Service Manual

Open front screen

Side Engine Loadalls

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 Data Systems

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General Information

Service Manual - Side Engine Loadalls

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

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Section H - Steering

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Applications

Introduction

This manual contains topics that relate to some or all JCB Loadall machines in the 5A group. There are several machine model codes in the family.	Machine Group	Model Code	**Model Name**
	5A	F	**540-170**
	5A	G	**550-140**
	5A	L	**540-140**
	5A	M	**550-170**
	5A	N	**535-125 Hi Viz**
	5A	P	**535-140 Hi Viz**
Machine variants: There are different machine variants within the same model name. This happens because of market requirements, or when the machine specification changes after a period of time. Information relating specifically to different variants of the same model is given in the applications tables and in the Topics throughout the manual where applicable.			
Use the applications tables to see which topics relate to which machine models and variants. ***Important:*** *The machine model names are NOT referred to in the topics. You must refer to the applications tables for the applicable machine models.*			

⇨ *Tables (1-1-2)*

⇨ *Section 1 - General Information (1-1-2)*

⇨ *Section 2 - Care and Safety (1-1-3)*

⇨ *Section 3 - Routine Maintenance (1-1-4)*

⇨ *Section B - Body and Framework (1-1-5)*

⇨ *Section C - Electrics (1-1-6)*

⇨ *Section E - Hydraulics (1-1-7)*

⇨ *Section F - Transmission (1-1-8)*

⇨ *Section G - Brakes (1-1-9)*

⇨ *Section H - Steering (1-1-10)*

⇨ *Section K - Engine (1-1-11)*

⇨ *Section M - Electronic Data Systems (1-1-12)*

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Tables

Section 1 - General Information

			Machine models					
Topic Ref	**Title**	**Variant**	**540-170 5AF**	**550-140 5AG**	**540-140 5AL**	**550-170 5AM**	**535-125 HiViz 5AN**	**535-140 HiViz 5AP**
1-2	***Use***		All Machines					
1-3	***Machine Identification***		All Machines					
1-4	***Torque Settings***		All Machines					
1-5	***Service Tools***		All Machines					
1-6	***Service Consumables***		All Machines					
1-7	***Fuel***		All Machines					
1-8	***Stall Speed Combinations***		All Machines					

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Section 2 - Care and Safety

			Machine models					
Topic Ref	**Title**	**Variant**	**540-170 5AF**	**550-140 5AG**	**540-140 5AL**	**550-170 5AM**	**535-125 HiViz 5AN**	**535-140 HiViz 5AP**
2-1	***Safety Notices***		All Machines					
2-2	***General Procedures***		All Machines					

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Section 3 - Routine Maintenance

			Machine models					
Topic Ref	**Title**	**Variant**	**540-170 5AF**	**550-140 5AG**	**540-140 5AL**	**550-170 5AM**	**535-125 HiViz 5AN**	**535-140 HiViz 5AP**
3-1	***Introduction***		All Machines					
3-2	***Service Schedules - Machines with SD and SF Engines***	Mechanical F.I. engines	●	●	●	●	●	●
3-3	***Service Schedules - Machines with SE Engines***	Electronic F.I. engines	●	●	●	●		
3-4	***Fluids, Lubricants and Capacities***		All Machines					
3-5	***Cleaning the Machines***		All Machines					
3-6	***Inspection***		All Machines					
3-7	***Seat Belts***		All Machines					
3-8	***ROPS/FOPS (and OECD) Structure***		All Machines					
3-9	***Greasing***		All Machines					
3-10	***Heater and Air Conditioning***		All Machines					
3-11	***Brakes***		All Machines					
3-12	***Electrical System***		All Machines					
3-13	***Engine***		All Machines					
3-14	***Engine Air FIlter***		All Machines					
3-15	***Fuel System***		All Machines					
3-16	***Hydraulic System***		All Machines					
3-17	***Transmission***		All Machines					
3-18	***Tyres and Wheels***		All Machines					
3-19	***Wear Pads***		All Machines					
3-20	***Windscreen Washer***		All Machines					
3-21	***Access Panels***		All Machines					
3-22	***Fire Extinguisher***		All Machines					

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Section B - Body and Framework

			Machine models					
Topic Ref	Title	Variant	540-170 5AF	550-140 5AG	540-140 5AL	550-170 5AM	535-125 HiViz 5AN	535-140 HiViz 5AP
B1	***Fork Carriage***		●	●	●	●	●	●
B2	***Cab Heating and Ventilation SYSTEM***		●	●	●	●	●	●
B3	***Cab Air Conditioning SYSTEM***		●	●	●	●	●	●
B4	***Load Moment Indicator (LMI) SYSTEM***		●	●	●	●	●	●
B6	***Cab***		●	●	●	●	●	●
B7	***Air Conditioning Condensor - Cooling Pack Mounted***		●	●	●	●	●	●
B8	***Air Conditioning Condensor - Roof Mounted***		●	●	●	●	●	●
B9	***Cab HV and HVAC Unit***		●	●	●	●	●	●
B10	***Air Conditioning Binary Switch***		●	●	●	●	●	●
B11	***Heater Valve***		●	●	●	●	●	●
B12	***Fuel Tank***		●	●	●	●	●	●
B13	***Chassis Panels***		●	●	●	●	●	●
B14	***Boom***	3 Stage		●	●		●	●
		4 Stage	●			●		
B15	***LMI Axle Transducer***		●	●	●	●	●	●
B16	***Stabilisers***		●	●	●	●	●	●

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Section C - Electrics

			Machine models					
Topic Ref	Title	Variant	540-170 5AF	550-140 5AG	540-140 5AL	550-170 5AM	535-125 HiViz 5AN	535-140 HiViz 5AP
C1	***Fuses and Relays***		●	●	●	●	●	●
C2	***Schematics***		●	●	●	●	●	●
C3	***Electrical Harness SYSTEM***		●	●	●	●	●	●
C4	***Battery Charging SYSTEM***		●	●	●	●	●	●
C5	***Alternator***		●	●	●	●	●	●
C6	***Battery***		●	●	●	●	●	●

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Section E - Hydraulics

			Machine models					
Topic Ref	Title	Variant	540-170 5AF	550-140 5AG	540-140 5AL	550-170 5AM	535-125 HiViz 5AN	535-140 HiViz 5AP
E1	***Systems and Schematics***		●	●	●	●	●	●
E2	***Parallel Hydraulic SYSTEM***			●	●		●	●
E3	***Parallel Servo Hydraulic SYSTEM***		●			●		
E4	***Hydraulic Interlock SYSTEM***		●			●		
E5	***Parallel Control Valve - 6 Section***		To January 2009	●	●	To January 2009	●	●
E6	***Parallel Control Valve - 5 Section***		From January 2009			From January 2009		
E7	***Parallel Control Valve - 2 Section***		●			●		
E8	***Servo Control Valves***		●			●		
E9	***Servo Solenoid Diverter Valve Block***		●			●		
E10	***Stabiliser Isolation Valve***		●			●		
E11	***Sway/Fan Selector Valve***		●	●	●	●	●	●
E12	***Main Pump***	110 l/min		●	●		●	●
		170 l/min	●			●		
E13	***Cooling Fan Motor***		●	●	●	●	●	●
E14	***Extension Ram***		●	●	●	●	●	●
E15	***Lift Rams***		●	●	●	●	●	●
E16	***Tilt Ram***		●	●	●	●	●	●
E17	***Displacement Ram***		●	●	●	●	●	●
E18	***Sway Ram***		●	●	●	●	●	●
E19	***Stabiliser Rams***		●	●	●	●	●	●
E20	***Ram Maintenance***		●	●	●	●	●	●

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Section F - Transmission

			Machine models					
Topic Ref	Title	Variant	540-170 5AF	550-140 5AG	540-140 5AL	550-170 5AM	535-125 HiViz 5AN	535-140 HiViz 5AP
F1	**CONFIGURATION**		●	●	●	●	●	●
F2	***Wheels and Tyres***		●	●	●	●	●	●
F3	***Front Axles***	SD80 Pivot sway	●	●	●	●		
		SD80 Trunnion sway					●	●
F4	***Rear Axles***	SD80 Pivot sway	●	●	●	●		
		SD80 Trunnion sway					●	●
F5	***PS750 Gearbox SYSTEM***		●	●	●	●	●	●
F6	***PS750 Mk IV Gearbox SYSTEM***		●	●	●	●	●	●
F7	***PS764 Gearbox SYSTEM***		●	●	●	●		
F8	***PS750 Gearbox***		●	●	●	●	●	●
F9	***PS750 Mk IV Gearbox***		●	●	●	●	●	●
F10	***PS760 Gearbox***		●	●	●	●		
F11	***Bevel Gearbox***		●	●	●	●	●	●
F12	***Torque Converter***		●	●	●	●	●	●
F13	***Transmission Oil Cooler - Air Blast***	Intercooled engines	●	●	●	●	●	●
F14	***Transmission Oil Cooler - Liquid to Liquid***	Non intercooled engines	●	●	●	●	●	●
F15	***Propshafts***		●	●	●	●	●	●
F16	***Speed Sensors***		●	●	●	●	●	●
F17	***Speedometer***		●	●	●	●	●	●

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Section G - Brakes

			Machine models					
Topic Ref	Title	Variant	540-170 5AF	550-140 5AG	540-140 5AL	550-170 5AM	535-125 HiViz 5AN	535-140 HiViz 5AP
G1	***Twin Axle Service Brakes SYSTEM (S1)***						●	●
G2	***Twin Axle Service Brakes SYSTEM (S2)***		●	●	●	●		
G3	***External Park Brake SYSTEM***	PS750 gearbox	●	●	●	●	●	●
G4	***Internal Park Brake SYSTEM***	PS760 gearbox	●	●	●	●		
G5	***Park Brake Calliper***	PS750 gearbox	●	●	●	●	●	●
G6	***Park Brake Disc***	PS750 gearbox	●	●	●	●	●	●
G7	***Park Brake Switch***		●	●	●	●	●	●
G8	***Servo Exhauster Unit***		●	●	●	●	●	●
G9	***Servo Unit - Twin Axle Brakes***		●	●	●	●	●	●
G10	***Master Cylinder***		●	●	●	●	●	●
G11	***Fluid Reservoir***		●	●	●	●	●	●

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Section H - Steering

			Machine models					
Topic Ref	Title	Variant	540-170 5AF	550-140 5AG	540-140 5AL	550-170 5AM	535-125 HiViz 5AN	535-140 HiViz 5AP
H1	***Steering SYSTEM***		●	●	●	●	●	●
H2	***Manual Steer Mode SYSTEM***		●	●	●	●	●	●
H3	***Auto Steer Mode SYSTEM***		●	●	●	●	●	●
H4	***Hydraulic Steering Unit***		●	●	●	●	●	●
H5	***Priority Valve***		●	●	●	●	●	●
H6	***Power Track Rods***						●	●
H7	***Steer Rams***		●	●	●	●		
H8	***Steering Column***		●	●	●	●	●	●
H9	***Manual Steer Mode Valve***		●	●	●	●	●	●
H10	***Auto Steer Mode Valve***		●	●	●	●	●	●

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Section K - Engine

			Machine models					
Topic Ref	**Title**	**Variant**	**540-170 5AF**	**550-140 5AG**	**540-140 5AL**	**550-170 5AM**	**535-125 HiViz 5AN**	**535-140 HiViz 5AP**
K1	***Stop and Start SYSTEM (Mechanical F.I. Engines)***		●	●	●	●	●	●
K2	***Stop and Start SYSTEM (Electronic F.I. Engines)***		●	●	●	●		
K3	***Cold Start Heater SYSTEM***	Mechanical F.I. Engines	●	●	●	●	●	●
K4	***Starter Motor***		●	●	●	●	●	●
K5	***Cooling Pack - (Non Intercooled)***				●		●	●
K6	***Cooling Pack - (Intercooled Mechanical F.I. Engines)***		●	●	●	●	●	●
K7	***Cooling Pack - (Electronic F.I. Engines)***		●	●	●	●		
K8	***Coolant Expansion Tank***		●	●	●	●	●	●
K9	***Air Filter Vacuum Switch***		●	●	●	●	●	●
K10	***Throttle Pedal and Cable***		●	●	●	●	●	●
K11	***Throttle Position Sensor (TPS)***		●	●	●	●		
K12	***Exhaust Silencer***		●	●	●	●	●	●
K13	***JCB Dieselmax (Mechanical F.I. Engines)***		●	●	●	●	●	●
K14	***JCB Dieselmax (Electronic F.I. Engines)***		●	●	●	●		

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Section M - Electronic Data Systems

			Machine models					
Topic Ref	Title	Variant	540-170 5AF	550-140 5AG	540-140 5AL	550-170 5AM	535-125 HiViz 5AN	535-140 HiViz 5AP
M1	***CANbus SYSTEM***		●	●	●	●	●	●
M2	***Loadall Monitoring SYSTEM***		●	●	●	●	●	●
M3	***Fault Code SYSTEM***		●	●	●	●	●	●
M4	***Servicemaster SYSTEM***		●	●	●	●	●	●
M5	***Servicemaster Tools***		●	●	●	●	●	●
M6	***Electronic Control Unit Theory***		●	●	●	●	●	●
M7	***Pulse Width Modulation Theory***		●	●	●	●	●	●

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Use

Introduction

This topic contains information about the structure of the manual and how to use the manual.

⇨ *Scope (1-2-2)*
- ⇨ *Personnel (1-2-2)*
- ⇨ *Applications (1-2-2)*
- ⇨ *Newest Data (1-2-2)*

⇨ *Format (1-2-3)*
⇨ *Left and Right Sides (1-2-4)*
⇨ *Hydraulic Schematic Codes (1-2-5)*
- ⇨ *Colour Codes (1-2-5)*

⇨ *Electrical Device Codes (1-2-6)*

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Scope

Personnel

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

These personnel should have a sound knowledge of workshop practice, safety procedures, and general techniques associated with the maintenance and repair of hydraulic earthmoving equipment. Finally, please remember above all else SAFETY MUST COME FIRST!

Applications

This manual contains data relevant to a range of machines. Make sure you reference the data for the correct machine. ⇨ ***Applications (1-1-1)***

Newest Data

From time to time new machines, systems or devices require the manual to be re-issued. Make sure you have the newest issue.

Always check the on-line JCB data system for relevant technical information.

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Format

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

1 **General Information** - Use the **Applications Tables** at the front of the section to see which topic in the manual is applicable to which machine model. The section also includes general information such as torque settings and service tools.

2 **Care & Safety** - includes warnings, cautions and general procedures related to aspects of workshop procedures contained in the manual.

3 **Routine Maintenance** - includes service schedules and recommended lubricants for all the machine.

The remaining sections are alphabetically coded and deal with dismantling, overhaul etc. of specific components, for example:

A **Attachments**

B **Body and Framework**...etc.

The sections contain topics. Each topic is a self contained set of data about a machine SYSTEM or Device.

Some topics are only applicable to some machine models. Use the **Applications Tables** in this section to see which topic is applicable to which machine model.

Each topic contains data such as specifications, descriptions, fault finding and test procedures. Device topics also contain removal, replacement, dismantle and assemble procedures.

Some topics contain **procedures and specifications for different variants**. This happens because of market requirements, or when the machine specification changes after a period of time. Where applicable, a table in the introduction of each topic contains information to help you identify the correct specifications or procedures.

Each topic also contains a **Related Topics** table. This table lists all the topics that contain related data. For example a hydraulic SYSTEM contains devices such as valves and pumps. These devices have their own topics and they are listed in the SYSTEM related topics table.

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Left and Right Sides

'Left Hand' and 'Right Hand' are as viewed from the rear of the machine facing forwards.

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Hydraulic Schematic Codes

Colour Codes

The following colour coding, used on illustrations to denote various conditions of oil pressure and flow, is standardised throughout JCB Service Publications.

Red	**Full Pressure**: Pressure generated from operation of a service. Depending on application this may be anything between neutral circuit pressure and LSRV operating pressure.
Pink	**Pressure:** Pressure that is above neutral circuit pressure but lower than that denoted by Red.
Orange	**Pilot:** Oil pressure used in controlling a device (Pilot).
Blue	**Neural:** Neutral circuit pressure.
Green	**Exhaust:**
Light Green	**Cavitation:** Oil subjected to a partial vacuum due to a drop in pressure (cavitation).
Yellow	**Lock Up:** Oil trapped within a chamber or line, preventing movement of components (lock up).

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Electrical Device Codes

This manual uses a code system to help you identify the electrical devices on the machine.

When the electrical system is designed at the factory codes are given to the electrical connectors on the electrical harnesses. The system allows the same code to be used for different connectors.

For this reason a different system is used in this manual.

Each main category of devices is given a code type:

Code Type	Category
-000	Earth points
+000	Power (from battery or alternator)
1000	Switches
2000	Relays
3000	Valves/Coils
4000	ECU's
5000	Sensors
6000	Indicators/Lamps
7000	Other devices
8000	Harness Interconnections
9000	Fuses

Each device is given one code and the code is used throughout the manual. The same code is given to both the device and its electrical connector.

Important: *The electrical schematics and the harness drawings in Section C are reproduced from the factory drawings. For this reason they retain the factory connector codes.*

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Machine Identification

Introduction

This topic contains information about a machine identification. On the machine and on the machine devices there are identification data plates.

⇨ *Related Topics (1-3-2)*
⇨ *Machine Identification Plate (1-3-3)*
⇨ *Typical Product Identification Number (PIN) (1-3-3)*
⇨ *Component Identification Plates (1-3-5)*
⇨ *Typical Engine Identification Number (1-3-5)*
⇨ *Transmission Identification Numbers (1-3-6)*
⇨ *ROPS/FOPS and OECD Certification Plates (1-3-7)*

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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	⇨ *Applications (1-1-1)*	ALL

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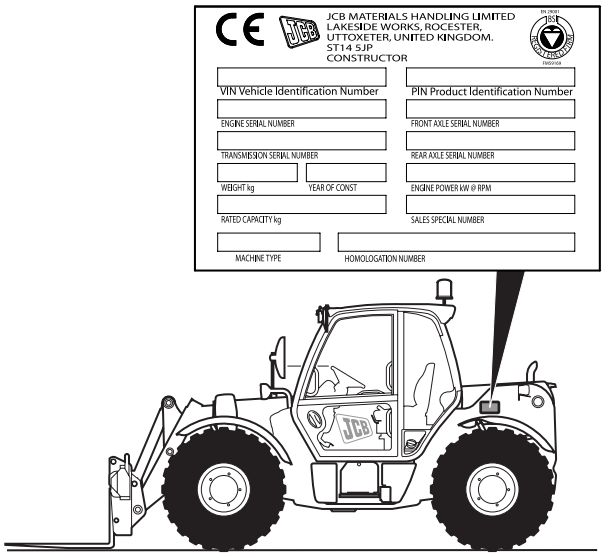
Machine Identification Plate

The machine has an identification plate mounted as shown. ⇒ *Fig 1. (1-3-3)*. The serial numbers of the machine and its major units are stamped on the plate.

Note: *The machine model and build specification is indicated by the PIN.*

The serial number of each major unit is also stamped on the unit itself. If a major unit is replaced by a new one, the serial number on the identification plate will be wrong. Either stamp the new number of the unit on the identification plate, or simply stamp out the old number. This will prevent the wrong unit number being quoted when replacement parts are ordered.

The machine and engine serial numbers can help identify exactly the type of equipment you have.

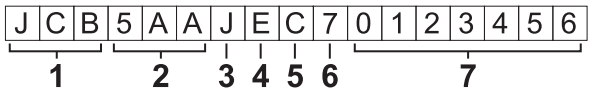


420811

Fig 1.

Typical Product Identification Number (PIN)

Machines Built Before January 2010



T011100

1 World Manufacturer Identification (3 Digits)

2 Machine Model (3 Digits)

Standard Builds:

5AF = 540-170	5AM = 550-170
5AG = 550-140	5AN = 535-125 HiViz
5AL = 540-140	5AP = 535-140 HiViz
5AM = 550-170	

3 Engine Type (1 Digit)

JCB Dieselmax (Tier 3):

R = Turbocharged and after-cooled, 97kW (130Hp)

S = Turbocharged and after-cooled, 74.2kW (100Hp)

T = Turbocharged, 63kW (85Hp)

4 Gearbox Model (1 Digit)

E = 3 Speed (PS750)	G = 4 Speed (PS750)
F = 3 Speed (PS760)	H = 4 Speed (PS760)

5 Randomly generated check letter (1 Digit)

6 Year of Manufacture (1 Digit)

7 = 2007	A = 2010
8 = 2008	B = 2011
9 = 2009	C = 2012

7 Machine Serial Number (7 Digits)

Each machine has a unique serial number.

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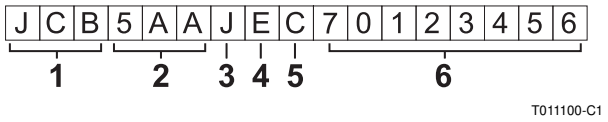
Machine Identification Plate

Machines Built After January 2010



1 World Manufacturer Identification (3 Digits)

2 Machine Model (3 Digits)

Standard Builds:

5AF = 540-170	5AM = 550-170
5AG = 550-140	5AN = 535-125 HiViz
5AL = 540-140	5AP = 535-140 HiViz
5AM = 550-170	

3 Engine Type (1 Digit)

JCB Dieselmax (Tier 3):

R = Turbocharged and after-cooled, 97kW (130Hp)

S = Turbocharged and after-cooled, 74.2kW (100Hp)

T = Turbocharged, 63kW (85Hp)

4 Gearbox Model (1 Digit)

E = 3 Speed (PS750)	G = 4 Speed (PS750)
F = 3 Speed (PS760)	H = 4 Speed (PS760)

5 Randomly generated check letter (1 Digit)

6 Machine Serial Number (8 Digits)

Each machine has a unique serial number.

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Component Identification Plates

Typical Engine Identification Number

Engine data labels **2A** are located on the cylinder block at position **2C** and rocker cover **2D** (if fitted). The data label contains important engine information and includes the engine identification number **2E**.

A typical engine identification number is explained as follows:

SD	**320/40001**	**U**	**00001**	**04**
1	**2**	**3**	**4**	**5**

1 Engine Type

SD = turbocharged

SE = electronic common rail fuel injection, turbocharged and intercooled.

SF = turbocharged and intercooled.

2 Engine part number

3 Country of manufacture

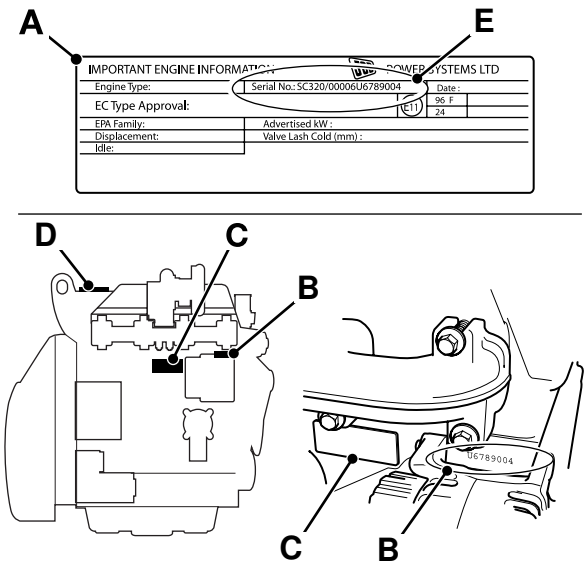
U = United Kingdom

4 Engine Serial Number

5 Year of Manufacture

The last three parts of the engine identification number are stamped on the cylinder block at position **2B**.

U 00001 04



C007280-C2

Fig 2. Engine

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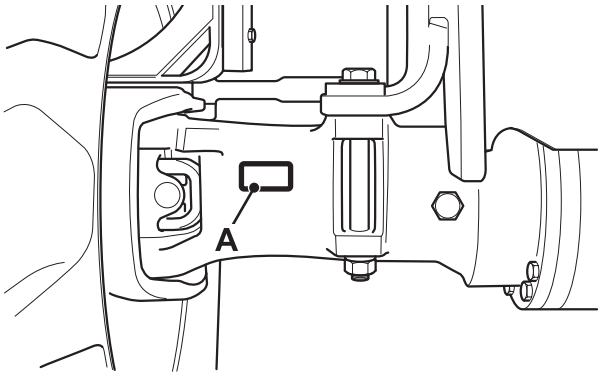
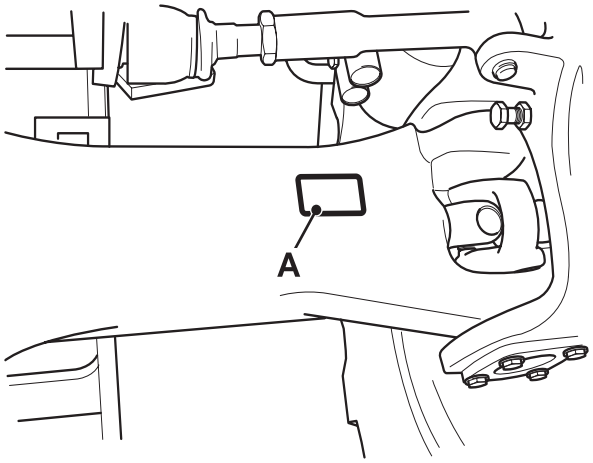
Transmission Identification Numbers

The transmission components have a serial number stamped on a data plate **A** as shown.



