Service Manual

2CX, 2DX, 210, 212 & VARIANTS

Backhoe Loader

From M/c No. 657001 TO 763230
&
481196 Onwards

PUBLISHED BY THE
TECHNICAL PUBLICATIONS DEPARTMENT
OF JCB SERVICE; © WORLD PARTS CENTRE,
CHEADLE ROAD, UTTOXETER, ST14 7BS
ENGLAND
Tel. ROCESTER (01889) 590312
PRINTED IN ENGLAND

Publication No. 9803/7110

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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

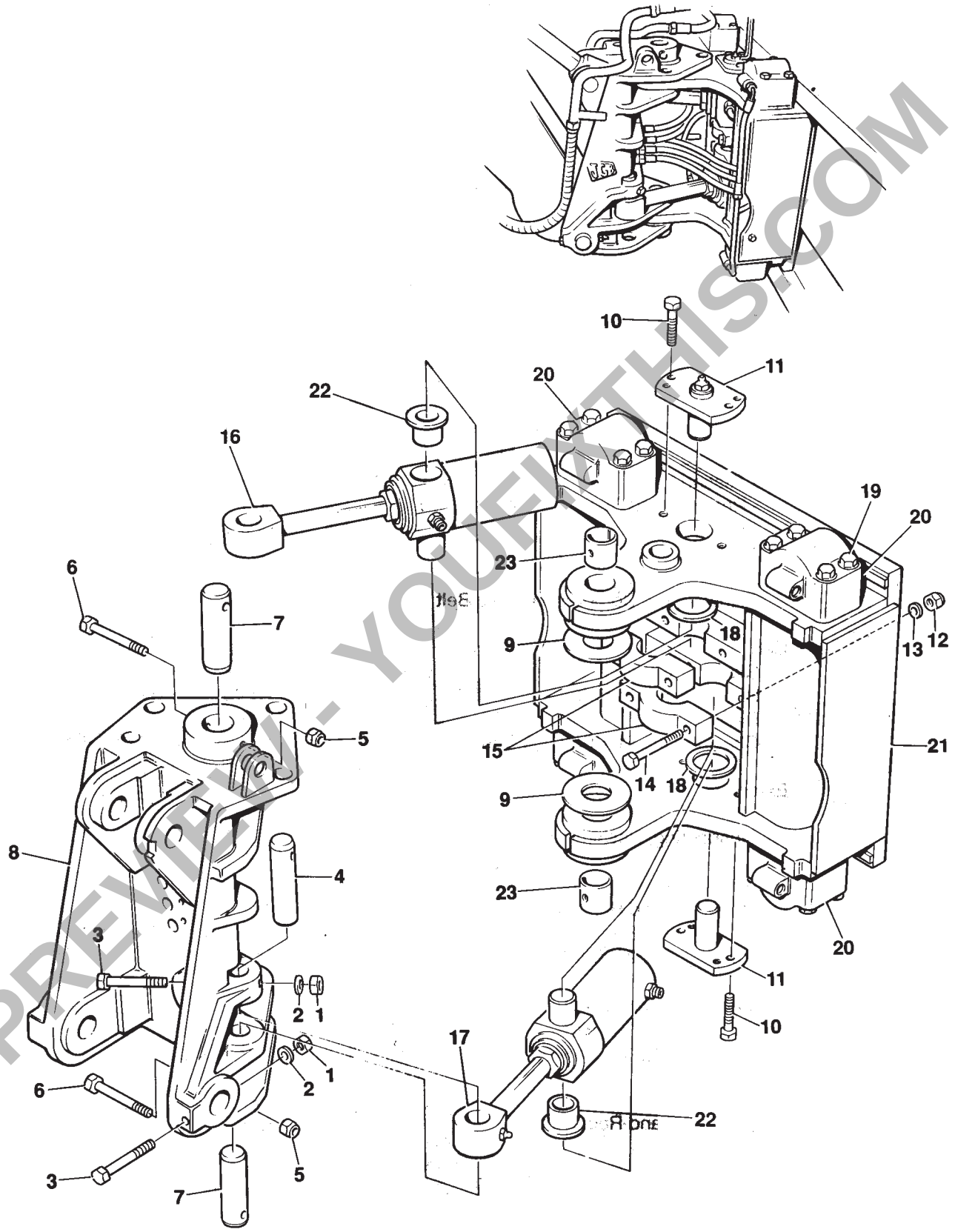
Metric Grade 8.8 Bolts

