CONTENTS

HOISTING INSTRUCTIONS

⚠ Heavy parts (25 kg or more) must be lifted with a hoist etc. In the Disassembly and Assembly section, every part weighing 25 kg or more is clearly indicated with the symbol

1. If a part cannot be smoothly removed from the machine by hoisting, the following checks should be made:
   - Check for removal of all bolts fastening the part to the relative parts.
   - Check for any part causing interference with the part to be removed.

2. Wire ropes

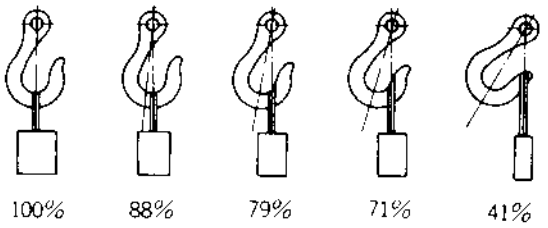
1) Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

WIRE ROPES (Standard «S» or «Z» twist ropes without galvanizing)	
Rope diameter (mm)	Allowable load (tons)
10.0	1.0
11.2	1.4
12.5	1.6
14.0	2.2
16.0	2.8
18.0	3.6
20.0	4.4
22.4	5.6
30.0	10.0
40.0	18.0
50.0	28.0
60.0	40.0

The allowable load value is estimated to be one-sixth or one-seventh of the breaking strength of the rope used.

2) Sling wire ropes from the middle portion of the hook. Slinging near the edge of the hook may cause the rope to slip off the hook during hoisting, and a serious accident can result.

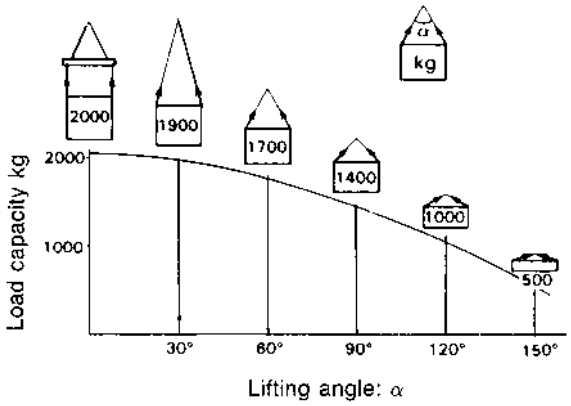
Hooks have maximum strength at the middle portion.



3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound on to the load.

⚠ Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can cause dangerous accidents.

4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook.
When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles.
The table below shows the variation of allowable load (kg) when hoisting is made with two ropes, each of which is allowed to sling up to 1000 kg vertically, at various handing angles.
When two ropes sling a load vertically, up to 2000 kg of total weight can be suspended.
This weight becomes 1000 kg when two ropes make a 120° hanging angle.
On the other hand, two ropes are subjected to an excessive force as large as 4000 kg if they sling a 2000 kg load at a lifting angle of 150°.



From mm to in.

1 mm = 0.03937 in.

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

From kg to lb.

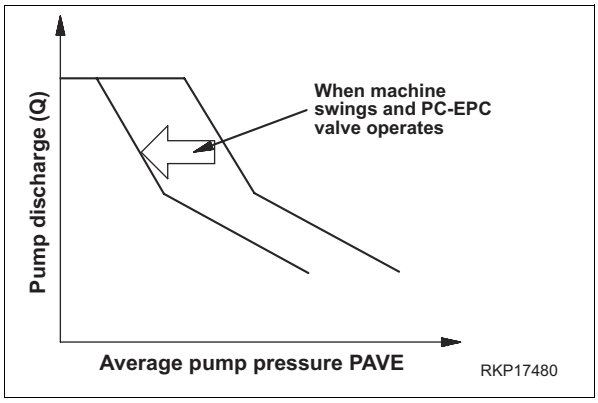
1 kg = 2.2046 lb.

	0	1	2	3	4	5	6	7	8	9
0	0	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.24	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

PC VALVE

FUNCTION

- The **PC** valve performs an approximate power check, and ensures that the hydraulic horse-power absorbed by the pumps does not exceed the horse-power delivered by the endothermal engine. This is achieved by limiting the pump delivery in function of the delivery pressure **PP**, even if the movement of the control valve spool requests an increase in delivery, in the presence of high pressure pump delivery.
- In other words, when during operation the delivery increases and the delivery pressure also increases simultaneously, the **PC** valve reduces the pump delivery. When the delivery pressure decreases, the **PC** valve increases the pump flow.
- This pump has 2 discharge openings and the average of discharge pressures **P1** and **P2** at those openings is sensed.
  The average of **P1** and **P2** is called the **PAVE**.
  The relationship between this average and pump discharge (discharge from the 2 discharge openings) is shown below.



OPERATION

1. Spring operation

- **PC** valve spring loading (2) is defined by swash plate position.
- If servo piston (6) moves to the right, spring (2) is compressed through lever (1) and its spring load changes.
  The spring constant of this spring changes to 2 levels

2. When pump pressure PAVE is low

- The force applied by the pressure against the spool (4) decreases, and the spool (3) shifts slightly to the right (Fig. 1).
  At the same time, a connection opens between passages **C** and **D**, and pressurised oil from valve **LS** is sent for relief (**PT**).
- Simultaneously, passages **F** and **G** on valve **LS** are interconnected: pressure at passage **J** is sent for relief **PT** ed il and the control piston (6) shifts to the left.
- Pump delivery increases as a result.
- When the control piston (6) moves, the lever (1) moves to the left, and the spring (2) expands, thereby reducing its load on the spool (3). Consequently, the spool (3) moves to the left and stops the oil flow between **C** and **D**, and a passage opens between ports **B** and **C**.
- As a result of that, the pressure in **C** increases, and the control piston (6) stops.

