

DSI M78 6-Speed A/T

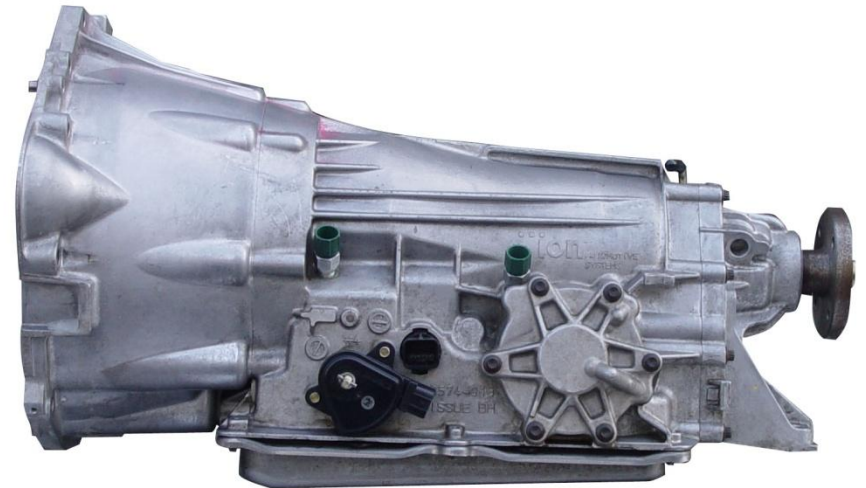
Overseas service team

Instructor : JH, Lee

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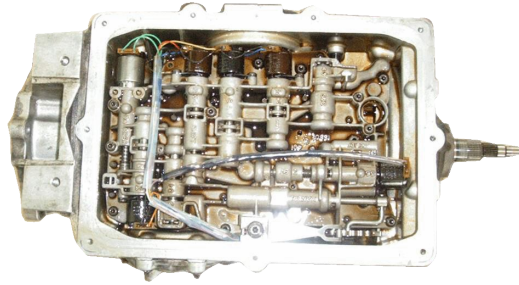
Tel : 82-31-610-2742

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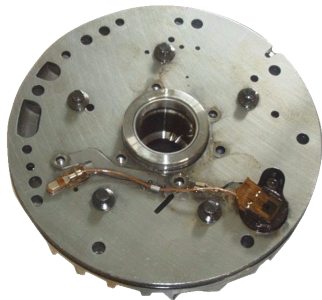
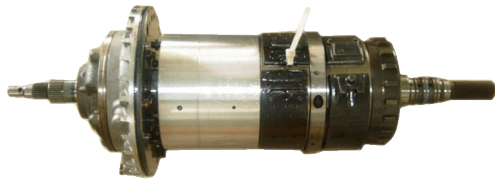


4-Speed vs 6-Speed

M74 4A/T



M78 6A/T



Advanced features for M78 A/T

Early down shift (shift skip) with hard braking

**Gear holding when uphill/downhill
(No up shifting when release the accel.pedal)**

**Up shifting prevention with fast off accel.pedal
To reduce busyness in sporty driving**

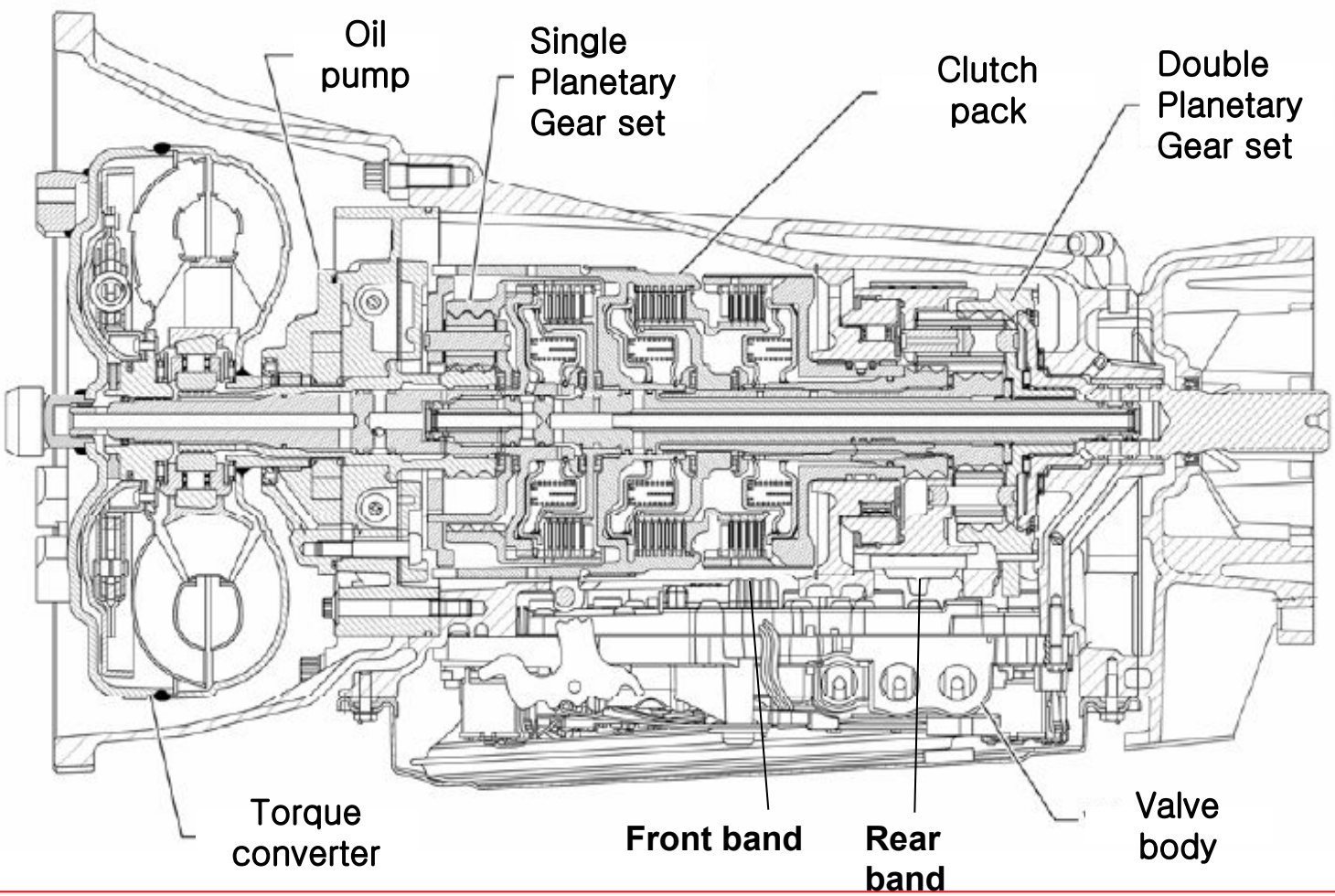
**Drive and Reverse engagement (~2.2s)
(No reverse shifting over 1,400rpm , TPS 12% , 10Km/h)**

T/Converter lock up clutch (Variable pressure control)

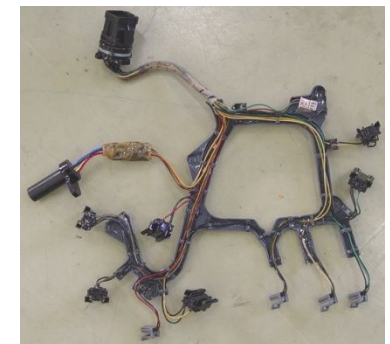
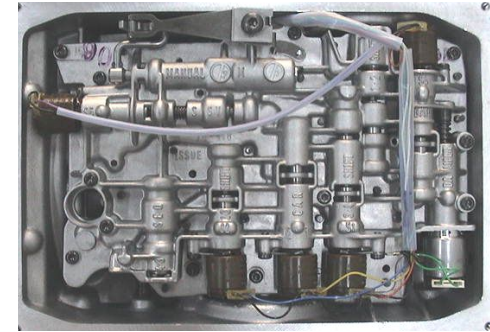
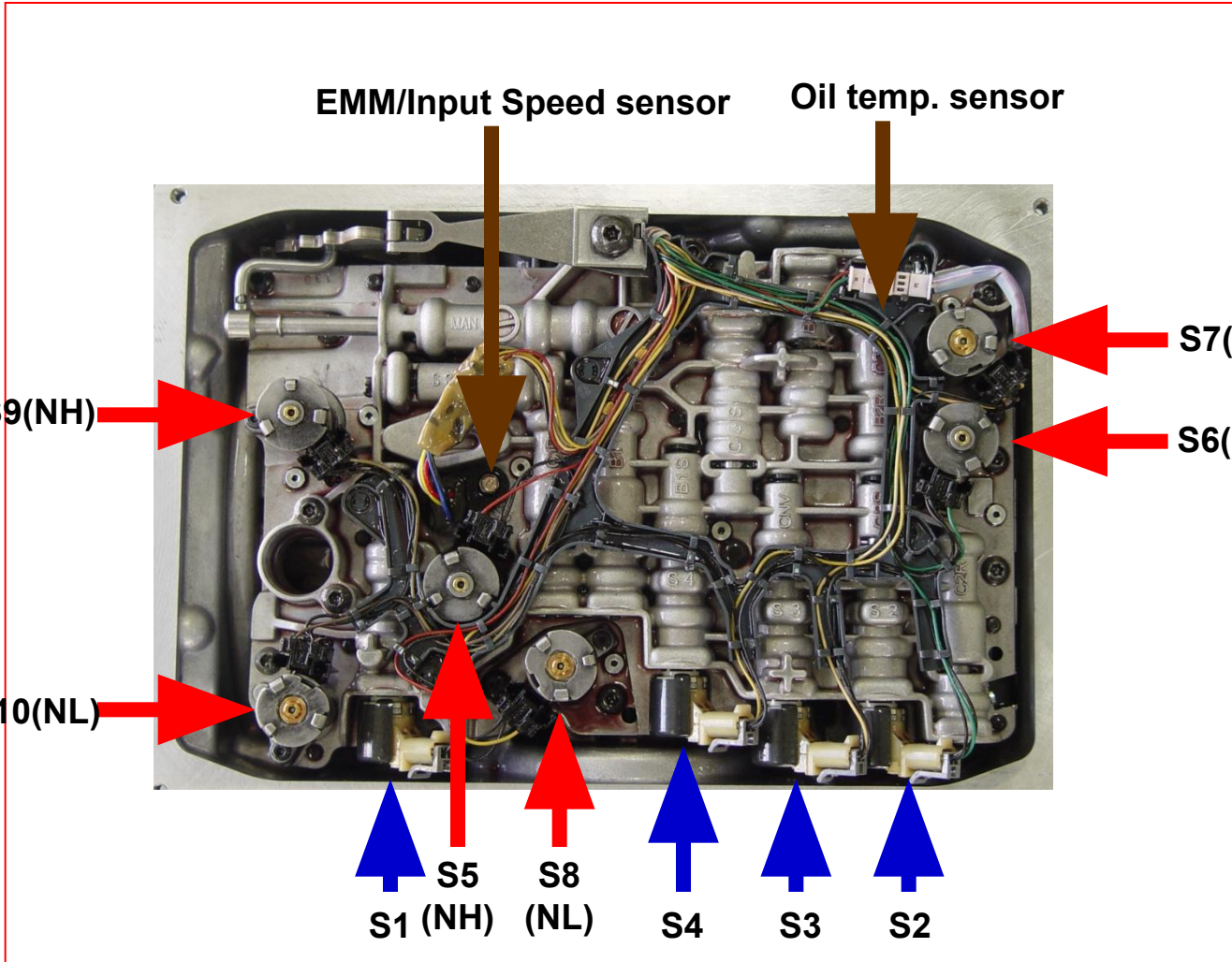
Embedded Memory Module (EMM)

Advanced cooling system (ATF)

Components

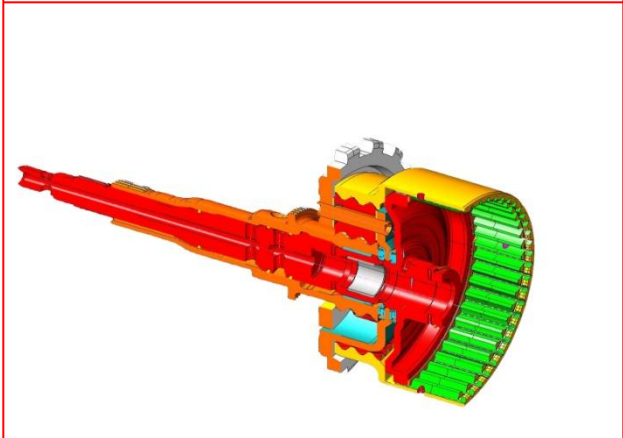
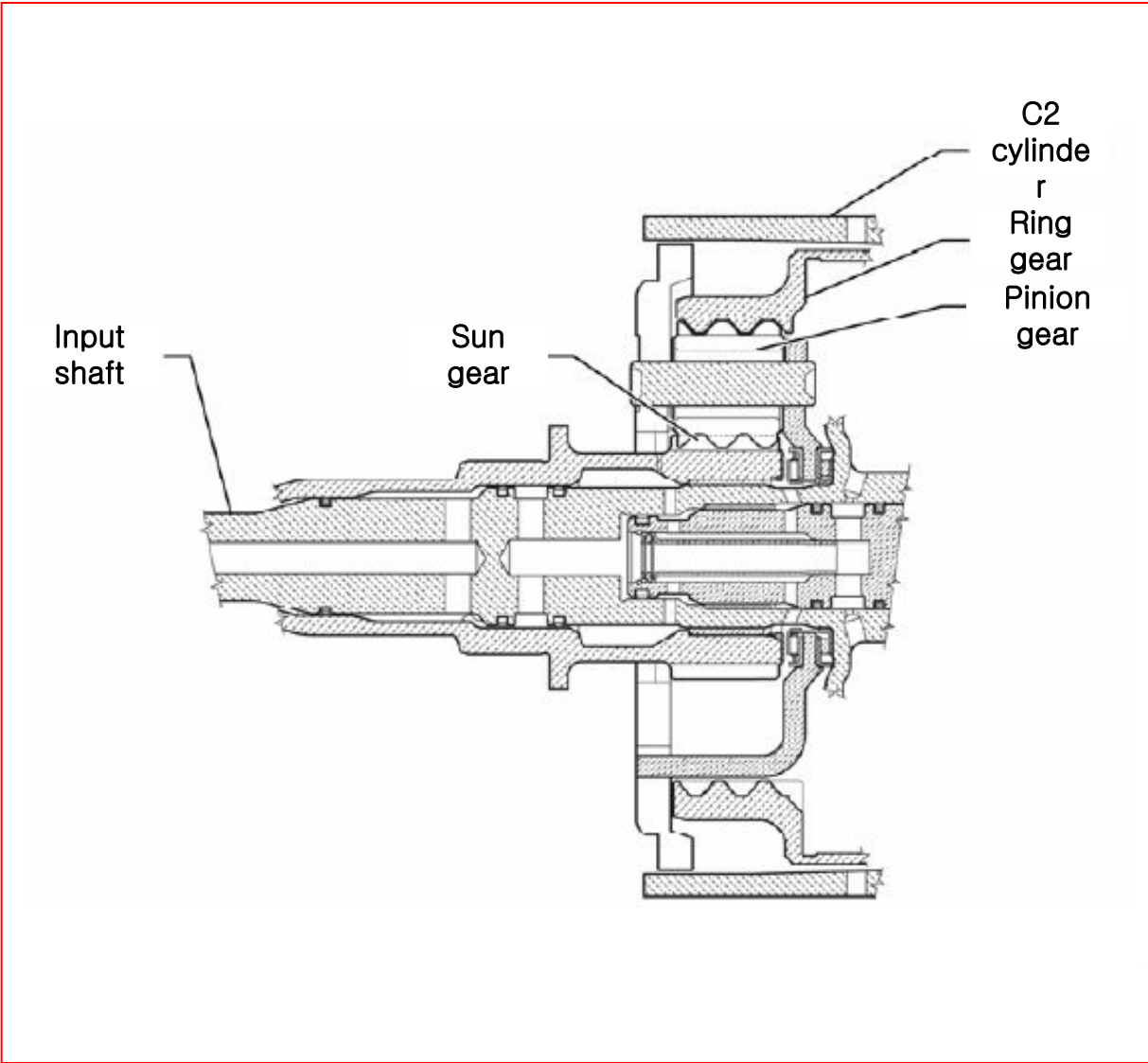


