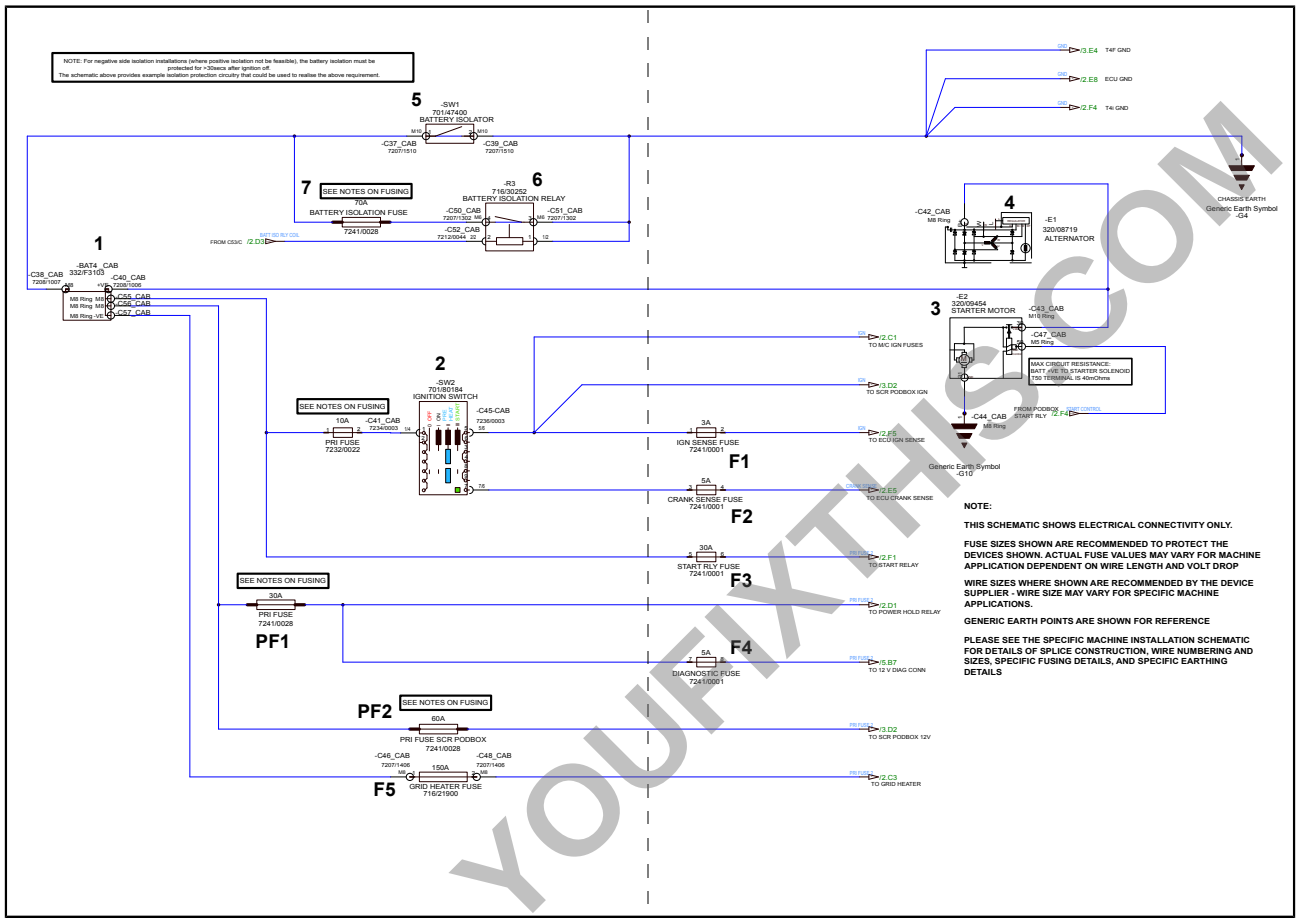
Page 33-12

Figure 298.

Page 33-13



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12 - Main Component Locations

