OPERATOR'S MANUAL



ENGINE

JCB T4F 444 Elec Engine (4 Cyl),
JCB T4F 448 Elec Engine (4 Cyl)

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THIS MANUAL SHOULD ALWAYS STAY WITH THE MACHINE

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Safety

Safety - Yours and Others

All machinery can be hazardous. When a machine is correctly operated and maintained, it is a safe machine to work with. When it is carelessly operated or poorly maintained it can become a danger to you (the operator) and others.

In this manual and on the machine you will find warning messages, you must read and understand them. They inform you of potential hazards and how to avoid them. If you do not fully understand the warning messages, ask your employer or JCB dealer to explain them.

Safety is not just a matter of responding to the warnings. All the time you are working on or with the machine you must be thinking of what hazards there might be and how to avoid them.

Do not work with the machine until you are sure that you can control it.

Do not start any work until you are sure that you and those around you will be safe.

If you are not sure of anything, about the machine or the work, ask someone who knows. Do not assume anything.

Remember:

- Be careful
- Be alert
- Be safe.

Safety Warnings

In this manual there are safety notices. Each notice starts with a signal word. The signal word meanings are given below.

The signal word 'DANGER' indicates a hazardous situation which, if not avoided, will result in death or serious injury.

The signal word 'WARNING' indicates a hazardous situation which, if not avoided, could result in death or serious injury.

The signal word 'CAUTION' indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

The signal word 'Notice' indicates a hazardous situation which, if not avoided, could result in machine damage.

The safety alert system symbol (shown) also helps to identify important safety messages in this manual. When you see this symbol your safety is involved, carefully read the message that follows.

