

JCB 1CX SERVICE MANUAL



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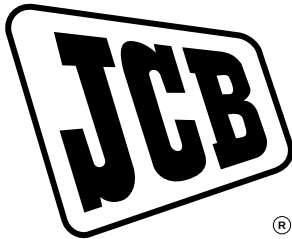
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Technical Data - 100 Series Engine up to machine no. 807552

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Service Manual

1CX, 208S Backhoe Loader

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Introduction

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

These personnel should have a sound knowledge of workshop practice, safety procedures, and general techniques associated with the maintenance and repair of hydraulic earthmoving equipment.

Renewal of oil seals, gaskets, etc., and any component showing obvious signs of wear or damage is expected as a matter of course. It is expected that components will be cleaned and lubricated where appropriate, and that any opened hose or pipe connections will be blanked to prevent excessive loss of hydraulic fluid and ingress of dirt. Finally, please remember above all else **SAFETY MUST COME FIRST!**

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

- 1** = **General Information** - includes torque settings and service tools.
- 2** = **Care & Safety** - includes warnings and cautions pertinent to aspects of workshop procedures etc.
- 3** = **Routine Maintenance** - includes service schedules and recommended lubricants for all the machine.

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

- A** = **Attachments**
- B** = **Body & Framework** ...etc.

The page numbering in each alphabetically coded section is not continuous. This allows for the insertion of new items in later issues of the manual.

Section contents, technical data, circuit descriptions, operation descriptions etc are inserted at the beginning of each alphabetically coded section.

All sections are listed on the front cover; tabbed divider cards align directly with individual sections on the front cover for rapid reference.

Where a torque setting is given as a single figure it may be varied by plus or minus 3%. Torque figures indicated are for dry threads, hence for lubricated threads may be reduced by one third.

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

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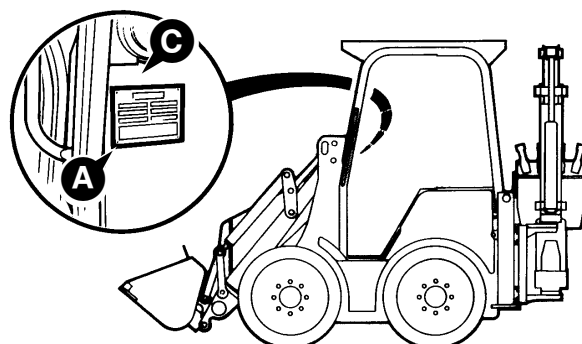
Machine Identification Plate

The machine identification plate **A** is located as shown. It is stamped with the serial numbers of the major individual units.

*Typical Vehicle Identification Number (VIN)

SLP 1CX S B V E 751601
1 2 3 4 5 6 7

- 1** World Manufacturer Identification
- 2** Machine Model
- 3** Machine Type (S = Standard, H = High-flow)
- 4** Build Type (A = Canopy, B = Cab)
- 5** Year of Manufacture:
 T = 1996
 V = 1997
 W = 1998
 X = 1999
 Y = 2000
 1 = 2001
 2 = 2002
 3 = 2003
 4 = 2004
 5 = 2005
- 6** Manufacturer Location (E = England)
- 7** Product Identification Number (PIN)



203650

CE		JCB		J.C.BAMFORD EXCAVATORS LTD. ROCESTER, STAFFS, ENGLAND.		EN 29001 REGISTERED	
CONSTRUCTOR		MADE IN UK					
Vehicle Identification No.				Product Identification No.			
ENGINE SERIAL No.				WEIGHT			
PUMP SERIAL No.				YEAR OF MANUFACTURE			
MODEL	80/1269/EEC		MODEL	80/1269/EEC			
	POWER KW	R.P.M.		POWER KW	R.P.M.		
160	32.5	2600	185	54.6	2200		
170	35	2800	185 HF	54.6	2200		
170 HF	35	2800	1105	58.1	2200		
160 HF	32.5	2600	1105 HF	58.1	2200		
1CX	35	2800	1CX HF	35	2800		

817/16599

Unit Identification

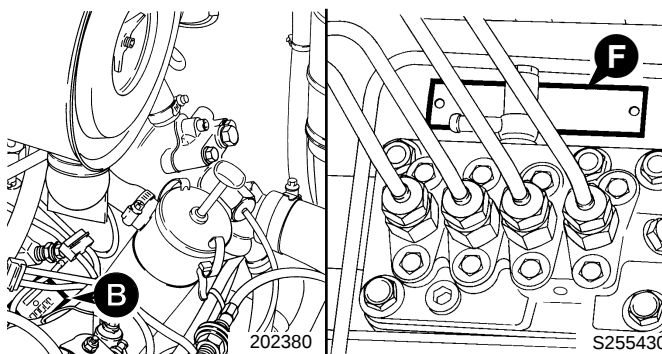
The engine serial number on XUD engines is stamped on an aluminium plate **B** on the side of the cylinder block. On Perkins engines the number is stamped on a label **F** on the right side of the cylinder block.

The chassis serial number **C** is stamped on the front wall of the cab above the machine identification plate.

The hydraulic motors have the date of manufacture stamped on a plate as shown at **D**.

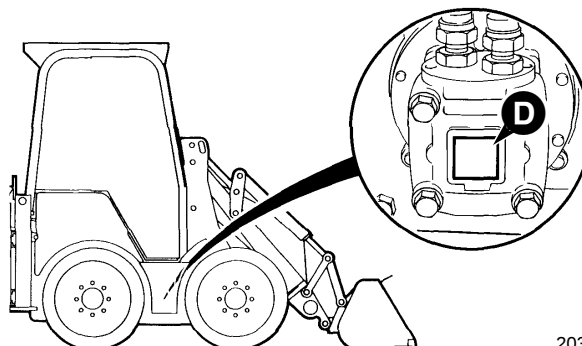
The hydraulic pump unit serial number is stamped on a plate on the bottom of the pump as shown at **E**.

If any of the above units are replaced with new ones, the relevant serial number on the Machine Identification Plate will be superseded. Either stamp the plate with the new number or stamp out the old number.

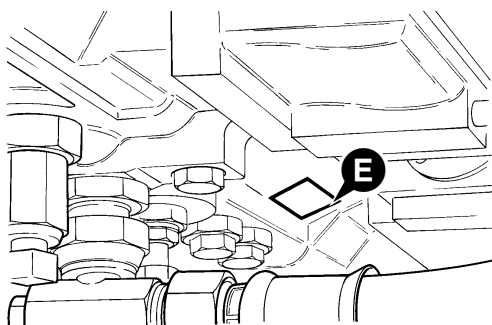


202380

S255430



203660



203640

Left Side, Right Side

In this manual, 'left' and 'right' mean your left and right when you are seated correctly in the machine, facing the loader.

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 in	(mm)	Hexagon (A/F) in	Nm	Torque Settings 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)	1 1/8	407	41.5	300
7/8	(22.2)	1 5/16	650	66.3	480
1	(25.4)	1 1/2	970	99.0	715
1 1/4	(31.7)	1 7/8	1940	198.0	1430
1 1/2	(38.1)	2 1/4	3390	345.0	2500

Metric Grade 8.8 Bolts

Bolt Size in	(mm)	Hexagon (A/F) in	Nm	Torque Settings 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.

BSP Adapters with Bonded Washers.

Adapter Size in	Spanner size mm	Nm	Torque Settings kgf m	lbf ft
1/8	11	20	2.0	15
1/4	19	34	3.5	25
3/8	22	75	7.6	55
1/2	27	102	10.4	75
5/8	30	122	12.4	90
3/4	32	183	18.7	135
1	38	203	20.7	150
1 1/4		305	31.1	225
1 1/2		305	31.1	225

SAE Adapters with 'O' rings.

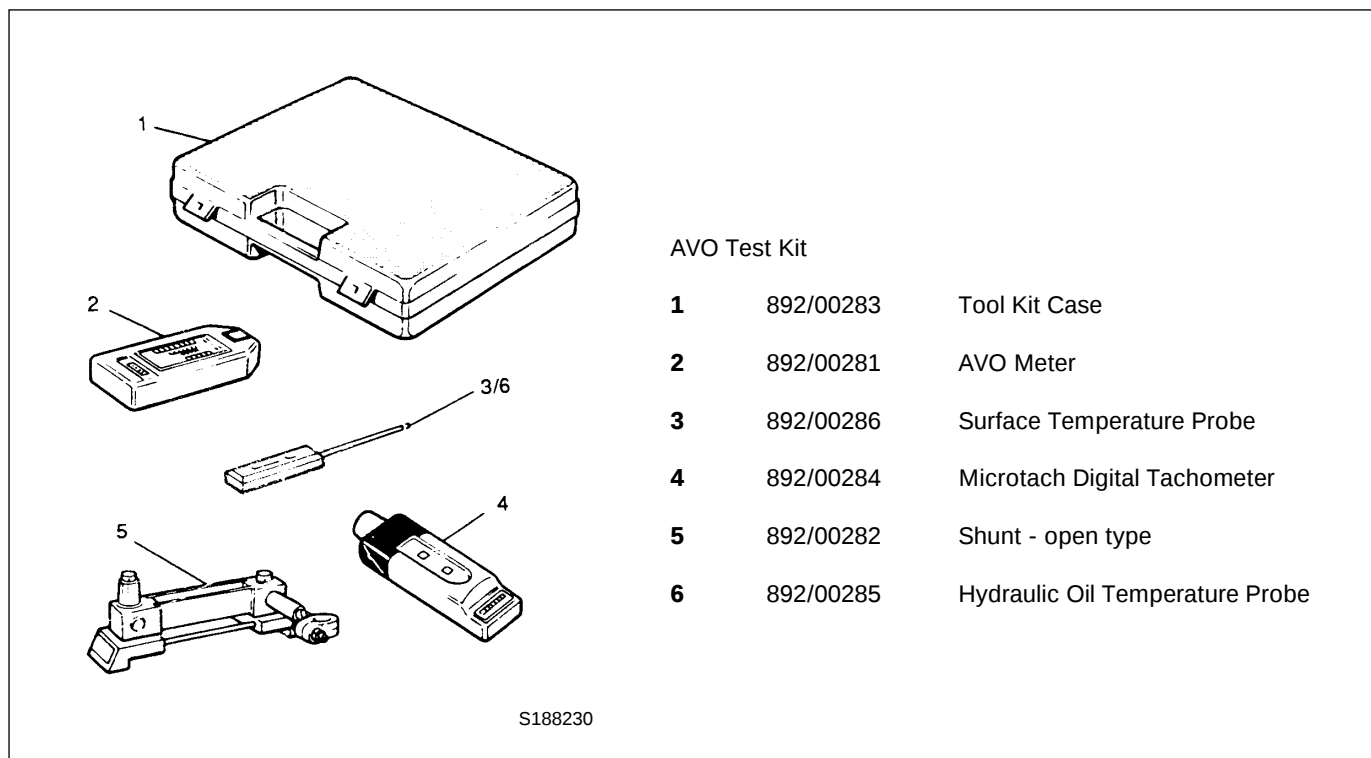
Adapter Size in	Nm	Torque Settings kgf m	lbf ft
7/16	20	2.0	15
9/16	35	3.6	26
3/4	81	8.3	60
7/8	108	11.0	80
1 1/16	183	18.7	135
1 5/16	298	30.4	220
1 5/8	380	38.8	280

Hydraulic Coned BSP Hoses.

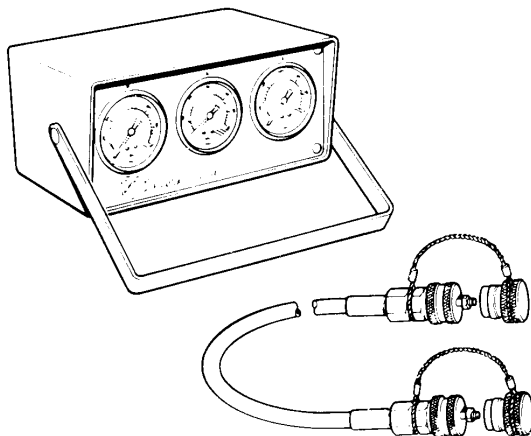
Hose Size in	Spanner size mm	Nm	Torque Settings kgf m	lbf ft
1/8	14	14	1.4	10
1/4	19	27	2.7	20
3/8	22	40	4.0	29
1/2	27	55	5.6	40
5/8	30	65	6.6	48
3/4	32	95	9.7	70
1	38	120	12.2	88
1 1/4		189	19.3	139
1 1/2		244	24.9	180

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816/00196	Blanking Cap	4 - 4	992/09600	Spanner	4 - 3
816/00197	Blanking Cap	4 - 4	993/99510	Half Moon Spanner	4 - 4
816/00294	Blanking Cap	4 - 4			
816/15118	Pressure Test Adapter	4 - 2	The following parts are replacement items for kits and would normally be included in the kit numbers quoted above.		
816/20008	Adapter	4 - 2	Replacement items for kit no. 892/00253		
816/50043	'T' Adapter	4 - 4	892/00201	Replacement Gauge	4 - 2
816/55038	Pressure Test 'T' Adapter	4 - 2	892/00202	Replacement Gauge	4 - 2
816/55040	Pressure Test 'T' Adapter	4 - 2	892/00203	Replacement Gauge	4 - 2
816/60096	'T' Adapter	4 - 4	892/00254	Replacement Hose	4 - 2
892/00047	'T' Adapter	4 - 4			
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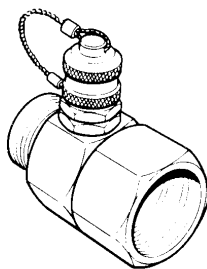
Section E - Hydraulics



Hydraulic Circuit Pressure Test Kit

892/00253	Pressure Test Kit
892/00201	Replacement Gauge 0-20 bar (0-300 lbf/in ²)
892/00202	Replacement Gauge 0-40 bar (0-600 lbf/in ²)
892/00203	Replacement Gauge 0-400 bar (0-400 lbf/in ²)
892/00254	Replacement Hose

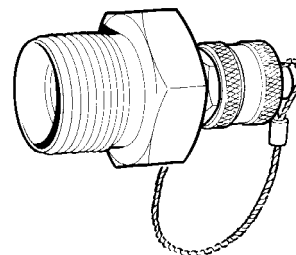
188120



188130

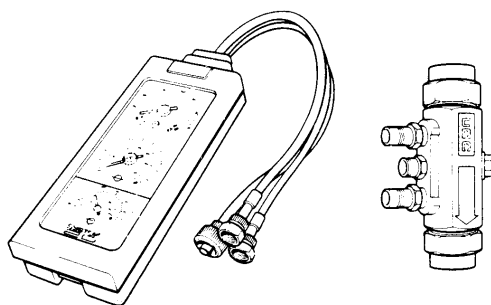
Pressure Test 'T' Adapters

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 BSPP x Test Point



Pressure Test Adapters

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

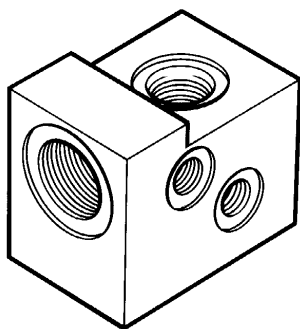


188150

Flow Test Equipment

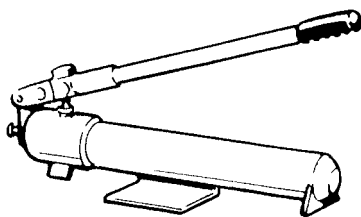
892/00268	Flow Monitoring Unit
892/00269	Sensor Head 0 - 100 l/min (0 - 22 UK gal/min)
892/00270	Load Valve
1406/0021	Bonded Washer
1604/0006	Adapter 3/4 in M x 3/4 in M BSP
1612/0006	Adapter 3/4 in F x 3/4 in M BSP
892/00271	Adapter 3/4 in F x 5/8 in M BSP
892/00272	Adapter 5/8 in F x 3/4 in M BSP
816/20008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

Section E - Hydraulics



S220840

892/00252 Test Block for A. R. V.



193850

Hand Pump Equipment

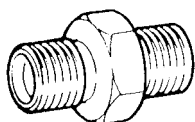
- 892/00223 Hand Pump
- 892/00137 Micro-bore Hose 1/4 in BSP x 5 metres
- 892/00274 Adapter 1/4 in M BSP x 3/8 in M BSP Taper
- 892/00262 1/4 in M BSP x 1/4 in F BSP x Test Point
- 892/00706 Test Probe
- 892/00278 Gauge 0 - 40 bar (0 - 60 lbf/in²)
- 892/00279 Gauge 0 - 400 bar (0 - 600 lbf/in²)



188140

Bonded Washers

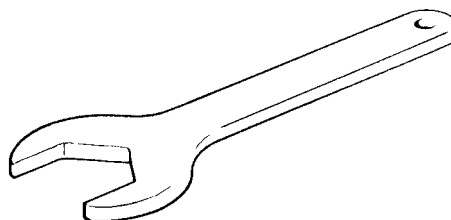
- | | |
|-----------|--------------|
| 1406/0011 | 1/4 in BSP |
| 1406/0018 | 1/2 in BSP |
| 1406/0021 | 3/4 in BSP |
| 1406/0029 | 1.1/4 in BSP |



193860

Male Adapters - BSP x BSP

- | | |
|-----------|-----------------|
| 1606/0003 | 3/8 in x 1/4 in |
| 1604/0003 | 3/8 in x 3/8 in |
| 1606/0004 | 1/2 in x 1/4 in |
| 1606/0007 | 1/2 in x 3/8 in |
| 1604/0004 | 1/2 in x 1/2 in |
| 1606/0008 | 3/4 in x 3/8 in |
| 1606/0009 | 3/4 in x 1/2 in |
| 1604/0006 | 3/4 in x 3/4 in |

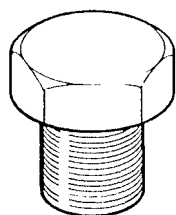


193930

Hexagon Spanners for Ram Pistons and End Caps

- | | |
|-----------|-----------|
| 992/09300 | 55 mm A/F |
| 992/09400 | 65 mm A/F |
| 992/09500 | 75 mm A/F |
| 992/09600 | 85 mm A/F |

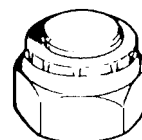
Section E - Hydraulics



193870

Female Cone Blanking Plug

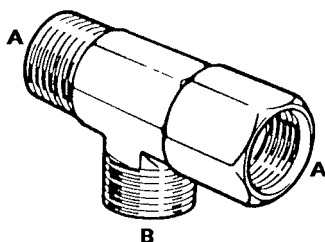
892/00055	1/4 in BSP
892/00056	3/8 in BSP
892/00057	1/2 in BSP
892/00059	3/4 in BSP
892/00060	1 in BSP'T'



193880

Male Cone Blanking Plug

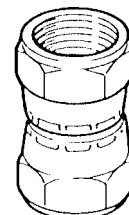
816/00294	1/4 in BSP
816/00189	3/8 in BSP
816/00190	1/2 in BSP
816/00197	5/8 in BSP
816/00196	3/4 in BSP
816/00193	1 in BSP



193890

'T' Adapters

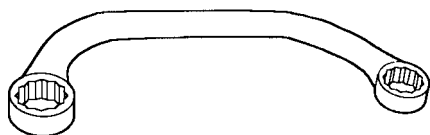
892/00047	3/8 in BSP (A) x 1/4 in BSP (B)
892/00048	1/2 in BSP (A) x 1/4 in BSP (B)
816/50043	3/4 in BSP (A) x 1/4 in BSP (B)
816/60096	3/4 in BSP (A) x 3/4 in BSP (B)



193900

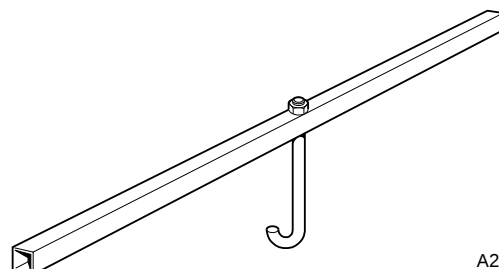
Female Connectors

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



193920

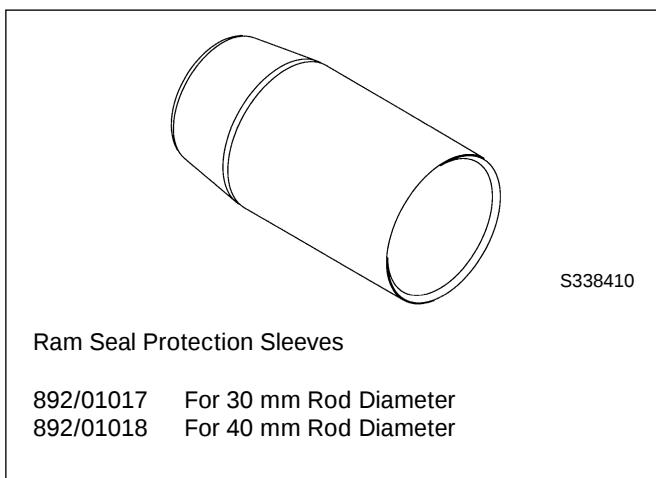
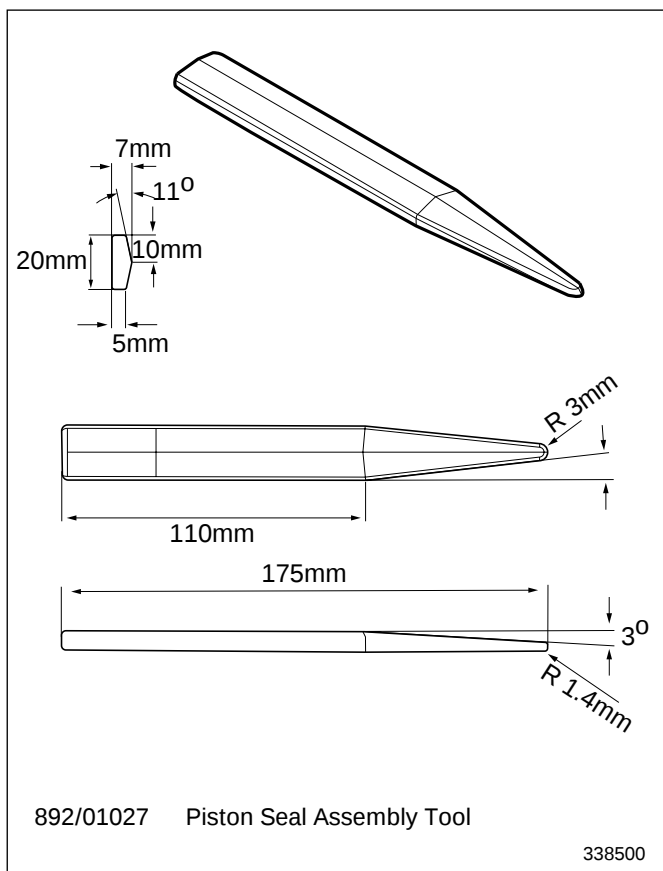
* 993/99510 Half Moon Spanner - for pump lower mounting bolt



A215880

* 892/00858 Pump support bracket - for engine removal

Section E - Hydraulics



JCB Multi-Gasket	A medium strength sealant suitable for all sizes of gasket flanges, and for hydraulic fittings of 25-65 mm diameter.	4102/1201	
JCB High Strength Threadlocker	A high strength locking fluid for use with threaded components.	4102/0551	
JCB Retainer (High Strength)	For retaining parts which are unlikely to be dismantled.	4101/0651	
JCB Threadlocker & Sealer	A medium strength locking fluid for sealing and retaining nuts, bolts, and screws up to 50 mm dia., and for hydraulic fittings up to 25 mm dia.	4101/0251	
JCB Threadlocker & Sealer (High Strength)	A medium to high strength locking fluid for retention and sealing of ram piston heads.	4101/0552	
JCB Threadlocker	A locking fluid for use on threads larger than 50 mm dia.	4101/0451	
JCB Activator	A cleaning primer which speeds the curing rate of anaerobic products.	4104/0251 4104/0253	Aerosol Bottle
JCB Cleaner/Degreaser	For degreasing components prior to use of anaerobic adhesives and sealants.	4104/1557	Aerosol

The part numbers and descriptions of sealing and retaining compounds available from JCB Service have been revised with effect from January 1997 (see MI 563/H, 507/HA, 511/E). The list above has been changed accordingly.

References to these products on subsequent pages in this service manual will be progressively updated but for convenience a cross reference table is shown below.

Old Description	Old Part Number	New Description	New Part Number
JCB High Strength Threadlocker	4102/0502	JCB High Strength Threadlocker	4102/0551
JCB High Strength Retainer	4101/0602	JCB Retainer (High Strength)	4101/0651
JCB Lock & Seal	4101/0202	JCB Threadlocker & Sealer	4101/0251
Loctite 243	4101/1101	Use 4101/0251	
Loctite 262	4101/0502	JCB Threadlocker & Sealer (High Strength)	4101/0552
Loctite 932	4101/0402	JCB Threadlocker	4101/0451
Loctite Activator N	4104/0101 Aerosol 4104/0102 Bottle	JCB Activator	4104/0251 4104/0253
JCB Cleaner & Degreaser	4104/1538 Aerosol	JCB Cleaner/Degreaser	4104/1557

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* Operating Safety	2 - 2
Maintenance Safety	2 - 2
* Safety Decals	2 - 4

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

All construction and agricultural equipment can be hazardous. When a JCB machine is correctly operated and properly maintained, it is a safe machine to work with. But when it is carelessly operated or poorly maintained it can become a danger to you (the operator) and others.

Do not work with the machine until you are sure that you can control it.

Do not start any job until you are sure that you and those around you will be safe.

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

Remember
BE CAREFUL
BE ALERT
BE SAFE

GEN-1-6

General Safety

WARNING

Decals

You can be injured if you do not obey the decal safety instructions. Keep decals clean. Replace unreadable or missing decals with new ones before operating the machine. Make sure replacement parts include warning decals where necessary.

INT-1-3-4

WARNING

Alcohol and Drugs

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

INT-1-3-9

WARNING

Care and Alertness

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

INT-1-3-5

WARNING

Clothing

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

INT-1-3-6

CAUTION

Lifting the Machine

When lifting the machine using the mainframe lifting points it is necessary to use a lifting frame to prevent the chains causing damage to the ROPS/FOPS structure.

GEN 9-1

WARNING

Lifting Equipment

You can be injured if you use faulty lifting equipment. Make sure that lifting equipment is in good condition. Make sure that lifting tackle complies with all local regulations and is suitable for the job. Make sure that lifting equipment is strong enough for the job.

INT-1-3-7

WARNING

Raised Attachments

Raised attachments can fall and injure you. Do not walk or work under raised attachments unless they are safely blocked.

INT-1-3-8

WARNING

Soft Ground

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

INT-3-2-4

Operating Safety

WARNING

Practice

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

INT-2-1-1

DANGER

Sparks

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

INT-2-2-10

WARNING

Machine Limits

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

INT-2-1-4

WARNING

Engine

The engine has exposed rotating parts. Do not open the engine cover while the engine is running. Do not use the machine with the cover open.

INT-2-1-6/1

WARNING

Passengers

Passengers in or on the machine can cause accidents. The JCB 1CX is a one man machine. Do not carry passengers.

INT-2-2-2

WARNING

Exhaust Gases

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

INT-2-1-10

Maintenance Safety

WARNING

Repairs

Do not try to do repairs or any other type of maintenance work you do not understand. To avoid injury and/or damage get the work done by a specialist engineer.

GEN-1-5

CAUTION

Cleaning

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

INT-3-2-11

WARNING

Metal Splinters

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

INT-3-1-3

WARNING

Electrical Circuits

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

INT-3-1-4

CAUTION

Do not switch the battery isolator OFF while the engine is running. Failure to comply may result in damage to the electrical circuits.

4-2-1-7

WARNING

Petrol

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

INT-3-1-6

WARNING

Diesel Fuel

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 or injury if you do not follow these precautions.

INT-3-2-2

WARNING

Oil

Oil is toxic. If you swallow any oil, do not induce vomiting, seek medical advice. Used engine oil contains harmful contaminants which can cause skin cancer. Do not handle used engine oil more than necessary. Always use barrier cream or wear gloves to prevent skin contact. Wash skin contaminated with oil thoroughly in warm soapy water. Do not use petrol, diesel fuel or paraffin to clean your skin.

INT-3-2-3

Maintenance Safety (cont'd)**⚠ CAUTION****'O' rings, Seals and Gaskets**

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

INT-3-2-12

⚠ WARNING**Fires**

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

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

INT-3-2-7/1

⚠ CAUTION

Non-approved modifications to drive ratios, machine weight or wheel and tyre sizes may adversely affect the performance of the parking brake.

3-2-3-11/1

⚠ WARNING**Hot Coolant**

The cooling system is pressurised when the engine is hot. Hot coolant can spray out when you remove the radiator cap. Let the system cool before removing the radiator cap. To remove the cap; turn it to the first notch and let the steam pressure escape, then remove the cap.

INT-3-2-9

⚠ WARNING**Battery**

A battery with frozen electrolyte can explode if it is used or charged. Do not use a machine with a frozen battery. To help prevent the battery from freezing, keep the battery fully charged.

INT-3-1-7

⚠ WARNING**Tyres and Rims**

Over-inflated or over-heated tyres can explode. Follow the instructions in this manual for inflating the tyres. Do not weld or cut rims. Get a tyre/wheel specialist to do any repair work.

INT-3-2-6

⚠ WARNING**Battery Gases**

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

INT-3-1-8

⚠ WARNING**Battery Terminals**

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

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

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

INT-3-1-9

⚠ DANGER**Electrolyte**

Battery electrolyte is toxic and corrosive. Do not breathe the gases given off by the battery. Keep the electrolyte away from your clothes, skin, mouth and eyes. Wear safety glasses. See Battery in MAINTENANCE section for First Aid treatment.

INT-3-2-1/2

⚠ WARNING**Hydraulic Hoses**

Damaged hoses can cause fatal accidents. Inspect the hoses regularly for:

Damaged end fittings
Chafed outer covers
Ballooned outer covers
Kinked or crushed hoses
Embedded armouring in outer covers
Displaced end fittings.

INT-3-3-2

⚠ CAUTION**Rams**

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

INT-3-2-10

⚠ WARNING**Hydraulic Pressure**

It is not possible to vent all residual pressure. Loosen the connection one full turn and allow the pressure to dissipate. Keep face and hands well clear of pressurised hydraulic oil and wear protective glasses.

HYD 4-3

Maintenance Safety (cont'd)

WARNING

Hydraulic Fluid

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 immediately.

INT-3-1-10/1

WARNING

Fluoroelastomeric Materials

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

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

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

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

- 1 Ensure that components have cooled then remove and place material into plastic bags.
- 2 Thoroughly wash contaminated area with 10% calcium hydroxide or other suitable alkali solution, if necessary use wire wool to remove burnt remains.
- 3 Thoroughly wash contaminated area with detergent and water.
- 4 Contain all removed material, gloves etc. used in this operation in sealed plastic bags and dispose of in accordance with Local Authority Regulations.

DO NOT BURN FLUOROELASTOMERIC MATERIALS.

If contamination of skin or eyes occurs, wash the affected area with a continuous supply of clean water or with calcium hydroxide solution for 15-60 minutes. Get medical attention immediately.

INT-3-3-5/1

Safety Decals

WARNING

Decals on the machine warn you of particular hazards. Each decal is attached close to a part of the machine where there is a possible hazard. Read and make sure you understand the safety message before you work with or on that part of the machine.

Keep all decals clean and readable. Replace lost or damaged decals. The decals and their attachment points are shown on the following pages. Each decal has a part number printed on it, use this number to order a new decal from your JCB distributor.

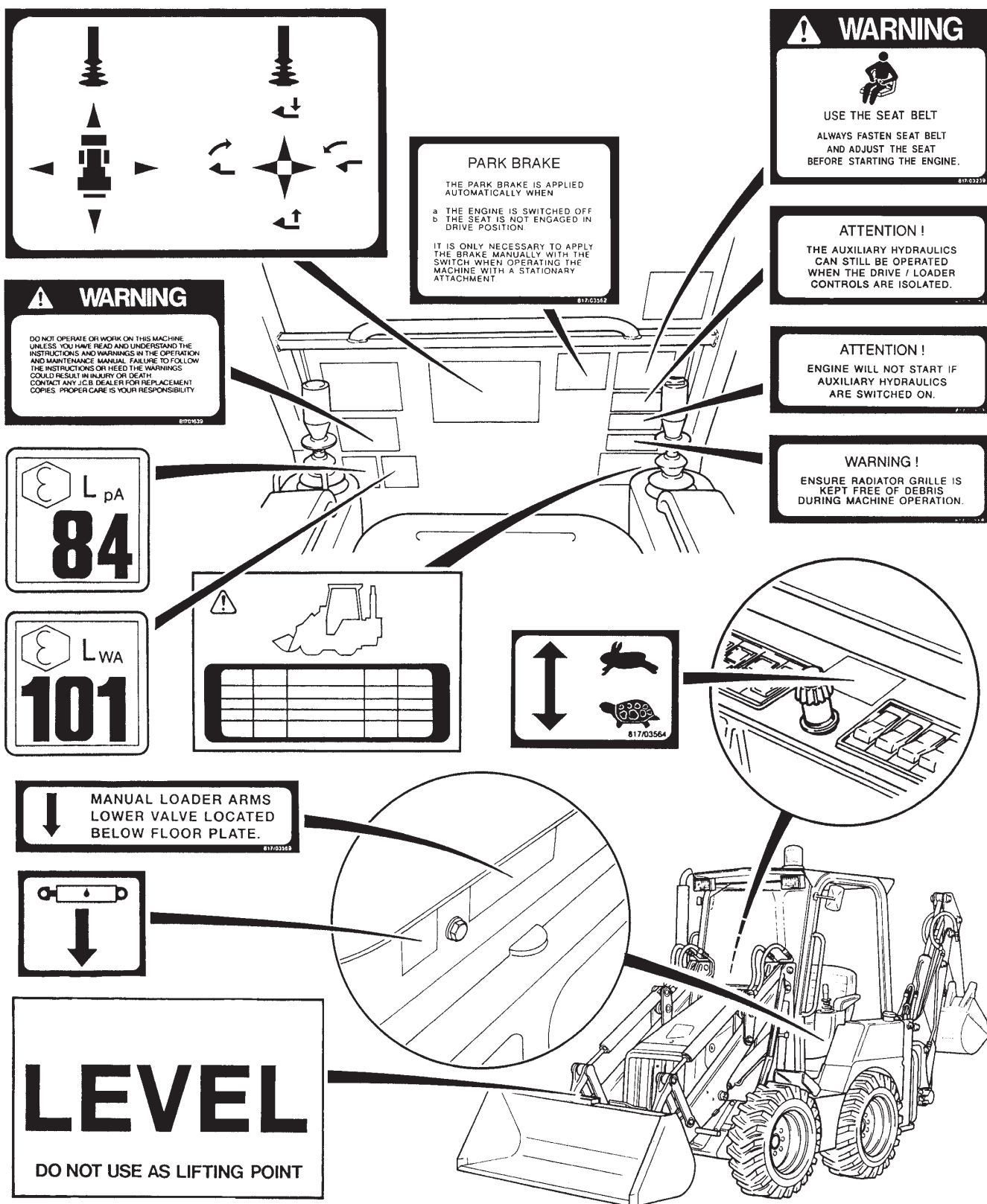
INT-3-3-3

WARNING

If you need eye-glasses for reading, make sure you wear them when reading the safety decals. Decals are strategically placed around the machine to remind you of possible hazards. Do not over-stretch or place yourself in dangerous positions to read the decals.

INT-3-3-4

Safety Decals (cont'd)



203470

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Fluids, Capacities and Lubricants - except North America

ITEM	CAPACITY	FLUID/LUBRICANT	SPECIFICATION
* Engine Oil XUD 100 series up to m/c no. 807552 400 series from m/c no. 807553	5 litres 8.2 litres 10.5 litres	JCB High Performance 15W/40	ACEA E2:B2:A2, API CF4/SG
Hydraulic System	45 litres	JCB High Performance 10W/30 JCB High Performance 15W/40 (top up only)	ACEA E2:B2:A2, API CF4/SG ACEA E2:B2:A2, API CF4/SG
Cooling System XUD Total coolant cap. Antifreeze 100 and 400 series Total coolant cap. Antifreeze	11 litres 5.5 litres 11 litres 5.5 litres	Water/Anti-freeze (see Coolant Mixtures) JCB Four seasons Antifreeze & Summer Coolant/water (see Coolant Mixtures)	Inhibited Ethanediol AL - 39 11 ASTM D3306, BS6580
Fuel System	45 litres	Diesel oil (see Types of Fuel)	ASTM D975-66T Nos. 1D, 2D
Grease Points	-	JCB Special HP Grease or JCB Special MPL-EP Grease	Lithium complex NLGI No. 2 consistency including extreme pressure additives Lithium based NLGI No. 2 consistency including extreme pressure additives
Chain Case	Fill to level plug	Engine Oil	
Slew Oil up to m/c no. 807225 Slew Oil from m/c no. 807226	Fill to level mark Fill to level plug	JCB HD90 Gear Oil JCB High Performance 10W/30	API GL 5 ACEA E2:B2:A2, API CF4/SG

Fluids, Capacities and Lubricants - North America

ITEM	CAPACITY	FLUID/LUBRICANT	SPECIFICATION
* Engine Oil XUD 100 series up to m/c no. 807552 400 series from m/c no. 807553	1.32 US gal 2.17 US gal 2.8 US gal	JCB Genuine Engine Oil 15W/40	CH-4/SJ, SAE 15W 40
* Hydraulic System	11.89 US gal	JCB Genuine Engine Oil 10W/30 JCB Genuine Engine Oil 15W/40 (top up only)	CH-4/SJ, SAE 10W 30 CH-4/SJ, SAE 15W 40
Cooling System XUD Total coolant cap. Antifreeze 100 and 400 series Total coolant cap. Antifreeze	2.9 US gal 1.45 US gal 2.9 US gal 1.45 US gal	Water/Anti-freeze (see Coolant Mixtures) Permanent Antifreeze	Inhibited Ethanediol AL - 39 11 ASTM D3306, BS6580
Fuel System	11.89 US gal	Diesel oil (see Types of Fuel)	ASTM D975-66T Nos. 1D, 2D
Grease Points	-	JCB Moly EP #2 Grease	Lithium complex NLGI #2 consistency including extreme pressure additives
Chain Case	Fill to level plug	Engine Oil	
Slew Oil up to m/c no. 807225 Slew Oil from m/c no. 807226	Fill to level mark Fill to level plug	Gear Oil EP90 JCB 30W	API GL 5 API CD/CE

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

Lubricants - Health and Safety

Hygiene

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

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

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

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

Storage

Always keep lubricants out of the reach of children.

Never store lubricants in open or unlabelled containers.

Waste Disposal

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

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

Handling

New Oil

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

Used Oil

Used engine crankcase lubricants contain harmful contaminants.

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

- 1 Avoid prolonged, excessive or repeated skin contact with used engine oils.
- 2 Apply a barrier cream to the skin before handling used engine oil.

3 Note the following when removing engine oil from skin:

- a Wash your skin thoroughly with soap and water.
- b Using a nail brush will help.
- c Use special hand cleansers to help clean dirty hands.
- d Never use petrol, diesel fuel, or paraffin for washing.
- e Avoid skin contact with oil soaked clothing.
- f Don't keep oily rags in pockets.
- g Wash dirty clothing before re-use.
- h Throw away oil-soaked shoes.

First Aid - Oil

Eyes

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

Swallowing

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

Skin

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

Spillage

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

Fires

Extinguish with carbon dioxide, dry chemical or foam. Fire-fighters should use self-contained breathing apparatus.

WARNING

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

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

7-3-1-3/1

Fuel System

Types of Fuel

Use good quality diesel fuel to get the correct power and performance from your engine. The recommended fuel specification for JCB engines is given below.

Cetane Number:	45 (minimum)
Viscosity:	2.5/4.5 Centistokes at 40°C (104°F)
Density:	0.835/0.855 kg/litre (0.872/0.904 lb/pint)
Sulphur:	0.5% of mass (maximum)
Distillation:	85% at 350 °C (662 °F)

Cetane Number

Indicates ignition performance. Fuel with a low cetane number can cause cold start problems and affect combustion.

Viscosity

Is the resistance to flow. If this is outside limits, the engine performance can be affected.

Density

Lower density will reduce engine power. Higher density will increase both engine power and exhaust smoke.

Sulphur

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 also use a highly alkaline engine lubricating oil; or change the normal oil more frequently.

Distillation

This indicates the mixture of different hydrocarbons in the fuel. A high ratio of lightweight hydrocarbons can affect the combustion characteristics.

Fuel Standards

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

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).

Flow improvers may also be available. These can be added to the fuel to reduce wax formation.

Petrol

WARNING

Do not use petrol in this engine. 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

Advice

If you have to use non-standard fuels, contact your JCB distributor for advice on engine adjustments and oil change periods.

* 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.

Filling the Tank

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

At the end of every working day, fill the tank with the correct type of fuel.

This will prevent condensation from developing in the fuel tank overnight.

We recommend that, if possible, you lock the fuel cap to prevent theft and tampering.

Service Schedules

**EVERY 10 OPERATING HOURS OR DAILY
whichever occurs first, for the first 50 Operating Hours
only**

Check (engine stopped)

- 1 Tightness of wheel bolts

**EVERY 10 OPERATING HOURS OR DAILY
whichever occurs first**

Clean

- 1 Machine generally, including cab interior

Check (Engine Stopped)

- 1 Generally for damage, including ROPS/FOPS structure
- 2 Engine coolant level and condition
- 3 Fuel system for leaks and contamination
- 4 Hydraulic fluid level
- 5 Hydraulic system for leaks
- 6 Engine oil level and condition
- 7 Engine generally for leaks
- 8 Tyre pressures and condition
- 9 Windscreen washer level (if fitted)
- *10 Alternator belt tension (100 & 400 series engines only)
- *11 Fuel filter - drain if necessary (XUD engine only)
- 12 Seat belt condition and security
- 13 Slew oil level

Check (Engine Running)

- 1 Warning lights extinguished
- 2 Operation of all electrical equipment
- 3 Exhaust for excessive smoke
- 4 Operation of all hydraulic services

Grease

- 1 Quickhitch pivot points
- 2 Loader arm pivot points
- 3 Backhoe pivot points

**EVERY 50 OPERATING HOURS OR WEEKLY
whichever occurs first**

Do the Daily jobs plus:

Check (Engine Stopped)

- 1 Oil cooler connections
- 2 Radiator hoses and condition
- 3 Alternator belt tension
- 4 Fuel filter - drain if necessary

Clean

- 1 Quickhitch square locking peg housings.

**EVERY 100 OPERATING HOURS OR 2 WEEKLY
whichever occurs first**

Do the Daily and 50 hour jobs plus:

Clean

- 1 Battery terminals
- 2 Air filter outer element when operating in dusty conditions

Check (Engine Stopped)

- 1 Condition of ram piston rods
- 2 Hoses and pipework for chafing and damage
- 3 Air cleaner hose security
- 4 Wiring for chafing

Oil

- 1 All linkage points
- 2 Door hinges (cabbed version)

**EVERY 250 OPERATING HOURS OR MONTHLY
whichever occurs first**

Do the Daily to 100 hour jobs plus:

Clean

- 1 Air cleaner dust valve
- 2 Radiator matrix
- 3 Hydraulic tank breather

Check (Engine stopped)

- 1 Tightness of wheel bolts
- 2 Engine and pump mounting bolts for tightness
- 3 Radiator hose condition
- 4 Motor mounting bolts for tightness
- 5 Hub mounting bolts for tightness
- 6 Drive chain case oil levels

Check (Engine running)

- 1 Idling speed
- 2 Maximum governed speed
- 3 Exhaust system security
- 4 Exhaust for excessive smoke
- 5 Throttle system and control pedal
- 6 Operation of all hydraulic services
- 7 Operation of control isolation
- 8 Parking brake operation
- 9 Operation of electrical system
- 10 Operation of attachments
- 11 Check for fluid leaks (e.g. coolant, engine oil, hydraulic oil, etc.

Change (Engine Stopped)

- 1 Engine oil and filter (up to machine no. 807552)
- 2 Fuel filter element (100 & 400 series engines only)
- 3 Hydraulic fluid filter

**EVERY 500 OPERATING HOURS OR 6 MONTHLY
whichever occurs first**

Do the Daily to 250 hour jobs plus:

Clean

- 1 Cab heater filter (if fitted)

Check (Engine Stopped)

- 1 Pivot pins and bushes
- 2 Battery charge and condition
- 3 Battery electrolyte level (if applicable)

Change

- *1 Engine oil and filter (from machine no. 807553)
- 2 Fuel filter element (XUD engine only)
- 3 Air filter outer element

**EVERY 1000 OPERATING HOURS OR YEARLY
whichever occurs first**

Do the Daily to 500 hour jobs plus:

Check (Engine Stopped)

- 1 Tighten cylinder head bolts (100 series engines only)
- 2 Engine cam belt - condition (XUD engine only)
- 3 Valve clearances (100 & 400 series engines only)
- 4 Renew alternator drive belt (100 & 400 series engines only)
- 5 Drive chain tension

Check (Engine Running)

- 1 M.R.V. pressure
- 2 A.R.V. pressure
- 3 Transmission stall pressure
- 4 Pressure reducing valve - check and adjust (up to serial no. 752462)

Change

- 1 Air filter inner element

**EVERY 2000 OPERATING HOURS OR 2 YEARLY
whichever occurs first**

Do the Daily to 1000 hour jobs plus:

Check (Engine Stopped)

- 1 Valve clearances (XUD engine only)

Change

- 1 Hydraulic fluid - sample/change (clean suction strainer)
- 2 Engine coolant
- 3 Engine cam belt (XUD engine only)
- 4 Drive chain case oil
- 5 Engine breather (from machine no. 807553)

Loader Arm Safety Strut

Installing

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

WARNING

You could be killed or seriously injured if the loader control is accidentally operated. Make sure that no-one goes near the machine whilst you fit the safety strut.

16-3-1-5

- 1** Empty the shovel or attachment, if appropriate, and raise the loader arm enough to fit the safety strut.
- 2** Stop the engine.
- 3** Fit the strut:
 - a** Remove the strut from its stowage position **C**.
 - b** Place the strut around the lift ram.
 - c** Secure the strut **A** into position using strap **B**.
- 4** Start the engine.
- 5** Slowly lower the loader arm onto the safety strut. Stop the movement immediately the weight of the arm is supported by the strut.

Note: Extreme care must be taken when lowering the loader arm onto the safety strut. 'Feather' the lever to lower the loader arm slowly.

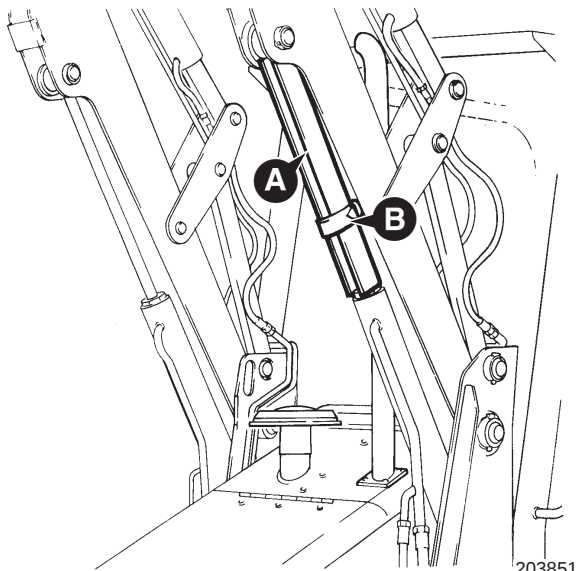
Removing

WARNING

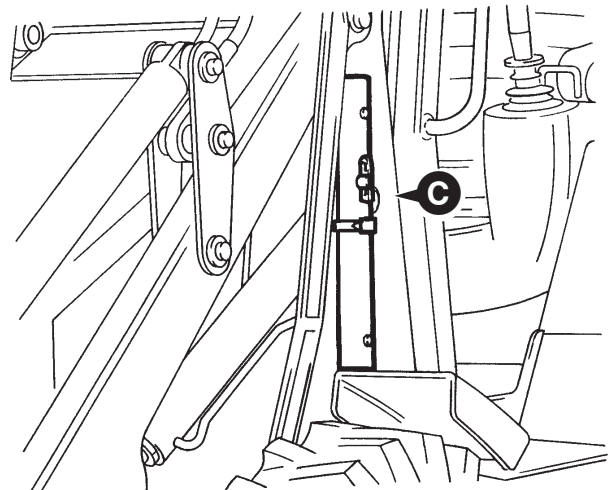
You could be killed or injured if the loader control is accidentally operated. Make sure no-one comes near the machine while you remove the safety strut.

2-3-1-3

- 1** Make sure that the drive control lever is in the neutral (rest) position.
- 2** Raise the loader arm to take the weight off the safety strut **A**. Stop the engine.
- 3** Remove the strut:
 - a** Release securing strap **B**.
 - b** Remove the safety strut from the lift ram.
 - c** Return the safety strut to its stowage position **C**.



203851



202720

Greasing

The machine must be greased regularly to keep it working efficiently. Regular greasing will also increase the machine's working life.

Grease should be applied with a grease gun, normally two strokes of the gun should be sufficient.

Stop the greasing procedure when fresh grease appears at the joint. Use the recommended grease. (See **Fluids Capacities and Lubricants**.)

In the following illustrations, the grease points are numbered. Count off the grease points as you apply grease to each one. Refit the dust caps after greasing.

Quickhitch Pivot Points - for interval see Service Schedule

Lower the loader arm as far as it will go. Tilt the Quickhitch fully forward to facilitate access to the central pivot pin grease points. **Switch off the engine and ensure it cannot be started while you are doing this job.**

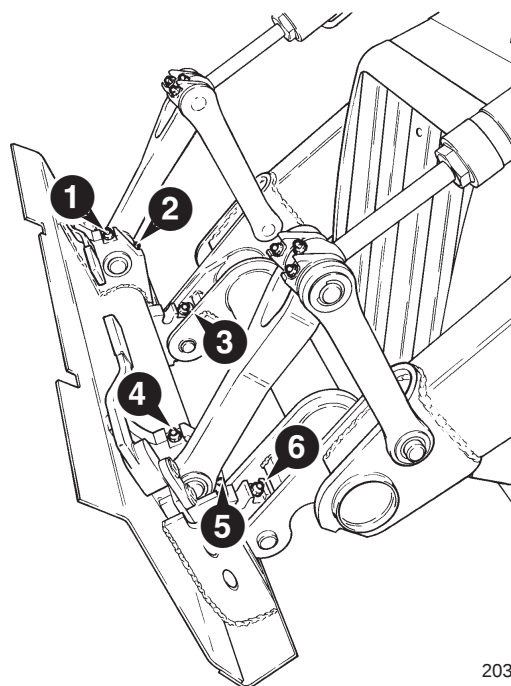
Total of 6 grease points.

⚠ WARNING

You will be working close into the machine for these jobs. Lower the attachments if possible. Remove the starter key and disconnect the battery. This will prevent the engine being started. Make sure the parking brake is engaged.

Block all four wheels before getting under the machine.

2-3-2-1



203960

Greasing (cont'd)

Loader Arm Pivot Points - for interval see Service Schedule

Switch off the engine and ensure it cannot be started while you are doing this job.

For each grease point shown there is another on the other side of the machine.

Note: Grease point 11 is at the lift ram/chassis pivot.

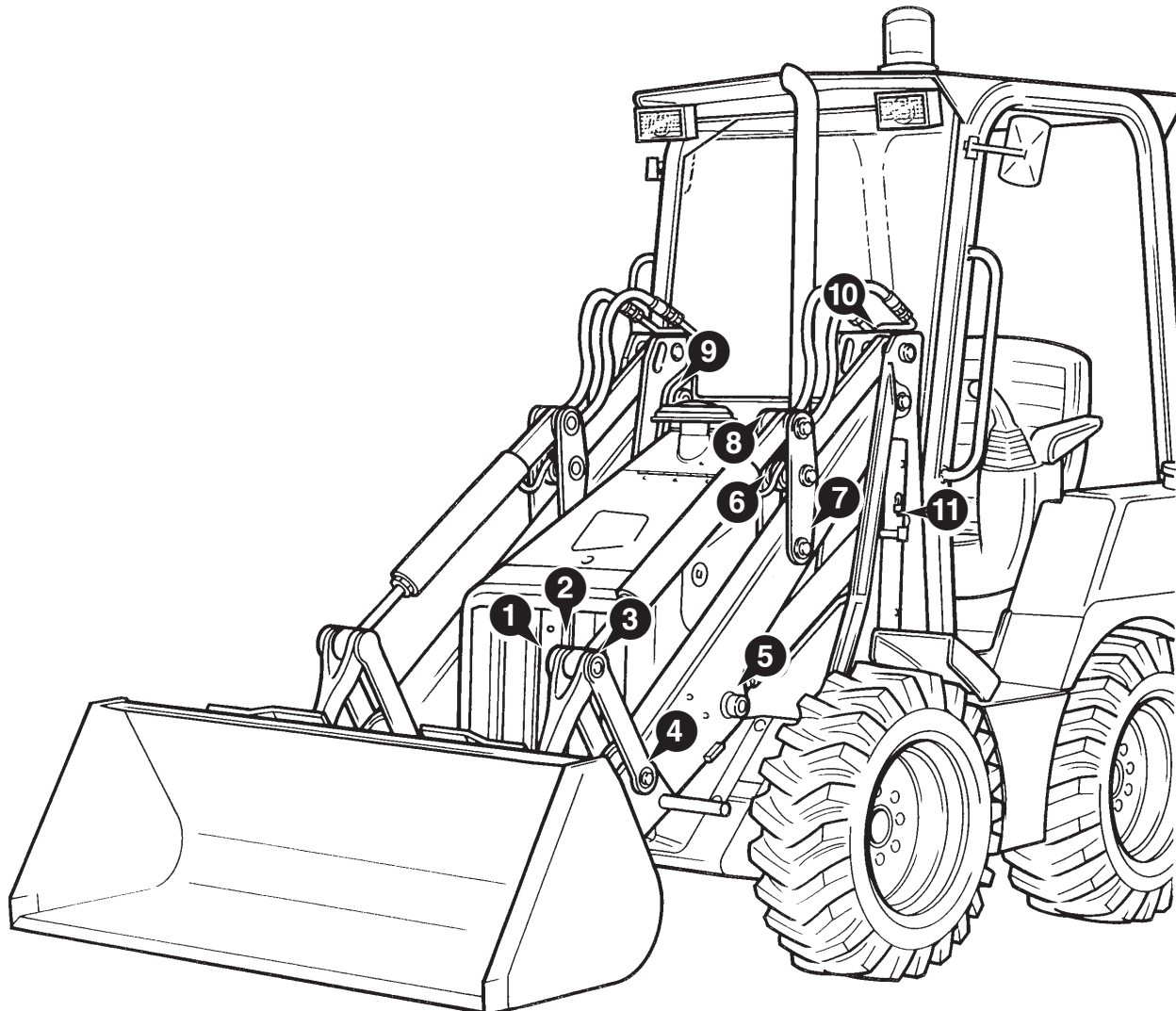
11 grease points each side -

Total 22 grease points.

⚠ 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



203481

Greasing (cont'd)

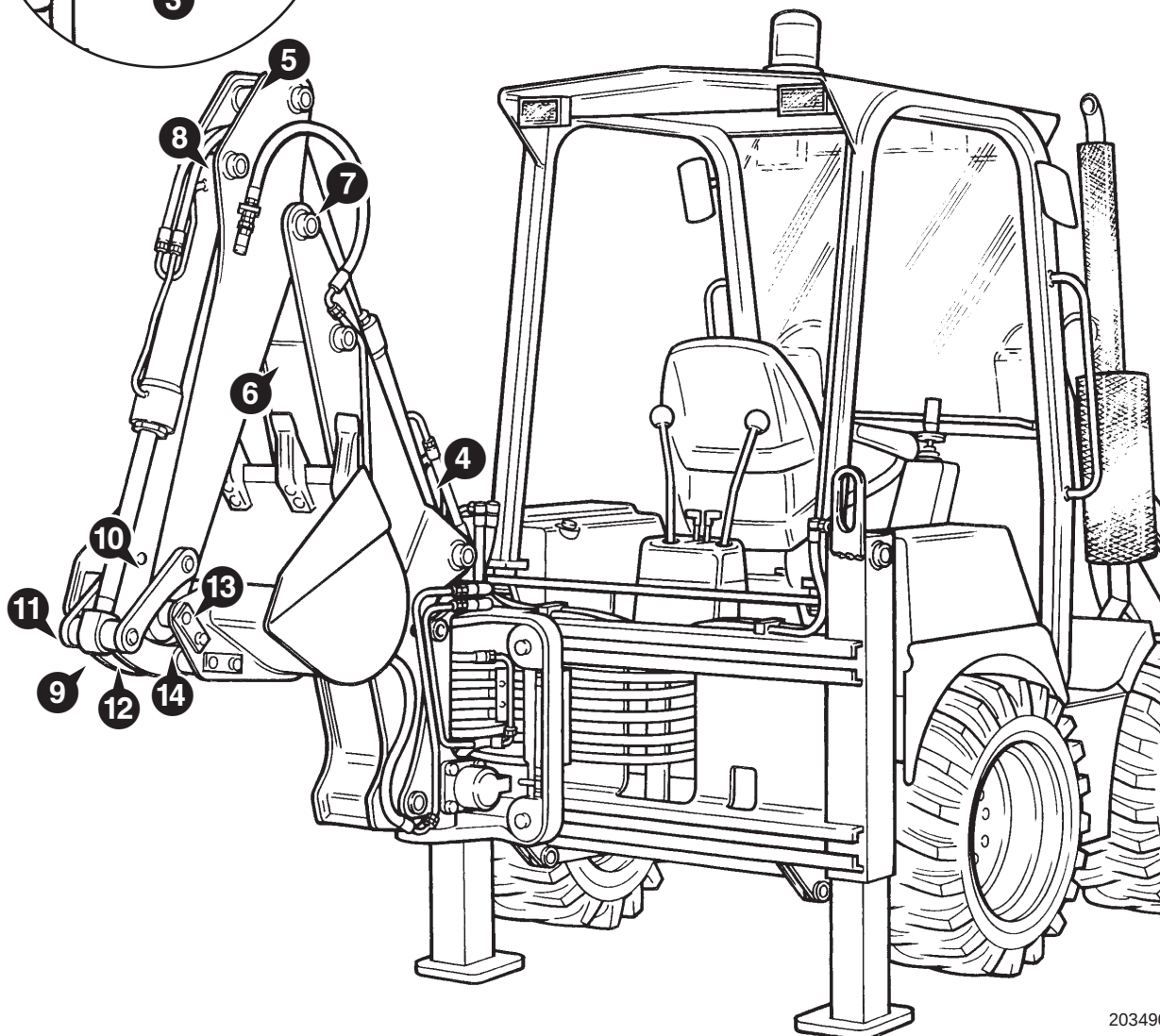
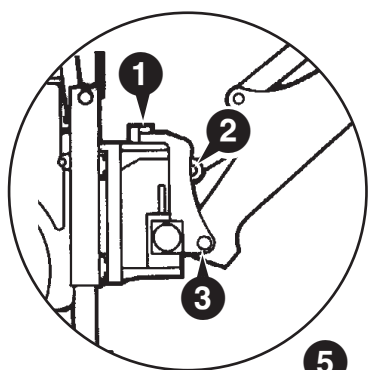
Backhoe Pivot Points - for interval see Service Schedule

Note: Lubricate the kingpost mounting rails and stabiliser legs with diesel oil or Waxoyl.

Switch off the engine and ensure it cannot be started while you are doing this job.

Note: Grease point 5 is at dipper ram dump end.
Grease point 14 is on end of dipper.

Total 14 grease points.

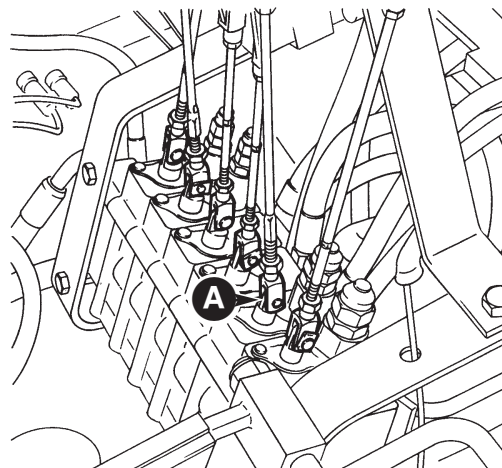


203490

Body and Framework

Oiling Control Levers - *for interval see Service Schedule*

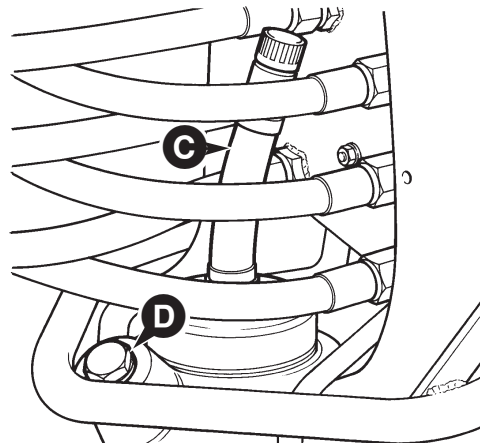
Oil the clevis **A** at the bottom of each backhoe control lever.



202740

*Checking Slew Oil Level - *for interval see Service Schedule*

- 1 Park the machine on level ground and stop the engine.
- 2 To machine number 807225: Check that the slew oil level is up to the mark on the breather **C**.
From machine number 807226 (not fitted with breather **C**): Remove plug **D** and check that oil is visible on the plug spigot.
- 3 If the level is low, remove plug **D** (if not already removed) and fill with new oil until oil runs from the hole. See **Fluids, Lubricants and Capacities** for recommended oil grade.
- 4 Refit plug **D**.
To machine number 807225 only: Fill through breather **C** to the level mark.
- 5 Operate the slew service fully in each direction five times.
- 6 Remove plug **D** and recheck the oil level. If level is low, repeat steps 3 to 5 until all air is expelled.



203940

Oiling Door Hinges (cabbed machines) - *for interval see Service Schedule*

Oil the door hinges **B** sparingly.

Checking Seat Belt Condition and Security - *for interval see Service Schedule*

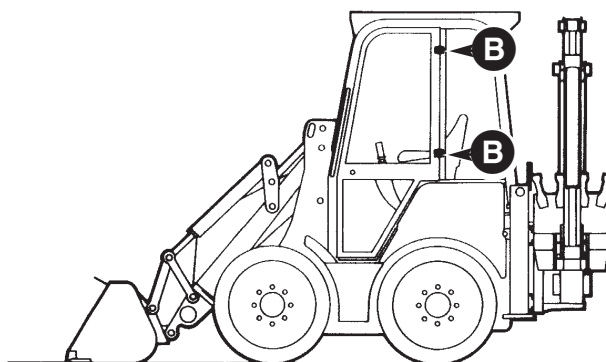
⚠ WARNING

Replace the seat belt with a new one if it is damaged, if the fabric is worn, or if the machine has been in an accident. Fit a new seat belt every three years regardless of condition.

2-3-1-8

When checking the seat belt, look for signs of fraying and stretching. Make sure the stitching is not loose or damaged. Make sure the buckle assembly is working correctly and not damaged. Fit a new seat belt every three years.

Make sure the belt mounting bolts are undamaged, correctly fitted and tightened.



203540

Electrical system

Battery Safety

⚠ WARNING

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

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

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

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

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

5-3-4-3

DO THE FOLLOWING FIRST AID, IF ELECTROLYTE:

GETS INTO YOUR EYES

Flush with water for 15 minutes, get medical help immediately.

IS SWALLOWED

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

GETS ONTO YOUR SKIN

Flush with clean water, remove affected clothing.

Checking the Electrolyte Level- for interval see Service Schedule

- 1 Stop the engine.
- 2 Remove the battery cover.
- 3 Remove battery cell cover(s) **B**.
- 4 Make sure the level in each cell is 6 mm ($\frac{1}{4}$ in) above the plates.
- 5 If necessary, top up with distilled water.
- 6 Refit battery cell cover(s) **B**.
- 7 Refit the battery cover and secure.

⚠ WARNING

Battery

A battery with frozen electrolyte can explode if it is used or charged. Do not use a machine with a frozen battery. To help prevent the battery from freezing, keep the battery fully charged.

INT-3-1-7

⚠ WARNING

Do not top up the battery with acid. The electrolyte could boil out and burn you.

2-3-4-6

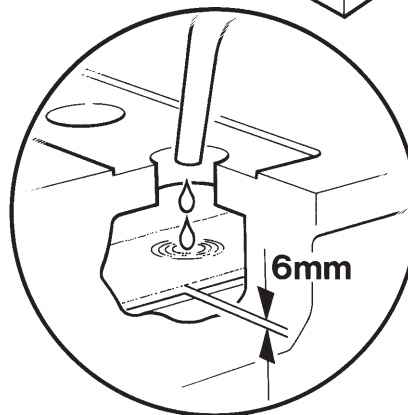
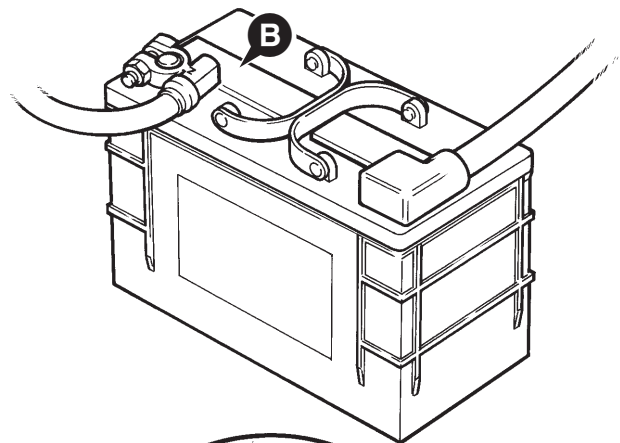
⚠ WARNING

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

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

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

INT-3-1-9



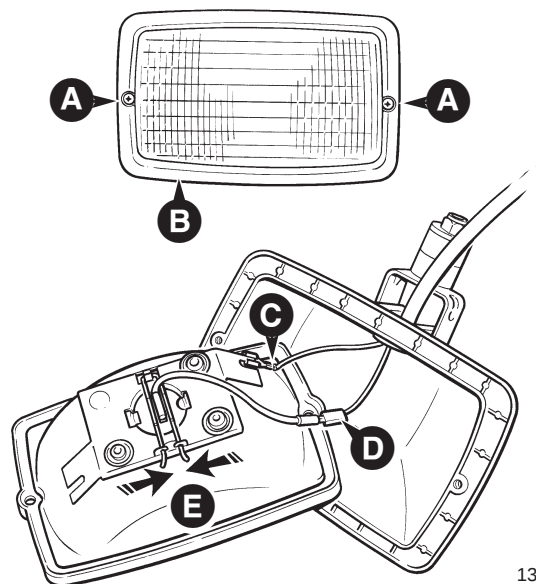
174420

Electrical system (cont'd)

Changing the Light Bulbs

Worklight Bulb

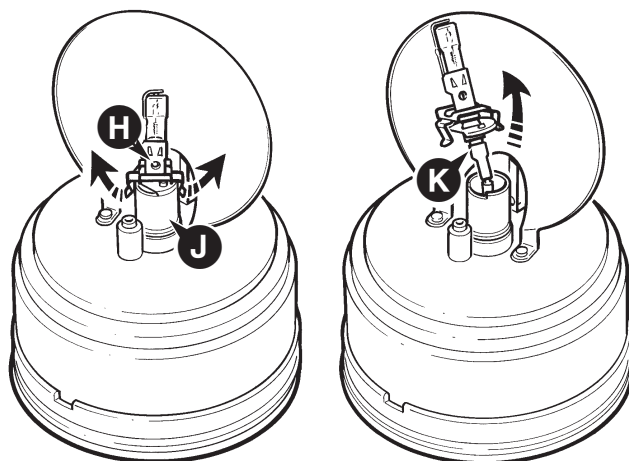
- 1 Support the light unit **B** remove screws **A**.
- 2 Lift and turn light unit **B** to gain access to connectors **C** and **D**.
- 3 Disconnect at **C** and **D**.
- 4 Remove the bulb by releasing clips **E**.
- 5 **Do not touch the new bulb with bare fingers.** Fit the new bulb.
- 6 Reassemble the light unit in the reverse order.



132930

Rotating Beacon Bulb

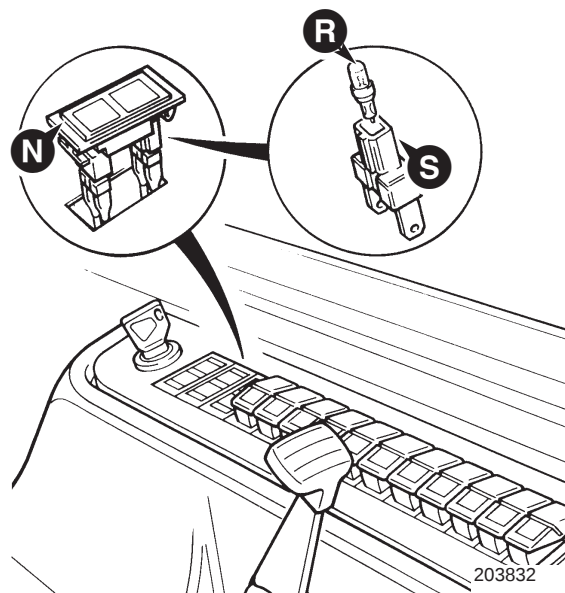
- 1 Remove the three screws holding the cover and remove the cover.
- 2 Release spring clip **H** and ease the bulb from its holder **J**.
- 3 Disconnect the bulb at **K**.
- 4 **Do not touch the bulb with bare fingers.** Fit the new bulb. Make sure that the bulb is seated correctly and the spring clip **H** is secure.
- 5 Reassemble the light unit in the reverse order.



133010

* Warning Lights

- 1 With a fine screwdriver ease the Warning Light **N** from its socket in the control panel.
- 2 The bulb holder **S** can then be pulled from the back of the Warning Light and the bulb will come with it.
- 3 The bulb **R** is a straight pull from the holder.
- 4 Fit the new bulb.
- 5 Re-assemble the Warning Light in the reverse order.



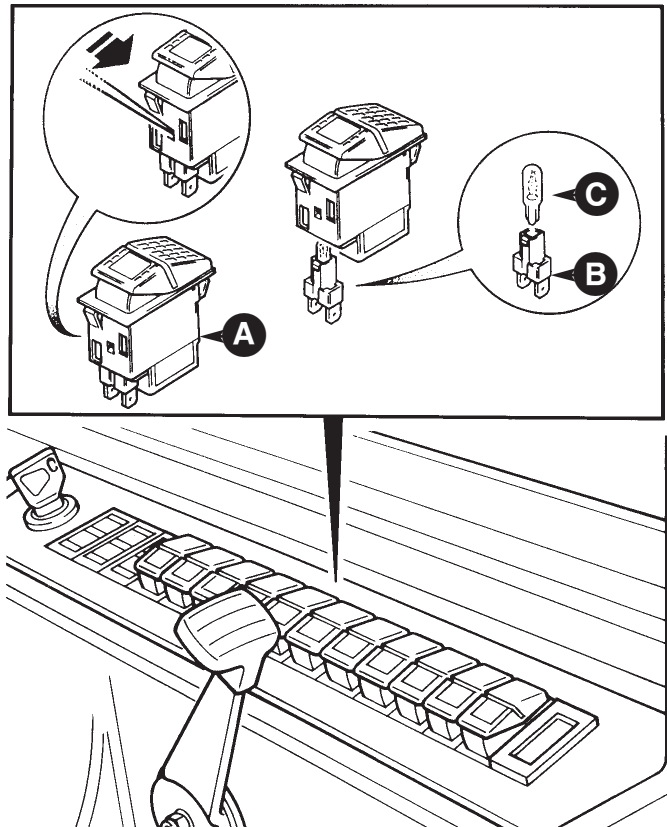
203832

Electrical system (cont'd)

Changing the Light Bulbs

Switches

- 1 With a fine screwdriver ease the Switch **A** from its socket in the control panel.
- 2 The bulb holder **B** can then be pulled from the back of the Switch and the bulb will come with it.
- 3 The bulb **C** is a straight pull from the holder.
- 4 Fit the new bulb.
- 5 Re-assemble the Switch in the reverse order.



207341

Hydraulic System

⚠ 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 immediately.

INT-3-1-10/1

Checking the Fluid Level - for interval see Service Schedule

- 1 Position the backhoe in the travel position and stop the engine.
- 2 Look at the fluid level in the sight glass **A**. The level should be visible in the sight glass.
- 3 If the level needs topping up, wait five minutes, remove the battery compartment cover, loosen the hydraulic top-up filler cap **B** and allow all pressure to dissipate.
- 4 Open filler cap **B** and top up with the recommended fluid. Pour slowly to prevent blow-back.

⚠ CAUTION

If the fluid is cloudy, water or air has entered the system. This could damage the hydraulic pump. Contact your JCB distributor.

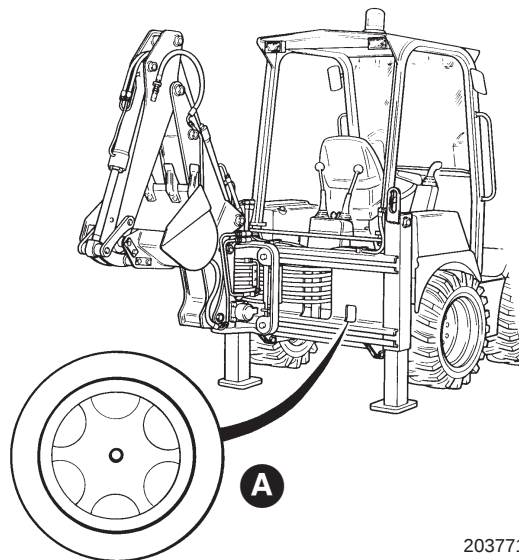
7-3-6-1

Changing the Filter - for interval see Service Schedule

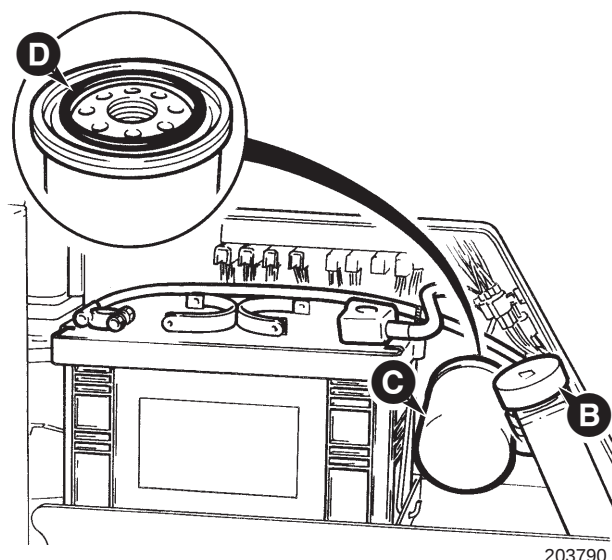
- 1 Stop the engine and wait for 5 minutes.
- 2 Loosen the hydraulic tank filler cap **B** and allow all pressure to dissipate. Remove the filler cap.
- 3 Unscrew the old filter canister **C**, using a chain wrench if necessary, and discard.
- 4 Lubricate seal **D** on the new filter canister with clean engine oil.
- 5 Screw on the new filter canister **hand tight only**.

***Note:** Machines fitted with the High-flow hydraulic system have a second filter **E** which must also be changed. The two filter canisters, although visually similar, are different and must not be mixed.

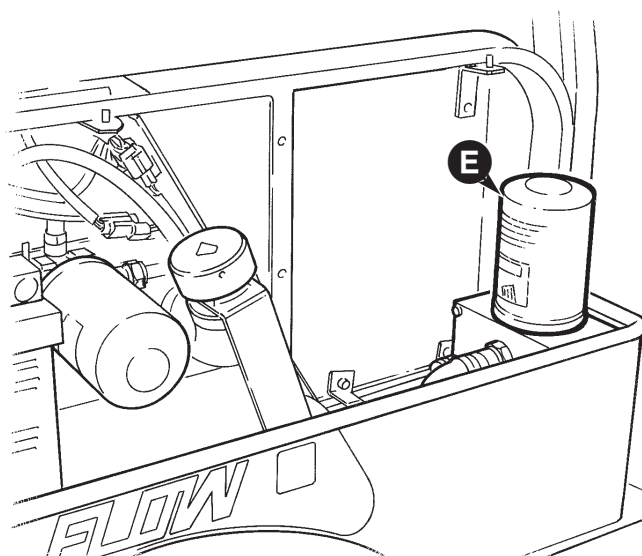
- 6 Add engine oil slowly through filler point **B**.
- 7 Refit cap **B**, run the engine for a few minutes, then re-check the fluid level.