3. When pump pressure PAVE is high

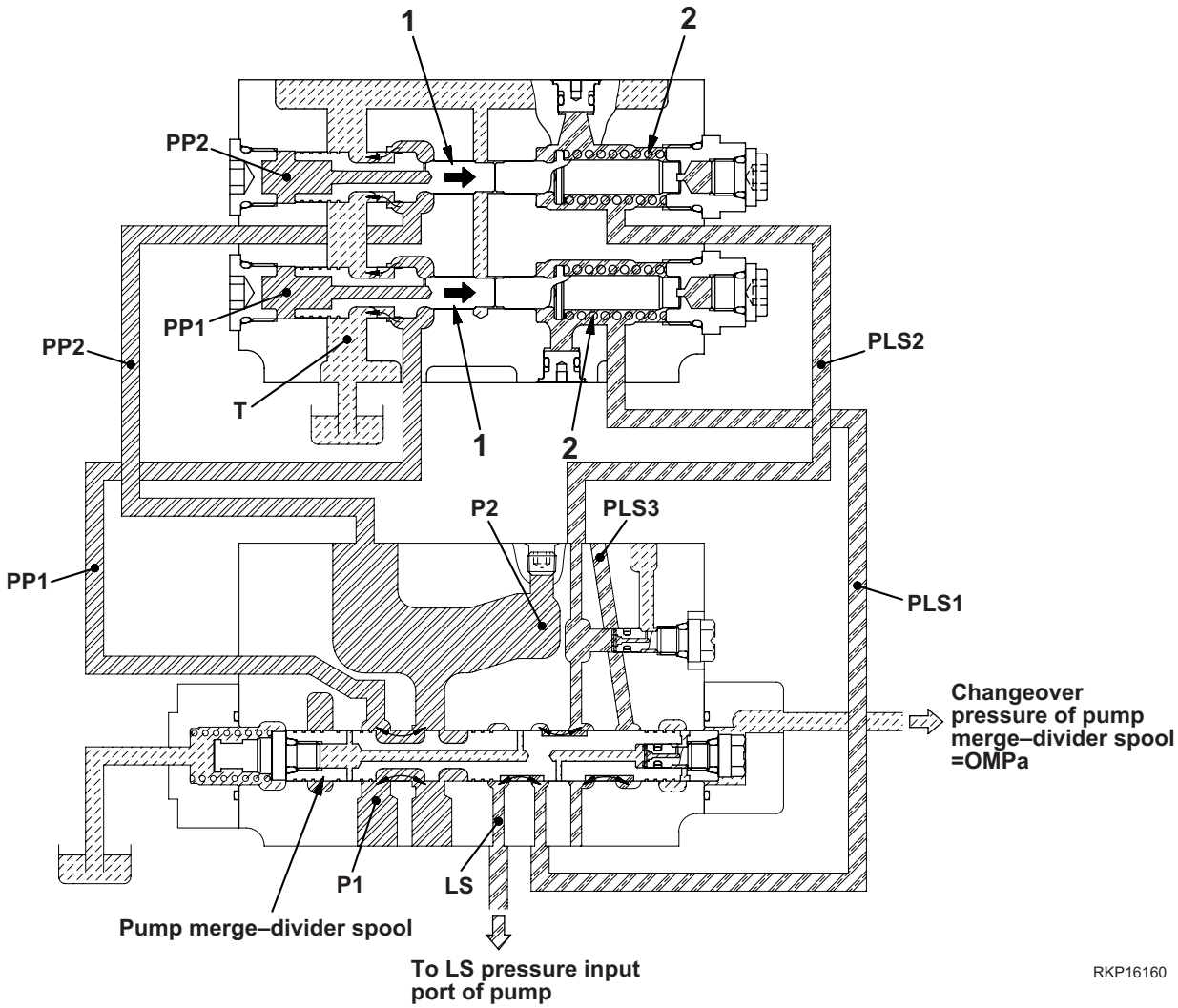
- The force applied by the pressure against the spool (4) increases, and the spool (3) shifts slightly to the left (Fig. 2). At the same time, a connection opens **C** and **B**, and the pressure of the oil sent to valve **LS** becomes equivalent to the pump's delivery pressure (**PP**).
- Simultaneously, passages **F** and **G** in valve **LS** are interconnected, and pressure at port **J** becomes equivalent to the pump's delivery pressure (**PP**), and the control piston (6) shifts to the right.
- Pump delivery decreases as a result.
- When the control piston (6) moves, the lever (1) moves to the right, and the spring (2) compresses, thereby increasing its load on the spool (3).
  Consequently, the spool (3) moves to the right and stops the oil flow **C** and **B**, and a passage opens **D** and **C**.
- As a result of that, the pressure in **C** decreases, and the control piston (6) stops.
- The equilibrium between the force applied by pressure **PP** against spool (4) and the force applied by spring (2) against spool (3) is what determines the position at which the control piston (6) (hence pump delivery) stops.

3. When swing gear pump pressure rises/lowers

- The pressure of spool (4) changes and the pump discharge changes similarly to the case where the **PAVE** rises/lowers
  The **PC-EPC** valve changes the output pressure according to the input current from the controller, then the pressure of spool (5) changes and the pump discharge changes similarly to the case where the **PAVE** rises/lowers.

