Open front screen

General Information

Service Manual - Side Engine Loadalls

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Notes:

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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

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					

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					

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					

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***		●	●	●	●	●	●

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***		●	●	●	●	●	●

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***		●	●	●	●	●	●

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***		●	●	●	●	●	●

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***		●	●	●	●	●	●

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***		●	●	●	●	●	●

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)***		●	●	●	●		

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***		●	●	●	●	●	●

Use

Introduction

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

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.

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.

Left and Right Sides

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

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).

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.*

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

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

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.

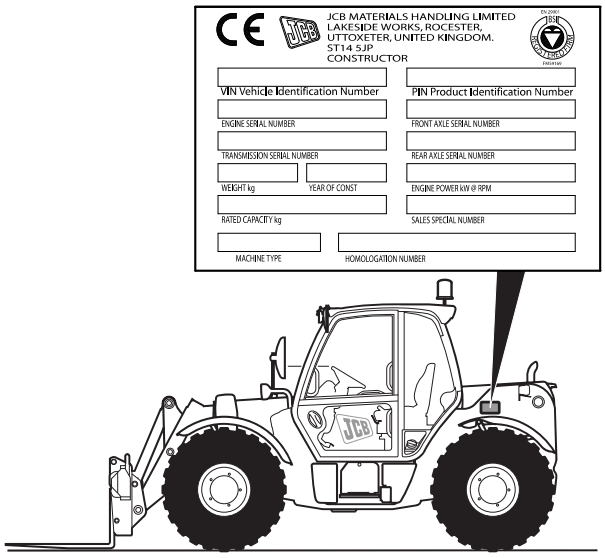

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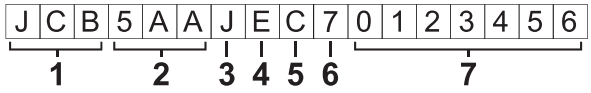
Fig 1.

Typical Product Identification Number (PIN)

Machines Built Before January 2010



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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)

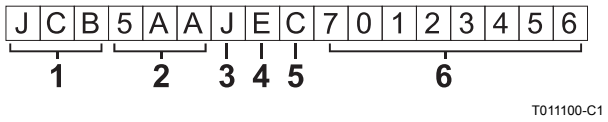
7 = 2007	A = 2010
8 = 2008	B = 2011
9 = 2009	C = 2012

7 Machine Serial Number (7 Digits)

Each machine has a unique serial number.

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.

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

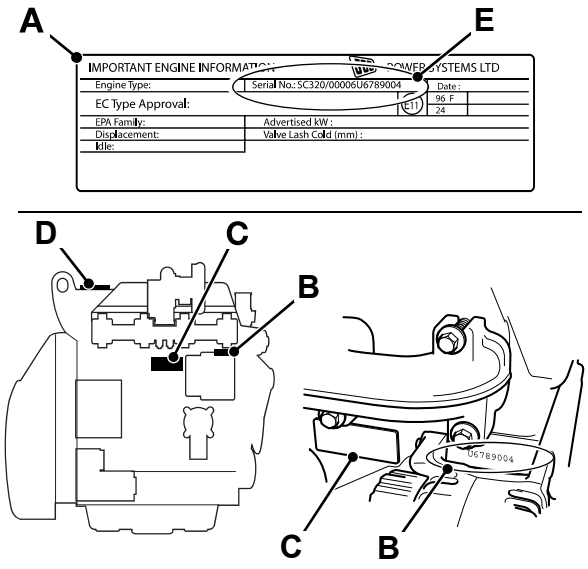


Fig 2. Engine

Transmission Identification Numbers

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

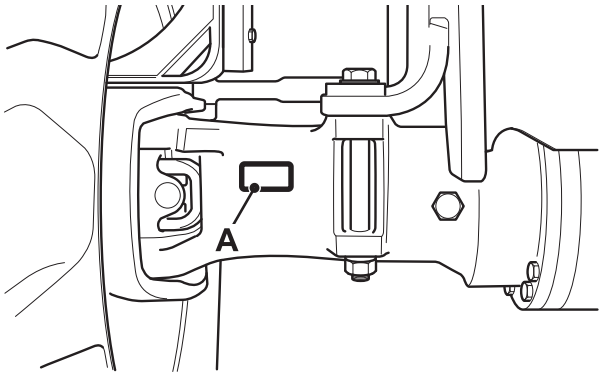


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Fig 3. Front Axle

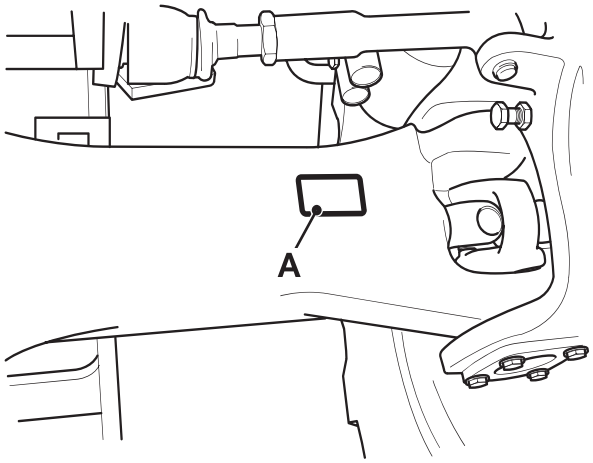

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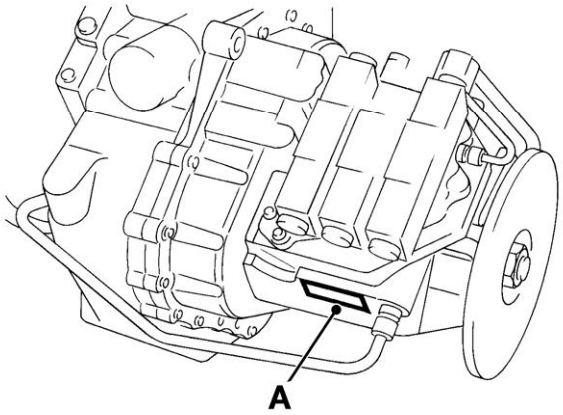
Fig 4. Rear Axle



263370-C1

Fig 5. PS750 Powershift Transmission

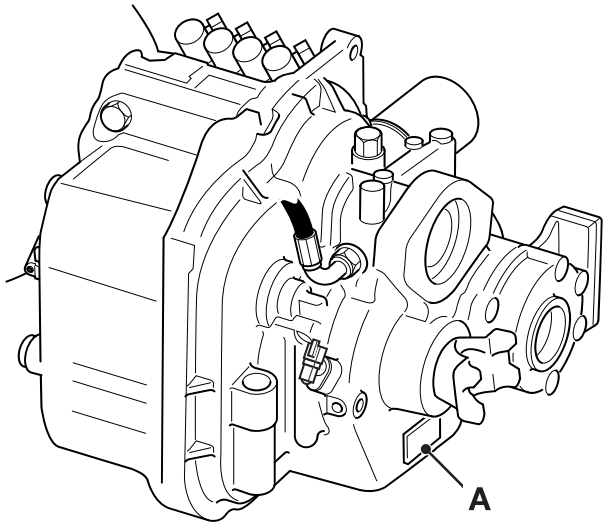


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Fig 6. PS760 Powershift Transmission

