Dear JCB Customer

Even if you have operated this type of equipment before, it is very important that your new machines operations and functions are explained to you by a JCB Dealer Representative following delivery of your new machine.

Following the installation you will know how to gain maximum productivity and performance from your new product.

Please contact your local JCB dealer if the Installation Form has not yet been completed with you.

Your Local JCB Dealer is:

OPERATOR MANUAL

THIS MANUAL SHOULD ALWAYS STAY WITH THE MACHINE

JCB ECOMAX ENGINE: T4I (68-129KW) T4 ENGINE (55KW)

ENGLISH - 9821/2950 - ISSUE 3 - NOVEMBER 2013

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Care and Safety

Important Information

T1-042

The Operator Manual

⚠ WARNING

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

INT-1-4-2

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

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

Safety Warnings



This safety alert system identifies important safety messages in this manual. When you see this symbol, be alert, your safety is involved, carefully read the message that follows, and inform other operators.

In this publication and on the machine, there are safety notices. Each notice starts with a signal word. The signal word meanings are given below.

⚠ DANGER

Denotes an extreme hazard exists. If proper precautions are not taken, it is highly probable that the operator (or others) could be killed or seriously injured.

INT-1-2-1

⚠ WARNING

Denotes a hazard exists. If proper precautions are not taken, the operator (or others) could be killed or seriously injured.

INT-1-2-2

⚠ CAUTION

Denotes a reminder of safety practices. Failure to follow these safety practices could result in injury to the operator (or others) and possible damage to the machine.

INT-1-2-3

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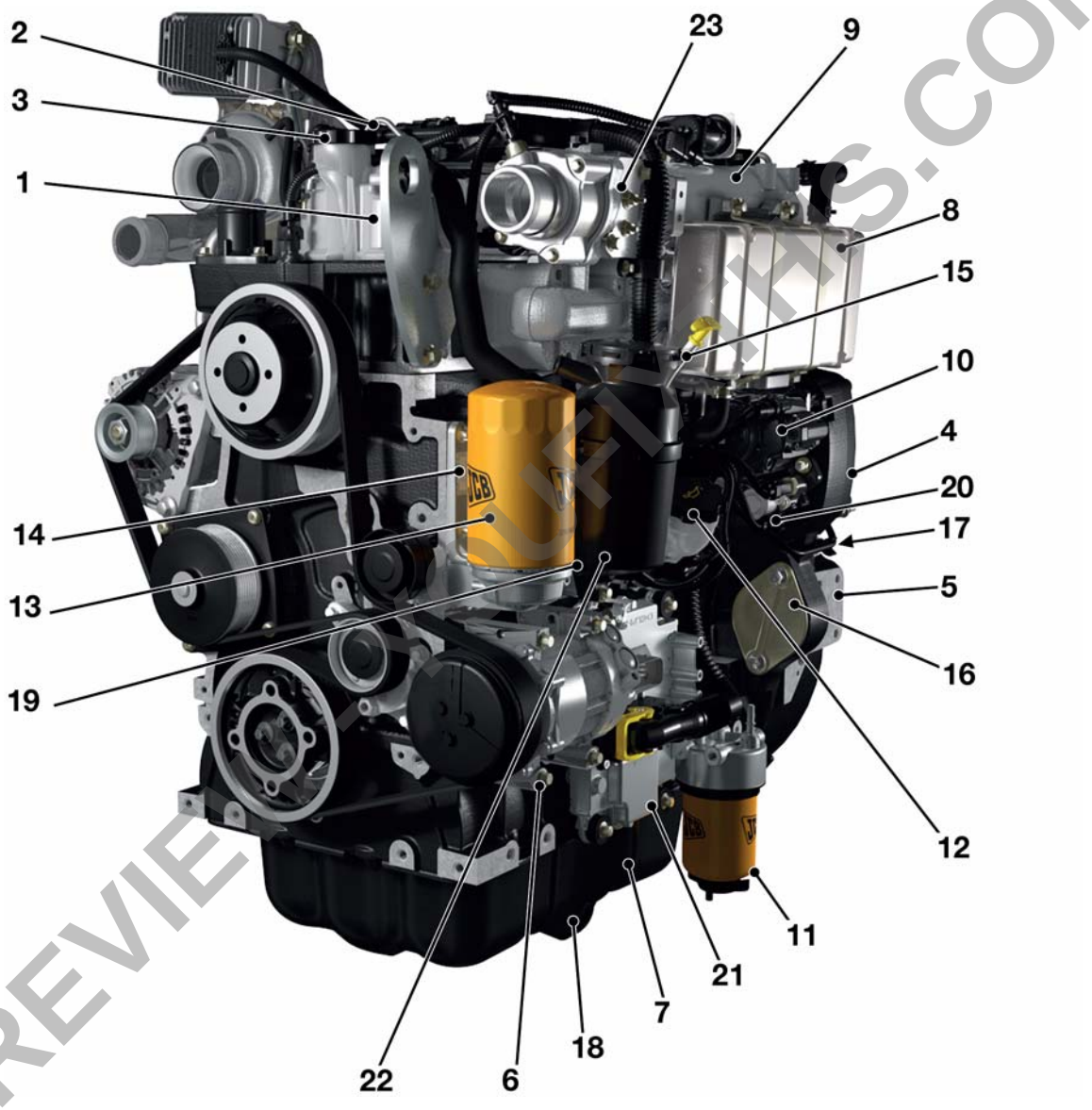
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Engine Component Identification