203771



203790



218730

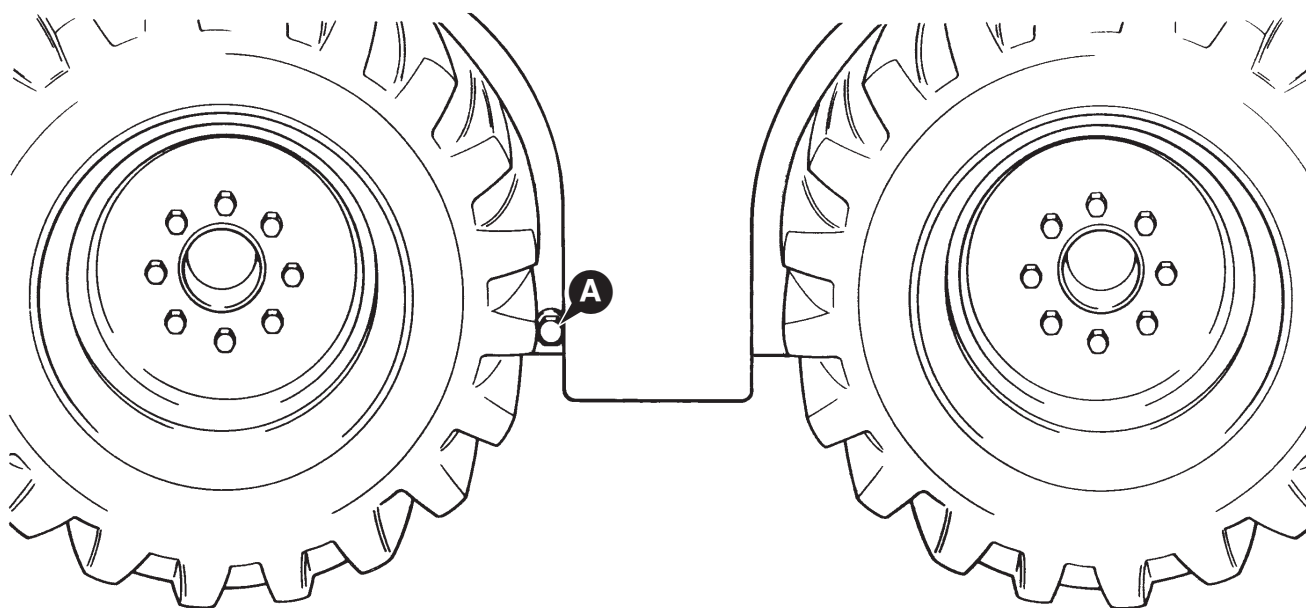
Transmission

Drive Chain Lubrication

The final drive to the wheels is by chains. A chain casing on each side of the machine houses two chains, one to the front wheel and one to the rear wheel. The chains run in an oil bath.

Checking the Oil Levels

- 1 Park the machine on level ground.
- 2 Stop the engine.
- 3 On the left side of the machine, remove inspection plug **A** and check that the oil level is up to the bottom of the aperture.
- 4 If necessary, top up through the aperture using the recommended oil. Wipe up any oil spillage.
- 5 Check that the washer on plug **A** is undamaged. Renew if necessary.
- 6 Clean plug **A** and its aperture before refitting. Do not overtighten or you could strip the threads in the housing.
- 7 Repeat steps 3 to 6 on the right side of the machine.



203750

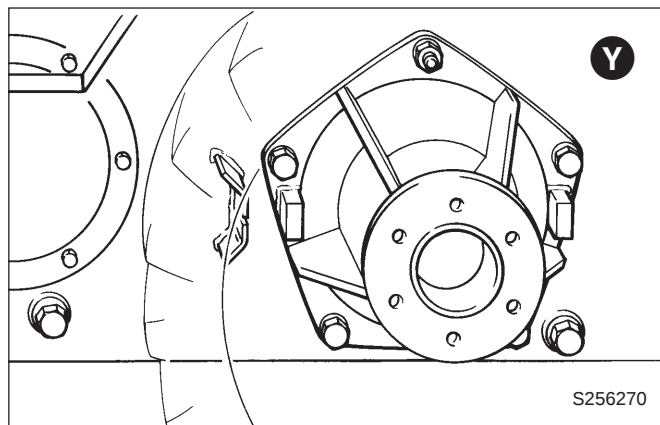
Transmission (cont'd)

Adjusting the Drive Chain Tension

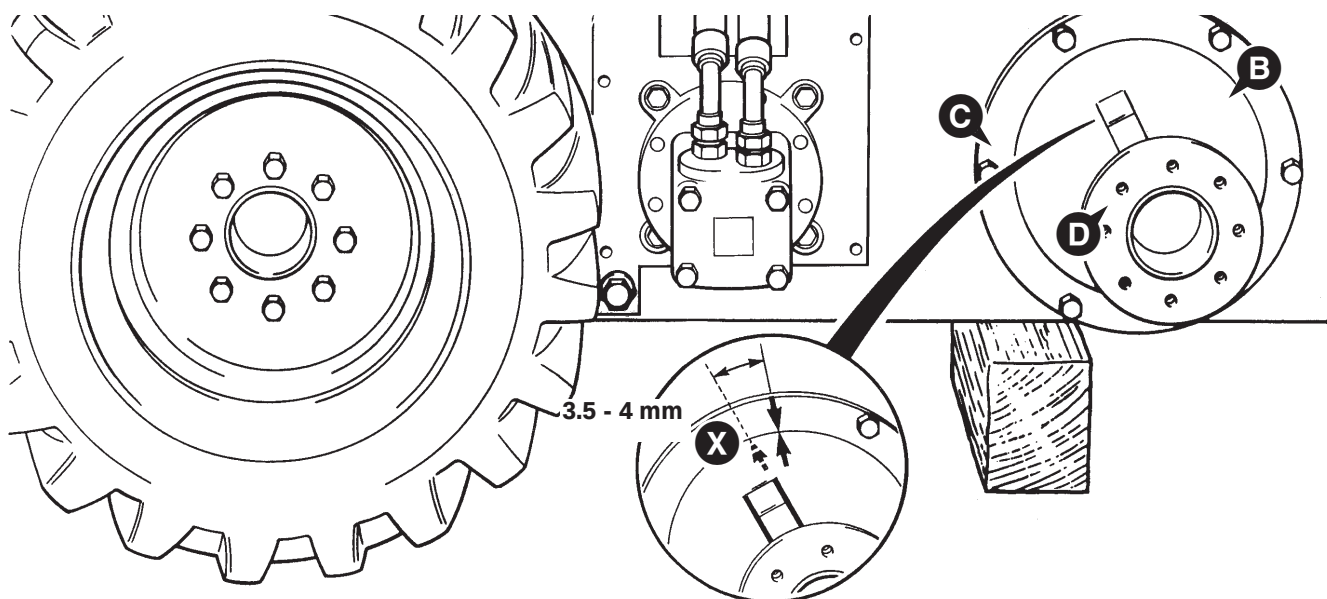
***Note:** The drive chains on machines after serial no. 751600 are pre-tensioned during manufacture and there is no provision for routine adjustment in service. These machines are fitted with a different style hub as shown at **Y**. Refer to **Wheel Hub Assembly Removal and Replacement (SECTION F)** for initial setting procedure.

- 1 Park the machine on firm level ground.
- 2 Stop the engine and remove the starter key.
- 3 Jack-up the left side of the machine, positioning the jack under the centre of the chain case between the wheels. Support the machine on blocks.

Note: Ensure that the jack is capable of lifting at least 3000 kg (3 tons).



- 4 Remove the rear wheel.
- 5 Adjust the tension as described below:
 - a Loosen the six bolts **B** securing the hub locking ring **C**.
 - b Using a large adjustable spanner grip the lug on hub **D**, then rotate the hub until no further movement is possible. Mark this position as shown at **X**.
 - c Slacken the tension with the adjustable spanner until the mark on the hub is 3.5 to 4.0 mm back from that on the locking ring as shown.
 - d Re-tighten the six bolts of hub locking ring **C** to a torque of 98 Nm (72 lbf ft, 10 kgf m).
- *6 Refit the rear wheel, tightening the bolts to the correct torque (see page 3/9 - 3).
- 7 Repeat steps 3 to 6 for the front wheel.
- 8 Repeat steps 3 to 7 on the right side of the machine.



203920

Transmission (cont'd)

Tyres and Wheels

Inflating the Tyres

WARNING

Over-inflated or overheated tyres can explode. Do not cut or weld the rims. Get a tyre/wheel specialist to do any repair work.

5-3-2-4

These instructions are for adding air to a tyre which is already inflated. If the tyre has lost all its air pressure, call in a qualified tyre mechanic. The tyre mechanic should use a tyre inflation cage and the correct equipment to do the job.

1 Prepare the Wheel

Before you add air to the tyre, make sure it is correctly fitted on the machine or installed in a tyre inflation cage.

2 Prepare the Equipment

Use only an air supply system which includes a pressure regulator. Set the regulator no higher than 1.38 bar (20 lbf/in²) above the recommended tyre pressure. (See Table below).

Use an air hose fitted with a self-locking air chuck and remote shut-off valve.

3 Add the Air

Make sure that the air hose is correctly connected to the tyre valve. Clear other people from the area. Stand behind the tread of the tyre while adding the air.

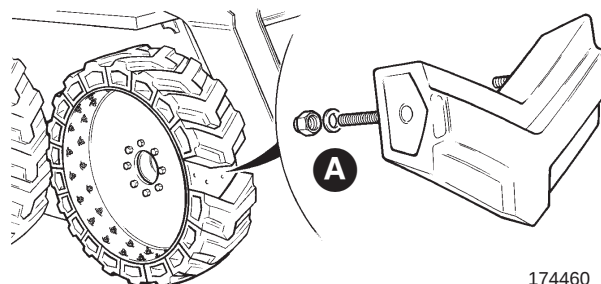
Inflate the tyre to the recommended pressure. Do not over-inflate.

Renewing Segments of Optional Non-Inflatable Tyres

Non-inflatable tyres are available as an option. These tyres consist of a number of individual segments bolted to the wheel rim.

Damaged segments can be renewed individually. Loosen and remove the four nuts and washers **A** (two each side of the wheel). Lift the segment clear by extracting its fixing studs from the holes in the wheel rim.

Fit a new segment in reverse order to removal, then tighten the retaining nuts to a torque of 28 Nm (21 lbf ft, 3 kgf m).



Checking the Wheel Bolt Torques

On new machines, and whenever a wheel has been removed, check the wheel bolt torques every two hours until they stay correct.

Every day, before starting work, check that the wheel bolts are tight.

The correct torques are shown in the table below.

8 bolt fixing Front & Rear			6 bolt fixing Front & Rear		
Nm	lbf ft	kgf m	Nm	lbf ft	kgf m
220	162	22	405	298	41

WARNING

If, for whatever reason, a wheel bolt is renewed, all the bolts for that wheel must be changed as a set, since the remaining bolts may have been damaged.

3-3-2-1

* Tyre Table

--

Engine

Air Filter

Changing the Elements - for intervals, see Service Schedule

⚠ CAUTION

The outer element must be renewed immediately if the warning light on the instrument panel illuminates.

2-3-3-1

⚠ CAUTION

Do not run the engine when the outer element has been removed.

16-3-3-1

⚠ CAUTION

The inner element of the engine air filter must be replaced with a new one. Do not attempt to clean or wash the old element.

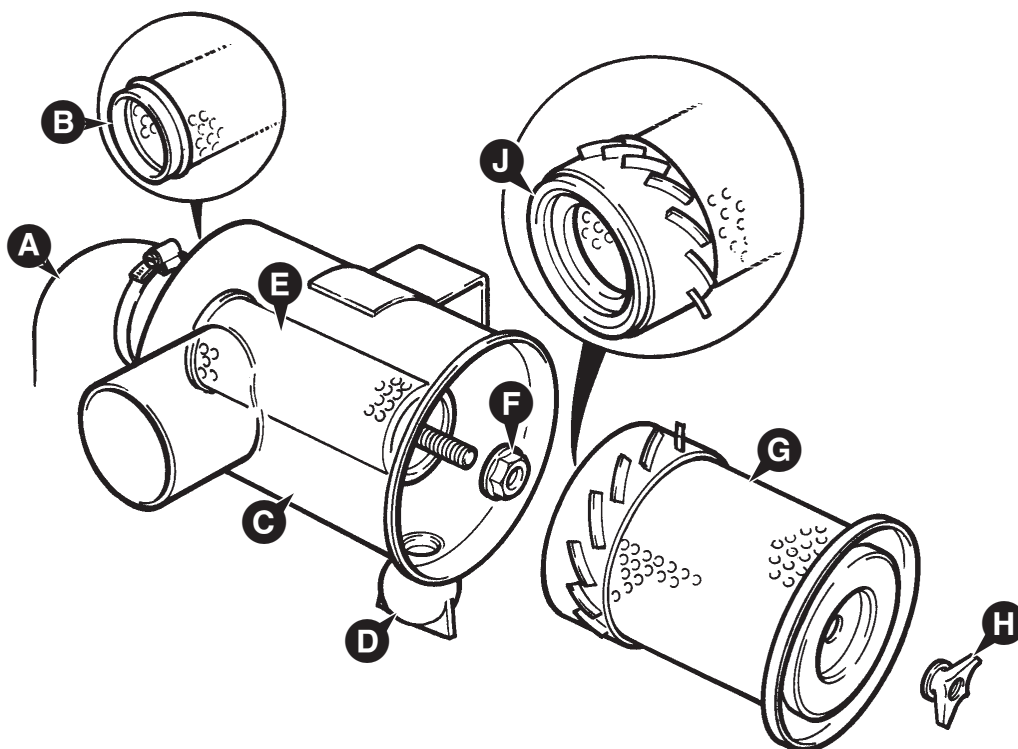
16-3-4-1

- 1 Stop the engine.
- 2 Gain access to the engine compartment by opening the bonnet.
- 3 If changing the inner element, disconnect the filter induction hose **A**. Cover the end of the hose to prevent rain and dirt from getting into the engine.
- 4 Unscrew wingnut **H**. Remove the outer element **G**. Take care not to tap or knock the element.

- 5 If required, unscrew nut **F** and remove inner element **E**.
- 6 Clean inside the canister **C** and dust valve **D**.
- 7 Test the seating of seals **B** and **J**:
 - a Smear the seals on the new elements with grease.
 - b Insert the new elements in canister **C**.
 - c Remove the elements and check for witness marks on the inside base of the canister.
- 8 If the seals are secure, re-insert the new inner element and tighten nut **F**.
- 9 Insert the new outer element and tighten nut wing **H**.
- 10 Refit the induction hose **A** (if disconnected). Make sure that the wire to the Air Filter Blocked switch is attached to the spade connector.

Note: Do not run the engine with the dust valve **D** removed.

Note: In dusty conditions, the outer element can be cleaned by blowing through in the reverse direction with clean dry compressed air. If the element is damaged, it must be replaced. A new inner element must be fitted at least every third time the outer element is changed. As a reminder, mark the inner element with a felt tipped pen each time the outer element is changed.



202760

Engine (cont'd)

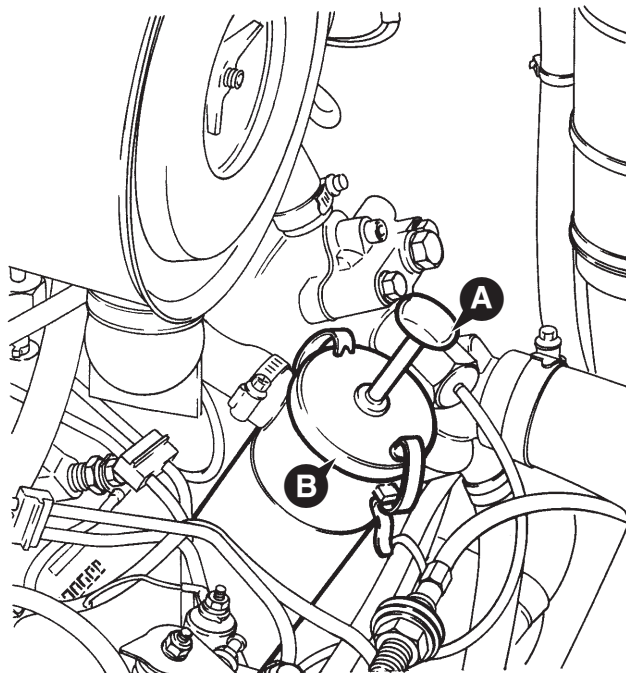
* Checking the Oil Level - XUD engine - for interval, see Service Schedule

⚠ WARNING

Hot oil and engine components can burn you. Make sure the engine is cool before doing this job.

2-3-3-2

- 1 Park the machine on level ground and lower the attachments to the ground.
- 2 Stop the engine and remove the starter key.
- 3 Raise the bonnet.
- 4 Check that the oil level is between the two marks on the dipstick **A**.
- 5 If necessary, add the recommended oil through the filler point **B**.
- 6 Make sure the filler cap and the dipstick are secure.
- 7 Close the bonnet.



202770

Changing the Oil and Filter- for interval, see Service Schedule

⚠ WARNING

Hot oil and engine components can burn you. Make sure the engine is cool before doing this job.

2-3-3-2

⚠ WARNING

Oil is toxic. If you swallow any oil, do not induce vomiting, seek medical advice. Used engine oil contains harmful contaminants which can cause skin cancer. Do not handle used engine oil more than necessary. Always use barrier cream or wear gloves to prevent skin contact. Wash skin contaminated with oil thoroughly in warm soapy water. Do not use petrol, diesel fuel or paraffin to clean your skin.

INT-3-2-3

- 1 Do Steps 1 to 3 of **Checking the Oil Level**
- 2 Remove the left hand side panel.

Engine (cont'd)

* Changing the Oil and Filter - XUD engine (continued)

- 3 Drain the oil. This should be done using the drain plug kit.
 - a Place a container that can hold at least 12 litres (3.6 gal) beneath the drain hole at the right hand front corner of the engine compartment.
 - b Remove dust cap **C** and, making sure that the free end of the hose is in the container, screw on the coupling **D** and clear plastic hose **E**. This automatically opens the valve, allowing the oil to flow into the container.

Note: The drain coupling needs only to be hand tight.

- c When the oil has drained, unscrew drain coupling **D** and replace the dust cap **C**.

Note: The valve closes automatically as the coupling is removed. The dust cap needs only to be hand tight.

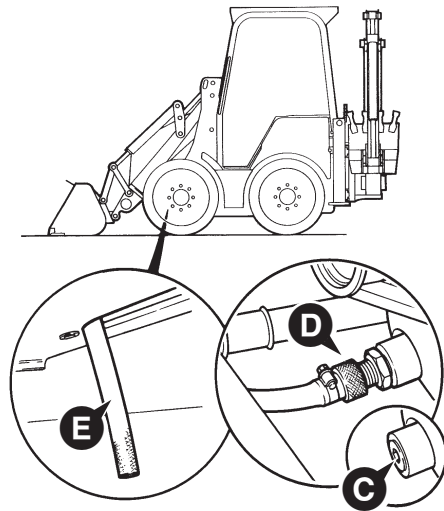
- 4 Change the filter:
 - a Unscrew the filter canister **F**; remember that it will be full of oil.
 - b Check that the filter head adapter is secure.
 - c Clean the filter head.
 - d Add clean engine lubricating oil to the new filter canister. Allow enough time for the oil to pass through the filter element.
 - e Smear the seal **G** on the new filter with oil. Screw in the new filter canister - **hand tight only**.

- 5 Fill the engine to the max mark on the dipstick with the recommended oil through the filler. Wipe off any spilt oil. Check for leaks. Make sure the filler cap is correctly fitted.

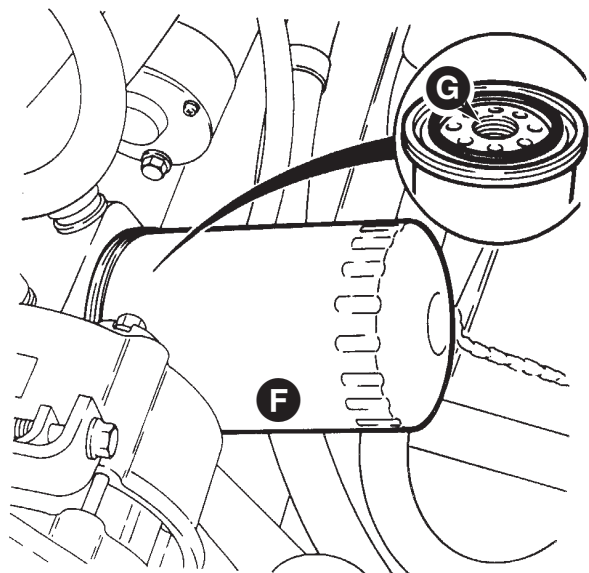
- 6 Make sure the engine will not start by removing the engine shut-off solenoid (ESOS) fuse. Turn the engine using the starter key until the oil pressure warning light is extinguished.

- 7 Refit the ESOS fuse and start the engine. Check for leaks. When the engine has cooled, check the oil level and, if necessary, top up with clean engine oil.

- 8 Refit the left hand side panel and lower the bonnet.



203930



203550

Engine (cont'd)

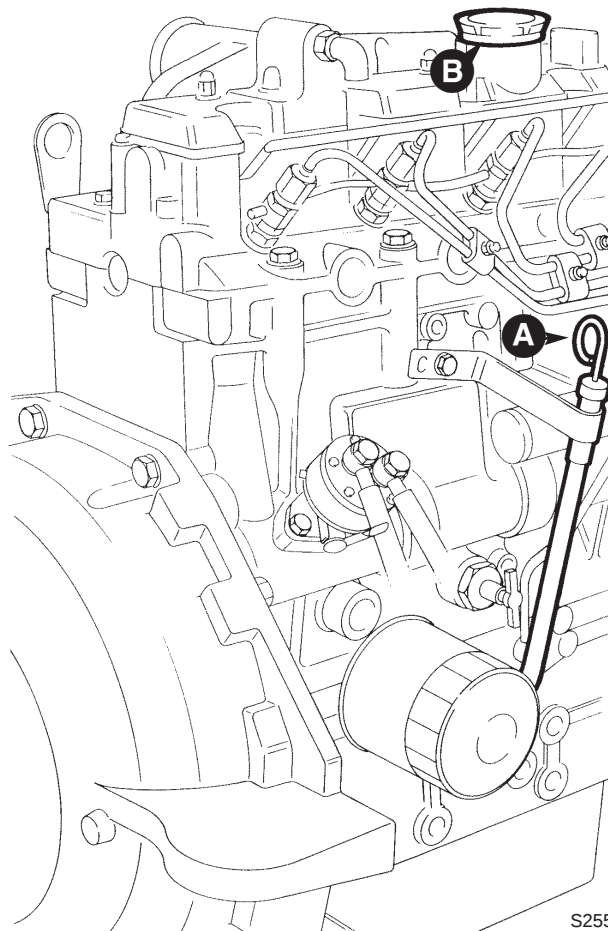
*** Checking the Oil Level - 100 series engine
up to machine no. 807552**
- for interval see Service Schedule

⚠ WARNING

Hot oil and engine components can burn you. Make sure the engine is cool before doing this job.

2-3-3-2

- 1 Park the machine on level ground and lower the attachments to the ground.
- 2 Stop the engine and remove the starter key.
- 3 Raise the bonnet.
- 4 Check that the oil level is within the marked area on the dipstick **A**.
- 5 If necessary, add the recommended oil through the filler point **B**.
- 6 Make sure the filler cap and the dipstick are secure.
- 7 Close the bonnet.



S255840

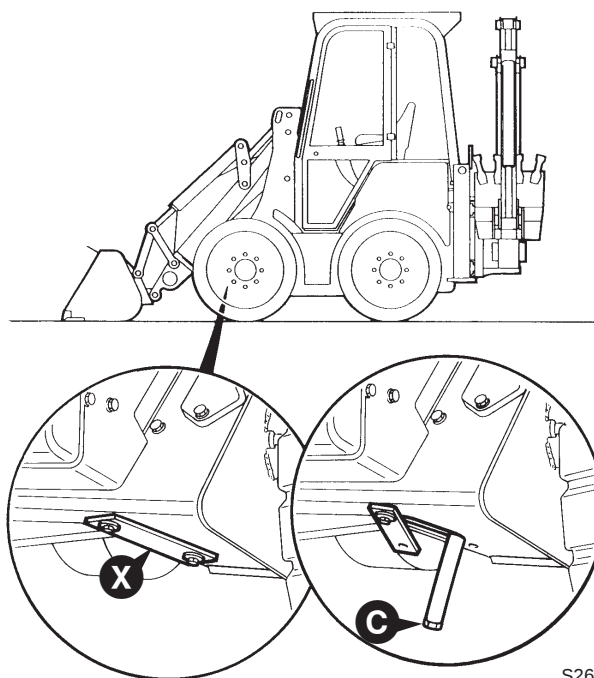
*** Changing the Oil and Filter - 100 series engine
up to machine no. 807552**
- for interval see Service Schedule

⚠ WARNING

Hot oil and engine components can burn you. Make sure the engine is cool before doing this job.

2-3-3-2

- 1 Do Steps 1 to 2 of **Checking the Oil Level**.
- 2 Remove the left hand side panel.
- 3 Remove blanking plate **X** from underneath the front of the machine on the right hand side and pull out the oil drain hose.
- 4 Place a suitable container beneath the machine to catch the oil.
- 5 Remove the drain plug **C** from the end of the hose and allow the oil to flow into the container.
- 6 After emptying the sump, replace the drain plug **C**. Position the drain hose back inside the chassis and refit the blanking plate **X**.

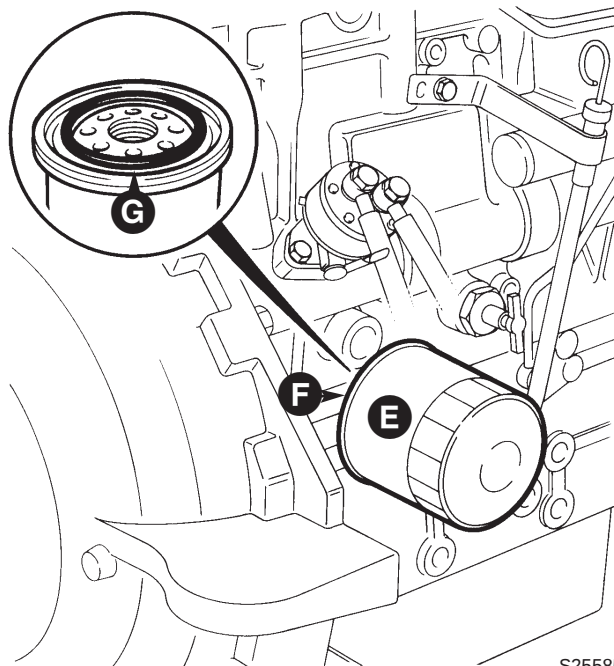


S262150

Engine (cont'd)

* Changing the Oil and Filter - 100 series engine up to machine no. 807552 (cont'd)

- 6 Unscrew the filter canister **E**, using a chain wrench if necessary. Remember that it will contain some oil.
- 7 Clean filter head **F**.
- 8 Add clean engine oil to the new filter canister. Allow time for the oil to pass through the filter element.
- 9 Smear the seal **G** on the new filter canister with clean engine oil.
- 10 Screw in the new filter canister - **hand tight only**.
- 11 Fill the engine with the recommended oil, to the **MAX** mark on the dipstick **A**, through the filler point **B**. Wipe off any spilt oil, refit the filler cap and make sure it is secure.
- 12 Make sure the engine will not start by removing the engine shut-off solenoid (ESOS) fuse. Turn the engine using the starter key until the oil pressure warning light is extinguished.
- 13 Refit the engine shut-off solenoid fuse and start the engine. Check for leaks. When the engine has cooled, check the oil level and, if necessary, top up with clean engine oil.
- 14 Refit the left hand side panel and lower the bonnet.



S255850

Engine (cont'd)

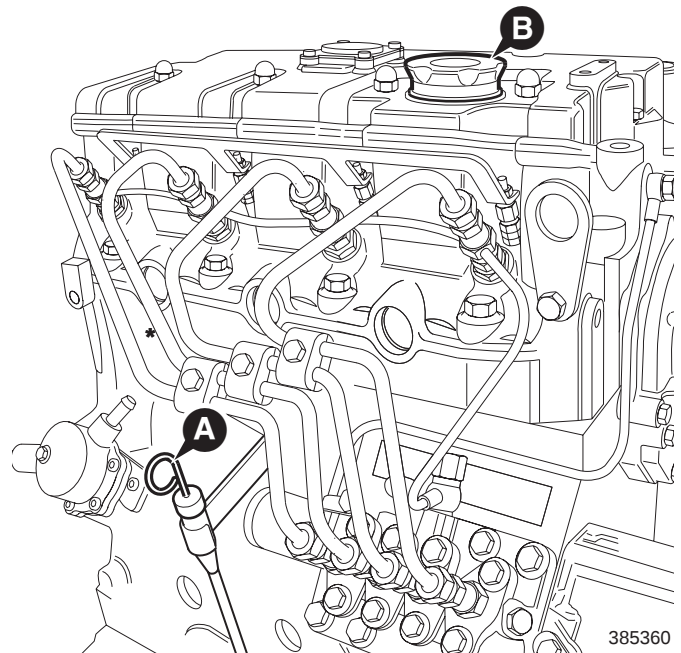
- * Checking the Oil Level - 400 series engine
from machine no. 807553**
- for interval see Service Schedule

⚠ WARNING

Hot oil and engine components can burn you. Make sure the engine is cool before doing this job.

2-3-3-2

- 1 Park the machine on level ground and lower the attachments to the ground.
- 2 Stop the engine and remove the starter key.
- 3 Raise the bonnet.
- 4 Check that the oil level is within the marked area on the dipstick **A**.
- 5 If necessary, add the recommended oil through the filler point **B**.
- 6 Make sure the filler cap and the dipstick are secure.
- 7 Close the bonnet.



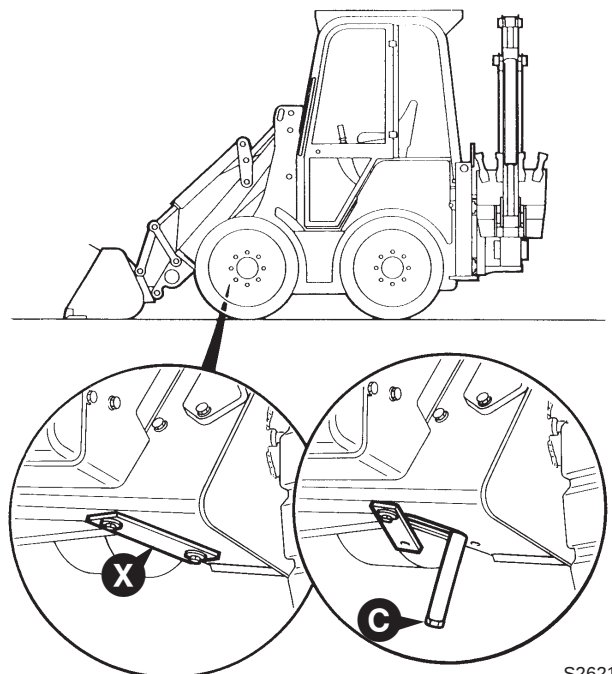
- * Changing the Oil and Filter - 400 series engine
from machine no. 807553**
- for interval see Service Schedule

⚠ WARNING

Hot oil and engine components can burn you. Make sure the engine is cool before doing this job.

2-3-3-2

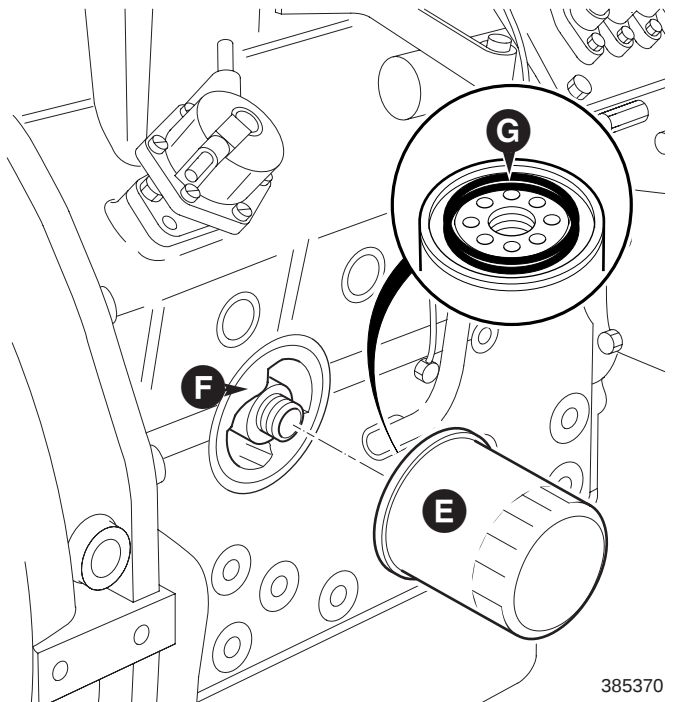
- 1 Do Steps 1 to 2 of **Checking the Oil Level**.
- 2 Remove the left hand side panel.
- 3 Remove blanking plate **X** from underneath the front of the machine on the right hand side and pull out the oil drain hose.
- 4 Place a suitable container beneath the machine to catch the oil.
- 5 Remove the drain plug **C** from the end of the hose and allow the oil to flow into the container.
- 6 After emptying the sump, replace the drain plug **C**. Position the drain hose back inside the chassis and refit the blanking plate **X**.



Engine (cont'd)

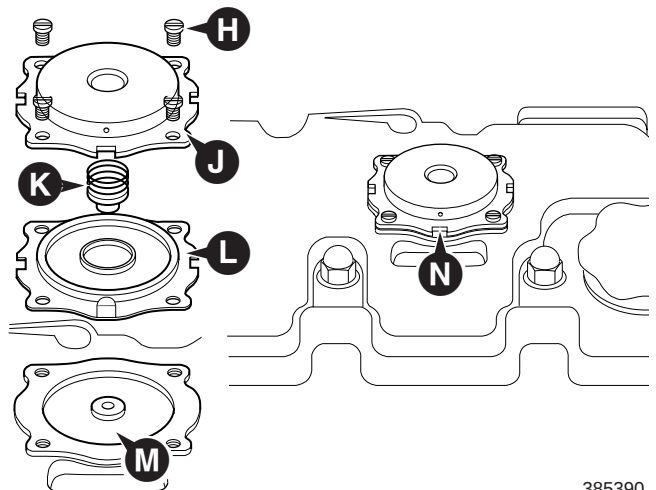
* Changing the Oil and Filter - 400 series engine from machine no. 807553 (cont'd)

- 6 Unscrew the filter canister **E**, using a chain wrench if necessary. Remember that it will contain some oil.
- 7 Clean filter head **F**.
- 8 Add clean engine oil to the new filter canister. Allow time for the oil to pass through the filter element.
- 9 Smear the seal **G** on the new filter canister with clean engine oil.
- 10 Screw in the new filter canister - **hand tight only**.
- 11 Fill the engine with the recommended oil, to the **MAX** mark on the dipstick **A**, through the filler point **B**. Wipe off any spilt oil, refit the filler cap and make sure it is secure.
- 12 Make sure the engine will not start by removing the engine shut-off solenoid (ESOS) fuse. Turn the engine using the starter key until the oil pressure warning light is extinguished.
- 13 Refit the engine shut-off solenoid fuse and start the engine. Check for leaks. When the engine has cooled, check the oil level and, if necessary, top up with clean engine oil.
- 14 Refit the left hand side panel and lower the bonnet.



Renewing the Engine Breather (from machine no. 807553)

- 1 Unscrew the four setscrews **H** and remove the breather cover **J**, spring **K** and diaphragm assembly **L**.
- 2 Clean the breather cavity **M** in the rocker cover. It is important that the area around the vent hole **N** is clean.
- 3 Fit a new breather assembly into the rocker cover cavity, ensuring that the diaphragm, spring and cover are assembled correctly.
- 4 Tighten the four setscrews



Engine (cont'd)

* Draining the Fuel Filter - XUD engine

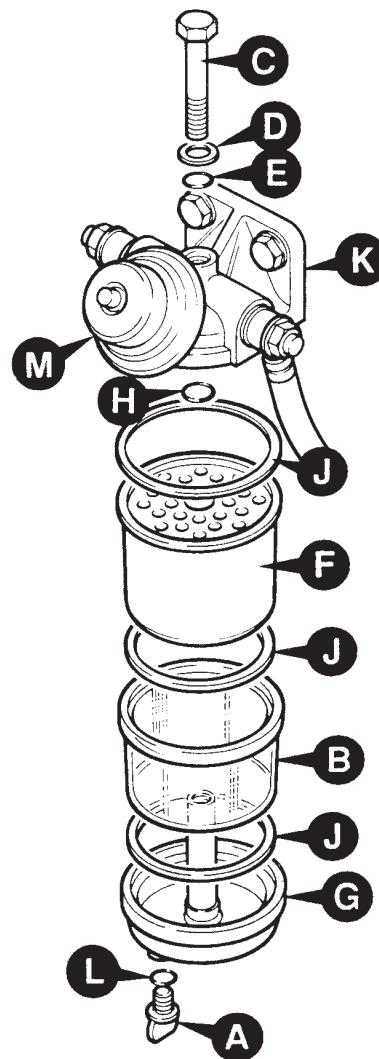
- for interval, see Service Schedule

The fuel filter is located on the rear left hand side of the engine compartment.

- 1 Stop the engine.
- 2 Open the bonnet.
- 3 Drain off any water in the bowl **B** by opening tap **A**.
- 4 Re-tighten tap **A**.
- 5 If there is sediment in the bowl **B** change the element **F**.

Changing the Fuel Filter Element - for interval, see Service Schedule

- 1 Stop the engine.
- 2 Open the bonnet.
- 3 Place a receptacle under the filter to catch any fuel. Slacken tap **A**.
- 4 Support the bowl **B** and unscrew bolt **C**. Remove the bolt **C**, remove and discard washer **D** and 'O' ring **E**.
- 5 Remove filter element **F**, bowl **B** and base **G** as a unit.
- 6 Discard 'O' ring **H**.
- 7 Separate element **F**, bowl **B** and base **G**.
- 8 Remove and discard seals **J** (3 off), discard 'O' ring **L**.
- 9 Lubricate all seals and 'O' rings with clean fuel oil.
- 10 Fit new seals **J** (3 off) to base **G**, bowl **B** and element **F**, fit 'O' ring **H** to the centre of the element **F**.
- 11 Fit element **F**, bowl **B**, base **G**, to the head **K**.
- 12 Insert centre bolt **C** after fitting new washer **D** and 'O' ring **E**. Tighten the bolt **C** carefully by hand to ensure that all seals are correctly seated. Fit new 'O' ring **L** to tap **A** and insert tap into base **G**.
- 13 Torque tighten bolt **C** to 8-11 Nm (6-8 lbf ft, 0.8-1.1 kgf m).
- 14 Slacken a fuel line connection at the fuel pump on the engine or on the engine side of the priming pump **M**.
- 15 Prime the fuel pump **M** until fuel spurts from the loosened connection with no entrapped air.
- 16 Tighten the fuel line connection and check filter for leaks. Tighten connections or change seals as required.



193640

Engine (cont'd)

* Draining the Fuel Filter - 100 & 400 series engines

- for interval see Service Schedule

The fuel filter is located at the front left hand side of the engine compartment.

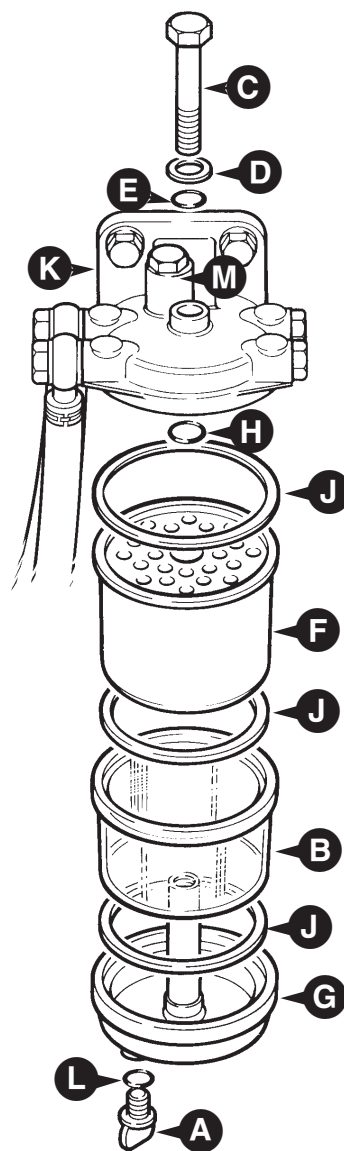
- 1 Stop the engine.
- 2 Open the engine compartment rear door.
- 3 Drain off any water in the bowl **B** by opening tap **A**.
- 4 Re-tighten tap **A**.
- 5 If there is sediment in the bowl **B** change the element **F**.

* Changing the Fuel Filter Element - 100 & 400 series engines

- for interval see Service Schedule

- 1 Stop the engine.
- 2 Open the engine compartment rear door.
- 3 Place a receptacle under the filter to catch any fuel. Slacken tap **A**.
- 4 Support the bowl **B** and unscrew bolt **C**. Remove the bolt **C**, remove and discard washer **D** and 'O' ring **E**.
- 5 Remove filter element **F**, bowl **B** and base **G** as a unit.
- 6 Discard 'O' ring **H**.
- 7 Separate element **F**, bowl **B** and base **G**.
- 8 Remove and discard seals **J** (3 off), discard 'O' ring **L**.
- 9 Lubricate all seals and 'O' rings with correct fuel oil.
- 10 Fit new seals **J** (3 off) to base **G**, bowl **B** and element **F**, fit 'O' ring **H** to the centre of the element **F**.
- 11 Fit element **F**, bowl **B**, base **G**, to the head **K**.
- 12 Insert centre bolt **C** after fitting new washer **D** and 'O' ring **E**. Tighten the bolt **C** carefully by hand to ensure that all seals are correctly seated. Fit new 'O' ring **L** to tap **A** and insert tap into base **G**.
- 13 Torque tighten bolt **C** to 8-11 Nm (6-8 lbf ft, 0.8-1.1 kgf m).

continued



S255820

Engine (cont'd)

* Draining the Fuel Filter - 100 & 400 series engines (cont'd)

- 14** Prime the Filter.

Early Machines

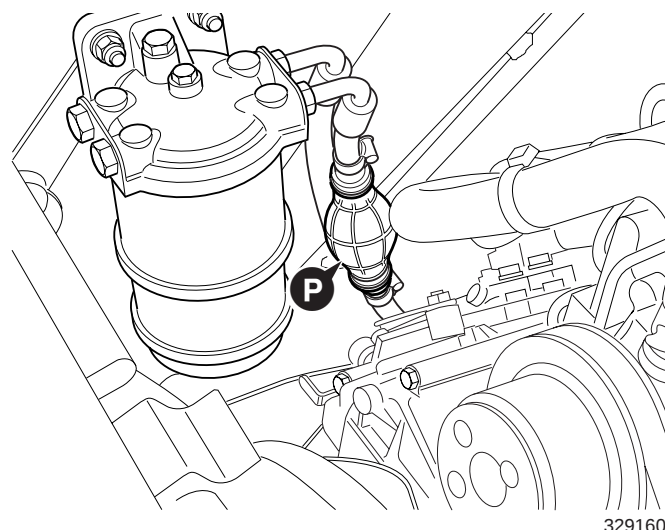
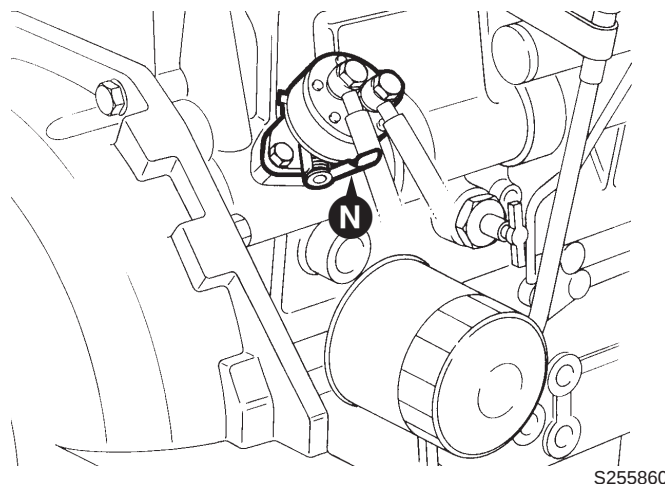
Slacken bleed screw **M** and operate the lift pump priming lever **N** until fuel spurts from the loosened connection with no entrapped air.

Note: If no fuel is moved when the fuel lift pump priming lever **N** is operated, then the pump diaphragm may have rested in the 'maximum lift' position. To move the diaphragm, use the starter key to turn the engine, then try the priming lever again.

Later Machines

Slacken bleed screw **M** and operate the priming pump **P** by squeezing the body until fuel spurts from the loosened screw with no entrapped air.

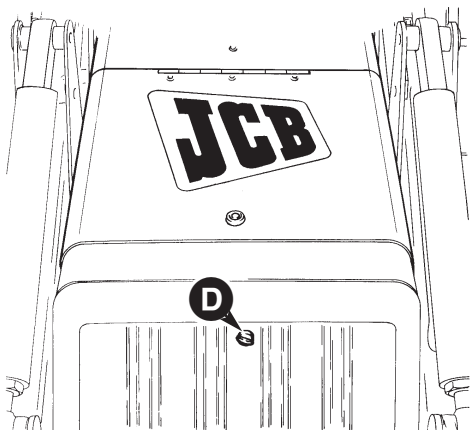
- 15** Tighten the bleed screw and check the filter for leaks. Tighten connections or change seals as required.



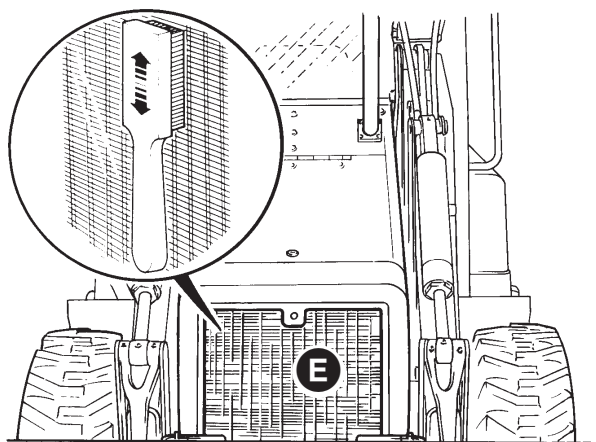
Engine (cont'd)

Cleaning the Coolant Radiator

- 1 Park the machine on level ground within reach of a compressed air line. Stop the engine and remove the key. Open the bonnet and remove outer radiator grille by unscrewing fastener **D** and lifting off the grille.
- 2 After allowing the engine to cool down use compressed air to remove debris from the radiator **E**.
- 3 Use a brush to remove any further debris.
- 4 Inspect the radiator for damage.
- 5 Refit the outer radiator grille, screwing fastener **D** hand tight, and close the bonnet.



S203521



S202791

Coolant Mixtures

* To prevent the coolant freezing in cold conditions, antifreeze must be added. On XUD engine machines use Inhibited Ethenediol AL-39 antifreeze (JCB Part Number 4006/0200).

Solution	Starts to freeze at
50%	- 37 °C (- 35 °F)

* On 100 and 400 series engine machines use JCB Four Seasons Antifreeze and Summer Coolant.

Solution	Maintains circulation down to		Protects against damage down to	
	deg C	deg F	deg C	deg F
50%	-33	-27	-45	-49

Never use less than 45% antifreeze solution otherwise there will not be enough corrosion protection.

Never use more than 50% antifreeze solution otherwise the cooling system may be damaged.

Leave the antifreeze in all the year round as it gives protection against corrosion.

Check the strength of antifreeze solution at least once a year, preferably at the start of the cold period. Always renew the antifreeze every two years.

A 50% antifreeze solution should be used even if frost protection is not needed. This gives protection against corrosion and raises the coolant's boiling point.

⚠ WARNING

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

7-3-4-4

⚠ WARNING

The cooling system is pressurised when the coolant is hot. Hot coolant will burn you. Make sure the engine is cool before checking the coolant level or draining the system.

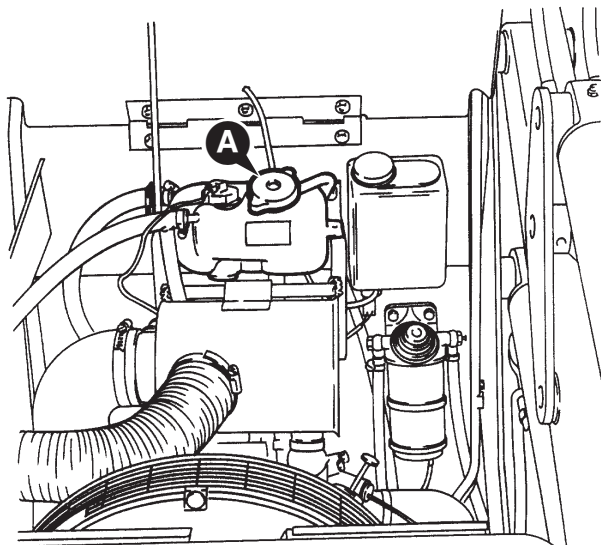
2-3-3-3

Engine (cont'd)*** Checking the Coolant Level - XUD engine****! WARNING**

The cooling system is pressurised when the coolant is hot. Hot coolant will burn you. Make sure the engine is cool before checking the coolant level or draining the system.

2-3-3-3

- 1 Park the machine on level ground. Stop the engine and let it cool down.
- 2 Raise the bonnet. Carefully loosen the cooling system filler cap **A** just enough to let any pressure escape. Remove the cap when all pressure is released.
- 3 If necessary top up the system to the level indicated inside the expansion/filler bottle.
- 4 Refit the filler cap and make sure it is tight.
- 5 Run the engine for a while to raise the coolant to working temperature and pressure. Stop the engine and check for leaks.

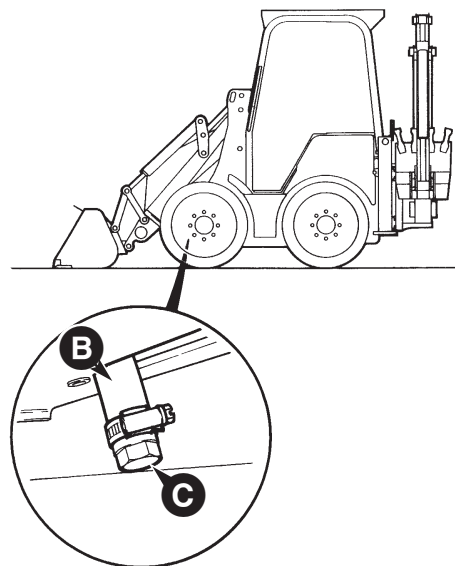


202780

*** Changing the Coolant - XUD engine**

- for interval, see Service Schedule

- 1 Park the machine on level ground. Stop the engine and let it cool down. Open the bonnet.
- 2 Carefully loosen filler cap **A** just enough to let any pressure escape. Remove the cap when all pressure is released.
- 3 Move the drain branch **B** of the bottom radiator hose so that it protrudes from the drain access hole at the front right hand side of the engine compartment.
- 4 Open the drain valve **C** and allow the coolant to drain.
- 5 Flush the system by pouring clean water into filler cap **A**.
- 6 Close drain valve **C** and tuck the drain branch of the bottom hose back through the drain access hole.
- 7 Fill the system to the level indicated inside the expansion/filler bottle using the necessary anti-freeze solution.
- 8 Refit the filler cap **A**.
- 9 Check for leaks.
- 10 Run the engine for a while to raise the coolant to working temperature and pressure. Stop the engine and check for leaks. Check the coolant level and top up if necessary.



203840

Engine (cont'd)

* Checking the Coolant Level - 100 & 400 series engines

WARNING

The cooling system is pressurised when the coolant is hot. Hot coolant will burn you. Make sure the engine is cool before checking the coolant level or draining the system.

2-3-3-3

- 1 Park the machine on level ground. Stop the engine and let it cool down.
- 2 Raise the bonnet. Check that the coolant level in the expansion bottle is $\frac{2}{3}$ full.

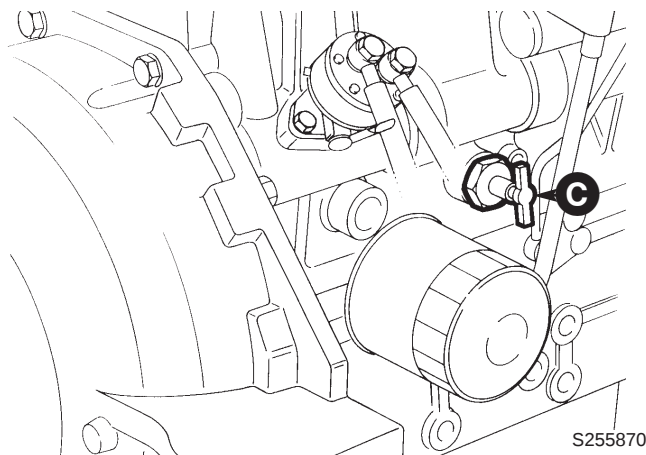
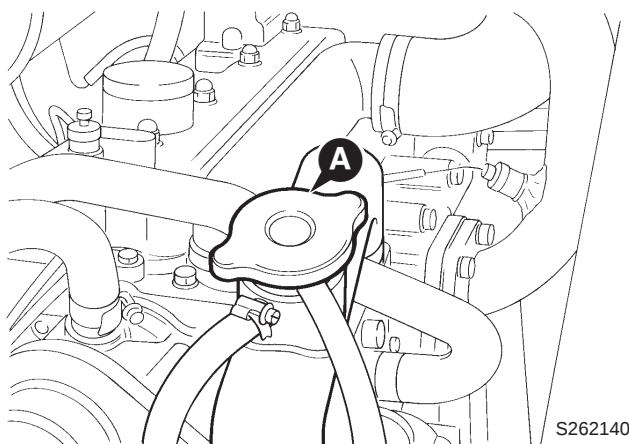
Note: If the level in the expansion bottle is low, then continue with steps 3 to 6.

- 3 Top up the expansion bottle through the filler cap A. The bottle should be $\frac{2}{3}$ full.
- 4 Refit the filler cap and make sure it is tight.
- 5 If there is little or no coolant in the expansion bottle, remove filler cap B and top up the level to just below the filler neck. Refit the filler cap and make sure it is tight
- 6 Run the engine for a while to raise the coolant to working temperature and pressure. Stop the engine and check for leaks.

* Changing the Coolant - 100 & 400 series engines

- for interval, see Service Schedule

- 1 Park the machine on level ground. Stop the engine and let it cool down. Open the bonnet.
- 2 Carefully loosen filler cap A just enough to let any pressure escape. Remove the cap when all pressure is released.
- 3 Remove the bottom hose from the lower box of the radiator.
- 4 Unscrew the cylinder block drain tap C.
- 5 Flush the system by pouring clean water into filler cap A.
- 6 Clean and refit bottom hose and tighten cylinder block drain tap C.
- 7 Fill the system to just below the filler neck using the necessary anti-freeze solution. (See **Coolant Mixtures.**)
- 8 Refit the filler cap A.
- 9 Top up the expansion bottle through the filler cap B. The bottle should be $\frac{2}{3}$ full.
- 10 Run the engine for a while to raise the coolant to working temperature and pressure. Stop the engine and check for leaks. Check the coolant level and top up if necessary.



Engine (cont'd)

***Note:** The top illustration shows the XUD engine, the middle illustration shows the 100 series engine up to machine number 807552, the bottom illustration shows the 400 series engine from machine number 807553.

Checking the Alternator Belt Tension - for interval, see *Service Schedule*

- 1 Park the machine on level ground.
- 2 Stop the engine.
- 3 Open the bonnet and remove the left hand engine side panel.
- 4 When correctly set the belt has approximately 10 mm (3/8 in) of slack at point **X**.
- 5 If the belt requires adjusting proceed as below **Adjusting the Alternator Belt**.

⚠ WARNING

Make sure the engine cannot be started. Disconnect the battery before doing this job.
2-3-3-5

Adjusting the Alternator Belt

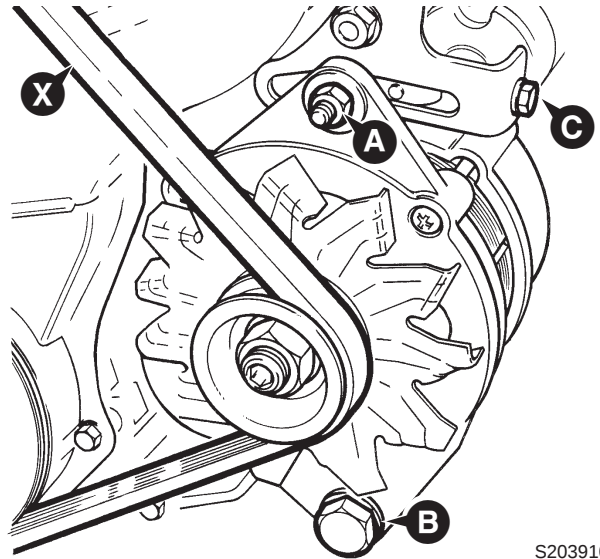
- 1 Loosen nut **A** and bolt **B** which secure the alternator.
- 2 Adjust the fan belt by:

Peugeot engine - turning bolt **C** to give 10 mm (3/8 in) slack at point **X**.

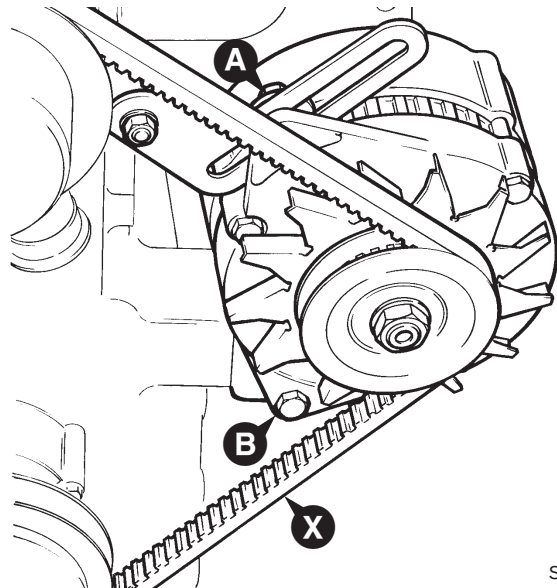
Perkins engine - reposition the alternator to give 10 mm (3/8 in) slack at point **X**.
- 3 Tighten nut **A** and bolt **B**.
- 4 Refit the left hand engine side panel and close the bonnet.

Fitting a New Alternator Belt

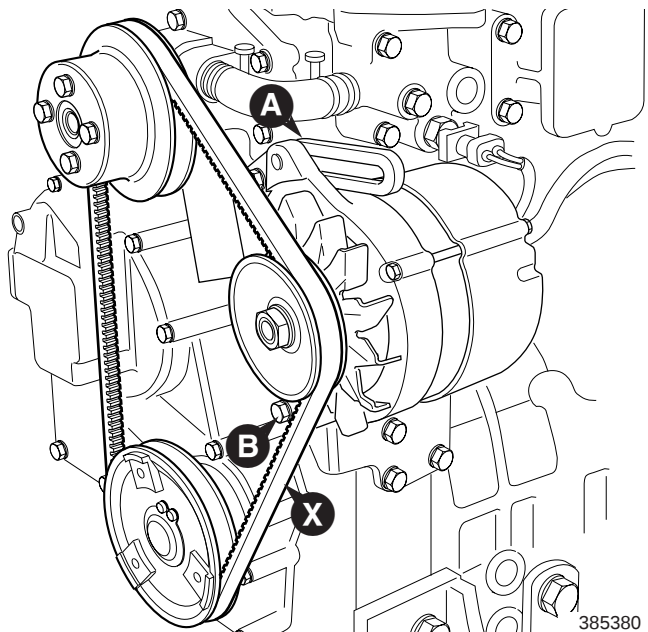
- 1 Carry out step 1 of **Adjusting the Alternator Belt**.
- 2 Turn bolt **C** or reposition the alternator to slacken the belt sufficiently to allow removal. Remove the belt.
- 3 Fit the new belt over the pulleys.
- 4 Carry out Steps 2 to 4 of **Adjusting the Alternator Belt**.



S203910



S255830



385380

Contents	Page No.
Quick Release Couplings	1 - 1
Shovels	
General Purpose and Light Duty Shovels	3 - 1
6-in-1 Shovels	3 - 1
Pallet Forks	4 - 1
Manure/Silage Fork With Top Grab	5 - 1
Attachment Frame	6 - 1

Flat face quick release couplings allow the operator to remove and install attachments swiftly and efficiently. The attachment pipework has two male couplings fitted on the loader arms and two on the backhoe. The attachment hoses have corresponding female couplings fitted.

⚠ WARNING

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

2-4-1-15

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

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

Quick Release Couplings - Do's & Don'ts

DO wipe the two faces of the coupling and make sure they are clean before connecting.

DO make sure the outside sleeve (female coupling) is pulled back when disconnecting.

DO connect and disconnect a new coupling two or three times to 'work' the PTFE seals - sometimes a new coupling will stick if the seals have not been 'worked'.

DO use a spanner on the hexagon flats of the coupling when fitting adaptors.

DO use a rubber or hide hammer to disconnect a coupling if it sticks - sticking may occur if there is dirt present in the coupling.

DON'T attempt to re-connect a damaged half coupling - this will destroy the seals and necessitate replacing both half couplings.

DON'T leave the coupling where it may be run over by a machine or otherwise crushed - this will distort the coupling sleeve and prevent correct connection and disconnection.

DON'T clamp on the smooth diameter of the coupling when fitting adaptors - always use the hexagon.

DON'T try to turn the sleeve (female coupling) when the coupling has been disconnected - the locking ball will wedge underneath the sleeve and destroy the coupling.

DON'T damage the faces of the couplings - this can prevent connection and disconnection, or damage seals and cause leakage.

DON'T try to dismantle the couplings - they are non serviceable parts. If a coupling is damaged it should be replaced with a new one.

⚠ WARNING

Hydraulic Pressure

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

HYD 1-5

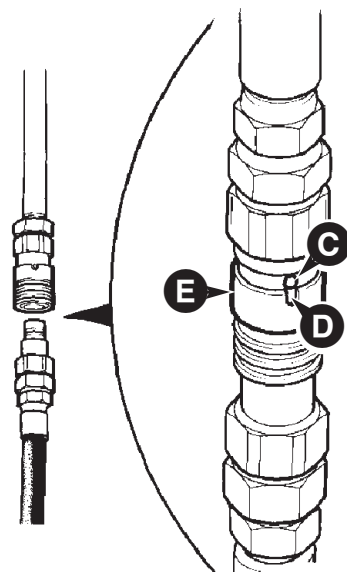
Before connecting or removing any hydraulic hose, residual hydraulic pressure trapped in the service hose line must be vented (see **Connecting/Disconnecting Hydraulic Hoses** on page E/2 - 1).

Connecting Quick Release Couplings

- 1 Remove any residual hydraulic pressure trapped in the service line hose.
- 2 Wipe the two faces of the male and female couplings and make sure they are clean.
- 3 Make sure that the ball **C** in the female coupling is located in one of its slots.
- 4 Fit the male coupling into the female coupling. To ensure that the coupling is not accidentally released, rotate sleeve **E** half a turn and make sure that the locking ball **C** does not align with slot **D**.

Disconnecting Quick Release Couplings

- 1 Remove any residual hydraulic pressure trapped in the service line hoses.
- 2 Align slot **D** with ball **C**.
- 3 Pull back sleeve **E** to release the coupling.



169490

Some attachments are hydraulically powered. The following paragraphs describe how to connect and disconnect the hydraulic hoses safely.

WARNING

Hydraulic Pressure

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

HYD-1-5

Venting Hydraulic Pressure

Stop the engine. When the engine has stopped, vent the hydraulic pressure as follows:

- a** For the hoses at the excavator end, operate the controls to release the trapped pressure.
- b** For the hoses at the loader end, turn the starter key to IGN.

Operate the Auxiliary Attachment Control Switch or the Auxiliary Attachment Detent Switch for a short time to relieve residual pressure in the hydraulic circuit.

Turn the starter key to OFF and remove the key.

Connecting the Hoses

- 1** Connect the hoses. **See Connecting Quick Release Couplings** on page 1 - 1.

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 immediately.

INT-3-1-10/1

- 2** Check for leaks as follows:
 - a** Start the engine.
 - b** Either operate the Auxiliary Control Switch to build up pressure in the loader end hoses or operate the appropriate excavator control to pressurise an excavator hose.
 - c** Switch off the engine. Remove the starter key. Check for signs of leakage at the hose connections.

Disconnecting the Hoses

- 1** Vent the hydraulic pressure as described on this page.
- 2** Disconnect the hoses. See **Connecting/Disconnecting Quick Release Couplings** on page 1 - 1.

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 immediately.

INT-3-1-10/1

- 3** Check for leaks. See step 2 of **Connecting the Hoses**.

General Purpose and Light Duty Shovels

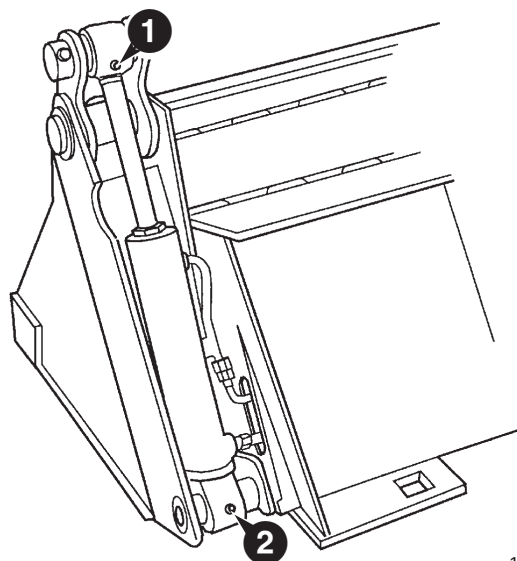
Daily Maintenance

- 1 Clean with the rest of the machine.
- 2 Ensure that the Quickhitch framework is not damaged or badly worn. Repair if necessary.
- 3 Check for damage.

6-in-1 Shovel

Daily Maintenance

- 1 Clean with the rest of the machine.
- 2 Check for damage. Repair or replace as necessary.
- 3 Check for signs of hydraulic leaks in hoses, adapters, rams. Should the rams require service, see **Section E, Hydraulics**.



174600

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 immediately.

INT-3-1-10/1

- 4 Grease at the points indicated.

Total of 4 grease points. (1 and 2 as illustrated, 3 and 4 at opposite end.)

The pallet fork frame includes a Rating Plate which gives its weight and its Safe Working Load.

The forks should always be used in pairs as supplied. Each fork is stamped with its Part Number and Safe Working Load.

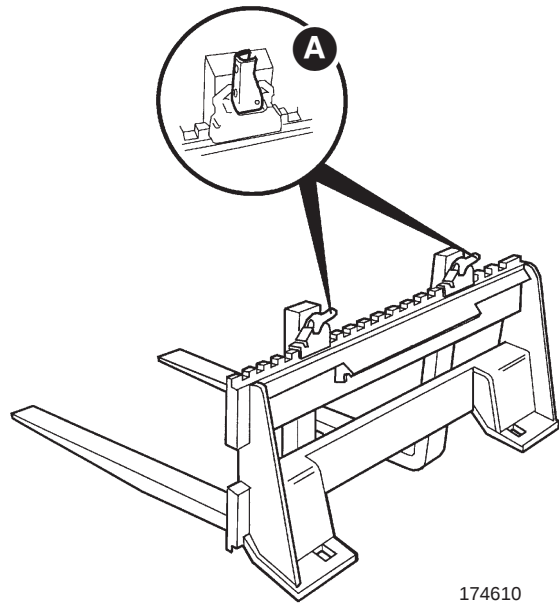
CAUTION

The Safe Working Load stamped on each fork is for the fork itself. It is not for the machine to which the fork may be fitted. Before lifting any load, check the weight of the load against the Safe Working Load of the machine.

2-4-5-3

Daily Maintenance

- 1 Clean with the rest of the machine.
- 2 Oil the spring loaded locking levers **A**.
- 3 Grease top rail slots.
- 4 Check for damage. Repair or replace as necessary. Remember that the forks must be replaced as a pair.



174610

The Manure/Silage fork is fitted with a top grab as standard which gives extra security to the pay load when moving the machine.

The grab is opened and closed by a hydraulic ram mounted on the fork frame.

Daily Maintenance

- 1 Clean with the rest of the machine.
- 2 Check for damage. Make sure the tines are secure and in good condition.
- 3 Check for signs of hydraulic leaks

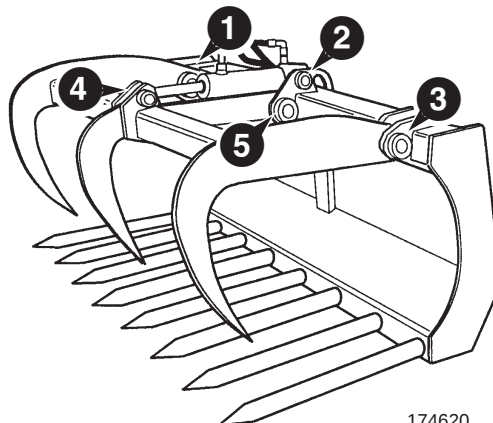
WARNING

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 immediately.

INT-3-1-10/1

- 4 Grease at the points indicated.

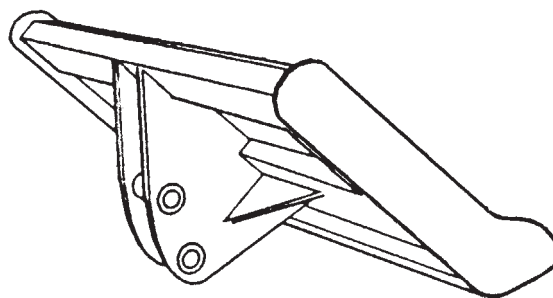
Total of 5 grease points.



*Some attachments utilise an attachment frame for installing on the machine.

Daily Maintenance

- 1 Clean with the rest of the machine.
- 2 Check for damage. Repair or replace as necessary.



204170

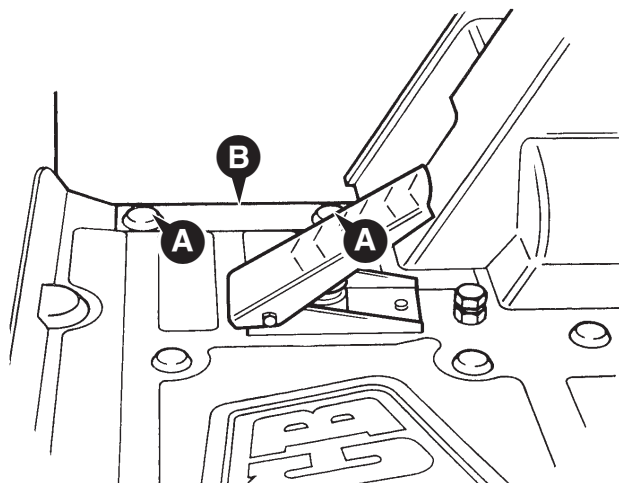
Contents	Page No.
Floor Plates	
Removal and Replacement	1 - 1
Loader Arm	
Removal and Replacement	2 - 1
Dipper	
Removal and Replacement	3 - 1
Boom	
Removal and Replacement	4 - 1
*Kingpost Assembly	
Removal and Replacement up to machine no. 807225	
- Slew Cylinder	5 - 1
- Kingpost	5 - 1
Removal and Replacement from machine no. 807226	
- Slew Cylinder	5 - 3
- Kingpost	5 - 3

To gain access to the pumps, motors, valves and pipework, it is necessary to remove some of the floor plates.

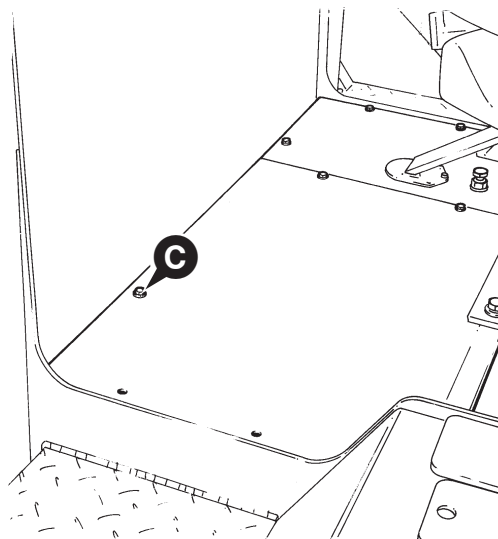
Removal and Replacement

- 1 At each side, remove the two bolts **A** and the metal strip **B** which hold the floor mat in position.
- 2 Carefully feed the mat out from the left hand side of the machine (the mat is split at the right hand side to make this easier).
- 3 Remove the bolts **C** holding the required section of floor plate.

Replacement is a reversal of the removal procedure.



203951



204310

Removal

⚠ WARNING

Lifting Equipment

You can be injured if you use faulty lifting equipment. Make sure that lifting equipment is in good condition. Make sure that lifting tackle complies with all local regulations and is suitable for the job. Make sure that lifting equipment is strong enough for the job.

INT-1-3-7

Ensure that all attachments are removed from the loader arm and park the machine on clean level ground. Raise the loader arm so that the lift ram eye end pivot pin is clear of the machine structure. Support the weight of the loader arm using suitable lifting equipment. Stop the engine and vent hydraulic pressure from the system (see page E/2 - 1).

⚠ WARNING

Hydraulic Pressure

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

HYD 1-5

Disconnect and plug the auxiliary hoses and the crowd ram hoses on both sides. Mark the hoses to ensure correct reconnection.

Remove the bolts retaining the lift ram eye end pivot pin **A** from both sides. Ensuring that the weight of the loader arm is supported at the front end, and also supporting the lift rams, drift out the lift ram eye end pivot pins from both sides. Allow the rams to rest on the bodywork. Lower the loader arm to the ground.

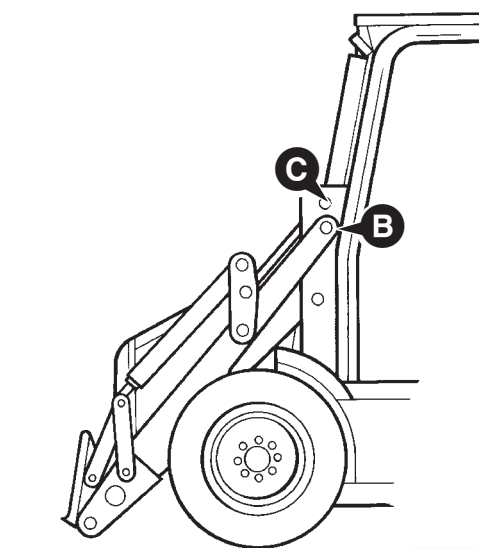
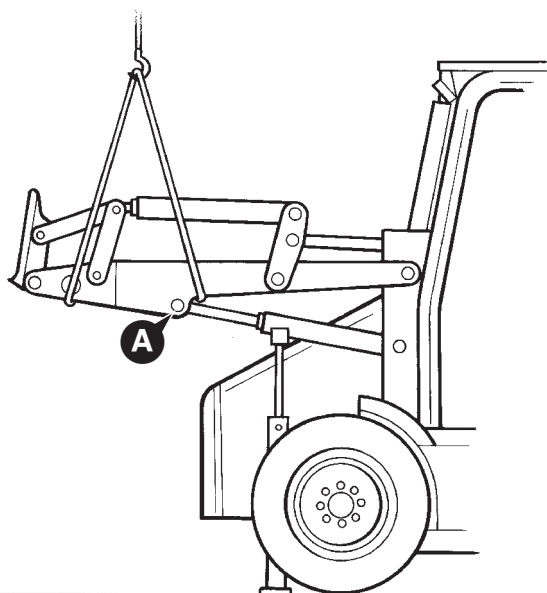
Remove the locking pins for the lift arm pivots **B** and compensating arm pivots **C** on both sides. Supporting the weight of the loader arm, drift out the lift arm and compensating arm pivot pins. The loader arm can now be manoeuvred from the machine using the lifting equipment. Place the loader arm on a clean dry surface.