Valve body

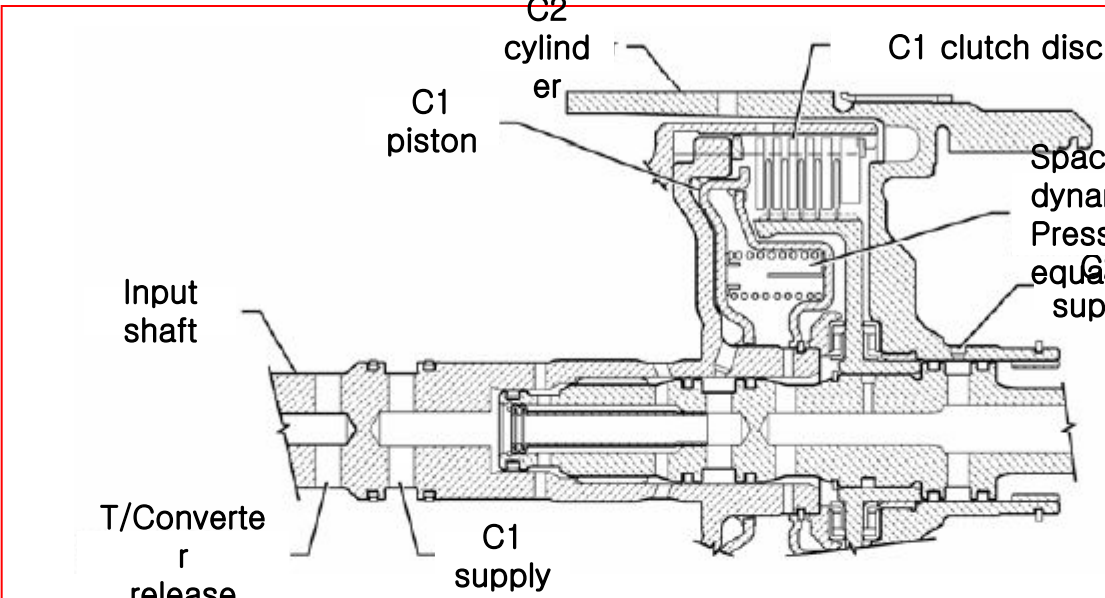


Valve body

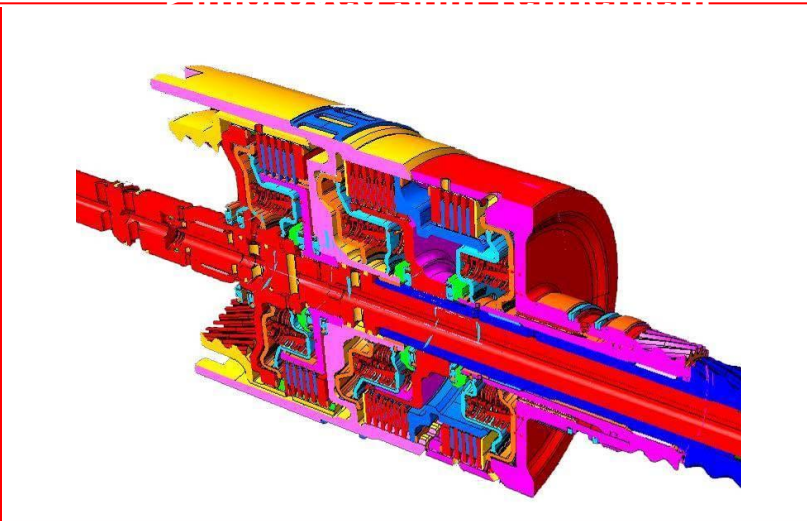
Single planetary gear set



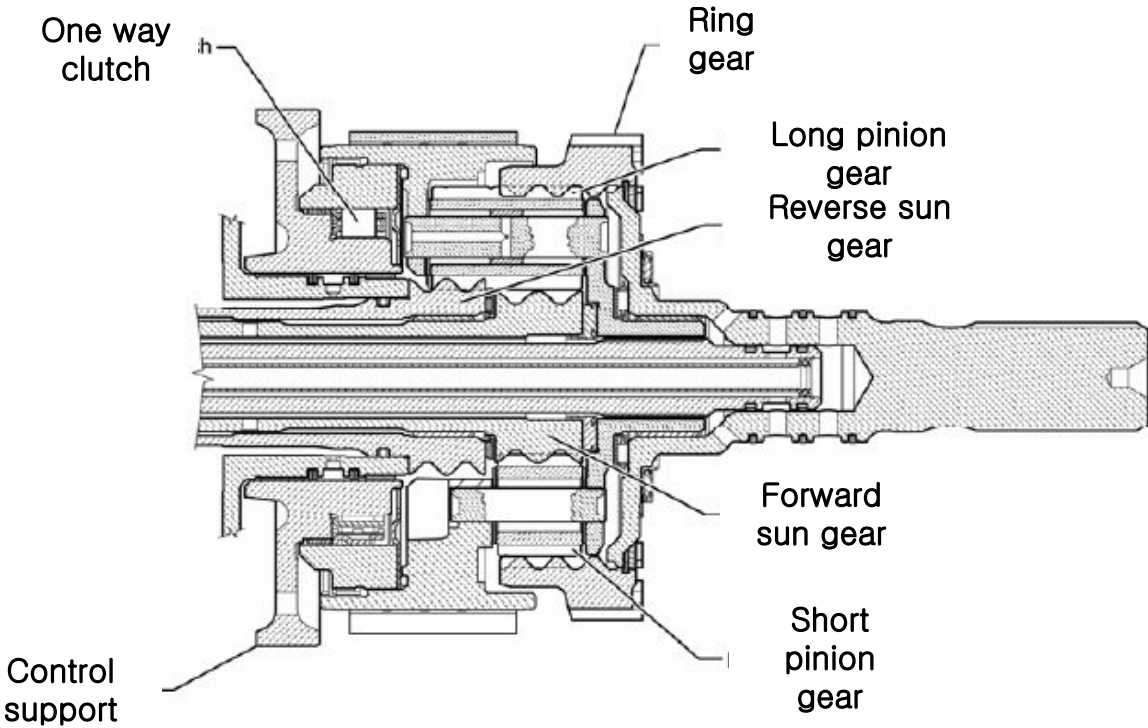
Clutch pack



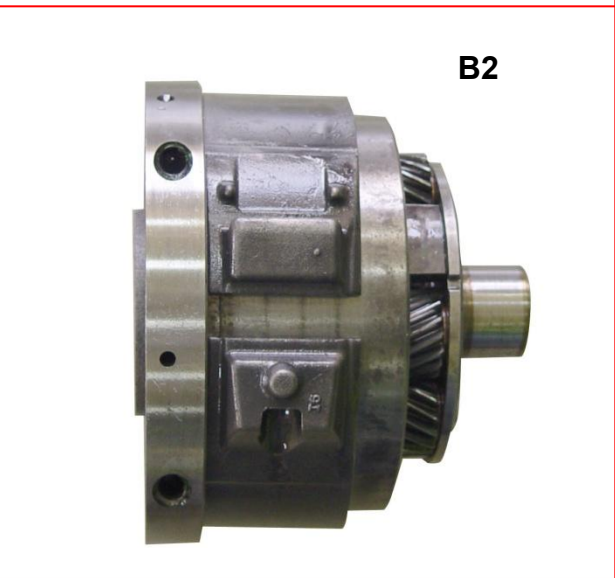
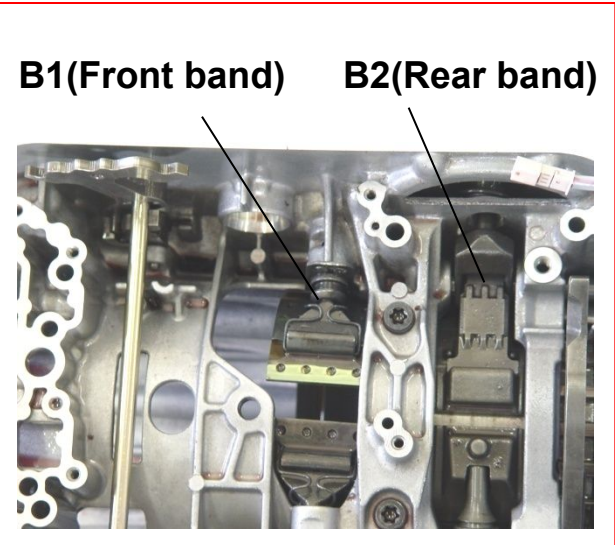
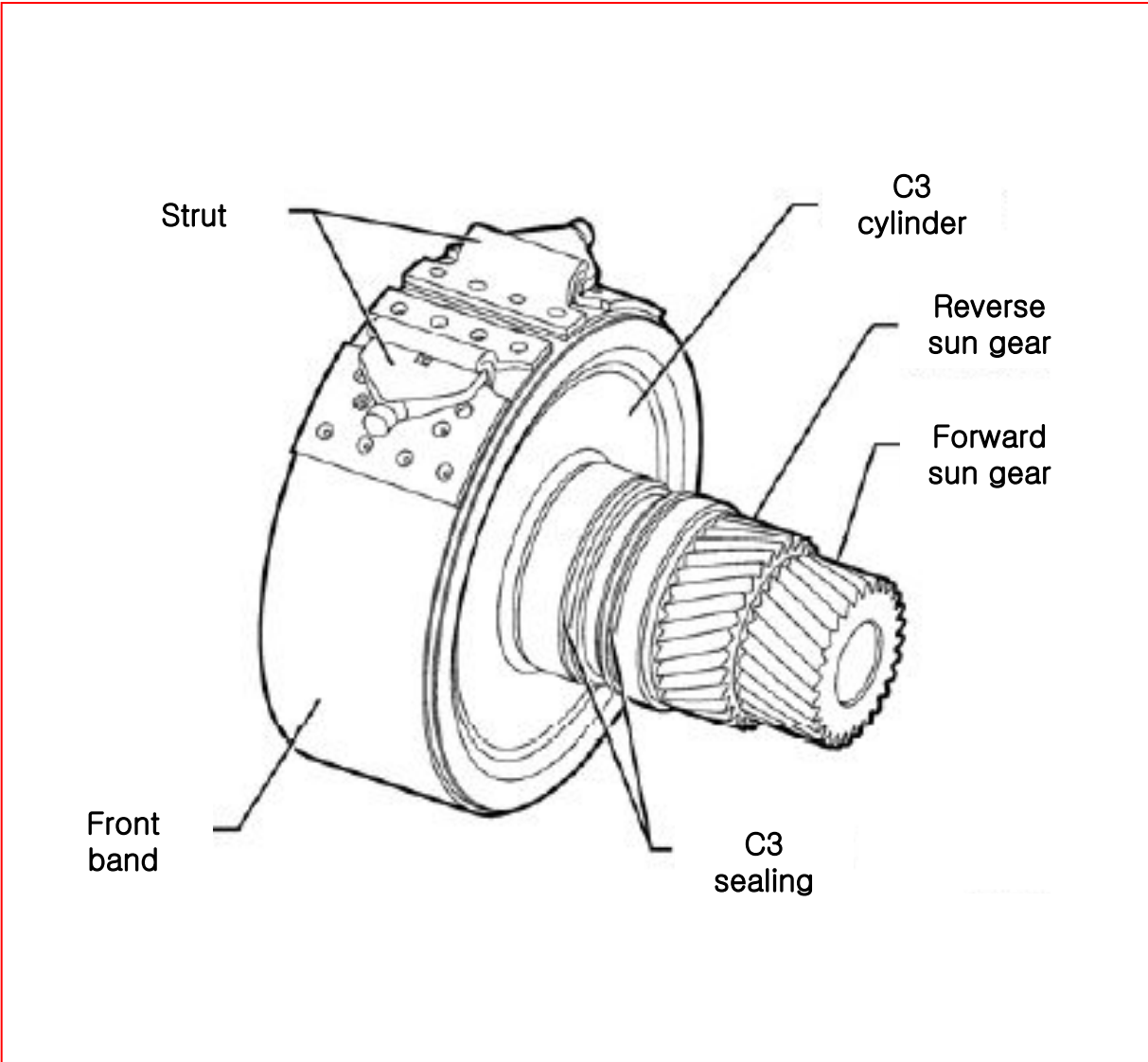
***Dynamic pressure equalization**
->Reliable clutch engagement and release
>Improved shift refinement



Double planetary gear set



Brake band



Clutch pack / Brake band (M74)

Clutch pack

C1 O/D(3rd, 4th)

C2 Forward

C3 Reverse

C4 Engine braking
(M1,M2,M3)

Brake band

B1 2nd, 4th

B2 P/R/N/M1

Clutch disc pack / Brake band(M78)

Clutch pack

C1 Rear planetary gear carrier (4th, 5th, 6th)

C2 Forward sun gear (M1, 1st, 2nd, 3rd, 4th)

C3 Reverse sun gear (3rd, 5th, Reverse)

Brake band

B1 Hold reverse sun gear (2nd, 6th)

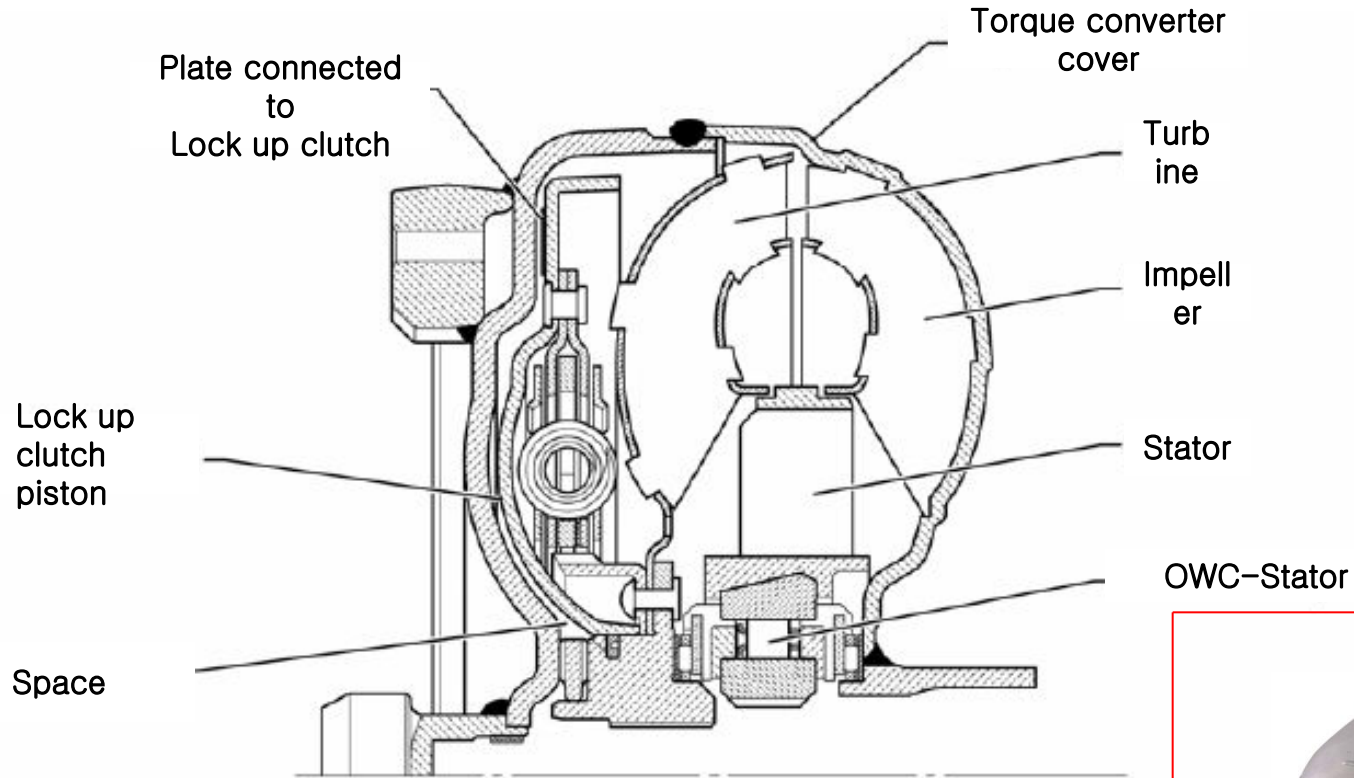
B2 Hold rear planetary gear carrier (M1, Reverse)



Shifting components

Gear	Gear ratio	Operating components (Clutch & Brake band)						Shift On/Off Solenoid valve				Variable Bleeding Solenoid Valve-VBS					
		C1	C2	C3	B1	B2	1-2 OWC	S1	S2	S3	S4	S5 (A)	S6 (A)	S7 (A)	S8 (A)	S9 (A)	S10 (A)
M1	3.536		ON			ON		ON				1	0	1			
1st	3.536		ON				ON	ON				1	0			0-1	
2nd	2.143		ON		ON			ON			ON	1	0		1	0-1	
3rd	1.478		ON	ON				ON		ON		1	0	1		0-1	
4th	1.156	ON	ON									0	0			0-1	
5th	0.866	ON		ON					ON	ON		0	1	1		0-1	
6th	0.677	ON			ON				ON		ON	0	1		1	0-1	
Reverse	-3.094			ON		ON		ON	ON	ON		1	1	1		0-1	

