WEBM000201

SHOP MANUAL

PC20R-8
PC27R-8

HYDRAULIC EXCAVATOR

SERIAL NUMBER

PC20R-8 F30791 and up

PC27R-8 F31103 and up

KOMATSU

Utility

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IMPORTANT SAFETY NOTICE

Proper service and repair is extremely important for the safe operation of your machine.
The service and repair techniques recommended by Komatsu Utility and describe in this manual are both effective and safe methods of operation. Some of these operations require the use of tools specially designed by Komatsu Utility for the purpose.

To prevent injury to workers, the symbols ⚠ and ⚠ are used to mark safety precautions in this manual. The cautions accompanying these symbols should always be carefully followed. If any danger arises or may possibly arise, first consider safety, and take necessary steps to face.

SAFETY

GENERAL PRECAUTIONS

Mistakes in operation extremely dangerous.
Read all the Operation and Maintenance Manual carefully BEFORE operating the machine.

1. Before carrying out any greasing or repairs, read all the precautions written on the decals which are suck on the machine.
2. When carrying out any operation, always wear safety shoes and helmet. Do not wear loose work clothes, or clothes with buttons missing.
   - Always wear safety glasses when hitting parts with a hammer.
   - Always wear safety glasses when grinding parts with a grinder, etc.
3. If welding repairs are needed, always have a trained, experienced welder carry out the work. When carrying out welding work, always wear welding gloves, apron, glasses, cap and other clothes suited for welding work.
4. When carrying out any operation with two or more workers, always agree on the operating procedure before starting. Always inform your fellow workers before starting any step of the operation. Before starting work, hang UNDER REPAIR signs on the controls in the operator's compartment.
5. Keep all tools in good condition and learn the correct way to use them.
6. Decide a place in the repair workshop to keep tools and removed parts. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dirt or oil on the floor.
   Smoke only in the areas provided for smoking. Never smoke while working.

PREPARATIONS FOR WORK

7. Before adding or making any repairs, park the machine on hard, level ground, and block the tracks to prevent the machine from moving.
8. Before starting work, lower blade, bucket or any other work equipment to the ground. If this is not possible, use blocks to prevent the work equipment from falling down. In addition, be sure to lock all the control levers and hang warning sign on them.
9. When disassembling or assembling, support the machine with blocks, jacks or stands before starting work.
10. Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine.
    Never jump on or off the machine.
    If it is impossible to use the handrails, ladders or steps, use a stand to provide safe footing.

PRECAUTIONS DURING WORK

11. When removing the oil filler cap, drain plug or hydraulic pressure measuring plugs, loosen them slowly to prevent the oil from spurting out.
    Before disconnecting or removing components of the hydraulic circuit and engine cooling circuit, first remove the pressure completely from the circuit.
12. The water and oil in the circuits are not hot when the engine in stopped, so be careful not to get burned.
    Wait for the oil water to cool before carrying out any work on the cooling water circuits.

13. Before starting work, remove the leads from the battery. Always remove the lead from the negative (–) terminal first.
14. When raising heavy components, use a hoist or crane. Check that the wire rope, chains and hooks are free from damage.
    Always use lifting equipment which has ample capacity. Install the lifting equipment at the correct places.
    Use a hoist or crane and operate slowly to prevent the component from hitting any other part.
    Do not work with any part still raised by the hoist or crane.
15. When removing covers which are under internal pressure or under pressure from a spring, always leave two bolts in position on opposite sides. Slowly release the pressure, then slowly loosen the bolts to remove.
16. When removing components, be careful not to break or damage the wiring.
    Damage wiring may cause electrical fires.
17. When removing piping, stop the fuel or oil from spilling out. If any fuel or oil drips on to the floor, wipe it up immediately.
    Fuel or oil on the floor can cause you to slip, or can even start fires.
18. As a general rule, do not use gasoline to wash parts. In particular, use only the minimum of gasoline when washing electrical parts.
19. Be sure to assemble all parts again in their original places. Replace any damage parts with new parts.
    When installing hoses and wires, be sure that they will not be damaged by contact with other parts when the machine is being operated.
20. When installing high pressure hoses, make sure that they are not twisted. Damaged tubes are dangerous, so be extremely careful when installing tubes for high pressure circuits. Also, check that connecting parts are correctly tightened.
21. When assembling or installing parts, always use specified tightening torques.
    When installing the parts which vibrate violently or rotate at high speed, be particulary careful to check that they are correctly installed.
22. When aligning two holes, never insert your fingers or hand.
23. When measuring hydraulic pressure, check that the measuring tool is correctly assembled before taking any measurement.
24. Take sure when removing or installing tracks. When removing the track, the track separates suddenly, so never let anyone stand at either end of the track.

FOREWORD

This shop manual has been prepared as an aid to improve the quality of repairs by giving the operator an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.

This shop manual mainly contains the necessary technical information for operations performed in a service workshop.

The manual is divided into chapters on each main group of components; these chapters are further divided into the following sections.

STRUCTURE AND FUNCTION

This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.

TESTING AND ADJUSTING

This sections explains checks to be made before and after performing repairs, as well as adjustments to be made at completion of the checks and repairs.

Troubleshooting charts correlating «Problems» to «Causes» are also included in this section.

DISASSEMBLY AND ASSEMBLY

This section explains the order to be followed when removing, installing, disassembling or assembling each component, as well as precautions to be taken for these operations.

MAINTENANCE STANDARD

This section gives the judgement standards when inspecting disassembled parts.

NOTICE

The specifications contained in this shop manual are subject to change at any time and without any notice.
Contact your Komatsu Utility distributor for the latest information.

HOW TO READ THE SHOP MANUAL

VOLUMES

Shop manual are issued as a guide to carry out repairs. These various volumes are designed to avoid duplicating the same information.

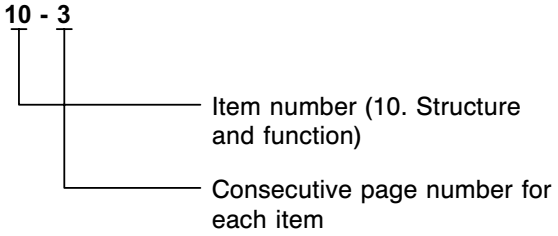
DISTRIBUTION AND UPDATING

Any additions, amendments or other changes will be sent to Komatsu Utility distributors.
Get the most up-to-date information before you start any work.

FILING METHOD

1. See the page number on the bottom of the page. File the pages in correct order.
2. Following examples show you how to read the page number.

   Example



3. Additional pages: additional pages are indicated by a hyphen (-) and number after the page number.
   Fle as in the example.
   Example:
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REVISED EDITION MARK
(① ② ③ ....)

When a manual is revised, an edition mark is recorded on the bottom outside corner of the pages.

REVISIONS

Revised pages are shown on the LIST OF REVISED PAGES between the title page and SAFETY page.

SYMBOLS

In order to make the shop manual greatly chelpful, important points about safety and quality are marked with the following symbols.

Symbol	Item	Remarks
	Safety	Special safety precautions are necessary when performing the work.
		Extra special safety precautions are necessary when performing the work because it is under internal pressure.
	Caution	Special technical precautions or other precautions for preserving standards are necessary when performing the work.
	Weight	Weight of parts or systems. Caution necessary when selecting hoisting wire, or when working posture is important, etc.
	Tightening torque	Parts that require special attention for the tightening torque during assembly.
	Coat	Parts to be coated with adhesives and lubricants etc.
	Oil, water	Places where oil, water or fuel must be added, and their quantity.
	Drain	Places where oil or water must be drained, and quantity to be drained.

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 kg

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

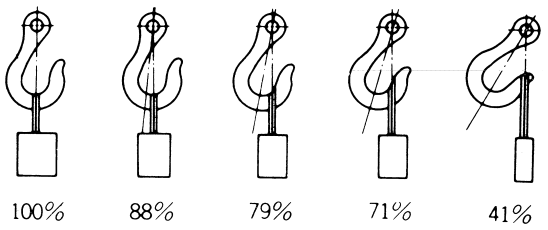
1) Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

WIRE ROPES
(Standard «S» or «Z» twist ropes without galvanizing)

Rope diameter (mm)	Allowable load (tons)
10	1.0
11.2	1.4
12.5	1.6
14	2.2
16	2.8
18	3.6
20	4.4
22.4	5.6
30	10.0
40	18.0
50	28.0
60	40.0

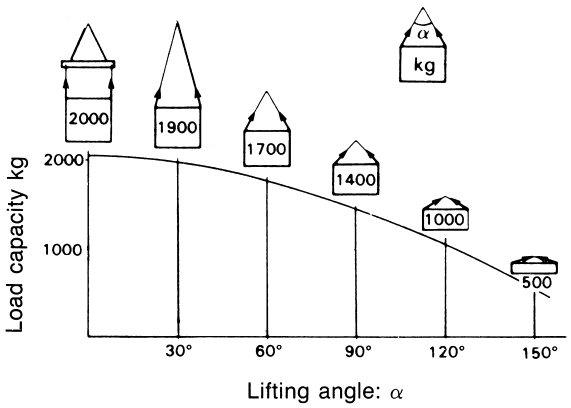
The allowable load value is estimated to be one-sixth or one-seventh of the breaking strength of the rope used.

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°.



STANDARD TIGHTENING TORQUE

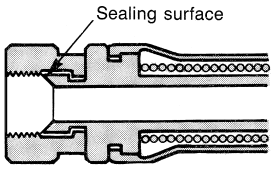
The following charts give the standard tightening torques of bolts and nuts. Exceptions are given in sections of «**Disassembly and Assembly**».

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	kgm	Nm
6	1	10	5	0.96±0.1	9.5±1	1.3±0.15	13.5±1.5
8	1.25	13	6	2.3±0.2	23±2	3.2±0.3	32.2±3.5
10	1.5	17	8	4.6±0.5	45±4.9	6.5±0.6	63±6.5
12	1.75	19	10	7.8±0.8	77±8	11±1	108±11
14	2	22	12	12.5±1	122±13	17.5±2	172±18
16	2	24	14	19.5±2	191±21	27±3	268±29
18	2.5	27	14	27±3	262±28	37±4	366±36
20	2.5	30	17	38±4	372±40	53±6	524±57
22	2.5	32	17	52±6	511±57	73±8	719±80
24	3	36	19	66±7	644±70	92±10	905±98
27	3	41	19	96±10	945±100	135±15	1329±140
30	3.5	46	22	131±14	1287±140	184±20	1810±190
33	3.5	50	24	177±20	1740±200	250±27	2455±270
36	4	55	27	230±25	2250±250	320±35	3150±350
39	4	60	—	295±33	2900±330	410±45	4050±450

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**



Nm

2. TIGHTENING TORQUE FOR NUTS OF FLARED

Use these torques for nut part of flared.

Thread diameter of nut part (mm)	Width across flats of nut part (mm)	TIGHTENING TORQUE	
		kgm	Nm
1/2" - 20	17	2.6±0.5	25.5±4.9
9/16" - 18	17	4±0.5	39.2±4.9
3/4" - 16	22	6.7±2	65.7±19.6
7/8" - 14	27	8±2	78.5±19.6
1.1/16" - 12	32	9.7±3	95.15±29.4
1.5/16" - 12	38	17±3	166.7±29.4
1.5/8" - 12	50	20±5	196.2±49
22	27	8±2	78.5±19.6
33	41	20±5	196.2±49

COATING MATERIALS

The recommended coating materials prescribed in Komatsu Utility Shop Manuals are listed below:

Nomenclature	Code	Applications
Adhesives	Loctite 222	Used for low resistance locking of screws, check nuts and adjustment nuts.
	Loctite 242	To prevent the loosening of bolts, nuts and plugs and the leakage of oil. Used for medium resistance locking of screws and nuts of every type, and for locking keys and bearings.
	Loctite 262	Used for high resistant of threaded parts that can be removed with normal tools.
	Loctite 270	Used for high resistant locking and for sealing threaded parts, bolts and stud bolts.
	Loctite 542	Used for sealing the union threads for hydraulic tubes.
	Loctite 573	Used for sealing rather exact plane surfaces when the option of possible future dismantling is required.
	Loctite 601	Used for high resistant locking of mechanical components that can be removed only after heating
	Loctite 675	Used to lock cylindrical couplings and for the permanent locking of threaded parts, and also to lock shafts to bearings, gears, pulleys, pins, bushings, etc.
Gasket sealant	Loctite 510	Used by itself on mounting surface on the final drive and transmission cases. (Clearance between flange surfaces within 0.2 mm).
	Loctite 518	Used by itself on mounting flat surface (Clearance between surfaces within 0.5 mm)
Grease (Lithium grease)	ASL800050	Applied to bearings, sliding parts and oil seals for lubrication, rust prevention and facilitation of assembling work.
Vaseline	–	Used for protecting battery electrode terminals from corrosion.

CABLE

ELECTRIC WIRE CODE

In the wiring diagrams various colours and symbols are employed to indicate the thickness of wires.
This wire code table will help you understand WIRING DIAGRAMS.
Example: R -N 1.5 indicates a cable having a nominal number 1.5 and red coating with black stripe.

CLASSIFICATION BY THICKNESS

Nominal number	Copper wire			Cable O.D. (mm)	Current rating (A)	Applicable circuit
	Number strands	ø of strands (mm)	Cross section (mm^2)			
1	14	0.30	0.99	2.80	11	Warning light, light etc.
1.5	21	0.30	1.48	3.35	14	Working beam, solenoid valve, etc.
2.5	35	0.30	2.47	3.80	20	Control panel, etc.
4	56	0.30	3.95	4.60	28	Pre-heating
6	84	0.30	5.93	5.20	37	Control panel
35	266	0.40	9.20	12.20	125	Battery - Ground

CLASSIFICATION BY COLOUR AND CODE

	Primary	Auxiliary							
Code	A	A – R	A/R	A – V	–	A – N	–	–	–
Colour	Light blue	Light blue - Red		Light blue - Green		Light blue - Black		–	
Code	B	B – G	–	B – N	–	B – R	–	–	–
Colour	White	White – Yellow		White – Black		White – Red		–	
Code	C	C – N	C/N	C – L	–	–	–	–	–
Colour	Orange	Orange – Black		Orange – Blue		–		–	
Code	G	G – N	–	–	G/R	–	–	–	–
Colour	Yellow	Yellow – Black		Yellow – Red		–		–	
Code	H	H – N	–	H – L	–	H – R	–	H – G	–
Colour	Gray	Gray – Black		Gray – Blue		Gray Red		Gray – Yellow	
Code	L	L – R	–	L – N	–	–	–	–	–
Colour	Blue	Blue – Red		Blue – Black		–		–	
Code	M	M – V	–	M – N	–	M – B	–	–	–
Colour	Brown	Brown – Green		Brown – Black		Brown – White		–	
Code	N	–	–	–	–	–	–	–	–
Colour	Black	–		–		–		–	
Code	R	R – V	–	R – N	–	R – G	–	–	–
Colour	Red	Red – Green		Red – Black		Red – Yellow		–	
Code	S	S – N	–	S – G	–	–	–	–	–
Colour	Pink	Pink – Black		Pink – Yellow		–		–	
Code	V	V – N	–	–	–	–	–	–	–
Colour	Green	Green – Black		–		–		–	

COMPOSITION OF THE COLOURS

The coloration of two-colour wires is indicated by the composition of the symbols listed.
Example: G-V = Yellow-Green with longitudinal colouring.
G/V = Yellow-Green with transversal colouring.

WEIGHT TABLE

⚠ This weight table is a guide for use when transporting or handling components.

Unit: kg

Machine model	PC20R-8	PC27R-8
From serial no.	F30791-	F31103-
Engine assembly (dry) • Engine • Engine support • Power train • Pump	 130 10 4 19	 130 10 6 22
Radiator - exchanger	15	15
Revolving frame	1000	1400
Cabin	208	208
Canopy	73	73
Seat support	30	30
Seat	20	20
Platform	40	40
Engine hood	18	18
Fuel tank (without fuel)	14	14
Hydraulic tank (without hydraulic oil)	30	30
Control valve	31	31
Rear counterweight	70	150
Lateral counterweight • L.H. • R.H.	 29 37	 29 37
Swing motor	27	31,5
Swivel joint	5,5	5,5
Track frame assembly	1150	1500
Track roller	5	5
Idler assy.	19	19
Final drive	35	35
Sprocket	7	7
Swing circle	25	33
Shoe • Steel shoe L = 300 mm • Rubber shoe	 159 88	 172 117
Swing bracket	37	52
Boom	80	126
Arm • Standard • Long arm	 35 48	 50 70
Bucket (standard)	40	50
Blade	100	137
Boom cylinder	20	25
Arm cylinder	20	28
Bucket cylinder	11	12
Boom swing cylinder	17	22
Blade cylinder	13	13

TABLE OF OIL AND COOLANT QUANTITIES

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE	CAPACITY (ℓ)			
			Specified		Refill	
		–20 –10 0 10 20 30°C	PC20R-8	PC27R-8	PC20R-8	PC27R-8
Crankcase sump	OIL • API CD	SAE 10W / SAE 20W-20 / SAE 30 / SAE 40	3.6	5.2	3.6	5.2
Hydraulic circuit	OIL • API CD	SAE10W	48	48	29	29
Final drive (each)	OIL • API CD	SAE 10W	0.7	0.7	0.7	0.7
Fuel tank	FUEL	✻ / ASTM D975 N. 2	35	35	—	—
Engine coolant system	WATER + ANTI-FREEZE		4	4	—	—
	WATER		4	4	—	—
	PERMANENT LIQUID		4	4	—	—

✻ ASTM D975 N. 1

ASTM: America Society of Testing and Materials
SAE: Society of Automotive Engineers
API: American Petroleum Institute
MIL: USA Military Specification
CCMC: Common Market Constructors Committe

Specified capacity: Total amount of oil including oil for components and oil in piping.
Refill capacity: Amount of oil needed to refill system during normal inspection and maintenance.

NOTE:

(1) When fuel sulphur content is less than 0.5%, change oil in the oil pan ebery periodic maintenance hours described in operation and maintenance manual.
Change oil according to the following table if fuel sulphur content is above 0.5%.

Fuel sulphur content	Oil change interval in engine oil pan
0.5 to 1.0%	1/2 of regular interval
Above 1.0%	1/4 of regular interval

(2) When starting the engine is weathers temperature below 0°C, be sure to use engine oil SAE 10W, SAE 20W-20, even if weather temperature goes up to 10°C day time.

(3) Use classification CD as engine oil, if use classification CC, reduce the engine oil change interval to half.

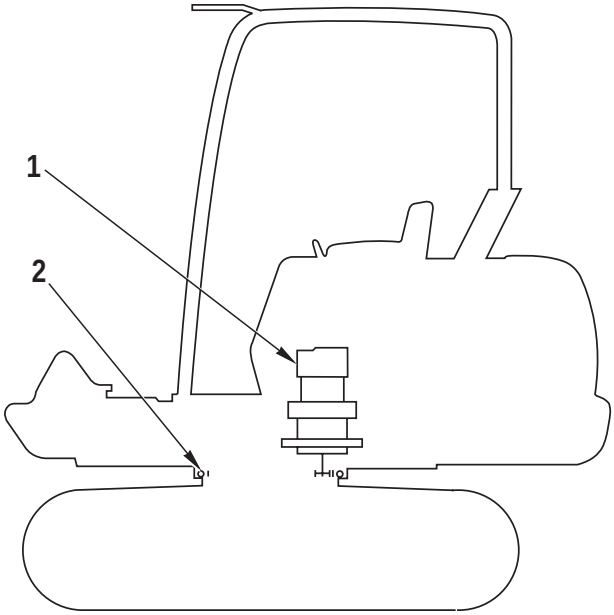
(4) Use original products, which have characteristics specifically formulated and approved for the engine, the hydraulic circuit of equipment and for reductions.

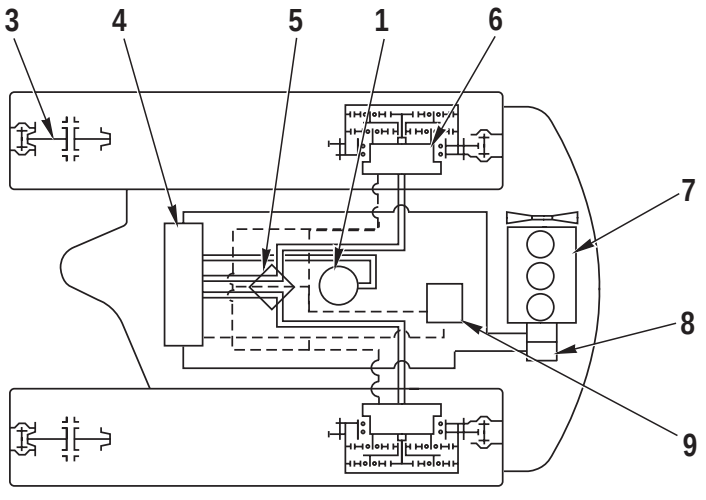
GRUPPO 10

10 STRUCTURE AND FUNCTION

POWER TRAIN

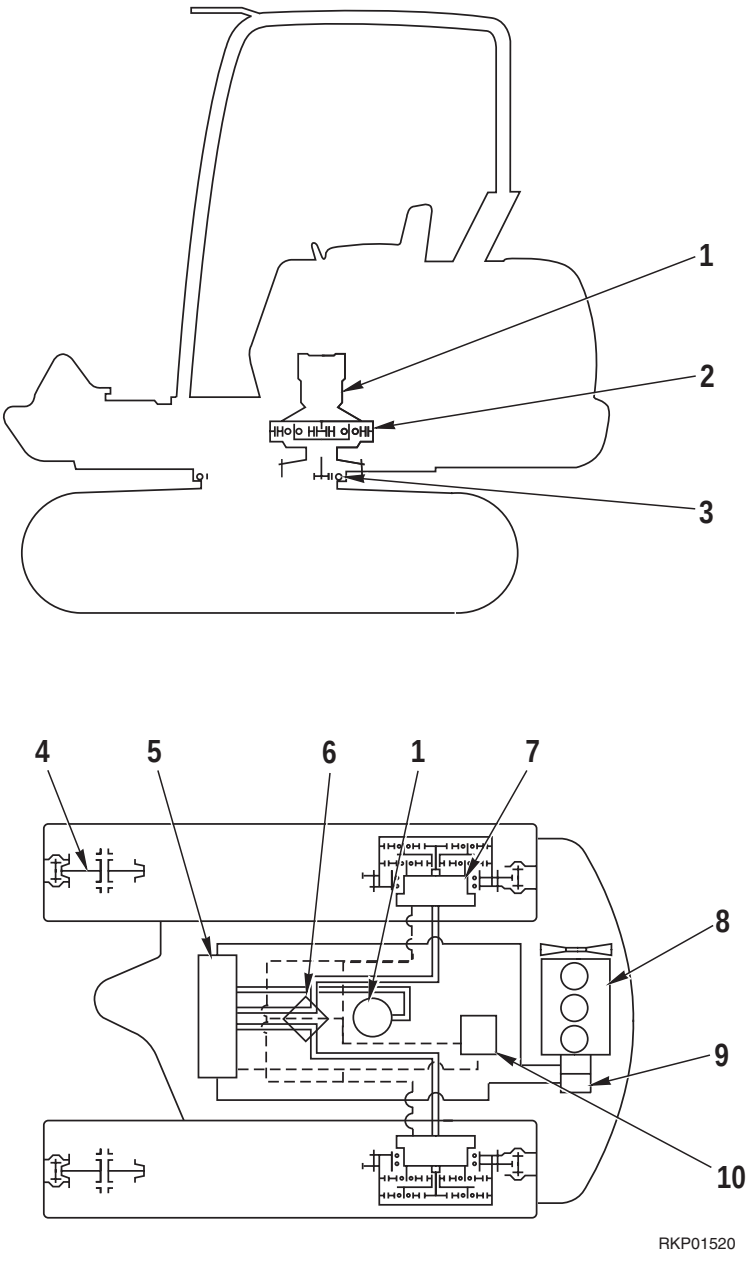
PC20R-8





1. Swing motor
2. Swing circle
3. Track shoe idler
4. Control valve
5. Swivel joint
6. Travel motor
7. Engine
8. Hydraulic pump
9. Servocontrol - travel speed increment solenoid valve

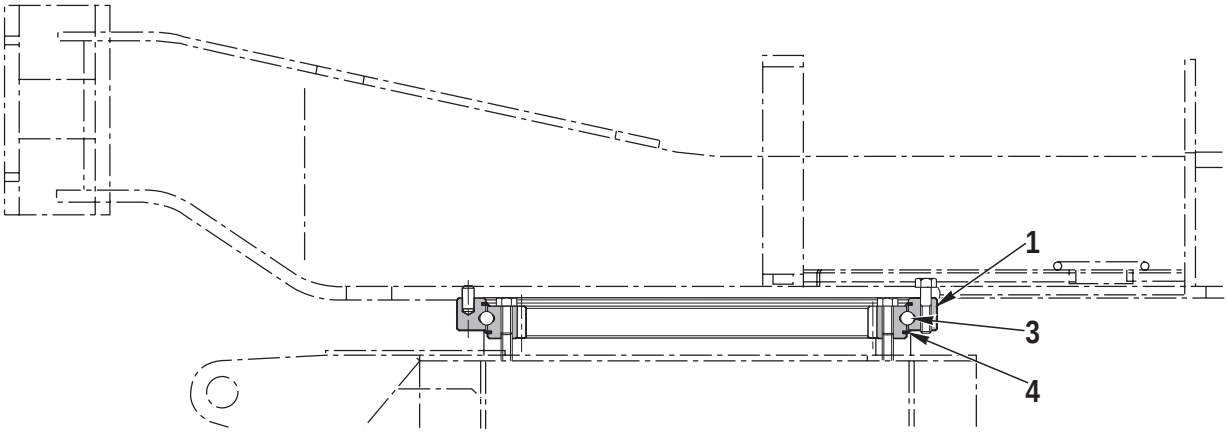
PC27R-8



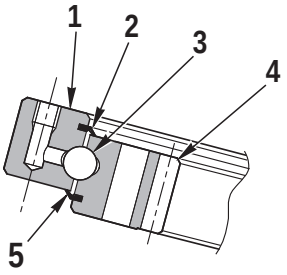
1. Swing motor
2. Swing machinery
3. Swing circle
4. Track shoe idler
5. Control valve
6. Swivel joint
7. Swivel joint
8. Engine
9. Hydraulic pump
10. Servocontrol - travel speed increment solenoid valve

SWING CIRCLE

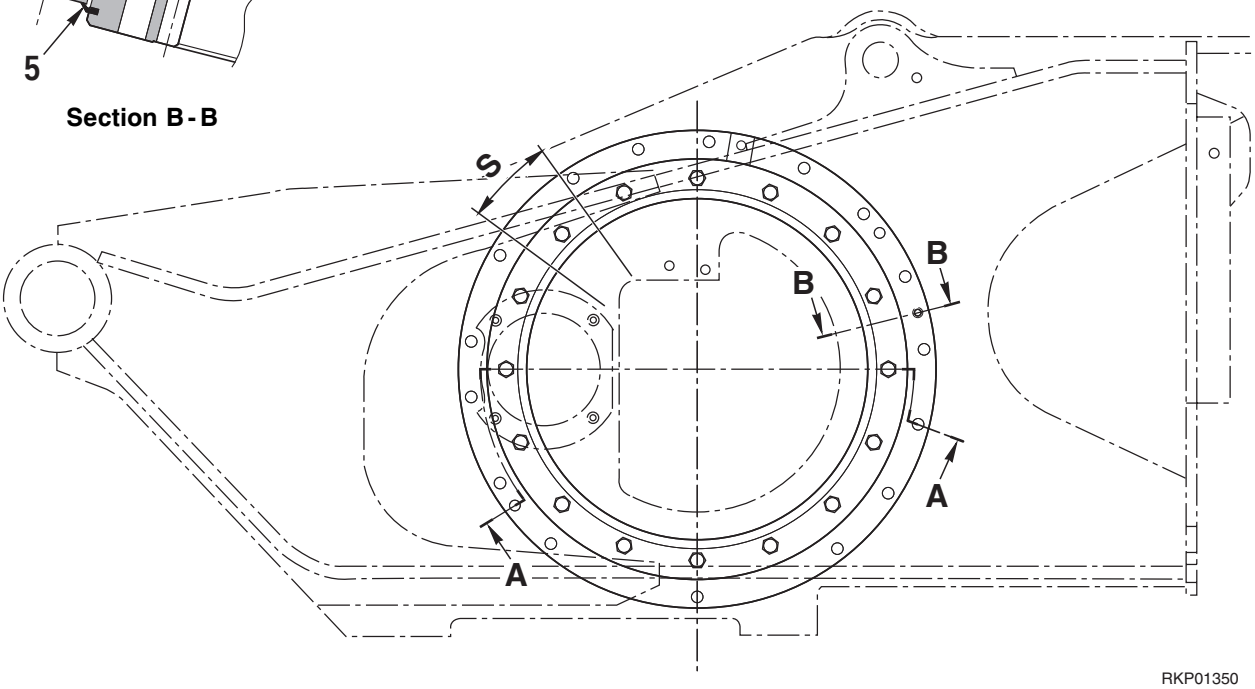
PC20R-8



Section A - A

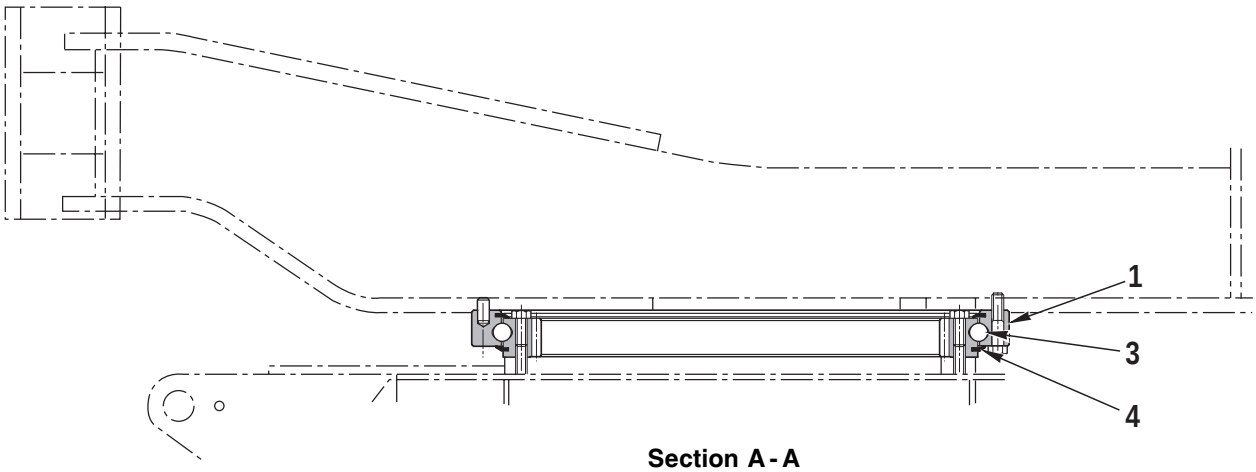


Section B - B



1. Outer race
2. Upper seal
3. Ball bearing
4. Inner race
5. Lower seal

PC27R-8



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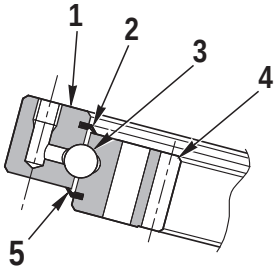