Replacement

Replacement is a reversal of the removal procedure. Grease all pins and securing bolts with JCB Special MPL grease.

Shims are available in two thicknesses (2 mm and 3 mm) and should be fitted as required on the left hand side of the loader arm pivot to eliminate end float.

Reconnect all hoses and bleed the hydraulic system.



205440

Removal

Remove the bucket or other attachment from the machine and park the machine on clean level ground. Place the excavating end in the position shown.

Stop the engine and vent hydraulic pressure from the system (see page E/2 - 1).

! WARNING

Hydraulic Pressure

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

HYD 1-5

Disconnect and plug the auxiliary hoses, marking the hoses to ensure correct reconnection. Remove the auxiliary hose bracket **A** from the dipper. Disconnect and plug the crowd ram feed and return hoses, marking the hoses to ensure correct reconnection.

* Remove the bolt retaining the dipper ram eye end pivot pin **B**. Supporting the ram, drift out the dipper ram eye end pivot pin. Allow the ram to rest on the boom.

! WARNING

Lifting Equipment

You can be injured if you use faulty lifting equipment. Make sure that lifting equipment is in good condition. Make sure that lifting tackle complies with all local regulations and is suitable for the job. Make sure that lifting equipment is strong enough for the job.

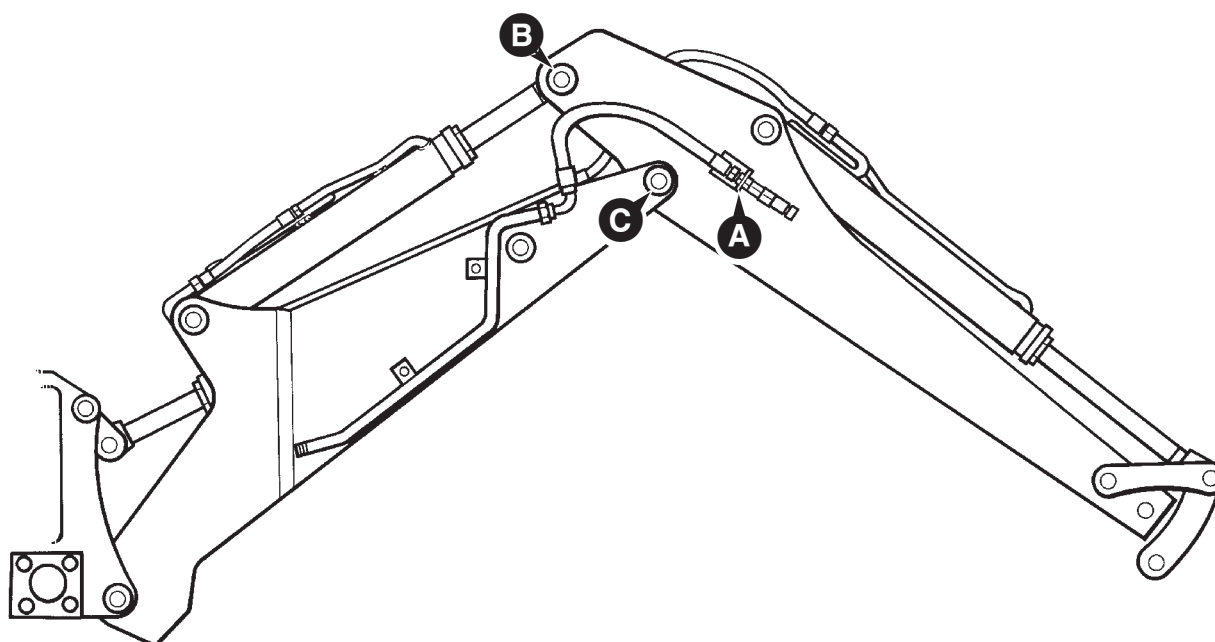
INT-1-3-7

Remove the locking pins (2 off) for the dipper pivot pin **C**. Supporting the weight of the dipper, drift out the pivot pin. The dipper can now be manoeuvred from the machine using the lifting equipment. Place the dipper on a clean dry surface.

Replacement

Replacement is a reversal of the removal procedure. Grease all pins and securing bolts with JCB Special MPL grease.

Reconnect all hoses and bleed the hydraulic system.



205450

Removal

It is assumed that the dipper has been removed as described on page B/3 - 1.

! WARNING

Hydraulic Pressure

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

HYD 1-5

Disconnect and plug the auxiliary hoses, marking the hoses to ensure correct reconnection (see page E/2 - 1). Disconnect and plug the feed and return hoses **A** (6 off), marking the hoses to ensure correct reconnection.

- * Remove the bolt retaining the boom ram eye end pivot pin **B**. Supporting the ram, drift out the boom ram eye end pivot pin.

! WARNING

Lifting Equipment

You can be injured if you use faulty lifting equipment. Make sure that lifting equipment is in good condition. Make sure that lifting tackle complies with all local regulations and is suitable for the job. Make sure that lifting equipment is strong enough for the job.

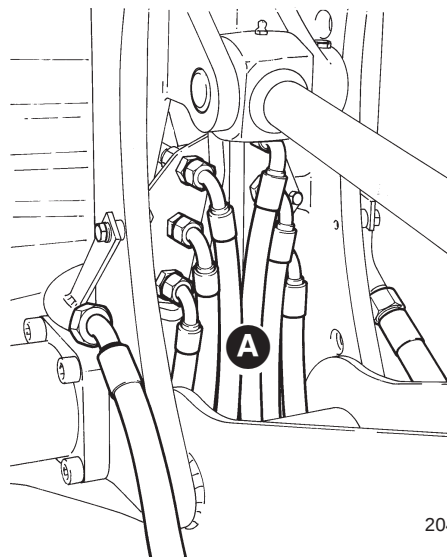
INT-1-3-7

Remove the bolt retaining the boom pivot pin **C**. Supporting the weight of the boom, drift out the pivot pin. The boom can now be manoeuvred from the machine using the lifting equipment. Place the boom on a clean dry surface.

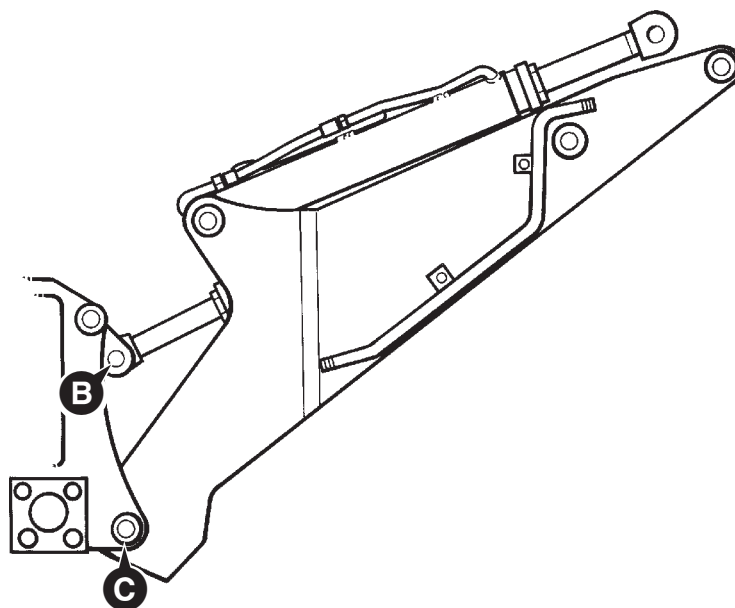
Replacement

Replacement is a reversal of the removal procedure. Grease all pins and securing bolts with JCB Special MPL grease.

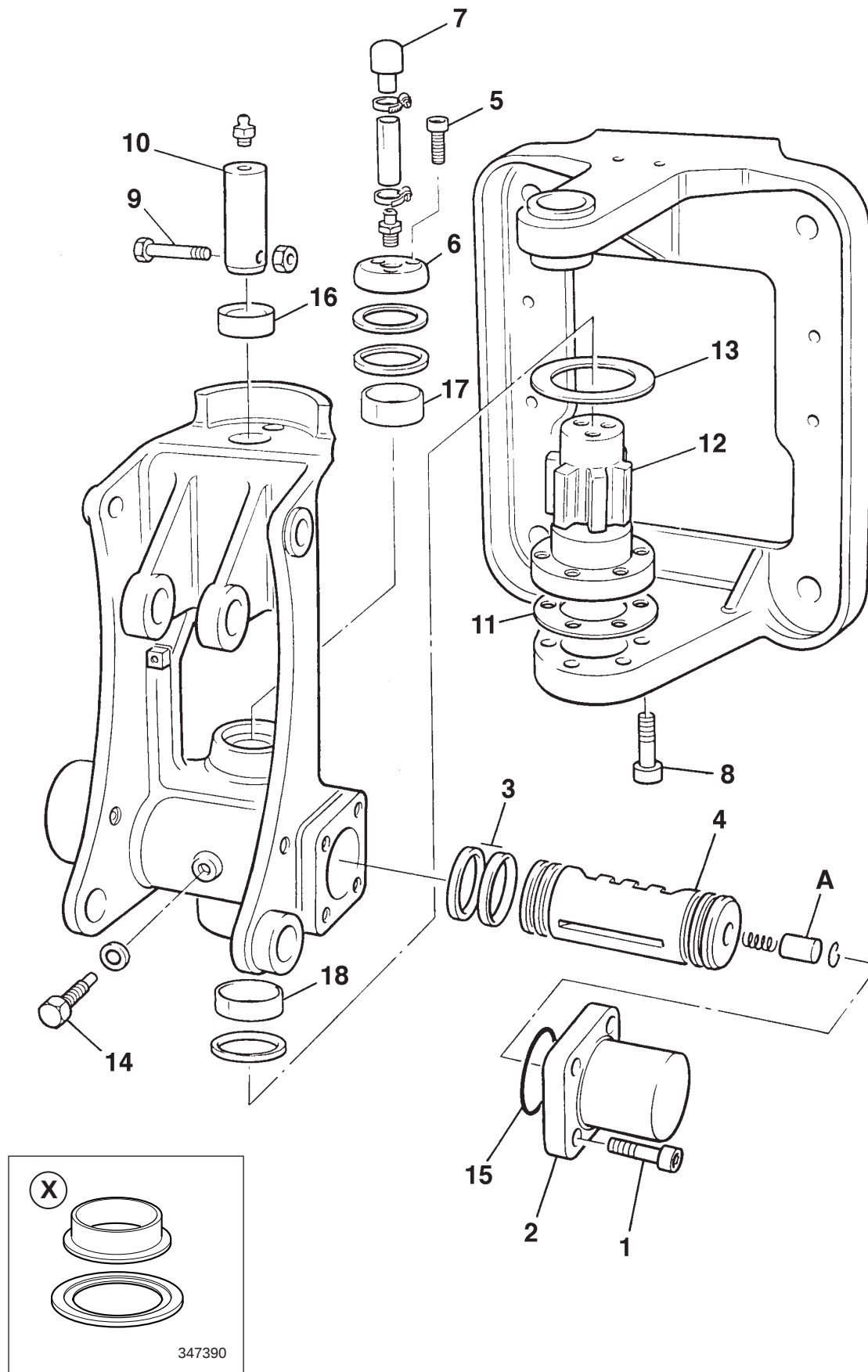
Reconnect all hoses and bleed the hydraulic system.



204260



205460



S242442

* Removal and Replacement up to machine no. 807225

Slew Cylinder - Removal

Position the machine on firm level ground, rest the front shovel on the ground and position the excavator bucket just above the ground. Stop the engine. Operate the excavator controls to vent residual hydraulic pressure.

Release the hydraulic connections to the slew cylinders.

Unscrew and remove capscrews **1** from each slew cylinder **2**.

Position an oil tray underneath the kingpost to catch any oil lost during dismantling.

Withdraw the cylinders by manually swinging the excavator assembly to one side and then the other. This will push off each cylinder in turn.

Remove rack seals **3** as each side of the rack **4** is exposed.

Kingpost - Removal

If required, remove the boom and dipper (see pages B/3-1 and B/4-1).

Note: Unless the kingpost is to be renewed, it is not necessary to remove the boom and dipper to release the kingpost from the machine.

WARNING

Hydraulic Pressure

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

HYD 1-5

At the kingpost, disconnect and plug the hydraulic hoses, marking the hoses to ensure correct reconnection (see page E/2-1).

Position an oil tray underneath the kingpost to catch any oil lost during dismantling. Remove capscrews **5** and lift off the thrust cap **6** complete with filler tube assembly **7**.

Slacken and remove the pinion capscrews **8**.

Support the backhoe by placing a sling from a crane around the boom ram to kingpost pivot. (If the boom and dipper have been removed, place the sling around the kingpost.)

Remove locking bolt **9** and kingpost pivot pin **10**.

Using the crane, lift the excavator assembly up which will free the pinion from the carriage base then pull the assembly back away from the carriage, taking care to collect shim **11**.

Note: Shim **11** is not fitted to later machines.

Remove pinion **12** and thrust washer **13** from the kingpost.

Remove the anti-rotation pin **14** and withdraw the rack **4**.

Kingpost - Replacement

Replacement is a reversal of the removal procedure.

If bushes **16,17** or **18** are to be renewed, coat outside diameter with JCB Multi-Gasket before pressing into position.

Note: On later machines, bush **18** was changed to a flanged type and is fitted with a thrust washer as shown at **X**. The flanged type bush may be fitted to earlier machines provided the thrust washer is also fitted.

Lubricate the pinion and rack with gear oil before assembly.

Apply JCB Special MPL grease to pivot pin **10**.

Check that shim **11** is the latest steel type; replace if not.

Note: Shim **11** is not fitted to later machines; the pinion flange is machined 3 mm deeper. The shim should be discarded if the later pinion is fitted to earlier machines.

Clean threads of capscrews **8** and apply JCB Threadlocker and Sealer. Tighten to correct torque.

After replacement, refill the slew housing with the appropriate grade of oil (see page 3/6-1 for correct procedure).

* Slew Cylinder - Replacement

Fit new seals **3** to rack **4**. Ensure that plungers **A** move freely in their bores without sticking.

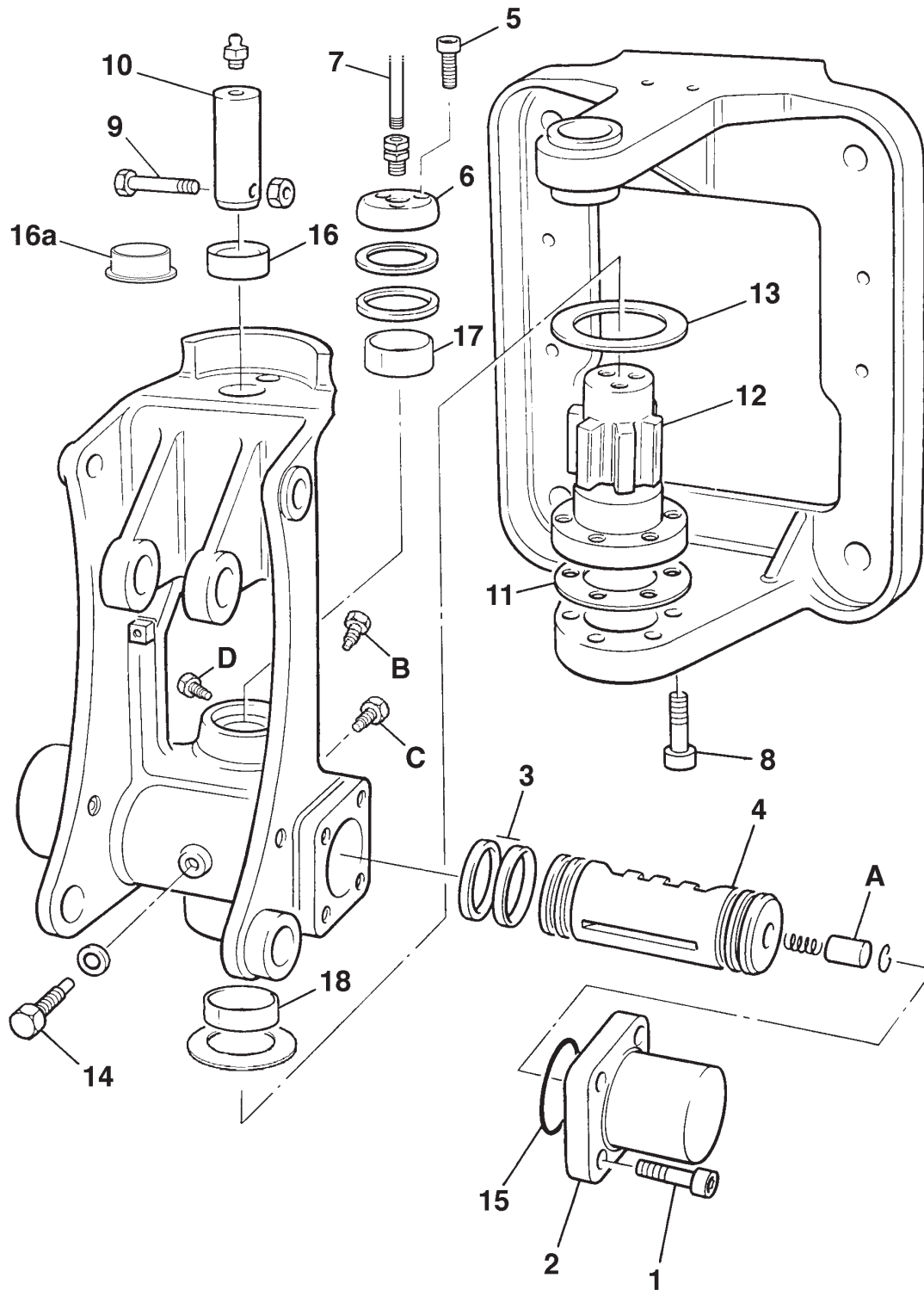
Assemble cylinders **2** using new 'O' ring **15**. Reconnect hydraulic pipework.

After replacement, refill the slew housing with the appropriate grade of oil (see page 3/6-1 for correct procedure).

When assembly is complete, operate excavator services fully to bleed the hydraulic system then check the hydraulic level.

Torque Settings

Item	Nm	kgf m	lbf ft
1	300	30.6	221
5	159	16.2	117
8	395	40.3	291



S242442A

Removal and Replacement from machine no. 807226

Slew Cylinder - Removal

Position the machine on firm level ground, rest the front shovel on the ground and position the excavator bucket just above the ground. Stop the engine. Operate the excavator controls to vent residual hydraulic pressure.

Release the hydraulic connections to the slew cylinders.

Unscrew and remove capscrews **1** from each slew cylinder **2**.

Position an oil tray underneath the kingpost and remove plug **C** to drain the oil from the slew gearbox.

Withdraw the cylinders by manually swinging the excavator assembly to one side and then the other. This will push off each cylinder in turn.

Remove rack seals **3** as each side of the rack **4** is exposed.

Kingpost - Removal

If required, remove the boom and dipper (see pages B/3-1 and B/4-1).

Note: Unless the kingpost is to be renewed, it is not necessary to remove the boom and dipper to release the kingpost from the machine.

WARNING

Hydraulic Pressure

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

HYD 1-5

At the kingpost, disconnect and plug the hydraulic hoses, marking the hoses to ensure correct reconnection (see page E/2-1).

Position an oil tray underneath the kingpost and remove plug **C** to drain the oil from the slew gearbox. Remove capscrews **5** and lift off the thrust cap **6** complete with vent tube assembly **7**.

Slacken and remove the pinion capscrews **8**.

Support the backhoe by placing a sling from a crane around the boom ram to kingpost pivot. (If the boom and dipper have been removed, place the sling around the kingpost.)

Remove locking bolt **9** and kingpost pivot pin **10**.

Using the crane, lift the excavator assembly up which will free the pinion from the carriage base then pull the assembly back away from the carriage, taking care to collect shim **11**.

Remove pinion **12** and thrust washer **13** from the kingpost.

Remove the anti-rotation pin **14** and withdraw the rack **4**.

* **Note:** From machine no. 808254 (or possibly slightly before) flanged bush **16a** is fitted in place of bush **16**. The flanged bush cannot be fitted to later machines unless a new later kingpost is also fitted.

If bushes **17** or **18** are to be renewed, first unscrew the retaining screw **D**. Remove the bushes using a suitable press.

Kingpost - Replacement

Replacement is a reversal of the removal procedure.

If bush **16** is to be renewed, coat outside diameter with JCB Multi-Gasket before pressing into position.

Lubricate the pinion and rack with gear oil before assembly.

Apply JCB Special MPL grease to pivot pin **10**.

Clean threads of capscrews **8** and apply JCB Threadlocker and Sealer. Tighten to correct torque.

* **Note:** From machine no. 808254, special lock washers are used with capscrews **8**. These can be fitted to earlier machines if required.

After replacement, refill the slew housing with the appropriate grade of oil (see page 3/6-1 for correct procedure).

Slew Cylinder - Replacement

Fit new seals **3** to rack **4**. Ensure that plungers **A** move freely in their bores without sticking.

Assemble cylinders **2** using new 'O' ring **15**. Reconnect hydraulic pipework.

After replacement, refill the slew housing with the appropriate grade of oil (see page 3/6-1 for correct procedure).

When assembly is complete, operate excavator services fully to bleed the hydraulic system then check the hydraulic level.

Torque Settings

Item	Nm	kgf m	lbf ft
1	300	30.6	221
5	159	16.2	117
8	395	40.3	291

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*Sensing Switches	1 - 5
Test Methods	
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Measuring DC Voltage	2 - 3
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from machine no. 752676	6 - 7

System Type

Battery

Cold crank amps for 1 minute to

1.4 VPC at -18 °C (0 °F)

Reserve capacity (minutes) for 25 Amp load

12 Volts, negative earth

420 to 585 | according to battery type
170 to 230

* Alternator

XUD Engines

100 and 400 Series Engines

12V, 50 Amp output

12V, 55 Amp output

Light Bulbs

Working Lights

Indicator Lights

Warning Lights

Beacon (if fitted)

Interior Light (if fitted)

Side Lights (if fitted)

55W (Halogen)

21W

1.2W

70W

10W

5W

Relays up to machine no. 751599

Overheat Delay Relay

Alarm Buzzer

Indicator Flasher Relay

Neutral Start Relay

Loader Isolation Relay

Horn Relay

Glow Plug Relay

A

B

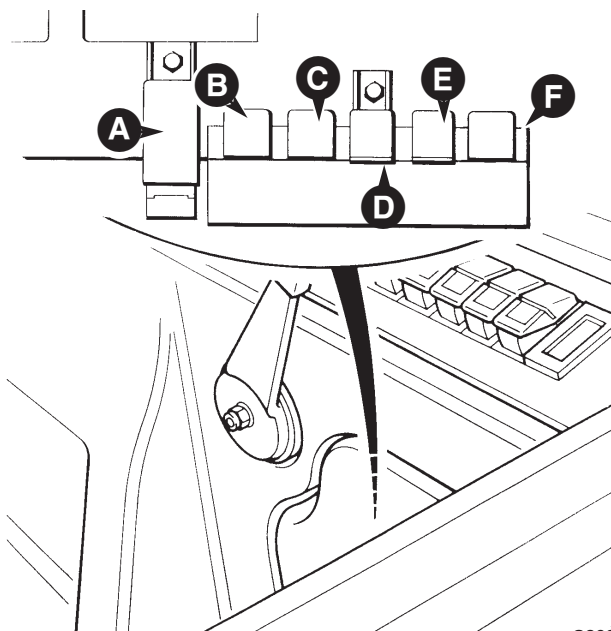
C

D

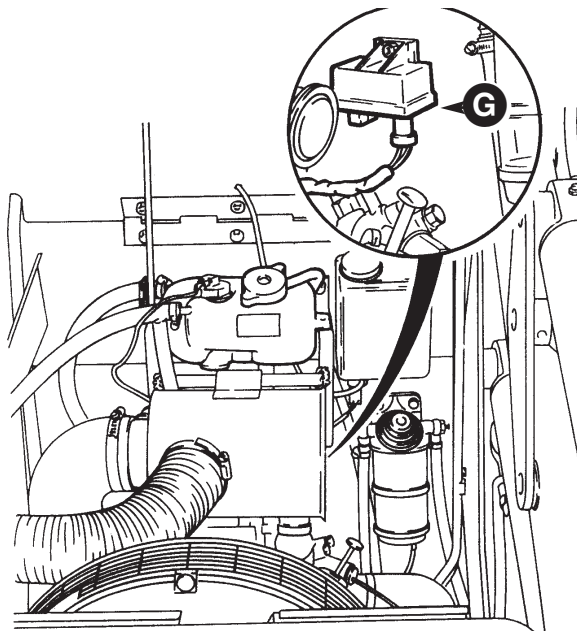
E

F

G



S203822



S202800

* Circuit Protection up to machine no. 751599

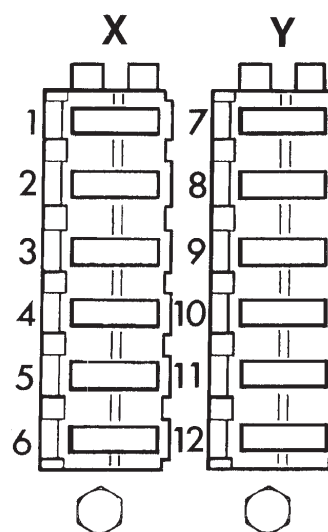
Fuses

The electrical circuits are protected by fuses. The fuses are located behind the panel **A** as shown in the illustration.



S203812

Fuse Number	Service	Fuse Size
1	Beacon Side lights and headlights	10 amp
2	Front worklights (see note)	10 amp
3	Interlock relay Pressure reducing solenoid valve	5 amp
4	Auxiliary hydraulics Rear worklights	10 amp
5	Warning lights and buzzer ESOS	5 amp
6	Horn Low coolant warning Stabiliser warning	15 amp
7	Hazard warning Rear wiper Interior light	10 amp
8	Front wiper Washer bottle Direction indicators	10 amp
9	Heater Heated seat	10 amp
10	Reverse alarm Brake light unit	10 amp
11	R. H. front & rear sidelights	5 amp
12	L. H. front & rear sidelights	5 amp



S203802

Note: Fuse 2 also supplies, where fitted, Hydraulic Float, Brake Lights and High-flow Hydraulics. If any or all of these are fitted, the fuse rating is increased to 15 amps.

* Circuit Protection from machine no. 751600 to 752370

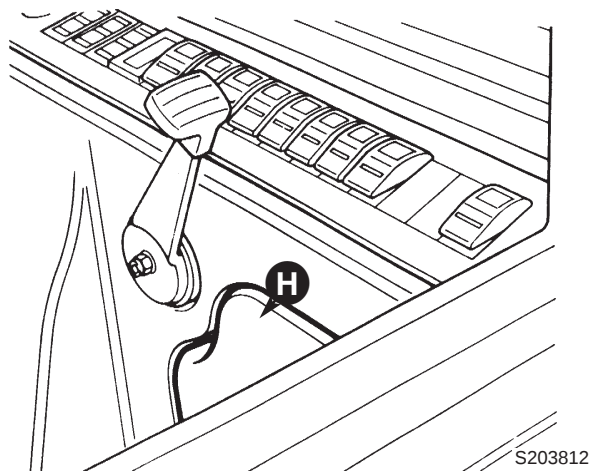
Fuses

The electrical circuits are protected by fuses. The fuses are located behind panel **H**.

A1	Parkbrake
A2	Auxiliary Hydraulics
A3	High-flow Hydraulics
A4	Instrumentation
A5	Front / Rear Horn
A6	Hazard Indicators
A7	Direction Indicators
A8	Engine Shut-off Solenoid
A9	Front Wash/wipe, Rear Wiper
A10	Heater Motor
B1	Dip Beam
B2	L.H. Side Lights
B3	R.H. Side Lights
B4	Front Work Lights
B5	Rear Work Lights
B6	Reverse Alarm, Brake Lights
B7	Hand Held Attachments, Float Hydraulics
B8	Face Level Fan
B9	Junction Box
B10	Beacon, Interior Light

Fuse Colour Code

Orange	5 amp
Red	10 amp
Blue	15 amp



	1	2	3	4	5	6	7	8	9	10
B	10	5	5	10	10	10	10	15	10	10
A	5	5	5	5	15	5	10	5	10	15

1	2	3	4
5	6	7	8

S262020

* Relays from machine no. 751600 to 752370

* The relays are located behind panel **H**.

1	Work Light
2	Park Brake
3	Ignition
4	Isolator
5	Horn
6	Neutral Start
7	Indicator Flasher
8	Alarm Buzzer

Circuit Protection from machine no. 752371

Fuses

The electrical circuits are protected by fuses. The fuses are located behind panel **H**.

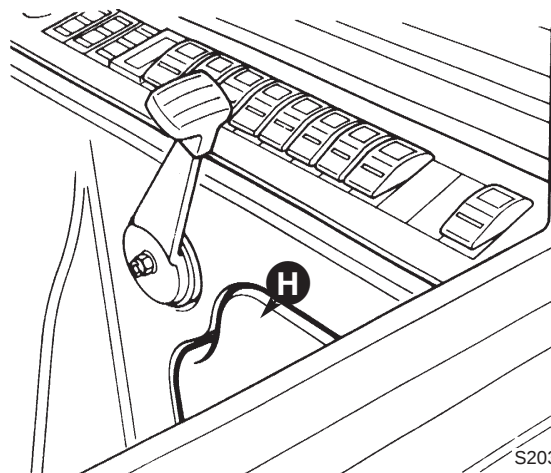
A1	Park Brake
A2	Auxiliary Hydraulics
A3	High-flow Hydraulics
A4	Instrumentation
A5	Engine Shut-off Solenoid
A6	Float Hydraulics
A7	Rear Wiper
A8	Front / Rear Horn
A9	Beacon, Interior Light
A10	Hazard Indicators
B1	Dip Beam
B2	L.H. Side Lights
B3	R.H. Side Lights
B4	Front Work Lights
B5	Rear Work Lights
B6	Junction Box
B7	Heater Motor
B8	Front Wash/wipe
B9	Reverse Alarm, Brake Lights
B10	Direction Indicators

Fuse Colour Code

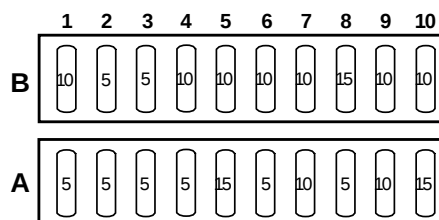
Orange 5 amp

Red 10 amp

Blue 15 amp



S203811



Relays from machine no. 752371

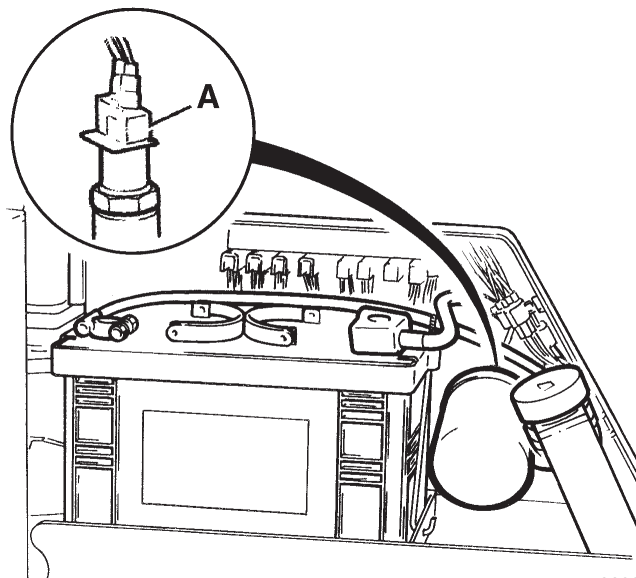
The relays are located behind panel **H**.

1	Neutral Start
2	Isolator
3	Ignition
4	Park Brake
5	Alarm Buzzer
6	Indicator Flasher

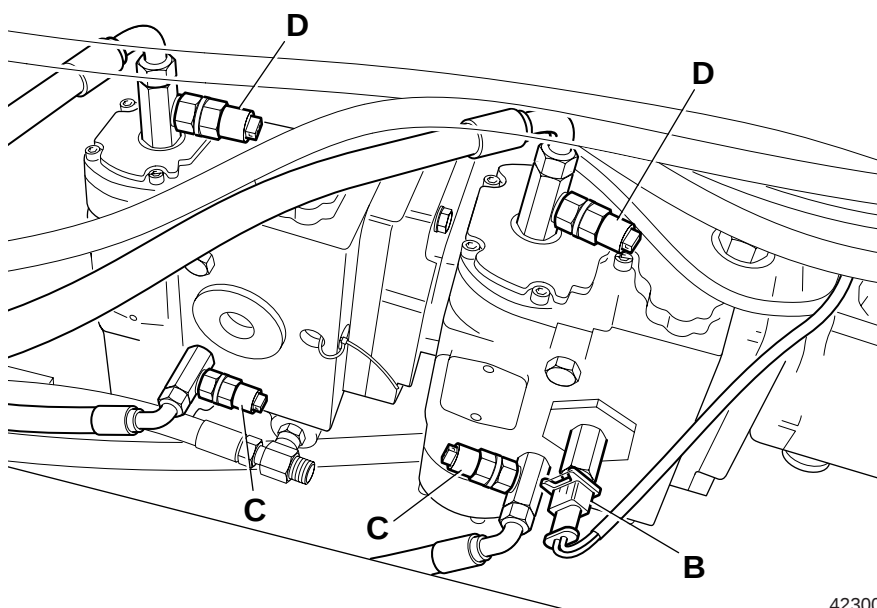
SS262021

Sensing Switches

- A** Transmission Charge Pressure Switch.
Normally closed, opens at 2-3.4 bar (30-50 lbf/in²) falling.
- B** Transmission Oil Temperature Switch.
Normally open, closes at 107-113 °C (225-235 °F) rising.
- C** Reverse Alarm Pressure Switches.
Normally open, closes at 7 bar (100 lbf/in²) rising.
- D** Brake Light Pressure Switches.
Normally open, closes at 4 bar (58 lbf/in²) rising.



422990



423000

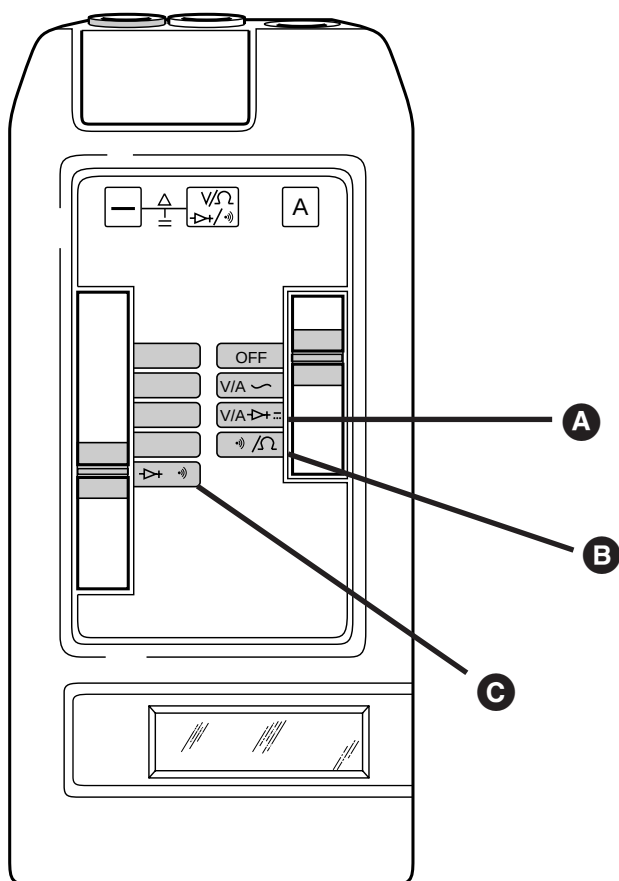
Use Of Multimeter

* In order to obtain maximum benefit from the fault finding information contained in Section C it is important that the technician fully understands the approach to fault finding and the use of the recommended test equipment, in this case an AVO 2003 digital multimeter, or a moving pointer (analogue) multimeter. The approach is based on a fault finding check list. In tracing the fault from the symptoms displayed you will be directed to make measurements using a multimeter.

These instructions are intended to cover the use of the recommended multimeters.

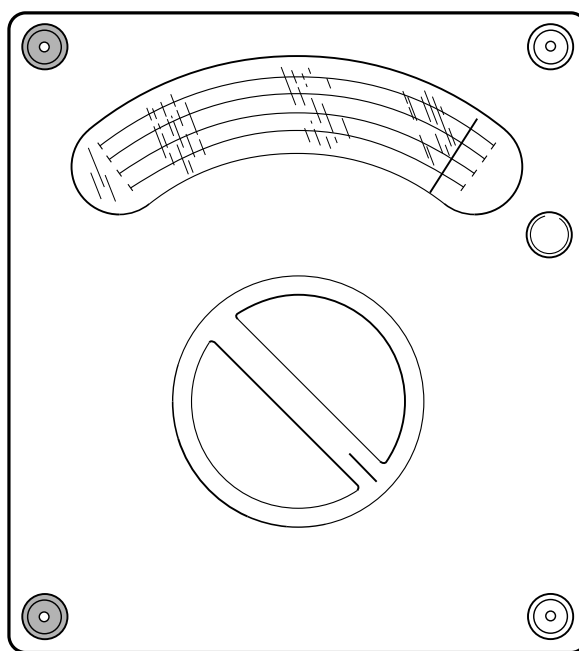
- 1 Make sure that the test leads are plugged into the correct sockets. The black test lead should be plugged into the black socket (sometimes, this socket is also marked by a " - ", or "E" or marked as "COMMON" or "COM"). The red test lead should be plugged into the red socket marked with "+", "V" or " ".
- 2 When making measurements ensure that the test probes have a good clean contact with bare metal, free from grease, dirt, and corrosion as these can cause a false reading.
- 3 When measuring voltage:
Make sure that the correct range is selected, that is set the selector to a value equal to or greater than that you are about to measure. e.g. If asked to measure 12 Volts, set the selector to the 12V range. If there is no 12V range, set the selector to the next range higher, 20V for instance.
If the meter is set to a range that is too low, it may be damaged.
e.g. setting to the 2V range to measure 12V.

AVO 2003



A171900

A typical analogue meter



A171890

Measuring DC Voltage

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 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 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.

Testing a Diode or a Diode Wire

A diode wire is a diode with male connector fitted on one end and a female connector fitted on the other end. The diode is sealed in heatshrink sleeving.

On the AV0 2003

Move the right hand slider to position **A**, and the left hand slider switch to position **C**.

Connect the black probe to the end of the diode marked with a band, or to the male connector of the diode wire, the red probe should be connected to the other end of the diode or diode wire. If the Avometer does not buzz the diode is faulty.

Connect the red probe to the end of the diode marked with a band, or to the male connector of the diode wire, the black probe should be connected to the other end of the diode or diode wire. If the Avometer does not read "1" the diode is faulty.

On an analogue meter

Select the Ohms 1000s (1k) range.

Connect the black probe to the end of the diode marked with a band, or to the male connector of the diode wire, the red probe should be connected to the other end of the diode or diode wire. The meter should read 20-400 K , if it reads more than this the diode is faulty.

Select the Ohms 100s range.

Connect the red probe to the end of the diode marked with a band, or to the male connector of the diode wire, the black probe should be connected to the other end of the diode or diode wire. The meter should read 300-400 , if it reads less than this the diode is faulty.

Safety

WARNING

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

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

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

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

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

5-3-4-3

First Aid - Electrolyte

EYES Flush with water for 15 minutes. Get medical help fast.

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

SKIN Flush with water. Remove affected clothing.

Maintenance

To ensure that the battery provides optimum performance the following steps should be observed:

- 1 Make sure that the electrical connections are clean and tight. Smear petroleum jelly on connectors to prevent corrosion.
- 2 Never allow the electrolyte level to fall below the recommended level - 6 mm (1/4 in) above the plates.
- 3 Use only distilled water for topping up.
- 4 Keep the battery at least three quarters charged, otherwise the plates may become sulphated (hardened) - this condition makes recharging the battery very difficult.

Extra precautions must be taken when bench charging maintenance free batteries, they are more prone to damage by overcharging than the standard type of battery:

- NEVER boost-charge a maintenance free battery.

- NEVER charge a maintenance free battery at a voltage in excess of 15.8 Volts.

- NEVER continue to charge a maintenance free battery after it begins to gas.

Specific Gravity (SG) Test

The specific gravity of the electrolyte gives an idea of the state of charge of the battery. Readings should be taken using a hydrometer, when the electrolyte temperature is 15 °C (60 °F). If the battery has recently been on charge, wait approximately one hour (or slightly discharge the battery) to dissipate the 'surface charge' before testing.

Readings should be as tabulated and should not vary between cells by more than 0.04. A greater variation indicates an internal fault on that particular cell.

Specific Gravity Readings at 15 °C (60 °F)

	Fully Charged	Half Discharged	Fully Discharged
Ambient temperature up to 27 °C (80 °F)	1.270 - 1.290	1.190 - 1.210	1.110 - 1.130
Ambient temperature above 27 °C (80 °F)	1.240 - 1.260	1.170 - 1.190	1.090 - 1.110

If the electrolyte temperature is other than 15 °C (60 °F) a 'correction factor' must be applied to the reading obtained. Add 0.007 per 10 °C (18 °F) if the temperature is higher than 15 °C (60 °F) and subtract the same if the temperature is lower.

For example:

$$\begin{aligned}\text{SG reading at temperature of } 45\text{ °C (114 °F)} &= 1.250 \\ \text{Equivalent SG at } 15\text{ °C (60 °F)} &= 1.250 + (3 \times 0.007) \\ &= 1.250 + 0.021 \\ &= 1.271\end{aligned}$$

* Battery Testing

This test is to determine the electrical condition of the battery and to give an indication of the remaining useful 'life'.

Before testing ensure that the battery is at least 75% charged (SG of 1.23 to 1.25 for ambient temperature up to 27°C).

Ensure that the battery is completely disconnected from the vehicle.

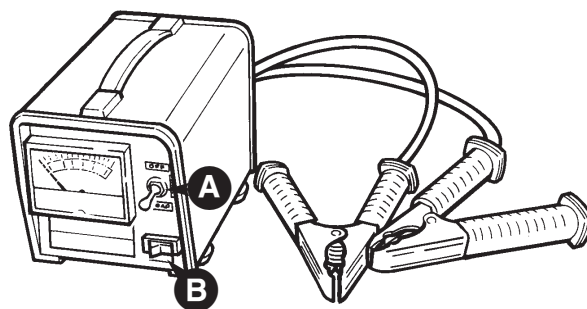
Connect up the battery tester (part no. 993/85700) as follows:

- 1 Set the CHECK/LOAD switch **A** to OFF.
- 2 Set rocker switch **B** to the battery voltage (12V).
- 3 Connect the red flying lead to the battery positive (+) terminal and the black flying lead to the battery negative (-) terminal.
- 4 Set the CHECK/LOAD switch **A** to CHECK to read the battery no-load voltage which should be at least 12.4 volts.

- 5 Set the CHECK/LOAD switch **A** to LOAD and hold down for 5 - 10 seconds until the meter reading stabilises. The reading should be at least 9 volts.

Note: Do not hold the switch in the LOAD position for more than 10 seconds.

- 6 If the foregoing tests are unsatisfactory, consult Fault Diagnosis below.



239510

Fault Diagnosis

Battery Tester Readings	Remedy
1 CHECK: 0 - 12.6 Volts LOAD: less than 6 Volts	Renew battery
2 CHECK: 6 - 12.4 Volts LOAD: less than 9 Volts and falls steadily but remains in yellow zone.	Recharge and re-test. If tests still unsatisfactory renew battery.
3 CHECK: less than 10 Volts LOAD: less than 3 Volts	Indicates battery has been over-discharged and unlikely to recover. Renew battery.
4 CHECK: more than 11 Volts LOAD: 6 - 10 Volts steady	Charge battery which will probably recover.

The alternator is a three phase generator having a rotating field winding and static power windings.

When the start switch is turned on, current from the battery flows by way of the 'No Charge' warning light to the field winding. This creates a magnetic field which supplements the residual magnetism in the rotor poles. As the engine is started, the fan belt drives the rotor and alternating current is generated in the power windings as they are cut by the rotating magnetic field. Output is controlled by a solid state regulator which varies the field current in accordance with electrical demand.

Servicing is restricted to periodic inspection of slip ring brushes. Bearings are 'sealed for life'.

Service Precautions

- a** Ensure that the battery negative terminal is connected to the earthing cable.
- b** Never make or break connections to the battery or alternator, or any part of the charging circuit whilst the engine is running. Disregarding this instruction will result in damage to the regulator or rectifying diodes.
- c** Main output cables are 'live' even when the engine is not running. Take care not to earth connectors in the moulded plug if it is removed from the alternator.
- d** During arc welding on the machine, protect the alternator by removing the moulded plug.
- e** If slave starting is necessary, connect the second battery in parallel without disconnecting the vehicle battery from the charging circuit. The slave battery may then be safely removed after a start has been obtained. Take care to connect batteries positive to positive, negative to negative. See also note **b**.

Charging Test

If the battery is in a fully charged condition, switch on the working lights for 3 minutes before commencing the test. Alternatively, operate the starter for a few moments with Fuse 5 (ESOS) removed.

Install a 100 amp open - type shunt between the battery and positive lead terminal.

Connect a multimeter positive lead to machine side of the shunt and negative lead to battery side of the shunt. Connect the leads to the meter and set the meter to the relevant range as follows.

- AVO 2002 Red lead to volts (middle) socket on meter.
 Black lead to negative on meter.
 RH slider to DC voltage.
 LH slider as shown at **A**.

- AVO 2003 Red lead to amps socket (marked **A**) on the meter.
 Black lead to negative on meter.
 RH slider to DC voltage
 LH slider to 200 Shunt

Start the engine and run at maximum speed (see Technical Data). Meter should show maximum alternator output in Amps (see Technical Data).

Note: The meter reading should be taken as soon as possible after starting the engine, as the charging current will fall rapidly.

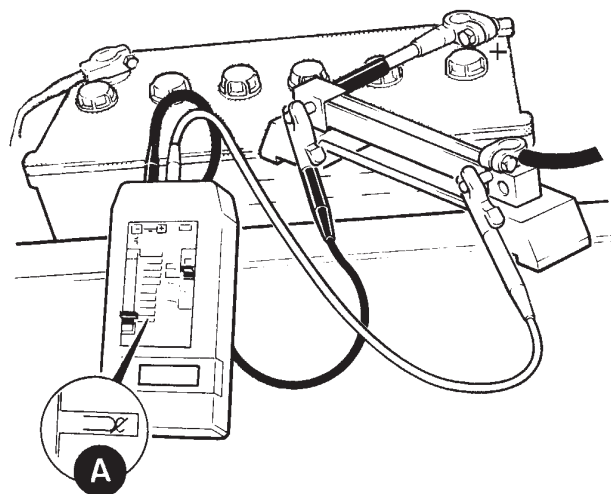
A zero reading indicates failure of the alternator and may be caused by one of the following conditions. These are listed in the order of probability.

- a** Defective suppression capacitor.
- b** Dirty slip rings or worn brushes.
- c** Defective regulator.
- d** Defective rectifier.
- e** Open or short - circuited field (rotor) windings.
- f** Open or short - circuited power (stator) windings.

To check for fault **a**, disconnect the capacitor and repeat the charging test. Renew the capacitor if necessary.

To check for faults **b** and **c**, remove the regulator and brush box assembly. Check the condition of the brushes and, if necessary, clean the slip rings using extra-fine glasspaper. The regulator may only be checked by substitution.

Faults **d**, **e**, and **f** may be checked only by removing and dismantling the alternator for further testing.



Removal and Replacement

* XUD Engines

Removal

Disconnect the battery negative lead.

Disconnect the wiring from the rear of the alternator.

Loosen the pivot bolt **A** and the adjustment lock nut **B**. Unscrew the adjustment bolt **C** to release the tension then slip the drive belt from the pulleys.

Remove the adjustment lock nut **B**. Swivel the alternator outwards, remove the pivot bolt **A** and lift it from the engine. Examine the drive belt for wear.

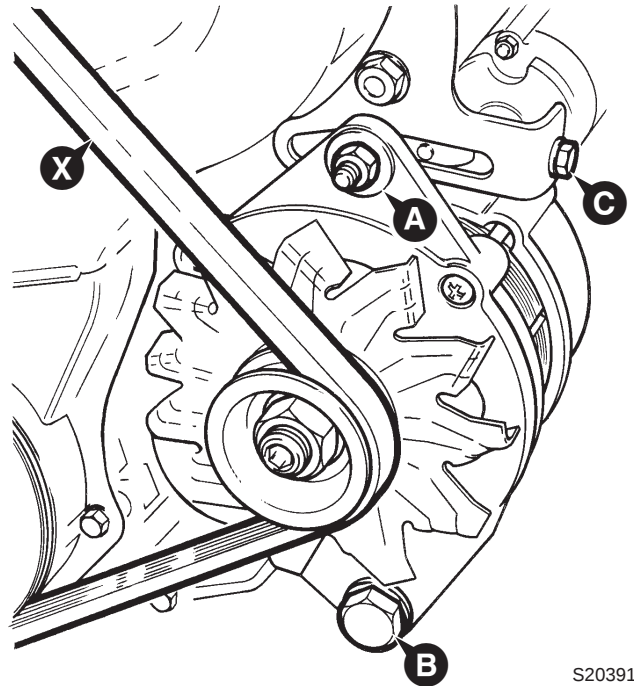
Replacement

Replacement is a reversal of the removal procedure. Position the alternator until belt deflection at **X** is approximately 10 mm ($\frac{3}{8}$ in). Part tighten **A** and **B**, then adjust bolt **C** until deflection is 10 mm at **X**. Fully tighten **A** and **B**.

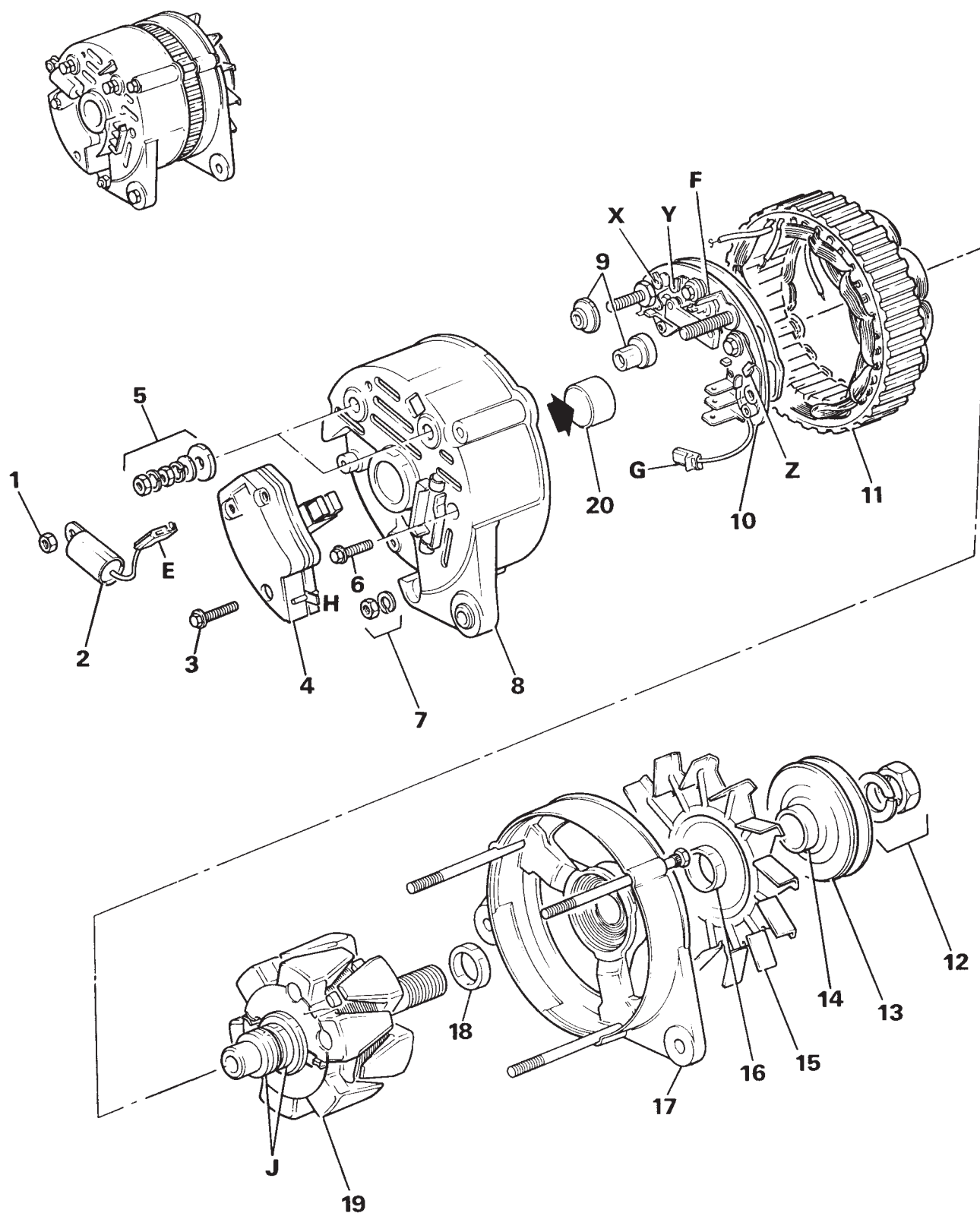
Torque Settings

A 35 Nm (26 lbf ft, 3.6 kgf m)

B 35 Nm (26 lbf ft, 3.6 kgf m)



S203910



S213570

Removal and Replacement

Perkins Engines

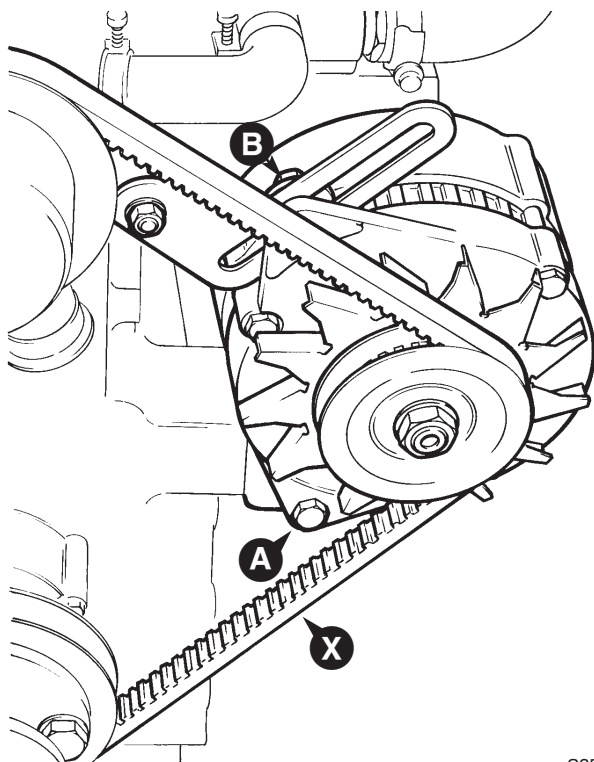
Disconnect the battery negative lead.

Disconnect the wiring from the rear of the alternator.

Loosen the pivot bolt **A** and the adjustment bolt **B**. Reposition the alternator to release the tension then slip the drive belt from the pulleys.

Remove the adjustment bolt **B**. Swivel the alternator outwards, remove the pivot bolt **A** and lift it from the engine. Examine the drive belt for wear.

Replacement is a reversal of the removal procedure. Position the alternator until belt deflection at **X** is approximately 10 mm (3/8 in) then tighten bolts **A** and **B**.



S255830

Dismantling and Assembling

Dismantling

Remove suppressor **2** (if fitted) by removing nut **1** and disconnecting lead **E** from terminal **F**.

Unscrew bolts **3** and disconnect lead **G** from terminal **H** to remove the brush box and regulator assembly **4**. If the brush length is less than 5mm (0.2in) [new length 17mm(0.67in)], or if spring pressure is less than 1.3 N the brush box and regulator assembly must be renewed.

Remove nuts and washers **5**, bolts **6** and nuts **7**. Remove slip ring end bracket **8**.

Carefully remove rectifier **10** and stator **11** as an assembly. Unsolder the interconnecting wires at **X**, **Y**, and **Z** only if renewing either of these components.

Remove nut and washer **12** using an 8mm Allen key in the shaft hexagon hole to prevent rotation. If necessary, use a press to remove rotor **19** from the drive end bracket **17**.

Check the rotor poles and the inner faces of the stator for signs of rubbing, which indicates worn bearings. The drive end bearing is part of bracket **17** and cannot be removed separately. If requiring renewal, needle roller bearing **20** should be pressed out in the direction of the arrow.

Assembling

Reverse the dismantling procedure, but note the following:

Ensure that spacers **14**, **16** and **18** are correctly positioned as shown.

Ensure that the slip rings **J** are clean and smooth, using extra fine glasspaper to rectify slight imperfections.

Ensure that insulation bushes **9** and washer **5** are positioned as shown.

Take care not to damage the brushes when fitting the brush box and regulator assembly.

Torque Settings

Item	Nm	Kgf m	lbf ft
3	2.7	0.28	2.0
5	4.1	0.41	3.0
6	3.4	0.35	2.5
7	5.4	0.55	4.0
12	60.0	6.10	44.2

Starting Circuit Test

Before carrying out the voltmeter tests, check the battery condition (see Battery Testing) and ensure that all connections are clean and tight.

To prevent the engine starting during the tests ensure that the engine shut off solenoid lead is disconnected at the fuel pump.

Check the readings in the following sequence using a voltmeter. Unless otherwise stated, the readings must be taken with the starter switch in the 'start' position and the transmission forward/reverse selector in neutral.

- 1 Connect the voltmeter across the battery terminals. Reading in 'start' position: 10.0V approximately.

A low reading probably indicates a fault in the starter motor.

- 2 Connect the voltmeter between the starter main terminal **A** and the commutator end bracket **B**. In the 'start' position, the reading should not be more than 0.5V below the reading obtained in Test 1.

- 3 Connect the voltmeter between the solenoid terminal **C** and a good earth.

Minimum reading in 'start' position: 8.0V.

If the reading is less than specified, connect the voltmeter between the neutral start relay terminal **D** and earth. An increase in reading to 8.0V indicates a fault in the wiring from the start relay to the solenoid. If the reading between terminal **D** and earth is below 8.0V, connect the voltmeter between terminal **E** and earth. An increase in the reading to 8.0V indicates either a faulty start relay or a fault in the feed from the transmission selector switch to the relay solenoid. Check also the solenoid earth connection.

If the reading between **E** and earth is less than 8.0V, the fault must be in either the starter switch (terminals **F** and **G**) or in the wiring between the solenoid, starter switch, and the start relay.

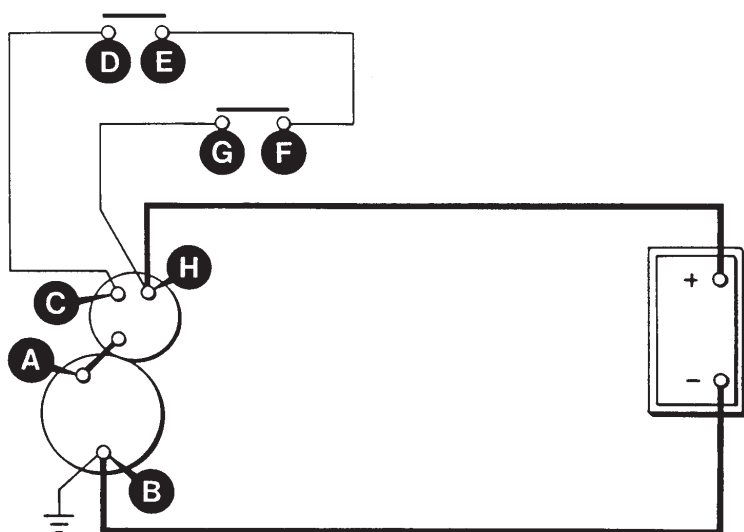
- 4 Connect the voltmeter between the battery negative and starter earth connection **B**. The reading in the 'start' position should be practically zero.

If the reading is appreciably above zero, a high resistance in the earth lead or connections is indicated.

- 5 Connect the voltmeter battery positive and the starter main terminal **A**. With the starter switch 'off', the voltmeter should indicate battery voltage, but it should fall to practically zero when the switch is turned to the 'on' position.

If the reading is appreciably above zero, a high resistance is present in the insulated lead or in the solenoid. Connect the voltmeter between the battery positive and solenoid connection **H**. If the voltmeter now reads zero with the switch closed, the fault is in the solenoid.

Finally reconnect the engine shut off solenoid lead.



S8320A

Removal and Replacement

* XUD Engines

Disconnect the battery negative lead.

Disconnect the cables from main starter terminal **A** and solenoid terminal **B**. Unscrew securing bolts (3 off) and withdraw the starter.

Replacement is a reversal of the removal procedure.

Torque Settings

Securing bolts **C** 34 Nm (25 lbf ft, 3.5 kgf m).

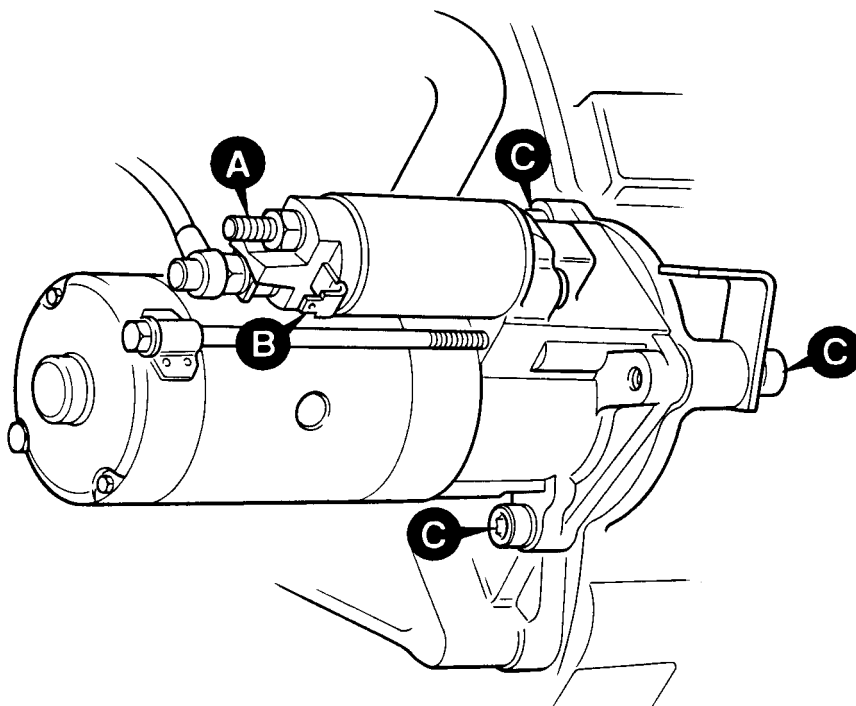
Service Procedures

Servicing this equipment is not recommended. Should faults occur, then the starter motor should be changed for a Service Replacement.

Removal and Replacement

* 100 and 400 Series Engines

* For Removal, Replacement and Servicing procedures refer to 100 Series Engine Workshop Manual (JCB part no. 9806/2100) or 400 Series Engine Workshop Manual (JCB part no. 9806/2190).



*** Up to machine no. 751599****Main Components**

- 1 Battery
- 2 Glow Plug
- 3 Glow Plug
- 4 Glow Plug
- 5 Glow Plug
- 6 Pre-heat Timer Relay
- 7 Starter Switch
- 8 Starter Solenoid
- 9 Starter Motor
- 10 Neutral Start Relay
- 11 Side Lights Switch
- 12 Head Lights Switch
- 13 Beacon Motor
- 14 Beacon Switch
- 15 Front Worklight Switch
- 16 Interlock Relay
- 17 Park Brake Switch
- 18 Operational Solenoid
- 19 Park Brake Solenoid
- 20 Seat Switch
- 21 Override Switch
- 22 Auxiliary Attachments Control Switch
- 23 Auxiliary Attachments Detent Switch
- 24 Auxiliary Hydraulics - Forward Solenoid
- 25 Auxiliary Hydraulics - Reverse Solenoid
- 26 Rear Worklight Switch
- 27 Alternator
- 28 Hourmeter
- 29 Warning Buzzer
- 30 Engine Oil Pressure Switch
- 31 Engine Coolant Temperature Switch
- 32 Air Cleaner Warning Switch
- 33 Charge Pump Pressure Switch
- 34 Hydraulic Oil Temperature Switch
- 35 L. H. Stabiliser Switch
- 36 R. H. Stabiliser Switch
- 37 Engine Shut Off Solenoid
- 38 Brake Pressure Switch
- 39 Horn Pushbutton
- 40 Low Coolant E.C.U.
- 41 Low Coolant Float Switch
- 42 Horn Relay
- 43 Front Horn
- 44 Rear Horn
- 45 Hazard Warning Switch
- 46 Flasher Relay
- 47 Indicator Switch & Warning Light
- 48 Wash/Wipe Switch & Warning Light
- 49 Rear Wiper Switch
- 50 Front Wiper Motor
- 51 Rear Wiper Motor
- 52 Washer Bottle
- 53 Interior Light Switch
- 54 Heater Blower Switch
- 55 Heater Blower Resistor
- 56 Heater Blower
- 57 Heated Seat
- 58 Reverse Alarm
- 59 Reverse Alarm Switches
- 60 Heated Seat Switch

- 61 Brake Light Switches
- 62 Brake Light Timer
- 63 Hydraulic Float Switch
- 64 Hydraulic Float Pressure Switch
- 65 Hydraulic Float Relay
- 66 Hydraulic Float Solenoid
- 67 High-flow Hydraulic Solenoid
- 68 High-flow Hydraulic Switch

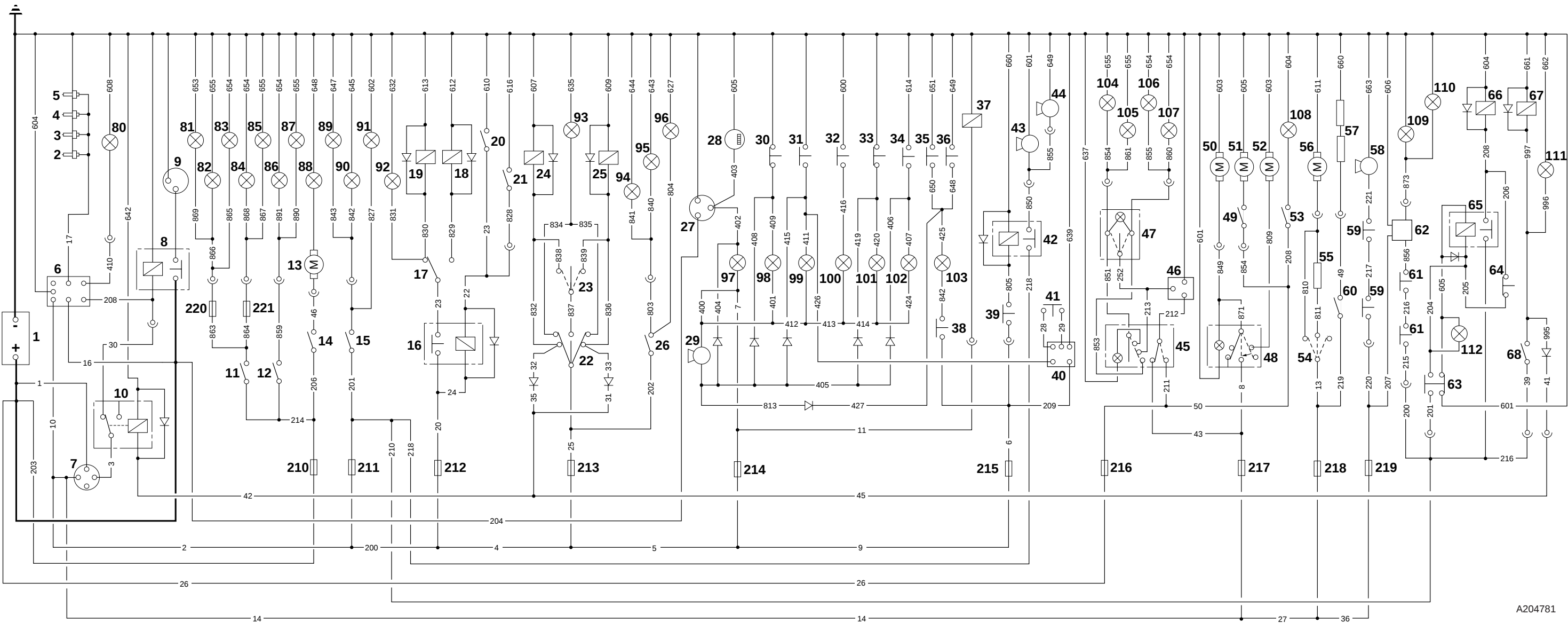
Lamps

- 80 Pre-heat Warning
- 81 Number Plate Light
- 82 R. H. Rear Side Light
- 83 R. H. Front Side Light
- 84 L. H. Rear Side Light
- 85 L. H. Front Side Light
- 86 R. H. Headlight Dip
- 87 L. H. Headlight Dip
- 88 Beacon Light
- 89 Left Hand Front Worklight
- 90 Right Hand Front Worklight
- 91 Worklight Warning
- 92 Park Brake Warning
- 93 Auxiliary Hydraulics Warning
- 94 Left Hand Rear Worklight
- 95 Right Hand Rear Worklight
- 96 Rear Worklight Warning
- 97 Alternator Warning
- 98 Engine Oil Pressure Warning
- 99 Engine Coolant Temperature Warning
- 100 Air Cleaner Warning
- 101 Charge Pump Pressure Warning
- 102 Hydraulic Oil Temperature Warning
- 103 Stabiliser Warning
- 104 L. H. Rear Direction Indicator
- 105 L. H. Front Direction Indicator
- 106 R. H. Rear Direction Indicator
- 107 R. H. Front Direction Indicator
- 108 Interior Light
- 109 L. H. Rear Brake Light
- 110 R. H. Rear Brake Light
- 111 High-flow Hydraulic Warning

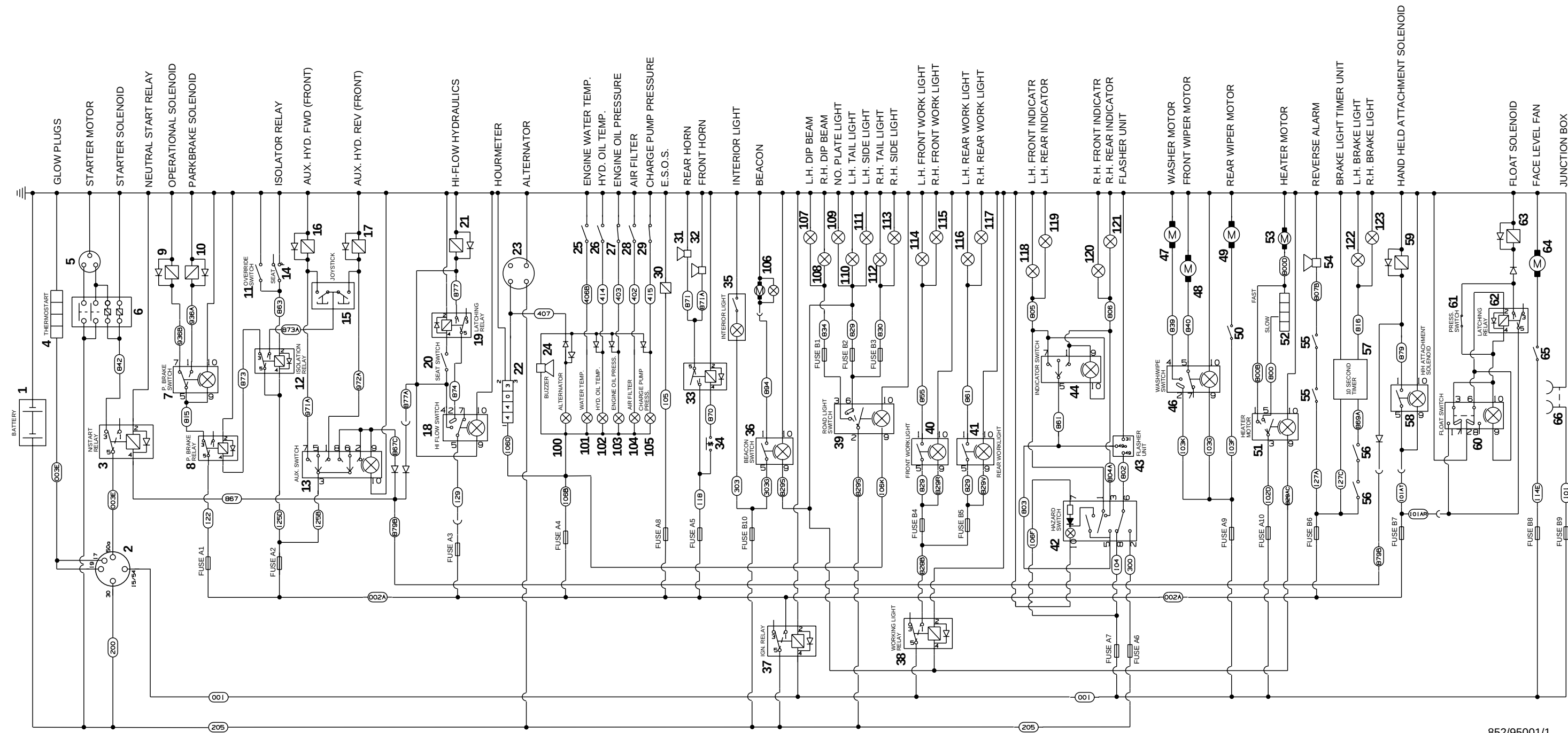
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- 210 Beacon, Sidelights, Headlights
- 211 Front Worklights, Brake Lights, Hydraulic Float, High-flow Hydraulics
- 212 Interlock Relay, Pressure Reducing Solenoid Valve
- 213 Auxiliary Hydraulics, Rear Worklights
- 214 Engine Shut Off Solenoid, Warning Lights and Buzzer
- 215 Horn, Low Coolant E.C.U., Stabiliser Warning
- 216 Hazard Warning, Rear Wiper, Interior Light
- 217 Front Wiper/Washer, Direction Indicators
- 218 Heater, Heated Seat
- 219 Reverse Alarm, Rear Brake Lights
- 220 R. H. Front/Rear Sidelights
- 221 L. H. Front/Rear Sidelights

Note: For fuse ratings, see page C/1 - 2; for bulb ratings, see page C/1 - 1



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*** From machine no. 751600 to 752370****Main Components**

- 1 Battery
- 2 Starter Switch
- 3 Neutral Start Relay
- 4 Glow Plugs
- 5 Starter Motor
- 6 Starter Solenoid
- 7 Park Brake Switch
- 8 Park Brake Relay
- 9 Operational Solenoid
- 10 Park Brake Solenoid
- 11 Override Switch
- 12 Isolator Relay
- 13 Auxiliary Attachments Switch
- 14 Seat Switch
- 15 Joystick Switch
- 16 Auxiliary Hydraulics - Forward Solenoid
- 17 Auxiliary Hydraulics - Reverse Solenoid
- 18 High-flow Hydraulic Switch
- 19 Latching Relay
- 20 Seat Switch
- 21 High-flow Hydraulic Solenoid
- 22 Hourmeter
- 23 Alternator
- 24 Warning Buzzer
- 25 Engine Coolant Temperature Switch
- 26 Hydraulic Oil Temperature Switch
- 27 Engine Oil Pressure Switch
- 28 Air Cleaner Warning Switch
- 29 Charge Pump Pressure Switch
- 30 Engine Shut Off Solenoid
- 31 Rear Horn (when fitted)
- 32 Front Horn
- 33 Horn Relay
- 34 Horn Pushbutton
- 35 Interior Light and Switch
- 36 Beacon Switch
- 37 Ignition Relay
- 38 Working Light Relay
- 39 Road Lights Switch
- 40 Front Worklight Switch
- 41 Rear Worklight Switch
- 42 Hazard Warning Switch
- 43 Flasher Unit
- 44 Indicator Switch & Warning Light
- 46 Wash/Wipe Switch & Warning Light
- 47 Washer Motor
- 48 Front Wiper Motor
- 49 Rear Wiper Motor
- 50 Rear Wiper Switch
- 51 Heater Blower Switch
- 52 Heater Blower Resistor
- 53 Heater Blower
- 54 Reverse Alarm
- 55 Reverse Alarm Switches
- 56 Brake Light Switches
- 57 Brake Light Timer
- 58 Hand Held Attachment Switch & Warning Light
- 59 Hand Held Attachment Solenoid
- 60 Hydraulic Float Switch

