WEBM002800

Shop Manual

PC15R-8

HYDRAULIC EXCAVATOR

SERIAL NUMBERS PC15R-8 - F21803 and up

JANUARY 2001

STANDARD TIGHTENING TORQUE

The following charts give the stardard tightening torques of bolts and nuts. Exceptions are given in sections of «**Disassembly and Assembly**».

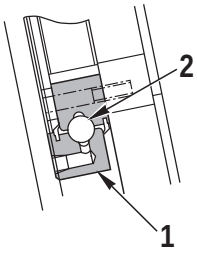
1. STANDARD TIGHTENING TORQUE OF BOLTS AND NUT

Thread diameter of bolts (mm)	Pitch of bolts (mm)	Width across flat (mm)		8.8			10.9		
		S	S	kgm	Nm	lb. ft.	kgm	Nm	lb. ft.
6	1	10	5	0.96±0.1	9.5±1	7±0.74	1.3±0.15	13.5±1.5	10±1
8	1.25	13	6	2.3±0.2	23±2	17±1.5	3.2±0.3	32.2±3.5	24±2.6
10	1.5	17	8	4.6±0.5	45±4.9	6.5±0.6	6.5±0.6	63±6.5	47±4.8
12	1.75	19	10	7.8±0.8	77±8	11±1	11±1	108±11	80±8
14	2	22	12	12.5±1	122±13	17.5±2	17.5±2	172±18	127±13
16	2	24	14	19.5±2	191±21	141±15	27±3	268±29	198±22
18	2.5	27	14	27±3	262±28	194±21	37±4	366±36	270±26
20	2.5	30	17	38±4	372±40	275±30	53±6	524±57	387±42
22	2.5	32	17	52±6	511±57	377±42	73±8	719±80	531±59
24	3	36	19	66±7	644±70	475±52	92±10	905±98	668±72
27	3	41	19	96±10	945±100	698±74	135±15	1329±140	980±103
30	3.5	46	22	131±14	1287±140	950±103	184±20	1810±190	1336±140
33	3.5	50	24	177±20	1740±200	1282±147	250±27	2455±270	1809±199
36	4	55	27	230±25	2250±250	1658±184	320±35	3150±350	2321±258
39	4	60	–	295±33	2900±330	2137±243	410±45	4050±450	2985±332

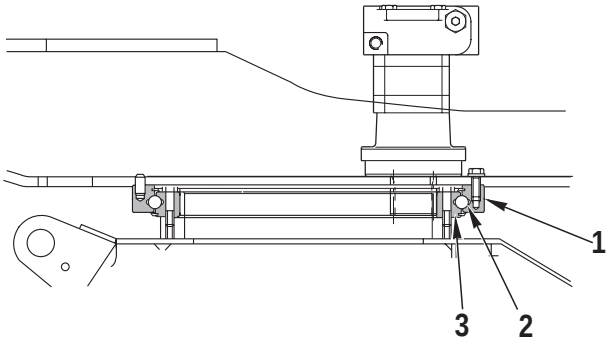
This torque table does not apply to bolts or nuts which have to fasten nylon or other parts non-ferrous metal washer.

★ **Nm (Newton meter): 1 Nm = 0.102 kgm (0.737 lb.ft.)**

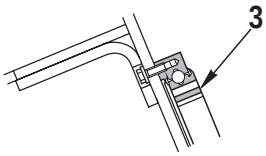
SWING CIRCLE



Section B - B



Section A - A



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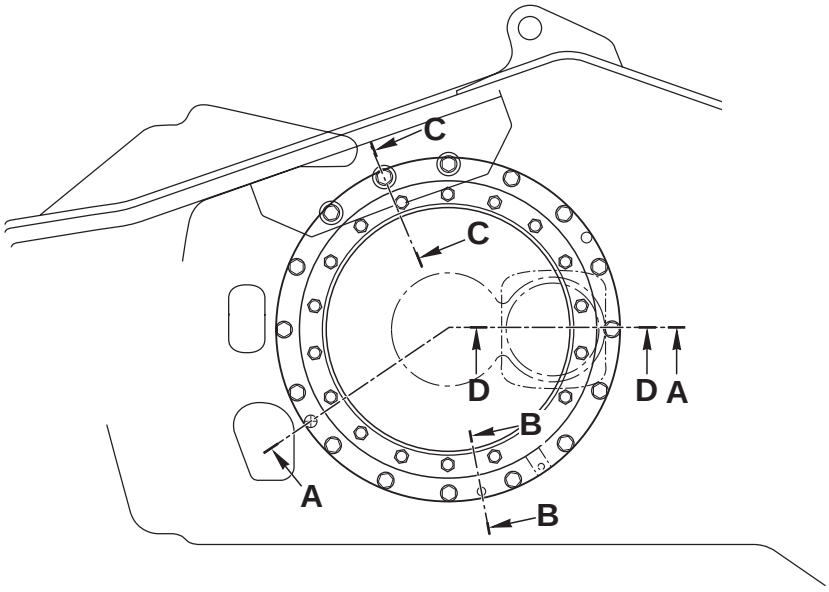

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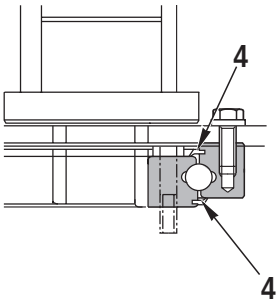
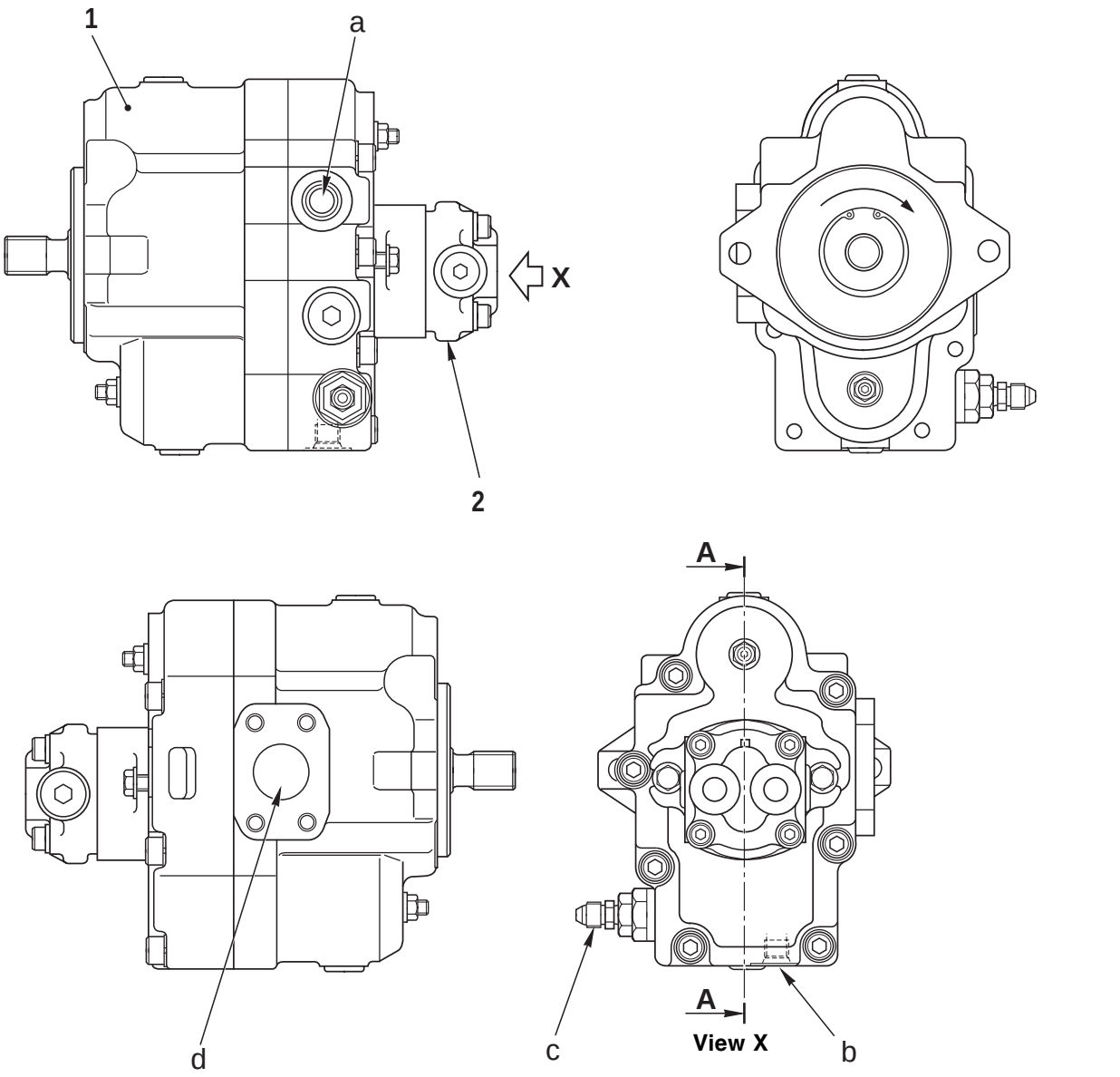


