

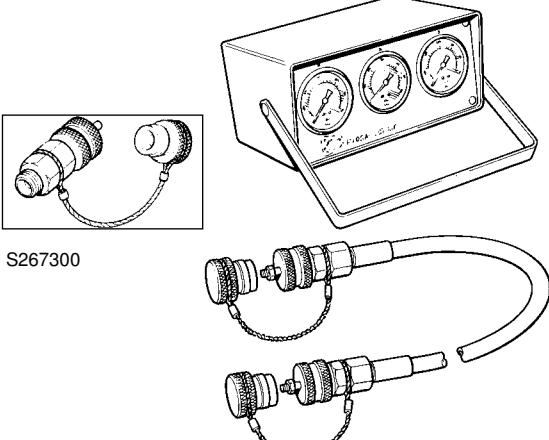
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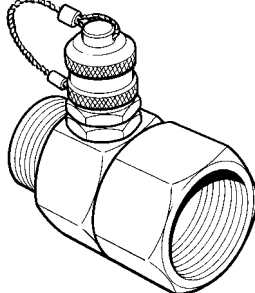


S267300

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 (0-6000 lbf/in ²)
:892/00254	Replacement Hose
993/69800	Seal Kit for 892/00254 (can also be used with probe 892/00706)
892/00706	Test Probe

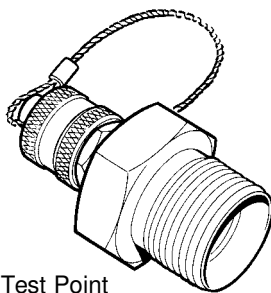
S188121



S188131

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 BSP x Test Point



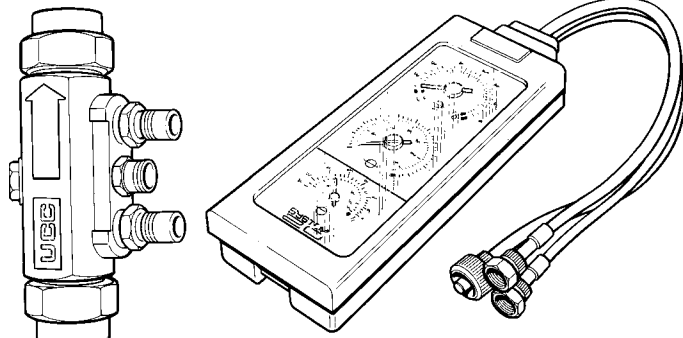
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Pressure Test Adapters

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

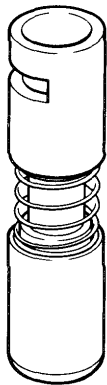
Flow Test Equipment

892/00268	Flow Monitoring Unit
892/00269	Sensor Head 0 - 100 l/min (0 - 22 UK gal/min)
892/00293	Connector Pipe
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
892/00273	Sensor Head 0 - 380 l/min
892/00294	Connector Pipe
1606/0015	Adapter 1.1/4 in M BSP x 1 in M BSP
892/00078	Connector 1 in F x 1 in F BSP
1604/0008	Adapter 1 in M x 1 in M BSP
1606/0012	Adapter 1 in M x 3/4 in M BSP
816/20013	Adapter 3/4 in F x 1 in M BSP

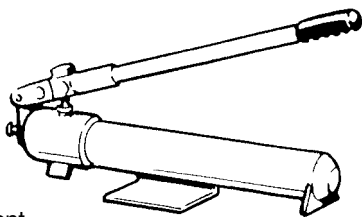


S188151

892/00881 Valve Spool Seal Fitting Tool



S261220



Hand Pump Equipment

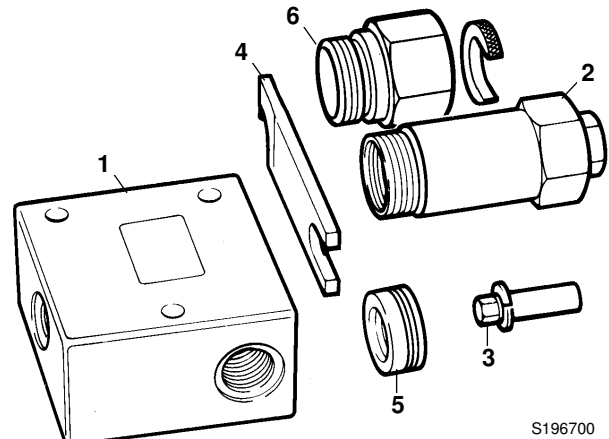
- 892/00223 Hand Pump
- 892/00137 Micro-bore Hose 1/4 in BSP x 3 metres
- 892/00274 Adapter 1/4 in M BSP x 3/8 in M BSP Taper
- 892/00262 1/4 in M BSP x 1/4 in F BSP x Test Point
- 892/00706 Test Probe
- 892/00278 Gauge 0 - 40 bar (0 - 600 lbf/in²)
- 892/00279 Gauge 0 - 400 bar (0 - 6000 lbf/in²)

S193850

Components for Valve Block A.R.V. Testing

For 4CX Variable Flow machines use 25/201103

- | | |
|---------------|-------------------------------|
| 892/00309 | A.R.V. Pressure Test Kit |
| 1 : 892/00340 | Test Block Body |
| 2 : 892/00341 | Setting Body |
| 3 : 993/68300 | Adjusting Pin |
| 4 : 892/00343 | Spanner |
| 5 : 892/00345 | Anti-cavitation Lock Out Bung |
| 6 : 892/00335 | A.R.V. Cartridge Removal Tool |



S196700

Bonded Washers

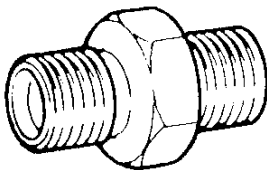
- | | |
|-----------|---------------|
| 1406/0011 | 1/4 in. BSP |
| 1406/0018 | 1/2 in. BSP |
| 1406/0014 | 5/8 in. BSP |
| 1406/0021 | 3/4 in. BSP |
| 1406/0029 | 1.1/4 in. BSP |



S188140

Male Adapters - BSP x NPT (USA only)

- | | |
|-----------|-------------------|
| 816/00439 | 3/8 in. x 1/4 in. |
| 816/00440 | 1/2 in. x 1/4 in. |
| 816/15007 | 3/8 in. x 3/8 in. |
| 816/15008 | 1/2 in. x 3/8 in. |



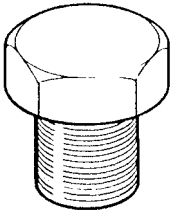
S193860

Male Adapters - BSP x BSP

- | | |
|-----------|-------------------------|
| 1606/0003 | 3/8 in. x 1/4 in. |
| 1604/0003 | 3/8 in. x 3/8 in. |
| 892/00071 | 3/8 in. x 3/8 in. taper |
| 1606/0004 | 1/2 in. x 1/4 in. |
| 1606/0007 | 1/2 in. x 3/8 in. |
| 1604/0004 | 1/2 in. x 1/2 in. |
| 1606/0017 | 5/8 in. x 1/2 in. |
| 1606/0008 | 3/4 in. x 3/8 in. |
| 1606/0009 | 3/4 in. x 1/2 in. |
| 1604/0006 | 3/4 in. x 3/4 in. |
| 1606/0012 | 3/4 in. x 1 in. |
| 1606/0014 | 3/4 in. x 1.1/4 in. |
| 1606/0015 | 1 in. x 1.1/4 in. |

Female Cone Blanking Plug

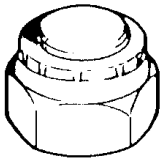
- 892/00055 1/4 in. BSP
- 892/00056 3/8 in. BSP
- 892/00057 1/2 in. BSP
- 892/00058 5/8 in. BSP
- 892/00059 3/4 in. BSP
- 892/00060 1 in. BSP



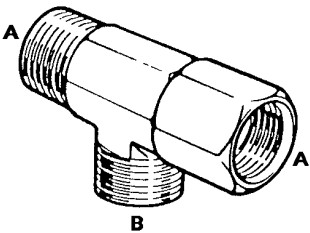
S193870

Male Cone Blanking Cap

- 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

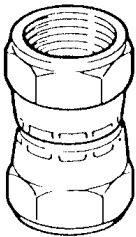


S193880



S193890

- 892/00047 3/8 in. BSP (A) x 1/4 in. BSP (B)
- 892/00048 1/2 in. BSP (A) x 1/4 in. BSP (B)
- 892/00049 5/8 in. BSP (A) x 1/4 in. BSP (B)
- 816/50043 3/4 in. BSP (A) x 1/4 in. BSP (B)
- 892/00051 1 in. BSP (A) x 1/4 in. BSP (B)
- 816/50005 1/2 in. BSP (A) x 1/2 in. BSP (B)
- 816/60096 3/4 in. BSP (A) x 3/4 in. BSP (B)
- 816/00017 1 in. BSP (A) x 1 in. BSP (B)

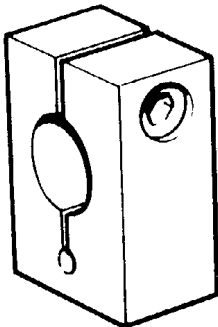


S193900

Female Connectors

- 892/00074 3/8 in. BSP x 3/8 in. BSP
- 892/00075 1/2 in. BSP x 1/2 in. BSP
- 892/00076 5/8 in. BSP x 5/8 in. BSP
- 892/00077 3/4 in. BSP x 3/4 in. BSP

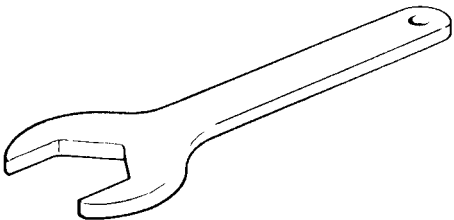
- 992/09100 Excavator Spool Clamp
- 892/00011 Spool Clamp

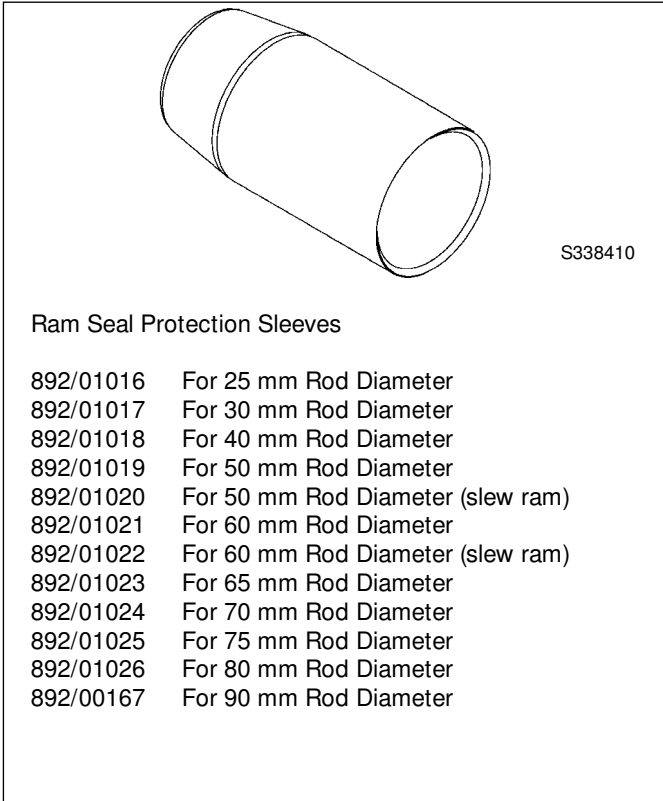
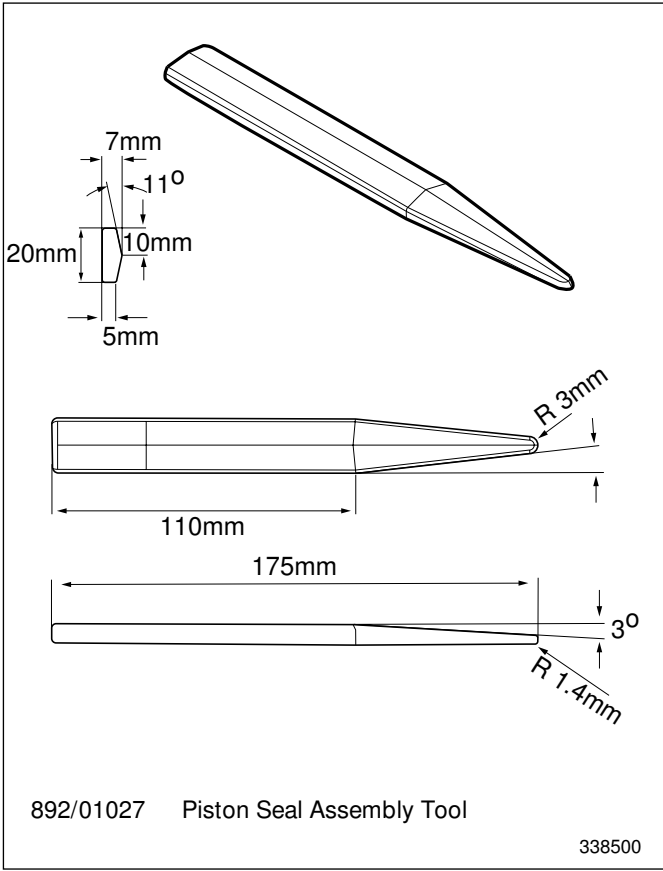
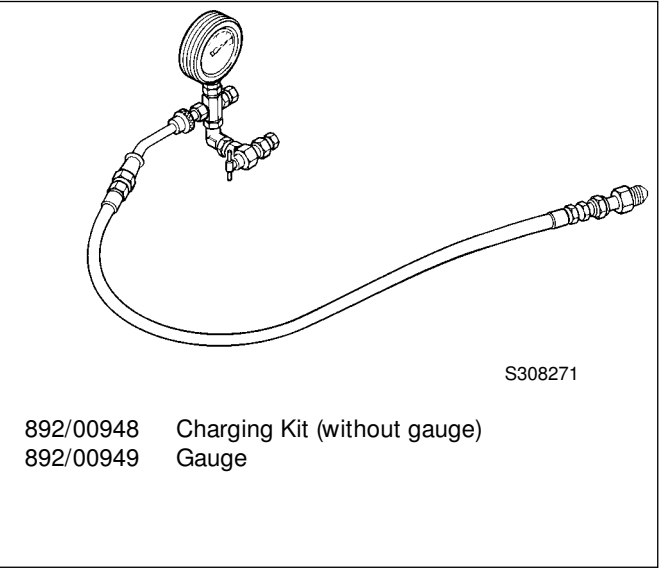
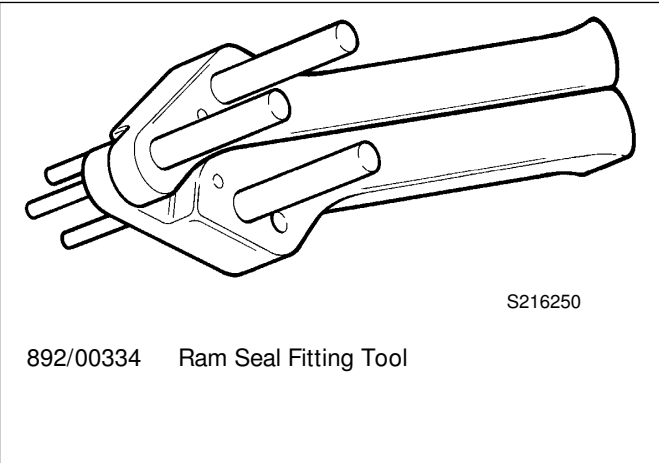


S216210

Hexagon Spanners for Ram Pistons and End Caps

- 992/09300 55mm A/F
- 992/09400 65mm A/F
- 992/09500 75mm A/F
- 992/09600 85mm A/F
- 992/09700 95mm A/F
- 992/09900 115mm A/F
- 992/10000 125mm A/F





Hydraulic Pumps

Fixed Flow

*	Model/Reference	Double pump/4070H		
	Mounting	Gearbox		
	Theoretical displacement:	cc/rev	cu in/rev	
	Pump section 1 (mounting flange end)	33	2.01	
	Pump section 2	23	1.40	
	Flow at 2200 rev/min and system pressure (90% min displacement):	litres/min	UK gal/min	US gal/min
	Pump section 1 (mounting flange end)	65.3	14.4	17.2
	Pump section 2	45.5	10.0	12.0
	Maximum speed @ pressure P1	3000 rev/min		
	Minimum speed @ pressure P1	500 rev/min		
	Approximate Weight	24kg (53 lbs)		
*	Model/Reference	Double pump/83103		
	Mounting	Gearbox		
	Theoretical displacement:	cc/rev	cu in/rev	
	Pump section 1 (mounting flange end)	36	2.19	
	Pump section 2	26	1.59	
	Flow at 2200 rev/min and system pressure (90% min displacement):	litres/min	UK gal/min	US gal/min
	Pump section 1 (mounting flange end)	71.3	15.7	18.8
	Pump section 2	51.5	11.3	13.5
	Maximum speed @ pressure P1	3000 rev/min		
	Minimum speed @ pressure P1	500 rev/min		
	Approximate Weight	23.8kg (52 lbs)		
*	Model/Reference	Double pump/7441N		
	Mounting	Gearbox		
	Theoretical displacement:	cc/rev	cu in/rev	
	Pump section 1 (mounting flange end)	41	2.50	
	Pump section 2	26	1.59	
	Flow at 2200 rev/min and system pressure (90% min displacement):	litres/min	UK gal/min	US gal/min
	Pump section 1 (mounting flange end)	81.2	17.9	21.5
	Pump section 2	51.5	11.3	13.5
	Maximum speed @ pressure P1	3000 rev/min		
	Minimum speed @ pressure P1	500 rev/min		
	Approximate Weight	24.5kg (54 lbs)		
*	Model/Reference	Double pump/4071F		
	Mounting	Gearbox		
	Theoretical displacement:	cc/rev	cu in/rev	
	Pump section 1 (mounting flange end)	41	2.50	
	Pump section 2	29	1.77	
	Flow at 2200 rev/min and system pressure (90% min displacement):	litres/min	UK gal/min	US gal/min
	Pump section 1 (mounting flange end)	81.2	17.9	21.5
	Pump section 2	57.4	12.6	15.1
	Maximum speed @ pressure P1	3000 rev/min		
	Minimum speed @ pressure P1	500 rev/min		
	Approximate Weight	24.5kg (54 lbs)		

continued.....

Hydraulic Pumps

Fixed Flow (continued)

*	Model/Reference	Double pump/PGP620/Common outlet		
	Mounting	Gearbox		
	Theoretical displacement:	cc/rev	cu in/rev	
	Pump section 1 (mounting flange end)	29	1.77	
	Pump section 2	23	1.40	
	Flow at 2200 rev/min and system pressure (90% min displacement):	litres/min	UK gal/min	US gal/min
	Pump section 1 (mounting flange end)	57.4	12.6	15.1
	Pump section 2	45.5	10.0	12.0
	Maximum speed @ pressure P1	3000 rev/min		
	Minimum speed @ pressure P1	500 rev/min		
	Approximate Weight	24kg (53 lbs)		

Hydraulic Pumps

Variable Flow

Type	Variable Displacement
Reference	A10VO - 978753
* Mounting	Gearbox
Load Sense Pressure (in neutral position)	Maximum permitted - 5 bar; 72.5 lbf/in ²
Load sense pressure relief Valve (if fitted)	230 bar; 3335 lbf/in ²
Stand-by Pressure	20 bar; 290 lbf/in ²
Maximum Hydraulic Stall Pressure	
460001 to 472554 without relief valve	232 bar; 3364 lbf/in ²
460001 to 472554 with relief valve and all from 472555	270 bar; 3915 lbf/in ²
Maximum Displacement	74cc/rev; 4.5 in ³ /rev
Flow at 2200 rev/min and 2500 lb/in ² pressure †	
- minimum acceptable flow rate (new or rebuilt pump)	75 -80 litres/min; 16.5 - 17.6 UK gal/min
- minimum acceptable flow rate (used pump)	70 - 75 litres/min; 15.4 - 16.5 UK gal/min
Flow in the Load Sense Line at 2200 rev/min (no pressure)	1 - 5 litres/min; 0.22 - 1.1 UK gal/min
Weight	TBAkg (TBA lbs)

† **Note:** It is not possible to test full pump flow at system pressure, figures quoted give a ‘snapshot’ indication of pump performance. For more detail refer to **Service Procedures, Variable Flow Pumps - Flow and Pressure Testing**.

Relief Valve Pressures

Loader Valve - Fixed Flow

	bar	kgf/cm ²	lbf/in ²
Main Relief Valve (M.R.V.)	236 - 241	240 - 245	3420 - 3500
Unloader Valve	207 - 214	207 - 211	3000 - 3100
Auxiliary Relief Valves (A.R.V.)			
Loader			
Shovel Ram Head Side	172 - 179	176 - 183	2500 - 2600
Shovel Ram Rod side	310 - 317	316 - 323	4500 - 4600

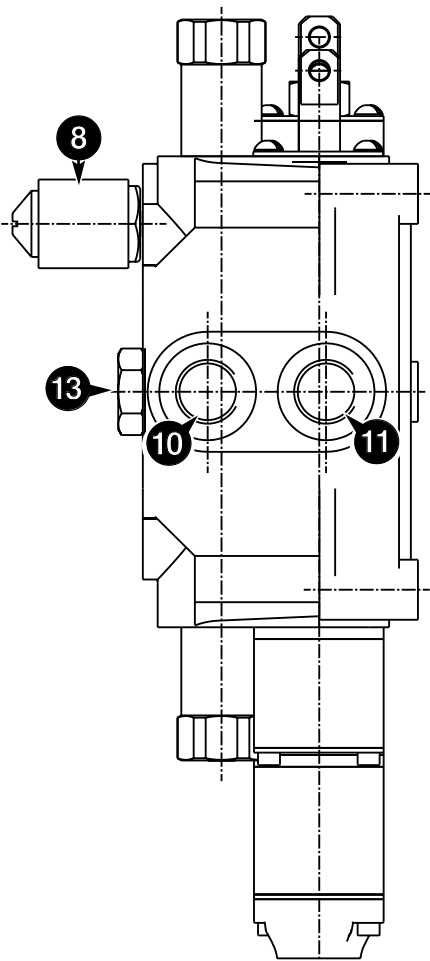
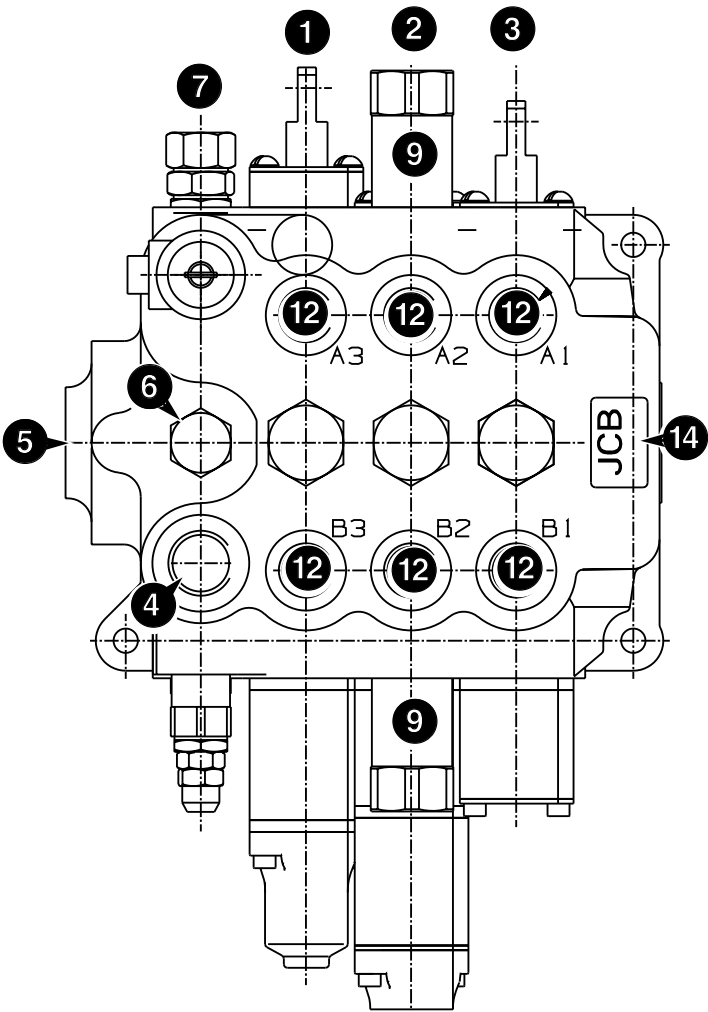
Note: Instructions for pressure testing and adjustment are described in **Service Procedures, Loader Valve - Pressure Testing.**

Weight

25kg (55lbs) (3 spool)
TBA (2 spool)

Component Key:

- | | | | |
|---|------------------------|----|--------------------------------------|
| 1 | Arms lift service | 8 | Unloader solenoid |
| 2 | Shovel service | 9 | Auxiliary relief valve |
| 3 | Auxiliary (optional) | 10 | Tank port |
| 4 | Pump section 1 - inlet | 11 | High pressure carry-over (HPCO) port |
| 5 | Pump section 2 - inlet | 12 | Service ports |
| 6 | Pressure test port | 13 | Load hold check valve assemblies |
| 7 | Unloader Assembly | 14 | Data plate |



A262160

Relief Valve Pressures

Loader Valve - Precision Control (Servo)

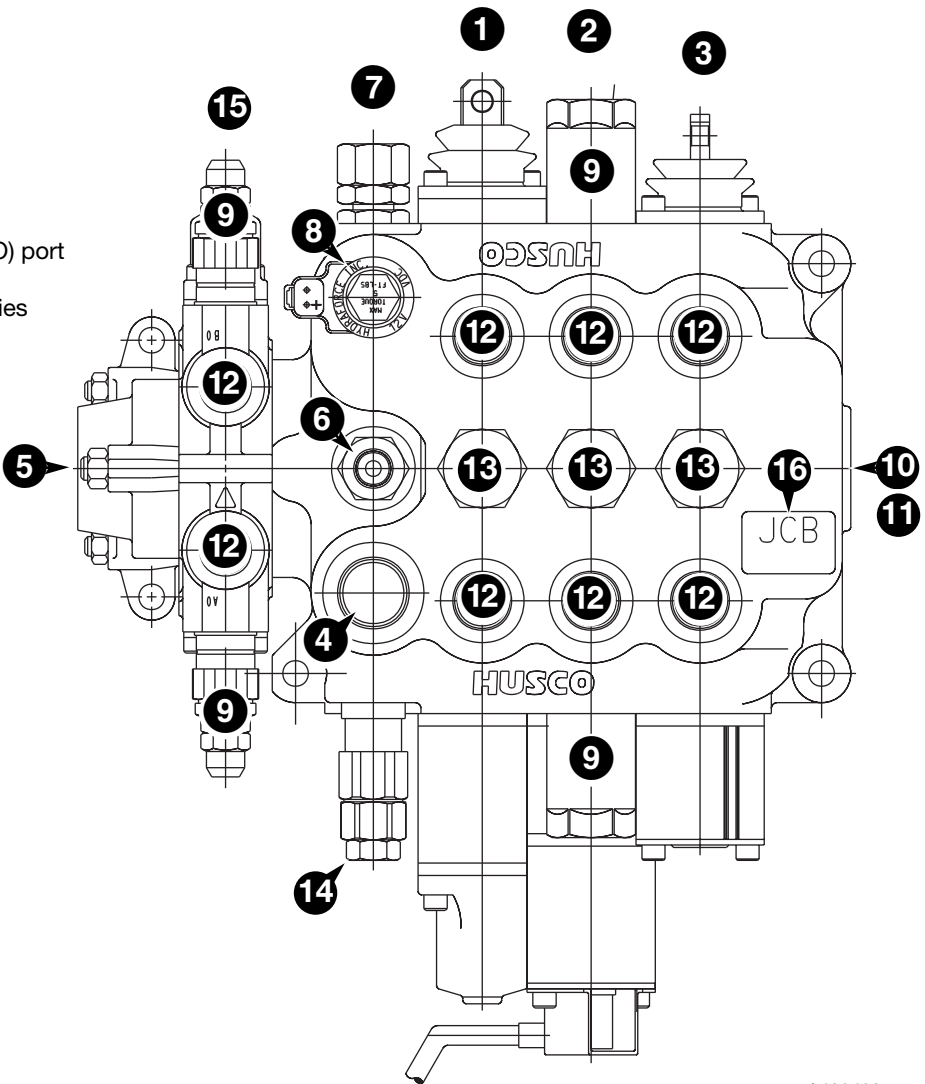
* (Machines up to serial no. 931159)

	bar	kgf/cm ²	lbf/in ²
Main Relief Valve (M.R.V.)	227 - 231	232 - 235	3300 - 3350
Unloader Valve	203 - 207	207 - 211	2950 - 3000
Auxiliary Relief Valves (A.R.V.)			
Loader			
Shovel Ram Head Side	172 - 175	175 - 179	2500 - 2550
Shovel Ram Rod side	308 - 312	315 - 318	4475 - 4525
Bolt on Auxiliary Spool (extending dipper, if fitted)			
Top relief valve	136 - 140	139 - 142	1975 - 2025
Bottom relief valve	205 - 208	209 - 212	2975 - 3025

Note: Instructions for pressure testing and adjustment are described in **Service Procedures, Loader Valve - Pressure Testing.**

Component Key:

- 1 Arms lift service
- 2 Shovel service
- 3 Auxiliary (optional)
- 4 Pump section 1 - inlet
- 5 Pump section 2 - inlet
- 6 Pressure test port
- 7 Unloader Assembly
- 8 Unloader solenoid
- 9 Auxiliary relief valve
- 10 Tank port
- 11 High pressure carry-over (HPCO) port
- 12 Service ports
- 13 Load hold check valve assemblies
- 14 Main relief valve (MRV)
- 15 Bolt on auxiliary spool
- 16 Data plate



A402480

Relief Valve Pressures

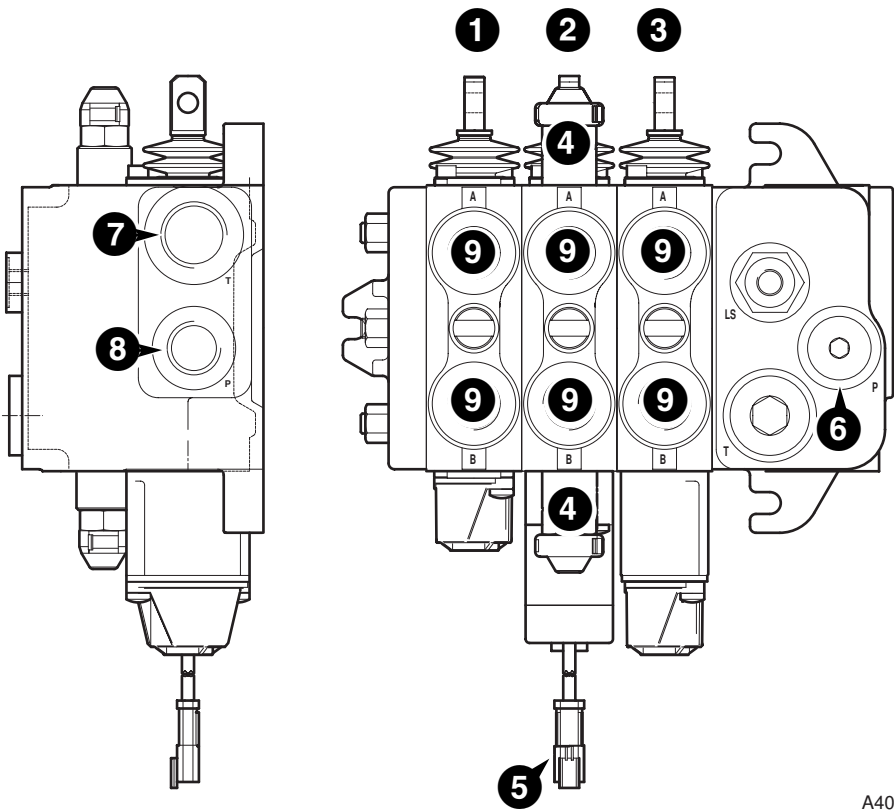
Loader Valve - Precision Control (Servo)
(Machines from January 2003)

	bar	kgf/cm ²	lbf/in ²
Auxiliary Relief Valves (A.R.V.)			
Shovel Ram Head Side	310	315	4500
Shovel Ram Rod Side	170	175	2500

Note: Instructions for pressure testing and adjustment are described in **Service Procedures, Loader Valve - Pressure Testing**.

Component Key:

- 1 Auxiliary (options)
- 2 Shovel service
- 3 Arms lift service
- 4 Auxiliary relief valves
- 5 Electric detent spool connector
- 6 Inlet port (secondary pump section P2)
- 7 Tank port
- 8 Inlet port (main pump section P1)
- 9 Service ports



A403690

Relief Valve Pressures

Loader Valve - Variable Flow

	bar	kgf/cm ²	lbf/in ²
Priority Relief Valve†	170 - 176	173 - 179	2450 - 2550
Auxiliary Relief Valves (A.R.V.) @ 0.5gal/min (1.9 litres/min)			
Shovel Ram Head Side	170 - 174	173 - 177	2465 - 2520
Shovel Ram Rod side	306 - 314	312 - 320	4450 - 4550

† **Note:** Steer circuit pressure is controlled by a relief valve housed in the hydraulic steer unit (Refer to Section H **Steering**). The priority relief valve housed in the loader valve must be set at 2500 lbf/in², this will ensure it does not interfere with the operation of the relief valve housed in the hydraulic steer unit.

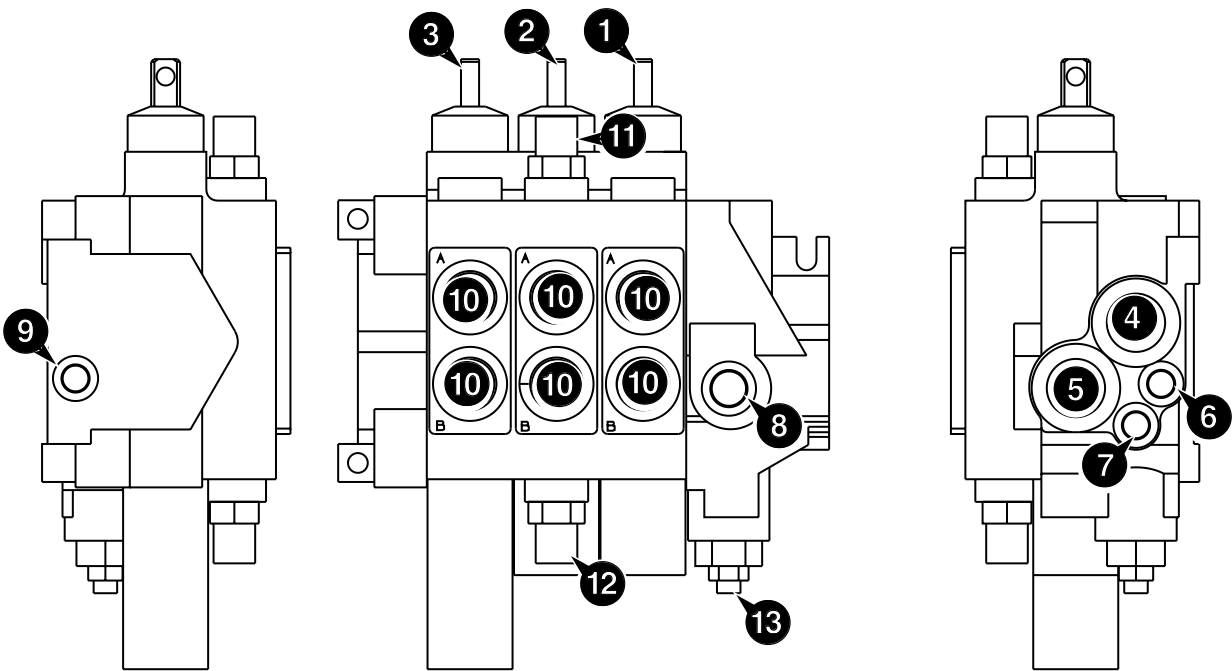
Weight:

2 Spool - TBA kg (TBA lbs)

3 Spool - TBA kg (TBA lbs)

Component Key:

- 1 Auxiliary (optional) service
- 2 Shovel service
- 3 Arms lift service
- 4 Pump inlet
- 5 Tank port
- 6 Load sense port (to pump)
- 7 Priority load sense port (from steer unit)
- 8 Priority work port (to steer unit)
- 9 Load sense carry over port (to backhoe valve)
- 10 Service ports
- 11 Auxiliary relief valve (rod side)
- 12 Auxiliary relief valve (head side)
- 13 Priority relief valve †



A273670

Relief Valve Pressures

Excavator Valve - Fixed Flow

	bar	kgf/cm ²	lbf/in ²
Boom Ram Head Side	248 - 255	253 - 260	3600 - 3700
Boom Ram Rod Side	345 - 352	351 - 358	5000 - 5100
Bucket Ram Head Side			
Centremount (17' , 15' 6" backhoe - except knuckle)	310 - 317	316 - 323	4500 - 4600
Centremount (14' backhoe, 15' 6" backhoe with a knuckle fitted)	248 - 255	253 - 260	3600 - 3700
Sideshift	248 - 255	253 - 260	3600 - 3700
Bucket Ram Rod Side (Machines with Rockbreaker only)	248 - 255	253 - 260	3600 - 3700
Dipper Ram Head Side	248 - 255	253 - 260	3600 - 3700
Dipper Ram Rod Side	248 - 255	253 - 260	3600 - 3700
Slew Left and Right	262 - 269	267 - 274	3800 - 3900

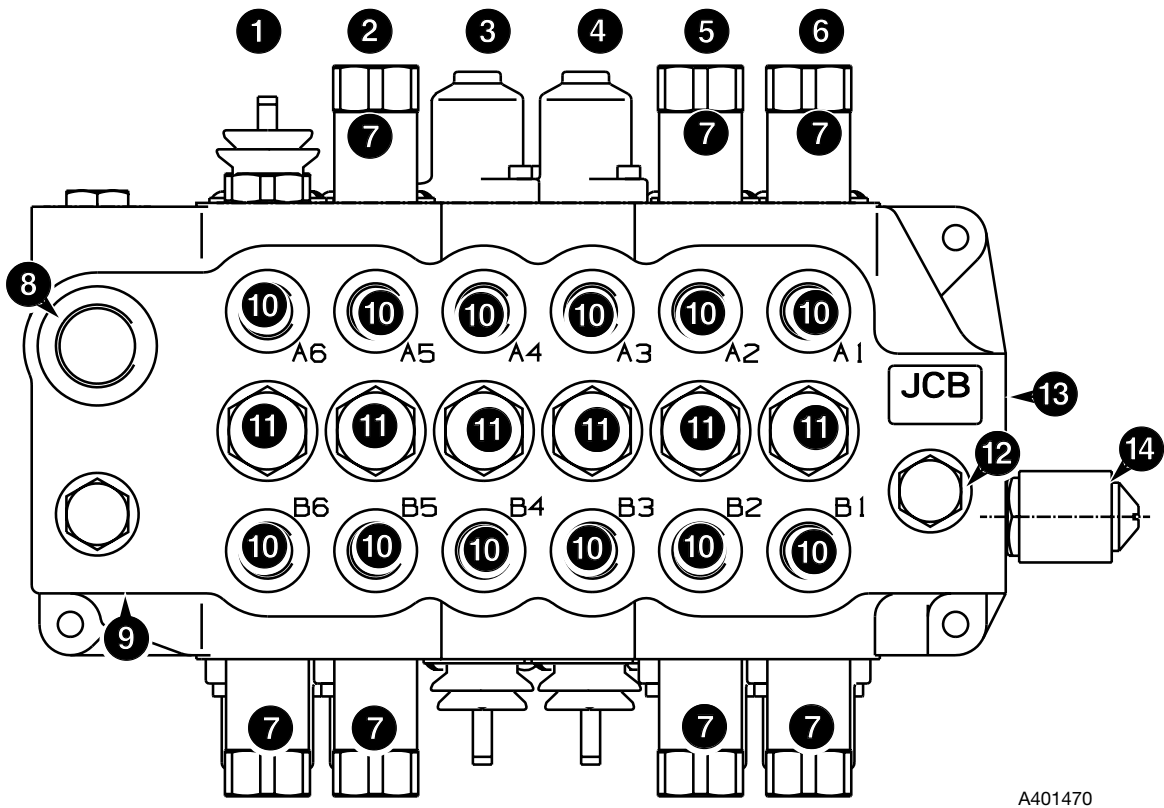
Weight:
44 kg (97 lbs) - Centremount
46 kg (101 lbs) - Sideshift

Note: Instructions for pressure testing and adjustment are described in **Service Procedures, Loader Valve - Pressure Testing**.

† System shown is for JCB plus pattern and JCB diagonal pattern. For ISO system, the boom and dipper spools change position, i.e. boom is position 2 and dipper is position 5. The bottom ARV from spool 5 will also be swapped with the bottom ARV from spool 2.

- Component Key:**

1	Bucket crowd
2	Dipper †
3	Stabiliser
4	Stabiliser
5	Boom †
6	Slew
7	Auxiliary relief valve
- | | |
|----|--------------------------------------|
| 8 | Tank port |
| 9 | High pressure carry-over (HPCO) port |
| 10 | Service ports |
| 11 | Load hold check valve assemblies |
| 12 | Make-up check valve assembly |
| 13 | Inlet port |
| 14 | Hydraclamp solenoid |



A401470

Relief Valve Pressures

Excavator Valve - Precision Control (Servo)

*(Machines up to serial no. 931159)

	bar	kgf/cm ²	lbf/in ²
Boom Ram Head Side	248 - 255	253 - 260	3600 - 3700
Boom Ram Rod Side	345 - 352	351 - 358	5000 - 5100
Bucket Ram Head Side	248 - 255	253 - 260	3600 - 3700
Bucket Ram Rod Side	248 - 255	253 - 260	3600 - 3700
Dipper Ram Head Side	248 - 255	253 - 260	3600 - 3700
Dipper Ram Rod Side	248 - 255	253 - 260	3600 - 3700
Slew Left and Right	262 - 269	267 - 274	3800 - 3900
Load Sense Relief Valve †	208 - 212	213 - 216	3025 - 3075

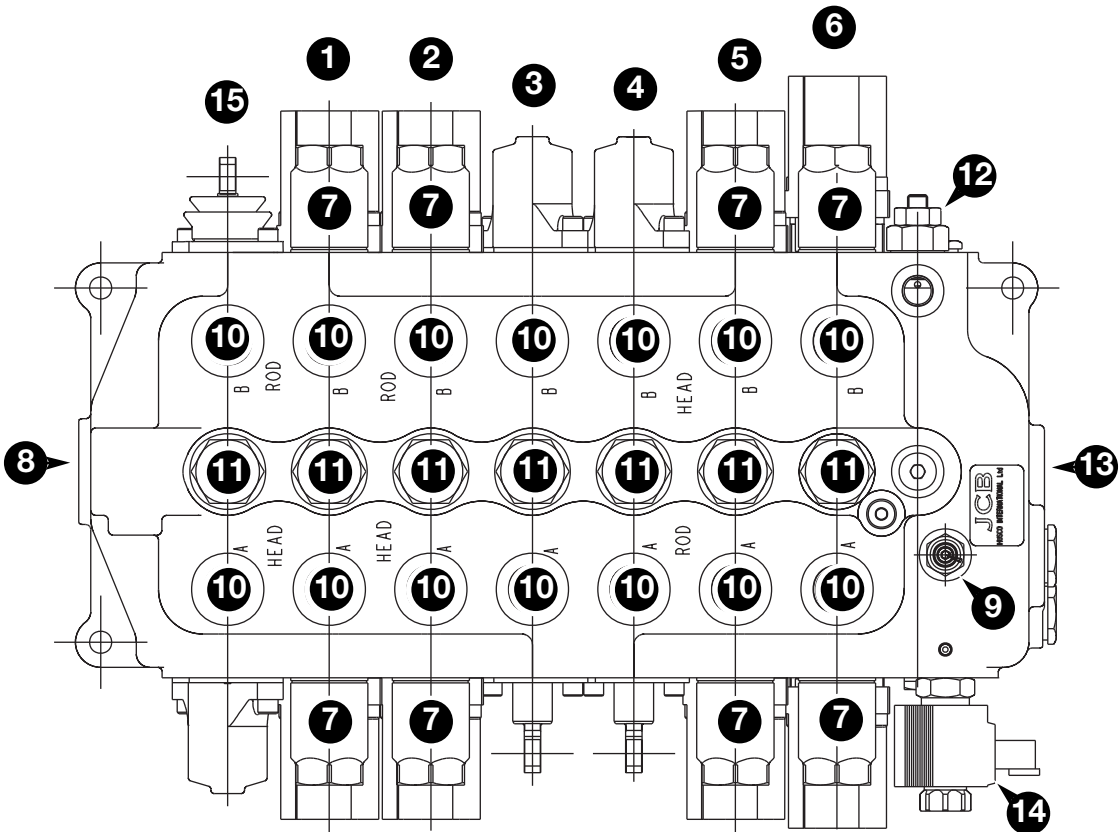
Note: Instructions for pressure testing and adjustment are described in **Service Procedures, Loader Valve - Pressure Testing.**

† Note: For pressure testing and adjustment of the load sense relief valve, see **Service Procedures, Pressure Testing, Load Sense Drain Regulator and Relief Valve.**

Component Key:

- 1 Bucket
- 2 Dipper
- 3 Stabiliser
- 4 Stabiliser
- 5 Boom
- 6 Slew
- 7 Auxiliary relief valve
- 8 Tank port

- 9 Pilot operated check valve (hydraclamp)
- 10 Service ports
- 11 Load sense valve
- 12 Load sense drain regulator and relief valve
- 13 Inlet port
- 14 Hydraclamp solenoid
- 15 Auxiliary spool



A402500

Relief Valve Pressures

Excavator Valve - Precision Control (Servo)
(Machines from January 2003)

	bar	kgf/cm ²	lbf/in ²
Auxiliary Relief Valves (A.R.V.)			
Boom Ram Head Side	245	250	3550
Boom Ram Rod Side	350	355	5000
Bucket Ram Head Side	255	260	3700
Bucket Ram Rod Side	255	260	3700
Dipper Ram Head Side	255	260	3700
Dipper Ram Rod Side	255	260	3700
Slew Left and Right	265	270	3850
Load Sense Relief Valve †			
	250	255	3650

Note: Instructions for pressure testing and adjustment are described in **Service Procedures, Loader Valve - Pressure Testing**.
† **Note:** For pressure testing and adjustment of the load sense relief valve, see **Service Procedures, Pressure Testing, Load Sense Relief Valve**.

Component Key:

- 1

Auxiliary (options)
- 2

Bucket
- 3

Dipper
- 4

Stabiliser
- 5

Stabiliser
- 6

Boom
- 7

Slew
- 8

Auxiliary relief valves
- 9

Anti-cavitation valve
- 10

Load sense relief valve
- 11

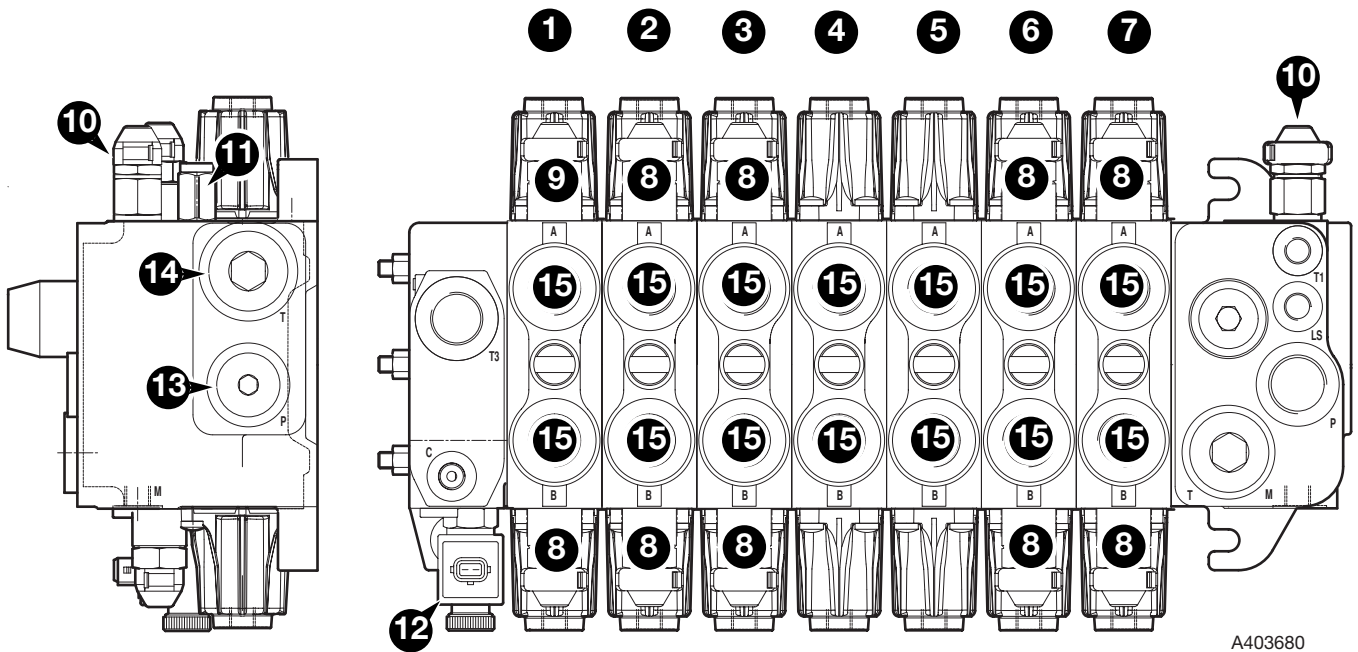
Flow regulator valve
- 12

Hydraclamp solenoid
- 13

Inlet port
- 14

Tank port
- 15

Service ports



Relief Valve Pressures

Auxiliary Valve - Fixed Flow

	bar	kgf/cm ²	lbf/in ²
Extradig Ram Head Side	138 - 145	141 - 148	2000 - 2100
Extradig Ram Rod Side	207 - 214	211 - 218	3000 - 3100
Jaw Bucket Ram Head Side	138 - 145	141 - 148	2000 - 2100
Jaw Bucket Ram Rod Side	207 - 214	211 - 218	3000 - 3100
Knuckle Ram Head Side	138 - 145	141 - 148	2000 - 2100
Knuckle Ram Rod Side	207 - 214	211 - 218	3000 - 3100
Hammermaster	207 - 214	211 - 218	3000 - 3100
Power Sideshift (both)	207 - 214	211 - 218	3000 - 3100
Hand Held Tools	138 - 150	141 - 153	2000 - 2200

Component Key:

- 1 Auxiliary Spool
- 2 Inlet port
- 2 Outlet port
- 3 Auxiliary relief valve
- 4 High pressure carry-over (HPCO) port
- 7 Service 'A' ports
- 8 Service 'B' ports

Weight:

TBA kg (TBA lbs)

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Smooth Ride System

System Type

A piston type accumulator operates as a liquid spring absorbing displaced fluid from the lift rams. Selectable from a switch in the cab.

Charging Gas
Accumulator Capacity
Accumulator Weight

Air Free Dry Nitrogen
1.0 litre (58 cu/in)
4.4 kg (9.75 lb)

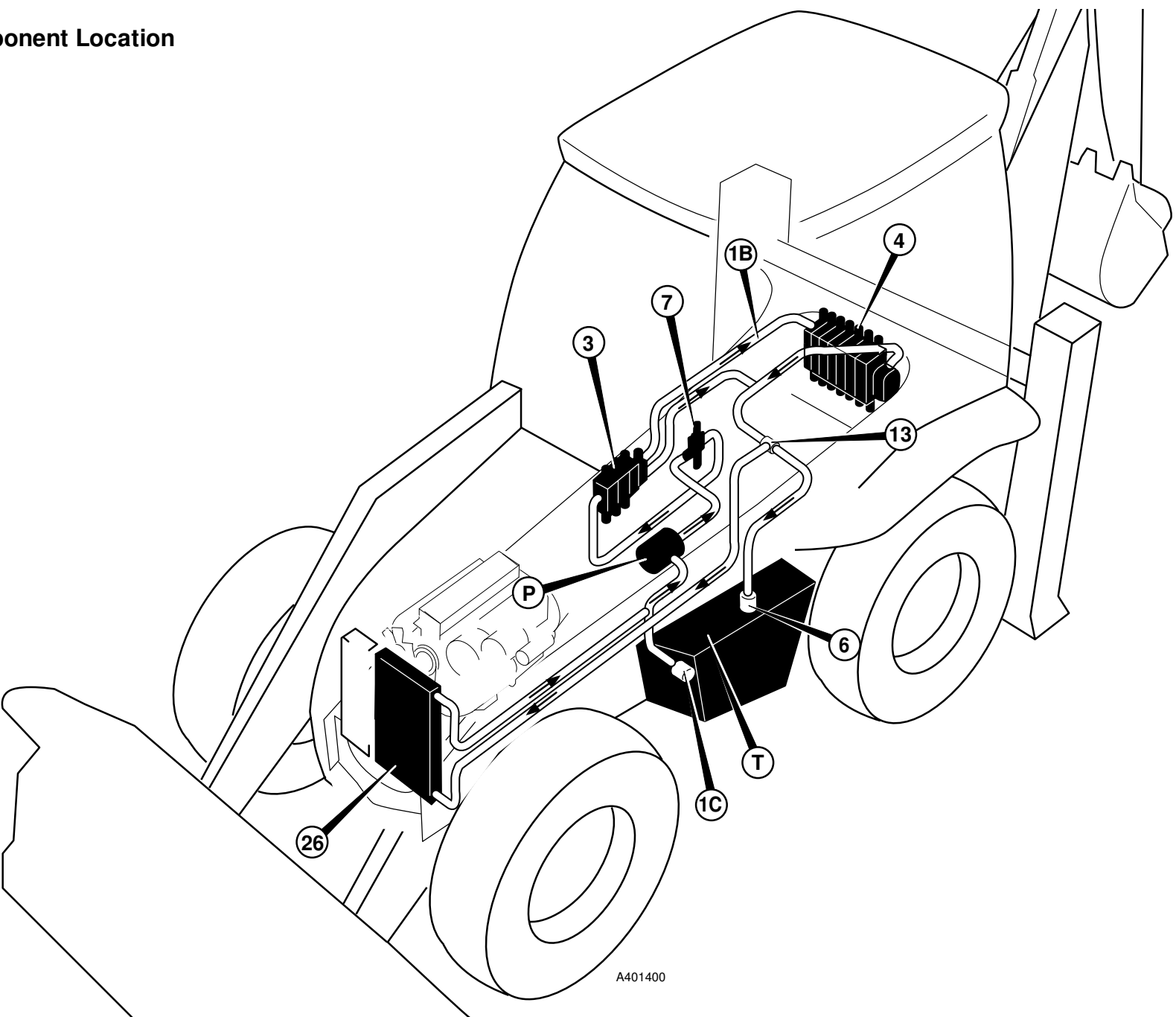
Accumulator Charge Pressure

As a general guide for given shovel weights (loaded) see below:-

	bar	kgf/cm ²	lbf/in ²
Shovel weights up to 700 kg (1540 lb)	13.8	14	200
Shovel weights 700 kg to 950 kg (1540 - 2100 lb)	19	19.4	275
Shovel weights over 950 kg (2100 lb)	24	24.5	350

Note: Replacement accumulators will only be supplied in an uncharged, non pressureised condition to meet Health and Safety/Airfreight hazardous goods requirements.

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Component Location

Component Location

Component Key:

- T** Hydraulic Tank
- P** Hydraulic Pump (engine driven)
- 1B** Hose - High Pressure Carry Over
- 3** Loader Valve Block
- 4** Excavator Valve
- 6** Return Line Filter (inside hydraulic tank)
- 7** Steer Circuit Priority Valve
- 13** Return Line Check Valve
- 26** Hydraulic Oil Cooler

Neutral Circuit Description

Fixed Flow - Single Pump

Oil is drawn from the hydraulic tank **T** by the single stage hydraulic pump **P**. The pump is mounted on the rear of the gearbox and is engine driven via a driveshaft.

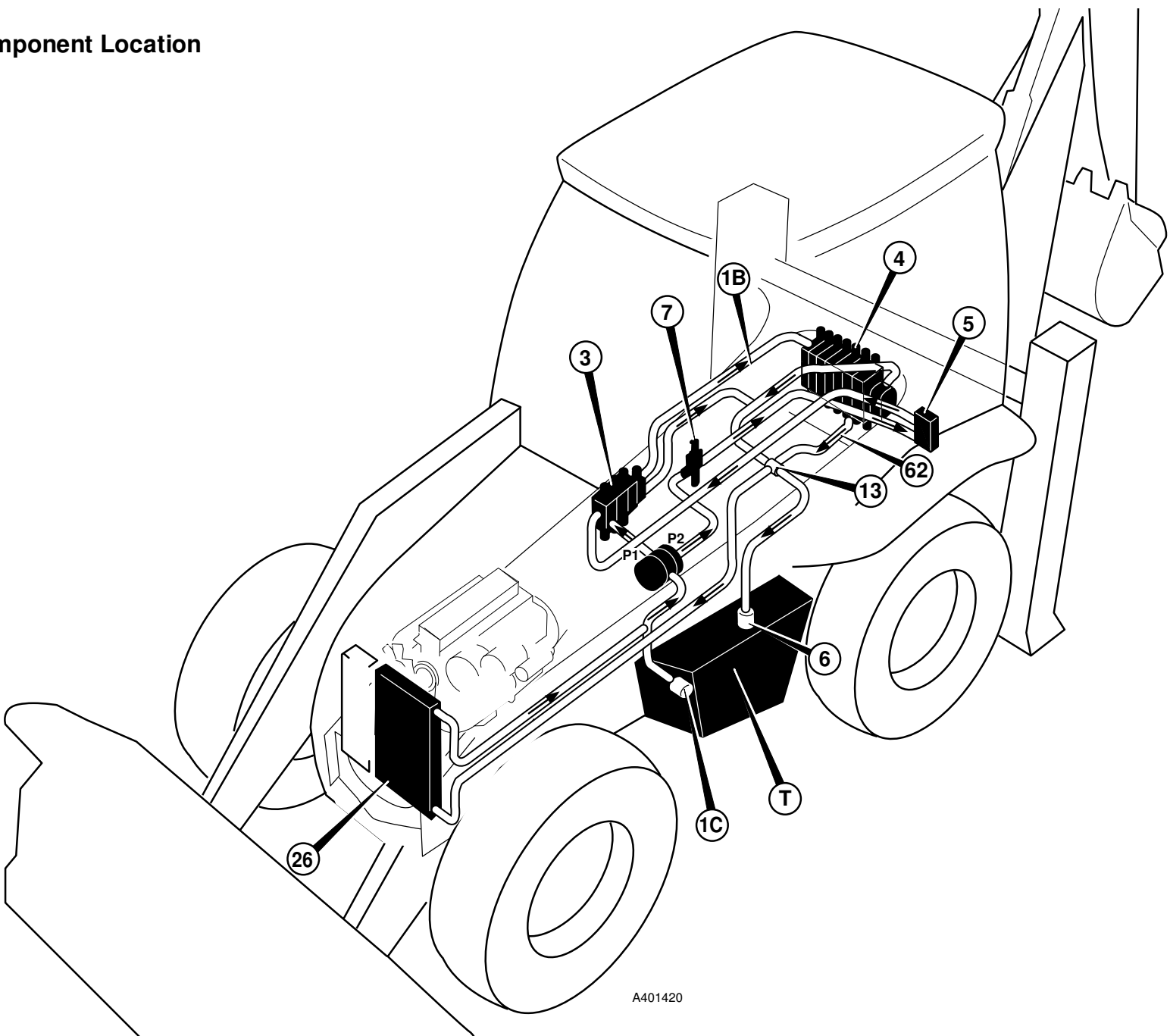
Pressurised oil from the pump flows to steering priority valve **7**, and in neutral circuit flows through the priority valve to the loader valve **3**.

From the loader valve neutral gallery, oil flows via a high pressure carry-over line **1B** to the excavator valve **4**.

Some of the exhaust oil flows directly back to the tank through an in-tank filter **6**, and some of the exhaust oil returns to tank via the hydraulic oil cooler **26**.

To help prevent excavator dipper ram and loader lift ram cavitation, there is a check valve **13** fitted to the return line. The check valve raises approximately 5 bar (75 lbf/in²) of pressure in the line, which improves the operation of the respective anti-cavitation valves.

Component Location



A401420

Neutral Circuit Description

Fixed Flow - Double Pump

Oil is drawn from the hydraulic tank **T** by the hydraulic pump. The pump has two sections, **P1** and **P2**.

The hydraulic pump is mounted on the rear of the gearbox and is driven by the engine via a driveshaft.

Oil from the larger section **P1** flows direct to the loader valve **3**. Oil from pump section **P2**, flows to steering priority valve **7**, and in neutral circuit flows through the priority valve to the auxiliary valve **5** and then to join the flow from **P1** at the loader valve.

From the loader valve neutral gallery, oil flows via a high pressure carry-over line **1B** to the excavator valve **4**.

Some of the exhaust oil flows directly back to the tank through an in-tank filter **6**, and some of the exhaust oil returns to tank via the hydraulic oil cooler **26**.

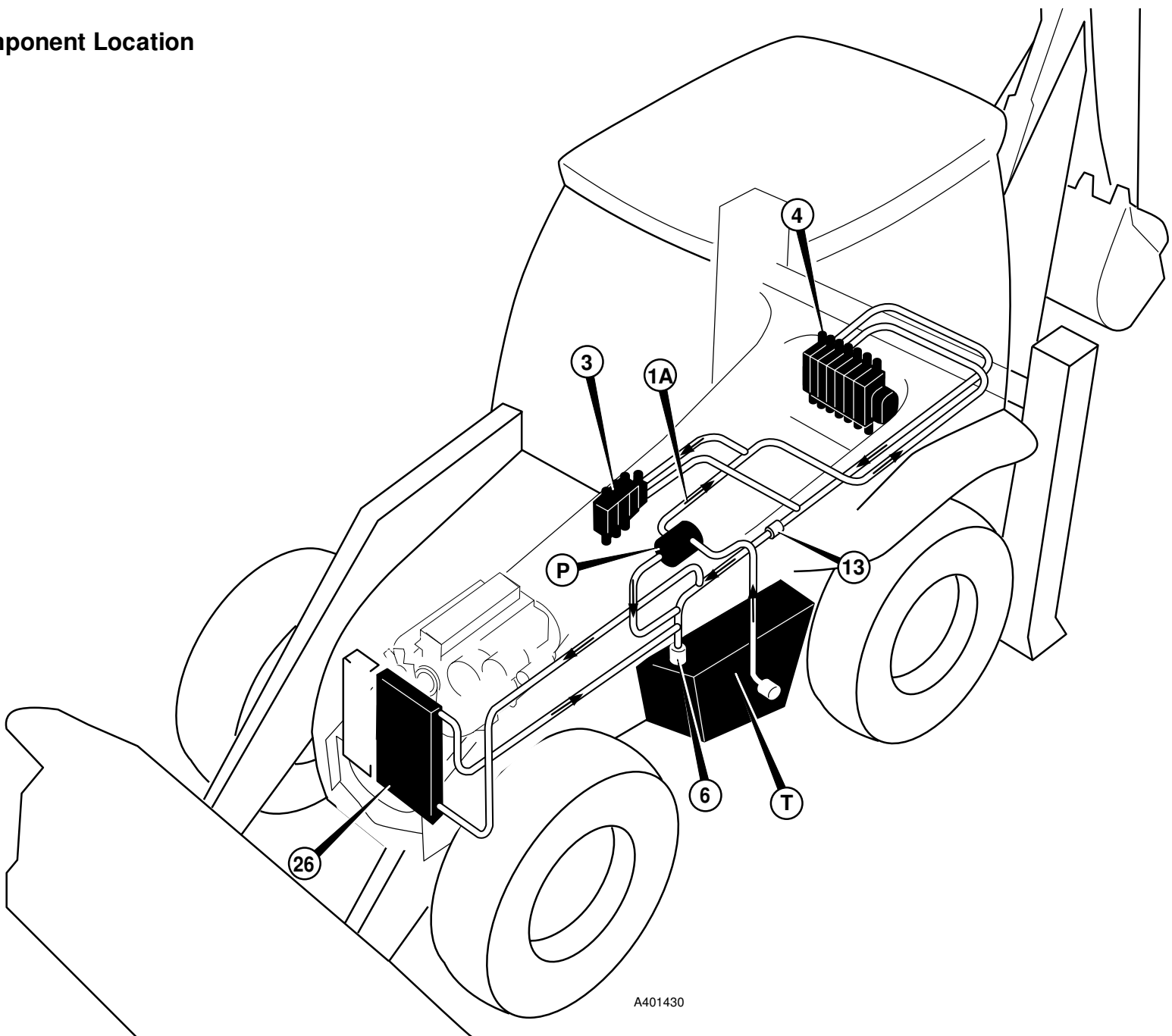
To help prevent excavator dipper ram and loader lift ram cavitation, there is a check valve **13** fitted to the return line. The check valve raises approximately 5 bar (75 lbf/in²) of pressure in the line, which improves the operation of the respective anti-cavitation valves.

On sideshift machines only, hydraclamp exhaust hose **62** is fitted. The hose connects the hydraclamp spool directly into the exhaust circuit. This prevents the clamps from 'locking-up' when the sideshifting operation is required.

Component Location

Component Key:

- T** Hydraulic Tank
- P1** Hydraulic Pump (main section)
- P2** Hydraulic Pump (secondary section)
- 1B** Hose - High Pressure Carry Over
- 3** Loader Valve Block
- 4** Excavator Valve
- 5** Auxiliary Valve
- 6** Return Line Filter (inside hydraulic tank)
- 7** Steer Circuit Priority Valve
- 13** Return Line Check Valve
- 26** Hydraulic Oil Cooler
- 62** Hydraclamp exhaust hose



A401430

Component Location

Neutral Circuit Description

Variable Flow

The variable flow displacement pump **P** is mounted on the rear of the gearbox and is engine driven via a driveshaft.

With variable flow hydraulics, there is no 'neutral' circuit. This is because the pump **P** operates on a demand signal from the services (see **Circuit Descriptions, Hydraulic Pump - Variable Flow Operation**). If there is no demand, then the pump does not draw oil from the tank and no oil is delivered, there is no pump flow in the neutral position.

When a service is selected, the pump senses the demand and oil is drawn from the hydraulic tank **T**. Pressurised oil from the pump flows to the loader valve **3** and/or the excavator valve **4** via hose and pipe assembly **1A**.

The loader valve **3** is fitted with a priority inlet manifold, oil entering the loader valve is distributed to the (priority) steer circuit and/or the loader services as required (see **Circuit Descriptions, Loader Valve - Variable Flow Operation**).

Some of the exhaust oil flows directly back to the tank through an in-tank filter **6**, and some of the exhaust oil returns to tank via the hydraulic oil cooler **26**.

To help prevent excavator dipper ram and loader lift ram cavitation, there is a check valve **13** fitted to the return line. The check valve raises approximately 5 bar (75 lbf/in²) of pressure in the line, which improves the operation of the respective anti-cavitation valves.

Component Location

Component Key:

- T** Hydraulic Tank
- P** Hydraulic Pump (engine driven)
- 1A** Pump Outlet Pipe/Hose
- 3** Loader Valve Block
- 4** Excavator Valve
- 6** Return Line Filter (inside hydraulic tank)
- 13** Return Line Check Valve
- 26** Hydraulic Oil Cooler

Introduction to Hydraulic Schematic Symbols

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

There are many symbols in use and it would be impossible to include them all here. However it should be noted that most are only variations or refinements on the basic principles explained here. If more detailed information is required you are recommended to obtain a copy of BS2917 or ISO1219.

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

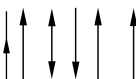
General (Basic & Functional Symbols)

 Spring

 Flow restriction affected by viscosity

 Direction of flow

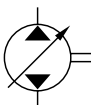
 Indication of rotation

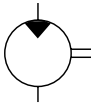
 Indication of direction and paths of flow

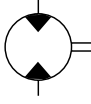
 Variable control

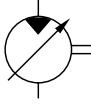
A189660

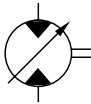
Pumps & Motors

 Variable capacity pump
two directions of flow

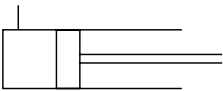
 Fixed capacity motor
one direction of flow

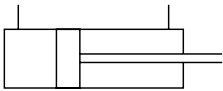
 Fixed capacity motor
two directions of flow

 Variable capacity motor
one direction of flow

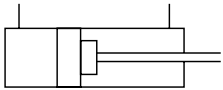
 Variable capacity motor
two directions of flow

Rams

 Single acting

 Double acting

 Double ended

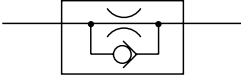
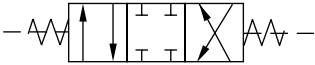
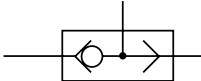
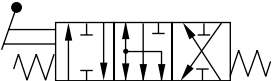
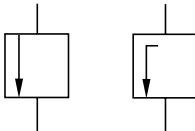
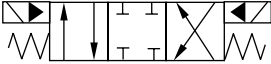
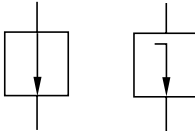
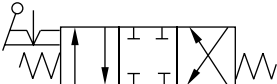
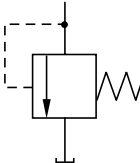
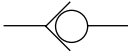
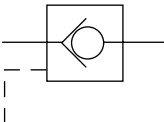
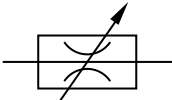
 Double acting with damping at rod area end

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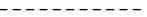
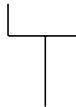
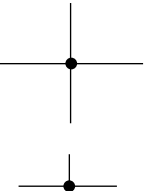
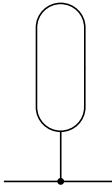
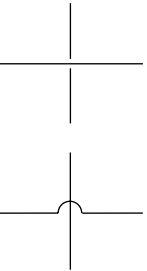
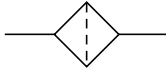
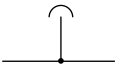
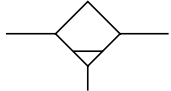
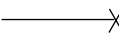
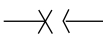
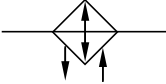
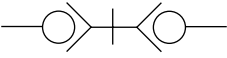
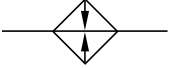
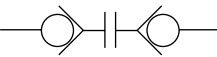
Introduction to Hydraulic Schematic Symbols (cont'd)

Control Valves

	Used to enclose several valves indicating that they are supplied as one unit		One way restrictor
	3-Position, 4-Port spring centred pilot operated valve		High pressure selector (shuttle valve)
	3-Position, 6-Port spring centred hand operated valve		Throttling orifice - normally closed
	3-Position, 4-Port spring centred solenoid & pilot pressure operated valve		Throttling orifice - normally open
	3-Position, 4-Port spring centred detent hand operated valve		Relief valve
	Non - return valve		Non - return valve with back pressure spring
	Pilot operated non - return valve		Variable restrictor

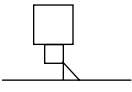
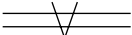
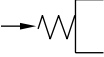
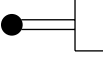
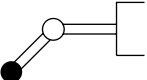
Introduction to Hydraulic Schematic
Symbols (cont'd)

Energy Transmissions and Conditioning

	Working line, return or feed		Reservoir - return line above fluid level
	Pilot control		Reservoir - return line below fluid level
	Drain lines		Header tank
	Flexible pipe		Pressure sealed tank
	Line junction		Accumulator
	Crossing lines		Filter or strainer
	Air bleed		Water trap
	Line plugged, also pressure test point		Cooler - with no indication of coolant flow
	Line plugged with take off line		Cooler - indicating direction of coolant flow
	Quick release couplings - connected		Heater
	Quick release couplings - disconnected		

Introduction to Hydraulic Schematic Symbols (cont'd)

Control Mechanisms

	Rotating shaft-one direction		Solenoid one winding
	Rotating shaft-two directions		Solenoid two winding
	Detent		Electric motor operated
	Locking device		Internal pressure pilot operated
	Over centre device		External pressure pilot operated
	Simple linkage		Pressure operated spring release
	General control		Pilot operated by solenoid pilot valve
	Push button operated		Pilot operated by a solenoid or separate pilot valve
	Lever operated		Pressure gauge
	Pedal operated		Pressure switch
	Stem operated		
	Spring operated		
	Roller operated		
	Roller trip operated (one directional)		

Introduction to Hydraulic Schematic Symbols (cont'd)

Control Valves

Control valves are usually represented by one or more square boxes.

Fig. 1 shows a control valve represented by three boxes. The number of boxes indicates the number of possible valve operating positions, (4 boxes - 4 positions etc).

Fig. 2 - In circuit diagrams the pipework is usually shown connected to the box which represents the unoperated condition. (Hydraulic circuit diagrams are usually shown in the unoperated condition).

Fig. 3 shows a valve described as a 3- position, 4-port control valve. Port describes the openings to and from the valve by which the hydraulic fluid enters or leaves. In the fig shown, Position 2 indicates that in an unoperated condition all 4 ports are blocked.

If the valve spool was moved to Position 1, movement of the spool would connect Port 1 to Port 2, and Port 3 to Port 4.

If the valve spool was moved to Position 3, movement of the spool would connect Port 1 to Port 4, and Port 3 to Port 2.

It must be noted that not all spools are of the same type. Their operating designs can be seen by following the path the flow arrows take in their respective operating squares.

Three typical JCB style spools are known as 'D' spools, 'F' spools and 'N' spools.

The 'D' spools generally control rams because when in the neutral position the outlet ports are blocked, preventing ram movement. Fig 3 shows a 'D' type spool.

Fig 4 - 'F' spools are often shown as four position spools with the three normal positions for neutral and service control; and the forth position, which has a detent, connects both sides of the ram together to allow the service to 'float'.

Fig 5 - 'N' spools are sometimes used to control hydraulic motors, and it can be seen from the flow arrows, that in neutral position both service ports are connected to the exhaust oil port

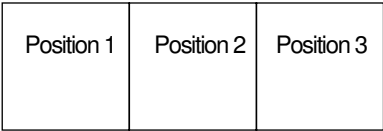


FIG 2

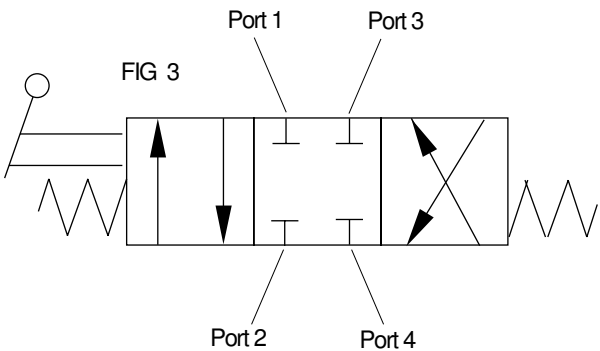
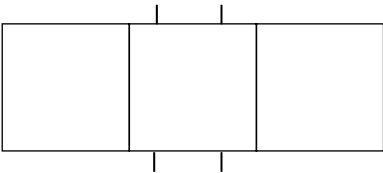


FIG 4

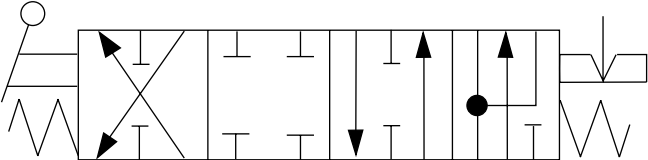
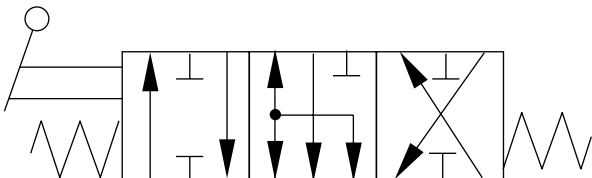


FIG 5



Introduction to Hydraulic Schematic Symbols (cont'd)

Example of Schematic Circuit

Some of the symbols described on the preceding pages have been arranged into a simple schematic circuit shown below.

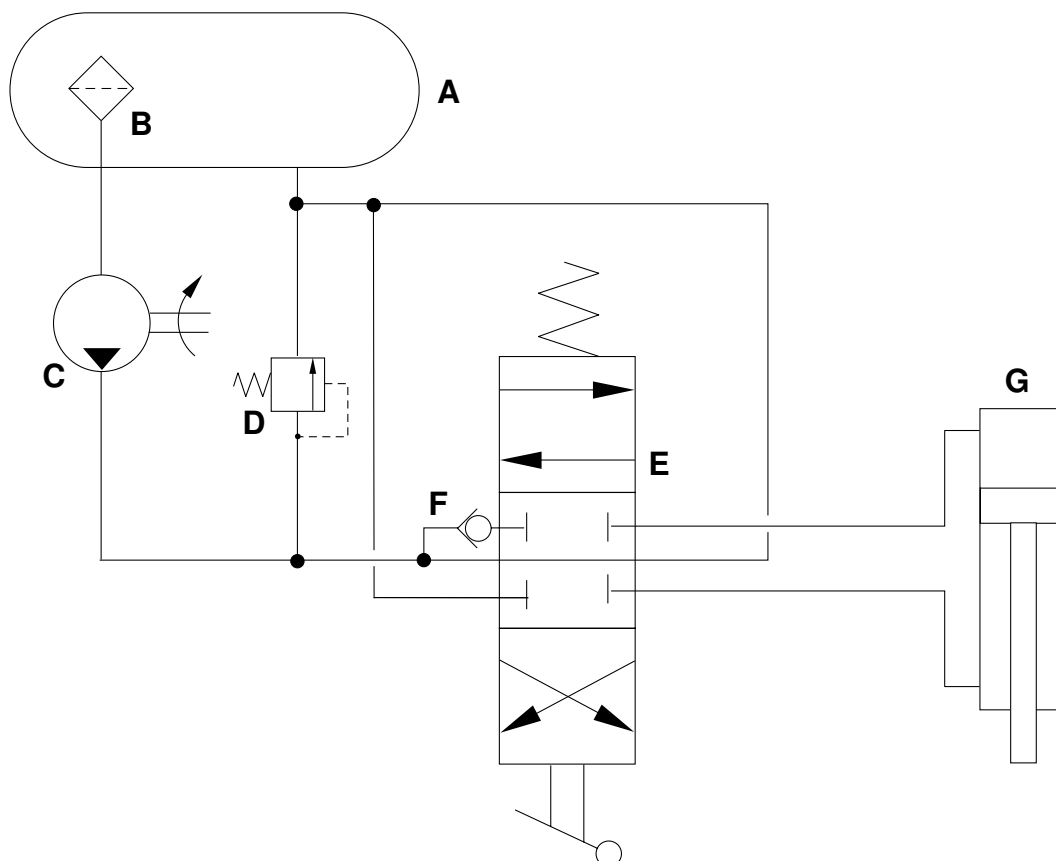
Hydraulic tank **A** is a pressurised tank with an internally mounted strainer **B** on the suction line to the fixed displacement pump **C**. System pressure is limited to the setting of relief valve **D**.

Valve spool **E** is an open-centre spool that is in neutral position; flow from the pump passes through the spool and returns to the hydraulic tank.

If the lever operated spool is moved away from neutral position hydraulic fluid is directed to either head side or rod side of hydraulic ram **G**. Notice that the fluid must first open one way valve **F** before flowing to the ram.

Example Circuit Key

A	Hydraulic Tank
B	Strainer
C	Fixed Displacement Pump
D	Relief Valve
E	Spool
F	One Way Valve
G	Double Acting Hydraulic Ram



A189770

3CX, 4CX, 214, 215, 217 & 'S' Series Machines

The policy of JCB is one of continuous improvement, therefore as products develop, there may be variations to the circuits.

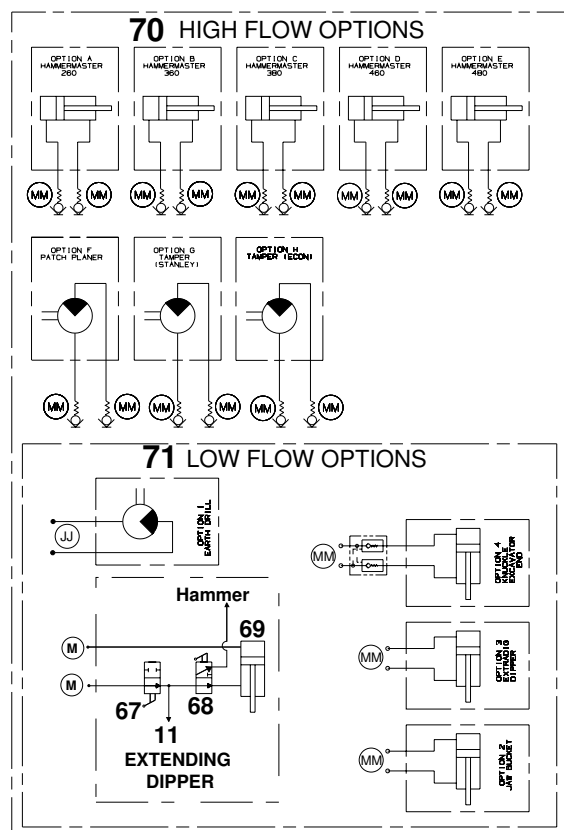
Component Key

C	Tank Cap
JJ	Connections (as applicable)
P1	Pump, Main Section
P2	Pump, Secondary Section
P2A	Pressure Test Point (auxiliary & unloader)
S	Suction Line
T	Tank
M	Connections (as applicable)
MM	Quick Release Couplings
1A	Neutral Circuit Line
1B	Neutral Circuit Line
2A	Neutral Circuit Line
3	Loader Valve Block
3A	Pressure Test Point (M.R.V.)
3B	Unloader Pilot Valve
3C	Loader Lift Ram Spool
3D	Loader Shovel Ram Spool
3E	Clamshovel Spool
3F	Shovel Ram Head Side A.R.V.
3G	Shovel Ram Rod Side A.R.V.
3J	Load Hold Check Valve
3L	Unloader Valve Spool
3M	Main Relief Valve
3N	Unloader Check Valve
3Q	Hydraulic Speed Control Solenoid
4	Excavator Valve Block

Excavator services shown here are to the JCB control pattern. If ISO, Case or Ford control pattern is used, the excavator spools and relief valves will apply to different services.

4A	Slew Spool
4B	Boom Spool
4C	Stabiliser Spool
4D	Stabiliser Spool
4E	Dipper Spool
4F	Bucket Spool
4G	Hydraclamp Valve (Sideshift Machines Only)
4H	Slew A.R.V.
4J	Slew A.R.V.
4K	Boom Ram Rod Side A.R.V.
4L	Boom Ram Side A.R.V.
4M	Dipper Ram Head Side A.R.V.
4N	Dipper Ram Rod Side A.R.V.
4P	Bucket Ram Head Side A.R.V.
5	Auxiliary Valve Block (foot operated)
5A	Auxiliary Spool
5B	A.R.V.
5C	A.R.V.
6	In-tank Filter
6A	Filter By-pass Valve
6B	Suction Strainer
7	Priority Valve
8	Filter
9	Filter
10	Diverter Valve (hammer only)
11	Sequence Valve (hammer only)
12	Flow Regulator Valve
13	Anti-cavitation Check Valve

14	Check Valve (optional)
15	Smooth Ride System Selector Valve Assembly
16	Smooth Ride System Accumulator
26	Hydraulic Oil Cooler
31	Shovel Ram R.H.
32	Shovel Ram L.H.
33	Lift Ram R.H.
34	Lift Ram L.H.
35	Clam Shovel Ram R.H.
36	Clam Shovel Ram L.H.
38	2 Wheel Steer Power Track Rod
39	AWS Rear Axle Power Track Rod
40	AWS Front Axle Power Track Rod
41	AWS Valve Assembly
42	Steer Control Valve
43	Shock Valves
44	Steer Control Valve Relief Valve
51	Bucket Ram
52	Boom Ram
53	Stabiliser Ram
54	Stabiliser Ram
55	Dipper Ram
56	Left Hand Slew Ram
57	Right Hand Slew Ram
59	Stabiliser Check Valve
62	Hydraclamps (Sideshift Machines Only)
65	Restrictor
66	Dipper Restrictor with By-Pass
67	Manual Isolation Valve
68	Manual Change Over Valve
69	Extending Dipper Ram
70	High Flow Options
71	Low Flow options



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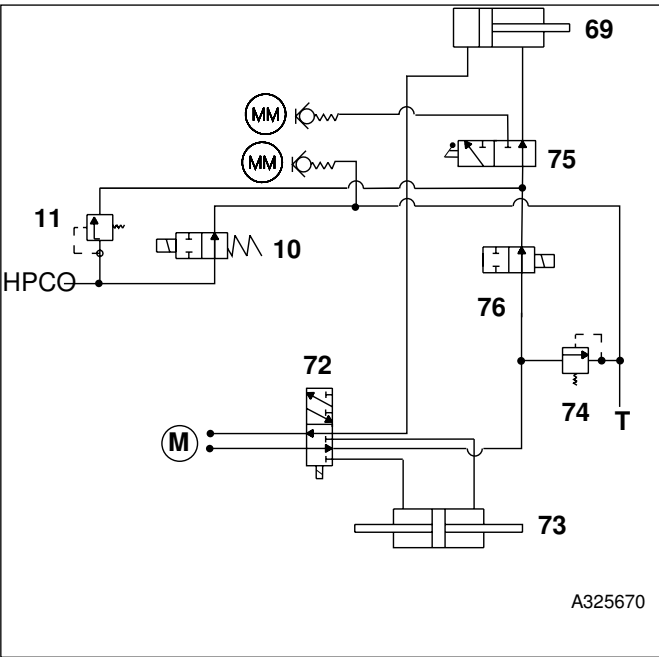


3CX ‘S’ Series & 4CX Gear Pump Options

This circuit shows the Extending Dipper and Power Sideshift, for the main hydraulic circuit see pages E/3-20 and E/3-21.

Component Key

- HPCO High Pressure Carry Over (From Excavator Valve Block 4)
- M Hydraulic Connections
- MM Quick Release Couplings
- T Hydraulic Tank Return
- 10 Diverter valve
- 11 Sequence valve
- 69 Extending Dipper Ram
- 72 Change Over Valve
- 73 Power Sideshift Cylinder
- 74 Relief Valve
- 75 Manual Change Over Valve
- 76 Isolation Valve

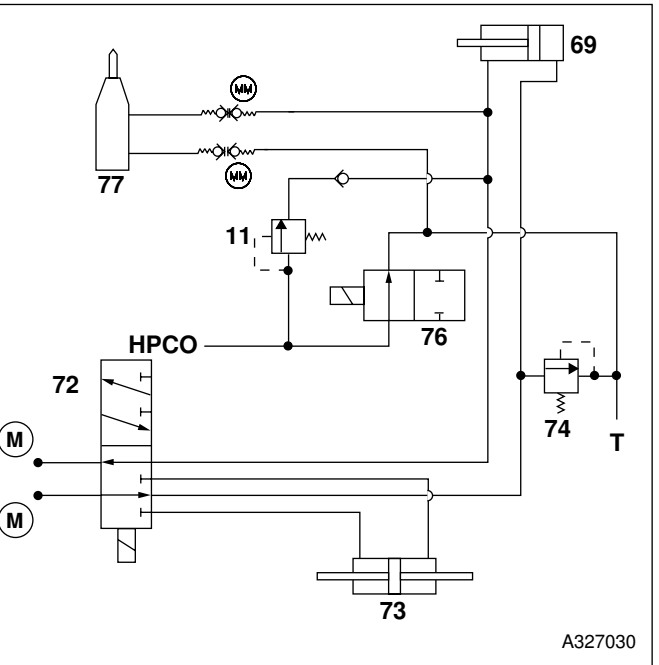


3CX ‘S’ Series Options

This circuit shows the Low Flow Hammer, Extending Dipper and Power Sideshift, for the main hydraulic circuit see pages E/3-20 and E/3-21.

Component Key

- HPCO High Pressure Carry Over (From Excavator Valve Block 4)
- M Hydraulic Connections
- MM Quick Release Couplings
- T Hydraulic Tank Return
- 11 Sequence valve
- 69 Extending Dipper Ram
- 72 Change Over Valve
- 73 Power Sideshift Cylinder
- 74 Relief Valve
- 76 Isolation Valve
- 77 Hammer

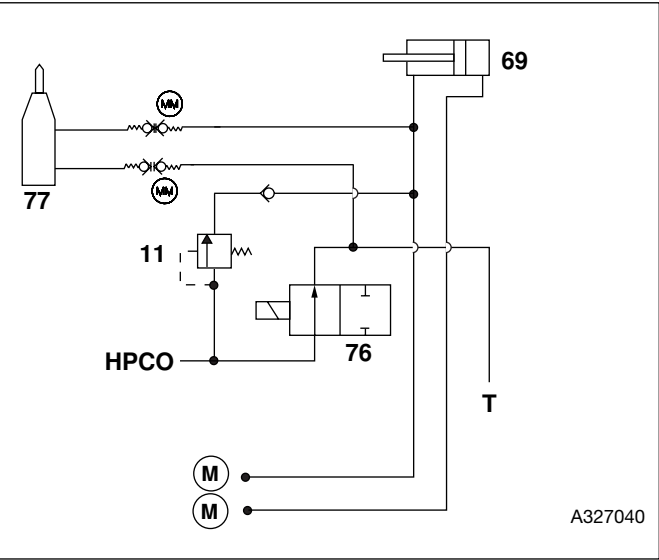


3CX 'S' Series Options

This circuit shows the Low Flow Hammer and Extending Dipper, for the main hydraulic circuit see pages E/3-20 and E/3-21.

Component Key

- HPCO High Pressure Carry Over (From Excavator Valve Block 4)
- M Hydraulic Connections
- T Hydraulic Tank Return
- 11 Sequence valve
- 69 Extending Dipper Ram
- 76 Isolation Valve
- 77 Hammer

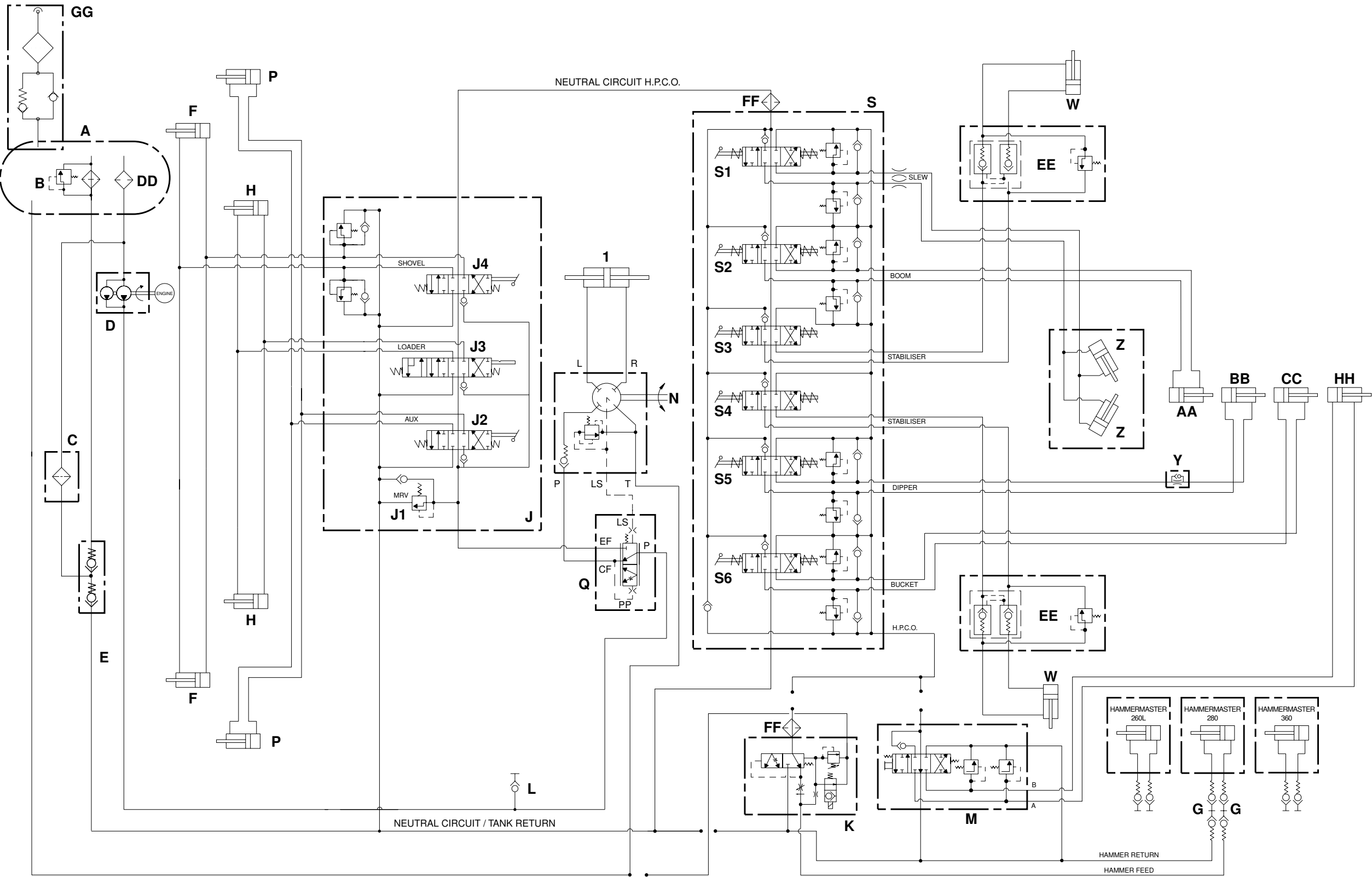


214e Machines**Component Key:**

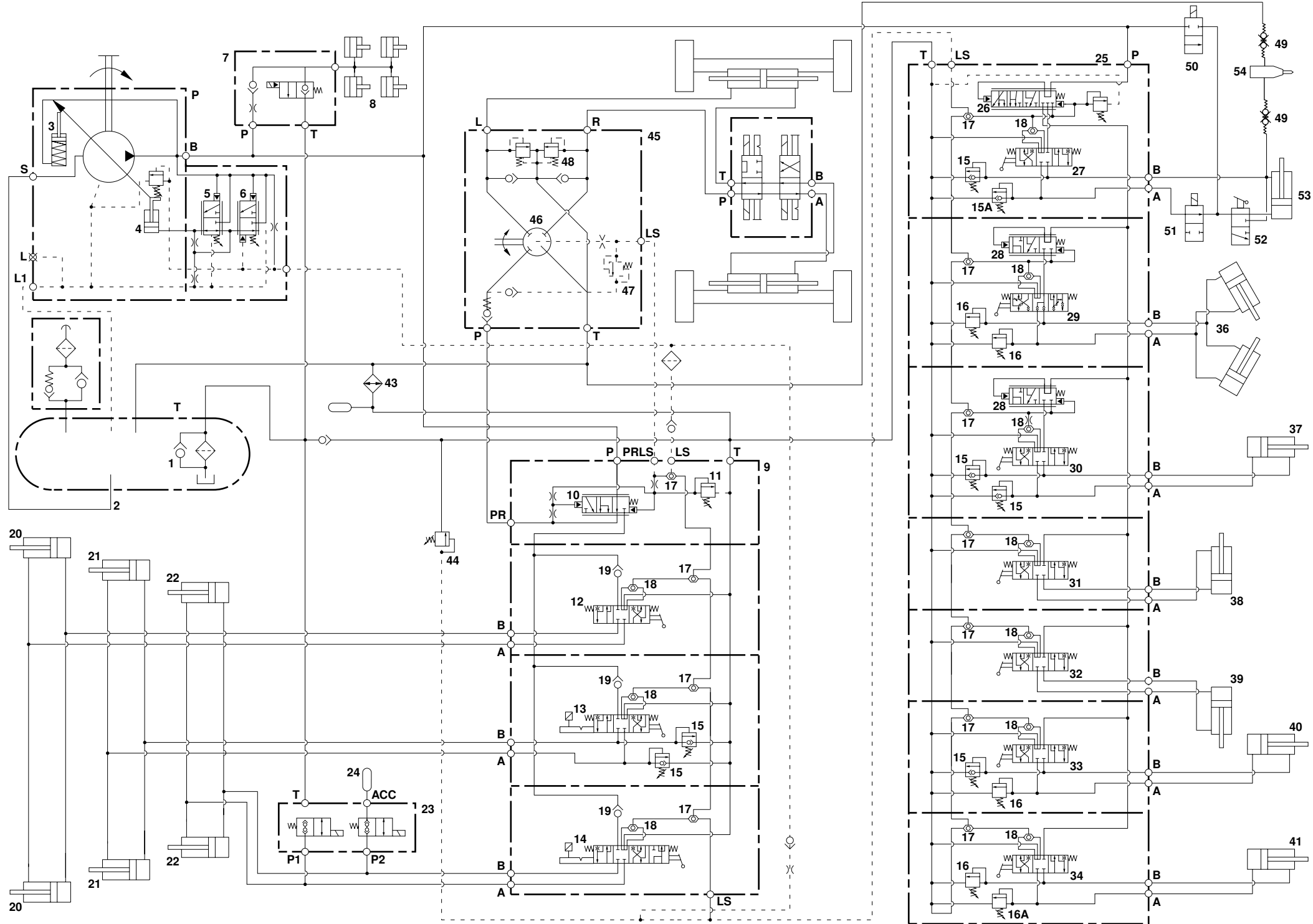
A	Hydraulic Tank
B	Return filter
C	Hydraulic Oil Cooler
D	Hydraulic Pump
E	Twin Check Valve
F	Shovel Rams
G	Quick Release Couplings
H	Lift Rams
J	Loader Valve Block
J1	Main Relief Valve
J2	Auxiliary Spool
J3	Lift Spool
J4	Shovel Spool
K	Flow Regulator Valve (Option)
L	Pressure Test Point
M	Auxiliary Valve Block (Option)
	Either option K or M can be fitted but not both.
N	Steer Control Valve
P	Auxiliary Rams
Q	Priority Valve
S	Excavator Valve Block
S1	Slew Spool
S2	Boom Spool
S3	Stabiliser Spool
S4	Stabiliser Spool
S5	Dipper Spool
S6	Bucket Spool
W	Stabiliser Rams
Y	One Way Restrictor
Z	Slew Rams
AA	Boom Ram
BB	Dipper Ram
CC	Bucket Ram
DD	Suction Strainer
EE	Stabiliser Check Valve
FF	Last Chance Filter
GG	Tank Cap
HH	Extending Dipper
1	2WS Front Power Track Rod

Note: For smooth ride system schematic, refer to **Circuit Descriptions - Smooth Ride System**.

