Service Manual

3CX, 4CX, & Variants

From M/c No. 400001 To 460000

Publicación No. 9803/3260 Issue 9

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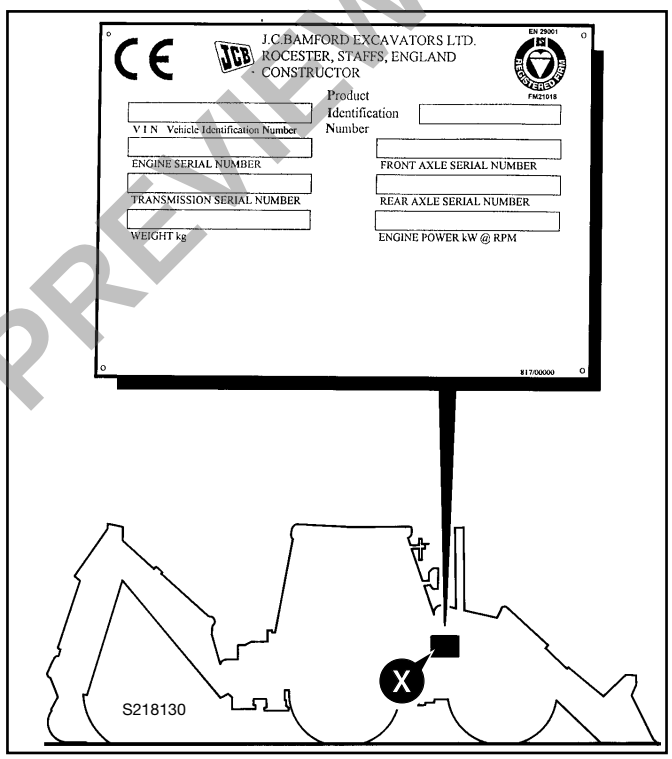
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Machine Identification Plate

Your machine has an identification plate **X** mounted on the loader tower as shown. The serial numbers of the machine and its major units are stamped on the plate.

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.



Typical Machine Identification Number

SLP	3CX	T	S	R	E	0430001
A	B	C	D	E	F	G

A World Manufacturer Identification

B Machine Model

C Steer Type (T= 2WS, F=4WS)

D Build Type (S=Sideshift, C=Centremount, L=Loader)

E Year of Manufacture:

R = 1994	1 = 2001
S = 1995	2 = 2002
T = 1996	3 = 2003
V = 1997	4 = 2004
W = 1998	5 = 2005
X = 1999	6 = 2006
Y = 2000	7 = 2007

F Manufacturer Location (E = England)

G Machine Serial Number:

Typical Engine Identification Number

AB	50262	U	500405	P
A	B	C	D	E

A Engine Type
AB = 4 cylinder turbo

B Build Number

C Country of Origin

D Engine Sequence Number

E Year of Manufacture

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Torque Settings

Use only where no torque setting is specified in the text. Values are for dry threads and may be within three per cent of the figures stated. For lubricated threads the values should be REDUCED by one third.

UNF Grade 'S' Bolts

Bolt Size		Hexagon (A/F)	Torque Settings		
in	(mm)	in	Nm	kgf m	lbf ft
1/4	(6.3)	7/16	14	1.4	10
5/16	(7.9)	1/2	28	2.8	20
3/8	(9.5)	9/16	49	5.0	36
7/16	(11.1)	5/8	78	8.0	58
1/2	(12.7)	3/4	117	12.0	87
9/16	(14.3)	13/16	170	17.3	125
5/8	(15.9)	15/16	238	24.3	175
3/4	(19.0)	11/8	407	41.5	300
7/8	(22.2)	15/16	650	66.3	480
1	(25.4)	11/2	970	99.0	715
11/4	(31.7)	17/8	1940	198.0	1430
11/2	(38.1)	21/4	3390	345.0	2500

Metric Grade 8.8 Bolts

Bolt Size		Hexagon (A/F)	Torque Settings		
	(mm)	mm	Nm	kgf m	lbf ft
M5	(5)	8	7	0.7	5
M6	(6)	10	12	1.2	9
M8	(8)	13	28	3.0	21
M10	(10)	17	56	5.7	42
M12	(12)	19	98	10	72
M16	(16)	24	244	25	180
M20	(20)	30	476	48	352
M24	(24)	36	822	84	607
M30	(30)	46	1633	166	1205
M36	(36)	55	2854	291	2105

Rivet Nut Bolts/Screws

Bolt Size		Torque Settings (for steel rivet nuts)		
	(mm)	Nm	kgf m	lbf ft
M3	(3)	1.2	0.12	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

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

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Safety Notices

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

⚠ DANGER

Denotes an extreme hazard exists. If proper precautions are not taken, it is highly probable that the operator (or others) could be killed or seriously injured.
INT-1-2-1

⚠ WARNING

Denotes a hazard exists. If proper precautions are not taken, the operator (or others) could be killed or seriously injured.
INT-1-2-2

⚠ CAUTION

Denotes a reminder of safety practices. Failure to follow these safety practices could result in injury to the operator (or others) and possible damage to the machine.
INT-1-2-3

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Lubricants & Capacities

ITEM	CAPACITY Litres	CAPACITY UK Gal	FLUID/LUBRICANT	INTERNATIONAL SPECIFICATION
Fuel Tank	100	22	Diesel Oil	ASTM D975-66T Nos. 1D, 2D
Engine (Oil) ①			**JCB 15W/40 Multigrade**	SAE15W/40, MIL-L-46152B,
2 Wheel Steer Machines			-10 °C to 50 °C (14 °F to 122 °F)	API CD/SE, MIL-L-2104D
- Build AA	9.7	2.1		
- Build AA (Hot Climate)	11.0	2.4	**JCB Super Universal Agricultural**	SAE10W/30, MIL-L-2105,
- Build AB	10.0	2.2	-15 °C to 30 °C (5 °F to 86 °F)	MIL-L-46152, API CD/SE, MIL-L-2104C
4 Wheel Steer Machines				
- Build AB	10.0	2.2	**JCB Torque Converter Fluid** -18 °C to 0 °C (0 °F to 32 °F)	SAE10W, MIL-L-46152, MIL-L-2104D, API CD/SE
Engine (Coolant)	20.0	4.4	**JCB Universal Antifreeze/water**	ASTM D3306-74
Syncro Shuttle (2WD) ②	15.75	3.5	**JCB Special Transmission Fluid**	ESP-M2C 33G
Syncro Shuttle (4WD) ②	16.25	3.6		
(machines up to serial number 431230)				
Syncro Shuttle (2WD) ②	13.0	2.9	**JCB Special Transmission Fluid**	ESP-M2C 33G
Syncro Shuttle (4WD) ②	14.0	3.1		
(machines from serial number 431230 to TBA)				
* Syncro Shuttle (2WD) ②	14.4	3.2	**JCB Special Transmission Fluid**	ESP-M2C 33G
Syncro Shuttle (4WD) ②	15.4	3.4		
(machines from serial number TBA - fitted with 12.2 inch convertors)				
Powershift ②	14.75	3.25	**JCB Special Transmission Fluid**	ESP-M2C 33G
Front Axle (4WD)				
Housing (2WS)	13	2.86	**JCB HD90 Gear Oil**	API-GL-5
Housing (AWS) ⑥	18	3.96		MIL-L-2105C
* Hubs (x2)	2.0	0.44		
Rear Axle (AWS)				
Housing	18	3.96	**JCB Special Gear Oil Plus**	API-GL-4
* Hubs (x2)	2.0	0.44		
Rear Axle (2WS)	23	5.0	**JCB Special Gear Oil Plus**	API-GL-4
Slew Gearbox	4.3	0.9	**JCB HD90 Gear Oil**	API-GL-5, MIL-L-2105C
Brake System				
- Standard	1.2	0.26	**JCB Light Hydraulic Fluid**	ISO VG15
- Servo	1.4	0.31	⚠ **CAUTION: DO NOT USE ORDINARY BRAKE FLUID**	
Hydraulic System ③	135	29.7	**JCB High Performance Hydraulic Oil** (Above 38 °C, 100 °F)	ISO VG46
			JCB Hydraulic Fluid HP32 (Below 38 °C, 100 °F)	ISO VG32
* Air Conditioning System	1544 g	3.4 lb	**Refrigerant**	Freon 12

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Service Schedules

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

⚠ WARNING

Raised loader arms can drop suddenly and cause serious injury. Before working under raised loader arms, fit the loader arm safety strut.