External

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

⇨ *Table 1. Engine - As viewed on the left hand side (21)*



T063430

Fig 2. Engine - As viewed on the left hand side

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4	Bed plate	12	Coolant temperature sensor
5	Lubrication oil pan (sump)		
6	Crankshaft pulley		
7	FEAD tensioner		
8	Coolant pump and drive pulley assembly		

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Operating Procedures

Starting the Engine

Pre-Start Notes

⚠ WARNING

On turbo-charged machines, do not keep the accelerator pedal fully depressed when the engine has started. Do not race the engine until the oil pressure low light has gone out. Racing the engine too soon could damage the turbo-charger due to insufficient lubrication.

16-2-4-1

Several factors will influence the starting performance of the engine, these include:

- The ambient temperatures
- The condition of the battery
- The viscosity of the engine oil
- The condition of the starter motor

The engine does not require any cold starting aids for temperatures down to -18°C.

If the engine is operating in temperatures below -18°C, then a pre-heater is available. The heater fits in the inlet manifold as shown, and is linked into the machine's electrical system.

In severe cold climate conditions, a block heater can be installed.

Make sure that all the necessary machine pre-start checks have been completed, these will include:

- engine oil level
- engine coolant level
- battery connections
- fuel tank has sufficient fuel
- fuel pre-filters drained
- the machine is safe and ready to start



T062700

Fig 1.

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made as to the possible effects of running these products with such fuels".

The three most common Fame types are RME - Rapeseed methyl ester (preferred crop in Europe), SME - Soyabean methyl ester (preferred crop in USA). Less common FAME's can be derived from animal fats (e.g. modified beef extracts) and reclaimed cooking oils.

4 Unmodified Vegetable Oils

Burned in diesel engines neat or used as an extender to mineral derived fuel. When these are subjected to heat in the fuel injection system they form sticky deposits that can be found inside the fuel pump and a hard lacquer in the injectors where exposure to even higher temperatures takes place.

Sulphur Content

⚠ CAUTION

A combination of water and sulphur will have a corrosive chemical effect on fuel injection equipment. It is essential that water is eradicated from the fuel system when high sulphur fuels are used.