Figure 2. The safety alert system symbol



General Safety

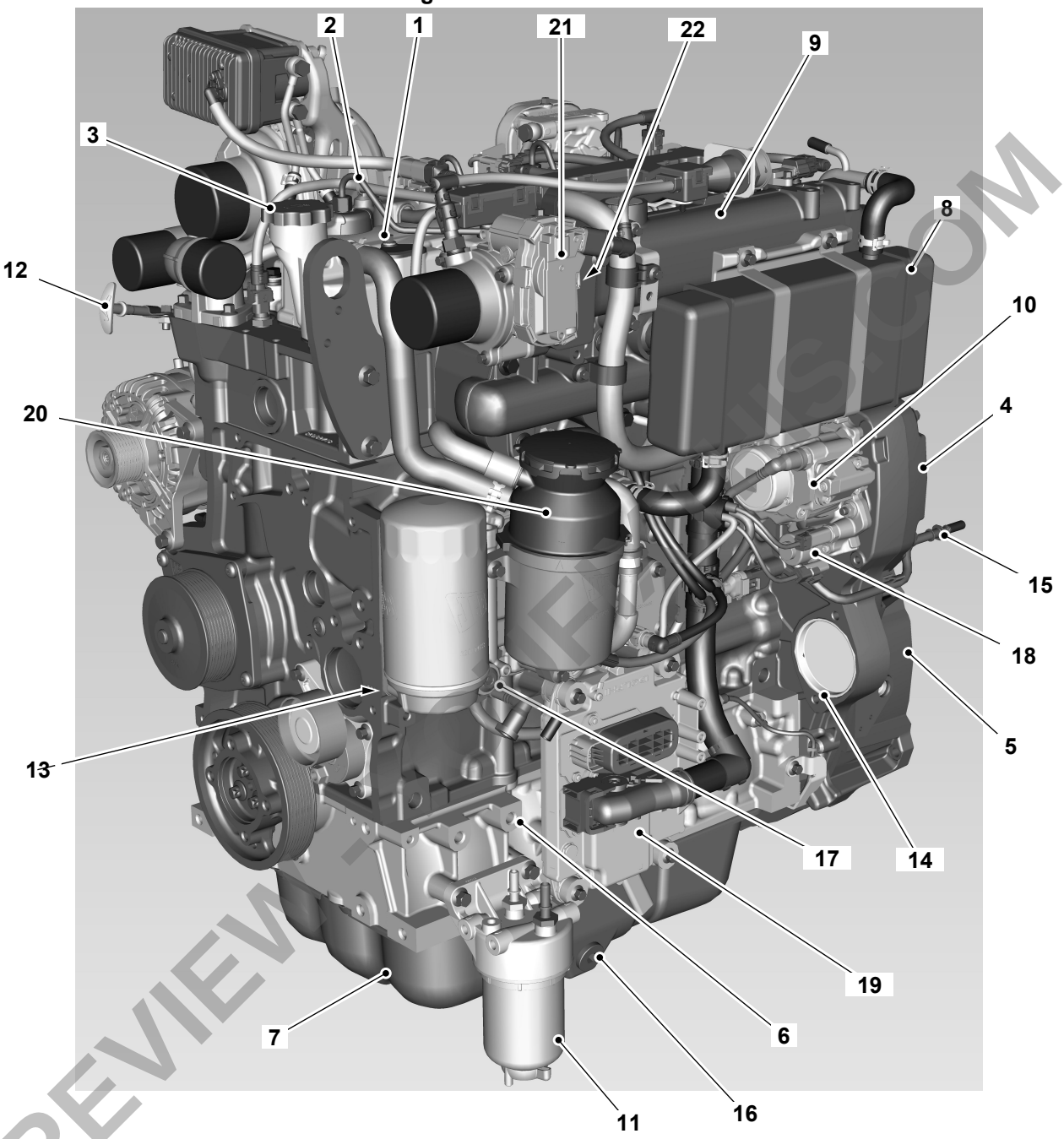
Engine Application and Specification

Use the engine only for the application for which it was intended. Do not change the specification of the engine.

Do not install unauthorised aftermarket modifications.

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Figure 3. 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 dipstick
13 Lubrication oil cooler housing
14 Low duty PTO (Power Take-Off) (blanking cover if no device is installed)
15 Low pressure fuel line (to tank)
16 Oil drain plug (sump)
17 Oil filter housing drain plug
18 IMV (Inlet Metering Valve)
19 ECM (Engine Control Module)
20 Crankcase ventilation filter assembly
21 Electronic air intake throttle
22 Inlet manifold induction heater (if installed)

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Torque Values

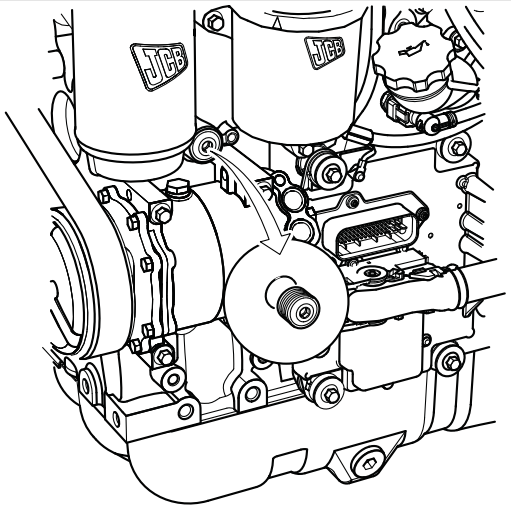
General

This section details all the torque figures to be used on the JCB Ecomax Engine. Some of the torques must be used in conjunction with the recommended procedures contained in this manual, for instance if the torques need to be applied in a specific sequence. For convenience, the list below is arranged in alphabetical order to help you quickly locate the item.

Table 52.

Alternator Retaining Bolts Refer to Table 64.
Exhaust Manifold Bolts Refer to Table 60.
Fan Belt Tensioner Bolts Refer to Table 56.
Fuel Filter Retaining Strap Bolt Refer to Table 55.
Lifting Bracket Bolts Refer to Table 63.
Oil Cooler Drain Plug Refer to Table 53.
Oil Sump Plug and Retaining Bolts Refer to Table 54.
PTO (Power Take-Off) Pump Bolts Refer to Table 62.
Starter Motor Retaining Bolts Refer to Table 65.
Thermostat Housing Bolts Refer to Table 57.
Water Inlet Connector Bolts Refer to Table 58.
Water Temperature Sender/Switch Refer to Table 59.

Table 53. Oil Cooler Drain Plug

Item	Torque	Angle	Figure
	N·m		
Oil Cooler drain plug	35 –40	-	

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Fault Finding Tables

Table 13.

A Charts
Engine - Will Not Start or Difficult to Start (No Exhaust Smoke) Refer to Table 17.
Engine - Will Not Start or Difficult to Start (Exhaust Smoke) Refer to Table 18.
Engine - Will Not Crank or Cranks Slowly Refer to Table 19.
Engine - Starts then Stops Refer to Table 20.
Engine - Poor Running Refer to Table 21.
Engine - Poor Running at Idle Refer to Table 22.
Engine - Noise Excessive Refer to Table 23.
Engine - Compression Knocks Refer to Table 24.
Engine - Reduced Power Output Refer to Table 25.
Engine - Will Not Reach Maximum RPM Refer to Table 26.
Engine - RPM (Revolutions Per Minute) Surges Refer to Table 27.
Engine - Vibration Excessive Refer to Table 28.
Engine - Exhaust Smoke Excessive (Black Smoke) Refer to Table 29.
Engine - Exhaust Smoke Excessive (White/Blue Smoke) Refer to Table 30.
Engine - Will Not Shut Off Refer to Table 31.

Table 14.

B Charts
Fuel - Consumption Excessive Refer to Table 32.
Fuel/Oil - Leaking from Exhaust Manifold Refer to Table 33.

