

ACTYON

Service Training

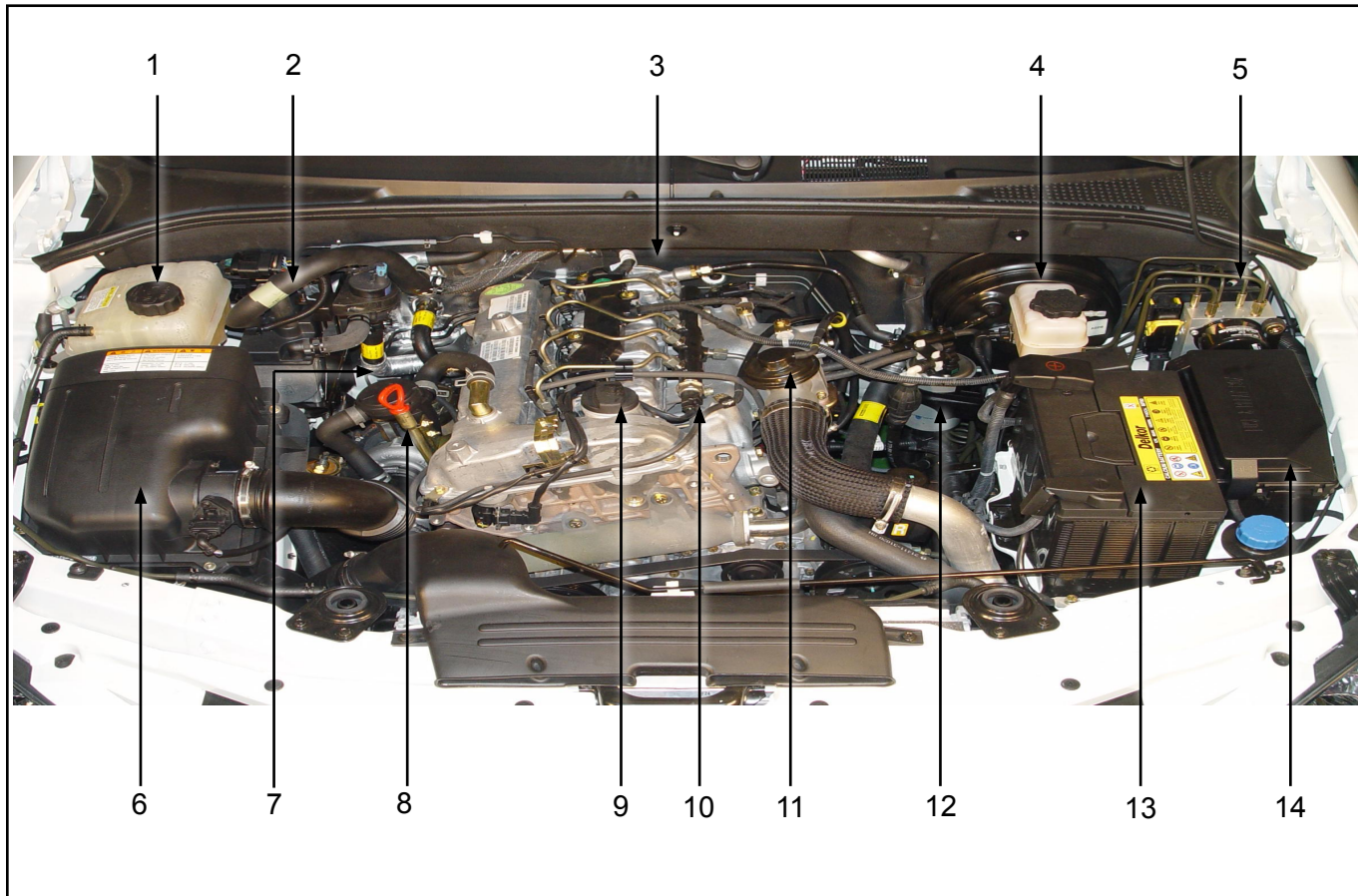


- **Engine : D20DT / D27DT**
- **Subject : Engine General**
- **Date : March .13 . 2006**
- **Instructor : Brian Cho**

Contents

- D20DT Engine General
- Removal & Installation
- Turbo Charger (VGT)
- Diagnosis

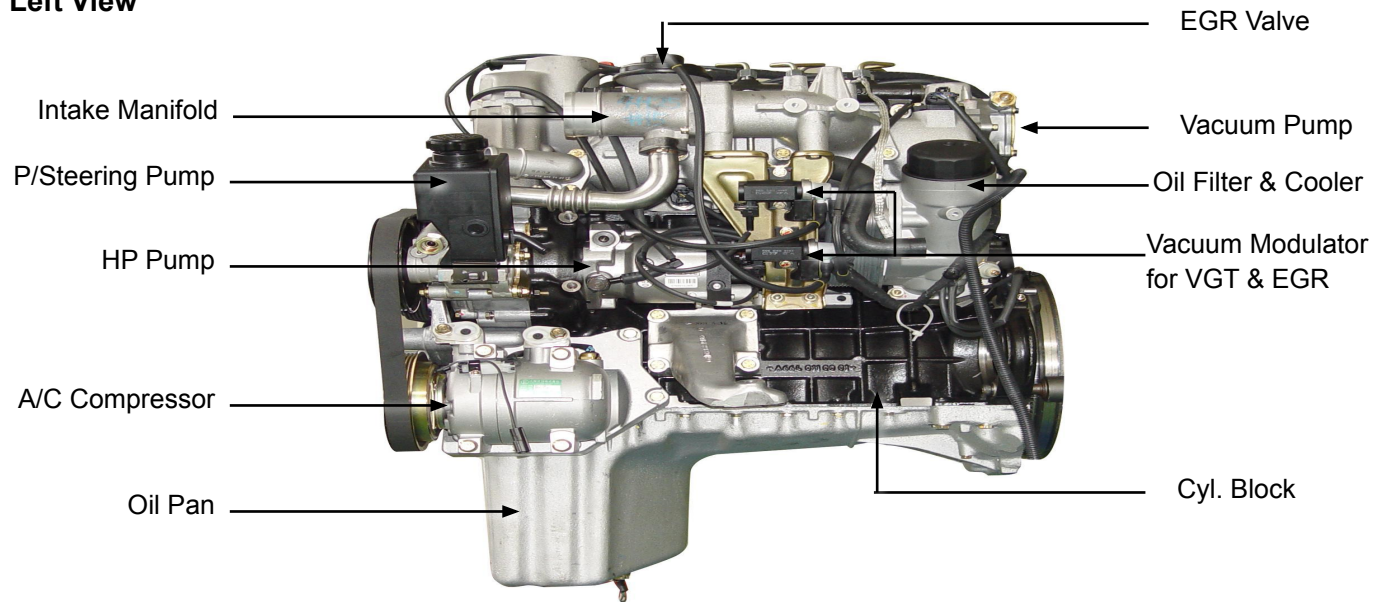
1. Engine Room Description



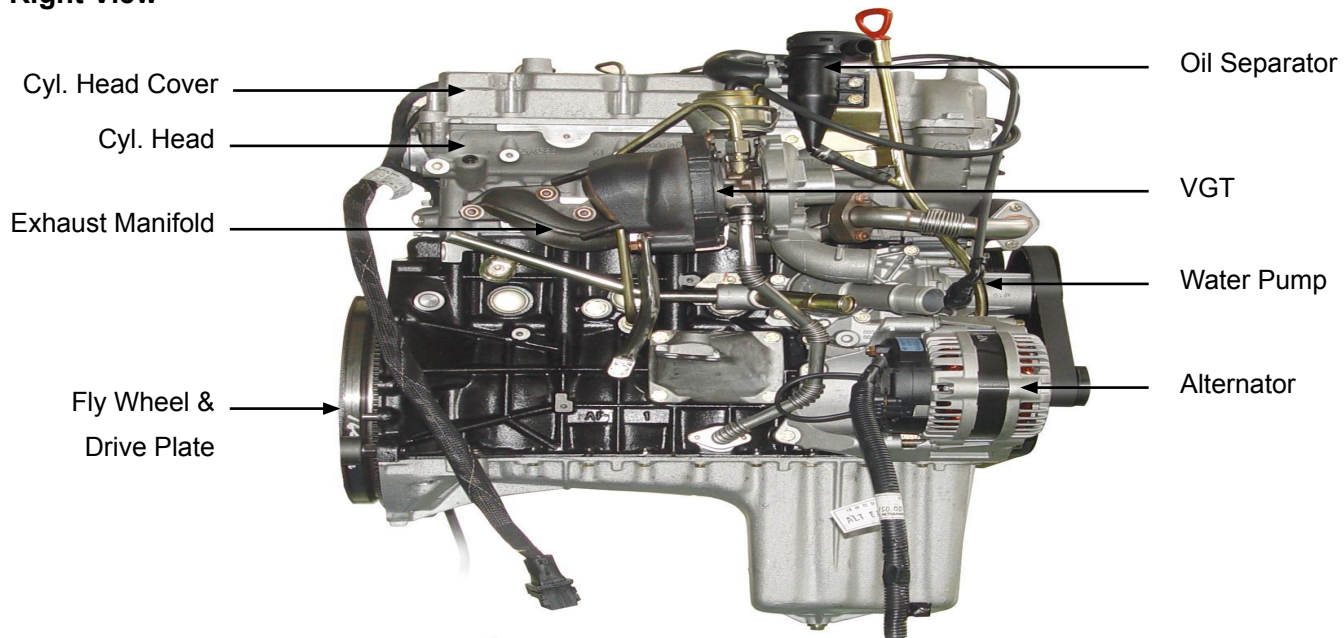
- | | |
|-----------------------|---------------------------|
| 1. Reservoir Tank | 2. FFH(Fuel Fired Heater) |
| 3. Vacuum Pump | 4. Brake Booster |
| 5. ABS/ESP Unit | 6. Air Cleaner |
| 7. Turbo Charger(VGT) | 8. Dipstick Gauge |
| 9. Oil filler | 10. Common Rail |
| 11. EGR Valve | 12. Fuel Filter |
| 13. Battery | 14. Engine Room Fuse Box |

