

ENGINE ASSEMBLY

**1336-04 / 1336-25 / 1130-12 / 1610-01 / 1330-01 /
1990-02 / 1990-03 / 1990-11 / 1225-01 / 1214-01 /
1315-01 / 1533-08 / 1533-08 / 1330-40 / 1330-13**

INDEX

ENGINE ASSEMBLY

GENERAL INFORMATION

1. SPECIFICATION.....	3
2. TIGHTENING TORQUE.....	4
3. CHECK AND INSPECTION.....	7
4. GUIDELINES ON ENGINE SERVICE.....	12

OVERVIEW AND OPERATING PROCESS

1. BELT SYSTEM.....	14
2. VACUUM PUMP.....	15
3. ENGINE MOUNTING.....	16
4. INTAKE/EXHAUST SYSTEM.....	17
5. CYLINDER HEAD COVER AND OIL SEPARATOR.....	18
6. CYLINDER HEAD.....	19
7. CHAIN AND GEAR DRIVE SYSTEM.....	21
8. OIL PAN.....	25
9. MASS BALANCE UNIT (MBU).....	26
10.FLYWHEEL AND DRIVE PLATE.....	27
11.PISTON/CRANKSHAFT/CYLINDER BLOCK.....	28

CONFIGURATION

1. BELT SYSTEM.....	29
2. VACUUM PUMP.....	33
3. ENGINE MOUNTINGS.....	34
4. INTAKE/EXHAUST MANIFOLD.....	36
5. OIL SEPARATOR.....	39
6. CYLINDER HEAD ASSEMBLY.....	41
7. CHAIN DRIVE SYSTEM.....	46
8. OIL PAN.....	52
9. MASS BALANCE UNIT (MBU).....	53
10.DUAL MASS FLYWHEEL (DMF) AND DRIVE PLATE.....	54
11.PISTON/CONNECTING ROD/CRANKSHAFT/CYLINDER BLOCK.....	57

REMOVAL AND INSTALLATION

1336-00 TIMING CASE (D20DTF).....	65
1336-04 BELT TENSIONER ASSEMBLY...	66
1336-25 IDLER PULLEY ASSEMBLY NO.1 (NO.2)	70
1130-00 CRANKSHAFT.....	72
1130-12 ISOLATION DAMPER ASSEMBLY.....	73
1610-00 VACUUM PUMP.....	77
1610-01 VACUUM PUMP ASSEMBLY.....	78

REMOVAL AND INSTALLATION

1990-00 ENGINE MOUNTING.....	81
1330-01 ENGINE MOUNTING INSULATOR (LH-MTG)	82
1990-02 ENGINE MOUNTING INSULATOR (RH-MTG)	85
1990-03 ENGINE MOUNTING INSULATOR (FRT-MTG)	87
1990-11 ENGINE MOUNTING INSULATOR (RR-MTG)	89
1225-00 CYLINDER HEAD COVER AND CAMSHAFT (D20DTF).....	91
1225-01 CYLINDER HEAD COVER.....	92
1214-00 CYLINDER HEAD ASSEMBLY AND CYLINDER HEAD GASKET..	96
1214-01 CYLINDER HEAD ASSEMBLY.....	97
0000-00 ENGINE ASSEMBLY (D20DTF)....	112
1315-00 CHAIN DRIVE.....	127
1315-01 TIMING CHAIN ASSEMBLY (UPPER CHAIN-BUSH).....	128
1533-08 OIL PAN ASSEMBLY.....	137
1533-08 OIL PAN ASSEMBLY.....	138
1130-00 CRANKSHAFT AND FLYWHEEL..	141
1130-40 MASS BALANCE SHAFT UNIT (MBU).....	142
1130-13 DUAL MASS FLYWHEEL (DMF) ASSEMBLY.....	144
1120-00 ENGINE OVERHOLE.....	146

D20DTF ENGINE

0000-00

GENERAL INFORMATION

1. SPECIFICATION

Unit	Description		Specification	Remark
Cylinder head	Height		142.9 to 143.1 mm	
	Flatness		below 0.1 mm	
	Valve protrusion	Intake valve	0.1 to 0.7 mm	
		Exhaust valve	0.1 to 0.7 mm	
	Flatness on manifold side	Intake manifold	0.08 mm	
Exhaust manifold		0.08 mm		
Mass Balance Unit (MBU)	Backlash		0.05 to 0.15 mm	
Connecting rod	End play		0.5 to 1.5 mm	
Camshaft	Axial end play	Intake	0.1 to 0.35 mm	
		Exhaust	0.1 to 0.35 mm	
Camshaft position sensor	Distance between Camshaft position sensor and sprocket		0.20 to 1.80 mm	
Valve	Clearance between valve and piston	Intake	Approx. 0.7 mm	
		Exhaust	Approx. 0.8 mm	
	Valve recess	Intake	0.1 to 0.7 mm	
		Exhaust		
Cylinder block	Piston protrusion		0.541 to 0.649 mm	
Piston ring	TOP ring end gap		0.20 to 0.35 mm	
	2nd ring end gap		0.35 to 0.50 mm	
	3rd ring end gap		0.2 to 0.40 mm	
	Offset		0.3 mm	
Head gasket	Piston protrusion	0.475~0.540	1.2t	
		0.541 to 0.649	1.3t	
		0.650 to 0.745	1.4t	

Modification basis	
Application basis	
Affected VIN	

D20DTF ENGINE
ENGINE ASSEMBLY
ENGINE FUEL
INTAKE SYSTEM
EXHAUST SYSTEM
TURBOCHARGER
LUBRICATION
ENGINE COOLING
CHARGE SYSTEM
PRE-HEATING
STARTING
CRUISE CONTROL
E-GR SYSTEM
CDPF SYSTEM
ENGINE CONTROL

