DSI M78 6-Speed A/T

Overseas service team

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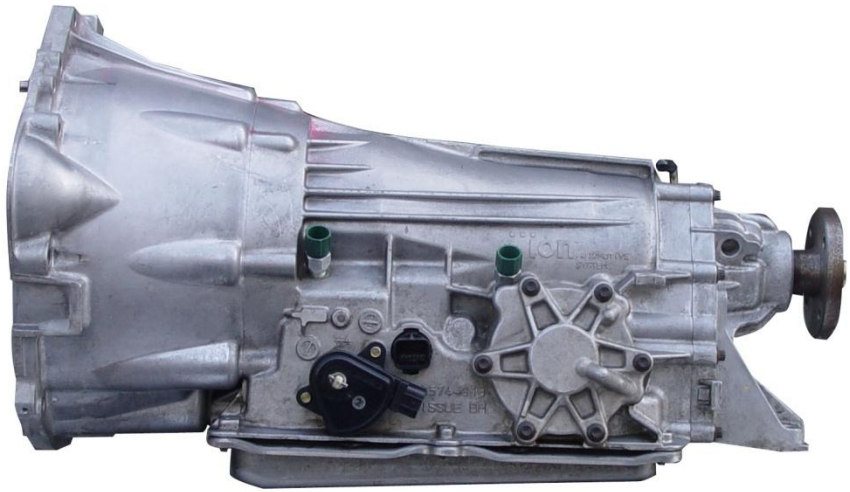
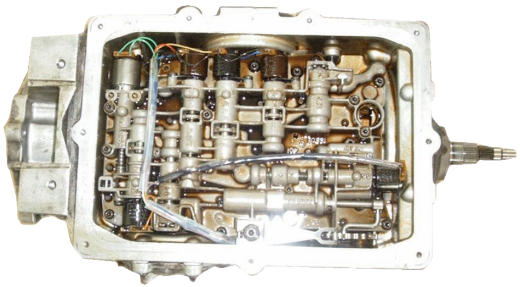


4-Speed vs 6-Speed

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

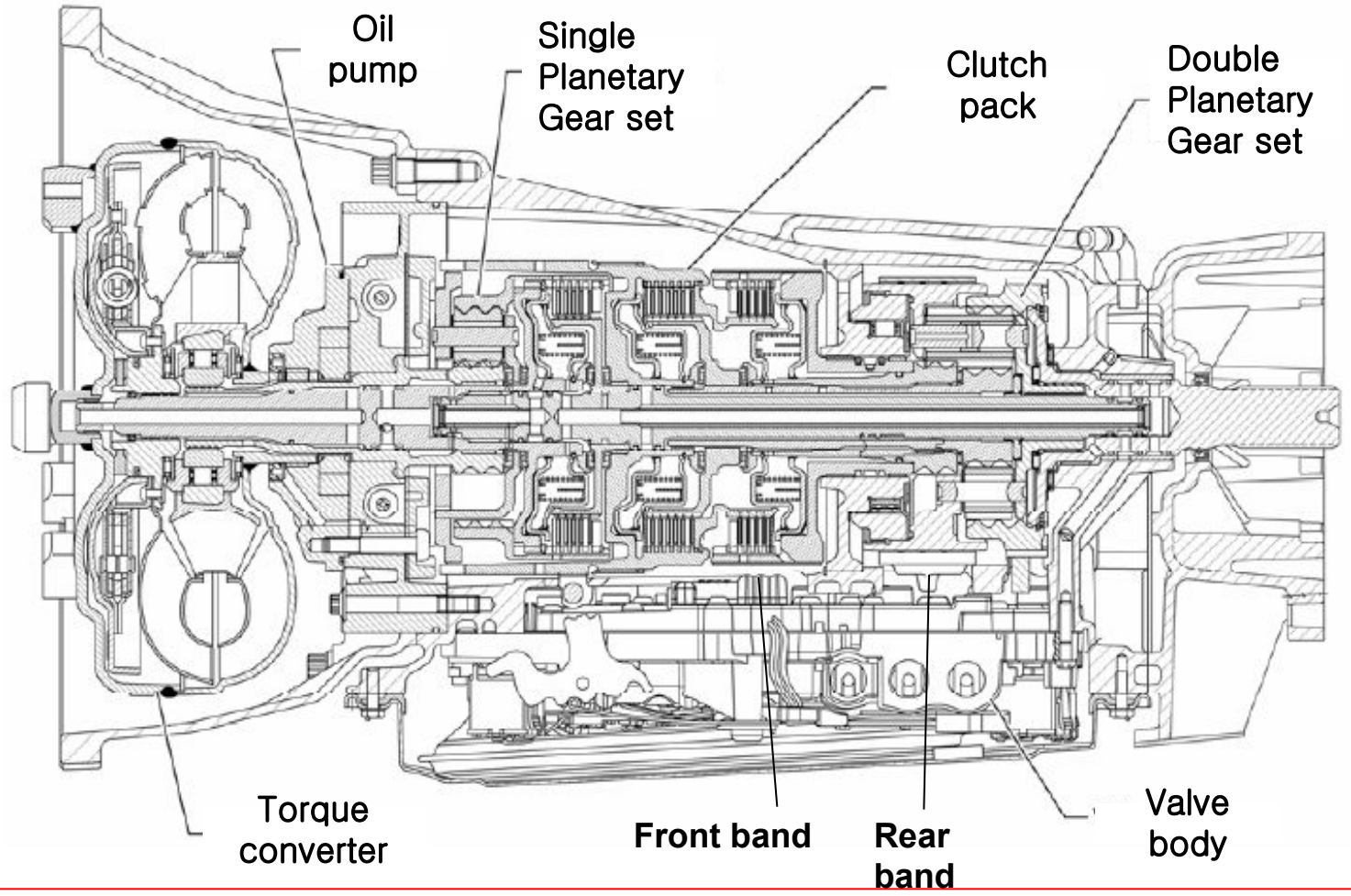
Drive and Reverse engagement (~2.2s)
(No reverse shifting over 1,400rpm , TPS 12% , 10Km/h)

T/Converter lock up clutch (Variable pressure control)

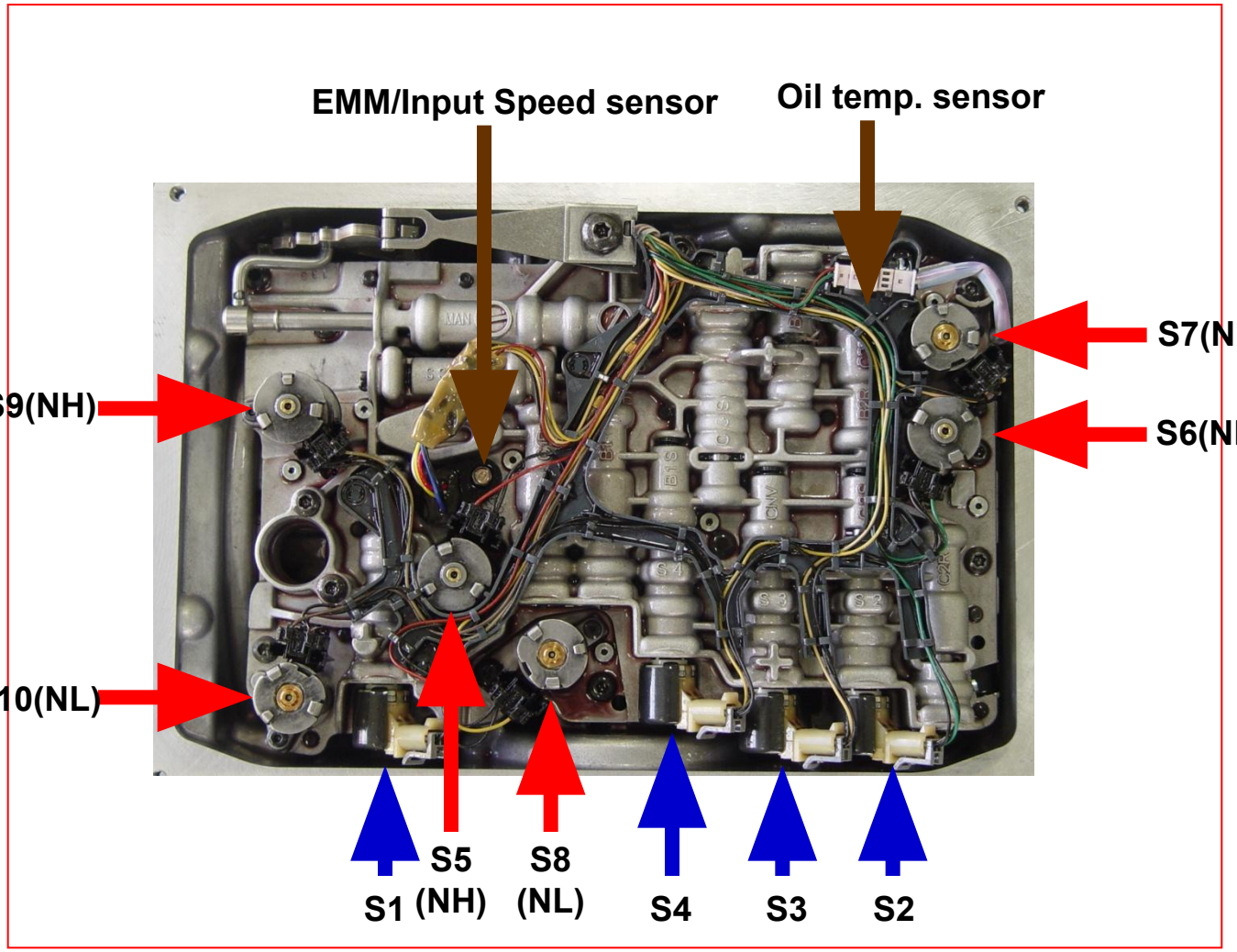
Embedded Memory Module (EMM)

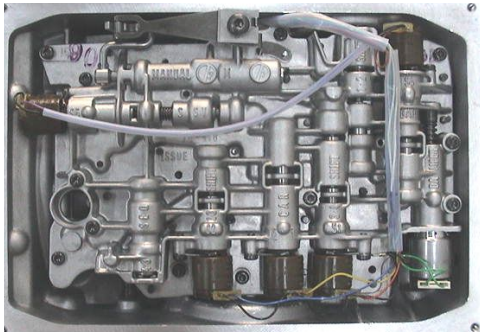
Advanced cooling system (ATF)

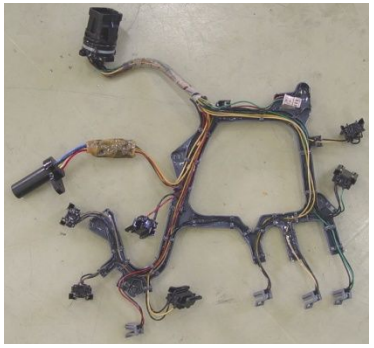
Components


Oil pump
Single Planetary Gear set
Clutch pack
Double Planetary Gear set
Torque converter
Front band
Rear band
Valve body

