SERVICE MANUAL

WHEELED EXCAVATOR

JS145W, JS160W, JS175W

EN - 9813/2650 - ISSUE 3 - 08/2016

This manual contains original instructions, verified by the manufacturer (or their authorized representative).

Foreword

The Operator's Manual

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You and others can be killed or seriously injured if you operate or maintain the machine without first studying the Operator's Manual. You must understand and follow the instructions in the Operator's Manual. If you do not understand anything, ask your employer or JCB dealer to explain it.

Do not operate the machine without an Operator's Manual, or if there is anything on the machine you do not understand.

Treat the Operator's Manual as part of the machine. Keep it clean and in good condition. Replace the Operator's Manual immediately if it is lost, damaged or becomes unreadable.

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Introduction

This section contains information about the complete engine assembly. For specific engine technical information refer to the technical data section.

Make sure that the correct engine service tools, consumables and torque figures are used when you perform service procedures.

Renewal of oil seals, gaskets, etc., and any component showing obvious signs of wear or damage is expected as a matter of course.

It is expected that components will be cleaned and lubricated where appropriate, and that any opened hose or pipe connections will be blanked to prevent excessive loss of hydraulic fluid, engine oil and ingress of dirt.

Basic Description

The JCB ecoMax engine is a 4 cylinder diesel engine in which the fuel is ignited by compression ignition. The engine operates on a four stroke cycle.

The engine is started by an electric starter motor. The starter motor turns the engine via a pinion and teeth on the engine flywheel, refer to (PIL 15-75).

When the engine runs the crankshaft drives the camshaft via gears. The camshaft opens and closes the inlet and exhaust valves and via push rods in time with the four stroke cycle. The engine has 16 valves, 2 inlet and 2 exhaust valves for each cylinder.

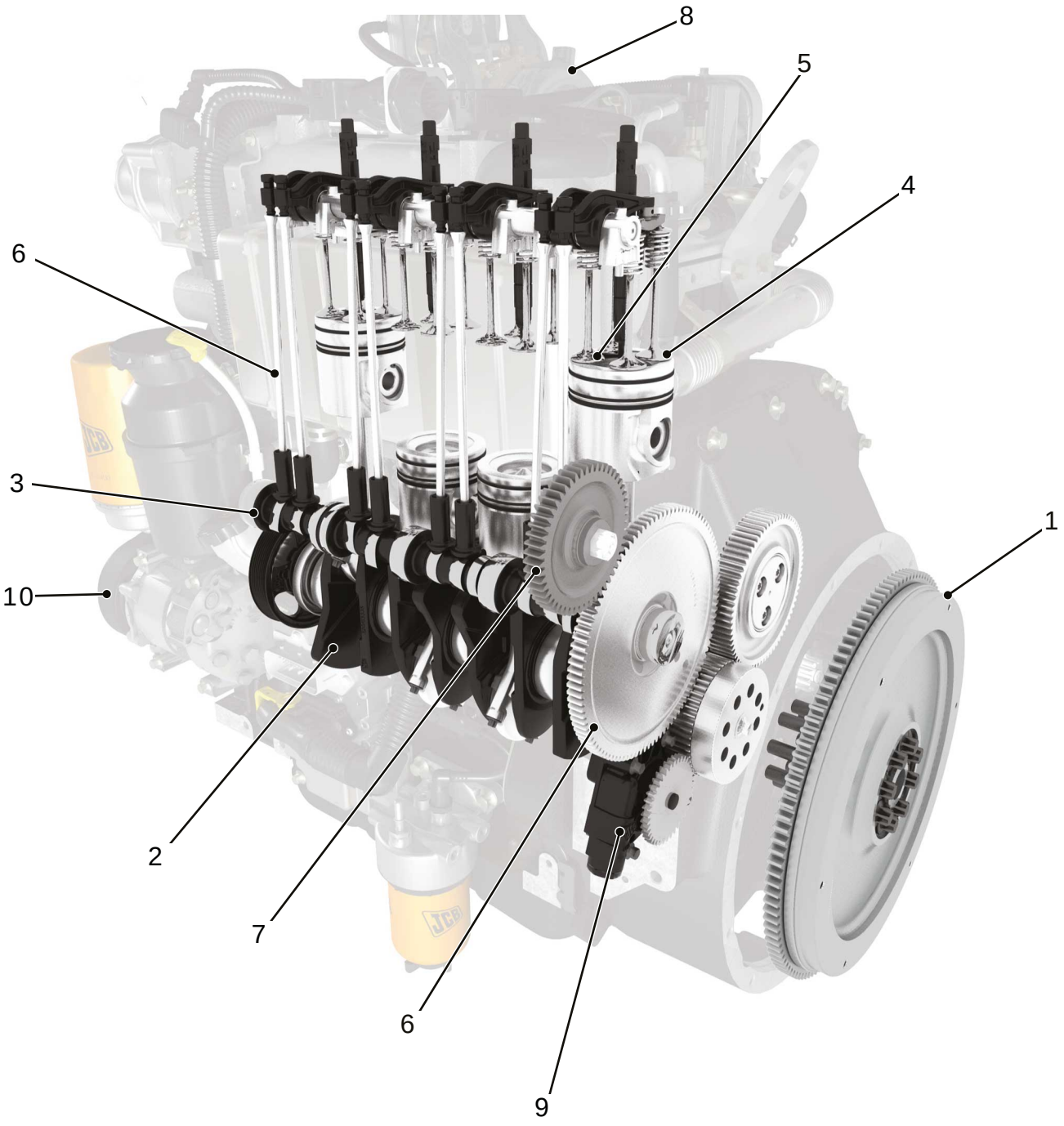
The crankshaft also drives a high pressure fuel pump via gears. The pump is part of the electronically controlled common rail fuel injection system, refer to (PIL 18-00).