2. TIGHTENING TORQUE

Component	Size	Bolt Quantity	Specified torque (Nm)	Remark (Total torque)
Main bearing cap	M11×62 (small) M11×67 (large)	10	55±5 Nm, 130°+10°	80 to 130 Nm
Connecting rod cap	M9×52	8	40±5 Nm, 90°+10°	50 to 80 Nm
Rear cover	M6×20	6	10 ± 1 Nm	
Timing gear cover	M6×55	3	10 ± 1 Nm	
	M6×45	8	10 ± 1 Nm	
Oil pump	M8×35SOC	3	25 ± 2.5 Nm	
Flywheel	M10×22	8	45 ± 5 Nm, 90°+10°	60 to 100 Nm
Crankshaft center bolt	M18×50	1	200 ± 20 Nm, 180°+20°	660 to 720 Nm
Oil pan	M6×20	18	10 ± 1 Nm	
	M6×35	2	10 ± 1 Nm	
	M6×85	2	10 ± 1 Nm	
	M6×120	2	10 ± 1 Nm	
	M8×40	2	25 ± 2.5 Nm	
HP pump main nut	M14×1.5-8-1	1	65 ± 5 Nm	
HP pump bolt	M8×55	3	25 ± 2.5 Nm	
Cylinder head	M12×177	12	85 ± 8.5 Nm + 270° ± 10°	
Camshaft cap	M6×	16	10 ± 1 Nm	
	M8×	4	25 ± 2.5 Nm	
Exhaust stud bolt		10	40 ± 4 Nm	
Exhaust sprocket bolt	M11×40	1	30 ± 3 Nm	
Screw bolt	M24	1	25 ± 2.5 Nm	
Coolant temperature sensor		1	20 ± 2.0 Nm	
Auto tensioner	M7×45 (Low)	1	25 ± 2.5 Nm	
	M12×90 (Up)	1	55 ± 5.5 Nm	
Coolant pump	M6×50	7	10 ± 1.0 Nm	

Component	Size	Bolt Quantity	Specified torque (Nm)	Remark (Total torque)
Hot water inlet pipe	M6×12	2	10 ± 1 Nm	
Alternator	M10×90	1	25 ± 2.5 Nm	
	M10×116	1	46 ± 4.6 Nm	
A/C bracket	M8×25	4	7.8 to 11.8 Nm	
A/C sub bracket	M6×14	4	10 ± 1 Nm	
Intake manifold	M8×35	2	25 ± 2.5 Nm	
	M8×110	6	25 ± 2.5 Nm	
Oil cooler			25 ± 2.5 Nm	
Knock sensor	M8×28	2	20 ± 5 Nm	
Cam position sensor	M8×14	1	10 to 14 Nm	
Booster pressure sensor	M6×20	2	10 ± 1 Nm	
Exhaust manifold	M8	10	40 ± 4 Nm	
Turbocharger	M8	3	25 ± 2.5 Nm	
Support bolt		1	25 ± 2.5 Nm	
Support nut	M8	1	25 ± 2.5 Nm	
T/C oil supply pipe	M6 (block side)	1	10 ± 1.0 Nm	
	M6 (turbo side)	1	17 ± 2.0 Nm	
T/C oil return pipe	M6×16 (turbo side)	2	10 ± 1 Nm	
	M6×16 (block side)	2	10 ± 1 Nm	
EGR valve	M8×22	2	25 ± 2.5 Nm	
EGR pipe bolt (Intake side)	M8×16	2	25 ± 2.5 Nm	
EGR pipe bolt (EGR cooler side)	M8×16	2	25 ± 2.5 Nm	
EGR combination bolt	M6×16	4	10 ± 1 Nm	
	M8×16	16	25 ± 2.5 Nm	
Tensioner pulley		1	45 ± 4.5 Nm	
Glow plug	M5	4	20 ± 2 Nm	
Vacuum pump	M8×25	3	25 ± 2.5 Nm	

D20DTF ENGINE
ENGINE ASSEMBLY
ENGINE FUEL
INTAKE SYSTEM
EXHAUST SYSTEM
TURBOCHARGER
LUBRICATION
ENGINE COOLING
CHARGE SYSTEM
PRE-HEATING
STARTING
CRUISE CONTROL
E-EGR SYSTEM
CDPF SYSTEM
ENGINE CONTROL

Modification basis	
Application basis	
Affected VIN	

Component	Size	Bolt Quantity	Specified torque (Nm)	Remark (Total torque)
Cooling fan bracket	M6×25	5	10 ± 1 Nm	
	M6×60	1	10 ± 1 Nm	
	M6×85	3	10 ± 1 Nm	
Cylinder head cover	M6×35	21	10 ± 1 Nm	
Oil gauge tube	M6×16	1	10 ± 1 Nm	
Oil filter	M8×35SOC	1	25 ± 2.5 Nm	
Fuel rail	M8×35SOC	2	25 ± 2.5 Nm	
Injector clamp bolt	M6×60	2	10 ± 1 Nm, 120°+10°	
High pressure pipe (between HP pump and fuel rail)	M17	1	30 ± 3 Nm	
High pressure pipe (between fuel rail and injector)	M17	4	30 ± 3 Nm	
Crank position sensor	M5×14	1	8 ± 0.4 Nm	
Main wiring	M6×16	5	10 ± 1 Nm	
Intake duct bracket	M8×16	3	25 ± 2.5 Nm	
Power steering pump	M8×100	3	25 ± 2.5 Nm	

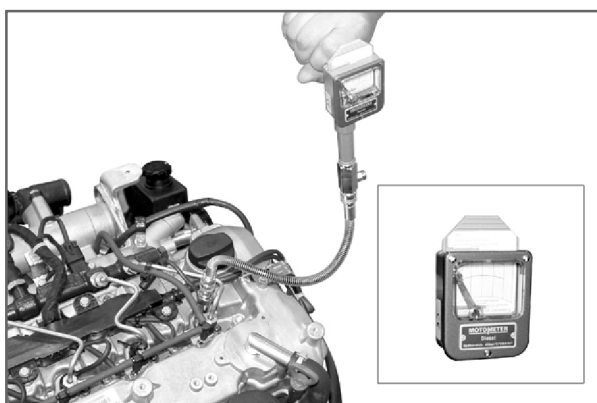
3. CHECK AND INSPECTION

1) Cylinder

(1) Compression pressure test

► Specified value

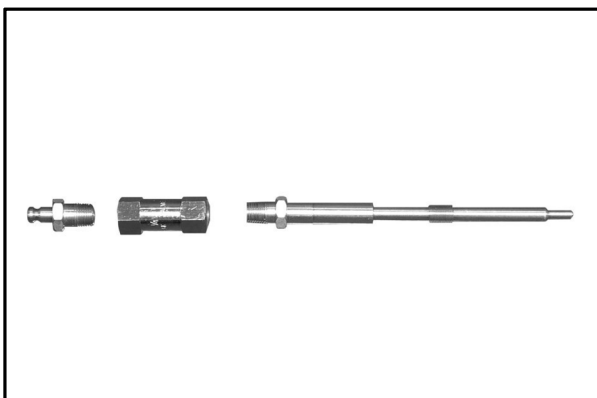
Compression ratio		16.5 : 1
Test condition		at normal operating temperature (80°C)
Compression pressure	Standard	32 bar
	Minimum	18 bar
Differential limit between cylinders		Maximum 3 bar



The compression pressure test is to check the conditions of internal components (piston, piston ring, intake and exhaust valve, cylinder head gasket). This test provides current engine operating status.