Valve body

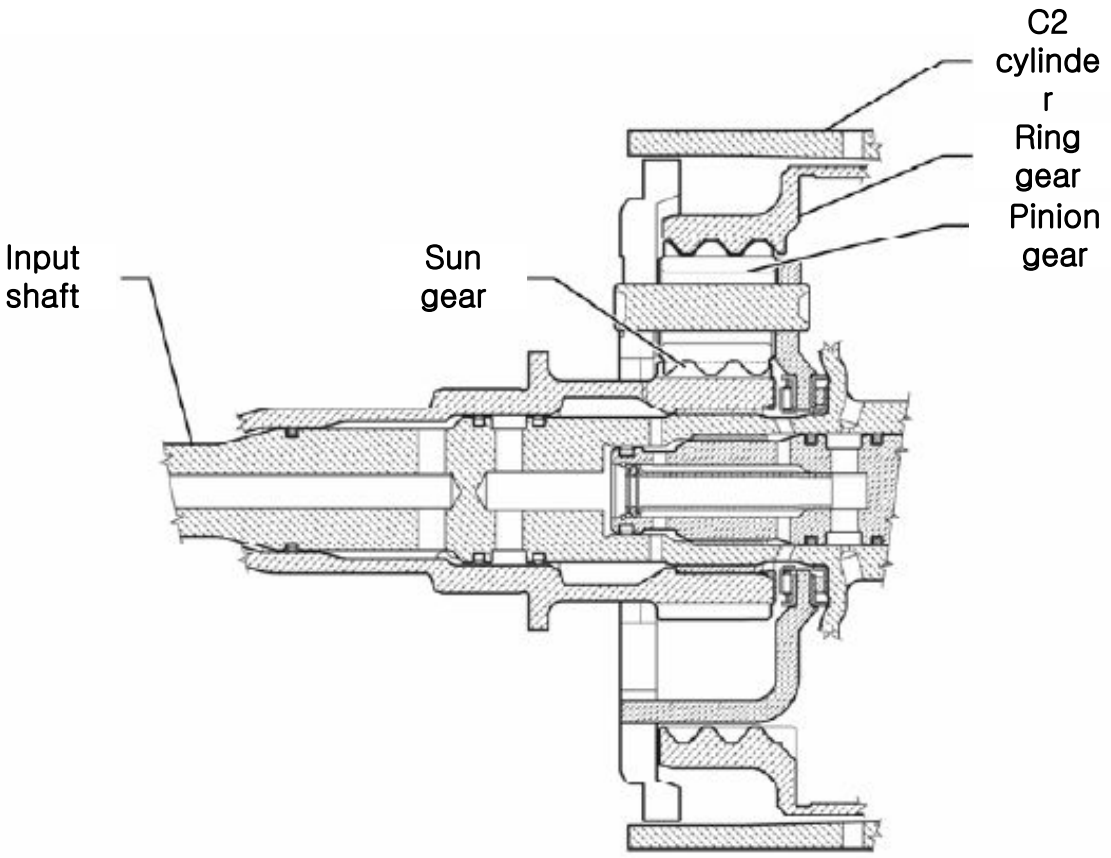


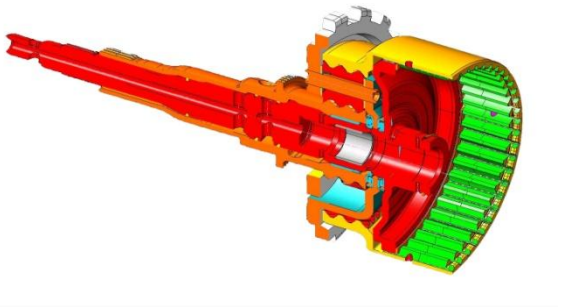




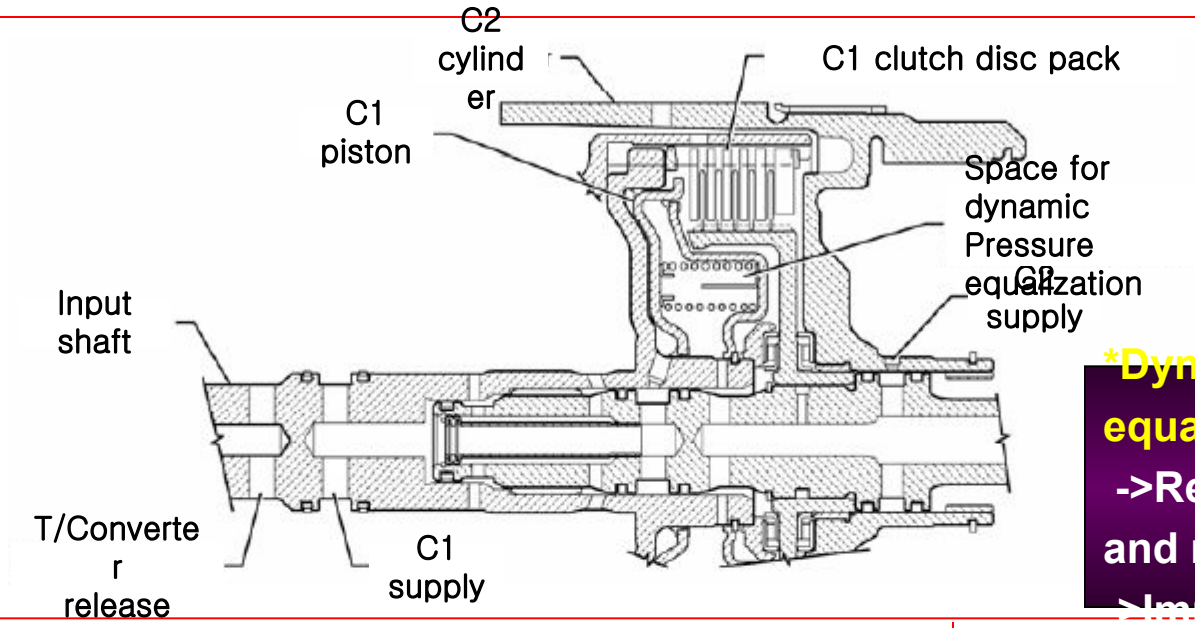
Valve body

Single planetary gear set

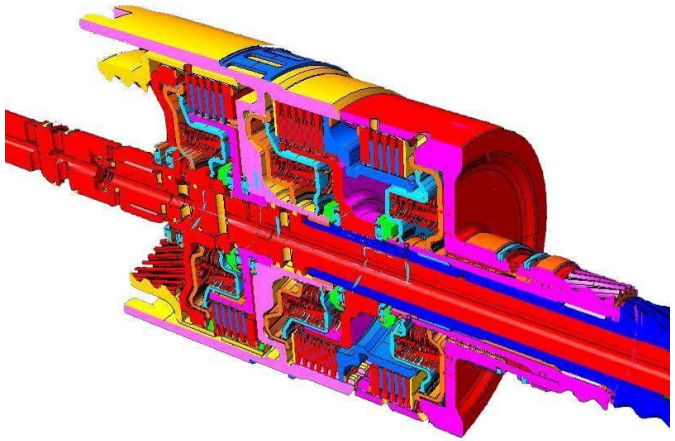




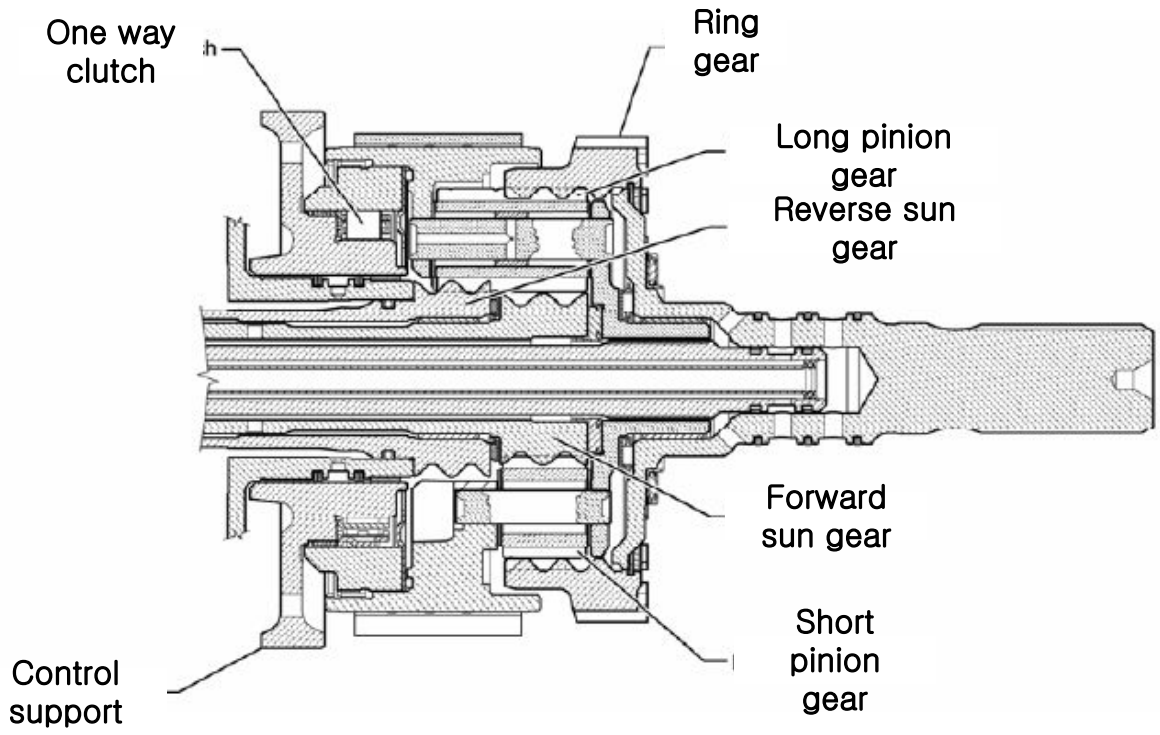
Clutch pack



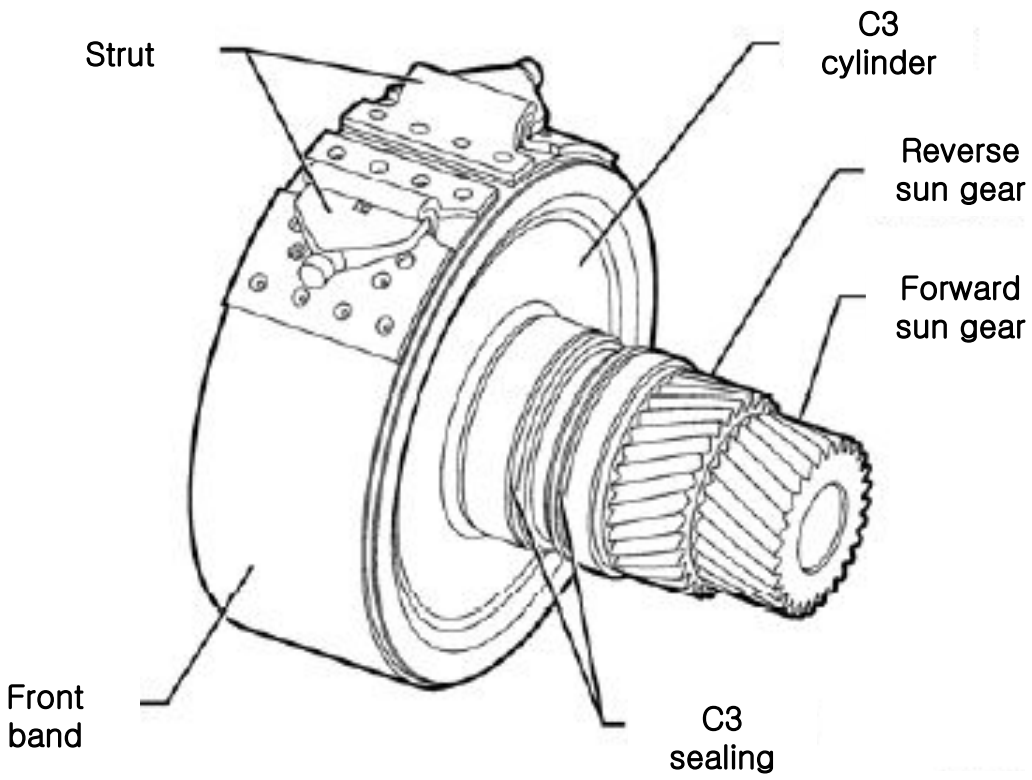
*Dynamic pressure equalization
->Reliable clutch engagement and release
->Improved shift refinement

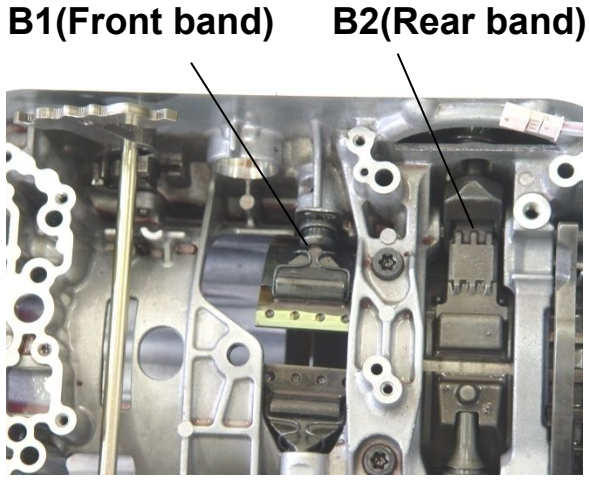


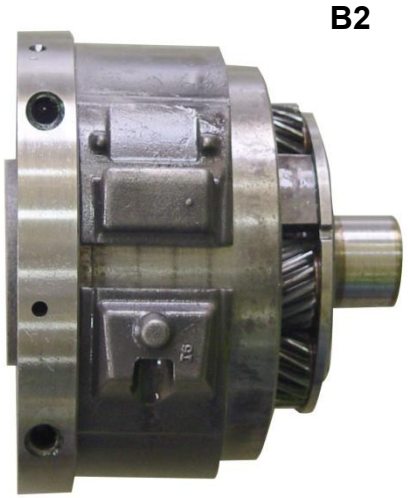
Double planetary gear set



Brake band


Strut
C3
cylinder
Reverse
sun gear
Forward
sun gear
Front
band
C3
sealing


B1(Front band)
B2(Rear band)


B2

Clutch pack / Brake band (M74)

Clutch pack		Brake band	
C1	O/D(3^{rd}, 4^{th})	B1	2^{nd}, 4^{th}
C2	Forward	B2	P/R/N/M1
C3	Reverse		
C4	Engine braking (M1,M2,M3)		

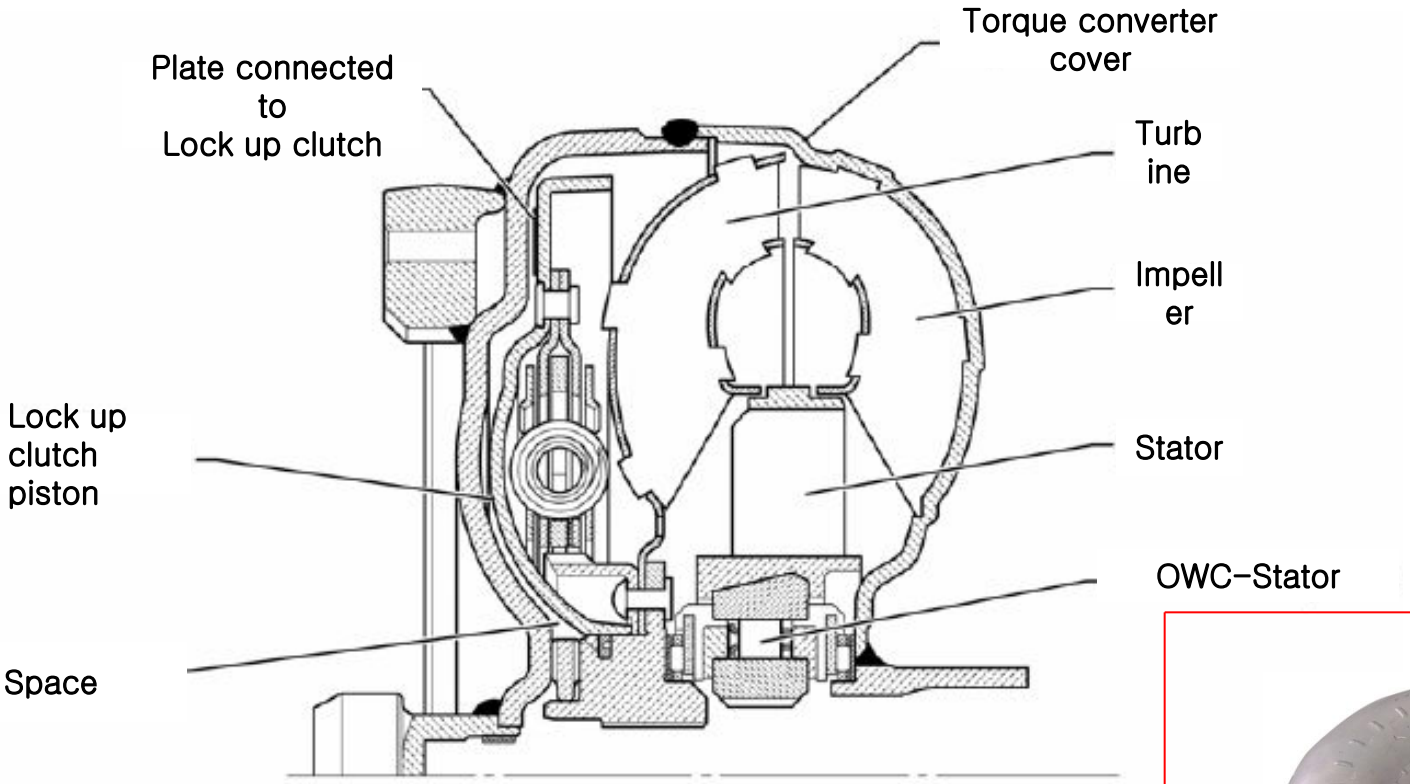
Clutch disc pack / Brake band(M78)

Clutch pack		Brake band	
C1	Rear planetary gear carrier (4^{th}, 5^{th}, 6^{th})	B1	Hold reverse sun gear (2^{nd}, 6th)
C2	Forward sun gear (M1, 1^{st}, 2^{nd}, 3^{rd}, 4^{th})	B2	Hold rear planetary gear carrier (M1, Reverse)
C3	Reverse sun gear (3^{rd}, 5^{th}, Reverse)		

Shifting components

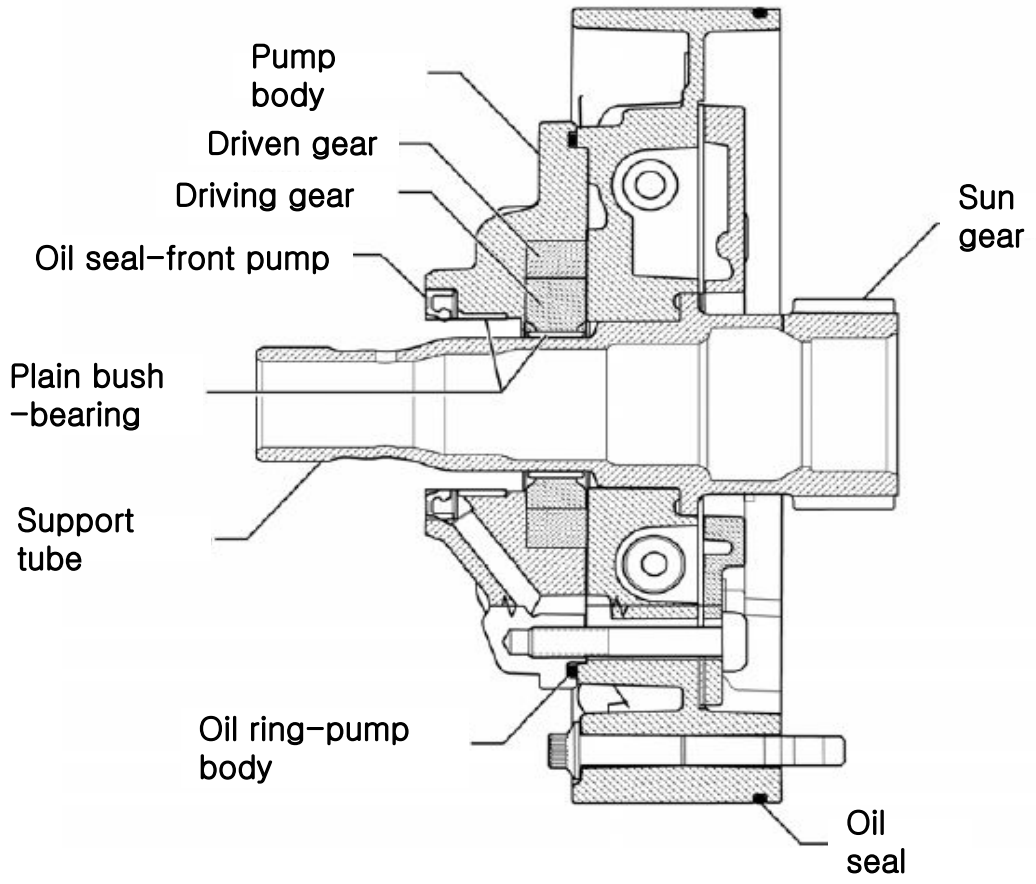
Gear	Gear ration	Operating components (Clutch & Brake band)						Shift On/Off Solenoid valve				Variable Bleeding Solenoid Valve-VBS					
		C1	C2	C3	B1	B2	1-2 OWC	S1	S2	S3	S4	S5 (A)	S6 (A)	S7 (A)	S8 (A)	S9 (A)	S10 (A)
M1	3.536		ON			ON		ON				1	0	1			
1st	3.536		ON				ON	ON				1	0			0-1	
2nd	2.143		ON		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	

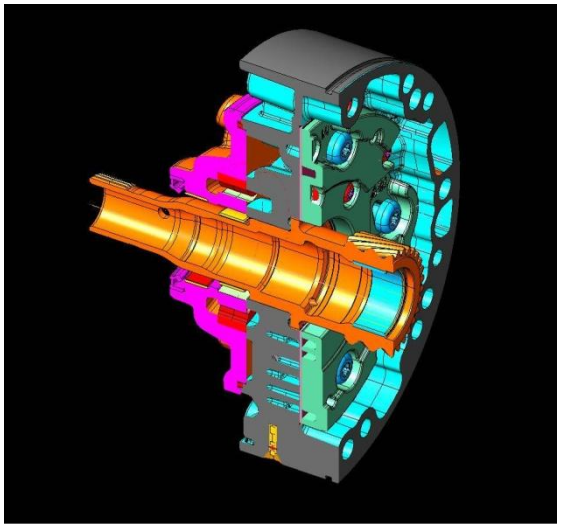
Torque converter



VBS : Solenoid S10

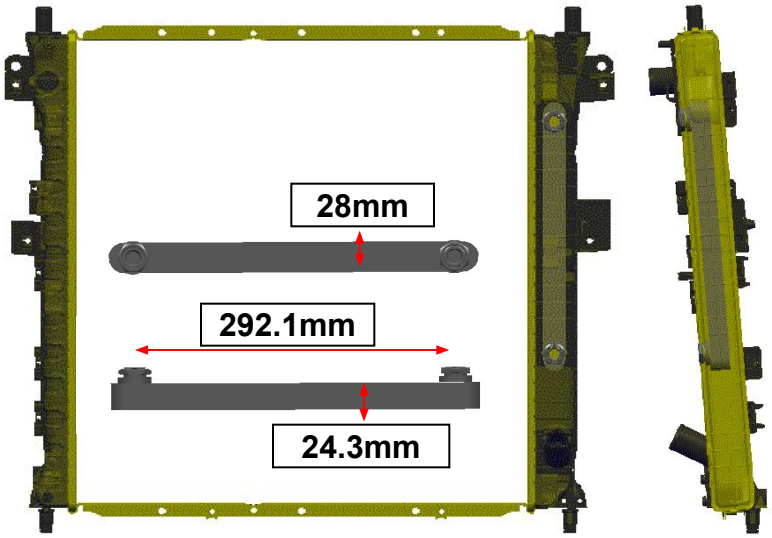
Oil pump

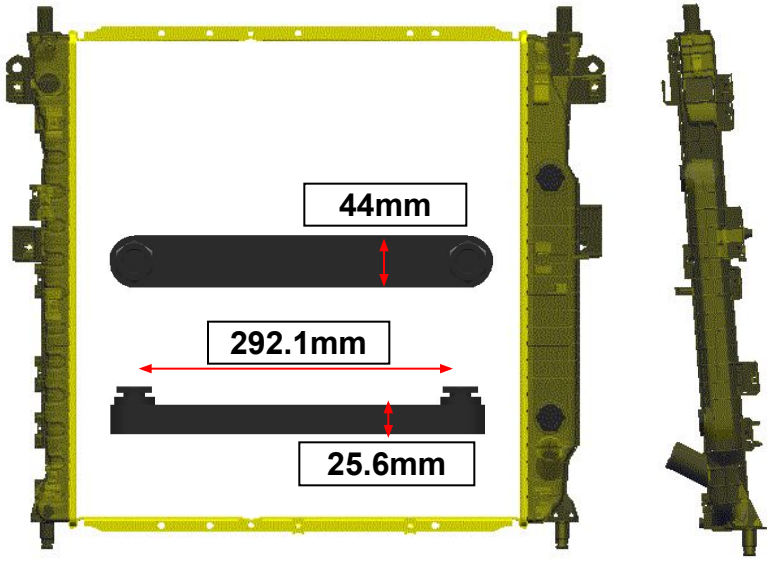




17.6cc / revolution (Sun gear)

