



## Section K

# Engine

Service Manual - 506-36, 507-42, 509-42, 510-56

[Section 1 - General Information](#)

[Section 2 - Care and Safety](#)

[Section 3 - Routine Maintenance](#)

[Section B - Body and Framework](#)

[Section C - Electrics](#)

[Section E - Hydraulics](#)

[Section F - Transmission](#)

[Section G - Brakes](#)

[Section H - Steering](#)

[Section K - Engine](#)

[Section M - Electronic Network](#)



Publication No.  
**9803/3740-05**



World Class  
Customer Support

Sample Manual. Download All pages at

<https://www.arepairmanual.com/downloads/jcb-506-36-507-42-509-42-510-56-telescopic-handler-service-repair-manual/>



<b>Contents</b>	<b>Page No.</b>
<b>Applications</b>	
Table .....	K0 - 1
<b>Start and Stop SYSTEM</b>	
Introduction .....	K1 - 1
Related Topics .....	K1 - 2
Operation Overview .....	K1 - 3
Electrical Operation and Schematics .....	K1 - 5
Electrical Connectors .....	K1 - 7
<b>Cold Start Heater SYSTEM</b>	
Introduction .....	K2 - 1
Related Topics .....	K2 - 2
Operation Overview .....	K2 - 3
Electrical Operation and Schematics .....	K2 - 4
Electrical Connectors .....	K2 - 5
Fault Finding .....	K2 - 6
Diagnostic 'Blink' Codes .....	K2 - 6
<b>Starter Motor</b>	
Introduction .....	K3 - 1
Related Topics .....	K3 - 2
Removal, Inspection and Replacement .....	K3 - 3
Removal .....	K3 - 3
Inspection .....	K3 - 3
Replacement .....	K3 - 3
Renewing the Brush Gear .....	K3 - 4
Renewing the Starter Solenoid .....	K3 - 5
<b>Cooling Pack</b>	
Introduction .....	K4 - 1
Related Topics .....	K4 - 2
Removal and Replacement .....	K4 - 3
Removal .....	K4 - 4
Replacement .....	K4 - 4
Dismantle and Assemble .....	K4 - 6
<b>Coolant Expansion Tank</b>	
Introduction .....	K5 - 1
Related Topics .....	K5 - 2
Removal and Replacement .....	K5 - 3
Tank Removal .....	K5 - 3
Tank Replacement .....	K5 - 4
Coolant Level Sensor Removal .....	K5 - 4
Coolant Level Sensor Replacement .....	K5 - 4
<b>Exhaust Silencer</b>	
Introduction .....	K6 - 1
Related Topics .....	K6 - 2
Removal and Replacement .....	K6 - 3
Removal .....	K6 - 3
Replacement .....	K6 - 4
<b>Throttle Cable</b>	
Introduction .....	K7 - 1

<b>Contents</b>	<b>Page No.</b>
Related Topics .....	K7 - 2
Removal and Replacement .....	K7 - 3
Removal .....	K7 - 3
Replacement .....	K7 - 3
Cable Adjustment .....	K7 - 4
Throttle Pedal Stop Adjustment .....	K7 - 5
Machines with no Throttle Position Sensor (TPS) .....	K7 - 5
<b>JCB Dieselmax</b>	
Introduction .....	K8 - 1
Related Topics .....	K8 - 2
Specifications .....	K8 - 3
Removal and Replacement .....	K8 - 4
Removal .....	K8 - 6
Replacement .....	K8 - 7
Separating the Engine From the Bevel Box .....	K8 - 8
Dismantling .....	K8 - 8
Assembly .....	K8 - 9

# Applications

## Table

**Important:** The machine model names are NOT referred to in the topics. You must refer to the applications table for the applicable machine models. Table entries shaded grey indicate a topic not included in this issue of the manual.

Topic Ref	Title	VARIANT	Machine models		
			506-36 5CD	507-42 5CE 509-42 5CF	510-55 5CG
K1	<b>Start and Stop SYSTEM</b>		●	●	●
K2	<b>Cold Start Heater SYSTEM</b>		●	●	●
K3	<b>Starter Motor</b>		●	●	●
K4	<b>Cooling Pack</b>		●	●	●
K5	<b>Coolant Expansion Tank</b>		●	●	●
K6	<b>Exhaust Silencer</b>		●	●	●
K7	<b>Throttle Cable</b>		●	●	●
K8	<b>JCB Dieselmax Engines</b>	63kW	●	507-42 5CE	
		74kW	●	●	
		85kW			●



**Page left intentionally blank**

# Start and Stop SYSTEM

## Introduction

This topic contains information about a machine SYSTEM. Make sure you are referring to the correct system. Refer to the applications table.

Descriptions and procedures relate to the system and not related devices. For information about the devices refer to the relevant topics.

This topic is intended to help you understand what the system does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ \*Related Topics\* \(□ K1-2\)](#)

[⇒ \*Operation Overview\* \(□ K1-3\)](#)

[⇒ \*Electrical Operation and Schematics\* \(□ K1-5\)](#)

[⇒ \*Electrical Connectors\* \(□ K1-7\)](#)

## Related Topics

Table 1. Related Topics in This Publication

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to *Section 1 - Applications*.

Sections	Topic Titles	Sub Titles
1	<b>Applications</b>	ALL
2	ALL (Care and Safety) <sup>(1)</sup>	ALL
C	<b>Fuses and Relays</b>	ALL
C	<b>Electrical Harness SYSTEM</b>	ALL
K	<a href="#">⇒ Cold Start Heater SYSTEM (□ K2-1)</a>	ALL
K	<a href="#">⇒ Starter Motor (□ K3-1)</a>	ALL

(1) You must obey all of the relevant care and safety procedures.

### Operation Overview

Before the engine will start the transmission must be set to N (neutral).

The engine is started with an electric starter motor **1-A**. Electrical solenoid **1-B** moves the starter pinion gear into mesh with the engine flywheel ring gear before closing switch contacts to energise the motor. The solenoid is energised when the machine starter switch **1-C** is set to position III.

When the engine is coolant is cold switch **1-F** closes and cold start solenoid **1-G** is energised. The fuel injection pump is adjusted for cold starting.

When the engine has started the starter switch **1-C** is released it moves to position I. The ESOS (electric shut-off solenoid) **1-D** remains energised and there is fuel supply to the engine.

While the engine is running an output from the alternator sends a signal to hour meter **1-E**. The meter increments the time units.

When the starter switch **1-C** is set to position O the ESOS (electric shut-off solenoid) **1-D** is de-energised and there is no fuel supply to the engine. The engine stops.

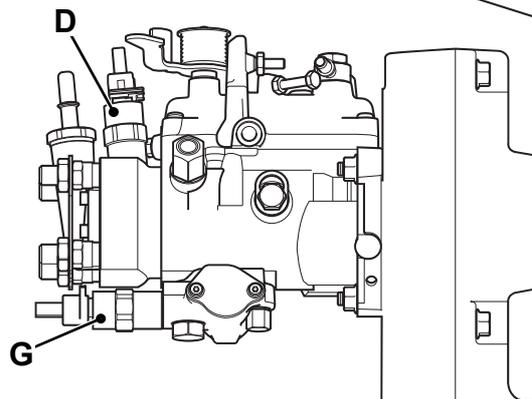
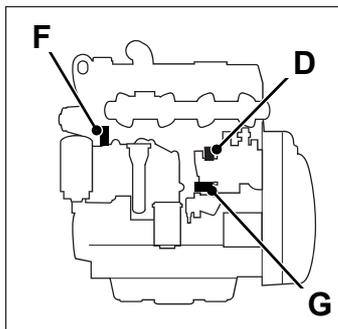
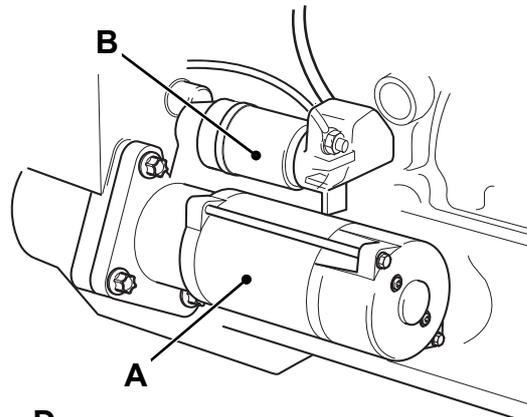
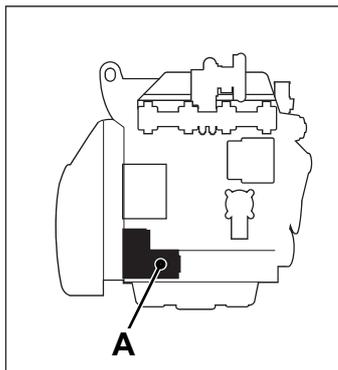
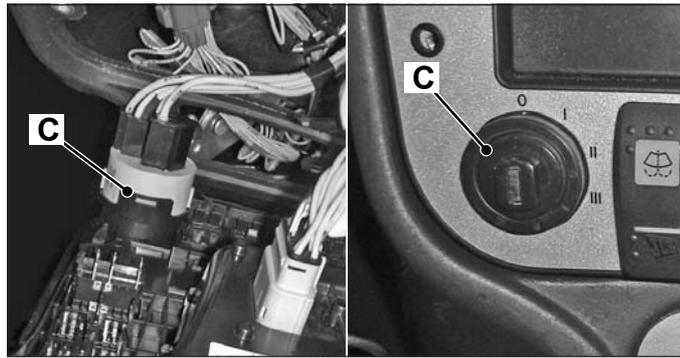
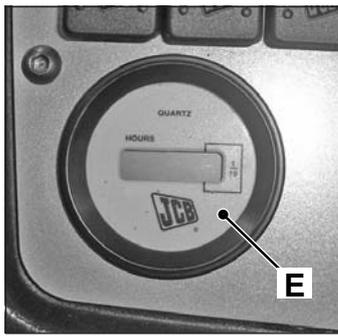


Fig 1.

C075130

## Electrical Operation and Schematics

The harness connector pin numbers are shown on the schematic. Harness connector details are shown on a separate page. → [Electrical Connectors \(K1-7\)](#)

The schematic is shown with the ignition switch set to position III and the transmission set to N (column switch L/H). The starter motor is energised. The engine shut-off solenoid is energised.

