Service Manual

Loadall

Models:

520-50
from Serial No. 754001

525-50
from Serial No. 789308

525-50S
from Serial No. 1037581

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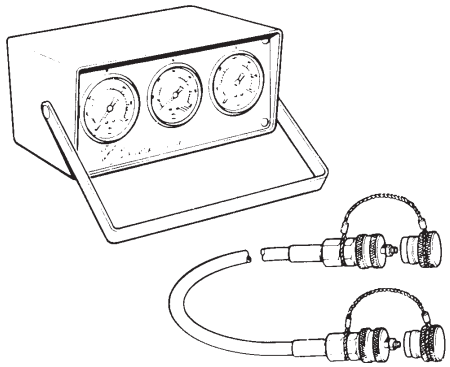

Hydraulic Circuit Pressure Test Kit

892/00253 Pressure Gauge Kit
892/00201 Replacement Gauge 0-20 bar (0-300 lbf/in²)
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

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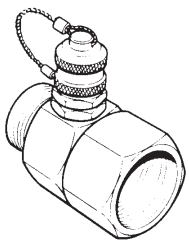


S188130

*Pressure Test 'T' Adaptors

892/00262 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

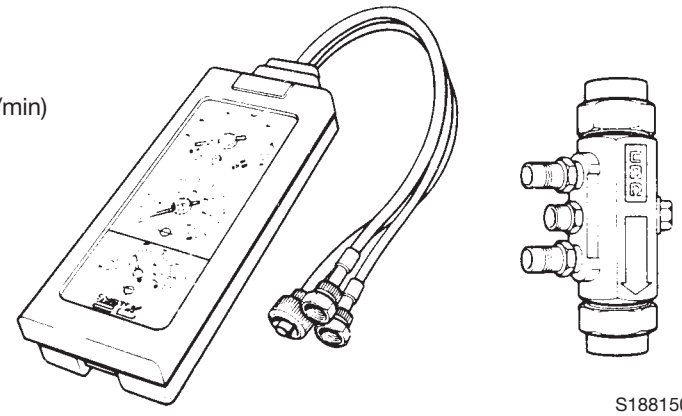
S188140

* 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

Flow Test Equipment

892/00268 Flow Monitoring Unit
892/00269 Sensor Head 0 to 100 l/min (0 to 22 UK gal/min)
892/00270 Load Valve
1406/0021 Bonded Washer
1604/0006 Adapter 3/4 in M x 3/4 M BSP
1612/0006 Adapter 3/4 in F x 3/4 M BSP
892/00271 Adapter 3/4 in F x 5/8 M BSP
892/00272 Adapter 5/8 in F x 3/4 M BSP
816/20008 Adapter 3/4 in F x 1/2 M BSP
892/00275 Adapter 1/2 in F x 3/4 M BSP
892/00276 Adapter 3/4 in F x 3/8 M BSP
892/00277 Adapter 3/4 in F x 3/4 M BSP



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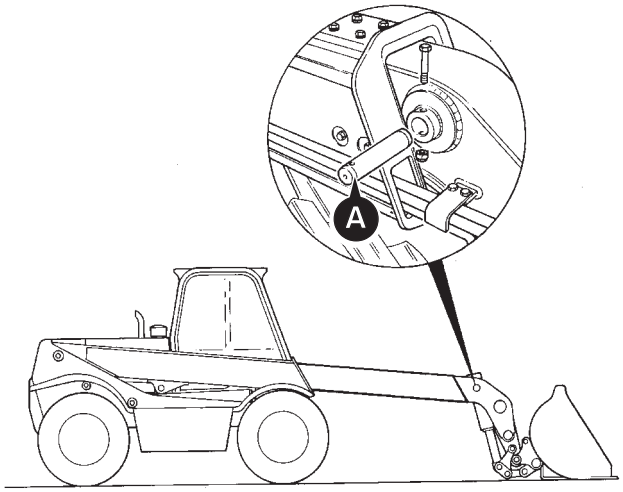
Grease Every 1000 Hours

See Greasing (Daily) for general information on greasing.

Remove inner extension ram pivot pin **A** and coat with specified grease. Refit pivot pin.

***Note**: Use another pivot pin to support the ram while greasing the other pivot pin.*



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Fuel System

* Types of Fuel

Use good quality diesel fuel to get the correct power and performance from your engine.

Recommended Fuel Specification

EN590 Diesel Fuel Types - Auto/Co/C1/C2/C3/C4
BS2869 Class A2
ASTM D975-91 Class 2-2DA, US DF1, US DF2, US DFA
JIS K2204 (1992) Grades 1, 2, 3, and Special Grade 3

Note: Where low sulphur/low aromatic fuels are used it is important that lubricity additives are used. 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 have not been tested or approved by the engine manufacturer. They should be added by your fuel supplier who should understand the concentration level necessary.

1 Elf 2S 1750. Dosage 1000-1500 ppm (0.1 - 0.15%), specifically for Indian Superior Herosene (SKO) but may be applicable to other fuels.

2 Lubrizol 539N. Dosage (on Swedish low sulphur fuel) 250 ppm.

3 Paradyne 7505 (from Infineum). Dosage 500 ppm (0.05%).

⚠ CAUTION

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

Acceptable Fuel Specification

⚠ CAUTION

The fuel specification below is acceptable, however this fuel may reduce the life of the fuel injection equipment. The use of this fuel may also affect the engine performance.

ASTM D975-91 Class 1-1DA
JP7, MIL T38219 XF63
NATO F63

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.

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

Aviation Kerosene Fuels

Note: Aviation kerosene fuels are not approved and their use may cause damage to components. Warranty will not be allowed on any component where damage is found to have been caused by the use of aviation kerosene.

Low Temperature Fuels

Special winter fuels may be available for engine operation at temperatures below 0°C (32°F). These fuels have a lower viscosity. They also limit wax formation in the fuel at low temperatures. *(Wax forming in the fuel can stop the fuel flowing through the filter.)*

Fatty Acid Methyl Ester Fuels as a Replacement for Diesel Fuels

Fuel resources such as Rape Methyl Ester and Soybean Methyl ester, collectively known as Fatty Acid Methyl Esters are being used as alternatives and extenders for mineral oil.

Fatty Acid Methyl Esters must conform to certain standards to be of acceptable quality, just as mineral oils do at present.

Consult your JCB distributor for advice about the use of Fatty Acid Methyl Ester fuels, as improper application may impair engine performance.

⚠ WARNING

Diesel fuel is flammable; keep naked flames away from the machine. Do not smoke while refuelling the machine or working on the engine. Do not refuel with the engine running. There could be a fire and injury if you do not follow these precautions.

INT-3-2-2

Petrol

⚠ WARNING

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

INT-3-1-6

Checking the Hub Oil Levels

Hubs must be checked separately.

1 Park the machine on level ground with the OIL LEVEL mark **A** horizontal as shown. Engage the parking brake. Lower the forks to the ground. Stop the engine. Remove the starter key.

2 Clean the area around the front plug **B**. Remove the plug. Oil should be level with the bottom of the hole. If necessary add oil, *see the chart at the end of MAINTENANCE section for capacity and recommended* * *oil*. Clean the plug before refitting it. Torque tighten drain/fill plug to 35-40Nm (26-30 lbf ft).

Oil Immersed Brakes

The axle oil is used to lubricate the brake components, and to cool the brake plates.

It is important that the oil is changed regularly as specified in the service schedule - the lubricating properties of the oil will reduce as a result of brake wear.

Consult your JCB Distributor for advise if necessary.

Changing the Hub Oil

1 Park the machine on level ground, with plug **C** at the bottom as shown. Engage the parking brake. Lower the forks to the ground. Stop the engine. Remove the starter key.