UNLOADING VALVE

1. When the control valve is in "NEUTRAL" position



FUNCTION

- When the control valve is at NEUTRAL, pump discharge amount **Q** for the minimum swash plate angle is released to the tank circuit.
  At this time, the pump discharge pressure **PP1** and **PP2** is set at 24.5 bar by the spring (2) inside the valve. (**PLS1** and **PLS2** signal: 0 bar)
- Since the pump merge-divider valve is at the merge position, pump discharge pressures **PP1** and **PP2** are merged. **LS** pressures **PLS1**, **PLS2**, and **PLS3** are also merged.

OPERATION

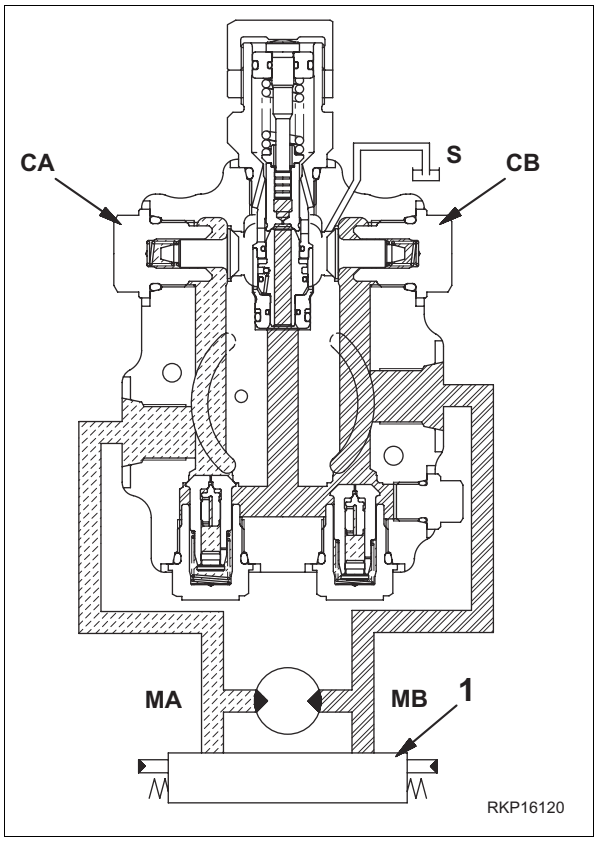
- Pump discharge pressures **PP1** and **PP2** are acting on the left end of unload spool (1) and **LS** pressures **PLS1** and **PLS2** are acting on the right end. (**PP1** = **PP2**, **PLS1** = **PLS2**)
- Since no **LS** signal with **PLS1** e **PLS2** pressure is generated when the control valve is in “NEUTRAL” position, the only pressure acting on spool (1) in this condition is the pump's delivery pressure **PP1** and **PP2** as regulated by spring compression (2).
- As pump discharge pressure **PP1** and **PP2** rises and reaches the load of spring (2) (2.45 MPa {25.0 kg/cm2}), spool (1) is moved to the right. Pump discharge pressures **PP1** and **PP2** are connected to tank circuit **T** through the cut of spool (1).
- This ensures that the pump delivery pressure **PP1** and **PP2** stays regulated at 24.5 bar.

BRAKE VALVE

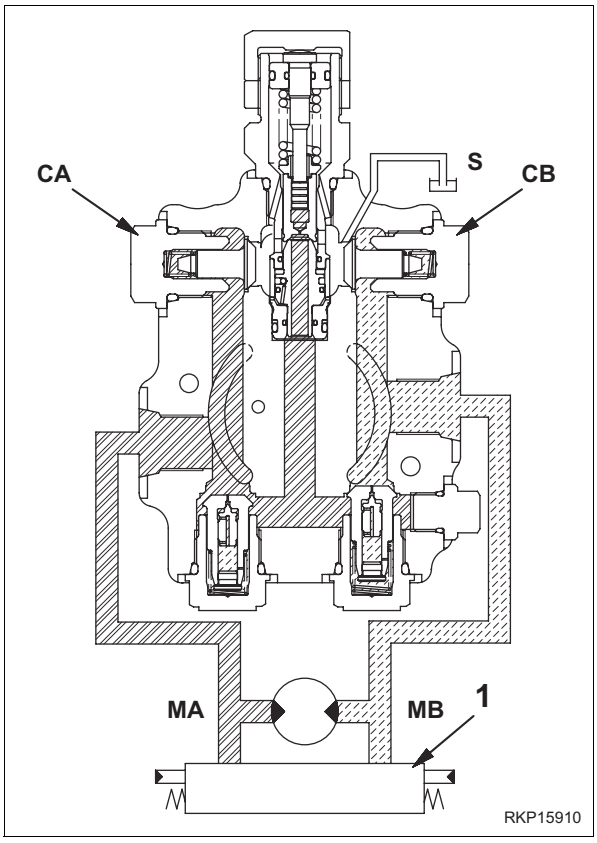
DESCRIPTION
The brake valve consists of a check valve and a safety valve.