214e Machines



4CXE, 4CX Super Machines
(7 Spool With High Flow Options)



4CX, 4CX Super Machines**(7 Spool With High Flow Options)****Component Key**

Small letters on the schematic indicate port markings. Refer to Technical Data pages at the beginning of this section for more information. Ports **A** and **B** are always identified as service ports (feed and return from respective ram).

T	Hydraulic Tank
1	By-pass Filter
2	Suction Line
P	Pump Variable Flow
3	Stroking Piston
4	Control Piston
5	System Pressure Spool
6	Stand-by Pressure Spool
7	Hydraclamp Valve
8	Hydraclamps
9	Loader Valve Block
10	Priority Inlet Section
11	Relief Valve †
12	Auxiliary Service Spool
13	Shovel Service Spool
14	Lift Service Spool
15	Auxiliary Relief Valves (anti-cavitation)
15A	ARV item 16 if Rockerbreaker Application
16	Auxiliary Relief Valves (direct acting)
16A	ARV Only Fitted For Rockbreaker Application
17	Secondary Shuttle Valve
18	Primary Shuttle Valve
19	Load Hold Check Valve
20	Auxiliary Rams
21	Shovel Rams
22	Lift Rams
23	Smooth Ride Selector Valve
24	Smooth Ride Accumulator
25	Backhoe Loader Valve Block
26	Extradig Priority Valve
27	Extradig Service Spool
28	Compensator Valves
29	Slew Service Spool
30	Boom Service Spool
31	Stabiliser Service Spool
32	Stabiliser Service Spool
33	Dipper Service Spool
34	Bucket Service Spool
35	Extradig Ram
36	Slew Rams
37	Boom Ram

38	Stabiliser Ram
39	Stabiliser Ram
40	Dipper Ram
41	Bucket Ram
42	Accumulator
43	Oil Cooler
44	Load Sense Relief Valve
45	Steer Unit Assembly
46	Steer Valve
47	Relief Valve
48	Shock Valves
49	Quick release Couplings
50	Isolation Valve
51	Extending Dipper Isolation Valve
52	Foot Valve
53	Extending Dipper Ram
54	Hammer

†**Note:** Steer circuit pressure is controlled by a relief valve housed in the hydraulic steer unit (refer to Section H **Steering**). The priority relief valve housed in the loader valve must be set at 2500 lb/in² (173 bar, 176 kgf/cm²) this will ensure it does not interfere with the operation of the relief valve housed in the hydraulic steer unit.

4CX, 4CX Super Machines

(6 Spool With High/Low Flow Options)

Component Key

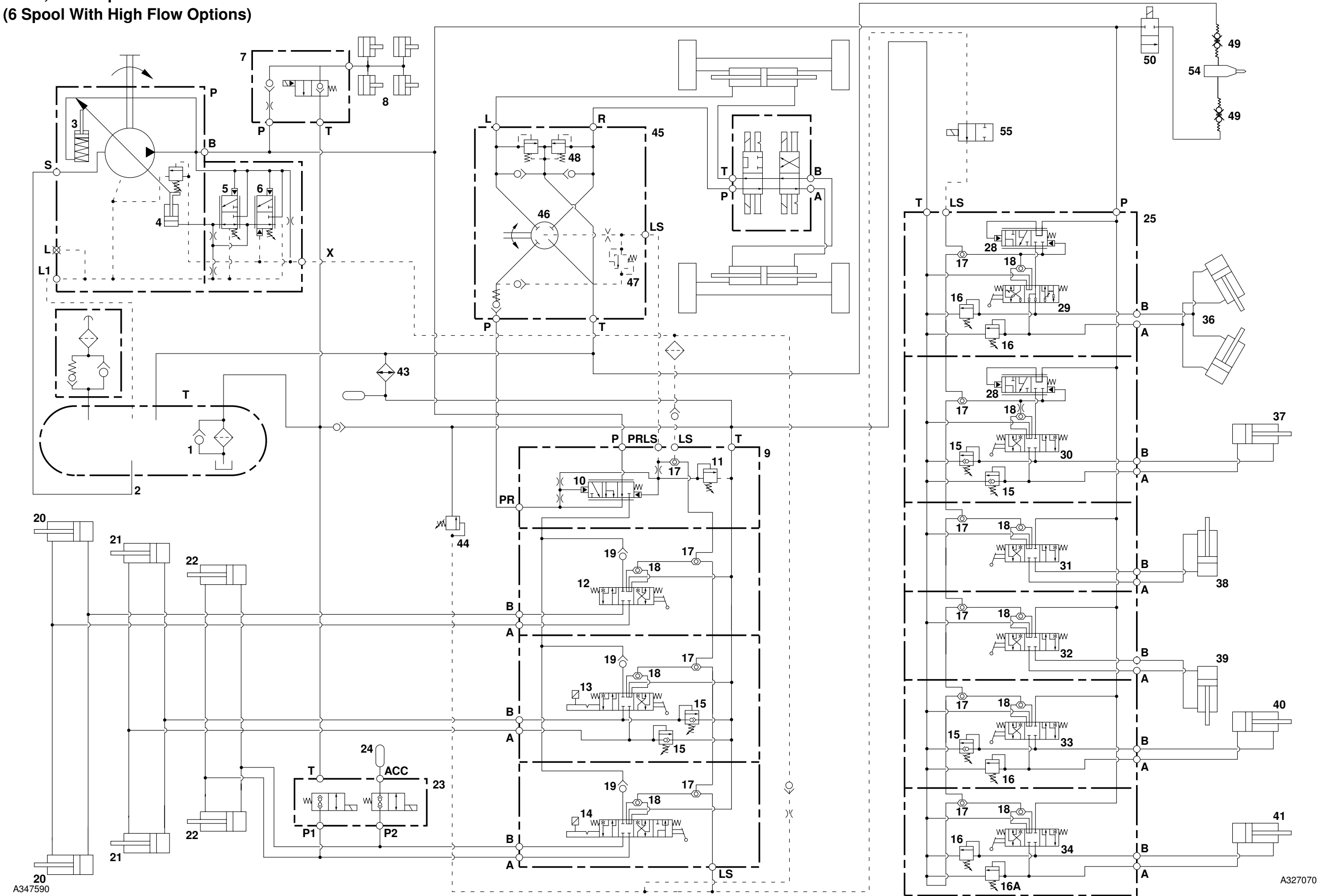
Small letters on the schematic indicate port markings. Refer to Technical Data pages at the beginning of this section for more information. Ports **A** and **B** are always identified as service ports (feed and return from respective ram).

T	Hydraulic Tank
1	By-pass Filter
2	Suction Line
P	Pump Variable Flow
3	Stroking Piston
4	Control Piston
5	System Pressure Spool
6	Stand-by Pressure Spool
7	Hydraclamp Valve
8	Hydraclamps
9	Loader Valve Block
10	Priority Inlet Section
11	Relief Valve †
12	Auxiliary Service Spool
13	Shovel Service Spool
14	Lift Service Spool
15	Auxiliary Relief Valves (anti-cavitation)
16	Auxiliary Relief Valves (direct acting)
16A	ARV Only Fitted For Rockbreaker Application
17	Secondary Shuttle Valve
18	Primary Shuttle Valve
19	Load Hold Check Valve
20	Auxiliary Rams
21	Shovel Rams
22	Lift Rams
23	Smooth Ride Selector Valve
24	Smooth Ride Accumulator
25	Backhoe Loader Valve Block
28	Compensator Valves
29	Slew Service Spool
30	Boom Service Spool
31	Stabiliser Service Spool
32	Stabiliser Service Spool
33	Dipper Service Spool
34	Bucket Service Spool
36	Slew Rams
37	Boom Ram

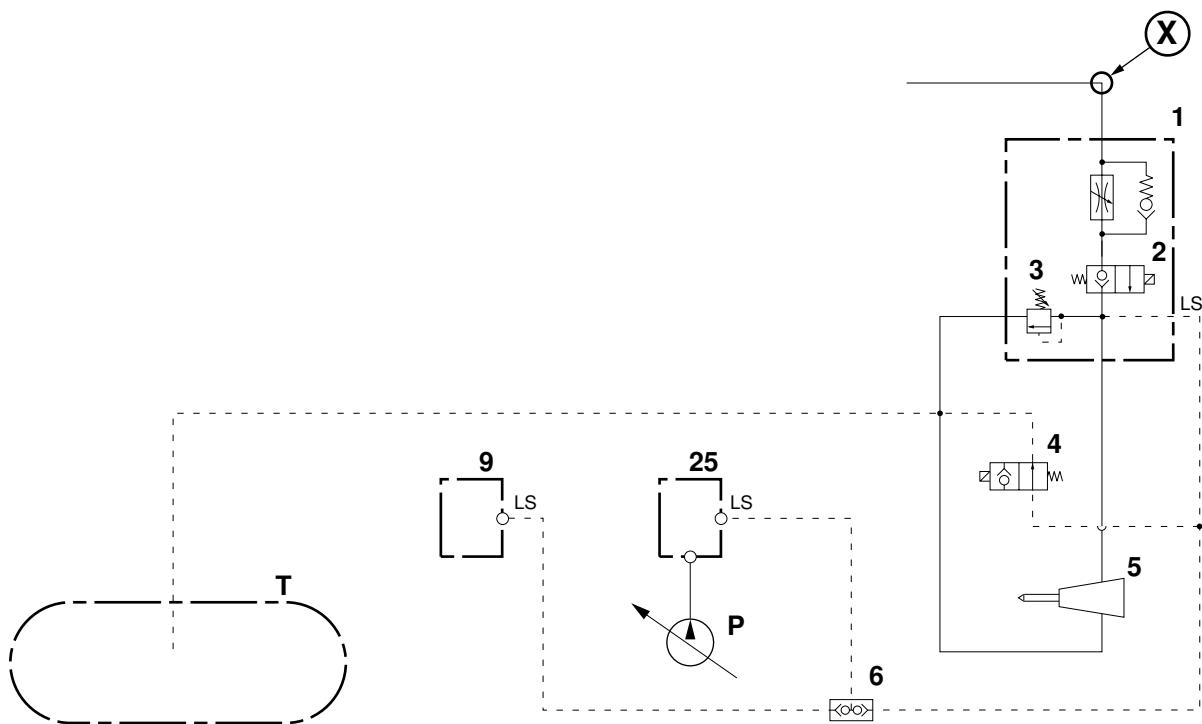
38	Stabiliser Ram
39	Stabiliser Ram
40	Dipper Ram
41	Bucket Ram
42	Accumulator
43	Oil Cooler
44	Load Sense Relief Valve
45	Steer Unit Assembly
46	Steer Valve
47	Relief Valve
48	Shock Valves
49	Quick release Couplings
50	Isolation Valve
54	Hammer
55	Load Sense Isolation Valve

†**Note:** Steer circuit pressure is controlled by a relief valve housed in the hydraulic steer unit (refer to Section H **Steering**). The priority relief valve housed in the loader valve must be set at 2500 lb/in² (173 bar, 176 kgf/cm²) this will ensure it does not interfere with the operation of the relief valve housed in the hydraulic steer unit.

4CXE, 4CX Super Machines
(6 Spool With High Flow Options)



4CX, 4CX Super Machines Hand Held Tools Option



A322650

Component Key

- P Pump Variable Flow
- T Hydraulic Tank
- X Main Circuit Connection
- 1 Pressure Flow Regulator
- 2 High Pressure Flow Spool
- 3 Relief Valve (2000 lb/in² - 138 bar - 146 kgf/cm²)
- 4 Load Sense Solenoid
- 5 Hand Held Tool
- 6 Shuttle Valve
- 9 Excavator Valve Block
- 25 Loader Valve Block

Hydraulic Circuit Schematic

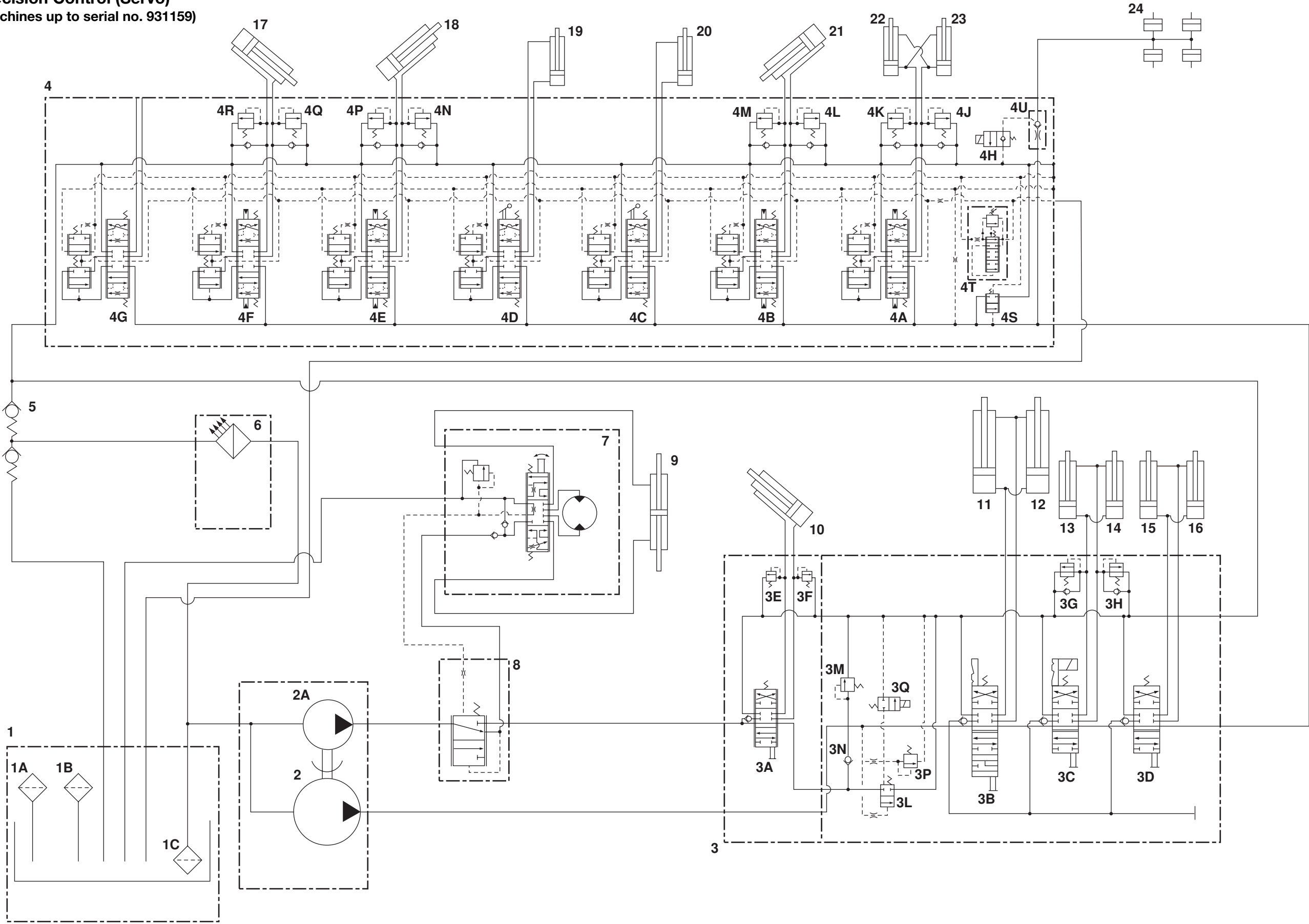
Precision Control (Servo)

* (Machines up to serial no. 931159)

Component Key:

1	Tank	5	Anti Cavitation Check Valve
1A	Breather	6	Hydraulic Oil Cooler
1B	Fill Screen	7	Steer Unit
1C	Suction Strainer	8	Priority Valve
2	Pump, Main Section	9	2WS Power Track Rod Ram
2A	Pump, Secondary Section	10	Extending Dipper Ram
3	Loader Valve Block	11	Lift Ram L.H.
3A	Extending Dipper Spool	12	Lift Ram R.H.
3B	Loader Lift Ram Spool	13	Shovel Ram L.H.
3C	Loader Shovel Ram Spool	14	Shovel Ram R.H.
3D	Clamshovel Spool	15	Clam Shovel Ram L.H.
3E	Extending Dipper Ram Rod Side A.R.V.	16	Clam Shovel Ram R.H.
3F	Extending Dipper Ram Head Side A.R.V.	17	Bucket Ram
3G	Shovel Ram Head Side A.R.V.	18	Dipper Ram
3H	Shovel Ram Rod Side A.R.V.	19	Stabiliser Ram
3L	Unloader Valve Spool	20	Stabiliser Ram
3M	Main Relief Valve (MRV)	21	Boom Ram
3N	Unloader Check Valve	22	Slew Ram L.H.
3P	Unloader Pilot Valve	23	Slew Ram R.H.
3Q	Hydraulic Speed Control Solenoid	24	Hydraclamps (Sideshift Only)
4	Excavator Valve Block		
4A	Slew Spool		
4B	Boom Spool		
4C	Right Stabiliser Spool		
4D	Left Stabiliser Spool		
4E	Dipper Spool		
4F	Bucket Spool		
4G	Auxiliary Spool		
4H	Hydraclamp Valve (Sideshift Only)		
4J	Slew A.R.V.		
4K	Slew A.R.V.		
4L	Dipper Ram Head Side A.R.V.		
4M	DipperRam Rod Side A.R.V.		
4N	Boom Ram Rod Side A.R.V.		
4P	Boom Ram Head Side A.R.V.		
4Q	Bucket Rod Side ARV (Hammer Only)		
4R	Bucket Ram Head Side A.R.V.		
4S	Bypass Compensator Valve		
4T	Load Sense Drain Regulator and Relief Valve		
4U	Pilot Operated Check Valve (Hydraclamp)		

Precision Control (Servo)
* (Machines up to serial no. 931159)



Hydraulic Circuit Schematic

Precision Control (Servo) (Machines from January 2003)

The schematic shows the main system hydraulics for Precision Control (Servo) machines. For the pilot circuit refer to relevant pages.

Note: The boom and dipper services are interchanged for the ISO control pattern.

Component Key:

Small letters on the schematic indicate port markings. Refer to **Technical Data** pages at the beginning of this section for more information. Ports **A** and **B** are always identified as service ports (feed and return from respective ram).

1	Tank	5	Hydraulic Oil Cooler
1B	Return Filter	6	Anti Cavitation Check Valve
1C	Suction Strainer	7	Lift Ram R.H.
2	Pump, Main Section	8	Lift Ram L.H.
2A	Pump, Secondary Section	9	Shovel Ram R.H.
3	Loader Valve Block	10	Shovel Ram L.H.
3A	Loader Lift Ram Spool	11	Clam Shovel Ram R.H.
3B	Loader Shovel Ram Spool	12	Clam Shovel Ram L.H.
3C	Clam Shovel Spool	13	Steer Mode Control Valve
3D	Shovel Ram Head Side A.R.V.	14	Steer Unit
3E	Shovel Ram Rod Side A.R.V.	15	AWS Power Track Rod Rams
4	Excavator Valve Block	16	2WS Power Track Rod Ram
4A	Slew Spool	17	Unloader Valve
4B	Boom Spool (Dipper ISO)	18	Priority Valve
4C	Right Stabiliser Spool	19	Stabiliser Ram R.H.
4D	Left Stabiliser Spool	20	Stabiliser Ram L.H.
4E	Dipper Spool (Boom ISO)	21	Hydraclamps (Sideshift Only)
4F	Bucket Spool	22	Boom Ram (Dipper ISO)
4G	Extending Dipper Spool	23	Slew Ram R.H.
4H	Hydraclamp Valve (Sideshift Only)	24	Slew Ram L.H.
4J	Slew A.R.V.	25	Dipper Ram (Boom ISO)
4K	Slew A.R.V.	26	Bucket Ram
4L	Boom Ram Rod Side A.R.V.	27	Extending Dipper Ram
4M	Boom Ram Head Side A.R.V.		
4N	Dipper Ram Head Side A.R.V.		
4P	Boom Ram Rod Side A.R.V.		
4Q	Bucket Ram Head Side A.R.V. (Hammer Only)		Hammer Option:
4R	Bucket Ram Rod Side A.R.V.	40	Hammer Flow Valve
4S	Extending Dipper Ram Rod Side A.R.V.	41	Hammer Selector Valve
4T	Extending Dipper Ram Head Side A.R.V.	42	Hammer Feed Coupling QR
4U	Flow Regulator Valve	43	Hammer Return Coupling QR
4V	Flushing Valve		
4W	Load Sense Relief Valve		Power Sideshift Option:
		44	Power Sideshift Selector Valve
		45	Power Sideshift Ram

Hydraulic Circuit Schematic

Precision Control (Servo) (Machines from January 2003)

The schematic shows the pilot circuit for Precision Control (Servo) machines. For the main system hydraulics refer to relevant pages.

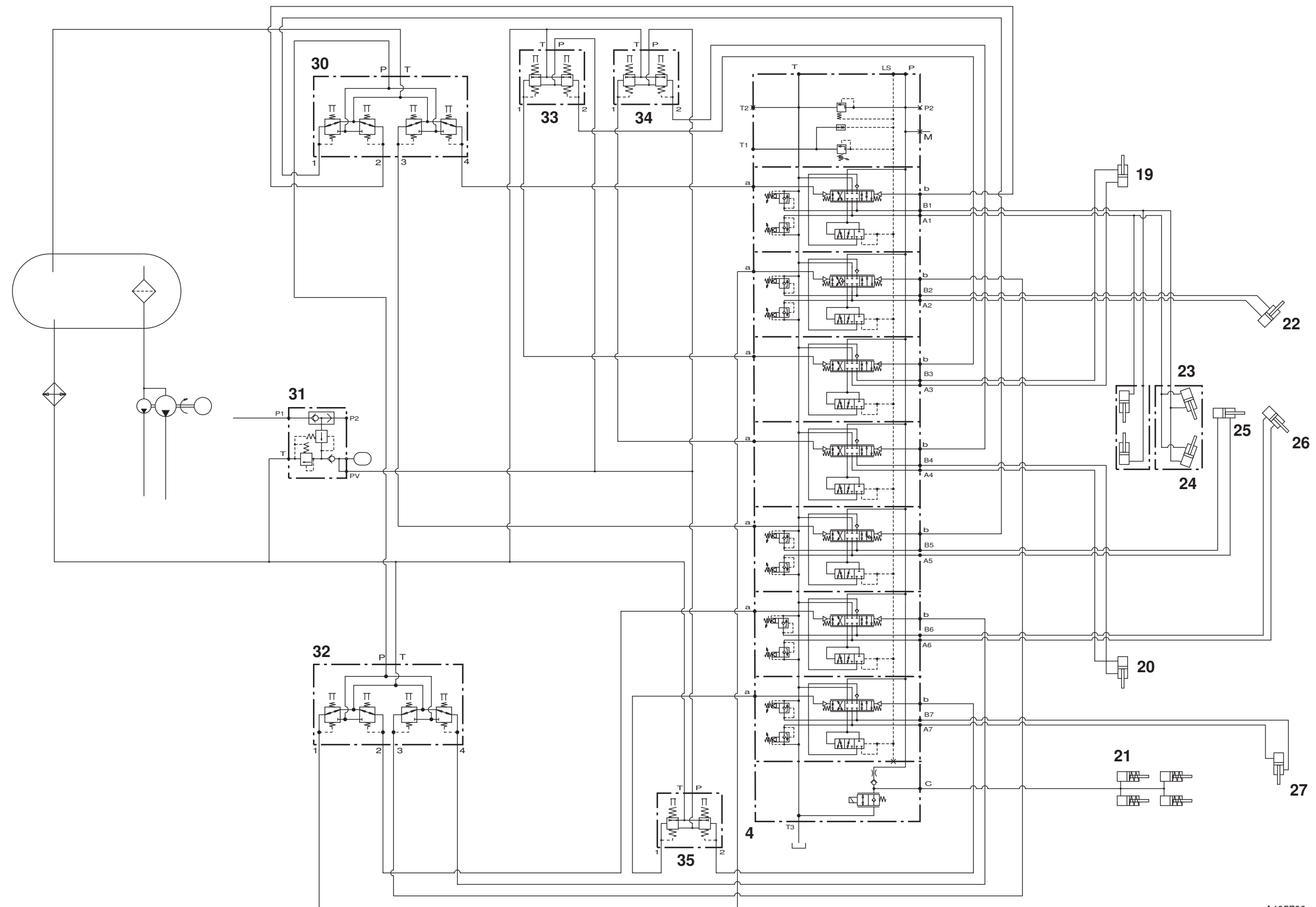
Note: The boom and dipper services are interchanged for the ISO control pattern.

Component Key:

Small letters on the schematic indicate port markings. Refer to **Technical Data** pages at the beginning of this section for more information. Ports **A** and **B** are always identified as service ports (feed and return from respective ram).

4	Excavator Valve Block
19	Stabiliser Ram R.H.
20	Stabiliser Ram L.H.
21	Hydraclamps (Sideshift Only)
22	Boom Ram (Dipper ISO)
23	Slew Ram R.H.
24	Slew Ram L.H.
25	Dipper Ram (Boom ISO)
26	Bucket Ram
27	Extending Dipper Ram
30	Joystick Controller L.H.
31	Servo Pressure Supply Valve
32	Joystick Controller R.H.
33	Stabiliser Control R.H.
34	Stabiliser Control L.H.
35	Footpedal Control (Extending Dipper)

Precision Control (Servo) (Machines from January 2003)



A405700

Component Key:

- A** Spur Gear - Idler
- B** Spur Gear - Driven
- C** Channel
- D** Recess
- P1** Main Section
- P2** Secondary Section

Hydraulic Pump - Fixed Flow**Single Pump - Operation**

The hydraulic pump is a gear type. The basic principle of the pump depends on the meshing of the two spur gears **A** and **B**, one of which is engine-driven whilst the other is an idler. Oil is picked up on the inlet side of the pump by the gears and carried round between the gear teeth and the pump body. As the gears come into mesh the oil is forced through the pump outlet port.

Lubrication is provided by the hydraulic oil which is directed around the unit, via special oil ways, by the motion of the meshing gears.

Double Pump - Operation

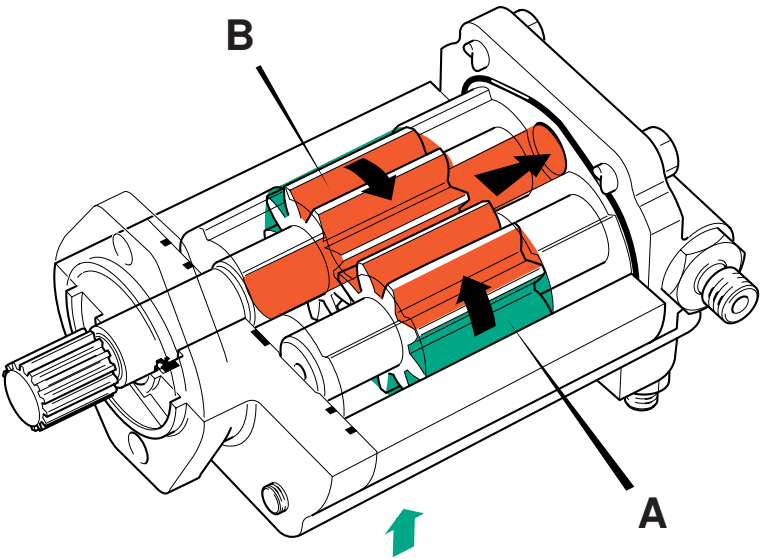
Both sections **P1** and **P2** operate as described below:

The basic principle of the gear pump depends on the meshing of two spur gears **A**, one of which is engine driven while the other is an idler.

Oil is picked up by the gear teeth on the inlet side of the pump and carried around between the teeth and the pump body. As the gears come into mesh, the space carrying the oil is filled by a gear tooth on the mating gear, forcing the oil out of the space and the through the pump outlet.

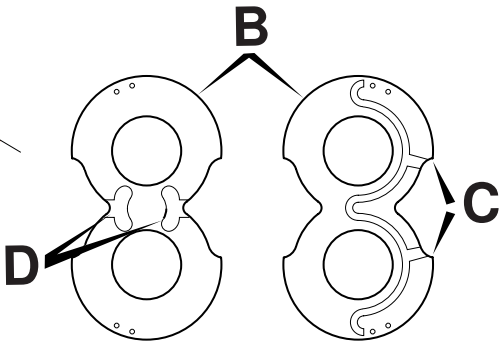
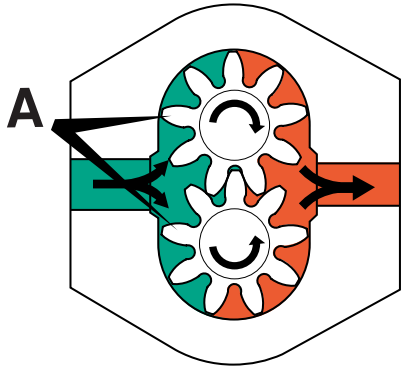
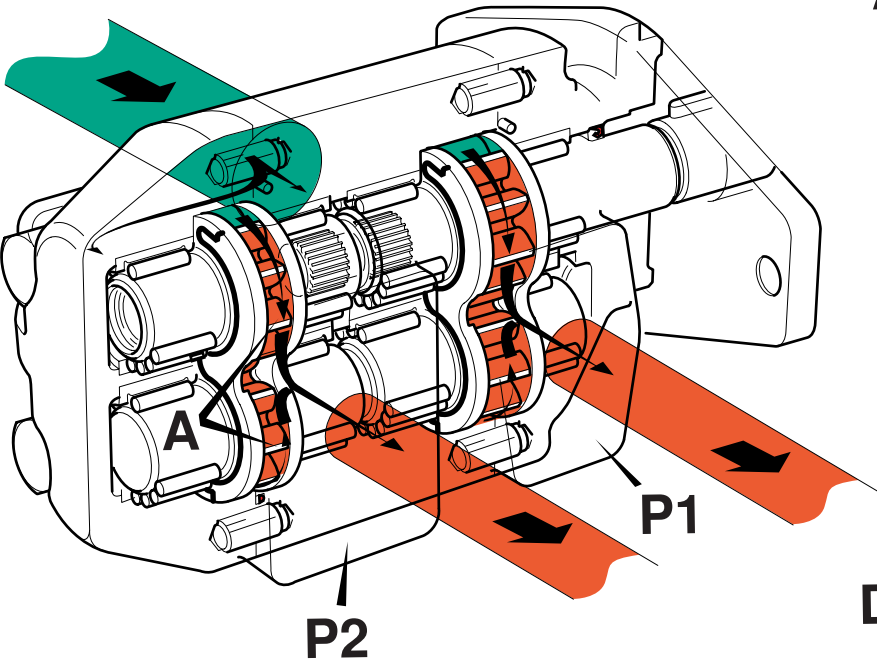
The wear plates **B** are loaded towards the gears by pressurised oil which is fed to the backs of the wear plates via channels **C**. This ensures that the clearance between the wear plates and gears is prevented from becoming excessive as outlet pressure rises.

The side of each wear plate that faces the gears has two recesses **D**. The recess on the inlet side of the pump assists the flow of oil into the gear spaces, thus raising the cavitation threshold of the pump. The recess on the outlet side vents oil trapped between meshing gear teeth to prevent compression loads on the bearings.



Key to Oil Flow & Pressure	
	Full Pressure
	Pressure
	Servo
	Neutral
	Exhaust
	Cavitation
	Lock Up

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Hydraulic Pump - Variable Flow

Operation

The pump is a variable displacement axial piston type. Displacement of oil is achieved by the continuous operation of nine pistons. Pump fluid output is controlled by a tilting cam (swashplate), the angle of which is regulated to ensure that only the amount of fluid necessary to satisfy load conditions is delivered. If a load condition is such that no flow is required, only sufficient fluid for cooling and lubrication is provided.

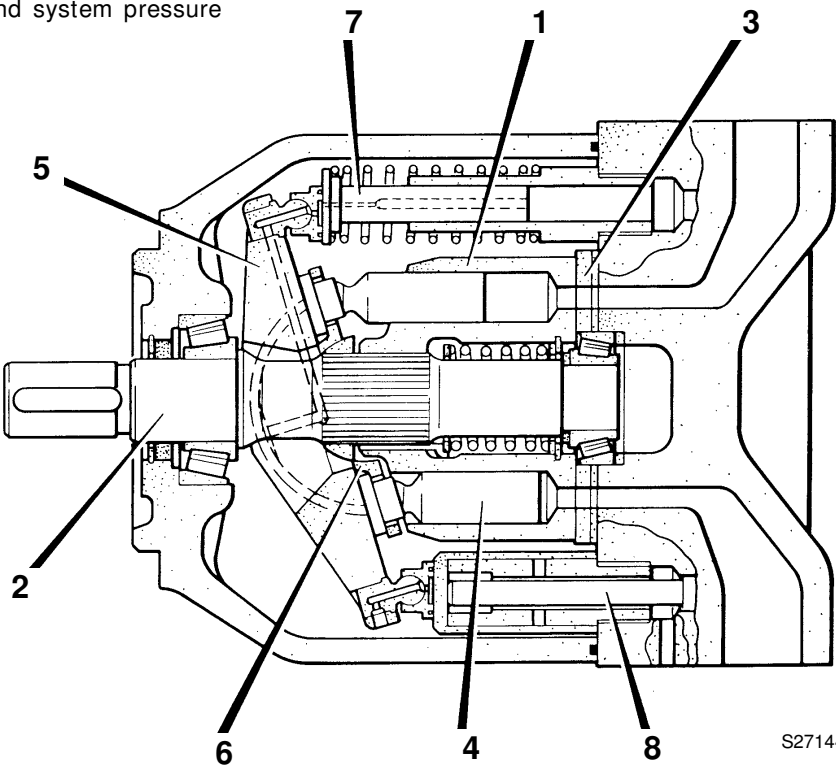
Main components of pump **P** are a cylinder barrel **1** splined to a drive shaft **2** which is held against a kidney plate **3**. Contained in the cylinder barrel are the axial pistons **4**, each having an articulated shoe that is in held contact with the swashplate **5** by an attachment plate **6**. The tilting action of the swashplate is exercised by a stroking piston **7** and a control piston **8**, the latter fed by servo pressure. Fitted to the pump exterior is the valve block **9** housing the pressure/flow regulators that provide servo control.

Rotation of the cylinder barrel causes linear movement of the axial pistons and fluid from the suction port is drawn into the pump through the kidney plate to fill a developing vacuum behind the piston. As the cylinder barrel rotates the fluid is carried from an elongated suction kidney to an elongated pressure kidney where linear movement starts to return the piston into the cylinder barrel. Fluid is forced from the pump through the pressure port.

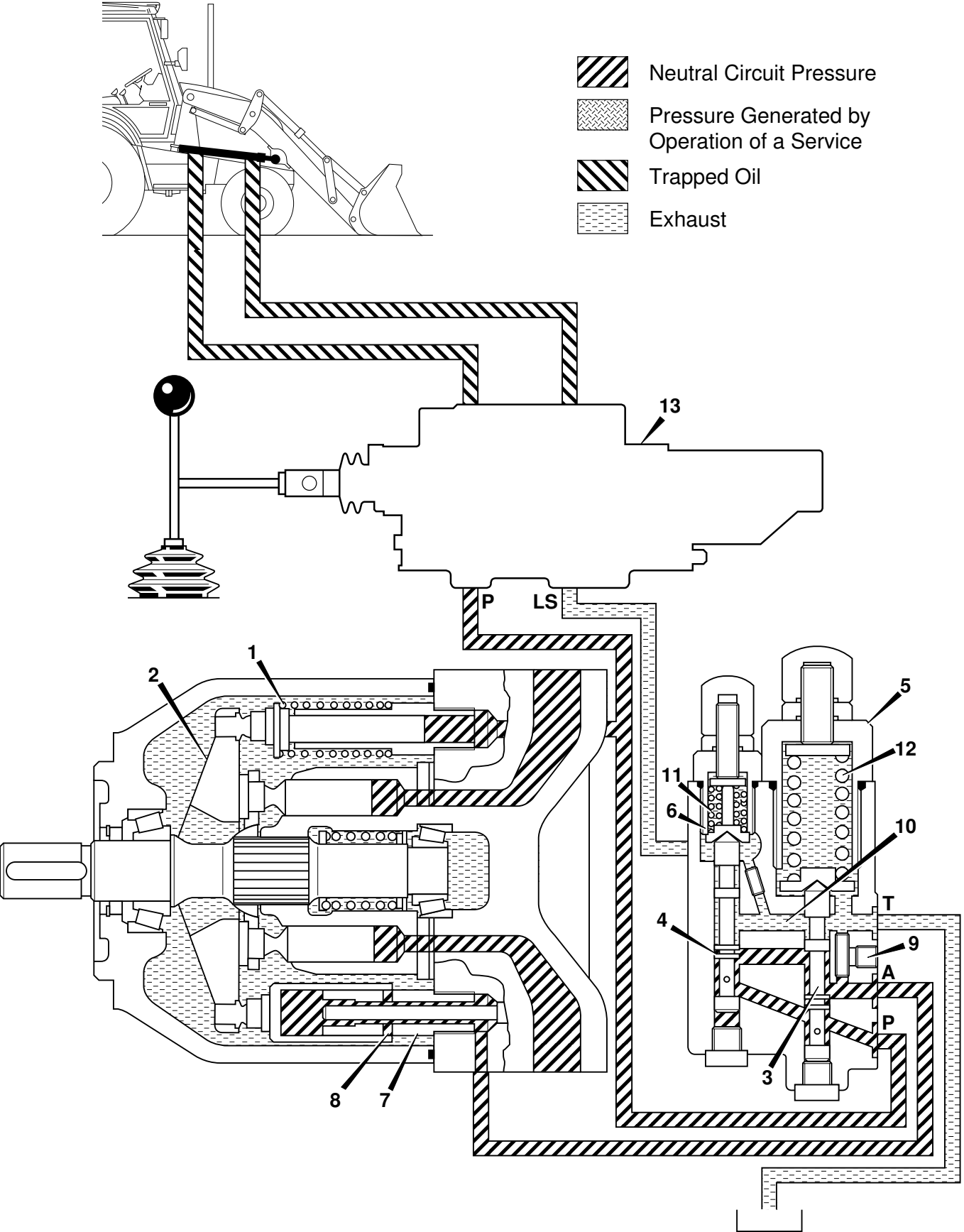
The stroke length of the pistons and consequently the output of fluid is directly related to the swashplate angle. The swashplate is normally held in its maximum displacement angle by the stroking piston spring and system pressure inside the stroking piston.

Component Key:

P	Pump
1	Cylinder Barrel
2	Drive Shaft
3	Kidney Plate
4	Axial Piston
5	Swashplate
6	Shoe Plate
7	Stroking Piston
8	Control Piston
9	Pressure/Flow Compensator Valve



S271440



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Hydraulic Pump - Variable Flow

Pressure/Flow Regulator Valve

The pressure and flow regulator valve assembly is mounted to the pump. The valve maintains the pump pressure and flow rate in accordance with demand at the service valve blocks.

Load Sensing - Stand-by Position

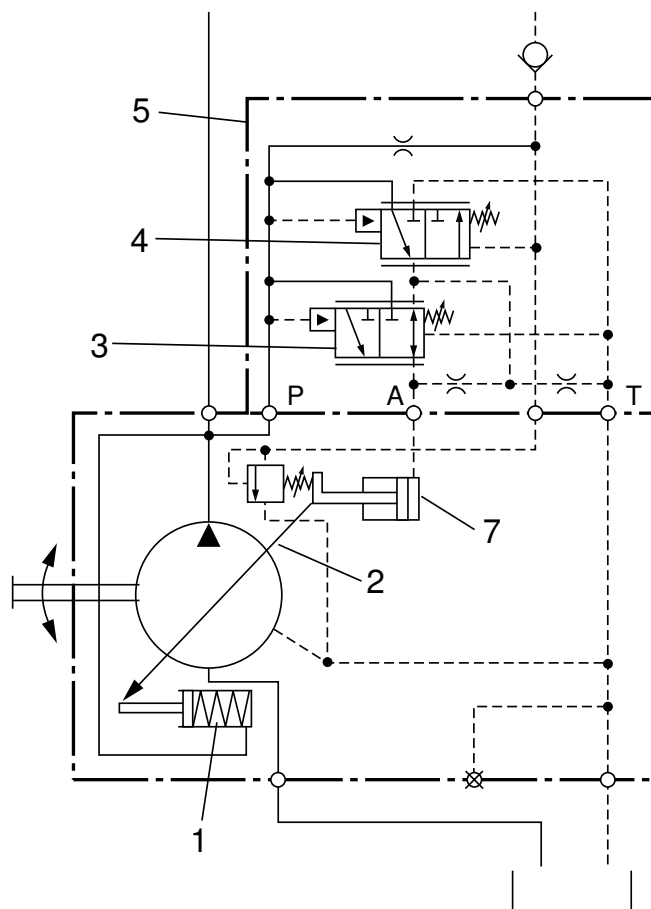
Stand-by is when the machine is running but the control levers are in neutral position, i.e. no implements are being used. There is no pressure or flow demands on the pump, therefore there will be no pressure signal.

With the engine switched off, spring **1** holds swashplate **2** at the maximum angle. When the engine is started and the pump begins to turn, oil begins to flow and pressure builds in the closed centre hydraulic system.

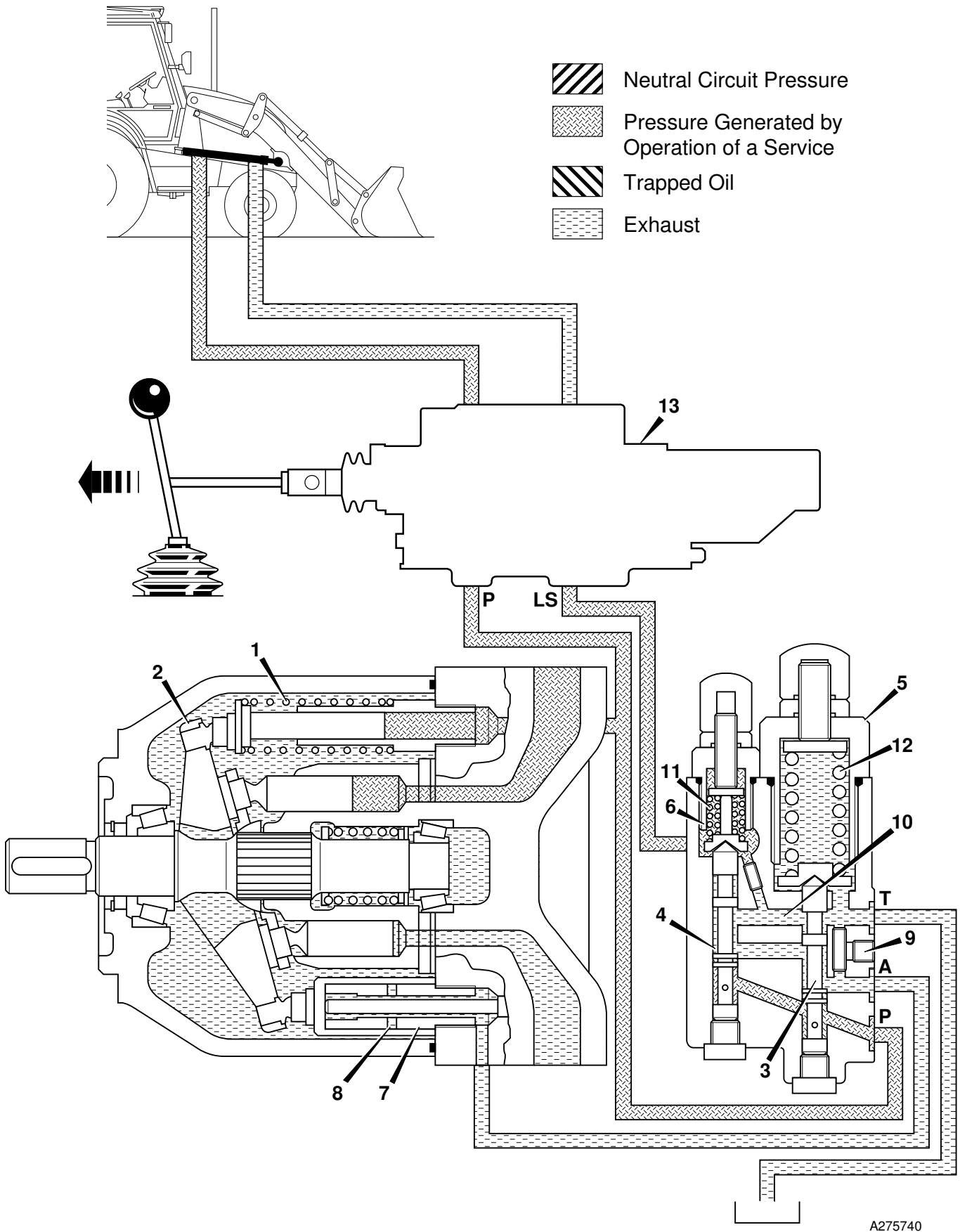
Valve **5** houses a flow regulator spool **4** and pressure regulator spool **3**. Pressure which is building in the closed centre system is sensed at port **P** of the regulator valve. The increasing pressure pushes flow compensating spool **4** up against its spring **6**. This movement creates a flow path from port **P** to port **A**. Oil now flows from the flow regulator valve (via port **A**) to swashplate control piston **7**.

The control piston now moves the swashplate **2** towards its minimum angle. As the piston moves towards its full travel position, cross-drilled holes **8** are uncovered allowing oil to drain.

The cross-drilled holes limit the travel of the control piston - when the holes are exposed, pump flow is insufficient to make up for leakage through the holes and maintain the pressure behind the control piston. Therefore the piston moves back to partially cover the cross holes thus maintaining enough flow to cater for normal system leakage whilst establishing a system stand-by pressure (see **Technical Data** for pressure).



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Hydraulic Pump - Variable Flow

Pressure/Flow Regulator Valve

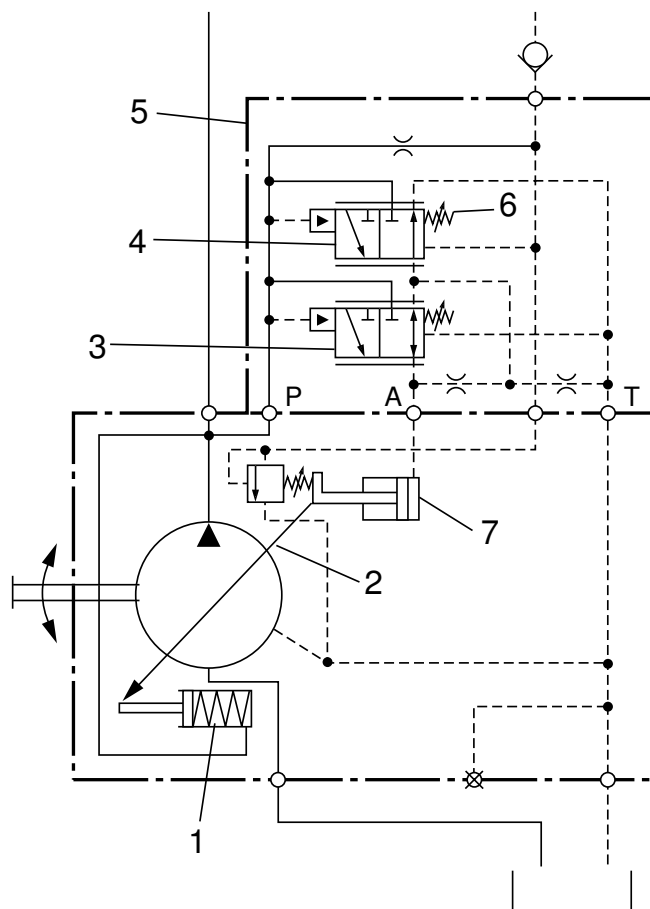
Load Sensing - Maximum Flow

When a service is operated, the signal pressure from the loader (or backhoe) valve **13** increases. The increase in signal pressure combined with the force of spring **6** moves spool **4** down. Oil in control piston **7** is allowed to drain back to the tank via restrictor **9** and passage **10**.

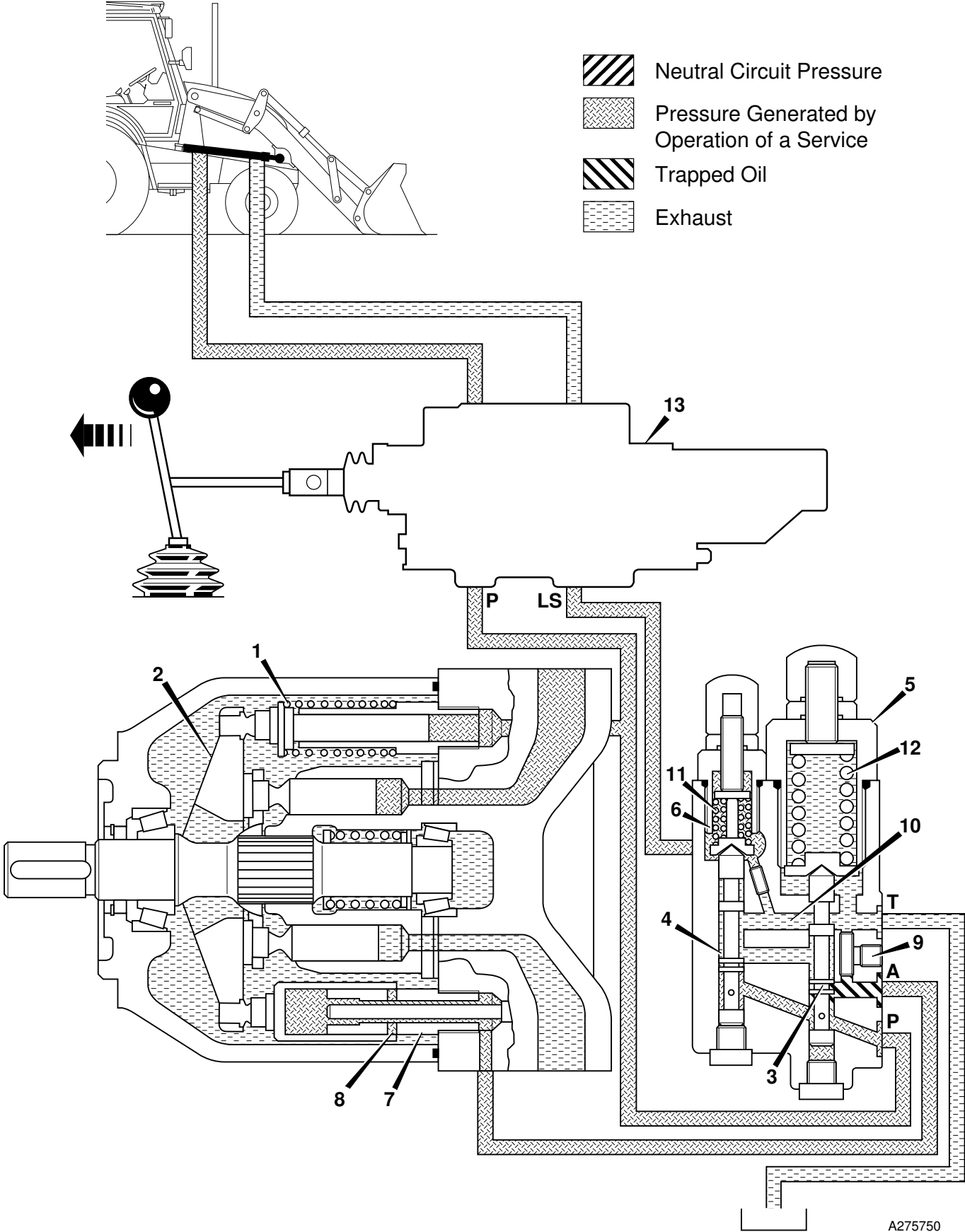
The force of spring **1** is now sufficient to increase the angle of swashplate **2**. The increased angle of the swashplate increase the output of the pump.

The pump output pressure will continue to increase, eventually the pressure will move flow regulating spool **4** against the force of spring **6** and the signal pressure in cavity **11**. Pump output pressure is now sent to control piston **7** via port **A**. Control piston **7** will overcome the force of spring **1**. The pump swashplate angle decreases and therefore the pump outlet decreases. Eventually the pressure in the load sense line and the force of spring **6** will move spool **4** down and the 'metering' cycle starts again.

The up and down movement of the spool **4** keeps the pressure on both ends of the spool equal. Spring **6** is equivalent to 20 bar (290 lbf/in²), therefore the pump pressure should be this amount greater than the signal pressure (except when at maximum pressure - see **Load Sensing - Maximum Pressure (no flow)**).



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Hydraulic Pump - Variable Flow

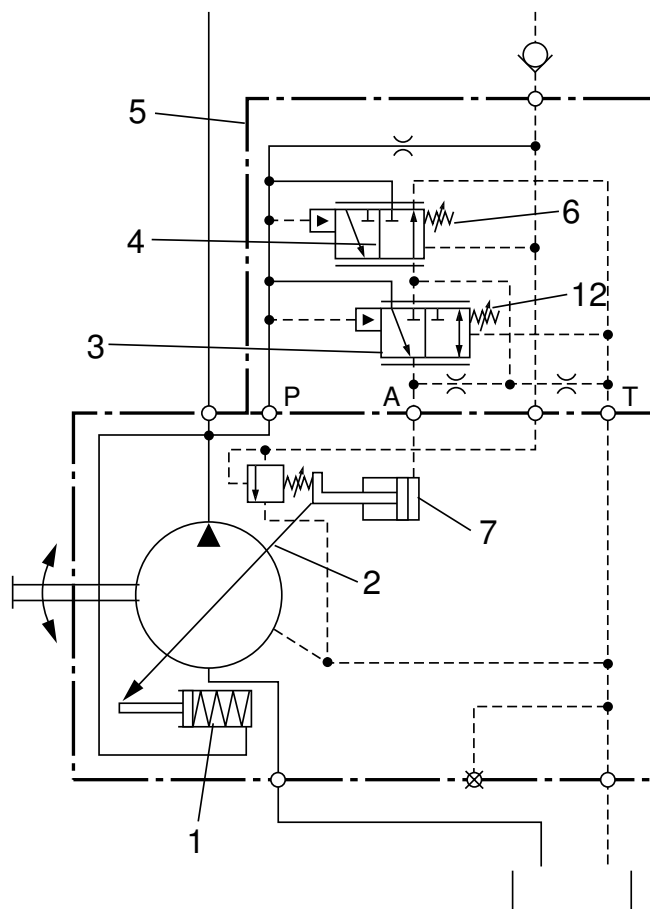
Pressure/Flow Regulator Valve

Load Sensing - Maximum Pressure (no flow)

When a service ram reaches the end of its stroke or the service meets resistance (for instance tearing out), the signal pressure from the loader (or backhoe) valve **13** will increase to the same pressure as pump output pressure.

The force of spring **6** is sufficient to move spool **4** down. The pressure in the system is also sufficient to move spool **3** up against the force of spring **12**, this creates a connection from the pump outlet to control piston **7** via port **A**.

Control piston **7** moves thus decreasing the angle of swashplate **2**. Pump output flow now decreases whilst the system pressure is maintained at maximum setting. There is now no flow but maximum system pressure.



A275780

Component Key:

B	Parallel gallery
C	Gallery
D	Drilling
T	Tank Port
1A	Pump Inlet (section P1)
1B	High Pressure Carry Over
1C	Pump Inlet (section P2)
3B	Main Relief Valve
3C	Lift Ram Spool
3D	Shovel Ram Spool
3E	Auxiliary Spool
3L	Unloader Valve Spool
3M	Unloader Pilot Valve
3N	Check Valve
3P	Spring Cavity
3Q	Solenoid Valve

Loader Valve - Neutral Circuit

The loader valve is mounted on the chassis frame, right hand side (when viewed from the rear).

It includes the lift ram spool **3C**, shovel ram spool **3D** and auxiliary spool **3E**. Linkage rods connect the spool ends to the control levers.

In neutral circuit hydraulic oil from the pump section **P2** enters the loader valve at **1C** via the steering priority valve. On entering the valve block, oil flows around the waisted section of the unloader valve **3L**, past check valve **3N** and joins the flow from pump section **P1**.

Oil from pump section **P1** enters the loader valve at **1A**.

Combined oil flow from **P1** and **P2** passes the main relief valve (MRV) **3B** and fills the parallel gallery **B**. From the parallel gallery the oil flows around the waisted central portions of spools **3C**, **3D** and **3E** (all in neutral position) and flows on to feed the excavator valve via high pressure carry over line **1B**.

Pressure in inlet gallery **C** is sensed by pilot valve **3M** via the bore of spool **3L**. At pressures below the setting of the unloader valve, both pilot valve **3M** and spool **3L** remain closed.

Loader Valve - Unloader Operation

Unloader spool operation protects the engine from being overloaded if a service is being worked particularly hard, for example when using the excavator to tear out. It does this by dumping the oil from the pump section **P2** to tank, allowing engine power to be applied fully to the main pump section **P1**.

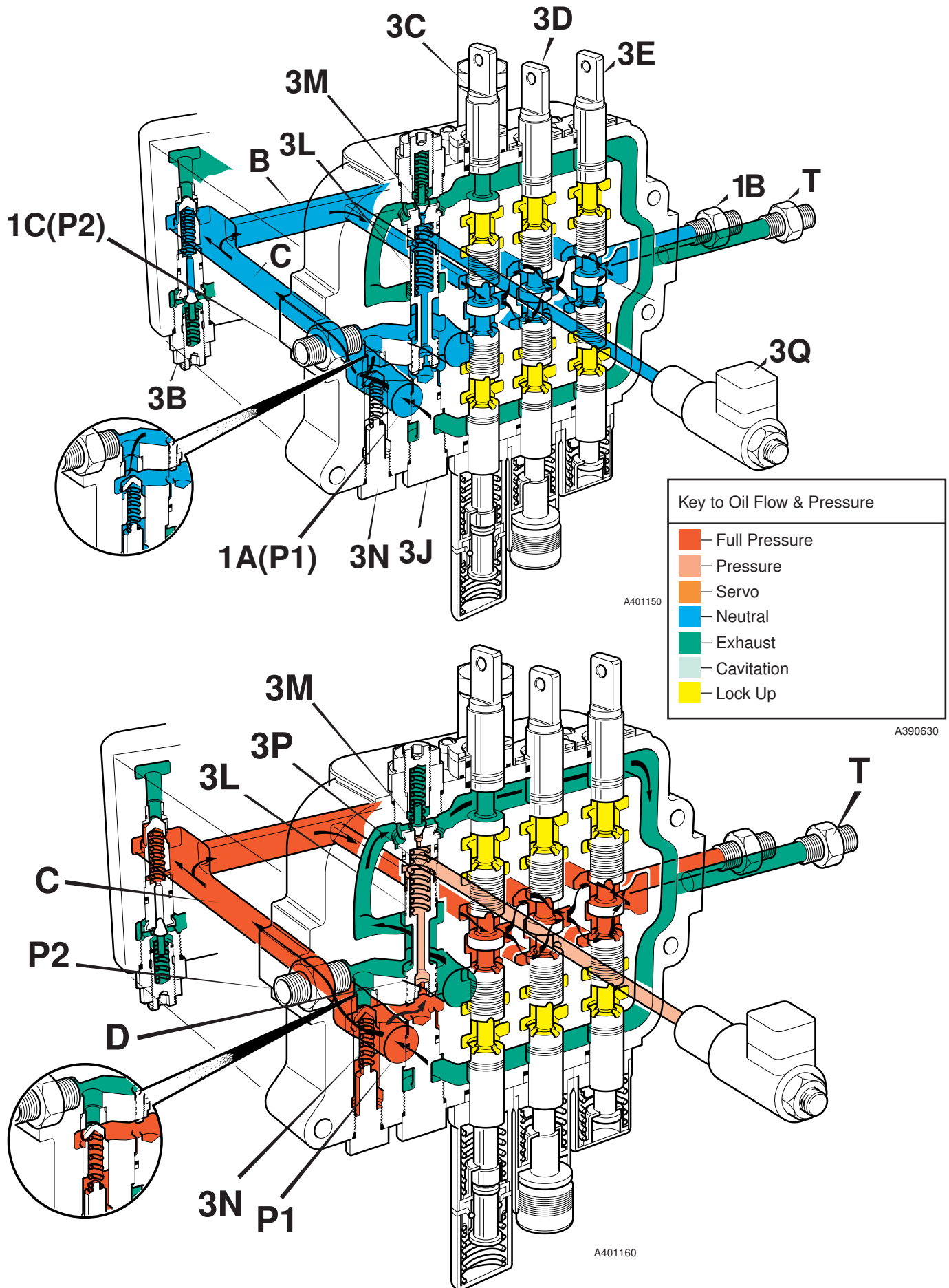
If the pressure in the inlet gallery **C** rises to the setting of the pilot valve **3M**, this valve will open, allowing oil in spring cavity **3P** to escape more quickly than it can be replaced by oil entering through the small drilling **D**.

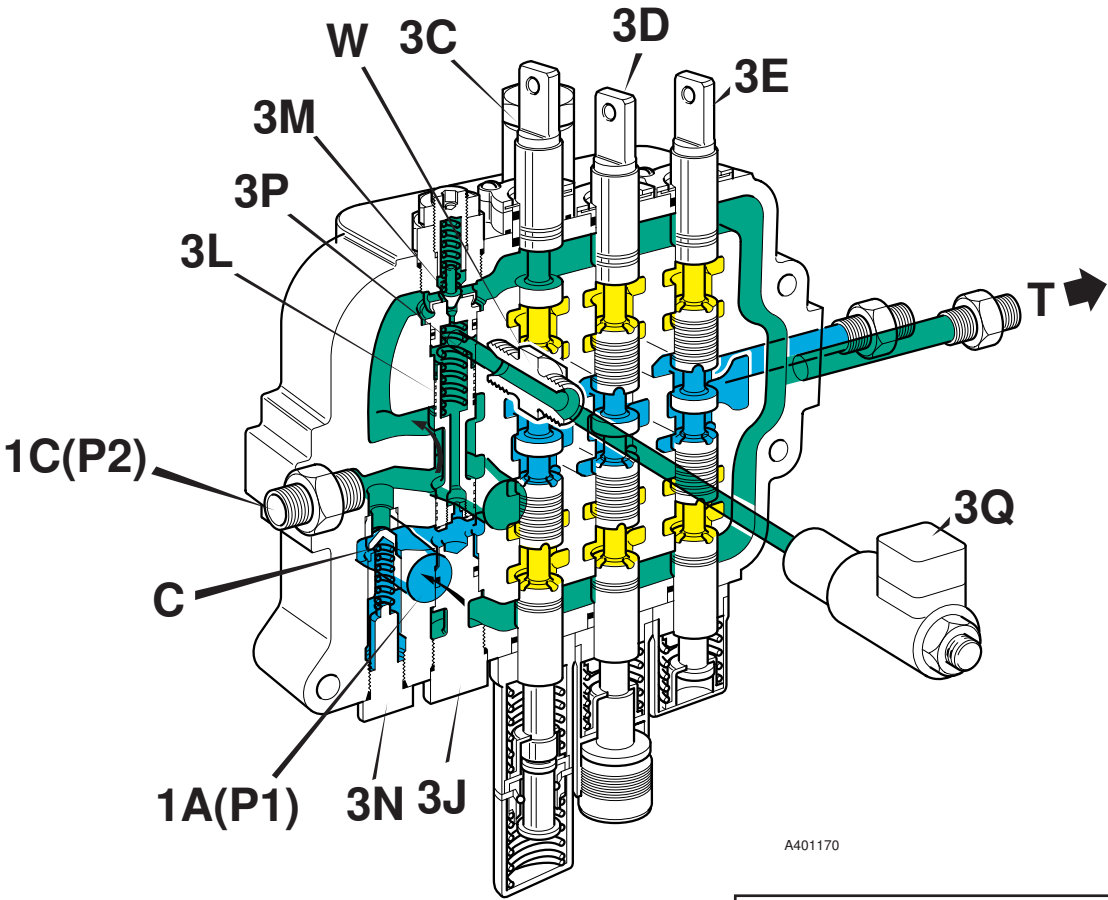
This creates a pressure differential between the spring cavity **3P** and gallery **C**. Higher pressure in gallery **C** acts on the face of spool **3L** causing the spool to be moved off its seat.

Oil entering the valve block from pump section **P2** now flow directly to tank **T**.

High pressure in gallery **C** also holds check valve **3N** firmly closed, preventing oil from pump section **P1** from also being dumped.

When pressure in inlet gallery **C** falls, for example if the excavator has stopped tearing out, pilot valve **3M** will close. This means oil in spring cavity **3P** will be at the same pressure as oil in gallery **C**, spring pressure will move spool **3L** back onto its seat, closing pump section **P2** connection to tank.





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Key to Oil Flow & Pressure	
■	Full Pressure
■	Pressure
■	Servo
■	Neutral
■	Exhaust
■	Cavitation
■	Lock Up

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Loader Valve
- Hydraulic Speed Control (HSC)

Solenoid valve **3Q** allows the operator to control the unloader spool movement (to dump flow from the hydraulic pump section **P2**) using a switch. There are two main applications for this operation:

- 1** More tractive force can be applied to the loader end when entering a stock pile. This is because more power is available from the engine as flow from pump section **P2** is being dumped directly to tank.
- 2** More power can be made available from the engine whilst the machine is travelling on the highway. Again, this is because flow from pump section **P2** is being dumped directly to tank.

When the solenoid valve **3Q** is de-energised its spool is moved by spring pressure. This spool movement makes a connection from the unloader spool chamber **3P** to tank.

Because the unloader chamber is now connected to tank, and so at exhaust pressure, pressure in gallery **C** (neutral shown) acts on the face of unloader spool **3L** causing the spool to be moved off its seat. Oil entering the valve block from pump section **P2** now flows directly to tank.

When solenoid valve **3Q** is energised its spool closes the connection from the unloader valve spool chamber to tank. Spool **3L** is once again controlled by system pressure.

Component Key:

- B** Parallel gallery
- C** Gallery
- D** Drilling
- T** Tank Port
- 1A** Pump Inlet (section P1)
- 1B** High Pressure Carry Over
- 1C** Pump Inlet (section P2)
- 3B** Main Relief Valve
- 3C** Lift Ram Spool
- 3D** Shovel Ram Spool
- 3E** Auxiliary Spool
- 3L** Unloader Valve Spool
- 3M** Unloader Pilot Valve
- 3N** Check Valve
- 3P** Spring Cavity
- 3Q** Solenoid Valve

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Component Key:

- 1A** Pump Inlet
- B** Parallel Gallery
- D** Service Line
- 3C** Lift Ram Spool
- 3J** Load Hold Check Valve
- 33** Lift Ram
- 34** Lift Ram

Loader Valve - Load Hold Check Valves**Operation 1**

The illustration shows 'arms raise' being selected by the lift ram spool **3C**.

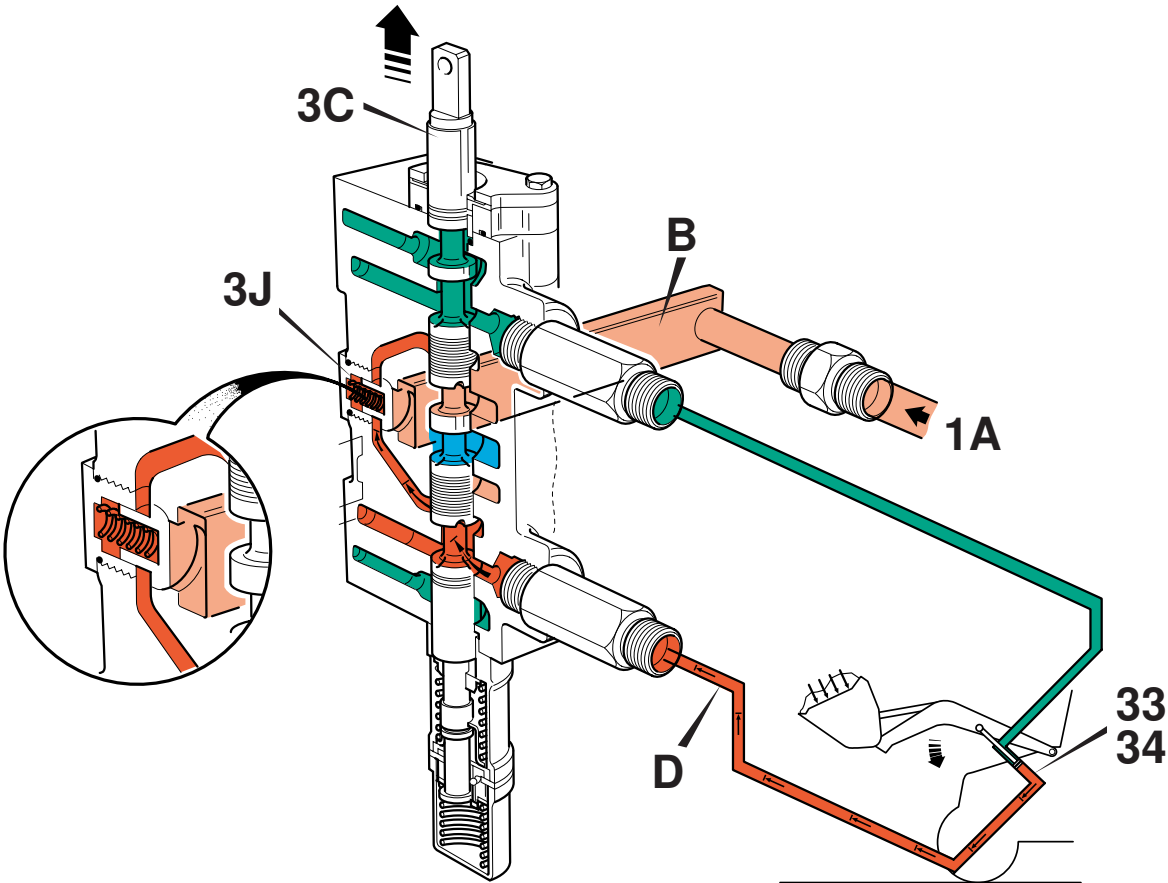
The weight of the loaded shovel, as indicated by the arrows, produces a higher pressure in service line **D** than in the parallel gallery **B**.

This pressure differential causes load hold check valve **3J** to close, thus preventing the load from dropping.

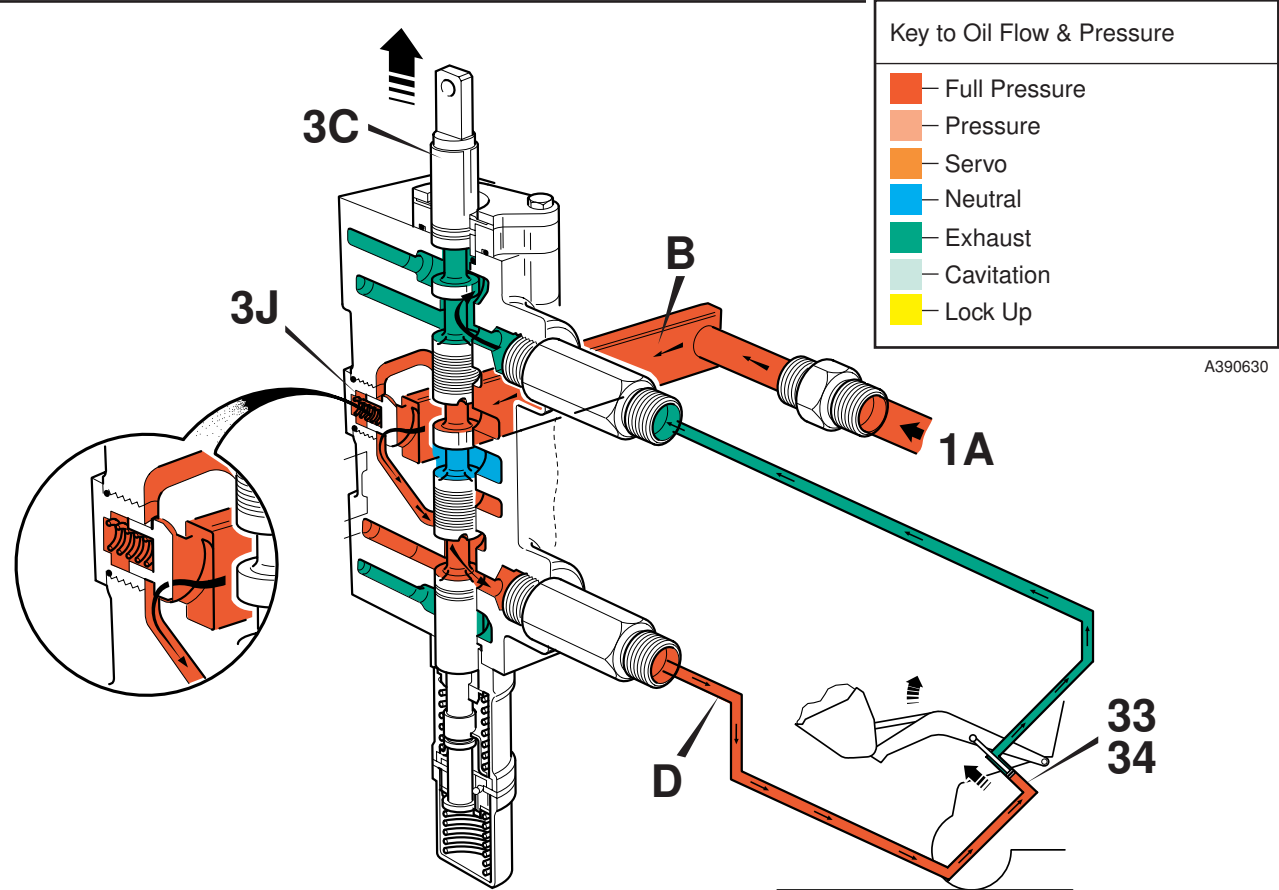
Operation 2

As the neutral circuit has been blocked by the central land of the selected spool **3C**, the pressure in parallel gallery **B** increases until it is greater than that in service line **D**.

At this point, load hold check valve **3J** opens, allowing oil to flow from the parallel gallery into the service line and operate the lift rams **33** and **34**.

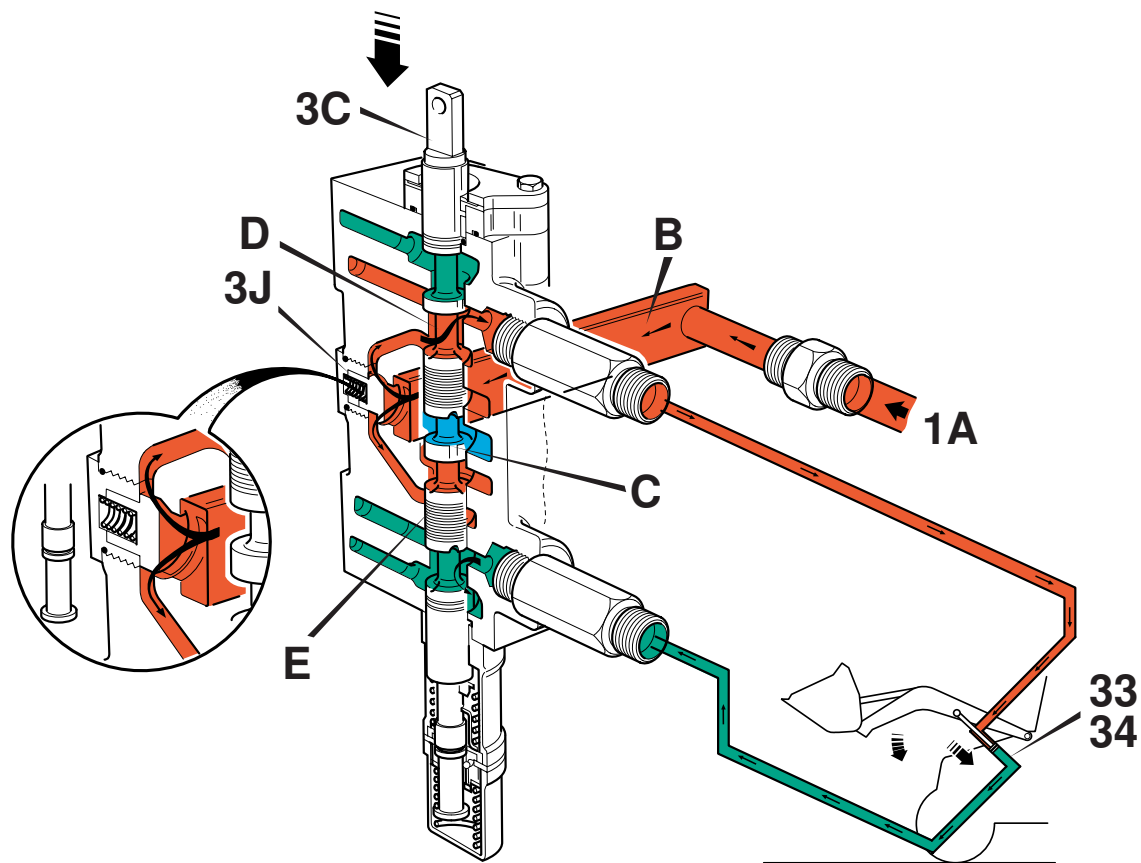


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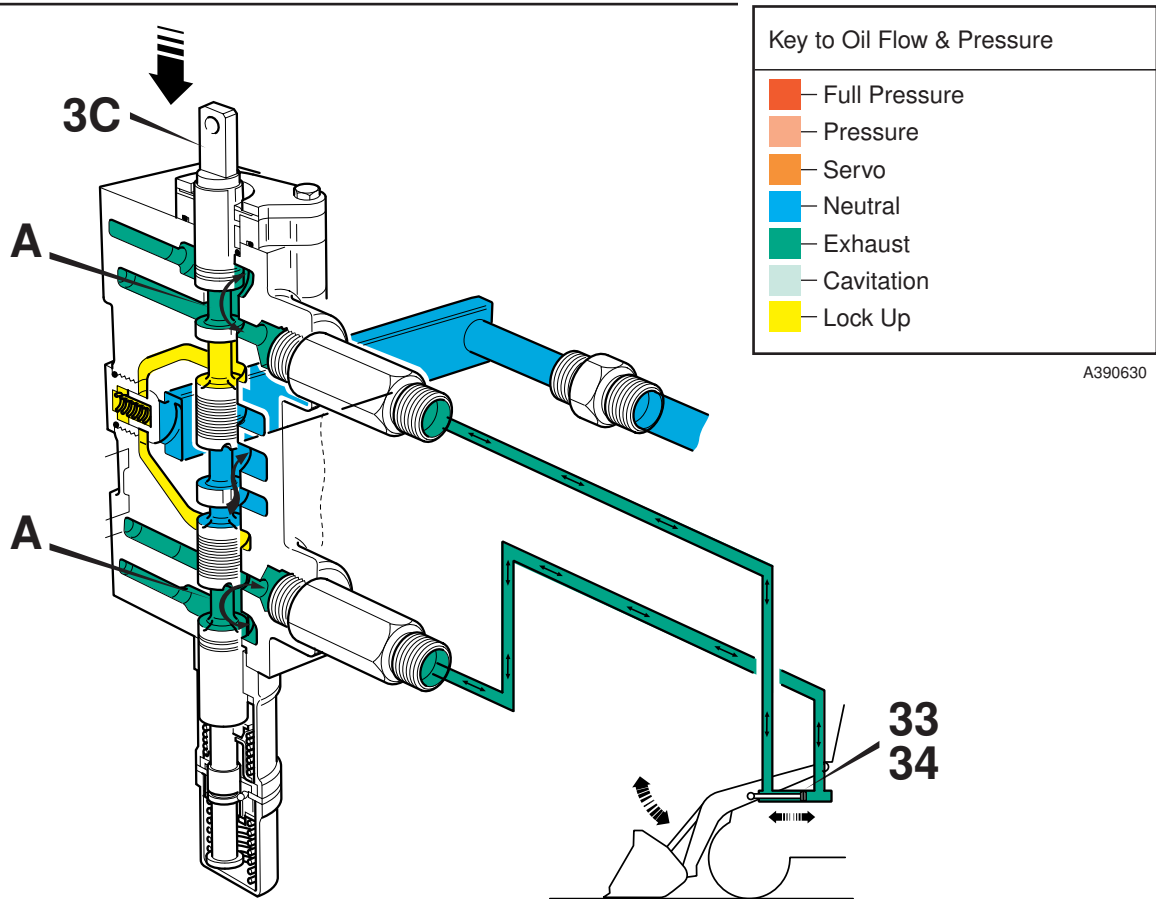


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Loader Valve

Arms Lower

When a spool is selected as shown at **3C**, the central land of the spool **C** blocks the neutral circuit. Oil from the pump, entering at **1A**, is diverted into the parallel gallery **B**, opens the load hold check valve **3J**, and flows around the waisted section of the spool **D** and out to the rod side of lift rams **33** and **34**.

The lower land of the selected spool **E** blocks the flow from the parallel gallery to the head side port and oil returning from the rams is diverted into the exhaust gallery.

Component Key:

- A** Spool Waists
- B** Parallel Gallery
- C** Central Land
- D** Spool Waist
- E** Lower Waist
- 1A** Pump Inlet
- 3C** Lift Ram Spool
- 3J** Load Hold Check Valve
- 33** Lift Ram
- 34** Lift Ram

Float

The float facility is provided to allow the arms to move up and down so that the shovel can follow the surface contours as the machine is driven over uneven ground.

This is achieved by moving the lift spool **3C** down beyond 'arms lower' into the 'float' detent, when the feed from the parallel gallery to the service ports is blocked and the neutral circuit is re-opened. Both service ports are connected to exhaust via the spool waists **A**.

Oil can then be displaced from either end of the lift rams **33** and **34** into the exhaust gallery, allowing the rams to open and close as required.

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Loader Valve - A.R.V. Operation

Component Key:

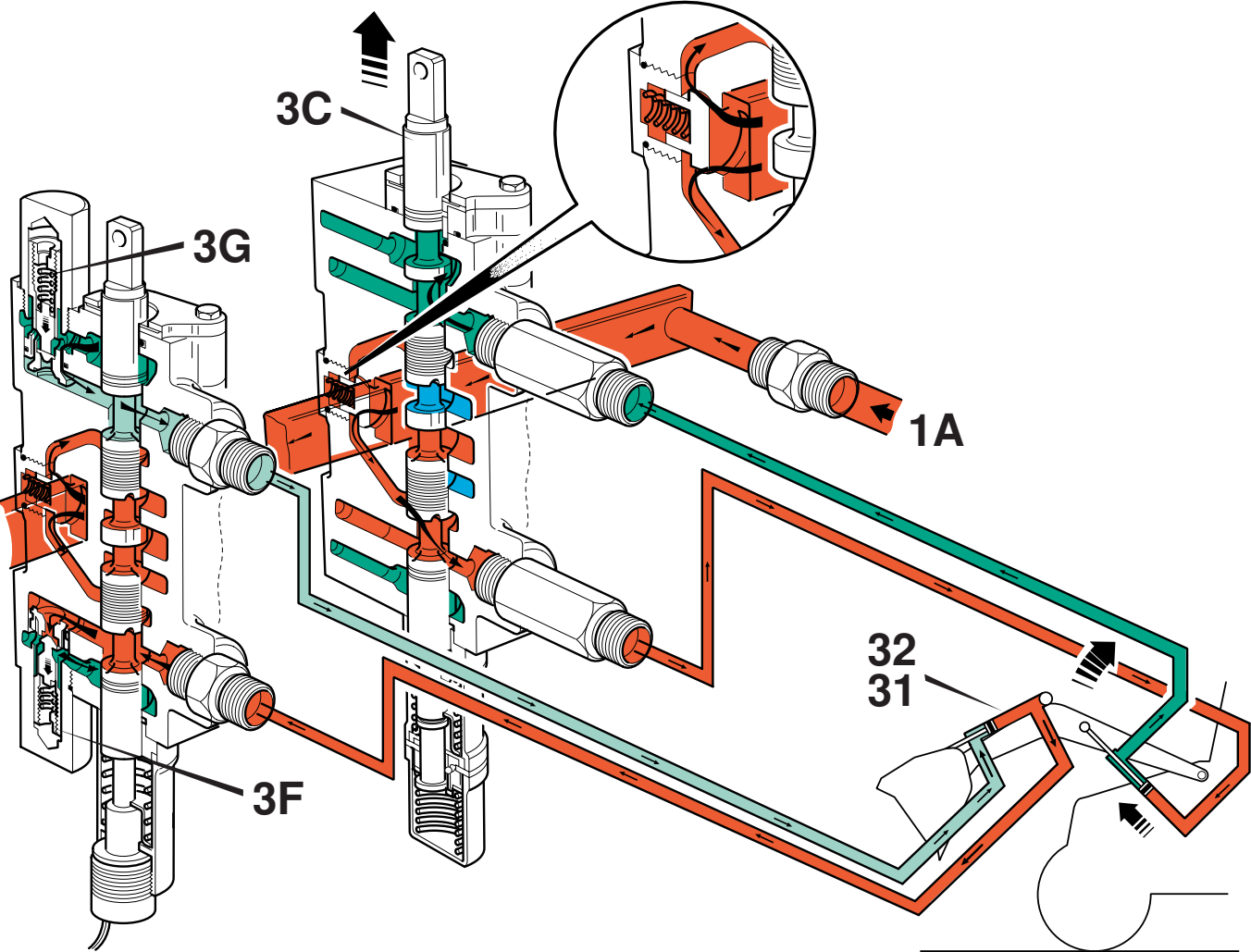
- 1A** Pump Inlet
- 3C** Lift Ram Spool
- 3D** Shovel Ram Spool
- 3F** ARV - Head Side
- 3G** ARV - Rod Side
- 31** Shovel Ram
- 32** Shovel Ram

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

If, as illustrated, the shovel is fully tipped when the arms are being raised, the shovel is unable to tip further, producing back pressure in the head side of the shovel rams **31** and **32** and cavitation in the rod side.

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

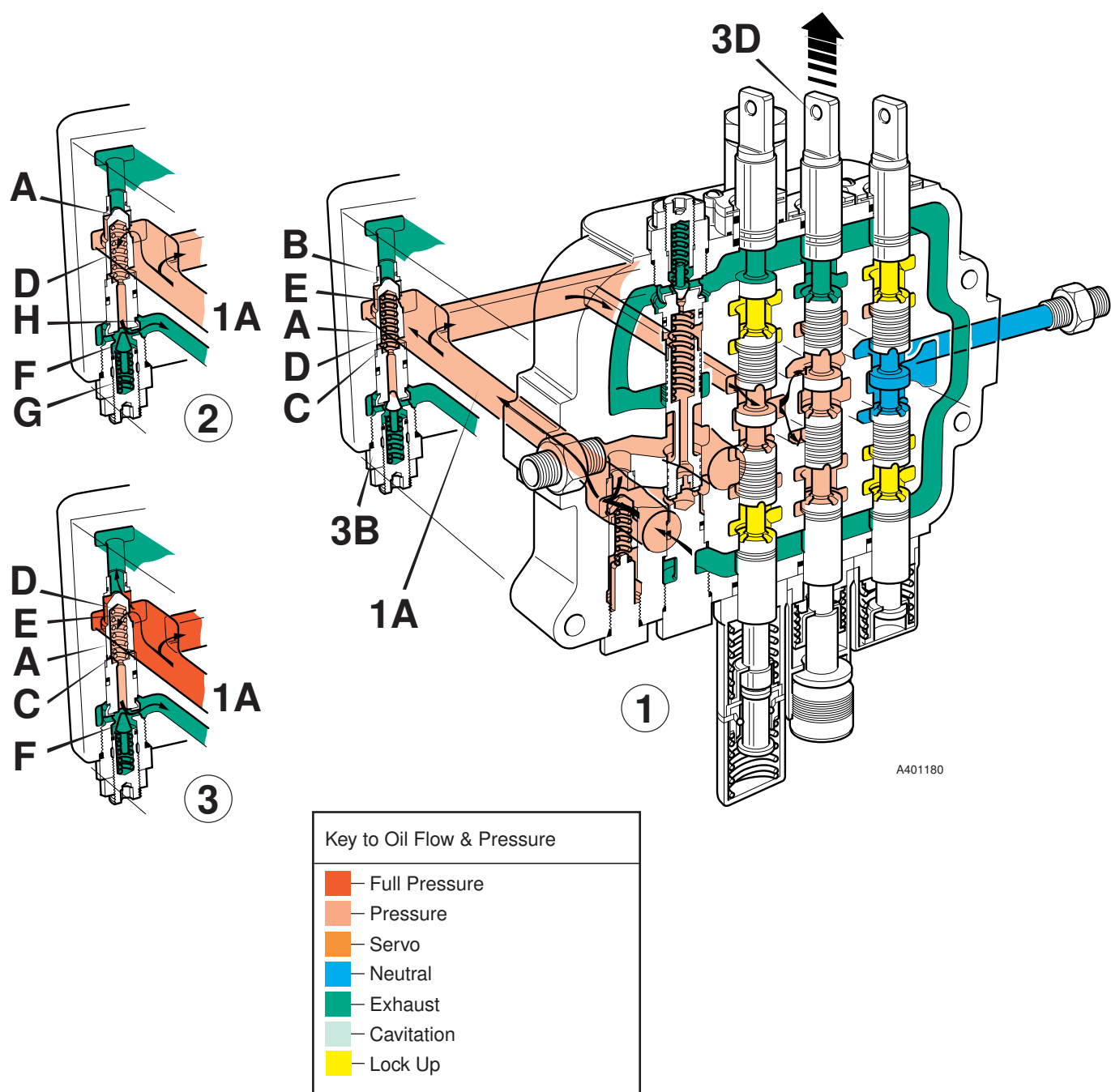
The rod side A.R.V. **3G** senses a higher pressure in the exhaust gallery than in the service port and therefore opens to allow exhaust oil to overcome the cavitation.



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Key to Oil Flow & Pressure	
—	Full Pressure
—	Pressure
—	Servo
—	Neutral
—	Exhaust
—	Cavitation
—	Lock Up

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Main Relief Valve (MRV) - Operation

The main relief valve (M.R.V.) **3B**, situated in the loader valve block, provides control of both loader and excavator pressures.

1 Valve at Rest

The illustration **1** shows a loader service selected by spool **3D** causing pressure to rise in the service line and back through the loader valve to the pump via line **1A**. The service is operating under light load and the pressure is not sufficient to cause any response in the M.R.V.

The main plunger **A** is held on its seat **B** by the combined effect of spring **C** and the pump pressure which enters chamber **D** through the small drilling **E**. Pump pressure outside the chamber is not high enough to lift the plunger off its seat.

2 Pilot Valve Opens

If, as shown in view **2**, pump pressure rises high enough to force the pilot valve **F** from its seat (against spring **G**), the pressure in chamber **D** is vented into the exhaust gallery **H**.

Unless the pressure continues to rise, plunger **A** will remain on its seat.

3 Valve Moves off its seat

In view **3**, pump pressure at **1A** has risen to the setting of the main relief valve but pressure in chamber **D** has not risen because the seat orifice of pilot valve **F** is larger than small drilling **E** and oil is unable to fill the chamber as quickly as it is being exhausted.

Pressure acting on the upper faces of main plunger **A** is therefore greater than the combined force of spring **C** and the pressure in chamber **D**. The plunger then moves off its seat, allowing pressure to be released to the exhaust gallery.

As the pump pressure decreases, the pilot valve is able to reseat and pressure in chamber **D** assists spring **C** to force the main plunger **A** back onto its seat.

Component Key:

A	Main Plunger
B	Valve Seat
C	Spring
D	Chamber
E	Drilling
F	Pilot Valve
G	Spring
H	Exhaust Gallery
1A	Pump Inlet
3B	Main Relief Valve
3D	Shovel Ram Spool

Loader Valve - Variable Flow

Operation

The loader valve is mounted on the chassis frame, right hand side (when viewed from rear).

It is a stack type, directional control valve that is configured for closed centre operation. The valve block comprises two or three service valve sections and a priority steer inlet section.

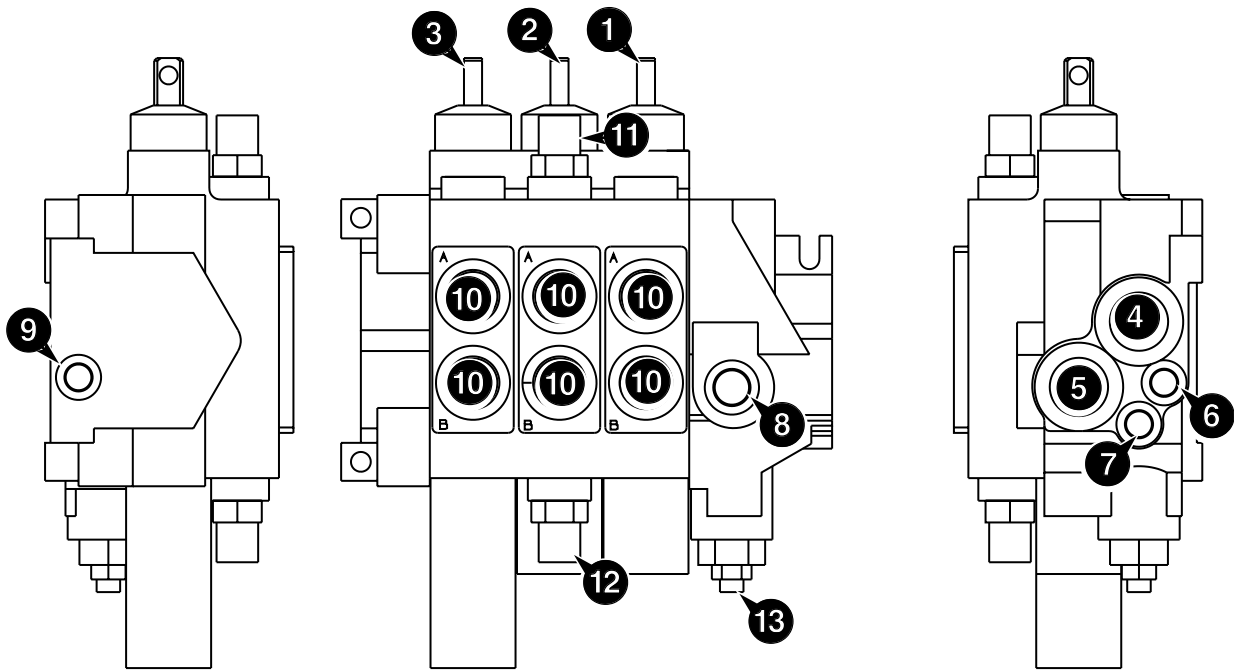
When operated, the designated valve section controls the volume and direction of oil by way of service ports **A** or **B**. A constant flow is maintained regardless of changing load pressures.

While the spools are in neutral position, the primary shuttles and secondary shuttles are vented to tank. When a spool is operated, the load pressure sensed at the work port is directed via the primary and secondary shuttles to the hydraulic pump, where the pump subsequently 'swashes' to meet this load sense demand.

Component Key:

- 1 Auxiliary (optional) spool
- 2 Shovel spool
- 3 Arms lift spool
- 4 Pump inlet
- 5 Tank port
- 6 Load sense port (from valve blocks)
- 7 Priority load sense port (from steer unit)
- 8 Priority work port (to steer unit)
- 9 Load sense carry over port (to backhoe valve)
- 10 Service ports
- 11 Auxiliary relief valve (rods side)
- 12 Auxiliary relief valve (head side)
- 13 Priority relief valve †

†Note: Steer circuit pressure is controlled by a relief valve housed in the hydraulic steer unit (refer to Section H **Steering**). The priority relief valve housed in the loader valve must be set at 2500 lb/in², this will ensure it does not interfere with the operation of the relief valve housed in the hydraulic steer unit.



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Loader Valve - Variable Flow

Priority Inlet Section Operation

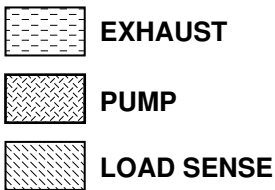
The priority inlet section houses the steering priority valve and a relief valve assembly. Operation is as follows:

Steering

When the steering wheel is turned, a priority pressure demand signal is sent from the hydraulic steer unit and received at the priority inlet section (port **PRLS**). The signal oil flows through port **A** into chamber **C** via gallery **B**.

