

Shop Manual

PC35R-8 PC45R-8

HYDRAULIC EXCAVATOR

SERIAL NUMBERS PC35R-8 - F20518 and up
PC45R-8 - F20666

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STANDARD TIGHTENING TORQUE



STANDARD TIGHTENING TORQUE

The following charts give the standard tightening torques of bolts and nuts. Exceptions are given in sections of «Dis-assembly and Assembly».

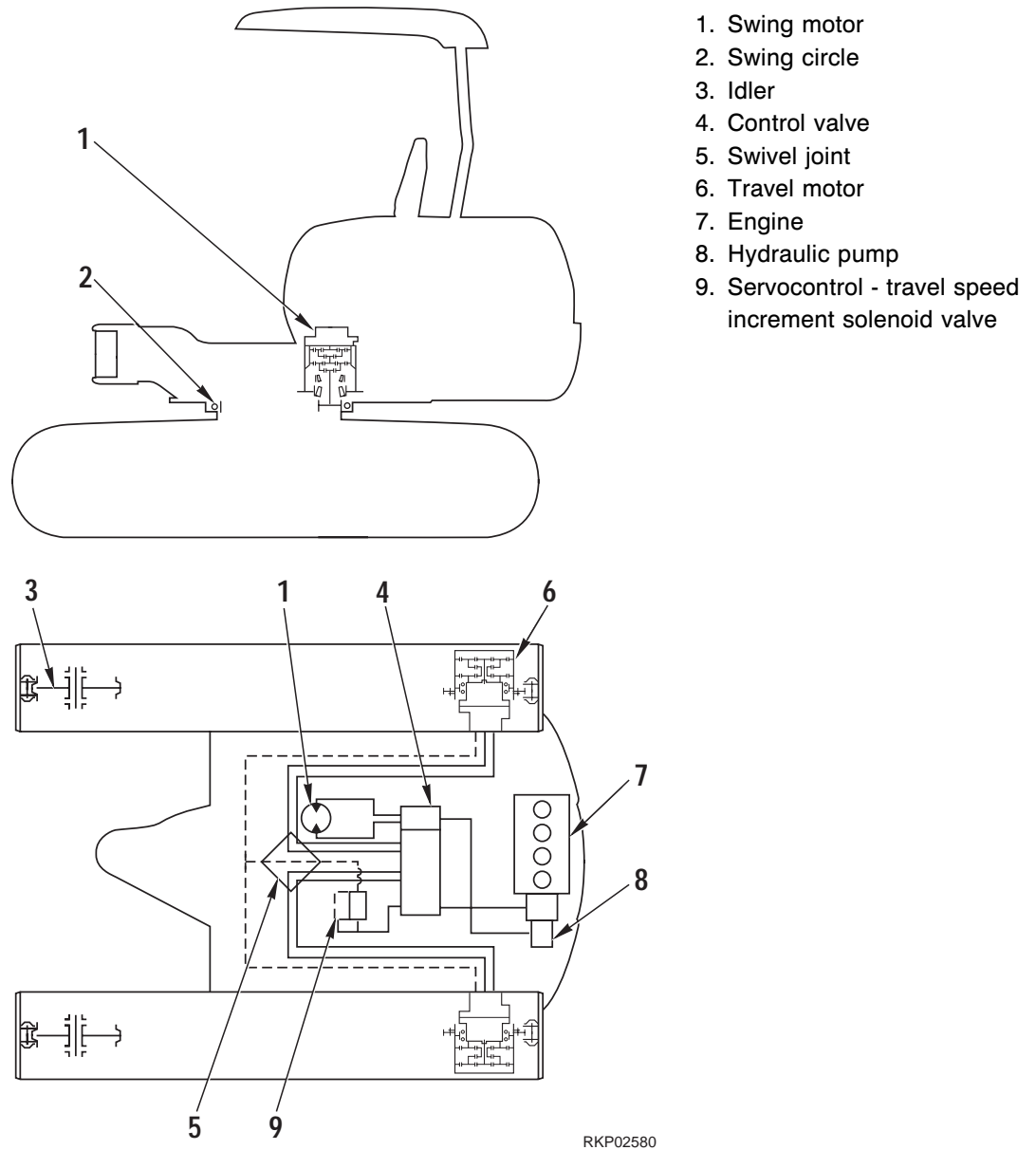
1. STANDARD TIGHTENING TORQUE OF BOLTS AND NUT

Thread diameter of bolts (mm)	Pitch of bolts (mm)	Width across flat (mm)		8.8			10.9		
				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.)

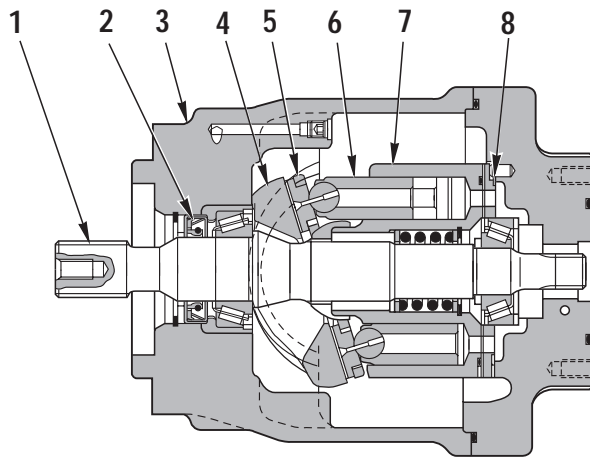
POWER TRAIN



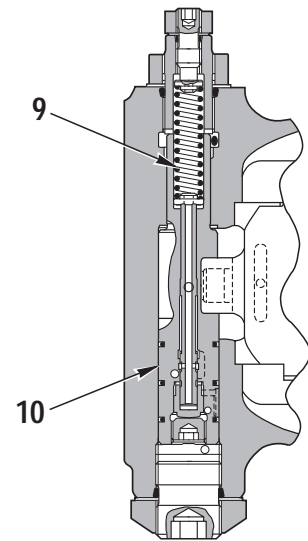
DESCRIPTION

The mechanical power from engine (7) is converted to hydraulic power by hydraulic pump (8). This hydraulic power is divided by control valve (4) according to the purpose. it is converted back to mechanical power by hydraulic motor (1), travel motor (6), or the hydraulic cylinders of each piece of work equipment, and is used to operate the travel, swing and work equipment.

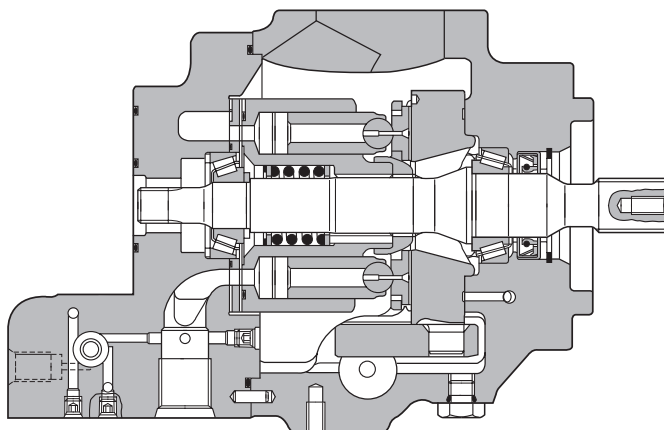
1. MAIN PUMP



Section A - A



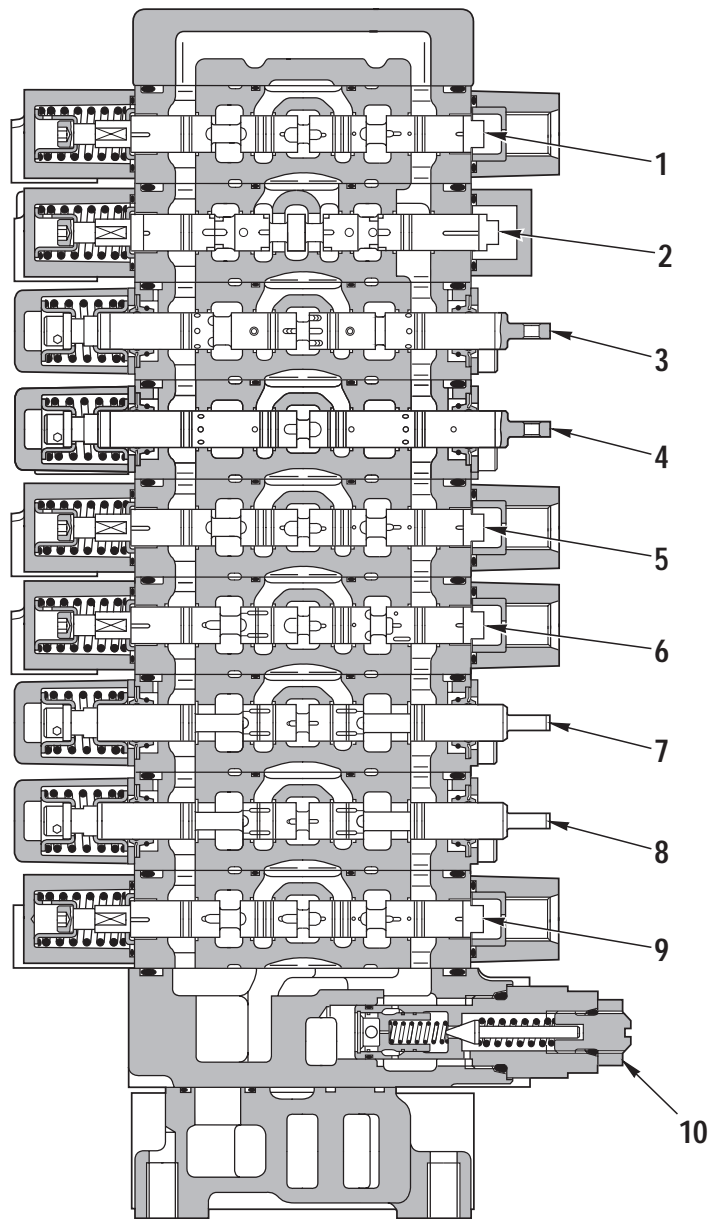
Section C - C



Section B - B

RKP02090

- 1. Shaft
- 2. Oil seal
- 3. Case
- 4. Swash plate
- 5. Shoe
- 6. Piston
- 7. Cylinder lock
- 8. Valve plate
- 9. Spring
- 10. Servo piston

