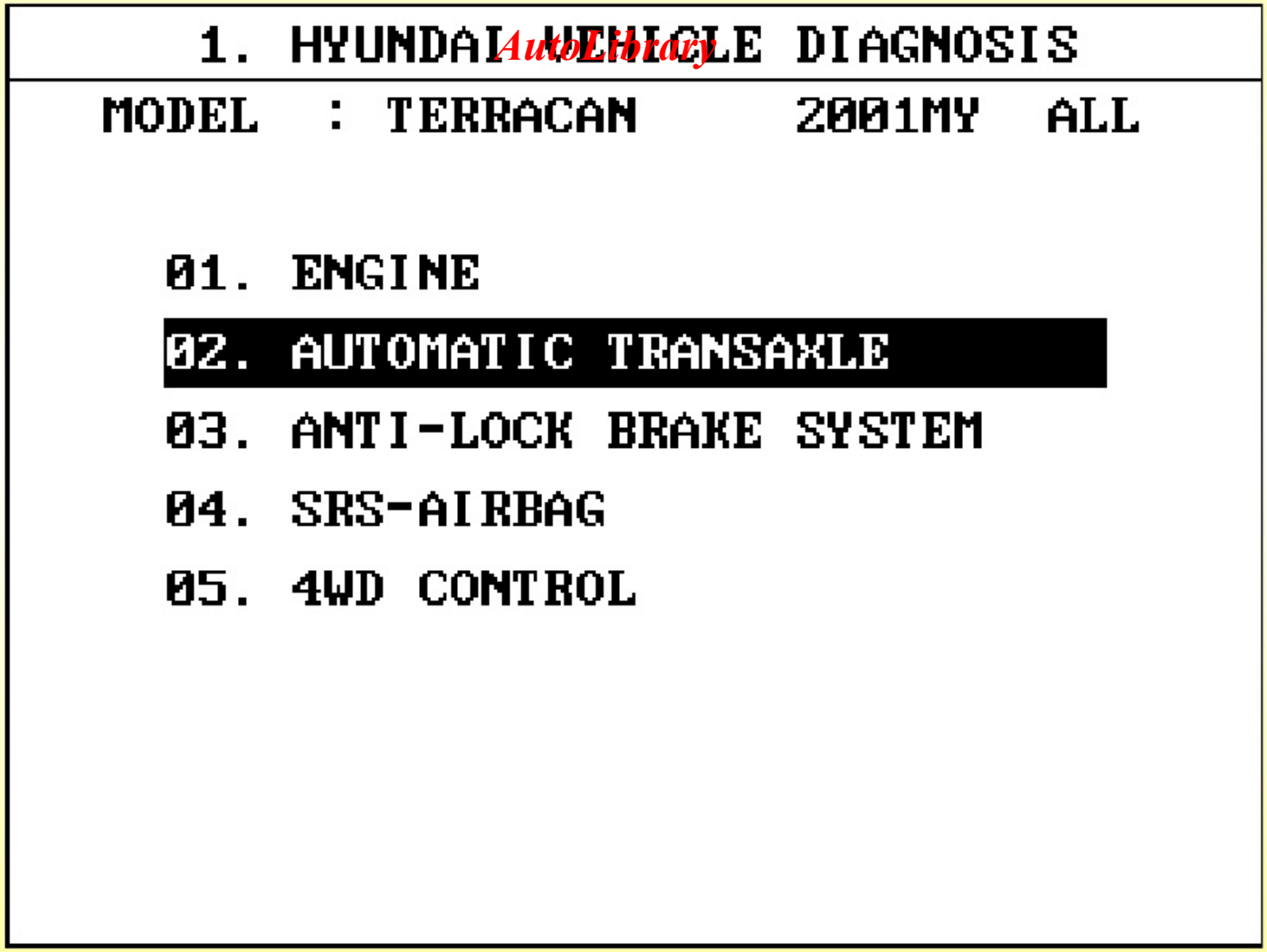
**Emergency mode 2**

**Emergency mode 2**

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



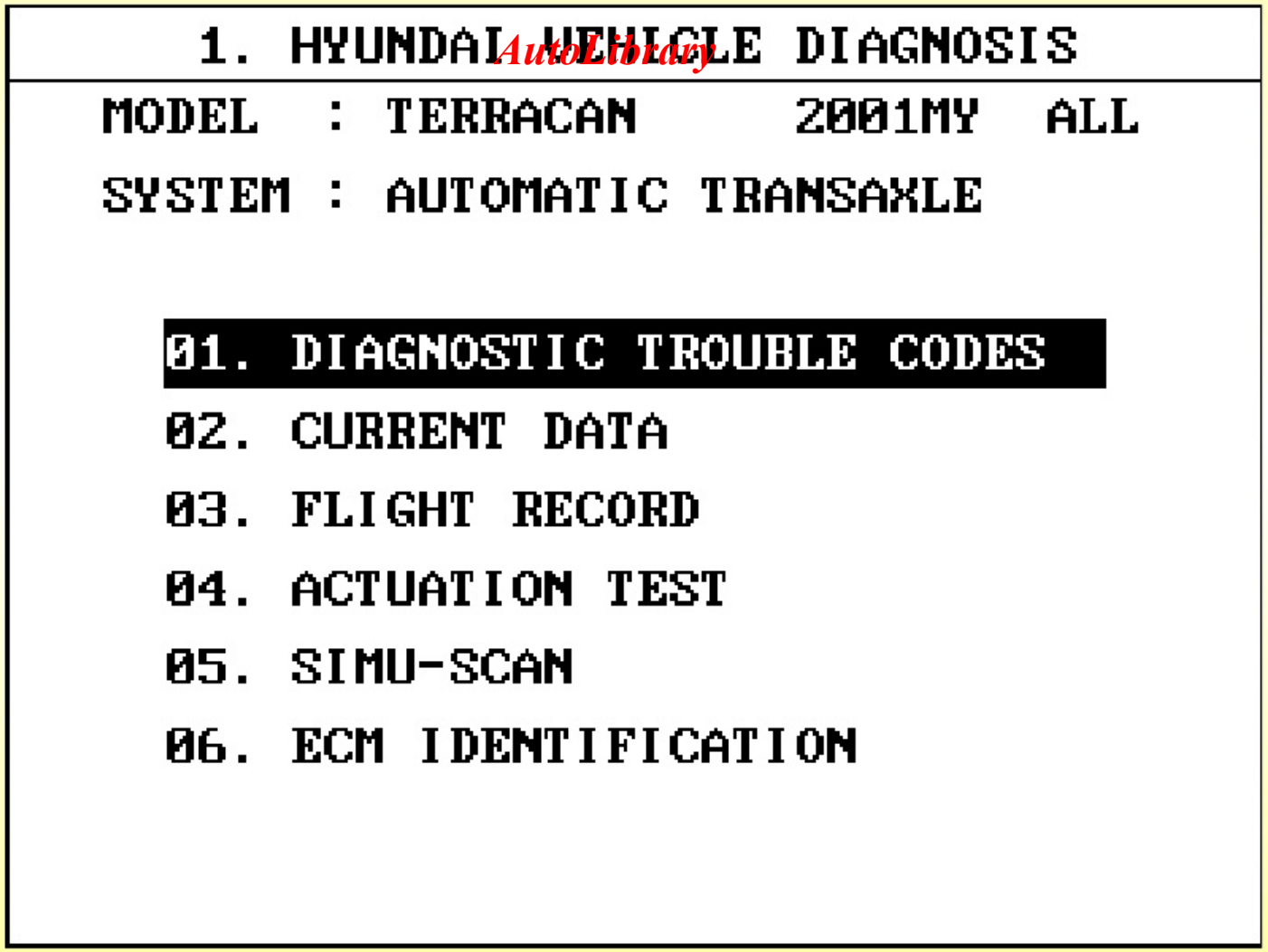
| | "D" | | | | "2" | | | "L" | |
|---|---|---|---|---|---|---|---|---|---|
| Gear range | 1st | 2nd | 3rd | 4th | 1st | 2nd | 3rd | 1st | 2nd |
| Failure | **4th** | | | | **3rd** | | | **1st** | |