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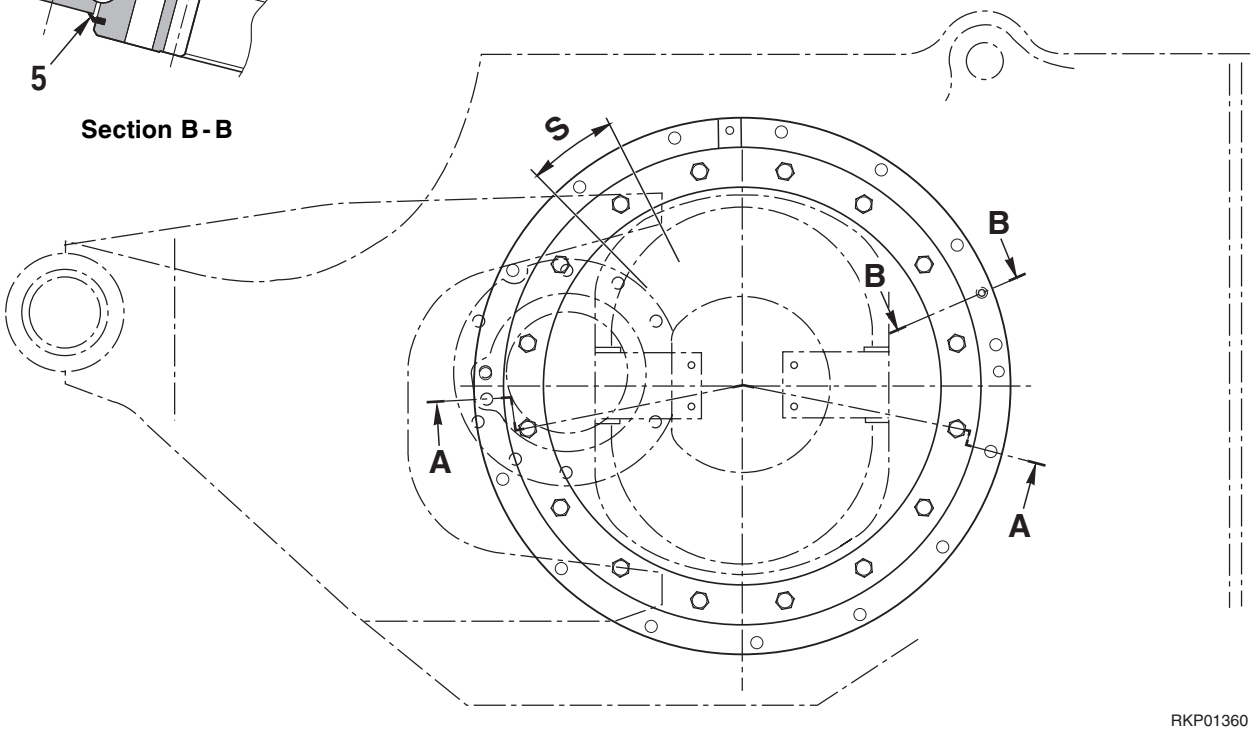
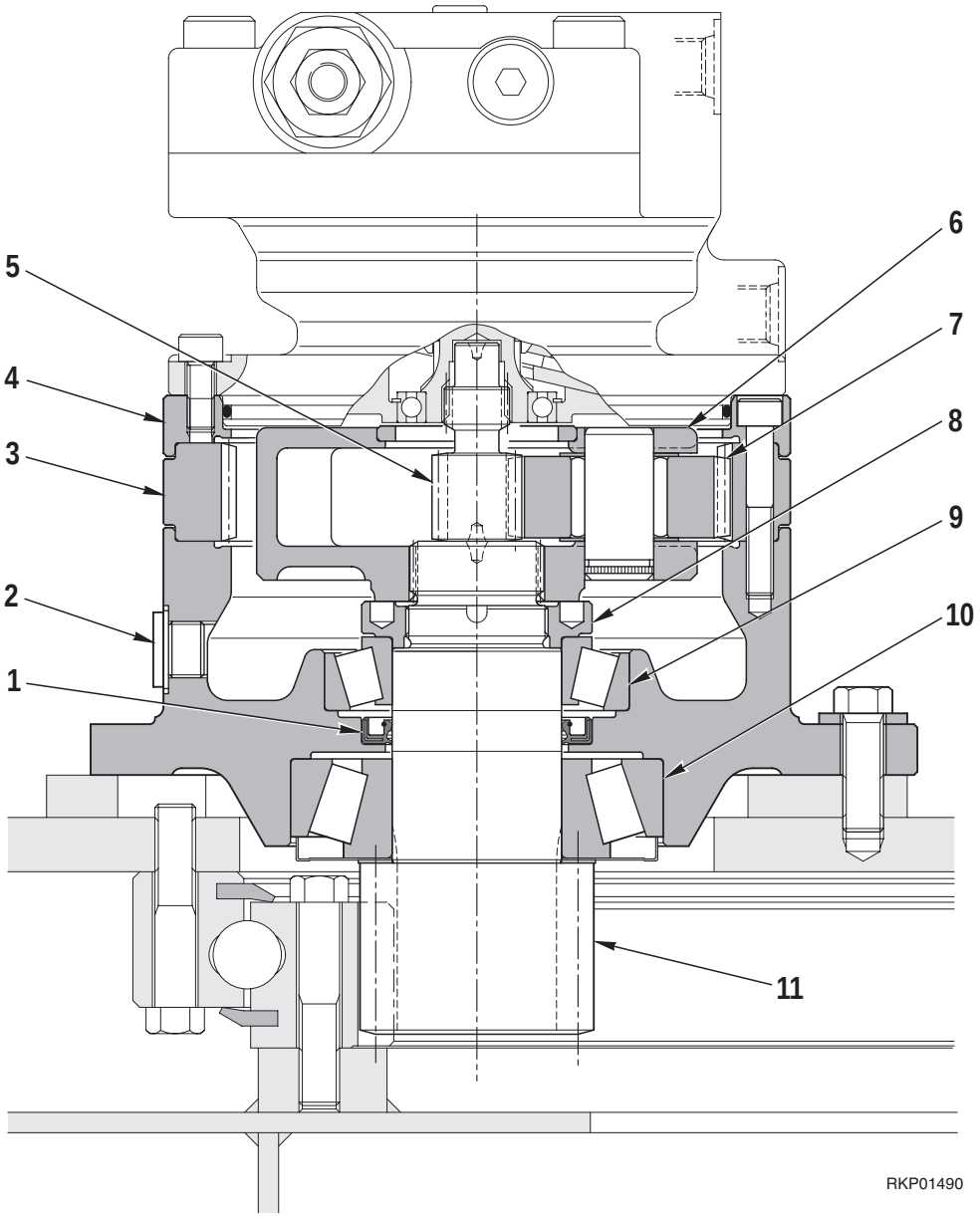


RKP01360

1. Outer race
2. Upper seal
3. Ball bearing
4. Inner race
5. Lower seal

SWING MACHINERY

PC27R-8

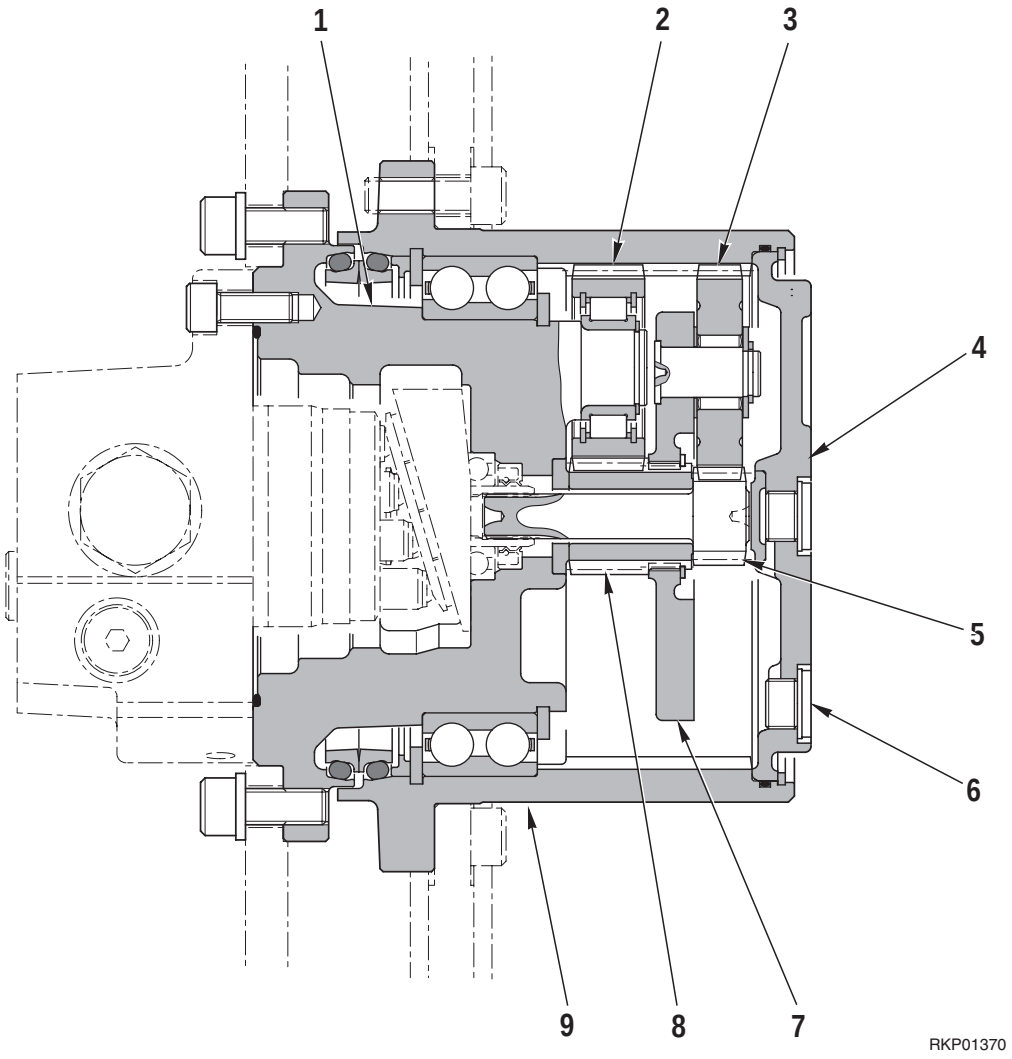


1. Seal ring
2. Oil drainage plug
3. Crown (Z = 72)
4. Spacer
5. Sun gear (Z = 10)
6. Planetary carrier
7. Planetary gear
8. Ring nut
9. Bearing
10. Bearing
11. Pinion

SPECIFICATION

Reduction ratio: 1:8.2

FINAL DRIVE



1. Crankcase
2. No. 2 reduction gear
3. No. 1 reduction gear
4. Cover
5. No. 1 sun gear
6. Oil drainage plug
7. No. 1 planetary gear
8. No. 2 sun gear (Z = 16)
9. Housing

SPECIFICATIONS

PC20R-8

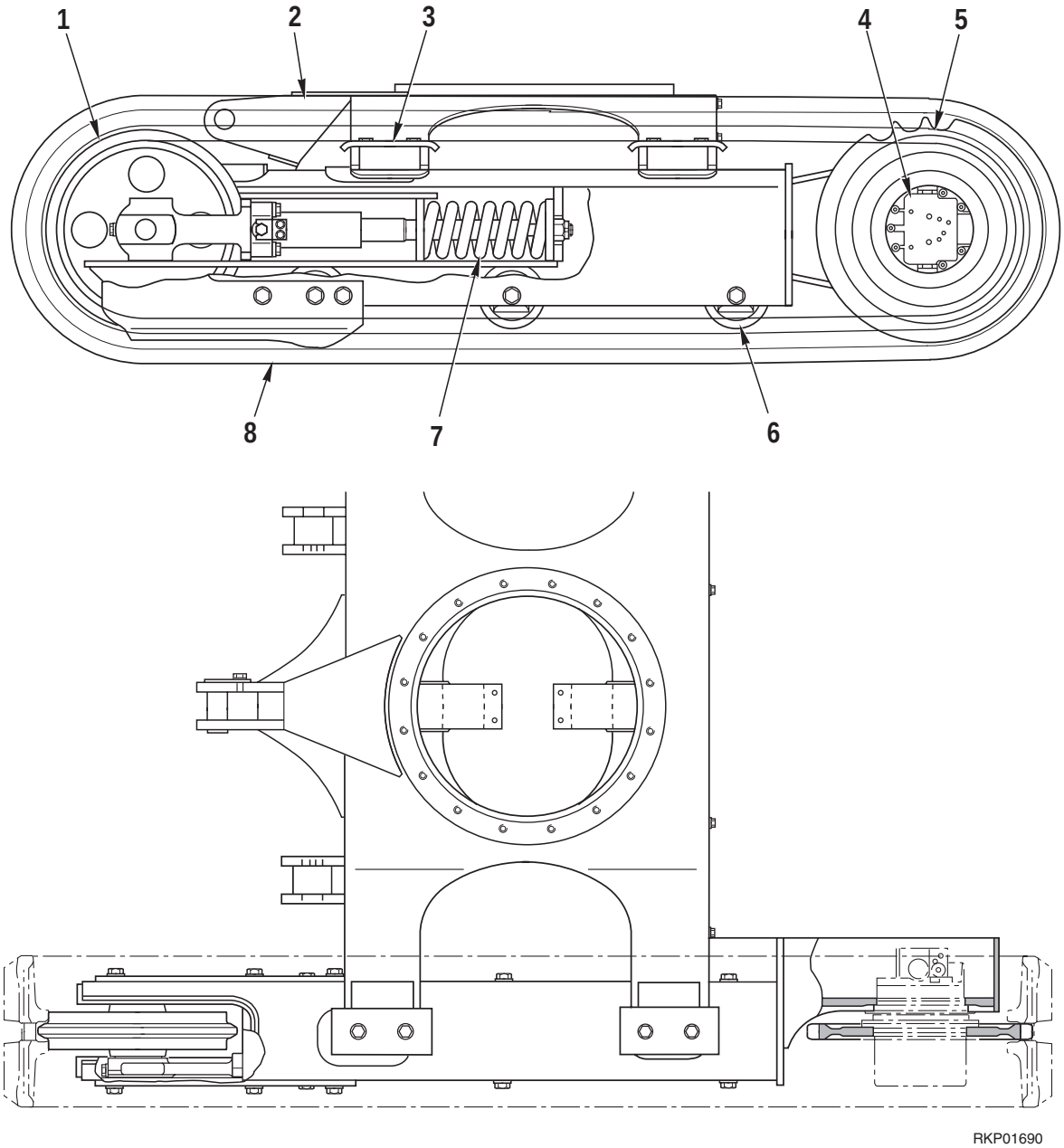
Reduction ratio:	1 – 41.92

PC27R-8

Reduction ratio:	1 – 53

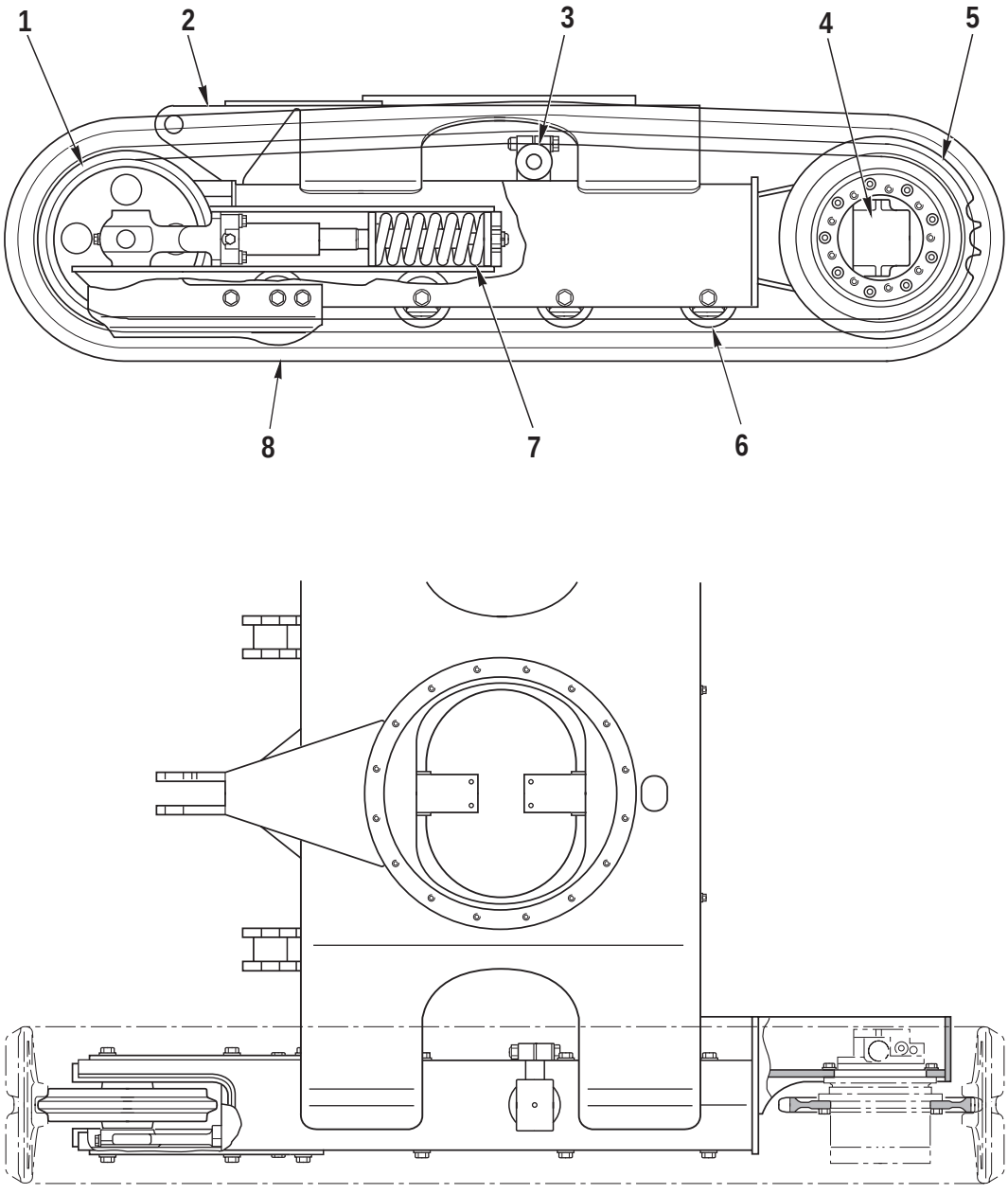
TRACK FRAME

PC20R-8



1. Idler
2. Track frame
3. Sliding plate
4. Travel motor
5. Sprocket
6. Track roller
7. Recoil spring
8. Track shoe

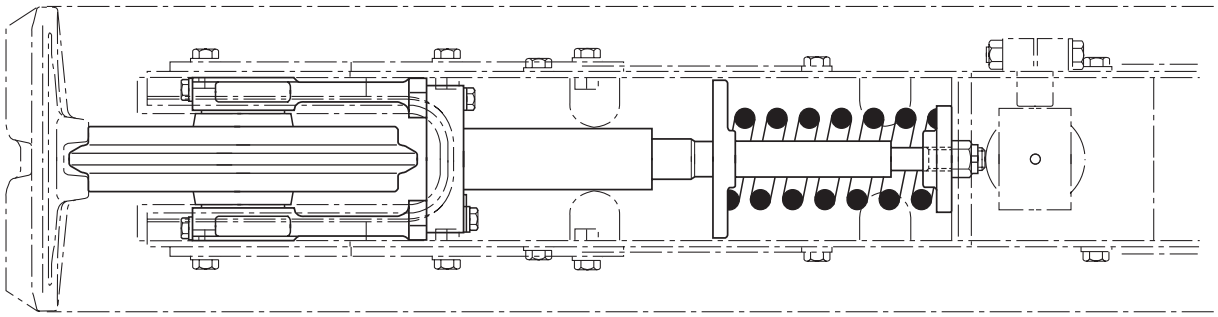
PC27R-8

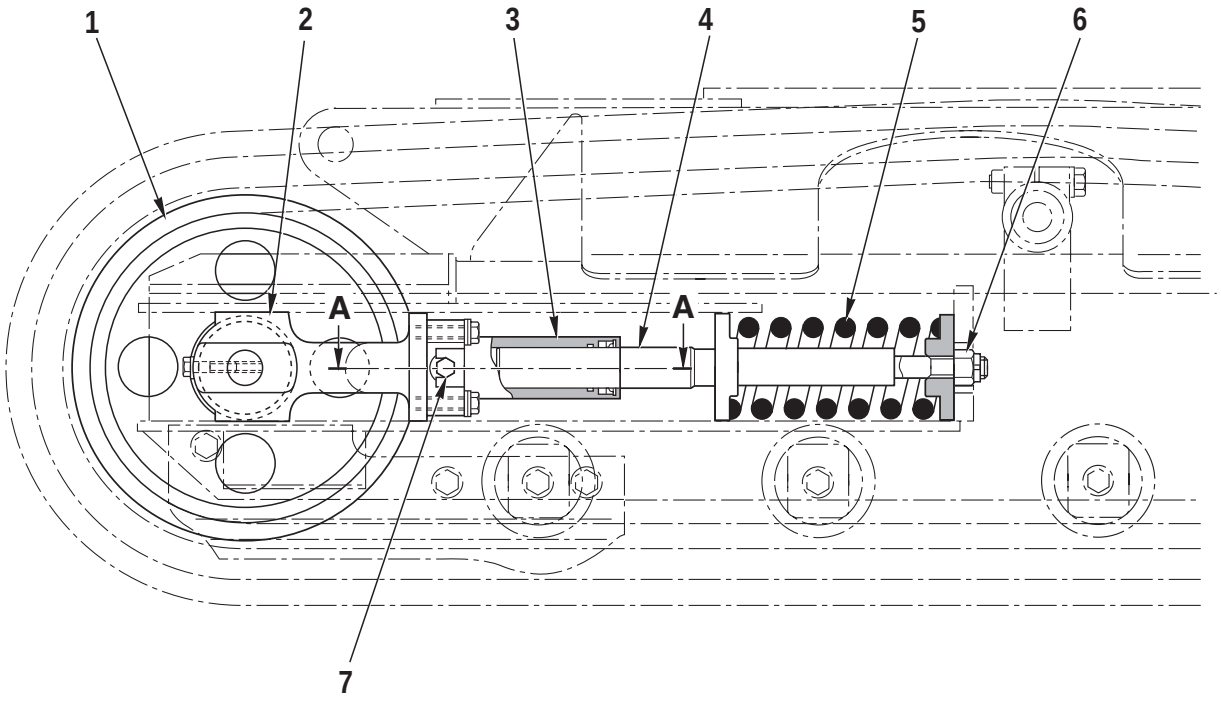


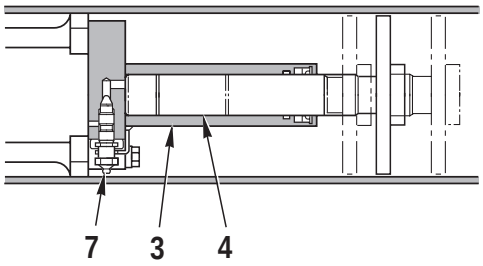
RKP01670

1. Idler
2. Track frame
3. Sliding plate
4. Travel motor
5. Sprocket
6. Track roller
7. Recoil spring
8. Track shoe

RECOIL SPRING







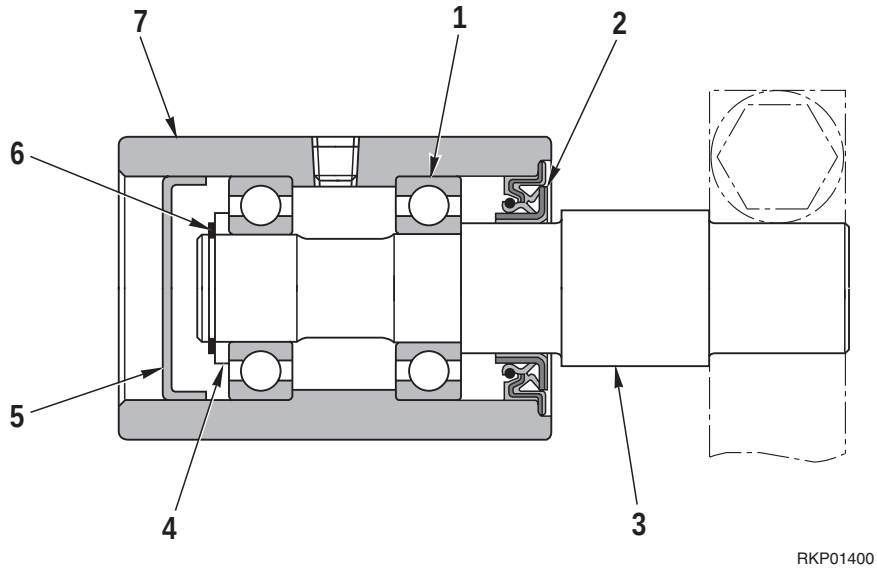
Section A - A

RKP01680

1. Idler
2. Support
3. Cylinder
4. Rod
5. Recoil spring
6. Nut
7. Nipple

CARRIER ROLLER

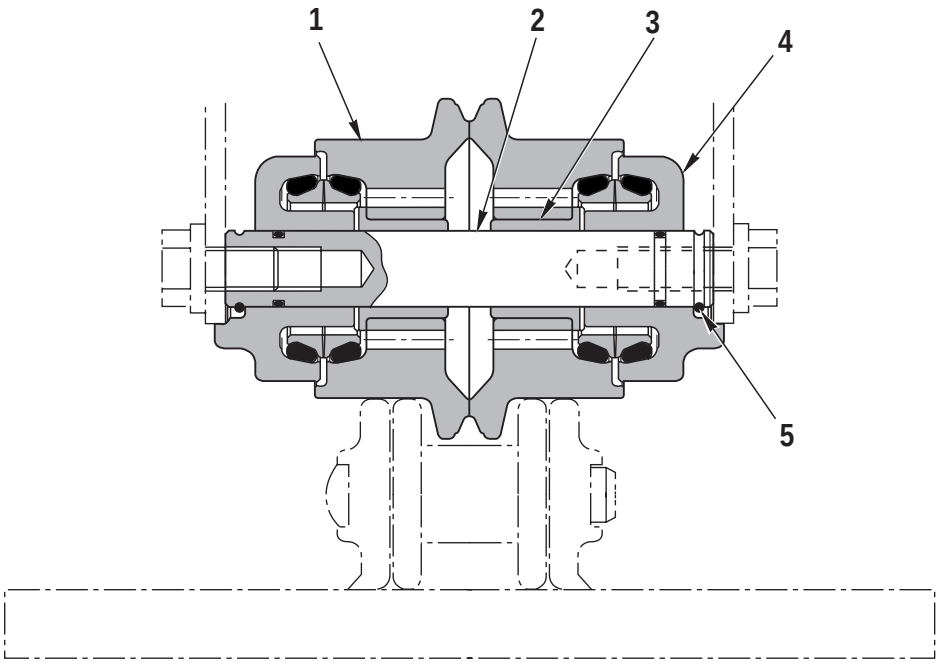
PC27R-8



RKP01400

1. Bearing
2. Gasket
3. Shaft
4. Spacer
5. Cover
6. Seal ring
7. Roller

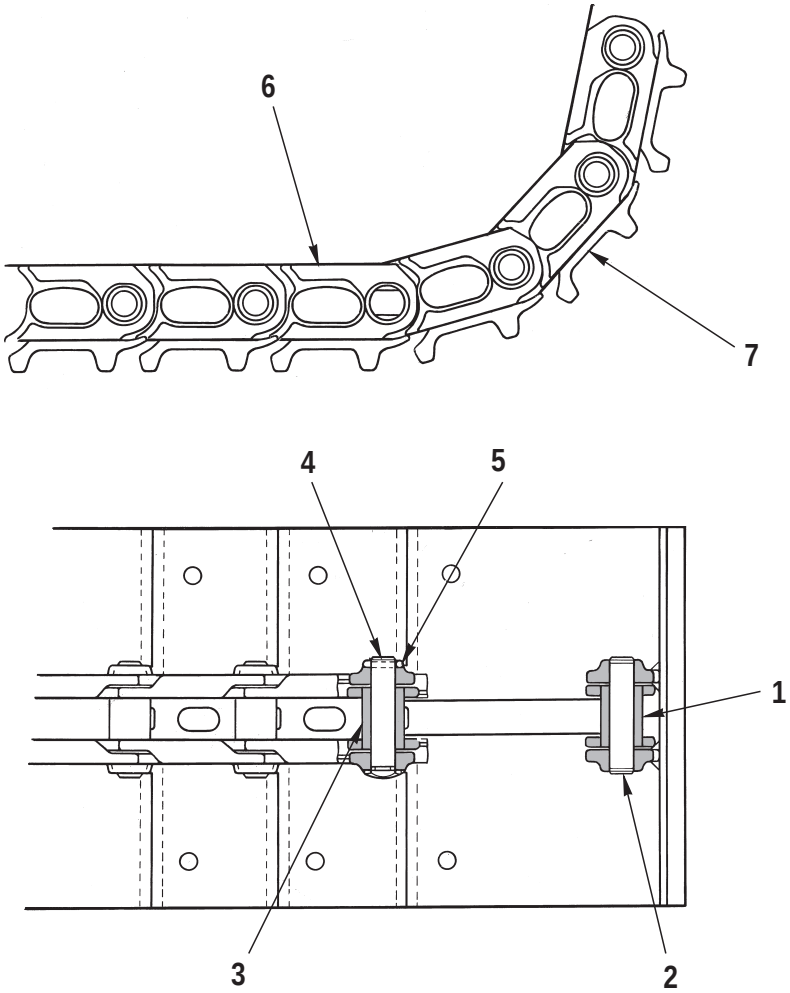
TRACK ROLLER



RKP01410

1. Roller
2. Shaft
3. Bushing
4. Shoulder
5. Seal ring

STEEL SHOE



RKP02010

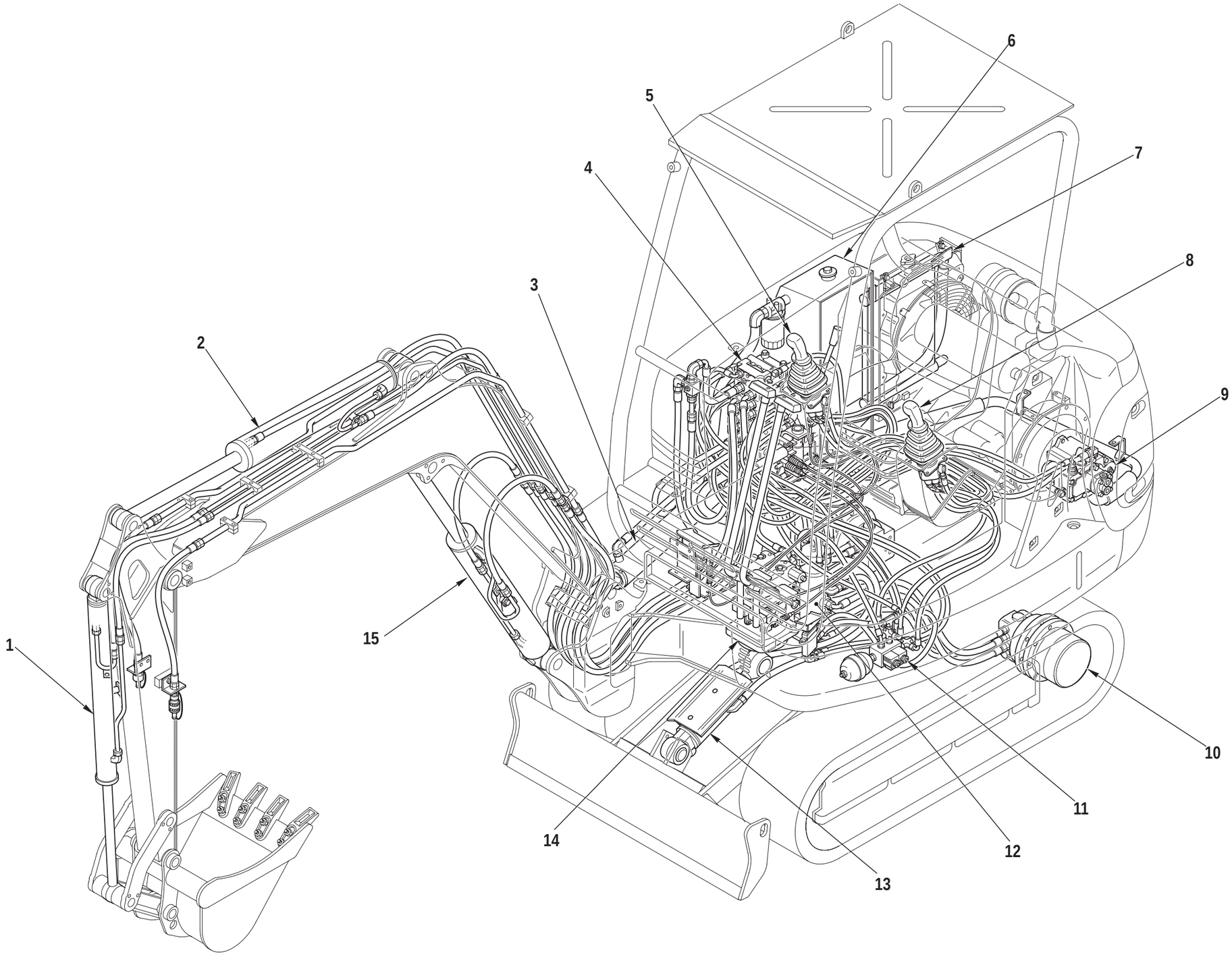
1. Bushing
2. Pin
3. Master housing
4. Master pin
5. Cotter pin
6. Link
7. Shoe

