

Document Title: <b>Engine, description</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2014/3/30</b>
Profile: <b>CEX, EW60C [GB]</b>			

## Engine, description

### D3.4D Engine

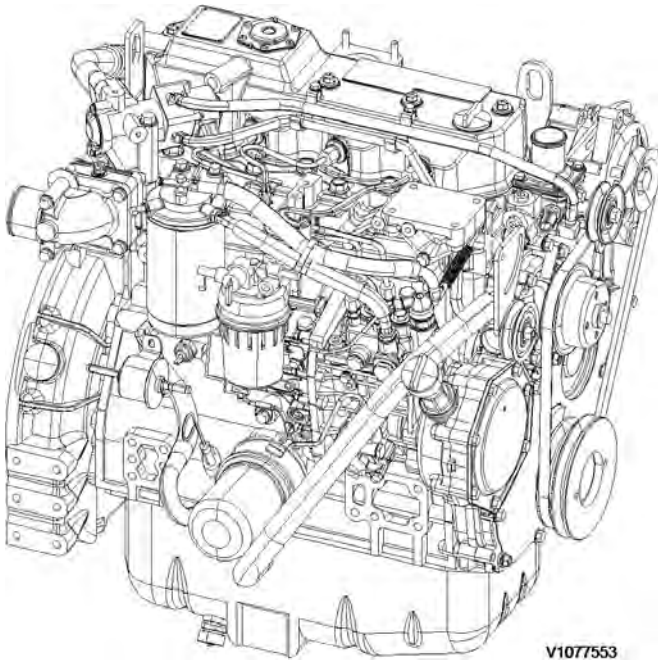
The D3.4D configuration is a four stroke, straight four cylinder, direct injected, water cooled diesel engine.

The engine produces powerful performance using direct injection type combustion chamber.

The valve mechanism receives its movement from the camshaft via rods and rocker arms. Turning direction is counter-clockwise seen from the flywheel. Firing order is 1-3-4-2 and the first cylinder is on the flywheel side.

The lubrication system consists of forced lubrication with trochoid pump.

The cooling of the engine is performed by a high capacity radiator and a hydraulic oil cooler.



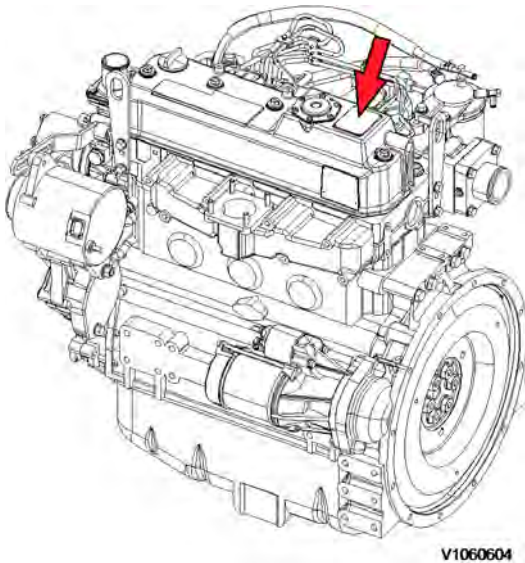
**Figure 1**  
**Engine, D3.4D**

Document Title: <b>Engine, identification</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2014/3/30</b>
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## Engine, identification

### Identification plate

The engine model, serial number and performance data are stamped on an identification plate which is attached on the cylinder head cover. The engine model designation and serial number must be indicated when ordering spare parts.



**Figure 1**  
**Engine identification**

Document Title: <b>Engine, tightening torque</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2014/3/30</b>
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## Engine, tightening torque

Tightening torque, unit: Nm (lbf ft)