CAUTION

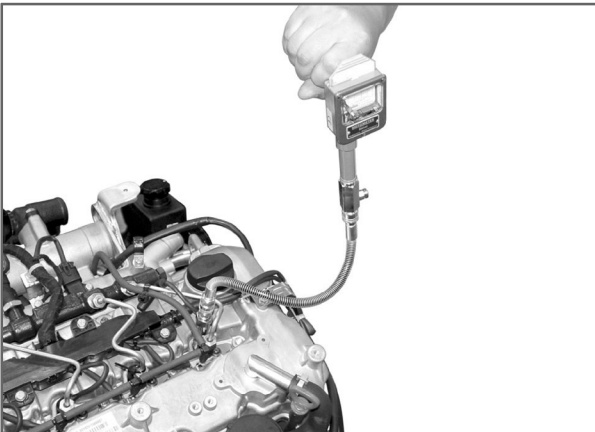
- Before cranking the engine, make sure that the test wiring, tools and persons are keeping away from moving components of engine (e.g., belt and cooling fan).
- Park the vehicle on the level ground and apply the parking brake.
- Do not allow anybody to be in front of the vehicle.



1. Warm the engine up to normal operating temperature (80°C).
2. Disconnect the fuel rail pressure sensor connector to cut off the fuel injection.
3. Place the diagram sheet to compression pressure tester.

Modification basis	
Application basis	
Affected VIN	

D20DTF ENGINE
 ENGINE ASSEMBLY
 ENGINE FUEL
 INTAKE SYSTEM
 EXHAUST SYSTEM
 TURBOCHARGER
 LUBRICATION
 ENGINE COOLING
 CHARGE SYSTEM
 PRE-HEATING
 STARTING
 CRUISE CONTROL
 E-GR SYSTEM
 CDPF SYSTEM
 ENGINE CONTROL



4. Remove the glow plugs and install the compression pressure tester into the plug hole.

5. Crank the engine for approx. 10 seconds by using the start motor.

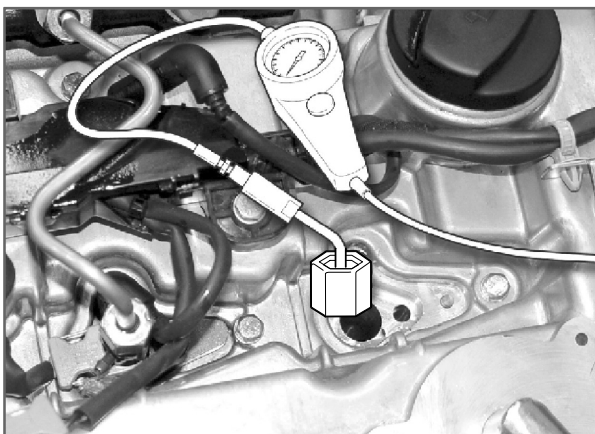
6. Record the test result and measure the compression pressure of other cylinders with same manner.

7. If the measured value is out of specified value, perform the cylinder pressure leakage test.

(2) Cylinder pressure leakage test

► Specified value

Test condition: normal engine operating temperature (80°C)	Specified value
Whole engine	below 25%
at valve and cylinder head gasket	below 10%
at piston ring	below 20%

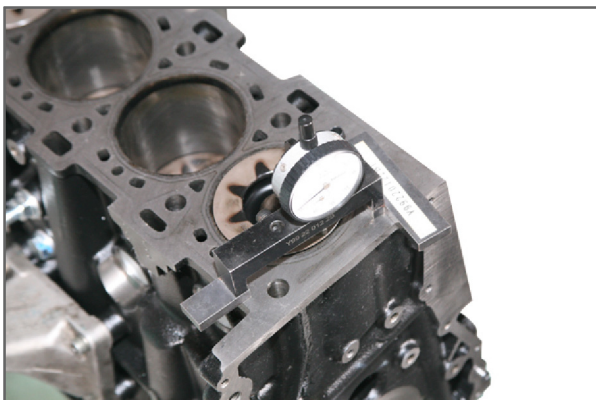


If the measured value of the compression pressure test is not within the specifications, perform the cylinder pressure leakage test.

⚠ CAUTION

- Perform this test in the sequence of firing order.
- Do not test the cylinder pressure leakage with wet type test procedure. (do not inject the engine oil into the combustion chamber)

(3) Piston protrusion check



Position the piston at TDC and measure the piston protrusion from crank case mating surface.

Specified value	0.541 to 0.649 mm
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⚠ CAUTION
- Measure it at both ends of crankshaft.

- D20DTF ENGINE
- ENGINE ASSEMBLY
- ENGINE FUEL
- INTAKE SYSTEM
- EXHAUST SYSTEM
- TURBOCHARGER
- LUBRICATION
- ENGINE COOLING
- CHARGE SYSTEM
- PRE-HEATING
- STARTING
- CRUISE CONTROL
- E-GR SYSTEM
- CDPF SYSTEM
- ENGINE CONTROL

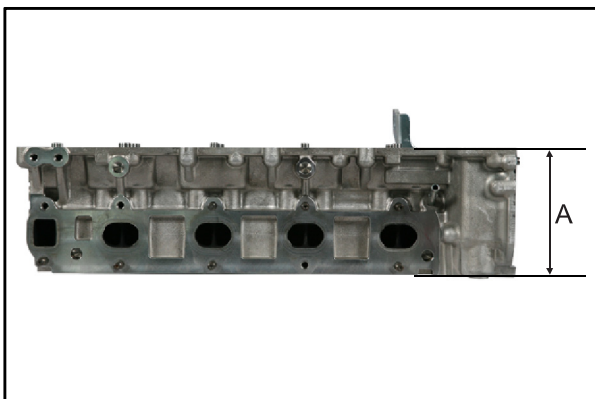
Modification basis	
Application basis	
Affected VIN	

