

JCB Dieselmix Tier 3 SE Engine

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General Information

Service Manual - JCB Dieselmix Tier 3 SE Engine

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Introduction

About this Manual

Using the Service Manual

This publication is designed for the benefit of JCB Distributor Service Engineers who are receiving, or have received, training by JCB Technical Training Department.

These personnel should have a sound knowledge of workshop practice, safety procedures, and general techniques associated with the maintenance and repair of engines.

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. Finally, please remember above all else **SAFETY MUST COME FIRST!**

The manufacturer's policy is one of continuous improvement. The right to change the specification of the engine without notice is reserved. No responsibility will be accepted for discrepancies which may occur between the specifications of the engine and the descriptions contained in this publication.

Section Numbering

The manual is compiled in sections, the first three are numbered and contain information as follows:

- 1 General Information** includes torque settings and service tools.
- 2 Care & Safety** includes warnings and cautions pertinent to aspects of workshop procedures etc.
- 3 Routine Maintenance** includes service schedules and recommended lubricants.

The remaining sections deal with Descriptions, Fault Finding, Dismantling, Overhaul etc. of specific components, for example:

- 4 Systems Descriptions**

- 5 Fault Finding ...etc.**

Left Side, Right Side

References to the 'left' side and the 'right' side of the engine are when viewed from the flywheel end of the engine, as shown at **1A**.

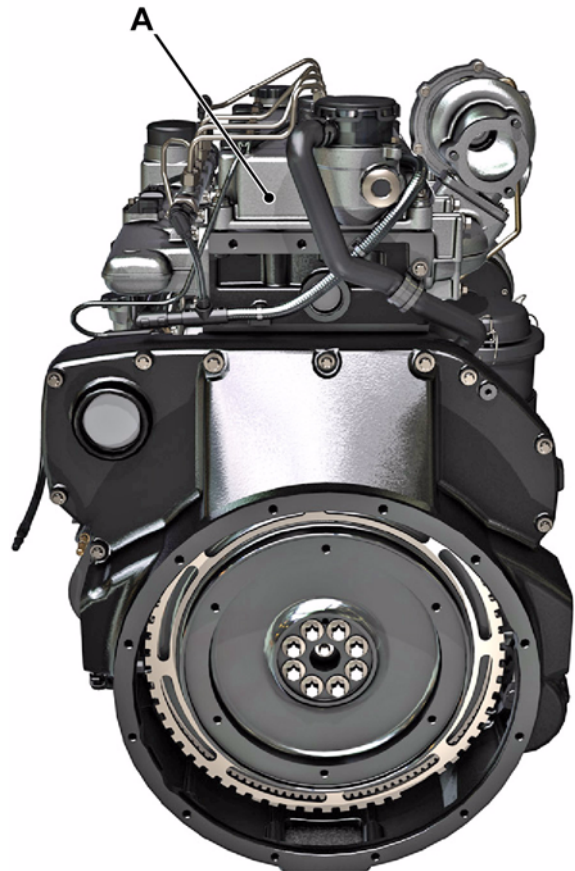


Fig 1.

Units of Measurement

In this manual, the S.I. system of units is used. For example, liquid capacities are given in litres. The imperial units follow in parenthesis () e.g. 28 litres (6 UK gal).



Machine Related Data

The JCB Diesemax Engine can be fitted to a variety of constructions and agricultural machines. The scope of this publication is limited to the engine, but references to a typical machine installation will be made. Tasks and information specific to a machine installation will be listed in the relevant machine Service Manual, for example engine removal and replacement procedures.

Cleanliness Requirements

Effects of Contamination

When carrying out service procedures on the engine cleanliness is of paramount importance.

Common Rail Fuel Injection System

⚠ WARNING

The high pressure fuel system is extremely susceptible to damage if it is contaminated. Always clean the engine using the correct procedures before carrying out maintenance. Contamination of the fuel system can cause catastrophic failure of the engine.

Whilst the requirement for a good level of cleanliness is well known and common practice, the introduction of high pressure common rail fuel injection necessitates working to new levels of cleanliness.

Once inside the system, fuel circuit contaminants greatly effect the performance and life of the fuel injection equipment. For example, contaminants in the fuel pump will develop internal wear to cause internal leakage and hence lower discharges. Use of poor quality fuels and poor maintenance could also lead to contaminants entering the fuel injectors. There is a possibility of catastrophic equipment failure if debris should prevent the injectors from fully closing. The main contaminants can be classified as follows:

- Solid Particles - sand, fibres, metallic particles, welding scale, sealing materials and wear particles etc.
- Liquid - usually water and incompatible oils and greases.
- Gases - Air, sulphur dioxide etc. which can create corrosive compounds if dissolved in the fluid.