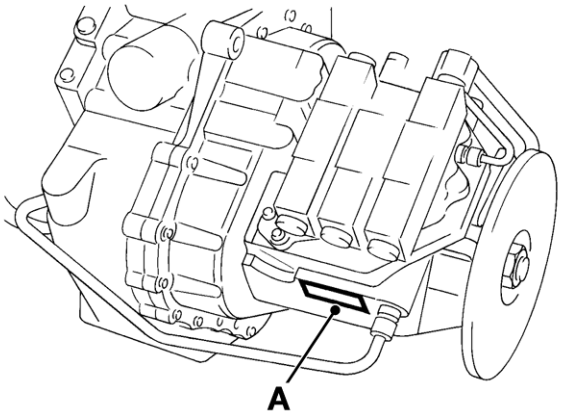
A710840-C1

Fig 3. Front Axle



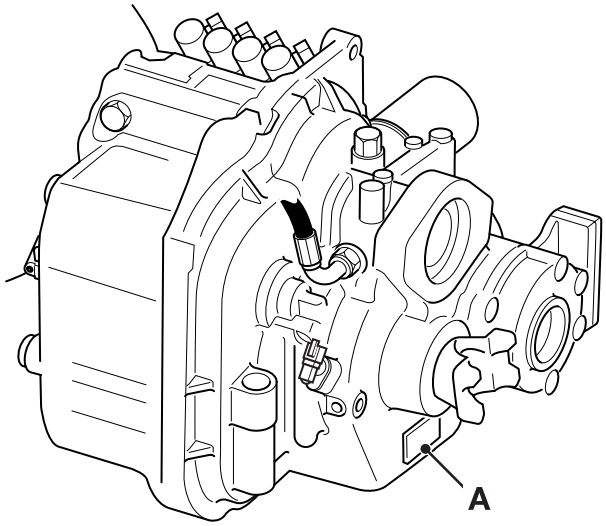
A710830-C1

Fig 4. Rear Axle



263370-C1

Fig 5. PS750 Powershift Transmission



A401030-C2

Fig 6. PS760 Powershift Transmission

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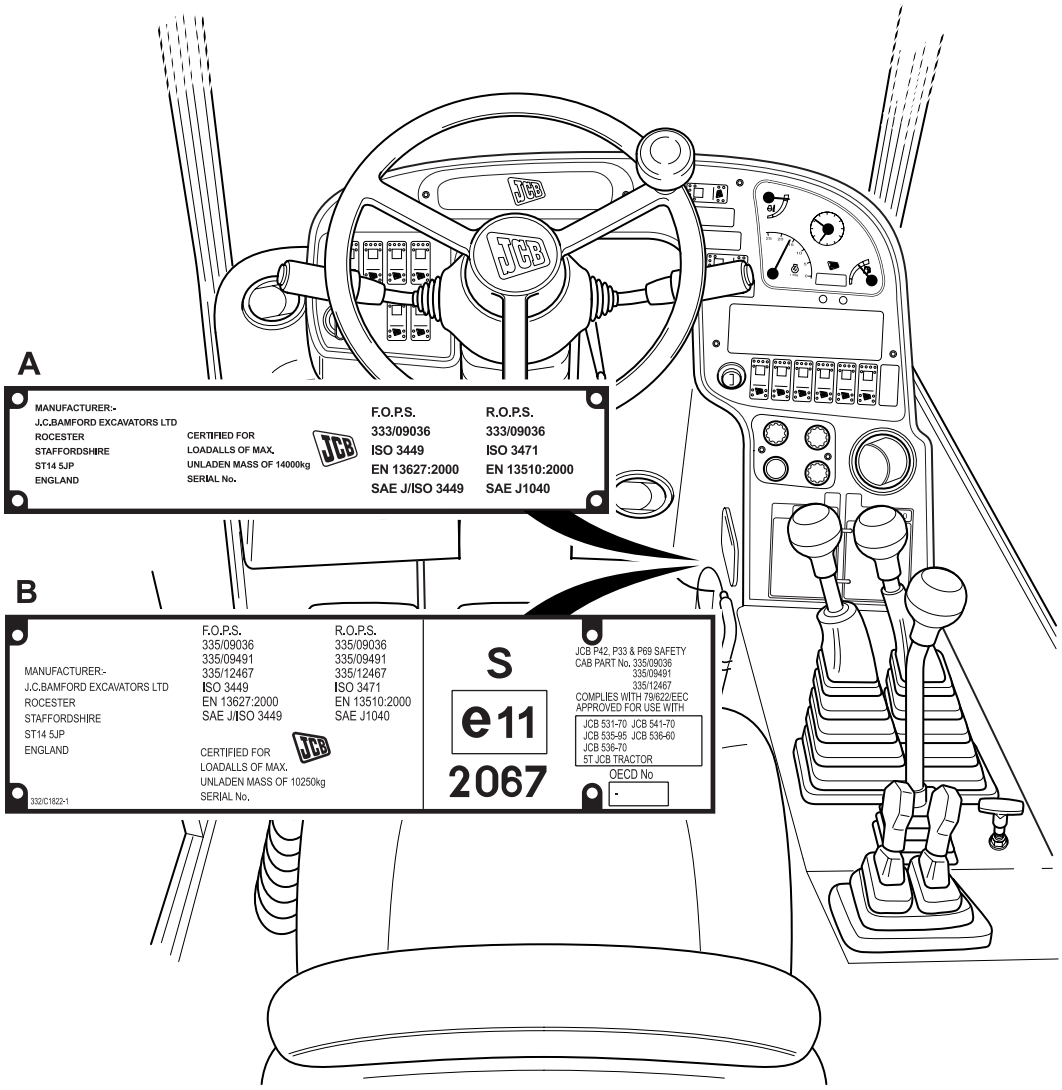
ROPS/FOPS and OECD Certification Plates



445911-5

Fig 7.

Machines built to ROPS/FOPS standards have an identification label **A** fitted to the inside of the cab. Machines built to ROPS/FOPS and OECD standards have identification label **B** fitted to the inside of the cab.

Definition of terms:

ROPS	Roll Over Protection Structure
FOPS	Falling Objects Protection Structure
OECD	Organisation for Economic Co-operation and Development.

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Torque Settings

Introduction

This topic contains information about torques. Torque values are given for types and sizes of bolts and hydraulic connectors and adapters.

Where a torque is given as a single figure it may be varied by plus or minus 3%. Torque figures are given for fasteners with different surface treatments. Make sure you use the correct torque figures.

Where torques are given in topics within the other sections always use these values.

⇒ *Zinc Plated Fasteners and Dacromet Fasteners (1-4-2)*
- ⇒ *Introduction (1-4-2)*
- ⇒ *Bolts and Screws (1-4-2)*

⇒ *Hydraulic Connections (1-4-6)*
- ⇒ *'O' Ring Face Seal System (1-4-6)*
- ⇒ *'Torque Stop' Hose System (1-4-9)*

⇒ *`Positional Type' Hydraulic Adaptors (1-4-10)*
- ⇒ *Fitting Procedure (1-4-10)*

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Zinc Plated Fasteners and Dacromet Fasteners

T11-002

Introduction

Some external fasteners on JCB machines are manufactured using an improved type of corrosion resistant finish. This type of finish is called Dacromet and replaces the original Zinc and Yellow Plating used on earlier machines.

The two types of fasteners can be readily identified by colour and part number suffix. ⇨ *Table 1. Fastener Types (1-4-2)*.

Table 1. Fastener Types

Fastener Type	Colour	Part No. Suffix
Zinc and Yellow	Golden finish	'Z' (e.g. 1315/3712Z)
Dacromet	Mottled silver finish	'D' (e.g. 1315/3712D)

Note: *As the Dacromet fasteners have a lower torque setting than the Zinc and Yellow fasteners, the torque figures used must be relevant to the type of fastener.*

Note: *A Dacromet bolt should not be used in conjunction with a Zinc or Yellow plated nut, as this could change the torque characteristics of the torque setting further. For the same reason, a Dacromet nut should not be used with a Zinc or Yellow plated bolt.*

Note: *All bolts used on JCB machines are high tensile and must not be replaced by bolts of a lesser tensile specification.*

Note: *Dacromet bolts, due to their high corrosion resistance are used in areas where rust could occur. Dacromet bolts are only used for external applications. They are not used in applications such as gearbox or engine joint seams or internal applications.*

Bolts and Screws

Use the following torque setting tables only where no torque setting is specified in the text.

Note: *Dacromet fasteners are lubricated as part of the plating process, do not lubricate.*

Torque settings are given for the following conditions:

Condition 1

- Un-lubricated fasteners
- Zinc fasteners
- Yellow plated fasteners

Condition 2

- Zinc flake (Dacromet) fasteners
- Lubricated zinc and yellow plated fasteners
- Where there is a natural lubrication. For example, cast iron components

Verbus Ripp Bolts

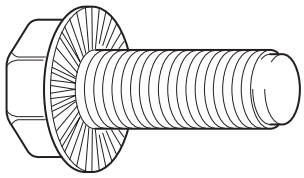

Fig 1.

Torque settings for these bolts are determined by the application. Refer to the relevant procedure for the required settings.

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Zinc Plated Fasteners and Dacromet Fasteners

Table 2. Torque Settings - UNF Grade 'S' Fasteners

Bolt Size		Hexagon (A/F)	Condition 1			Condition 2		
in.	mm	in.	Nm	kgf m	lbf ft	Nm	kgf m	lbf ft
1/4	6.3	7/16	11.2	1.1	8.3	10.0	1.0	7.4
5/16	7.9	1/2	22.3	2.3	16.4	20.0	2.0	14.7
3/8	9.5	9/16	40.0	4.1	29.5	36.0	3.7	26.5
7/16	11.1	5/8	64.0	6.5	47.2	57.0	5.8	42.0
1/2	12.7	3/4	98.00	10.0	72.3	88.0	9.0	64.9
9/16	14.3	13/16	140.0	14.3	103.2	126.0	12.8	92.9
5/8	15.9	15/16	196.0	20.0	144.6	177.0	18.0	130.5
3/4	19.0	1 1/8	343.0	35.0	253.0	309.0	31.5	227.9
7/8	22.2	1 15/16	547.0	55.8	403.4	492.0	50.2	362.9
1	25.4	1 1/2	814.0	83.0	600.4	732.0	74.6	539.9
1 1/8	31.7	1 7/8	1181.0	120.4	871.1	1063.0	108.4	784.0
1 1/4	38.1	2 1/4	1646.0	167.8	1214.0	1481.0	151.0	1092.3

Table 3. Torque Settings - Metric Grade 8.8 Fasteners

Bolt Size		Hexagon (A/F)	Condition 1			Condition 2		
ISO Metric Thread	mm	mm	Nm	kgf m	lbf ft	Nm	kgf m	lbf ft
M5	5	8	5.8	0.6	4.3	5.2	0.5	3.8
M6	6	10	9.9	1.0	7.3	9.0	0.9	6.6
M8	8	13	24.0	2.4	17.7	22.0	2.2	16.2
M10	10	17	47.0	4.8	34.7	43.0	4.4	31.7
M12	12	19	83.0	8.5	61.2	74.0	7.5	54.6
M16	16	24	205.0	20.9	151.2	184.0	18.8	135.7
M20	20	30	400.0	40.8	295.0	360.0	36.7	265.5
M24	24	36	690.0	70.4	508.9	621.0	63.3	458.0
M30	30	46	1372.0	139.9	1011.9	1235.0	125.9	910.9
M36	36	55	2399.0	244.6	1769.4	2159.0	220.0	1592.4

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Zinc Plated Fasteners and Dacromet Fasteners

Table 4. Metric Grade 10.9 Fasteners

Bolt Size		Hexagon (A/F)	Condition 1			Condition 2		
ISO Metric Thread	mm	mm	Nm	kgf m	lbf ft	Nm	kgf m	lbf ft
M5	5	8	8.1	0.8	6.0	7.3	0.7	5.4
M6	6	10	13.9	1.4	10.2	12.5	1.3	9.2
M8	8	13	34.0	3.5	25.0	30.0	3.0	22.1
M10	10	17	67.0	6.8	49.4	60.0	6.1	44.2
M12	12	19	116.0	11.8	85.5	104.0	10.6	76.7
M16	16	24	288.0	29.4	212.4	259.0	26.4	191.0
M20	20	30	562.0	57.3	414.5	506.0	51.6	373.2
M24	24	36	971.0	99.0	716.9	874.0	89.1	644.6
M30	30	46	1930.0	196.8	1423.5	1737.0	177.1	1281.1
M36	36	55	3374.0	344.0	2488.5	3036.0	309.6	2239.2

Table 5. Metric Grade 12.9 Fasteners

Bolt Size		Hexagon (A/F)	Condition 1			Condition 2		
ISO Metric Thread	mm	mm	Nm	kgf m	lbf ft	Nm	kgf m	lbf ft
M5	5	8	9.8	1.0	7.2	8.8	0.9	6.5
M6	6	10	16.6	1.7	12.2	15.0	1.5	11.1
M8	8	13	40.0	4.1	29.5	36.0	3.7	26.5
M10	10	17	80.0	8.1	59.0	72.0	7.3	53.1
M12	12	19	139.0	14.2	102.5	125.0	12.7	92.2
M16	16	24	345.0	35.2	254.4	311.0	31.7	229.4
M20	20	30	674.0	68.7	497.1	607.0	61.9	447.7
M24	24	36	1165.0	118.8	859.2	1048.0	106.9	773.0
M30	30	46	2316.0	236.2	1708.2	2084.0	212.5	1537.1
M36	36	55	4049.0	412.9	2986.4	3644.0	371.6	2687.7

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Table 6. Torque Settings - Rivet Nut Bolts/Screws

Bolt Size				
ISO Metric Thread	mm	Nm	kgf m	lbf ft
M3	3	1.2	0.1	0.9
M4	4	3.0	0.3	2.0
M5	5	6.0	0.6	4.5
M6	6	10.0	1.0	7.5
M8	8	24.0	2.5	18.0
M10	10	48.0	4.9	35.5
M12	12	82.0	8.4	60.5

Table 7. Torque Settings - Internal Hexagon Headed Cap Screws (Zinc)

Bolt Size			
ISO Metric Thread	Nm	kgf m	lbf ft
M3	2.0	0.2	1.5
M4	6.0	0.6	4.5
M5	11.0	1.1	8.0
M6	19.0	1.9	14.0
M8	46.0	4.7	34.0
M10	91.0	9.3	67.0
M12	159.0	16.2	117.0
M16	395.0	40.0	292.0
M18	550.0	56.0	406.0
M20	770.0	79.0	568.0
M24	1332.0	136.0	983.0

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Hydraulic Connections

T11-003

'O' Ring Face Seal System

Adaptors Screwed into Valve Blocks

Adaptor screwed into valve blocks, seal onto an 'O' ring which is compressed into a 45° seat machined into the face of the tapped port.

Table 8. Torque Settings - BSP Adaptors

BSP Adaptor Size	Hexagon (A/F)			
in.	mm	Nm	kgf m	lbf ft
1/4	19.0	18.0	1.8	13.0
3/8	22.0	31.0	3.2	23.0
1/2	27.0	49.0	5.0	36.0
5/8	30.0	60.0	6.1	44.0
3/4	32.0	81.0	8.2	60.0
1	38.0	129.0	13.1	95.0
1 1/4	50.0	206.0	21.0	152.0

Table 9. Torque Settings - SAE Connections

SAE Tube Size	SAE Port Thread Size	Hexagon (A/F)			
		mm	Nm	kgf m	lbf ft
4	7/16 - 20	15.9	20.0 - 28.0	2.0 - 2.8	16.5 - 18.5
6	9/16 - 18	19.1	46.0 - 54.0	4.7 - 5.5	34.0 - 40.0
8	3/4 - 16	22.2	95.0 - 105.0	9.7 - 10.7	69.0 - 77.0
10	7/8 - 14	27.0	130.0 - 140.0	13.2 - 14.3	96.0 - 104.0
12	1 1/16 - 12	31.8	190.0 - 210.0	19.4 - 21.4	141.0 - 155.0
16	1 5/16 - 12	38.1	290.0 - 310.0	29.6 - 31.6	216.0 - 230.0
20	1 5/8	47.6	280.0 - 380.0	28.5 - 38.7	210.0 - 280.0

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Hoses Screwed into Adaptors

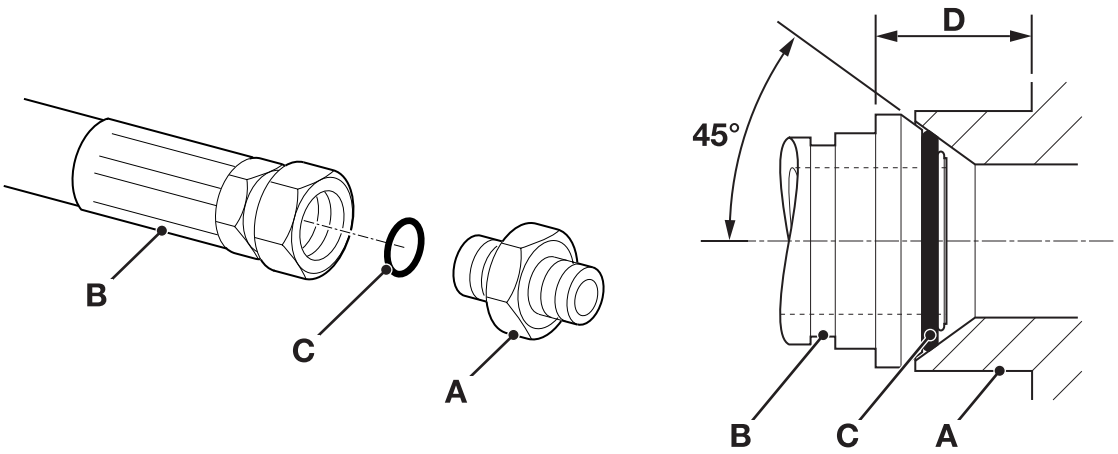

Fig 2.

Hoses **2-B** screwed into adaptors **2-A** seal onto an `O' ring **2-C** which is compressed into a 45° seat machined into the face of the adaptor port.

Note: *Dimension **2-D** will vary depending upon the torque applied.*

Table 10. BSP Hose - Torque Settings

BSP Hose Size	Hexagon (A/F)			
in.	mm	Nm	kgf m	lbf ft
1/8	14.0	14.0 - 16.00	1.4 - 1.6	10.3 - 11.8
1/4	19.0	24.0 - 27.0	2.4 - 2.7	17.7 - 19.9
3/8	22.0	33.0 - 40.0	3.4 - 4.1	24.3 - 29.5
1/2	27.0	44.0 - 50.0	4.5 - 5.1	32.4 - 36.9
5/8	30.0	58.0 - 65.0	5.9 - 6.6	42.8 - 47.9
3/4	32.0	84.0 - 92.0	8.6 - 9.4	61.9 - 67.8
1	38.0	115.0 - 126.0	11.7 - 12.8	84.8 - 92.9
1 1/4	50.0	189.0 - 200.0	19.3 - 20.4	139.4 - 147.5
1 1/2	55.0	244.0 - 260.0	24.9 - 26.5	180.0 - 191.8

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Adaptors into Component Connections with Bonded Washers

Table 11. BSP Adaptors with Bonded Washers - Torque Settings

BSP Size			
in.	Nm	kgf m	lbf ft
1/8	20.0	2.1	15.0
1/4	34.0	3.4	25.0
3/8	75.0	7.6	55.0
1/2	102.0	10.3	75.0
5/8	122.0	12.4	90.0
3/4	183.0	18.7	135.0
1	203.0	20.7	150.0
1 1/4	305.0	31.0	225.0
1 1/2	305.0	31.0	225.0

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'Torque Stop' Hose System

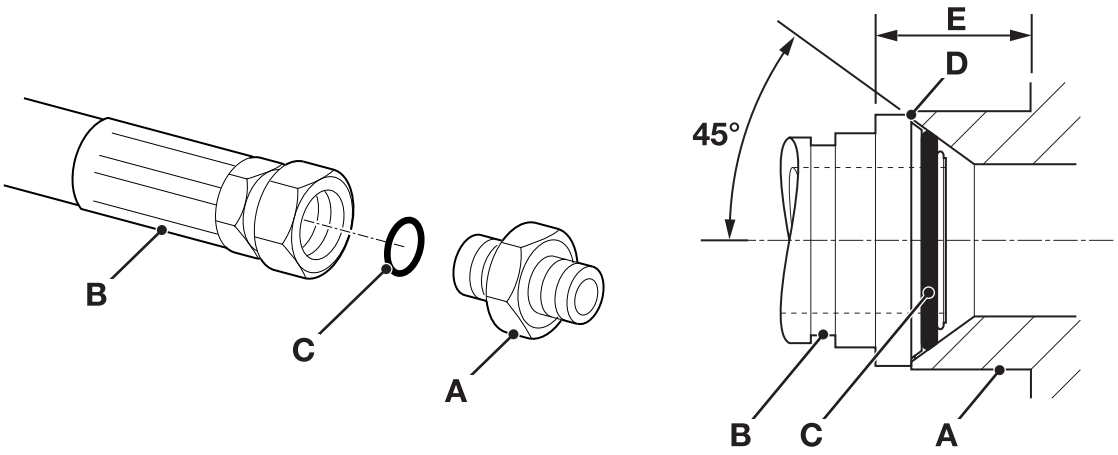

Fig 3.

`Torque Stop' Hoses **3-B** screwed into adaptors **3-A** seal onto an 'O' ring **3-C** which is compressed into a 45° seat machined in the face of the adaptor port. To prevent the 'O' ring being damages as a result of over tightening, 'Torque Stop' Hoses have an additional shoulder **3-D**, which acts as a physical stop.

Note: *Minimum dimension **3-E** fixed by shoulder **3-D**.*

Table 12. BSP `Torque Stop' Hose - Torque Settings

BSP Hose Size	Hexagon (A/F)			
in.	mm	Nm	kgf m	lbf ft
1/8	14.0	14.0	1.4	10.0
1/4	19.0	27.0	2.7	20.0
3/8	22.0	40.0	4.1	30.0
1/2	27.0	55.0	5.6	40.0
5/8	30.0	65.0	6.6	48.0
3/4	32.0	95.0	9.7	70.0
1	38.0	120.0	12.2	89.0
1 1/4	50.0	189.0	19.3	140.0
1 1/2	55.0	244.0	24.9	180.0

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`Positional Type' Hydraulic Adaptors

Fitting Procedure

On a typical machine, some hydraulic components may utilise `Positional Type' SAE Hydraulic Adaptors. When fitting `Positional Type' Hydraulic Adaptors it is important to adopt the following procedure. If this procedure is not followed correctly, damage to the `O' ring seal **4-A** can occur resulting in oil leaks.

1 Ensure the locknut **4-B** is screwed back onto the body of the adaptor as far as possible as shown.

2 Check the `O' ring backing washer **4-C** is a tight fit on the adaptor. Note that the washer should not move freely, if the washer is slack do not use the adaptor.

3 Check the `O' ring **4-A** is fitted and that it is free from damage or nicks. Before fitting the adaptor, smear the `O' ring with clean hydraulic fluid.

Note: *The dimensions and shore hardness of the `O' ring is critical. Should it become necessary to replace the `O' ring, ensure that only JCB Genuine Parts are used.*

4 Screw the adaptor into the port of the hydraulic component as far as possible, so that ALL the threads engage and the `O' ring is correctly seated against the sealing face.

5 Set the angular position of the adaptor as required, then secure by tightening the locknut **4**-**B**.

Note: *When fitted correctly no more than one thread should be visible at **5-Z** as shown.*

6 Torque tighten the locknut to 81 Nm (60 lbf ft).

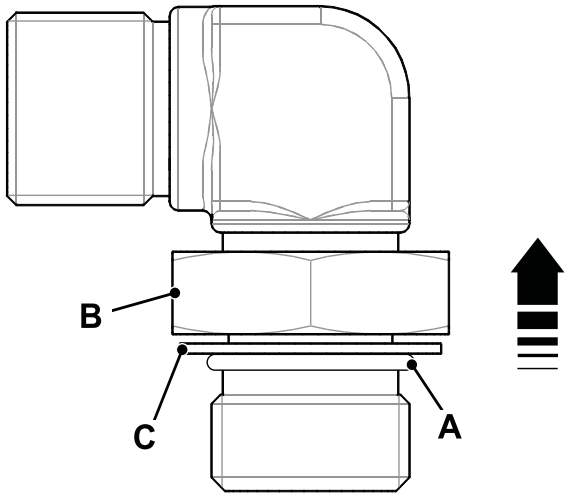

Fig 4.

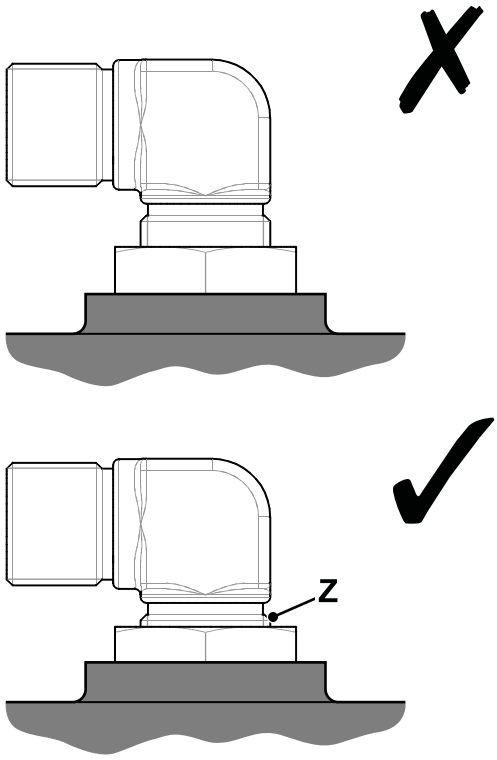

Fig 5.

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Service Tools

Introduction

The tools listed in the table are special tools required for carrying out the procedures described in this manual. These tools are available from JCB Service or, in some instances, can be manufactured locally from the specifications given in this section.

Note: *Tools other than those listed will be required. It is expected that such general tools will be available in any well equipped workshop or be available locally from any good tool supplier.*

⇨ ***Numerical List (1-5-2)***
⇨ ***Tool Detail Reference (1-5-5)***
⇨ ***Rivet Nuts (1-5-23)***
⇨ ***Slide Hammer Kit (1-5-25)***

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Numerical List

Some tools are supplied as kits or sets. Cross references are given to tables showing the kit contents.