Section D - D

1. Outer race
2. Ball bearing
3. Inner race
4. Seal

HYDRAULIC PUMP



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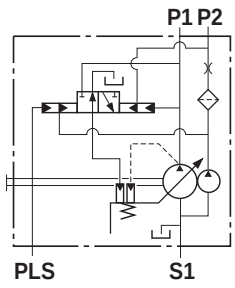

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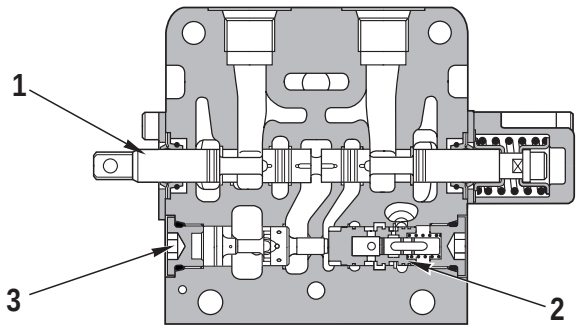
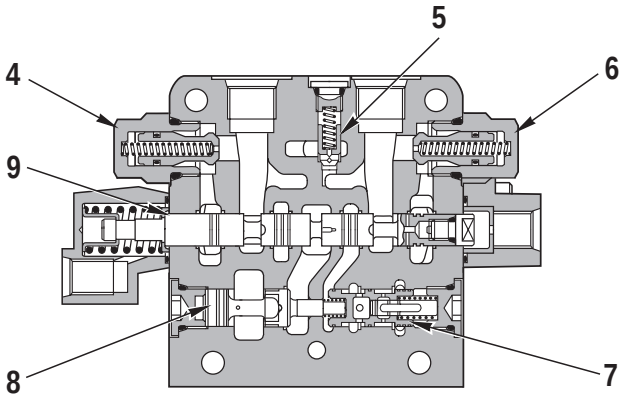
a - P1 Port - To control valve (P Port)
b - P2 Port - To control valve (Pi1 Port)
c - PLS Port - From control valve (LS Port)
d - S1 Port - From hydraulic tank
1. Main pump
2. Gear pump

SPECIFICATIONS

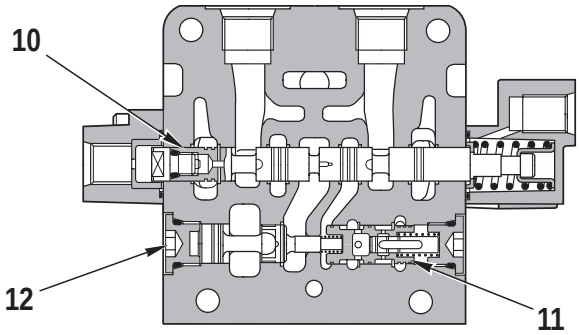
Type:	PVK - OB - 16
Displacement:	16 cc + 2.75 cc
Normal pressure:	
- Main pump:	205.8 bar (3016.6 psi)
- Gear pump:	29 bar (420.6 psi)



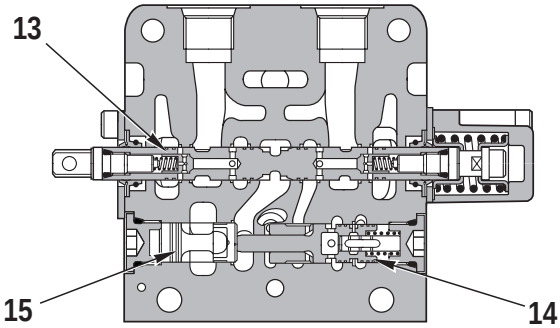
Section H - H



Section J - J



Section K - K



Section L - L

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TRAVEL VALVE

1. Spool
2. Reducing pressure compensation valve
3. Flow compensation valve

BOOM VALVE

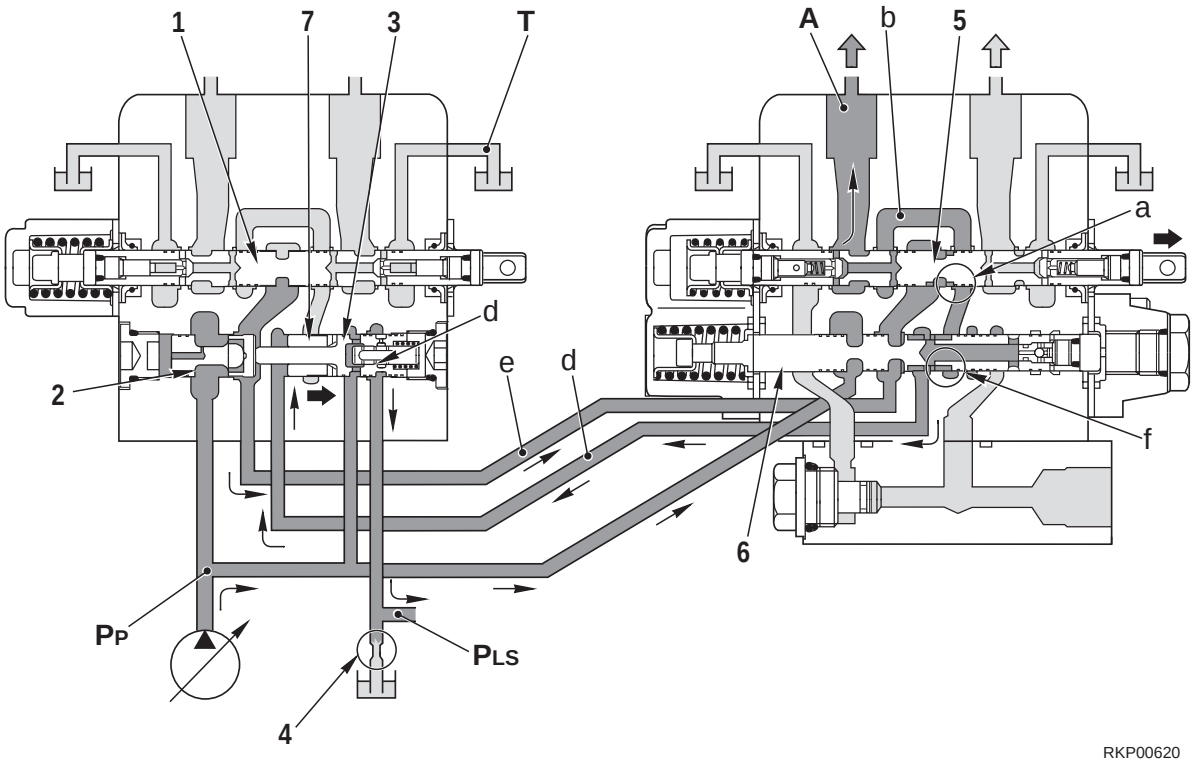
4. Suction valve
5. Check valve
6. Suction valve
7. Reducing pressure compensation valve
8. Flow compensation valve
9. Spool