GEN 3-2

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

Calendar equivalents:

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

Pre-start Cold Checks Service Points and Fluid Levels	Operation	10 Hr	50 Hr	†100 Hr	500 Hr	1000 Hr	2000 Hr
ENGINE							
Oil level	- Check		•				
Oil and Filter ④	- Change			•	•	•	•
Air Cleaner Dust Valve	- Clean			•	•	•	•
Air Cleaner Outer Element	- Change					•	•
* Air Cleaner Inner Element	- Change						•
Fuel Filter	- Change			•	•	•	•
Fuel Filter	- Drain		•				
Coolant Quality/Level	- Check		•	•	•	•	•
Fuel Sedimenter	- Drain and Clean		•	•	•	•	•
Fan Belt Tension/Condition	- Check		•	•	•	•	•
Valve Clearances ③	- Check and Adjust						•
Engine Mounting Bolts for Tightness ③	- Check			•	•	•	•
Radiator	- Clean				•	•	•
All Hoses - Condition	- Check			•	•	•	•
Precleaner	- Clean	•	•	•	•	•	•
TRANSMISSION, AXLES AND STEERING							
Transmission Oil Level	- Check		•	•	•		
Transmission Oil	- Change					•	•
Transmission Filter	- Change			•	•	•	•
Axle Oil Level (incl. Hubs when applicable) ①	- Check			•	•		
Axle Oil (incl. Hubs when applicable)	- Change					•	•
Axle Oil (Limited Slip Diff.)	- Change				•	•	•
* Tyre Pressures/Condition	- Check		•	•	•	•	•
Front Hub Bearings ③	- Check			•	•	•	•
Transmission Strainer	- Clean					•	•
Drive Shafts	- Security/Grease			•	•	•	•
Steer Axle Movement/Shimming ③	- Check			•	•	•	•
Steer Axle Pivots and Linkages ⑦	- Grease			•	•	•	•

*

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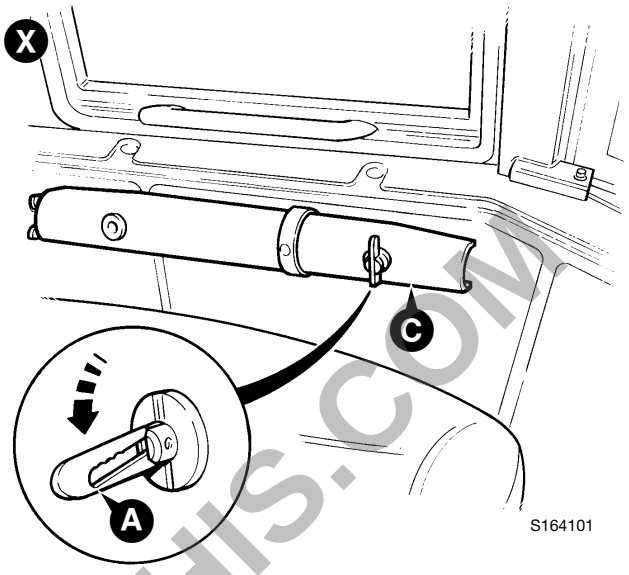
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Loader Arm Safety Strut

Fitting and Removing

Install the loader arm safety strut as detailed below before working underneath raised loader arms.

* Depending on the age and type of machine, the strut may be stowed inside the cab, mounted on the left hand fender cladding, as shown at **X**. Alternatively, the strut may be stowed on the loader arm, as shown at **Y**.



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Fitting

⚠ WARNING

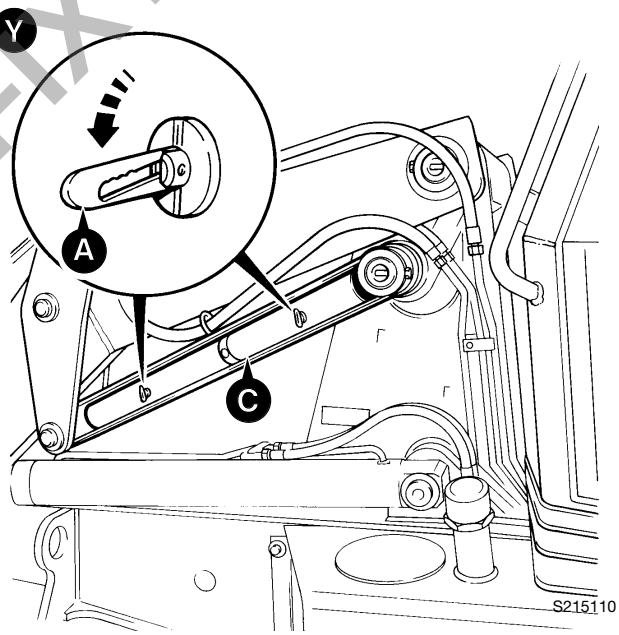
The loader arm safety strut must be fitted before any work is done beneath raised loader arms. Make sure the shovel is empty, then fit the safety strut as instructed below.
GEN-1-7