SPECIFICATIONS

Width: 300 mm
Pitch: 101.6 mm

HYDRAULIC SYSTEM

PC20R-8



1. Bucket cylinder
2. Arm cylinder
3. Boom swing cylinder
4. Control valve
5. R.H. PPC valve
6. Hydraulic tank
7. Hydraulic oil cooler
8. L.H. PPC valve
9. Hydraulic pump
10. Final drive
11. Servocontrol feed unit
12. Swivel joint
13. Blade cylinder
14. Swing motor
15. Boom cylinder

RKP03650

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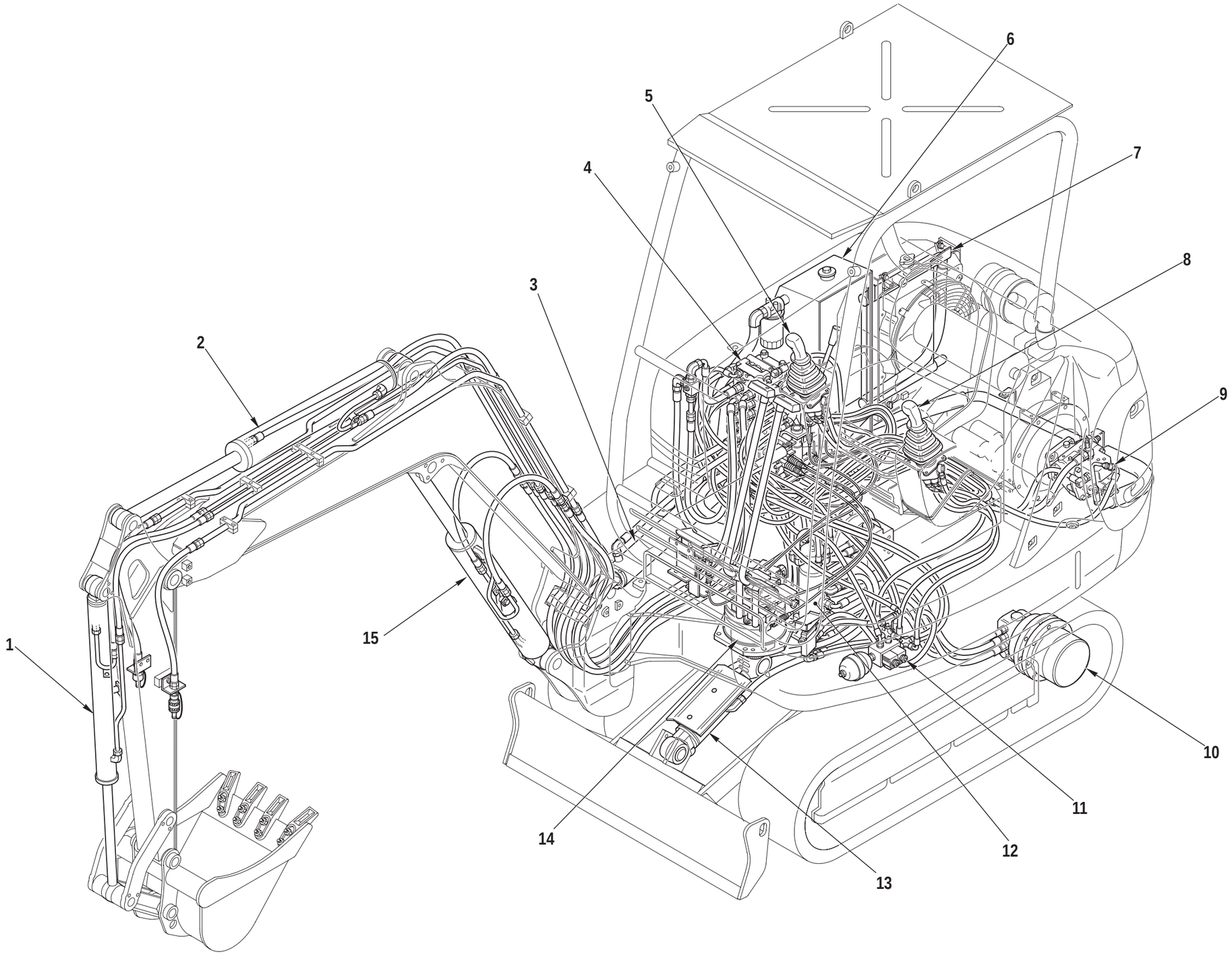

1. Bucket cylinder
2. Arm cylinder
3. Boom swing cylinder
4. Control valve
5. R.H. PPC valve
6. Hydraulic tank
7. Hydraulic oil cooler
8. L.H. PPC valve
9. Hydraulic pump
10. Final drive
11. Servocontrol feed unit
12. Swivel joint
13. Blade cylinder
14. Swing motor
15. Boom cylinder

RKP03660

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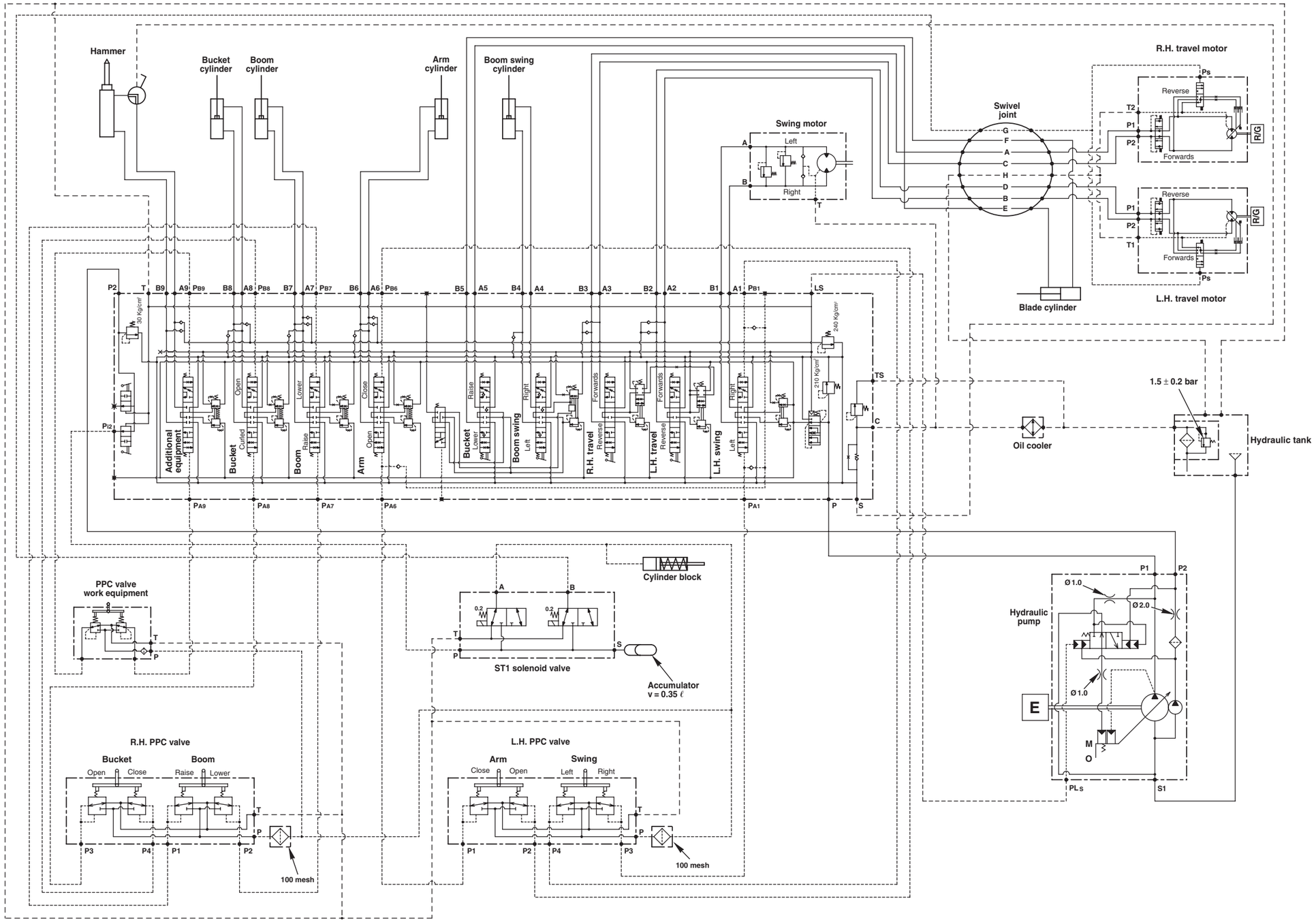
HYDRAULIC CIRCUIT DIAGRAM

PC20R-8



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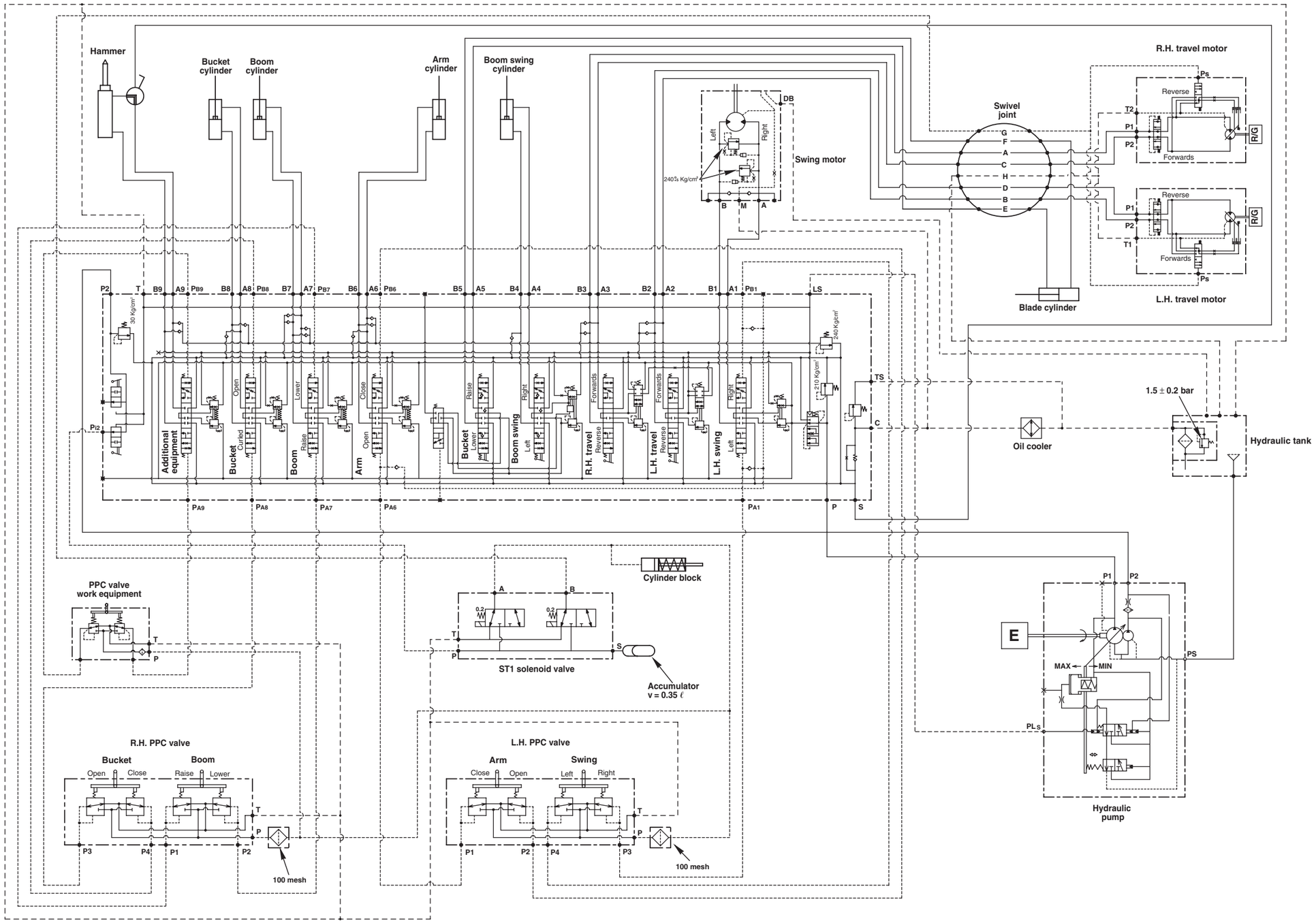
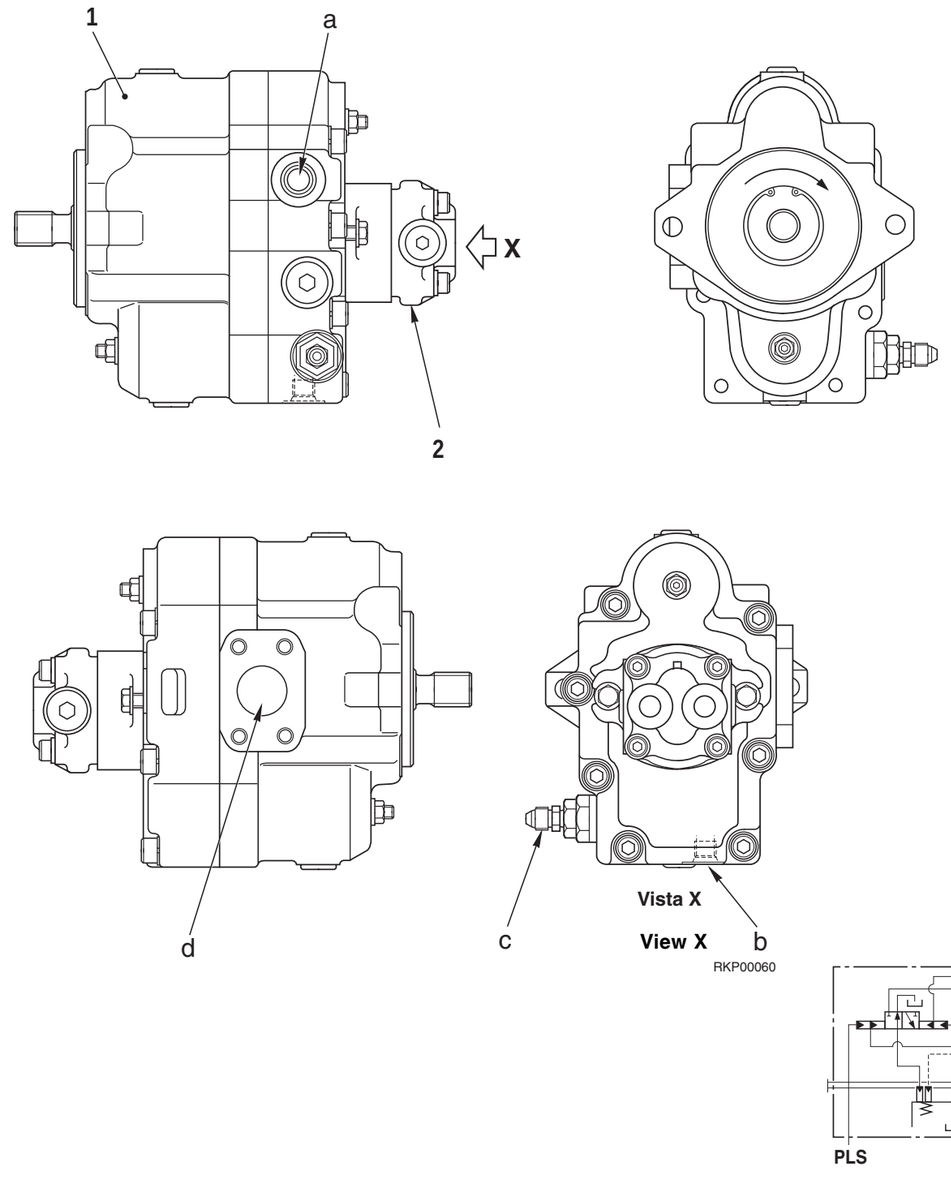

Hammer
Bucket cylinder
Boom cylinder
Arm cylinder
Boom swing cylinder
Swing motor
DB
Left
Right
240 Kg/cm²
B
M
A
Swivel joint
G
F
A
C
H
D
B
E
R.H. travel motor
Ps
Reverse
T2
P1
P2
R/G
Forwards
L.H. travel motor
T1
Blade cylinder
P2
T
B9
A9
PB9
B8
A8
PB8
B7
A7
PB7
B6
A6
PB6
B5
A5
B4
A4
B3
A3
B2
A2
B1
A1
PB1
LS
30 Kg/cm²
240 Kg/cm²
210 Kg/cm²
TS
C
P12
Additional equipment
Bucket
Curled
Open
Boom
Lower
Raise
Arm
Close
Raise
Lower
Right
Left
Forwards
Reverse
PA9
PA8
PA7
PA6
PA1
P
S
1.5 ± 0.2 bar
Oil cooler
Hydraulic tank
PPC valve work equipment
T
P
Cylinder block
A
B
0.2
ST1 solenoid valve
S
Accumulator v = 0.35 ℓ
R.H. PPC valve
Bucket
Boom
Open
Close
Raise
Lower
P3
P4
P1
P2
100 mesh
L.H. PPC valve
Arm
Swing
Left
Right
E
MAX
MIN
PS
PLs
Hydraulic pump

RKP04441

HYDRAULIC PUMP

PC20R-8

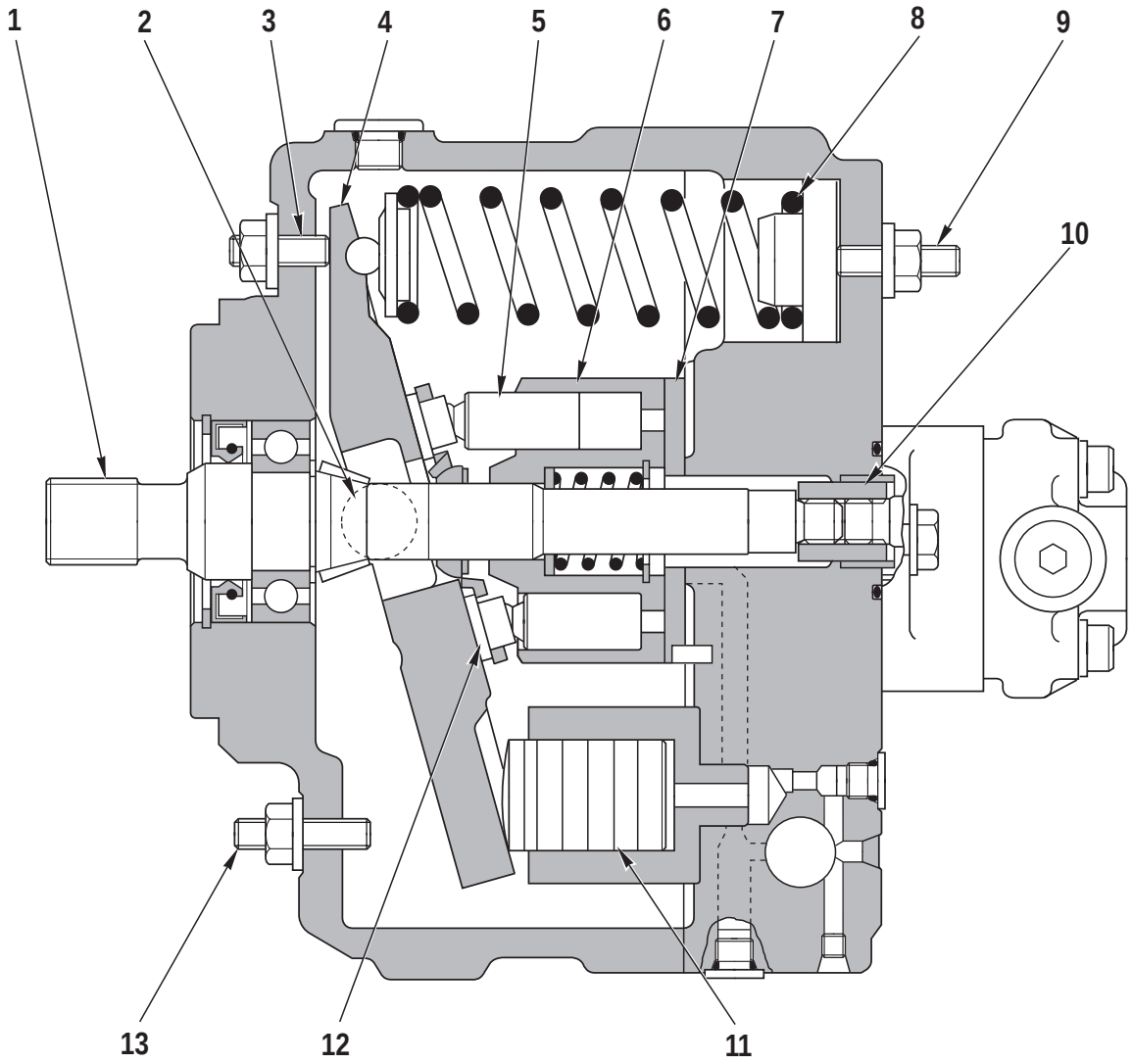


a - P1 Port - To control valve (P port)
b - P2 Port - To control valve (P2 port)
c - PLS Port - From control valve (LS port)
d - S1 Port - From hydraulic tank

1. Main pump
2. Gear pump

SPECIFICATIONS

Type:	PVK
Displacement:	22 cc + 2.75 cc
Set pressure:	
- Main pump:	206 bar (210 kg/cm^2)
- Gear pump:	29 bar (30 kg/cm^2)



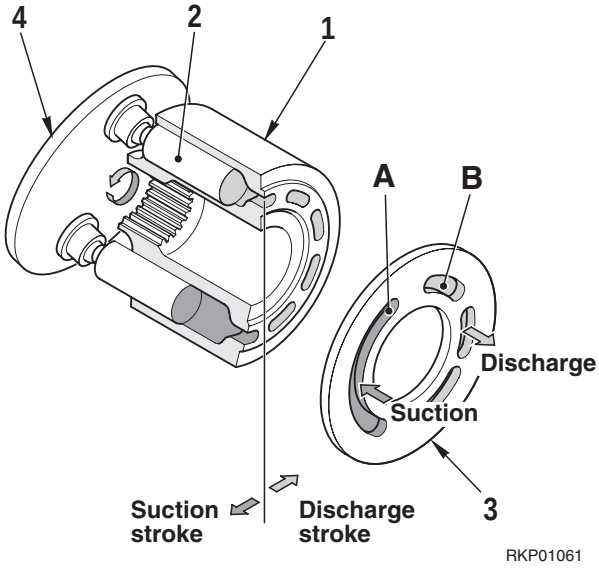
Section A - A

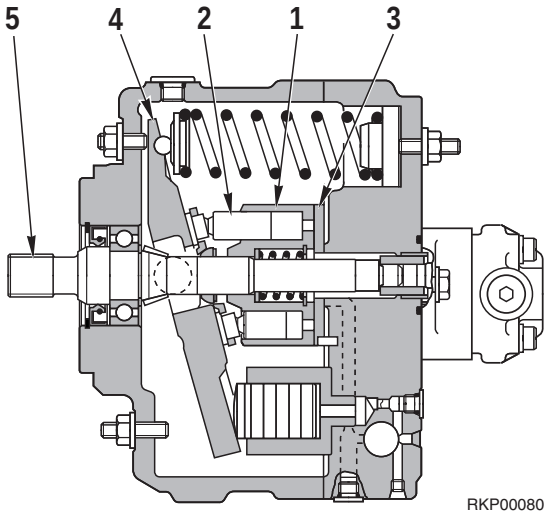
RKP00070

1. Input shaft
2. Ball
3. Adjustment screw
4. Swash plate
5. Piston
6. Cylinder block
7. Valve plate
8. Spring
9. Adjustment screw
10. Joint
11. Control piston
12. Sliding shoe
13. Adjustment screw

1. Operation

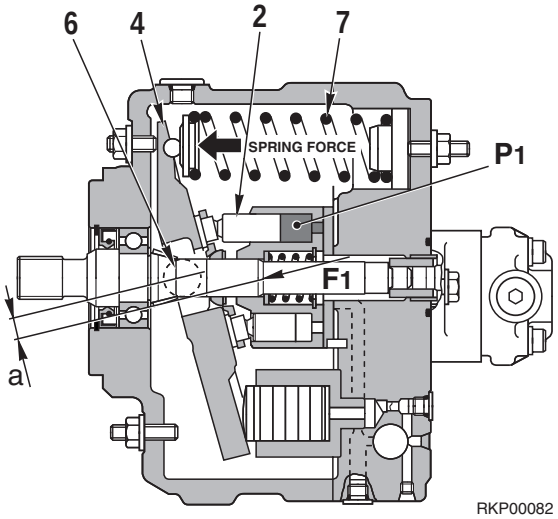
- This pump has the functions of load response control and constant horsepower control.
  There are nine pistons (2) assembled inside cylinder block (1), and the face is in contact with valve plate (3).
  Suction port **A** and discharge port **B** are provided in valve plate (3).
  In this structure, swash plate (4) is secured to the body at a certain angle, and pistons (2) rotate along swash plate (4).
- By rotating shaft (5), cylinder block (1) rotates, and pistons (2) assembled inside cylinder block (1) move in a reciprocal motion following swash plate (4). This movement performs the suction and discharge action of the pump.
- Each of the nine pistons (2) performs one suction and discharge stroke for each rotation of cylinder block (1), so the rotation of shaft (5) provides continuous suction and discharge.
  The volume of the stroke of piston (2) depends on the angle of swash plate (4), so by changing the angle of swash plate (4) it is possible to change the amount of the discharge flow.



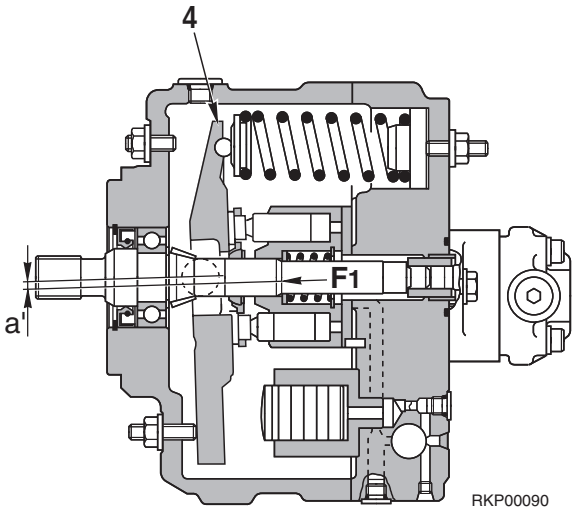


2. Constant horsepower control

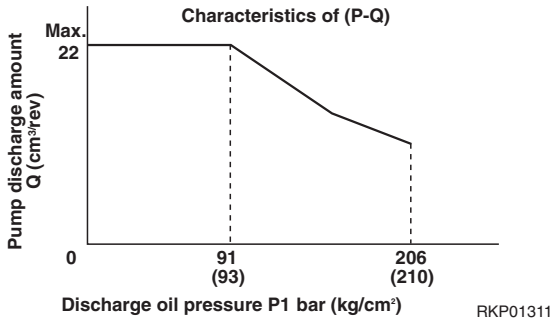
- Rocker pin (6) is assembled to swash plate (4), and it is installed to the body to make it possible to change the swash plate angle. In addition, swash plate (4) is equipped with spring (7) and cylinder block piston (2), which acts in the opposite way to spring (7), and the discharge pressure of **P1** acts on piston (2).
- When the discharge pressure **P1** is lower than the set value of spring (7), the angle of swash plate (4) is held at the maximum position by spring (7).
  When the discharge pressure becomes greater than the set value of spring (7), the angle of swash plate (4) is made smaller by total piston force **F1** x **a** and is held at the position where the discharge pressure is balanced with the force of the spring.



- If the discharge pressure rises further, the angle of swash plate (4) becomes smaller. When this happens, the length of the arm applying total piston force **F1** is reduced from **a** to **a'**, so a larger force **F1** is needed for the angle of swash plate (4).

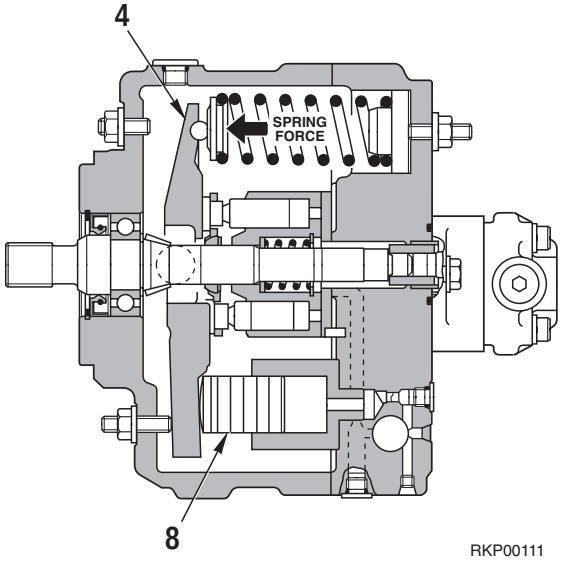


- Is this way, curve **P - Q** becomes a curve (constant horsepower control) which gives effective use of the engine horsepower.