2. Engine Structure

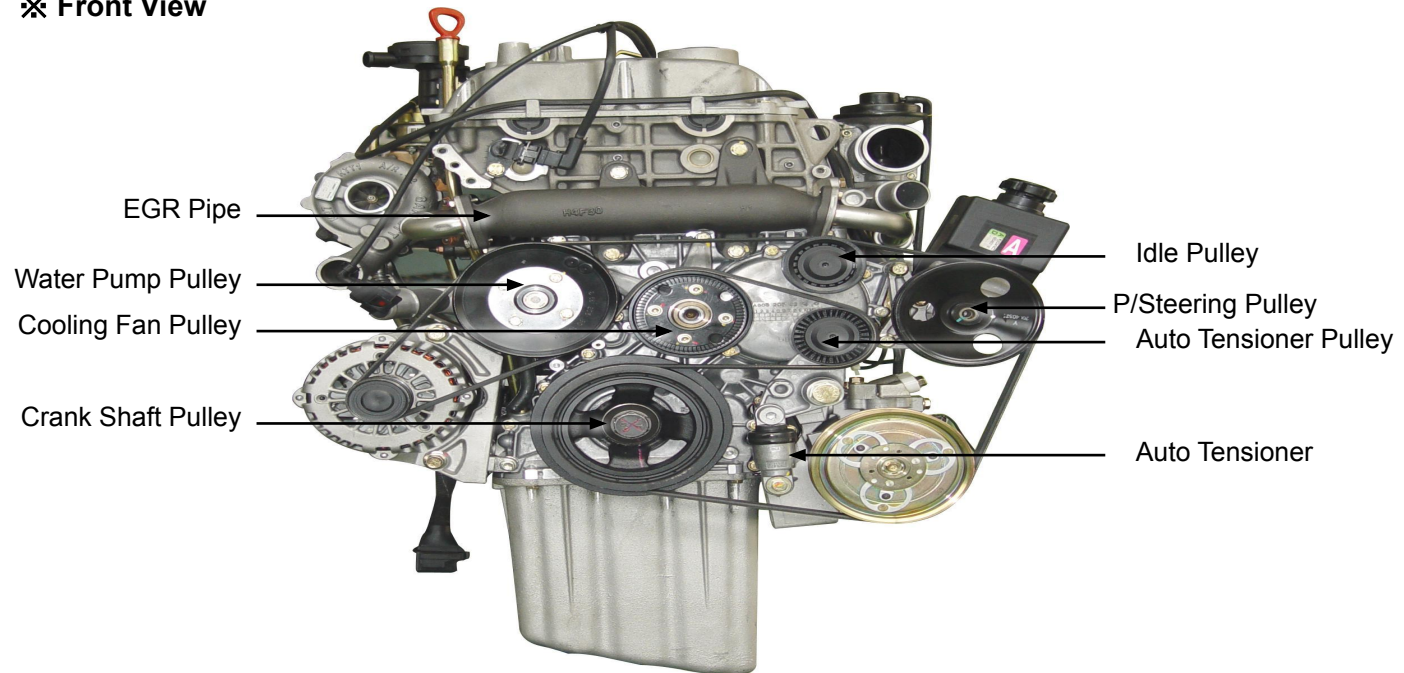
※ Left View



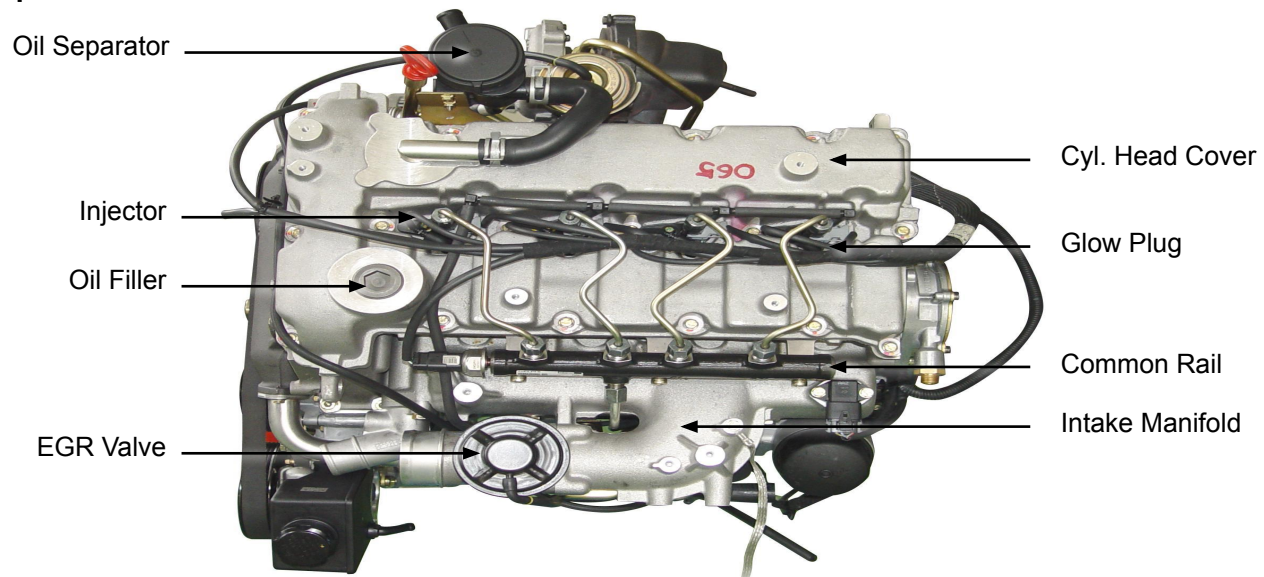
※ Right View



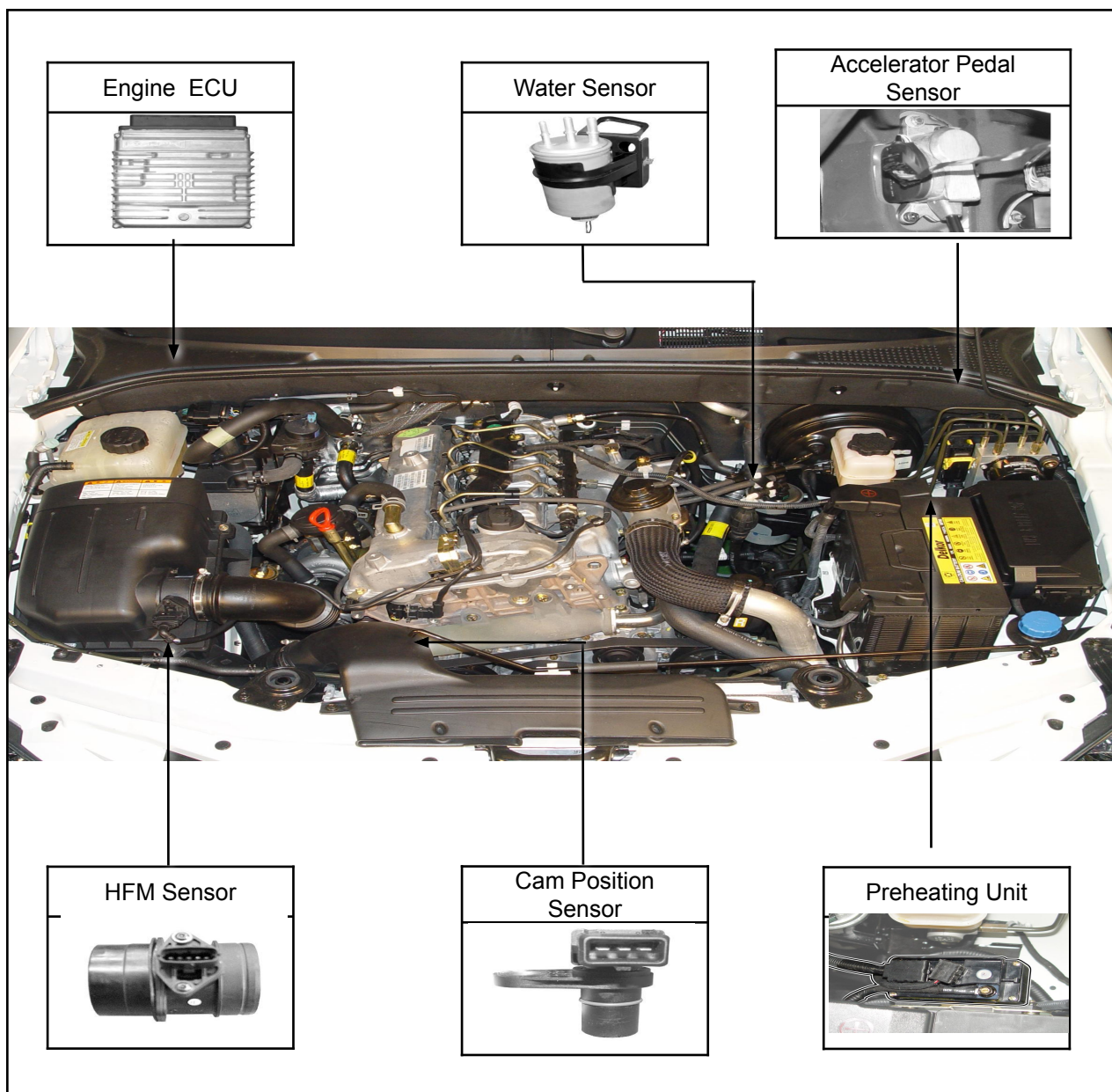
※ Front View



※ Top View

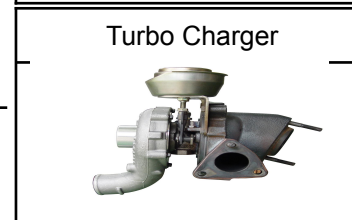
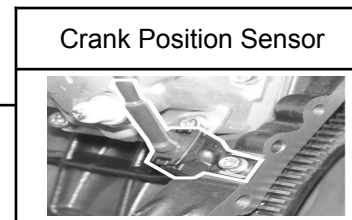
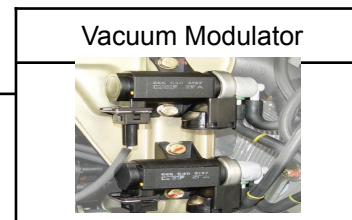
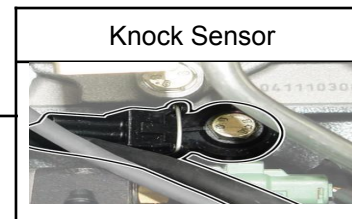
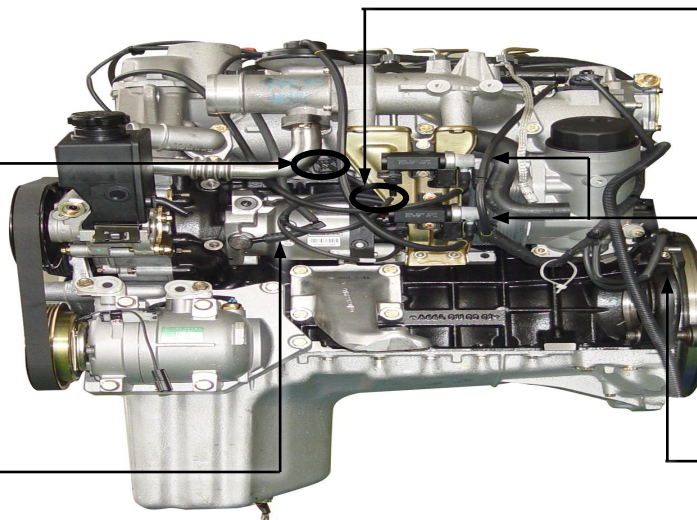
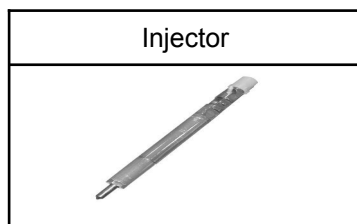
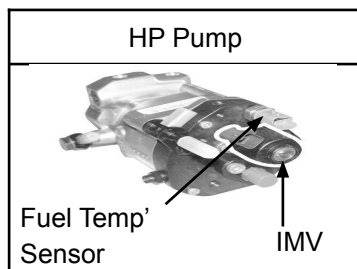
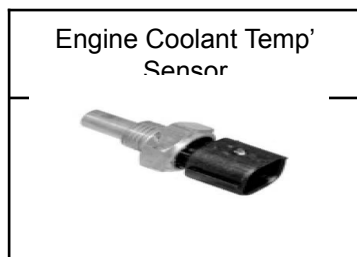


3. Location of Sensors & Actuators



D20DT Engine General

6

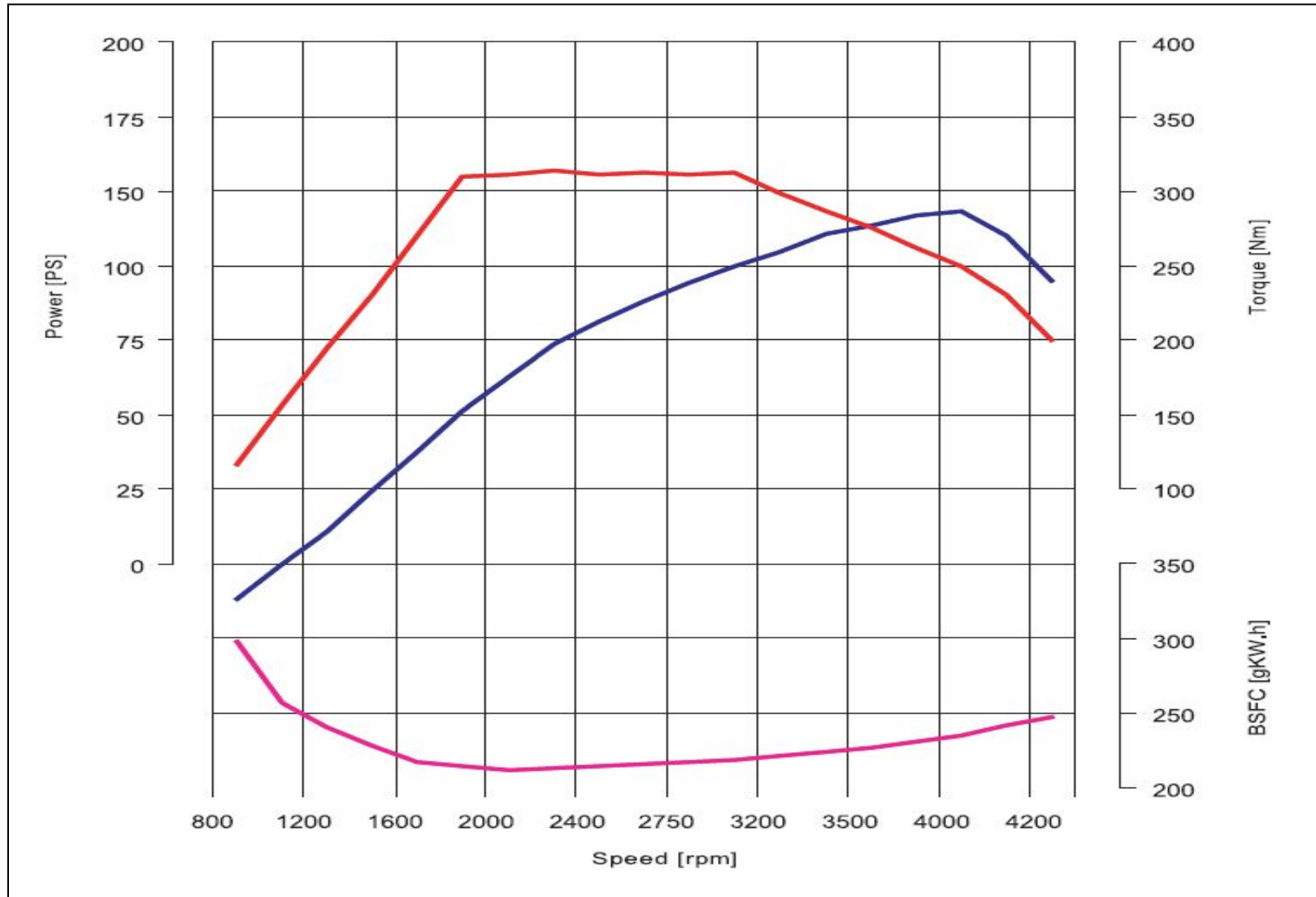


4. Engine Specifications

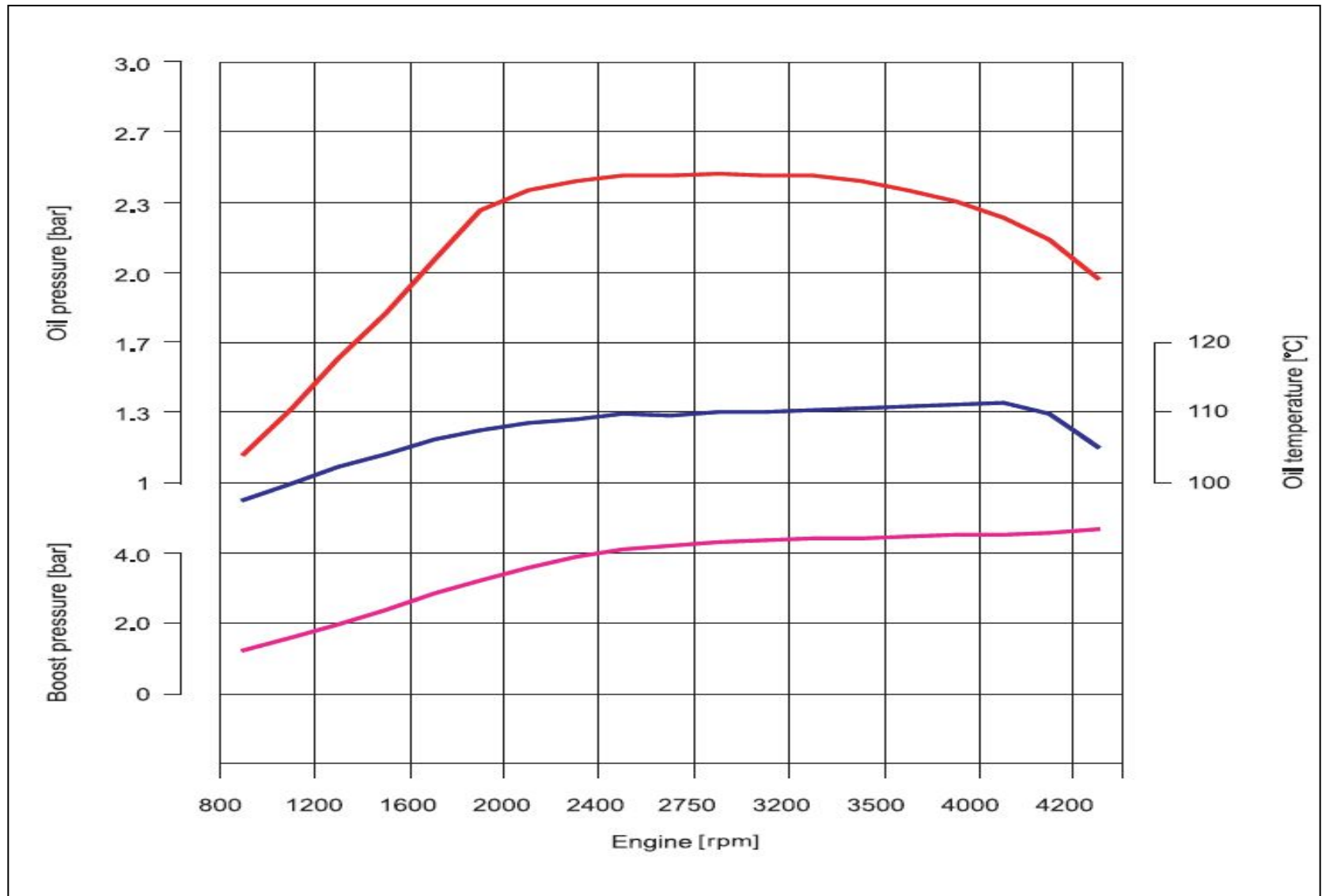
Item		D27DT	D20DT
Cylinder Arrangement		L – 5(In-line 5 Cylinder)	L-4(In-line 4 Cylinder)
Displacement (cc)		2696 cc	1998cc
Max Power (PS/RPM)		165/4,000	141/4,000
Max Torque (Nm)		340/1,800~2,750	310/1,800~2,750
Fuel Consumption (ℓ/km)		10.4	C100 4WD A/T : 11.7
Compression Ratio		18 : 1	17.5 : 1
Firing Order		1 – 2 – 4 – 5 – 3	1-3-4-2
Cylinder	Bore (mm)	86.2	86.2
	Stroke (mm)	92.4	85.6
	Bore Pitch (mm)	97.0	97.0
Camshaft	Type	DOHC	DOHC
Valve Adjustment		HLA	HLA
Idle RPM	AT/MT	750±50rpm	780±50
Thermostat Opening (°C)		80	85
Combustion Chamber		Bowl on Piston Crown (Direct Injection)	Bowl on Piston Crown (Direct Injection)
Engine Oil Capacity (ℓ) (SAE 10W-40, 5W-40 / API CG or Above)		8.5 ℓ	7.5 ℓ
Coolant Capacity(ℓ)		Approx. 11.5 ℓ	Approx. 10.5 ~ 11.0ℓ