ROPS/FOPS and OECD Certification Plates

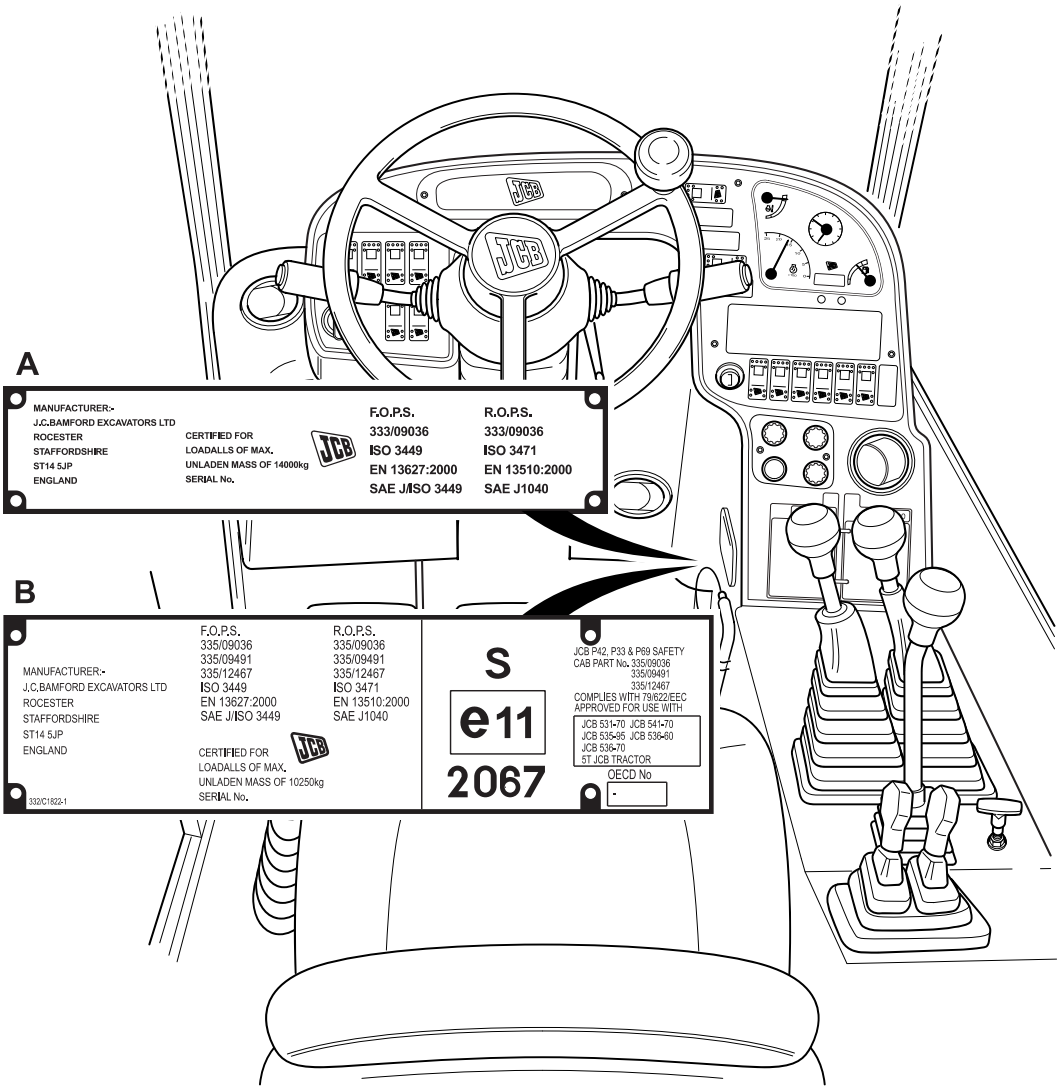

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Fig 7.

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

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

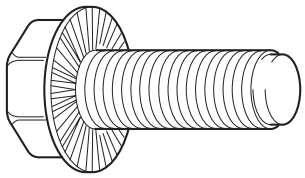

Fig 1.

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

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

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

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

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

Hoses Screwed into Adaptors

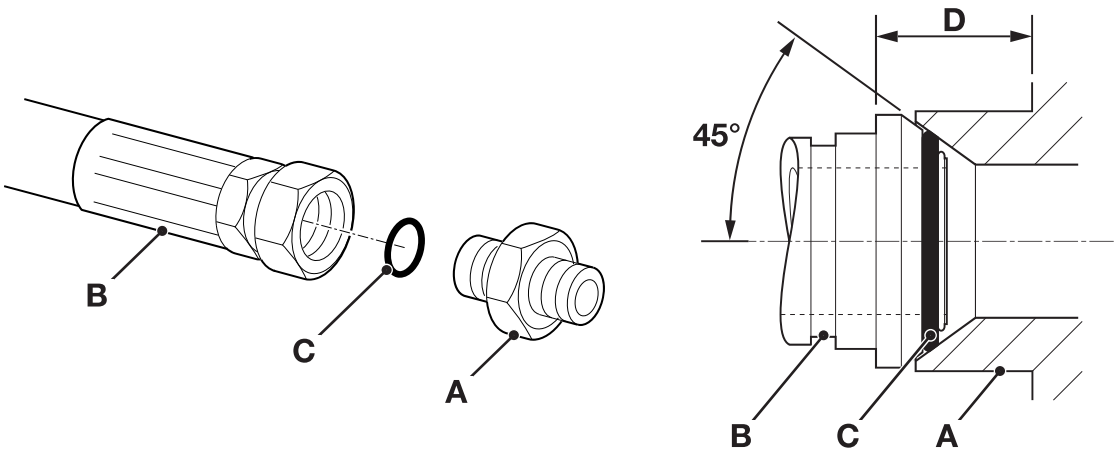

Fig 2.

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

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

'Torque Stop' Hose System

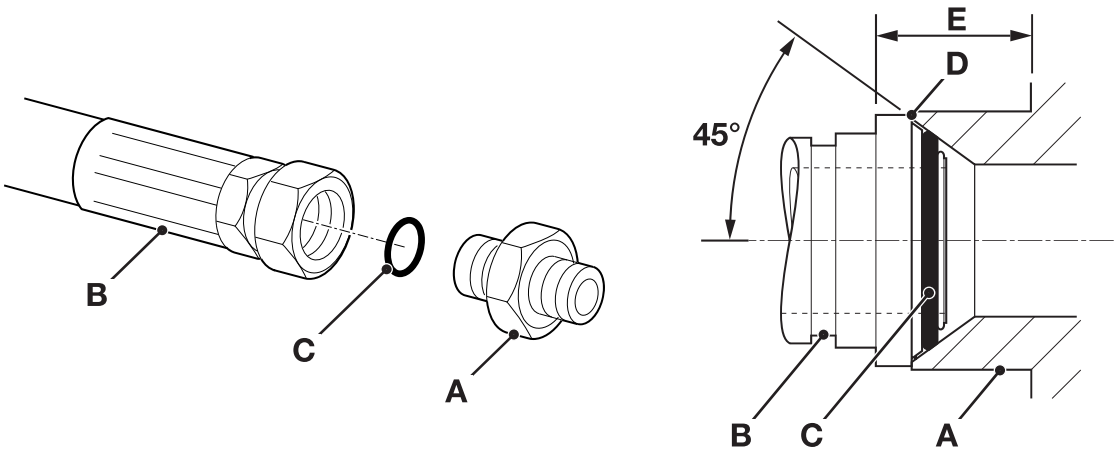

Fig 3.