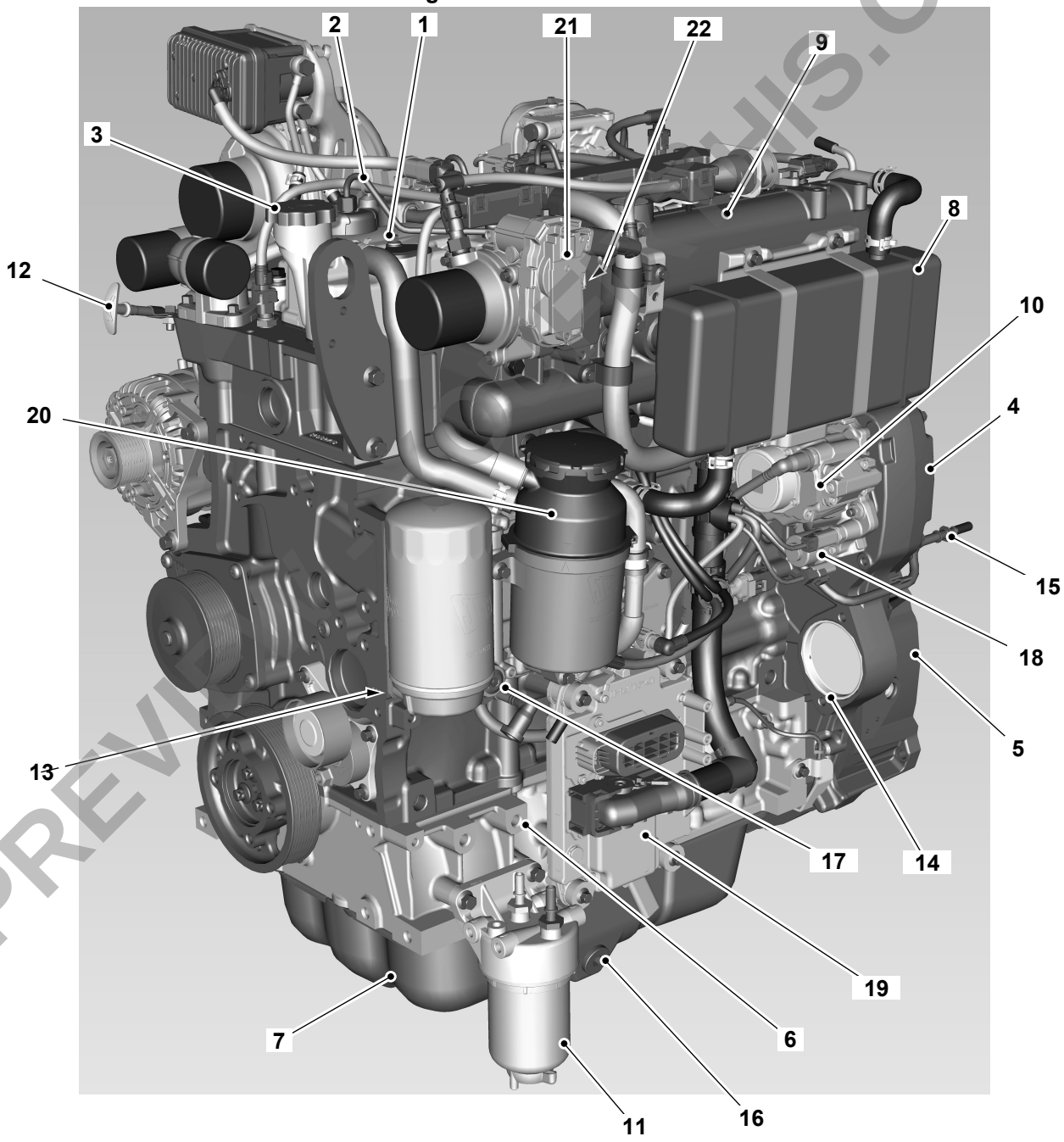
Introduction

Your engine may differ according to its specification from the one shown. The engine shown has capping plugs fitted. If applicable, consult the operator or service manual provided by the installer of this engine.

External

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

Figure 2. Left hand Side

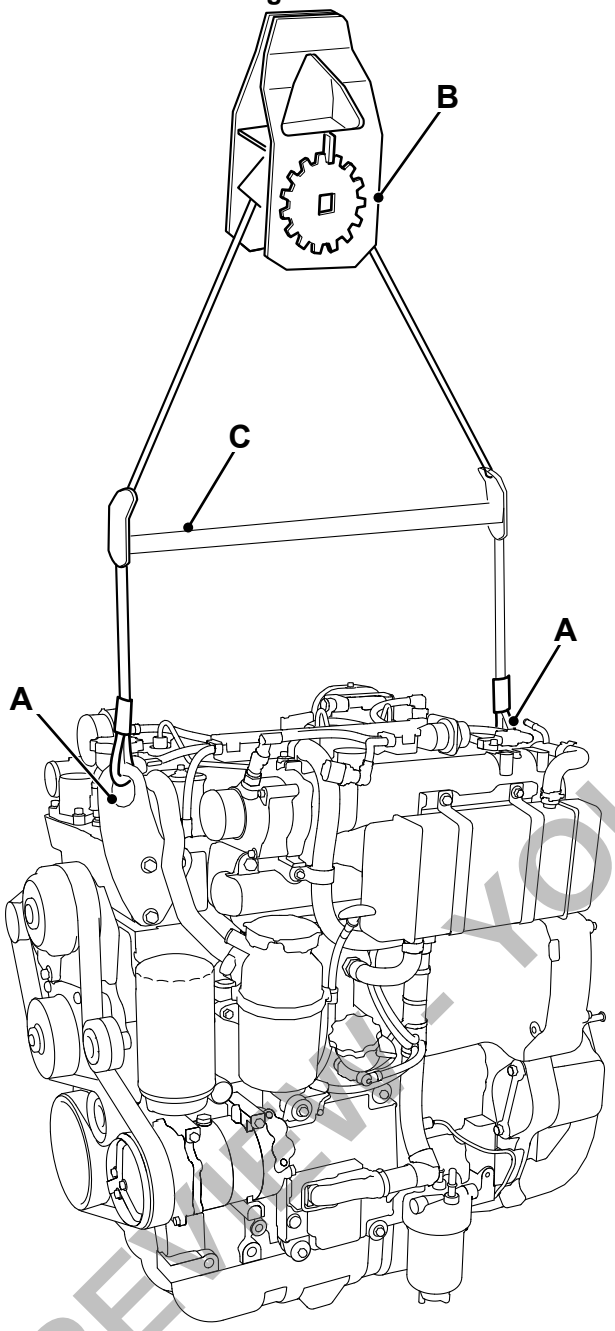


1 Rocker cover

2 Fuel injectors and high pressure fuel pipes

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Figure 21.



A Lifting bracket mounting bolts
B Lifting equipment
C Spreader bar

Install

1. Replacement is a reversal of the removal procedure. Note the following:
2. Important: It is vitally important that the torque converter is installed at the gearbox and engine flywheel correctly. Failure to locate the converter correctly will result in damage to the gearbox oil pump on engine start up.
3. Fill the cooling system with the correct mix of coolant fluid. Refer to (PIL 21-00).
4. Fill and Check the hydraulic fluid level. Refer to (PIL 30-00).
5. Fill and Check the engine oil level. Make sure the correct oil is used. Refer to (PIL 75-03).
6. On completion, check the hydraulic and cooling system for leakage and levels.
7. Check the function of the drive and loader services.