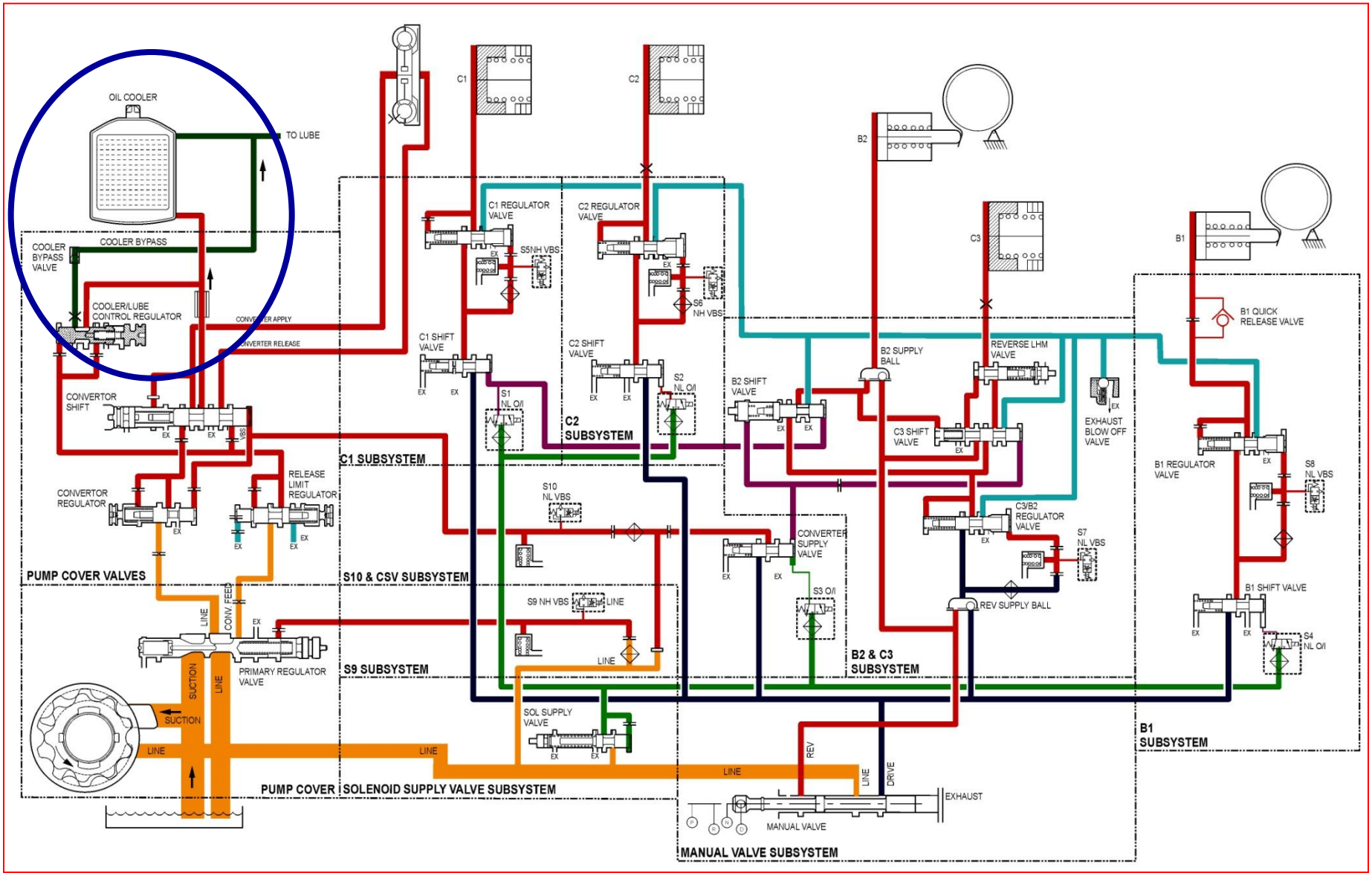
Oil cooler



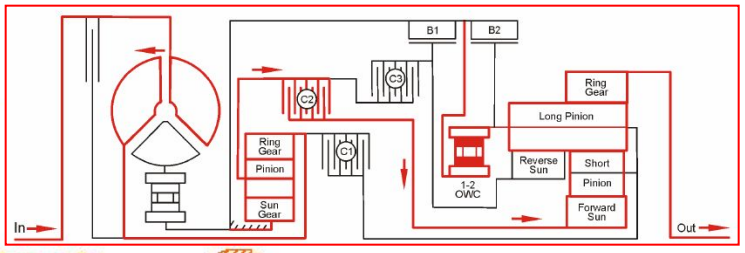


Items	Unit	Actyon	A/Sports
Heat radiation	kcal/hr (kW)	Max3.100 −10% (3.6 −10%)	Max.3850 −10% (4.49 −10%)
Oil Prss. Drop	kg/cm^2 (kPa)	Min.0.6 + 10% (58.8 + 10%)	Min.0.72 +10% (70 +10%)
Weight	g	Dry : 191 With oil : 266	Dry : 331 With oil : 397

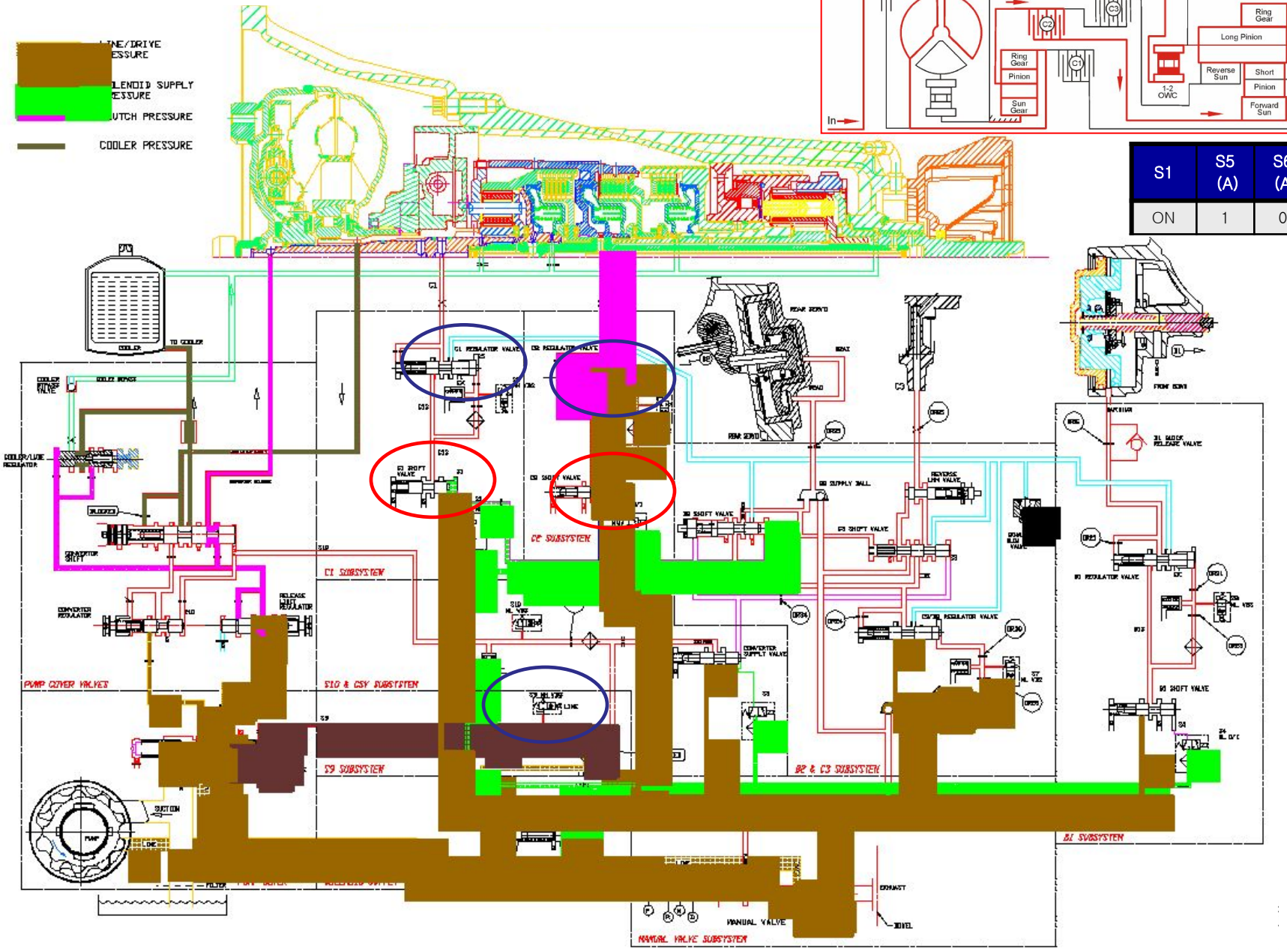
Hydraulic circuit



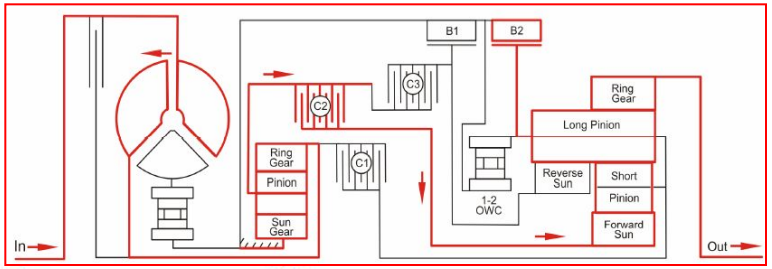
1st – 3.53:1(C2 & OWC)



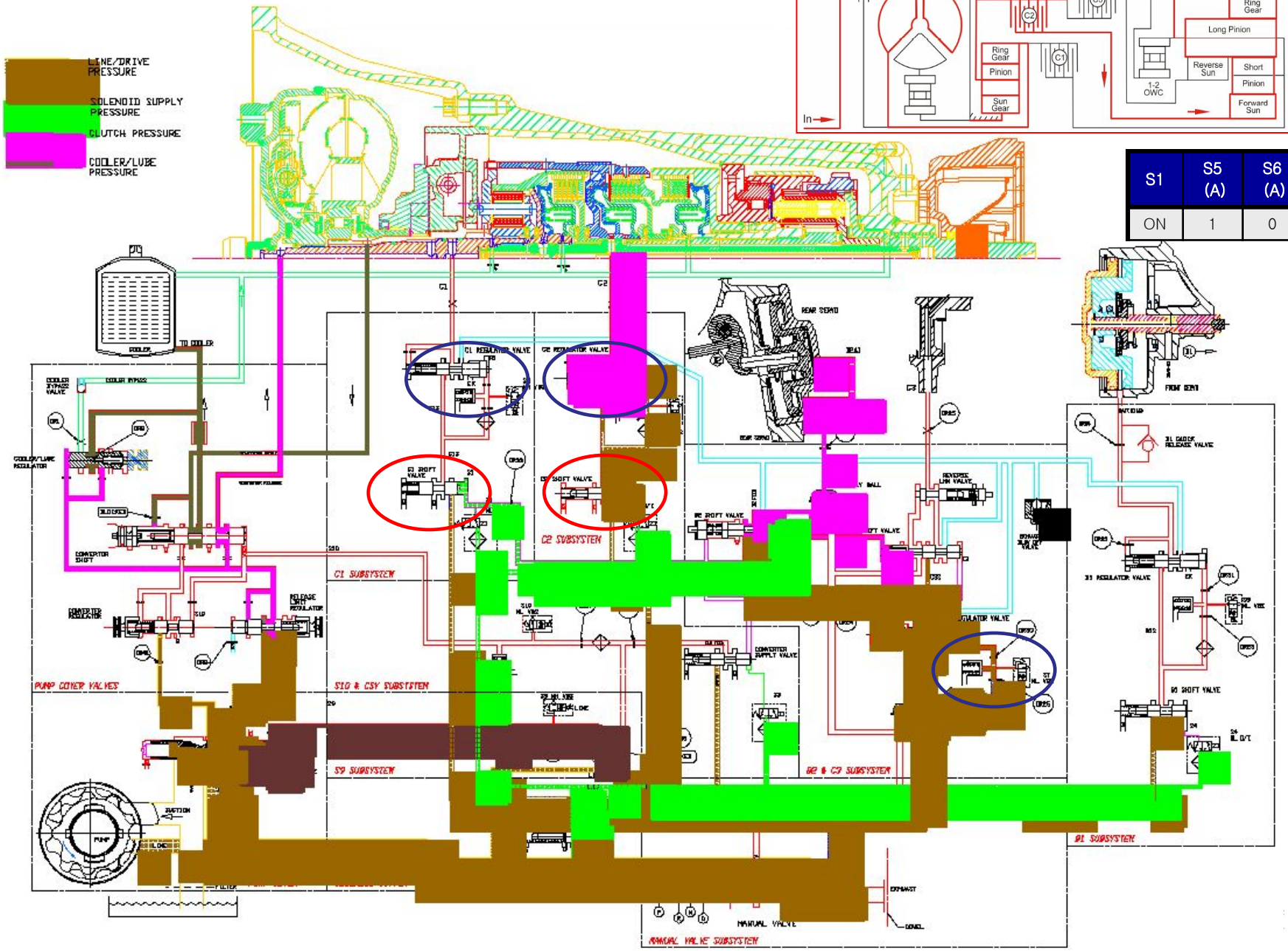
S1	S5 (A)	S6 (A)	S9 (A)
ON	1	0	0–1



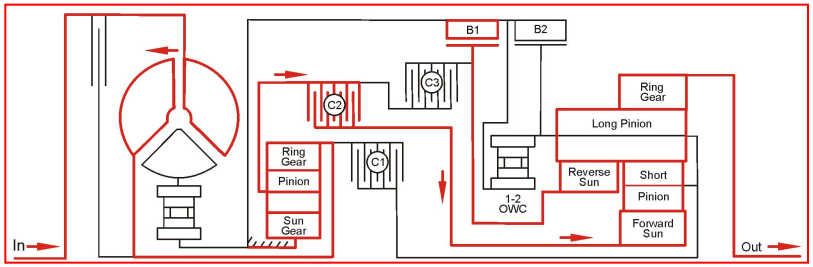
M 1st – 3.53:1(C2 & B2)