`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

`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).

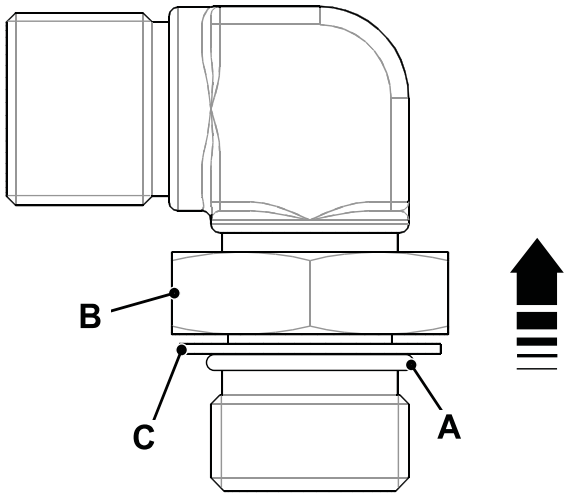

Fig 4.

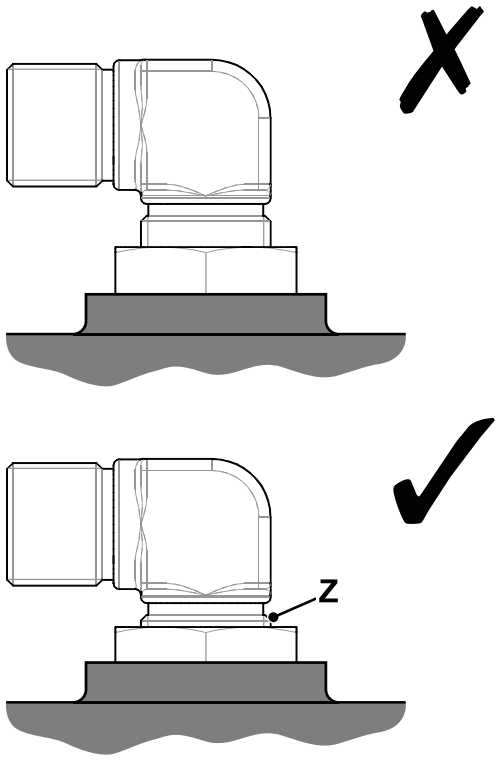

Fig 5.

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

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)

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)

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)*

Tool Detail Reference

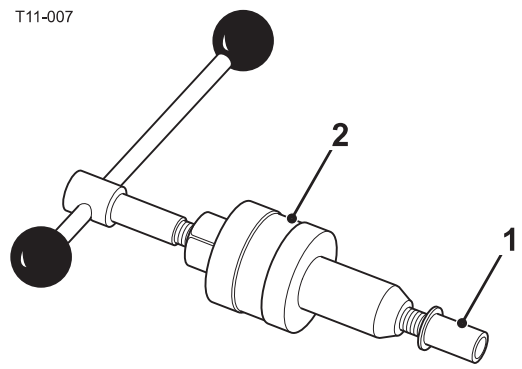

Fig 1. Rivet Nut Tool

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***)

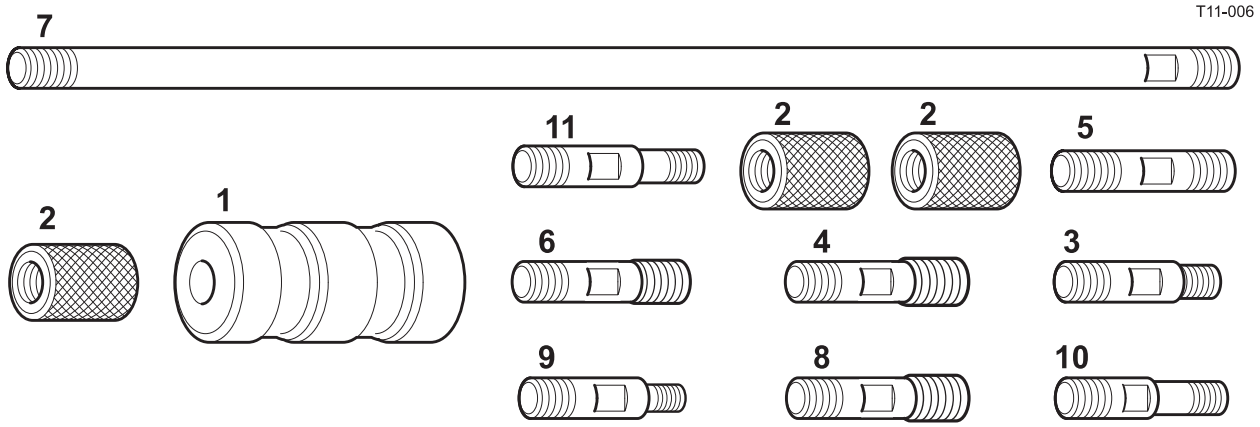

Fig 2. 993/68100 Slide Hammer Kit

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			

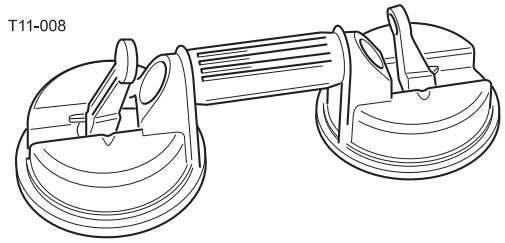

Fig 3. 892/00842 Glass Lifter

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

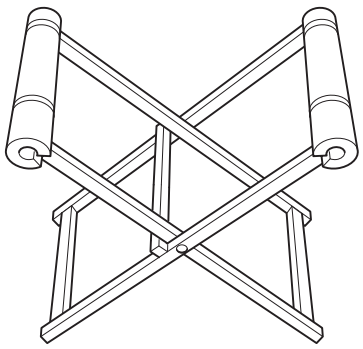

Fig 4. 892/00843 Folding Stand

Essential for preparing new glass prior to installation.

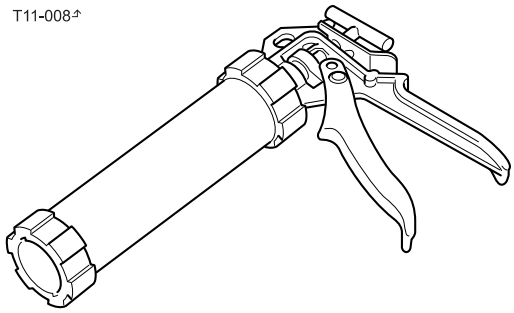

Fig 5. 892/00845 Cartridge Gun

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

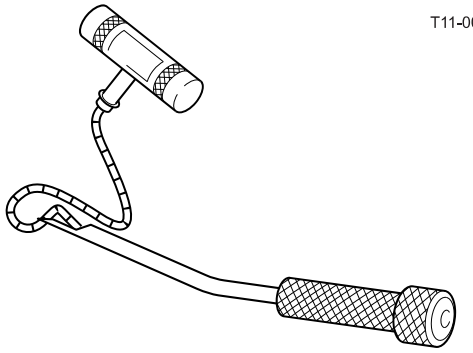

Fig 6. 892/00846 Glass Extractor (Handles)