BUCKET VALVE

10. Spool
11. Reducing pressure compensation valve
12. Flow compensation valve

BLADE VALVE

13. Spool
14. Reducing pressure compensation valve
15. Flow compensation valve

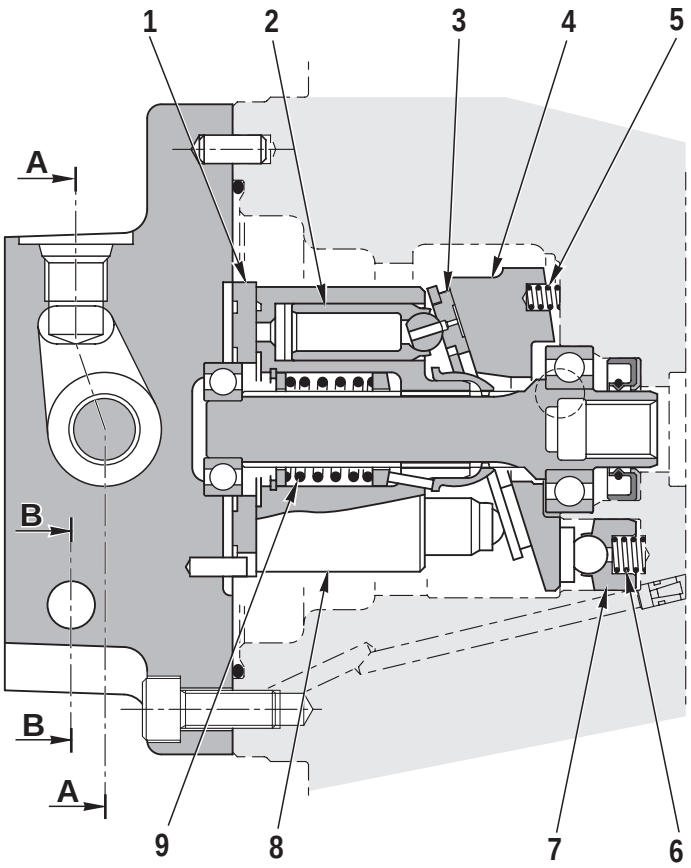


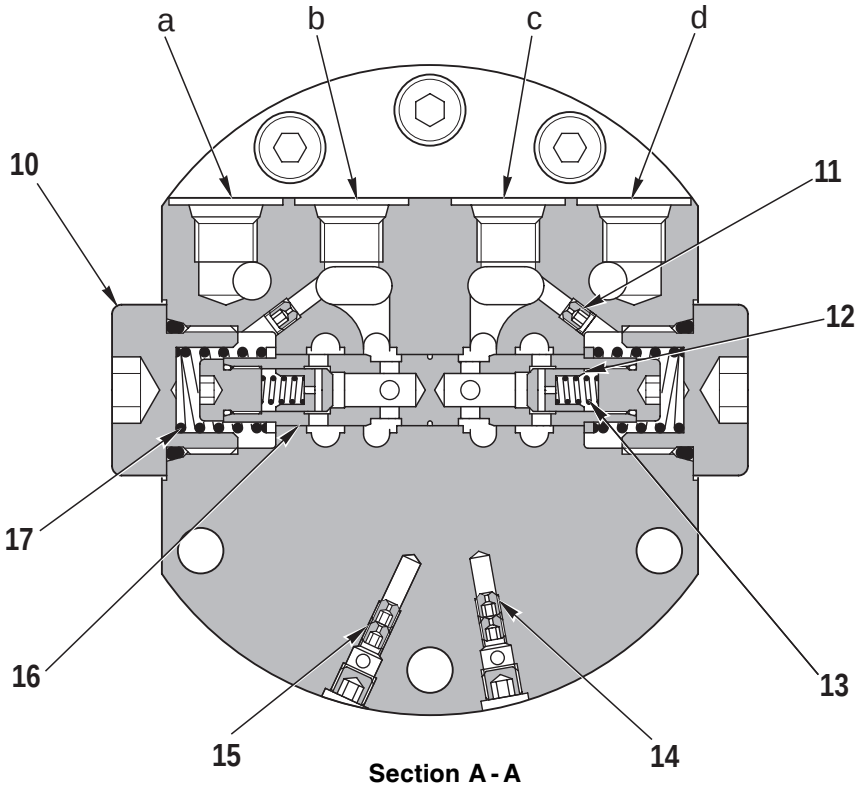
2) Boom swing, blade valve

- When boom swing spool (1) is operated, pump pressure **PP** is reduced by reducing valve (3) (in the same way as in item 1), and is sent to the **LS** circuit **PLS**.
- When the blade spool (5) is operated, pump pressure **PP** flows from flow control valve (2), passage **e**, and notch **a** in blade spool (5) through bridge passage **b** to actuator circuit **A**.
- At the same time, the actuator circuit pressure passes through notch **f** in hammer spool (6), then goes through passage **d**, and acts on the left end of piston (7). Piston (7) and reducing valve (3) then move to the right.
- As a result, pump pressure **PP** is reduced at notch **d**, becomes the actuator circuit pressure, and is sent to **LS** circuit **PLS**.

★ The boom swing and blade valves are different from the boom, arm, bucket, and travel valves: they share one pressure compensation valve and bring in the **LS** pressure.

TRAVEL MOTOR





Section A - A

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FUNCTION

1. At neutral

Ports **A** and **B** of the control valve and ports **P1** and **P2** of the PPC valve are connected to drain chamber **D** through fine control hole **f** in spool (1). (Fig. 1)

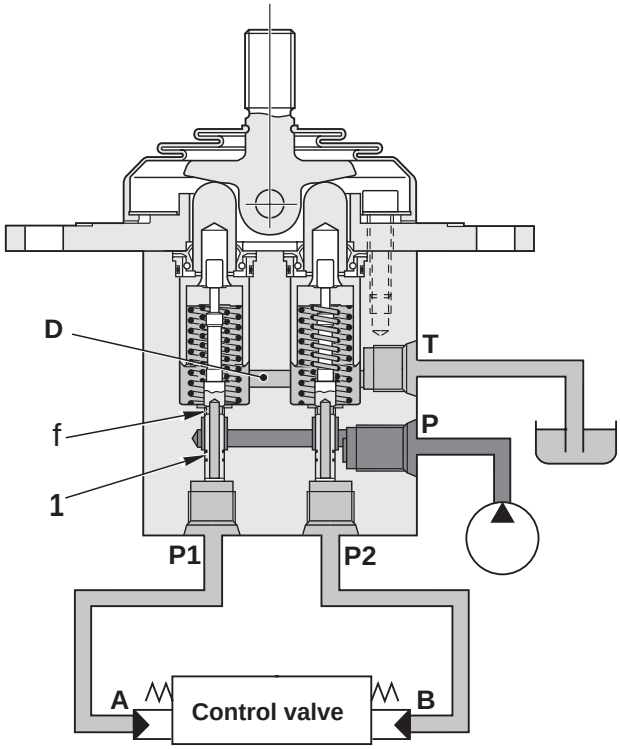

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Fig. 1

2. During fine control (NEUTRAL → fine control)

When piston (4) starts to be pushed by lever (5), retainer (7) is pushed; spool (1) is also pushed by metering spring (2), and moves down.

When this happens, fine control hole **f** is shut off from drain chamber **D**, and at almost the same time, it is connected to pump pressure chamber **P_P**, so pilot pressure oil from the control pump passes through fine control hole **f** and goes from port **P1** to port **A**.

When the pressure at port **P1** becomes higher, spool (1) is pushed back and fine control hole **f** is shut off from pump pressure chamber **P_P**.

At almost the same time, it is connected to drain chamber **D** to release the pressure at port **P1**.

When this happens, spool (1) moves up or down so that the force of metering spring (2) is balanced with the pressure at port **P1**. The relationship in the position of spool (1) and body (8) (fine control hole **f** is at a point midway between drain hole **D** and pump pressure chamber **P_P**) does not change until retainer (7) contacts spool (1).

Therefore, metering spring (2) is compressed proportionally to the amount of movement of the control lever, so the pressure at port **P1** also rises in proportion to the travel of the control lever. In this way, the control valve spool moves to a position where the pressure in chamber **A** (the same as pressure at port **P1**) and the force of the control valve spool return spring are balanced. (Fig. 2)

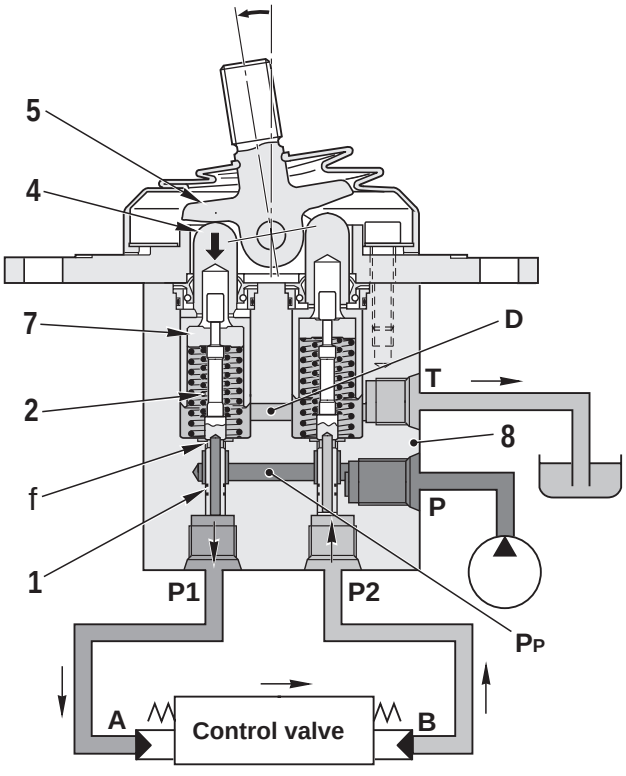

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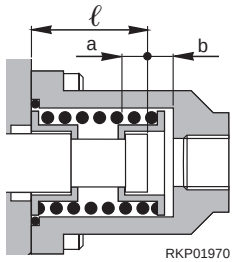
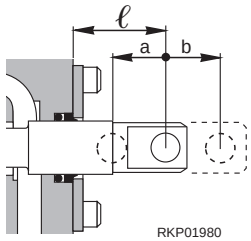
Fig. 2