→ [Electrical Schematic - Engine Start \(K1-6\)](#)

Key	Device
A	Alternator
1012	Cold start temperature switch
1013	Column switch L/H
1030	Ignition switch
2026	Neutral start relay
3018	Engine shut-off solenoid (ESOS)
3053	Engine cold start solenoid
6020	Hour meter
7024	Immobiliser
7069	Starter motor
8003	Chassis harness to engine harness connector
8004	Panel harness to chassis harness connector
9003	Secondary fuse box C
9007	Primary fuse A
-001	Chassis harness ground
-003	Panel harness ground

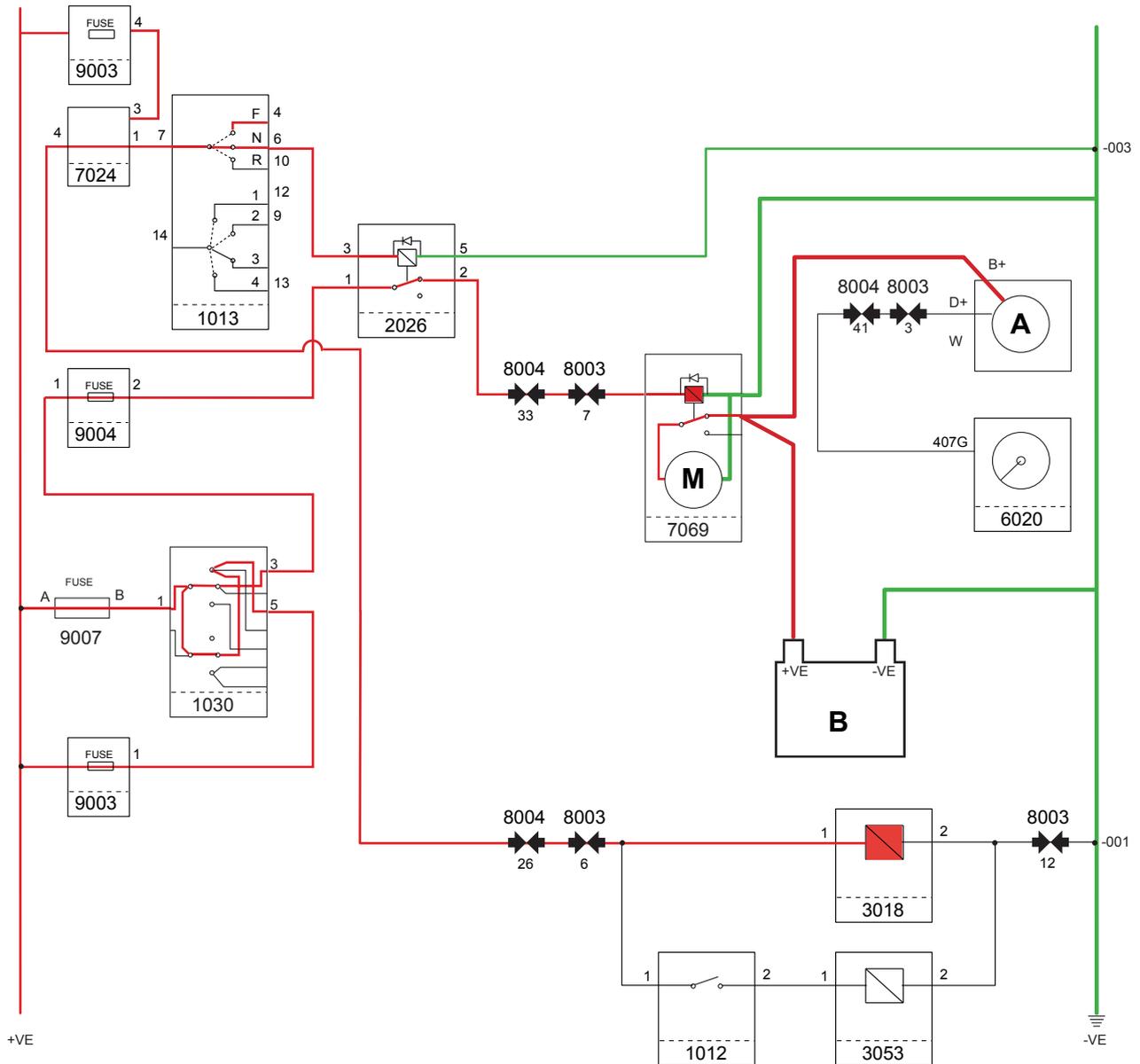


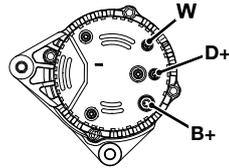
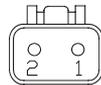
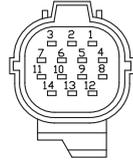
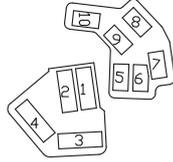
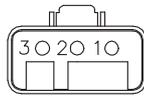
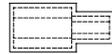
Fig 2. Electrical Schematic - Engine Start

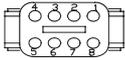
C075150-C1

## Electrical Connectors

The table shows the harness connectors that connect to the electrical devices. The connectors are shown looking at the mating face when disconnected. Remember that the drawings show the harness connectors NOT the device connectors.

Use the table and the relevant electrical schematic to identify the pins in the harness connectors. Continuity checks on the harness wires can be carried out using a multi-meter. Do not touch ECU connector pins. Do not use a multi-meter on ECU connector pins.

Device	Description	Location	Harness Connector
A	Alternator	On the right side of engine.	
-000	Chassis harness grounds	<a href="#">⇒ Related Topics (□ K1-2)</a>	
1012	Cold start temperature switch	On the left side of engine cylinder block. Near to the oil filter.	
1013	Column switch L/H	A cable and connector connects to the panel harness at the steering column below the steering wheel.	
1030	Ignition switch	Right side instrument panel.	
2000	Relays	Refer to <b>Section C - Fuses and Relays.</b> <a href="#">⇒ Related Topics (□ K1-2)</a>	
3018	Engine shut off solenoid (E.S.O.S.)	At the top of the fuel injection pump.	
6020	Hour meter signal	The hour meter connectors are located behind the instrument panel. See cab removal and replacement procedures. <a href="#">⇒ Related Topics (□ K1-2)</a>	

7024	Immobiliser	TBA	
7069	Starter motor	On the right side of the engine.	
8000	Harness interconnections	Refer to <b>Section C - Electrical Harness SYSTEM</b> . <a href="#">⇒ Related Topics (□ K1-2)</a>	
9000	Fuse boxes	Refer to <b>Section C - Fuses and Relays</b> . <a href="#">⇒ Related Topics (□ K1-2)</a>	
-000	Earth points	Refer to <b>Section C - Electrical Harness SYSTEM</b> . <a href="#">⇒ Related Topics (□ K1-2)</a>	

---

# Cold Start Heater SYSTEM

## Introduction

This topic contains information about a machine SYSTEM. Make sure you are referring to the correct system. Refer to the applications table.

Descriptions and procedures relate to the system and not related devices. For information about the devices refer to the relevant topics.

This topic is intended to help you understand what the system does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ \*Related Topics\* \(□ K2-2\)](#)

[⇒ \*Operation Overview\* \(□ K2-3\)](#)

[⇒ \*Electrical Operation and Schematics\* \(□ K2-4\)](#)

[⇒ \*Electrical Connectors\* \(□ K2-5\)](#)

[⇒ \*Fault Finding\* \(□ K2-6\)](#)

[⇒ \*Diagnostic 'Blink' Codes\* \(□ K2-6\)](#)

## Related Topics

Table 1. Related Topics in This Publication

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to *Section 1 - Applications*.

Sections	Topic Titles	Sub Titles
1	<b><i>Applications</i></b>	ALL
2	ALL (Care and Safety) <sup>(1)</sup>	ALL
C	<b><i>Fuses and Relays</i></b>	ALL
C	<b><i>Electrical Harness SYSTEM</i></b>	ALL

(1) You must obey all of the relevant care and safety procedures.

## Operation Overview

This section explains how the cold start heater system works.

The system aids engine starting by heating the air in the induction manifold via electrical 'grid heater' **7068**. Operation of the system is fully automatic and is controlled by ECU **4003**. Ambient air temperature sensor **7067** enables the system when air temperature is less than  $-6^{\circ}\text{C}$  ( $21^{\circ}\text{F}$ ). The heating sequence is as follows:

- 1 Starter key set to the ON position
- 2 Warning light **1-A** illuminated - grid heater ON - engine not ready to start
- 3 After a preset 'pre-heat' time the warning light **1-A** extinguishes - engine ready to start <sup>(1)</sup>
- 4 Starter key turned to engage starter motor and start the engine - grid heater on
- 5 Engine started - starter motor disengaged - grid heater OFF <sup>(2)</sup>

- (1) The 'pre-heat' stage can not be repeated unless the starter key is first set to the OFF position.
- (2) If the engine stalls and is restarted without turning the starter key to OFF, the grid heater will come on while the starter motor is engaged.

The cold start heater circuit electrical harness connects to the machine electrical system via harness interconnects **8002**.

Electrical power is connected to the grid heater via relay **2007**. The system is protected via power fuse **+24**

If the ECU senses a system fault it turns the warning light **6017** ON and OFF to form a blink code. → [Diagnostic 'Blink' Codes \(K2-6\)](#)

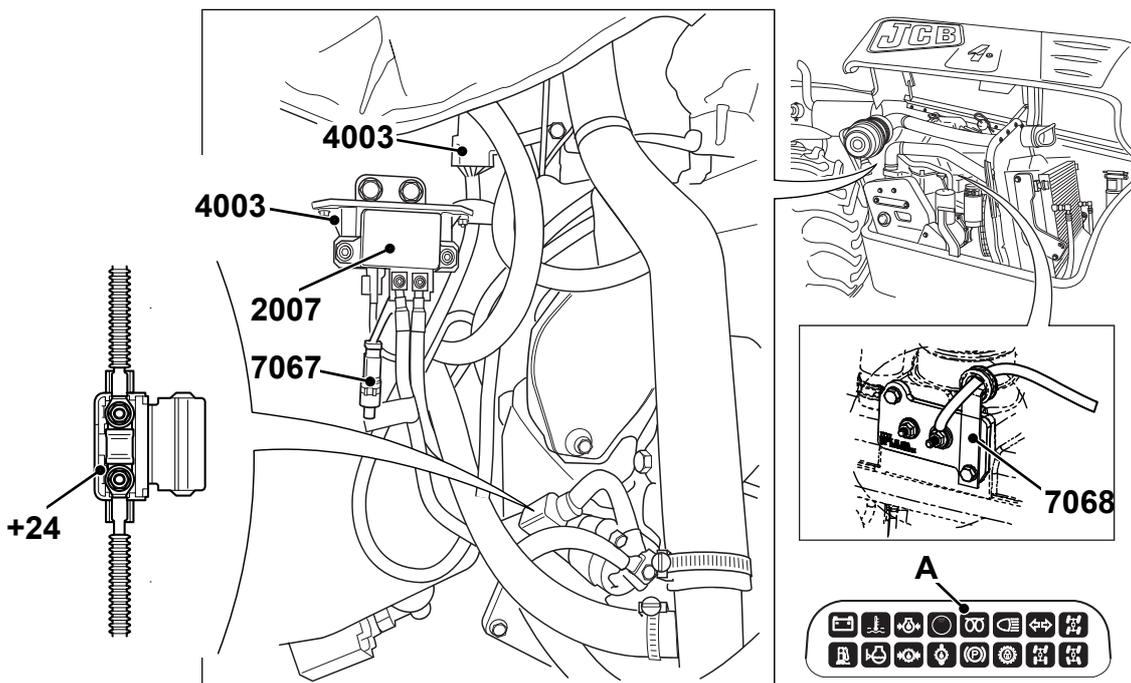


Fig 1.