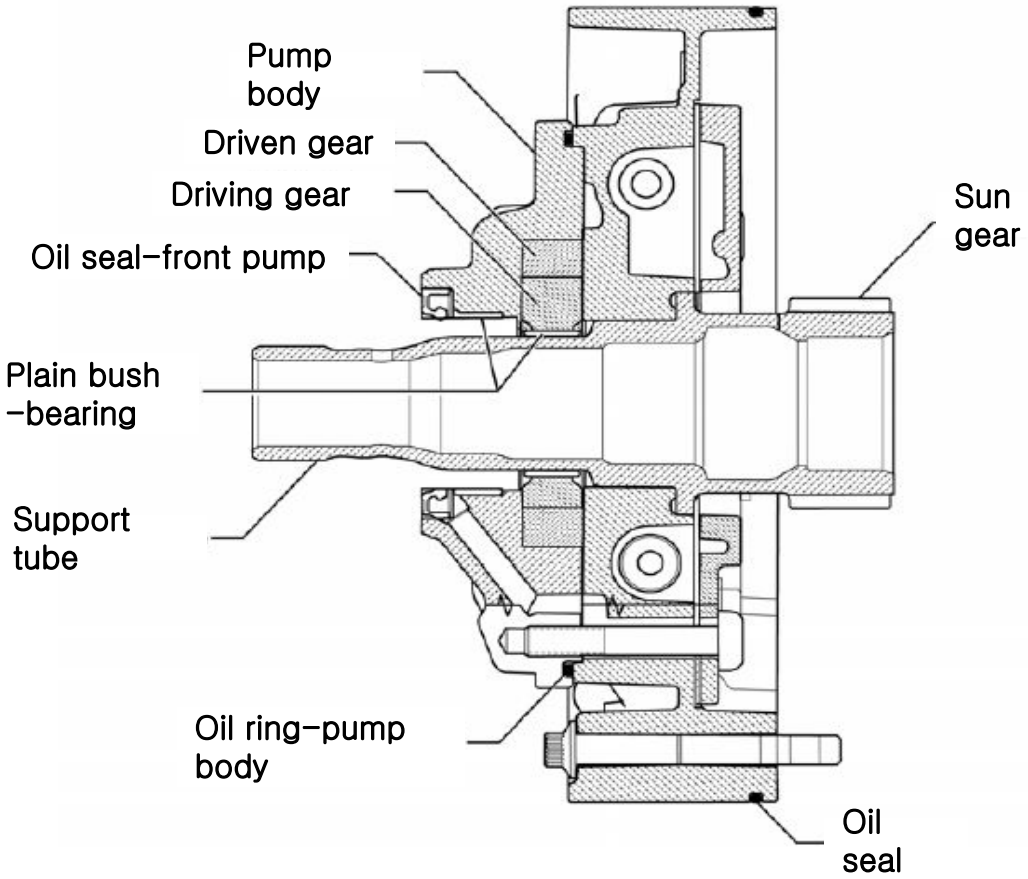
Torque converter



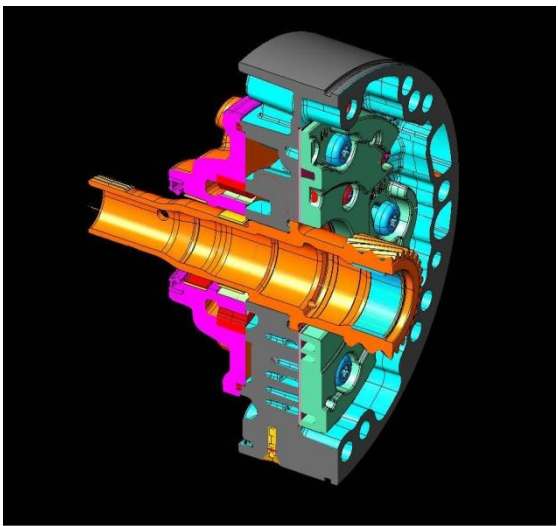
VBS : Solenoid S10



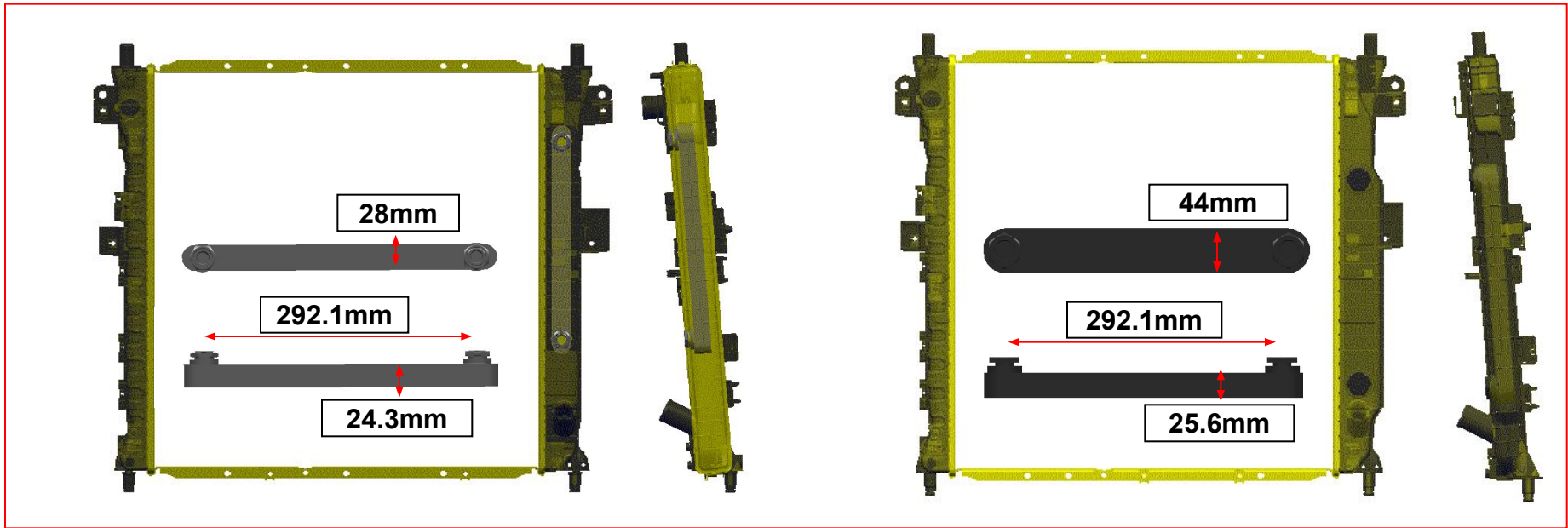
Oil pump



**17.6cc / revolution
(Sun gear)**

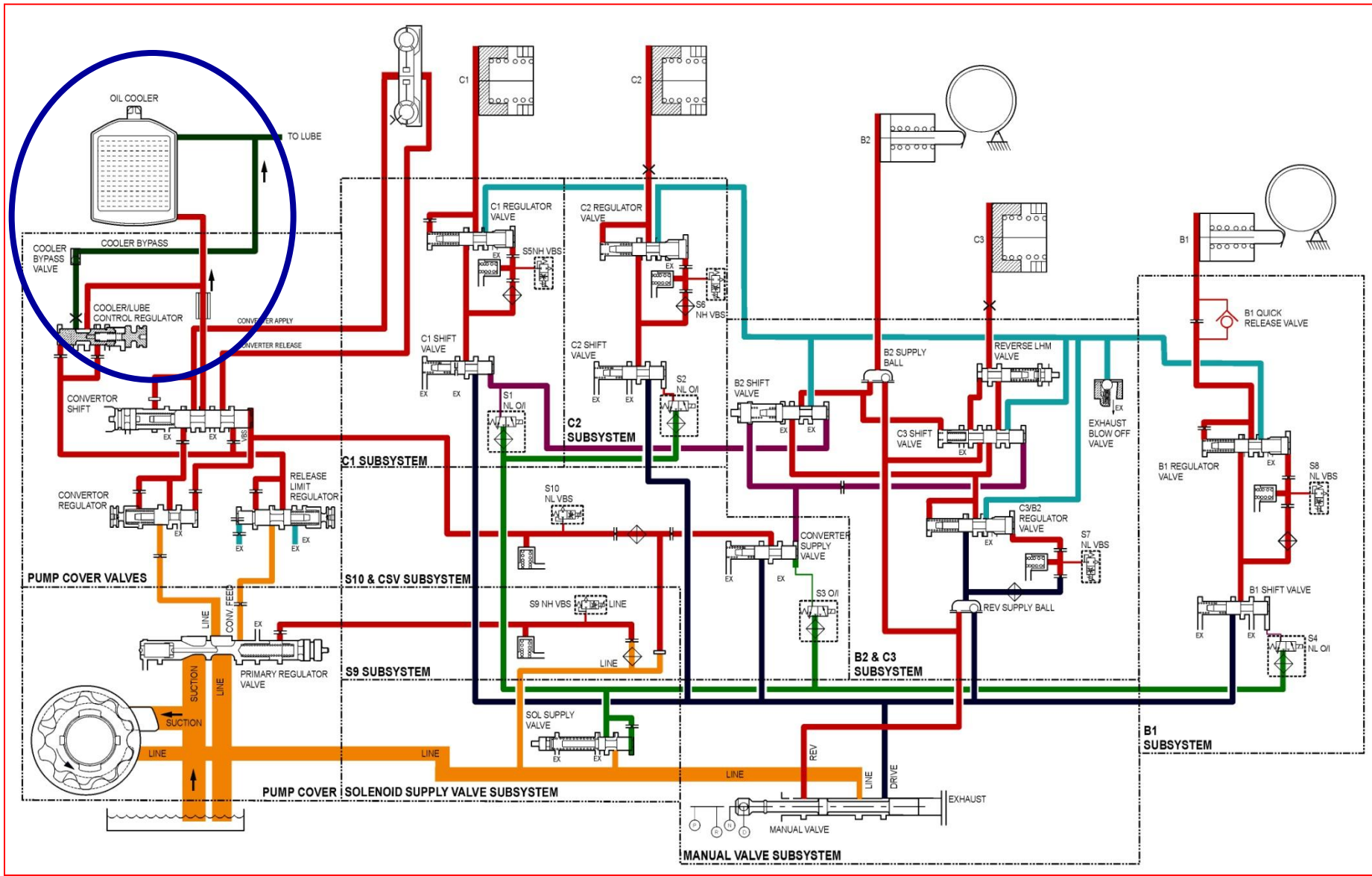


Oil cooler



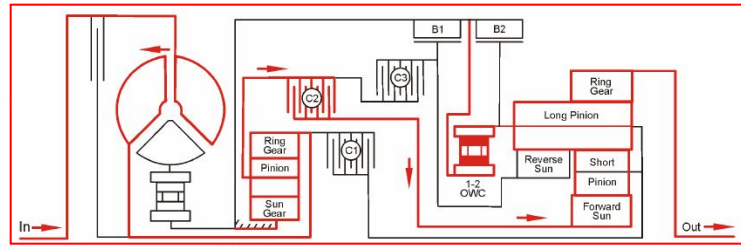
Items	Unit	Actyon	A/Sports
Heat radiation	kcal/hr (kW)	Max3.100 -10% (3.6 -10%)	Max.3850 -10% (4.49 -10%)
Oil Prss. Drop	kg/cm ² (kPa)	Min.0.6 + 10% (58.8 + 10%)	Min.0.72 +10% (70 +10%)
Weight	g	Dry : 191 With oil : 266	Dry : 331 With oil : 397

Hydraulic circuit

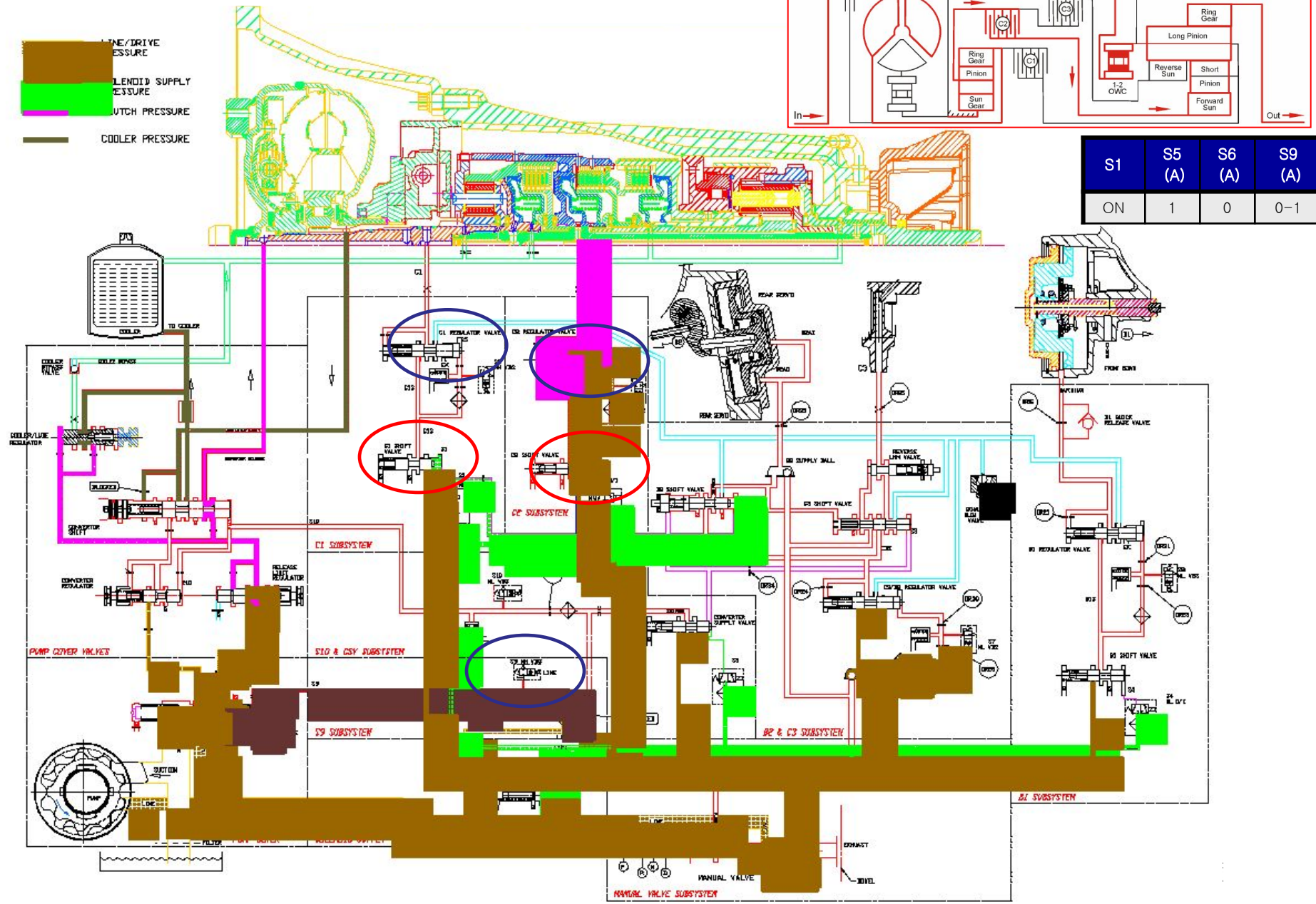


1st - 3.53:1 (C2 & OWC)

LINE/DRIVE PRESSURE
 BLEND/D SUPPLY PRESSURE
 BUTCH PRESSURE
 COOLER PRESSURE

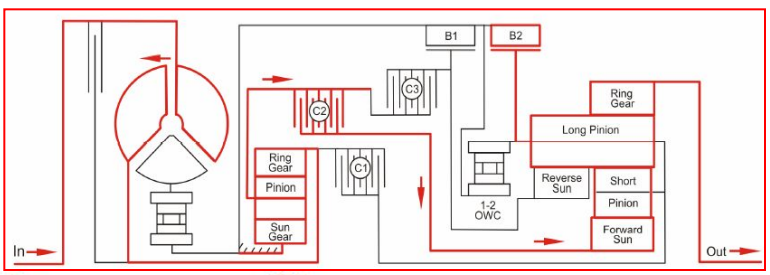


S1	S5 (A)	S6 (A)	S9 (A)
ON	1	0	0-1

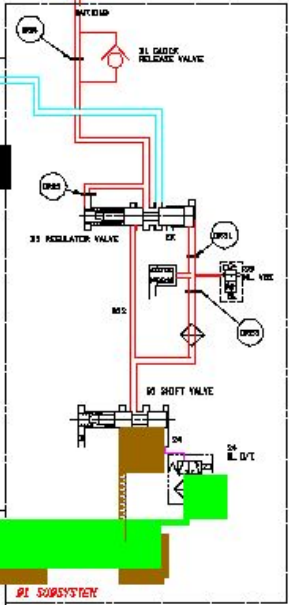
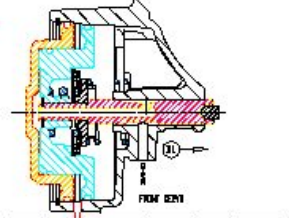
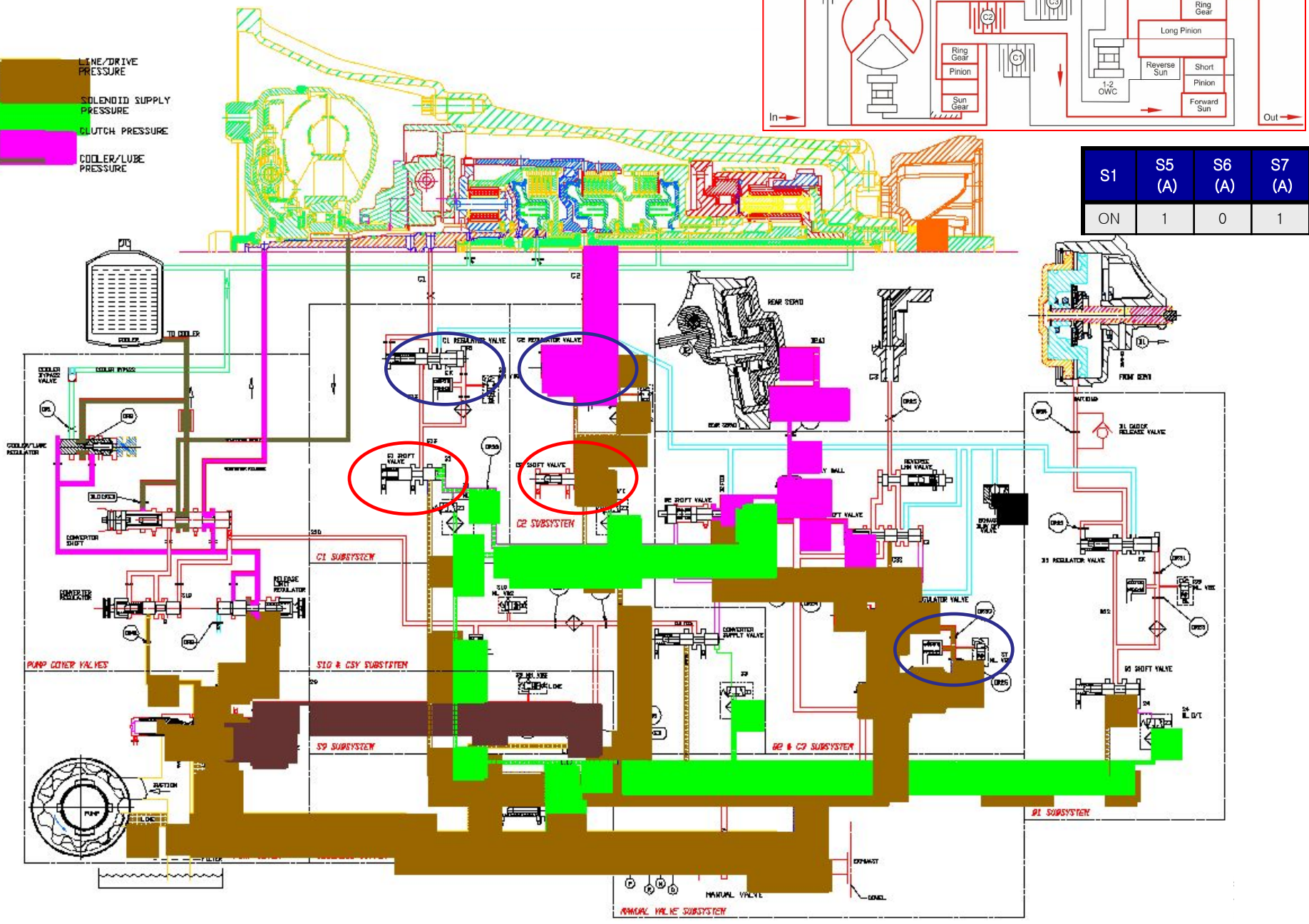


M 1st – 3.53:1(C2 & B2)

LINE/DRIVE PRESSURE
 SOLENOID SUPPLY PRESSURE
 CLUTCH PRESSURE
 COOLER/LUBE PRESSURE



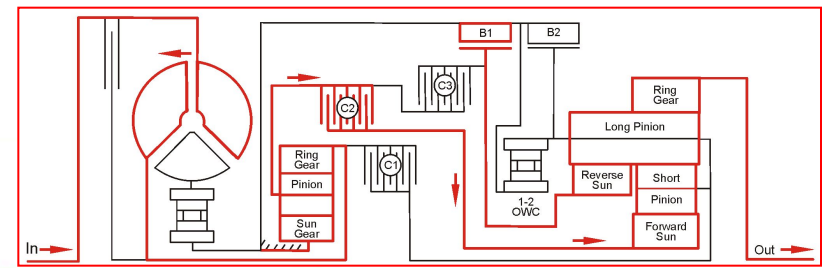
S1	S5 (A)	S6 (A)	S7 (A)
ON	1	0	1



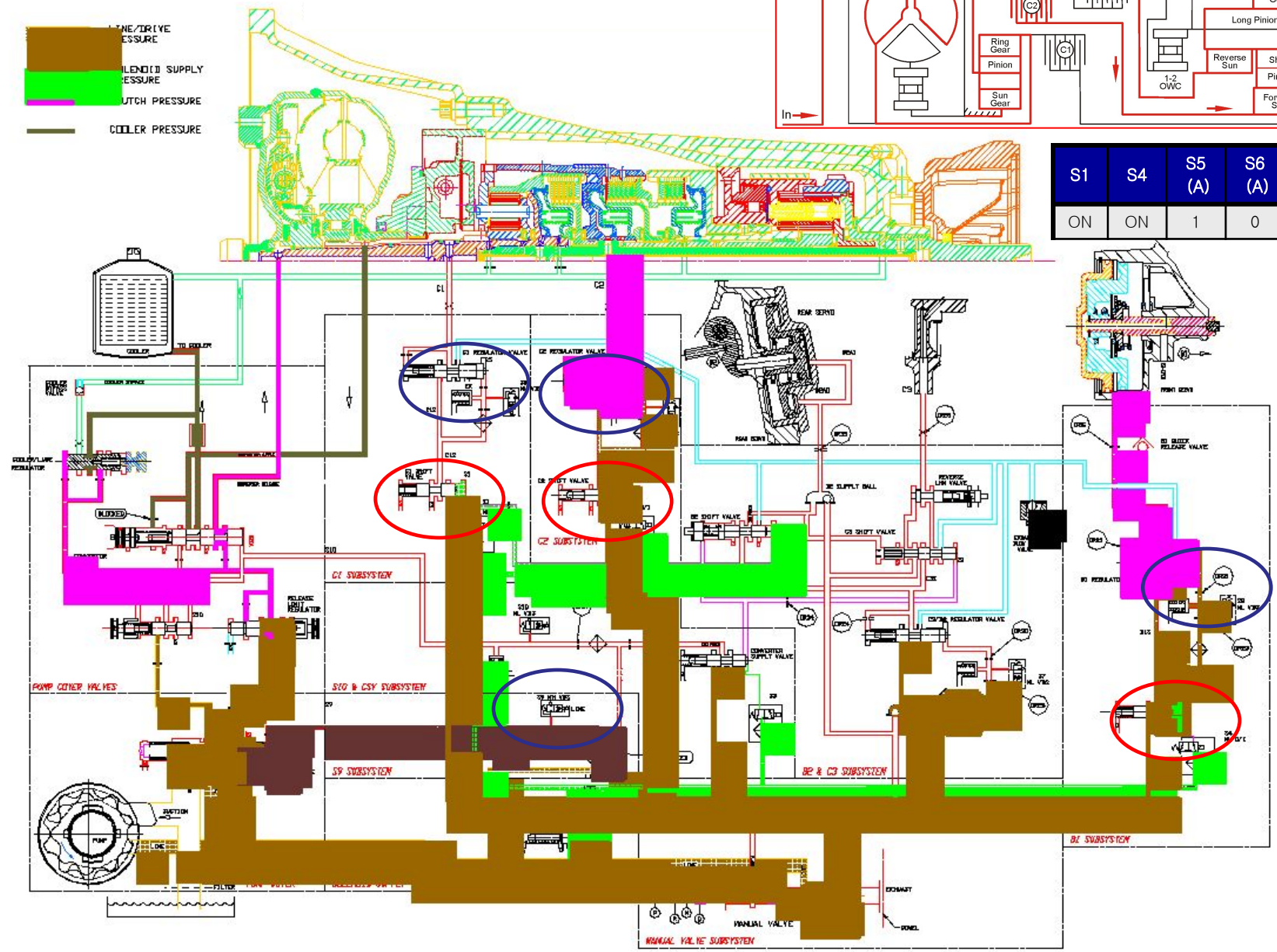
MANUAL VALVE SUBSYSTEM
 EXHAUST
 LEVEL

2nd – 2.14:1(C2 & B1)