Air is drawn into the engine, via the inlet manifold and exhaust gases exit via the exhaust manifold. The engine uses a VGT (Variable Geometry Turbocharger) which pressurises the air at the inlet manifold, refer to (PIL 18-36).

A mechanical lubrication oil pump is driven by the crankshaft via gears. The pump pressurises and circulates oil for engine lubrication and cooling purposes.

A drive belt driven by the crankshaft, drives a coolant circulation pump, alternator, radiator cooling fan and other ancillaries such as an air conditioning compressor.

Figure 91.

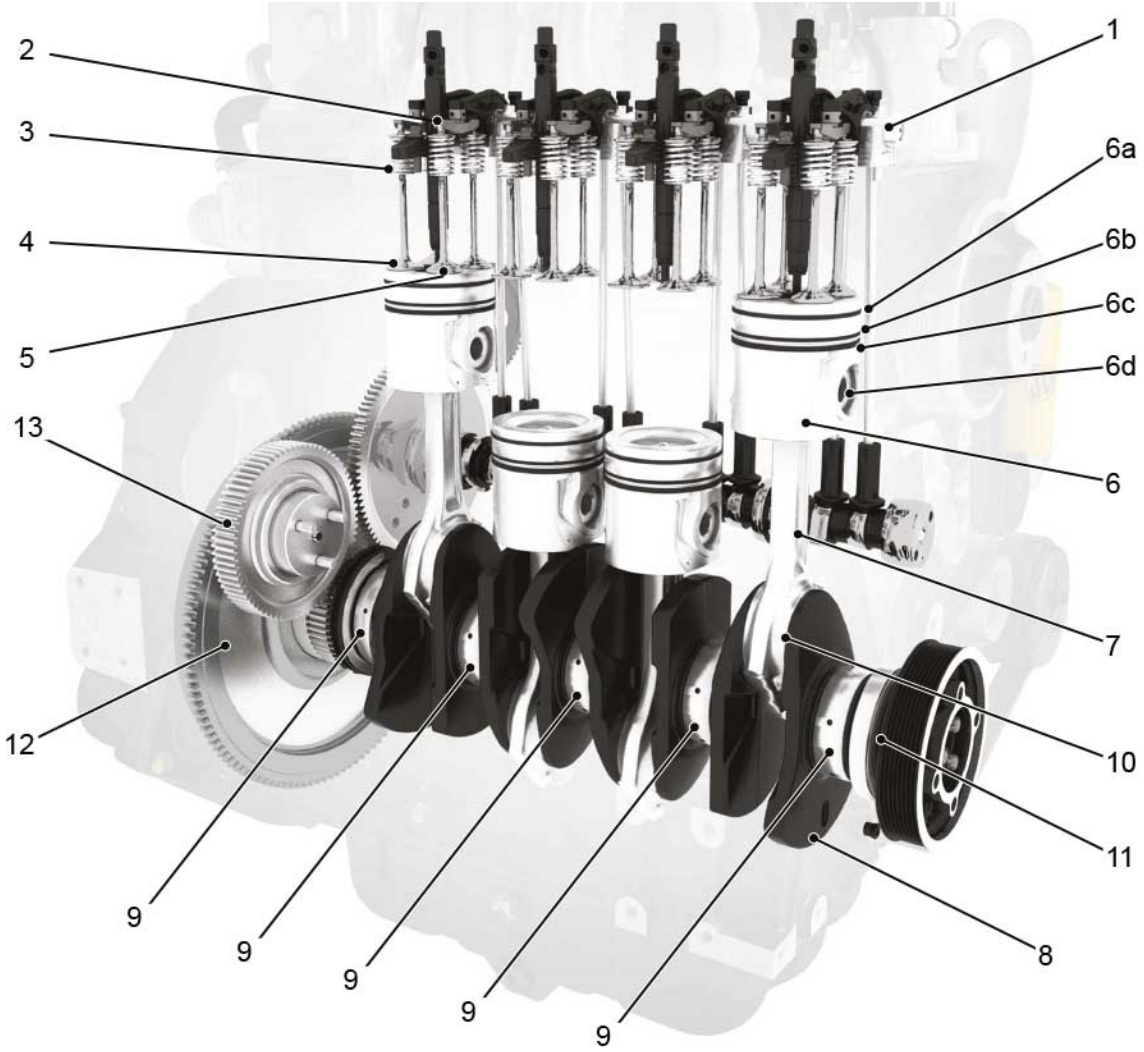


1 Flywheel
2 Crankshaft
3 Camshaft
4 Inlet valves (x8)
5 Exhaust valves (x8)
6 Push rods (x8)
7 High pressure fuel pump drive gear
8 Turbocharger
9 Lubrication oil pump
10 Front end drive belt