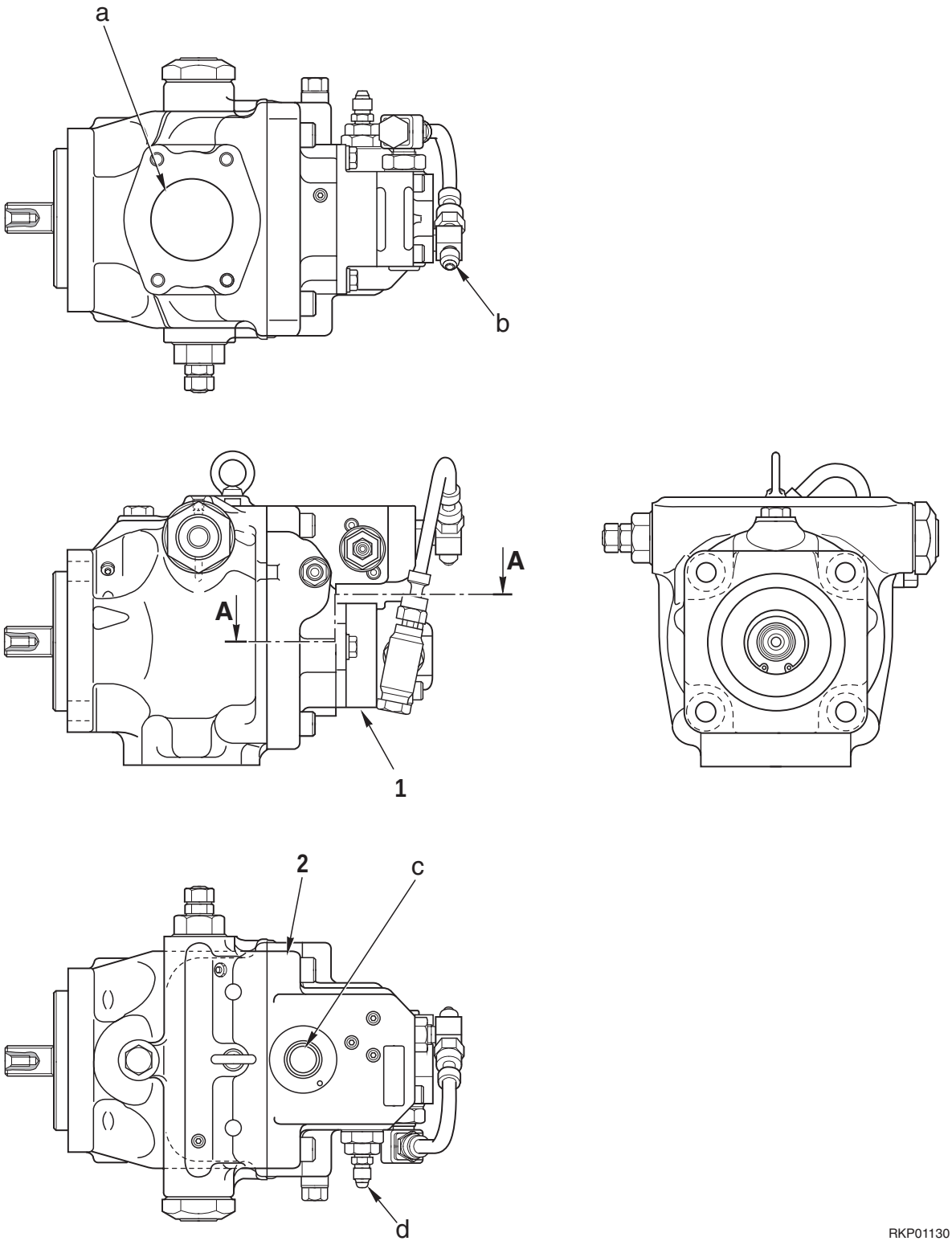
3. Load response control

- When carrying out load response control, the signal pressure from the **LS** valve is transmitted to control piston (8), and control piston (8) pushes swash plate (4). The angle of swash plate (4) changes to a point where this force is balanced with the total force of the spring and piston, so the discharge amount changes.
- Constant horsepower control is carried out with priority over load response control, so the discharge amount changes in the range below the flow at constant horsepower control.



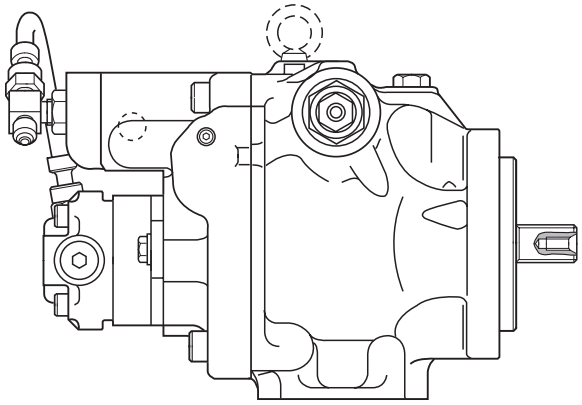
HYDRAULIC PUMP

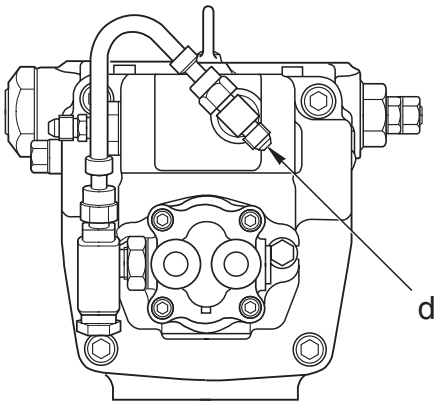
PC27R-8

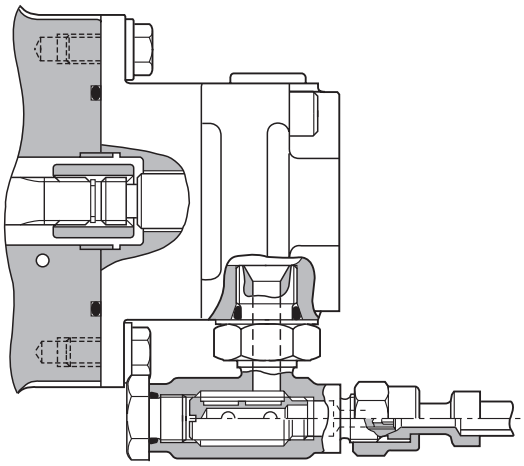


1. Gear pump
2. Main pump

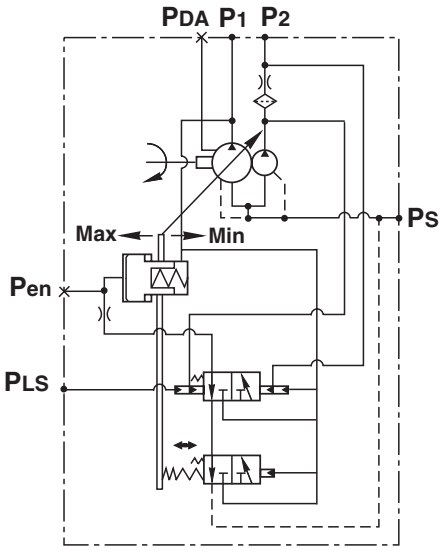
a - PS Port - From hydraulic tank
b - P2 Port - To control valve (P2 port)
c - P1 Port - To control valve (P port)
d - P_{LS} Port - To control valve (LS port)







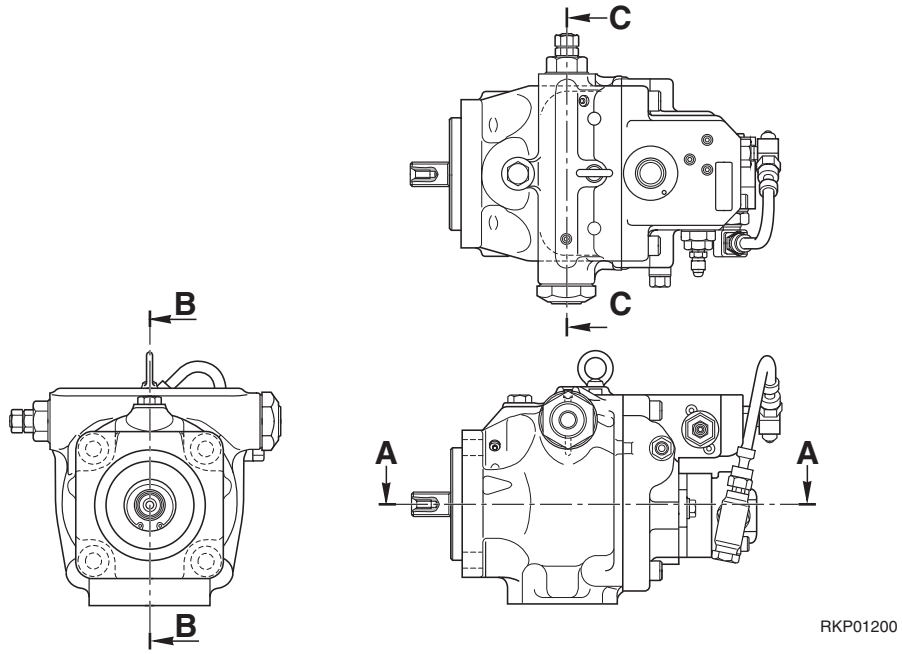
Section A - A



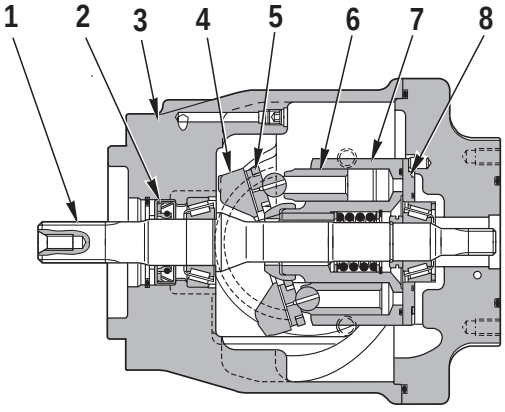
RKP01140

- The main pump is an integrated unit consisting of the pump, servo piston, **TCC** valve and **LS** valve. The explanation of the structure and function is divided into separate sections:
  1. Main pump
  2. **TCC** valve
  3. **LS** valve

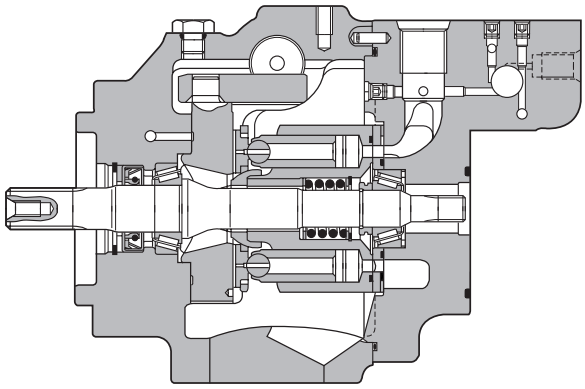
1. Main pump



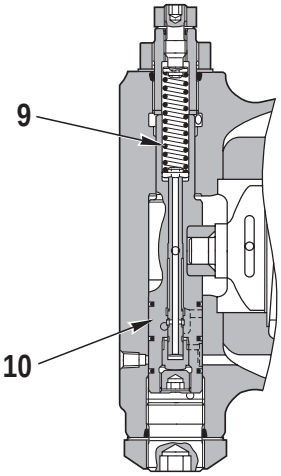
RKP01200



Section A - A



Section B - B



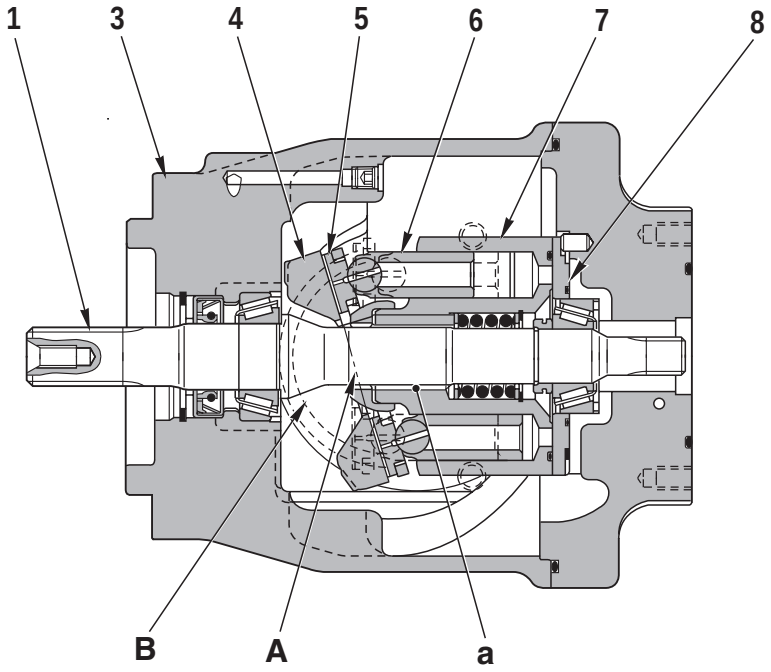
Section C - C

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

RKP01150

FUNCTION

- The rotation and torque transmitted to the pump shaft is converted to hydraulic energy and pressurized oil is discharged according to the load.
- It is possible to change the discharge amount by changing the swash plate angle.



Section A - A RKP01220

STRUCTURE

- Cylinder block (7) is supported to shaft (1) by **a** spline, and shaft (1) is supported by the front and rear bearings.
- The end of piston (6) has a concave ball shape and shoe (5) is caulked to it to form one unit.
  Piston (6) and shoe (5) form a spherical bearing.
- Rocker cam (4) has plane **A**, and shoe (5) is always pressed against this surface as it slides in a circle. Rocker cam (4) forms a static bearing sending high pressure oil at cylindrical surface **B** with to the case, and carries out a sliding movement.
- Piston (6) carries out motion relative to the axial direction inside each cylinder chamber of cylinder block (7).
- The cylinder block (7) carries out rotation relative to valve plate (8) while sealing the pressurized oil, and this surface ensures that the hydraulic balance is maintained correctly.
  The oil inside each cylinder chamber of cylinder block (7) is sucked in and discharged through valve plate (8).

OPERATION

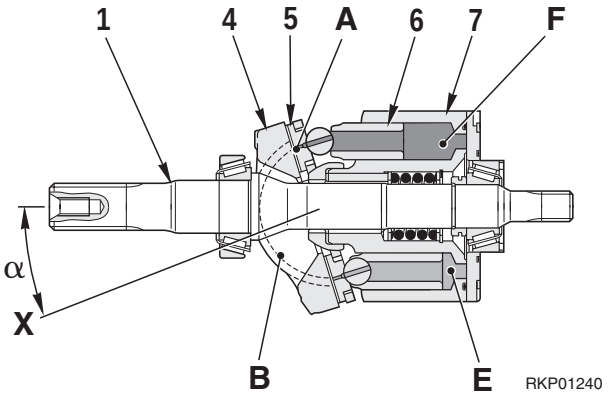
1. Pump operation

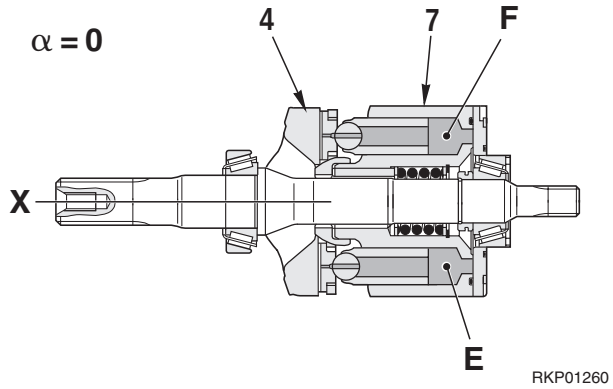
1 - The cylinder block (7) rotates together with the shaft (1), and the shoe (5) slides on the flat surface **A**.
At this time, the rocker cam (4) moves along the cylindrical surface **B**, so the angle α between the center line **X** of the rocker cam (4) and the inclination of the cylinder block (7) in the axial direction changes.
This angle α is called the swash plate angle.

2 - When the center line **X** of the rocker cam (4) maintains the swash plate angle α in relation to the axial direction of the cylinder block (7), the flat surface **A** acts as a cam for the shoe (5).
By this, the piston (6) slides on the inside of the cylinder block (7), creates a difference between capacities **E** and **F**, then suction and discharge of oil for the amount of this difference (**F** – **E**) will be carried out.
In other words, oil is discharge as the capacity of the chamber **F** decreases when the cylinder block (7) rotates.
In the mean time, the capacity of the chamber **E** increases, and the oil is sucked at this process.
(The figure shows the state of the pump when suction of the chamber **F** and discharge of the chamber **E** have completed).

3 - When the center line **X** of the rocker cam (4) becomes in line with the axial direction of the cylinder block (7) (swash plate angle = 0), the difference between capacities of **E** and **F** inside the cylinder block (7) becomes 0, so the pump does not carry out any suction or discharge action of oil.
(In actual fact, the swash plate angle never becomes 0).

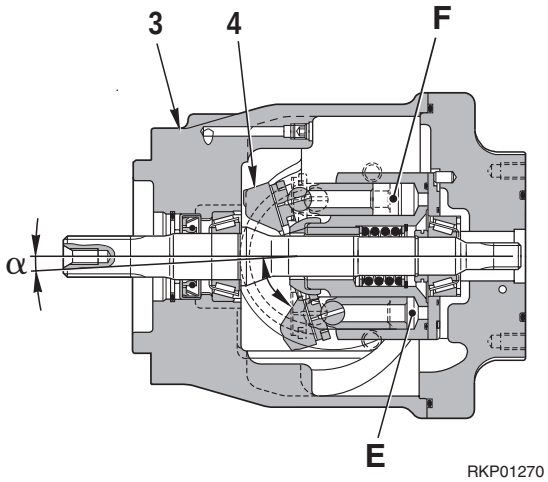
4 - In other words, discharge amount of the pump is directly proportional to the swash plate angle α.



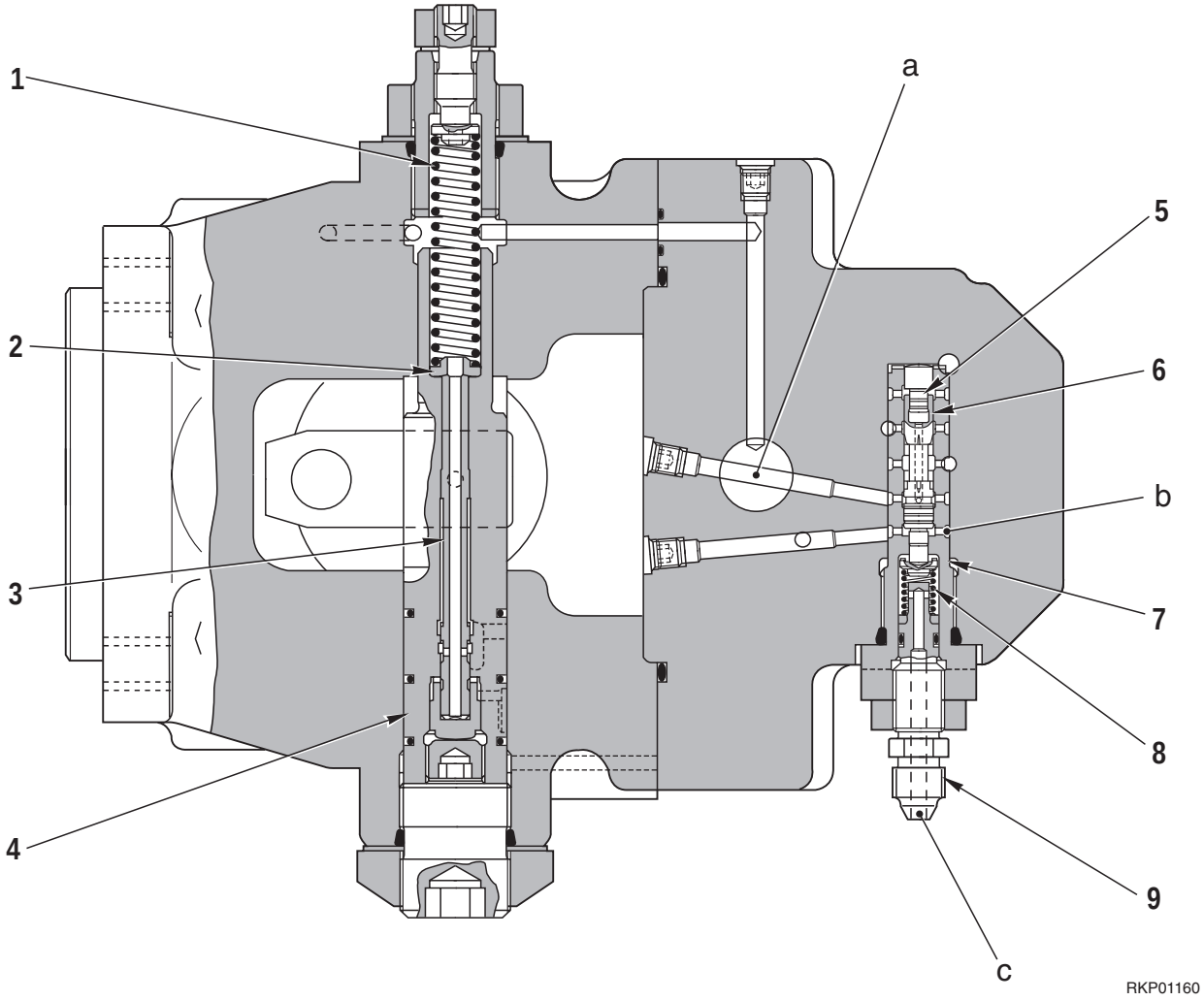


2. Control of discharge amount

- As the swash plate angle α becomes larger, difference between the capacities **E** and **F** becomes larger, so the discharge amount **Q** increases.
  The swash plate angle α is changed by the servo piston.
- The servo piston moves in a linear reciprocating motion ($\updownarrow$) under the signal pressure of **TCC** and **LS** valve.
  This linear motion is transmitted to the rocker cam (4), which is supported by the cylindrical surface of the case (3), and the rocker cam slides in the semi-circular reciprocating direction ($\circlearrowleft$).
- The upper and lower pressure receiving area of the servo piston are different from each other, and to the pressure chamber of the smaller piston side (upper), discharge pressure (self pressure) **PP** of the main pump is always introduced.
  To the pressure chamber of the larger piston side (lower), output pressure **PEN** of the **LS** valve is introduced.
  Movement of the servo piston is controlled by the relationship between pressures **PP** and **PEN** and the proportion of the pressure receiving areas of the smaller and larger pistons.



2. TCC VALVE, LS VALVE, SERVO PISTON



SERVO PISTON

1. Spring
2. Spacer
3. Piston
4. Servo piston

LS VALVE

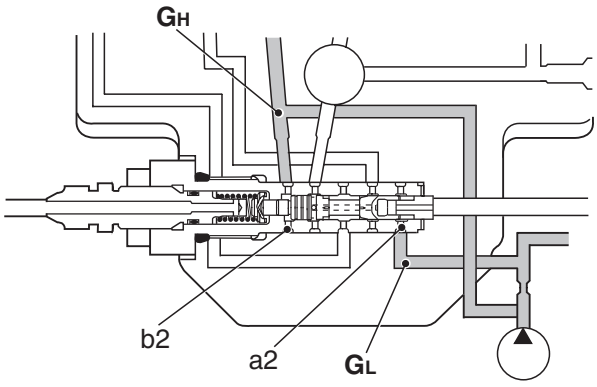
5. Piston
6. Piston
7. Sleeve
8. Spring
9. Union

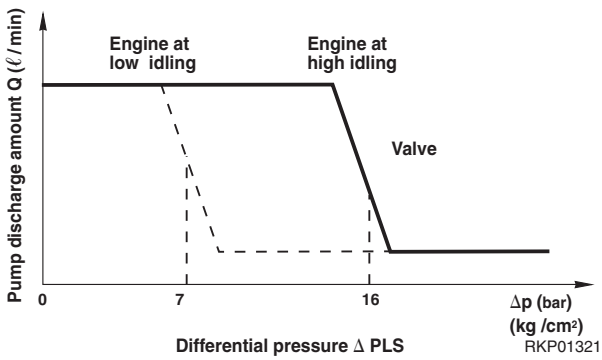
a - P1 Port - Main pump pressure inlet port
b - GH Port - Gear pump pressure inlet port
c - PLS Port - From control valve (LS port)

LS VALVE

Function

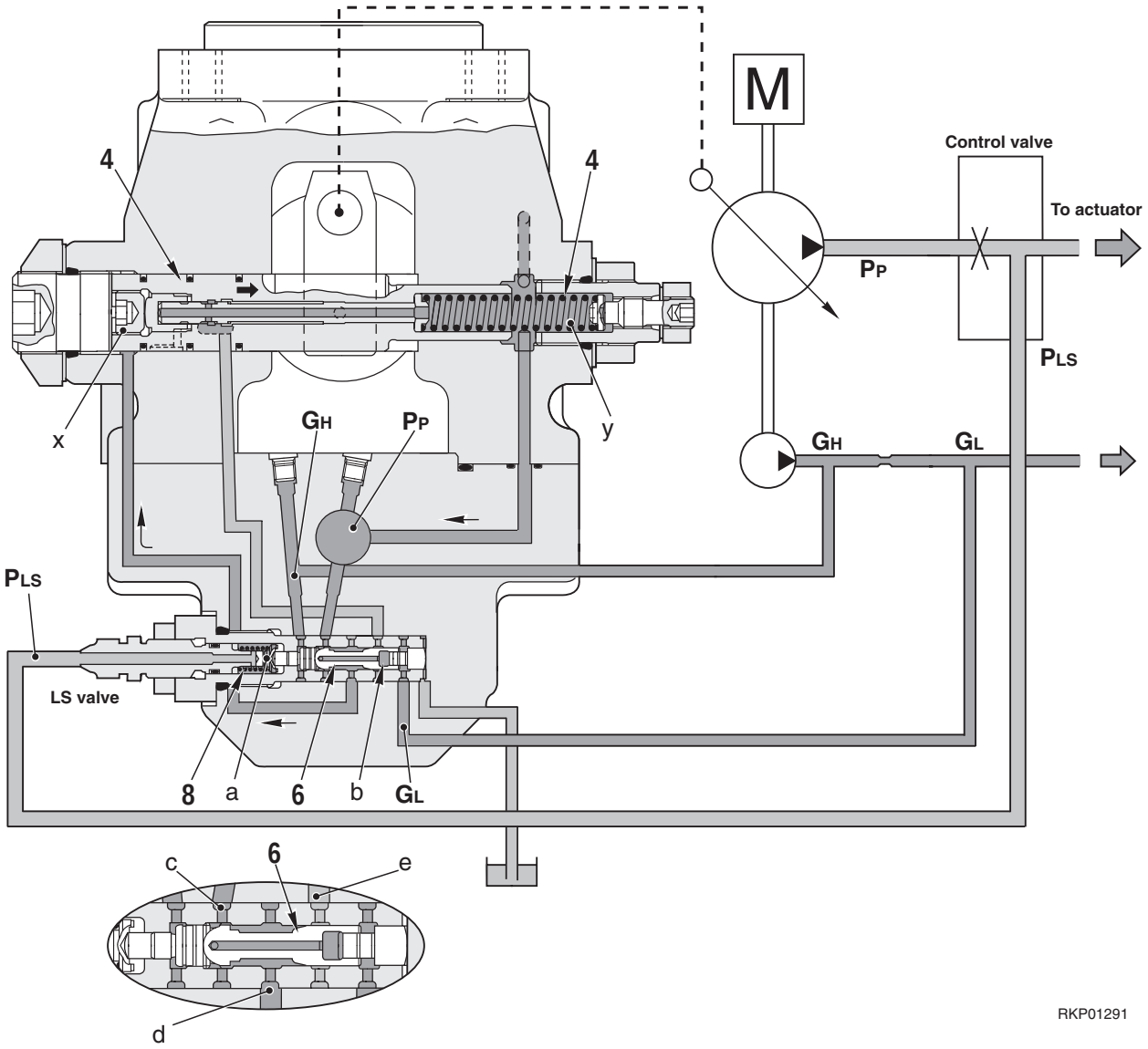
- The **LS** valve controls the pump discharge amount according to the amount of movement of the control lever (that is the oil flow demanded by the actuator).
- The **LS** valve detects the oil flow demanded by the actuator from the differential pressure **ΔPLS** between main pump discharge pressure **PP** and control valve outlet pressure **PLS**, and controls main pump discharge amount **Q**.
  (**PP** is called the pump pressure, **PLS** is called the **LS** pressure, and **ΔPLS** is called the **LS** differential pressure).
- In other words, the pressure loss (= **LS** differential pressure **ΔPLS**) generated by the flow of oil from the pump passing through opening area of the control valve spool is detected.
  By controlling pump discharge amount **Q** so that this pressure loss remains constant, a pump discharge amount is supplied in accordance with the demands of the control valve by controlling pump discharge amount **Q**.
- However, when carrying out fine control or in other cases where the range does not exceed the maximum flow of the pump (the flow demanded by the control valve is always supplied), the discharge amount is the same as when the engine is at high idling, even if the engine is at low idling.
  To overcome this, a function has been added to automatically lower the **LS** differential pressure and reduce the discharge amount when the engine is running at low idling.
- The engine speed is detected by pressures **GH** and **GL** on both sides of the fixed throttle (metering throttle) in the gear pump discharge passage.
  This acts on **LS** valve No. 3 and No. 4 pressure receiving chambers **a2** and **b2**, and changes the **LS** setting. When the engine is running at low idling, the gear pump discharge amount is reduced, so pressures **GH** and **GL** on both sides of the metering throttle become almost the same (the metering differential pressure between **GH** and **GL** becomes lower).
  On the other hand, when the engine is run at full throttle, the gear pump discharge amount is increased and the metering differential pressure becomes higher.
  - When the metering pressure is high (engine speed is high) the **LS** setting is made higher.
  - When the metering pressure is low (engine speed is low) the **LS** setting is made lower.
- Pump pressure **PP**, **LS** pressure **PLS**, and the pressures on both sides of gear pump metering throttle (**GH** and **GL**) are brought to the **LS** valve.
  The relationship between pump discharge amount **Q** and **LS** differential pressure **ΔPLS** changes as shown in the diagram on the right.





OPERATION

1. When control valve is at HOLD position

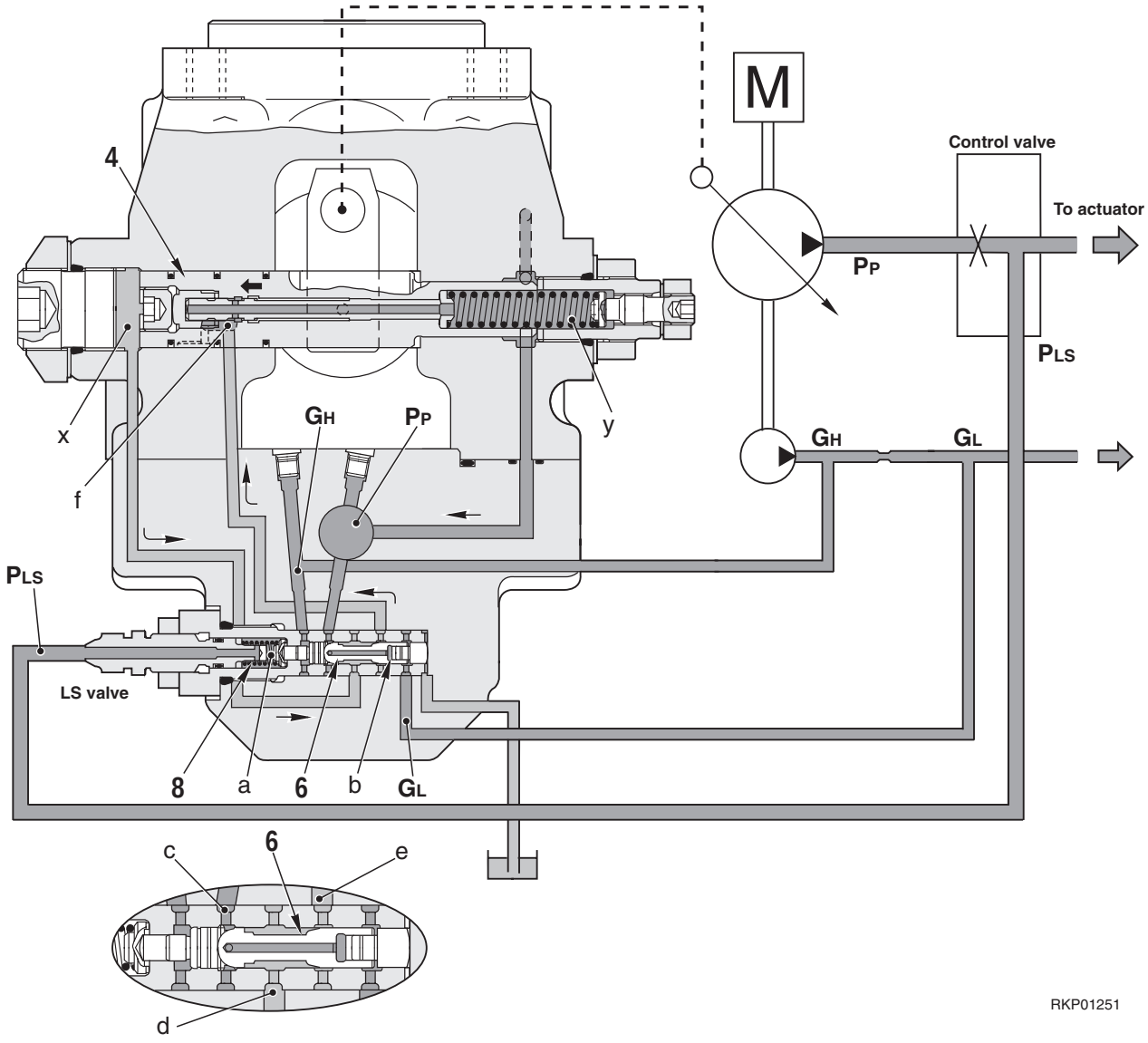


- **LS** pressure **PLS** is brought from the control valve outlet port to spring chamber **a** of the **LS** valve. Pump pressure **PP** is brought to chamber **b** at the tip of piston (6) on the opposite side.
- The position of piston (6) is determined by the size of pump pressure **PP**, the combined force of **LS** pressure **PLS** + force of spring (8), and the size of the differential pressure (**GH - GL**) on both sides of the gear pump metering throttle.
- Before the engine is started, servo piston (4) is pushed to the left (direction of maximum swash plate angle) by spring (1).
- After the engine is started, if all the control valves are at the HOLD position, no pressure oil flows to the control valve outlet port, so **LS** pressure **PLS** is 0 bar (0 kg/cm^2).