5. Engine Performance Curve

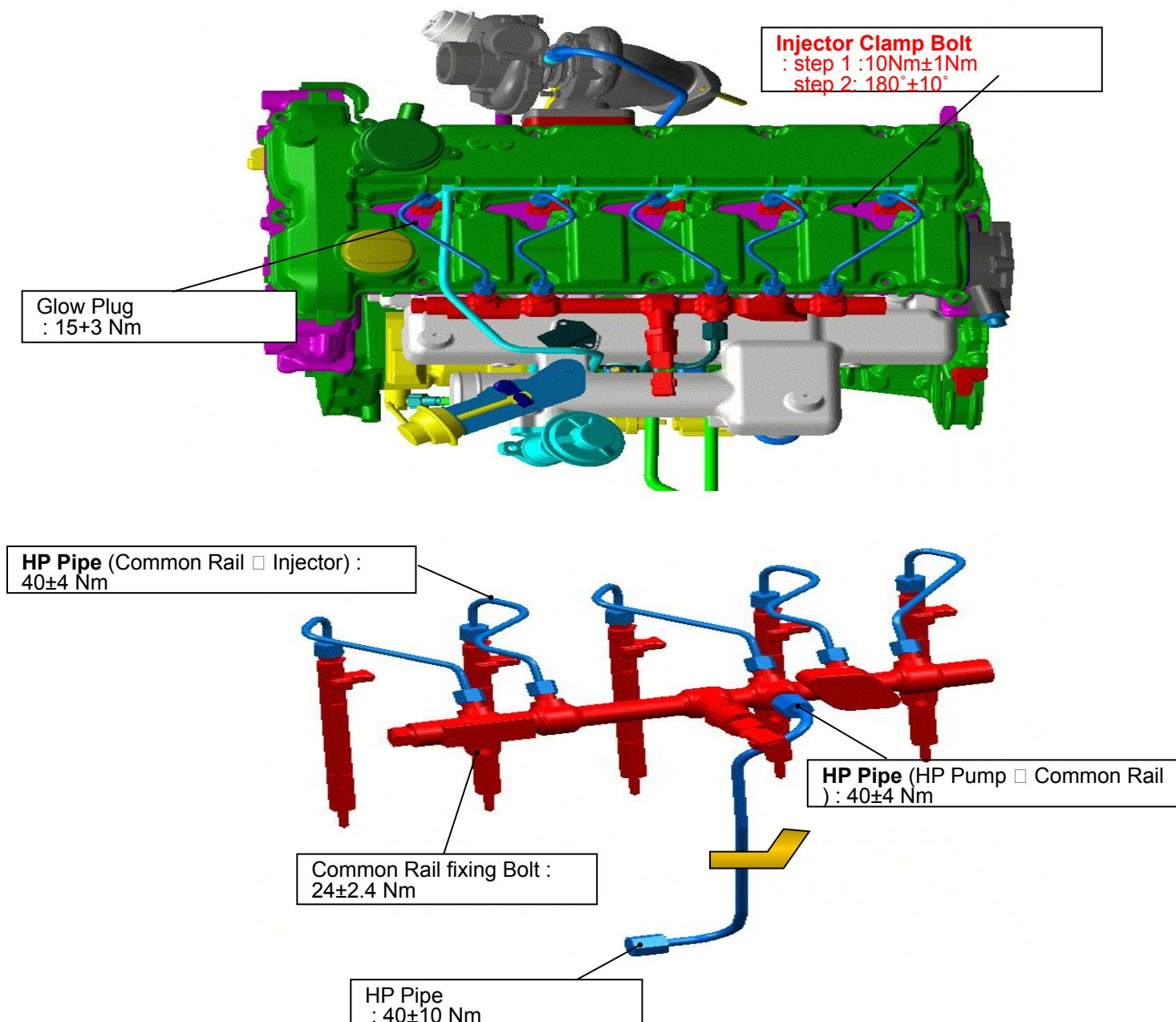
1) Horse Power & Torque



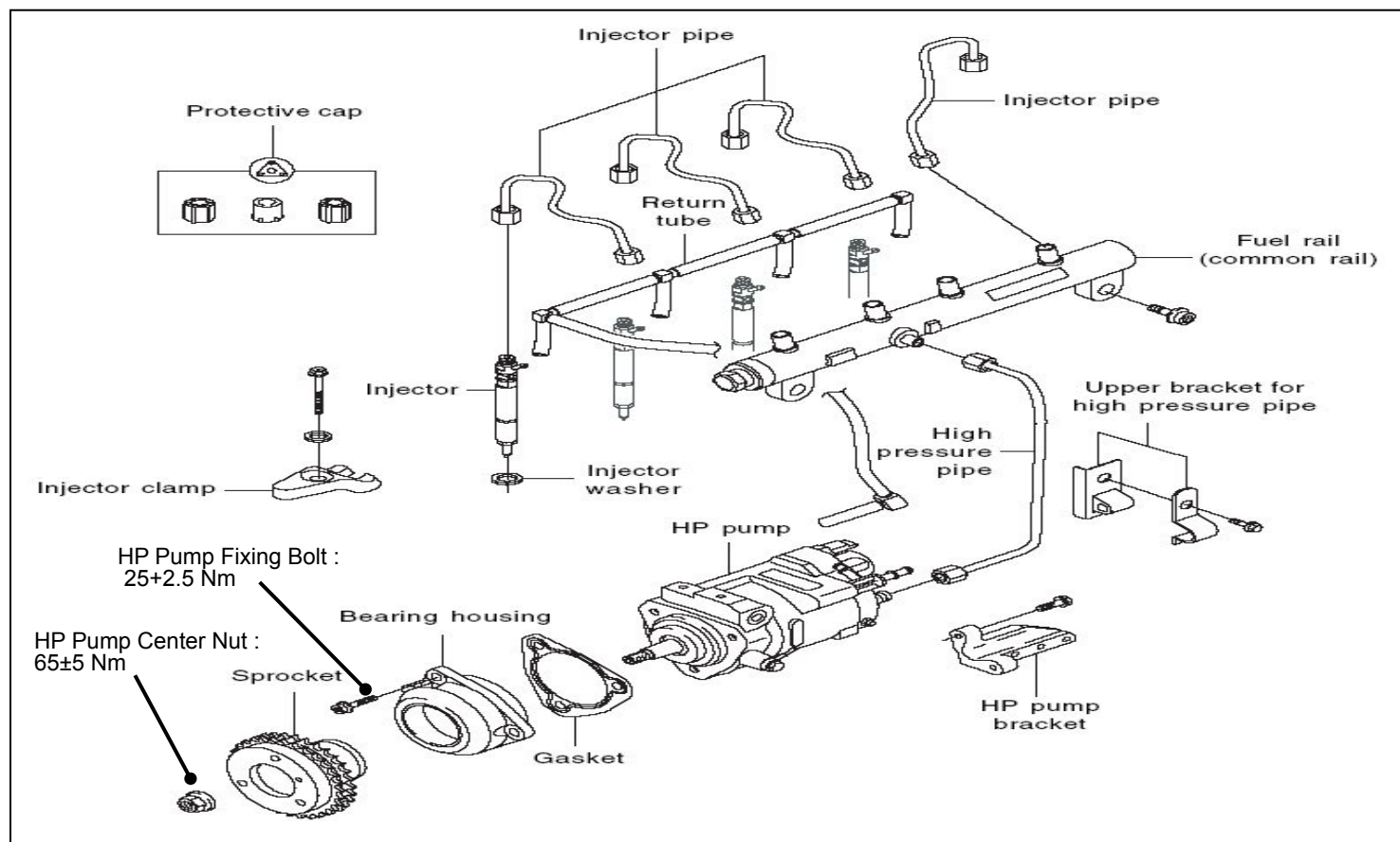
2) Oil Pressure and Temperature & Boost Pressure



1. Fuel System Tightening Torque (D27DT / D20DT)



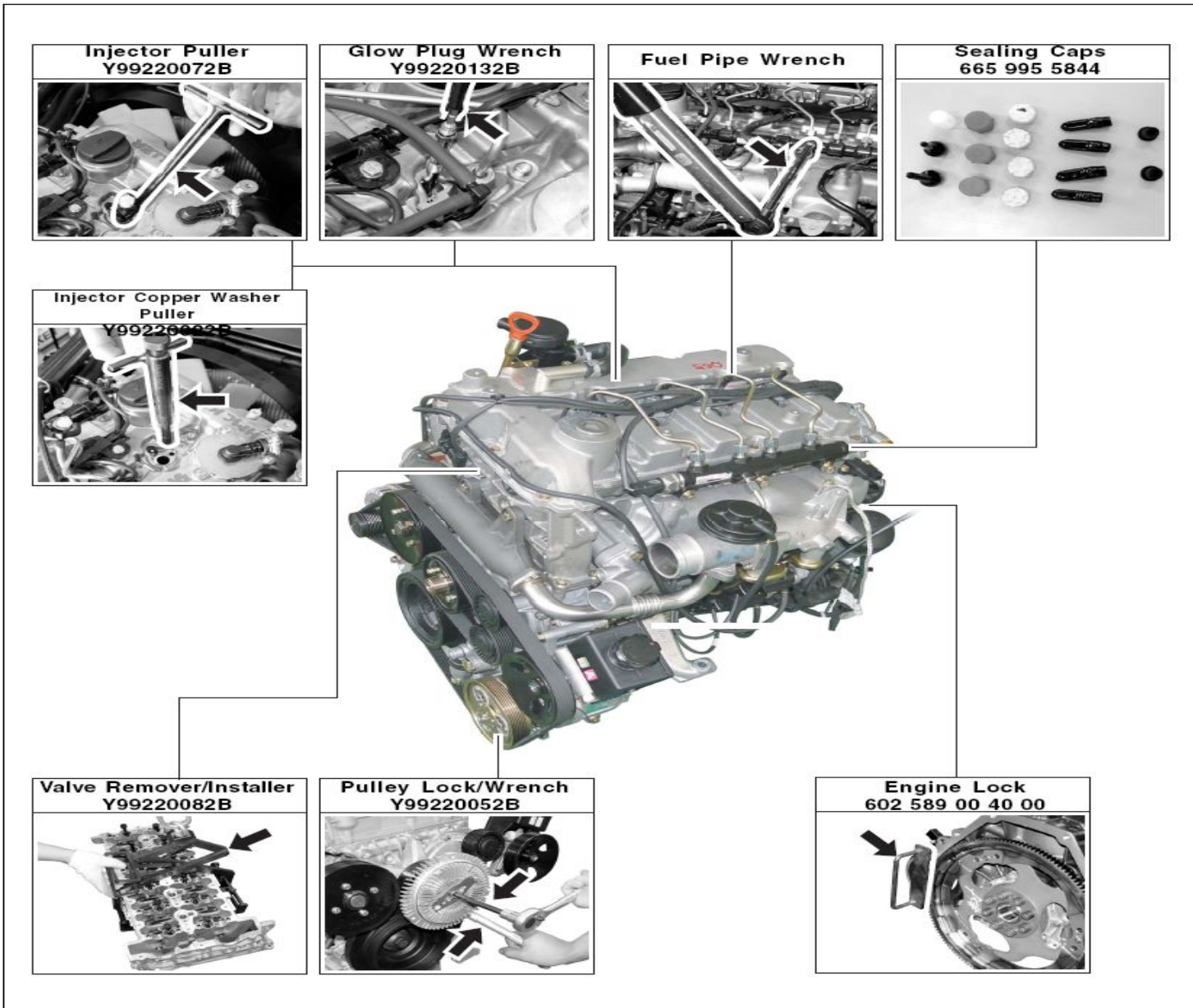
2. HP Pump System Tightening Torque (D20DT)



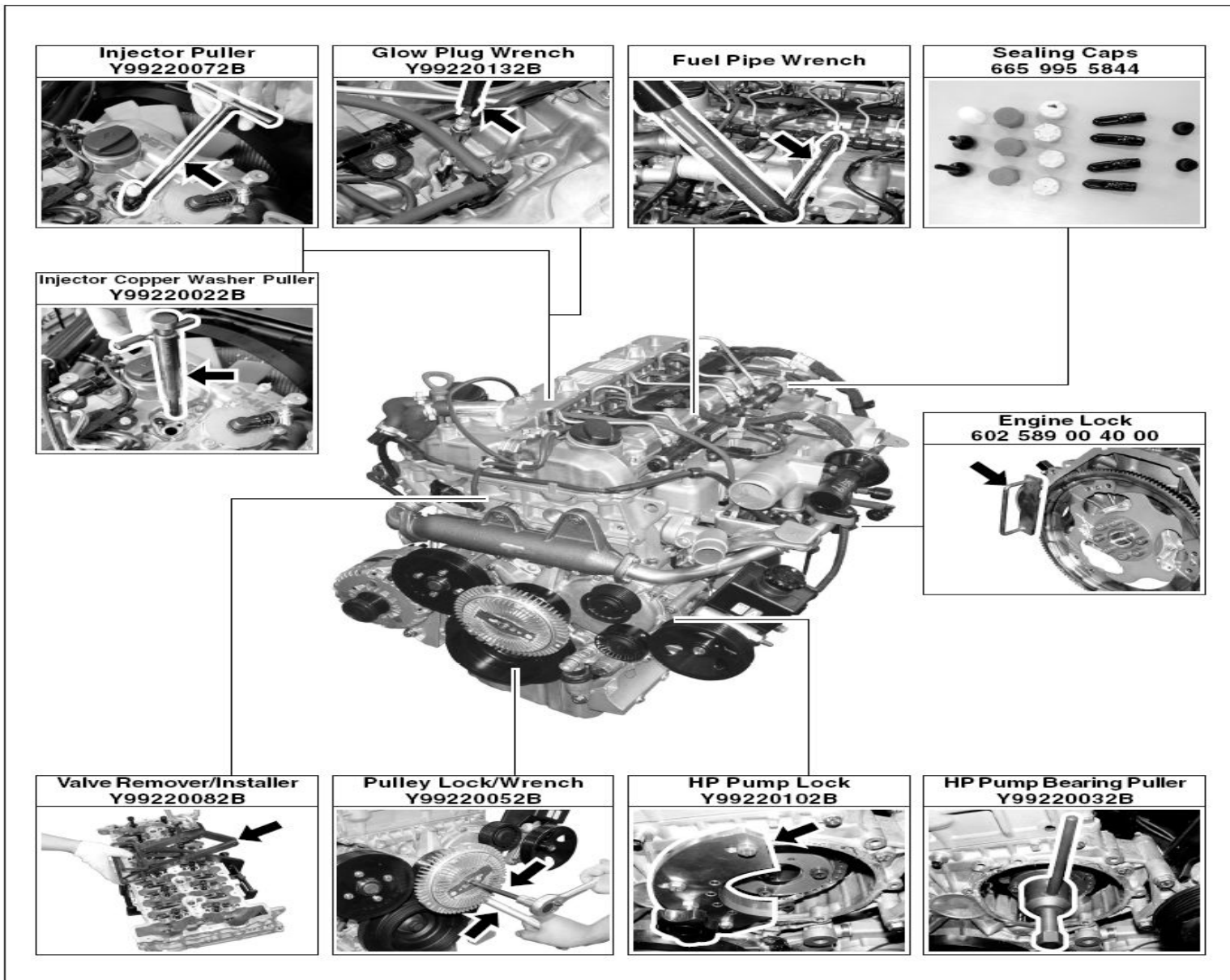
Part Name	Tightening Torque	Part Name	Tightening Torque
Fuel Pipe : Common Rail □ Injector	40±4.0Nm	Fuel Pipe : HP Pump □ Common Rail	40±4.0Nm
Injector Fixing Bolt	1st step : 10Nm 2nd step : 180±10°	Sprocket Fixing Bolt : (Only for D27DT)	1 st step : 20±2Nm 2 nd step : 90±10°
HP Pipe Fixing Bracket	8.6±0.9Nm	HP Pump Center Nut	65±5Nm
HP Pump Fixing Bolt	25±2.5Nm		

1. Components and Special Tools

► D20DT Engine



► D27DT Engine



2. List for Special Tools

No	SST Name	SST P/Number	Application
1	Common Rail Tester	Y9922 0012B	D20/D27
2	Injector Puller	Y9922 0072B	D20/D27
3	Glow Plug Wrench	Y9922 0132B	D20/D27
4	Sealing Caps	665 995 5844	D20/D27
5	Copper Washer Puller	Y9922 0022B	D20/D27
6	Engine Lock Fixture	A9910 0150B (602 589 004000)	D20/D27
7	Cylinder Head Bolt Wrench (14mm)	W9912 0035B	D20/D27
8	HP Bearing Puller	Y9922 0302B	D20/D27
9	HP Pump Lock	Y9922 0102B	D27

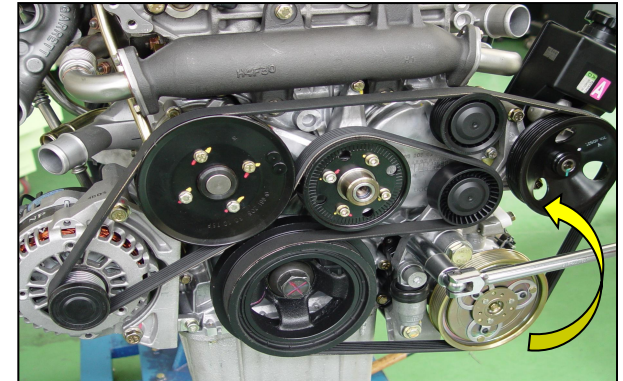
3. D20DT HP Pump Removal & Installation

1) Removal

Preceding Works:

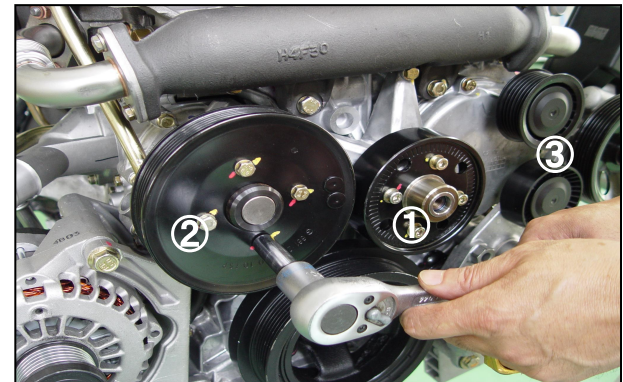
- Disconnect the negative battery cable.
- Apply the parking brake and place the chocks under the tires.
(transmission "N" position)

1. Turn the auto tensioner counterclockwise
and remove the fan belt.



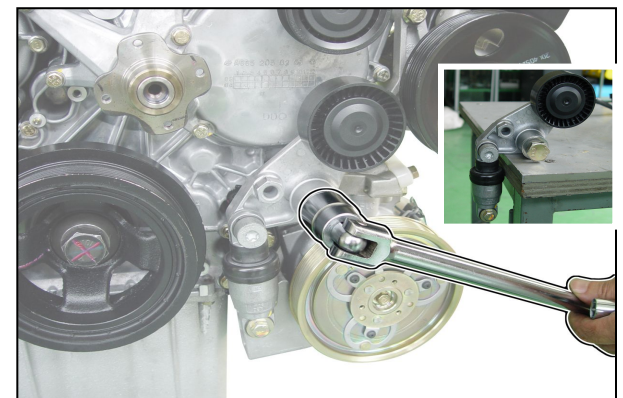
2. Remove the engine belt pulleys.