Internal

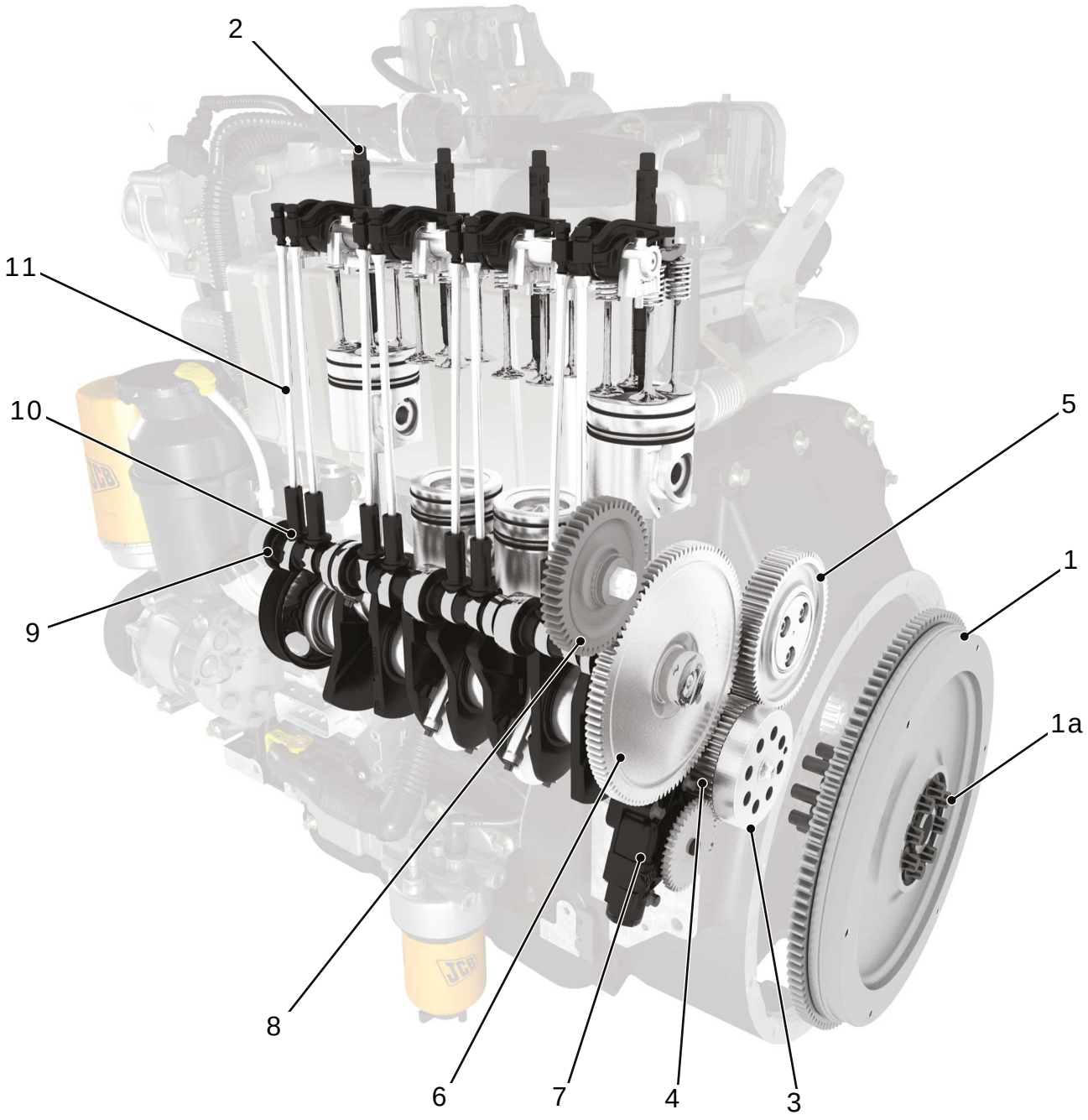
The following identifies the main internal components of a typical engine assembly. Some variants may differ in detail.

Figure 92.



1 Rocker assembly
2 Valve bridge piece (x8)
3 Valve spring (x16)
4 Inlet valve (x8)
5 Exhaust valve (x8)
6 Piston assembly (x4)
6a Piston ring - top compression (x4)
6b Piston ring - 2nd compression (x4)
6c Piston ring - oil control (x4)
6d Gudgeon pin (x4)
7 Connecting rod assembly (x4)
8 Crankshaft
9 Main bearing - crankshaft (x5)
10 Big end bearing - crankshaft / connecting rod (x4)
11 Front crankshaft oil seal
12 Flywheel
13 High duty PTO (Power Take-Off) idler gear (if installed)

Figure 93.



1 Flywheel
2 Fuel injector (atomiser) (x4)
4 Crankshaft drive gear
6 Camshaft drive gear
8 High pressure fuel pump drive gear
10 Tappet (x8)
1A Flywheel - crankshaft fixing bolts (x8)
3 Flywheel hub
5 High duty PTO idler gear (if installed)
7 Lubrication oil pump
9 Camshaft
11 Push rod (x8)

Health and Safety

Hot Components

Touching hot surfaces can burn skin. The engine and machine components will be hot after the unit has been running. Allow the engine and components to cool before servicing the unit.

Turning the Engine

Do not try to turn the engine by pulling the fan or fan belt. This could cause injury or premature component failure.