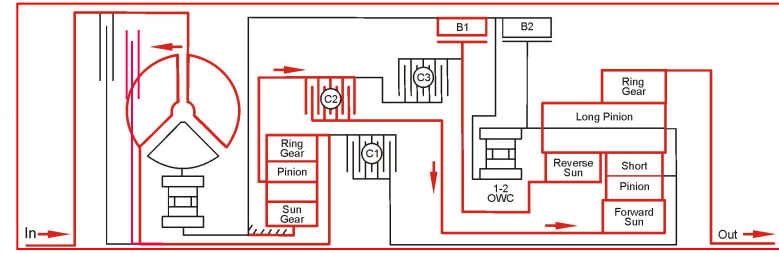
 LINE/DRIVE PRESSURE
 BLEND/D SUPPLY PRESSURE
 BUTCH PRESSURE
 COOLER PRESSURE



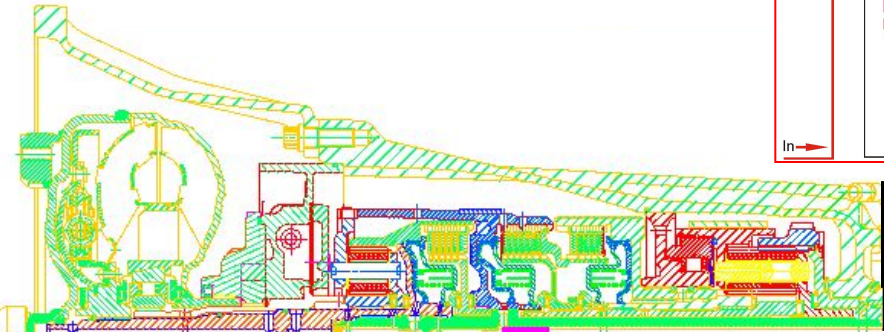
S1	S4	S5 (A)	S6 (A)	S8 (A)	S9 (A)
ON	ON	1	0	1	0-1



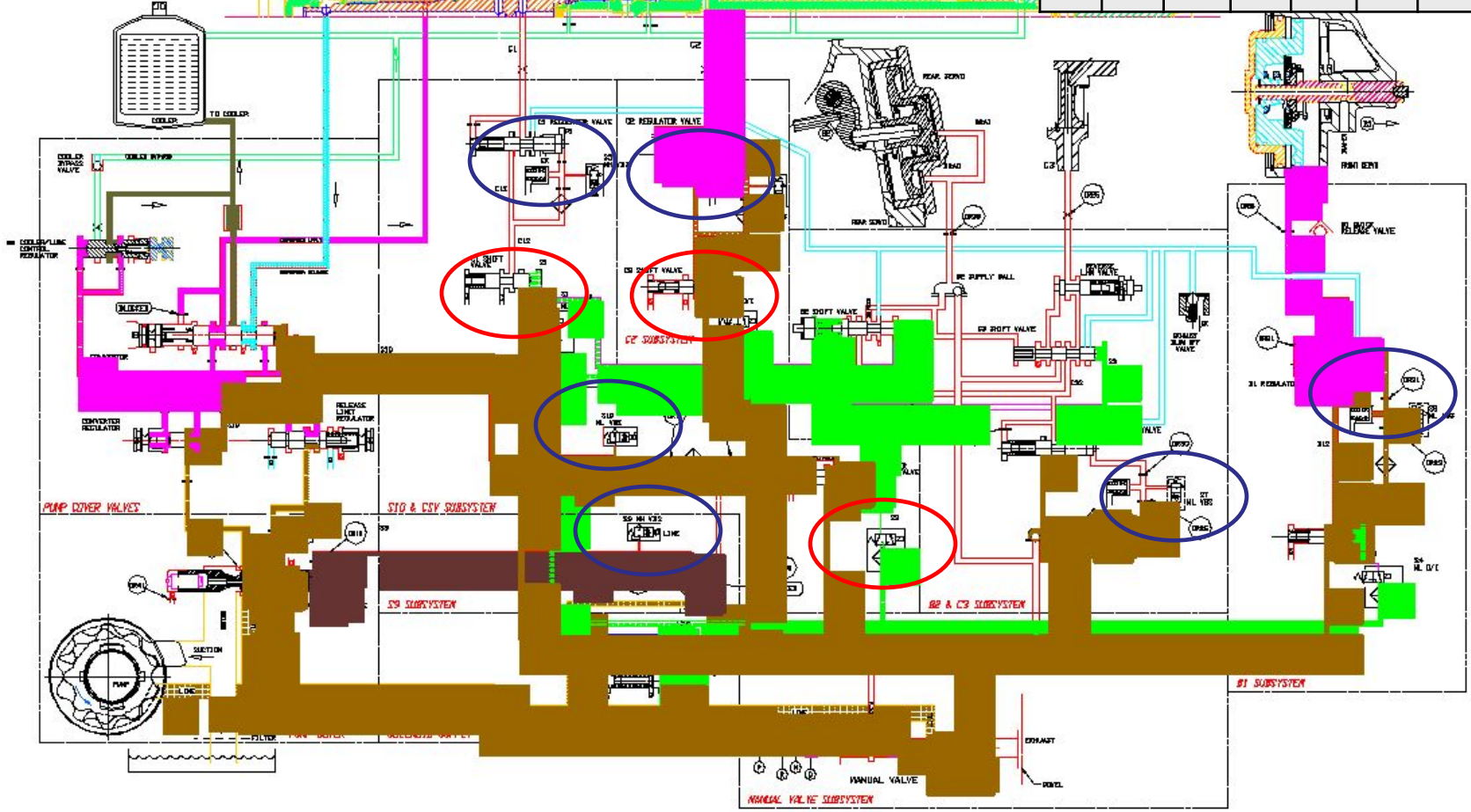
2nd(L/Up) – 2.14:1(C2 & B1 & TCC)



LINE/DRIVE PRESSURE
 BLEND/D SUPPLY PRESSURE
 LUTCH PRESSURE
 COOLER PRESSURE

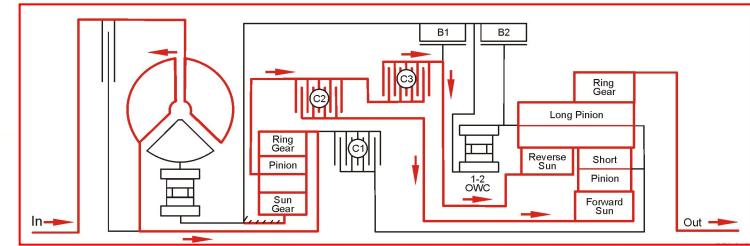


S1	S3	S4	S5 (A)	S6 (A)	S7 (A)	S8 (A)	S9 (A)	S10 (A)
ON	ON	ON	1	0	0	1	0-1	1

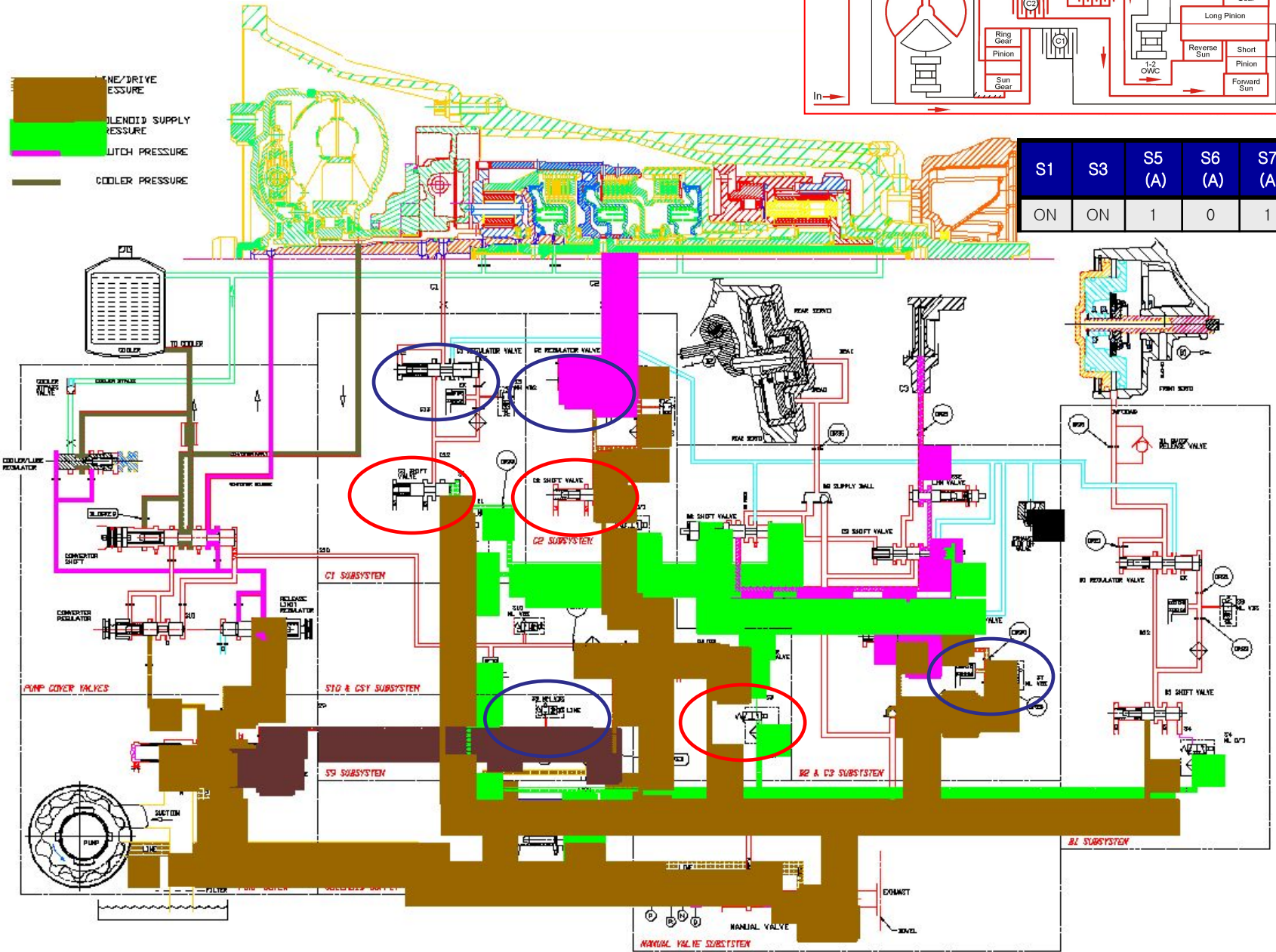


3rd – 1.48:1 (C2 & C3)

ENGINE DRIVE PRESSURE
 HOLENOSE SUPPLY PRESSURE
 CLUTCH PRESSURE
 COOLER PRESSURE

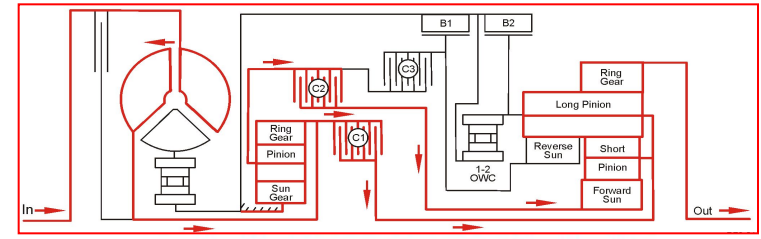


S1	S3	S5 (A)	S6 (A)	S7 (A)	S9 (A)
ON	ON	1	0	1	0-1

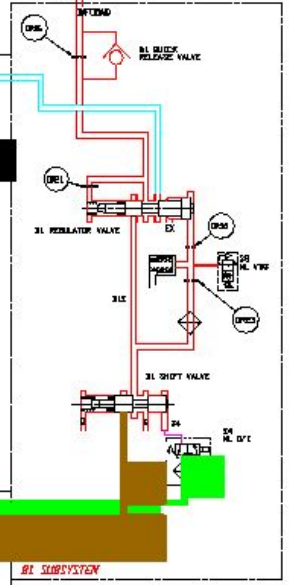
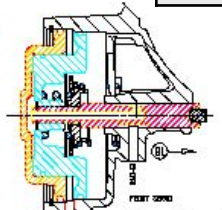
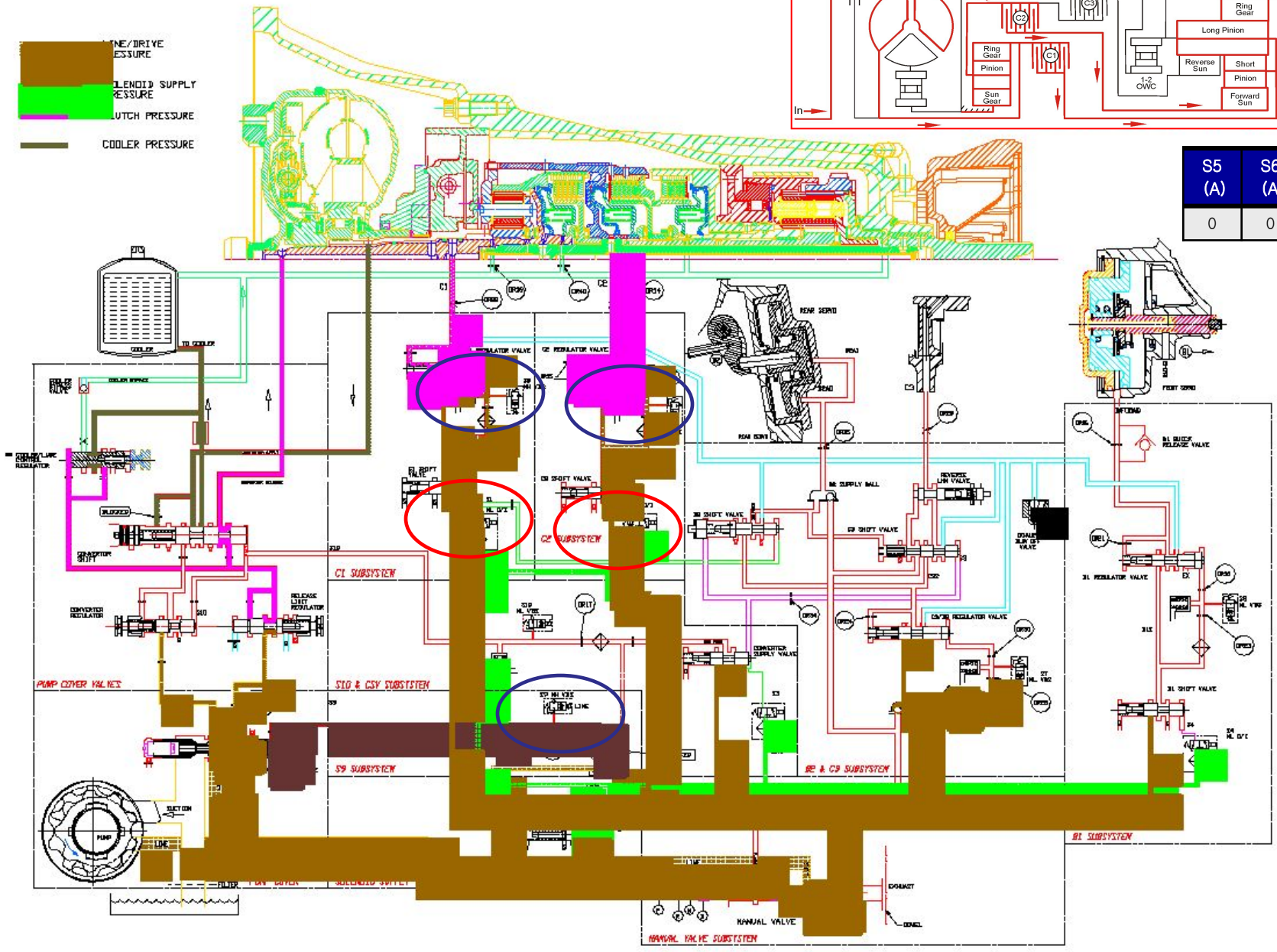


4th(4th in LHM) – 1.16:1(C1 & C2)