Part Number:	Description:	Tool Detail Reference:
-	Bonded Washers - see tool detail reference for content	⇒ Fig 39. (1-5-15)
-	Electrical Repair Kit - see tool detail reference for content	⇒ Fig 23. (1-5-10)
-	Female Cone Blanking Plugs - see tool detail reference for content	⇒ Fig 36. (1-5-15)
-	Female Connectors - see tool detail reference for content	⇒ Fig 38. (1-5-15)
-	Hydraulic Hand Pump Equipment - see tool detail reference for content	⇒ Fig 42. (1-5-16)
-	Male Adaptors BSP x BSP - see tool detail reference for content	⇒ Fig 32. (1-5-14)
-	Male Cone Blanking Caps - see tool detail reference for content	⇒ Fig 37. (1-5-15)
-	Pressure Test Point `T' Adaptors - see tool detail reference for content	⇒ Fig 34. (1-5-14)
-	Pressure Test Point Adaptors - see tool detail reference for content	⇒ Fig 33. (1-5-14)
-	Rivet Nut Tool - see tool detail reference for content	⇒ Fig 1. (1-5-5)
320/20050	Engine Lifting Bracket Kit	⇒ Fig 63. (1-5-22)
332/E7911	Exhaust fitting clamp	⇒ Fig 61. (1-5-21)
4104/1310	Hand Cleaner	⇒ Fig 15. (1-5-8)
460/15708	Flow Test Adaptor (Powershift) - Other components required, see tool detail	⇒ Fig 46. (1-5-17)
718/20235	USB PC Cable	⇒ Fig 64. (1-5-22)
718/20236	Serial PC Cable	⇒ Fig 64. (1-5-22)
718/20237	Machine Cable	⇒ Fig 64. (1-5-22)
728/26500	USB DLA	⇒ Fig 64. (1-5-22)
892/00011	Spool Clamp	⇒ Fig 49. (1-5-18)
892/00167	Ram Protection Sleeve for 90 mm Rod Diameter	⇒ Fig 53. (1-5-20)
892/00180	Seal Fitting Tool - Hydraulic Steer Unit	⇒ Fig 50. (1-5-18)
892/00229	Flow Meter	⇒ Fig 44. (1-5-16)
892/00253	Hydraulic Pressure Test Kit - see tool detail reference for content	⇒ Fig 29. (1-5-13)
892/00268	Flow Monitoring Unit - Other components required, see tool detail	⇒ Fig 27. (1-5-12)
892/00334	Ram Seal Fitting Tool	⇒ Fig 54. (1-5-20)
892/00349	Crimp Tool	⇒ Fig 25. (1-5-11)
892/00350	Butane Heater Assembly	⇒ Fig 24. (1-5-10)
892/00351	Splice 0.5-1.5 mm (Red)	⇒ Fig 26. (1-5-11)
892/00352	Splice 1.5-2.5 mm (Blue)	⇒ Fig 26. (1-5-11)
892/00353	Splice 3.0-6.0 mm (Yellow)	⇒ Fig 26. (1-5-11)
892/00812	Drive Coupling Spanner	⇒ Fig 59. (1-5-21)

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Numerical List

Part Number:	Description:	Tool Detail Reference:
892/00822	Splined Bolt Socket	⇨ Fig 58. (1-5-21)
892/00842	Glass Lifter	⇨ Fig 3. (1-5-6)
892/00843	Folding Stand for Holding Glass	⇨ Fig 4. (1-5-6)
892/00844	Long Knife	⇨ Fig 17. (1-5-8)
892/00845	Cartridge Gun	⇨ Fig 5. (1-5-6)
892/00846	Glass Extractor (Handles)	⇨ Fig 6. (1-5-6)
892/00847	Nylon Spatula	⇨ Fig 7. (1-5-6)
892/00848	Wire Starter	⇨ Fig 8. (1-5-6)
892/00849	Braided Cutting Wire	⇨ Fig 9. (1-5-7)
892/00881	Valve Spool Seal Fitting Tool	⇨ Fig 43. (1-5-16)
892/00893	Torque Converter Alignment Tool	⇨ Fig 60. (1-5-21)
892/00905	LMI Test Box	⇨ Fig 21. (1-5-9)
892/00948	Nitrogen Charging Kit (without gauge)	⇨ Fig 48. (1-5-17)
892/00949	Gauge	⇨ Fig 48. (1-5-17)
892/00964	Test Point 1/8 BSP (Powershift)	⇨ Fig 40. (1-5-16)
892/00965	Test Point 3/8 BSP (Powershift)	⇨ Fig 41. (1-5-16)
892/01016	Ram Protection Sleeve for 25 mm Rod Diameter	⇨ Fig 53. (1-5-20)
892/01017	Ram Protection Sleeve for 30 mm Rod Diameter	⇨ Fig 53. (1-5-20)
892/01018	Ram Protection Sleeve for 40 mm Rod Diameter	⇨ Fig 53. (1-5-20)
892/01019	Ram Protection Sleeve for 50 mm Rod Diameter	⇨ Fig 53. (1-5-20)
892/01020	Ram Protection Sleeve for 50 mm Rod Diameter	⇨ Fig 53. (1-5-20)
892/01021	Ram Protection Sleeve for 60 mm Rod Diameter	⇨ Fig 53. (1-5-20)
892/01022	Ram Protection Sleeve for 60 mm Rod Diameter	⇨ Fig 53. (1-5-20)
892/01023	Ram Protection Sleeve for 65 mm Rod Diameter	⇨ Fig 53. (1-5-20)
892/01024	Ram Protection Sleeve for 70 mm Rod Diameter	⇨ Fig 53. (1-5-20)
892/01025	Ram Protection Sleeve for 75 mm Rod Diameter	⇨ Fig 53. (1-5-20)
892/01026	Ram Protection Sleeve for 80 mm Rod Diameter	⇨ Fig 53. (1-5-20)
892/01027	Piston Seal Assembly Tool	⇨ Fig 56. (1-5-20)
892/01174	Data Link Adaptor Kit	⇨ Fig 64. (1-5-22)
892/01268	Digital Pressure Gauge 0-400 bar	⇨ Fig 45. (1-5-16)
892/01271	Hose for Digital Pressure Gauge 892/01268	⇨ Fig 45. (1-5-16)
926/15500	Rubber Spacer Blocks	⇨ Fig 10. (1-5-7)
992/01100	Glazing Tool	⇨ Fig 16. (1-5-8)
992/04000	Torque Multiplier	⇨ Fig 57. (1-5-21)
992/04800	Flange spanner	⇨ Fig 62. (1-5-21)
992/09100	Spool Clamp	⇨ Fig 49. (1-5-18)
992/09300	Hexagon Spanner 55 mm A/F	⇨ Fig 55. (1-5-20)

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Numerical List

Part Number:	Description:	Tool Detail Reference:
992/09400	Hexagon Spanner 65 mm A/F	⇨ *Fig 55. (1-5-20)*
992/09500	Hexagon Spanner 75 mm A/F	⇨ *Fig 55. (1-5-20)*
992/09600	Hexagon Spanner 85 mm A/F	⇨ *Fig 55. (1-5-20)*
992/09700	Hexagon Spanner 95 mm A/F	⇨ *Fig 55. (1-5-20)*
992/09900	Hexagon Spanner 115 mm A/F	⇨ *Fig 55. (1-5-20)*
992/10000	Hexagon Spanner 125 mm A/F	⇨ *Fig 55. (1-5-20)*
992/12300	12V Mobile Oven	⇨ *Fig 11. (1-5-7)*
992/12400	24V Static Oven (2 Cartridge)	⇨ *Fig 12. (1-5-7)*
992/12800	Cut-Out Knife	⇨ *Fig 13. (1-5-7)*
992/12801	`L' Blades	⇨ *Fig 14. (1-5-7)*
993/68100	Slide Hammer Kit - see tool detail reference for content	⇨ *Fig 2. (1-5-5)*
993/85700	Battery Tester	⇨ *Fig 22. (1-5-9)*

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Tool Detail Reference

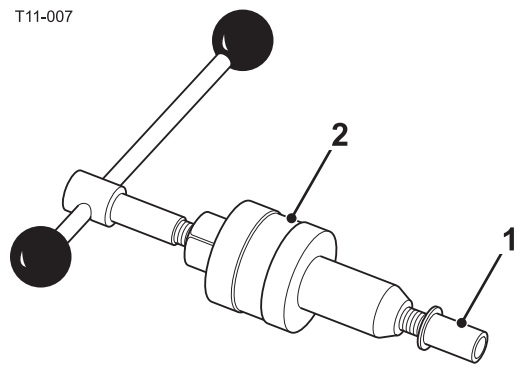

Fig 1. Rivet Nut Tool

1	826/01099	M6 x 16 mm Rivet Nut
	826/01101	M6 x 19 mm Rivet Nut
	826/01102	M8 x 18 mm Rivet Nut
	826/01103	M8 x 21 mm Rivet Nut
	826/01104	M10 x 23 mm Rivet Nut
	826/01105A	M10 x 26 mm Rivet Nut
2	-	Installation Tool available from: Bollhoff Fastenings Ltd (***www.bollhof.com***)

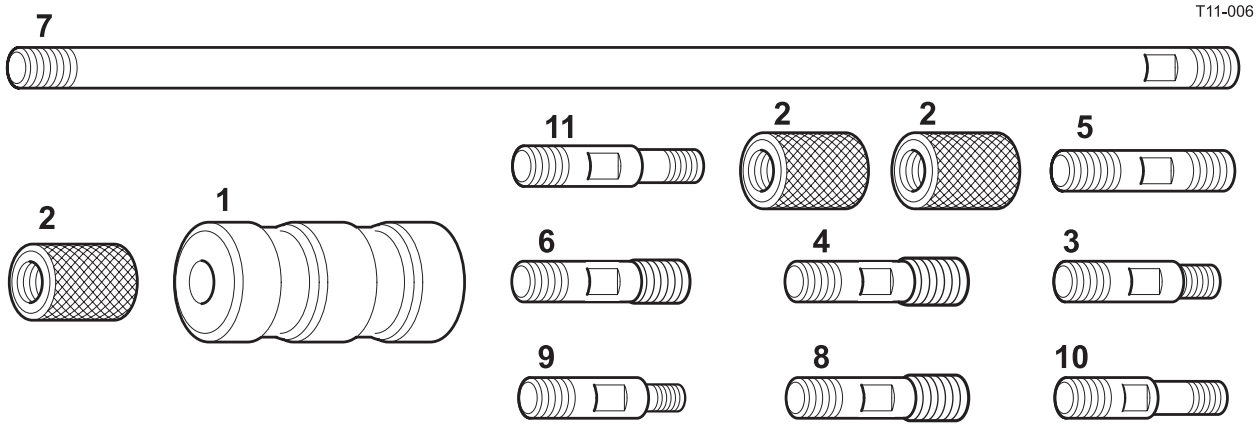

Fig 2. 993/68100 Slide Hammer Kit

1	993/68101	Slide Hammer	**7**	993/68107	Bar - M20 x M20 X 800 mm
2	993/68102	End Stops	**8**	993/68108	Adaptor - M20 x 7/8" UNF
3	993/68103	Adaptor - M20 x 5/8" UNF	**9**	993/68109	Adaptor - M20 x M12
4	993/68104	Adaptor - M20 x 1" UNF	**10**	993/68110	Adaptor - M20 x 5/8" UNF (Shoulder)
5	993/68105	Adaptor - M20 x M20	**11**	993/68111	Adaptor - M20 x 1/2" UNF
6	993/68106	Adaptor - M20 x M24			

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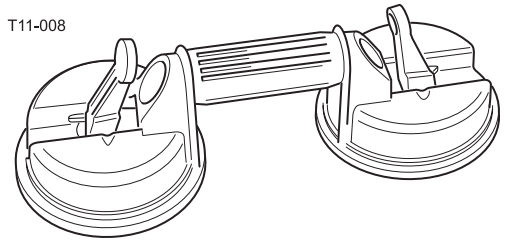

Fig 3. 892/00842 Glass Lifter

Minimum 2 off - Essential for glass installation, 2 required to handle large panes of glass. Ensure suction cups are protected from damage during storage.

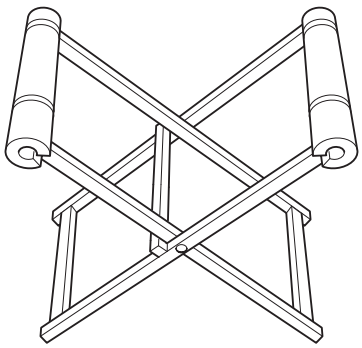

Fig 4. 892/00843 Folding Stand

Essential for preparing new glass prior to installation.

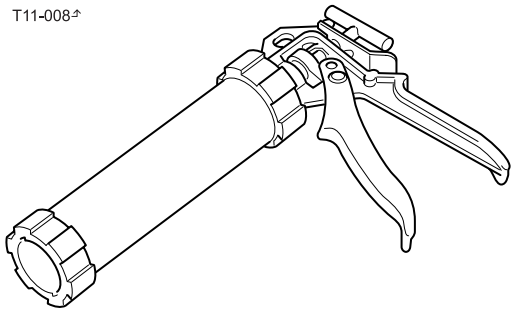

Fig 5. 892/00845 Cartridge Gun

Hand operated. Essential for the application of sealants, polyurethane materials etc.

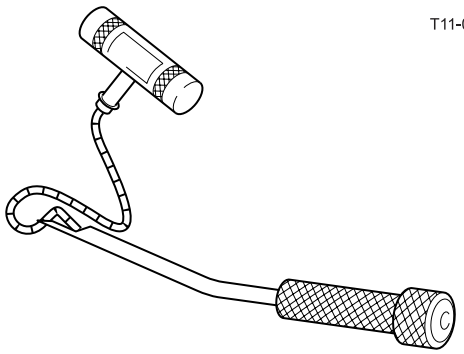

Fig 6. 892/00846 Glass Extractor (Handles)

Used with braided cutting wire to cut out broken glass. ⇨ *Fig 9. (1-5-7)*.

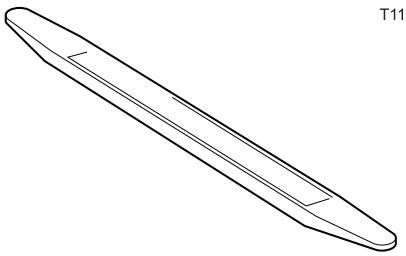

Fig 7. 892/00847 Nylon Spatula

General tool used for smoothing sealants - also used to re-install glass in rubber glazing because metal tools will chip the glass edge.

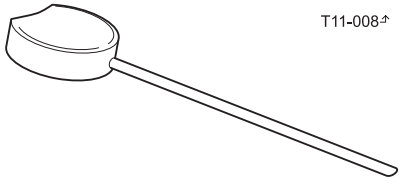

Fig 8. 892/00848 Wire Starter

Used to access braided cutting wire through original polyurethane seal. ⇨ *Fig 9. (1-5-7)*.

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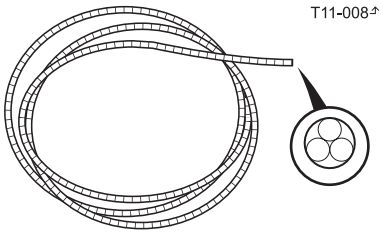

Fig 9. 892/00849 Braided Cutting Wire

Consumable heavy duty cut-out wire used with the glass extraction tool. ⇨ *Fig 6. (1-5-6)*. Approx 25 m length.

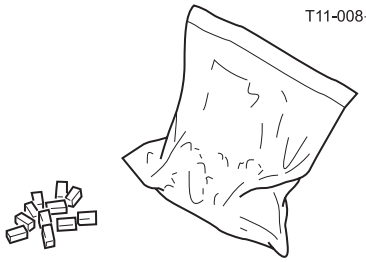

Fig 10. 926/15500 Rubber Spacer Blocks

Used to provide the correct set clearance between glass edge and cab frame. Unit quantity = 500 off.

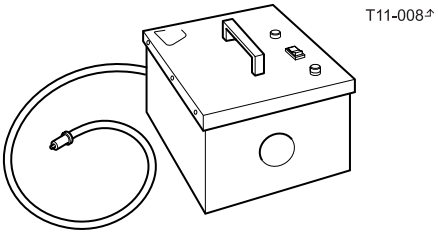

Fig 11. 992/12300 Mobile Oven 12V

1 cartridge capacity. Required to pre-heat adhesive prior to use. It is fitted with a male plug (703/23201) which fits into a female socket (715/04300).

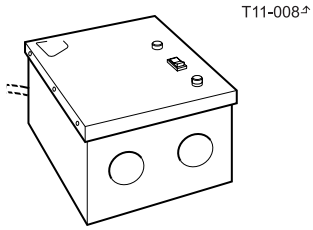

Fig 12. 992/12400 Static Oven 240V

Required to pre-heat adhesive prior to use. No plug supplied.

Note: *110V models available upon request - contact JCB Technical Service.*

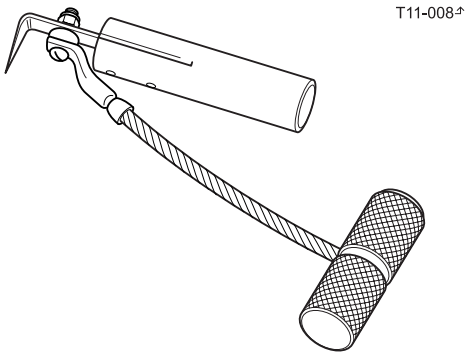

Fig 13. 992/12800 Cut-Out Knife

Used to remove broken glass.

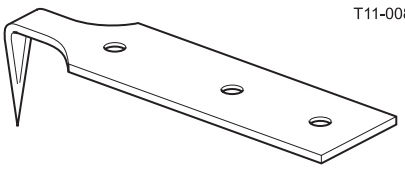

Fig 14. 992/12801 'L' Blades

25 mm (1 in.) cut. Replacement blades for cut-out knife. ⇨ *Fig 13. (1-5-7)*. Unit quantity = 5 off.

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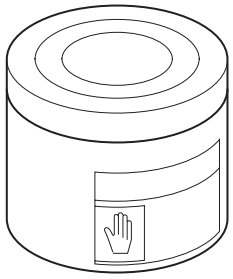

Fig 15. 4104/1310 Hand Cleaner

Special blend for the removal of polyurethane adhesives (454g; 1 lb tub).

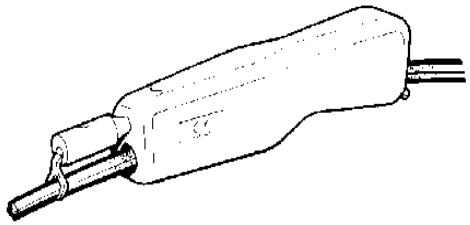

Fig 16. 992/01100

Glazing Tool, used to insert aperture seal expansion strip.

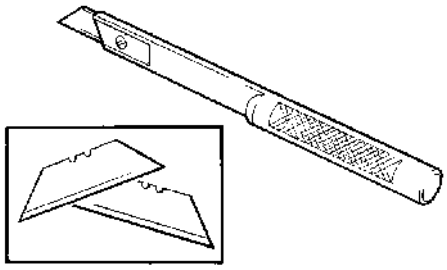

Fig 17. 892/00844 Long Knife

Used to give extended reach for normally inaccessible areas.

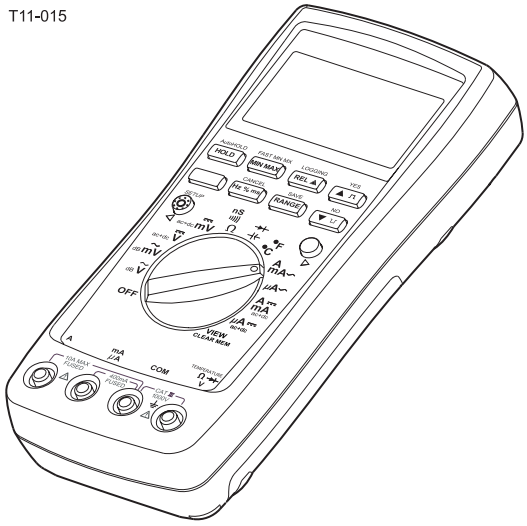

Fig 18. 892/00298 Fluke Meter

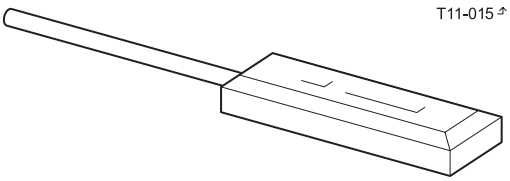

Fig 19. 892/00285 Hydraulic Temperature Probe

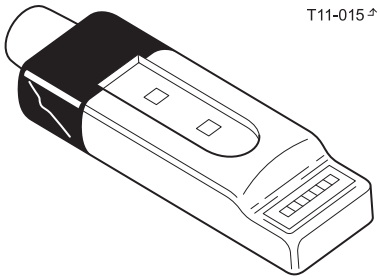

Fig 20. 892/00284 Venture Microtach Digital Tachometer

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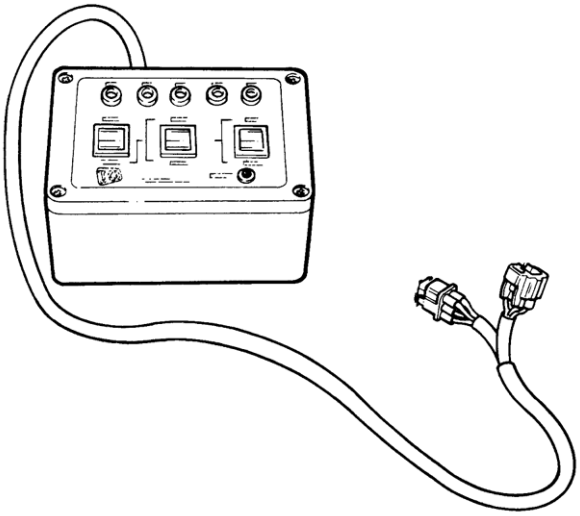

Fig 21. 892/00905 LMI Test Box

For testing load moment indicator system

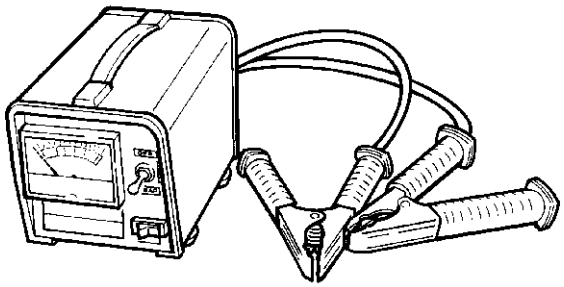

Fig 22. 993/85700 Battery Tester

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⇒ *Electrical Repair Kit (1-5-10)*		
1		Electrical Repair Kit
2A	7212/0002	2 Way Pin Housing
2B	7212/0004	2 Way Pin Retainer
2C	7212/0003	2 Way Socket Retainer
2D	7212/0001	2 Way Socket Connector
3A	7213/0002	3 Way Pin Housing
3B	7213/0004	3 Way Pin Retainer
3C	7213/0003	3 Way Socket Retainer
3D	7213/0001	3 Way Socket Connector
4A	7213/0006	3 Way Pin Housing (DT)
4B	7213/0008	3 Way Pin Retainer (DT)
4C	7213/0007	3 Way Socket Retainer (DT)
4D	7213/0005	3 Way Socket Connector (DT)
5A	7214/0002	4 Way Pin Housing
5B	7214/0004	4 Way Pin Retainer
5C	7214/0003	4 Way Socket Retainer
5D	7214/0001	4 Way Socket Connector
6A	7216/0002	6 Way Pin Housing
6B	7216/0004	6 Way Pin Retainer
6C	7216/0003	6 Way Socket Retainer
6D	7216/0001	6 Way Socket Connector
7A	7218/0002	8 Way Pin Housing
7B	7218/0004	8 Way Pin Retainer
7C	7218/0003	8 Way Socket Retainer
7D	7218/0001	8 Way Socket Connector
8A	7219/0002	10 Way Pin Housing
8B	7219/0004	10 Way Pin Retainer
8C	7219/0003	10 Way Socket Retainer
8D	7219/0001	10 Way Socket Connector
9A	7219/0006	14 Way Pin Housing
9B	7219/0008	14 Way Pin Retainer
9C	7219/0007	14 Way Socket Retainer
9D	7219/0005	14 Way Socket Connector
10	7210/0001	Dummy Plug
11	7210/0002	Wire Seal (1.4 - 2.2 mm dia.)
12	7210/0003	Wire Seal (2.2 - 2.9 mm dia.)

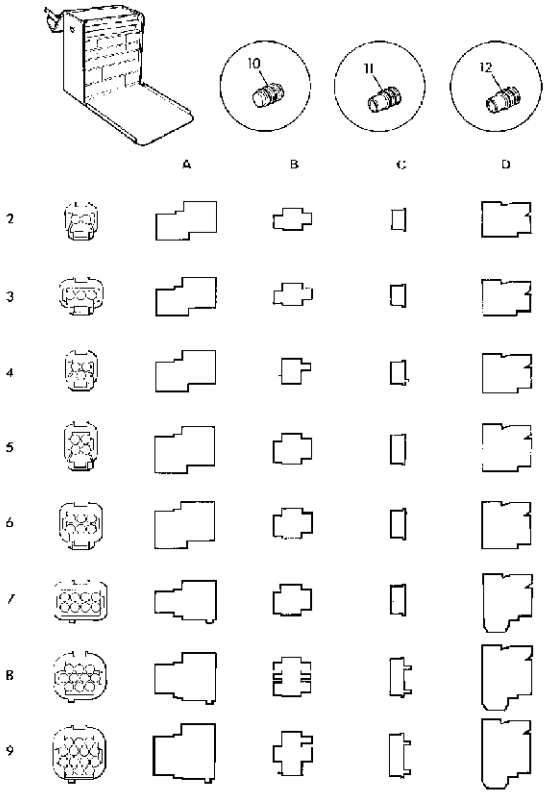

Fig 23. Electrical Repair Kit

Fig 24. 892/00350 Butane Heater Assembly

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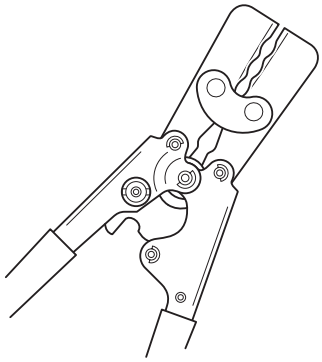

Fig 25. 892/00349 Crimp Tool

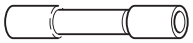

Fig 26. Splice

892/00351	Splice 0.5-1.5 mm (Red)
892/00352	Splice 1.5-2.5 mm (Blue)
892/00353	Splice 3.0-6.0 mm (Yellow)

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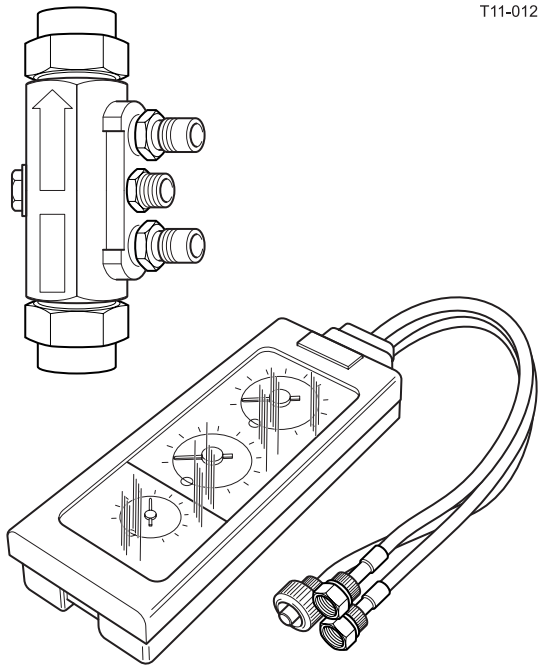
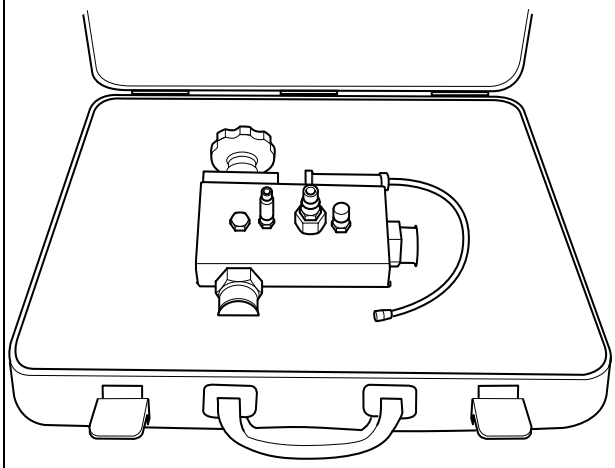
Note: *No longer available, refer to 998/11046 JCB ServiceMaster Flow Test Kit.* ⇨ *Fig 28. (1-5-12).*	892/00268	Flow Monitoring Unit
 **Fig 27. Flow Test Equipment**	892/00269	Sensor Head 0 - 100 l/min (0 - 22 UK gal/min)
	892/00273	Sensor Head 0 - 380 l/min (0 - 85.5 UK gal/min)
	892/00293	Connector Pipe
	892/00270	Load Valve
	1406/0021	Bonded Washer
	1604/0006A	Adapter 3/4 in M x 3/4 in M BSP
	1612/2054	Adapter 3/4 in F x 3/4 in M BSP
	892/00271	Adapter 3/4 in F x 5/8 in M BSP
	892/00272	Adapter 5/8 in F x 3/4 in M BSP
	816/20008	Adapter 3/4 in F x 1/2 in M BSP
	892/00275	Adapter 1/2 in F x 3/4 in M BSP
	892/00276	Adapter 3/4 in F x 3/8 in M BSP
	892/00277	Adapter 3/8 in F x 3/4 in M BSP
	1606/0015	Adapter 1.1/4 in M BSP x 1 in M BSP
	892/00078	Connector 1 in F x 1 in F BSP
	1604/0008	Adapter 1 in M x 1 in M BSP
	1606/0012	Adapter 1 in M x 3/4 in M BSP
	816/20013	Adapter 3/4 in F x 1 in M BSP

 **Fig 28. 998/11046 JCB ServiceMaster Flow Test Kit**	998/11047	600 LPM Flow Turbine with Loading Valve
	998/11048	1-7/8" UNF x1 - 1/4" BSP Flow Block Adaptors x2
	998/11049	Carrying Case for Flow Test Kit
	998/11050	Temperature Sensor (125°C Max)

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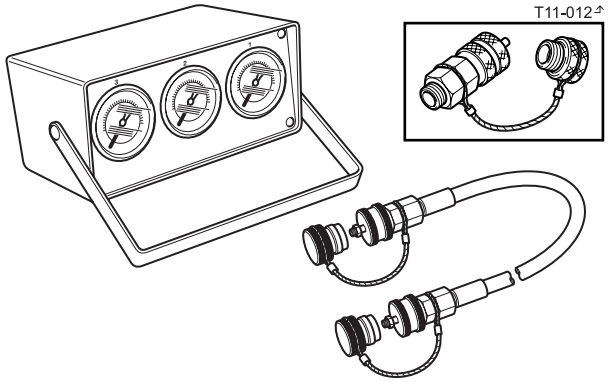
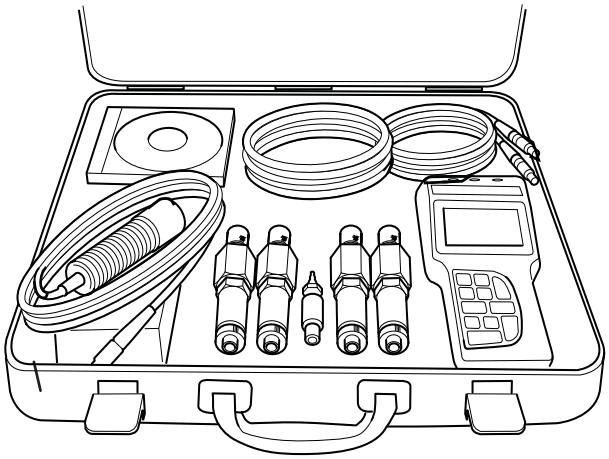
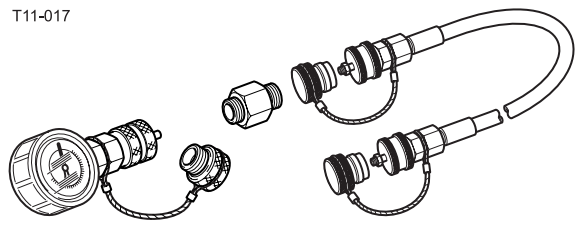
Note: *No longer available, refer to 998/11051 JCB ServiceMaster Digital Hydraulic Datalogger Pressure Test Kit.* ⇨ ***Fig 30. (1-5-13)***.	892/00201	Replacement Gauge 0-20 bar (0-300 lbf/in²)
 **Fig 29. 892/ 00253 Hydraulic Circuit Pressure Test Kit**	892/00202	Replacement Gauge 0-40 bar (0-600 lbf/in²)
	892/00203	Replacement Gauge 0-400 bar (0-6000 lbf/in²)
	892/00254	Replacement Hose
	993/69800	Seal Kit for 892/00254 (can also be used with probe 892/00706)
	892/00706	Test Probe
	892/00347	Connector - Hose to gauge

 **Fig 30. 998/11051 JCB ServiceMaster Digital Hydraulic Datalogger Pressure Test Kit**	998/11052	Hand Held 4-Channel ServiceMaster Unit
	998/11053	SensoWin Software Kit and PC Cable
	998/11054	Equiment Case SCC-750
	998/11055	0-600 Bar Pressure Transduce x2
	998/11056	0-100 Bar pressureTransducer x2
	998/11057	RPM Tachometer (includes fixed cable, 2 meters)
	998/11058	5 Meter Connecting Cable
	998/11059	M16 Metric Adaptors for Test Points x4
	998/11060	400mm Test Hose 90˚ HSP to M16 x2
	998/11061	400mm Test Hose Straight HSP to M16 x2

 **Fig 31. Hydraulic Circuit Test Gauges and Connections**	892/00280	Pressure Gauge 0-600 bar (0-9000 lbf/in²)
	892/00279	Pressure Gauge 0-400 bar (0-6000 lbf/in²)
	892/00346	Pressure Gauge 0-70 bar (0-1000 lbf/in²)
	892/00347	Connector
	892/00254	Hose

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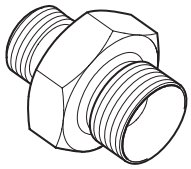

Fig 32. Male Adaptors

	Male Adapters - BSP x NPT (USA only)
816/00439	3/8 in. x 1/4 in.
816/00440	1/2 in. x 1/4 in.
816/15007A	3/8 in. x 3/8 in.
816/15008	1/2 in. x 3/8 in.