# DIAGNOSIS

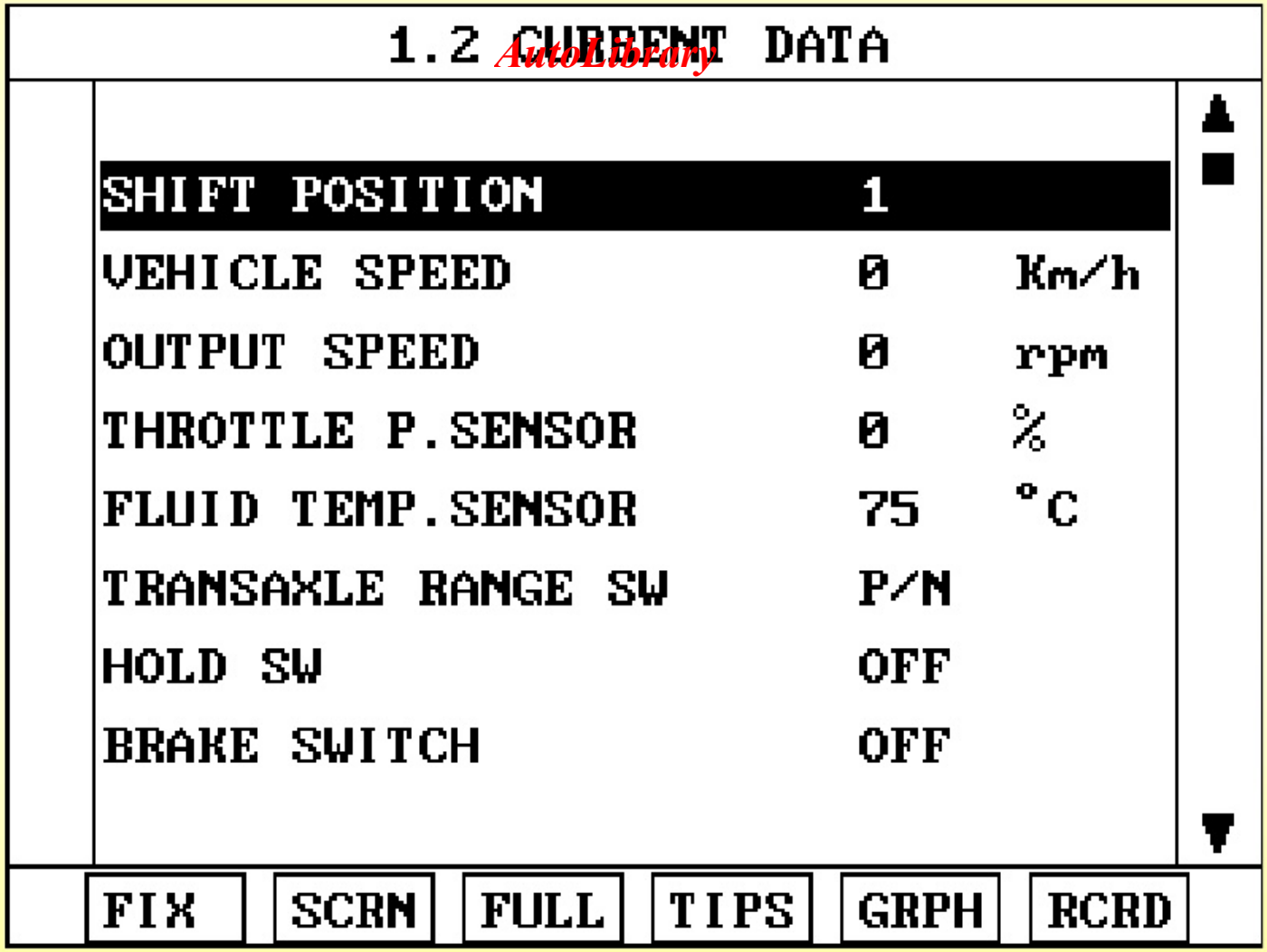
Hi-scan





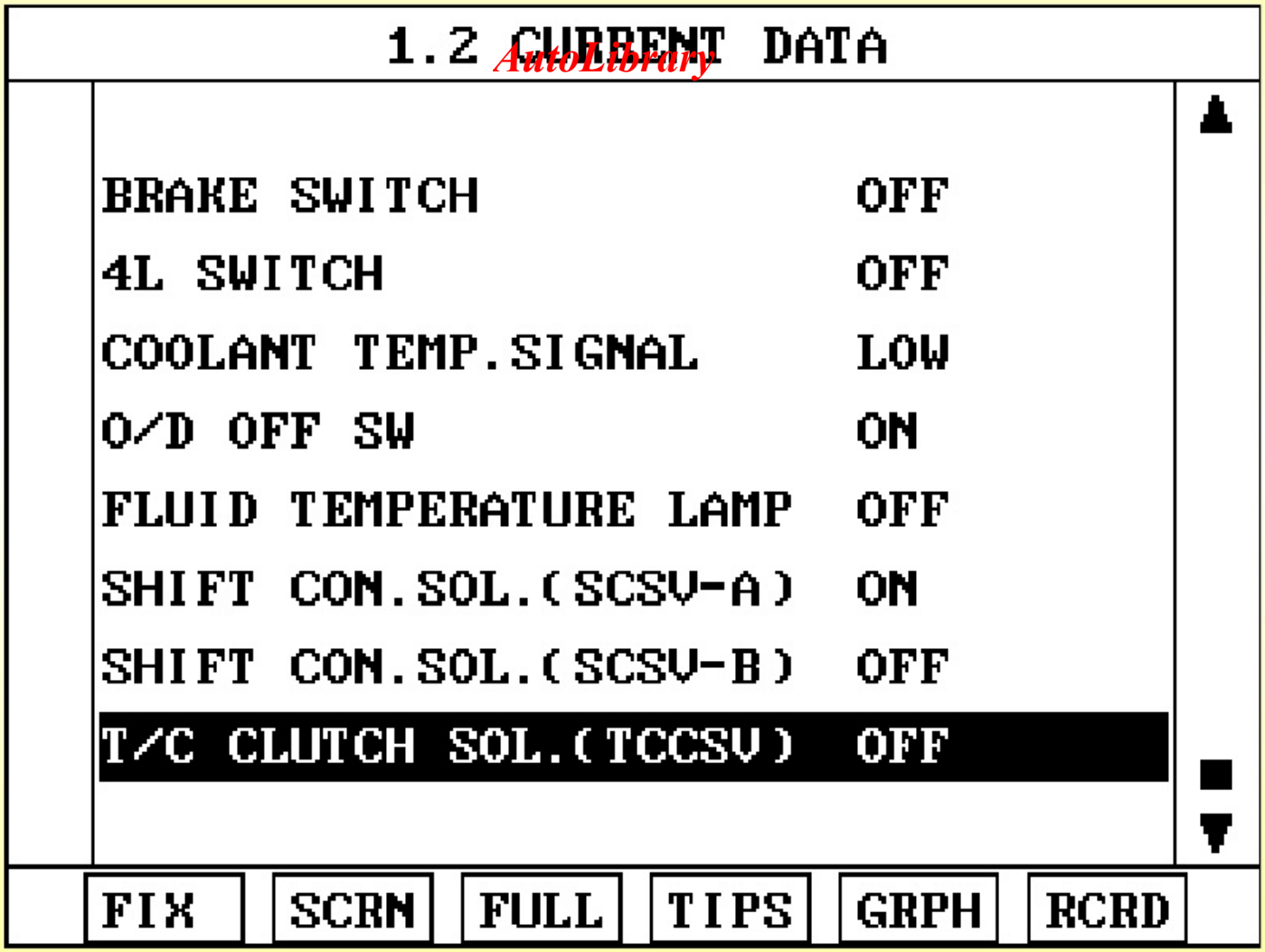

# DIAGNOSIS

Hi-scan






# DIAGNOSIS






# DIAGNOSIS



## Troubleshooting

| | |
|---|---|
| P0750, P0753<br>P0755, P0758 | Solenoid No.1 (S1) Open, Ground short<br>Solenoid No.2 (S2) Open, Ground short |
| P0740, P0743 | L-up solenoid (SL) Open, Ground short |



| DTC DETECTION CONDITION | CAUSE OF FAILURE |
|---|---|
| Ground short: DTC decides a failure in case any trouble is detected at the other gears at **8 times** after a trouble detection at a gear for **0.3 sec.**.<br>Open: DTC decides a failure in case any trouble is detected at the other gears at **8 times** after a trouble detection at a gear for **0.5 sec.**.<br>And 2 driving cycles detect. | 1. Harness or connector between each shift solenoid and TCM<br>2. Each shift solenoid<br>3. TCM |

| P0748 | Pressure control solenoid Open, Ground short |
|---|---|



| DTC DETECTION CONDITION | CAUSE OF FAILURE |
|---|---|
| Open, GND short: When detected detection condition that the electric current value of less than **20 mA** has been detected in **12.5 seconds** normal value is output from TCM, DTC is decided.<br>(+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. | 1. Harness or connector between pressure control solenoid and TCM.<br>2. Pressure control solenoid<br>3. TCM |

| | |
|---|---|
| P0715<br>P0720, P0722 | Input speed sensor No signal<br>Output speed sensor No signal |



| DTC DETECTION CONDITION | CAUSE OF FAILURE |
|---|---|
| No C0 signal:<br>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.<br>No SP signal :<br>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 times** 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. | 1. Harness or connector between each speed sensor and TCM.<br>2. Each speed sensor<br>3. TCM |

| | |
|---|---|
| P0705 | **TR switch No signal, Open** |



| DTC DETECTION CONDITION | CAUSE OF FAILURE |
|---|---|
| No signal:<br>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.<br>Open:<br>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 D TC decides a failure. | 1. Harness or connector between TR switch and TCM.<br>2. TR switch<br>3. TCM |

| | |
|---|---|
| P0710 | Oil temperature (OT) Open, Ground short |



| DTC DETECTION CONDITION | CAUSE OF FAILURE |
|---|---|
| Open:<br>When detected detection condition that the abnormal condition of oil temperature after **15 mimutes** 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.<br><br>Ground short:<br>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. | 1. Harness or connector between oil temperature sensor and TCM.<br>2. Oil temperature sensor<br>3. TCM |



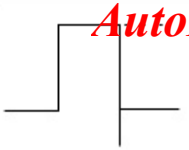
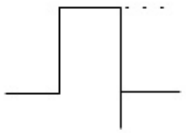
# TCM SIGNALS



## Standard sheet for TCM signals (3.5V6)



| No. | Items | Condition | Signals | | Description | Remarks |
|---|---|---|---|---|---|---|

| No | | Items | Condition | Type | Level | Description | Remarks |
|---|---|---|---|---|---|---|---|
| 1 | A1 | SCSV 1 | IDLE | Hz |  Vbatt 0V | 1st/2nd : 13.6V/13.2V<br>3rd/4th : 0V | Current : 0.95A |
| 2 | A2 | SCSV 2 | IDLE | Hz |  Vbatt 0V | 2nd/3rd : 13V/13.1V<br>1st/4th : 0V | Current : 0.95A |
| 5 | B1 | W/TEMP SIG (FROM ECU) | 40℃ or more | DC | Vbatt-2V ~ Vbatt | 11.5V | |
| | | | 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<br>LO : $V_{GND}$-0.3 ~ 1.5V<br>FREQ. : 100Hz<br>DUTY(-) : C.T - 10%<br>W.O.T - 83% | HI : 7.24V<br>LO : 0V<br>FREQ. : 100Hz<br>DUTY(-) : C.T - 10.4%<br>W.O.T - 82% | |
| 7 | B3 | Input speed sensor signal | IDLE | PULSE |  VHI VLOW<br>16PULSE/CO CYLINDER REV. | Vp-p : 5.68V (IDLE)<br>HI : 5.24V<br>LO : -0.44V<br>FREQ. : 91Hz | 3000rpm :<br>Vp-p : 18.1V<br>HI:11.4V/LO:-6.7V<br>FREQ. : 398Hz |



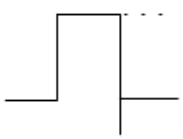
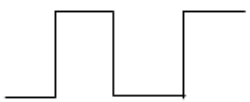


# TCM SIGNALS



## Standard sheet for TCM signals(3.5V6)

| No | Items | Condition | Signals | | Description | Remarks |
|---|---|---|---|---|---|---|
| | | | Type | Level | | |

| | | | | Type | Level | | |
|---|---|---|---|---|---|---|---|
| 8 | B4 | Output speed sensor signal | Driving | PULSE |   12PULSE/TM REV. | Vp-p : 4.24V(30KPH)<br>HI : 4.58V<br>LO : 0.34V<br>FREQ. : 199Hz | 60KPH :<br>Vp-p : 6.12V<br>HI:5.44V/LO:-0.68V<br>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 |  Vbatt<br>0V<br>Io : 1.9A MAX | HI : 13.1V($I_{HI}$ : 1.84A)<br>LO : 0V($I_{LO}$ : 1.15A) | |
| 14 | A7 | PCSV | IDLE | PULSE |  Vbatt<br>0 ~ 0.5V<br>Io : 1A MAX | HI : 13.1V($I_{HI}$ : 0.94A)<br>LO : 0V($I_{LO}$ : 0.65A)<br>FREQ. : 299Hz(-DUTY:44.4%) | 3000rpm :<br>-DUTY : 53.2%<br>FREQ. : 300Hz |





# TCM SIGNALS



## Standard sheet for TCM signals(3.5V6)

| No | Items | Condition | Signal | | Description | Remarks |
|---|---|---|---|---|---|---|
| | | | Type | Level | | |

| | | | | Type | Level | | |
|---|---|---|---|---|---|---|---|
| 17 | A10 | EARTH FOR PCSV | | | | | G/LVL |
| 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 CONTROL | Driving | PULSE | 4V MIN<br>1.5V MAX<br>FREQ. : 100Hz | HI : 4.2V<br>LO : 0V<br>FREQ. : 100Hz(-DUTY:20%) | |
| 23 | B10 | EARTH FOR CO CYLINDER | | | | | G/LVL |
| 24 | B11 | EARTH FOR VSS | | | | | G/LVL |
| 25 | B12 | ENG. REVOLUTION FROM ECU | IDLE | PULSE | 4.0V MIN<br>$V_{GND}$-0.3 ~ 1V<br>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) | |



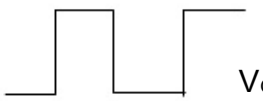


# TCM SIGNALS



## Standard sheet for TCM signals (3.5V6)

| No. | Items | Condition | Signals | | Description | Remarks |
|---|---|---|---|---|---|---|
| | | | Type | Level | | |

| No | | Items | Condition | Type | Level | Description | Remarks |
|---|---|---|---|---|---|---|---|
| 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<br>LOGIC "1" : Vbatt 80% or more | 0V<br>12.1V | |
| 44 | B24 | SPEEDMETER | Driving | Hz |  Vbatt<br>$V_{GND}$-0.3 ~ 1V<br>FREQ. : 42.5Hz(60KPH) | HI : 11.4V<br>LO : 0V<br>FREQ. : 12Hz(20KPH) | |





# TCM SIGNALS



## Standard sheet for TCM signals (3.5V6)

| No | Items | Condition | Signals | | Description | Remarks |
|---|---|---|---|---|---|---|
| | | | Type | Level | | |

| No | | Items | Condition | Type | Level | Description | Remarks |
|---|---|---|---|---|---|---|---|
| 45 | B25 | DIAG. SW | IGN OFF | DC | 0V | 0V | DTC CODE OUTPUT : |
| | | | IGN ON | ↑ | Vbatt | 10.7V | GND(VGND-0.3 ~ 1V) |
| 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 | |