1 Fully raise the loader arms and stop the engine.

2 Release fastener **A** and withdraw strut **C** from its stowage bracket.

3 Push the strut **C** over the ram piston rod and secure the strut in position with strap **B**.

4 Start the engine and slowly lower the loader arms until the weight of the arms is just taken by the strut.



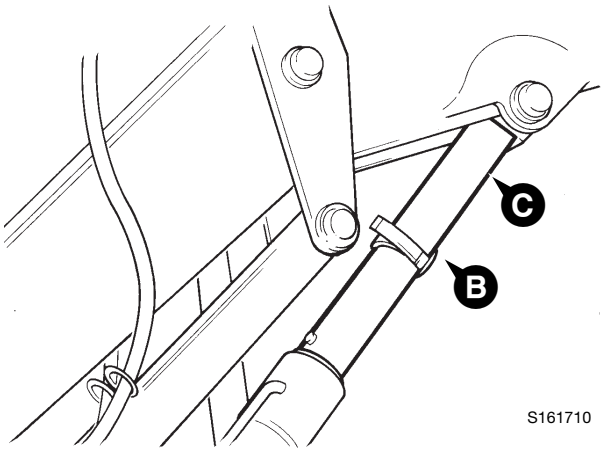
S215110

Removing

1 Raise the loader arms to take the weight off the strut, then stop the engine.

2 Undo strap **B**, remove the strut **C** and return it to its stowage position.

3 Secure the strut in its stowage position with fastener **A**.

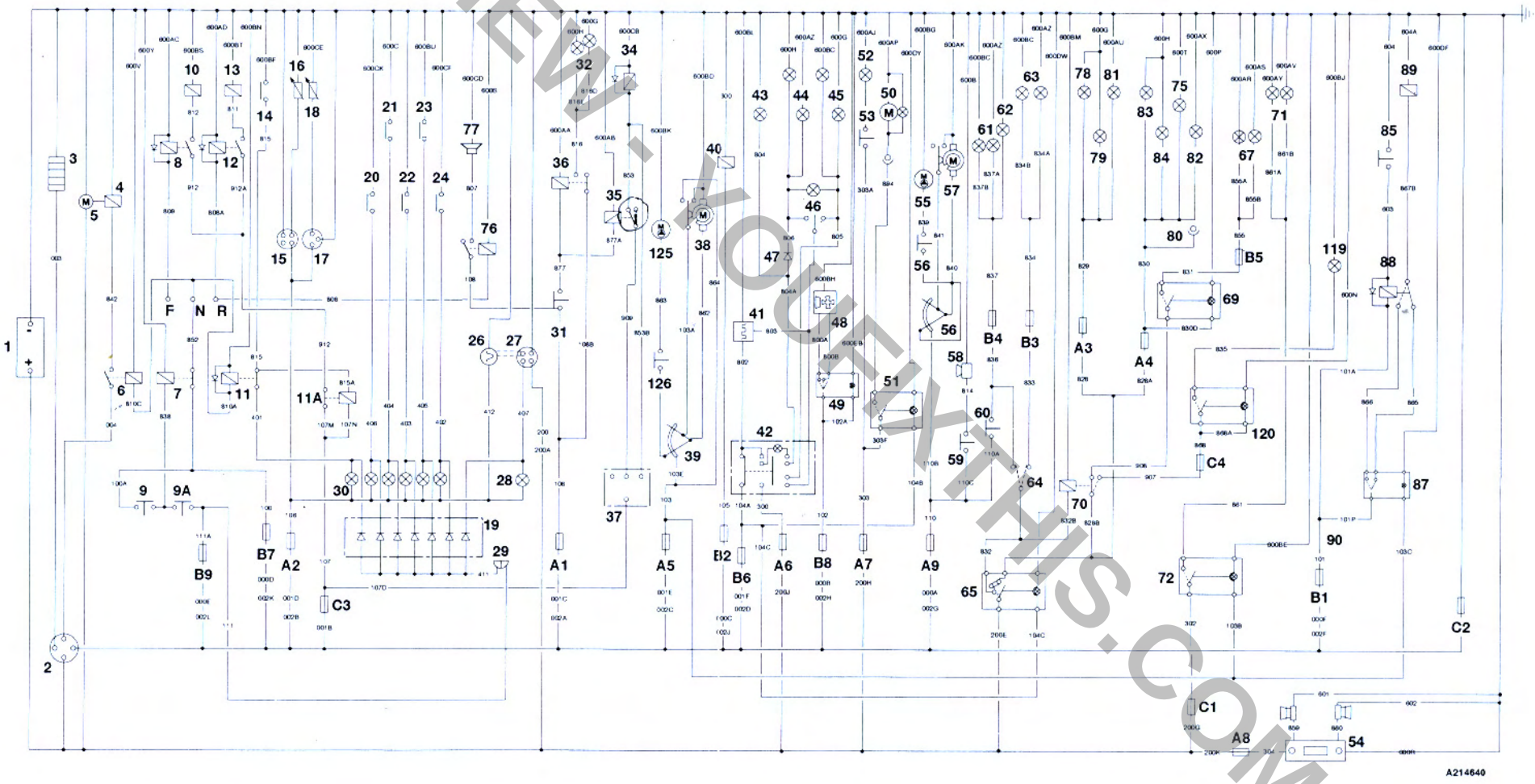


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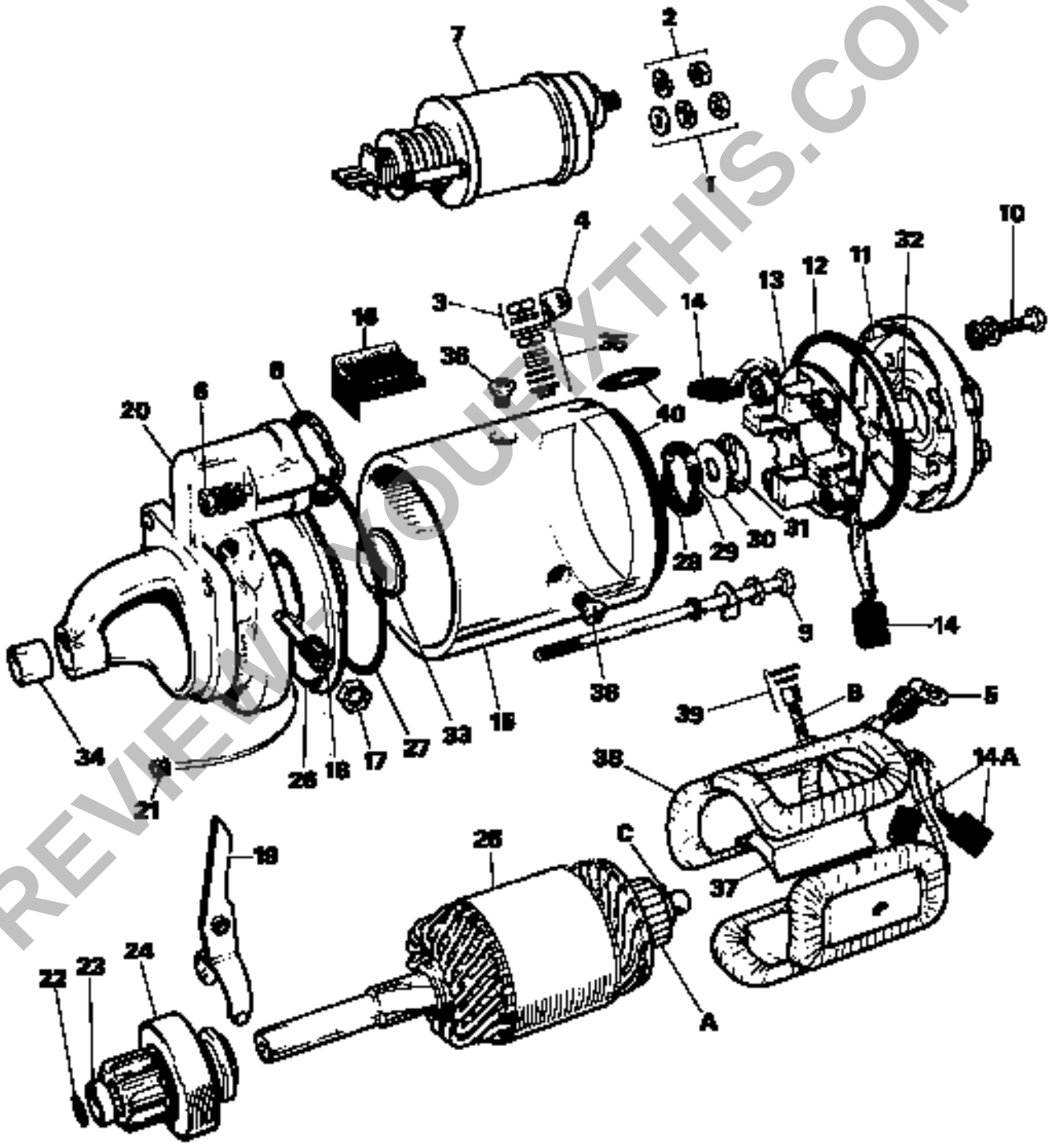
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Electrics Section C
Circuit Diagrams and Component Lists 15 - 1



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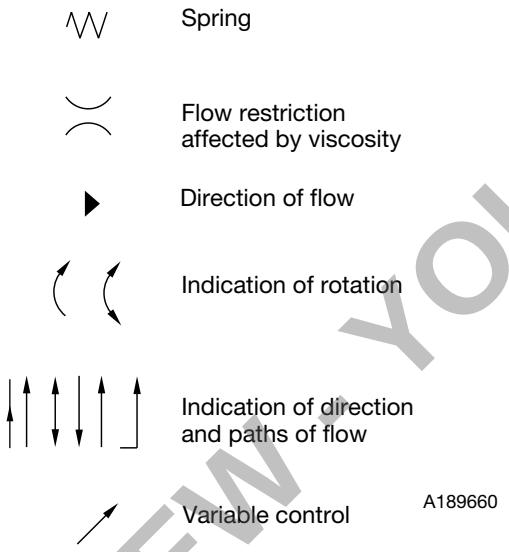
Introduction to Hydraulic Schematic Symbols

Complex hydraulic components and circuits can be described to the engineer by using graphical symbols. The following pages illustrate and give a brief description for some of the more common symbols used.

