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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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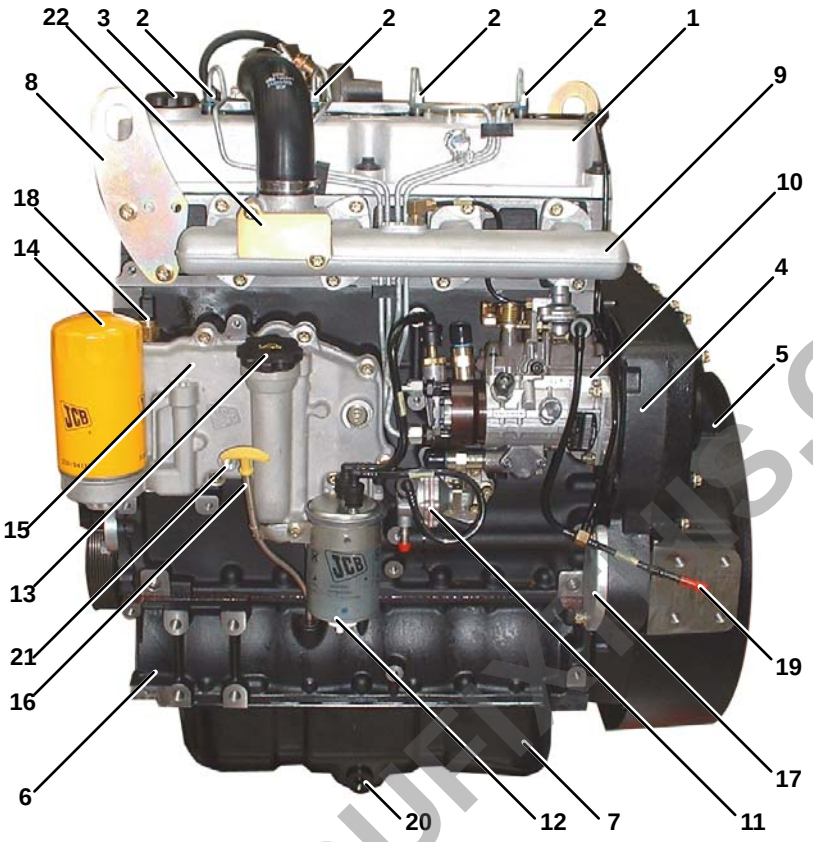


Fig 2.

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Operating Procedures

Starting the Engine

Pre-Start Notes

The following descriptions refer to a typical key start installation. In these examples, the engine speed is controlled with an accelerator pedal - always read the OEM equipment operating instructions before using the equipment for the first time.

⚠ 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

Cold climate starting aids are available, typically the operating ranges for the start aids for applications except generator set applications are:

- Down to -12°C = No Aid Required
- Below -12°C to -20°C = Grid Heater ⇒ *Fig 1. (23)*
- Below -20°C = Grid Heater + Block Heater ⇒ *Fig 2. (24)*

Cold climate starting aids are available, typically the operating ranges for the start aids for generator set applications are:

- Down to -8°C = No Aid Required
- Below -8°C to -20°C = Grid Heater ⇒ *Fig 1. (23)*
- Below -20°C = Grid Heater + Block Heater ⇒ *Fig 2. (24)*

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.

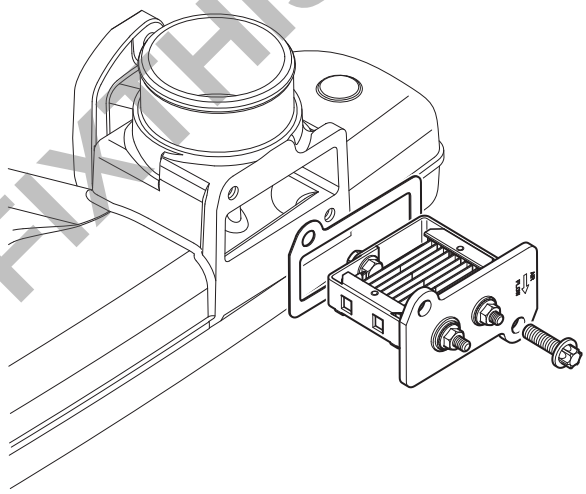


Fig 1.

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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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Air Intake System

Air Cleaners

Engine performance and durability will be severely affected if the quality of the air intake is poor.

A dirty and blocked air cleaner element will reduce the amount of air entering the combustion chamber which can cause engine mis-firing, black smoke and low output power.

