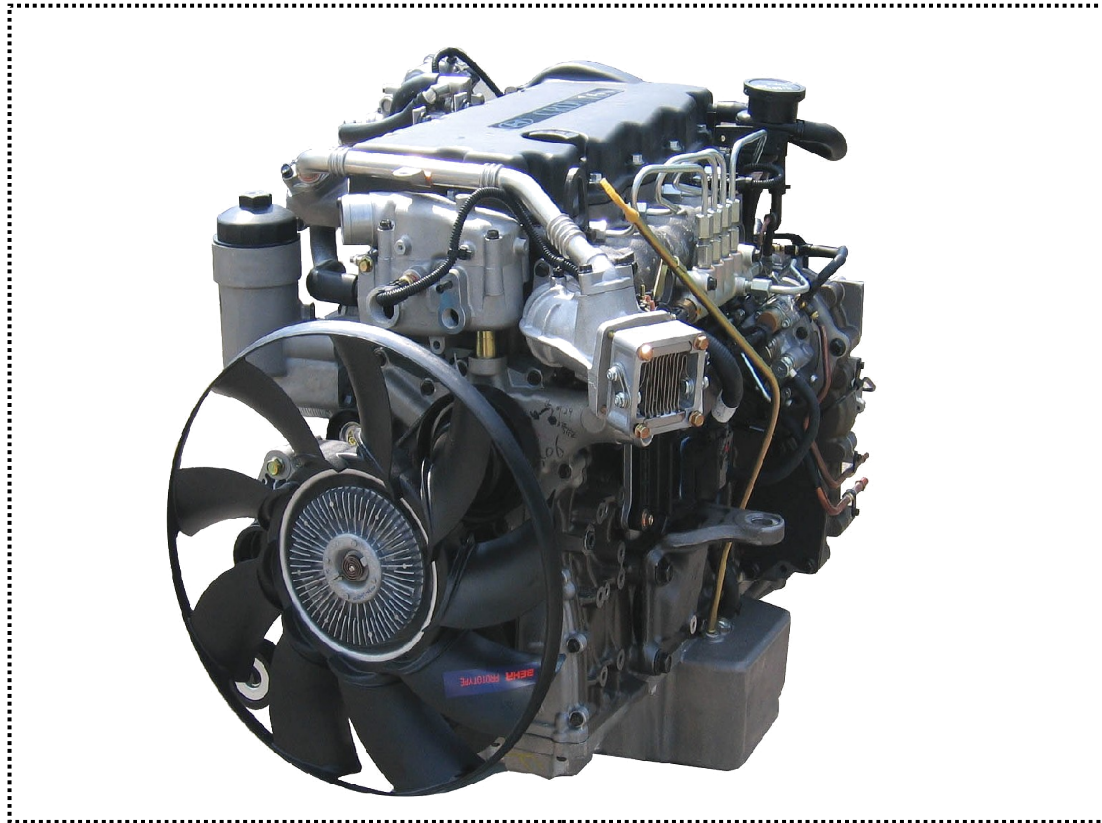


F- Engine

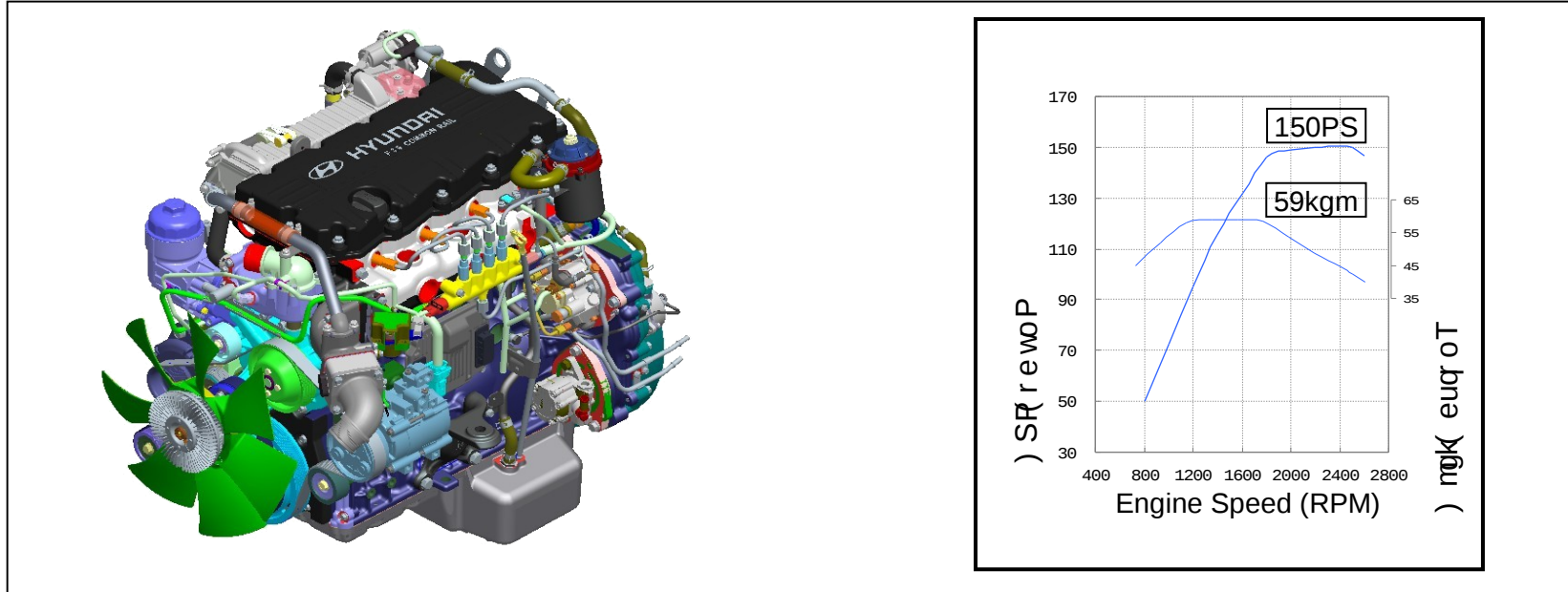


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Specifications

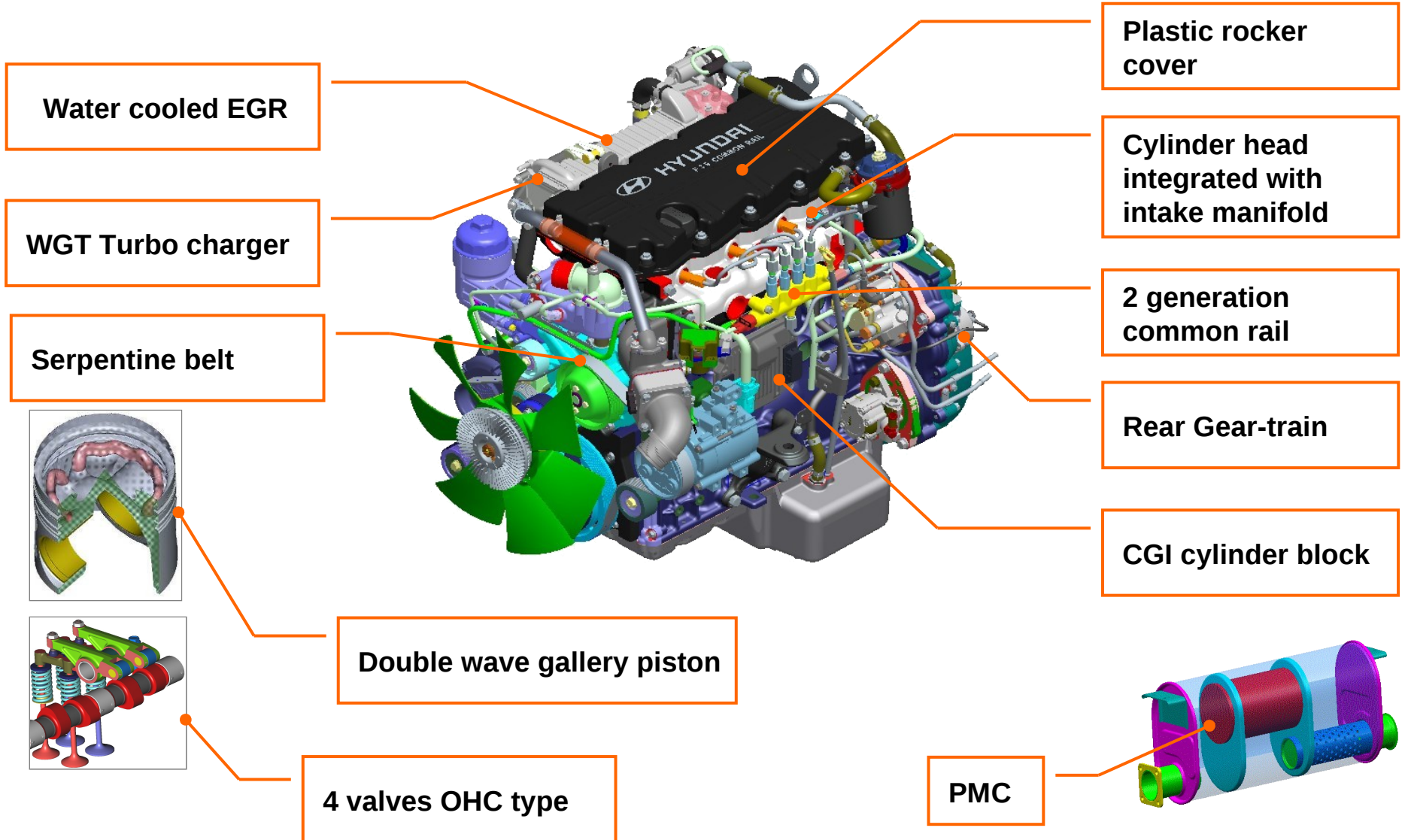
Items		F-engine
General	Displacement (ℓ)	3,933
	Bore X Stroke (ℓ)	103 x 118
	Cylinder type	I4
	Compression ratio	17
	Maximum power (ps/rpm)	150 / 2500
	Maximum torque (kg·m/rpm)	59 / 1400~1800
	Total weight (kg)	440
Material of cylinder head and block		CGI (Compacted Graphite Iron)
VALVE No. / CAM type		4 / OHC
Turbo type		WGT
Fuel injection system		Common rail
Emission system		EGR+PMC
Electrical system	Alternator (Truck/Bus)	70AH / 80AH
	Starter	5.5 KW
Engine oil capacity (ℓ) (Oil pan/ total quantity)		13.5/15

Main feature



- Features:
- 4 valves OHC
 - Common rail (1600bar)
 - Serpentine belt and Auto-tensioner
 - CGI (Compacted Graphite Iron) cylinder block
 - Compacted cylinder head (In-Manifold integrated)
 - Improve fuel consumption
 - Cope with emission regulation (Euro 4)
 - Reduce the noise (various step injection)
 - Oil replacement period expended

Main feature

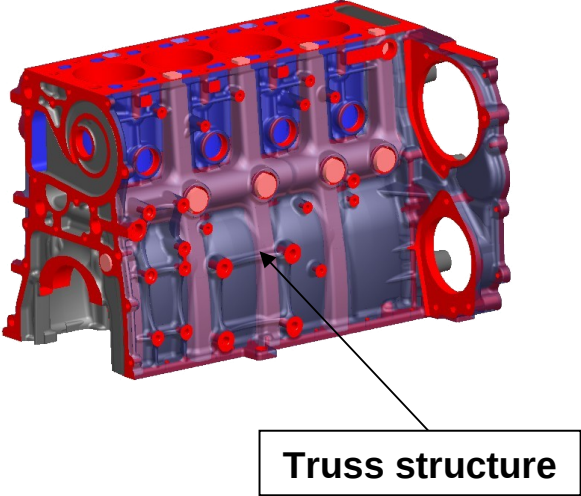


Main feature

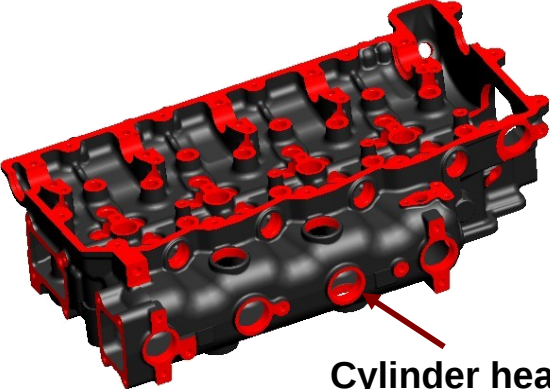
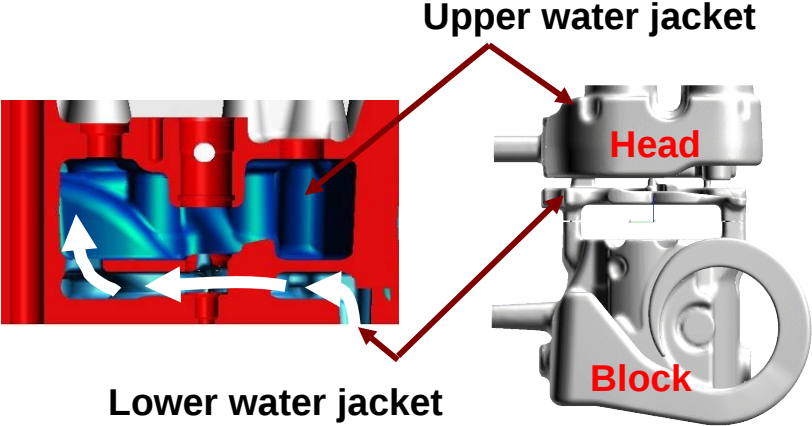
* Tightening Torque

Position	Bolt			Torque / Angle (Kgm)
	Part name	No.	P/No.	
Cylinder block	BOLT-MAIN CAP	6	M21114- 52000	17+110°
Cylinder head	BOLT-CAM CAP	7	M22155- 52000	2+90°
Cylinder block	BOLT-CYLINDER HEAD	6	M22321- 52000	10+90°+90°
Crankshaft	BOLT-CRANKSHAFT PULLEY	6	M23127- 48000	10+80°
Crankshaft	BOLT-FLYWHEEL (M/T)	8	M23231- 52000	14+120°
Connecting rod	BOLT-CONNECTING ROD	2	M23513- 52000	4+100°
Cylinder head	BOLT-FLANGE (ROCKER SHAFT)	2	M22229- 52000	2.5+90°