C024910-C1

## Electrical Operation and Schematics

Key	
-001	Chassis harness ground
2007	Cold start heater relay
4003	Cold start/HVCS ECU
6017	Centre cluster display (cold start heater warning light)
7067	Ambient air temperature sensor
7068	Cold start grid heater

Key	
8002	Cold start harness to chassis harness connector
8004	Panel harness to chassis harness connector A
9001	Fuse box A
9003	Fuse box C
9004	Fuse box D

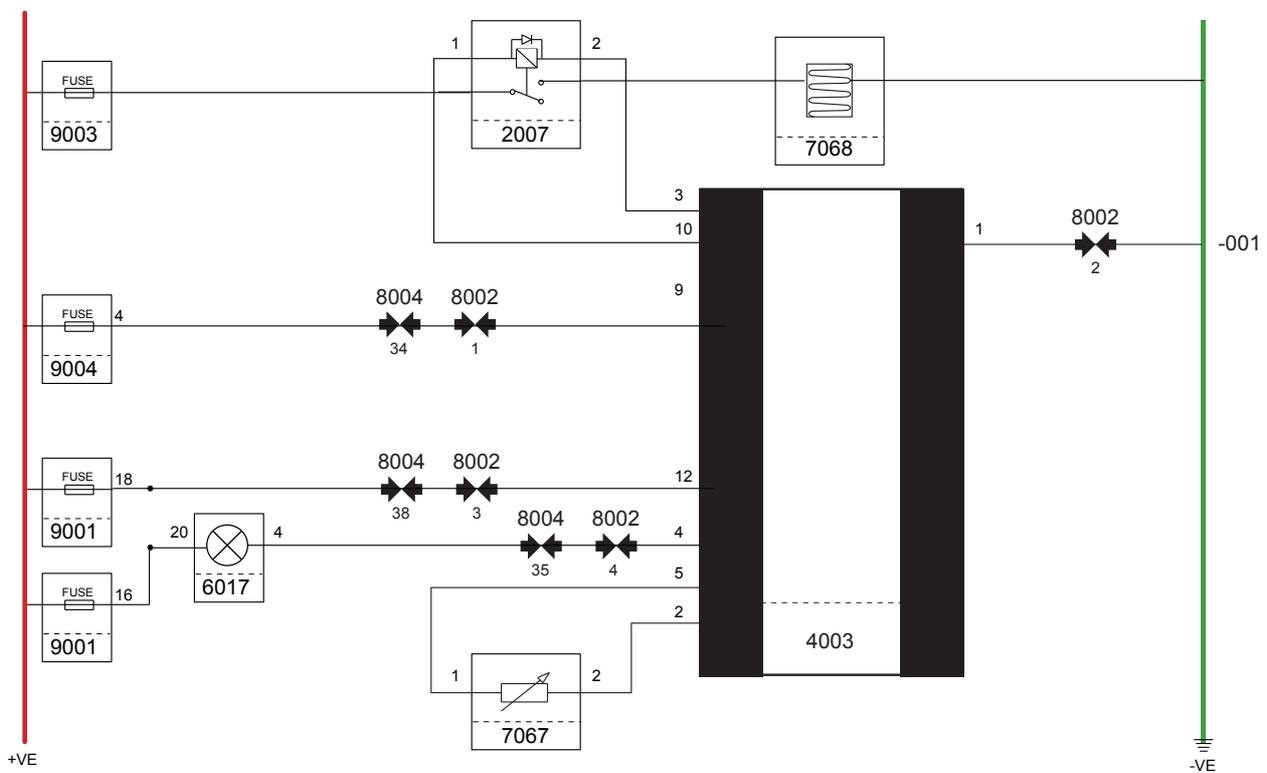


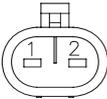
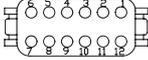
Fig 2.

C067420

## Electrical Connectors

The table shows the harness connectors that connect to the electrical devices. The connectors are shown looking at the mating face when disconnected. Remember that the drawings show the harness connectors NOT the device connectors.

Use the table and the relevant electrical schematic to identify the pins in the harness connectors. Continuity checks on the harness wires can be carried out using a multi-meter. Do not touch ECU connector pins. Do not use a multi-meter on ECU connector pins.

Device	Description	Location	Harness Connector
+24	Cold start heater fuse	Inside the engine compartment adjacent to the starter motor.	
-000	Chassis harness grounds	<a href="#">⇒ Related Topics (□ K2-2)</a>	
2007	Cold start heater relay	Inside the engine compartment. Fixed to the chassis to the rear of the engine.	
4003	Cold start/HVCS ECU	Inside the engine compartment. Fixed to the chassis to the rear of the engine.	
6017	Centre cluster display (cold start heater warning light)	Rear of centre cluster display.	
7067	Ambient air temperature sensor	Inside the engine compartment. Fixed to the chassis to the rear of the engine.	
7068	Cold start grid heater	Side of engine inlet manifold	
8000	Harness interconnections	Refer to <b>Section C - Electrical Harness SYSTEM</b> . <a href="#">⇒ Related Topics (□ K2-2)</a>	
9000	Fuse boxes	Refer to <b>Section C - Fuses and Relays</b> . <a href="#">⇒ Related Topics (□ K2-2)</a>	
-000	Earth points	Refer to <b>Section C - Electrical Harness SYSTEM</b> . <a href="#">⇒ Related Topics (□ K2-2)</a>	

## Fault Finding

### Diagnostic 'Blink' Codes

Machines fitted with a cold start heater incorporate an electronic control unit (ECU). The ECU has the facility to detect faults with the cold start heater electrical system. These faults are indicated using the cold start indicator light **3-A** in the instrument panel. The blink code sequence consists of the light being switched ON for approximately one second followed by a number of flashes (the code). The sequence is repeated until the fault is cleared.

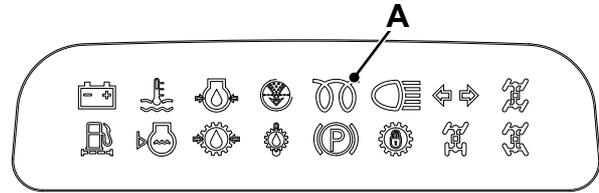


Fig 3.

C044330-C2

Blink Code	Cause	Action
 C044330-C3		
1 flash	Temperature sensor or circuit fault (open circuit).	Check temperature sensor (infinite resistance) related harness wires and connectors. → <a href="#">Electrical Operation and Schematics (□ K2-4)</a>
2 flashes	Temperature sensor or circuit fault (short circuit).	Check temperature sensor (no resistance) related harness wires and connectors. → <a href="#">Electrical Operation and Schematics (□ K2-4)</a>
3 flashes	Heater Relay fault.	Check related relay and related harness wires and connectors. → <a href="#">Electrical Operation and Schematics (□ K2-4)</a>
4 flashes	Heater Relay output fault (open or short circuit).	Check related relay and related harness wires and connectors. → <a href="#">Electrical Operation and Schematics (□ K2-4)</a>

---

# Starter Motor

## Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

This topic is intended to help you understand what the device does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ \*Related Topics\* \(□ K3-2\)](#)

[⇒ \*Removal, Inspection and Replacement\* \(□ K3-3\)](#)

[⇒ \*Removal\* \(□ K3-3\)](#)

[⇒ \*Inspection\* \(□ K3-3\)](#)

[⇒ \*Replacement\* \(□ K3-3\)](#)

[⇒ \*Renewing the Brush Gear\* \(□ K3-4\)](#)

[⇒ \*Renewing the Starter Solenoid\* \(□ K3-5\)](#)

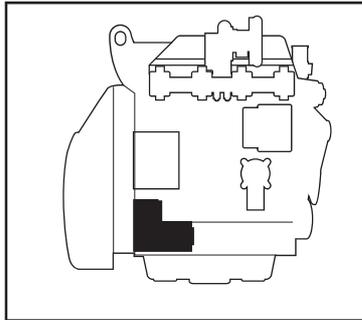
## Related Topics

**Table 1. Related Topics in This Publication**

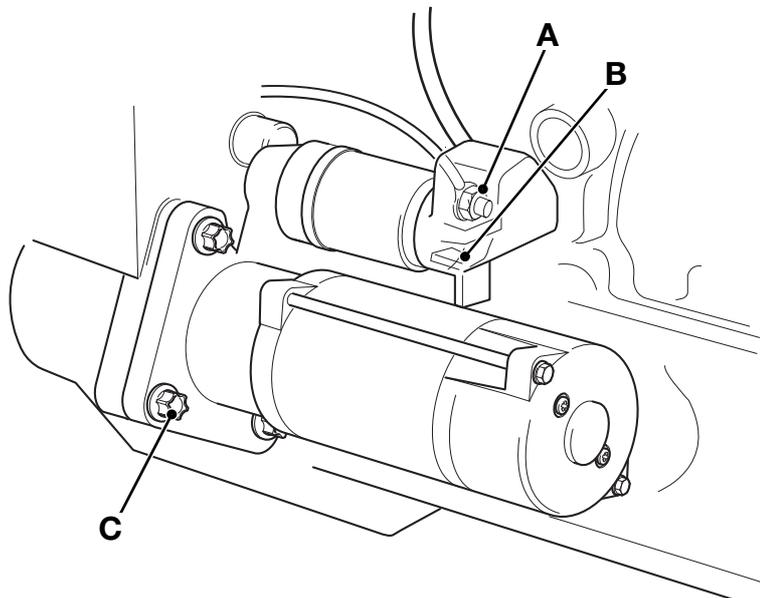
<b>The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to <i>Section 1 - Applications</i>.</b>		
<b>Sections</b>	<b>Topic Titles</b>	<b>Sub Titles</b>
1	<b><i>Applications</i></b>	ALL
2	ALL (Care and Safety) <sup>(1)</sup>	ALL

(1) *You must obey all of the relevant care and safety procedures.*

### Removal, Inspection and Replacement



743720-C1



743720-C1

Fig 1.