2) Cylinder Head

(1) Cylinder head mating surface check

► Specified value

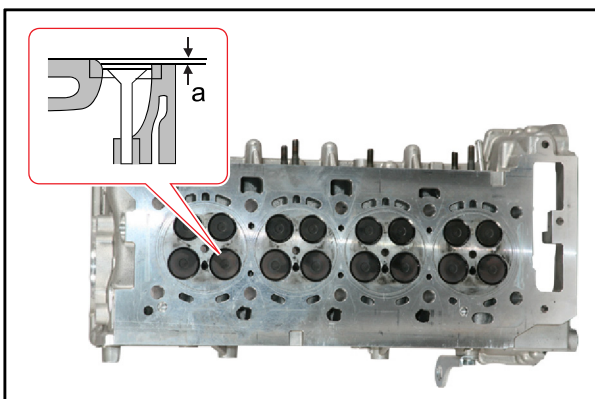
Total height "A"		142.9 to 143.1 mm
Minimum height after machining		142.4 mm
Flatness	Longitudinal direction	0.08 mm
	Transverse direction	0.0 mm
Parallel deviation of cylinder head		below 0.1 mm
Peak-to valley of surface		0.004 mm
valve recess "a"	Intake valve	0.1 to 0.7 mm
	Exhaust valve	0.1 to 0.7 mm



1. Measure the cylinder head height "A".

⚠ CAUTION

- If the height is less than the limit, the cylinder head must be replaced.



2. Insert the valves into the valve guides and measure the recesses.

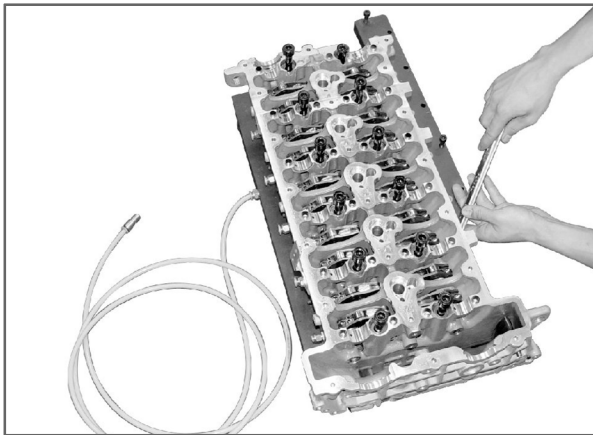
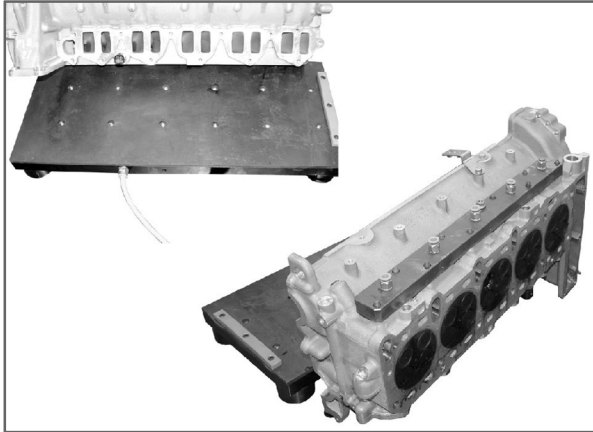
Valve recess "a"	0.1 to 0.7 mm
------------------	---------------

⚠ CAUTION

- If the measured value is out of the specified range, machine the valve seat as much as necessary until the specified value is achieved.

(2) Cylinder head pressure Leak test

- Preceding work**
- Removal of cylinder head
 - Removal of intake and exhaust manifold
 - Removal of valves



1. Place the pressure plate on a flat-bed work bench.

2. Install the cylinder head on the pressure plate.

Tightening torque 60 Nm

3. Immerse the cylinder head with the pressure plate into warm water (approx. 60°C) and pressurize with compressed air to 2 bar.

CAUTION

- Examine the cylinder head for air bubbling. If the air bubbles are seen, replace the cylinder head.

Modification basis	
Application basis	
Affected VIN	

4. GUIDELINES ON ENGINE SERVICE

To prevent personal injuries and vehicle damages that can be caused by mistakes during engine and unit inspection/repair and to secure optimum engine performance and safety after service works, basic cautions and service work guidelines that can be easily forgotten during engine service works are described in.

► Cautions before service works

- D20DTF engine is for FF (Front Engine Front Drive) type vehicle. Therefore, there are some deferent maintenance and repair works compared to the engine for FR (Front Engine Rear Drive) type vehicle.

For safe and correct works, you must observe the working procedures and instructions in this manual. And, use the designated tools as follow:

: Power train mounting stand / Engine hanger / Engine stand / Heavy duty engine jack

- Before work on engine and each electrical equipment, be sure to disconnect battery negative (-) terminal.
- Before service works, be sure to prepare the works by cleaning and aligning work areas.
- Always position the ignition switch to OFF if not required. If not, there can be electrical equipment damages or personal injuries due to short-circuit or ground by mistake.
- There should be no leak from fuel injection system (HP pump, fuel hose, high pressure pipe) of the D20DTF engine. So they should be protected from foreign materials.
- While removing the engine, do not position the jack and others under the oil pan or engine. To secure the safety, use only safety hook on the engine.
- When removing the engine, use only the safety hook on engine and engine hanger. Do not support it with jack under the oil pan.

► Engine and accessories

Engine has a lot of precise portions so tightening torque should be correct during disassembly/assembly and removal/installation and service work should be done in clean ways during disassembly/assembly. Maintaining working area clean and cautious service administration is essential element of service works while working on the engine and each section of the vehicle. So the mechanics should well aware of it.

- While removing the engine, related parts (bolts, gaskets, etc.) should be aligned as a group.
- While disassembling/assembling internal components of the engine, well aware of disassembly/assembly section in this manual and clean each component with engine oil and then coat with oil before installation.
- While removing engine, drain engine oil, coolant and fuel in fuel system to prevent leakage.
- During service work of removal/installation, be sure to check each connected portions to engine not to make interference.

Modification basis	
Application basis	
Affected VIN	

► Fuel and lubrication system

Painted surface of the body can be damaged or rubber products (hose) can be corroded if engine oil and fuel are spilled over. If spilled over engine, foreign materials in air can be accumulated on the engine damaging fuel system.