Table 25. Torque Values

Item	Nm
A	47

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Technical Data

Table 156. Engine Fault Codes

J2012 Fault Codes		Lamps				
J2012 P Code (HM Byte)	**J2012 FTB**	**Amber**	**Red**	**DTC Severity as per STD00236**	**Dash Display**	**Fault Description**
P0001	13		Y	SERVICE	P0001-13-Please Contact JCB Dealer	IMV driver fault is detected
P0002	1B		Y	SERVICE	P0002-1B-Please Contact JCB Dealer	Rail pressure control Error (pressure Error too high).
P0002	1A		Y	SERVICE	P0002-1A-Please Contact JCB Dealer	Rail pressure control Error (pressure Error too low).
P0002	00		Y	SERVICE	P0002-00-Please Contact JCB Dealer	Rail pressure Negative Control Error During 'IMV-Only' control. PID controller not able to stabilise the RPC value
P0002	00	Y		CRITICAL	P0002-00-Please Contact JCB Dealer	Rail pressure Positive Control Error During 'IMV-Only' control. PID controller not able to stabilise the RPC value
P0003	18	Y		CRITICAL	P0003-18-Please Contact JCB Dealer	Rail pressure control feedback low Error
P0003	11		Y	SERVICE	P0003-11-Please Contact JCB Dealer	IMV driver fault is detected
P0004	19		Y	SERVICE	P0004-19-Please Contact JCB Dealer	Rail pressure control feedback high Error
P0004	12		Y	SERVICE	P0004-12-Please Contact JCB Dealer	IMV driver fault is detected
P007A	00		Y	SERVICE	P007A-00-Please Contact JCB Dealer	Charge Air Cooler temperature Sensor Circuit
P007C	23		Y	SERVICE	P007C-23-Please Contact JCB Dealer	Charge Air Cooler temperature Sensor Circuit Low
P007D	24		Y	SERVICE	P007D-24-Please Contact JCB Dealer	Charge Air Cooler temperature Sensor Circuit High
P0087	23	Y		CRITICAL	P0087-23-Please Contact JCB Dealer	Rail pressure build low fault
P0087	23	Y		CRITICAL	P0087-23-Please Contact JCB Dealer	Rail pressure build normal fault

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Before Removal

1. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.
2. Position the machine on firm level ground. Make the machine safe, refer to (PIL 01-03).
3. Get access to the engine.

Remove

1. Disconnect and remove the battery. Refer to (PIL 33-03).
2. Drain the engine oil. Refer to (PIL 15-21).
3. Drain the engine coolant, remove the cooling pack. Refer to (PIL 21-03).
4. Discharge the hydraulic pressure. Refer to (PIL 30-00).
5. Drain the hydraulic tank. Disconnect and plug the hydraulic suction and delivery lines at the transmission pump and gear pump. Label the hoses to ensure correct reassembly. Refer to (PIL 30-00).
6. Disconnect and plug the hydraulic cooler hoses. Label the hoses to ensure correct reassembly.
7. Disconnect the exhaust system.
8. Label the cab heater hoses at the engine block connectors. Release the hose clips and remove the hoses.
9. Disconnect the wiring connections from the starter motor. Refer to (PIL 15-75).
10. Disconnect the wiring connections from the alternator. Refer to (PIL 15-72).
11. Disconnect the wiring connections from the engine sensors and actuators. Refer to (PIL 15-84).
12. Disconnect the fuel supply line at the fuel lift pump and the spill line at the fuel injection pump. Cap all hoses and ports to prevent ingress of dirt.
13. Disconnect the electrical harness at the engine harness.
14. Uncouple the electrical harness at the ECM (Engine Control Module) machine side connector. Important: Do not touch the connector pins on the ECM or harness connectors. Cover the connectors to prevent contamination.
15. Ensure that all relevant harnesses and hoses are unclipped from the engine and tied out of the way.
16. Disconnect and plug the hoses at the hydraulic pump.
17. Disconnect the wiring to the hydraulic pump.
18. Remove the gearbox to engine retaining bolts, pull the transmission and converter clear of the engine, make sure that the converter stays mounted on the gearbox shaft.
19. Attach slings to the engine lifting eyes.

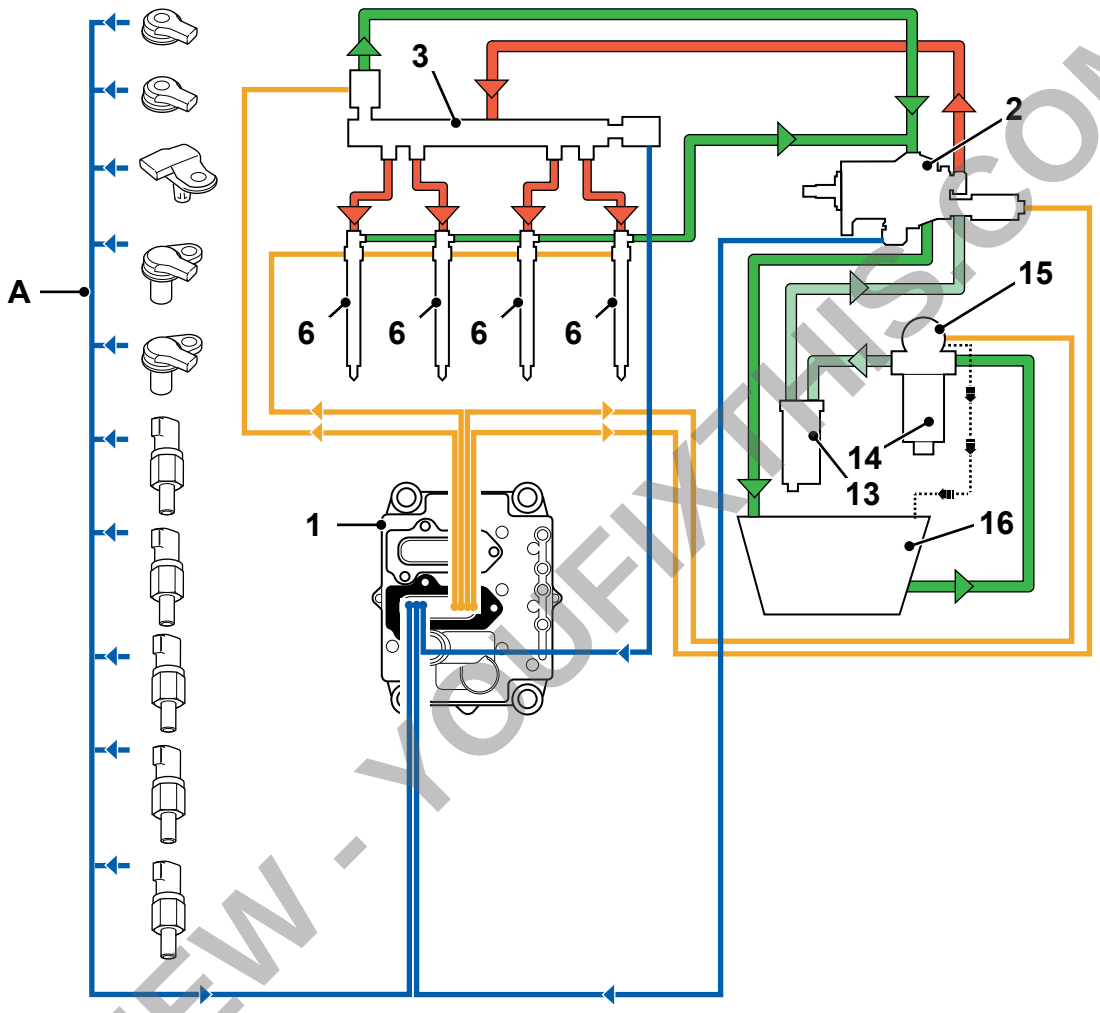
    Special Tool: Lifting Bracket Front (Qty.: 1)
    Special Tool: Lifting Bracket Rear (Qty.: 1)
    Special Tool: Engine Lifting Spreader Bar (Qty.: 1)
20. Take the weight of the engine on the hoist and remove the engine mounting bolts.
21. Withdraw the engine in a level attitude until the hydraulic pump is clear of the chassis. Raise the engine to lift it clear of the machine.
22. Lower the engine into a suitable stand that is capable of supporting the weight of the engine.