• FOR THE MACHINE

Machine model				PC15R-8					
Classification	Check item	Test Condition	Unit	Standard value			Permissible value		
Engine	Engine speed with one pump at max. pressure	• Hydraulic oil temperature: 45 – 55°C (113 – 131°F) • Cooling circuit: in correct range • Engine oil pressure: in correct range • Bucket circuit: max. pressure ★ Measure when pressure has stabilised	rpm						
Control valve	Boom control Arm control Bucket control Swing control Work equipment control		mm (in.)	ℓ	a	b	ℓ	a	b
				30 (1.182)	6 (0.236)	6 (0.236)	30 (1.182)	6 (0.236)	6 (0.236)
	Blade control Boom swing control Travel control			20 (0.788)	6 (0.236)	6 (0.236)	20	6 (0.236)	6 (0.236)
Stroke of levers and pedals	Boom control lever	• At centre of lever knob • Reading at end of travel • Equipment on the ground • Engine stopped • Tip of pedal	Neutral → Raise / Lower	75 (2.955)			65 – 85 (2.561 – 3.349)		
	Arm control lever		Neutral → Open / Curled	75 (2.955)			65 – 85 (2.561 – 3.349)		
	Bucket control lever		Neutral → Open / Curled	75 (2.955)			65 – 85 (2.561 – 3.349)		
	Swing control lever		Neutral → Swing RH / Swing LH	75 (2.955)			65 – 85 (2.561 – 3.349)		
	Blade control lever		Neutral → Raise / Lower	60 (2.364)			50 – 70 (1.970 – 2.758)		
	Boom swing pedal		Neutral → Swing RH / Swing LH	20 (0.788)			17 – 23 (0.670 – 0.906)		
	Travel control lever		Neutral → Forward / Backward	85 (3.349)			70 – 100 (2.758 – 3.940)		
	Accelerator lever		Min. — Max.	60 (2.364)			50 – 70 (1.970 – 2.758)		
	Play of control lever		Work equipment, swing	Max. 5 (Max. 0.197)			Max. 8 (Max. 0.315)		
			Travel	Max. 10 (Max. 0.394)			Max. 15 (Max. 0.591)		

SPECIAL TOOLS

Measurement check points	Symbol		Code	Name	Q.ty	Remarks
Valve clearance	A	1	Commercially available	Feeler gauge	1	—
Compression pressure	B	1	ATR800090	Compression gauge	1	0-70 kg/cm^2
		2	ATR800130	Adapter	1	—
Engine speed	C	1	ATR800070	Multi-scale tachometer	1	20 - 4000 rpm
		2	ATR800060	Stroboscopic tachometer	1	6 - 30000 rpm
Water and oil temperature	D	1	Commercially available	Digital temperature gauge	1	– 50 - 1200 °C
Hydraulic pressure	E	1	ATR800170	Compression gauge	1	Scale 60 bar
		2	ATR800140	Compression gauge	1	Scale 400 bar
		3	ATR800010	Compression gauge	1	Scale 600 bar
		4	ATR800200	Servocontrol kit (Differential pressure)	1	—
		5	3F3055600	Elbow	1	P2 Pressure
	F	1	ATR800120	Flowmeter	1	—
		2		Tube union kit	1	
Track shoe tension	G	1	823001135	Grease nipple	1	Included in the machine tool kit

CENTERING ADJUSTMENT OF THE BOOM SWING COMMAND PEDAL

★ Test conditions:
- Engine: switched off
- Working equipment: resting on the ground.

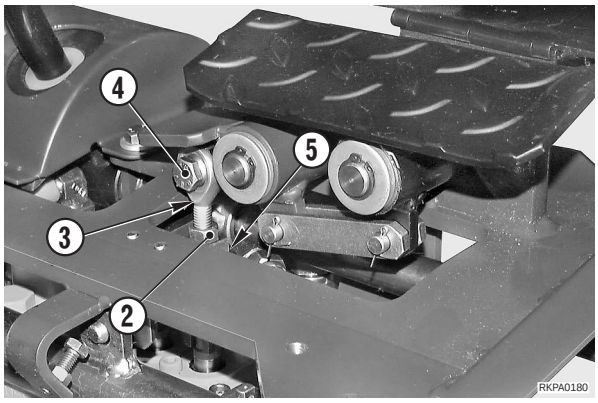
1 - Raise the rubber mat (1) on the right-hand side of the machine.

2 - Loosen the nut (2) on the joint (3) for a few turns.

3 - Remove the screw (4).

4 - Tighten or unscrew the joint (3) in the fork (5) connected to the control valve until the horizontal position of the pedal has been restored.

5 - Mount the screw (4) and secure the position of the joint (3) with the nut (2).

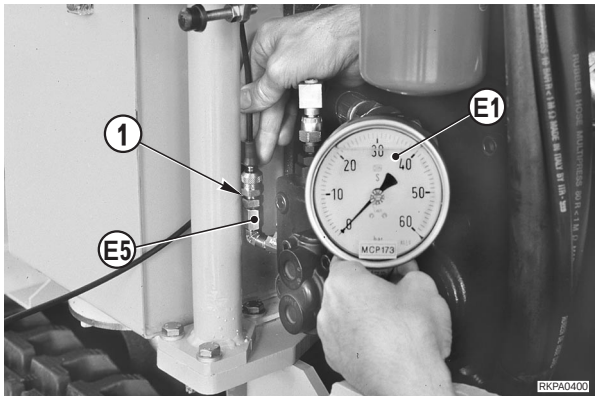


CONTROL AND REGULATION OF THE SERVO-CONTROL POWER SUPPLY

★ Test conditions:
- Engine: at working temperature.
- Hydraulic oil temperature: 45 – 55°C (113 –131°F).

Before removing the cap to measure the pressure, release the residual pressures from the circuits (See «ELIMINATION OF RESIDUAL PRESSURES OF THE CIRCUIT AND THE TANK») and put the safety device engagement levers into their locked position.

After connecting the pressure gauge, pressurise the tank. For details see «PRESSURISATION OF THE TANK».



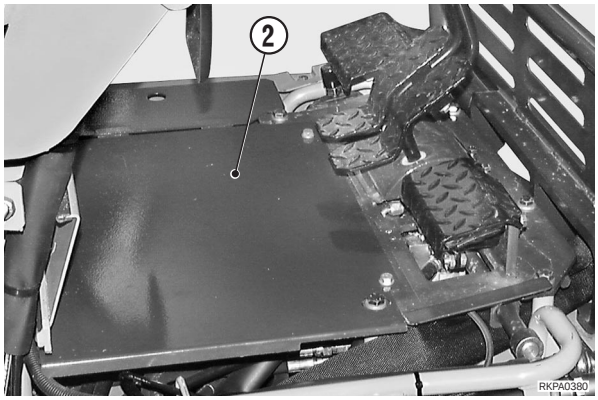
1. Checking the pressure of the servo-controls

1 - Remove the cap (1) of pump P2 and mount elbow **E5** and a pressure adapter.

2 - Connect the pressure gauge **E1** (60 bar).

3 - Start the engine and bring it up to high idling with all leers in neutral position.