2 Drain the oil:

a Place a container of suitable size beneath plug **C**. *(To catch the oil, see the chart at the end of MAINTENANCE section for capacity.)*

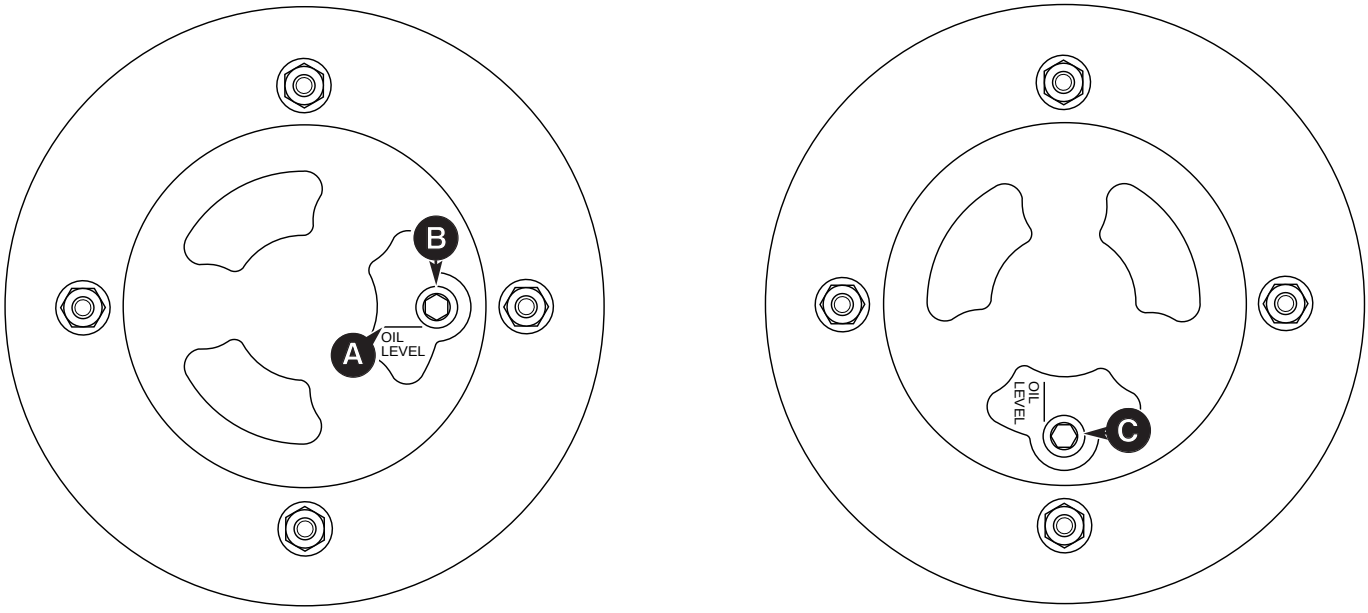
⚠ CAUTION

Oil will gush from the hole when the drain plug is removed. Keep to one side when you remove the plug.
2-3-4-2

b Remove plug **C**. Allow the oil to drain out. The drain plug is magnetic. Wipe it clean. *(Metallic particles should be carefully removed).*

* **3** Fill with new oil, *see* ***Checking the Hub Oil Levels***.

4 Refit plug **C** and its seal. Torque tighten drain/fill plug to 35-40Nm (26-30 lbf ft).



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Removal

Carry out **Machine Safety** procedures, *see* ***Working with the Boom Raised****, Section 3.*

Disconnect the battery.

Remove the seat and seat pan.

Disconnect and cap all hydraulic hoses from steering unit, shown at **A**.

Remove heater cover and disconnect cab heater hoses at heater, shown at **B**.

Disconnect engine throttle cable **C** at engine.

Remove valve block control lever gaiter plate and push gaiters outside cab.

Disconnect cab electrical harness, shown at **D**.

Remove gear lever gaiter plate and push the gaiter outside the cab.

Disconnect hitch cable (if fitted).

Unscrew and remove cab mounting bolts **F** and **G**.

Make sure that the throttle and hitch control cables are clear of any obstruction when the cab is lifted.

Attach appropriate lifting equipment to ROPS & FOPS cage.

Remove cab from machine.

Replacement

Replacement is reversal of the removal procedure.

Check that all electrical and hydraulic services operate correctly.

Check that all cables are connected and correctly adjusted. Make sure that they are routed and secured correctly.

Torque Settings

Item	Nm	kgf m	lbf ft
F, G	244	25	180

* Wear Pads

For interval see Service Schedule.

The extension ram must be removed to gain access to the rear wear pads, *see Section E*.

Carry out **General Safety** procedures, *see **Machine Safety**, Section 3.*

Packing pieces and, in some cases, shims are fitted under the pads to ensure correct boom clearance when new pads are fitted.

Removing and Replacing Front Wear Pads

Raise boom slightly so that the tool carrier is just off the ground.

Make a note of the total thickness of shims and number of washers used in each location so that the same size shims and number of washers are refitted.

Remove the upper and side short wear pad packs.

Rest the tool carrier on the ground so that there is no weight on the front lower wear pads.

Place wedges under the inner boom before removing the lower long wear pad packs.

Remove the countersunk screws **1** and dismantle the lower wear pad packs.

Assemble new lower wear pad packs, using new long wear pads **2**, long shims **3**, if required, and long packing pieces **4**, securing with countersunk screws **1**.

Fit new lower wear pad packs, using bolts **5** and existing washers **6** and **7**. Torque tighten bolts **5** and remove wedges.

Raise boom slightly so that the tool carrier is just off the ground.

Assemble new upper and side wear pad packs, using new short wear pads **8**, short shims **9**, if required, and short packing pieces **10**, securing with countersunk screws **1**.

Fit new upper and side short wear pad packs, using bolts **5** and existing washers **6** and **7**. Torque tighten bolts **5**.

Removing and Replacing Rear Wear Pads

Remove the extension ram, *see Section E*.

Rest the tool carrier on the ground so that there is no weight on the upper wear pads.

Make a note of the total thickness of shims and number of washers used in each location so that the same size shims and number of washers are fitted.

Remove the long upper wear pad packs.

Remove the short side wear pad packs.

Raise boom slightly so that the tool carrier is just off the ground.

Place wedges under the inner boom before removing the short lower wear pad packs.

Remove the countersunk screws **1** and dismantle the lower wear pad packs.

Assemble new lower wear pad packs, using new short wear pads **8**, short shims **9**, if required, and short packing pieces **10**, securing with countersunk screws **1**.

Fit new lower wear pad packs, using bolts **5** and existing washers **6** and **7**. Torque tighten bolts **5** and remove wedges.

Rest the tool carrier on the ground so that there is no weight on the rear upper wear pads.

Assemble new side wear pad packs, using new short wear pads **8**, short shims **9**, if required, and short packing pieces **10**, securing with countersunk screws **1**.

Assemble new upper wear pad packs, using new long wear pads **2**, long shims **3**, if required, and long packing pieces **4**, securing with countersunk screws **1**.

Fit new upper and side wear pad packs, using bolts **5** and existing washers **6** and **7**. Torque tighten bolts **5**.

Check the front and rear wear pad clearance which should not exceed a total of 1.5 mm (0.05 in) from side to side or top to bottom.

Alter shims as required. Divide the number of shims required equally between top and bottom and side to side to make sure the inner boom runs centrally within the outer boom.

Check that the attachment is parallel to the ground. Alter front lower and rear upper shims as required to achieve this.

⚠ 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

Apply Waxoyl to working surface of outer boom. Allow 2- 3 hours drying time before operating machine.