- 61 Hydraulic Float Pressure Switch
- 62 Latching Relay
- 63 Hydraulic Float Solenoid
- 64 Face Level Fan
- 65 Face Level Fan Switch
- 66 Junction Box

Lamps

- 100 Alternator Warning
- 101 Engine Coolant Temperature Warning
- 102 Hydraulic Oil Temperature Warning
- 103 Engine Oil Pressure Warning
- 104 Air Cleaner Warning
- 105 Charge Pump Pressure Warning
- 106 Beacon Light
- 107 L. H. Headlight Dip
- 108 R. H. Headlight Dip
- 109 Number Plate Light
- 110 L. H. Rear Side Light
- 111 L. H. Front Side Light
- 112 R. H. Rear Side Light
- 113 R. H. Front Side Light
- 114 Left Hand Front Worklight
- 115 Right Hand Front Worklight
- 116 Left Hand Rear Worklight
- 117 Right Hand Rear Worklight
- 118 L. H. Front Direction Indicator
- 119 L. H. Rear Direction Indicator
- 120 R. H. Front Direction Indicator
- 121 R. H. Rear Direction Indicator
- 122 L. H. Rear Brake Light
- 123 R. H. Rear Brake Light

Fuses

Note: For fuse applications and ratings, see page C/1 - 3;
for bulb ratings, see page C/1 - 1

*** From machine no. 752371 to 752675****Main Components**

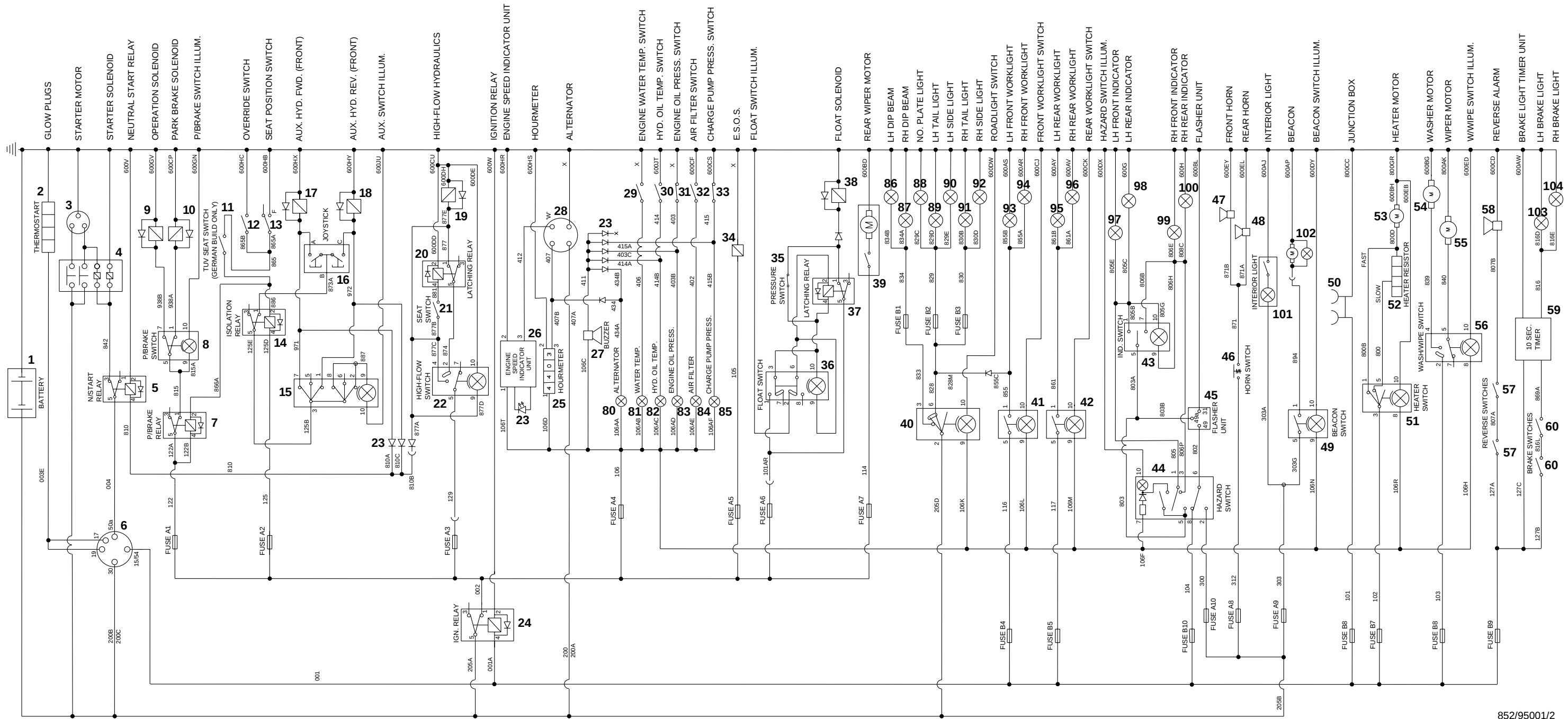
- 1 Battery
- 2 Glow Plugs
- 3 Starter Motor
- 4 Starter Solenoid
- 5 Neutral Start Relay
- 6 Starter Switch
- 7 Park Brake Relay
- 8 Park Brake Switch
- 9 Operational Solenoid
- 10 Park Brake Solenoid
- 11 TUV Seat Switch (German machines only)
- 12 Override Switch
- 13 Seat Switch
- 14 Isolator Relay
- 15 Auxiliary Attachments Switch
- 16 Joystick Switch
- 17 Auxiliary Hydraulics - Forward Solenoid (Front)
- 18 Auxiliary Hydraulics - Reverse Solenoid (Front)
- 19 High-flow Hydraulic Solenoid
- 20 Latching Relay
- 21 Seat Switch
- 22 High-flow Hydraulic Switch
- 23 Diode
- 24 Ignition Relay
- 25 Hourmeter
- 26 Engine Speed Indicator Unit
- 27 Warning Buzzer
- 28 Alternator
- 29 Engine Coolant Temperature Switch
- 30 Hydraulic Oil Temperature Switch
- 31 Engine Oil Pressure Switch
- 32 Air Cleaner Warning Switch
- 33 Charge Pump Pressure Switch
- 34 Engine Shut Off Solenoid
- 35 Hydraulic Float Pressure Switch
- 36 Hydraulic Float Switch
- 37 Latching Relay
- 38 Hydraulic Float Solenoid
- 39 Rear Wiper Motor
- 40 Road Lights Switch
- 41 Front Worklight Switch
- 42 Rear Worklight Switch
- 43 Indicator Switch & Warning Light
- 44 Hazard Warning Switch
- 45 Flasher Unit
- 46 Horn Switch
- 47 Front Horn
- 48 Rear Horn (when fitted)
- 49 Beacon Switch
- 50 Junction Box
- 51 Heater Blower Switch
- 52 Heater Blower Resistor
- 53 Heater Blower
- 54 Washer Motor
- 55 Wiper Motor
- 56 Wash/Wipe Switch & Warning Light
- 57 Reverse Alarm Switches
- 58 Reverse Alarm
- 59 Brake Light Timer
- 60 Brake Light Switches

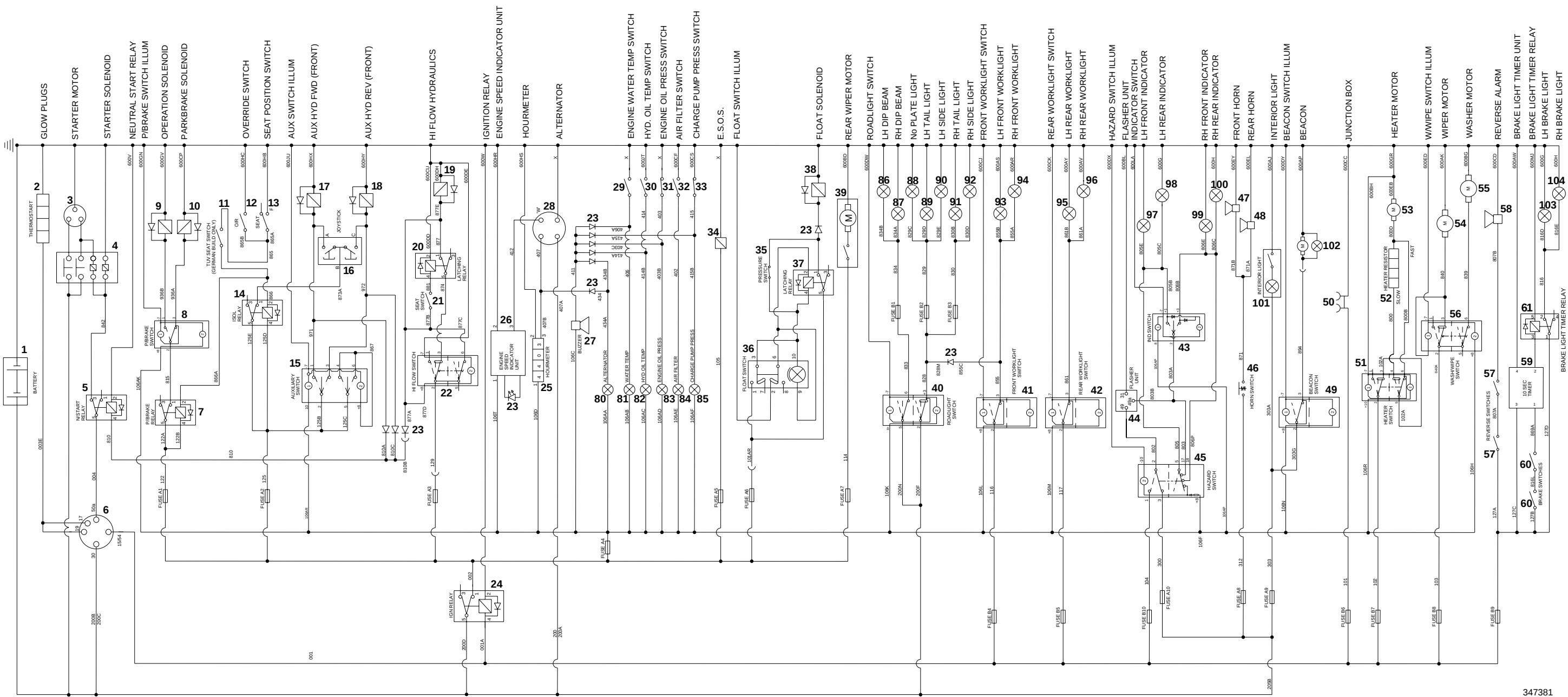
Lamps

- 80 Alternator Warning
- 81 Engine Coolant Temperature Warning
- 82 Hydraulic Oil Temperature Warning
- 83 Engine Oil Pressure Warning
- 84 Air Cleaner Warning
- 85 Charge Pump Pressure Warning
- 86 L. H. Headlight Dip
- 87 R. H. Headlight Dip
- 88 Number Plate Light
- 89 L. H. Tail Light
- 90 L. H. Side Light
- 91 R. H. Tail Light
- 92 R. H. Side Light
- 93 Left Hand Front Worklight
- 94 Right Hand Front Worklight
- 95 Left Hand Rear Worklight
- 96 Right Hand Rear Worklight
- 97 L. H. Front Direction Indicator
- 98 L. H. Rear Direction Indicator
- 99 R. H. Front Direction Indicator
- 100 R. H. Rear Direction Indicator
- 101 Interior Light and Switch
- 102 Beacon Light
- 103 L. H. Rear Brake Light
- 104 R. H. Rear Brake Light

Fuses

Note: For fuse applications and ratings, see page C/1 - 4;
for bulb ratings, see page C/1 - 1





From machine no. 752676**Main Components**

- 1 Battery
- 2 Glow Plugs
- 3 Starter Motor
- 4 Starter Solenoid
- 5 Neutral Start Relay
- 6 Starter Switch
- 7 Park Brake Relay
- 8 Park Brake Switch
- 9 Operational Solenoid
- 10 Park Brake Solenoid
- 11 TUV Seat Switch (German machines only)
- 12 Override Switch
- 13 Seat Switch
- 14 Isolator Relay
- 15 Auxiliary Attachments Switch
- 16 Joystick Switch
- 17 Auxiliary Hydraulics - Forward Solenoid (Front)
- 18 Auxiliary Hydraulics - Reverse Solenoid (Front)
- 19 High-flow Hydraulic Solenoid
- 20 Latching Relay
- 21 Seat Switch
- 22 High-flow Hydraulic Switch
- 23 Diode
- 24 Ignition Relay
- 25 Hourmeter
- 26 Engine Speed Indicator Unit
- 27 Warning Buzzer
- 28 Alternator
- 29 Engine Coolant Temperature Switch
- 30 Hydraulic Oil Temperature Switch
- 31 Engine Oil Pressure Switch
- 32 Air Cleaner Warning Switch
- 33 Charge Pump Pressure Switch
- 34 Engine Shut Off Solenoid
- 35 Hydraulic Float Pressure Switch
- 36 Hydraulic Float Switch
- 37 Latching Relay
- 38 Hydraulic Float Solenoid
- 39 Rear Wiper Motor
- 40 Road Lights Switch
- 41 Front Worklight Switch
- 42 Rear Worklight Switch
- 43 Indicator Switch & Warning Light
- 44 Flasher Unit
- 45 Hazard Warning Switch
- 46 Horn Switch
- 47 Front Horn
- 48 Rear Horn (when fitted)
- 49 Beacon Switch
- 50 Junction Box
- 51 Heater Blower Switch
- 52 Heater Blower Resistor
- 53 Heater Blower
- 54 Wiper Motor
- 55 Washer Motor
- 56 Wash/Wipe Switch & Warning Light
- 57 Reverse Alarm Switches
- 58 Reverse Alarm
- 59 Brake Light Timer
- 60 Brake Light Switches
- * 61 Brake Light Timer Relay

Lamps

- 80 Alternator Warning
- 81 Engine Coolant Temperature Warning
- 82 Hydraulic Oil Temperature Warning
- 83 Engine Oil Pressure Warning
- 84 Air Cleaner Warning
- 85 Charge Pump Pressure Warning
- 86 L. H. Headlight Dip
- 87 R. H. Headlight Dip
- 88 Number Plate Light
- 89 L. H. Tail Light
- 90 L. H. Side Light
- 91 R. H. Tail Light
- 92 R. H. Side Light
- 93 Left Hand Front Worklight
- 94 Right Hand Front Worklight
- 95 Left Hand Rear Worklight
- 96 Right Hand Rear Worklight
- 97 L. H. Front Direction Indicator
- 98 L. H. Rear Direction Indicator
- 99 R. H. Front Direction Indicator
- 100 R. H. Rear Direction Indicator
- 101 Interior Light and Switch
- 102 Beacon Light
- 103 L. H. Rear Brake Light
- 104 R. H. Rear Brake Light

Fuses

Note: For fuse applications and ratings, see page C/1 - 4;
for bulb ratings, see page C/1 - 1

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- Adjustment	1 - 1
Throttle Cable	
- Removal and Replacement	1 - 2
Adjusting the Idle and Non-Stalling Settings	1 - 2

Hand and Foot Throttles

Description

The combined foot and hand throttle controls are designed to operate in conjunction with each other. Once the engine has been started, the hand throttle can be set to give an engine speed suitable for the operations to be performed. This hand setting can be overridden by the foot throttle to give a speed in excess of that set by the hand throttle, up to the maximum for the engine as set in the factory. However, when the foot throttle is released, the engine speed reverts to that set by the hand control.

Removal

Undo the connector **A** to expose the hand throttle cable connection. Disconnect the cable by twisting and pulling. The hand throttle may then be removed by undoing nut **B** and lifting the unit from the instrument panel.

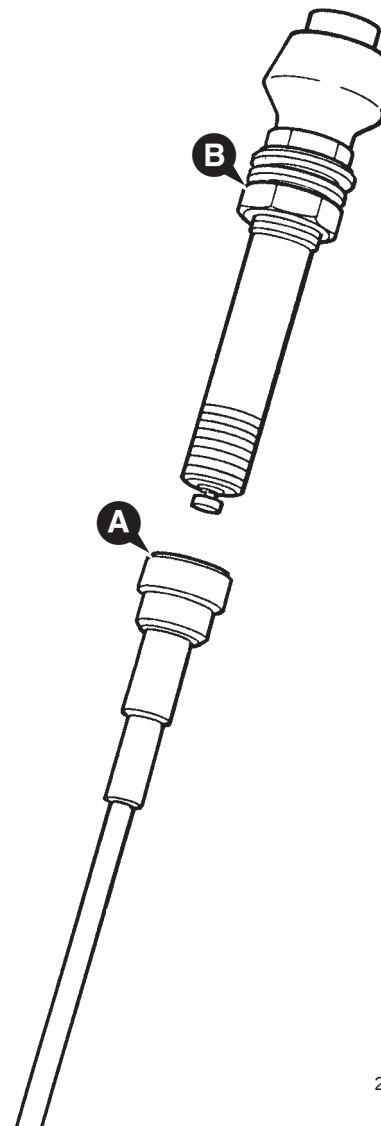
Lift the floor panel on which the foot throttle is mounted until the underside of the foot throttle is exposed, then disconnect the linkages at the white plastic clip **C** and the black clip **D**. Remove the screws (3 off) securing the foot throttle to the floor panel, lift off the unit and remove.

Replacement

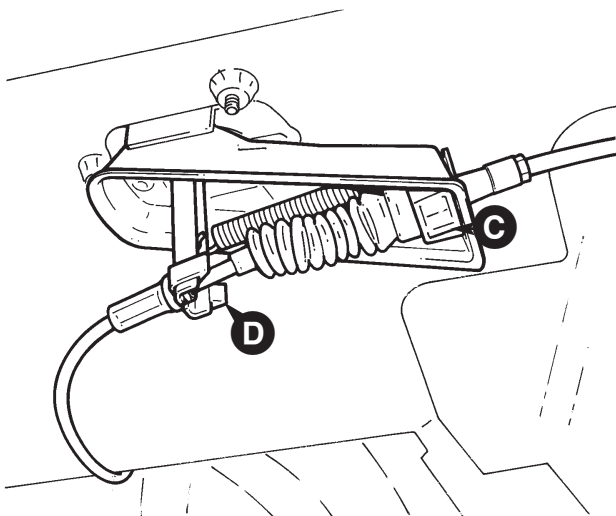
Replacement is a reversal of the removal procedure.

Adjustment

The maximum flow and speed adjustments are sealed and should only be adjusted by a specialist agent. Only idling and non-stalling settings may be adjusted (see page D/1 - 2).



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Throttle Cable

Removal

Remove the inner cable from the slot in the accelerator lever. Disconnect the cable adjustment ferrule and outer cable from the bracket.

Replacement

Replacement is a reversal of the removal procedure. Check and adjust the cable length as follows:

Have an assistant fully depress the throttle pedal, then check that the throttle lever **4** is touching the maximum speed adjustment screw **10**. If not, reposition the ferrule **11**. With the throttle pedal fully released, check that the throttle lever **4** is touching the stop screw **3**.

Note: The maximum speed screw **10** and the idle screw **6** are factory set and should only be adjusted by a specialist.

Adjusting the Idle and Non-Stalling Settings

Note: These adjustments should be carried out with the engine warm.

Loosen the nut **9** and deceleration screw **8** so that the latter protrudes 13 to 14 mm from the face of the regulator casing.

Slacken locknut **5** and start the engine.

With the fast idling control at MINIMUM, make sure that the acceleration lever comes back to contact the stop screw **3**.

Turn screw **3** to adjust the idling speed to 850 - 900 rpm.

Lock the locknut **5**.

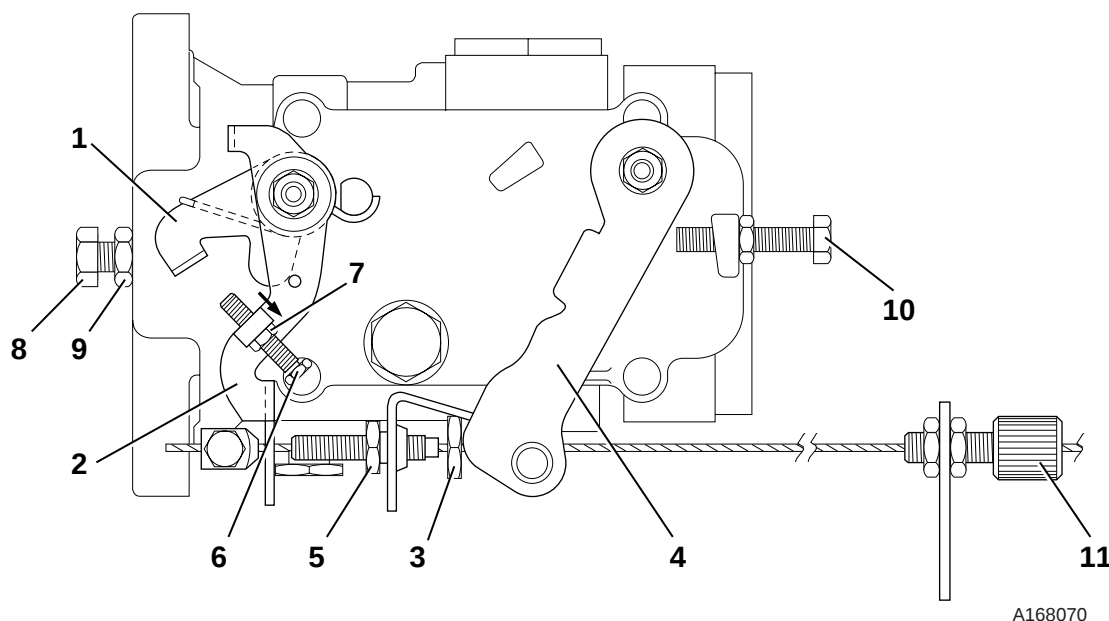
Slacken the locknut **9**.

Tighten the deceleration screw **8** until the idling speed increases by 50 rpm, then tighten one turn more.

While holding back screw **8**, lock the locknut **9**.

Accelerate the engine fully, then release the accelerator; the engine should not stall.

Repeat the operation several times, making sure that the idling speed has not been modified. If the engine stalls, tighten the deceleration screw $\frac{1}{4}$ of a turn.



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Note: System Cleanliness is to be to ISO 16/13 - See page E/3 - 1 for guidance.

Up to machine number 752462

Auxiliary Pump - Standard

Type	Gear
Displacement	48 l/min (10.5 UK gal/min, 12.7 US gal/min) at 3000 rev/min
Maximum Working Pressure	185 - 192 bar (2683 - 2785 lbf/in ² , 188 - 196 kgf/cm ²)
Maximum Speed	3200 rpm
Maximum Input Torque	121 Nm (89 lbf ft, 12 kgf m)

Auxiliary Pump - High-Flow

Type	Tandem gear
Displacement - Front Section	90 l/min (19.8 UK gal/min, 23.8 US gal/min) at 3600 rev/min
Displacement - Rear Section	57 l/min (12.5 UK gal/min, 15 US gal/min) at 3600 rev/min
Maximum Working Pressure	185 - 192 bar (2683 - 2785 lbf/in ² , 188 - 196 kgf/cm ²)
Maximum Speed	3600 rpm
Maximum Input Torque	121 Nm (89 lbf ft, 12 kgf m)

Main Pump (2-off) up to machine no. 751011

* Type	Tandem axial piston Series 40 M35
Displacement	35 cc/rev (2.13 in ³ /rev)
Control	Servo non-feedback proportional, 18 bar (261 lbf/in ²) to give max pump displacement.
Maximum Working Pressure	280 bar (4060 lbf/in ²)
Maximum Speed	3600 rpm
Maximum Input Torque	121 Nm (89 lbf ft, 12 kgf m)
Charge Pressure (oil temperature at 50° C)	6 bar (87 lb/in ²) at engine idle; 18 bar (261 lb/in ²) at 3000 rev/min

Main Pump (2-off) from machine no. 751012

* Type	Tandem axial piston Series 42 M28
Displacement	28 cc/rev (1.71 in ³ /rev)
Control	Servo non-feedback proportional, 15 bar (218 lbf/in ²) to give max pump displacement.
Maximum Working Pressure	350 bar (5076 lbf/in ²)
Maximum Speed	3900 rpm
Charge Pressure (oil temperature at 50° C)	7.5 bar (109 lb/in ²) at engine idle; 19.5 bar (283 lb/in ²) at 3000 rev/min

* Servo Joysticks

Output Characteristics - Transmission control spools	5 bar (72 lb/in ²) at 15% stroke. 15 bar (217.5 lb/in ²) at 95% stroke.
Output Characteristics - Loader control spools	3.3 - 3.7 bar (48 - 53 lb/in ²) at 15% stroke. 14.5 - 16.5 bar (210 - 239 lb/in ²) at 95% stroke.

Hydraulic Motors up to machine no. 751011

* Type	OMT 400 FX
Displacement	410.9 cc/rev (25 in ³ /rev)
Maximum Working Pressure	280 bar (4061 lbf/in ²) continuous
Maximum Speed	306 rpm continuous
Maximum Flow	125 l/min (27.5 UK gal/min, 33 US gal/min) continuous

Hydraulic Motors from machine no. 751012

* Type	MCR03
Displacement	328 cc/rev (20 in ³ /rev)
Maximum Working Pressure	414 bar (6000 lbf/in ²) continuous
Maximum Speed	237 rpm continuous
Maximum Flow	84 l/min (18.5 UK gal/min, 24 US gal/min) continuous

*** Up to machine number 752462**

Relief Valve Operating Pressures	bar	kgf/cm ²	lbf/in ²
Main Relief Valve (M.R.V.) at 1500 rev/min	207	211	3006
Auxiliary Relief Valves (A.R.V.)			
Loader			
Shovel Crowd	235	240	3410
Shovel Dump	100-103	102-105	1450-1494
Lift Ram Raise	235	240	3410
Excavator			
Slew Rams	241	246	3500
Boom Raise	241	246	3500
Boom Lower	241	246	3500
Dipper In	241	246	3500
Dipper Out	241	246	3500
Bucket Crowd	241	246	3500
Bucket Dump	241	246	3500
Auxiliary Spool (optional) - both ports (see note)	241	246	3500
Optional Hand Tool Circuit	138	141	2001

Note: The return line auxiliary A.R.V. should be set to zero when a Rockbreaker is fitted (Refer to Technical Information 1/011). The A.R.V. must be returned to the correct setting when the Rockbreaker is removed.

Pressure Reducing Solenoid Valve

Maximum Inlet Pressure	207 Bar (3006 lbf/in ² , 211 kgf/cm ²)
Regulated Pressure	24 Bar (348 lbf/in ² , 24.47 kgf/cm ²)
Minimum Rated Flow	10 l/min (2.2 UK gal/min, 2.64 US gal/min)
Maximum Leakage	25 cc/min (1.52 in ³ /min) at 210 Bar (3045 lbf/in ²) and 10 cSt
Oil Temperature Range	- 40 °C to +106 °C
Solenoid Valve (including Diodes)	3 Position, 3 Port Cartridge Valve
Reducing Valve	Cartridge Type
Electrics	12 Volt

Filter

Type	High Pressure Spin On - 5 micron
Suction Strainer	125 micron

Rams		Bore		Rod Dia		Stroke	
		mm	in	mm	in	mm	in
Lift	(60 x 30)	60	2.36	30	1.18	500	19.69
Shovel	(60 x 30)	60	2.36	30	1.18	500	19.69
Boom	(70 x 40)	70	2.75	40	1.57	600	23.62
Dipper	(70 x 40)	70	2.75	40	1.57	500	19.69
Bucket	(70 x 40) (Long and Short Dipper)	70	2.75	40	1.57	400	15.75
Stabiliser	(60 x 30)	60	2.36	30	1.18	500	19.69

Ram Torque Settings		Nm	lbf ft	Kgf m
Piston Head				
Lift Rams		300	222	30.7
Shovel Rams (Crowd)		300	222	30.7
Boom Ram		405	300	41.5
Stabiliser Rams		300	222	30.7
Dipper Ram		405	300	41.5
Bucket Ram		405	300	41.5
End Cap				
Lift Rams		450	332	45.9
Shovel Rams		450	332	45.9
Boom Ram		678	500	69.2
Stabiliser Rams		450	332	45.9
Dipper Ram		678	500	69.2
Bucket Ram		678	500	69.2

Note: System Cleanliness is to be to ISO 16/13 - See page E/3 - 1 for guidance.

From machine number 752463

Auxiliary Pump - Standard

Type	Gear
Displacement	48 l/min (10.5 UK gal/min, 12.7 US gal/min) at 3000 rev/min
Maximum Working Pressure	185 - 192 bar (2683 - 2785 lbf/in ² , 188 - 196 kgf/cm ²)
Maximum Speed	3200 rpm
Maximum Input Torque	121 Nm (89 lbf ft, 12 kgf m)

Auxiliary Pump - High-Flow

Type	Tandem gear
Displacement - Front Section	90 l/min (19.8 UK gal/min, 23.8 US gal/min) at 3600 rev/min
Displacement - Rear Section	57 l/min (12.5 UK gal/min, 15 US gal/min) at 3600 rev/min
Maximum Working Pressure	185 - 192 bar (2683 - 2785 lbf/in ² , 188 - 196 kgf/cm ²)
Maximum Speed	3600 rpm
Maximum Input Torque	121 Nm (89 lbf ft, 12 kgf m)

Main Pump (2-off)

* Type	Tandem axial piston Series 42 M28
Displacement	28 cc/rev (1.71 in ³ /rev)
Control	Servo non-feedback proportional, 15 bar (218 lbf/in ²) to give max pump displacement.
Maximum Working Pressure	350 bar (5076 lbf/in ²)
Maximum Speed	3900 rpm
Charge Pressure (oil temperature at 50° C) up to machine number 807734	7.5 bar (109 lbf/in ²) at engine idle 19.5 bar (283 lbf/in ²) at 3000 rev/min 11.5 bar (167 lbf/in ²) at engine idle 23.5 - 24 bar (340 - 348 lbf/in ²) at 3000 rev/min
from machine number 807735	

Note: Earlier machines may be adjusted to the higher pressure if there is a requirement to raise the lift arms at engine idle.

* Servo Joysticks up to machine no. 807146

Output Characteristics - Transmission control spools	5 bar (72 lbf/in ²) at 15% stroke. 15 bar (217.5 lbf/in ²) at 95% stroke.
Output Characteristics - Loader control spools	3.3 - 3.7 bar (48 - 53 lbf/in ²) at 15% stroke. 14.5 - 16.5 bar (210 - 239 lbf/in ²) at 95% stroke.

* Servo Joysticks from machine no. 807147

Output Characteristics - Single Lever Drive Control	
Transmission for/rev (spools 2 & 4)	3.5 bar (51 lbf/in ²) at 15% stroke.
Transmission left/right (spools 1 & 3)	5.5 bar (80 lbf/in ²) at 15% stroke.
Loader	3.5 bar (51 lbf/in ²) at 15% stroke.
Output Characteristics - Dual Lever Drive Control	
Transmission control spools	5.5 bar (80 lbf/in ²) at 15% stroke.
Loader control spools	3.5 bar (51 lbf/in ²) at 15% stroke.

Hydraulic Motors

* Type	MCR03
Displacement	328 cc/rev (20 in ³ /rev)
Maximum Working Pressure	414 bar (6000 lbf/in ²) continuous
Maximum Speed	237 rpm continuous
Maximum Flow	84 l/min (18.5 UK gal/min, 24 US gal/min) continuous

*** From machine number 752463**

Relief Valve Operating Pressures	bar	kgf/cm ²	lbf/in ²
Main Relief Valve (M.R.V.) at 1500 rev/min	207	211	3006
Auxiliary Relief Valves (A.R.V.)			
Loader			
Shovel Crowd	235	240	3410
Shovel Dump	100-103	102-105	1450-1494
Lift Ram Raise	235	240	3410
Excavator			
Slew Rams	241	246	3500
Boom Raise	241	246	3500
Boom Lower	241	246	3500
Dipper In	241	246	3500
Dipper Out	241	246	3500
Bucket Crowd	241	246	3500
Bucket Dump	241	246	3500
Auxiliary Spool (optional) - both ports (see note)	241	246	3500
Optional Hand Tool Circuit	138	141	2001

Note: The return line auxiliary A.R.V. should be set to zero when a Rockbreaker is fitted (Refer to Technical Information 1/011). The A.R.V. must be returned to the correct setting when the Rockbreaker is removed.

Solenoid Brake Valve

Type	3 position, 4 way Directional Control
Electrics	12 Volt

Filter

Type	High Pressure Spin On - 5 micron
Suction Strainer	125 micron

Rams		Bore		Rod Dia		Stroke	
		mm	in	mm	in	mm	in
Lift	(60 x 30)	60	2.36	30	1.18	500	19.69
Shovel	(60 x 30)	60	2.36	30	1.18	500	19.69
Boom	(70 x 40)	70	2.75	40	1.57	600	23.62
Dipper	(70 x 40)	70	2.75	40	1.57	500	19.69
Bucket	(70 x 40) (Long and Short Dipper)	70	2.75	40	1.57	400	15.75
Stabiliser	(60 x 30)	60	2.36	30	1.18	500	19.69

Ram Torque Settings		Nm	lbf ft	Kgf m
Piston Head				
Lift Rams		300	222	30.7
Shovel Rams (Crowd)		300	222	30.7
* 6-in-1 Shovel		405	300	41.5
Boom Ram		405	300	41.5
Stabiliser Rams		300	222	30.7
Dipper Ram		405	300	41.5
Bucket Ram		405	300	41.5
End Cap				
Lift Rams		450	332	45.9
Shovel Rams		450	332	45.9
* 6-in-1 Shovel		678	500	69.2
Boom Ram		678	500	69.2
Stabiliser Rams		450	332	45.9
Dipper Ram		678	500	69.2
Bucket Ram		678	500	69.2

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

WARNING

Hydraulic Pressure

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

HYD-1-5

Venting Hydraulic Pressure

Stop the engine. When the engine has stopped, vent the hydraulic pressure as follows:

- a** For the hoses at the excavator end, operate the controls to release the trapped pressure.
- b** For the hoses at the loader end, turn the starter key to IGN.

Operate the Auxiliary Attachment Control Switch or the Auxiliary Attachment Detent Switch for a short time to relieve residual pressure in the hydraulic circuit.

Turn the starter key to OFF and remove the key.

Connecting the Hoses

- 1** Connect the hoses. Where the connection is of the quick release type, see **Connecting Quick Release Couplings** on page A/1 - 1. For all other hose connections, use correct tools and ensure that connections are not cross-threaded. Support the weight of the hose until the connection is made. Do not exceed the recommended torque loading.

WARNING

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 immediately.

INT-3-1-10/1

- 2** Check for leaks as follows:
 - a** Start the engine.
 - b** Either operate the Auxiliary Control Switch to build up pressure in the loader end hoses or operate the appropriate excavator control to pressurise an excavator end hose.
 - c** Switch off the engine. Remove the starter key. Check for signs of leakage at the hose connections.

Disconnecting the Hoses

- 1** Vent the hydraulic pressure as described on this page.
- 2** Disconnect the hoses. Where the connection is of the quick release type, see **Connecting/Disconnecting Quick Release Couplings** on page A/1 - 1. For all other hose connections, plug both sides of the connection to prevent loss of fluid.

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 immediately.

INT-3-1-10/1

- 3** Check for leaks. See Step 2 of **Connecting the Hoses**.

Hydraulic Fluid Quality

Construction machinery uses a large volume of fluid in the hydraulic system for power transmission, equipment lubrication, rust prevention and sealing.

According to a survey conducted by a pump manufacturer, seventy per cent of the causes of problems in hydraulic equipment were attributable to inadequate maintenance of the quality of the hydraulic fluid.

Therefore, it is obvious that control of the quality of the hydraulic fluid helps prevent hydraulic equipment problems and greatly improves safety and reliability. Furthermore from an economic angle it extends the life of the hydraulic fluid if quality is maintained.

Effects of Contamination

Once inside the system, hydraulic circuit contaminants greatly effect the performance and life of hydraulic equipment. For example, contaminants in a hydraulic pump develop internal wear to cause internal leakage and hence lower discharges. Wear particles generated will circulate with the hydraulic fluid to cause further deterioration in the performance of this and other equipment.

Contaminants also enter principal sliding sections of the equipment causing temporary malfunction, scuffing, sticking and leakage and can lead to major problems.

The main contaminants can be classified as follows:-

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

These contaminants can appear during manufacture, assembly and operation.

Contaminant Standards

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

1 micron= 0.001 mm (0.0000394 in)

Listed below are a few typical comparisons:-

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

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

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

Filters

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

Cleaning Operation

The purpose of cleaning the hydraulic oil is to remove contaminants of all types and sludge.

Procedure

- 1 Retract all rams.
- 2 Drain the hydraulic tank.
- 3 Remove and flush the tank ensuring that it is clean and dry.
- 4 Fit a new 5 micron rated filter element, part number 581/18020.
- 5 Refit the tank and fill with new oil of the recommended grade. Note that a close check needs to be kept on the tank level as the hydraulic system is being filled (not just the tank).
- 6 Disconnect and remove the pump to motor loop hoses. Using compressed air, blow down the loop hoses to remove oil and debris particles. Refit the hoses.
- 7 Disconnect the hydraulic lines to the rams.
- 9 Connect the hydraulic line to the head side of the rams (the retracting side), leave the rod side disconnected.
- 10 At low engine revs, operate the services slowly to extend the rams, this will expel the dirty oil from the rod side of the rams and new oil will be put into the head side. Check oil level and top as required.
- 11 Reconnect the rod side lines. Check oil level and top as required.
- 12 Operate all rams for approximately 15 - 20 minutes whilst building engine speed up to full throttle.
- 13 Replace the hydraulic filter, again using a 5 micron element, part number 581/18020.
- 14 After 250 hours operation or at the first 250 hour service (whichever occurs first) the hydraulic filter should be replaced with the standard element.

WARNING

Make sure all services are safely supported before disconnecting hydraulic lines.

0078

- 8 Slowly activate each circuit to flush the lines with new oil.

WARNING

The oil will be under pressure. Make sure the hose ends are secured and emptying into a suitable container.

0079

Check oil level and top as required.

* General Description up to machine no. 752462

The main components of the hydraulic circuit are the tank, pumps, drive motors, the servo operated loader and drive control circuits, the manually operated excavator valves, filters, cooler, rams and pressure reducing solenoid valve.

The pumps are driven by the engine and are mounted in tandem. They deliver pressurised oil to the valves and motors. The valves are operated by either a servo joystick in the case of the loader or drive circuits, or a manual control lever for the excavator circuit. When a valve is operated, it delivers the oil to one end of the appropriate ram or to the pump servo-controls depending on which control is operated. The pressurised oil forces the ram's piston along the bore of the ram or operates the pump servo controls, which changes the flow direction to the motors and hence the direction of rotation. A Pressure Reducing Solenoid Valve maintains the required pressure at various components and relief valves prevent system pressure from rising too far.

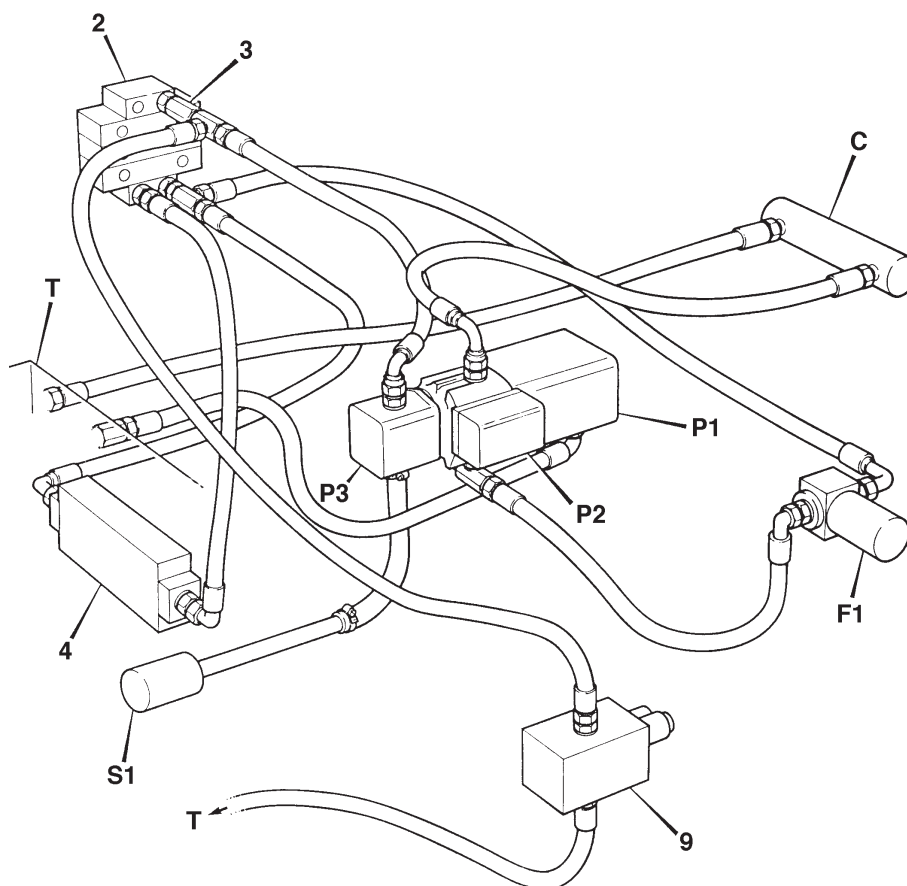
The Pressure Reducing Solenoid Valve (together with its associated electrical circuitry) is designed to both limit the pressure in the circuit and act as a safety device. The safety function ensures that the machine controls cannot be operated without the operator being seated correctly in his seat and the door properly closed and latched.

Machine Neutral Circuit

(This description should be read in conjunction with the diagram below and the Hydraulic Schematic Diagrams starting on page E/30 - 1)

Oil is drawn from the tank **T** by the auxiliary pump **P3** via a suction strainer **S1**. The pump **P3** delivers pressurised oil to the pressure reducing solenoid valve **9** and, providing that solenoid valve **9** is in the energised position, to the loader control valve **2**. In the de-energised position, valve **9** returns the oil to the hydraulic tank. This ensures that there is insufficient pressure available to operate the 5 bar check valve **3**.

* If valve **9** is energised, oil is permitted to flow to the loader control valve **2**. After passing through the loader valve, the oil flows through the excavator valve **4** and then via the filter **F1** to the main pumps **P1** and **P2**. Oil from **P1** and **P2** is returned via the cooler **C** to the tank **T**. Valve **9** also allows the transmission brakes to be manually applied.



204361

General Description from machine no. 752463

The main components of the hydraulic circuit are the tank, pumps, drive motors, the servo operated loader and drive control circuits, the manually operated excavator valves, filters, cooler, rams and solenoid brake valve.

The pumps are driven by the engine and are mounted in tandem. They deliver pressurised oil to the valves and motors. The valves are operated by either a servo joystick in the case of the loader or drive circuits, or a manual control lever for the excavator circuit. When a valve is operated, it delivers the oil to one end of the appropriate ram or to the pump servo-controls depending on which control is operated. The pressurised oil forces the ram's piston along the bore of the ram or operates the pump servo controls, which changes the flow direction to the motors and hence the direction of rotation. Relief valves prevent system pressure from rising too far.

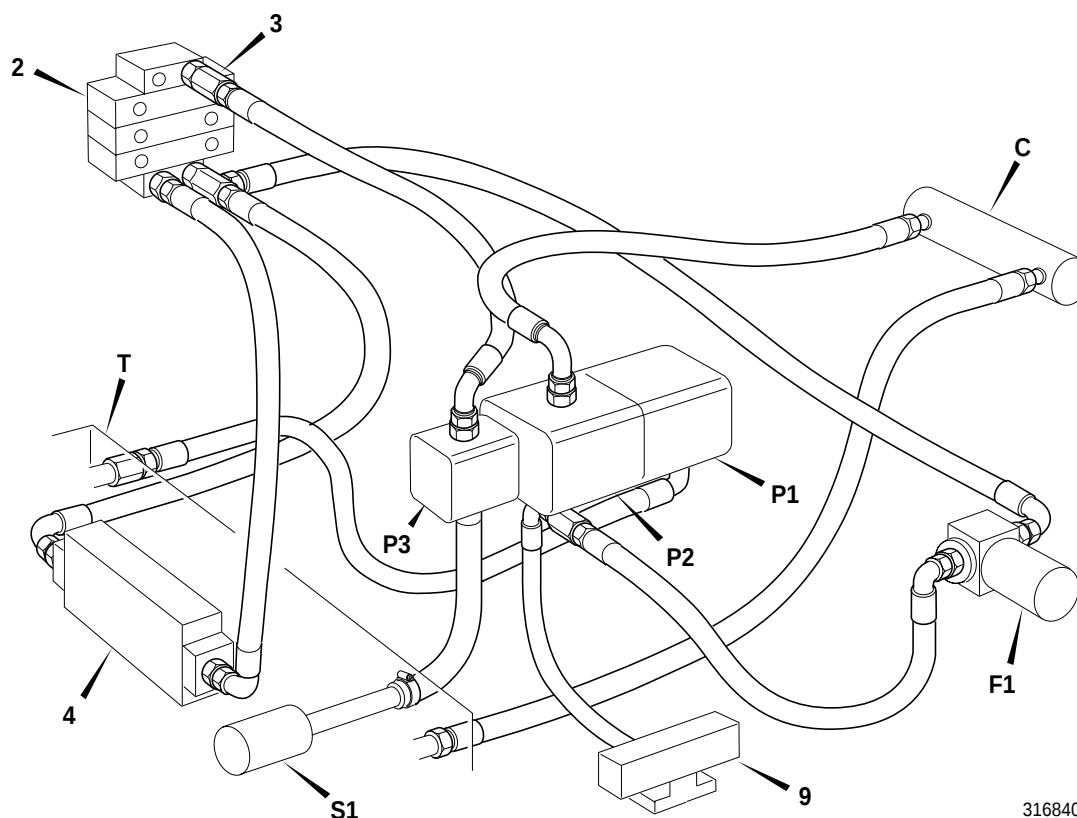
The Solenoid Brake Valve (together with its associated electrical circuitry) acts as a safety device. The safety function ensures that the machine loader and transmission controls cannot be operated without the operator being seated correctly and the door properly closed and latched.

Machine Neutral Circuit

(This description should be read in conjunction with the diagram below and the Hydraulic Schematic Diagrams starting on page E/30 - 1)

Oil is drawn from the tank **T** by the auxiliary pump **P3** via a suction strainer **S1**. The pump **P3** delivers pressurised oil via non return valve **3** to the loader control valve **2**. Oil flows through the loader valve and onto the excavator valve **4** then via the filter **F1** to the main pumps **P1** and **P2**. Oil from **P1** and **P2** is returned via the cooler **C** to the tank **T**. The oil feed for the servo controls is taken from the main pump charge circuit via the solenoid brake valve **9**.

The solenoid brake valve **9** acts as a safety device by preventing the oil supply to the loader and transmission servo controls until the operator is seated correctly and the door properly closed and latched. The brake valve also allows the transmission brakes to be manually applied.



316840

Excavator Valve - Pilot-Operated A.R.V. Pressure Relief Operation

1 Valve at Rest

A.R.V.'s are positioned in the excavator valve block in order to relieve excessive pressure in the services as shown on page E/8 - 6.

When the service is in neutral and there are no excessive forces acting on the equipment, service pressure at **A** will be acting on the lower face of poppet **B** and will also be felt inside the valve via hollow piston **C**.

The force of springs **D** and **F**, combined with the service pressure acting on the upper faces of poppet **B** and piston **C**, keeps poppets **B** and **E** tightly seated.

The force of spring **F** is adjustable to suit the relevant service by means of adjuster screw and locknut **G**.

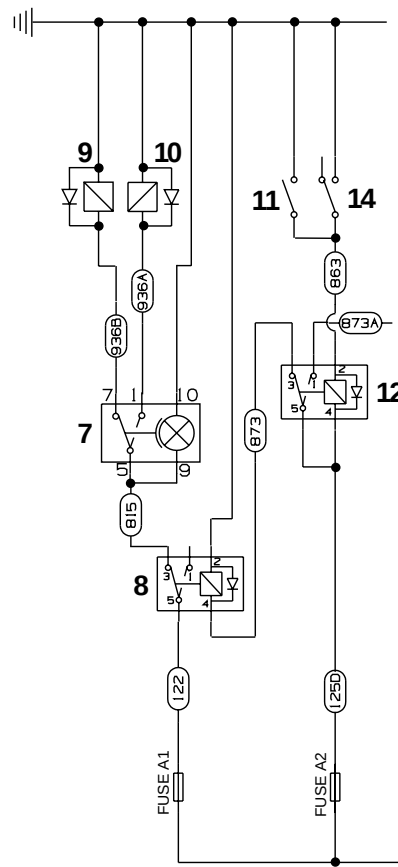
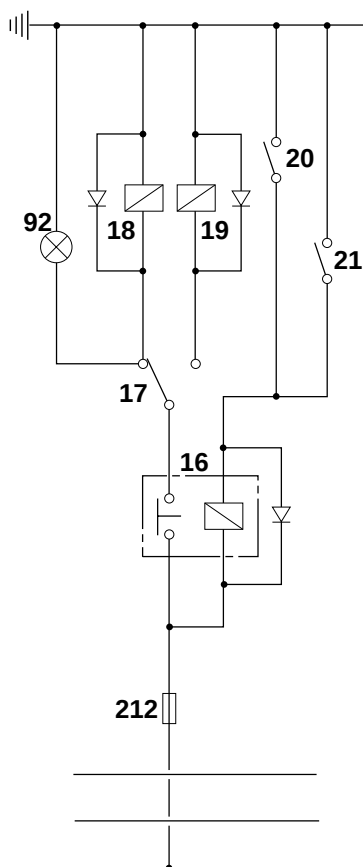
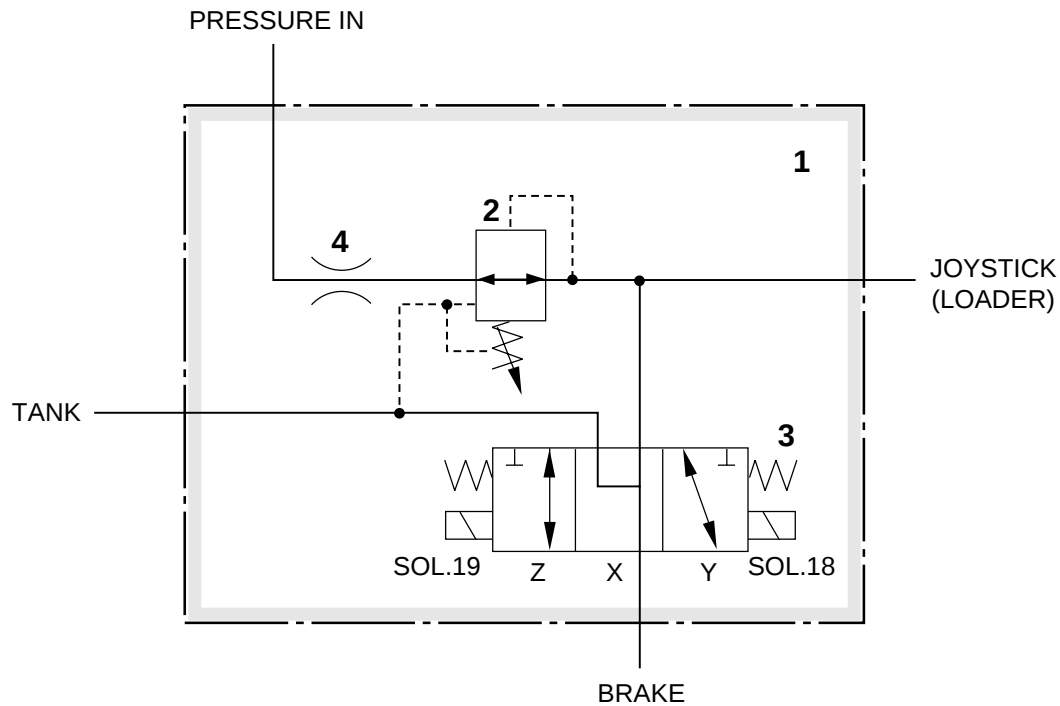
2 Pilot Valve Opens

As service pressure reaches the pilot setting of the valve, pilot poppet **E** lifts, allowing oil to escape into cavity **H** and pass down the sides of sleeve **J** into the exhaust gallery **K**.

3 Main Poppet Opens

As service pressure continues to rise and oil escapes from cavity **L**, the pressure differential between the upper and lower surfaces of piston **C** causes this piston to rise and seat on the point of pilot poppet **E**.

Oil continues to escape from cavity **L** but the incoming flow to the cavity has been cut off. This produces a pressure drop above poppet **B**, causing the poppet to lift and release service pressure into exhaust gallery **K**.



A204763

EXTRACTS FROM WIRING
DIAGRAM SCHEMATICS

Pressure Reducing Solenoid Valve (up to machine no. 751599)

This valve supplies hydraulic oil at reduced pressure to operate the loader joystick and the automatic parking brake. It is controlled by the seat position switch, the override switch and the park brake switch.

It contains a reducing valve cartridge and a 3 position, 3 port cartridge solenoid valve.

The relevant sections of the hydraulic and electrical circuits are shown on the opposite page. Refer to the left hand electrical schematic.

When first entering the machine, assuming the starter switch is OFF, there is no hydraulic pressure as the auxiliary pump is not running and the solenoid valve is in position **X** as there is no electrical supply.

If the parking brake is ON (switch **17** in the position shown) and the seat facing forward (seat switch **20** closed), starting the engine energises the interlock relay **16** and solenoid **18**, moving the solenoid valve to position **Y**.

In this position the valve directs hydraulic power via the loader joystick to the loader valve and other circuits, but the brake pressure is still dumped to tank.

Operation of the parking brake switch **17** de-energises solenoid **18** and energises solenoid **19**. This causes the solenoid valve to move to position **Z**, directing hydraulic power via the loader joystick as before, but also pressurising the brake circuit (brakes OFF).

If the seat is rotated to face the rear of the machine, seat switch **20** opens, de-energising relay **16**. Both solenoids **18** and **19** de-energise, and the solenoid valve returns to position **X**. In this condition, pressure from the auxiliary pump is dumped to tank (brakes ON and no hydraulic pressure available at the loader joystick).

When the override switch **21** is closed, the seat switch **20** is by-passed allowing the loader to be used with the seat facing rearwards.

Key to L. H. Electrical Schematic (up to machine no. 751599)

- 16** Interlock Relay
- 17** Parking Brake Switch
- 18** Operational Solenoid
- 19** Parking Brake Solenoid
- 20** Seat Switch
- 21** Override Switch

Pressure Reducing Solenoid Valve (from machine no. 751600)

This valve supplies hydraulic oil at reduced pressure to operate the loader joystick and the automatic parking brake. It is controlled by the seat position switch, the override switch and the park brake switch.

It contains a reducing valve cartridge and a 3 position, 3 port cartridge solenoid valve.

The relevant sections of the hydraulic and electrical circuits are shown on the opposite page. Refer to the right hand electrical schematic.

When first entering the machine, assuming the starter switch is OFF, there is no hydraulic pressure as the auxiliary pump is not running and the solenoid valve is in position **X** as there is no electrical supply.

If the parking brake is ON (switch **7** in the position shown) and the seat facing forward (seat switch **14** closed), starting the engine energises the isolation relay **12** and solenoid **9**, moving the solenoid valve to position **Y**.

In this position the valve directs hydraulic power via the loader joystick to the loader valve and other circuits, but the brake pressure is still dumped to tank.

Operation of the parking brake switch **7** de-energises solenoid **9** and energises solenoid **10**. This causes the solenoid valve to move to position **Z**, directing hydraulic power via the loader joystick as before, but also pressurising the brake circuit (brakes OFF).

If the seat is rotated to face the rear of the machine, seat switch **14** opens, de-energising relay **12**. Both solenoids **9** and **10** de-energise, and the solenoid valve returns to position **X**. In this condition, pressure from the auxiliary pump is dumped to tank (brakes ON and no hydraulic pressure available at the loader joystick).

When the override switch **11** is closed, the seat switch **14** is by-passed allowing the loader to be used with the seat facing rearwards.

Key to R. H. Electrical Schematic (from machine no. 751600)

- 7** Parking Brake switch
- 8** Parking Brake Solenoid
- 9** Operation Solenoid
- 10** Parking Brake Solenoid
- 11** Override Switch
- 12** Isolation Relay
- 14** Seat Switch

Drive Motor Operation

Note: On the illustration below, the main parts of the motor are shown slightly separated for purposes of explanation.

Basically, this type of motor comprises a gearwheel set **D** which is connected by a valve drive **E** to a disc valve **F**.

The gearwheel set consists of a toothed internal gear (the rotating part) and a fixed external gear rim whose 'teeth' are formed by rollers. The internal gear is free to rotate in a circular orbit within the gear rim.

The disc valve is arranged to create a series of inlets and outlets which, as the gear rotates, always align precisely with the chambers formed between the internal gear teeth and the gear rim rollers.

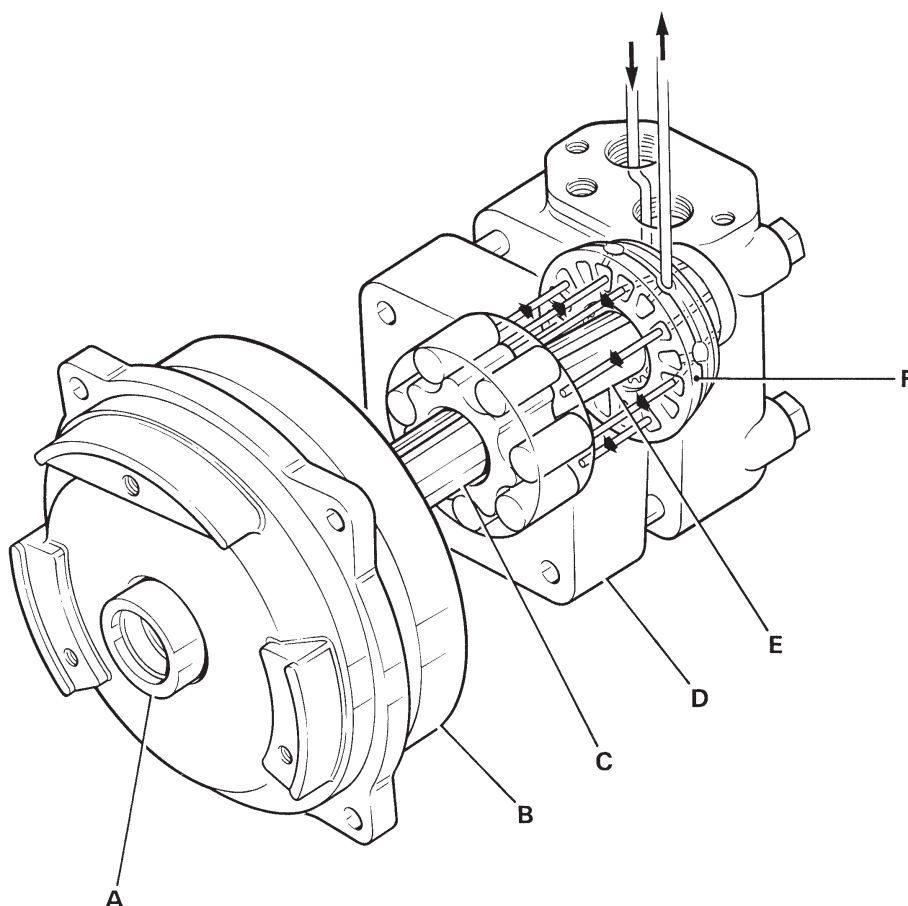
Oil under pressure passes through the disc valve inlets to the inter-tooth chambers on one side of the gearwheel set. These chambers are so shaped that the oil pressure within them creates an imbalance of forces which causes the internal gear to rotate. As the gear rotates the oil in the chambers is progressively connected to the disc valve outlets, from where it returns to tank.

A cardan shaft **C** connects the inner gear to the output shaft **A**.

* Brake pack **B** comprises a series of alternate friction plates and brake pads. The brake is normally held 'on' by spring force and released by hydraulic pressure.

Key

- A** Output Shaft
- B** Brake Pack
- C** Cardan Shaft
- D** Gearwheel Set
- E** Valve Drive
- F** Disc Valve



167740

Drive Motor Operation

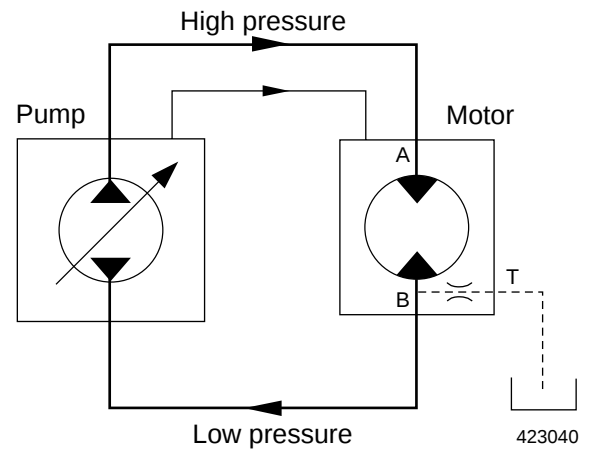
From machine no. 751818, a different type motor is fitted which has a flushing circuit. This is used to cool the motors during operation.

To save efficiency losses the flushing is taken off through an orifice on the low pressure side of the motor circuit.

Although the motors operate in both forward and reverse they are expected to operate in the forward direction for 90% of the time so the flushing is taken off the return line (port B when in forward). This is the normal flushing rate.

When the motors are in reverse mode there is higher pressure in the B port and also through the orifice, so the flow rate is higher in this mode.

It is important, when checking the flushing circuit flow, to take the measurement in forward drive only.



Transmission Operation - Neutral

With the engine running but no drive selected, oil from pump **P3** is fed through the loader valve **2**, excavator valve **4** and filter **F1** to main pumps **P1** and **P2**. A small amount of oil flows through the charge valve **Pa**, enters the pump casing and is returned via line **z** to tank **T**.

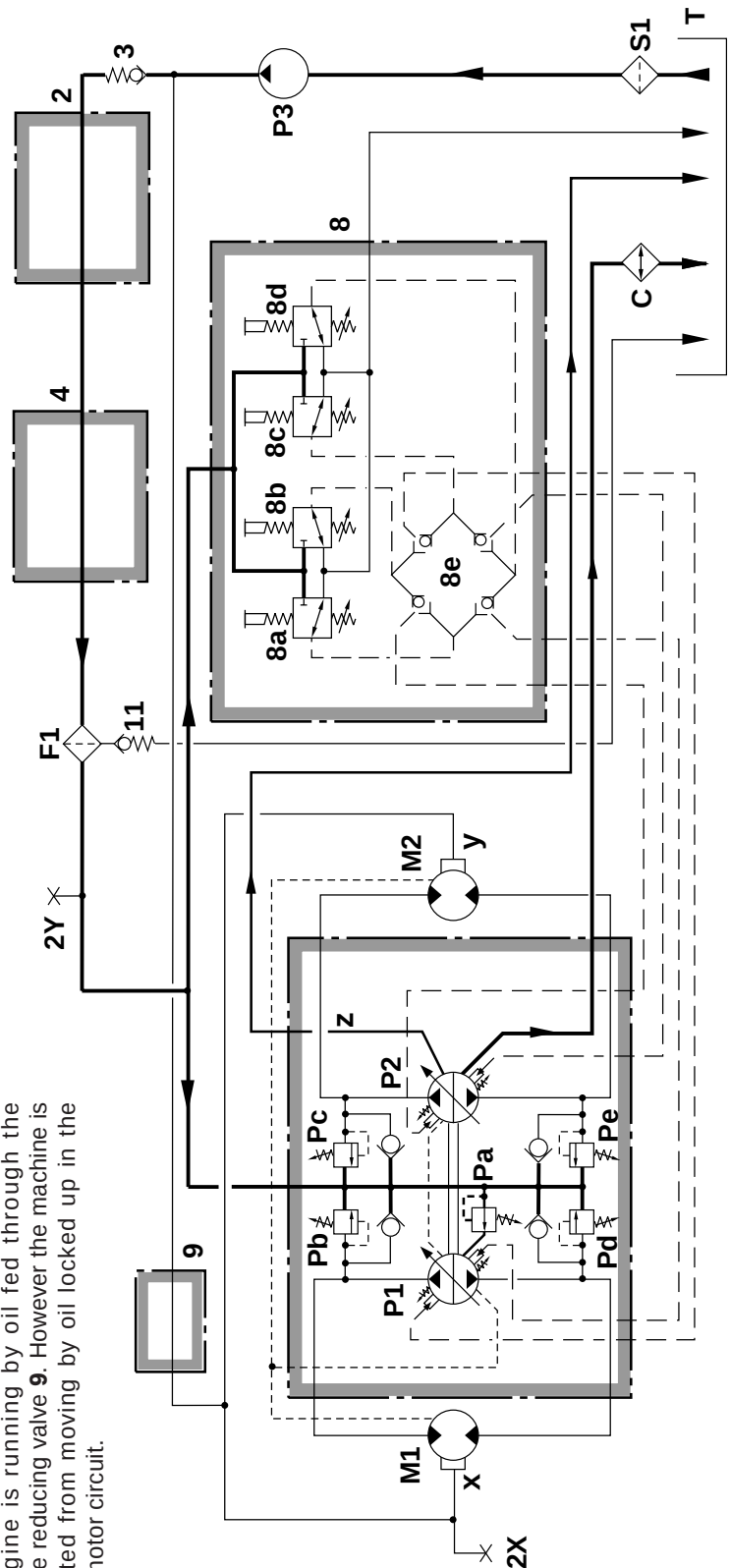
Oil is also fed from pump **P3** to the transmission servo joystick **8** but, because the joystick is not operated, the oil is blocked by the spools **8a**, **8b**, **8c** and **8d** and therefore no servo pressure is applied to operate the swash plates of pumps **P1** and **P2**.

As the pump swash plates are spring loaded to the neutral position there is no delivery from either pump and the machine remains stationary.

The motor brakes **x** and **y** are released whenever the engine is running by oil fed through the pressure reducing valve **9**. However the machine is prevented from moving by oil locked up in the pump/motor circuit.

Key

C	Cooler	2	Loader Valve
F1	Filter	2X	Pressure Test Point
P1	Main Pump	2Y	Pressure Test Point
P2	Main Pump	* 3	Check Valve (5 bar)
P3	Auxiliary Gear Pump	4	Excavator Valve
Pa	Charge Valve	8	Drive Control Joystick
Pb	Pressure Relief Valve	8a	Joystick Control Spool
Pc	Pressure Relief Valve	8b	Joystick Control Spool
Pd	Pressure Relief Valve	8c	Joystick Control Spool
Pe	Pressure Relief Valve	8d	Joystick Control Spool
M1	Left Hand Drive Motor	8e	Shuttle Valves
M2	Right Hand Drive Motor	9	Pressure Reducing Solenoid Valve
S1	Suction Strainer	11	Filter By-pass Valve
T	Tank		



A242320

Transmission Operation - Forward

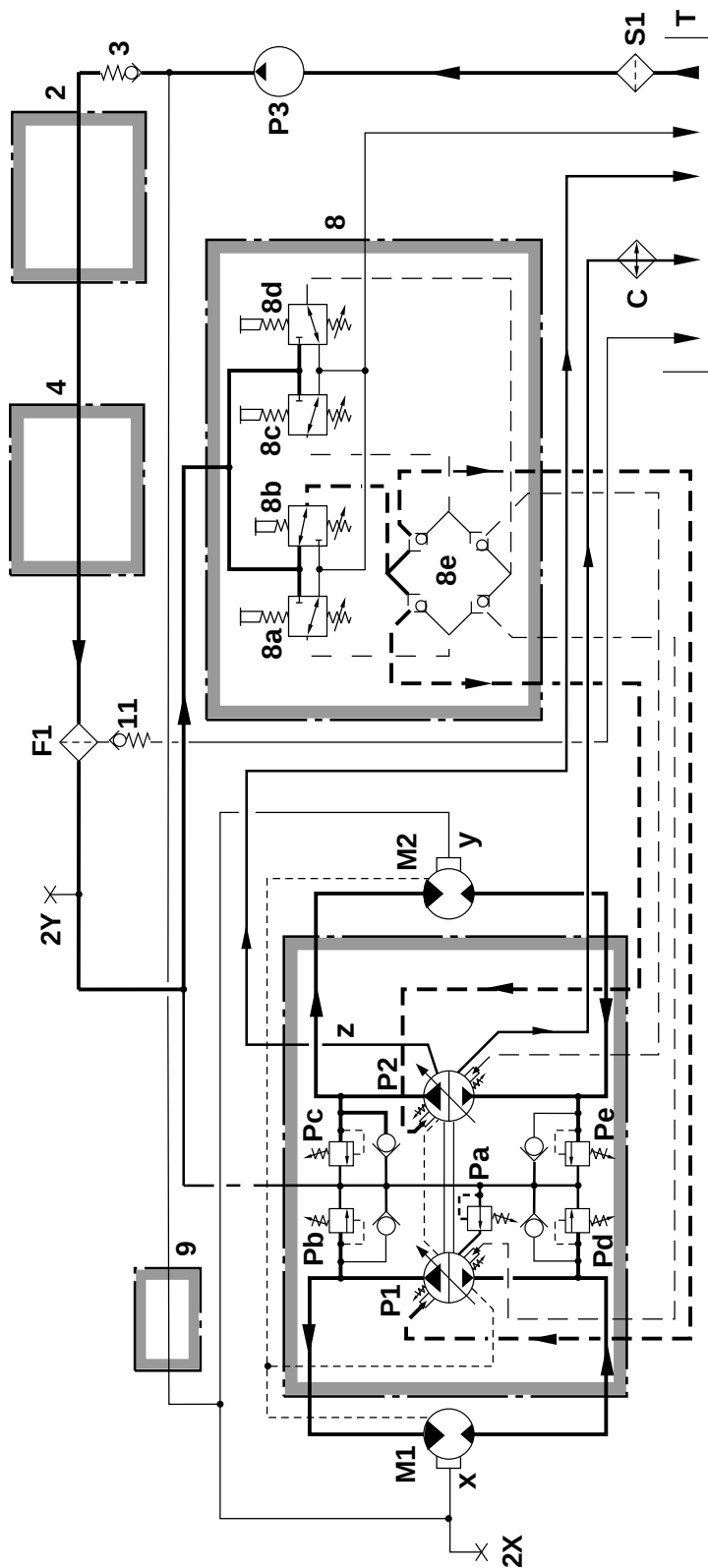
When the joystick **8** is moved to select forward drive spool **8b** is operated allowing oil from pump **P3** to pass via shuttle valves **8e** to the swash plate servos on pumps **P1** and **P2**. The swash plates are tilted causing flow to pass to the motors **M1** and **M2** and the machine moves forward.

Return oil from the motors flows back into the main pumps. Any excess oil from the pump casing is fed back to tank via cooler **C**.

Shuttle valves **8e** prevent servo pressure from being fed into other servo circuits.

Key

C	Cooler	2	Loader Valve
F1	Filter	2X	Pressure Test Point
P1	Main Pump	2Y	Pressure Test Point
P2	Main Pump	3	Check Valve (5 bar)
P3	Auxiliary Gear Pump	4	Excavator Valve
Pa	Charge Valve	8	Drive Control Joystick
Pb	Pressure Relief Valve	8a	Joystick Control Spool
Pc	Pressure Relief Valve	8b	Joystick Control Spool
Pd	Pressure Relief Valve	8c	Joystick Control Spool
Pe	Pressure Relief Valve	8d	Joystick Control Spool
M1	Left Hand Drive Motor	8e	Shuttle Valves
M2	Right Hand Drive Motor	9	Pressure Reducing Solenoid Valve
S1	Suction Strainer	11	Filter By-pass Valve
T	Tank		



A242330

Hydrostatic Transmission Problem Solving

The purpose of this page is to help you trace transmission problems to a faulty unit (pump, motor, joystick etc). Once you have traced the faulty unit, refer to the appropriate dismantling, inspecting and test instructions given elsewhere in the manual.

- * Before you begin problem solving, read the Safety Information at the beginning of this manual.
- * Make simple checks before say, stripping a major component.
- * Make sure that the hydraulic fluid is at correct working temperature (50 °C, 122 °F).
- * Whatever the fault, check the condition of the hydraulic fluid. Drain and replace if necessary.
- * Be sure to remove ALL contamination and if possible identify its origin. It may be part of a component from elsewhere in the circuit.

PROBLEM

No drive in any direction
 No drive in either forward or reverse
 No spin turn either left or right
 No drive on one side
 Machine will not travel in a straight line
 Poor drive performance, no tractive effort
 Machine creeps in neutral
 Machine will not move at idle but moves at max. revs.
 Hydraulic fluid is overheating
 Noise in transmission

CAUSE

1, 3, 4, 9, 16
 1, 4, 6, 8, 10, 11
 2, 3, 10, 11, 14
 4, 5, 6, 8, 10, 11, 14, 15
 2, 7, 8, 10, 11, 12, 13, 14
 3, 5, 6
 7

 3
 1, 17, 18
 15

KEY TO CAUSE	REMEDY	PAGE REF.
1 No oil in hydrostatic system or oil level too low	Top-up as necessary.	3/8-1
2 Tyres worn or pressure incorrect	Check tyre pressures and condition.	3/9-3
3 Charge pressure low	Adjust charge pressure at transmission pump.	E12-3 & E12-11
4 Brake release pressure incorrect	Check brake valve.	
5 No or low pump output	Check pump - carry out wheel speed check. If one pump suspect, swop motor feed hoses and notice if problem changes sides - if 'yes', pump related fault; if 'no', motor related fault.	E12-8 & E12-13 E12-14
6 High pressure 'loop' relief valve/tow valve open/set incorrectly	Check that valves have been re-tightened after towing. Replace relief valve and re-check.	E12-2 & E12-10
7 Pump neutral position set incorrectly	Adjust servo neutral position.	E12-8 & E12-12
8 Feed hose failure	Check motor feed hoses.	
9 No hydraulic feed to joystick	Check for feed to joystick.	E12-16

..... continued

Hydrostatic Transmission Problem Solving (cont'd)

KEY TO CAUSE	REMEDY	PAGE REF.
10 No hydraulic feed from joystick to pump	Check for feed from joystick to pump.	E12-16
11 Motor seal leakage	Check motor case drain for confirmation of seal leakage (compare one motor with the other). Check for shaft seal leakage by checking chain case oil level.	E12-15
12 Joystick inoperative	Check joystick (plunger movement, leaking seals, etc.)	
13 Chain tension	Check chain tension.	3/9-2 & F1-5
14 Motor failure	Inspect motor for damage. Repair as required.	E13-3, E13-5 & E13-8
15 Chain/sprocket damage	Inspect chain and sprocket. Repair as required.	Sect F
16 Pump/engine drive coupling failure	Check coupling.	E11-2
17 Oil temperature switch faulty	Replace switch.	
18 Restriction in oil cooler	Carry out flow check. Check for damage to hoses and pipework. Replace oil cooler.	

Removal and Replacement

***Note:** The illustration shows an early pump but although later pumps are visually different the same procedure applies.

Removal

Disconnect the battery. Remove the front floor plates (page B/1 - 1). Drain the hydraulic tank. Disconnect the microswitch at the base of the seat. Remove the two front and the left hand rear bolts securing the seat. Slacken but do not remove the right hand rear bolt. The seat can now be rotated towards the rear of the machine. Unclip the wiring loom and battery lead from the front seat mounting rail. Remove the seat mounting rail.

If the auxiliary pump is to be removed, disconnect the auxiliary pump hoses and plug exposed connections. Remove bolts **A** and lift out the pump.

If the main pump assembly is to be removed, do not disconnect the auxiliary pump hoses but remove bolts **A** and lift the pump off the main pump assembly and secure to the rear seat mounting rail with cable ties or similar.

Remove and plug all connections to the main pump assembly and the servo units.

Detach the electrical wiring from the left hand side of the pump by cutting the cable ties. Slacken the pump mounting bolts **B** and support the weight of the pump using suitable lifting equipment.

Remove two bolts **B** and ease the unit away from the engine. Once the pump unit coupling has separated from the engine, the unit can be lifted clear.

Replacement

Using suitable lifting equipment, ease the pump unit into position, making sure that the pump unit/engine couplings engage smoothly and completely. (See page E/11 - 2.)