4 - Check the pressure.
★ Normal pressure: 29^{+6}_{-3} bar (420.6^{+87}_{-44} psi)



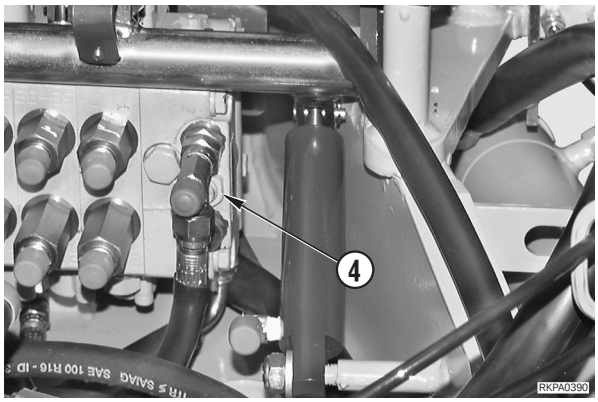
2. Regulating the servo-control valve

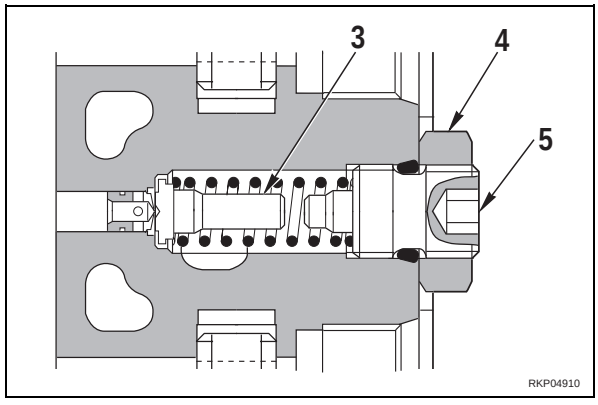
If the pressure value does not fall within the tolerances, regulate the valve (3) as follows:

1 - Take up the flooring (2).

2 - Loosen the lock nut (4) and turn the adjusting screw (5).
- To INCREASE pressure, rotate in a CLOCKWISE direction.
- To DECREASE pressure, rotate in a COUNTER-CLOCKWISE direction.
★ Each turn of the screw (5) varies the pressure by 56 kg/cm^2 (797.6 psi).

3 - Lock the nut (4).
Nm Nut: 22±2.5 Nm (16.2±1.84 lb.ft.)





CHECKING FOR ANY LEAKAGES INSIDE THE WORKING EQUIPMENT CYLINDERS

★ Test conditions:
- Engine: at working temperature.
- Hydraulic oil: 45 – 55°C (113 –131°F).

1 - Fully extend the rod of the cylinder to be checked and stop the engine.

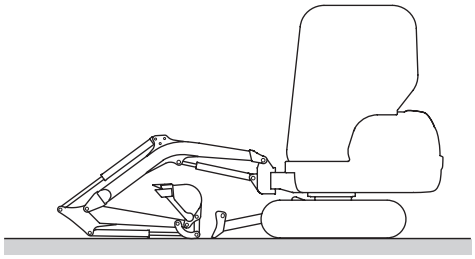
2 - Disconnect the tube (1) from the head side of the cylinder and bind it to the structure.

⚠ Take great care not to disconnect the tube on the base side of the cylinder.

3 - Start the engine, bring it up to high idling and bring the base side of the cylinder up to maximum pressure.

4 - After 30 seconds, wait for a full minute to collect any leakages from the free tube.

POSITION FOR THE BOOM TEST



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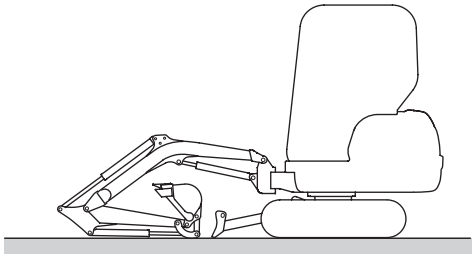
POSITION FOR THE ARM AND BUCKET TEST



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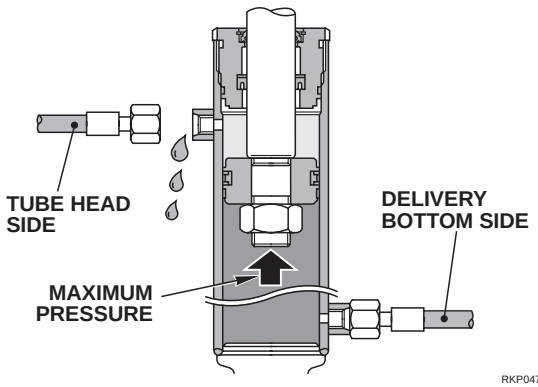

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PRECAUTIONS TO BE TAKEN WHILE WORKING

★ When dismantling or installing a part, always take the following general precautions.

1. Precautions for removal operations

- If not otherwise indicated, lower the work equipment until it rests on the ground.
- If the coolant liquid contains an anti-freeze substance, follow the instructions given for drainage.
- After having removed flanges and tubes, insert plugs to prevent impurities from entering.
- Before removing a cylinder, fully retract the piston and tie it with wire.
- Use a sufficiently large container to collect the oil.
- Before removing a part from the machine, check the alignment reference marks which show the correct installation position. If necessary add further marks to avoid incorrect installation.
- While dismantling the connectors, always grasp them firmly to avoid undue strain on the wiring.
- If necessary, attach markers to the wires and tubes to avoid muddling them up during installation.
- Check the number and height of the adjustments to a given clearance and store them in a safe place.
- When raising the machine or some parts of it, use adequate equipment for the weight of the part concerned.
- When using screws or eyebolts to remove items of the machinery, screw them alternately, and as deeply as they will go.
- Before removing a piece, clean the surrounding area and, after removal, cover the area to prevent dirt or dust from gaining entrance.

2. Precautions to be taken during installation

- Tighten nuts and screws with the specified tightening torques.
- Install the flexible hoses, taking care not to entangle or twist them.
- Bend the cotter pins and stops in such a way as to secure them.
- When coating the threads with adhesives, clean the piece to remove oil and grease, then apply just enough adhesive to cover the threading in a uniform manner.
- When applying a liquid sealant, clean the surface involved, remove residual oil and grease, check that there are no dents or dirt, then apply the liquid sealant in a uniform manner.
- Clean all the parts, remove dirt, rust, burrs, or dents.
- Apply a film of engine oil over all the moving parts.
- Apply a film of anti-friction grease (ASL800040) over all surfaces assembled with pressure, to avoid sticking.
- After having mounted the snap-rings, check that they are firmly positioned in their seatings.
- When installing electrical system jacks, remove any oil, dust or water that may have penetrated into them, then connect them firmly.
- If using eyebolts, check that they are not distorted, screw them in fully, and then align the eye with the hoisting hook.
- Mount the flanges in a uniform manner, and tighten the screws in criss-cross sequence, to avoid excessive pull on one side only.

3. Precautions to be taken on completion of removal and installation operations.

- If the coolant liquid has been drained away, close the drainage plug and add new liquid up to normal level. Start the engine to circulate the liquid throughout the cooling system and then top up the level once more.
- When the hydraulic equipment has been dismantled, add engine oil to the indicated level. Start up the engine to circulate the oil in the hydraulic circuits, and then top up to the indicated level.
- If hoses or hydraulic equipment, such as hydraulic cylinders, pumps, motors, solenoid valves and valves, are removed for repairs or substitution, bleed air from the hydraulic circuits after having re-assembled the machine.
  ★ For details, see «20. TESTING AND ADJUSTMENTS».
- After having re-assembled cylinder joints or cylinders, or work equipment articulations, lubricate thoroughly.

INSTALLATION OF THE CYLINDER HEAD

- To install, reverse the removal procedure.

※1

1 - Fill up the cooling circuit.

Coolant: approx. 3.2 ℓ (0.9 US.gall)

2 - Start the engine to circulate the liquid through all circuits. Stop the engine and check the level.

★ **Only for machines with cab heating**
Make sure that the heating cock is open.

※2

Muffler screws and nuts:
23 – 29 Nm (16.9 – 21.3 lb.ft.)

※3

Rear guard screws:
108±11 Nm (79.6 – 8.1 lb.ft.)

※4

★ Adjust belt tension. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

※5

★ Check the gaskets:

Screws M6: 9.8 – 11.7 Nm (7.2 – 8.6 lb.ft.)

Screws M8: 23 – 28 Nm (16.9 – 20.6 lb.ft.)

※6

High-pressure pipe unions:
29 – 34 Nm (21.3 – 25 lb.ft.)

※7

★ Check that the valve tappets are firmly engaged in the rods.

★ Start tightening the rocker-arm shaft from the centre outwards.

Rocker-arm shaft screws:
23 – 28 Nm (16.9 – 20.6 lb.ft.)