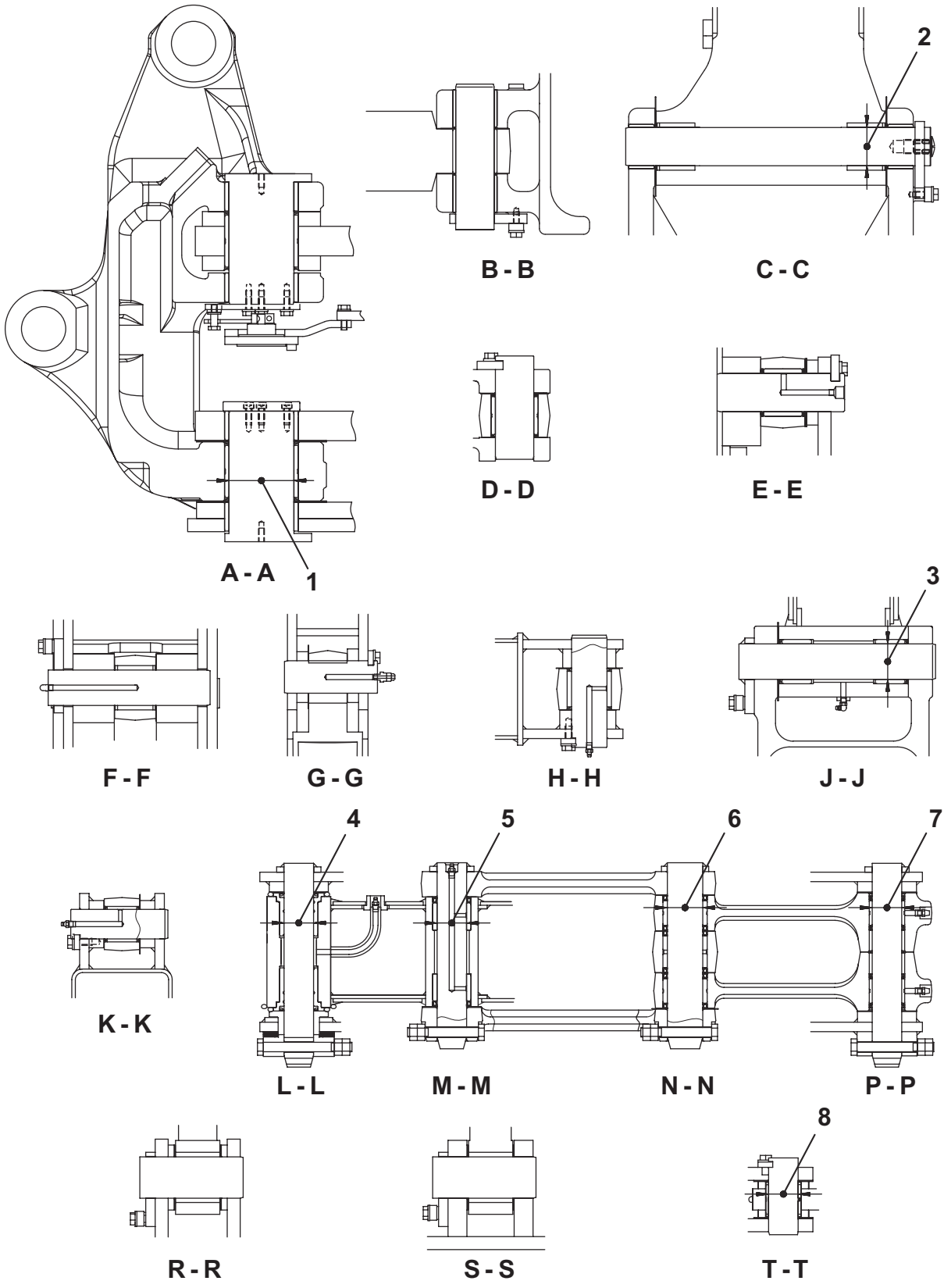
FUNCTION
- When swing operation is stopped, outlet circuit of the motor is closed by the control valve.
  However, the motor will run for a while by inertial force, so pressure at the outlet side of the motor will abnormally rise, which may cause damage to the motor.
  To avoid such danger, the safety valve releases the abnormally high pressure oil from the outlet side of the motor.

OPERATION
1. PPC valve (swing) actuated
- When the swing control lever is operated to SWING LEFT, pressure oil from the pump will be sent to the Port **MB** through the control valve (1).
  By this, pressure in the Port **MB** rises, which generates starting force to the motor, and the motor starts to swing. Oil coming out of the outlet Port returns to the tank from the Port **MA** though the control valve.



2. When swing stops
- When the swing control lever is returned to the NEUTRAL position, pressure oil from the control valve is not sent to the Port **MB**. Since the return circuit for the oil from the motor outlet to the tank is closed by control valve, the pressure in port **MA** rises and revolution resis- tance is generated in the motor, then the motor is braked.
- The pressure in port **MA** rises to the set pressure of the safety valve. As a result, high braking torque is generated in the motor, then the motor stops.
- While the safety valve is operating, the oil discharged from the safety valve and the oil from port **S** are supplied through check valve **CB** to port **MB** so that cavitation will not occur in port **MB**.



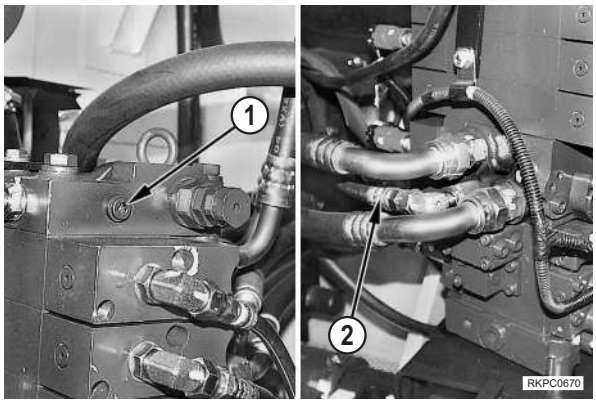


RKP17500

CHECKING AND ADJUSTING THE LS (Load Sensing) VALVE

1. With differential pressure gauge C5

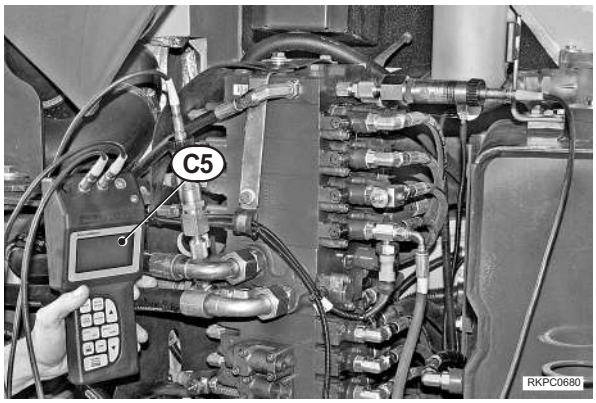
1 - Remove plug (1) and disconnect the LS signal plug (2).