	Male Adapters - BSP x BSP
1606/2052	3/8 in. x 1/4 in.
1604/0003A	3/8 in. x 3/8 in.
892/00071	3/8 in. x 3/8 in. taper
1606/0004	1/2 in. x 1/4 in.
1606/0007A	1/2 in. x 3/8 in.
1604/0004A	1/2 in. x 1/2 in.
1606/0017	5/8 in. x 1/2 in.
1606/0008	3/4 in. x 3/8 in.
1606/0009	3/4 in. x 1/2 in.
1604/2055	3/4 in. x 3/4 in.
1606/0012	3/4 in. x 1 in.
1606/0014	3/4 in. x 1.1/4 in.
1606/0015	1 in. x 1.1/4 in.

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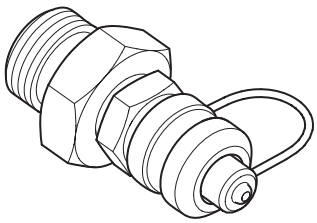

Fig 33. Pressure Test Adapters

892/00255	1/4 in. BSP x Test Point
892/00256	3/8 in. BSP x Test Point
892/00257	1/2 in. BSP x Test Point
892/00258	5/8 in. BSP x Test Point
816/15118	3/4 in. BSP x Test Point
892/00259	1 in BSP x Test Point
892/00260	1.1/4 in. BSP x Test Point
892/00261	5/8 in. UNF x Test Point

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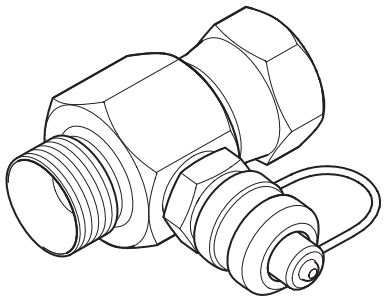

Fig 34. Pressure Test 'T' Adapters

816/55045	1/4 in. M BSP x 1/4 in. F BSP x Test Point
816/55038	3/8 in. M BSP x 3/8 in. F BSP x Test Point
816/55040	1/2 in. M BSP x 1/2 in. F BSP x Test Point
892/00263	5/8 in. M BSP x 5/8 in. F BSP x Test Point
892/00264	3/4 in. M BSP x 3/4 in. F BSP x Test Point
892/00265	1 in. M BSP x 1 in. F BSP x Test Point
892/00266	1.1/4 in. M BSP x 1.1/4 in. F BSP x Test Point
892/00267	1.1/4 in. M BSP x 1.1/2 in. F BSP x Test Point

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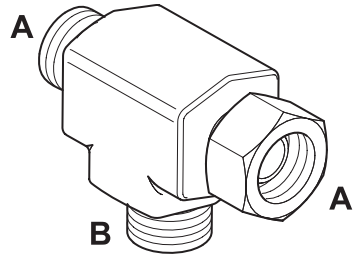

Fig 35. 'T' Adapters

892/00047	3/8 in. BSP (**A**) x 1/4 in. BSP (**B**)
892/00048	1/2 in. BSP (**A**) x 1/4 in. BSP (**B**)
892/00049	5/8 in. BSP (**A**) x 1/4 in. BSP (**B**)
816/50043	3/4 in. BSP (**A**) x 1/4 in. BSP (**B**)
892/00051	1 in. BSP (**A**) x 1/4 in. BSP (**B**)
816/50005	1/2 in. BSP (**A**) x 1/2 in. BSP (**B**)
816/60096	3/4 in. BSP (**A**) x 3/4 in. BSP (**B**)
816/00017	1 in. BSP (**A**) x 1 in. BSP (**B**)

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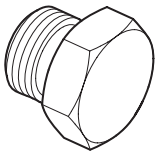

Fig 36. Female Blanking Caps

892/00055A	1/4 in. BSP
892/00056A	3/8 in. BSP
892/00057	1/2 in. BSP
892/00058A	5/8 in. BSP
892/00059A	3/4 in. BSP
892/00060	1 in. BSP

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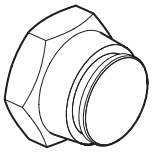

Fig 37. Male Cone Blanking Caps

816/90045	1/4 in. BSP
816/00189A	3/8 in. BSP
816/00190A	1/2 in. BSP
816/90022	5/8 in. BSP
816/90274	3/4 in. BSP
816/90205	1 in. BSP

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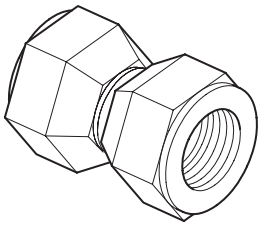

Fig 38. Female Connectors

892/00074	3/8 in. BSP x 3/8 in. BSP
892/00075	1/2 in. BSP x 1/2 in. BSP
892/00076	5/8 in. BSP x 5/8 in. BSP
892/00077	3/4 in. BSP x 3/4 in. BSP

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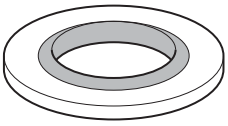

Fig 39. Bonded Washers

1406/0011	1/4 in. BSP
1406/0018	1/2 in. BSP
1406/0014	5/8 in. BSP
1406/0021	3/4 in. BSP
1406/0029	1.1/4 in. BSP

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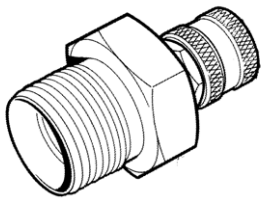

Fig 40. 892/00964 Test Point 1/8 BSP

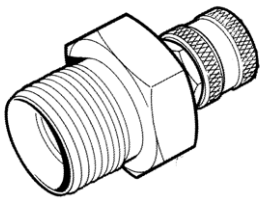

Fig 41. 892/00965 Test Point 3/8 BSP

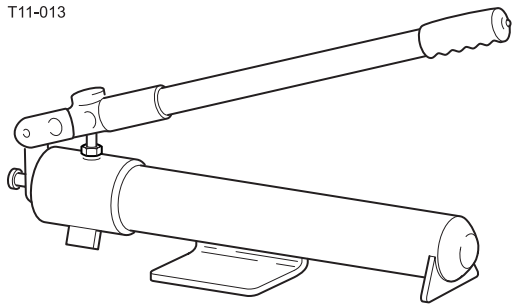

Fig 42. Hand Pump Equipment

892/00223	Hand Pump
892/00137	Micro-bore Hose 1/4 in BSP x 3 metres
892/00274	Adapter 1/4 in M BSP x 3/8 in M BSP Taper
892/00262	1/4 in M BSP x 1/4 in F BSP x Test Point
892/00706	Test Probe
892/00278	Gauge 0 - 40 bar (0 - 600 lbf/in^2)
892/00279	Gauge 0 - 400 bar (0 - 6000 lbf/in^2)

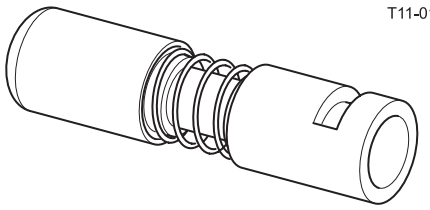

Fig 43. 892/00881 Valve Spool Seal Fitting Tool

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Fig 44. 892/00229 Flow Meter

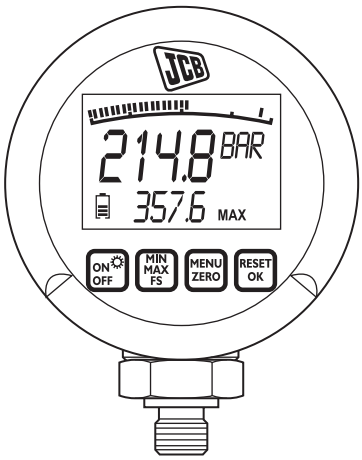

Fig 45. 892/01268 Digital Pressure Gauge 0-400 bar

892/01271 Hose for pressure gauge

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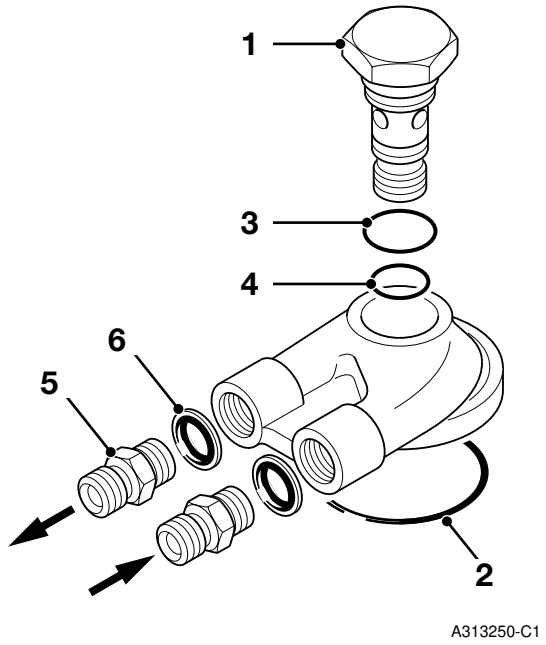

Fig 46. 460/15708 Flow Test Adaptor

Note: *Components listed below also required:*

Item	Description
1	460/15707 Banjo bolt
2	2401/0222 O-ring
3	2403/0110 O-ring
4	2403/0108 O-ring
5	1604/0004 Adaptor - 2 off
6	1406/0018 Sealing washer - 2 off

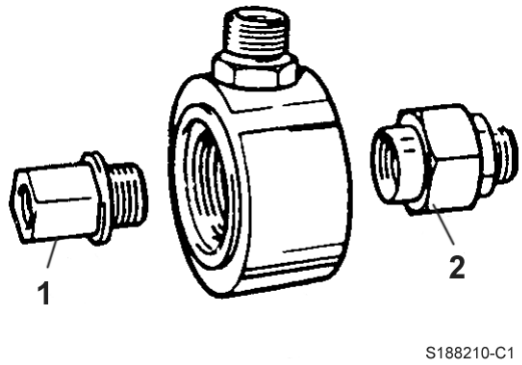

Fig 47. 892/00301 Flow Test Adaptor

Note: *Components listed as follows also required:*

Item	Description
1	892/00920 Adaptor
2	892/00302 Adaptor

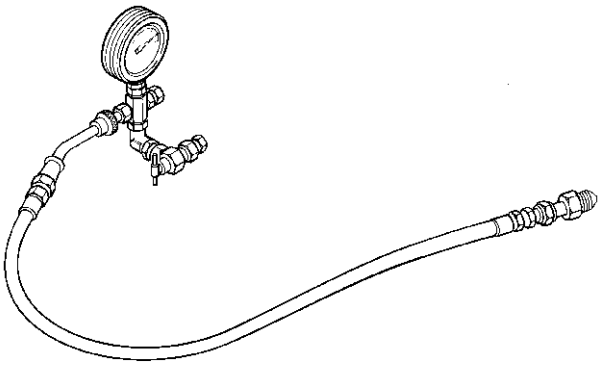

Fig 48. Nitrogen Charging Kit

892/00948 Charging Kit (without gauge)

892/00949 Gauge

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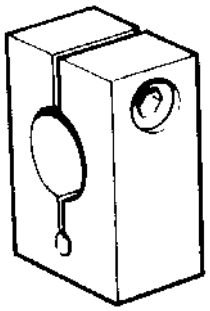

Fig 49. Spool Clamps

992/09100	Spool Clamp
892/00011	Spool Clamp

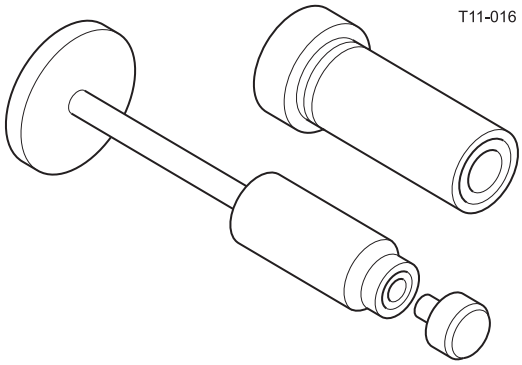

Fig 50. 892/00180 - Seal Fitting Tool

Seal Fitting Tool for fitting 'O' ring and back-up ring to Danfoss Orbitrol Unit.

892/00181 - Replacement Plastic Boss

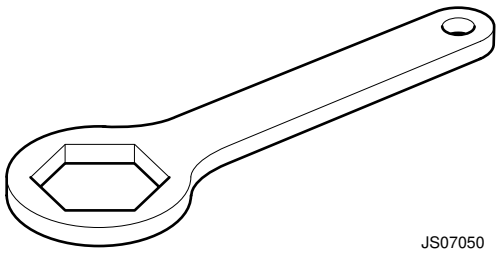

Fig 51. Ram Piston Nut Removal/Fitting Spanner

993/99512	Spanner 55 mm A/F
993/99513	Spanner 60 mm A/F
993/99514	Spanner 65 mm A/F
993/99515	Spanner 70 mm A/F
993/99516	Spanner 75 mm A/F
993/99517	Spanner 85 mm A/F
993/99518	Spanner 90 mm A/F
993/99519	Spanner 100 mm A/F
993/99520	Spanner 110 mm A/F
993/99521	Spanner 115 mm A/F
SSP0046	Spanner 80 mm A/F
SSP0047	Spanner 95 mm A/F

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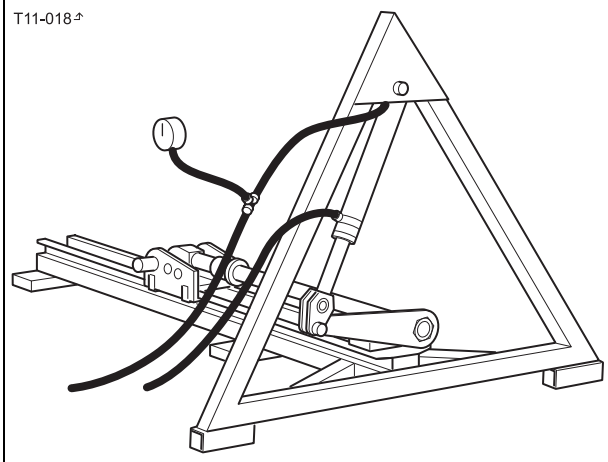

Fig 52. Ram Piston Nut Removal/Fitting Rig

993/99525	Rig Assembly (not including spanners and ram)
993/99522	Anchor Side Plate (supplied loose unwelded)
993/99523	Anchor Cross Member (supplied loose unwelded)
993/99524	Ram Eye End Modification Plate Assembly
556/43400	Lift Ram
545/18000	Lynch Pin
811/50232	1.1/4in Pivot Pin

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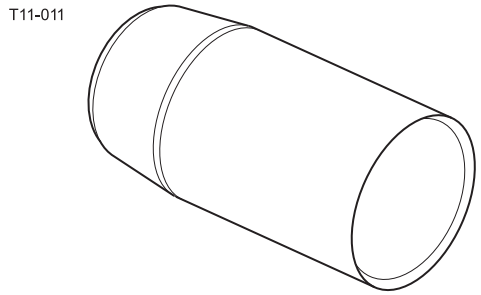

Fig 53. Ram Protection Sleeves

892/01016	For 25 mm Rod Diameter
892/01017	For 30 mm Rod Diameter
892/01018	For 40 mm Rod Diameter
892/01019	For 50 mm Rod Diameter
892/01020	For 50 mm Rod Diameter (slew ram)
892/01021	For 60 mm Rod Diameter
892/01022	For 60 mm Rod Diameter (slew ram)
892/01023	For 65 mm Rod Diameter
892/01024	For 70 mm Rod Diameter
892/01025	For 75 mm Rod Diameter
892/01026	For 80 mm Rod Diameter
892/00167	For 90 mm Rod Diameter

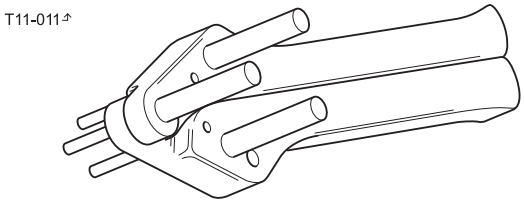

Fig 54. 892/00334 Ram Seal Fitting Tool

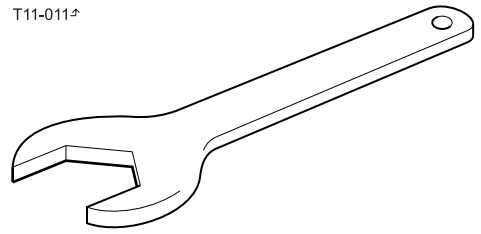

Fig 55. Hexagon Spanners for Ram Pistons and End Caps

992/09300	55mm A/F
992/09400	65mm A/F
992/09500	75mm A/F
992/09600	85mm A/F
992/09700	95mm A/F
992/09900	115mm A/F
992/10000	125mm A/F

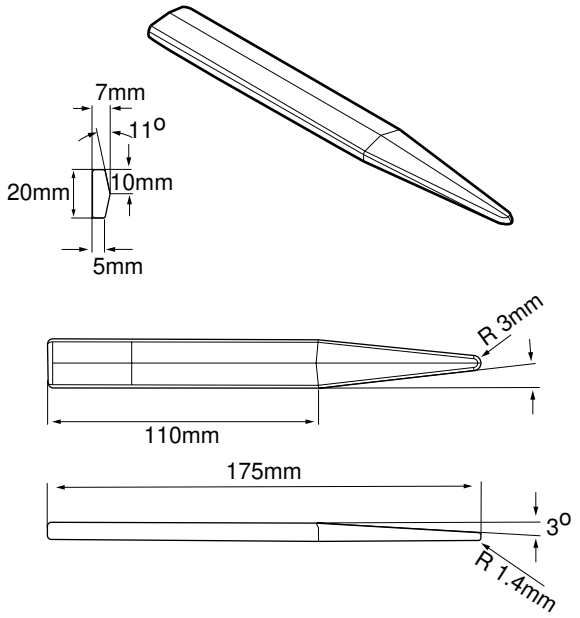

Fig 56. 892/01027 Piston Seal Assembly Tool

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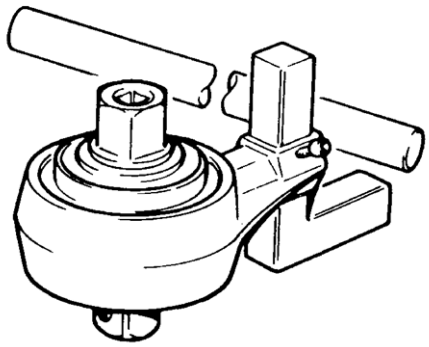

Fig 57. 992/04000 Torque Multiplier

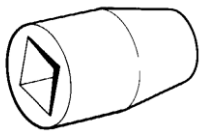

Fig 58. 892/00822 Splined Bolt Socket

Fig 59. 892/00812 Drive Coupling Spanner

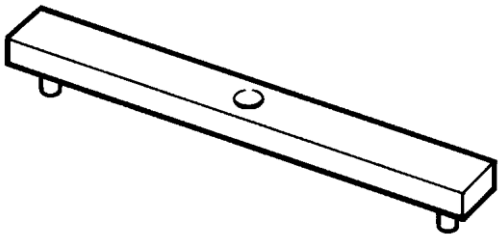

Fig 60. 892/00893 Torque Converter Alignment Tool

For use with 11” torque converters

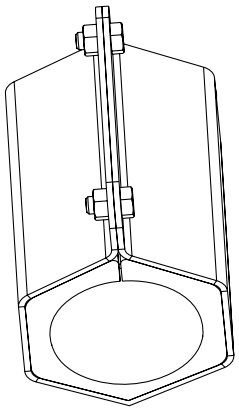

Fig 61. 332/E7911 Exhaust Fitting Clamp

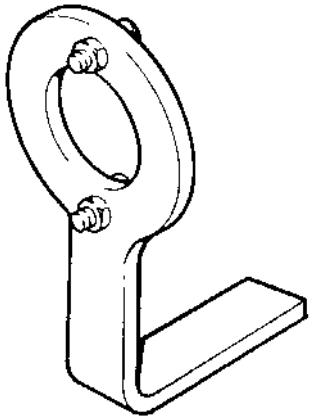

Fig 62. 992/04800 Flange Spanner

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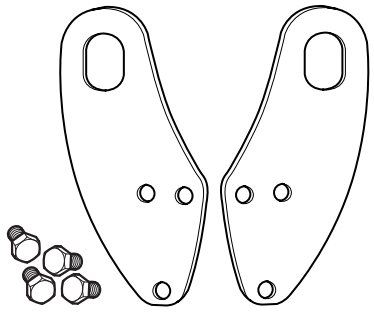

Fig 63. 320/20050 Lifting Bracket Kit

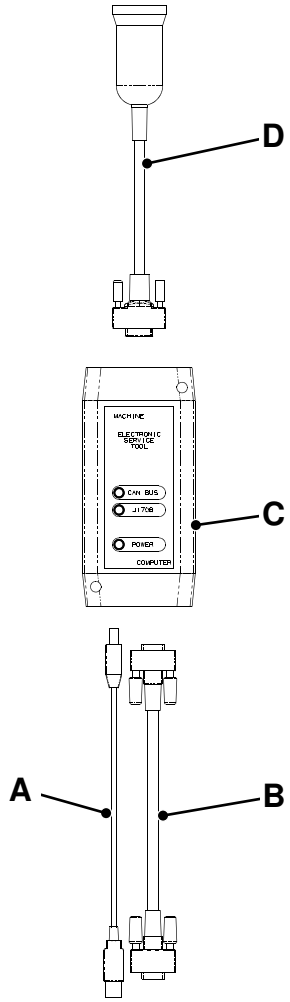

Fig 64. 892/01174 Data Link Adaptor Kit

A	USB PC Cable	718/20235
B	Serial PC Cable	718/20236
C	USB DLA	728/26500
D	Machine Cable	718/20237
Kit 892/01174 (includes items A,B,C and D)		

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Rivet Nuts

TB-001_2

A 'Rivet Nut' is a one piece fastener installed 'blind' from one side of the machine body/framework. The rivet nut **65-A** is compressed so that a section of its shank forms an 'upset' against the machine body/framework, leaving a durable thread **65-B**.

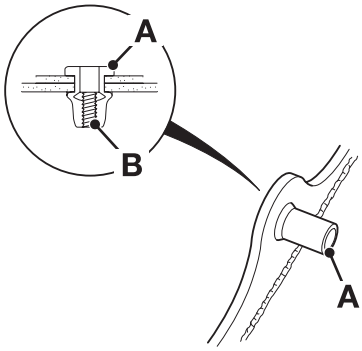

Fig 65.

Rivet nuts are fitted to various parts of the machine body and framework. They are used in a number of applications, for instance, hose clamp and hydraulic valve retention etc.

Various sized rivet nuts are available. ⇨ ***Table 1. Specifications (1-5-23)*** to determine the size of rivet nut to be used for particular applications.

If for any reason a new rivet nut requires fitting, then the correct installation procedure must be followed. ⇨ ***Fitting Procedure (1-5-24)***.

Note: *In an emergency, and if no installation tool is available, it is possible to fit a rivet nut by using a nut and bolt the same thread diameter as the rivet nut being installed. However, this is not the recommended method.*

Table 1. Specifications

Rivet Nut Thread Diameter	Rivet Nut Outside Diameter	Material Thickness	Rivet Length (Total)	Drill Hole Dia.
M5	7	0.25 - 3.00	14.00	7.10
		3.00 - 5.50	17.00	
M6	9	0.50 - 3.00	16.00	9.10
		3.00 - 5.50	19.00	
M8	11	0.50 - 3.00	18.00	11.10
		3.00 - 5.50	21.00	
M10	13	1.00 - 3.50	23.00	13.10
		3.50 - 6.00	26.00	

Note: *All dimensions in mm*

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Fitting Procedure

1 Drill a hole in the machine body/framework where the rivet nut is to be fitted. De-burr hole edges.

2 Screw the rivet nut onto the mandrel of the installation tool. The bottom of the mandrel should be in line with the bottom of the rivet nut **66-A**.

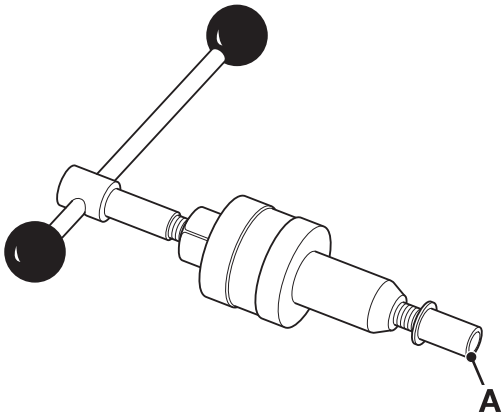

Fig 66.