These contaminants can appear during manufacture, assembly, operation and maintenance.

It is critical that the machine is thoroughly cleaned prior to completing any maintenance work. ⇒ [Cleaning the Engine \(1-6\)](#).

The main filter is rated at 2 micron = 0.002 mm (0.0007874 in). The pre-filter is rated at 5 micron.

Listed are a few typical comparisons of micron size:

- Red Blood Cell = 8 microns (0.008 mm, 0.000315 in).
- Human Hair = 70 microns (0.07 mm, 0.00275 in).
- Grain of Salt = 100 microns (0.1 mm, 0.00394 in).
- The smallest particle visible to the naked eye is 40 microns (0.00157in) approximately.

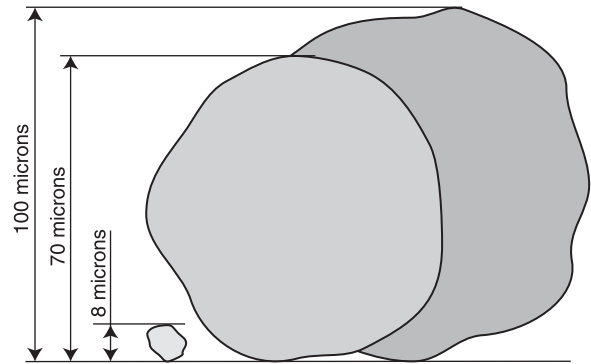


Fig 2.

The main filter and pre-filter must be changed in accordance with the applicable service schedule and procedures. The water in fuel sensor must be maintained to ensure correct operation at all times.

The potential for engine damage due to fuel contamination is much greater when using common rail injection technology than with mechanical injection systems. This is because common rail requires components with smaller manufacturing tolerances, especially the fuel injectors. In addition, common rail operates at much higher fuel pressures, over five times that of mechanical systems.

Similar pressures are used by commercial water jet cutting machines to cut metal. Fortunately clean diesel fuel has lubricating qualities that prevents erosion of components but it is obvious that contaminated fuel will cause serious damage at such high pressures.

Maintenance Environment, Common Rail Fuel Injection

WARNING

The high pressure fuel system is extremely susceptible to damage if it is contaminated. Always clean the engine using the correct procedures before carrying out maintenance. Contamination of the fuel system can cause catastrophic failure of the engine.

Depending on circumstances engine maintenance may be required in various working environments. Obviously procedures are best carried out in a dedicated workshop equipped with a suitable clean room, but in practice this is not always possible.

Maintenance procedures requiring removal or replacement of fuel system components, particularly high pressure components, require special precautions to make the working environment suitable, reducing the risk of contamination to an absolute minimum.

Use the following guidelines to make sure you reduce the chances of fuel system contamination when working in different environments:

<p>Site - open to weather. This repair site is not an acceptable location. Only in extremely extenuating circumstances should a machine be repaired on an open site prepared using the guidelines below.</p>
<p>Action</p>
<p>Clean the engine → Cleaning the Engine (□ 1-6). If the machine is on hard standing, clean away the material washed from the engine.</p>
<p>Place suitable clean boards on the ground around the machine.</p>
<p>Erect clean plastic sheeting to shelter the engine from wind and rain.</p>
<p>Wear a new disposable environmental type suit when working on the fuel system. If the suit becomes contaminated with mud, move away from the engine and change into a new suit.</p>
<p>Use clean latex gloves (non-powdered).</p>
<p>Before you start work make sure that all the required replacement parts and tools are on site. Make sure that the replacement parts are still sealed inside their packaging.</p>
<p>Cap all exposed ports and orifices immediately. Do not leave them open.</p>
<p>High pressure fuel pipes MUST BE RENEWED if any pipe joint is loosened or disconnected. DO NOT re-use the original pipe.</p>



Section 1 - General Information Cleanliness Requirements

Maintenance Environment, Common Rail Fuel Injection

Site - closed to weather from above. Least acceptable conditions, if possible move the machine to a more suitable environment.
Action
Clean the engine → Cleaning the Engine (1-6) . Clean the floor of all material washed from the engine.
Place suitable clean boards on the ground around the machine.
Erect clean plastic sheeting to shelter the engine from the wind and the possibility of debris such as dirt and dust falling from above.
Wear a new disposable environmental type suit when working on the fuel system. If it becomes contaminated with mud, move away from the engine and change into a new suit.
Use clean latex gloves (non-powdered).
Before you start work make sure that all the required replacement parts and tools are on site. Make sure that the replacement parts are still sealed inside their packaging.
Cap all exposed ports and orifices immediately. Do not leave them open.
High pressure fuel pipes MUST BE RENEWED if any pipe joint is loosened or disconnected. DO NOT re-use the original pipe.