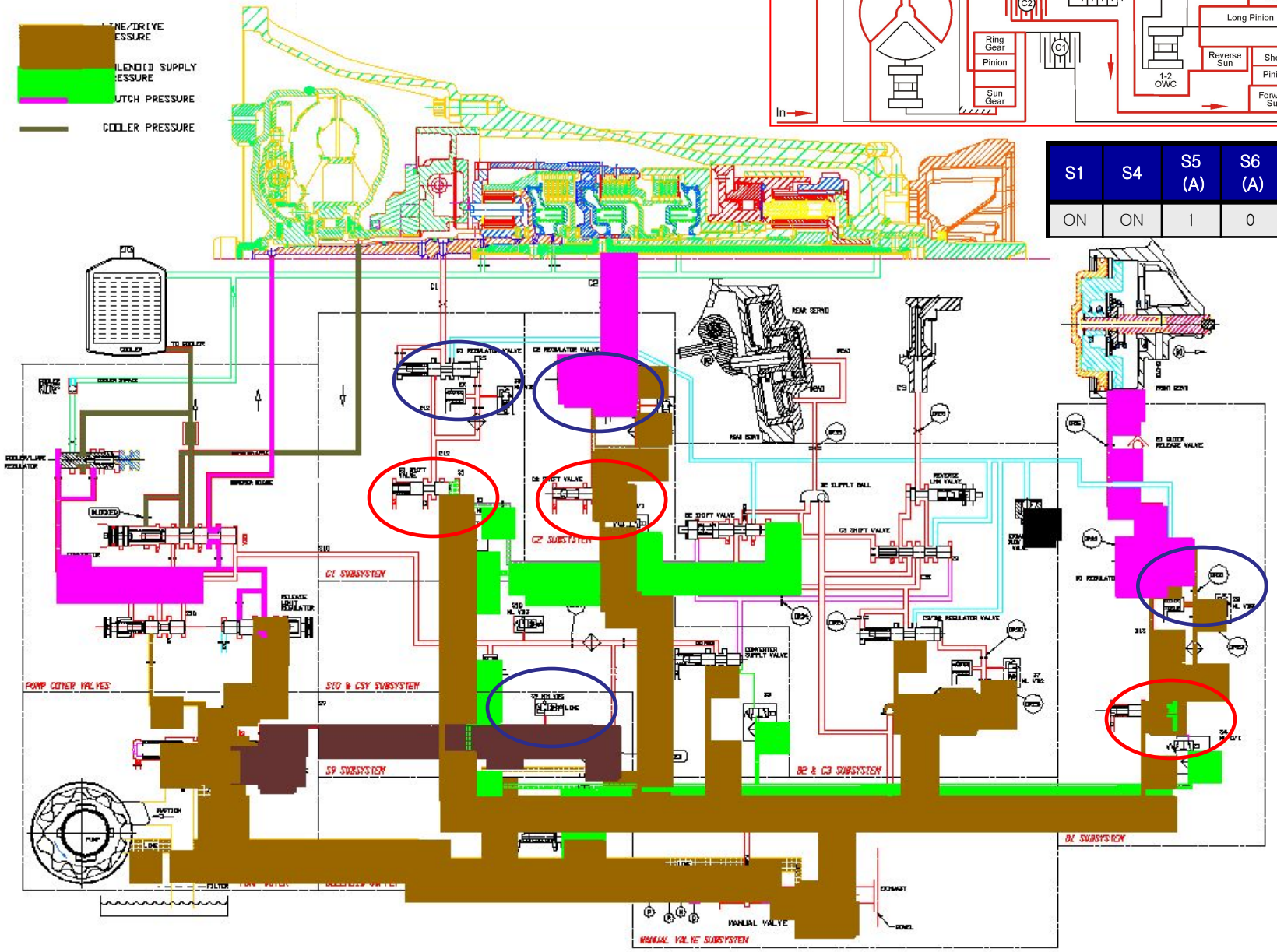
S1	S5 (A)	S6 (A)	S7 (A)
ON	1	0	1



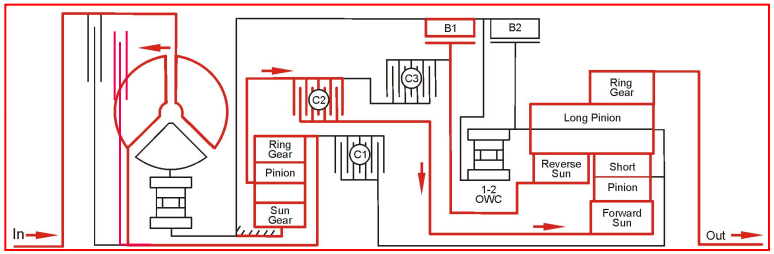
2nd – 2.14:1(C2 & B1)



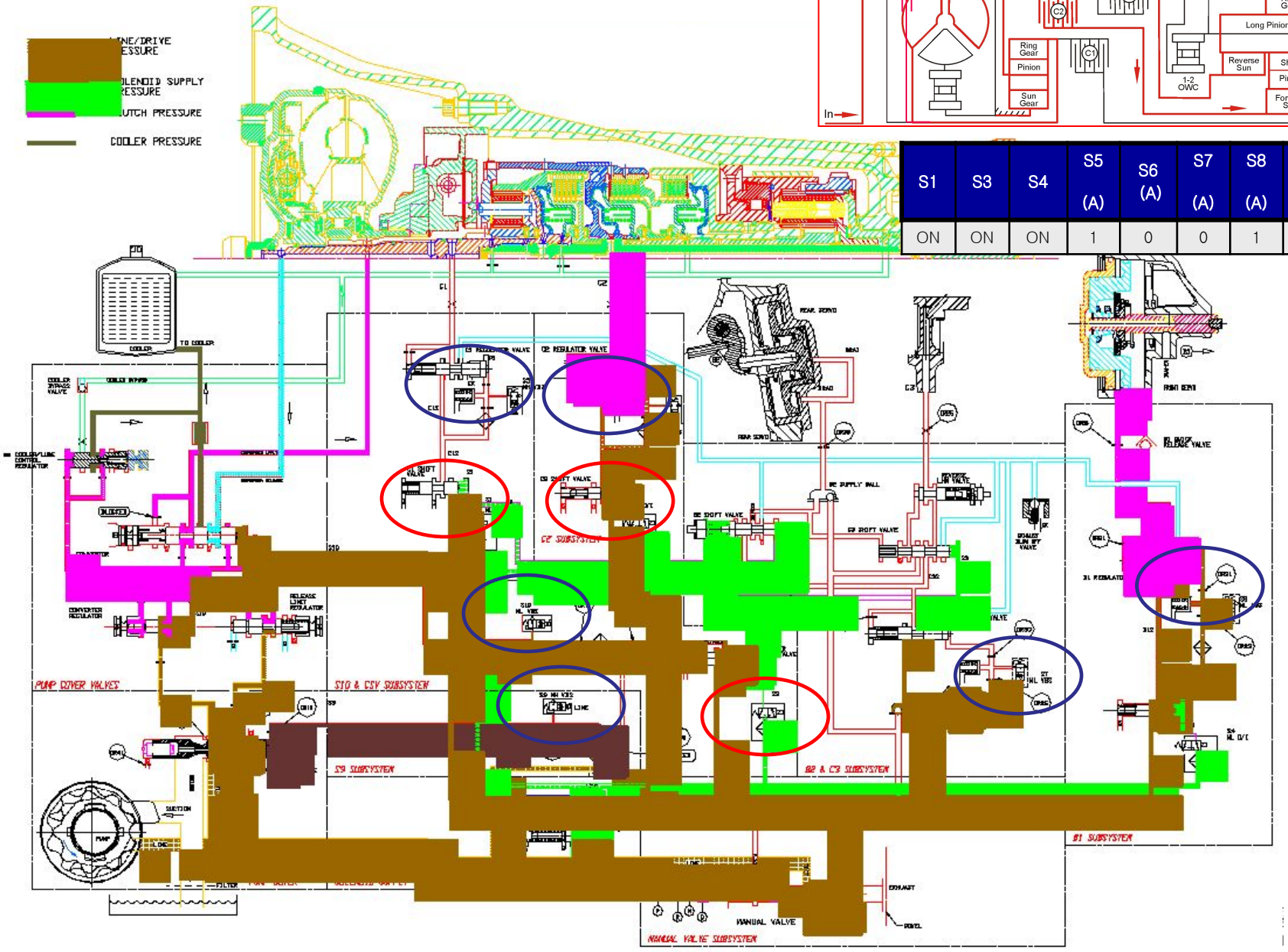
S1	S4	S5 (A)	S6 (A)	S8 (A)	S9 (A)
ON	ON	1	0	1	0-1



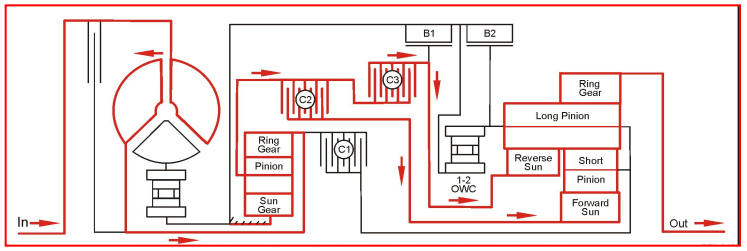
2nd(L/Up) – 2.14:1(C2 & B1 & TCC)



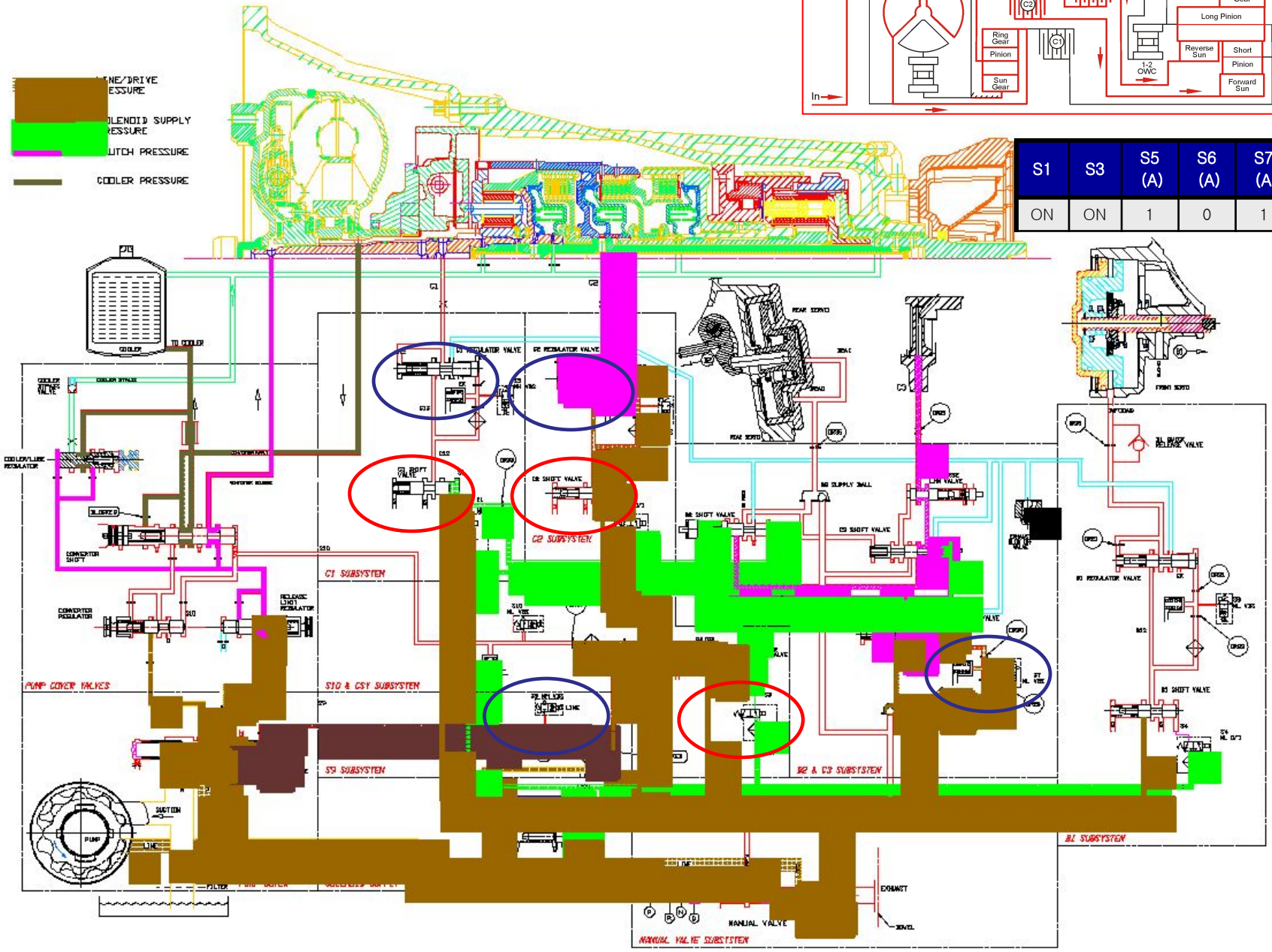
S1	S3	S4	S5 (A)	S6 (A)	S7 (A)	S8 (A)	S9 (A)	S10 (A)
ON	ON	ON	1	0	0	1	0-1	1



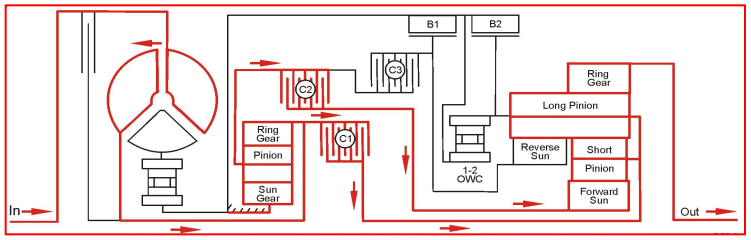
3rd – 1.48:1(C2 & C3)



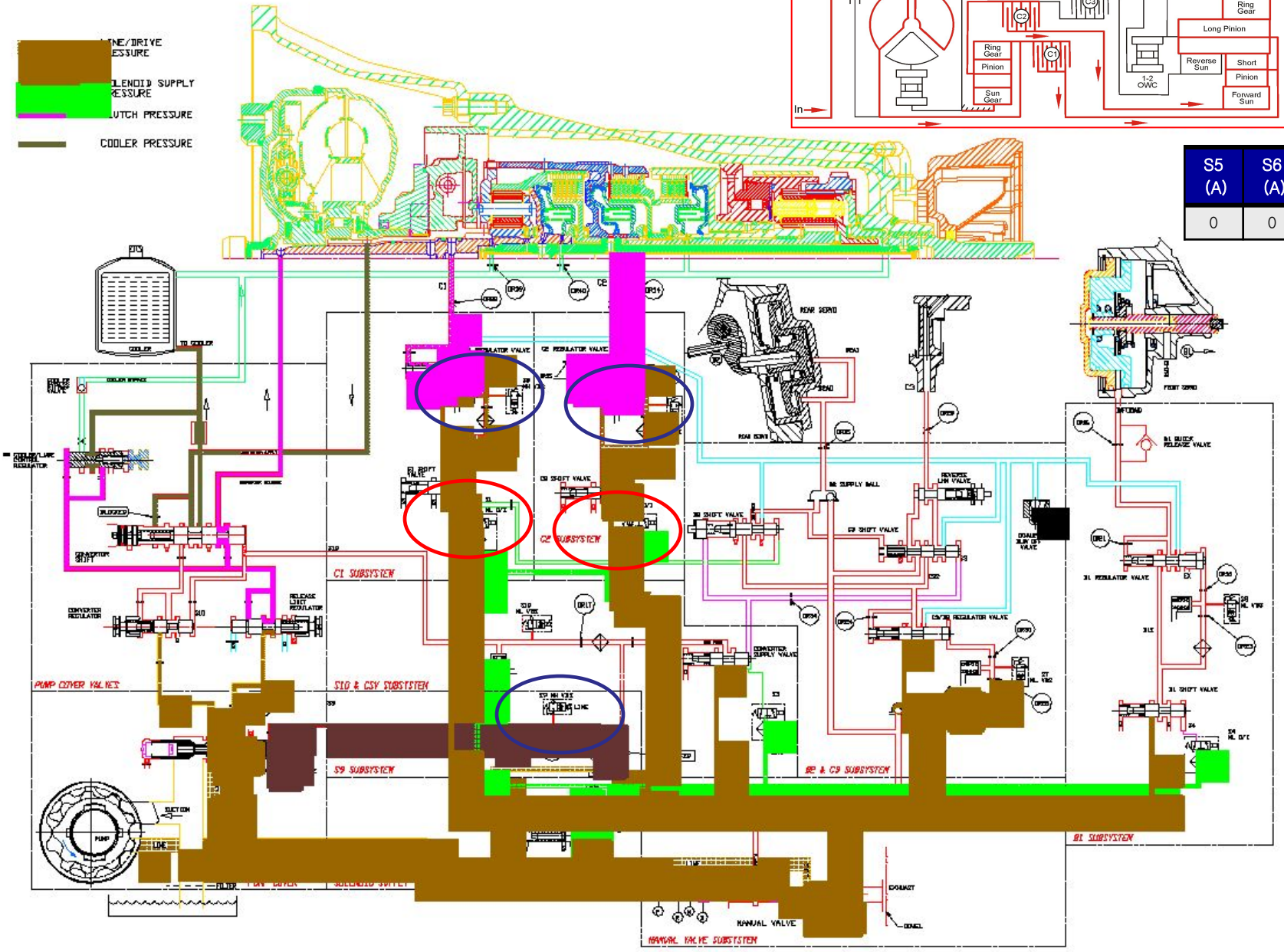
S1	S3	S5 (A)	S6 (A)	S7 (A)	S9 (A)
ON	ON	1	0	1	0-1



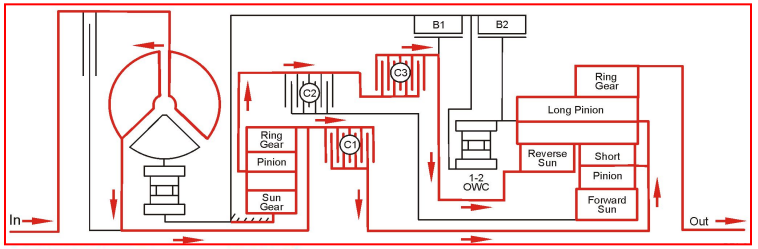
4th(4th in LHM) – 1.16:1(C1 & C2)



S5 (A)	S6 (A)	S9 (A)
0	0	0–1



5th – 0.87:1(C1 & C3)