LINE/DRIVE PRESSURE
 BLENDING SUPPLY PRESSURE
 CLUTCH PRESSURE
 COOLER PRESSURE

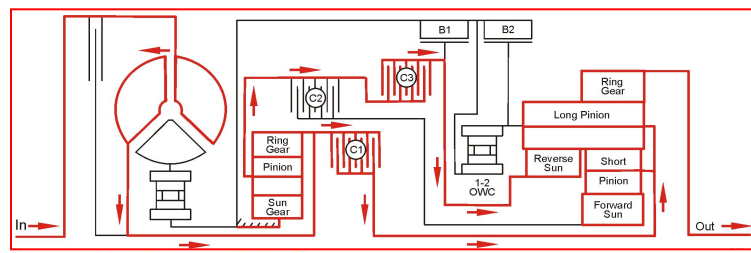


S5 (A)	S6 (A)	S9 (A)
0	0	0-1

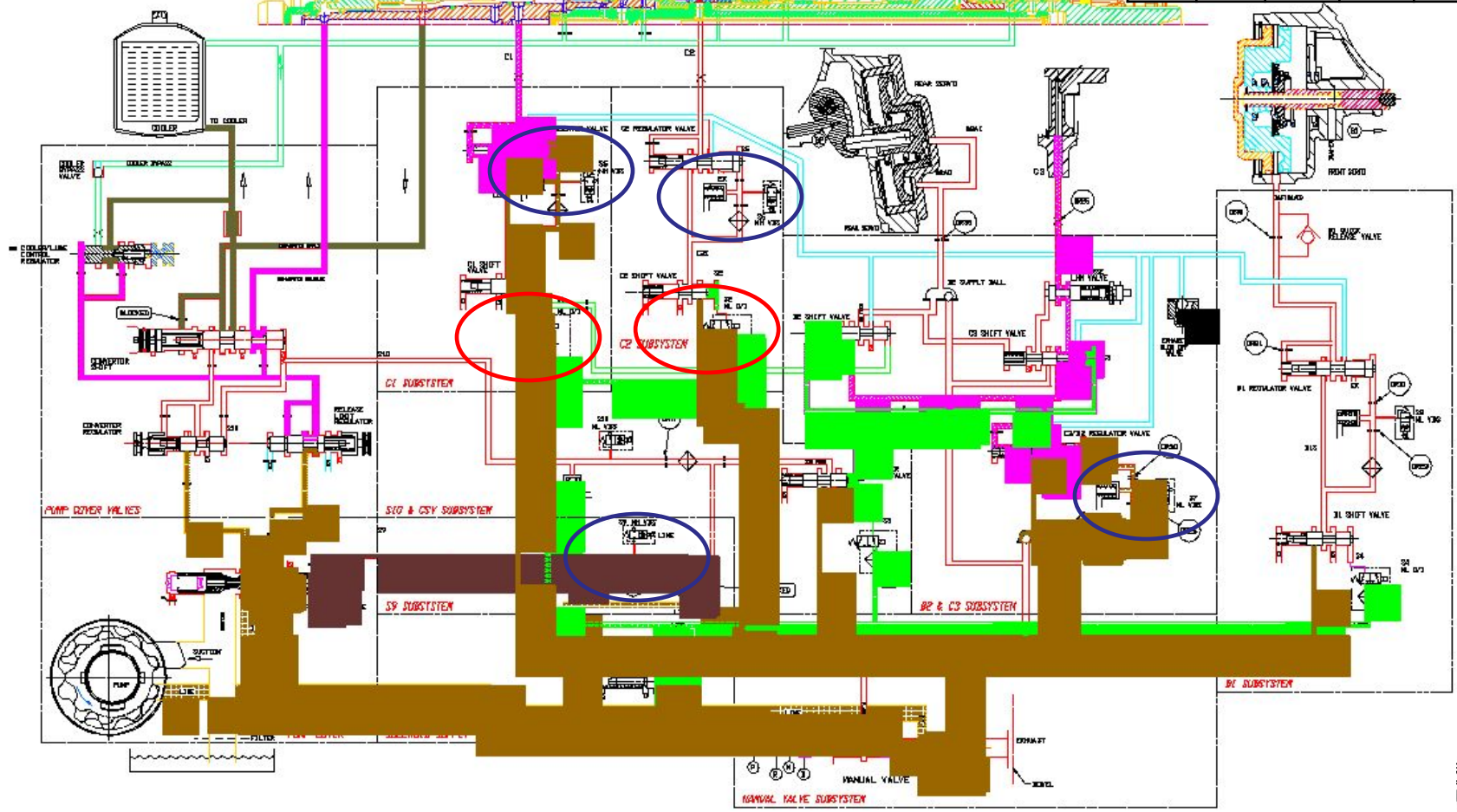


5th – 0.87:1(C1 & C3)

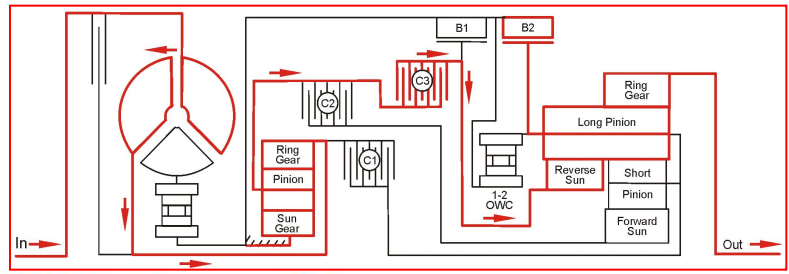
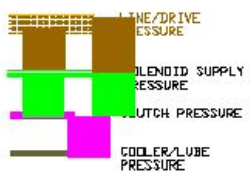
LINE/DRIVE PRESSURE
 BLEND/D SUPPLY PRESSURE
 CLUTCH PRESSURE
 COOLER PRESSURE



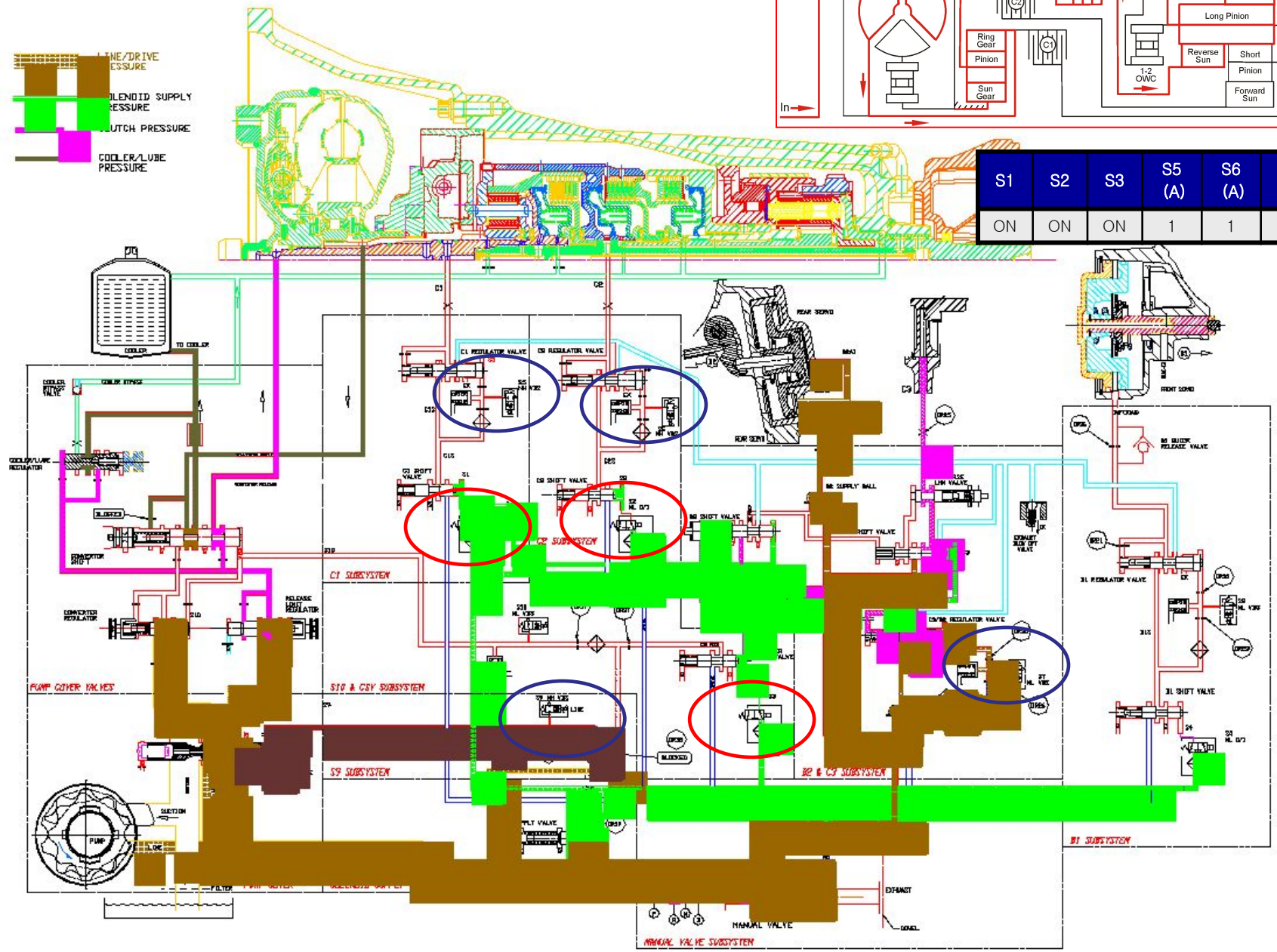
S2	S3	S5 (A)	S6 (A)	S7 (A)	S9 (A)
ON	ON	0	1	1	0-1



Reverse – 3.09:1(C3 & B2)

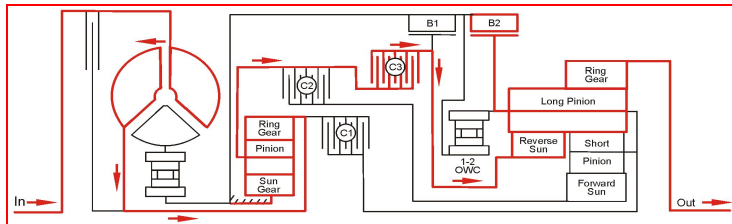


S1	S2	S3	S5 (A)	S6 (A)	S7 (A)	S9 (A)
ON	ON	ON	1	1	1	0-1

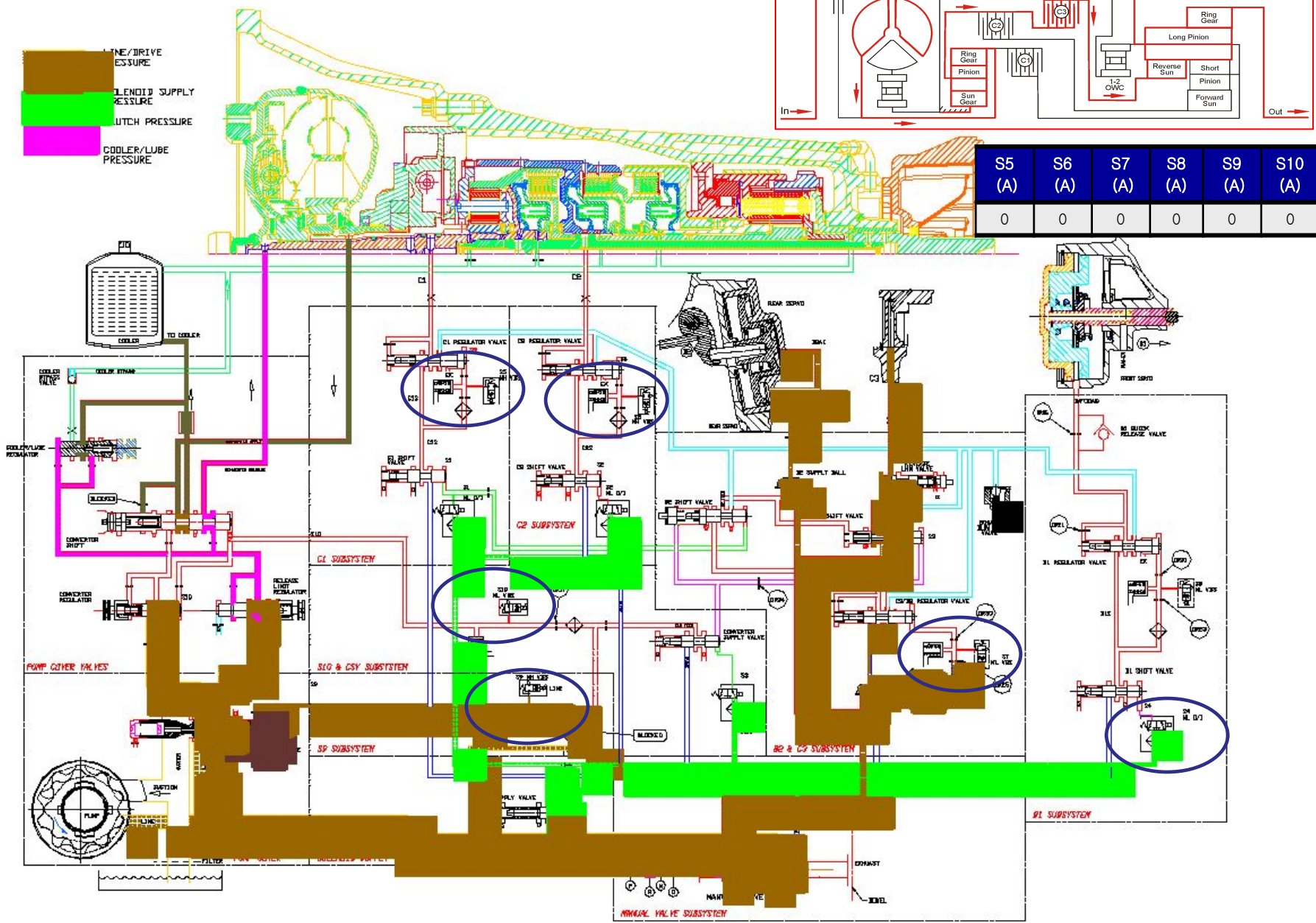


Reverse in LHM – 3.09:1(C3 & B2)

LINE/DRIVE PRESSURE
 BLEND/D SUPPLY PRESSURE
 LUTCH PRESSURE
 COOLER/LUBE PRESSURE

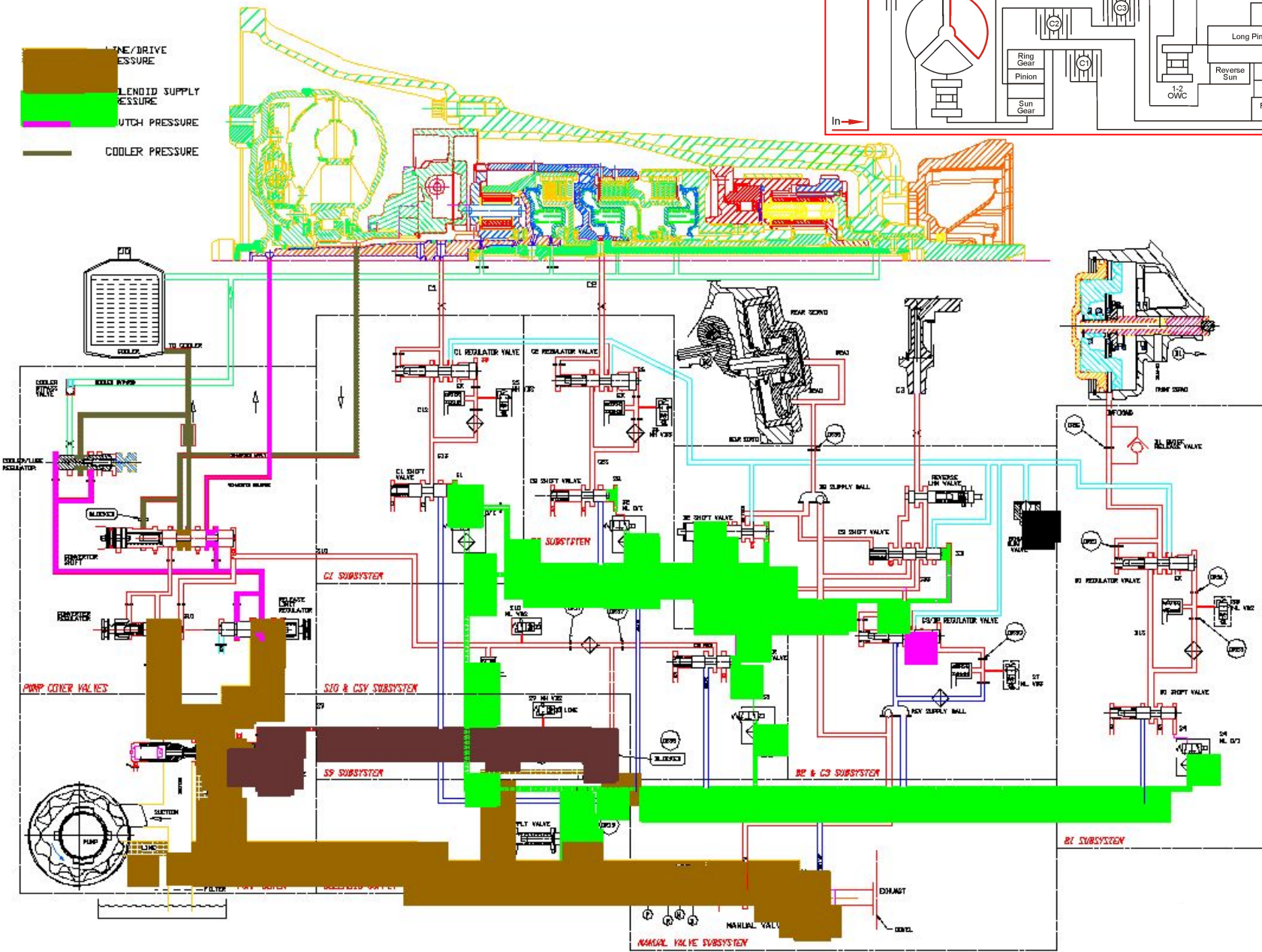
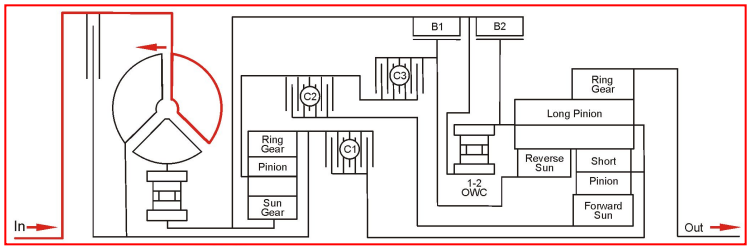


S5 (A)	S6 (A)	S7 (A)	S8 (A)	S9 (A)	S10 (A)
0	0	0	0	0	0



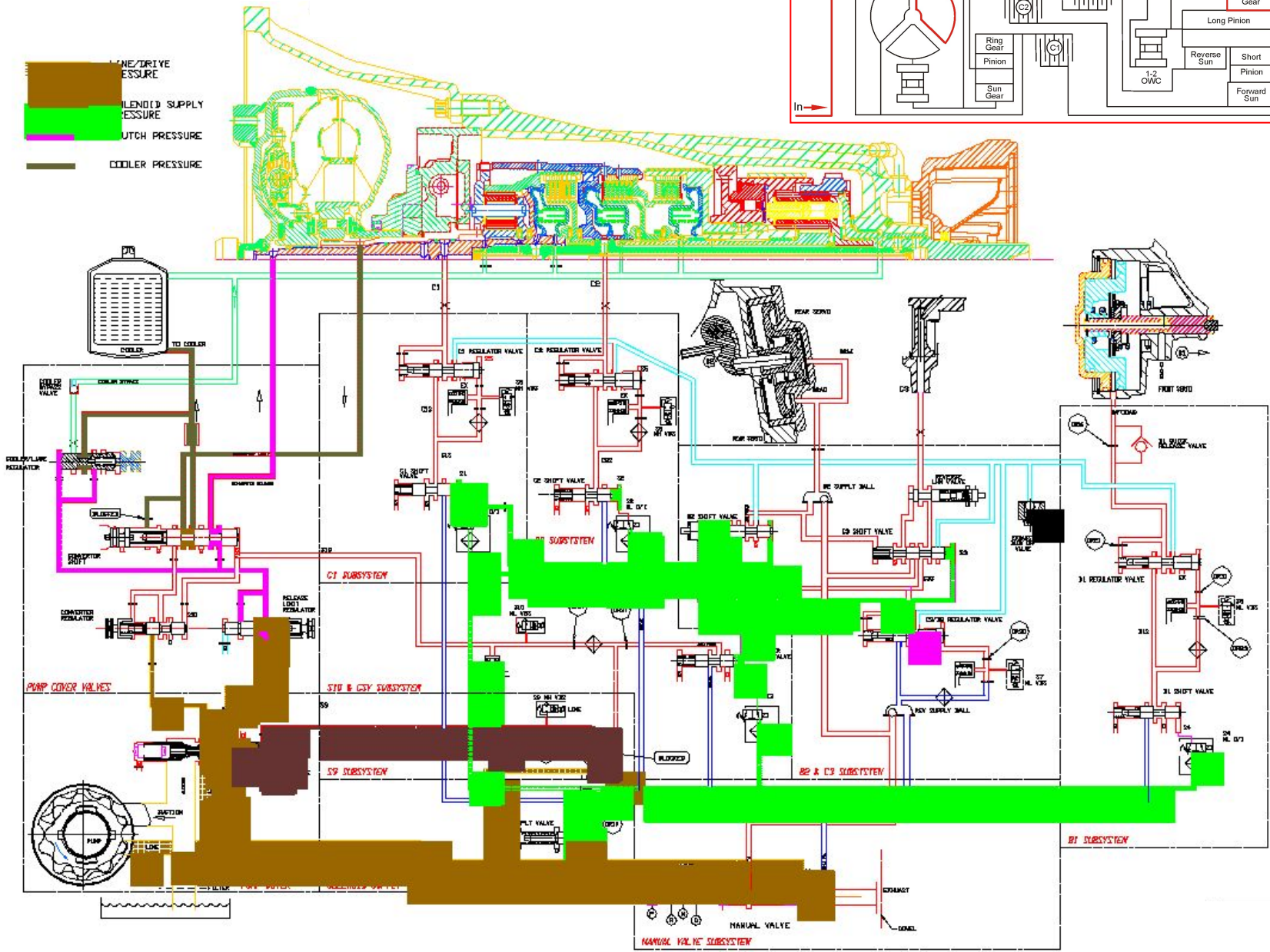
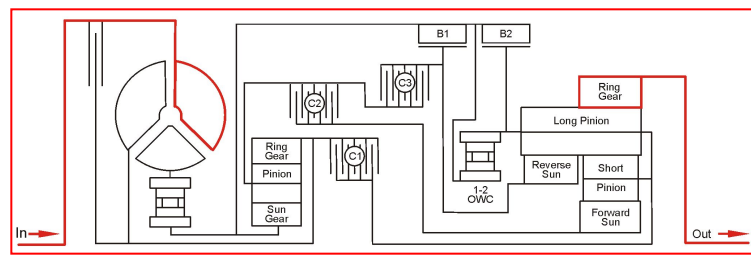
Neutral