There are many symbols in use and it would be impossible to include them all here. However it should be noted that most are only variations or refinements on the basic principles explained here. If more detailed information is required you are recommended to obtain a copy of BS2917 or IS01219.

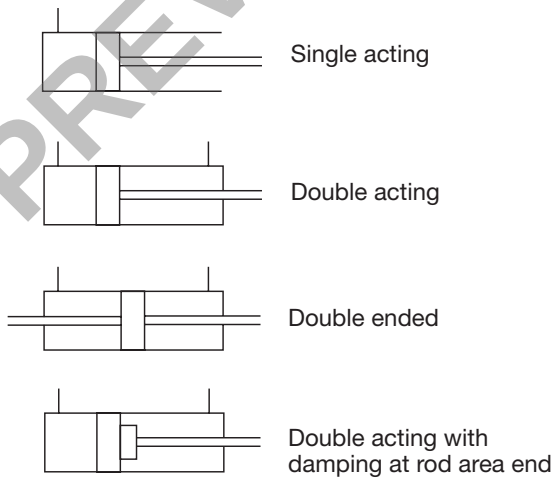
Once familiar with the symbols, the engineer can use hydraulic circuit diagrams as an aid to fault finding. It will be possible to see the complete hydraulic circuit and decipher the relationship between hydraulic components.

General (Basic & Functional Symbols)



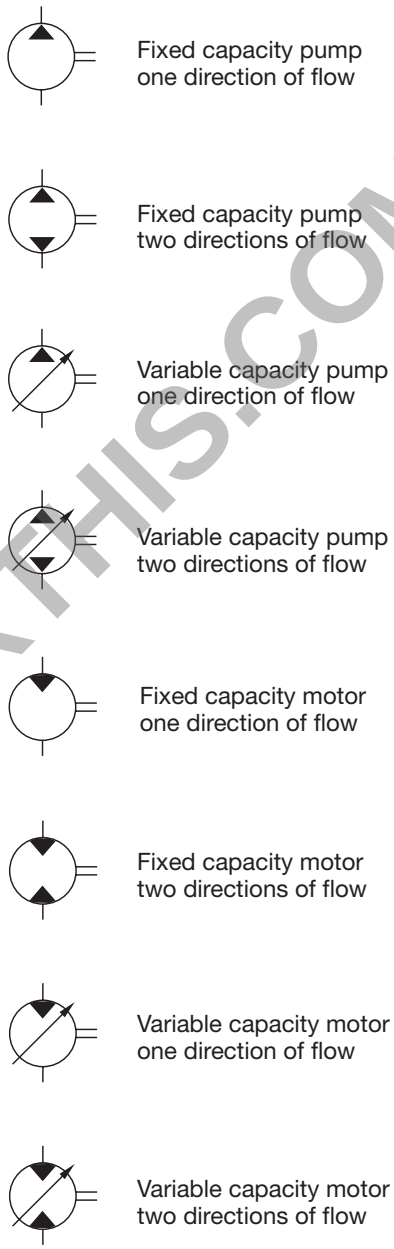
A189660

Rams



A189670

Pumps & Motors



A189680

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Fault Finding Contents

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One hydraulic service fails to operate or is slow to operate	25 - 2
The engine tends to stall when the hydraulics are under load	25 - 2
A spool is sticking	25 - 3
Leaking Oil Seal (Control Valves)	25 - 3
Ram creep	25 - 3
Hydraulic oil becomes too hot	25 - 4
Steering fails to operate or is stiff to operate	25 - 4
Steering fails to respond to selected mode	25 - 4

Introduction

The purpose of this section is to help you trace hydraulic faults to a faulty unit (valve, actuator, ram etc). Once you have traced the faulty unit, refer to the appropriate dismantling, inspecting and test instructions given elsewhere in the hydraulics section.

To help identify circuits, valves, rams etc mentioned in the fault finding procedures, refer to the hydraulic schematic diagrams (near the beginning of the Hydraulics Section).

1 Before you begin fault finding, read the Safety information at the beginning of this manual.

2 Make simple checks before say, stripping a major component.

3 Make sure that the hydraulic fluid is at correct working temperature (50 °C, 122 °F).

4 What ever the fault, check the condition of the hydraulic fluid. Drain and replace if necessary.

5 Make any relevant electrical checks before moving on to the hydraulics.

6 Be sure to remove ALL contamination and if possible identify its origin. It may be part of a component from elsewhere in the circuit.

7 Replace any seals such as 'O' rings before re-assembling hydraulic components.

Fault	Probable Cause	Action
1 Lack of power in all hydraulic functions.	Insufficient hydraulic fluid.	Check for leaks and top up as required.
	Hydraulic leaks in system.	Check hoses, replace as required.
	Engine performance.	Check engine performance, see transmission section for stall speed test procedures.
	Main relief valve (MRV) setting incorrect.	Check and adjust as required.
	Low pump flow.	Check pump flow, if required service or replace pump.
	Hydraulic tank breather	Clean or replace the breather
	Tank filter by-pass valve	Check condition of hydraulic filter
	Unloader valve pressure setting too high	Check pressure setting of the unloader valve.

..... continued

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Type	Perkins 1000 Series 4 cylinder Engines AB - turbocharged, AA - Naturally Aspirated	
Bore (nominal)	100mm (3.937 in)	
Stroke	127mm (5.000 in)	
Swept Volume	4 litres (243 in3)	
Compression Ratio	Turbocharged 16.0:1, Naturally Aspirated 16.5:1	
Compression Pressure	28 bar (400 lbf/in²) [maximum variation between cylinders 3.5 bar (50 lbf/in2)]	
Injection Sequence	1,3,4,2	
Valve Clearance - Cold	- Inlet	0.20mm (0.008 in)
	- Exhaust	0.45mm (0.018 in)
Oil Pressure (hot) at maximum speed	- AA	2.1 bar (30 lbf/in2)
	- AB	2.6 bar (40 lbf/in2)
Maximum Air Cleaner Restriction		559mm (22 in H2O)

Fuel System
Injection System Details

Engine			Injection Pump		Injectors	
Model	Type	BHP	Code	Static Timing	Code	Working/Setting Pressures
All Wheel Steer Machines						
AB50364	Turbocharged	96	CM78L/1100/1/2420	15.5° BTDC	JG	230 atm
2 Wheel Steer Machines						
AA50386	Naturally Aspirated	76	DM55L/1000/1/2420	16.5° BTDC	HZ	220 atm
AB50388	Turbocharged	90	GM64L/1000/2/2420	23.0° BTDC	JK	220 atm
AB50389	Turbocharged	96	CM78L/1100/1/2420	15.5° BTDC	JG	230 atm

Idling Speed	- All builds	750 rev/min
Maximum Governed Speed	- All builds	2200 rev/min
Maximum No-load Speed (High Idle)	- All builds	2320 - 2420 rev/min

Cooling System	
Coolant Pressure	0.48 bar (7 lbf/in2)
Coolant Temperature (Normal)	80-85 °C (176-185 °F)
Temperature Warning Light operates at:	98 °C (208 °F)

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Syncro Shuttle Transmission

Check Level - *for Interval see Service Schedule*

Ⓐ - Dipstick/Filler

Oil level should be to the full mark on the dipstick when the oil is cold i.e. before starting machine operation.

DO NOT OVERFILL

Change Oil & Clean Strainer
- for Interval see Service Schedule

Drain oil by removing strainer **B**. Clean strainer using a suitable solvent.

When refitting strainer, renew gasket **C** and apply JCB Lock and Seal to bolts **D**.