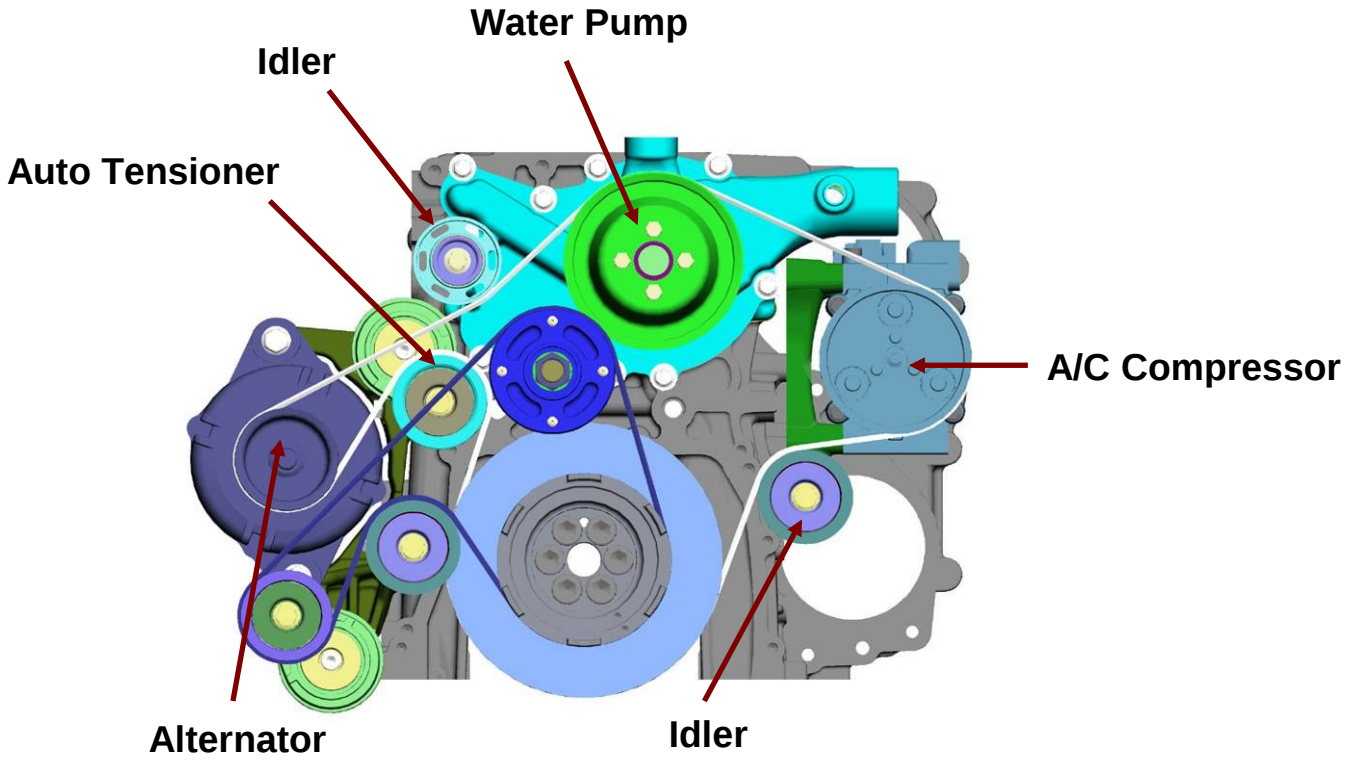
Main feature

System	Description	Structure
<p>Cylinder block</p>	<ul style="list-style-type: none"> ■ Feature <ol style="list-style-type: none"> 1. Enhanced durability and decreased weight adopting CGI material. 2. Enhanced cylinder block's strength by truss structure. ■ Improvement <ol style="list-style-type: none"> 1. Enhanced durability 2. Improve NVH 	

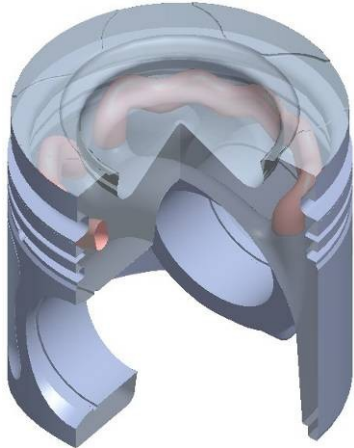
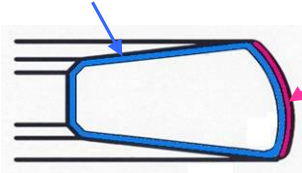
Main feature

System	F-engine
<p>Cylinder head</p>	 <p>Cylinder head Integrated with in-manifold</p>  <p>Upper water jacket</p> <p>Lower water jacket</p> <p>Head</p> <p>Block</p>

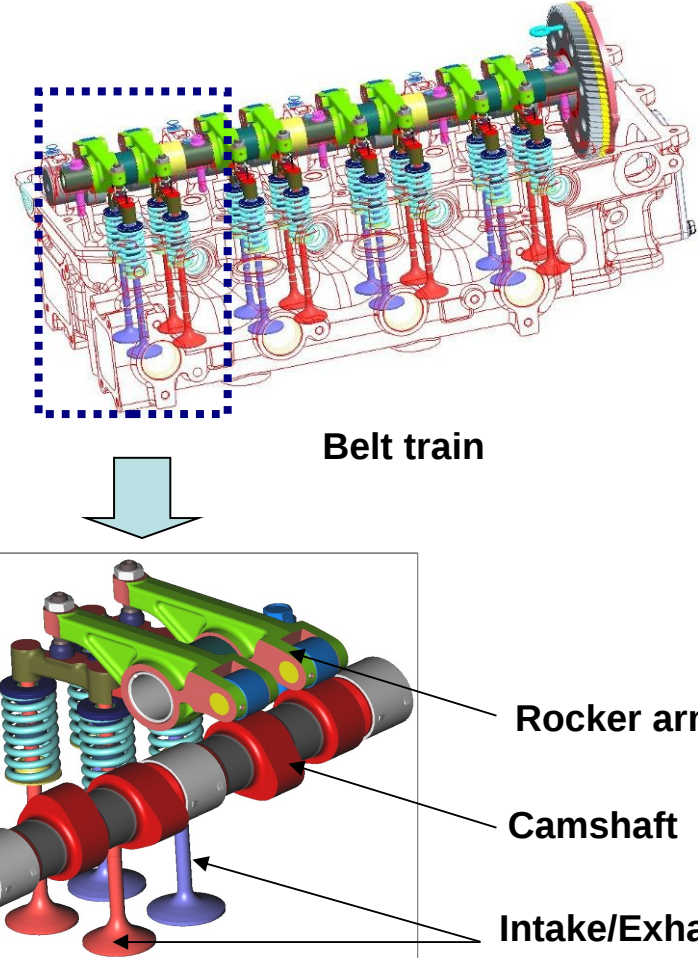
Main feature

System	F-engine
Belt system	 <p>The diagram illustrates the belt system of the F-engine. It features a central crankshaft pulley (blue) and a large water pump pulley (green) at the top. An auto tensioner (purple) is positioned to the left of the water pump. An alternator (dark blue) is located at the bottom left. Two idlers (purple) are used to guide the belts. An A/C compressor (grey) is located on the right side. Red arrows point from the labels to the corresponding components.</p>

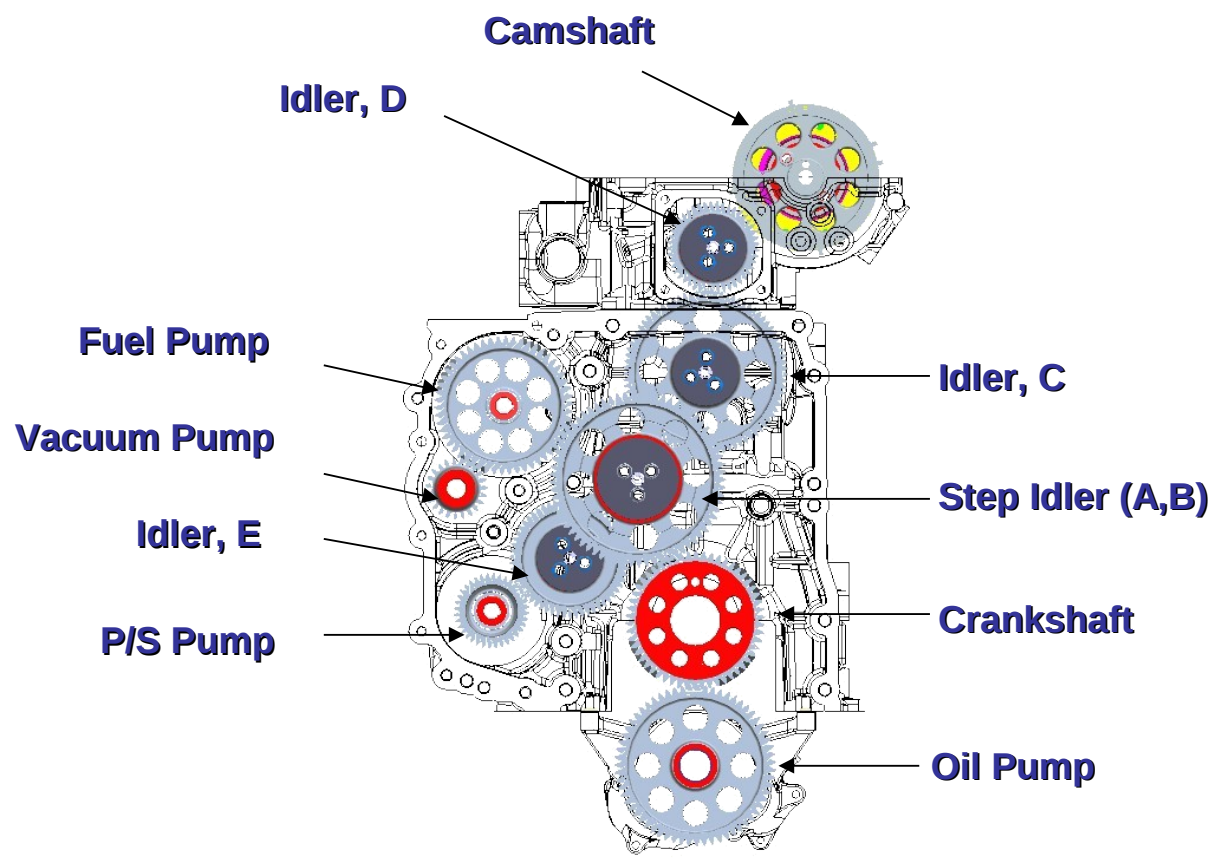
Main feature

System	F-engine
<p>Moving</p>	<div style="text-align: center;">  <p>Double wave Cooling gallery</p> </div> <div style="text-align: center; margin-top: 20px;">  <p>Gas nitriding</p> <p>PVD (Physical Vapor deposition) coating</p> </div>

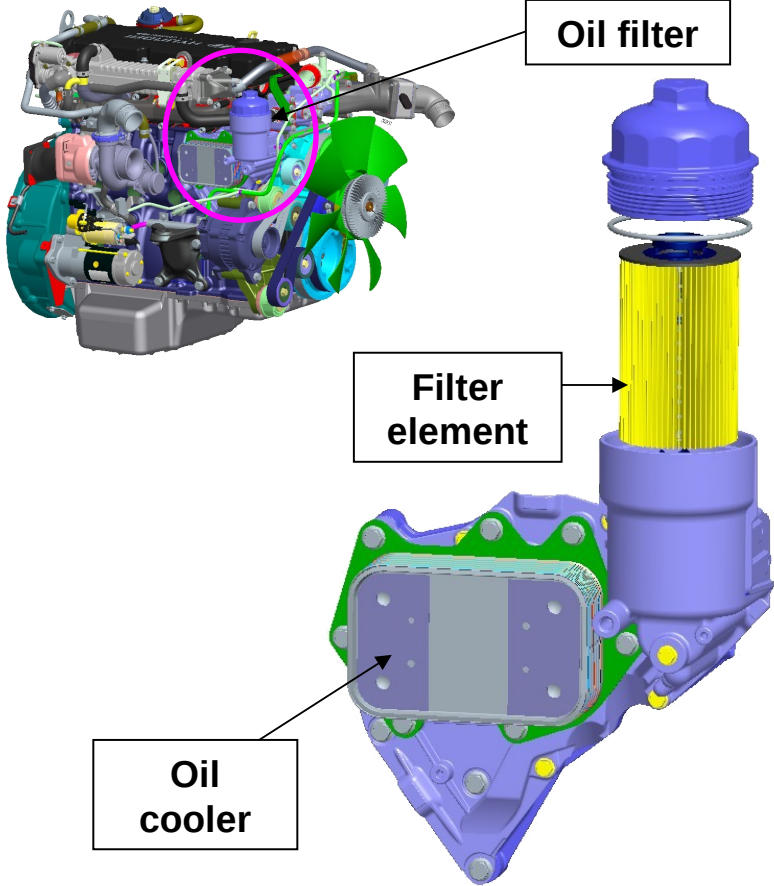
Main feature

System	F-engine
<p>Timing (Belt train)</p>	 <p style="text-align: center;">Belt train</p> <ul style="list-style-type: none"> → Rocker arm → Camshaft → Intake/Exhaust valve

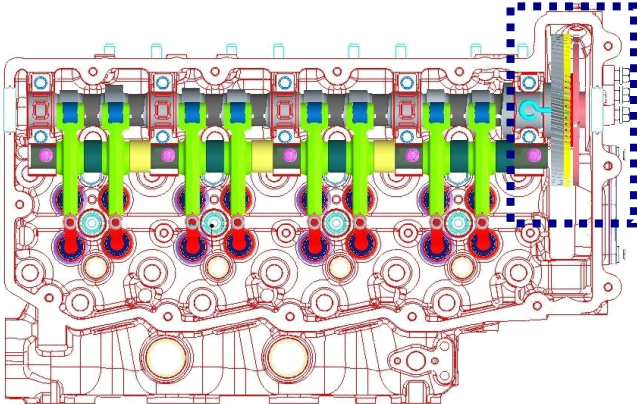
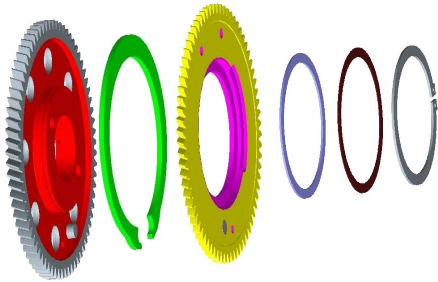
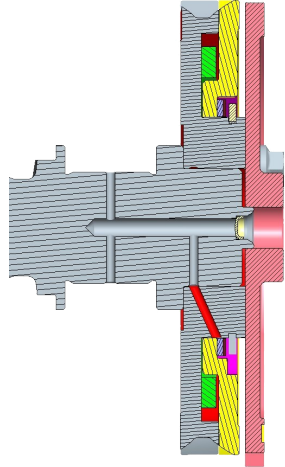
Main feature

System	F-engine
<p>Timing (Gear train)</p>	 <p>The diagram illustrates the timing gear train of an F-engine. It shows a central crankshaft (red) at the bottom, which is connected to a Step Idler (A,B) gear. This Step Idler meshes with Idler, E and Idler, C. Idler, E is connected to the P/S Pump gear. Idler, C is connected to the Vacuum Pump gear. Idler, D is connected to the Fuel Pump gear. The Camshaft is located at the top and is driven by Idler, D. The Oil Pump gear is also shown at the bottom, driven by the crankshaft.</p> <ul style="list-style-type: none"> Fuel Pump Vacuum Pump Idler, E P/S Pump Camshaft Idler, D Idler, C Step Idler (A,B) Crankshaft Oil Pump