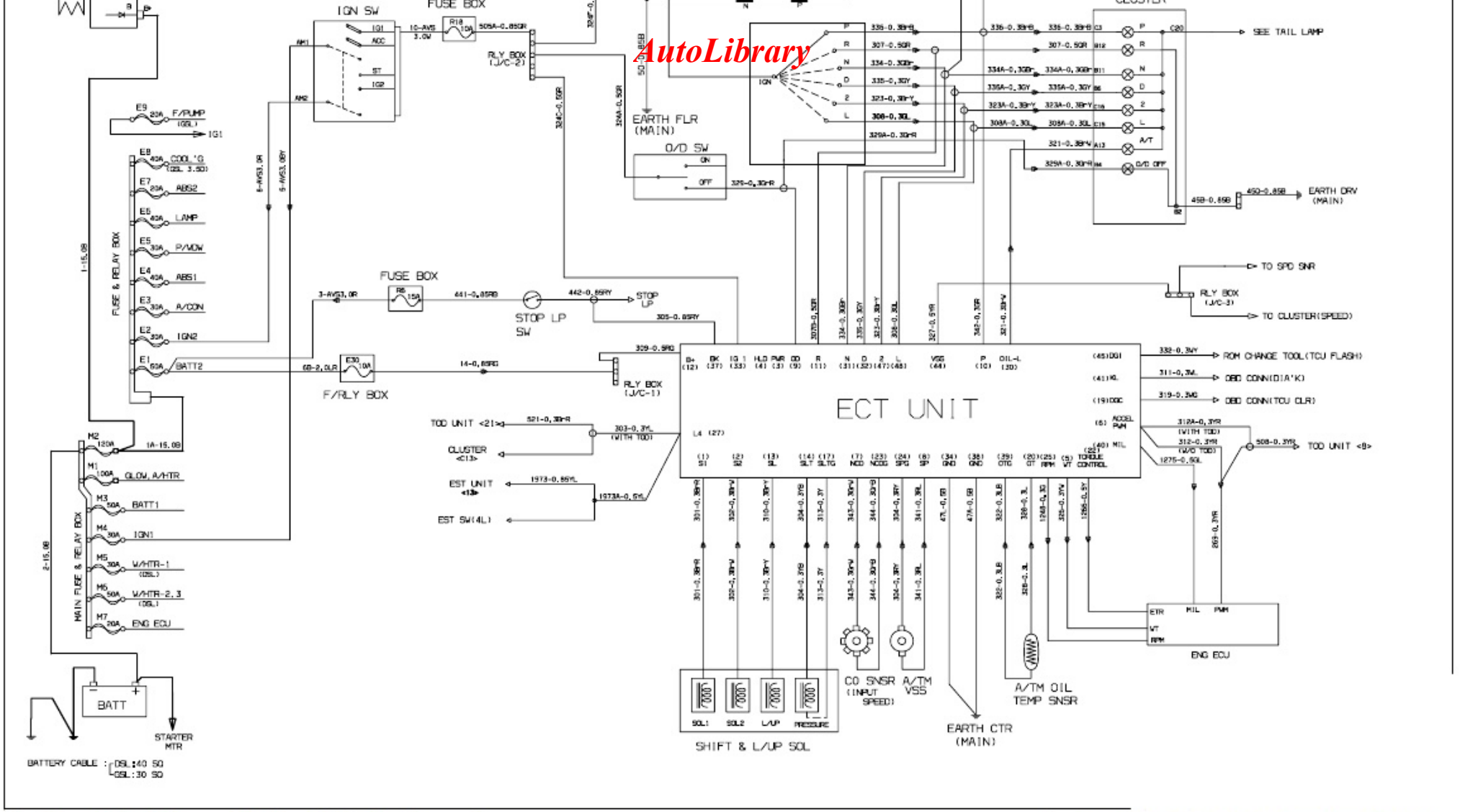




# WIRING DIAGRAM



## Electrical wiring diagram

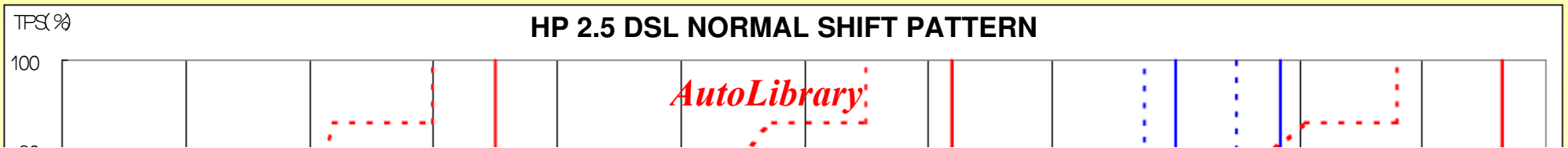


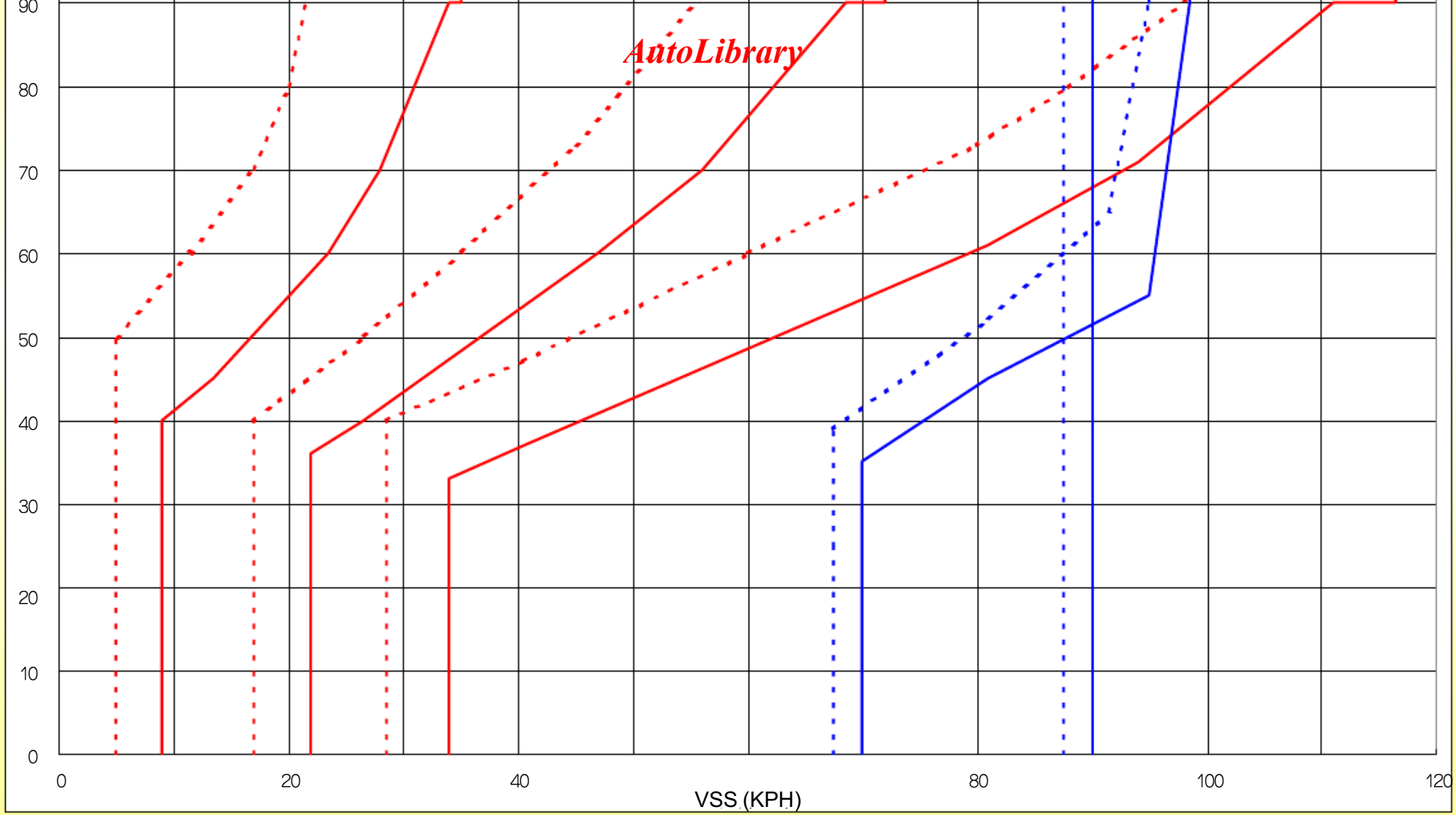





# SHIFT PATTERN



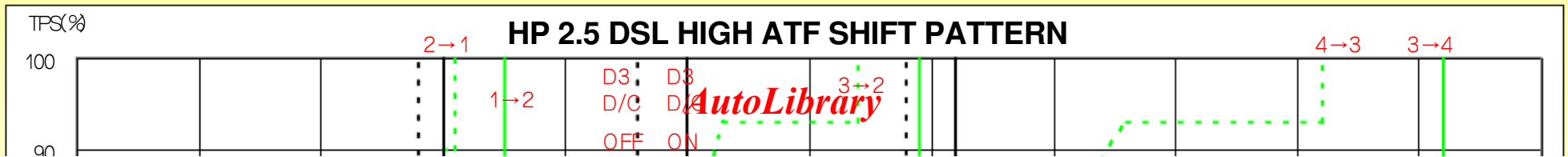


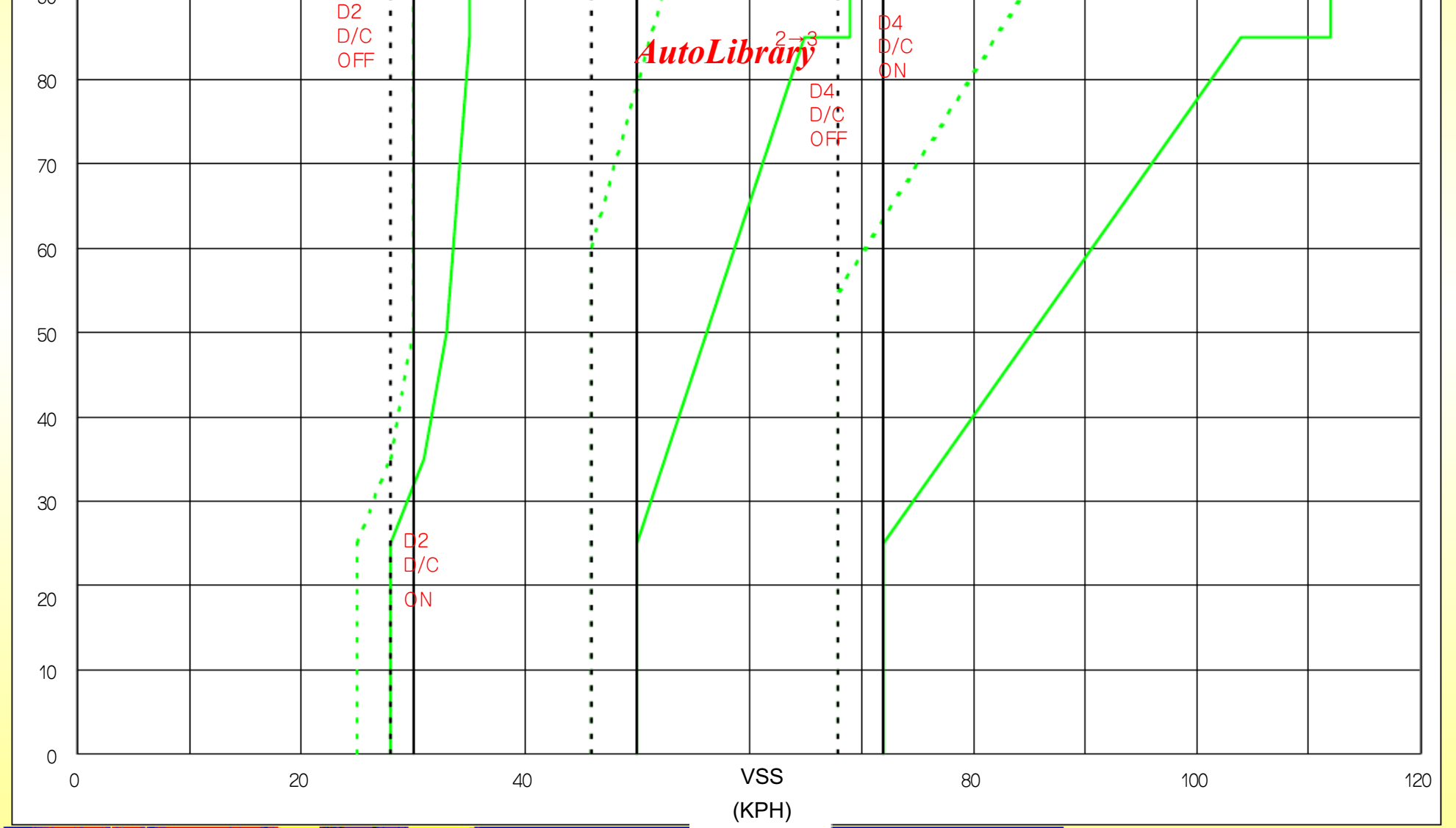





# SHIFT PATTERN



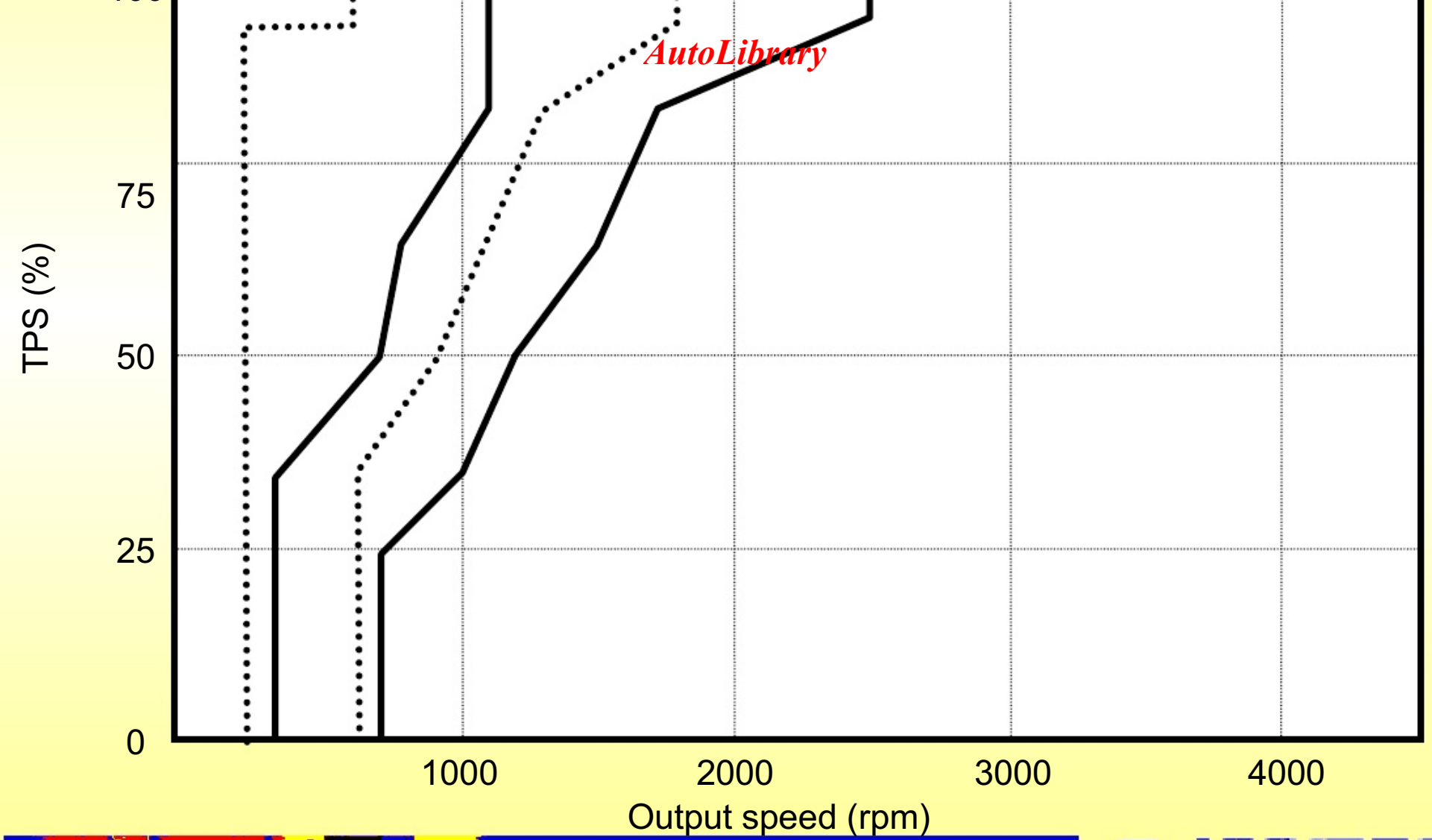