Notice: *The engine and other components could be damaged by high pressure washing systems. Special precautions must be taken if the machine is to be washed using a high pressure system.Make sure that the alternator, starter motor and any other electrical components are shielded and not directly cleaned by the high pressure cleaning system. Do not aim the water jet directly at bearings, oil seals or the engine air induction system.*

WARNING! *To bleed the injectors you must turn the engine. When the engine is turning, there are parts rotating in the engine compartment.Before starting this job make sure that you have no loose clothing (cuffs, ties etc) which could get caught in rotating parts.When the engine is turning, keep clear of rotating parts.*

Notice: *Clean the engine before you start engine maintenance. Obey the correct procedures. Contamination of the fuel system will cause damage and possible failure of the engine.*

Notice: *Do not exceed the correct level of engine oil in the sump. If there is too much engine oil, the excess must be drained to the correct level. An excess of engine oil could cause the engine speed to increase rapidly without control.*

WARNING! *The engine has exposed rotating parts. Switch off the engine before working in the engine compartment. Do not use the machine with the engine cover open.*

WARNING! *Hot oil and engine components can burn you. Make sure the engine is cool before doing this job.Used engine crankcase lubricants contain harmful contaminants. In laboratory tests it was shown that used engine oils can cause skin cancer.*

Notice: *A drive belt that is loose can cause damage to itself and/or other engine parts.*

WARNING! *Do not open the high pressure fuel system with the engine running. Engine operation causes high fuel pressure. High pressure fuel spray can cause serious injury or death.*

CAUTION! *It is illegal to pollute drains, sewers or the ground. Clean up all spilt fluids and/or lubricants.Used fluids and/or lubricants, filters and contaminated materials must be disposed of in accordance with local regulations. Use authorised waste disposal sites.*

Technical Data

Table 31.

Description	SL Engine	SH Engine	DH Engine
Engine Variants	Turbocharged with inter-cooler	Turbocharged with Inter-cooler	Turbocharged with Inter-cooler
Emission compliance	US-EPA Tier 4 Final, EU Stage IV	US-EPA Tier 4i, EU Stage IIIB	US-EPA Tier 4i, EU Stage IIIB
Rated speed	2200 RPM (Revolutions Per Minute)	2200 RPM	2200 RPM (108kW), 2050 RPM (129kW)
Weight (Dry)	(Dry weight-No cooling fan drive) 496kg	(Dry weight-No cooling fan drive) 496kg	(Dry weight-No cooling fan drive) 496kg
Number of cylinders	4	4	4
Nominal bore size	103mm	103mm	106mm
Stroke	132mm	132mm	135mm
Cylinder arrangement	In line	In line	In line
Combustion Cycle	4-stroke	4-stroke	4-stroke
Firing order	1-3-4-2	1-3-4-2	1-3-4-2
Displacement	4.399L	4.399L	4.765L
Compression ratio	16.7: 1	16.7: 1	16.7: 1
Engine Compression	Compression variance between each cylinder should be no greater than 3.5bar (50.7psi)	Compression variance between each cylinder should be no greater than 3.5bar (50.7psi)	Compression variance between each cylinder should be no greater than 3.5bar (50.7psi)
Direction of rotation (viewed from front {crank-shaft pulley} end)	Clockwise	Clockwise	Clockwise
Valves	4 per cylinder	4 per cylinder	4 per cylinder
Valve clearances mea-sured at the tappet end of the rockers (measured cold)			
- Inlet	0.23–0.04mm	0.23–0.04mm	0.23–0.04mm
- Exhaust	0.6–0.04mm	0.6–0.04mm	0.6–0.04mm
Lubricating oil pressure (Dependent on engine temperature and speed)	1.6–6.5bar (23.2–94.2psi)	1.6–6.5bar (23.2–94.2psi)	1.6–6.5bar (23.2–94.2psi)
Filter type	Screw-on canister (with drain facility)	Screw-on canister (with drain facility)	Screw-on canister (with drain facility)
Pressure to open by-pass valve	-	1.6bar (23.2psi)	1.6bar (23.2psi)
Oil pressure relief valve setting	6bar (87.0psi)	6bar (87.0psi)	6bar (87.0psi)
Oil pressure switch set-ting	0.6bar (8.7psi) falling	0.6bar (8.7psi) falling	0.6bar (8.7psi) falling
Oil pump[(1)]	Integral unit with relief valve	Integral unit with relief valve	Integral unit with relief valve

Description	SL Engine	SH Engine	DH Engine
Combustion system	Common rail direct Injection	Common rail direct Injection	Common rail direct Injection
High pressure fuel pump	High pressure with electronically controlled fuel metering	High pressure with electronically controlled fuel metering	High pressure with electronically controlled fuel metering