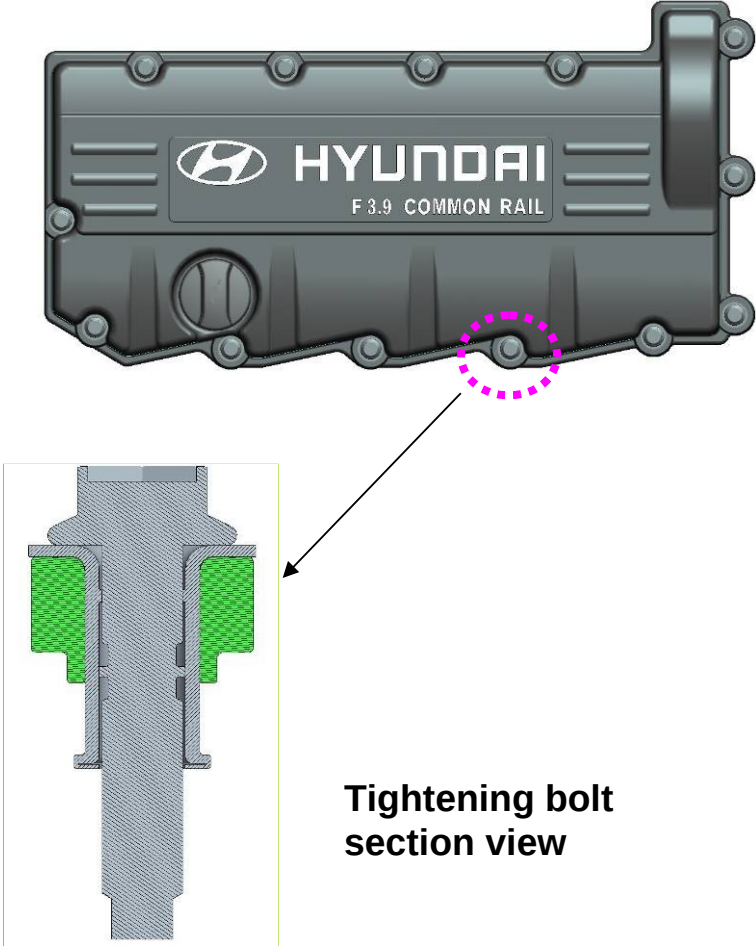
Main feature

System	F-engine
Oil filter & Oil cooler	 <p>The diagram illustrates the oil filter and oil cooler components of the F-engine. On the left, a 3D cutaway view of the engine shows the oil filter location circled in pink. To the right, a detailed view of the oil filter assembly is shown, consisting of a blue top cap, a white spring, and a yellow pleated filter element. Below the filter, the oil cooler is depicted as a green and blue component with a rectangular cooling core. Labels with arrows point to the 'Oil filter', 'Filter element', and 'Oil cooler'.</p>

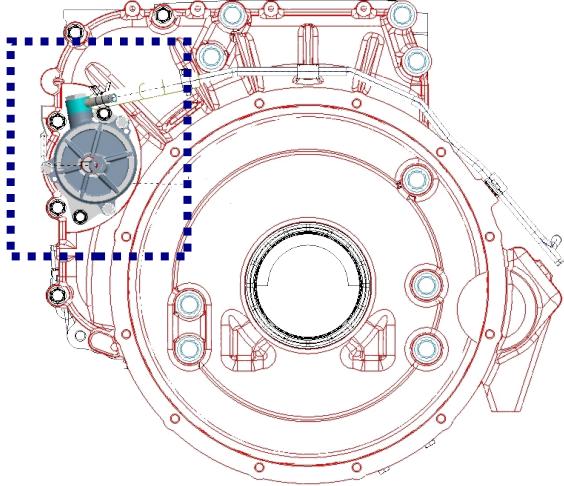
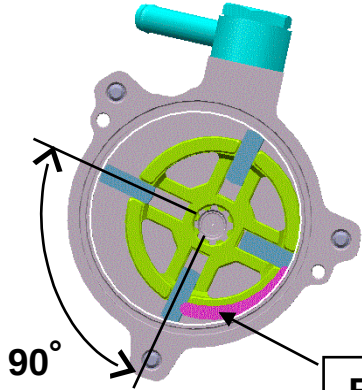
Main feature

System	F-engine		
<p>Timing (Scissors Gear)</p>			
	<p>Scissors gear</p>	<p>Components</p>	<p>Section view</p>

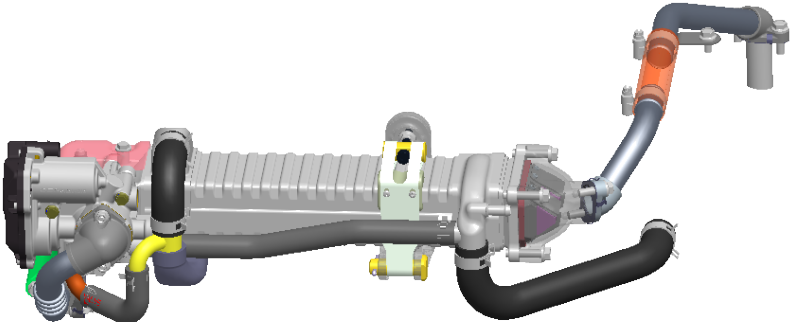
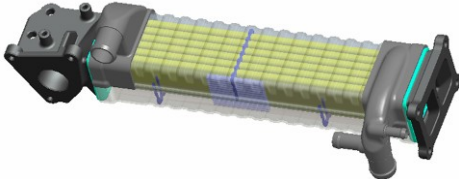

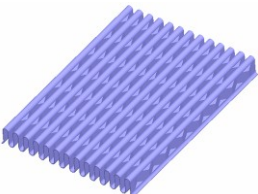

Main feature

System	F-engine
<p>Timing (Rocker cover)</p>	 <p>The diagram shows a black plastic timing cover for a Hyundai F 3.9 Common Rail engine. The cover features the Hyundai logo and the text "HYUNDAI F 3.9 COMMON RAIL". A callout box provides a cross-sectional view of a tightening bolt, showing its internal structure and the green gasket material it secures.</p> <p>Tightening bolt section view</p>

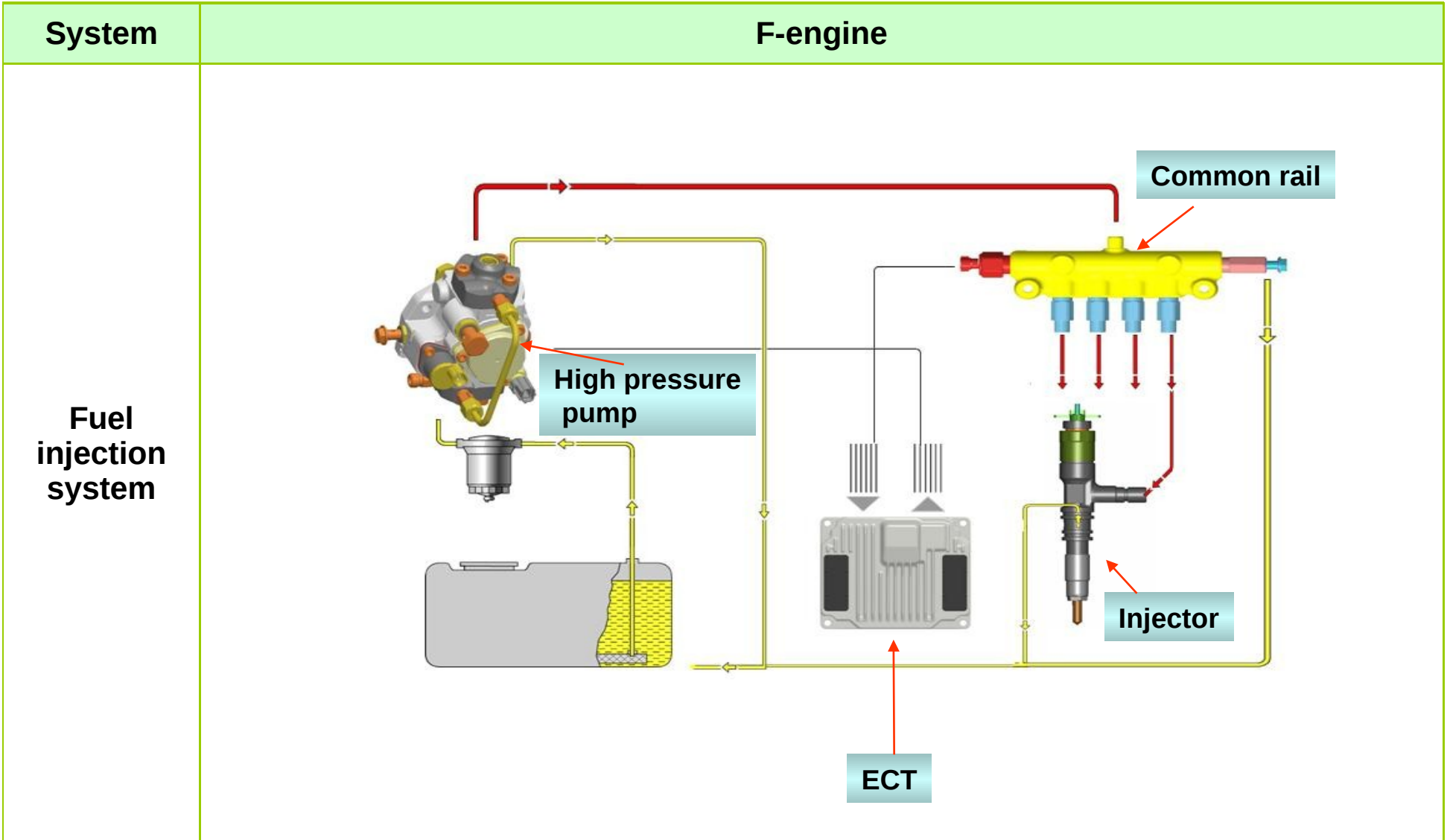
Main feature

System	F-engine
Vacuum pump	 <p>Vacuum Pump Installation</p>  <p>Exhaust port</p> <p>90°</p>

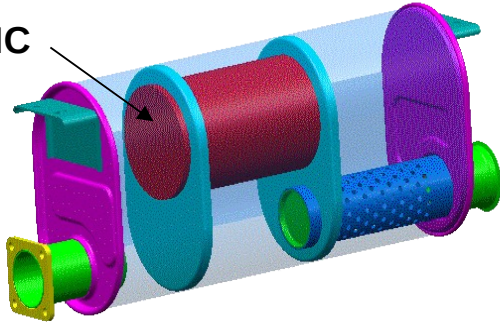
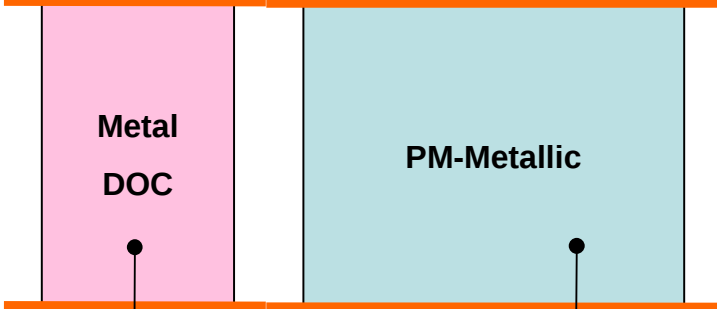
Main feature

System	F-engine
<p>EGR system</p>	   <p>Oval EGR cooler with wave fin Reed valve</p>   <p>Wave fin Strap type mounting</p>

Main feature

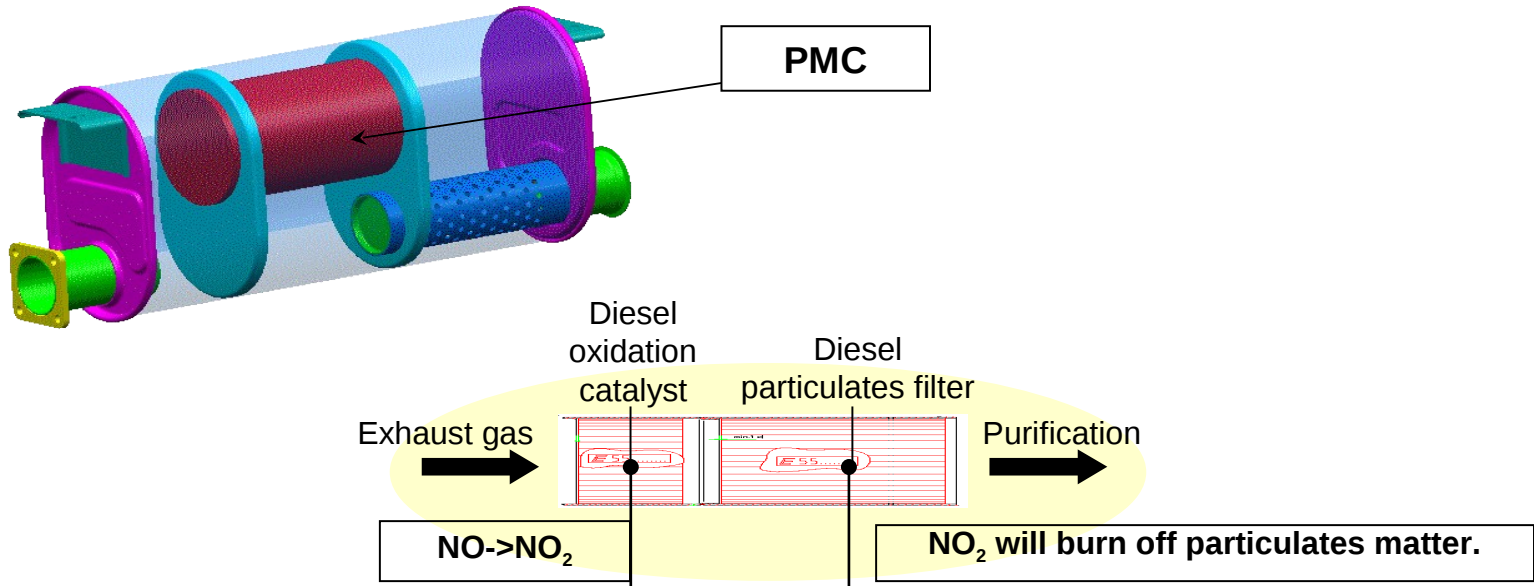


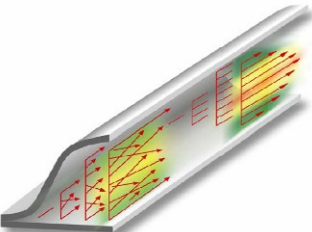
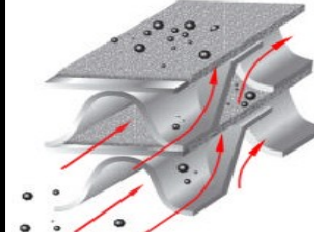
Main feature

System	F-engine
<p>PMC</p>	<div style="display: flex; justify-content: space-around; align-items: center;"> <div>  <p>PMC</p> </div> <div> <div style="text-align: center;"> $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$ $\text{C} + 2\text{NO}_2 \rightarrow \text{CO}_2 + \text{N}_2$ $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$ </div>  <div style="display: flex; justify-content: space-around;"> <div> <p>Metal Substrate</p> <ul style="list-style-type: none"> - Catalytic coating place - $\text{NO} \rightarrow \text{NO}_2$ </div> <div> <p>Metal Partial Filter</p> <ul style="list-style-type: none"> - PM collecting and combustion - Open flow type </div> </div> <p style="text-align: center;">- <u>PMC (Particulate Matter Catalyst)</u> -</p> </div> </div>

* DOC: Diesel Oxidation Catalyst

PMC (Particulate Matter Catalyst)