Torque Settings

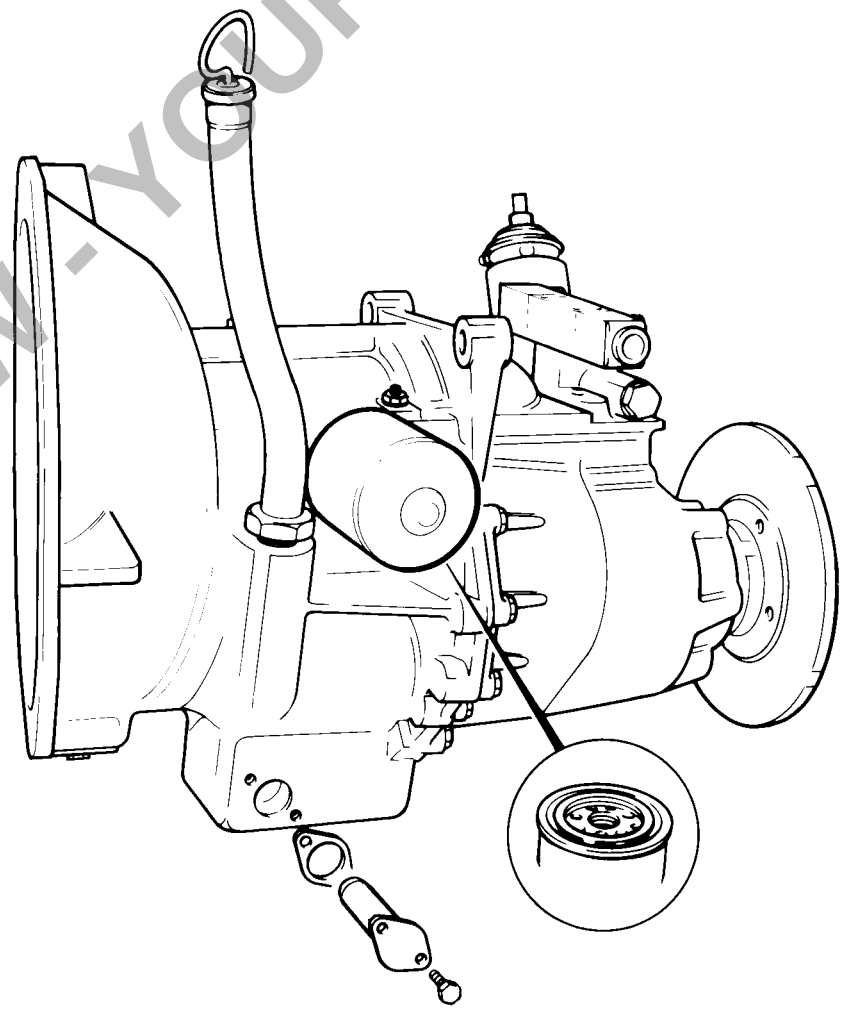
Item	Nm	kgf m	lbf ft
D	10	1.0	7.4

Renew Filter - *for Interval see Service Schedule*

Unscrew and discard element **E**.

Smear seal **F** with transmission oil, and fit new element hand tight only.

Fill system to dipstick mark with JCB Special Transmission Fluid.



143030

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Fault Finding (cont'd)

Harness Wires

Use the illustration below to complete continuity checks on the air conditioning system harness wires.

Key

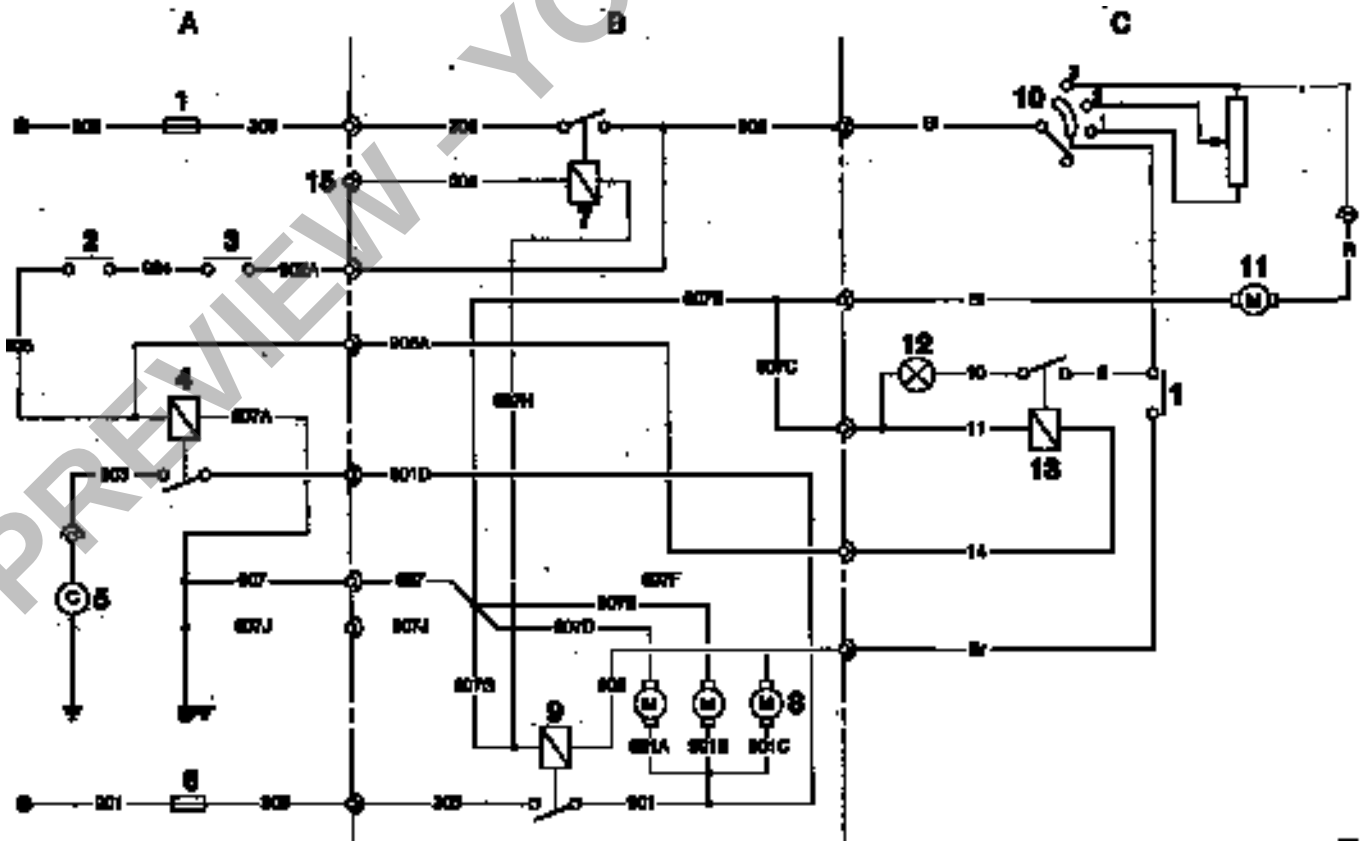
1 Fuse, 25A
2 Pressure Switch
3 Pressure Switch
4 Clutch Relay
5 Compressor Clutch
6 Fuse, 25A
7 Blower Relay
8 Cooling Fans
9 Fan Relay
10 Blower ON/OFF/Speed Switch
11 Blower
12 Warning llght
13 Warning Light Relay
14 Thermostat
15 From Starter Switch

Colour Code

BL Black
Br Brown
R Red

Zones

A Engine
B Cab
C Air Conditioning Unit



A209120

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Powershift Transmission & Steer Circuit - AWS Machines Only (from Serial Number 430001)

Note: Except for the transmission and steer circuits (shown above), the AWS electrical circuit is the same as shown on Page C/18-1 to C/18-4.