- LINE/DRIVE PRESSURE
- BLENDID SUPPLY PRESSURE
- BUTCH PRESSURE
- COOLER PRESSURE

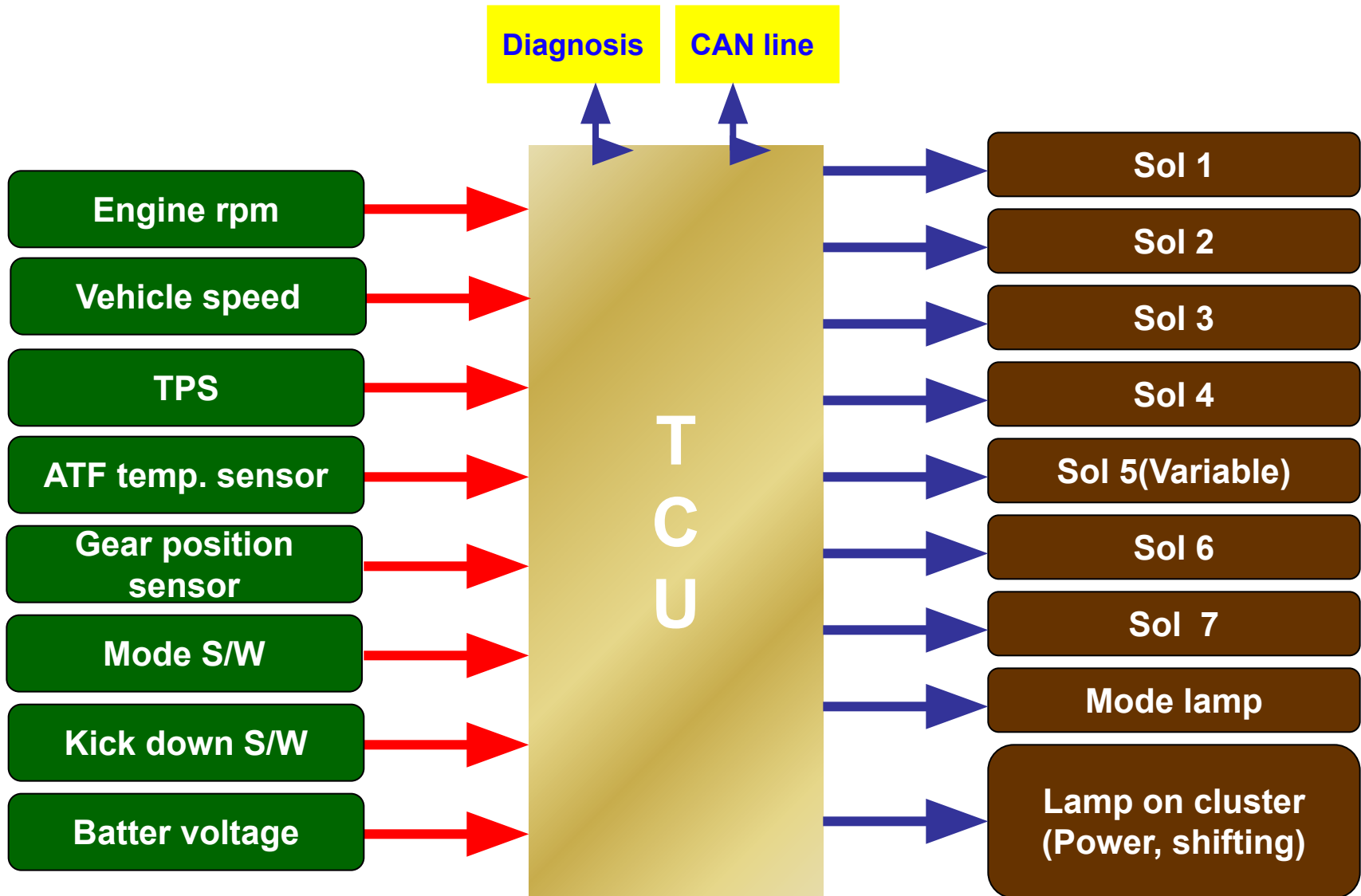


Parking

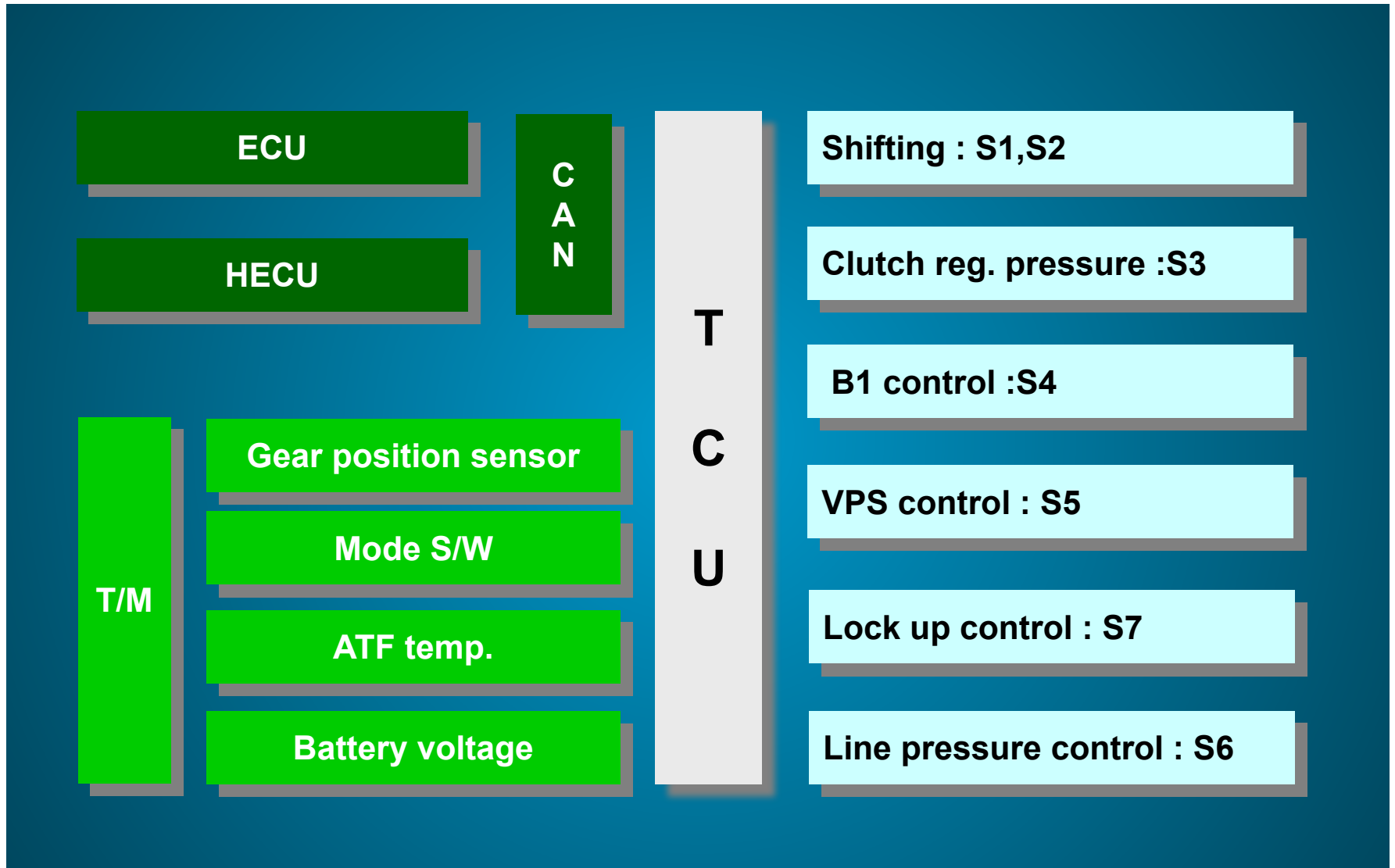
- LINE/DRIVE PRESSURE
- BLEND/D SUPPLY PRESSURE
- CLUTCH PRESSURE
- COOLER PRESSURE



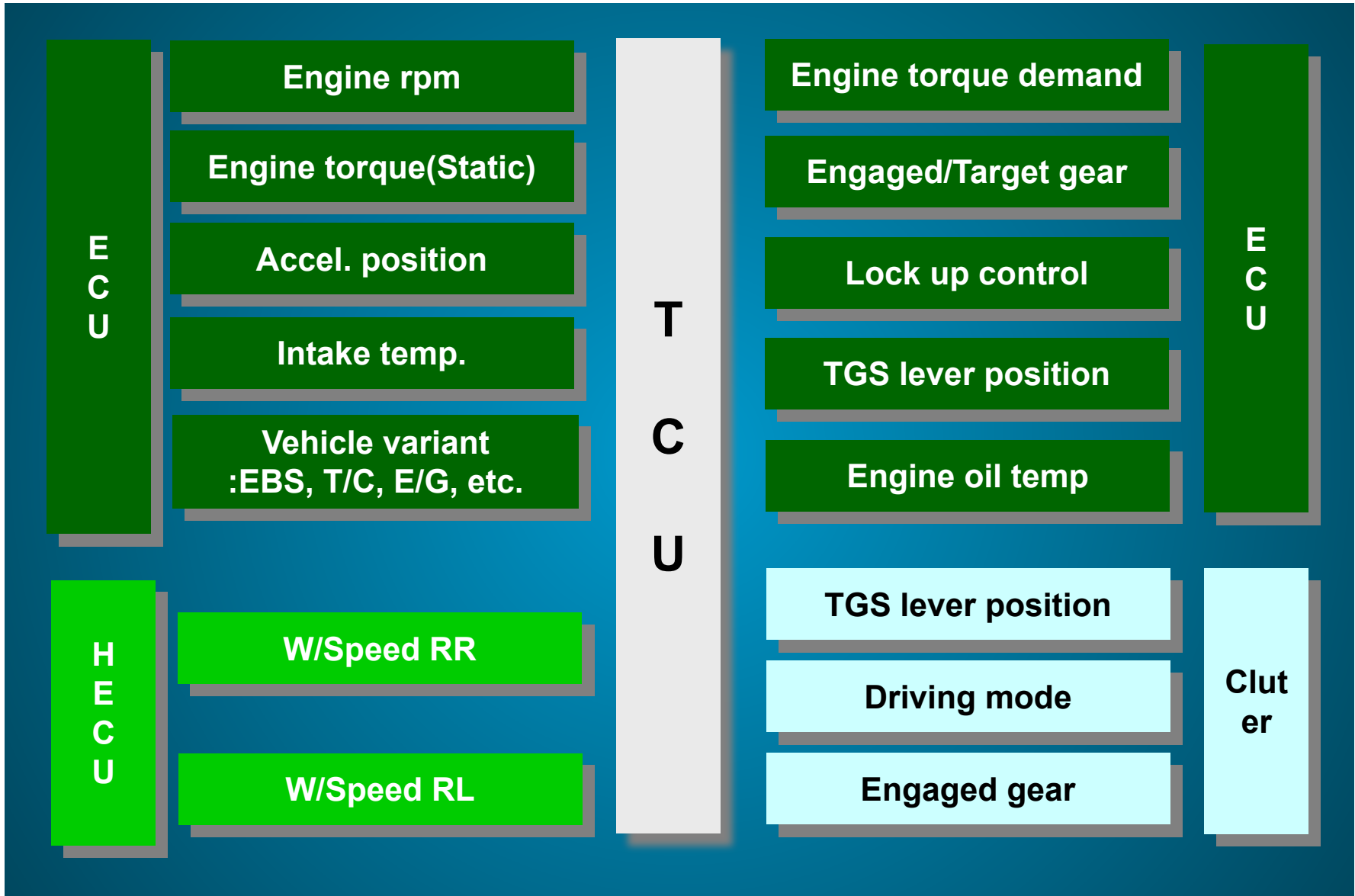
TCU Input & Output (M74-IDI Engine)



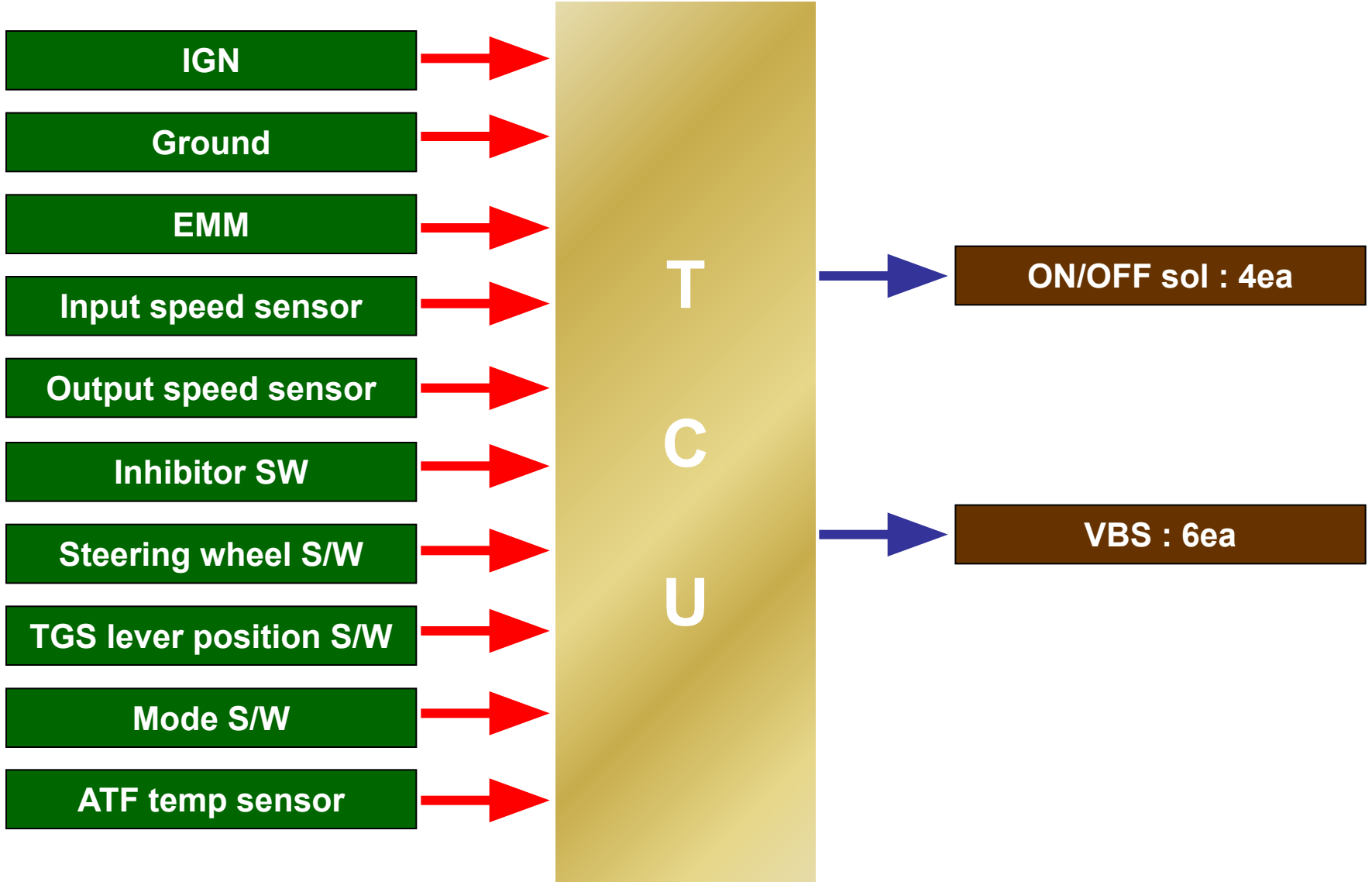
TCU Input & Output I (M74-DI Engine)