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

LINE/DRIVE PRESSURE

SOLENOID SUPPLY PRESSURE

CLUTCH PRESSURE

COOLER PRESSURE

C2 SUBSYSTEM

C1 SUBSYSTEM

PUMP DRIVER VALVES

SIG & CSV SUBSYSTEM

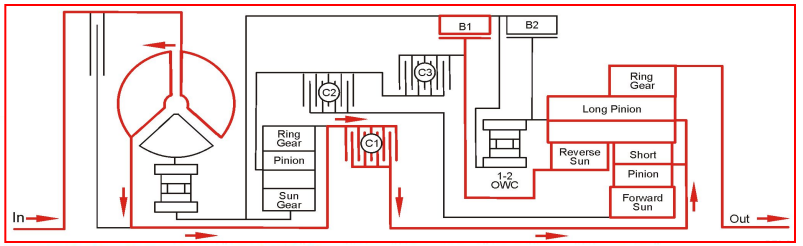
S9 SUBSYSTEM

B2 & C3 SUBSYSTEM

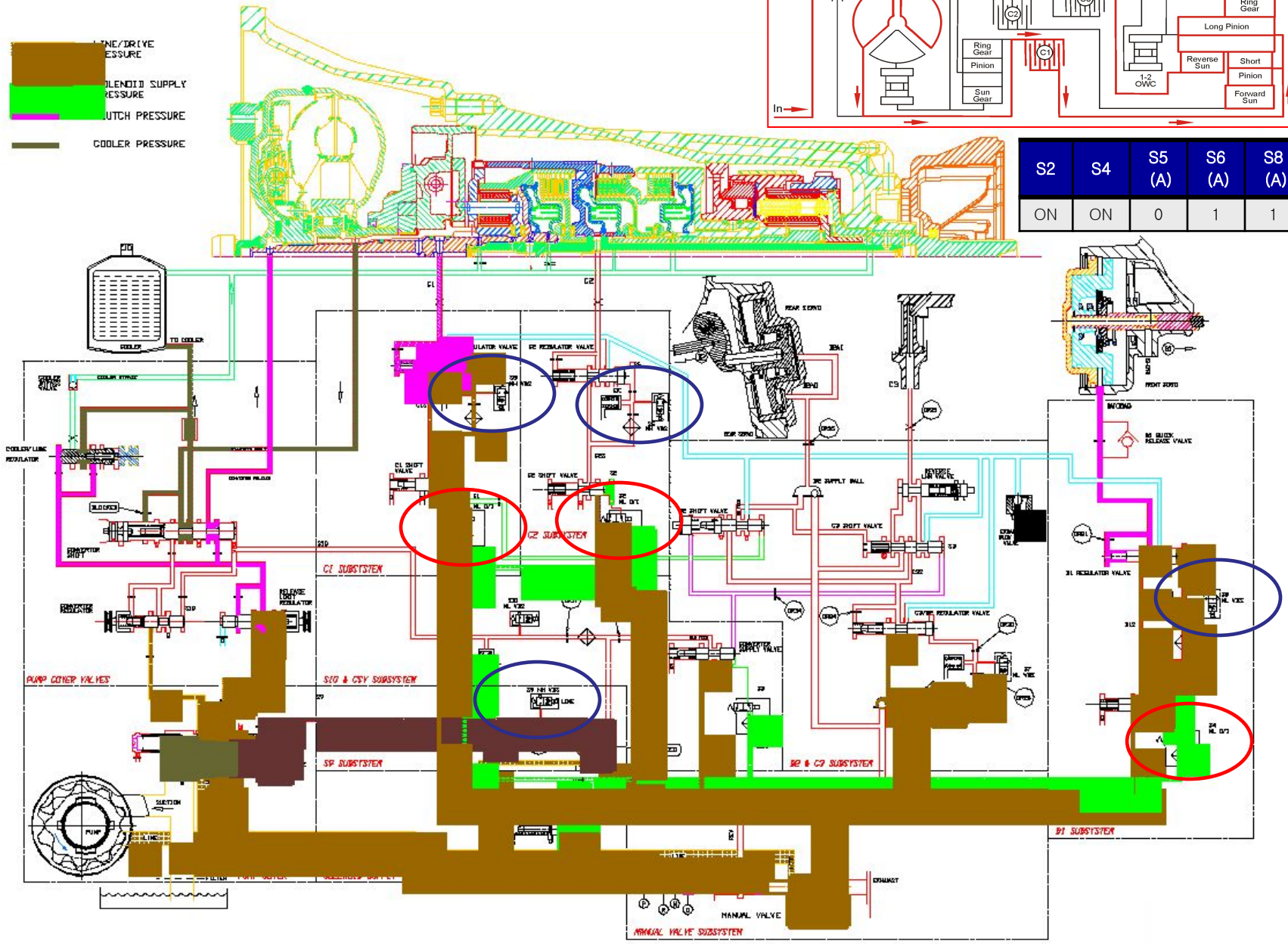
B1 SUBSYSTEM

MANUAL VALVE SUBSYSTEM

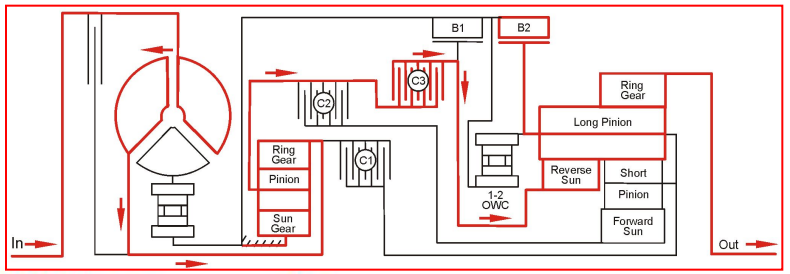
6th - 0.68:1(C1 & B1)



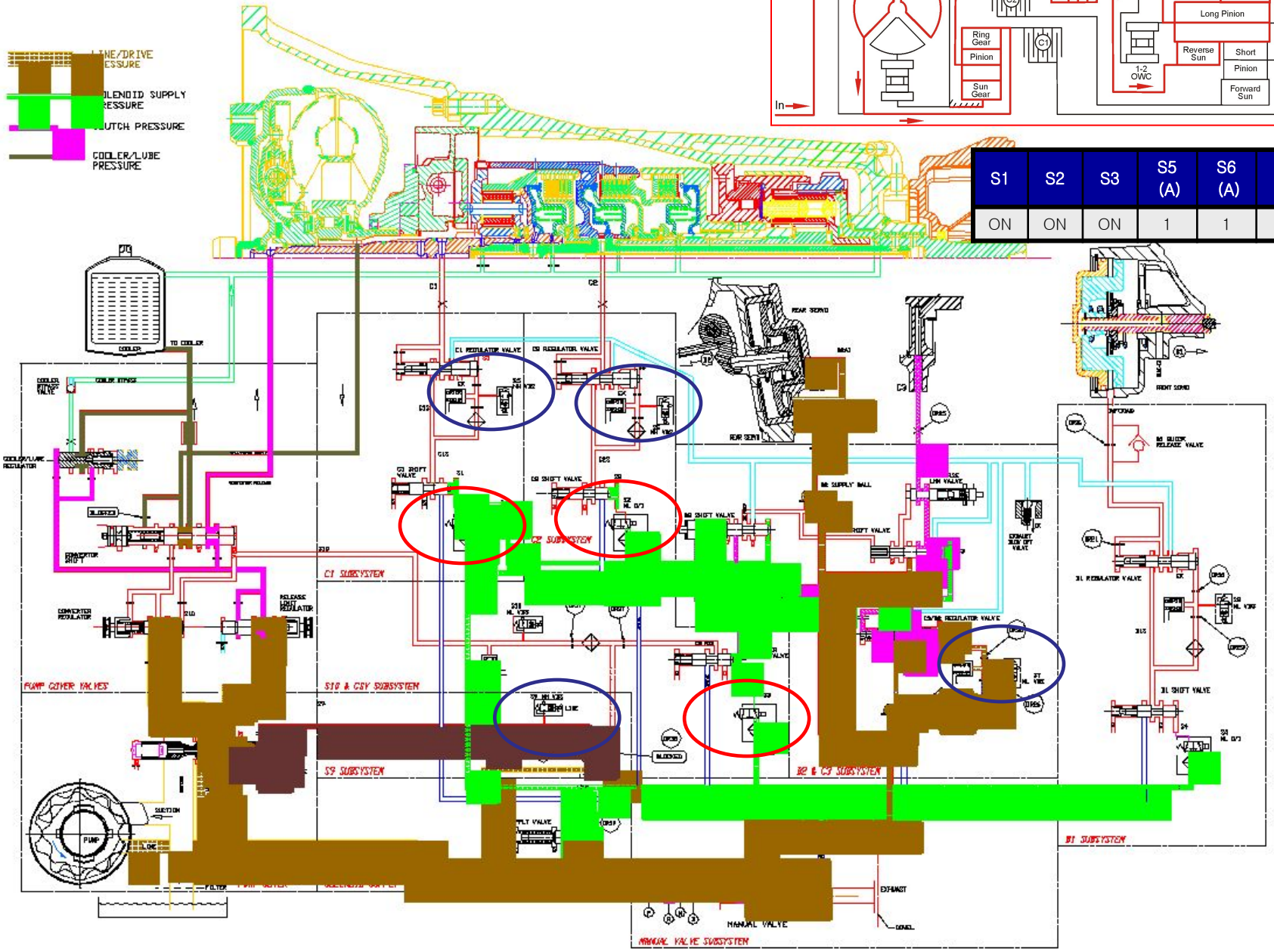
S2	S4	S5 (A)	S6 (A)	S8 (A)	S9 (A)
ON	ON	0	1	1	0-1



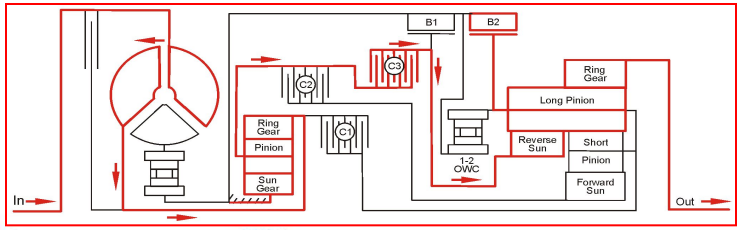
Reverse – 3.09:1(C3 & B2)



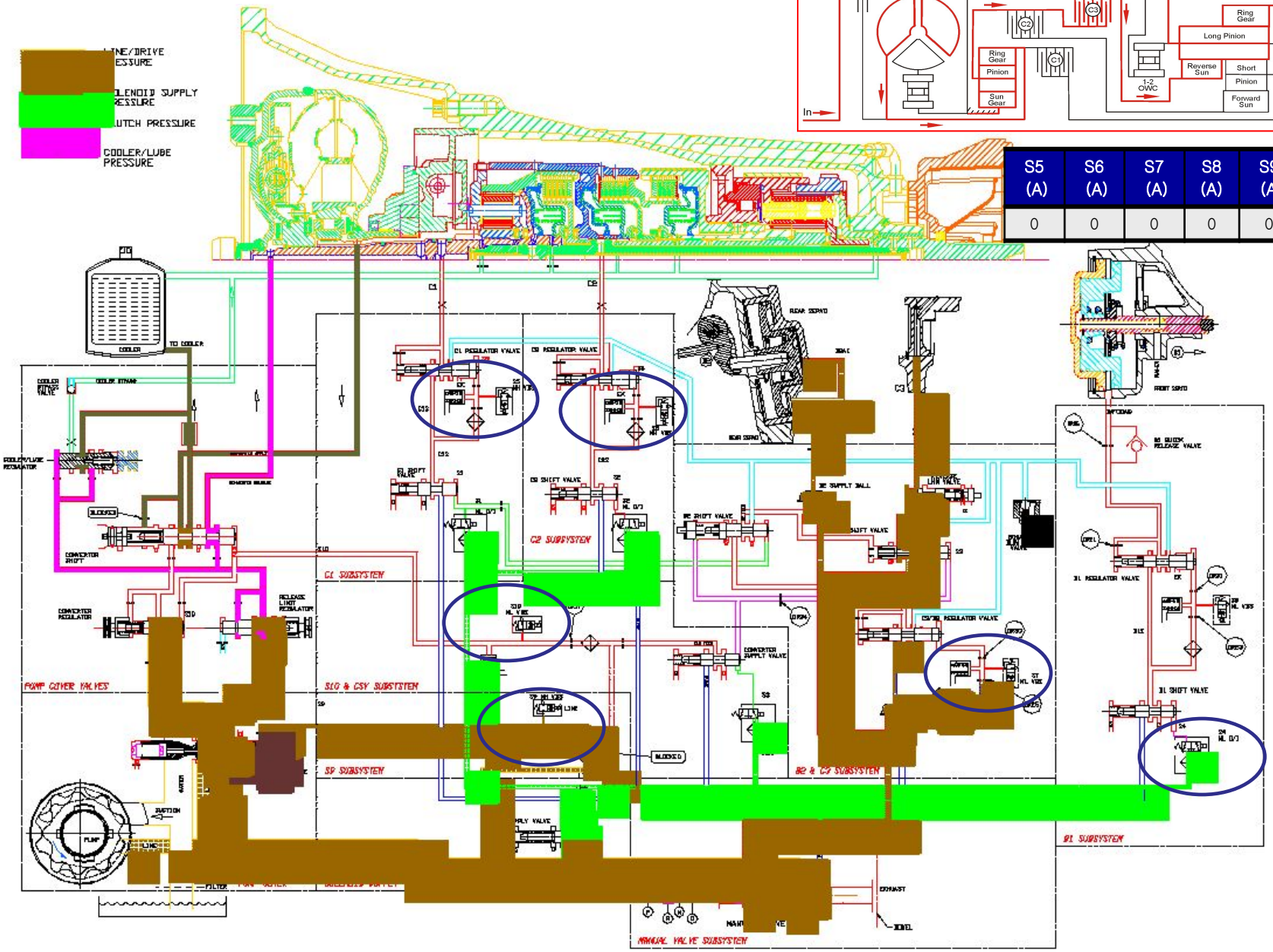
S1	S2	S3	S5 (A)	S6 (A)	S7 (A)	S9 (A)
ON	ON	ON	1	1	1	0–1



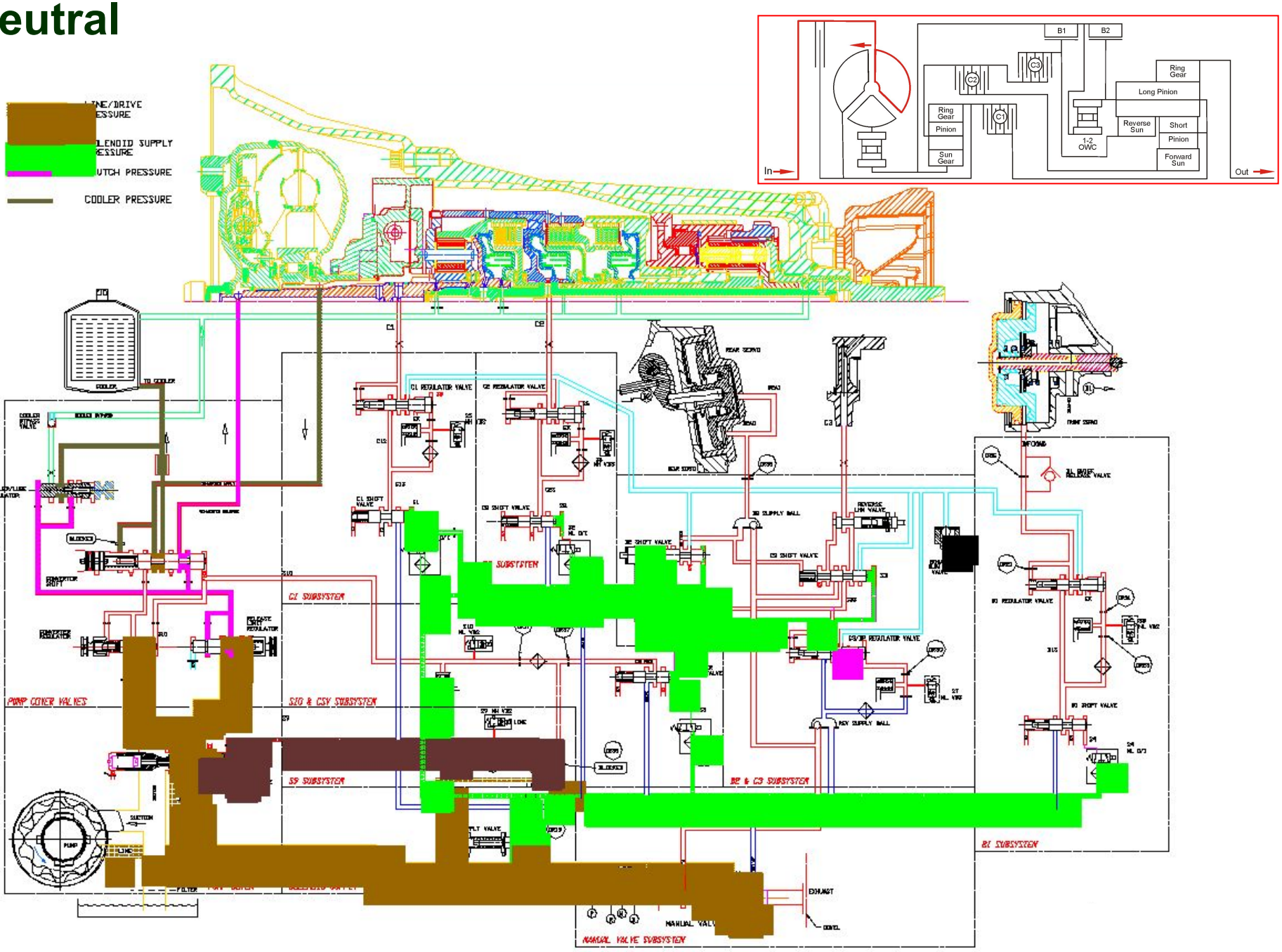
Reverse in LHM – 3.09:1(C3 & B2)