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

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

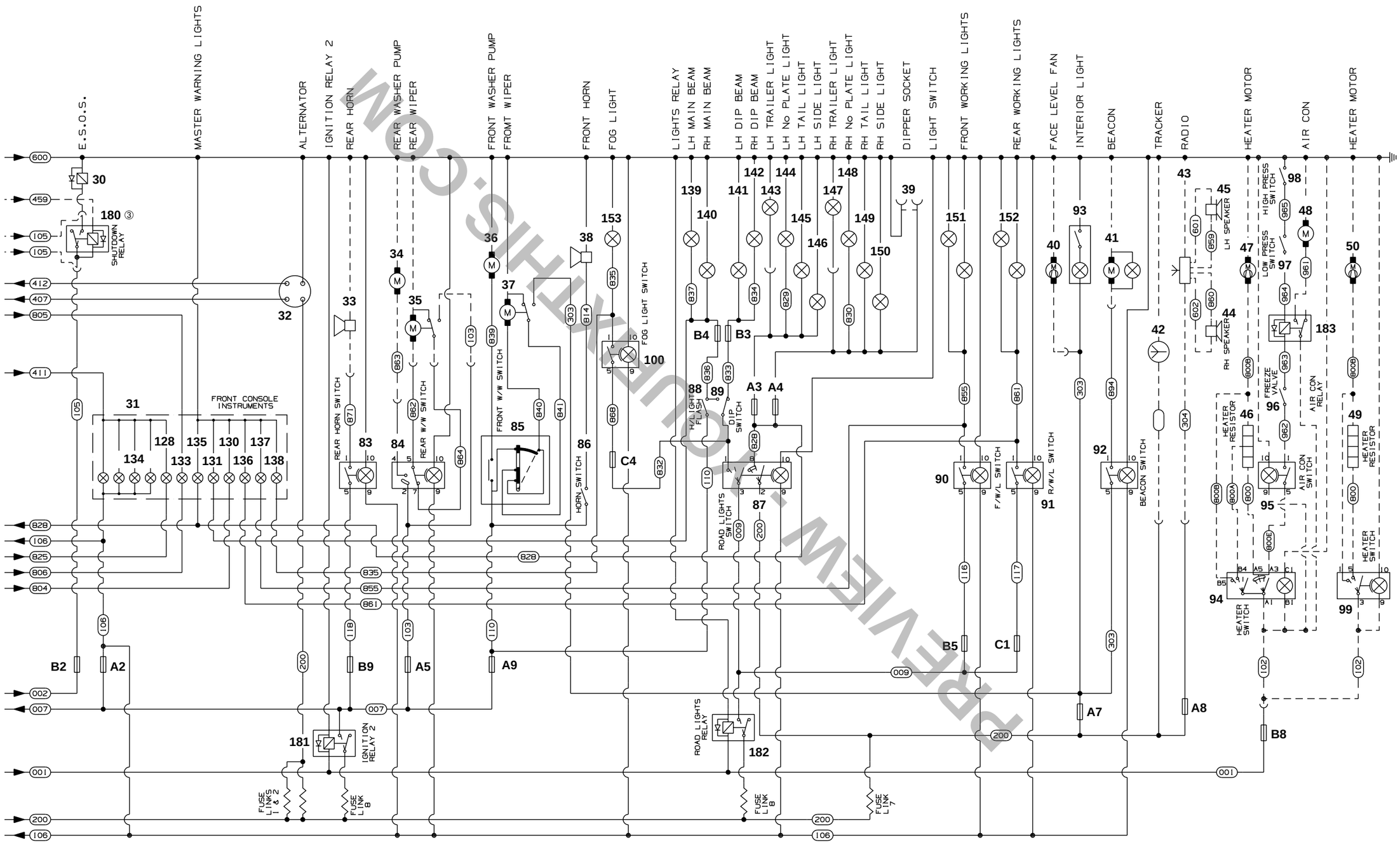
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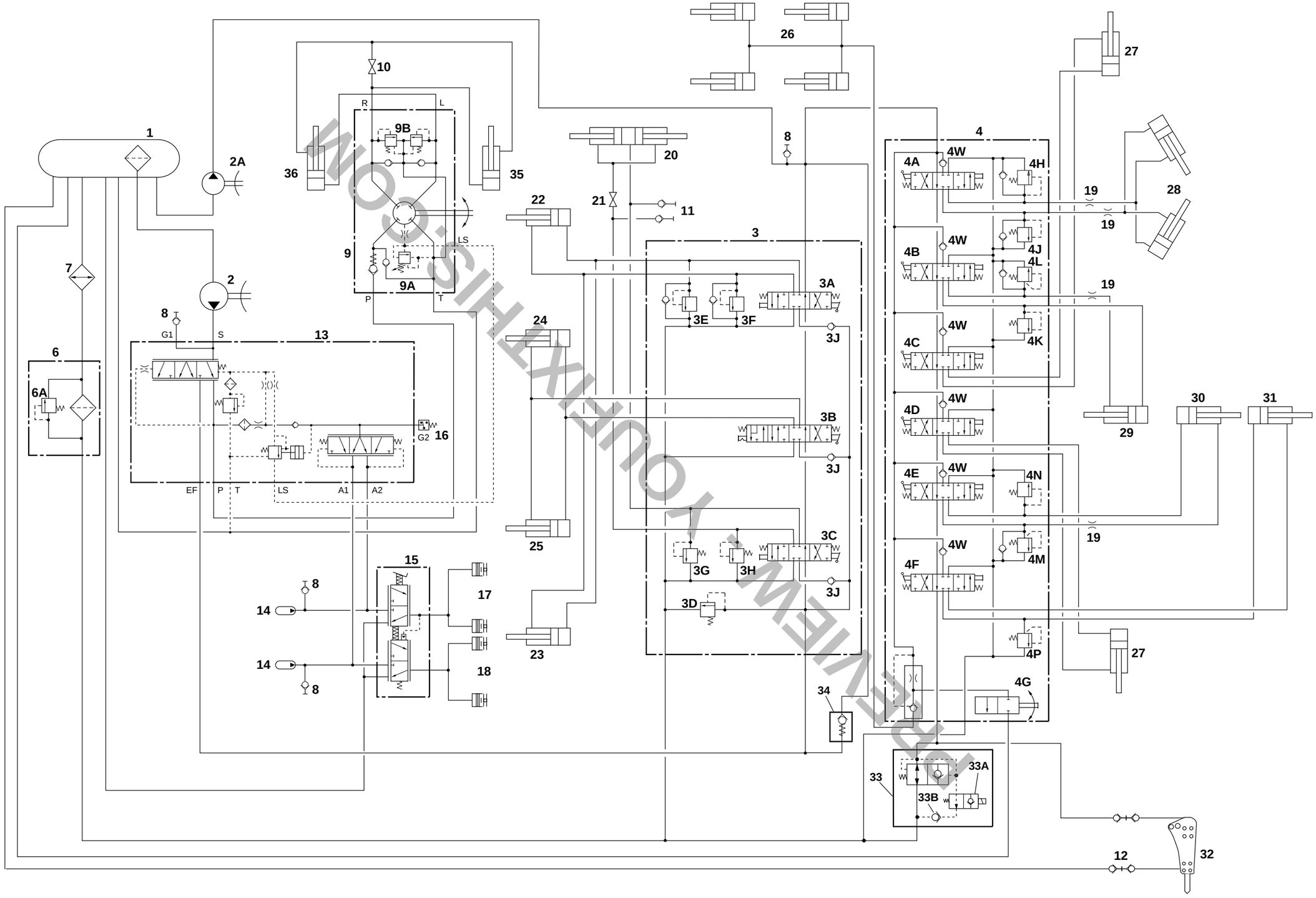
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Fault Finding

Procedures that require charging or discharging the system are not given in this manual as they require special equipment that is usually held only by trained refrigeration engineers.