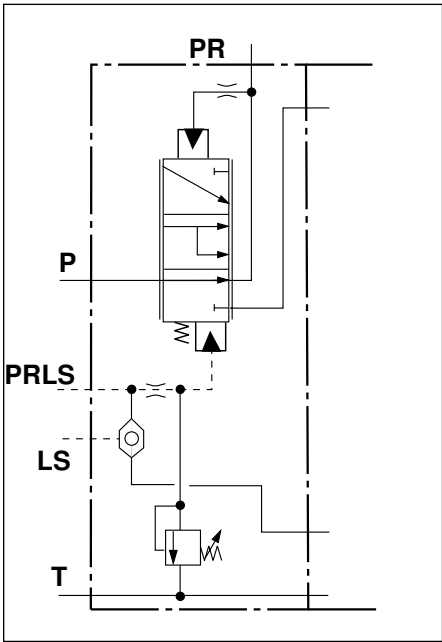
The combined force of spring **D** and signal oil pressure moves spool **E** up. The position of the spool now allows oil from the pump inlet port **P** to flow out to the hydraulic steer unit via priority work port **PR**.

It must be noted that relief valve assembly **J** is redundant. This relief valve is part of the inlet section, however the hydraulic steer unit also houses a steer system relief valve. To ensure the relief valve in the hydraulic steer unit controls the steer system pressure, valve **J** is set abnormally high (172 bar; 2500 lb/in²).

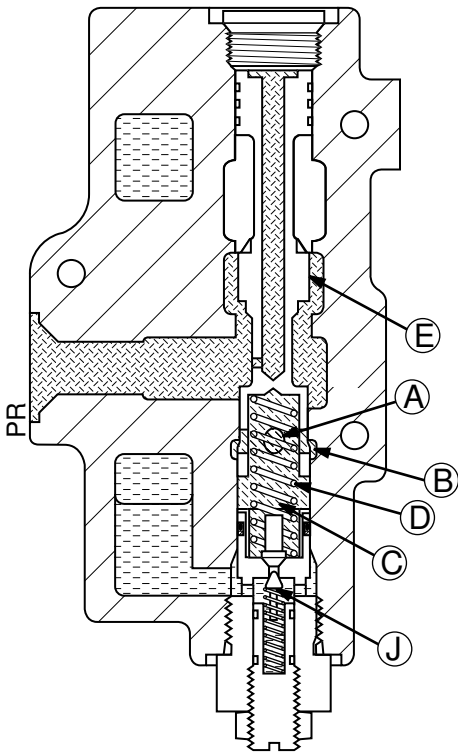
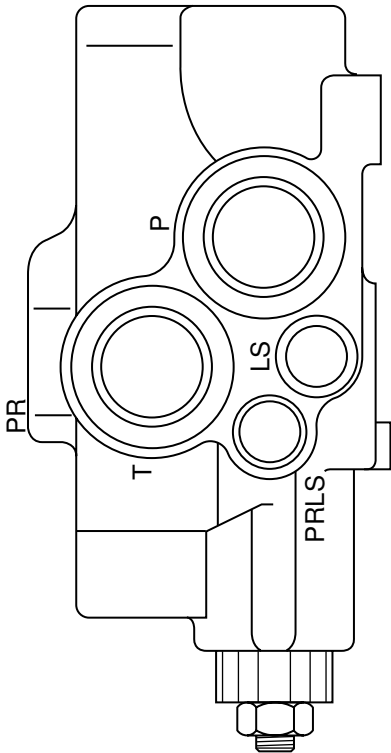


Component Key:

P	Pump Inlet
T	Tank
LS	Load sense port (to pump)
PRLS	Priority Load Sense Port (from steer unit)
PR	Priority Work Port (to steer unit)



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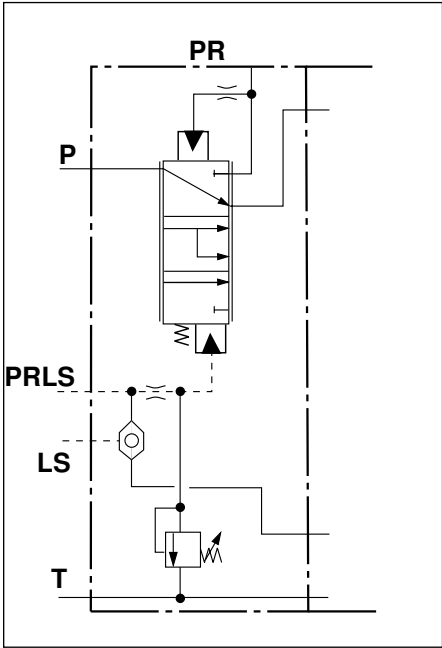
Loader Valve - Variable Flow

Priority Inlet Section Operation

Service Selected (no steering demand)

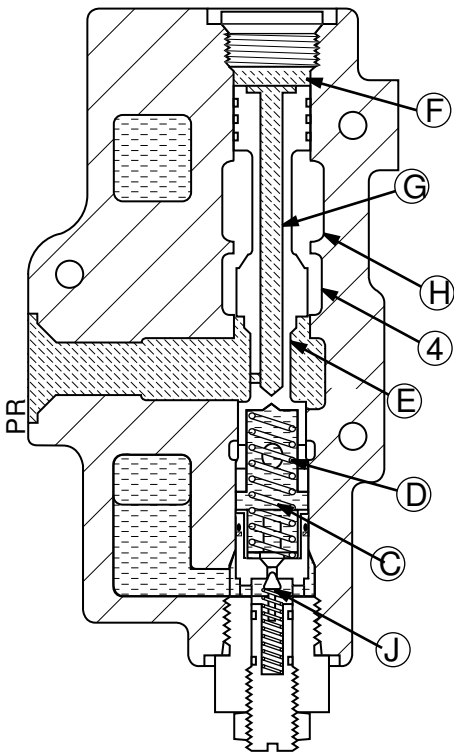
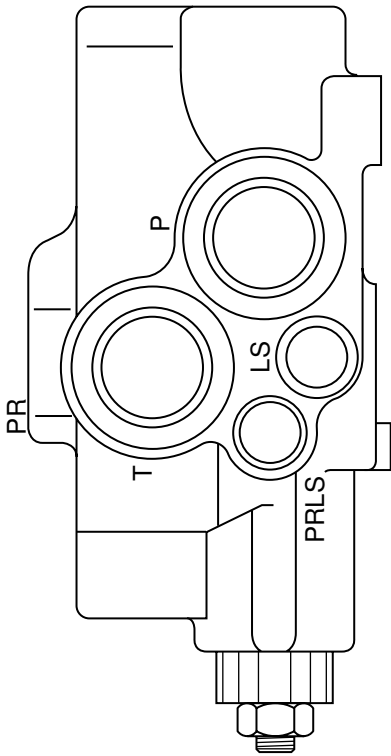
If the steering is not selected, there will be no pressure demand signal in chamber **C**. Pump pressure is ‘dead ended’ at the steer unit, this pressure is felt in chamber **F** via priority port **PR** and drilling **G**. The pressure is sufficient to force spool **E** down against the force of spring **D**. The position of the spool now allows oil from the pump inlet port **P** to flow into passage **H** and on to the selected service via the valve block service ports.

- Component Key:**
- P** Pump Inlet
 - T** Tank
 - LS** Load sense port (to pump)
 - PRLS** Priority Load Sense Port (from steer unit)
 - PR** Priority Work Port (to steer unit)



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-  **EXHAUST**
-  **PUMP**
-  **LOAD SENSE**



A273980

Loader Valve - Variable Flow

Auxiliary Spool

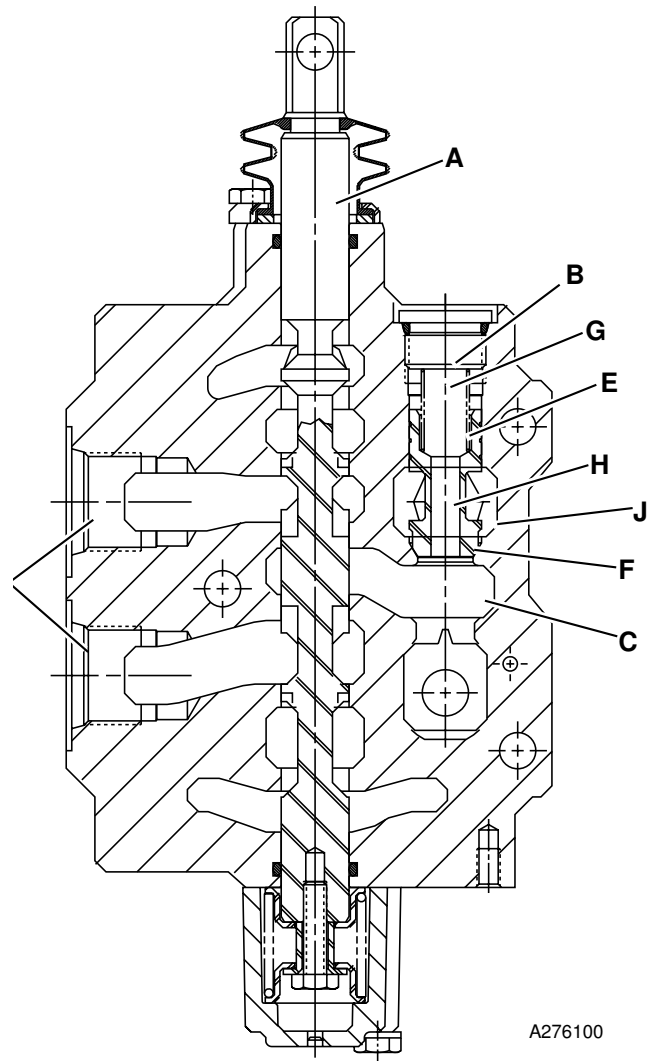
The auxiliary valve section comprises the spool assembly **A**, load hold check valve assembly **B**, primary and secondary shuttles, items **L** and **K** respectively.

While the spools are in neutral position, the primary shuttles and secondary shuttles are vented to tank. When a spool is operated, the load pressure sensed at the work port is directed via the primary and secondary shuttles to the hydraulic pump, where the pump subsequently 'swashes' and increases its output to meet this load sense demand.

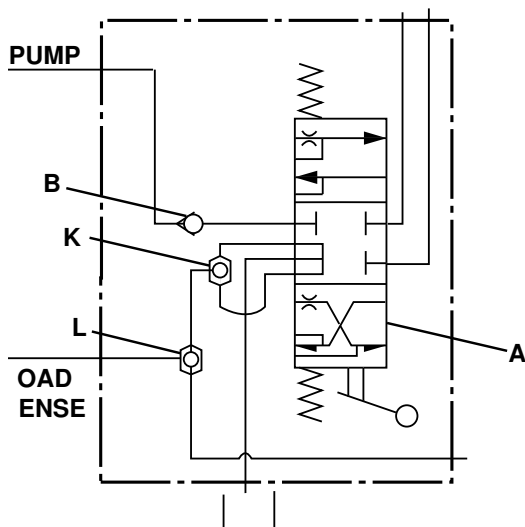
When a service is selected (the spool moved up or down), the waisted sections of the spool connect passage **C** to one of the service ports **D**. Oil from the pump must overcome the force of spring **E** to lift poppet **F** and make the connection from the pump passage **J** to the service ports **D** via passage **C**.

In some instances there is a back pressure in the service line (e.g. generated by the weight of a loaded shovel). This pressure is felt in chamber **G** via drilling **H** in poppet **F**. The back pressure combined with the force of spring **E** keeps the load hold check valve firmly closed, preventing the load from dropping.

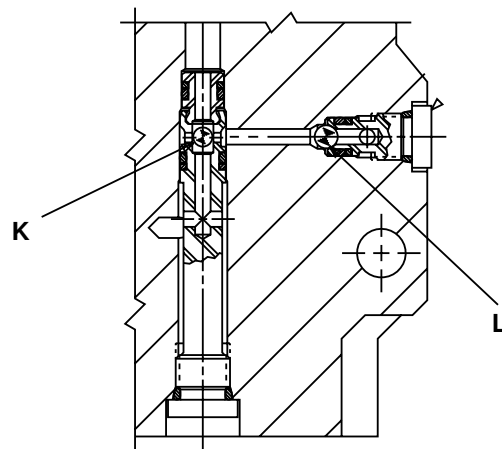
The pressure in pump passage **J** will increase until it is greater than that in the service line. At this point, the load hold check valve will open, as previously described.



A276100



A276290



Loader Valve - Variable Flow

Loader Shovel Spool

The loader shovel spool operates in the same manner as the auxiliary spool, refer to **Auxiliary Spool**.

The shovel valve section also houses auxiliary relief valves (items **30** and **30A**).

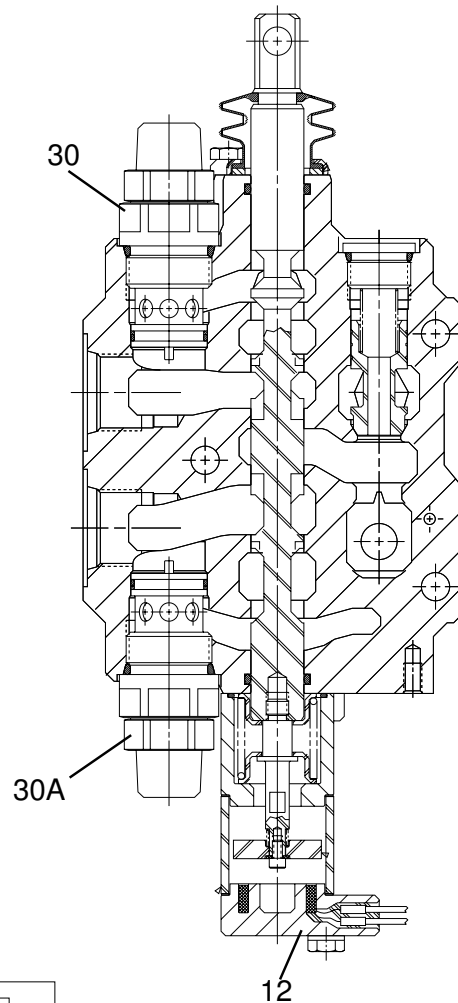
Under normal operating conditions, with the shovel in the 'carry' position, the mechanical linkage keeps the shovel level as the arms are raised, to prevent spillage of the load.

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

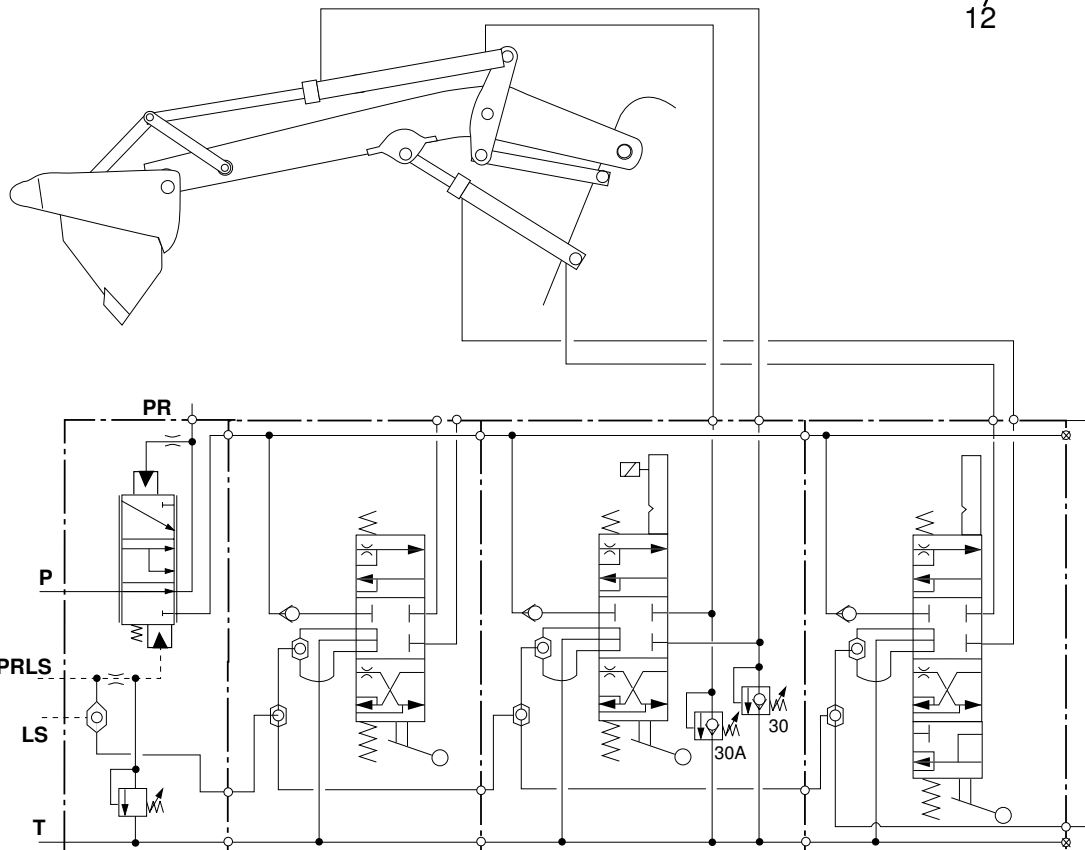
As the arms continue to rise, the back pressure increases until it reaches the setting of A.R.V. **30A**. This A.R.V. then opens, allowing the excess back pressure to be dumped to exhaust and prevent the rams and linkage from being damaged.

The rod side A.R.V. **30** senses a higher pressure in the exhaust gallery than in the service port and therefore opens to allow exhaust oil to overcome the cavitation.

The shovel service may also be fitted with a 'return to dig' detent solenoid **12**.



A278920



A279300

Loader Valve - Variable Flow

Loader Lift Spool

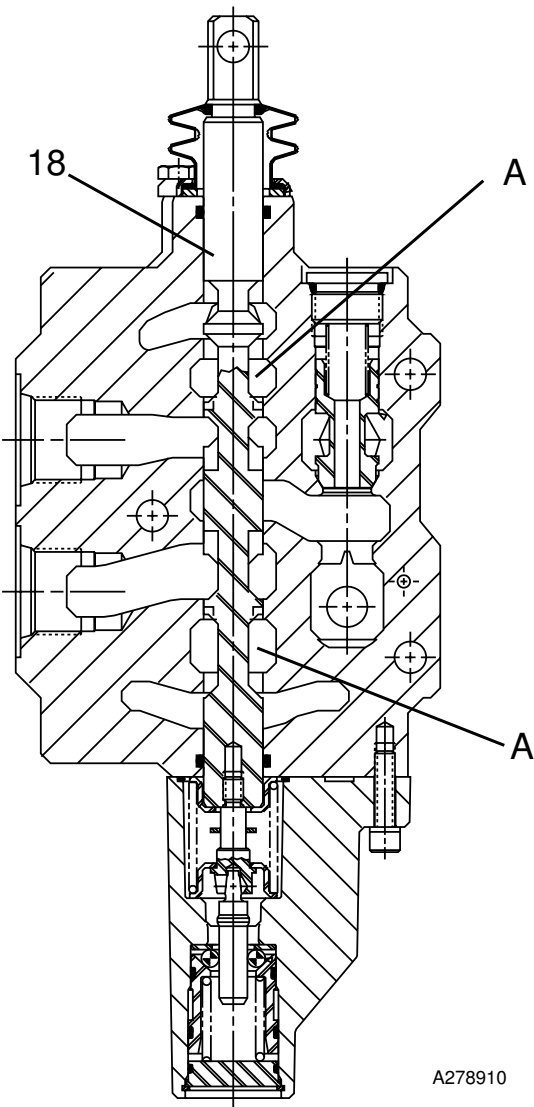
The loader lift spool operates in the same manner as the auxiliary spool, refer to **Auxiliary Spool**.

The lift service spool (item **18**) has a 'float' detent position.

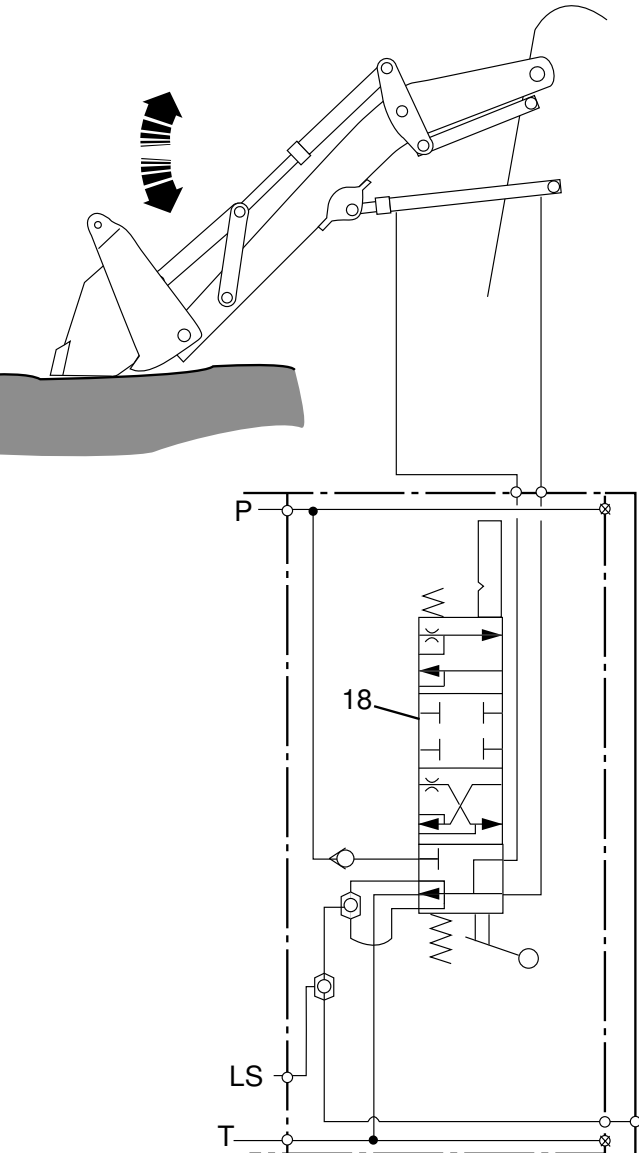
The float facility is provided to allow the arms to move up and down so that the shovel can follow the surface contours as the machine is driven over uneven ground.

This is achieved by moving the lift spool **18** down beyond 'arms lower' into the 'float' detent. Both service ports are connected to exhaust via the spool waists **A**.

Oil can then be displaced from either end of the lift rams and into the exhaust gallery, allowing the rams to open and close as required.



A278910



A279430

Loader Valve - Variable Flow

Shuttle Valve Signal Network

Each control valve section has two shuttle valves. Each valve compares two pressure signals. One of the shuttles is the primary **18** and the other is the secondary **17**.

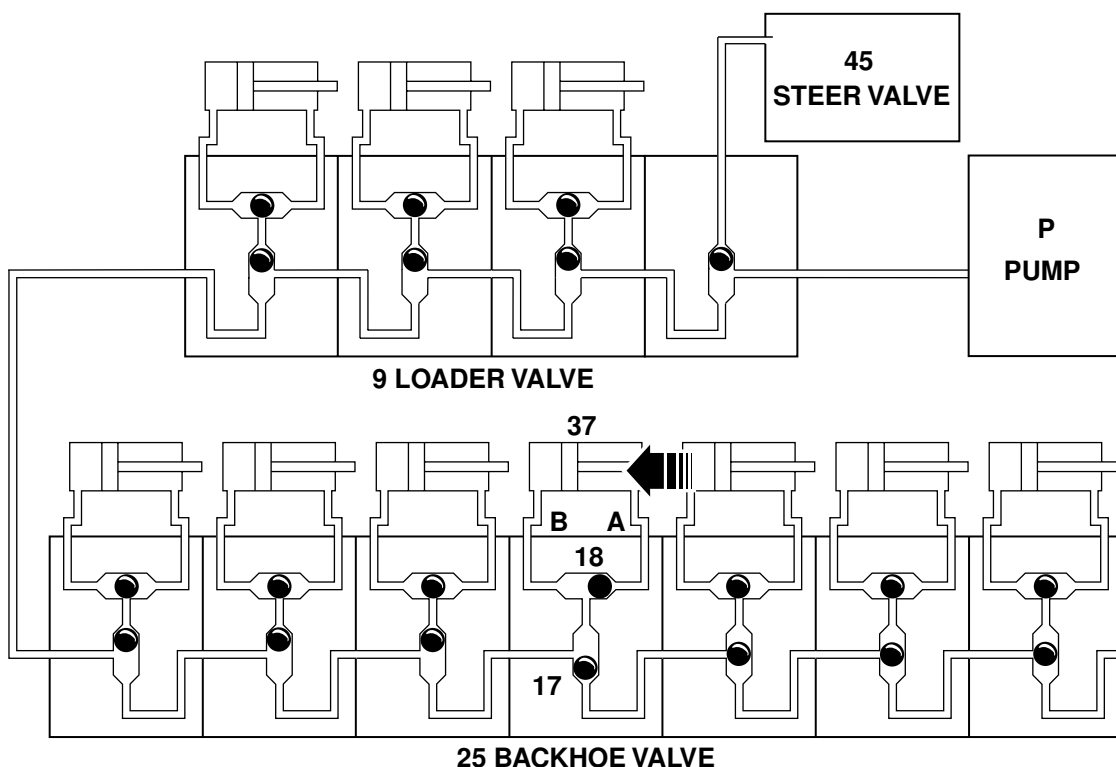
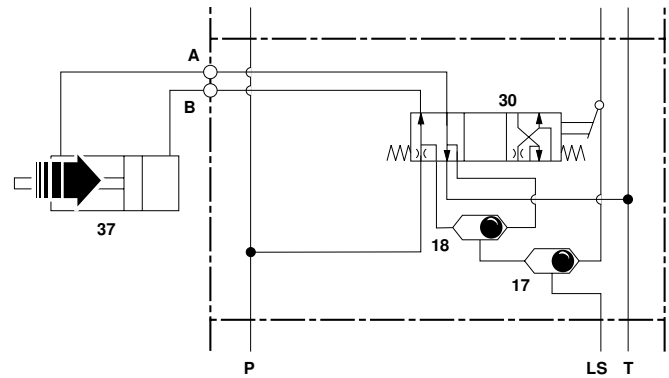
The primary shuttle **18** compares the pressure signal between the two service ports **A** and **B** in each valve section, the head and the rod pressure of the cylinder. In the example shown the boom service **37** port **B** pressure signal is greater than port **A**. Primary shuttle **18** moves across, the pressure signal is the highest shuttle pressure. This signal pressure passes to the next shuttle.

The secondary shuttle operates the same as the primary shuttle but compares pressure signals between valve sections.

The signal network is arranged in series. It starts at loader valve block **9** inlet section which is connected to the steer valve **45**. The last secondary shuttle in the loader valve block is connected to the first secondary shuttle in the backhoe valve block **25**. The highest shuttle signal pressure from the loader valve block goes to the backhoe valve block.

The highest shuttle signal pressure is felt at the hydraulic pump which instructs the pump to vary the output to meet the highest shuttle load requirement. The stand-by pressure spool in the pump adds margin pressure to the load requirement. The single highest shuttle signal pressure plus margin pressure governs pump output.

The pump will not change output until the shuttle network identifies a different shuttle signal.



A316510

Component Key: (JCB 'X' Control Pattern)

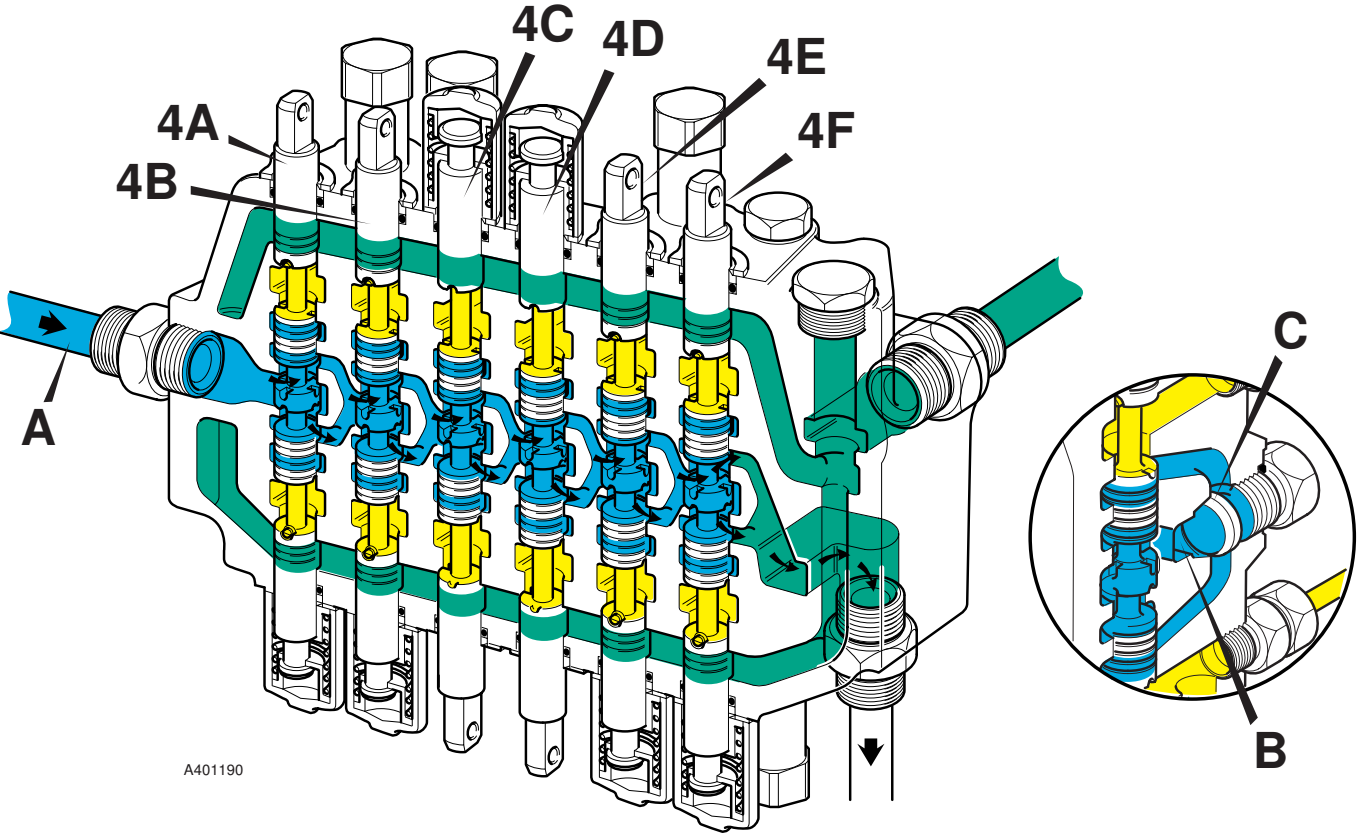
- A** Inlet
- B** Parallel Gallery
- C** Load Hold Check Valves
- 4A** Slew Spool
- 4B** Boom Spool
- 4C** Stabiliser Spool
- 4D** Stabiliser Spool
- 4E** Dipper Spool
- 4F** Bucket Spool

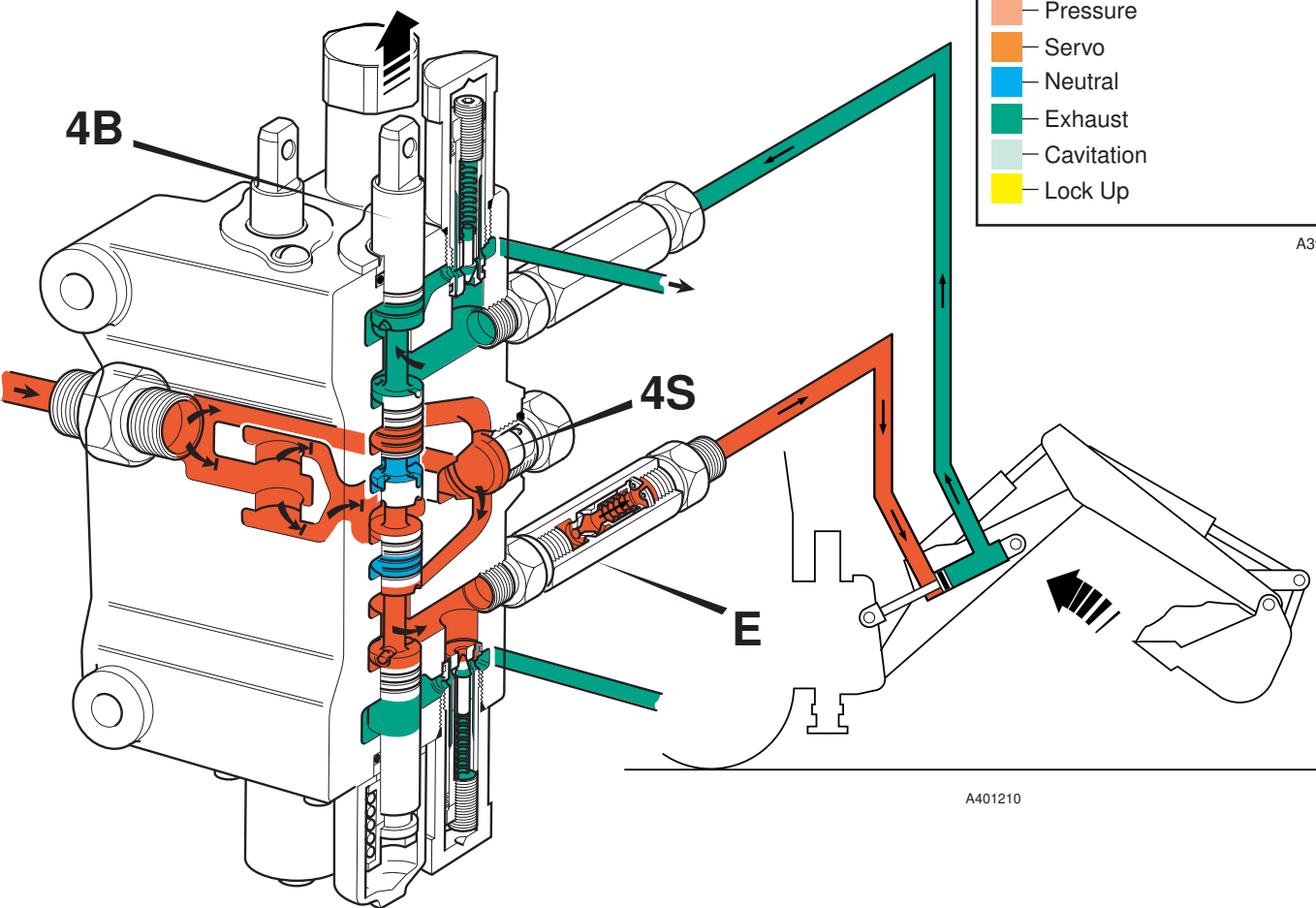
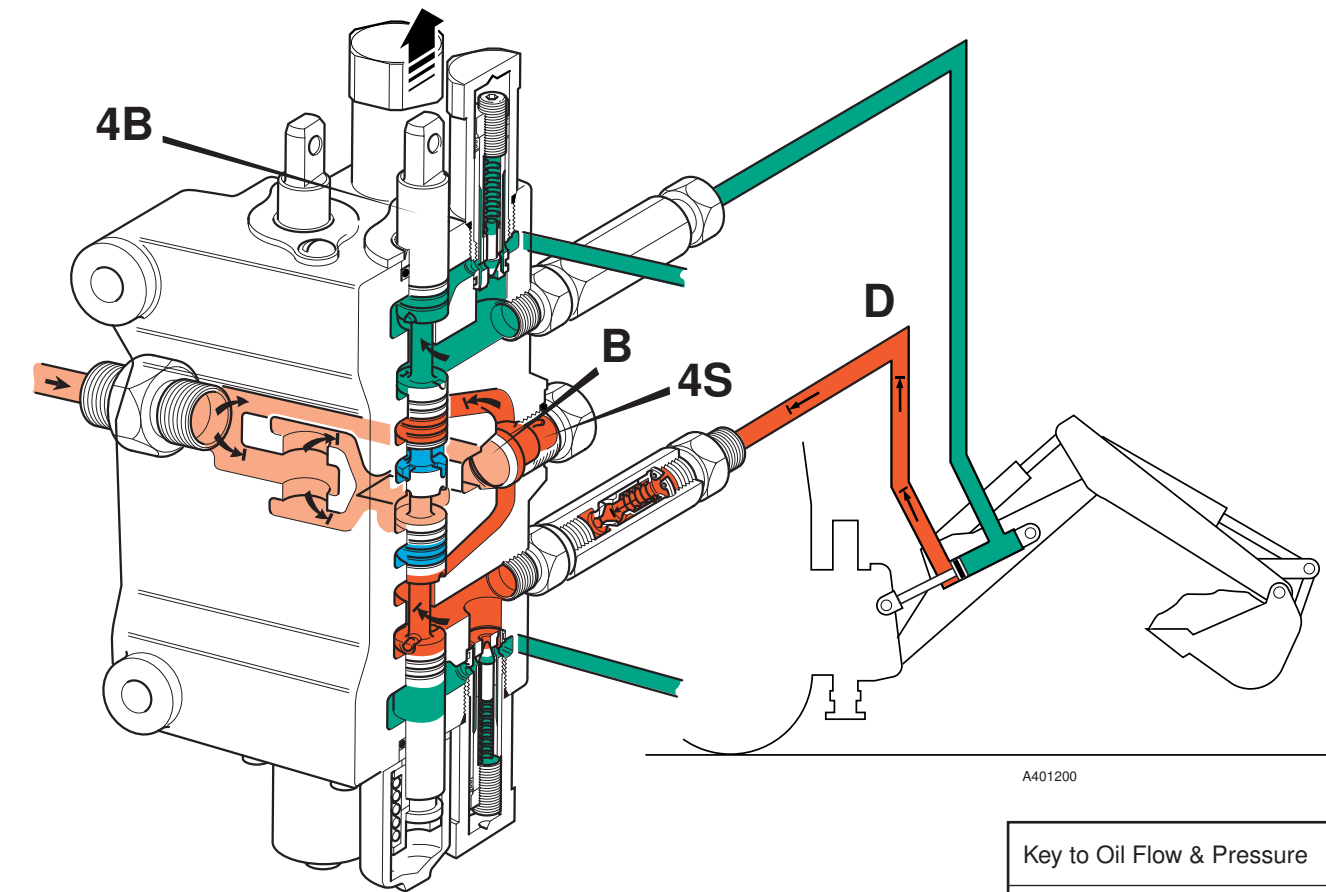
Note: Machines with ISO control pattern have the boom and dipper spools interchanged.

Excavator Valve

Manual Control - Neutral Circuit

Oil from the loader valve enters the excavator valve at **A** and flows through the neutral gallery and around the waists of the solid spools. It also fills the parallel gallery **B** but is not at a high enough pressure to open the load hold check valves **C**.





Key to Oil Flow & Pressure	
—	Full Pressure
—	Pressure
—	Servo
—	Neutral
—	Exhaust
—	Cavitation
—	Lock Up

Excavator Valve - Load Hold Check Valves

Operation 1

Flow to the service via a typical solid spool **4B** is controlled by the load hold check valve **4S** which is a spring-loaded non-return valve operating across the pressure feed from the parallel gallery **B**. The valve prevents reverse flow from the rams into the pressure feed line, so maintaining ram pressure until exceeded by system pressure. The illustration shows a service selected but back pressure **D** exceeds system pressure which closes the load hold check valve **4S**.

Component Key:

- B** Parallel Gallery
- D** Service Line
- 4B** Spool
- 4S** Load Hold Check Valve

Operation 2

When pressure in the feed line exceeds back pressure, the load check valve **4S** opens and oil operates the ram. The remaining load hold check valves are also opened by system pressure but the galleries are dead-ended because the spools are in neutral.

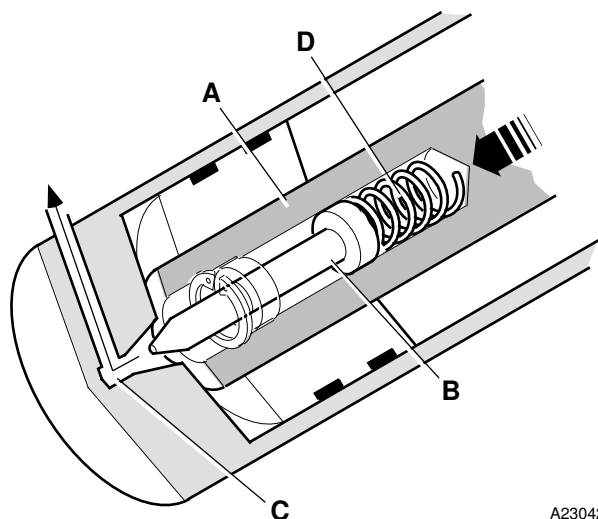
cardiagn.com

Componet Key:

- C** Lower Service Port
- D** Upper Service Port
- E** One Way Restrictor
- X** Parallel Gallery
- 4A** Slew Spool
- 4B** Boom Spool
- 4H** ARV
- 4J** ARV

Slew Ram End Damping

As ram **A** nears the closed position, damping rod **B** seats in cone **C**, where it is held by spring **D**. Tapered flutes on the end of the rod produce a restricting orifice, thus restricting the speed of the oil being exhausted from the ram. This provides a cushioning effect between the piston and the dump end of the ram, effectively damping out the shock loads which would otherwise occur when the boom reaches the end of its slewing arc.



A230420

- A** Ram
- B** Damping Rod
- C** Cone Seat
- D** Spring

Excavator Valve

- One Way Restrictor Operation

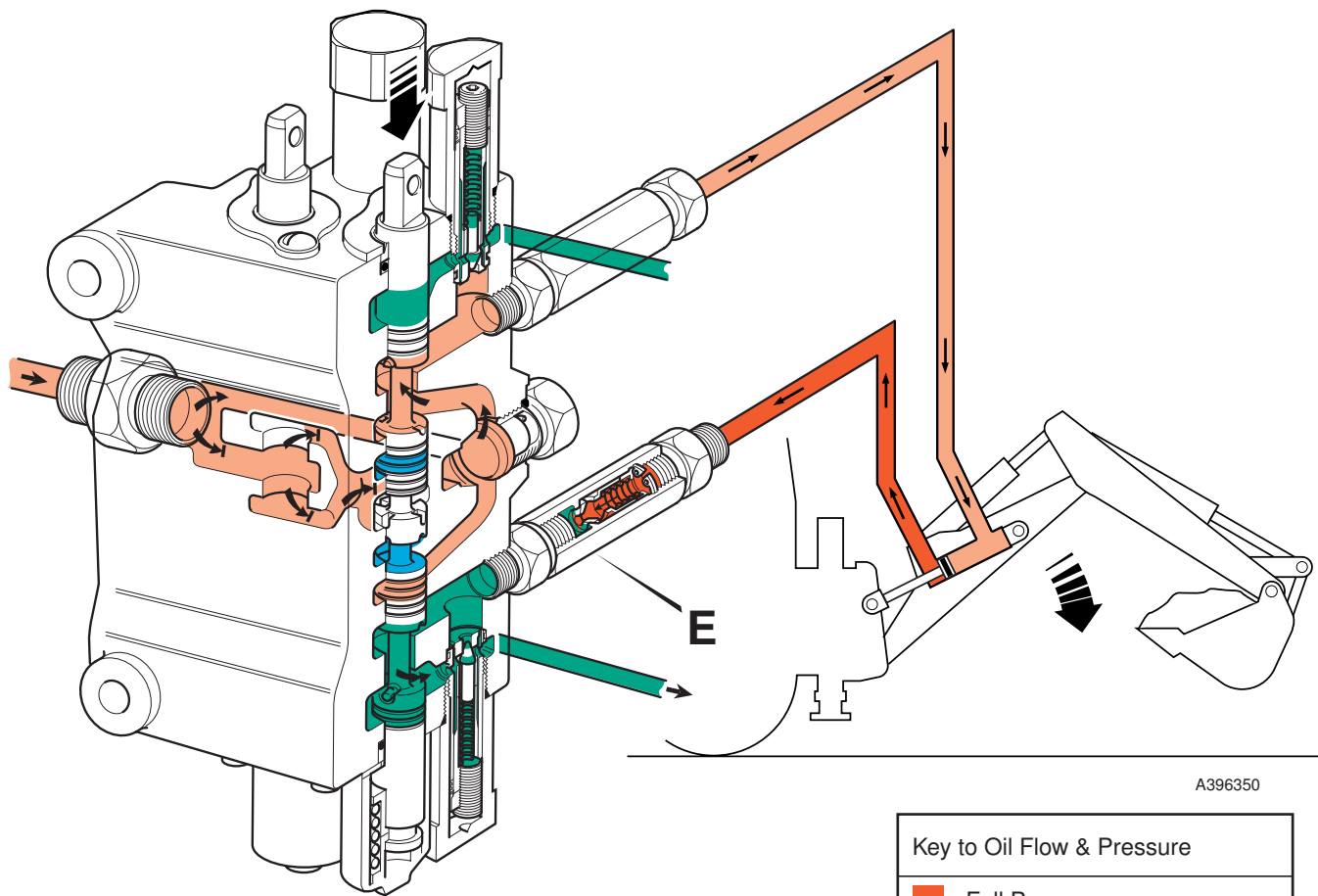
Because of its weight, the excavator end could take over control when boom lower was selected. The falling boom would tend to push oil out of the ram faster than the head side was being filled. Consequently, when the excavator had reached the ground, there would be a time lapse while the ram filled with oil before the service would operate again.

To prevent this from happening, the boom service is fitted with a one way restrictor. When the boom is being raised, the poppet in restrictor **E** is held off its seat by the pressurised oil flow, therefore oil delivery to the boom ram rod side is unrestricted.

When the boom is being lowered, the oil flow through the one way restrictor **E** re-seats the poppet, therefore the flow of oil is restricted through the small drilling in the base of the poppet. This slows the boom down to a controllable speed.

Excavator Valve - Slew Operation

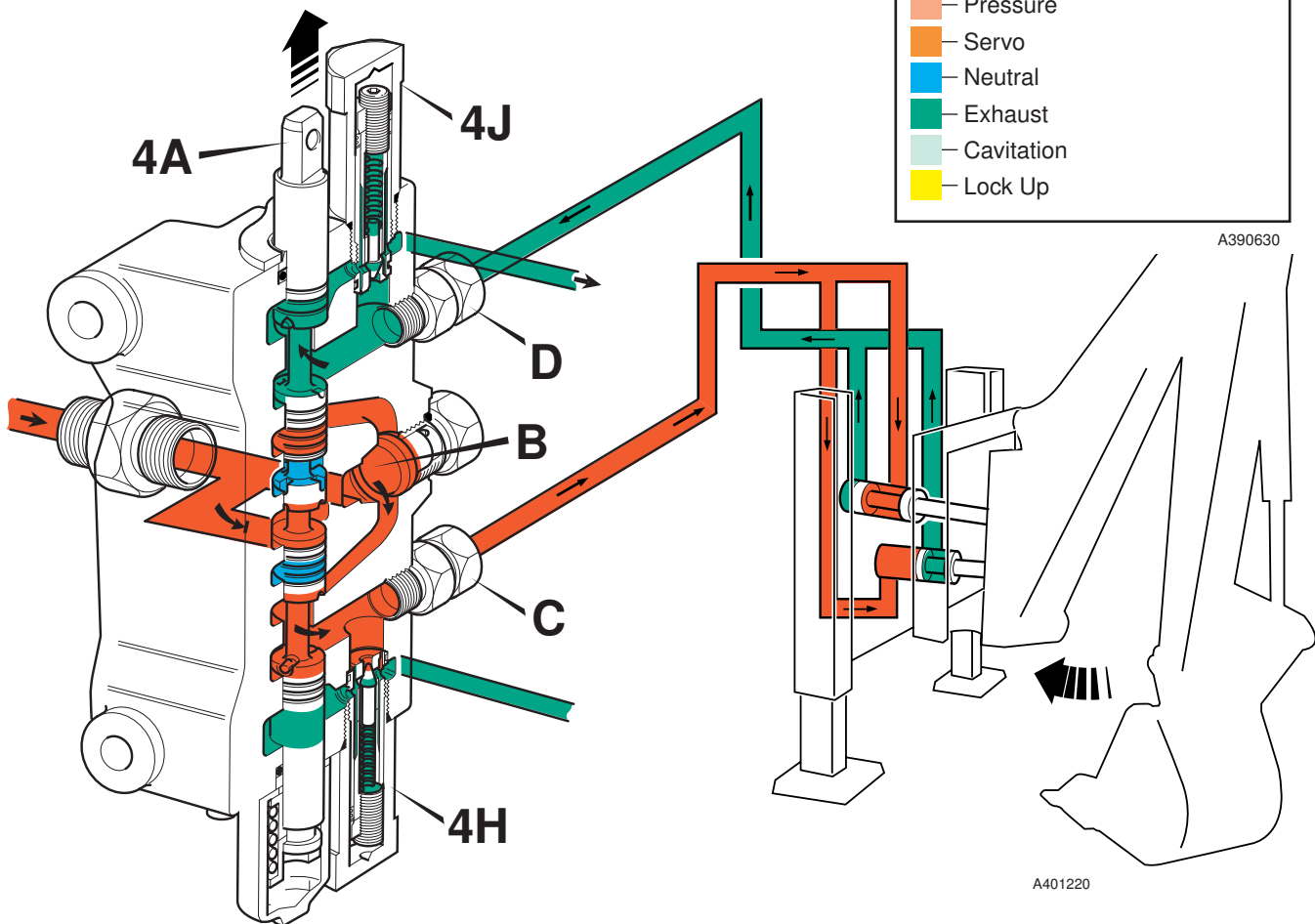
The illustration shows R.H. slew selected. The lower port **C** has been pressurised by the spool. Oil flows from the parallel gallery **B**, out past A.R.V. **4H** to both the head side of the L.H. slew ram and the rod side of the R.H. slew ram. The boom therefore slews to the right hand side of the machine. Displaced oil from the rod side of the L.H. slew ram and from the head side of the R.H. slew ram flows back through the upper service port **D** and back to tank.



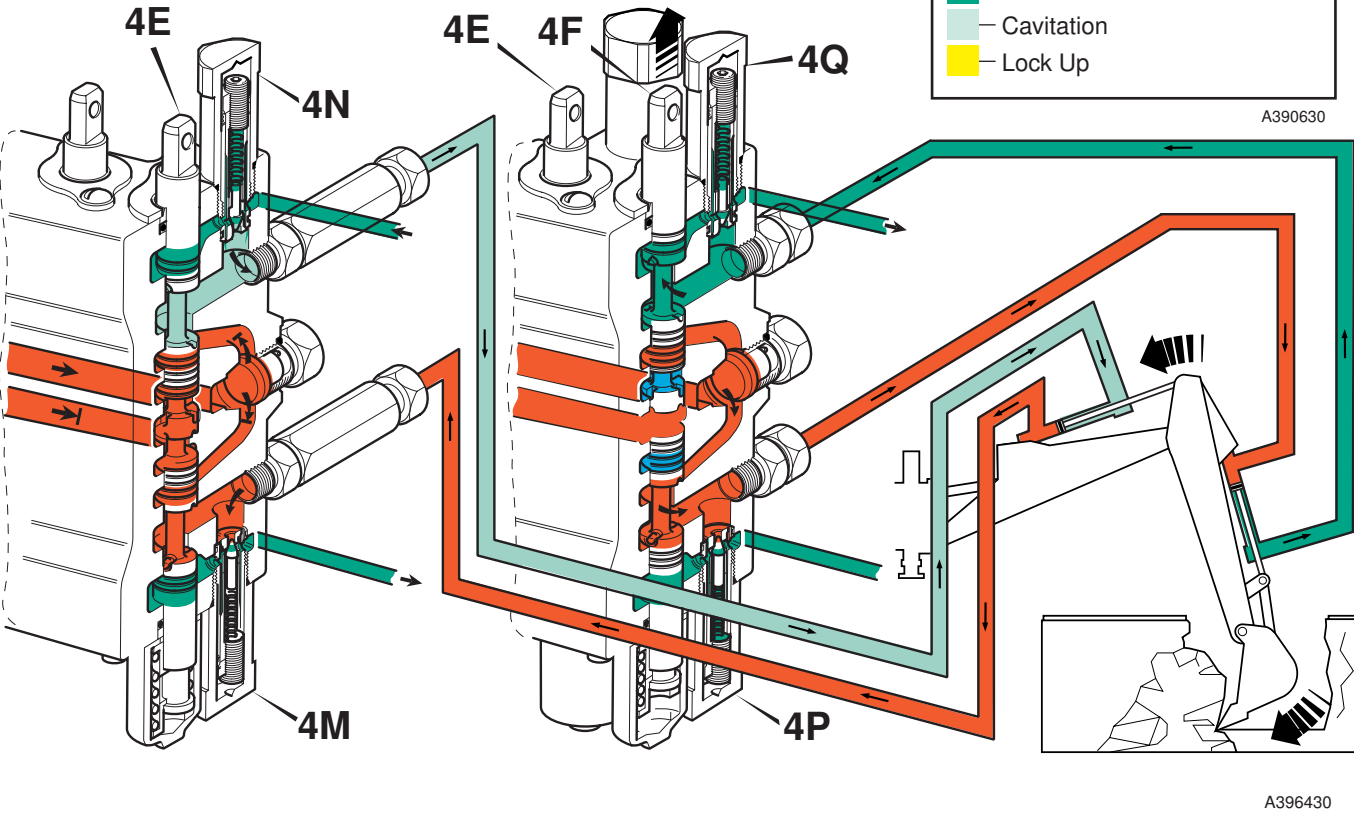
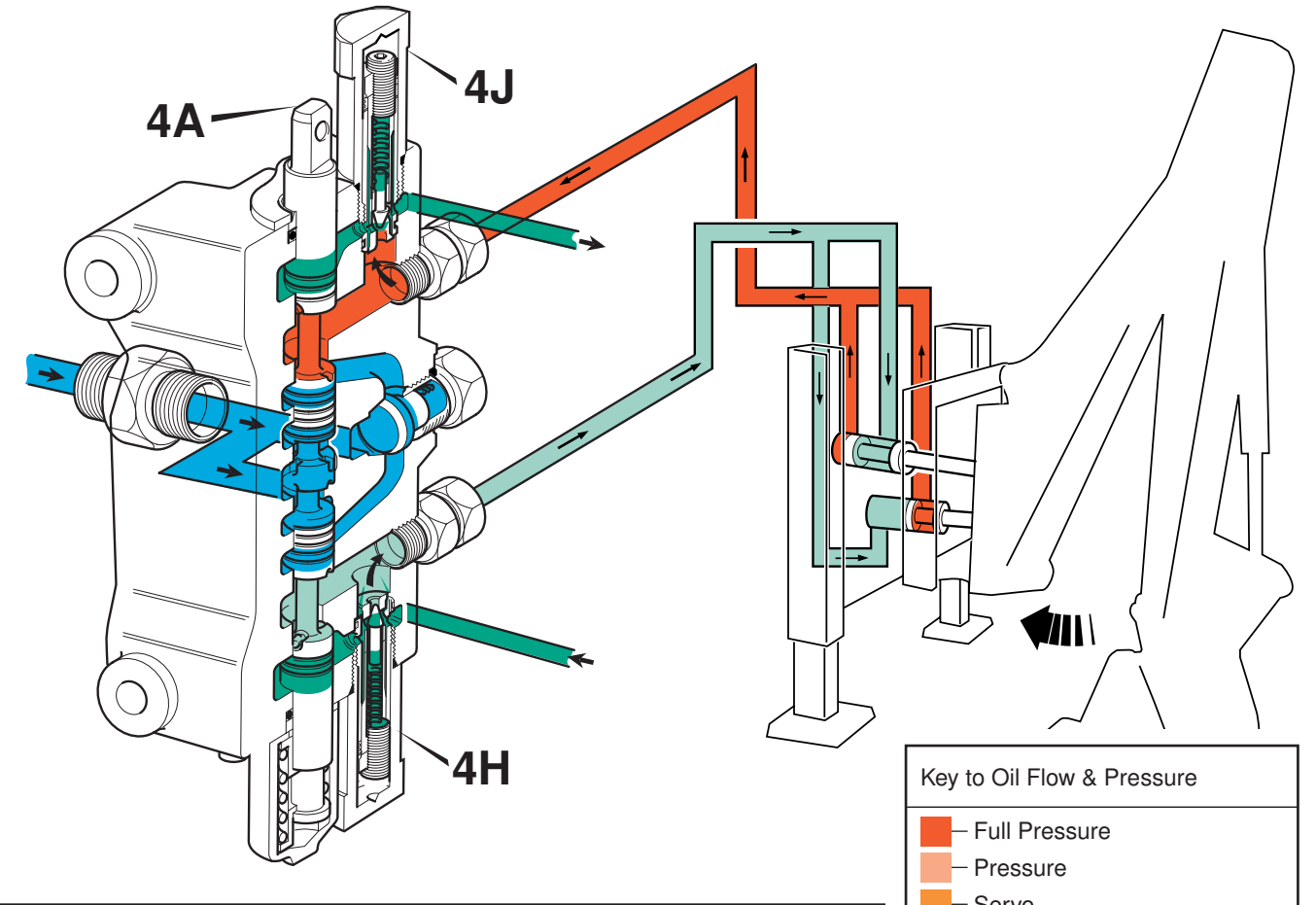
A396350

Key to Oil Flow & Pressure	
—	Full Pressure
—	Pressure
—	Servo
—	Neutral
—	Exhaust
—	Cavitation
—	Lock Up

A390630



A401220



Excavator Valve - Slew A.R.V. and Anti-Cavitation Operation

The spool **4A** is in neutral but the momentum of the slewing excavator end creates back pressure in the head side of the R.H. slew cylinder and in the rod side of the L.H. slew cylinder. This opens A.R.V. **4J** and dumps oil to exhaust. At this point the cylinders cavitate and exhaust oil pressure causes A.R.V. **4H** to open, allowing oil from the exhaust gallery to fill the L.H. cylinder.

Component Key:

4A	Slew Spool
4E	Dipper Spool
4F	Bucket Spool
4H	ARV
4J	ARV
4M	ARV
4N	ARV
4P	ARV
4Q	ARV (option)

Excavator Valve - A.R.V. Operation

The illustration shows the bucket spool **4F** selected to operate the service against an immovable object. This forces the dipper away from the obstruction and pressurises the head side of the dipper ram.

When this pressure reaches the setting of A.R.V. **4M**, this valve opens, relieving the pressure into the exhaust gallery.

Cavitation occurs in the rod side of the dipper service until A.R.V. **4N** opens, allowing the higher pressure in the exhaust gallery to supplement that in the service line.

Note: A.R.V. **4Q** is only fitted to machines with a Rockbreaker.

For a further detailed description, refer also to **Pilot - Operated Pressure Relief Valve Operation**.

Pilot - Operated Pressure Relief Valve Operation

Component Key:

- A** Service Pressure
- B** Poppet
- C** Piston
- D** Spring
- E** Poppet
- F** Spring
- G** Locknut
- H** Cavity
- J** Sleeve
- K** Exhaust Cavity
- L** Cavity

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 described in **Excavator Valve - ARV Operation**.

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**.

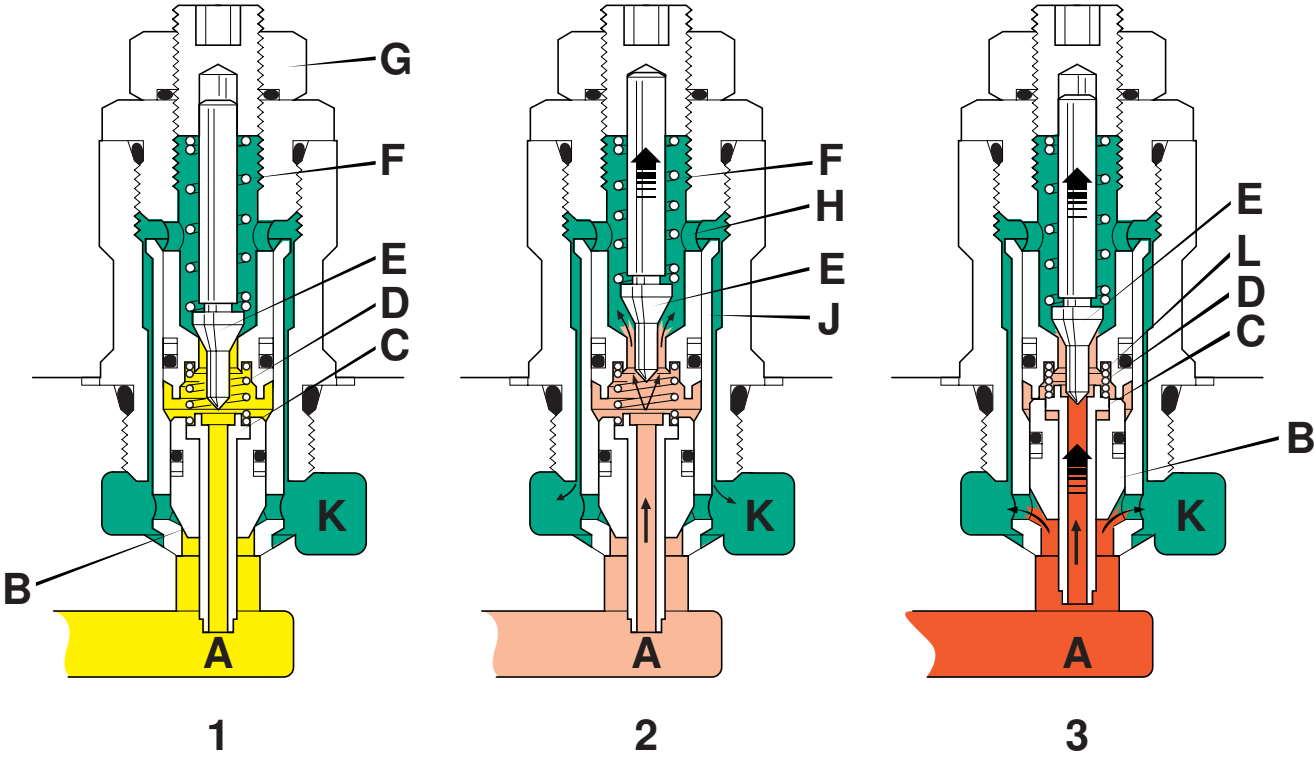
2 Pilot Valve Opens

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**.



A390480

Key to Oil Flow & Pressure	
	Full Pressure
	Pressure
	Servo
	Neutral
	Exhaust
	Cavitation
	Lock Up

A390630

* Excavator Valve - Manual Control

Hydraclamp Valve Operation (Sideshift Machines)

When the backhoe is being used for excavating duties, the kingpost assembly must be 'clamped' to the sideshift rearframe.

The hydraclamp control valve assembly (items **G**, **D** and **C**) is positioned in the inlet end of the excavator valve block and is connected directly to the parallel gallery **B**. The valve operates in conjunction with solenoid valve **E** housed in the side of the excavator valve block.

1 - Clamps Pressurised

When the hydraclamp switch **A** is in the OFF position (not pressed), the solenoid valve **E** is de-energised. The solenoid valve in this de-energised state blocks the exhaust path from the parallel gallery **B** to the drain port (tank).

When an excavator service is operated, pressure is generated in parallel gallery **B**, this pressurised oil enters the clamp valve **C** and lifts poppet **D** off its seat against the force of spring **G**. The oil flows past the poppet and out to the hydra-clamps **62**.

2 - Clamps Released - Not Precision Control Machines

When the hydraclamp switch **A** is in the ON position (pressed down), the solenoid valve **E** is energised. The solenoid valve in this energised state now allows a connection to be made from the parallel gallery **B** to the drain port (tank) via gallery **F**.

Oil from the hydra-clamps is vented through the clamp valve and gallery **F** to the drain port (tank).

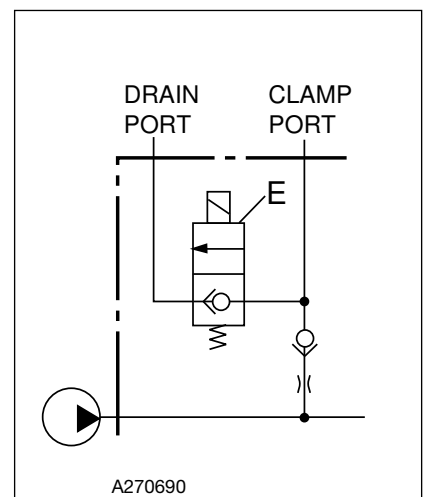
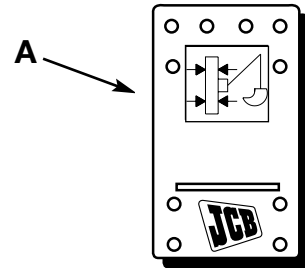
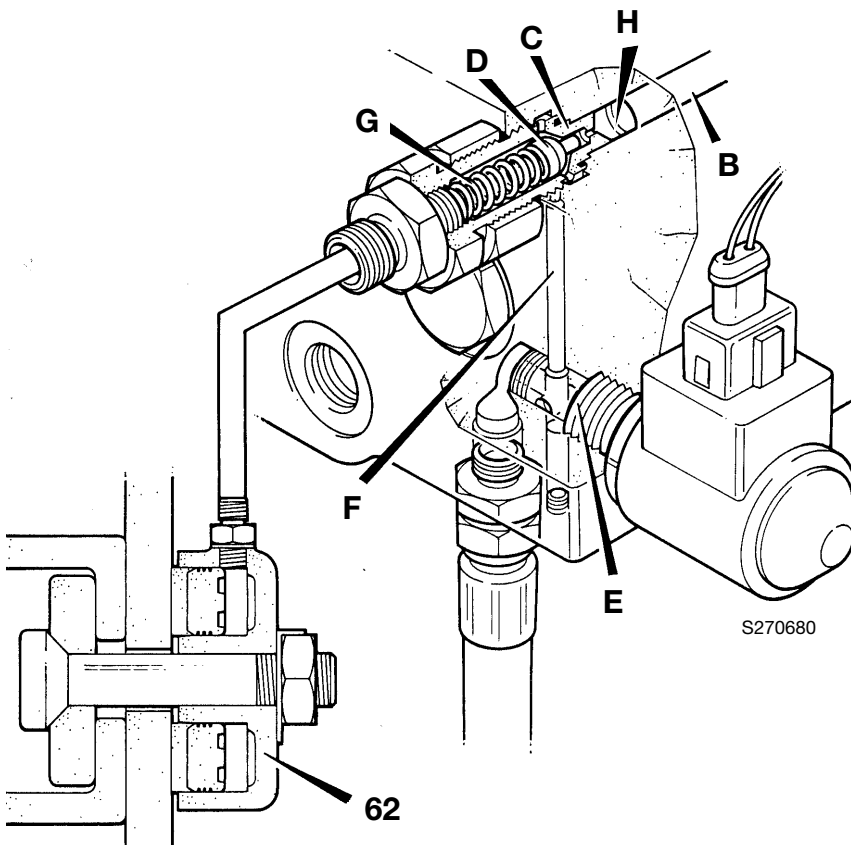
Also, pressure resulting from the operation of an excavator service passes by poppet **D** as before but the oil takes the path of least resistance and is vented via gallery **F** to the drain port (tank).

Restrictor **H** ensures that not all oil in gallery **B** is dumped back to tank.

3 - Clamps Locked Up

If no service is being operated, pressure in the parallel gallery **B** falls to that of the neutral circuit and the force of spring **G** is sufficient to keep the poppet seated.

Pressure is therefore trapped in the line to the clamps, maintaining the excavator end in a securely clamped condition.



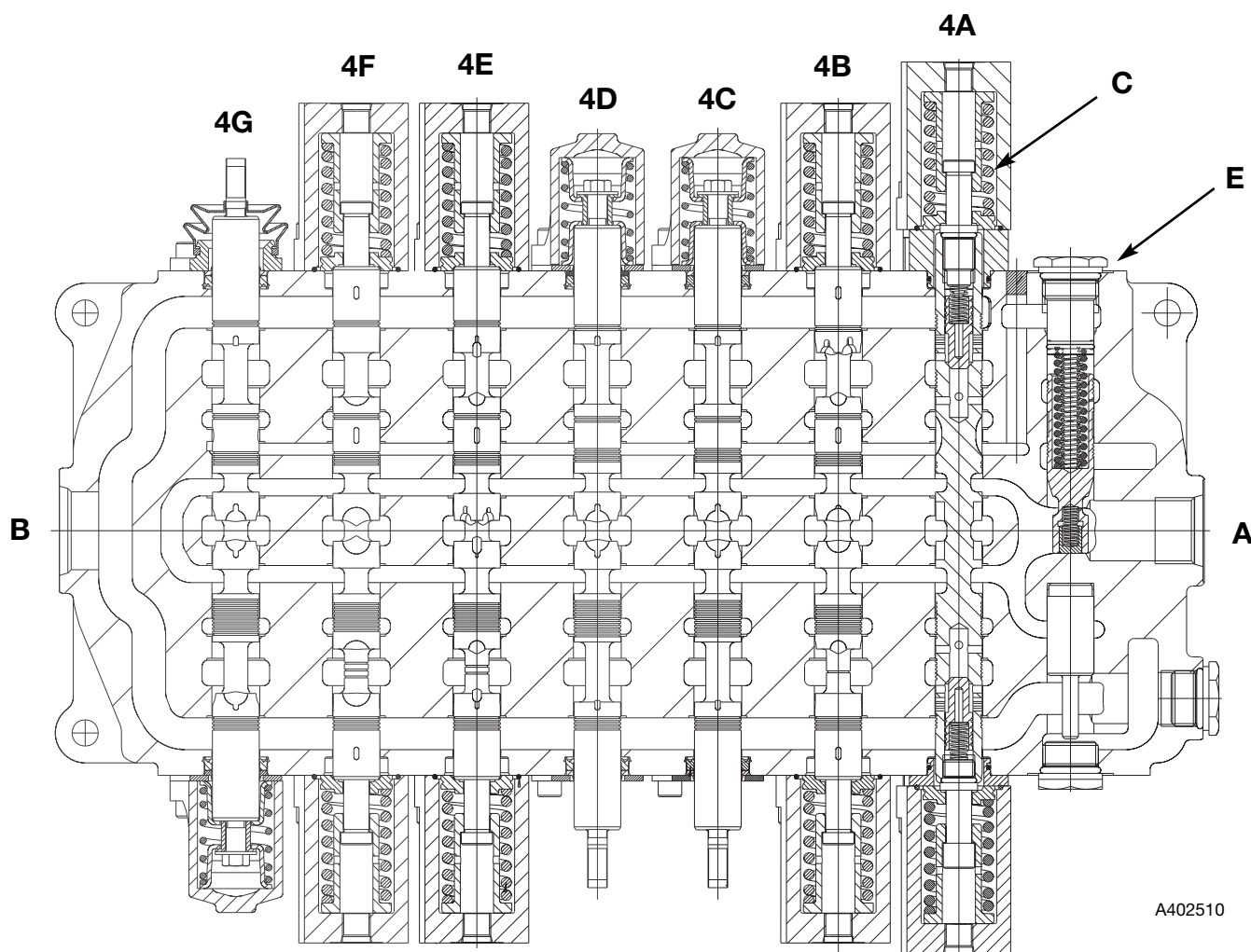
Excavator Valve

Precision Control (Servo)

* (Machines up to serial no. 931159)

Component Key:

- A** Inlet Port
- B** Outlet Port
- C** Centering Spring
- D** Integral Load Sensing Valves (Isolator Compensator Spools)
- E** Bypass Compensator Valve
- F** Load Sense Drain Regulator and Relief Valve
- G** Hydra-clamp Solenoid Valve
- H** Pilot Operated Check Valve
- J** Load Sense Drain Port
- 4A** Slew Spool
- 4B** Boom Spool
- 4C** Stabiliser Spool
- 4D** Stabiliser Spool
- 4E** Dipper Spool
- 4F** Bucket Spool
- 4G** Aux. Spool (not used on some machine variants)



A402510

Excavator Valve

Precision Control (Servo) (continued)

* (Machines up to serial no. 931159)

In the interest of machine efficiency and consistent backhoe operation the excavator valve is of a closed centre design and incorporates load sensing valves **D**, for each service. These features enable the valve to operate as follows:

No service is selected (all spools in neutral)

Oil from the loader valve high pressure carry over enters the excavator valve at the inlet port **A**. Oil flows across the bypass compensator spool assembly **E** and returns to tank from the outlet port **B**.

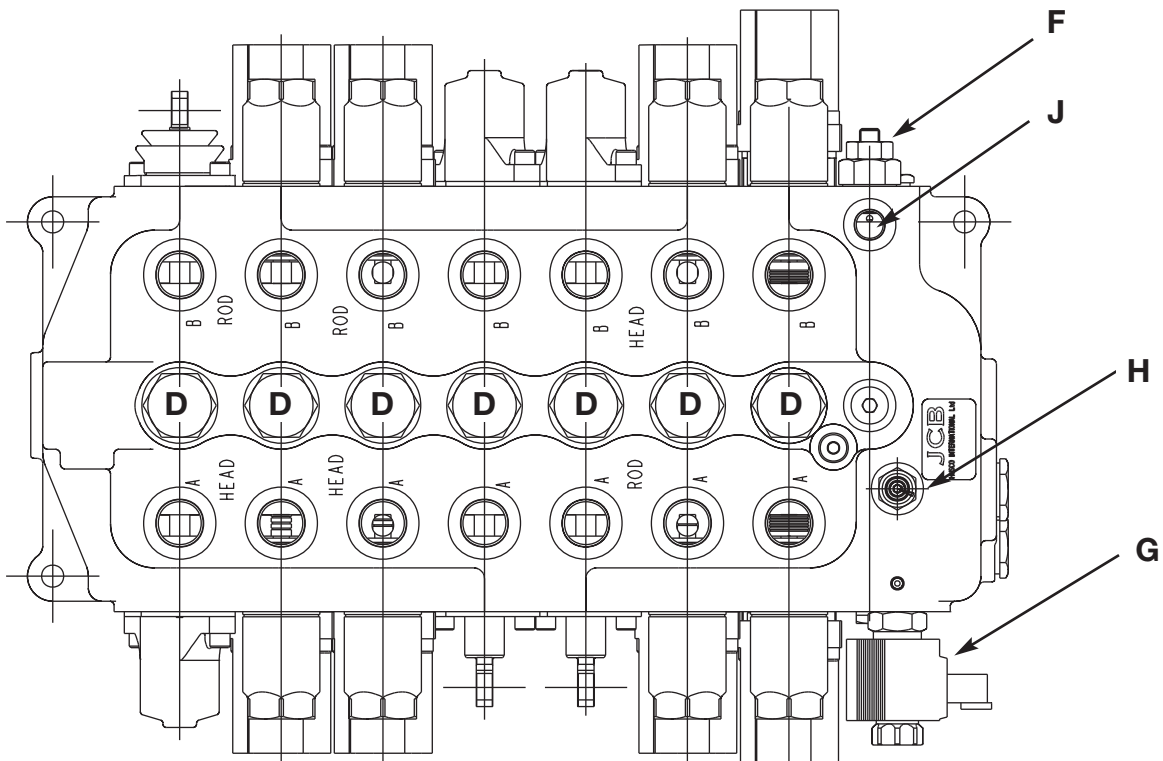
Servo Spool Actuation

When a service is operated servo pressure from the joystick control valve acts on the end of the relevant service spool Eg. **4A** and displaces the spool proportionally against the force of the centering spring **C**, allowing the oil to flow to move the required service. When the servo pressure on the end of the service spool is reduced the force of the centering spring overcomes the servo pressure and the service spool will move back proportionally to the central neutral position. Note that spools **4G**, **4D** and **4C** are manually actuated.

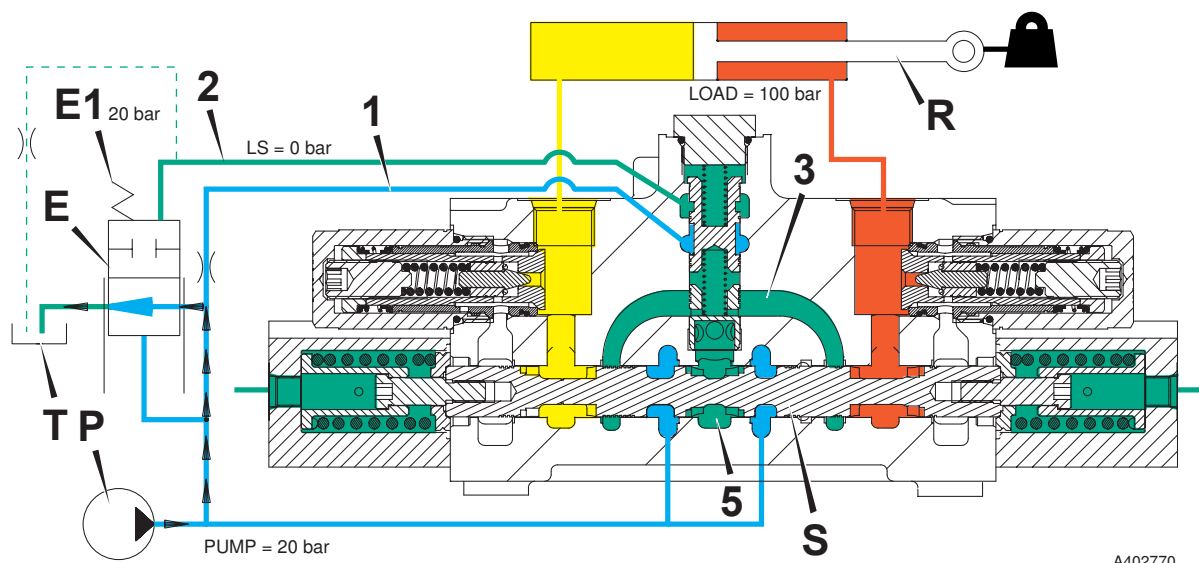
When a Service is Selected

When one or more services are selected the load sense valves detect the service generating the highest pressure. This causes the bypass compensator valve **E** to close and allow pump flow to the spools and service ports at sufficient pressure to move the load. The load sense valves **D** also incorporate check valves. These valves prevent the load falling back if the load pressure is greater than the pump pressure. The closed centre design ensures consistent service operation regardless of load.

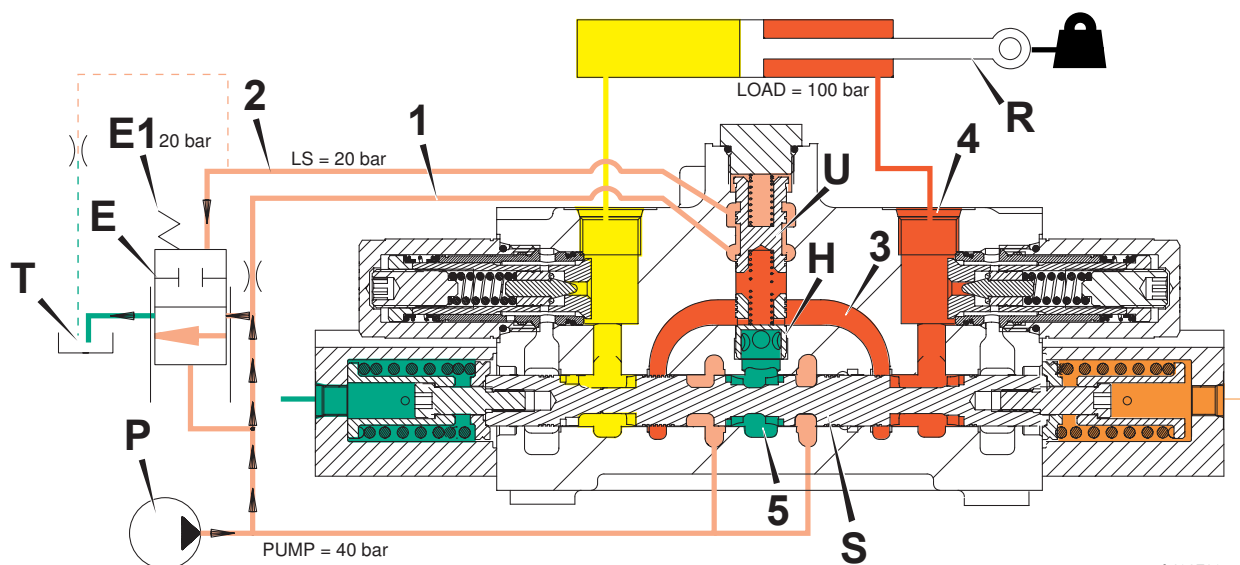
For a full description of spool and load sense valve operation see **Load Sense (Isolator Compensator) Valve Operation** on the next page.



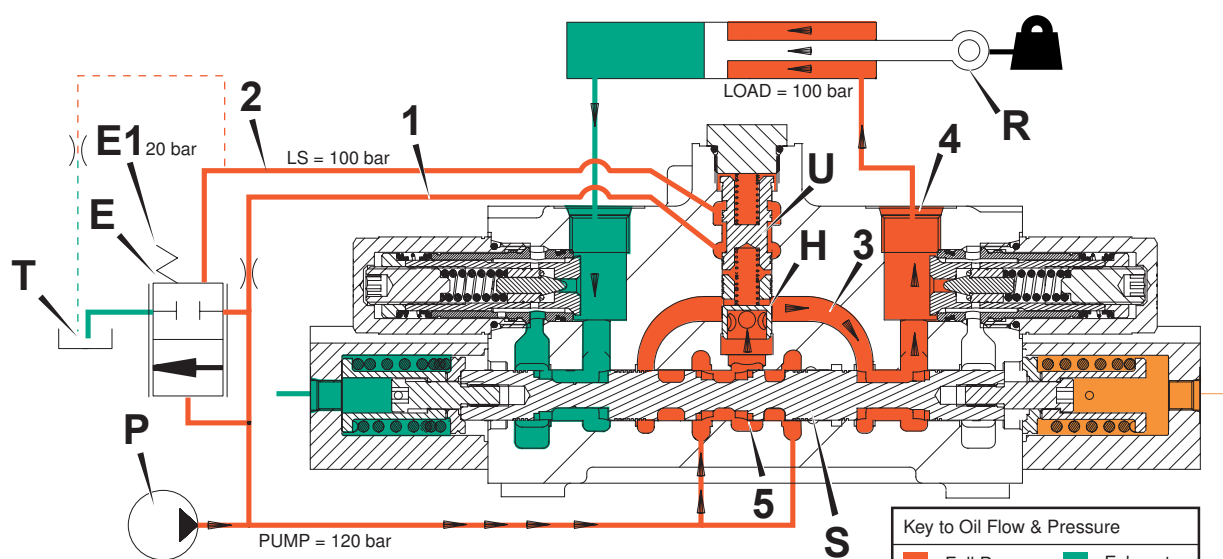
A402500



A402770



A402780



A402790

Key to Oil Flow & Pressure	
 — Full Pressure	 — Exhaust
 — Pressure	 — Lock Up
 — Servo	 — Neutral

Excavator Valve

Precision Control (Servo) (continued)

* (Machines up to serial no. 931159)

Load Sense (Isolator Compensator) Valve Operation

No service is selected (all spools in neutral)

With the spools in the neutral position oil from the pump **P** flows to each spool and is dead ended. This generates sufficient pressure (about 20bar) to overcome the spring **E1** and oil flows across the bypass compensator spool assembly **E** to tank. Note that oil from the pump also flows into the 'auxiliary pump gallery' **1**. Oil from the 'bridge galleries' **3** is vented to tank via a groove in the main spool **S**.

Any load on the service ram **R** is held by the main spool **S**. Oil is also vented to tank from the load sense gallery **2** via the load sense drain regulator/relief valve **F** (see below).

Spool at point of operating a service

Pressure from the load on ram **R** enters the bridge gallery **3** via the service port **4**. Compensator check valve **H** is held down on its seat preventing the load moving. At the same time the isolator spool **U** lifts and allows oil from the auxiliary pump gallery **1** to flow into the load sense gallery **2**. Oil pressure builds in gallery **1** and the bypass compensator spool **E** begins to close under the action of the oil and spring (**E1**) pressure. This causes the pump pressure to rise to a new value as follows:

Pump pressure = Pressure in load sense gallery **2** + pressure from spring **E1**.

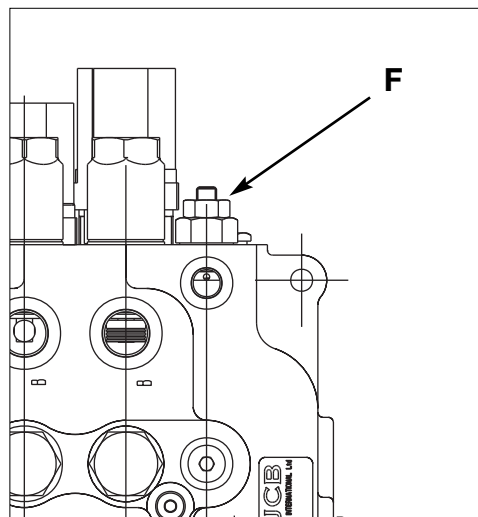
When the pressure in load sense gallery **2** reaches the load pressure, isolator spool **U** moves down and closes off the auxiliary pump gallery **1** from load sense gallery **2**. If the load pressure subsequently rises or falls, the isolator spool moves due to pressure imbalance and maintains the pressure in the load sense gallery **2** at the same pressure as the load pressure. The pressure in the load sense gallery **2** always

bleeds to tank, again causing pressure imbalance and the isolator spool to move, allowing the pressure in the gallery to be 'topped up'. This ensures that 'pressure balance' is always maintained.

It must be noted that the load sense gallery **2** is connected to all load sense valves (one for each service). The pressure in the gallery **2** will always be equal to the highest load from any of the backhoe services. The maximum load sense pressure is regulated by the load sense drain regulator/relief valve **F** (see below).

Spool fully operating a service

As the spool **S** is moved further oil from the pump is diverted into the central gallery **5**. If the pump pressure has risen sufficiently (to a pressure equal to the load + spring pressure **E1**) then check valve **H** moves up off its seat and allows oil to flow into bridge gallery **3**, and out to the ram **R** via service port **4**. Exhaust oil from the other side of ram **R** is diverted to tank.



Excavator Valve

Precision Control (Servo)

* (Machines up to serial no. 931159)

Hydraclamp Valve Operation

When the backhoe is being used for excavating duties, the kingpost assembly must be 'clamped' to the sideshift rearframe.

The hydraclamp control valve assembly (items **G**, **D** and **C**) is positioned in the front face of the excavator valve block and is connected directly to the parallel gallery **B**. The valve operates in conjunction with solenoid valve **E** located in the bottom of the excavator valve block.

1 - Clamps Pressurised

When the hydraclamp switch **A** is in the OFF position (not pressed), the solenoid valve **E** is de-energised. The solenoid valve in this de-energised state blocks the exhaust path from the galleries **B** and **F** to the drain port **T** (tank).

When an excavator service is operated, pressure is generated in parallel gallery **B**, this pressurised oil moves piston **C** which pushes ball **D** off its seat against the force of spring **G**. The oil flows through restrictor **H**, past the ball and out to the hydra-clamps **62**.

2 - Clamps Released - Precision Control Machines Only

To enable clamps release, the hydraclamp switch **A** must be in the ON position (pressed down), the solenoid valve **E** is energised. Pressure resulting from the operation of an excavator service moves piston **C** which pushes ball **D** off its seat.

With the hydraclamp switch **A** in the ON position (pressed down), the solenoid valve **E** is energised. Pressure resulting from the operation of an excavator service moves piston **C** which pushes ball **D** off its seat.

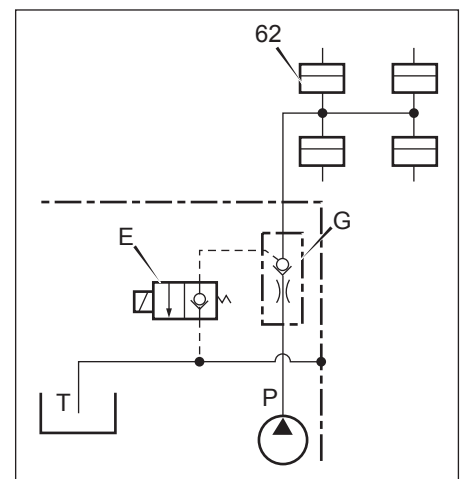
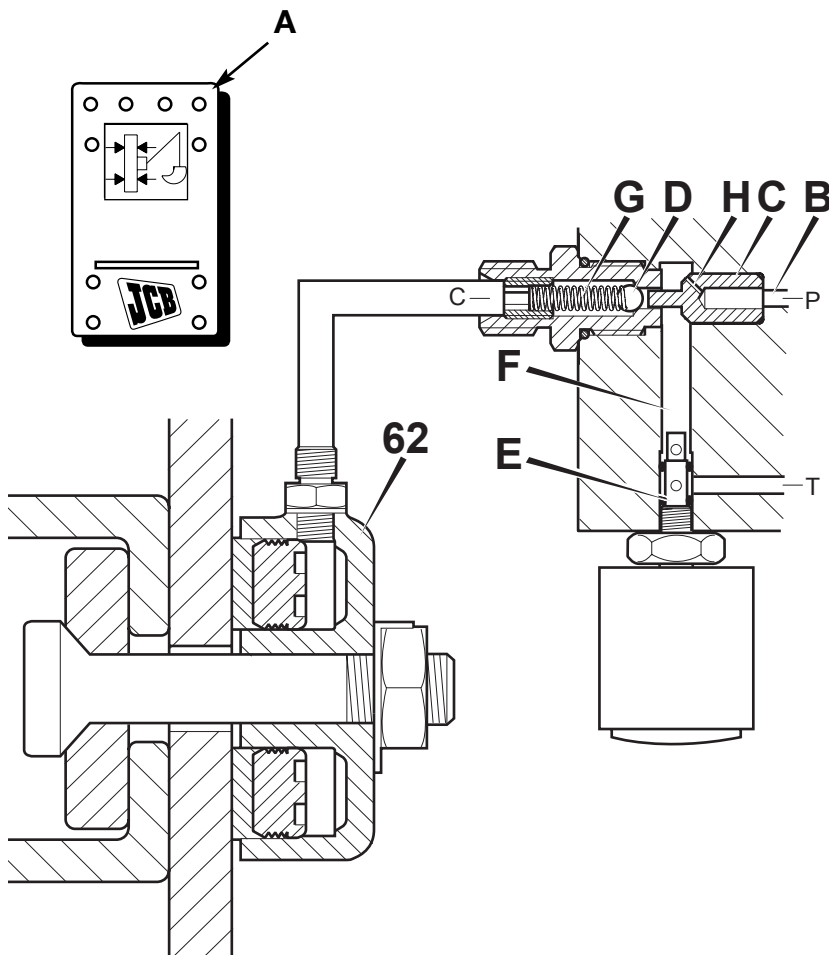
With ball **D** lifted and the solenoid valve in its energised state, oil from the hydra-clamps is vented through the clamp valve and gallery **F** to the drain port **T** (tank).

Also, pressure resulting from the operation of an excavator service passes through restrictor **H**. The oil takes the path of least resistance and is vented via gallery **F** to the drain port **T** (tank).

Restrictor **H** ensures that only a small amount of oil from gallery **B** is dumped back to tank.

3 - Clamps Locked Up

If no service is being operated, pressure in the parallel gallery falls to that of the neutral circuit and the force of spring **G** is sufficient to keep the ball **D** seated. Pressure is therefore trapped in the line to the clamps, maintaining the excavator end in a securely clamped condition.



A402930

Excavator Valve

Precision Control (Servo) (continued) (Machines from January 2003)

In the interest of machine efficiency and consistent backhoe operation the excavator valve is of a closed centre design and incorporates pressure compensating valves **F**, for each service.

These features enable the valve to operate as follows:

No service selected (all spools in neutral)

Oil from the loader valve high pressure carry over enters the excavator valve at the inlet port **A**. Oil flows across the flushing valve spool assembly **B** and returns to tank from the outlet port **C**.

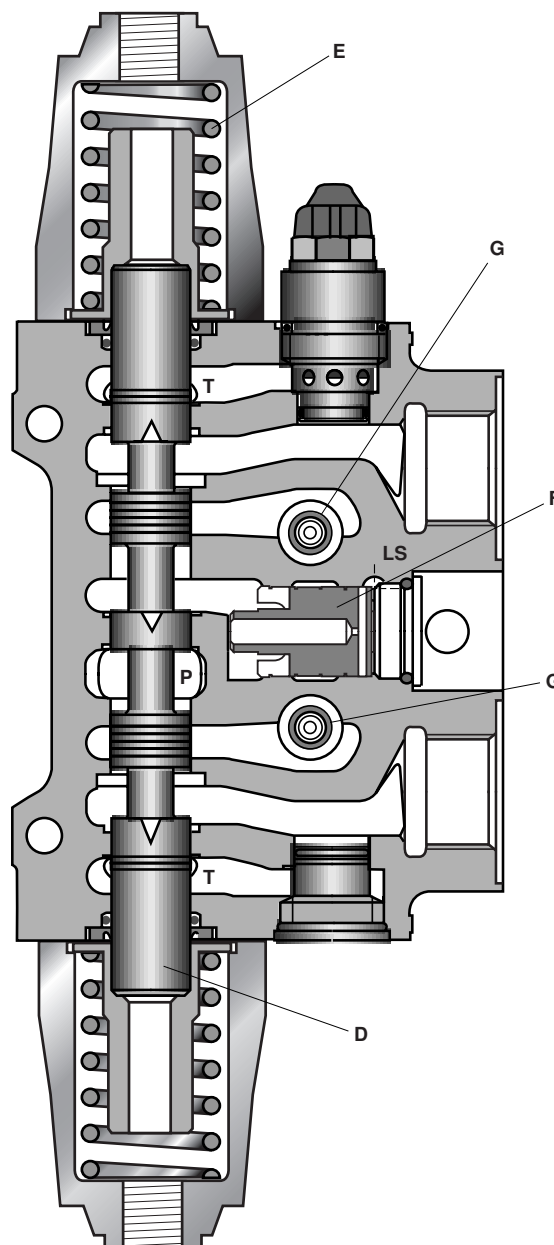
Servo Spool Actuation

When a service is operated servo pressure from the joystick control valve acts on the end of the relevant service spool **D** and displaces the spool proportionally against the force of the centering spring **E**, allowing the oil to flow to move the required service. When the servo pressure on the end of the service spool is reduced the force of the centering spring overcomes the servo pressure and the service spool will move back proportionally to the central neutral position.

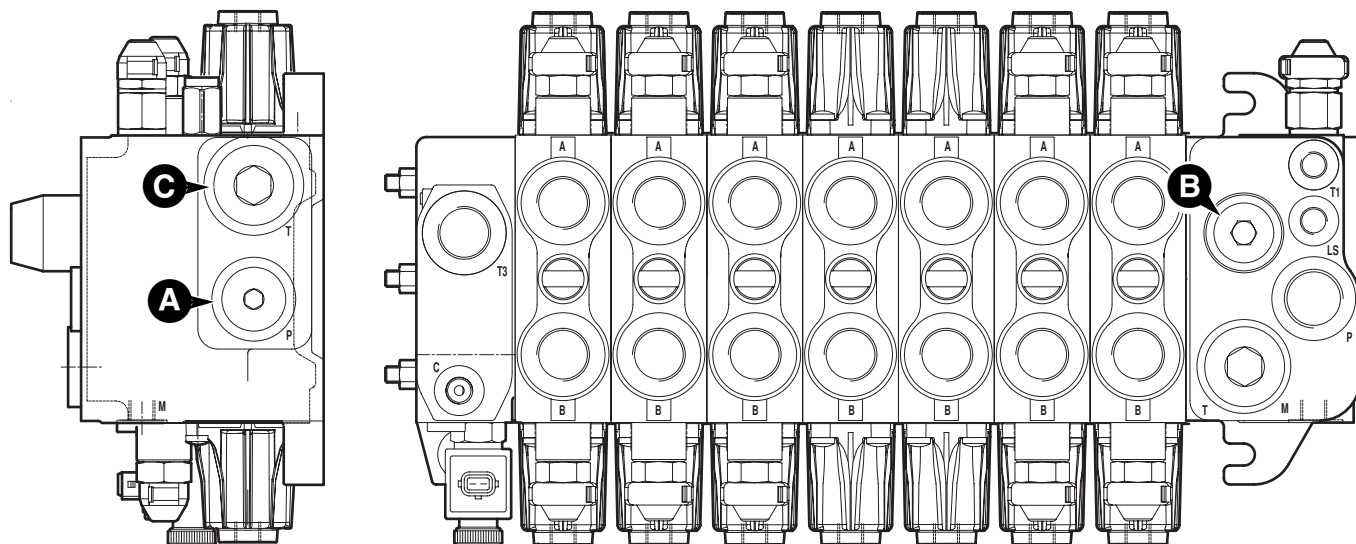
When a Service is Selected

When one or more services are selected the pressure compensator valves **F** detect the service generating the highest pressure. This causes the flushing valve spool **B** to close and allow pump flow to the spools and service ports at sufficient pressure to move the load. Load hold check valves **G** prevent the load falling back if the load pressure is greater than the pump pressure. The closed centre design ensures consistent service operation regardless of load.

For a full description of spool and pressure compensator valve operation see **Load Sense - Pressure Compensator Valve Operation**.



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Excavator Valve

Precision Control (Servo) (continued) (Machines from January 2003)

Load Sense - Pressure Compensator Valves Operation

No service selected (all spools in neutral)

With the spools in the neutral position oil from the pump **P** flows to each service spool **S** and is dead ended. This generates sufficient pressure (about 15bar) to overcome the spring **E1** and oil flows across the flushing valve spool assembly **E** to tank **T**. Any load acting on the service ram **R** is held by the service spool **S**.

Oil in the load sense gallery **LS** is vented to tank across the flow regulator valve **F**.

The pressure compensator valve **PC** and load hold check valves **CV** are closed.