# SHIFT PATTERN

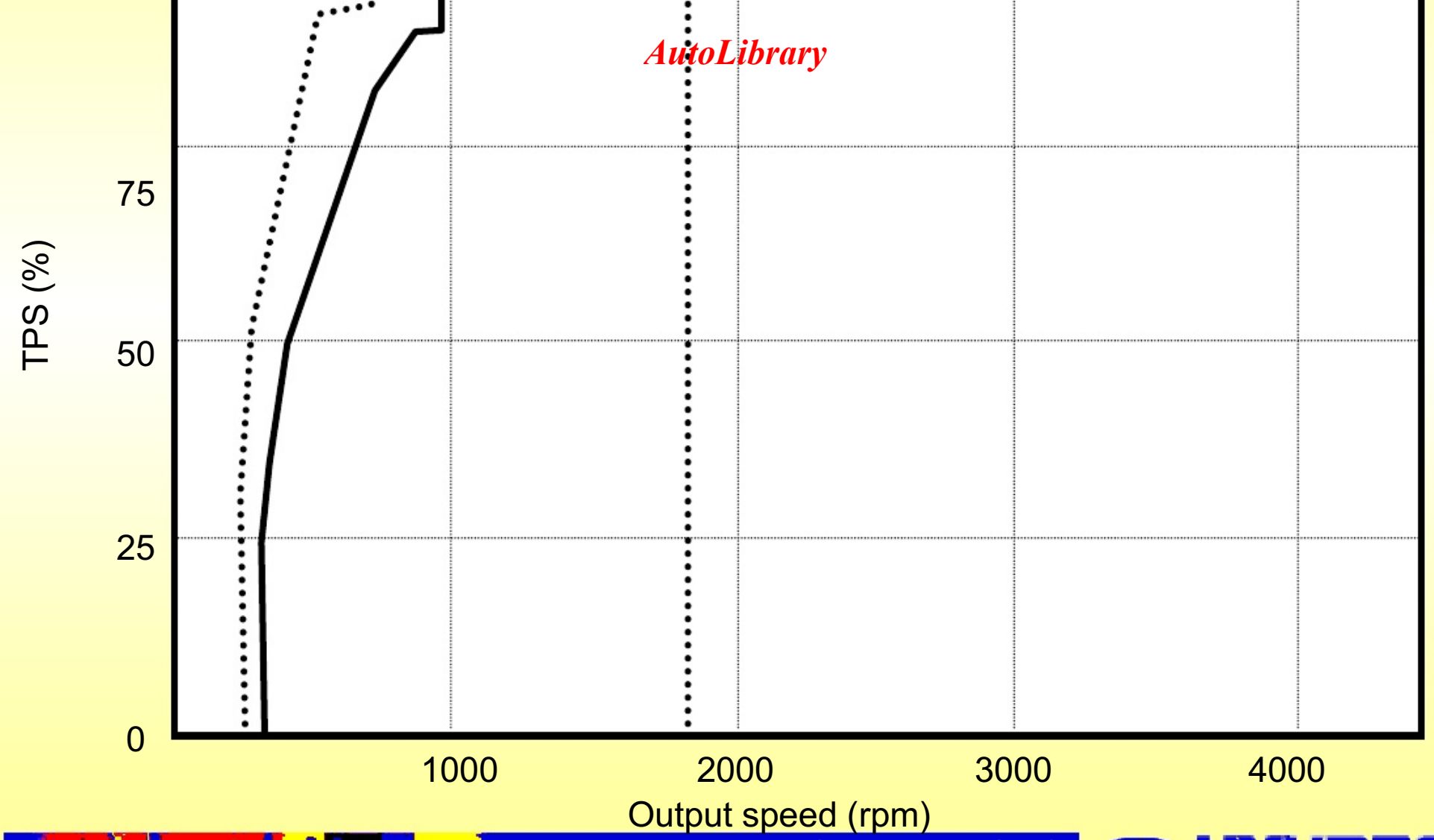
**HP 2.5 DSL D RANGE 4LOW MODE**






# SHIFT PATTERN

**HP 2.5 DSL 2 RANGE 4LOW MODE**

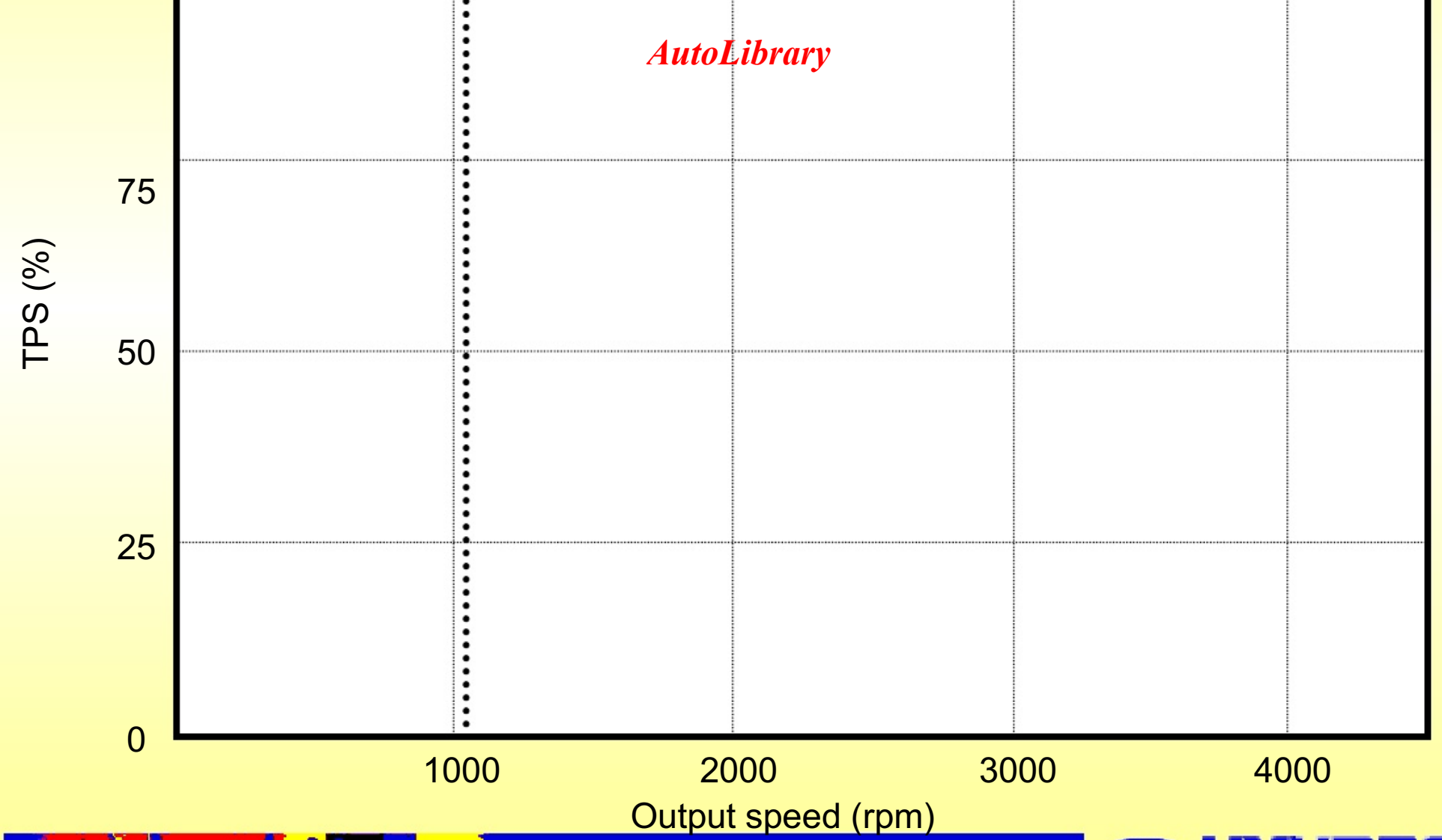





# SHIFT PATTERN

**HP 2.5 DSL L RANGE 4LOW MODE**

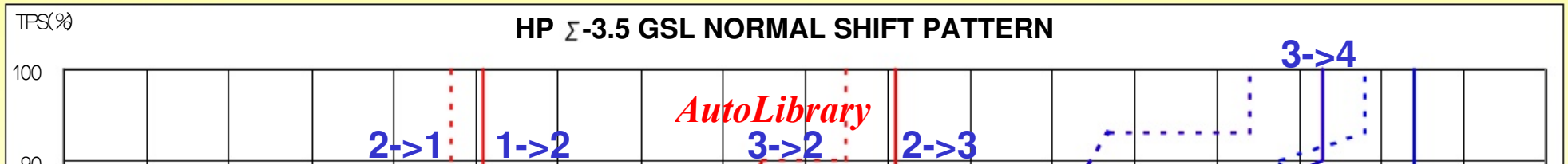


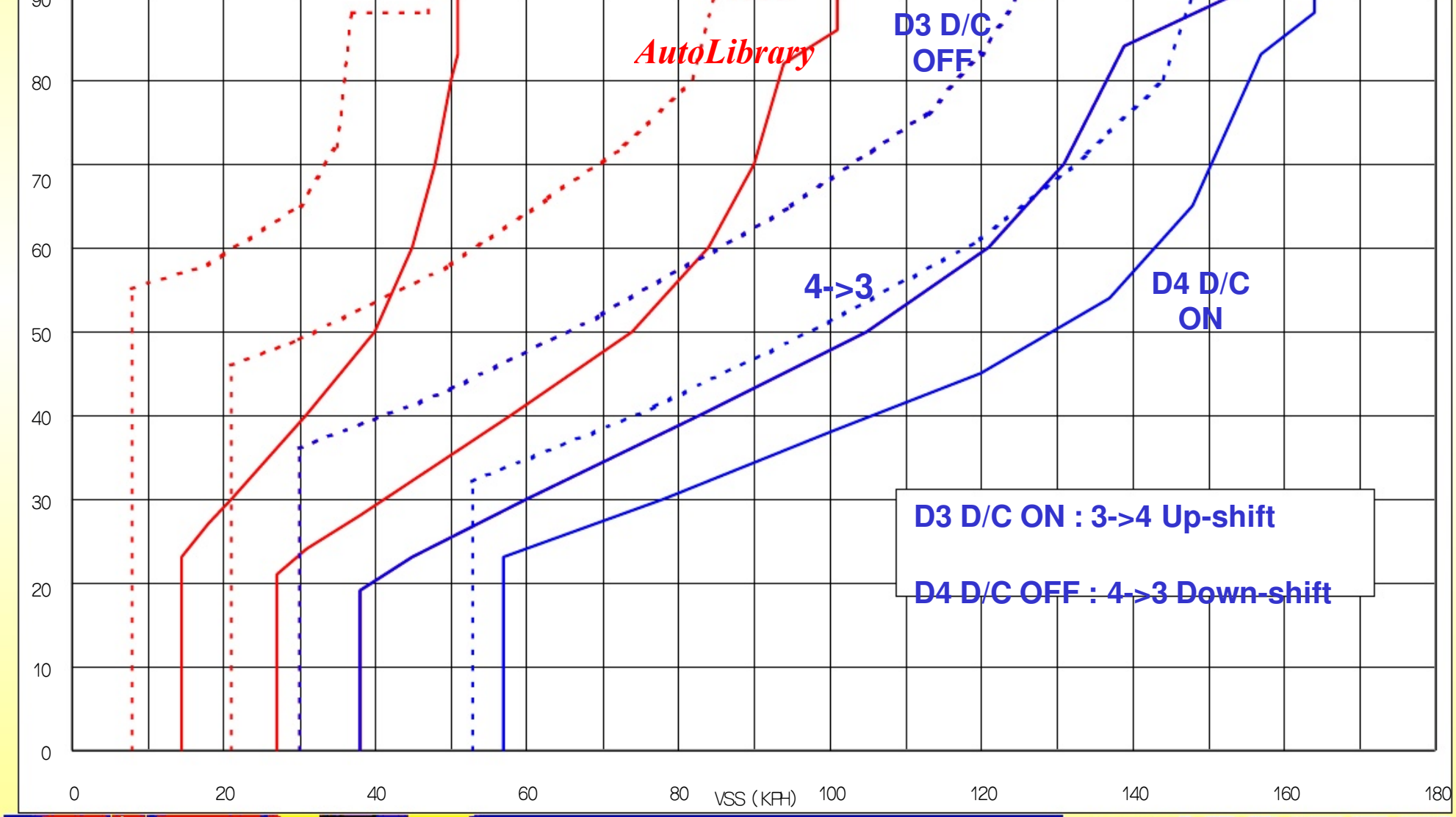





# SHIFT PATTERN



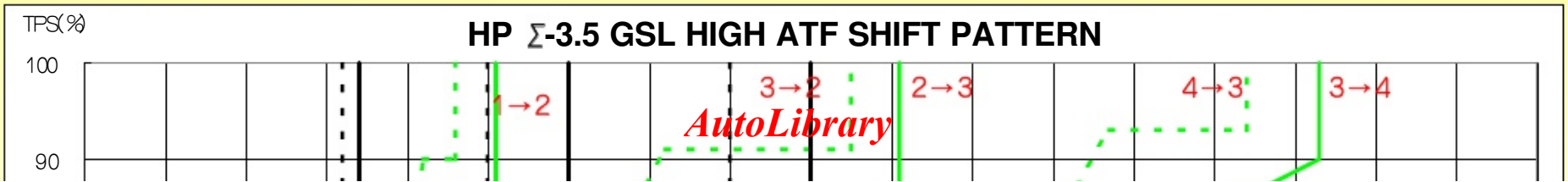