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Component Identification

Figure 175.



1 ECM (Engine Control Module)(refer to PIL 33-45)
2 High pressure fuel injection pump (refer to PIL 18-18)
3 Common fuel rail (refer to PIL 18-18)
6 Fuel injectors (refer to PIL 18-18)
13 Fuel filter (2 micron) (refer to PIL 18-09)
14 Fuel pre-filter and water separator (5 micron) (refer to PIL 18-12)
15 Electric feed pump (refer to PIL 18-21)
A Electrical sensors (refer to PIL 15-84)
B Fuel tank (refer to PIL 18-03)

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Fault-Finding

Fault		
Engine - Will Not Start or Difficult to Start (No Exhaust Smoke)	Table 6.	Page 15-18
Engine - Will Not Start or Difficult to Start (Exhaust Smoke)	Table 7.	Page 15-19
Engine - Will Not Crank or Cranks Slowly	Table 8.	Page 15-20
Engine - Starts Then Stops	Table 9.	Page 15-20
Engine - Poor Running	Table 10.	Page 15-21
Engine - Poor Running at Idle	Table 11.	Page 15-21
Engine - Noise Excessive	Table 12.	Page 15-22
Engine - Compression Knocks	Table 13.	Page 15-23
Engine - Reduced Power Output	Table 14.	Page 15-23
Engine - Will Not Reach Maximum RPM	Table 15.	Page 15-24
Engine - RPM Surges	Table 16.	Page 15-24
Engine - Vibration Excessive	Table 17.	Page 15-25
Engine - Exhaust Smoke Excessive (Black Smoke)	Table 18.	Page 15-25
Engine - Exhaust Smoke Excessive (White/Blue Smoke)	Table 19.	Page 15-26
Engine - Will Not Shut Off	Table 20.	Page 15-26
Lubricating Oil - Consumption Excessive	Table 21.	Page 15-26
Lubricating Oil - Contaminated	Table 22.	Page 15-27
Lubricating Oil - Pressure Low	Table 23.	Page 15-27
Lubricating Oil - Pressure High	Table 24.	Page 15-27

Table 6. Engine - Will Not Start or Difficult to Start (No Exhaust Smoke)

Cause	Remedy
No fuel in supply tank.	Check the level in the fuel tank, use sight gauge or dipstick. Replenish as required.
Ignition switch or starter electrical system failure.	Check the operation of the ignition switch. Check the correct electrical wires for open or short circuits.
Improper starting procedure.	Verify proper starting procedure.
Fuel Filter blocked with water or other contamination.	Drain fuel/water separator or replace fuel filter.
Defective fuel lift pump (fuel supply inadequate).	Check that the lift pump operates and delivers fuel to the high pressure fuel pump. Check the correct electrical wires for open or short circuits. Check fuses.
Fuel is aerated.	Check the fuel system for loose connections and possible air ingress points. Rectify and bleed the fuel system.
Fuel inlet restriction.	Maximum inlet restriction to fuel lift pump must not exceed 100mm Hg.
Air intake or exhaust system blocked.	Visually check the air intake and exhaust system for blockage or obstruction. Remove as required. Check the air filter elements for signs of blocking. Replace as required.
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.
One or more fuel injectors worn or malfunctioning.	Check the electronic fault codes. Check the electrical connections at the injectors.

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Technical Data

Table 4.

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	Compression variance between each cylinder should be no greater than 3.5 bar
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	1.6 –6.5 bar
Fuel filter type	Screw-on canister (with drain facility)	Screw-on canister (with drain facility)
Oil pressure relief valve setting	6 bar	6 bar
Oil pressure switch setting	0.6 bar falling	0.6 bar 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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06 - Pre-start Cold Checks, Service Points and Fluid Levels

Introduction

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 183. 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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03 - Safety - Yours and Others

Introduction

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.