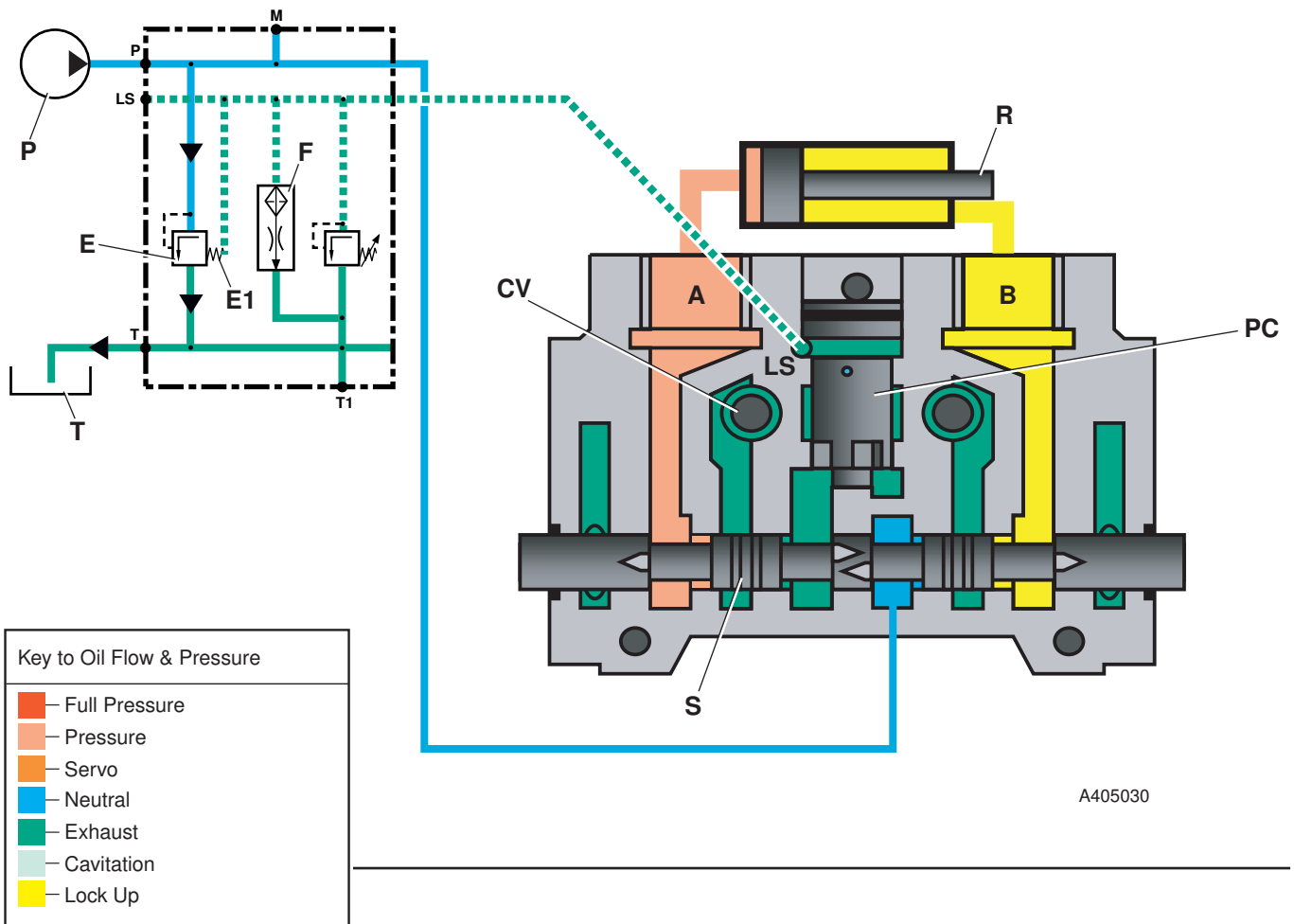
Operating a service

The service spool **S** is moved by servo pressure connecting the oil from the pump **P** to the gallery **P1**. The pressure in this chamber opens the pressure compensator valve **PC** allowing oil into the load sense gallery **LS**. Oil pressure builds in the gallery **LS** and the flushing valve spool **E** begins to close under the combined action of the oil pressure and spring force, causing the pump pressure to rise as follows:

Pump pressure = Pressure in load sense gallery **LS** + pressure from spring **E1**.

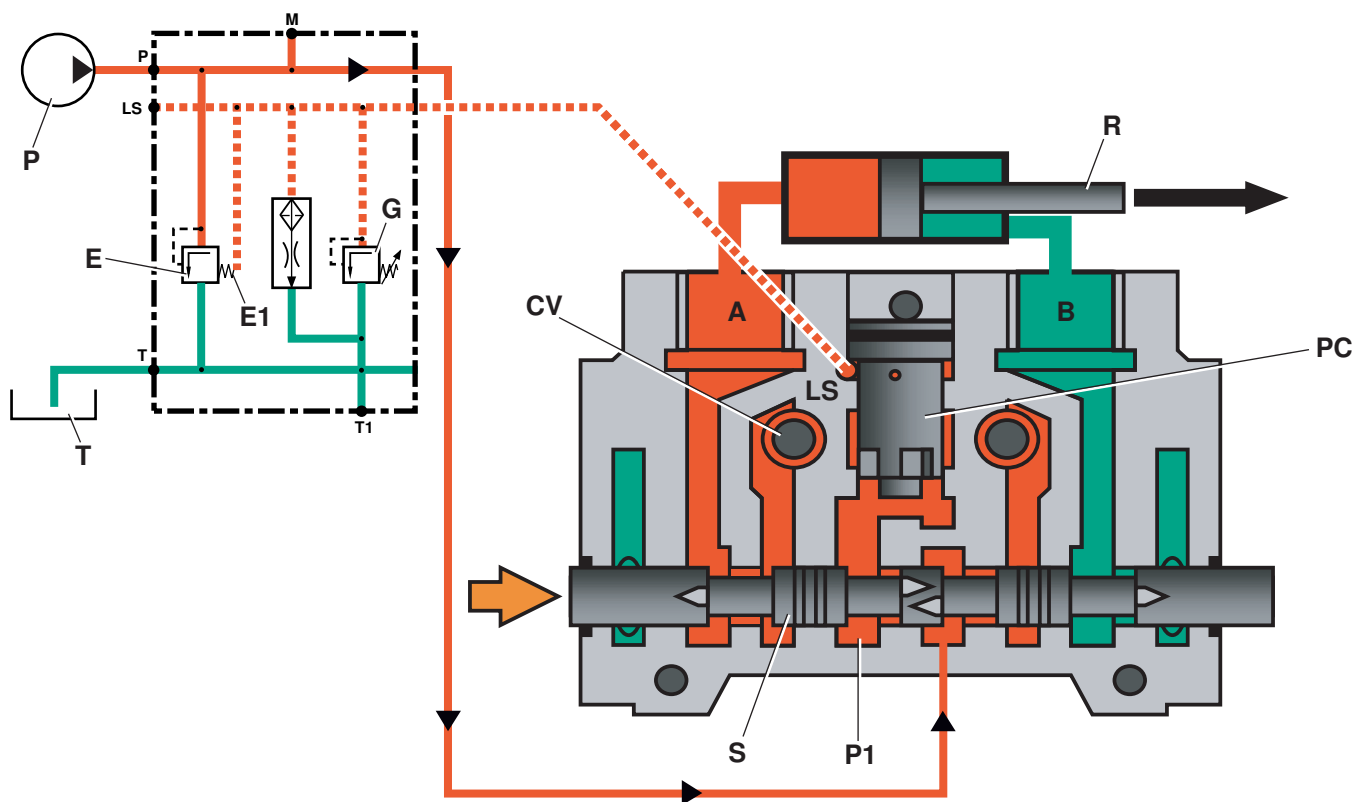
When the pump pressure has risen sufficiently i.e. to a pressure equal to the load + spring pressure (15 bar) the load hold check valve **CV** moves off its seat and allows oil to flow into the service gallery **A**, initiating movement of the service ram **R**. Exhaust oil from the other side of the service ram is directed by the service spool **S** to tank.

The maximum load sense pressure and hence pump pressure is set by the load sense relief valve **G**.

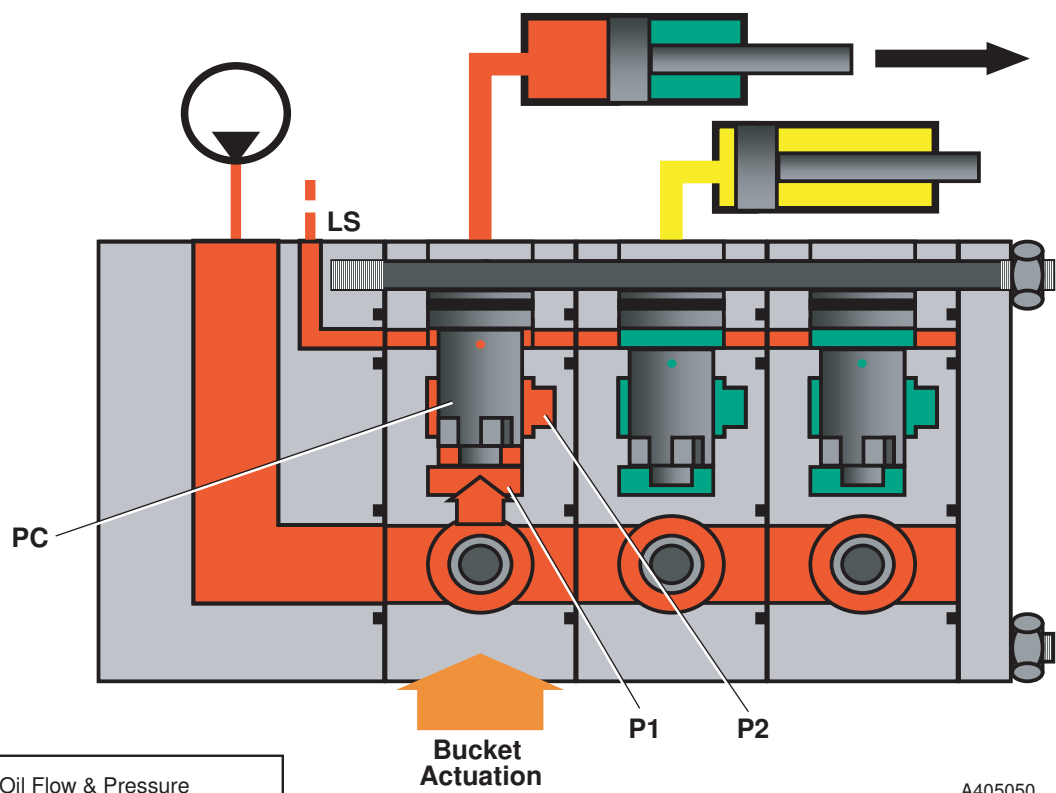


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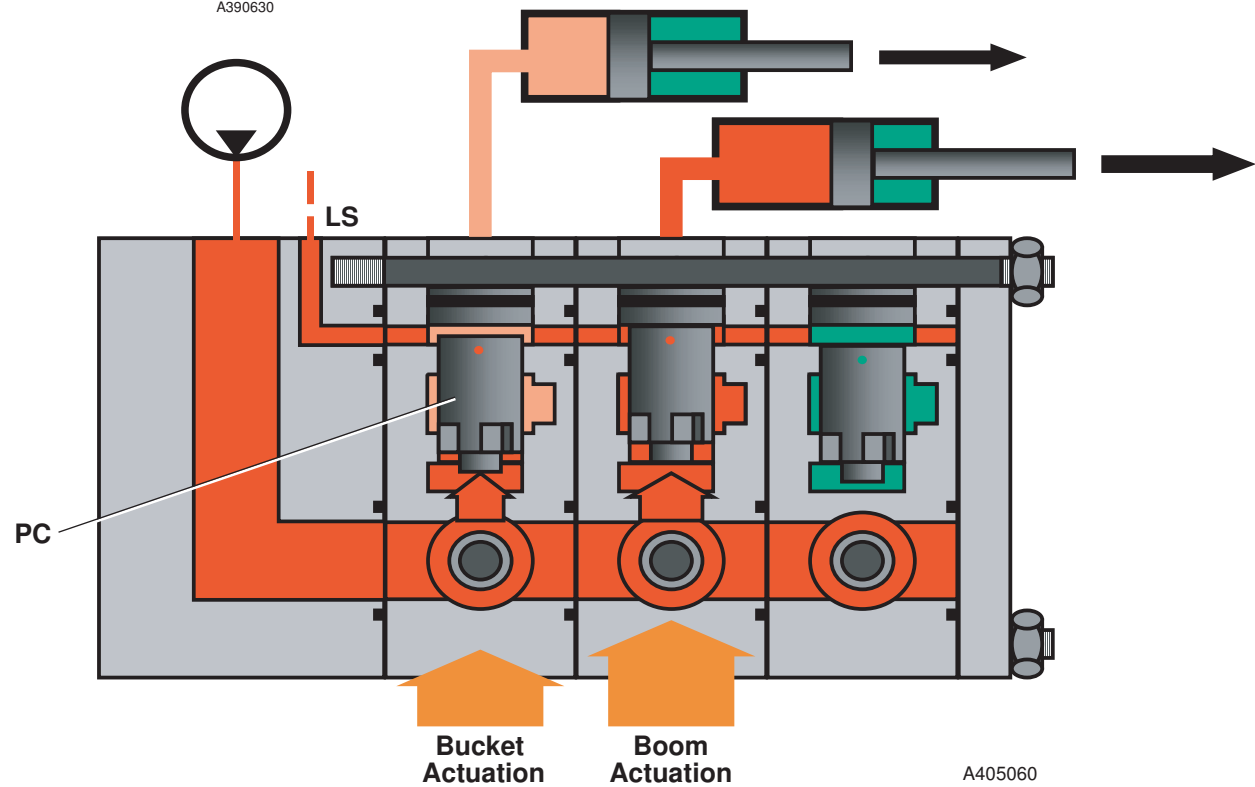
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A405050

Key to Oil Flow & Pressure	
	Full Pressure
	Pressure
	Servo
	Neutral
	Exhaust
	Cavitation
	Lock Up

A390630



A405060

Excavator Valve

Precision Control (Servo) (continued) (Machines from January 2003)

Load Sense - Pressure Compensator Valves Operation

Operating an individual service

It must be noted that the load sense gallery **LS** is connected to all the pressure compensator valves **PC** (one for each service) as shown. The pressure in the load sense gallery **LS** will always be equal to the highest load from any of the backhoe services.

The pressure compensator valves are fitted between each service spool and service ram and sense the pressure acting on either side of the particular service spool. The pressure compensator valve will move in response to the pressure drop (pressure differential) created across the spool.

When one service only is operated the pressure compensator valve **PC** is FULLY opened as shown, connecting the gallery **P1** to gallery **P2** and to the ram service port without any pressure drop.

Operating multiple services

a) Normal Condition

When another service with a higher load is operated simultaneously, a typical example is the lifting of the boom and simultaneous operation of the bucket as shown.

The higher load pressure in the boom service causes the pressure compensator valve **PC** in the bucket service to partially close, reducing the size of the opening through which the oil must flow, and in this way maintains a pressure drop across the pressure compensator equal to the pressure drop across the bucket service spool.

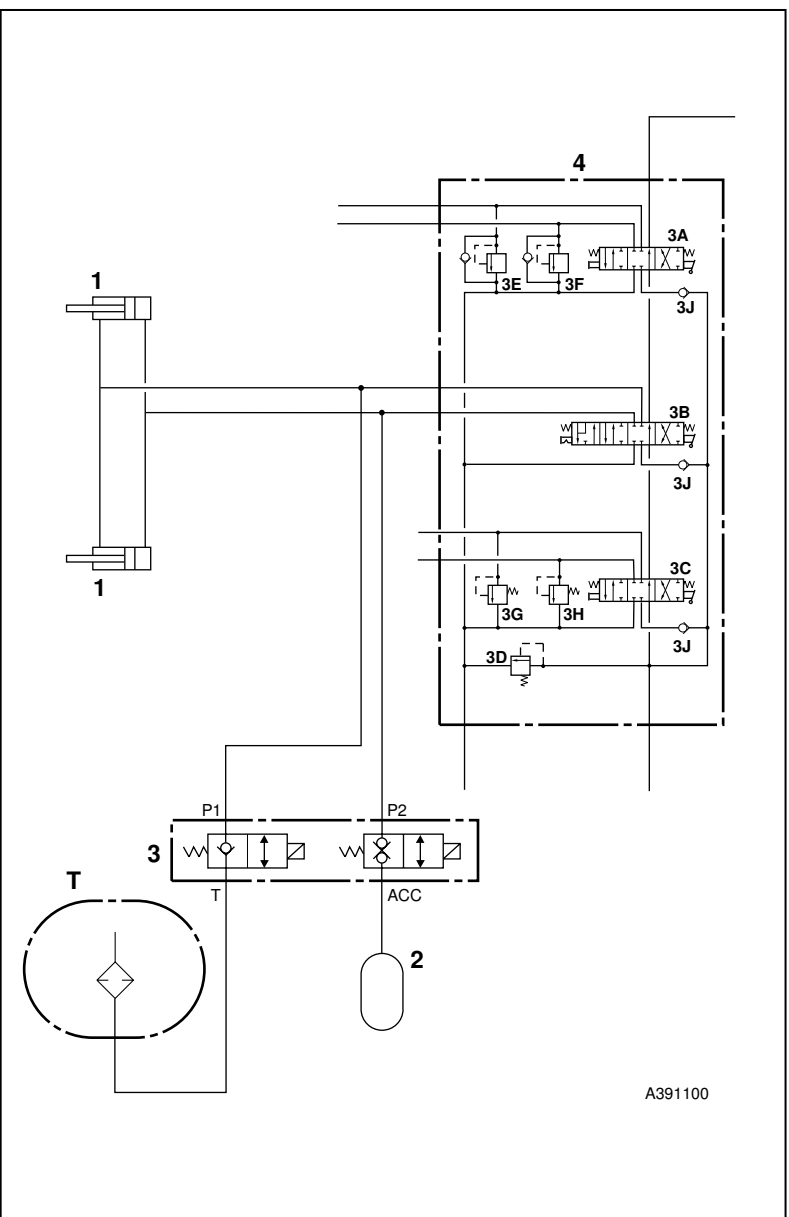
In this example, because of the action of the pressure compensator valve the bucket service is always kept independent of the other services, the bucket ram speed remains constant (as controlled by the bucket service spool) and is not affected by the greater operating pressure in the boom service.

b) With insufficient flow from pump

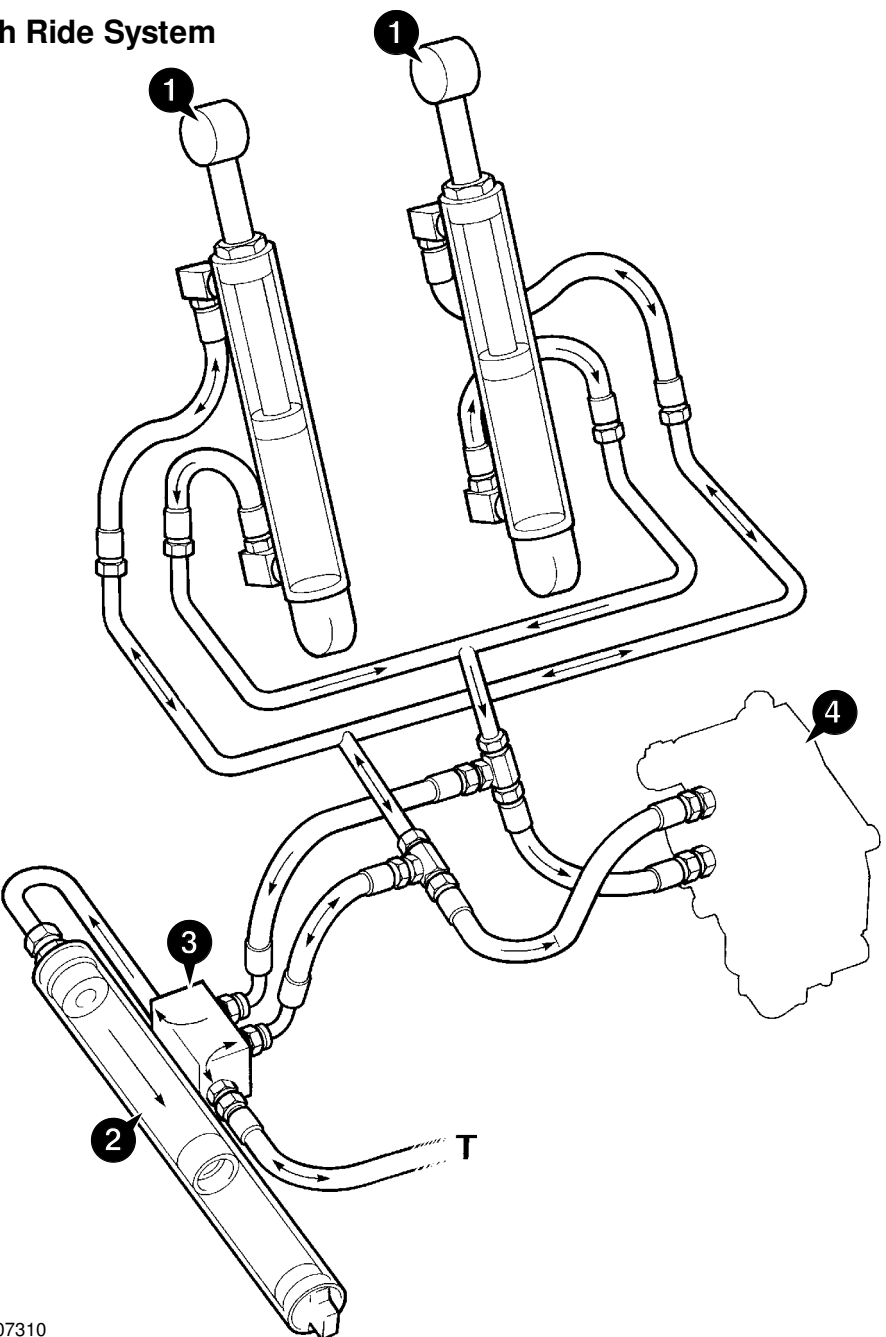
Should the oil flow demanded by the sum of the combined services operating ever exceed that of the pump, all the pressure compensator valves will partially close accordingly, effectively dividing the available flow between all the services proportionally.

In this condition the service ram with the highest load will NOT stop, because the speed of the other service rams operating will have been reduced proportionally by the action of the pressure compensator valves to compensate.

When one of the service spools is returned to neutral, the speed of the other service rams still operating will all increase proportionally.



Smooth Ride System



Smooth Ride System

Smooth Ride System (SRS) will enhance the comfort of the ride by damping out the forces imposed on the machine by the movement of the loader arms as the machine travels over uneven surfaces.

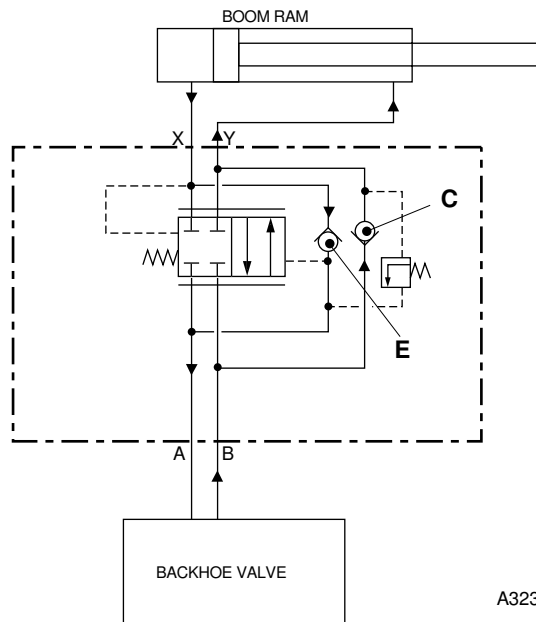
This is achieved by connecting the head side of the loader arms **1** to a pressurised piston type accumulator **2**.

When a switch in the cab is operated, selector valve **3** is energised and opens. Hydraulic oil from the piston head side is dead ended at the loader valve block **4** but is connected to the accumulator. The rod side of the loader ram is connected to tank **T** via the selector valve to make up or dissipate oil as required.

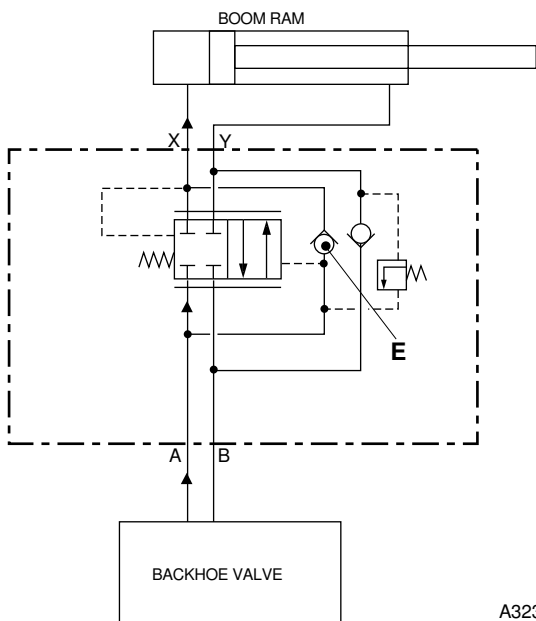
Note: The smooth ride system will not function on machines fitted with hose burst check valves.

Component Key:

- 1** Loader Lift Rams
- 2** Accumulator
- 3** Solenoid Valve Block
- 4** Loader Valve Block
- T** Tank



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Hose Burst Protection Valve

Boom & Dipper Operation

The small letter annotations **A**, **B**, **X**, and **Y** are stamped on the valve.

Operation 1 - Load Raise

When 'dipper out' is selected, oil from the excavator valve block is fed to port **B**, the oil opens check valve **C** against spring **D** and passes through internal galleries into the rod (raise) side of the ram via port **Y**.

Oil from the head side of the ram enters at port **X**, opens check valve assembly **E** and returns to tank via port **A** and the excavator valve block.

Operation 2 - Load Lower

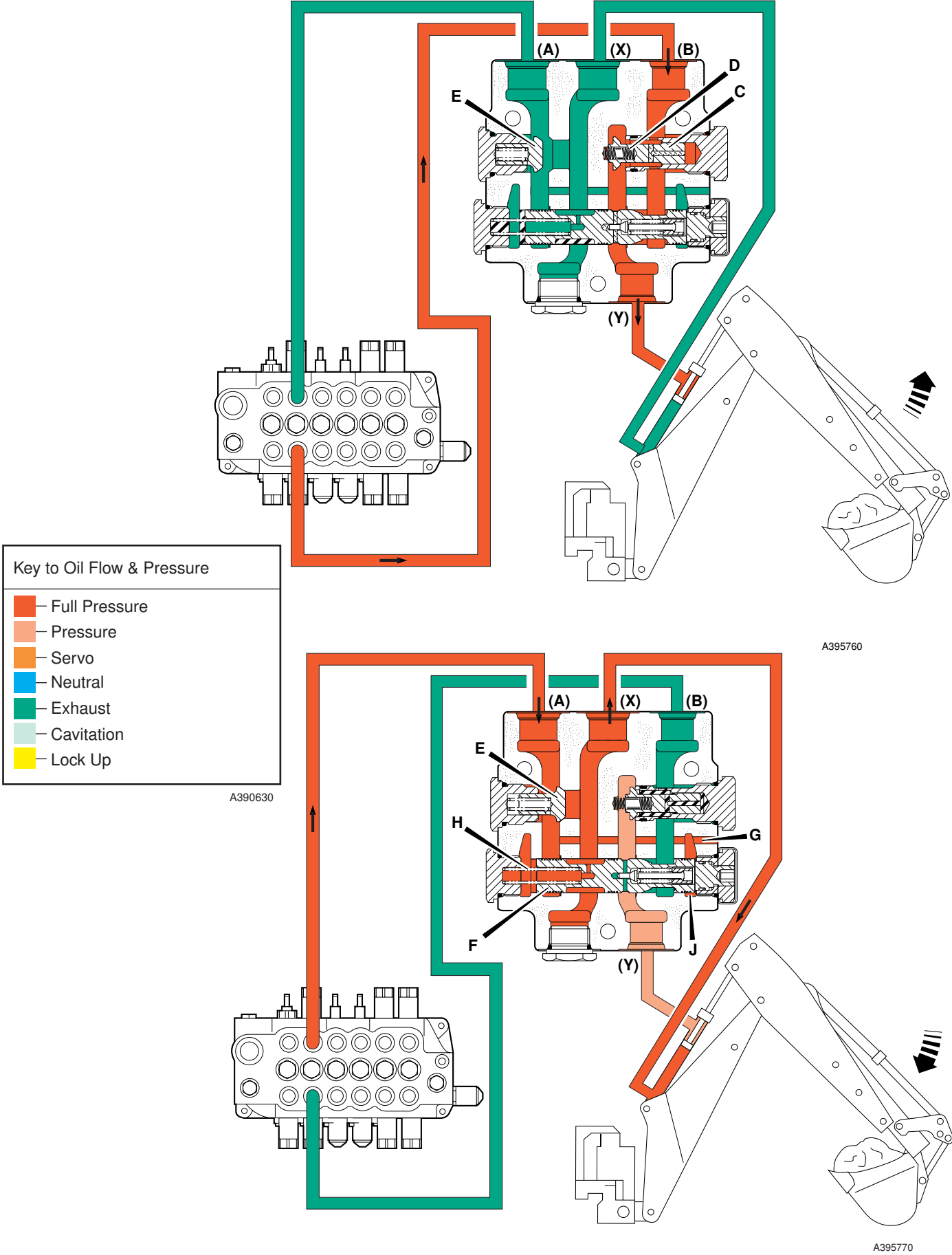
Oil from the excavator valve block is fed to port **A**. The connection to the head side of the ram is blocked by the check valve assembly **E** and the position of spool **F**.

A cross drilling **G** in the valve connects the **A** port gallery to cavity **J**. The pressure in cavity **J** increases to such a point that it moves spool **F** to the left against the force of spring **H**. The new position of the spool creates a connection between the **A** port gallery and the head side of the dipper ram (via port **X**).

There is also a connection between the **Y** port gallery and the **B** port gallery. Oil from the rod side of the ram enters at port **Y** and returns to tank via port **B** and the excavator valve block.

Component Key:

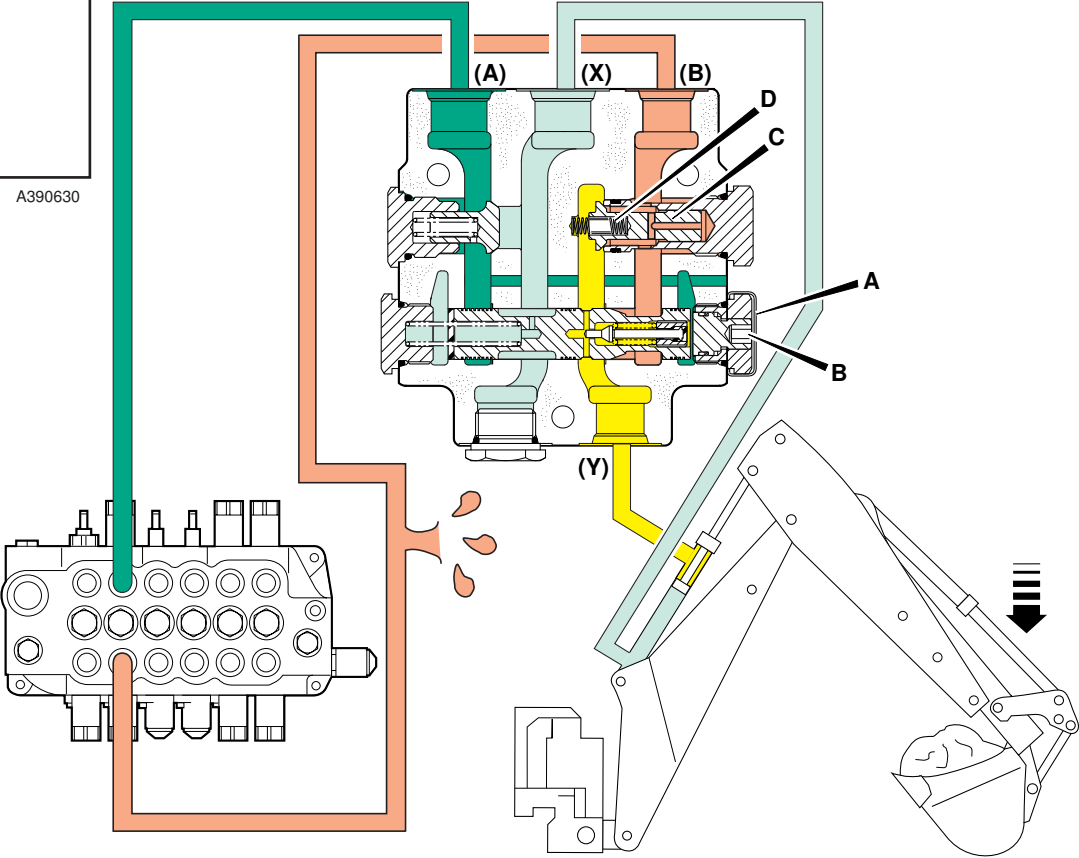
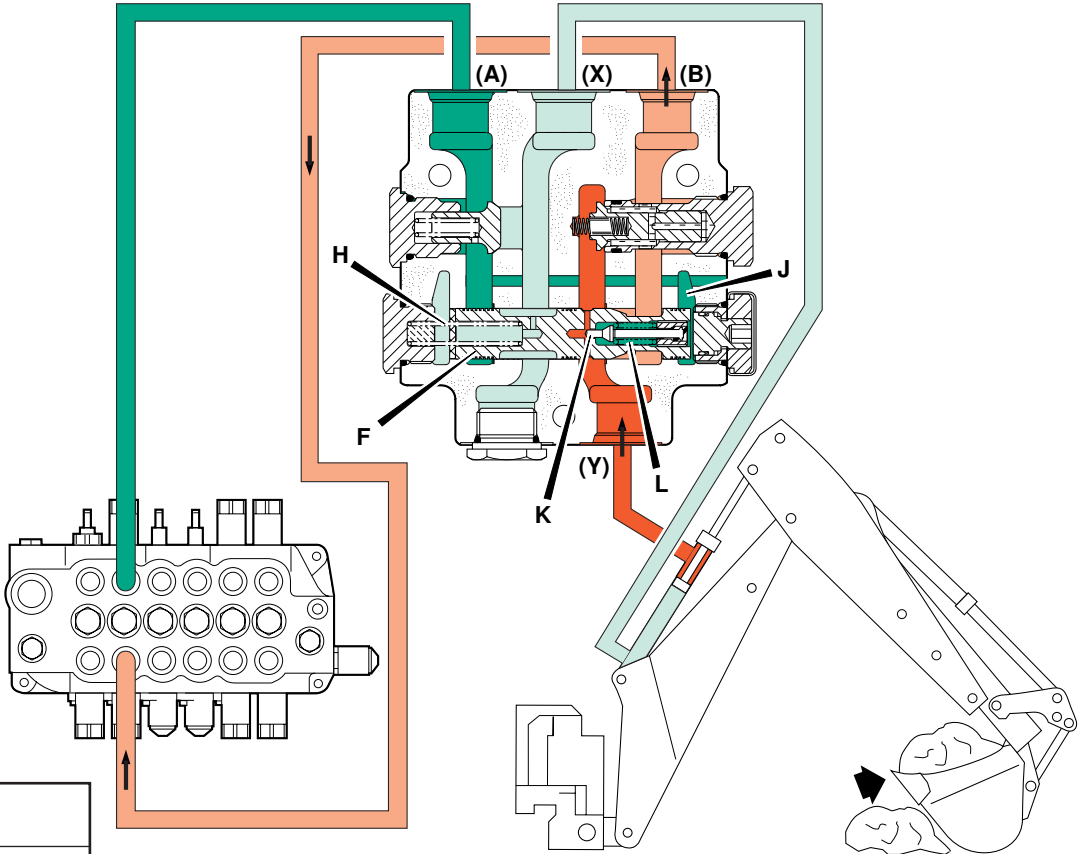
- C** Check Valve
- D** Spring
- E** Check Valve Assembly
- F** Spool
- G** Cross Drilling
- H** Spring
- J** Cavity



Key to Oil Flow & Pressure

- Full Pressure
- Pressure
- Servo
- Neutral
- Exhaust
- Cavitation
- Lock Up

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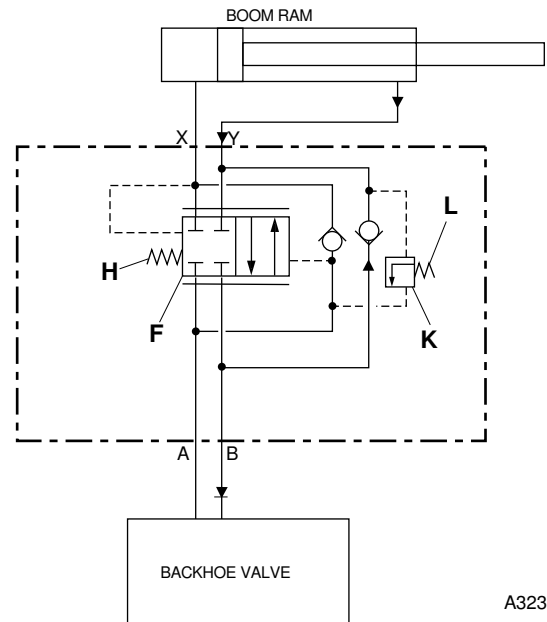
Hose Burst Protection Valve

Boom & Dipper Operation (Cont'd)

Operation 3 - Relief Valve

If during normal operation the pressure in the rod side of the dipper ram increases (for example, by the operation of the bucket against an obstacle), increasing pressure in the ram enters at port **Y**. The position of spool **F** prevents this increasing pressure from venting back to the tank. The pressure increases to such a point that it moves plunger **K** off its seat (to the right) against the force of spring **L**.

The new position of plunger **K** opens a connection to cavity **J**, the pressure is high enough to move spool **F** to the left against the force of spring **H**. The new position of the spool creates a connection from the rod side of the ram to port **B**. Note that oil exhausted via port **B** will not reduce to low pressure until the A.R.V. in the excavator valve block also opens.

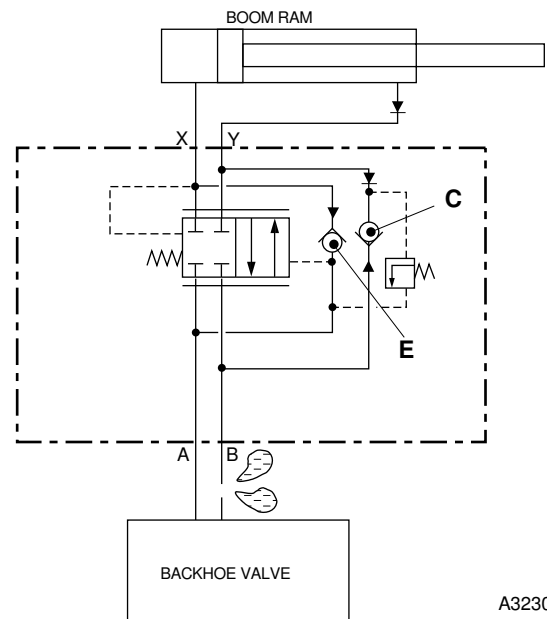


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Operation 4 - Hose Burst Condition

If a burst hose or other leakage occurs in the feed to the rod (raise) side of the ram, check valve **C** will be kept firmly held on its seat by the back pressure generated due to the weight the load in the bucket and the force of spring **D**.

Oil trapped between the valve and the ram will prevent movement of the load. To lower the load, see Lowering The Load.



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Component Key:

- C** Check Valve
- D** Spring
- F** Spool
- H** Spring
- J** Cavity
- K** Plunger
- L** Spring

Hose Burst Protection Valve

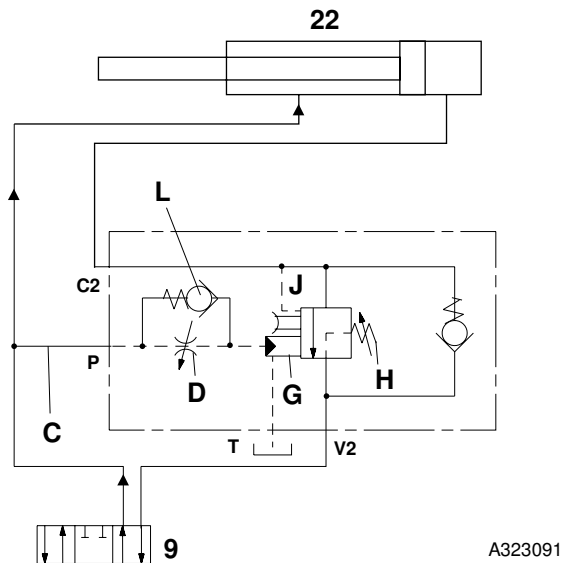
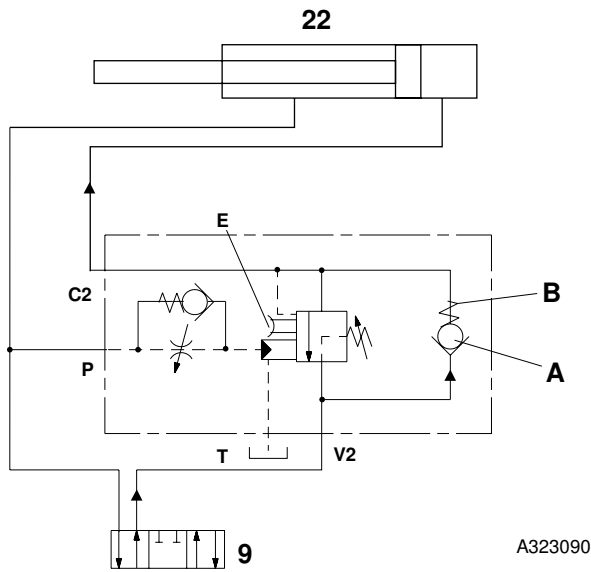
Loader Operation

The small letter annotations **V2**, **C2**, **P**, **T** and **E** are the same as the port markings found on the HBPV.

Operation 1 - Load Raise

When lift is selected, oil from the loader valve block **9** is fed to port **V2** on the HBPV, the oil opens check valve sleeve **A** against spring **B** and passes through internal galleries into the (raise) side of the ram via port **C2**.

Oil from the lower side of the ram returns to tank via port **P** and the loader valve block.



Component Key:

- A** Check Valve Sleeve
- B** Spring
- C** Pilot Line
- D** Drilling
- F** Thread
- G** Piston
- H** Spring
- J** Plunger
- L** Ball
- N** Orifice
- Q** Chamber
- 9** Loader Valve Block

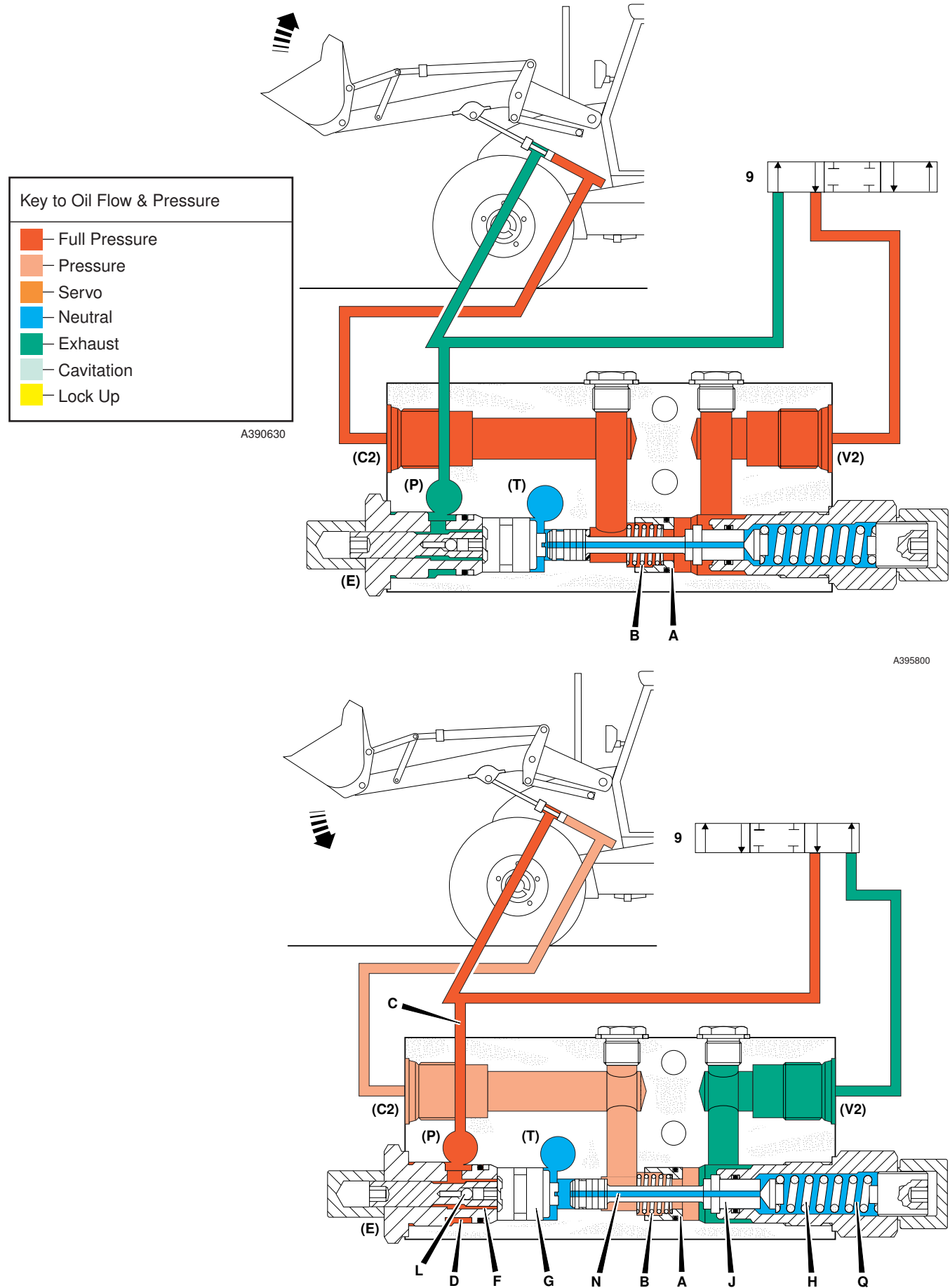
Operation 2 - Load Lower

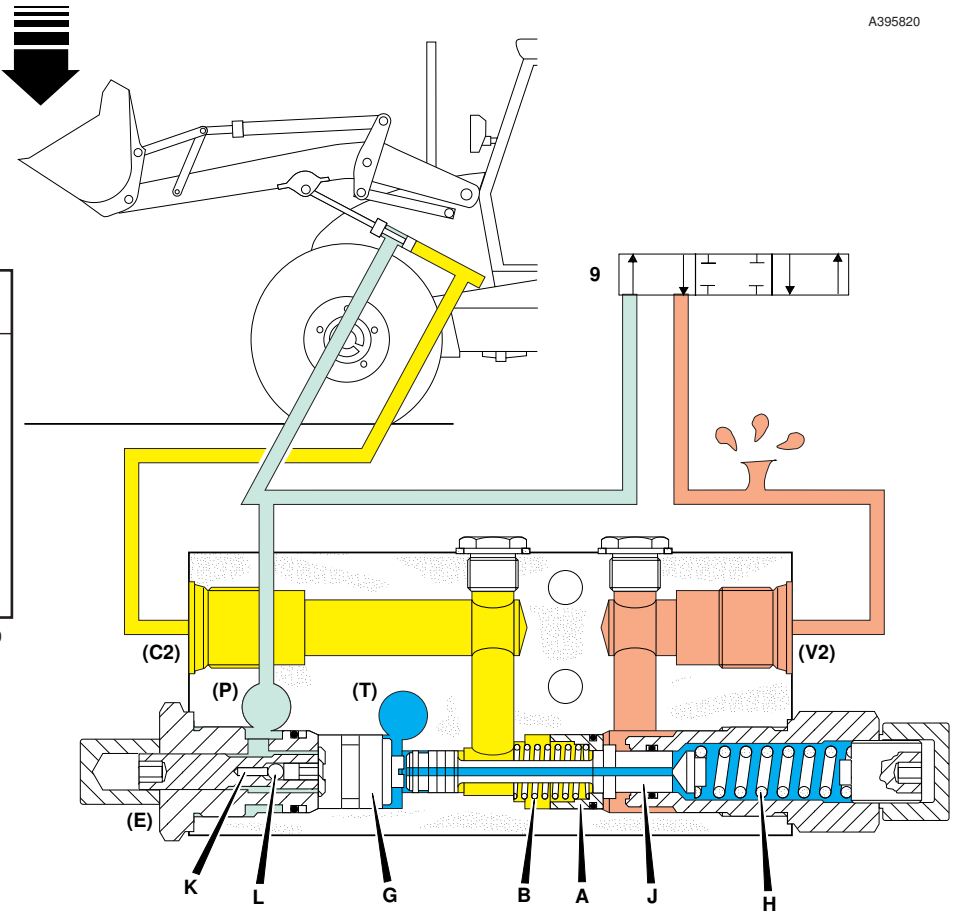
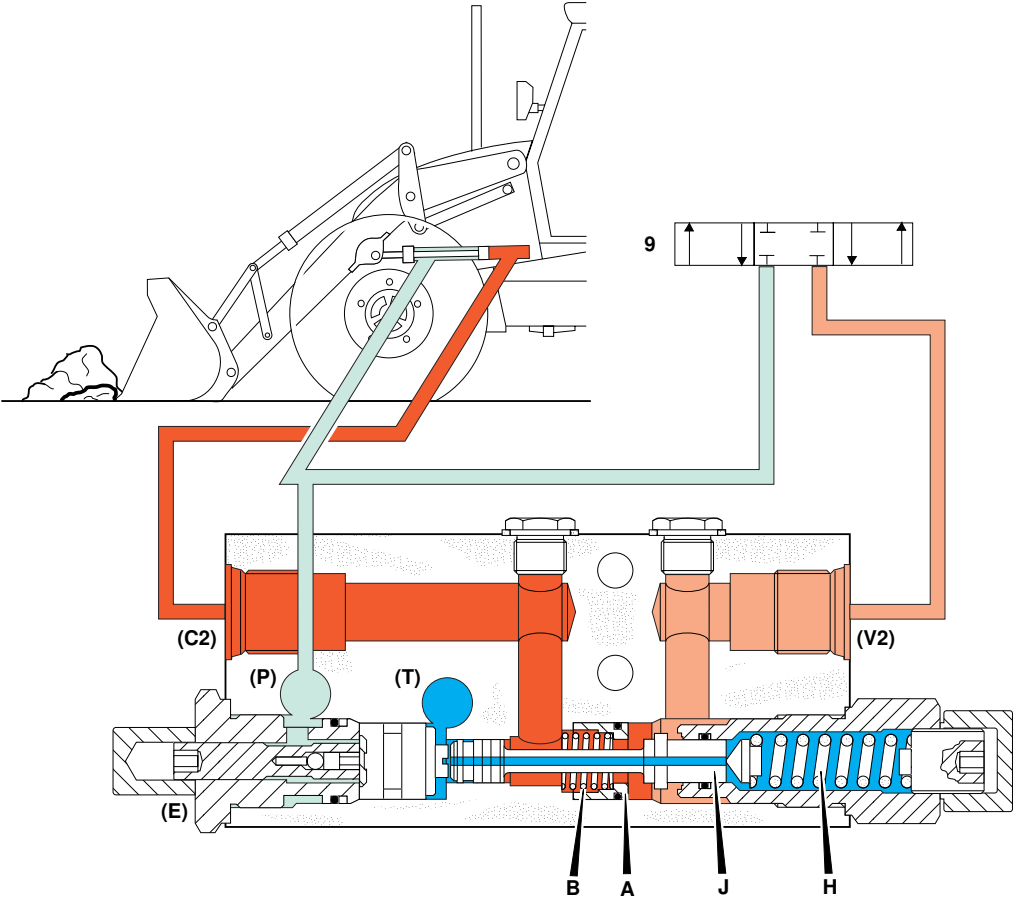
Oil from the loader valve block **9** is fed directly to the (lower) side of the ram. A pilot line **C** from the service line is connected to the HBPV at port **P**.

Oil enters the HBPV at port **P** and passes through drilling **D**, down threads **F** and acts on the end face of piston **G**. The pressure is sufficient to move piston **G** to the right, thus moving plunger **J** off its seat against spring **H**. With the plunger off its seat, oil from the opposite side of the ram enters the HBPV at port **C2**, passes through the HBPV and returns to tank via port **V2** and the valve block.

A drilled hole **N** through the centre of plunger **J** connects chamber **Q** to atmosphere **T**, this prevents the pressure in chamber **Q** from rising to such a point that it would prevent any movement of plunger **J**.

Threads **F** and the one-way check valve ball **L** act as restrictors to 'dampen' any adverse effects of operating the control levers erratically.





Key to Oil Flow & Pressure

- Full Pressure
- Pressure
- Servo
- Neutral
- Exhaust
- Cavitation
- Lock Up

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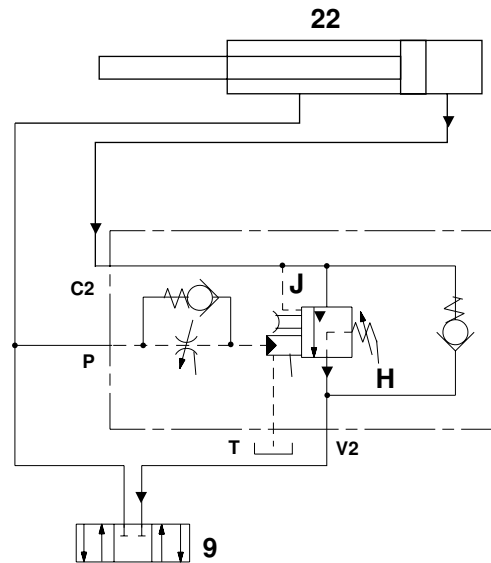
Hose Burst Protection Valve

Loader Operation (Cont'd)

Operation 3 - Relief Valve

If during normal operation the pressure in the ram increases (for example, by the operation of the bucket against an obstacle), increasing pressure in the ram enters the HBPV at **C2** and will be sensed on the face of plunger **J**. When the force of spring **H** is exceeded, the plunger is made to move off its seat thus allowing oil to flow through the valve to port **V2**.

Note: Oil exhausted via port **V2** will not reduce to low pressure until the A.R.V. in the valve block **9** also opens.

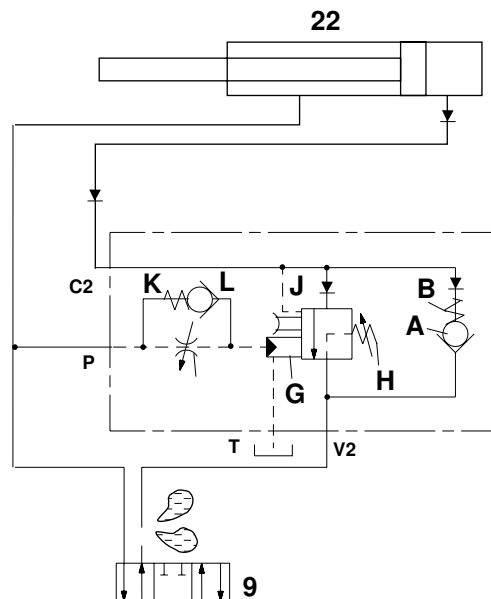


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Operation 4 - Hose Burst Condition

In the event of a hose burst or other leakage in the feed to the HBCV, plunger **J** will be held on its seat by the force of spring **H**. Also, back pressure and the force of spring **B** will hold check valve seat **A** firmly against the plunger, thus trapping a column of oil in the head side circuit which will prevent the load from dropping.

Note that before the plunger can move onto its seat, the pressure on the pilot side of the piston **G** must vent to atmosphere quickly, therefore ball **L** will open against the force of spring **K** which allows the oil to vent down the threads AND through the drilling previously plugged by ball **L**.



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Component Key:

- A** Check Valve Seat
- B** Spring
- G** Piston
- H** Spring
- J** Plunger
- K** Spring
- L** Ball
- 9** Loader Valve Block

Hydraulic System - Fixed Flow

Fault Finding Contents

Introduction

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

	Page No.	
Introduction	15 - 1	To help identify circuits, valves, rams etc mentioned in the fault finding procedures, refer to the hydraulic schematic diagrams (near the beginning of the Hydraulics Section).
Lack of power in all hydraulic functions	15 - 1	
All hydraulic rams slow to operate	15 - 2	1 Before you begin fault finding, read the Safety information at the beginning of this manual.
One hydraulic service fails to operate or is slow to operate	15 - 2	2 Make simple checks before say, stripping a major component.
The engine tends to stall when the hydraulics are under load	15 - 2	3 Make sure that the hydraulic fluid is at correct working temperature (50 °C, 122 °F).
A spool is sticking	15 - 3	4 What ever the fault, check the condition of the hydraulic fluid. Drain and replace if necessary.
Leaking Oil Seal (Control Valves)	15 - 3	
Ram creep	15 - 3	5 Make any relevant electrical checks before moving on to the hydraulics.
Hydraulic oil becomes too hot	15 - 4	6 Be sure to remove ALL contamination and if possible identify its origin. It may be part of a component from elsewhere in the circuit.
		7 Replace any seals such as 'O' rings before re-assembling hydraulic components.

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

Fault	Probable Cause	Action
2 All hydraulic rams slow to operate.	Neutral circuit or low pressure lines leaking, damaged, trapped or kinked.	Check pipe lines and replace as required.
	Low pump flow.	Check pump flow, if required service or replace pump.
	Priority valve operating.	Check if the priority valve is sticking, rectify as required.
	Main relief valve (MRV) setting incorrect.	Check and adjust as required.
	Unloader valve	Check if unloader valve is sticking, i.e. dumping flow from pump section P2.
	Tank filter by-pass valve	Check condition of hydraulic filter
	Hydraulic tank breather	Clean or replace the breather
3 One hydraulic service fails to operate or is slow to operate.	Associated service pipe lines , leaking damaged, trapped or kinked.	Check hoses, replace as required.
	Associated ram leaking.	Complete ram leakage check, replace seals as required.
	Auxiliary relief valve (ARV) setting incorrect.	Check and adjust as required.
	Associated valve block section leaking or not operating.	Check for leaks, rectify as required. Also, see fault 6 'Leaking Oil Seal (Control Valves)'. Make sure that the associated load hold check valve is operating.
	Check valve malfunctioning (if fitted, e.g. stabiliser circuit)	Check that the control lever and associated linkages is operating the spool, rectify as required. Also, see fault 5, 'A spool is Sticking'.
	Hose burst protection valve (if fitted) malfunctioning.	Test check valve, rectify as required.
	Piston rod is bent	Test HBPV, service as required. Replace piston rod, check pressure settings of MRV and ARV. Check that associated pivot pins are adequately greased
4 The engine tends to stall when hydraulics are under load.	M.R.V setting incorrect.	Check and adjust as required.
	Poor engine performance.	Check engine performance, see transmission section for stall speed test procedures.
	Unloader valve pressure setting too high	Check pressure setting of the unloader valve.

Fault	Probable Cause	Action
5 A spool is sticking.	Oil temperature abnormally high.	Check for correct fluid, see Lubricants and Capacities. Check oil cooler and grille for blockage.
	The hydraulic fluid is dirty.	Clean the tank strainer. If strainer badly clogged, drain and flush hydraulic system. Fill with clean hydraulic fluid.
	The service pipe connection is over tightened.	Check tightening torque.
	The valve housing was twisted during installation.	Loosen retaining bolts and tighten to correct torque figures.
	Pressure too high.	Check system pressure.
	A control linkage is bent	Disconnect the linkage. Repair the linkage if possible, or fit a new one
	A spool is bent	Dismantle the control valve. Renew spool as necessary.
	A return spring is broken.	Renew as necessary.
	A return spring or cap is out of alignment.	Remove the cap, check that the spring is in the correct position. Refit cap and torque tighten bolts
	Temperature distribution within control valve not uniform.	Warm the entire system up before using service.
6 Leaking Oil Seal (Control Valves)	Paint or dirt on the seal face.	Remove the seal and clean.
	The back pressure in the valve circuit is excessively high.	Check circuit pressures, adjust if possible. Otherwise investigate thoroughly.
	Spool damaged.	Dismantle. Inspect all parts. Renovate or renew as necessary.
	The seal is not secured.	Clean the seal and tighten the retaining bolts to the correct torque.
	The seal is cut or damaged.	Fit a new seal.
7 Ram creep.	Associated ram or pipe lines from ram leaking.	Check and rectify as required.
	Check valve malfunctioning (if fitted, e.g. stabiliser circuit)	Test check valve, rectify as required.
	Associated valve section spools leaking.	Rectify, check for contamination.
	Associated ARV leaking	Rectify, check for contamination

Note: Refer also to **Service Procedures, Ram Creep Tests - All Services**

Fault	Probable Cause	Action
8 Hydraulic oil becomes too hot	Oil cooler obstructed	Remove debris from cooler fins
	Restriction in neutral circuit lines	Check hoses, replace as necessary
	Hydraulic filter clogged and by-pass valve not working	Change hydraulic filter

Hydraulic System - Variable Flow

Fault Finding Contents

	Page No.
Introduction	15 - 10
High or low system pressure	15 - 10
Pump stays at high pressure	15 - 10
Pressure or flow obtained at one port only	15 - 10
No pressure or flow at either port	15 - 10
High work port leakage	15 - 10
Leaks between sections	15 - 11
Sticking spool	15 - 11
Detent will not hold	15 - 11
Electrical detent will not hold	15 - 11
Poor performance, slow operating speed and/or low maximum stall speed	15 - 11

Introduction

This section details the possible faults that may be found with the loader and backhoe valve blocks. The faults listed only appertain to valve blocks fitted on variable flow hydraulic machine systems (Rexroth valves).

- 1 Before you begin fault finding, read the Safety information at the beginning of this manual.
- 2 Make simple checks before say, stripping a major component.
- 3 Make sure that the hydraulic fluid is at correct working temperature (50 °C, 122 °F).
- 4 What ever the fault, check the condition of the hydraulic fluid. Drain and replace if necessary.
- 5 Make any relevant electrical checks before moving on to the hydraulics.
- 6 Be sure to remove ALL contamination and if possible identify its origin. It may be part of a component from elsewhere in the circuit.
- 7 Replace any seals such as 'O' rings before re-assembling hydraulic components.

PROBLEM: High or Low system pressure.
POSSIBLE CAUSE: 1) Wrong pressure and/or flow regulator valve settings. 2) Loss of pilot signal due to shuttle failure.
CORRECTIVE ACTION: 1) Readjust regulator valves. 2) Operate individual services to determine which shuttle is at fault, refer to **Service Procedures, Variable Flow Pumps, Shuttle Valve Signal Network - Testing**.

PROBLEM: Pump stays at high pressure.
POSSIBLE CAUSE: 1) Sticking main spool. 2) Sticking compensator spool.
CORRECTIVE ACTION: 1) See 'Sticking Spool' guide. 2) Remove & clean compensator spool.

PROBLEM: Can only obtain pressure or flow at one port.
POSSIBLE CAUSE: 1) Dirt in primary shuttle or damaged o-ring.
CORRECTIVE ACTION: 1) Remove & clean shuttle, inspect o-ring and replace if required.

PROBLEM: No pressure or flow at either port.
POSSIBLE CAUSE: 1) Dirt in secondary shuttle.
CORRECTIVE ACTION: 1) Shift one spool at a time with blocked ports until faulty section found, remove shuttle and clean, inspect o-ring and replace if required.

PROBLEM: High work port leakage.
POSSIBLE CAUSE: 1) Spool not centred. 2) Dirt in port relief valve.
CORRECTIVE ACTION: 1) Check centring springs. 2) Remove & clean relief valve.

PROBLEM: Leaks between sections.
POSSIBLE CAUSE: 1) Missing or cut seals.
CORRECTIVE ACTION: 1) Disassemble valve stack and check for missing or cut o-rings.

PROBLEM: Sticking spool.
POSSIBLE CAUSE: 1) Linkage binding. 2) Damaged spool. 3) Uneven torque of tie-rod. 4) Incorrect number of shims on tie-rods.
CORRECTIVE ACTION: 1) Check linkage. 2) Remove and inspect spool. 3) Loosen tie-rod bolts, check and re-torque. 4) Disassemble and check that each tie-rod has one shim.

PROBLEM: Mechanical detent will not hold.
POSSIBLE CAUSE: 1) Broken detent shaft.
CORRECTIVE ACTION: 1) Remove detent & inspect.

PROBLEM: Electrical detent will not hold.
POSSIBLE CAUSE: 1) Current broken.
CORRECTIVE ACTION: 1) Check current going into detent.

PROBLEM: Poor performance, slow operating speed and/or low maximum stall speed.
POSSIBLE CAUSE: 1) Blocked flow regulator spool.
CORRECTIVE ACTION: 1) Flow check, remove and clean flow regulator valve, refer to **Service Procedures, Variable Flow Pumps - Regulator Valve Adjustment**.

Smooth Ride System

Fault	Probable Cause	Action
1 Unable to power down loader arms with system switched OFF.	Rod side solenoid valve open.	Check if solenoid operating, replace solenoid or selector valve as required.
2 Restricted loader arm suspension movement when switched ON.	Rod side solenoid valve closed.	Check if solenoid operating, replace solenoid or selector valve as required.
3 Springy loader arm lift with system switched OFF.	Head side solenoid valve open.	Check if solenoid operating, replace solenoid or selector valve as required.
4 No suspension, unable to power down when switched ON.	Head side solenoid valve closed.	Check if solenoid operating, replace solenoid or selector valve as required.
5 Accumulator gas pressure decrease.	Leak across accumulator piston.	Recharge, if frequent replace seals in accumulator.
6 Oil in gas side of accumulator.	Leak across accumulator piston.	Discharge, drain and recharge, if frequent replace seals in accumulator.
7 Increase in charge pressure.	Oil to gas leak across accumulator piston.	Discharge, drain and recharge, if frequent replace seals in accumulator.

Note: It is normal for the loader arms to lift or lower slightly, when SRS is switched ON.

Check fuse A1 replace as required.

Hydraulic Contamination

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.

Cleaning Operation

The purpose of cleaning oil is to remove contaminants of all types and sludge by filtering hydraulic fluid through a cleaning unit, as illustrated or similar. General Bulletin 011 also refers.

Procedure

Connect the cleaning unit in place of the hydraulic filter and run the system for sufficient time to pump all the hydraulic fluid through the unit. Disconnect the cleaning unit and reconnect the filter. Top up the system with clean hydraulic fluid as required.

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)

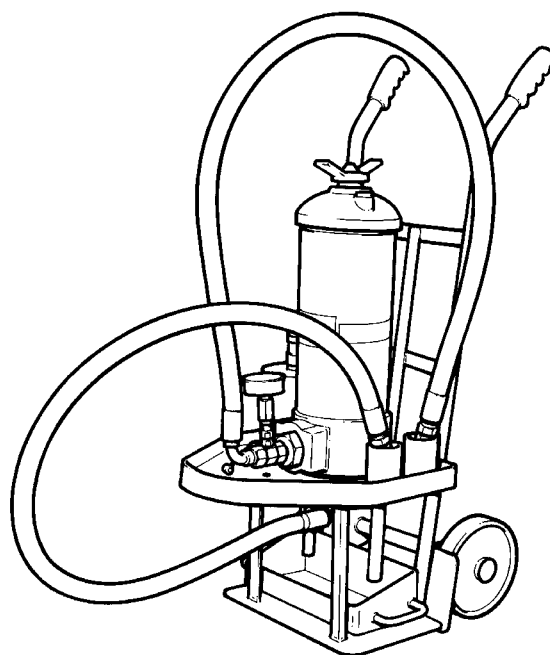
Smallest particle visible to the naked eye is 40 microns (0.00157) approximately.

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

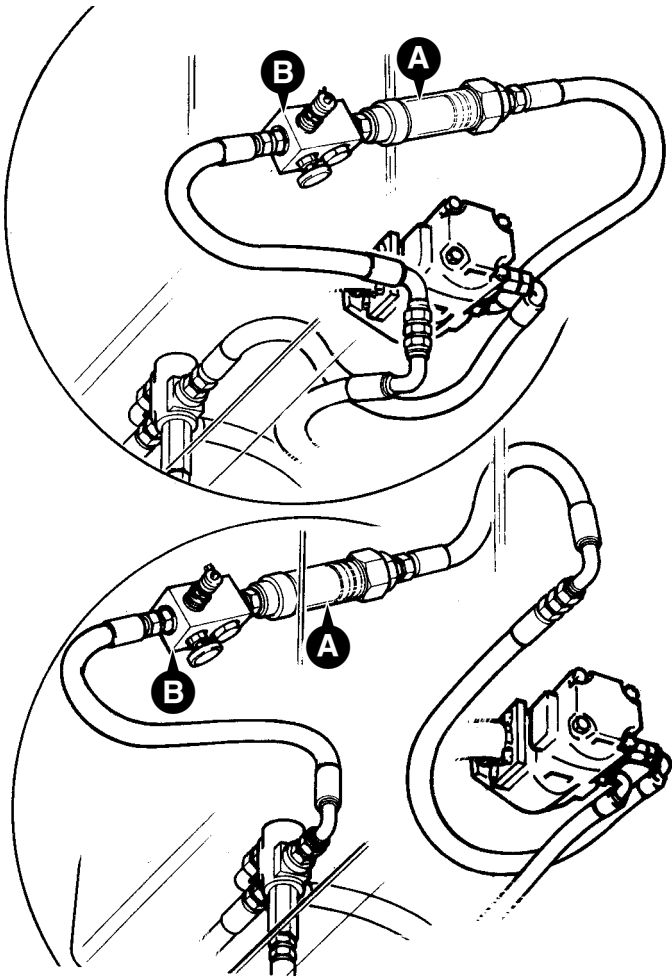
Filters

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. The filter must be serviced to the requirements of the machine Service Schedules.

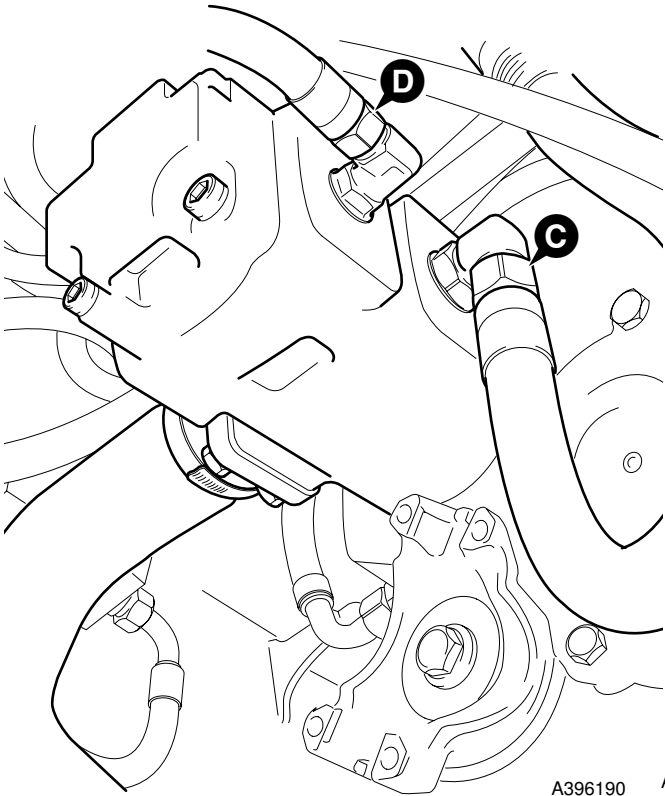
To ensure optimum performance and reliability it is important that the machines hydraulic system is serviced periodically in accordance with the manufacturers requirements. For service schedules refer to Section 3 **Routine Maintenance**.



S168050



S401440



A396190 A

Fixed Flow Pumps

Flow and Pressure Testing

Before removing the pump it is necessary to determine the source of any problem by measuring the output flow at system pressure from both of the pump outlet ports.

To check flow it is necessary to fit flow meter **A** into the output line of each pump section in turn. If available, load valve **B** (service tool 892/00270) should also be installed (see **Note 1**). Make sure the flow meter is installed with its arrow pointing away from the pump and, if applicable, located between the pump and the load valve.

Note 1: If no load valve is available, ignore the references to the load valve in **Fitting/Removing a Flow Meter and Load Valve** below. An alternative method of determining flow is included in the Checking Flow procedures following.

Fitting/Removing a Flow Meter and Load Valve

Before fitting/removing a flow meter and load valve, switch off the machine and operate the loader/excavator controls a few times to vent system pressure.

WARNING

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

WARNING

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

TRANS 1-2

Fitting

- 1 **a** Pump section 1 - disconnect hose **C** from the pump. Fit the flow meter and load valve (see **Note 2**) between hose **C** and the pump.
- b** Pump section 2 - disconnect hose **D** from the pump. Fit the flow meter and load valve (see **Note 2**) between hose **D** and the pump.

Note 2: Make sure the load valve is in the open position, i.e. with the adjusting knob screwed fully out, before carrying out the **Checking Flow** procedure.

Removing

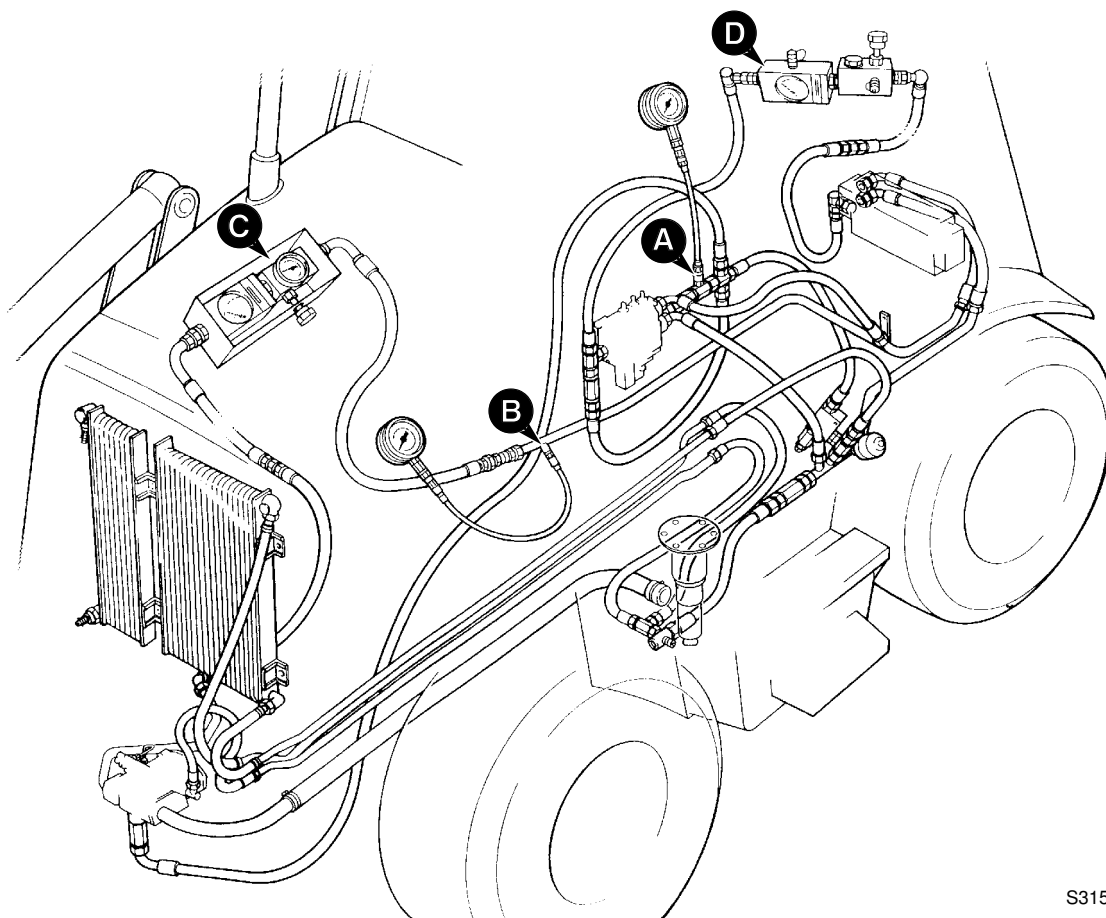
Removing is the reverse of fitting.

Checking Flow

- 1 Check the setting of the Main Relief Valve (MRV) as described in **Loader Valve, Pressure Testing**. Adjust if necessary.
- 2 **a** *Using a load valve* - fit a flow meter and load valve, as described in Fitting, to each pump outlet in turn. Fit a 0-400 bar (0-6000 lbf/in²) pressure gauge to the load valve pressure test connector.
- b** *If no load valve is available* - fit a flow meter, as described in Fitting, to each pump output in turn.
- 3 Start the engine and bring the hydraulics up to working temperature 50°C (122°F). Set the engine speed to 2200 rpm.
- 4 **a** *Using a load valve* - adjust the load valve so that the pressure gauge reading is just below the MRV setting.
- b** *If no load valve is available* - raise or lower the loader arms until the rams are fully open or closed. Continue to operate the raise/lower control so that system pressure builds up. Watch the flow meter and note its reading at the moment the MRV operates.
- 5 The flow reading should be as listed in **Technical Data**.

Variable Flow Pumps

Flow and Pressure Testing



S315770

Variable Flow Pumps

Flow and Pressure Testing

Load Sensing Pressure

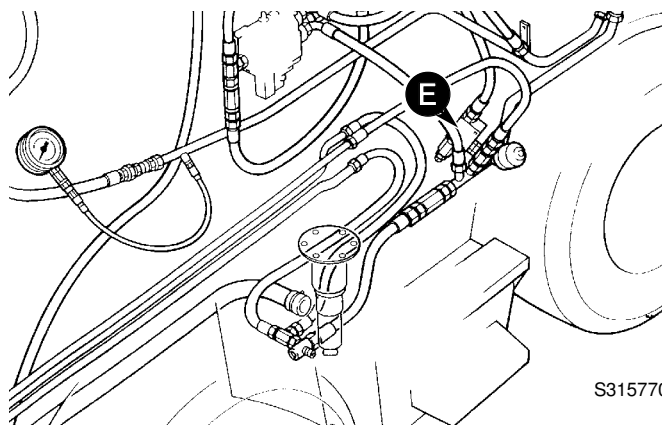
With no services operating, there should be no pressure in the load sense line, this is because hydraulic oil flows through the load sense circuit back to the hydraulic tank. If a shuttle valve is 'stuck', or a hose kinked, then a pressure could be induced in the load sense lines, this will have an effect on the hydraulic system. To check load sense pressure:

- 1 Warm the hydraulic oil to working temperature, i.e. 50 °C (122 °F):
 - a Set the engine speed to 2200 rev/min.
 - b Operate the loader shovel dump service to blow off the auxiliary relief valve.
- 2 Lower the backhoe bucket and loader shovel to rest on the ground; stop the engine; operate the control levers to vent residual hydraulic pressure.
- 3 Connect a 0 - 400 bar (0 - 6000 lbf/in²) pressure gauge to pressure test connector **A** located on the load sense line from the loader valve.
- 4 Start the engine and run at 2200 rev/min.
- 5 Do not move the steering wheel and make sure that all control levers remain in 'neutral' position.
- 6 Check the pressure gauge reading, which should be as specified in **Technical Data**.
- 7 If the pressure is higher than specified, first move the steering wheel and then any of the service levers. If this does not reduce the pressure, physically check the load sense lines for trapping or kinking. As a last resort, the service valves may have to be removed and checked for sticking shuttle valves. However, this should not be done until all other checks have been completed.
- 8 Machines with the load sense pressure relief valve adjust the load sense pressure relief valve **E**. Machines without a load sense pressure relief valve adjust the regulator valve.

Stand-by Pressure

With the engine switched off, the pump swashplate is spring loaded to the full flow position. On engine start up standby pressure moves the swash plate to minimum flow position (see descriptions). To check stand-by pressure:

- 1 Warm the hydraulic oil to working temperature, i.e. 50 °C (122 °F):
 - a Set the engine speed to 2200 rev/min.
 - b Operate the loader shovel dump service to blow off the auxiliary relief valve.
- 2 Lower the backhoe bucket and loader shovel to rest on the ground; stop the engine; operate the control levers to vent residual hydraulic pressure.
- 3 Connect a 0 - 400 bar (0 - 6000 lbf/in²) pressure gauge to pressure test connector **B** located on the pump pressure out line.
- 4 Start the engine and run at 2200 rev/min.
- 5 Do not move the steering wheel and make sure that all control levers remain in 'neutral' position.
- 6 Check the pressure gauge reading, which should be as specified in **Technical Data**.
- 7 If the pressure is not as specified, do not make any adjustments at this stage. Complete the other checks detailed in this section.
- 8 Refer to **Regulator Valve Adjustment**.



S315770

Variable Flow Pumps

Flow and Pressure Testing (Cont'd)

Maximum Hydraulic Stall

With variable flow hydraulics the pump swashplate angle will increase or decrease according to pressure demand. However in situations of maximum hydraulic stall, i.e. ram full travel, the pressure in the circuit will achieve the setting of the pressure regulator spool. To check the setting:

Note: Machines with a load sense relief valve, disconnect and blank the load sense relief valve **E** at **F**.

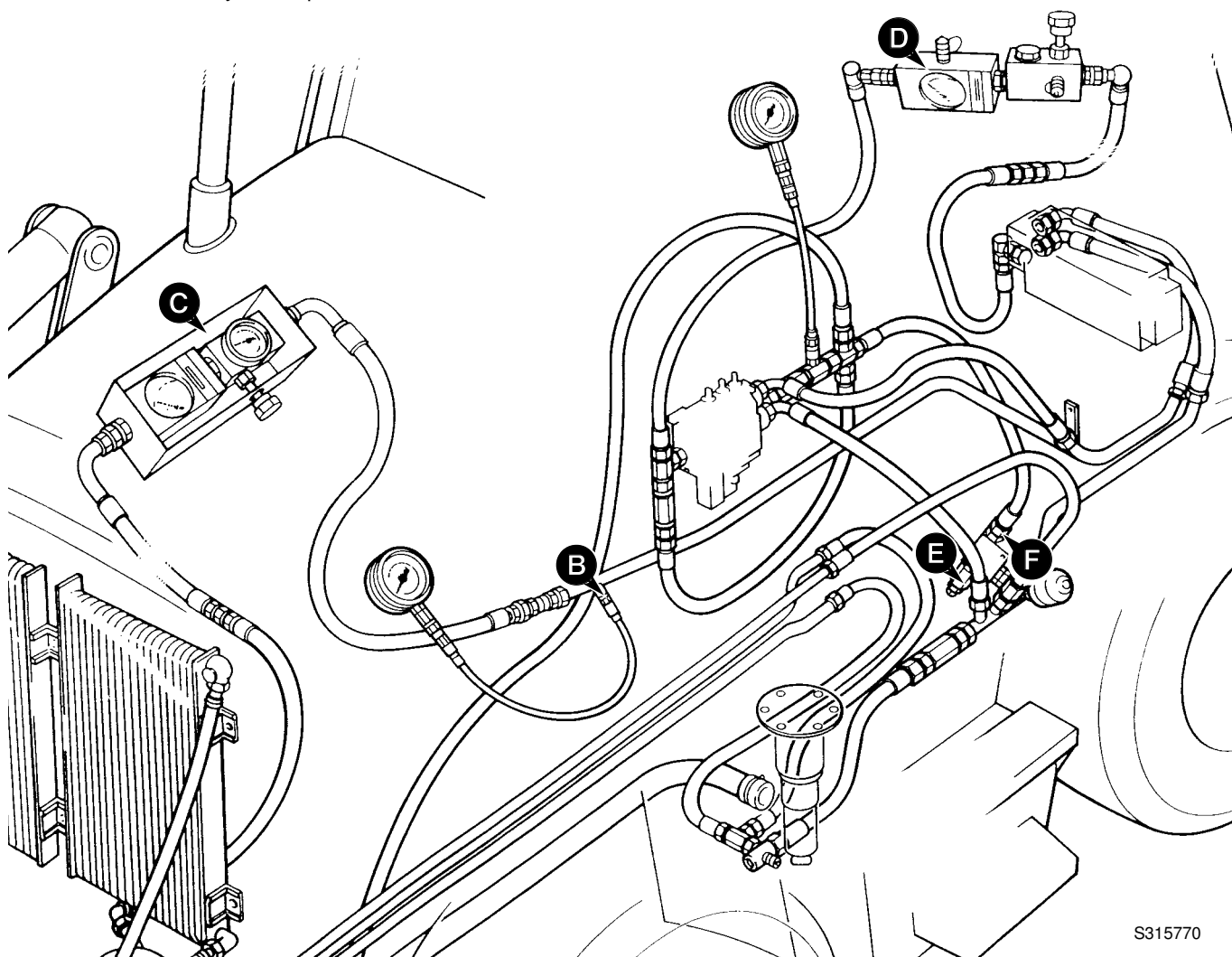
- 1** Warm the hydraulic oil to working temperature, i.e. 50 °C (122 °F):
 - a** Set the engine speed to 2200 rev/min.
 - b** Operate the loader shovel dump service to blow off the auxiliary relief valve.
- 2** Lower the backhoe bucket and loader shovel to rest on the ground; stop the engine; operate the control levers to vent residual hydraulic pressure.

- 3 Connect a 0 - 400 bar (0 - 6000 lbf/in²) pressure gauge to pressure test connector **B** located on the pump pressure out line.
- 4 Start the engine and run at 2200 rev/min.
- 5 Raise the loader arms to achieve full travel, hold the arms in this position and note the gauge reading, which should be as specified in **Technical Data**.
- 6 If the pressure is higher than specified, the pressure compensator spool may be set incorrectly or the swashplate may not be moving.

If the pump pressure is lower than specified, the flow spool may be set incorrectly, or there may be a leak in the load sense line.

Do not make any adjustments at this stage. Complete the other checks detailed in this section.

- 7** Refer to **Regulator Valve Adjustment**.



S315770

Variable Flow Pumps

Flow and Pressure Testing (Cont'd)

Pump Flow

It is not possible to test full pump flow at system pressure whilst the pump is installed on the machine. This is because the pump swashplate angle will return to minimum angle (zero flow) when the system reaches full pressure (see descriptions).

However, it is possible to test the pump flow whilst 'blowing off' an auxiliary relief valve which is set lower than system pressure. In the example below, the shovel head side A.R.V. is used. The readings taken in this test give a 'snapshot' of pump performance and can be used to establish if major pump maintenance is required.

- 1 Warm the hydraulic oil to working temperature, i.e. 50°C (122°F):
 - a Set the engine speed to 2200 rev/min.
 - b Operate the loader shovel dump service to blow off the auxiliary relief valve.
- 2 Lower the backhoe bucket and loader shovel to rest on the ground; stop the engine; operate the control levers to vent residual hydraulic pressure.
- 3 Connect a 0 - 400 bar (0 - 6000 lbf/in²) pressure gauge to pressure test connector **B** located on the pump pressure out line.
- 4 Connect a flowmeter to the pump pressure out line as shown at **C**.
- 5 Start the engine and run at 2200 rev/min.
- 6 Raise the loader arms and fully dump the loader shovel.
- 7 Hold the shovel in the dump position (to blow off the A.R.V.) and check the flow and pressure gauge readings, which should be as specified in **Technical Data**.
- 8 If the pump flow is not as indicated, do not make any adjustments at this stage. Complete the other checks detailed in this section.
- 9 Refer to **Regulator Valve Adjustment**.

Load Sense Line Flow

The load sense line communicates the load pressure required at a service to the pump. If there is a blockage or leak in the line, the hydraulic system will not operate effectively.

Load sensing is a 'dynamic flow' type. That is, there is a constant flow of oil from the pump to the shuttle valves. When a pressure signal is felt at the service port, the flow is interrupted and the pump immediately responds to the demand. (Unlike a 'static' system where the pressure signal must move from the valve block, back up the load sense line to the pump).

- 1 Warm the hydraulic oil to working temperature, i.e. 50°C (122°F):
 - a Set the engine speed to 2200 rev/min.
 - b Operate the loader shovel dump service to blow off the auxiliary relief valve.
- 2 Lower the backhoe bucket and loader shovel to rest on the ground; stop the engine; operate the control levers to vent residual hydraulic pressure.
- 3 Connect a flowmeter into the load sense line, a good access point is where the LS line enters the backhoe valve as shown at **D**.
- 5 Start the engine and run at 2200 rev/min. Check the flow which should be as specified in **Technical Data**.
- 6 If a service is selected, the flow should drop to zero (but the pressure will increase).
- 7 If there is no flow in the system, then check the load sense lines for being trapped or kinked, also move the service control levers and the steering wheel.

If there is still no flow, then there is the possibility of a shuttle valve being stuck. Do not dismantle valves at this stage but complete all other tests listed in this section.

Variable Flow Pumps

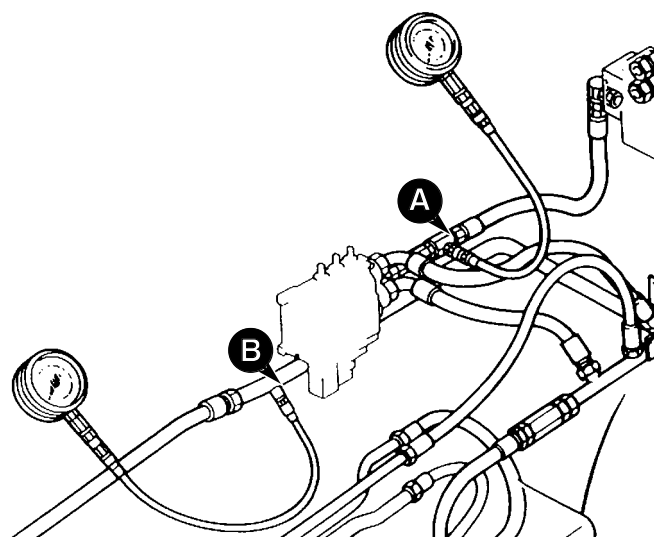
Regulator Valve Adjustment

Note: If a new regulator valve is fitted, or a valve stripped, cleaned and rebuilt, then the pressure spool should be backed off to a low pressure. This will prevent inadvertent damage to the pump.

Flow Regulator Spool

The pressure in the pump out line (pressure test connector **B**) should be 20 bar (290 lbf/in²) greater than the pressure in the load sense line (pressure test connector **A**). If not adjust the regulator flow spool as described below:

- 1 Lower the backhoe bucket and loader shovel to rest on the ground; stop the engine; operate the control levers to vent residual hydraulic pressure.
- 2 Gain access to the regulator valve assembly (mounted on the pump).
- 3 Remove cap **C** and loosen locknut **D**.
- 4 Turn adjusting screw **E** clockwise to increase pressure setting and anti-clockwise to decrease setting.
- 5 Repeat pressure test as detailed previously and establish valve is set correctly.
- 6 Tighten locknut, refit cap.

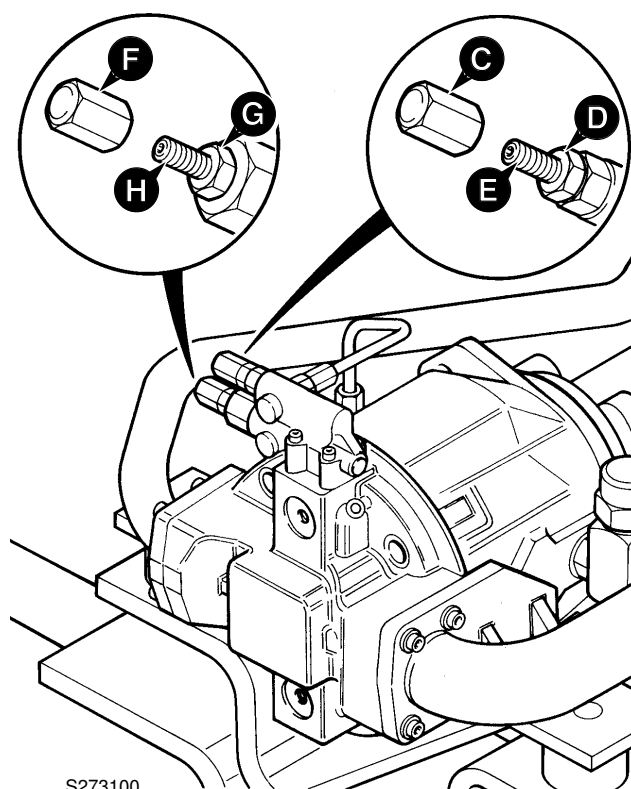


S273401

Pressure Regulator Spool

As previously explained, there is no 'main relief valve' to control the system pressure (the pump swashplate angle will increase or decrease according to pressure demand). However in situations of maximum hydraulic stall, i.e. ram full travel, the pressure in the circuit will achieve the setting of the pressure regulator spool. To adjust the setting:

- 1 Lower the backhoe bucket and loader shovel to rest on the ground; stop the engine; operate the control levers to vent residual hydraulic pressure.
- 2 Gain access to the regulator valve assembly (mounted on the pump).
- 3 Remove cap **F** and loosen locknut **G**.
- 4 Turn adjusting screw **H** clockwise to increase pressure setting and anti-clockwise to decrease setting.
- 5 Repeat pressure test as detailed previously and establish valve is set correctly.
- 6 Tighten locknut, refit cap.



S273100

Variable Flow Pumps

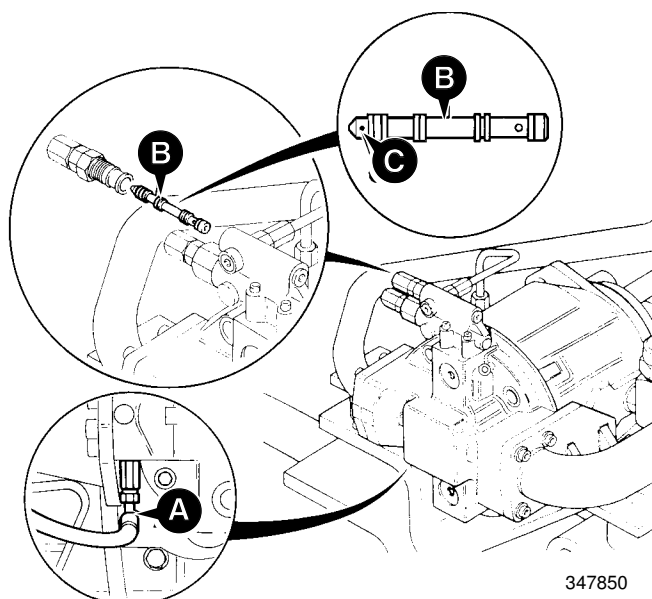
Regulator Valve Adjustment (Cont'd)

The load sense system is a dynamic type, which means a small flow (0.22 to 1.1 gall/1 to 5 litre per minute) is circulated through the load sense line.

The flow is available due to a 0.02 in (0.6 mm) orifice in the flow regulator spool in the pump control housing. This orifice can be blocked or partially restricted which will give poor performance, slow operating speed and/or low maximum stall speed. If completely blocked, margin pressure and stand-by pressure can be difficult to adjust and the loader services may operate intermittently even though the excavator operates correctly.

If any of the above symptoms are experienced carry out the following:

- 1 Lower the backhoe bucket and loader shovel to rest on the ground. Stop the engine and remove the starter key.
- 2 Gain access to the regulator valve assembly.
- 3 Disconnect the load sense line at **A**. Attach a 0.25 inch (6.35 mm) hose to pump of suitable length to route to a measuring container.
- 4 Start the engine and measure the flow which should be at least 0.22 gall/1 litre per minute at 2200 RPM.
- 5 If the flow is below 0.22gall/1 litre per minute, remove spool **B** and clean/unblock orifice **C** as required.
- 6 Fit spool **B** and check the flow as described at step 3 and 4.
- 7 If the flow is within limits check the stand-by pressure. Refer to **Flow and Pressure Testing**.

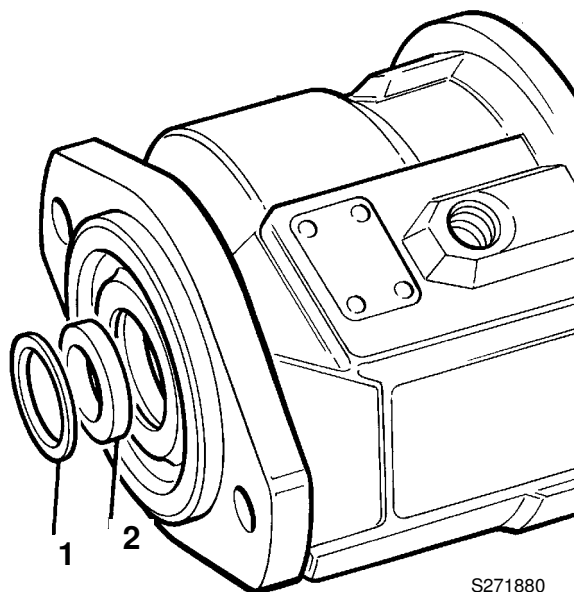


Variable Flow Pumps

Renewing Drive Shaft Seal

Note: The following procedure describes renewal of the shaft seal. However this is not the normal sequence, the sealing ring would normally be assembled with the taper roller bearing from inside the pump to ensure a secure sealing condition. If the shaft seal is to be renewed in this manner, it is extremely important not to scratch or damage the shaft, otherwise leakage will occur.

- 1 Remove retaining ring **1** and use a special rounded tool such as a ground screwdriver to remove the drive shaft sealing ring **2**.
- 2 Examine the seal running area (driveshaft and housing) for wear or damage. Damage in these areas will require the pump to be further dismantled.
- 3 Lubricate the new seal with JCB Special MPL Moly Grease.
- 4 Install the new seal, it is advisable to use a tube or similar located over the driveshaft to ensure the seal enters the housing evenly. DO NOT push the seal too far into the housing. If the shaft seal touches the bearing, the seal will be damaged.
- 5 Assemble the retaining ring **1**.