2 - Install fitting **C3** to plug hole (1) on the control valve, and install fitting **C4**; connect hose (2) to fitting.

3 - Connect the differential pressure gauge **C5**.

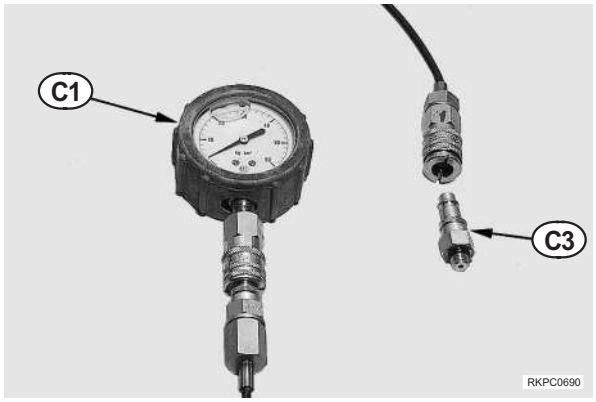
★ Connect the high pressure side to hole (1) and the **LS** pressure side (2) to fitting **C4** with another fitting **C3** placed in between.

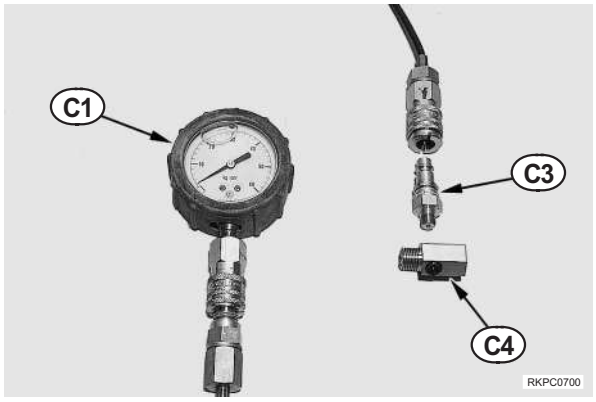


4 - Check differential pressure **LS** under the conditions listed in Table 1.

TTable 1

Fuel control levers	Operating mode	Differential pressure
Max.	All levers in NEUTRAL position	25–45
Max.	Bucket curl (lever operated to full curl position)	21.5–1

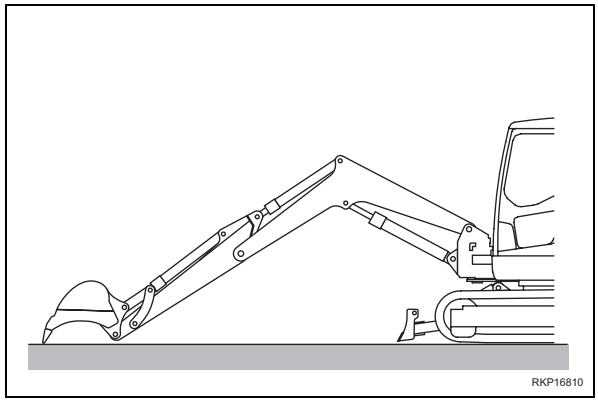




2. Arm test

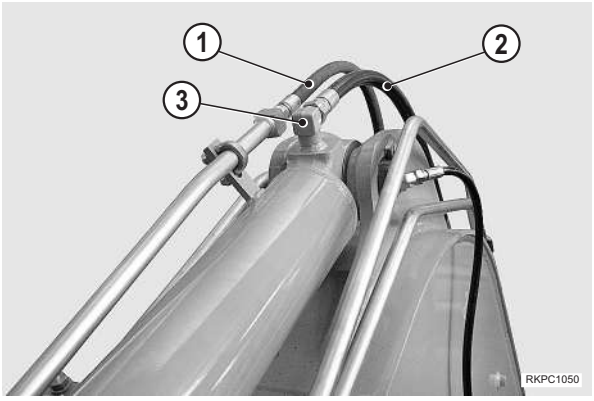
1 - Position the machine with the arm completely extended and the bucket teeth on the ground.

2 - Stop the engine and release any residual hydraulic pressure.



3 - Disconnect lines (1) and (2) from the pipe and cylinder and plug them to avoid contamination.

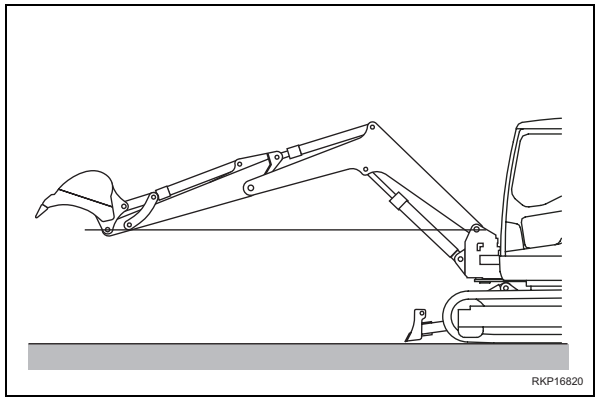
4 - Plug the arm cylinder feed hose (1) – head end – and fit a provisional hose to fitting (3) in order to catch any leakage.