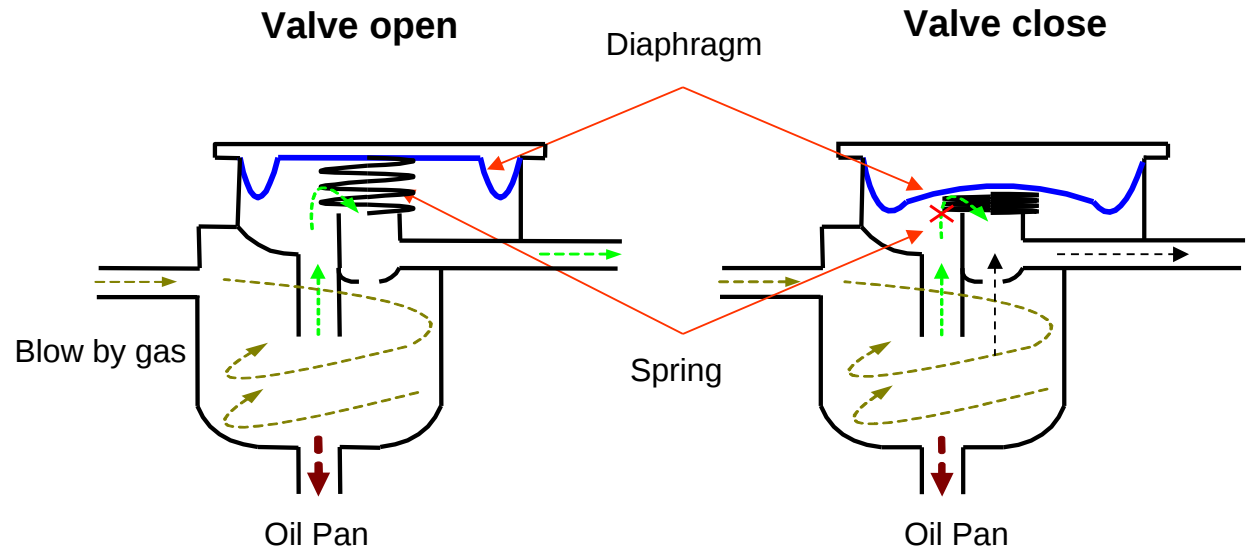
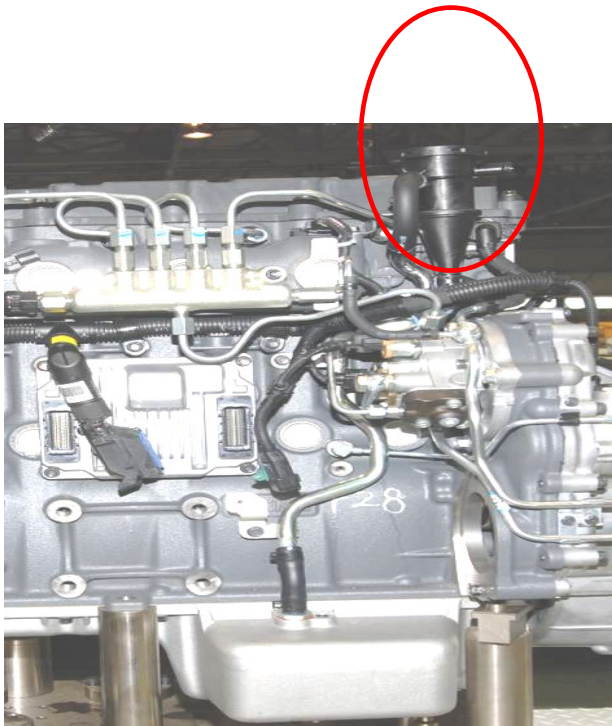


	<p>Material: Metal (Precious metal coating)</p> $2NO + O_2 \leftrightarrow 2NO_2$		<p>Material: Metal</p> <p>PM collecting and combustion</p> $2NO_2 + C \leftrightarrow CO_2 + 2NO$
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PM is separated between Waved layer and Special layer, and it is burning with O_2/NO_2 .

*NO: nitric oxide, NO_2 :nitrogen dioxide

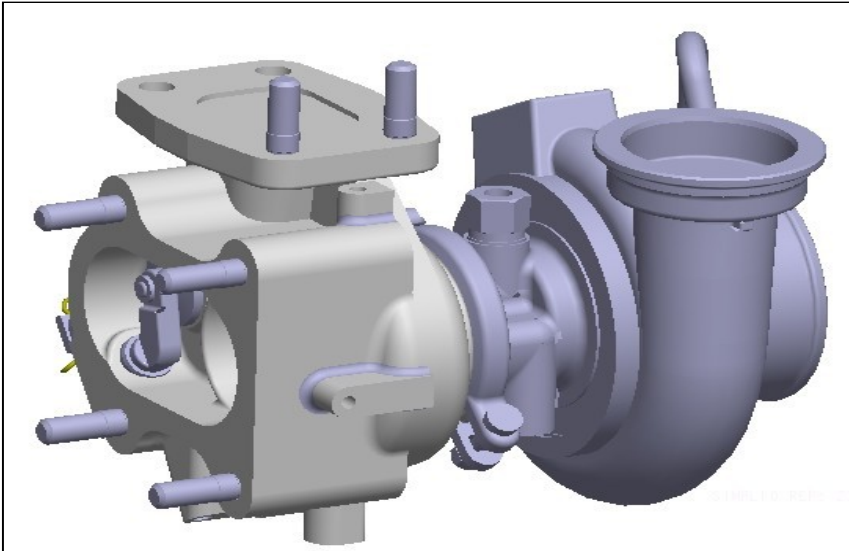
C.C.V (Closed Crankcase Ventilation)



Valve

- Type : Normal open type
- Closing pressure: -200 mmH₂O (-19.6mmbar)

Turbocharger



1) Maximum rotation

- ▶ 181,000 RPM

2) Control method

- ▶ Air pressure type (Same as D4 series engine)

3) Manufacturer

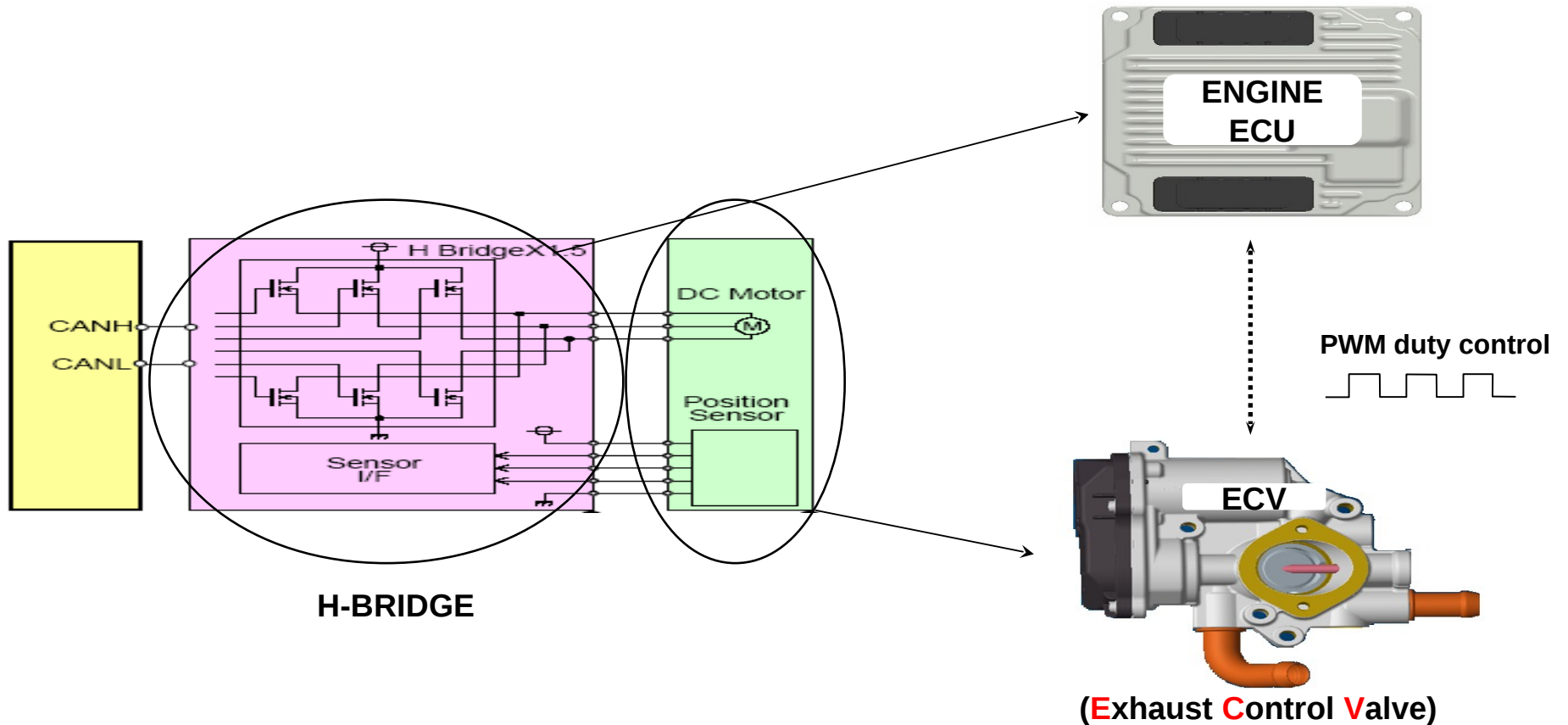
- ▶ Keyyang Precision Co., Ltd

4) Changing items compare with W-engine

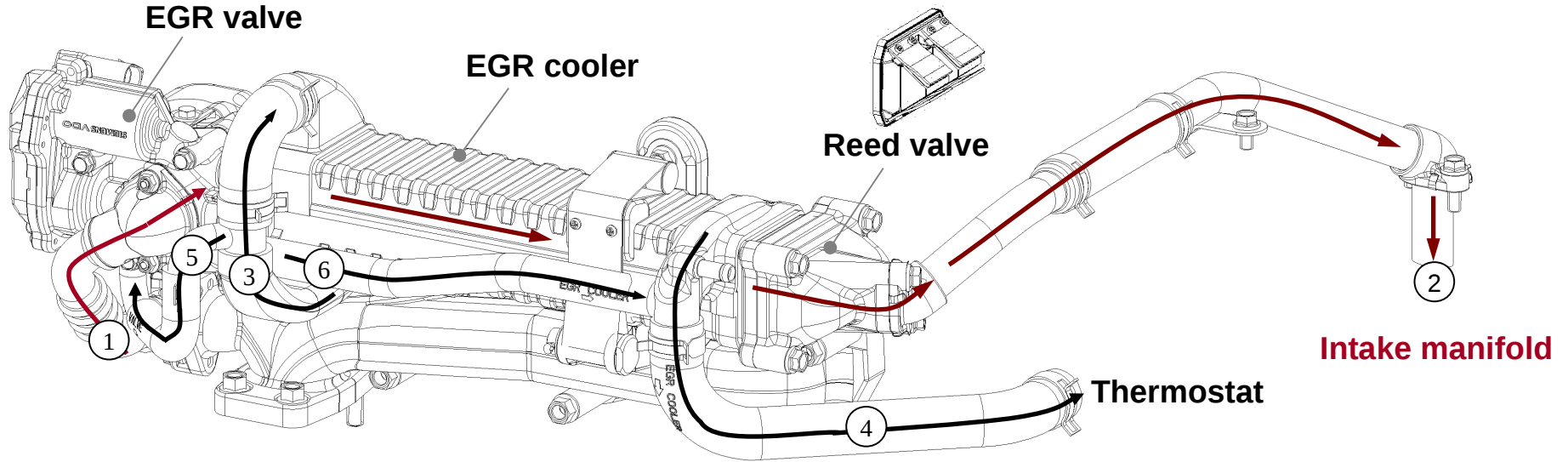
- ▶ Maximum rotation (160,000rpm -> 181,000 rpm)
- ▶ Actuator pressure (960+-35 -> 1800+-30)
- ▶ Nozzle diameter size (8cm² -> 4cm²)
- ▶ Maximum pressure rate (2.6 -> 3.0)

E.G.R control system

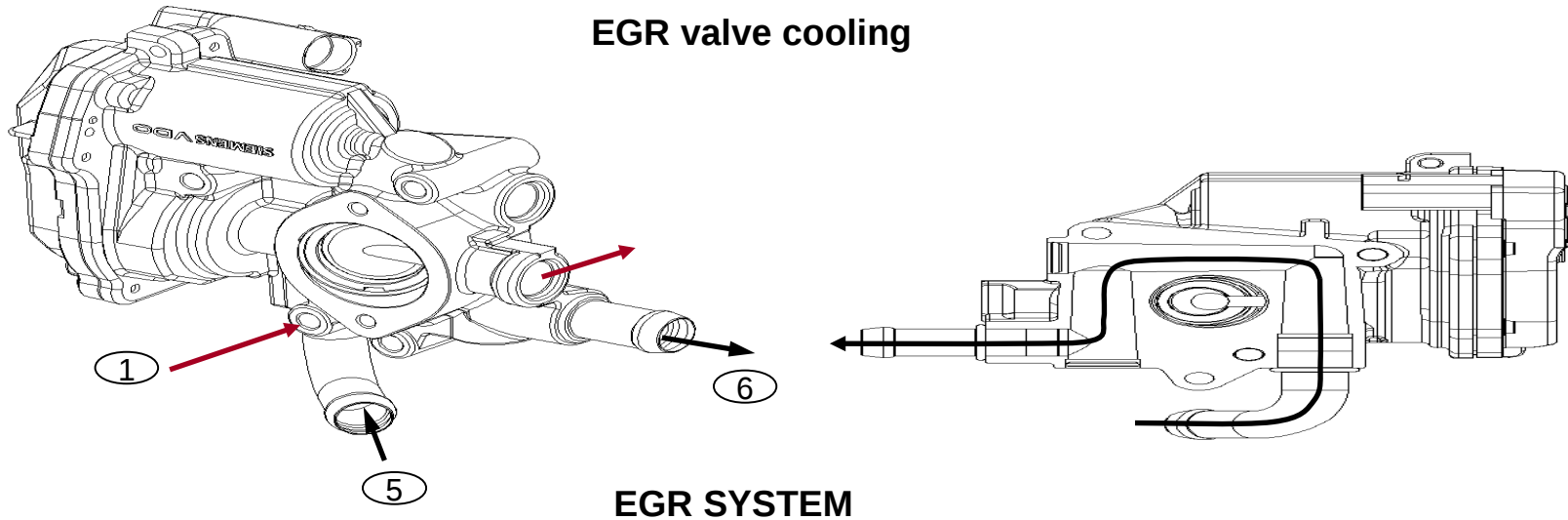
Type	Control method	Actuator	H-bridge	Valve
Integrated type (Actuator + Valve)	PWM	DC-Motor Brush type	ECU inside	Flap type (Single flow)



E.G.R control system (Valve)