#### Removal

- 1 Park the machine and make it safe. Install the boom maintenance strut. Obey the care and safety procedures. → [Related Topics \( K3-2\)](#)
- 2 Disconnect the negative (-) lead followed by the positive (+) lead from the battery terminals
- 3 Disconnect the electrical leads **1-A** and **1-B** from the starter motor terminals. Label the leads to ensure they are refitted in the correct positions on assembly.
- 4 Undo the 3 bolts **1-C** and withdraw the starter motor from the flywheel housing.

- Ensure that the flywheel housing and starter motor mating faces are clean.
- Smear the drive pinion splines with JCB MPL Grease before assembly.
- Torque tighten bolts **1-C**, K Table 212. Torque Settings ( T C-203).
- Be sure to reconnect the electrical leads to the starter motor in the correct positions.

Table 2. Torque Settings

Item	Nm	kgf m	lbf ft
1-C	47	4.8	34.7

#### Inspection

- 1 Check the drive pinion splines for damage and excessive wear.
- 2 Check the brushes for wear. Renew the brushes if the length is less than 8 mm (0.3 in). → [Renewing the Brush Gear \( K3-4\)](#)

#### Replacement

Replacement is the opposite of the removal procedure.

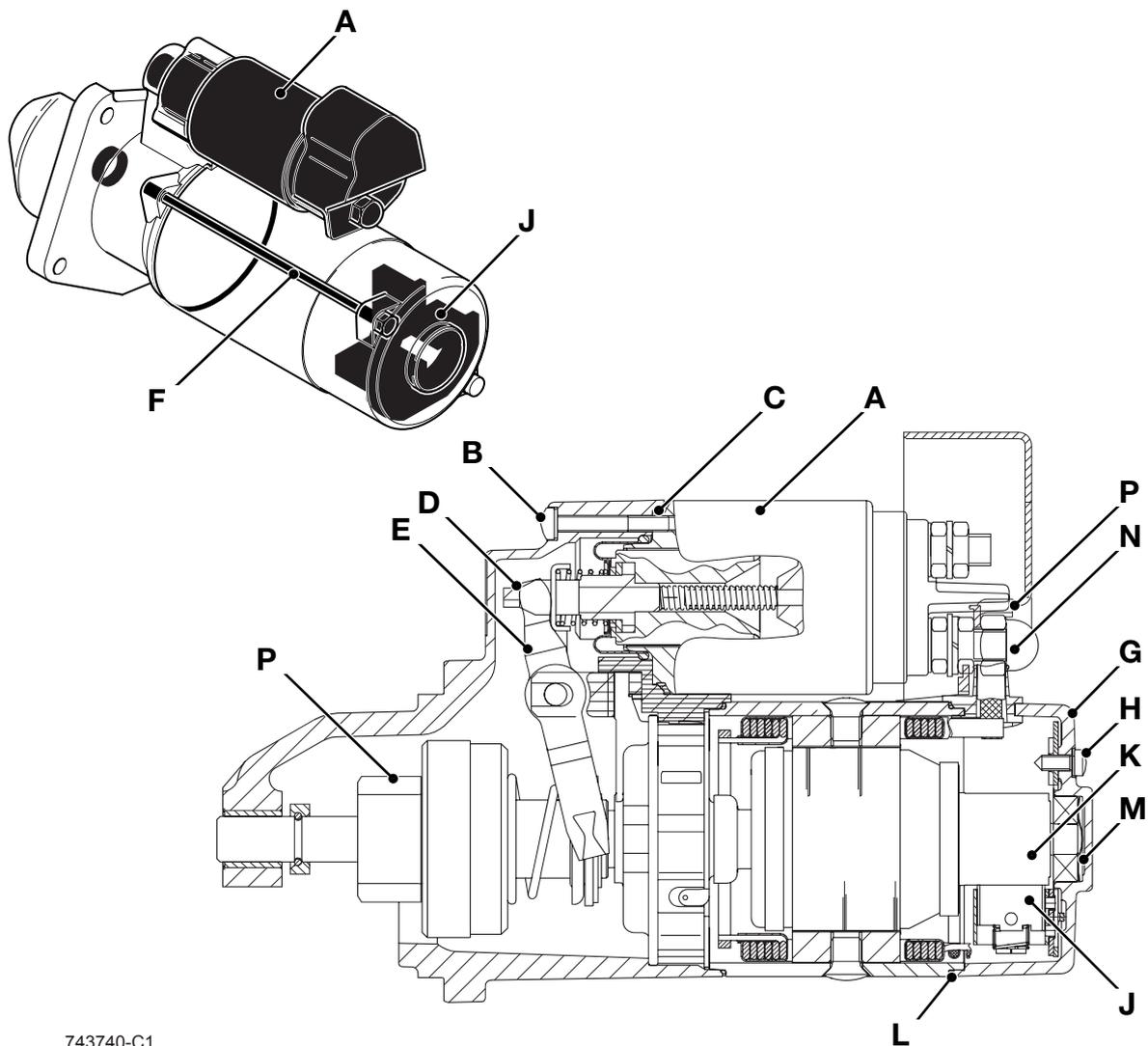
During the replacement procedure do this work also:

## Renewing the Brush Gear

- 1 Renew the brush gear as follows:
  - a Undo tie bolts **2-F** and carefully separate the commutator end cover **2-G**.
  - b Undo screws **2-H**. Remove the brush holder and brushes **2-J**.
  - c Check the brushes for wear. Renew the brushes if they are less than 8 mm (0.3 in) long. Refit or renew the brush set as required.
  - d Clean the commutator **2-K**.
  - e Before refitting the commutator end cover, make sure that the sealing ring **2-L** is undamaged and correctly fitted. Ensure wave washer **2-M** is fitted inside the cover.
  - f Carefully fit the commutator end cover, then tighten the tie bolts **2-F**.

### Renewing the Starter Solenoid

- 1 Renew the starter solenoid as follows:
  - a Disconnect the starter motor cable from the solenoid connector post **2-N**.
  - b Undo screws **2-B** and carefully withdraw the solenoid assembly **2-A**. Discard the solenoid.
  - c Before fitting the new solenoid, make sure that the sealing ring **2-C** is undamaged and correctly fitted.
  - d When fitting the new solenoid, be sure to engage the pinion lever arm **2-E** through the hole in the solenoid actuator rod **2-D**, then tighten the screws **2-B**.
  - e Reconnect the starter motor cable to the solenoid connector post **2-N**.



743740-C1

743740-C1

**Fig 2. Starter Motor**

**Component Key:**

- A** Starter solenoid
- B** Screws - starter solenoid (3 off)
- C** Sealing ring - solenoid
- D** Solenoid actuator rod
- E** Pinion lever arm
- F** Tie bolts (2 off)
- G** Commutator end cover
- H** Screws - commutator end cover (2 off)
- J** Brush set
- K** Commutator
- L** Sealing ring - commutator end cover
- M** Wave washer
- N** Cable connector post
- P** Pinion gear

# Cooling Pack

## Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

This topic is intended to help you understand what the device does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ \*Related Topics\* \(□ K4-2\)](#)

[⇒ \*Removal and Replacement\* \(□ K4-3\)](#)

[⇒ \*Dismantle and Assemble\* \(□ K4-6\)](#)

## Related Topics

**Table 1. Related Topics in This Publication**

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to <i>Section 1 - Applications</i> .		
Sections	Topic Titles	Sub Titles
1	<b><i>Applications</i></b>	ALL
2	ALL (Care and Safety) <sup>(1)</sup>	ALL
3	<b><i>Engine</i></b>	<b><i>Engine, Changing the Coolant</i></b>
3	Hydraulic System	Checking the Hydraulic Fluid Level
B	<b><i>Cab Air Conditioning SYSTEM</i></b> <sup>(2)</sup>	<b><i>Refrigerant Charging and Discharging</i></b>
E	<b><i>Cooling Fan Motor</i></b>	<b><i>Removal and Replacement</i></b>

(1) You must obey all of the relevant care and safety procedures.

(2) If fitted

### Removal and Replacement

The engine cooling pack is designed as a sub assembly which incorporates the following components:

⇒ [Fig 1.](#) ([□ K4-5](#))

- K** Air conditioning condenser matrix (if fitted)
- L** Radiator bottom hose connection
- M** Radiator top hose connection
- N** Air filter inlet hose connection
- R** Cooling fan and hydraulic motor assembly
- S** Cooling fan shroud
- T** Fuel sedimentor
- V** Engine coolant radiator matrix
- W** Anti recirculation air baffles

Although it is possible to remove individual components it will often be quicker and easier to remove the complete sub assembly, particularly if access is required for engine overhaul or removal and replacement for example.

### Removal

Park the machine and make it safe. Obey the care and safety procedures. [⇒ Related Topics \(□ K4-2\)](#)

#### Machines With Air Conditioning - Cooling Pack Mounted Condenser

#### WARNING

The air conditioning system is a closed loop system and contains pressurised refrigerant. No part of the system should be disconnected until the system has been discharged by a refrigeration engineer or a suitably trained person. You can be severely frostbitten or injured by escaping refrigerant.

4-3-4-1\_2

- 1 Discharge the air conditioning system. [⇒ Related Topics \(□ K4-2\)](#)

*Note: For some service procedures it may be sufficient remove the condenser 1-K without disconnecting the air conditioning hoses. Do not let the air conditioning hoses support the condenser.*

- 2 Disconnect the air conditioning hoses at 1-H and 1-J.

#### All Machines

- 1 Remove the engine cover assembly. [⇒ Related Topics \(□ K4-2\)](#)
- 2 Drain the engine coolant by disconnecting the radiator bottom hose at 1-L.
- 3 Disconnect the radiator top hose at 1-M.
- 4 Disconnect the air inlet hose at 1-N.
- 5 Disconnect the electrical connector 1-D at the sedimentor 1-T. Pull the harness through the baffle plate at position 1-E.
- 6 Label and disconnect the fuel pipes 1-A and 1-B at the sedimentor 1-T. Cap all open hoses and pipes. Pull the fuel pipes through the baffle plate at position 1-C.
- 7 Label and disconnect the fan motor hydraulic hoses 1-F and 1-G at the chassis. Cap all open hoses and pipes.