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01 - Machine

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SERVICE MANUAL

ENGINE

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

EN - 9806/6400 - ISSUE 4 - 04/2018

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

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Foreword

The Operator's Manual

⚠

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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01 - Machine
06 - Body and Framework
09 - Operator Station
15 - Engine
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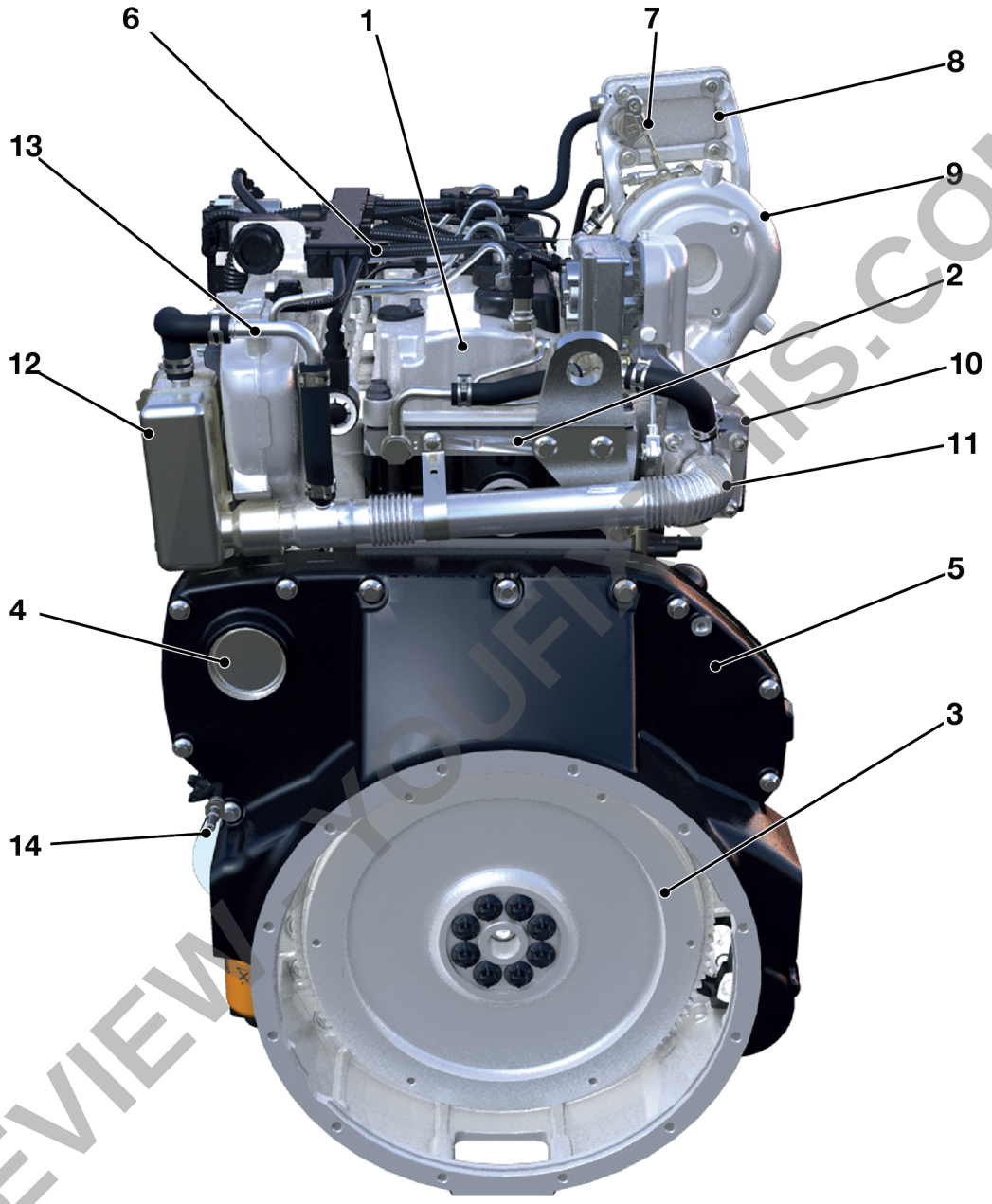
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Notes:

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Figure 15. 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 (not installed on <55kW Engines)
8 VGT actuator (not installed on <55kW Engines)
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

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09 - Rear Oil Seal

Remove and Install

Special Tools

Description	Part No.	Qty.
Crankshaft Rear Oil Seal Installation Tool	892/01156	1
Crankshaft Rear Oil Seal Alignment Tool	892/01158	1

Note: The flywheel hub and crankshaft rear oil seal need to be replaced as a pair.

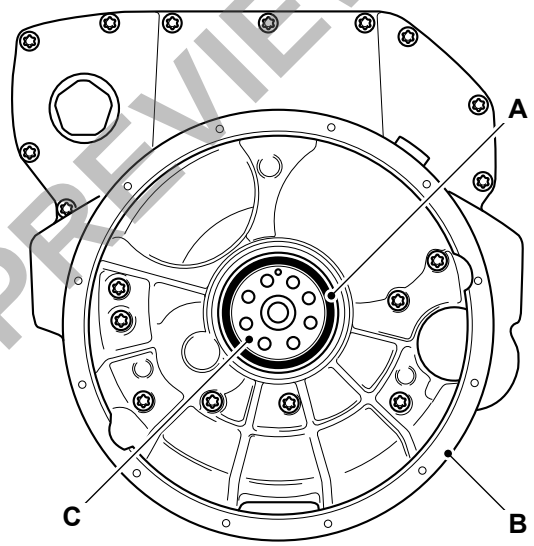
Before Removal

1. This procedure requires service parts. Make sure you have obtained the correct service parts before you start, refer to Parts Catalogue.
2. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.
3. Get access to the engine.
4. Remove the flywheel, refer to (PIL 15-54).

Remove

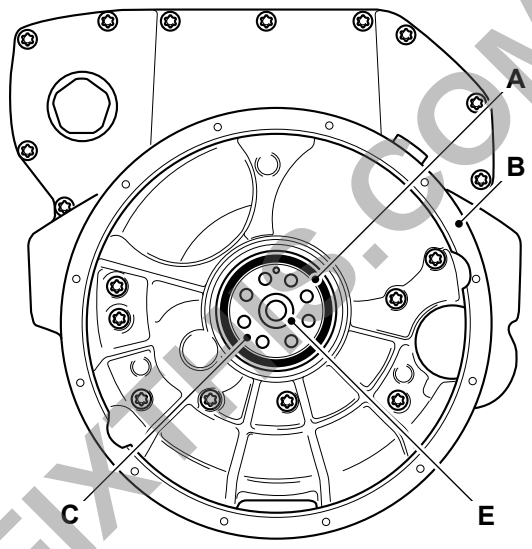
1. Use a suitable lever behind the lip of the seal to carefully prise out the rear oil seal from the counterbore in the flywheel housing. Take care not to scratch or damage the counterbore or the flywheel hub. Damaged or dirty sealing faces will cause the oil seal to fail.