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

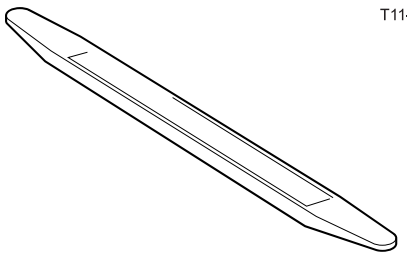

Fig 7. 892/00847 Nylon Spatula

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

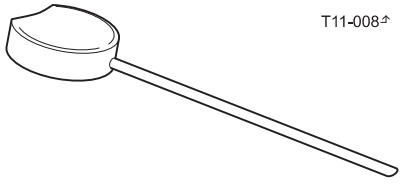

Fig 8. 892/00848 Wire Starter

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

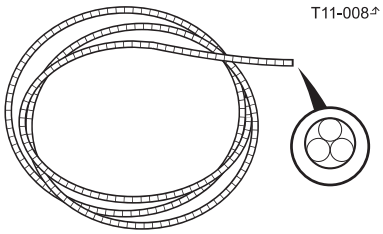

Fig 9. 892/00849 Braided Cutting Wire

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

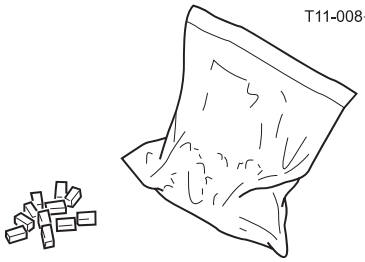

Fig 10. 926/15500 Rubber Spacer Blocks

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

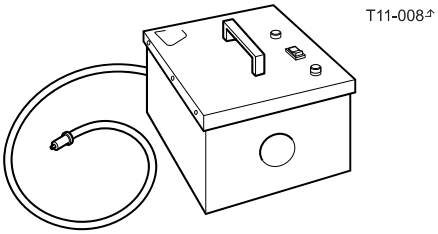

Fig 11. 992/12300 Mobile Oven 12V

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).

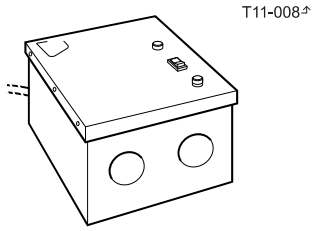

Fig 12. 992/12400 Static Oven 240V

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

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

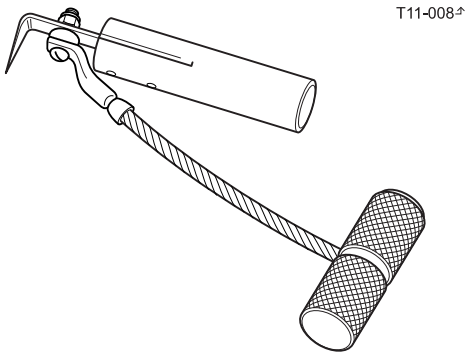

Fig 13. 992/12800 Cut-Out Knife

Used to remove broken glass.

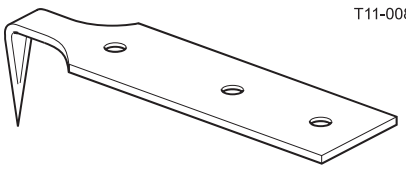

Fig 14. 992/12801 'L' Blades

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

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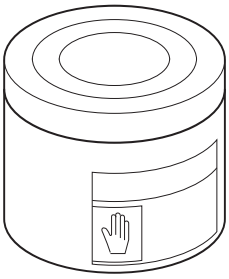

Fig 15. 4104/1310 Hand Cleaner

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

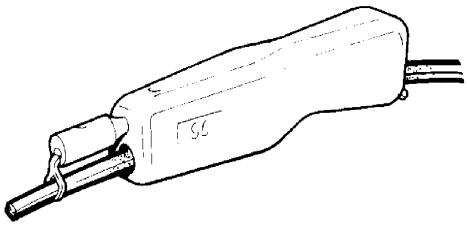

Fig 16. 992/01100

Glazing Tool, used to insert aperture seal expansion strip.

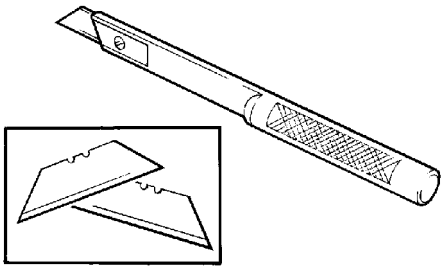

Fig 17. 892/00844 Long Knife

Used to give extended reach for normally inaccessible areas.

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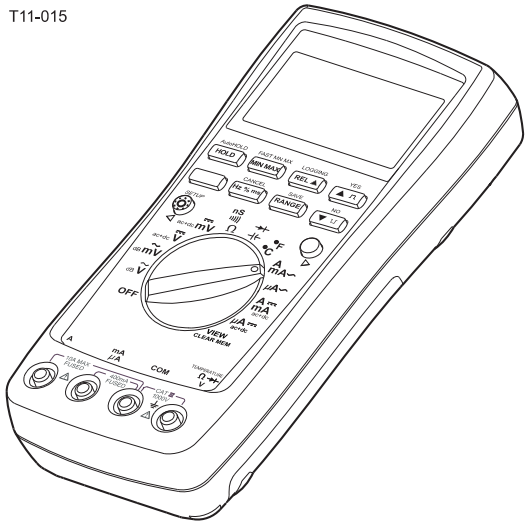

Fig 18. 892/00298 Fluke Meter

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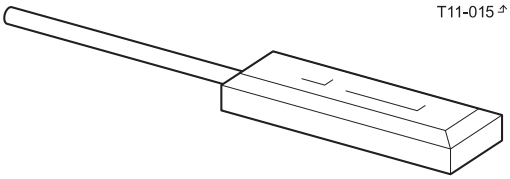


Fig 19. 892/00285 Hydraulic Temperature Probe

T11-015

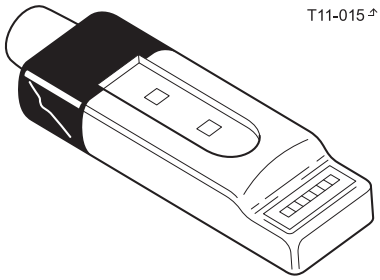


Fig 20. 892/00284 Venture Microtach Digital Tachometer

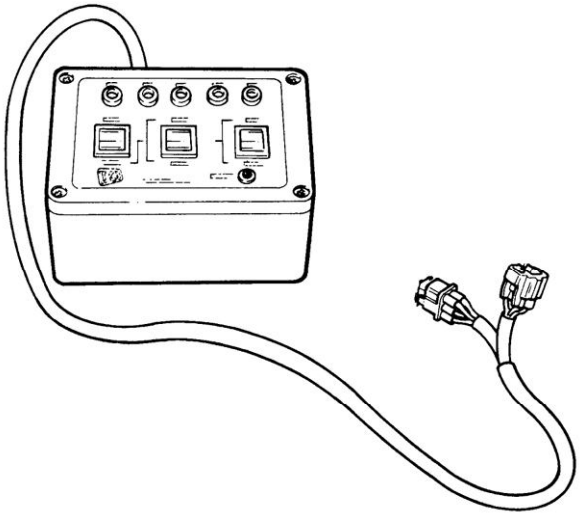


Fig 21. 892/00905 LMI Test Box

For testing load moment indicator system

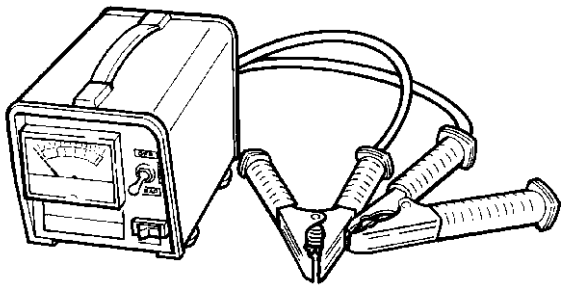


Fig 22. 993/85700 Battery Tester

⇒ *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.)