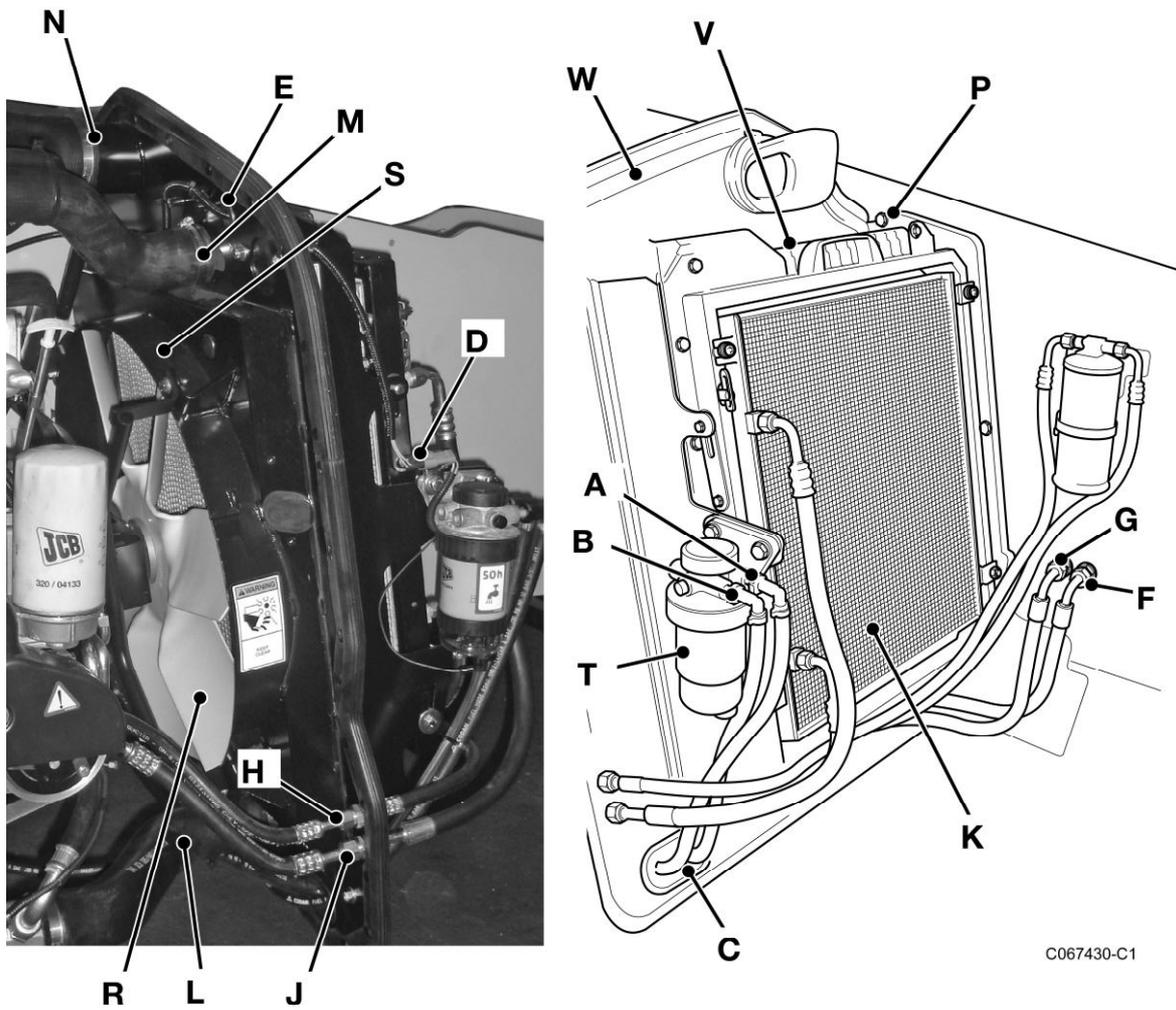
- 8 Support the cooling pack assembly, unscrew bolts 1-P and carefully lift the assembly away from the machine.

### Replacement

Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

- After replacement refill the engine cooling system with the correct coolant. [⇒ Related Topics \(□ K4-2\)](#)
- Run the engine and check the fan motor speed.
- Check the hydraulic fluid level. [⇒ Related Topics \(□ K4-2\)](#)



**Fig 1. Cooling Pack, Non-Intercooled Engines**

C067430-C1



---

## **Dismantle and Assemble**

With the cooling pack removed from the machine  
dismantle components as required.

---

# Coolant Expansion Tank

## Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

This topic is intended to help you understand what the device does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ \*Related Topics\* \(□ K5-2\)](#)

[⇒ \*Removal and Replacement\* \(□ K5-3\)](#)

[⇒ \*Tank Removal\* \(□ K5-3\)](#)

[⇒ \*Tank Replacement\* \(□ K5-4\)](#)

[⇒ \*Coolant Level Sensor Removal\* \(□ K5-4\)](#)

[⇒ \*Coolant Level Sensor Replacement\* \(□ K5-4\)](#)

## Related Topics

Table 1. Related Topics in This Publication

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to <i>Section 1 - Applications</i> .		
Sections	Topic Titles	Sub Titles
1	<b><i>Applications</i></b>	ALL
2	ALL (Care and Safety) <sup>(1)</sup>	ALL
3	<b><i>Engine</i></b>	<b><i>Changing the Coolant</i></b>

(1) You must obey all of the relevant care and safety procedures.

### Removal and Replacement

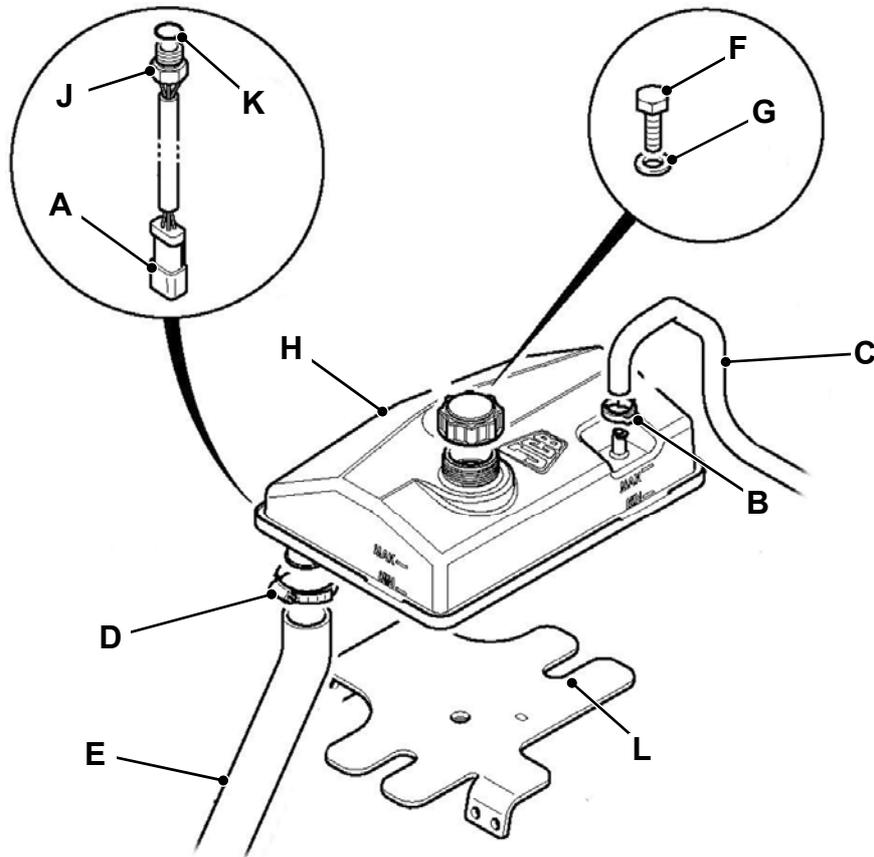


Fig 1.

C045370

#### Tank Removal

- 1 Park the machine and make it safe. Obey the care and safety procedures. [⇒ Related Topics \(□ K5-2\)](#)
- 2 Open the engine cover.
- 3 Drain the engine coolant. [⇒ Related Topics \(□ K5-2\)](#)
- 4 Disconnect the coolant level sensor electrical connector 1-A.
- 5 Release the hose clip 1-B and remove the hose 1-C at the expansion tank.
- 6 Release the hose clip 1-D and remove the hose 1-E at the expansion tank.
- 7 Remove bolt 1-F from the centre of the expansion tank.
- 8 Lift off the expansion tank 1-H. Remove washer 1-G.

## Tank Replacement

Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

- Engage the tank correctly with the mounting plate **1-L**.
- Torque tighten bolt **1-F**.
- Fill the engine cooling system with the correct type of coolant. → [Related Topics \(□ K5-2\)](#)
- When the replacement procedure is complete start the engine and check for coolant leaks.

**Table 2. Torque Settings**

Item	Nm	lbf ft	kgf m
<b>1F</b>	25	18	2.5

## Coolant Level Sensor Removal

- 1 Remove the coolant expansion tank from the machine. → [Tank Removal \(□ K5-3\)](#)
- 2 Carefully unscrew the coolant level sensor **1-J** from the tank.

## Coolant Level Sensor Replacement

**Note:** The coolant level sensor is a non-serviceable part. If the sensor is suspected as being faulty, it must be renewed as a complete assembly.

Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

- Renew the O-ring **1-K**.
- Torque tighten the coolant level sensor **1-J**.

**Table 3. Torque Settings**

Item	Nm	lbf ft	kgf m
<b>J</b> <sup>(1)</sup>	1.4 - 2.7	1 - 2	0.14 - 0.27

- (1) *DO NOT tighten more than 1/6 of a turn beyond that required to seat the sensor against the surface of the tank. Over tightening of the sensor can lead to water ingress into the sensor.*

---

# Exhaust Silencer

## Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

This topic is intended to help you understand what the device does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ \*Related Topics\* \(□ K6-2\)](#)

[⇒ \*Removal and Replacement\* \(□ K6-3\)](#)

[⇒ \*Removal\* \(□ K6-3\)](#)

[⇒ \*Replacement\* \(□ K6-4\)](#)

## Related Topics

Table 1. Related Topics in This Publication

<b>The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to <i>Section 1 - Applications</i>.</b>		
<b>Sections</b>	<b>Topic Titles</b>	<b>Sub Titles</b>
1	<b><i>Applications</i></b>	ALL
2	ALL (Care and Safety) <sup>(1)</sup>	ALL

(1) You must obey all of the relevant care and safety procedures.