Main Components

1 Battery
2 Starter Switch
3 Thermostart
4 Starter Solenoid
5 Starter Motor
8 Reverse Alarm
9 2/4 Wheel Drive Solenoid
16 Diode
43 Mainshaft Solenoid
44 Layshaft Solenoid
45 Forward Low Solenoid
46 Forward High Solenoid
47 Reverse High Solenoid
48 Reverse Low Solenoid
49 Crab/4 Wheel Steer Solenoid
50 4 Wheel Steer Solenoid
51 Crab Solenoid
52 2 Wheel Steer Solenoid
53 Steer Mode Printed Circuit Board

Switches

61 Transmission Dump Switch (Loader)
62 Forward/Reverse Switch
63 Park Brake Switch
64 Brake Light Switch
96 4 Wheel Drive Switch
97 Powershift Column Switch
98 Front Proximity Switch
99 Rear Proximity Switch
100 Steer Mode Select Switch
101 4 WS/Crab Selector (part of PCB - item 53)
102 2 WS/4 WS Selector (part of PCB - item 53)

Relay

110 Neutral Start Relay
111 Ignition Relay '1'
112 Transmission Dump Relay
113 Forward Relay
114 Reverse Relay
115 Park Brake Relay
116 4 Wheel Brake Relay
119 Ignition Relay '2'
123 Neutral Relay
124 Auto 2 Wheel Drive Relay
125 Drive Relay (Layshaft & Mainshaft)
126 Forward High/Low Relay
127 Reverse High/Low Realy

Lights

175 4 Wheel Steer Indicator Light
176 Crab Steer Indicator Light
177 2 Wheel Steer Indicator Light
178 Front Instrument Console Illumination

Wire Number Identification

Refer to pages C/42-1 on for full wire number identification and descriptions.

* **Note:** Fuse C6 is only fitted on machines from serial number:
3CX (214) - 438636; 4CX (214S) - 437866
Prior to this, the gear controls were protected by fuse C3.

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Excavator Valve - Auxiliary Relief Valve Operation

A.R.V's are positioned in the excavator valve block in order to relieve excessive pressure in the services as shown on pages E/10 - 1 and E/10 - 2.

1 Valve at Rest

Figure 1 shows the service in neutral with no forces acting on the equipment.

The force of spring **D** acting through collar **C** keeps poppet **B** firmly held on its seat.

Chamber **J** is connected to the exhaust gallery via small drilled holes **H**, this means the pressure in the chamber will always be at exhaust.

The A.R.V. pressure setting is adjustable by means of spring **D** and adjusting screw **E.** Turning the screw clockwise compresses the spring and therefore increases the pressure setting. And conversely, turning the screw anti-clockwise releases the spring which decreases the pressure setting.

2 Poppet Opens

Figure 2 shows the pressure in the service gallery **A** has reached the setting of the A.R.V.

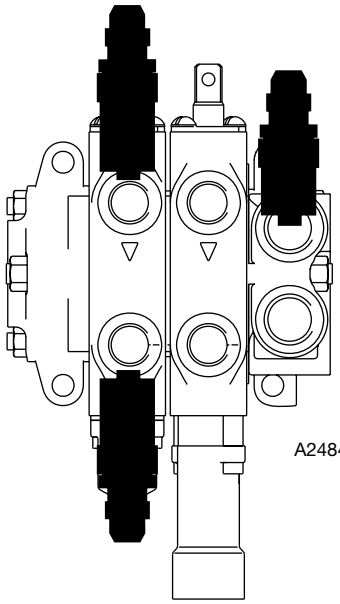
The pressure on the service side of the poppet is high enough to overcome the force of spring **D** so poppet **B** lifts off its seat. Oil in chamber **J** is displaced through small drilled holes **H.**

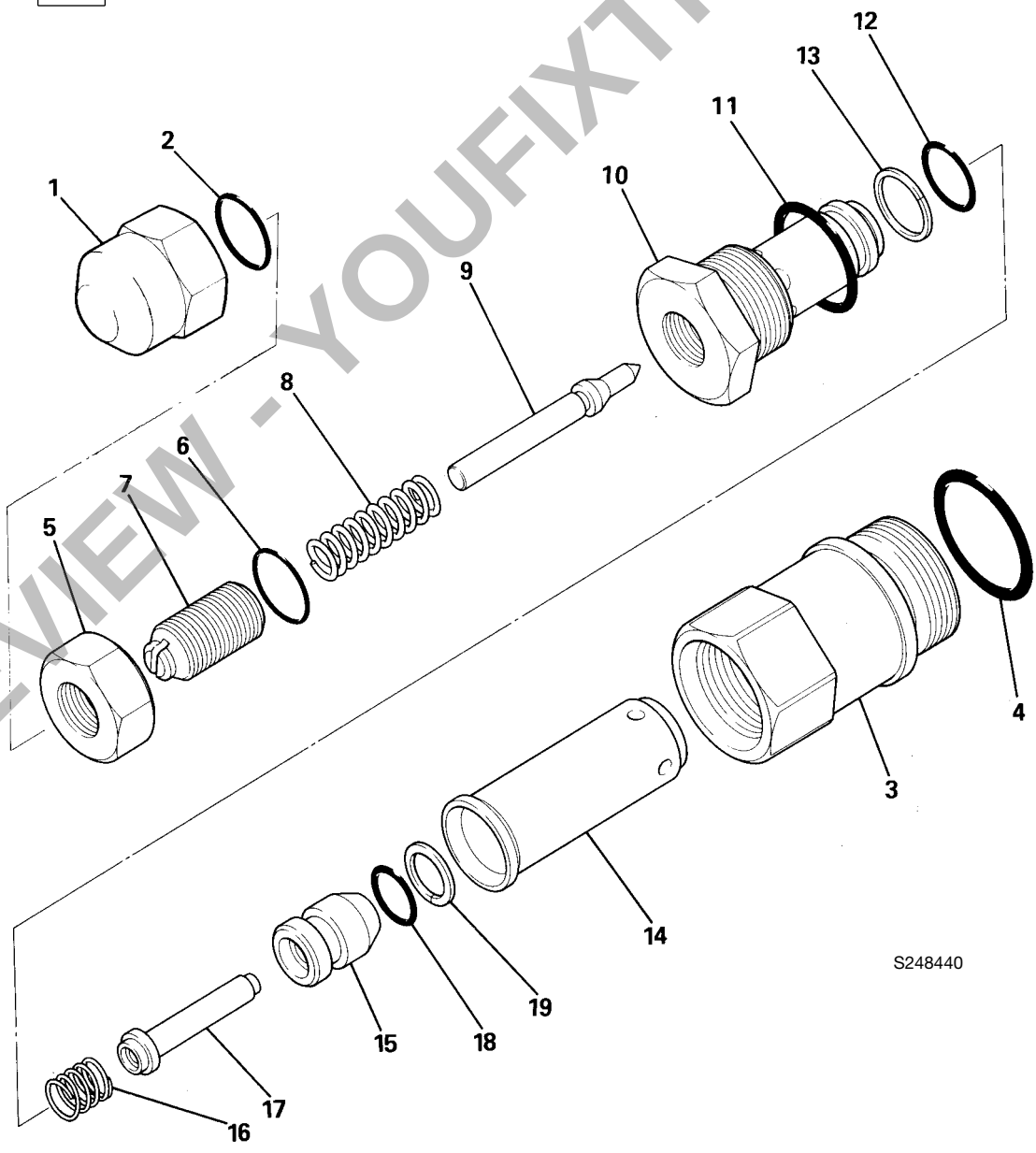
Service pressure at **A** is now released into exhaust gallery **K.**

Hydraulic Steer Unit (2 Wheel Steer Machines)

Operation 4 - Left Turn, Unassisted

The illustration shows the circuit operation with the engine stopped. Turning the steering wheel rotates the inner spool **A** until the cross pin engages with and rotates outer sleeve **B**, metering oil to the stator **D**, and pumping it out to ram **E** under manual pressure only. As there is no supply from the pump, oil from one side of the ram, supplemented by exhaust oil if necessary, is used to feed the other side via non-return valve **F**.