(Spring chamber **a** is connected to the drain circuit through the control valve spool).
At the same time, pump pressure **PP** is held at the unload pressure of approx. 26 bar (27 kg/cm^2).

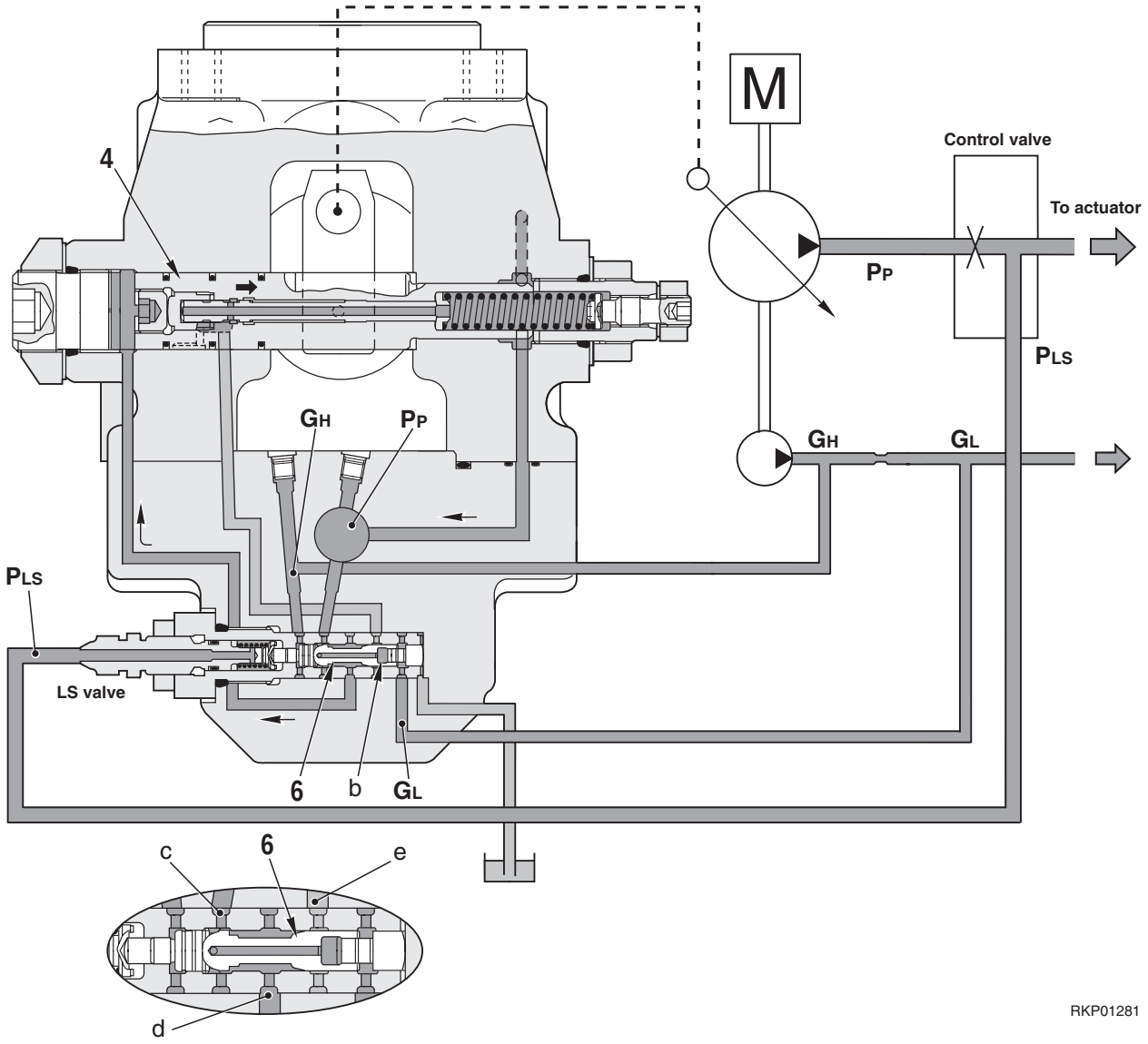
- For this reason, piston (6) is pushed to the left (←), port **c** and port **d** are interconnected, and pump pressure **PP** passes from port **c** to port **d**, and is brought to chamber **X** at the large diameter end of servo piston (4).
- Pump pressure **PP** is always supplied to chamber **Y** at the small diameter end of servo piston (4), but the force applied to the large diameter end of servo piston (4) is greater because of the difference in area at both ends of the piston, so servo piston (4) moves to the right (→) in the direction of the minimum swash plate angle.

2. When opening area of control valve is maximum (lever operated freely)



- When control lever is operated fully (that is, when the area of opening of the control valve becomes larger), the difference between pump pressure **PP** and **LS** pressure **PLS** (**LS** differential pressure **ΔPLS**) becomes smaller.
- **LS** pressure **PLS** brought to spring chamber **a** of the **LS** valve becomes close to pump pressure **PP**, and piston (6) is pushed to the right (→) by the combined force of **LS** pressure **PLS** + force of spring (8).
  This closes port **c** and interconnects port **d** and port **e**.
- As the result, the pressurized oil acting on chamber **X** at the large diameter end of servo piston (4) flows from port **d** to port **e** and is connected to port **f** of the **TCC** valve.
- At this point, port **f** of the **TCC** valve is drained inside the pump case through the inside of the piston, so the pressure in chamber **X** at the large diameter end of servo piston (4) also becomes the drain pressure.
- Because of this, servo piston (4) is moved to the left (←) in the direction of the maximum swash plate angle by pump pressure **PP** acting on chamber **Y** at the small diameter end of the piston.

3. When opening area of control valve is small (small movement of lever)



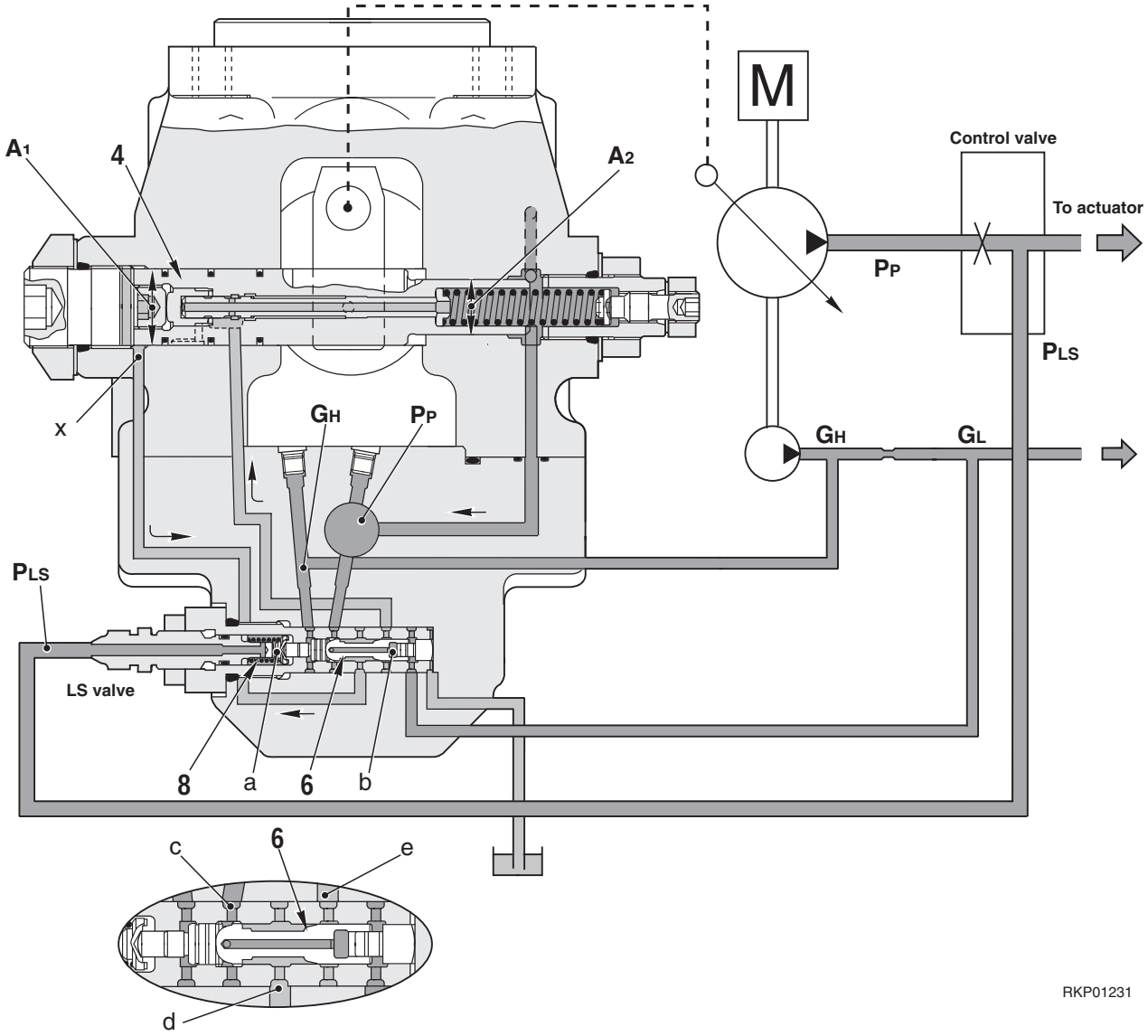
When engine is at high idling

- When the control lever is operated in small movements, or when it is operated to the HOLD position (in other words, when the area of opening of the control valve becomes smaller), the difference between pump pressure **PP** and **LS** pressure **PLS** (in other words, **LS** pressure **ΔPLS**) becomes larger.
- When this happens, the movement is the same as for "1. When control valve is at HOLD position": pump pressure **PP** pushes piston (6) to the left (←), so servo piston (4) is moved to the right (→) in the direction of the minimum swash plate angle.
  In other words, the **LS** set differential pressure of the **LS** valve is taken as 16 bar (16 kg/cm^2).
  In the range from the neutral position of the control valve to the small area of opening of the control valve (fine control), in the area where **LS** differential pressure **ΔPLS** is more than 16 bar (16 kg/cm^2), the pump swash plate angle moves in the minimum direction. If the area of opening of the control valve is further increased, and **LS** differential pressure **ΔPLS** goes below 16 bar (16 kg/cm^2), the pump swash plate angle is moved in the maximum direction.

When engine is at low idling

- The **LS** set differential pressure of the **LS** valve is taken as 7 bar (7 kg/cm^2). In the area where the **LS** differential pressure **ΔP**$_{LS}$ is more than 7 bar (7 kg/cm^2), the pump swash plate angle moves in the minimum direction. If the area of opening of the control valve is further increased and **LS** differential pressure **ΔP**$_{LS}$ goes below 7 bar (7 kg/cm^2), the pump swash plate angle is moved in the maximum direction. Even if the area of opening of the control valve is the same, the **LS** set differential pressure is lower than when the engine is running at full throttle (even when the lever is operated to the same halfway position), so the discharge flow is reduced below the level when the engine is running at full throttle.

4. When pump flow is amount demanded by control valve



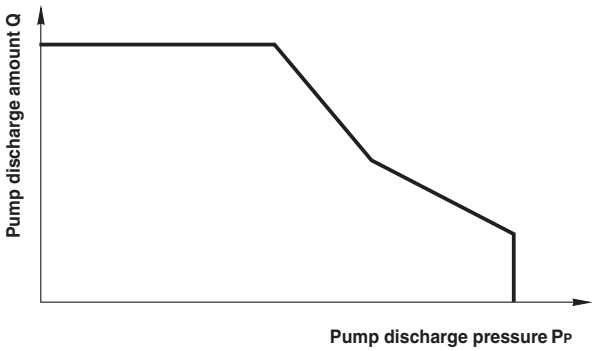
- Let us take the area receiving the pressure at the large diameter end of servo piston (4) as **A1**, the area receiving the pressure at the small diameter end as **A2**, the pressure acting on the large piston diameter end as **PEN** and the pressure acting on the small piston diameter end as **PP**.
- When the flow of oil from the pump reaches the flow demanded by the control valve, pump pressure **PP** acting on port **b** of the **LS** valve and the combined force of **LS** pressure **PLS** + force of spring (8) acting on spring chamber **a** are balanced, so piston (6) stops at almost the central position.
- As a result, port **c**, port **d** and port **e** open approximately the same amount, so the pump pressure flows from port **c** to port **d**.
  Part flows from port **e** to the tank case and is drained, so the pressure is reduced by approx. 1/2 and flows to chamber **X** at the large diameter end of servo piston (4).
- At this point, the relationship between the area receiving the pressure at both ends of servo piston (4) is **A2** : **A1** = **1** : **2**, so the pressure applied to both ends of servo piston (4) becomes **PP** : **PEN** = **2** : **1**. This makes the force acting on both ends of servo piston (4) **1** : **1**, so servo piston (4) stops in that position and the pump discharge amount is balanced with the oil flow demanded by the control valve.

- The force of the spring is adjusted so that $P_P - P_{LS} = \Delta P_{LS} = 16$ bar (16 kg/cm^2) at the point where piston (6) is balanced.
- In other words, when the area of opening of control valve is 1/2, the pump swash plate angle is also 1/2, and when the area of opening of control valve is 1/4, the pump swash plate angle is also 1/4. **LS** differential pressure ΔP_{LS} is always held at 16 bar (16 kg/cm^2), so the pump discharge amount is in accordance with the area of opening of the control valve.
- For example, after balancing at an area of opening 1/4 of the control valve, if the system is operated to 3/4 of the area of opening of the control valve, **LS** differential pressure ΔP_{LS} will drop momentarily. As a result, the **LS** valve is actuated and the pump discharge amount is increased, but when the pump swash plate angle rises to 3/4 the **LS** differential pressure ΔP_{LS} rises to 16 bar (16 kg /cm^2), so it is balanced in this position.

TCC VALVE

Function

- When discharge pressure **P_P** becomes higher, the area of opening of the control valve becomes larger, and even if the **LS** valve tries to increase pump discharge amount **Q**, the **TCC** valve carries out control to prevent any increase above fixed discharge amount **Q** to match discharge pressure **P_P**. It carries out approximate horsepower control to prevent the hydraulic horsepower absorbed by the pump from exceeding the engine horsepower.
- In other words, if the load during operations becomes larger and pump discharge pressure **P_P** rises, pump discharge amount **Q** is reduced; and if pump discharge pressure **P_P** goes down, pump discharge amount **Q** is increased.
- The relationship between pump discharge pressure **P_P** and pump discharge amount **Q** is as shown in the diagram on the right.



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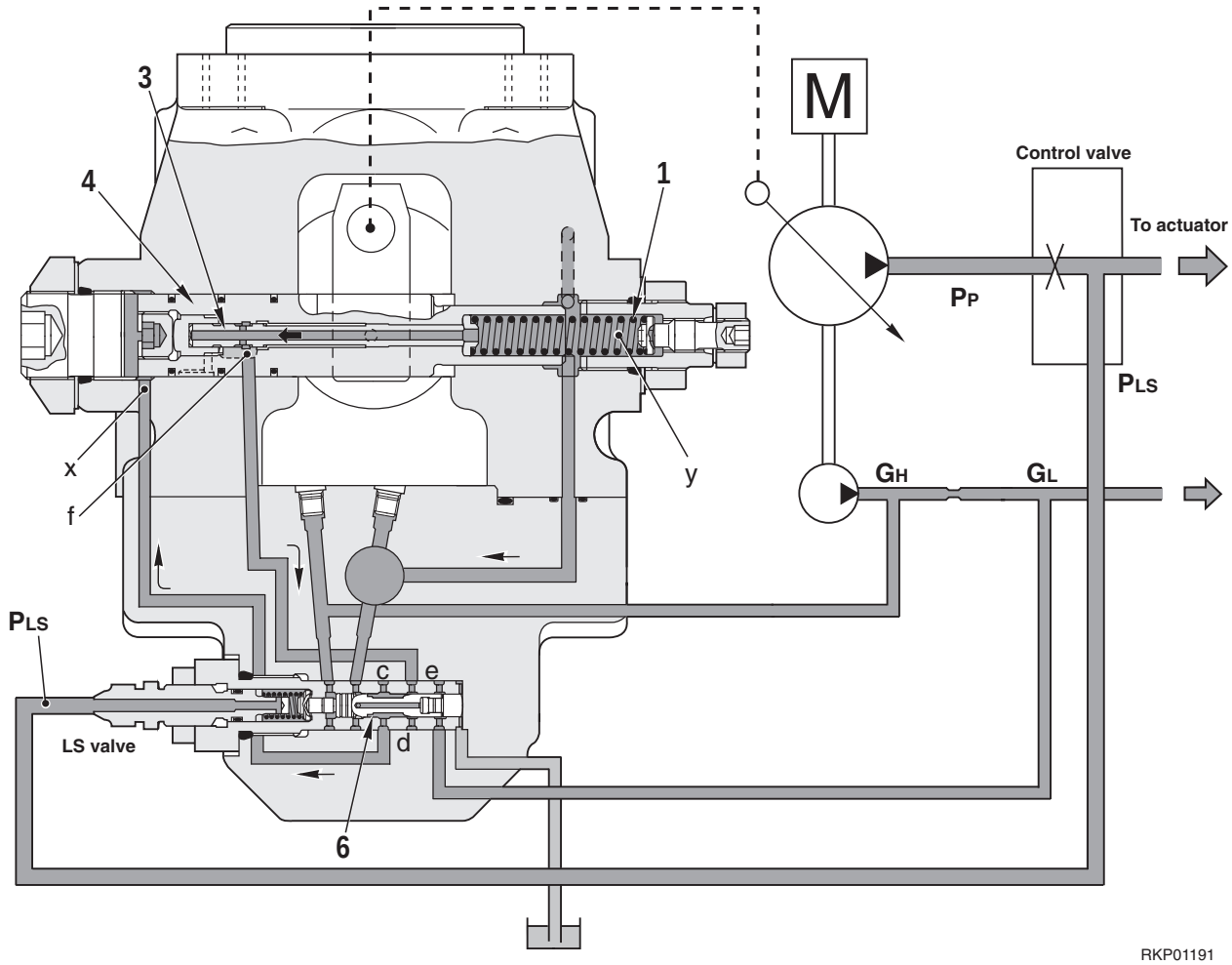
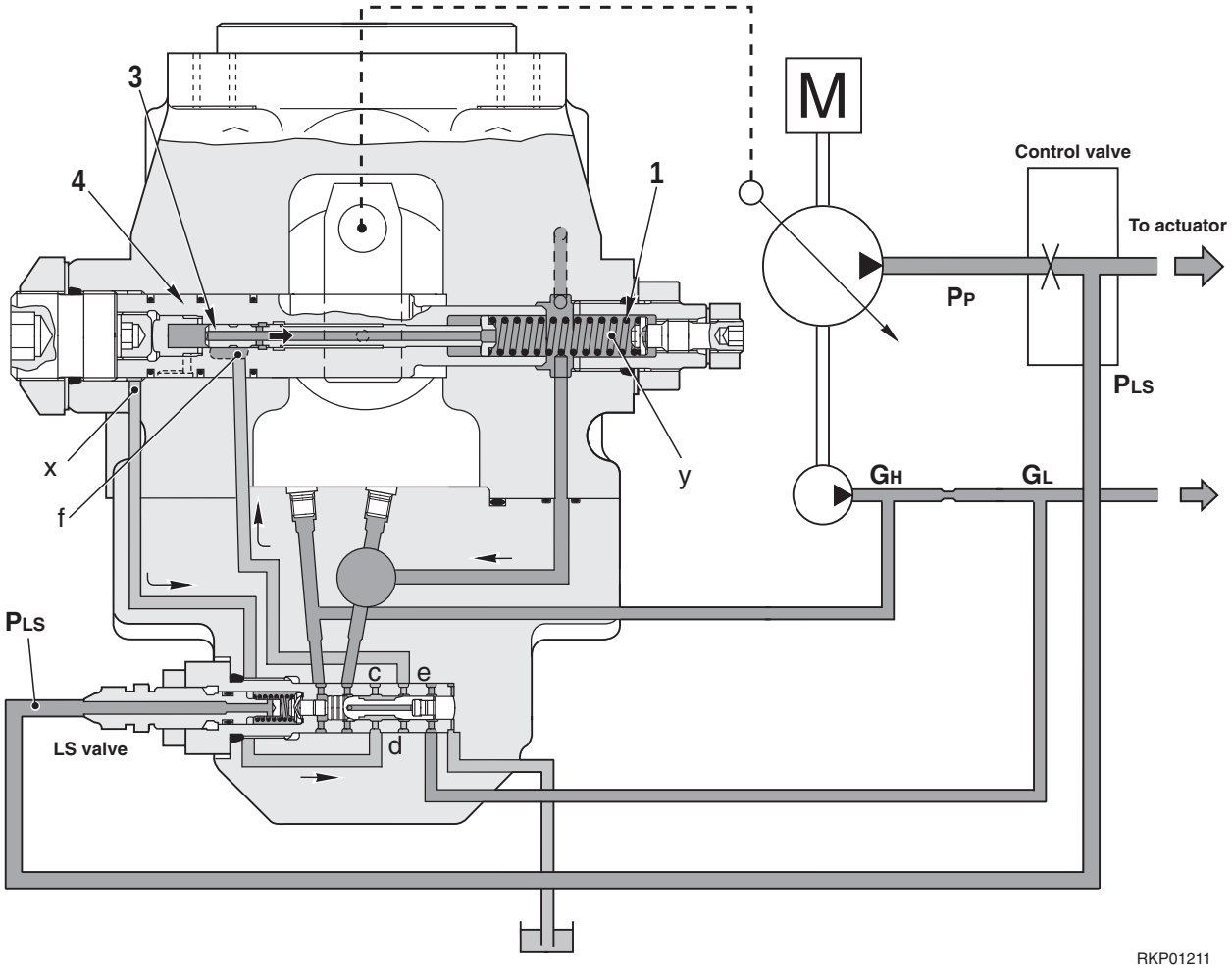
OPERATION

1. When actuator load is large (pump discharge pressure P_P is high)



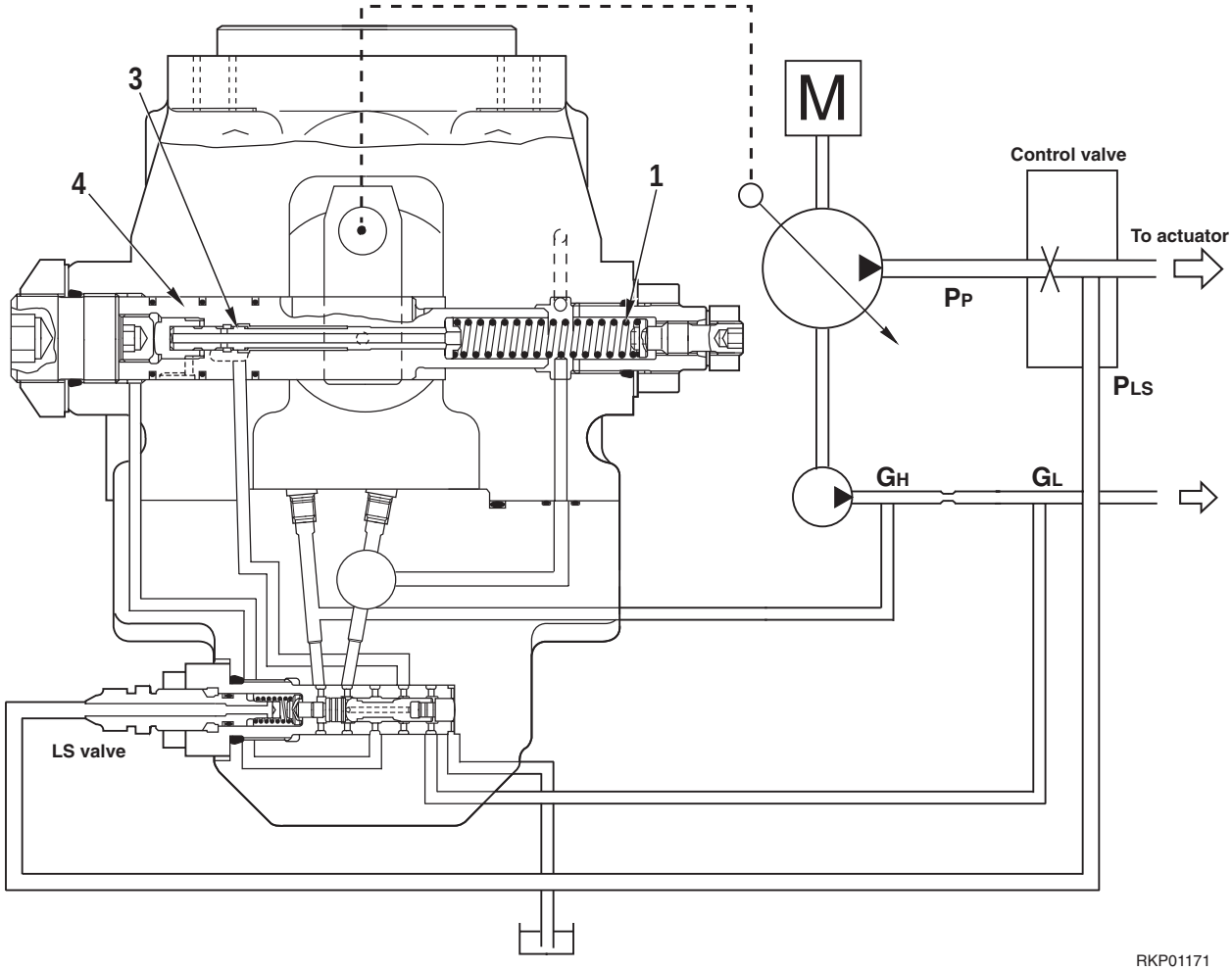
- When the load on the actuator becomes high and pump discharge pressure **P_P** rises, piston (3) is pushed to the left (←).
- As a result, port **f** and chamber **Y** are interconnected, pump pressure **P_P** flows from chamber **Y** to port **f**, and at the same time, port **f** and the drain circuit are shut off.
- If the **LS** valve takes action to increase the pump discharge amount, spool (6) of the **LS** valve is moved to the right (→) and port **d** and port **e** are interconnected.
- As a result, pump pressure **P_P** from port **f** of the **TCC** valve flows from port **e** of the **LS** valve to port **d**, enters chamber **X** at the large diameter end of servo piston (4), and stops the movement of servo piston (4).
- If pump discharge **P_P** rises further, piston (3) moves to the left (←) and servo piston (4) moves to the right (→) in the direction of the minimum swash plate angle because of the pressure in chamber **X** at the large diameter end.
- When servo piston (4) moves to the right (→) in the direction of the minimum swash plate angle, spring (1) is compressed, and piston (3) is moved to the right (→).
- When piston (3) is moved to the right (→) and port **f** and chamber **Y** are shut off, servo piston (4) stops moving to the right.
- The position where servo piston (4) stops is higher (closer to the minimum swash plate angle) than when the pump discharge pressure is low.

2. When actuator load becomes smaller (pump discharge pressure P_P drops)



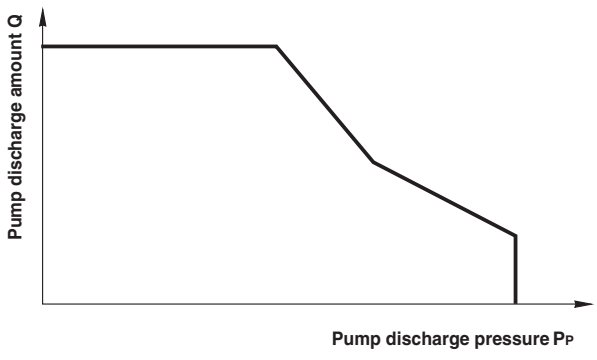
- When the load on the actuator becomes smaller and pump discharge pressure **P_P** drops, piton (3) is pushed to the right (→) by the pressure in chamber **X**.
- As a result, chamber **Y** and port **f** are shut off, and at the same time, port **f** is connected to the drain circuit.
- When this happens, if the **LS** valve is acting to increase the pump discharge pressure, the limit of the **TCC** valve disappears, so the pressurized oil in chamber **X** at the large diameter end of servo piston (4) passes from port **d** of the **LS** valve to port **e**, and flows from port **f** of the **TCC** valve to the drain circuit as explained in the section on the **LS** valve.
- For this reason, servo piston (4) is moved to the left (←) in the direction of the maximum swash plate angle by the pressure in chamber **Y** at the small diameter end.

3. Action of spring



RKP01171

- The spring load of spring (1) in the **TCC** valve is changed by the swash plate angle. In addition, spring (1) consist of 2 types of pitch: rough and fine.
- When servo piston (4) moves, the compression of spring (1) changes by that amount.
- If piston (4) moves to the right (→), first, both the rough and fine pitch of spring (1) are compressed. If it moves further to the right (→) the fine pitch portion comes into close contact, so only the rough pitch portion functions as a spring from this point. In other words, the spring load is changed by piston (4) extending or contracting spring (1).
- The pump absorption torque curve, which shows the relationship between pump discharge pressure **PP** and discharge amount **Q**, is a bent curve as shown in the diagram on the right because spring (1) has different spring pitches.



RKP01181

- The position where piston (3) stops, in other words, the pump absorption torque, is determined by the position where the force of spring (1) + pump pressure **P_P** acting on piston (3) are in balance.
- In other words, if pump discharge pressure **P_P** increases, pump discharge amount **Q** is reduced; and if pump discharge pressure **P_P** goes down, pump discharge amount **Q** is increased.