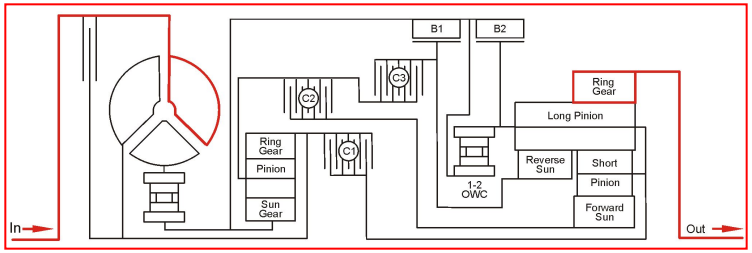
S5 (A)	S6 (A)	S7 (A)	S8 (A)	S9 (A)	S10 (A)
0	0	0	0	0	0

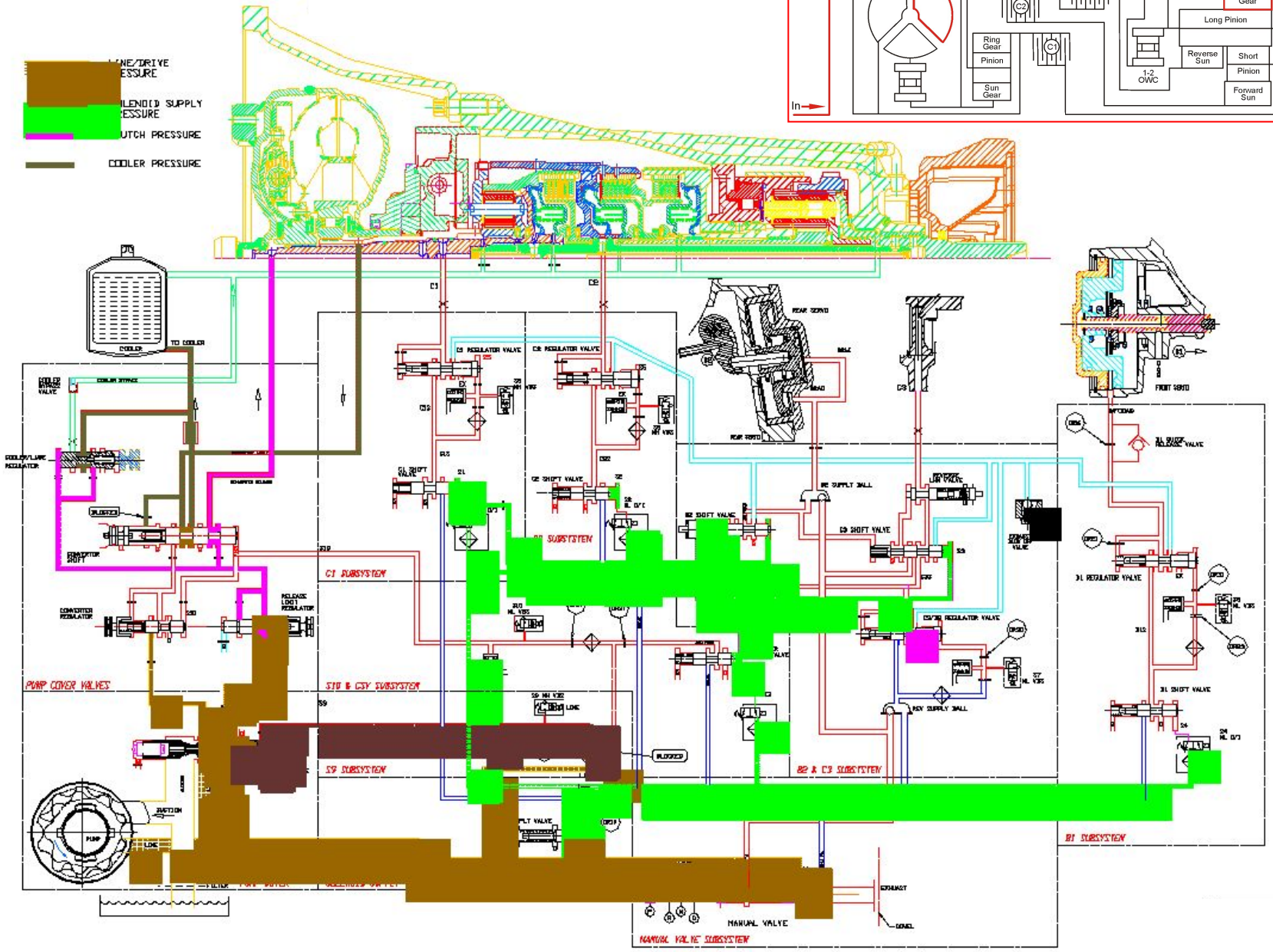


Neutral

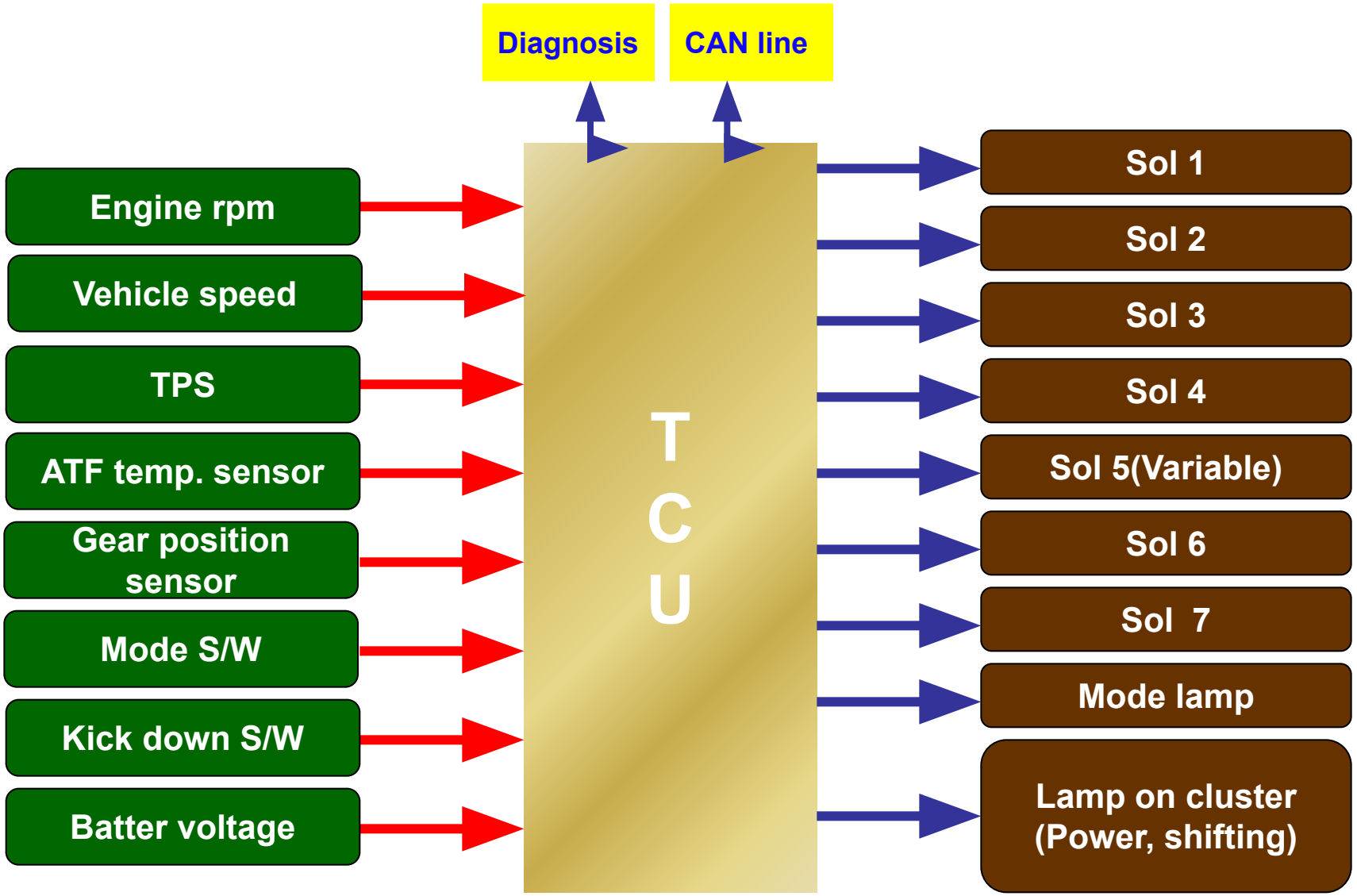

LINE/DRIVE PRESSURE
SOLENOID SUPPLY PRESSURE
CLUTCH PRESSURE
COOLER PRESSURE
B1
B2
C3
C2
C1
Ring Gear
Long Pinion
Ring Gear
Pinion
Sun Gear
Reverse Sun
Short Pinion
Forward Sun
1-2 OWC
In
Out
C1 REGULATOR VALVE
C2 REGULATOR VALVE
REAR SERVO
FRONT SERVO
C1 SHIFT VALVE
C2 SHIFT VALVE
C3 SHIFT VALVE
B2 SUPPLY BALL
REVERSE PIN VALVE
B1 RELEASE VALVE
B1 REGULATOR VALVE
B1 SHIFT VALVE
C3/B2 REGULATOR VALVE
MSV SUPPLY BALL
C1 SUBSYSTEM
PUMP COVER VALVES
SIG & CSV SUBSYSTEM
S3 SUBSYSTEM
B2 & C3 SUBSYSTEM
B1 SUBSYSTEM
MANUAL VALVE SUBSYSTEM
MANUAL VALVE
EXHAUST
PUMP
SUCTION
LINE
FILTER
TO COOLER
COOLER BYPASS VALVE
COOLER/LUBE REGULATOR
BLOCKER
CONVERTER CLUTCH
CONVERTER REGULATOR

Parking

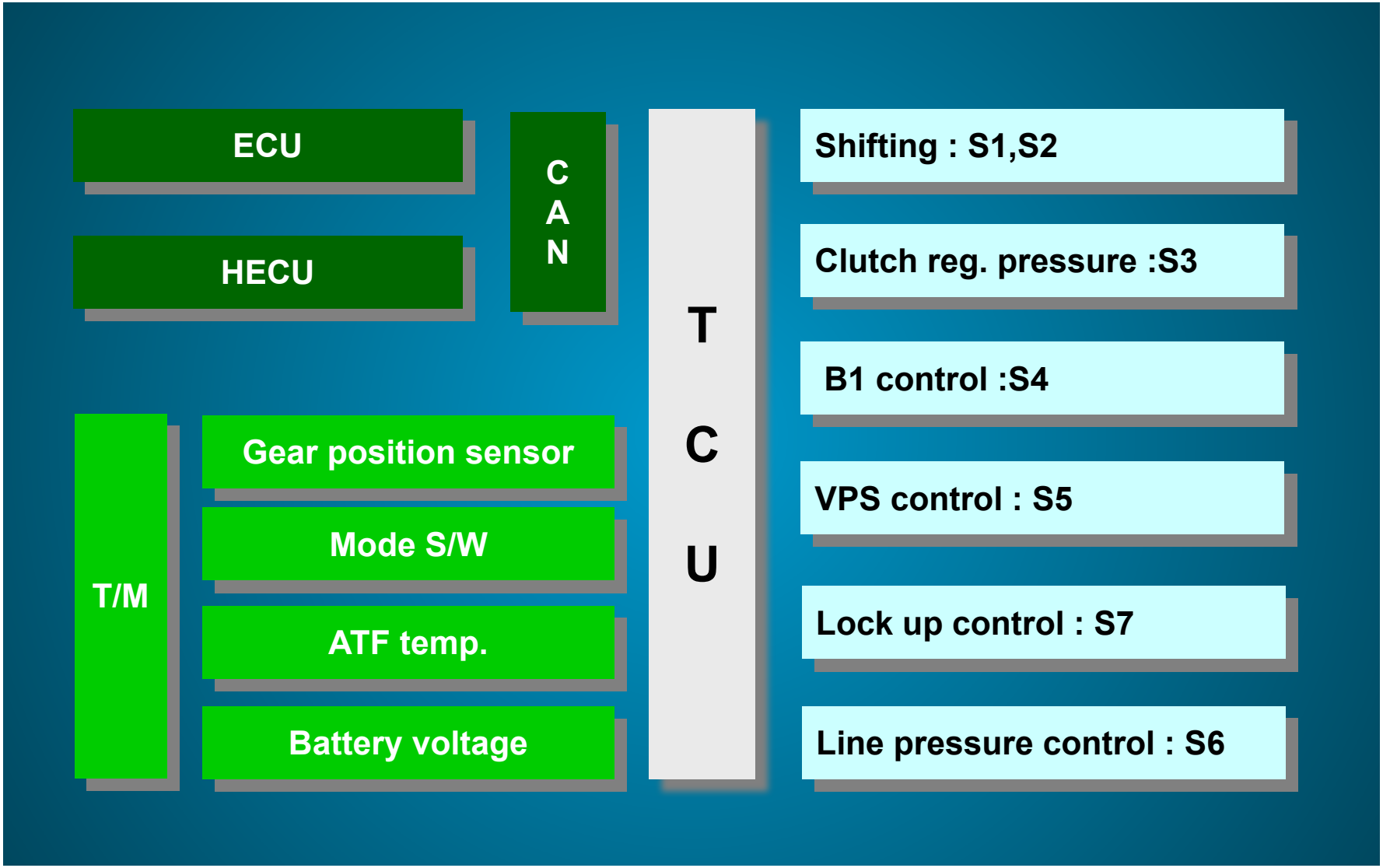

B1
B2
C3
C2
C1
Ring Gear
Long Pinion
Ring Gear
Pinion
Sun Gear
Reverse Sun
Short Pinion
Forward Sun
1-2 OWC
In
Out


LINE/DRIVE PRESSURE
SOLENOID SUPPLY PRESSURE
CLUTCH PRESSURE
COOLER PRESSURE
COOLER
TO COOLER
C1 SUBSYSTEM
PUMP COVER VALVES
MANUAL VALVE
MANUAL VALVE SUBSYSTEM

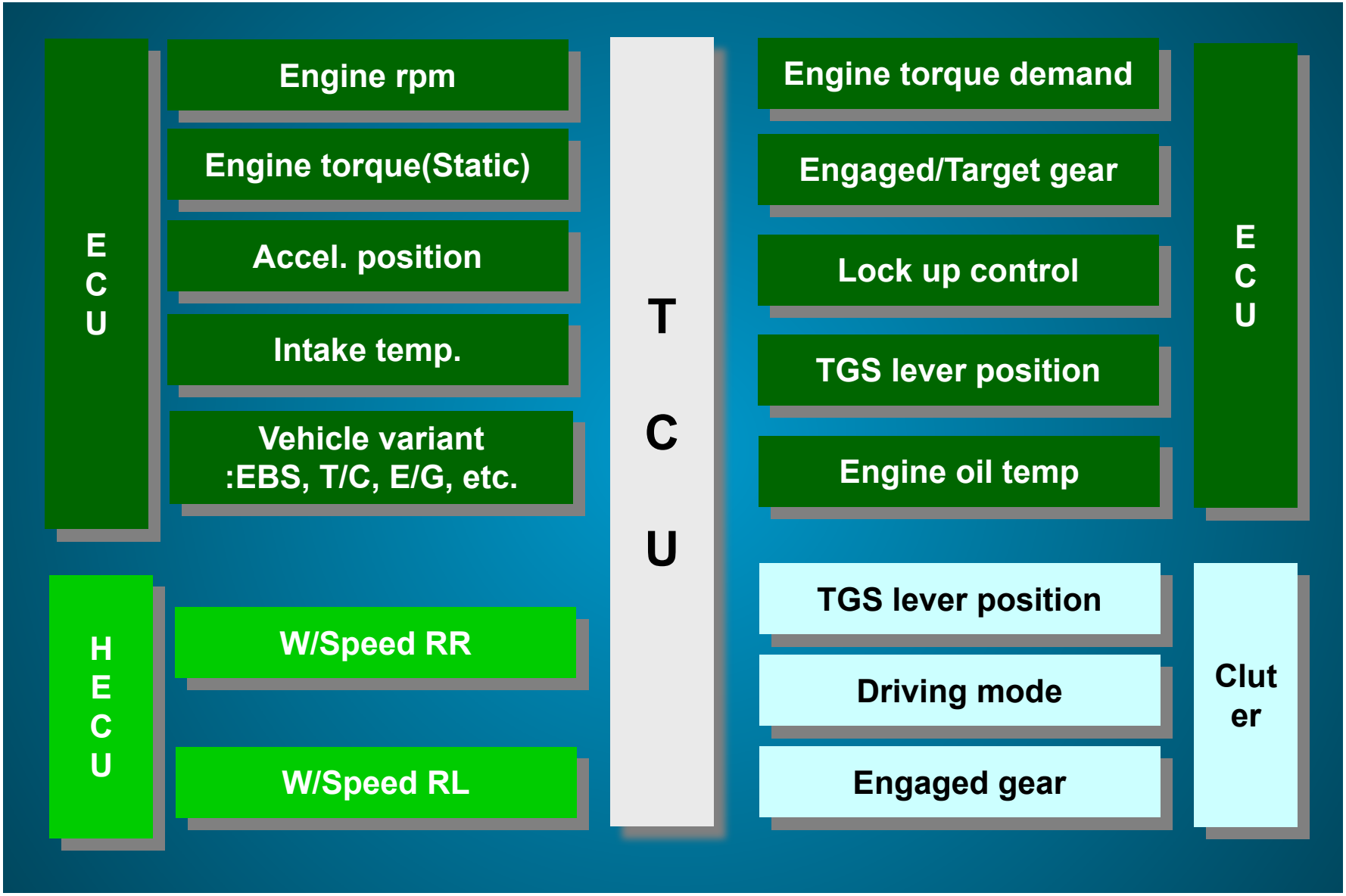
TCU Input & Output (M74-IDI Engine)