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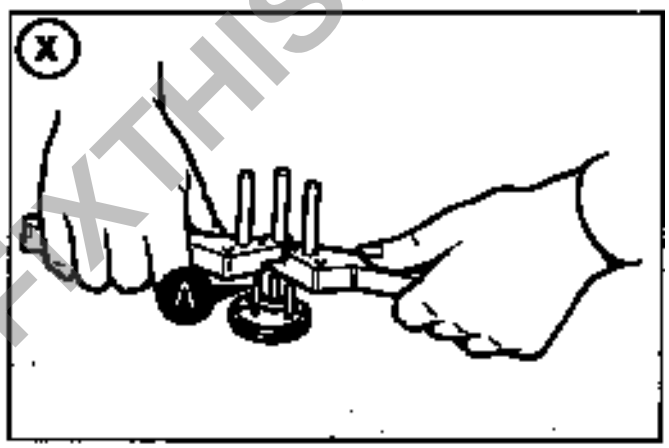
Gland Seal Fitting Procedure

The size (diameter) and position of pins **A** is determined by the diameter and radial width of the gland seal being fitted.

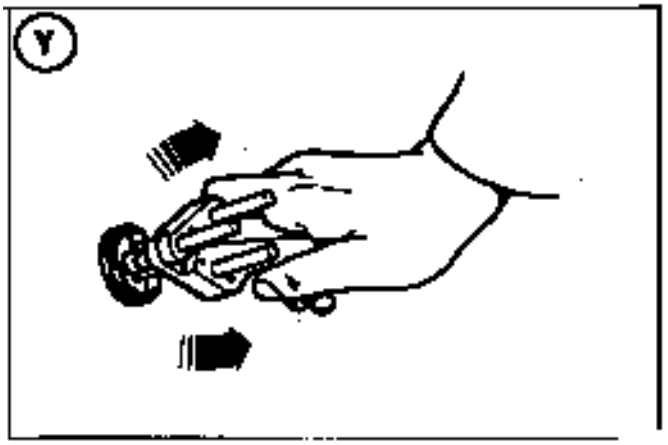
The pins are screwed into threaded holes in the tool body, the spacing of the holes are designed to suit small or large diameter gland seals.

To fit a new gland seal:

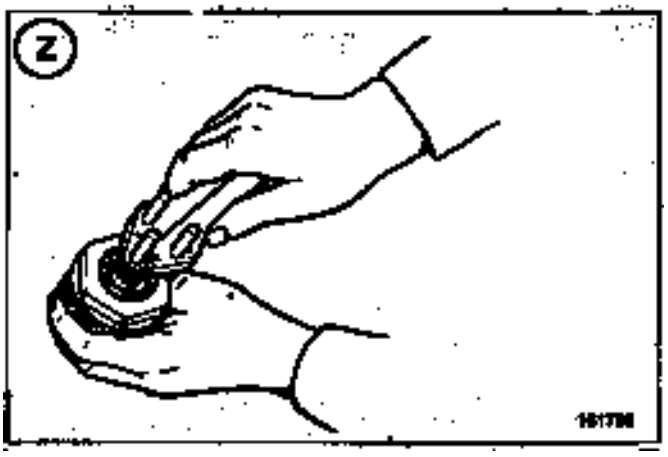
1 Open the tool as shown at **X** and insert the new gland seal, the seal must be fitted behind the two front pins but in front of the rear pin as shown.



2 Close the tool as shown at **Y**. The seal must form a reniform (kidney shape).



3 Locate the seal in the end cap groove, shown at **Z,** when the seal is in position, open the tool to release the seal. Make sure the seal is correctly installed in its groove and remove the tool.

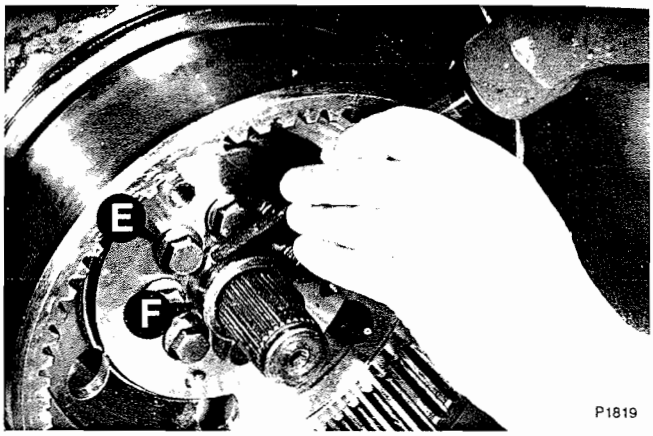


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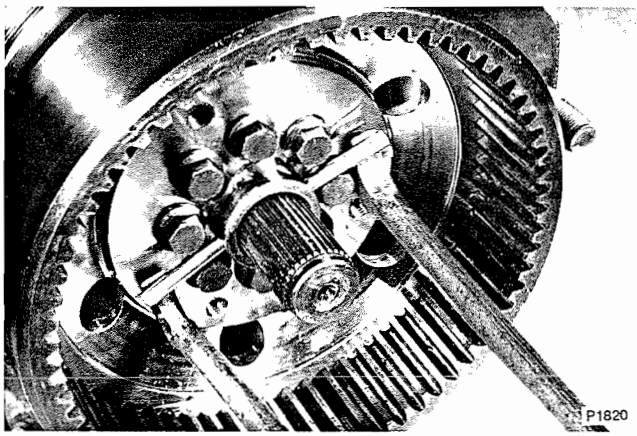
Hub and Driveshaft - Dismantling (cont'd)

8 To remove the 'Verbus Ripp' bolts **E**, it is necessary to remove the spacer **F**. Revolve the spacer with a suitable drift to align the holes in the spacer with the space between the bolts.

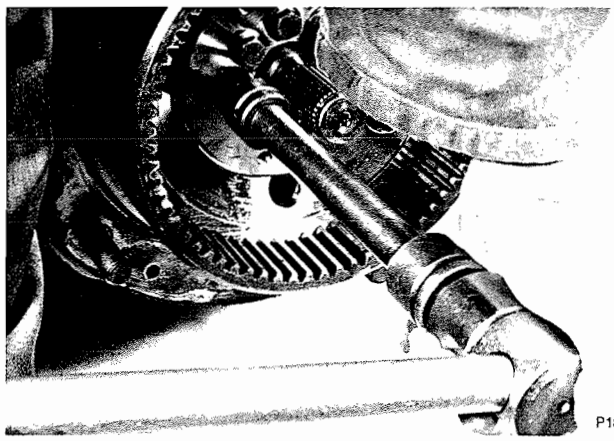


P1819

9 Using two dowels and two heel bars, remove the spacer using the method shown.

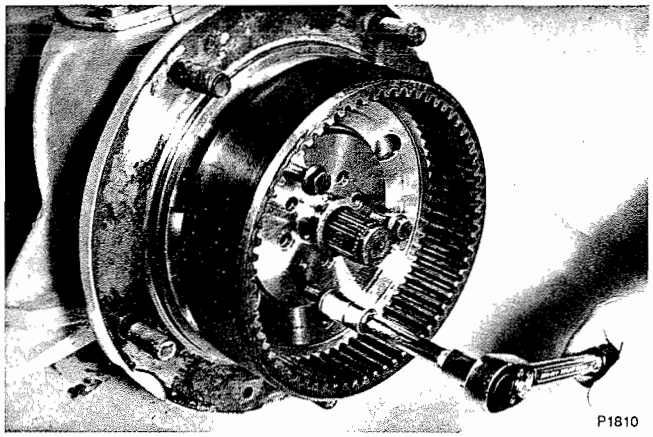

P1820

10 Remove the 'Verbus Ripp' bolts using a special tool (part number 892/00333). These bolts are very tight and care must be taken not to distort the bolt heads. Use as short an extension bar as possible.