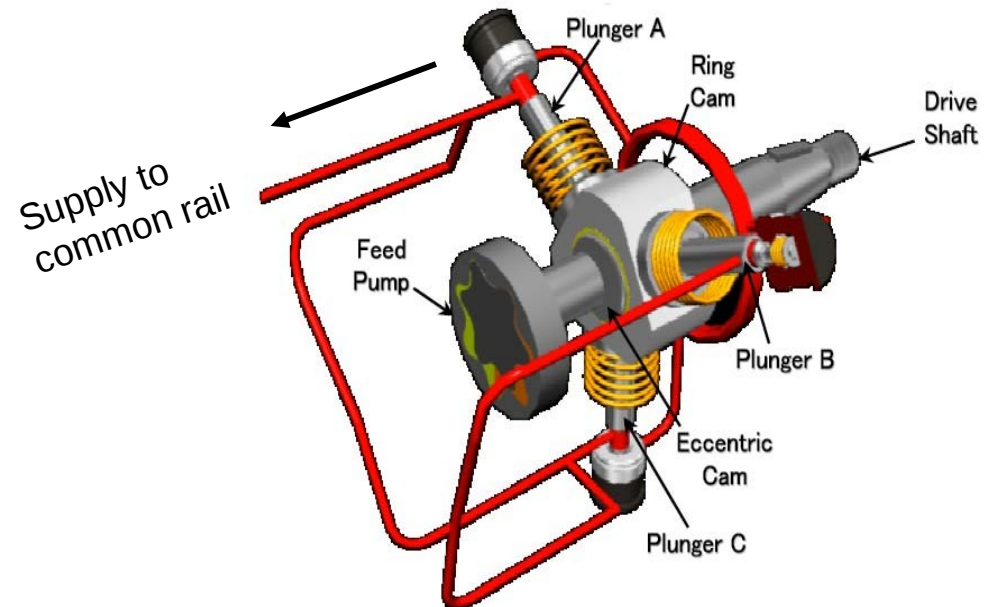
EGR valve cooling



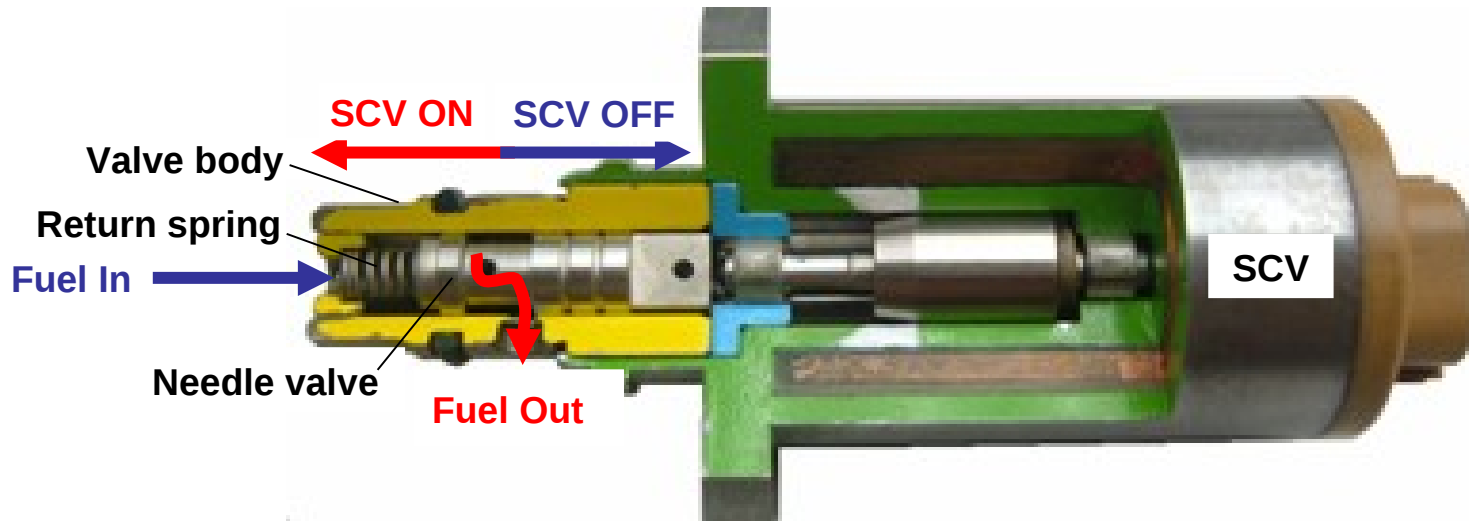
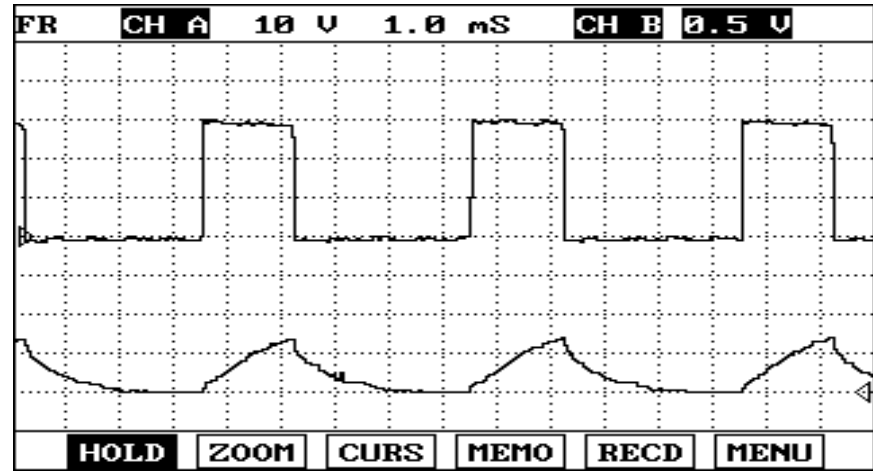
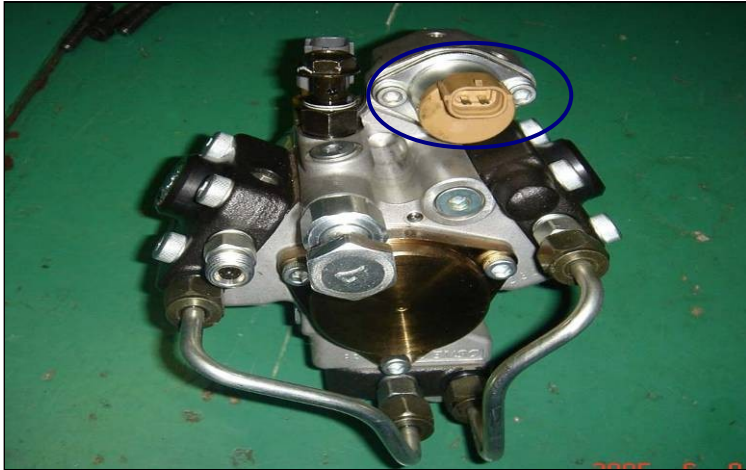
Fuel supply pump



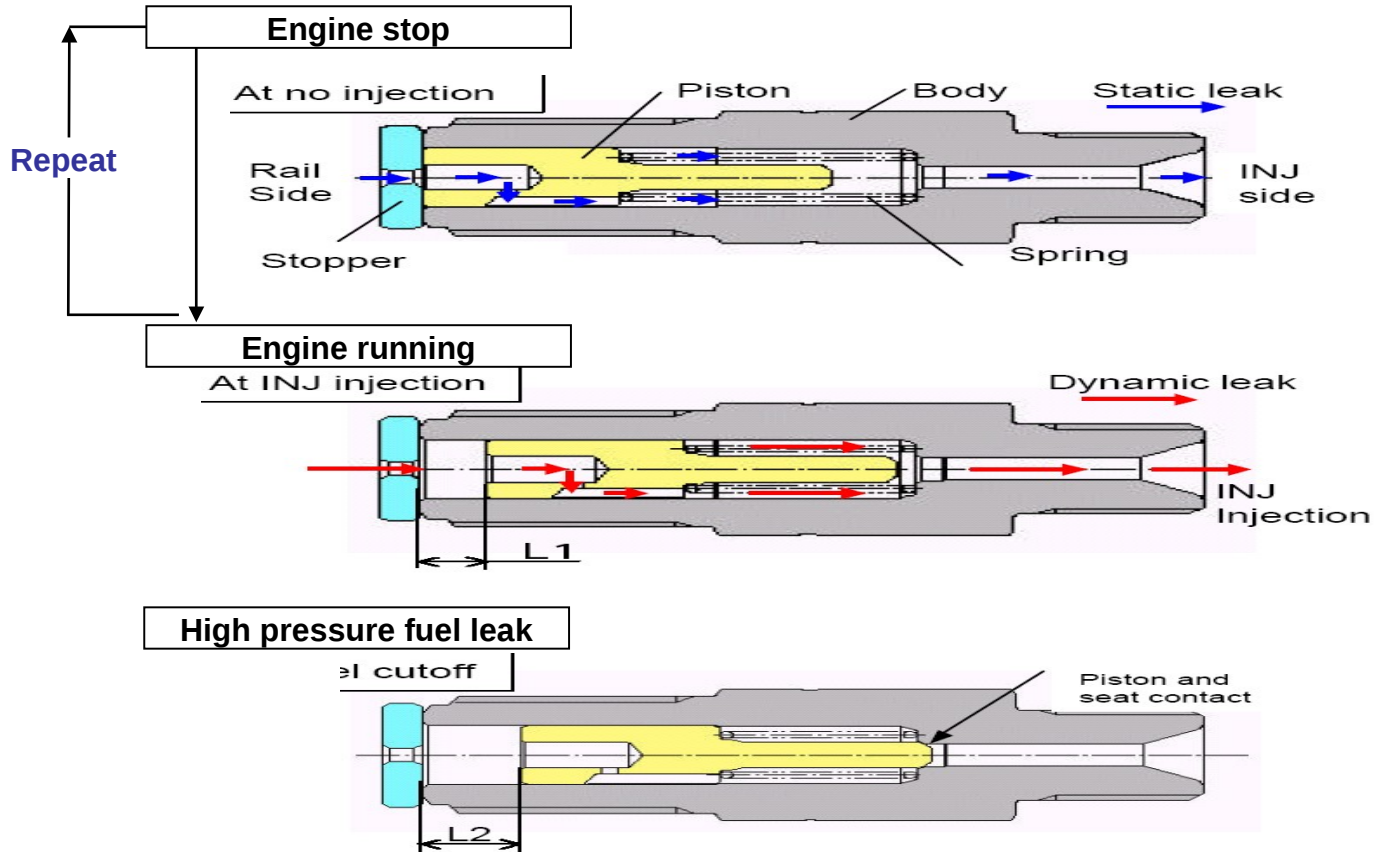
Fuel supply pump



SCV (Supply Control Valve)



Flow Damper



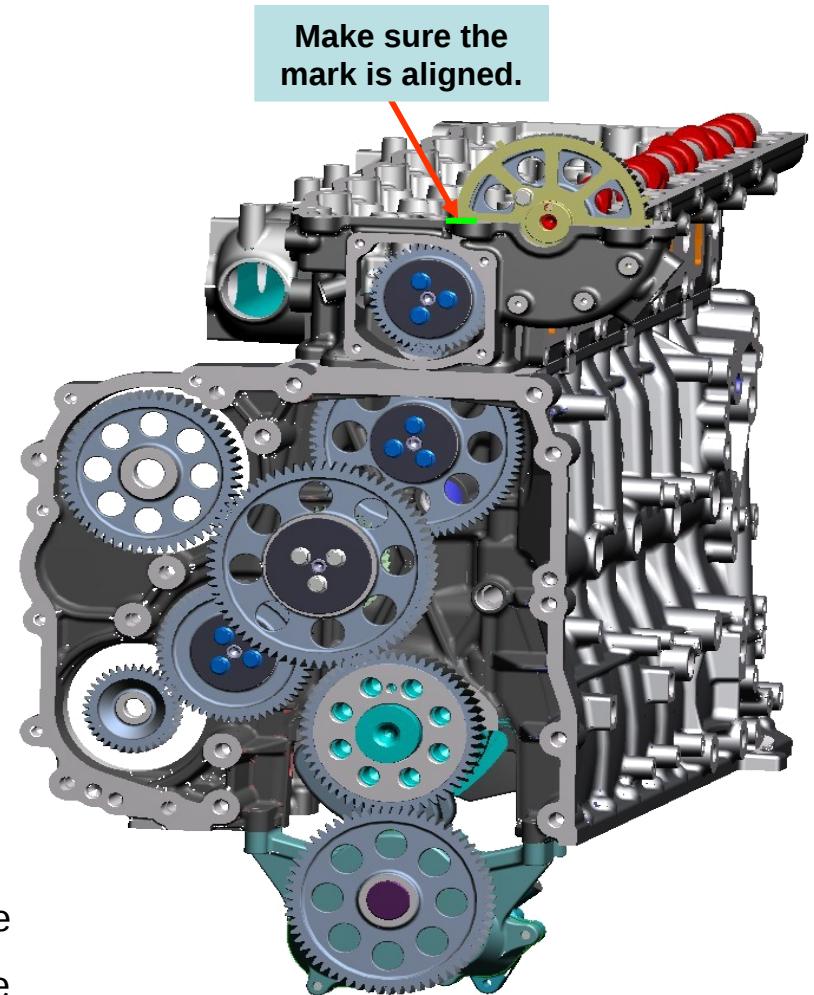
Fuel supply pump remove and reinstall

1. Rotate the crankshaft to align the engine No. 1 cylinder at the TDC (Top Dead Center) position.

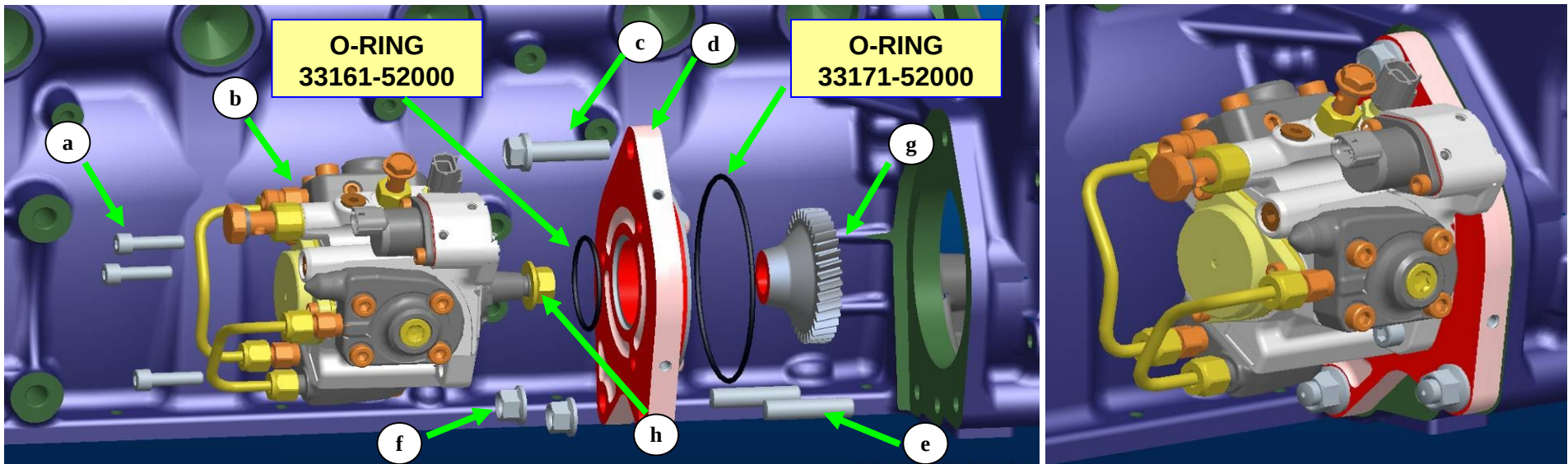
- Rotate the engine to align the marking line on "1, 4" side stamped on the periphery of the crankshaft pulley
- Remove the rocker cover and make sure that the mark on the camshaft position sensor gear plate is align with the upper surface of the cylinder head.

2. Install the pump to the engine after fixed the plate to the pump gear.

- Fix the plate to the pump, then install the gear to the pump shaft.
- At installation, ensure that the convex part of the plate is aligned with the 2 marks on the side of the pump. Fit the flange bolt hole to the engine correctly then it is automatically adjusted the angle to the idler gear.