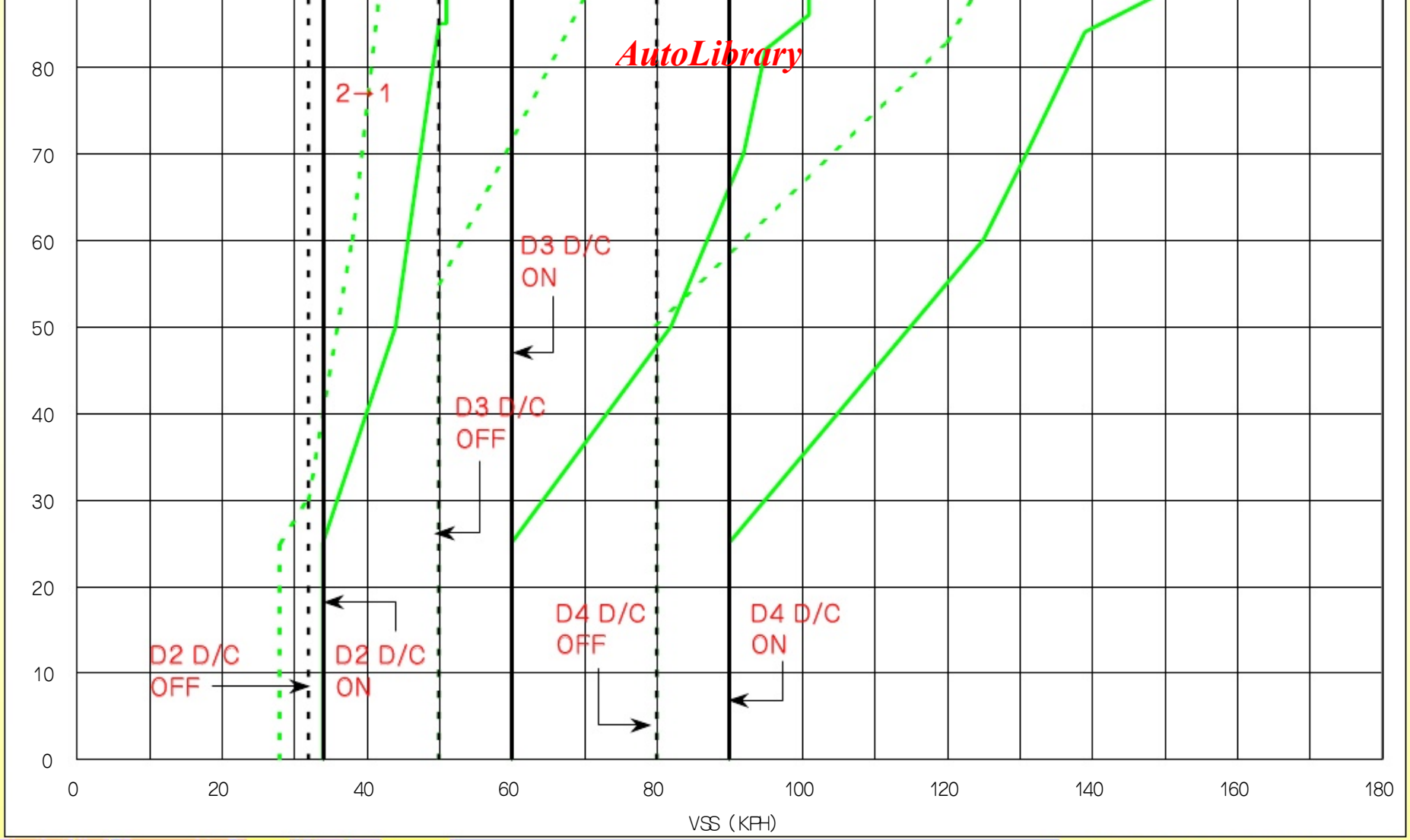





# SHIFT PATTERN



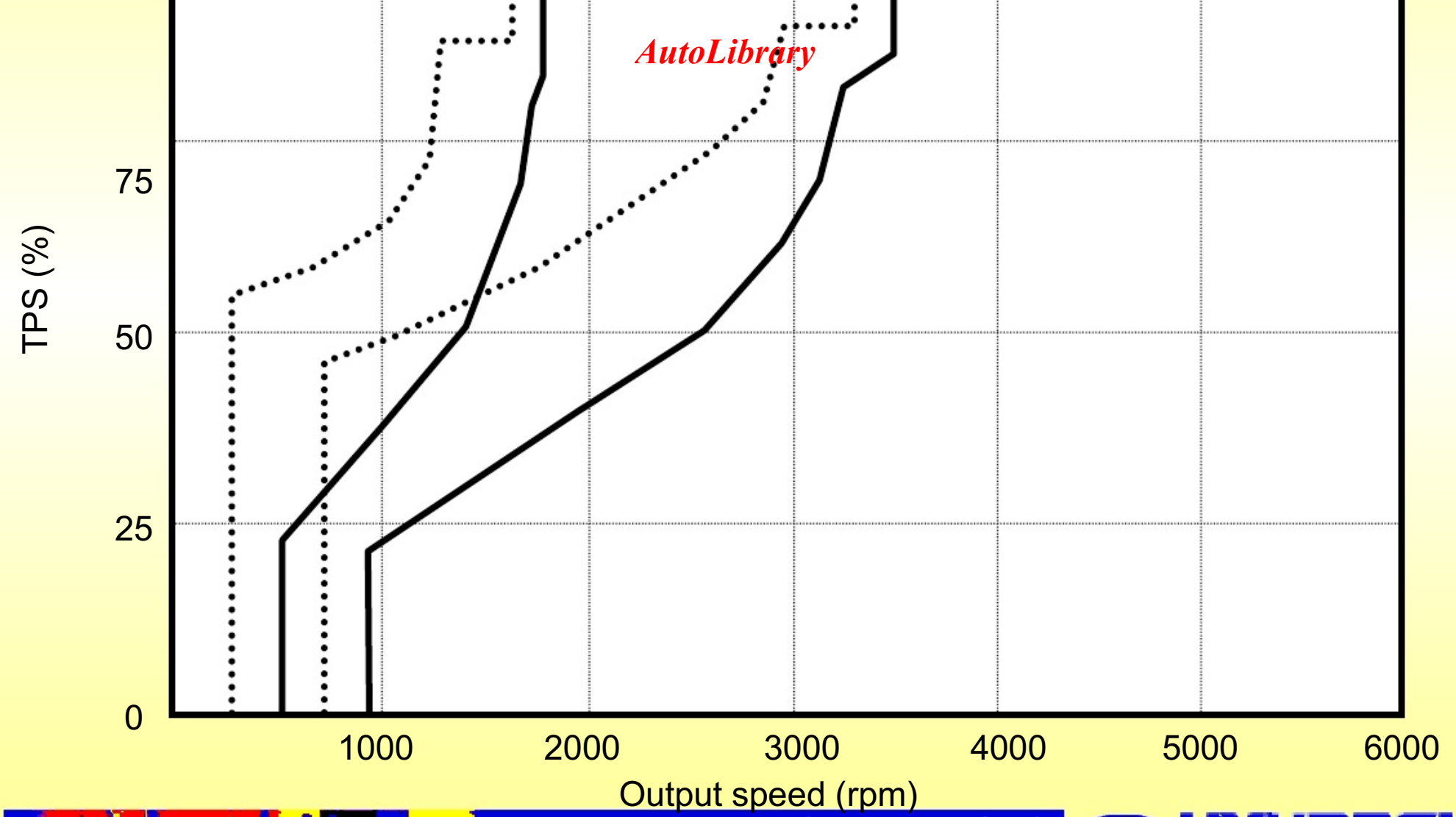







# SHIFT PATTERN

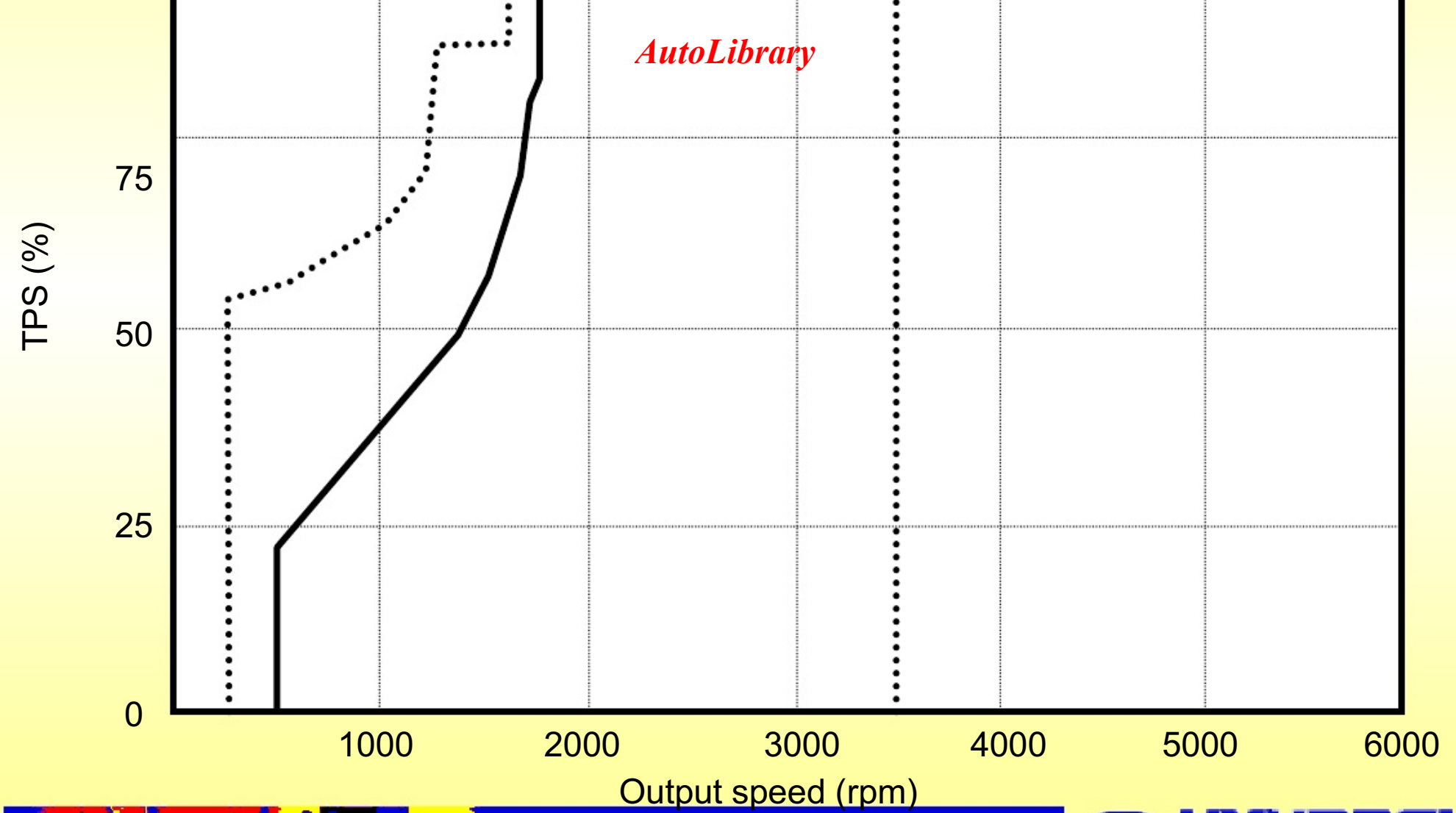
**HP 3.5 GSL D RANGE 4LOW MODE**






# SHIFT PATTERN

**HP 3.5 GSL 2 RANGE 4LOW MODE**

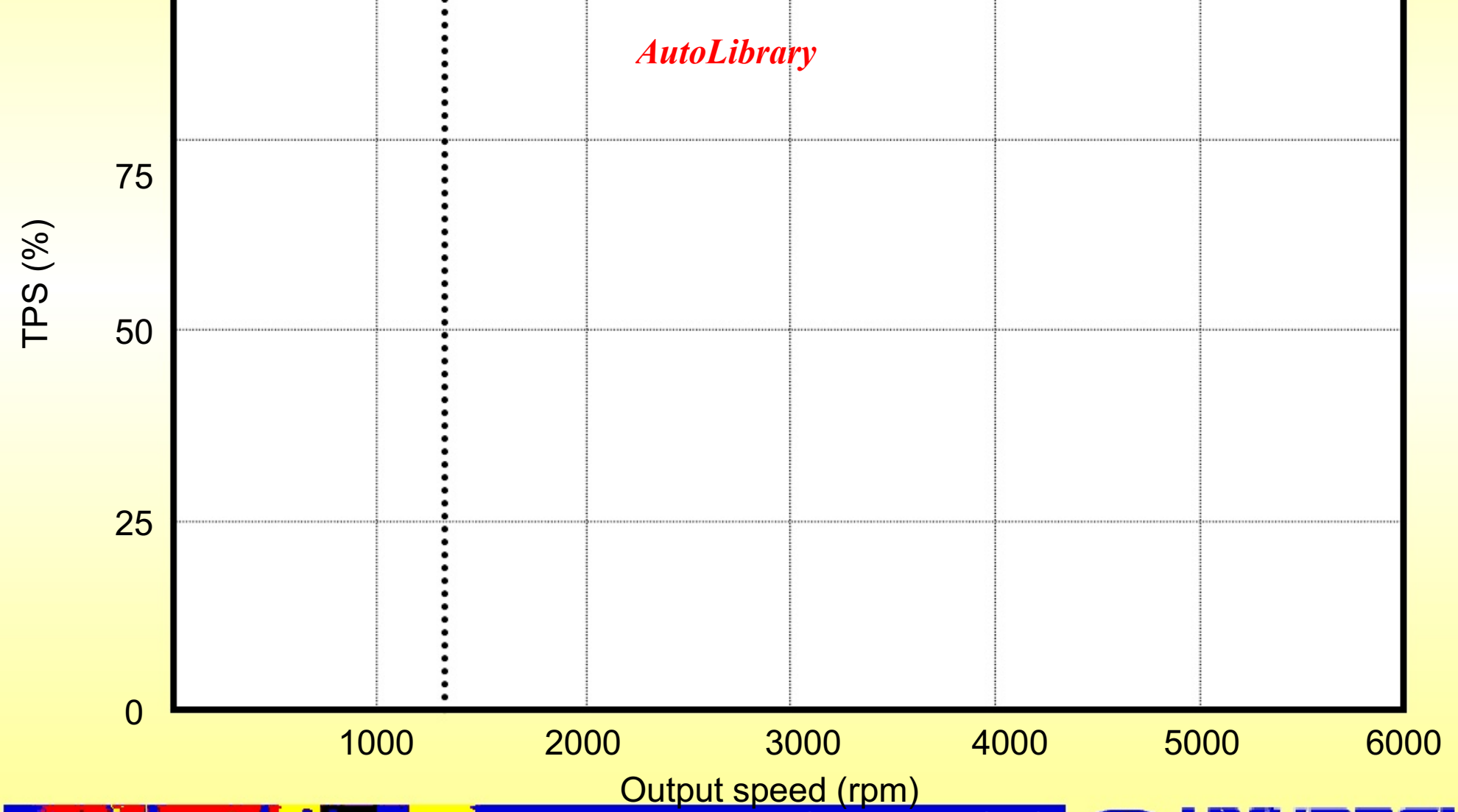




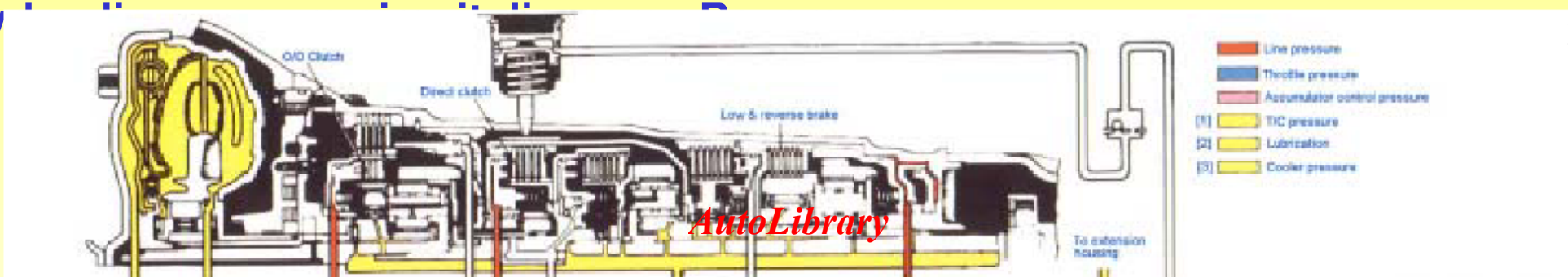