- 1) Cooling fan pulley
- 2) Coolant pump pulley

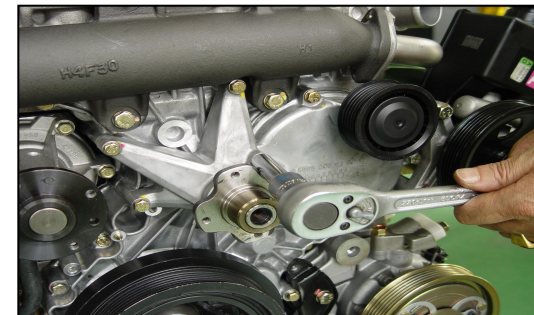


3. Unscrew lower bolt (13 mm) and upper bolt
(24 mm) and remove the auto tensioner.

- To prevent oil leaks, place the removed auto tensioner in upright position.
- Pump the auto tensioner several times before installing it.

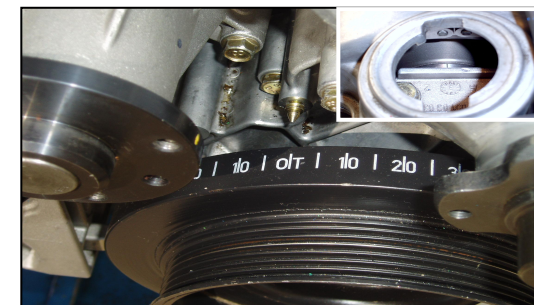


4. Remove the high pressure pump housing cover.

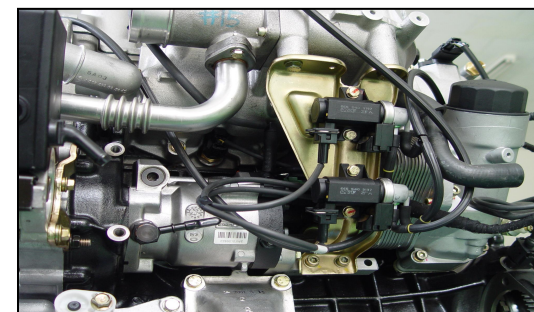


5. Align the OT mark by rotating the crankshaft.

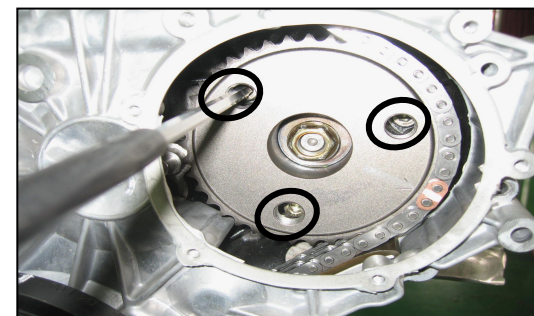
- 1) Open the oil filler cap and check if the OT mark on crankshaft is aligned to the notch on the camshaft.



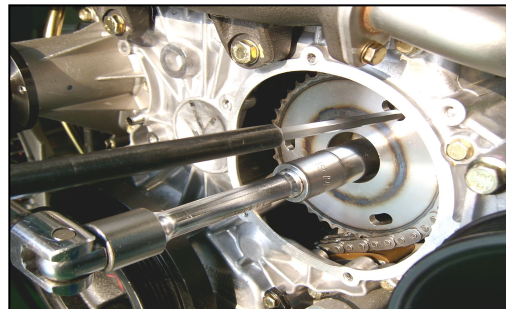
6. Remove the vacuum modulator bracket, and HP pipe (Pump to Common Rail)



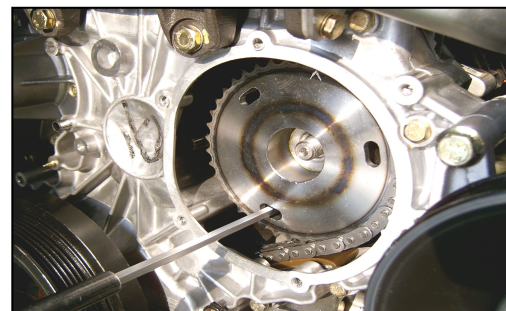
7. Rotate the crankshaft clockwise so that the HP pump sprocket holes are aligned to the bolt holes.



8. Hold the HP pump sprocket and slacken the center nut.



9. Slacken three HP pump mounting bolts until they contact with the sprocket.

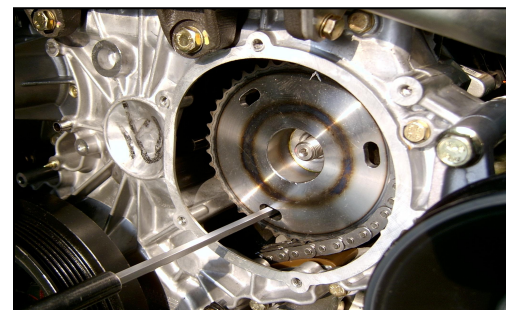


10. Loosen the HP pump center nut by tapping it with a hammer.

- Tap the center bolt using a soft hammer.
- Make sure not to damage the shaft thread.



11. Loosen the remaining bolts with the same manner and remove the high pressure pump.



2) Installation

1. Replace the HP pump gasket with new one.
(cannot be reused)

2. Tighten the HP pump bolts.

Tightening Torque	25Nm
-------------------	------

Caution)

Be sure to align the notch on the shaft to the sprocket groove when inserting the HP pump

3. Tighten the center nut after fixing the sprocket.

Tightening Torque	65Nm
-------------------	------

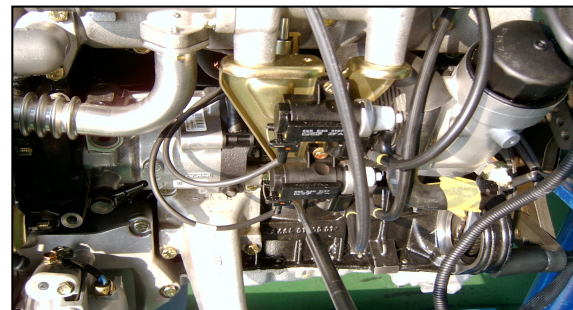
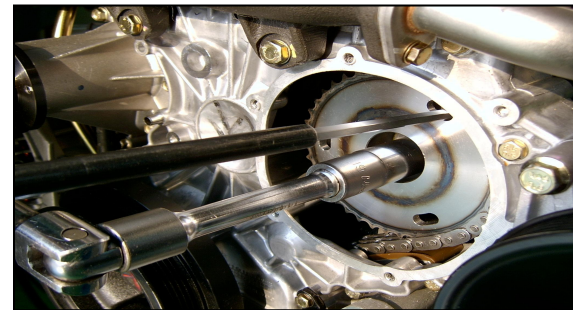
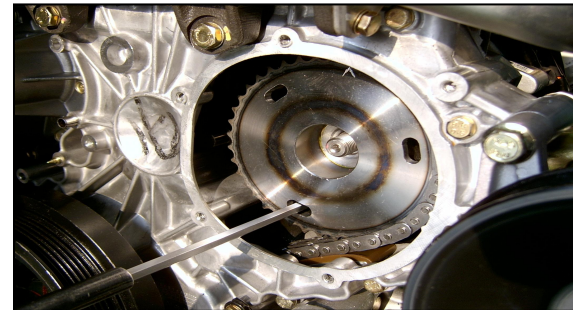
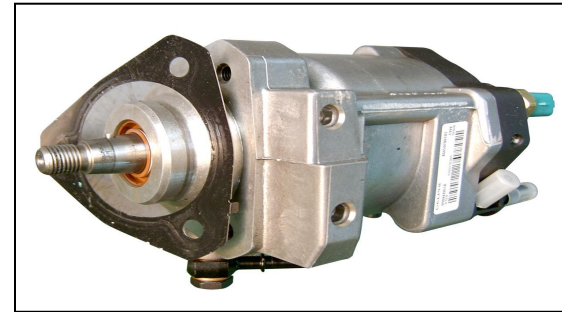
Caution)

Center nut cannot be reused.

4. Install HP pipe and vacuum modulator bracket.

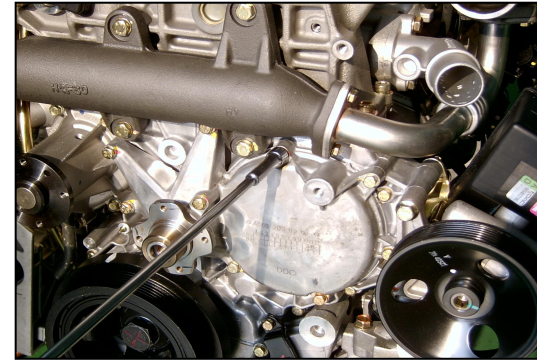
Caution)

Be sure that the 2 modulator connectors are not to be changed.

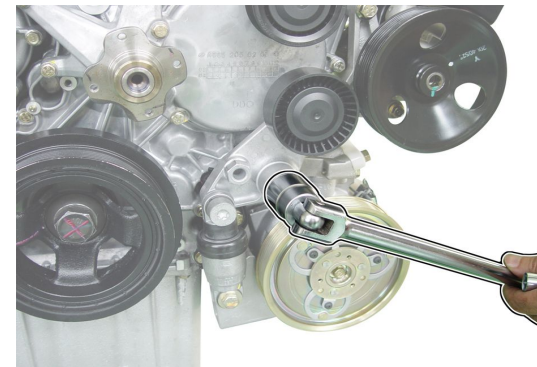


5. Install the HP pump housing cover after applying sealant.

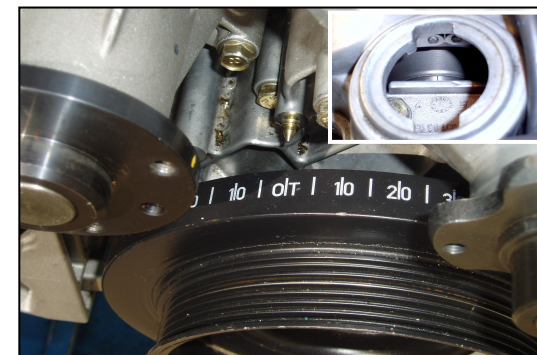
Note) · Sealant(DB2210) : 661 989 56 A0



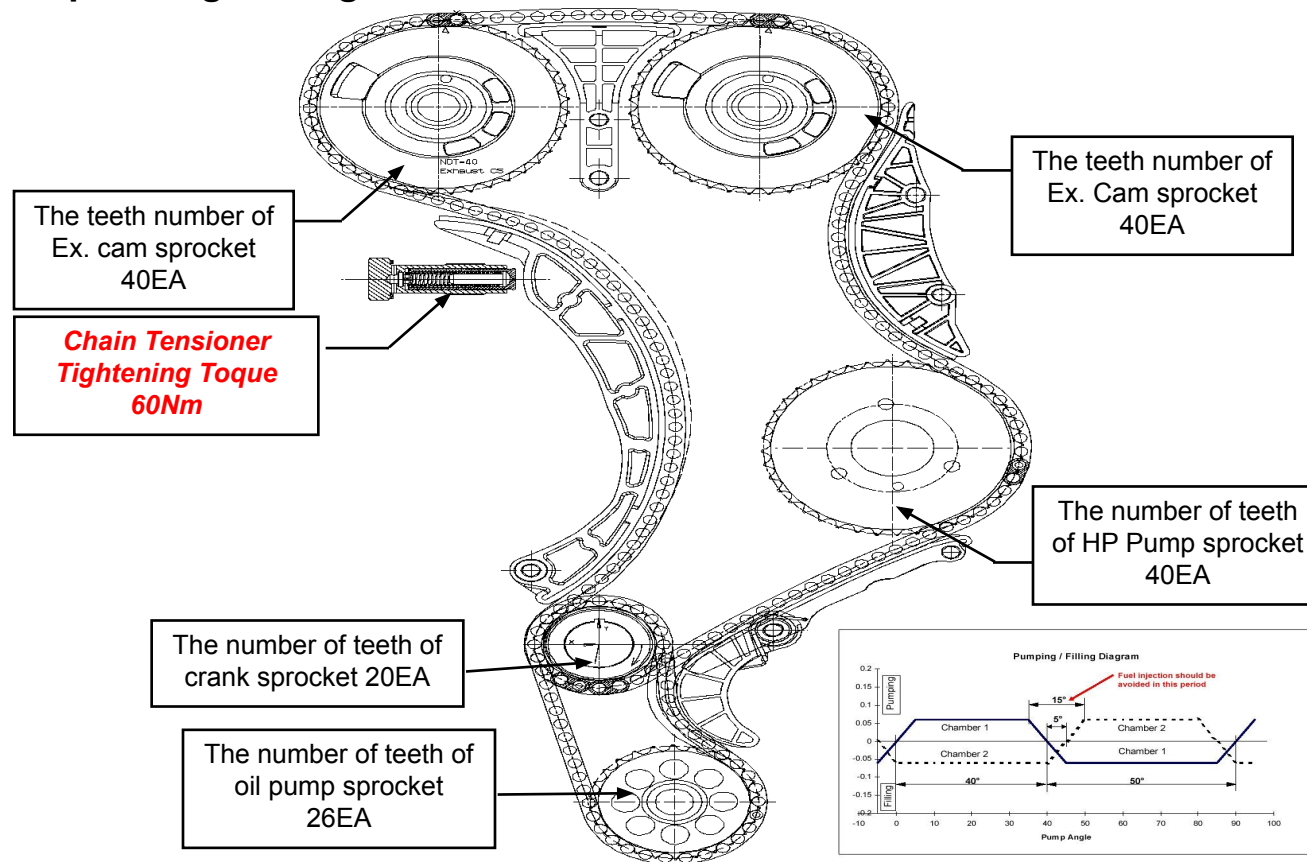
6. Install auto tensioner and belt pulley.



7. See if timing marks are aligned after rotating crank shaft 2 turns.



3. D20DT HP Pump Timing Setting

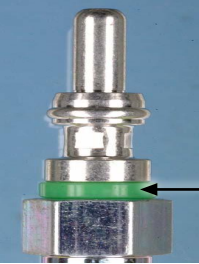
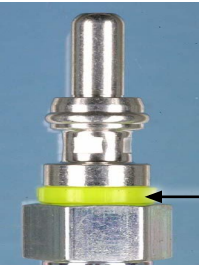
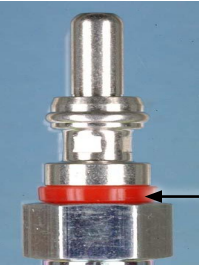


- ① When installing/removing of chain or sprocket, must align the timing mark “▶” and copper mark on crank, HP pump and IN/EX manifold sprocket.
- ② It is necessary to align the HP pump sprocket.
- ③ Major difference

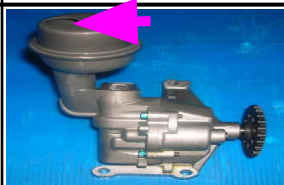
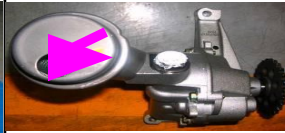
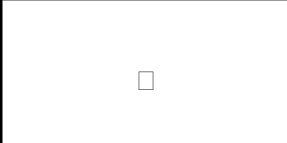
	D27DT	D20DT
Teeth number of HP pump sprocket	32 teeth	40 teeth
Number of Chain link	144 links	148 links
Crank rotations to coincide chain & sprocket timing marks	144 turns	74 turns

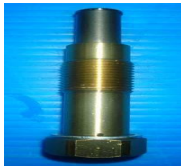
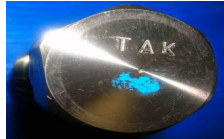
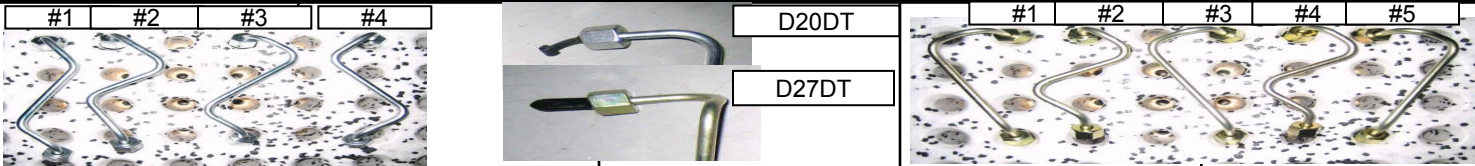
4. Glow plug distinction

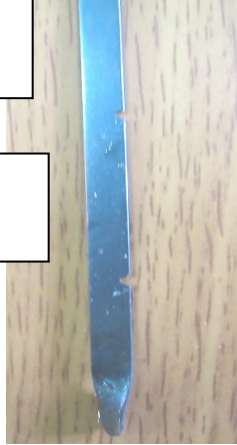
When replacing one or more plugs, must use the same type by distinguishing the color of insulator.