Item	Nominal size	Tighten torque	Lubricating oil application (thread portion, and seat surface)
Cylinder head screw	M 11 × 1.25	103.1 ~ 112.9 (76 ~ 83)	Applied
Connecting rod screw	M10 × 1.0	53.9 ~ 58.8 (40 ~ 43)	Applied
Flywheel set screw	M14 × 1.5	186.2 ~ 205.8 (137 ~ 152)	Applied
Bearing cap set screw	M 11 × 1.25	108.1 ~ 117.9 (80 ~ 87)	Applied
Crankshaft pulley set screw	M14 × 1.5	107.9 ~ 127.5 (80 ~ 94)	Applied
Fuel injection nozzle set screw	M 8 × 1.25	22.6 ~ 28.4 (17 ~ 21)	Not applied
Fuel feed pump drive gear set nut	M 18 × 1.5	113 ~ 123 (83 ~ 90)	Not applied
High-pressure fuel lines screw	M 12 × 1.5	19.6 ~ 24.5 (174 ~ 217)	Not applied
Fuel return pipe joint screw	M 6 × 1.0	7.8 ~ 9.8 (70 ~ 86)	Not applied

Tightening torque for standard screws and nuts, unit: Nm (lbf ft)

Item	Nominal size	Tighten torque	Lubricating oil application (thread portion, and seat surface)
Screw (7T) and nut	M 6 × 1.0	9.8 ~ 11.8 (7 ~ 9)	<ul style="list-style-type: none"> <li>Use 80% of the value at left when the tightening part is aluminium.</li> <li>Use 60% of the value at left for 4T screws and lock nuts.</li> </ul>
	M 8 × 1.25	22.6 ~ 28.4 (17 ~ 21)	
	M 10 × 1.5	44.1 ~ 53.9 (33 ~ 40)	
	M 12 × 1.75	78.4 ~ 98 (58 ~ 72)	
	M 14 × 1.5	127.5 ~ 147.1 (94 ~ 108)	
	M 16 × 1.5	215.7 ~ 235.4 (157 ~ 174)	
PT plug	1/8	9.8 (7)	
	1/4	19.6 (14)	
	3/8	29.4 (22)	
	1/2	58.5 (43)	
Pipe joint screw	M 8	12.7 ~ 16.7 (9 ~ 12)	
	M 10	19.6 ~ 25.5 (14 ~ 19)	
	M 12	24.5 ~ 34.3 (18 ~ 25)	
	M 14	39.2 ~ 49 (29 ~ 36)	
	M 16	49 ~ 58.8 (36 ~ 43)	

### NOTE!

Lubricating oil is not applied to threaded portion and seat surface.

Document Title: <b>Precautions</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2014/3/30</b>
Profile: <b>CEX, EW60C [GB]</b>			

## Precautions

Make preparation as follows before starting engine inspection and service.



**Risk of personal injury. Very heavy object.**

**Be sure to fix the engine securely to prevent injury or damage due to parts falling during the work.**



**Risk of personal injury! Wear safety glasses and use protective gloves.**

**Always wear glasses or a protective face shield when using compressed air or steam to prevent any foreign matter from getting into the eyes.**

- Fix the engine on a horizontal base.
- Remove the coolant hoses, fuel oil pipes, wire harness, control wires etc. connecting the driven machine and engine, and drain coolant, lubricating oil and fuel.
- Remove soil, oil, dust, etc. from the engine by washing with solvent, air, steam, etc. Carefully operate so as not to let any foreign matter enter the engine.
- Any part which is found defective as a result of inspection or any part whose measured value does not satisfy the standard or limit shall be replaced.
- Any part predicted to dissatisfy the standard or limit before the next service as estimated from the state of use should be replaced even when the measured value then satisfies the standard or limit.

Document Title: <b>Maintenance standards</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2014/3/30</b>
Profile: <b>CEX, EW60C [GB]</b>			