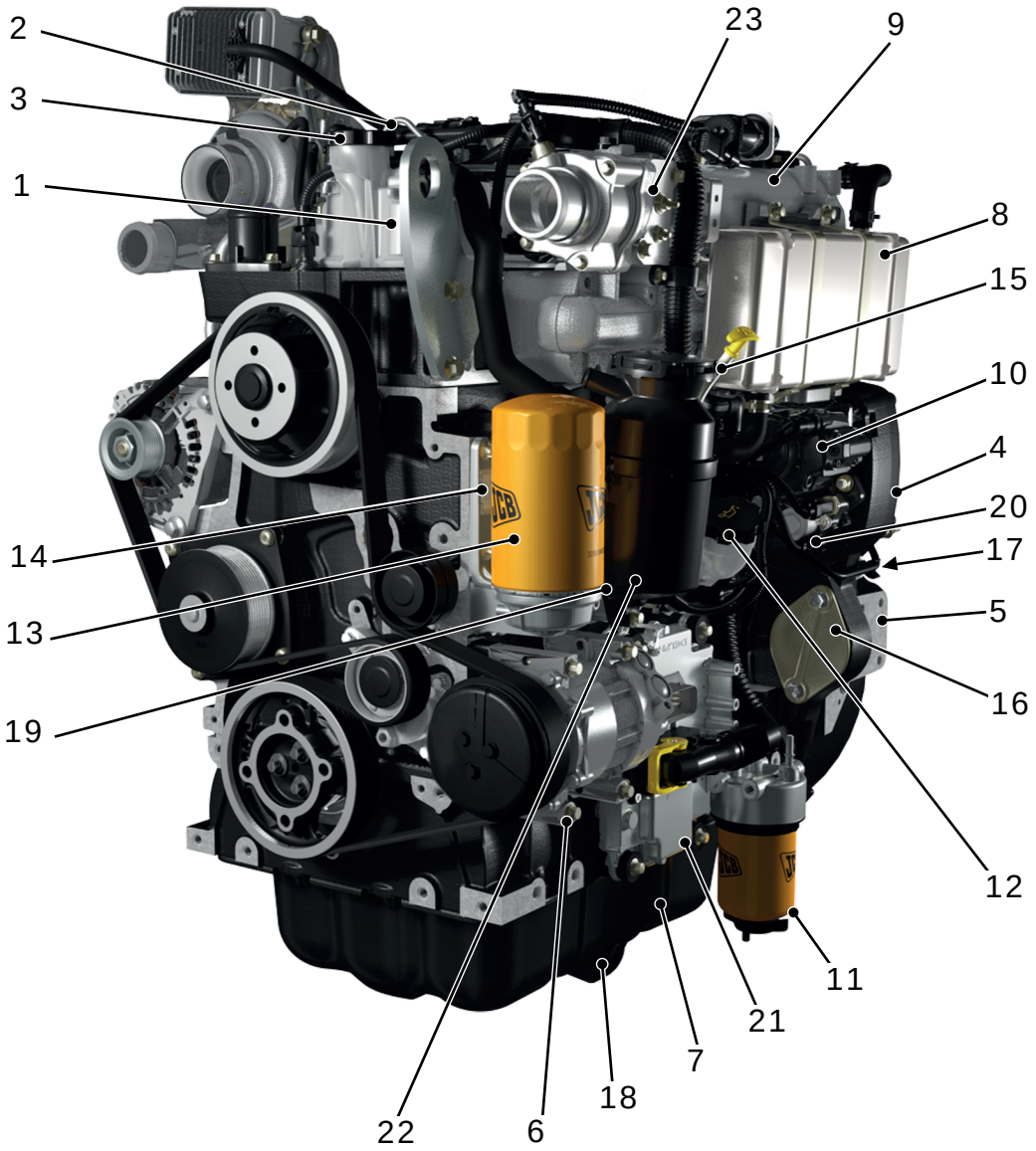
(1) The oil pump is a non-serviceable part

Component Identification

External

The following identifies the main components of a typical engine assembly visible from the exterior. Some variants may differ in detail.