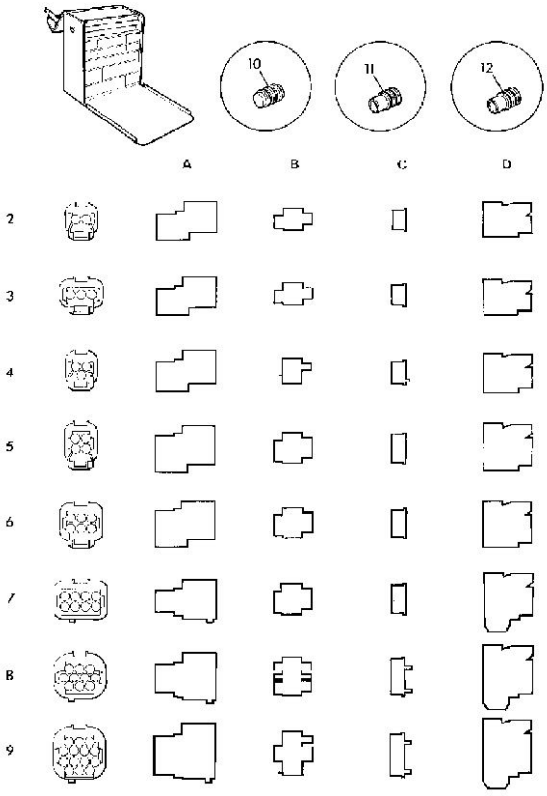


Fig 23. Electrical Repair Kit

Fig 24. 892/00350 Butane Heater Assembly

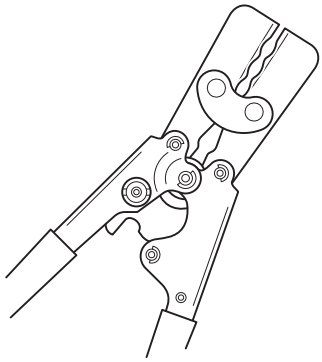


Fig 25. 892/00349 Crimp Tool

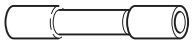
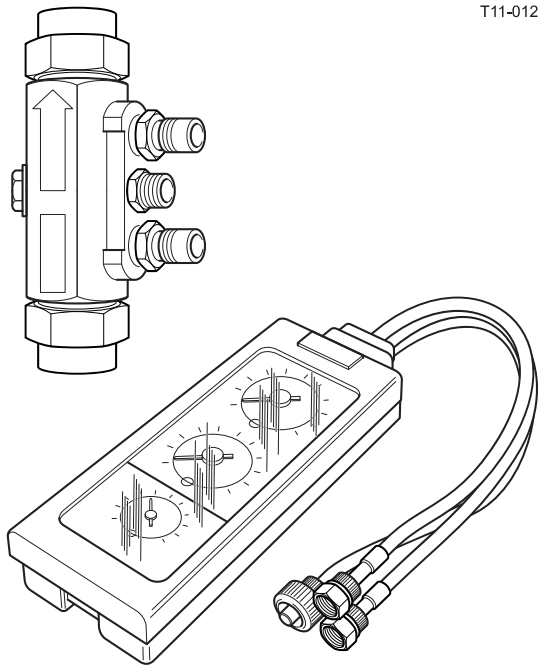
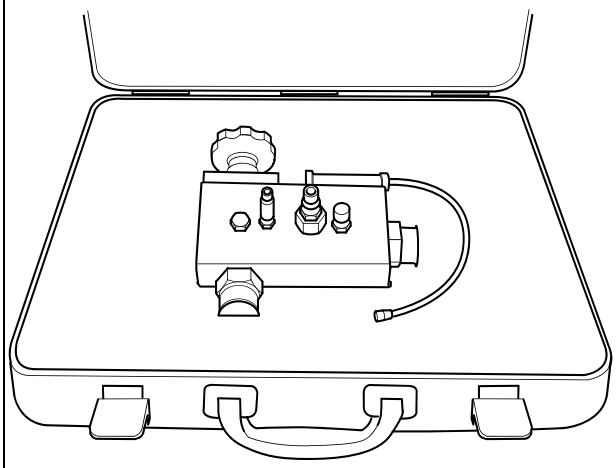
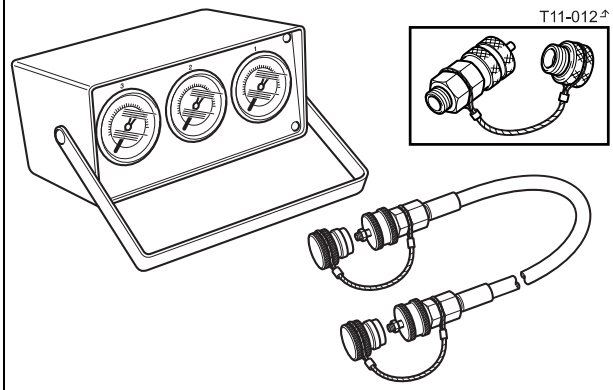


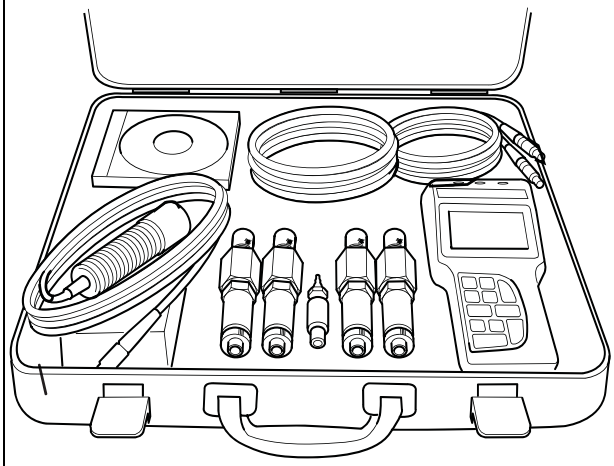
Fig 26. Splice

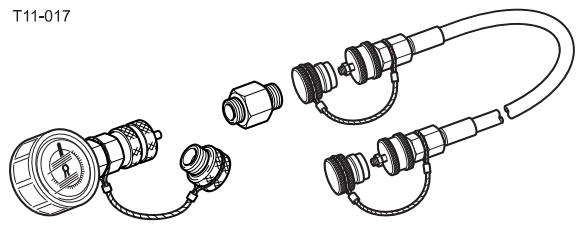
892/00351	Splice 0.5-1.5 mm (Red)
892/00352	Splice 1.5-2.5 mm (Blue)
892/00353	Splice 3.0-6.0 mm (Yellow)