## Maintenance standards

### Engine service standard

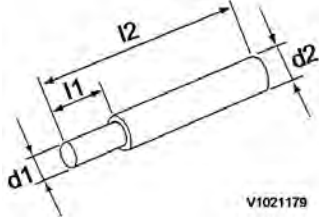
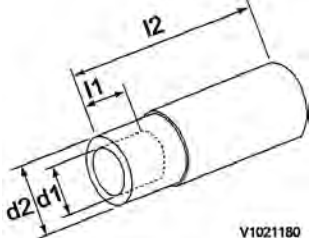
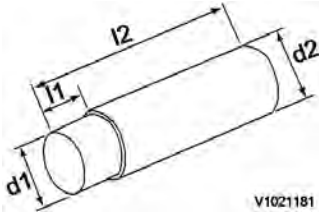
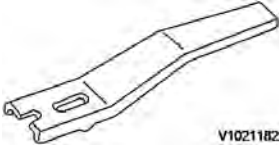
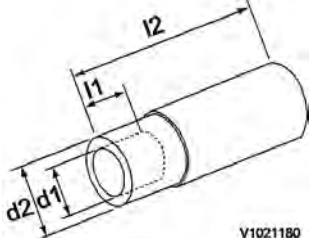
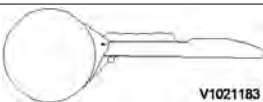
Inspection item	Unit	Standard	Limit
Intake / Exhaust Valve Clearance	mm (inch)	0.15 ~ 0.25 (0.006 ~ 0.010)	
Fuel injection pressure	MPa (kgf/cm <sup>2</sup> ) (psi) (bar)	21.6 ~ 22.6 (220 ~ 230) (3129 ~ 3271) (21.6 ~ 225.6)	
Compression at 250 rpm	MPa (kgf/cm <sup>2</sup> ) (psi) (bar)	3.43 ±0.09 (35 ±1) (498 ±14) (34.3 ±0.98)	2.74 ±0.09 (28 ±1) (398.2 ±14.2) (27.4 ±0.98)
Coolant capacity (engine only)	Liters (US gal)	4.2 (1.1)	
Lubricating oil capacity (oil pan)	High	11.6 (3)	
	Low	5.2 (1.4)	
Oil pressure switch operating pressure	MPa (kgf/cm <sup>2</sup> ) (psi)	0.04 ~ 0.06 (0.4 ~ 0.6) (5.8 ~ 8.8)	
Thermostat	Valve opening temperature	°C (°F)	82 (179.6)
	Full opening lift (temperature)	mm (inch) / °C (°F)	8 (0.32) or more / 95 (203)
Coolant Temperature Switch	°C (°F)	107 ~ 113 (225 ~ 235)	

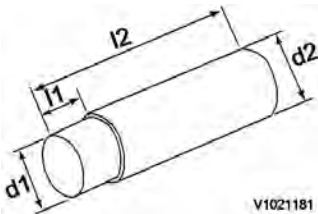



Document Title: <b>Special tools</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2014/3/30</b>
Profile: <b>CEX, EW60C [GB]</b>			

## Special tools

### Special tools
















### Special tools

Tool name	Applicable model and tool size	Illustration
Valve guide tool (for extracting valve guide)	Part number: 14527850 Drift  <ul style="list-style-type: none"> <li>○ l1 : 20 mm (0.787 in)</li> <li>○ l2 : 75 mm (2.953 in)</li> <li>○ d1 : 6.5 mm (0.256 in)</li> <li>○ d2 : 10 mm (0.394 in)</li> </ul>	 V1021179
Valve guide tool (for inserting valve guide)	Part number: 14527851 Drift  <ul style="list-style-type: none"> <li>○ l1 : 7 mm (0.276 in)</li> <li>○ l2 : 60 mm (2.362 in)</li> <li>○ d1 : 13 mm (0.512 in)</li> <li>○ d2 : 16 mm (0.630 in)</li> </ul>	 V1021180
Connecting rod bushing replacer (for removal/installation of connecting rod bushing)	Part number: 14527852 Drift  <ul style="list-style-type: none"> <li>○ l1 : 20 mm (0.787 in)</li> <li>○ l2 : 100 mm (3.937 in)</li> <li>○ d1 : 30 mm (1.181 in)</li> <li>○ d2 : 33 -0.3/-0.6 mm (1.299 -0.012/-0.024 in)</li> </ul>	 V1021181
Valve spring compressor (for removal/installation of valve spring)	Part number: 8931-00060 Press tool	 V1021182
Stem seal inserter (for inserting stem seal)	Part number: 14527853 Drift  <ul style="list-style-type: none"> <li>○ l1 : 11.8 mm (0.465 in)</li> <li>○ l2 : 65 mm (2.559 in)</li> <li>○ l3 : 4 mm (0.157 in)</li> <li>○ d1 : 15.2 mm (0.598 in)</li> <li>○ d2 : 21 mm (0.827 in)</li> <li>○ d3 : 12 mm (0.472 in)</li> </ul>	 V1021180
Filter wrench (for removal/installation of lubrication oil filter)	Available on the market	 V1021183