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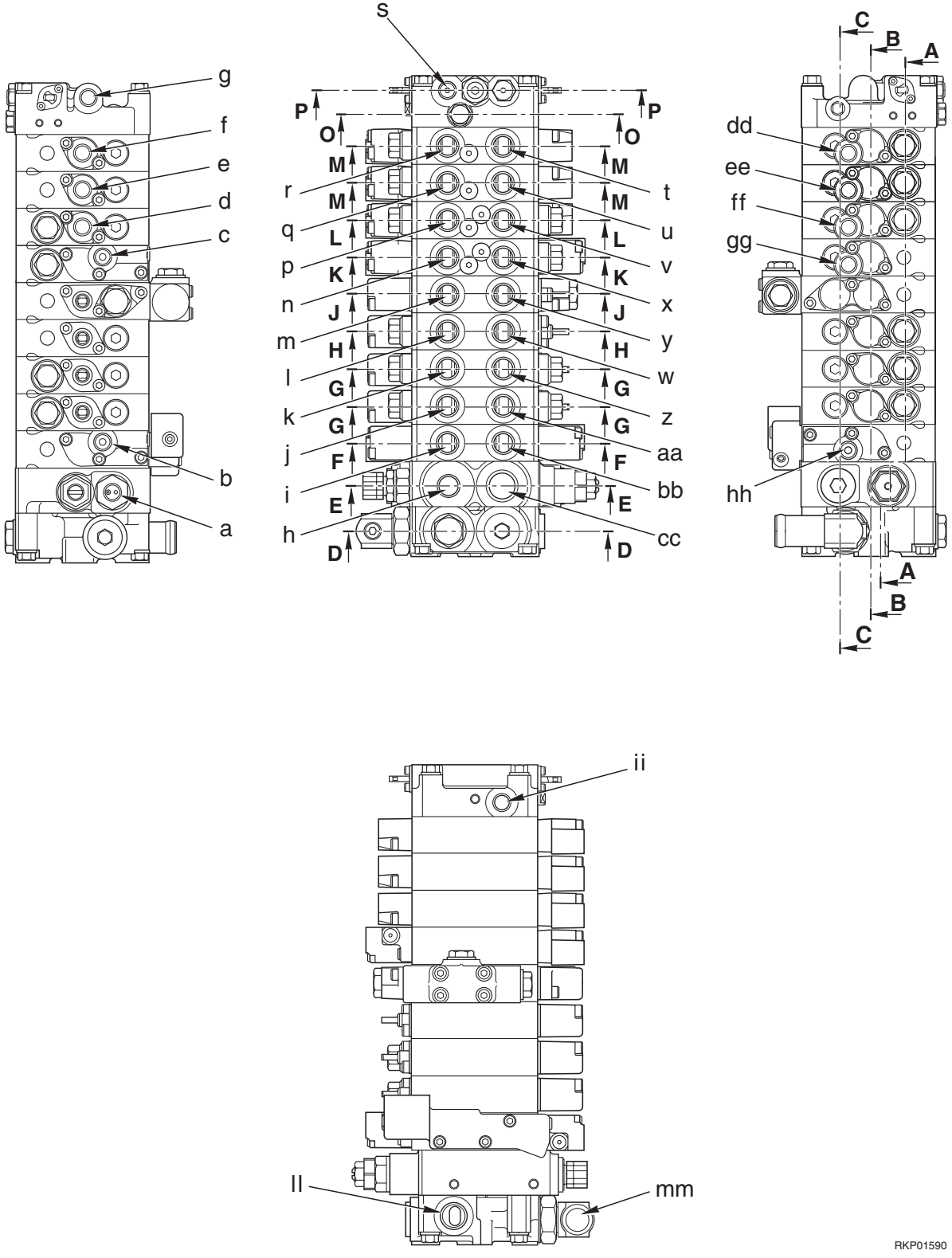
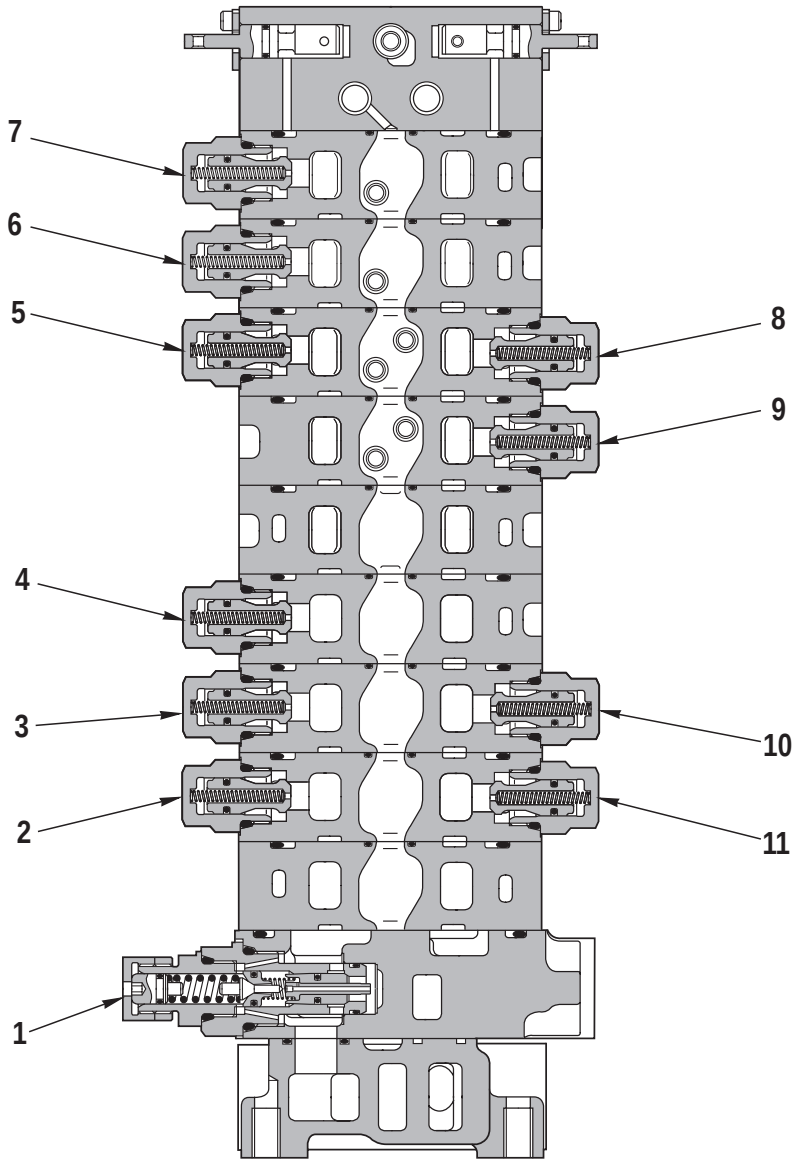
CONTROL VALVE



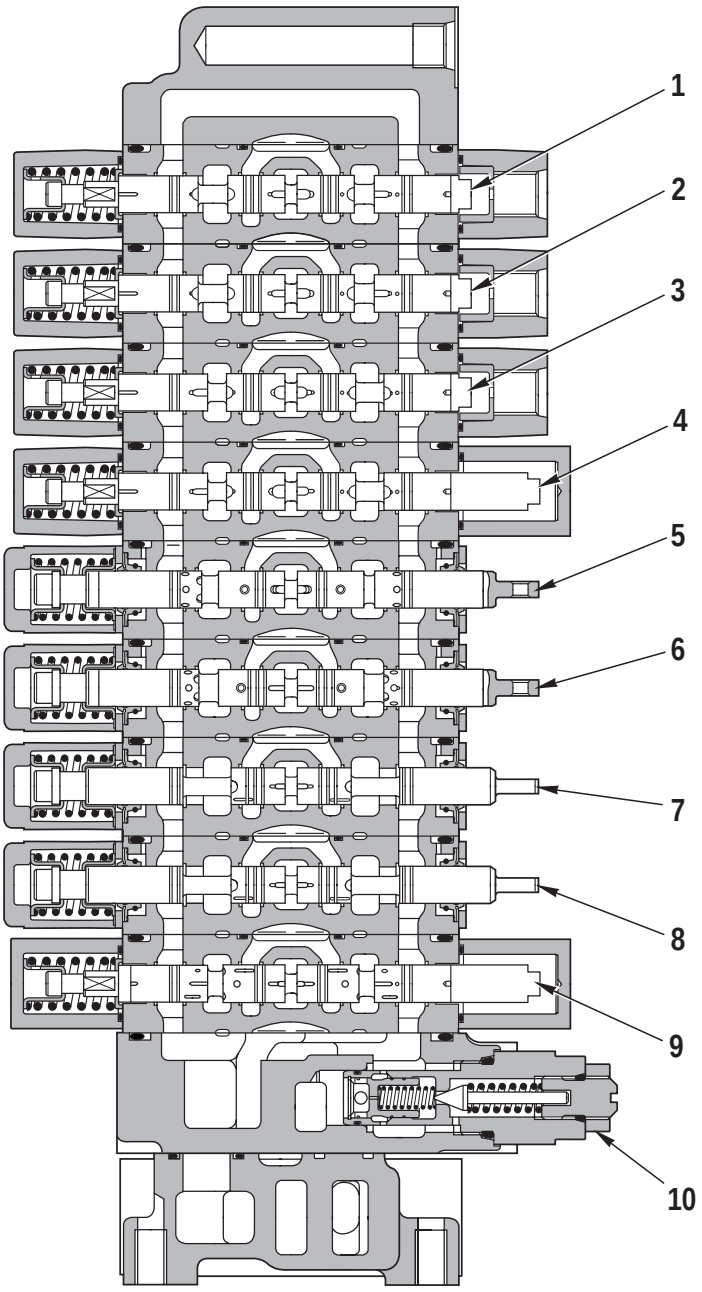
a. LS Port - From hydraulic pump (P_{LS} Port)
b. P_{A1} Port - From L.H. PPC valve (P3 Port)
c. P_{A6} Port - From L.H. PPC valve (P1 Port)
d. P_{A7} Port - From R.H. PPC valve (P2 Port)
e. P_{A8} Port - From R.H. PPC valve (P3 Port)
f. P_{A9} Port - From work equipment PPC valve (P2 Port)
g. P2 Port - From hydraulic pump (P2 Port)
h. S Port - From hydraulic tank
i. B1 Port - To swing motor (A Port)
j. B2 Port - To swivel joint (D Port)
k. B3 Port - To swivel joint (A Port)
l. B4 Port - To boom swing cylinder (Head side)
m. B5 Port - To swivel joint (F Port)
n. B6 Port - To arm cylinder (Head side)
p. B7 Port - To boom cylinder (Bottom side)
q. B8 Port - To bucket cylinder (Bottom side)
r. B9 Port - To attachment (R.H. side)
s. Pi2 Port - To ST1 solenoid valve (P Port)
t. A9 Port - To attachment (L.H. side)
u. A8 Port - To bucket cylinder (Head side)
v. A7 Port - To boom cylinder (Head side)
x. A6 Port - To arm cylinder (Bottom side)
y. A5 Port - To swivel joint (E Port)
w. A4 Port - To boom swing cylinder (Head side)
z. A3 Port - To swivel joint (C Port)
aa. A2 Port - To swivel joint (B Port)
bb. A1 Port - To swing motor (B Port)
cc. P Port - From hydraulic pump (P1 Port)
dd. P_{B9} Port - From work equipment PPC valve (P1 Port)
ee. P_{B8} Port - From R.H. PPC valve (P4 Port)
ff. P_{B7} Port - From R.H. PPC valve (P1 Port)
gg. P_{B6} Port - From L.H. PPC valve (P2 Port)
hh. P_{B1} Port - From L.H. PPC valve (P4 Port)
ii. TS Port - To hydraulic tank
ll. T Port - To hydraulic tank
mm. C Port - To exchange oil cooler



Section A - A

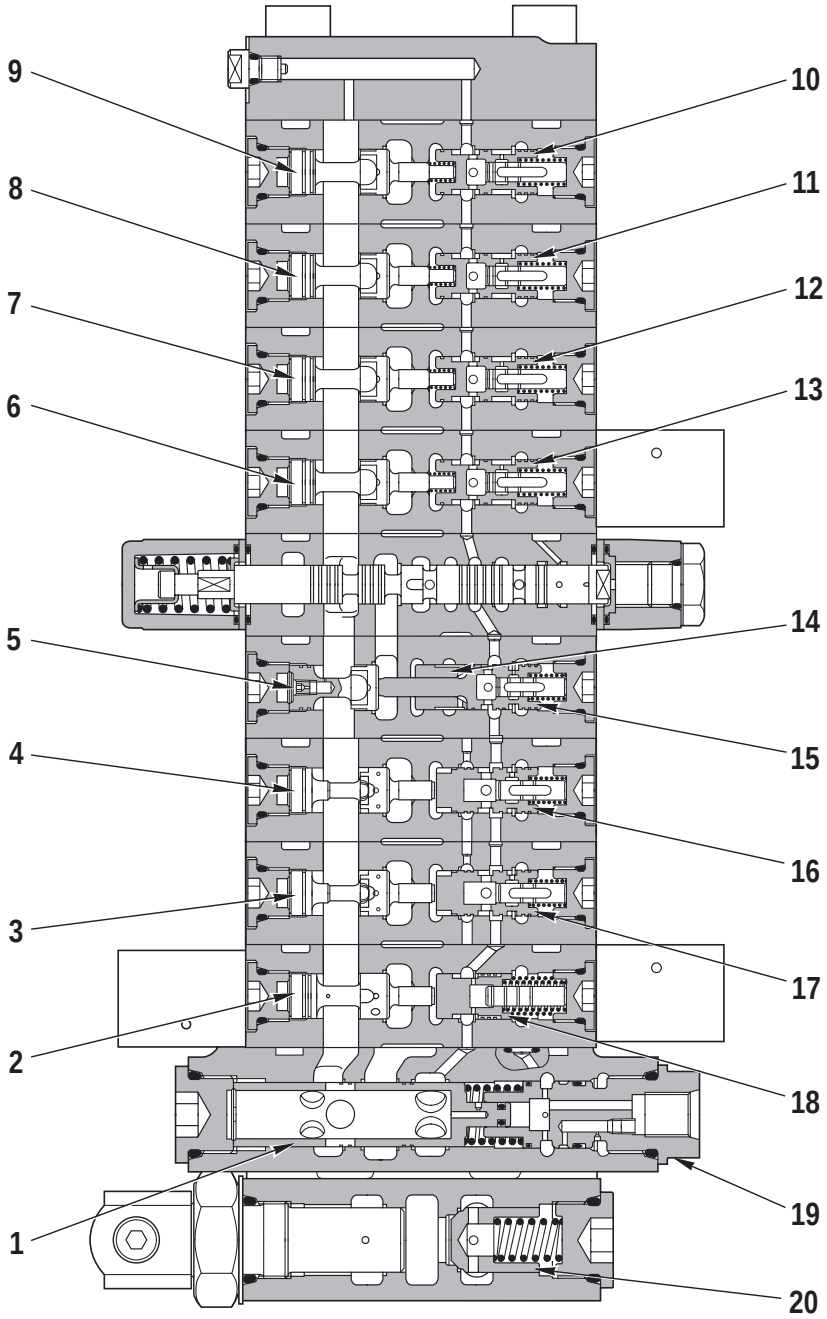
RKP01660

1 - Safety valve
2 - Suction valve (L.H. Travel reverse)
3 - Suction valve (R.H. Travel reverse)
4 - Suction valve (L.H. Boom swing)
5 - Suction valve (Raise boom)
6 - Suction valve (Close bucket)
7 - Suction valve (Work equipment R.H. side)
8 - Suction valve (Lower boom)
9 - Suction valve (Close arm)
10 - Suction valve (R.H. Travel forward)
11 - Suction valve (L.H. Travel forward)



Section B - B RKP01620

1 - Spool (hammer)
2 - Spool (bucket)
3 - Spool (boom)
4 - Spool (arm)
5 - Spool (blade)
6 - Spool (boom swing)
7 - Spool (R.H. travel)
8 - Spool (L.H. travel)
9 - Spool (swing)
10 - Main relief valve



Section C - C RKP01610

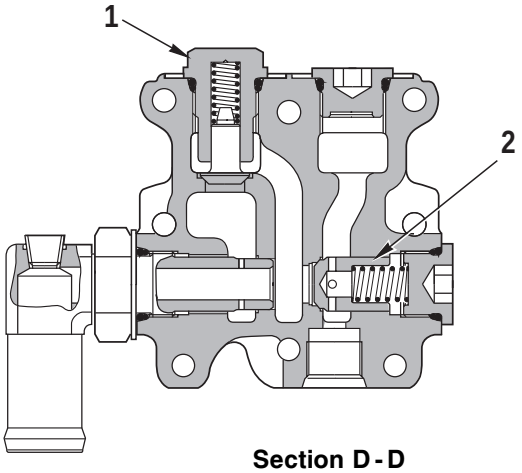
1. Unload valve

FLOW COMPENSATION VALVE

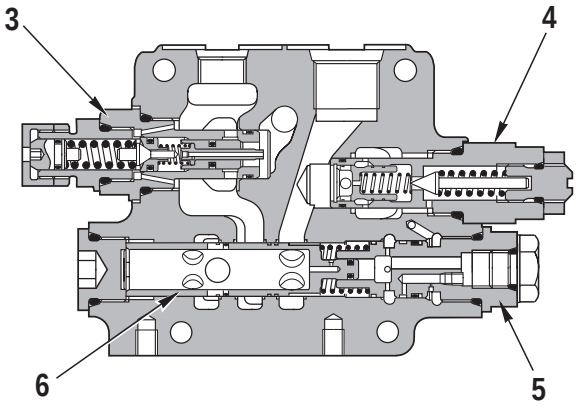
2 - Swing
3 - L.H. Travel
4 - R.H. Travel
5 - Boom swing and blade
6 - Arm
7 - Boom
8 - Bucket
9 - Attachment

REDUCING PRESSURE COMPENSATION VALVE

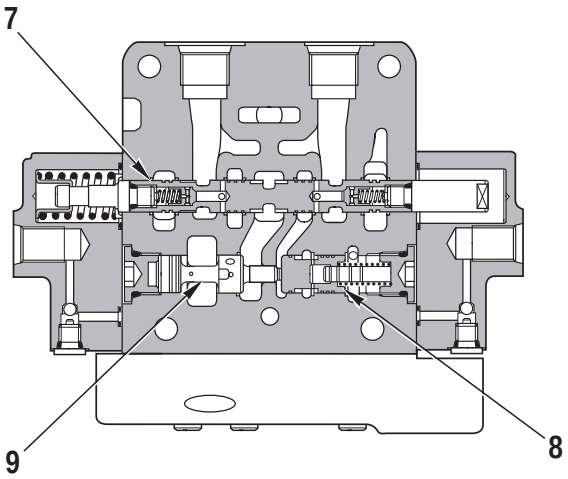
10 - Attachment
11 - Bucket
12 - Boom
13 - Arm
14 - Piston (boom swing and blade)
15 - Boom swing and blade
16 - R.H. Travel
17 - L.H. Travel
18 - Swing
19 - LS bypass plug
20 - Cooler check valve



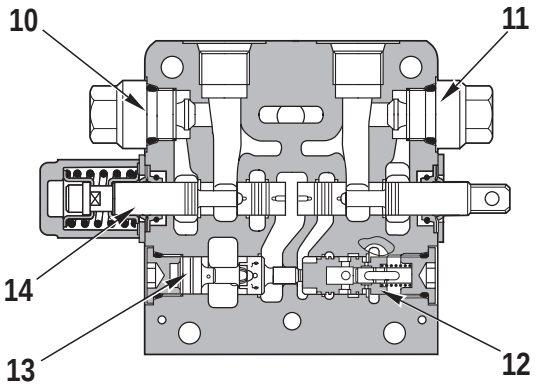
Section D - D



Section E - E



Section F - F



Section G - G

RKP01640

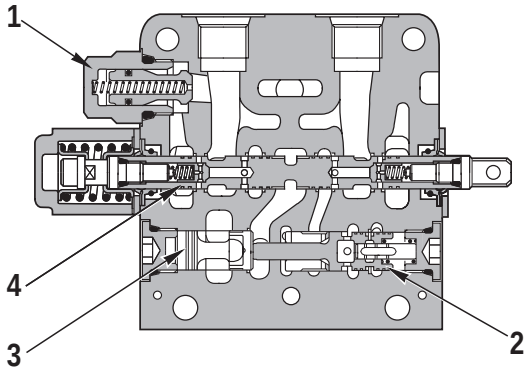
1 - Lift check valve
2 - Cooler check valve
3 - Safety valve
4 - Main relief valve
5 - LS bypass plug
6 - Unload valve

SWING VALVE

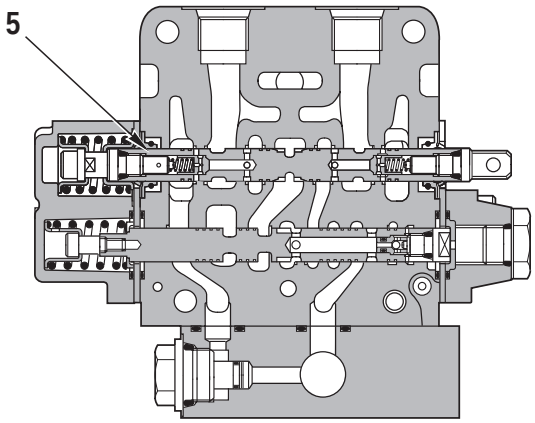
7 - Spool
8 - Reducing pressure compensation valve
9 - Flow compensation valve

TRAVEL VALVE

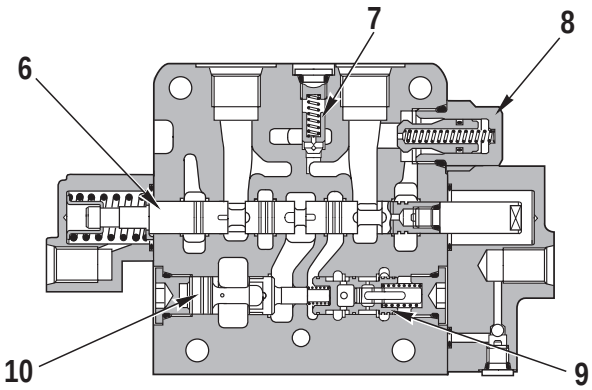
10 - Suction valve (FORWARD)
11 - Suction valve (REVERSE)
12 - Reducing pressure compensation valve
13 - Flow compensation valve
14 - Spool



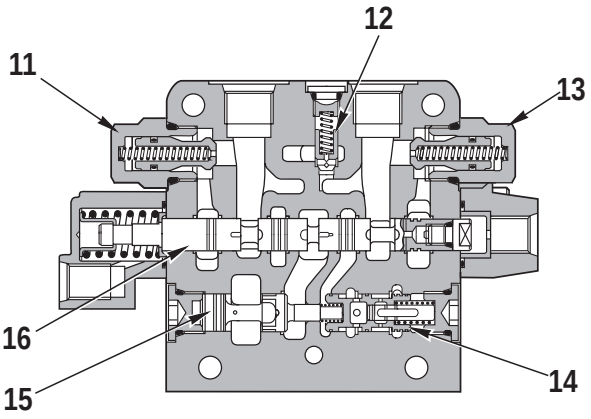
Section H - H



Section J - J



Section K - K



Section L - L

RKP01600

BOOM SWING VALVE

1 - Suction valve (L.H. swing)
2 - Reducing pressure compensation valve
3 - Flow compensation valve
4 - Spool

BLADE VALVE

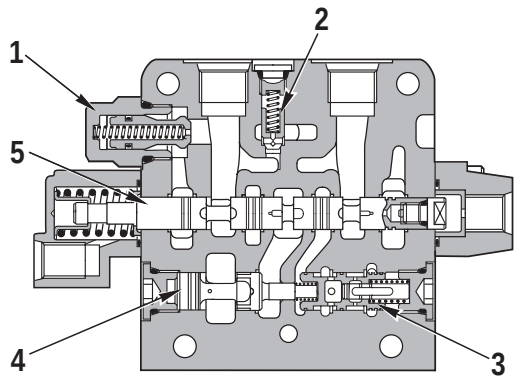
5 - Spool

ARM VALVE

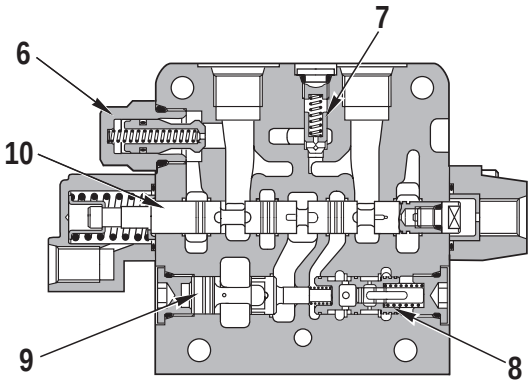
6 - Spool
7 - Check valve
8 - Suction valve
9 - Reducing pressure compensation valve
10 - Flow compensation valve

BOOM VALVE

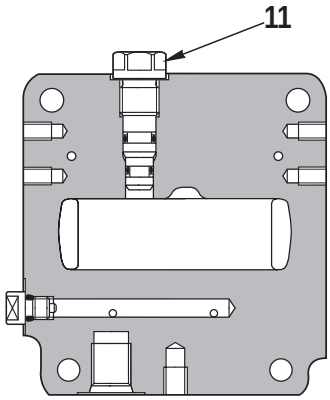
11 - Suction valve (raise)
12 - Check valve
13 - Suction valve (lower)
14 - Reducing pressure compensation valve
15 - Flow compensation valve
16 - Spool



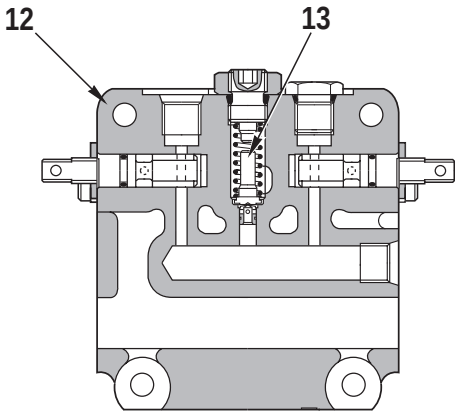
Section M - M



Section N - N



Section O - O



Section P - P

RKP01630

BUCKET VALVE

1 - Suction valve
2 - Check valve
3 - Reducing pressure compensation valve
4 - Flow compensation valve
5 - Spool

HAMMER VALVE

6 - Suction valve
7 - Check valve
8 - Reducing pressure compensation valve
9 - Flow compensation valve
10 - Spool
11 - Plug
12 - Cover
13 - Pilot relief valve:

CLSS

1. OUTLINE

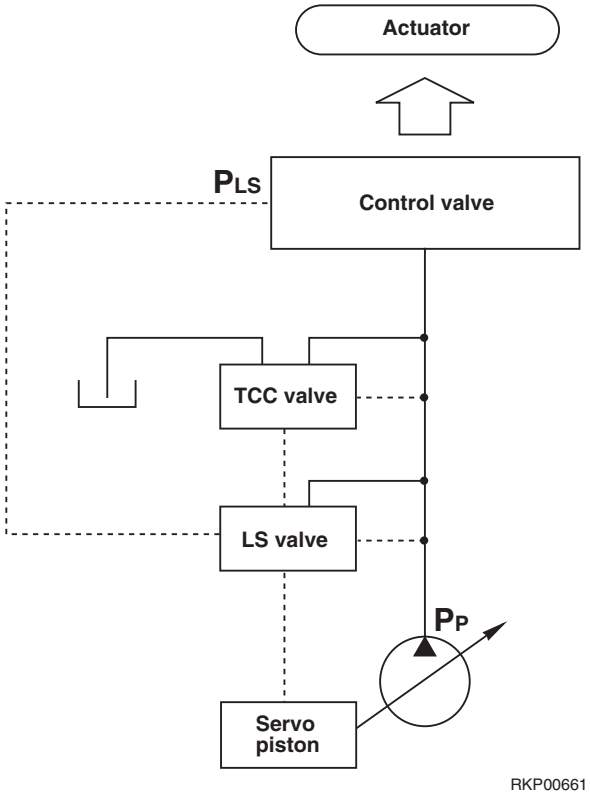
FEATURES

The term "**CLSS**" stand for the "Closed Center Load Sensing System" which has the following features.

a) Fine-controllability not affected by loads.
b) Controllability enabling digging even in the fine control mode.
c) Complex operability ensured by flow distribution determined according to the opening areas of spools during complex operation.
d) Energy-saving feature using variable pump control.

STRUCTURE

- The CLSS consists of a variable displacement single piston pump, control valve and actuators.
- The pump body consists of the main pump, **TCC** valve and **LS** valve.