Refit flange bolts **B**.

Refit all connections to the main pump. Refit the auxiliary pump if this has been removed, then refit and torque tighten connections.

Note: Refill the pumps with filtered, clean oil (see page 3/1 - 1) via the pump outlets before finally tightening the outlet connections.

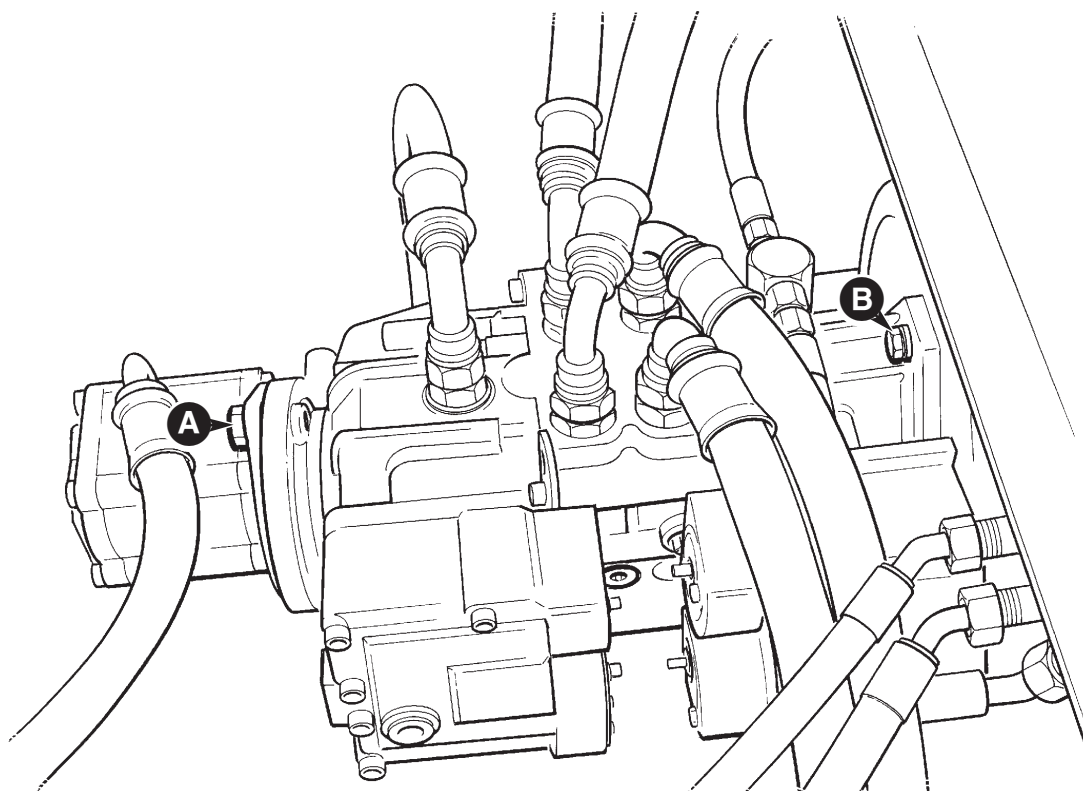
Refill the hydraulic tank. (see page 3/1 - 1).

Prime the system (see **Start-Up Procedure**).

Refit the front floor plates.

Torque Settings

Item	Nm	kgf m	lbf ft
A	77	7.9	57
B	77	7.9	57
Hydraulic Connections	45 - 50	4.6 - 5.1	33 - 37



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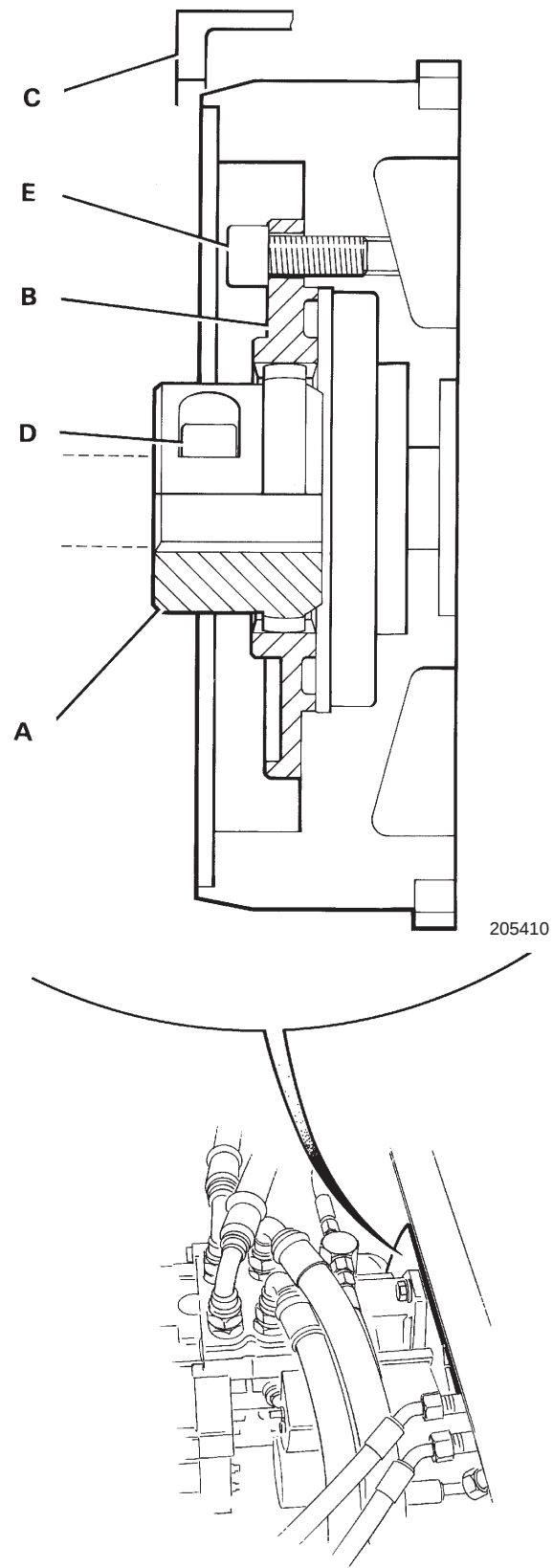
Pump/Engine Coupling

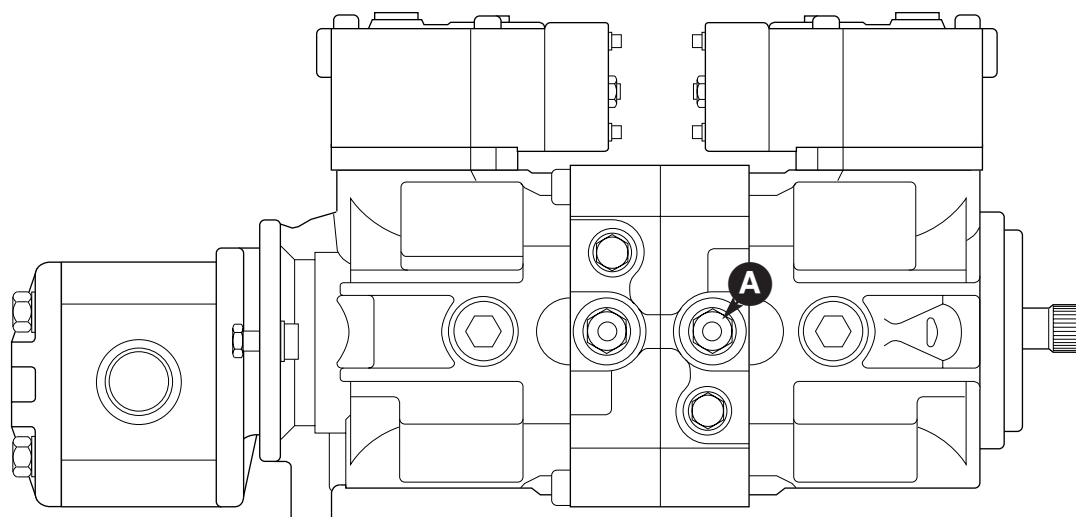
This is a gear type flexible coupling comprising an outer coupling **B**, bolted to the engine drive plate, and an inner coupling **A** clamped to the input shaft of the pump unit. Both are contained within casing **C**, to which the pump unit is bolted.

The outer coupling **B** is bolted to the engine with four capscrews **E**. The inner section **A** is tightened onto the pump shaft spline with cap screw **D**.

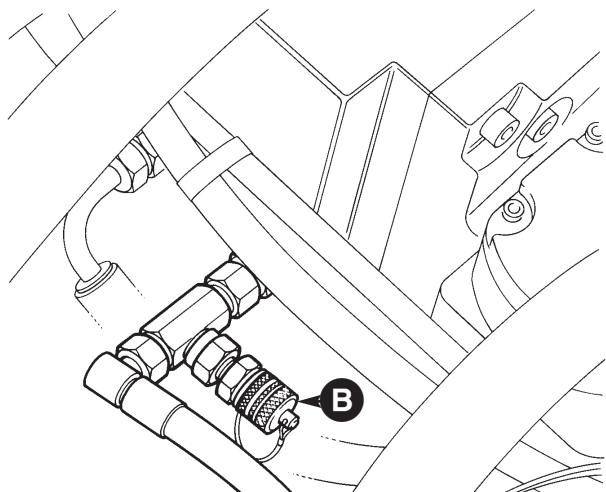
* Coat threads of capscrew **D** with JCB Threadlocker and Sealer and torque tighten to 47 Nm (35 lbf ft, 4.8 kgf m).

Coat threads of capscrews **E** with JCB Threadlocker and Sealer and torque tighten to 28 Nm (21 lbf ft, 2.8 kgf m).

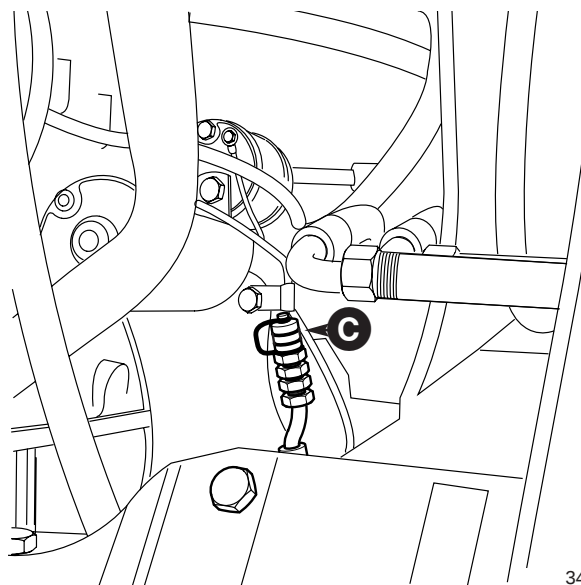




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Start-Up Procedure

The following start-up procedure should always be followed when starting up a new installation or when restarting an installation in which either a pump or motor has been removed from the system.

Note: If a new or rebuilt pump is being fitted always refill the pump with filtered oil prior to start up. Use the correct oil (see page 3/1 - 1).

WARNING

The following procedure requires the machine to be disabled (wheels raised off the ground, work function disconnected etc.) while the work is carried out.

HYD 8-1/1

Place the machine safely onto blocks, so that all four wheels are clear of the ground. Ensure that the machine is stable.

WARNING

Hydraulic Pressure

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

HYD 1-5

WARNING

Hydraulic Fluid

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 immediately.

INT-3-1-10/1

Fill the hydraulic tank with the correct fluid (see page 3/1 - 1), via a 10 micron filter (no by-pass).

Check that the pump inlet line from the hydraulic filter to the pump unit is filled with fluid, by 'cracking' the hose connection at the rear main pump.

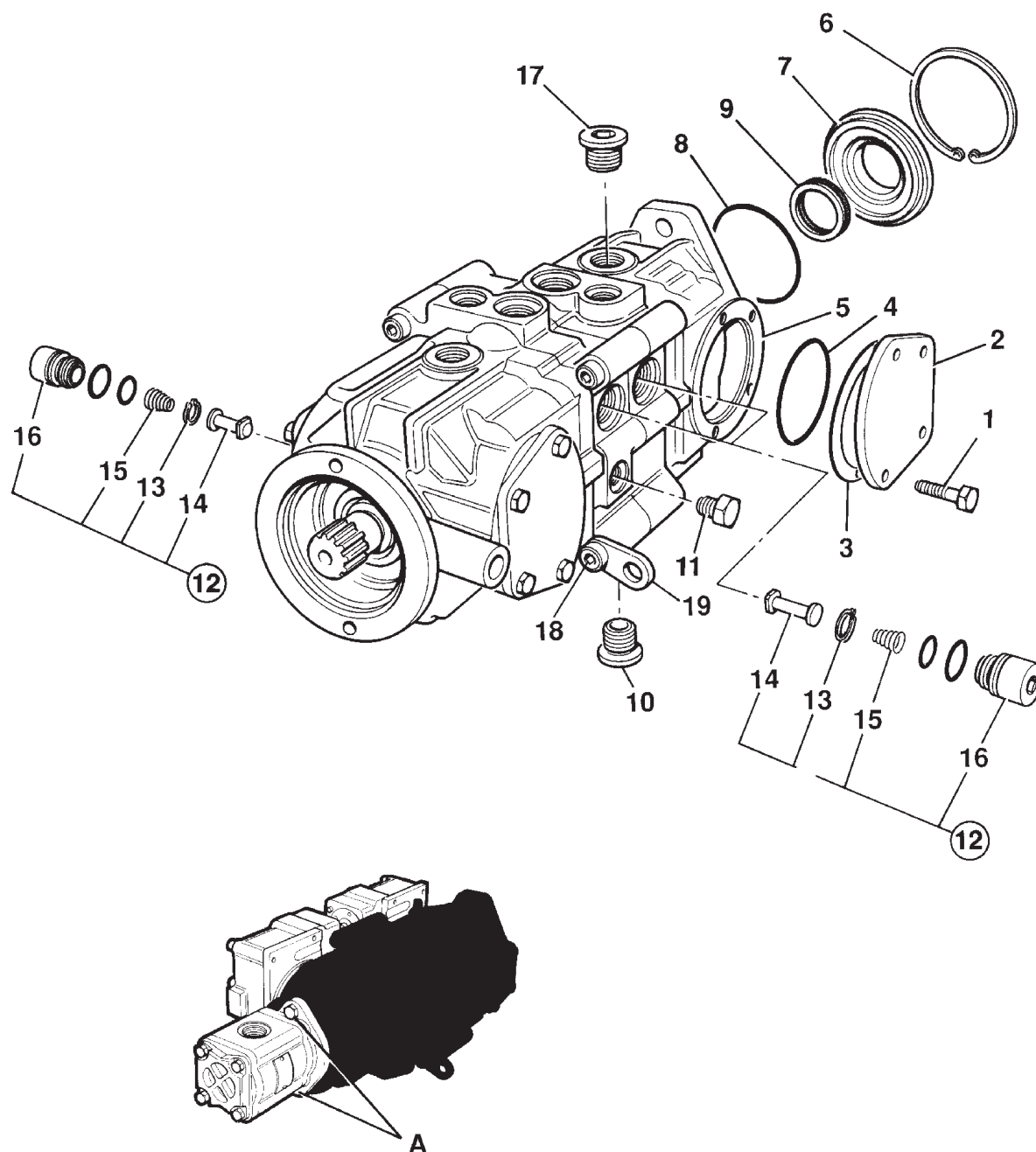
* Install a 0 - 35 bar (0 - 500 lb/in², 0 - 35 kg/cm²) pressure gauge in the charge pressure gauge port **A**, to monitor the charge pressure. After machine serial no. 751012 a test point is provided which, up to serial no. 751715, is positioned under the pump as shown at **B**. From serial no. 751716 this test point is positioned at the rear of the left hand side of the engine as shown at **C**.

Remove the ESOS fuse to prevent the engine from starting. With the Drive Control Lever (in the cab) at Neutral, 'jog' the engine using the starter. The pressure gauge should show a small rise in pressure as the engine turns. If so, replace the ESOS fuse and operate the starter whilst slowly increasing the throttle lever setting until the engine starts and runs at the lowest possible speed.

As air leaves the system, the charge pressure (as indicated on the gauge) should rise to a minimum of 7 bar (100 lb/in²). If the charge pressure is incorrect, shut-down and determine the cause.

Once the correct charge pressure has been established, operate the drive system 10 times in all directions with the engine at idle then slowly increase the engine speed whilst continuing to operate the system. Finally operate the system in all directions several times with the engine running at maximum speed.

Shut down engine and remove the pressure gauge. Check the system fluid level and top up as necessary.



168150

* Hydrostatic Pump up to machine no. 751011

Dismantling and Assembly

The information on this page covers the dismantling and assembly of those 'auxiliary' components which are accessible without actually splitting the main unit. For each component the numbering sequence is a guide to dismantling. The assembly procedure is a reverse of the dismantling procedure. Use new 'O' rings and lubricate components with hydraulic fluid on reassembly.

Auxiliary Pump

(If this was removed with main pump)

Remove bolts **A** and lift the pump away from the main unit. On reassembly, torque tighten the bolts to 77 Nm (57 lbf ft, 7.9 kgf m).

Trunnion Covers

When removing the trunnion covers **2** remove and retain shimpacks **3** as a set. (Note that only the rear pump trunnion cover is shown. The front pump cover is identical, but the shimpacks should not be mixed.)

On reassembly, lubricate the shimpack **3**. Torque tighten bolts **1** (4 off) to 24 - 30 Nm (18 - 22 lbf ft, 2.5 - 3.0 kgf m).

Shaft Seal

Remove circlip **6** from the housing. Carefully remove the seal cover **7**. (Take care not to damage the shaft or housing.) Remove the 'O' ring **8** from the seal cover and discard. Press out the seal **9** from the seal cover **7** using an arbor press and discard. Check the shaft and seal cover for damage and wear.

On reassembly, lubricate the new seal **9** with grease and, using the arbor press, press into the seal cover, ensuring that the seal lips face outwards.

Note: Wrap the spline of the shaft with tape during assembly.

Note: If a bevelled circlip **6** is used, install the bevelled side outwards.

Check Valves

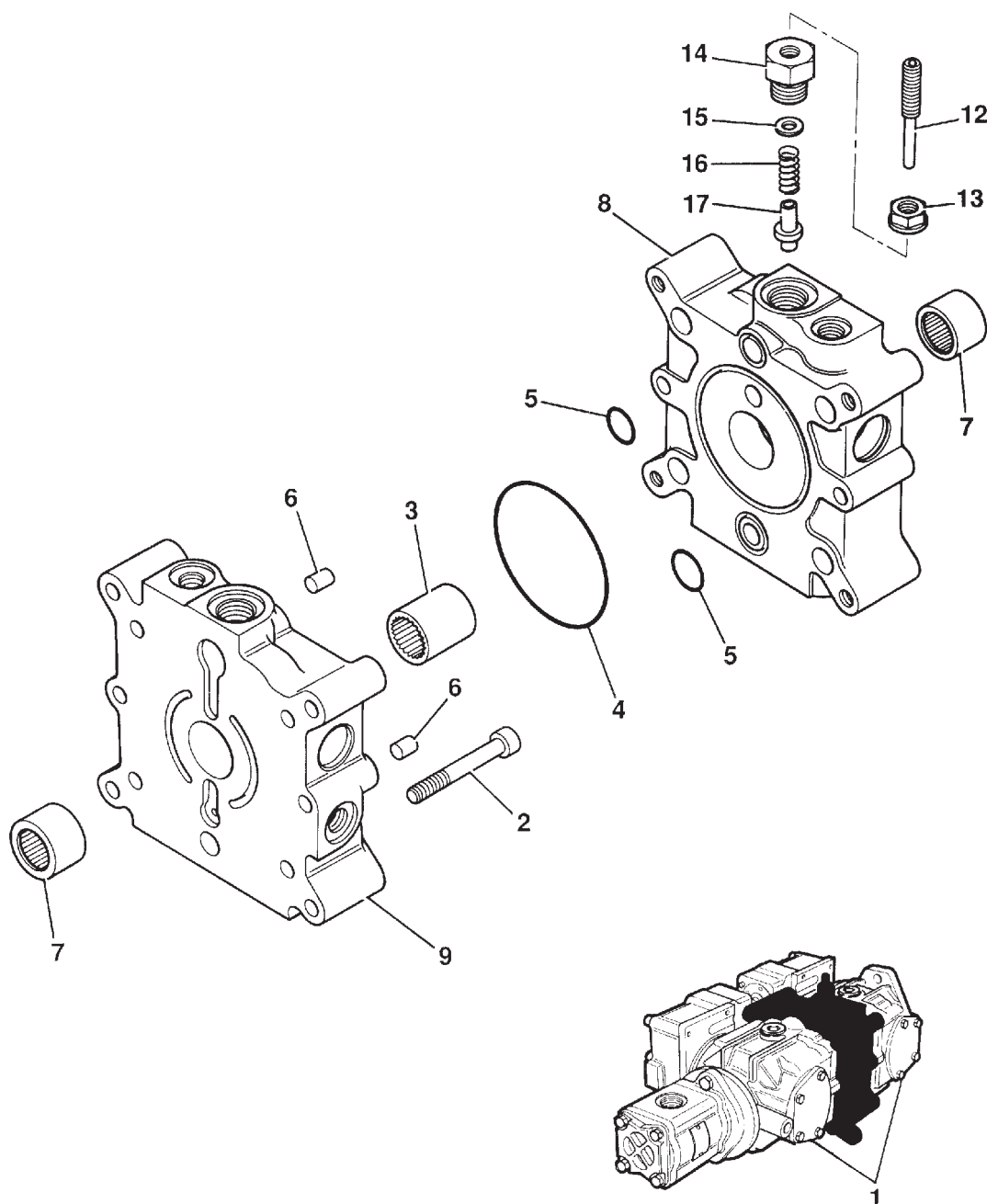
Remove the check valves **12** and place on a suitable clean surface. Inspect the valve and its mating seat in the housing for damage and foreign material.

On reassembly torque tighten to 41 - 68 Nm (30 - 50 lbf ft, 4 - 7 kgf m).

Separating the Front and Rear Pumps

The front and rear pumps are secured together by four capscrews **18**. On reassembly, ensure that the lifting eye **19** is refitted as shown. See page E/12 - 3 for details of pump 'O' rings and locating dowels.

Torque tighten screws **18** to 47 - 61 Nm (35 - 45 lbf ft, 4.8 - 6.2 kgf m).



168030

Hydrostatic Pump Endcaps up to machine no. 751011

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

Each endcap **8**, **9** is secured to its pump by four capscrews **2**. Before dismantling, matchmark each endcap to its pump. Note that 'O' rings **4** and **5** are only fitted to the rear pump endcap **8**. Locating dowels **6** need only be removed if damaged.

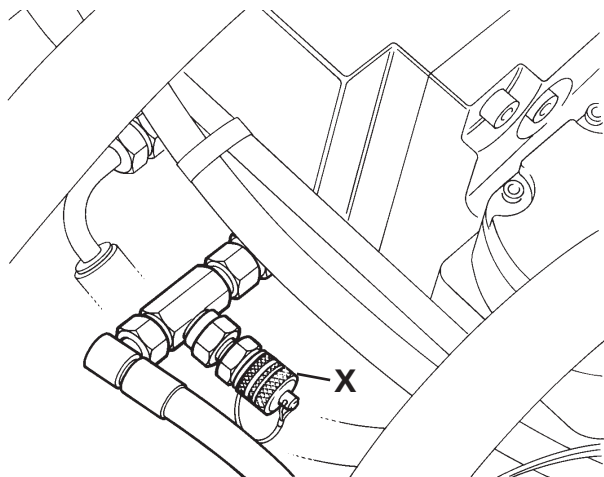
Note that shims **15** should be retained as a set. On reassembly, use new 'O' rings and bearings.

Torque tighten bolts **2** to 47 - 61 Nm (4.8 - 6.2 kgf m, 35 - 45 lbf ft).

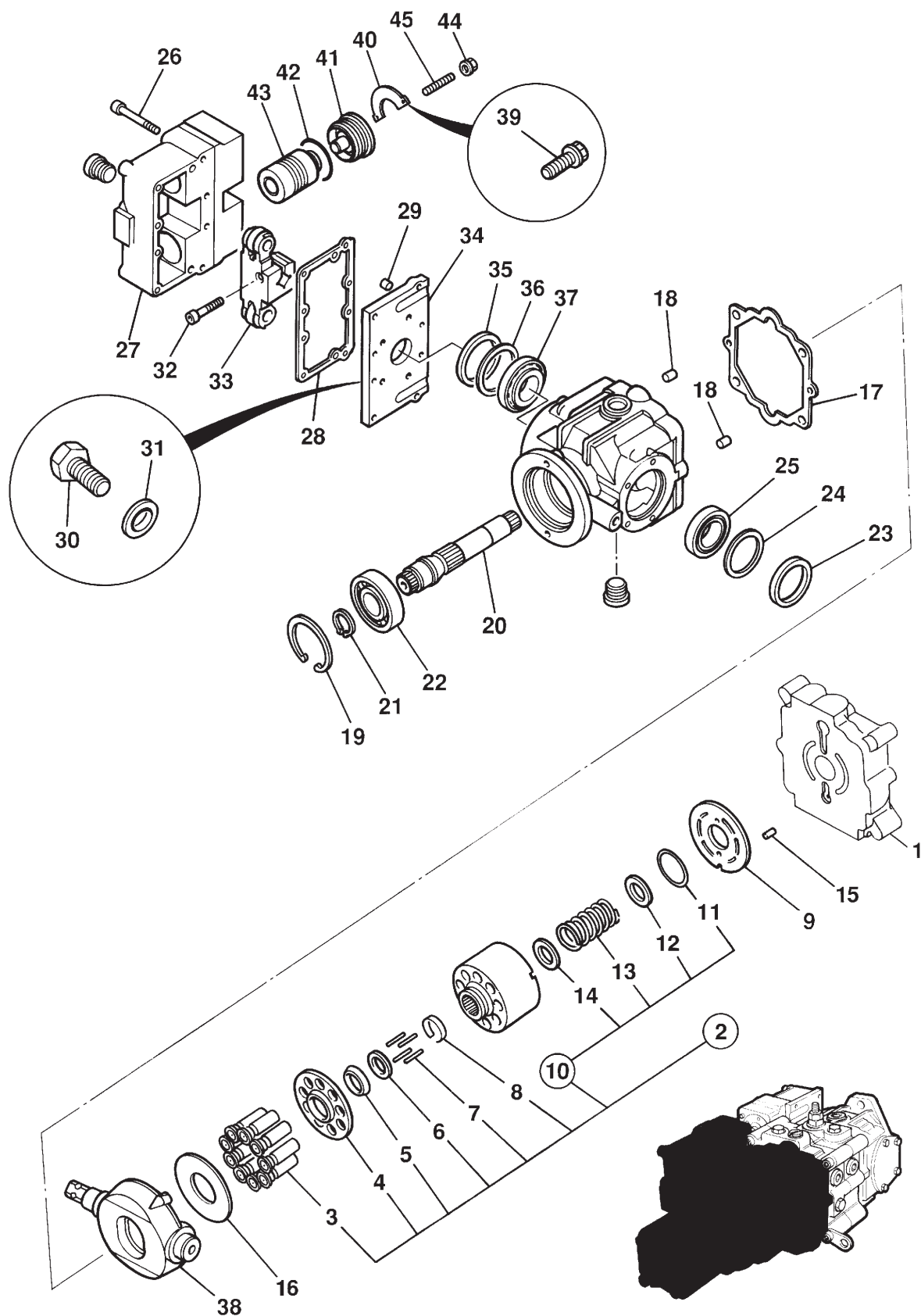
Torque tighten plug **14** to 54 - 135 Nm (40 - 100 lbf ft, 5.5 - 14 kgf m).

* Charge Pressure Checking and Adjustment

- 1** Stop engine. Connect a 0 - 40 bar (0 - 600 lb/in², 0 - 42 kg/cm²) pressure gauge into test point **X** situated underneath the pump.
- 2** Start engine and check pressure is as specified in Technical Data.
- 3** If the pressure is not as specified, stop the engine. Unscrew locknut **13** and turn adjuster **12** 4 turn at a time (clockwise to increase pressure) then re-tighten locknut. Start engine and re-check pressure. Continue procedure until pressure is correct then remove pressure gauge.



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168160

* Hydrostatic Pump up to machine no. 751011

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling. For assembly the sequence should be reversed.

Note: Only one pump is shown but the second pump is a mirror image of this.

Protect all exposed sealing surfaces and open cavities from damage and foreign material.

Mark the position of control linkage **33** before removing it from the swash plate **38**. Retain shims **36** as a set.

All gaskets and 'O' rings should be renewed on reassembly. Lightly lubricate all 'O' rings with clean vaseline prior to assembly.

During assembly, shims **36** should be held in position with grease until plate **34** is in place.

Torque tighten bolts **30** (4 off) to 24 - 30 Nm (18 - 22 lbf ft, 2.5 - 3.0 kgf m).

Fault Finding up to machine no. 751011

Machine veers to one side when travelling.

This condition may be corrected by adjusting the pump servo units but before attempting this, carry out the following preliminary checks.

Check tyre pressures and condition

The pressure of one tyre may be low or one or both tyres on one side of the machine may be new and the other tyres worn. In both these cases the rolling circumference of the tyres will be unequal causing the machine to veer to one side.

Check chain tension

Chains which are tensioned unequally will cause the machine to veer to one side. Always adjust the tension on all four chains, never just one.

Check brake release pressure, seal failure

Low pressure or faulty seals may cause the brake to drag on one side. Check the pressure at the anti-stall valve. Check the seal by using a hand pump to release the brake and see if the pressure holds.

Check the drive joystick

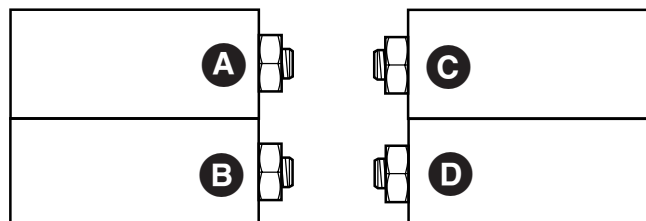
Check that the joystick spools are not sticking and are correctly operated by the lever.

Note: If the fault cannot be rectified by any of the above checks or adjustment, then either the pump or motor could be faulty. To identify which, swap the motor feed hoses at the pump. If the machine now veers in the opposite direction then the pump is faulty. If the machine continues to veer in the same direction the the motor is faulty.

Servo unit adjustment

The diagram shows the main pump servo units when viewed from the right hand side of the machine.

Note: On standard machines the servo unit adjuster screws are normally set to allow 5 mm gap when pump piston is at full swash. Therefore to limit piston travel it is necessary to screw in the grub screws by approximately 5 mm before adjustment can take place. On High-flow machines there is no gap between the adjuster screws and the pump piston.



If the machine does not travel in a straight line, proceed as follows:

Fault

1	Machine veers excessively to left in forward travel	Loosen locknut on adjuster screw D , screw in grub screw approx. 5 mm ($\frac{3}{16}$ in) and tighten locknut. Try machine. Keep adjusting $\frac{1}{2}$ turn at a time until straight line travel is achieved.
2	Machine veers excessively to right in forward travel	Proceed as for fault 1 but adjust screw A .
3	Machine veers excessively to left in reverse travel	Proceed as for fault 2 but adjust screw C .
4	Machine veers excessively to right in reverse travel	Proceed as for fault 3 but adjust screw B .

Fault Finding up to machine no. 751011

Machine moves when drive control is in neutral.

This may be caused by the neutral setting of the pump being incorrect but before assuming this check that the joystick spools are not sticking and are being correctly operated by the joystick lever.

WARNING

The following procedure requires the machine to be disabled (wheels raised off the ground, work function disconnected etc.) while the work is carried out.

HYD 8-1/1

Place the machine safely onto blocks, so that all four wheels are clear of the ground. Ensure that the machine is stable.

Position the operator's seat facing forwards so that the brakes are released.

Start engine and note which pair of wheels is turning. This will indicate which pump is not returning to neutral. Note that pump P1 (nearest the engine) feeds the left hand motors and pump P2 the right hand motors.

The neutral adjustment can be made by rotating the outer adjustment ring **E** on each pair of servo units. Note that any adjustment to one servo unit must be countered by an equal adjustment, in the opposite direction, of the other servo unit of the same pump.

Travel Speed

The maximum speed of the machine should be checked following the above adjustments. This involves raising the machine off the ground and checking the wheel speeds using a stroboscopic meter.

Note that excessive wheel speed may result in cooling problems as the hydraulic oil may overheat.

WARNING

The following procedure requires the machine to be disabled (wheels raised off the ground, work function disconnected etc.) while the work is carried out.

HYD 8-1/1

Place the machine safely onto blocks, so that all four wheels are clear of the ground. Ensure that the machine is stable.

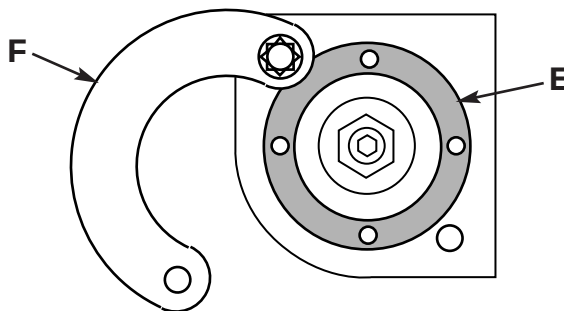
Position the operator's seat facing forwards so that the brakes are released.

Remove one locking plate screw and slacken the other screw then swing the locking plate **F** clear. Adjust as outlined in the following table. Refer to illustration on previous page.

Wheel Movement	Servo units to be adjusted
R. H. forwards	Screw B out and A in
R. H. backwards	Screw A out and B in
L. H. forwards	Screw C out and D in
L. H. backwards	Screw D out and C in

Turn each adjustment ring **E** one quarter turn at a time and recheck wheel movement. Always turn one adjustment ring out before turning the opposite ring in.

When adjustment is complete, re-assemble locking plates and re-stake.



Stick a piece of reflective tape on a wheel rim. Start the engine and run at maximum speed then operate the drive control. Measure the speed of wheel rotation in each direction which should be 81 rev/min. An allowance of 2% above this figure is permissible. Check the speed of the wheels on the opposite side of the machine.

If necessary the appropriate adjusting screws should be screwed in $\frac{1}{2}$ turn at a time until the correct wheel speed is achieved. Stop the engine while adjustment is carried out.

If the left hand wheels are rotating too fast screw in adjusters **C** and **A** (see illustration on previous page). Both adjusters must be turned by equal amounts to maintain straight line travel.

If the right hand wheels are rotating too fast screw in adjusters **D** and **B** by equal amounts.

Hydrostatic Pump from machine no. 751012

Dismantling and Assembly

Following a complete rebuild of this pump it is necessary for it to be set up on a dynamic test jig. Because of this it is recommended that no dismantling work is carried out beyond that covered in the following pages.

Shaft Seal

Removal and Replacement

- 1 Remove circlip **1**.

Note: It may be necessary to press shaft **2** into the body against spring force before the circlip can be removed. When the circlip is removed, seal carrier **3** will move out approximately 6 mm (0.25 in.) due to spring force.

- 2 Lightly tap the end of shaft **2** with a rubber mallet and remove seal carrier **3**.

Note: After the seal carrier has been removed, the shaft **2** and bearing assembly **4** are free in the body. Under no circumstances should the shaft be removed as this could cause loss of alignment of the pump internals necessitating a total strip and rebuild. Such a procedure is outside the scope of this Service Manual.

- 3 Remove O-ring **5** from seal carrier **3**. Discard the O-ring.

- 4 Using a suitable press, press out lip seal **6** from the seal carrier. Discard the lip seal.

- 5 Inspect seal carrier **3** for damage, and the sealing area on shaft **2** for signs of rust, wear or contamination. Polish the sealing area on the shaft if necessary.

- 6 Coat the outside diameter of new lip seal **6** with suitable sealant. Press the lip seal into the shaft bearing side of seal carrier **3**, ensuring that the seal lip faces the shaft bearing. Take care not to damage the lip seal.

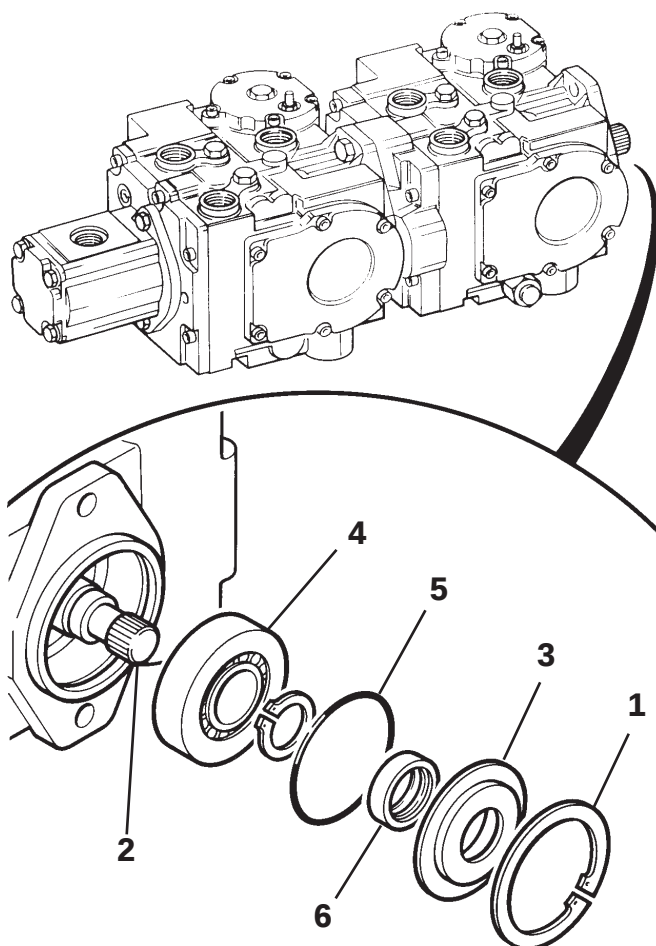
- 7 Lubricate the inside diameter of lip seal **6** with petroleum jelly.

- 8 Install new O-ring **5** onto seal carrier **3** and lubricate with petroleum jelly.

- 9 Wrap the splined end of shaft **2** with thin plastic to prevent damage to the lip seal during installation.

- 10 Slide seal carrier **3** over shaft **2** and press into position in the pump body recess.

- 11 Holding inward pressure against shaft **2**, refit circlip **1** to secure the assembly.



Hydrostatic Pump from machine no. 751012

Charge Check and High Pressure Relief Valves

Dismantling and Assembly

The charge check and high pressure relief valves are identical. The procedure for dismantling and assembly is, therefore, the same for both valves.

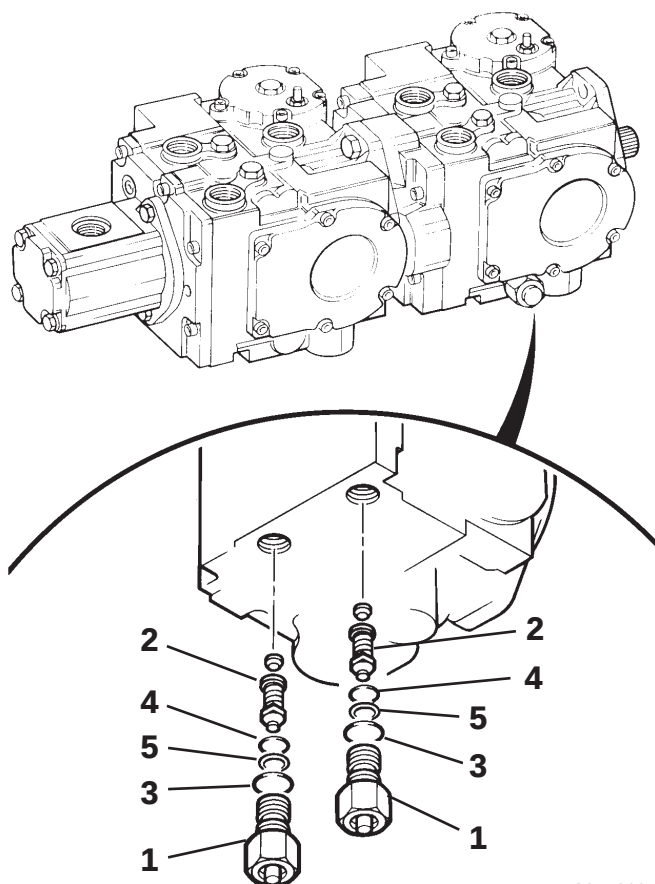
- 1 Unscrew plug **1** from the pump body.
- 2 Remove the relief valve assembly **2** from the body. The smaller end of the conical spring is crimped to retain it on the relief valve.

Note: The High Pressure Relief Valve is factory set and cannot be repaired.

- 3 Remove and discard O-rings **3** and **4**, and back-up ring **5** from plug **1**.
- 4 Inspect relief valve **2** and mating seat in plug **1** for damage. Replace if necessary.
- 5 Install a new outer O-ring **3**, new back-up ring **5** and new inner O-ring **4** on plug **1**.
- 6 Check that the conical spring is correctly retained on relief valve and install the valve in the pump body.

Note: The conical spring must be correctly retained on the relief valve to ensure satisfactory pump operation.

- 7 Refit plug **1** and torque tighten to 68 Nm (50 lbf ft).



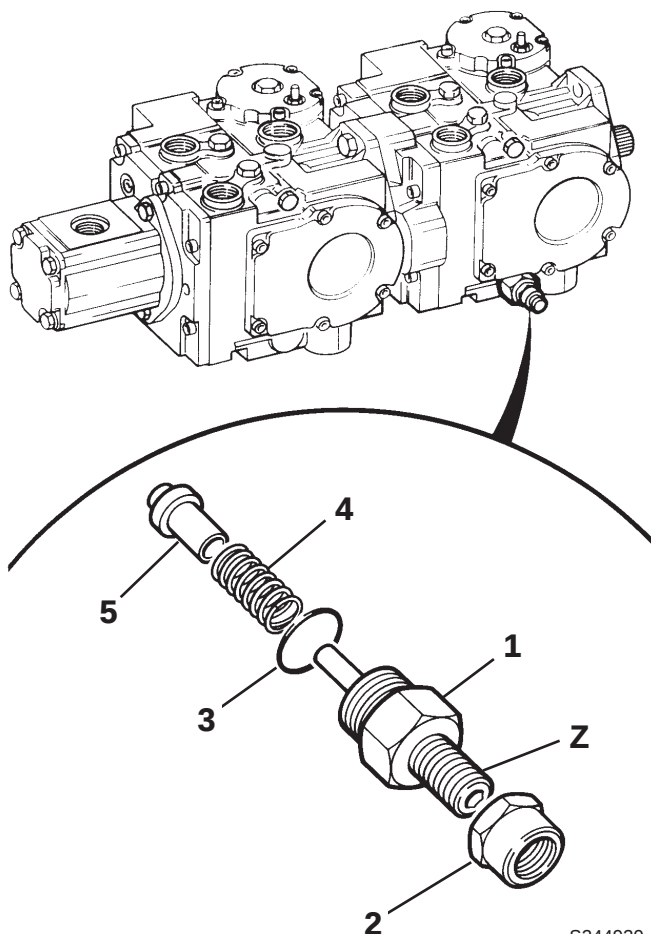
S244930

Hydrostatic Pump from machine no. 751012

Charge/Anti-stall Valve

Dismantling and Assembly

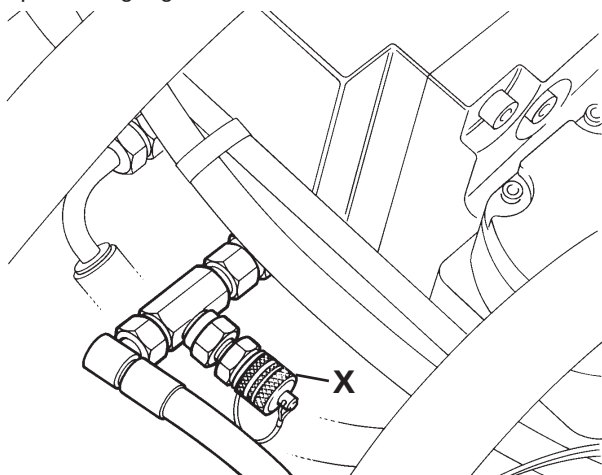
- 1 Mark the plug **1**, locknut **2** and the pump body so as to approximately maintain the original adjustment.
- 2 Loosen locknut **2** and unscrew plug **1** from pump body. Remove O-ring **3** from plug **1** and discard O-ring.
- 3 Remove spring **4** and poppet **5** from pump body.
- 4 Inspect poppet **5** and mating seat in pump body for damage. Renew as necessary.
- 5 Install a new O-ring **3** on plug **1**.
- 6 Fit poppet **5** and spring **4** into pump body.
- 7 Screw plug **1** complete with locknut **2** into pump body to align with the marks made during disassembly. Tighten the locknut.
- 8 Check the charge pressure and adjust as necessary.



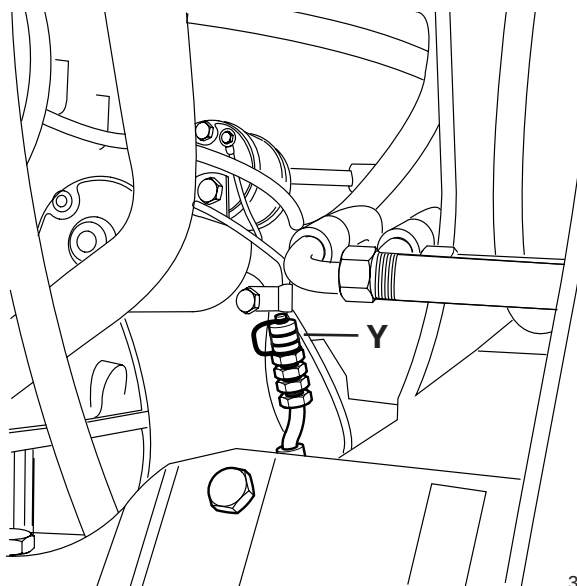
S244920

Charge Pressure Checking and Adjustment

- *1 Stop engine. Connect a 0 - 40 bar (0 - 600 lb/in², 0 - 42 kg/cm²) pressure gauge into the test point which up to machine no. 751715 is situated underneath the pump as shown at **X**. From serial no. 751716 the test point is positioned at the rear of the left hand side of the engine as shown at **Y**.
- 2 Start engine and check pressure is as specified in Technical Data.
- 3 If the pressure is not as specified, stop the engine. Unscrew locknut **2** and turn adjuster **Z** 1/4 turn at a time (clockwise to increase pressure) then re-tighten locknut. Start engine and re-check pressure. Continue procedure until pressure is correct then remove pressure gauge.



S246240



348890

Hydrostatic Pump from machine no. 751012

Pump Neutral Adjustment

This procedure may be carried out if the machine creeps when the drive joystick is in the neutral position. This fault may be due to an incorrect neutral setting of the servo piston. Before attempting any adjustment, carry out the following preliminary checks.

Check tyre pressures and condition

The pressure of one tyre may be low or one or both tyres on one side of the machine may be new and the other tyres worn. In both these cases the rolling circumference of the tyres will be unequal causing the machine to veer to one side.

Check chain tension

Chains which are tensioned unequally will cause the machine to veer to one side. Always adjust the tension on all four chains, never just one.

Check brake release pressure, seal failure

Low pressure or faulty seals may cause the brake to drag on one side. Check the pressure at the anti-stall valve. Check the seal by using a hand pump to release the brake and see if the pressure holds.

Check the drive joystick

Check that the joystick spools are not sticking and are correctly operated by the lever.

Note: If the fault cannot be rectified by any of the above checks or adjustment, then either the pump or motor could be faulty. To identify which, swop the motor feed hoses at the pump. If the machine now veers in the opposite direction then the pump is faulty. If the machine continues to veer in the same direction the the motor is faulty.

Adjustment procedure

WARNING

The following procedure requires the machine to be disabled (wheels raised off the ground, work function disconnected etc.) while the work is carried out.

HYD 8-1/1

Place the machine safely onto blocks, so that all four wheels are clear of the ground. Ensure that the machine is stable.

Position the operator's seat facing forwards so that the brakes are released.

1 Identify which pump section requires adjustment.

If the machine veers to the left this could be caused by either the right hand wheels moving forward or the left hand wheels moving in reverse. Remember that pump **P1** drives the left hand motor and pump **P2** drives the right hand motor.

If the machine moves either straight ahead or behind then both pump servos must be adjusted equally.

2 Stop the engine.

3 Remove the floor plates.

4 Loosen locknut **A** and turn the 'neutral' adjusting screw **B** 1/10 of a turn in the required direction then re-tighten the locknut.

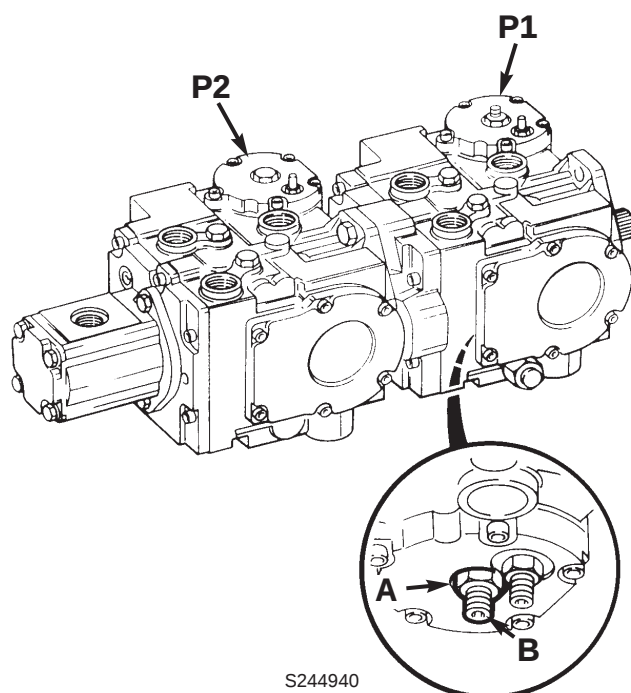
If the wheels are creeping forward, turn the adjusting screw in a clockwise direction (looking underneath the pump). If the wheels are creeping in reverse, turn the screw anti-clockwise.

Note: This adjustment is **very sensitive**. Turn the adjusting screw 1/10 of a turn at a time and re-check. A slight movement when the wheels are raised is acceptable provided that no movement occurs when the machine is resting on the ground.

5 Start the engine and check that the wheels are stationary.

6 Finally tighten locknut **A** to 23 Nm (17 lbf ft), taking care to retain the set position of adjusting screw **B**.

7 Re-check for wheel movement.



S244940

Fault Finding from machine no. 751012

Machine veers to one side when travelling.

If the machine does not travel in a straight line, proceed as follows:

Fault

1	Machine veers excessively to left in forward travel	Loosen locknut on adjuster screw A , screw in adjuster screw $\frac{1}{4}$ turn and tighten locknut. Try machine. Keep adjusting $\frac{1}{4}$ turn at a time until straight line travel is achieved.
2	Machine veers excessively to right in forward travel	Proceed as for fault 1 but adjust screw B .
3	Machine veers excessively to left in reverse travel	Proceed as for fault 2 but adjust screw C .
4	Machine veers excessively to right in reverse travel	Proceed as for fault 3 but adjust screw D .

Travel Speed

The maximum speed of the machine should be checked following the above adjustments. This involves raising the machine off the ground and checking the wheel speeds using a stroboscopic meter.

WARNING

The following procedure requires the machine to be disabled (wheels raised off the ground, work function disconnected etc.) while the work is carried out.

HYD 8-1/1

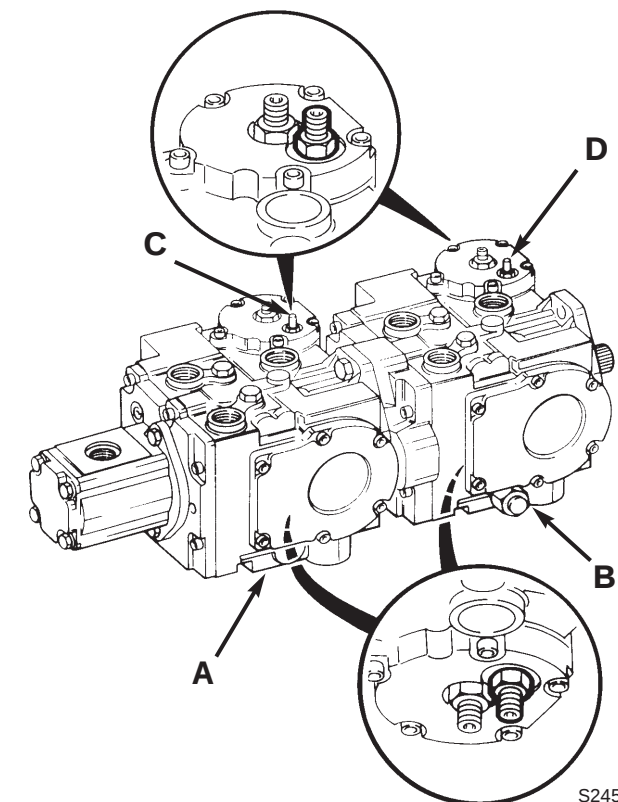
Place the machine safely onto blocks, so that all four wheels are clear of the ground. Ensure that the machine is stable.

Stick a piece of reflective tape on a wheel rim. Start the engine and run at maximum speed then operate the drive control. Measure the speed of wheel rotation in each direction which should be 81 rev/min. An allowance of 2% above this figure is permissible. Check the speed of the wheels on the opposite side of the machine.

Note that excessive wheel speed may result in cooling problems due to overheating of the hydraulic oil.

If necessary the appropriate adjusting screws should be screwed in $\frac{1}{4}$ turn at a time until the correct wheel speed is achieved. Stop the engine while adjustment is carried out.

If the left hand wheels are rotating too fast in forward or reverse, screw in adjusters **B** (forward) or **D** (reverse) to achieve the correct speed. If the right hand wheels are rotating too fast, screw in adjusters **A** (forward) or **C** (reverse).



S245710

Checking for Faulty Pump or Motor

If the transmission operates or is faulty on one side only then swop the motor feed hoses to check if the fault is with the pump or motor. If, after the hose swop, the suspect motor then operates the fault lies in the relevant pump unit. If the motor still does not operate then the motor itself is faulty.

Proceed as follows:

- 1 Stop the engine.
- 2 Remove the front floorplate to expose the pump.
- 3 To ensure correct replacement after the test is complete, mark the motor feed hoses **A** and **B** for the left hand motor, **C** and **D** for the right hand motor.
- 4 Swop the motor feed hoses from one side to the other as indicated in the illustration, i.e. swop hoses **A** and **C** then swop hoses **B** and **D**.

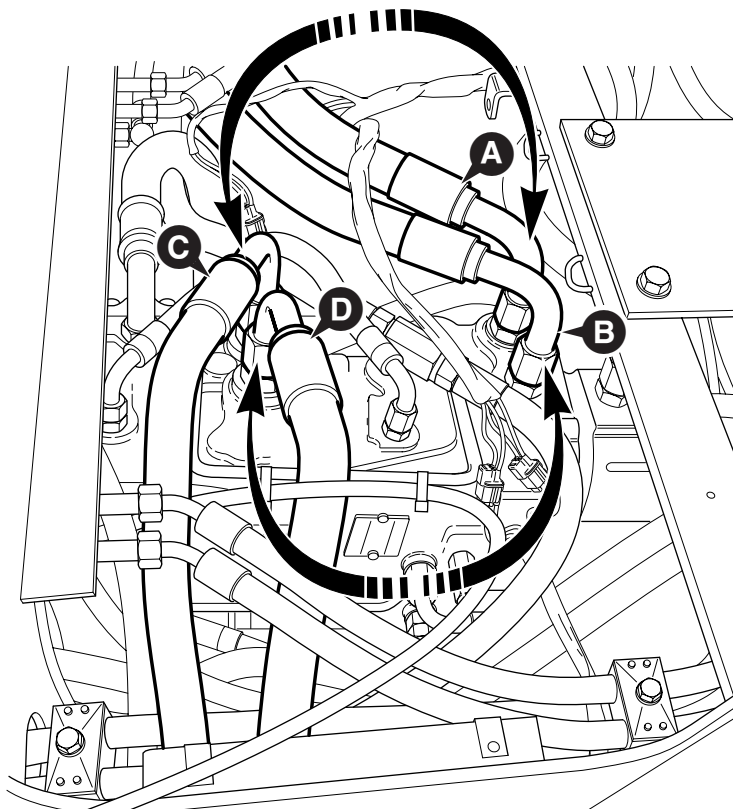
- 5 Restart the engine and re-check the operation of left and right motors. Note that when the left motor is selected the right motor should now drive and the left motor should drive when the right motor is selected. If the previously faulty motor now functions then the fault lies in the relevant pump unit. If the motor still does not operate then the motor itself is faulty.

WARNING

Hydraulic Fluid

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 immediately.

INT-3-1-10/1



422980

Checking Motor Leakage Rate

If the motor speed is low and the pump output is normal, the cause could be excessive internal wear in the motor which would result in high leakage of oil into the motor casing. By measuring the amount of oil leaking from the motor casing back to tank, it is possible to determine if the motor is worn.

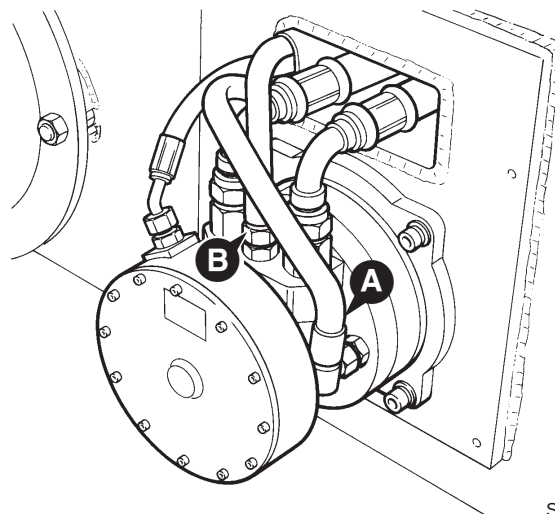
The leakage test should be done on both left hand and right hand motors so that their leak rates can be compared. If the motors have similar test results it is likely that they are not faulty (both are supplied with oil from the same source). If both have test results outside the range quoted the fault is probably somewhere other than in the motors.

Note: The following test must be done only with forward selected. Due to the internal design of the motors, the leakage rate is higher in reverse than in forward.

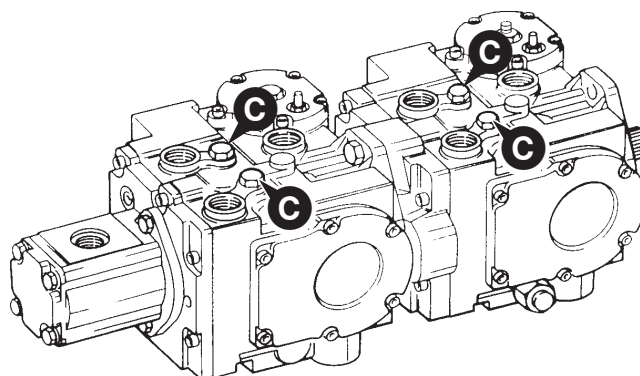
- 1 Stop the engine.
- 2 Remove the motor covers.
- 3 Connect a flowmeter into the motor drain hose **A**.
- 4 Disconnect and plug motor flushing line **B**. This is important otherwise a true leakage rate cannot be obtained.
- 5 Install a 0 - 400 bar (0 - 6000 lb/in², 0 - 422 kg/cm²) pressure gauge into the appropriate test point **C** on the pump to measure the pressure generated in the motor feed line.
- 6 Start the engine and, with the parking brake ON, operate the motor forward service. Measure the amount of oil expelled from the motor during one minute's operation and compare with the figures shown in the table below.

Note: If the parking brake will not hold the machine sufficiently to achieve the necessary line pressure, the machine should be driven against a solid, immovable object as shown at **D**.

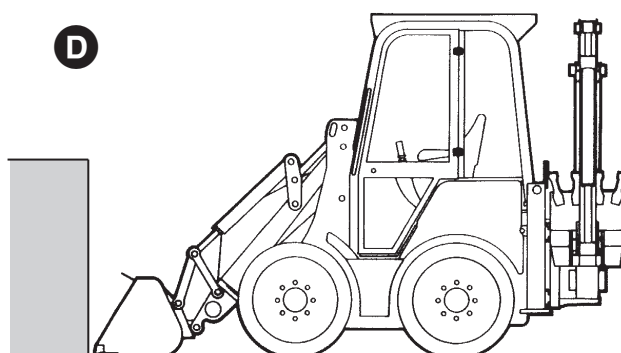
If the flow rate is higher than normal, the motor should be dismantled for repair as the distributor seals are probably worn.



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Average motor leakage rate

	Pressure - bar (lb/in ²)						
	20 (290)	50 (725)	100 (1450)	150 (2175)	200 (2900)	300 (4350)	400 (5800)
l/min (UK gal/min)	2.2 (0.48)	2.3 (0.50)	2.4 (0.53)	2.8 (0.62)	3.00 (0.66)	3.7 (0.81)	4.00 (0.88)
US gal/min	0.58	0.60	0.64	0.74	0.79	0.97	1.06

Checking the Joystick Hydraulic Lines

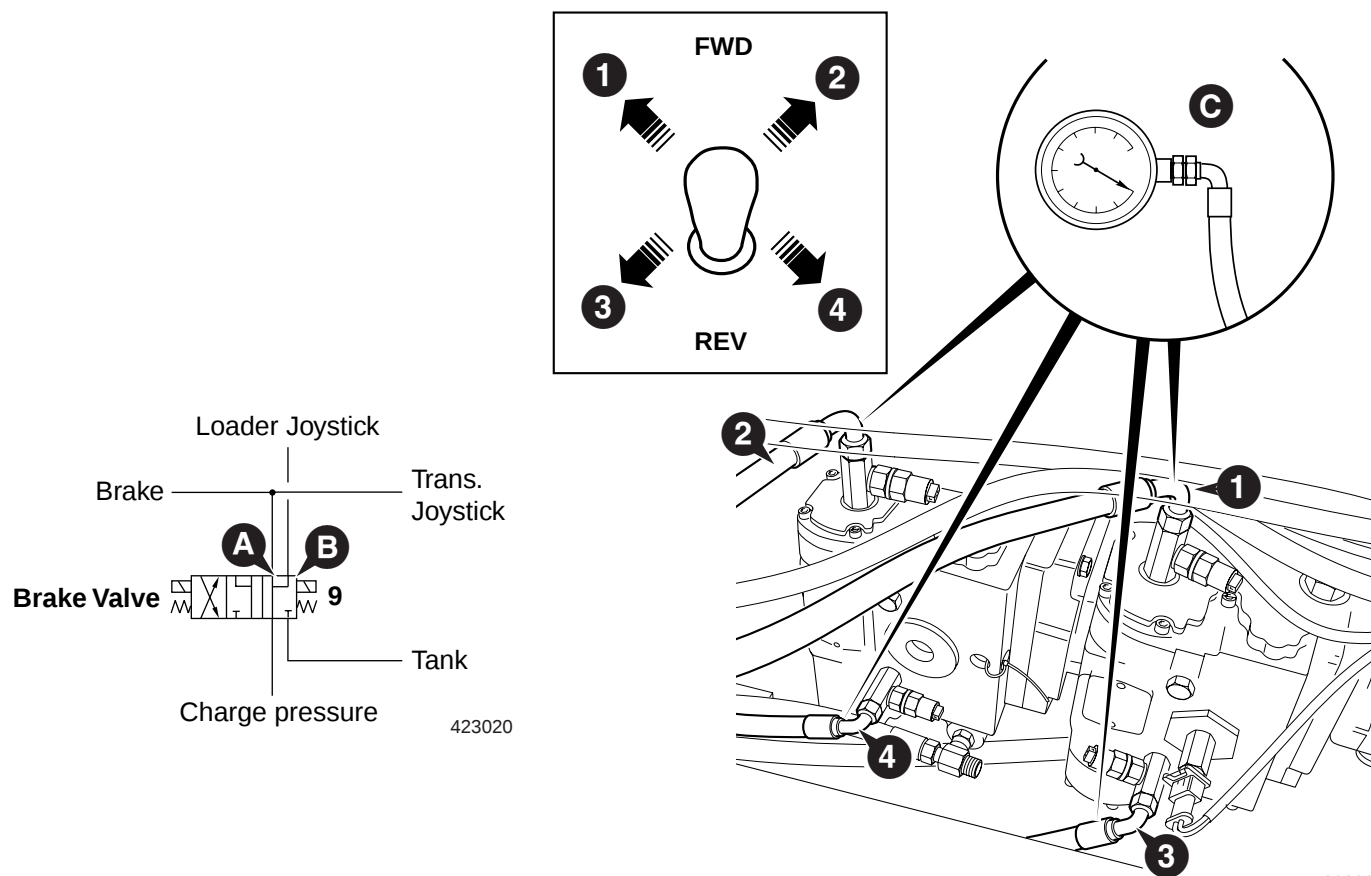
If the machine does not respond to joystick movements, check the hydraulic supply to and from the joystick as follows:

WARNING

The following procedure requires the machine to be disabled (wheels raised off the ground, attachment disconnected etc.) while the work is carried out.

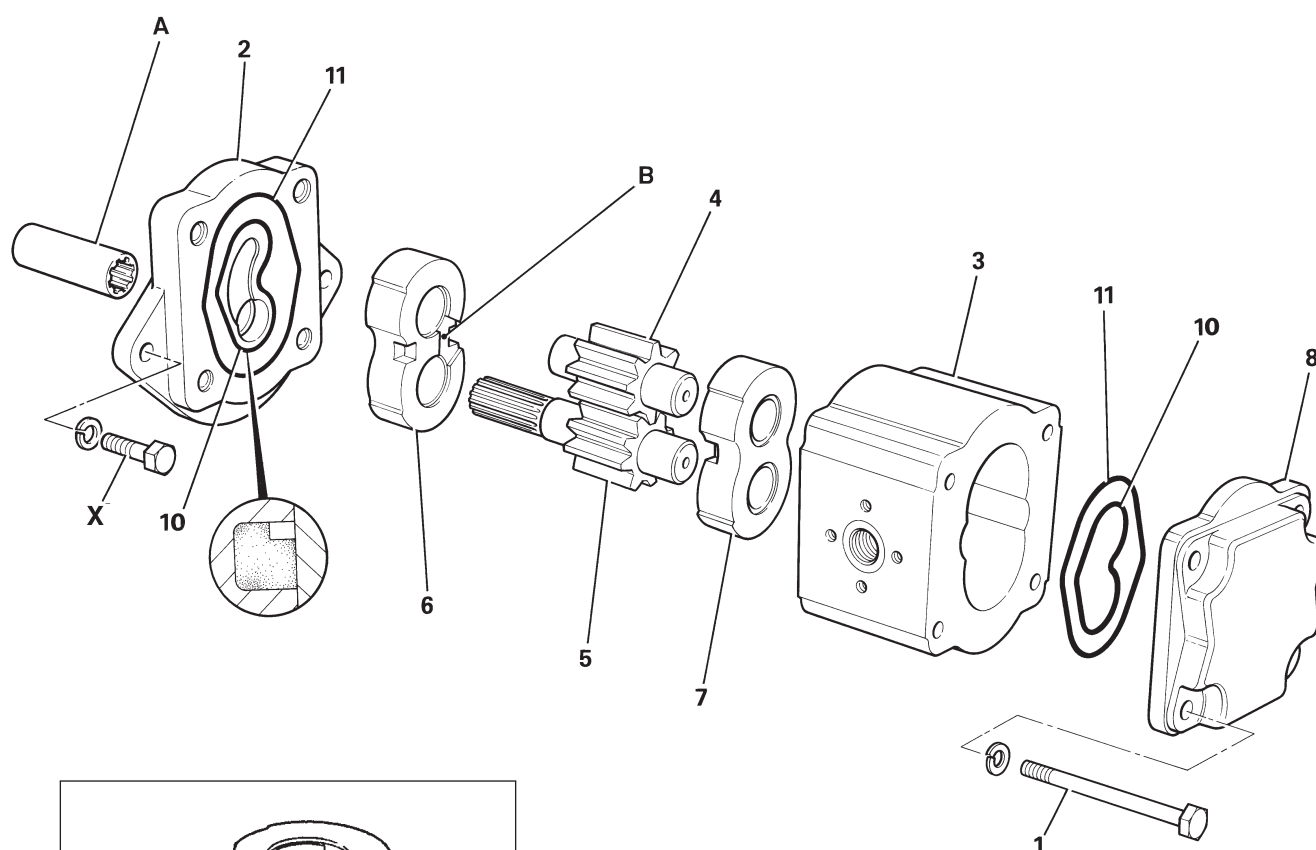
HYD 8-1/2

- 1 Raise and block the machine so that the wheels are clear of the ground. Stop the engine. Make sure the machine is stable.
- 2 Remove the front floorplate to access the hose connections.
- 3 Insert a tee piece and 0 - 40 bar (0 - 600 lb/in², 0 - 42 kg/cm²) pressure gauge into the joystick supply hoses at the brake valve at positions **A** and **B**.
- 4 Start the engine and observe the gauge reading which should show the transmission pump charge pressure (see Hydraulics Technical Data). Make sure the brake valve is selected.
- 5 If the gauge shows no or little pressure it could indicate a fault in the charge pressure relief valve in the hydrostatic pump or the pressure reducing solenoid valve.
- 6 If the supply pressure is correct, check the feed hose to the joystick for blockage.
- 7 Remove the tee piece and gauge and connect into each servo feed line in turn, as shown at **C**.
 - 1 Right hand side forward
 - 2 Left hand side forward
 - 3 Right hand side reverse
 - 4 Left hand side reverse
- 8 Start the engine and move the joystick lever fully in the appropriate direction to pressurise the relevant hose. The joystick positions shown are for single lever operation.
- 9 The pressure gauge should show transmission pump charge pressure with full joystick travel (see Hydraulics Technical Data).
- 10 If any readings are not correct, check the hoses for blockage. If the hoses are clear the joystick should be dismantled for repair.

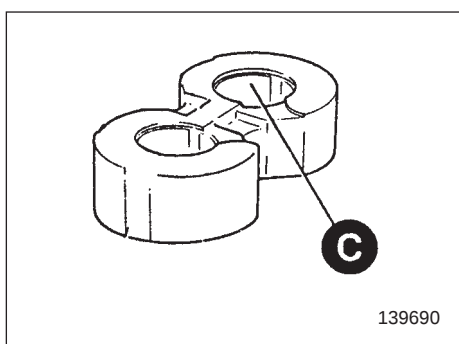


423020

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139690

Auxiliary Pump (Standard machines)

Removal and Replacement

Remove bolts **X** and lift the pump away from the main pump unit.

On replacement, torque tighten the bolts to 77 Nm (57 lbf ft, 7.9 kgf m).

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

Dismantling

Remove coupling **A** if still fitted.

Hold the body in a soft jawed vice with the mounting flange uppermost. Mark all parts to ensure correct alignment when assembling. Discard all seals and sealing rings.

Clean all parts in light aromatic kerosene, examine for damage and wear.

Damaged or worn parts must be renewed.

Inspection

It is normal for the gears to have cut a slight track in the body bore on the inlet side. The gear track wear can not be measured accurately but will be related to bearing wear. Examine the bearing bores **C** which are coated during manufacture with PTFE. If the grey PTFE is worn through so that the bronze base is visible, the complete pump must be renewed.

Renew the pump if the bearings are scored or if the gear side faces are chipped or damaged. DO NOT use any abrasives on the bearings or gears as this would destroy critical manufacturing dimensions.

Assembly

Fit the pressure loading ring/backing ring **10** and sealing rings **11** to the flange **2** and cover **8**. A little grease (JCB MPL Grease) in the grooves will help retain them.

Hold the flange **2** in a soft jawed vice with the sealing rings facing upwards and assemble the body **3**. Ensure that the body cut-in track corresponds to the inlet side of the flange.

Assemble the gear/bearing pack components **4**, **5**, **6** and **7** separately. It is important to return the flange end bearing **6** to the flange end of the unit, otherwise internal leakage can occur due to bedding in. Ensure that the bearing face recesses **B** are adjacent to the gear faces and that the relieved radii are both towards the pump outlet.

Lightly lubricate the body bore and bearings, then push the gear/bearing pack into the body.

Fit the cover **8**, ensuring the inlet side is in the correct position. Torque tighten bolts **1** to 61 - 68 Nm (45 - 50 lbf ft, 6.2 - 7.0 kgf m).

If the inlet adapter is disturbed, fit a new 'O' ring and tighten to 115 - 145 Nm (85 - 107 lbf ft, 11.7 - 14.8 kgf m). Do not overtighten.

* If the outlet adapter is disturbed, clean the threads and apply JCB Threadlocker and Sealer to two of the threads. Tighten to 95 Nm (70 lbf ft, 9.7 kgf m). Do not overtighten.

When refitting the auxiliary pump to the Hydrostatic pump, tighten mounting bolts to 77 Nm (57 lbf ft, 7.9 kgf m).

Testing

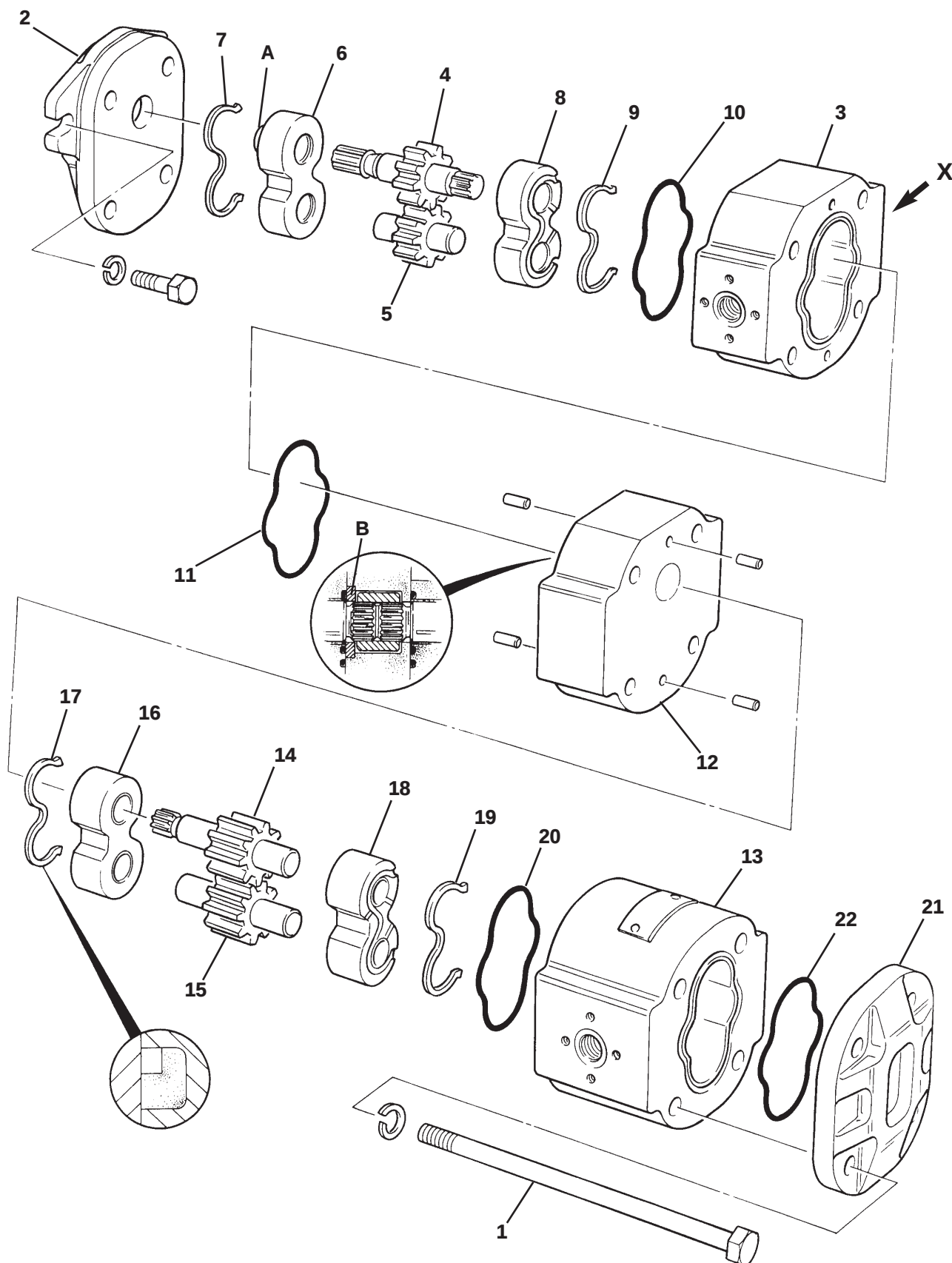
Install the pump onto a suitable test rig and test as follows.