Figure 43. 24mm Hub



A Crankshaft rear oil seal
B Flywheel housing
C Flywheel hub

Figure 44. 15mm Hub



A Crankshaft rear oil seal
B Flywheel housing
C Flywheel hub
E Fixing bolt

Install (24mm Hub)

1. Make sure that the counterbore and the flywheel hub are clean and free from damage and corrosion.

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36 - Piston

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00 - General

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Introduction

Flywheels are used to provide continuous energy in systems, where the energy source is not continuous. In such cases, the flywheel stores energy when torque is applied by the energy source, and it releases stored energy when the energy source is not applying torque to it.

In a reciprocating engine, a flywheel is used to maintain constant angular velocity of the crankshaft.

The flywheel, which is mounted on the crankshaft, stores energy when torque is exerted on it by a firing piston, and it releases energy to its mechanical loads when no piston is exerting torque on it.

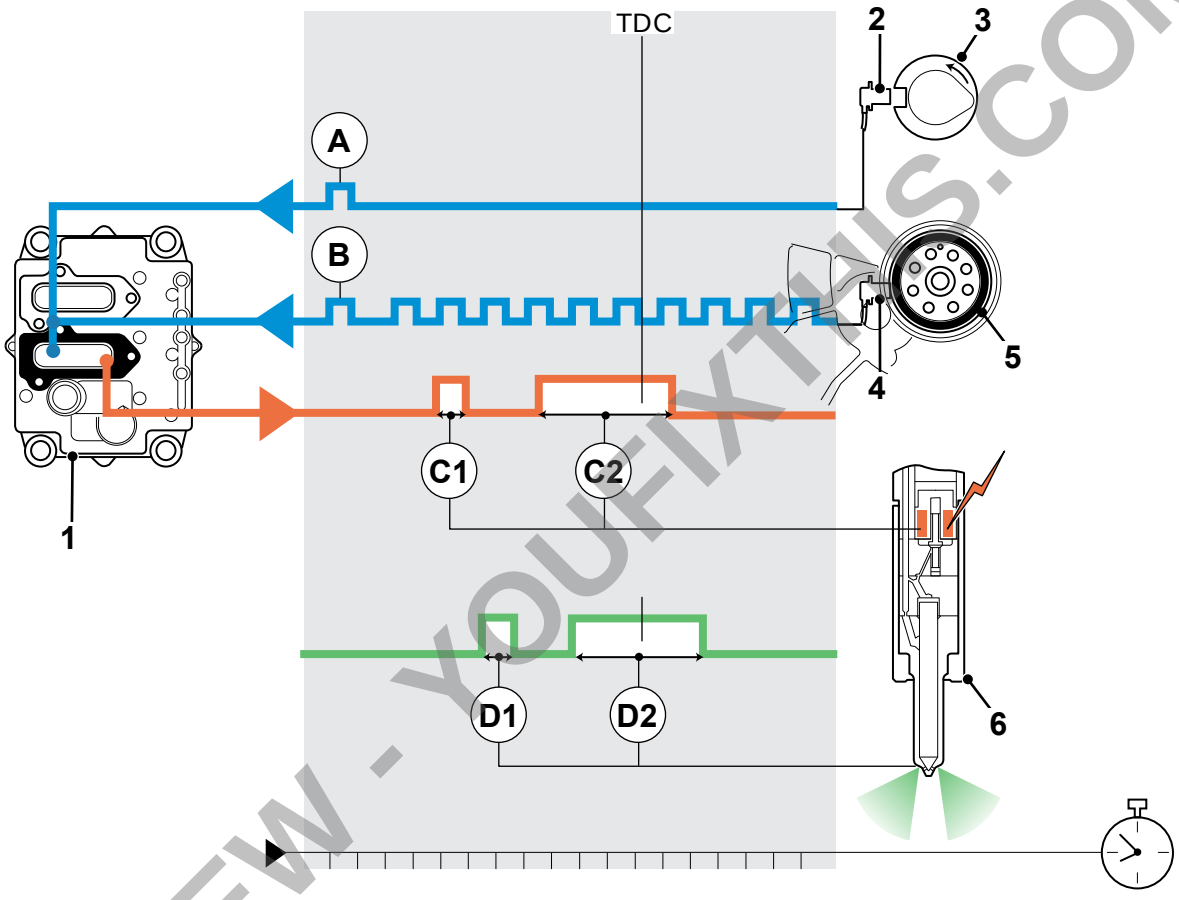
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Operation

A signal is generated by the crankshaft mounted target wheel and crankshaft position sensor. It is processed by the ECM (Engine Control Module) to determine the timing of fuel injection.

Figure 144.



1	ECM	**2**	Camshaft position sensor
3	Camshaft target wheel	**4**	Crankshaft position sensor
5	Crankshaft mounted target wheel	**6**	Fuel injector
A	Camshaft sensor signal	**B**	Crankshaft position sensor signal
C1-C2	Current pulse-injector solenoid coil	**D1-D2**	Fuel Injection
TDC	TDC (Top Dead Centre)		

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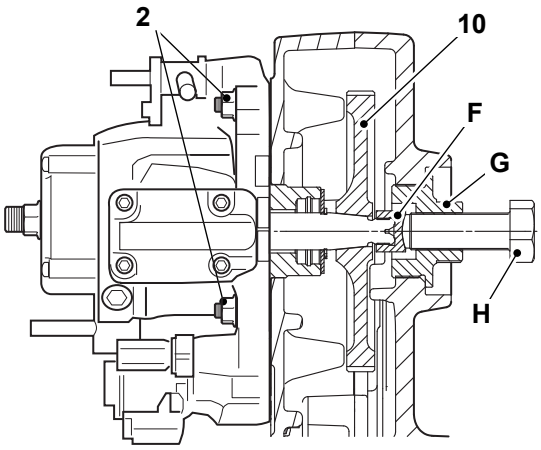
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Notes:

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Figure 215.