- If work on the fluid system such as fuel and oil, working area should be well ventilated and mechanic should not smoke.
- Gasket or seal on the fuel/lubrication system should be replaced with new and bolts and nuts should be tightened as specified.
- After removal/installation works, be sure to check whether there is leak on the connecting section.

If fine dust or foreign material enters into DI engine's fuel system, there can be serious damages between HP pump and injectors. So, be sure to cover removed fuel system components with cap and protect removed parts not to be contaminated with dirt. (Refer to cleanness in this manual while working on DI engine fuel system)

► Electrical equipment

Electrical equipment should be handled more carefully.

Currently, the engine is equipped with a lot of electrical equipments so there can be engine performance drops, incomplete combustion and other abnormal symptoms due to short and poor contact. Mechanics should well aware of vehicle's electrical equipment.

- If have to work on the electrical equipment, be sure to disconnect battery negative (-) terminal and position the ignition switch to off if not required.
- When replacing electrical equipment, use the same genuine part and be sure to check whether ground or connecting portions are correctly connected during installation.
If ground or connecting portion is loosened, there can be vehicle fire or personal injury.

D20DTF ENGINE
ENGINE ASSEMBLY
ENGINE FUEL
INTAKE SYSTEM
EXHAUST SYSTEM
TURBOCHARGER
LUBRICATION
ENGINE COOLING
CHARGE SYSTEM
PRE-HEATING
STARTING
CRUISE CONTROL
E-EGR SYSTEM
CDPF SYSTEM
ENGINE CONTROL

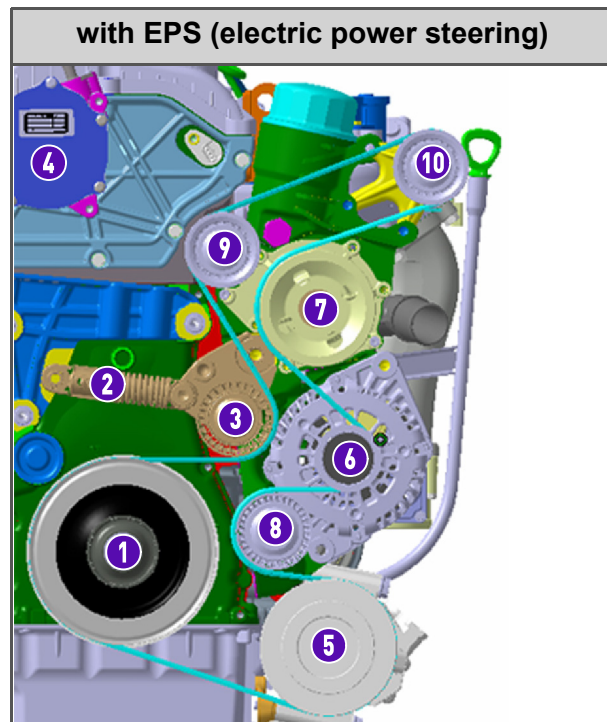
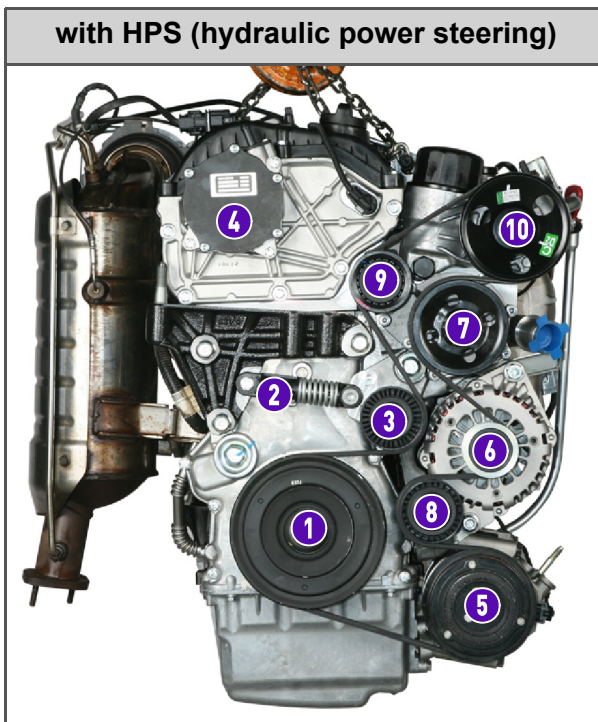
Modification basis	
Application basis	
Affected VIN	

OVERVIEW AND OPERATING PROCESS

1. BELT SYSTEM

The belt system is a single belt drive system which uses single belt and has components on the oil filter housing as FEAD (Front End Accessories Drive) type.

► Components



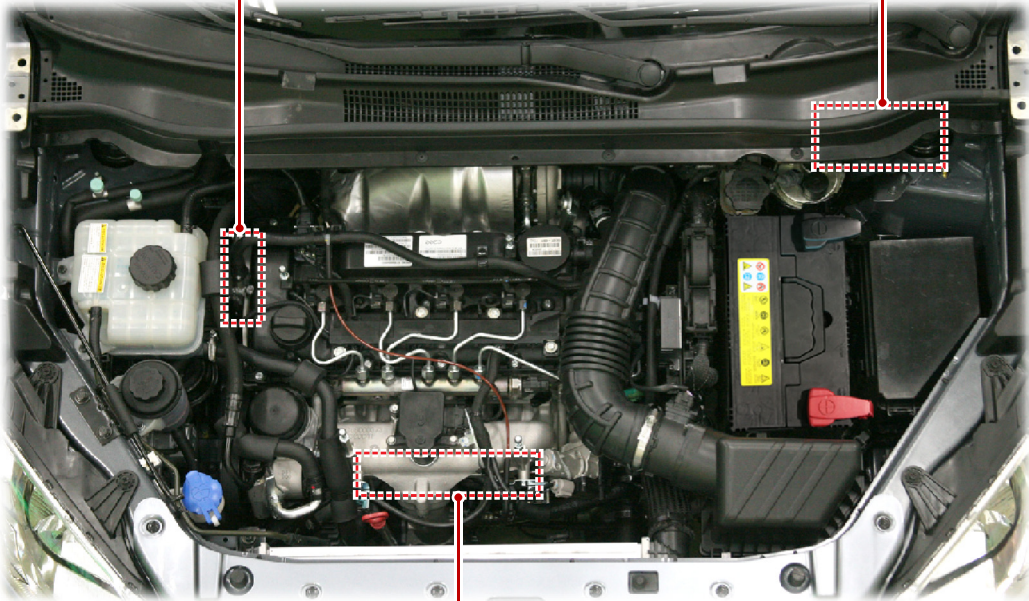
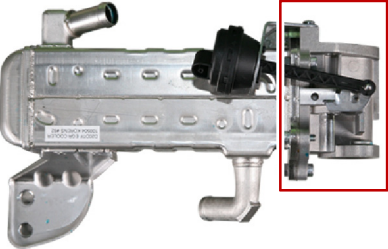