The system will not function in very low ambient temperatures, therefore tests should be carried out in a warm environment.

It is recommended that, to locate faults on the system accurately and quickly, an electronic leak detector and a refrigerant pressure gauge should be used. However, leaks can be detected on the system by using soapy water applied to the suspected leak area and system pressure can be assessed by the state of refrigerant passing through the receiver drier sight glass. Following sections of the manual deal with the major components of the air conditioning systems and give further fault finding and maintenance information.

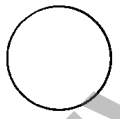
General Fault Indications

There are several indications that may help to determine the fault area on a system not working efficiently:

a)	Poor performance	Low system pressure - Condenser coil air flow restricted -	Evacuate and recharge system. Remove debris from around coil using compressed air or low pressure water.
b)	Warm or slightly cool air emitted from unit	Expansion valve stuck open or closed -	Renew expansion valve.
c)	Blower operates on fan speed 3 only	Blower resistor failed - Blower motor failed -	Renew resistor. Renew blower motor.
d)	Compressor clutch continually cuts out	Condenser coil blockage - Overcharging of refrigerant system- Blocked expansion valve/condenser -	Remove debris from around coil/renew condenser. Evacuate and recharge system. Clear blocked component .

Sight Glass Indications

An approximate indication of the condition of the refrigerant can be seen through the receiver/drier sight glass when the compressor is running. Refer also to **Checking Refrigerant Charge Level**, on page B/4-1.



Clear - No fault indicated unless the system is unable to provide cool air. The indication then is that the system is completely discharged of refrigerant.



Foam or bubbles - Refrigerant low and in need of charging.



Clouded - Dessicant breakdown in the receiver-drier.

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Note: Sight glass indications cannot always give a positive identification of a problem. Further diagnosis, preferably by a refrigeration engineer using pressure gauges, is advisable before reaching a definite conclusion.

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* Lubricants and Capacities (2CX up to machine serial No. 659598)

Note: New engines DO NOT require a running-in period. The engine/machine should be used in a normal work cycle immediately; glazing of the piston cylinder bores, resulting in excessive oil consumption, could occur if the engine is gently run-in. Under no circumstances should the engine be allowed to idle for extended periods; (e.g., warming up without load). Engines of new machines are filled at the factory with JCB 10W/30 Multigrade oil. This oil should be drained after the first 100 hours operation and the engine filled with the appropriate recommended grade as shown in the lubrication chart. JCB 10W/30 Multigrade should also be used for the first 100 hours operation whenever a new or reconditioned engine is fitted to the machine. After the first 100 hours operation, it is essential that the 10W/30 oil is replaced by the lubricant recommended below.

ITEM	CAPACITY Litres	UK Gal	USA Gal	FLUID/LUBRICANT	INTERNATIONAL SPECIFICATION
Fuel Tank	83.2	18.3	22.0	Diesel Oil	ASTM D975-66T Nos. 1D, 2D
Engine (Oil)	10.7	2.4	2.9	**JCB 15W/40 Multigrade** -10 °C to 50 °C (14 °F to 122 °F)	SAE15W/40, MIL-L-46152B, API CE/SF, MIL-L-2104D
				JCB Super Universal Agricultural -15 °C to 30 °C (5 °F to 86 °F)	SAE10W/30, MIL-L-2105, API CD/SE, MIL-L-2104C MIL-L-46152
				JCB Torque Converter Fluid -18 °C to 0 °C (0 °F to 32 °F)	SAE10W, MIL-L-46152, API CD/SE, MIL-L-2104D
Engine (Coolant)	11	2.4	2.9	**JCB Universal Antifreeze/water** (See **Coolant Mixtures**)	ASTM D3306-74
Syncro Shuttle	17.5	3.8	4.6	**JCB Special Transmission Fluid**	ESP-M2C 33G
Axles (2CX, 210S)					
Housing	4	0.88	1.1	**JCB Special Gear Oil**	ESEN-M2C 86A/B
Hubs (x4)	1	0.22	0.26	**JCB Special Gear Oil**	
Axles (2CXL, 2CX Farm Master, 210SL)					
Housing	8.8	1.94	2.33	**JCB Special Gear Oil**	ESEN-M2C 86A/B
Hubs (x4)	1.8	0.4	0.48	**JCB Special Gear Oil**	
Hydraulic System †	77 (including tank)	17	20.4	**JCB High Performance Hydraulic Oil** (Above 38 °C, 100 °F)	ISO VG46
				JCB Special Hydraulic Fluid (Below 38 °C, 100 °F)	ISO VG32
Grease Points	---			**JCB MPL Grease**	Lithium based, No. 2 consistency.
	---			**JCB HP Grease (High Performance)**	Lithium based, No. 2 consistency.

† **Note:** The total hydraulic system capacity depends on the equipment being used. Fill with all rams closed. Watch level indicator on hydraulic tank.