2 Fixing nuts
10 Injection pump drive gear
F Pump gear removal tool (Reaction cap)
G Pump gear removal tool (Body)
H Pump gear removal tool (Bolt)

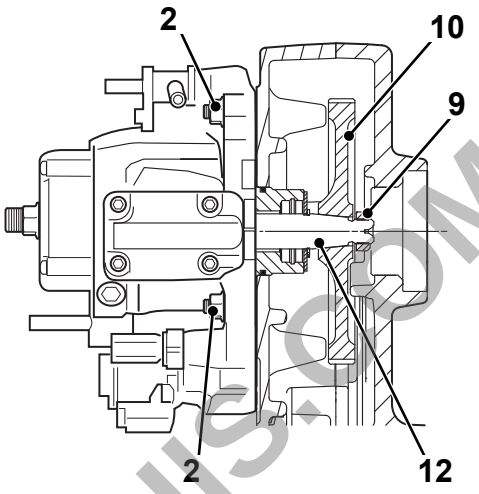
9. The injection pump drive gear is located on a taper on the pump drive shaft. To remove the pump the taper lock must be broken. Support the fuel pump. Tap the end of the bolt H with a soft faced hammer. When the taper breaks there will be an audible sound. Note: The pump drive gear connects to the injection pump drive shaft by means of taper lock alone, there is no mechanical locking key.

10. Remove the service tools. Withdraw the pump from the flywheel housing.

Install

1. Make sure that the taper surfaces on the injection pump drive shaft and gear are clean and free from oil and damage.

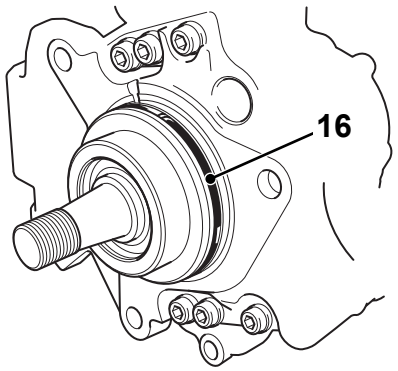
Figure 216.



2 Fixing nuts
9 Gear pump nut
10 Drive gear
12 Drive shaft

2. Make sure that the oil seal is correctly located on the pump mounting face.

Figure 217.



16 Oil seal

3. Locate the pump on to the mounting studs. Locate the drive gear over the pump drive shaft.

4. Install the fixing nuts and tighten to the correct torque value.

5. Install the gear pump nut and tighten to the correct torque value. Note: If a washer is supplied with a replacement pump, Do not install the washer. Secure the gear with the gear pump nut only.

6. Use the tamperproof cover removal tool to install the gear cover. Make sure its sealing O-ring is correctly installed. Tighten the gear cover to the correct torque value.

   Special Tool: Torque Wrench (10-100Nm) (Qty.: 1)
   Special Tool: Tamper proof Cover Removal Tool (Qty.: 1)

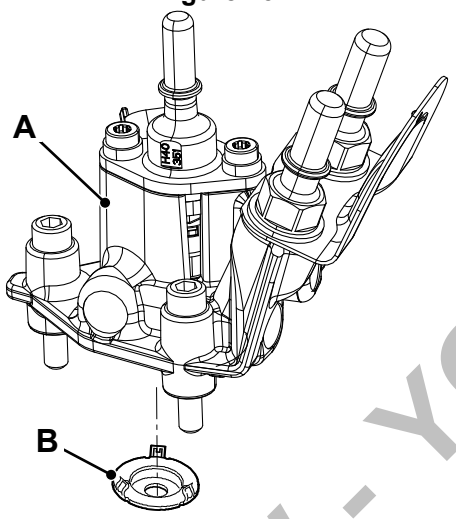
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5. Disconnect and cap the electrical connector.
6. Undo the bolts (x3).
7. Remove the dosing metering module from the mixer. Discard the metal gasket.
8. Install the caps on the mixer and the dosing metering module.

The dosing metering module is a non-serviceable item. If it is damaged or faulty it must be replaced. Do not attempt to disassemble the dosing metering module, any evidence of tampering will result in warranty claims being rejected.

Install

Figure 252.



A Dosing metering module
B Metal gasket

1. Installation is the reversal of the removal procedure.
2. Replace the metal gasket.
3. Tighten the bolts to the correct torque value.
4. Fill the engine cooling system.