ENG-3-2

Effects of Fuel Contaminates

The effect of dirt, water and other contaminants in diesel can be disastrous for injection equipment:

- Dirt - A severely damaging contaminant. Finely machined and mated surfaces such as delivery valves and distributor rotors are susceptible to the abrasive nature of dirt particles - increased wear will almost inevitably lead to greater leakage, uneven running and poor fuel delivery.
- Water - Water can enter fuel through poor storage or careless handling, and will almost inevitably condense in fuel tanks. The smallest amounts of water can result in effects that are just as disastrous to the fuel injection pump as dirt, causing rapid wear, corrosion and in severe cases, even seizure. It is vitally important that water is prevented from reaching the fuel injection equipment. The filter/water trap must be drained regularly.
- Wax - Wax is precipitated from diesel when the ambient temperature falls below that of the fuel's cloud point, causing a restriction in fuel flow resulting in rough engine running. Special winter fuels may be available for engine operation at temperatures below 0°C (32°F). These fuels have a lower viscosity and limit wax formation.

Chemical Contamination

It should be noted that exposure of fuel to surfaces containing Copper (Cu), Zinc (Zn) or Lead (Pb) can adversely affect fuel quality and should be minimised.

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Cleaning the Engine

⚠ WARNING

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.

ENG-8-5_2

Before carrying out any service procedures that require components to be removed, the engine must be properly cleaned.

Cleaning must be carried out either in the area of components to be removed or, in the case of major work, or work on the fuel system, the whole engine and surrounding machine must be cleaned.

Important: *Stop the engine and allow it to cool for at least one hour. DO NOT attempt to clean any part of the engine while it is running.*

1 Make sure that the electrical system is isolated.

2 Make sure that all electrical connectors are correctly coupled. If connectors are open fit the correct caps or seal with water proof tape.

3 Cover the alternator with a plastic bag to prevent water ingress.

4 Seal the engine air intake, exhaust and breather system.

5 Make sure that the oil filler caps and dipstick are correctly installed.

6 Use a low pressure water jet and brush to soak off caked mud or dirt.

⚠ CAUTION

The engine or certain components could be damaged by high pressure washing systems; special precautions must be taken if the engine is to be washed using a high pressure system.

Ensure that the alternator, starter motor and any other electrical components are shielded and not directly cleaned by the high pressure cleaning system.

ENG-3-3

7 Apply an approved cleaning and de-greasing agent with a brush. Obey the manufacturers instructions.

8 Use a pressure washer to remove the soft dirt and oil.

Important: *DO NOT aim the water jet directly at oil seals or electrical and electronic components such as the engine electronic control unit (ECU), alternator or fuel injectors.*

Important: *DO NOT place the jet nozzle closer than 600mm (24 in) to any part of the engine.*

9 When the pressure washing is complete move the machine away from the wash area, or alternatively, clean away the material washed from the machine.

10 Before working on specific areas of the engine use a compressed air jet to dry off any moisture. When the area is dry use a soft clean brush to remove any sand or grit particles that remain.

11 When removing components be aware of any dirt or debris that may be exposed. Cover any open ports and clean away the deposits before proceeding.

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Setting the Engine

The engine only needs to be set to two positions to measure and adjust all the valves. The tables show which valves are applicable at the engine positions. ⇨ *Table 2. (67)*, ⇨ *Table 3. (67)*.

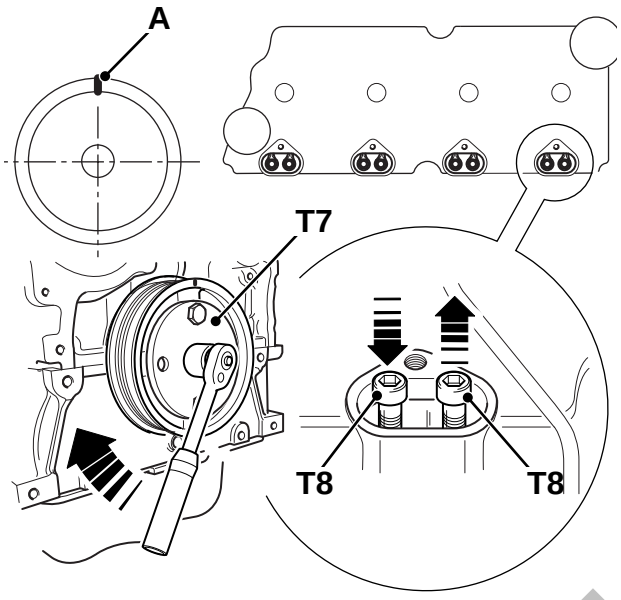


Fig 14.