# SHIFT PATTERN

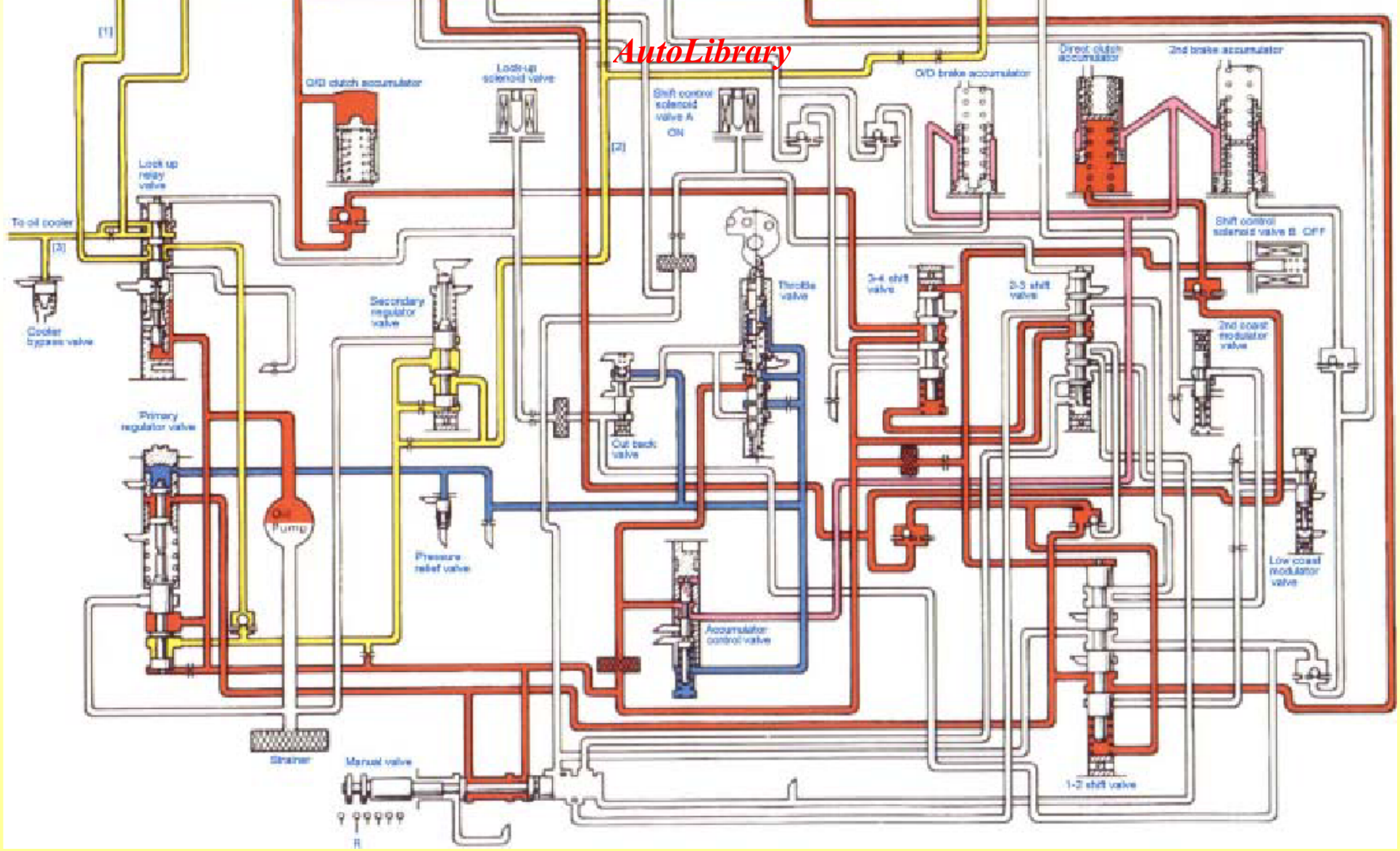
**HP 3.5 GSL L RANGE 4LOW MODE**







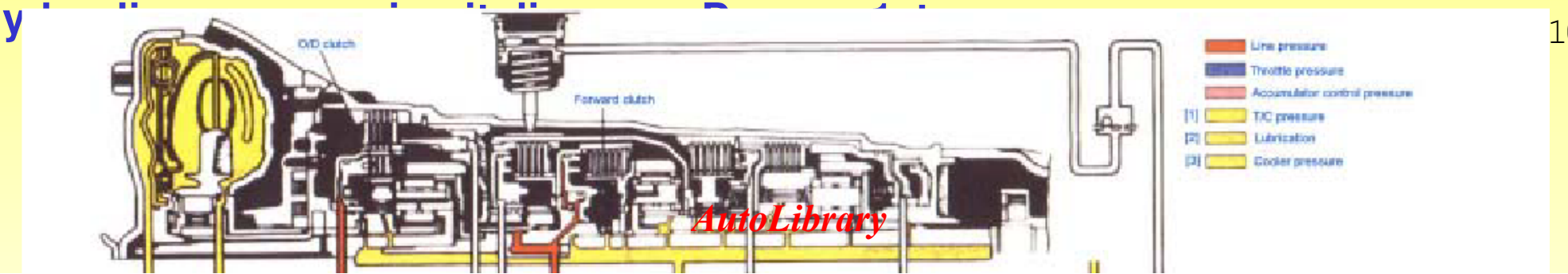



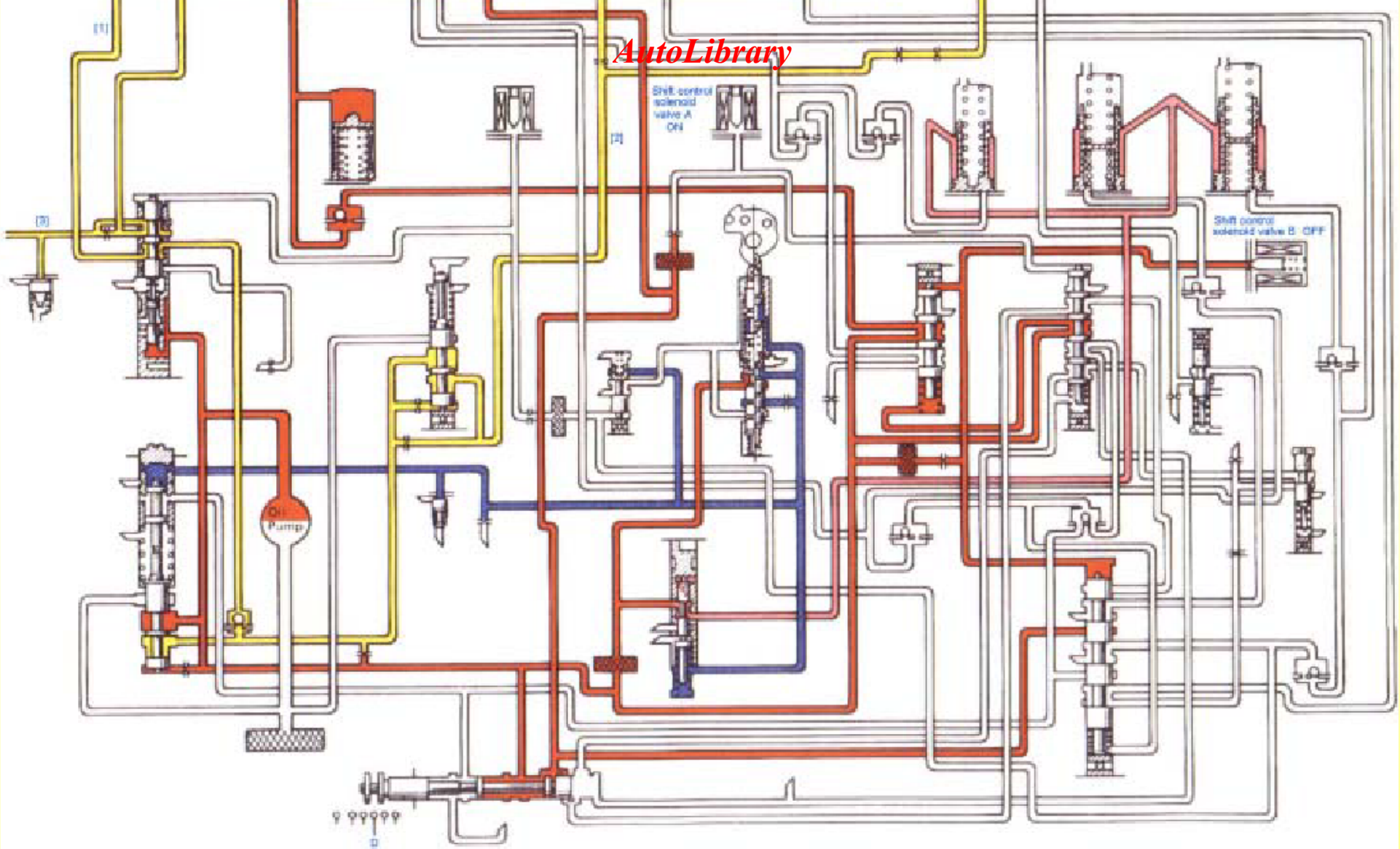



AW30-40LEi

## Hy



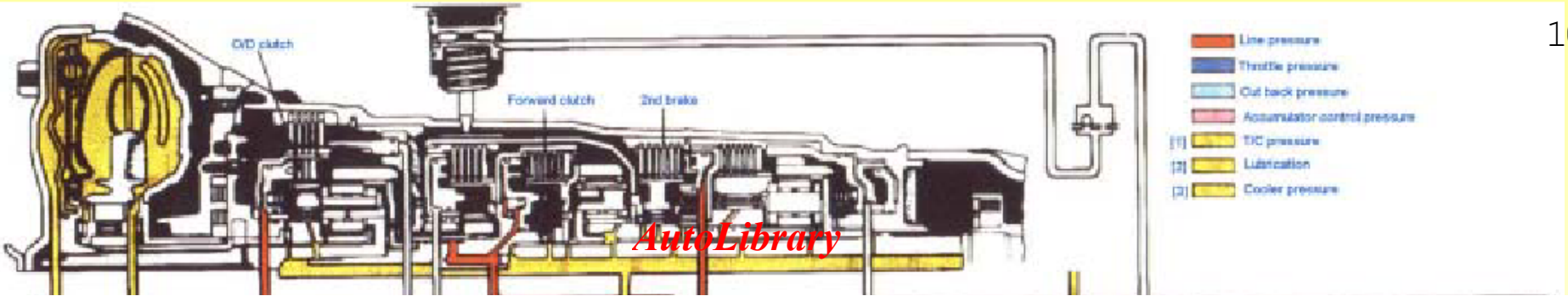


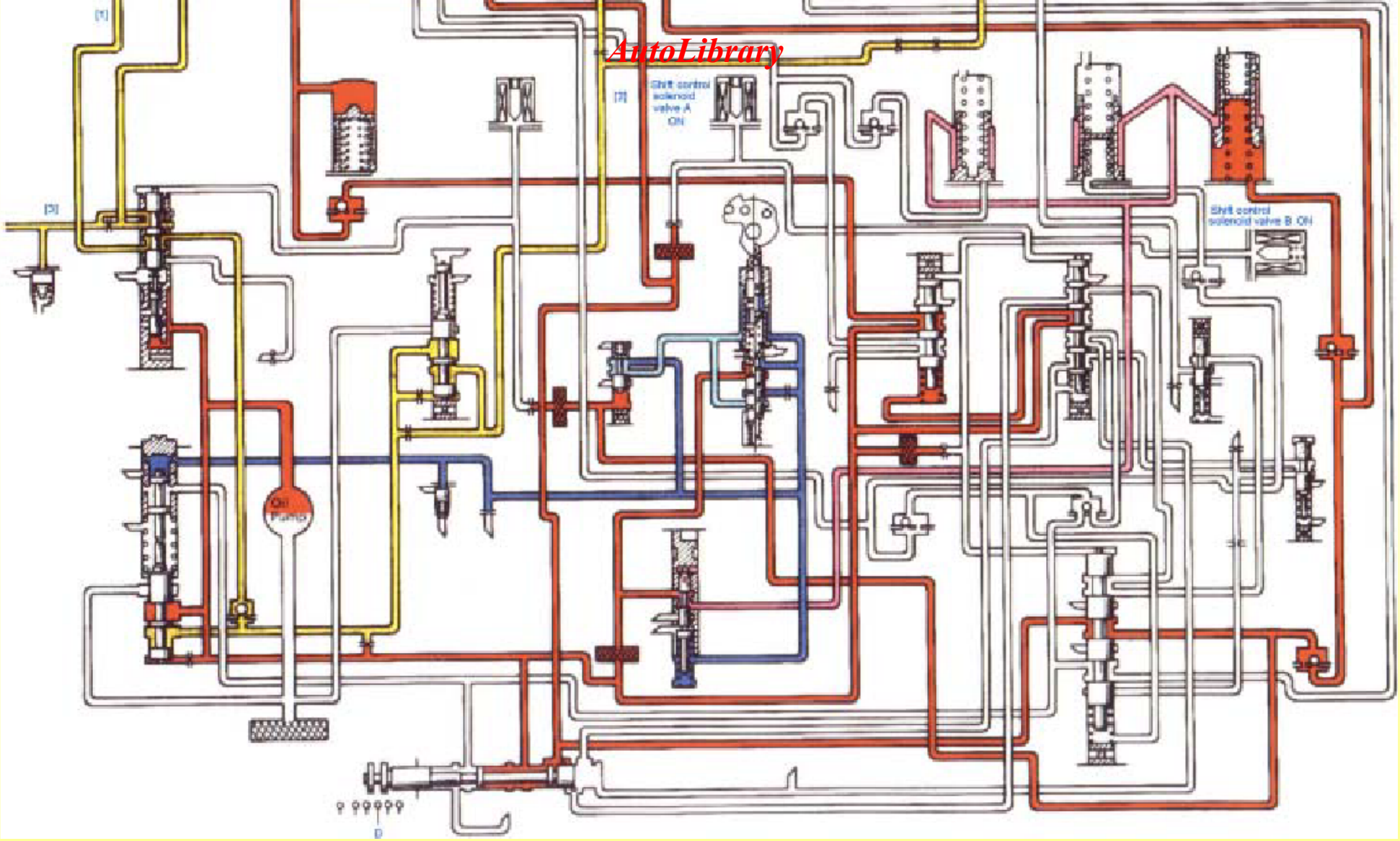



AW30-40LEi

Hy



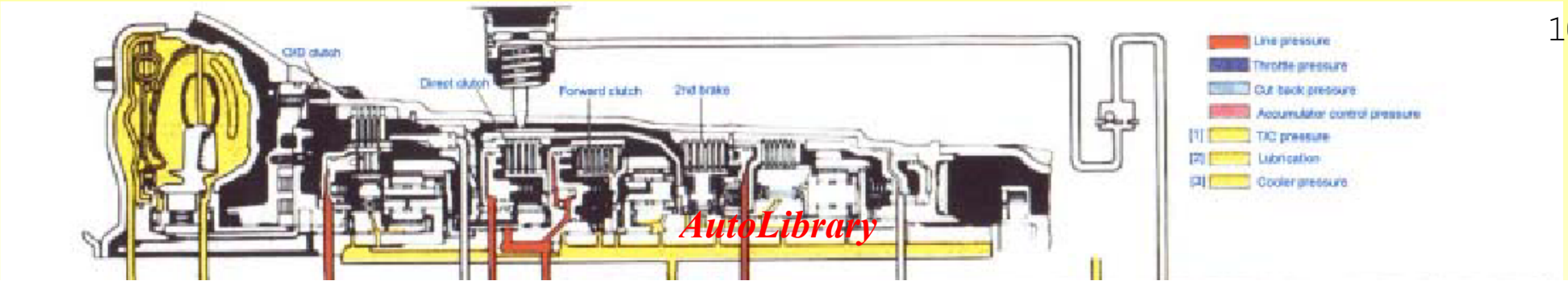


