



SERVICE MANUAL

EXCAVATOR
JS140, JS200, JS205, JS215

EN - 9813/0400 - ISSUE 7 - 02/2018

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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03 - Attachments, Couplings and Load Handling

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Introduction**Basic Description**

The Cummins mechanical fuel injected engine has fuel ignited by compression ignition (C.I.). The engine operates on a four stroke cycle.

The engine cylinders are arranged in-line. The cylinder head assembly has one inlet valve and one exhaust valve for each cylinder. Each valve has a single valve spring.

The crankshaft gear turns the camshaft gear and fuel injection pump gear. The gears are contained in a casing at the front of the engine.

The camshaft operates the valves by means of cam followers and push rods. The cam followers can be accessed by means of a removable cover on the side of the engine block.

Access for valve clearance maintenance is by means of a removable cover for each individual cylinder.

The oil pump is also driven by the crankshaft gear.

A pulley mounted on the front of the crankshaft incorporates a vibration damper. The pulley drives a FEAD (Front End Accessory Drive) belt which in turn drives fan, coolant pump and alternator pulleys. The belt tension is set by an automatic tensioner mechanism.

Engine efficiency, efficiency of emission controls, and engine performance depend on adherence to correct operation and maintenance recommendations. Engine performance and efficiency also depend on the use of recommended fuels, lubrication oils, and coolants. [Refer to: PIL 78-24.](#)

Health and Safety

accordance with local regulations. Use authorised waste disposal sites.

Hot Components

Touching hot surfaces can burn skin. The engine and machine components will be hot after the unit has been running. Allow the engine and components to cool before servicing the unit.

Turning the Engine

Do not try to turn the engine by pulling the fan or fan belt. This could cause injury or premature component failure.

Notice: *The engine and other components could be damaged by high pressure washing systems. Special precautions must be taken if the machine is to be washed using a high pressure system. Make sure that the alternator, starter motor and any other electrical components are shielded and not directly cleaned by the high pressure cleaning system. Do not aim the water jet directly at bearings, oil seals or the engine air induction system.*

WARNING! *To bleed the injectors you must turn the engine. When the engine is turning, there are parts rotating in the engine compartment. Before starting this job make sure that you have no loose clothing (cuffs, ties etc) which could get caught in rotating parts. When the engine is turning, keep clear of rotating parts.*

Notice: *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.*

Notice: *Do not exceed the correct level of engine oil in the sump. If the maximum is exceeded, the excess must be drained to the correct level. An excess of engine oil could cause the engine speed to increase rapidly without control.*

WARNING! *The engine has exposed rotating parts. Switch off the engine before working in the engine compartment. Do not use the machine with the engine cover open.*

WARNING! *Hot oil and engine components can burn you. Make sure the engine is cool before doing this job. Used engine crankcase lubricants contain harmful contaminants. In laboratory tests it was shown that used engine oils can cause skin cancer.*

Notice: *A drive belt that is loose can cause damage to itself and/or other engine parts.*

WARNING! *Do not open the high pressure fuel system with the engine running. Engine operation causes high fuel pressure. High pressure fuel spray can cause serious injury or death.*

CAUTION! *It is illegal to pollute drains, sewers or the ground. Clean up all spilt fluids and/or lubricants. Used fluids and/or lubricants, filters and contaminated materials must be disposed of in*

Technical Data

For: Cummins 4BT 3.9C Tier 3
 Page 15-5

For: Cummins 6BT 5.9 Tier 3
 Page 15-5

(For: Cummins 4BT 3.9C Tier 3)

Table 28.

Description	Data
Engine type	Cummins 4BT 3.9
Emission compliance	Tier 3
Number of cylinders	4
Nominal bore size	102mm
Stroke	120mm
Cylinder arrangement	Vertical In-line
Combustion Cycle	4-stroke
Firing order	1-3-4-2
Compression ratio	17.5:1
Swept volume	3.92L
Valve clearance (cold)	Inlet 0.25mm, Exhaust 0.51mm
Rotation (viewed from front)	Clockwise
Weight (approximate)	350kg
Oil pressure	At idle speed 0.7bar (10.1psi). At rated speed 2.07bar (30.0psi)

(For: Cummins 6BT 5.9 Tier 3)