### Removal and Replacement

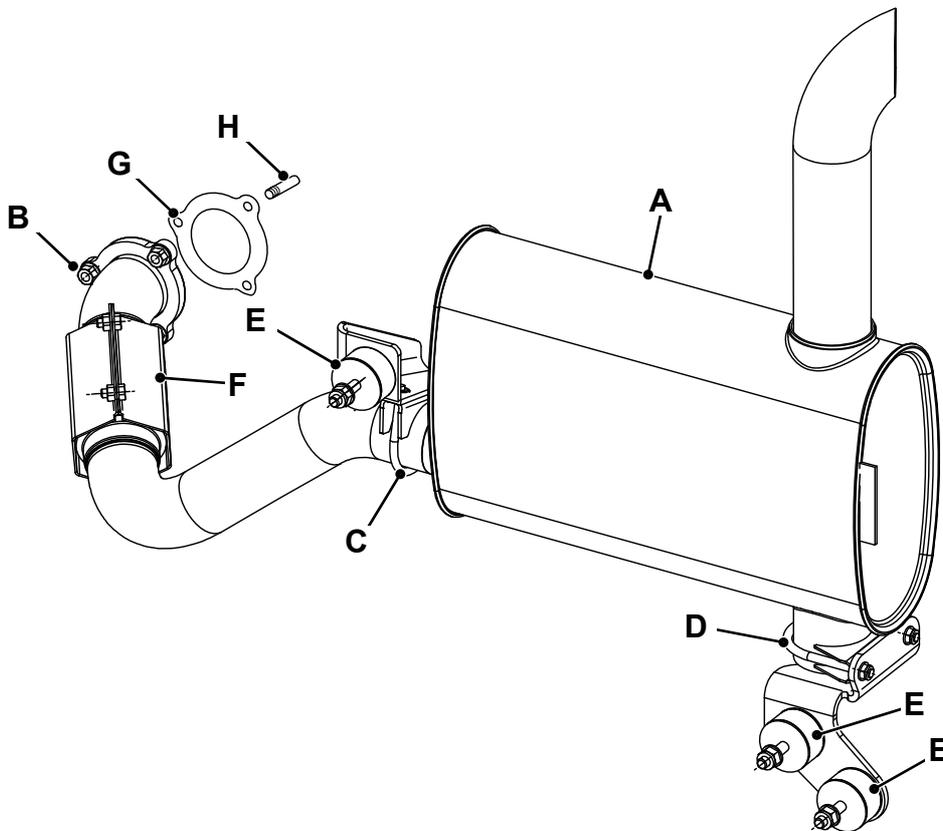


Fig 1.

C067910

#### Removal

- 1 Park the machine and make it safe. Obey the care and safety procedures. Let the engine cool.  
[→ Related Topics \(K6-2\)](#)
- 2 Open the engine cover.
- 3 Fit clamp 1-F (service tool) to the flexible section of the exhaust pipe.

**Note:** The clamp 1-F is designed to protect the flexible section of the exhaust pipe so that it can be re-fitted correctly. New silencers are supplied with a clamp 1-F fitted.

- 4 Remove the nuts 1-B.

- 5 Remove the clamp assembly 1-D.
- 6 Support the silencer 1-A. Remove the clamp assembly 1-C.
- 7 Lift off the silencer 1-A.
- 8 Remove and discard gasket 1-G.
- 9 Examine the rubber mounts 1-E. If they are defective replace them with new ones.
- 10 Examine the studs 1-H on the engine exhaust manifold. If they are defective replace them with new ones.

## Replacement

**Note:** Do not use a defective silencer. If the silencer is defective replace it with a new one.

Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

- Use a new gasket **1-G**.
- Loosely assemble the silencer to its mountings with clamps **1-C** and **1-D** and then torque tighten nuts **1-B**.  
⇒ [Table 2. Torque Settings \(□ K6-4\)](#).
- Tighten clamps **1-C** and **1-D**.
- Remove clamp **1-F** before starting the engine.

**Note:** New silencers are supplied with a clamp **1-F** fitted.

**Table 2. Torque Settings**

Item	Nm	kgf m	lbf ft
<b>1-B</b>	22 - 26	2.2 - 2.6	16 - 19

---

# Throttle Cable

## Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

This topic is intended to help you understand what the device does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ \*Related Topics\* \(□ K7-2\)](#)

[⇒ \*Removal and Replacement\* \(□ K7-3\)](#)

[⇒ \*Removal\* \(□ K7-3\)](#)

[⇒ \*Replacement\* \(□ K7-3\)](#)

[⇒ \*Cable Adjustment\* \(□ K7-4\)](#)

[⇒ \*Throttle Pedal Stop Adjustment\* \(□ K7-5\)](#)

## Related Topics

Table 1. Related Topics in This Publication

<b>The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to <i>Section 1 - Applications</i>.</b>		
<b>Sections</b>	<b>Topic Titles</b>	<b>Sub Titles</b>
1	<b><i>Applications</i></b>	ALL
2	ALL (Care and Safety) <sup>(1)</sup>	ALL

(1) You must obey all of the relevant care and safety procedures.

### Removal and Replacement

**Note:** One end of the cable is located outside the cab, below the cab heater unit, between the cab and the chassis. → [Fig 1.](#) (□ K7-3). The other end is attached to the fuel injection pump on the rear of the engine. → [Fig 2.](#) (□ K7-3)

#### Removal

- 1 Park the machine and make it safe. Install the boom maintenance strut. Obey the care and safety procedures. → [Related Topics](#) (□ K7-2)
- 2 Open the engine cover.
- 3 Remove locking pin **1-A** and withdraw clevis pin **1-B**.

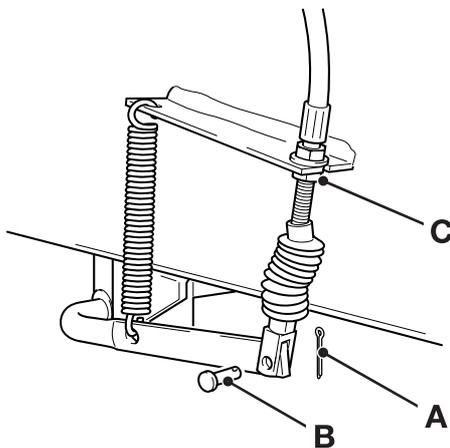
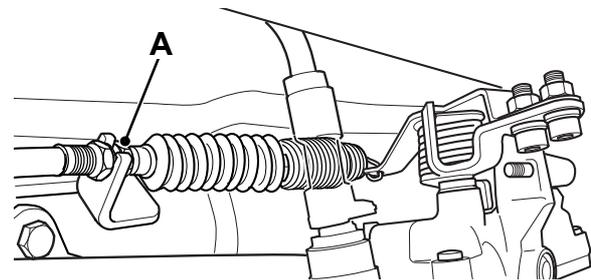


Fig 1.

A335361-1

- 4 Loosen locknuts **1-C** (13 mm AF). Screw the locknut to the bottom of the threaded section on the outer cable.
- 5 Lift the outer cable through the bracket and pass the inner cable through the slot in the front of the bracket.
- 6 Loosen locknut **2-A** and lift the cable through the slot in the support bracket.



C046920

Fig 2.

- 7 Disconnect the spring from the arm on the fuel injection pump and withdraw the cable.

#### Replacement

Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

- Adjust the throttle pedal stop. → [Throttle Pedal Stop Adjustment](#) (□ K7-5)
- Adjust the throttle cable. → [Cable Adjustment](#) (□ K7-4)

### Cable Adjustment

The cable can be adjusted at the fuel injection pump and the throttle pedal. When adjusting the cable make sure that the fuel injection pump throttle lever **3-B** returns to the closed position when the throttle pedal is not pressed.

Park the machine and make it safe. Install the boom maintenance strut. Obey the care and safety procedures.  
[→ Related Topics \(□ K7-2\)](#)

**Adjustment at the fuel injection pump.** Open the engine cover. Slacken locknut **3-A** to adjust the cable at the fuel injection pump. Remove slack in the cable without moving lever **3-B** from its closed position.

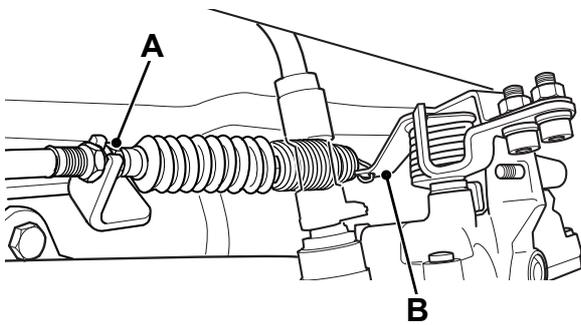


Fig 3.

C046920-C1

**Adjustment at the throttle pedal.** Slacken the locknuts **4-A** to adjust the cable at the throttle pedal. Remove slack in the cable without moving lever **3-B** from its closed position.

Press the throttle pedal to its maximum position. Make sure that the fuel injection pump throttle lever moves to the fully open position.

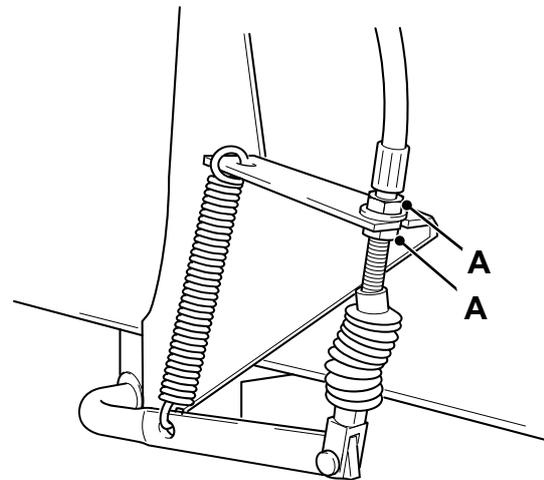


Fig 4.

C048660-C1

### Throttle Pedal Stop Adjustment

#### Machines with no Throttle Position Sensor (TPS)

Park the machine and make it safe. Obey the care and safety procedures. → [Related Topics \(□ K7-2\)](#)

The throttle pedal stop is adjusted by slackening the locknut **5-B** and adjusting screw **5-C**. Adjust the screw **5-C** until the threaded end protrudes from the foot plate by 28mm as shown at **5-A**.