Camshaft bushing tool (for removing camshaft bushing)	Part number: 8931-00080 Installation tool <ul style="list-style-type: none"> <li>○ l1 : 18 mm (0.709 in)</li> <li>○ l2 : 70 mm (2.756 in)</li> <li>○ d1 : 50 -0.3/-0.6 mm (1.967 -0.012/-0.024 in)</li> <li>○ d2 : 53-0.3/-0.6 mm (2.087 -0.012/-0.024 in)</li> </ul>	
Flex-hone (for re-honing of cylinder liner)	<ul style="list-style-type: none"> <li>○ Applicable bore : 89 ~ 101 mm (3.504 ~ 3.976 in)</li> </ul>	
Piston insertion tool (for inserting piston)	The above piston insertion tool is applicable to 60 ~ 125 mm (2.362 ~ 4.921 in) diameter piston.	
Piston ring replacer (for removal/installation of piston ring)	Available on the market	

### Measuring tools

### Measuring tools

Instrument name	Application	Illustration
Dial gauge	Measurements of shaft bending, strain and gap of surface	
Test indicator	Measurements of narrow or deep portions that cannot be measured by dial gauge.	
Magnetic stand	For holding the dial gauge when measuring using a dial gauge, standing angles adjustable	
Micrometer	For measuring the outside diameter of crankshaft, pistons, piston pins, etc.	
Cylinder gauge	For measuring the side diameters of cylinder liners, rod metal, etc.	
Callipers	For measuring outside diameters, depth, thickness and width	
Depth micrometer	For measuring of valve sink	
Square	For measuring valve spring inclination and straightness of parts	
V-block	For measuring shaft bend	
Torque wrench	For tightening nuts and screws to the specified torque	
Feeler gauge	For measuring gaps between ring and ring groove, and shaft joints during assembly	
Cap tester	For checking water leakage	
Battery/coolant tester	For checking concentration of antifreeze and the battery electrolyte charge status	
Nozzle tester	For measuring injection spray pattern of fuel injection nozzle and injection pressure	
Digital thermometer	For measuring temperature	