3 Wind the body of the installation tool down the threaded mandrel until it touches the head of the rivet nut **67-B**.

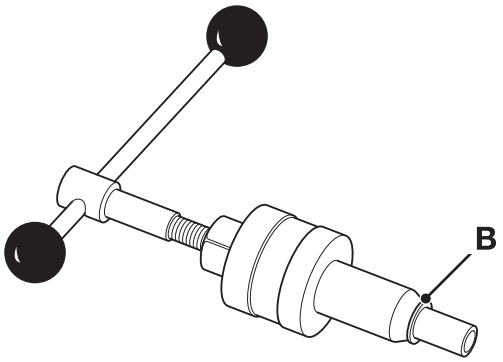

Fig 67.

4 Insert the rivet nut (assembled to the tool) into the hole drilled in step 1.

5 Hold handle **68-C** and at the same time draw the mandrel into the installation tool by turning nut **68-D**. The rivet nut will contract in length and form an 'upset' (smooth bulge) seating itself against the body/framework **68-E**.

Note: *The thread of the rivet nut must not be stripped, take care when 'upsetting' the rivet nut.*

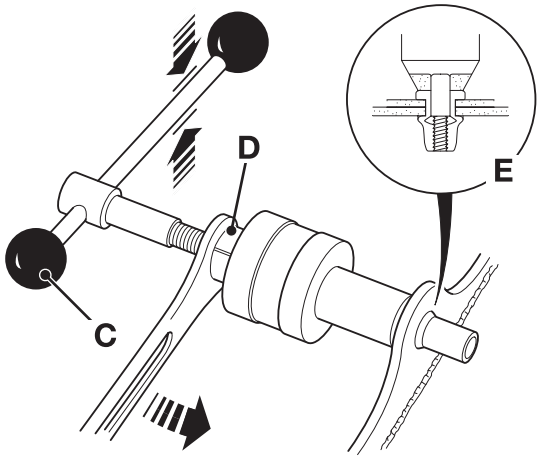

Fig 68.

6 Remove the installation tool.

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Slide Hammer Kit

TB-003

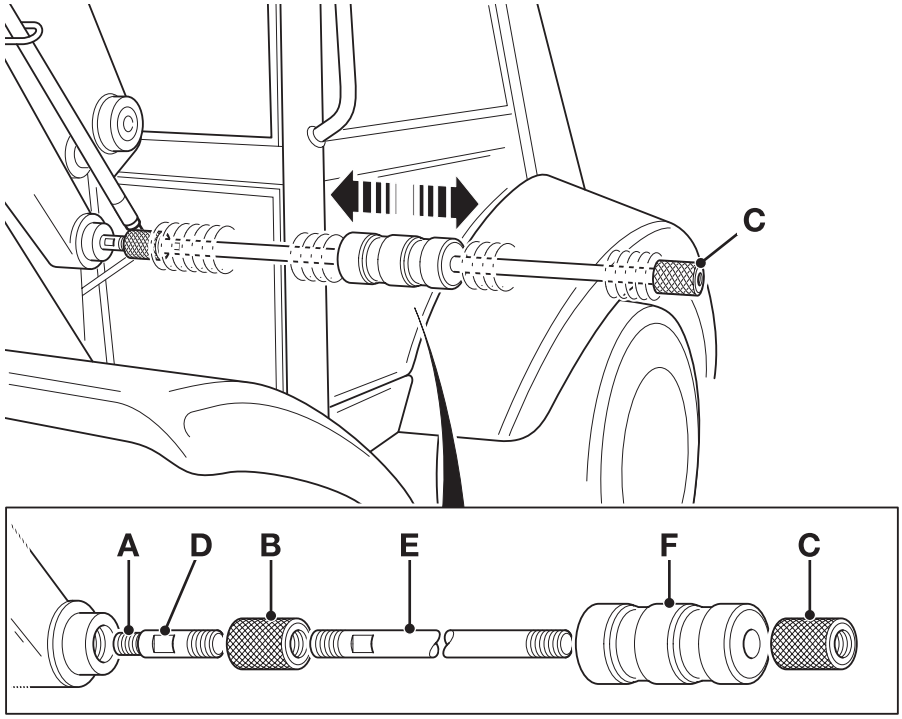

Fig 69. Typical M/c. Installation

The slide hammer kit is used to remove pivot pins that must be extracted, i.e. cannot be 'knocked through'. The purpose of this description is to explain how the kit and the various components are used to remove the pivot pins.

The adaptors **69-A** that form part of the kit have a screwed thread at each end. One of the threads will always be M20 size, this is to accommodate the end stops, items **69-B** and **69-C**. The other end of the adaptor will have varying thread sizes to suit the different size of threads in the pivot pins.

Fitting Procedure

1 Prepare the pivot pin, for instance, if fitted, remove the pivot pin retaining bolt.

2 Determine the thread size of the pivot pin and then fit the appropriate adaptor **69-A** as shown. Use the spanner flats **69-D** to securely fit the adaptor.

3 Fit an end stop **69-B** onto the other end of the adaptor (M20 thread size), make sure that the adaptor threads are fully engaged.

4 Fit the 'slide bar' **69-E** into the end stop. Again make sure that the threads are fully engaged.

5 Fit the 'slide hammer', item **69-F**, onto the slide bar as shown.

6 Finally, fit another end stop, item **69-C**, at the end of the slide bar, as shown. The slide hammer kit is now ready to use.

7 To extract the pivot pin, slide the hammer along the bar until it contacts end stop **69-C**. Repeat this step until the pivot pin is released.

8 To remove the slide hammer kit, reverse steps 2 to 7.

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Service Consumables

Introduction

Consumables such as sealing and retaining compounds are necessary to complete some procedures. Before you start work make sure that the consumables show in the tables are available.

⇨ *Sealing and Retaining Compounds (1-6-2)*

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Sealing and Retaining Compounds

T11-001_4

Table 1.

Type	Description	Part No.	Quantity
JCB Multi-Gasket	A medium strength sealant suitable for all sizes of gasket flanges, and for hydraulic fittings of 25-65 mm diameter.	4102/1212	50 ml
JCB High Strength Threadlocker	A high strength locking fluid for use with threaded components. Gasketing for all sizes of flange where the strength of the joint is important.	4102/0551	50 ml
JCB Retainer (High Strength)	For all retaining parts which are unlikely to be dismantled.	4101/0601	10 ml
		4101/0651	50 ml
JCB Threadlocker and Sealer	A medium strength locking fluid for sealing and retaining nuts, bolts, and screws up to 50 mm diameter, and for hydraulic fittings up to 25 mm diameter.	4101/0250	10 ml
		4101/0251	50 ml
JCB Threadlocker and Sealer (High Strength)	A high strength locking fluid for sealing and retaining nuts, bolts, and screws up to 50 mm diameter, and for hydraulic fittings up to 25 mm diameter.	4101/0550	10 ml
		4101/0552	200 ml
JCB Threadseal	A medium strength thread sealing compound.	4102/1951	50 ml
JCB Activator	A cleaning primer which speeds the curing rate of anaerobic products.	4104/0251	200 ml (Aerosol)
		4104/0253	1 ltr (Bottle)
JCB Cleaner/Degreaser	For degreasing components prior to use of anaerobic adhesives and sealants.	4104/1557	400 ml (Aerosol)
Direct Glazing Kit	For one pane of glass; comprises of: – 1 x Ultra Fast Adhesive (310 ml) – 1 x Active Wipe 205 (30 ml) – 1 x Black Primer 206J (30 ml) – plus applicator nozzle etc.	993/55700	
Ultra Fast Adhesive	For direct glazing.	4103/2109	310 ml
Active Wipe 205	For direct glazing.	4104/1203	250 ml
Black Primer 206J	For direct glazing.	4201/4906	30 ml
Clear Silicone Sealant	To seal butt jointed glass.	4102/0901	
Plastic to Metal Bonder	To seal plastic to metal joints.	4103/0956	50 g
Black Polyurethane Sealant	To finish exposed edges of laminated glass.	4102/2309	310 ml

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Fuel

Introduction

This topic contains information fuel types and use with JCB Dieselmax engines.

When investigating engine related faults find out what types and sources of fuel are used by the operator.

⇨ *Related Topics (1-7-2)*
⇨ *Acceptable and Unacceptable Fuels (1-7-3)*
⇨ *Additives (1-7-4)*
⇨ *Service Requirements for use of B20 Biodiesel (1-7-4)*
⇨ *Fuel Types (1-7-5)*
⇨ *Usage and Effects of Fuels (1-7-6)*
⇨ *Sulphur Content (1-7-7)*
⇨ *Effects of Fuel Contaminates (1-7-8)*

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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	⇨ ***Machine Identification (1-3-1)***	
2	ALL (Care and Safety)(1)	ALL
3	***Service Schedules***	ALL

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

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Acceptable and Unacceptable Fuels

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

⚠ CAUTION

Consult your fuel supplier or JCB distributor about the suitability of any fuel you are unsure of.

GEN-9-2

Fuel Specification	Applicable Engines	Service Requirements
EN590 Diesel fuel types - Auto/C0/C1/C2/C3/C4	SE, SD, SF Engines.	Obey the usual routine maintenance schedules and procedures
BS2869 Class A2		
ASTM D975-91 Class 2, US DF1, US DF2, US DFA		
JIS K2204 (1992) Grades 1, 2, 3 and Special Grade 3		
ASTM D975-91 Class 1DA	SE, SD, SF Engines. **Engines operated with these fuels may have a reduced service life**	Obey the usual routine maintenance schedules and procedures. **Fuel additives are recommended for use with low sulphur fuels** ⇨ *Additives (1-7-4)*
MIL T38219 XF63		
NATO F63		
French EN590 (RME5) with 5% maximum		
AVTURFSII, NATO F34, JP8, MIL T83133, DERD 2463, DEF STAN 91-87	SE, SD, SF Engines. **Engines operated with these fuels will have a reduced service life**	Obey the usual routine maintenance schedules and procedures. **Fuel additives MUST be used** ⇨ *Additives (1-7-4)*
AVCAT FSII, NATO F44, JP5, MIL T5624, DERD 2452, AVTOR		
NATO F35, JET A1, DEF STAN 91-91, DERD 2494, JP7		
AVCAT, NATO F43 (obsolete), JP5 without additives		
JET A (ASTM D1655)		
ASTM D3699 Kerosene		
B20 Biodiesel - RME content blended with mineral derived diesel (20% maximum) - ASTM D6751, DIN 51606, ISO 14214	SE, SD, SF Engines. **Engines manufactured from 2007 on ONLY**(1)	**YOU MUST obey special routine maintenance schedules and procedures**. ⇨ *Service Requirements for use of B20 Biodiesel (1-7-4)*
AVTAG (obsolete)	**These fuels are NOT ACCEPTABLE with or without additives. Engines MUST NOT be operated with these fuels**	
AVTAG FSII (obsolete), NATO F40, JP4, DERD 2454		
JET B (ASTM D1655)		
BS MA100		
JIS K2203 No.2		
Unmodified vegetable oils		

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

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Additives

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

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

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

Service Requirements for use of B20 Biodiesel

- The engine oil must be a grade CH4 as minimum specification.
- Do not leave unused B20 biodiesel in the fuel tank for extended periods (top up each day).
- Make sure that 1 in 5 fuel tank fills use standard diesel to EN590 specification, this will help to prevent 'gumming'.
- Make sure regular oil sampling is completed (look for excessive unburnt fuel content, water or wear particles.
- Change the engine oil and filter more frequently (as a minimum half the recommended intervals), or as indicated by oil sampling.
- Change the fuel filters more frequently (as a minimum half the recommended intervals), or if there are engine performance related issues.
- Make sure the fuel is stored correctly, care must be taken to make sure no water enters the machine fuel tank (or the storage tank). Water will encourage micro-bacterial growth.
- Make sure that the fuel pre-filter is drained daily (not every week as currently advised).
- Only JCB engines built after Jan. 2007 are applicable (i.e. engines with 07 on the end of their serial number and factory filled with CH4 oil) - this is not approved with other manufacturers.
- Use heater kits in low ambient temperature territories.
- The biodiesel must meet the following standards: ASTM D6751, DIN 51606, ISO 14214

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

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

Warranty

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

Using a B20 blend of biodiesel requires caution and additional servicing of the engine is required. ⇨ ***Service Requirements for use of B20 Biodiesel (1-7-4)***.

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

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

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Fuel Types

Note: *The information that follows does not indicate types of fuel that are acceptable or unacceptable.* ⇨ ***Acceptable and Unacceptable Fuels (1-7-3)***.

Any fuel purchased for operation of the JCB Dieselmax engine must be purchased from reputable oil producers/ outlets and stored in accordance with the manufacturers recommendations. ⇨ ***Effects of Fuel Contaminates (1-7-8)***

1 Diesel - mineral derived, hydrocarbon fuels to European standard EN590 or equivalent.

2 Low Sulphur Diesel - mineral derived, hydrocarbon fuels to EN590 or equivalent. This fuel has totally replaced automotive (road use) diesel in the European Union since October 1996 and has sulphur limited to a maximum of 0.05% by weight.

3 Ultra Low Sulphur Diesel - Reformulated mineral derived, hydrocarbon fuels to EN590 or equivalent. Now widely available in the UK, mainland Europe and some parts of the USA. Sulphur limited to a maximum of 0.005% by weight or lower. ⇨ ***Sulphur Content (1-7-7)***

4 Vegetable Oil -unmodified. Certain pure vegetable oils (sunflower oil, rapeseed oil etc.)

5 Biodiesel - chemically modified vegetable oil. By chemically modifying vegetable oils, methyl esters of that oil are produced. These are collectively known as "Fatty Acid Methyl Esters" (FAME) or "Vegetable Oil Methyl Esters" (VOME).

Note: *Refer also to additional information.* ⇨ ***Usage and Effects of Fuels (1-7-6)***.

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Usage and Effects of Fuels

Note: *The information that follows does not indicate types of fuel that are acceptable or unacceptable.* ***⇒ Acceptable and Unacceptable Fuels (1-7-3)***.

1 Low Sulphur Diesel

In its basic form because of the process of reducing sulphur by removal of sulphur containing compounds (which contribute to mechanical lubrication) an increase in the wear rate of the fuel injection equipment could occur. In view of this, the major fuel producers add suitable lubricity improvers to enable the FIE to run satisfactorily, with no acceleration in wear rate. They must ensure that the lubricity improvers do not themselves create residual deposits that could block the fuel system e.g. filter, injectors etc.

In addition to the lubrication effect there can also be a further reduction in the aromatic content of the fuel which can lead to shrinking/cracking of traditionally nitrile rubber seals throughout the fuel injection equipment that has previously been exposed to higher sulphur level fuels. The major fuel producers tend to maintain the total aromatic content to an acceptable level (15% by volume).

2 Ultra Low Sulphur Diesel

Also known as `city diesel'. Available throughout the UK and some parts of Europe since March 1999. This fuel has a maximum sulphur content of 0.005% by weight and a further reduction in the natural lubricity and aromatic content than experienced with low sulphur diesel. Major oil producers will add lubrication improvers and also maintain the total aromatic content to an acceptable level.

3 Unmodified Vegetable Oils

Burned in diesel engines neat or used as an extender to mineral derived fuel. When these are subjected to heat in the fuel injection system they form sticky deposits that can be found inside the fuel pump and a hard lacquer in the injectors where exposure to even higher temperatures takes place.

4 Chemically Modified Vegetable Oils (FAME/VOME)

These fuels have been derived from a wide range of vegetable oils and animal fats, resulting in better stability, viscosity and cetane number than those produced from unmodified vegetable oils, but it is recognised that there are potential problems associated with the finished fuel characteristics. These oils are less stable than mineral oil derived fuels when stored and they will readily degrade producing fatty acids, methanol and water, none of which are desirable in the FIE. These effects are known to be accelerated when the fuel is stored in the presence of air and water together.

An extract `common statement' from the FIE manufactures specifies that "The fuel injection equipment manufacturers can accept no liability whatsoever for failure attributable to operating their products with fuels for which the products were not designed, and no warranties or representations are made as to the possible effects of running these products with such fuels".

The three most common Fame types are RME - Rapeseed methyl ester (preferred crop in Europe), SME - Soyabean methyl ester (preferred crop in USA). Less common FAME's can be derived from animal fats (e.g. modified beef extracts) and reclaimed cooking oils.

5 B20 Biodiesel

Biodiesel refers to pure fuel (FAME/VOL) before it is blended with diesel fuel ***⇒ Chemically Modified Vegetable Oils (FAME/VOME) (1-7-6)***. When biodiesel is blended with diesel fuel it is referred to as B5, B20 etc., where the number indicates the percentage of biodiesel in the fuel, for example B5 contains 5% biodiesel.

Biodiesel has different characteristics than mineral based fuels in that it is able to mix with water and therefore will have a high water retention capacity - this could lead to seals swelling, fuel system corrosion and seal damage.

Biodiesels will `cloud' at higher temperatures than mineral based fuels. To explain Cloud Point - the lowest temperature at which fluid can flow and performs its functions is referred to as Pour Point. Just prior to reaching its Pour Point the diesel fluid becomes `cloudy' due to crystallization of waxy constituents - this is know as Cloud Point. Using diesel at temperature below its cloud point can result

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in filter clogging. To prevent this happening pre-heating will be required.

Using B20 biodiesel can result in unburnt fuels accumulating in the engine oil, ultimately this can affect the engine oil efficiency and lead to engine damage (with standard diesel any unburnt fuel evaporates off the lubricating oil). Biodiesels must be stored to exclude water absorption and oxidation.

The natural properties of biodiesel make it a good medium for micro bacterial growth, these microbes can cause fuel system corrosion and early fuel filter blocking. It will be necessary to consult and seek advice from your fuel supplier, the effectiveness of conventional antibacterial additives when used in biodiesel is still being investigated in the fuel industry. A high percentage biodiesel mixture (>20%) can lead to fuel gelling and filter blocking in low temperature operation, it may also effect the power and performance of the engine.

To minimise the risk of engine damage when using a B20 mix, there are additional service requirements. ⇨ *Service Requirements for use of B20 Biodiesel (1-7-4)*

If the recommended actions are not taken there may be the following consequences:- low temperature filter clogging- injectors lacquering / sticking- deterioration of seals and rubber hoses- corrosion of metal parts in the fuel system- engine performance problems. These risks will be increased if the fuel has been poorly stored, that is deteriorated through oxidation and / or water absorption.

Sulphur Content

High sulphur content can cause engine wear. (High sulphur fuel is not normally found in North America, Europe or Australia.) If you have to use high sulphur fuel you must change the engine oil more frequently. ⇨ *Table 2. Sulphur Content (1-7-7)*.

Low sulphur fuels must have the appropriate fuel lubricity additives, these lubricity improvers must not create residual deposits that block the fuel system, e.g. injectors, filters etc. Contact your fuel Supplier.

⚠ CAUTION

A combination of water and sulphur will have a corrosive chemical effect on fuel injection equipment. It is essential that water is eradicated from the fuel system when high sulphur fuels are used.

ENG-3-2

Table 2. Sulphur Content

Percentage of sulphur in the fuel (%)	Oil Change Interval
Less than 0.5	Normal
0.5 to 1.0	0.75 of normal
More than 1.0	0.50 of normal

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Effects of Fuel Contaminates

The effect of dirt, water and other contaminants in diesel can be disastrous for injection equipment:

- Dirt - A severely damaging contaminant. Finely machined and mated surfaces such as delivery valves and distributor rotors are susceptible to the abrasive nature of dirt particles - increased wear will almost inevitably lead to greater leakage, uneven running and poor fuel delivery.
- Water - water can enter fuel through poor storage or careless handling, and will almost inevitably condense in fuel tanks. The smallest amounts of water can result in effects that are just as disastrous to the fuel injection pump as dirt, causing rapid wear, corrosion and in severe cases, even seizure. It is vitally important that water is prevented from reaching the fuel injection equipment. The filter/water trap must be drained regularly.
- Wax - Wax is precipitated from diesel when the ambient temperature falls below that of the fuel's cloud point, causing a restriction in fuel flow resulting in rough engine running. Special winter fuels may be available for engine operation at temperatures below 0°C (32°F). These fuels have a lower viscosity and limit wax formation.

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Stall Speed Combinations

Introduction

If the operator reports poor machine performance the stall speed test is a very useful way to quickly and easily determining if the engine, transmission or hydraulic system is faulty. Do the stall speed tests to help diagnose which system is at fault.

Refer to the applicable section (Hydraulics, Transmission or Engine) for details of the test procedures.

⇒ *Related Topics (1-8-2)*
⇒ *Specifications (1-8-3)*

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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	⇨ ***Machine Identification (1-3-1)***	
2	ALL (Care and Safety)(1)	ALL
3	***Service Schedules***	ALL

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

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Specifications

Tests carried out at the factory record the correct engine r.p.m. (stall speed) when under maximum load from the transmission and hydraulic systems.

The figures relate to tests conducted at an ambient of 25 ^{0}C and barometric pressure of 100 kPa (sea level). Note that changes in ambient temperature, pressure and humidity and fuel grade will affect engine power and hence the stall figures.

As an example, at 10,000 ft the power reduction of a naturally aspirated engine could be 29% and for a turbo engine 8%.

Note: *The figures apply to `bedded-in' engines, i.e. engines that have done a minimum of 250 working hours, therefore they should not be used for pre-delivery inspection (PDI) checks.*

All figures are recorded with the transmission oil at 60°C (140 °F) and the hydraulic oil at 55 °C (131 °F). Figures achieved should be within +/- 100 rpm from the figures given in the table.

Table 2.

	Engine Build Code			
	SD	SE	SF	SF
Engine Stall Speeds r.p.m.				
Torque Converter Only	1820	2000	2000	2000
Hydraulics (M.R.V.) Only	2370	2350	2340	2340
Combined Converter + M.R.V. (1)	1300(2)	1725	1760(2)	1760(2)
Build Specification				
Engine size:				
85 h.p. (63 kW) Turbocharged	●			
100 h.p (74 kW) Turbocharged and Intercooled			●	
114 h.p. (85 kW) Turbocharged and Intercooled				●
130 h.p. (97 kW) Turbocharged and Intercooled		●		

(1) Combined stall tests are performed with the crowd service operated until the relief valve is lifted.
(2) Make sure that the hydraulic oil temperature is 60 degrees C.

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Care and Safety

Service Manual - Side Engine Loadalls

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 Data Systems

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Issued by JCB Technical Publications, JCB Aftermarket Training, Woodseat, Rocester, Staffordshire, ST14 5BW, England. Tel +44 1889 591300 Fax +44 1889 591400

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Safety Notices

Introduction

In this publication and on the machine, there are safety notices. Each notice starts with a signal word. The signal word meanings are given below.

⚠ DANGER

Denotes an extreme hazard exists. If proper precautions are not taken, it is highly probable that the operator (or others) could be killed or seriously injured.

INT-1-2-1

⚠ WARNING

Denotes a hazard exists. If proper precautions are not taken, the operator (or others) could be killed or seriously injured.

INT-1-2-2

⚠ CAUTION

Denotes a reminder of safety practices. Failure to follow these safety practices could result in injury to the operator (or others) and possible damage to the machine.

INT-1-2-3

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Important Information

T1-042

The Operator Manual

⚠ WARNING

You and others can be killed or seriously injured if you operate or maintain the machine without first studying the Operator Manual. You must understand and follow the instructions in the Operator Manual. If you do not understand anything, ask your employer or JCB dealer to explain it.

INT-1-4-2

Do not operate the machine without an Operator Manual, or if there is anything on the machine you do not understand.

Treat the Operator Manual as part of the machine. Keep it clean and in good condition. Replace the Operator Manual immediately if it is lost, damaged or becomes unreadable.

Safety Warnings

This safety alert system identifies important safety messages in this manual. When you see this symbol, be alert, your safety is involved, carefuly read the message that follows, and inform other operators.

In this publication and on the machine, there are safety notices. Each notice starts with a signal word. The signal word meanings are given below.

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INT-1-2-2

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Denotes a reminder of safety practices. Failure to follow these safety practices could result in injury to the operator (or others) and possible damage to the machine.

INT-1-2-3

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Safety Check List

Safety - Yours and Others

INT-1-3-1_3

All machinary can be hazardous. When a machine is correctly operated and properly maintained, it is a safe machine to work with. But 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. Read and understand them. They tell you of potential hazards and how to avoid them. If you do not fully understand the warning messages, ask your employer or JCB distributor to explain them.

But 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 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 job until you are sure that you and those around you will be safe.

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

Remember

BE CAREFUL
BE ALERT
BE SAFE

Common Rail (SE Engine) Specific

In addition to the general safety notices and general good workshop practices issued in this section and throughout the manual, there are specific points to note when completing maintenance on SE engine equipment:

Diesel Fuel Quality

Important: *The potential for engine damage due to the use of incorrect or contaminated fuel is much greater with common rail injection technology than with mechanical injection systems.*

For more information about cleanliness requirements and fuel types refer to ***Section 1 - General Information.***

⚠ CAUTION

Do not allow dirt to enter the fuel system. Before disconnecting any part of the fuel system, thoroughly clean around the connection. When a component has been disconnected, for example a fuel pipe, always fit protective caps and plugs to prevent dirt ingress.

Failure to follow these instruction will lead to dirt entering the fuel system. Dirt in the fuel system will seriously damage the fuel injection equipment and could be expensive to repair.

ENG-1-7

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Effects of Contamination

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

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

It is critical that the machine is thoroughly cleaned prior to completing any maintenance work. The main filter is rated at 2 micron = 0.002 mm (0.0007874 in).

Listed are a few typical comparisons of micron size:

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

Common Rail Safety Checklist

The following safety checklist is intended to help remind you of safety procedures and practices relating to a common rail SE engine.

SAFETY IS YOUR RESPONSIBILITY

- Do make sure the engine and surrounding area has been thoroughly cleaned prior to completing any maintenance tasks. Refer to Section 1, Cleanliness Requirements.
- Do complete all work in accordance with the Service Manual procedures.
- Do disconnect both the battery positive (+) and battery negative (-) cables prior to completing any welding on the machine.
- Do use the recommended grade of fuel (EN590). The fuel injection pump, injector or other parts of the fuel system can be damaged if you use a fuel or fuel additives not recommended by JCB. Refer to ***Section 1 - Acceptable and Unacceptable Fuels***.
- Do make sure all the necessary new parts are available before starting any maintenance work.
- Do not `crack' the injector high pressure fuel lines to bleed the fuel system. The system operates at pressures in excess of 1200 bar (17400lbs/in^2).
- Do not steam clean the electronic control unit (ECU) or the ECU connectors.
- Do not touch the ECU connector pins, this will eliminate the possibility of damage caused by electrostatic discharge.
- Do not leave any fuel connections `open' for any extended period of time.
- Do not open any new parts packaging until the part is ready to be fitted. Unnecessary exposure will increase the risk of contamination.
- Do not reuse high pressure fuel pipes. Reusing the pipes will lead to potential fuel leaks.
- Do not attempt to remove and replace the rail pressure sensor or high pressure valve. It is not possible to refit these components without the risk of fuel leaks. If the valve or sensor is diagnosed as faulty then a new common rail assembly must be fitted.

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General Safety

T1-043

⚠ WARNING

To operate the machine safely you must know the machine and have the skill to use it. You must abide by all relevant laws, health and safety regulations that apply to the country you are operating in. The Operator Manual instructs you on the machine, its controls and its safe operation; it is not a training manual. If you are a new operator, get yourself trained in the skills of using a machine before trying to work with it. If you don't, you will not do your job well, and you will be a danger to yourself and others.

INT-1-4-1

⚠ WARNING

Care and Alertness

All the time you are working with or on the machine, take care and stay alert. Always be careful. Always be alert for hazards.

INT-1-3-5

⚠ WARNING

Clothing

You can be injured if you do not wear the proper clothing. Loose clothing can get caught in the machinery. Wear protective clothing to suit the job. Examples of protective clothing are: a hard hat, safety shoes, safety glasses, a well fitting overall, ear-protectors and industrial gloves. Keep cuffs fastened. Do not wear a necktie or scarf. Keep long hair restrained. Remove rings, watches and personal jewellery.