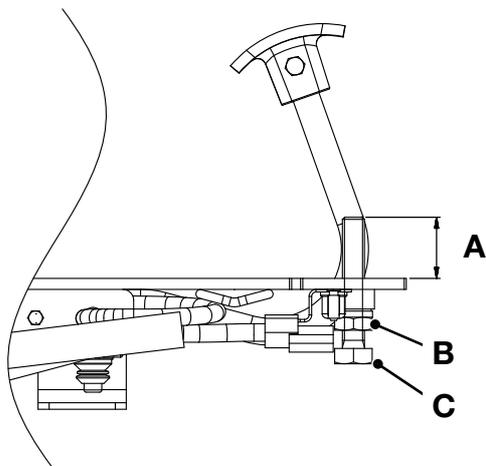


Fig 5.

C048840



## Section K7 - Engine Throttle Cable

Throttle Pedal Stop Adjustment

---

Page left intentionally blank

---

# JCB Dieselmax

## Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

This topic is intended to help you understand what the device does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ \*Related Topics\* \(□ K8-2\)](#)

[⇒ \*Specifications\* \(□ K8-3\)](#)

[⇒ \*Removal and Replacement\* \(□ K8-4\)](#)

[⇒ \*Removal\* \(□ K8-6\)](#)

[⇒ \*Replacement\* \(□ K8-7\)](#)

[⇒ \*Separating the Engine From the Bevel Box\* \(□ K8-8\)](#)

[⇒ \*Dismantling\* \(□ K8-8\)](#)

[⇒ \*Assembly\* \(□ K8-9\)](#)

## Related Topics

**Table 1. Related Topics in This Publication**

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to <i>Section 1 - Applications</i> .		
Sections	Topic Titles	Sub Titles
1	<b>Applications</b>	ALL
1	<b>Fuel</b>	<b>Acceptable and Unacceptable Fuels</b>
2	ALL (Care and Safety) <sup>(1)</sup>	ALL
3	<b>Brakes</b>	<b>Adjusting the Parking Brake</b>
3	<b>Engine</b>	<b>Changing the Coolant</b>
3	<b>Transmission</b>	<b>Checking the Transmission Oil Level</b>
K	<a href="#">⇒ Cooling Pack (□ K4-1)</a>	<a href="#">⇒ Removal and Replacement (□ K4-3)</a>
K	<a href="#">⇒ Coolant Expansion Tank (□ K5-1)</a>	<a href="#">⇒ Removal and Replacement (□ K5-3)</a>
K	<a href="#">⇒ Exhaust Silencer (□ K6-1)</a>	<a href="#">⇒ Removal and Replacement (□ K6-3)</a>

(1) You must obey all of the relevant care and safety procedures.

**Table 2. Related Topics in Publication 9806/3000, Dieselmax Engine**

The table lists topics in another manual that contain information related to this topic. Refer to the applicable topics to complete your procedures.		
Sections	Section Titles	Topic Titles
ALL	ALL	ALL

## Specifications

Engine variants	SD	Turbocharged	63 kW (85 bhp)
	SF	Turbocharged with intercooler	74 kW (100 bhp)
			85 kW (114 bhp)
Weight (dry)	SD, SF	477 kg (1052 lb)	
Number of cylinders	4		
Nominal bore size	103 mm (4.05 in)		
Stroke	132 mm (5.196 in)		
Cylinder arrangement	In line		
Cycle	4 stroke		
Firing Order	1, 3, 4, 2 - Number 1 cylinder at crankshaft pulley end		
Displacement	4.4 litres (268.5 in <sup>3</sup> )		
Compression ratio	SD, SF	17.2 : 1	
Direction of rotation (viewed from crankshaft pulley end)	Clockwise		
Valves	4 per cylinder		
Lubricating oil pressure <sup>(1)</sup>	4.0 to 4.8 bar (58 to 70 lbf/in <sup>2</sup> )		
Combustion system	Direct injection		
Fuel injection pump		Rotary mechanical	
Idle speed	910 r.p.m.		
Acceptable and Unacceptable Fuels	<a href="#">⇒ Related Topics (□ K8-2)</a>		

(1) Engine at normal operating temperature and maximum revs.

## Removal and Replacement

The engine, gearbox and bevel gearbox must be removed from the machine as a complete unit.

⇒ [Fig 1. \(□ K8-5\)](#)

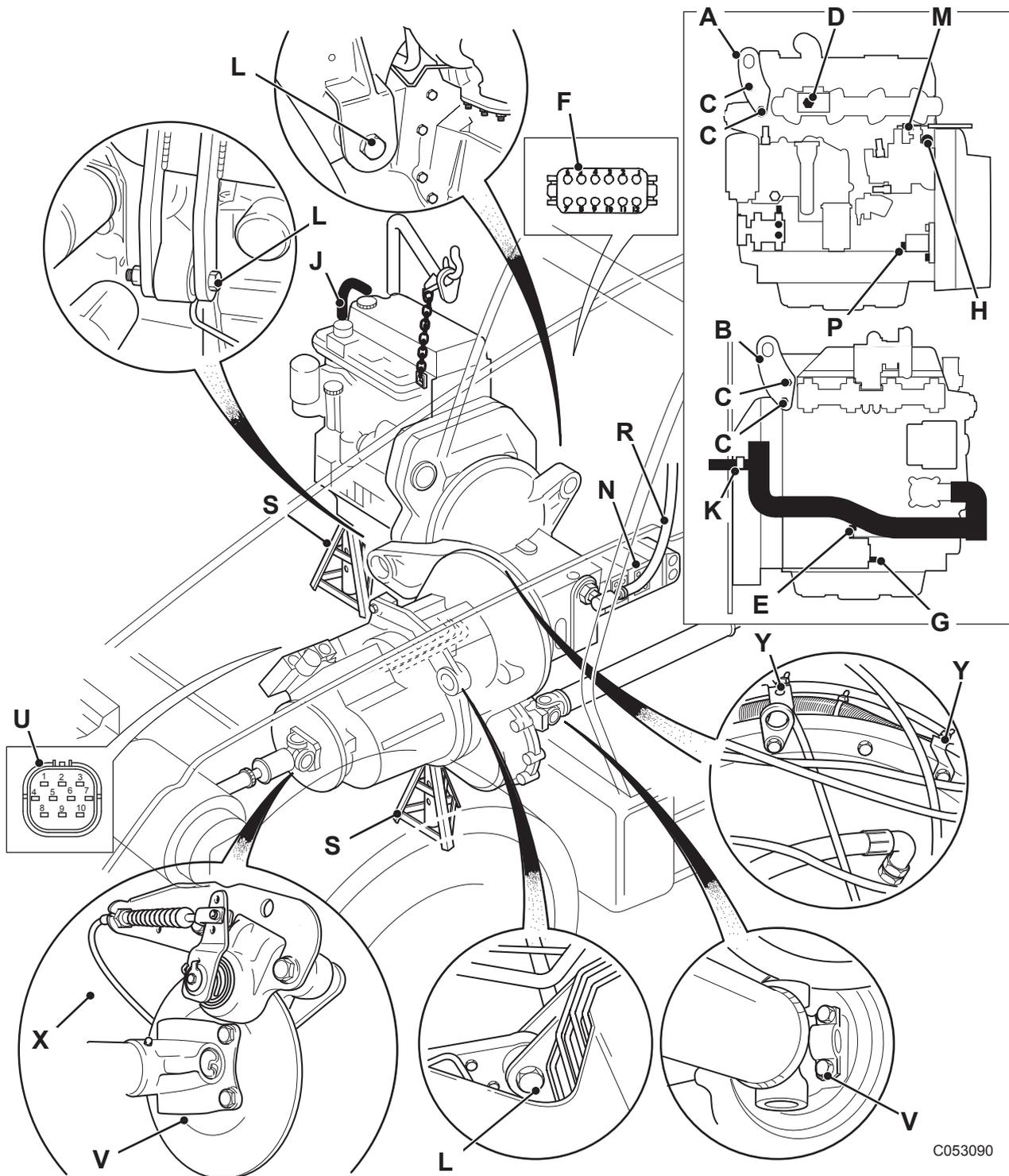
The main hydraulic pump can be removed with the complete unit or removed from the bevel gearbox before removal.

The total weight of the engine and gearboxes is approximately 1000 kg. A suitable overhead crane and lifting frame will be required to safely lift and manoeuvre the assembly in and out of the machine chassis.

The following procedures describe removing and replacing the engine and gearboxes as a complete unit. Follow the correct procedures to separate the engine from the bevel box. ⇒ [Separating the Engine From the Bevel Box \(□ K8-8\)](#).

**Note:** *The following component identification is for a typical engine installation. There will be some component differences depending on the machine variant.*

- A Lifting bracket - front
- B Lifting bracket - rear
- C Lifting bracket fixing bolts
- D Electrical connection - cold start heater (if fitted)
- E Electrical connection - starter motor
- F Electrical connector - engine electrical harness
- G Electrical connection - earth strap
- H Fuel line connector - return to tank line
- J Hose connection - cab heater
- K Hose connection - cab heater
- L Engine and gearbox mountings
- M Throttle cable
- N Hydraulic pump
- P Hose connection - brake vacuum
- R Breather hose - bevel gearbox
- S Support stands
- U Electrical connector - gearbox
- V Propshaft couplings - gearbox
- X Park brake cable
- Y Ties - electrical harnesses



C053090

C053090-C1

Fig 1.

### Removal

**Note:** The following procedures are for a typical engine and gearbox installation. There will be some procedural differences dependant on machine variant. Before attempting to remove the engine and gearbox ensure that all the necessary components have either been removed, or safely disconnected.

**Important:** Do not attempt to lift the engine and gearbox assembly using the engine lifting brackets. The brackets are designed to lift the engine only.

Park the machine and make it safe. Obey the care and safety procedures. [⇒ Related Topics \(□ K8-2\)](#)

### WARNING

**Make the machine safe before working underneath it. Park the machine on level ground, lower the attachments to the ground. Apply the park brake, put the transmission in neutral and stop the engine. Block both sides of all four wheels.**

**Disconnect the battery, to prevent the engine being started while you are beneath the machine.**

GEN-4-1\_1

### Machines with Air Conditioning

### WARNING

**The air conditioning system is a closed loop system and contains pressurised refrigerant. No part of the system should be disconnected until the system has been discharged by a refrigeration engineer or a suitably trained person. You can be severely frostbitten or injured by escaping refrigerant.**

4-3-4-1\_2

- 1 Discharge the air conditioning system. [⇒ Related Topics \(□ K8-2\)](#).