 Green	▶ Vendor : BERU ϕ 4 ▶ Application : D20DT & D27DT ▶ Resistance : $680 \pm 110 \text{m}\Omega$ (at 20°C)
 Yellow	▶ Vendor : NGK ϕ 3.5 ▶ Application : D20DT & D27DT ▶ Resistance : $140 \pm 30 \text{m}\Omega$ (at 20°C)
 Red	▶ Vendor : NGK AQGS ϕ 3.5 ▶ Application : D27DT Euro-IV ▶ Resistance : $140 \pm 30 \text{m}\Omega$ (at 20°C)
Diameter of Tip - BERU : 4.0mm - NGK : 3.5mm Color of Insulator - Green : BERU - Yellow : NGK 	

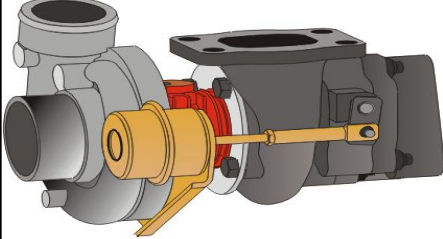
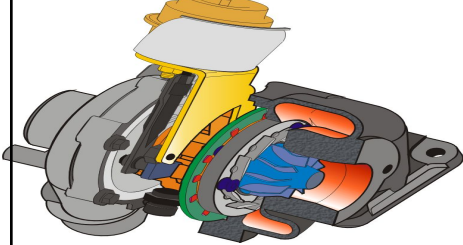
5. D20DT/D27DT Parts major difference

	D20DT(Actyon/Kyron)			D27DT	
				New Rexton	Rodius(Stavic)
Photo		D20DT	D27DT	D27DT(RD)	 
Oil Pump					
P/N	664 180 03 01			665 180 05 01	665 180 06 01
Feature	Higher basket than others			Basket hole 7 o'clock direction	Basket hole 9 o'clock direction
Photo					
Timing Chain					
P/N	664 997 01 94			665 997 00 94	
Feature	D20DT is 4 links longer than D27DT				
Photo		40 teeth	32 teeth		
HP pump sprocket					
P/N	664 075 02 29			665 075 01 29	
Feature	D20DT is bigger than D27DT D20DT sprocket incorporates bearing shaft. D27DT sprocket separates bearing shaft.				

	D20DT		D27DT		
			New Rexton / Rodius		
Photo					
Chain Tensioner					
P/N	664 050 00 11		665 050 00 11		
Feature	D20DT is blue painting cap on the top Spring constant for D20DT is greater than D27DT				
Photo		 D20DT D27DT			☐
Injector					
P/N	664 017 00 21		665 017 01 21	☐	☐
Feature	Distinguished by color : - D20DT : Green / D27DT : Yellow No of injector hole : - D20DT : 6 holes / D27DT : 5 holes				
Photo	 #1 #2 #3 #4 D20DT D27DT #1 #2 #3 #4 #5				
	Fuel Pipe (Common Rail ☐ Injector)				
P/N	664 070 00 33(No.1) 664 070 01 33(No.2) 664 070 03 33(No.3) 664 070 04 33(No.4)		665 070 06 33(1&3) 665 070 07 33(2&4) 665 070 08 33(5)		
Feature	Different color - D20DT : Silver / D27DT : Bronze				

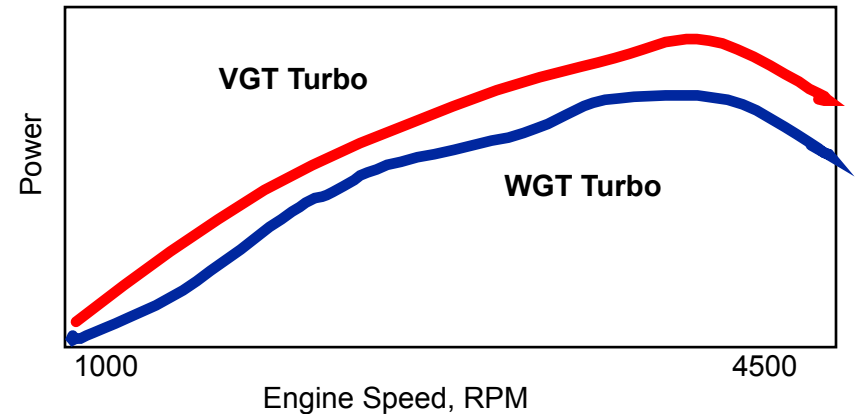
	D20DT		D27DT	
			New Rexton	Rodius
Photo				
	Oil dipstick gauge			
P/N	664 010 0772		665 010 0872	665 010 1272
Feature	D20DT : 66407 on the hand rail D27DT : 66508 on the hand rail for New Rexton 66512 on the hand rail for Rodius			
Level	 Max 7.5L Min 5.0L		 Max 8.5L Min 6.0L  Max 8.0L Min 6.0L	

1. Types of Turbo Charger

Classification	STD	WGT	VGT
Features	 · High load /high efficient driving · Non-supercharged torque in low speed · Excessively high supercharged pressure and high rotation in high speed range	 · Bypass valve for preventing excessive exhaust pressure · Improved performance by optimizing the turbine efficiency in low & mid speed range · Reduced pumping loss in high speed range	 · Variable control of inlet port dimension with a movable vane installed at exhaust turbine nozzle · Increases turbo charging pressure by suffocating the nozzle when the amount of gas flow is not sufficient in low speed range.
Strengths	· Simple structure · Outstanding high speed efficiency · Outstanding durability	· Outstanding low & mid speed range · Improved torque characteristics in low speed range · Simple control mechanism	· Improved torque characteristics in low speed range · Improved accelerating performance · Excellent control effects
Weakness	· Relatively low efficiency in low & mid speed range · Slow response	· Relatively low efficiency in high speed range	· Complicated control mechanism · High price

2. VGT Principle (Variable Geometry Turbocharger)

- ▷ This is the method to improve the torque in low & mid speed range and to control variably the size of the exhaust turbine inlet size for lowering the exhaust gas (smoke/PM) and enlarging the maximum output



Low RPM

- Exhaust gas passage becomes narrow
 - ☐ Gas speed increases
 - ☐ Turbine blade runs fast



High RPM

- Exhaust gas passage becomes wide
 - ☐ Gas amount increases
 - ☐ Turbine blade runs fast

3. VGT Non-Operating Conditions

In case of the following conditions, ECU stops VGT control.

- ✓ Lower than 700RPM
- ✓ Below 0°C
- ✓ EGR related trouble stored in ECU
- ✓ VGT Actuator faulty
- ✓ Boost Pressure Sensor faulty
- ✓ **Air Flow Sensor faulty**
- ✓ Accelerator Pedal Sensor faulty

4. VGT related Data List of Scan-100

① VGT vacuum modulator operating status

Engine Status	Modulator Duty(%)	Vane Control Actuator	Vane Passage
Low load & low rpm	75% (Duty Increases)	Pulling (Vacuum Applies)	Narrow
High load & high rpm	45% (Duty Decreases)	Return (Vacuum Releases)	Wide

② VGT vacuum modulator valve duty (%)

This represents that how much the ECU opens and closes the VGT vacuum modulator, Duty value increases to **75%** so that the VGT control actuator pulls the vane and the gas passage becomes narrow when low load/low speed. When high load/speed, Duty value decreases to **45%** so that the VGT control actuator releases and gas passage becomes wide by the return spring force.

③ Boost Pressure Sensor Value (mbar)

This indicates that the pressure generated in the event of air compression by turbo charging.

- Output value : varies in between 1000 ~ 2,700mbar

DATA LIST	
01. Fuel Temperature.....	19 [°C]
02. Boost Pressure.....	1.040 [Bar]
03. Airmeter.....	576 [mg/stk]
04. Boost Pressure(MAP)...	1.040 [Bar]
05. Turbo Valve Drive Duty	74.8 [%]
06. EGR Valve Duty.....	0.0 [%]
07. EGR Demand(MAP).....	493 [mg/stk]
08. Pedal Position.....	0.0 [%]
09. Rail Pressure.....	240 [Bar]
10. Atmospheric Pressure..	1.020 [Bar]

[Low rpm/low load]

DATA LIST	
*02. Boost Pressure.....	2.330 [Bar]
*05. Turbo Valve Drive Duty	76.8 [%]
*09. Rail Pressure.....	1300 [Bar]
*18. Injected Fuel Quantity	50.5 [mg/stk]
*28. Inlet Valve Duty(MAP).	25.4 [%]
22. Fan 1 Output (Low)....	OFF
23. Fan 2 Output (High)...	OFF
24. Pilot Advance(MAP)....	37.1 [°]
25. Main Advance(MAP)....	1.8 [°]
26. Pilot Fuel Qty(MAP)...	2.2 [mg/stk]

[High load/Stall test]

[VGT Actuator Duty Value (%)]

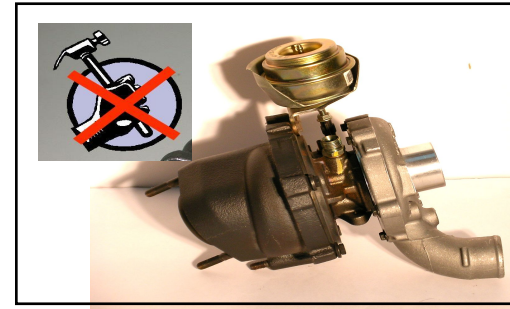
③ VGT control analysis

Check if the VGT operates in normal condition by looking into engine rpm/fuel injection amount/boost pressure sensor values simultaneously.

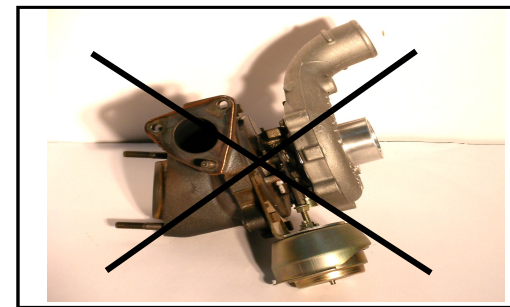
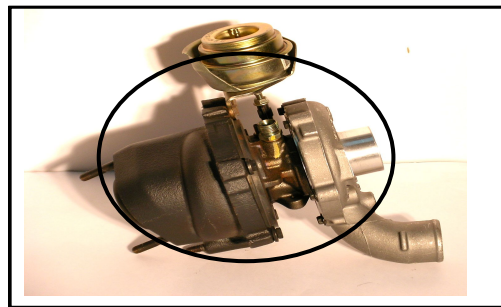
At high rpm/high injection amount, the **boost pressure value is also increased up to 2,700mbar** its maximum pressure. If boost pressure sensor value is not as high as it's requested, must check the boost pressure sensor or VGT system.

5. Cautions when dealing with VGT

- ① *Be sure not to transmit external impact* on turbo charger to prevent internal damage.



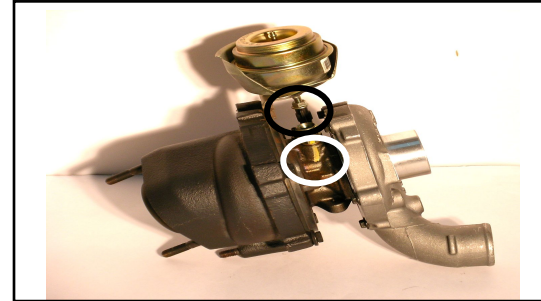
- ② *Keep horizontal stance* that the control actuator places upward when storing, if a lot of oil supply is made in turbo charger with actuator downward, the oil may inflow into the vane mechanism.



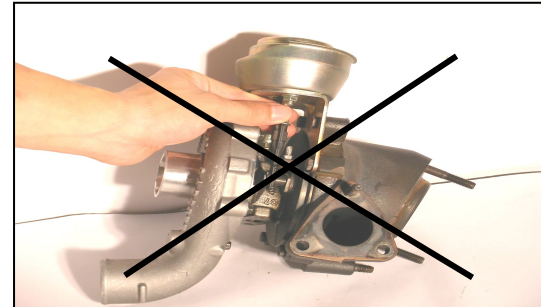
- ③ It's important *not to drastically increase the engine rpm right after starting the engine*. It could make rotation at excessive speed even before the journal bearing is lubricated and when the turbo charger rotates in poor oil supply condition, it could cause damage of bearing seizure within a few seconds.



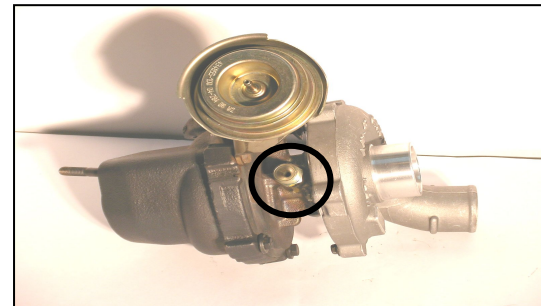
④ The screw for adjusting of *actuator shaft should not be adjusted*, since it's already adjusted precisely in assembly line.



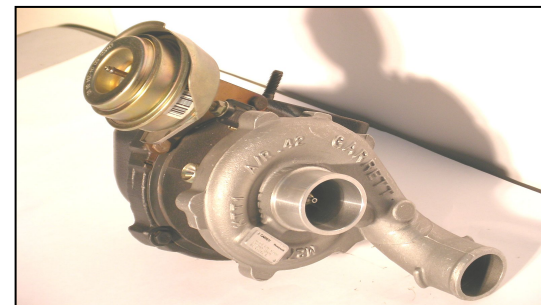
⑤ *Don't grip the actuator shaft* while transferring or removing.



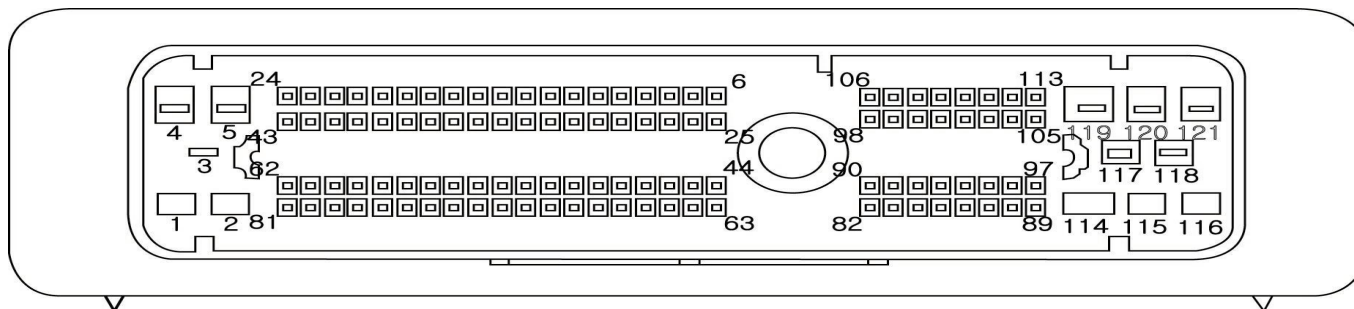
⑥ Before installing a new VGT, *fill a little of oil on the inlet pipe* connecting hold.



⑦ Be sure *not to be inserted any metallic matters* when installing.