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)

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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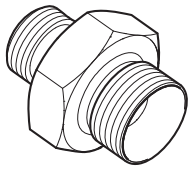

Fig 32. Male Adaptors

	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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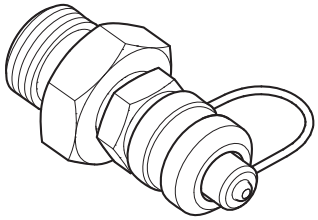

Fig 33. Pressure Test Adapters

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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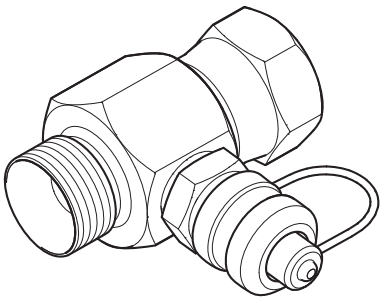

Fig 34. Pressure Test 'T' Adapters

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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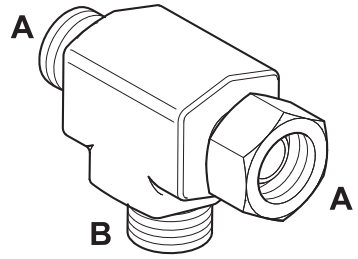

Fig 35. 'T' Adapters

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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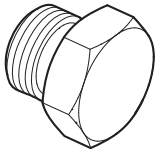

Fig 36. Female Blanking Caps

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

T11-010

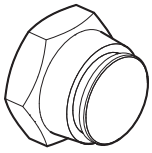

Fig 37. Male Cone Blanking Caps

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

T11-010

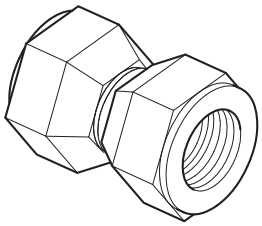

Fig 38. Female Connectors

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

T11-010

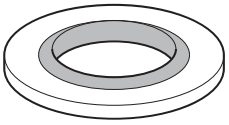

Fig 39. Bonded Washers

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

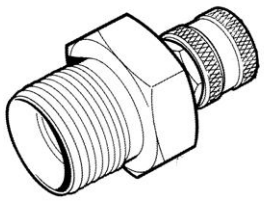

Fig 40. 892/00964 Test Point 1/8 BSP

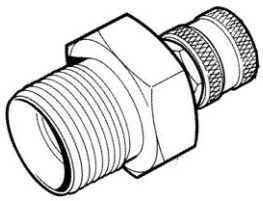

Fig 41. 892/00965 Test Point 3/8 BSP

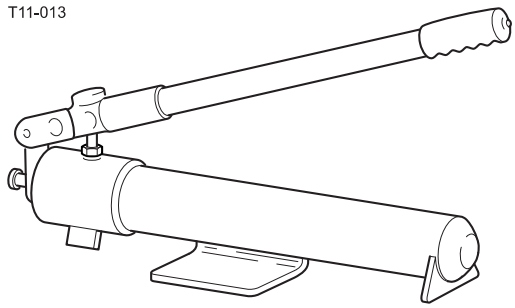

Fig 42. Hand Pump Equipment

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)

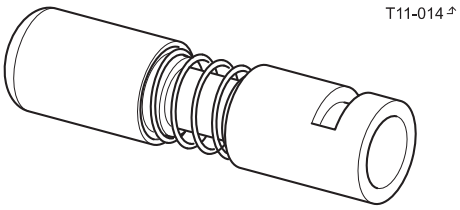

Fig 43. 892/00881 Valve Spool Seal Fitting Tool

TBA

Fig 44. 892/00229 Flow Meter

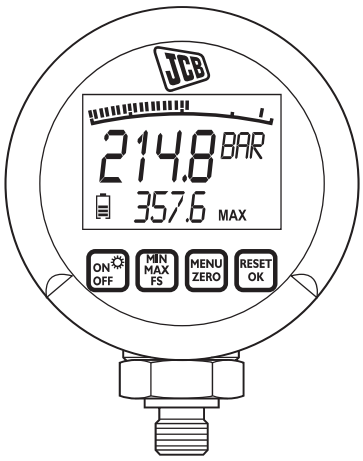

Fig 45. 892/01268 Digital Pressure Gauge 0-400 bar

892/01271 Hose for pressure gauge

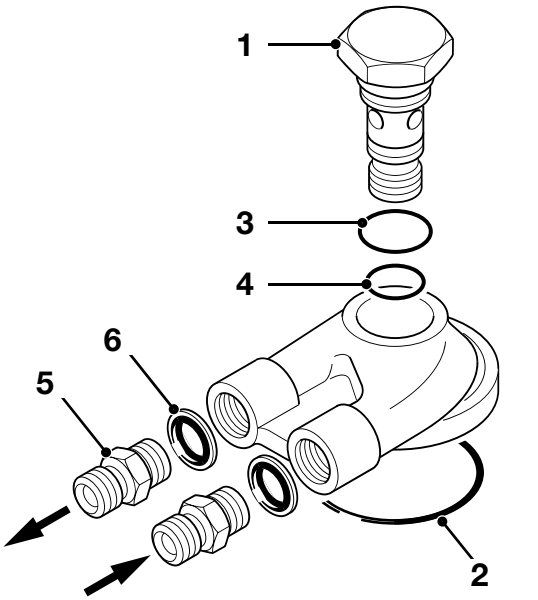

Fig 46. 460/15708 Flow Test Adaptor

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

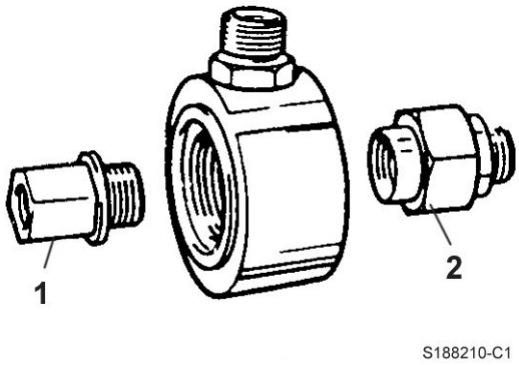

Fig 47. 892/00301 Flow Test Adaptor

Note: *Components listed as follows also required:*

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

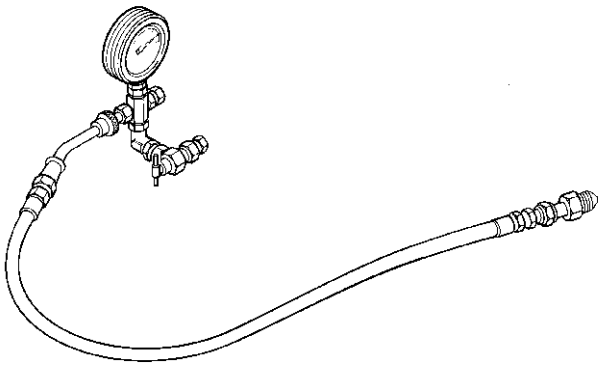

Fig 48. Nitrogen Charging Kit

892/00948 Charging Kit (without gauge)