Reassemble for fuel supply pump, plate and pump gear



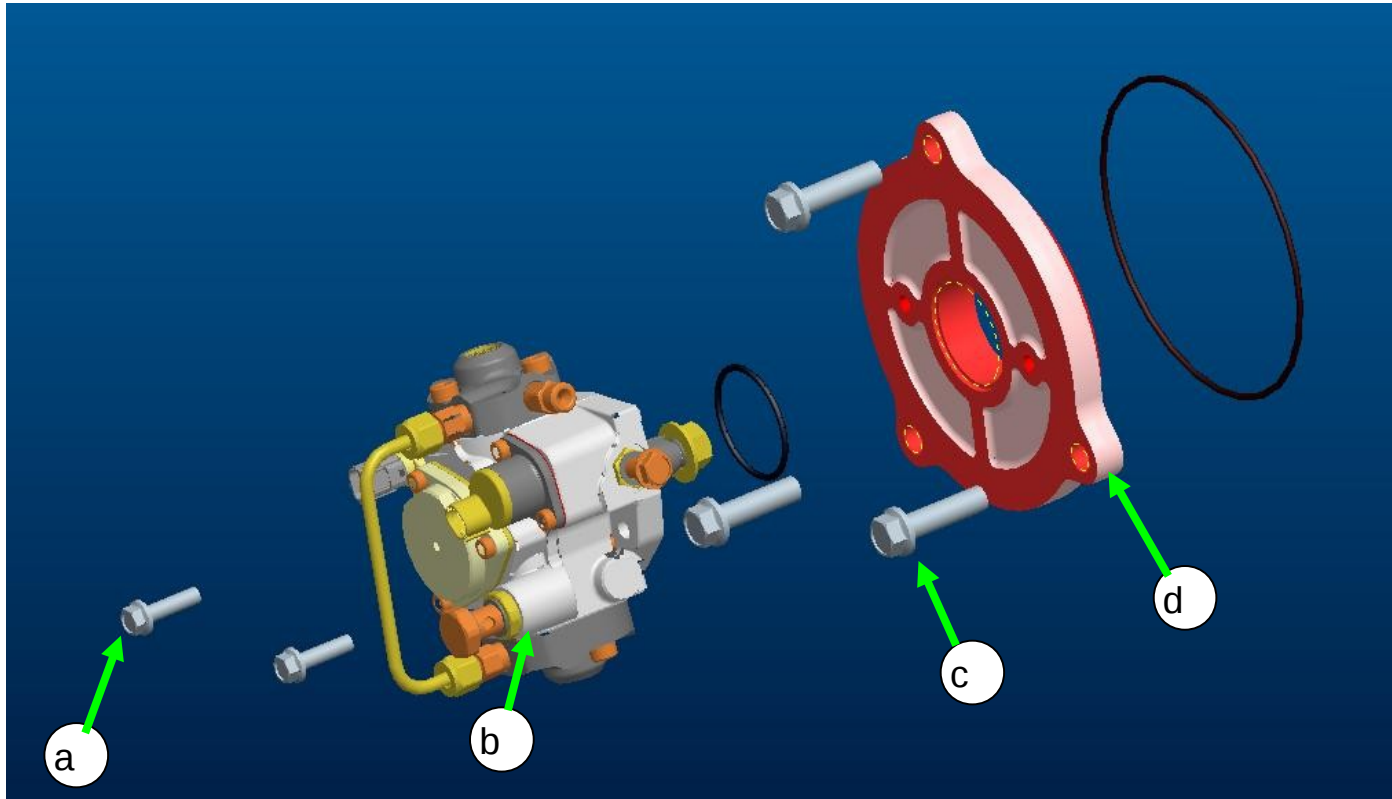
Install the fuel supply pump as above picture.

Fix the 2 stud (e) to the cylinder block lower part. Put the pump (b) to the flange (d), and tighten them with bolts (a).

After the gear (g) and the pump shaft has been assembled temporarily , put the gear and pump assembly in to the stud (e) and tighten them with bolt (f) and nut (c). Before put it in make sure that the gear and plunger rotational direction is correctly matched.

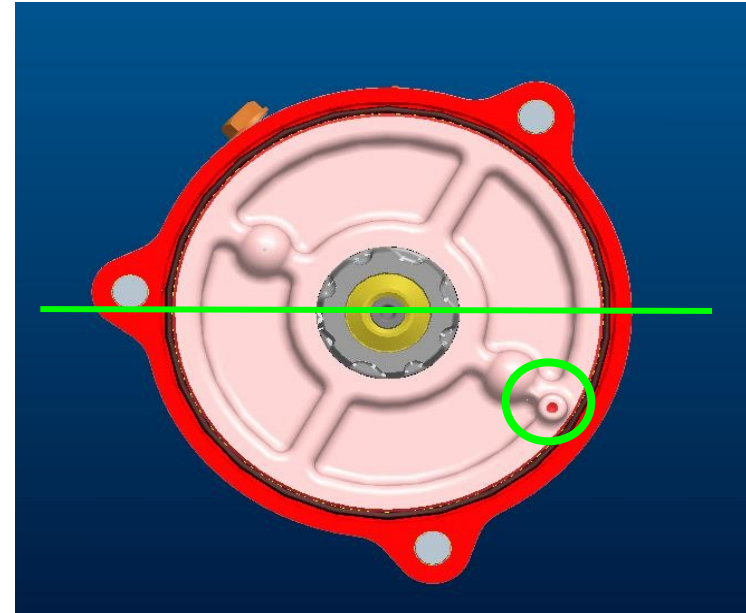
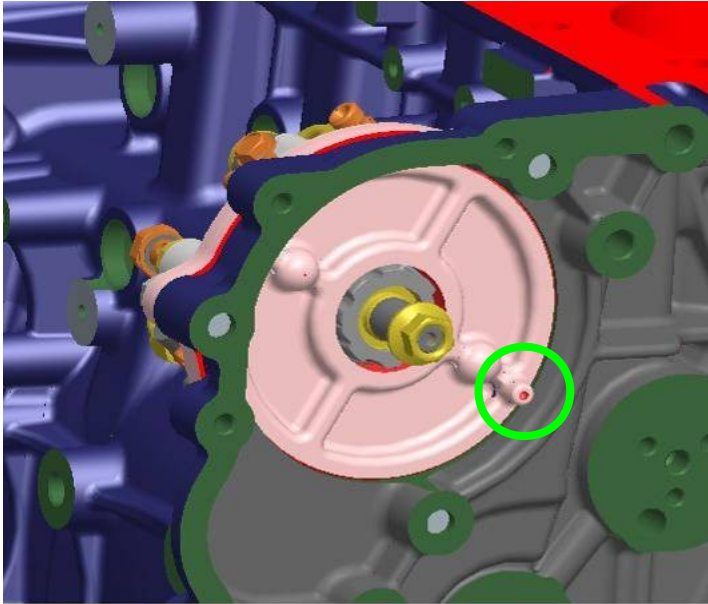
Insert the O-ring (33161-52000) between the pump (b) and flange (d), then tighten the bolt (a) (11703-08303) and nut (h).

Reassemble for fuel supply pump



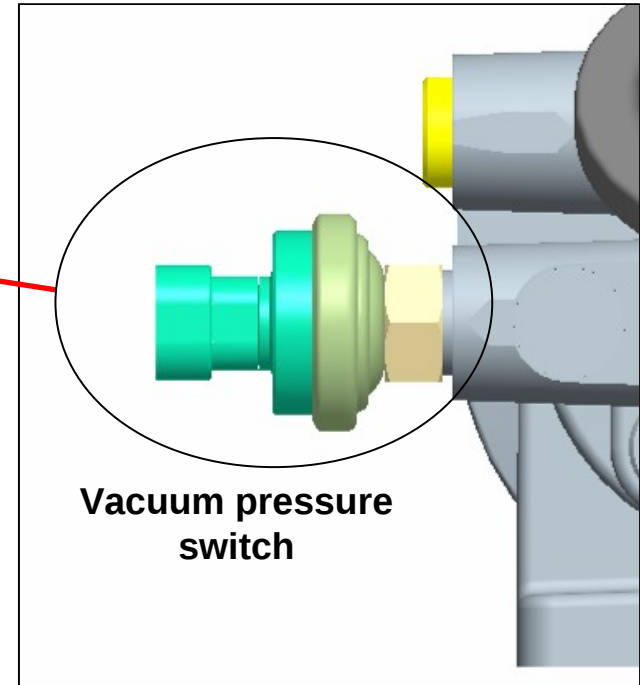
Install the fuel supply pump from (b) to (d) direction as above picture.
 At this moment, insert the O-ring(33161-52000) between the pump (b) and flange (d), then tighten them with the bolt (a).

Match the Idler gear and supply pump gear



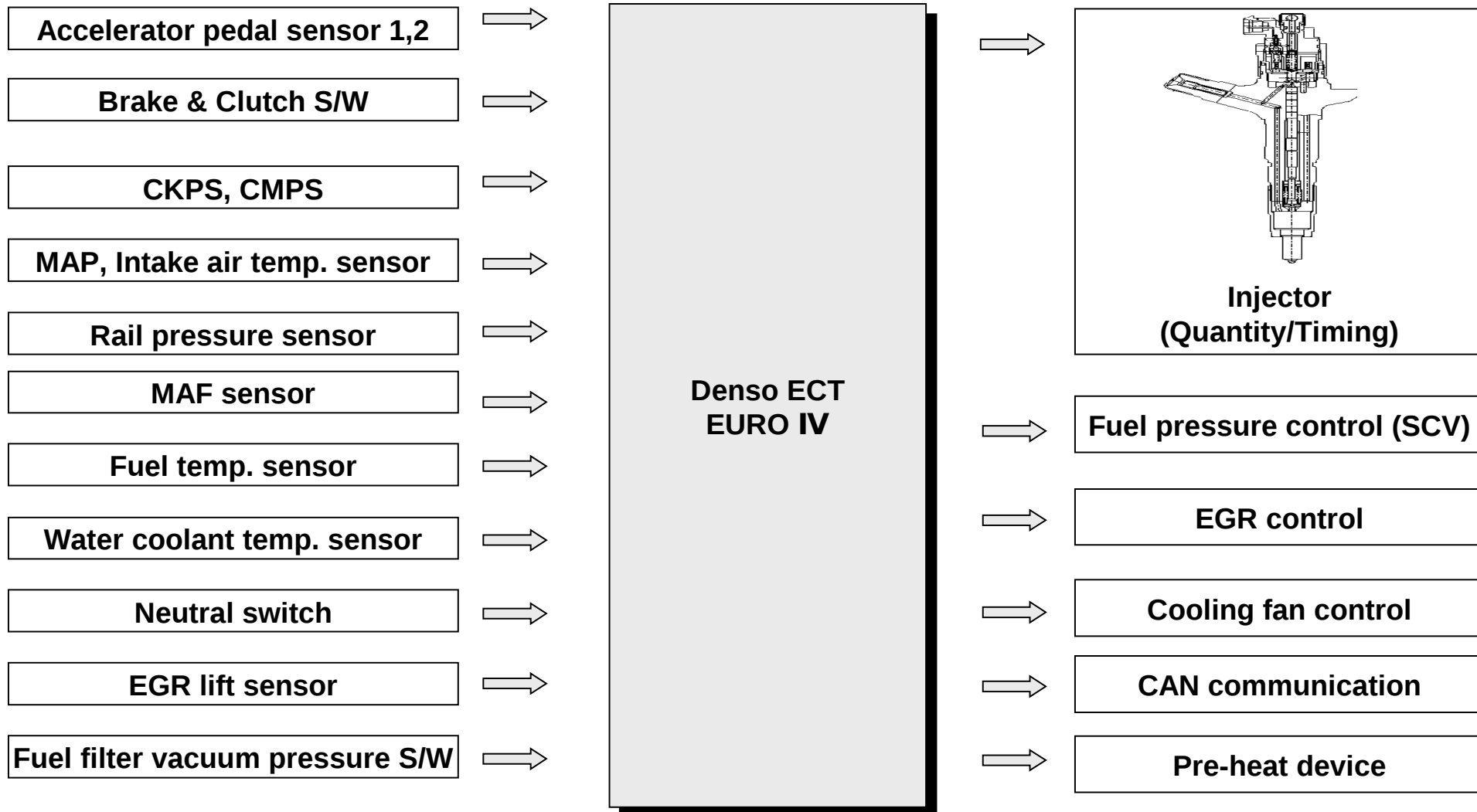
When you fit the pump assembly in cylinder block, make sure that the mark on the flange back side is positioned like the picture.

Fuel filter



- ▶ Vacuum pressure switch continuously monitors the fuel suction pressure. If the pressure is reached at -32kpa due to filter plugging, ECT will go into failsafe mode for preventing damage of common rail system.
- ▶ The warning lamp blinks continuously in case of the suction pressure keeps less than -32kpa for 5 hours or it reaches -32kpa 50 times or more.

Input and output

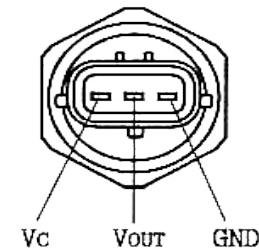
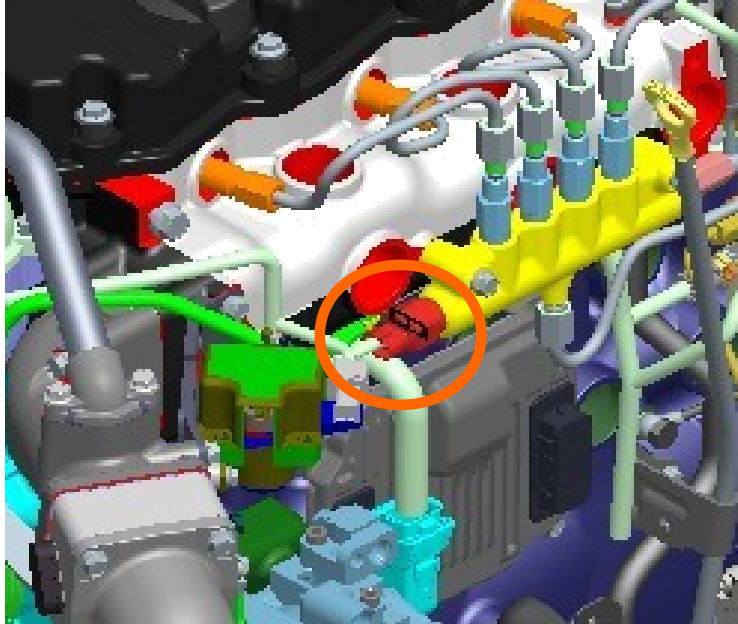