Test Data

Oil Viscosity	40 - 45 cSt at 50 °C, (122 °F)
Oil Temperature	45 - 50 °C (113 - 122 °F) at pump inlet
Test Speed	1500 rev/min nominal

Run pump initially off load and check for leaks. Increase pressure in stages of 40 bar (600 lb/in², 40 kg/cm²) and allow to run for 1 minute at each stage. This will allow components to readjust and flow readings will indicate if re-build is correct. Check pump output under the following conditions.

Pressure	230 bar (3335 lb/in ² , 230 kg/cm ²)
Minimum Flow	22 l/min (4.8 UK gal/min, 5.8 US gal/min)



291090

Auxiliary Pump (High-flow machines)

Dismantling and Assembly

Note: Before removing and dismantling the pump, check flow and pressure. If either of these is low, renewal of components such as gears, bearings and housings will not effect a permanent cure. If the pump output is satisfactory but there is external leakage, the pump may be removed and dismantled for re-sealing only.

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

When Dismantling

Mark housings and covers to ensure correct re-assembly.

Keep bearing blocks **6, 8, 16, 18** and gears **4, 5, 14** and **15** together in sets to ensure refitting of the bearing blocks in their original positions.

Extended bush **A** in bearing block **6** is a light push fit in flange **2**.

DO NOT remove plug **B** as it is an interference fit, assembled to a critical dimension.

Inspection

Wash all components then apply hydraulic oil immediately afterwards to prevent moisture from collecting.

It is normal for the gears to have cut a slight track in the body bore on the inlet side. The gear track wear cannot be measured accurately but will be related to bearing wear. Examine the bores of the bearing blocks **6, 8, 16** and **18** which are coated during manufacture with PTFE. If the grey PTFE is worn through so that the bronze base is visible, the complete pump must be renewed.

Renew pump if faces of bearing blocks are scored or if side faces of gears are chipped or damaged. DO NOT use any abrasives on the bearing blocks or gears as this would destroy critical manufacturing dimensions.

When Assembling

Renew all seals. Hold them in position with grease during assembly. Ensure that the ends of seals **7, 9, 17** and **19** do not overhang the bearing blocks to become trapped in the housings.

Bearings must be assembled with cast recesses (not seal grooves) against gear faces and with seal ends towards the inlet side of the pump.

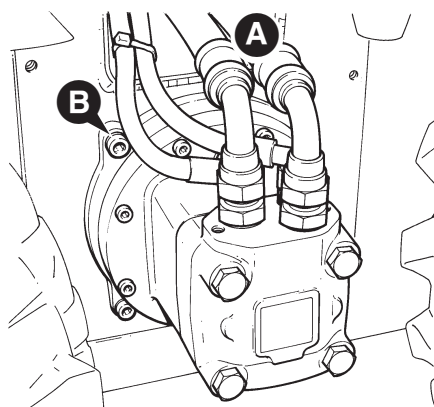
Lightly lubricate threads of bolts **1** and finger tighten only.

Hold flange **2** in a vice and apply a force of 200-250 N (45-55 lbf) to body **3** at position indicated by arrow **X** (within 10 mm [0.4 in] of the flange). Whilst maintaining this force, torque tighten bolts **1** in a diagonal sequence. This procedure is necessary to ensure metal to metal contact between front bearing lobes and inlet side of body.

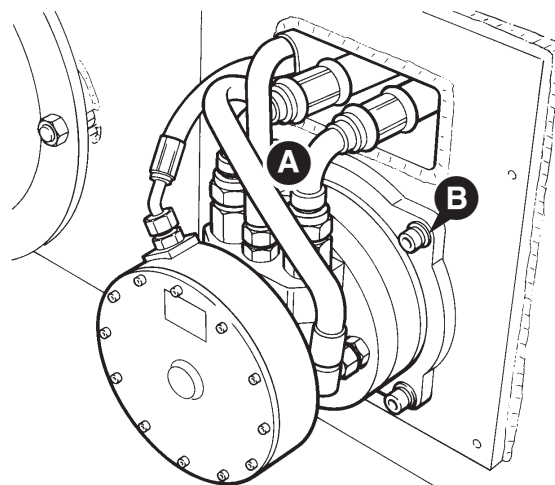
Torque tighten bolts **1** to 61 - 68 Nm (45 - 50 lbf ft, 6.2 - 7.0 kgf m).

If the inlet adapters are disturbed, fit new 'O' rings and tighten to 115 - 145 Nm (85 - 107 lbf ft, 11.7 - 14.8 kgf m). Do not overtighten.

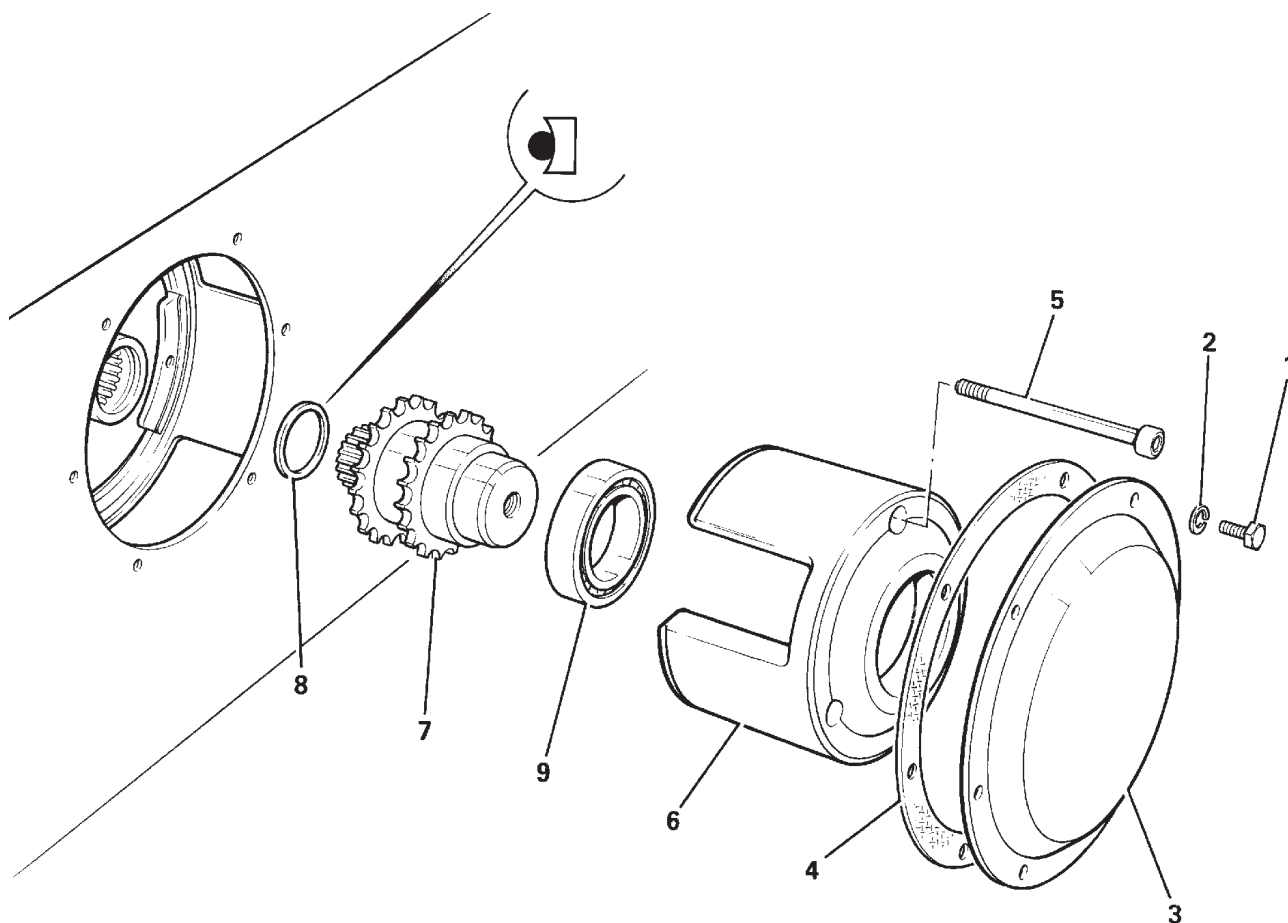
* If the outlet adapters are disturbed, clean the threads and apply JCB Threadlocker and Sealer to two of the threads. Tighten to 95 Nm (70 lbf ft, 9.7 kgf m). Do not overtighten.



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S246250



205150

Removal and Replacement

WARNING

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

INT-1-3-6

The removal of the drive motors can be divided into two sections: removal of the motors themselves and removal of the drive sprockets and chains.

Removal of the Drive Sprocket

On machines up to serial number 751817, remove the roadwheels (see page F/1 - 1).

Remove the front floorplates (see page B/1 - 1). From the inside of the chassis, remove bolts **1** (6 off) and washers **2** (6 off). Take off cover **3**, remove and discard gasket **4**. Turn both stub axles until the drive chains are at their slackest (see page F/1 - 2).

On machines up to serial number 751817, remove bolts **5** and withdraw spider **6**. Draw out sprocket **7**, then remove and discard oil seal **8**. Examine the condition of bearing **9**. Do not remove it unless it is to be renewed.

On machines from serial number 751818 the spider assembly is no longer fitted, the sprocket being splined directly onto the motor shaft.

Removal of Motor

The left hand illustration shows the motor installation up to machine number 751011. The right hand illustration shows machines from serial number 751012

On machines up to serial number 751817, remove the drive sprocket as previously described.

On machines from serial number 751818 the sprocket is splined directly onto the motor shaft therefore it is not necessary to remove the sprocket or disturb the hubs and chains.

Remove the motor cover. Disconnect the hydraulic hoses **A** from the motor. Plug exposed connections. Withdraw capscrews **B** (4 off). The motors can now be lifted clear.

Replacement

Replacement is the reversal of the removal procedure.

Note: The motors fitted from machine number 751012 are constructed differently for left and right hand operation and this is indicated on the serial number plate. Due to the installation on this machine the actual position may be opposite to that indicated on the motor, i.e. a motor marked for left hand operation would be fitted to the right hand side of the machine and vice versa. However on machines built around May 1997 onwards the motors are correctly marked. Refer to the parts catalogue for the correct motor.

Renew all seals and 'O' rings.

* Apply JCB Threadlocker and Sealer to bolts **5** before fitting. Apply JCB High Strength Retainer to capscrews **B** before fitting.

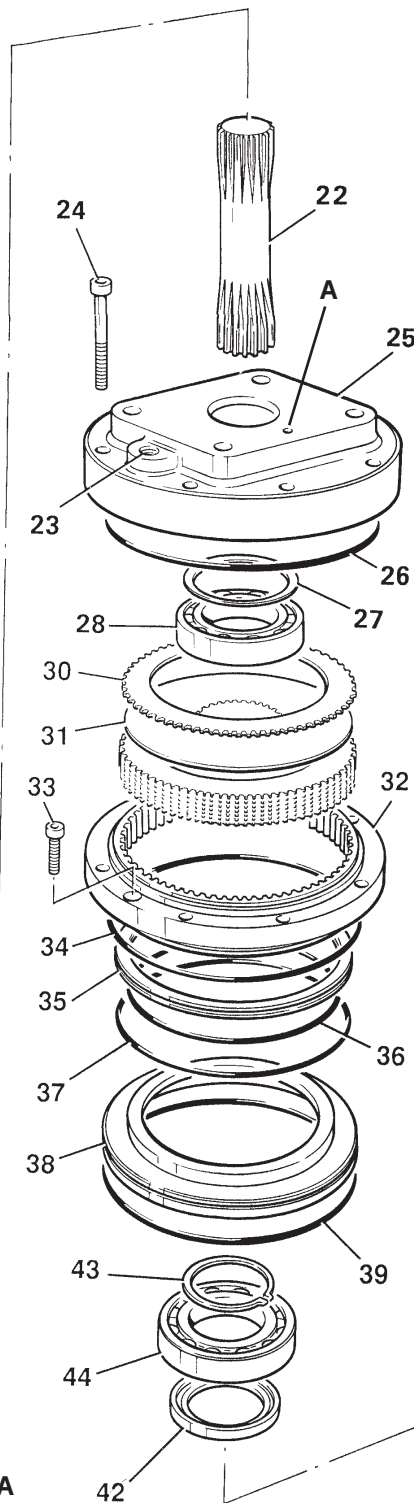
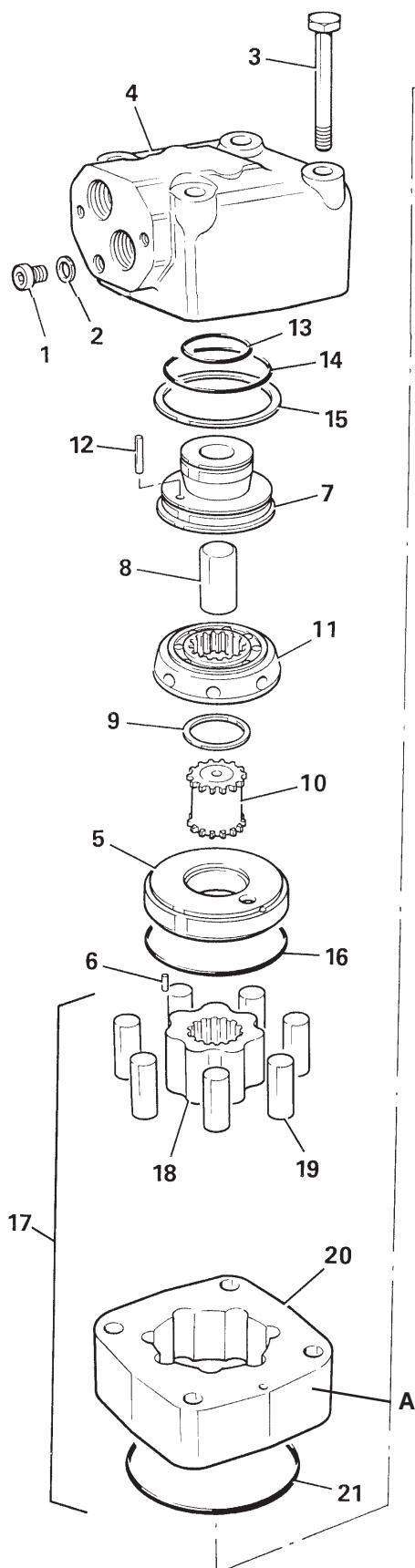
* **Note:** On machines after serial number 751476 capscrews **B** are increased in size to M12. Earlier machines may be fitted with the larger capscrews if required, see Technical Information Bulletin 1/008.

On machines after serial number 751818 capscrews **B** are further increased in size to M14. These have since been changed to M14 setscrews with hardened plain washers and no spring washer. The setscrews and hardened washers may be fitted as complete sets to earlier machines in place of the M14 cap screws, plain and spring washers.

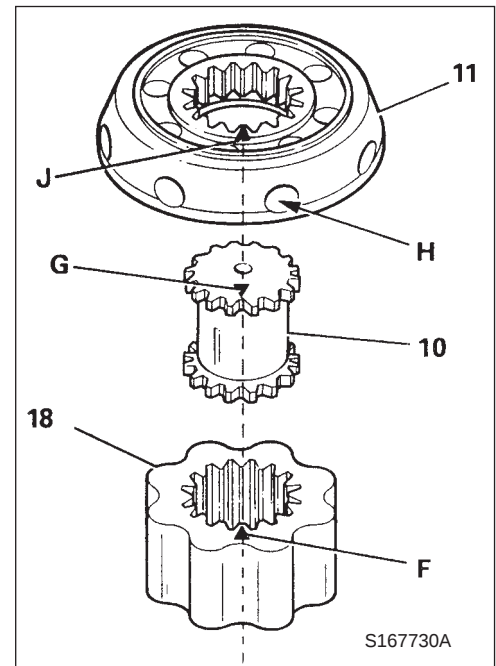
On machines up to serial number 751817, adjust the drive chain tension (see Section 3 - **Routine Servicing**) before fitting motor cover **3**.

* Torque Settings

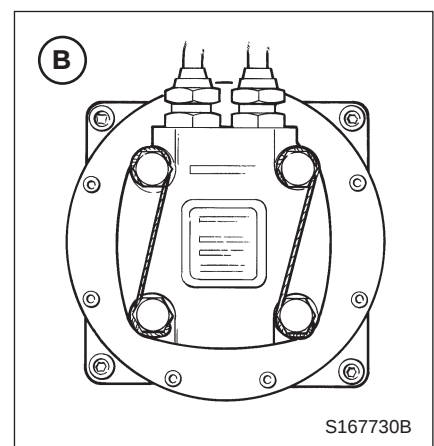
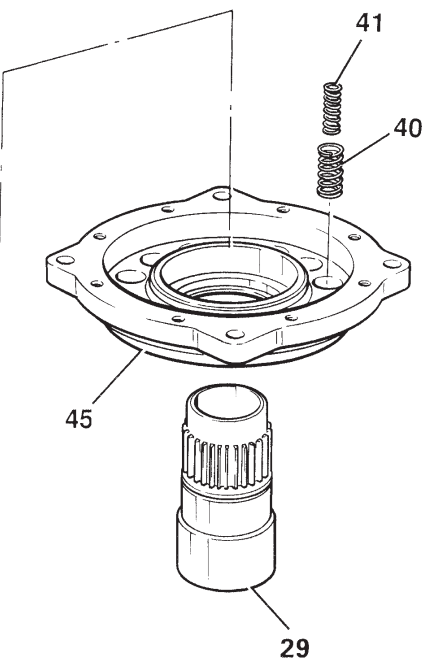
Item	Nm	lbf ft	kgf m
1 Bolts M8 x 16 (6 off)	28	21	2.9
5 Cap screw M10 x 100 (3 off)	56	42	5.8
A Hydraulic Connections	44-50	33-37	4.6-5.1
B Cap screw M10 x 30 (8 off)	56	42	5.8
B Cap screw M12 x 30 (8 off)	98	72	10
B Cap screw M14 x 35 (8 off)	220	162	22.4
B Setscrew M14 x 35 (8 off)	220	162	22.4



167730



S167730A



S167730B

Dismantling and Assembly

The numerical sequence shown is a guide to dismantling. For assembly the sequence should be reversed.

Dismantling

Note: Later motors are fitted with Eslock type bolts **3** which are wirelocked. When early motors are dismantled the later type bolts must be fitted and wirelocked. The bolts must always be renewed whenever a motor is dismantled. New bolts and lockwire are supplied as part of the replacement seal kit.

Note: To gain access to the brake only, remove bolts **24**, do not disturb bolts **3**.

After removing plug **1** and washer **2**, place the unit in a holding tool or jig with housing **4** uppermost.

Mark relative positions of housings **4** and **25** and outer gear **20** to ensure correct position on re-assembly.

Housing **4** and channel plate **5** should be removed together and placed on a clean area of the bench. Remove guide pin **6** before separating the channel plate from the housing.

To remove the balance plate **7** from housing **4**, first remove spacer **8**, then fill the hole with grease (to act as a hydraulic piston). Press a mandrel into the hole and force out the balance plate.

Before removing inner gear **18** mark its position in the outer gear **20** to ensure that it is returned the same way upon assembly.

Keep all parts of the gearwheel set **17** together after removal. Do not mix gearwheel parts from different motors.

Before dismantling the brake assembly, seal the hydraulic port **23** to prevent ingress of dirt. Mark the position of the flanges to ensure correct assembly.

Keep brake friction plates **30** and discs **31** together as a set.

Discard all seals and 'O' rings. Any bearings removed must be renewed. Clean all parts in low aromatic kerosene.

Note: Fretting between the housing flanges is acceptable provided that components are assembled in the same relative positions.

Assembly

***Note:** Soak new brake plates in oil for 1 hour before assembly.

Before assembling, lubricate all parts with oil. Grease all seals and 'O' rings with Vaseline.

Ensure bearing **44** is pressed fully onto the shoulder of shaft **29**.

When fitting bolts **24**, tighten them in sequence to avoid tilting the bearing **28**.

Do the following to ensure correct alignment of the gearwheel set components:

- a** Mark any spline peak on the inner gear **18** that lies across a valley of the lobes as at **F**.
- b** Mark the bottom of a spline tooth on the valve drive **10** as at **G**.
- c** On disc valve **11** select a trough aligning with any outer hole (eg. **H**) and mark the next peak to the left as at **J**.
- d** When the disc valve **11**, valve drive **10** and inner gear **18** are assembled, all marks must align.

Note: Failure to follow the above procedure could result in the motor driving in the wrong direction.

When assembling outer gear **20** to housing **25** ensure that holes **A** are aligned.

Using Vaseline on spacer **8** will prevent it dropping out during assembly.

When fitting bolts **3**, torque tighten initially to 145 - 155 Nm (107 - 114 lbf ft; 14.8 - 15.8 kgf m) then slacken one half turn before tightening to the correct torque specified below. Wirelock bolts in pairs as shown at **B**.

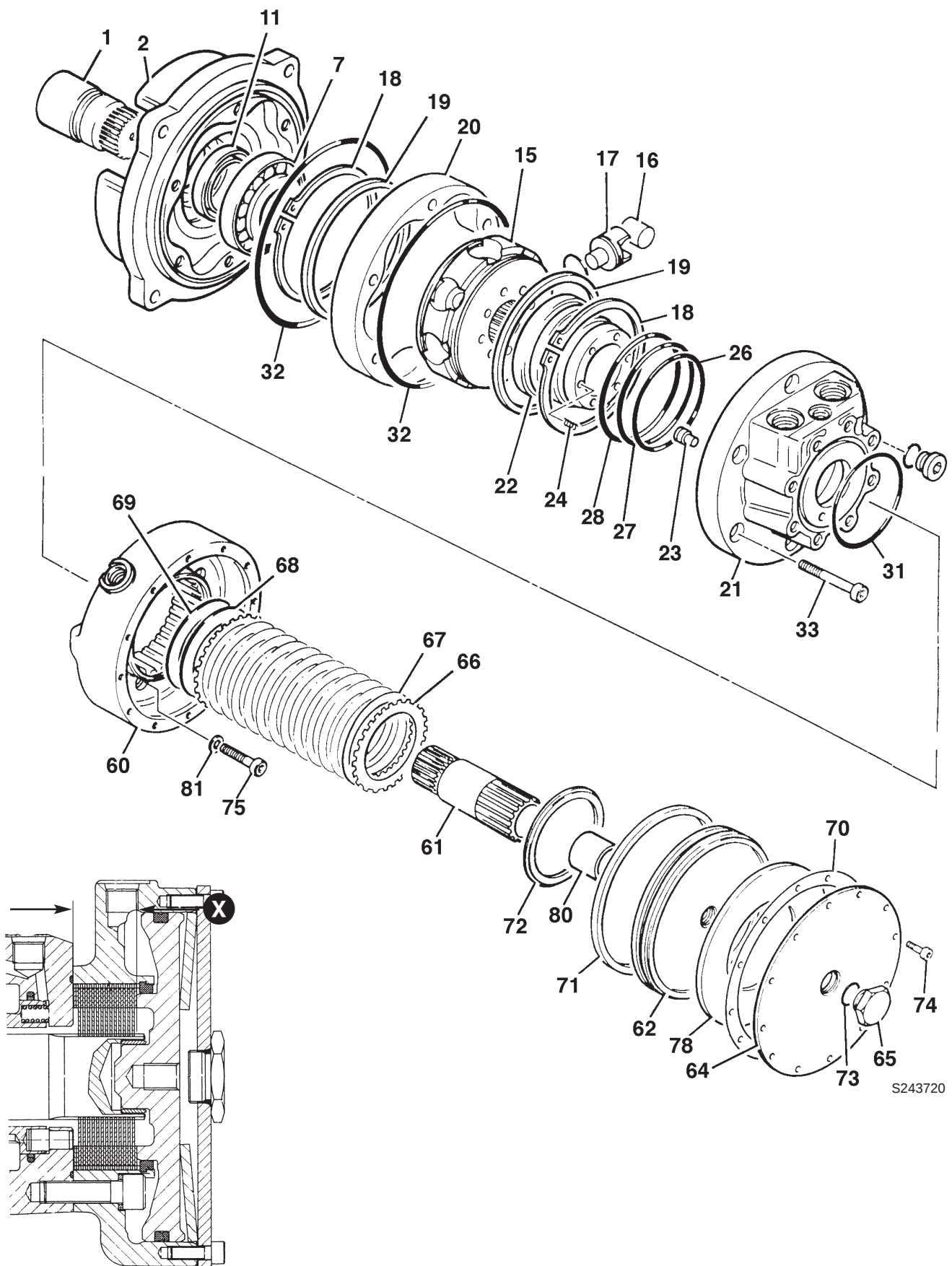
Fill the assembled motor with the correct oil (see **Lubricants and Capacities** in Section 3) before fitting to the machine.

After fitting to the machine, run the motor for a few minutes with the wheels raised off the ground. This is to circulate oil through the motor prior to operation under load.

If the motor is to be stored, or fitted but not connected for any length of time, it is advisable to fit plugs to the brake and motor connection ports.

Torque Table

		Nm	lbf ft	kgf m
3 (see text)	4 off	135 - 145	99.5 - 107	13.8 - 14.8
1	1 off	30 - 60	22 - 44	3 - 6
33	4 off	31 - 39	23 - 29	3.2 - 4.0
24	8 off	31 - 39	23 - 29	3.2 - 4.0
Port plugs	4 off	5 - 10	3.7 - 7.4	0.5 - 1.0



S243870

S243720

* Dismantling and Assembly up to machine number 807172

Dismantling

Drain the oil from the motor.

Mark the relative positions of the front case **2**, rear case **21** and brake housing **60**.

Remove capscrews **33** and separate the rear case and brake housing assembly from the front case and cam assembly.

Support the front case and cam assembly on blocks.

Separate cam **20** from front case **2**.

Note: On later motors the output shaft is supported by two taper roller bearings which are preloaded. The dismantling and assembly of this part of the motor is covered on the next page.

Press shaft **1** out of bearing **7**. Note that on later motors, shaft **1** has a male end, not female as shown.

Using a suitable puller, remove bearing **7** from front cover **2**.

Remove shaft seal **11** from front case **2**. Discard the shaft seal.

Remove O-ring **32** from front case **2**. Discard the O-ring.

Separate cylinder block **15** from cam **20**.

Remove circlips **18** and retaining rings **19** from cylinder block **15**.

Withdraw pistons **17** and rollers **16** from cylinder block **15**. If difficulty is experienced, low pressure air can be applied to the ports in the cylinder block.

Remove and discard the O-rings fitted to pistons **17**.

Withdraw brake shaft **61** from rear case and brake housing assembly.

Tap rear case **21** lightly with a rubber mallet to release distributor ring **22**.

Remove O-ring **32** from rear case **21**. Discard the O-ring.

Make a note of the position of stop pin **23** in the slot in rear case **21** then remove the stop pin.

Note: To ensure that motor rotation is correct on re-assembly, the slots in the rear case are identified 'L' or 'R'. Note that the actual position of the motor may be opposite to that indicated on the serial plate (see parts catalogue).

Remove seal rings **26**, **27**, and **28** from distributor ring **22**. Discard the seal rings.

Remove springs **24** from their bores in distributor ring **22**.

Unscrew plug **65** from end cover **64**. Remove and discard O-ring **73**.

Unscrew capscrews **74** in a progressive manner then remove end cover **64** from brake housing **60**. Remove and discard gasket **70**.

Withdraw spring disc **78** from brake housing **60**.

Insert a suitable bolt in the tapped hole in brake piston **62** and withdraw the brake piston from brake housing **60**.

Remove seal **71** from brake piston **62**. Discard the seal.

Unscrew capscrews **75** and separate brake housing **60** from rear case **21**. Remove and discard O-ring **31**.

Remove seal **72** from interior of brake housing **60**. Withdraw brake pack comprising inner plates **67** and outer plates **66** from brake housing **60**, together with shims **68** and **69** (if fitted).

Assembly

Assembly is a reversal of the dismantling procedure.

Inspect the inner plates **67** and outer plates **66** for signs of wear or damage. Plates should not be renewed individually, the entire plate pack should be renewed.

* Clean all components and oil before assembly. All new seals and O-rings should be greased with petroleum jelly.

The space between the lips of shaft seal **11** should be filled with JCB HP Grease.

The contact surfaces of spring disc **78** should be coated with JCB Special MPL Moly grease.

If a new plate pack is to be fitted, the overall plate pack dimension **X** (when clamped) must be between 28.1 and 28.3 mm. The desired dimension should be achieved using shims **68** and **69** fitted between the end of the plate pack and the rear case **21** as shown. One or two additional outer plates **66** may be used to reduce the number of shims if required.

Thoroughly degrease capscrews **75** and **33** and mating parts, then assemble using JCB Threadlocker and Sealer.

Examine pistons **17** and their bores in cylinder block **15** for signs of damage. Replace as necessary.

Inspect springs **24** for signs of damage and/or distortion. Replace as necessary.

Torque Settings

Item	Nm	lbf ft	kgf m
33	117 - 122	86 - 90	11.9 - 12.4
74	14 - 16	10 - 12	1.4 - 1.6
75	70 - 77	52 - 57	7.1 - 7.8

Dismantling and Assembly (cont'd)

Later type motor with twin bearing output shaft.

Dismantling

Drain the oil from the motor and mark the relative positions of the front and rear cases. Separate the front case **2** from the rear case as detailed on the previous page.

Remove split ring **3** using a soft steel drift to separate. Remove shim washer **4**.

Support the front casing on blocks and press out shaft **1**. Remove bearing cone **7** from the assembly.

Remove bearing cup **7** from the front case using a puller.

Carefully remove seal **11** from the front case.

Remove bearing cup **8** from the front case and the cone from the shaft. Use a puller or soft steel drift.

The remainder of the dismantling procedure is as described on the previous page.

Assembly

Carefully press bearing cup **8** into the front casing.

Insert seal **11** into the front case. Grease lips of seal with JCB HP Grease.

Carefully press bearing cup **7** into the front casing.

Position drive shaft **1** vertically on a press. Warm bearing cone **8** and press into position on the shaft.

Pack the front bearing cone with JCB HP Grease and assemble the front cover onto the shaft, taking care not to damage the lips of seal **11** on the splines of the shaft.

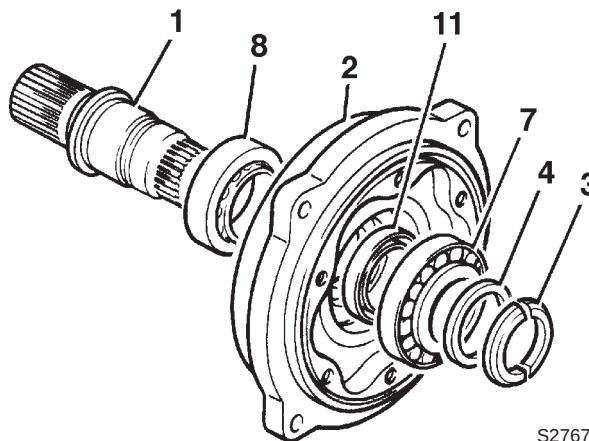
Warm bearing cone **7** and press onto the shaft to a load of 5 tonnes. Rotate the front case during this process. Allow assembly to cool.

Using a press, apply a preload of 1.5 tonnes to bearing **7**. Rotate the front casing during this process. With the preload still applied, fit split ring **3** onto the shaft. Using a feeler gauge, measure the gap between bearing **7** and the split ring.

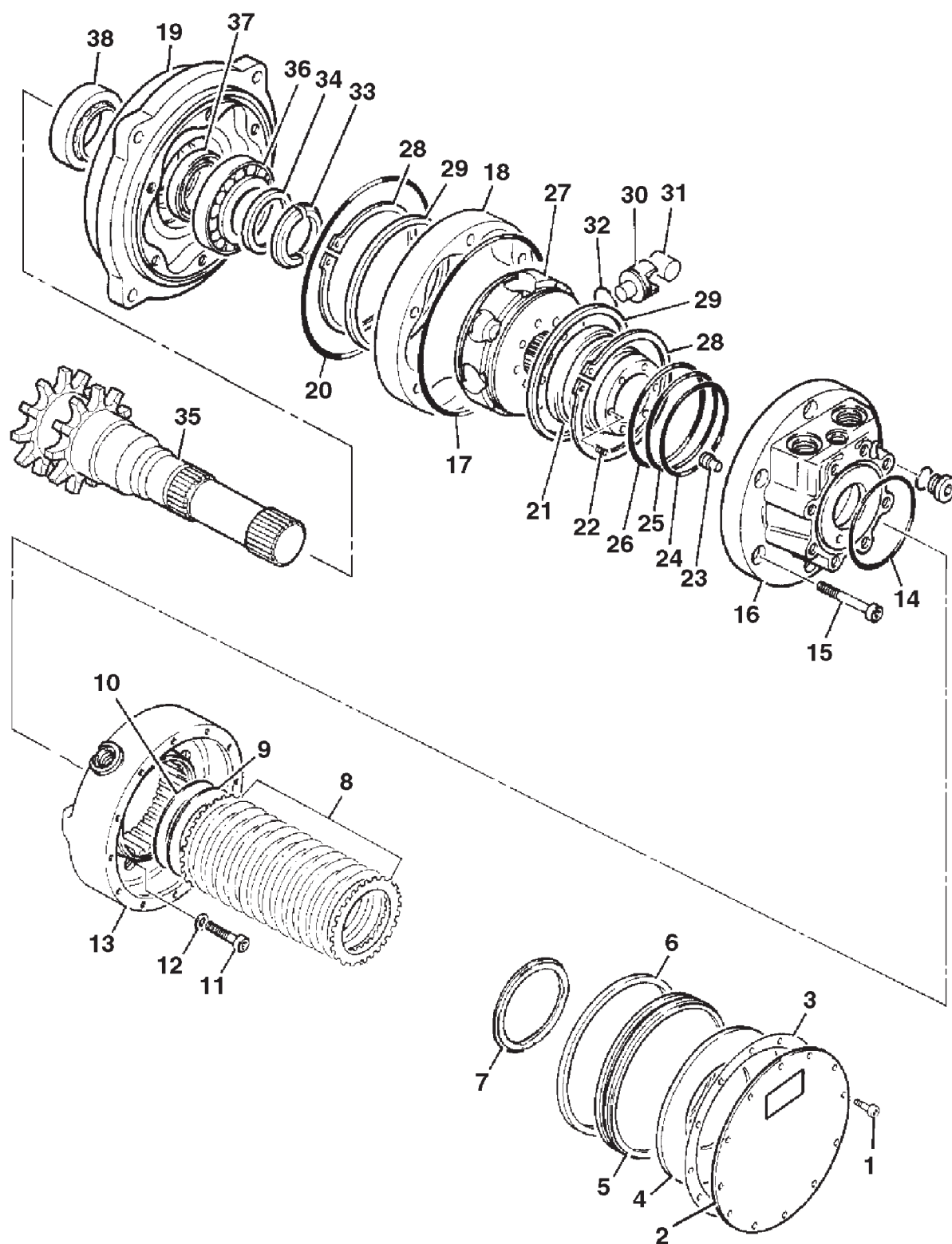
Remove the split ring and fit washer **4** with thickness 0.05 - 0.2 mm (0.002 - 0.008 in) greater than the measured gap. Refit the split ring and remove the load.

Check that the shaft rotates in the front casing.

The remainder of the assembly procedure is as described on the previous page.



S276770A



387340

Dismantling and Assembly from machine number 807173

Dismantling

Drain the oil from the motor.

Mark the relative positions of the front case **19**, rear case **16** and brake housing **13**.

Unscrew capscrews **1** in a progressive manner then remove end cover **2** from brake housing **13**. Remove and discard gasket **3**. Withdraw spring disc **4**.

Remove the brake piston **5** from brake housing **13** using low pressure compressed air. Take care to collect piston as it is being ejected.

Remove and discard seal **6** from the brake piston.

Unscrew capscrews **11** and remove with washers **12** then separate brake housing **13** from rear case **16**. Remove and discard 'O' ring **14**.

Remove seal **7** from interior of brake housing **13**. Withdraw brake pack **8** from brake housing **13** together with shims **9** and **10** (if fitted).

Remove capscrews **15** and separate the rear case **16** from the front case and cam assembly.

Support the front case and cam assembly on blocks. Separate cam assembly **18** from front case **19**.

Remove and discard 'O' rings **17** and **20**.

Tap rear case **16** lightly with a rubber mallet to release distributor ring **21**.

Make a note of the position of stop pin **23** in the slot in rear case **16** then remove the stop pin.

Note: To ensure that motor rotation is correct on re-assembly, the slots in the rear case are identified 'L' or 'R'.

Remove seal rings **24**, **25**, and **26** from distributor ring **21**. Discard the seal rings.

Remove springs **22** from their bores in distributor ring **21**.

Separate cylinder block **27** from cam **18**.

Remove circlips **28** and retaining rings **29** from cylinder block **18**.

Withdraw pistons **30** and rollers **31** from cylinder block **27**. If difficulty is experienced, low pressure air can be applied to the ports in the cylinder block.

Remove and discard 'O' rings **32** fitted to pistons **30**.

Using a soft steel drift, remove split ring **33** and washer **34**.

Support the front case on blocks and press shaft **35** out of bearings **36** and **38**.

Remove the cone from bearing **36**. Using a soft steel drift, remove bearing cups **36** and **38** from front casing **19**.

Remove bearing cone **38** from shaft **35** using a puller. This action may damage the bearing cone, in which case it should be replaced.

Remove and discard shaft seal **37** from front casing **19**.

Assembly

Clean all components and oil before assembly. All new seals and 'O' rings should be greased with petroleum jelly.

Warm bearing cone **38** and press onto shaft **35** using a bench press.

Press shaft seal **37** into front case **19** using a bench press. Take care not to damage the seal. Fill the space between the lips of the seal with grease.

Press bearing cup **38** into front case **19** using a bench press.

Turn the front case over and press bearing cup **36** into the front casing using a bench press.

Cover the splines of shaft **35** with tape to protect the shaft seal. Fit the completed front casing assembly to the shaft assembly. Check that the shaft seal **37** is undamaged then remove the tape from the shaft splines.

Warm bearing cone **36** and, while rotating the front case, press onto shaft **35** using a bench press to a load of 4 tonnes.

Using a bench press, apply a pre-load of 1.5 tonnes to the bearing cone **36** while rotating the front case. Fit split ring **33** onto shaft **35** and measure the gap between bearing **36** and the split ring.

Remove split ring **33** and fit washer **34** with a thickness of between 0.05 to 0.1 mm (0.002 to 0.004 in.) greater than the measured gap. Refit the split ring and remove the pre-load.

Check that shaft **35** runs freely and without binding, but with a slight stiffness, in the front case.

The remainder of the assembly is a reversal of the dismantling procedure.

Examine pistons **31** and their bores in cylinder block **27** for signs of damage. Replace as necessary.

Inspect springs **22** for signs of damage and/or distortion. Replace as necessary.

Dismantling and Assembly from machine number 807173

Assembly (continued)

Thoroughly degrease capscrews **15** and **11** and mating parts, then assemble using JCB Threadlocker and Sealer.

Inspect the brake plates **8** for signs of wear or damage. Plates should not be renewed individually, the entire plate pack should be renewed.

If a new plate pack is to be fitted, the overall length of the pack (when clamped) must be between 28.1 and 28.3 mm. The desired dimension should be achieved using shims **9** and **10** fitted between the end of the plate pack and the rear case **13**. One or two additional brake outer plates may be used to reduce the number of shims if required.

The contact surfaces of spring disc **4** should be coated with JCB Special MPL Moly grease.

Torque Settings

Item	Nm	lbf ft	kgf m
1	14 - 16	10 - 12	1.4 - 1.6
11	70 - 77	52 - 57	7.1 - 7.8
15	117 - 122	86 - 90	11.9 - 12.4

Loader/Excavator Circuit Problem Solving

The purpose of this page is to help you trace hydraulic problems 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 manual.

To help identify circuits, valves, rams etc. mentioned in the problem solving procedures, refer to hydraulic schematic diagrams.

- * Before you begin problem solving, read the Safety Information at the beginning of this manual.
- * Make simple checks before say, stripping a major component.
- * Make sure that the hydraulic fluid is at correct working temperature (50 °C, 122 °F).
- * Whatever the fault, check the condition of the hydraulic fluid. Drain and replace if necessary.
- * Be sure to remove ALL contamination and if possible identify its origin. It may be part of a component from elsewhere in the circuit.

PROBLEM	CAUSE
Lack of power in all loader/excavator functions.	1, 2, 3, 4, 6, 7, 19
All hydraulic rams slow to operate.	3, 4, 7, 10, 12
One hydraulic service fails to operate or operates slowly.	13, 14, 15, 16, 18
Engine tends to stall when hydraulics are under load.	3, 19
Valve spool sticking.	3, 21, 22, 23, 24, 25, 26, 27, 28
Ram creep.	14, 17
Hydraulic oil becomes too hot.	5, 6, 11, 20

KEY TO CAUSE	REMEDY	PAGE REF.
1 Insufficient hydraulic fluid.	Check for leaks and top up as required.	3/8-1
2 Hydraulic leaks in system.	Check hoses, replace as required.	
3 Main relief valve (MRV) setting incorrect.	Check and adjust as required.	E15-1
4 Low loader pump flow.	Check pump flow, if necessary service or replace pump.	
5 Hydraulic filter clogged.	Change hydraulic filter.	3/8-1
6 Filter by-pass valve leaking.	Check condition of hydraulic filter. Check operation of by-pass valve.	3/8-1
7 Charge pressure incorrect.	Carry out charge pressure check.	E12-3, E12-11
8 Servo pressure low	Carry out charge pressure check. Check for blocked service feed hose or faulty joystick.	E12-3, E12-11 E12-16
9 Charge pressure/flow low.	Carry out charge pressure check.	E12-3, E12-11

..... continued

KEY TO CAUSE	REMEDY	PAGE REF.
10 Neutral circuit or low pressure lines leaking, damaged, trapped or kinked.	Check pipe lines and replace as required.	
11 Restriction in neutral circuit lines.	Check hoses and pipes, replace as necessary.	
12 Air in hydraulic system	Bleed system.	
13 Service pipe lines leaking, damaged, trapped or kinked.	Check hoses and pipes, replace as required.	
14 Ram or pipe lines from ram leaking.	Check and rectify as required.	
15 Valve spool not operating.	Check for leaks, rectify as required. Make sure that associated load hold check valve is operating. Check operation of joystick and feed hoses.	Loader E14-2 Excavator E17-1
16 Valve spool not moving fully from neutral to full selection.	Spool movement should be 5 mm (0.2 in) Check servo (charge) pressure.	Loader E14-2 Excavator E17-1 E12-3, E12-11
17 Valve spool leaking	Rectify, check for contamination.	Loader E14-2 Excavator E17-1
18 Piston rod bent.	Replace piston rod. Check pressure setting of MRV. Check that associated pivot pins are adequately greased.	E22-1 E15-1
19 Poor engine performance.	Check engine performance.	K1-1
20 Oil cooler obstructed.	Remove debris from cooler fins.	
21 Oil temperature abnormally high.	Check for correct fluid, see Lubricants and Capacities. Check oil cooler and grille for blockage.	
22 Hydraulic fluid dirty.	Clean tank strainer. If strainer badly clogged, drain and flush hydraulic system then fill with clean hydraulic fluid.	E27-1
23 Service pipe connection over tightened.	Check tightness.	
24 Valve housing twisted during installation.	Loosen retaining bolts and tighten to correct torque.	Loader E14-1
25 Bent spool.	Dismantle control valve. Renew spool as necessary.	Loader E14-2 Excavator E17-1
26 Spool return spring broken.	Renew as necessary.	Loader E14-2 Excavator E17-1
27 Spool return spring or cap out of alignment.	Remove cap, check that spring is in correct position. Refit cap and torque tighten bolts.	Loader E14-2 Excavator E17-1
28 Temperature distribution within control valves not uniform.	Warm up entire system before using service.	

Loader Valve

Removal

Remove rear floor plates (see page B/1 - 1).

⚠ WARNING

Hydraulic Pressure

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

HYD-1-5

Before working on the hydraulic system ensure that the engine is switched off and the starter key removed.

Vent the hydraulic pressure (see page E/2 - 1). Drain the hydraulic tank.

Disconnect all hydraulic hoses from the valve ports (one check valve at inlet **A**, six work ports **B**, four servo connections **C** (two on the opposite side), one high pressure carry over **D** and one outlet **E**). Cover exposed connections to prevent ingress of dirt. Mark the hoses to ensure correct reconnection.

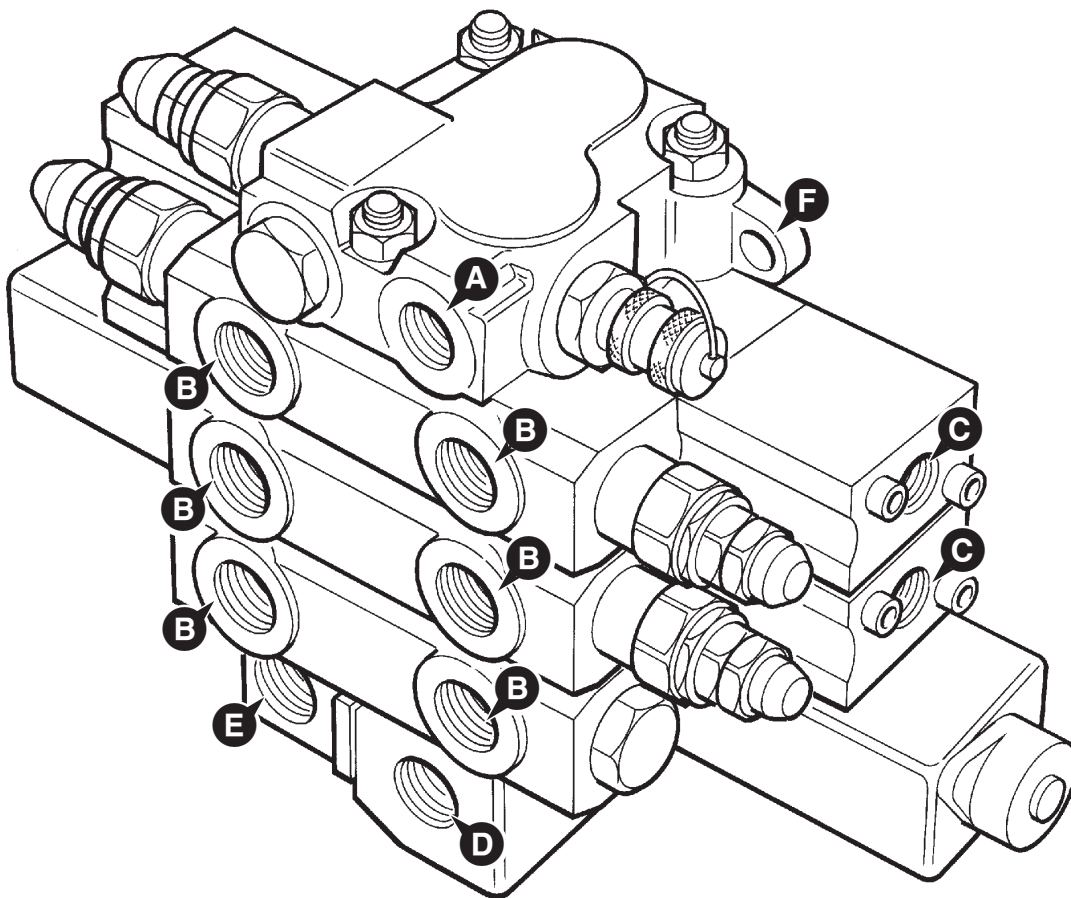
Disconnect the electrical connectors to the solenoids. Mark the connectors to ensure correct reconnection.

Remove the securing nuts from mounting lugs **F** and lift the valve block from the machine.

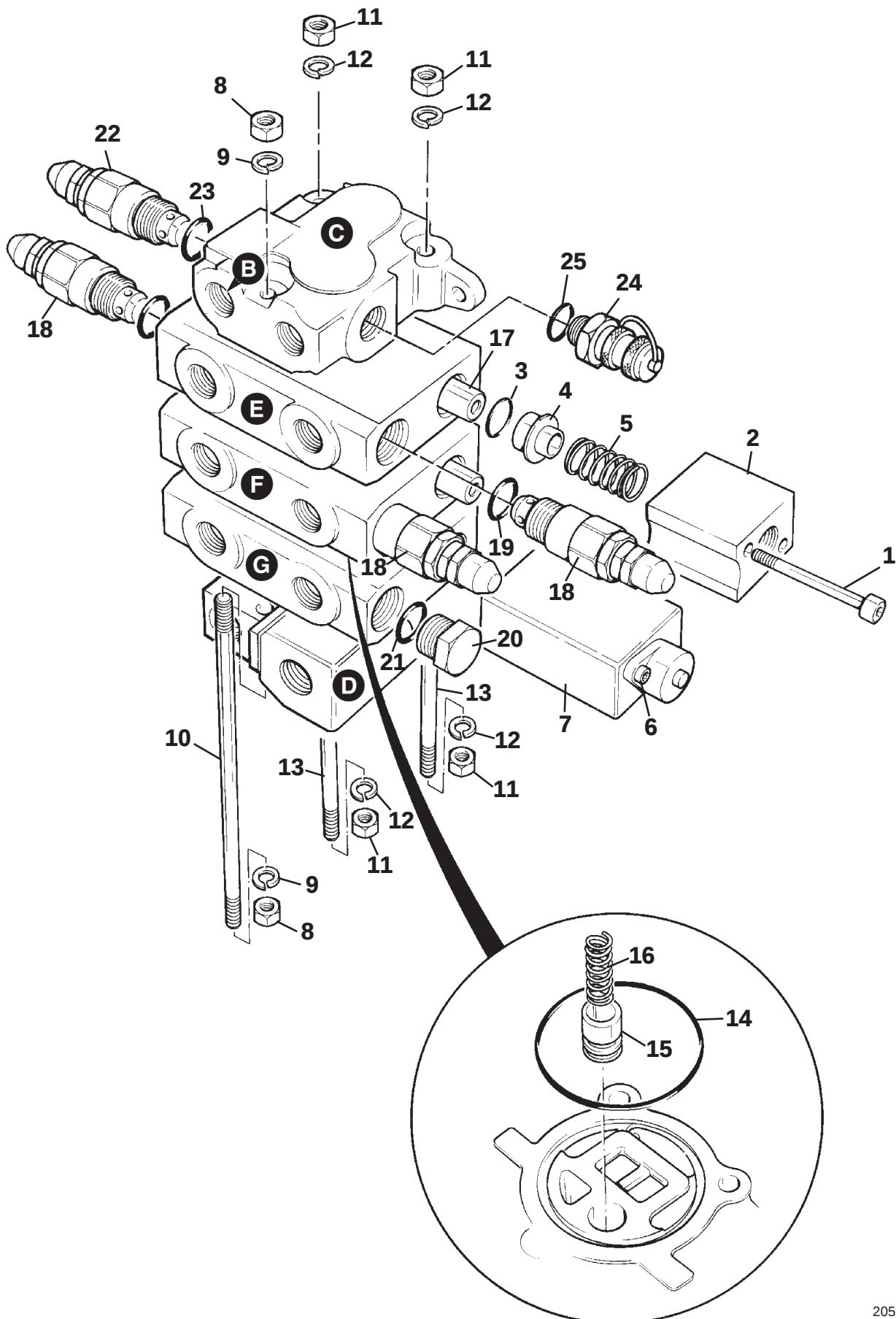
Replacement

Replacement is a reversal of the removal procedure.

Ensure all hoses and ports are clean and free from dirt. Torque securing nuts to 56 Nm (5.7 kg fm, 42 lbf ft)



205110



205140

Loader Valve

Dismantling

Always work on a clean, dirt free surface.

- 1 Remove the plug from port **B**.
- 2 Remove the cap screws **1** from the end caps **2**. Carefully remove the 'O' ring **3**, spring seat **4** and spring **5** from each end cap **2**. Keep all parts of each end cap together. Discard 'O' ring **3**.

Note: The four end caps **2** are identical. Do not mix parts between individual end caps.

- 3 Remove cap screws **6** from the solenoids **7**, then remove the solenoids (2 off).
- 4 Remove nuts **8** (2 off) and washers **9** (2 off) from tie rod **10**, withdraw tie rod **10**.
- 5 Remove nuts **11** (4 off) and washer **12** (4 off) from tie rods **13** (2 off), withdraw tie rods **13**.
- 6 Carefully separate inlet section **C**, operation sections **E**, **F**, **G** and outlet section **D**. Discard the 'O' rings **14** (4 off) from between the sections.

Note: Work on the operation sections **E**, **F**, **G** individually. Do not interchange parts from individual sections.

- 7 Carefully push out the check valve **15** and spring **16**. Push out the spool **17**. (Only spool **E** is described, but **F** and **G** are similar.)
- 8 Remove the auxiliary relief valves **18** (2 from **E**, 1 from **F**).
- 9 Remove plugs **20** (1 from **F**, 2 from **G**), remove and discard 'O' rings **21** (3 off).
- 10 Remove the main relief valve **22** from the inlet section **C**. Remove and discard 'O' ring **23**.
- 11 Remove the test connector **24** from the inlet section. Remove and discard 'O' ring **25**.
- 12 Clean all parts in kerosene, inspect and check for damage.

Damaged sections should be replaced complete.

Assembly

Assembly is a reversal of the dismantling procedure.

Renew all seals and 'O' rings.

Ensure that the spools are inserted with their larger waisted sections towards the bottom.

Lubricate all parts with hydraulic oil before assembly and all 'O' rings and seals with vaseline.

Torque Settings

Item		Nm	lbf ft	kgf m
Tie Rod 10	(1 off)	44.75	33.0	4.6
Tie Rod 13	(2 off)	20.0	14.0	2.0
A.R.V. 18	(3 off)	44.75	33.0	4.6
M.R.V. 22	(1 off)	44.75	33.0	4.6
Plug 20	(3 off)	44.75	33.0	4.6
Plug B	(1 off)	9.5	7.0	1.0
Cap screws 1 & 6	(6 off)	34.0	25.0	3.5

Main Relief Valve and Auxiliary Relief Valves

Note: The M.R.V. **X** and loader valve A.R.V.'s **Y** are identical in design.

Removal

(Assumes rear floor plates removed.)

Ensure that the engine is stopped and hydraulic pressure released from the system.

Each valve is removed by unscrewing nut **1**.

Dismantling and Assembly

The manufacturers do not recommend renewing individual components of the M.R.V. or A.R.V.'s. Each valve should be renewed as a unit if a component is defective.

Renew all 'O' rings. Lubricate parts with Hydraulic Fluid before assembly.

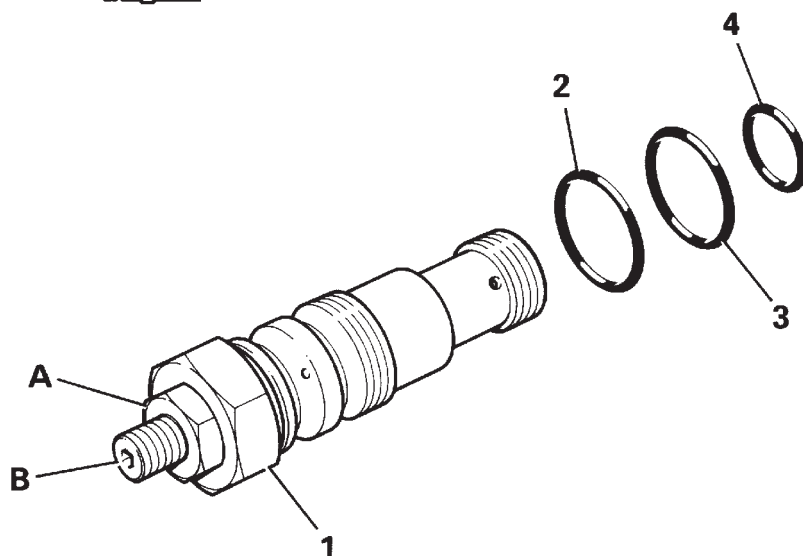
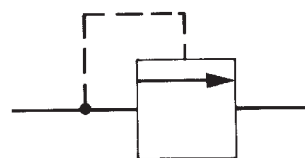
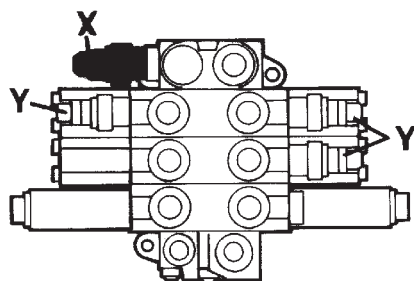
The M.R.V. can be tested/adjusted in situ (see page E/15 - 1). The A.R.V.'s are tested/adjusted on a bench (see page E/15 - 2).

Replacement

Replacement is a reversal of the removal procedure.

Torque Settings

Item	Nm	kgf m	lbf ft
1	44.75	4.6	33



205090

Pressure Testing - Main Relief Valve (M.R.V.) - In Situ

Connect a 0 - 400 bar (0 - 6000 lb/in², 0 - 422 kg/cm²) pressure gauge to test connector **A** located on the right-hand end of the loader valve block.

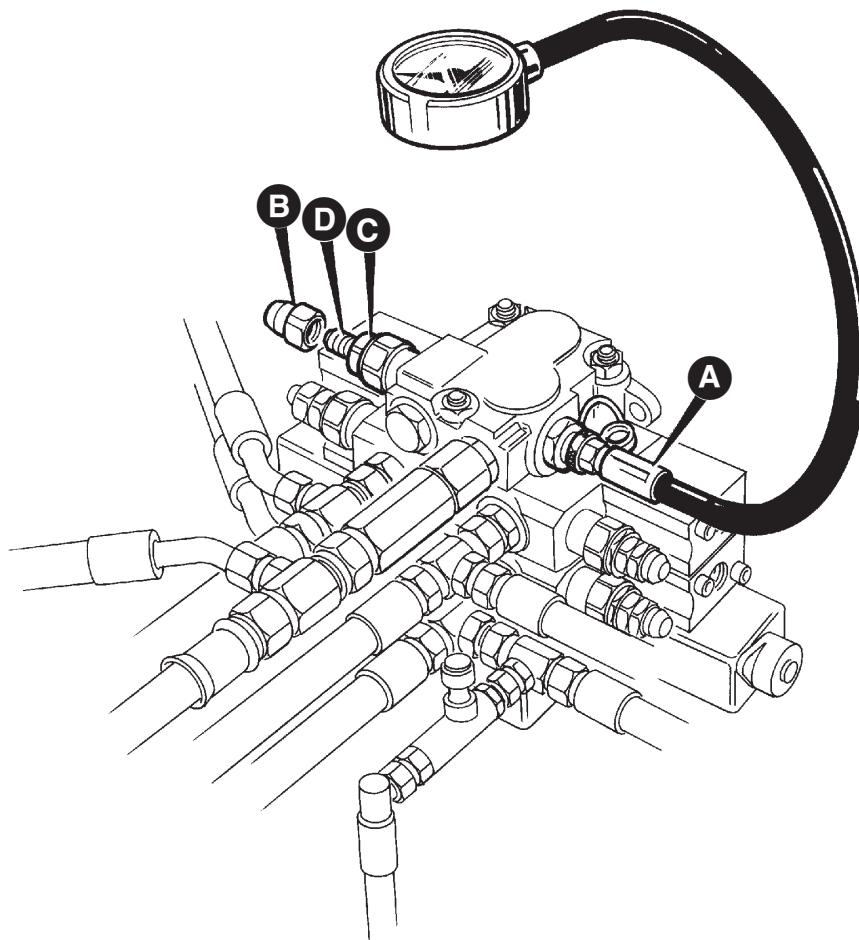
* With the engine running at 1500 rev/min, check the M.R.V. setting by lowering the loader arm until the rams are fully closed and noting the maximum gauge reading. **Keep clear of the loader arm.** The maximum pressure should be as stated in Technical Data.

If the pressure is incorrect, remove dome nut **B**, slacken locknut **C** and adjust screw **D**. Turn it clockwise to increase pressure and anti-clockwise to decrease the pressure. When the pressure is correct, tighten the locknut.

Note that the pressure setting is stamped on the body of the valve.

Torque Settings

Item	Nm	kgf m	lbf ft
B	5.4 - 8.2	0.55 - 0.83	4 - 6
C	5.4 - 8.2	0.55 - 0.83	4 - 6



205160

Pressure Testing - Auxiliary Relief Valve (A.R.V.'s) - Using Hand Pump

Insert the A.R.V. into the test block, part no. 892/00252. Connect hand pump 892/00223 and a 0 - 400 bar (0 - 6000 lb/in², 0 - 422 kg/cm²) pressure gauge.

Plug the two large diameter (3/4 inch B.S.P.) ports of the test block using blanking plugs (892/00059) and bonded washers (1406/0021).

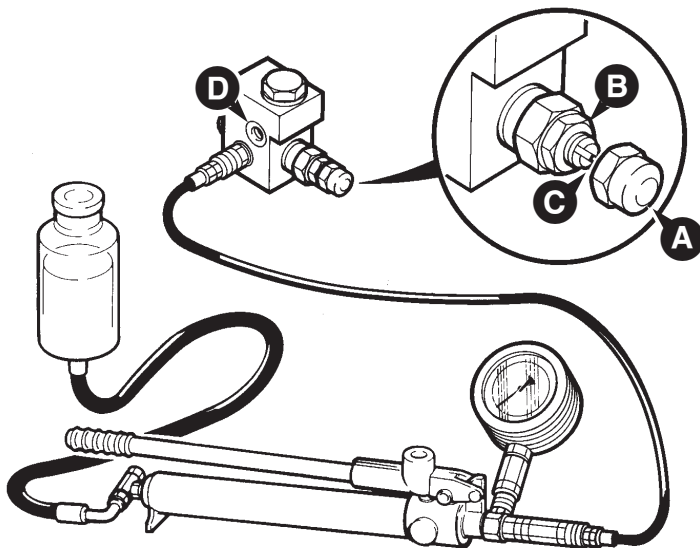
Pressurise until oil begins to escape from the drain hole **D**. At this point the gauge will indicate the crack pressure of the A.R.V.

The pressure should be as given in Technical Data.

If required, adjust the pressure by removing dome nut **A**, slackening locknut **B** and turning screw **C**.

Torque Settings

Item	Nm	kgf m	lbf ft
A	5.4 - 8.2	0.55 - 0.83	4 - 6
B	5.4 - 8.2	0.55 - 0.83	4 - 6



S221130

Check Valve

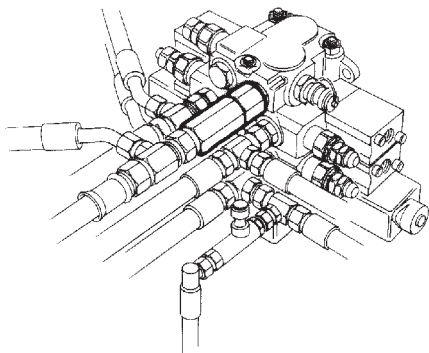
The check valve consists of a plug **A**, plus a poppet and spring **B** in a body **C**.

Opening pressure is 5 bar (75 lbf/in²).

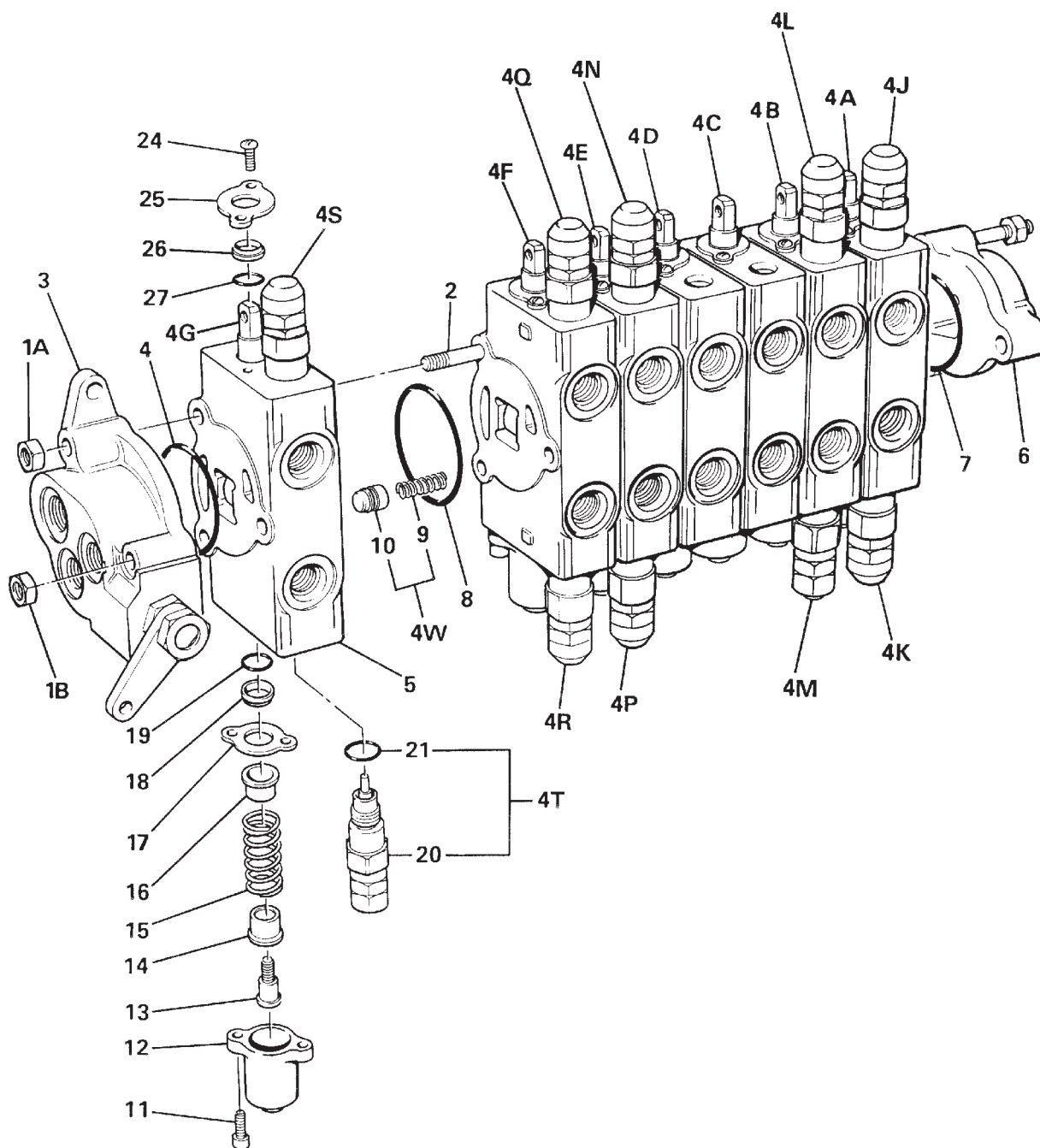
*To check the opening pressure, compare the difference between the recorded pressures at the MRV test point and the brake pressure test point. These should be checked with the hydraulic oil at correct working temperature, the seat facing forward and the engine running at 1000 rev/min. The difference in the two pressures should equal the opening pressure of the check valve.

To adjust the opening pressure, screw plug **A** in or out of the body **C** as required.

If the valve is damaged or worn replace as a unit. Do not fit parts from other valves.



S205100



205170

Excavator Valve

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

Check Valves

Each spool has an identical load hold check valve which can be removed as shown at **4W**. Note only **4W** shown on illustration.

Ensure good condition of seating face on poppet **10** and on the mating face in the valve block.

Note: All valve block adapters are torqued to 81 Nm (60 lbf ft; 8.3 kgf m).

Spools

Spools **4B**, **4C**, **4D**, **4E**, **4F** and **4G** are identical but must not be interchanged as they are matched to their bores. Slew spool **4A** is different in design from the above spools.

All spools have the same centring and sealing components items **11** to **19** and **24** to **27**.

To completely dismantle a spool, follow the sequence **11** to **19** and **24** to **27**. To prevent spool rotation when turning screw **13**, hold a rod through the eye end of the spool.

Lubricate new seals with Hydraulic Fluid and take care to prevent them from being damaged by the sharp edges of the spool.

Apply JCB Lock and Seal to threads of screw **13**.

Torque Settings

Item	Nm	kgf m	lbf ft
1A	17.6 - 20.4	1.76 - 2.04	13 - 15
1B	41 - 49	4.2 - 5	30 - 36
11	6.1 - 7.5	0.62 - 0.76	4.5 - 5.5
13	9.5 - 10.9	0.97 - 1.11	7 - 8

Relief Valves

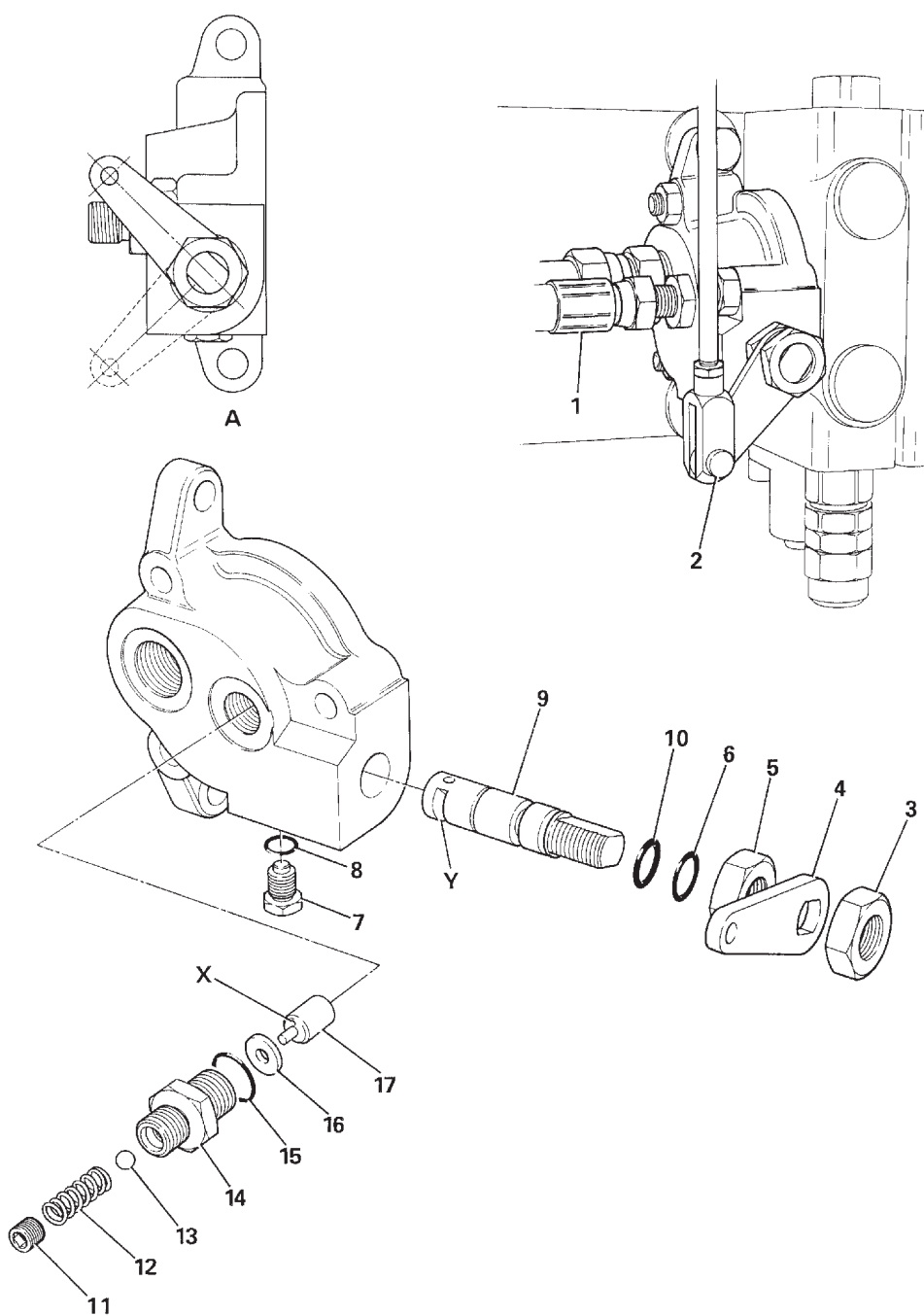
Ensure that A.R.V's **4J** to **4T** are correctly adjusted and fitted in their specified positions.

Torque tighten A.R.V's to 41 - 68 Nm (30 - 50 lbf ft, 4.15 - 6.9 kgf m).

The manufacturers do not recommend renewing individual components of the A.R.V.'s. Each valve should be renewed as a unit if a component is defective.

Renew all 'O' rings. Lubricate parts with Hydraulic Fluid before assembly.

The A.R.V's are tested/adjusted on a bench (see page E/15 - 2).



175600

Hydraclamp Valve

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

When Dismantling

Plug hose **1** to prevent loss of oil and entry of dirt.

When Assembling

Note: View 'A' shows the clamp in the OFF position.

Ensure that orifice **X** is clear.

Lubricate new seals with Hydraulic Fluid.

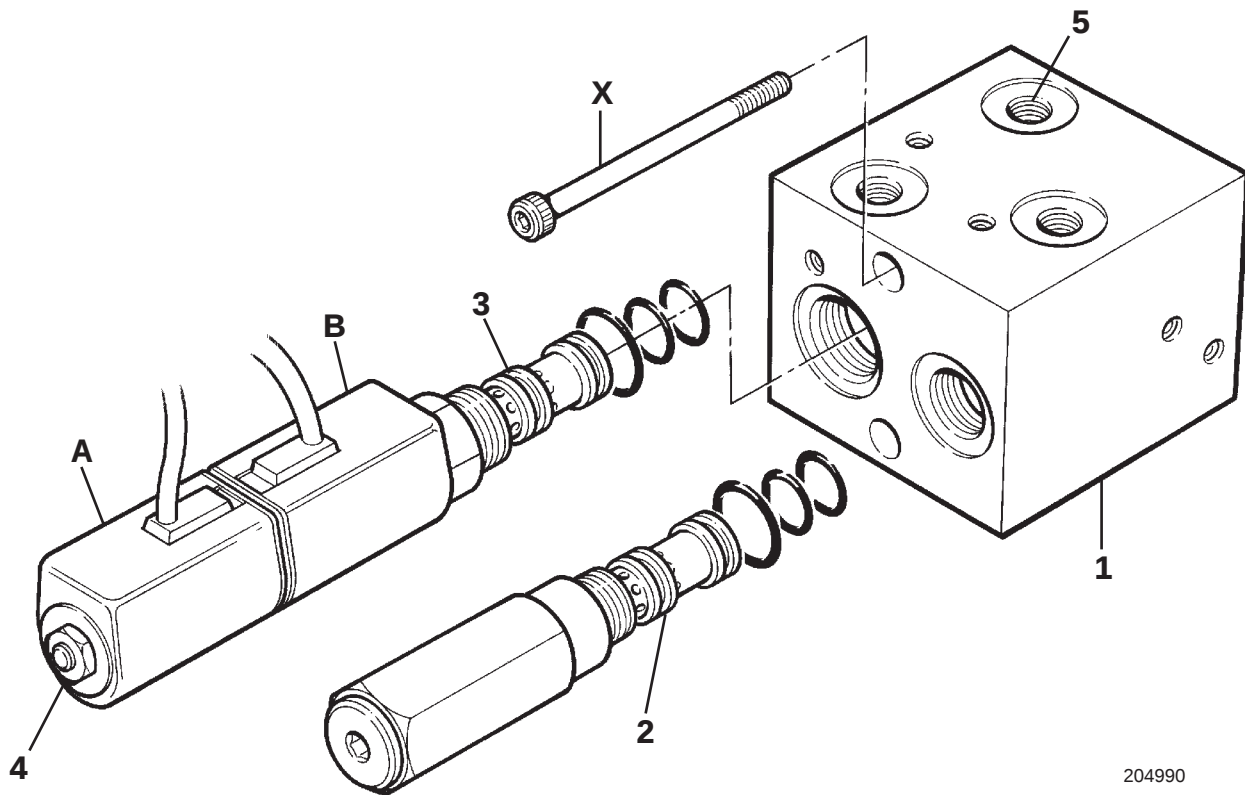
Ensure that plug **7** locates in groove **Y** of rotary spool **9**.

Torque nut **5** finger-tight before locking lever **4**.