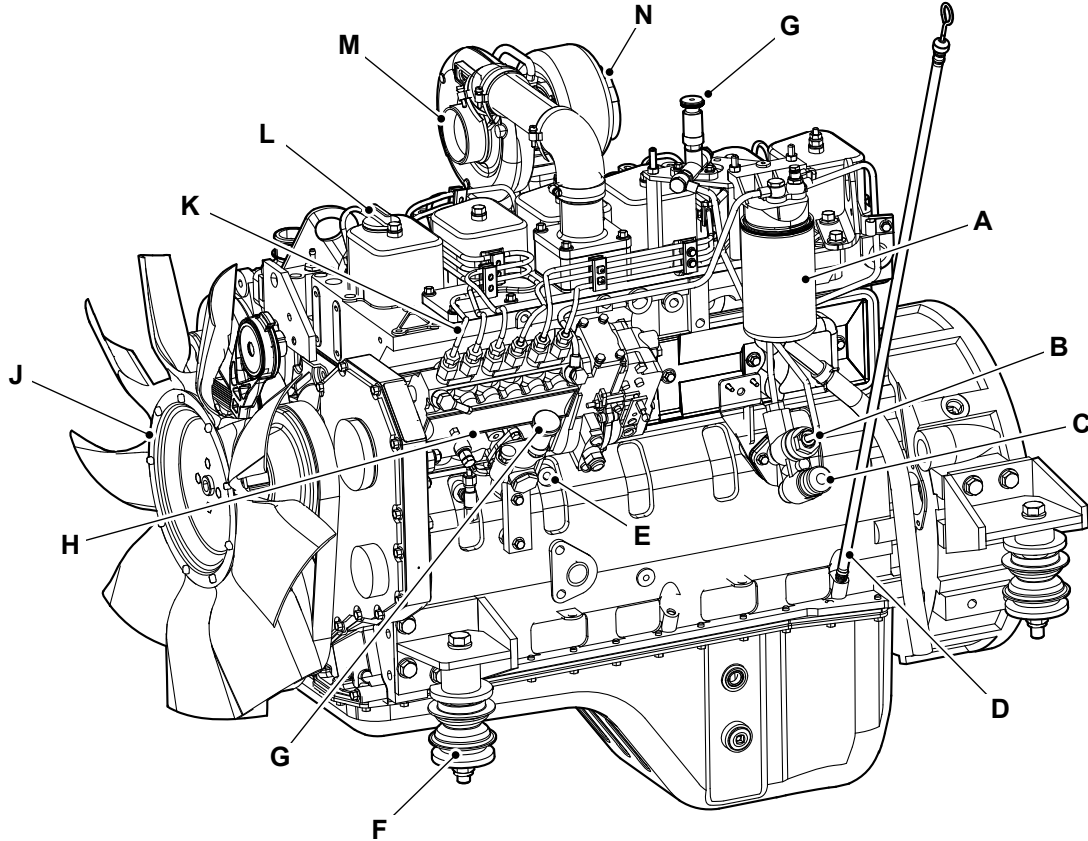
Table 29.

Description	Data
Engine type	Cummins 6BT 5.9
Emission compliance	Tier 3
Number of cylinders	6
Nominal bore size	102mm
Stroke	120mm
Cylinder arrangement	Vertical In-line
Combustion Cycle	4-stroke
Firing order	1-5-3-6-2-4
Compression ratio	17.5:1
Swept volume	5.88L
Valve clearance (cold)	Inlet 0.25mm, Exhaust 0.51mm
Rotation (viewed from front)	Clockwise
Weight (approximate)	440kg
Oil pressure	At idle speed 0.7bar (10.1psi). At rated speed 2.07bar (30.0psi)