	HPS	EPS
1	Crankshaft pulley (DDU)	←
2	Auto tensioner	←
3	Tensioner pulley	←
4	Vacuum pulley	←
5	A/C compressor pulley	←
6	Alternator pulley	←
7	Water pump pulley	←
8	NO. 1 idler pulley	←
9	NO. 2 idler pulley	←
10	Power steering pump	NO. 3 idler pulley

2. VACUUM PUMP

Vacuum pump generates the vacuum pressure and supplies it to EGR cooler bypass solenoid. This pump is single vane type and displacement is 210 cc/rev. The lubrication oil is supplied through the hole in hollow shaft.

► Components

Vacuum pump		Brake booster
	Pump capacity: 210 cc/rev Speed: 700 to 6,000 rpm Lubrication temperature: -40 to 155°C Oil: 5W30 Drive type: Driven by exhaust Camshaft sprocket	
		
<h3>EGR cooler bypass valve</h3>		
	Exhaust gas goes to combustion chamber without through EGR cooler in engine cooled, and the valve is closed by vacuum pressure.	





Modification basis	
Application basis	
Affected VIN	

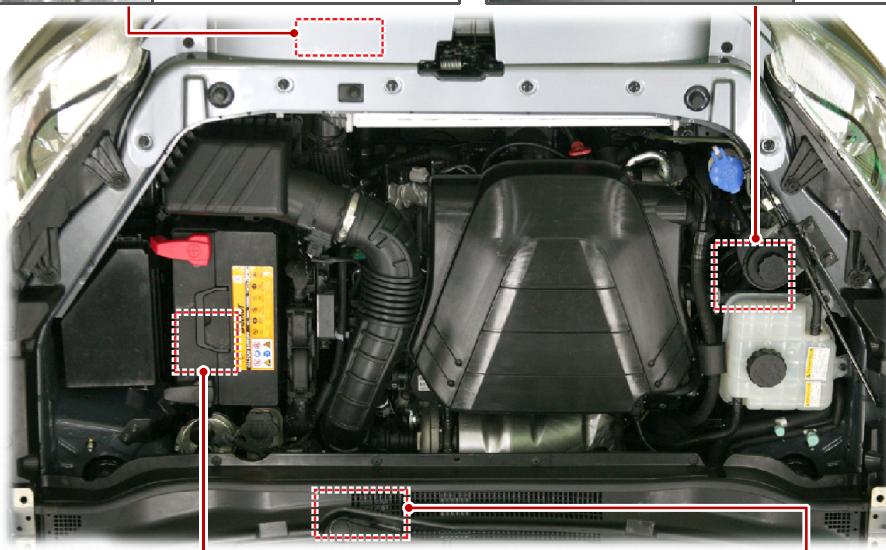
D20DTF ENGINE
 ENGINE ASSEMBLY
 ENGINE FUEL
 INTAKE SYSTEM
 EXHAUST SYSTEM
 TURBOCHARGER
 LUBRICATION
 ENGINE COOLING
 CHARGE SYSTEM
 PRE-HEATING
 STARTING
 CRUISE CONTROL
 E-EGR SYSTEM
 CDPF SYSTEM
 ENGINE CONTROL

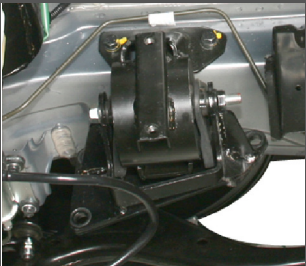



3. ENGINE MOUNTINGS

D20DTF engine mounting is 4-point mounting type and supports the engine and transaxle. Front and rear mountings are rubber type and support the torque reaction. Left and right mountings support the power train rods and torque reaction. Additionally, left mounting is hydraulic type and supports the engine vibration.

► Components

Front mounting assembly Location: Front side of transfer axle housing and front side of sub frame		Right mounting assembly Location: Engine block side and body side member	
Location	Front mounting	Location	Right mounting
			



Left mounting assembly Location: Upper side of transfer axle housing and body side member		Rear mounting assembly Location: Rear side of transfer axle housing and front side of sub frame	
Location	Left mounting	Location	Rear mounting
			

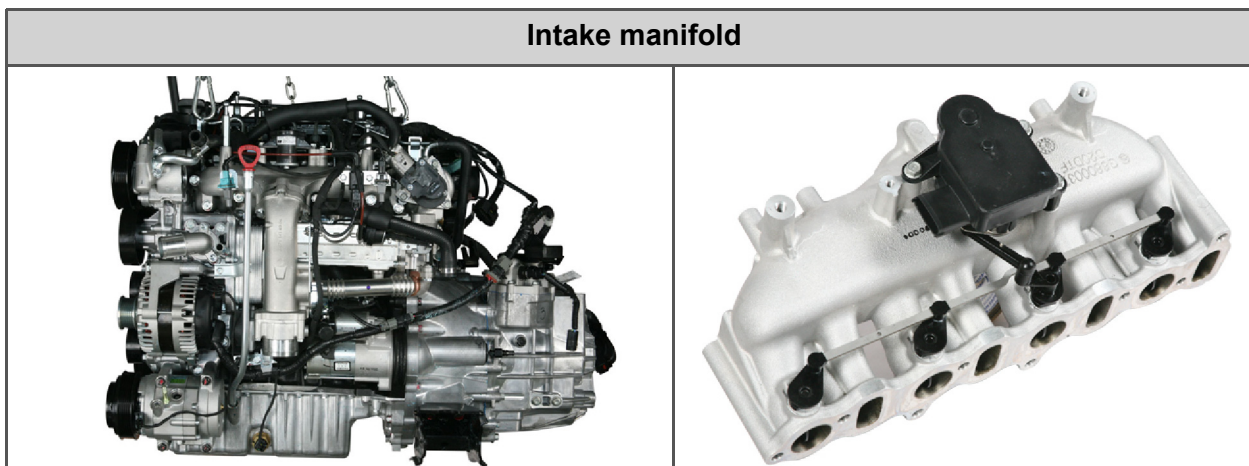
Modification basis	
Application basis	
Affected VIN	

4. INTAKE/EXHAUST SYSTEM

1) Intake Manifold

Intake manifold is installed on the cylinder head with 8 bolts. The variable swirl valve is introduced to improve the EGR gas mixture and turbulence in combustion chamber and to decrease the exhaust gas.