1 Remove the tappet covers. ⇨ *Removing the Tappet Covers (66)*.

2 Put the indicator pins **14-T8** into the holes inside the tappet adjusters for cylinder number 4. Make sure that the pins do not fall into the engine.

3 Turn the engine crankshaft clockwise using the turning tool **14-T7**. Stop turning the crankshaft when one indicator pin starts to move up after the other pin has moved down. This is the position where the exhaust valve is almost closed and the inlet valve is just starting to open. ⇨ *Fig 14. (67)*.

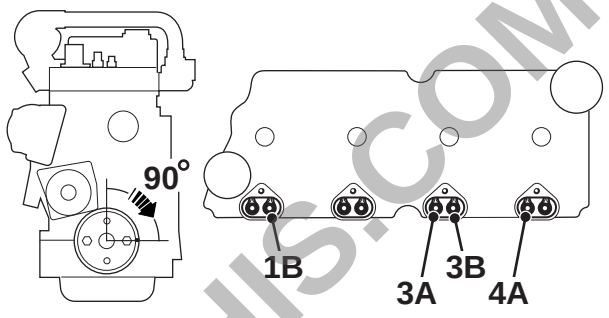
4 Put a mark **14-A** on the crankshaft pulley at the 12 O'clock position.

5 Turn the engine crankshaft 90 degrees clockwise.

6 Measure and, if necessary, adjust the clearances for the correct valves. ⇨ *Table 2. (67)*.

Table 2.

Cylinder	Valve	Tappet adjuster
1	Inlet valve	**1B**
3	Exhaust valve	**3A**
3	Inlet valve	**3B**
4	Exhaust valve	**4A**



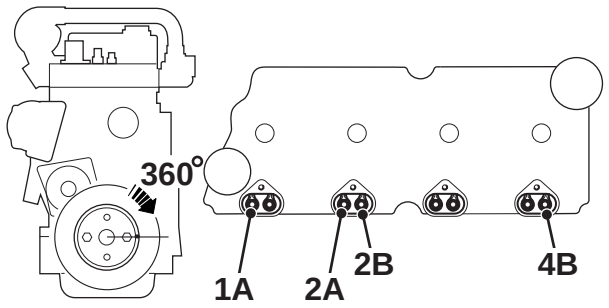
⇨ *Measuring and Adjusting the Valve Clearances (68)*

7 Remove the valve clearance measuring tools. Turn the engine crankshaft 360 degrees clockwise. Use the mark on the crankshaft pulley as a reference.

8 Measure and, if necessary, adjust the clearances for the correct valves. ⇨ *Table 3. (67)*.

Table 3.

Cylinder	Valve	Tappet adjuster
1	Exhaust valve	**1A**
2	Exhaust valve	**2A**
2	Inlet valve	**2B**
4	Inlet valve	**4B**