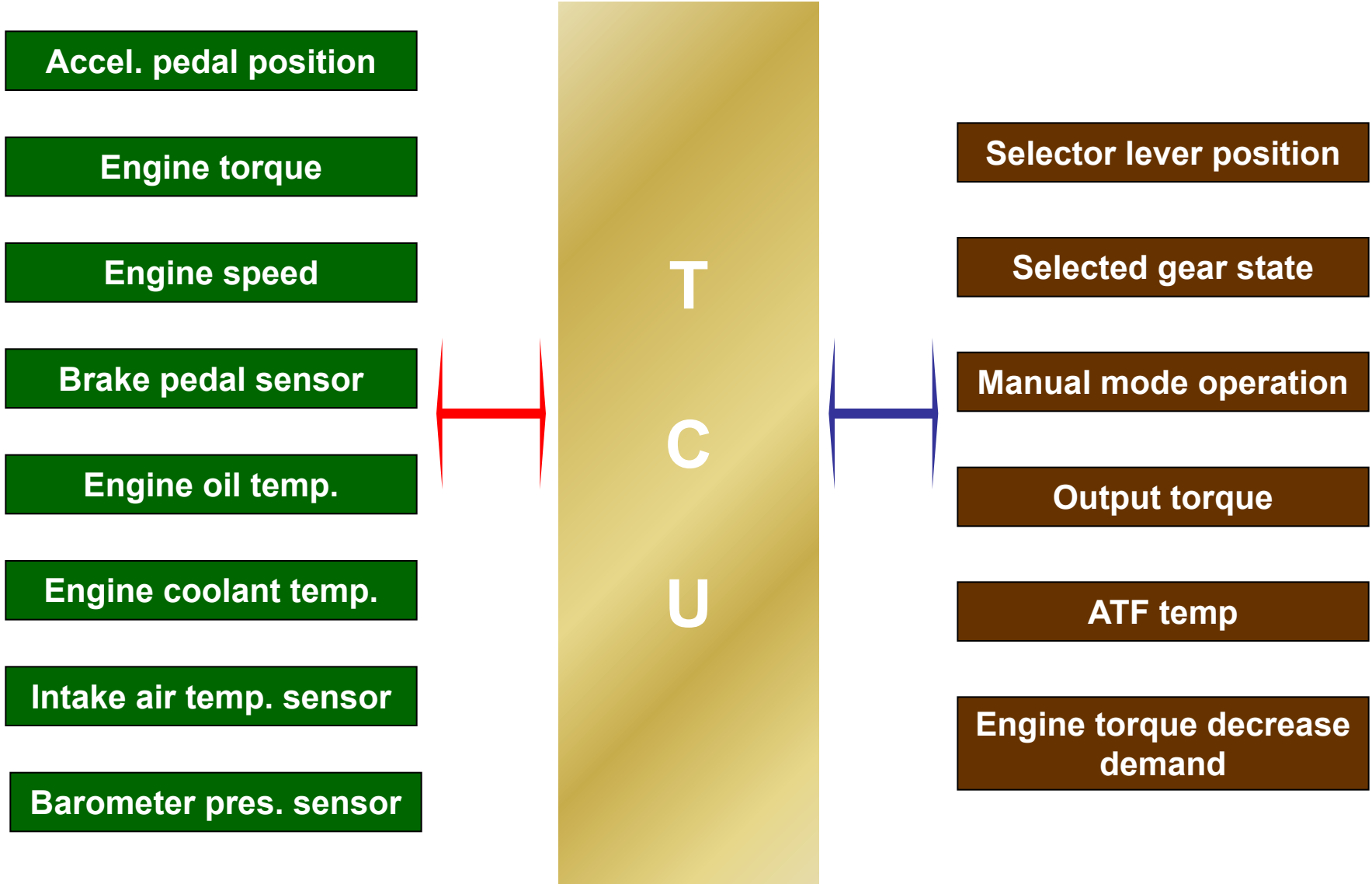
TCU Input & Output II (M74-DI Engine)



TCU Input & Output (M78)



TCU Input & Output (M78) - CAN



TCU input signal

■ EMM(Embedded Memory Module)

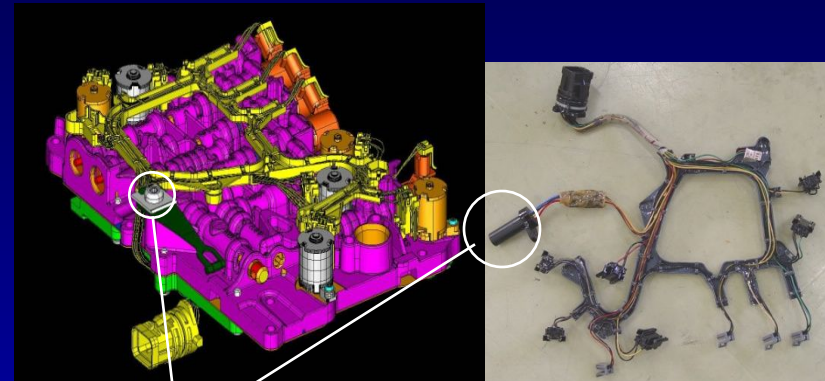
- Input speed sensor clustered
- Storing T/M characteristic
- TCU check by every “key on”

■ Input shaft speed(ISS) sensor

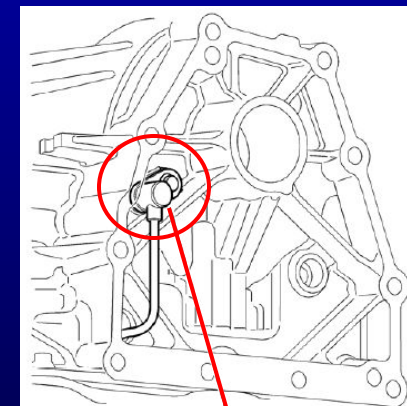
- Hall effect type sensor
- Monitoring torque converter slip
- Close loop control

■ Output shaft speed(OSS) sensor

- Hall effect type sensor
- Using gear schedule

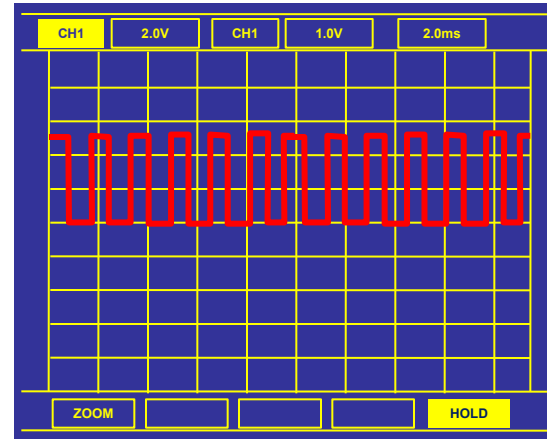
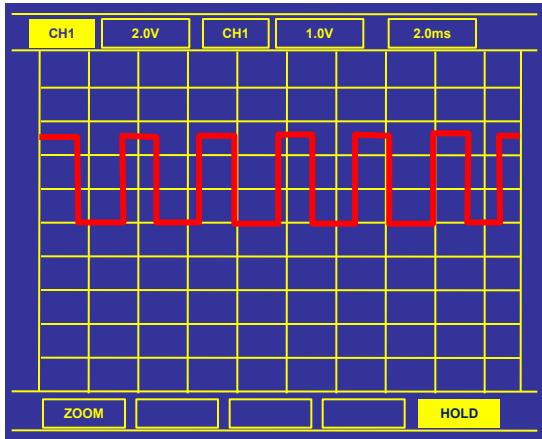


ISS sensor/
EMM

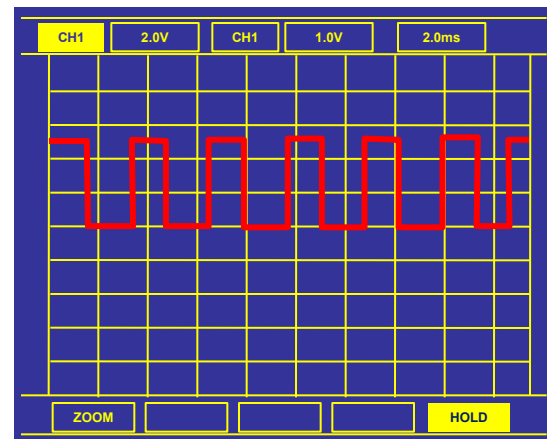
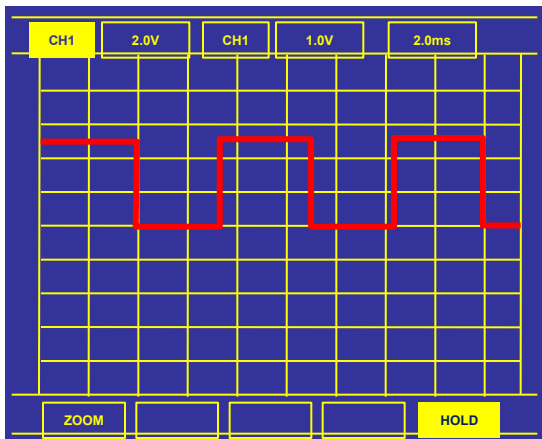


Output Shaft Speed
Sensor (OSS)

Input & Output signal wave form



Input shaft speed sensor



Output shaft speed sensor

TCU input signal

■ Inhibitor switch

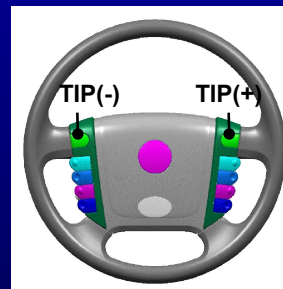
- TGS lever position detect
- Engine starting(P/N)
- Back up lamp



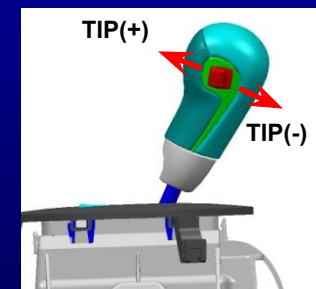
Inhibitor switch

■ Steering wheel S/W

- TGS “M” selection
- “+” or “-”



S/Wheel S/W



Gear selector
S/W

■ Gear selector lever S/W

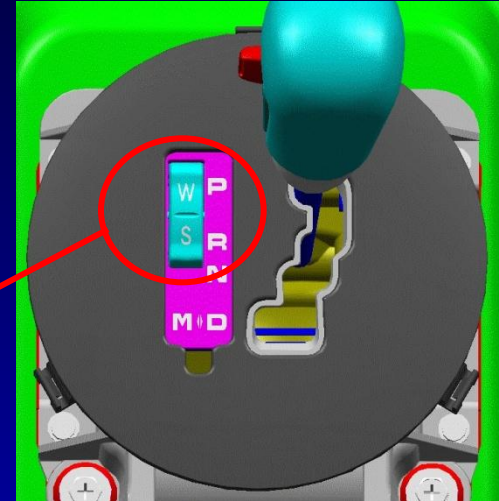
- TGS “M” selection
- “+” or “-”

TCU input signal

■ Mode S/W

- DURA TGS lever
- Standard mode
- Winter mode

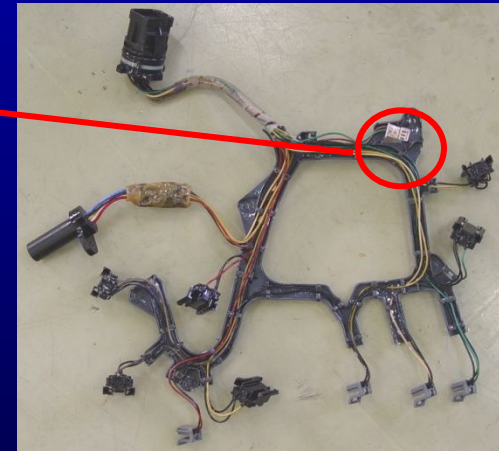
Mode switch



■ ATF temp. sensor

- NTC type
- Clustered to valve body wiring
- Viscosity compensating function

ATF temp.
sensor



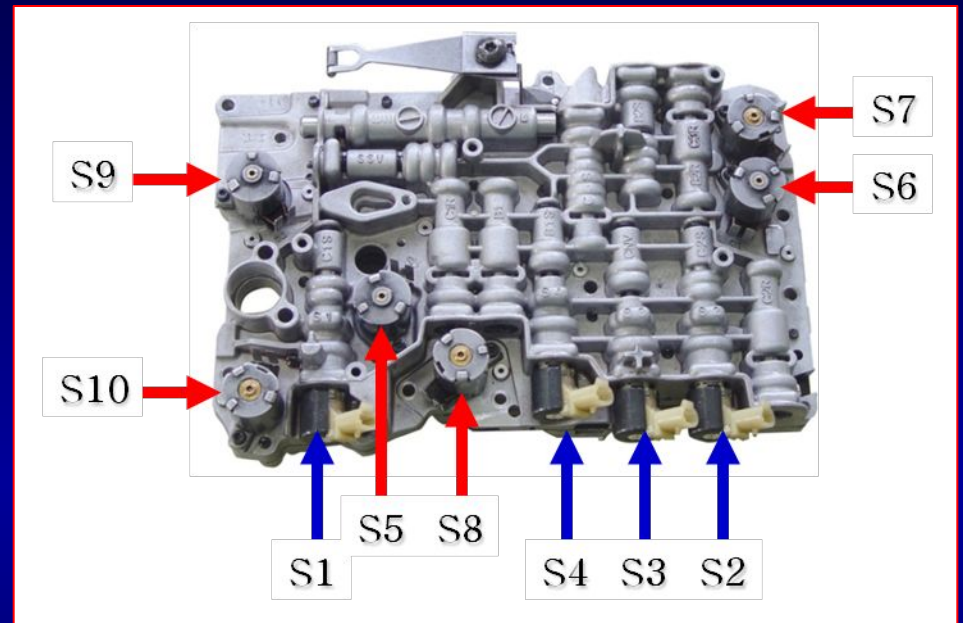
TCU output signal

■ ON/OFF sol. valve

- S1, S2, S3, S4
- 0V / 12V
- $22.0 \pm 1.2\Omega$
- Making gear shifting

■ VBS

- S5, S6, S7, S8, S9, S10
- 0mA / 1100mA
- $4.14 \pm 0.3\Omega$
- Shifting quality control



Function of solenoids (M74)

S1	Making gear shifting	-
S2		-
S3	Control shifting order & shifting quality	Clutch regulator valve control
S4		Front brake band control
S5	-Variable Bleed Solenoid : VBS -PWM control while shifting : (0.2A~1A)	S3,S4,S7 control
S6	H/Line pressure control<=TPS	-
S7	Converter lock up control	Operating in 3rd / 4th

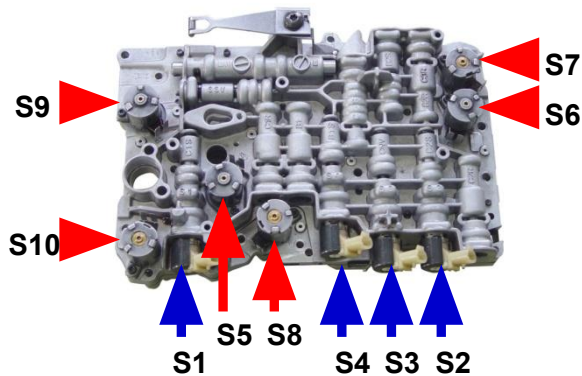
Function of solenoids (M78)

ON/OFF solenoid

- S1** C1 supply/release
- S2** C2 supply/release
- S3** C3 & B2 supply/release
- S4** B1 supply/release

Variable Bleed Solenoid

- S5** C1 supply pre. control
- S6** C2 supply pre. control
- S7** C3 & B2 supply pre. control
- S8** B1 supply pres. control
- S9** Line pressure control
- S10** T/converter pre. control



NH : S5, S6, S9

NL : S1, S2, S3, S4, S7, S8, S10

T/M control monitoring by TCU

■ Supply voltage monitoring

- Voltage sensor inside TCU

■ Solenoid supply voltage monitoring

- Open/Short circuit detection by TCU internal transistor current monitoring

■ Gear ratio monitoring

- Monitoring gear engaged
- Also, monitoring the time for engage (allowance : 0.5sec)

■ Torque converter monitoring

- Check if TCC is locked correctly=>LHM (Safety mode) if TCC is defective

Shift energy management

■ Engine output torque increase/decrease

- Improved durability by shortening the slipping time.
 - Improving the shift comfort by reducing the step change in torque by the gear shift
 - Transferring a higher engine power
- =>This is allowed by the mechanical in-gear strength of the transmission

Shift map selection

*Shift map => Mode S/W, ATF temp., Road gradient

■ Normal mode

- Mode S/W : “S”
- “D” position
- Normal temp. range
- Normal driving state/
- Targeted fuel efficiency

■ Uphill/downhill mode

- Adjusted shift points
- Adjusted lock up points

■ Altitude mode

- Compensate reduced engine torque

■ Winter mode

- Mode S/W : “W”
- Starting with 2nd shifting
- M1 : Starting with 1st shifting

■ Low range schedule

- 4WD Low
- Starting with 2nd shifting
- Skip gears (ex. 2->4) to optimize the engine rpm

■ Warm up schedule

- Below 20°C : TCC is unlocked to increase the ATF temp quickly

Shift map selection II

■ Hot mode

- 110°C ~ 145°C

- Lock up state is increased (prevent heat generation by T/C)

- Over 110°C : Radiator electric fan in “on”

- Over 130°C : Engine torque reduction, “Winter” lamp blinks

- Over 145°C : Go in the “Neutral” till below 120°C

(Below 105°C, all hot mode state is finished)

- “Hot mode” feature over-rule all other transmission performance feature

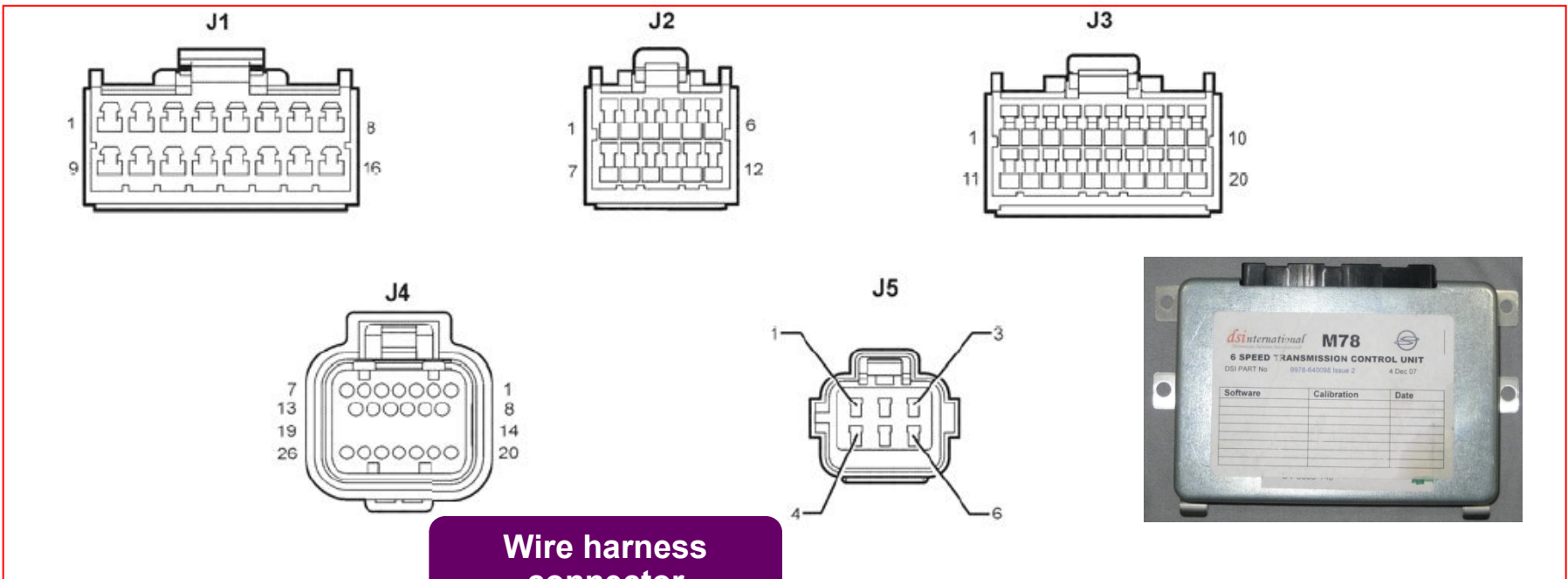
- Degradation in shift feel may be experienced as TCC is not
unlock during shifting