P1821

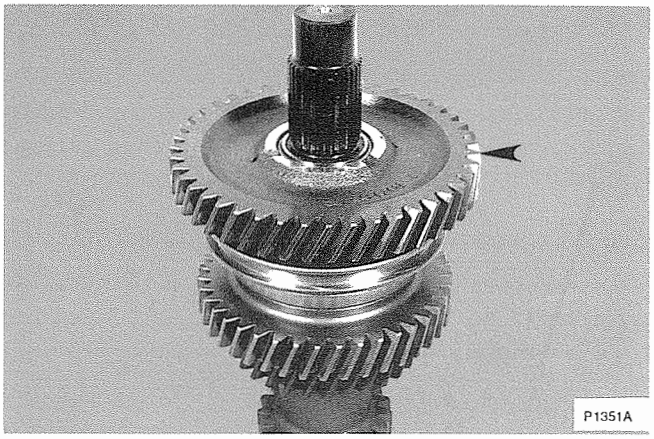
11 Using 3 high grade M12 bolts as jacking screws, remove the annulus carrier.

Note: Fretting between the hub swivel and annulus carrier mating faces might be evident; this condition is normal, do not attempt to repair. If the hub swivel and annulus carrier are to be re-used, the carrier **must** be assembled in the same angular position it was removed; match mark the hub swivel and carrier before removing the carrier.

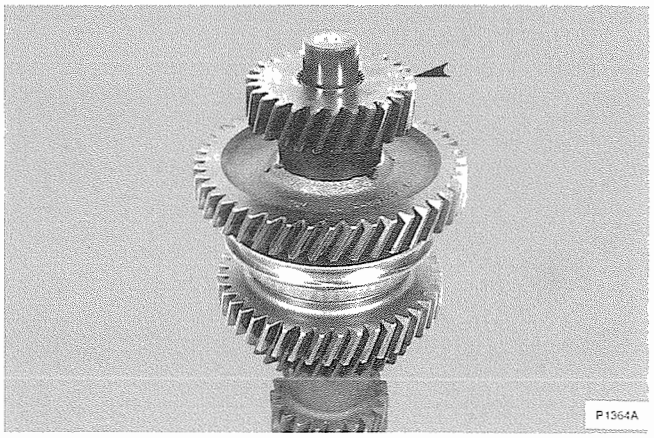

P1810

Gearbox - Assembly (cont'd)

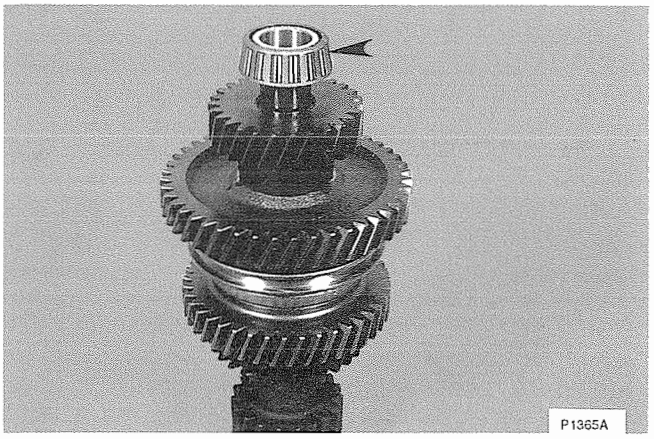
5 Fit 1st gear over needle roller bearings.



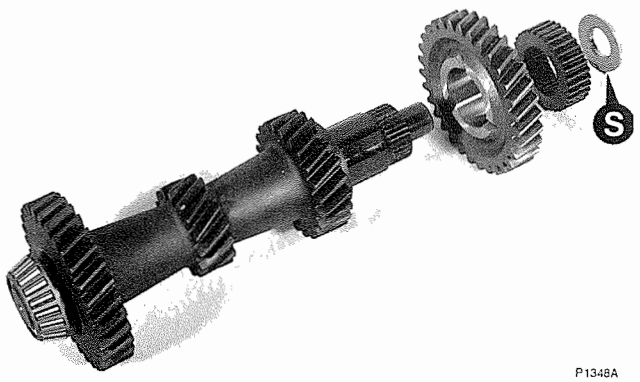
6 Assemble 4WD transfer gear over splines. On 2WD machines slide spacer over splines.



7 Press bearing onto assembled layshaft and smear bearing with MPL Grease.



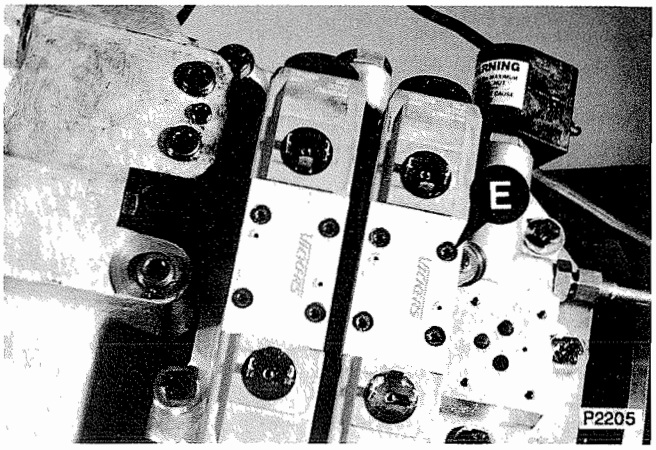
8 Smear bearing surface of mainshaft with MPL Grease and assemble 3rd gear and synchro-hub. Fit spacer washer **S** with bevel towards bearing. Press bearing onto shaft and smear with MPL Grease.



Powershift - Assembly

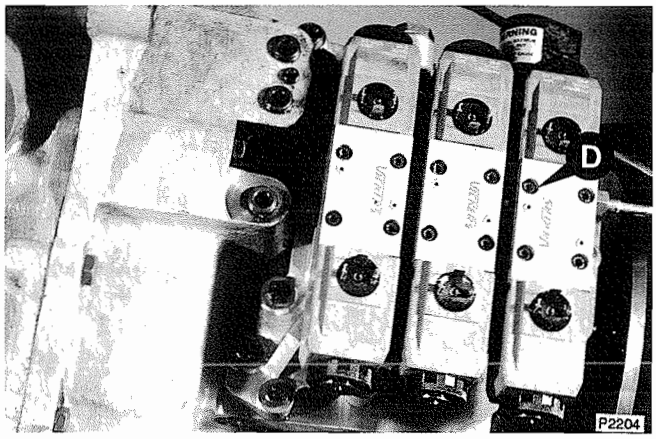
45 Mount the mainshaft/layshaft clutch solenoid valve onto adaptor block. Fit cap screws **E** and tighten to 5 Nm (4 lbf ft).

Note: The mounting holes will only align when the solenoid valve has been positioned correctly on the adaptor block.

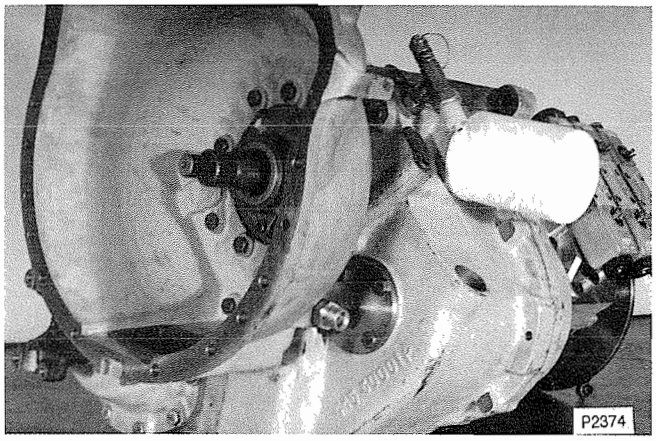


46 Mount the reverse high/low clutch solenoid valve onto adaptor block. Fit cap screws **D** and tighten to 5 Nm (4 lbf ft).

Note: The mounting holes will only align when the solenoid valve has been positioned correctly on the adaptor block.



47 Smear seal of new filter with oil and install hand tight only. Fit the drain plug with a new sealing washer - torque tighten to 203 Nm (150 lbf ft). Refit the mainline pressure test adaptor with a new sealing washer.



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