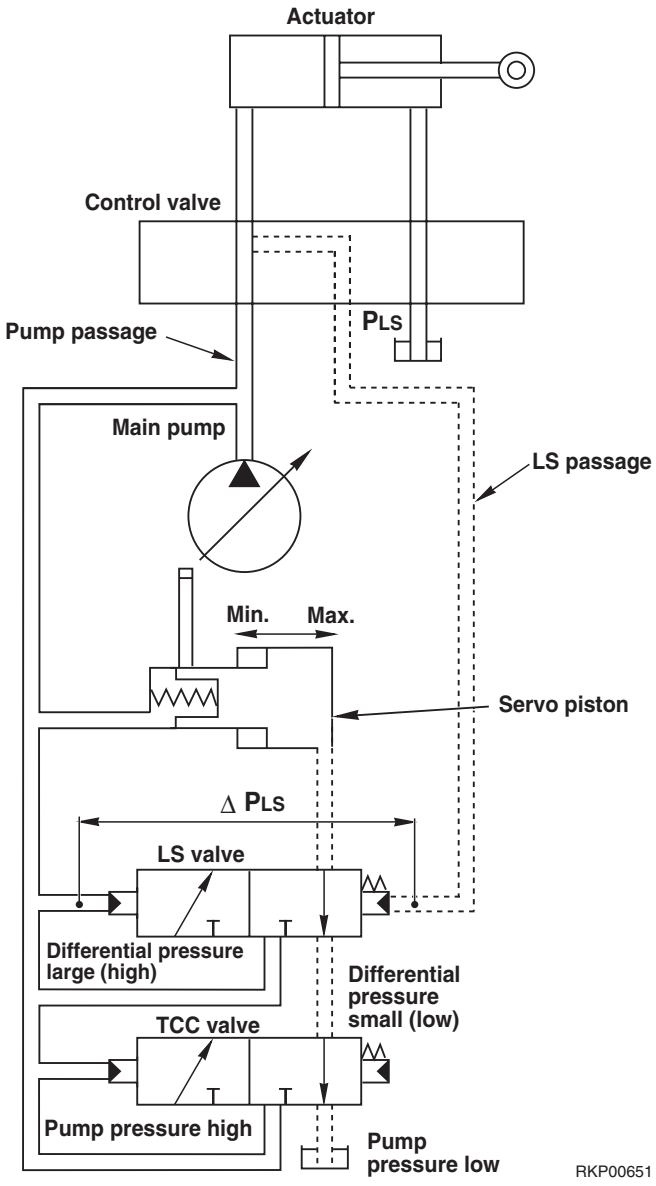


2. BASIC PRINCIPLE

1) Control of pump swash plate angle

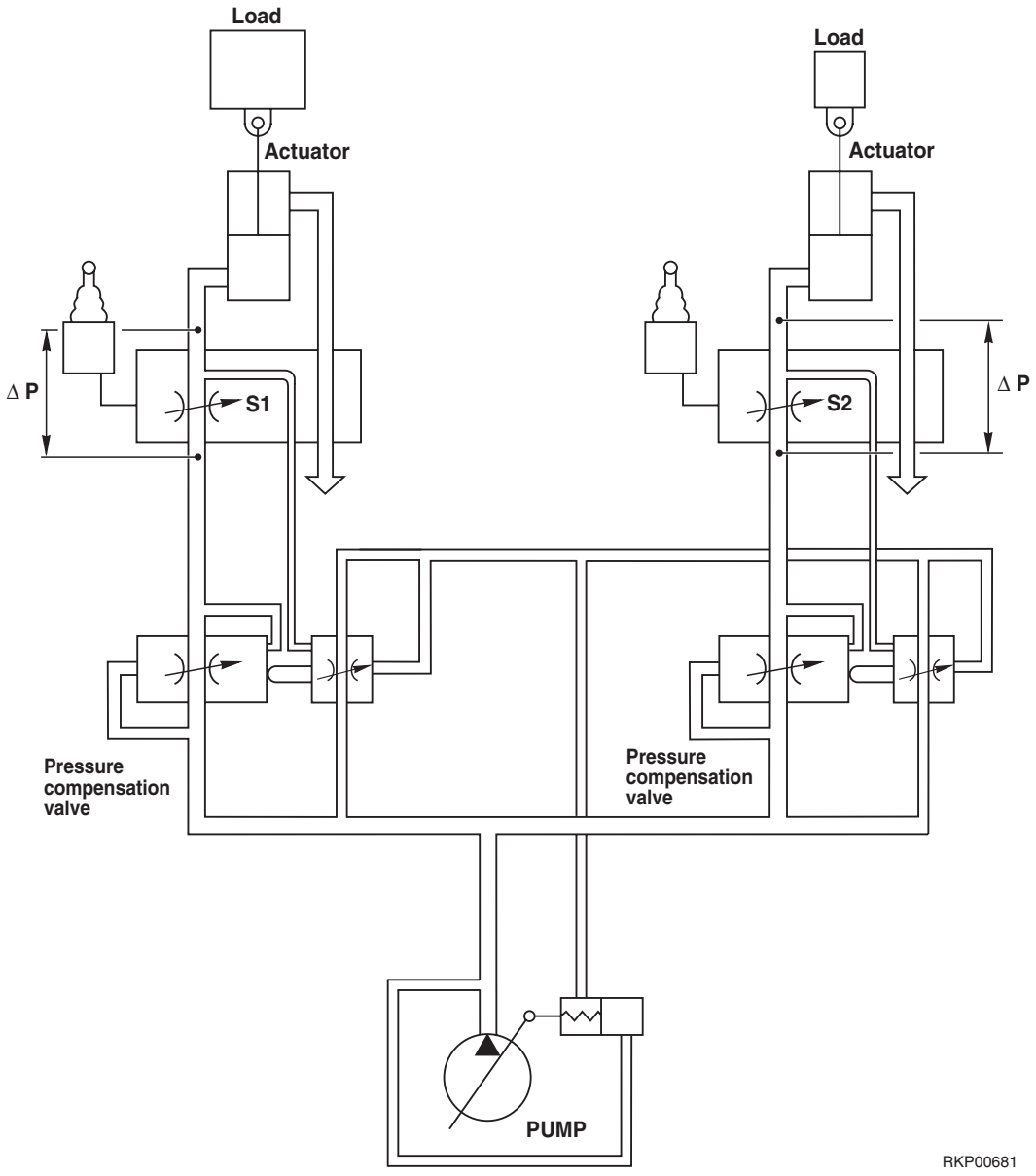
- The pump swash plate angle (pump discharge amount) is so controlled that the **LS** differential pressure ΔP_{LS}, which is the difference between the pump discharge pressure P_P and the **LS** pressure P_{LS} at the outlet port of the control valve (actuator load pressure), is maintained at a constant level.
  (**LS** differential pressure ΔP_{LS} = Pump discharge pressure P_P – pressure P_{LS}).
- If the **LS** differential pressure ΔP_{LS} becomes lower than the setting pressure of the **LS** valve, the pump swash plate angle becomes larger, and if it becomes higher, the pump swash plate angle becomes smaller.

★ For the details of this action, refer to the descriptions of «HYDRAULIC PUMP».



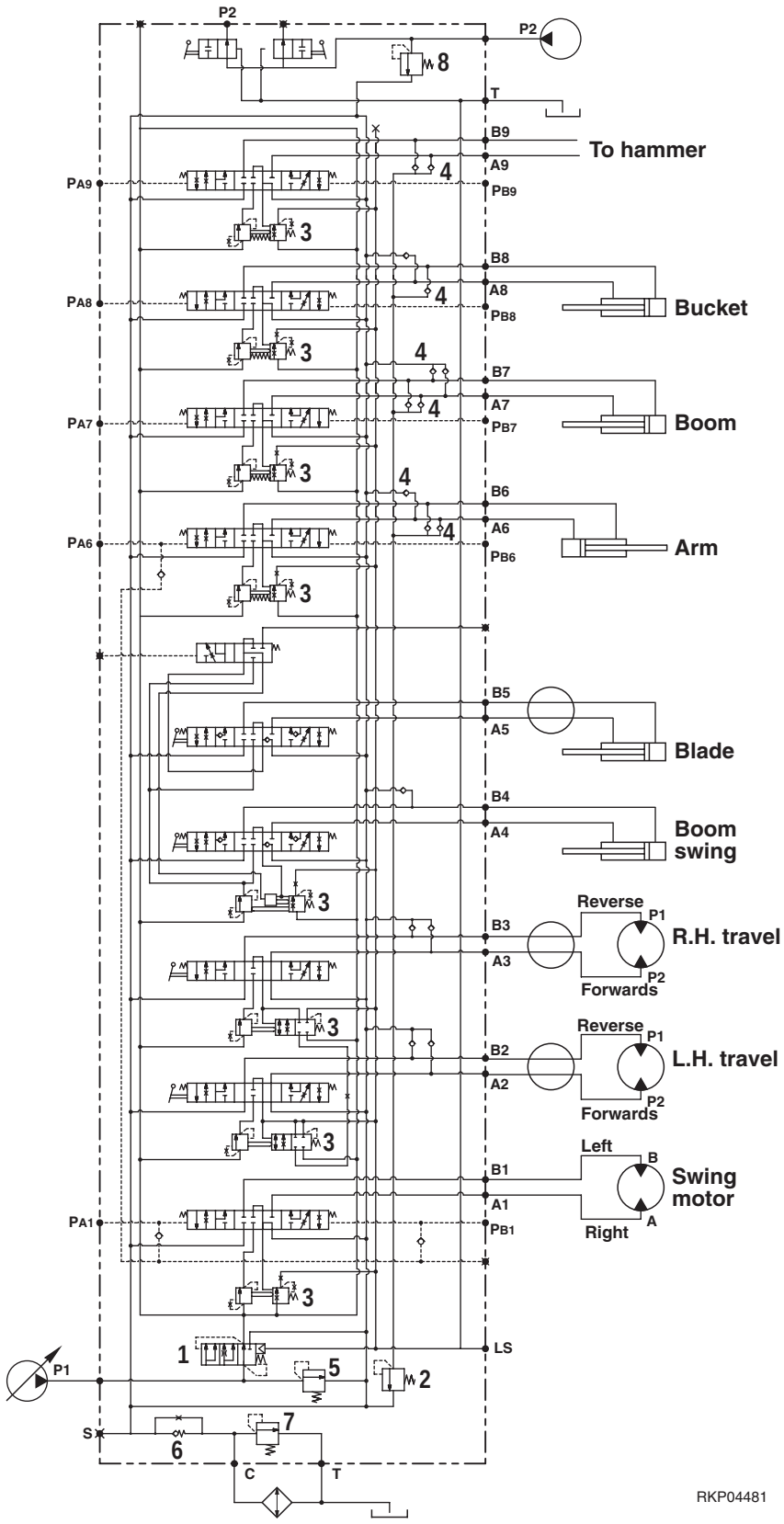
2) Pressure compensation control

- Valves (pressure compensation valves) are installed at the inlet port side of the spools of the control valves to balance the loads.
  When the actuators are complex-operated, the pressure differences **ΔP** at the upstream (inlet) and downstream (outlet) are made equal by these valves.
  In this way, the flow from the pump are distributed in proportion to the opening areas **S1** and **S2** of each valve.



3. Functions and operation of each valve

NAMES OF HYDRAULIC CIRCUITS AND VALVES

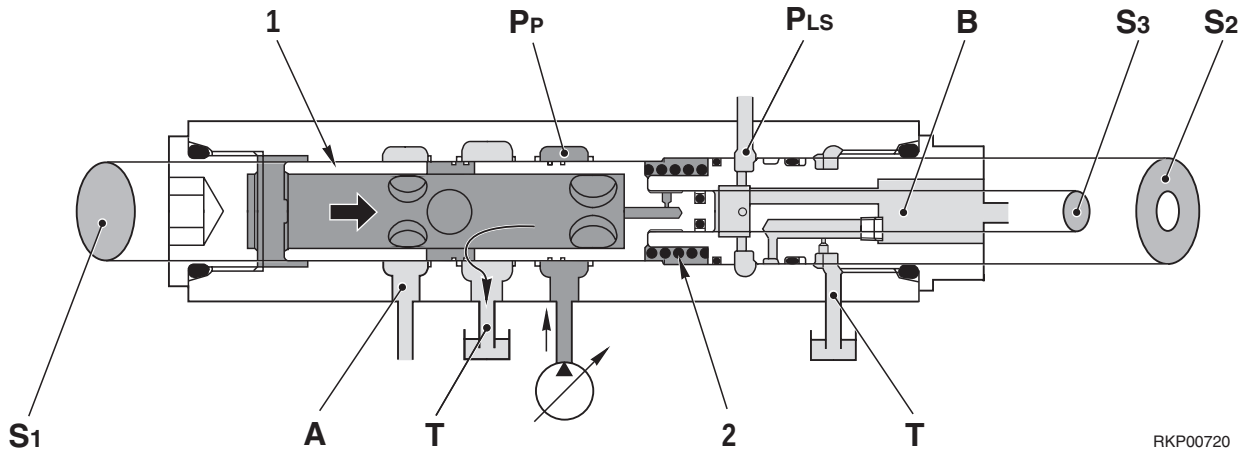


1. Unload valve LS + 16 bar (16 kg/cm^2)
2. Safety valve: 206 bar (210 kg/cm^2)
3. Pressure compensation valve
4. Suction valve
5. Main relief valve: 235 bar (240 kg/cm^2)
6. Back pressure check valve (cracking pressure): 0.45 bar (4.5 kg/cm^2)
7. Cooler by-pass valve (cracking pressure): 0.4 bar (4 kg/cm^2)
8. Pilot relief valve: 29 bar (30 kg/cm^2)

1. Unload valve

FUNCTION

1) When the control valve is at HOLD, pump discharge amount **Q** discharged by the minimum swash plate angle is released to the tank circuit. When this happens, pump discharge pressure **P_P** is set to 16 bar (16 kg/cm^2) by spring (2) inside the valve.
(**LS** pressure **P_{LS}** = 0 bar (0 kg/cm^2)



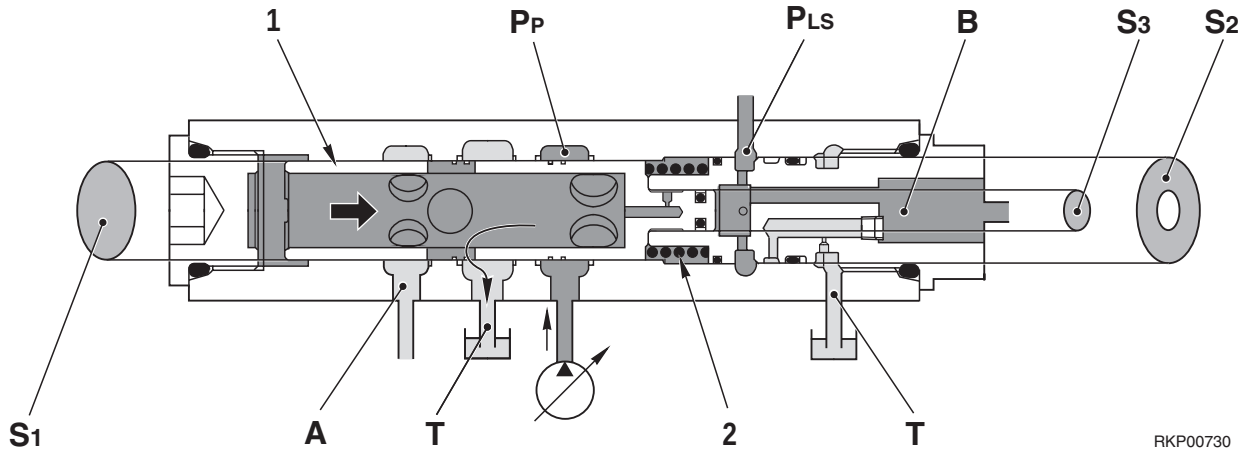
OPERATION

When control valve is at HOLD

- At the left end of spool (1), pump pressure **P_P** is acting on area **S1**, and at the right end of spool (1), pump pressure **P_P** is acting on area **S2**, and **LS** pressure **P_{LS}** is acting on area **S3**.
- When the control valve is at HOLD, **LS** pressure **P_{LS}** is not generated, so only pump discharge **P_P** has any effect, and **P_P** is set by the load of spring (2).
- As pump discharge pressure **P_P** rises and reaches the **P_P** x **S1** = **P_P** x **S2** + spring force of spring (2), spool (1) is moved to the right.
  Pump circuit **P_P** is then connected to tank circuit **T** through the drill hole.
- In this way, pump discharge pressure **P_P** is set to 16 bar (16 kg/cm^2).

P_P = Pump circuit
P_{LS} = LS circuit
T = Tank circuit
A = To valves
B = To pump **LS** valve

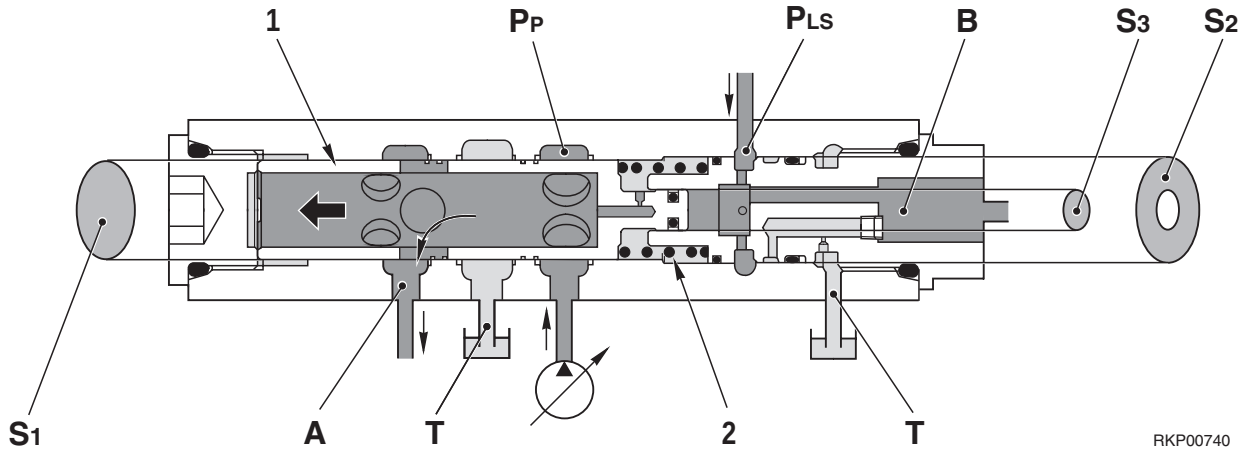
2) During fine control of the control valve, when the demand flow for the actuator is within the amount discharged by the minimum swash plate angle of the pump, pump discharge pressure **P_P** is set to **LS** pressure **P_{LS}** + 16 bar (16 kg/cm^2).
When the difference in pressure between pump discharge pressure **P_P** and **LS** pressure **P_{LS}** reaches the load of spring (2) (16 bar (16 kg/cm^2)) the unload valve opens, so **LS** differential pressure **ΔP_{LS}** becomes 16 bar (16 kg/cm^2).



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 **S3** at the right and 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) (16 bar (16 kg/cm^2)) + **LS** pressure **P_{LS}**, and **LS** differential pressure **ΔP_{LS}** becomes 16 bar (16 kg/cm^2).

3) When the control valve is being operated and the demand flow for the actuator becomes greater than the pump discharge from the minimum swash plate angle, the flow of the oil out, to tank circuit **T** is shut off, and all of pump discharge amount **Q** flows to the actuator circuit.



OPERATION

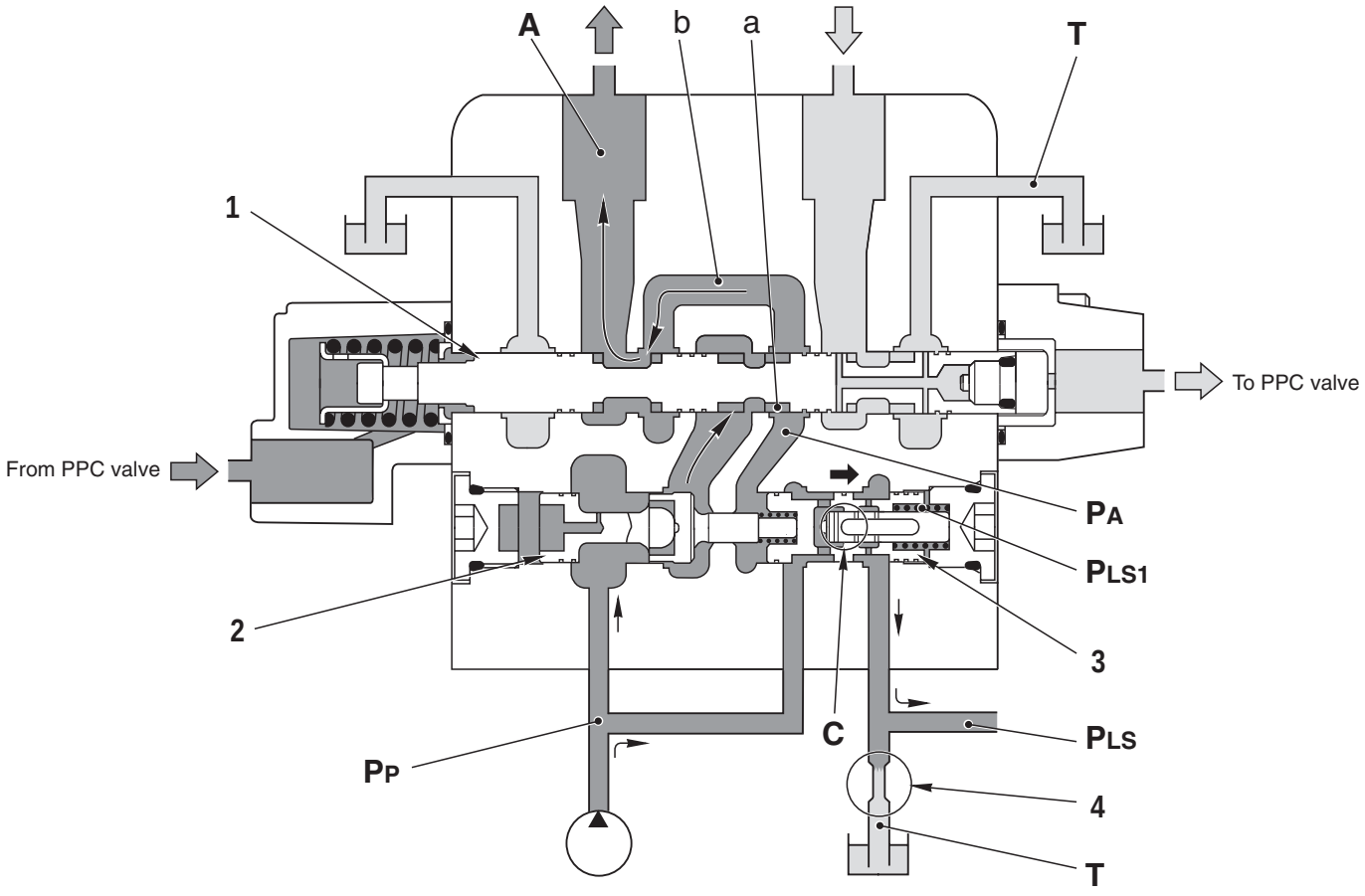
Control valve operated

- When the control valve is operated to a larger stroke, **LS** pressure **PLS** is generated and acts on area **S3** at the right end of spool (1).
  When this happens, the area of the opening of the control valve spool is large, so the difference between **LS** pressure **PLS** and pump discharge pressure **PP** is small.
- For this reason, the difference in pressure between pump discharge pressure **PP** and **LS** pressure **PLS** does not reach the load of spring (2) (19.69.8 bar (2010 kg/cm^2)), so spool (1) is pushed to the left by spring (2).
- As a result, pump circuit **PP** and tank circuit **T** are shut off, and all the pump discharge amount **Q** flows to the actuator circuit.

2. Introduction of LS pressure

FUNCTION

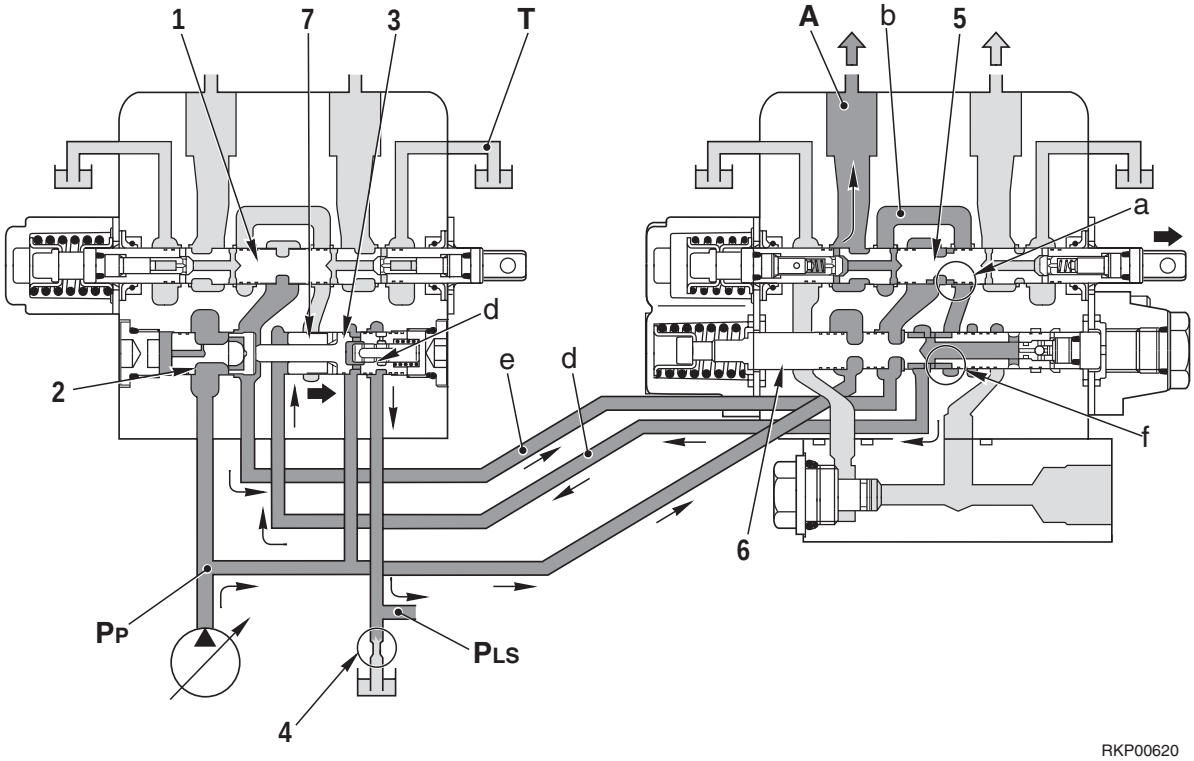
- The **LS** pressure is the actuator load pressure at the outlet port end of the control valve.
- It actually reduces pump pressure **P_P** at reducing valve (3) of the pressure compensation valve to the same pressure as actuation circuit pressure **A**, and sends it to the **LS** circuit **P_{LS}**.
- With the boom swing and blade valves, pump pressure **P_P** is reduced to the same pressure as actuator circuit pressure **A** by one reducing valve (3) used for both systems, and the pressure is sent to the **LS** circuit **P_{LS}**.



OPERATION

1) Boom, arm, bucket, travel valve

- When spool (1) is operated, pump pressure **P_P** flows from control valve (2) and notch **a** in spool (1) through bridge passage **b** to actuator circuit **A**.
- At the same time, reducing valve (3) also moves to the right, so pump pressure **P_P** has its pressure reduced by the pressure loss at notch **C**. It is introduced to **LS** circuit **P_{LS}**, and then goes to spring chamber **P_{LS1}**.
- When this happens, **LS** circuit **P_{LS}** is connected to tank circuit **T** from **LS** by-pass plug (4) (see the section on the **LS** by-pass plug).
- Actuator circuit pressure **P_A** (= **A**) acts on the left end of reducing valve (3); the reduced pump pressure **P_P** acts on the other end.
- As a result, reducing valve (3) is balanced at a position where actuator circuit pressure **P_A** and the pressure of spring chamber **P_{LS1}** are the same. Pump pressure **P_P** reduced at notch **C** becomes actuator circuit pressure **A** and is taken to **LS** circuit **P_{LS}**.



2) Boom swing, blade valve

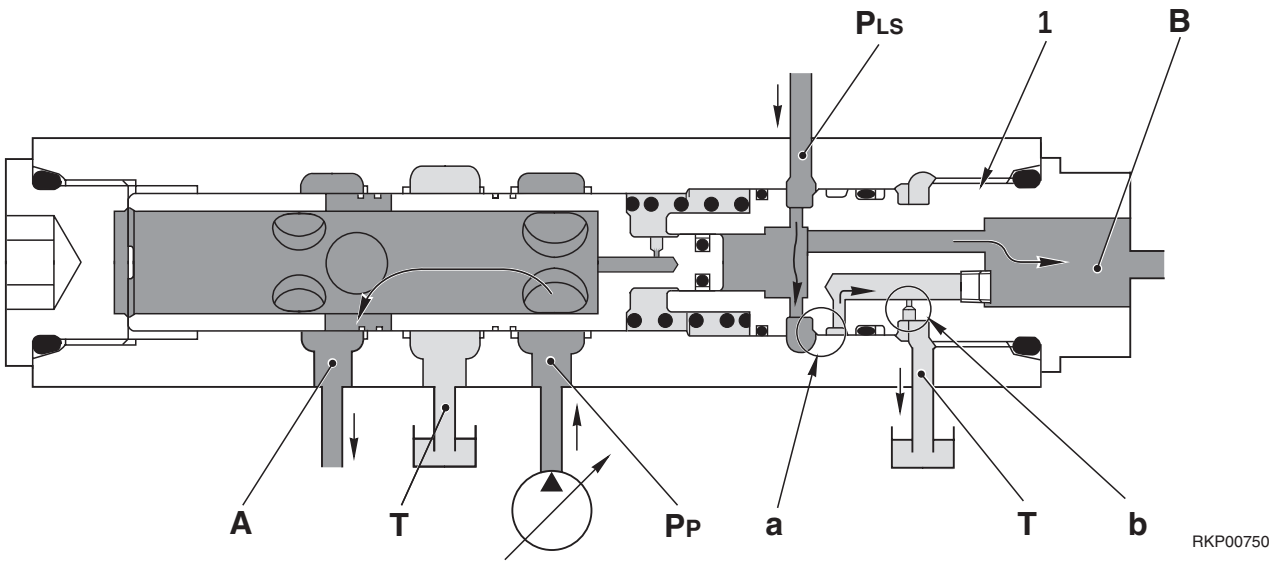
- When boom swing spool (1) is operated, pump pressure **PP** is reduced by reducing valve (3) (in the same way as in item 1), and is sent to the **LS** circuit **PLS**.
- When the blade spool (5) is operated, pump pressure **PP** flows from flow control valve (2), passage **e**, and notch **a** in blade 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.

3. LS by-pass plug

FUNCTION

- It releases the residual pressure of **LS** pressure **PLS**.
- It makes the speed of the rise in pressure of **LS** pressure **PLS** more gentle. In addition, with this discharge throttled flow, it creates a pressure loss in the throttled flow of the spool or shuttle valve, and increases the stability by lowering the effective **LS** differential pressure.



OPERATION

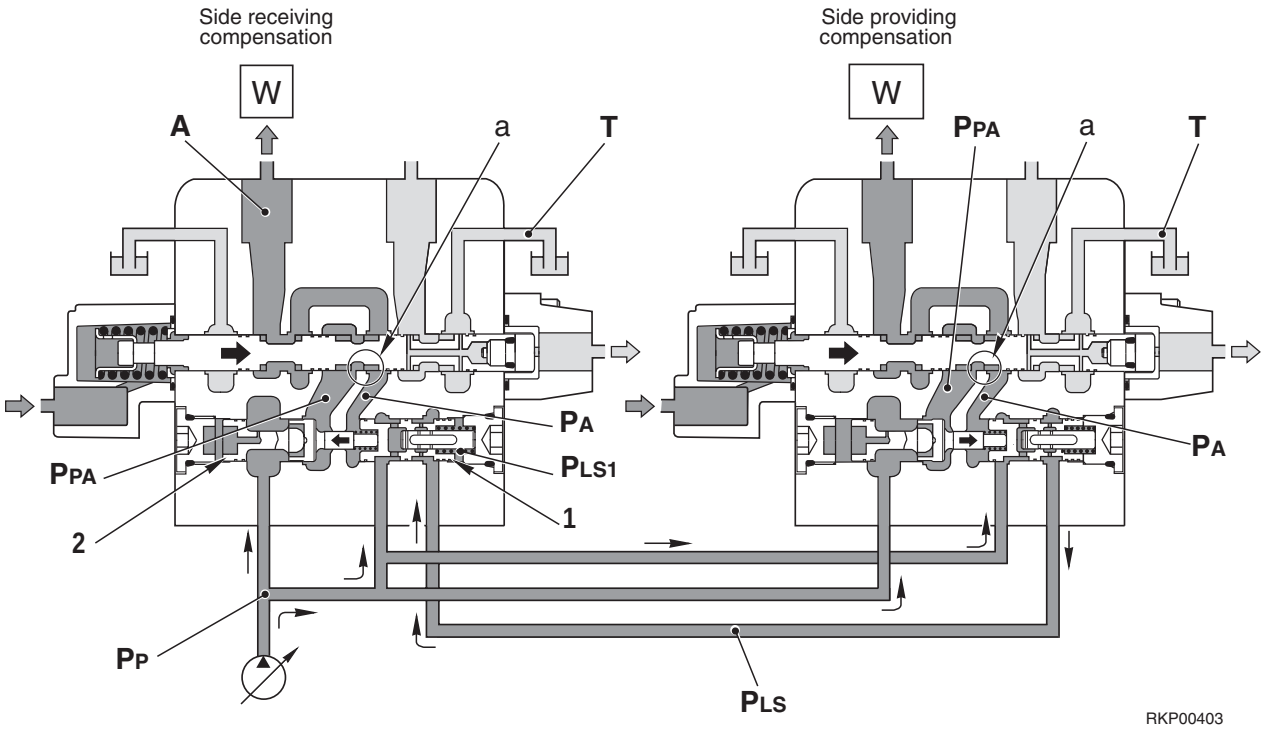
- The pressurized oil for **LS** circuit **PLS** passes from clearance filter **a** (formed by the clearance between **LS** by-pass plug (1) and the valve body) through orifice **b** and flows to the tank circuit **T**.

PP = Pump circuit
PLS = LS circuit
T = Tank circuit
A = To valves
B = To pump **LS** valve

4. Pressure compensation valve

FUNCTION

- During compound operations, if the load pressure becomes lower than the other actuator and the oil flow tries to increase, compensation is received. (When this happens, the other actuator being used for compound operation (right side) is at a higher load than the actuator on this side (left side)).