Accelerator pedal position sensor



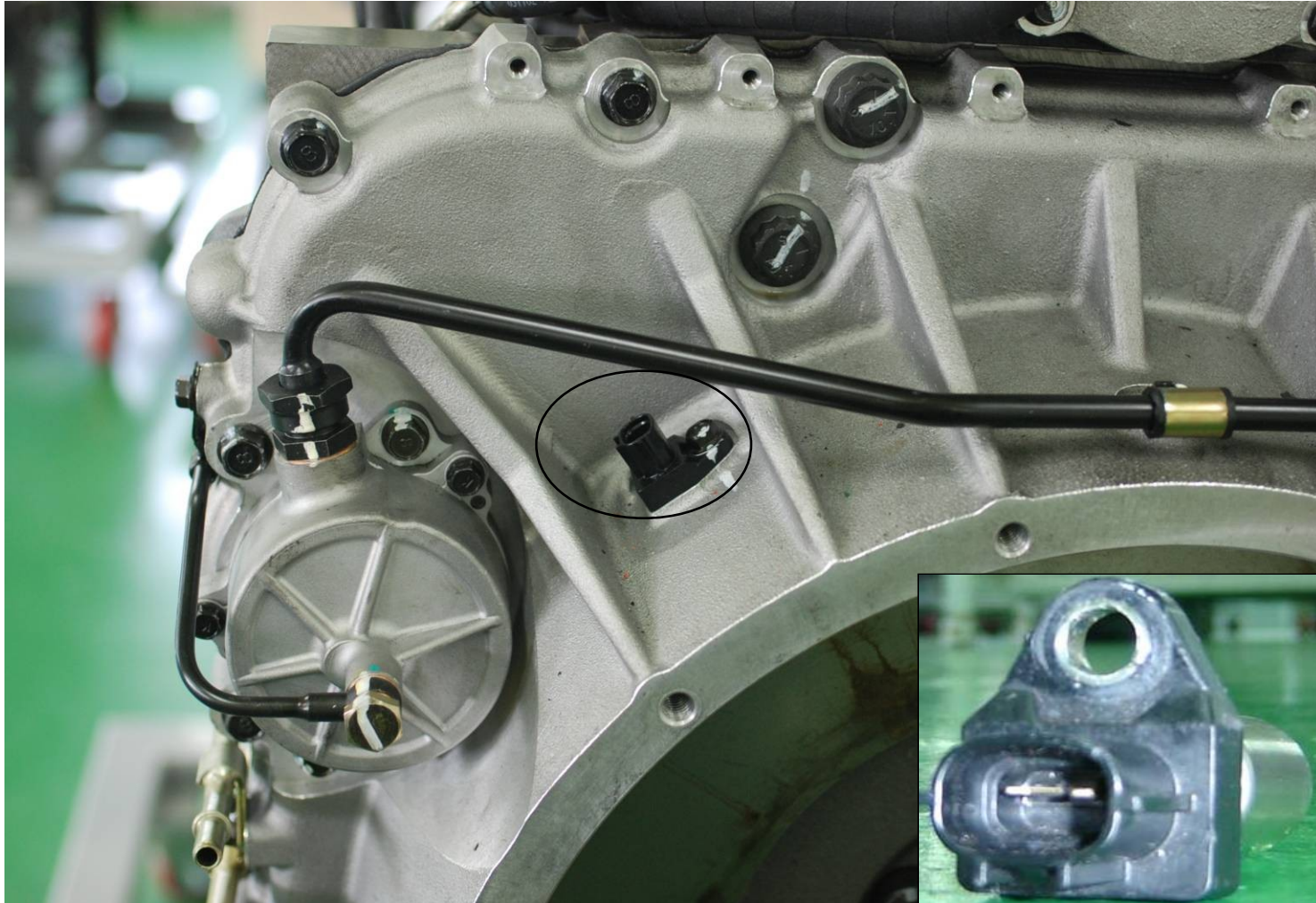
Accelerator pedal sensor	Specification	
	Idle condition (0%)	Full pressed condition (100%)
	0.65V	3.85V

Rail pressure sensor



Checking items	Rail pressure sensor
Data mark	Rail pressure
Checking condition	Engine idle condition
Rail pressure	35~50MPa (350~500bar)
Normal pressure (Scan tool)	40MPa (400bar)

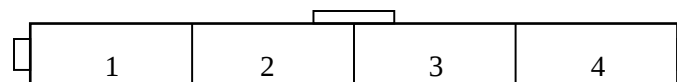
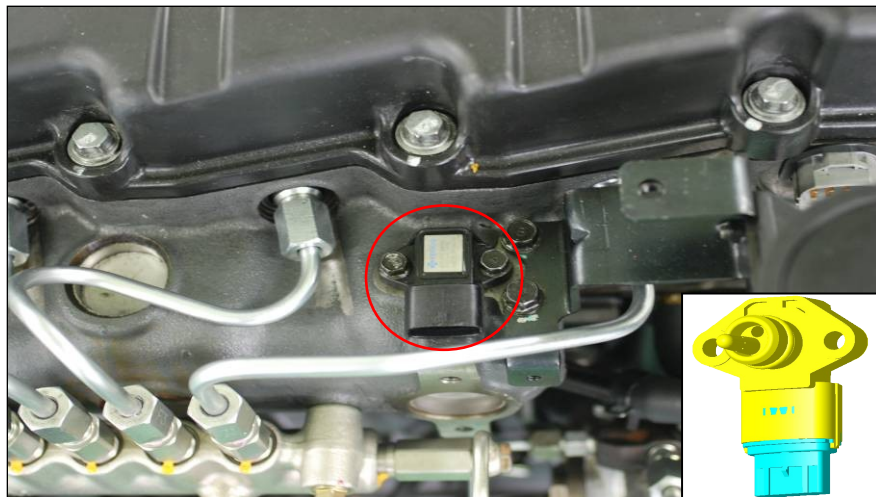
CKP (Crankshaft Position sensor)



CMP (Camshaft Position sensor)



Boost air pressure sensor



- 1 : Intake air pressure signal
- 2 : Sensor power source
- 3 : Intake air temp signal
- 4 : Sensor ground

	Specification	
	Intake air pressure (Kpa)	Voltage (V)
Intake air pressure sensor	32.5	0.5
	50	0.78
	70	1.96
	270	4.28
	284	4.5
	300	4.75

	Specification	
	Intake air temp.	
Intake air temp.	0 °C	5.4 ~6.0
	10 °C	3.5 ~3.9
	30 °C	1.6 ~1.7
	50 °C	0.8 ~0.9

Water Temperature Sensor



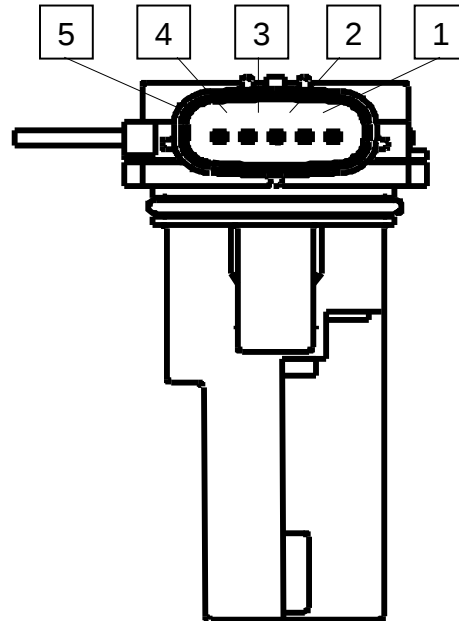
Water coolant temp(°C)	Specification (KΩ)
-20	15.48
0	5.79
20	2.45
40	1.148
60	0.322

Fuel Temperature Sensor



Temperature (Celsius degree)	Specification (K Ω)
-20	13.4~17.7
-10	8.24~10.66
0	5.23~6.62
20	2.26~2.76
40	1.08~1.28
60	0.56~0.64
80	0.3~0.34
120	0.11~0.12

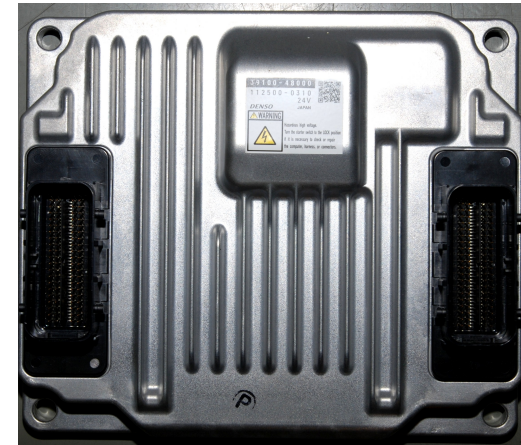
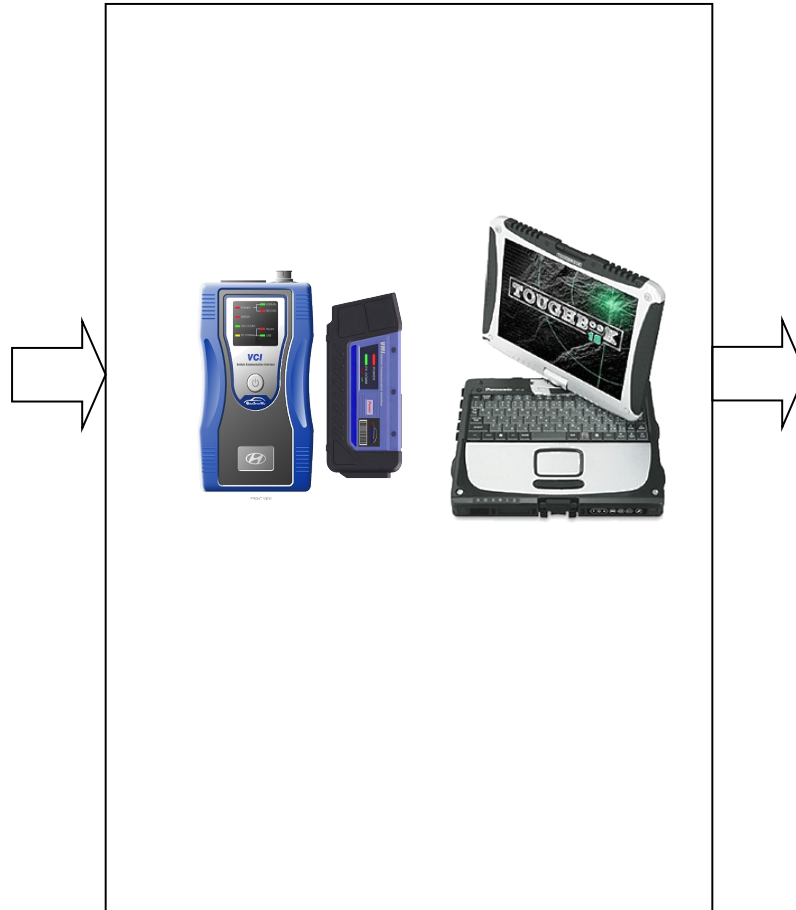
Mass air flow sensor



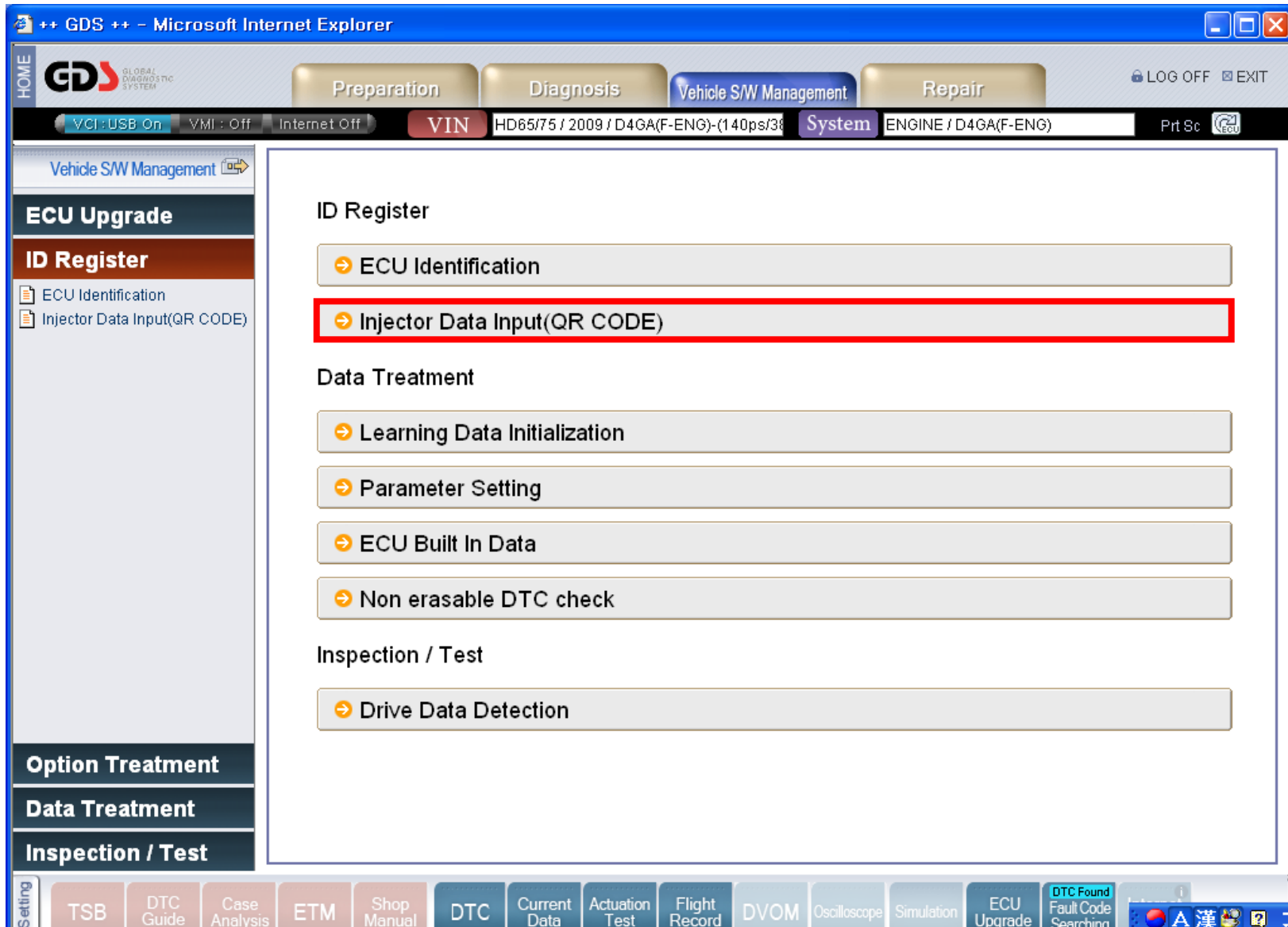
No.	Descriptions
1	Intake air temp sensor ground
2	Intake air temp sensor signal
3	Power source
4	Ground
5	Intake air mess signal

QR compensation

QR compensation



QR compensation method



The screenshot displays the GDS++ software interface within a Microsoft Internet Explorer browser window. The title bar reads "++ GDS ++ - Microsoft Internet Explorer". The main interface features a top navigation bar with buttons for "Preparation", "Diagnosis", "Vehicle SW Management", and "Repair". Below this, a status bar shows "VCI: USB On", "VMI: Off", "Internet Off", and a VIN field containing "HD65/75 / 2009 / D4GA(F-ENG)-(140ps/38". The "System" menu is open, showing "ENGINE / D4GA(F-ENG)".

The left sidebar contains a "Vehicle SW Management" section with a sub-menu "ID Register" highlighted. Under "ID Register", there are two items: "ECU Identification" and "Injector Data Input(QR CODE)".

The main content area is titled "ID Register" and contains several menu items:

- ECU Identification
- Injector Data Input(QR CODE)** (highlighted with a red border)
- Data Treatment
 - Learning Data Initialization
 - Parameter Setting
 - ECU Built In Data
 - Non erasable DTC check
- Inspection / Test
 - Drive Data Detection

At the bottom of the interface, there is a row of icons for various functions: Setting, TSB, DTC Guide, Case Analysis, ETM, Shop Manual, DTC, Current Data, Actuation Test, Flight Record, DVOM, Oscilloscope, Simulation, ECU Upgrade, and DTC Found Fault Code Searching.