S271880

Variable Flow Pumps

Shuttle Valve Signal Network - Testing

The shuttle network can be easily checked. Start the engine and operate the hydraulic system until the oil is at working temperature.

With the engine at 1500 revs/min operate each service in the following order:

- 1 Bucket
- 2 Dipper
- 3 Right Stabiliser
- 4 Left Stabiliser
- 5 Boom
- 6 Slew
- 7 Extradig
- 8 Lift
- 9 Shovel
- 10 Auxiliary
- 11 Steering

Note: If your machine is not equipped with these valve sections, start with the furthest section from the pump and work back to the nearest section.

If one valve section function either fails to work or is slow to work in either one or both directions, the primary shuttle in that section may be at fault.

If two or more valve sections next to each other fail to operate correctly, check the secondary shuttles. To check the secondary shuttle operate each service in sequence, the last correctly functioning service nearest the pump may have a secondary shuttle in that section at fault.

When a shuttle is suspected of malfunctioning, do the following check:

Stall any control valve that is near the pump than the suspected control valve. This should stall the entire system. While at stall operate the malfunctioning valve section, if the section operates correctly the shuttle in question is at fault.

If section still malfunctions the shuttle is NOT at fault.

Shuttles may be removed, check the seals and the shuttle ball. Clean and refit or fit a new shuttle as required.

Loader Valve - Pressure Testing

Main Relief Valve (M.R.V.)

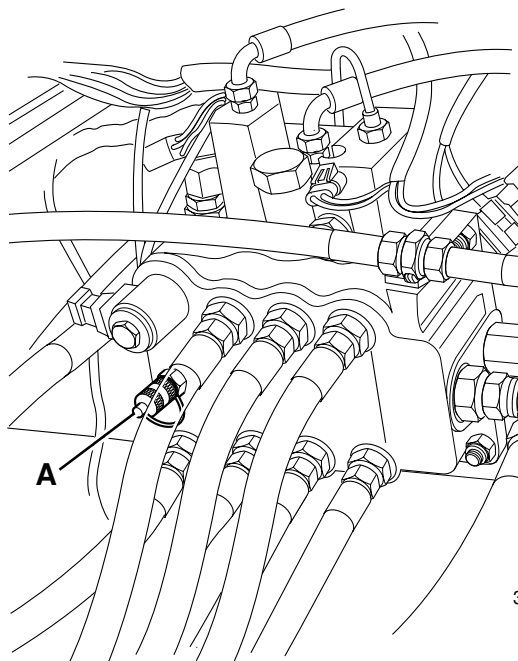
Make sure that the hydraulic oil is at working temperature, i.e. 50°C (122°F).

Lower the backhoe bucket and loader shovel to rest on the ground; stop the engine; operate the control levers to vent residual hydraulic pressure.

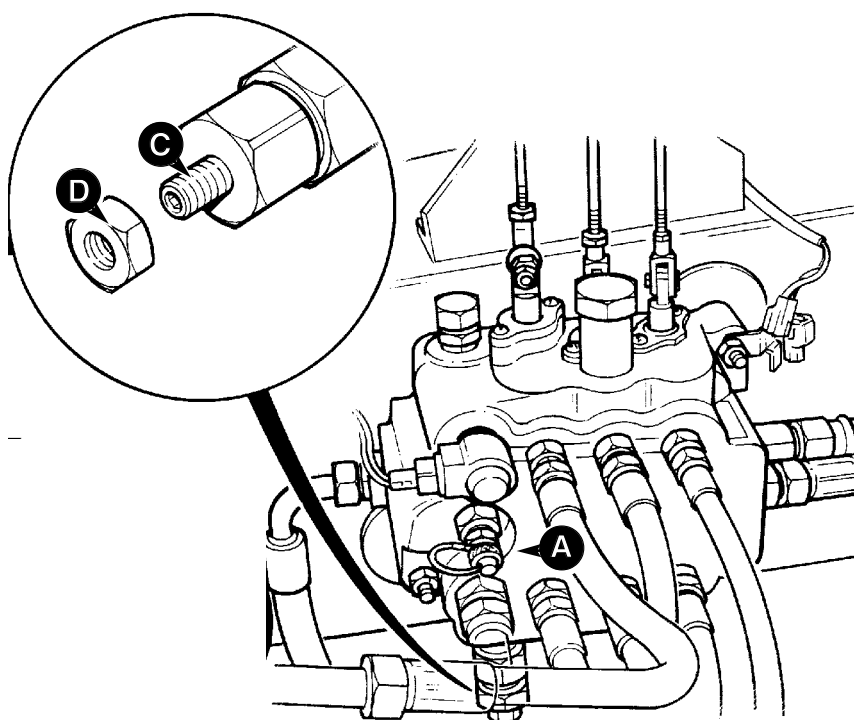
- 1 Connect a 0 - 400 bar (0 - 6000 lbf/in²) pressure gauge to pressure test connector **A** on the loader valve, (refer to **Service Tools**).
- 2 With the engine running at 1500 revs/min, check M.R.V. pressure by raising or lowering the loader arms until the rams are fully open or closed and noting the maximum gauge reading. **CAUTION:** Do not select 'float'. The maximum pressure should be as stated in Technical Data.

Note: The rams must be 'held' open or closed when reading gauge.

- 3 If the pressure is incorrect, loosen locknut **D** and adjust screw **C**. Turn it clockwise to increase pressure and anti-clockwise to decrease the pressure. When the pressure is correct, tighten the locknut and check the pressure again. Adjust as required.



352710



S266281

Loader Valve - Pressure Testing

Unloader Valve

Make sure that the hydraulic oil is at working temperature, i.e. 50°C (122°F).

Lower the backhoe bucket and loader shovel to rest on the ground; stop the engine; operate the control levers to vent residual hydraulic pressure.

Make sure that the 'hydraulic speed control' and 'smooth ride system' facilities are NOT switched on, otherwise the correct unloader valve pressure cannot be obtained.

If the machine has a front-mounted roadbreaker, ensure that the roadbreaker control valve lever is in the 'off' position (lever down), otherwise the roadbreaker relief valve will operate and prevent unloader valve pressure from being reached.

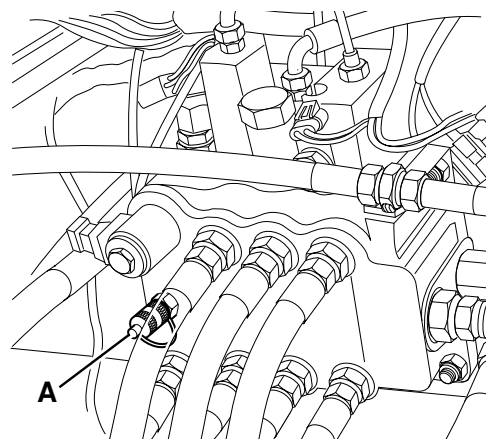
- 1 Connect a 0 - 400 bar (0 - 6000 lbf/in²) pressure gauge to pressure test connector **A**.
- 2 With the engine running at 1500 revs/min, slowly operate arms raise or lower.

Note 1: The arms raise or lower service is specified because it has no auxiliary relief valve (A.R.V.). Selecting this service ensures that the pressure vents through the M.R.V. and not an A.R.V.

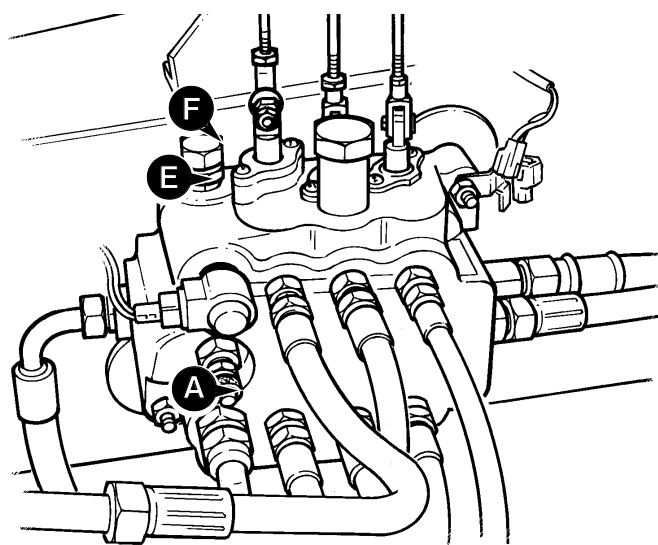
- 3 When the service reaches full travel, return the lever to the neutral position. Select the service again, very slowly, the pressure gauge will rise until a step/kick is seen in the rate of change in the pressure increase. This is the start of unloader operation. Keep selecting the service until a sudden sharp increase in pressure is observed with a change of engine sound, this point is the unloader setting and should be as specified in **Technical Data**.

- 4 If the pressure is incorrect, slacken locknut **E** and adjust cap **F**. Turn it clockwise to increase pressure and anti-clockwise to decrease the pressure. When the pressure is correct, tighten the locknut and check the pressure again. Adjust as required.

If the correct pressure cannot be achieved, add or subtract shims as required, refer to **Loader Valve - Fixed Flow, Dismantling and Assembly - Unloader Valve**.



352710



S266300

Loader Valve - Pressure Testing

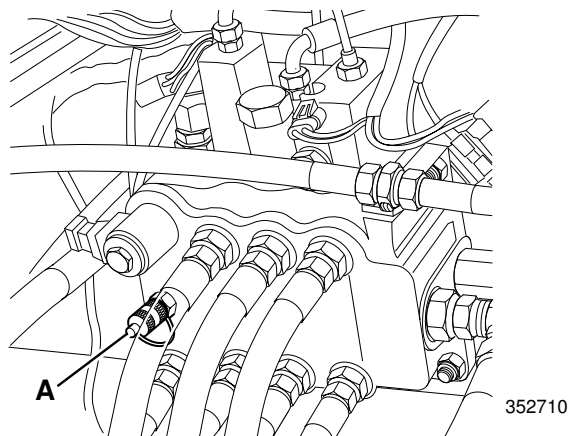
Hydraulic Speed Control (HSC)

The following procedure can be used to establish if the hydraulic speed control facility is working correctly.

Make sure that the hydraulic oil is at working temperature, i.e. 50°C (122°F).

Lower the backhoe bucket and loader shovel to rest on the ground; stop the engine; operate the control levers to vent residual hydraulic pressure.

- 1 Connect a 0 - 400 bar (0 - 6000 lbf/in²) pressure gauge to pressure test connector **A**.
- 2 With the engine running at 1500 revs/min, slowly operate arms raise, the pressure should be approximately 138 bar (2000 lbf/in²).
- 3 Make sure that the HSC rocker switch (mounted on the console) is in the OFF position. Raise the arms slowly, select the rocker switch to ON, the arms should raise quicker.
- 4 Make sure that the HSC rocker switch (mounted on the console) is in the OFF position. Raise the arms slowly, press the button on the loader control knob, the arms should raise quicker.
- 5 If the loader arms fail to respond, then check the HSC hydraulic and electrical circuits for any faults.

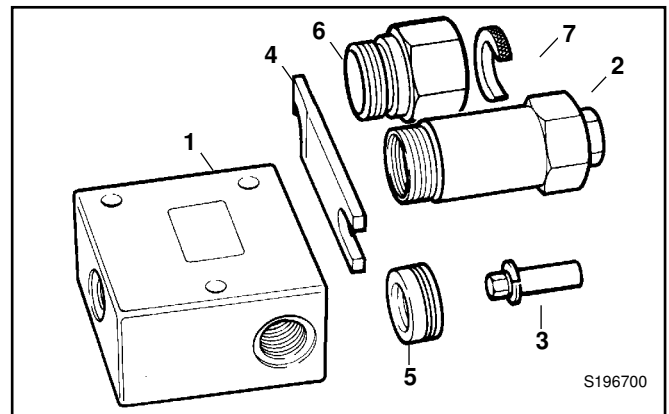


Loader Valve - Pressure Testing

Auxiliary Relief Valves - Using Hand Pump

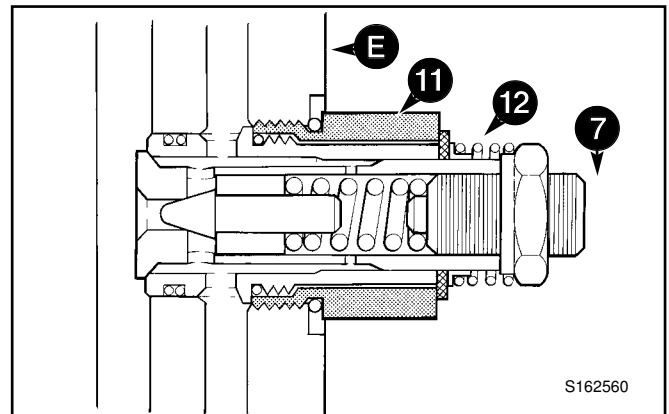
To pressure test and re-set the auxiliary relief valves (A.R.V.'s), service kit 892/00309 must be used.

The service kit comprises; a test block **1**, a setting body **2** with adjusting pin **3**, a special spanner **4**, anti-cavitation lock out bung **5**. A.R.V. cartridge removal tool 892/00335 comprises; an extractor cap **6** and a 'C' washer **7**.

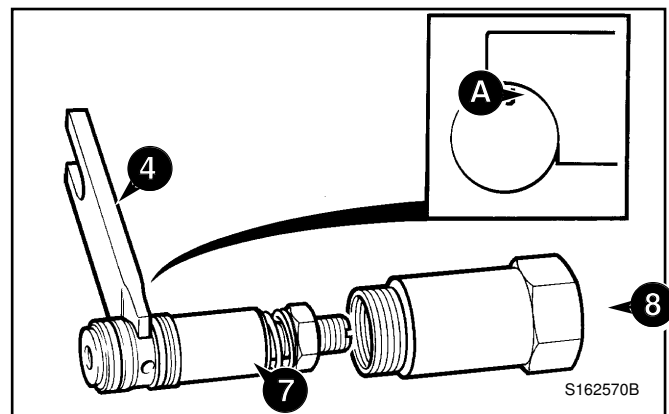


- 1 Remove the complete A.R.V. assembly from the valve block. If the A.R.V. sub-assembly **7** remains in the valve block, proceed as follows:

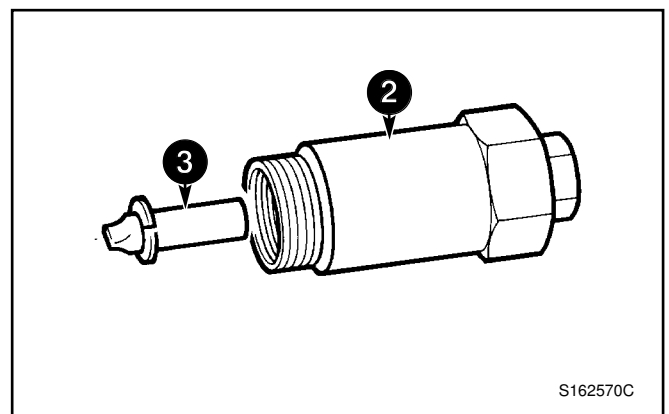
- a Fit extractor cap **11** over the A.R.V. sub-assembly **7**, into the valve block **E**.
- b Fit 'C' washer **12** on top of the extractor cap, but under the anti-cavitation spring seat as shown.
- c Unscrew the extractor cap, - the A.R.V. sub-assembly will withdraw with the extractor cap.



- 2 Use special spanner **4** located in cross holes **A** and separate the A.R.V. sub-assembly **7** from its cap **8**.



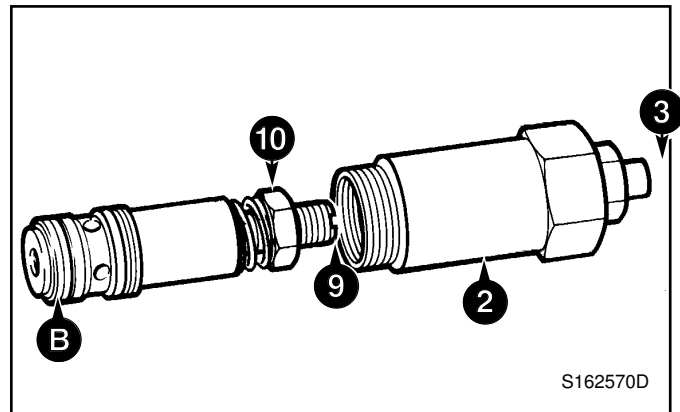
- 3 Install adjusting pin **3** into setting body **2**.



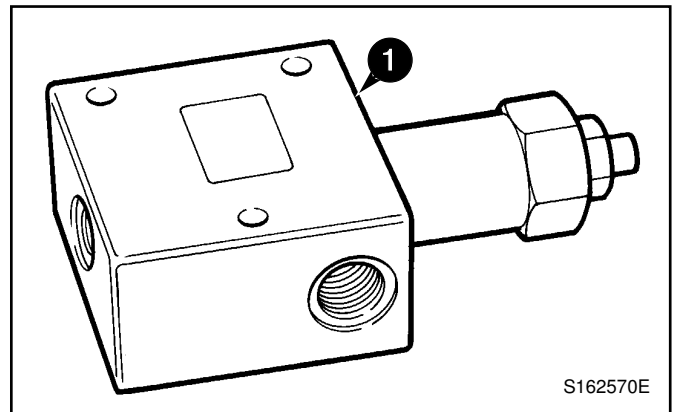
Auxiliary Relief Valves - Using Hand Pump

- 4 Install the A.R.V. sub-assembly into setting body 2. Make sure that the adjusting pin 3 correctly locates in adjusting screw 9.

Make sure that the lock nut 10 correctly locates in the setting body socket - the anti-cavitation cone should still be closed, as shown at B.



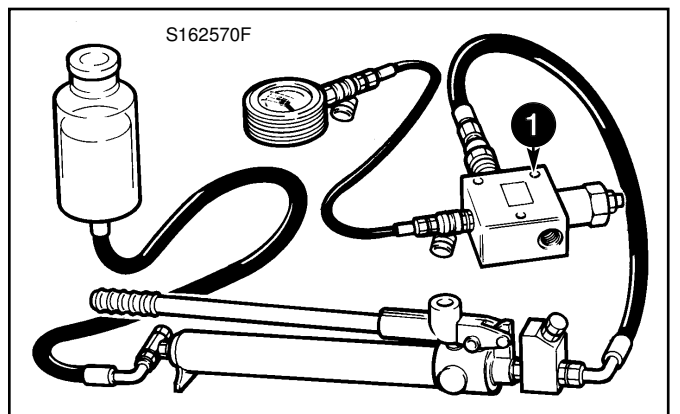
- 5 Install the A.R.V. sub-assembly and setting body into test block 1. Make sure that the assembly is installed in the port marked 'RV' (relief valve).



- 6 Connect a hydraulic hand pump to port 'P' (pump) of the test block 1. Make sure that the hand pump is filled with JCB Hydraulic fluid.

Connect a 0 to 400 bar (0 to 6000 lbf/in²) pressure test gauge to port 'G' (gauge) of the test block 1.

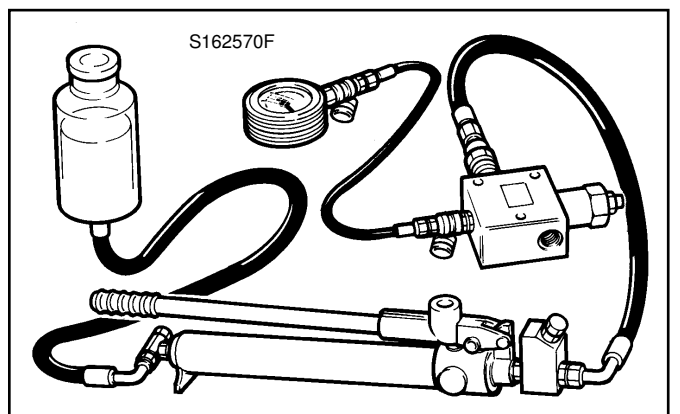
Port 'T' (tank) can be left open when using a hydraulic hand pump.



- 7 Raise the pressure at the valve inlet using the hydraulic hand pump, when the A.R.V. 'cracks' and oil escapes from the port marked 'T' the pressure gauge will indicate the A.R.V. setting.

If the A.R.V. setting is correct, move to step 12.

If the A.R.V. setting is not correct, move to step 8.



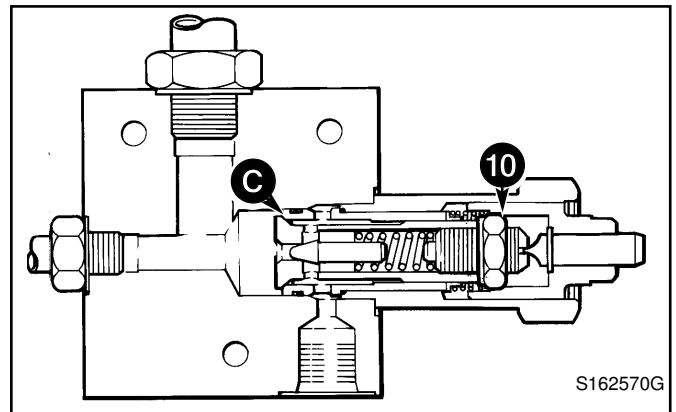
Auxiliary Relief Valves - Using Hand Pump

- 8** Use the hand pump to raise approximately 172 bar (2500 lbf/in²) pressure at the valve inlet.

Note: Raising the pressure at the valve inlet locks the anti-cavitation cone **C** onto its seat, this allows the A.R.V. adjusting screw lock nut **10** to be loosened (step 10).

If the pressure is maintained move to step 10.

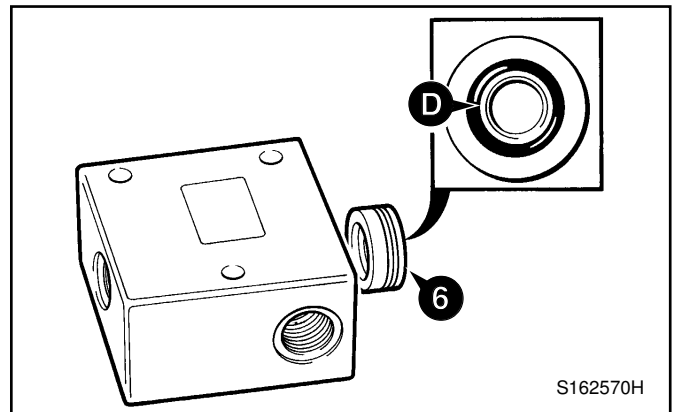
If the pressure falls off rapidly, or if no pressure can be obtained it is possible that the anti-cavitation cone is not seating effectively, in this instance move to step 9.



- 9** If no pressure can be raised (see step 8) at the valve inlet, remove the A.R.V. assembly and install anti-cavitation lock-out bung **6** in the port marked 'RV', make sure that the bung O-ring face seal **D** is facing out. Re-fit the A.R.V. assembly.

Note: The anti-cavitation lock-out bung seals and locks the A.R.V. anti-cavitation function. The bung is only suitable for the test block application and must NEVER be fitted to the valve block.

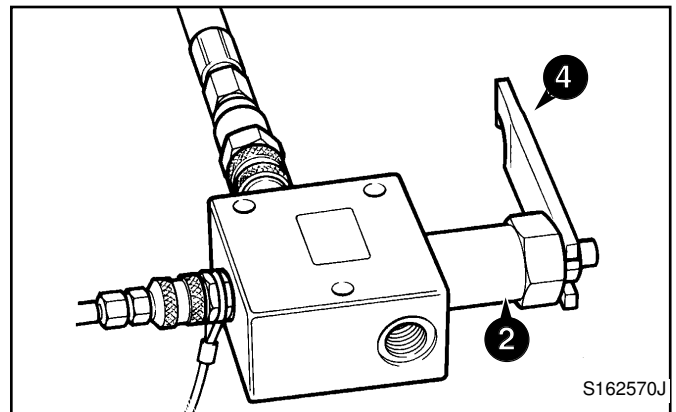
The bung can be extracted using a 3/8 - 16 UNC threaded bolt.



- 10** Release the A.R.V. adjusting screw lock nut (see note):

Engage the nut at the end of setting body **2** using the slot in special spanner **4**, turn the nut anti-clockwise to release the A.R.V. adjusting screw lock nut.

Note: Remember, it will not be possible to release the lock nut if there is not approximately 172 bar (2500 lbf/in²) pressure at the valve inlet.

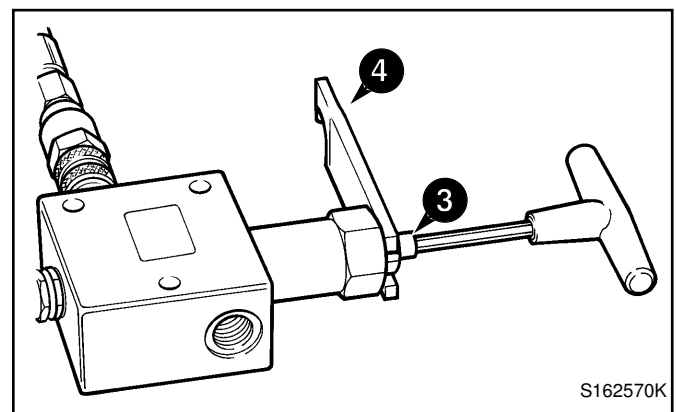


- 11** Insert an allen key into adjusting pin **3** (T-Bar type shown). Push the adjusting pin down and make sure it has engaged with the A.R.V. adjusting screw.

Rotate the T-bar clockwise to increase the pressure setting and anti-clockwise to decrease the pressure setting.

After adjustment, use the slot in spanner **4** to lock the A.R.V. adjusting screw lock nut (see note).

Note: Remember, pressure must be maintained at the valve inlet to ensure the lock nut is tightened.



Auxiliary Relief Valves - Using Hand Pump

- 12** When the correct A.R.V. setting has been attained, release the pressure in the test block. Remove the A.R.V. sub-assembly and its setting body from the test block.

Separate the A.R.V. sub-assembly from its setting body.

Install the A.R.V. sub-assembly into its cap.

Excavator Valve - Pressure Testing

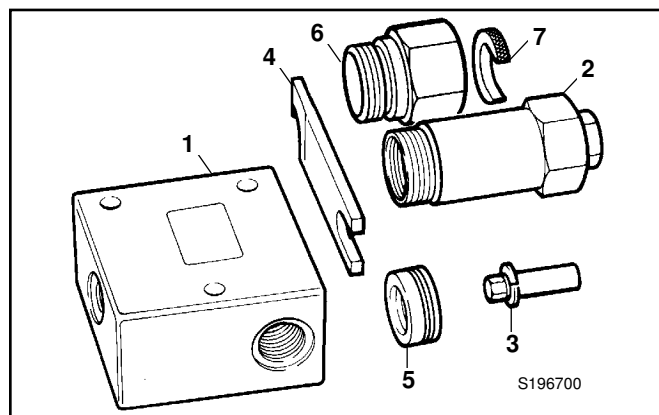
Auxiliary Relief Valves - Using Hand Pump

The auxiliary relief valves found in the backhoe valve block are identical in design to those found in the loader valve block.

Therefore please refer to **Loader Valve - Pressure Testing, Auxiliary Relief Valves (ARV's)** for the correct pressure test procedures.

To pressure test and re-set the auxiliary relief valves (A.R.V.'s), service kit 892/00309 must be used.

The service kit comprises; a test block **1**, a setting body **2** with adjusting pin **3**, a special spanner **4**, anti-cavitation lock out bung **5**. A.R.V. cartridge removal tool 892/00335 comprises; an extractor cap **6** and a 'C' washer **7**.



Excavator Valve - Precision Control (Servo)

* (Machines up to serial no. 931159)

Pressure Testing

Load Sense Drain Regulator and Relief Valve

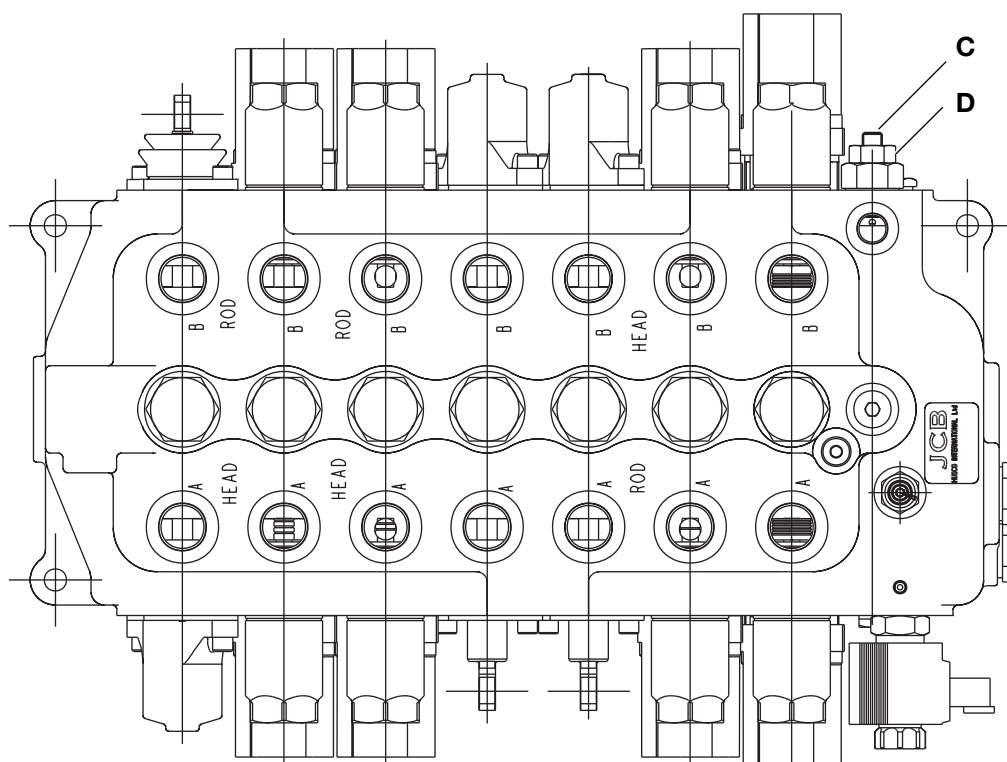
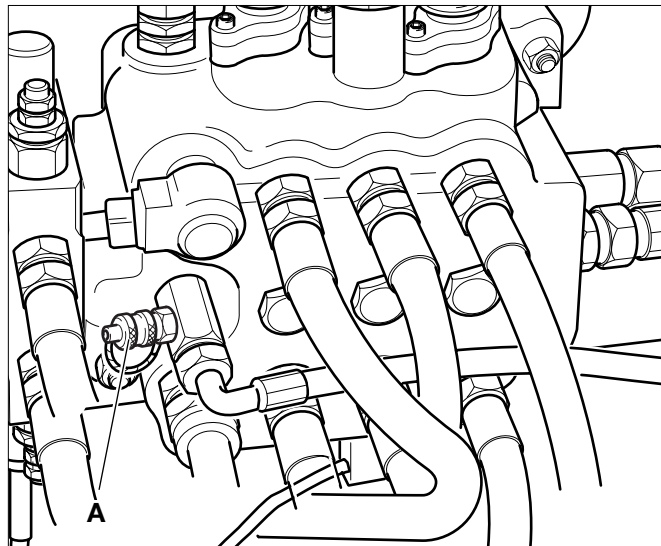
Make sure that the hydraulic oil is at working temperature, i.e. 50°C (122°F).

Lower the backhoe bucket and loader shovel to rest on the ground; stop the engine; operate the control levers to vent residual hydraulic pressure.

- 1 Connect a 0 - 400 bar (0 - 6000 lbf/in²) pressure gauge to pressure test connector **A** on the loader valve, (refer to **Service Tools**).
- 2 With the engine running at 1500 revs/min, check that the M.R.V. pressure is correct, see **Loader Valve - Pressure Testing, Main Relief Valve**.
- 3 With the engine running at 1500 revs/min, operate a stabiliser service fully and at the same time note the reading in the gauge which should be as stated in **Technical Data**.

Note: The ram must be 'held' open or closed when reading gauge.

- 4 If the pressure is incorrect, loosen locknut **D** and adjust screw **C**. Turn the screw **C** clockwise to increase pressure and anti-clockwise to decrease the pressure. When the pressure is correct, tighten the locknut and check the pressure again. Adjust as required.



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Excavator Valve - Precision Control (Servo)
(Machines from January 2003)

Pressure Testing

Load Sense Relief Valve

TBA

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Excavator Valve - Precision Control (Servo)

Pressure Compensator Network - Testing

The pressure compensator valve network can be easily checked as follows:

- 1 Start the engine and operate the hydraulic system until the oil is at working temperature.
- 2 With the engine at 1500 revs/min operate each service in turn starting with the service furthest from the pump inlet section.

If one control valve section function either fails to work or is slow to work in either one or both directions, the pressure compensator valve in that section may be at fault.

When a pressure compensator valve is suspected of malfunctioning, do the following check:

- 3 Stall any control valve that is nearer the pump inlet section than the suspected control valve section. This should stall the entire system. While at stall operate the malfunctioning valve section, if the section operates correctly the pressure compensator valve in question is at fault.

If the section still malfunctions the pressure compensator valve is NOT at fault.

Note: The pressure compensator valves may be removed for inspection, refer to **Excavator Valve - Dismantling and Assembly**. Clean and refit, or fit a new pressure compensator valve as required.

Ram Creep Tests - All Services

If ram creep is suspected the following procedures must be carried out to define if the leakage is within tolerance. Ram creep can be caused by a number of reasons: Cylinder/Piston Leakage, Spool Leakage, ARV Leakage.

The text and illustrations show a typical ram installation (in this instance the boom ram), the principle applies to all rams.

Note: The procedures are not applicable for rams fitted with hose burst protection valves.

WARNING

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

WARNING

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

TRANS 1-2

A Test for Ram Creep

- 1 Operate the machine to bring the hydraulic oil to a normal working temperature of 50°C (122°F) which can be measured using a hydraulic oil temperature probe (service tool 892/00285).
- 2 Fit an appropriate pressure gauge **A** to a tee-piece in the service hose which is pressurised when the ram in question is supported (Fig 1).

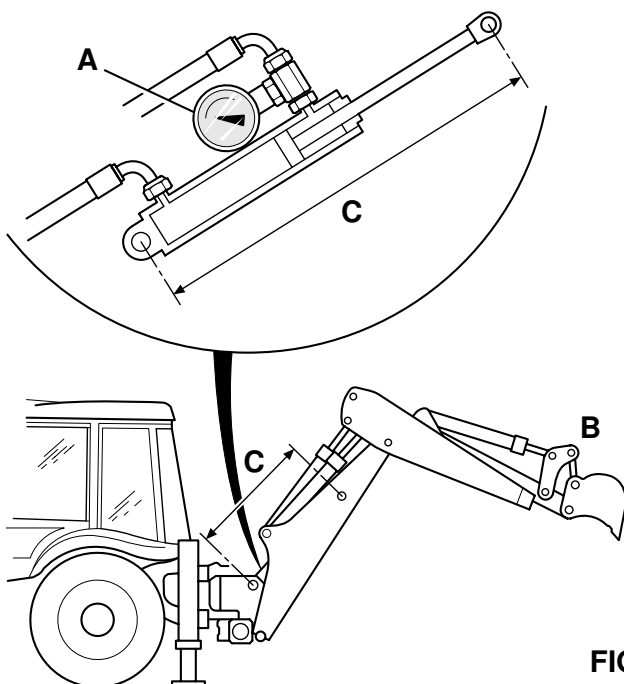


FIG 1

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- 3 Operate the rams to ensure they are full of hot oil.
- 4 Apply a load to the suspect ram for example the boom ram by raising the dipper to the horizontal as at **B**.
- 5 Measure the actual piston rod movement over 10 minutes. Measure the movement by checking the pivot pin to pivot pin dimensions as at **C**. Alternatively mark the rod with a felt tip pen 150mm (5.9 in) from the end cap and check the movement after 10 minutes, this is not possible on the majority of boom/extending dipper rams.
- 6 Using Table 1, check if the piston rod movement is within the recommended tolerance. If so, the ram creep is acceptable.

Note: The table indicates the MAXIMUM permitted ram movement.

- 7 If the rate of movement is unacceptable, identify if the fault is as a result of cylinder/piston leakage or spool leakage at the control valve, see procedure **B** and **C**.

B Test Cylinder/Piston Leakage

- 1 Ensure that the oil temperature is at 50°C (122°F) by using the hydraulic oil temperature probe detailed in A1.
- 2 Take the weight off the ram to be tested, in this example, by positioning the backhoe with dipper vertical and bucket on the ground.
- 3 Use a suitable pressure gauge **A** to blank off the supporting port of the ram.
- 4 Disconnect the hose from the opposite port **D** and leave the port open to atmosphere.
- 5 Apply a load to the suspect ram for example the boom ram by raising the dipper to the horizontal as at **B**.
- 6 After the initial movement measure the pin to pin movement as at **C** and note the rod movement over 10 minutes.
- 7 If rod movement is evident the ram is defective.

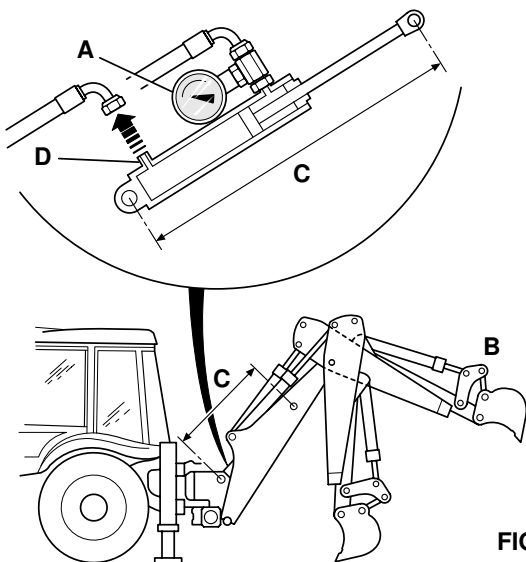


FIG 2
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C Test Spool Leakage

Note: The following procedure applies only to services fitted with A.R.V.'s. Note A.R.V.'s are not fitted to loader lift, loader auxiliary, stabilisers or to the bucket rod side service except when a Rockbreaker is fitted.

- 1 Render the A.R.V.'s inoperative in the suspect service. This is achieved by removing the A.R.V. and replacing with a blanking plug (part no. 25/609901) and seal kit (25/610301).
- 2 Re-check the piston rod movement as described steps A1 to A6.

A.R.V.	Control Layout	
	JCB	ISO
Slew		
- Right	B1	B1
- Left	A1	A1
Boom		
- Rod	B2	B5
- Head	A2	A5
Dipper		
- Rod	A5	A2
- Head	B5	B2
Bucket		
- Rod	A6	A6
- Head	B6	B6

Note: Bucket ram rod side ARV only fitted to machines equipped with Rockbreakers.

- 3 If the rod movement is now acceptable the A.R.V. must be at fault. The A.R.V. may only require cleaning and then resealing. If dirt is evident, the hydraulic tank should be drained and cleaned. It is recommended that when re-filling the hydraulic tank that new oil and filter be used to prevent further contamination. If the A.R.V. is worn it should be replaced.

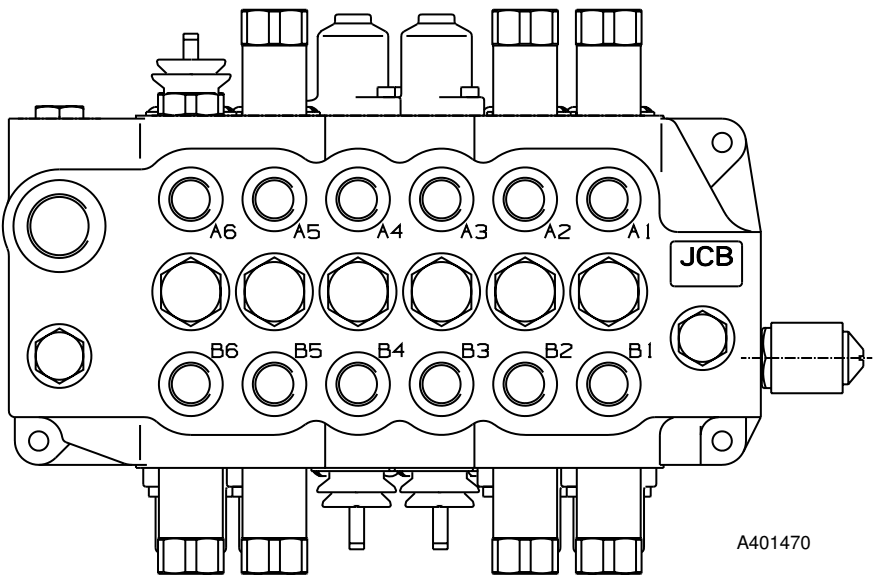


Table 1

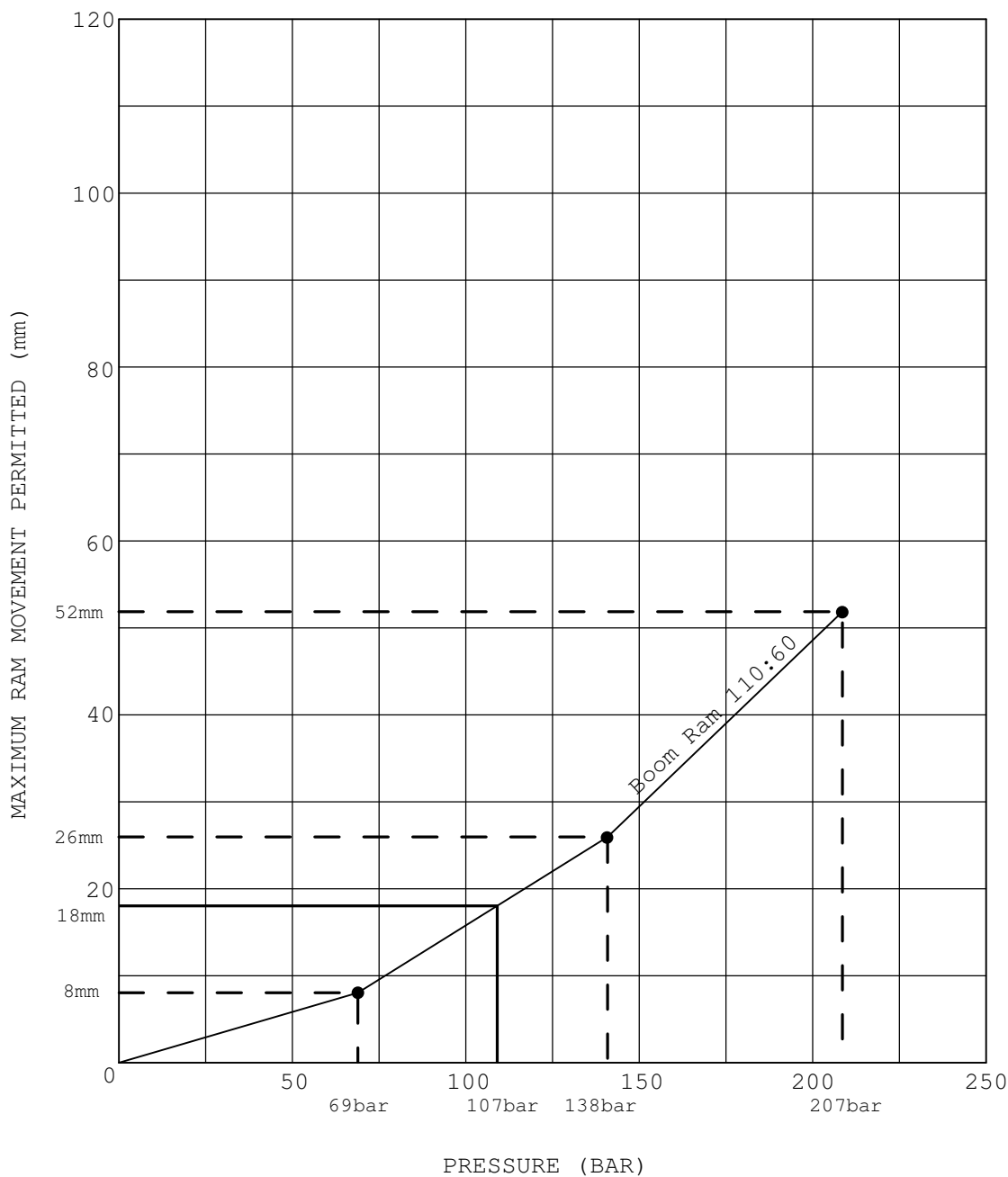
Ram	Cylinder Dia. (mm)	Rod Dia. (mm)	Total Displacement - mm/10 minutes @		
			69 bar (1000 lb/in ²)	138 bar (2000 lb/in ²)	207 bar (3000 lb/in ²)
HEAD SIDE					
Backhoe					
S/shift Jack Leg	70	40	13	44	91
Knuckle	100	60	6	16	32
Ext Dip	70	40	13	32	65
Loader					
Clam	70	40	6	22	45
Lift	80	50	5	17	35
Lift	90	50	4	13	28
ROD SIDE					
Backhoe					
Boom	110	60	8	26	52
Boom	120	65	6	22	44
Boom	130	70	5	19	37
Boom	140	75	5	16	32
Bucket	90	50	11	45	114
Bucket	100	60	10	40	99
Dipper	100	60	10	34	70
Dipper	110	65	8	28	57
Ext Dip	70	40	19	66	96
Loader					
Shovel	70	40	10	33	68

Using the figures above, a graph can be plotted and the maximum amount of movement determined. See the next page for a working example.

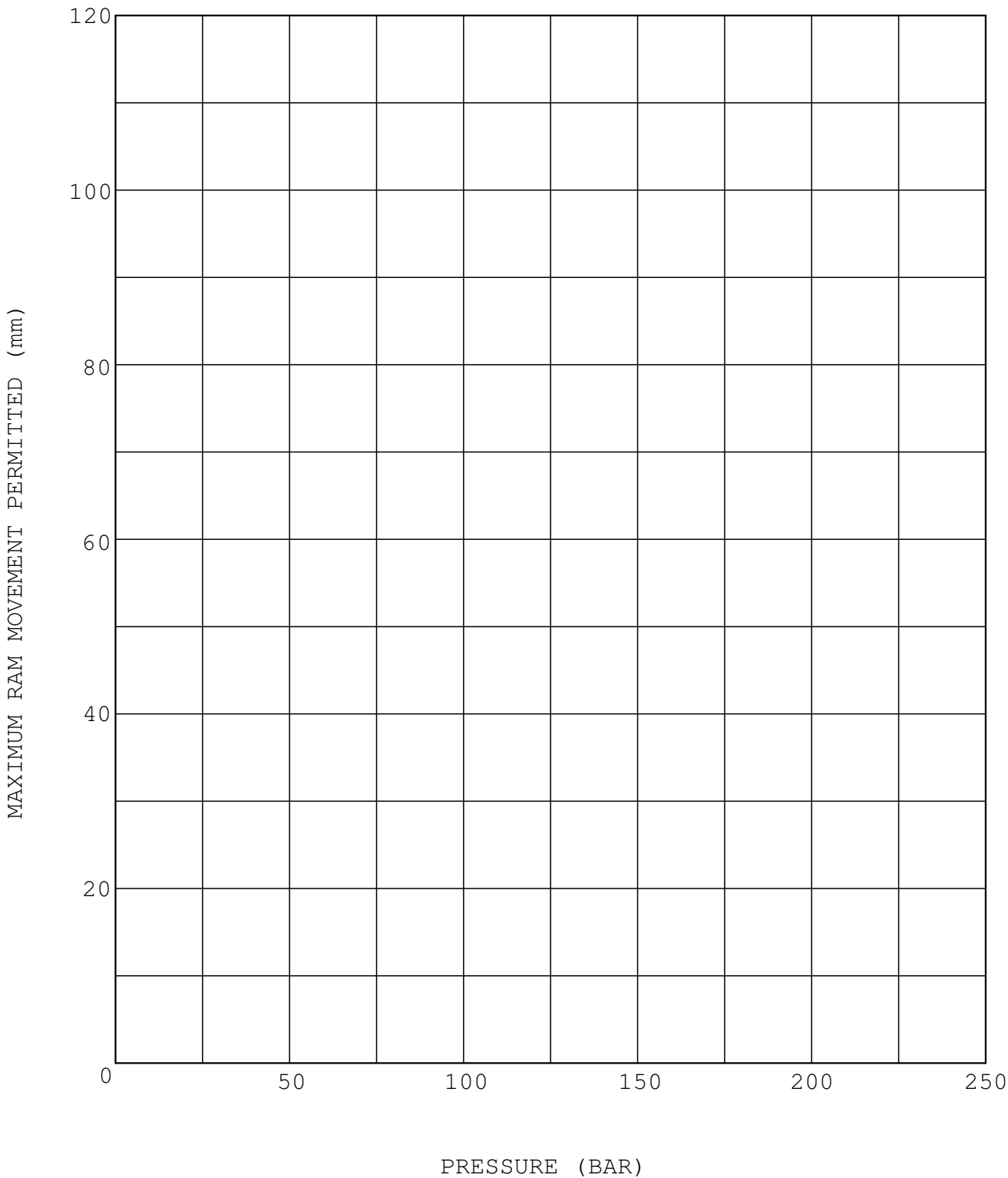
EXAMPLE - Boom Ram110 x 60

- 1 Using the figures given in the table on page 3, plot a graph for the ram to be tested.
- 2 Check the pressure in the ram (induced by the applied load). In this example the pressure on the gauge reads 107 bar; 1500 lb/in².
- 3 Draw a vertical line from the pressure reading to the plotted graph line. Where the vertical line intercepts the graph line, draw a horizontal line and read the permitted ram displacement. In this example the permitted maximum displacement is 18 mm.

Note: A blank graph is provided on the next page, photocopy and use as required.



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Quick Release Couplings

- Connecting and Disconnecting

Flat face quick release couplings allow the operator to remove and install attachments swiftly and efficiently. Generally, your machine pipework will have female couplings **A** fitted, and the optional attachment hoses will have male couplings **B** fitted.

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 fluid at pressure can injure you. Make the machine safe before connecting or disconnecting quick release couplings; stop the engine and then operate the attachment control a few times to vent residual hydraulic pressure in the attachment hoses.

2-4-1-11

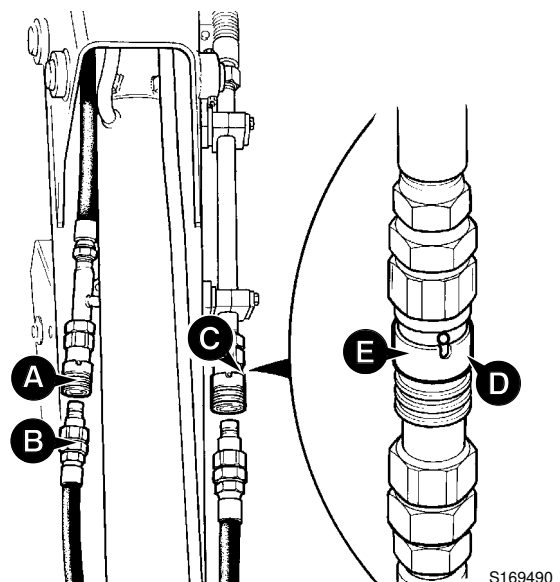
Before connecting or removing any hydraulic hose, residual hydraulic pressure trapped in the service hose line must be vented. This is usually achieved by switching off the engine and then operating the attachment control lever several times. Make sure the hose service line has been vented before connecting or removing hoses - refer to the appropriate attachment information in this section.

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 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 the slot **D**.

Disconnecting Quick Release Couplings

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



Smooth Ride System

Charging/Discharging the Accumulator

Charging

- 1 Park the machine on level ground, lower the loader arms, switch off the engine and chock all four wheels. Release all hydraulic pressure in the accumulator by selecting the starter key to the ON position without the engine running, SRS ON and operating the loader arm hydraulic lever.
- 2 Remove gas valve guard **A** and gas valve cap **B**.
- 3 Screw T handle **C** all the way out (counter clockwise) before attaching charging tool (service tool 892/00948) to accumulator gas valve.
- 4 Close bleed valve **D**.
- 5 Making sure not to loop or twist the hose, connect the charging tool to the gas valve. Tighten to 1.0 lbf ft (1.36 Nm, 0.14 kgf m).
- 6 Connect charging tool to a bottle of compressed nitrogen gas.
- 7 Screw T handle **C** all the way in (clockwise), this will depress the core in the gas valve. Check charge pressure which should be set to suit the loader and the attachment fitted to the machine. For recommended charge pressures refer to **Technical Data - Smooth Ride System**.
- 8 If charge pressure is low, carefully open hand valve **E** on the nitrogen bottle and SLOWLY fill the accumulator. Close valve **E** when the required charge pressure is reached on the gauge.
- 9 Let the pressure settle for 10 to 15 minutes. This will allow the gas temperature to stabilise. If the charge pressure is exceeded, with the gas bottle closed, open bleed valve **D**. Reduce pressure as required, then close bleed valve.

CAUTION

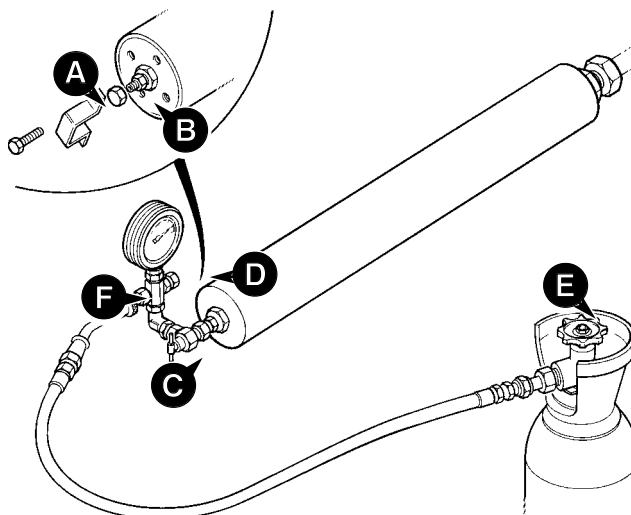
To reduce pressure use the recommended charging tool or the charge valve could be damaged which may result in rapid discharge of the accumulator.

HYD 2-4

- 10 When complete screw T handle **C** all the way out (counter clockwise) then open the bleed valve **D** to vent the hose.
- 11 Hold the gas valve to keep from turning, loosen nut and remove charging tool.
- 12 Refit gas valve cap and valve guard.

Discharging

- 1 Park the machine on level ground, lower the loader arms, switch off the engine and chock all four wheels. Release all hydraulic pressure in the accumulator by selecting the starter key to the ON position without the engine running, SRS ON and operating the loader arm hydraulic lever.
- 2 Remove gas valve guard **A** and gas valve cap **B**.
- 3 Screw T handle **C** all the way out (counter clockwise) before attaching charging tool (service tool 892/00948) to accumulator gas valve.
- 4 Close bleed valve **D**.
- 5 Either connect charging tool to a bottle of compressed nitrogen gas which is turned off or remove hose **F** and fit a suitable blank on charging tool.
- 6 Screw T handle **C** all the way in (clockwise), this will depress the core in the gas valve.
- 7 Open bleed valve **D** until all the gas charge is relieved from the accumulator. Remove the charging tool.



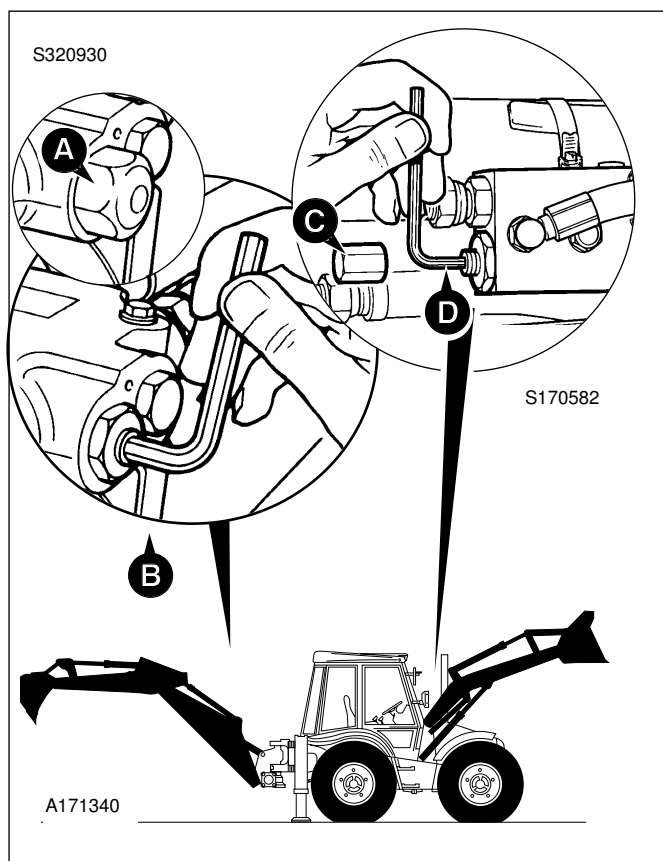
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Hose Burst Protection Valves

The hose burst protection valves (if fitted) prevent the loader or backhoe falling in the event of a hose burst. These valves may be fitted on rams which raise or lower the loader arms, the boom or the dipper.

Checking

- 1 Raise the loader arms fully. Raise the boom to about 45°. Raise the dipper to the horizontal.
- 2 Stop the engine
- 3 Using the control levers, try to lower the loader, boom and dipper. Push the levers fully to the 'lower' position. If there is any movement, adjust or replace the hose burst protection valve as applicable.



Lowering a Load - In a Failure Condition

During normal operation, the engine must be running before a load can be lowered. The following paragraphs describe how to safely and correctly lower a load in the event of engine failure or a hose burst; we recommend that only a competent maintenance engineer perform the procedures.

After lowering a load do not use the machine until the manual over-ride screw has been reset (Loader HBPV, refer to **Pressure Testing - Loader Lift Ram**) or a new end cap and valve assembly fitted (Boom HBPV, refer to **Hose Burst Protection Valves - Dismantling and Assembly**), otherwise the valve will not operate as intended.

⚠ DANGER

Do not stand underneath the raised load during the lowering procedure. Stand clear and to one side until the load has been safely lowered. Make sure that the area is clear of other people before lowering the load. If you do not follow these precautions you or others could be killed or seriously injured.

2-3-5-3

Boom and Dipper Hose Burst Protection Valve (HBPV)

- 1 Remove cap **A** and pierce the warning label.
- 2 If a hose has burst, position a suitable container to catch the oil.
- 3 Insert an 6mm allen key into the socket head of screw **B**. Slowly turn the allen key in a clockwise direction until the load just begins move.
Burst hose - Lower the boom using screw **B**, turn the screw counter-clockwise to slow or stop the load from lowering.
Dead engine - Operate the control lever in the cab to lower the load.

Loader Hose Burst Protection Valve (HBPV)

- 1 Remove cap **C** from both HCPV check valves on the loader lift arms.
- 2 If a hose has burst, position a suitable container to catch the oil.
- 3 On the burst hose HBPV, insert an 5mm allen key into the socket head of screw **D**. Turn the allen key in a clockwise direction so that the screw winds fully in. Repeat slowly for the opposite side as the load is now supported on this HBPV.

Note: Count the number of full turns on each screw for resetting purposes.

- 4 Operate the control lever in the cab to lower the load.

Hose Burst Protection Valves

Pressure Testing - Loader Lift Ram

The following text describes the pilot valve setting procedures and pressure testing sequences for ONE HBPV only, repeat the procedures for BOTH loader arm lift rams.

Preparation

Before starting the pressure testing procedure vent hydraulic system pressure as follows:

- 1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral.
- 2 Lower the loader arms to the ground (not lifting the machine).
- 3 Select 'ARMS LOWER' to raise the front wheels approximately 25 - 50 mm (1 - 2 in) off the ground.
- 4 Switch off the engine.
- 5 Make sure all personnel are clear of the machine before completing step 6.
- 6 Select 'ARMS RAISE' - this will vent residual hydraulic pressure from the loader rams (head side).
- 7 Move all the backhoe control levers back and forth to vent any other residual hydraulic pressure from the backhoe service hoses.

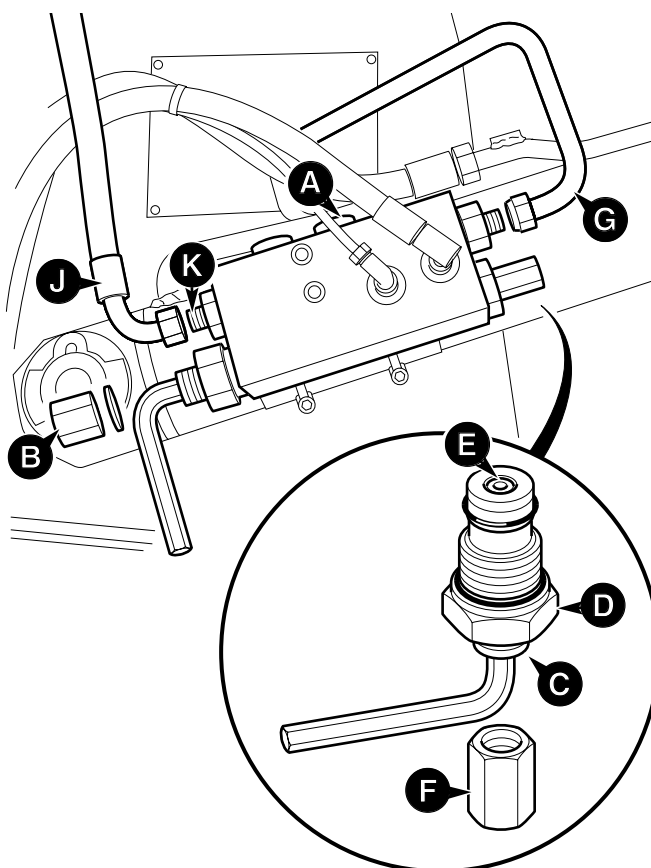
Pilot Valve Setting Procedure

The pilot valve assembly, shown at **C**, must be set correctly before doing the relief valve pressure test. If the pilot valve is screwed too far into the HBPV it will create a flow path connection from port C2 to port V2 (see descriptions of operation).

To set the pilot valve assembly:

- 1 Remove pilot housing, item **D**, from the HBPV.
- 2 Check that the end face of the pilot valve assembly, item **C**, is flush (level) with the end face of its housing **D**, as shown at **E**.
- 3 If necessary, remove end cap **F** and, using a suitable Allen key, adjust the pilot valve as required.
- 4 Refit the end cap.

Continued.....



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Hose Burst Protection Valves

Pressure Testing - Loader Lift Ram (continued)

Relief Valve Pressure Test

If the hose burst protection valve has been stripped and cleaned, then pre-set the valve as detailed in step 1. The pressure test procedure is described in steps 2 to 6.

- 1 Pre-set the relief valve:
 - a Remove cap **B** and its copper washer. Using an Allen key, turn the adjusting screw anti-clockwise to remove all tension.
 - b Using your fingers, turn the adjusting screw clockwise until a soft force (resistance) is felt.
 - c Using an Allen key, turn the adjusting screw a further $2\frac{1}{4}$ turns to pre-set the relief valve. Refit the cap and washer.
- 2 Remove hose **G** from port C2. Cap and plug the hose and valve port adapter (the valve port adapter **MUST** be plugged, otherwise the test procedure will not work).
- 3 Remove hose **J** from port V2. Plug the hose but **DO NOT** cap the valve port adapter.
- 4 Remove plug **A** and in its place fit a 0-400 bar (0-6000 lbf/in²) pressure gauge connected to a hand pump.
- 5 Use the hand pump to increase the pressure. When the pressure reaches the setting of the relief valve, oil will escape from port V2, shown at **K**. Note the maximum gauge reading (the setting of the hose burst relief valve) which should be 250 bar (3625 lbf/in²).
- 6 If necessary, adjust the pressure setting as follows:
 - a Remove cap **B** and its copper washer.
 - b Using an Allen key, turn the adjusting screw clockwise to increase the pressure or anti-clockwise to decrease the pressure. For information; one full turn of the relief valve adjusting screw is equivalent to approximately 110 bar (1595 lbf/in²).
 - c Replace the cap and washer.
 - d Repeat pressure test, adjust as necessary.

Fixed Flow

Removal and Replacement

The following Procedure describes removal and replacement of a double section pump, follow the same procedure for single section pumps.

Removal

⚠ WARNING

Make the machine safe before getting beneath it. Ensure that any fitments on the machine are secure; engage the parking brake, remove the starter key, disconnect the battery.

INT-3-3-8

- 1 Remove the propshaft, refer to Section F **Propshafts - Removal and Replacement**.
- 2 Drain the hydraulic fluid from the hydraulic tank.
- 3 Remove flange bolts **B** (4 off) and disconnect the pump inlet hose flange from the pump body. Blank off all exposed connections to prevent ingress of dirt.
- 4 Disconnect the pump outlet hoses **C** and **D** from the elbow fittings. Blank off all exposed connections to prevent ingress of dirt.

⚠ CAUTION

The hydraulic pump is heavy. Do not attempt to remove the pump unless its weight is held by a sling. Make sure that the sling is attached to a suitable lifting appliance.

HYD 2-3

- 5 Secure the pump using a sling around the pump body, remove the pump mounting bolts **E** and carefully withdraw the pump clear of the gearbox.

Torque Settings

Item	Nm	kgf m	lbf ft
B	TBA		
E	TBA		

Replacement

Replacement is the reverse of the removal procedure.

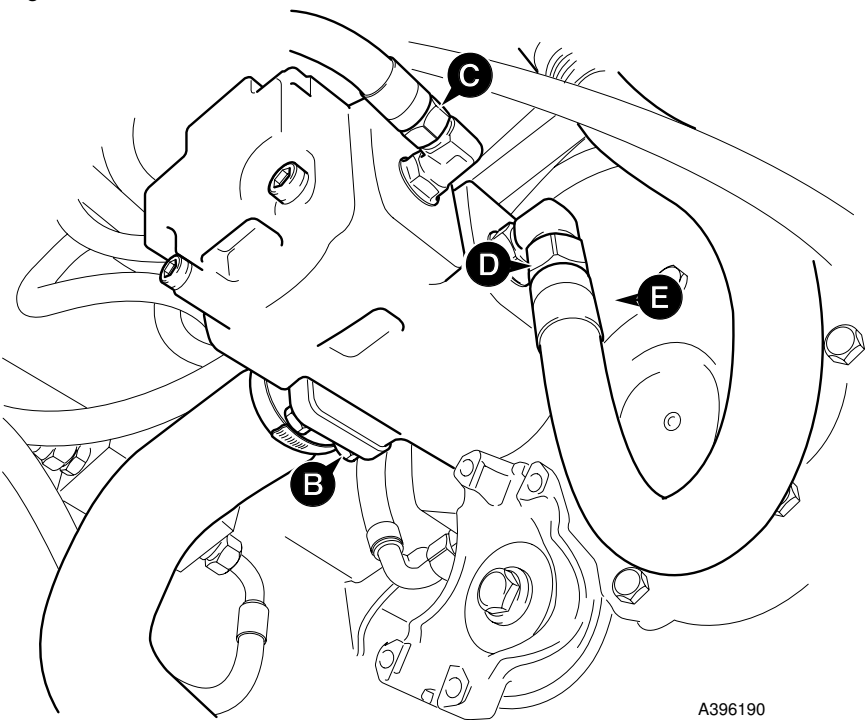
- 1 Clean off all traces of gasket compound from the pump and gearbox mounting faces. Apply a thin bead of JCB Multigasket to the gearbox mounting face.
- 2 Locate the splined shaft of the pump into the gearbox. Apply JCB Threadlocker and Sealer to bolts **E** and secure the pump flange to the gearbox mounting face.
- 3 Reconnect the pump outlet hoses **C** and **D** to the elbow fittings.

Note: All hydraulic adapters that are installed together with a bonded sealing washer must also have sealant JCB Threadseal applied to the threads of the adapter.

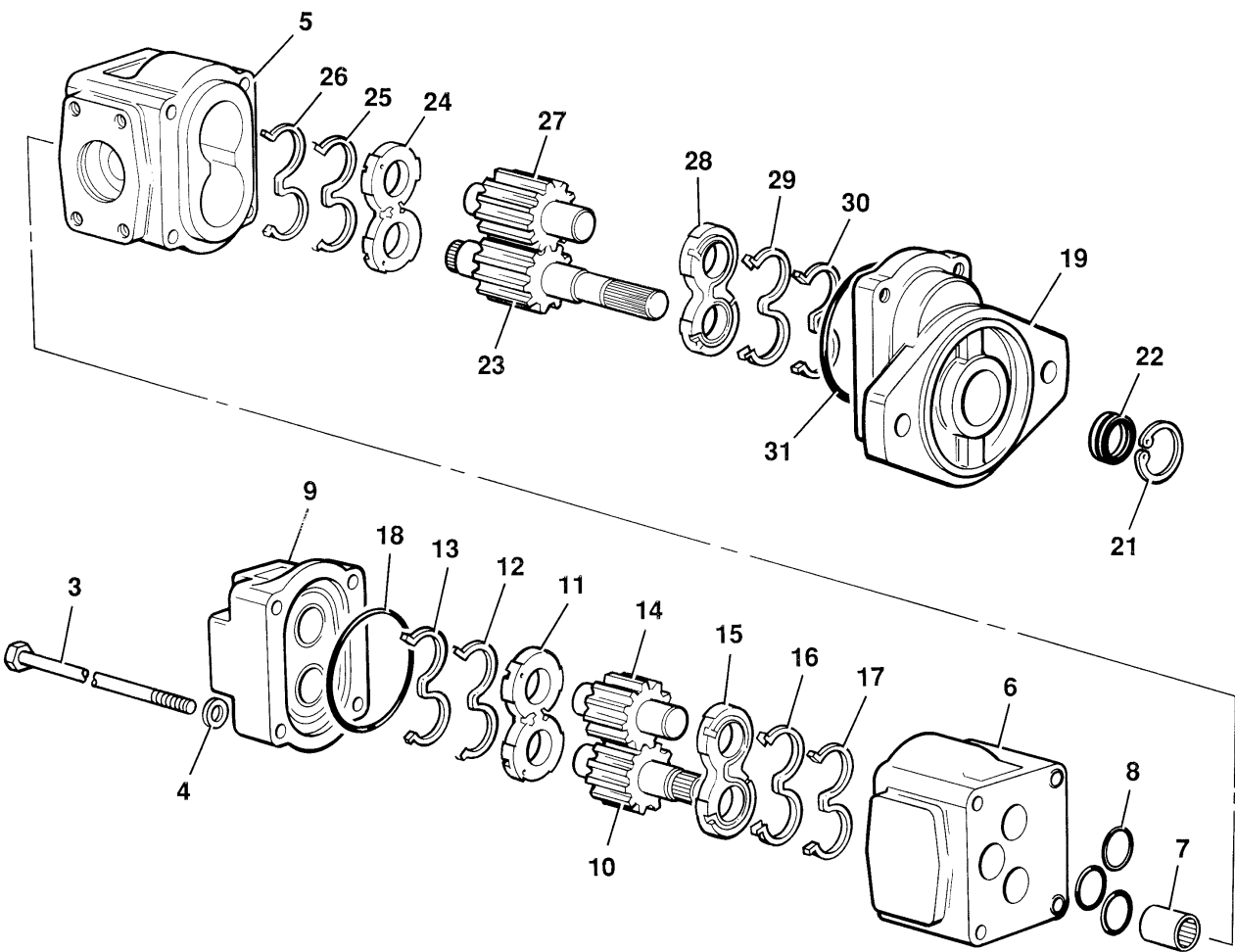
- 4 Reconnect the pump inlet hose flange to the pump body with bolts **B** (4 off).
- 5 Fit the propshaft, refer to Section F **Propshafts - Removal and Replacement**.
- 6 Fill the system to the correct level with recommended hydraulic fluid, refer to Section 3 **Fluids, Lubricants, Capacities and Specifications**.

Note: Replace the suction strainer and return line filter after fitting a new or serviced pump.

- 7 After fitting a new or serviced pump and before starting the engine screw the main relief valve out. Run the engine and check for leaks, also check the main relief valve (M.R.V.) operating pressure. Refer to Section E **Service Procedures, Pressure Testing - MRV**.



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Fixed Flow

Dismantling and Assembly

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

Before removing and dismantling the pump, make sure the exterior of the pump and working area is thoroughly cleaned and free of possible sources of contamination.

Dismantling

- 1 Remove the four bolts **3** and serrated washers **4** which clamp the units together.
- 2 Use a soft faced hammer to separate front body **5** and rear body **6** after first marking them to ensure correct re-assembly.
- 3 Remove splined coupling **7** and O-rings **8**. Discard the O-rings.
- 4 Use a soft faced hammer to separate end cover **9** from rear body **6**, after first marking them to ensure correct re-assembly.
- 5 Remove drive gear **10** from its bore. Pushing it out of the rear body will also remove balance plate **11** complete with seal **12** and seal energiser **13**. Discard the seal and seal energiser. Note the position of the driveshaft and the balance plate to ensure correct re-assembly.
- 6 Remove driven gear **14**, followed by balance plate **15** complete with seal **16** and seal energiser **17**. Discard the seal and seal energiser.
- 7 Discard O-ring **18**.
- 8 Use a soft hammer to separate mounting flange **19** from front body **5**, after first marking them to ensure correct re-assembly.
- 9 Remove circlip **21** and shaft seals **22**. Note which way round the seal lips are fitted to ensure correct fitting of new seals on re-assembly.
- 10 Remove driveshaft **23** from front body **5**. Removal will also remove balance plate **28** complete with seal **29** and seal energiser **30**. Discard the seal and seal energiser.
- 11 Remove driven gear **27** followed by balance plate **24**, seal **25** and seal energiser **26**. Discard the seal and seal energiser.

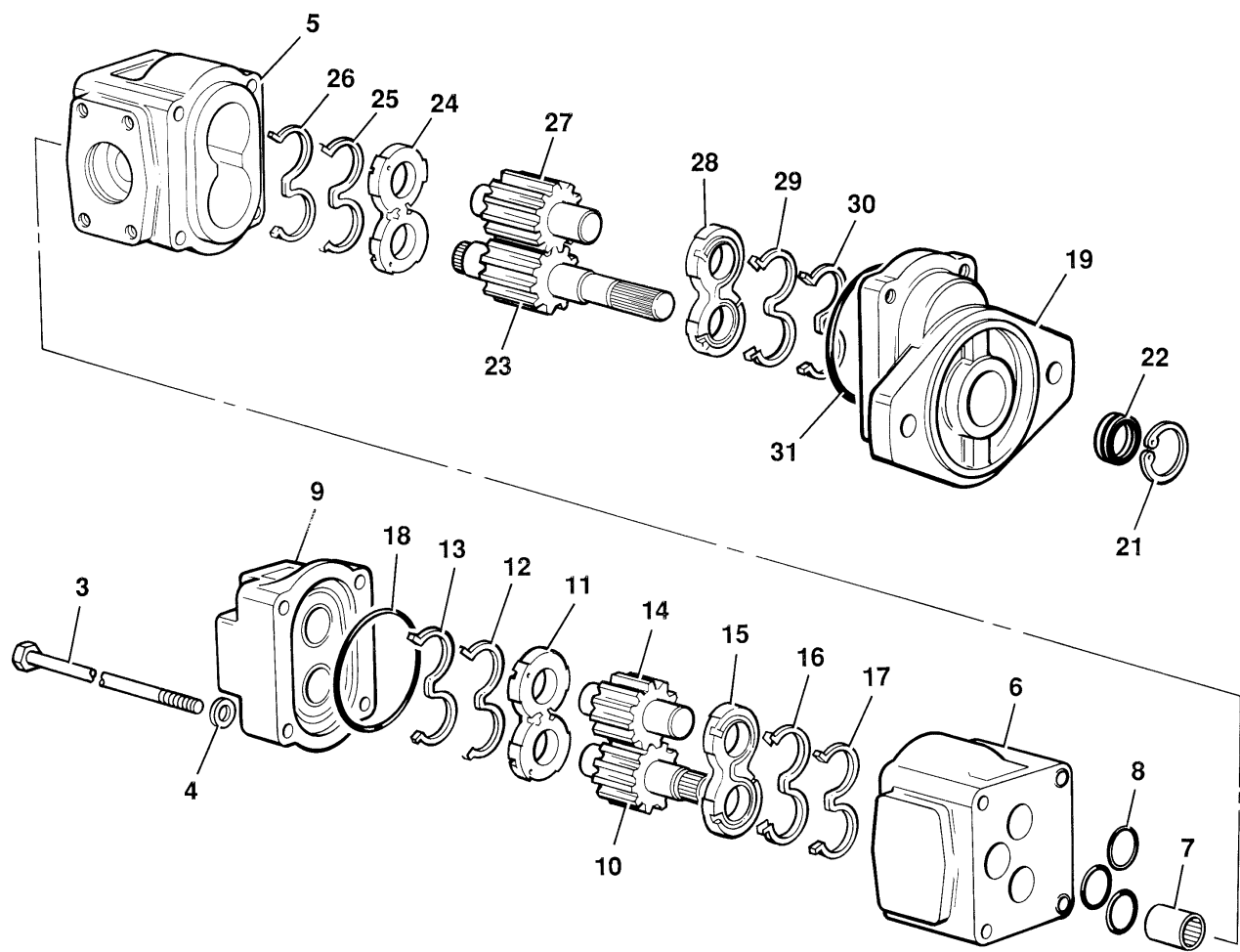
- 12 Discard O-ring **31**.

- 13 Remove all sealant from the contact faces of the mounting flange/front body and end cover/rear body interfaces.

- 14 Wash all components and immediately apply a coating of hydraulic oil to prevent corrosion.

Inspection

- 1 Generally check all pump parts for damage and/or wear. The O-ring grooves, the seal recess in the mounting flange and all sealing faces must be free of burrs and scores which could result in seal damage and hence hydraulic oil leakage.
- 2 Renew the pump if any of the following symptoms exist:
 - a The PTFE coated bearings in the pump bodies, the mounting flange and the end cover are worn through to reveal the bronze backing.
 - b The gear side faces are scored. Often contaminated fluid results in a distinct wear step coincident with the gear root diameter. This can normally be felt by drawing a sharp point across the gear side face from the journal towards the tip of the gear.
 - c There is a noticeable wear groove on driveshaft **23** where seals **22** run.
 - d The balance plate faces are scored, particularly in the area adjacent to the gear root diameter.
 - e The shaft splines are worn or severely fretted.
 - f The gear "cut-in" area in the low pressure side of the pump body is deeper than 0.15 mm (0.006 in) or has a torn or pitted appearance.



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Fixed Flow

Dismantling and Assembly (continued)

Assembling

When carrying out the following procedure, renew all seals and O-rings. Lubricate using JCB Special Hydraulic Fluid.

- 1 Fit shaft seals **22** into mounting flange **19**, making sure the seal lips are the correct way round as noted in dismantling. Fit circlip **21** into its groove in the flange. Coat the seal lips with high melting point grease.

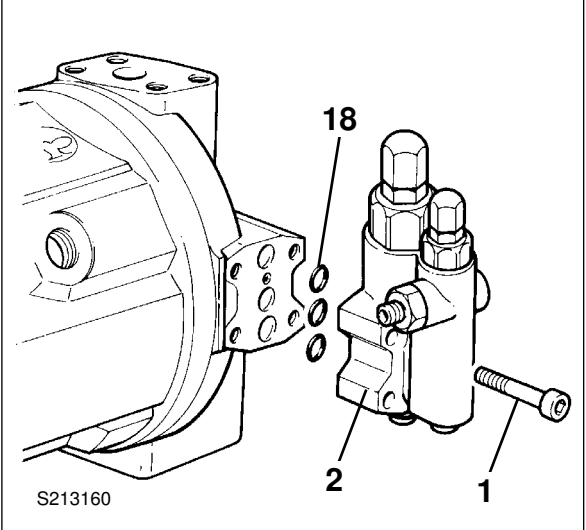
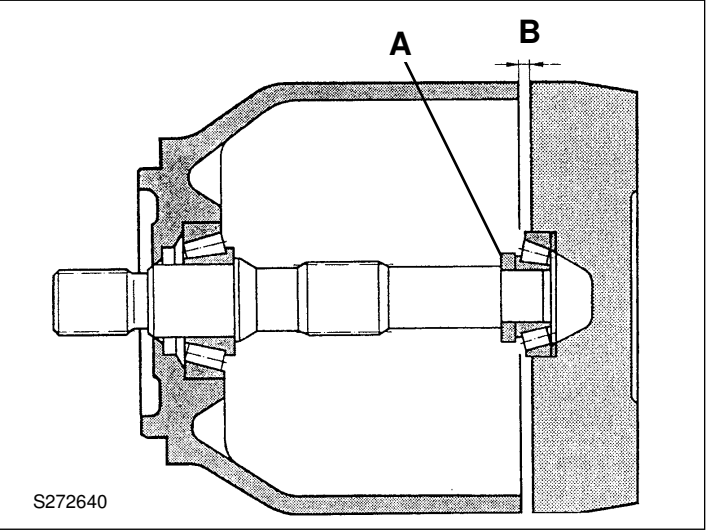
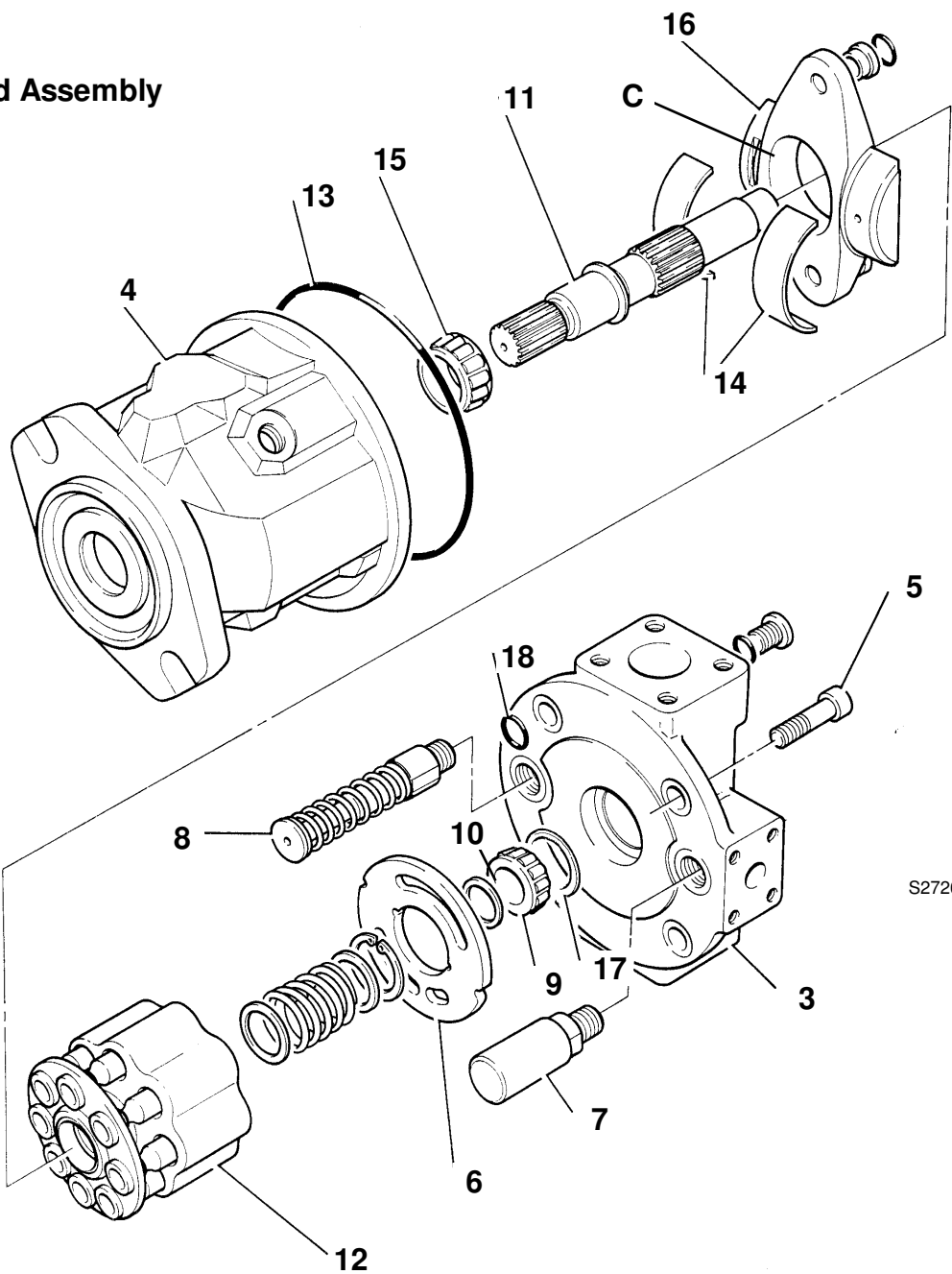
Note: If the seal recess is scored, it is permissible to seal outside diameter with JCB Multigasket to prevent leakage.

- 2 Stand front body **5** on its rear face. Fit seal **25** and seal energiser **26** into balance plate **24**.
- 3 Ensuring that the seals do not fall out, carefully feed the balance plate into the bores of the front body **5** with the two small holes through the balance plate to the low pressure side of the body (i.e. side with the large 4-bolt port pattern).
- 4 Insert driveshaft **23** and driven gear **27** into the original bores.
- 5 Fit balance plate **28** over the driveshaft and gear stub. Insert seal **29** and seal energiser **30** into the balance plate.
- 6 Fit O-ring **31** into the groove on mounting flange **19**.
- 7 Apply a small amount of JCB Multigasket to the face of front body **5** which seals with mounting flange **19** (i.e. the face containing the clamping bolt holes).
- 8 Carefully feed mounting flange **19** over driveshaft **23** in its original position, as marked earlier. Use a soft faced hammer to tap the flange onto its location spigot.
- 9 Support the front pump assembly on the mounting flange (but not the driveshaft). Fit O-rings **8** into the grooves on the rear face of the front body **5**. Install splined coupling **7**.
- 10 Fit rear body **6** onto front body **5** in its original position, as marked earlier, ensuring that it locates on the dowels and that the clamping bolt holes line up.
- 11 Fit seal **16** and seal energiser **17** into balance plate **15**. Ensuring that the seals do not fall out, carefully feed the balance plate into rear body **6** with the two small holes through the balance plate to the low pressure side (i.e. side without a port).
- 12 Fit drive gear **10** so that it locates with splined coupling **7**. Fit driven gear **14**.

- 13 Fit balance plate **11** in its original position (i.e. with the two small holes to the low pressure side). Fit seal **12** and seal energiser **13** into the balance plate.
- 14 Fit O-ring **18** into end cover **9**.
- 15 Apply a small amount of JCB Multigasket to the exposed face of rear body **6** (i.e. the face containing the clamping bolt holes).
- 16 Fit end cover **9** in its original position, as marked earlier.
- 17 Install the four bolts **3**, each with a serrated washer **4**, and tighten evenly and progressively to a torque of 90 - 100 Nm (66 - 74 lbf ft).
- 18 Pour a small amount of clean JCB Special Hydraulic Fluid into the ports. Check that driveshaft **23** rotates without undue force. If excessive force is required it is possible that one or more of the balance plate seals are trapped, in which case it will be necessary to dismantle and assemble the pump again.

Variable Flow

Dismantling and Assembly



Variable Flow

Dismantling and Assembly

Before removing and dismantling the pump, make sure it is the pump that is at fault. Complete all the necessary checks as detailed in **Service Procedures, Variable Flow Pumps**. Make sure that the exterior of the pump and working area is thoroughly cleaned and free of possible sources of contamination. Following removal of the pump from the machine, transfer it to a clean dirt free environment ready for dismantling.

The variable displacement pump has matched-ground components. For this reason, some items will only be available as a sub-assembly, for instance the barrel and piston assembly.

All the 'O' rings, seals and bearings are available in a kit form from your JCB Distributor.

Dismantling

Refer also to **Service Procedures, Variable Flow Pumps - Renewing Drive Shaft Seal**.

- 1 Remove capscrews 1 (4 off) and detach the regulator assembly 2 from the pump housing.
- 2 Mark the position of the port plate 3 to pump housing 4.
- 3 Remove socket screws 5, and remove the port plate together with the valve plate 6, control piston 7 and stroking piston 8. Hold the plate in position during removal.
- 4 Remove taper roller bearing 9 and shim 10 from the drive shaft 11.
- 5 Remove the rotary piston assembly 12 from the pump housing. Assembly includes shaft 11, bearing 15, and cradle 16.
- 6 Remove and discard port plate to pump housing 'O' ring 13.
- 7 Remove bearing shells 14 and disc 17.
- 8 Remove the outer bearing races (not shown) from the pump housing and the port plate. Only remove the races if they are damaged and unserviceable.
- 9 Lift the valve plate 6 off the port plate, do not lose the dowel pins (not shown).
- 10 Remove and discard 'O' rings 18.
- 11 Remove control piston 7. Note that the control piston is mounted on the same side as the regulator valve.
- 12 Remove the stroking piston assembly 8.

Further dismantling and assembly of the pump is not recommended.

Inspecting Parts

Generally check all pump parts for damage and/or wear. Any parts that are scored or damaged must be replaced with new ones.

The shaft 'O' ring grooves and all sealing faces must be free of burrs and scores. During assembly, make sure that the rotary piston group move freely. Renew all 'O' rings and seals.

Assembly

Assembly is generally a reversal of the dismantle procedure, but note the following:

The taper roller bearing must have a preload of 0.0 to 0.05mm (0.0 to 0.002in.). If the original bearing and shim is being fitted no preload adjustment is required. If a new bearing is installed a preload adjustment is required:

Preload Adjustment:

Install a setting shim of known thickness (as shown at **A**). The shim thickness must be manufactured to a tolerance of $\pm 0.01\text{mm}$ (0.0004in.). In this example the shim thickness is 1.5mm.

Fit the port plate item **3** and finger tighten the socket screws. It is important that the socket screws are tightened evenly and the port plate sits square.

Using feeler gauges measure the gap **B** between the port plate and the pump housing **4**. Measure in more than one position to establish the port plate is fitted evenly. Obtain shim thickness (dimensions in mm):

Example measured gap	1.26
Subtract preload	- 0.05
Total	1.21
Known shim thickness	1.50
Subtract calculated preload	-1.21
SHIM THICKNESS	0.29

When the shim thickness has been calculated, remove the setting shim **A** and fit the required shim (in this instance the shim would be 0.29mm).

Note: Setting shim **A** is not currently available as a service tool. The shim (and the calculated shim) can be manufactured locally. Maintain a tolerance of $\pm 0.01\text{mm}$ (0.0004in.).

The lubrication bore relief (item **C**) on the cradle must be fitted on the pressure side of the pump.

Check the control piston and the stroking piston move smoothly.

The regulator valve assembly is currently a non serviceable part.

Removal and Replacement

Manual Control

⚠ WARNING

Make the machine safe before working underneath it. Park the machine on level ground, lower the arms. Apply the parking brake, put the transmission in neutral and stop the engine. Chock both sides of all four wheels.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.

GEN-1-2

⚠ DANGER

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

Removal

* **Note:** The illustration shows a valve fitted with a bolt on auxiliary spool **1**. This item is only fitted to some machines, typically Precision Control machines with extending dipper.

- * **1** Operate the valve block levers back and forth to vent residual pressure. On Precision Control machines also operate the extending dipper foot pedal (if fitted).
- * **2** Remove clevis pins **A** and nuts **B** to disconnect the control levers from the valve block spools. Disconnect the control cable **D** (if fitted). Undo the lock nut **E**. Undo the housing fixing screws and slide it down the cable. Remove the pin **F**.

- 3** Disconnect all hydraulic hoses from the valve block and plug all orifices to prevent ingress of dirt. Label each hose before disconnecting, this will ensure correct position when refitting.
- * **4** Uncouple the dump solenoid electrical connector **G**. Uncouple the electric detent connector **H** (if fitted).
- * **5** Loosen and remove the three fixing nuts **J**. Remove the loader valve and spacing washers **C**.

Replacement

Replacement is a reversal of the removal sequence.

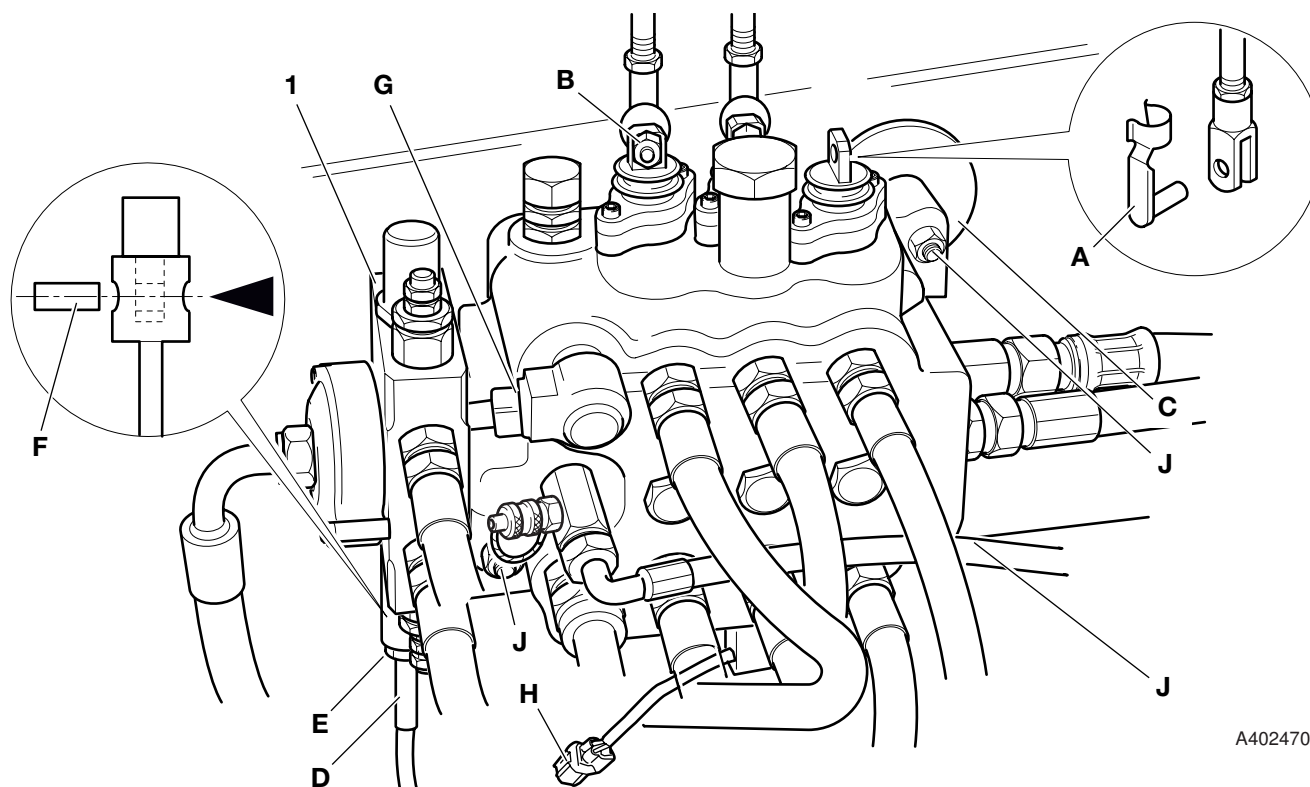
⚠ WARNING

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.

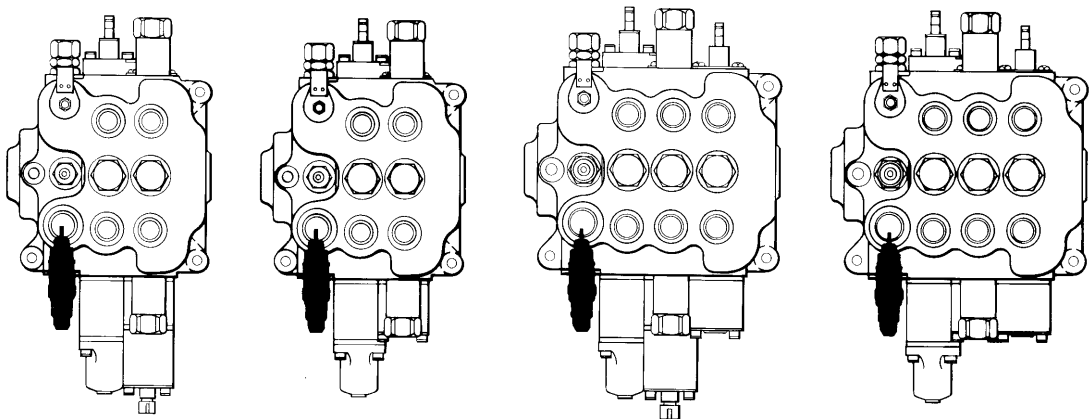
INT-3-1-10/1

After replacement check the main relief valve (M.R.V.) and auxiliary relief valve (A.R.V.) pressure settings.