5 - Start the engine and raise the boom.

6 - Stop the engine and check the position of the arm for 15 minutes.

- If the arm drops, the drift is due to the cylinder gasket.
- If the arm does not drop, the drift is due to the control valve.



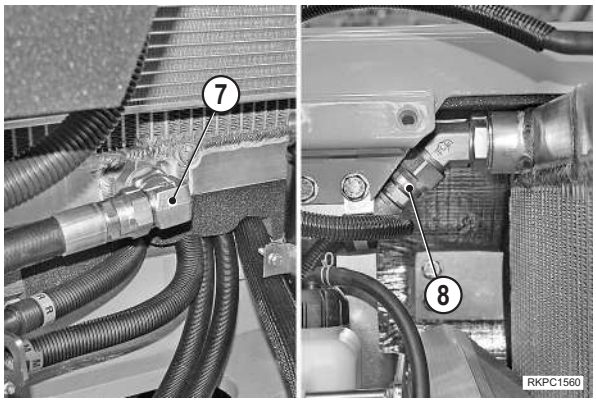
SPECIAL TOOLS

Nature of work	Mark		Code	Name	Q.ty	Remarks
Disassembly/Assembly of swing machinery	C	1		Wrench	1	To remove and mount lock-nut
		2		Plunger	3	To remove inside ring from pinion bearing
		3		Plunger	1	To assemble inside bearing ring
		4		Plunger	1	To mount outside bearing ring
Removal of boom cylinder (2-piece boom)	D		21W-09-R4690	Tool	1	Pin removal
Assembly of track shoe idler	L	1	790-101-5001	Full piston	1	Bushing assembly
		2	796-230-1110	Tool	1	Floating seal installation
Assembly of lower idler rollers		3	790-101-5001	Full piston	1	Bushing assembly
		4	796-230-1120	Tool	1	Floating seal installation
Disassembly – assembly of recoil spring	M		791-685-8005	Tool	1	Spring compression
			790-201-2860	Spacer	1	
			791-365-3160	Extension	1	
			790-101-1600	Cylinder (686 kN)	1	
			790-101-1102	Pump	1	
Removal of steel shoes	R		791-616-1030	Tool	1	Connecting pin removal
			790-105-1100	Cylinder (294 kN)	1	
			790-101-1102	Pump	1	
Swivel joint disassembly	T		790-101-2501	Full puller	1	Rotor and ring removal
Disassembly - Cylinder assembly	U	1	790-502-1003	Cylinder repair bench	1	All cylinders
			790-101-1102	Pump	1	
		2	790-102-3802	Spanner with torque amplifier	1	Boom, blade and boom swing cylinders
			790-330-1100		1	Arm and bucket cylinders
		3	790-302-1340	Wrench (80 mm)	1	Boom and blade cylinders
			790-102-1470	Wrench (70 mm)	1	Arm and boom swing cylinders
			790-302-1290	Wrench (60 mm)	1	Bucket
		4	790-720-1000	Expander	1	

5 - Loosen the lower fitting (7) and allow oil cooler oil to flow into a receptacle.

Oil: approx 2 ℓ

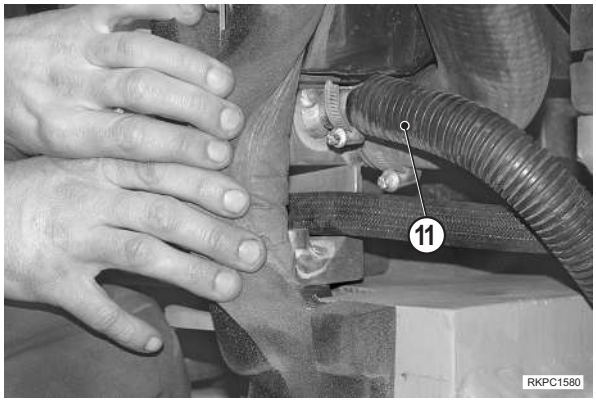
6 - Disconnect the lower hose (7) and the upper hose (8).



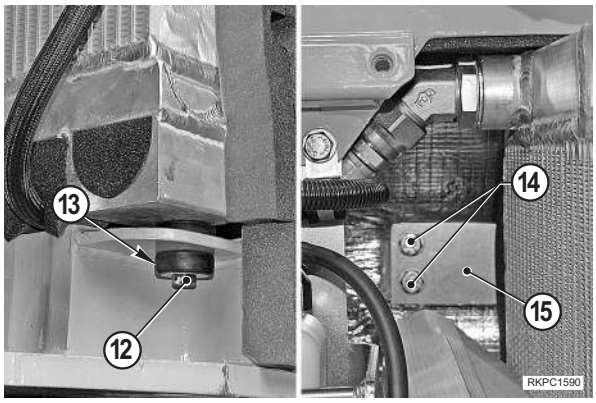
7 - Drain the coolant liquid and disconnect hoses (9) and (10) from radiator.

Coolant liquid needed: approx 8 ℓ

8 - Disconnect the coolant liquid drain hose (11) from the radiator.



9 - Remove screws (12), vibration dampers (13), screws (14) on bracket (15) and the complete radiator.