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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							
Engine Mount Security ✶	- Check			•	•	•	•
Oil Level	- Check	•	•				
Oil and Filter ✸	- Change			•	•	•	•
Fuel Filter	- Change			•	•	•	•
Air Cleaner Dust Valve	- Clean				•	•	•
Air Cleaner Outer Element ✧	- Change				•	•	•
Air Cleaner Inner Element	- Change						•
Valve Clearances ✶	- Check and Adjust						•
External Oil Leaks	- Check	•	•	•	•	•	•
Fan Belt Tension/Condition	- Check		•	•	•	•	•
Fuel Sedimenter and Filter	- Drain		•	•	•	•	•
Coolant Level and Antifreeze Strength	- Check	•	•	•	•	•	•
Pre-cleaner	- Clean (if fitted)	•	•	•	•	•	•
Radiator Hose - Condition	- Check			•	•	•	•
TRANSMISSION AND AXLES							
Drive/Steer Axle Oil Level ◴	- Check			•			
Drive/Steer Axle Oil	- Change				•	•	•
Steer Hub Oil Level ◴	- Check			•			
Steer Hub Oil	- Change				•	•	•
Drive Shaft	- Security/Grease			•	•	•	•
Oil Filter	- Change			•	•	•	•
Steering Swivels	- Grease				•	•	•
Transmission Oil Level	- Check	•	•	•	•		
Transmission Oil	- Change					•	•
Axles/Hubs/Transmission for Leaks ◴	- Check	•	•		•	•	•
Steer Axle Pivots and Linkages	- Grease/Check	•	•	•	•	•	•
Propshafts	- Grease				•	•	•
Tyre Pressures/Condition	- Check	•	•	•	•	•	•
Wheel Nut Security ③	- Check	•	•	•	•	•	•

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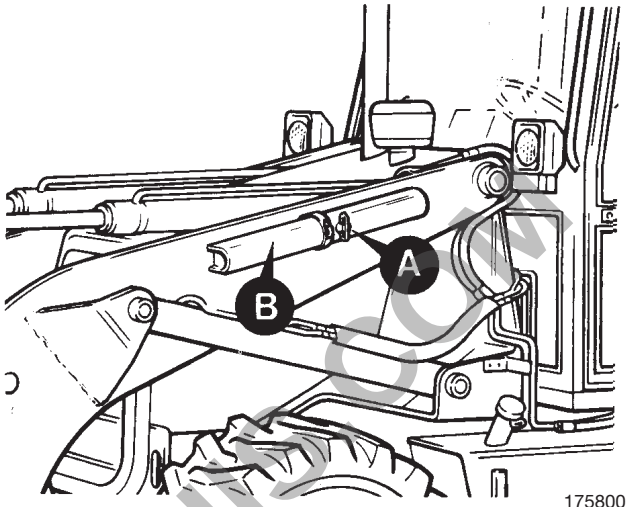
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Loader Arm Safety Strut

⚠ WARNING

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

2-1-1-6



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Installing

1 Empty the shovel and raise the loader arms fully.

2 Stop the engine. Remove the starter key.

⚠ WARNING

You could be killed or injured if the loader control is accidentally operated. Make sure no-one comes near the machine while you release the safety strut.

2-3-1-2

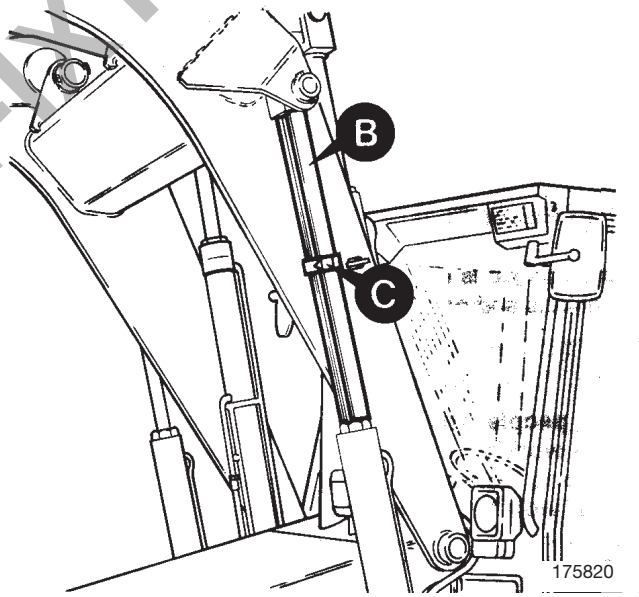
3 Open fastener **A.** Remove strut **B**.

4 Push strut **B** over the ram piston rod. Secure the strut in position with strap **C**.

5 Lower the strut onto the ram.

To prevent any chance of the loader arms creeping down and trapping your fingers, the loader arms should be carefully lowered onto the safety strut as shown.

Start the engine and slowly lower the loader arms onto the safety strut, stop the movement immediately the weight of the loader arms is supported by the safety strut.



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Note: When lowering the loader, operate the control lever carefully. 'Feather' the lever to lower the loader very slowly.

Removing

1 Fully raise the loader arms to take the weight off the safety strut.

2 Stop the engine. Remove the starter key.

3 Undo strap **C**. Remove strut **B** from the ram piston rod.

4 Stow strut **B** onto the loader arm and secure with fastener **A**.

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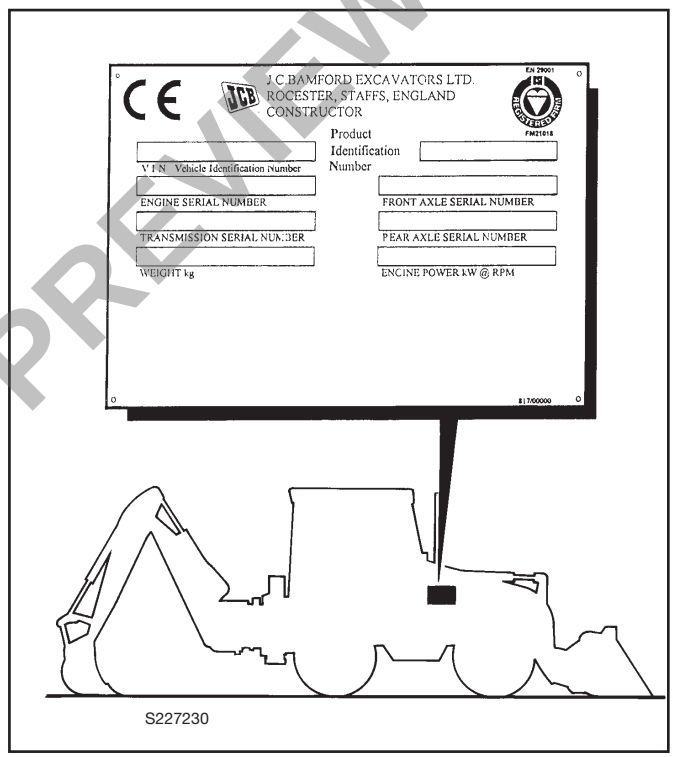
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Machine Identification Plate

Your machine has an identification plate mounted on the right hand side of the machine just below the driver's cab door. 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.