Component Identification

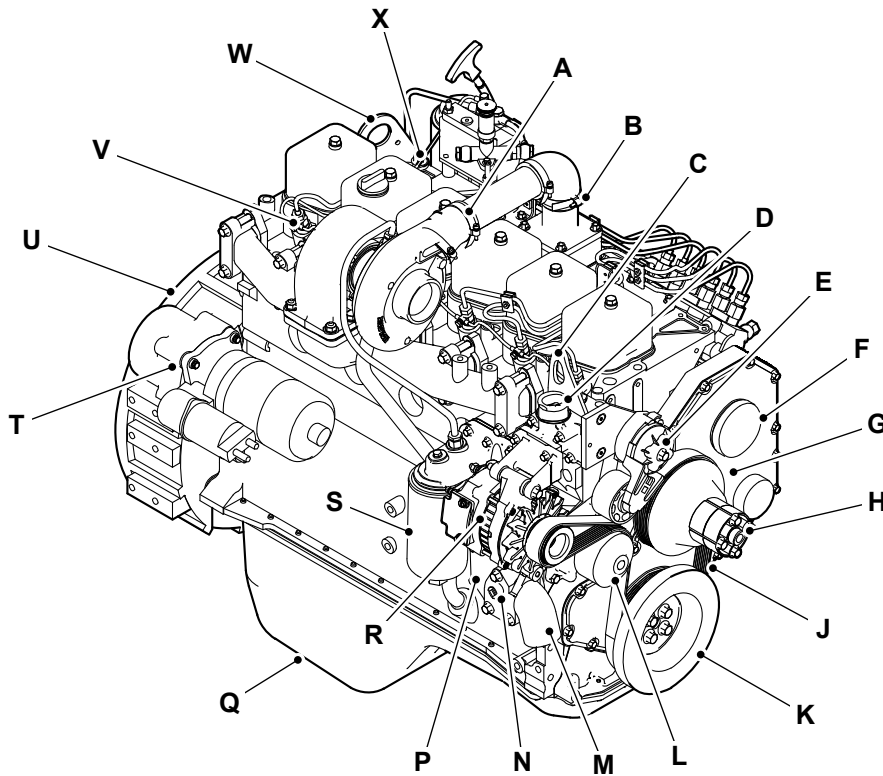
The illustrations show a 6 cylinder variant. 4 cylinder variants have the same main components and component locations.

Figure 92.



- A Fuel filter / water separator
- C Fuel lift pump
- E Connection - oil pressure switch
- G Fuel bleed pump
- J Engine fan
- L Oil filler cap
- N Turbo exhaust outlet

- B Connection - fuel inlet
- D Dipstick
- F Engine mounting
- H In-line fuel injection pump
- K High pressure fuel lines
- M Turbo air inlet

Figure 93.


- A Turbo air outlet
- C Front lift bracket
- E Automatic belt tensioner
- G Front gear cover
- J FEAD (Front End Accessory Drive)
- L Coolant pump
- N Coolant heater return
- Q Oil drain plug
- S Oil filter
- U Flywheel housing
- W Rear lift bracket

- B Engine air inlet
- D Coolant outlet
- F Fuel pump drive cover
- H Fan pulley
- K Vibration damper
- M Coolant inlet
- P Oil cooler
- R Alternator
- T Starter motor and solenoid
- V Fuel injection nozzles
- X Connection - fuel return

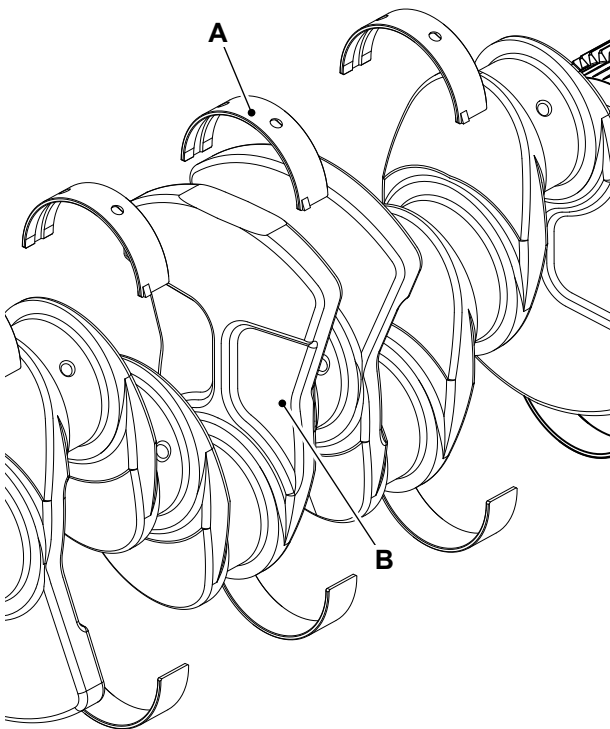
03 - Main Bearing

Introduction

In a piston engine, the main bearings are the bearings on which the crankshaft rotates.

The bearings hold the crankshaft in place and prevent the forces created by the piston and transmitted to the crankshaft by the connecting rods from dislodging the crankshaft, instead forcing the crank to convert the reciprocating movement into rotation.

Figure 94.



- A** Main bearing
- B** Crankshaft



00 - General

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Introduction

The relationship between the rotation of the camshaft and the rotation of the crankshaft is of critical importance.