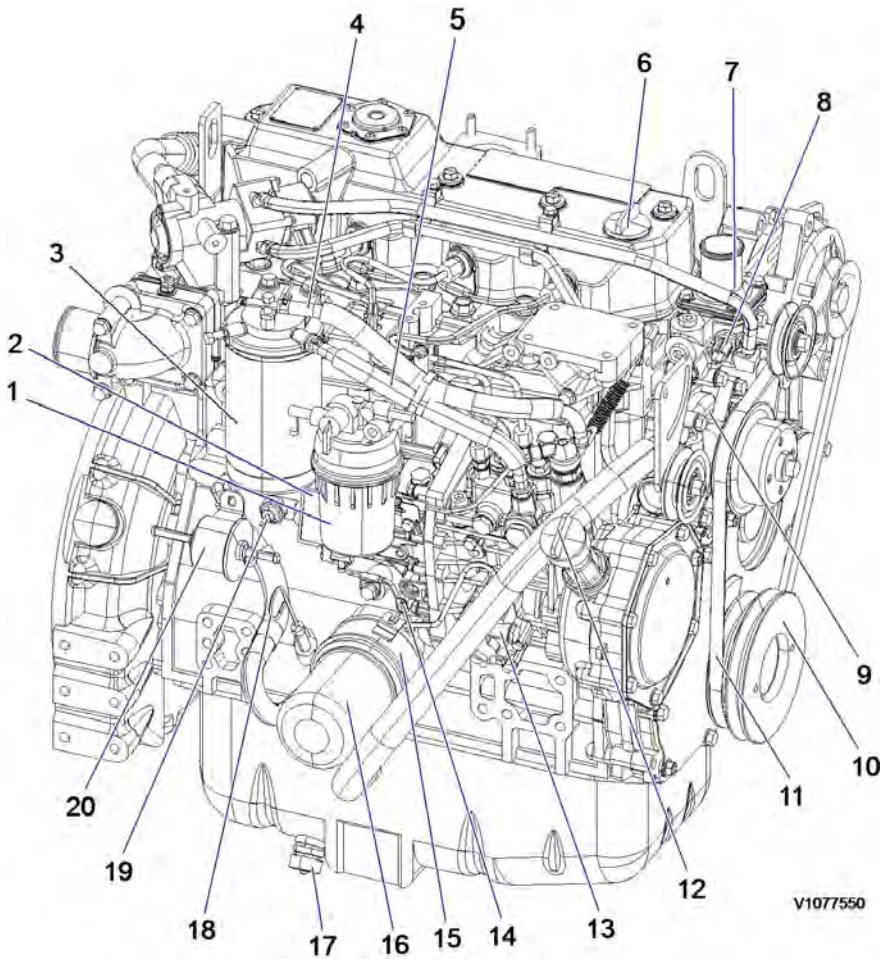
Speedometer (contact type)	For measuring revolution by contacting the mortise in the revolving shaft	1 : Revolving shaft
Speedometer (photoelectric type)	For measuring revolution by sensing the reflecting mark on the outer periphery of the revolving shaft	1 : Revolving shaft 2 : Reflection mark
Circuit tester	For measuring resistance voltage and continuity of electrical circuits	1 : Voltage 2 : Resistance 3 : Continuity
Compression gauge kit	Part number: 14546935 For measuring compression pressure	1 : Gauge 2 : Piston 3 : Ring



Document Title: <b>Component locations</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2014/3/30</b>
Profile: <b>CEX, EW60C [GB]</b>			

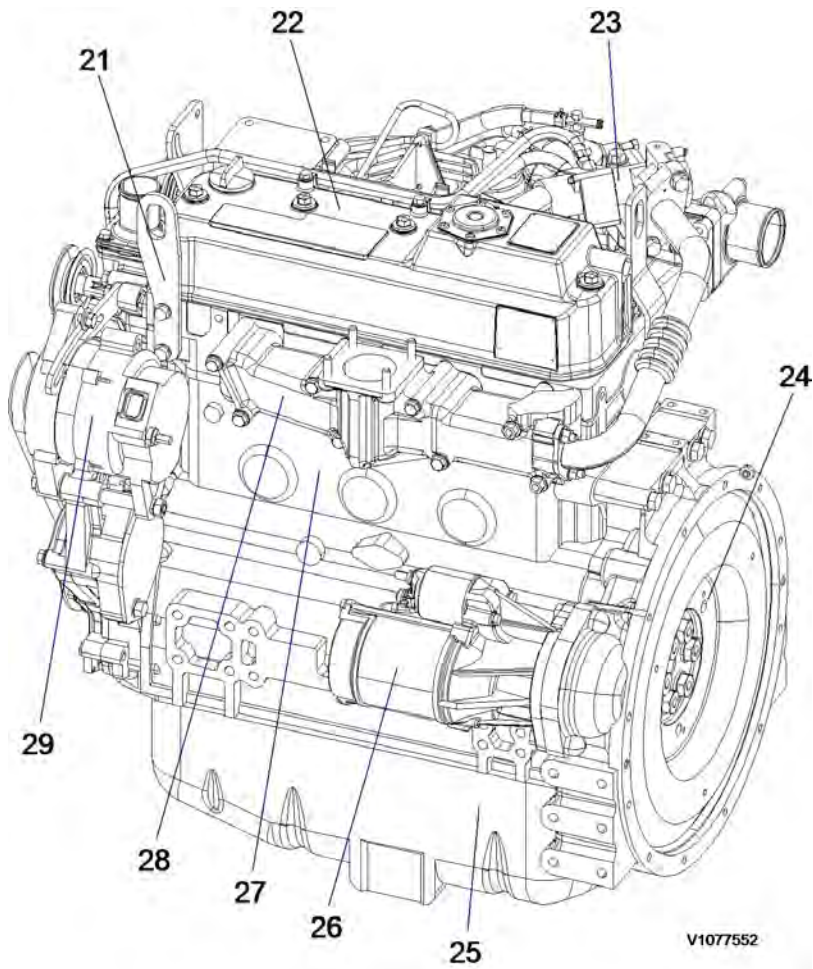
## Component locations

Component position, engine D3.4D. The following figures show the position of a number of components on engine D3.4D.