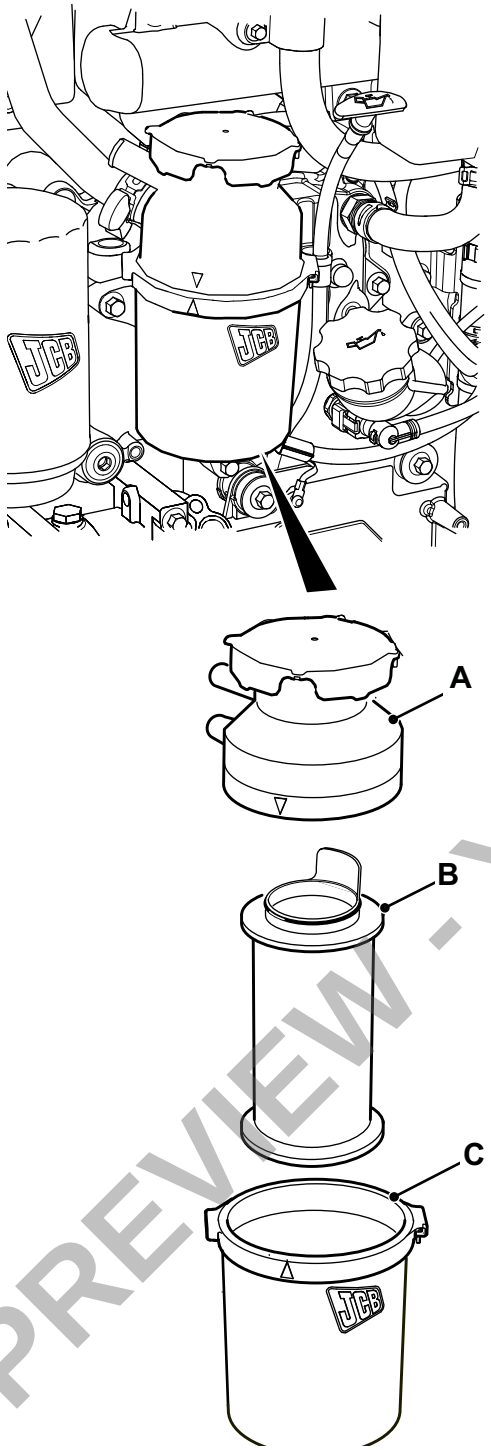
⇨ *Measuring and Adjusting the Valve Clearances (68)*

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T063710

Fig 12.



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Technical Data

Basic Engine Data (444)

Engine Variants:	
- SH	Turbocharged with Intercooler
Emission compliance	US-EPA Tier 4i, EU Stage IIIB
Rated speed	2200 rpm
Weight (Dry):	
- SH	496 kg (1091 lb)(1)
Number of cylinders	4
Nominal bore size	103 mm (4.055 in)
Stroke	132 mm (5.16 in)
Cylinder arrangement	In line
Combustion Cycle	4-stroke
Firing order	1-3-4-2
Displacement	4.40 litres
Compression ratio	
- SH	16.9: 1
Engine Compression	see Note (2)
Direction of rotation (viewed from front {crankshaft pulley} end)	Clockwise
Valves	4 per cylinder
Valve clearances measured at the tappet end of the rockers (measured cold):	
- Inlet	0.15 to 0.20 mm (0.006 to 0.008 in)
- Exhaust	0.43 to 0.50 mm (0.017 to 0.020 in)
Lubricating oil pressure (3)	1.6 - 6.5 bar (23 - 91lb in^2)
Combustion system	Common rail direct Injection
High pressure fuel pump	High pressure with electronically controlled fuel metering

(1) Dry weight. No cooling fan drive.
(2) Compression variance between each cylinder should be no greater than 3.5 bar (50 lb in2)
(3) Dependent on engine temperature and speed.

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Electrical Equipment Data (448)

Alternator	
Make	Letrika - AAK 5820
Rating	
- option 1	14V, 95Amp
- option 2	28V, 55Amp
Cooling	Internal Fan
W-terminal	For engine speed indication
Alternator speed	2.8 x engine speed
Starter Motor (1)	
Make	Letrika - AZF 4301
Rating	
- option 1	12V, 4.2kW
- option 2	24V, 4.2kW
Operating range	-30 to +120°C (-22 to 248°F)
Number of pinion teeth	11

(1) Never operate the starter motor longer than 20 seconds. Allow at least 2 minutes for cooling and battery recovery before operating again. Overheating caused by excessive operation will seriously damage the starter motor.

Switches and Sensors

Crankshaft position sensor	
- type	Hall effect

Camshaft position sensor	
- type	Hall effect

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