892/00949 Gauge

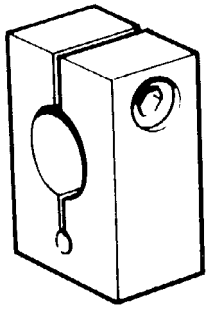

Fig 49. Spool Clamps

992/09100	Spool Clamp
892/00011	Spool Clamp

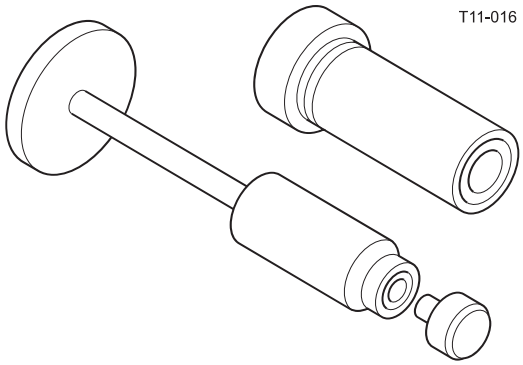

Fig 50. 892/00180 - Seal Fitting Tool

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

892/00181 - Replacement Plastic Boss

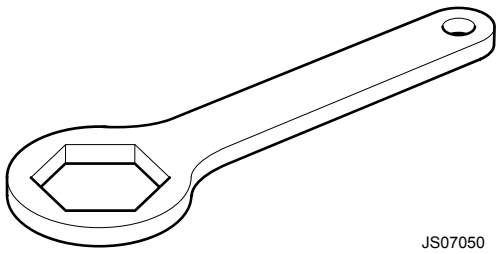

Fig 51. Ram Piston Nut Removal/Fitting Spanner

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

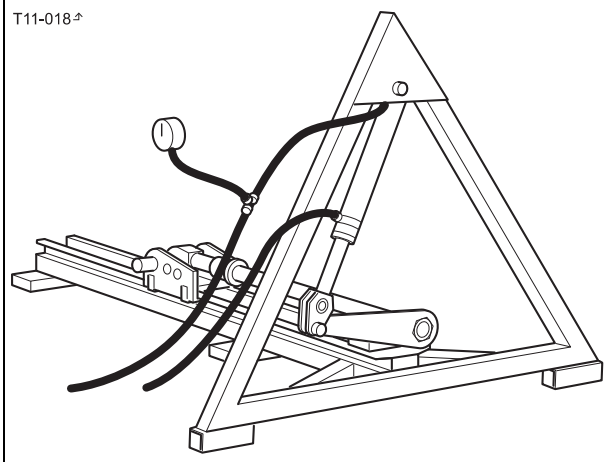

Fig 52. Ram Piston Nut Removal/Fitting Rig

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

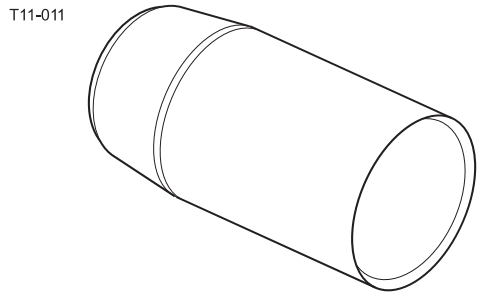

Fig 53. Ram Protection Sleeves

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

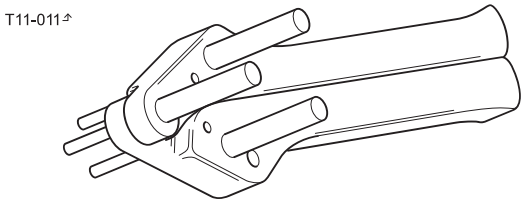

Fig 54. 892/00334 Ram Seal Fitting Tool

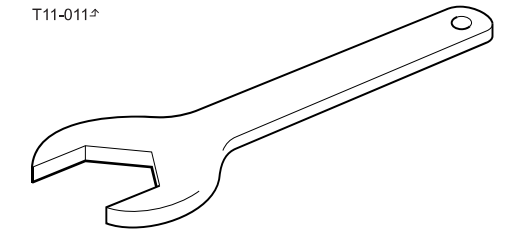

Fig 55. Hexagon Spanners for Ram Pistons and End Caps

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

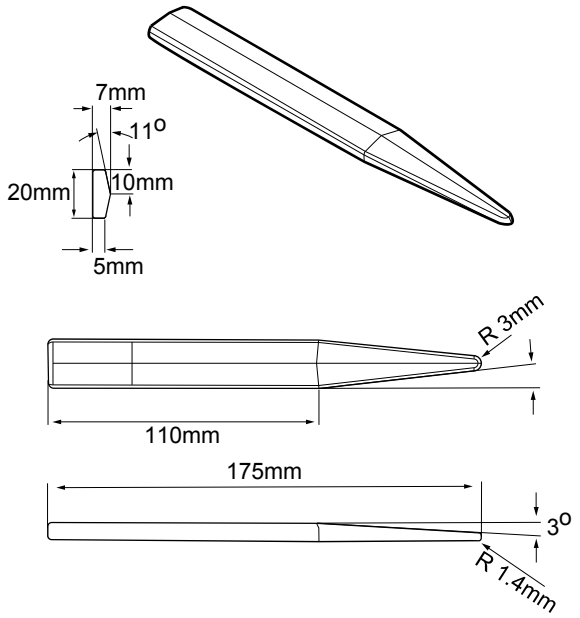

Fig 56. 892/01027 Piston Seal Assembly Tool

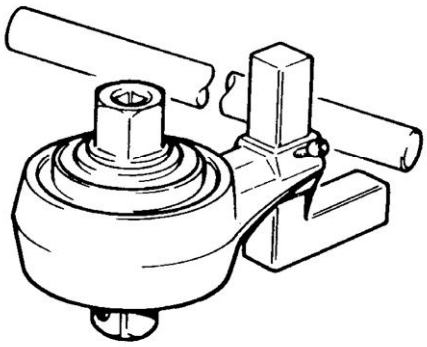

Fig 57. 992/04000 Torque Multiplier

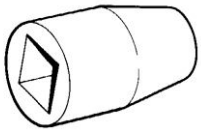

Fig 58. 892/00822 Splined Bolt Socket

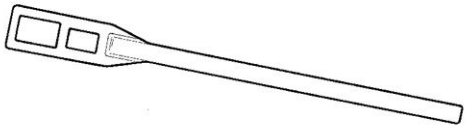

Fig 59. 892/00812 Drive Coupling Spanner

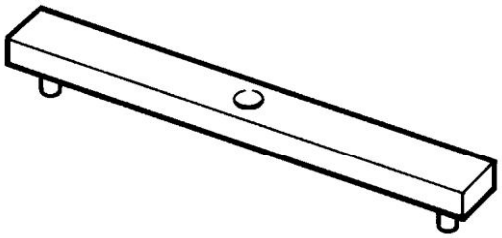

Fig 60. 892/00893 Torque Converter Alignment Tool

For use with 11” torque converters

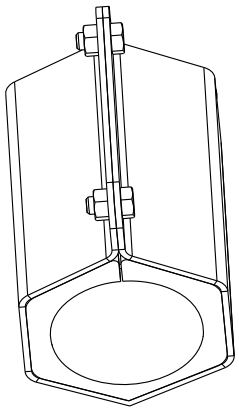

Fig 61. 332/E7911 Exhaust Fitting Clamp

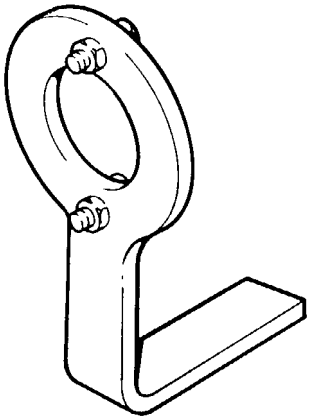

Fig 62. 992/04800 Flange Spanner

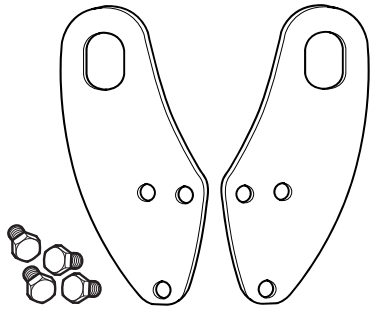