A dirty and blocked air filter can also lead to abrasion of the cylinder bores and valves (referred to as `dusting'). This will cause excessive oil consumption, black smoke, low output power and a reduced engine life.

Refer to the machine's operator handbook for the air filter element removal and replacement procedures.

Inspect hoses and fittings for splits and poor clamping which may allow unfiltered air to enter the engine. Make sure that hoses are not restricted or blocked.

Note: *Engines with Closed Crankcase Ventilation (CCV); It is normal to find some oil inside the air intake hoses on turbocharged engines. The oil is transferred from the crankcase ventilation hose* ***11D****. Wipe away oil deposits. Make sure dirt or grit does not get into the inlet hoses or turbocharger.*

In hostile environments, change the air filter elements more frequently.

In some applications, an air filter pre-cleaner can be fitted.

A typical air filter installation is shown, **11A** is the outer element and **11B** is the inner element. Item **11C** shows a potential problem as the hose has split allowing dirty unfiltered air to enter the engine.

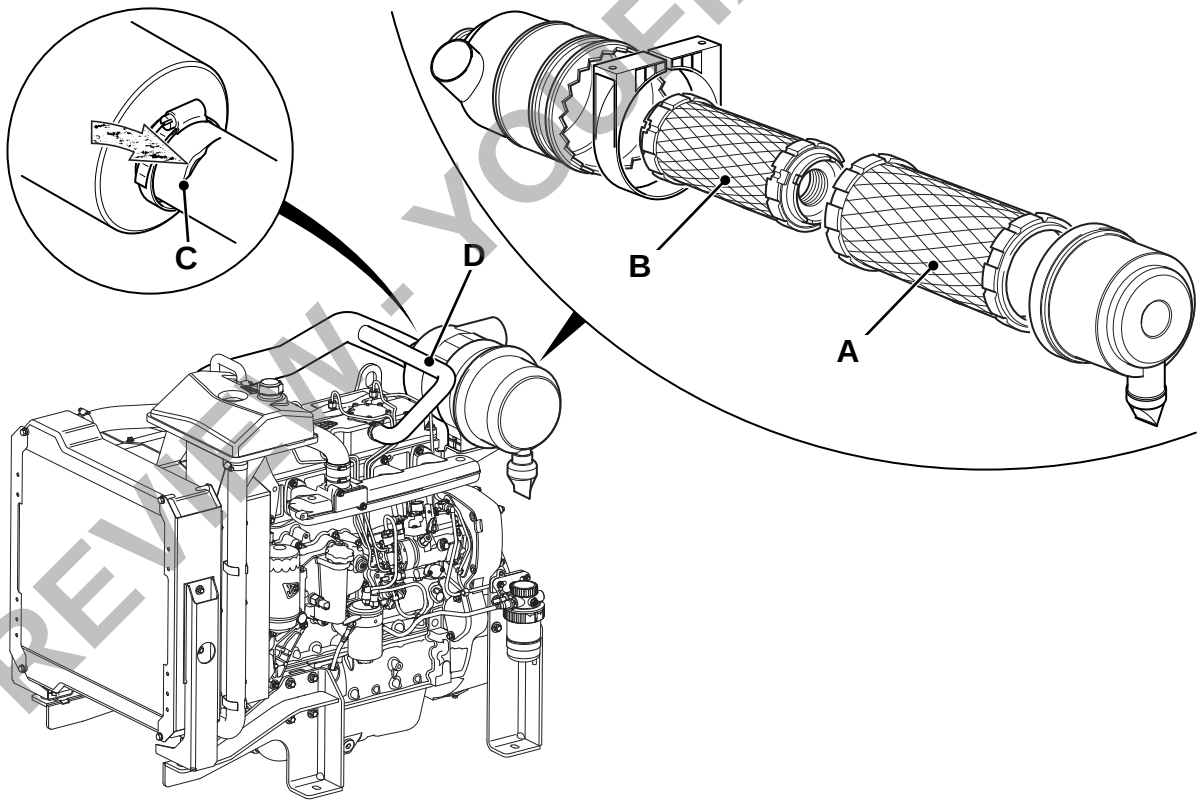


Fig 11.