★ Adjust valve clearance. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

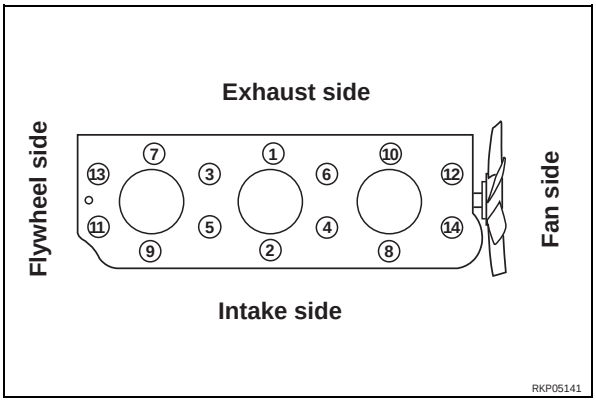
※8

★ Raise the cylinder head, keeping it horizontal, and place it on the gasket without shifting anything.

★ Lubricate the screw-threadings with engine oil.

★ Tighten the screws in the sequence indicated. (See figure).

Cylinder head screws:
37.2 – 41 Nm (27.4 – 30.2 lb.ft.)



REMOVAL OF THE HYDRAULIC OIL TANK

Completely lower the working equipment until it is resting on the ground and stop the engine.

Release all residual pressures from the circuits and the tank. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

★ Drain out the hydraulic oil.

Hydraulic oil: approx. 22 ℓ (5.8 US.gall)

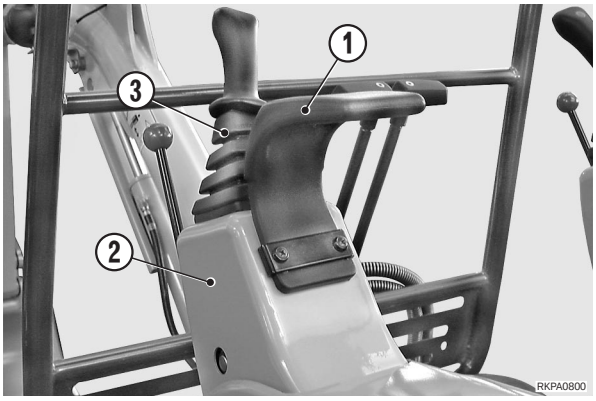
1 - Lift off the top cover and the left-hand side panel. (For details, see «REMOVAL OF THE TOP COVER AND THE SIDE PANELS»).

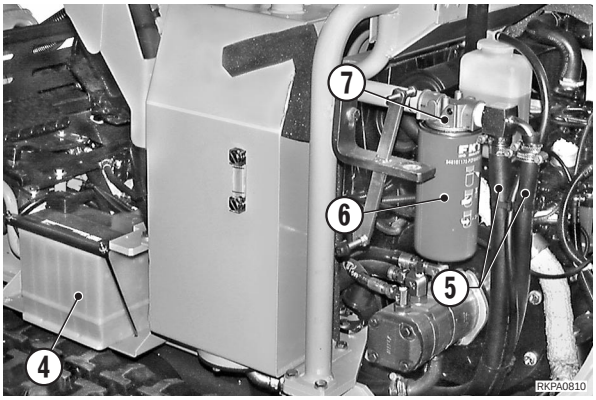
2 - Remove the arm-rest (1) and the casing (2) of the left-hand PPC valve (3).

3 - Remove the battery (4). ※1

Disconnect first the negative terminal (–) and then the positive terminal (+).

4 - Disconnect the drainage tubes (5) and remove the filter (6). Also remove the filter head (7). ※2





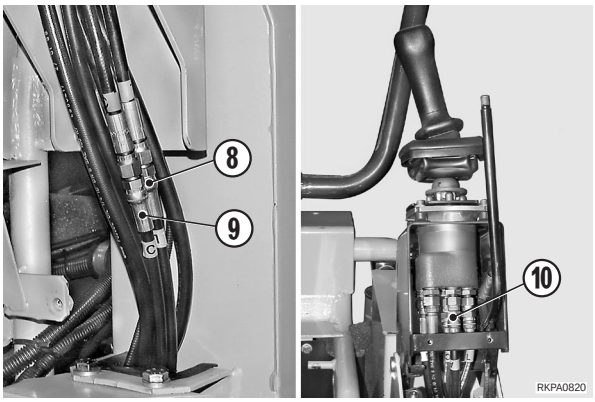
5 - Disconnect the servo-controls tubes (L blue) (8) and (C green) (9).

★ Plug the tubes to prevent entry of impurities.

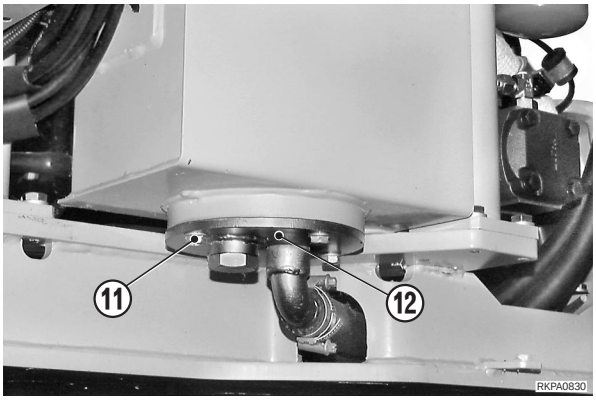
6 - Disconnect the other tubes (10) from the left-hand PPC valve and draw them off the tank support.

★ Plug the tubes to prevent entry of impurities.

※3



7 - Take out the screws (11) and remove the suction flange (12). ※4



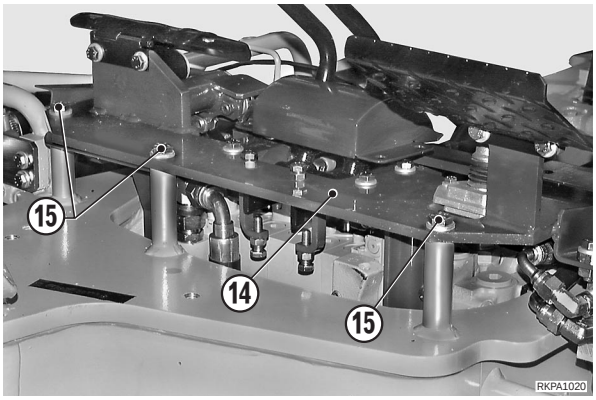
9 - Put a sling around the control valve group and connect it to some hoisting tackle.

★ Adjust the length of the cables to balance the group.

10 - Take out the screws (15) and remove the control valve group complete with its support.

kg Control valve group: 45 kg (99.1 lb.)

⚠ Accompany the tubes that are still connected to the control valve.



INSTALLATION OF THE CONTROL VALVE

- To install, reverse the removal procedure.

⚠ While positioning the control valve group, direct and accompany the tubes still connected to it, to avoid creasing or entangling them.

1 - Fill the hydraulic oil tank up to its maximum level.

Hydraulic oil required:
approx. 22 ℓ (5.8 US.gall)

2 - Start the engine to circulate the oil, and check that there are no leaks.

3 - Stop the engine, check the level of the hydraulic oil and, if necessary, top it up.

4 - Bleed the air from all circuits and pressurise the tank. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

REMOVAL OF RUBBER TRACK SHOES

1 - Rotate the turret by 90° to the side of the track-shoe to be removed and rest the back of the bucket on the ground with the arm perpendicular to the ground.

2 - Slowly loosen the grease nipple (1) to let out the grease and release the tension of the track-shoe (2).
※1

The grease contained in the idler cylinder is under pressure and could seriously injure the Operator. For this reason the valve should never be loosened by more than one turn.

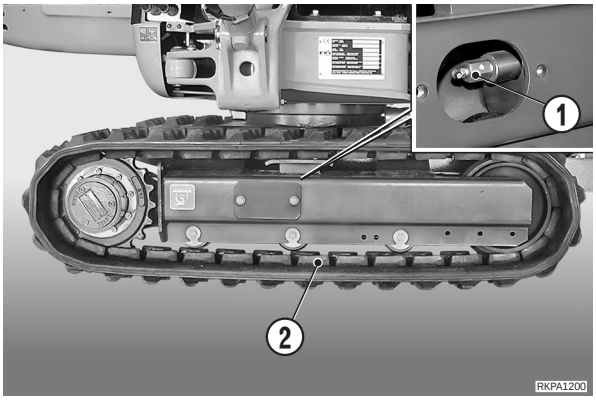
★ If the grease does not run out easily, move the machine slowly backwards and forwards.