Table 15.

C Charts
Lubricating Oil - Consumption Excessive Refer to Table 34.
Lubricating Oil - Contaminated Refer to Table 35.
Lubricating Oil - Pressure Low Refer to Table 36.
Lubricating Oil - Pressure High Refer to Table 37.

Table 16.

D Charts
Coolant - Loss Refer to Table 38.
Coolant - Over Temperature Refer to Table 39.
Coolant - Under Temperature Refer to Table 40.
Coolant - Contaminated Refer to Table 41.

WARNING! *Fine jets of fluid at high pressure can penetrate the skin. Keep face and hands well clear of pressurised fluid and wear protective glasses. If fluid penetrates your skin, get medical help immediately.*

A Charts-Engine

Table 17. Engine - Will Not Start or Difficult to Start (No Exhaust Smoke)

Cause	Remedy
Refer to: Starting the Engine (Page 18).	
No fuel in supply tank.	Check the level in the fuel tank, use sight gauge or dipstick. Replenish as required.

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Fluids, Lubricants and Capacities

General

New engines DO NOT require a running-in period. The engine/machine should be used in a normal work cycle immediately, glazing of the piston cylinder bores, resulting in excessive oil consumption, could occur if the engine is gently run-in. Under no circumstances should the engine be allowed to idle for extended periods; (e.g. warming up without load).

A minimum API CJ-4 grade oil must be used. Superior grade oils may be more appropriate for heavy duty applications (such as sustained high loads and operation at elevated temperatures).

The choice of lubricant viscosity should be made based the lowest ambient temperature at which the machine will be started and the maximum ambient temperature at which it will operate.

The following table provides guidance as to the temperature range that can be accommodated by standard oil viscosities and can be used to select an appropriate grade. Refer to Table 43.

When selecting the oil viscosity grade make sure the oil conforms with or exceeds the recommended specification. Refer to Table 44.

Table 43.

Oil Viscosity	Minimum Temperature °C (°F)	Maximum Temperature °C (°F)
SAE 5W30	-30 °C (-22.0 °F)	30 °C (86.0 °F)
SAE 5W40	-30 °C (-22.0 °F)	46 °C (114.7 °F)
SAE 10W30	-15 °C (5.0 °F)	46 °C (114.7 °F)

Recommended Oils

Table 44. With exhaust after treatment

Engine Oil	Specification
JCB 5W/30 (Part 4001/3100)	CJ-4
JCB 5W/40 (Part 4001/3400)	CJ-4
JCB 10W/30 (Part 4001/3000)	CJ-4

Engine Oil Capacity

Choose the grade of oil to suit the temperature range as detailed. Refer to Table 43.

The engine oil capacity, including filter and clean sump is 11.5 L MIN and 14 L MAX mark on the dipstick. Refer to Table 45.

Table 45.

Item	Capacity L	
	Minimum	Maximum
Engine	11.5 L	14 L

DEF System

Table 46.

Item	Specification
DEF filter 'O' rings	deionised/demineralised water or DEF (Diesel Exhaust Fluid)

Fuel

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Pre-start Cold Checks, Service Points and Fluid Levels

The following maintenance procedure refers to the JCB engine only. It does not apply to the machine or equipment in which it is installed. Consult the manufacturers operation manual for further information.

Table 11. All Applications Except Generator Set Applications.

Pre-start Cold Checks Service Points and Fluid Levels	Operation	10 h	50 h	500 h	1,000 h	1,500 h	2,000 h	8,000 h
ENGINE								
Oil level	Check	O	O	□	□	□	□	□
Coolant Quality/ level	Check	O	O	□	□	□	□	□
Coolant or Oil Leaks	Check	O	O	□	□	□	□	□
Water Sedimenter	Check for Contamination and Drain		O	□	□	□	□	□
Fuel Filter (both machine mounted filter)	Change			□	□	□	□	□
Oil and Filter[1]	Change			□	□	□	□	□
All Hoses - Condition	Check			□	□	□	□	□
Radiator[2]	Clean			□	□	□	□	□
Front End Accessory Drive (FEAD) Belt Condition	Check			□	□	□	□	□
Air Cleaner Outer Element[2]	Change				□	□	□	□
DEF (Diesel Exhaust Fluid) Filter (if installed)[4]	Change				□	□	□	□
Crankcase Ventilation Filter	Change					□	□	□
Air Cleaner Inner Element	Change						□	□
Valve Clearances[3]	Check and Adjust						□	□
Oil Filler and Dipstick O-rings	Change						□	□
Cooling system	Drain and Fill						□	□
Front End Accessory Drive (FEAD) Belt	Change							□
Injectors[3]	Change							□
Injector(s) Leak-Off Rail[3]	Change							□
High Pressure Fuel Lines[3]	Change							□

(1) If operating under arduous conditions, do an engine oil flush (use the normal recommended engine oil) every 250 hours. Change the engine oil and filter every 250 hours.
(2) If operating in dusty adverse working environments, do these jobs more frequently.
(3) These jobs must be done by a qualified engineer.
(4) Change DEF filter more regularly under arduous conditions.