Fit the extension ram, *see Section E*.

Torque Settings

Item	Nm	Kgf. m	lbf. ft
5	55	5.5	40

Measuring DC Voltage

On the FLUKE 85
Turn the switch to position **B**.

On the AV0 2003
Move the right slider switch to position **A**, and the left hand slider switch to the appropriate range.

On an analogue meter
Turn the dial to the appropriate DC Volts range.

Connect the black probe to the nearest available suitable earth point, usually this will be the starter motor earth, the battery negative, or the chassis.
Connect the red probe to the wire or contact from which you are measuring the voltage.

Measuring Resistance

Make sure there is no power to the part of the circuit you are about to measure.

Connect one probe at one end of the component or wire to be checked and the other probe at the other end. It does not matter which way round the two probes are placed.

On the FLUKE 85
Turn the switch to position **C** and check that the sign at the right hand side of the display window is on. If the **F** sign is on instead, press the blue button **G** to change the reading to .

Touch the meter lead probes together and press the **REL** [3] key on the meter to eliminate the lead resistance from the meter reading.

On the AV0 2003
Move the right hand slider switch to position **B**, and the left hand slider switch to the appropriate Ohms ( ) range.

On an analogue meter
Move the dial to the appropriate Ohms ( ) range.

Measuring Continuity

Make sure there is no power to the part of the circuit you are checking for continuity.

Connect one probe to one end of the component or wire to be checked and the other probe to the other end. It does not matter which way round the two probes are placed.

On the FLUKE 85
Turn the switch to position **C** and check that the beeper symbol appears at the left hand side of the display window. If the **F** sign is on instead, press the button labelled **F** in the meter drawing.

If there is continuity in the circuit, the beeper will sound. If there is no continuity (open circuit), the beeper will not sound.

On the AV0 2003
Move the right hand slider switch to position **B**, and the left hand slider switch to position **C**.

If there is continuity (i.e. very low resistance) between two points the buzzer will sound.

On an analogue meter
Turn the dial to the lowest Ohms ( ) range.

If there is continuity (i.e. very low resistance) between two points the needle will move across fully (or almost fully) to the right hand side of the scale.

Machines with 3-mode Steer Option (continued)

Key (Sheet 2)

23A First trailer turn indicator (see Sheet 1)
23B Steer mode indicator
52 Steer mode control unit (SMCU)
- **A** Crab steer relay
- **B** All wheel steer relay
- **C** Two wheel steer relay
- **D** Four wheel steer relay
- **E** Two wheel/four wheel steer mode selector
- **F** Crab/four wheel steer mode selector

53 Steer mode switch
- **X** Four wheel steer select
- **Y** Two wheel steer select
- **Z** Crab steer select

54 Front proximity switch
55 Rear proximity switch
56 Four-wheel/crab steer solenoid
57 Four-wheel steer solenoid
58 Crab steer solenoid
59 Two-wheel steer solenoid
60 Junction box
61 Front washer pump
62 Front wiper
63 Front wash/wipe switch
64 Front horn
65 Ignition relay
66 Rear wash/wipe switch
67 Rear wiper
68 Rear washer pump
69 Roof wiper switch
70 Roof wiper
71 Heater switch
72 Heater unit
73 Air conditioning switch
74 Condenser relay
75 Thermostat
76 Condenser fan
77 Compessor clutch
78 Pressure switch
79 Lights relay
80 Roadlights switch
81 Headlight flash switch
82 Foglight switch
83 Left trailer light
84 Left number plate light
85 Left tail light
86 Left sidelight
87 Right trailer light
88 Right number plate light
89 Right tail light
90 Right sidelight
91 Right dipped beam
92 Left dipped beam
93 Right main beam
94 Left main beam
95 Left fog light
96 Right fog light
97 Worklight switch
98 Right front worklight
99 Left front worklight
100 Rear worklight
101 Face level fan
102 Interior light
103 Beacon switch
104 Beacon
105 Tracker
106 Radio/cassette
107 Left loudspeaker
108 Right loudspeaker

Wire Number Identification (continued)

Cab Harness - Wire numbers - 800 to 999 (continued)

Wire No	Source
834A	FUSE B3 TO RH DIP BEAM
834B	FUSE B3 TO LH DIP BEAM
835	FOG LIGHT SWITCH TO REAR FOG LIGHT
836	DIP/MAIN BEAM SWITCH TO FUSE B4 (MAIN BEAM)
837	FUSE B4 TO MAIN BEAM SPLICE
837A	MAIN BEAM SPLICE TO RH MAIN BEAM
837B	MAIN BEAM SPLICE TO LH MAIN BEAM
* 837D	RH COLUMN SWITCH TO FRONT WASHER PUMP
839	RH COLUMN SWITCH TO FRONT WASHER PUMP
840	RH COLUMN SWITCH TO FRONT WIPER MOTOR
841	FRONT WIPER MOTOR (SELF PARK) TO RH COLUMN SWITCH
842	NEUTRAL START RELAY TO STARTER SOLENOID
855	FRONT WORK LIGHT SWITCH TO FRONT WORK LIGHT SPLICE
855A	FRONT WORK LIGHT RH TO FRONT WORK LIGHT SPICE
855B	FRONT WORK LIGHT LH TO FRONT WORK LIGHT SPICE
855F	FRONT WORK LIGHT SPLICE TO FRONT WORK LIGHT SPLICE
859	RADIO CASSETTE TO LH SPEAKER (+VE)
860	RADIO CASSETTE TO RH SPEAKER (+VE)
861	REAR WORK LIGHT SWITCH TO REAR WORK LIGHT SPLICE
862	REAR WIPER SWITCH TO REAR WIPER MOTOR
863	REAR WASH SWITCH TO REAR WASH PUMP
864	REAR WIPER MOTOR TO REAR WIPER SWITCH (SELF PARK)
868	FUSE C4 TO FOG LIGHT SWITCH
894	BEACON SWITCH TO BEACON SOCKET
912	DUMP RELAY TO FORWARD RELAY
912A	FORWARD RELAY TO REVERSE RELAY
933	BRAKE LIGHT SWITCH TO FUSE A1
934	DUMP RELAY COIL TO DUMP SWITCH SPLICE
934C	DUMP RELAY COIL TO DIODE GATE (P/BRAKE)
936	PARKBRAKE SWITCH TO PARKBRAKE RELAY
936A	PARKBRAKE RELAY TO PARKBRAKE SOLENOID
937	PARKBRAKE RELAY TO PARKBRAKE LIGHT RELAY
937C	DIODE GATE TO PARKBRAKE LIGHT RELAY (DUMP)
967	PARKBRAKE LIGHT RELAY TO NEUTRAL START RELAY COIL
974	FUSE C2 TO SAFE LOAD INDICATOR

Introduction

The machine is fitted with either an electrical Safe Load Indicator (SLI) or a Load Moment Indicator (LMI).

The indicators warn the operator when the machine is nearing its maximum working limit (ie. when it could tip forward). A sensor measures the load exerted on the rear axle and sends a signal to the indicator.

Machines destined for the North American market are not normally fitted with a Safe Load Indicator or Load Moment Indicator.

Testing procedures described in this section should be carried out on level ground with the road wheels in the straight ahead position.

Safe Load Indicator

When the load carried by the forks is within the maximum working limit in terms of weight and boom extension, the green LEDs **C** on the display unit will illuminate.

As the load nears the maximum working limit, the LEDs illuminate progressively as the load increases and the amber LEDs **D** will illuminate.

When the maximum working limit is reached, the red LEDs **E** will flash and an audible warning will activate.