Since the valves control the flow of the air/fuel mixture intake and exhaust gases, they must be opened and closed at the appropriate time during the stroke of the piston.

For this reason, the camshaft is connected to the crankshaft through a gear mechanism.

When the engine runs the crankshaft drives the camshaft through the gears. The camshaft opens and closes the inlet and exhaust valves through the push rods in time with the four stroke cycle.

Check (Condition)

1. Inspect the camshaft gear teeth for signs of damage or excessive wear.
2. Inspect the cam lobes for signs of excessive wear, scoring or pitting.
3. Inspect the cam bearing surfaces for signs of excessive wear, or scoring. Check that the dimensions are within service limits.
4. Inspect the cam bearing surfaces inside the crankcase for signs of excessive wear, or scoring. Check that the dimensions are within service limits.
5. Inspect the bearing surfaces of the tappets for signs of excessive wear or damage. Check that the dimensions are within service limits.
6. Inspect the tappet bores inside the crankcase for signs of excessive wear or damage. Check that the dimensions are within service limits.
7. If any of the camshaft bearings or lobes are worn or damaged then the relative oil feed galleries in the crankcase and camshaft may be blocked. Make sure all oil ways are clear and free from debris.



03 - Drive Belt

Health and Safety	15-35
Check (Condition)	15-36
Remove and Install	15-36

Health and Safety

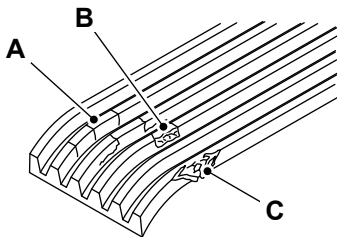
▲ Notice: A drive belt that is loose can cause damage to itself and/or other engine parts.

Check (Condition)

At the recommended service interval, visually inspect the drive belt for damage.

1. Make the machine safe.
 Refer to: [PIL 01-03](#).
2. Stop the engine and let it cool down.
3. Renew the drive belt if it has cracks or if it is frayed or has pieces of material missing.

Figure 95.



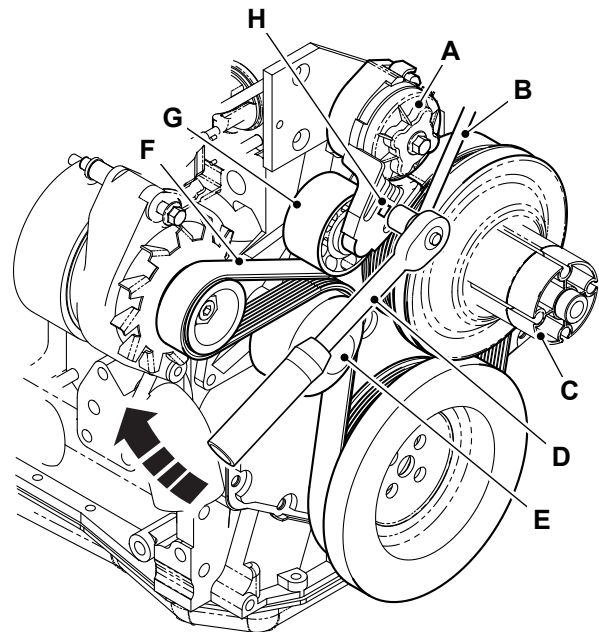
- A Crack in belt
- B Missing piece of belt
- C Frayed belt

Remove and Install

Remove

1. Make the machine safe.
 Refer to: [PIL 01-03](#).
2. Remove the compressor belt (if installed).
 Refer to: [PIL 15-18-04](#).
3. Using a suitable ratchet inserted into the square drive on the spring loaded tensioner, carefully rotate the tensioner to release the tension on the belt.
4. Lift the FEAD (Front End Accessory Drive) belt from the engine and then release the tensioner.
5. Make sure that the fan pulley and idlers rotate smoothly and that there is no excessive bearing play. Replace defective pulleys and idlers.

Figure 96.