INT-1-3-6_2

⚠ WARNING

Alcohol and Drugs

It is extremely dangerous to operate machinery when under the influence of alcohol or drugs. Do not consume alcoholic drinks or take drugs before or while operating the machine or attachments. Be aware of medicines which can cause drowsiness.

INT-1-3-9_2

⚠ WARNING

Feeling Unwell

Do not attempt to operate the machine if you are feeling unwell. By doing so you could be a danger to yourself and those you work with.

8-1-2-4

⚠ WARNING

Mobile Phones

Switch off your mobile phone before entering an area with a potentially explosive atmosphere. Sparks in such an area could cause an explosion or fire resulting in death or serious injury.

Switch off and do not use your mobile phone when refuelling the machine.

INT-3-3-9

⚠ WARNING

Lifting Equipment

You can be injured if you use incorrect or faulty lifting equipment. You must identify the weight of the item to be lifted then choose lifting equipment that is strong enough and suitable for the job. Make sure that lifting equipment is in good condition and complies with all local regulations.

INT-1-3-7_2

⚠ WARNING

Raised Equipment

Never walk or work under raised equipment unless it is supported by a mechanical device. Equipment which is supported only by a hydraulic device can drop and injure you if the hydraulic system fails or if the control is operated (even with the engine stopped).

Make sure that no-one goes near the machine while you install or remove the mechanical device.

13-2-3-7_3

⚠ WARNING

Raised Machine

NEVER position yourself or any part of your body under a raised machine which is not properly supported. If the machine moves unexpectedly you could become trapped and suffer serious injury or be killed.

INT-3-3-7_1

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⚠ DANGER

Lightning

Lightning can kill you. Do not use the machine if there is lightning in your area.

5-1-1-2

⚠ WARNING

Machine Modifications

This machine is manufactured in compliance with legislative and other requirements. It should not be altered in any way which could affect or invalidate any of these requirements. For advice consult your JCB Distributor.

INT-1-3-10_2

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Operating Safety

⚠ WARNING

Machine Condition

A defective machine can injure you or others. Do not operate a machine which is defective or has missing parts. Make sure the maintenance procedures in this manual are completed before using the machine.

INT-2-1-2_2

⚠ WARNING

Machine Limits

Operating the machine beyond its design limits can damage the machine, it can also be dangerous. Do not operate the machine outside its limits. Do not try to upgrade the machine performance with unapproved modifications.

INT-2-1-4

⚠ WARNING

Engine/Steering Failure

If the engine or steering fails, stop the machine as quickly as possible. Do not operate the machine until the fault has been corrected.

INT-2-1-5

⚠ 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.

5-2-6-5

⚠ WARNING

Exhaust Gases

Breathing the machine exhaust gases can harm and possibly kill you. Do not operate the machine in closed spaces without making sure there is good ventilation. If possible, fit an exhaust extension. If you begin to feel drowsy, stop the machine at once and get into fresh air.

INT-2-1-10_2

⚠ WARNING

You could be killed or seriously injured if you operate a machine with a damaged or missing ROPS/FOPS. If the Roll Over Protection Structure (ROPS)/Falling Objects Protection Structure (FOPS) has been in an accident, do not use the machine until the structure has been renewed. Modifications and repairs that are not approved by the manufacturer may be dangerous and will invalidate the ROPS/FOPS certification.

INT-2-1-9_6

⚠ WARNING

Work Sites

Work sites can be hazardous. Inspect the site before working on it. Look for potholes, weak ground, hidden rocks etc. Check for utilities such as electric cables (overhead and underground), gas and water pipes etc. Mark the positions of the underground cables and pipes. Make sure that you have enough clearance beneath overhead cables and structures.

INT-2-2-1

⚠ WARNING

Communications

Bad communications can cause accidents. Keep people around you informed of what you will be doing. If you will be working with other people, make sure any hand signals that may be used are understood by everybody. Work sites can be noisy, do not rely on spoken commands.

INT-2-2-3

⚠ WARNING

Parking

An incorrectly parked machine can move without an operator. Follow the instructions in the Operator Manual to park the machine correctly.

INT-2-2-4_2

⚠ WARNING

Banks and Trenches

Banked material and trenches can collapse. Do not work or drive too close to banks and trenches where there is danger of collapse.

INT-2-2-5

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⚠ WARNING

Ramps and Trailers

Water, mud, ice, grease and oil on ramps or trailers can cause serious accidents. Make sure ramps and trailers are clean before driving onto them. Use extreme caution when driving onto ramps and trailers.

INT-2-2-6

⚠ WARNING

Safety Barriers

Unguarded machines in public places can be dangerous. In public places, or where your visibility is reduced, place barriers around the work area to keep people away.

INT-2-2-8

⚠ DANGER

Sparks

Explosions and fire can be caused by sparks from the exhaust or the electrical system. Do not use the machine in closed areas where there is flammable material, vapour or dust.

INT-2-2-10

⚠ WARNING

Hazardous Atmospheres

This machine is designed for use in normal out door atmospheric conditions. It should not be used in an enclosed area without adequate ventilation. Do not use the machine in a potentially explosive atmosphere, i.e. combustible vapours, gas or dust, without first consulting your JCB Distributor.

INT-2-1-14

⚠ CAUTION

Regulations

Obey all laws, work site and local regulations which affect you and your machine.

INT-1-3-3

⚠ WARNING

Practice

You or others can be killed or seriously injured if you do unfamiliar operations without first practising them. Practise away from the work site on a clear area. Keep other people away. Do not perform new operations until you are sure you can do them safely.

INT-2-1-1

⚠ WARNING

Reversing

Reversing at high speeds can cause accidents. Do not reverse in a high gear with full throttle. Always drive at a safe speed to suit working conditions.

INT-2-2-9_1

⚠ WARNING

Airborne particles of light combustible material such as straw, grass, wood shavings, etc. must not be allowed to accumulate within the engine compartment or in the propshaft guards (when fitted). Inspect these areas frequently and clean at the beginning of each work shift or more often if required. Before opening the engine cover, ensure that the top is clear of debris.

5-3-1-12_3

⚠ WARNING

Keep the machine controls clean and dry. Your hands and feet could slide off slippery controls. If that happens you could lose control of the machine.

2-2-3-6

⚠ WARNING

Visibility

Accidents can be caused by working in poor visibility. Use your lights to improve visibility. Keep the road lights, windows and mirrors clean.

Do not operate the machine if you cannot see clearly.

5-1-4-7

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⚠ WARNING

Electrical Power Cables

You could be electrocuted or badly burned if you get the machine or its attachments too close to electrical power cables.

You are strongly advised to make sure that the safety arrangements on site comply with the local laws and regulations concerning work near electric power lines.

Before you start using the machine, check with your electricity supplier if there are any buried power cables on the site.

There is a minimum clearance required for working beneath overhead power cables. You must obtain details from your local electricity supplier.

2-2-5-4

⚠ CAUTION

If you have an attachment which is not covered in the Operator Manual do not install it, use it or remove it until you have obtained, read and understood the pertinent information. Install attachments only on the machines for which they were designed.

5-5-1-1_2

⚠ WARNING

Use only the JCB approved attachments that are specified for your machine. Operating with non-specified attachments can overload the machine, causing possible damage and machine instability which could result in injury to yourself or others.

The use of non-approved attachments could invalidate your warranty.

2-4-5-2_1

⚠ WARNING

Controls

You or others can be killed or seriously injured if you operate the control levers from outside the machine. Operate the control levers only when you are correctly seated.

0179_2

⚠ WARNING

Fires

If your machine is equipped with a fire extinguisher, make sure it is checked regularly. Keep it in the correct machine location until you need to use it.

Do not use water to put out a machine fire, you could spread an oil fire or get a shock from an electrical fire. Use carbon dioxide, dry chemical or foam extinguishers. Contact your nearest fire department as quickly as possible. Firefighters should use self-contained breathing apparatus.

INT-3-2-7_2

⚠ WARNING

Should the machine start to roll over, you can be crushed if you try to leave the cab. If the machine starts to roll over, do not try and jump from the cab. Stay in the cab, with your seat belt fastened.

INT-2-1-12

⚠ CAUTION

Fork Spacing

Loads can fall off incorrectly spaced forks. Always space the forks correctly for the load. Make sure the forks are completely under the load before lifting.

5-1-4-2

⚠ CAUTION

One-Fork Lifting

A load lifted on one fork can slip off. Never lift a load with one fork.

5-1-4-3

⚠ CAUTION

Unloading

Never unload the forks by stopping the machine suddenly. Follow the procedures in the Operator Manual for unloading.

5-1-4-4_2

⚠ CAUTION

Uneven Ground

Loads stacked on uneven ground can topple. Never stack loads on uneven ground.

5-1-4-5

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⚠ WARNING

Scaffolding

Overloaded scaffolding can collapse. Never load scaffolding beyond the regulation capacity.

5-1-4-6

⚠ CAUTION

Overhead Clearance

A raised boom can strike overhead objects. Always check for overhead clearance before raising the boom.

5-1-5-1

⚠ WARNING

Boom/Travelling

Operating the boom while travelling can cause accidents. You will not have total control of the machine. Never operate the boom while travelling.

5-1-5-2

⚠ DANGER

Forks/Working Platform

Using the forks alone as a working platform is hazardous; you can fall off and be killed or injured. Never use the forks as a working platform.

5-1-5-3

⚠ WARNING

Forks/Turning

The forks extend beyond the end of the boom. Make sure there is enough clearance for the forks when making turns.

5-1-5-4

⚠ WARNING

Entering/Leaving

Entering or leaving the cab or canopy must only be made where steps and handrails are provided. Always face the machine when entering and leaving. Make sure the step(s), handrails and your boot soles are clean and dry. Do not jump from the machine. Do not use the machine controls as handholds, use the handrails.

INT-2-1-7_1

⚠ WARNING

Controls

You or others can be killed or seriously injured if you operate the control levers from outside the machine. Operate the control levers only when you are correctly seated in the machine.

0179

⚠ WARNING

Powershift Transmission

Do not change from a high gear to a low gear (for instance, 4th to 1st) in one sudden movement when the machine is moving. Otherwise the machine will rapidly decelerate, you or others could be killed or seriously injured. When selecting lower gears, allow the engine speed to drop before each gear change.

2-1-1-9_1

⚠ CAUTION

Passengers

Passengers in or on the machine can cause accidents. Do not carry passengers.

INT-2-2-2_1

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Maintenance Safety

⚠ WARNING

Communications

Bad communications can cause accidents. If two or more people are working on the machine, make sure each is aware of what the others are doing. Before starting the engine make sure the others are clear of the danger areas; examples of danger areas are: the rotating blades and belt on the engine, the attachments and linkages, and anywhere beneath or behind the machine. People can be killed or injured if these precautions are not taken.

INT-3-1-5

⚠ WARNING

Repairs

If your machine does not function correctly in any way, get it repaired straight away. Neglect of necessary repairs could result in an accident or affect your health. Do not try to do repairs or any other type of maintenance work you do not understand. To avoid injury and/or damage get the work done by a specialist engineer.

GEN-1-5_2

⚠ WARNING

Metal Splinters

You can be injured by flying metal splinters when driving metal pins in or out. Use a soft faced hammer or copper pin to remove and fit metal pins. Always wear safety glasses.

INT-3-1-3_2

⚠ WARNING

Electrical Circuits

Understand the electrical circuit before connecting or disconnecting an electrical component. A wrong connection can cause injury and/or damage.

INT-3-1-4

⚠ WARNING

Fluid Under Pressure

Fine jets of fluid at high pressure can penetrate the skin. Keep face and hands well clear of fluid under pressure and wear protective glasses and gloves. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of fluid. If fluid penetrates your skin, get medical help immediately.

INT-3-1-10_3

⚠ WARNING

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before connecting or removing any hydraulic hose, residual hydraulic pressure trapped in the service hose line must be vented. Make sure the hose service line has been vented before connecting or removing hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11_2

⚠ WARNING

Fuel

Fuel is flammable; keep naked flames away from the fuel system. Stop the engine immediately if a fuel leak is suspected. Do not smoke while refuelling or working on the fuel system. Do not refuel with the engine running. Completely wipe off any spilt fuel which could cause a fire. There could be a fire and injury if you do not follow these precautions.

INT-3-2-2_3

⚠ WARNING

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.

INT-3-2-3

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⚠ 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.

INT-3-2-14

⚠ WARNING

Soft Ground

A machine can sink into soft ground. Never work under a machine on soft ground.

INT-3-2-4

⚠ WARNING

Always wear safety glasses when dismantling assemblies containing components under pressure from springs. This will protect against eye injury from components accidentally flying out.

GEN-6-2

⚠ CAUTION

Rams

The efficiency of the rams will be affected if they are not kept free of solidified dirt. Clean dirt from around the rams regularly. When leaving or parking the machine, close all rams if possible to reduce the risk of weather corrosion.

INT-3-2-10

⚠ CAUTION

Cleaning

Cleaning metal parts with incorrect solvents can cause corrosion. Use only recommended cleaning agents and solvents.

INT-3-2-11

⚠ WARNING

When using cleaning agents, solvents or other chemicals, you must adhere to the manufacturer's instructions and safety precautions.

GEN-1-9

⚠ CAUTION

'O' rings, Seals and Gaskets

Badly fitted, damaged or rotted 'O' rings, seals and gaskets can cause leakages and possible accidents. Renew whenever disturbed unless otherwise instructed. Do not use Triochloroethane or paint thinners near 'O' rings and seals.

INT-3-2-12

⚠ WARNING

Hydraulic Hoses

Damaged hoses can cause fatal accidents. Inspect the hoses regularly. Do not use the machine if a hose or hose fitting is damaged.

INT-3-3-2_4

⚠ CAUTION

Waxoyl contains turpentine substitute which is flammable. Keep flames away when applying Waxoyl. Waxoyl can take a few weeks to dry completely. Keep flames away during the drying period.

Do not weld near the affected area during the drying period. Take the same precautions as for oil to keep Waxoyl off your skin. Do not breathe the fumes. Apply in a well-ventilated area.

5-3-1-9

⚠ WARNING

Working Under the Machine

Make the machine safe before getting beneath it. Ensure that any fitments on the machine are secure; engage the park brake, remove the starter key, disconnect the battery.

INT-3-3-8_2

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⚠ WARNING

Certain seals and gaskets (e.g. crankshaft oil seal) on JCB machines contain fluoroelastomeric materials such as Viton, Fluorel and Technoflon. Fluoroelastomeric materials subjected to high temperatures can produce highly corrosive hydrofluoric acid. THIS ACID CAN SEVERELY BURN.

New fluoroelastomeric components at ambient temperature require no special safety precautions.

Used fluoroelastomeric components whose temperatures have not exceeded 300°C (572°F) require no special safety precautions. If evidence of decomposition (e.g. charring) is found, refer to the next paragraph for safety instructions DO NOT TOUCH COMPONENT OR SURROUNDING AREA.

Used fluoroelastomeric components subjected to temperatures greater than 300°C (572°F) (e.g. engine fire) must be treated using the following safety procedure. Make sure that heavy duty gloves and special safety glasses are worn:

1 **Thoroughly wash contaminated area with 10% calcium hydroxide or other suitable alkali solution, if necessary use wire wool to remove burnt remains.**

2 **Thoroughly wash contaminated area with detergent and water.**

3 **Contain all removed material, gloves etc. used in this operation in sealed plastic bags and dispose of in accordance with Local Authority Regulations.**

DO NOT BURN FLUOROELASTOMERIC MATERIALS.

INT-3-3-5_3

⚠ WARNING

Protect your eyes when grinding metal. Wear safety glasses or goggles. Remove or protect any combustible materials from the area which could be ignited by sparks.

GEN-1-12

⚠ WARNING

To avoid burning, wear protective gloves when handling hot components. To protect your eyes, wear goggles when using a brush to clean components.

HYD-1-3_2

⚠ WARNING

Arc Welding

To prevent the possibility of damage to electronic components, disconnect the battery and the alternator before arc-welding on the machine or attached implements.

If the machine is equipped with sensitive electrical equipment, i.e. amplifier drivers, electronic control units (E.C.U.s), monitor displays, etc., then disconnect them before welding. Failure to disconnect the sensitive electrical equipment could result in irreparable damage to these components.

Parts of the machine are made from cast iron; welds on cast iron can weaken the structure and break. Do not weld cast iron. Do not connect the welder cable or apply any weld to any part of the engine.

Always connect the welder earth (ground) cable to the same component that is being welded, i.e. boom or dipper, to avoid damage to pivot pins, bearings and bushes. Attach the welder earth (ground) cable no more than 0.6 metres (2 feet) from the part being welded.

INT-3-1-15_2

⚠ WARNING

Counterweights

Your machine may be fitted with counterweights. They are extremely heavy. Do not attempt to remove them.

INT-3-2-5

⚠ WARNING

Compressed air is dangerous. Wear suitable eye protection and gloves. Never point a compressed air jet at yourself or others.

0147_1

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⚠ CAUTION

Do not disconnect the battery while the engine is running, otherwise the electrical circuits may be damaged.

INT-3-1-14

⚠ WARNING

If you try to charge a frozen battery, or jump start and run the engine, the battery could explode. Do not use a battery if its electrolyte is frozen. To prevent the battery electrolyte from freezing, keep the battery at full charge.

0125

⚠ WARNING

Battery Gases

Batteries give off explosive gases. Keep flames and sparks away from the battery. Do not smoke close to the battery. Make sure there is good ventilation in closed areas where batteries are being used or charged. Do not check the battery charge by shorting the terminals with metal; use a hydrometer or voltmeter.

INT-3-1-8

⚠ DANGER

Electrolyte

Battery electrolyte is toxic and corrosive. Do not breathe the gases given off by the battery. Keep the electrolyte away from your clothes, skin, mouth and eyes. Wear safety glasses.

INT-3-2-1_3

⚠ WARNING

Battery Terminals

The machine is negatively earthed. Always connect the negative pole of the battery to earth.

When connecting the battery, connect the earth (-) lead last.

When disconnecting the battery, disconnect the earth (-) lead first.

INT-3-1-9

⚠ WARNING

Accumulators

The accumulators contain hydraulic fluid and gas at high pressure. Prior to any work being carried out on systems incorporating accumulators, the system pressure must be exhausted by a JCB distributor, as the sudden release of the hydraulic fluid or gas may cause injury.

INT-3-1-17

⚠ WARNING

Petrol

Do not use petrol in this machine. Do not mix petrol with the diesel fuel; in storage tanks the petrol will rise to the top and form flammable vapours.

INT-3-1-6

⚠ WARNING

The cooling system is pressurised when the coolant is hot. When you remove the cap, hot coolant can spray out and burn you. Make sure that the engine is cool before you work on the cooling system.

9-3-3-1_2

⚠ WARNING

An exploding tyre can kill. Inflated tyres can explode if over-heated or over-inflated. Follow the instructions given when inflating the tyres. Do not cut or weld the rims. Use a tyre/wheel specialist for all repair work.

2-3-2-7_2

⚠ WARNING

Jacking

A machine can roll off jacks and crush you unless the wheels have been blocked. Always block the wheels at the opposite end of the machine that is to be jacked. Do not work underneath a machine supported only by jacks. Always support a jacked-up machine on axle stands before working underneath it.

INT-3-2-8

⚠ WARNING

Under no circumstances must the engine be run with the transmission in gear and only one driving wheel jacked clear of the ground, since the wheel on the ground will move the machine.

INT-3-1-16

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⚠ WARNING

Wheels and tyres are heavy. Take care when lifting or moving them.

Store with care to ensure that they cannot fall and cause injury.

13-3-1-7_1

⚠ CAUTION

Never use water or steam to clean inside the cab. The use of water or steam could damage the on-board computer and render the machine inoperable. Remove dirt using a brush or damp cloth.

8-3-4-8

⚠ WARNING

Boom Maintenance Strut

A raised boom can drop suddenly and cause serious injury. Before working under a raised boom, fit the boom maintenance strut. See Boom Maintenance Strut, MAINTENANCE section.

5-1-5-7_2

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Safety Labels

Introduction

T1-014_2

⚠ WARNING

Safety Labels

Safety labels on the machine warn you of particular hazards. You can be injured if you do not obey the safety instructions shown.

INT-1-3-11

Safety labels are strategically placed around the machine to remind you of possible hazards.

If you need eye-glasses for reading, make sure you wear them when reading the safety labels. Do not over-stretch or place yourself in dangerous positions to read the safety labels. If you do not understand the hazard shown on the safety label, then refer to ***Safety Label Identification***.

Note: *The illustration(s) show a typical machine model. Your machine may look different from the model shown.*

Keep all safety labels clean and readable. Replace lost or damaged safety labels. Make sure replacement parts include safety labels where necessary. Each safety label has a part number printed on it, use this number to order a new decal from your JCB distributor.

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General Procedures

Introduction

When work is done on the machine it is important that the correct care is taken. This will help to prevent personal injury and reduce the risk of component failure.

As part of the procedures in this manual you will need to do some general procedures. Two examples of these general procedures are; parking the machine and making it safe, and venting hydraulic pressure.

These procedures are given here as an alternative to again and again in the manual. Where applicable you will see a cross reference to this section so that you can refer to the detailed procedures.

⇨ *Parking the Machine and Making it Safe (2-2-3)*
⇨ *Boom Safety Strut (2-2-4)*
- ⇨ *Installing (2-2-4)*
- ⇨ *Removing (2-2-6)*

⇨ *Venting Hydraulic Pressure (2-2-7)*
⇨ *Connecting/Disconnecting Hydraulic Hoses (2-2-8)*
- ⇨ *Introduction (2-2-8)*
- ⇨ *Connecting the Hoses (2-2-8)*
- ⇨ *Disconnecting the Hoses (2-2-8)*

⇨ *Quick Release Couplings (2-2-9)*
⇨ *Hydraulic Contamination (2-2-11)*
- ⇨ *Hydraulic Fluid Quality (2-2-11)*
- ⇨ *Effects of Contamination (2-2-11)*
- ⇨ *Cleaning Operation (2-2-11)*
- ⇨ *Contaminant Standards (2-2-12)*
- ⇨ *Filters (2-2-12)*

⇨ *Battery Disconnection/Connection (2-2-13)*
- ⇨ *Disconnection (2-2-13)*
- ⇨ *Connection (2-2-13)*

⇨ *Removing and Replacing Components (2-2-14)*
⇨ *Battery Charging System Precautions (2-2-15)*
⇨ *Hydraulic Rams (2-2-16)*
- ⇨ *Installation (2-2-16)*
- ⇨ *Caution During Use (2-2-16)*
- ⇨ *Maintenance, Inspection Points (2-2-16)*

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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	***General Information***	ALL

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Parking the Machine and Making it Safe

1 Position the machine on firm level ground. If possible choose an area that is clean and dry. When possible park the machine in a covered area if procedures include work on the hydraulic or fuel systems.

2 Lower attachments to the ground and if necessary, remove them. Refer to the correct documents and procedures.

3 If necessary install the boom safety strut. ⇨ *Boom Safety Strut (2-2-4)*

4 Stop the engine and apply the park brake.

5 Vent the hydraulic pressure. ⇨ *Venting Hydraulic Pressure (2-2-7)*

6 Remove the starter key.

7 Let the machine cool sufficiently before you do work on, or near to, the engine or hydraulic system.

8 If procedures include work on the electrical system disconnect the battery. ⇨ *Battery Disconnection/ Connection (2-2-13)*

⚠ WARNING

Communications

Bad communications can cause accidents. If two or more people are working on the machine, make sure each is aware of what the others are doing. Before starting the engine make sure the others are clear of the danger areas; examples of danger areas are: the rotating blades and belt on the engine, the attachments and linkages, and anywhere beneath or behind the machine. People can be killed or injured if these precautions are not taken.

INT-3-1-5

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Boom Safety Strut

Note: *If you lift the boom to get access for maintenance, you must install the maintenance strut on the boom.*

Installing

⚠ WARNING

You could be killed or injured if the boom drops while you are working under it. Fit the boom maintenance strut as instructed before doing any maintenance work with the boom raised.

Keep people away from the machine while you fit or remove the boom maintenance strut.

5-3-1-2_2

Before installing the safety strut remove any load on the forks and make sure that buckets or attachments are empty.

1 Fully retract the boom (unless it necessary to extend it for maintenance). Lift the boom sufficiently to install the strut.

2 Stop the engine. Make sure the park brake is engaged and the transmission is in neutral. Remove the starter key.

⚠ CAUTION

You will have to climb onto the machine to fit or remove the strut. Take care, especially if the machine is wet. Remove mud and oil before climbing onto the machine. Do not use the exhaust as a handhold. It can burn you.

5-3-1-4_1

3 Remove the strut from its stowage position **A**.

The stowage location for the boom safety strut can change with each machine. ⇨ ***Table 2. Safety Strut Stowage Locations (2-2-4)***.

4 Put the strut **B** around the lift ram piston rod. Use the strap to attach it to the ram piston rod.

5 To prevent boom creeping down and causing injury the boom must be lowered onto the strut.

Note: *Lower the boom carefully, to prevent possible damage to the strut. Stop as soon as the weight of the boom is on the strut.*

6 Disconnect the battery to prevent accidental operation of the engine.

7 If necessary, put chocks against the two sides of the wheels before you get below the machine.

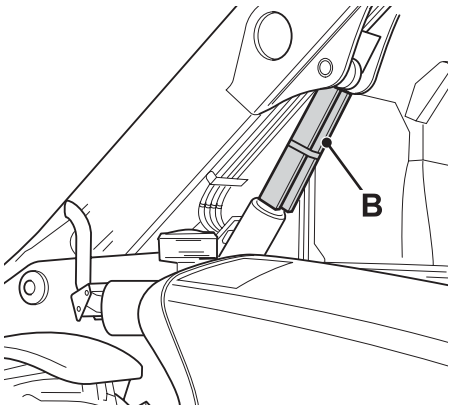

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Fig 1.

Table 2. Safety Strut Stowage Locations

Model	Stowage Position
535-125 HiViz, 535-140 HiViz	⇨ ***Fig 2. (2-2-5)***
540-140, 540-170	⇨ ***Fig 3. (2-2-5)***

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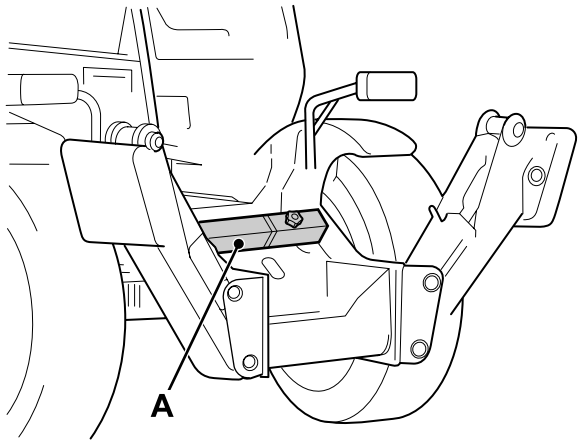

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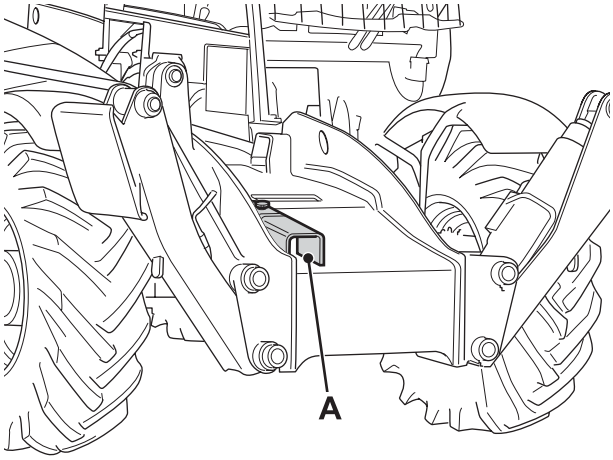
Fig 2.



T012120-2

Fig 3.

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Removing

⚠ WARNING

You could be killed or injured if the boom drops while you are working under it. Fit the boom maintenance strut as instructed before doing any maintenance work with the boom raised.