S227230

* Typical Machine Identification Number

SLP 2DX T S R E 123456
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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Hydraulic Fluid

Check the Fluid Level - *for Interval see Servicing Schedule.*

⚠ WARNING

Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid 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 fluid. If hydraulic fluid penetrates your skin, get medical help quickly.

INT-3-1-10/1

1 Position the machine on level ground. Set the loader shovel on the ground. Raise the boom, swing in the dipper and close the bucket. Stop the engine. Remove the starter key.

* **2** Look at the fluid level in the plastic glass **A**. The level should be at the red mark (or above). If the fluid is cloudy, water or air has entered the system. Water or air in the system could damage the hydraulic pump.

* **Note:** Earlier machines have a sight tube **E**, the level should be between the two marks on the tube.

3 If necessary, remove filler cap **B** and add recommended oil. See p.1-1 for recommended oil. Replace filler cap **B** when level is satisfactory.

Hydraulic Filter

Changing the Filter Element - *for Interval see Servicing Schedule.*

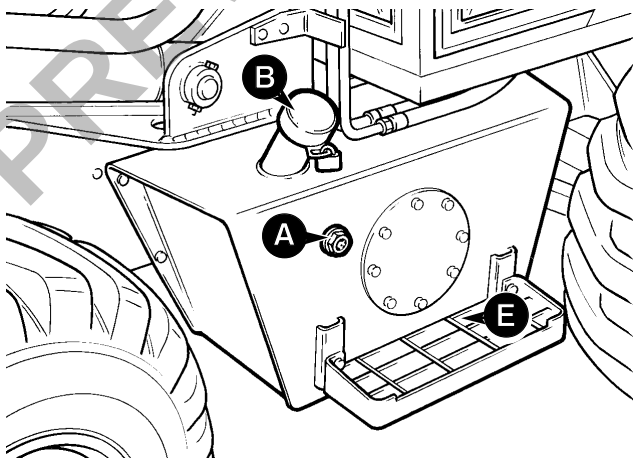
1 Park the machine on level ground. Make sure the parking brake is engaged. Set the loader shovel on the ground. Raise the boom, swing in the dipper and close the bucket. Stop the engine. Put the transmission in neutral

2 Gain access to the filter element by removing the battery cover. Unscrew the filter canister **C** - remember that it will be full of oil.

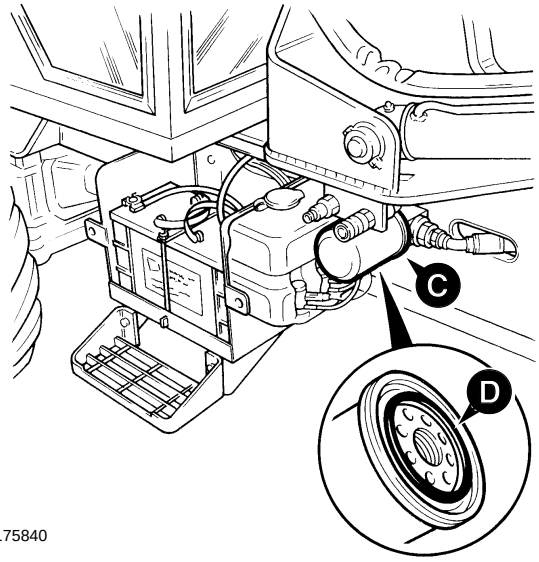
3 Clean the mating faces of the new element and filter holder. Smear the seal **D** of the new filter element with hydraulic oil. Screw the new filter element on clockwise into the filter head until the gasket makes contact. Tighten the filter a further half a turn.

4 Top up the hydraulic tank with recommended fluid. See p. 1-1 for recommended oil.

Make sure the filler cap is replaced and run the engine for a few minutes. Make the machine safe and check that there are no leaks at the filter.



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Stabiliser Leg

Removal and Replacement

The following steps (1 to 11) describe the removal procedures for the stabiliser inner leg, the stabiliser foot and the stabiliser ram. However, it is possible to remove these items as a complete assembly, see step 12.

Removal

1 Park the machine on firm level ground. Engage the parking brake and set the transmission to neutral.

2 Lower the loader shovel to the ground.

3 Make sure that the backhoe assembly is set central to the mainframe as shown. If necessary 'sideshift' the backhoe into a central position.

4 Lower the stabiliser legs until the pads are approximately 25 mm (1 in) off the ground.

5 Remove the bottom locking nut **A** and bolt **B**.

6 Drive out the bottom pivot pin **C** to release the foot.

Note: Steps 7 to 10 only apply if renewing or repairing the stabiliser ram, however, removing the ram will give more room when refitting the stabiliser inner leg.

7 Make sure the engine is switched off, vent residual hydraulic pressure by moving the backhoe and stabiliser control levers back and forth.

8 Loosen and remove the stabiliser hoses **D** and **E**, label the hoses before removing (as an aid to assembly). Plug all open orifices to prevent loss of fluid and ingress of dirt.