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Starting the Engine

General

Start Procedure

⚠ **Notice:** Do not operate the starter motor for more than 20 s at one time. Let the starter motor cool for at least 2 min.

1. Make sure that all controls (if applicable) are set correctly for starting. Consult the manufacturers operators manual for further information as the actual installation may differ.
2. If fitted, turn the start key to position (I) to connect the battery to all of the electrical circuits.
3. For engine coolant temperatures below the figure specified for the use of a grid heater (if installed), the grid heater light will illuminate. Wait for the grid heater light to extinguish.

   Temperature: -4 °C (24.8 °F)
4. Turn the starter key further to position (II) and hold it there until the engine starts. Do not operate the starter for more than the time specified.

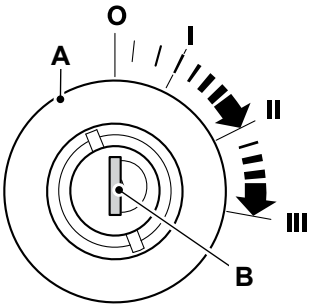
   Duration: 20 s
5. There is an intentional delay prior to starting the engine to ensure the engine lubrication system is primed. The delay time is determined by the engine coolant temperature and can be up to:

   Duration: 20 s
6. If the engine does not start, return the ignition key to the "0" position, Allow the starter to cool for the time specified:

   Duration: 2 min
7. After you start the engine there is an intentional delay at idle during which time the throttle control is overridden to make sure that the lubrication system is primed. This is determined by the engine coolant temperature. The delay time can be up to:

   Duration: 28 s

Figure 10.



A Ignition switch **B** Ignition key

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Operation
Introduction

General

JCB may not have any control over the installation and use of their products, thus it is necessary to read this operation section in conjunction with the manufacturers operators manual through from beginning to end.

The operator must always be aware of events happening in or around the product. Safety must always be the most important factor when you operate the product.

If it applies to the machine / product, make sure you understand any operating controls, gauges and switches, practice using them.

If it applies to the machine / product (subject to the manufacturers approval), drive the product in an open space, clear of people. Get to know the 'feel' of the product and its driving controls.

Do not rush the job of learning, make sure you fully understand everything in all documentation appropriate to the equipment / product. Take your time and work efficiently and safely.

Remember:

- Be careful.
- Be alert.
- Be safe.

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Technical Data
Performance Dimensions

General

Table 42.

Description	SJ Engine	DJ Engine
Engine Variants	Turbocharged with intercooler and exhaust after treatment system	Turbocharged with intercooler and exhaust after treatment system
Emission compliance	US-EPA Tier 4 Final, EU Stage IV	US-EPA Tier 4 Final, EU Stage IV
Rated speed	2200 rpm	2200 rpm (108 kW), 2050 rpm (129 kW)
Weight (Dry)	(Dry weight-No cooling fan drive) 496 kg	(Dry weight-No cooling fan drive) 496 kg
Number of cylinders	4	4
Nominal bore size	103 mm	106 mm
Stroke	132 mm	135 mm
Cylinder arrangement	In line	In line
Combustion Cycle	4-stroke	4-stroke
Firing order	1-3-4-2	1-3-4-2
Displacement	4.399 L	4.765 L
Compression ratio	16.7: 1	16.7: 1
Engine Compression	Compression variance between each cylinder should be no greater than 3.5 bar (50.7 psi)	Compression variance between each cylinder should be no greater than 3.5 bar (50.7 psi)
Direction of rotation (viewed from front {crankshaft pulley} end)	Clockwise	Clockwise
Valves	4 per cylinder	4 per cylinder
Valve clearances measured at the tappet end of the rockers (measured cold)		
- Inlet	0.15 –0.21 mm	0.15 –0.21 mm
- Exhaust	0.43 –0.49 mm	0.43 –0.49 mm
Lubricating oil pressure (Dependent on engine temperature and speed)	1.6 –6.5 bar (23.2 –94.2 psi)	1.6 –6.5 bar (23.2 –94.2 psi)
Fuel filter type	Screw-on canister (with drain facility)	Screw-on canister (with drain facility)
Oil pressure relief valve setting	6 bar (87.0 psi)	6 bar (87.0 psi)
Oil pressure switch setting	0.6 bar (8.7 psi) falling	0.6 bar (8.7 psi) falling
Oil pump[1]	Integral unit with relief valve	Integral unit with relief valve
Combustion system	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

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

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Notes:

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