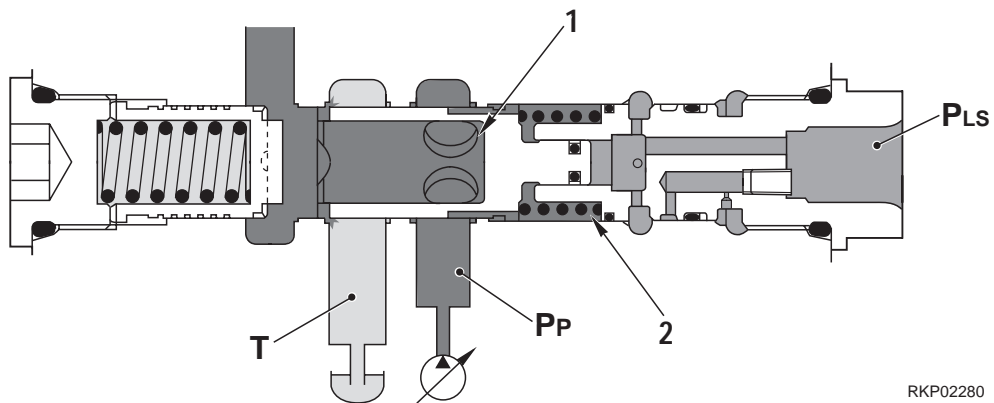


Section B - B

RKP02370

1. Spool (Attachment)
2. Spool (Swing)
3. Spool (Blade)
4. Spool (Boom swing)
5. Spool (Bucket)
6. Spool (Boom)
7. Spool (R.H. travel)
8. Spool (L.H. travel)
9. Spool (Arm)
10. Main relief valve

- 2) During fine control of the control valve, when the demand flow for the actuator is within the amount discharged by the minimum swash plate angle of the pump, pump discharge pressure P_P is set to $P_{LS} + 34.3$ bar (497.5 psi). When the difference pressure between pump discharge pressure P_P and LS pressure P_{LS} reaches the load of spring (2) (34.3 bar (497.5 psi)), The unload valve opens, so ΔP_{LS} becomes 34.3 bar (497.5 psi).



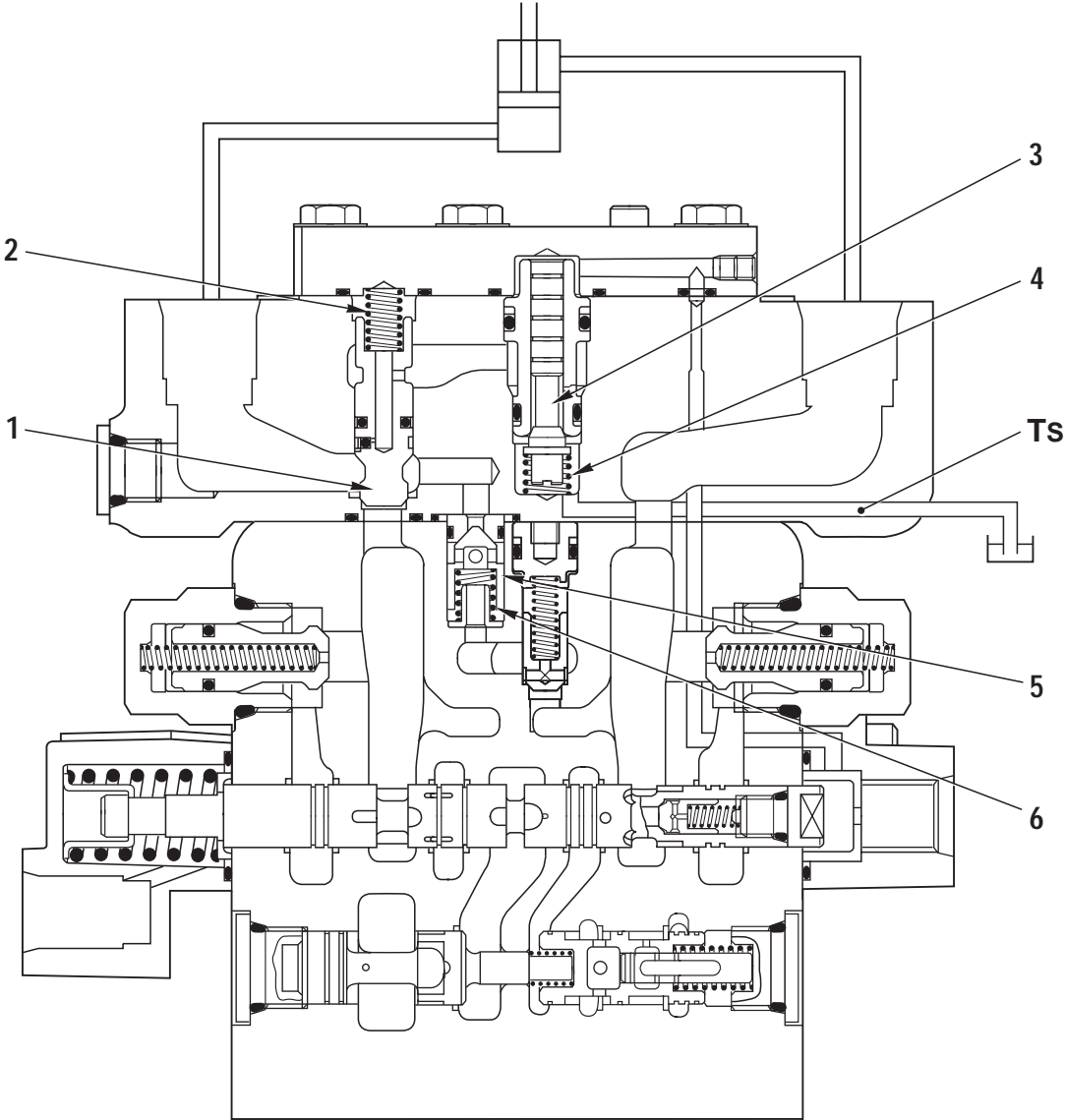
RKP02280

OPERATION

During fine control of control valve

- When fine control is carried out on the control valve, LS pressure P_{LS} is generated and acts on area S_3 at the right end of spool (1). When this happens, the area of the opening of the control valve spool is small, so there is a big difference between LS pressure P_{LS} and pump discharge pressure P_P .
- When the difference in pressure between pump discharge pressure P_P and LS pressure P_{LS} reaches the load of spring (2), spool (1) moves to the right, and pump circuit P_P and tank circuit T are connected.
- In other words, pump discharge pressure P_P is set to a pressure equal to the force of spring (2) (34.3 bar (497.5 psi) + LS pressure P_{LS} , and LS differential pressure ΔP_{LS} becomes 34.3 bar (497.5 psi).

8. Boom holding valve

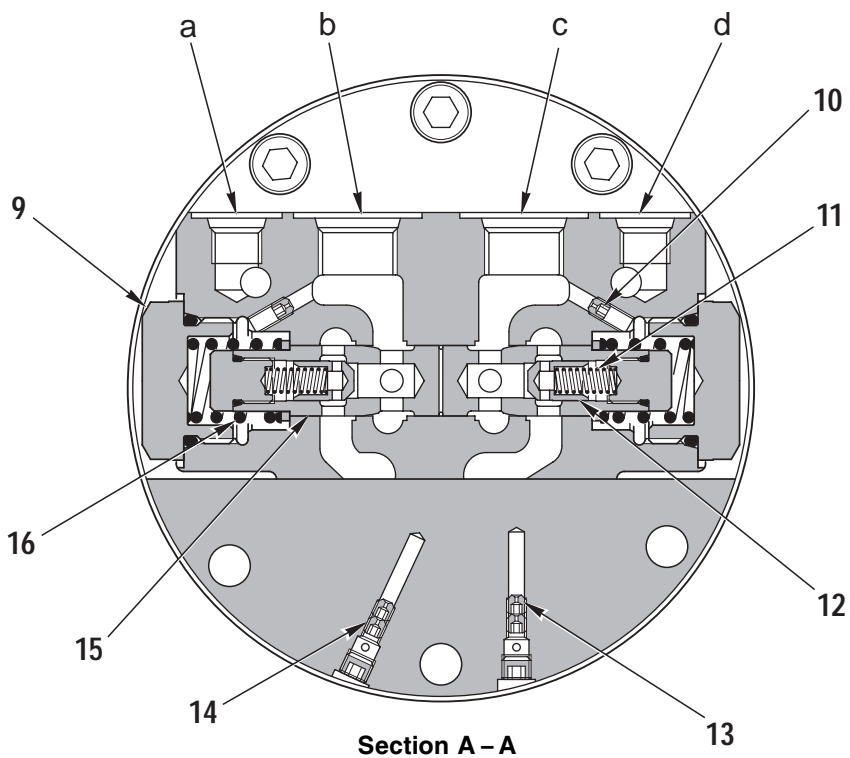
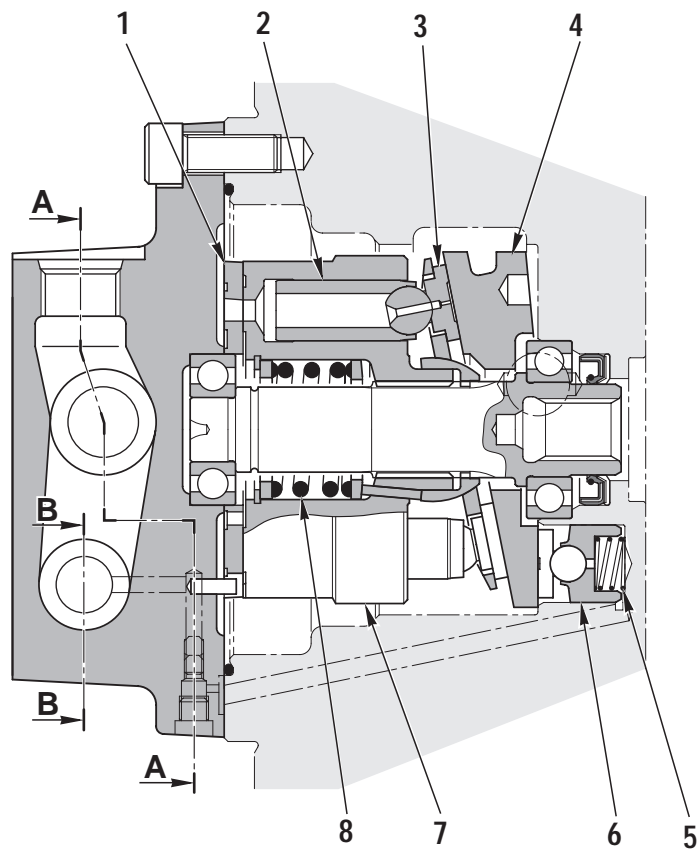