Load Moment Indicator

The LMI system has additional features which are listed below:

(a) simplified calibration procedure;
(b) increased environmental protection;
(c) axle transducer re-located for improved accuracy.
(d) user friendly fault diagnosis with error indication showing nature of fault;
(e) increased functionality, including alarm volume and LED brightness control;

The indicator converts the signal from the transducer on the rear axle into a display of three green LEDs **C**, one amber LED **D** and one red LED **E**. The LEDs will illuminate progressively as the load increases.

All LEDs will flash as the load nears the maximum working limit.

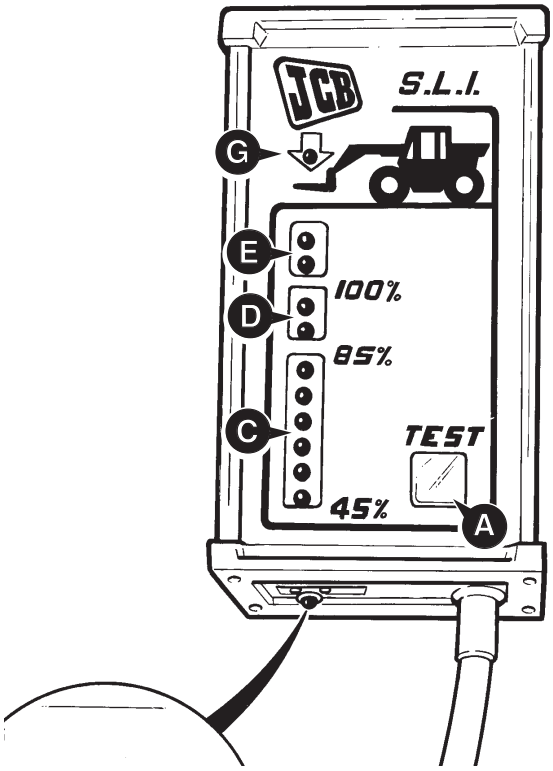
If the load exceeds the maximum working limit, the red LED **E** will illuminate and an audible warning will activate.

If a system fault is detected, various combinations of LEDs will indicate a fault code. See **Diagnostic Fault Codes**.

LED **G** remains on whenever power is supplied to the display box.

The new LMI display box is not interchangeable with the earlier SLI system.

SLI System



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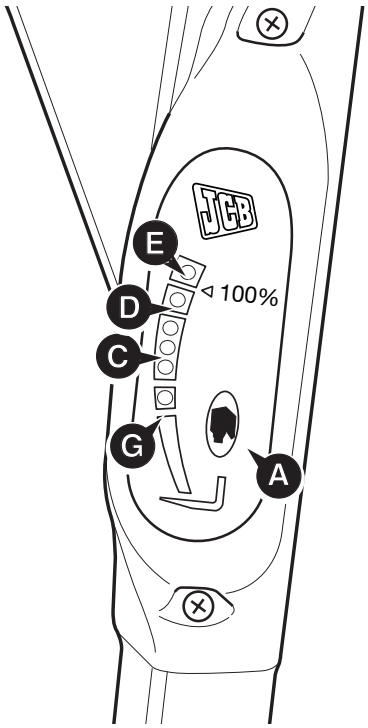
LMI System



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Testing - SLI and LMI

Note: The Safe Load Indicator and Load Moment Indicator are not fitted to machines supplied to North America (N. Am).

Introduction

If the calibration procedure fails to rectify a problem, there are three main areas where faults can occur: the readout box, the transducer, and the machine electrical harness. The test box (892/00905) is designed to assist the service engineer to diagnose faults in the SLI system down to component level.

This unit should be used when the standard calibration procedure has been attempted and failed.

The test box contains five test points: TP 1 to TP 5 which allow currents in the circuits to be read as voltages by an AVO digital multimeter. The test points also allow continuity and open/short circuit tests to be made.

TP1 Earth
TP2 Readout box 12V supply
TP3 Transducer 12V supply
TP4 Transducer output (Signal)
TP5 Transducer output (voltage)

Test point TP4 reads signal current in the transducer return wire and converts this to a voltage which can be read by the multimeter.

Test point TP5 is a direct connection to the transducer return wire.

The Black lead of the multimeter should be connected to TP1 (earth) when testing voltages.

Note: When returning equipment under warranty, the results of the following tests MUST be stated.

The test box also contains three switches: TEST 1/TEST 2, TRANS/BOSS, RUN/CHECK to change settings for the various tests.

The box is connected between the four-pin plug and socket which connects the readout box to the machine wiring harness behind the instrument panel in the cab.

Before carrying out the tests make sure that:

(a) the machine is on level ground with the boom horizontal;
(b) the forks are fitted, with no load;
(c) the boom is fully retracted;
(d) two-wheel drive is engaged (if fitted) and the machine has been driven backwards and forwards several times with the wheels in the straight ahead position;
(e) the ignition switch is on, but the engine is not running.

Note: The readout display will be affected by extreme steer lock and axle angles.

Service Procedure

Remove the instrument panel and connect test box **A** as shown. The BOSS/TRANS switch should be set to the TRANS position for all tests on machines fitted with transducers.

Pump

Type	Powermaster 2PR 036, gear type		
Flow at 2200 engine rev/min			
— at zero pressure	79.0 litres/min	17.4 UK gal/min	21.0 US gal/min
— at system pressure	75.0 litres/min	16.5 UK gal/min	20.0 US gal/min

Control Valves

Type	Kontak, parallel service, double acting spools.
Services Operated	
— Spool 1	Auxiliary
— Spool 2	Boom Raise & Lower
— Spool 3	Carriage Tilt
— Spool 4	Boom Extend & Retract

Relief Valve Operating Pressures	**bar**	**kgf/cm²**	**lbf/in²**
Main Relief Valve (M.R.V.)	241	245	3500
Auxiliary Relief Valves (A.R.V.)			
— Auxiliary, rod side	185	188	2683
— Auxiliary, head side	185	188	2683
— Carriage Tilt Crowd, head side	250	255	3625
— Carriage Tilt Dump, rod side	275	280	3987

Rams	**Bore**		**Rod Dia.**		**Stroke**		**Open centre**		**Closed centre**	
	mm	in	mm	in	mm	in	mm	in	mm	in
Boom Lift	110	4.3	60	2.3	1020	40.1	2390	94.0	1370	53.9
Boom Extension	70	2.7	50	1.9	1700	66.0			2545	100.2
Tilt	120	4.7	70	2.75	334	13.1			651	25.6
Displacement	70	2.7	40	1.5	503	19.8			744	29.3
Hitch	50	1.9	25	0.9	254	9.8	698	27.5	444	17.5

Filter

Filter Type	Partial flow ('spin on')
Filtration Size	25 microns (0.001 in)
Relief Valve Setting	1.05 bar
Suction Strainer	125 microns (0.005 in)

Hydraulic Tank

Capacity	70 litres (15.4 gals)

*	**Fan Motor Speed**	2700 rpm at engine speed of 2190rpm

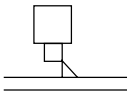
INTRODUCTION TO HYDRAULIC SCHEMATIC SYMBOLS (continued)

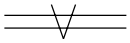
Control Mechanisms


Rotating shaft-one direction


Rotating shaft-two directions


Detent


Locking device


Over centre device


Simple linkage


General control

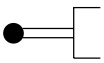

Push button operated

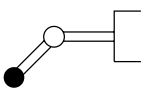

Lever operated


Pedal operated


Stem operated

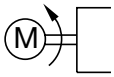

Spring operated


Roller operated

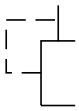

Roller trip operated (one directional)

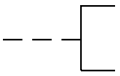

Solenoid one winding

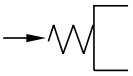

Solenoid two winding

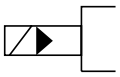


Electric motor operated

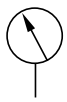

Internal pressure pilot operated

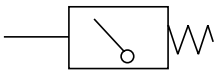

External pressure pilot operated


Pressure operated spring release


Pilot operated by solenoid pilot valve


Pilot operated by a solenoid or separate pilot valve


Pressure gauge


Pressure switch

A189730 A189740

Valve Block (continued)

Dismantling

The spools and their components can be removed without separating the valve sections but tie rod **1** must be removed to release load hold check valve plugs **2**. Check valves **3** are not fitted to all sections. Do not remove back up ring **A** as this cannot be renewed in service.