9 Loosen and remove the top pivot pin retaining nut and bolt, as shown at **F**.

⚠ CAUTION

The ram is heavy. It is recommended that the ram is removed with the assistance of a sling and suitable lifting appliance.
BF 2-4

10 Remove the stabiliser ram - take the ram out from the top. Be careful, the ram is heavy.

⚠ WARNING

Make the machine safe, place blocks underneath the sideshift rails.
BF 2-5

11 Use the boom and dipper to raise the rear of the machine, as shown at **G**. Do not raise the machine too high but allow just enough room for the stabiliser inner leg to slide clear. Refer to the warning above.

Note: Use the widest backhoe bucket available.

12 If required, the stabiliser inner leg, stabiliser foot and stabiliser ram can be removed as a complete assembly.

12.1 Complete steps **1** to **4**.

12.2 Make sure the engine is switched off, vent residual hydraulic pressure by moving the backhoe and stabiliser control levers back and forth.

12.3 Loosen and remove the stabiliser hoses **D** and **E**, label the hoses before removing (as an aid to assembly). Plug all open orifices to prevent loss of fluid and ingress of dirt.

⚠ WARNING

Make the machine safe, place blocks underneath the sideshift rails.
BF 2-5

12.4 Loosen and remove the top pivot pin retaining nut and bolt, as shown at **F**.

*__12.5__ Slacken off leg adjusters **X** (2DX), or **Y** (2CX from serial No. 489724).

12.6 Use the widest backhoe bucket available (if possible, a ditching bucket), and position the backhoe as shown at **G**. Do not raise the machine too high but allow just enough room for the stabiliser leg assembly to slide clear. Refer to the warning above.

Inspection

The inner leg should be free from nicks, marks or scores.

Replacement

Replacement is a reversal of the removal sequence.

Use suitable lifting appliances to locate the stabiliser ram.

After replacing or fitting the stabiliser leg, connect the hydraulic pipes, making sure that the ram and leg operate freely and do not foul. Set the leg adjusters as described on page 15 - 3.

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Circuit Options - 2CX, 2DX, 212SU (Later Machines) (cont'd)

Compressor Circuit - 2CX, 2DX

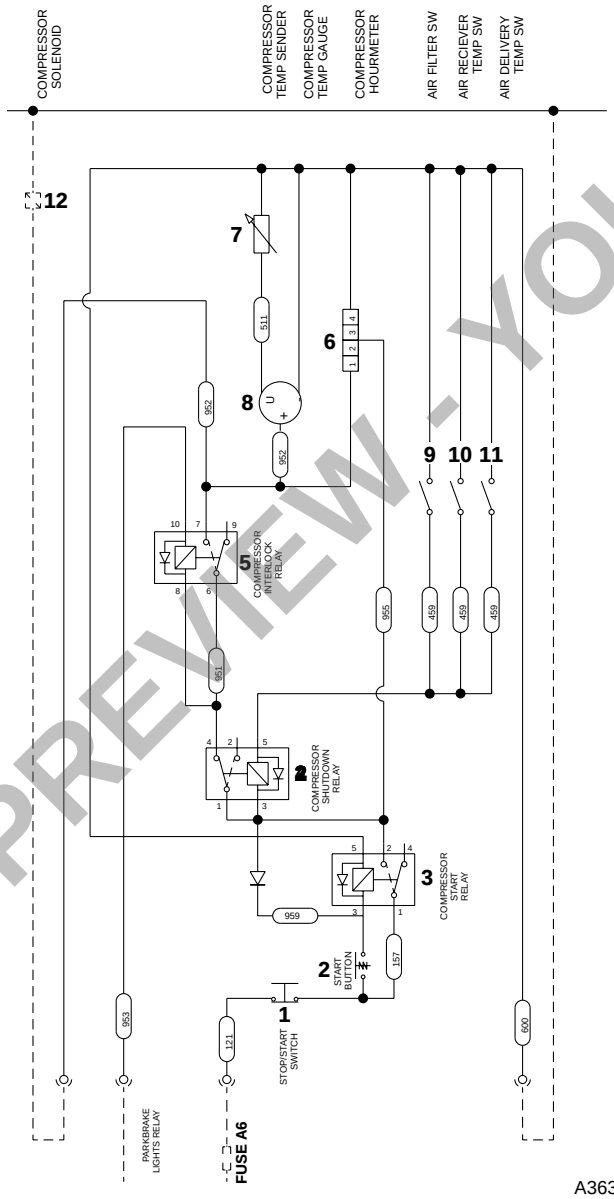
Main Components

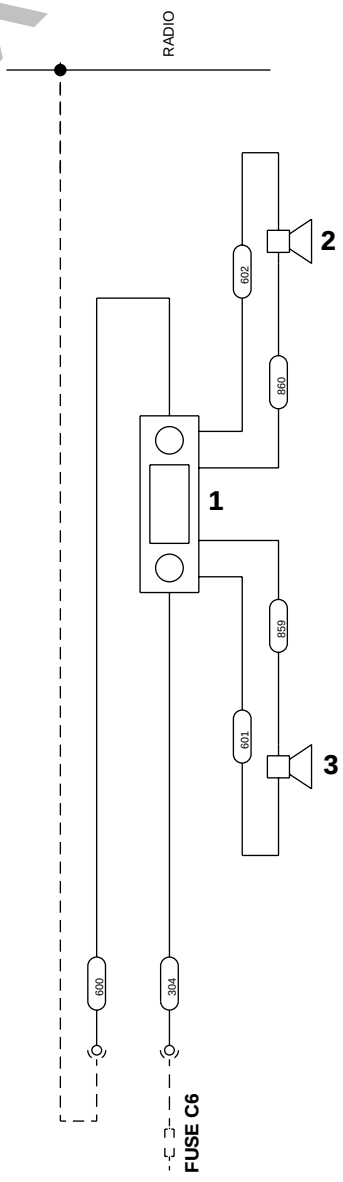
1 Stop/Start button
2 Start button
3 Compressor start relay
4 Compressor shut-down relay
5 Compressor interlock relay
6 Compressor hourmeter
7 Compressor temperature sender
8 Compressor temperature gauge
9 Air filter blocked switch
10 Air receiver temperature cut-out switch
11 Air delivery temperature cut-out switch
12 Compressor solenoid (already fitted)

Radio Circuit

Main Components

1 Radio unit
2 Loudspeaker
3 Loudspeaker





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Loader Valve - A.R.V. Operation

Under normal operating conditions, with the shovel in the 'carry' position, the mechanical linkage keeps the shovel level as the arms are raised, to prevent spillage of the load.