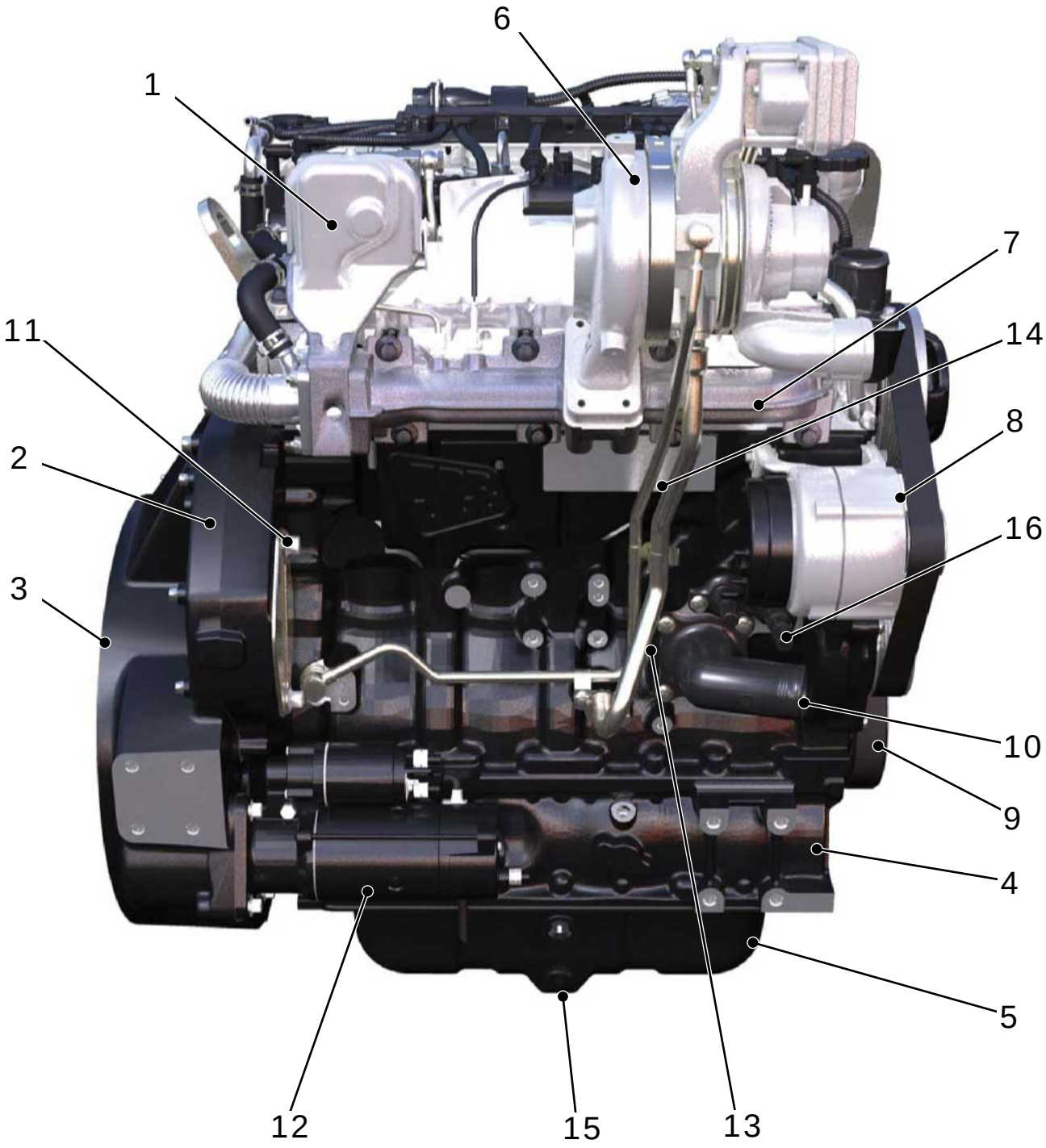
Figure 94. Left hand Side



1 Rocker cover
2 Fuel injectors and high pressure fuel pipes
3 Lubrication oil filler cap
4 Timing gear case
5 Flywheel housing
6 Bedplate
7 Lubrication oil sump
8 EGR (Exhaust Gas Recirculation) cooler
9 Air inlet manifold
10 High pressure fuel pump
11 Fuel filter
12 Lubrication oil filler cap
13 Lubrication oil filter
14 Lubrication oil cooler housing

15 Lubrication oil dipstick
16 Low duty PTO (Power Take-Off) (blanking cover if no device is installed)
17 Low pressure fuel pipe (to tank)
18 Oil drain plug (sump)
19 Oil filter housing drain plug
20 IMV (Inlet Metering Valve)
21 ECM (Engine Control Module)
22 Crankcase ventilation filter assembly
23 Inlet manifold induction heater

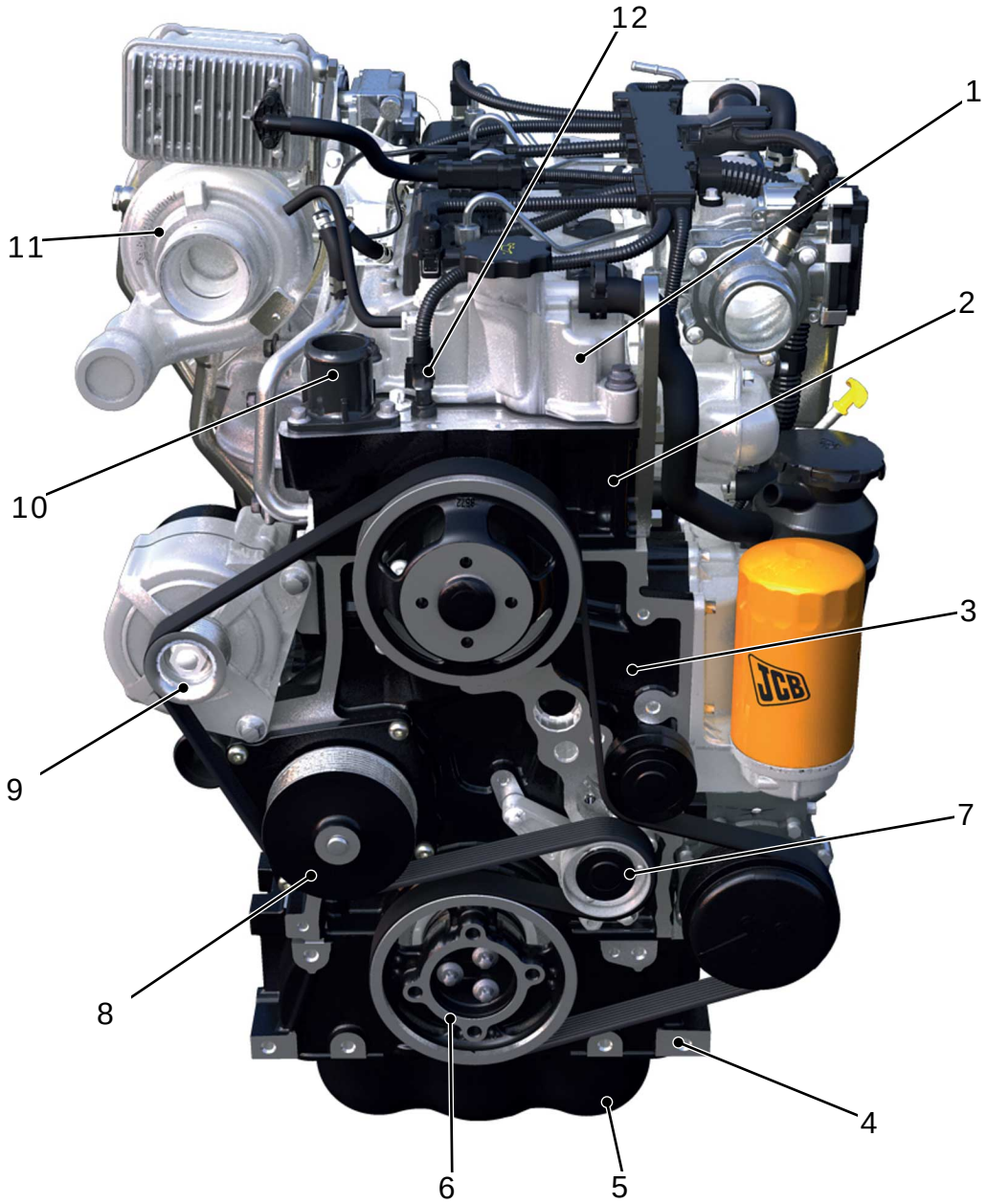
Figure 95. Right Hand Side



1 EGR valve heatshield
2 Timing gear case
3 Flywheel housing
4 Bedplate
5 Lubrication oil sump
6 VGT (Variable Geometry Turbocharger)