RKP02160

- 1. Poppet
- 2. Poppet spring
- 3. Pilot spool
- 4. Pilot spring
- 5. Check valve
- 6. Check valve spring

TRAVEL MOTOR

PC35R



Section A - A

RKP02600

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)

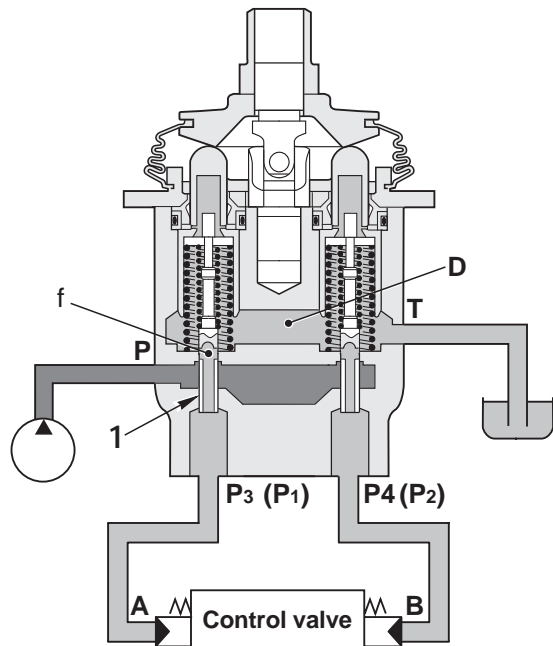


FIG. 1

RKP01091

2. During fine control (NEUTRAL → fine control)

When piston (4) starts to be pushed by disc (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 **PP**, 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 **PP**.

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 **PP**) 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)

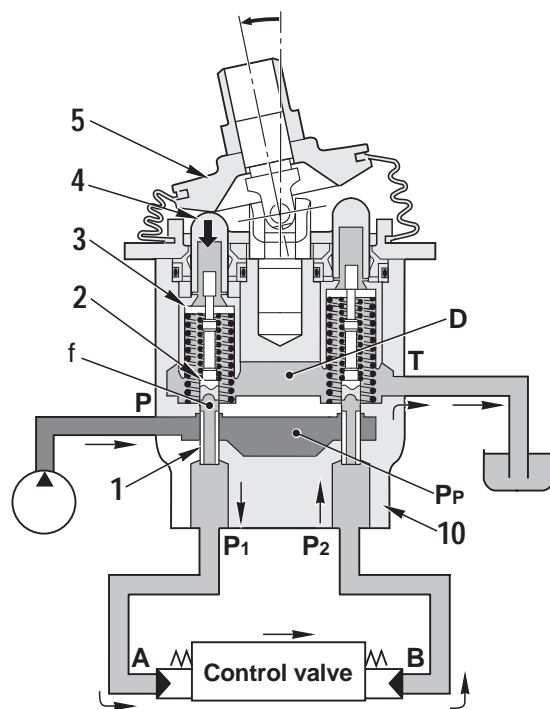






FIG. 2

RKP01101

20 TESTING AND ADJUSTMENTS

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Adjustment of the rubber pad and safety microswitch for servo-control engagement	37		

-  When carrying out controls, adjustments or analyses for troubleshooting, park the machine on firm, level ground. Apply all the machine safety devices and use blocks to prevent any machine movement.
-  When more than one person is engaged in the work, use the prescribed notices that indicate that the machine is undergoing maintenance. Do not allow any unauthorised persons to remain in the vicinity.
-  When checking the level of the cooling liquid, wait until this liquid has cooled. If the radiator cap is removed while the liquid is still hot and under pressure, it may cause severe burns.
-  Take great care not to get entangled in moving parts (fan, alternator belt or any of the rotating elements).

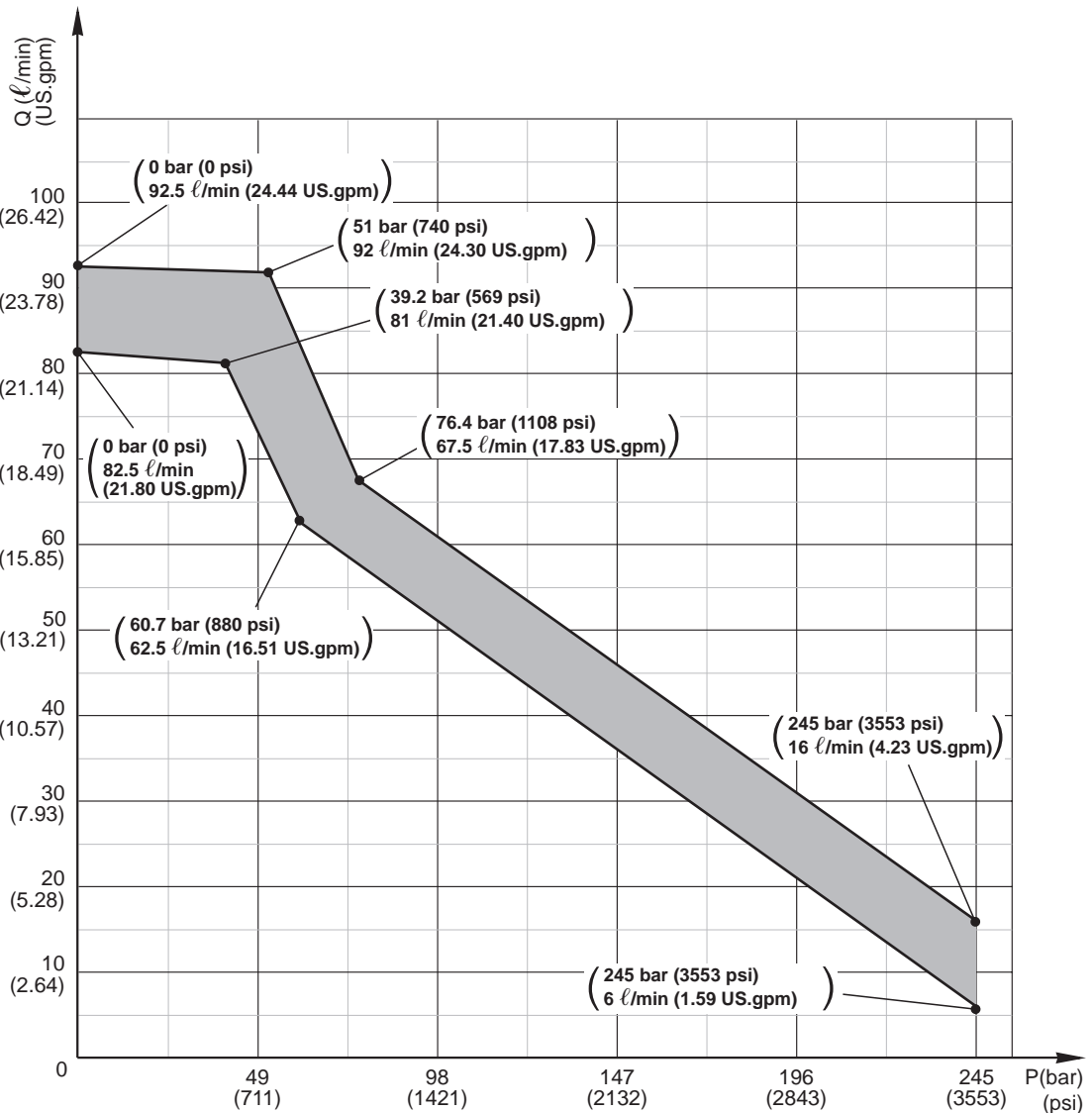
● FOR THE MACHINE

PC45R-8					
Standard value	Permissible value				
—	—				
35	30 – 40				
22	18 – 26				
25.5 (26.3)	21 – 30 (22 – 31)				
15.5 (16.0)	12 – 19 (12.5 – 19.5)				
Max. 500 (Max. 19.7)	Max. 550 (Max. 21.67)				
Max. 300 (Max. 11.82)	Max. 330 (Max. 13.002)				

Classification

- Delivery piston pump P1
- Pump speed: 2500 rpm
- Hydraulic oil temperature: 45 – 55°C (113 – 131°F)
- Gear pump P2: at max. pressure

Pump characteristics



RKP06722

- ★ When measuring deliveries with the pumps mounted on the machine, it is difficult to use the accelerator to count the precise number of revs needed for this test. Make delivery measurements with the engine running at a speed close to the test speed and then make a proportional calculation.