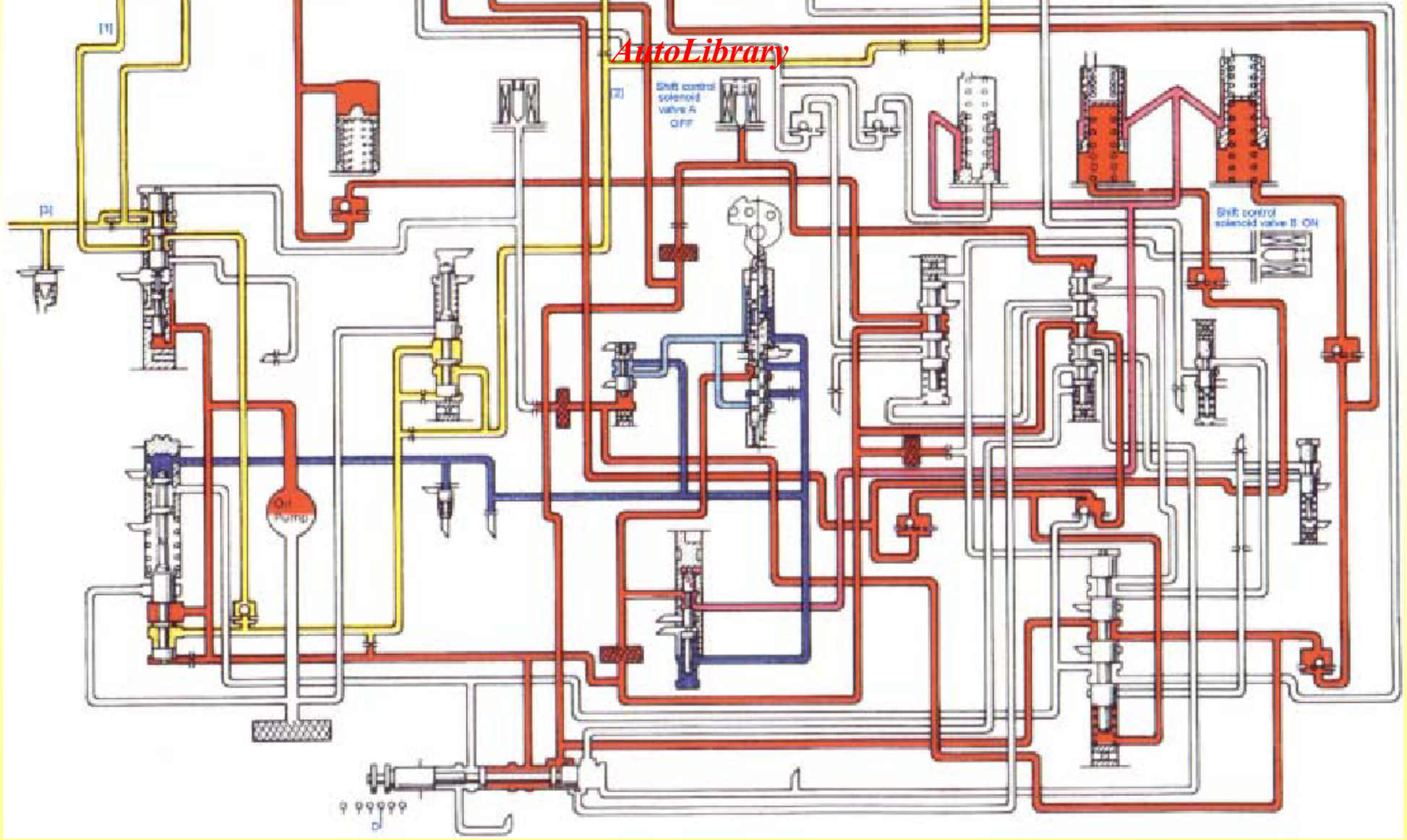



## Hydraulic pressure circuit diagram - D range 3rd gear

AW30-40LEi



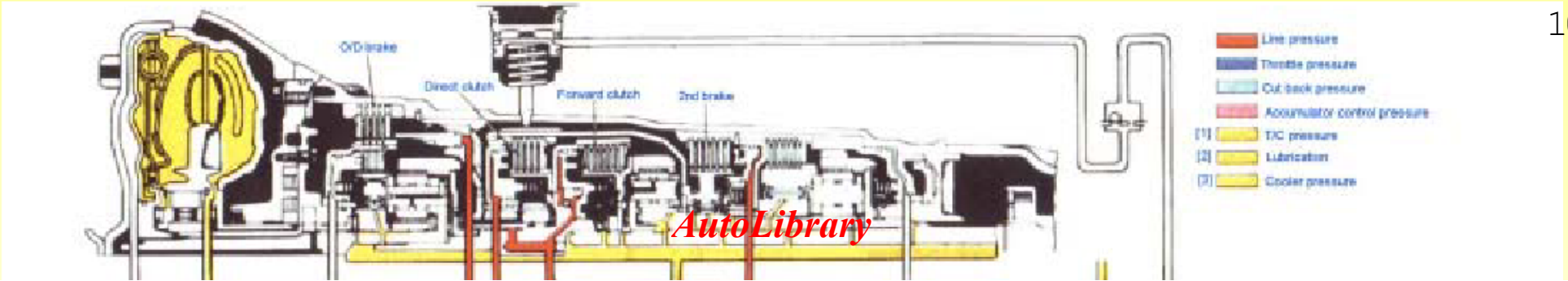


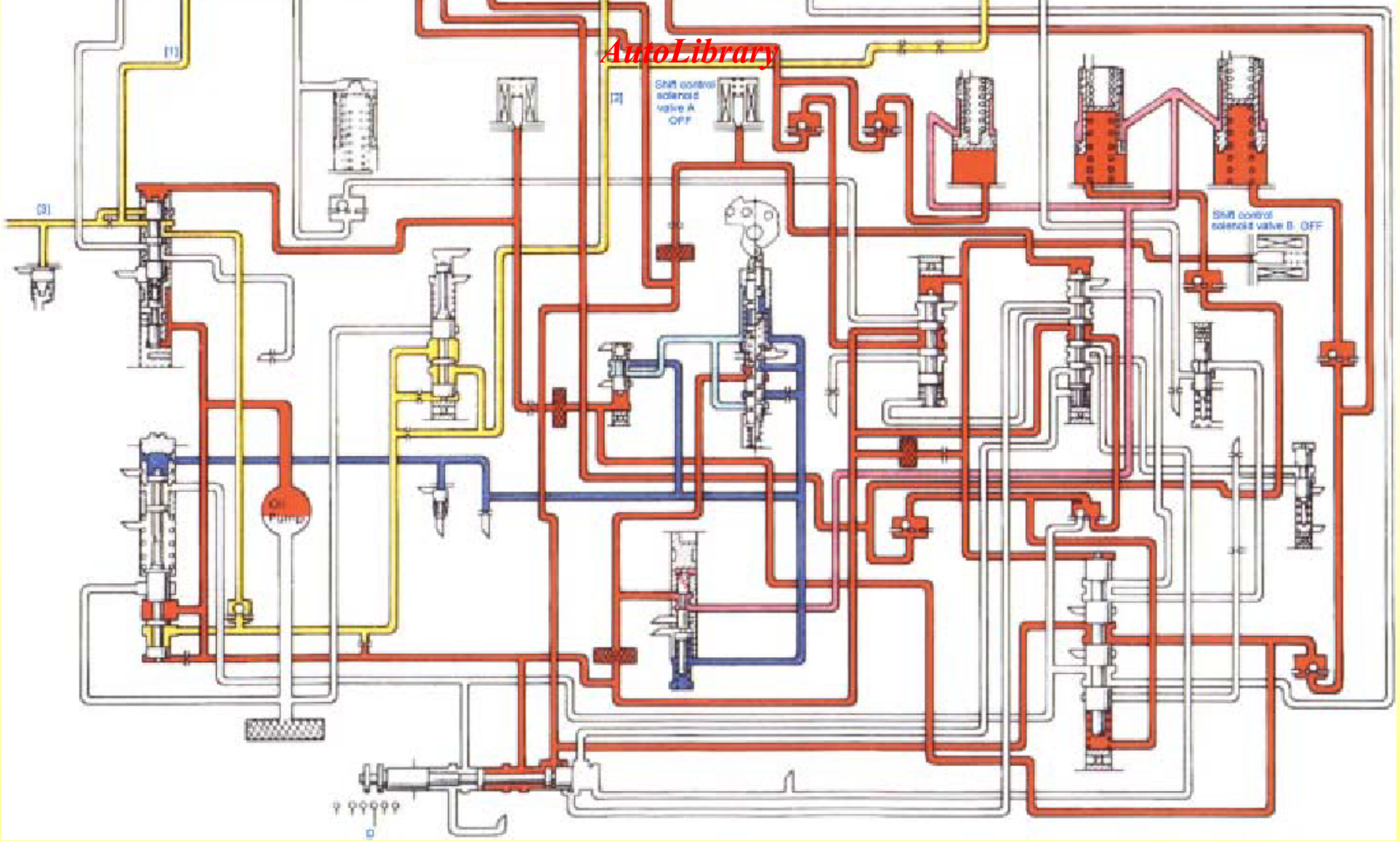



## Hydraulic pressure circuit diagram - D range 4th gear

AW30-40LEi



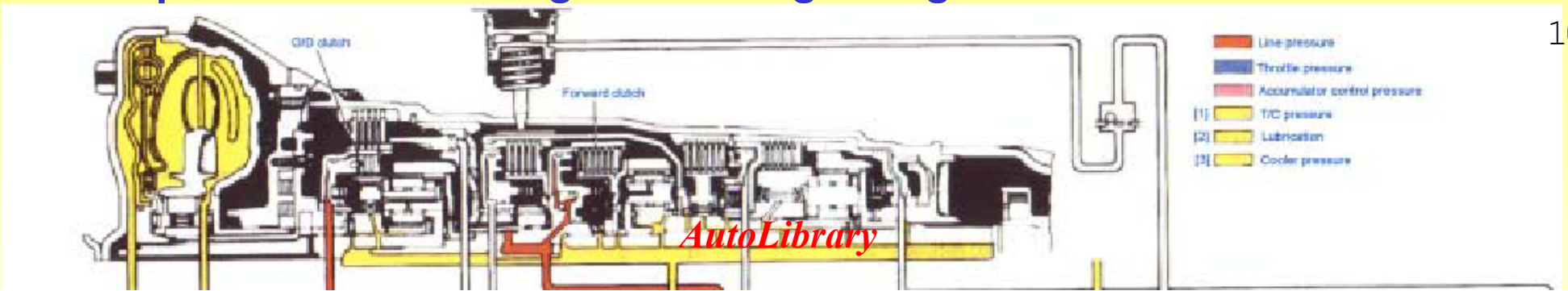


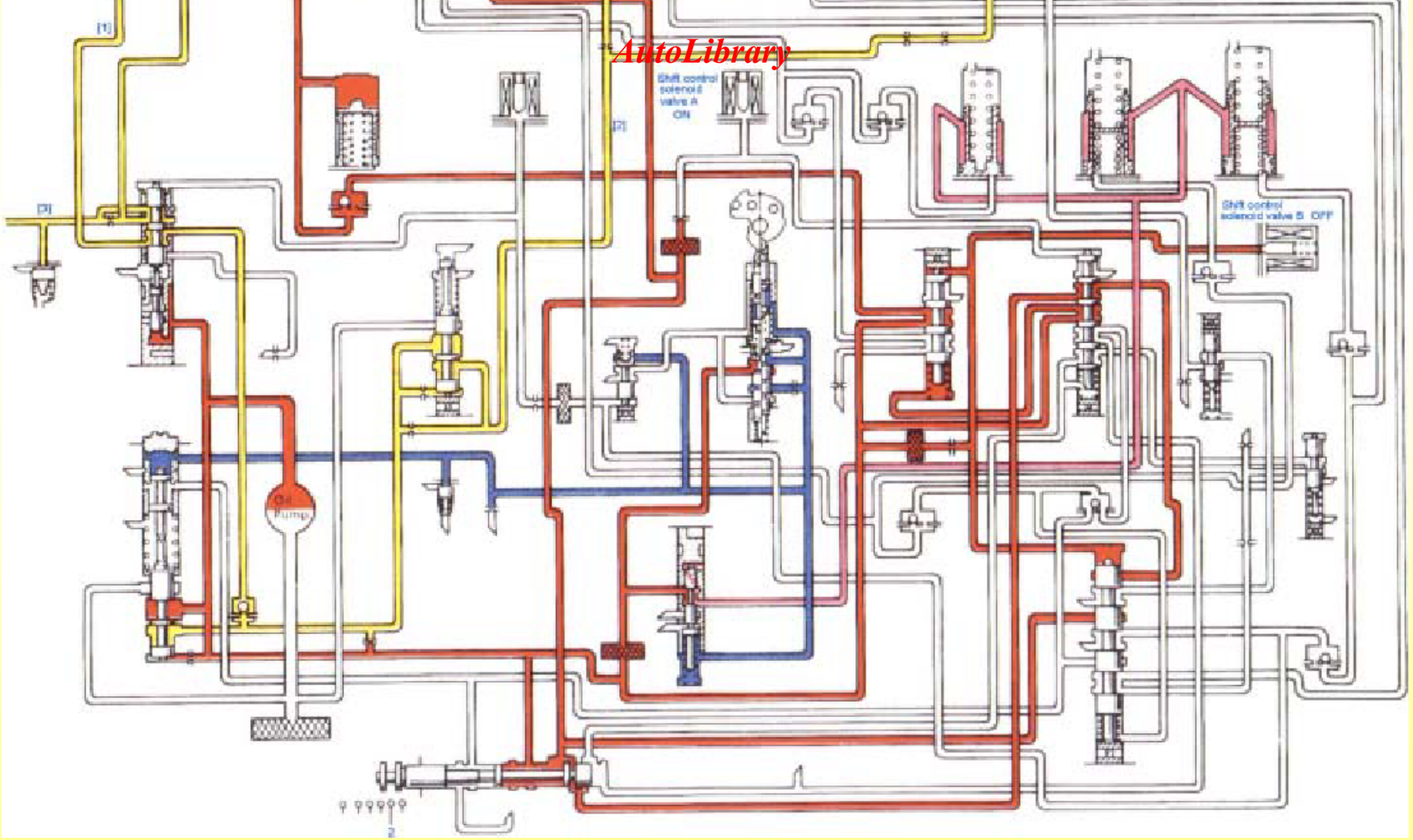