- A Spring loaded tensioner
- B Compressor belt
- C Fan pulley
- D Ratchet
- E Idler 1
- F FEAD belt
- G Idler 2
- H Square drive

Install

1. The installation procedure is the opposite of the removal procedure.

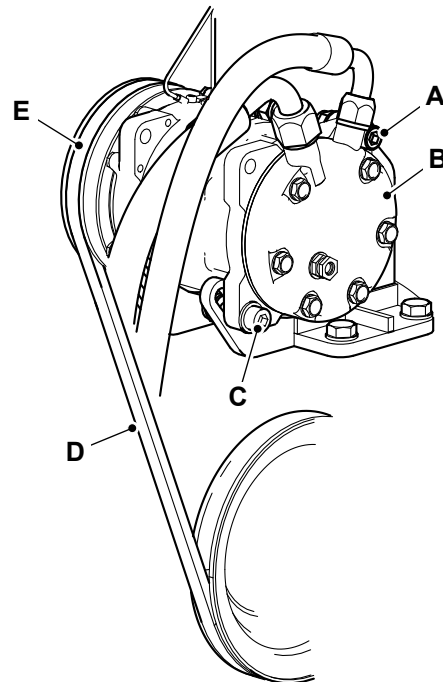
04 - Compressor Belt

Adjust 15-37
 Remove and Install 15-38

Adjust

1. Make the machine safe.
 Refer to: PIL 01-03.
2. Use a suitable gauge to measure the belt tension. Position the gauge at the position shown. The tension should be as specified.
 Weight/Force: 60 ± 2.5kg
3. If the tension is not correct, adjust the belt.

Figure 97.



- A** Screws 1 (x 2)
- B** Compressor
- C** Screws 2 (x 2)
- D** Measuring position - tension
- E** Belt

- 3.1. Loosen the two screws 1.
- 3.2. Loosen the two screws 2.
- 3.3. Rotate the compressor on the screws 1 to increase or decrease the belt tension as applicable.
- 3.4. Tighten the screws 1 and screws 2.
- 3.5. Start the engine and let it run at low idle for the specified time period.
 Duration: 15min
- 3.6. Stop the engine and remeasure the belt tension.

Remove and Install

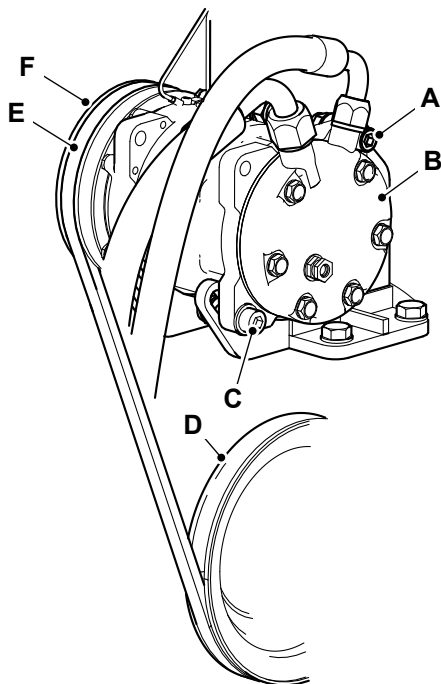
Remove

1. Make the machine safe.
[Refer to: PIL 01-03.](#)
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. Remove the cooling fan.
4. Loosen the two screws 1.
5. Loosen the two screws 2.
6. Rotate the compressor on the two screws 1 so that the tension on the belt is released.
7. When the tension is slack remove the belt from the pulleys.
8. Inspect the belt for cracks, fraying or missing pieces. If the belt is defective replace it with a new one.

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following step.
2. Tension the belt correctly.
[Refer to: PIL 15-18-04.](#)

Figure 98.



- A Screws 1 (x 2)
- B Compressor
- C Screws 2 (x 2)
- D Drive pulley
- E Belt
- F Compressor clutch pulley



00 - General

Health and Safety	15-41
Check (Level)	15-42
Remove and Install	15-42

Health and Safety

Oil

Oil is toxic. If you swallow any oil, do not induce vomiting, seek medical advice. Used engine oil contains harmful contaminants which can cause skin cancer. Do not handle used engine oil more than necessary. Always use barrier cream or wear gloves to prevent skin contact. Wash skin contaminated with oil thoroughly in warm soapy water. Do not use petrol, diesel fuel or paraffin to clean your skin.

CAUTION! *It is illegal to pollute drains, sewers or the ground. Clean up all spilt fluids and/or lubricants. Used fluids and/or lubricants, filters and contaminated materials must be disposed of in accordance with local regulations. Use authorised waste disposal sites.*

CAUTION! *Oil will gush from the hole when the drain plug is removed. Keep to one side when you remove the plug.*

CAUTION! *The oil filter canister will contain some oil which could spill out when you remove the canister.*

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