Example:

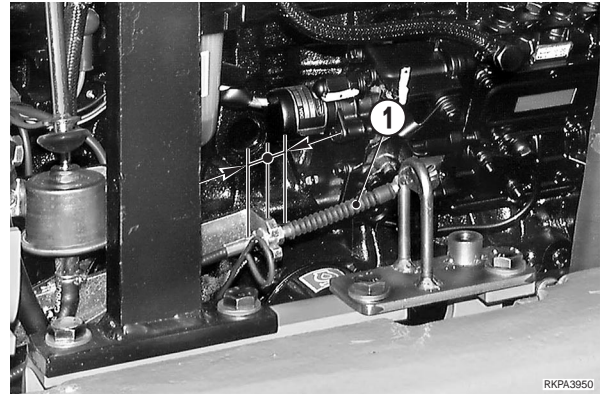
MEASUREMENT

- Engine speed: 2450 rpm
- Delivery: 42 l/min (11.1 US.gpm)

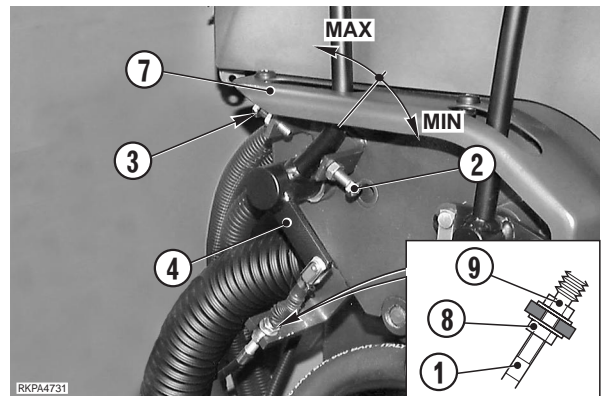
PROPORTIONAL DELIVERY AT 2500 rpm
 $(42 \times 2500) / 2450 = 42.8$ l/min (11.3 US.gpm)

CONTROL AND ADJUSTMENT OF THE ACCELERATOR STROKE

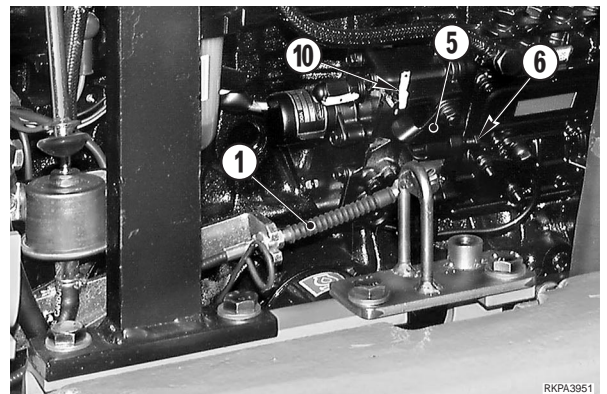
- ★ Test conditions:
 - Engine: switched off.
 - Working equipment: resting on the ground.
- ★ If the sheathing (1) is to be substituted, before proceeding with the adjustments, secure the pump side of the sheathing (1) in the intermediate position.



- 1 - Loosen the screws (2) and (3) by a few turns.
- 2 - Push the accelerator control lever (4) to the end of its stroke, in the minimum position, until the lever (5) rests against the minimum-adjustment screw (6).
 - ★ If the lever (4) touches the housing (7), loosen the inside nut (8) and tighten the nut (9) sufficiently to bring the lever back to a distance of 3 - 4 mm (0.118 - 0.158 in.) from the edge of the housing (7).
- 3 - Tighten the screw (2) until it is 0.1 mm (0.004 in.) from the lever (4) and tighten the lock-nut.



- 4 - Push the accelerator control lever (4) to the end of its stroke in the maximum position, until the lever (5) rests against the maximum-adjustment screw (10).
- 5 - Tighten the screw (3) until it is 0.1 mm (0.004 in.) from the lever (4) and then tighten the lock-nut.



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Valve adjustment

★ The unloading valve cannot be re-adjusted, only substituted.

1. Adjustment of the main relief valve


If the pressures measured for the working equipment and machine travel do not fall within normal values, adjust the main relief valve (1) as follows:

2 - Loosen the lock nut (2) and rotate the adjusting screw (3).

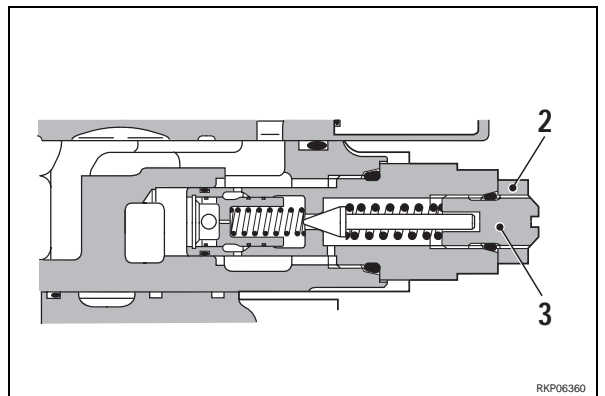
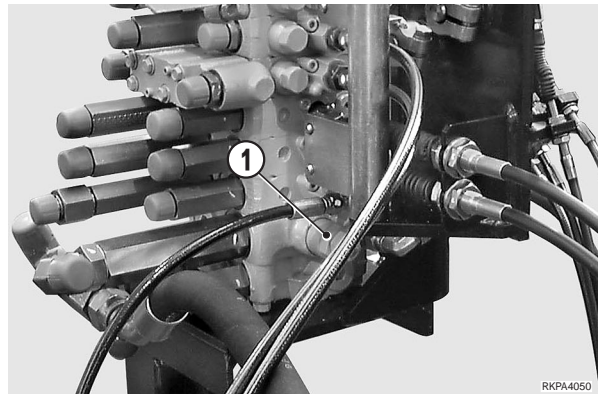
- To INCREASE pressure, turn in a CLOCKWISE direction.
- To DECREASE pressure, turn in a COUNTER-CLOCKWISE direction.

★ Each turn of the adjusting screw (3) varies the pressure by about 125 bar (1820 psi).


3 - Lock the nut (2).

 Nut: 69±10 Nm (50.8±7.4 lb.ft.)

★ After adjustment, check the adjustment of the main relief valve with the same procedures as used for the measurements.



2. Adjustment of the safety valve of the swing motor

 Do not calibrate the valves when the circuits are under pressure.

★ To perform these adjustments, follow the procedures described in the calibration control section.


If the pressures measured for the swings to the right and to the left do not come within the normal values, adjust the safety valve (1) of the swing motor as follows:

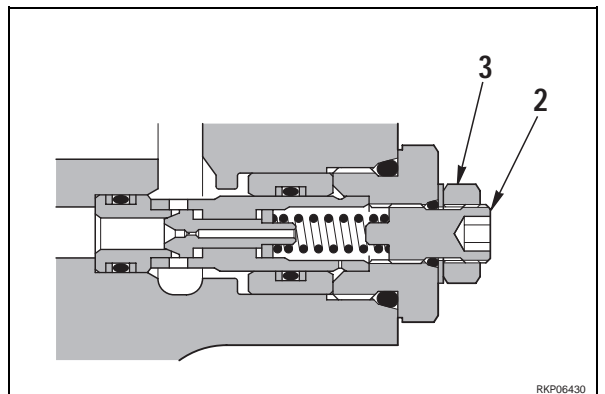
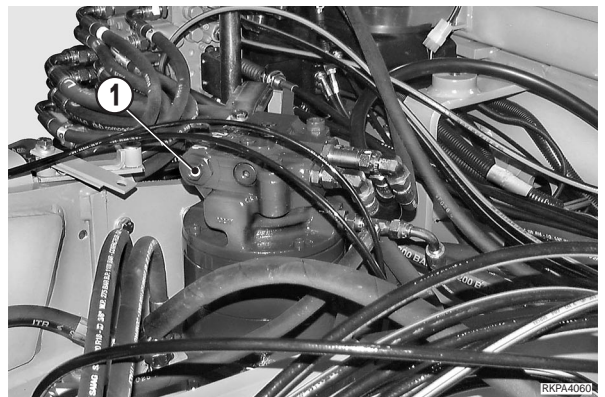
1 - Loosen the lock nut (2) and turn the adjusting screw (3).

- To INCREASE pressure, turn in a CLOCKWISE direction.
- To DECREASE pressure, turn in a COUNTER-CLOCKWISE direction.

★ Each turn of the adjusting screw (3) varies the pressure by about 100 bar (1450 psi).