1. ECU Connector



2. ECU Terminal Description

Pin Number	D27DT	D20DT	Remarks
1	Engine Ground	Engine Ground	
2	Engine Ground	Engine Ground	
3	Main Power (B+)	Main Power (B+)	
4	Main Power (B+)	Main Power (B+)	
5	Main Power (B+)	Main Power (B+)	
6	RPS power supply	RPS power supply	
7	-	-	
8	-	-	
9	Engine Main Relay	Engine Main Relay	
10	-	-	
11	-	-	
12	Neutral s/w(only for New Rexton)	-	
13	-	-	

Pin Number	D27DT	D20DT	Remarks
26	RPS Ground	RPS Ground	
27	-	-	
28	ECU Ground	ECU Ground	
29	-	-	
30	-	-	
31	Auto Cruise +	Auto Cruise +	
32	Accel Pedal Sensor 2 Signal	Accel Pedal Sensor 2 Signal	
33	-	-	
34	K-LINE (for Preheating/Immo)	K-LINE (for Preheating/Immo)	
35	K-LINE (Diagnosis)	K-LINE (Diagnosis)	
36	VSS (Non ABS/ESP)	VSS (Non ABS/ESP)	
37	IG 1	IG 1	
38	Clutch Pedal S/W (M/T)	Clutch Pedal S/W (M/T)	

Pin Number	D27DT	D20DT	
53	Accel Pedal Sensor 1 Ground	Accel Pedal Sensor 1 Ground	
54	CAN - HI	CAN - HI	
55	-	-	
56	-	-	
57	Accel Pedal Sensor 2 Power	Accel Pedal Sensor 2 Power	
58	Brake Lamp S/W	Brake Lamp S/W	
59	-	-	
60	-	-	
61	PTC #1 Relay	PTC #1 Relay	
62	PTC #2 Relay	PTC #2 Relay	
63	Knock Sensor 2 Ground	-	
64	HFM Sensor (Ambient signal)	HFM Sensor (Ambient signal)	
65	-	-	

Pin Number	D27DT	D20DT	
76	A/Con Middle Pressure S/W	A/Con Middle Pressure S/W	
77	Brake S/W	Brake S/W	
78	-	-	
79	A/Con Compressor Relay	A/Con Compressor Relay	
80	-	-	
81	-	-	
82	Crank Position Sensor Ground	Crank Position Sensor Ground	
83	HFM Sensor Signal	HFM Sensor Signal	
84	HFM Sensor Ground	HFM Sensor Ground	
85	-	-	
86	HFM Sensor Power Supply	HFM Sensor Power Supply	
87	IMV	IMV	
88	ECU Ground	ECU Ground	

Pin Number	D27DT	D20DT	Remarks
101	Engine Coolant Temp Signal	Engine Coolant Temp Signal	
102	Engine Coolant Temp Ground	Engine Coolant Temp Ground	
103	Cam Position Sensor Signal	Cam Position Sensor Signal	
104	Cam Position Sensor Ground	Cam Position Sensor Ground	
105	Engine Warning Lamp	Engine Warning Lamp	
106	-	-	
107	A/Con S/W	A/Con S/W	
108	Boost Pressure Sensor Power Supply	Boost Pressure Sensor Power Supply	
109	Fuel Temp Sensor Signal	Fuel Temp Sensor Signal	
110	Fuel Temp Sensor Ground	Fuel Temp Sensor Ground	
111	Cam Position Sensor Power Supply	Cam Position Sensor Power Supply	
112	Immo Lamp (Old Model)	-	
113	Preheating Control Signal	Preheating Control Signal	
114	Injector # 1	Injector # 1	

2. Diagnostic Trouble Code

No	DTC	Description	MIL	Torque Reduction	Limp home	Delay Stop
1	P0102	Low HFM Sensor Signal (Circuit Open)	O			
2	P0103	High HFM Sensor Signal	O			
3	P0105	Boost Pressure Sensor Power Supply Error				
4	P0106	Boost Pressure Sensor Signal High				
5	P0107	Boost Pressure Sensor Open				
6	P0108	Boost Pressure Sensor Short				
7	P0109	Boost Pressure Sensor Signal Low				
8	P0110	Ambient Temp Sensor Power Supply Error				
9	P0112	Ambient Temp Sensor Open				
10	P0113	Ambient Temp Sensor Short				
11	P0115	ECT Sensor Power Supply Error				
12	P0117	ECT Sensor Open				
13	P0118	ECT Sensor Short				
14	P0120	APS 1 Power Supply Error	O	50%		
15	P0122	APS 1 Open	O	50%		
16	P0123	APS 1 Short	O	50%		
17	P0180	Fuel Temp Sensor Power Supply Error				
18	P0182	Fuel Temp Sensor Short to Ground				
19	P0183	Fuel Temp Sensor Open				
20	P0190	RPS Power Supply Error		50%		

No	DTC	Description	MIL	Torque Reduction	Limp home	Delay Stop
21	P0191	RPS Signal Impossible to measure		50%		
22	P0192	RPS Signal Open	O	50%		
23	P0193	RPS Signal Short	O	50%		
24	P0201	#1 Injector Open	O			
25	P0202	#2 Injector Open	O			
26	P0203	#3 Injector Open	O			
27	P0204	#4 Injector Open	O			
28	P0205	#5 Injector Open	O			
29	P0215	Main Relay Stuck for over 3 sec				
30	P0219	CKP Sensor Clearance Low	O			
31	P0220	APS 2 Power Supply Error	O	50%		
32	P0222	APS 2 Open	O	50%		
33	P0223	APS 2 Short	O	50%		
34	P0245	VGT Modulator Circuit Short	O	50%		
35	P0246	VGT Modulator Circuit Open	O	50%		
36	P0251	IMV Driving Circuit Short	O		O 2000bar	60 sec later
37	P0253	IMV Driving Circuit Short to ground	O		O 2000bar	60 sec later
38	P0255	IMV Driving Circuit Open	O		O 2000bar	60 sec later
39	P0263	#1 Cyl. Balance Error	O			

No	DTC	Description	MIL	Torque Reduction	Limp home	Delay Stop
40	P0266	#2 Cyl. Balance Error	O			
41	P0269	#3 Cyl. Balance Error	O			
42	P0272	#4 Cyl. Balance Error	O			
43	P0275	#5 Cyl. Balance Error	O			
44	P0325	#1 Knock Sensor Error	O			
45	P0330	#2 Knock Sensor Error	O			
46	P0335	No Crank Signal				
47	P0336	CKP Sensor Large Clearance	O			
48	P0337	CKP Sensor Signal Error (No Recognition)				
49	P0341	Synchronization with CMP Error	O			
50	P0344	CMP Sensor Signal Error	O			
51	P0372	CKP Sensor Signal Error (Faulty Drive Plate)	O			
52	P0400	EGR Control Error	O			
53	P0500	Vehicle Speed Signal Error				
54	P0503	Vehicle Speed Signal Error				
55	P0530	A/C Pressure Sensor short to B+				
56	P0532	A/C Pressure Sensor Signal Low				
57	P0533	A/C Pressure Sensor High				
58	P0560	Battery Voltage Error : Too Low		50%		
59	P0562	Battery Voltage Too Low	O	50%		
60	P0563	Battery Voltage Too High : over 16v				

No	DTC	Description	MIL	Torque Reduction	Limp home	Delay Stop
61	P0606	ECU Watch Dog Error				
62	P0633	Immobilizer Error, (key coding impossible)				
63	P0636	Immobilizer Error				
64	P0641	#1 ECU Power Supply Error (5V)	O			
65	P0642	#1 ECU Power Supply Low (5V)	O			
66	P0643	#1 ECU Power Supply High (5V)	O			
67	P0651	#2 ECU Power Supply Error (5V)	O		O	60 sec later
68	P0652	#2 ECU Power Supply Low (5V)	O		O	60 sec later
69	P0653	#2 ECU Power Supply High (5V)	O		O	60 sec later
70	P0671	#3 Glow Plug Open	Glow lamp			
71	P0672	#4 Glow Plug Open	Glow lamp			
72	P0673	#5 Glow Plug Open	Glow lamp			
73	P0674	#1 Glow Plug Open	Glow lamp			
74	P0675	#2 Glow Plug Open	Glow lamp			
75	P0685	Main Relay Faulty	O			
76	P0697	ECU Power Supply Error (2.5V)	O			
77	P0698	ECU Power Supply Low	O			
78	P0699	ECU Power Supply High	O			
79	P0700	TCU Signal Error	O			

No	DTC	Description	MIL	Torque Reduction	Limp home	Delay Stop
80	P0704	Clutch Switch Faulty				
81	P1105	Atmospheric Pressure Sensor (Power Supply)				
82	P1106	Atmospheric Pressure Sensor Error				
83	P1107	Atmospheric Pressure Sensor open/short				
84	P1108	Atmospheric Pressure Sensor short				
85	P1109	Boost Pressure Initial Check Error				
86	P1115	ECT Sensor short to ground				
87	P1116	ECT Sensor Error				
88	P1120	APS 1 Error	O	50%		
89	P1121	APS 2 Error	O	50%		
90	P1122	APS Error (Emergency)	O			
91	P1123	APS Error (Limp-home)		50%	O	
92	P1148	Accelerometer Adaptation Error		20%		
93	P1149	Water detected in fuel filter (over 39cc)		20%		
94	P1170	Torque Trim High	O			
95	P1171	#1 Injector MDP Error	O			
96	P1172	#2 Injector MDP Error	O			
97	P1173	#3 Injector MDP Error	O			
98	P1174	#4 Injector MDP Error	O			
99	P1175	#5 Injector MDP Error	O			
100	P1190	RPS Initial Signal Error	O			

No	DTC	Description	MIL	Torque Reduction	Limp home	Delay Stop
101	P1191	Rail Pressure Creation Too Slow	O			
102	P1192	RPS Initial Signal Low	O	50%		
103	P1193	RPS Initial Signal High	O	50%		
104	P1201	#1 Injector Circuit Short	O			
105	P1202	#2 Injector Circuit Short	O			
106	P1203	#3 Injector Circuit Short	O			
107	P1204	#4 Injector Circuit Short	O			
108	P1205	#5 Injector Circuit Short	O			
109	P1235	Boost Pressure Control Error	O	50%		
110	P1252	IMV Pressure Excessive	O			
111	P1253	RPS Too Low (pressure difference)	O			
112	P1254	RPS Too High (pressure difference)	O			
113	P1256	Insufficient low pressure (IMV current high)				
114	P1257	Excessive low pressure	O			
115	P1258	Insufficient high pressure	O			
116	P1259	Excessive high pressure	O			
117	P1286	#1 Injector wiring low resistance	O			
118	P1287	#1 Injector wiring high resistance	O			
119	P1288	#2 Injector wiring low resistance	O			
120	P1289	#2 Injector wiring high resistance	O			
121	P1290	#3 Injector wiring low resistance	O			

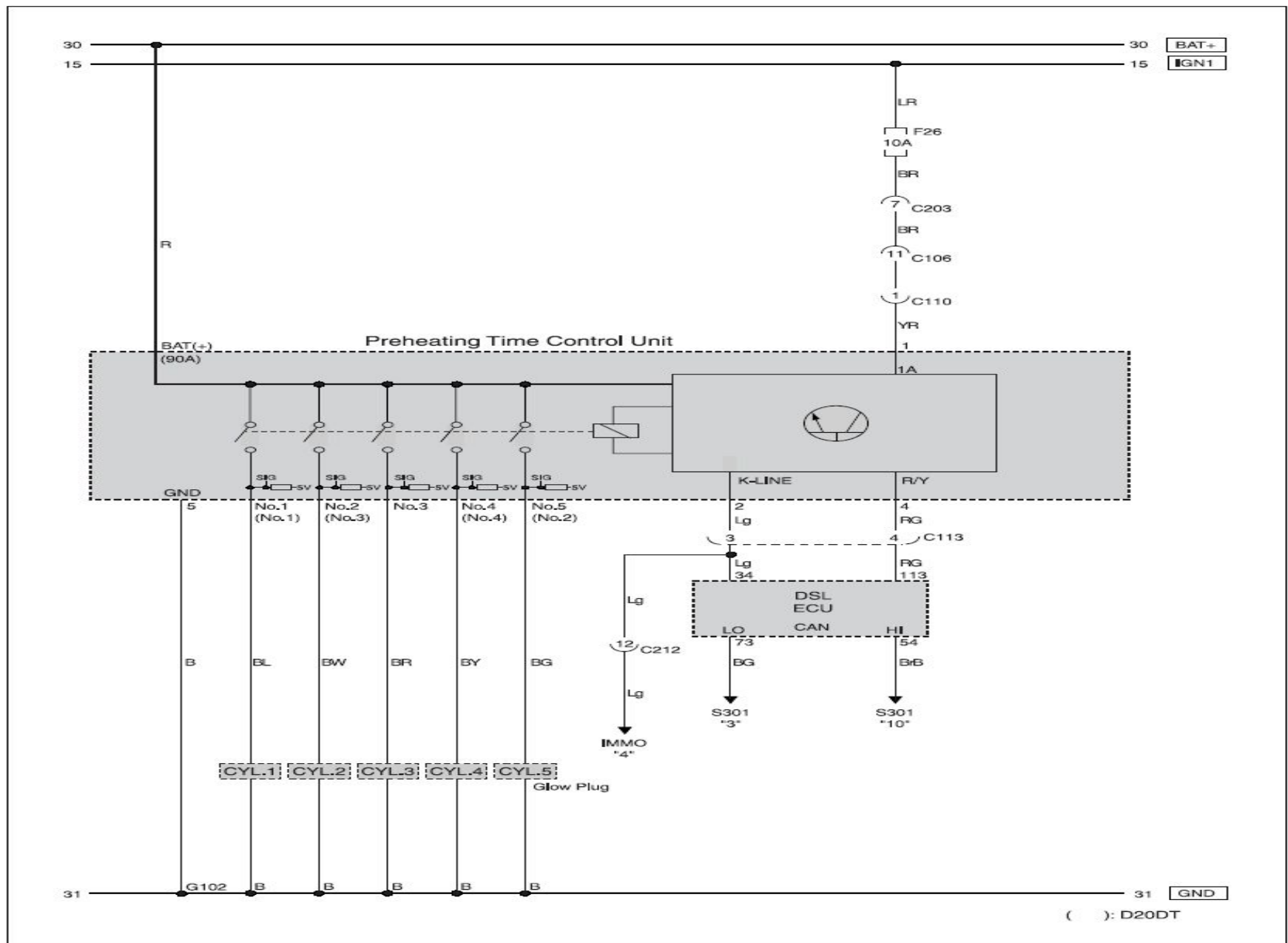
No	DTC	Description	MIL	Torque Reduction	Limp home	Delay Stop
122	P1291	#3 Injector wiring high resistance	O			
123	P1292	#4 Injector wiring low resistance	O			
124	P1293	#4 Injector wiring high resistance	O			
125	P1294	#5 Injector wiring low resistance	O			
126	P1295	#5 Injector wiring high resistance	O			
127	P1405	EGR Modulator Circuit Open	O			
128	P1406	EGR Modulator Circuit Short	O			
129	P1480	#1 Condenser Fan Circuit Open				
130	P1481	#1 Condenser Fan Circuit Short				
131	P1482	#1 Condenser Fan Circuit Short to ground				
132	P1500	No Vehicle Speed Signal	O			
133	P1526	#2 Condenser Fan Circuit Open				
134	P1527	#2 Condenser Fan Circuit Short				
135	P1528	#2 Condenser Fan Circuit Short to ground				
136	P1530	#1 PTC Control Circuit Open	O			
137	P1531	#1 PTC Control Circuit Short				
138	P1532	#1 PTC Control Circuit Short to ground				
139	P1534	#2 PTC Control Circuit Open	O			
140	P1535	#2 PTC Control Circuit Short	O			

No	DTC	Description	MIL	Torque Reduction	Limp home	Delay Stop
141	P1536	#2 PTC Control Circuit Short to ground	O			
142	P1540	A/C Comp Control Circuit Open				
143	P1541	A/C Comp Control Circuit Short				
144	P1542	A/C Comp Control Circuit Short to ground				
145	P1571	Brake Lamp Signal Error (ECU #77)	O			
146	P1572	Brake Lamp Signal Error (ECU #58)	O			
147	P1600	ECU Shut Down Error (Injector Control)	O			
148	P1601	ECU Error (Injector Control)	O			
149	P1602	ECU Error (Injector Control)	O			
150	P1606	ECU Error (CAN/KWP2000 Error)	O		O	
151	P1607	ECU Injector Cut Error	O			
152	P1608	ECU Error (Injector Control)	O			
153	P1614	ECU Error (C2I / MDP)	O		O	
154	P1615	ECU Error (Rail Pressure Calculation)	O		O	
155	P1616	ECU Error (DTC Watchdog)	O		O	
156	P1618	Injector Bank 2 Voltage Low	O			
157	P1619	Injector Bank 2 Voltage High	O			
157	P1620	ECU Error (Injection Timing Error)	O		O	
159	P1621	ECU Error (DTC Control)	O		O	