It is important to identify the spools with their respective bores to ensure correct replacement as some valve blocks have half motor spools. Failure to fit spools correctly could result in machines not operating correctly and damage to components.

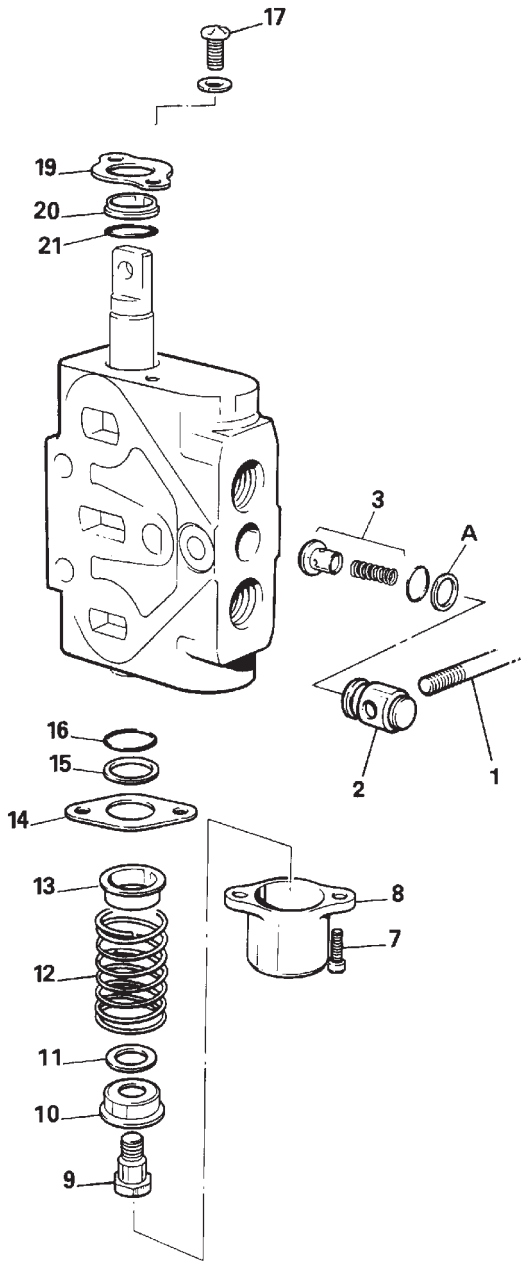
Assembling

Ensure the spools are fitted in their original bores.

Apply JCB Lock and Seal to screw **9**.

Torque Settings

Item	Nm	Kgf.m	lbf.ft
7	5-8	0.5-0.8	4-6
17	5-8	0.5-0.8	4-6



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Parking Brake

PARKING BRAKE INOPERATIVE BUT TRANSMISSION FUNCTIONS IN FORWARD AND REVERSE

	CHECK		ACTION
1	Is distance spacer fitted to centre bolt (B, page F/2-1)?	YES: NO:	Check 2. Fit spacer.
2	Is the parking brake solenoid spool sticking?	YES: NO:	Free off or renew valve. Check 3.
3	Put the starter switch in 'IGN' position. Disengage the parking brake, is there a voltage reading at the parking brake feed wire?	YES: NO:	Dismantle parking brake and check condition. Check 4.
4	Put the starter switch in 'IGN' position. Is there a voltage reading at the parking brake solenoid feed wire?	YES: NO:	Renew parking brake relay. Check switch and wiring.

PARKING BRAKE PERMANENTLY ENGAGED

	CHECK		ACTION
1	Is the parking brake solenoid spool sticking?	YES: NO:	Free off or renew valve. Check 2.
2	Put the starter switch in 'IGN' position. Disengage the parking brake, is there a voltage reading at the parking brake feed wire?	YES: NO:	Check 4. Check 3.
3	Put the starter switch in 'IGN' position. Is there a voltage reading at the parking brake solenoid feed wire?	YES: NO:	Check 4. Check switch and wiring.
4	Has the parking brake been dismantled recently?	YES: NO:	Dismantle and check for correct build. Check 5.
5	Is the transmission main line pressure correct?	YES: NO:	Check 6. See Hydraulic Fault Finding Procedures, starting at page F/4-1.
6	Is the main line pressure correct with the parking brake circuit isolated?	YES: NO:	Dismantle parking brake and check condition. See Hydraulic Fault Finding Procedures, starting at page F/4-1.

Assembly (Cont'd)

28 Temporarily refit taper plug **67**.

29 Remove short extension from adaptor.

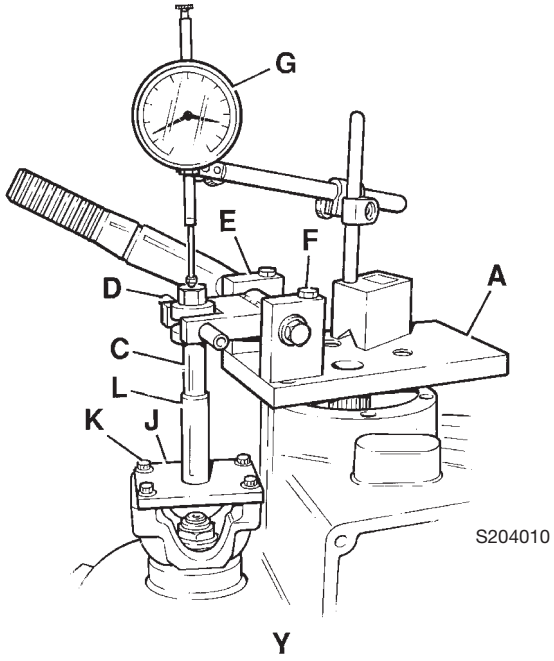
30 Fit the rear output yoke **15,** washer **14** and stake nut **13.** Torque tighten to 350 Nm (258.2 lbf ft).

31 Fit the output yoke adaptor **J** and secure with bolts **K**. Torque tighten to 22 Nm (16.2 lbf ft). Screw the adaptor **C** into the yoke adaptor extension **L** until tight.

32 Fit the lever arm pegs **D** into the adaptor annular space. Position the lever unit mounting blocks **E** in the appropriate position on the base plate **A** and secure with bolts **F**. Tighten the bolts.

33 Fit a magnetic base DTI **G** onto the base plate with the pin resting on the top of the adaptor.

34 Measure the output shaft end float and determine shim thickness by repeating steps 19 and 20. Refer to view **Y**.



Y

35 Remove the lever unit, adaptor, base plate and output yoke adaptor.

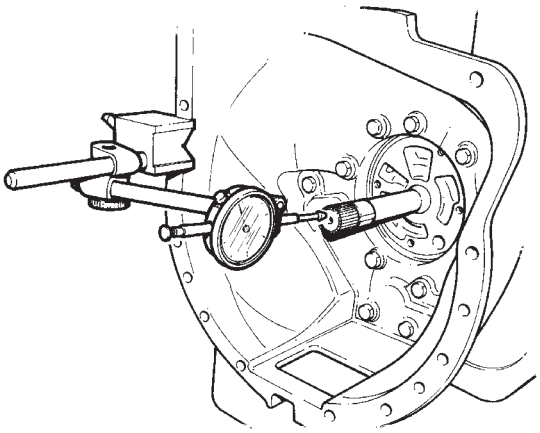
36 Remove the rear stake nut **13**, washer **14** and output yoke **15**.