**Figure 1**  
**Component locations, front side**

1 Water separator	8 Coolant temperature sensor	15 Engine oil cooler
2 Fuel control PWM valve (Governor)	9 Coolant pump	16 Engine oil filter
3 Fuel filter	10 Crankshaft V-pulley	17 Engine oil drain plug
4 Fuel return line	11 V-belt	18 Engine oil dipstick
5 Fuel supply line	12 Side filler port (engine oil)	19 Oil pressure switch
6 Top filler port (engine oil)	13 Fuel injection pump	20 Fuel feed pump
7 Thermostat	14 Speed sensor	



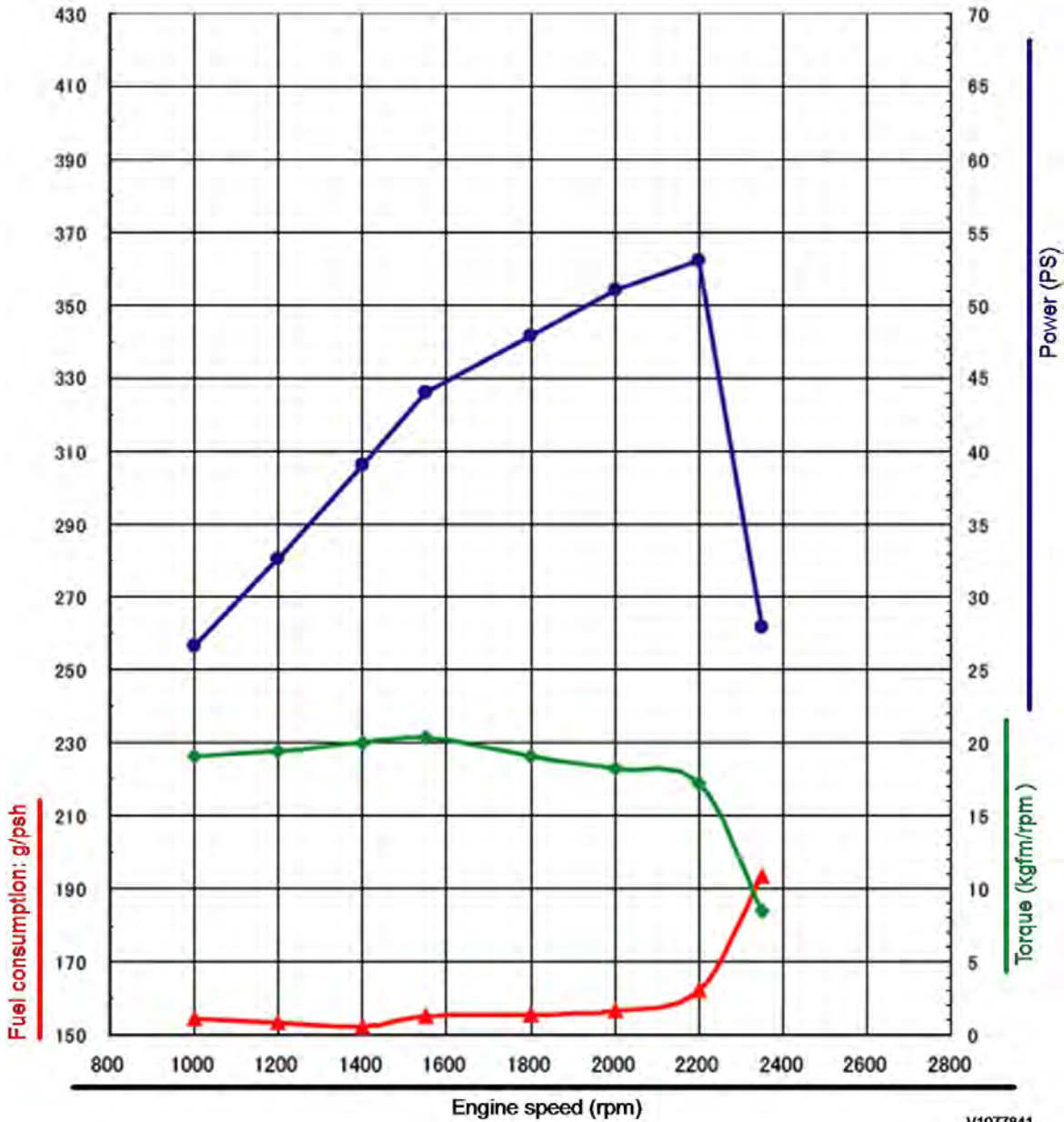
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**Figure 2**  
**Component locations, flywheel side**