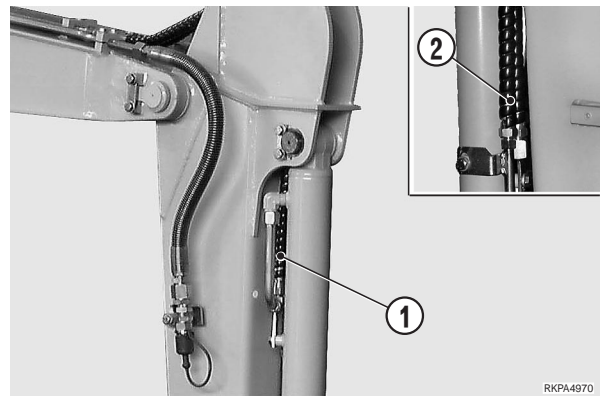
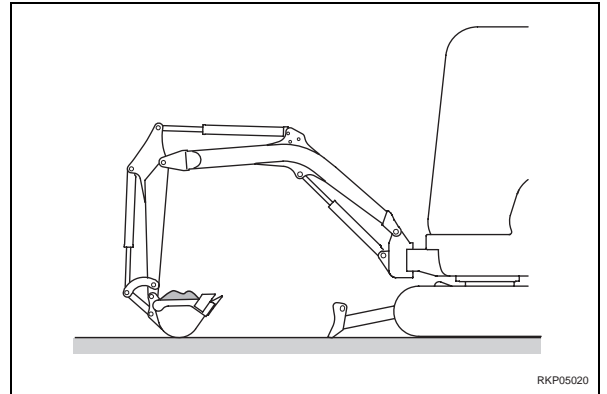
2 - Lock the nut (2).

 Nut: 8.8±1 Nm (6.5±0.74 lb.ft.)

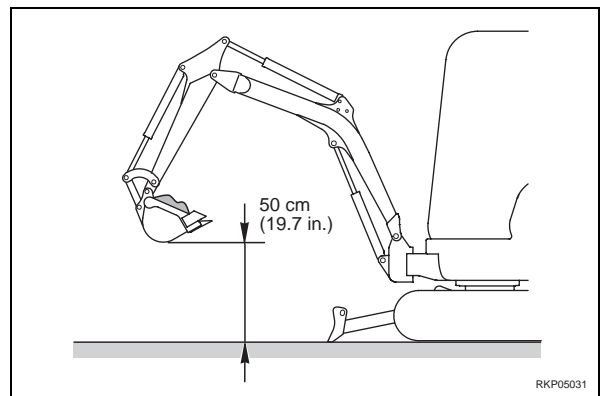


3. Bucket test

- 1 - Position the machine with the arm vertical and the bucket resting on the ground in a horizontal position. Put a weight in the bucket, or fill it with earth.
- 2 - Stop the engine and release the residual hydraulic pressures.
- 3 - Disconnect the bucket cylinder hoses (1) and (2) and plug them to prevent the entry of impurities.
- 4 - Plug the hole of the bucket cylinder on the base side and attach a provisional tube on the head side to catch any oil leakages.



- 5 - Start the engine and raise the boom.
- 6 - Stop the engine and check the position of the bucket for 15 minutes.
 - If the bucket makes an opening movement the drift is due to the cylinder gaskets.
 - If the bucket does not move, the drift is due to the control valve.




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REMOVAL OF WATER COOLANT PUMP

! Disconnect the negative terminal cable (-) from the battery.

★ Drain the engine coolant.

 Coolant: approx. 8 ℓ (2.2 US.gall)

※ 1

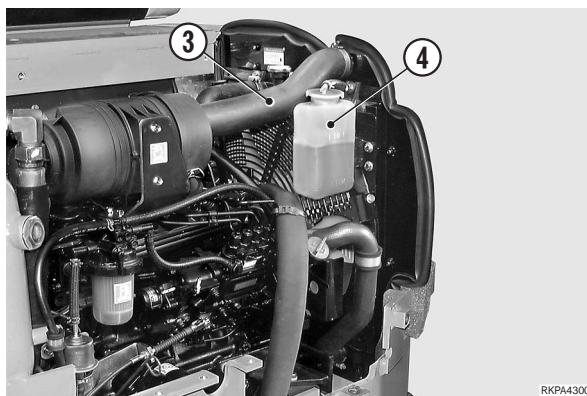
1 - Remove the engine hood (1) and R.H. lateral counterweight (2).

 R.H. lateral counterweight: 45 kg (99 lb.) ※ 2



RKPA4290

2 - Disconnect the air intake tube (3) and remove the coolant tank (4).



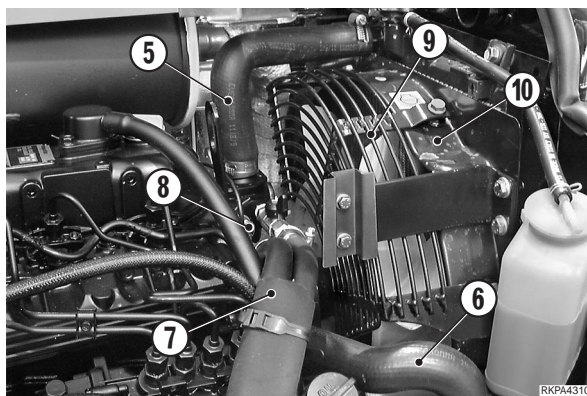
RKPA4300

3 - Disconnect the tube (5) and (6).

★ **Only for cabin version.** Disconnect the heating circuit tube (7).

4 - Disconnect the connectors (8).

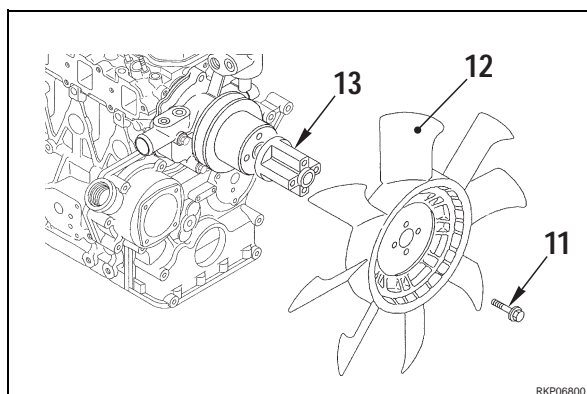
5 - Remove from the radiator the fan cover (9) and disconnect the fan-cooling conveyor (10).



RKPA4310

6 - Loosen the screws (11), remove the cooling fan (12) and the spacer (13). Take out the fan-cooling conveyor (10).

Loosen the alternator drive belt and disengage the pulley of the water pump. ※ 3



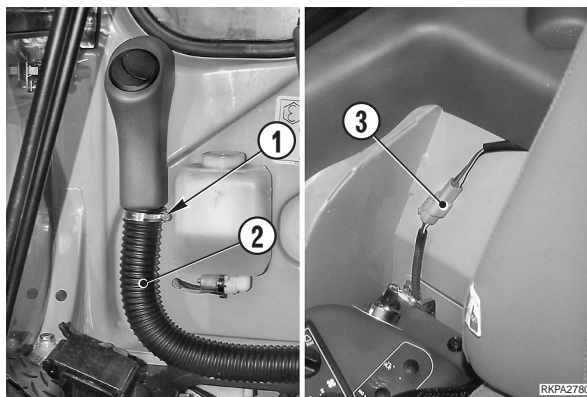
RKP06800

REMOVAL OF CAB

! Completely lower the working equipment until it is resting on the ground and stop the engine and take out the ignition key.

1 - Loosen the clamp (1) and disconnect the heating pipe (2).

2 - Remove the cover (3).



3 - Attach the cab (4) to some hoisting tackle.

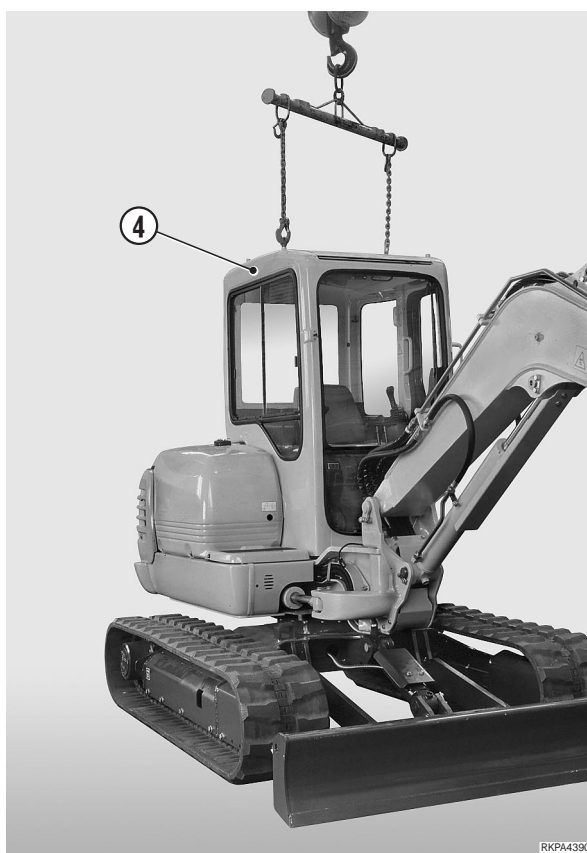
4 - Loosen the cab lock crews (No. 10).



5 - Take out the cab (4).



Cab: 208 kg (458.2 lb.)



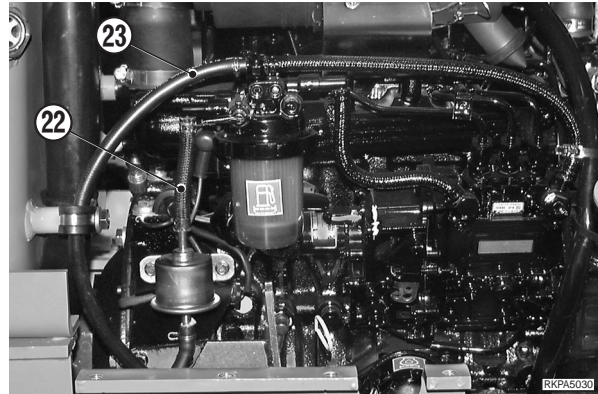
INSTALLATION OF CAB

• To install, reverse the removal procedure.