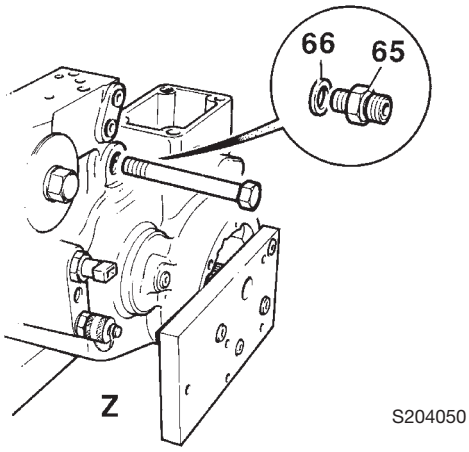
37 Remove oil inlet adaptor **65** and sealing washer **66** from the rear casing.

38 Turn the gearbox into the horizontal position.

39 Clean the mounting face of the flywheel housing. Mount the DTI on the face with the probe resting on the end of the reverser unit shaft. Firmly press the reverser unit shaft in to take up any shaft end float. Zero the DTI. Refer to view **Z**.

40 Screw a threaded bolt or rod into the threads exposed when oil inlet adaptor **65** was removed, until it touches the end of the reverser unit shaft.





41 Screw bolt or rod in further (approx. 10 Nm; 7.4 lbf ft) whilst turning output shaft. Stop when increasing resistance is felt. DO NOT overtighten. Take the DTI reading.

42 Calculate the required shim thickness as detailed in step 20.

43 Remove bolt or rod and the DTI. Temporarily refit oil inlet adaptor **65** and sealing washer **66**.

44 Turn the gearbox into the vertical position, with the rear casing upwards.

45 Screw a lifting eye into a brake housing bolt hole. Using a suitable hoist, lift the rear casing **37** away from the front casing **38**. Pry bars may be used at the points provided to assist in 'cracking' the joint. Turn the rear casing over.

Pressure and Flow Testing

Before completing any of the transmission pressure/flow tests, make sure that the oil level is correct and at normal operating temperature.

All gauges etc used in the following pressure/flow tests are shown in Section 1.

⚠ WARNING

Fine jets of hydraulic oil at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic oil leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of hydraulic oil. If hydraulic oil penetrates your skin, get medical help immediately.

HYD 1-1

⚠ WARNING

Take care when disconnecting hydraulic hoses and fittings as the oil will be HOT.

Trans 1-2

⚠ WARNING

DO NOT go underneath the machine with the engine running. Switch off the engine, apply the parking brake and chock both sides of all wheels before going underneath the machine.

Trans 2-1

TEST POINTS

A - Mainline pressure

B - Forward clutch pressure

C - Reverse clutch pressure

D - Converter inlet/converter relief valve pressure

E - Converter outlet pressure

F - Pump flow (remove filter and fit adapters)

G - Lubrication pressure

H - Cooler flow (flowmeter in line from transmission to cooler)

J - Load Valve

If testing the complete transmission, the following procedures are listed in a logical sequence and should therefore be completed in the same sequence. Also, refer to the fault finding procedures at the beginning of the transmission section for reference to specific tests.

Mainline Pressure

1 Stop engine, connect a 0-20 bar (0-300 lbf/in^2) pressure gauge to test connector **A**.

2 Start engine and run at 1000 rev/min. With the transmission in neutral the pressure gauge will show the **Mainline Pressure** which should be as shown in Technical Data, page F/1-2.

3 Repeat step 2 and note gauge readings with engine running at 2000 rev/min.

4 Stop engine and remove test gauge.

If the mainline pressure is low, refer to the fault 'Low Mainline Pressure' on page F/6-1 for a list of possible reasons. A high reading could indicate a faulty pressure maintenance valve.

Clutch Pressure (Forward Clutch Given in Example)

1 Stop engine, connect a 0-20 bar (0-300 lbf/in^2) pressure gauge to test connector **B** (item **C** for reverse clutch).

2 Start engine and run at 1000 rev/min. With parking brake and footbrake firmly applied, select **Forward**, the pressure gauge will show the **Clutch Pressure** which should be as shown in Technical Data, page F/1-2.

Note: *If the mainline pressure is in the lower part of the tolerance band (see Technical Data, page F/1-2), then the forward and reverse clutch pressures should also be in the lower part of the tolerance band and vice versa.*

3 Repeat step 2 and note gauge readings with engine running at 2000 rev/min.

4 Stop engine and remove test gauge.

If the clutch pressure is low, the clutch could be leaking. A leaking clutch is easier to detect when the engine is running at idle. With the engine at idling speed, check the mainline pressure and then check the clutch pressure as described above, if the clutch pressure is 1.7 bar (25 lbf/in^2) less than the mainline pressure, then the clutch is probably leaking. Refer to the fault 'Low Clutch Pressure' on page F/6-2 before dismantling the clutch.

A high reading could indicate a faulty pressure maintenance valve.

Drive Head - Assembly (cont'd)

* The following procedures apply to both the SD40 and SD55 axles; the illustrations show a typical axle.

Note 1: *Both the crownwheel **15** and pinion **20** and the bevel gears **9** and **10** are matched and should be renewed as sets if any of their components are damaged or excessively worn. The two differential housing halves **8A** and **8B** are also matched. Do not use unmatched halves.*

Make sure all bearings are lightly oiled before fitting and setting. Make sure bearings are rotated whilst being set.

1 Select shims **23** required for pinion depth setting and fit behind new bearing cup **22**. (See Pinion Depth Setting Procedure, page F/31-2)

2 Fit new pinion head bearing cone **22** onto pinion **20.**

3 Fit a new collapsible spacer **24** onto pinion **20.** Lightly oil pinion head bearing **22.** Lightly oil pinion tail bearing **21** and fit the bearing. Using a suitable drift tap the tail bearing fully into position in the carrier. Locate the pinion in carrier **2.** (Before inserting, ensure that the pinion matches crownwheel **15.**) Insert a new oil seal **19** into housing. Pack grease between the seal lips. Fit drive flange **18** using a new stake nut **16** and washer **17**.

4 Tighten stake nut **16** until end float is almost zero, then check the seal drag torque is between 0.40 Nm - 0.75 Nm (3.54 lbf in - 6.64 lbf in). Continue to tighten the stake nut to collapse spacer and give a rolling torque of 1.7 Nm - 2.8 Nm (15 lbf in - 24.8 lbf in) (excluding seal drag). Record the rolling torque figure obtained. Rotate flange **18** in each direction to bed in the bearings before measuring. Stake the nut when the pre-load is correct.

Note 2: *If the specified rolling torque is exceeded, the collapsible spacer will be distorted. Renew the spacer and start again.*

5 Assemble the trunnion pins **11**, bevel gears **9** and **10** and their thrust washers **12** and **13** into differential half case **8A** (see **Note 1** above).

* **6** Position differential half case **8B** onto half case **8A,** aligning the match-mark letters (see **Note 1** above). Apply JCB Threadlocker and Sealer to the threads of bolts **7,** then fit and torque tighten to 28 Nm (21 lbf ft, 3 kgf m). Check the gears for free rotation.