### All Machines

- 1 Remove the engine cover and side pod. [⇒ Related Topics \(□ K8-2\)](#)
- 2 Remove the cooling pack. [⇒ Cooling Pack \(□ K4-1\)](#)
- 3 Remove the coolant expansion tank. [⇒ Coolant Expansion Tank \(□ K5-1\)](#)

- 4 Disconnect the following at the engine:
  - a Throttle cable **1-M**.
  - b Fuel leak-off pipe **1-H**.
  - c Heater hoses **1-J** and **1-K**.
  - d Brake servo vacuum hose **1-P**.
  - e Cold start heater electrical cable **1-D** (if fitted).
- 5 Uncouple the engine electrical harness connector **1-F**.
- 6 Remove the exhaust silencer assembly. [⇒ Exhaust Silencer \(□ K6-1\)](#)
- 7 Disconnect the parking brake cable **1-X** at the brake caliper or gearbox as applicable.
- 8 Disconnect the front and rear propshafts at the gearbox. **1-V**. [⇒ Related Topics \(□ K8-2\)](#)
- 9 Drain the hydraulic fluid from the hydraulic tank into a suitable clean container.
- 10 Label and disconnect the pipe and hose connections at the hydraulic pump **1-N**.
- 11 Uncouple the gearbox electrical connector **1-U**.
- 12 Make sure that all the relevant hoses pipes and wiring have been disconnected and tied away from the transmission assembly.
- 13 Attach a specially fabricated lifting beam to engine and transmission assembly. Using suitable lifting equipment take the weight of the engine and transmission assembly (approx. 1000 kg).

**Important:** Do not attempt to lift the engine and gearbox assembly using the engine lifting brackets. The brackets are designed to lift the engine only.

**Note:** The tool (lifting beam) is designed specifically to lift the side mounted engine, bevel box and Powershift gearbox as a complete assembly.

**Important:** The tool (lifting beam) is not to be used to lift the engine on its own, any other part of the machine or for any other lifting duty or use.

- 14 Place suitable engine support stands **1-S** under the engine and gearbox. DO NOT place support stands under the engine sump.
- 15 Undo and remove the three transmission mounting bolts **1-L**. Make sure that the assembly is safely supported by the lifting equipment and then remove the stands.
- 16 Lower and withdraw the assembly from the machine.

### Replacement

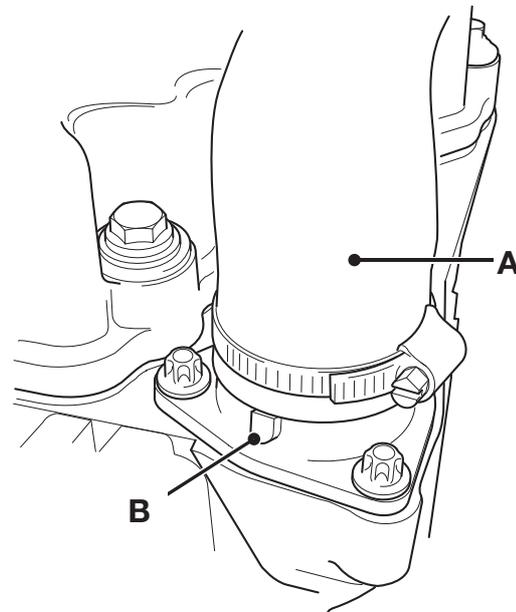
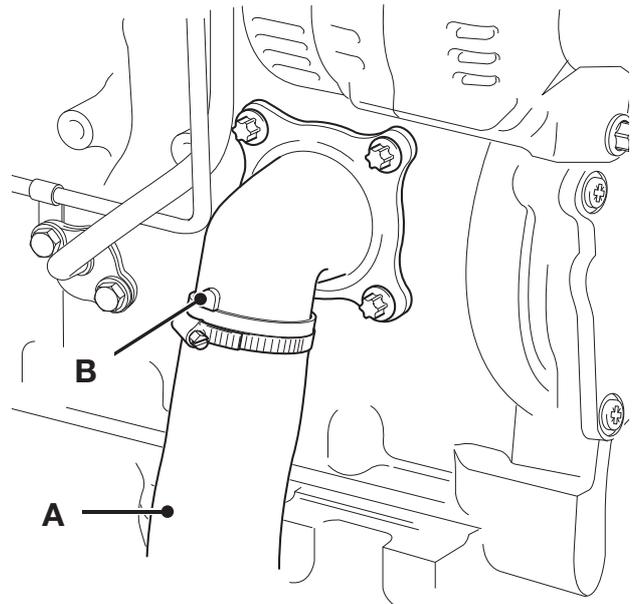
Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

- If coolant hoses have been removed during the engine dismantle and assembly procedures, refit the hoses. Push the hose **2-A** on in the position shown. Do not push the hose past the location stop **2-B**.
- Fill the engine with the correct coolant. → [Related Topics \(□ K8-2\)](#)
- Check the transmission oil level. → [Related Topics \(□ K8-2\)](#)
- Adjust the parking brake. → [Related Topics \(□ K8-2\)](#)

**Table 3. Torque Settings**

Item	Nm	kgf m	lbf ft
<b>L</b>	118	12	87



744240\_C1

744240-C1

**Fig 2.**

## Separating the Engine From the Bevel Box

### Dismantling

The engine, gearbox and bevel box must be removed from the machine as one complete unit before carrying out the following procedure. → [Removal \(K8-6\)](#)

- 1 Check the lifting brackets **3-A** for damage and security before the engine is lifted. The correct torque for the lifting bracket setscrews is 44 Nm (33 lbf ft).

**Note:** If the engine does not have lifting brackets you must get the correct brackets.

Use the correct lifting equipment attached to the engine lifting brackets **3-A**. The equipment must be capable of lifting 600 kg (1320 lb).

**Note:** The lifting equipment must be arranged so that it provides a vertical lift directly above each of the two lifting brackets, as shown at **3-A**, ensuring that there is a clearance between the hooks and the rocker cover to avoid damage to the engine. Never use a single bracket to raise an engine.

Use the lifting equipment to support the weight of the engine.

**Important:** Do not attempt to lift the engine and gearbox assembly using the engine lifting brackets. The brackets are designed to lift the engine only.

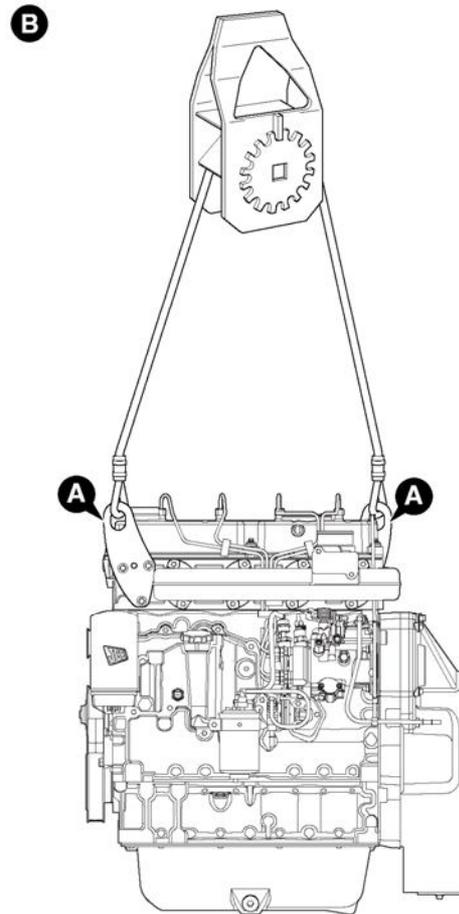


Fig 3.

763960-C1

- 2 Remove bell housing bolts **4-A**.

**Note:** The bolts **4-A** are sized to suit their positions. Bell housing bolts must be replaced in the same positions.

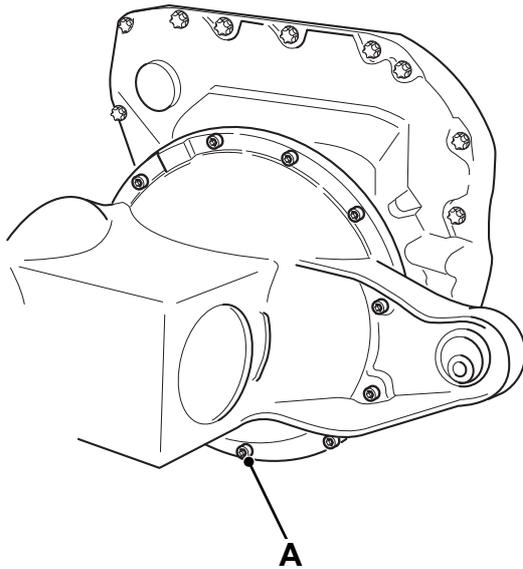


Fig 4.

C025680

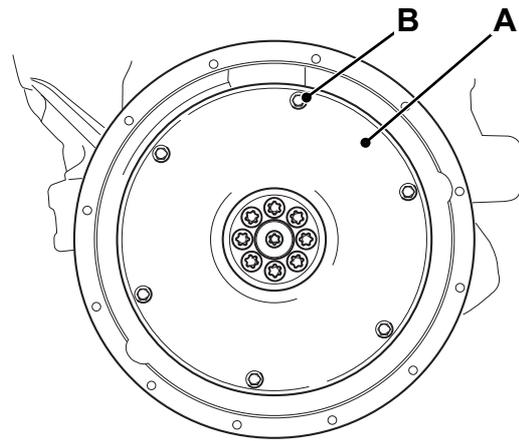


Fig 5.

C025660

Table 4. Torque Settings

Item	Nm	kgf m	lbf ft
4-A	98	10	72
5-B	67 - 72	6.8 - 7.3	49 - 53

3 Carefully draw the engine away from the transmission. Be careful not to put any side force on the transmission input shaft. Lift the engine clear of the machine.

4 Place the engine on a suitable stand.

## Assembly

Assembly is the opposite of the dismantling procedure.

During the assembly procedure do this work also:

- If the damper **5-A** has been removed, clean the mating faces with a clean, dry cloth. The damper can be fitted in any position as it is balanced individually.
- Apply JCB Activator and JCB Threadlocker and Sealer to the 6 bolts **5-B**.
- Torque tighten the 6 bolts **5-B**. → [Table 4. Torque Settings \(□ K8-9\)](#).
- Apply locking fluid and torque tighten bolts **4-A**, making sure the bolts are fitted in the correct position, as marked during removal.



**Page left intentionally blank**