Vehicle SW Management

ECU Upgrade

ID Register

- ECU Identification
- Injector Data Input(QR CODE)

Option Treatment

Data Treatment

Inspection / Test

CYL1 INJECTOR



- Injector Data Input(QR)
 - CYL1 INJECTOR**
 - CYL2 INJECTOR
 - CYL3 INJECTOR
 - CYL4 INJECTOR
 - INPUT INFORMATION

CYL1 INJECTOR

Current Injector Data

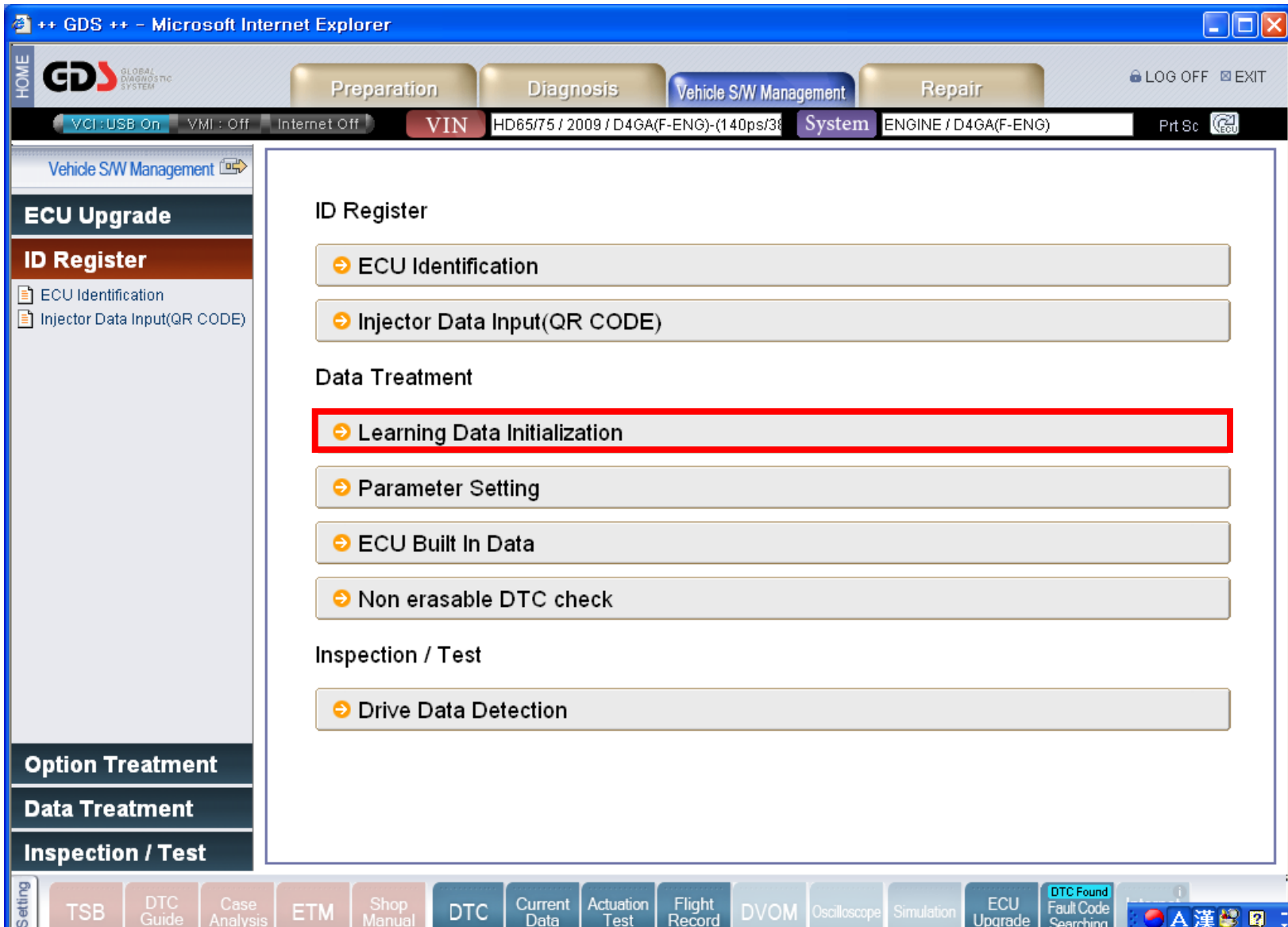
<< **C300E900D8F5D300D100E0000000E5** >>

*Input Method

- 1.Input the 30 figure written at upper side of injector.
- 2.When input complete, press [OK] button.

Ok Cancel

Resetting fuel pump values



The screenshot displays the GDS software interface within a Microsoft Internet Explorer browser window. The title bar reads "++ GDS ++ - Microsoft Internet Explorer". The interface includes a navigation menu with buttons for "Preparation", "Diagnosis", "Vehicle SW Management", and "Repair". The "Vehicle SW Management" button is currently selected. Below the navigation menu, there are status indicators for "VCI: USB On", "VMI: Off", and "Internet Off". A "VIN" field contains the text "HD65/75 / 2009 / D4GA(F-ENG)-(140ps/38". To the right of the VIN field, there are buttons for "System" and "ENGINE / D4GA(F-ENG)".

The main content area is titled "Vehicle SW Management" and contains a sidebar on the left with the following menu items: "ECU Upgrade", "ID Register", "ECU Identification", and "Injector Data Input(QR CODE)". The "ID Register" menu item is currently selected. The main content area displays the "ID Register" section, which includes the following options:

- ECU Identification
- Injector Data Input(QR CODE)
- Learning Data Initialization** (highlighted with a red border)
- Parameter Setting
- ECU Built In Data
- Non erasable DTC check

Below the "ID Register" section, there is an "Inspection / Test" section with the following option:

- Drive Data Detection

At the bottom of the interface, there is a toolbar with various diagnostic tools: "Setting", "TSB", "DTC Guide", "Case Analysis", "ETM", "Shop Manual", "DTC", "Current Data", "Actuation Test", "Flight Record", "DVOM", "Oscilloscope", "Simulation", "ECU Upgrade", "DTC Found", "Fault Code Searching", and a system tray with a clock and language indicator.

Vehicle SW Management

ECU Upgrade

ID Register

- ECU Identification
- Injector Data Input(QR CODE)

Option Treatment

Data Treatment

Inspection / Test

SCV Pump Learn Clear



- Learning Data Initializat
 - SCV Pump Learn Cl**
 - Accel Sensor Idle Le

*Condition : IG Key ON or Engine Run

This feature pump (or SCV) and the ECU exchange operation characteristics of a normal fuel pump and ECU to control the mode that is entered into.

[Pump Learning Flag : DONE]

Press [OK] button.

Ok Cancel

ECT up-grade

ECT up-grade

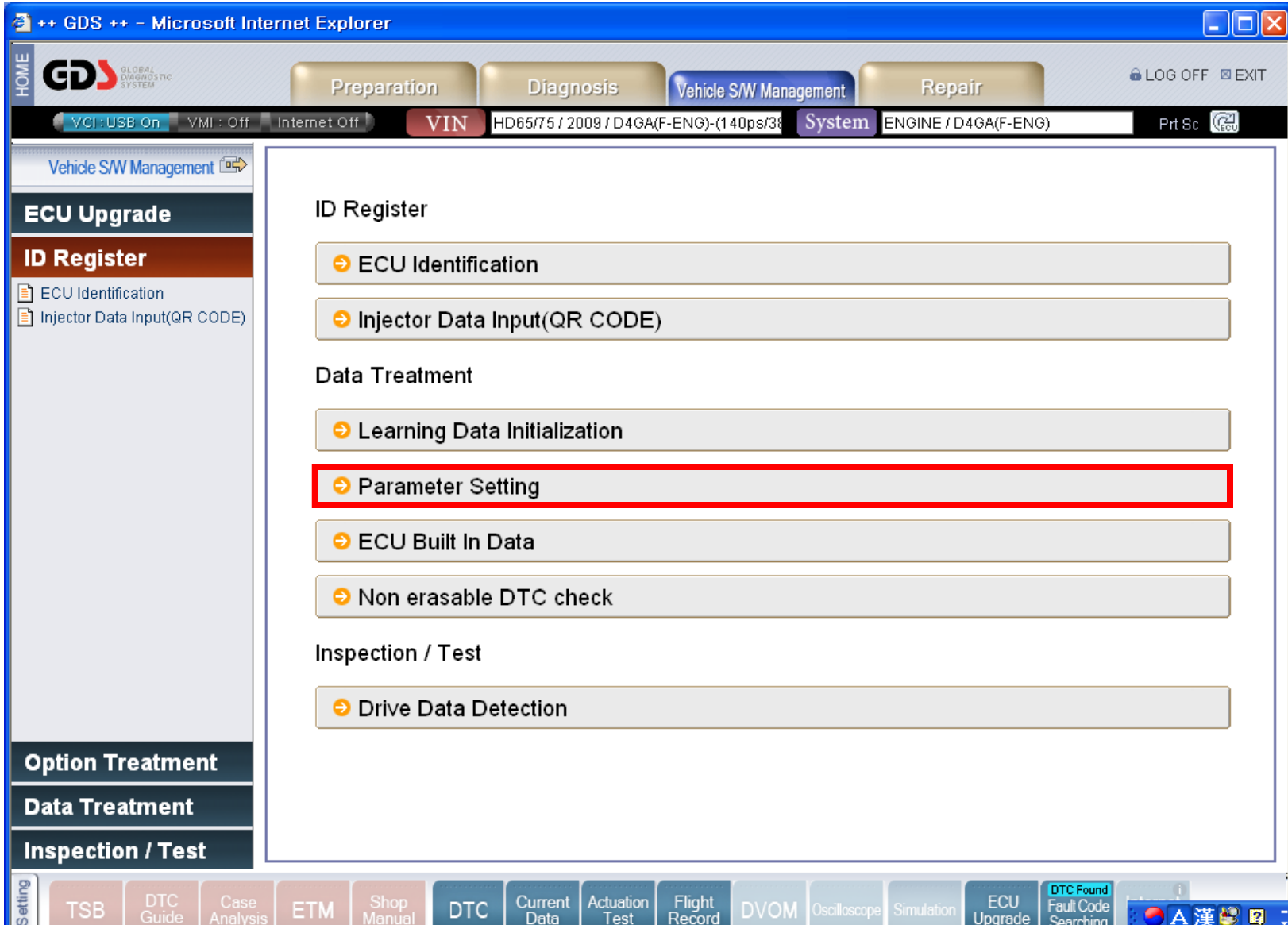
- ▶ If you want to ECT up-grade using Hi-scan pro, you have to use an extra ROM pack for this event.



Parameter setting

01. Gear Ratio Threshold
02. Vehicle Speed Calculation Parameter
03. PTO Parameter Setting
04. Fan Mode Setting
05. Speed Limiter Control
06. Idling Maintain Control
07. Starter Relay Control
08. Engine ID Number Write
09. VIN Write
10. MAF TYPE Set

Compensation method



The screenshot displays the GDS++ software interface within a Microsoft Internet Explorer browser window. The title bar reads "++ GDS ++ - Microsoft Internet Explorer". The interface features a top navigation bar with buttons for "Preparation", "Diagnosis", "Vehicle SW Management", and "Repair". Below this, a status bar shows "VCI : USB On", "VMI : Off", "Internet Off", and a VIN field containing "HD65/75 / 2009 / D4GA(F-ENG)-(140ps/38". The "System" menu is open, showing "ENGINE / D4GA(F-ENG)".

The main content area is titled "Vehicle SW Management" and contains a sidebar on the left with the following menu items: "ECU Upgrade", "ID Register", "ECU Identification", and "Injector Data Input(QR CODE)". The "ID Register" section is expanded, showing a list of options:

- ECU Identification
- Injector Data Input(QR CODE)

Below these are the "Data Treatment" options:

- Learning Data Initialization
- Parameter Setting** (highlighted with a red border)
- ECU Built In Data
- Non erasable DTC check

The "Inspection / Test" section includes:

- Drive Data Detection

At the bottom of the interface, there is a row of icons for various functions: Setting, TSB, DTC Guide, Case Analysis, ETM, Shop Manual, DTC, Current Data, Actuation Test, Flight Record, DVOM, Oscilloscope, Simulation, ECU Upgrade, and DTC Found Fault Code Searching. The Windows taskbar at the very bottom shows the system tray with a clock and language indicator.

Vehicle S/W Management

ECU Upgrade

ID Register

- ECU Identification
- Injector Data Input(QR CODE)

Option Treatment

Data Treatment

Inspection / Test

Parameter Setting

Input Password

Password

Ok Cancel

Vehicle S/W Management

ECU Upgrade

ID Register

- ECU Identification
- Injector Data Input(QR CODE)

Option Treatment

Data Treatment

Inspection / Test

Gear Ratio Threshold



- Parameter Setting M
 - Gear Ratio Thresh**
 - Vehicle Speed Ca
 - PTO Parameter S
 - FAN Mode Set
 - Speed Limitter Co
 - Idling Maintain Co
 - Starter Relay Cor
 - Engine ID Number
 - VIN Wirte
 - MAF TYPE Set

Item	Applied Value	Unit
TM MODEL	MANUAL	
1st Gear ratio High	2.40	
1st Gear ratio Low	2.50	
2nd Gear ratio High	2.75	
2nd Gear ratio Low	2.60	
3rd Gear ratio High	1.60	
3rd Gear ratio Low	1.60	
4th Gear ratio High	1.60	
4th Gear ratio Low	1.60	
5th Gear ratio High	1.60	
5th Gear ratio Low	1.60	
6th Gear ratio High	0.00	
6th Gear ratio Low	1.60	
Neutral Gear ratio High	5.75	
Neutral Gear ratio Low	5.60	

[Input method]
 1. Select the items change.
 2. Input a value/select in the input window.
 3. Press [OK] button.

Ok Cancel

Vehicle SW Management

ECU Upgrade

ID Register

- ECU Identification
- Injector Data Input(QR CODE)

Option Treatment

Data Treatment

Inspection / Test

PTO Parameter Setting



- Parameter Setting M
 - Gear Ratio Thresh
 - Vehicle Speed Ca
 - PTO Parameter S**
 - FAN Mode Set
 - Speed Limitter Co
 - Idling Maintain Co
 - Starter Relay Cor
 - Engine ID Number
 - VIN Wirte
 - MAF TYPE Set

Item	Applied Value	Unit
PTO Max Engine Speed	3000	RPM
PTO Initial Engine Speed	2500	RPM
PTO Max Vehicle Speed High threshold	0	km/h
PTO Max Vehicle Speed Low threshold	0	km/h
Flag PTO Cong Mode	DISABLE	
Flag PTO Accel Pedal Mode	DISABLE	
Flag PTO Remote Pedal Mode	DISABLE	
Flag PTO Remote Reset Engine Sppeed M.	DISABLE	
Flag PTO Clutch Mode	DISABLE	
Flag PTO Foot Brake Mode	DISABLE	
EEPROM PTO Increase Eng. Speed Delta	0	RPM
EEPROM PTO Decrease Eng. Speed Delta	0	RPM
Remote PTO Target Speed 1	0	RPM
Remote PTO Target Speed 2	0	RPM

[Input method]
 1. Select the items change.
 2. Input a value/select in the input window.
 3. Press [OK] button.

Ok Cancel

Vehicle SW Management

ECU Upgrade

ID Register

- ECU Identification
- Injector Data Input(QR CODE)

Option Treatment

Data Treatment

Inspection / Test

Engine ID Number Write



- Parameter Setting M
 - Gear Ratio Thresh
 - Vehicle Speed Ca
 - PTO Parameter S
 - FAN Mode Set
 - Speed Limitter Co
 - Idling Maintain Co
 - Starter Relay Cor
 - Engine ID Number**
 - VIN Wirte
 - MAF TYPE Set

*Condition : IG Key ON (Engine Stop)

This feature is a mode to enter the engine ID number.
After value entry, press [OK] button will be saved.

[Old] D4GA7000073

[New]

Ok Cancel

Vehicle SW Management

ECU Upgrade

ID Register


- ECU Identification
- Injector Data Input(QR CODE)

Option Treatment

Data Treatment

Inspection / Test

VIN Wirte



This mode to enter the 17 digit chassis number.
One input is available.
Accurately enter.

- Parameter Setting M
 - Gear Ratio Thresh
 - Vehicle Speed Ca
 - PTO Parameter S
 - FAN Mode Set
 - Speed Limiter Co
 - Idling Maintain Co
 - Starter Relay Cor
 - Engine ID Number
 - VIN Wirte**
 - MAF TYPE Set

Ok Cancel