21	Lifting bracket	26	Starter motor
22	Rocker arm cover	27	Cylinder block
23	EGR valve	28	Exhaust manifold
24	Flywheel	29	Alternator
25	Oil pan		

Document Title: <b>Engine characteristic curve</b>	Function Group: <b>210</b>	Information Type: <b>Service Information</b>	Date: <b>2014/3/30</b>
Profile: <b>CEX, EW60C [GB]</b>			

**Engine characteristic curve**



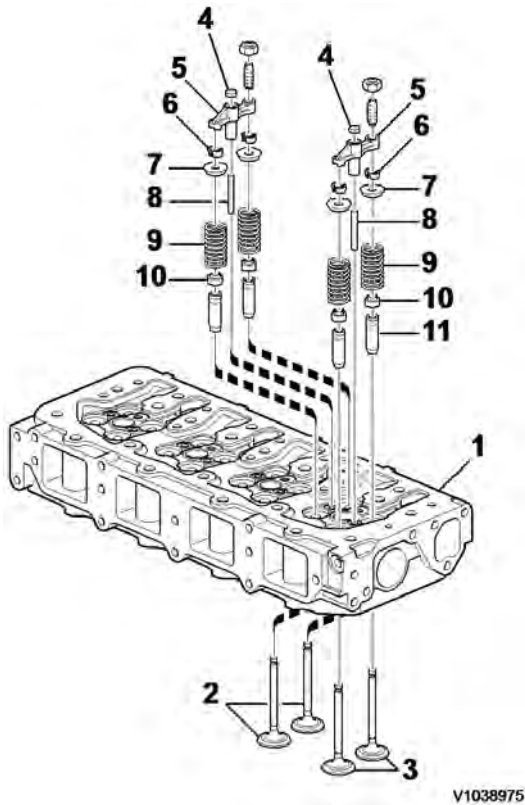
V1077841

**Figure 1**  
Engine characteristic curve (Gross power)

Document Title: <b>Cylinder head, description</b>	Function Group: <b>211</b>	Information Type: <b>Service Information</b>	Date: <b>2014/3/30</b>
Profile: <b>CEX, EW60C [GB]</b>			

## Cylinder head, description

The cylinder head, which covers all cylinders, is a sixteen valve cylinder head. The cylinder head has two inlet valves and two exhaust valves for each cylinder.