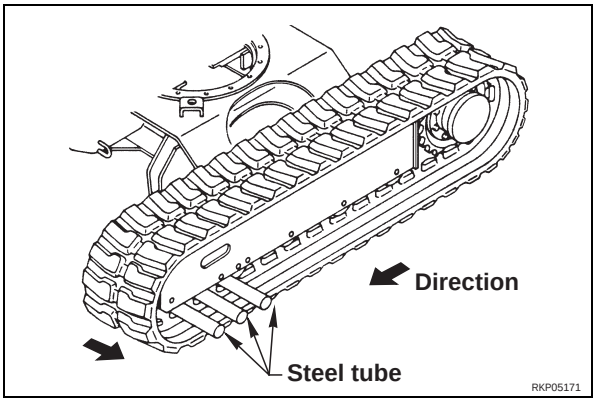
3 - Force the boom downwards to raise the machine.

4 - Insert three steel pipes into the track-shoe and then reverse the track-shoe until the first pipe is above the idler.

5 - Push the track-shoe (2) outwards and remove it.

kg Track-shoe: 45 kg (99.2 lb.)





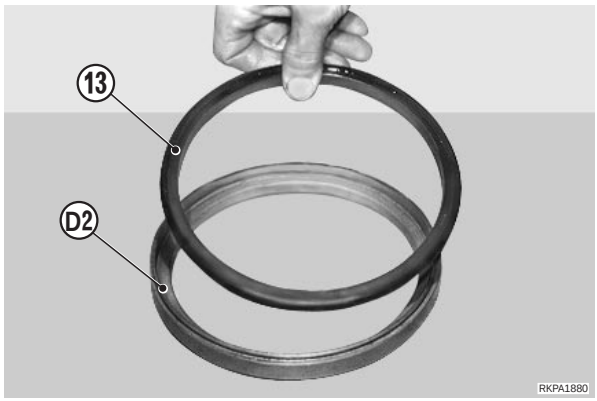
INSTALLATION OF RUBBER TRACK-SHOES

- To install, reverse the removal procedure.

※1

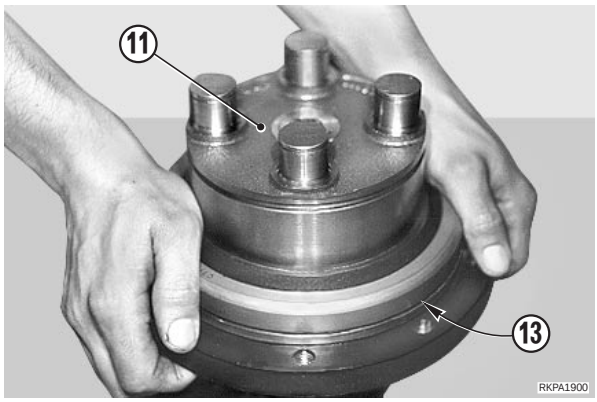
★ Adjust the track-shoe tension. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

5 - Mount the first half-seal (13) on the tool **D2**.

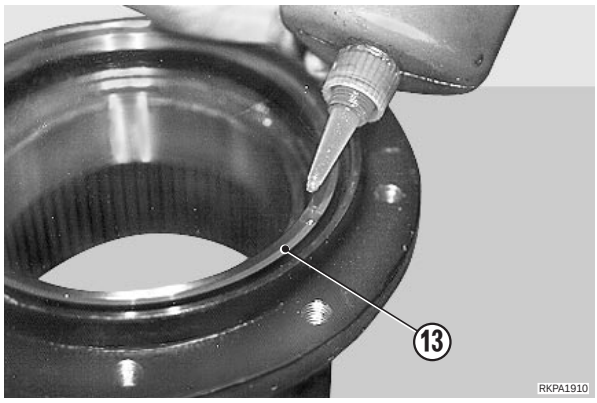


6 - Assemble the first half-seal (13) on the housing (4).

7 - Repeat the operation of point 5 for the second half-seal (13) and assemble it on the hydraulic motor (11).



8 - Lubricate the metal surface of the seal (13) with oil.



REMOVAL OF THE BUCKET CYLINDER

⚠ Completely open the front equipment. Make the necessary movements to rest the bucket teeth on the ground with the arm supported on a block «A».

1 - Stop the engine and release the pressures from the cylinder (1) by moving the right-hand PPC valve lever several times.

2 - Place a block «B» beneath the cylinder (1) and remove the pin (2). ※1 ※2 ※3

3 - Start the engine and retract the piston rod (3).

★ Bind the piston rod with wire to secure the fully retracted position.

4 - Stop the engine and release any residual hydraulic pressures. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

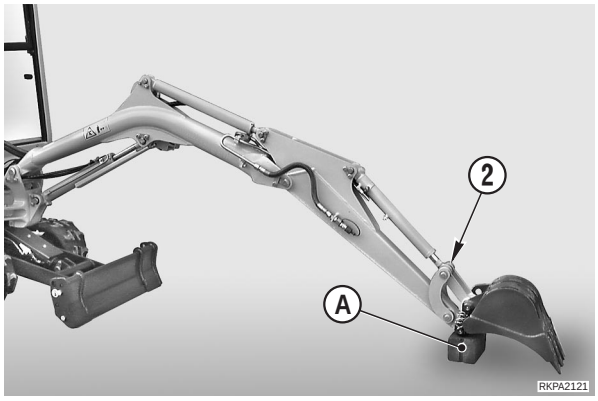
5 - Disconnect the hoses (4) and plug them. Also plug the holes in the cylinder to prevent the entry of impurities.

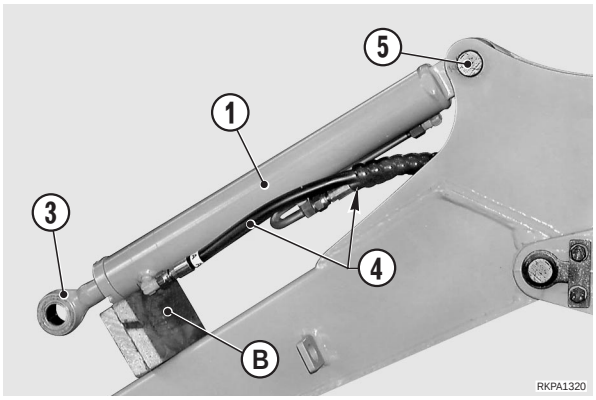
6 - Put a sling round the cylinder (1).

7 - Remove the pin (5). ※2 ※3 ※4

8 - Remove the cylinder (1).

kg Bucket cylinder: 9 kg (19.8 lb.)





INSTALLATION OF THE BUCKET CYLINDER

- To install, reverse the removal procedure.

※1

★ Insert the shims on both sides of the piston rod.

※2

⚠ When aligning the positions between the hole and the pin, do not insert fingers in the holes to check alignment.

※3

Internal bushings: ASL800040

※4

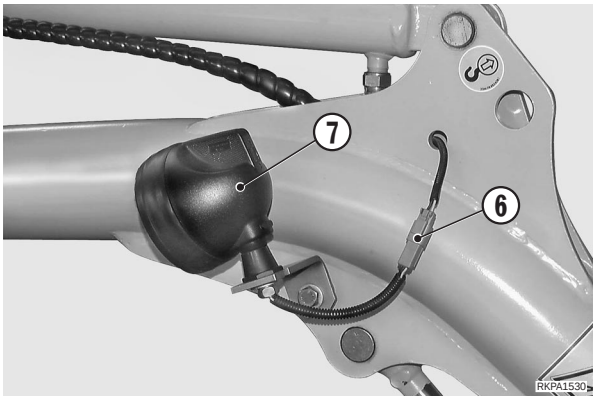
★ Insert the shims on both sides of the piston rod.

- Start the engine and bleed the air from the cylinder. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

★ After bleeding the air, check the oil level in the tank.

9 - Disconnect the connector (6) that supplies current to the working spotlight (7), and pull off the power supply cable to the boom.

10- Remove the working spotlight (7) complete with its bracket.



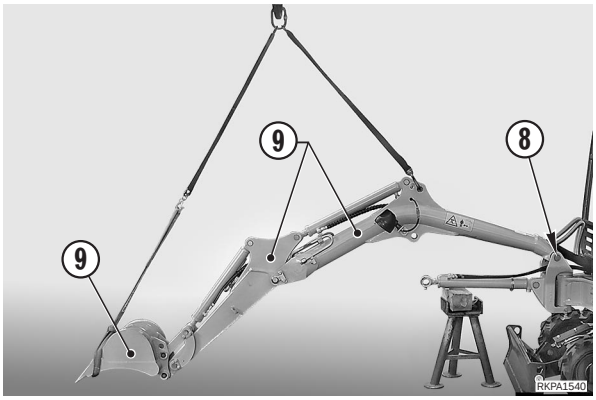
11 - Put a sling around the equipment and apply a slight tension to the cables.

★ Adjust the length of the cables to balance the load.

12 - Take away the pin (8). Remove the working equipment (9).