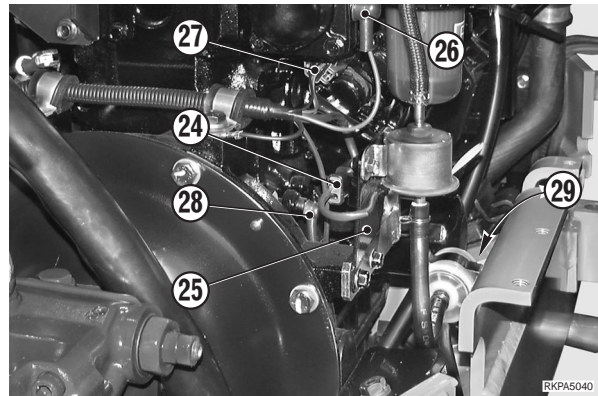


Screw: Nm (..... lb.ft.)

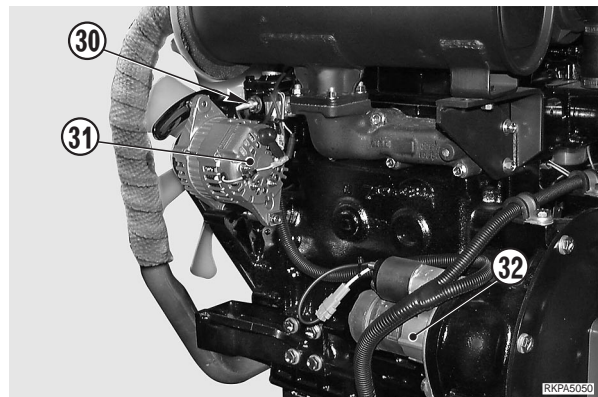
- 15 - Disconnect the fuel delivery tube (22) and fuel return tube (23).
- 16 - Disconnect the control accelerator cable. ※ 1
- 17 - Disconnect the connector (24).
- 18 - Disconnect the support (25) and move away it from the engine.



- 19 - Disconnect the pre-heater wiring (26), the engine stop connector (27) and the oil pressure connector (28).
- 20 - Disconnect the ground (29).

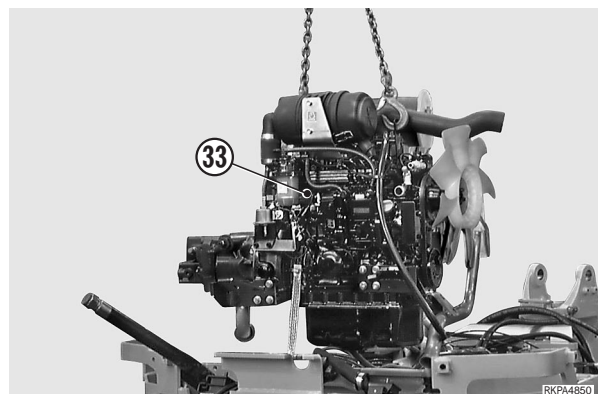


- 21 - Disconnect the water temperature connectors (30).
- 22 - Disconnect the alternator connector (31) and starting motor connector (32).

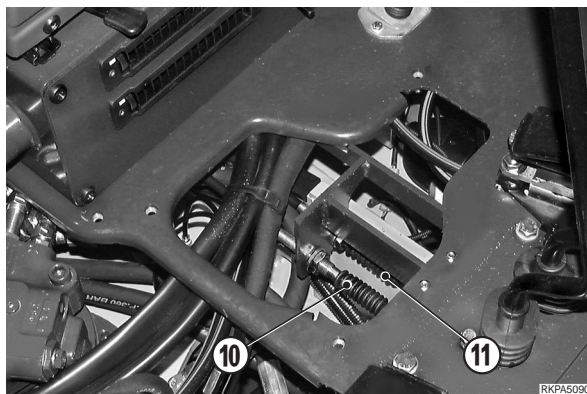


- 23 - Attach the engine hoisting hook to some hoisting tackle and apply a slight tension to the cable.
- 24 - Take out the nuts (33) and the four washers, raise the engine slowly and lift it out. ※ 2
- ★ Check that the motor swings completely free while it is being raised, and that no other parts are damaged.

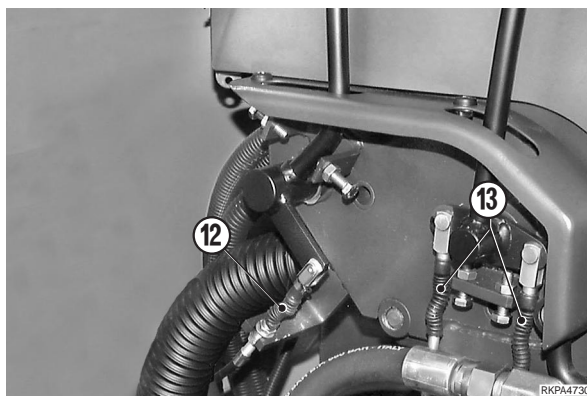
kg Engine -pump group: PC35R: 210 kg (463 lb.)
PC45R: 260 kg (573 lb.)



7 - Disconnect the cables (10) and (11) of travel command. ※2



8 - Disconnect the cables (12) and (13) of accelerator and blade command. ※3

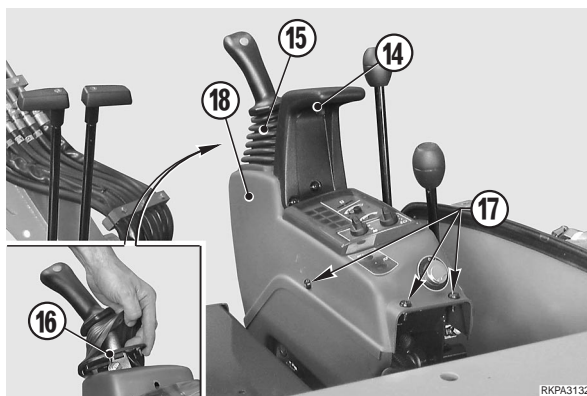


9 - Take off the arm-rest (14).

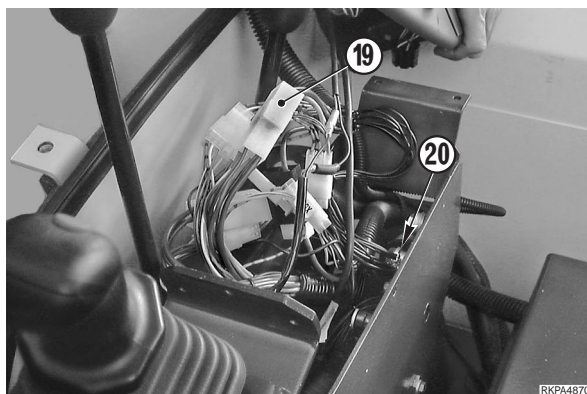
10 - Disconnect cup (15).

★ Take great care not to damage the frame (16).

11 - Take out the screws (17) overturn the cover (18) toward engine hood.



12- Disconnect the connectors (19) and ground cables (20).




REMOVAL OF STEEL TRACK-SHOES

1 - Rotate the track-shoe until the connecting pin (1) is above the horizontal axis of the idler (2).

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

※ 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 - Using the tool **A1**, remove the connecting pin (1).

★ First remove the safety cotter-pin.

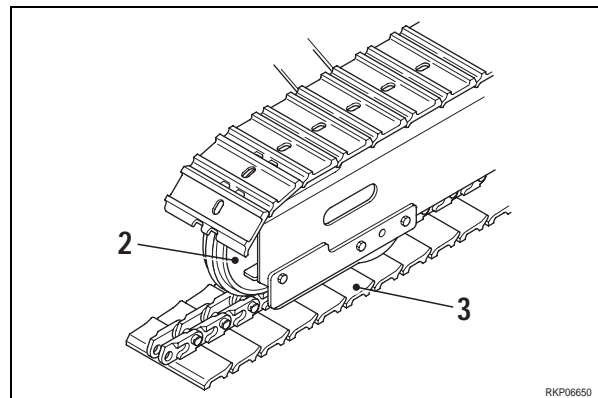
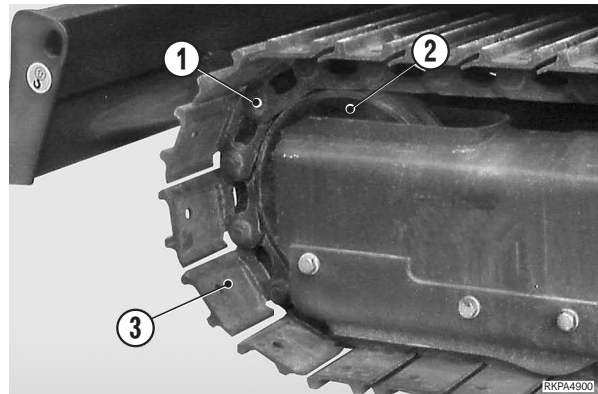
★ While dismantling the track-shoe, support the part of the track-shoe that is wound round the idler with a block placed under the shoe-ribbing. Once the track shoe has been unfastened, lay it on the ground.

4 - Keeping the horizontal end-piece of the track-shoe raised, move the machine in order to remove the track-shoe (3) and lay it on the ground.

5 - Push down with the boom in order to raise the lower track-frame and pull out the track-shoe (3).



Track-shoe: PC35R: 180 kg (367 lb.)
PC45R: 294 kg (648 lb.)



INSTALLATION OF STEEL TRACK-SHOES

• To install, reverse the removal procedure.