Fig 63. 320/20050 Lifting Bracket Kit

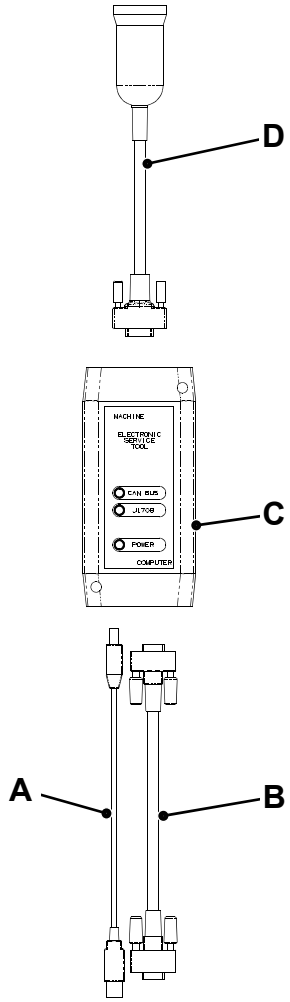

Fig 64. 892/01174 Data Link Adaptor Kit

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)		

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**.

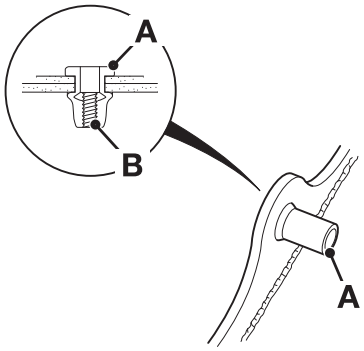

Fig 65.

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*

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**.

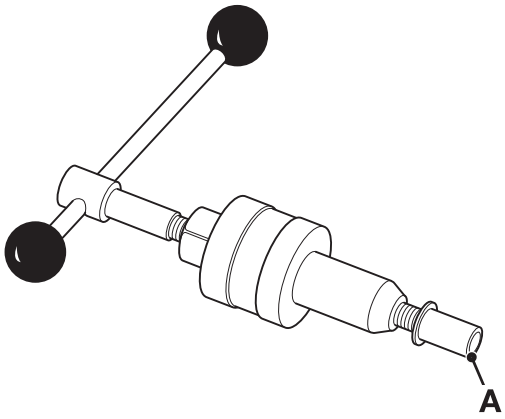

Fig 66.

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

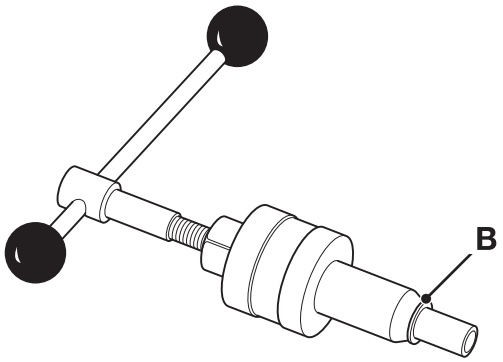

Fig 67.

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.*

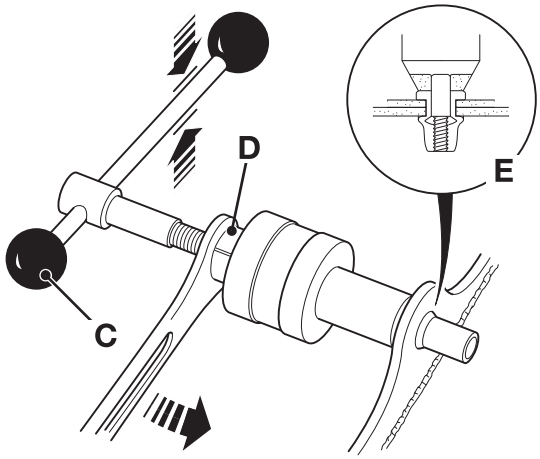

Fig 68.

6 Remove the installation tool.

Slide Hammer Kit

TB-003

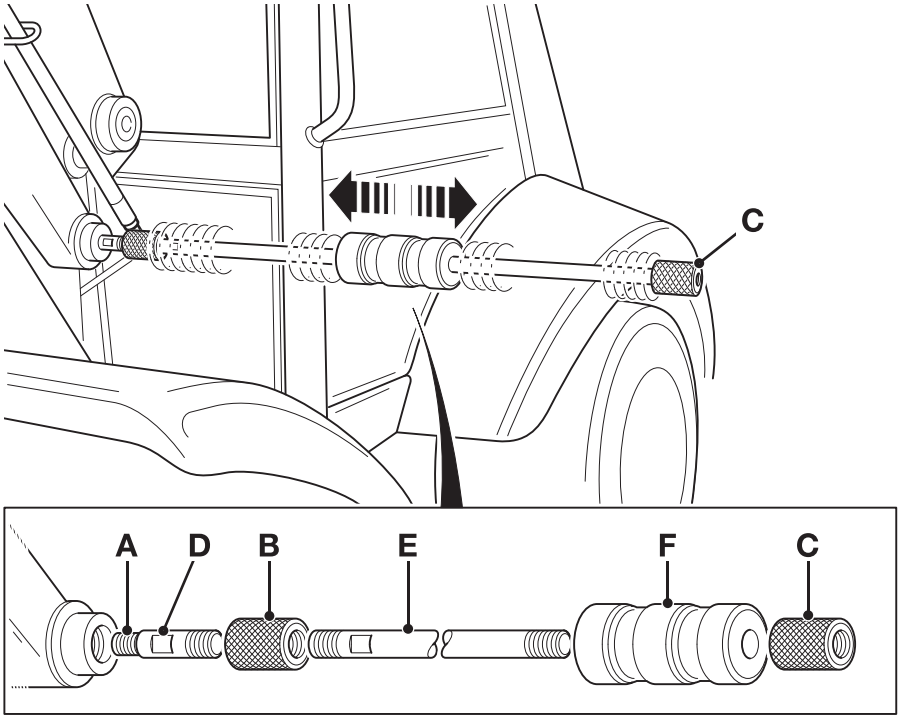

Fig 69. Typical M/c. Installation

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)*

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

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

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.

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

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.

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)***.

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

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

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.

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)*

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.

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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