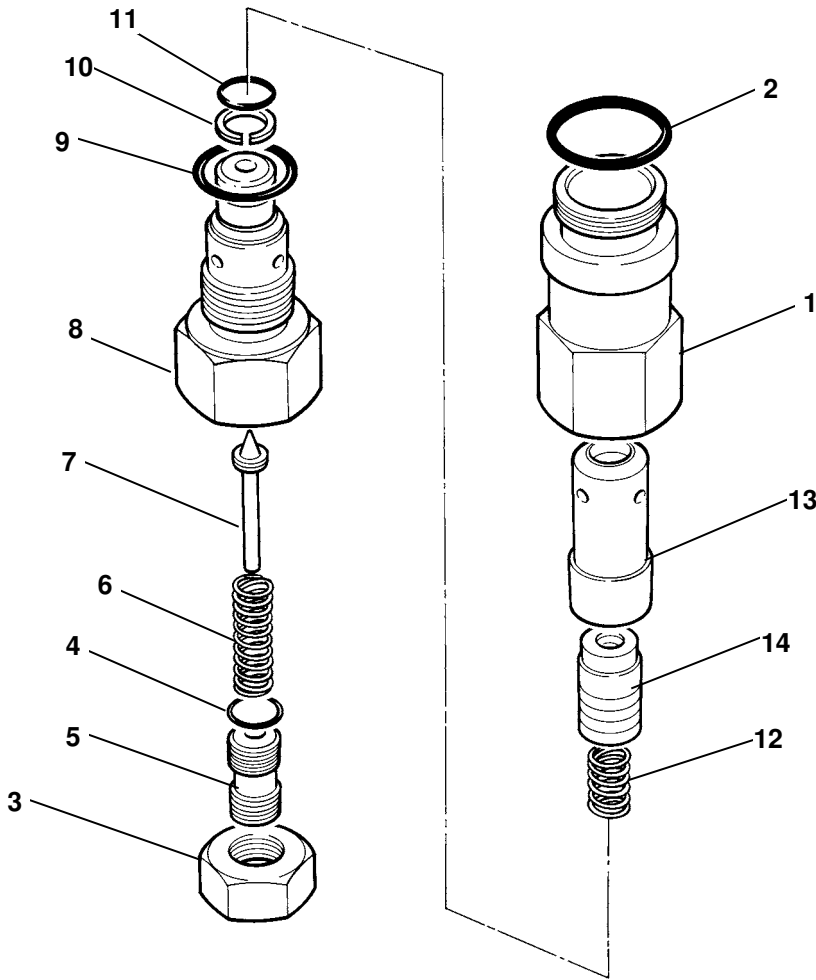
Note: All hydraulic adapters that are installed together with a bonded sealing washer must also have JCB Threadseal applied to the threads of the adapter.



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Dismantling and Assembly

Main Relief Valve (MRV)

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

For assembly the sequence should be reversed.

The following points MUST be avoided when dismantling and assembling the valve:

- CONTAMINATION
- DAMAGE TO SPOOL
- DAMAGE TO SEAL GROOVES

All or any of the above points may result in possible problems with the valve.

Dismantling

When removing 'O' rings and seals, use an appropriately rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' rings and back up rings. DO NOT use worn or damaged items.

Inspect the valve components for scratches, nicks or any other type of damage, replace with new if required.

Assembly

Renew all 'O' rings and back-up rings.

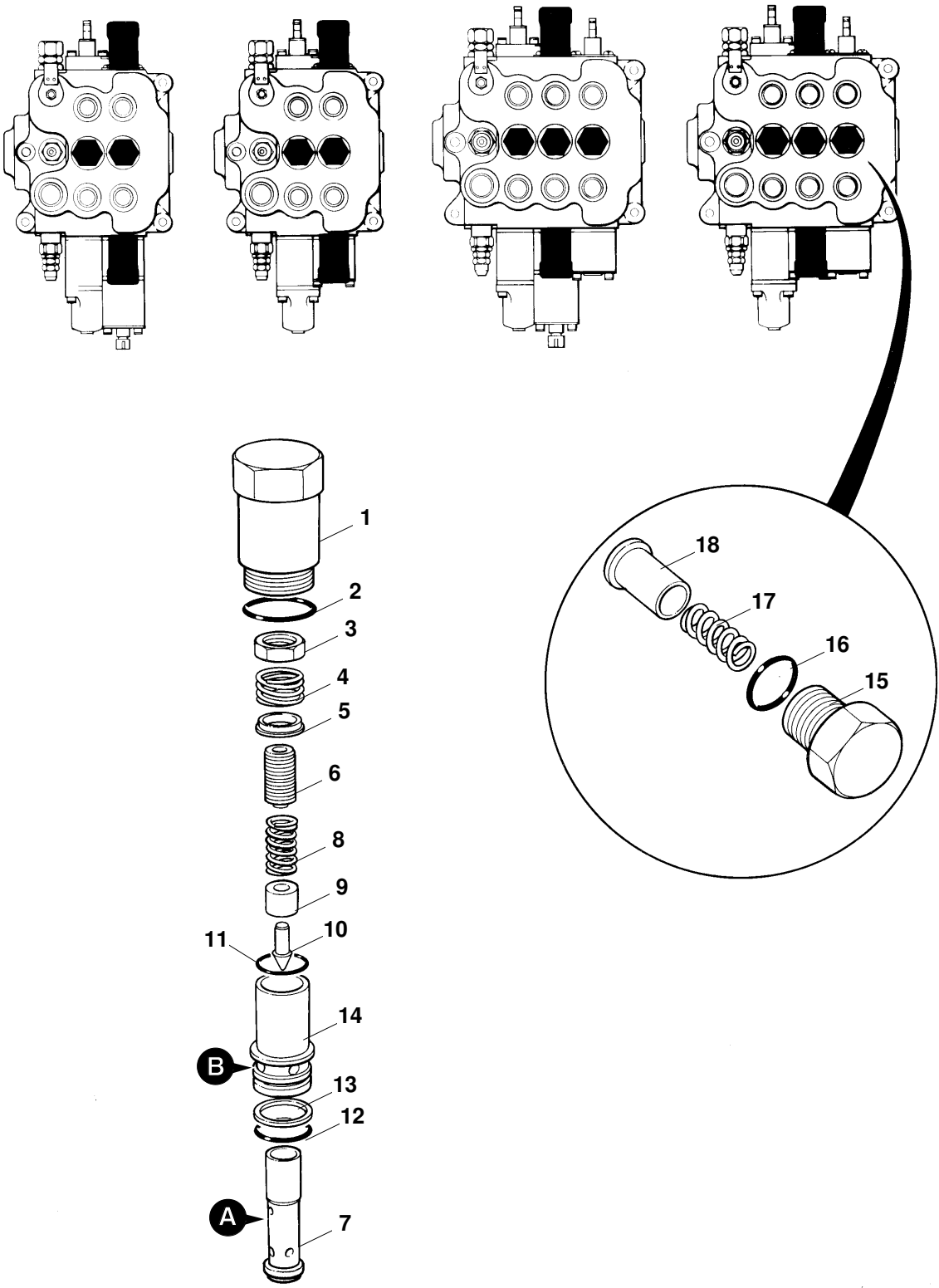
Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.

Make sure that the 'O' rings and back-up rings are fitted the correct way, items **10** and **11**.

Adjust pressure setting as required, refer to **Service Procedures, Loader Valve - Pressure Testing**.

Torque Settings

Item	Nm	kgf m	lbf ft
3	5.4	0.6	4



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Dismantling and Assembly

Auxiliary Relief Valves (ARV) and Load Hold Check Valves (LHCV)

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

For assembly the sequence should be reversed.

The following points **MUST** be avoided when dismantling and assembling the valve:

- CONTAMINATION
- DAMAGE TO SPOOL
- DAMAGE TO SEAL GROOVES

All or any of the above points may result in possible problems with the valve.

The ARV's are identical in design but have different pressure settings, refer to **Technical Data**.

The LHCV's are identical.

Dismantling

When removing 'O' rings and seals, use an appropriately rounded tool that **WILL NOT** cause any damage to the seal grooves.

Discard ALL 'O' rings and back up rings. **DO NOT** use worn or damaged items.

Dismantle sub-assembly **14** from item **1** using a special tool (see **Service Tools**). The special spanner locates in cross holes **B**.

Make sure that small drilling **A** is not blocked.

Ensure good condition of seating faces on poppet **18** and on the mating face of the valve block.

Inspect the valve components for scratches, nicks or any other type of damage, replace with new if required.

Assembly

Renew all 'O' rings and back-up rings.

Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.

Fit back-up ring **13** on the upper side of 'O' ring **12**.

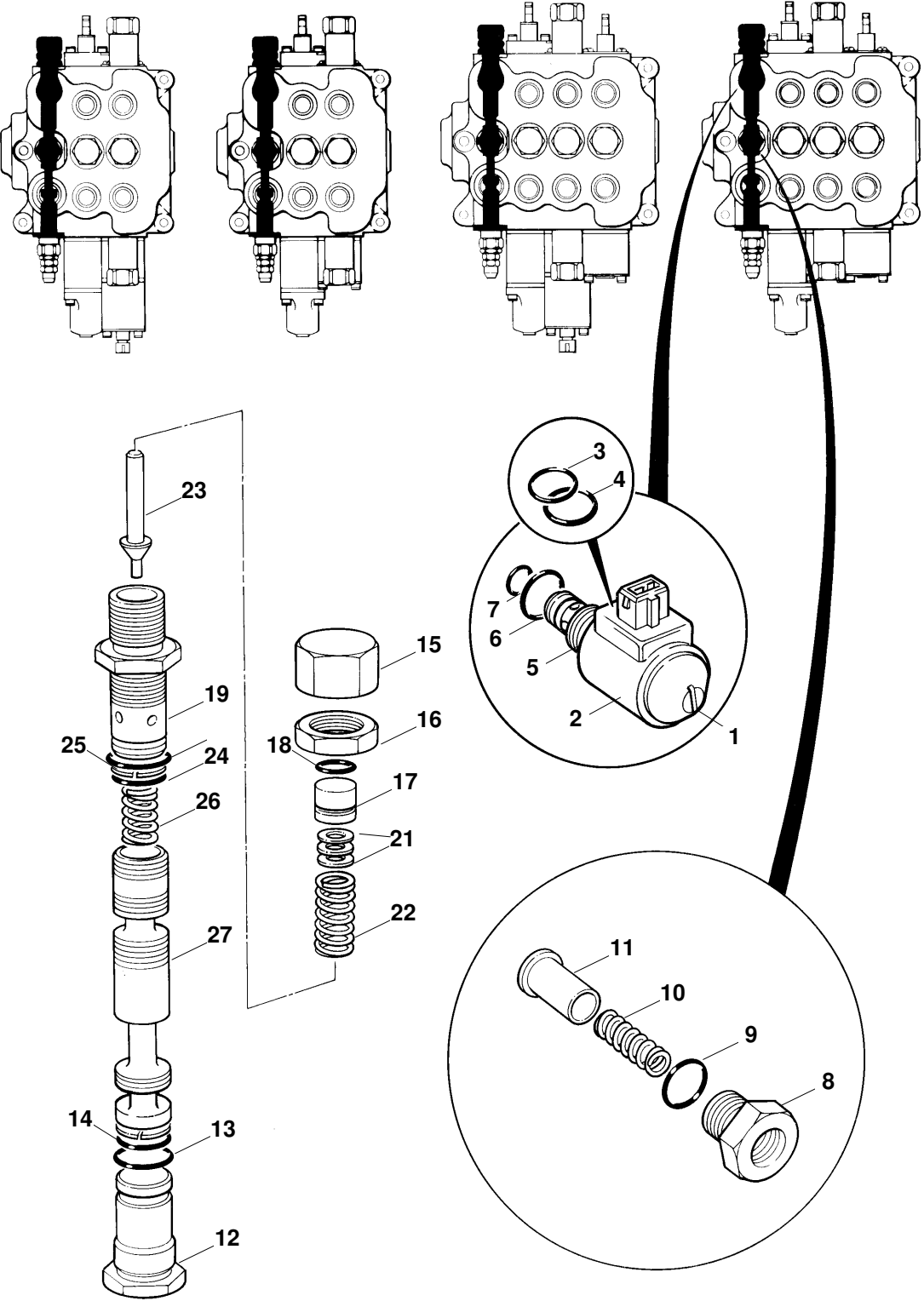
Fit flat face of sleeve **9** against shoulder of poppet **10**.

Torque tighten item **14** using the special tool (see **Service Tools**), until its shoulder seats firmly against item **1**.

Pressure test the relief valves, refer to **Service Procedures, Loader Valve - Pressure Testing**.

Torque Settings

Item	Nm	kgf m	lbf ft
1	65	6.6	48
3	24	2.5	18
15	81	8.3	60



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Dismantling and Assembly

Unloader Valve

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

For assembly the sequence should be reversed.

The following points MUST be avoided when dismantling and assembling the valve:

- CONTAMINATION
- DAMAGE TO SPOOL
- DAMAGE TO SEAL GROOVES

All or any of the above points may result in possible problems with the valve.

Dismantling

When removing 'O' rings and seals, use an appropriately rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' rings and back up rings. DO NOT use worn or damaged items.

Use a nylon rod to push out spool assembly item 23, DO NOT damage spool bore.

Inspect the valve components for scratches, nicks or any other type of damage, replace with new if required.

Assembly

Renew all 'O' rings and back-up rings.

Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.

Ensure that the small drilling through the centre of items 23, is clear.

Shims 21 are intended to limit the maximum pressure setting, the specified pressure setting is achieved by adjusting capnut 15. If the specified pressure cannot be achieved under test, it is permissible to add shims as required. There MUST be at least one hardened shim next to the spring item 22.

Do not over-tighten the solenoid assembly, it may effect the operation of the solenoid, use the spanner flats and torque tighten to figure indicated in the table below (items 1 and 5).

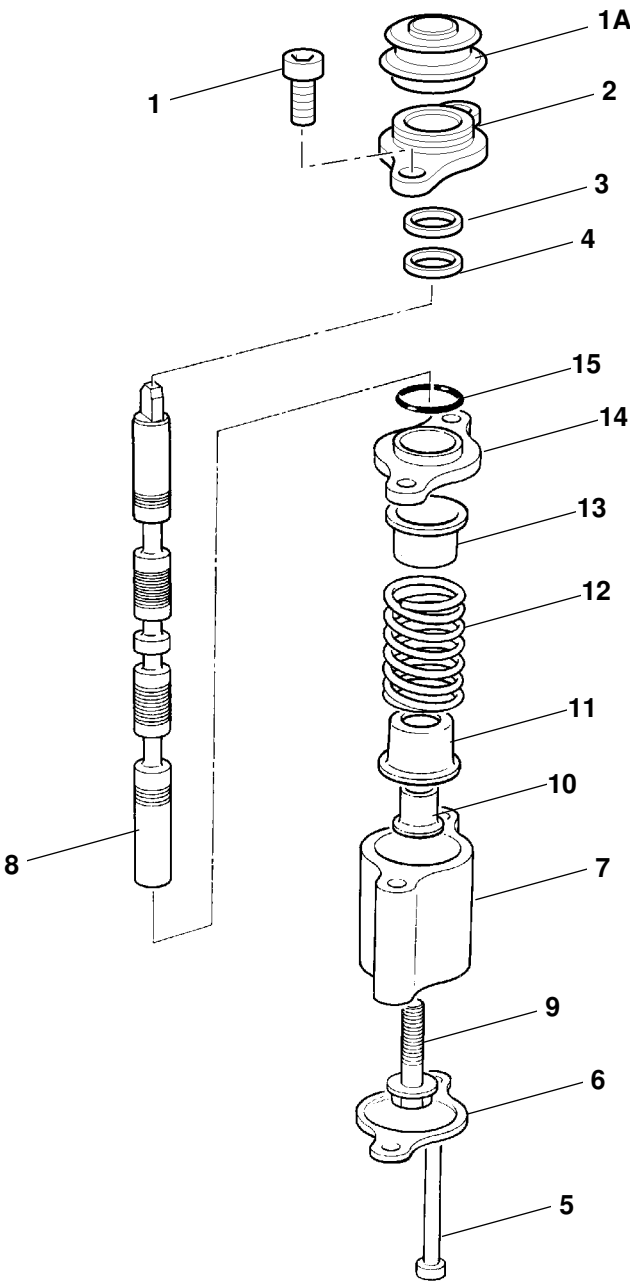
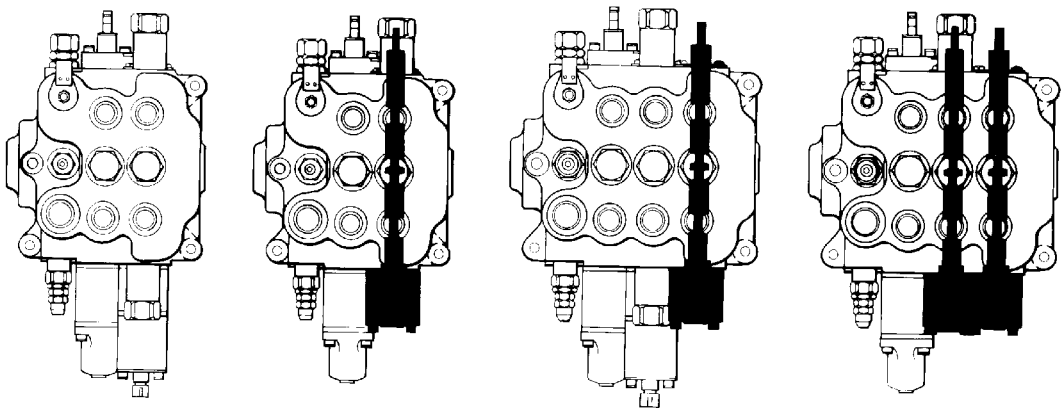
Fit chamfered end of spring 22 against head of pilot poppet item 23.

Check pressure setting after refitting, refer to **Service Procedures, Loader Valve - Pressure Testing**.

Check the operation of the hydraulic speed control, refer to **Service Procedures, Loader Valve - Pressure Testing**.

Torque Settings

Item	Nm	kgf m	lbf ft
1	6.7	0.7	5
5	27	2.8	20
8	81	8.3	60
12	81	8.3	60
16	45	4.6	33
19	34	3.5	25



S386380

Dismantling and Assembly

Standard Spool - Manual

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

For assembly the sequence should be reversed.

The following points **MUST** be avoided when dismantling and assembling the valve:

- CONTAMINATION
- DAMAGE TO SPOOL
- DAMAGE TO SEAL GROOVES

All or any of the above points may result in possible problems with the valve.

Dismantling

Remove the lever linkage from the tang (lever) end of the spool.

When removing 'O' rings and seals, use an appropriately rounded tool that **WILL NOT** cause any damage to the spool or seal grooves, for instance, item **3**, which is a wiper seal and is a press fit in the counterbore.

Care must be taken to ensure that the spool **8** is not damaged when removing it from the valve block.

Hold the spool in clamp 992/10100, unscrew bolt **9** and remove spring **12**, spacer **10** and cups **11** and **13**.

Check for surface contamination on the under side of the seal plates **2** and **14**. Clean if necessary. Check for the flatness of the seal plate. If found to be bent - replace with new (any work previously carried out on this valve may have resulted in the bending of the seal plate).

Assembly

- 1** Fit the boot **1A** to the seal plate **2**.
- 2** Fit a new lipseal **4** into the valve block, ensure square. Fit wiper **3** on top of lipseal.
- 3** Fit the seal plate and boot assembly to valve block section but do not torque tighten capscrews **1** at this stage. Ensure wiper locates into seal plate.
- 4** Use clean hydraulic oil as a lubricant. From the bottom, insert spool through the valve block, do not use excessive force when fitting, a turning motion should ease the spool through the valve block.
- 5** Check that the tang end of the spool passes through the boot without dislodging or damaging the boot. Ensure that the tang aligns with the control rod and that the boot is not distorted and is located in the spool land.
- 6** Torque tighten cap screws **1**.
- 7** When fitting bolt **9**, clean the threads thoroughly using JCB Cleaner/Degreaser, leave it for 10 minutes then apply a small quantity of JCB Threadlocker and Sealer to the threads of the spool.
- 8** Make sure that all the parts move freely, check that item **10** does not interfere with item **13**.
- 9** Renew 'O' ring **15**. Make sure the 'O' ring is not trapped or damaged.
- 10** Fit seal **15** and seal plate **14** to the valve block section. Torque tighten capscrew **5** on completion.

Re-connect the lever mechanism to the tang (lever) end of the spool.

Run the engine and inspect the valve for external leaks.

Torque Settings

Item	Nm	kgf m	lbf ft
1	9.5	0.96	7
5	9.5	0.96	7
9	9.5	0.96	7

Dismantling and Assembly

Float Spool - Manual

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

For assembly the sequence should be reversed.

The following points **MUST** be avoided when dismantling and assembling the valve:

- CONTAMINATION
- DAMAGE TO SPOOL
- DAMAGE TO SEAL GROOVES

All or any of the above points may result in possible problems with the valve.

Dismantling

Remove the lever linkage from the tang (lever) end of the spool.

When removing 'O' rings and seals, use an appropriately rounded tool that **WILL NOT** cause any damage to the spool or seal grooves, for instance, item **4**, which is a wiper seal and is a press fit in the counterbore.

Care must be taken to ensure that the spool **13** is not damaged when removing it from the valve block.

Carefully remove collar **9** and collect detent balls **10**.

Using tool 992/10100 to hold the spool, remove circlip **16**, plug **17**, ball **18** and spring **19**. Unscrew detent pin **20** and remove spring **22** and cups **21** and **23**.

Check for surface contamination on the under side of the seal plates **3** and **14**. Clean if necessary. Check for the flatness of the seal plate. If found to be bent - replace with new (any work previously carried out on this valve may have resulted in the bending of the seal plate).

Assembly

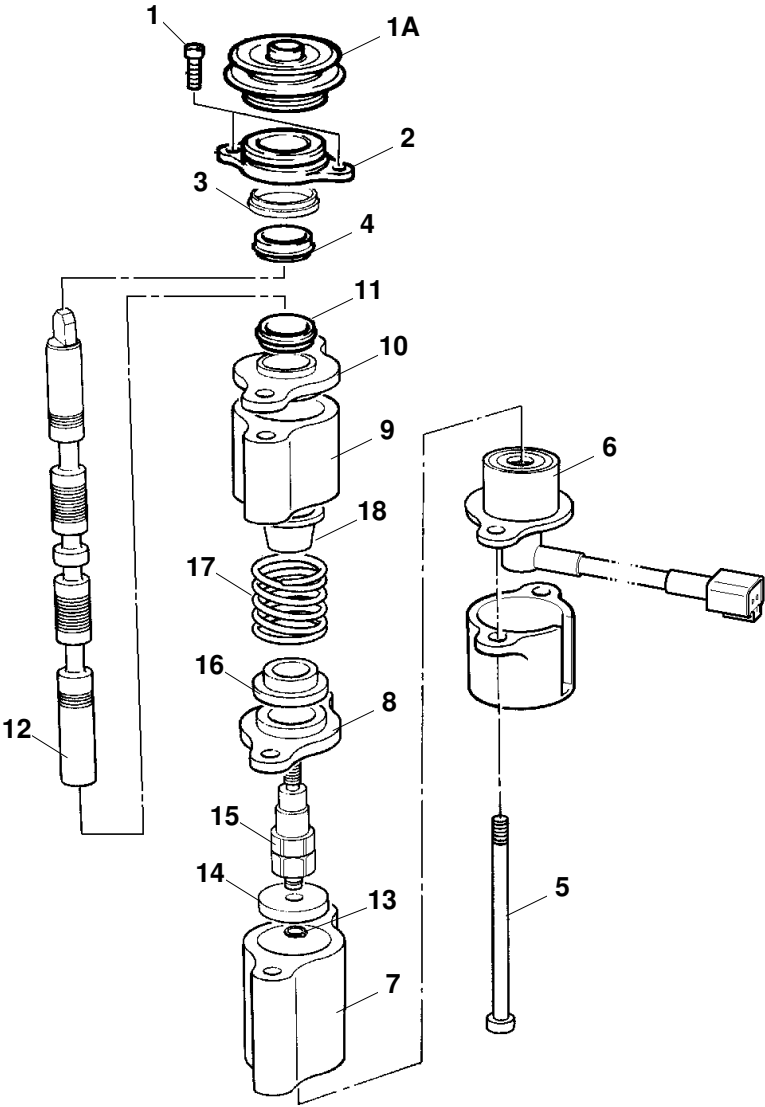
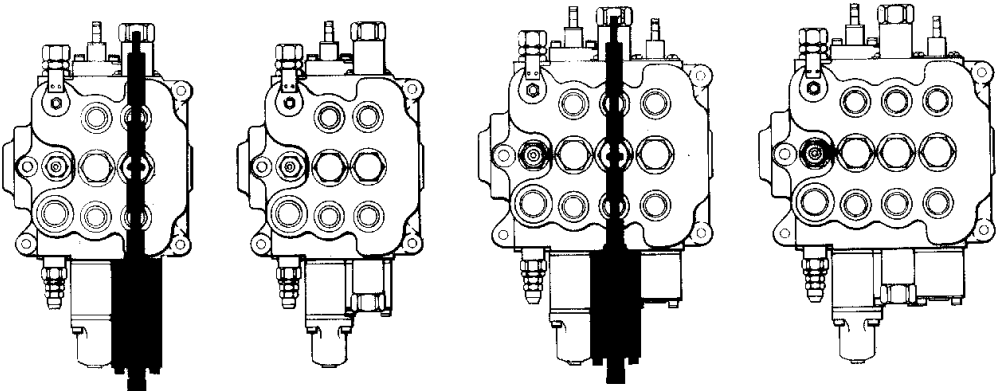
- 1 Fit the boot **2** to the seal plate **3**.
- 2 Fit a new lipseal **5** into the valve block, ensure square. Fit wiper **4** on top of lipseal.
- 3 Fit the seal plate and boot assembly to valve block but do not torque tighten capscrews **1** at this stage. Ensure wiper locates into seal plate.
- 4 Use clean hydraulic oil as a lubricant. From the bottom, insert spool through the valve block, do not use excessive force when fitting, a turning motion should ease the spool through the valve block.
- 5 Check that the tang end of the spool passes through the boot without dislodging or damaging the boot. Ensure that the tang aligns with the control rod and that the boot is not distorted and is located in the spool land.
- 6 Torque tighten cap screws **1**.
- 7 When fitting detent pin **20**, clean the threads thoroughly using JCB Cleaner/Degreaser, leave it for 10 minutes then apply a small quantity of JCB Threadlocker and Sealer to the threads of the spool.
- 8 Apply grease liberally balls **10**, this will help to hold the balls in position whilst assembling.
- 9 Renew 'O' ring **15**. Make sure the 'O' ring is not trapped or damaged.
- 10 Fit seal **15** and seal plate **14** to the valve block section. Torque tighten capscrew **6** on completion.

Re-connect the lever mechanism to the tang (lever) end of the spool.

Run the engine and inspect the valve for external leaks.

Torque Settings

Item	Nm	kgf m	lbf ft
1	9.5	0.96	7
6	9.5	0.96	7
20	9.5	0.96	7



S401460

Dismantling and Assembly

Electric Detent Spool - Manual

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

For assembly the sequence should be reversed.

The following points **MUST** be avoided when dismantling and assembling the valve:

- CONTAMINATION
- DAMAGE TO SPOOL
- DAMAGE TO SEAL GROOVES

All or any of the above points may result in possible problems with the valve.

Dismantling

When removing 'O' rings and seals, use an appropriately rounded tool that **WILL NOT** cause any damage to the spool or seal grooves, for instance, item **3**, which is a wiper seal and is a press fit in the counterbore.

Care must be taken to ensure that the spool **12** is not damaged when removing it from the valve block.

Use tool 992/10100 to hold the spool, remove circlip **13** and 'clapper' **14**. Unscrew spool end **15** and remove spring **17** with cups **16** and **18**.

Check for surface contamination on the under side of the seal plates **2**, **8** and **10**. Clean if necessary. Check for the flatness of the seal plate. If found to be bent - replace with new (any work previously carried out on this valve may have resulted in the bending of the seal plate).

Assembly

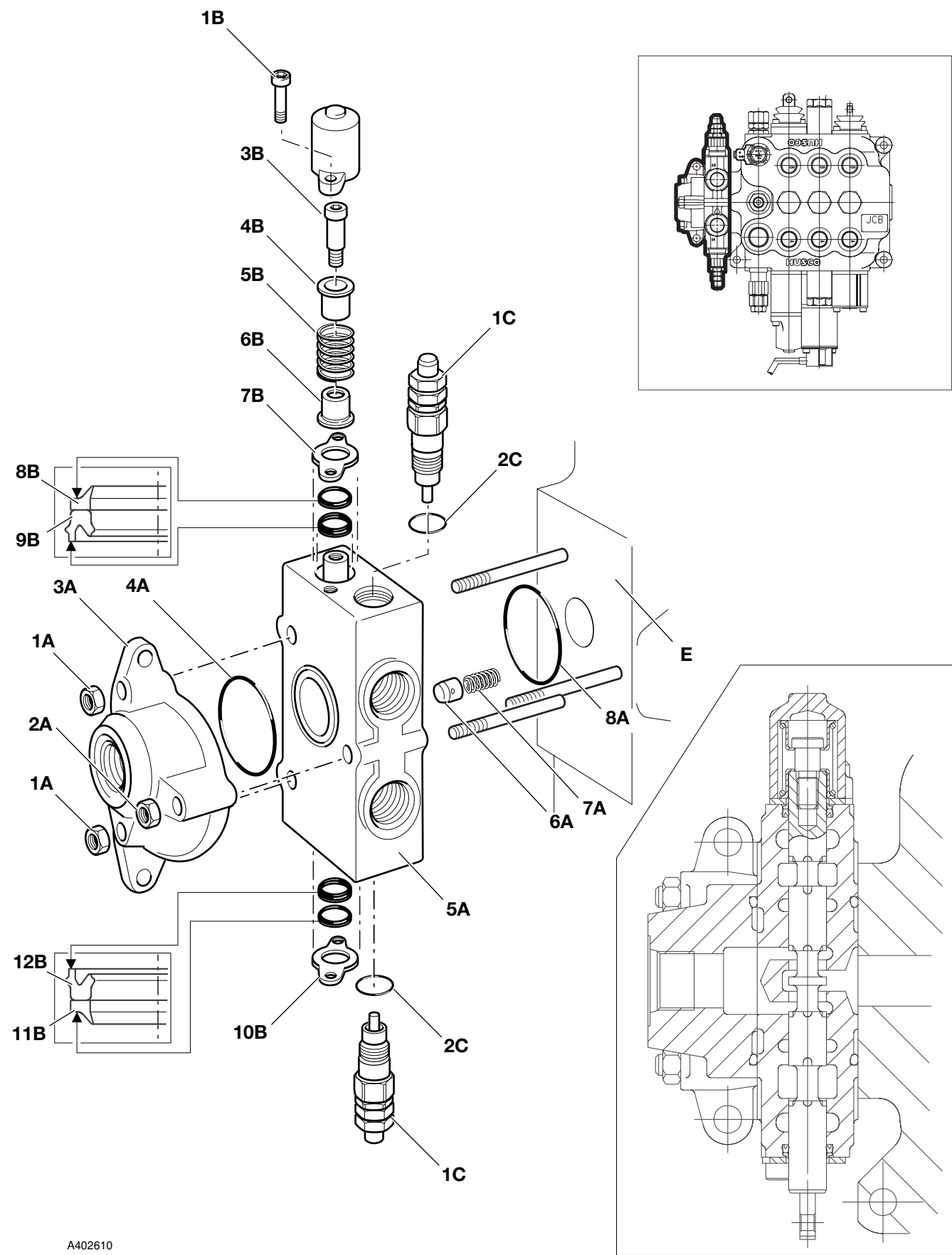
- 1** Fit the boot **1A** to the seal plate **2**.
- 2** Fit a new lipseal **4** into the valve block, ensure square. Fit wiper **3** on top of lipseal.
- 3** Fit the seal plate and boot assembly to valve block but do not torque tighten capscrews **1** at this stage. Ensure wiper locates into seal plate.
- 4** Use clean hydraulic oil as a lubricant. From the bottom, insert spool through the valve block, do not use excessive force when fitting, a turning motion should ease the spool through the valve block.
- 5** Check that the tang end of the spool passes through the boot without dislodging or damaging the boot. Ensure that the tang aligns with the control rod and that the boot is not distorted and is located in the spool land.
- 6** Torque tighten cap screws **1**.
- 7** When fitting spool end **15**, clean the threads thoroughly using JCB Cleaner/Degreaser, leave it for 10 minutes then apply a small quantity of JCB Threadlocker and Sealer to the threads of the spool.
- 8** Make sure that the chamfer on item **14** faces away from the solenoid, item **6**.
- 9** Renew lipseal **11**. Make sure the lipseal is not trapped or damaged.
- 10** Fit lipseal **11** and seal plate **10** to the valve block section. Torque tighten capscrew **5** on completion.

Check the operation of the solenoid **6** after assembly by connecting a 12V supply. The spool should be held when it is pushed into the detent position and returned when the supply is disconnected.

Run the engine and inspect the valve for external leaks.

Torque Settings

Item	Nm	kgf m	lbf ft
1	9.5	0.96	7
5	9.5	0.96	7
15	9.5	0.96	7



A402610

Dismantling and Assembly

Bolt on Auxiliary Spool Section
Body and Spool

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

Two dismantling sequences are shown:
Components prefixed **A** - inlet section, valve body and non-return valve.
Components prefixed **B** - valve spool components.

The valve spool components can be dismantled and assembled with the valve body **5A** still assembled to the loader valve **E** if required.

For assembly the sequence should be reversed.

The following points **MUST** be avoided when dismantling and assembling the valve:

- CONTAMINATION
- DAMAGE TO SPOOL
- DAMAGE TO SEAL GROOVES

All or any of the above points may result in possible problems with the valve.

For dismantling and assembly of the auxiliary relief valves **1C**, see **Bolt on Auxiliary Spool Section - Auxiliary Relief Valves**.

When Dismantling

When removing 'O' rings and seals, use an appropriately rounded tool that **WILL NOT** cause any damage to the spool or seal grooves.

When dismantling the spool hold a rod through the eye end of the spool to prevent it rotating when undoing the screw at the opposite end.

Inspection

Inspect the valve components for signs of scratches, nicks or any other type of damage. Renew damaged components as required.

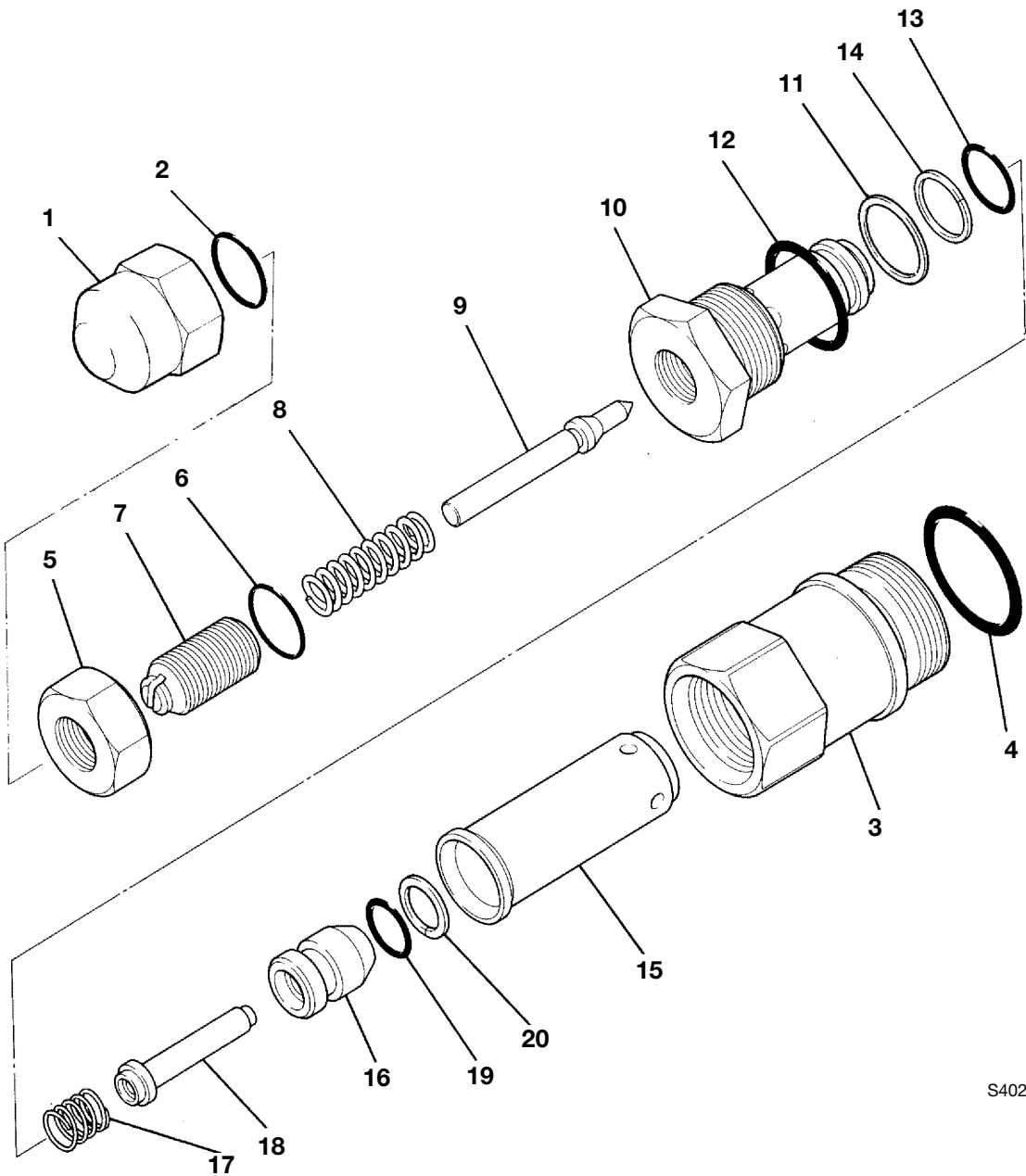
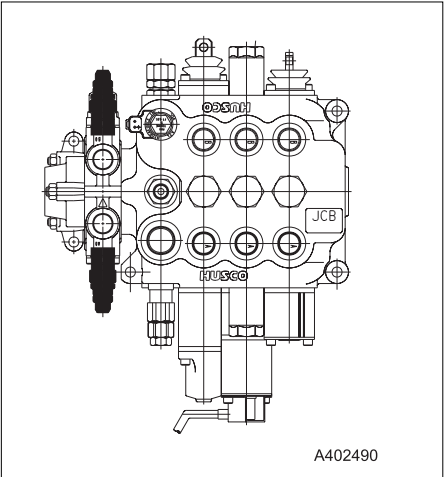
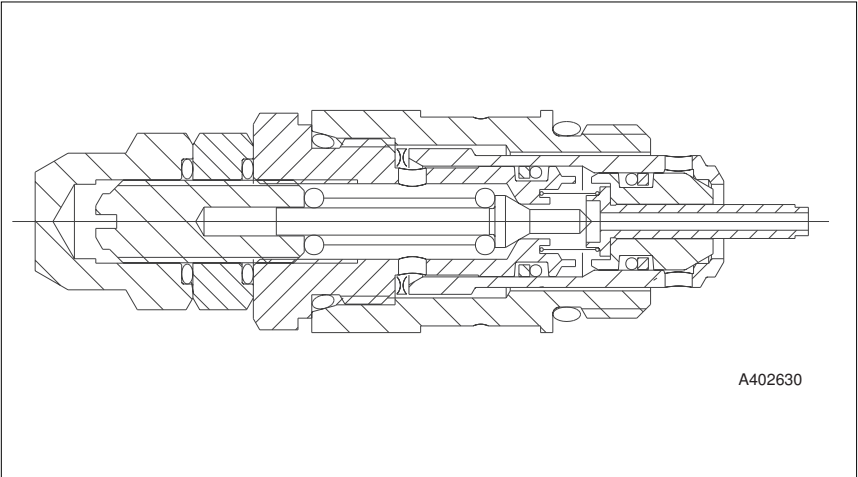
When Assembling

Renew 'O' ring seals **4A**, **8A**, and **2C**. Make sure the 'O' ring seals are not trapped or damaged.

Renew wiper seals **8B** and **11B**, and spool seals **9B** and **12B**, note the correct seal orientation shown at **X**. When fitting seals **9B** and **12B** make sure they are square to the valve body.

Torque Settings

Item	Nm	kgf m	lbf ft
1A	19	1.9	14
2A	45	4.6	33
1B, 3B	8 - 11	0.8 - 1.1	6 - 8
1C	40 - 49	4 - 5	30 - 36



S402620

Dismantling and Assembly

Bolt on Auxiliary Spool Section

Auxiliary Relief Valve (ARV)

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

For assembly the sequence should be reversed.

Great care should be taken when dismantling and assembling a valve to avoid the following:-

Contamination
Damage to spools
Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.

When Dismantling

When removing 'O' Rings and seals, use an appropriately rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' Rings and back-up rings. DO NOT use worn or damaged items.

Inspection

Inspect the valve components for scratches, nicks or any other type of damage, replace with new if required.

When Assembling

Renew all 'O' rings and back-up rings.

Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.

Make sure that the 'O' rings and back-up rings are fitted the correct way, items **13, 14** and **19, 20**.

Adjust pressure setting as required, refer to **Service Procedures, Pressure Testing - MRV and ARV's**.

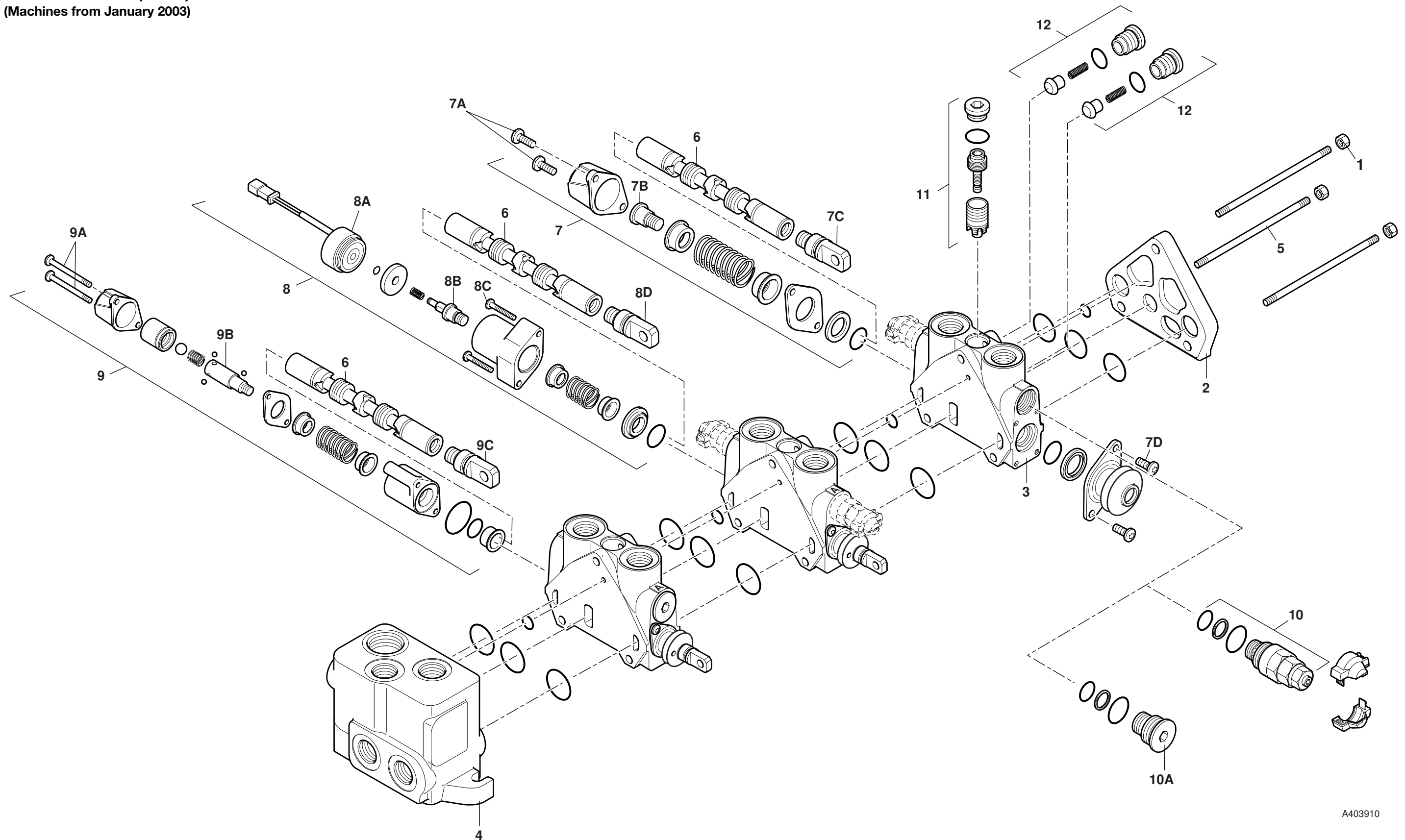
Torque Settings

Item	Nm	kgf m	lbf ft
1	62	6.4	46
5	5.4 - 8.2	0.55 - 0.83	4 - 6
10	41 - 68	4.15 - 6.9	30 - 50

Dismantling and Assembly

Precision Control (Servo)

(Machines from January 2003)



A403910

Dismantling and Assembly

Precision Control (Servo)
(Machines from January 2003)

Dismantling

The loader valve block is a 'sandwich type', which is made up of a number of separate sections. The illustration shown on the opposite page is intended as a guide to dismantling. Be sure to note the location of all components when dismantling. Although some components may appear to be identical they are not interchangeable. Make sure that components are assembled in their original positions.

- 1 Remove the loader valve block from the machine.
- 2 Remove the three tie rod nuts 1.
- 3 Carefully separate and remove the end plate 2 followed by the remaining service sections 3. If the inlet section 4 is to be replaced, remove and retain the tie rods 5.

Assembly

Assembly is the reverse of the dismantling sequence.

- 1 Clean the valve components in an appropriate solvent. Ensure that the mating faces of the valve sections are thoroughly clean before assembly.
- 2 Renew the 'O' rings located between the valve sections. Make sure the 'O' ring seals are not trapped or damaged.
- 3 Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.

Torque Settings

Item	Nm	kgf m	lbf ft
1	35	3.6	25.8
7A	10	1	7.4
7B	10	1	7.4
7C	10	1	7.4
7D	10	1	7.4
8A	20	2	14.8
8B	10	1	7.4
8C	10	1	7.4
8D	10	1	7.4
9A	10	1	7.4
9B	10	1	7.4
9C	10	1	7.4
10	70	7.1	51.6
10A	70	7.1	51.6
11	60	6.1	44.3
12	30	3	22.1

Service Spools

Care must be taken to ensure that the spools 6 are not damaged when removing them from the block. Note that all spools may be similar in appearance but must not be interchanged as they are matched to their bores.

Standard Spool

The dismantling and assembly procedures for the standard spool assembly 7 are detailed separately, refer to **Standard Spool**.

Electric Detent Spool

The dismantling and assembly procedures for the electric detent spool assembly 8 are detailed separately, refer to **Electric Detent Spool**.

Mechanical Detent Spool

The dismantling and assembly procedures for the mechanical detent spool assembly 9 are detailed separately, refer to **Mechanical Detent Spool**.

Auxiliary Relief Valves

The A.R.V's 10 appear identical but have various pressure settings, refer to **Technical Data**. Ensure that they are correctly adjusted and fitted in their specified positions. The dismantling and assembly procedures for the ARV's are detailed separately, refer to **Excavator Valve, Dismantling and Assembly - Auxiliary Relief Valves (ARV's)**.

Pressure Compensator Valves

Each of the pressure compensator valves 11 can be removed as shown. Note that all valves are identical in appearance. Note that components are not interchangeable.

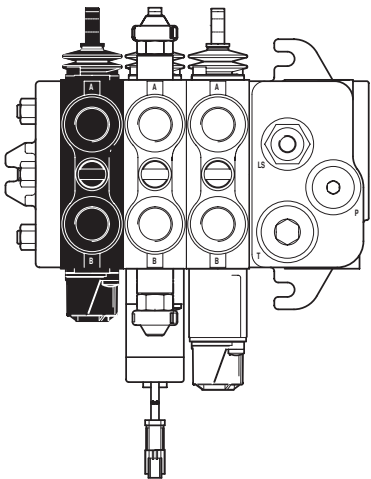
Load Hold Check Valves

Each of the load hold check valves 12 can be removed as shown. Note that all valves are identical in appearance. Ensure good condition of seating faces on poppets and on the mating faces in the valve block.

Dismantling and Assembly

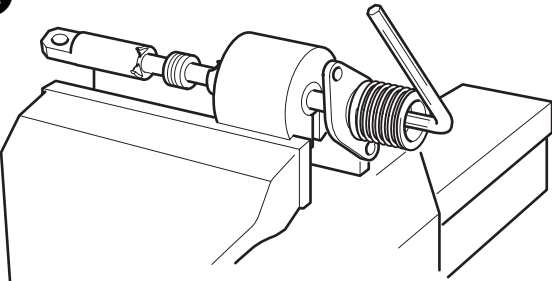
Precision Control (Servo)
(Machines from January 2003)

Standard Spool



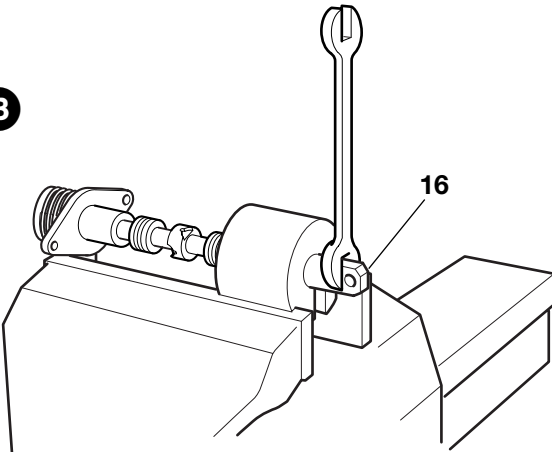
A403690

A

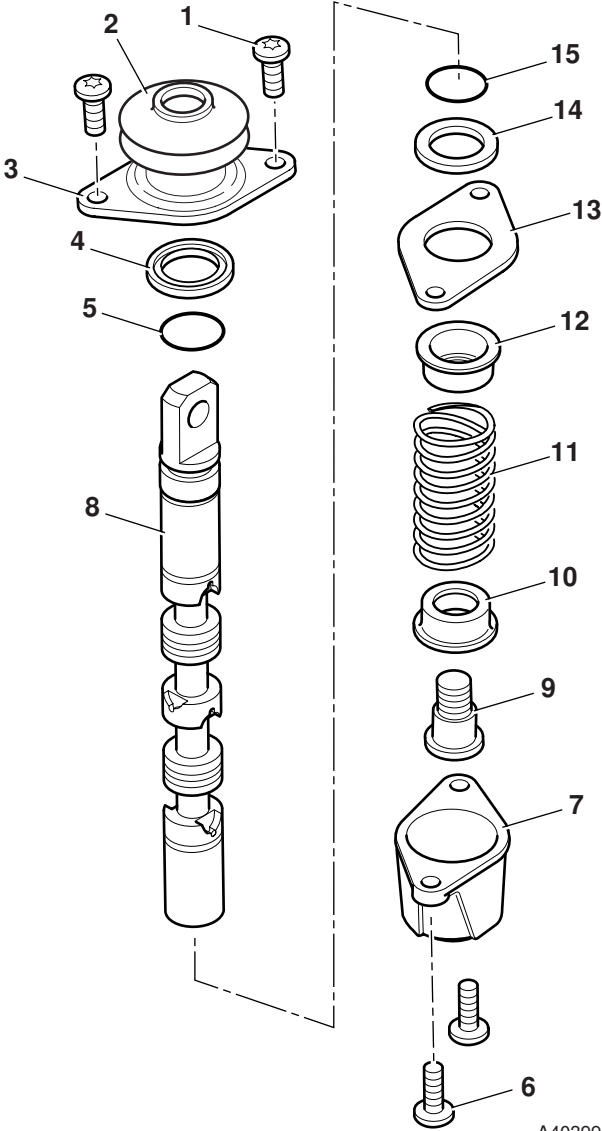


A403950

B



A404060



A403990

Dismantling and Assembly

Precision Control (Servo) (Machines from January 2003)

Standard Spool

Removal

It is possible to remove a spool without removing the loader valve block from the machine. The centring spring **11** is at the bottom, so the spool must be removed from the bottom.

- 1 Gain access to the loader valve and disconnect and blank any hoses or pipes which may interfere with the removal of the spool.
- 2 Disconnect the control rod linkage from the spool tongue.
- 3 Remove the screws **1**, boot **2** and plate **3**.
- 4 Remove the screws **6**, cover **7** and carefully withdraw the spool assembly from the valve body.

Dismantling

Great care should be taken when dismantling and assembling a valve to avoid the following:-

- Contamination
- Damage to spools
- Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.

- 1 Hold the spool assembly in a vice using the spool clamp (service tool no. TBA, refer to **Service Tools**) as shown at **A**.
- 2 Unscrew the spool end **9** and remove the centring spring **11** with spring retainers **10** and **12**. It may be necessary to pre-heat the spool to 200° C in an oven or with a heat gun to remove the spool end.

Note: When removing 'O' Rings and seals, use an appropriately rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' Rings and back-up rings. DO NOT use worn or damaged items.

Inspection

- 1 Inspect the valve components for scratches, pitting, corrosion or any other type of damage.

Assembly

Assembly is the reverse of the dismantling sequence.

- 1 Clean the valve components in an appropriate solvent.
- 2 Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.
- 3 Renew lip seals **4** and **14**, and 'O' rings **5** and **15**.

Note: The lip seal MUST be fitted carefully onto the end of the spool to ensure that it is not damaged by the spool lands and that its tightness property does not deteriorate. The metal part of the seal should be on the outside.

Torque Settings

Item	Nm	kgf m	lbf ft
1	10	1	7.4
6	10	1	7.4
9	10	1	7.4
16	10	1	7.4

Tongue Replacement (if necessary)

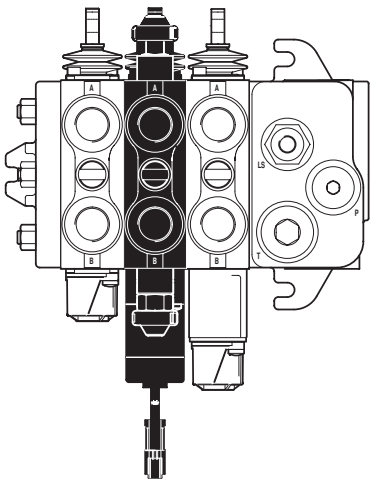
- 1 Hold the spool assembly in a vice using the spool clamp (service tool no. TBA, refer to **Service Tools**).
- 2 Loosen the tongue **16** with an open ended wrench as shown at **B**. It may be necessary to pre-heat the spool to 200° C in an oven or with a heat gun to dismantle the spool.

Note: DO NOT use a welding torch to heat the tongue as deformation of the spool may result.

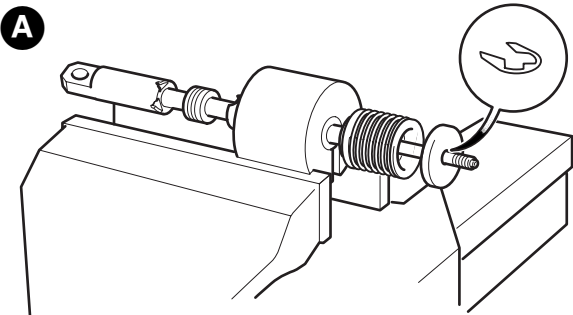
Dismantling and Assembly

Precision Control (Servo)
(Machines from January 2003)

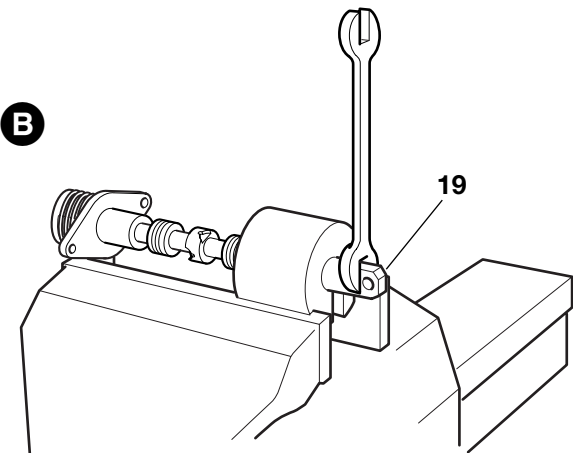
Electric Detent Spool



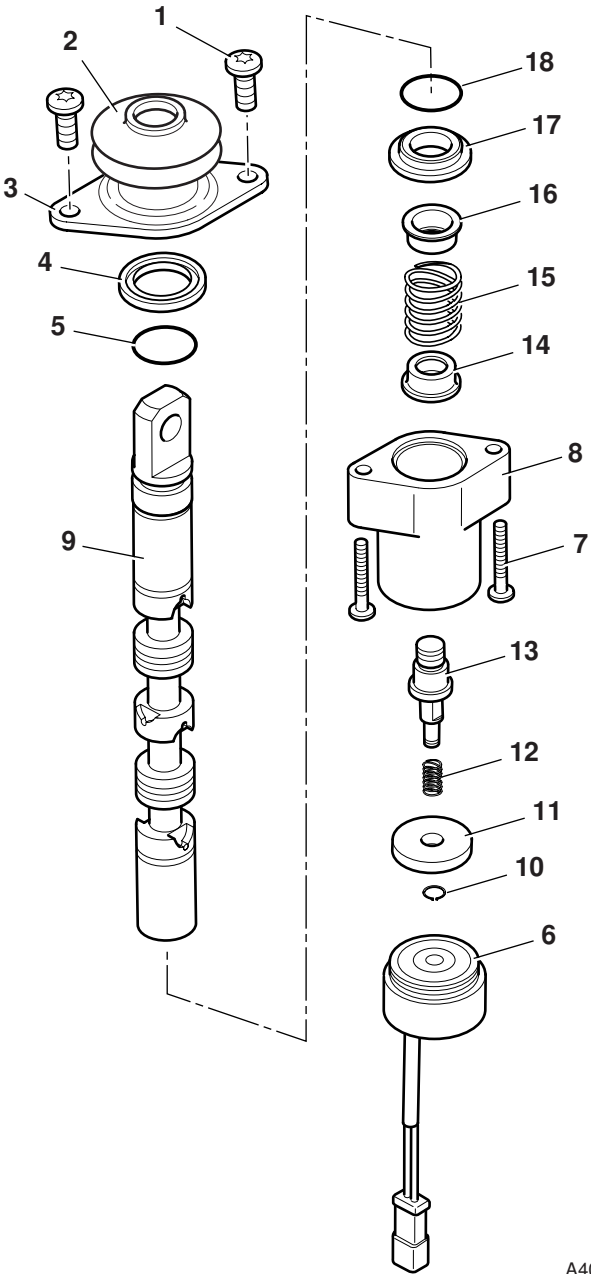
A403970



A404070



A404060



A404000

Dismantling and Assembly

Precision Control (Servo) (Machines from January 2003)

Electric Detent Spool

Removal

It is possible to remove a spool without removing the loader valve block from the machine. The centring spring **15** is at the bottom, so the spool must be removed from the bottom.

- 1 Gain access to the loader valve and disconnect and blank any hoses or pipes which may interfere with the removal of the spool.
- 2 Disconnect the control rod linkage from the spool tongue.
- 3 Remove the screws **1**, boot **2** and plate **3**.
- 4 Unscrew the solenoid **6** from the housing **8**. Remove the screws **7**, housing **8** and carefully withdraw the spool assembly from the valve body.

Dismantling

Great care should be taken when dismantling and assembling a valve to avoid the following:-

- Contamination
- Damage to spools
- Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.

- 1 Hold the spool assembly in a vice using the spool clamp (service tool no. TBA, refer to **Service Tools**) as shown at **A**.
- 2 Remove the circlip **10**, disc **11** and spring **12**.
- 3 Unscrew the spool end **13** and remove the centring spring **15** with spring retainers **14** and **16**. It may be necessary to pre-heat the spool to 200° C in an oven or with a heat gun to remove the spool end.

Note: When removing 'O' Rings and seals, use an appropriately rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' Rings and back-up rings. DO NOT use worn or damaged items.

Inspection

- 1 Inspect the valve components for scratches, pitting, corrosion or any other type of damage.

Assembly

Assembly is the reverse of the dismantling sequence.

- 1 Clean the valve components in an appropriate solvent.
- 2 Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.
- 3 Renew lip seal **4** and 'O' rings **5** and **18**.

Note: The lip seal MUST be fitted carefully onto the end of the spool to ensure that it is not damaged by the spool lands and that its tightness property does not deteriorate. The metal part of the seal should be on the outside.

Torque Settings

Item	Nm	kgf m	lbf ft
1	10	1	7.4
7	10	1	7.4
13	10	1	7.4
19	10	1	7.4

Tongue Replacement (if necessary)

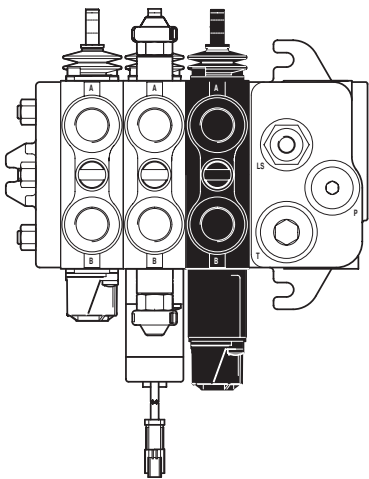
- 1 Hold the spool assembly in a vice using the spool clamp (service tool no. TBA, refer to **Service Tools**).
- 2 Loosen the tongue **19** with an open ended wrench as shown at **B**. It may be necessary to pre-heat the spool to 200° C in an oven or with a heat gun to dismantle the spool.

Note: DO NOT use a welding torch to heat the tongue as deformation of the spool may result.

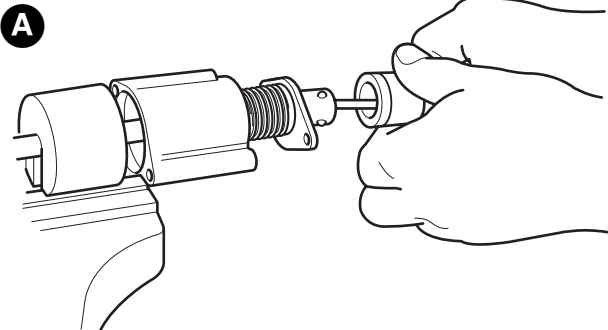
Dismantling and Assembly

Precision Control (Servo)
(Machines from January 2003)

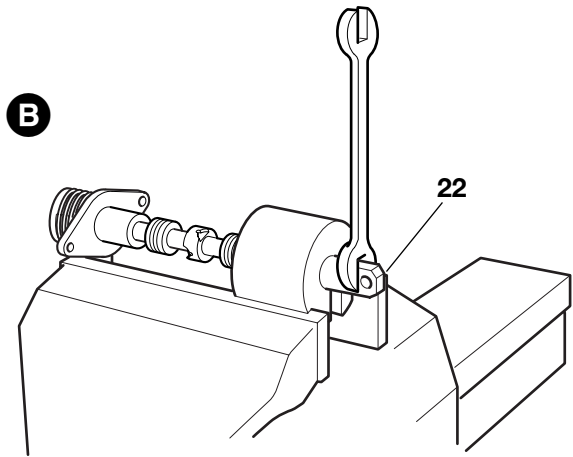
Mechanical Detent Spool



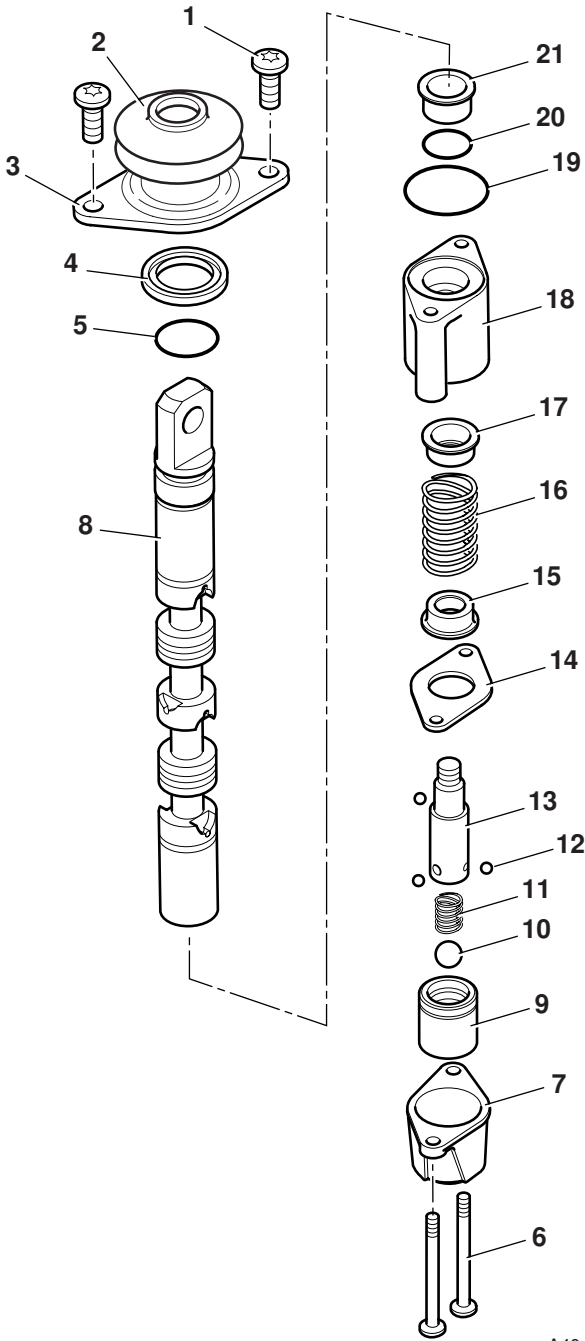
A403980



A404080



A404060



A404010

Dismantling and Assembly

Precision Control (Servo) (Machines from January 2003)

Mechanical Detent Spool

Removal

It is possible to remove a spool without removing the loader valve block from the machine. The centring spring **16** is at the bottom, so the spool must be removed from the bottom.

- 1 Gain access to the loader valve and disconnect and blank any hoses or pipes which may interfere with the removal of the spool.
- 2 Disconnect the control rod linkage from the spool tongue.
- 3 Remove the screws **1**, boot **2** and plate **3**.
- 4 Remove the screws **6**, cover **7** and carefully withdraw the spool assembly from the valve body.

Dismantling

Great care should be taken when dismantling and assembling a valve to avoid the following:-

- Contamination
- Damage to spools
- Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.

- 1 Hold the spool assembly in a vice using the spool clamp (service tool no. TBA, refer to **Service Tools**) as shown at **A**.
- 2 Use a metal rod (min. length 80 mm x 6 mm diameter) to push on the central ball **10** whilst extracting the detent bush **9** as shown. Mark the orientation of the bush to ensure that it is fitted the correct way round on re-assembly.
- 3 Carefully remove the balls **10** and **12**, and the spring **11**.
- 4 Unscrew the spool end **13** and remove the centring spring **16** with spring retainers **15** and **17**. It may be necessary to pre-heat the spool to 200° C in an oven or with a heat gun to remove the spool end.

Note: When removing 'O' Rings and seals, use an appropriately rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' Rings and back-up rings. DO NOT use worn or damaged items.

Inspection

- 1 Inspect the valve components for scratches, pitting, corrosion or any other type of damage.

Assembly

Assembly is the reverse of the dismantling sequence.

- 1 Clean the valve components in an appropriate solvent.
- 2 Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.
- 3 Renew lip seal **4** and 'O' rings **5**, **19** and **20**.

Note: The lip seal MUST be fitted carefully onto the end of the spool to ensure that it is not damaged by the spool lands and that its tightness property does not deteriorate. The metal part of the seal should be on the outside.

Torque Settings

Item	Nm	kgf m	lbf ft
1	10	1	7.4
6	10	1	7.4
13	10	1	7.4
22	10	1	7.4

Tongue Replacement (if necessary)

- 1 Hold the spool assembly in a vice using the spool clamp (service tool no. TBA, refer to **Service Tools**).
- 2 Loosen the tongue **16** with an open ended wrench as shown at **B**. It may be necessary to pre-heat the spool to 200° C in an oven or with a heat gun to dismantle the spool.

Note: DO NOT use a welding torch to heat the tongue as deformation of the spool may result.

Removal and Replacement

⚠ WARNING

Make the machine safe before working underneath it. Park the machine on level ground, lower the arms. Apply the parking brake, put the transmission in neutral and stop the engine. Chock both sides of all four wheels.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.

GEN-1-2

⚠ DANGER

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

Removal

- 1 Operate the valve block levers back and forth to vent residual pressure.
- 2 Remove clevis pins **A** to disconnect the control levers from the valve block spools.
- 3 Disconnect all hydraulic hoses from the valve block and plug all orifices to prevent ingress of dirt. Label each hose before disconnecting, this will ensure correct position when refitting.
- 4 Loosen and remove nuts **B**, spacers **C**, the loader valve and resilient mounts **D**.

Inspection

Inspect the resilient mounts **D** for damage, cracking etc. If the mounts are suspect, then replace them with new ones.

Replacement

Replacement is a reversal of the removal sequence.

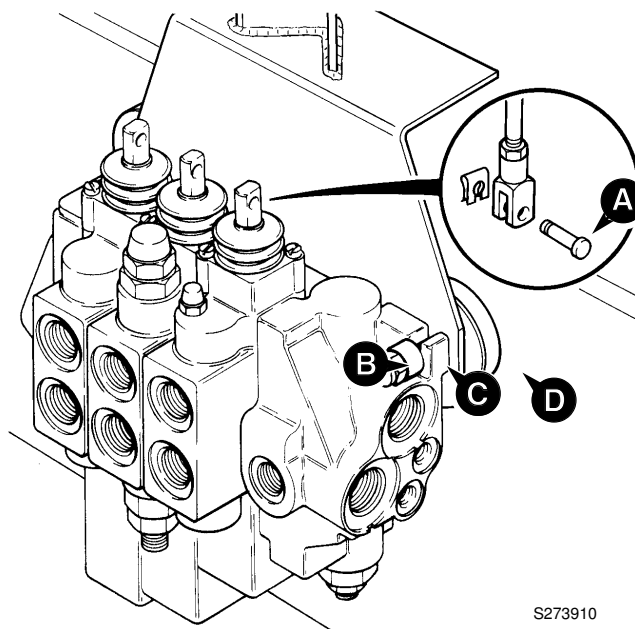
⚠ WARNING

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

After replacement check the auxiliary relief valve (A.R.V.) pressure settings.

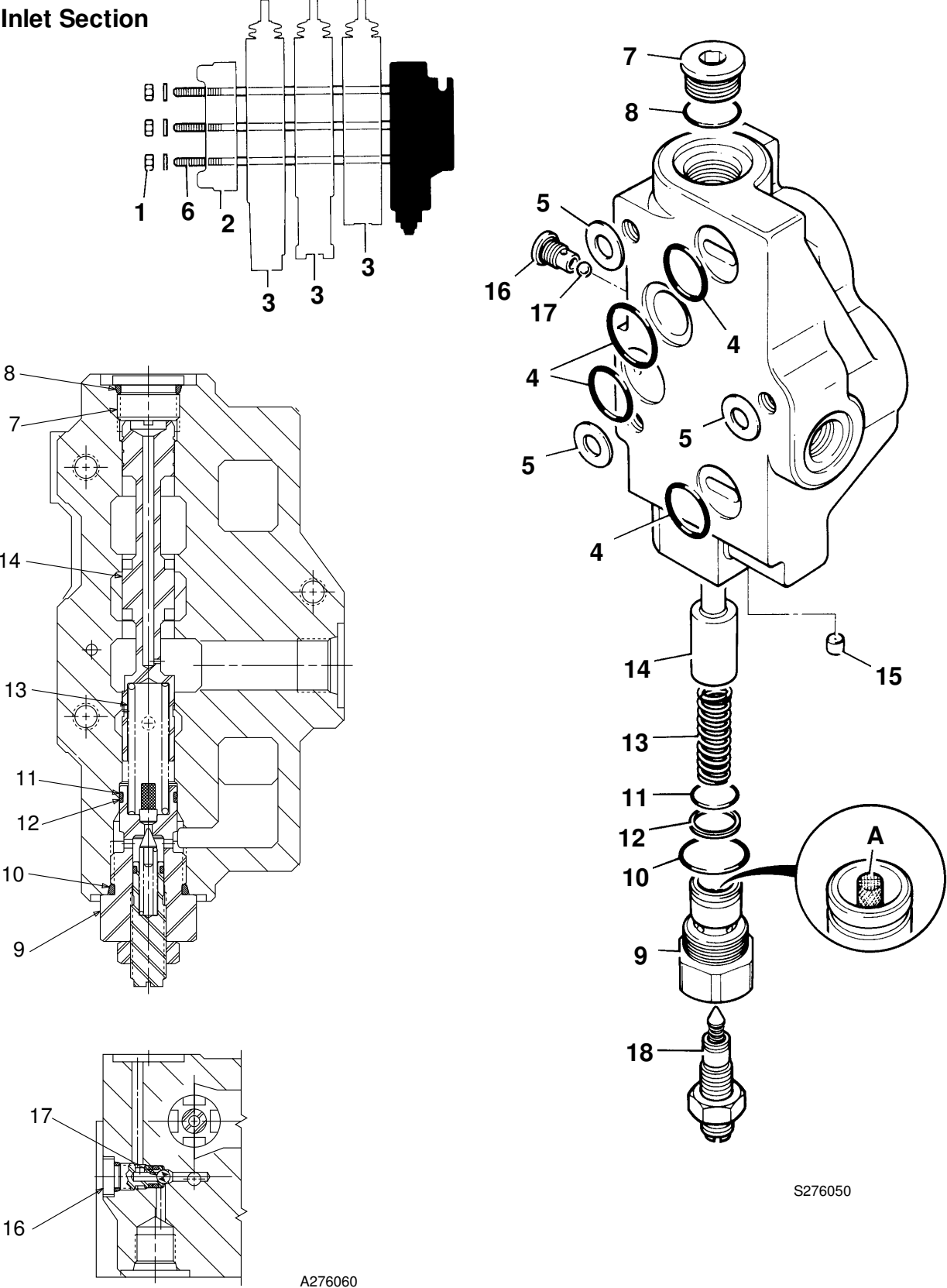
Note: All hydraulic adapters that are installed together with a bonded sealing washer must also have sealant (JCB Threadseal) applied to the threads of the adapter.



S273910

Dismantling and Assembly

Priority Inlet Section



Dismantling and Assembly

Priority Inlet Section

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

For assembly the sequence should be reversed.

The following points MUST be avoided when dismantling and assembling the valve:

- CONTAMINATION
- DAMAGE TO SPOOL
- DAMAGE TO SEAL GROOVES

All or any of the above points may result in possible problems with the valve.

Dismantling

Remove tie rod nuts **1** and end cover **2**. Separate the valve sections **3** take care not to lose shims **5**. Remove and discard 'O' rings **4**.

When removing 'O' rings and seals, use an appropriately rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' rings and back up rings. DO NOT use worn or damaged items.

Inspect the valve components for scratches, nicks or any other type of damage, replace with new if required.

Inspect screen **A**, make sure the screen is clean and free of dirt.

Take care not to lose ball bearing **17**.

If required, the relief valve assembly **9** can be dismantled for cleaning. It is important to note that this relief valve is fitted as a standard part of the inlet section. However, in this application it does not perform any duties. This is because the steer system pressure is controlled by a relief valve in the orbitrol steer unit (see Steering section), NOT relief valve assembly **9**.

After assembling the relief valve, screw the adjusting screw **18** fully into the valve housing. This will ensure assembly **9** does not interfere with the steer system pressure.

Assembly

Renew all 'O' rings and back-up rings.

Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.

Make sure that the 'O' rings and back-up rings are fitted the correct way, items **11** and **12**

ALWAYS fit three shim (item **5**) in between each valve block section as shown.

After assembly, make sure the steering operates correctly. The steer circuit will always have priority (see descriptions).

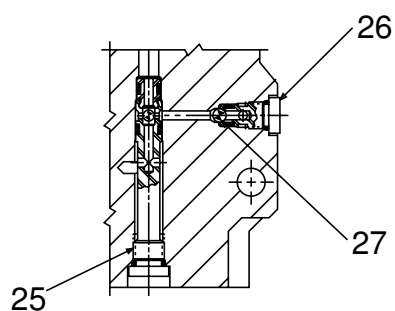
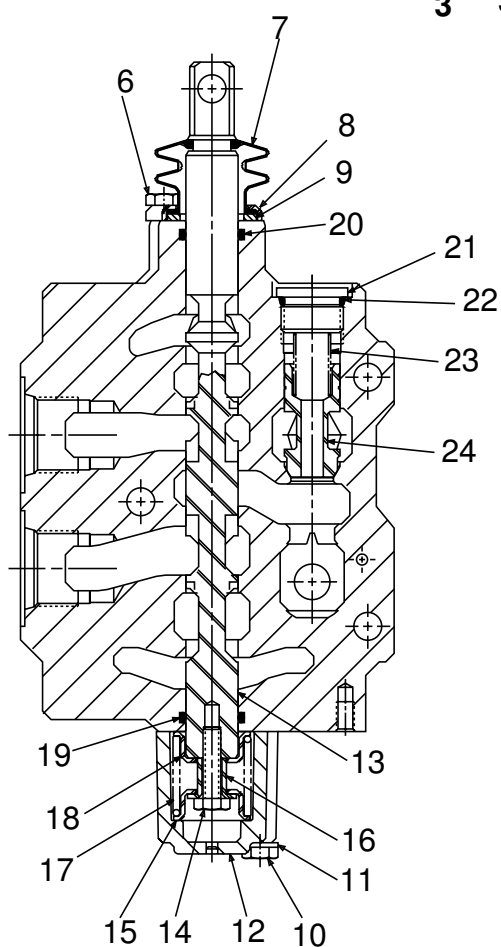
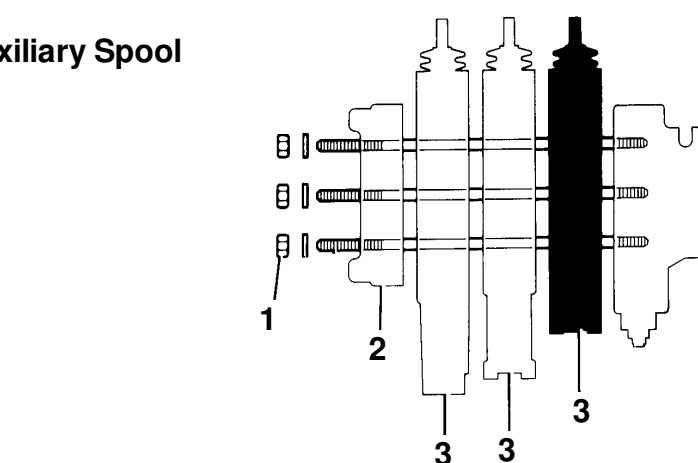
Torque Settings

Item	Nm	kgf m	lbf ft
1	41	4.1	30
7	67	6.9	50
9	67	6.9	50
16	13.5	1.38	10

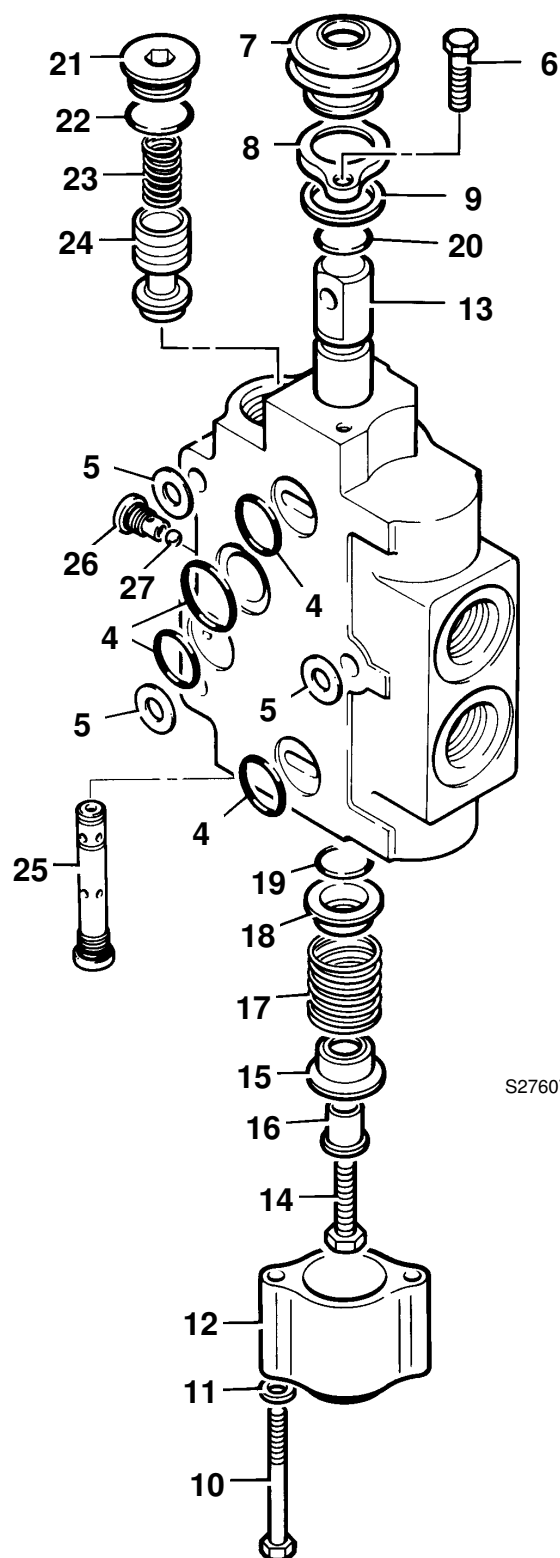
Item	Description
1	Tie rod nuts
2	End cover
3	Valve section
4	O-ring
5	Shim
6	Tie rod
7	Plug
8	O-ring
9	Relief valve assembly
10	O-ring
11	O-ring
12	Back-up ring
13	Spring
14	Spool
15	Expansion plug
16	Shuttle plug assembly
17	Ball bearing
18	Adjusting Screw

Dismantling and Assembly

Auxiliary Spool



A276080



S276070

Dismantling and Assembly

Auxiliary Spool

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

For assembly the sequence should be reversed.

The following points **MUST** be avoided when dismantling and assembling the valve:

- CONTAMINATION
- DAMAGE TO SPOOL
- DAMAGE TO SEAL GROOVES

All or any of the above points may result in possible problems with the valve.

Dismantling

Remove tie rod nuts **1** and end cover **2**. Separate the valve sections **3** take care not to lose shims **5**. Remove and discard 'O' rings **4**.

When removing 'O' rings and seals, use an appropriately rounded tool that **WILL NOT** cause any damage to the spool or seal grooves.

Care must be taken to ensure that the spool **13** is not damaged when removing it from the valve block.

Hold the spool in a suitable clamp, unscrew bolt **14** and remove spring **17**, spacer **16** and cups **15** and **18**.

Assembly

Renew all 'O' rings and back-up rings.

When fitting bolt **14**, clean the threads then apply a small quantity of JCB Threadlocker & Sealer to the threads of the spool.

When fitting spool seals **19** and **20** refer to the procedure **Fitting Spool Seal**.

ALWAYS fit three shim (item **5**) in between each valve block section as shown.

Run the engine and inspect the valve for external leaks.

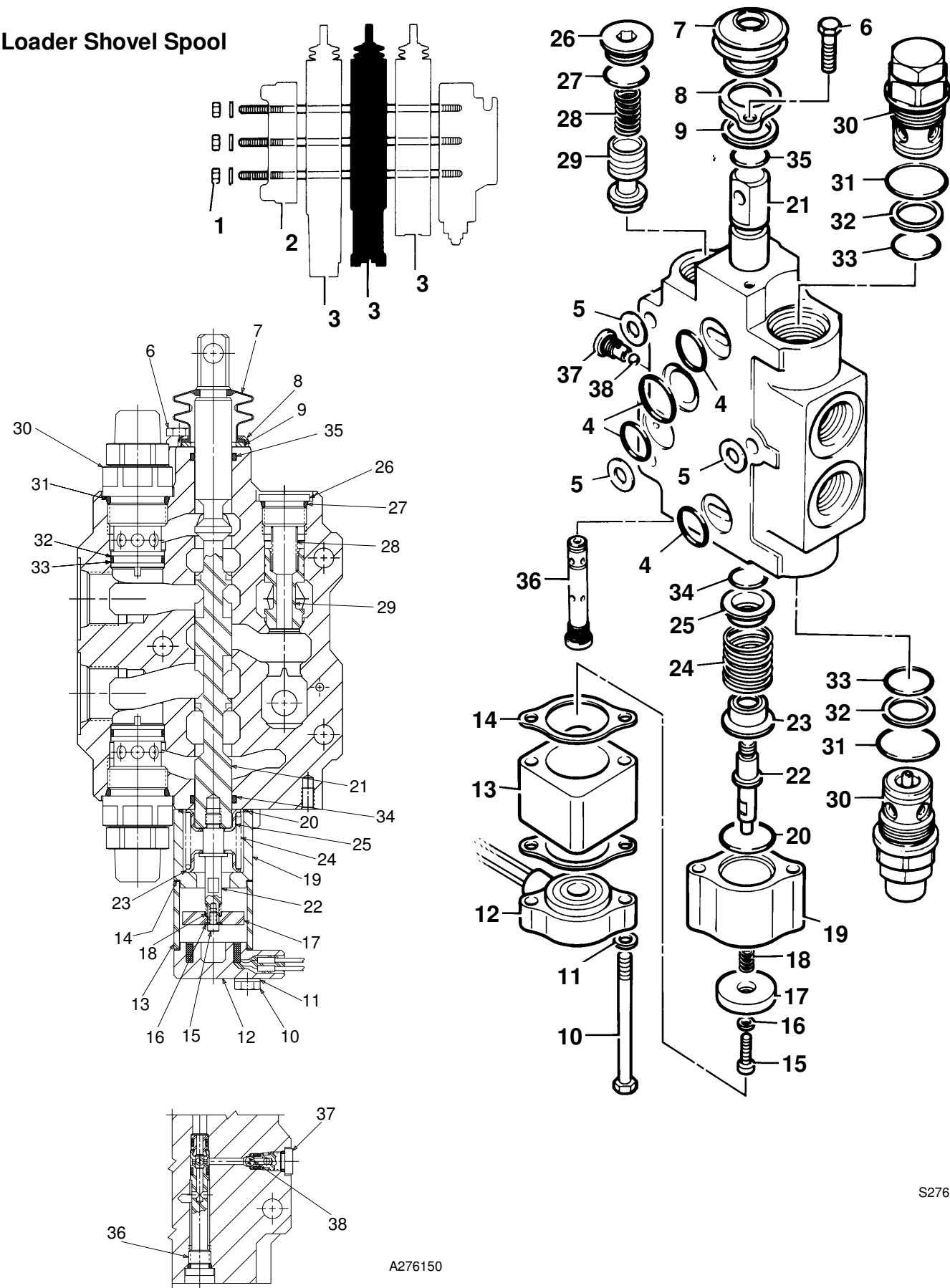
Torque Settings

Item	Nm	kgf m	lbf ft
1	41	4.1	30
6	6	0.55	4
10	8	0.8	6
14	8	0.8	6
21	67	6.9	50
25	13.5	1.38	10
26	13.5	1.38	10

Item	Description
1	Tie rod nuts
2	End cover
3	Valve section
4	O-ring
5	Shim
6	Bolt
7	Dust boot
8	Dust guard
9	Seal
10	Bolt
11	Washer
12	Centering spring housing
13	Spool assembly
14	Bolt
15	Spring cup
16	Spacer
17	Spring
18	Spring cup
19	O-ring
20	O-ring
21	Plug
22	O-ring
23	Spring
24	Poppet
25	Primary shuttle housing
26	Shuttle plug assembly
27	Ball bearing

Dismantling and Assembly

Loader Shovel Spool



S276140

A276150

Dismantling and Assembly

Loader Shovel Spool

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

For assembly the sequence should be reversed.

The following points **MUST** be avoided when dismantling and assembling the valve:

- CONTAMINATION
- DAMAGE TO SPOOL
- DAMAGE TO SEAL GROOVES

All or any of the above points may result in possible problems with the valve.

Dismantling

Remove tie rod nuts **1** and end cover **2**. Separate the valve sections **3** take care not to lose shims **5**. Remove and discard 'O' rings **4**.

When removing 'O' rings and seals, use an appropriately rounded tool that **WILL NOT** cause any damage to the spool or seal grooves.

Place a suitable rod through the eye end of spool **21**.

Care must be taken to ensure that the spool **21** is not damaged when removing it from the valve block.

Hold the spool in a suitable clamp, Unscrew coupling **22** and remove spring **24** and cups **23** and **25**.

Relief valve assembly **30** can be dismantled for cleaning purposes only. Individual parts for the relief valve are not available (except seal kits).

Assembly

Renew all 'O' rings and back-up rings.

Inspect gasket **14**, replace with a new one if required.

When fitting coupling **22**, clean the threads then apply a small quantity of JCB Threadlocker & Sealer to the threads of the spool.

Check the operation of the solenoid **12** after assembly by connecting a 12V supply . The spool should be held when it is pushed into the detent position and returned when the supply is disconnected.

When fitting spool seals **34** and **35** refer to the procedure **Fitting Spool Seal**.

ALWAYS fit three shim (item **5**) in between each valve block section as shown.

Run the engine and inspect the valve for external leaks.

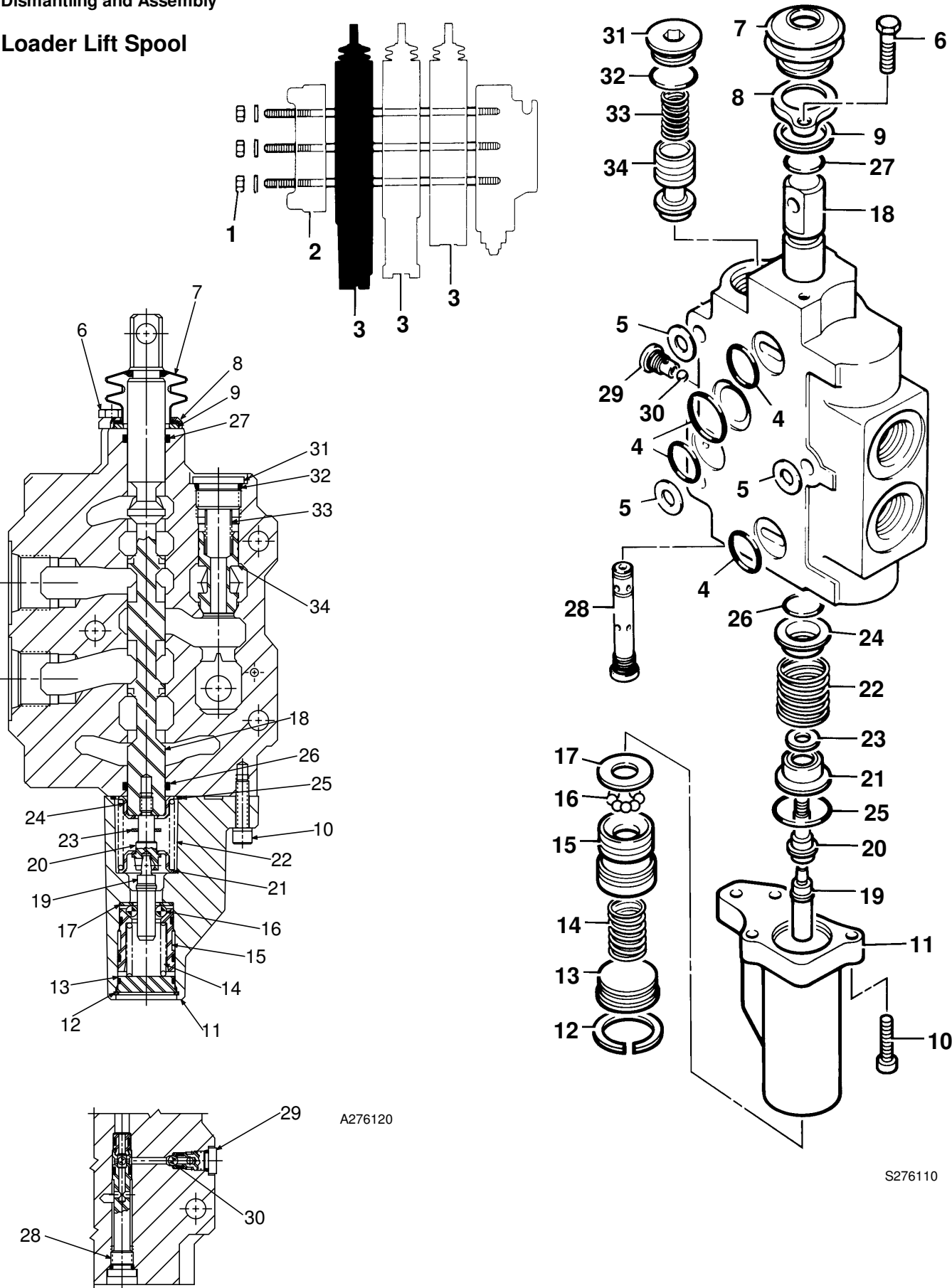
Torque Settings

Item	Nm	kgf m	lbf ft
1	41	4.1	30
6	6	0.55	4
10	8	0.8	6
15	2.7	0.27	2
22	11	1.1	8
26, 30	67	6.9	50

Item	Description
1	Tie rod nuts
2	End cover
3	Valve section
4	O-ring
5	Shim
6	Bolt
7	Dust boot
8	Dust guard
9	Seal
10	Bolt
11	Washer
12	Detent Solenoid
13	Tube
14	Gasket
15	Capscrew
16	Washer
17	Armature Plate
18	Spring
19	Centering Spring Housing
20	O-ring
21	Spool
22	Coupling
23	Spring cup
24	Spring
25	Spring cup
26	Plug
27	O-ring
28	Spring
29	Poppet
30	Relief valve assembly
31	O ring
32	Back-up ring
33	O-ring
34	O-ring
35	O-ring
36	Primary shuttle housing
37	Shuttle plug assembly
38	Ball bearing

Dismantling and Assembly

Loader Lift Spool



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Dismantling and Assembly

Loader Lift Spool

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

For assembly the sequence should be reversed.

The following points **MUST** be avoided when dismantling and assembling the valve:

- CONTAMINATION
- DAMAGE TO SPOOL
- DAMAGE TO SEAL GROOVES

All or any of the above points may result in possible problems with the valve.

Dismantling

Remove tie rod nuts **1** and end cover **2**. Separate the valve sections **3** take care not to lose shims **5**. Remove and discard 'O' rings **4**.

When removing 'O' rings and seals, use an appropriately rounded tool that **WILL NOT** cause any damage to the spool or seal grooves.

Care must be taken to ensure that the spool **18** is not damaged when removing it from the valve block.

Hold the spool in a suitable clamp, use a punch to separate detent shaft **19** from coupling **20**. Unscrew coupling **20** and remove spring **22**, spacer **23** and cups **21** and **24**.

Use a suitable press to compress spring **14** and remove retaining ring **12**. Take care not to lose detent balls **16**.

Assembly

Renew all 'O' rings and back-up rings.

When fitting coupling **20**, clean the threads then apply a small quantity of JCB Threadlocker & Sealer to the threads of the spool.

When fitting spool seals **26** and **27** refer to the procedure **Fitting Spool Seal**.

ALWAYS fit three shim (item **5**) in between each valve block section as shown.

Run the engine and inspect the valve for external leaks.

Torque Settings

Item	Nm	kgf m	lbf ft
1	41	4.1	30
6	6	0.55	4
10	8	0.8	6
20	8	0.8	6
28	13.5	1.38	10
29	13.5	1.38	10
31	67	6.9	50

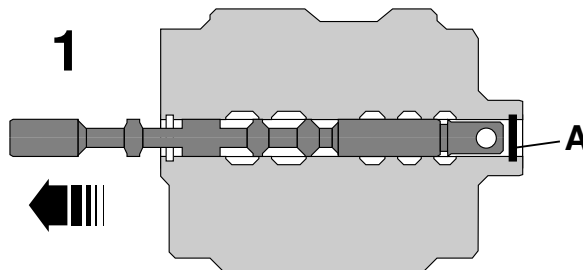
Item	Description
1	Tie rod nuts
2	End cover
3	Valve section
4	O-ring
5	Shim
6	Bolt
7	Dust boot
8	Dust guard
9	Seal
10	Capscrew
11	Detent housing
12	Retaining ring
13	Retainer
14	Spring
15	Piston
16	Detent balls
17	Washer
18	Spool assembly
19	Detent shaft
20	Pivot coupling
21	Spring cup
22	Spring
23	Spacer
24	Spring cup
25	O-ring
26	O-ring
27	O-ring
28	Primary shuttle housing
29	Shuttle plug assembly
30	Ball bearing
31	Plug
32	O-ring
33	Spring
34	Poppet

Dismantling and Assembly

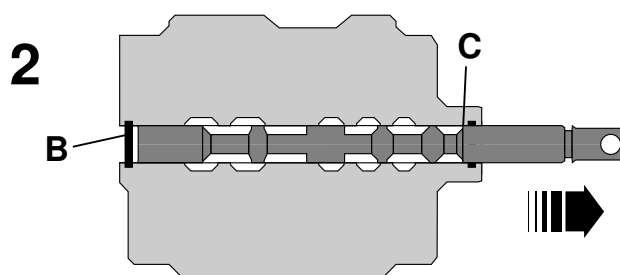
Fitting Spool Seal

Use the procedure described below to correctly install the valve spool seals:

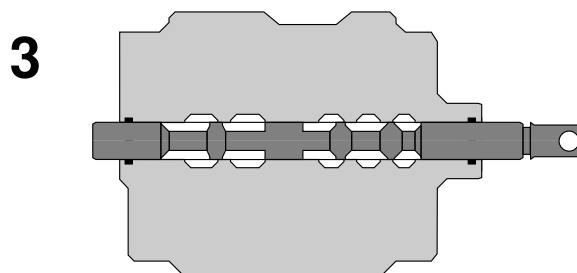
- 1 Lubricate the spool, bore and O-ring groove with JCB Hydraulic Fluid. Move the spool to the position shown and then install the O-ring **A** in its groove.