※ 1

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

※ 2

1 - Rotate the turret 90° towards the side on which the track-shoe is to be installed. Push down with the boom to raise the lower track-frame.

2 - Arrange the track-shoe on the ground beneath the bottom rollers. Lower the track-frame.

3 - Attach the first articulated joint of the sprocket wheel and move the machine forwards until the articulated joint is close to the sprocket wheel.

4 - Keeping the track-shoe raised, travel in order to bring the end-piece above the idler.

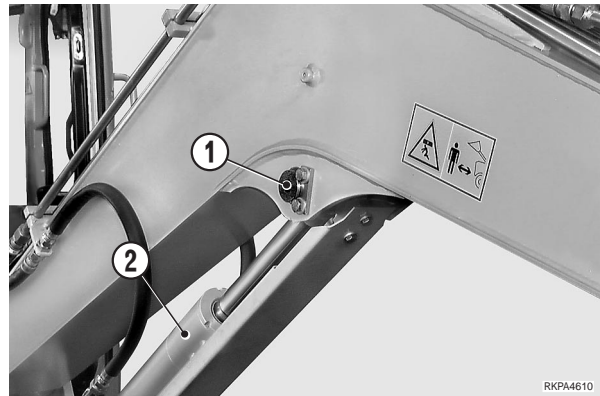
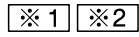
5 - Install the connecting-pin using the tool **A1**.

6 - Install the safety cotter pin.

REMOVAL OF BOOM CYLINDER

! Fully extend the arm and open the bucket completely. Lower the equipment until it rests on the ground.

1 - Remove the pin (1).



2 - Lower the cylinder (2) until it rests on a stand «A».

3 - Start the engine to retract the piston (3).

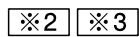
★ Bind the piston rod with wire to secure the fully retracted position.

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

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



6 - Remove the pin (5).

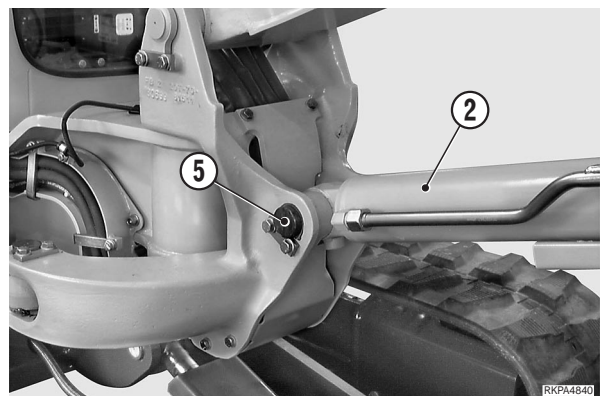
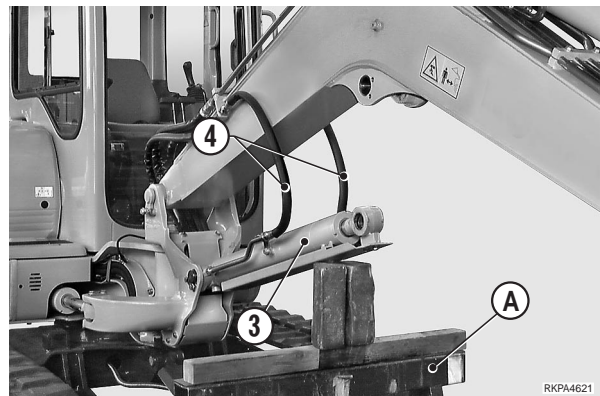


7 - Remove the cylinder (2).



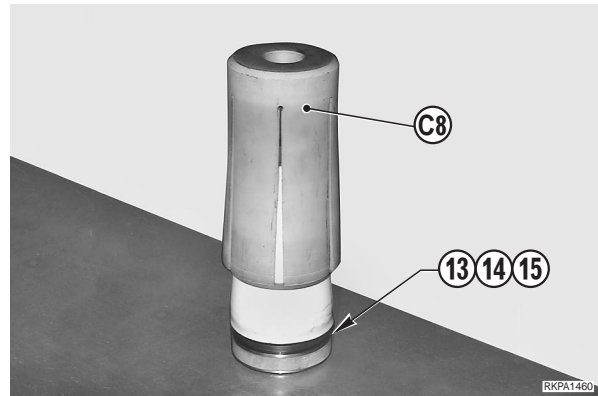
Boom cylinder: PC35R: 30 kg (66 lb.)

PC45R: 40.5 kg (89.2 lb.)



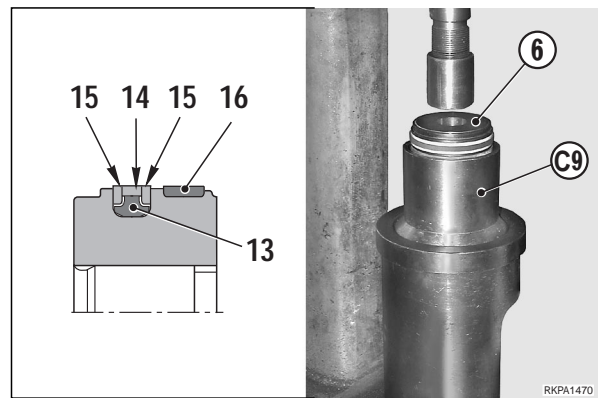
2. Piston assembly

1 - Using the tool **C8**, mount the piston seal. Mount in sequence the rubber ring (13), the outer seal (14) and the anti-extrusion rings (15).



2 - Mount the guide ring (16).

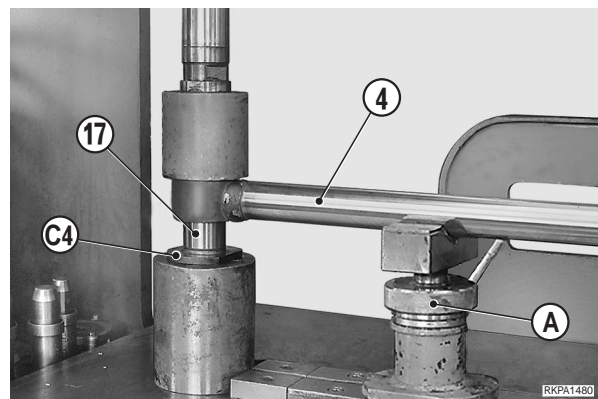
3 - Calibrate the diameter of the gasket (14) of the piston (6), mounting the group beneath the press and using the calibrating ring **C9** adapted to fit the piston diameter.



3. Piston rod group assembly

1 - Using a press and the tool **C4** adapted to the diameter, insert the bushing (17) into the piston rod (4).

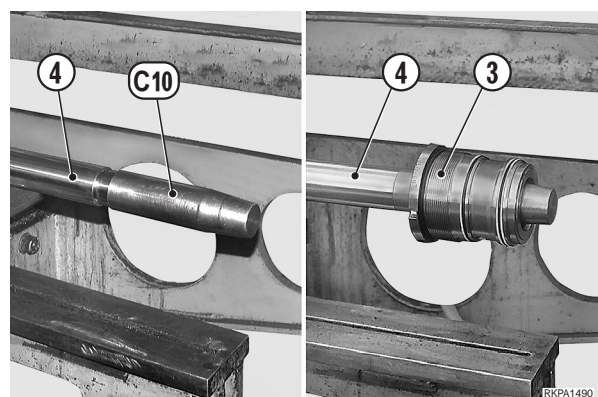
2 - Insert the support «A» beneath the piston rod.



3 - Mount the pilot boss **C10** adapted to the diameter onto the extremity of the piston rod.

4 - Slide the head (3) onto the piston rod (4).

5 - Remove the pilot boss **C10** from the extremity of the piston rod.



INSTALLATION OF THE BOOM

- To install, reverse the removal procedure.

※1

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



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.



Internal bushings: ASL800050

※2



Internal bushings: ASL800040

- ★ Insert the shims on both sides of the arm.

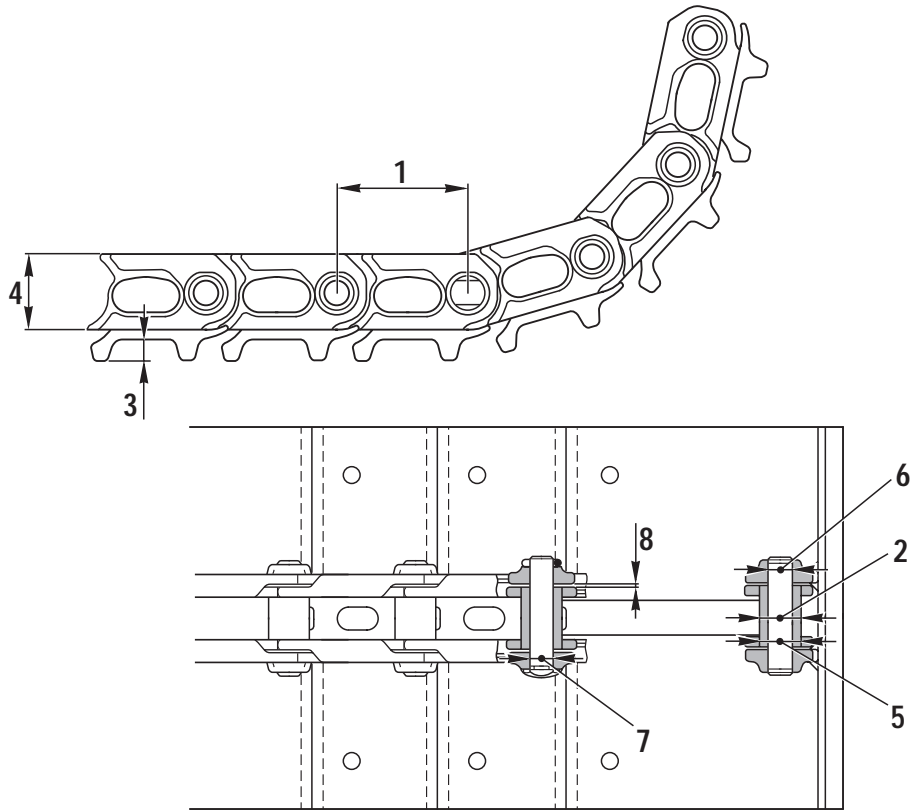


When aligning the positions between the hole and the pin, do not insert fingers in the holes to check alignment.