Vehicle Maintenance Workshop. Unless the workshop has a dedicated 'sealable clean room' work bay, precautions must still be taken.
Action
Clean the engine → Cleaning the Engine (1-6) . Clean the engine in the dedicated area and then move it to the workshop.
Clean the floor area around the machine.
Erect clean plastic sheeting to shelter the engine from any wind and the possibility of debris such as dirt and dust falling from above.
Ensure that workshop doors to the outside are kept closed. A gust of wind through an open door will easily blow sand particles into the air.
Make sure your work wear is clean, non-flocking and lint free. If in doubt wear a new disposable environmental type suit.
Use clean latex gloves (non-powdered).
Before you start work make sure that all the required replacement parts and tools are on site. Make sure that the replacement parts are still sealed inside their packaging.
Cap all exposed ports and orifices immediately. Do not leave them open.
High pressure fuel pipes MUST BE RENEWED if any pipe joint is loosened or disconnected. DO NOT re-use the original pipe.

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 degreasing 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.

[⇒ Further Cleaning Procedures, Common Rail Fuel Injection \(1-7\)](#)

Further Cleaning Procedures, Common Rail Fuel Injection

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

Important: Additional cleaning must be carried out prior to working on the high pressure fuel system. It is extremely important the high pressure fuel components and the adjacent parts of the engine are meticulously cleaned before any components are removed. → [Effects of Contamination \(□ 1-3\)](#).

- 1 Clean the engine as described in Cleaning the Engine. → [Cleaning the Engine \(□ 1-6\)](#).
- 2 Remove hoses, electrical harnesses and ancillaries to improve access and expose any remaining trapped dirt close to the relevant high pressure components.
- 3 Wash away any remaining dirt or debris and then dry the area using a compressed air jet. When the area is dry use a soft clean brush to remove sand or grit particles that remain.

Important: Before starting work on the high pressure fuel system make sure that the working environment is suitable. → [Maintenance Environment, Common Rail Fuel Injection \(□ 1-4\)](#)

Terms and Definitions

Acronyms and Abbreviations

Some of the following acronyms and abbreviations are used in this service manual. The remainder are used in the automotive industry and are repeated for reference only.

°C	Celsius	mm	Millimetre
°F	Fahrenheit	MPH	Miles per Hour
A/R	As Required	NA	Naturally Aspirated
API	American Petroleum Institute	N/A	Not Applicable/Not Available
BBDC	Before Bottom Dead Centre	Nm	Newton Metre
BDC	Bottom Dead Centre	NSP	Non Serviced Part
BSFC	Brake Specific Fuel Consumption	O/D	Outside Diameter
BTDC	Before Top Dead Centre	OEM	Original Equipment Manufacturer
CCV	Crankcase Vent	PPM	Parts per Million
CID	Cubic inch Displacement	PSI	Pounds per square Inch
cST	Centistokes	PTO	Power Take Off
ECM	Electronic Control Module	PWM	Pulse Width Modulation
ECS	Emission Control System	RH	Right Hand
ECU	Electronic Control Unit	RME	Rapeseed Methyl Ester
EPA	Environmental Protection Agency	RPM	Revolutions per Minute
CAN	Controller Area Network	SAE	Society of Automotive Engineers
DLA	Diagnostic Link Adapter	SME	Sunflower Methyl Ester
FAME	Fatty Acid Methyl Esters	SOME	Soyabean Methyl Ester
FEAD	Front End Accessory Drive	STD	Standard
FIE	Fuel Injection Equipment	TBA	To be Advised
Hg	Mercury	TC	Turbocharged
HP	Horse Power	TCA	Turbocharged Aftercooled
HPV	High Pressure Valve	TDC	Top Dead Centre
I/D	Inside Diameter	TI	Technical Information
IMV	Inlet Metering Valve	TMAP	Temperature and Mass Air Pressure
kg	Kilogram	TPS	Throttle Position Sensor
KPH	Kilometres per hour	VOME	Vegetable Oil Methyl Esters
Kw	Kilowatt		
LH	Left Hand		
ltr	Litre		
MIL	Malfunction Indicator lamp		

Technical Data

Fuel

Acceptable and Unacceptable Fuels

Important: No warranty liability whatsoever will be accepted for failure of fuel injection equipment where the failure is attributed to the quality and grade of the fuel used.