- 2 Move the spool to the position shown and then install the O-ring **B**. It is important to note that the spool must not be moved beyond the position shown, otherwise the edge of the spool (face **C**) may damage the first fitted O-ring (item **A**).



- 3 Position the spool in its central position as shown. Re-assemble the centering assembly, dust boot etc as detailed previously in this section.



A276280

Removal and Replacement

Manual Control

⚠ WARNING

Make the machine safe before working underneath it. Park the machine on level ground, lower the arms. Apply the parking brake, put the transmission in neutral and stop the engine. Chock both sides of all four wheels.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.

GEN-1-2

⚠ DANGER

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

Removal

- 1 Operate the valve block levers back and forth to vent residual pressure.
- 2 Remove the rear valance.
- 3 Remove clevis pins **A** to disconnect the control levers from the valve block spools.
- 4 Disconnect all hydraulic hoses from the valve block and plug all orifices to prevent ingress of dirt. Label each hose before disconnecting, this will ensure correct position when refitting.
- 5 Loosen nuts **B** - do not completely remove the retaining nuts.

⚠ CAUTION

This component is heavy. Do not attempt to remove it unless its weight is held by a sling. Make sure that the sling is attached to a suitable lifting appliance.

HYD 2-3/1

- 6 Wrap a suitable sling around the valve, make sure that the weight of the valve is supported by the sling.
- 7 Remove nuts **B** and lower the valve block to the ground.

Replacement

Replacement is a reversal of the removal sequence.

Hoses and pipes (when applicable) must be re-connected and phased in same position as removal. Refer to **Dismantling and Assembly, Hoses and Pipes**.

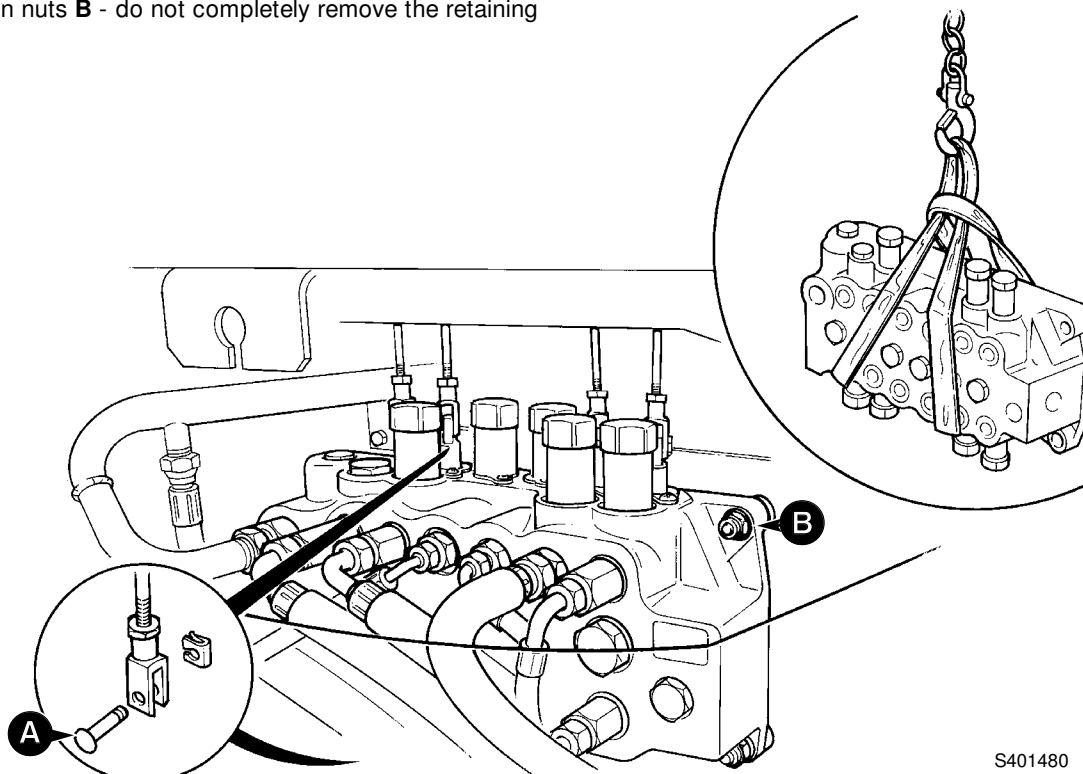
⚠ WARNING

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

After replacement check the auxiliary relief valve (A.R.V.) pressure settings.

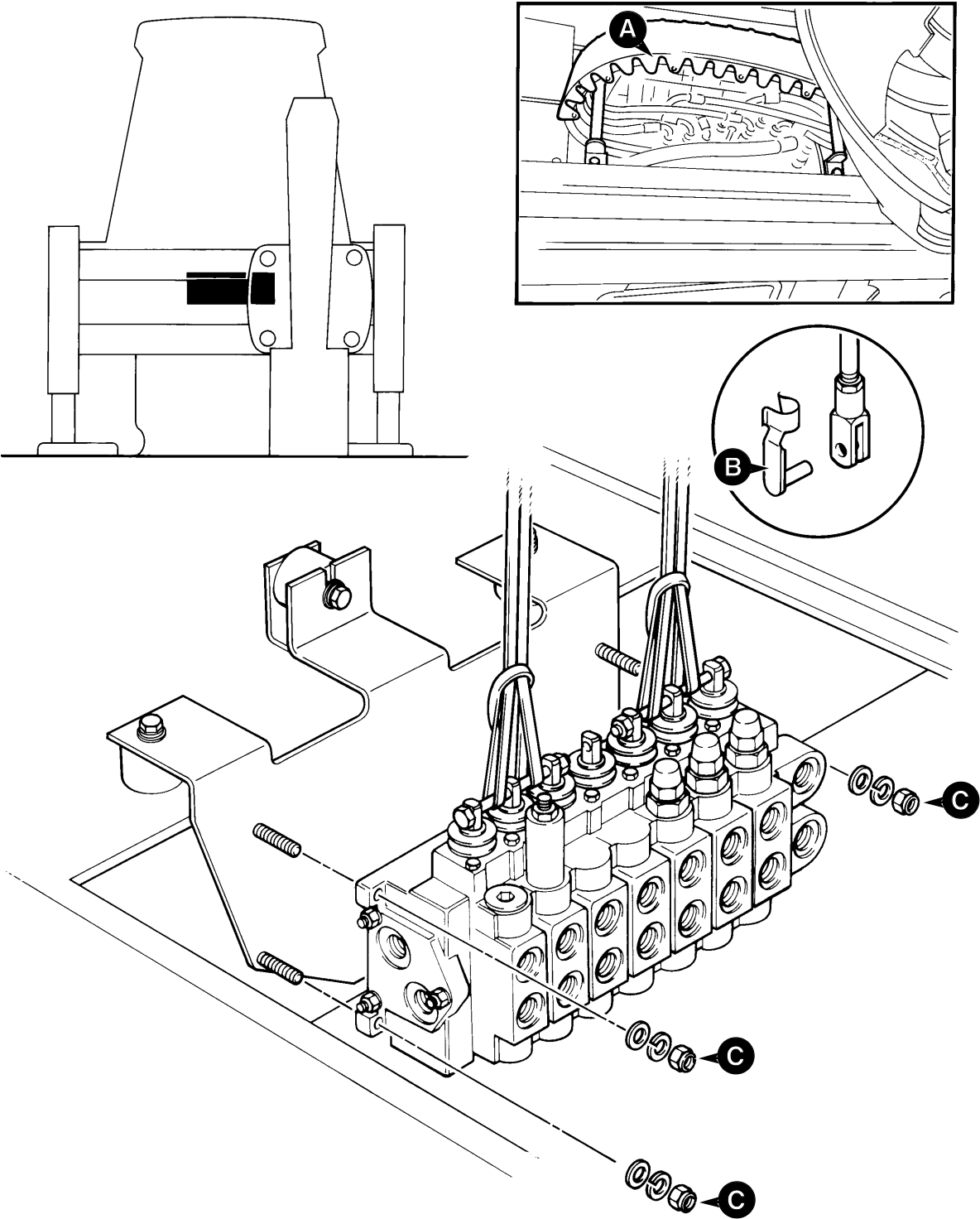
Note: All hydraulic adapters that are installed together with a bonded sealing washer must also have JCB Threadseal applied to the threads of the adapter.



S401480

Removal and Replacement

Variable Flow



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Removal and Replacement

Variable Flow

WARNING

Make the machine safe before working underneath it. Park the machine on level ground, lower the arms. Apply the parking brake, put the transmission in neutral and stop the engine. Chock both sides of all four wheels.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.

GEN-1-2

DANGER

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

Removal

- 1 Sideshift the carriage to one side as shown (sideshift machines only). Lower the backhoe and loader end to the ground and stop the engine.
- 2 Operate the valve block levers back and forth to vent residual pressure.
- 3 Remove the hose guide **A** (this makes access to the valve block easier).
- 3 Remove clevis pins **B** to disconnect the control levers from the valve block spools.
- 4 Disconnect all hydraulic hoses from the valve block and plug all orifices to prevent ingress of dirt. Label each hose before disconnecting, this will ensure correct position when refitting.
- 5 Insert two M10 bolts through the eye end spools (three spools each end) as shown. Make sure the bolt has a retaining nut on each end. When the bolts are in place thread suitable slings around the bolts as shown.

CAUTION

This component is heavy. Do not attempt to remove it unless its weight is held by a sling. Make sure that the sling is attached to a suitable lifting appliance.

HYD 2-3/1

- 7 Remove nuts **C** and lower the valve block to the ground.

Inspection

Inspect the resilient mounts for damage, cracking etc. If the mounts are suspect, then replace them with new ones.

Replacement

Replacement is a reversal of the removal sequence.

Hoses and pipes (when applicable) must be re-connected and phased in same position as removal. Refer to **Dismantling and Assembly, Hoses and Pipes**.

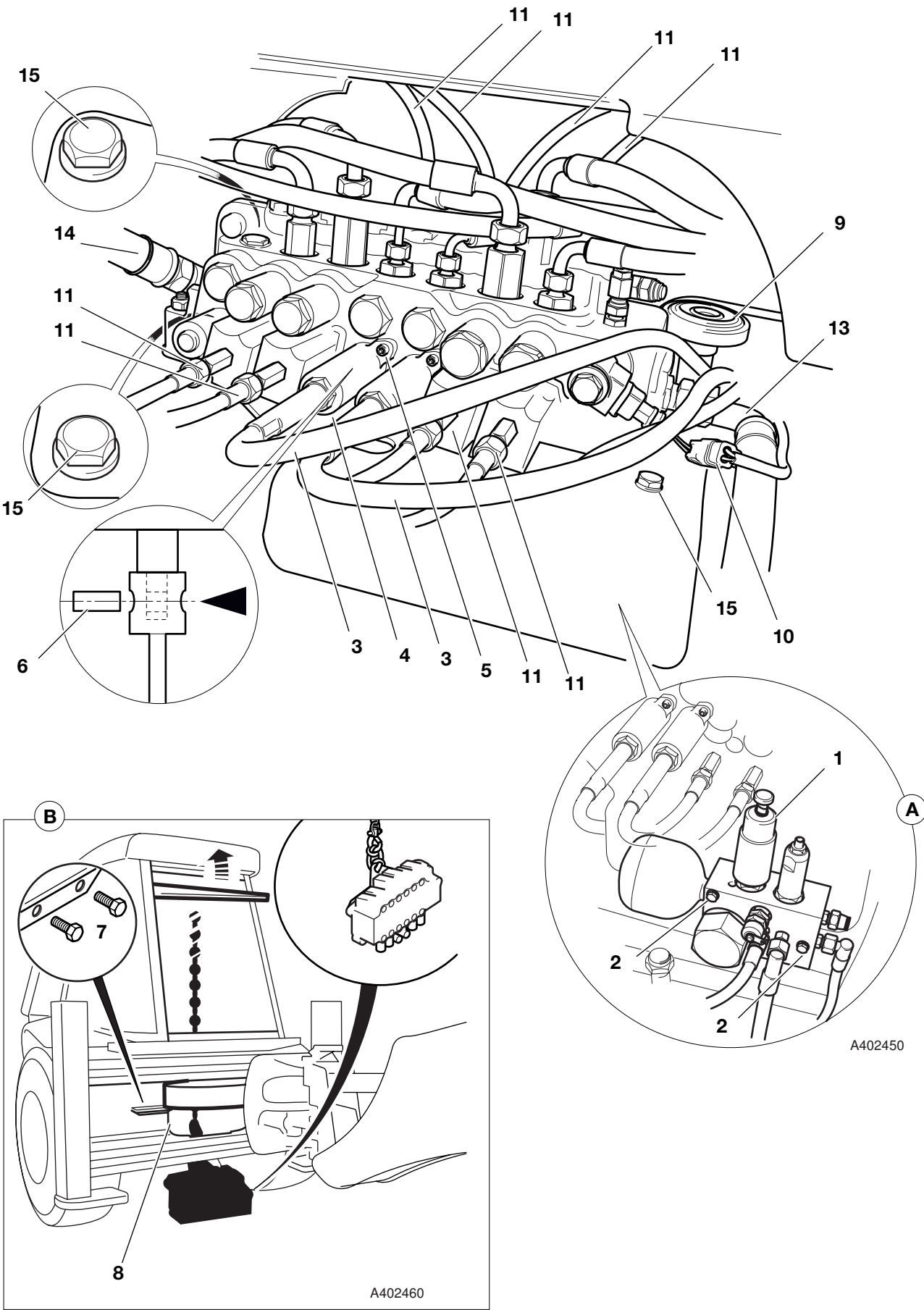
WARNING

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

After replacement check the auxiliary relief valve (A.R.V.) pressure settings.

Note: All hydraulic adapters that are installed together with a bonded sealing washer must also have JCB Threadseal applied to the threads of the adapter.



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Removal and Replacement

Precision Control (Servo)

DANGER

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

Removal

It is recommended that the valve is removed complete with its mounting plate. The assembly is lowered down and then out from under the rear on the machine. Before commencing make sure that there is sufficient clearance between the machine and the ground. If necessary raise the rear of the machine using the stabilisers. Chock the machine securely, remembering to leave access for removal of the valve assembly.

The illustration is viewed from the bottom.

Before proceeding, vent the hydraulic pressure as follows:

- 1 Stop the engine. With the operator seat set in the rear facing position (for backhoe operation), switch the starter to ON without starting the engine. Operate the joystick controls several times to vent the hydraulic pressure from the servo system and backhoe rams.
- 2 Operate the stabiliser controls several times to vent pressure from the stabiliser rams.
- 3 Turn the starter switch to the OFF position and remove the key.

WARNING

Make the machine safe before working underneath it. Park the machine on level ground, lower the arms. Apply the parking brake, put the transmission in neutral and stop the engine. Chock both sides of all four wheels.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.

GEN-1-2

To avoid damage to the pilot supply valve (shown at **A**), remove it as follows:

- 1 Carefully tag all the hoses connected at the valve. Record the phasing. Disconnect the hoses.
- 2 Uncouple the solenoid electrical connector **1**.
- 3 Undo the two fixing bolts **2** and remove the valve.

Disconnect the stabiliser spool control cables **3** as follows:

- 1 Undo the lock nut **4**.
- 2 Undo the housing retaining screws **5** and slide the housing down the cable.
- 3 Push out the cable connecting pin **6** and disconnect the cable at the spool. Tie the cables out of harms way.

Remove the excavator valve as follows:

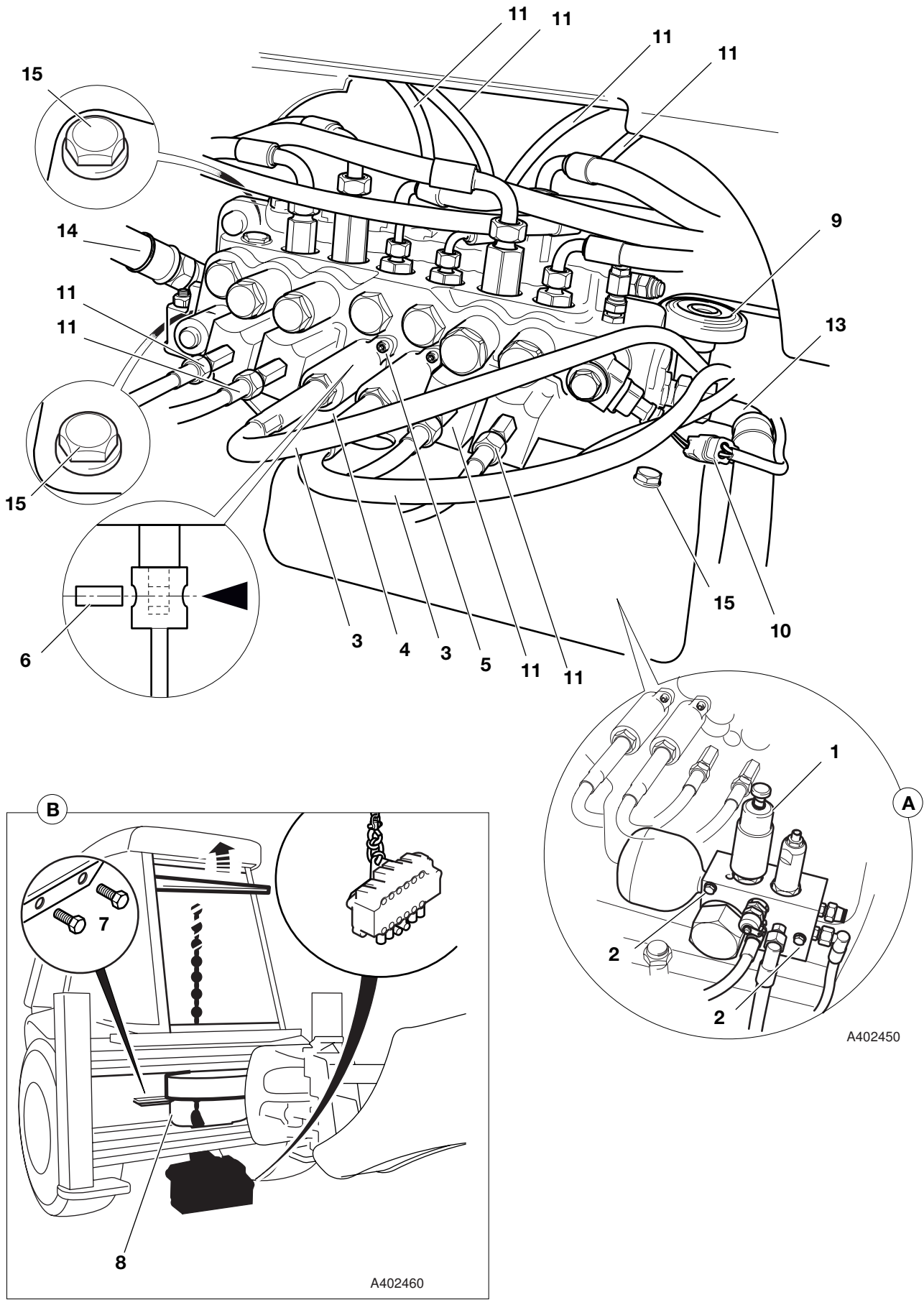
- 1 For access remove bolts **7** and tie hose guard **8** out of the way.
- 2 Uncouple electrical connection to the rear horn **9**.
- 3 Uncouple electrical connection **10** to the hydraclamp solenoid.
- 4 Record the phasing of the pilot hoses **11** connected at the top and bottom of the excavator valve. The hoses should be labelled, if not label each hose before disconnecting, this will ensure correct position when refitting. Disconnect all hydraulic pilot hoses from the valve block and plug all open ends and ports to prevent ingress of dirt.
- 5 Record the phasing of the service hoses connected at the front of the excavator valve. Label each hose before disconnecting, this will ensure correct position when refitting. Disconnect all the hoses from the valve block and plug all open ends and ports to prevent ingress of dirt.
- 6 Disconnect the inlet **13** and tank return **14** hoses from the valve block, plug all open ends and ports to prevent ingress of dirt.
- 7 Loosen the three mounting plate bolts **15** - DO NOT completely remove the retaining bolts.

CAUTION

This component is heavy. Do not attempt to remove it unless its weight is held by a sling. Make sure that the sling is attached to a suitable lifting appliance.

HYD 2-3/1

- 8 Open the rear window. Remove the access plate in the cab floor above the excavator valve. Attach a suitable sling to the mounting bracket slinging point, make sure that the weight of the valve is supported by the sling (shown at **B**).
- 9 Remove bolts **15** and lower the valve block to the ground.
- 10 If the hose adaptors are going to be removed from the valve block, label before removing to ensure replacement in the correct ports. Record the positions of any restrictors.



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Removal and Replacement (Cont'd)

Precision Control (Servo)

Replacement

Replacement is a reversal of the removal sequence.

Hoses and pipes (when applicable) must be re-connected and phased in same position as removal.

 WARNING

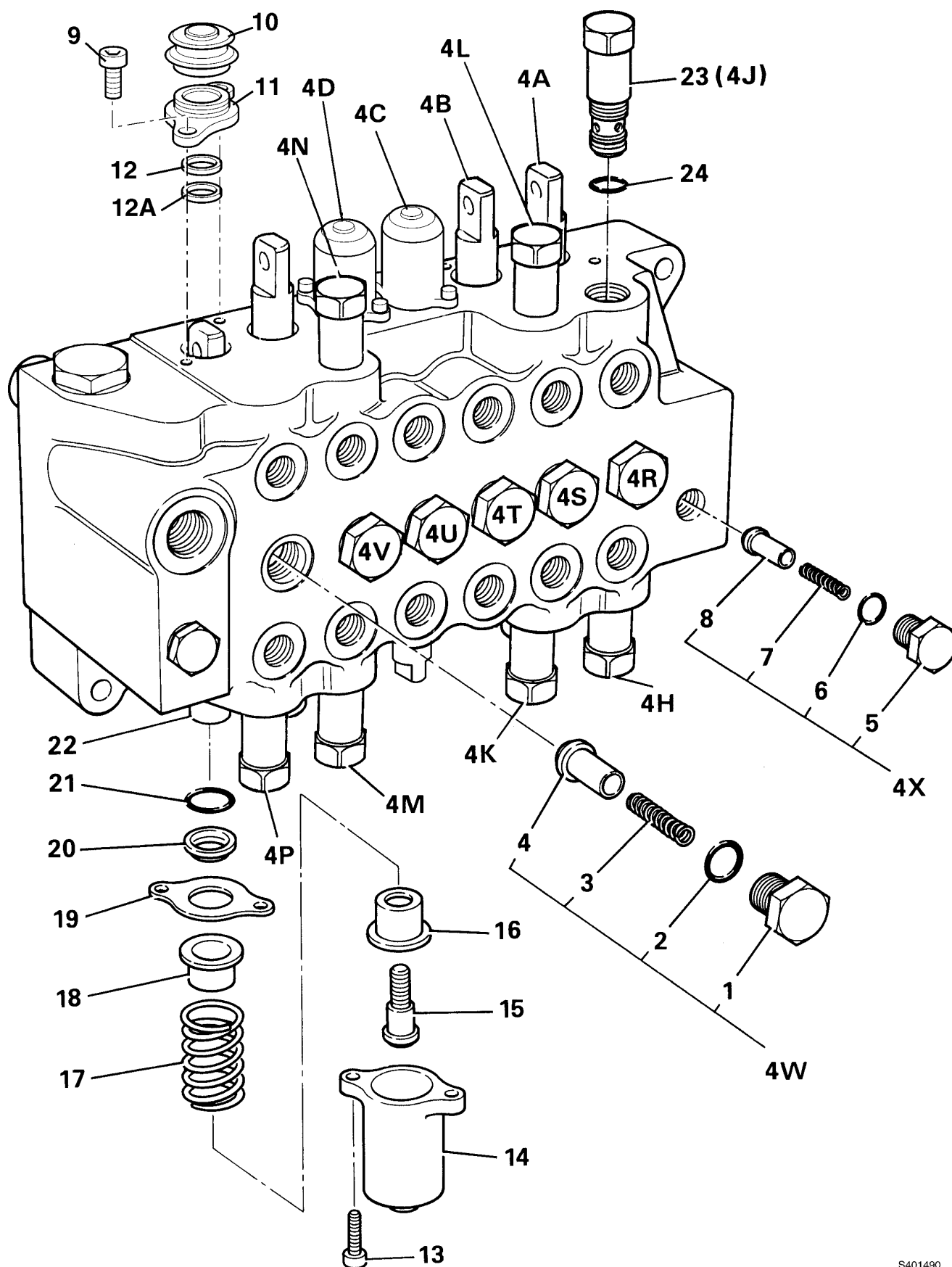
Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of hydraulic fluid. If hydraulic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

INT-3-1-10/1

After replacement check the auxiliary relief valve (A.R.V.) pressure settings.

Torque Settings

Item	Nm	kgf m	lbf ft
5	8 - 11	0.8 - 1.1	6 - 8



Dismantling and Assembly

Manual Control

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

For assembly the sequence should be reversed.

Check Valves

Each of the identical load hold check valves **4R** to **4W** can be removed as shown at **4W**. Make-up check valve **4X** is a smaller size but otherwise identical.

Ensure good condition of seating faces on poppets **4** and **8** and on the mating faces in the valve block.

Spools

Spools **4A**, **4B**, **4E** and **4F** are identical but must not be interchanged as they are matched to their bores. Stabiliser spools **4C** and **4D** are identical to each other but different from the excavator spools.

All spools have the same centring and sealing components items **9** to **21**.

To completely dismantle a spool, follow the sequence **9** to **21**. To prevent spool rotation when turning screw **15**, hold a rod through the eye end of the spool.

If only renewing the seals, dismantle as far as cap **14** then remove items **15** to **22** as an assembly.

Lubricate new seals with JCB Hydraulic Fluid and take care to prevent them from being damaged by the sharp edges of the spool.

Apply JCB Threadlocker and Sealer to threads of screw **15**.

Relief Valves

A.R.V's **4H** to **4P** appear identical but have various pressure settings, refer to **Technical Data**. Ensure that they are correctly adjusted and fitted in their specified positions.

Relief valve dismantling and assembly procedures are detailed separately.

Note: All hydraulic adapters that are installed together with a bonded sealing washer must also have JCB Threadseal applied to the threads of the adapter.

Assembly

- 1** Fit the boot **10** to the seal plate **11**.
- 2** Fit a new lipseal **12A** into the valve block, ensure square. Fit wiper **12** on top of lipseal.
- 3** Fit the seal plate and boot assembly to valve block but do not torque tighten capscrews **9** at this stage. Ensure wiper locates into seal plate.
- 4** Use clean hydraulic oil as a lubricant. From the bottom, insert spool through the valve block, do not use excessive force when fitting, a turning motion should ease the spool through the valve block.
- 5** Check that the tang end of the spool passes through the boot without dislodging or damaging the boot. Ensure that the tang aligns with the control rod and that the boot is not distorted and is located in the spool land.
- 6** Torque tighten cap screws **9**.
- 7** When fitting bolt **15**, clean the threads thoroughly using JCB Cleaner/Degreaser, leave it for 10 minutes then apply a small quantity of JCB Threadlocker and Sealer to the threads of the spool.
- 8** Make sure that all the parts move freely, check that item **16** does not interfere with item **18**.
- 9** Renew 'O' ring **21** and seal **20**. Make sure the 'O' ring and wiper seal are not trapped or damaged.
- 10** Fit seal **20** and seal plate **19** to the valve block section. Torque tighten capscrew **13** on completion.

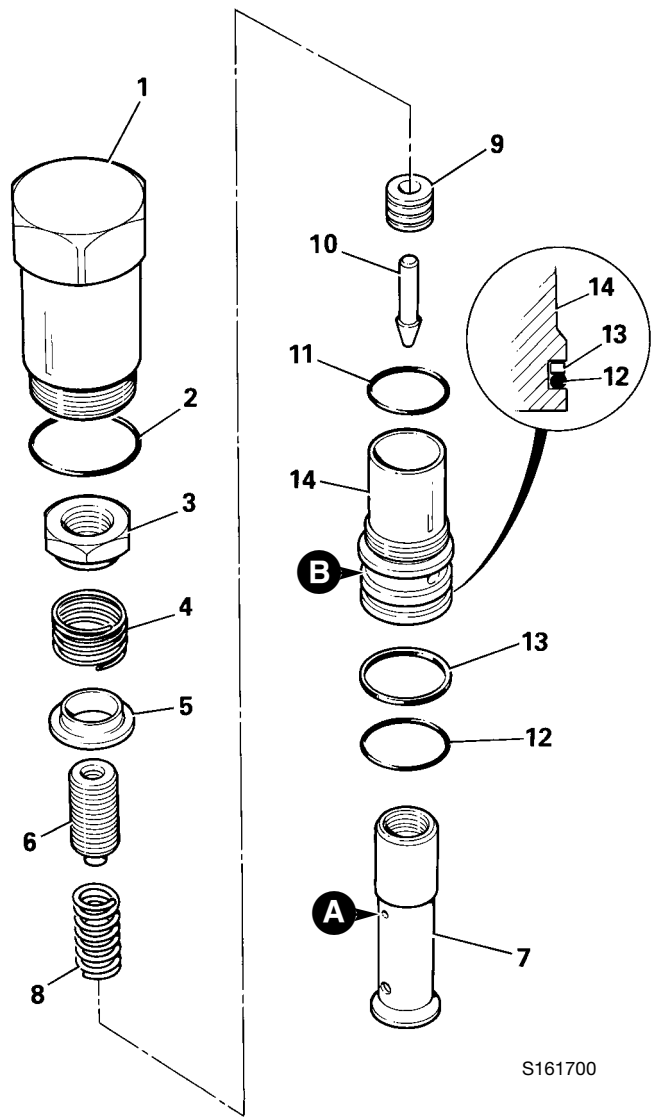
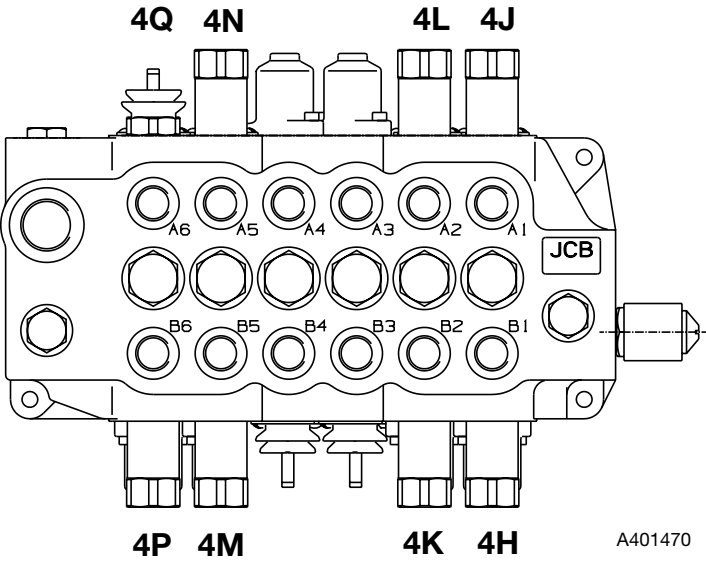
Re-connect the lever mechanism to the tang (lever) end of the spool.

Run the engine and inspect the valve for external leaks.

Torque Settings

Item	Nm	kgf m	lbf ft
1	122	12.4	90
5	80	8.3	60
9	9.5	0.96	7
13	7	0.7	5
15	11	1.1	8
23	95	10	70

Auxiliary Relief Valves



Dismantling and Assembly

Auxiliary Relief Valves

Eight A.R.V's are fitted at positions **4H** to **4Q**. These are identical in design but have various pressure settings, refer to **Technical Data**.

Note: Valve **4Q** is only fitted to machines equipped with a Powerbreaker.

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

For assembly the sequence should be reversed.

Dismantling

Dismantle sub-assembly **14** from item **1** using a special tool (see **Service Tools**). The special spanner locates in cross holes **B**.

Dismantle sub-assembly **14** into its component parts.

Make sure that small drilling **A** is not blocked.

Discard old and worn O-rings and back-up rings.

Assembly

Renew all O-rings and back-up rings.

Lubricate O-rings and back-up rings with JCB Hydraulic Fluid.

Fit back-up ring **13** on the upper side of 'O' ring **12** as shown in the inset.

Fit flat face of sleeve **9** against shoulder of poppet **10**.

Torque tighten item **14** using the special tool (see **Service Tools**), until its shoulder seats firmly against item **1**.

Pressure test the relief valves, refer to **Service Procedures, Excavator Valve - Pressure Testing**.

Torque Settings

Item	Nm	kgf m	lbf ft
1	65	6.6	48
3	24	2.5	18

A.R.V. Position Key

	Control Layout			
	JCB	ISO	Case	Ford
Slew Right	4H	4H	4H	4H
Slew Left	4J	4J	4J	4J
Boom Rod	4K	4M	4M	4K
Boom Head	4L	4N	4N	4L
Dipper Rod	4N	4L	4K	4N
Dipper Head	4M	4K	4L	4M
Bucket Rod	4Q	4Q	4Q	4P
Bucket Head	4P	4P	4P	4Q

Note: The bucket rod side A.R.V. is only fitted to machines equipped with a Powerbreaker.

Dismantling and Assembly

Hydraclamp Valve - (Sideshift Machines) (Not Precision Control Machines)

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

The following points **MUST** be avoided when dismantling and assembling the valve:

- CONTAMINATION
- DAMAGE TO POPPET AND SEAT
- DAMAGE TO SEAL GROOVES

All or any of the above points may result in possible problems with the valve.

When removing 'O' rings and seals, use an appropriately rounded tool that **WILL NOT** cause any damage to the seal grooves. Discard **ALL** 'O' rings **DO NOT** use worn or damaged items.

Note that the hydraclamp comprises two separate valve assemblies; 1) the check valve assembly (items 1 to 8); 2) the solenoid assembly (items 11 to 14).

Dismantling

Loosen nut 1 (turn anti-clockwise) and then remove the check valve assembly from the valve block. If required, the check valve assembly can be dismantled into its component parts (items 1 to 8).

Inspect the valve components for scratches, nicks or any other type of damage, particularly on the poppet and seat faces. Replace with new if required.

Assembly

Renew all 'O' rings. The parts microfiche will identify the correct seal kit part numbers for items 2, 2A, 4, 6, 10 and 14.

Fit seal 2A with the recess towards 'O' ring 2, as shown at A.

Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.

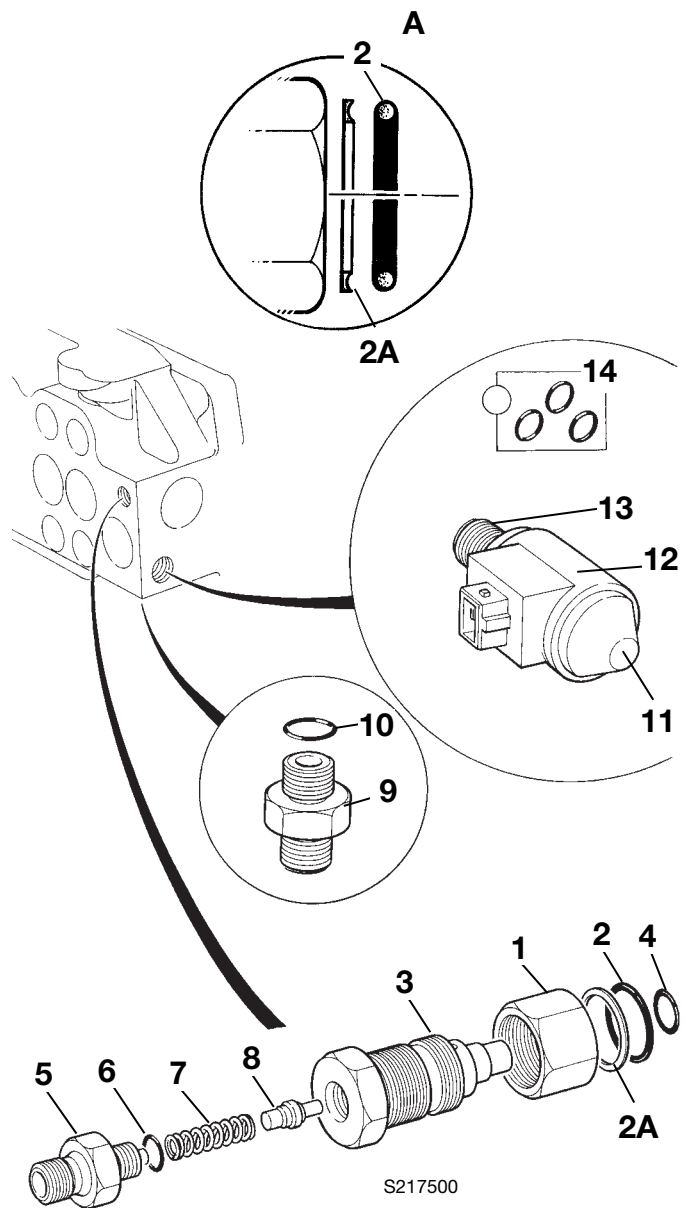
Ensure that the small drilling through the centre of item 3, is clear.

Do not over-tighten the solenoid assembly, it may affect the operation of the solenoid, use the spanner flats and torque tighten to figure indicated in the table below (items 11 and 13).

Check the operation of the electric hydraclamp, refer to **Circuit Descriptions, Excavator Valve - Manual Control - Hydraclamp Valve Operation**.

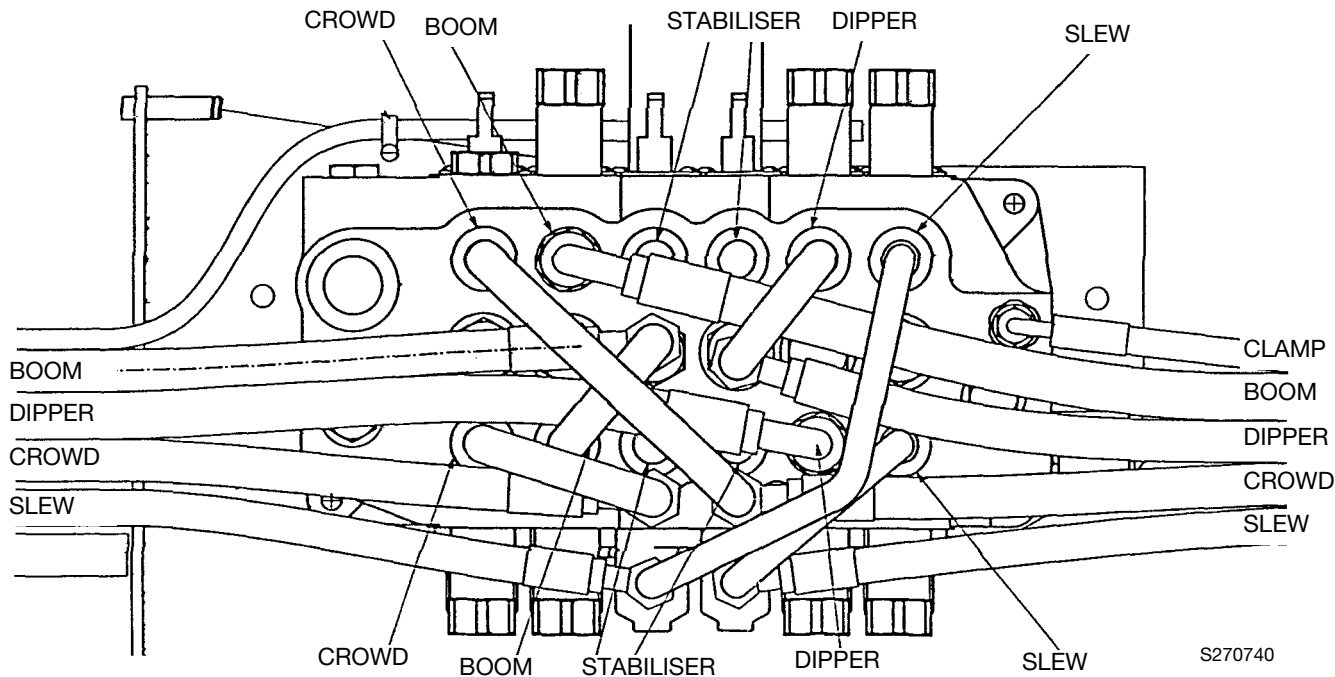
Torque Settings

Item	Nm	kgf m	lbf ft
1	13.5	1.4	10
3	24.5	2.5	18
5	13.5	1.4	10
11	5.5	0.5	4
13	24.5	2.5	18

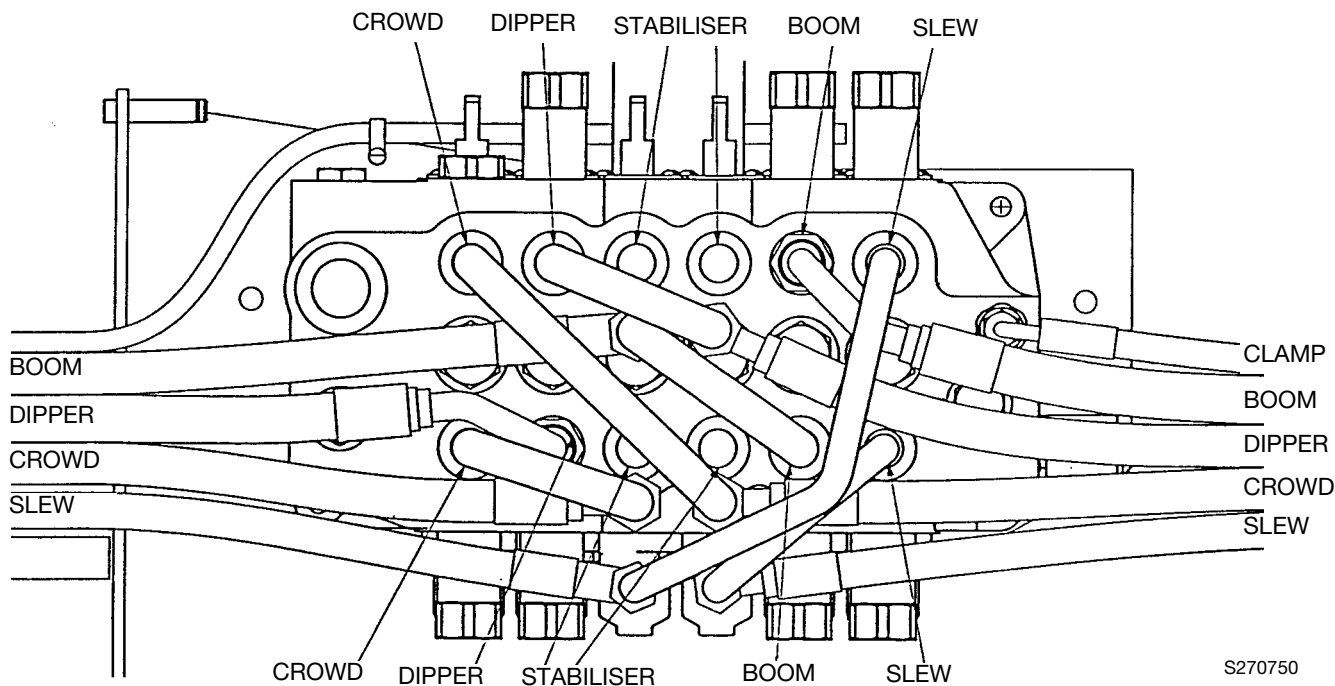


Dismantling and Assembly
- Hoses and Pipes (Sideshift Valve)

Refer to **Excavator Valve, Removal and Replacement** for valve block removal and replacement procedure. Hoses and pipes (when applicable) must be re-connected and phased in same position as removal.



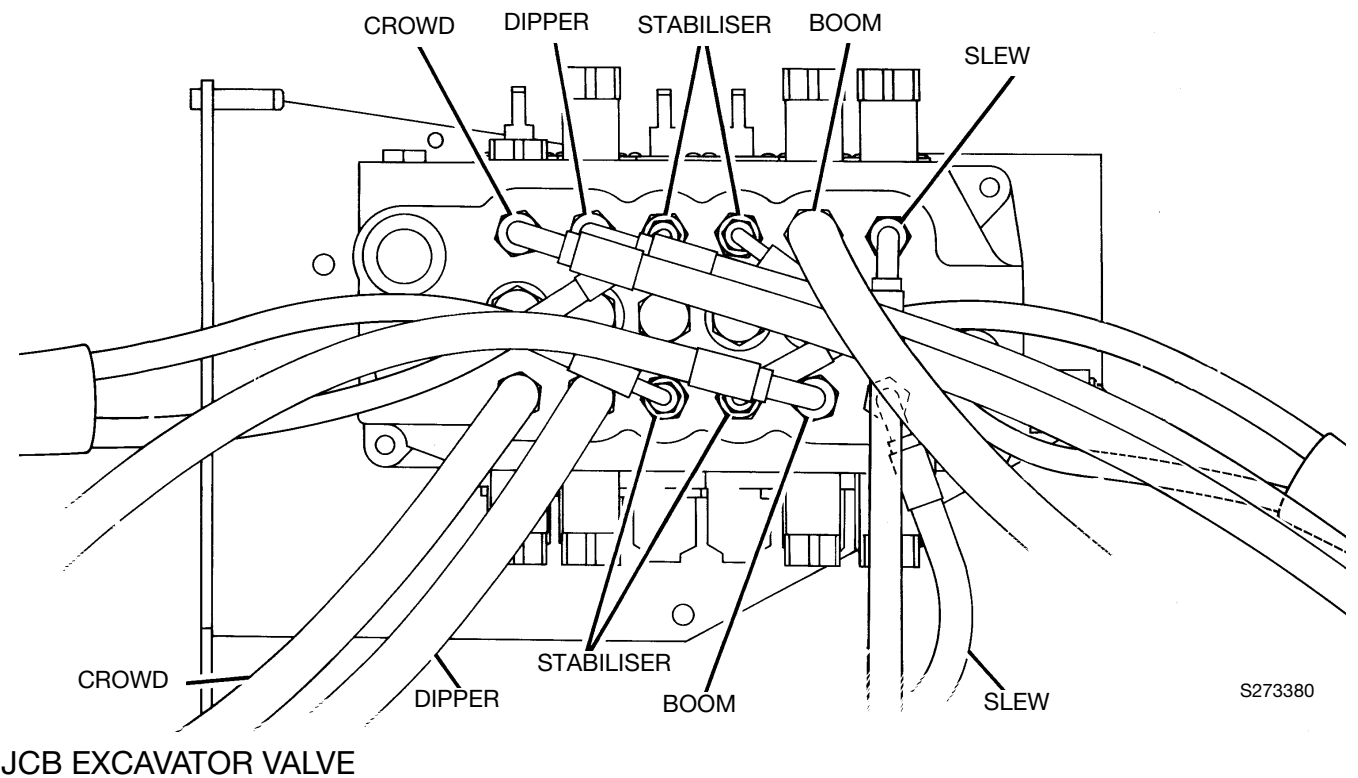
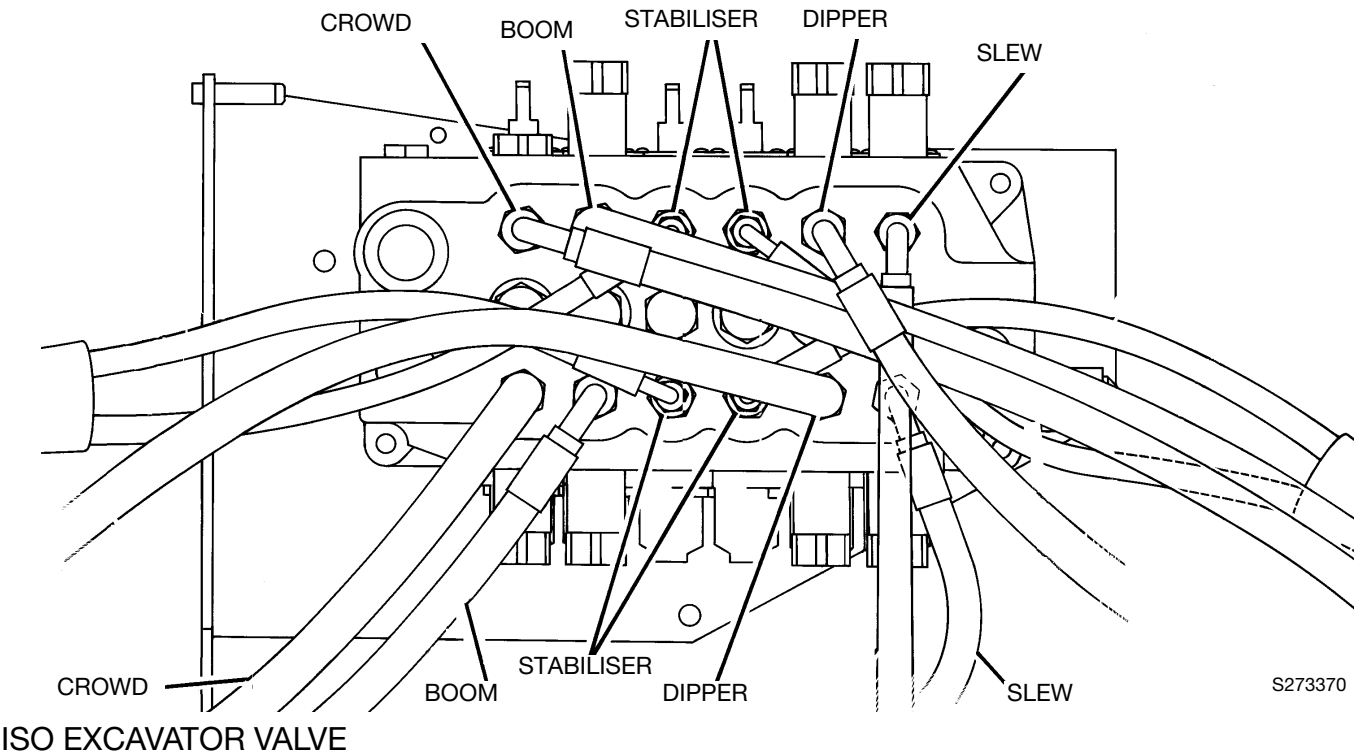
ISO EXCAVATOR VALVE

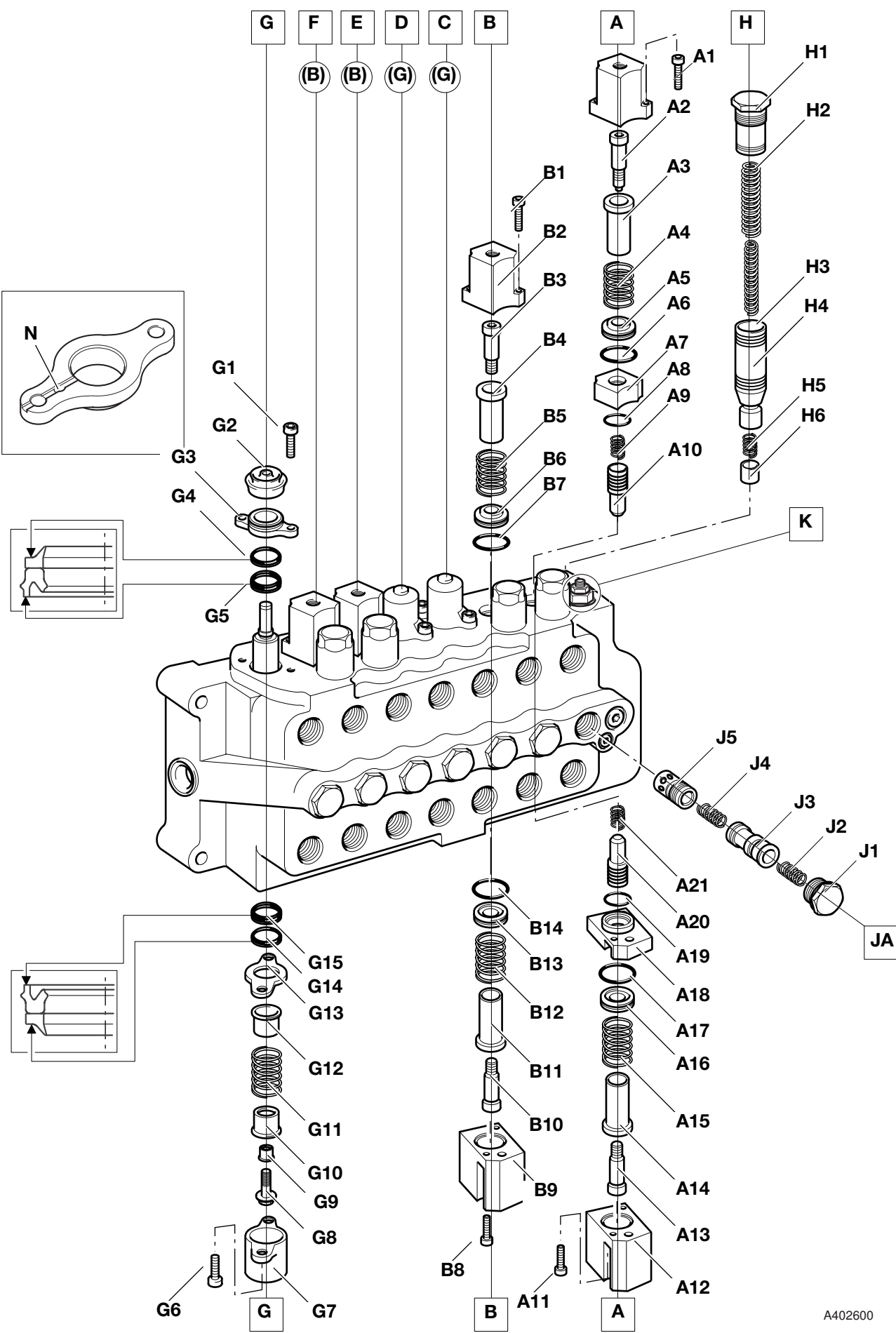
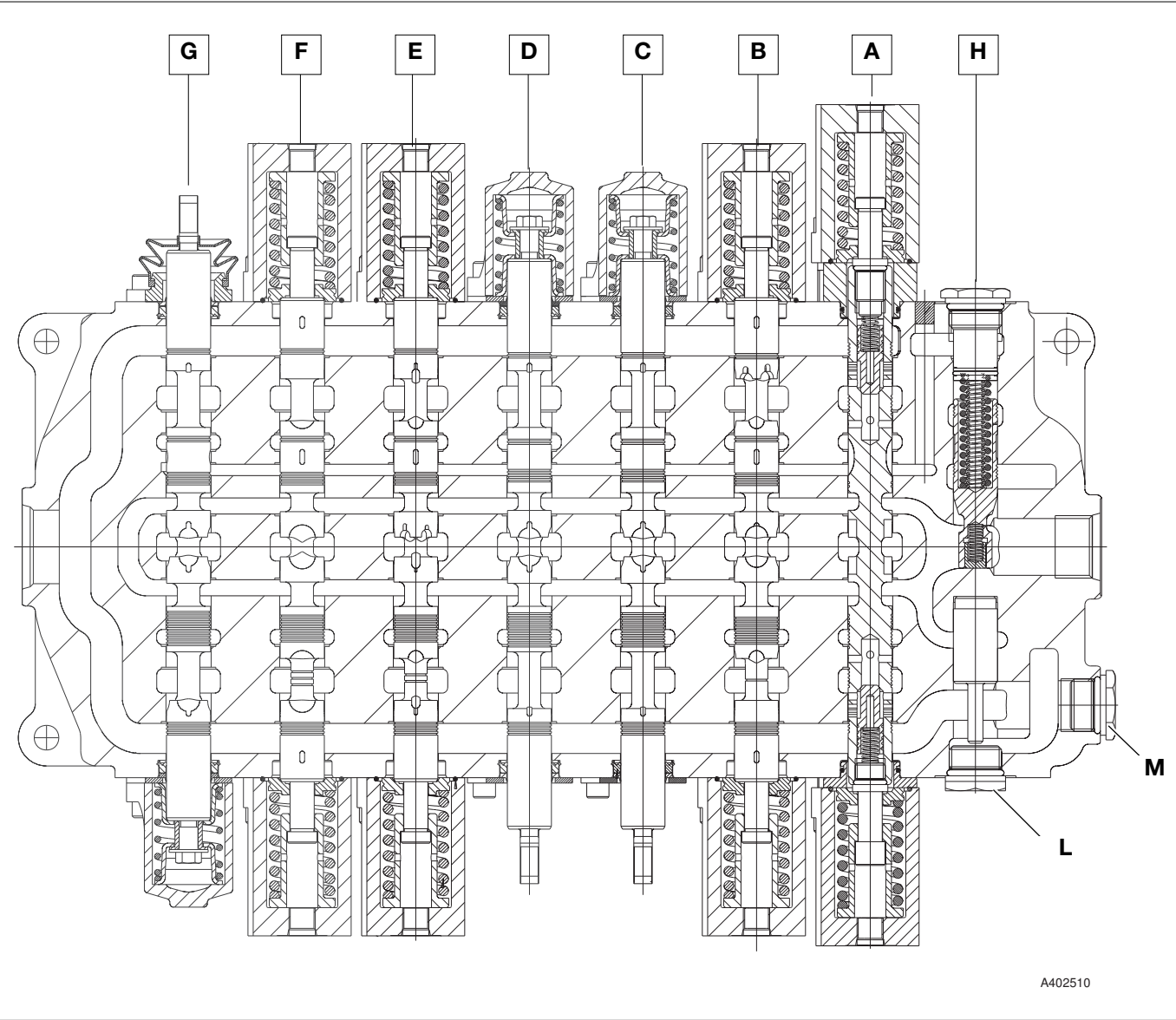
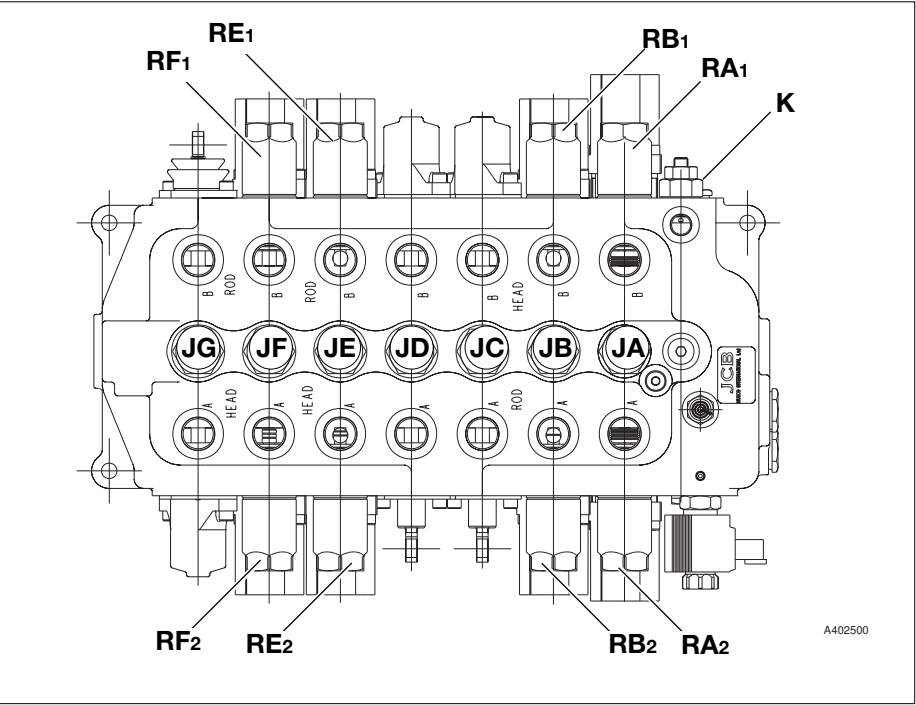


JCB EXCAVATOR VALVE

Dismantling and Assembly
- Hoses and Pipes (Centremount Valve)

Refer to **Excavator Valve, Removal and Replacement** for valve block removal and replacement procedure. Hoses and pipes (when applicable) must be re-connected and phased in same position as removal.





Dismantling and Assembly

Precision Control (Servo)
(Machines up to serial no. 931159)

Introduction

The numerical sequence shown on the illustration is intended as a guide to dismantling. Be sure to note the location of all components when dismantling. Although some components may appear to be identical they are not interchangeable. Make sure that components are assembled in their original positions.

For assembly the sequence should be reversed.

Load Sense (Isolator/Compensator) Valves

Each of the load sense valves **JA** to **JG** can be removed as shown at **JA**. Note that all valves are identical in appearance except valve **JE**. This valve is of the same configuration but is dimensionally different. Note that components are not interchangeable, see the introduction above.

Spools

Note that the not all the spools are shown with their components. This is because some spool assemblies are of the same configuration:

For spools **F** and **E** see spool **B**.

For spools **D** and **C** see spool **G**. Note that the spools are inverted relative to spool **G**.

Stabiliser spools **1D** and **4E** are identical to each other but different from the excavator spools. Spools must not be interchanged as they are matched to their bores

To dismantle spools **C**, **D** and **G** hold a rod through the eye end of the spool to prevent it rotating when undoing the screw at the opposite end. To dismantle spools **B**, **E** and **F** use allen keys in both screws, holding one whilst undoing the other. After removing one screw, hold the spool using service tool 992/10100 and then undo the remaining screw.

It is strongly recommended that that spool **A** is not dismantled. The spool has additional valve components in each end and can easily be damaged when dismantling. If the spool is damaged then the valve must be renewed. Only attempt to dismantle the spool in exceptional circumstances.

Lubricate new seals with JCB Hydraulic Fluid and take care to prevent them from being damaged by the sharp edges of the spool.

Note that the breather groove **N** in the seal retaining plates **G3** must be orientated facing the rear mounting face of the valve block

Relief Valves

A.R.V's **RA** to **RF** appear identical but have various pressure settings, refer to **Technical Data**. Ensure that they are correctly adjusted and fitted in their specified positions.

Relief valve dismantling and assembly procedures are detailed separately.

Bypass Compensator Valve

The bypass compensator valve is shown at **H**. Note that the assembly **L** is a blanking spool and would not normally need to be removed.

Load Sense Drain Regulator and Relief Valve

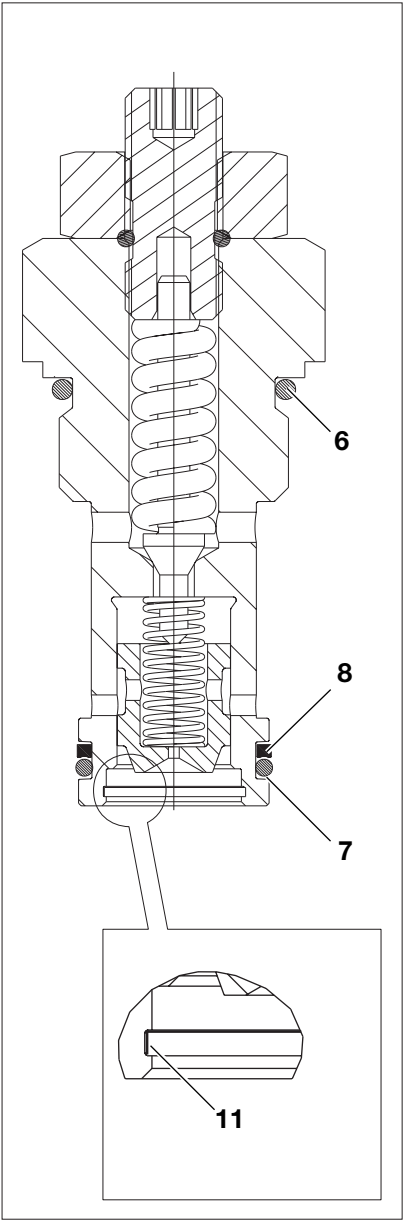
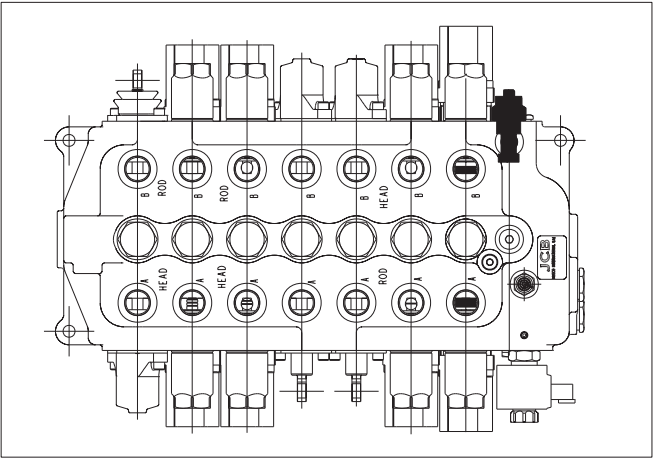
The dismantling and assembly procedure for the drain regulator and relief valve assembly **K** is detailed separately, see **Drain Regulator and Relief Valve**.

When assembling apply JCB Threadlocker to the following components:

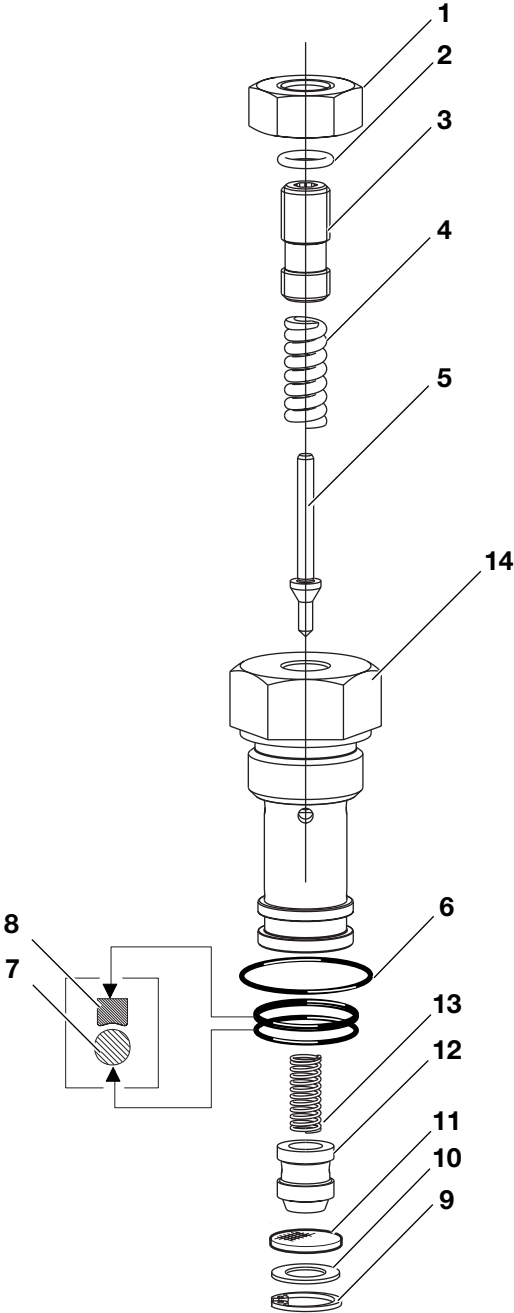
A2
A13
G8

Torque Settings

Item	Nm	kgf m	lbf ft
A1	8 - 11	0.8 - 1.1	6 - 8
A2	8 - 11	0.8 - 1.1	6 - 8
A11	8 - 11	0.8 - 1.1	6 - 8
A13	8 - 11	0.8 - 1.1	6 - 8
B1	8 - 11	0.8 - 1.1	6 - 8
B3	17 - 21	1.7 - 2.1	12.5 - 15.5
B8	8 - 11	0.8 - 1.1	6 - 8
B10	17 - 21	1.7 - 2.1	12.5 - 15.5
G1	8 - 11	0.8 - 1.1	6 - 8
G6	8 - 11	0.8 - 1.1	6 - 8
G8	8 - 11	0.8 - 1.1	6 - 8
H1	58 - 72	6 - 7.3	43 - 53
JA	58 - 72	6 - 7.3	43 - 53
K	58 - 72	6 - 7.3	43 - 53
M	58 - 72	6 - 7.3	43 - 53
RA - RF	58 - 72	6 - 7.3	43 - 53



A402640



Dismantling and Assembly

Precision Control (Servo)
(Machines up to serial no. 931159)

Load Sense Drain Regulator and Relief Valve

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

Note that components **6 - 13** can be dismantled and assembled without disturbing components **1 - 5**. If components **1 - 5** are dismantled, the valve must be reset to the correct operating pressure after assembly.

For assembly the sequence should be reversed.

Great care should be taken when dismantling and assembling a valve to avoid the following:-

- Contamination
- Damage to spools
- Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.

When Dismantling

When removing 'O' Rings and seals, use an appropriately rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' Rings and back-up rings. DO NOT use worn or damaged items.

Inspection

Inspect the valve components for scratches, nicks or any other type of damage, replace with new if required.

When Assembling

Renew all 'O' rings and back-up rings.

Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.

Make sure that the 'O' rings and back-up rings are fitted the correct way, items **7** and **8**.

Be sure to fit filter screen **11** the correct way round.

Adjust pressure setting as required.

Torque Settings

Item	Nm	kgf m	lbf ft
1	8 - 11	0.8 - 1.1	6 - 8

Dismantling and Assembly

Precision Control (Servo)
(Machines up to serial no. 931159)

Hydraclamp Valve

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

The following points MUST be avoided when dismantling and assembling the valve:

- CONTAMINATION
- DAMAGE TO BALL SEAT AND PISTON
- DAMAGE TO SEAL GROOVES

All or any of the above points may result in possible problems with the valve.

When removing 'O' rings and seals, use an appropriately rounded tool that WILL NOT cause any damage to the seal grooves. Discard ALL 'O' rings DO NOT use worn or damaged items.

Note that the hydraclamp comprises two separate valve assemblies; the clamp valve assembly shown at **A** and the solenoid assembly shown at **B**.

Dismantling

Unsecrew the clamp valve assembly **A** from the excavator valve block. Withdraw the piston **3** from the excvator valve block, if necessary use thin nose pliers.

Hold the body **1** and undo the spring retaining plug **4**. Withdraw the spring **5** and ball **6**.

Undo the nut **7** and remove solenoid coil **8**. Undo the valve stem **9**.

Make sure that all components and associated cross drillings are clean and free from debris.

Inspect the valve components for scratches, nicks or any other type of damage, particularly on the ball and seat faces. Carefully inspect the outside diameter of the piston **3** and its bore in the excavator valve block for damage or excessive wear. Renew components as required.

Assembly

Renew all 'O' rings.

Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.

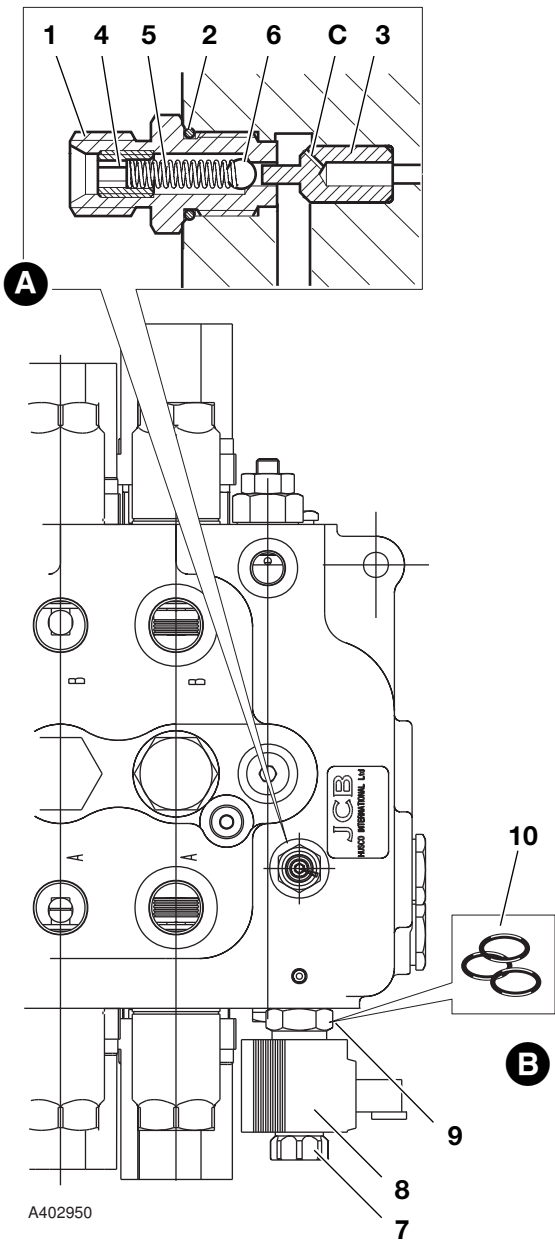
Ensure that the small drilling **C** in the piston **3** is clear.

Do not over-tighten the solenoid assembly, it may affect the operation of the solenoid, use the spanner flats and torque tighten to figure indicated in the table.

Check the operation of the electric hydraclamp, refer to **Circuit Descriptions, Excavator Valve - Precision Control - Hydraclamp Valve Operation.**

Torque Settings

Item	Nm	kgf m	lbf ft
4	8 - 11	0.8 - 1.1	6 - 8
7	4.7 - 6.1	0.5 - 0.6	3.5 - 4.5
9	41 - 48	4.1 - 5	30 - 36



Dismantling and Assembly

Precision Control (Servo)
(Machines from January 2003)

Dismantling

The excavator valve block is a ‘sandwich type’, which is made up of a number of separate sections. The illustration shown on the opposite page is intended as a guide to dismantling. Be sure to note the location of all components when dismantling. Although some components may appear to be identical they are not interchangeable. Make sure that components are assembled in their original positions.

- 1 Remove the excavator valve block from the machine.
- 2 Remove the three tie rod nuts 1.
- 3 Carefully separate and remove the outlet section 2 followed by the remaining service sections 3. If the inlet section 4 is to be replaced, remove and retain the tie rods 5.

Assembly

Assembly is the reverse of the dismantling sequence.

- 1 Clean the valve components in an appropriate solvent. Ensure that the mating faces of the valve sections are thoroughly clean before assembly.
- 2 Renew the ‘O’ rings located between the valve sections. Make sure the ‘O’ ring seals are not trapped or damaged.
- 3 Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.

Torque Settings

Item	Nm	kgf m	lbf ft
1	35	3.6	25.8
6A	10	1	7.4
7	20	2	14.8
8	45	4.6	33.2
9	100	10.2	73.8
10	70	7.1	51.6
11	70	7.1	51.6
11A	70	7.1	51.6
12	60	6.1	44.3
13	30	3	22.1
14	20	2	14.8
14A	45	4.6	33.2

Service Spools

Each of the service spools 6 can be removed as shown. Care must be taken to ensure that the spool is not damaged when removing it from the block. Note that all spools are similar in appearance but must not be interchanged as they are matched to their bores. All spools have the same centring and sealing components.

Flow Regulator Valve

The dismantling and assembly procedures for the flow regulator valve 7 are detailed separately, refer to **Flow Regulator Valve**.

Load Sense Relief Valve

The dismantling and assembly procedures for the load sense relief valve 8 are detailed separately, refer to **Load Sense Relief Valve**.

Flushing Valve

The flushing valve 9 can be removed as shown.

Auxiliary Relief Valves

The A.R.V's 10 appear identical but have various pressure settings, refer to **Technical Data**. Ensure that they are correctly adjusted and fitted in their specified positions. The dismantling and assembly procedures for the ARV's are detailed separately, refer to **Auxiliary Relief Valves (ARV's)**.

Anti-cavitation Valve

The dismantling and assembly procedures for the anticavitation valve 11 are detailed separately, refer to **Anti-cavitation Valve**.

Pressure Compensator Valves

Each of the pressure compensator valves 12 can be removed as shown. Note that all valves are identical in appearance. Note that components are not interchangeable.

Load Hold Check Valves

Each of the load hold check valves 13 can be removed as shown. Note that all valves are identical in appearance. Ensure good condition of seating faces on poppets and on the mating faces in the valve block.

Hydra-clamp Solenoid Valve

The hydra-clamp solenoid valve 14 can be removed as shown.

Dismantling and Assembly

Precision Control (Servo) (Machines from January 2003)

Flow Regulator Valve

Removal

It is possible to remove a valve without removing the excavator valve block from the machine.

Note: If removing components from a valve block that is fitted on a machine the pilot circuit accumulator pressure must be vented first. With the operator seat locked in the rear facing position and with the arm rests raised forward (for backhoe operation), switch the starter to ON without starting the engine. Operate the joystick controls several times to vent the hydraulic pressure from the servo system and backhoe rams. Turn the starter switch to the OFF position and remove the key.

- 1 Gain access to the excavator valve and disconnect and blank any hoses or pipes which may interfere with the removal of the flow regulator valve.
- 2 Unscrew the flow regulator valve from the excavator valve block. Cover the ports to prevent the ingress of dirt and remove to a clean working area.

Dismantling

Great care should be taken when dismantling and assembling a valve to avoid the following:-

- Contamination
- Damage to spools
- Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.

- 1 Unscrew and remove top plug 1.
- 2 Carefully remove shims 2, spring 3 and piston 4.

Note: When removing 'O' Rings and seals, use an appropriately rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' Rings and back-up rings. DO NOT use worn or damaged items.

Inspection

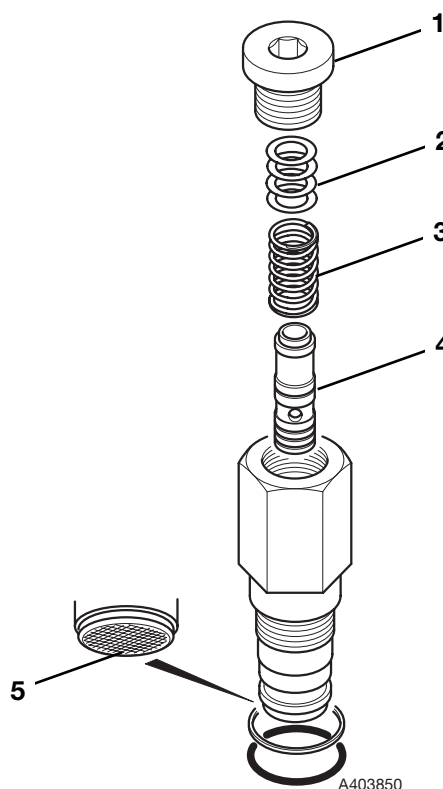
- 1 Inspect the valve components for scratches, pitting, corrosion or any other type of damage.
- 2 Clean the filter gauze 5 fitted in the end of the valve body.

Note: If any part other than 'O' rings are damaged the entire valve must be renewed.

Assembly

Assembly is the reverse of the dismantling sequence.

- 1 Clean the valve components in an appropriate solvent.
- 2 Renew all 'O' rings and back-up rings.
- 3 Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.
- 4 Be sure to fit filter gauze 5 the correct way round.



Dismantling and Assembly

Precision Control (Servo) (Machines from January 2003)

Load Sense Relief Valve

Removal

It is possible to remove a valve without removing the excavator valve block from the machine.

Note: If removing components from a valve block that is fitted on a machine the pilot circuit accumulator pressure must be vented first. With the operator seat locked in the rear facing position and with the arm rests raised forward (for backhoe operation), switch the starter to ON without starting the engine. Operate the joystick controls several times to vent the hydraulic pressure from the servo system and backhoe rams. Turn the starter switch to the OFF position and remove the key.

- 1 Gain access to the excavator valve and disconnect and blank any hoses or pipes which may interfere with the removal of the load sense relief valve.
- 2 Unscrew the load sense relief valve from the excavator valve block. Cover the ports to prevent the ingress of dirt and remove to a clean working area.

Dismantling

Great care should be taken when dismantling and assembling a valve to avoid the following:-

- Contamination
- Damage to spools
- Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.

- 1 Loosen locknut **1**, unscrew and remove adjuster nut **2** and adjuster screw **3**.
- 2 Carefully remove spring **4** and poppet **5** from valve body.

Note: When removing 'O' Rings and seals, use an appropriately rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' Rings and back-up rings. DO NOT use worn or damaged items.

Inspection

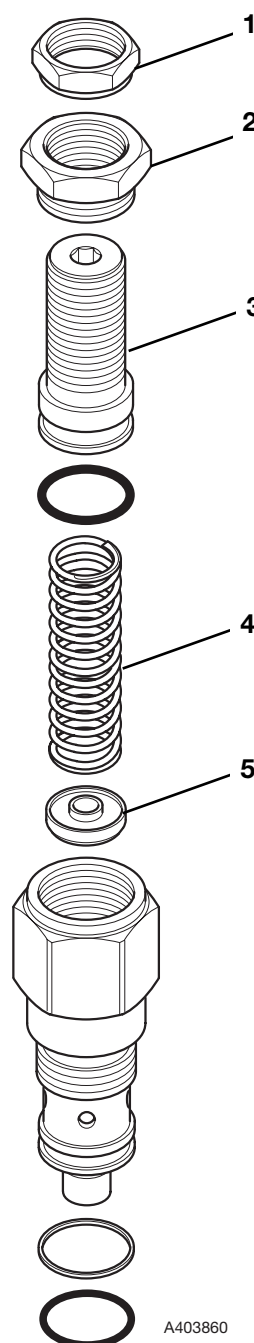
- 1 Inspect the valve components for scratches, pitting, corrosion or any other type of damage.

Note: If any part other than 'O' rings are damaged the entire valve must be renewed.

Assembly

Assembly is the reverse of the dismantling sequence.

- 1 Clean the valve components in an appropriate solvent.
- 2 Renew all 'O' rings and back-up rings.
- 3 Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.
- 4 Adjust the pressure setting as required. Refer to **Service Procedures, Pressure Testing, Load Sense Relief Valve**.



Dismantling and Assembly

Precision Control (Servo) (Machines from January 2003)

Auxiliary Relief Valves (ARV's)

Removal

It is possible to remove a valve without removing the excavator valve block from the machine.

Note: If removing components from a valve block that is fitted on a machine the pilot circuit accumulator pressure must be vented first. With the operator seat locked in the rear facing position and with the arm rests raised forward (for backhoe operation), switch the starter to ON without starting the engine. Operate the joystick controls several times to vent the hydraulic pressure from the servo system and backhoe rams. Turn the starter switch to the OFF position and remove the key.

- 1 Gain access to the excavator valve and disconnect and blank any hoses or pipes which may interfere with the removal of the auxiliary relief valve(s).
- 2 Unscrew the auxiliary relief valve(s) from the excavator valve block. Cover the ports to prevent the ingress of dirt and remove to a clean working area.

Dismantling

Great care should be taken when dismantling and assembling a valve to avoid the following:-

- Contamination
- Damage to spools
- Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.

- 1 Prise off plastic locking cap.
- 2 Loosen locknut 1 and remove adjuster screw 2.
- 3 Carefully remove spring 3 and poppet 4.
- 4 Unscrew upper valve body 5 and remove springs 6 and piston 7.

Note: When removing 'O' Rings and seals, use an appropriately rounded tool that WILL NOT cause any damage to the seal grooves. Discard ALL 'O' Rings and back-up rings. DO NOT use worn or damaged items.

Inspection

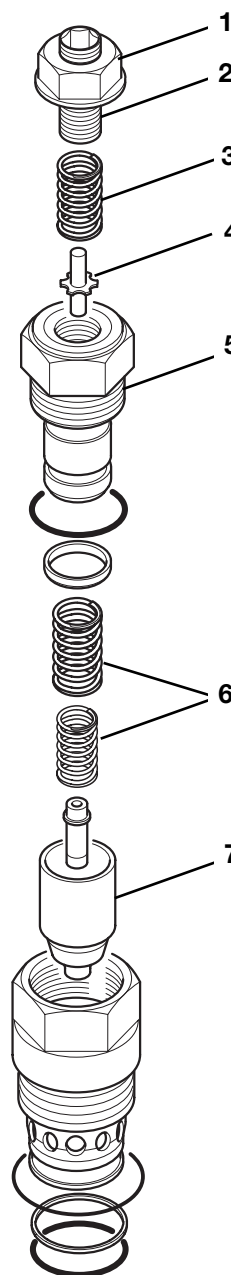
- 1 Inspect the valve components for scratches, pitting, corrosion or any other type of damage.

Note: If any part other than 'O' rings are damaged the entire valve must be renewed.

Assembly

Assembly is the reverse of the dismantling sequence.

- 1 Clean the valve components in an appropriate solvent.
- 2 Renew all 'O' rings and back-up rings.
- 3 Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.
- 4 Adjust the pressure setting as required. Refer to **Service Procedures, Auxiliary Relief Valve - Setting**.



A403870

Dismantling and Assembly

Precision Control (Servo) (Machines from January 2003)

Anti-cavitation Valve

Removal

It is possible to remove a valve without removing the excavator valve block from the machine.

Note: If removing components from a valve block that is fitted on a machine the pilot circuit accumulator pressure must be vented first. With the operator seat locked in the rear facing position and with the arm rests raised forward (for backhoe operation), switch the starter to ON without starting the engine. Operate the joystick controls several times to vent the hydraulic pressure from the servo system and backhoe rams. Turn the starter switch to the OFF position and remove the key.

- 1 Gain access to the excavator valve and disconnect and blank any hoses or pipes which may interfere with the removal of the anti-cavitation valve.
- 2 Unscrew the anti-cavitation valve from the excavator valve block. Cover the ports to prevent the ingress of dirt and remove to a clean working area.

Dismantling

Great care should be taken when dismantling and assembling a valve to avoid the following:-

- Contamination
- Damage to spools
- Damage to seal grooves

Any of the above may result in possible problems with the operation of the valve.

- 1 Unscrew and carefully remove the top nut **1** complete with piston **2** from the valve body.
- 2 Remove the piston **2** and spring **3** from the top nut spindle.

Note: When removing 'O' Rings and seals, use an appropriately rounded tool that WILL NOT cause any damage to the seal grooves.

Discard ALL 'O' Rings and back-up rings. DO NOT use worn or damaged items.

Inspection

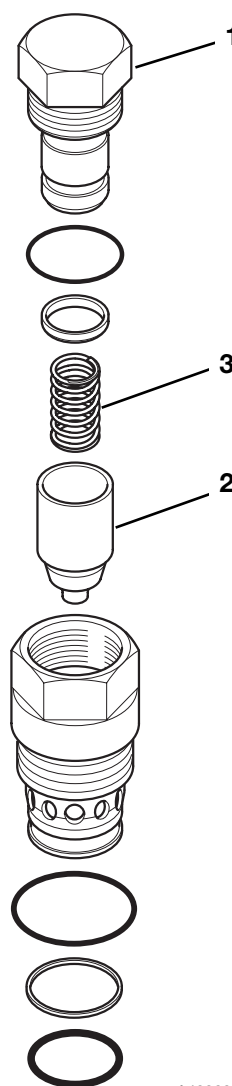
- 1 Inspect the valve components for scratches, pitting, corrosion or any other type of damage.

Note: If any part other than 'O' rings are damaged the entire valve must be renewed.

Assembly

Assembly is the reverse of the dismantling sequence.

- 1 Clean the valve components in an appropriate solvent.
- 2 Renew all 'O' rings and back-up rings.
- 3 Lubricate parts with JCB Hydraulic Fluid before assembling. Make sure that all the parts move freely.



A403880

Removal and Replacement

⚠ WARNING

Make the machine safe before working underneath it. Park the machine on level ground, lower the arms. Apply the parking brake, put the transmission in neutral and stop the engine. Chock both sides of all four wheels.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.

GEN-1-2

⚠ DANGER

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

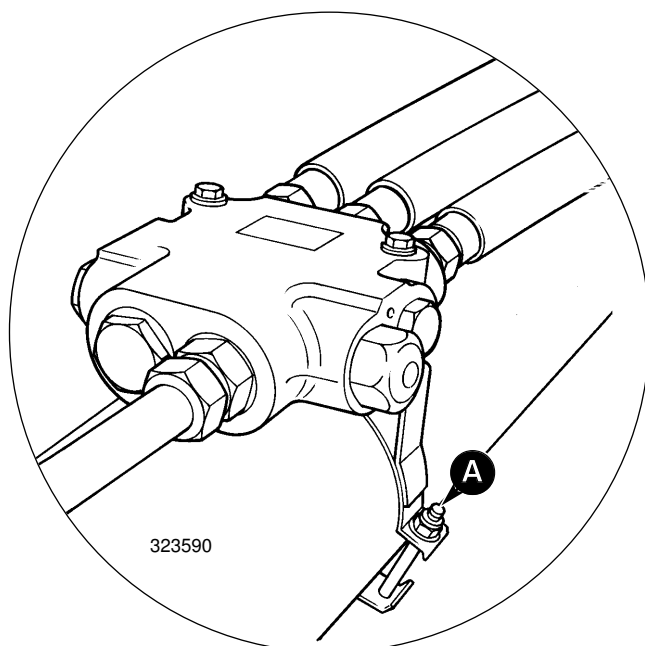
INT-3-1-11/1

Removal

- 1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Lower the backhoe and loader end to the ground and stop the engine.

Note: Refer to **Service Procedures, Hose Burst Protection Valves, Lowering a Load - In a Failure Condition** for lowering a load with engine failure or a burst hose.

- 2 Turn the manual over-ride screw fully clockwise.
- 3 Operate the main service control levers back and forth to vent residual pressure. For instance, if the HBPV is fitted on the boom or dipper then operate the backhoe control levers. If the HBPV is fitted on the loader arms then operate the loader control levers.



- 4 Disconnect all hydraulic hoses from the HBPV and plug all orifices to prevent ingress of dirt. Label each hose before disconnecting, this will ensure correct position when refitting.

- 5 Undo the retaining clips **A** and remove the HBPV.

Replacement

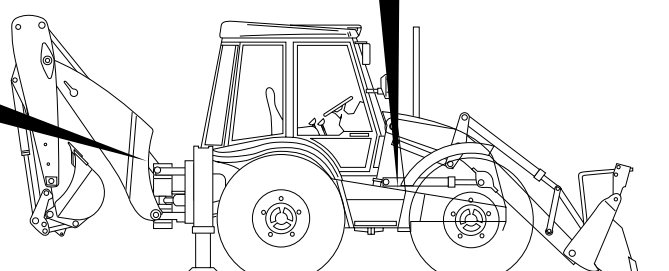
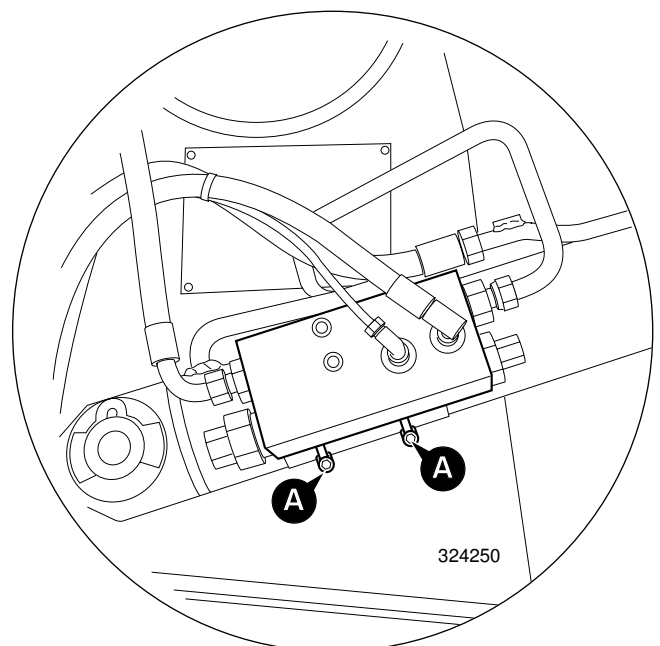
Replacement is a reversal of the removal sequence.

⚠ 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

After refitting the valve to the machine, ensure that the valve operates correctly, refer to **Service Procedures, Hose Burst Protection Valves - Checking**.



A260734

Dismantling and Assembly - Loader Lift Ram

This procedure applies to Hose Burst Protection Valves fitted to the loader arm rams ONLY.

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

For assembly the sequence should be reversed.

Dismantling

If possible, avoid disturbing pressure settings, remove cartridges by unscrewing hexagons **1** and **13** and do not remove capnuts **3** and **16**.

Spool **2** and check valve **11** each have a Teflon ring fitted (items **A** and **B** respectively). These Teflon rings should only be removed and replaced with new ones if they are damaged.

Do not try to dismantle items **20**, **21** and **22** (these items are shown for pictorial reference only). To clean, use a non-metallic probe to move the ball **21** against spring **22** whilst assembly **17** is submersed in cleaning fluid.

Check condition of all visible seating faces. If any are damaged, renew complete cartridge or valve assembly.

Check valve bores and spools for nicks, scratches or scoring, if necessary, renew complete cartridge or valve assembly.

Assembly

DO NOT apply JCB Threadlocker and Sealer or any other type of locking fluid to the threads of item **17**. The threads form an integral part of the valve operating sequences - applying locking fluid to the threads will seriously effect the operation of the valve.

Ensure that the small drilled holes **C** and **D** in items **2** and **17** respectively are not blocked.

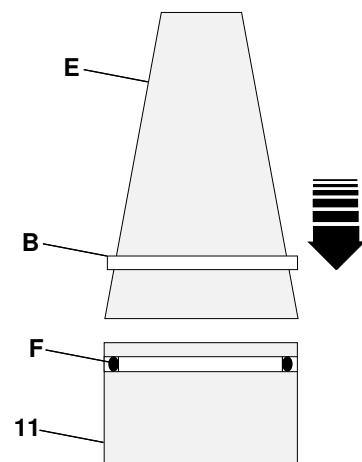
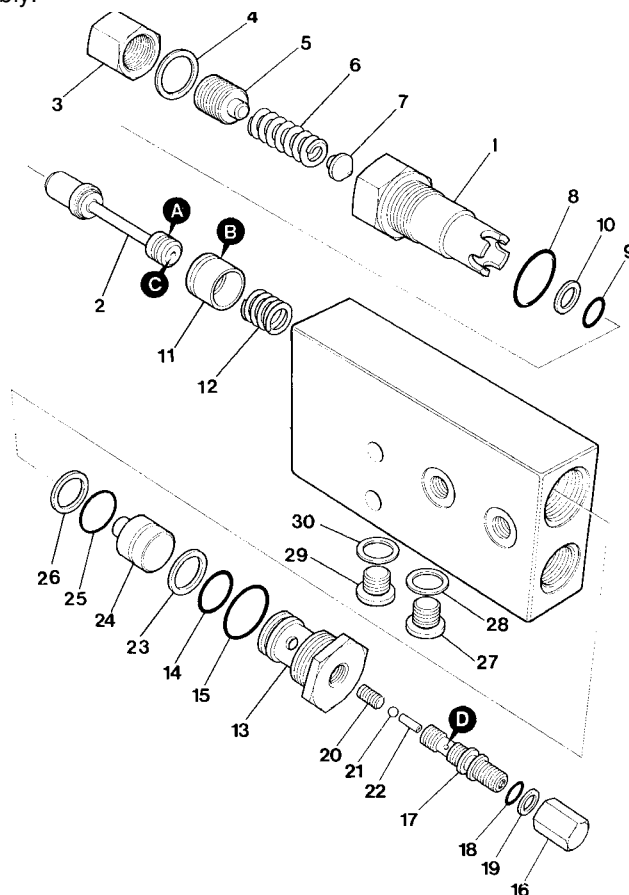
Renew all seals. If fitting new Teflon rings **A** & **B**, use a conical guide, such as item **E**, to expand the rings gradually. Complete the ring fitting procedure as quickly as possible, otherwise the ring will stretch. See below.

Note: There is an O-ring **F** fitted underneath each Teflon ring, if the Teflon rings are to be renewed, make sure that new O-rings are fitted first.

After assembly, make sure that the valve parts move freely, if they don't, check that all the seals are correctly fitted.

After refitting the valve to the machine, ensure that pressure settings are correct, see **Technical Data** page, and check that the valve operates correctly.

If the pressure settings were disturbed, then the valve must be re-set, refer to **Service Procedures, Hose Burst Protection Valves, Pressure Testing - Loader Lift Ram**.



Dismantling and Assembly (Cont'd) - Boom and Dipper Rams

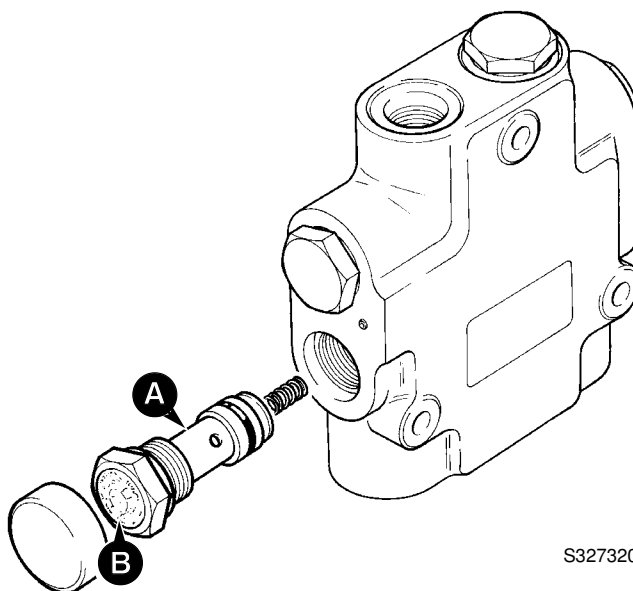
This procedure applies to Hose Burst Protection Valves fitted to the boom/dipper rams ONLY.

There is no servicing permitted on this valve apart from the removing and fitting a new check valve assembly **A** when the seal **B** has been broken.