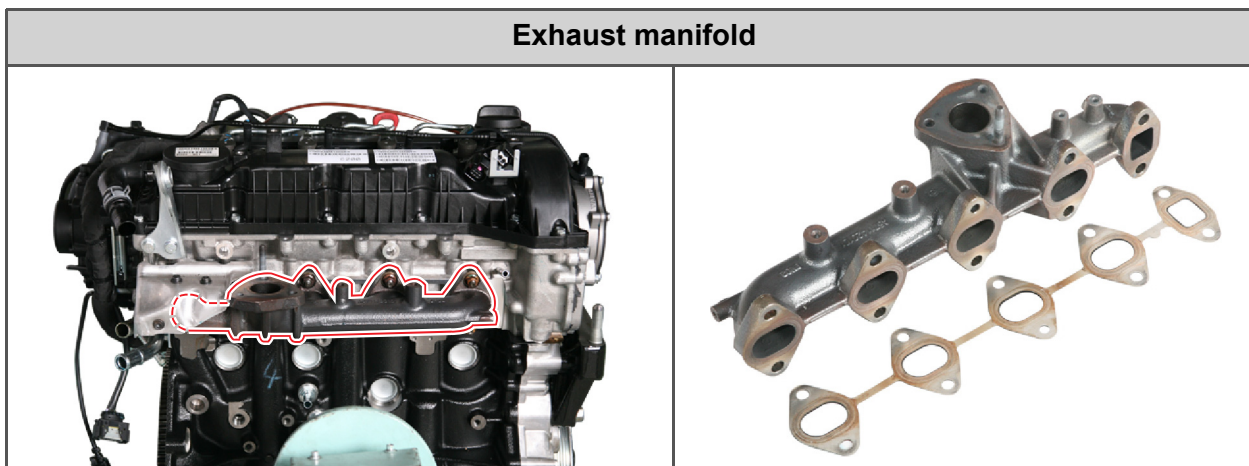
► Components



2) Exhaust Manifold

Exhaust manifold is installed on the cylinder head with 10 stud bolts and nuts. EGR port is integrated in cylinder head.

► Components



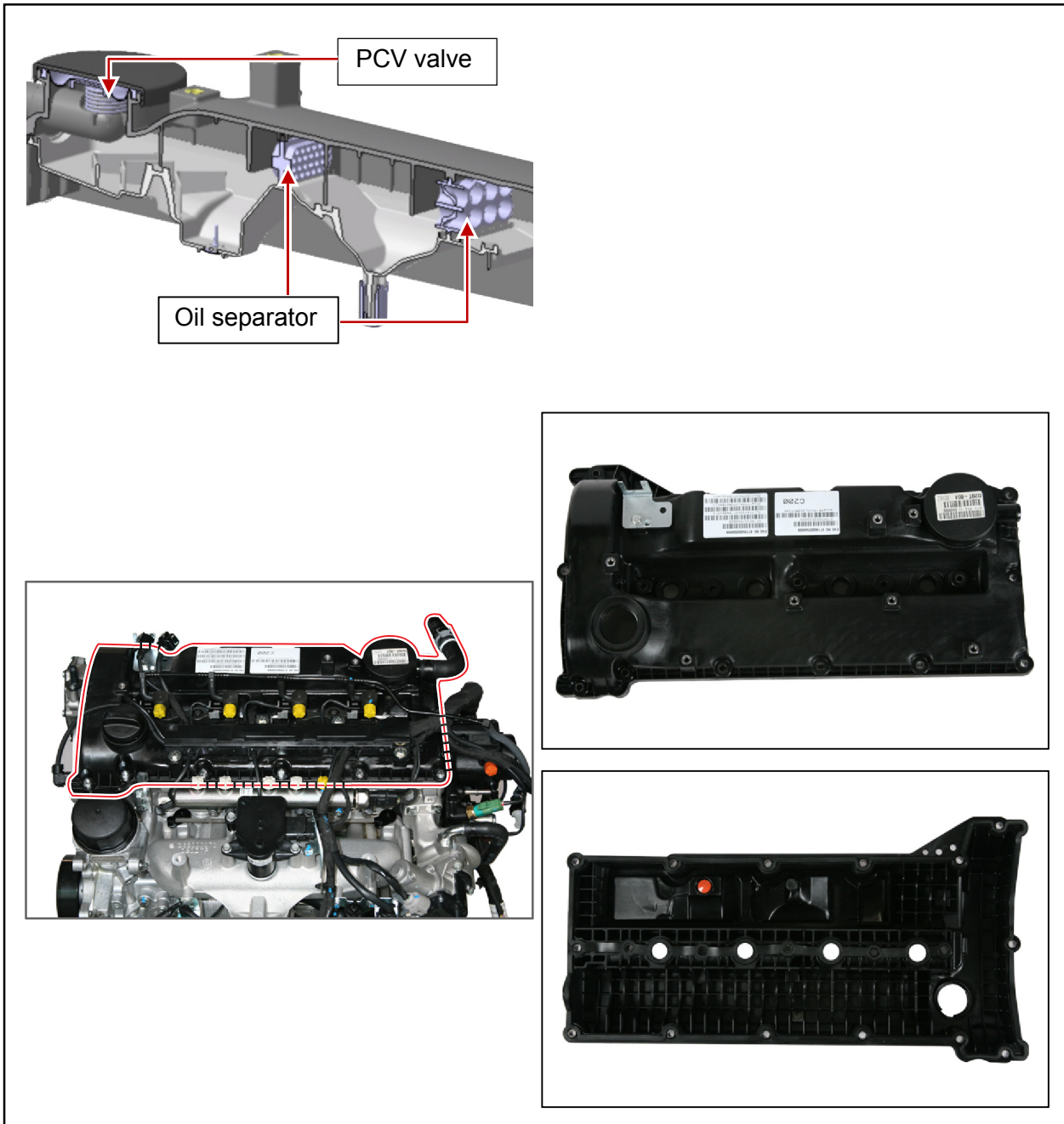
Modification basis	
Application basis	
Affected VIN	