If, as illustrated, the shovel is fully tipped when the arms are being raised, the shovel is unable to tip further, producing back pressure in the head side of the shovel rams **22** and **23** and cavitation in the rod side.

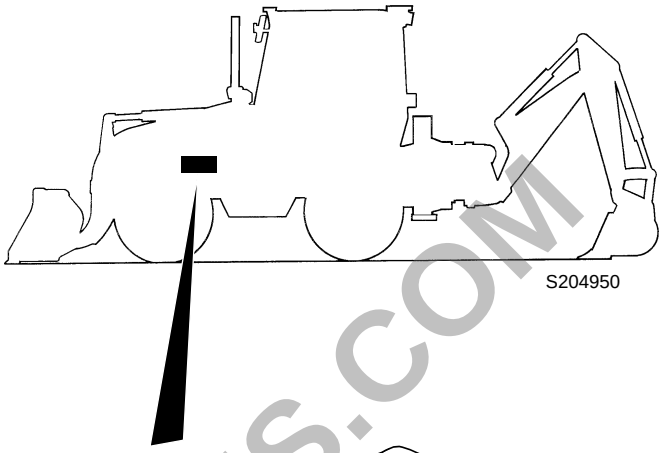
As the arms continue to rise, the back pressure increases until it reaches the setting of A.R.V. **3E**. This A.R.V. then opens, allowing the excess back pressure to be dumped to exhaust and prevent the rams and linkage from being damaged.

The rod side A.R.V. **3F** senses a higher pressure in the exhaust gallery than in the service port and therefore opens to allow exhaust oil to overcome the cavitation.

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Auxiliary Pump (2DX machines)

Before removing and dismantling the pump, check flow and pressure. If either of these are low and cannot be corrected at the relief valve, the pump must be renewed completely. Renewal of components such as gears, bearings and housing will not effect a permanent cure. If the pump output is satisfactory but there is external leakage, the pump should be removed and dismantled for re-sealing only.



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Removal

Operate the controls to vent residual pressure.

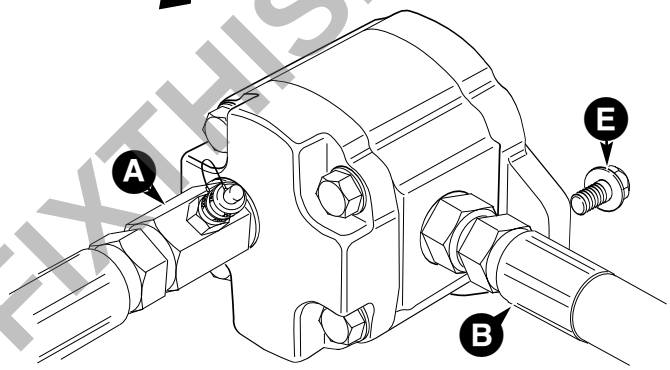
Disconnect and plug feed hose **A**.

Disconnect and plug suction hose **B**.

Undo bolts **E**, remove pump from machine.

Replacement

Replacement is a reversal of the removal procedure.



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Syncro Shuttle (cont'd)

Converter Pressures (in neutral)		**bar**	**kgf/cm²**	**lbf/in²**
Converter In at 50 deg.C	1000 rev/min	2.4 - 3.4	2.5 - 3.5	35 - 50
	2000 rev/min	5.2 - 6.5	5.3 - 6.7	75 - 95
Converter In at 100 deg.C	1000 rev/min	1.3 - 2.0	1.4 - 2.1	20 - 30
	2000 rev/min	5.2 - 5.9	5.3 - 6.0	75 - 85
Converter Out (measure at 50 deg.C and 2000 rev/min)		3.4	3.5	50 max
Converter Relief (Safety) Valve Pressure		6.5	6.7	95 max
Lubrication Pressures (in neutral)				
At 50 deg.C	1000 rev/min	0.2 - 0.3	0.2 - 0.4	3.0 - 5.0
	2000 rev/min	0.4 - 0.7	0.4 - 0.7	6.0 - 10.0
At 100 deg.C	1000 rev/min	0.1 - 0.2	0.1 - 0.2	2.0 - 3.0
	2000 rev/min	0.3 - 0.6	0.3 - 0.6	4.0 - 8.0
Main Line Pressure (in neutral)				
At 50 deg. C	1000 rev/min	9.3 - 10.3	9.5 - 10.5	135 - 150
	2000 rev/min	10.7 - 11.7	10.9 - 12.0	155 - 170
At 100 deg.C	1000 rev/min	9.3 - 10.3	9.5 - 10.5	135 - 150
	2000 rev/min	9.3 - 10.3	9.5 - 10.5	135 - 150
Clutch Pressure (forward and reverse) †				
At 50 deg. C	1000 rev/min	7.6 - 9.7	7.7 - 9.8	110 - 140
	2000 rev/min	9 - 11	9.1 - 11.25	130 - 160
At 100 deg.C	1000 rev/min	7.6 - 9.7	7.7 - 9.8	110 - 140
	2000 rev/min	7.6 - 9.7	7.7 - 9.8	110 - 140

† **Note:** The forward and reverse clutch pressures should always be the same as the mainline pressure less (a maximum of) 1.7bar (25lbf/in²; 1.8kgf/cm²). If the mainline pressure is in the lower part of the tolerance band, then the forward and reverse clutch pressures should also be in the lower part of the tolerance band and vice versa.