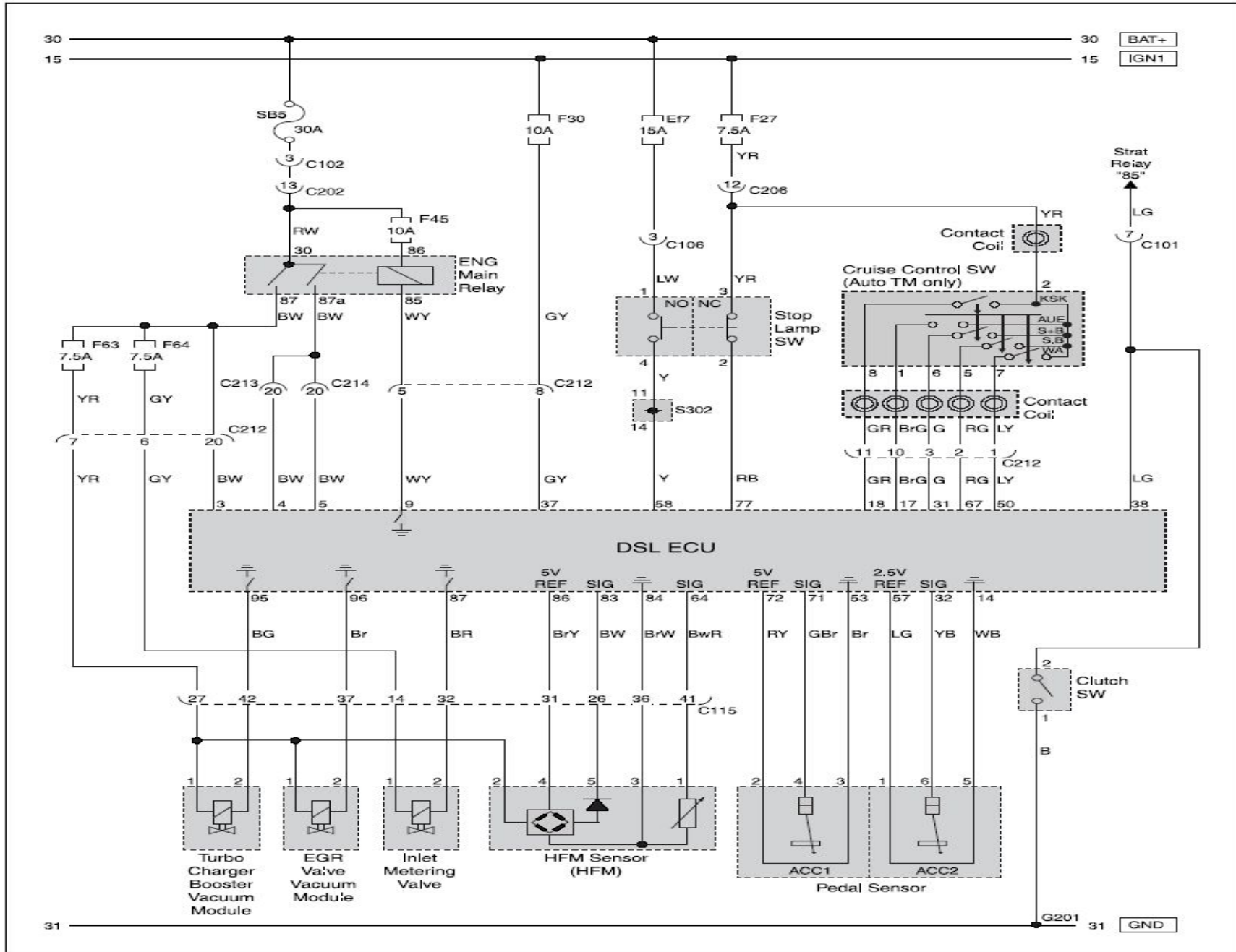
No	DTC	Description	MIL	Torque Reduction	Limp home	Delay Stop
160	P1622	ECU Error (Variant Coding)	O		O	
161	P1630	Immobilizer Response Error (Transponder)				
162	P1631	Immobilizer Error				
163	P1632	Immobilizer Error (system invalid)				
164	P1633	Immobilizer Error (Key coding is needed)				
165	P1634	Immobilizer Response Error				
166	P1635	Immobilizer Response Error (Invalid response)				
167	P1636	Immobilizer Error (unidentified failure)				
168	P1671	#3 Glow Plug Short				
169	P1672	#4 Glow Plug Short				
170	P1673	#5 Glow Plug Short				
171	P1674	#1 Glow Plug Short				
172	P1675	#2 Glow Plug Short				
173	P1676	Glow Plug Communication Error (Preheating Unit and ECU)				
174	P1677	Preheating Unit Communication Error (Preheating Unit and ECU)				
175	P1678	Glow Plug Open				
176	P1679	Glow Plug Short				
177	P1680	Glow Plug Short to ground				

3. Electrical Wiring Diagram

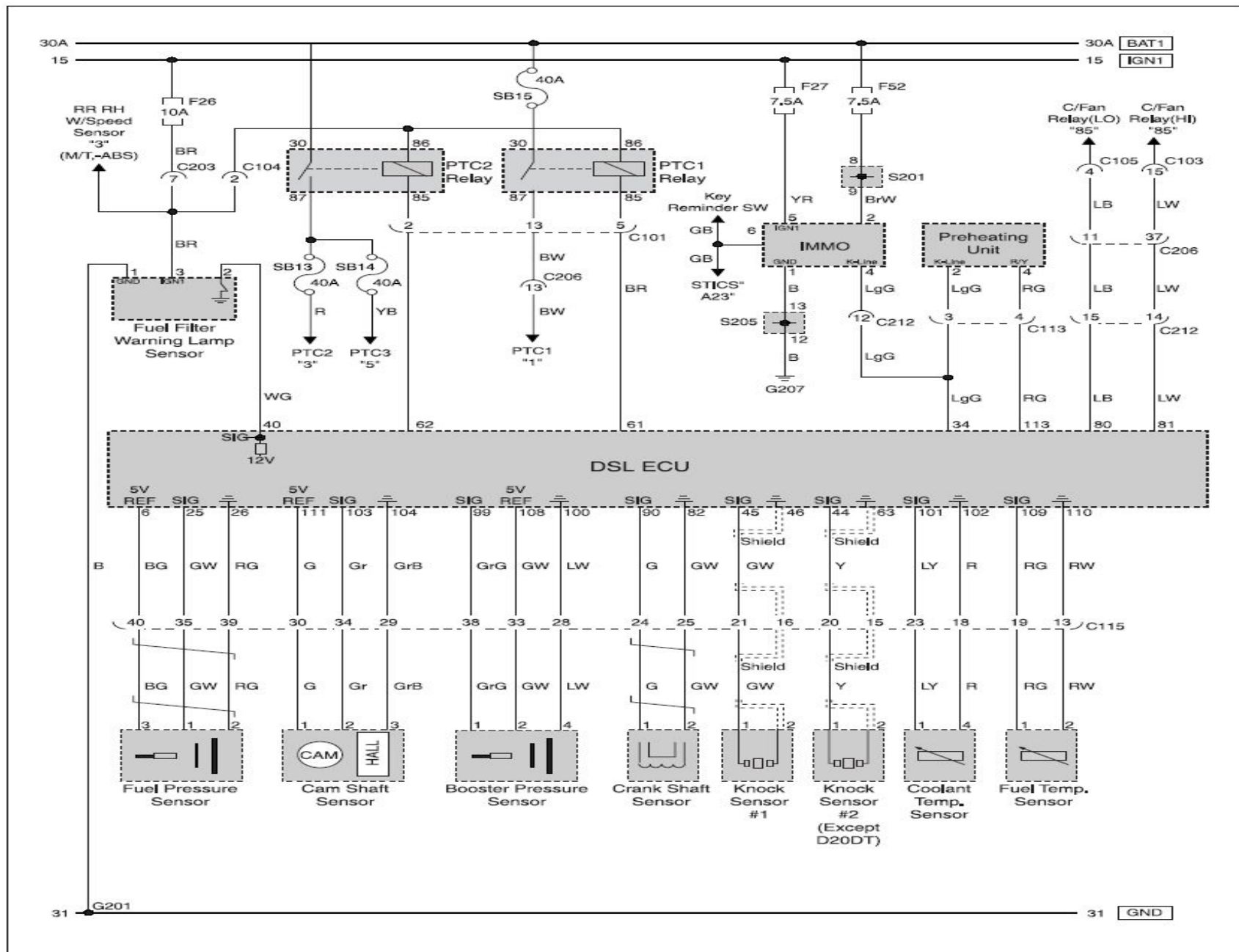
1) Preheating



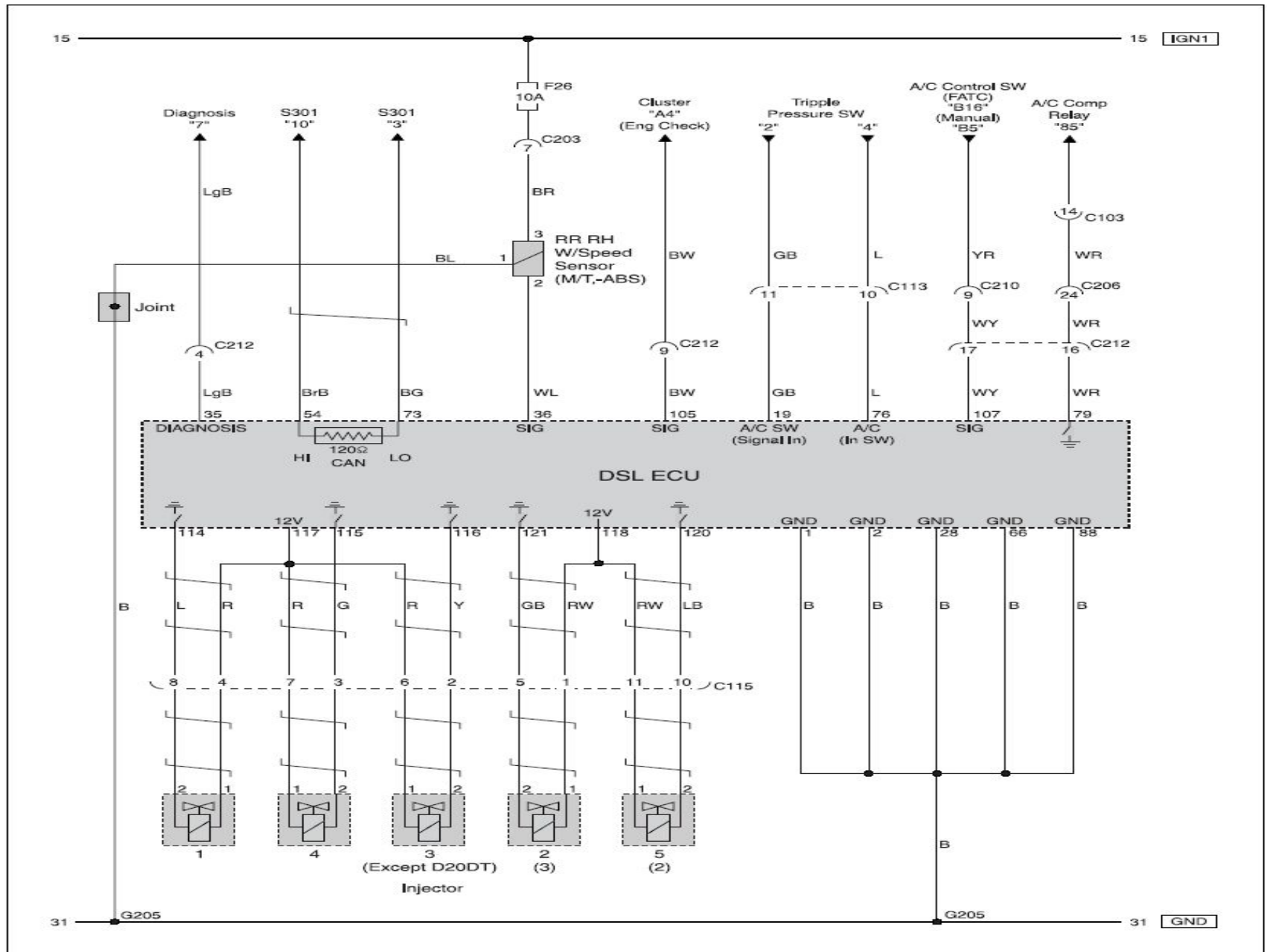
2) Power Supply / VGT / EGR / IMV / HFM / APS



3) Immobilizer & Sensors



4) Injector / Air-con / Triple Pressure Switch



레일 압력 현재값과 목표값(MAP)을 비교하여 현재값이 낮을 경우
연료계통의 기계적 혹은 전기적 문제,
현재값과 목표값이 동일하나, 목표값이 정상차량대비 낮은 경우,
이는 ECU연산에 영향을 주는 입력신호의 문제로 접근

DATA LIST	
*02.Boost Pressure.....	0.980 [Bar]
*03.Airmeter.....	329 [mg/stk]
*06.EGR Valve Duty.....	89.7 [%]
04.Boost Pressure(MAP)...	0.980 [Bar]
05.Turbo Valve Drive Duty	89.7 [%]
07.EGR Demand(MAP).....	329 [mg/stk]
08.Pedal Position.....	0.0 [%]
09.Rail Pressure.....	240 [Bar]
10.Atmospheric Pressure..	1.020 [Bar]
11.Coolant Temperature...	85 [°C]
▲, ▼	
Fix	UnFix
Item	Item
Init.	Spec.
Menu	Disp.
Line	Graph
Full	Disp.

Boost Pressure at Idle

DATA LIST	
*02.Boost Pressure.....	2.330 [Bar]
*05.Turbo Valve Drive Duty	76.8 [%]
*09.Rail Pressure.....	1300 [Bar]
*18.Injector Fuel Quantity	50.5 [mg/stk]
*28.Inlet Valve Duty(MAP).	25.4 [%]
22.Fan 1 Output (Low)....	OFF
23.Fan 2 Output (High)...	OFF
24.Pilot Advance(MAP)....	37.1 [°]
25.Main Advance(MAP)....	1.8 [°]
26.Pilot Fuel Qty(MAP)...	2.2 [mg/stk]
▲, ▼	
Fix	UnFix
Item	Item
Init.	Spec.
Menu	Disp.
Line	Graph
Full	Disp.