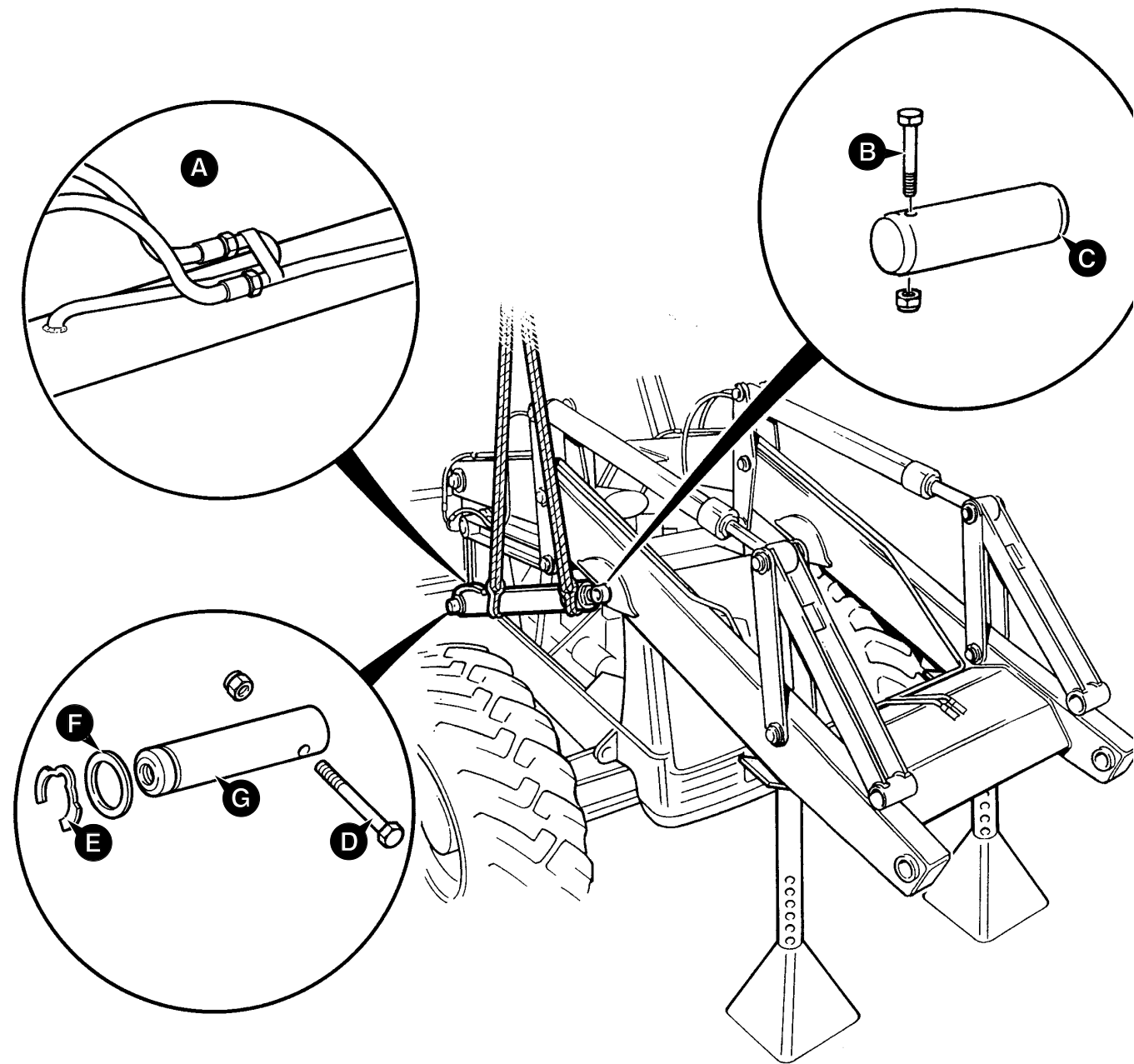
DO NOT use the machine with a broken seal.

If the assembly is fitted to the machine, before removing the check valve **A**, operate the main service control levers back and forth to vent residual pressure.

After fitting a new check valve ensure that the valve assembly operates correctly, refer to **Service Procedures, Hose Burst Protection Valves - Checking**.



**Removal and Replacement
- Loader Lift Ram**



cardiagn.com

S266330

Removal and Replacement

- Loader Lift Ram

Removal

WARNING

The loader arm interlevers are potentially dangerous, when pivoting about their centre they form a 'scissor' point with the loader arm. Make sure the interlevers are securely blocked when working in the loader arm area.

BF 2-1

- 1 Park the machine on firm level ground. Engage the parking brake and set the transmission to neutral.
- 2 Raise the loader arms to give access to the lift ram pivot pins **C**. The loader arms must be supported, use a tool as shown.

DANGER

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

- 3 Switch off the engine and vent residual hydraulic pressure from the loader end by operating the loader controls back and forth several times.

Note: If a hose burst protection valve is fitted on the ram, the system will not vent. Extreme caution must be used when releasing hydraulic connections - release the connections one turn and allow the pressure to dissipate.

- 4 Label and then remove the lift ram hoses **A**. Plug and cap all open orifices to prevent loss of fluid and ingress of dirt.

CAUTION

This component is heavy. Do not attempt to remove it unless its weight is held by a sling. Make sure that the sling is attached to a suitable lifting appliance.

HYD 2-3/1

- 5 Fasten lifting straps to the lift ram, make sure that the weight of the ram is supported by the sling.
- 6 Remove pivot pin retaining bolt **B** and then remove the pivot pin **C**.
- 7 Remove pivot pin retaining bolt **D**.
- 8 Remove klipring **E** and shim **F** from both sides of ram, use slide hammer kit (service tool 993/68100) to remove pivot pin **G**.
- 9 Remove the lift ram.

Replacement

Replacement is a reversal of the removal sequence.

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

Coat pivot pins with anti-rust lubricant.

Make sure that the head of item **D** is on the engine side.

Coat mainframe bores with grease.

Assembly sequence for shim **F** and klipring:

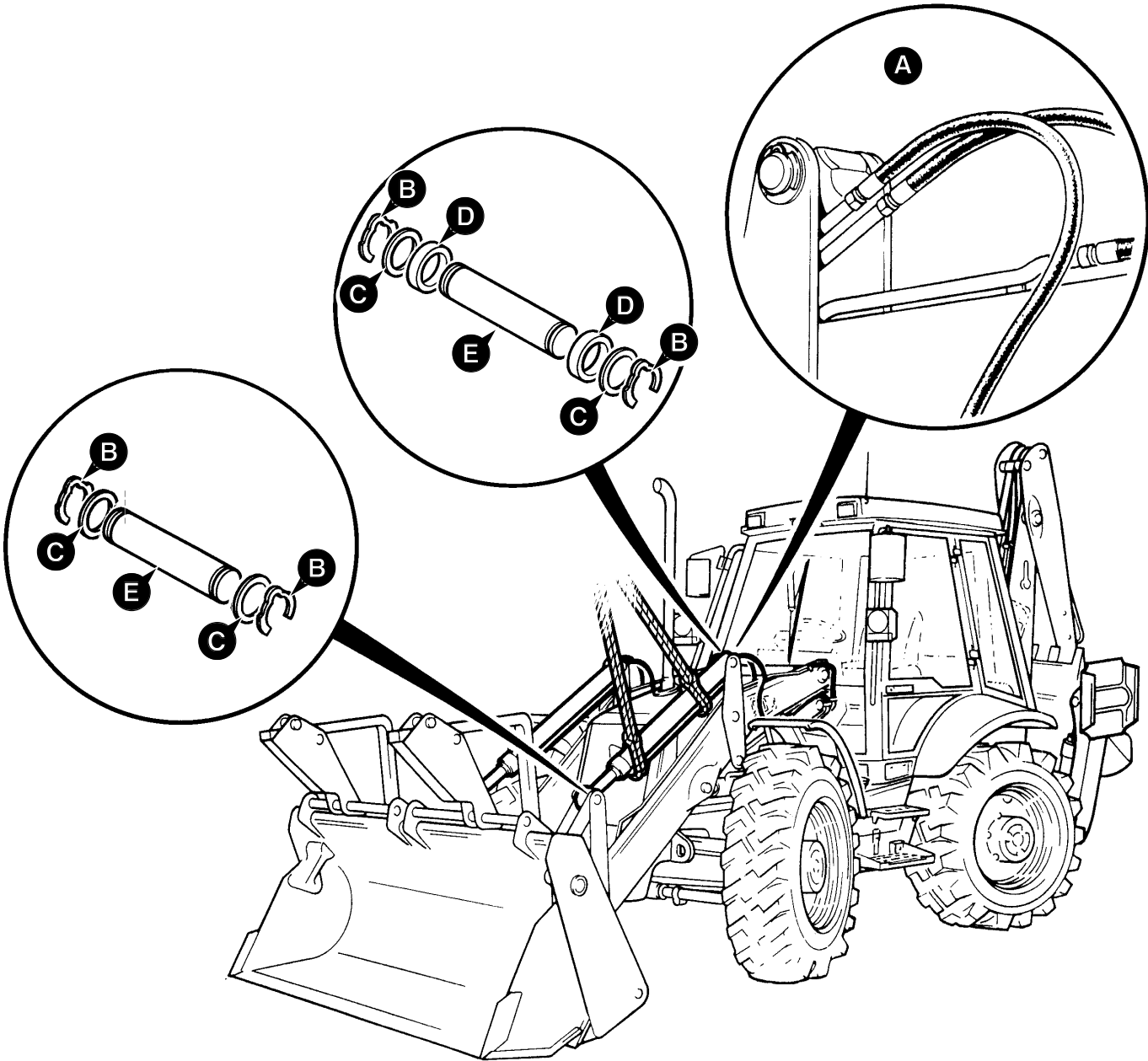
- 1st shim
- 2nd ram
- 3rd shim (as required)
- 4th klipring

Pivot pins with M24 pin extractor hole

- 1st spacer
- 2nd ram
- 3rd shim (as required)
- 4th klipring

All klipring installations to have a maximum end float of 2mm (0.080in.)

Removal and Replacement
- Loader Shovel Ram



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S266340

Removal and Replacement - Loader Shovel Ram

Removal

WARNING

The loader arm interlevers are potentially dangerous, when pivoting about their centre they form a 'scissor' point with the loader arm. Make sure the interlevers are securely blocked when working in the loader arm area.

BF 2-1

- 1 Park the machine on firm level ground. Engage the parking brake and set the transmission to neutral.
- 2 Rest the shovel flat on the ground.

DANGER

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

- 3 Switch off the engine and vent residual hydraulic pressure from the loader end by operating the loader controls back and forth several times.
- 4 Label and then remove the shovel ram hoses **A**. Plug and cap all open orifices to prevent loss of fluid and ingress of dirt.

CAUTION

This component is heavy. Do not attempt to remove it unless its weight is held by a sling. Make sure that the sling is attached to a suitable lifting appliance.

HYD 2-3/1

- 5 Fasten lifting straps to the shovel ram, make sure that the weight of the ram is supported by the sling.
- 6 Remove kliprings **B**, shims **C** and spacers **D**.
- 7 Remove pivot pins **E**.

Replacement

Replacement is a reversal of the removal sequence.

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.

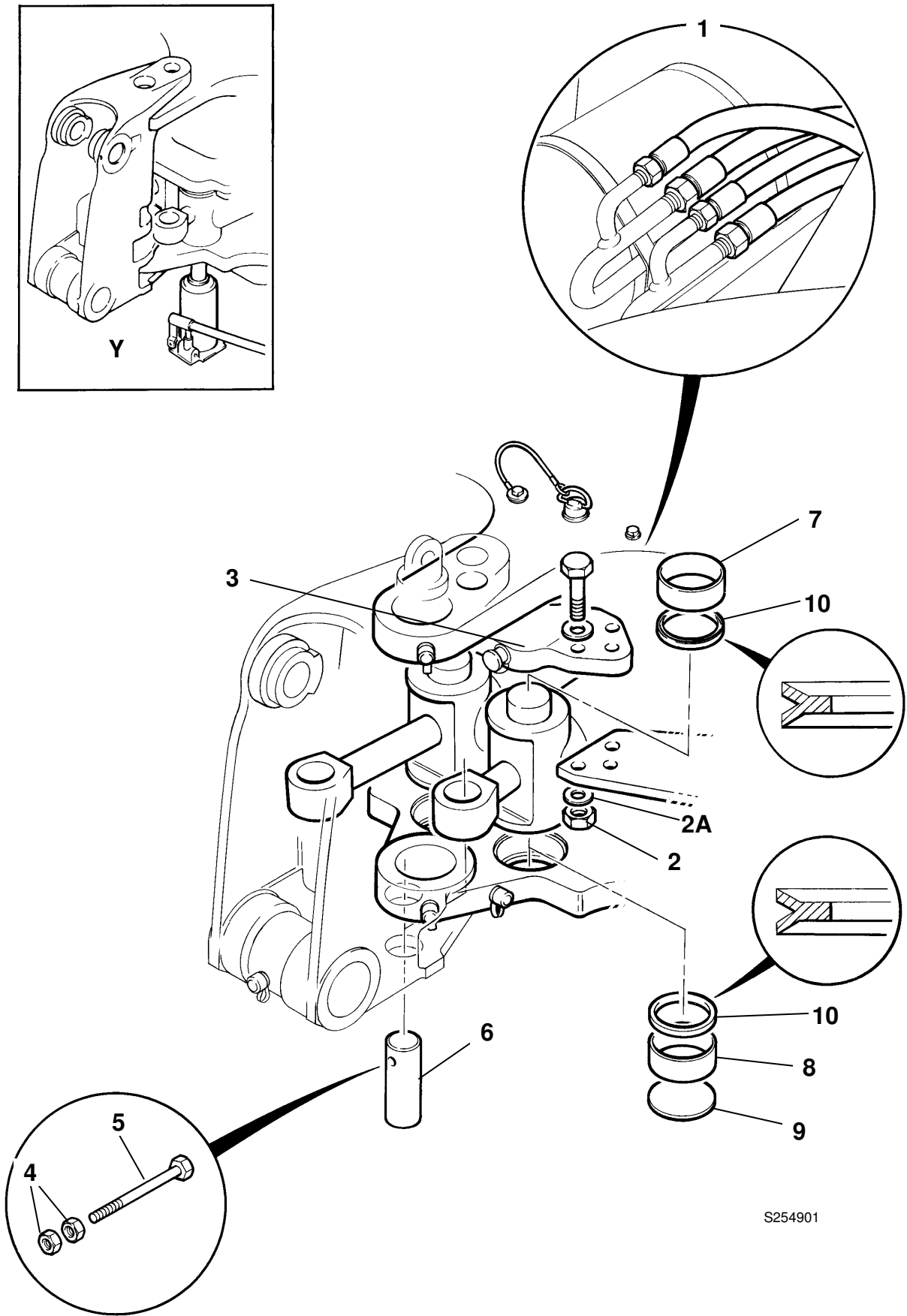
INT-3-1-10/1

Coat pivot pins with anti-rust lubricant.

All klipring intallations to have a maximum end float of 2mm (0.080in.)

Make sure that each klipring is installed with a shim.

Removal and Replacement
- Slew Ram



S254901

Removal and Replacement

- Slew Ram

Removal

- 1 Slew the backhoe to the left to remove the right hand slew ram and visa versa.
- 2 Lower the bucket to the ground and switch off the engine.

WARNING

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

- 3 Vent any residual hydraulic pressure by operating the backhoe and slew control levers.
- 4 Disconnect the hydraulic hoses 1 to the slew rams - before disconnecting the hoses make sure that they are labelled (to assist with reassembly).
- 5 Plug and cap all open hydraulic connections to prevent ingress of dirt and loss of hydraulic fluid.
- 6 Loosen and remove trunnion bracket retaining nuts 2 and hardened washers 2A (see note).

Note: On assembly, the correct grade of nut (grade 12) and bolt (grade 10.9) must be used. Also, use hardened washers 2A - NOT ordinary washers. Using incorrect specification items could result in a reduction of clamping efficiency.

- 7 Remove the trunnion bracket 3.

CAUTION

This component is heavy. Do not attempt to remove it unless its weight is held by a sling. Make sure that the sling is attached to a suitable lifting appliance.

HYD 2-3/1

- 8 Attach suitable lifting straps to the slew ram assembly. Note that the weight of the slew ram assembly is approximately 44 kg (97 lbs).
- 9 Remove thin nuts 4 (2 off per pivot pin) and remove the pivot pin retaining bolt 5. Use a 25 - 30 mm diameter bar to knock the pin out vertically.
- 10 Remove the slew ram (eye end) pivot pin 6 and swing the ram to clear the kingpost casting.
- 11 Lift the slew ram assembly clear of the machine.

Inspection

Inspect the liner bearings 7 (located in the trunnion retaining bracket 3) and liner bearing 8 for signs of damage, wear, scores or nicks etc. Replace as required.

To remove the liner bearing 8 use a jack located against blanking plate 9. Shown in the inset at Y.

To remove the bearing liner 7 from the trunnion bracket use flat faced bearing pullers.

Replacement

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

Replacement is generally a reversal of the removal procedures, however note the following:

The liner bearings 7 and 8 have a 'lead-in' diameter (noticeable with a slight step), always install the smaller diameter first into the pivot bore. The bearings must be installed so that they sit flush.

The eye end pivot pins 6 should be secured first - i.e. BEFORE the trunnion bracket retaining nuts 2, this will help to maximise ram assembly alignment.

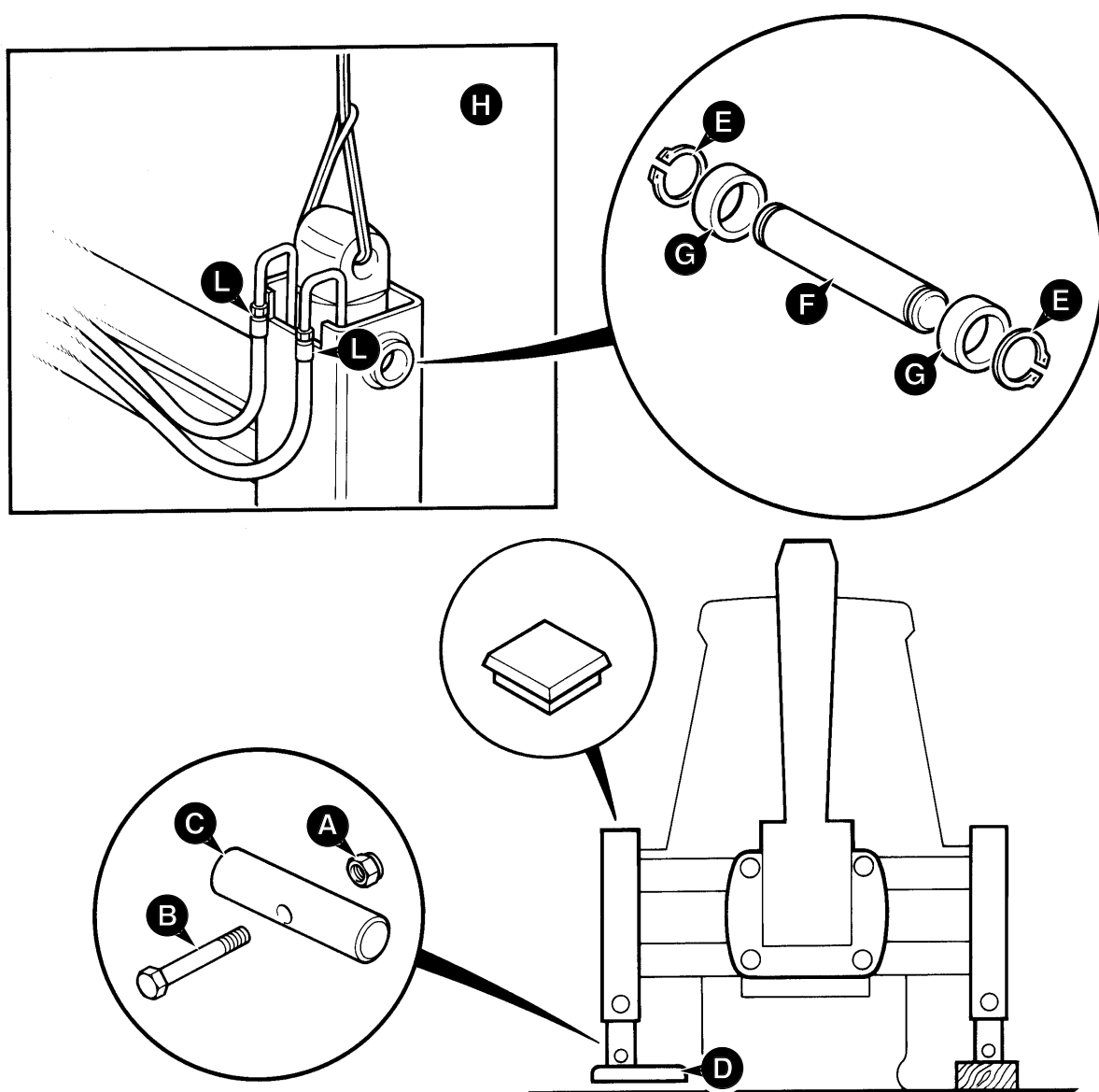
Make sure that the hydraulic hoses are correctly installed.

Make sure that any new or reused bearings are clean and smeared with grease prior to reassembly of pins and trunnion journals.

When fully assembled, apply grease at each grease nipple BEFORE operating the machine.

Torque Setting

Item	Nm	lb ft	kgf m
2	650	480	66.3



S271860

Removal and Replacement

- Stabiliser Ram (Sideshift)

Removal

- 1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Lower the backhoe and loader end to the ground.
- 2 Lower the stabiliser legs until the pads are approximately 4 in. (100mm) off the ground and stop the engine.
- 3 Remove the bottom locking nut **A** and bolt **B**. Drive out the bottom pivot pin **C** and allow the stabiliser foot **D** to fall clear. Lift the inner leg and temporarily refit the pivot pin **C** through inner leg and ram.
- 4 Place a block of wood underneath the stabiliser leg.
- 5 Remove circlips **E** and drive out top pivot pin **F** with spacing collars **G**.
- 6 Start the engine and slowly extend the stabiliser ram so that the dump end of the ram protrudes from the top of the outer leg section.
- 7 Attach suitable lifting gear to the ram as shown at **H**. Make sure that the weight of the ram is supported by the sling and remove the bottom pivot pin **C**.

DANGER

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

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

Note: If a check valve is fitted on the ram, the system will not vent. Extreme caution must be used when releasing hydraulic connections - release the connections one turn and allow the pressure to dissipate.

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

CAUTION

This component is heavy. Do not attempt to remove it unless its weight is held by a sling. Make sure that the sling is attached to a suitable lifting appliance.

HYD 2-3/1

- 10 Using suitable lifting equipment, lift the ram clear.

Replacement

Replacement is a reversal of the removal sequence.

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

Use suitable lifting appliances to locate the stabiliser ram.

After replacing or fitting the ram, connect the hydraulic pipes, make sure that the ram and leg operate freely and do not foul.

Removal and Replacement

- Stabiliser Ram (Centremount)

Removal

- 1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Lower the stabiliser legs to the ground.
- 2 Lower the backhoe and loader end to the ground and stop the engine.

⚠ DANGER

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

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

Note: If a check valve is fitted on the ram, the system will not vent. Extreme caution must be used when releasing hydraulic connections - release the connections one turn and allow the pressure to dissipate.

- 4 Carefully disconnect hydraulic hoses **A** and **B** from the stabiliser hydraulic ram, label the hoses before removing (as an aid to assembly). Release the connections slowly.

⚠ CAUTION

This component is heavy. Do not attempt to remove it unless its weight is held by a sling. Make sure that the sling is attached to a suitable lifting appliance.

HYD 2-3/1

- 5 Wrap a suitable sling around the stabiliser ram, make sure that the weight of the ram is supported by the sling.
- 6 Remove the ram pivot pin retaining nut and bolt, drive out the ram pivot pin as shown at **C**.
- 7 Remove the stabiliser ram.

Replacement

Replacement is a reversal of the removal sequence.

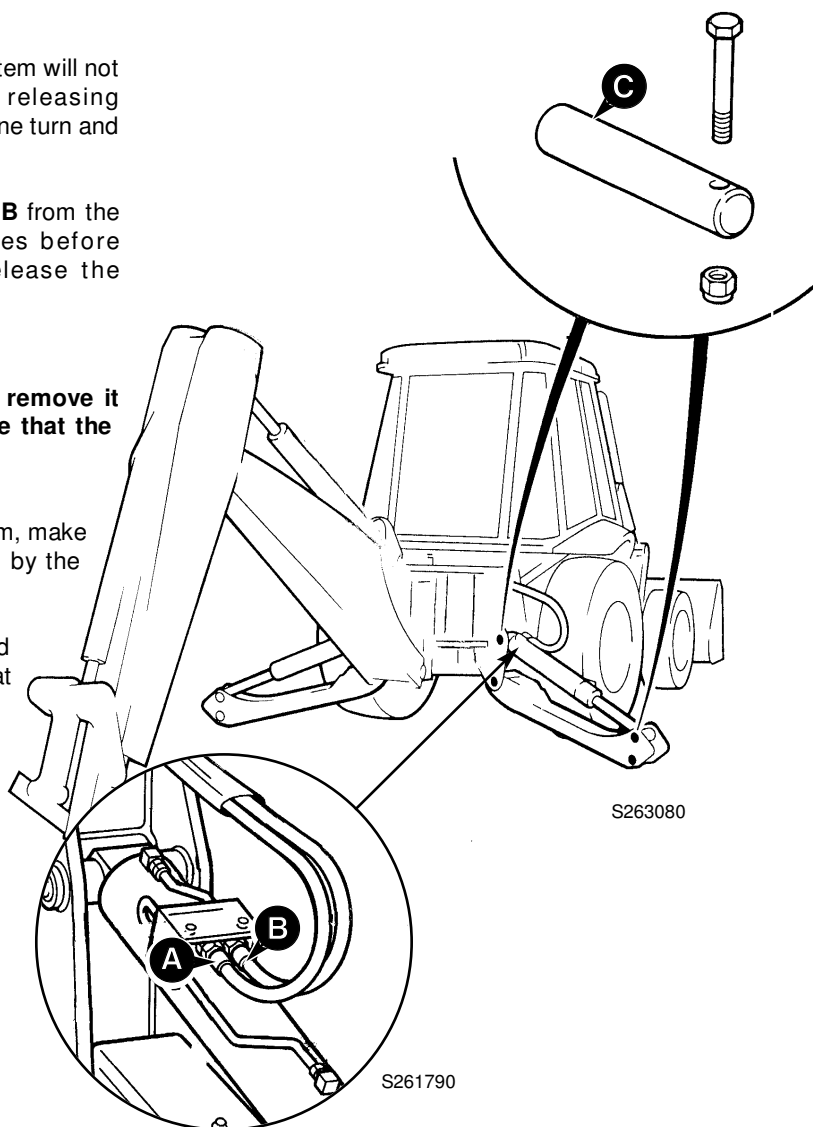
⚠ WARNING

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.

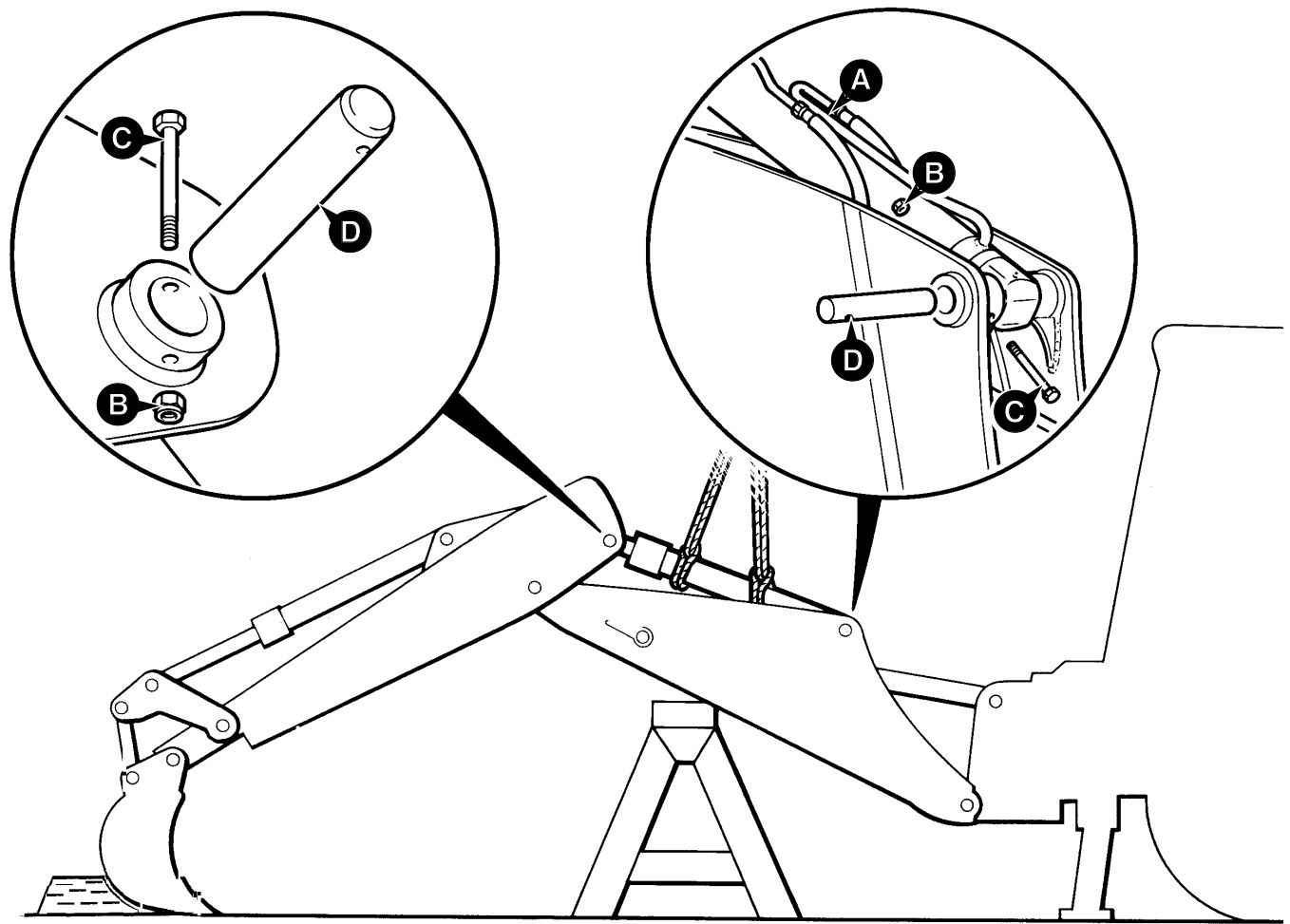
INT-3-1-10/1

Use suitable lifting appliances to locate the stabiliser ram.

After replacing or fitting the ram, connect the hydraulic pipes, make sure that the ram and leg operate freely and do not foul.



Removal and Replacement
- Dipper Ram



S266350

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Removal and Replacement - Dipper Ram

Removal

- 1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Lower the backhoe and loader end to the ground and stop the engine.

DANGER

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

- 2 Vent residual hydraulic pressure from the backhoe hoses by operating the backhoe controls back and forth several times.

Note: If a hose burst protection valve is fitted on the ram, the system will not vent. Extreme caution must be used when releasing hydraulic connections - release the connections one turn and allow the pressure to dissipate.

- 3 Label and then remove the dipper ram hoses **A**. Plug and cap all open orifices to prevent loss of fluid and ingress of dirt.

CAUTION

This component is heavy. Do not attempt to remove it unless its weight is held by a sling. Make sure that the sling is attached to a suitable lifting appliance.

HYD 2-3/1

- 4 Fasten lifting straps to the dipper ram, make sure that the weight of the ram is supported by the sling.
- 5 Remove the pivot pin retaining nut **B** and bolt **C**, remove the pivot pin **D**.
- 6 Remove dipper ram.

Replacement

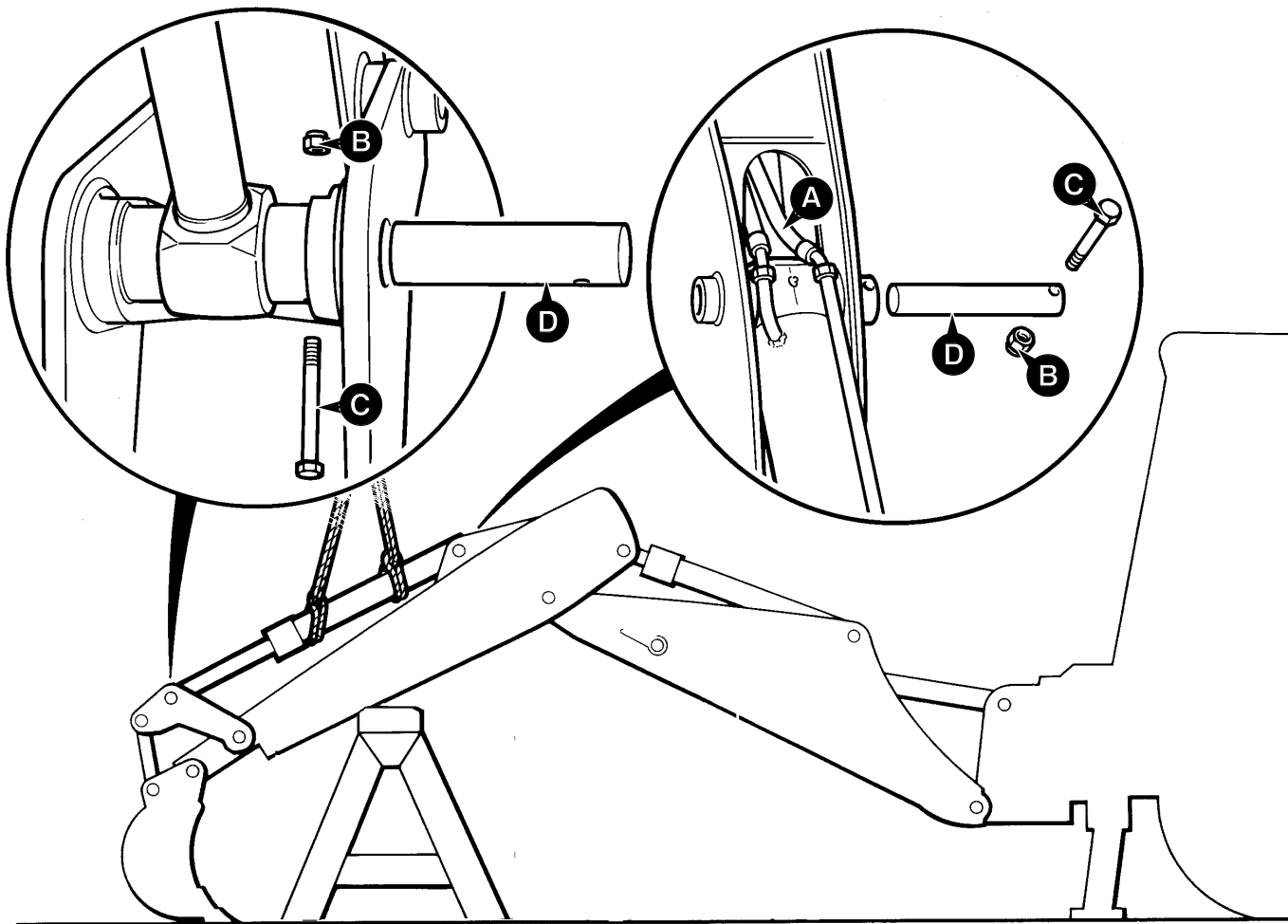
Replacement is a reversal of the removal sequence.

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

Removal and Replacement
- Bucket Crowd Ram



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S266360

Removal and Replacement - Bucket Crowd Ram

Removal

- 1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Lower the backhoe and loader end to the ground and stop the engine.

DANGER

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

- 2 Vent residual hydraulic pressure from the backhoe hoses by operating the backhoe controls back and forth several times.

Note: If a hose burst protection valve is fitted on the ram, the system will not vent. Extreme caution must be used when releasing hydraulic connections - release the connections one turn and allow the pressure to dissipate.

- 3 Label and then remove the bucket crowd ram hoses **A**. Plug and cap all open orifices to prevent loss of fluid and ingress of dirt.

CAUTION

This component is heavy. Do not attempt to remove it unless its weight is held by a sling. Make sure that the sling is attached to a suitable lifting appliance.

HYD 2-3/1

- 4 Fasten lifting straps to the bucket crowd ram, make sure that the weight of the ram is supported by the sling.
- 5 Remove the pivot pin retaining nut **B** and bolt **C**, remove the pivot pin **D**.
- 6 Remove the bucket crowd ram.

Replacement

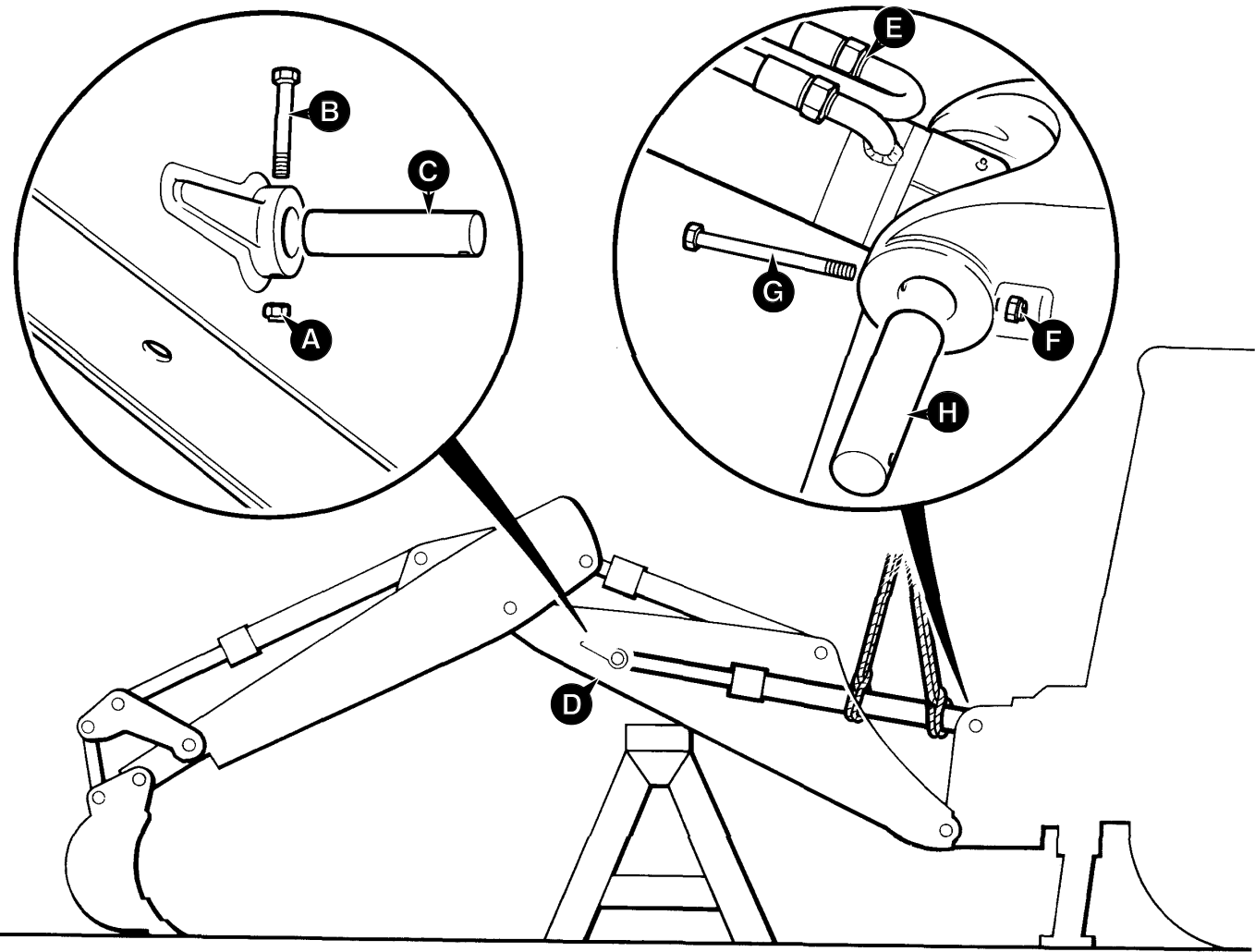
Replacement is a reversal of the removal sequence.

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

Removal and Replacement
- Boom Ram



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S266370

Removal and Replacement - Boom Ram

Removal

- 1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Lower the backhoe and loader end to the ground and stop the engine.
- 2 Remove pivot pin retaining nut **A** and bolt **B**. Remove the pivot pin **C**.
- 3 Remove the grease nipple from the eye end of the ram (through access hole **D**).
- 4 Use the machine hydraulics to SLOWLY retract the ram.
- 5 Remove the hose clamp.

DANGER

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

- 6 Vent residual hydraulic pressure from the backhoe hoses by operating the backhoe controls back and forth several times.

Note: If a hose burst protection valve is fitted on the ram, the system will not vent. Extreme caution must be used when releasing hydraulic connections - release the connections one turn and allow the pressure to dissipate.

- 7 Label and then remove the boom ram hoses **E**. Plug and cap all open orifices to prevent loss of fluid and ingress of dirt.

CAUTION

This component is heavy. Do not attempt to remove it unless its weight is held by a sling. Make sure that the sling is attached to a suitable lifting appliance.

HYD 2-3/1

- 8 Fasten lifting straps to the boom ram, make sure that the weight of the ram is supported by the sling.
- 9 Remove the pivot pin retaining nut **F** and bolt **G** remove the kingpost pivot pin **H**.
- 10 Remove the boom ram.

Replacement

Replacement is a reversal of the removal sequence.

WARNING

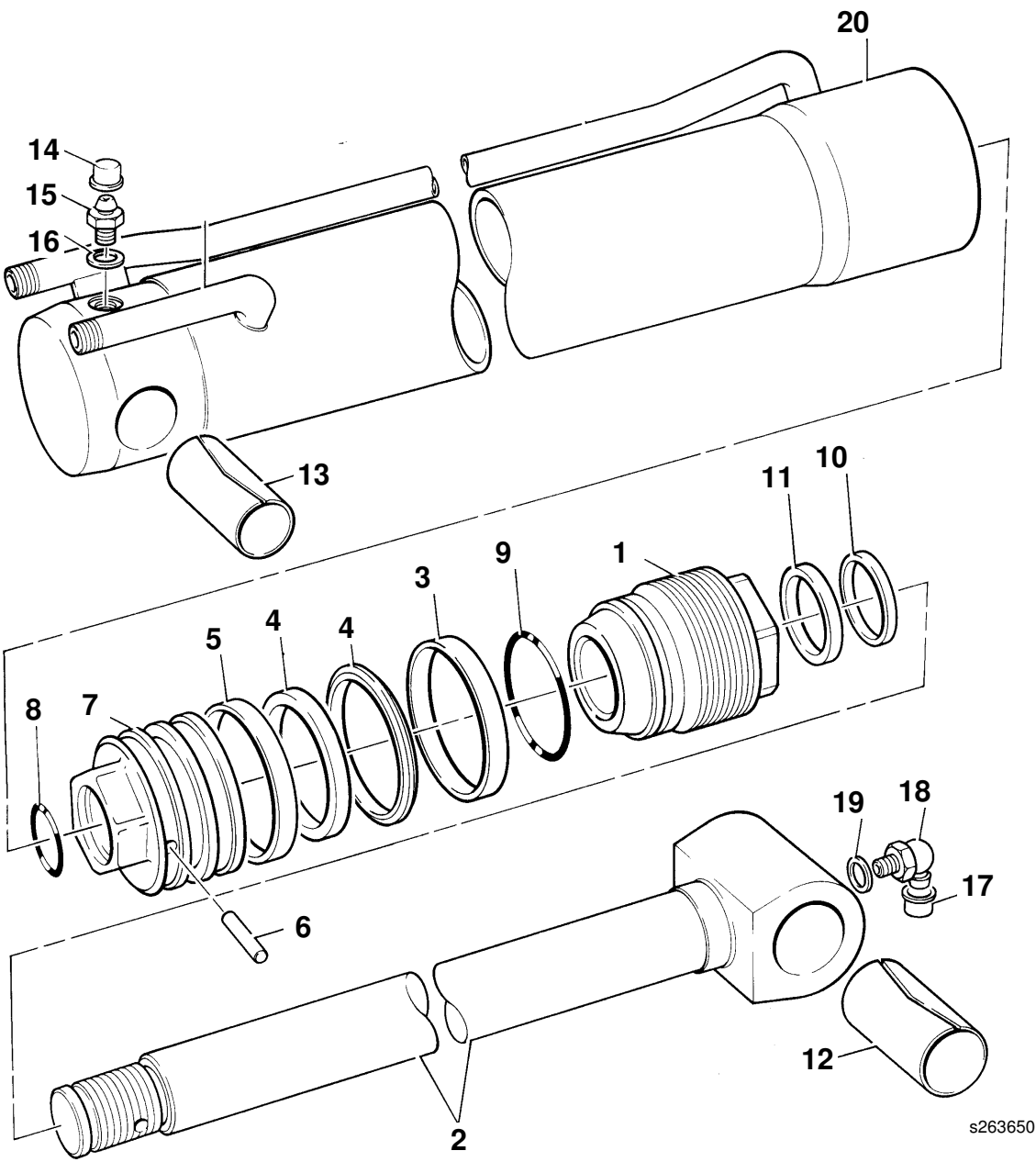
Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of hydraulic fluid. If hydraulic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

INT-3-1-10/1

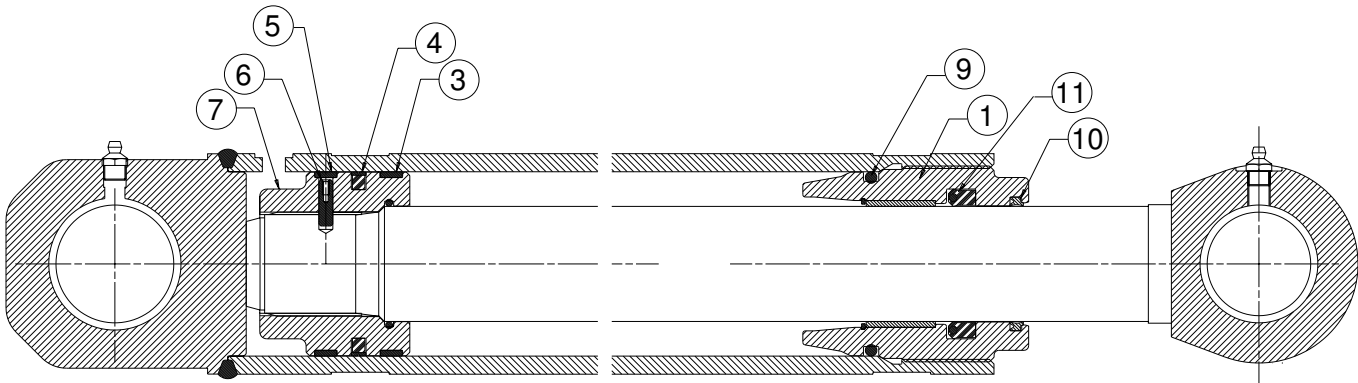
It will be necessary to extend the ram to align and engage the boom pivot pin **C**. As the ram extends, the ram will tend to turn.

For this reason it is recommended that a smaller diameter steel bar is used to locate the boom ram at the kingpost casting. The steel bar can be more readily removed to allow for re-alignment of the boom pivot pin **C**.

When the boom pivot pin has been correctly aligned and fitted, then fit the correct pivot pin **H** at the kingpost.



s263650



TYPICAL RAM ASSEMBLY

Note that on boom and bucket rams, pivot pin grease seals are fitted.

A263680

Dismantling and Assembly

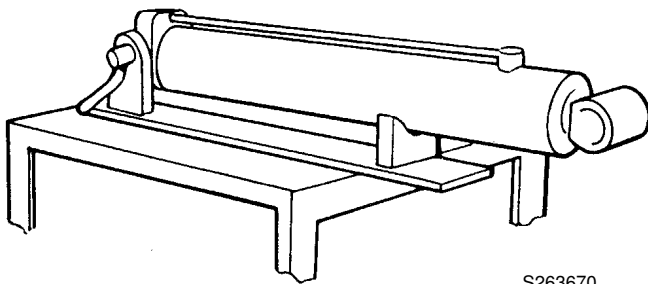
- Loader Lift Ram
- Loader Shovel Ram
- Boom Ram
- Bucket Ram
- Stabiliser Ram

Dismantling

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

For assembly the sequence should be reversed.

Place ram assembly on a locally manufactured strip/rebuild bench as shown.



S263670

Slacken end cap **1** using special spanner (see **Service Tools**), and remove the piston rod assembly **2** 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 piston rod assembly on bench in place of ram cylinder. Remove seal **4** and wear rings **3** and **5** from piston head.

Extract dowel **6** from the piston head using a metric screw (M3, M4, or M6 depending on ram size) threaded into the extractor hole.

Remove piston head from rod using special spanner (see **Service Tools**).

Remove gland bearing and end cap **1** from piston rod and remove the 'O' ring **9**, wiper seal **10** and rod seal **11**. Check the end cap bearing for damage, scores or nicks. If damaged, the bearing must be replaced as part of the end cap assembly.

Ensure that metal components are free from scoring, nicks and burrs. A damaged rod will impair the life of the seals.

Check the bore of the ram cylinder for damage.

Assembly

Clean threads of 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 sealant. Allow 15 minutes for solvent to dry before applying JCB Threadlocker and Sealer (High Strength).

Ensure that lubricants used during assembly do not come into contact with the JCB Threadlocker and Sealer (High Strength).

Refer to **JCB Ram Sealing Procedure** for the correct method of fitting seals to the end cap and piston head.

Apply JCB Activator to threads of end cap and cylinder. Allow Activator to dry for 15 minutes before bringing into contact with the JCB Threadlocker and Sealer (High Strength).

Note: Neither the JCB Threadlocker and Sealer (High Strength) nor Activator must be allowed to contact seals, bearing rings, or 'O' rings.

Fit locking dowel **6** to piston head/rod as follows:

- 1** Fit 'O' ring **8** into piston head **7**.
- 2** Fit piston head to piston rod and torque tighten to 405 Nm (300 lbf ft).
- 3** New ram Shaft and piston head fitted.
 - If both are required, the following procedure should be followed:
 - a** Drill through piston head into piston rod. Use an undersized diameter drill first as a guide and then drill with the correct size diameter drill to suit; refer to the table for drill diameters and depths.
 - b** Remove all swarf and contamination. Insert dowel **6** into drilled hole, make sure tapped extractor hole is to outside.
- 4** New piston head fitted on a **pre-drilled piston rod**.
 - Re-drill and dowel **BOTH** the piston head and piston rod at 90° from the existing drilled dowel hole in the piston rod. Follow the procedures described in step 3.
- 5** 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 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.

.....continued

Dismantling and Assembly:

- Loader Lift Ram
- Loader Shovel Ram
- Boom Ram
- Bucket Ram
- Stabiliser Ram

Assembly (continued)

- b** Use an undersized diameter drill as a guide and drill into the piston rod to the required depth (see table), make sure the drill has centred correctly on the 'centre mark' made at step 5a.
- 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.

Position cylinder on bench and install rod assembly into cylinder.

Apply JCB Threadlocker and Sealer (High Strength) to first three threads of cylinder, torque tighten the end cap to 678 Nm (500 lbf ft).

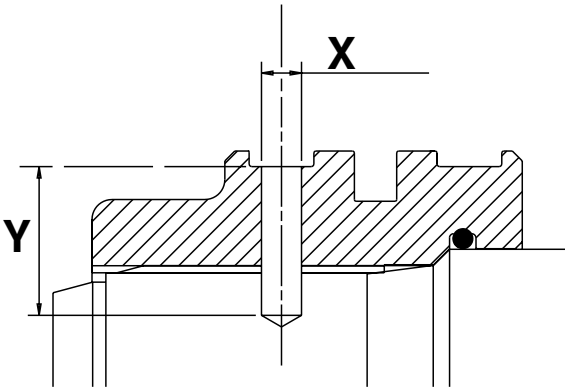
Note: If hydraulic oil contacts the uncured JCB Threadlocker and Sealer (High Strength) a weakening of the bond will result. Cure times vary according to the ambient temperature. Allow a minimum of 2 hours between assembly and filling the ram with oil.

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.

Torque Settings

Item	Nm	kgf m	lbf ft
7	405	41.3	300
1	678	69.2	500

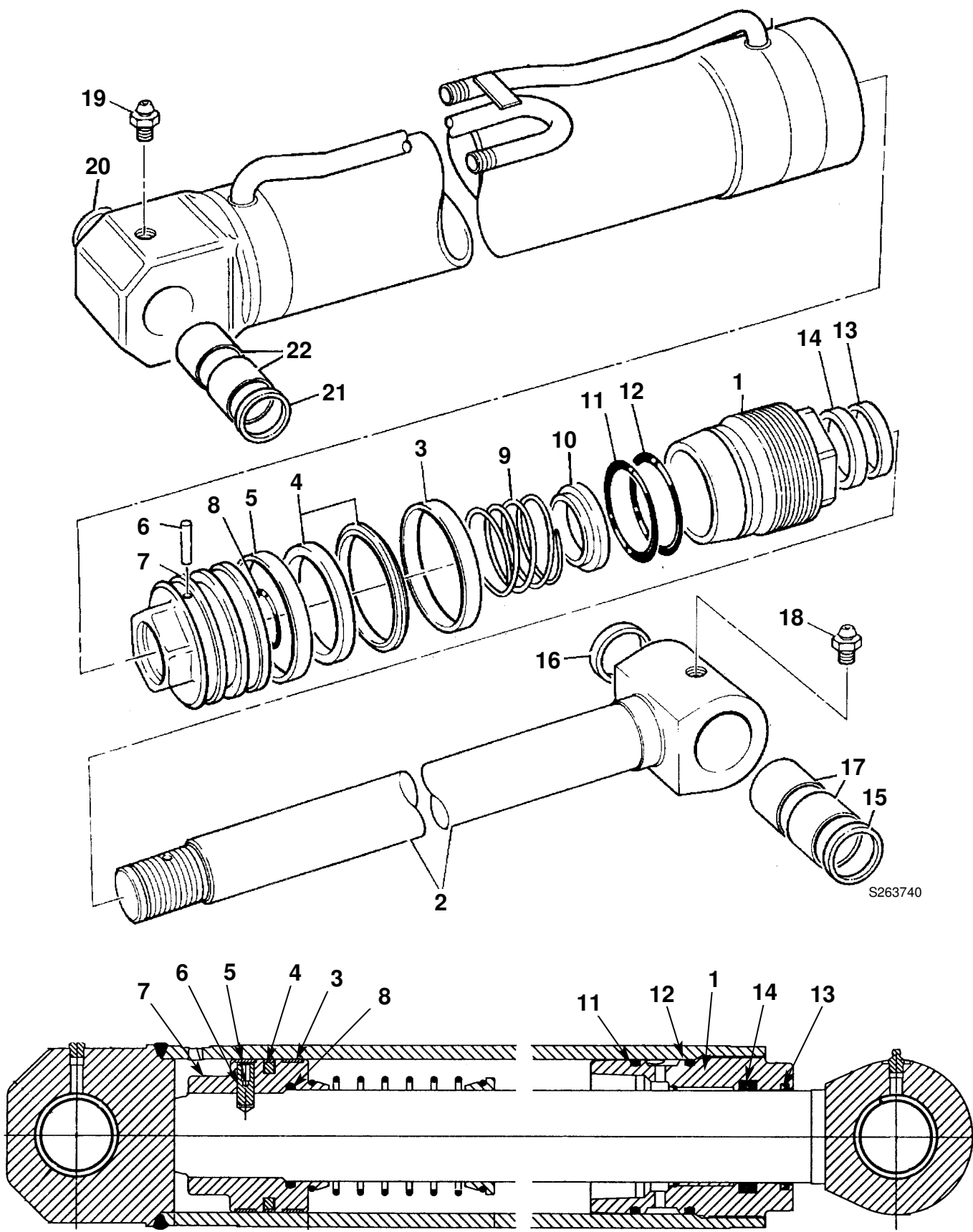
DRILLING DETAILS FOR PISTON HEAD RETENTION



A263750

(all dimensions in mm)

Ram Size	Dowel Size	Guide Drill Ø	Guide Drill Depth	Dowel Drill Ø X	Dowel Drill Depth Y
80 x 50 70 x 40	6Ø x 20	4	21	6.02/6.10	22/23
90 x 50 100 x 60	8Ø x 25	5	24	8.02/8.10	27/28
110 x 60 110 x 65	12Ø x 30	8	28	12.02/12.10	32/33
120 x 65 130 x 75	12Ø x 35	8	33	12.02/12.10	37/38



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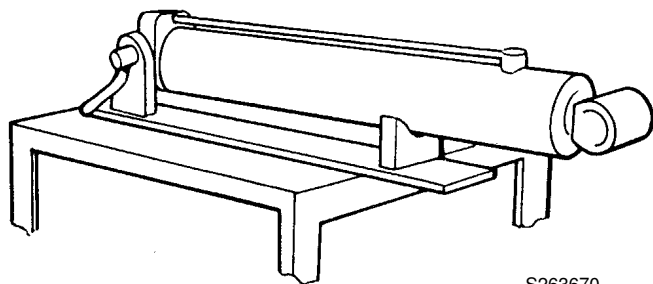
Dismantling and Assembly - Dipper Ram

Dismantling

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

For assembly the sequence should be reversed.

Place ram assembly on a locally manufactured strip/rebuild bench as shown.



S263670

Slacken end cap **1** using special spanner (see **Service Tools**), and remove the piston rod assembly **2** 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 piston rod assembly on bench in place of ram cylinder. Remove seal **4** and wear rings **3** and **5** from piston head.

Extract dowel **6** from the piston head using a metric screw (M3, M4, or M6 depending on ram size) threaded into the extractor hole.

Remove piston head from rod using special spanner (see **Service Tools**).

Remove gland bearing and end cap **1** from piston rod and remove the 'O' rings **11** and **12**, wiper seal **13** and rod seal **14**. Check the end cap bearing for damage, scores or nicks. If damaged, the bearing must be replaced as part of the end cap assembly.

Ensure that metal components are free from scoring, nicks and burrs. A damaged rod will impair the life of the seals.

Check the bore of the ram cylinder for damage.

Assembly

Clean threads of 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 sealant. Allow 15 minutes for solvent to dry before applying JCB Threadlocker and Sealer (High Strength).

Ensure that lubricants used during assembly do not come into contact with the JCB Threadlocker and Sealer (High Strength).

Refer to **JCB Ram Sealing Procedure** for the correct method of fitting seals to the end cap and piston head.

Apply JCB Activator to threads of end cap and cylinder. Allow Activator to dry for 15 minutes before bringing into contact with the JCB Threadlocker and Sealer (High Strength).

Note: Neither the JCB Threadlocker and Sealer (High Strength) nor Activator must be allowed to contact seals, bearing rings, or 'O' rings.

Ensure that end damping spring **9** is engaged with collar **10** and piston head **7**.

Fit locking dowel **6** to piston head/rod as follows:

- 1** Fit 'O' ring **8** into piston head **7**.
- 2** Fit piston head to piston rod and torque tighten to 405 Nm (300 lbf ft).
- 3** New ram Shaft and piston head fitted.
 - If both are required, the following procedure should be followed:
 - a** Drill through piston head into piston rod. Use an undersized diameter drill first as a guide and then drill with the correct size diameter drill to suit; refer to the table for drill diameters and depths.
 - b** Remove all swarf and contamination. Insert dowel **6** into drilled hole, make sure tapped extractor hole is to outside.
- 4** New piston head fitted on a **pre-drilled piston rod**.
 - Re-drill and dowel **BOTH** the piston head and piston rod at 90° from the existing drilled dowel hole in the piston rod. Follow the procedures described in step 3.
- 5** 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.

.....continued

Dismantling and Assembly:
- Dipper Ram

Assembly (continued)

- a Use a drill 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), make sure the drill has centred correctly on the 'centre mark' made at step 5a.
- 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.

Position cylinder on bench and install rod assembly into cylinder.

Apply JCB Threadlocker and Sealer (High Strength) to first three threads of cylinder, torque tighten the end cap to 678 Nm (500 lbf ft).

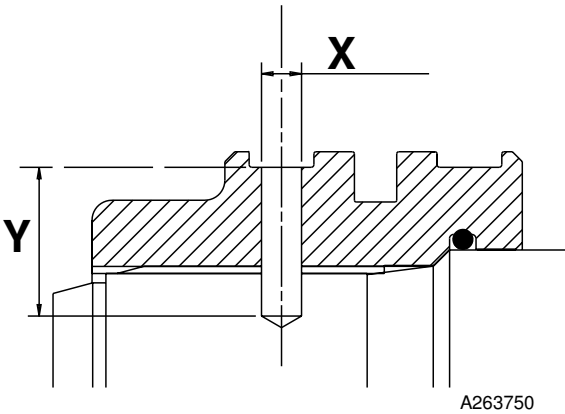
Note: If hydraulic oil contacts the uncured JCB Threadlocker and Sealer (High Strength) a weakening of the bond will result. Cure times vary according to the ambient temperature. Allow a minimum of 2 hours between assembly and filling the ram with oil.

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.

Torque Settings

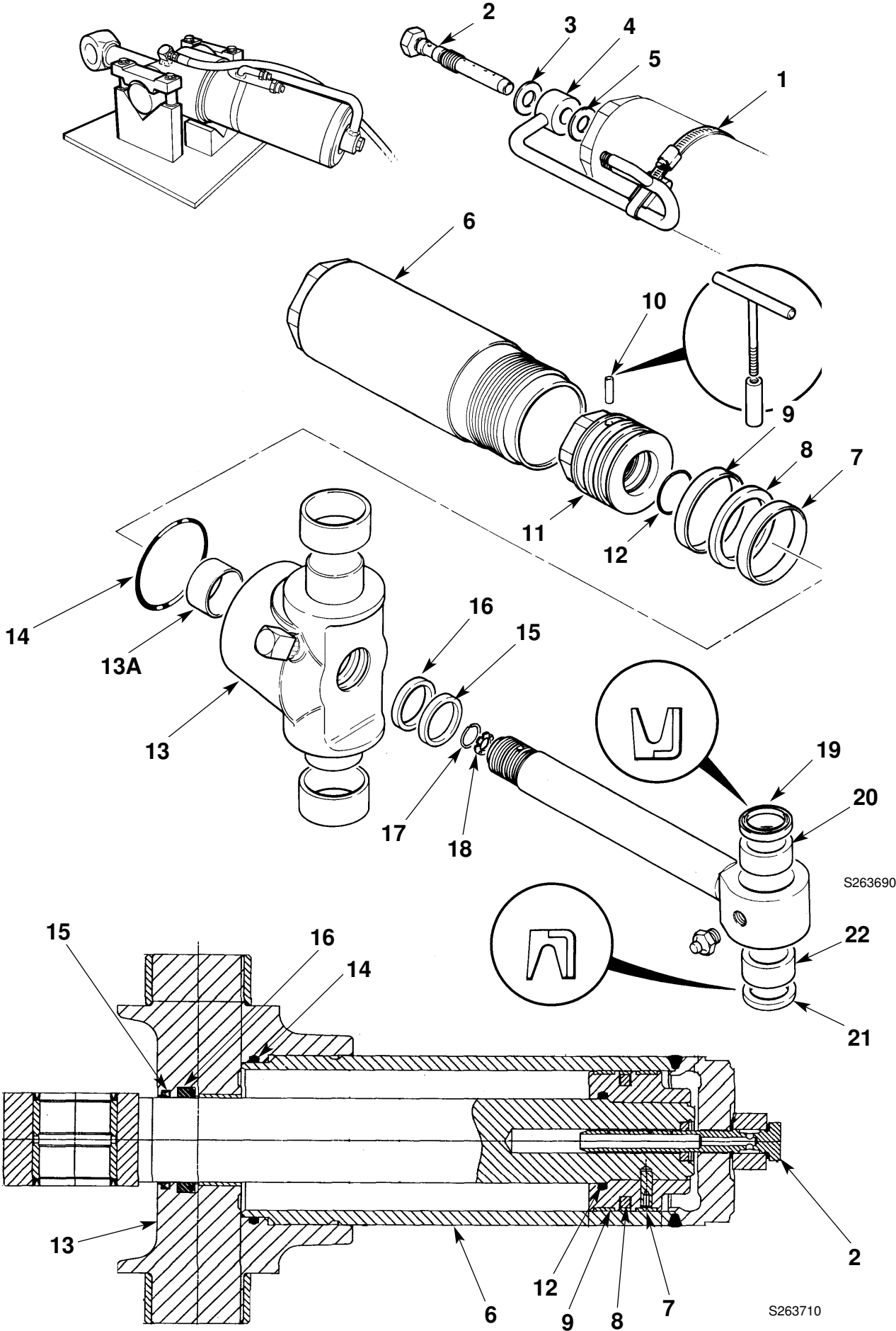
Item	Nm	kgf m	lbf ft
7	405	41.3	300
1	678	69.2	500

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
80 x 50 70 x 40	6Ø x 20	4	21	6.02/6.10	22/23
90 x 50 100 x 60	8Ø x 25	5	24	8.02/8.10	27/28
110 x 60 110 x 65	12Ø x 30	8	28	12.02/12.10	32/33
120 x 65 130 x 75	12Ø x 35	8	33	12.02/12.10	37/38



Dismantling and Assembly

- Slew Ram

Dismantling

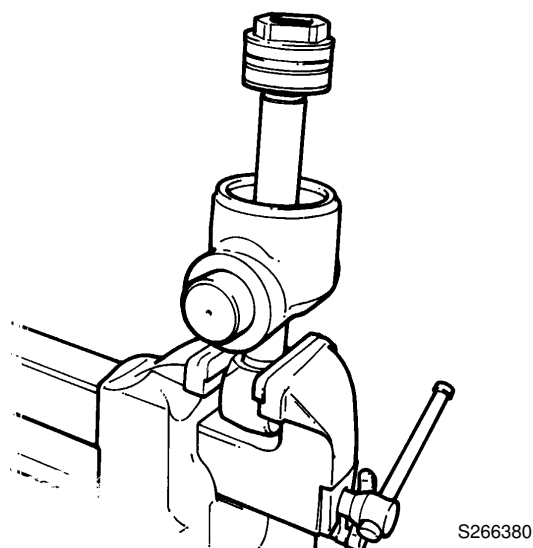
The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

Place ram assembly on a locally manufactured strip/rebuild bench as shown, or alternatively, hold the ram in a suitable vice taking care not to damage machined faces.

Remove cylinder **6** using special spanner (see **Service Tools**). Tap the cylinder off the piston head assembly using a suitable drift (e.g. nylon).

Position the piston rod assembly in a vice, use soft jaws and stand the assembly vertical whilst clamping on the eye end.



Remove seal **8** and wear rings **7** and **9** from piston head. Extract dowel **10** from the piston head using a metric screw threaded into the extractor hole.

Remove piston head from rod using special spanner (see **Service Tools**).

Remove 'O' ring **12**.

Lift the end cap assembly **13** off the piston rod. Remove 'O' ring **14**, rod wiper seal **15** and rod seal **16** from the end cap assembly. Check the end cap bearing **13A** for damage, scores or nicks.

Item **18** is the metering orifice plate and item **17** its retaining wire, do not remove these items unless problems with the metering are suspected.

Ensure that metal components are free from scoring, nicks and burrs. A damaged rod will impair the life of the seals.

Check the bore of the ram cylinder for damage.

Assembly

Clean threads of 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 sealant. Allow 15 minutes for solvent to dry before applying JCB Threadlocker and Sealer (High Strength).

Ensure that lubricants used during assembly do not come into contact with the JCB Threadlocker and Sealer (High Strength).

Refer to **JCB Ram Sealing Procedure** for the correct method of fitting seals to the end cap and piston head.

Apply JCB Activator to threads of end cap and cylinder. Allow Activator to dry for 15 minutes before bringing into contact with the JCB Threadlocker and Sealer (High Strength).

Note: Neither the JCB Threadlocker and Sealer (High Strength) nor Activator must be allowed to contact seals, bearing rings, or 'O' rings.

Fit locking dowel **10** to piston head/rod as follows:

- 1 Fit 'O' ring **12** into piston head **11**.
- 2 Fit piston head to piston rod and torque tighten to 405 Nm (300 lbf ft).
- 3 New ram Shaft and piston head fitted.
 - If both are required, the following procedure should be followed:
 - a Drill through piston head into piston rod. Use an undersized diameter drill first as a guide and then drill with the correct size diameter drill to suit; refer to the table for drill diameters and depths.
 - b Remove all swarf and contamination. Insert dowel **10** into drilled hole, make sure tapped extractor hole is to outside.
- 4 New piston head fitted on a **pre-drilled piston rod**.
 - Re-drill and dowel **BOTH** the piston head and piston rod at 90° from the existing drilled dowel hole in the piston rod. Follow the procedures described in step 3.
- 5 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 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.

.....continued

Dismantling and Assembly
- Slew Ram

Assembling (continued)

- b Use an undersized diameter drill as a guide and drill into the piston rod to the required depth (see table), make sure the drill has centred correctly on the 'centre mark' made at step 5a.
- 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.

Install cylinder onto the rod assembly, make sure that the cylinder is fitted square to the rod assembly. Firmly push the cylinder over the piston head seals.

Apply JCB Threadlocker and Sealer (High Strength) to first three threads of cylinder, torque tighten the cylinder to 678 Nm (500 lbf ft).

Note: If hydraulic oil contacts the uncured JCB Threadlocker and Sealer (High Strength) a weakening of the bond will result. Cure times vary according to the ambient temperature. Allow a minimum of 2 hours between assembly and filling the ram with oil.

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.

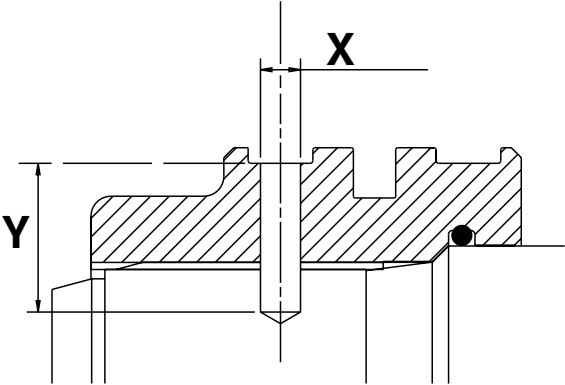
Position pipe assembly in correct position and torque tighten probe assembly **2** to 75Nm (55 lbf ft; 7.6 kgf m). DO NOT over-tighten the probe.

Make sure seals **19** and **21** are fitted the correct way as shown.

Torque Settings

Item	Nm	kgf m	lbf ft
11	405	41.3	300
6	678	69.2	500

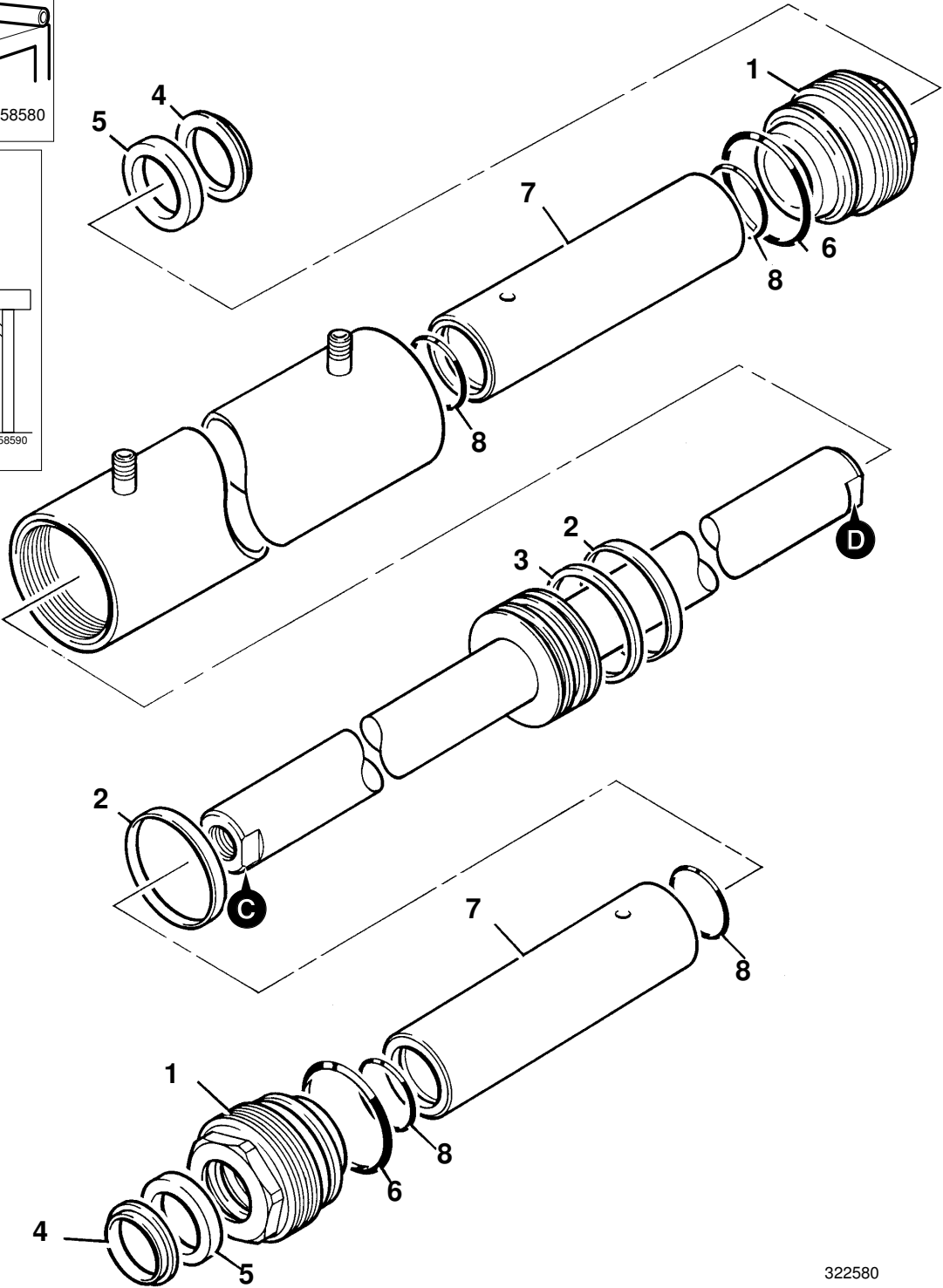
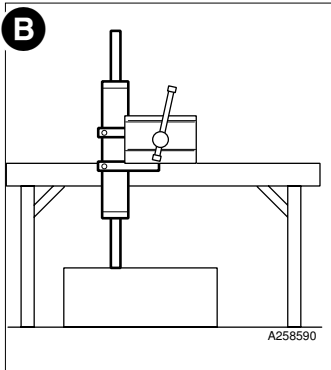
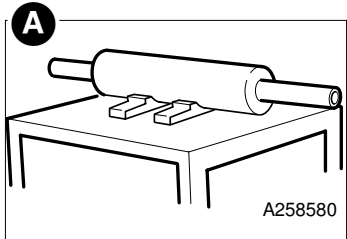
DRILLING DETAILS FOR PISTON HEAD RETENTION



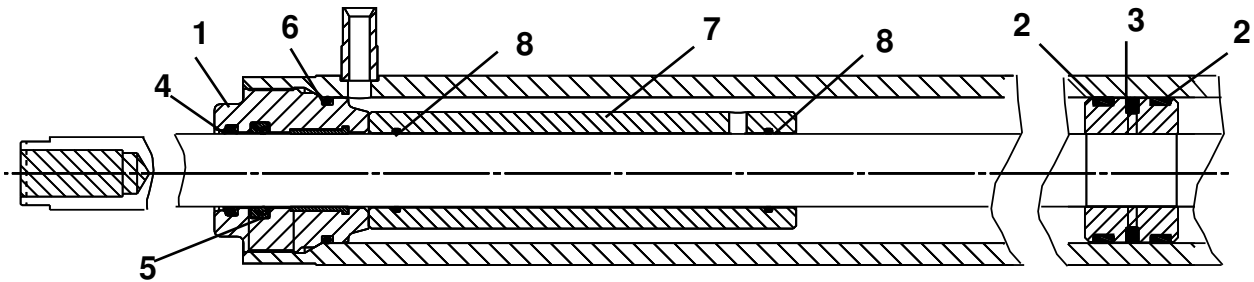
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(all dimensions in mm)

Ram Size	Dowel Size	Guide Drill Ø	Guide Drill Depth	Dowel Drill Ø X	Dowel Drill Depth Y
80 x 50 70 x 40	6Ø x 20	4	21	6.02/6.10	22/23
90 x 50 100 x 60	8Ø x 25	5	24	8.02/8.10	27/28
110 x 60 110 x 65	12Ø x 30	8	28	12.02/12.10	32/33
120 x 65 130 x 75	12Ø x 35	8	33	12.02/12.10	37/38



322580



A326710

Dismantling and Assembly - Power Sideshift Ram

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

For assembly the sequence should be reversed.

Dismantling

- 1 Fix the ram assembly on a locally manufactured strip/rebuild bench as shown at **A**.
- 2 Remove both end caps **1**, (46mm AF). Pull the piston rod assembly from the cylinder.

Note 1: DO NOT allow the piston rod to come into contact with the cylinder bore. The cylinder bore may be damaged by careless dismantling.

- 3 Position the piston rod assembly on a bench in place of the ram cylinder. Remove the wear rings **2** and seal **3** from the piston head.

Note 2: The piston head cannot be removed from the rod. If there is damage to the rod or piston head, replace the complete assembly.

- 4 Carefully inspect the bore of the cylinder and the piston rod outer diameter for scoring, nicks and burrs. If such damage is visible the components must be renewed.

Note 3: If burrs are evident on the ends of the piston rod at positions **C** or **D** remove by careful filing.

- 5 Remove the end cap seal **4**, wiper seal **5** and 'O' ring **6**, both end caps are the same
- 6 Remove spacers **7** and 'O' rings **8**.

Assembly

- 1 Clean the threads of the end caps and cylinder using a wire brush.
- 2 Use JCB Cleaner/Degreaser to ensure that all threads are free from grease, hydraulic oil and sealant. Allow 15 minutes for solvent to dry before applying JCB Threadlocker and Sealer (High Strength).

Ensure that lubricants used during assembly do not come into contact with the JCB Threadlocker and Sealer (High Strength).

- 3 Refer to **JCB Ram Sealing Procedure** for the correct method of fitting seals to the end cap and piston head.
- 4 Clamp the cylinder vertically and lower the piston rod assembly in from the top, as shown at **B**. Take care not to allow the piston rod to come into contact with the cylinder bore. Be sure to engage the piston head new wear rings and seal carefully into the cylinder. If the piston head wear rings or seal are damaged during this stage, they must be renewed.

- 5 Fit new 'O' rings **8** to spacers **7**, slide onto the piston head and rod assembly.

- 6 Apply JCB Activator to threads of the end caps and cylinder. Allow Activator to dry for 15 minutes before bringing into contact with the JCB Threadlocker and Sealer (High Strength).

Note 4: Neither the JCB Threadlocker and Sealer (High Strength) nor Activator must be allowed to contact seals, bearing rings or 'O' rings.

- 7 Apply JCB Threadlocker and Sealer (High Strength) to threads of the ends caps, fit new 'O' rings **6**.
- 8 Ensure that there are no burrs at the ends of the piston rod, see **Dismantling - Note 3:**
- 9 Fit an end cap over the piston rod. Apply light hand pressure to the cap to engage the gland seal on the piston rod. DO NOT use excessive force. Screw on the first end cap and then fix the assembly on the strip/rebuild bench as shown at **A**. Fit the remaining cap and then torque tighten both caps.

Note 5: If hydraulic oil contacts the uncured JCB Threadlocker and Sealer (High Strength) a weakening of the bond will result. Cure times vary according to the ambient temperature. Allow a minimum of 2 hours between assembly and filling the ram with oil.

Torque Settings

Item	Nm	kgf m	lbf ft
1	400	40.8	295

JCB Ram Sealing Procedure

To fit new rod seal:

Use seal fitting tool (892/00334) to fit rod seals, 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).

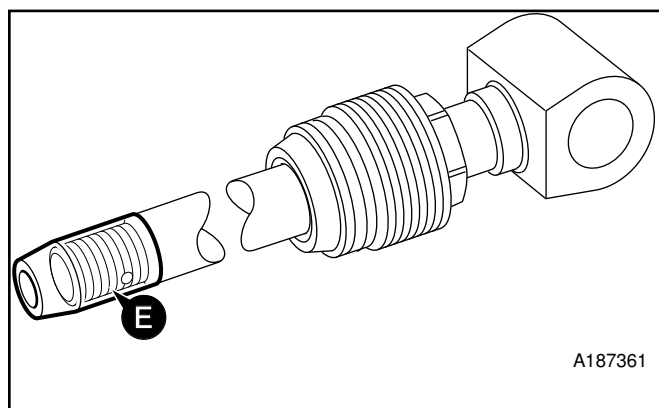
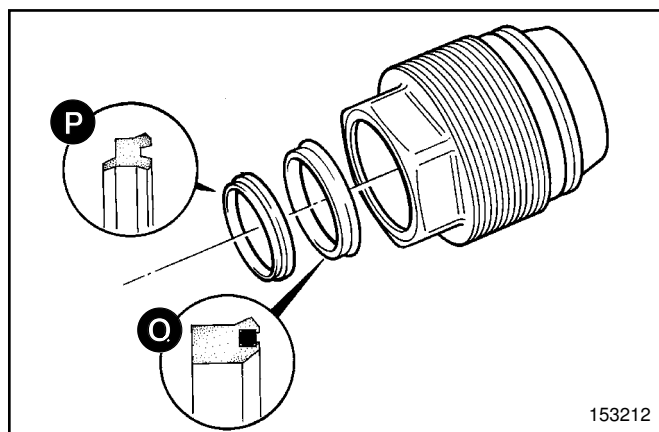
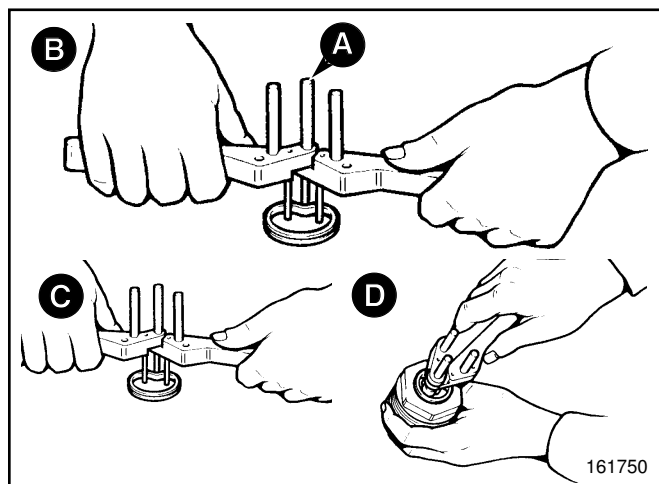
- 3 Before fitting the rod seals check the seal grooves are free of contamination and sharp edges,

- 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 **P** into seal groove. Make sure the seal is correctly installed as shown.

Note: Some rod wipers, ie power track rod, may use a metal encased seal which is pressed into the housing. Care must be taken to ensure the seal is square before it is pressed in.

Sleeve **E** must be used to protect the rod seals from damage when fitting end cap onto the piston rod. There are various sizes of sleeve, see **Service Tools**. Make sure the hexagon on the end cap is towards the eye end of the rod.



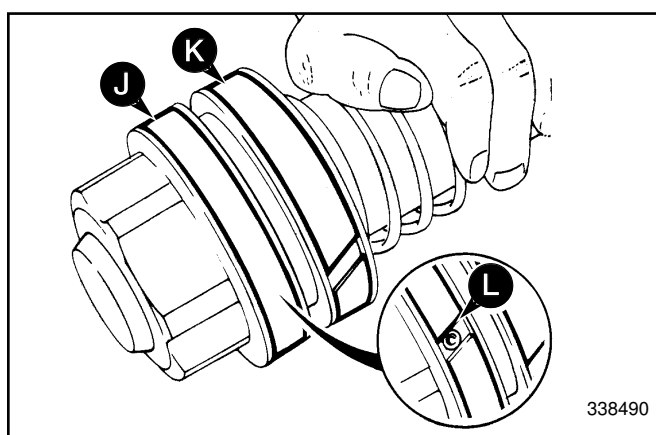
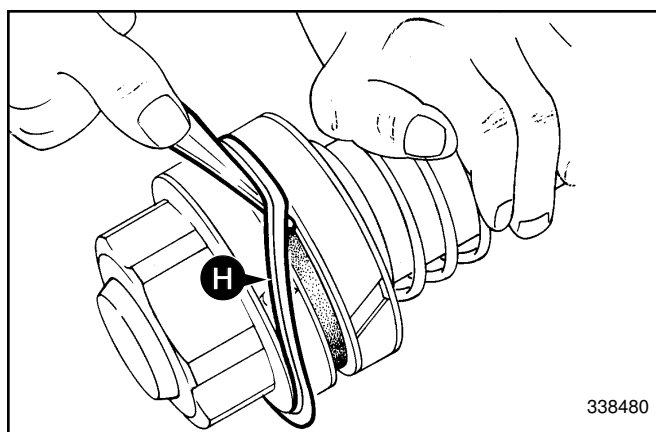
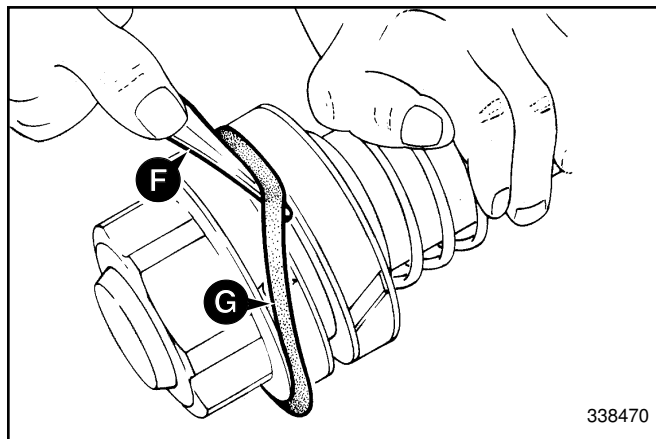
JCB Ram Sealing Procedure (continued)

Fit new piston head seals:

- 6 Use a blunt instrument (892/01027) 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
- 7 Fit outer seal **H** using the same procedure as step 6. Check the external grooves are visible.
- 8 Ensure O ring is fitted into the internal seal groove on the piston head. Screw the piston head onto the thread of the piston rod, refer to the relevant section for torque figure and completion of ram assembly.
- 9 Fit the piston head retaining dowel, see ram dismantling and assembling relevant section
- 10 Fit wear rings **J** and **K**. Rotate the wear rings so that the piston retention dowel is covered by the wear ring, NOT as shown at **L**.

Fit the piston rod and head assembly into the cylinder:

- 11 Insert the piston/rod assembly into the cylinder. Align the rod and head assembly until parallel with the cylinder then push the assembly into the cylinder.
- 12 Fit the end cap, refer to the relevant section for torque figure and completion of ram assembly.



Removal and Replacement

⚠ WARNING

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

GEN 3-2

⚠ DANGER

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses, stop the engine and operate the controls to release pressure trapped in the hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11/1

Removal

- 1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Lower the backhoe and loader end to the ground and stop the engine.
- 2 Vent residual hydraulic pressure by operating the controls back and forth several times.
- 3 Label and then remove hydraulic hoses **A** and **B** (see note). Plug and cap all open ports to prevent loss of fluid and ingress of dirt.

Note: When installing and removing hoses from the cooler, it is essential to note that adaptor **C** must be held with a spanner whilst installing or removing the hose. It may be easier to remove the top hose connection once the cooler has been removed from the machine (disconnect top hose at connection **D**).

- 4 Loosen and remove cooler mounting bolts **E** (4 off) and remove the cooler **F**.

Replacement

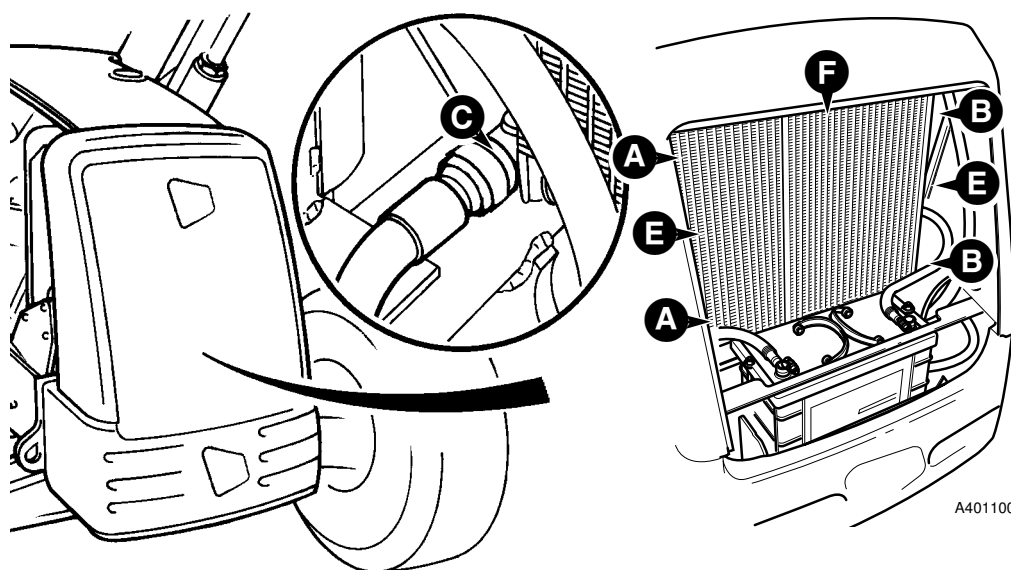
Replacement is a reversal of the removal sequence.

⚠ 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

When installing and removing hoses from the cooler, it is essential to note that adaptor **C** must be held with a spanner whilst installing or removing the hose. Tighten hose connections to a torque of 58 Nm (42 lbf ft).



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A401100

Accumulator

Removal and Replacement

Removal

- 1 Park the machine on level ground, lower the loader arms, switch off the engine and chock all four wheels. Release all hydraulic pressure in the accumulator by selecting the SRS ON and operating the loader arm hydraulic lever.

⚠ DANGER

Before disconnecting or dismantling the accumulator discharge all gas pressure. Failure to comply can cause rapid discharge of gas and/or hydraulic fluid which can result in death, personal injury and damage to the machine.

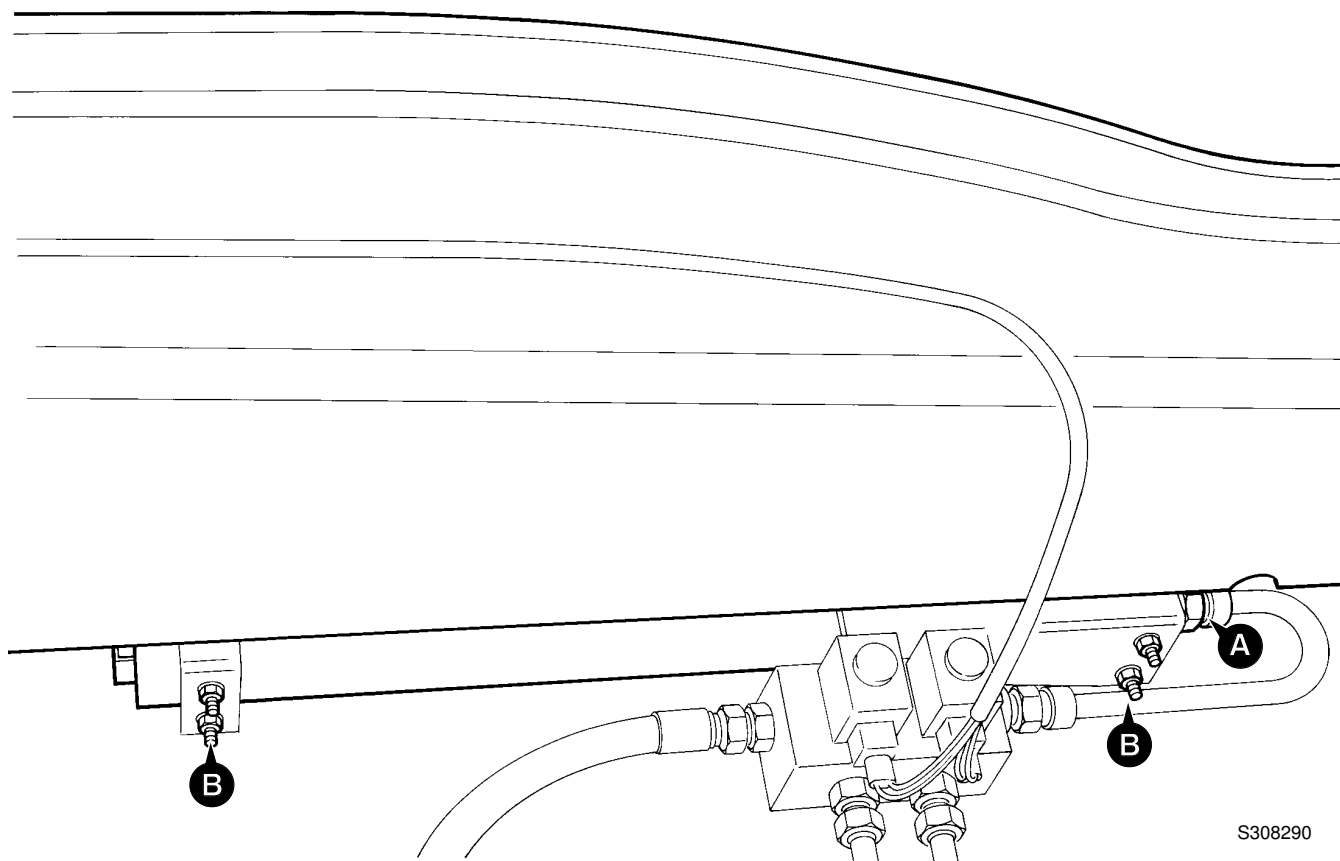
Hyd 2-5

- 2 Discharge the accumulator, refer to **Service Procedures, Smooth Ride System - Charging/Discharging the Accumulator**.
- 3 Disconnect hydraulic hose **A** and plug.
- 4 Loosen both 'U' clamps **B** and slide the accumulator towards the front of the machine. When clear of the 'U' clamps carefully lower and withdraw accumulator.

Replacement

Replacement is a reverse of removal.

- 1 Charge the accumulator, refer to **Service Procedures, Smooth Ride System - Charging/Discharging the Accumulator**.
- 2 Operate the machines hydraulic system. Check for correct operation and leaks.
- 3 Replenish the hydraulic system with the recommended hydraulic fluid as required, refer to Section 3 **Fluids, Lubricants, Capacities and Specifications**.



S308290

Accumulator

Dismantling and Assembly

Dismantling

DANGER

Before disconnecting or dismantling the accumulator discharge all gas pressure. Failure to comply can cause rapid discharge of gas and/or hydraulic fluid which can result in death, personal injury and damage to the machine.

HYD 2-5

- 1 Check that the accumulator has been discharged, refer to **Service Procedures, Smooth Ride System - Charging/Discharging the Accumulator**.
- 2 Secure the accumulator in horizontal position.

CAUTION

The gas end cap (cap with gas valve) must be removed before the hydraulic end cap. This allows any residual pressure to escape through the safety vent holes. If the hydraulic end cap is removed first the piston will cover the safety vent holes, which could result in the piston being forced out under pressure which may result in personal injury.

HYD 2-6

- 3 Fit three pins into the holes in gas end cap **4**, using a long bar working against the pins unscrew the end cap.
- 4 Fit three pins into the holes in hydraulic end cap **5**, using a long bar working against the pins unscrew the end cap.
- 5 Remove and discard 'O' rings and back up rings from end caps.
- 6 Remove the piston **6** by pushing from the hydraulic end with a bar.

CAUTION

Do not remove the piston by applying compressed air at the opposite end.

HYD 2-7

- 7 Remove piston seal and 'O' rings.

Inspection

Inspect piston for cracks, burrs around the 'O' ring grooves, or damage. Examine the body bore **1**, using a light, for scratches or scoring. Inspect end caps for damaged threads or burrs on 'O' ring grooves.

Minor nicks, scratches or light scoring of the body bore may be removed by using a very fine paper. Dress the bore until all apparent imperfections have been removed.

All seals and 'O' rings must be discarded and new ones fitted.

Assembly

- 1 Coat all internal components with clean hydraulic oil.
- 2 Fit piston seal **9**, teflon back up rings **10** and seals **11**.
- 3 Fit piston assembly into bore **1** with hollow side towards the gas end. Do not let piston seal drag on threads, the piston must go into the bore exactly square and very slowly. The piston is a tight fit, use a hammer and a block of wood to tap the piston until all of the piston is 2in. (50mm) below the beginning of honed bore.

Note: Keep pressure on the piston while tapping through the bore chamfer, otherwise the piston will bounce back, damaging the piston ring.

- 4 Fit end cap back up seal **7**. Make sure the seal is fitted with leading edge **A** pointing in a counter clockwise direction otherwise the seal will bind when the end cap is fitted.
- 5 Fit end cap 'O' rings **8**, it is important that seals **7** and **8** are fitted in the correct position in relation to each other to prevent leaks.
- 6 Fit end caps **4** and **5**, use pins and a long bar. Make sure the gas end cap is fitted to the correct end, piston hollow end to gas side.

Note: The end caps will stop against the chamfer leading into the honed bore, 'O' ring sealing is not dependent upon cap tightness.

- 7 Use new 'O' ring **13** and fit the gas valve **12**.