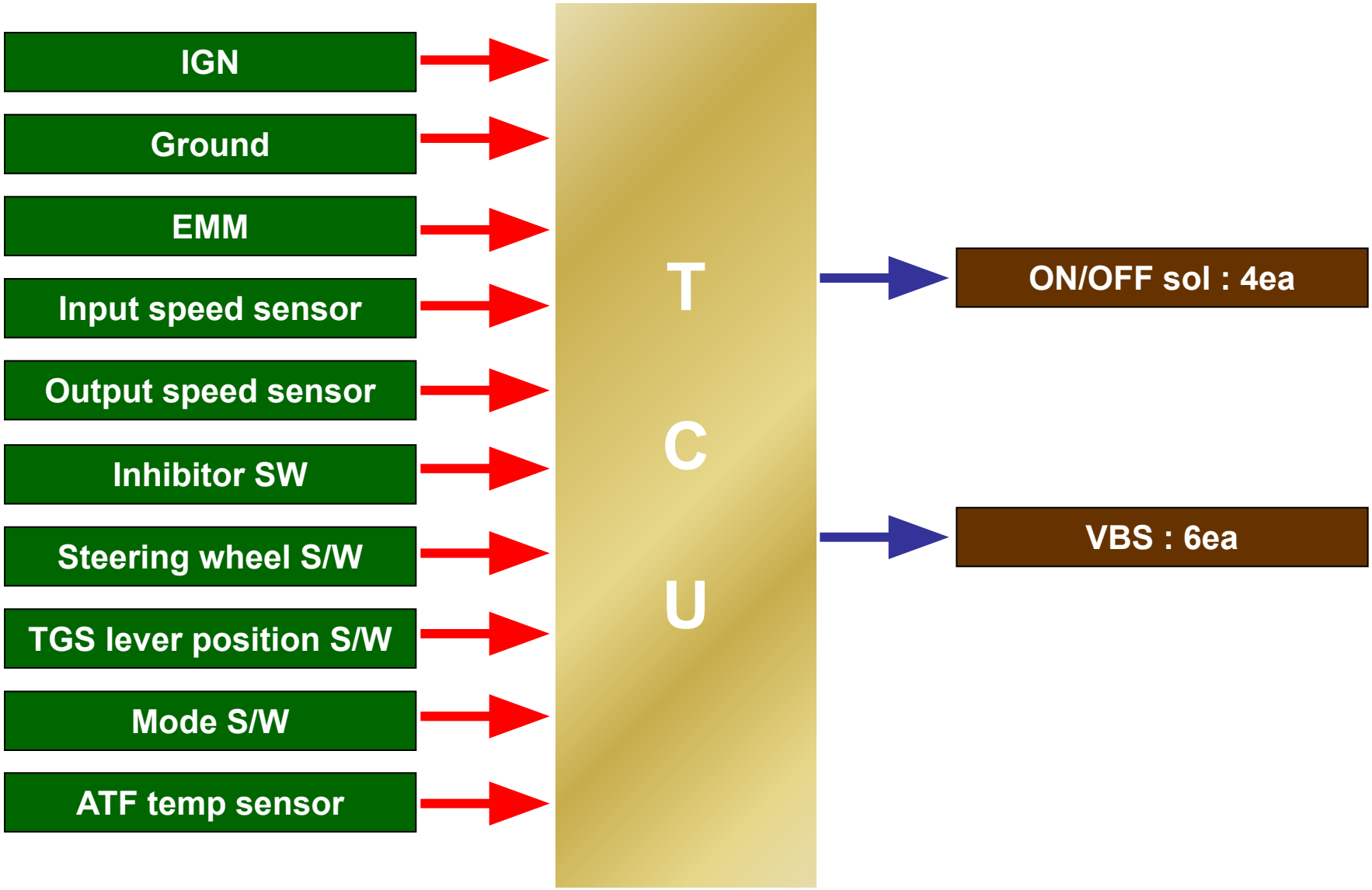
TCU Input & Output I (M74-DI Engine)



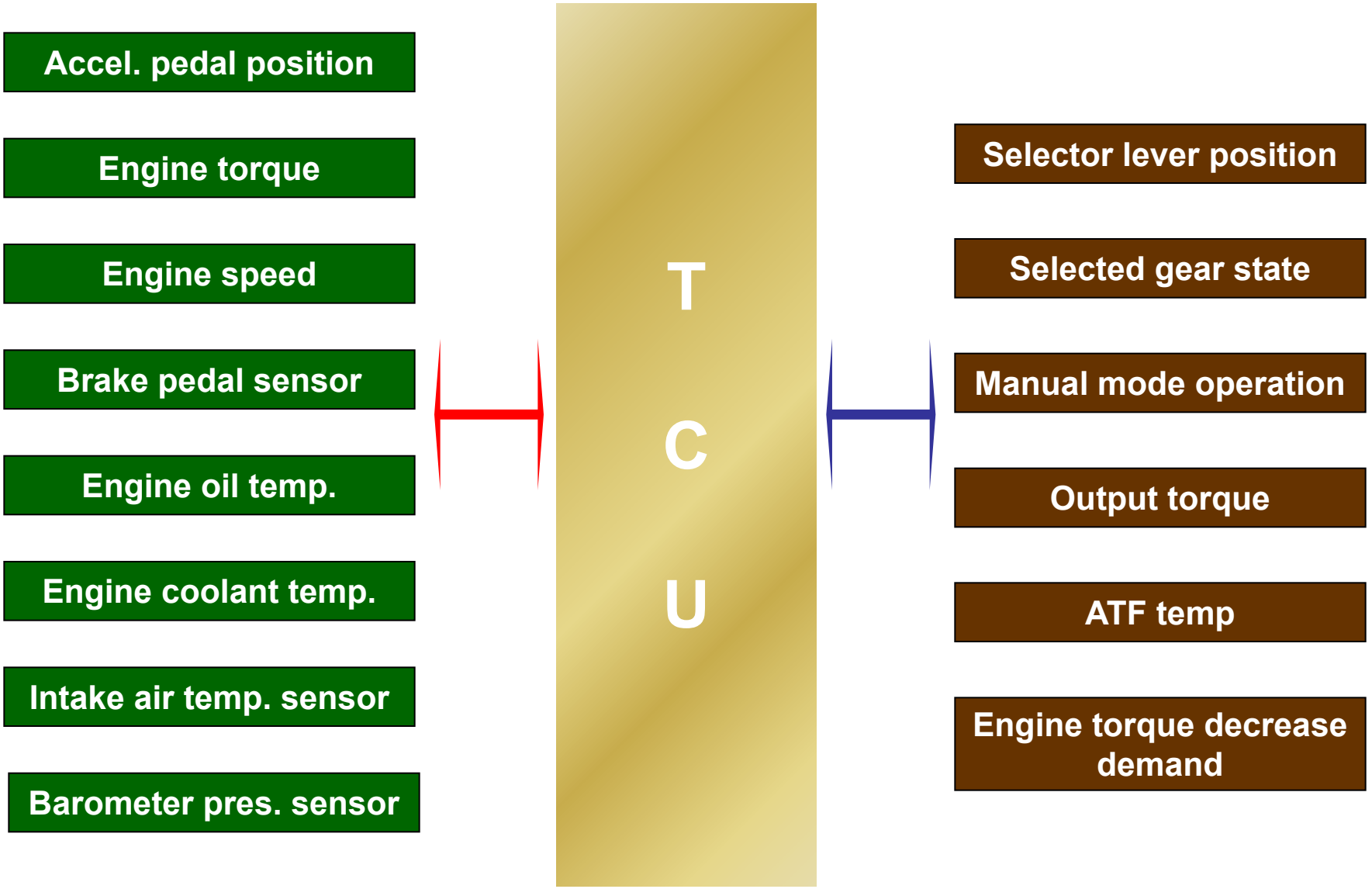
TCU Input & Output II (M74-DI Engine)



TCU Input & Output (M78)

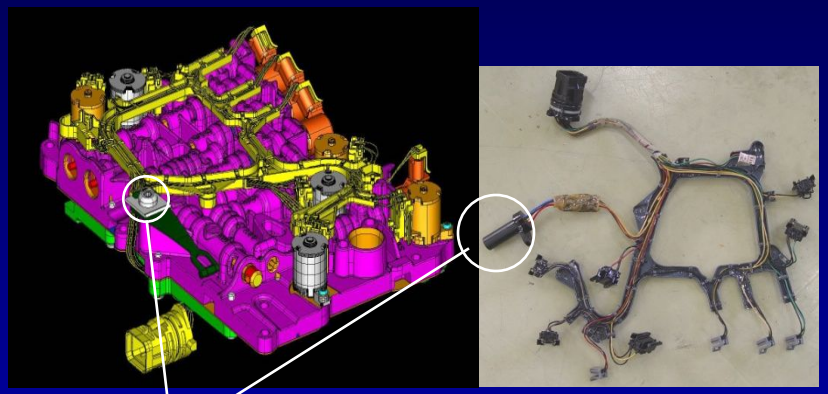


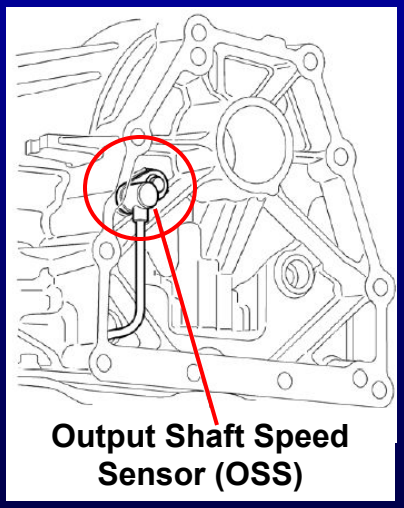
TCU Input & Output (M78) - CAN



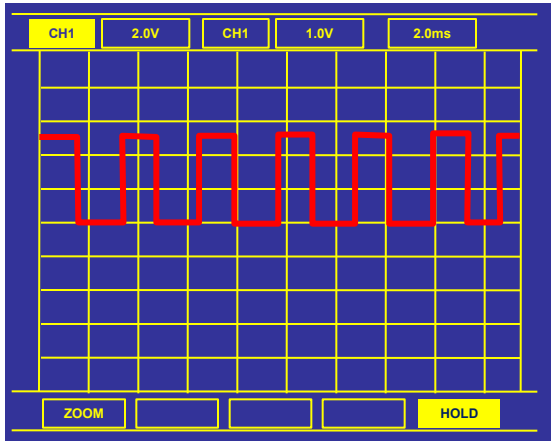
TCU input signal

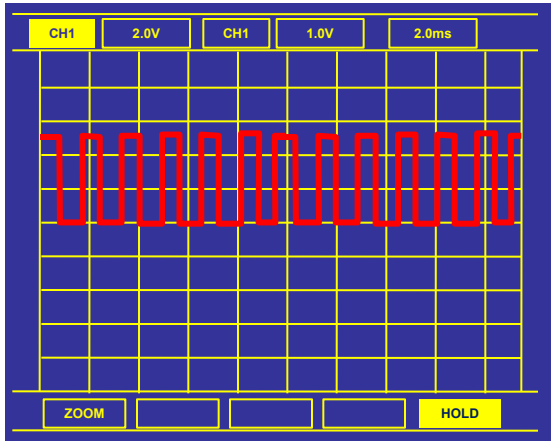
- **EMM(Embedded Memory Module)**
  - Input speed sensor clustered
  - Storing T/M characteristic
  - TCU check by every “key on”
- **Input shaft speed(ISS) sensor**
  - Hall effect type sensor
  - Monitoring torque converter slip
  - Close loop control
- **Output shaft speed(OSS) sensor**
  - Hall effect type sensor
  - Using gear schedule



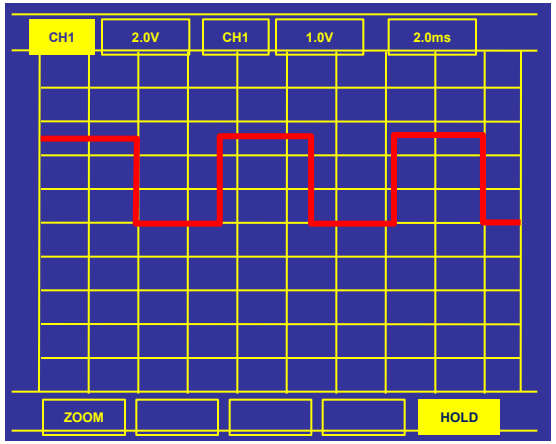


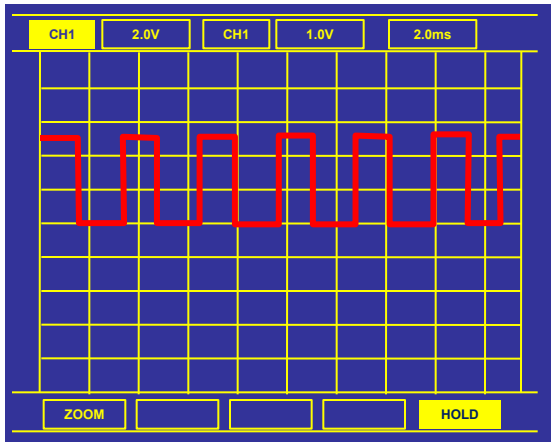
Input & Output signal wave form





Input shaft speed sensor





Output shaft speed sensor

TCU input signal

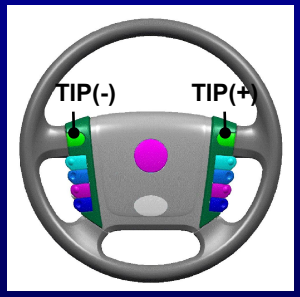
■ **Inhibitor switch**

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

Inhibitor switch

■ **Steering wheel S/W**

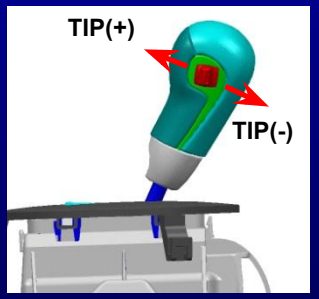
- TGS “M” selection
- “+” or “-”



S/Wheel S/W

■ **Gear selector lever S/W**

- TGS “M” selection
- “+” or “-”



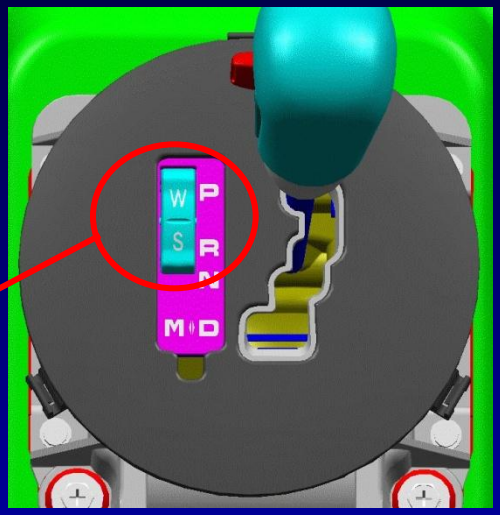
Gear selector S/W

TCU input signal

■ Mode S/W

- DURA TGS lever
- Standard mode
- Winter mode

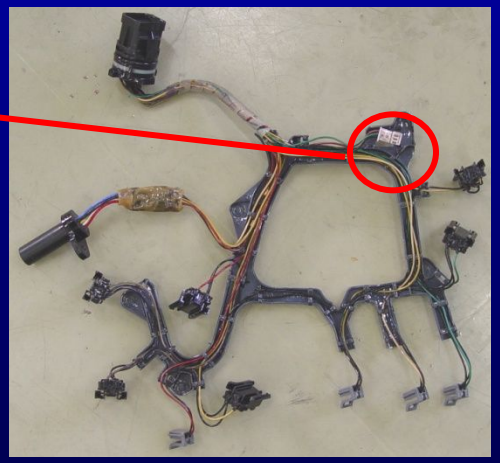
Mode switch



■ ATF temp. sensor

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

ATF temp. sensor



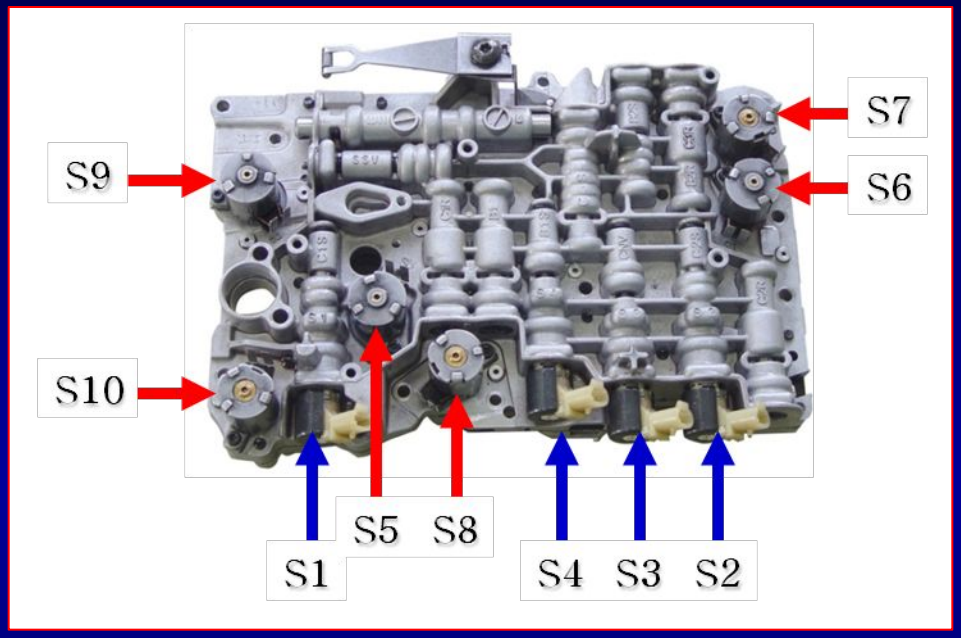
TCU output signal

■ **ON/OFF sol. valve**

- S1, S2, S3, S4
- 0V / 12V
- 22.0 ± 1.2Ω
- Making gear shifting

■ **VBS**

- S5, S6, S7, S8, S9, S10
- 0mA / 1100mA
- 4.14 ± 0.3Ω
- Shifting quality control