- D20DTF ENGINE
- ENGINE ASSEMBLY
- ENGINE FUEL
- INTAKE SYSTEM
- EXHAUST SYSTEM
- TURBOCHARGER
- LUBRICATION
- ENGINE COOLING
- CHARGE SYSTEM
- PRE-HEATING
- STARTING
- CRUISE CONTROL
- EGR SYSTEM
- CDPF SYSTEM
- ENGINE CONTROL

5. CYLINDER HEAD COVER AND OIL SEPARATOR

The cylinder head cover is made by high strength plastic to reduce the weight. The multi twist type oil separator improves the oil consumption.

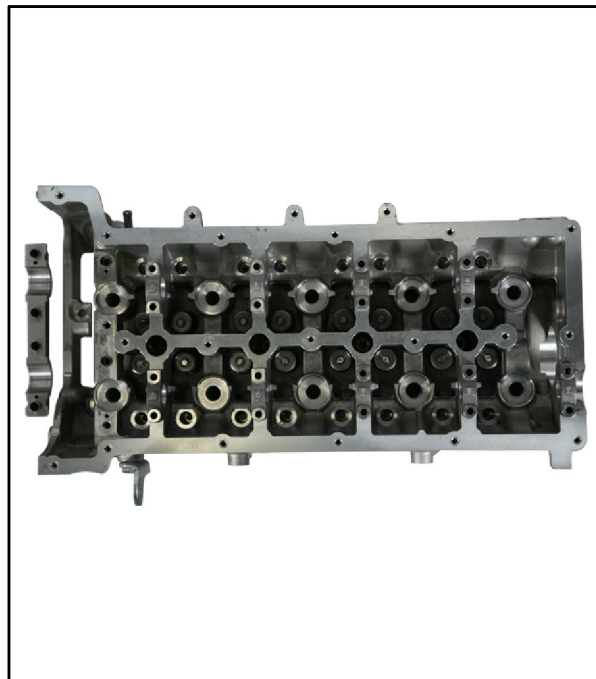
► Components



Modification basis	
Application basis	
Affected VIN	

6. CYLINDER HEAD

Cylinder head contains cam position sensor, vacuum pump, intake manifold, exhaust manifold and valve assembly. Vacuum pump and the high pressure (HP) pump are driven by Camshaft and valves are install in vertical direction. This enables the compact layout in cylinder head assembly.



D20DTF
ENGINE

ENGINE
ASSEMBLY

ENGINE
FUEL

INTAKE
SYSTEM

EXHAUST
SYSTEM

TURBO
CHARGER

LUBRICA
TION

ENGINE
COOLING

CHARGE
SYSTEM

PRE-
HEATING

STARTIN
G

CRUISE
CONTRO




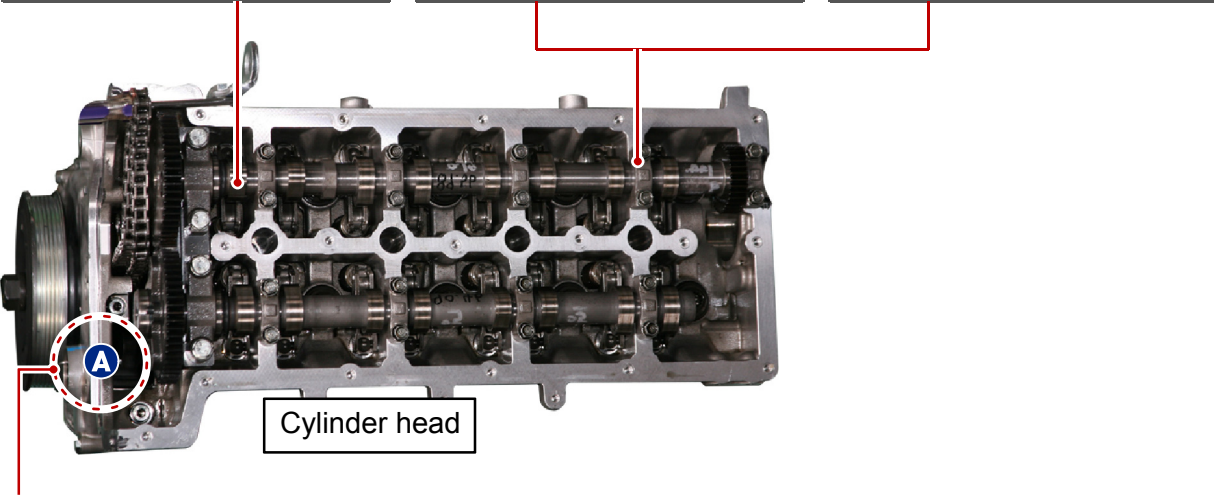


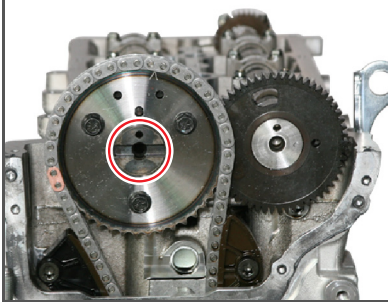
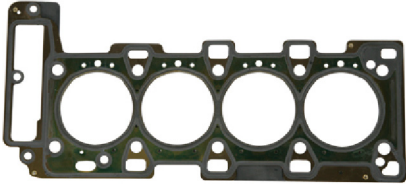
E-EGR
SYSTEM

CDPF
SYSTEM

ENGINE
CONTRO

Modification basis	
Application basis	
Affected VIN	

► Components

<p>Finger follower & HLA</p> 	<p>Intake/exhaust Camshafts</p> 	<p>Camshaft sprocket</p> 
 <p style="text-align: center;">Cylinder head</p>		
<p>Camshaft position sensor</p> 	<p>HP pump drive gear</p> 	<p>Vacuum pump drive</p> 
<p>Cylinder head gasket</p> 		

Modification basis	
Application basis	
Affected VIN	