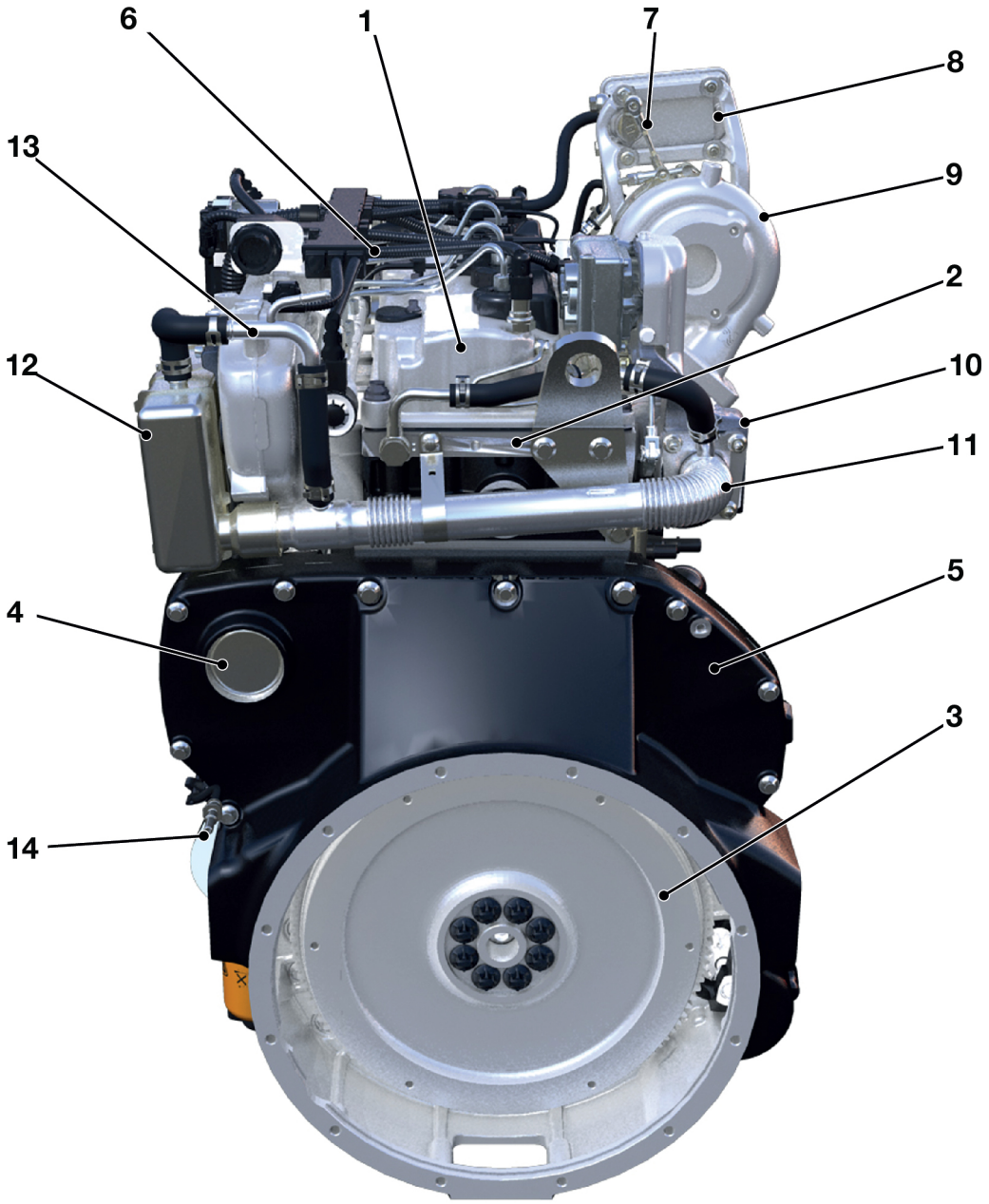
7 Exhaust manifold
8 Alternator
9 Coolant pump housing (crankcase)
10 Coolant inlet/radiator hose connector
11 Heavy duty PTO (blanking cover if no device is installed)
12 Starter motor assembly
13 Turbocharger oil drain pipe
14 Turbocharger oil feed pipe
15 Oil drain plug (sump)
16 Cab heater connections

Figure 96. Front End



1 Rocker cover
2 Cylinder head
3 Crankcase
4 Bedplate
5 Lubrication oil sump
6 Crankshaft pulley
7 FEAD tensioner
8 Coolant pump and drive pulley assembly
9 Alternator and drive pulley assembly
10 Coolant thermostat housing/radiator hose connector
11 VGT
12 Coolant temperature sensor

Figure 97. Rear End



1 Rocker cover
2 Cylinder head
3 Flywheel
4 High pressure fuel pump drive gear cover
5 Flywheel housing
6 Engine electrical harness
7 VGT linkage
8 VGT actuator
9 Turbocharger
10 EGR valve
11 EGR co-axial cooler
12 EGR plate cooler
13 EGR water cooler pipe
14 Low pressure return pipe to tank

Operation

The Four Stroke Cycle - 4 Cylinder Engine

This section describes the cycle sequence, for the 4 cylinder engine.

With the crankshaft positioned as shown, the pistons in numbers 1 and 4 cylinders are at top dead centre and pistons in numbers 2 and 3 cylinders are at bottom dead centre.