Keep people away from the machine while you fit or remove the boom maintenance strut.

5-3-1-2_2

1 Lift the boom to remove the weight from the strut.

2 Stop the engine. Make sure the park brake is engaged and the transmission is in neutral. Remove the starter key.

⚠ CAUTION

You will have to climb onto the machine to fit or remove the strut. Take care, especially if the machine is wet. Remove mud and oil before climbing onto the machine. Do not use the exhaust as a handhold. It can burn you.

5-3-1-4_1

3 Remove the strut.

4 Attach the strut to its stowage position.

The stowage location for the boom safety strut can change with each machine. ⇨ *Table 2. Safety Strut Stowage Locations (2-2-4)*.

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Venting Hydraulic Pressure

⚠ WARNING

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses or couplings, vent the pressure trapped in the hoses in accordance with the instructions given in this publication.

HYD-1-5

Important: *This procedure is only to be used before disconnecting hydraulic hoses. Before removing other hydraulic components refer to the correct Removal procedure.*

1 Park the machine and make it safe. ⇨ ***Parking the Machine and Making it Safe (2-2-3)***.

2 If necessary install the boom safety strut. ⇨ ***Boom Safety Strut (2-2-4)***. Stop the engine.

3 Carefully remove the hydraulic tank filler cap and vent the hydraulic pressure as follows:

a For manually operated services, operate the controls of the service to be disconnected.

b For electrical and pilot operated services, turn the starter key to the ON position but DO NOT start the engine.

Operate the controls of the service to be disconnected.

Note: *Make sure that the pressure is vented correctly. Electrical and pilot services have a small quantity of accumulated pressure available for venting.*

4 Refit the hydraulic tank filler cap.

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Connecting/Disconnecting Hydraulic Hoses

Introduction

The following paragraphs describe how to connect and disconnect hydraulic hoses safely.

Connecting the Hoses

1 Connect the hoses.

a For Quick Release Couplings refer to the correct data. ⇨ *Quick Release Couplings (2-2-9)*

b For all other hose connections, use correct tools and ensure that connections are not cross-threaded. Support the weight of the hose until the connection is made. Do not exceed the recommended torque loading.

⚠ WARNING

Fluid Under Pressure

Fine jets of fluid at high pressure can penetrate the skin. Keep face and hands well clear of fluid under pressure and wear protective glasses and gloves. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of fluid. If fluid penetrates your skin, get medical help immediately.

INT-3-1-10_3

2 Check for leaks as follows:

a Start the engine.

b Operate the controls to pressurise the required hose.

c Switch off the engine. Remove the starter key. Check for signs of leakage at the hose connections.

Disconnecting the Hoses

1 Vent the hydraulic pressure as described on this page.

2 Disconnect the hoses.

a For Quick Release Couplings see the procedures in this section. ⇨ *Quick Release Couplings (2-2-9)*

b For all other hose connections, plug both sides of the connection to prevent loss of fluid.

3 Check for leaks. See step 2, ⇨ *Connecting the Hoses (2-2-8)*

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Quick Release Couplings

T4-001_2

Connecting and Disconnecting

Flat face quick release couplings allow the operator to remove and install attachments swiftly and efficiently. Generally, your machine pipework will be fitted with a female coupling **A** and a male coupling **B**. The optional attachment hoses will also be fitted with a female coupling **A** and a male coupling **B**. ⇒ *Fig 4. (2-2-10)*.

The quick release couplings should be trouble free and relatively easy to connect and disconnect, provided they are kept clean and used correctly. The recommendations listed below should always apply when using flat face quick release couplings.

Finally, please read the correct fitting and releasing procedures before installing or removing any optional attachment fitted with quick release couplings.

Quick Release Couplings - Do's and Don'ts

- Do wipe the two faces of the coupling and make sure they are clean before connecting.
- Do make sure the outside sleeve (female coupling) is pulled back when disconnecting.
- Do connect and disconnect a new coupling two or three times to 'work' the PTFE seals - sometimes a new coupling will stick if the seals have not been 'worked'.
- Do use a spanner on the hexagon flats of the coupling when fitting adaptors.
- Do use a rubber or hide hammer to disconnect a coupling if it sticks - sticking may occur if there is dirt present in the coupling.
- Don't attempt to re-connect a damaged half coupling - this will destroy the seals and necessitate replacing both half couplings.
- Don't leave the coupling where it may be run over by a machine or otherwise crushed - this will distort the coupling sleeve and prevent correct connection and disconnection.
- Don't clamp on the smooth diameter of the coupling when fitting adaptors - always use the hexagon.
- Don't try to turn the sleeve (female coupling) when the coupling has been disconnected - the locking ball will wedge underneath the sleeve and destroy the coupling.
- Don't damage the faces of the couplings - this can prevent connection and disconnection, or damage seals and cause leakage.
- Don't try to dismantle the couplings - they are non serviceable parts. If a coupling is damaged it should be replaced with a new one.

⚠ WARNING

Hydraulic fluid at pressure can injure you. Make the machine safe before connecting or disconnecting quick release couplings; stop the engine and then operate the attachment control a few times to vent residual hydraulic pressure in the attachment hoses.

2-4-1-11

⚠ WARNING

The external surfaces of the couplings must be clean before connecting or disconnecting. Ingress of dirt will cause fluid leaks and difficulty in connecting or disconnecting. You could be killed or seriously injured by faulty Quick Release Couplings.

2-4-1-15

Before connecting or removing any hydraulic hose, residual hydraulic pressure trapped in the service hose line must be vented. Make sure the hose service line has been vented before connecting or removing hoses.

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Connecting Quick Release Couplings

1 Remove any residual hydraulic pressure trapped in the service line hose.

2 Wipe the two faces of the male and female couplings and make sure they are clean.

3 Make sure that ball **4-C** in the female coupling is located in one of its slots.

4 Fit the male coupling into the female coupling; To ensure that the coupling is not accidentally released, rotate sleeve **4-E** half a turn and make sure that the locking ball **4-C** does not align with the slot **4-D**.

Disconnecting Quick Release Couplings

1 Remove any residual hydraulic pressure trapped in the service line hose.

2 Align the slot **4-D** with ball **4-C**.

3 Pull back sleeve **4-E** to release the coupling.

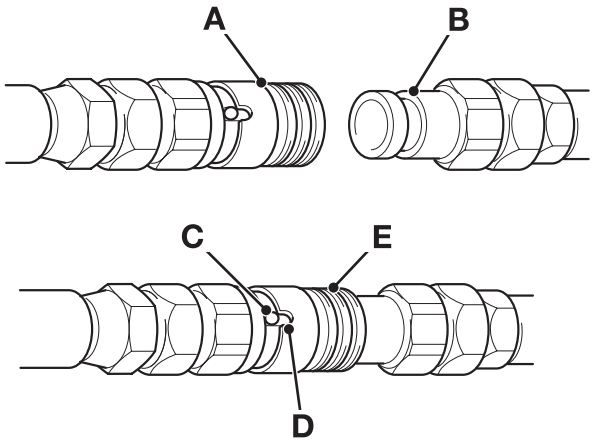

Fig 4.

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Hydraulic Contamination

TE-002_2

Hydraulic Fluid Quality

Construction machinery uses a large volume of fluid in the hydraulic system for power transmission, equipment lubrication, rust prevention and sealing. According to a survey conducted by a pump manufacturer, seventy per cent of the causes of problems in hydraulic equipment were attributable to inadequate maintenance of the quality of the hydraulic fluid. Therefore, it is obvious that control of the quality of the hydraulic fluid helps prevent hydraulic equipment problems and greatly improves safety and reliability. Furthermore from an economic angle it extends the life of the hydraulic fluid if quality is maintained.

Effects of Contamination

Once inside the system, hydraulic circuit contaminants greatly effect the performance and life of hydraulic equipment. For example, contaminants in a hydraulic pump develop internal wear to cause internal leakage and hence lower discharges. Wear particles generated will circulate with the hydraulic fluid to cause further deterioration in the performance of this and other equipment. Contaminants also enter principal sliding sections of the equipment causing temporary malfunction, scuffing, sticking and leakage and can lead to major problems.The main contaminants can be classified as follows:

1 **Solid Particles** - sand, fibres, metallic particles, welding scale, sealing materials and wear particles etc.

2 **Liquid** - usually water and incompatible oils and greases.

3 **Gases** - Air, sulphur dioxide etc. which can create corrosive compounds if dissolved in the fluid.

These contaminants can appear during manufacture, assembly and operation.

Cleaning Operation

The purpose of cleaning oil is to remove contaminants of all types and sludge by filtering hydraulic fluid through a cleaning unit. ⇨ *Fig 5. (2-2-11)*. General Bulletin 011 also refers.

Procedure

Connect the cleaning unit in place of the hydraulic filter. ⇨ *Fig 5. (2-2-11)*. Run the system for sufficient time to pump all the hydraulic fluid through the unit. Disconnect the cleaning unit and reconnect the filter. Top up the system with clean hydraulic fluid as required.

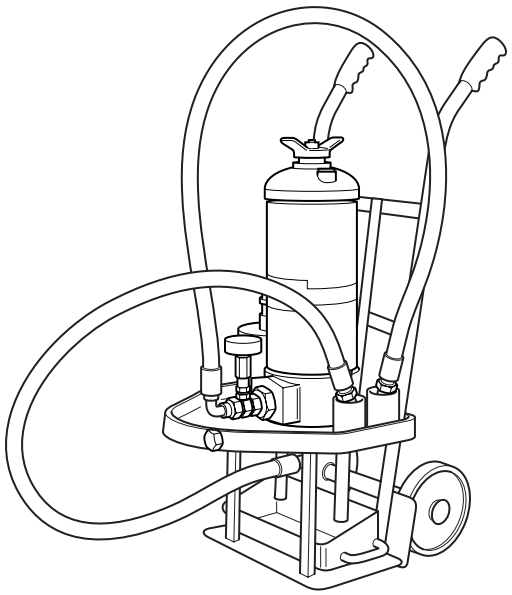

Fig 5. Cleaning Unit

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Contaminant Standards

Dirt that damages your system is in many cases too small to be seen with the eye. The particle size is measured in microns.

1 micron = 0.001 mm (0.0000394 in).

Listed below are a few typical comparisons:

- Red Blood Cell = 8 microns (0.008 mm, 0.000315 in)
- Human Hair = 70 microns (0.07 mm, 0.00275 in)
- Grain of Salt = 100 microns (0.1 mm, 0.00394 in)

Smallest particle visible to the naked eye is 40 microns (0.00157) approximately.

Standards will often be quoted to ISO (International Standards Organisation) for which literature can be obtained.

Filters

The filter assembly fitted to all product ranges is designed to filter all the contamination that is generated through use to the required level of cleanliness. The filter must be serviced to the requirements of the machine Service Schedules.

To ensure optimum performance and reliability it is important that the machines hydraulic system is serviced periodically in accordance with the manufacturers requirements.

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Battery Disconnection/Connection

⚠ WARNING

Keep metal watch straps and any metal fasteners on your clothes, clear of the positive (+) battery terminal. Such items can short between the terminal and nearby metal work. If it happens you can get burned.

5-2-2-4

Disconnection

1 Get access to the battery. See ⇨ *Related Topics (2-2-2)*

2 Remove the leads. Disconnect the earth (-) terminal first.

Connection

1 Check the battery.

a If the terminal is dirty, clean the post.

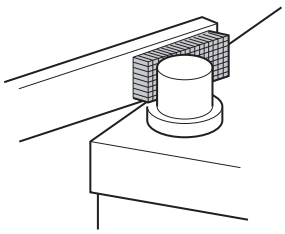

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Fig 6.

b If the terminal post is corroded and generates white powder wash the terminal with hot water. If considerable corrosion is detected, clean with a wire brush or abrasive paper.

c After cleaning, apply a thin coat of petroleum jelly to the terminal.

2 Re-connect the leads. Connect the earth (-) terminal last.

3 Close and lock the access panels.

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Removing and Replacing Components

Renewal of oil seals, gaskets, etc., and any component showing obvious signs of wear or damage is expected as a matter of course. It is expected that components will be cleaned and lubricated where appropriate, and that any opened hose or pipe connections will be blanked to prevent excessive loss of hydraulic fluid and ingress of dirt.

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Battery Charging System Precautions

Obey the procedures below to prevent damage to the alternator and battery.

1 Ensure that the battery negative terminal is connected to the earthing cable.

2 Never make or break connections to the battery or alternator, or any part of the charging circuit whilst the engine is running. Disregarding this instruction will result in damage to the regulator or rectifying diodes.

3 Main output cables are 'live' even when the engine is not running. Take care not to earth connectors in the moulded plug if it is removed from the alternator.

4 When arc welding on the machine, protect the alternator by removing the moulded plug (or if separate output cables fitted, remove the cables).

5 If slave starting is necessary, connect the second battery in parallel without disconnecting the vehicle battery from the charging circuit. The slave battery may then be safely removed after a start has been obtained. Take care to connect batteries positive to positive, negative to negative.

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Hydraulic Rams

Installation

1 Precautions when installing the ram on the machine.

a When installing and removing from the machine, suspend the ram safely.

b Suspending the ram by the piping is not only dangerous, but can also cause damage to the cylinder.

c Secure the piston rod with a band. It is very dangerous if the rod extends unexpectedly. Also, the rod can be damaged and become unusable.

2 Welding after installing the ram may result in damage.

a If electric welding is done even at a point away from the ram, there may be sparking inside the ram and it will become necessary to replace the ram with a new one.

3 When painting the machine, mask the ram.

a If paint adheres to the rod surface or to the wiper ring and the ram is operated, the wiper ring will not function properly and foreign matter and paint can easily enter the ram. This will cause damage to the seals, drastically shortening the life of the ram.

4 Install the ram only when it is clean.

Caution During Use

1 Use only under designated conditions.

a If hydraulic oil other than the designated oil is used, the seals quickly degenerate and become damaged. If the relief valve is set at a value higher than specified, it may cause ram damage and is dangerous.

b In high temperature environments (approx. 90°C and above) or low temperature environments (below -20°C), seals quickly become damaged. Special seal materials are necessary so check to see if the ram that you are using is suitable or not.

c The number one cause of ram oil leakage is rod damage. Be careful not to damage the rod.

2 Warm up sufficiently before beginning work.

a In cold conditions the rod seals may be frozen, so if the ram is operated at maximum pressure and maximum speed, the seals will be damaged.

b There is a large amount of air in a new ram or one which has been left for a long time, so the ram will not operate smoothly. Also, if pressure is applied suddenly without bleeding the air, high temperatures will be generated due to adiabatic compression and the seals may burn.

c Before beginning work, always move the ram at full stroke with no load and expel air from the cylinder.

3 When stopping or storing, do it at a safe and fixed position.

a The installed ram cannot maintain the same position for a long period of time, because the oil inside the ram may leak and the hydraulic oil volume decreases as it cools. Stop or store the machine in a safe and fixed position.

Maintenance, Inspection Points

1 Carry out daily maintenance and inspection.

a The key point for correct long-term ram function is daily maintenance and inspection. Carry out maintenance and inspection so that the ram functions fully at all times. Always remove any mud, water, dust or oil film adhering to the rod and keep it in normal condition. However, when cleaning the wiper ring and seals, do not get them wet with water but wipe clean with a rag. To prevent rust forming during storage, the amount of exposed ram piston rod should be kept to a minimum. If leaving for more than one week, apply a light coating of suitable grease or petroleum jelly to the exposed part of the ram piston rod.

2 Use genuine JCB parts when replacing parts.

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a If parts other than genuine JCB parts are used, the desired results may not be obtained. Use only genuine JCB parts.

3 Caution during dismantling and reassembly.

a Dismantling the ram while it is still installed on the machine can be dangerous as unexpected movements of the machine can occur. Remove the ram from the machine and then dismantle.

b If reassembled with dirty hands, foreign matter can enter the ram causing a shorter life span and also the other hydraulic equipment may be damaged. Reassemble in a clean state.

c Follow the instructions in the diagrams regarding torque tightening for screwed parts. If the torque is too high or too low, it can cause damage.

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Section 3

Routine Maintenance

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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 Data Systems

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Introduction

Health and Safety

Lubricants

T3-060_2

Introduction

It is most important that you read and understand this information and the publications referred to. Make sure all your colleagues who are concerned with lubricants read it too.

Hygiene

JCB lubricants are not a health risk when used properly for their intended purposes.

However, excessive or prolonged skin contact can remove the natural fats from your skin, causing dryness and irritation.

Low viscosity oils are more likely to do this, so take special care when handling used oils, which might be diluted with fuel contamination.

Whenever you are handling oil products you should maintain good standards of care and personal and plant hygiene. For details of these precautions we advise you to read the relevant publications issued by your local health authority, plus the following.

Storage

Always keep lubricants out of the reach of children.

Never store lubricants in open or unlabelled containers.

Waste Disposal

⚠ 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.

INT-3-2-14

All waste products should be disposed of in accordance with all the relevant regulations.

The collection and disposal of used oil should be in accordance with any local regulations. Never pour used engine oil into sewers, drains or on the ground.

Handling

⚠ WARNING

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.

INT-3-2-3

New Oil

There are no special precautions needed for the handling or use of new oil, beside the normal care and hygiene practices.

Used Oil

Used engine crankcase lubricants contain harmful contaminants.

Here are precautions to protect your health when handling used engine oil:

1 Avoid prolonged, excessive or repeated skin contact with used oil.

2 Apply a barrier cream to the skin before handling used oil. Note the following when removing engine oil from skin:

   a Wash your skin thoroughly with soap and water.

   b Using a nail brush will help.

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c Use special hand cleansers to help clean dirty hands.

d Never use petrol, diesel fuel, or paraffin for washing.

3 Avoid skin contact with oil soaked clothing.

4 Don't keep oily rags in pockets.

5 Wash dirty clothing before re-use.

6 Throw away oil-soaked shoes.

First Aid - Oil

Eyes

In the case of eye contact, flush with water for 15 minutes. If irritation persists, get medical attention.

Swallowing

If oil is swallowed do not induce vomiting. Get medical advice.

Skin

In the case of excessive skin contact, wash with soap and water.

Spillage

Absorb on sand or a locally approved brand of absorbent granules. Scrape up and remove to a chemical disposal area.

Fires

⚠ WARNING

Do not use water to put out an oil fire. This will only spread it because oil floats on water.

Extinguish oil and lubricant fires with carbon dioxide, dry chemical or foam. Fire fighters should use self contained breathing apparatus.

7-3-1-3_1

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Battery

T3-061

⚠ WARNING

Batteries give off an explosive gas. Do not smoke when handling or working on the battery. Keep the battery away from sparks and flames.

Battery electrolyte contains sulphuric acid. It can burn you if it touches your skin or eyes. Wear goggles. Handle the battery carefully to prevent spillage. Keep metallic items (watches, rings, zips etc) away from the battery terminals. Such items could short the terminals and burn you.

Set all switches to OFF before disconnecting and connecting the battery. When disconnecting the battery, take off the earth (-) lead first.

Re-charge the battery away from the machine, in a well ventilated area. Switch the charging circuit off before connecting or disconnecting the battery. When you have installed the battery in the machine, wait five minutes before connecting it up.

When reconnecting, fit the positive (+) lead first.

5-3-4-12

⚠ CAUTION

Do not disconnect the battery while the engine is running, otherwise the electrical circuits may be damaged.

INT-3-1-14

⚠ WARNING

Electrical Circuits

Understand the electrical circuit before connecting or disconnecting an electrical component. A wrong connection can cause injury and/or damage.

INT-3-1-4

⚠ DANGER

Electrolyte

Battery electrolyte is toxic and corrosive. Do not breathe the gases given off by the battery. Keep the electrolyte away from your clothes, skin, mouth and eyes. Wear safety glasses.

INT-3-2-1_3

⚠ CAUTION

Damaged or spent batteries and any residue from fires or spillage should be put in a closed acid proof receptacle and must be disposed of in accordance with local environmental waste regulations.

INT-3-1-12

⚠ WARNING

Battery Gases

Batteries give off explosive gases. Keep flames and sparks away from the battery. Do not smoke close to the battery. Make sure there is good ventilation in closed areas where batteries are being used or charged. Do not check the battery charge by shorting the terminals with metal; use a hydrometer or voltmeter.

INT-3-1-8

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Warning Symbols

The following warning symbols may be found on the battery.

Symbol	Meaning
A289230-1	Keep away from children.
A289260-1	Shield eyes.
A289280	No smoking, no naked flames, no sparks.
A289250	Explosive Gas.
A289240	Battery acid.
A289270	Note operating instructions.

First Aid - Electrolyte

Do the following if electrolyte:

Gets into your eyes

Immediately flush with water for 15 minutes, always get medical help.

Is swallowed

Do not induce vomiting. Drink large quantities of water or milk. Then drink milk of magnesia, beaten egg or vegetable oil. Get medical help.

Gets onto your skin

Flush with water, remove affected clothing. Cover burns with a sterile dressing then get medical help.

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Service Schedules - Machines with SD and SF Engines

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	General Information	***Fuel***
2	ALL (Care and Safety)(1)	ALL

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

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Introduction

A badly maintained machine is a danger to the operator and the people working around him. Make sure that the regular maintenance and lubrication jobs listed in the service schedules are done to keep the machine in a safe and efficient working condition.

⚠ WARNING

Maintenance must be done only by suitably qualified and competent persons. Before doing any maintenance make sure the machine is safe. It should be correctly parked on firm level ground.

To prevent anyone starting the engine, remove the starter key. Disconnect the battery and block the wheels when you are working beneath the machine.

If you do not take these precautions you could be killed or injured.

9-3-1-1

Apart from the daily jobs, the schedules are based on machine running hours. Keep a regular check on the hourmeter readings to correctly gauge service intervals. Do not use a machine which is due for a service. Make sure any defects found during the regular maintenance checks are rectified immediately.

Fuel System

Important: *B20 Biodiesel must only be used in engines built after January 2007 only.*

If Biodiesel fuel is used there are additional service procedures which must be carried out to prevent engine damage. Failure to adhere to these additional procedures may invalidate the warranty.

For these additional procedures see ⇨ ***Related Topics (3-2-1)***

How to Use the Service Schedules

In the example shown, **A** shows all service requirements to be carried out every 10 hours and **B** shows the requirements to be carried out every 500 hours.

Important: *Services should be carried out at either the hourly interval or calendar interval, whichever occurs first. Refer to* ⇨ ***Calendar Equivalents (3-2-2)***

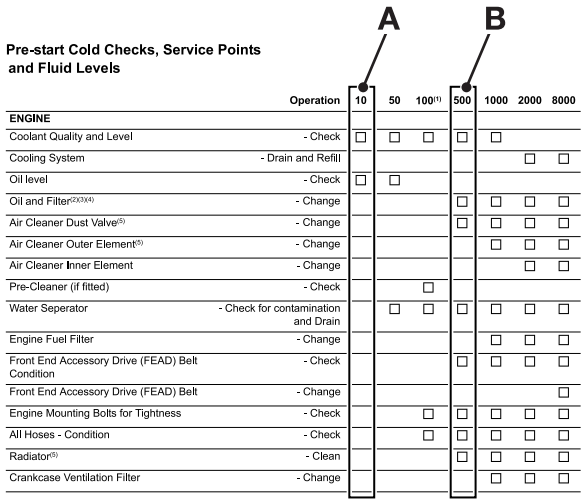

Fig 1.

Calendar Equivalents

Every 10 Hours = Daily
Every 50 Hours = Weekly
Every 500 Hours = Six Months
Every 1000 Hours = Yearly
Every 2000 Hours = 2 Years
Every 6000 Hours = 6 Years

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Pre-start Cold Checks, Service Points and Fluid Levels

	Operation	10	50	100[1]	500	1000	2000	6000
ENGINE								
Coolant Quality and Level	- Check	☐	☐	☐	☐	☐		
Cooling System	- Drain and Refill						☐	☐
Oil level	- Check	☐	☐					
Oil and Filter[2][3][4]	- Change				☐	☐	☐	☐
Air Cleaner Dust Valve[5]	- Clean				☐	☐	☐	☐
Air Cleaner Outer Element[5]	- Change				☐	☐	☐	☐
Air Cleaner Inner Element	- Change						☐	☐
Pre-Cleaner (if fitted)	- Check			☐				
Water Separator and Engine Fuel Filter	- Drain		☐	☐	☐	☐	☐	☐
Water Separator Fuel Filter[6]	- Change				☐	☐	☐	☐
Engine Fuel Filter[6]	- Change					☐	☐	☐
Front End Accessory Drive (FEAD) Belt Condition	- Check				☐	☐	☐	☐
Front End Accessory Drive (FEAD) Belt	- Change							☐
Engine Mounting Bolts for Tightness	- Check			☐	☐	☐	☐	☐
All Hoses - Condition	- Check			☐	☐	☐	☐	☐
Radiator[5]	- Clean				☐	☐	☐	☐
Breather Gauze (if fitted)	- Clean						☐	☐
Valve Clearances[7]	- Check and Adjust						☐	☐
Oil Filler and Dipstick Seals	- Change						☐	☐
Rocker Cover and Injector Seals[7]	- Change						☐	☐
Injectors[7]	- Change							☐
Injector(s) Leak Off Rail[7]	- Change							☐
High Pressure Fuel Lines[7]	- Change							☐
TRANSMISSION, AXLES AND STEERING								
Transmission Mount Security	- Check			☐				
Transmission Oil Level	- Check	☐	☐	☐	☐			
Transmission Oil[8]	- Change					☐	☐	☐
Transmission Oil Filter	- Change			☐	☐	☐	☐	☐

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Pre-start Cold Checks, Service Points and Fluid Levels

	Operation	10	50	100[1]	500	1000	2000	6000
Axle Mount Security	- Check			☐				
Axle(s) Oil Level	- Check		☐	☐				
Axle(s) Oil	- Change				☐	☐	☐	☐
Hub Oil Level (Without Oil Immersed Brakes)	- Check			☐				
Hub Oil (Without Oil Immersed Brakes)[9]	- Change					☐	☐	☐
Hub Oil (With Oil Immersed Brakes)[9]	- Change			☐	☐	☐	☐	☐
Axle Breather(s)	- Check			☐	☐	☐	☐	☐
Trunnion Bearings[7]	- Check/Adjust			☐	☐	☐	☐	☐
Steering Stops (if fitted)	- Security			☐	☐	☐	☐	☐
Front Hub Bearings	- Check			☐	☐	☐	☐	☐
Wheel Nut Security	- Check	☐	☐	☐	☐	☐	☐	☐
Tyre Pressures/Condition	- Check	☐	☐	☐	☐	☐	☐	☐
Wheel Alignment	- Check	☐	☐	☐	☐	☐	☐	☐
Transmission Strainer	- Clean					☐	☐	☐
Drive Shafts and Universal Joints[10]	- Security and Grease			☐	☐	☐	☐	☐
Axle Pivots and Linkages[10]	- Grease		☐	☐	☐	☐	☐	☐
HYDRAULICS								
Oil Level	- Check		☐	☐	☐	☐		
Oil[7]	- Sample, Change						☐	☐
Oil Filter[11]	- Change			☐	☐	☐	☐	☐
Suction Strainer	- Clean						☐	☐
Pilot Filter (if fitted)	- Change			☐	☐	☐	☐	☐
BRAKES								
Brake System Fluid Level	- Check	☐	☐	☐	☐	☐		
Brake System Fluid	- Change						☐	☐
Brake Plate Condition	- Check					☐	☐	☐
ELECTRICS								
Battery Electrolyte Level (if applicable)	- Check				☐	☐	☐	☐
Wiring for Chafing/Routing	- Check			☐	☐	☐	☐	☐
Battery Terminals for Condition and Tightness	- Check			☐	☐	☐	☐	☐
BODYWORK AND CAB								

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Pre-start Cold Checks, Service Points and Fluid Levels

	Operation	10	50	100(1)	500	1000	2000	6000
Lift/Displacement/Tilt/Steer Ram Pivot Pins	- Grease		☐		☐	☐	☐	☐
Extension Ram Piston Rod Pivot Pin	- Grease					☐	☐	☐
All Other Pivot Pins	- Grease		☐	☐	☐	☐	☐	☐
Fire Extinguisher (if fitted)	- Check	☐	☐		☐	☐	☐	☐
Wing Mirrors Condition and Security	- Check	☐	☐		☐	☐	☐	☐
ROPS/FOPS Structure	- Check	☐	☐	☐	☐	☐	☐	☐
Doors and Hinges	- Lubricate			☐	☐	☐	☐	☐
Control Lever Linkages	- Lubricate			☐	☐	☐	☐	☐
Windscreen Washer Fluid Level	- Check	☐	☐	☐	☐	☐	☐	☐
Cab Heater Fresh Air Filter (if fitted)	- Change				☐	☐	☐	☐
Cab Heater Re-Circulation Filter (if fitted)	- Change				☐	☐	☐	☐
Boom Wear Pad Runways	- Waxoyl				☐	☐	☐	☐
Inner Boom Hoses	- Grease				☐	☐	☐	☐
Boom Wear Pad Clearance (12)	- Check/Adjust				☐	☐	☐	☐
Boom Wear Pad Condition and Security (Replace if required)(12)	- Check/Adjust			☐	☐	☐	☐	☐
ATTACHMENTS								
Carriage Lock Pins	- Grease		☐		☐	☐	☐	☐
Hydraulic Tow Hitch Inner Leg (if fitted)	- Waxoyl				☐	☐	☐	☐
Hydraulic Tow Hitch Pivot Pin (if fitted)	- Grease				☐	☐	☐	☐
Hydraulic Tow Hitch Release Cable/Return Spring/Retaining Latch (if fitted)	- Check		☐		☐	☐	☐	☐
REGISTRATION/CERTIFICATION								
SWL Stickers (UK) and Flip Chart	- Renew as Required	☐	☐	☐	☐	☐	☐	☐

(1) First 100 Hours Service only, to be completed by your JCB Distributor.
(2) 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.
(3) The oil service interval will be affected if there is a high sulphur content in the fuel. Refer to Fuel System for more information.
(4) When the engine is operated with 20% biodiesel change the engine oil and filter every 250 hours. Refer to Fuel System for more information.
(5) More frequently if operating in dusty working environments.
(6) If the engine is difficult to start or the engine has poor performance, fit new filters.
(7) Jobs which should only be done by a specialist.
(8) After a major transmission repair, the new oil should be run to operating temperature and changed again to remove any contamination which entered during the repair. Change the oil and filter after a further 100 hours if the oil was heavily contaminated because of, or from the failure (e.g. water contamination).