Boost Pressure at Stall Test

<table> <tr><th colspan="2">DATA LIST</th></tr> <tr><td>01.Fuel Temperature.....</td><td>19 [°C]</td></tr> <tr><td>02.Boost Pressure.....</td><td>1.040 [Bar]</td></tr> <tr><td>03.Airmeter.....</td><td>576 [mg/stk]</td></tr> <tr><td>04.Boost Pressure(MAP)...</td><td>1.040 [Bar]</td></tr> <tr><td>05.Turbo Valve Drive Duty</td><td>74.8 [%]</td></tr> <tr><td>06.EGR Valve Duty.....</td><td>0.0 [%]</td></tr> <tr><td>07.EGR Demand(MAP).....</td><td>493 [mg/stk]</td></tr> <tr><td>08.Pedal Position.....</td><td>0.0 [%]</td></tr> <tr><td>09.Rail Pressure.....</td><td>240 [Bar]</td></tr> <tr><td>10.Atmospheric Pressure..</td><td>1.020 [Bar]</td></tr> </table>	DATA LIST		01.Fuel Temperature.....	19 [°C]	02.Boost Pressure.....	1.040 [Bar]	03.Airmeter.....	576 [mg/stk]	04.Boost Pressure(MAP)...	1.040 [Bar]	05.Turbo Valve Drive Duty	74.8 [%]	06.EGR Valve Duty.....	0.0 [%]	07.EGR Demand(MAP).....	493 [mg/stk]	08.Pedal Position.....	0.0 [%]	09.Rail Pressure.....	240 [Bar]	10.Atmospheric Pressure..	1.020 [Bar]	<table> <tr><th colspan="2">DATA LIST</th></tr> <tr><td>11.Coolant Temperature...</td><td>87 [°C]</td></tr> <tr><td>12.Air Temperature.....</td><td>20 [°C]</td></tr> <tr><td>13.Battery Voltage.....</td><td>14.5 [V]</td></tr> <tr><td>14.Vehicle Speed.....</td><td>0 [Km/H]</td></tr> <tr><td>15.Gear Ratio.....</td><td>P/N</td></tr> <tr><td>16.Engine Block Noise 1..</td><td>32</td></tr> <tr><td>17.Engine Block Noise 2..</td><td>NOT AVAIL</td></tr> <tr><td>18.Injected Fuel Quantity</td><td>4.5 [mg/stk]</td></tr> <tr><td>19.Engine Speed.....</td><td>768 [RPM]</td></tr> <tr><td>20.Engine Torque(MAP)....</td><td>28 [Nm]</td></tr> </table>	DATA LIST		11.Coolant Temperature...	87 [°C]	12.Air Temperature.....	20 [°C]	13.Battery Voltage.....	14.5 [V]	14.Vehicle Speed.....	0 [Km/H]	15.Gear Ratio.....	P/N	16.Engine Block Noise 1..	32	17.Engine Block Noise 2..	NOT AVAIL	18.Injected Fuel Quantity	4.5 [mg/stk]	19.Engine Speed.....	768 [RPM]	20.Engine Torque(MAP)....	28 [Nm]
DATA LIST																																													
01.Fuel Temperature.....	19 [°C]																																												
02.Boost Pressure.....	1.040 [Bar]																																												
03.Airmeter.....	576 [mg/stk]																																												
04.Boost Pressure(MAP)...	1.040 [Bar]																																												
05.Turbo Valve Drive Duty	74.8 [%]																																												
06.EGR Valve Duty.....	0.0 [%]																																												
07.EGR Demand(MAP).....	493 [mg/stk]																																												
08.Pedal Position.....	0.0 [%]																																												
09.Rail Pressure.....	240 [Bar]																																												
10.Atmospheric Pressure..	1.020 [Bar]																																												
DATA LIST																																													
11.Coolant Temperature...	87 [°C]																																												
12.Air Temperature.....	20 [°C]																																												
13.Battery Voltage.....	14.5 [V]																																												
14.Vehicle Speed.....	0 [Km/H]																																												
15.Gear Ratio.....	P/N																																												
16.Engine Block Noise 1..	32																																												
17.Engine Block Noise 2..	NOT AVAIL																																												
18.Injected Fuel Quantity	4.5 [mg/stk]																																												
19.Engine Speed.....	768 [RPM]																																												
20.Engine Torque(MAP)....	28 [Nm]																																												
D20D1																																													
<table> <tr><th colspan="2">DATA LIST</th></tr> <tr><td>01.Fuel Temperature.....</td><td>50 [°C]</td></tr> <tr><td>02.Boost Pressure.....</td><td>0.980 [Bar]</td></tr> <tr><td>03.Airmeter.....</td><td>588 [mg/stk]</td></tr> <tr><td>04.Boost Pressure(MAP)...</td><td>0.980 [Bar]</td></tr> <tr><td>05.Turbo Valve Drive Duty</td><td>89.7 [%]</td></tr> <tr><td>06.EGR Valve Duty.....</td><td>0.0 [%]</td></tr> <tr><td>07.EGR Demand(MAP).....</td><td>329 [mg/stk]</td></tr> <tr><td>08.Pedal Position.....</td><td>0.0 [%]</td></tr> <tr><td>09.Rail Pressure.....</td><td>250 [Bar]</td></tr> <tr><td>10.Atmospheric Pressure..</td><td>1.020 [Bar]</td></tr> </table>	DATA LIST		01.Fuel Temperature.....	50 [°C]	02.Boost Pressure.....	0.980 [Bar]	03.Airmeter.....	588 [mg/stk]	04.Boost Pressure(MAP)...	0.980 [Bar]	05.Turbo Valve Drive Duty	89.7 [%]	06.EGR Valve Duty.....	0.0 [%]	07.EGR Demand(MAP).....	329 [mg/stk]	08.Pedal Position.....	0.0 [%]	09.Rail Pressure.....	250 [Bar]	10.Atmospheric Pressure..	1.020 [Bar]	<table> <tr><th colspan="2">DATA LIST</th></tr> <tr><td>11.Coolant Temperature...</td><td>86 [°C]</td></tr> <tr><td>12.Air Temperature.....</td><td>52 [°C]</td></tr> <tr><td>13.Battery Voltage.....</td><td>14.2 [V]</td></tr> <tr><td>14.Vehicle Speed.....</td><td>0 [Km/H]</td></tr> <tr><td>15.Gear Ratio.....</td><td>P/N</td></tr> <tr><td>16.Engine Block Noise 1..</td><td>64</td></tr> <tr><td>17.Engine Block Noise 2..</td><td>48</td></tr> <tr><td>18.Injected Fuel Quantity</td><td>5.5 [mg/stk]</td></tr> <tr><td>19.Engine Speed.....</td><td>736 [RPM]</td></tr> <tr><td>20.Engine Torque(MAP)....</td><td>52 [Nm]</td></tr> </table>	DATA LIST		11.Coolant Temperature...	86 [°C]	12.Air Temperature.....	52 [°C]	13.Battery Voltage.....	14.2 [V]	14.Vehicle Speed.....	0 [Km/H]	15.Gear Ratio.....	P/N	16.Engine Block Noise 1..	64	17.Engine Block Noise 2..	48	18.Injected Fuel Quantity	5.5 [mg/stk]	19.Engine Speed.....	736 [RPM]	20.Engine Torque(MAP)....	52 [Nm]
DATA LIST																																													
01.Fuel Temperature.....	50 [°C]																																												
02.Boost Pressure.....	0.980 [Bar]																																												
03.Airmeter.....	588 [mg/stk]																																												
04.Boost Pressure(MAP)...	0.980 [Bar]																																												
05.Turbo Valve Drive Duty	89.7 [%]																																												
06.EGR Valve Duty.....	0.0 [%]																																												
07.EGR Demand(MAP).....	329 [mg/stk]																																												
08.Pedal Position.....	0.0 [%]																																												
09.Rail Pressure.....	250 [Bar]																																												
10.Atmospheric Pressure..	1.020 [Bar]																																												
DATA LIST																																													
11.Coolant Temperature...	86 [°C]																																												
12.Air Temperature.....	52 [°C]																																												
13.Battery Voltage.....	14.2 [V]																																												
14.Vehicle Speed.....	0 [Km/H]																																												
15.Gear Ratio.....	P/N																																												
16.Engine Block Noise 1..	64																																												
17.Engine Block Noise 2..	48																																												
18.Injected Fuel Quantity	5.5 [mg/stk]																																												
19.Engine Speed.....	736 [RPM]																																												
20.Engine Torque(MAP)....	52 [Nm]																																												
27D																																													

DATA LIST	
21.Rail Pressure(MAP)....	250 [Bar]
22.Fan 1 Output (Low)....	OFF
23.Fan 2 Output (High)...	OFF
24.Pilot Advance(MAP)....	24.4 [°]
25.Main Advance(MAP)....	- 1.0 [°]
26.Pilot Fuel Qtt(MAP)...	1.5 [mg/stk]
27.Main Fuel Qtt(MAP)....	5.5 [mg/stk]
28.Inlet Valve Duty(MAP).	30.5 [%]
29.Idle Target RPM.....	768 [RPM]
30.Engine State.....	RUNNING

DATA LIST	
31.Engine Start Enable...	YES
32.Clutch Switch.....	OFF
33.Brake Light Switch....	ON
34.Brake Safty Switch....	ON
35.Brake Switch.....	ON
36.A/C Switch Input.....	OFF
37.A/C HeadPressure Input	OFF
38.Pedal #1 Sensor Pos...	0.0 [%]
39.Pedal #2 Sensor Pos...	0.0 [%]
40.A/C Control Output....	OFF

D20DT

DATA LIST	
21.Rail Pressure(MAP)....	250 [Bar]
22.Fan 1 Output (Low)....	OFF
23.Fan 2 Output (High)...	OFF
24.Pilot Advance(MAP)....	14.5 [°]
25.Main Advance(MAP)....	- 2.4 [°]
26.Pilot Fuel Qtt(MAP)...	0.5 [mg/stk]
27.Main Fuel Qtt(MAP)....	5.0 [mg/stk]
28.Inlet Valve Duty(MAP).	32.1 [%]
29.Idle Target RPM.....	736 [RPM]
30.Engine State.....	RUNNING

DATA LIST	
31.Engine Start Enable...	YES
32.Clutch Switch.....	OFF
33.Brake Light Switch....	OFF
34.Brake Safty Switch....	OFF
35.Brake Switch.....	OFF
36.A/C Switch Input.....	OFF
37.A/C HeadPressure Input	OFF
38.Pedal #1 Sensor Pos...	0.0 [%]
39.Pedal #2 Sensor Pos...	0.0 [%]
40.A/C Control Output....	OFF

D27DT

DATA LIST	
41.Power Relay Output....	ON
42.Glow Plug Output.....	OFF
43.PTC Relay(#1).....	OFF
44.PTC Relay(#2).....	OFF
45.Cruise Off Switch.....	ON
46.Cruise Safty Switch...	OFF
47.Cruise Accel. Switch..	OFF
48.Cruise Decel. Switch..	OFF
49.Cruise Resume Switch..	OFF
50.Rear Blower Input.....	OFF

DATA LIST	
51.Glow Plug Lamp.....	OFF
52.Check Engine Lamp.....	OFF
53.Fuel Filter Water In..	OFF
54.#1 Inj. MDP Count.....	1
55.#2 Inj. MDP Count.....	1
56.#3 Inj. MDP Count.....	1
57.#4 Inj. MDP Count.....	1
.....	
01.Fuel Temperature.....	20 [°C]
02.Boost Pressure.....	1.040 [Bar]

D20DT

DATA LIST	
41.Power Relay Output....	ON
42.Glow Plug Output.....	OFF
43.PTC Relay(#1).....	OFF
44.PTC Relay(#2).....	OFF
45.Cruise Off Switch.....	ON
46.Cruise Safty Switch...	OFF
47.Cruise Accel. Switch..	OFF
48.Cruise Decel. Switch..	OFF
49.Cruise Resume Switch..	OFF
50.Rear Blower Input.....	OFF

DATA LIST	
50.Rear Blower Input.....	OFF
51.Glow Plug Lamp.....	OFF
52.Check Engine Lamp.....	OFF
53.Fuel Filter Water In..	OFF
54.#1 Inj. MDP Count.....	0
55.#2 Inj. MDP Count.....	0
56.#3 Inj. MDP Count.....	0
57.#4 Inj. MDP Count.....	0
58.#5 Inj. MDP Count.....	0
.....	

D27DT

1. Scan-100 Data List : Actyon(D20) / New Rexton(D27)

At above 82 °C of ECT

No	Item	Unit	Description	Idle		Remark
1	Fuel Temperature	°C	Fuel temperature in HP pump	Below 75		NTC resistor 95°C when faulty
2	Boost Pressure : combination with #4,5 - stall test	Bar	Absolute pressure in intake manifold, higher than atmospheric due to turbo charger.	1.01 ~ 1.06 bar(D20) 0.98 ~ 1.01bar(D27)		VGT for D20DT WGT for D27DT No EGR when faulty
				Max (Stall)	D20 : 2.350 bar D27 : 2.330bar	
3	Air Meter : Combination with #6	mg/strk	HFM sensor signal	W/EGR (Max opening)	150	When EGR valve stuck open, no acceleration, rough idle and black smoke occur.
				W/O EGR	550	
4	Boost Pressure (MAP) : combination with #2	Bar	Calculated absolute pressure by ECU	1.01 ~ 1.06 bar(D20) 0.98 ~ 1.01bar(D27)		Must same as actual boost pressure
5	Turbo Valve Drive Duty : combination with #2 - stall test	%	VGT modulator operating duty, as rpm increases, the duty decreases. Compare with Boost Pressure.	74.8%(D20) / %(D27)		VGT for D20DT WGT for D27DT
				Max	D20 : 45 %	
					D27 : %	
				at 1500 rpm	D20 : 50~65 %	
					D27 : %	
6	EGR Valve Duty : combination with #3	%	EGR modulator operating duty, as rpm increases, the duty increases.	0%		EGR Cut Conditions: 1. Above 2950rpm 2. Above 105km/h 3. Above 1000m 4. Above 100 °C ,below 10 5. Idle 50sec continues
				At 1500 rpm	D20: 50 %	
					D27 : %	
7	EGR Demand (MAP) : combination with #3	mg/strk	Target EGR volume. Air Meter value determines EGR volume.	576 (D20) / 329 (D27)		Almost same as #3 when EGR is operating
8	Pedal Position	%	Calculated accelerator pedal sensor	0% (99.9% at WOT)		APS 1 is main signal Check for its max position

No	Item	Unit	Description	Idle	Remark
9	Rail Pressure : combination with #21,28,8 - <u>stall test</u>	Bar	Rail pressure sensor signal	250 bar	At IMV 32%
				Cranking : 250 ~290 bar	
10	Atmospheric Pressure	Bar	Atmospheric pressure sensor in ECU (same with boost pressure sensor when IG ON)	1.010bar	Varies by altitude
11	Coolant Temperature	°C	Calculated engine coolant temperature sensor signal	82 ~ 90	Warm-up condition
12	Air Temperature	°C	Ambient temperature in HFM sensor	Variable	Consider the ambient temp'
13	Battery Voltage	V	Battery voltage for compensating Injection quantity by voltage level.	Charging voltage	Check if it is different from charging voltage
14	Vehicle Speed	Km/h	Vehicle speed from ABS/ESP unit via CAN line	Variable	Check if ABS/ESP unit displays normal speed.
15	Gear Ratio	-	Current gear position, data from TCU via CAN	P/N or D , 1 ~ 4 by speed	MT : Neutral signal from cluster via CAN
16	Engine Block Noise 1	Numeric	Calculated knock signal into numeric unit, knock sensor condition can be checked.	30 ~ 60	ECU takes certain period of knock signal.
				Stall : 144	
17	Engine Block Noise 2	Numeric	Calculated knock signal	30 ~ 50, Stall : 144	Only for D27DT
18	Injected Fuel Quantity - <u>stall test</u>	mg/strk	Total injection amount for each cylinder : Pilot + Main	4.5 (D20) / 5.5 (D27)	Main is much more than Pilot
				Stall : 30 ~ 50	
19	Engine Speed - <u>stall test</u>	rpm	Calculated crank position sensor signal	768(D20) / (D27)	

No	Item	Unit	Description	Idle	Remark
20	Engine Torque (MAP)	Nm	Calculates using RPM,APS and Injection amount	44(D20) / 52 (D27)	Not actual engine torque
				Stall : 310 ~ 340	
21	Rail Pressure (MAP) : combination with #9 -stall test	Bar	Target rail pressure calculated by APS	Must same as rail pressure	Check the difference with Rail Pressure
22	Fan 1 Output (Low)	On/Off	Condenser Fan Low speed	With normal A/C operation or over 91 °C of ECT	
23	Fan 2 Output (High)	On/Off	Condenser Fan Low speed	When middle pressure S/W is ON or over 95 °C of ECT	19Kg/cm ²
24	Pilot Advance (MAP) : combination with #12,19	°	Pilot injection timing advance depending on engine load	BTDC 24.4(D20) / 14.5(D27)	CKP & CMP sensor are basic to calculate timing.
				Racing : BTDC 39	
25	Main Advance (MAP)	°	Main injection timing advance depending on engine load	ATDC 1(D20) / 2.4(D27)	
				Racing : BTDC 7.5	
26	Pilot Fuel Quantity (MAP) : combination with #16,17	mg/strk	Pilot injection quantity calculated with knock signal	0.7~1.5	Related to MDP Adaptation
				Stall : 1.0 / D range : 1.4	
27	Main Fuel Quantity (MAP) : combination with #9	mg/strk	Main injection quantity calculated from APS & rpm	2.5 ~ 5.5	Greater value than normal means low pressure.
				Stall : 34 / D range : 7	
28	Inlet Valve Duty (MAP) : combination with #9 - stall test	%	IMV control duty, as Rail Pressure (MAP) increases, duty decreases.	N : 32.1% □ 240~250bar D : 31.7% □ 260bar Stall : 27.8% □ 1070bar	Lower value than normal means low pressure
29	Idle Target RPM	rpm	Depending on engine temperature and load	730 ~ 780	Warm-up condition

No	Item	Unit	Description	Idle	Remark
30	Engine State	Running /Stop	Judges by vehicle speed from ABS/ESP unit via CAN		
31	Engine Start Enable	Yes/No	Result of Immobilizer response		Immobilizer only
32	Clutch Switch - Check if rpm increases when releasing clutch engaging gear.	On/Off	To increase rpm when clutch release with neutral S/W off. ON when depressed.		M/T only
33	Brake Light Switch	On/Off	Main brake S/W signal. ON when depressed.		NO type
34	Brake Safety Switch	On/Off	Monitoring S/W signal for main S/W , ON when depressed.		NC type
35	Brake Switch	On/Off	Brake pedal status, ON when depressed		
36	A/C Switch Input	On/Off	12v from A/C S/W to ECU when A/C S/W is ON.		
37	A/C Head Pressure Input	On/Off	ON when middle pressure switch is on		19Kg/cm ²
38	Pedal #1 Sensor Position : combination with #39	%	Main signal opening %	0%	99.9% at W.O.T
39	Pedal #2 Sensor Position	%	Monitoring signal opening %	0%	99.9% at W.O.T
40	A/C Control Output : combination with #36	On/Off	A/C Compressor Relay driving output		0V when Comp' is ON
41	Power Relay Output	On/Off	Main relay driving output, ON when IG ON and for 10 sec after IG OFF.		0V when IG ON

No	Item	Unit	Description	Idle	Remark
42	Glow Plug Output	On/Off	Glow plug output signal to Preheating Unit via K-line.		Depends on engine temp.
43	PTC Relay #1	On/Off	PTC Relay output depending on engine temp and ambient temp.		Supply current for PTC 1
44	PTC Relay #2	On/Off	PTC Relay output depending on engine temp and ambient temp.		Supply current for PTC 2 & 3
45	Cruise Off Switch	On/Off	Auto Cruise S/W signal		
46	Cruise Safety Switch	On/Off			
47	Cruise Accel Switch	On/Off			
48	Cruise Decel Switch	On/Off			
49	Cruise Resume Switch	On/Off			
50	Rear Blower Input	On/Off	Rear Blower S/W signal input		New Rexton (dual A/C) / Rodius only
51	Glow Plug Lamp	On/Off	On when IG ON, blinks when preheating system is faulty		Operating signal from ECU via CAN
52	Engine Check Lamp	On/Off	Engine check lamp		Ground control by ECU
53	Fuel Filter Water Inflow	On/Off	ON when water is detected more than 39cc, Lamp operating signal goes to cluster via CAN		
54	#1 ~ #5 Inj. MDP Count	Numeric	The number of MDP (Minimum Drive Pulse) Adaptation		