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Technical Data and Specifications

Basic Engine Data - 444 Engine

Engine Variants (Tier 2/Stage 2):	
- SA	Naturally Aspirated
- SB	Turbocharged
- SC	Turbocharged with Intercooler
Engine Variants (Tier 3):	
- SD	Naturally Aspirated
- SF	Turbocharged with Intercooler
Rated speed	
Vehicle applications	2200 rpm
Generator set application - 50 Hz	1500 rpm
Generator set application - 60 Hz	1800 rpm
Weight (Dry):	
- SA	472 kg (1040 lb)
- SB	477 kg (1052 lb)
- SC, SD, SF	477 kg (1052 lb)
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	
- SA	18.6 : 1
- SB	18.3 : 1
- SC	17.5 : 1
- SD	17.2 : 1
- SE	17.1 : 1
- SF	17.2 : 1
Engine Compression	see Note (1)
Direction of rotation (viewed from front {crankshaft pulley} end)	Clockwise
Valves	4 per cylinder
Valve tip clearances (measured cold):	
- Inlet	0.19 to 0.27 mm (0.007 to 0.011 in)

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Table 2. Engine - As viewed on the right hand side

Remember that the left and right sides are determined when viewing the flywheel (rear) end of the engine.

1	Rocker cover	11	Exhaust manifold
2	Breather chamber inspection cover	12	Alternator and drive pulley assembly (belt not fitted)
3	Cylinder block	13	Coolant pump drive pulley (belt not fitted)
4	Timing gear case	14	Coolant pump housing (cylinder block)
5	Flywheel housing	15	Coolant inlet/radiator hose connector
6	Bed plate	16	Heavy duty PTO (blanking cover if no device is fitted)
7	Lubrication oil pan (sump)	17	Starter motor assembly
8	Lifting eye	18	Turbocharger oil drain line (turbocharged engine only)
9	Turbocharger (turbocharged engine only)	19	Turbocharger oil feed line (turbocharged engine only)
10	Turbocharger waste gate actuator assembly	20	Oil drain plug (sump)

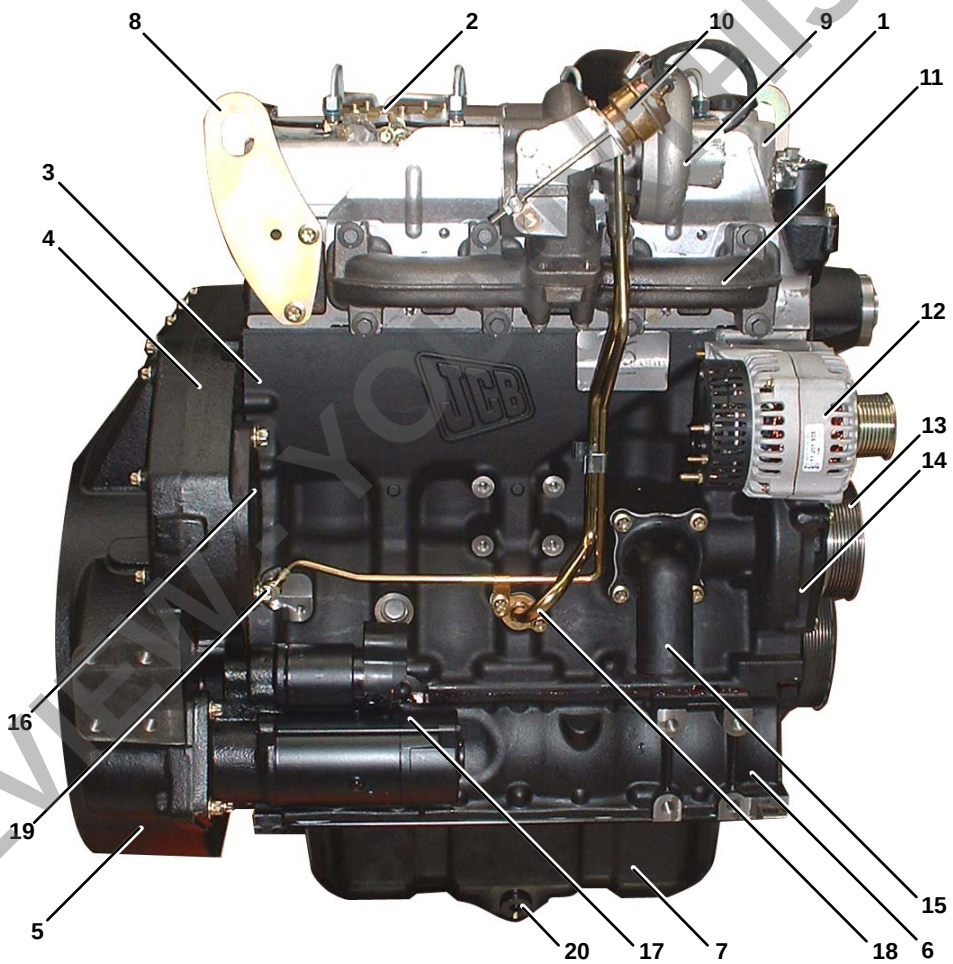


Fig 3.