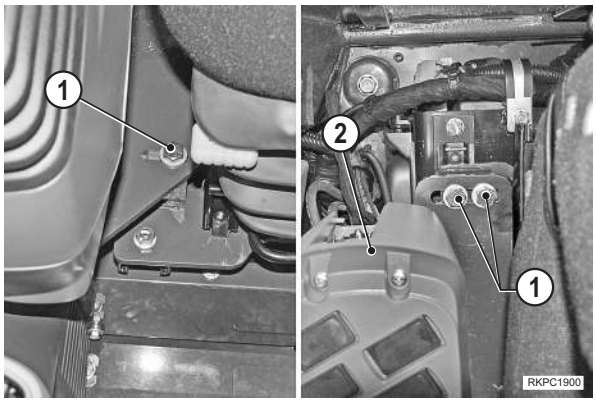
BLADE PPC VALVE

Removal

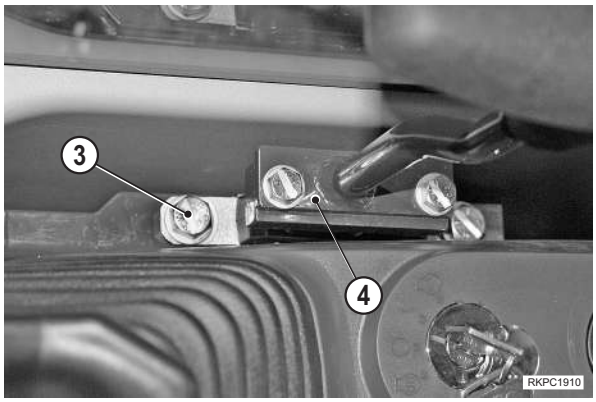
Lower the work equipment until it is resting on the ground and switch off the engine.

1 - Release residual pressures from all circuits. (For details see "20 TESTING AND ADJUSTMENTS").

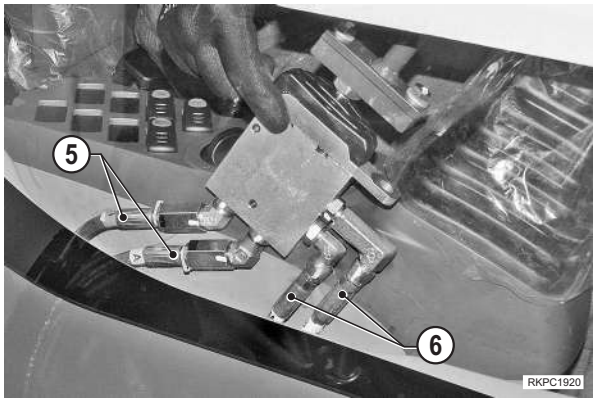
2 - Loosen three screws (1) and move box (2) away from the cab right wall.



3 - Loosen and remove screws (3) and lift PPC valve (4).



4 - Disconnect quick-coupling hoses (5) and hoses (6) in sequence.



Installation

- To install, reverse the removal procedure.

1 - Start the engine to circulate the oil.

2 - Make a few manoeuvres with the blade to bleed air from servo-control circuit.

REVOLVING FRAME

Removal

⚠ Disconnect the clamp from battery negative terminal (–).

★ Remove the equipment.
(For details see "EQUIPMENT (1-piece boom version)" or "UPPER EQUIPMENT (2-piece boom version)").

★ Remove the complete cab.
(For details, see "CABIN").

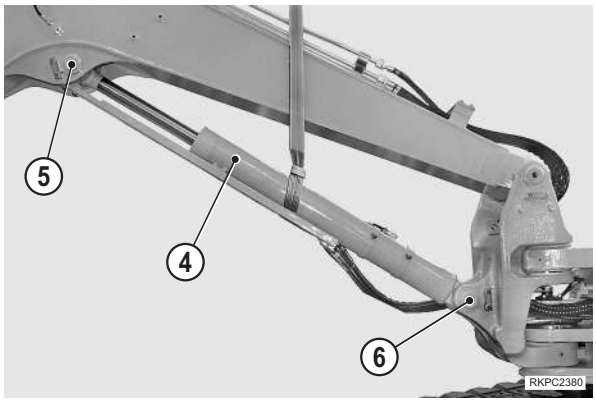
★ Move the hoses for the removed equipment inside the revolving frame and secure them.

1 - Remove the engine-hood. (1).

2 - Remove the air filter (2) and the air filter support.

3 - Remove cooling fan hood (3).

4 - Sling boom cylinder (4), disconnect hoses, remove fulcrum pins (5), (6) and cylinder.



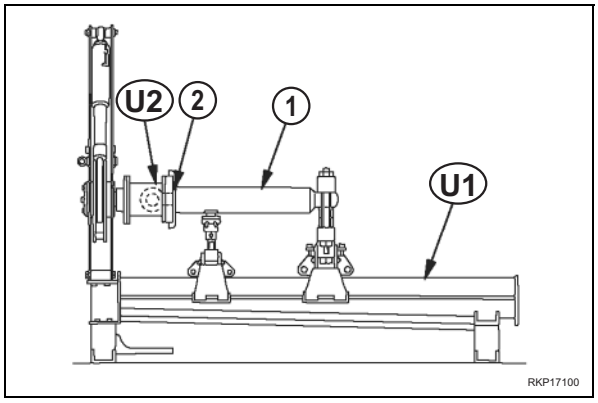
CYLINDERS

Disassembly

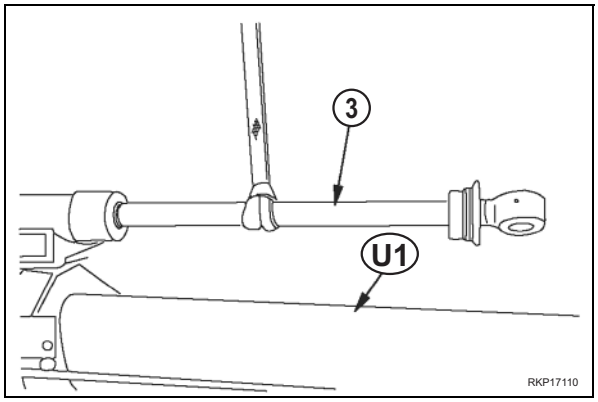
1. CYLINDER

1 - Position cylinder (1) to equipment **U1**.