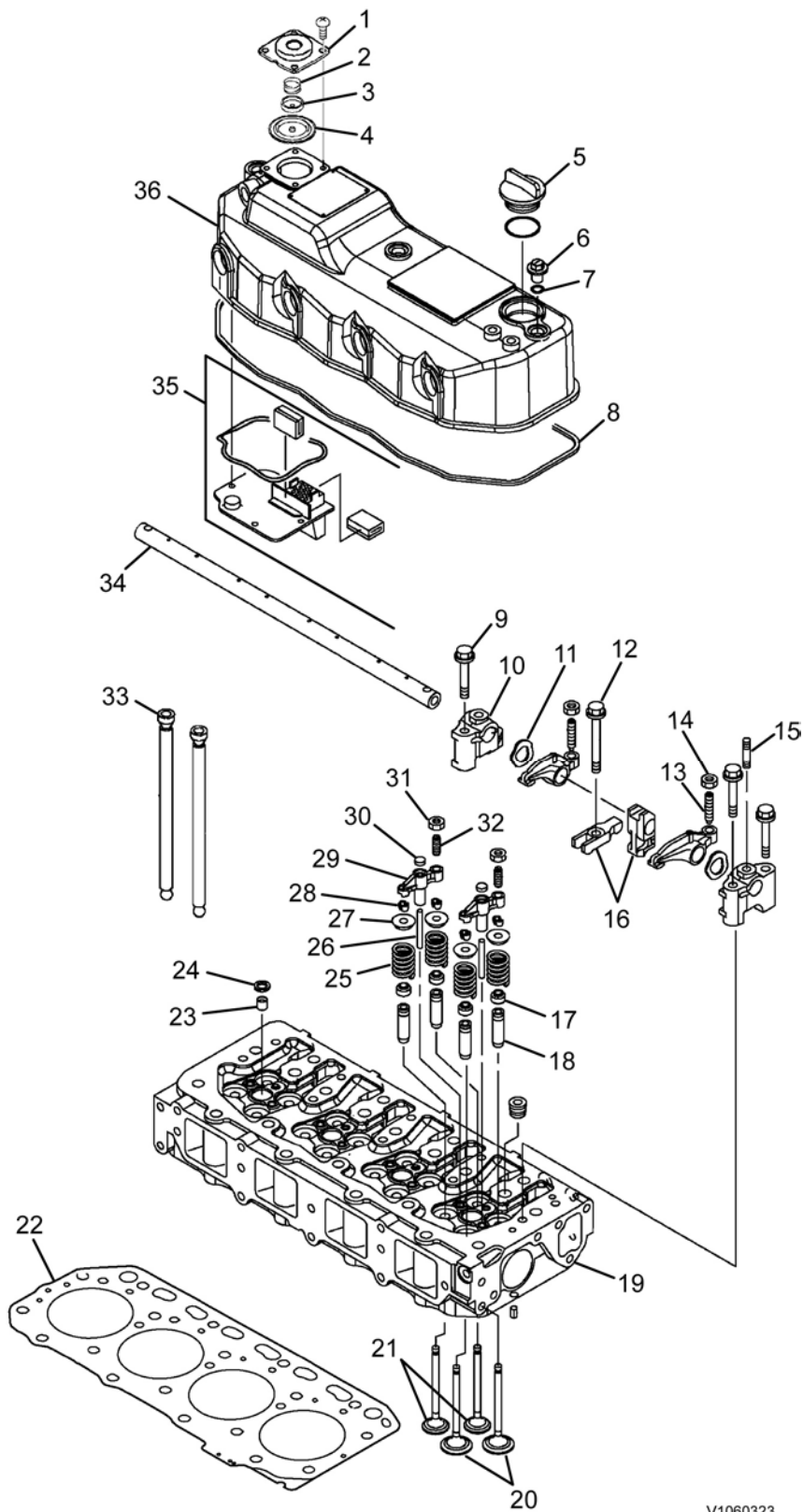


**Figure 1**  
**Cylinder head with valve mechanism**

1.	Cylinder head	7.	Spring guide
2.	Exhaust valve	8.	Guide
3.	Inlet valve	9.	Spring
4.	Plug	10.	Seal
5.	Yoke	11.	Guide
6.	Valve collet		

Document Title: <b>Exploded view, cylinder head</b>	Function Group: <b>211</b>	Information Type: <b>Service Information</b>	Date: <b>2014/3/30</b>
Profile: <b>CEX, EW60C [GB]</b>			

## **Exploded view, cylinder head**



V1060323

**Figure 1**  
**Exploded view, cylinder head**

1	Crankcase breather cover	19	Cylinder head
2	Diaphragm spring	20	Intake valve
3	Diaphragm cup	21	Exhaust valve
4	Crankcase breather diaphragm	22	Cylinder head gasket

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