■ Cruiser

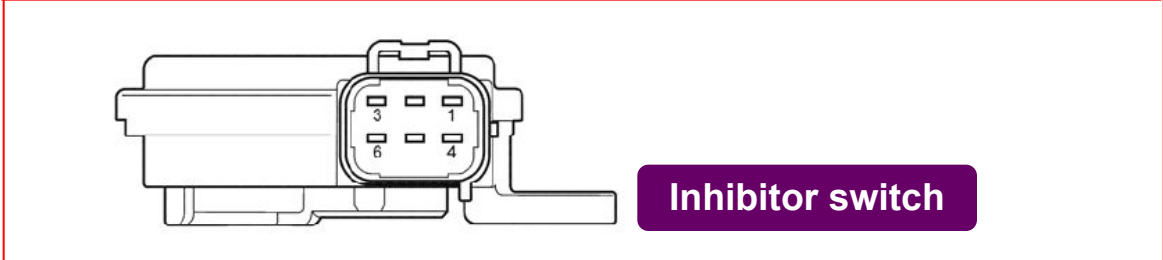
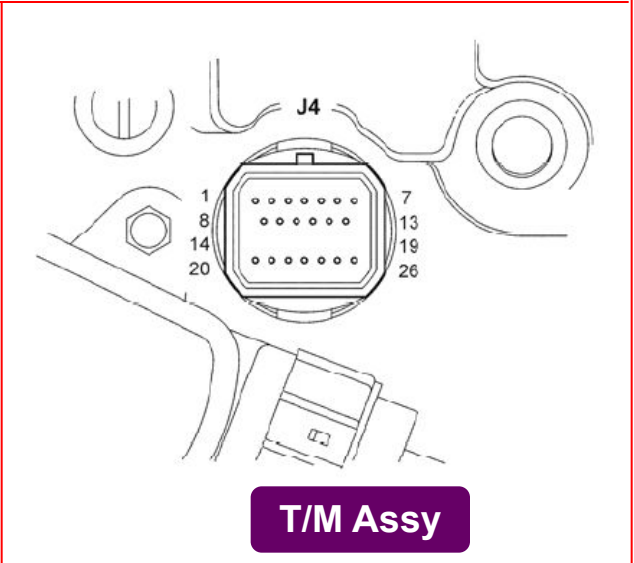
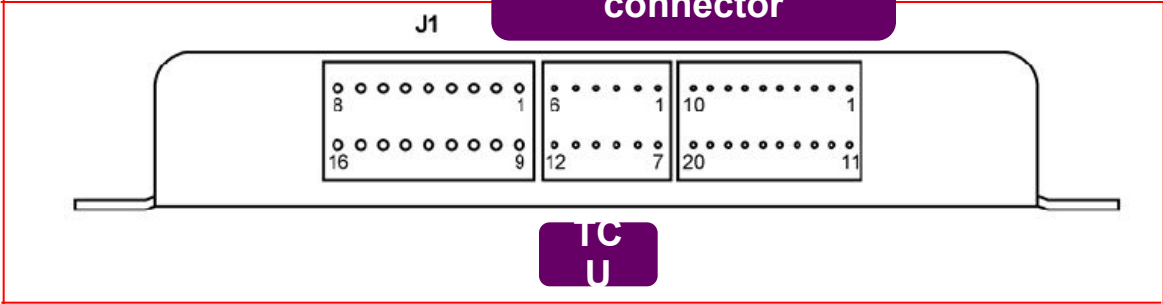
- ECU request downshift for higher engine power & braking

(under trailing condition)

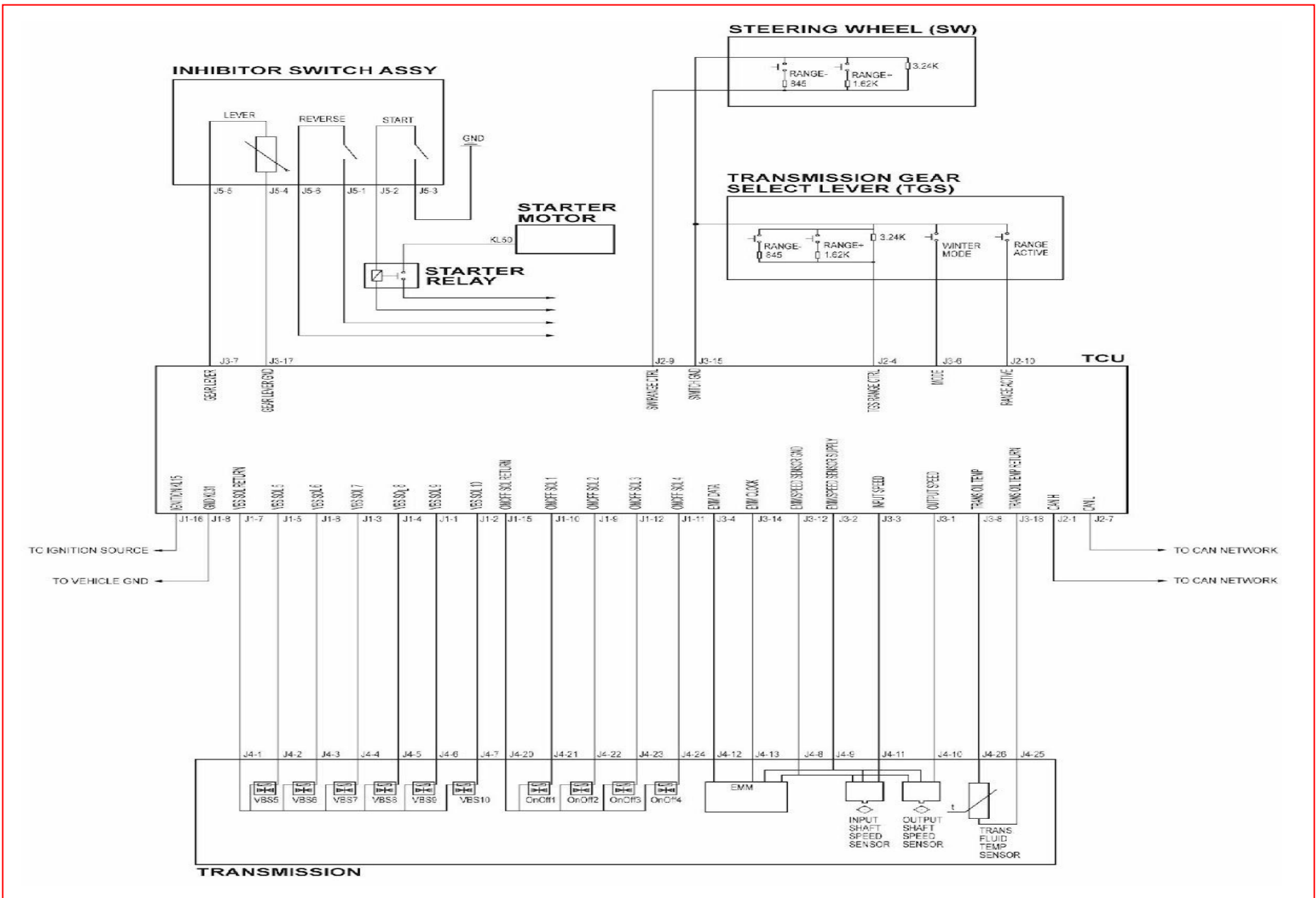
Connectors



Wire harness connector



Electric wiring diagram



Maintenance

1. Stall test

- Applying hand brake
 - > Engine running
 - > Braking in max load
 - > TGS lever in “D”
 - > Full throttle(100%) for 6seconds
 - > Check engine rpm
 - > Release accel. pedal
 - > Selector lever in “R”
 - > Full throttle(100%) for 6seconds.
 - > Check engine rpm
 - > Release the accel. pedal
- If stall rpm exceed 3,000rpm, T/M internal fault suspected

2. Green offset

■ After T/M assembly replacement

- Connect the SCAN100 to the diagnostic connector

-> TGS lever in “P”

-> IGN on (Engine OFF)

-> Set the parameter “Set Km Travelled” to “0Km”

-> Run the task “Activate Adaptive green offset”

-> IGN off

-> Check the engine running if it works fine

3. Adaptive reset

■ After T/M or TCU replacement

- Connect the SCAN100 to the diagnostic connector
- TGS lever “P”
- IGN on (Engine off)
- Set the parameter “Set Km Travelled” to “0Km”
- Perform “Reset adaptive data”
- IGN off
- Check the engine running if it works fine

4. Oil check

■ ATF specified

- Caltex PED 1712 ATF

■ Check procedure

- Drive the car at least 5 minutes
- > Check the ATF temp. if it is over 50°C =>SCAN100
- > Engine off
- > Remove the filling plug and drain the overflowing for 50 seconds
- > Install the filling plug
(Tightening torque : 30 ~ 35Nm)
- > Check the car if it runs well (If ATF leaked)

DURA TGS lever

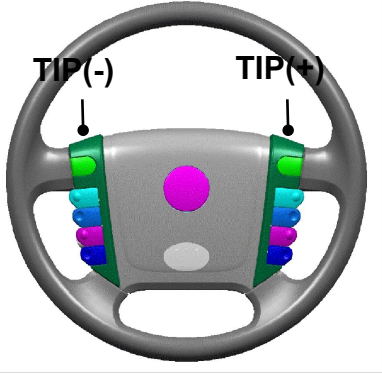
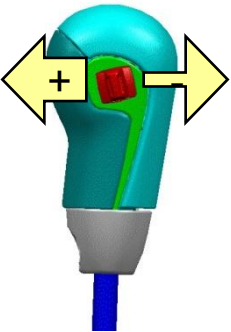
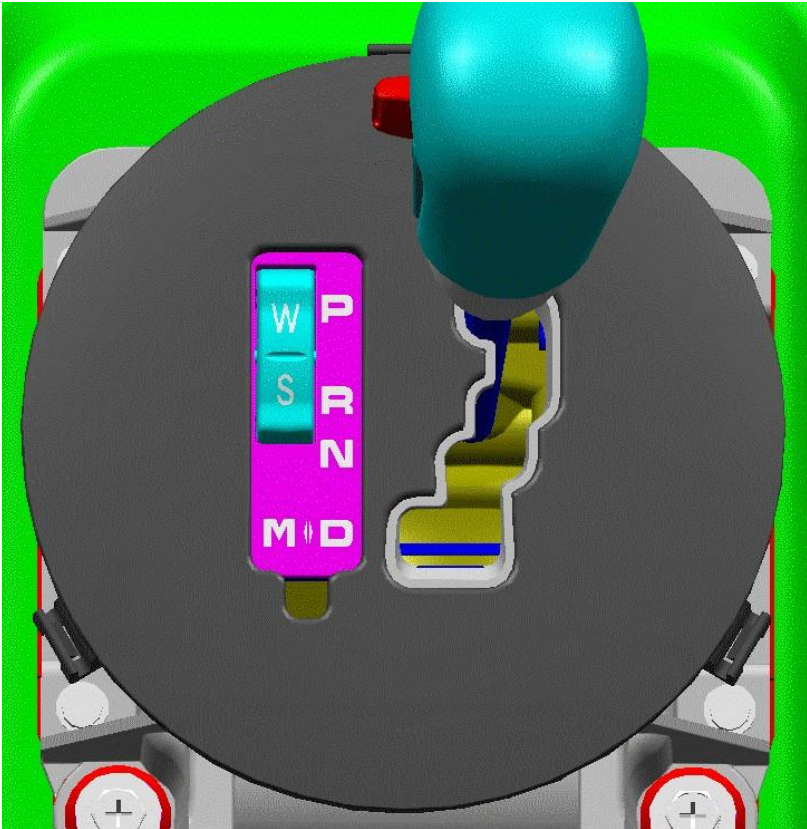


Step gate type

POWER/NORMAL/WINTER

"M" mode (manual)

Standard / Winter



TGS lever position

TGS lever position

Function

P

Parking (P-lock), Starting

R

Reverse driving

N

**Neutral, Starting, Towing
(Only for short distance)**

D

1st ~ 6th shifting

M

Manual mode (1st ~6th)

Shifting mode

Manual mode

Manual Up / Down shift

Knob & S/Wheel Up/Down signal detect



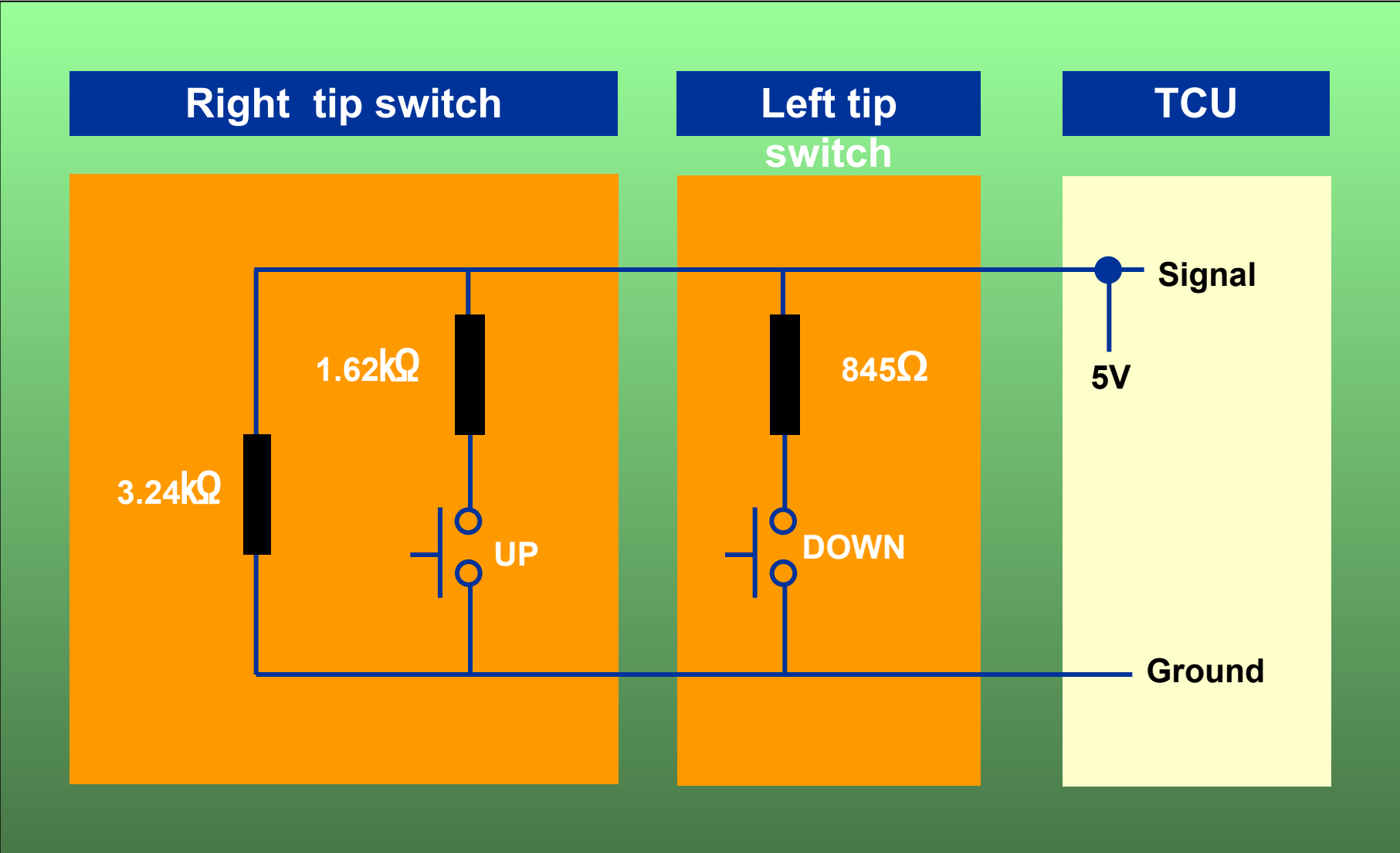
Operating by time order

D → M

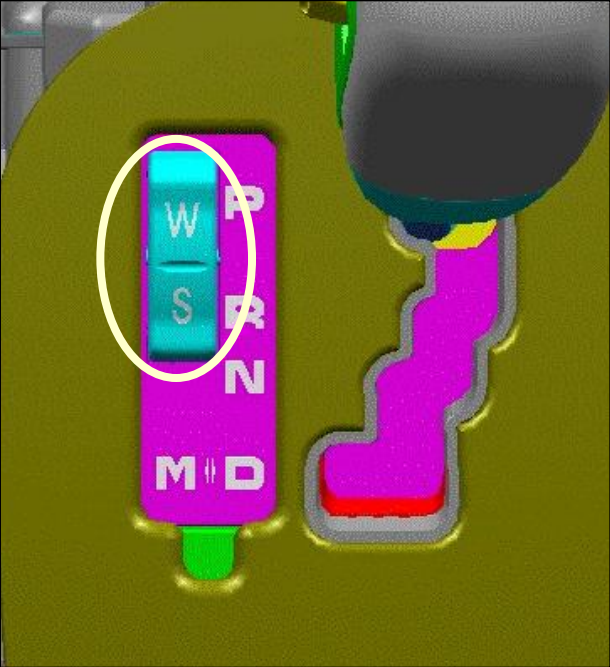
Lower by 1 or 2 shift than “D”

While driving → Driving in current shifting

Tip switch in S/Wheel



Mode switch



Standard mode

Starting in 1st shifting

**Gradient :
Approx.10%**

Winter mode

**Starting in 2nd
shifting**

**Gradient :
Approx.20%**

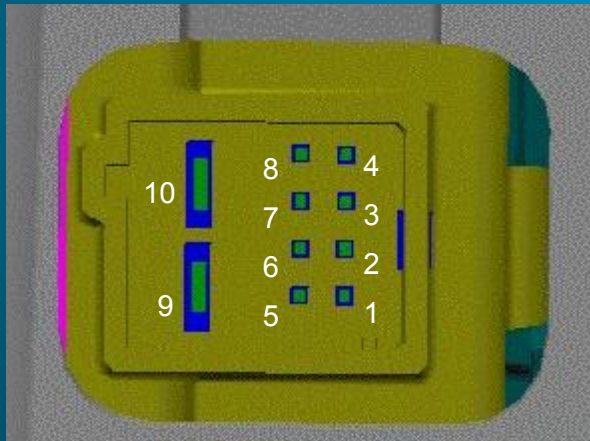
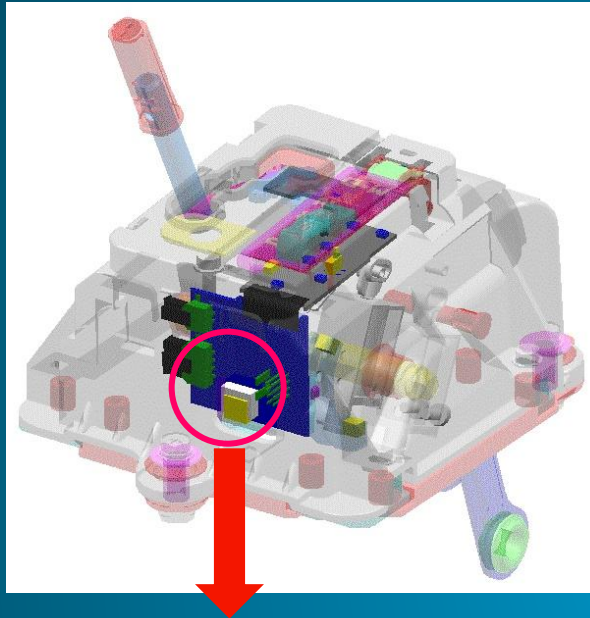


Full (Full Throttle)

- 2WD, AWD : Chang to “S” mode

- 4WD : Remain in “W” mode

TGS lever control unit



1	W/S switch output
2	Manual mode output
3	Up/Down tip shift(knob)
4	Ground for TGS lever unit
5	Signal-brake switch
6	Ground(M/Mode,W/S, Tip SW)
7	
8	Power-TGS lever unit
9	-
10	-

Electric wiring diagram