Fuel Specification	Applicable Engines	Service Requirements
EN590 Diesel fuel types - Auto/C0/C1/C2/C3/C4	All Dieselmex engines.	Obey the usual routine maintenance schedules and procedures
BS2869 Class A2		
ASTM D975-91 Class 2, US DF1, US DF2, US DFA		
JIS K2204 (1992) Grades 1, 2, 3 and Special Grade 3		
ASTM D975-91 Class 1DA	All Dieselmex engines. Engines operated with these fuels may have a reduced service life	Obey the usual routine maintenance schedules and procedures. Fuel additives are recommended for use with low sulphur fuels ⇒ Additives (□ 1-10)
MIL T38219 XF63		
NATO F63		
French EN590 (RME5) with 5% maximum		
AVTURFSII, NATO F34, JP8, MIL T83133, DERD 2463, DEF STAN 91-87	All Dieselmex engines. Engines operated with these fuels will have a reduced service life	Obey the usual routine maintenance schedules and procedures. Fuel additives MUST be used ⇒ Additives (□ 1-10)
AVCAT FSII, NATO F44, JP5, MIL T5624, DERD 2452, AVTOR		
NATO F35, JET A1, DEF STAN 91-91, DERD 2494, JP7		
AVCAT, NATO F43 (obsolete), JP5 without additives		
JET A (ASTM D1655)		
ASTM D3699 Kerosene		
B20 Biodiesel - RME content blended with mineral derived diesel (20% maximum) - ASTM D6751, DIN 51606, ISO 14214	Dieselmex engines manufactured from 2007 on ONLY⁽¹⁾	YOU MUST obey special routine maintenance schedules and procedures. ⇒ Service Requirements for use of B20 Biodiesel (□ 1-10)
AVTAG (obsolete)	These fuels are NOT ACCEPTABLE with or without additives. Engines MUST NOT be operated with these fuels	
AVTAG FSII (obsolete), NATO F40, JP4, DERD 2454		
JET B (ASTM D1655)		
BS MA100		
JIS K2203 No.2		
Unmodified vegetable oils		

(1) The year of manufacture is part of the engine serial number. Refer to Identifying the Engine.

Additives

The additives listed below are advertised as being suitable for bringing the lubricity levels of kerosene/low sulphur fuels up to those of diesel fuels. They must be used as specified by your fuel supplier who will understand the concentration level necessary.

- Elf 2S 1750. Dosage 1000-1500 ppm (0.1 - 0.15%), specifically for Indian Superior Kerosene (SKO) but may be applicable to other fuels.
- Lubrizol 539N. Dosage (on Swedish low sulphur fuel) 250 ppm.
- Paradyne 7505 (from Infineum). Dosage 500 ppm (0.05%).

Note: These products are given as examples only. The information is derived from the manufacturers data. The products are not recommended or endorsed by JCB.

Service Requirements for use of B20 Biodiesel

- The engine oil must be a grade CH4 as minimum specification.
- Do not leave unused B20 biodiesel in the fuel tank for extended periods (top up each day).
- Make sure that 1 in 5 fuel tank fills use standard diesel to EN590 specification, this will help to prevent 'gumming'.
- Make sure regular oil sampling is completed (look for excessive unburnt fuel content, water or wear particles).
- Change the engine oil and filter more frequently (as a minimum half the recommended intervals), or as indicated by oil sampling.
- Change the fuel filters more frequently (as a minimum half the recommended intervals), or if there are engine performance related issues.
- Make sure the fuel is stored correctly, care must be taken to make sure no water enters the machine fuel tank (or the storage tank). Water will encourage micro-bacterial growth.
- Make sure that the fuel pre-filter is drained DAILY (not every week as currently advised).
- Only JCB ENGINES built after Jan. 2007 are applicable (i.e. engines with 07 on the end of their

serial number and factory filled with CH4 oil) - this is not approved with other manufacturers.

- Use heater kits in low ambient temperature territories.
- The biodiesel must meet the following standards: ASTM D6751, DIN 51606, ISO 14214

Note: If necessary use a test kit to confirm the fuel specification. Testing kits are available (not from JCB currently), use the internet as a source for the kits.

Note: If performance related issues are to be reported to JCB Service, and the engine has been run on biodiesel, then the fuel system must be filled with standard diesel (at least 2 x tank fills) to EN590 specification and relevant stall speeds recorded prior to making the report.

Warranty

JCB have shown a commitment to support the environment by approving the use of biodiesel blended fuels.

Using a B20 blend of biodiesel requires caution and additional servicing of the engine is required. → [Service Requirements for use of B20 Biodiesel \(1-10\)](#)

Failure to follow the additional recommended service requirements may lead to a warranty claim being declined.

Failures resulting by the incorrect use of biodiesels or other fuel additives are not defects of the JCB Dieselmax engine workmanship and therefore will not be supported by JCB Warranty.

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