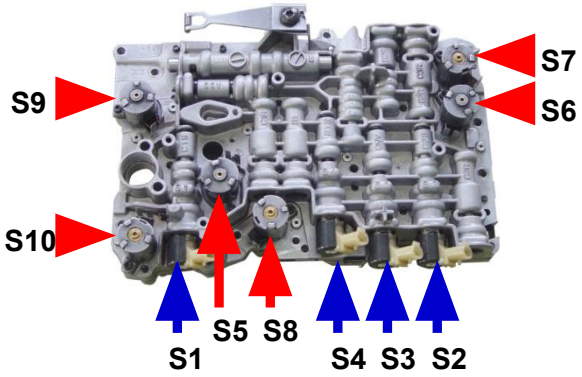


Function of solenoids (M74)

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℃ : TCC is unlocked to increase the ATF temp quickly

Shift map selection II

■ Hot mode

- 110℃ ~ 145℃
- Lock up state is increased (prevent heat generation by T/C)
- Over 110℃ : Radiator electric fan in “on”
- Over 130℃ : Engine torque reduction, “Winter” lamp blinks
- Over 145℃ : Go in the “Neutral” till below 120℃

  (Below 105℃, 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

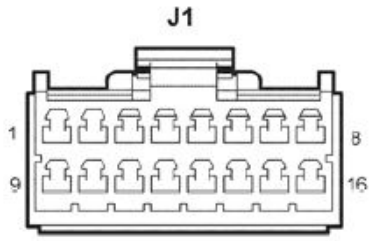
  unlock during shifting

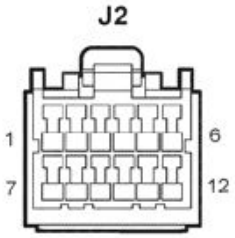
■ Cruiser

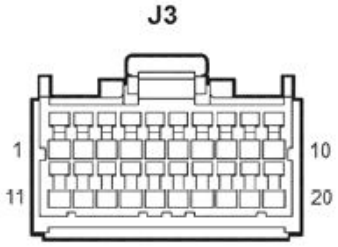
- ECU request downshift for higher engine power & braking

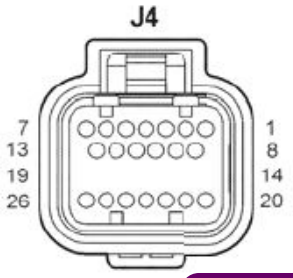
  (under trailing condition)

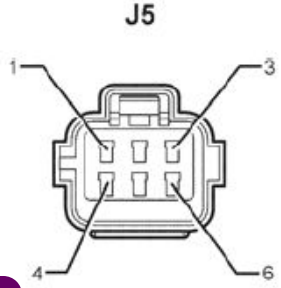
Connectors



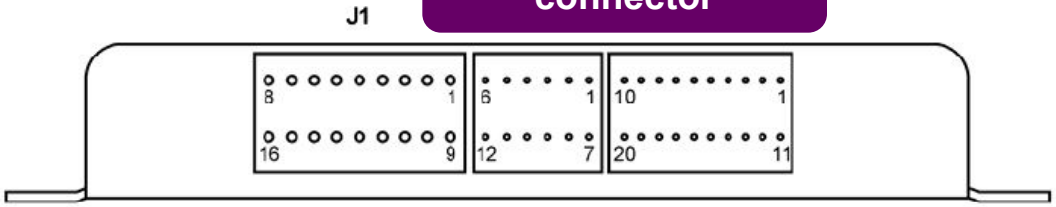




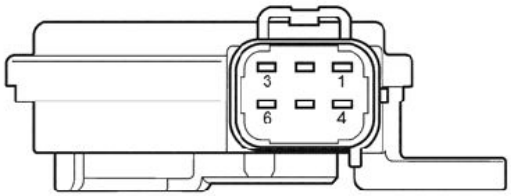




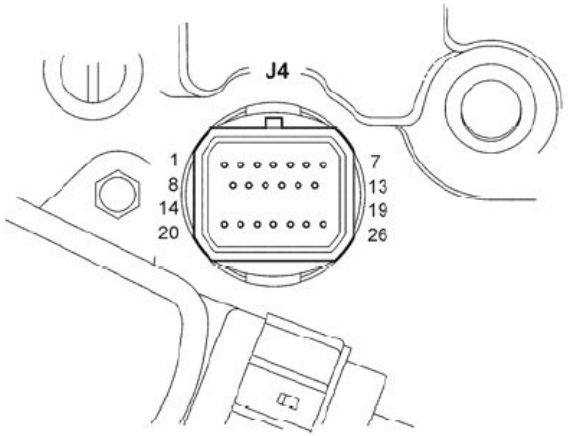
Wire harness connector



TC U

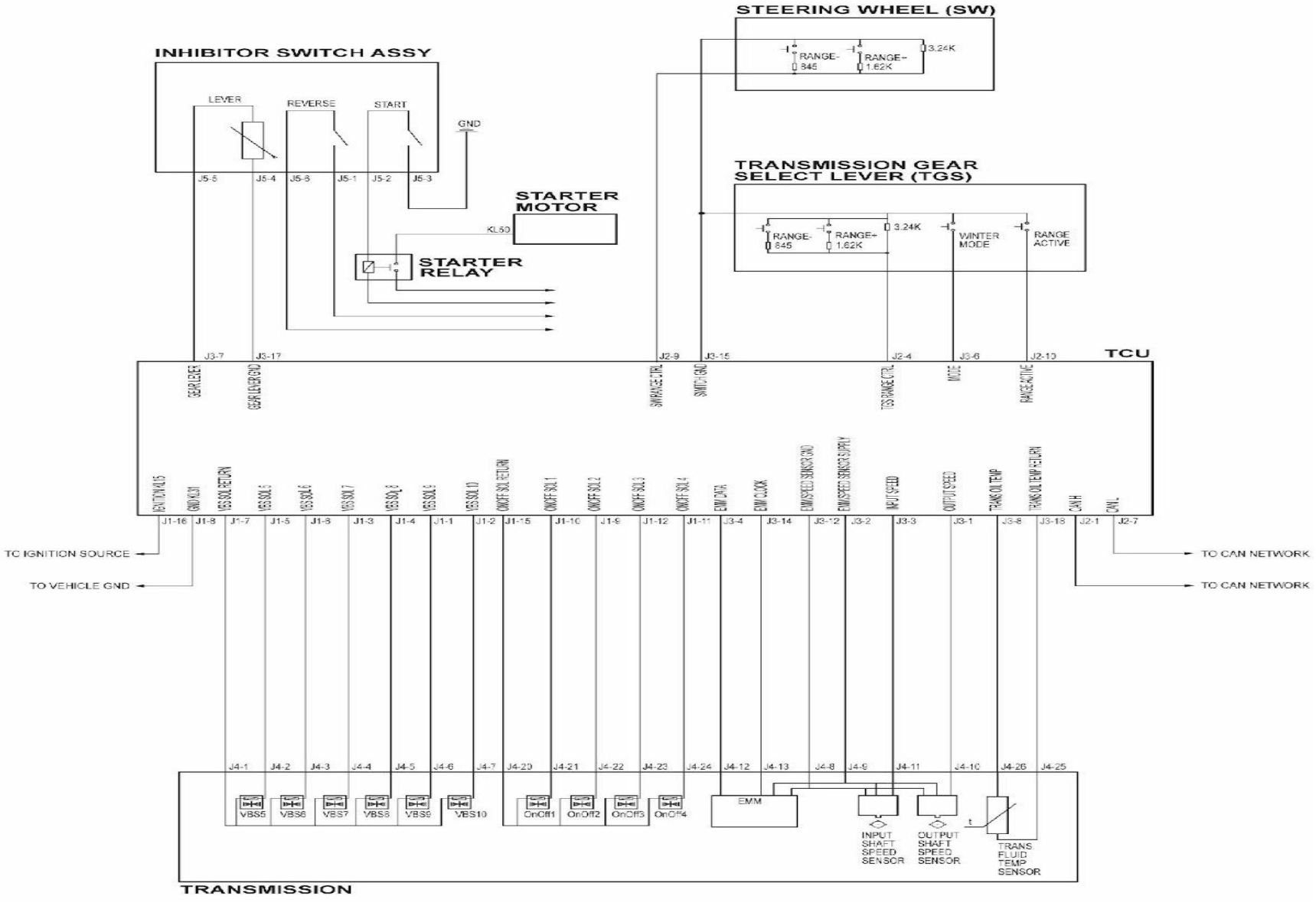


Inhibitor switch



T/M Assy

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℃ =>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)

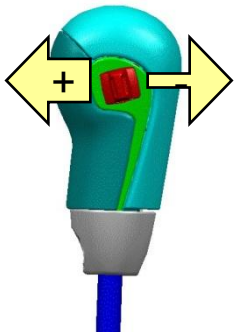
DURA TGS lever

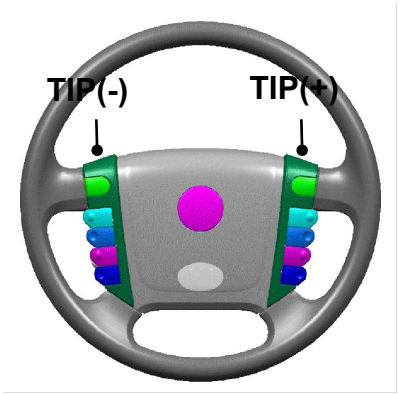
Step gate type

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

↓

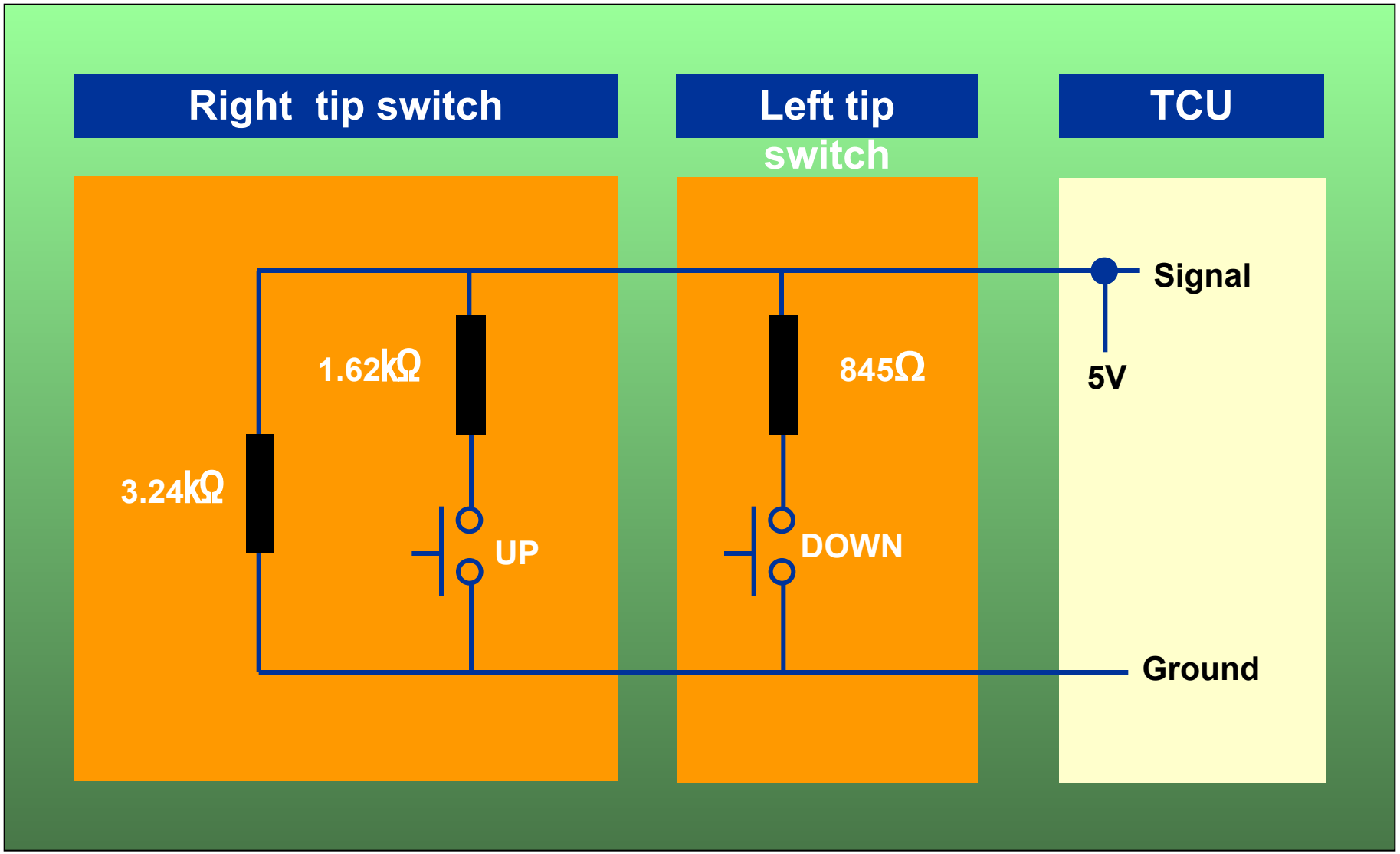
Operating by time order

D → M

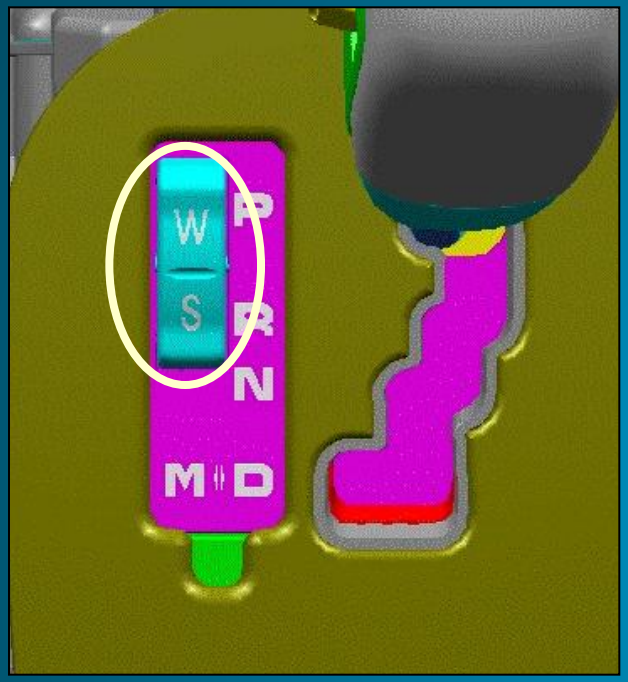
Lower by 1 or 2 shift than “D”

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

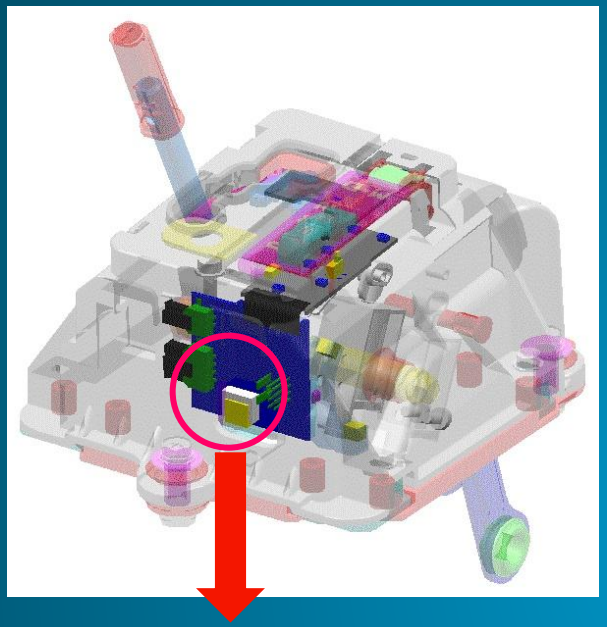
Gradient : Approx.20%

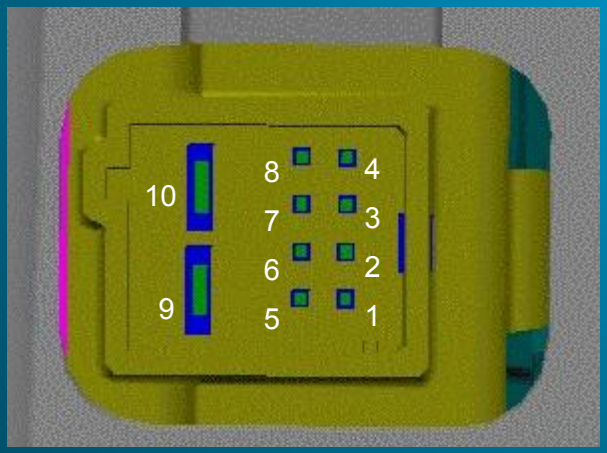
Full (Full Throttle)

- 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