Table 123. Torque Values

Item	Nm
3	8

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06 - Expansion Tank

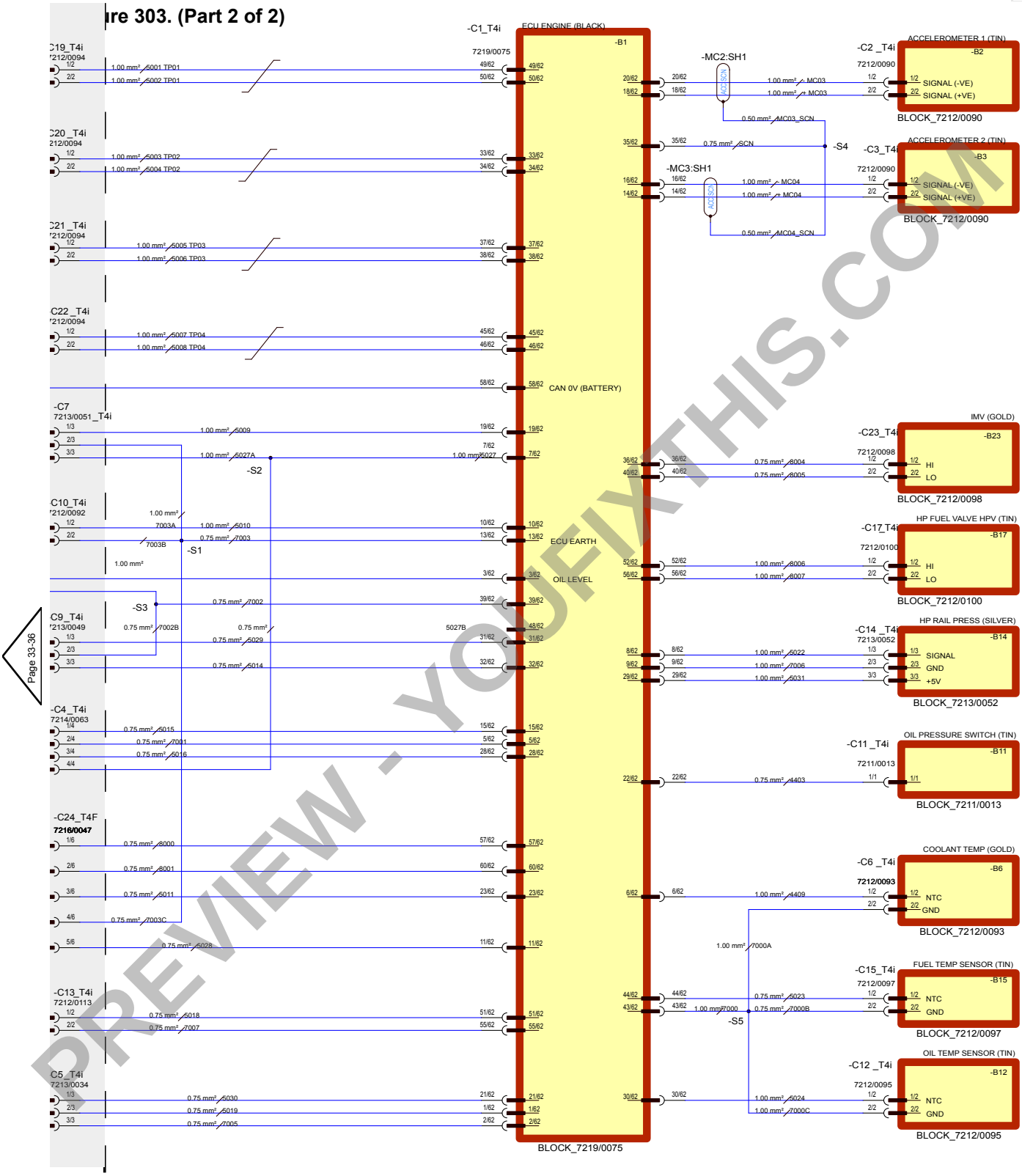
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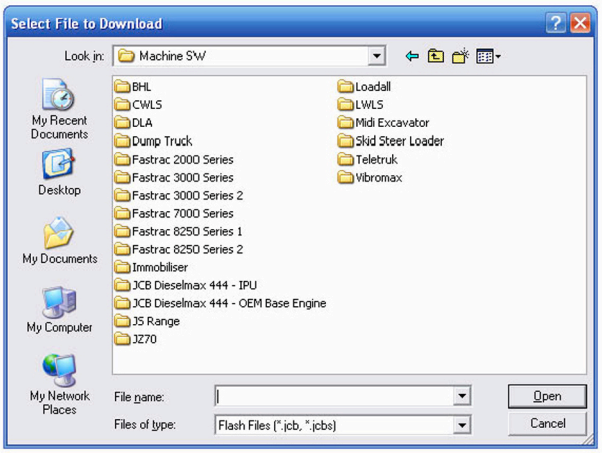
ıre 303. (Part 2 of 2)



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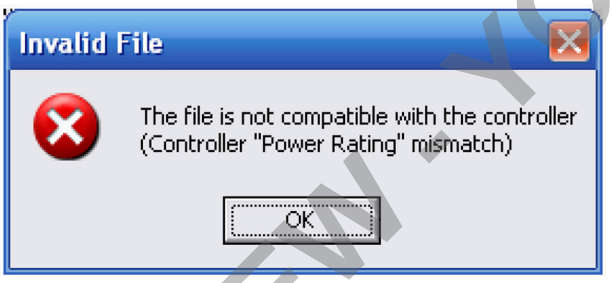
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Figure 368.



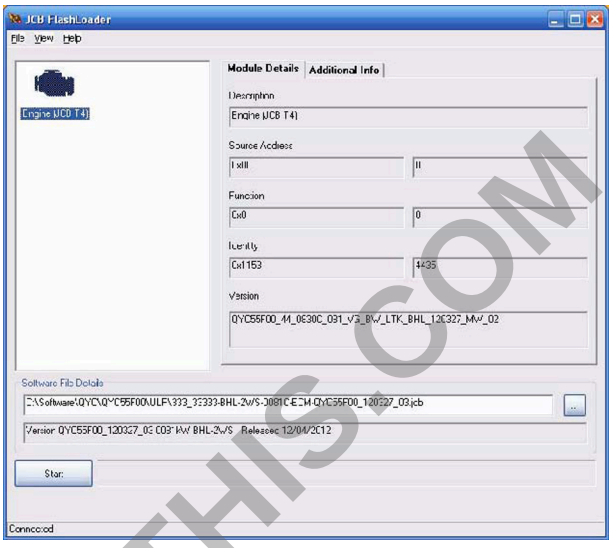
8. Navigate to the relevant application folder.
9. Navigate to the ECM folder.
10. Select and Open the relevant file and which matches the Make, Model and Power Rating.
11. If the file selected does not match the Make, Model and Power Rating which is currently stored in the ECM it will cause an error.

Figure 369.



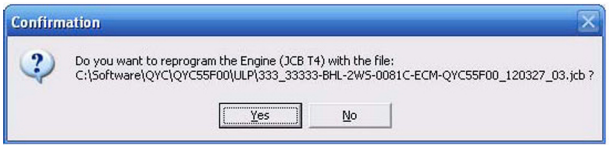
12. Please make another selection or close the Flashloader Tool and use the Engine Setup Tool to correct the Make or Model.
13. If no error occurs and the file information below the file path populates you are ready to flash the engine.

Figure 370.



14. Before pressing start please ensure that:
    14.1. All electrical connections between the laptop and machine are secure.
    14.2. The laptop battery is sufficient.
    14.3. You are familiar with any safety cut out feature on the machine (seat switch) and do not invoke it during the flash.
15. Pressing Yes will flash the ECM.

Figure 371.



16. Pressing No will abort the download.
17. Ecomax Engine only - If the Engine Immobiliser is active you can not flash the ECM. You will get this warning.

Figure 372.



18. Please refer to the immobiliser guide to disable the immobiliser before proceeding.
19. Flashing process will then start and progress bar will update.

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06 - Bolts

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