2 - Using wrench **U2** with torque amplifier, loosen the head (2).



3 - Extract the entire piston (3).



2. PISTON ROD

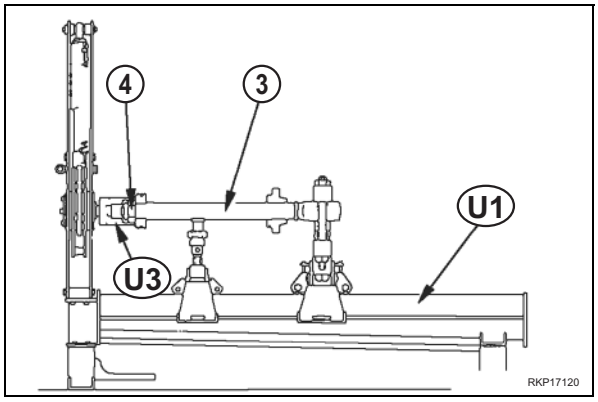
1 - Position piston rod (3) to equipment **U1**.

2 - Using a wrench with torque amplifier and tool **U3**, remove nut (4) from piston (5).

Width across flats of socket:

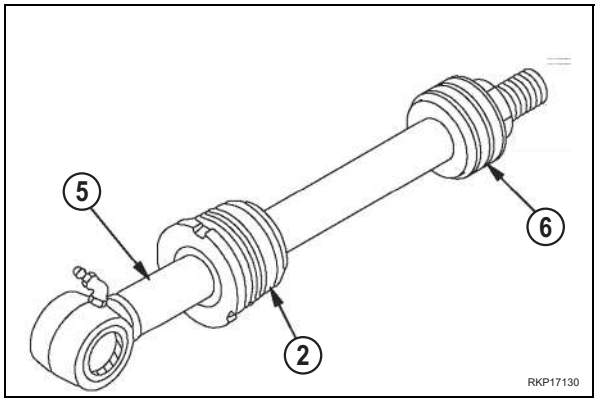
Unit: mm

Cylinder	Boom	Arm	Bucket	Boom swing	Blade
Wrench	80	75	60	70	75



3 - Remove the entire piston (6).

4 - Remove head (2).

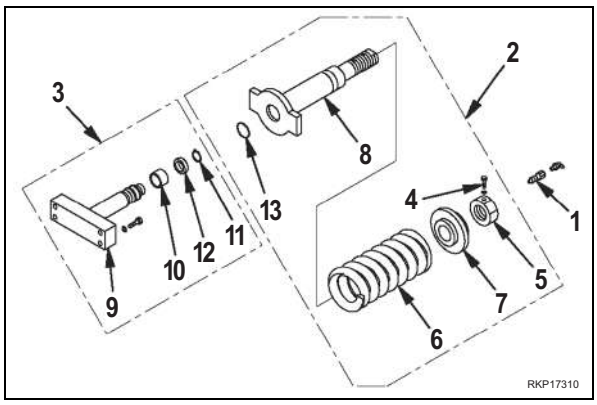


Assembly

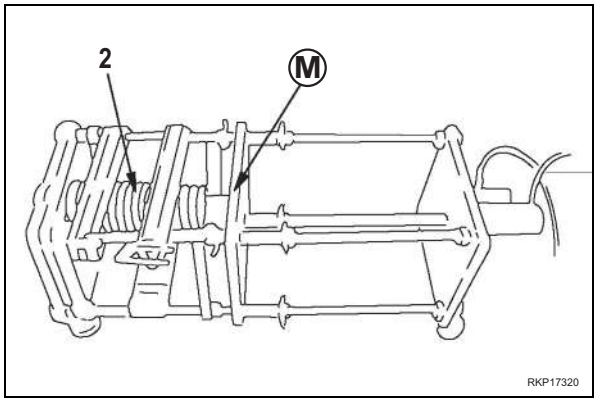
1 - Assemble piston assembly by reversing the disassembly procedure.

2 - Assemble O-ring (13) to cylinder (8).

3 - Install cylinder (8) to spring (6) and position the spring guide (7).



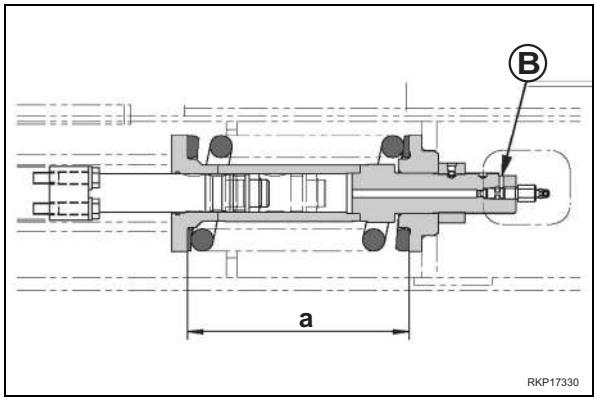
4 - Position the spring assembly (2) into tool "**M**".



5 - Slowly apply pressure and compress the spring (6). Tighten nut (5) until a spring length (**a**) is obtained.

Nut: Molikote (LM - P)

★ Spring length (**a**):
Rubber shoes: 283 mm
Steel shoes: 323 mm



6 - Remove spring assembly (2) from tool **M** and tighten nut (5) with screw (4).

Screw: 60-73 Nm

7 - Fill cylinder (8) with grease.

Grease: G2 - LI

★ Amount of grease:
Rubber shoes: 232 cm^3
Steel shoes: 96 cm^3