7 Fit crownwheel **15** using new Verbus Ripp bolts **14** tightened to 94 Nm (69 lbf ft, 9.59 kgf m).

8 Locate crownwheel assembly (without bearings) into housing.

9 Drive bearing cones **5** and **6** onto differential case spigots. Lightly oil the bearings then fit their bearing cups and castellated nuts **4** into drive head carrier **2**. Do not fit the roll pins **3** at this stage.

10 Adjust castellated nuts **4** to give an increase in input pinion rolling torque of between 1.36 Nm - 2.5 Nm (12 lbf in - 22 lbf in) more than that recorded in Step **4**.

11 Measure the backlash between crownwheel **15** and pinion **20,** which should be 0.13 mm - 0.20 mm (0.005 in - 0.008 in). Adjust castellated nuts **4** by equal amounts when altering backlash. When backlash and preload are both correct, fit roll pins **3**.

12 Check tooth marking as per page F/32-1. If incorrect, adjust.

13 Apply JCB Multi-gasket to the mating faces of drive head carrier **2** and the axle casing. Fit the drive head carrier to the axle casing with the crownwheel towards the short drive shaft. Fit securing bolts **1** and tighten to 56 Nm (42 lbf ft, 6 kgf m).

* **14** Reasemble both driveshafts and hub assemblies.

Re-fill the hubs and differential with the correct grade of oil. Refit the propshaft.

Drive Head with Limited Slip Differential - Assembly (SD55 AXLES)

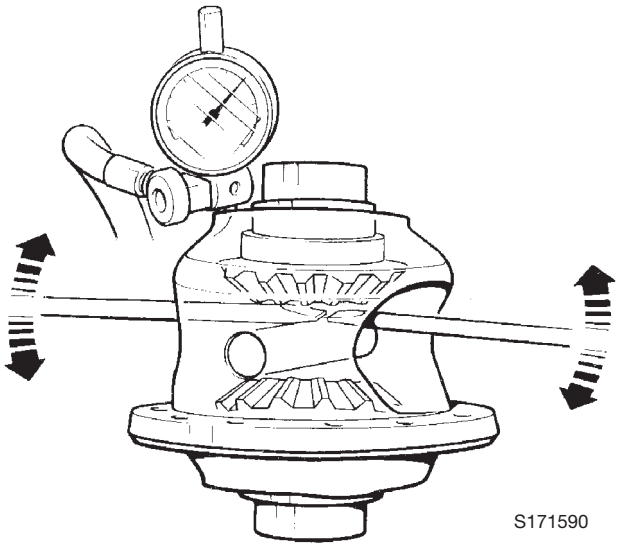
1 Fit side gears **15**, with pressure plates **19**, counter plates **17** and friction plates **18** into differential case **8**.

Note: *Do not fit the shims **16** at this point.*

Position planet gears **13** and thrust washers **14** until they are engaged with side gears and diametrically opposed. Rotate side gears until planet gears and washers align with trunnion pin bore.

2 Drive in trunnion pin **12** until bolt **11** can be located.

3 Using a dial test indicator, with two screwdrivers or suitable levers, gently apply pressure to side gear **15** away from the trunnion pins **12** as shown. Measure and note the end-float of the side gear.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4 Turn the differential assembly over and repeat step **3** for the second side gear.

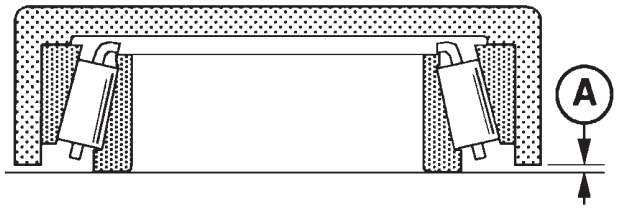
5 Dismantle the differential assembly. Add shims **16** to give end-float between 0.1 and 0.2mm (0.004 and 0.008in.).

6 Repeat steps **2**, **3**, and **4**. If the end float is correct. Remove bolt **11** apply JCB Threadlocker and Sealer to threads of bolt then fit and tighten to 28 Nm (20 lbf ft).

7 Fit crownwheel **10** using new Verbus Ripp bolts **9** tightened to 94 Nm (70 lbf ft).

8 Determine Pinion Depth Setting (See Note 1)

a Place new pinion head bearing assembly on a flat surface and position bearing cup 892/00174 over the bearing. Measure gap **A** (e.g. 0.20 mm) and add this to the cup depth stamped on the tool (e.g. 30.01 mm) to obtain the bearing depth.



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b From the face of the pinion, obtain the etched deviation figure (e.g. + 2) which is in units of 0.01 mm. If positive, add this to the bearing depth; if negative, subtract from the bearing depth.

c Obtain the deviation figure (e.g. -1) stamped on the differential housing bolt flange. If negative, add to bearing depth; if positive, subtract from bearing depth.

d Subtract the total of the above figures from the standard value of 31.19 mm. The result will be the thickness of shims required behind the pinion head bearing cup.

Example (all dimensions in millimetres)

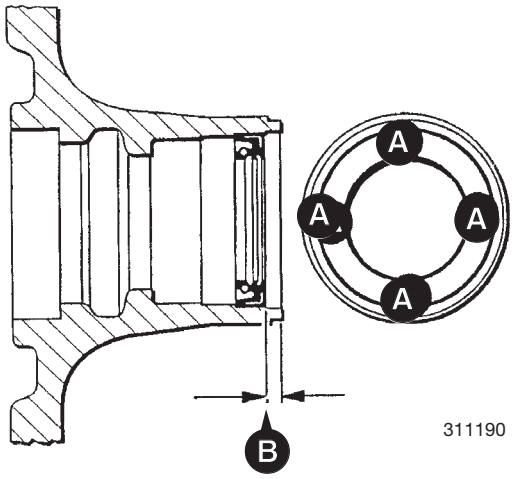
Cup depth	30.01
Gap **A**	+0.20
Bearing depth	30.21
Pinion deviation (+ 2)	+0.02
Housing deviation (- 1)	+0.01
Total	30.24
Standard value	31.19
Less Total above	30.24
SHIM THICKNESS	0.95

Note 1*: See page F/32-1 for general guidance on crownwheel and pinion adjustment.*

Note 2*: Note: Both the crownwheel **10** and pinion **23** and the side gears **15** and planet gears **13** are matched and should be renewed as pairs if any of their components are damaged or excessively worn.*

9 Select shims **29** required for pinion depth setting and fit behind new bearing cup **28**.

Axle and Gearbox Driveshaft Flange Seals (all JCB axles)



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Leaks can be caused by one or more of the following:

1 Oil seal not fitted square.

After fitting, measure the oil seal depth **B** in four places as shown at **A**, if the depth varies by more than 0.50mm (0.0195in) carefully tap the new seal until square or fit another seal.

2 Dirt ingress/contamination.

Dirt can enter an oil seal if the unit or flange is not thoroughly cleaned before removal and before fitting a new seal.

3 Oil seal damaged when fitting.

Check that the oil seal is not damaged, distorted or the lips cut or torn. When fitting an oil seal use a suitable tool or tube that does not touch the seal lip and fully supports the casing of the seal without distorting the seal during fitting. Lubricate the seal's external and internal diameters sparingly with JCB HP grease and check the spring was not displaced during fitting.

4 Poor seal yoke/flange surface finish.

When the leak is a seepage around the seal check and if none of the other points are evident check the yoke/flange surface carefully for damage.

Restoring Surface Finish

Light damage, scratches/marks of the surface finish can be restored. (Marks or scratches barely visible by eye can allow hot oil to leak past the seal).