## Hydraulic pressure circuit diagram - 2 range 1st gear

AW30-40LEi



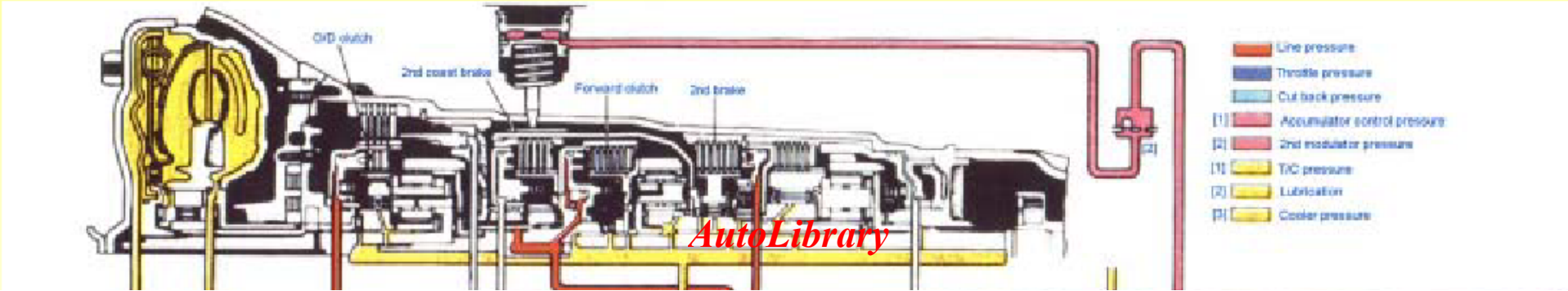


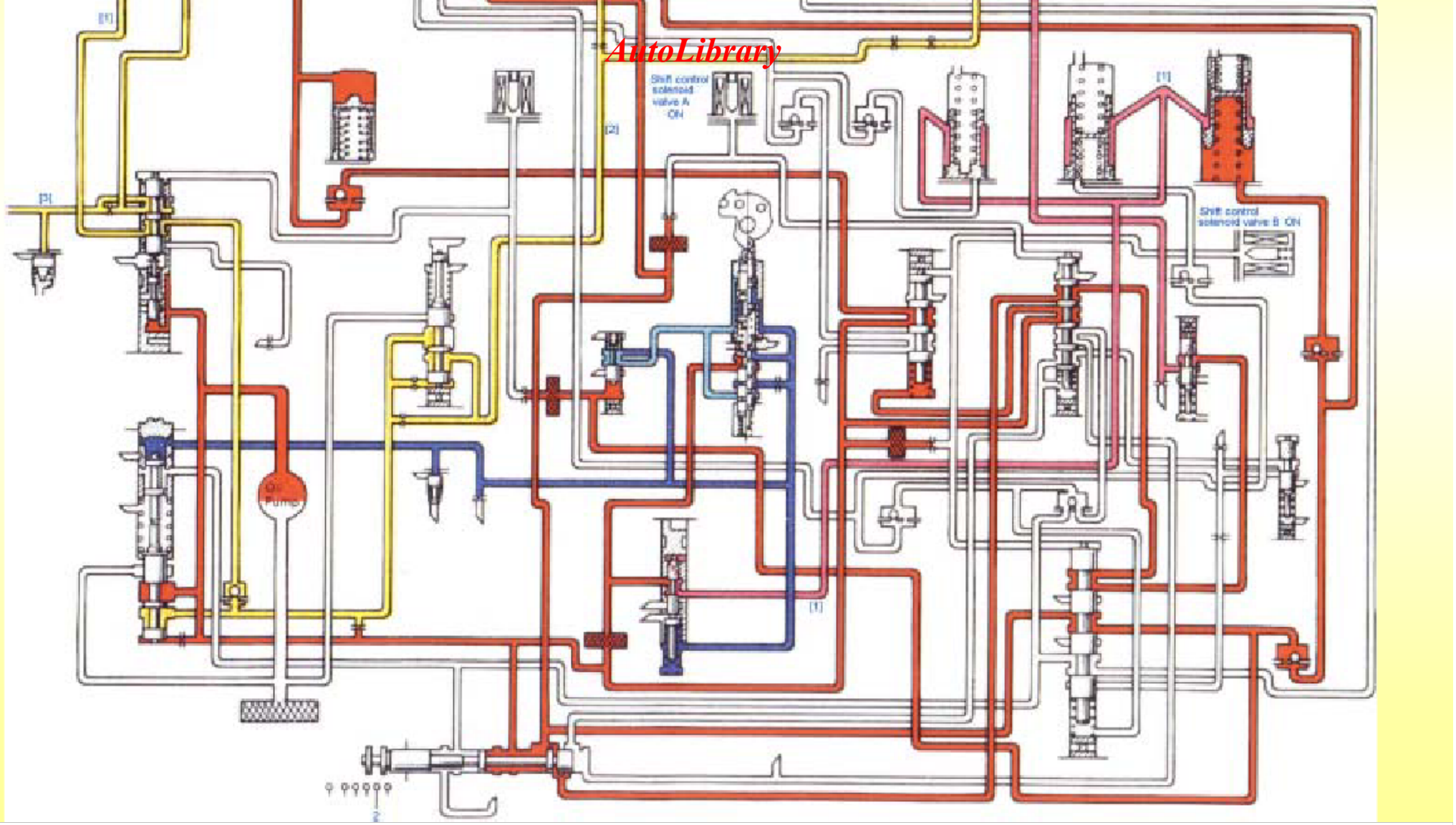



## Hydraulic pressure circuit diagram - 2 range 2nd gear

AW30-40LEi








# Hydraulic pressure circuit diagram - 2 range 3rd gear

## Hydraulic pressure circuit diagram - L range 1st gear

AW30-40LEi