★ Check and make a note of the position of the shim. ※4

kg Working equipment: 160 kg (352.5 lb.)



INSTALLATION OF THE UPPER WORKING EQUIPMENT

- To install, reverse the removal procedure.

※1

★ Check the centering and the smooth movement of the protection (1).

Shoes and guides: ASL800050

※2

★ Insert shims on both sides of the piston rod.

※3

⚠ When aligning the positions between the hole and the pin, turn the engine over at low idling. Do not insert fingers in the holes to check alignment.

※4

★ Insert the shim.

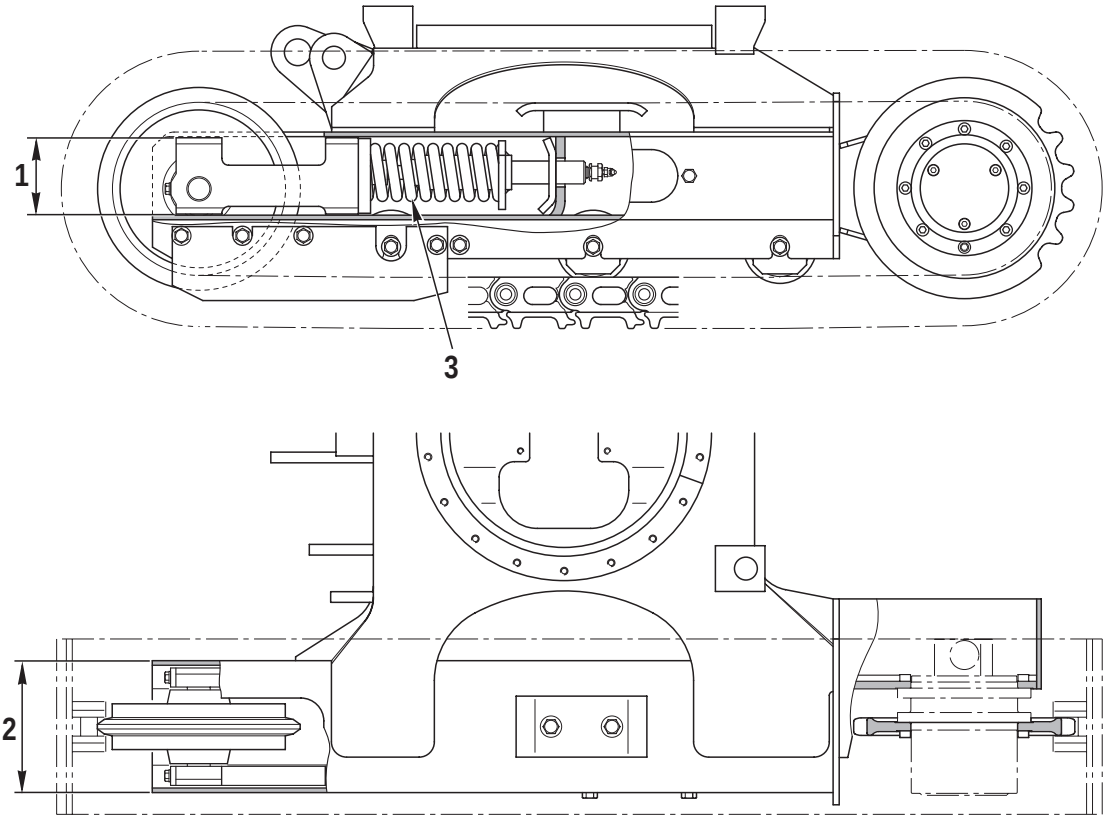
Internal bushings: ASL800040

Nm Pin screws: 63±6.5 Nm (46.4±4.8 lb.ft.)

- Start the engine to circulate the oil and bleed the air from the cylinder.

★ After bleeding the air, stop the engine and check the oil level in the tank.

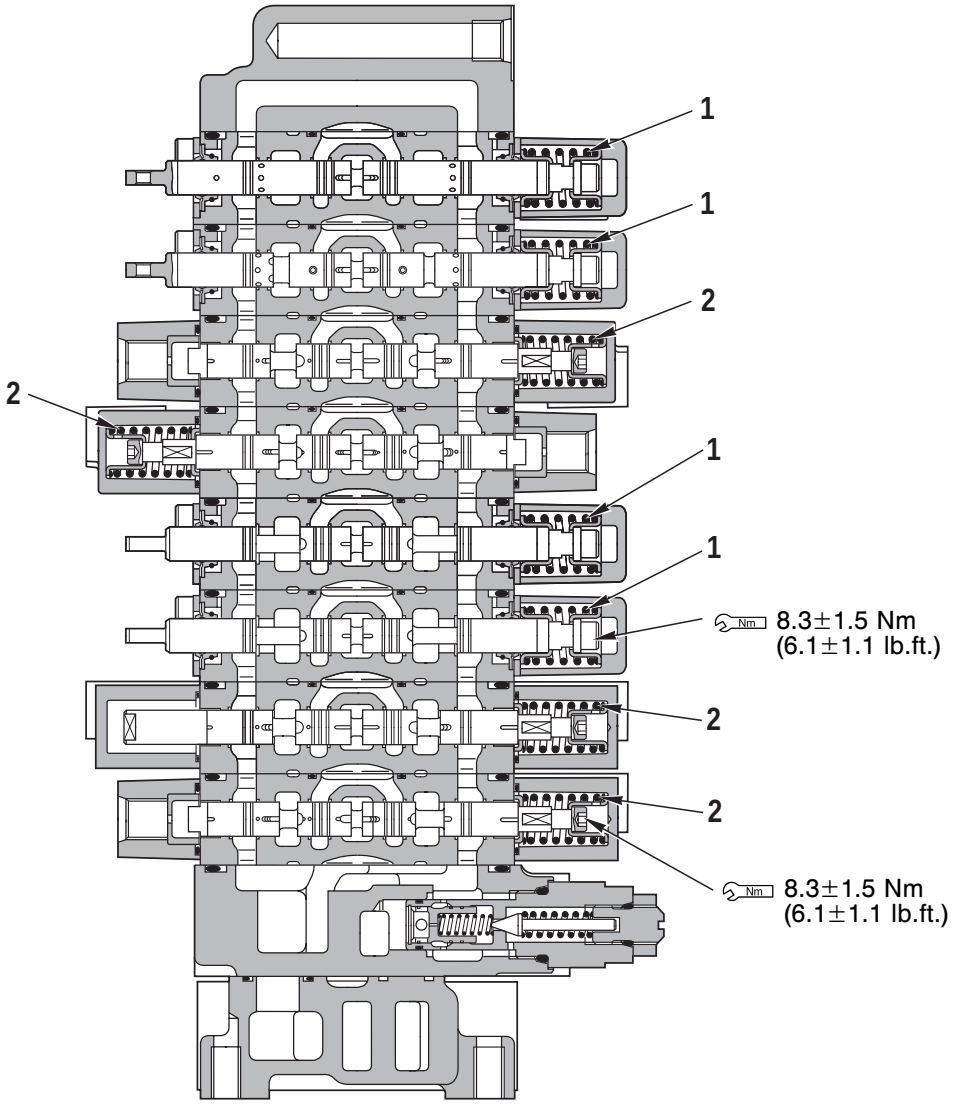
TRACK FRAME AND RECOIL SPRING



RKP02020

Unit: mm (in.)

No.	Check item	Criteria					Remedy
1	Vertical width of idler guide	Item		Standard size	Repair limit		Build up by welding
		Track frame		103 (4.058)	106 (4.176)		
		Idler support		100 (3.94)	93 (3.664)		Build up by welding or replace
2	Horizontal width of idler guide	Track frame		161 (6.343)	164 (6.462)		Build up by welding
		Idler support		158 (6.225)	155 (6.107)		Build up by welding or replace
3	Recoil spring	Standard size			Repair limit		Replace
		Free length	Preloaded length	Installed load	Free length	Installed load	
		200 (7.88)	168 (6.62)	6865 N (700 kg)	195.6 (7.706)	5997 N (611.5 kg)	



Section B - B

RKP00211

Unit: mm (in.)

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Spool return spring (travel, blade, boom swing)	Free length x Ø.D.	Installed length	Installed load	Free length	Installed load	When damage or deformation is found, replace the spring
		46.2x20 (1.82x0.788)	25.4 (1)	98 N (10 kg)	—	78.4 N (8 kg)	
2	Spool return spring (arm, swing, boom, bucket)	29x17.5 (1.142x0.69)	28.5 (1.123)	22.6 N (2.3 kg)	—	18.1 N (1.84 kg)	