- 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.

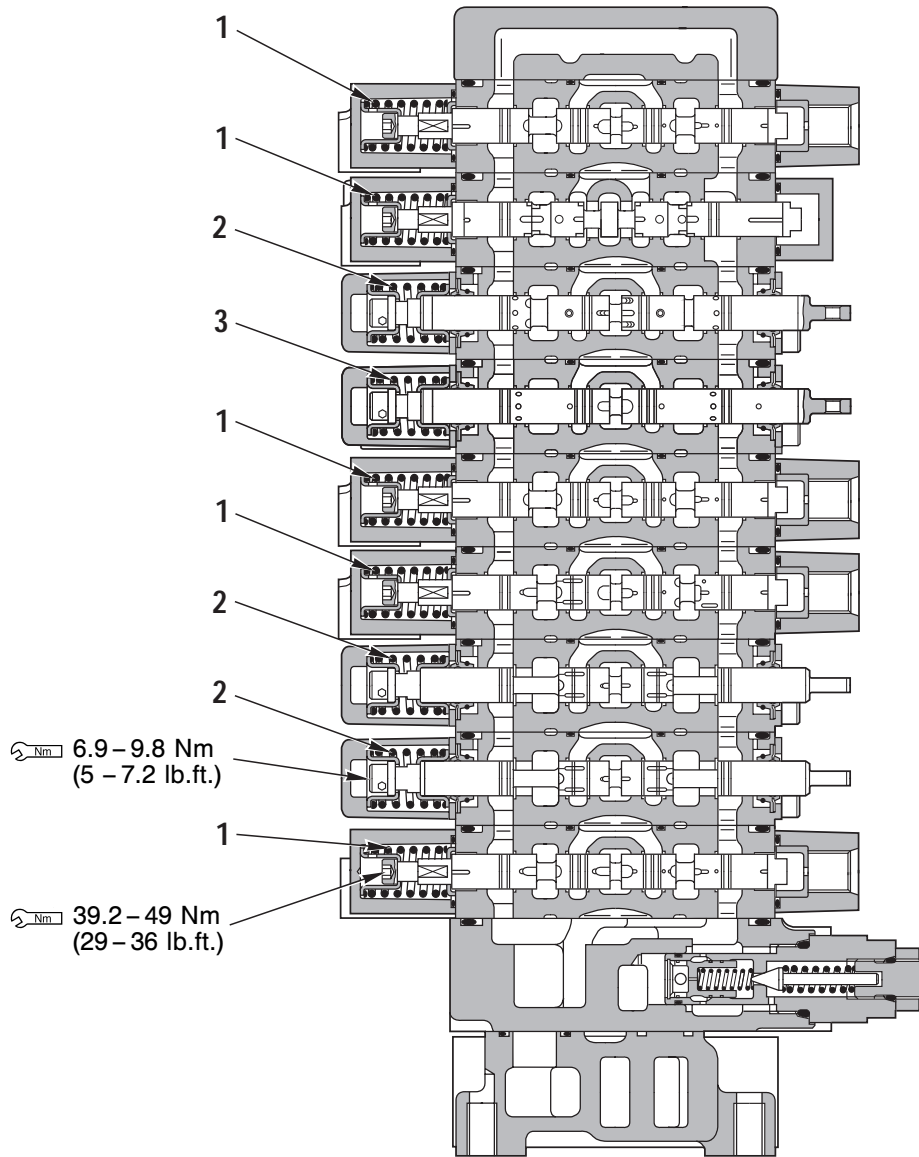
STEEL SHOE

PC35R



Unit: mm (in.)

No.	Check item	Criteria				Remedy
		Standard size	Tolerance		Repair limit	
1	Link pitch	101.6 (4.003)			—	Rotate pin or replace
					104 (4.098)	Replace
2	Outer diameter of bushing	32 (1.261)			30 (1.182)	Rotate bushing or replace
					28 (1.103)	Replace
3	Grouser height	16.5 (0.65)			8.5 (0.335)	Build up by welding or replace
4	Link height	61 (2.403)			5 (0.197)	
5	Interference between regular pin and link	Standard size 32 (1.261)	Tolerance		Standard interference 0.07 (0.028)	Interference limit 0.22 (0.0087)
			Shaft	Hole		
6	Interference between pin and link	19 (0.749)	+0.22	0	0.07 (0.028)	0.15 (0.0059)
			+0.12 (+0.0087 +0.0047)	+0.05 (0 +0.0020)		
7	Interference between master pin and link	19 (0.749)	-0.02	0	0.02 (0.0008)	0.12 (0.0047)
			-0.07 (-0.0008 -0.0028)	+0.05 (0 +0.0020)		
8	Clearance between link joint faces	Standard size		Clearance limit		
		0.6 (0.024)		1.2 (0.047)		



Section B – B

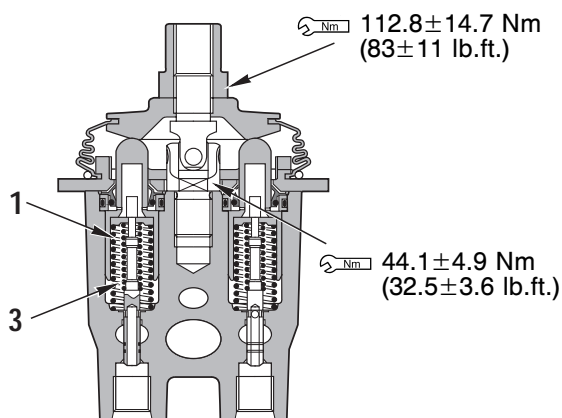
RKP02690

Unit: mm (in.)

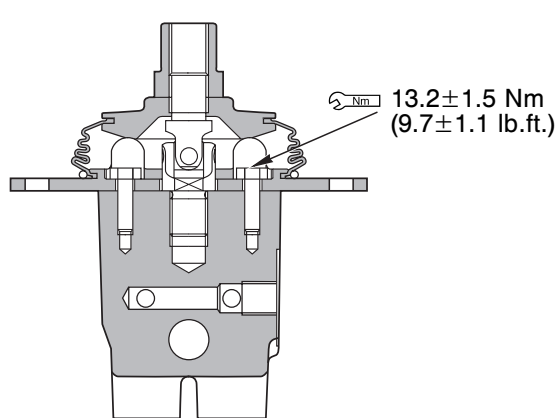
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length x Ø.D.	Installed length	Installed load	Free length	Installed load	
1	Spool return spring (boom, arm, bucket, swing, hammer)	29x17.5 (1.142x0.689)	28.5 (1.123)	22.6N (2.3 kg)	—	18.1 N (1.8 kg)	When damage or deformation is found, replace the spring
2	Spool return spring (blade, travel)	46.2x20 (1.820x0.788)	25.4 (1.000)	98 N (10 kg)	—	78.4 N (8.0 kg)	
3	Spool return spring (boom swing)	42x20 (1.655x0.788)	25.4 (1.000)	74.5 N (7.6 kg)	—	59.6 N (6.1 kg)	

PPC VALVE

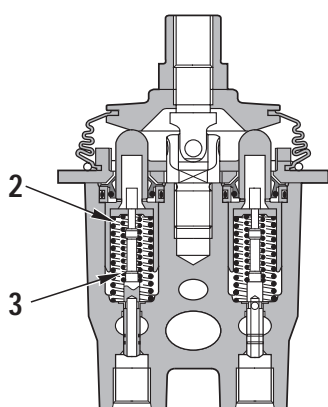
FOR BOOM, ARM, BUCKET, SWING



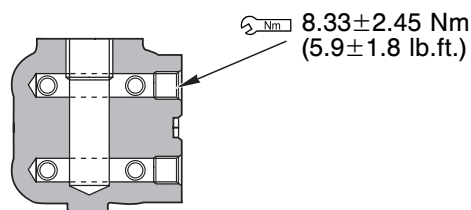
Section A - A



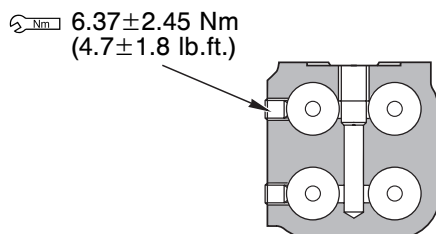
Section B - B



Section C - C



Section D - D



Section E - E

RKP01330

Unit: mm (in.)

No.	Check item	Criteria				Remedy	
		Standard size		Repair limit		When damage or deformation is found, replace the spring	
Free length x Ø.D.	Installed length	Installed load	Free length	Installed load			
1	Centering spring (P3 and P4 port)	38.7x15.5 (1.52x0.61)	34 (1.34)	9.8 N (1.0 kg)	—		
2	Centering spring (P1 and P2 port)	42.5x15.5 (1.67x0.61)	34 (1.34)	17.7 N (1.8 kg)	—	14.1 N (1.44 kg)	
3	Metering spring	26.5x9.2 (1.04x0.36)	24.9 (0.98)	16.7 N (1.7 kg)	—	13.7 N (1.4 kg)	

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