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(9) After a hub repair, the new oil should be run to operating temperature and changed again to remove any contamination which entered during the repair. Change the oil after a further 100 hours to remove any bedding-in wear. This is particularly important if new brake plates have been fitted.

(10) The axles and driveshafts are factory greased with a high performance grease, if during service a standard grease is used, then the interval must be reduced to every 50 hours, contact your JCB Distributor for advice.

(11) An additional canister filter is fitted to machines with the variable flow pump option. You must change both filters at the intervals shown in the Service Schedule.

(12) If operating under arduous conditions, check the boom wear pads every 250 hours.

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Functional Test and Final Inspection

	Operation	10	50	100(1)	500	1000	2000	6000
ENGINE								
Idle Speed(2)	- Check and Adjust			☐	☐	☐	☐	☐
Torque Converter Stall Speed(2)	- Check			☐	☐	☐	☐	☐
Max. No-Load Speed(2)	- Check and Adjust			☐	☐	☐	☐	☐
Exhaust Smoke	- Check		☐	☐	☐	☐	☐	☐
Exhaust System Security(2)	- Check			☐	☐	☐	☐	☐
Air Inlet System Security	- Check			☐	☐	☐	☐	☐
Throttle System and Control Cable(2)	- Check			☐	☐	☐	☐	☐
Engine for Vibration/Noise								
TRANSMISSION, AXLES AND STEERING								
Steering - Operation/Phasing	- Check	☐	☐	☐	☐	☐	☐	☐
2WD/4WD Selection (if fitted)	- Check			☐	☐	☐	☐	☐
Transmission Operation	- Check	☐	☐	☐	☐	☐	☐	☐
Forward/Reverse/Gear - Selection/ Operation	- Check			☐	☐	☐	☐	☐
Torque Converter Main Line Pressure(2)	- Check			☐	☐	☐	☐	☐
Neutral Start Operation	- Check			☐	☐	☐	☐	☐
Clutch Disconnect/Dump Pedal/Button	- Check			☐	☐	☐	☐	☐
HYDRAULICS								
MRV Pressure at Max RPM(2)	- Check and Adjust			☐	☐	☐	☐	☐
Operation of All Services	- Check	☐	☐	☐	☐	☐	☐	☐
Hose Burst Protection Valves (if fitted)	- Check			☐	☐	☐	☐	☐
ARV Pressure at 750 RPM(2)	- Check and Adjust			☐	☐	☐	☐	☐
Steer Circuit MRV Pressure(2)	- Check and Adjust			☐	☐	☐	☐	☐
Fan Motor Speed (If fitted)(2)	- Check				☐	☐	☐	☐
Attachment Operation/Remote Servo (if fitted)	- Check			☐	☐	☐	☐	☐
Piston Rods Chrome	- Check			☐	☐	☐	☐	☐
Boom Extension/Phasing (3 stage boom)(2)	- Check	☐	☐	☐	☐	☐	☐	☐
Parallel Lift/Lower	- Check			☐	☐	☐	☐	☐
Stabilizer Leg Cut-out (if fitted)(2)	- Check			☐	☐	☐	☐	☐

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Functional Test and Final Inspection

	Operation	10	50	100(1)	500	1000	2000	6000
Chassis Levelling (Sway) Cut-out (if fitted)(2)	- Check			☐	☐	☐	☐	☐
BRAKES								
Foot Brake - Operation	- Check	☐	☐	☐	☐	☐	☐	☐
Park Brake	- Check/Adjust	☐	☐	☐	☐	☐	☐	☐
ELECTRICS								
Starter Motor(2)	- Check			☐	☐	☐	☐	☐
Alternator - Output(2)	- Check			☐	☐	☐	☐	☐
All Electrical Equipment Operation, (warning lights, beacon, alarms, horn, wipers etc.)	- Check	☐	☐	☐	☐	☐	☐	☐
Load Moment Indicator(2)	- Check/Calibrate	☐	☐	☐	☐	☐	☐	☐
Stabilizer Indicators	- Check	☐	☐	☐	☐	☐	☐	☐
BODYWORK AND CAB								
Inclinometer (if fitted)(2)	- Check			☐	☐	☐	☐	☐
Glazing for Correct Fit/Leaks	- Check			☐				
Seat/Seat Belts	- Check	☐	☐	☐	☐	☐	☐	☐
Air Conditioning (if fitted)	- Check			☐	☐	☐	☐	☐
Forks	- Fit and Check Security	☐	☐	☐	☐	☐	☐	☐
Generally for damage, leaks and wear	- Check	☐	☐	☐	☐	☐	☐	☐

(1) First 100 Hours Service only, to be completed by your JCB Distributor.
(2) Jobs which should only be done by a specialist.

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Service Schedules - Machines with SE Engines

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	***General Information***	***Fuel***
2	ALL (Care and Safety)(1)	ALL
2	***Safety Check List***	***Common Rail (SE Engine) Specific***

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

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Introduction

A badly maintained machine is a danger to the operator and the people working around him. Make sure that the regular maintenance and lubrication jobs listed in the service schedules are done to keep the machine in a safe and efficient working condition.

⚠ WARNING

Maintenance must be done only by suitably qualified and competent persons.

Before doing any maintenance make sure the machine is safe, it should be correctly parked on level ground.

To prevent anyone starting the engine, remove the starter key. Disconnect the battery when you are not using electrical power. If you do not take these precautions you could be killed or injured.

8-3-1-1

Apart from the daily jobs, the schedules are based on machine running hours. Keep a regular check on the hourmeter readings to correctly gauge service intervals. Do not use a machine which is due for a service. Make sure any defects found during the regular maintenance checks are rectified immediately.

Calendar Equivalents

Calendar equivalents:

Every 10 Hours = Daily

Every 50 Hours = Weekly

Every 500 Hours = Six Months

Every 1000 Hours = Yearly

Every 2000 Hours = 2 Years

Every 8000 Hours = 8 Years

Note: *Services should be carried out at either the hourly interval or calendar interval, whichever occurs first.*

How to Use the Service Schedules

In the example shown, A shows all service requirements to be carried out every 10 hours and B shows the requirements to be carried out every 500 hours.

Important: *Services should be carried out at either the hourly interval or calendar interval, whichever occurs first. Refer to* ⇨ ***Calendar Equivalents (3-3-2)***

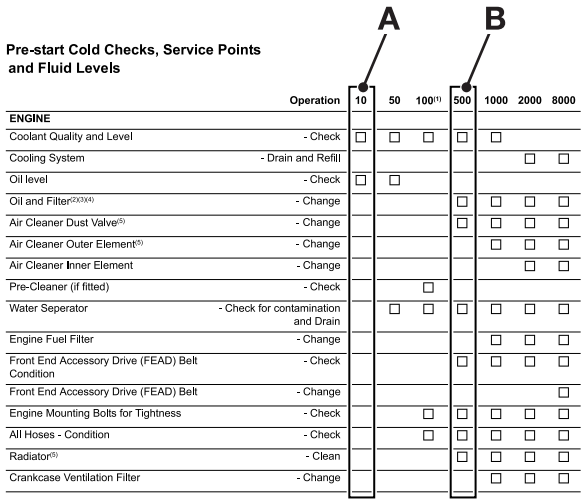

Fig 1.

Fuel System

Important: *B20 Biodiesel must only be used in engines built after January 2007 only.*

If Biodiesel fuel is used there are additional service procedures which must be carried out to prevent engine damage. Failure to adhere to these additional procedures may invalidate the warranty.

For these additional procedures see ⇨ ***Related Topics (3-3-1)***

SE Engines

In addition to the general safety notices and general good workshop practices issued in this section and throughout the manual, there are specific points to note when completing maintenance on SE engine equipment. Refer to ⇨ ***Related Topics (3-3-1)***

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Pre-start Cold Checks, Service Points and Fluid Levels

	Operation	10	50	100(1)	500	1000	2000	8000
ENGINE								
Coolant Quality and Level	- Check	☐	☐	☐	☐	☐		
Cooling System	- Drain and Refill						☐	☐
Oil level	- Check	☐	☐					
Oil and Filter(2)(3)(4)	- Change				☐	☐	☐	☐
Air Cleaner Dust Valve(5)	- Clean				☐	☐	☐	☐
Air Cleaner Outer Element(5)	- Change					☐	☐	☐
Air Cleaner Inner Element	- Change						☐	☐
Pre-Cleaner (if fitted)	- Check			☐				
Water Separator	- Check for contamination and Drain		☐	☐	☐	☐	☐	☐
Water Separator Fuel Filter(6)	- Change				☐	☐	☐	☐
Engine Fuel Filter(6)	- Change					☐	☐	☐
Front End Accessory Drive (FEAD) Belt Condition	- Check				☐	☐	☐	☐
Front End Accessory Drive (FEAD) Belt	- Change							☐
Powertrain Mounting Bolts for Tightness	- Check			☐	☐	☐	☐	☐
All Hoses - Condition	- Check			☐	☐	☐	☐	☐
Radiator(5)	- Clean				☐	☐	☐	☐
Crankcase Ventilation Filter (if fitted)	- Change					☐	☐	☐
Valve Clearances(7)	- Check and Adjust						☐	☐
Oil Filler and Dipstick Seals	- Change						☐	☐
Injectors(7)	- Change							☐
Injector(s) Leak Off Rail(7)	- Change							☐
High Pressure Fuel Lines(7)	- Change							☐
TRANSMISSION, AXLES AND STEERING								
Transmission Mount Security	- Check			☐				
Transmission Oil Level	- Check	☐	☐	☐	☐			
Transmission Oil(8)	- Change					☐	☐	☐
Transmission Oil Filter	- Change			☐	☐	☐	☐	☐
Axle Mount Security	- Check			☐				

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	Operation	10	50	100[1]	500	1000	2000	8000
Axle(s) Oil Level	- Check		☐	☐				
Axle(s) Oil	- Change				☐	☐	☐	☐
Hub Oil Level (Without Oil Immersed Brakes)	- Check			☐				
Hub Oil (Without Oil Immersed Brakes)[9]	- Change					☐	☐	☐
Hub Oil (With Oil Immersed Brakes)[9]	- Change			☐	☐	☐	☐	☐
Axle Breather(s)	- Check			☐	☐	☐	☐	☐
Steering Stops (if fitted)	- Security			☐	☐	☐	☐	☐
Wheel Nut Security	- Check	☐	☐	☐	☐	☐	☐	☐
Tyre Pressures/Condition	- Check	☐	☐	☐	☐	☐	☐	☐
Wheel Alignment	- Check	☐	☐	☐	☐	☐	☐	☐
Transmission Strainer	- Clean					☐	☐	☐
Drive Shafts and Universal Joints[10]	- Security and Grease			☐	☐	☐	☐	☐
Axle Pivots and Linkages[10]	- Grease		☐	☐	☐	☐	☐	☐
HYDRAULICS								
Oil Level	- Check		☐	☐	☐	☐		
Oil[7]	- Sample, Change						☐	☐
Oil Filter[11]	- Change			☐	☐	☐	☐	☐
Suction Strainer	- Clean						☐	☐
Pilot Filter (if fitted)	- Change			☐	☐	☐	☐	☐
BRAKES								
Brake System Fluid Level	- Check	☐	☐	☐	☐	☐		
Brake System Fluid	- Change						☐	☐
ELECTRICS								
Battery Electrolyte Level (if applicable)	- Check				☐	☐	☐	☐
Battery Terminals for Condition and Tightness	- Check			☐	☐	☐	☐	☐
BODYWORK AND CAB								
Lift/Displacement/Tilt/Steer Ram Pivot Pins	- Grease		☐		☐	☐	☐	☐
Extension Ram Piston Rod Pivot Pin	- Grease					☐	☐	☐
All Other Pivot Pins	- Grease		☐	☐	☐	☐	☐	☐
Fire Extinguisher (if fitted)	- Check	☐	☐		☐	☐	☐	☐
Wing Mirrors Condition and Security	- Check	☐	☐		☐	☐	☐	☐

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	Operation	10	50	100(1)	500	1000	2000	8000
ROPS/FOPS Structure	- Check	☐	☐	☐	☐	☐	☐	☐
Doors and Hinges	- Lubricate			☐	☐	☐	☐	☐
Control Lever Linkages	- Lubricate			☐	☐	☐	☐	☐
Windscreen Washer Fluid Level	- Check	☐	☐	☐	☐	☐	☐	☐
Cab Heater Fresh Air Filter (if fitted)	- Change				☐	☐	☐	☐
Boom Wear Pad Runways	- Waxoyl				☐	☐	☐	☐
Inner Boom Hoses	- Grease				☐	☐	☐	☐
Boom Wear Pad Clearance (12)	- Check/Adjust				☐	☐	☐	☐
Boom Wear Pad Condition and Security (Replace if required)(12)	- Check/Adjust			☐	☐	☐	☐	☐
ATTACHMENTS								
Carriage Lock Pins	- Grease		☐		☐	☐	☐	☐
Hydraulic Tow Hitch Inner Leg (if fitted)	- Waxoyl				☐	☐	☐	☐
Hydraulic Tow Hitch Pivot Pin (if fitted)	- Grease				☐	☐	☐	☐
Hydraulic Tow Hitch Release Cable/ Return Spring/Retaining Latch (if fitted)	- Check		☐		☐	☐	☐	☐
REGISTRATION/CERTIFICATION								
SWL Stickers (UK) and Flip Chart	- Renew as Required	☐	☐	☐	☐	☐	☐	☐

(1) First 100 Hours Service only, to be completed by your JCB Distributor.
(2) 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.
(3) The oil service interval will be affected if there is a high sulphur content in the fuel. Refer to Fuel System for more information.
(4) When the engine is operated with 20% biodiesel change the engine oil and filter every 250 hours. Refer to Fuel System for more information.
(5) More frequently if operating in dusty working environments.
(6) If the engine is difficult to start or the engine has poor performance, fit new filters.
(7) Jobs which should only be done by a specialist.
(8) After a major transmission repair, the new oil should be run to operating temperature and changed again to remove any contamination which entered during the repair. Change the oil and filter after a further 100 hours if the oil was heavily contaminated because of, or from the failure (e.g. water contamination).
(9) After a hub repair, the new oil should be run to operating temperature and changed again to remove any contamination which entered during the repair. Change the oil after a further 100 hours to remove any bedding-in wear. This is particularly important if new brake plates have been fitted.
(10) The axles and driveshafts are factory greased with a high performance grease, if during service a standard grease is used, then the interval must be reduced to every 50 hours, contact your JCB Distributor for advice.
(11) An additional canister filter is fitted to machines with the variable flow pump option. You must change both filters at the intervals shown in the Service Schedule.
(12) If operating under arduous conditions, check the boom wear pads every 250 hours.

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Functional Test and Final Inspection

	Operation	10	50	100(1)	500	1000	2000	8000
ENGINE								
Idle Speed(2)	- Check and Adjust			☐	☐	☐	☐	☐
Torque Converter Stall Speed(2)	- Check			☐	☐	☐	☐	☐
Max. No-Load Speed(2)	- Check and Adjust			☐	☐	☐	☐	☐
Exhaust System Security(2)	- Check			☐	☐	☐	☐	☐
Air Inlet System Security	- Check			☐	☐	☐	☐	☐
TRANSMISSION, AXLES AND STEERING								
Steering - Operation/Phasing	- Check	☐	☐	☐	☐	☐	☐	☐
2WD/4WD Selection (if fitted)	- Check			☐	☐	☐	☐	☐
Transmission Operation	- Check	☐	☐	☐	☐	☐	☐	☐
Forward/Reverse/Gear - Selection/ Operation	- Check			☐	☐	☐	☐	☐
Torque Converter Main Line Pressure(2)	- Check			☐	☐	☐	☐	☐
Neutral Start Operation	- Check			☐	☐	☐	☐	☐
Clutch Disconnect/Dump Button	- Check			☐	☐	☐	☐	☐
HYDRAULICS								
MRV Pressure at Max RPM(2)	- Check and Adjust			☐	☐	☐	☐	☐
Operation of All Services	- Check	☐	☐	☐	☐	☐	☐	☐
Hose Burst Protection Valves (if fitted)	- Check			☐	☐	☐	☐	☐
ARV Pressure at 750 RPM(2)	- Check and Adjust			☐	☐	☐	☐	☐
Steer Circuit MRV Pressure(2)	- Check and Adjust			☐	☐	☐	☐	☐
Fan Motor Speed (If fitted)(2)	- Check				☐	☐	☐	☐
Attachment Operation/Remote Servo (if fitted)	- Check			☐	☐	☐	☐	☐
Piston Rods Chrome	- Check			☐	☐	☐	☐	☐
Boom Extension/Phasing (3 stage boom)(2)	- Check	☐	☐	☐	☐	☐	☐	☐
Parallel Lift/Lower	- Check			☐	☐	☐	☐	☐
Stabiliser Leg Cut-out (if fitted)(2)	- Check			☐	☐	☐	☐	☐
Chassis Levelling (Sway) Cut-out (if fitted)(2)	- Check			☐	☐	☐	☐	☐

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	Operation	10	50	100(1)	500	1000	2000	8000
BRAKES								
Foot Brake - Operation	- Check	☐	☐	☐	☐	☐	☐	☐
Park Brake	- Check/Adjust	☐	☐	☐	☐	☐	☐	☐
ELECTRICS								
Alternator - Output(2)	- Check			☐	☐	☐	☐	☐
All Electrical Equipment Operation, (warning lights, beacon, alarms, horn, wipers etc.)	- Check	☐	☐	☐	☐	☐	☐	☐
Load Moment Indicator(2)	- Check	☐	☐	☐	☐	☐	☐	☐
Stabiliser Indicators	- Check	☐	☐	☐	☐	☐	☐	☐
BODYWORK AND CAB								
Inclinometer (if fitted)(2)	- Check			☐	☐	☐	☐	☐
Glazing for Correct Fit/Leaks	- Check			☐				
Seat/Seat Belts	- Check	☐	☐	☐	☐	☐	☐	☐
Air Conditioning (if fitted)	- Check			☐	☐	☐	☐	☐
Forks	- Fit and Check Security	☐	☐	☐	☐	☐	☐	☐
Generally for damage, leaks and wear	- Check	☐	☐	☐	☐	☐	☐	☐

(1) First 100 Hours Service only, to be completed by your JCB Distributor.
(2) Jobs which should only be done by a specialist.

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Fluids, Lubricants and Capacities

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	***General Information***	***Fuel***
2	ALL (Care and Safety)(1)	ALL

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

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Specifications

Table 2.

ITEM	CAPACITY Litres (Gal)	FLUID/LUBRICANT	SPECIFICATION	
			INTERNATIONAL	JCB
Fuel Tank		Diesel Oil	⇨ *Related Topics (3-4-1)*	
Machines up to August 2010				
535-125 HiViz, 535-140 HiViz, 540-140, 540-170	125 (27.5)			
Machines from August 2010	145 (31.9)			
Engine (Oil)		JCB Engine Oil EP -10°C to 50°C (14°F to 122°F)(1)(2)	SAE15W/40, ACEA E5/B3/A3, API CH-4/SJ	4001/1800
		JCB Cold Climate Engine Oil -20°C to 50°C (-4°F to 122°F)(1)(2)	EP 5W-40, SAE 5W-40, ACEA E5/B3/A3, API CH-4/SJ	4001/2700
- MIN	12.5 (2.75)			
- MAX	15 (3.3)			
Engine (Coolant)				
All Engines	22 (4.4)	JCB High Performance Antifreeze and Inhibitor/Water. ⇨ *Coolant Mixtures (3-4-4)*.	ASTM D6210	4006/1100
Transmission		JCB Extreme Performance Transmission Fluid(3)		
		-32°C to 40°C (-25°F to 104°F)	10W, EL4117	4000/2500
		-5°C to 40°C (-25°F to 104°F)	SAE30, EL4118	4000/2600
Machines with SC type engine and 4 speed gearbox only.				
- Wet fill	17 (3.7)			
- Dry fill	19 (4.2)			
Machines with SS700 Gearbox				
- Wet fill	11.5 (2.5)			
- Dry fill	13.5 (3.0)			
All other machines				
- Wet fill	21 (4.6)			
- Dry fill	23 (5.0)			
Front Axle				
Housing	17.7 (4.7)	JCB Gear Oil HP Plus	API-GL-4(4)	4000/2200
Hubs (x2)	1.9 (0.5)			
Rear Axle				
Housing		JCB Gear Oil HP Plus	API-GL-4(4)	4000/2200
535-125 HiViz, 535-140 HiViz	17.7 (4.7)			
540-140, 540-170	19 (4.2)			
Hubs (x2)	2 (0.5)			

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Specifications

ITEM	CAPACITY Litres (Gal)	FLUID/LUBRICANT	SPECIFICATION	
			INTERNATIONAL	JCB
Brake System		JCB Light Hydraulic Fluid(5)	ISO VG15	4002/0500
Hydraulic Tank(6)		JCB High Performance Hydraulic Oil		
		- Above 100 °F, 38 °C	ISO VG46	4002/0800
		- Below 100 °F, 38 °C	ISO VG32	4002/1000
535-125 HiViz, 535-140 Hiviz	127 (27.9)			
540-140	131 (28.8)			
540-170	180 (39)			
Grease Points		JCB Special HP Grease(8)	Lithium based, No. 2 consistency(7)	4003/2000
		JCB Special MPL-EP Grease(8)		4003/1500
Wear Pad Runways		JCB Waxoyl		4004/0500
Boom Hoses		JCB Special Slide Lubricant		4003/1100

(1) !CAUTION: Do not use ordinary engine oil.
(2) Superior grade oils may be more appropriate for heavy duty applications (such as sustained high loads and operation at elevated temperatures).
(3) Friction modified oils must not be used (e.g. Dexron ATF type).
(4) Must be suitable for use with oil immersed brakes and limited slip differentials (LSD).
(5) !CAUTION: Do not use ordinary brake fluid.
(6) This is nominal tank capacity. The total hydraulic system capacity depends on the equipment being used. Fill with all cylinders closed. Watch level sight glass when filling.
(7) Includes extreme performance additives.
(8) JCB HP Grease is the recommended specification grease. If JCB MPL Grease is used, all 50 hour greasing operations must be carried out at ten (10) hour intervals; all 500 hour greasing operations must be carried out at 50 hour intervals.

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Coolant Mixtures

T3-009_3

Check the strength of the coolant mixture at least once a year, preferably at the start of the cold period.

Replace the coolant mixture according to the intervals shown in the machine's Service Schedule.

⚠ WARNING

Antifreeze can be harmful. Obey the manufacturer's instructions when handling full strength or diluted antifreeze.

7-3-4-4_1

You must dilute full strength antifreeze with clean water before use. Use clean water of no more than a moderate hardness (pH value 8.5). If this cannot be obtained, use de-ionized water. For further information advice on water hardness, contact your local water authority.

The correct concentration of antifreeze protects the engine against frost damage in winter and provides year round protection against corrosion.

The protection provided by JCB High Performance Antifreeze and Inhibitor is shown below.

50% Concentration (Standard)

Protects against damage down to -40 °C (-39 °F)

60% Concentration (Extreme Conditions Only)

Protects against damage down to -56 °C (-68 °F)

Important: *Do not exceed a 60% concentration, as the freezing protection provided reduces beyond this point.*

If you use any other brand of antifreeze:

- Ensure that the antifreeze complies with International Specification ASTM D6210.
- Always read and understand the manufacturer's instructions.
- Ensure that a corrosion inhibitor is included. Serious damage to the cooling system can occur if corrosion inhibitors are not used.
- Ensure that the antifreeze is ethylene glycol based and does not use Organic Acid Technology (OAT).

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Cleaning the Machine

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	***General Information***	ALL
2	ALL (Care and Safety)(1)	ALL
3	***Greasing***	⇨ *Every 50 Hours (3-9-3)*
3	⇨ *Access Panels (3-21-1)*	ALL

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

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Introduction

T3-024

Clean the machine using water and or steam. Do not allow mud, debris etc. to build upon the machine.

Before carrying out any service procedures that require components to be removed:

1 Cleaning must be carried out either in the area of components to be removed or, in the case of major work, or work on the fuel system, the whole engine and surrounding machine must be cleaned.

2 When cleaning is complete move the machine away from the wash area, or alternatively, clean away the material washed from the machine.

Important: *When removing components be aware of any dirt or debris that may be exposed. Cover any open ports and clean away the deposits before proceeding.*

Detergents

Avoid using full strength detergent - always dilute detergents as per the manufacturer's recommendations, otherwise damage to the paint finish may occur.

Always adhere to local regulations regarding the disposal of debris created from machine cleaning.

Pressure Washing and Steam Cleaning

⚠ CAUTION

Never use water or steam to clean inside the cab. The use of water or steam could damage the on-board computer and render the machine inoperable. Remove dirt using a brush or damp cloth.

8-3-4-8

⚠ CAUTION

The engine or certain components could be damaged by high pressure washing systems; special precautions must be taken if the engine is to be washed using a high pressure system.

Ensure that the alternator, starter motor and any other electrical components are shielded and not directly cleaned by the high pressure cleaning system.

ENG-3-3

Important: *Do not aim the water jet directly at bearings, oil seals or electrical and electronic components such as the engine electronic control unit (ECU), alternator or fuel injectors.*

Use a low pressure water jet and brush to soak off caked mud or dirt.

Use a pressure washer to remove soft dirt and oil.

Note: *The machine must always be greased after pressure washing or steam cleaning.*

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