Flow Rates (in neutral)		**litres/min**	**UK gal/min**	**US gal/min**
Cooler at 50 deg.C	1000 rev/min	10.4 - 13.6	2.3 - 3.0	2.8 - 3.6
	2000 rev/min	14.5 - 20.0	3.2 - 4.4	3.8 - 5.3
Cooler at 100 deg.C	1000 rev/min	10.2 - 12.5	2.3 - 2.8	2.7 - 3.3
	2000 rev/min	22.7 - 26.1	5.0 - 5.7	6.0 - 6.9
Pump at 50 deg.C	1000 rev/min	11.0 - 15.0	2.5 - 3.3	2.9 - 4.0
	2000 rev/min	22.5 - 29.5	5.0 - 6.5	6.0 - 7.8

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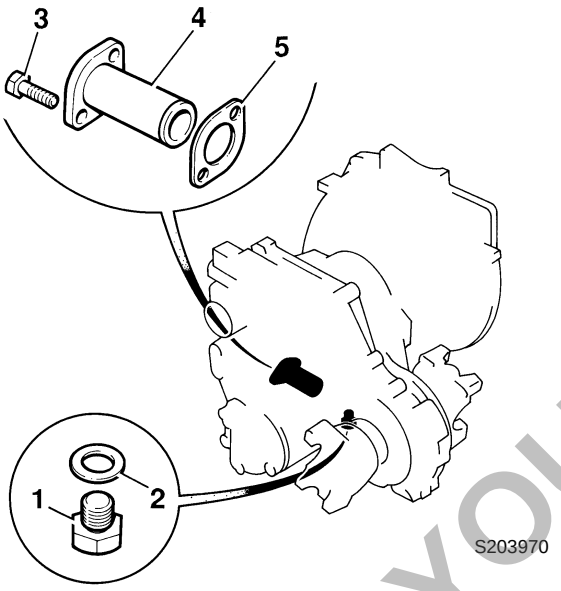
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Dismantling

1 Drain the oil from the casing into a suitable container by removing the drain plug **1** and sealing washer **2**. Discard the sealing washer.

2 Remove suction strainer retaining bolts **3** and remove the strainer **4**. Remove and discard the strainer cap gasket **5**.

3 Remove and discard the oil filter.



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4 Position the gearbox with the rear casing **37** uppermost.

5 Unscrew capscrews **6** and remove spacers **7** (4 off). Remove the solenoid valve assembly **8.** Retain the spacers (4 off) but discard the 'O' rings **9** (4 off).

6 Remove output yoke stake nuts **13** using service tool 892/00812. Discard the stake nuts. Remove washers **14** and yokes **15** from the output shaft **16**.

7 Remove and discard the output shaft oil seals **17**.

8 Remove the gear change turret retaining bolts **18** (4 off). Remove the turret **19** and gasket **20**. Discard the gasket.

9 Remove the brake feed pipe **21**.

* **10 30 k.p.h. Gearbox**
Remove the brake end cover retaining bolts **22** (4 off) and **23** (2 off) and remove the end cover **24**. Remove and discard the end cover gaskets **25** and spacer **M**.

* **20 k.p.h. Gearbox**
Remove the brake end cover retaining bolts **22** (4 off) and **23** (2 off) and remove the end cover **24**. Remove and discard the end cover gasket **25**.

11 Press out brake operating piston **26** from the end cover **24** by removing the piston housing centre bolt **28** and spacer **29** and screwing in an M10 x 30 bolt to press out the piston. Remove and discard the piston 'O' ring **27**. Remove the M10 x 30 bolt and refit the original bolt and spacer.

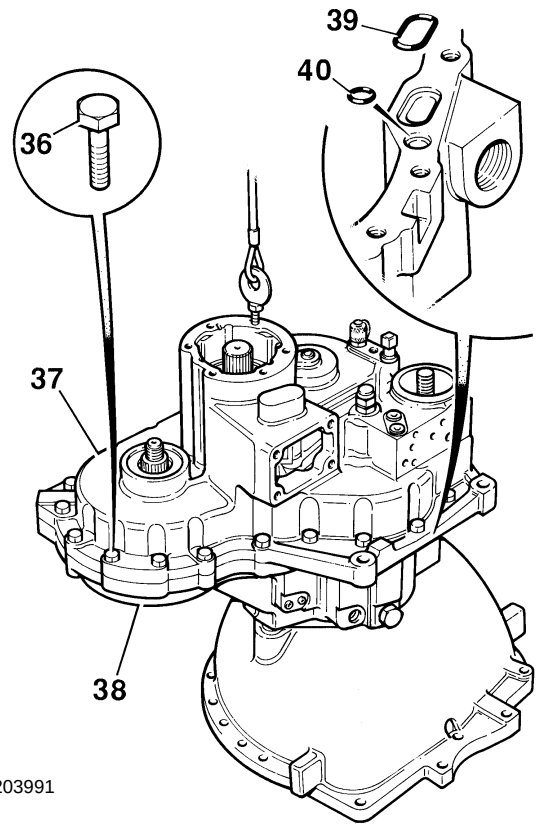
12 30 k.p.h. Gearbox
Remove counter plates **31** (10 off), friction plates **32** (9 off), annular pressure plate **33**, reaction pins **34** (3 off) and the disc spring assembly **35** from the brake casing.

12A 20 k.p.h. Gearbox
Remove brake pressure plate **30**, counter plates **31** (7 off), friction plates **32** (6 off), annular pressure plate **33**, reaction pins **34** (3 off) and the disc spring assembly **35** from the brake casing.

13 Remove the adaptor block assembly retaining setscrews **10** (4 off) and remove the block **11**. Remove and discard the gasket **12.**

14 Remove the casing retaining bolts **36**.

15 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. Remove and discard the face 'O' rings **39** and **40**.



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