It is important to note that number 1 cylinder is firing and about to start its power stroke. Rotating the crankshaft a further full rotation would position the pistons as described but the engine would be at a different stage in its four stroke cycle, with number 1 cylinder about to start its Induction stroke.

The stages in the four stroke cycle for each cylinder are as follows:

Table 32. The Four Stroke Cycle

Stage number	Piston operation	Valve operation
1	The piston is at the top of its Compression stroke and is about to start its Power stroke.	Inlet and exhaust valves closed
2	The piston is at the bottom of its Power stroke and is about to start its Exhaust stroke.	Inlet valves closed, exhaust valves about to open
3	The piston is at the bottom of its Induction stroke and is about to start its Compression stroke.	Exhaust valves closed, inlet valves about to close
4	The piston is at the top of its Exhaust stroke and is about to start its Induction stroke.	Valve Operation Exhaust valves about to close, inlet valves about to open

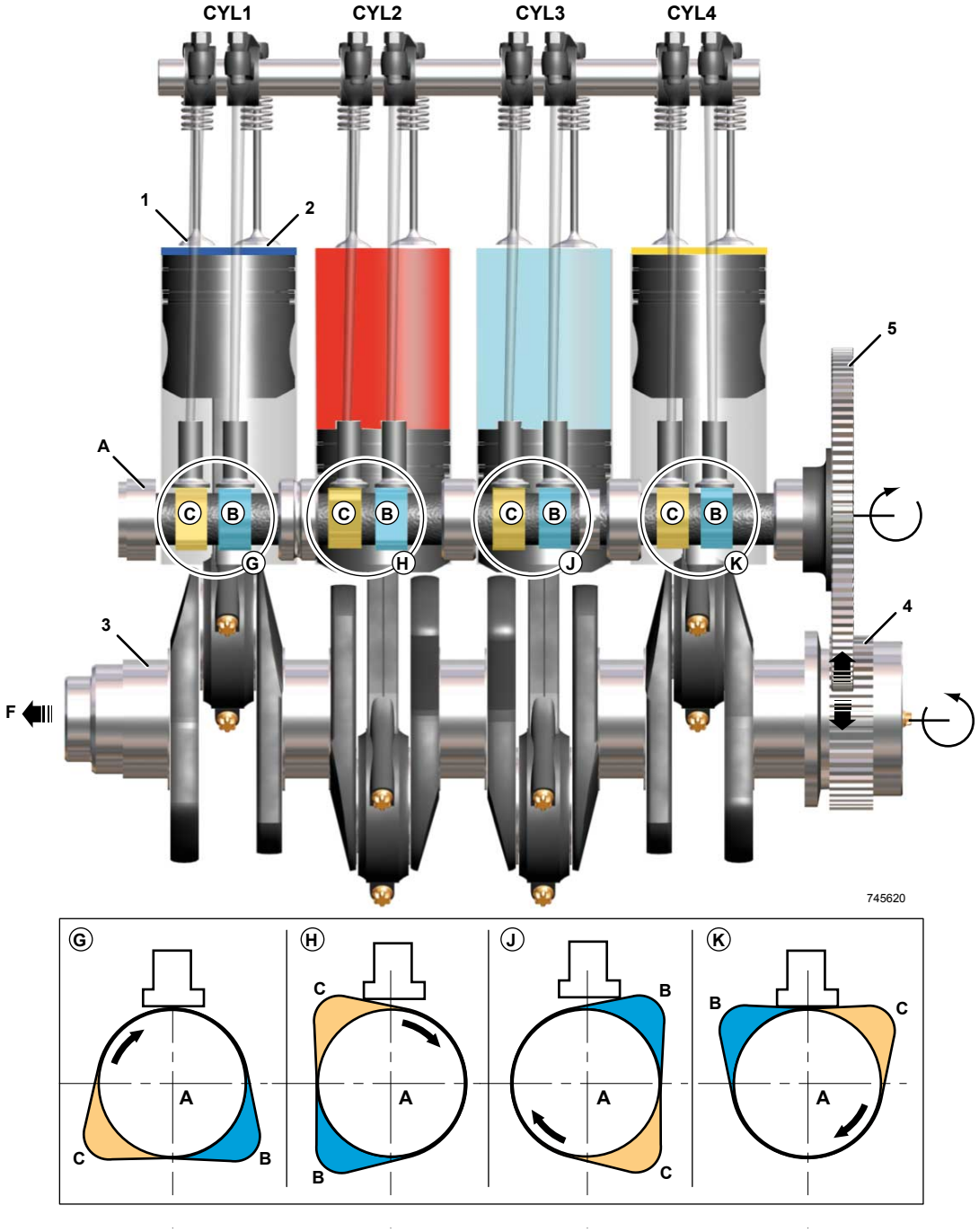
Firing Order

A cylinder is said to be firing, when the fuel / air mixture ignites and the piston is about to start its power stroke.

From the stages described, it can be seen that number 1 cylinder will be next to fire. Number 3 cylinder is starting its compression stroke and is next in the cycle, followed by cylinders 4 and 2.

The firing order is therefore; 1, 3, 4, 2.

Figure 98.



CYL1 Cylinder number 1
CYL2 Cylinder number 2
CYL3 Cylinder number 3
CYL4 Cylinder number 4
A Camshaft
B Camshaft lobe - Inlet valve operation
C Camshaft lobe - Exhaust valve operation
F Front of engine
1 Exhaust valves
2 Inlet valves
3 Crankshaft
4 Crankshaft gear
5 Camshaft drive gear

Our support email:

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