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First Aid - Oil

Eyes

In the case of eye contact, flush with water for 15 minutes. If irritation persists, get medical attention.

Swallowing

If oil is swallowed do not induce vomiting. Get medical advice.

Skin

In the case of excessive skin contact, wash with soap and water.

Spillage

Absorb on sand or a locally approved brand of absorbent granules. Scrape up and remove to a chemical disposal area.

Fires

Extinguish with carbon dioxide, dry chemical or foam. Fire-fighters should use self-contained breathing apparatus.

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Table 2. Engine - Will Not Start or Difficult to Start (Exhaust Smoke)

Cause	Remedy
Starting procedure incorrect.	Verify proper starting procedure.
Cold starting aid not working (if fitted).	Check for correct operation of the cold start advance.
Air intake system blocked or restricted.	Visually check the air intake for blockage or obstruction - remove as required. Check the air filter elements for signs of blocking - replace as required.
Fuel is aerated.	Check the fuel system for loose connections and possible air ingress points.
Fuel lift pump not operating correctly (fuel supply inadequate).	Check that the lift pump is operating and delivering fuel to the injection pump.
Fuel is contaminated or incorrect grade diesel fuel used.	If the fuel is suspect, verify by operating the engine with recommended clean fuel from a temporary tank. ⇨ *Fuel (32)*.
Fuel filter(s) blocked, fuel supply restricted.	Check/replace the fuel filter(s). ⇨ *Engine Fuel System (50)*. Check fuel lines for restriction.
Fuel drain return line blocked, not connected properly.	Verify that the fuel return line is not obstructed and connected to the top of the fuel tank.
Check fuel inlet restriction.	Maximum inlet restriction to fuel transfer pump must not exceed 100 mm Hg (4 in. Hg).
Injection pump timing incorrect.	If the pump has recently been removed and replaced, the timing could be incorrect if the correct removal procedures were not followed. The timing can only be checked by a local FIE specialist using the appropriate equipment.
Inlet and exhaust valve clearances set incorrectly.	Set the valve clearances to the recommended clearances. ⇨ *Valve Clearances and Adjustment (56)*.
One or more engine injector worn or malfunctioning.	Check and externally clean the injector. If the problem still persists, the injector must be checked by a local FIE specialist, or they can be replaced with new.
Engine compression low in one or more cylinders.	Check the engine compression.
Cranking speed too slow.	Refer to ⇨ *Table 3. Engine - Will Not Crank or Cranks Slowly (63)* for possible low cranking speed faults.
Worn or malfunctioning fuel injection pump (injection pump not delivering fuel).	Check for operation of the fuel injection pump. The fuel injection pump must be take to a local FIE specialist to have the fuel delivery timing checked. Ensure that all obvious causes have been eliminated before removing the injection pump.

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D Charts - Coolant

Table 22. Coolant - Loss

Cause	Remedy
Incorrect coolant level.	Check the level. ⇨ *Checking the Oil Level (45)*.
Coolant leaking from engine radiator or cab heater.	Visually inspect the radiator, heater, hoses and connection to locate the leak. If oil is present in the coolant, check for a transmission or engine oil cooler leak
External engine coolant leak.	Visually inspect the engine and components for seal, gasket hose connection leaks. Make sure all hose clips are in good condition and torqued to the recommended figure.
Overheating or compression gases leaking, resulting in loss through the radiator overflow.	⇨ *Table 23. Coolant - Over Temperature (84)*.
If equipped, transmission cooler leak.	Check for mixing of coolant and transmission fluid.
If the engine is coolant aftercooled, aftercooler leak.	Check/replace the aftercooler. Look for coolant in the intake manifold and in the oil.
Lubricating oil cooler leak.	Check/replace the oil cooler. Look for coolant in the oil.
Cylinder head gasket leak.	Check/replace the head gasket.
Cylinder head cracked or porous.	Check/replace the head.
Cylinder block coolant passages leaking.	Check/replace the cylinder block.

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