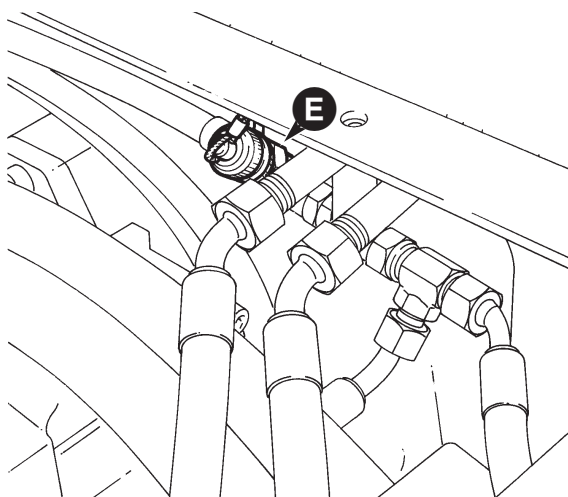
Ensure that spool **9** rotates freely after tightening nuts **5** and **3**.

Torque Settings

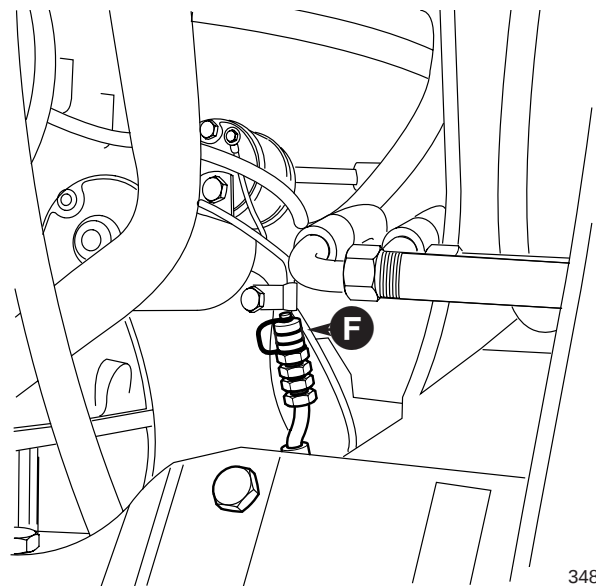
Item	Nm	kgf m	lbf ft
3	55 - 67	5.6 - 6.84	40.5 - 49.5
7	3.3 - 4.7	0.35 - 0.49	2.5 - 3.5
14	21.3 - 26.7	2.22 - 2.78	16 - 20



204990



204330



348890

* Pressure Reducing Solenoid Valve up to serial no. 752462

Removal



WARNING

Hydraulic Pressure

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

HYD-1-5

Before working on the hydraulic system ensure that the engine is switched off and the starter key removed.

Vent the hydraulic pressure (see page E/2 - 1).

Remove and plug all hydraulic hoses. Plug exposed connections in the valve body **1**. Disconnect the solenoid electrical cables.

Remove bolts **X** (2 off) and remove the valve.

Replacement

Replace bolts **X** and torque tighten to 12 Nm (9 lbf ft, 1.2 kgf m).

Reconnect the solenoid valves and all hydraulic connections.

Dismantling

Secure the valve body **1** into a suitable soft jaw vice or fixture. Remove the pressure reducing cartridge valve **2** and the solenoid cartridge valve **3**. Solenoids **A** and **B** can be removed if necessary by unscrewing the coil retaining nut **4**.

All seals and 'O' rings should be discarded. Do not dismantle the cartridges.

If damage or excessive wear is found a cartridge should be replaced as a complete unit.

The machined orifice **5** should be examined for wear but not removed unless being renewed. Examine wiring for damage or chafing; replace as necessary.

Assembly

Assembly is a reversal of the dismantling procedure. Fit new 'O' ring seals. Torque tighten to 23-28 Nm (17 - 21 lbf ft, 2.3 - 2.9 kgf m).

Check (and if necessary adjust) the setting of cartridge valve **2** (see below).

Replace solenoids on cartridge **3**, torque tighten the coil retaining nut **4** to 5 - 7 Nm (3.7 - 5.2 lbf ft, 0.5 - 0.7 kgf m).

Adjusting the Pressure Reducing Valve Cartridge

This cartridge should not be dismantled. If it malfunctions it should be replaced by a new one.

Before checking the setting make sure the hydraulic oil is at it's correct working temperature.

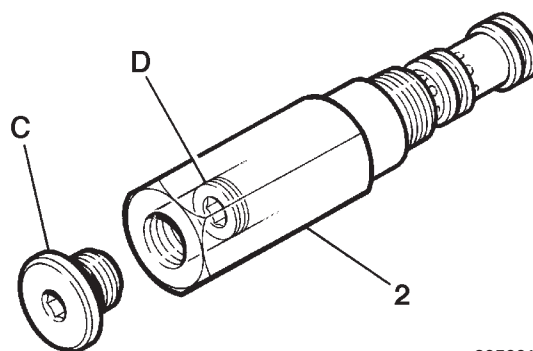
* To check the setting, connect a pressure gauge to the test point as follows:

- On machines up to serial no. 751715 the test point is located under the throttle pedal plate as shown at **E**.
- From serial no 751716 the test point is located at the rear of the left hand side of the engine as shown at **F**.

Ensure that the seat is facing forward then start the engine and run at maximum speed. Operate the arms lower service until the rams are fully closed to 'blow off' the M.R.V. Check the gauge reading which should show the regulated pressure.

See **Technical Data** for correct setting.

If the setting is incorrect, stop the engine. Remove the cartridge dust cover **C** and adjust screw **D** to achieve the required pressure. Replace dust cover **C** before restarting the engine to recheck the pressure otherwise oil will leak from the valve.



205001

* Brake Valve from serial no. 752463

Dismantling

Unscrew the knurled nut **2** and remove 'O' ring **3**, withdraw the solenoid **4** and 'O' ring **5**.

Hold the solenoid valve body **6** in a vice, using the spanner flats **A**, remove spindle **7** and 'O' ring **8**.

Pull out actuating pin **9**, spring **10**, spring retainer **11** and spool **12**.

Inspect the spool and spool bore for signs of wear, nicks, scratches, etc.

Assembling

Assembly is the reversal of the dismantling procedure.

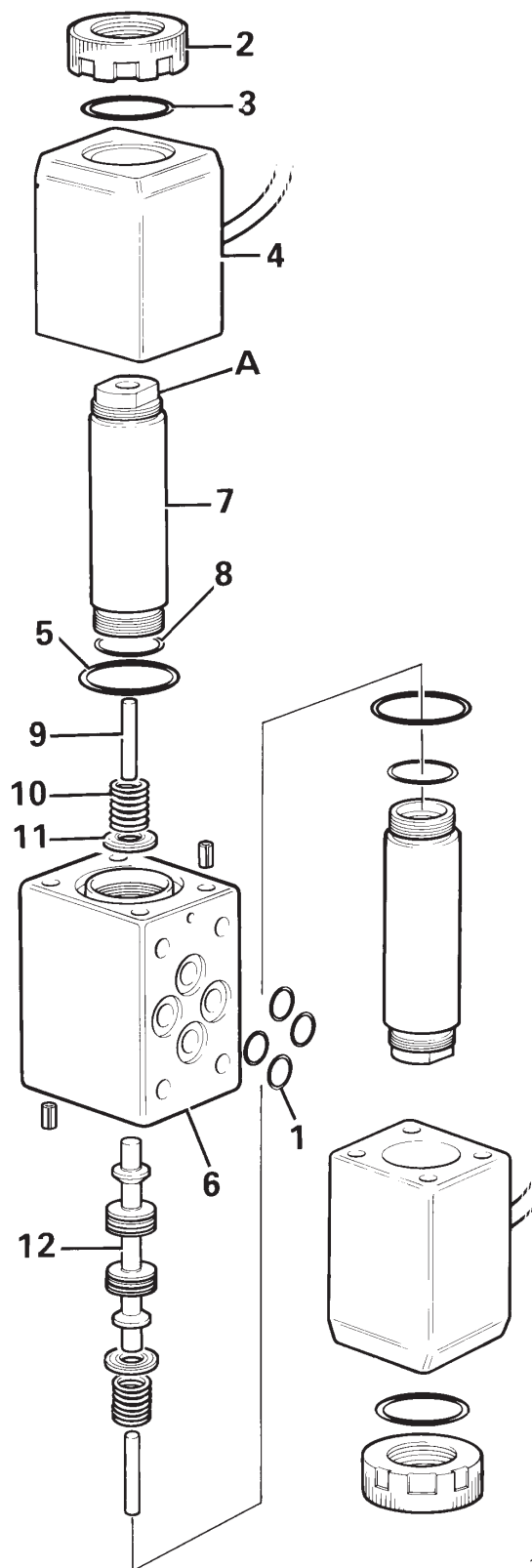
Renew all 'O' rings.

Lightly lubricate all parts with clean hydraulic fluid before assembling.

Check that the flying leads are secure and that the connectors are intact.

Torque Settings

Item	Nm	kgf m	lbf ft
2	10 to 15	1 to 1.5	8 to 10



161590

Removal and Replacement

Removal

Note: Only the right-hand joystick is shown in the illustration. The other joystick is removed and replaced in the same way.

Ensure that the engine is stopped and all hydraulic pressure is released from the system (see page E/2 - 1).

WARNING

Hydraulic Pressure

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

HYD 1-5

Mark the joystick flange and supporting flange at **1** to ensure correct realignment on replacement.

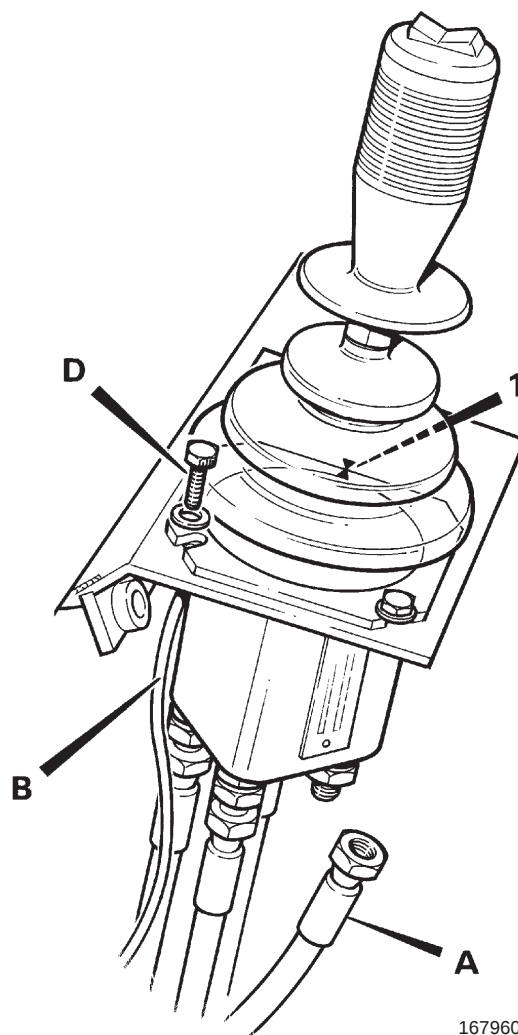
Remove the hydraulic flexible hoses at **A**, plug exposed connections to prevent ingress of dirt and water. Disconnect electrical connection **B**. Remove four bolts **D** and lift the joystick unit clear.

Replacement

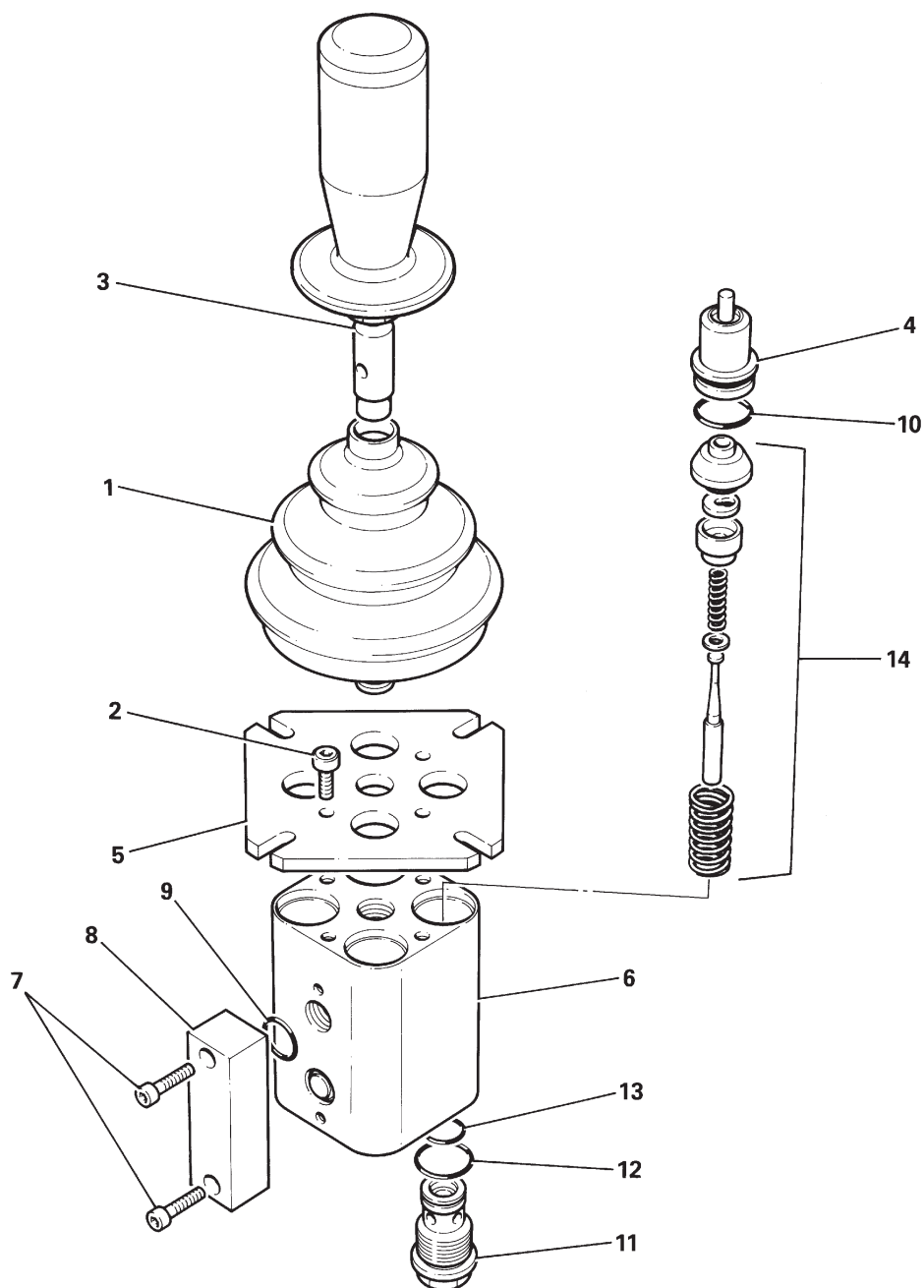
Replacement is a reversal of the removal procedure.

Torque tighten hydraulic connections **A** to 30 Nm (22 lbf ft, 3 kgf m).

Torque tighten bolts **D** (4 off) to 12 Nm (9 lbf ft, 1.2 kgf m).



167960



167950

* Joystick up to machine number 807146

Dismantling

The numerical sequence is intended as a guide to dismantling, assembly is the reverse of this sequence.

To remove the handle assembly **3**, lift up the gaiter **1** and remove the four cap head screws **2**. This will allow the handle assembly to be separated from the valve body **6**.

Note: Ensure that the components of valve units **14** are kept together as sets and returned to their original locations in the body. Do not mix components from different valve units.

Assembly

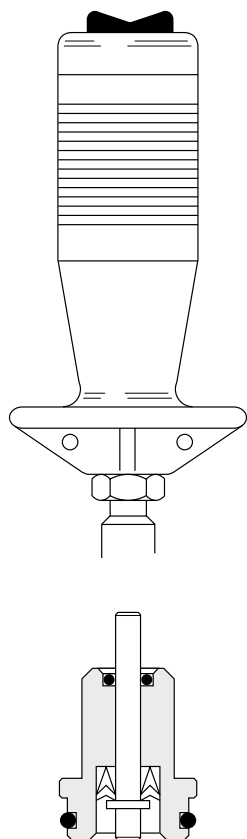
* Lubricate all parts with hydraulic fluid before assembly. 'O' rings and seals should be lightly coated with petroleum jelly prior to assembly. See note opposite regarding valve units **14**.

Torque Settings

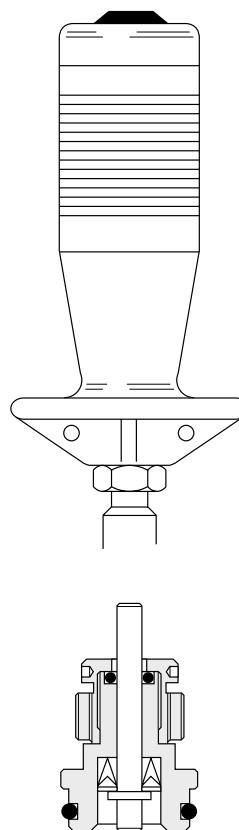
	Nm	kgf m	lbf ft
Bolts 2 (4 off)	12	1.2	9
Bolts 7 (2 off)	12	1.2	9

The handles complete with switches can be replaced as a unit. Ensure that the correct assembly is used, see below.

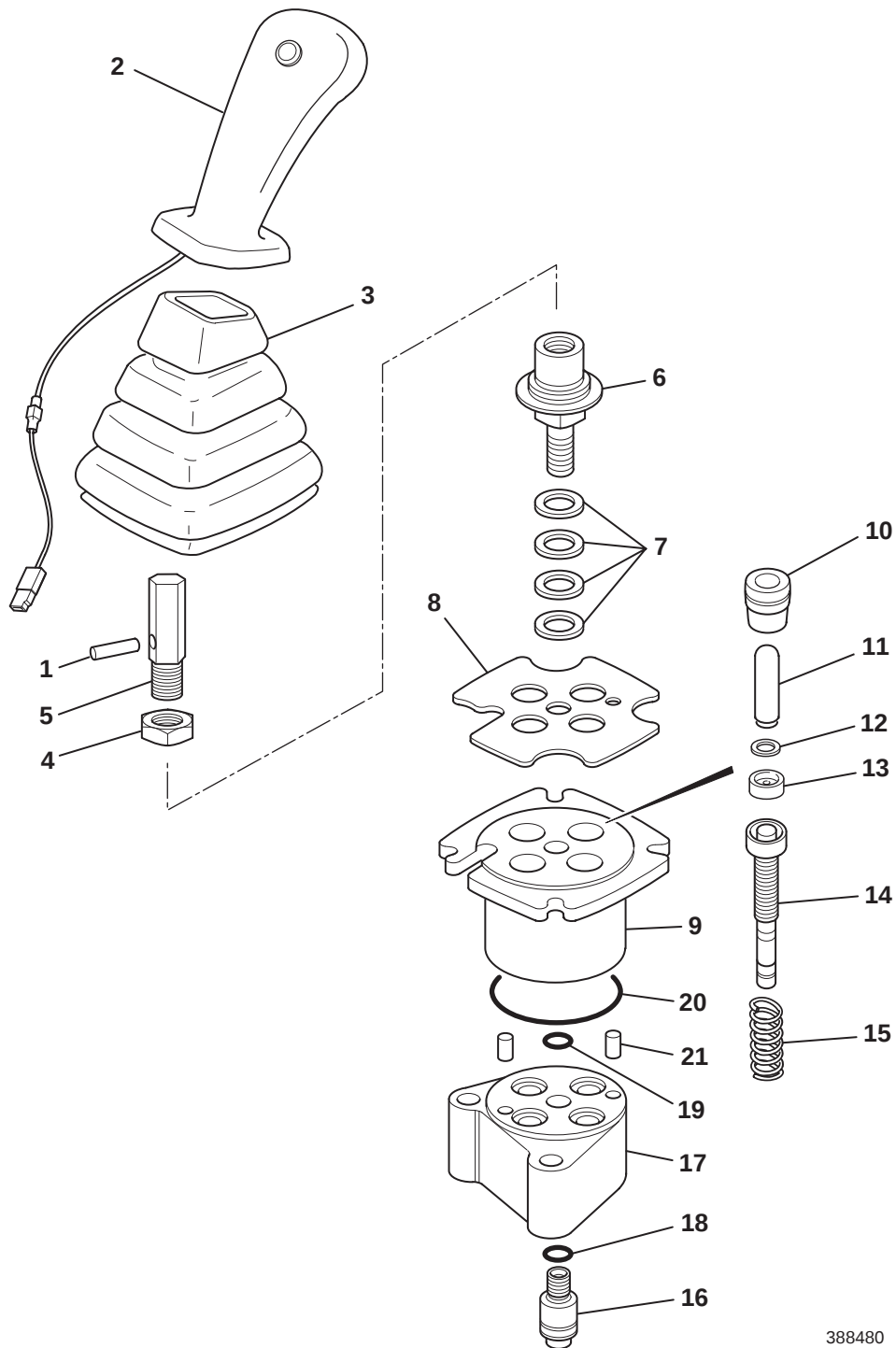
A Handle assembly used on the loader control joystick.



B Handle assembly used on direction control joystick.



A168110



388480

Joystick from machine number 807147

Dismantling

The illustration shows a typical joystick. Slight variations may occur depending on the application.

The numerical sequence is intended as a guide to dismantling, assembly is the reverse of this sequence.

Note: Ensure that the components of the valve units are kept together as sets and returned to their original locations in the body. Do not mix components from different valve units and do not mix components between different joysticks.

Assembly

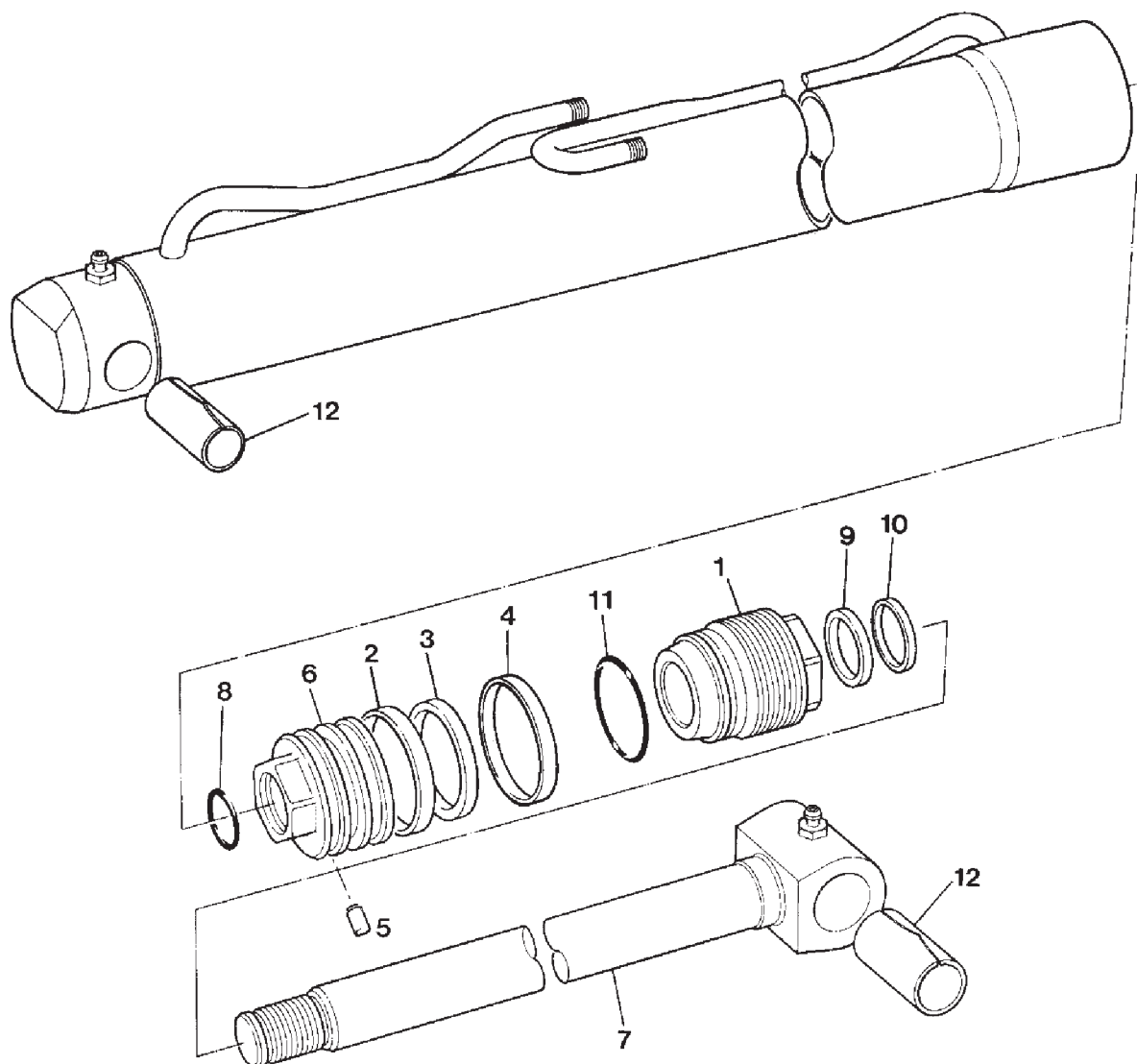
Lubricate all parts with hydraulic fluid before assembly. 'O' rings and seals should be lightly coated with petroleum jelly prior to assembly. Ensure that valve units are returned to their original bores in the valve body.

Select shims **7** so that there is a small clearance between cam plate **6** and the tops of plungers **11** when the lever is in the neutral position.

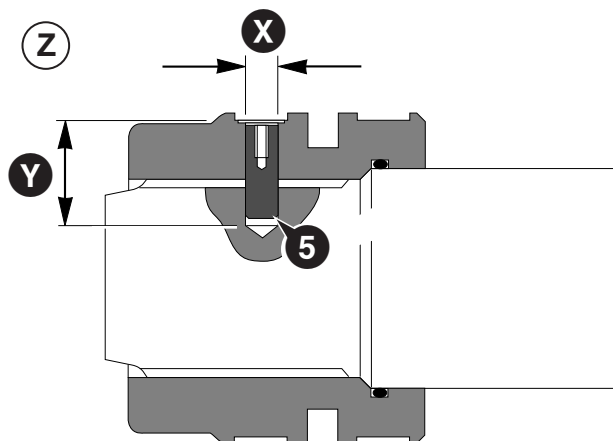
Coat threads of item **5** with JCB Threadlocker and Sealer (High Strength) before assembly.

Torque Settings

Item	Nm	kgf m	lbf ft
4	30	3.0	22
6	40	4.1	30
16	50	5.1	37



140731



343030

Typical Ram (with dowelled piston head)

Dismantling and Assembly

Dismantling

Place the ram assembly on a locally manufactured strip/rebuild bench.

Slacken the end cap **1** using a special spanner (see **Service Tools**, Section 1) and remove the piston rod assembly from the cylinder.

WARNING

If air or hydraulic pressure is used to force out the piston assembly, ensure that the end cap is securely fitted. Severe injury can be caused by a suddenly released piston rod.

HYD 1 - 2

Position the piston rod assembly on the bench in place of the ram cylinder. Remove the piston head seals **2**, **3** and **4**.

Extract dowel **5** from the piston head using a metric screw (M3) threaded into the extractor hole.

Note: Any attempt to remove the piston head without removing the dowel will cause damage to both the piston head and rod.

Remove piston head **6** from rod **7** using a special spanner (see **Service Tools**, Section 1). Remove the piston head internal 'O' ring **8**.

Remove the end cap **1** from the piston rod and remove the inner and outer seals **9**, **10** and **11**.

Ensure that all metal components are free from scoring, nicks and burrs. A damaged rod will impair the life of the inner rod and wiper seals.

Discard all seals and 'O' rings.

* Assembling

Renew all seals and 'O' rings.

Thoroughly clean the threads of the piston rod, piston head, end cap and cylinder using a wire brush. Use JCB Cleaner/Degreaser to ensure that all threads are free from grease, hydraulic oil and locking fluids. Allow 15 minutes for the solvent to dry before applying JCB Activator.

Ensure that lubricants used during assembly do not come into contact with locking fluids.

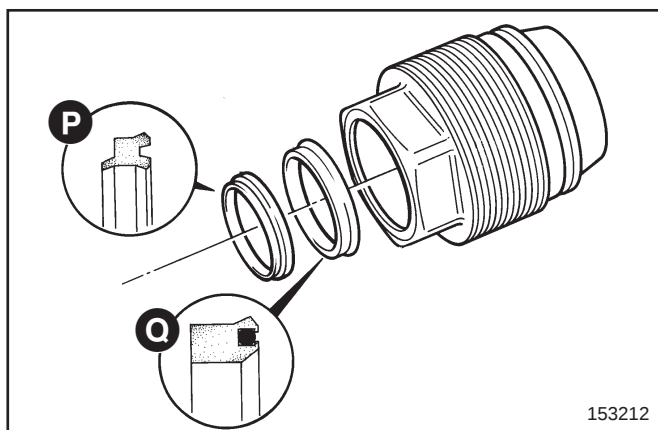
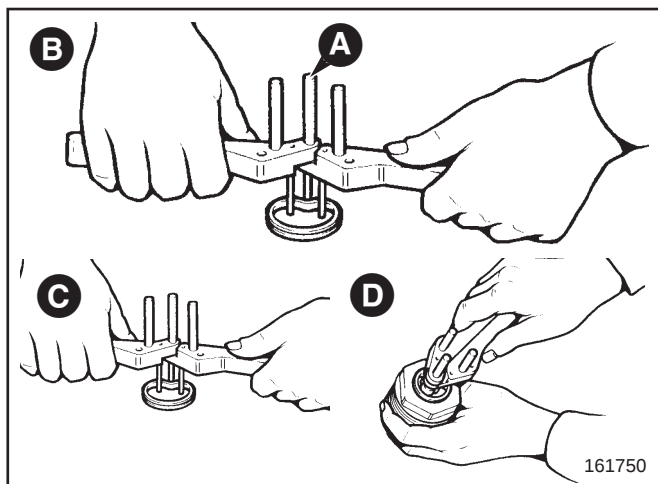
Use seal fitting tool (892/00334) to fit rod seals **9** and **10**. The size (diameter) and position of pins **A** is determined by the diameter and radial width of the rod seal being fitted.

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

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

Note: Make sure the seals are fitted the correct way round, as shown at **P** and **Q**.

- 2 Close the tool as shown at **C**. The seal must form a reniform (kidney shape).
- 3 Before fitting the rod seals check the seal grooves are free of contamination and sharp edges.
- 4 Locate the seal in the end cap groove, shown at **D**, 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.
- 5 Fit rod wiper seal **10** into seal groove. Make sure the seal is correctly installed as shown.



Assembling (cont'd)

Sleeve **E** must be used to protect the rod seals from damage when fitting end cap **1** onto the piston rod **7**. There are various sizes of sleeve (see **Service Tools**, Section 1). Make sure the hexagon on the end cap is towards the eye end of the rod.

Apply JCB Activator to the threads of the piston head **6**. Allow to dry for 15 minutes before bringing into contact with JCB Threadlocker.

Note: Neither Threadlocker nor Activator must be allowed to contact seals, bearing rings or 'O' rings.

Apply JCB Threadlocker & Sealer (High Strength) to all threads of the piston rod. Fit and torque-tighten the piston head.

Fit the locking dowel **5** to the piston head/rod as follows:

1 New rod and piston head.

If both are required, the following procedure should be followed:

- a** Drill through the piston head into the piston rod, shown at **Z**. Use an undersized diameter drill first as a guide and then drill using the correct size diameter drill to suit: refer to the table for drill diameters and depths.
- b** Remove all swarf and contamination. Insert dowel **5** into the drilled hole, making sure that the tapped extractor hole is to the outside.

2 New piston head fitted to a **pre-drilled piston rod**.

- a** Redrill and dowel **BOTH** the piston head and piston rod at 90° from the existing drilled dowel hole in the piston rod. Follow the procedure described in step 1.

3 New piston rod fitted to a **pre-drilled piston head**.

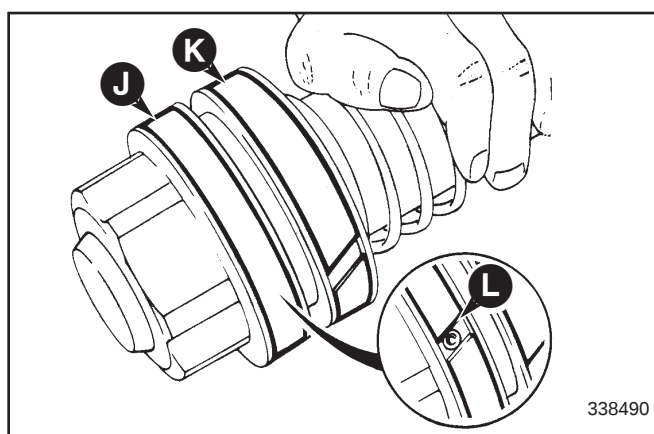
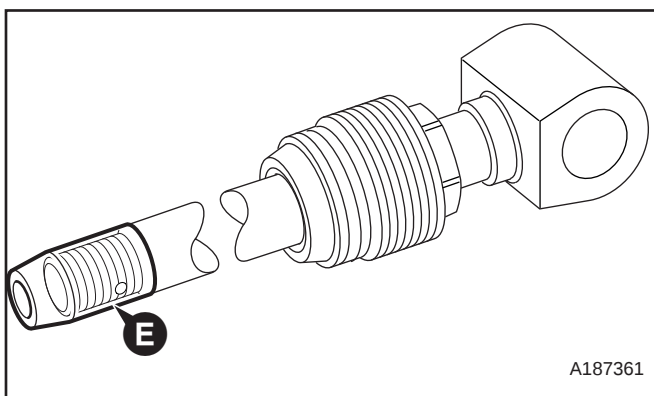
Use the pre-drilled hole in the piston head. Care must be taken not to elongate the existing hole in the piston head.

- a** Use a drill of the same diameter as the pre-drilled hole in the piston head to make a 'centre mark' in the piston rod. **DO NOT** drill the piston rod at this stage.
- b** Use an undersized diameter drill as a guide and drill into the piston rod to the required depth (see table), making sure that the drill has centred correctly on the 'centre mark' made in step 3a.
- c** Use the correct size diameter drill to suit the dowel and drill to the required depth (see table).
- d** Remove all swarf and contamination. Insert the dowel **5** into the drilled hole, making sure that the tapped extractor hole is to the outside.

Fit new wear rings **J** (**2**) and **K** (**4**). Rotate the wear rings so that the piston retention dowel is covered by the wear ring, NOT as shown at **L**.

DRILLING DETAILS FOR PISTON HEAD RETENTION
(all dimensions in mm)

Ram Size	Dowel Size	Guide Drill Ø	Guide Drill Depth	Dowel Drill Ø X	Dowel Drill Depth Y
50 x 25	20 x 6Ø	4	19	6.1/6.02	23/22
60 x 30	20 x 6Ø	4	19	6.1/6.02	23/22
70 x 40	20 x 6Ø	4	19	6.1/6.02	23/22
80 x 50	20 x 6Ø	4	19	6.1/6.02	23/22



Assembling (cont'd)

Fit new piston head seals **3** as follows:

- 1 Using a blunt instrument (892/01027) as shown at **F**, lever the inner seal **G** into the piston head seal groove, do not let the seal twist. There are identification marks on the outer diameter of the seal, make sure the marks are visible and the seal is free to rotate, if not remove the seal and refit.
- 2 Fit outer seal **H** using the same procedure as step 1. Check the external grooves are visible.

Position the cylinder on the bench and install the rod assembly into the cylinder.

Taking care to retain the end cap **1** at the further end of the piston rod from the cylinder, coat the thread of the cylinder with JCB Activator. Next apply JCB Threadlocker to the thread of the end cap. Wait 15 minutes before bringing the two together and then torque-tighten the end cap into the cylinder.

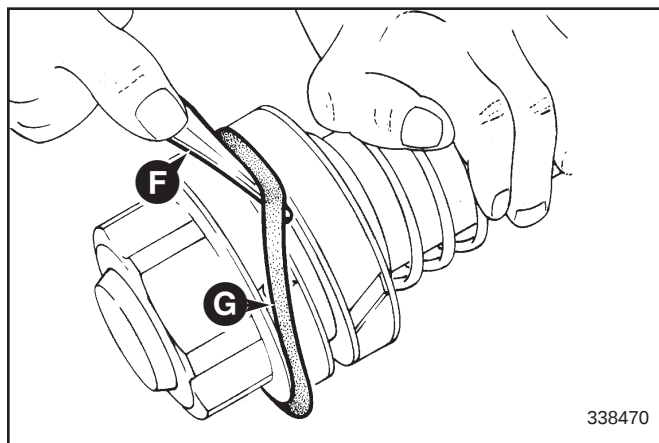
Note: If hydraulic oil contacts uncured Threadlocker, a weakening of the bond will result. Cure times vary according to the ambient temperature. Allow approximately 1 hour at 20° C between assembly and filling the ram with oil.

Torque Settings

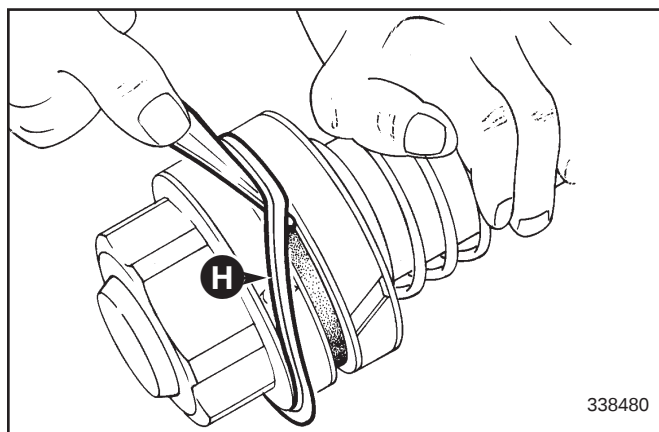
For torque settings required, refer to **Technical Data** on page 1 - 1.

Note: When fitting cylinder and piston eye bushes **12**, ensure that the split in the bush is set at 90° to the longitudinal centreline of the cylinder.

Note: Cold weather operation. When operating in conditions which are consistently below freezing, it is recommended that the rams are operated slowly to their full extent before commencing normal working.



338470



338480

Slew Cylinder

Re-seal

Position machine on firm level ground. Slew the excavator fully round so that the cylinder to be worked on is facing rearwards. Fit the boom lock and stop the engine. Operate slew control levers to vent residual hydraulic pressure.

WARNING

Hydraulic Pressure

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

HYD 1-5

Oil will run out of the slew housing when the cylinder is removed. Position a container underneath to catch the oil.

Disconnect hydraulic feed pipe **1** from cylinder. Unscrew capscrews **2** and remove cylinder **3**.

Remove seals **4** from rack. Check that seal grooves are clean and free from burrs.

Check end damping plunger **5** which should move freely in its bore and be returned by the force of spring **6**.

Lubricate new seals **4** with clean engine oil and fit to rack. Renew 'O' ring **7**.

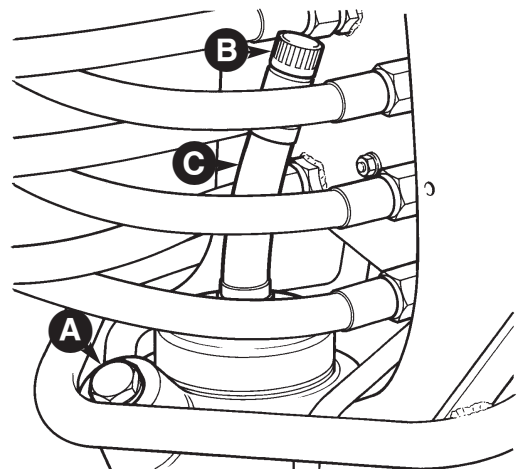
Re-assemble components in reverse order. Tighten capscrews **2** to 300 Nm (221 lbf ft, 31 kgf m).

Repeat for other slew cylinder if required then fill the slew housing with oil (see opposite).

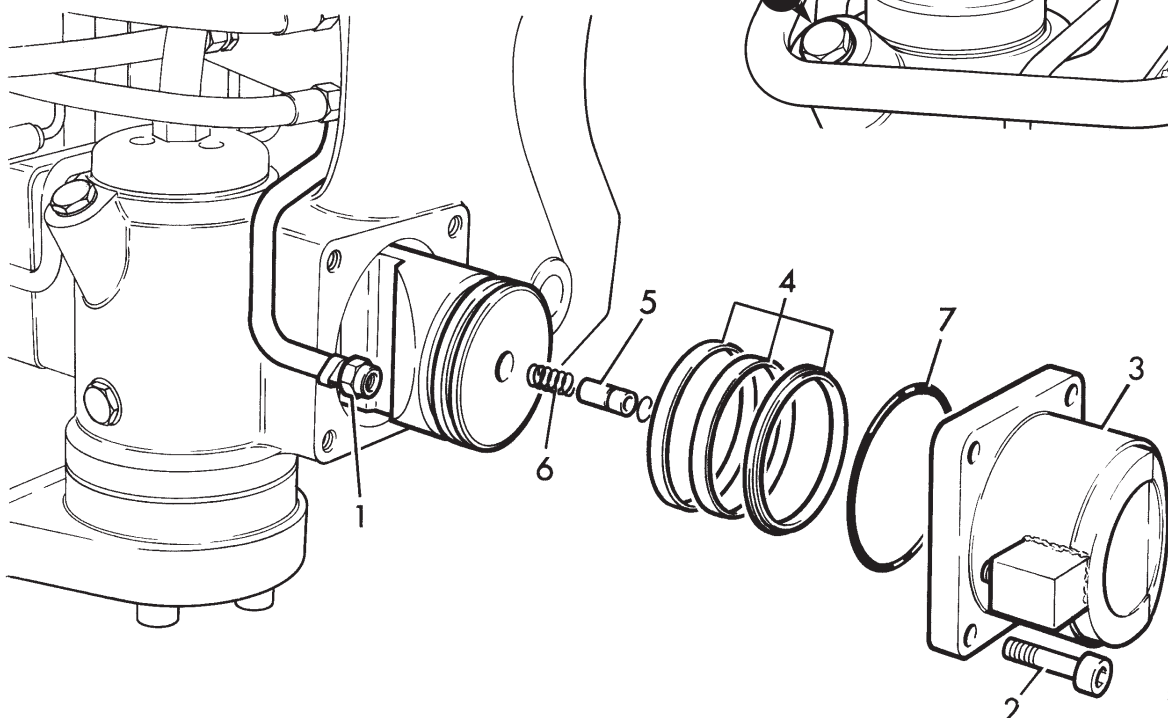
Filling Procedure

Whenever the slew housing is re-filled with oil the following procedure must be carried out to ensure that all air is expelled:

- 1** Remove plug **A** and fill with clean oil to the level of the plug. Replace the plug.
- 2** Remove plug **B** and half fill the breather tube **C** with clean oil.
- 3** Start the engine and operate the slew service until the oil level rises in the breather tube. Stop the engine.
- 4** Remove plug **A** to release the air then replace the plug. Top up the oil level in the breather tube.
- 5** Repeat the operation until all air is expelled.
- 6** Check that the oil level is up to the mark in the breather tube and replace plug **B**.



203940



S215900

Removal and Replacement

See Section 3 **Routine Maintenance** for renewal of the filter element.

WARNING

Hydraulic Pressure

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

HYD-1-5

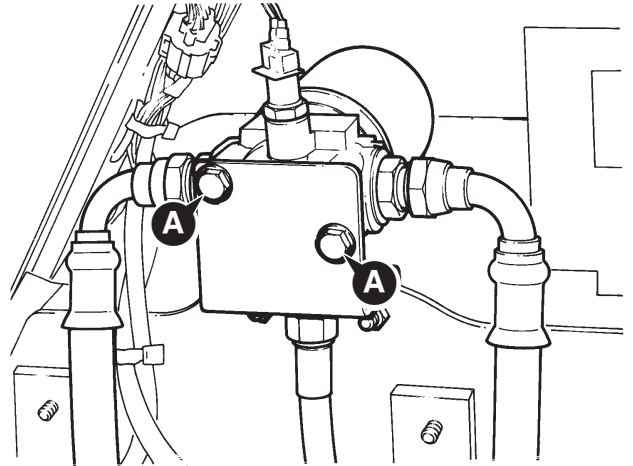
Before working on the hydraulic system ensure that the engine is switched off and the starter key removed.

- 1 Vent the hydraulic pressure (see page E/2 - 1).
- 2 Remove the battery compartment cover and the corresponding inside panel.
- 3 Remove the hydraulic filler cap.
- 4 Remove the hydraulic tank drain plug at the rear of the tank and drain the hydraulic oil to below the level of the filter return connection.

Note: Always drain into a suitable container.

- 5 Disconnect and blank the connections to the filter.
- 6 Remove bolts **A** and withdraw filter assembly from machine.

Replacement is a reversal of the removal procedure. Start and run the engine for a few minutes then check for leaks. Top up as necessary with the correct fluid.



204350

Removal and Replacement

⚠ WARNING

Hydraulic Pressure

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

HYD-1-5

Before working on the hydraulic system ensure that the engine is switched off and the starter key removed.

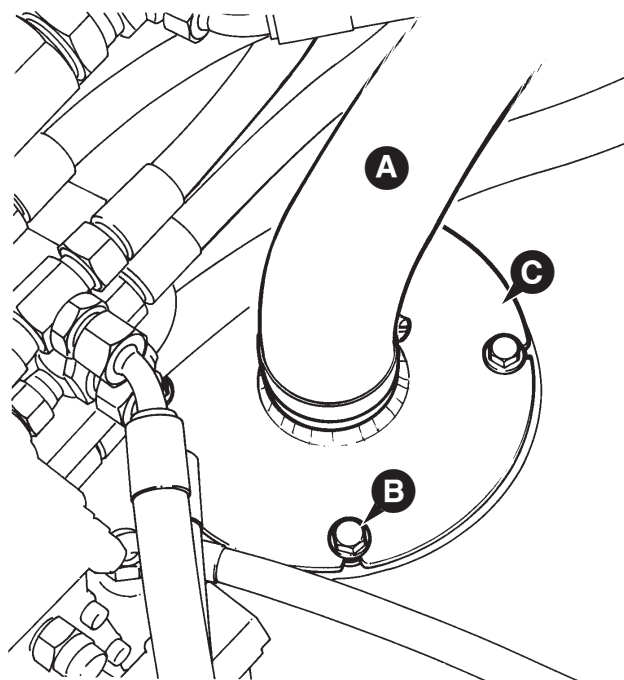
- 1 Vent the hydraulic pressure (see page E/2 - 1).
- 2 Remove the battery compartment cover and remove the hydraulic filler cap.
- 3 Remove the rear floor plate to gain access to the hydraulic tank cover plate.
- 4 Remove the hydraulic tank drain plug at the rear of the tank and drain the hydraulic oil to below the level of the tank cover plate.

Note: Always drain into a suitable container.

- 5 Loosen worm drive clip and withdraw hose **A** from cover plate.
- 6 Unscrew bolts **B**, remove cover plate **C** together with its gasket.
- 7 Unscrew and remove the main suction strainer, which is screwed into a bulkhead connector inside the tank. Wash in a suitable solvent and allow to dry.

Note: A new strainer should be similarly washed before fitting, to remove the protective coating.

- 8 Reassemble in reverse order using a new gasket coated with Red Hermetite. Refill the tank with the correct fluid (see page 3/1 - 1).



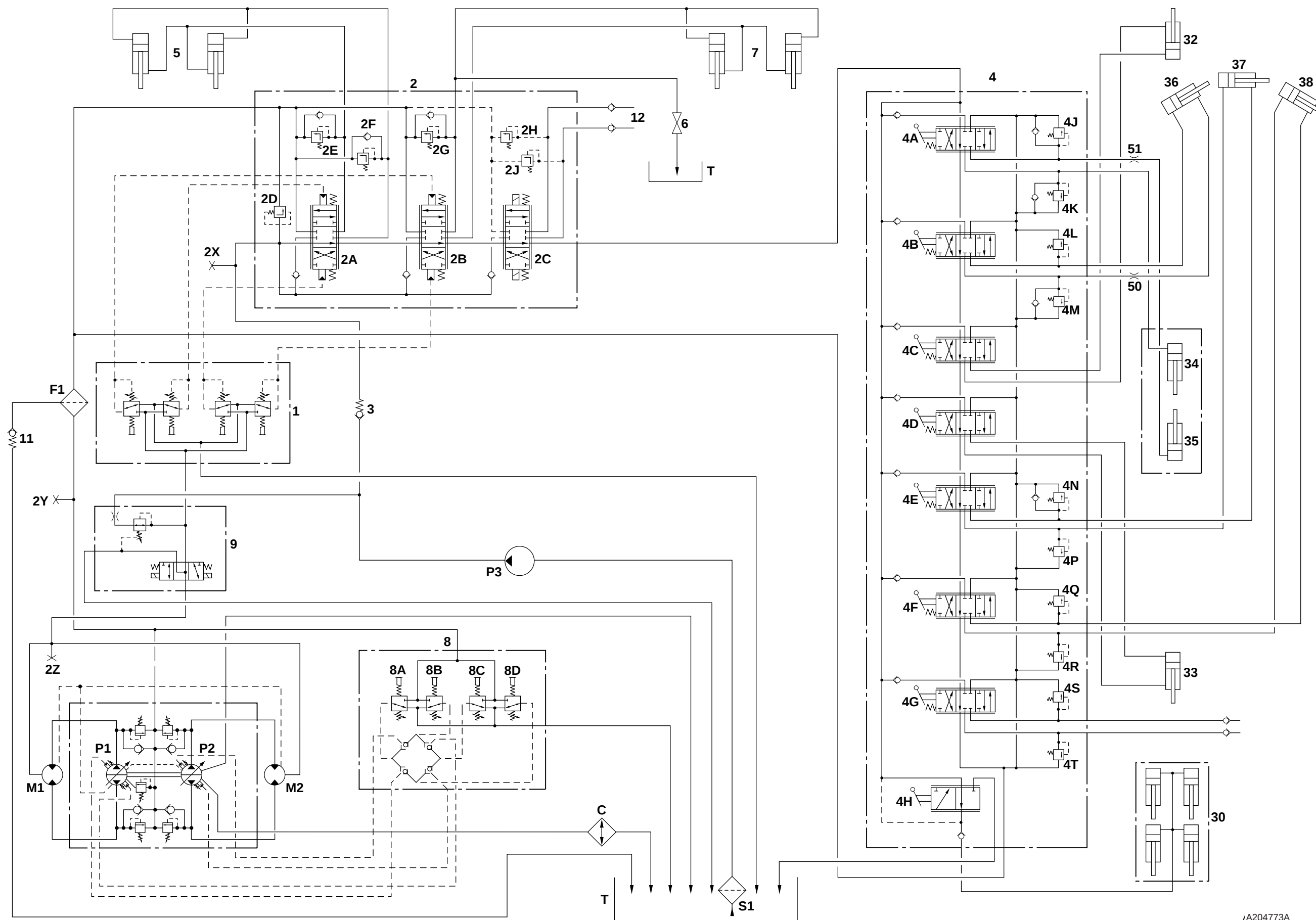
204340

*** Component Key - Standard Machine up to machine no. 751011**

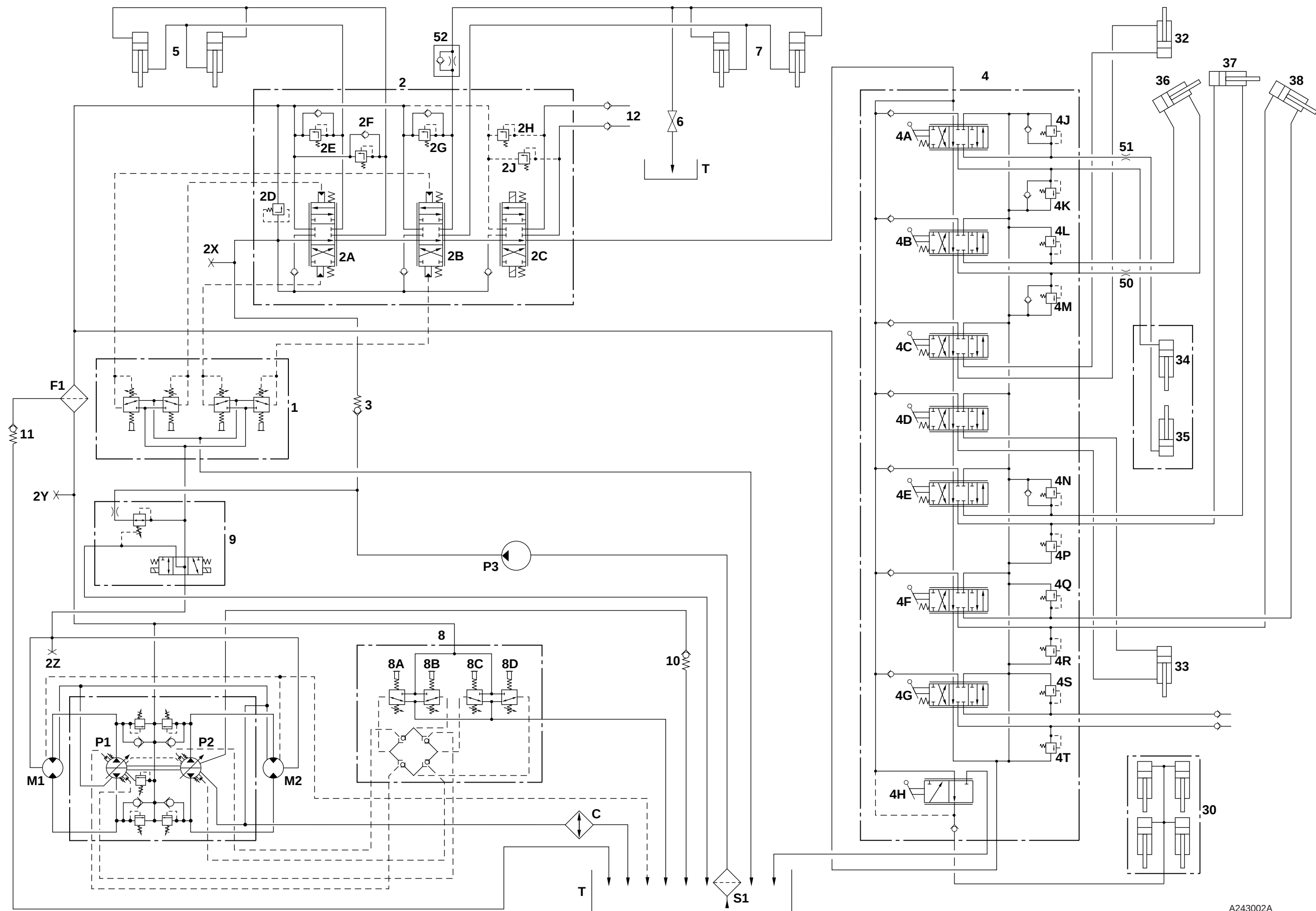
C	Cooler
F1	Filter
P1	Main Pump
P2	Main Pump
P3	Auxiliary Gear Pump
M1	Left Hand Drive Motor
M2	Right Hand Drive Motor
S1	Suction Strainer
T	Tank
1	Loader Joystick
2	Loader Valve Block
2A	Crowd Spool
2B	Lift Spool
2C	Auxiliary Spool
2D	Main Relief Valve (MRV)
2E	Crowd Ram Rod Side ARV
2F	Crowd Ram Head Side ARV
2G	Lift Ram Head Side ARV
2H	Auxiliary ARV
2J	Auxiliary ARV
2X	Pressure Test Point (Main Relief Valve)
2Y	Pressure Test Point (Transmission Charge Pressure)
2Z	Pressure Test Point (Brake Pressure) & Hand Pump Connector (Manual Brake Release)
3	Check Valve (5 bar)
4	Excavator Valve Block
4A	Slew Spool
4B	Boom Spool
4C	Stabiliser Spool
4D	Stabiliser Spool
4E	Dipper Spool
4F	Bucket Spool
4G	Auxiliary Spool
4H	Hydraclamp Valve
4J	Slew ARV
4K	Slew ARV
4L	Boom Ram Head Side ARV
4M	Boom Ram Rod Side ARV
4N	Dipper Ram Rod Side ARV
4P	Dipper Ram Head Side ARV
4Q	Bucket Ram Rod Side ARV
4R	Bucket Ram Head Side ARV
4S	Auxiliary ARV
4T	Auxiliary ARV
5	Crowd Rams
6	Manually Operated Dump Valve
7	Lift Rams
8	Drive Control Joystick
8A	Reverse Spool
8B	Left Turn Spool
8C	Forward Spool
8D	Right Turn Spool
9	Pressure Reducing Solenoid Valve
11	Filter By-pass Valve (3 bar)
12	Auxiliary Feeds
30	Hydraclamp
32	Stabiliser Ram
33	Stabiliser Ram
34	Slew Ram
35	Slew Ram
36	Boom Ram

37	Dipper Ram
38	Bucket Ram
50	Bi-restrictor
51	Bi-restrictor

Note: Excavator services shown here are to the JCB 'X' control pattern. For ISO '+' control pattern, components 36 and 37 are swapped over.



J204773A



A243002A

*** Component Key - Standard Machine from machine no. 751012 to 752462
- Single Lever Drive Control**

C	Cooler	32	Stabiliser Ram
F1	Filter	33	Stabiliser Ram
P1	Main Pump	34	Slew Ram
P2	Main Pump	35	Slew Ram
P3	Auxiliary Gear Pump	36	Boom Ram
M1	Left Hand Drive Motor	37	Dipper Ram
M2	Right Hand Drive Motor	38	Bucket Ram
S1	Suction Strainer	50	Bi-restrictor
T	Tank	51	Bi-restrictor
1	Loader Joystick	52	One-way Restrictor
2	Loader Valve Block		
2A	Crowd Spool		
2B	Lift Spool		
2C	Auxiliary Spool		
2D	Main Relief Valve (MRV)		
2E	Crowd Ram Rod Side ARV		
2F	Crowd Ram Head Side ARV		
2G	Lift Ram Head Side ARV		
2H	Auxiliary ARV		
2J	Auxiliary ARV		
2X	Pressure Test Point (Main Relief Valve)		
2Y	Pressure Test Point (Transmission Charge Pressure)		
2Z	Pressure Test Point (Brake Pressure) & Hand Pump Connector (Manual Brake Release)		
3	Check Valve (8 bar)		
4	Excavator Valve Block		
4A	Slew Spool		
4B	Boom Spool		
4C	Stabiliser Spool		
4D	Stabiliser Spool		
4E	Dipper Spool		
4F	Bucket Spool		
4G	Auxiliary Spool		
4H	Hydraclamp Valve		
4J	Slew ARV		
4K	Slew ARV		
4L	Boom Ram Head Side ARV		
4M	Boom Ram Rod Side ARV		
4N	Dipper Ram Rod Side ARV		
4P	Dipper Ram Head Side ARV		
4Q	Bucket Ram Rod Side ARV		
4R	Bucket Ram Head Side ARV		
4S	Auxiliary ARV		
4T	Auxiliary ARV		
5	Crowd Rams		
6	Manually Operated Dump Valve		
7	Lift Rams		
8	Drive Control Joystick		
8A	Reverse Spool		
8B	Left Turn Spool		
8C	Forward Spool		
8D	Right Turn Spool		
9	Pressure Reducing Solenoid Valve		
10	Check Valve (2 bar)		
11	Filter By-pass Valve (3 bar)		
12	Auxiliary Feeds		
30	Hydraclamp		

Note: Excavator services shown here are to the JCB 'X' control pattern. For ISO '+' control pattern, components 36 and 37 are swapped over.

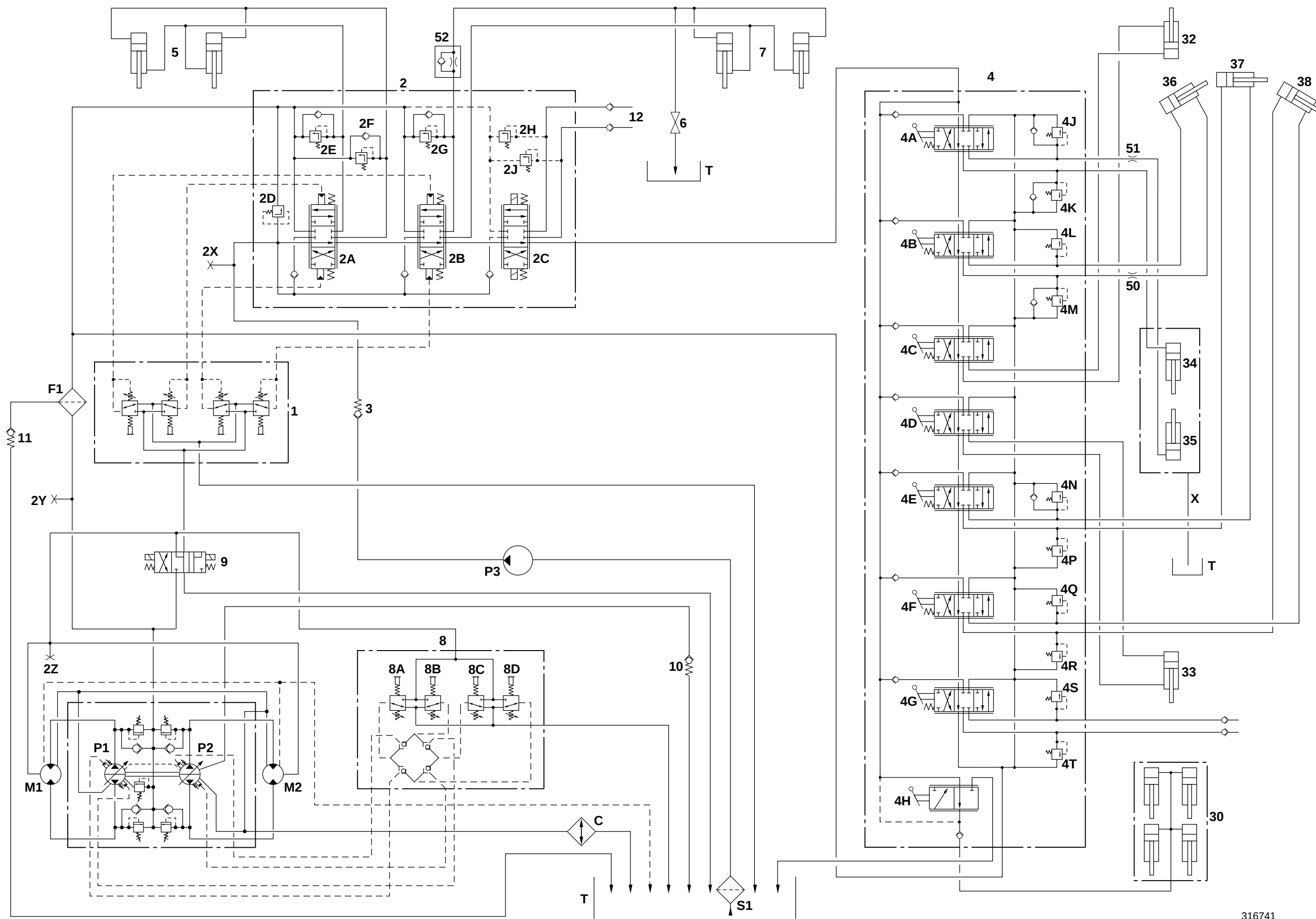
Component Key - Standard Machine from machine no. 752463 - Single Lever Drive Control

C	Cooler
F1	Filter
P1	Main Pump
P2	Main Pump
P3	Auxiliary Gear Pump
M1	Left Hand Drive Motor
M2	Right Hand Drive Motor
S1	Suction Strainer
T	Tank
1	Loader Joystick
2	Loader Valve Block
2A	Crowd Spool
2B	Lift Spool
2C	Auxiliary Spool
2D	Main Relief Valve (MRV)
2E	Crowd Ram Rod Side ARV
2F	Crowd Ram Head Side ARV
2G	Lift Ram Head Side ARV
2H	Auxiliary ARV
2J	Auxiliary ARV
2X	Pressure Test Point (Main Relief Valve)
2Y	Pressure Test Point (Transmission Charge Pressure)
2Z	Pressure Test Point (Brake Pressure) & Hand Pump Connector (Manual Brake Release)
3	Check Valve (8 bar)
4	Excavator Valve Block
4A	Slew Spool
4B	Boom Spool
4C	Stabiliser Spool
4D	Stabiliser Spool
4E	Dipper Spool
4F	Bucket Spool
4G	Auxiliary Spool
4H	Hydraclamp Valve
4J	Slew ARV
4K	Slew ARV
4L	Boom Ram Head Side ARV
4M	Boom Ram Rod Side ARV
4N	Dipper Ram Rod Side ARV
4P	Dipper Ram Head Side ARV
4Q	Bucket Ram Rod Side ARV
4R	Bucket Ram Head Side ARV
4S	Auxiliary ARV
4T	Auxiliary ARV
5	Crowd Rams
6	Manually Operated Dump Valve
7	Lift Rams
8	Drive Control Joystick
8A	Reverse Spool
8B	Left Turn Spool
8C	Forward Spool
8D	Right Turn Spool
9	Brake Valve
10	Check Valve (2 bar)
11	Filter By-pass Valve (3 bar)
12	Auxiliary Feeds
30	Hydraclamp

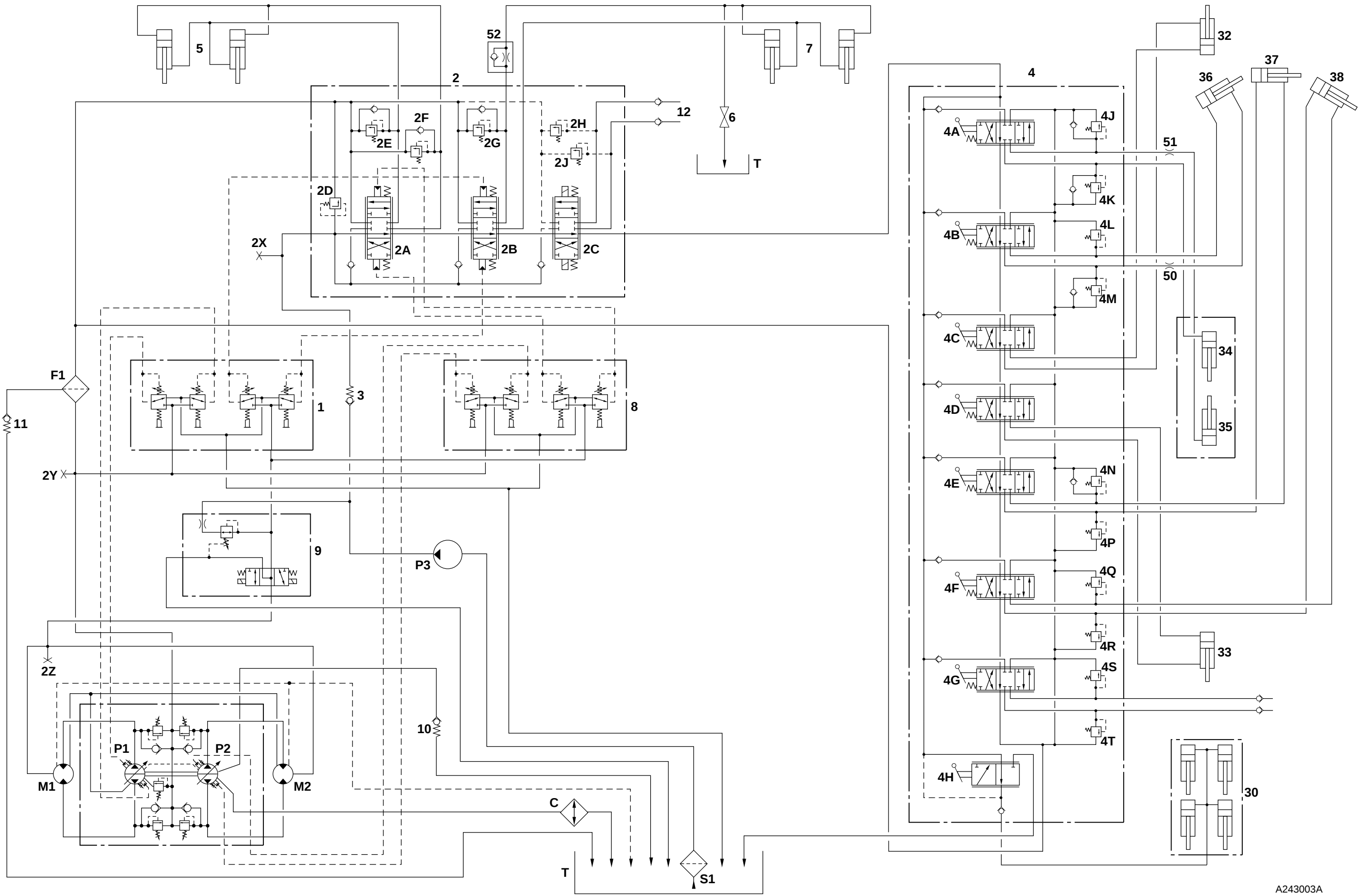
32	Stabiliser Ram
33	Stabiliser Ram
34	Slew Ram
35	Slew Ram
36	Boom Ram
37	Dipper Ram
38	Bucket Ram
50	Bi-restrictor
51	Bi-restrictor
*52	One-way Restrictor (see note 2)
X	Return line fitted from machine no. 807226

Note 1: Excavator services shown here are to the JCB 'X' control pattern. For ISO '+' control pattern, components **36** and **37** are swapped over.

*** Note 2:** On machines fitted with a Husco Loader Valve, One-way Restrictor **52** is deleted. On these machines a restrictor is fitted in the Valve Block.



316741



A243003A

Component Key - Standard Machine from machine no. 751012 to 752462

- Dual Lever Drive Control

C	Cooler	37	Dipper Ram
F1	Filter	38	Bucket Ram
P1	Main Pump	50	Bi-restrictor
P2	Main Pump	51	Bi-restrictor
P3	Auxiliary Gear Pump	52	One-way Restrictor
M1	Left Hand Drive Motor		
M2	Right Hand Drive Motor		
S1	Suction Strainer		
T	Tank		
1	Left Hand Joystick		
2	Loader Valve Block		
2A	Crowd Spool		
2B	Lift Spool		
2C	Auxiliary Spool		
2D	Main Relief Valve (MRV)		
2E	Crowd Ram Rod Side ARV		
2F	Crowd Ram Head Side ARV		
2G	Lift Ram Head Side ARV		
2H	Auxiliary ARV		
2J	Auxiliary ARV		
2X	Pressure Test Point (Main Relief Valve)		
2Y	Pressure Test Point (Transmission Charge Pressure)		
2Z	Pressure Test Point (Brake Pressure) & Hand Pump Connector (Manual Brake Release)		
3	Check Valve (8 bar)		
4	Excavator Valve Block		
4A	Slew Spool		
4B	Boom Spool		
4C	Stabiliser Spool		
4D	Stabiliser Spool		
4E	Dipper Spool		
4F	Bucket Spool		
4G	Auxiliary Spool		
4H	Hydraclamp Valve		
4J	Slew ARV		
4K	Slew ARV		
4L	Boom Ram Head Side ARV		
4M	Boom Ram Rod Side ARV		
4N	Dipper Ram Rod Side ARV		
4P	Dipper Ram Head Side ARV		
4Q	Bucket Ram Rod Side ARV		
4R	Bucket Ram Head Side ARV		
4S	Auxiliary ARV		
4T	Auxiliary ARV		
5	Crowd Rams		
6	Manually Operated Dump Valve		
7	Lift Rams		
8	Right Hand Joystick		
9	Pressure Reducing Solenoid Valve		
10	Check Valve (2 bar)		
11	Filter By-pass Valve (3 bar)		
12	Auxiliary Feeds		
30	Hydraclamp		
32	Stabiliser Ram		
33	Stabiliser Ram		
34	Slew Ram		
35	Slew Ram		
36	Boom Ram		

Note: Excavator services shown here are to the JCB 'X' control pattern. For ISO '+' control pattern, components 36 and 37 are swapped over.