If the surface is excessively damaged or worn, fit a new component.

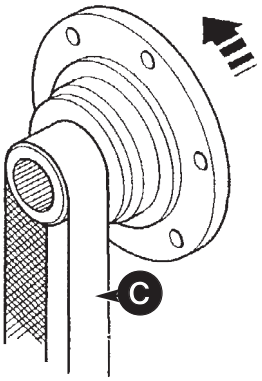
Restore by carefully polishing with 800 or finer grade abrasive grit paper **C**.

Use clean hydraulic oil as a lubricant and cutting fluid while polishing to prevent scoring or scratches.

The recommended procedure to polish a component is to mount in a lathe, rotate at 100 RPM approx. and gently apply a strip of 800 or finer abrasive grit paper and a film of hydraulic oil.

Note: Take care if polishing by hand when finishing to keep abrasive paper clean. Do not rotate the paper and the component in such a way as to create scratches or a spiral mark, which could 'screw' a small oil film under the seal lip.

Thoroughly clean all parts before and after polishing.



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Bleeding Procedure

Front Brakes

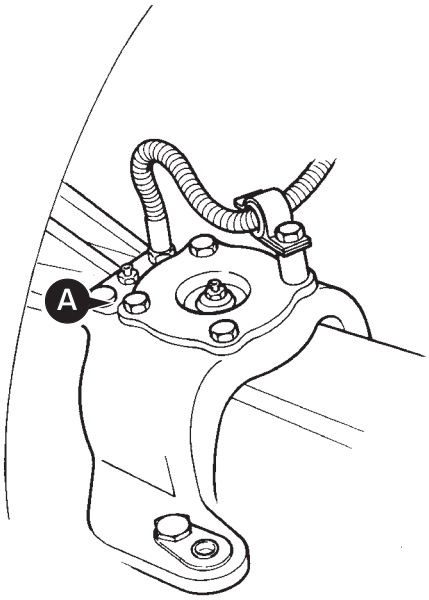
Bleed as follows:

a Attach tube to bleed screw **A**, ensuring that free end of tube is immersed in hydraulic fluid contained in a suitable jar.

b Open bleed screw **A** and apply one rapid stroke of the brake pedal followed by three rapid short strokes from the pedal half way position. After the third short stroke allow the pedal to return quickly to its stop.

c Continue bleeding normally until all air is expelled. Close bleed screw **A** with the pedal fully depressed.

d Repeat the procedure for the other side.



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Rear Brakes

Repeat front brakes procedure.

Dismantling and Assembly

The service brakes are located in the front and rear axles. Instructions for dismantling and assembly are detailed under **Front and Rear Axles - Axle Hub and Driveshaft in Section F**.

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* Steer Mode Valve 4 - 1

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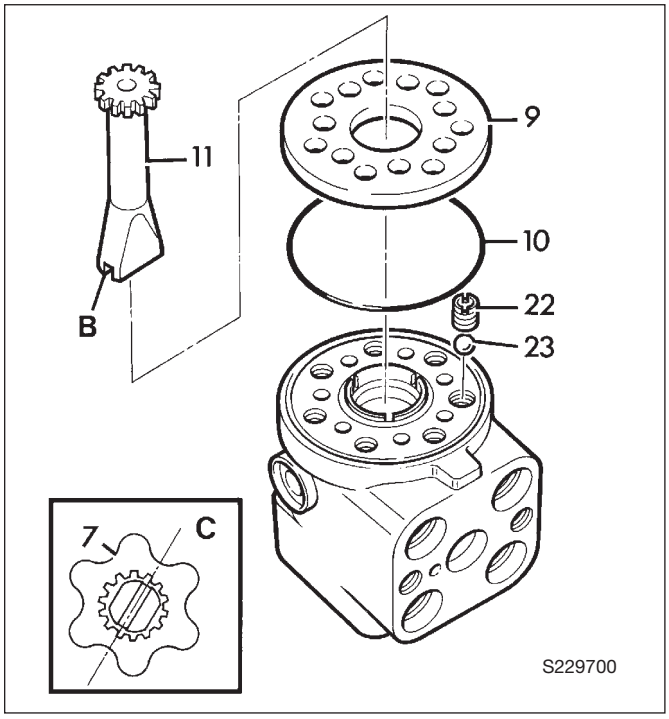
Bleeding Procedure 6 - 1

***Note**: For Charge/Priority Valve, see Brake Section G.*

7 Invert unit and place on a suitable hollow support so that body does not rest on protruding sleeve, thus preventing displacement of the new seals. Place ball **23** into check valve hole and fit bush **22**.

8 Fit new 'O' ring **10**.

9 Fit distributor plate **9** ensuring that holes align. Locate shaft **11** onto cross-pin **14**, noting position of slot. When rotor **7** is fitted, slot must align with hollows of rotor as shown at **C**.



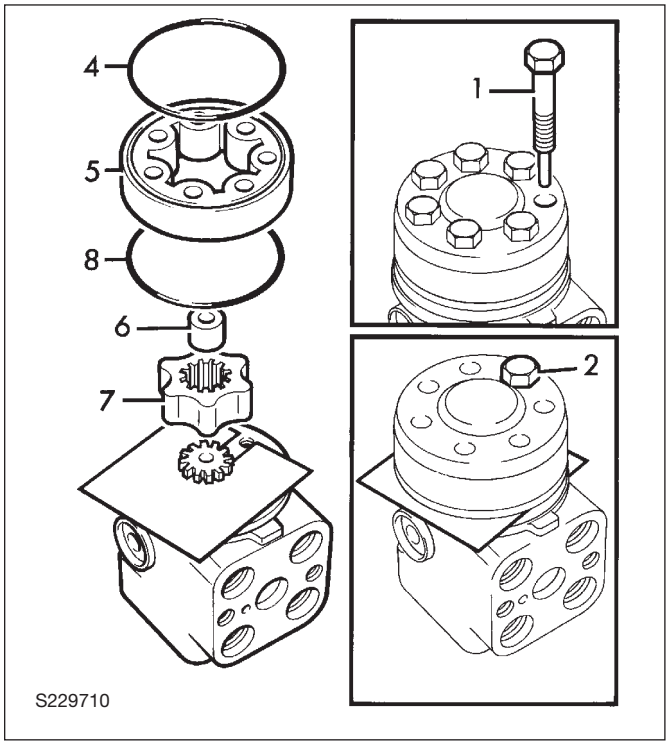
10 Use a suitable piece of rigid flat material, 0.25mm (0.010 in.) thick, to support the shaft and ensure positive engagement with the splines of rotor **7**.

11 Locate rotor onto shaft, ensuring alignment as at **C**. Fit spacing bush **6** into rotor.

12 Fit 'O' rings **4** and **8** each side of body **5**, then position body over rotor.

13 Refit the end plate and fit at least one bolt **2** before removing support material.

14 Fit remaining bolts, ensuring that special bolt **1** is correctly located. Tighten all bolts to 29Nm (22 lbf ft).



Pressure Relief Valve Cartridge

After renewing the 'O' ring, torque tighten the cartridge to 50 Nm (37 lbf ft). The valve is preset at 175 bar (178 kgf/cm^2, 2500 lbf/in^2) but the setting should be rechecked after fitting the steering unit to the machine.

Shock Valves

If the shock valves have been dismantled, clean the threads of adjusting screw **31** and the threads in the bore of the steering unit body using JCB Cleaner and Degreaser, allow to dry. Assemble seat **35**, ball **34**, cap **33** and spring **32** then coat threads of screw **31** with JCB Lock and Seal. Assemble screw to depth measured during dismantling (see page H/5 - 2) then fit plug **29** and washer **30**.