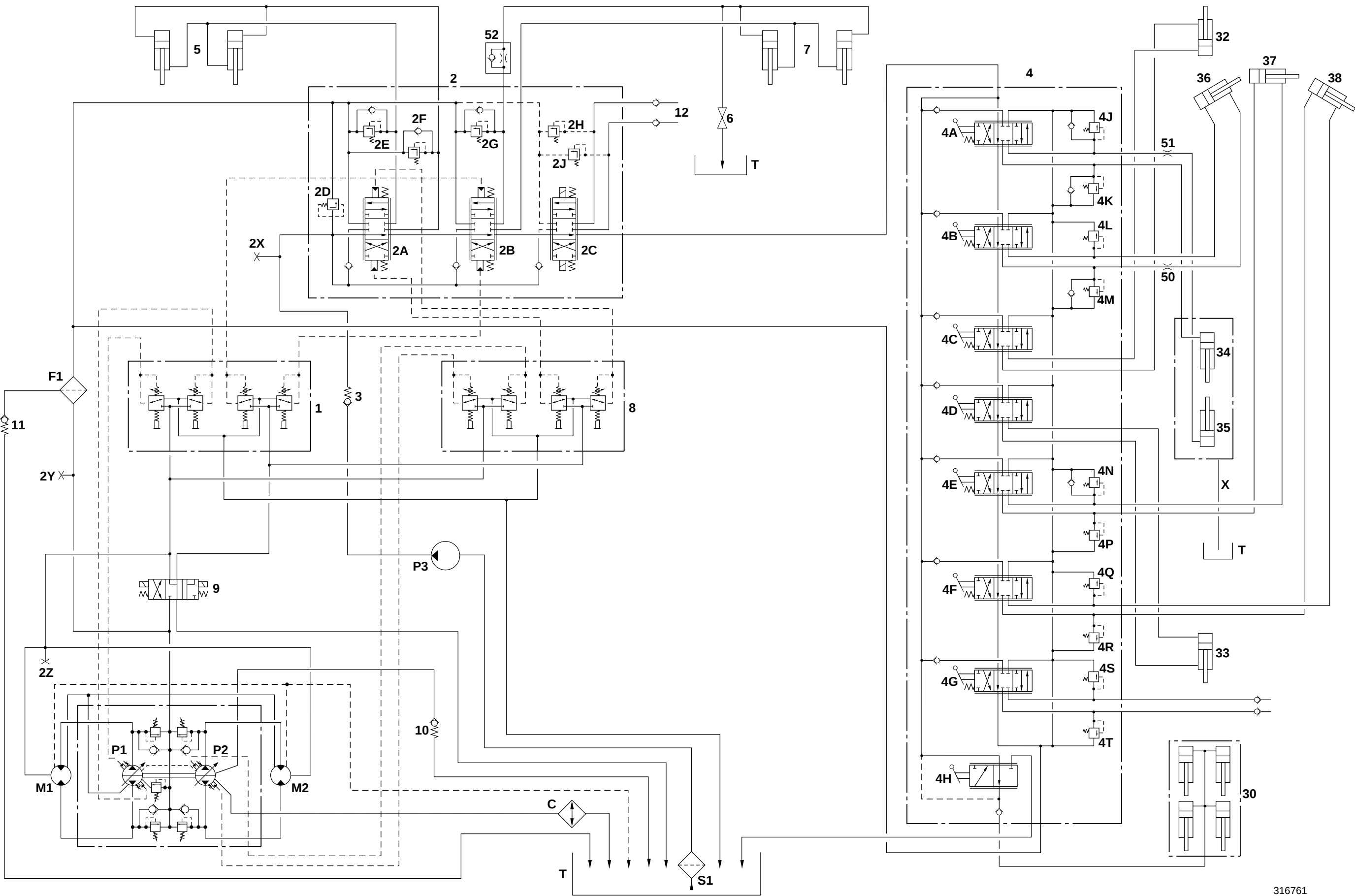
Component Key - Standard Machine from machine no. 752463 - Dual Lever Drive Control

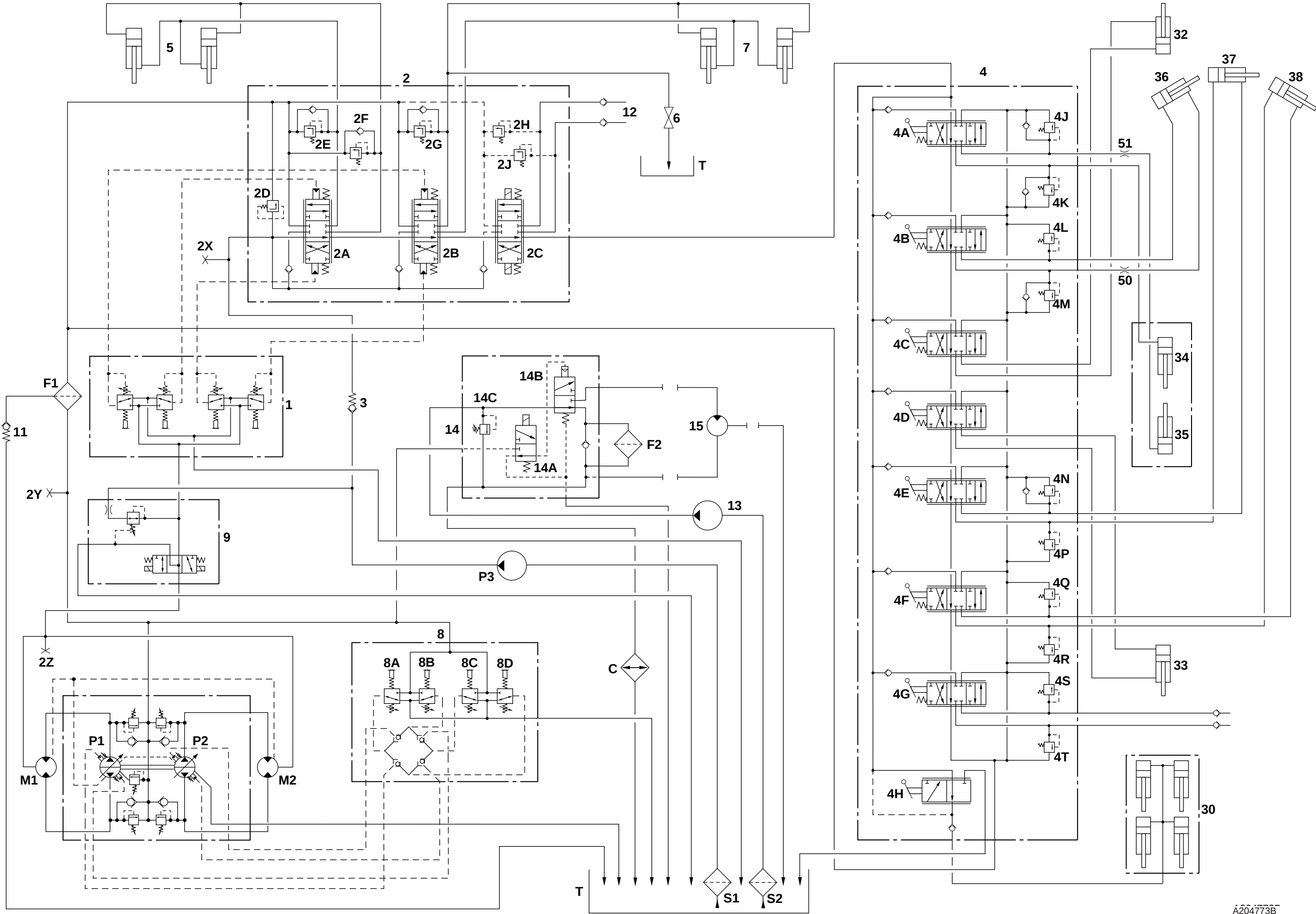
C	Cooler
F1	Filter
P1	Main Pump
P2	Main Pump
P3	Auxiliary Gear Pump
M1	Left Hand Drive Motor
M2	Right Hand Drive Motor
S1	Suction Strainer
T	Tank
1	Left Hand Joystick
2	Loader Valve Block
2A	Crowd Spool
2B	Lift Spool
2C	Auxiliary Spool
2D	Main Relief Valve (MRV)
2E	Crowd Ram Rod Side ARV
2F	Crowd Ram Head Side ARV
2G	Lift Ram Head Side ARV
2H	Auxiliary ARV
2J	Auxiliary ARV
2X	Pressure Test Point (Main Relief Valve)
2Y	Pressure Test Point (Transmission Charge Pressure)
2Z	Pressure Test Point (Brake Pressure) & Hand Pump Connector (Manual Brake Release)
3	Check Valve (8 bar)
4	Excavator Valve Block
4A	Slew Spool
4B	Boom Spool
4C	Stabiliser Spool
4D	Stabiliser Spool
4E	Dipper Spool
4F	Bucket Spool
4G	Auxiliary Spool
4H	Hydraclamp Valve
4J	Slew ARV
4K	Slew ARV
4L	Boom Ram Head Side ARV
4M	Boom Ram Rod Side ARV
4N	Dipper Ram Rod Side ARV
4P	Dipper Ram Head Side ARV
4Q	Bucket Ram Rod Side ARV
4R	Bucket Ram Head Side ARV
4S	Auxiliary ARV
4T	Auxiliary ARV
5	Crowd Rams
6	Manually Operated Dump Valve
7	Lift Rams
8	Right Hand Joystick
9	Brake Valve
10	Check Valve (2 bar)
11	Filter By-pass Valve (3 bar)
12	Auxiliary Feeds
30	Hydraclamp
32	Stabiliser Ram
33	Stabiliser Ram
34	Slew Ram
35	Slew Ram
36	Boom Ram

37	Dipper Ram
38	Bucket Ram
50	Bi-restrictor
51	Bi-restrictor
*52	One-way Restrictor (see note 2)
X	Return line fitted from machine no. 807226

Note 1: Excavator services shown here are to the JCB 'X' control pattern. For ISO '+' control pattern, components **36** and **37** are swapped over.

*** Note 2:** On machines fitted with a Husco Loader Valve, One-way Restrictor **52** is deleted. On these machines a restrictor is fitted in the Valve Block.





A204773B

Component Key - High-flow Machine up to machine no. 751011 - Single Lever Control

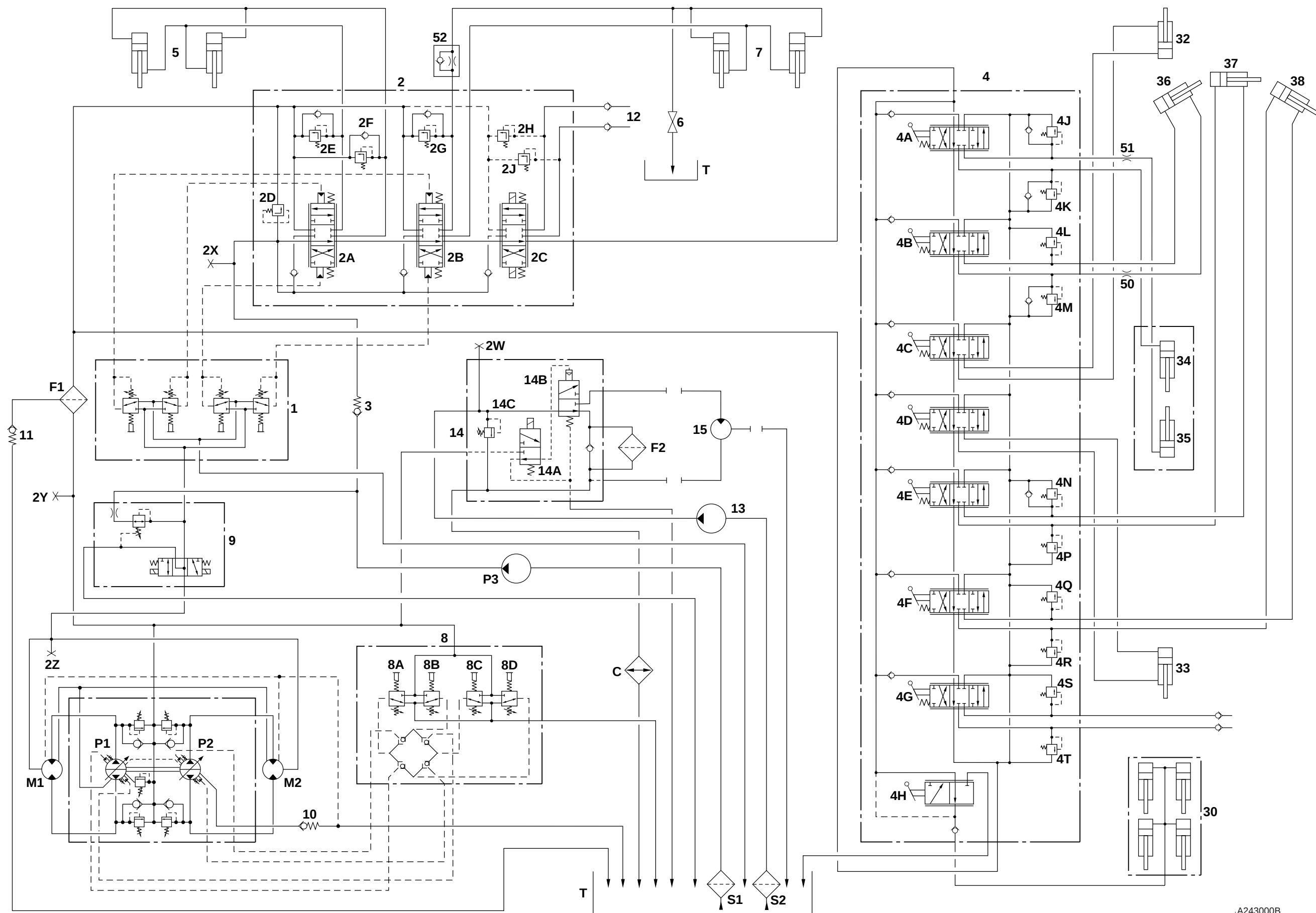
C	Cooler	13	High-flow Pump
F1	Filter	14	High-flow Valve
F2	High-flow Filter	14A	High-flow Pilot Valve
P1	Main Pump	14B	High-flow Control Valve
P2	Main Pump	14C	High-flow Circuit Relief Valve
P3	Auxiliary Gear Pump	15	Attachment Motor
M1	Left Hand Drive Motor	30	Hydraclamp
M2	Right Hand Drive Motor	32	Stabiliser Ram
S1	Suction Strainer	33	Stabiliser Ram
S2	High-flow Pump Suction Strainer	34	Slew Ram
T	Tank	35	Slew Ram
1	Loader Joystick	36	Boom Ram
2	Loader Valve Block	37	Dipper Ram
2A	Crowd Spool	38	Bucket Ram
2B	Lift Spool	50	Bi-restrictor
2C	Auxiliary Spool	51	Bi-restrictor
2D	Main Relief Valve (MRV)		
2E	Crowd Ram Rod Side ARV		
2F	Crowd Ram Head Side ARV		
2G	Lift Ram Head Side ARV		
2H	Auxiliary ARV		
2J	Auxiliary ARV		
2X	Pressure Test Point (Main Relief Valve)		
2Y	Pressure Test Point (Transmission Charge Pressure)		
2Z	Pressure Test Point (Brake Pressure) & Hand Pump Connector (Manual Brake Release)		
3	Check Valve (5 bar)		
4	Excavator Valve Block		
4A	Slew Spool		
4B	Boom Spool		
4C	Stabiliser Spool		
4D	Stabiliser Spool		
4E	Dipper Spool		
4F	Bucket Spool		
4G	Auxiliary Spool		
4H	Hydraclamp Valve		
4J	Slew ARV		
4K	Slew ARV		
4L	Boom Ram Head Side ARV		
4M	Boom Ram Rod Side ARV		
4N	Dipper Ram Rod Side ARV		
4P	Dipper Ram Head Side ARV		
4Q	Bucket Ram Rod Side ARV		
4R	Bucket Ram Head Side ARV		
4S	Auxiliary ARV		
4T	Auxiliary ARV		
5	Crowd Rams		
6	Manually Operated Dump Valve		
7	Lift Rams		
8	Drive Control Joystick		
8A	Reverse Spool		
8B	Left Turn Spool		
8C	Forward Spool		
8D	Right Turn Spool		
9	Pressure Reducing Solenoid Valve		
11	Filter By-pass Valve (3 bar)		
12	Auxiliary Feeds		

Note: Excavator services shown here are to the JCB 'X' control pattern. For ISO '+' control pattern, components 36 and 37 are swapped over.

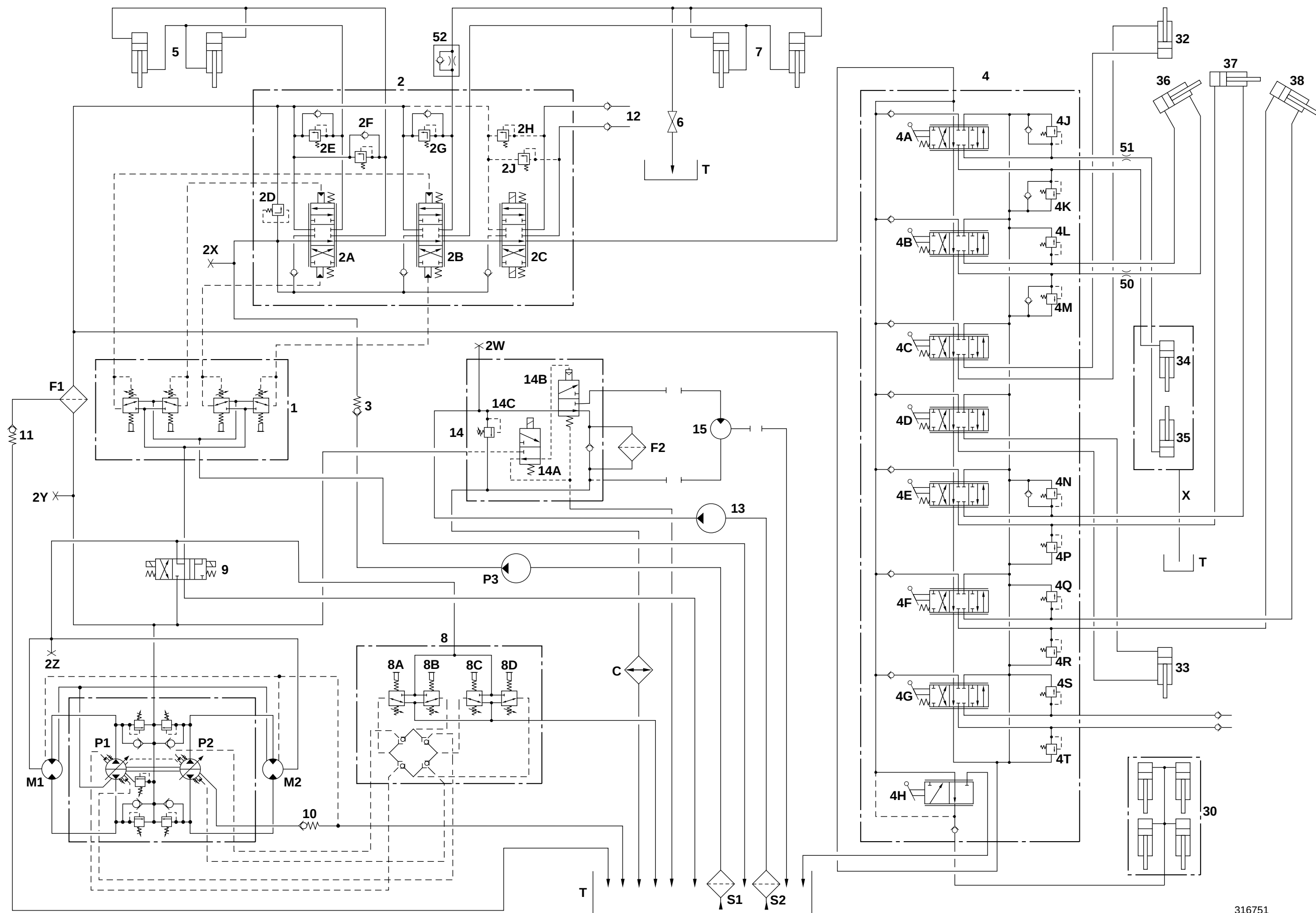
Component Key - High-flow Machine from machine no. 751012 to 752462
- Single Lever Drive Control

C	Cooler	13	High-flow Pump
F1	Filter	14	High-flow Valve
F2	High-flow Filter	14A	High-flow Pilot Valve
P1	Main Pump	14B	High-flow Control Valve
P2	Main Pump	14C	High-flow Circuit Relief Valve
P3	Auxiliary Gear Pump	15	Attachment Motor
M1	Left Hand Drive Motor	30	Hydraclamp
M2	Right Hand Drive Motor	32	Stabiliser Ram
S1	Suction Strainer	33	Stabiliser Ram
S2	High-flow Pump Suction Strainer	34	Slew Ram
T	Tank	35	Slew Ram
1	Loader Joystick	36	Boom Ram
2	Loader Valve Block	37	Dipper Ram
2A	Crowd Spool	38	Bucket Ram
2B	Lift Spool	50	Bi-restrictor
2C	Auxiliary Spool	51	Bi-restrictor
2D	Main Relief Valve (MRV)	52	One-way Restrictor
2E	Crowd Ram Rod Side ARV		
2F	Crowd Ram Head Side ARV		
2G	Lift Ram Head Side ARV		
2H	Auxiliary ARV		
2J	Auxiliary ARV		
2W	Pressure Test Point (High-flow Relief Valve)		
2X	Pressure Test Point (Main Relief Valve)		
2Y	Pressure Test Point (Transmission Charge Pressure)		
2Z	Pressure Test Point (Brake Pressure) & Hand Pump Connector (Manual Brake Release)		
3	Check Valve (8 bar)		
4	Excavator Valve Block		
4A	Slew Spool		
4B	Boom Spool		
4C	Stabiliser Spool		
4D	Stabiliser Spool		
4E	Dipper Spool		
4F	Bucket Spool		
4G	Auxiliary Spool		
4H	Hydraclamp Valve		
4J	Slew ARV		
4K	Slew ARV		
4L	Boom Ram Head Side ARV		
4M	Boom Ram Rod Side ARV		
4N	Dipper Ram Rod Side ARV		
4P	Dipper Ram Head Side ARV		
4Q	Bucket Ram Rod Side ARV		
4R	Bucket Ram Head Side ARV		
4S	Auxiliary ARV		
4T	Auxiliary ARV		
5	Crowd Rams		
6	Manually Operated Dump Valve		
7	Lift Rams		
8	Drive Control Joystick		
8A	Reverse Spool		
8B	Left Turn Spool		
8C	Forward Spool		
8D	Right Turn Spool		
9	Pressure Reducing Solenoid Valve		
10	Check Valve (2 bar)		
11	Filter By-pass Valve (3 bar)		
12	Auxiliary Feeds		

Note: Excavator services shown here are to the JCB 'X' control pattern. For ISO '+' control pattern, components 36 and 37 are swapped over.



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316751

Component Key - High-flow Machine from machine no. 752463 - Single Lever Drive Control

C	Cooler	13	High-flow Pump
F1	Filter	14	High-flow Valve
F2	High-flow Filter	14A	High-flow Pilot Valve
P1	Main Pump	14B	High-flow Control Valve
P2	Main Pump	14C	High-flow Circuit Relief Valve
P3	Auxiliary Gear Pump	15	Attachment Motor
M1	Left Hand Drive Motor	30	Hydraclamp
M2	Right Hand Drive Motor	32	Stabiliser Ram
S1	Suction Strainer	33	Stabiliser Ram
S2	High-flow Pump Suction Strainer	34	Slew Ram
T	Tank	35	Slew Ram
1	Loader Joystick	36	Boom Ram
2	Loader Valve Block	37	Dipper Ram
2A	Crowd Spool	38	Bucket Ram
2B	Lift Spool	50	Bi-restrictor
2C	Auxiliary Spool	51	Bi-restrictor
2D	Main Relief Valve (MRV)	*52	One-way Restrictor (see note 2)
2E	Crowd Ram Rod Side ARV		
2F	Crowd Ram Head Side ARV		
2G	Lift Ram Head Side ARV		
2H	Auxiliary ARV		
2J	Auxiliary ARV		
2W	Pressure Test Point (High-flow Relief Valve)		
2X	Pressure Test Point (Main Relief Valve)		
2Y	Pressure Test Point (Transmission Charge Pressure)		
2Z	Pressure Test Point (Brake Pressure) & Hand Pump Connector (Manual Brake Release)		
3	Check Valve (8 bar)		
4	Excavator Valve Block		
4A	Slew Spool		
4B	Boom Spool		
4C	Stabiliser Spool		
4D	Stabiliser Spool		
4E	Dipper Spool		
4F	Bucket Spool		
4G	Auxiliary Spool		
4H	Hydraclamp Valve		
4J	Slew ARV		
4K	Slew ARV		
4L	Boom Ram Head Side ARV		
4M	Boom Ram Rod Side ARV		
4N	Dipper Ram Rod Side ARV		
4P	Dipper Ram Head Side ARV		
4Q	Bucket Ram Rod Side ARV		
4R	Bucket Ram Head Side ARV		
4S	Auxiliary ARV		
4T	Auxiliary ARV		
5	Crowd Rams		
6	Manually Operated Dump Valve		
7	Lift Rams		
8	Drive Control Joystick		
8A	Reverse Spool		
8B	Left Turn Spool		
8C	Forward Spool		
8D	Right Turn Spool		
9	Brake Valve		
10	Check Valve (2 bar)		
11	Filter By-pass Valve (3 bar)		
12	Auxiliary Feeds		

X Return line fitted from machine no. 807226

Note 1: Excavator services shown here are to the JCB 'X' control pattern. For ISO '+' control pattern, components **36** and **37** are swapped over.

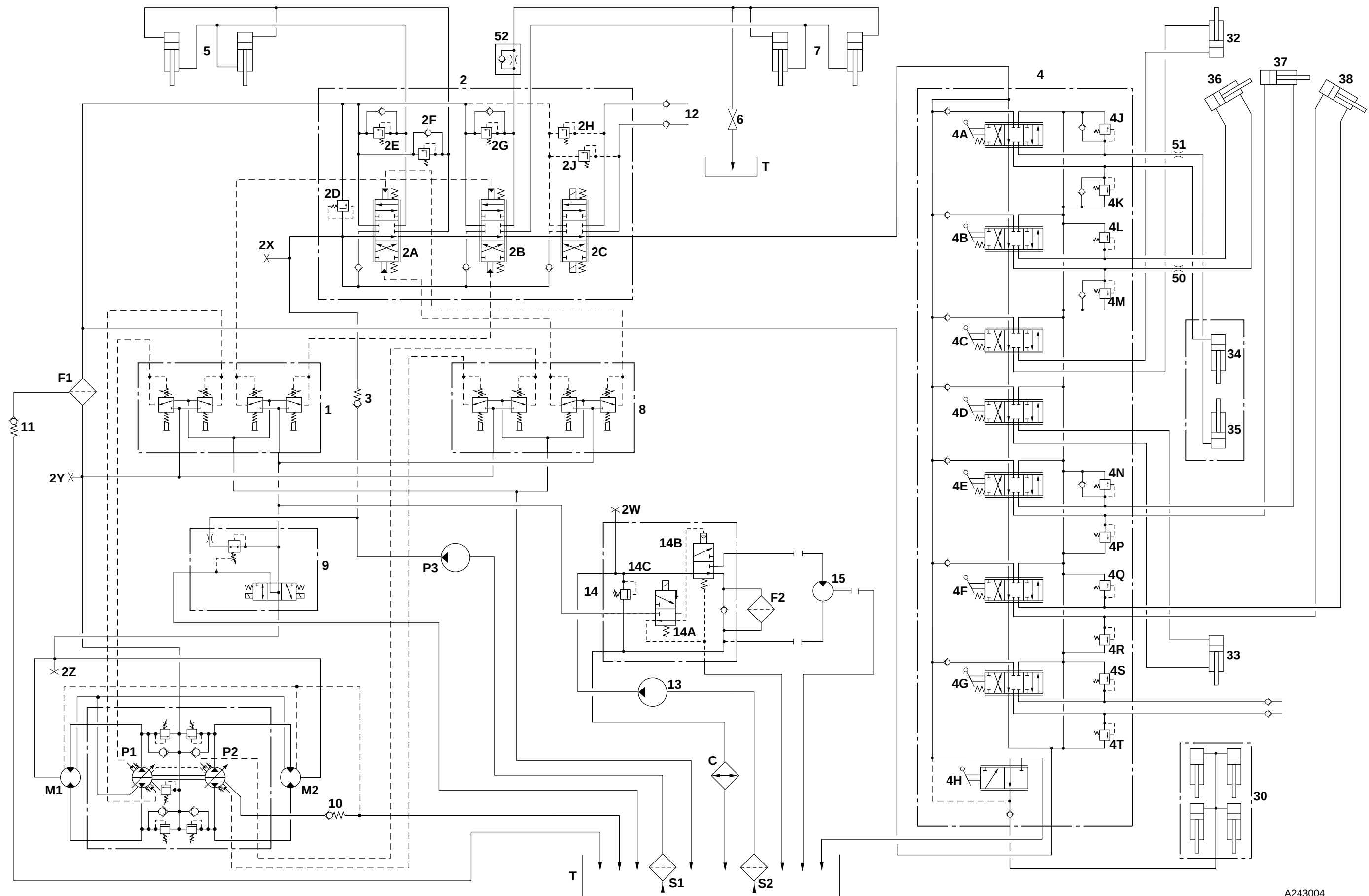
*** Note 2:** On machines fitted with a Husco Loader Valve, One-way Restrictor **52** is deleted. On these machines a restrictor is fitted in the Valve Block.

Component Key - High-flow Machine from machine no. 751012 to 752462

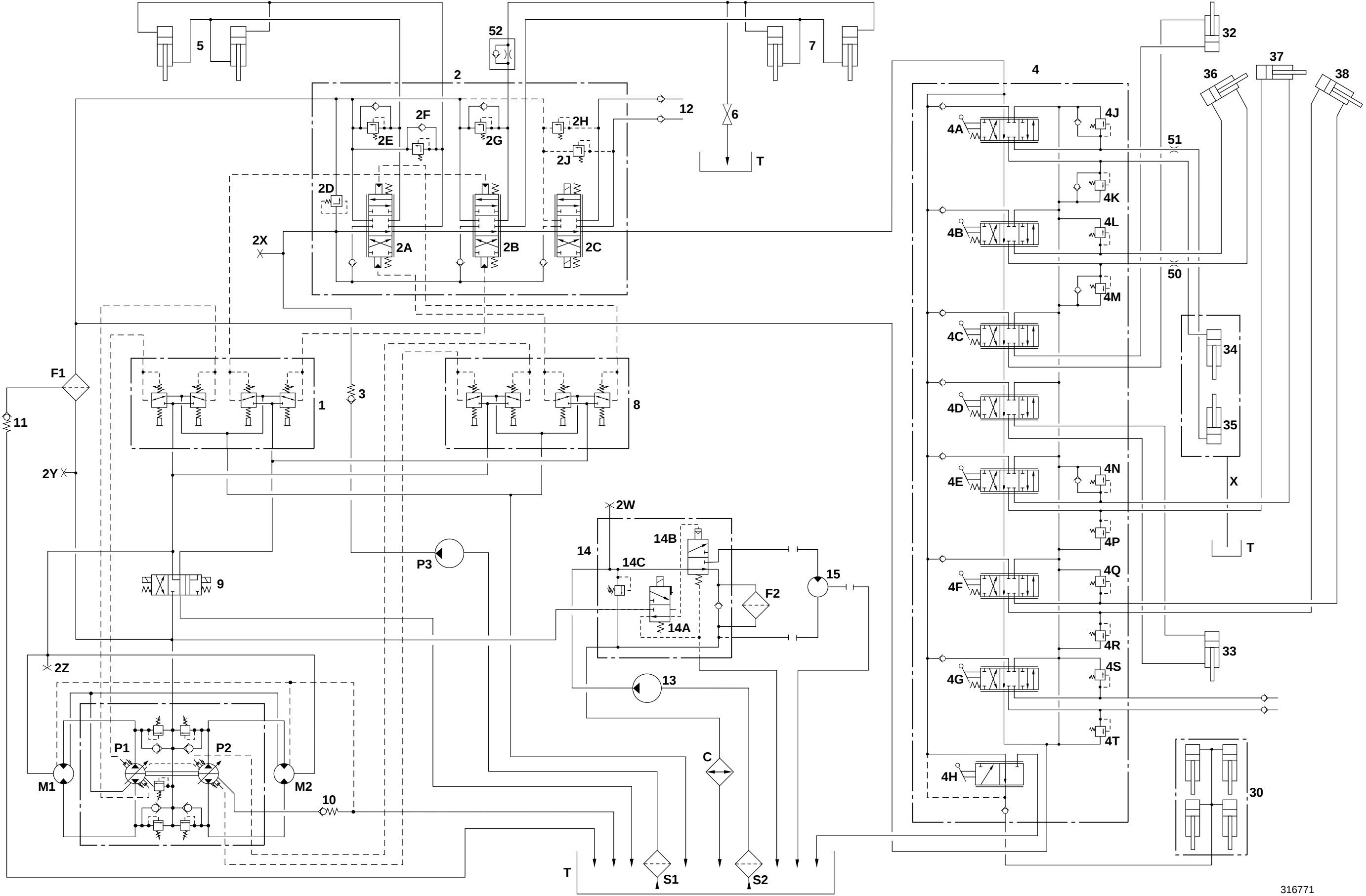
- Dual Lever Drive Control

C	Cooler	13	High-flow Pump
F1	Filter	14	High-flow Valve
F2	High-flow Filter	14A	High-flow Pilot Valve
P1	Main Pump	14B	High-flow Control Valve
P2	Main Pump	14C	High-flow Circuit Relief Valve
P3	Auxiliary Gear Pump	15	Attachment Motor
M1	Left Hand Drive Motor	30	Hydraclamp
M2	Right Hand Drive Motor	32	Stabiliser Ram
S1	Suction Strainer	33	Stabiliser Ram
S2	High-flow Pump Suction Strainer	34	Slew Ram
T	Tank	35	Slew Ram
1	Left Hand Joystick	36	Boom Ram
2	Loader Valve Block	37	Dipper Ram
2A	Crowd Spool	38	Bucket Ram
2B	Lift Spool	50	Bi-restrictor
2C	Auxiliary Spool	51	Bi-restrictor
2D	Main Relief Valve (MRV)	52	One-way Restrictor
2E	Crowd Ram Rod Side ARV		
2F	Crowd Ram Head Side ARV		
2G	Lift Ram Head Side ARV		
2H	Auxiliary ARV		
2J	Auxiliary ARV		
2W	Pressure Test Point (High-flow Relief Valve)		
2X	Pressure Test Point (Main Relief Valve)		
2Y	Pressure Test Point (Transmission Charge Pressure)		
2Z	Pressure Test Point (Brake Pressure) & Hand Pump Connector (Manual Brake Release)		
3	Check Valve (8 bar)		
4	Excavator Valve Block		
4A	Slew Spool		
4B	Boom Spool		
4C	Stabiliser Spool		
4D	Stabiliser Spool		
4E	Dipper Spool		
4F	Bucket Spool		
4G	Auxiliary Spool		
4H	Hydraclamp Valve		
4J	Slew ARV		
4K	Slew ARV		
4L	Boom Ram Head Side ARV		
4M	Boom Ram Rod Side ARV		
4N	Dipper Ram Rod Side ARV		
4P	Dipper Ram Head Side ARV		
4Q	Bucket Ram Rod Side ARV		
4R	Bucket Ram Head Side ARV		
4S	Auxiliary ARV		
4T	Auxiliary ARV		
5	Crowd Rams		
6	Manually Operated Dump Valve		
7	Lift Rams		
8	Right Hand Joystick		
9	Pressure Reducing Solenoid Valve		
10	Check Valve (2 bar)		
11	Filter By-pass Valve (3 bar)		
12	Auxiliary Feeds		

Note: Excavator services shown here are to the JCB 'X' control pattern. For ISO '+' control pattern, components 36 and 37 are swapped over.



A243004



316771

Component Key - High-flow Machine from machine no. 752463 - Dual Lever Drive Control

C	Cooler
F1	Filter
F2	High-flow Filter
P1	Main Pump
P2	Main Pump
P3	Auxiliary Gear Pump
M1	Left Hand Drive Motor
M2	Right Hand Drive Motor
S1	Suction Strainer
S2	High-flow Pump Suction Strainer
T	Tank
1	Left Hand Joystick
2	Loader Valve Block
2A	Crowd Spool
2B	Lift Spool
2C	Auxiliary Spool
2D	Main Relief Valve (MRV)
2E	Crowd Ram Rod Side ARV
2F	Crowd Ram Head Side ARV
2G	Lift Ram Head Side ARV
2H	Auxiliary ARV
2J	Auxiliary ARV
2W	Pressure Test Point (High-flow Relief Valve)
2X	Pressure Test Point (Main Relief Valve)
2Y	Pressure Test Point (Transmission Charge Pressure)
2Z	Pressure Test Point (Brake Pressure) & Hand Pump Connector (Manual Brake Release)
3	Check Valve (8 bar)
4	Excavator Valve Block
4A	Slew Spool
4B	Boom Spool
4C	Stabiliser Spool
4D	Stabiliser Spool
4E	Dipper Spool
4F	Bucket Spool
4G	Auxiliary Spool
4H	Hydraclamp Valve
4J	Slew ARV
4K	Slew ARV
4L	Boom Ram Head Side ARV
4M	Boom Ram Rod Side ARV
4N	Dipper Ram Rod Side ARV
4P	Dipper Ram Head Side ARV
4Q	Bucket Ram Rod Side ARV
4R	Bucket Ram Head Side ARV
4S	Auxiliary ARV
4T	Auxiliary ARV
5	Crowd Rams
6	Manually Operated Dump Valve
7	Lift Rams
8	Right Hand Joystick
9	Brake Valve
10	Check Valve (2 bar)
11	Filter By-pass Valve (3 bar)
12	Auxiliary Feeds

13	High-flow Pump
14	High-flow Valve
14A	High-flow Pilot Valve
14B	High-flow Control Valve
14C	High-flow Circuit Relief Valve
15	Attachment Motor
30	Hydraclamp
32	Stabiliser Ram
33	Stabiliser Ram
34	Slew Ram
35	Slew Ram
36	Boom Ram
37	Dipper Ram
38	Bucket Ram
50	Bi-restrictor
51	Bi-restrictor
*52	One-way Restrictor (see note 2)

X Return line fitted from machine no. 807226

Note 1: Excavator services shown here are to the JCB 'X' control pattern. For ISO '+' control pattern, components **36** and **37** are swapped over.

*** Note 2:** On machines fitted with a Husco Loader Valve, One-way Restrictor **52** is deleted. On these machines a restrictor is fitted in the Valve Block.

Optional Hand Tool Circuit

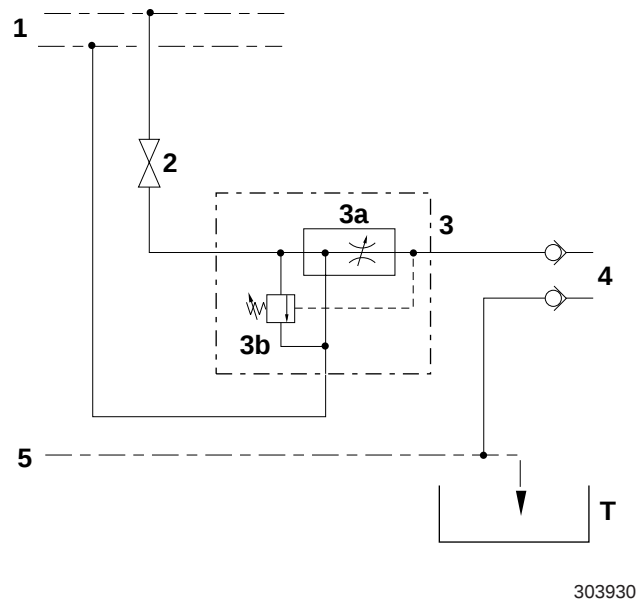
Description

The oil supply for the optional hand tool circuit is taken from the excavator valve auxiliary circuit feed lines. When the auxiliary circuit is selected by the foot pedal, oil is fed via the Manual Valve **2** to the Flow Regulator Valve **3**. Flow Regulator Spool **3a** controls the flow to the hand tool circuit **4**, dumping excess oil back to tank via the return line of the excavator auxiliary circuit. Return oil from the hand tool is fed directly back to tank. Relief Valve **3b** prevents pressure in the hand tool circuit from rising too far.

Manual Valve **2** is turned off to isolate the hand tool circuit when the excavator auxiliary circuit is to be used for other applications.

Component Key

- T** Tank
- 1** Excavator Valve Block Auxiliary Lines
- 2** Manual Valve
- 3** Flow Regulator Valve
- 3a** Flow Regulator Spool
- 3b** Relief Valve
- 4** Hand Tool Connection
- 5** Return Line from Brake Valve



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Tyres and Wheels

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- Removal and Replacement

1 - 1

Tyre Pressures

see Section 3

* Wheel Hub Assembly

- Removal and Replacement up to machine no. 751599

1 - 2

- Dismantling and Assembly up to machine no. 751599

1 - 3

- Removal and Replacement from machine no. 751600

1 - 4

- Dismantling and Assembly from machine no. 751600

1 - 4

Roadwheels

Removal

Procedure is the same for all four wheels.

Slacken off the roadwheel retaining bolts **A**. Then raise and support the ends of the machine on blocks. Remove the roadwheels.

Replacement

Replacement is a reversal of the removal procedure.

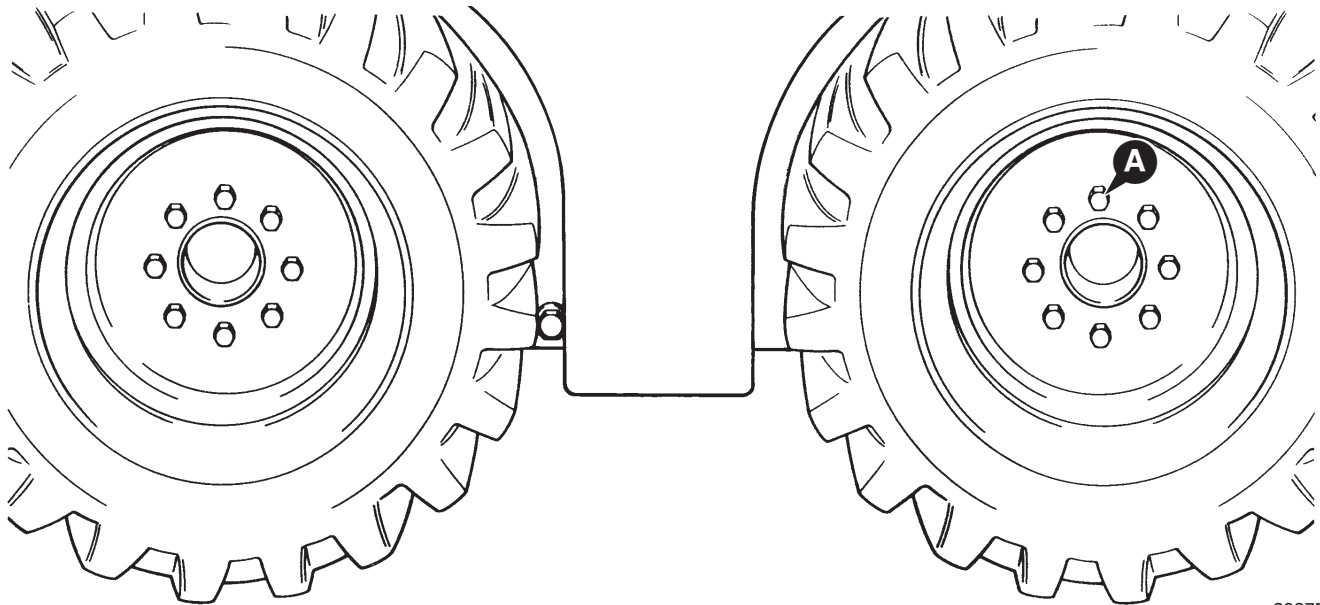
Tighten roadwheel retaining bolts to the correct torque (see Section 3, **Routine Maintenance**).

WARNING

A raised and badly supported machine can fall on you. Position the machine on a firm, level surface before raising one end. Ensure the other end is securely chocked. Do not rely solely on the machine hydraulics or jacks to support the machine when working under it.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.

GEN-001



203750

Wheel Hub Assembly

Removal

The procedure is the same for all four wheels.

It is assumed that roadwheels are removed and the machine is correctly supported.

Place a suitable receptacle under the wheel hub to collect the oil from the chain case.

Slacken, but do not remove, hub nuts **B** (6 off) on retaining ring **C** and allow the chain casing to drain completely. Fit a large adjustable spanner to the boss **D** and rotate the hub assembly until **D** is horizontal and pointing to the front of the machine (front wheel) or to the rear of the machine (rear wheel). In this position the drive chain is at its slackest. Remove the nuts and washers **B** and the retaining ring **C**. Pull the hub assembly out and remove the chain from the sprocket **E**. Remove the hub assembly from the chassis. Remove and discard seal **F**.

Replacement

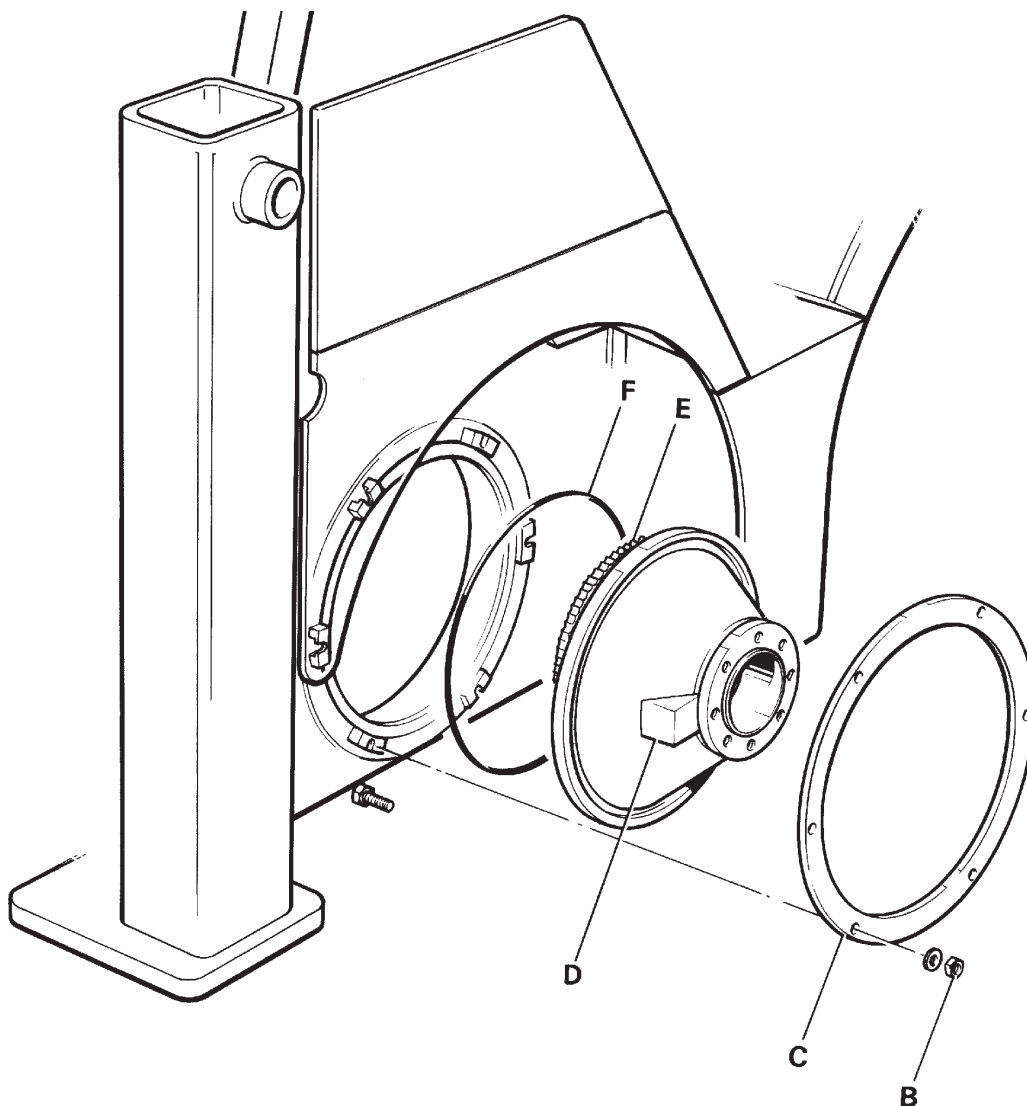
Replacement is a reversal of the removal procedure. Ensure that the bolts **G** are correctly and securely fitted in the mounting lugs.

A new 'O' ring **F** must be fitted. (Grease with JCB MPL Grease.)

Adjust the drive chain (see Section 3, **Routine Maintenance**)

Torque tighten nuts **B** to 98 Nm (72 lbf ft, 10 kgf m).

Refill the chain case with the correct oil (see Section 3, **Routine Maintenance**).



205120

Wheel Hub Assembly

Dismantling

It is assumed that the roadwheels have been removed and the hub assembly removed from the chain case.

The numerical sequence is a guide to dismantling.

Remove bolts **1** (8 off) and drive sprocket **2**. Support the assembly on face **3** and press out the stub axle assembly **4**. Bearing **5** will remain in the casing **6**, and can be removed separately if necessary. The bearing cap of bearing **7** will also be left in the casing and can be removed if necessary. Shaft seal **8** should be removed from the stub axle **4** and discarded. Examine the stub axle and casing for wear or damage.

Assembly

The numerical sequence shown in the dismantling procedure should be reversed.

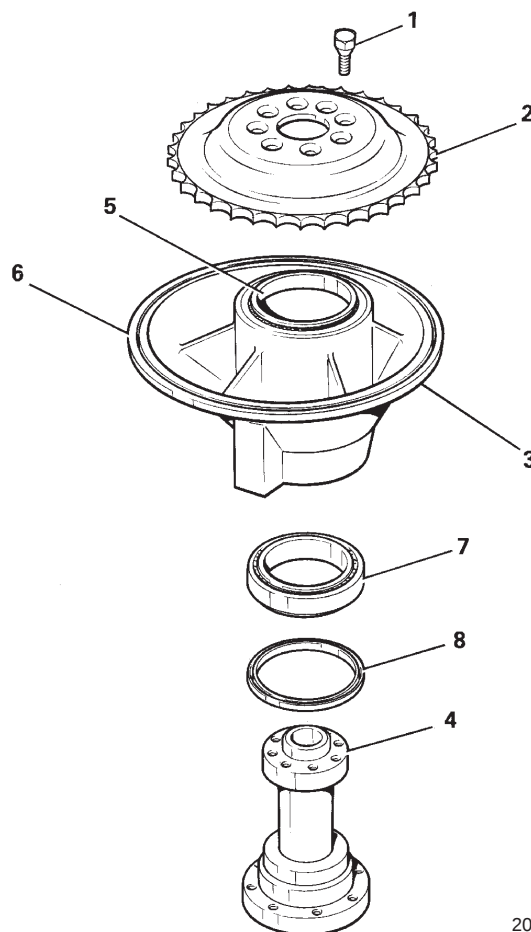
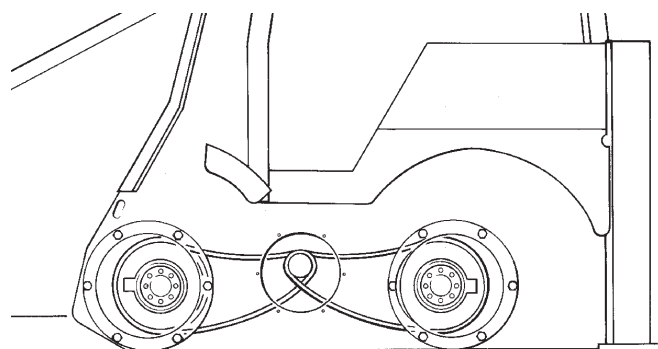
Lubricate all bearings and seals with JCB Special MPL Grease before assembly.

* Clean the mating faces of the sprocket and hub before assembly using JCB Cleaner/Degreaser. Apply JCB Retainer (High Strength) to the stub axle mounting face and place the sprocket onto the stub axle.

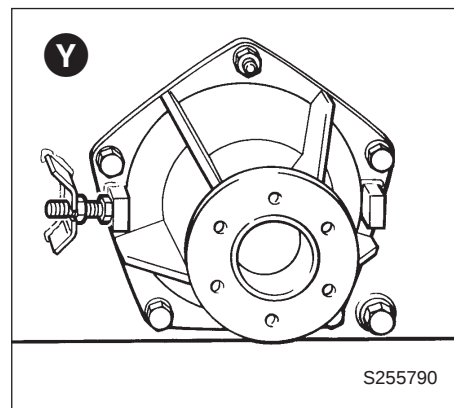
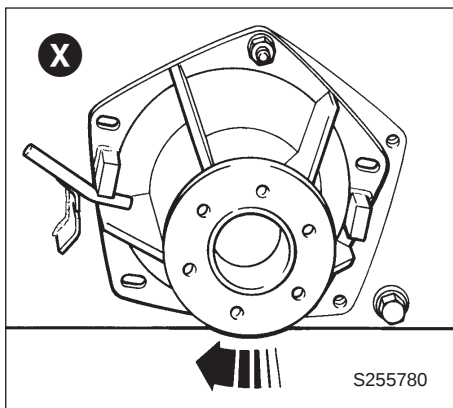
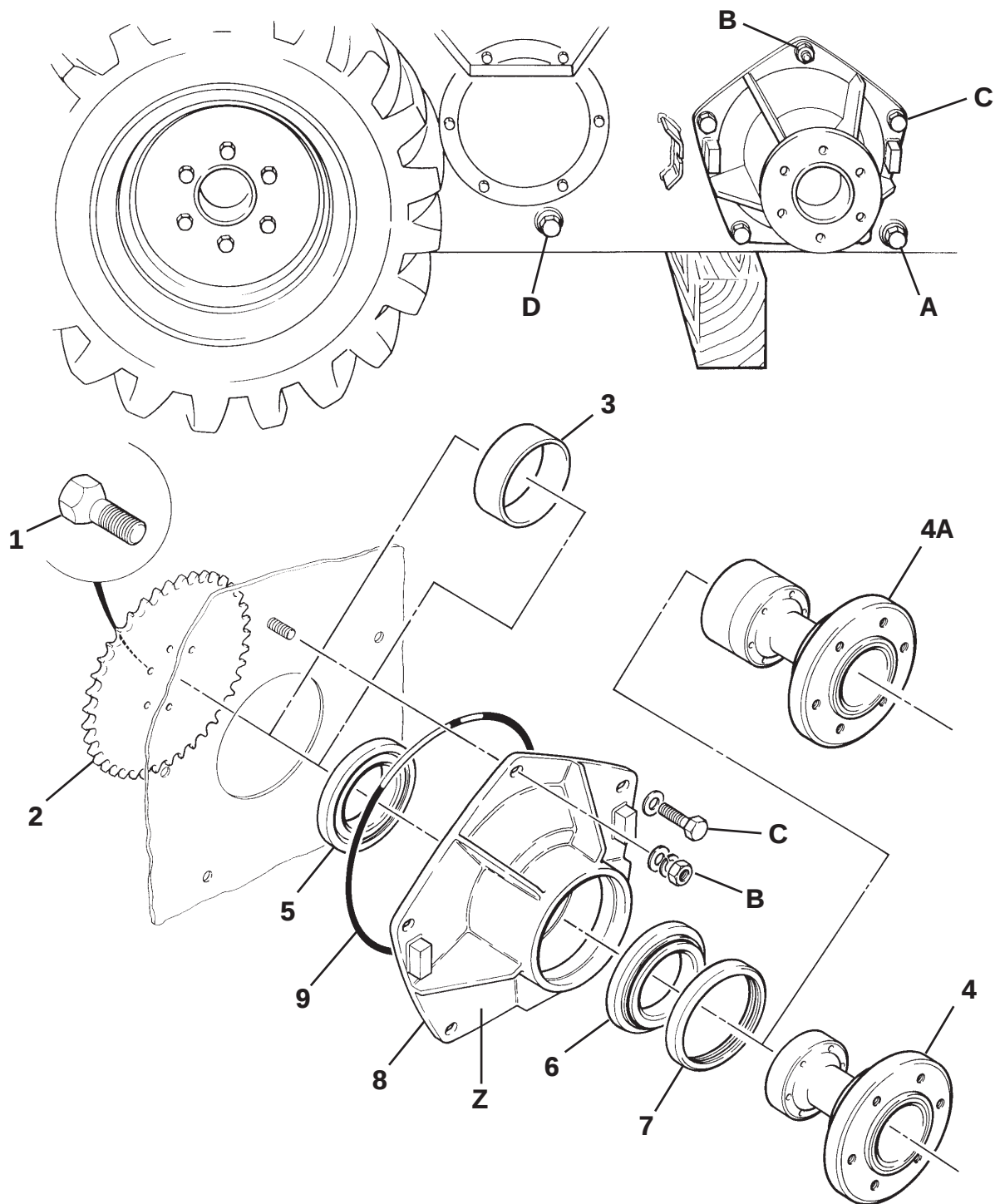
* Apply JCB Retainer (High Strength) to bolts **1**. Tighten evenly to the correct torque in a diagonal sequence whilst rotating the hub to seat the bearings.

Torque Settings

	Nm	lbf ft	kgf m
Drive sprocket bolts 1 (8 off)	220	162	22



205130



S255770

Wheel Hub Assembly

Removal

It is assumed that roadwheels are removed and the machine is correctly supported.

Drain the oil from the chain case via plug **A**.

Slacken nut **B** and remove bolts **C** (4 off). Remove hub adjustment bolt and nut and swing the hub assembly towards the centre of the machine so that the drive chain is at its slackest. Use a suitable bar to wedge the hub as shown at **X**.

Note: If the front hub is to be removed, both hubs on that side must be rotated to slacken both chains.

Remove cover plate **G** and remove the spider (see **Drive Motor Removal**, Section E). Lift off the appropriate chain from the drive sprocket. Note that the front hub is driven by the inner chain, therefore the rear chain will need to be lifted off first.

Remove the nut **B** and pull the hub assembly out; remove the chain from the sprocket **2**. Remove the hub assembly from the chassis. Remove and discard seal **9**.

Replacement

Replacement is a reversal of the removal procedure.

A new 'O' ring **9** must be fitted. Apply a thin smear of silicon sealer to the groove before fitting the 'O' ring, this will retain the ring in the groove. Smear the hub mounting face and 'O' ring with JCB HP Grease.

Adjust the drive chain(s) as follows:

- a** Mount the hub onto the machine and fit nut **B** finger tight only.
- b** Position adjustment bolt and nut into the slot in the adjustment bracket as shown at **Y**. Use the bolt to push the hub away from the centre of the machine and so tighten the chain.
- c** Rotate the sprocket so that one side of the chain is taut. Position the hub to give 25 mm (1 in) of slack on the opposite side of the chain at the midway point.
- d** When the correct tension is achieved, fit and tighten bolts **C** and tighten nut **B**.

Finally torque tighten nut **B** and bolts **C** to 244 Nm (180 lbf ft, 25 kgf m).

Note: The drive chains are pre-tensioned during manufacture and do not require routine adjustment in service.

Refill the chain case with the correct oil at point **D**.

Dismantling

The numerical sequence is a guide to dismantling.

Note: Stub axle **4** is fitted to rear hubs and **4A** to front hubs. Spacer **3** is only fitted to rear hubs.

Remove bolts **1** (6 off) and drive sprocket **2**. Support the assembly on face **Z** and press out the stub axle assembly **4** or **4A**. Bearing **5** will remain in the casing **8** and can be removed separately if necessary. The bearing cap of bearing **6** will also be left in the casing and can be removed if necessary. Shaft seal **7** should be removed from the stub axle **4** and discarded. Examine the stub axle and casing for wear or damage.

Assembly

The numerical sequence shown in the dismantling procedure should be reversed.

Lubricate all bearings and seals with JCB Special HP Grease before assembly.

- * Clean the mating faces of the sprocket and hub before assembly using JCB Cleaner/Degreaser. Apply JCB Retainer (High Strength) to the stub axle mounting face and place the sprocket onto the stub axle.
- * Apply JCB Retainer (High Strength) to bolts **1**. Tighten evenly to the correct torque in a diagonal sequence whilst rotating the hub to seat the bearings.

Note: The torque required to rotate the hub after assembly should be no more than 30 Nm (22 lbf ft, 3 kgf m).

Torque Settings	Nm	lbf ft	kgf m
Drive sprocket bolts 1 (6 off)	405	298	41

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* Preparation for Towing/Winching up to machine no. 751011

The braking system components on this machine are integral with the hydraulic drive motors and are covered in **Section E Hydraulics**.

Since the brakes are locked 'ON' whenever the engine is stopped, the following procedures should be followed before attempting to move a disabled machine.

It is only possible to tow or winch the machine for short distances at slow speed in a straight line. This is because the steering function is inoperative unless the machine is being self-propelled.

If at all possible repair the disabled machine where it stands.

If the machine needs to be returned to the workshop for repair, it must be winched onto a trailer or lifted onto a truck for transportation.

⚠ CAUTION

When lifting the machine using the mainframe lifting points it is necessary to use a lifting frame to prevent the chains causing damage to the ROPS/FOPS structure.

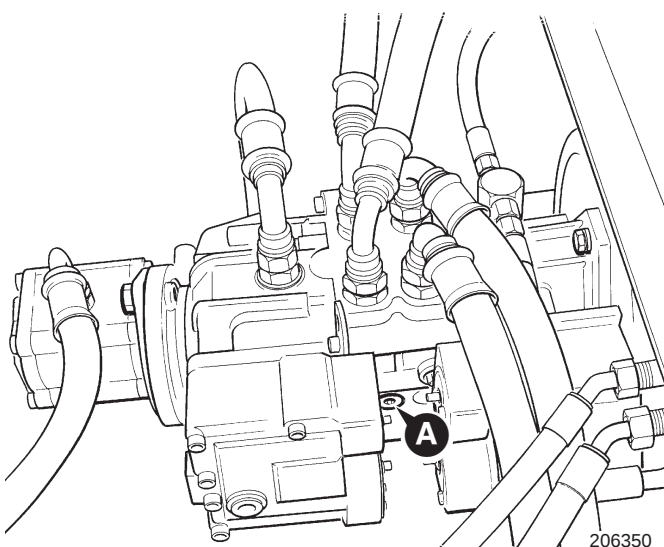
GEN 9-1

⚠ CAUTION

DO NOT attempt to tow/winch the machine without first releasing the hydrostatic braking otherwise damage will occur to the hydraulic pumps.

3-2-1-2

- 1 Block the wheels to prevent accidental movement when the brakes are released.
- 2 Remove the floor plates to gain access to the hydraulic pump assembly (see Section 3, **Routine Maintenance**).



- 3 Using an internal hexagonal wrench, loosen the four relief valves **A** (two on each side) on the hydraulic pump, by a maximum of four turns.

⚠ CAUTION

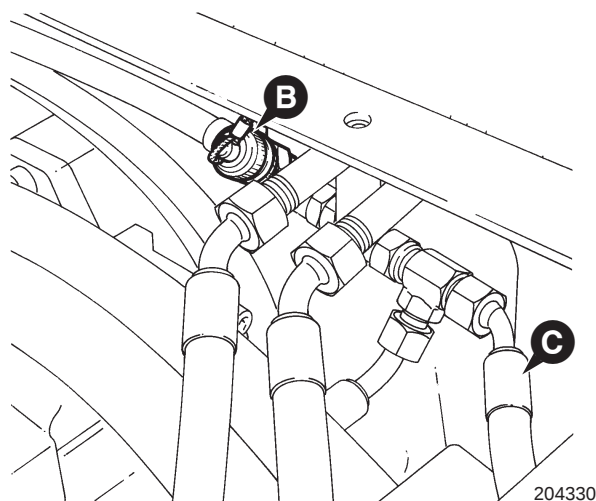
DO NOT loosen the relief valves by more than four turns otherwise hydraulic fluid will be lost.

3-2-1-3

- 4 Connect a hydraulic hand pump to the T-connector **B** in the hydraulic feed to the brake circuit.
- 5 Disconnect hose **C**. Plug the hose and cap the adapter to prevent loss of pressurised fluid.
- 6 Switch ON the starter switch, switch OFF the brake switch.
- 7 Use the hand pump to pressurise the brake circuit to 12 bar (174 lbf/in²) to release the brakes. Disconnect the hand pump.
- 8 Remove the wheel blocks only when the machine is hitched up ready for towing/winching. Keep personnel clear of the machine while the blocks are removed.

After Towing/Winching

- 1 Tighten the four relief valves **A** to a torque of 55 Nm (40 lbf ft, 5.6 kgf m).
- 2 Reconnect hose **C**.
- 3 Turn the starter switch OFF. This will vent the pressure in the brake circuit and re-apply the brakes.



Preparation for Towing/Winching from machine no. 751012

The braking system components on this machine are integral with the hydraulic drive motors and are covered in **Section E Hydraulics**.

Since the brakes are locked 'ON' whenever the engine is stopped, the following procedures should be followed before attempting to move a disabled machine.

It is only possible to tow or winch the machine for short distances at slow speed in a straight line. This is because the steering function is inoperative unless the machine is being self-propelled.

If at all possible repair the disabled machine where it stands.

If the machine needs to be returned to the workshop for repair, it must be winched onto a trailer or lifted onto a truck for transportation.

⚠ CAUTION

When lifting the machine using the mainframe lifting points it is necessary to use a lifting frame to prevent the chains causing damage to the ROPS/FOPS structure.

GEN 9-1

⚠ CAUTION

DO NOT attempt to tow/winch the machine without first releasing the hydrostatic braking otherwise damage will occur to the hydraulic pumps.

3-2-1-2

- 1 Block the wheels to prevent accidental movement when the brakes are released.
- 2 Remove the floor plates to gain access to the hydraulic pump assembly (see Section 3, **Routine Maintenance**).
- 3 Press in the by-pass plungers on the four Charge Check valves **A** underneath the pump. This will open the valves and allow oil from the motors to flow freely through the pump. The valves will stay open until the machine is next started when charge pressure will automatically close the valves.
- 4 Remove the motor outer covers and unscrew plug **B** on each motor end cover. Store the plugs in a safe place.
- 5 Using locally made pullers, jack out the brake piston to release the brake. The pullers must be constructed so that they rest on the outer edge of the motor casing and have a central bolt to screw into the tapped hole in the brake piston (see illustration).

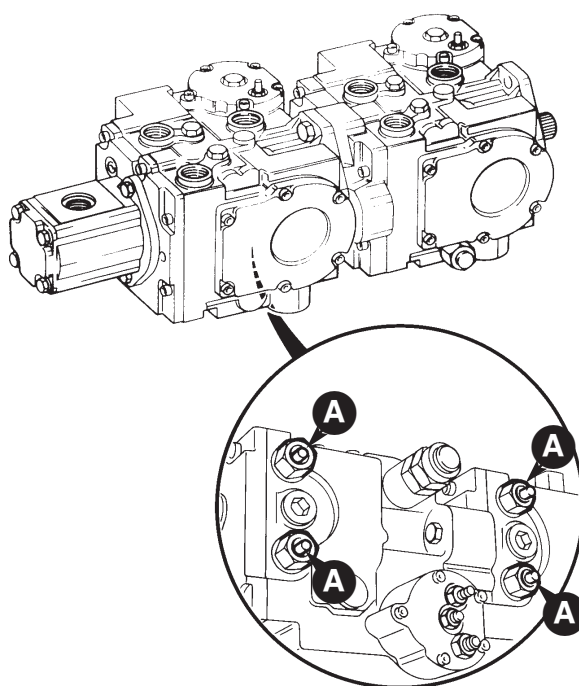
Note: DO NOT rest the puller against the central part of the motor end cover or the cover will be distorted.

- 6 Screw the M12 bolt in finger tight and then turn a further one complete turn to release the brake. Use washers under the bolt head if necessary to give correct thread engagement.

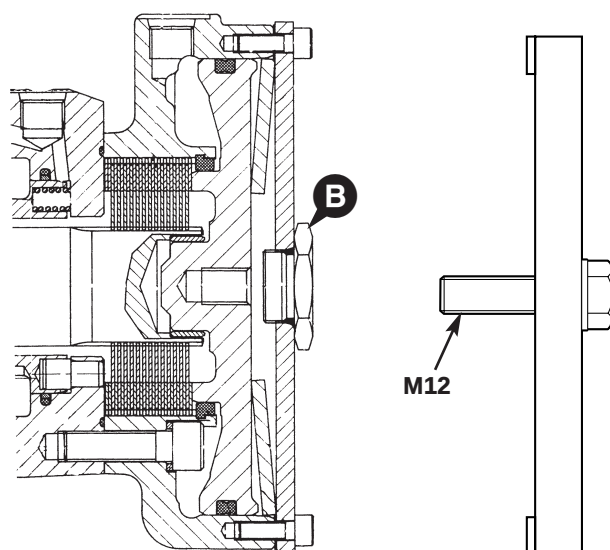
- 7 Remove the wheel blocks only when the machine is hitched up ready for towing/winching. Keep personnel clear of the machine while the blocks are removed.

After Towing/Winching

- 1 Remove the brake piston pullers and refit plugs **B**. Refit the motor outer covers.



S246230



S243870

A246440

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*** Technical Data - XUD engine**

Type	4 cylinder in-line, overhead camshaft, compression ignition, naturally aspirated.
Bore (nominal)	83 mm (3.268 in)
Stroke	88 mm (3.465 in)
Swept Volume	1905 cm ³ (116.24 in ³)
Compression Ratio	23.5 : 1
Compression Pressure (Measured with warm engine turned by the starter)	25 - 30 bar (363 - 435 lbf/in ² , 25.5 - 33 kgf/cm ²)
Injection Sequence	Maximum variation between cylinders 5 bar (72.5 lbf/in ² , 5.1 kgf/cm ²)
Valve Clearance - Cold - Inlet	1,3,4,2
Exhaust	0.15 - 0.20 mm (0.0059 - 0.0078 in)
Maximum Air Cleaner Restriction	0.30 - 0.35 mm (0.0118 - 0.0138 in)
Maximum Back Pressure (Exhaust)	20 mbar (0.29 lbf/in ² , 0.02 kgf/cm ²) at 3600 rev/min
	140 mbar (2.03 lbf/in ² , 0.143 kgf/cm ²) at 3600 rev/min

Speeds

Maximum Loaded	2630 rev/min
Maximum No Load - standard machines	3000 rev/min
Maximum No Load - High-flow machines	3500 rev/min
Idling Speed	880 - 920 rev/min
Oil Pressure at 110 °C (230 °F) at loaded speed	3.6 bar (52.2 lbf/in ² , 3.7 kgf/cm ²)

Fuel System

Injection Pump Type	Lucas CAV DPC R84 43
Governing	Mechanical
Pump Setting Code	063
Static Timing	16 $\pm$ 1° BTDC
Injector Codes	RDN O5DC 6730
Injector Setting Pressure	115 $\pm$ 5 bar (1667.5 $\pm$ 72.5 lbf/in ² , 117 $\pm$ 5.1 kgf/cm ²)

Cooling System

Fan Type	Mechanical
Coolant Pressure	1 bar (14.5 lbf/in ² , 1.02 kgf/cm ²)
Temperature Warning Light operates at	105 $\pm$ 2 °C (221 $\pm$ 3.6 °F)

Note: If at anytime during the life of a machine it is necessary to fit a new engine, then after the first 50 operating hours a new engine oil filter must be fitted and the engine oil changed. Failure to complete this could damage the engine.

Note: Should further details be required for the refitting of the engine refer to Engine Service Manual 9803/8600.

*** Technical Data - 100 Series engine up to machine no. 807552**

* Type	4 cylinder in-line, compression ignition, naturally aspirated.
Bore (nominal)	84 mm (3.31 in)
Stroke	100 mm (3.94 in)
Swept Volume	2216 cm ³ (135.2 in ³)
Compression Ratio	22 : 1
Injection Sequence	1,3,4,2
Valve Clearance - Cold - Inlet and Exhaust	0.2 mm (0.0078 in)
Oil Pressure	2.6 - 3.5 bar (38 - 52 lbf/in ² , 2.7 - 3.6 kgf/cm ²)

Speeds

Rated Speed	2800 rev/min
Idling Speed	850 - 950 rev/min

Fuel System

Governing	Mechanical
Static Timing	19° - 21° BTDC
Injector Codes	PN: 130506140
Injector Setting Pressure	150 - 162 bar (2175 - 2350 lbf/in ² , 153 - 165 kgf/cm ²)

Cooling System

Fan Type	Mechanical
Coolant Pressure	0.5 bar (7.25 lbf/in ² , 0.5 kgf/cm ²)
Thermostat operating temperature	82 - 94 °C (180 - 200 °F)
Temperature Warning Light operates at	97 - 103 °C (207 - 217 °F)

Note: If at anytime during the life of a machine it is necessary to fit a new engine, then after the first 50 operating hours a new engine oil filter must be fitted and the engine oil changed. Failure to complete this could damage the engine.

Note: Should further details be required, refer to Engine Service Manual 9806/2100.

*** Technical Data - 400 Series engine from machine no. 807553**

* Type	4 cylinder in-line, compression ignition, naturally aspirated.
Bore (nominal)	84 mm (3.31 in)
Stroke	100 mm (3.94 in)
Swept Volume	2216 cm ³ (135.2 in ³)
Compression Ratio	23.3 : 1
Injection Sequence	1,3,4,2
Valve Clearance - Cold - Inlet and Exhaust	0.2 mm (0.0078 in)
Oil Pressure	1 bar (15 lbf/in ²) min

Speeds

Rated Speed	2800 rev/min
Idling Speed	900 ±25 rev/min

Fuel System

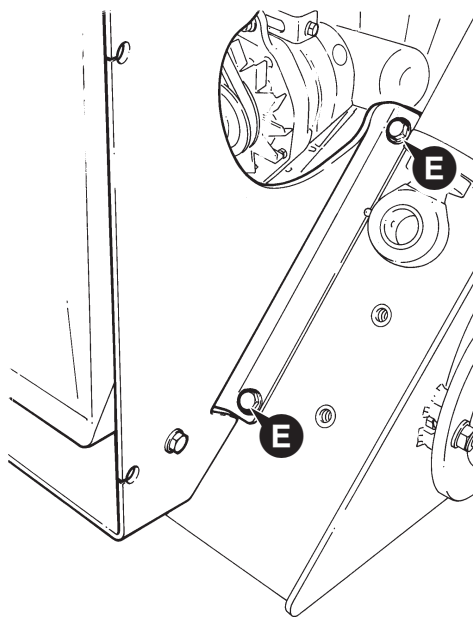
Governing	Mechanical
Static Timing	19° - 21° BTDC
Injector Codes	131 406 360
Injector Setting Pressure	147 bar (2133 lbf/in ²)

Cooling System

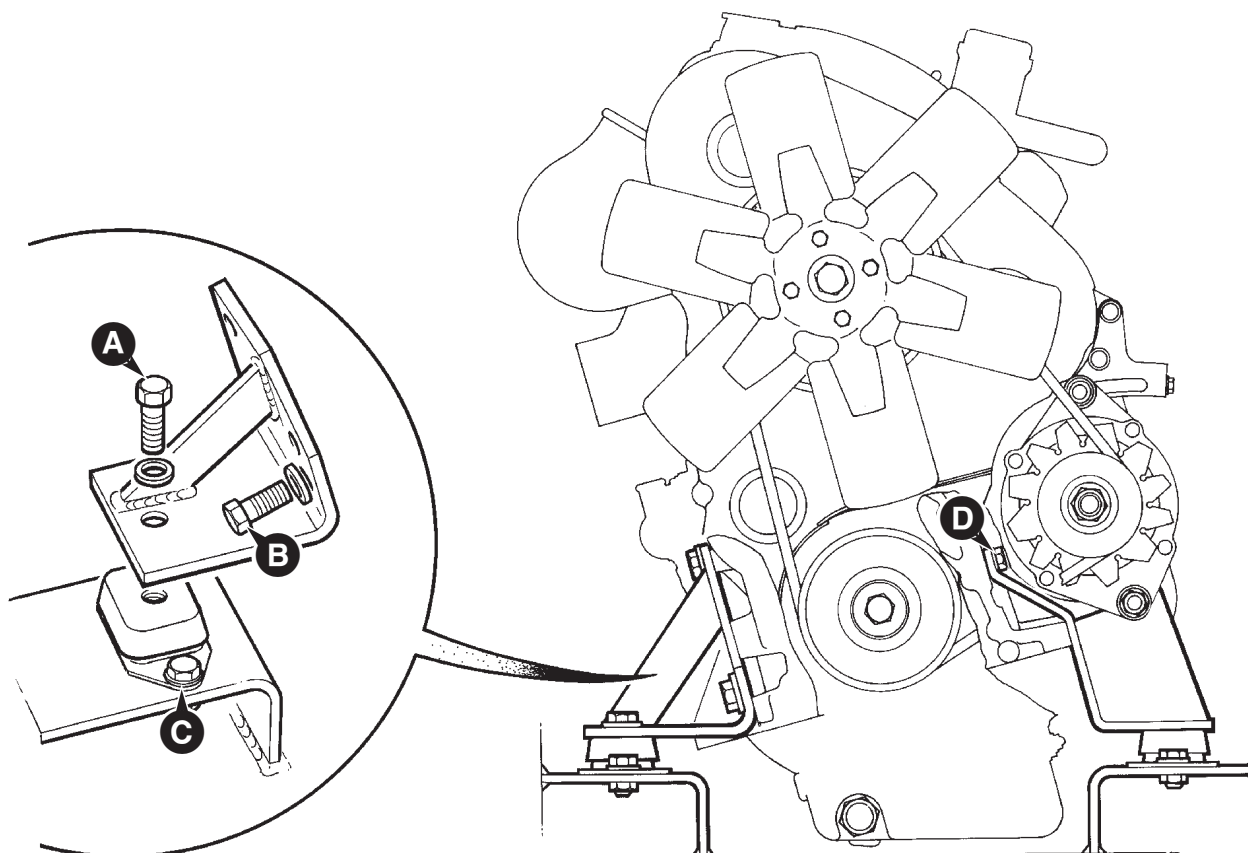
Fan Type	Mechanical
Coolant Pressure	1 bar (14.5 lbf/in ²)
Thermostat operating temperature	
- opens at:	82 °C (180 °F)
- fully open at:	95 °C (202 °F)
Temperature Warning Light operates at	97 - 103 °C (207 - 217 °F)

Note: If at anytime during the life of a machine it is necessary to fit a new engine, then after the first 50 operating hours a new engine oil filter must be fitted and the engine oil changed. Failure to complete this could damage the engine.

* **Note:** Should further details be required, refer to Engine Service Manual 9806/2190.



204290



205180

Removal

- 1 Position the machine on firm level ground. Fully lower the lift arms and stop the engine.
- 2 Open the bonnet and remove engine compartment side panels.
- 3 Disconnect and remove the battery.
- 4 Remove the exhaust and air filter assembly.
- 5 Drain the cooling system, then disconnect the radiator top hose, air vent hose and bottom hose.
- 6 Remove the coolant header tank and the bracket supporting it.
- 7 Support the weight of the cooling pack and remove the securing bolts **E** (4 off).
- 8 Lift the cooling pack clear.
- 9 Disconnect wiring connections from the starter motor and alternator, also water temperature and oil pressure senders from the engine.
- 10 Disconnect the engine/chassis earth strip.
- 11 Disconnect the engine oil cooler hose.
- 12 Disconnect the throttle and stop controls at the fuel pump.
- 13 Disconnect the fuel supply line and spill line at the engine.
- 14 Disconnect and plug all hydraulic lines (11 off) at the hydraulic pump assembly.
- 15 Disconnect wiring connections from the pump assembly.
- 16 Attach slings to the engine lifting eyes.

⚠ WARNING**Lifting Equipment**

You can be injured if you use faulty lifting equipment. Make sure that lifting equipment is in good condition. Make sure that lifting tackle complies with all local regulations and is suitable for the job. Make sure that lifting equipment is strong enough for the job.

INT-1-3-7

- 17 Take the weight of the engine on the hoist and remove mounting bolts **A** (4 off).
- 18 Withdraw the engine in a level attitude until the hydraulic pump is clear of the cab floor. Raise the engine to lift it clear of the machine.

Replacement

Replacement is a reversal of the removal procedure.

On completion, check hydraulic and cooling systems for leakage and level.

Note: If the mounting brackets are removed from the engine block it is necessary to use JCB Lock and Seal when re-installing the mounting bolts **B** before torque tightening.

Note: The metalastic flexible mounts can be removed by removing bolts **C**.

Note: The front left hand engine mount also carries the alternator and is held by 3 x M8 bolt **D** as opposed to 2 x M10 bolt **B**.

Torque Settings

	Nm	kg fm	lbf ft
A	56	5.7	42
B	56	5.7	42
C	98	10	72
D	28	3	21

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