OPERATION

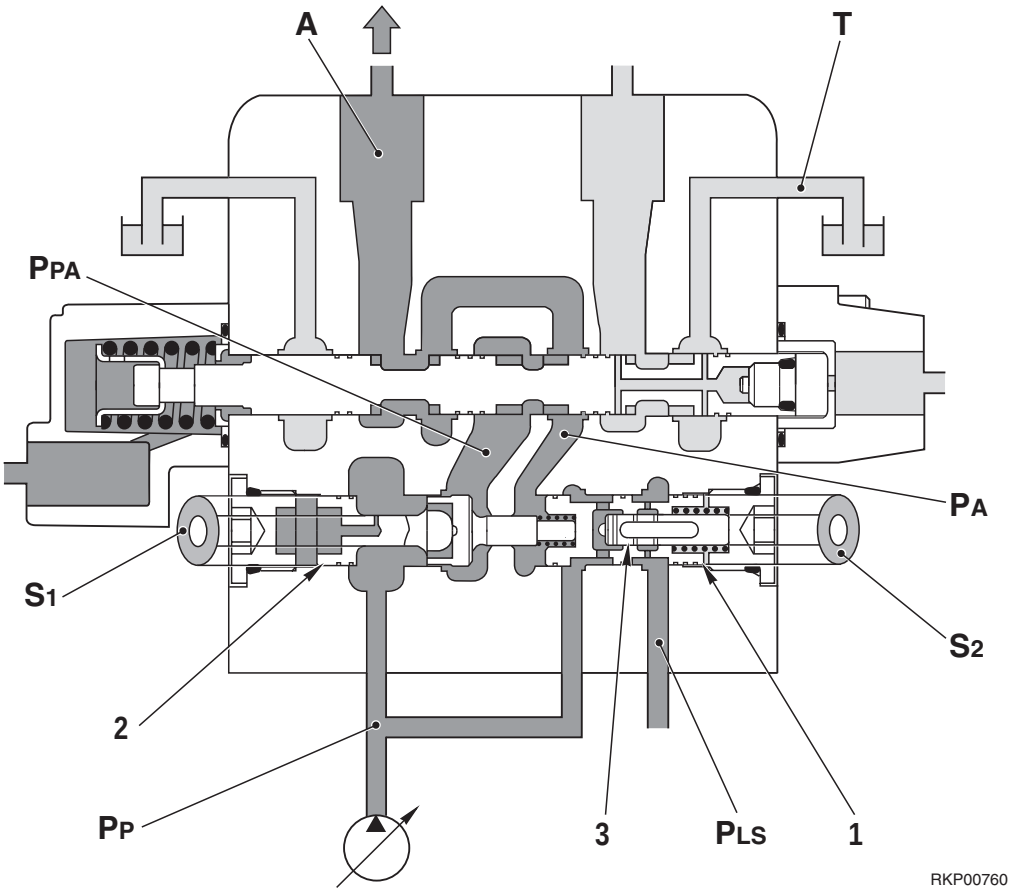
- If the load pressure of the other actuator (right side) becomes higher during compound operations, the oil flow in actuator circuit **A** on this side (left side) tries to increase.
- If this happens, the **LS** pressure P_{LS} of the other actuator acts on spring chamber P_{LS1}, and reducing valve (1) and flow control valve (2) are pushed to the left (←).
- Flow control valve (2) throttles the area of opening between pump circuit P_P and spool upstream P_{PA}, and pressure loss is generated between P_P and P_{PA}.
- Flow control valve (2) and reducing valve (1) are balanced in position where the difference in pressure between P_{LS} and P_A acting on both ends of reducing valve (1) and the pressure loss between P_P and P_{PA} on both sides of flow control valve (2) are the same.
- In this way, the pressure difference between upstream pressure P_{PA} and downstream pressure P_A of both spools used during compound operations is the same, so the pump flow is divided in proportion to the area of opening of notch **a** of each spool.

5. Area ratio of pressure compensation valve

FUNCTION

- The pressure compensation valve determines the compensation characteristics by carrying out fine adjustment of the area ratio (**S2**/**S1**) between area **S2** of reducing valve (1) and area **S1** of flow control valve (2) to match the characteristics of each actuator.

S1 = Area of flow control valve (2) – Area of piston (3).
S2 = Area of reducing valve (1) – Area piston (3).



Area ratio (S1:S2) and compensation characteristics

- When ration is 1.00 :
  [Pump pressure **PP** – spool notch upstream pressure **PPA**]≒[**LS** circuit pressure **PLS** – actuator circuit pressure **PA** (= **A**)] and oil flow is divided in proportion to area of opening of spool.
- When ratio is more than 1.00 : **PP** – **PPA** > **PLS** – **PA** (= **A**) and oil flow to side receiving compensation is divided in a proportion less than area of opening of spool.
- When ratio is less than 1.00 : **PP** – **PPA** < **PLS** – **PA** (= **A**) and oil flow to side receiving compensation is divided in a proportion more than area of opening of spool.

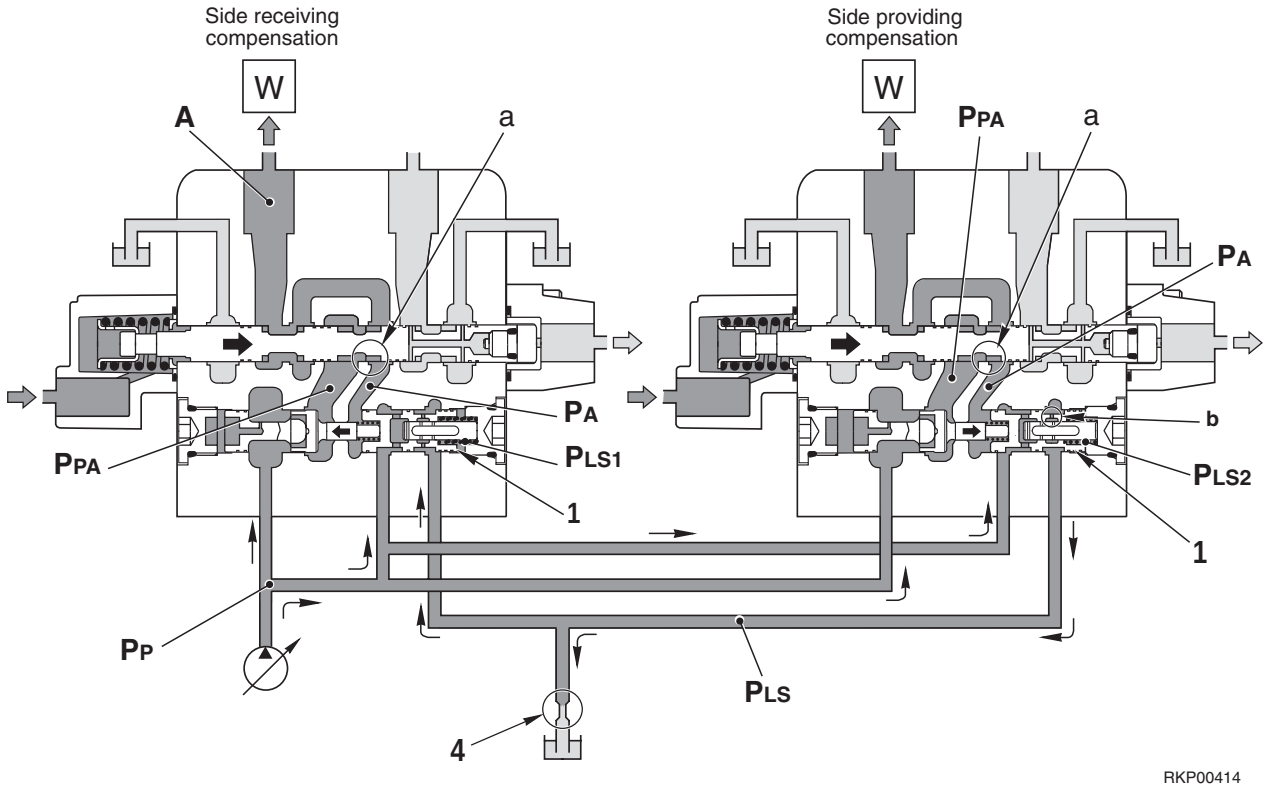
Ratio of area **S1** and **S2**			
Valve	Ratio	Valve	Ratio
Arm	0.98	Boom swing	0.98
Travel	1.00	Blade	0.98
Boom	0.95	Hammer	1.00
Bucket	1.00	Swing	0.95

6. Throttling LS introduction of pressure compensation valve

FUNCTION

- In the other actuator is relieved during compound operations, **LS** introduction throttle **b** of reducing valve (1) divides the flow and sends more oil to the side receiving compensation.

OPERATION

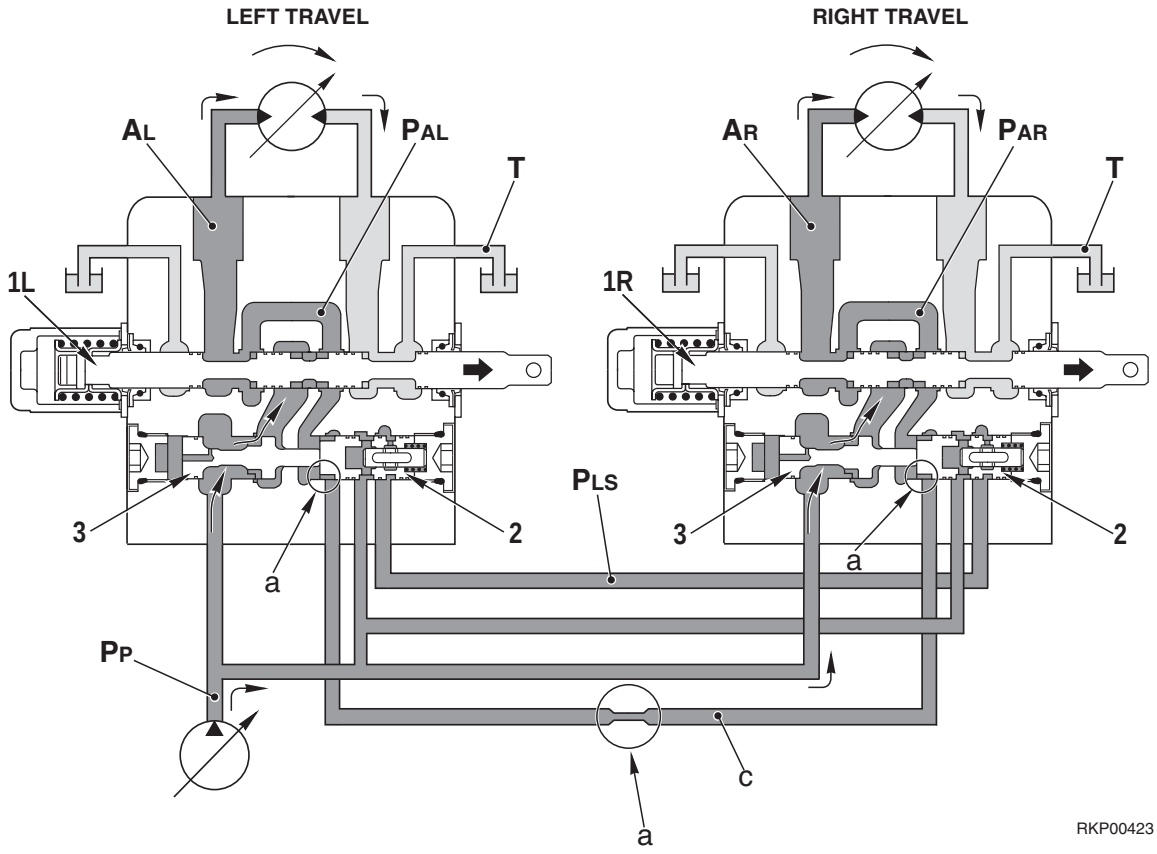


- If the other actuator (right side) is relieved during compound operations, each circuit pressure (P_{PA}, P_A) of the other actuator becomes the same as the pump circuit pressure (P_P = relief pressure).
- In this case, spring chamber P_{LS2} of the other actuator (right side) becomes the same as pump circuit pressure P_P because of the balance of reducing valve (1).
- P_{LS2} passes through **LS** introduction throttle **b** of reducing valve (1) and becomes P_{LS}. P_{LS} is connected to the tank circuit from **LS** by-pass plug (4), so pressure loss is generated at **LS** introduction throttle **b** (the condition becomes $P_{LS} < P_{LS2}$).
- As a result, even if the other actuator is relieved, a pressure differential is created between P_P and P_{LS}, so more oil flows to actuator circuit **A** on this side (left side).

7. L.H., R.H. travel junction circuit

FUNCTION

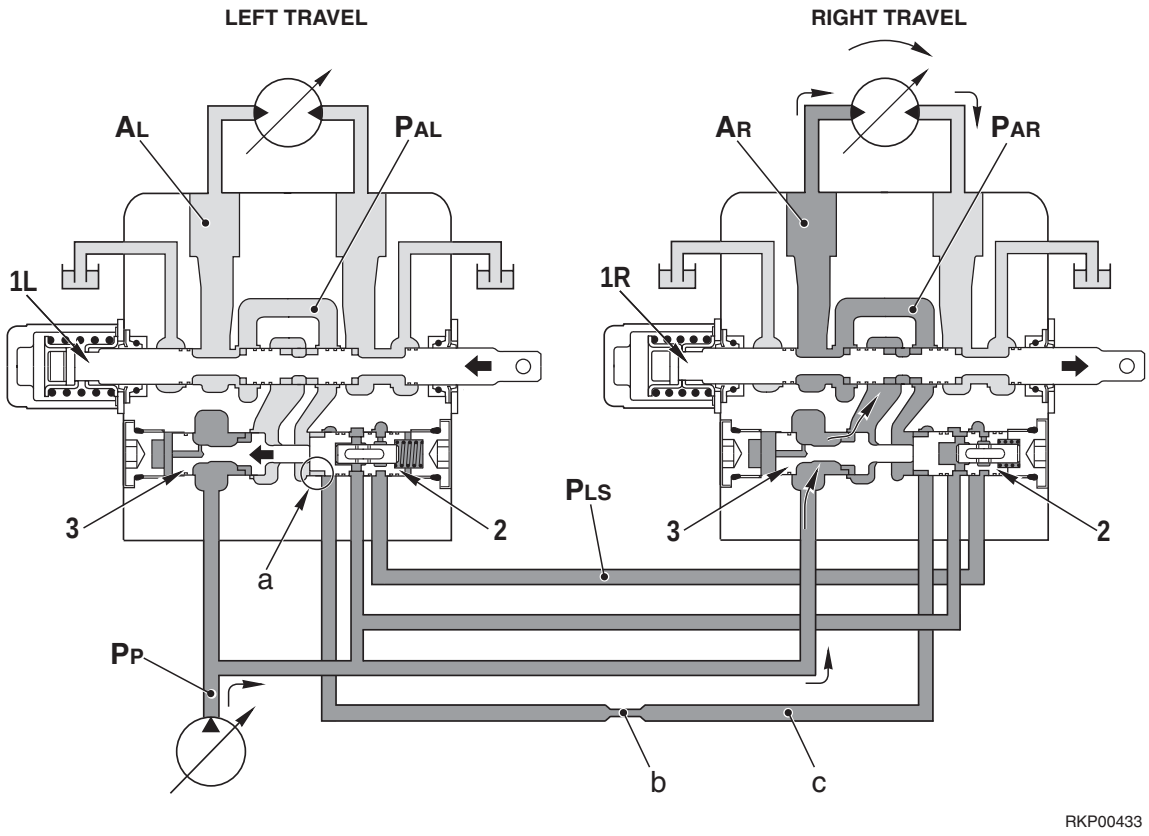
- To compensate for any difference in the oil flow in the left and right travel circuits when travelling in a straight line, the junction circuit opens when the left and right travel spools are operated.
  In this way, the flow of oil to the left and right travel motors is almost the same when travelling in a straight line, so there is no travel deviation.
- When steering the machine, the difference in the load pressure returns the reducing valve of the travel on the inside of the turn and the opening of the notch in the travel junction valve spool becomes smaller, so the machine can be steered.



OPERATION

When travelling in a straight lint

- When left and right travel spools (1) are operated, the pump discharge flows from pump circuit **PP** and circuits **PAL** and **PAR** to actuator circuits **AL** and **AR**.
- When travelling in a straight line, to make actuator circuits **PAL** and **PAR** equal, left and right reducing valves (2) are pushed to the right by the same amount, and notch **a** and the travel junction circuit are opened.
- In this way, the left and right travel actuator circuits are interconnected by the travel junction circuits, so if any difference occurs in the flow of oil to the left and right travel motors, the compensation is carried out to prevent any deviation in travel.



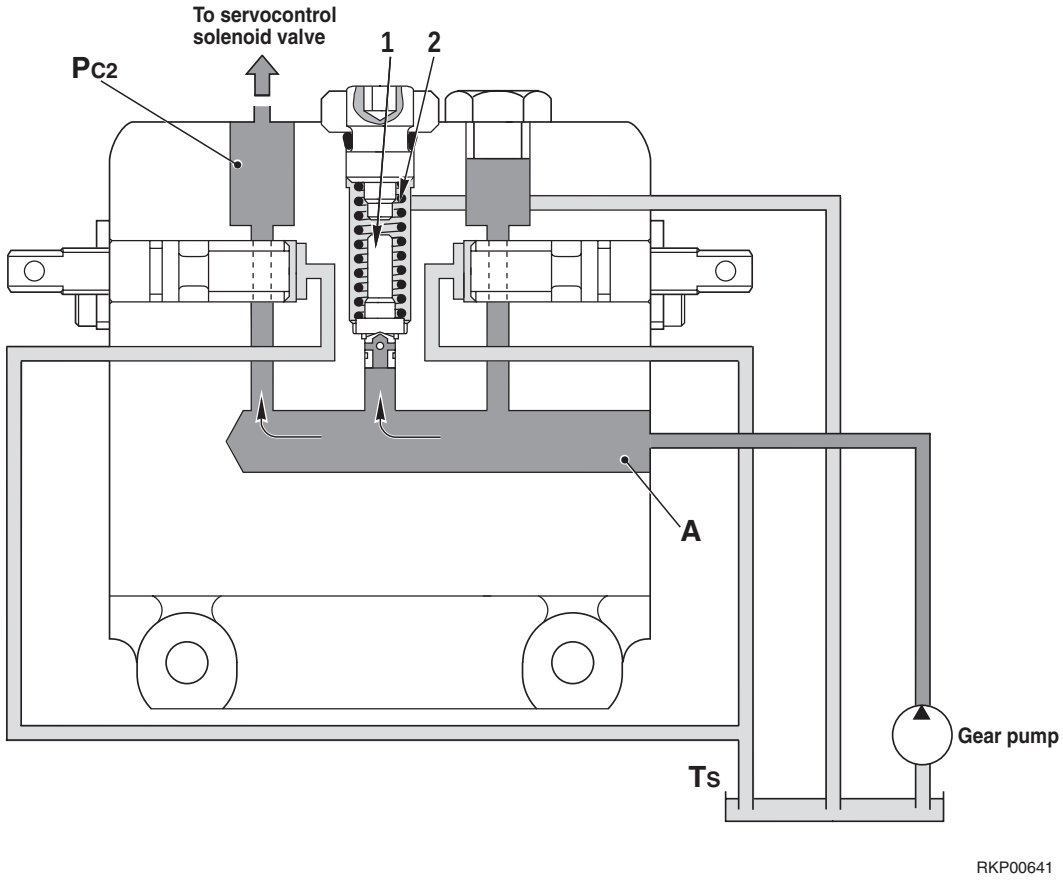
Steering when travelling

- When travelling in a straight line, if left travel spool (**1L**) is returned to the neutral position and the steering is operated, a difference (**AR** > **AL**) is generated in the load pressure of left and right travel actuator circuits **PAL** and **PAR**, and **LS** pressure **PLS** becomes the same pressure as **AR** (the side with the high load pressure).
- As a result, flow control valve (3) on the left travel side is pushed on the left by **LS** circuit **PLS**. Because of this, the opening of the left notch **a** is made smaller, so it becomes possible to operate the steering when travelling.
- Damper **b** is provided in the circuit to dampen any excessive characteristics in the opening or closing of the travel junction circuit if the spool is operated suddenly.

8. Servocontrol reducing valve

FUNCTION

- This valve set servocontrol pressure to 29.5 bar (30 kg/cm^2).



OPERATION

- The discharge pressure from the gear pump entering chamber **A** acts on the bottom of valve (1). The gear pump discharge pressure is set to 29.5 bar (30 kg/cm^2).

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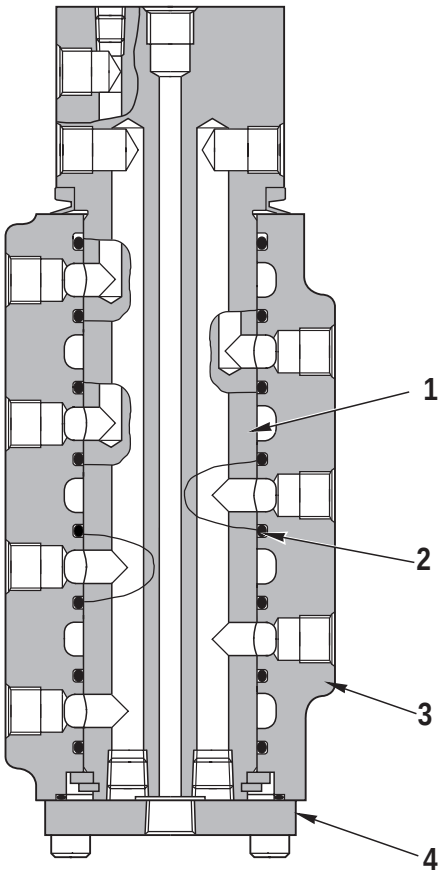
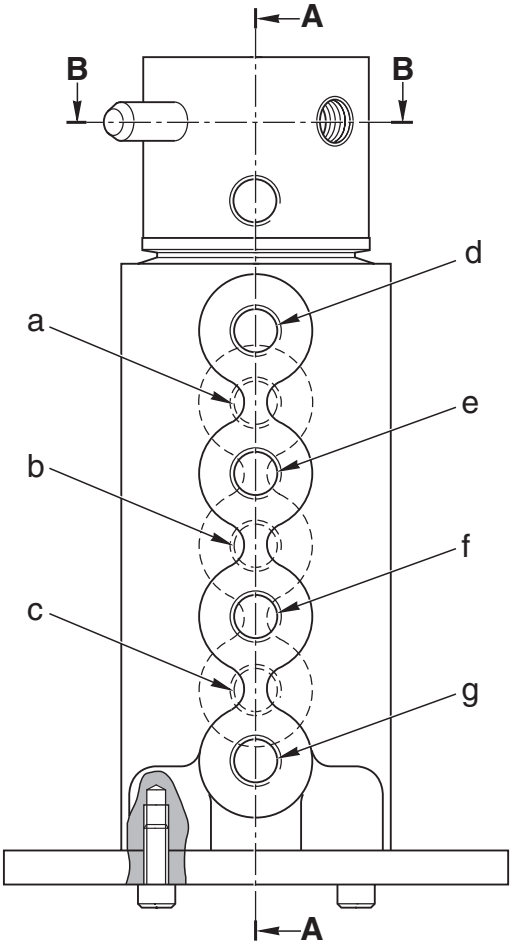
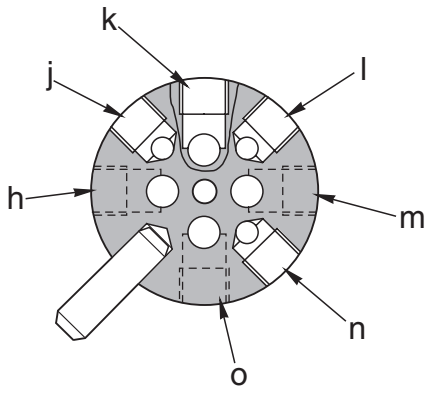
SWIVEL JOINT

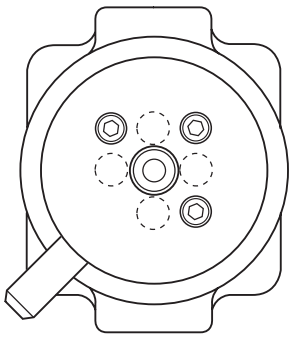


Section A - A





Section B - B



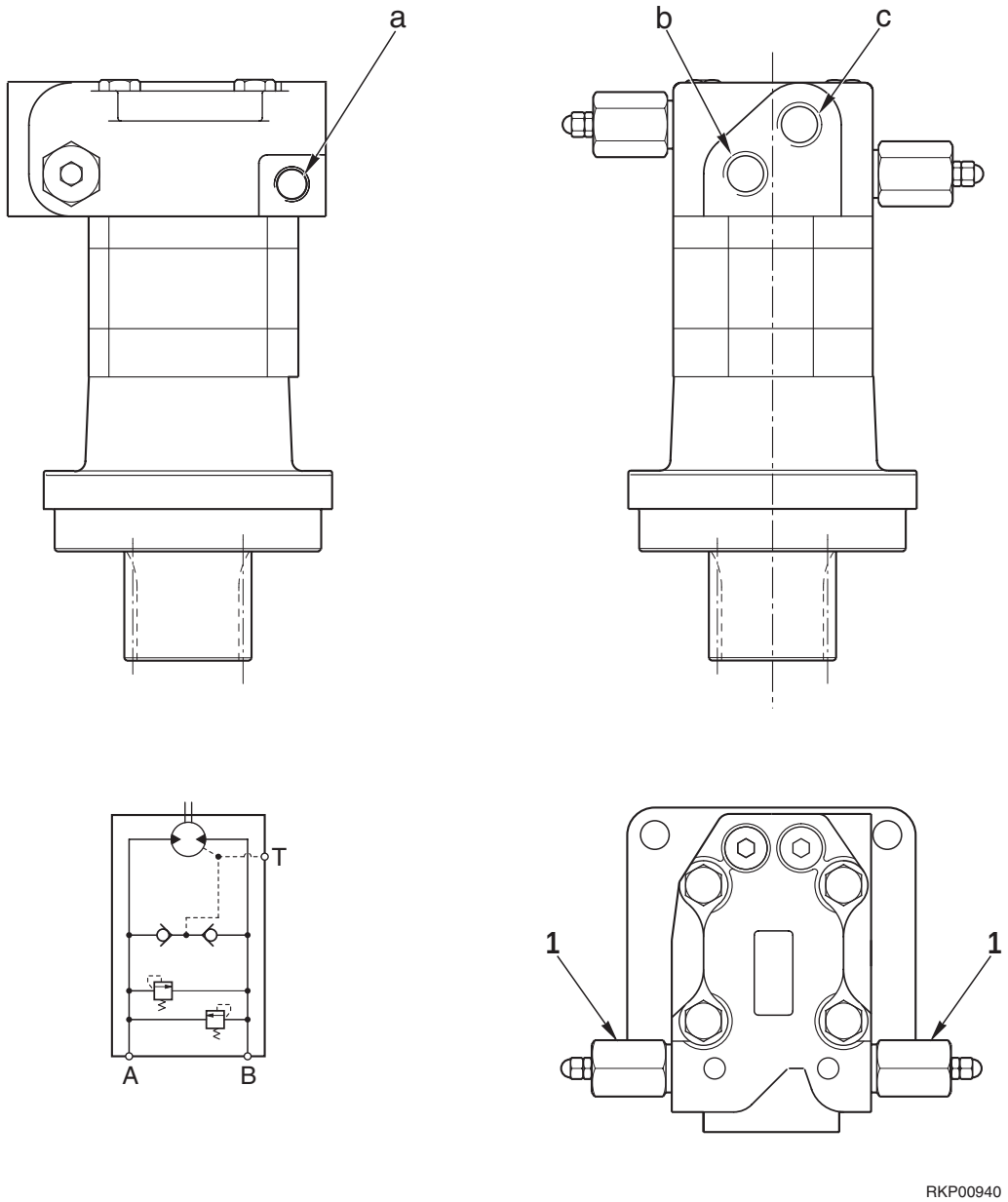
RKP00260

1. Shaft
2. Gasket
3. Body
4. Cover

a. f Port - To blade cylinder (Bottom side)
b. d Port - To L.H. travel motor (P1 Port)
c. b Port - To L.H. travel motor (P2 Port)
d. g Port - To travel motors (PS Port)
e. e Port - To blade cylinder (Head side)
f. c Port - To R.H. travel motor (P2 Port)
g. a Port - To R.H. travel motor (P1 Port)
h. B Port - From control valve (A2 Port)
j. E Port - From control valve (A5 Port)
k. C Port - From control valve (A3 Port)
l. F Port - From control valve (B5 Port)
m. D Port - From control valve (B2 Port)
n. G Port - From ST1 solenoid valve (B Port)
o. A Port - From control valve (B3 Port)

SWING MOTOR

PC20R-8

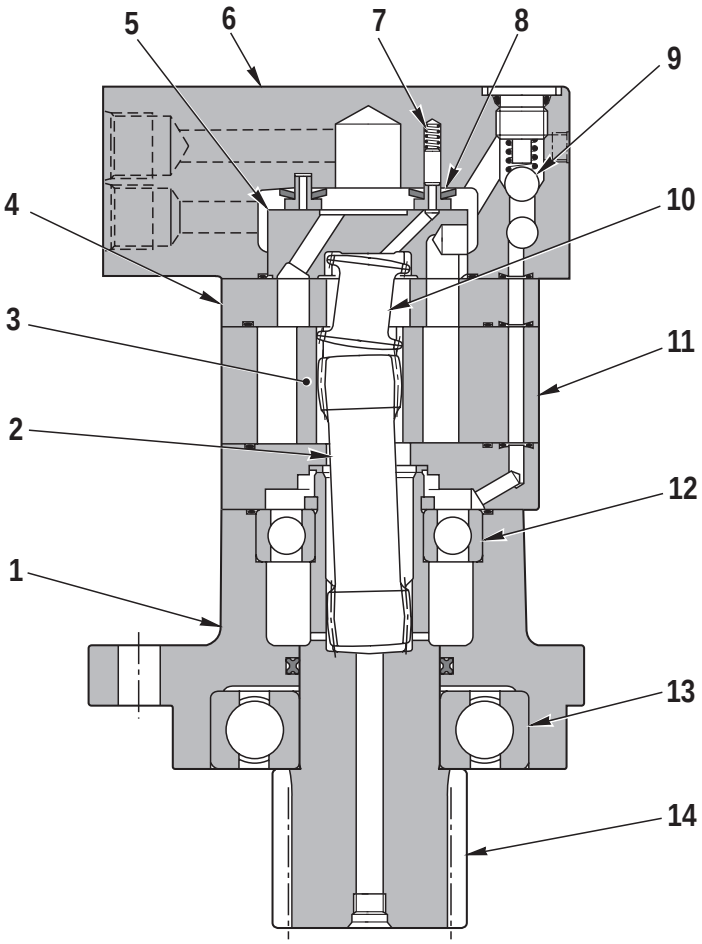


a. T Port - To hydraulic tank
b. B Port - From control valve (A1 Port)
c. A Port - From control valve (B1 Port)

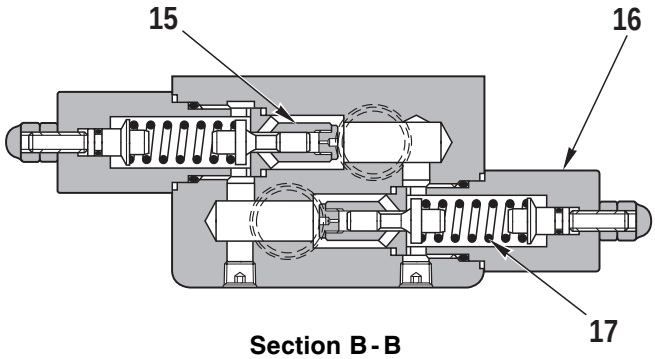
1. Safety valve

SPECIFICATION

Displacement: 195 rev.



Section A - A

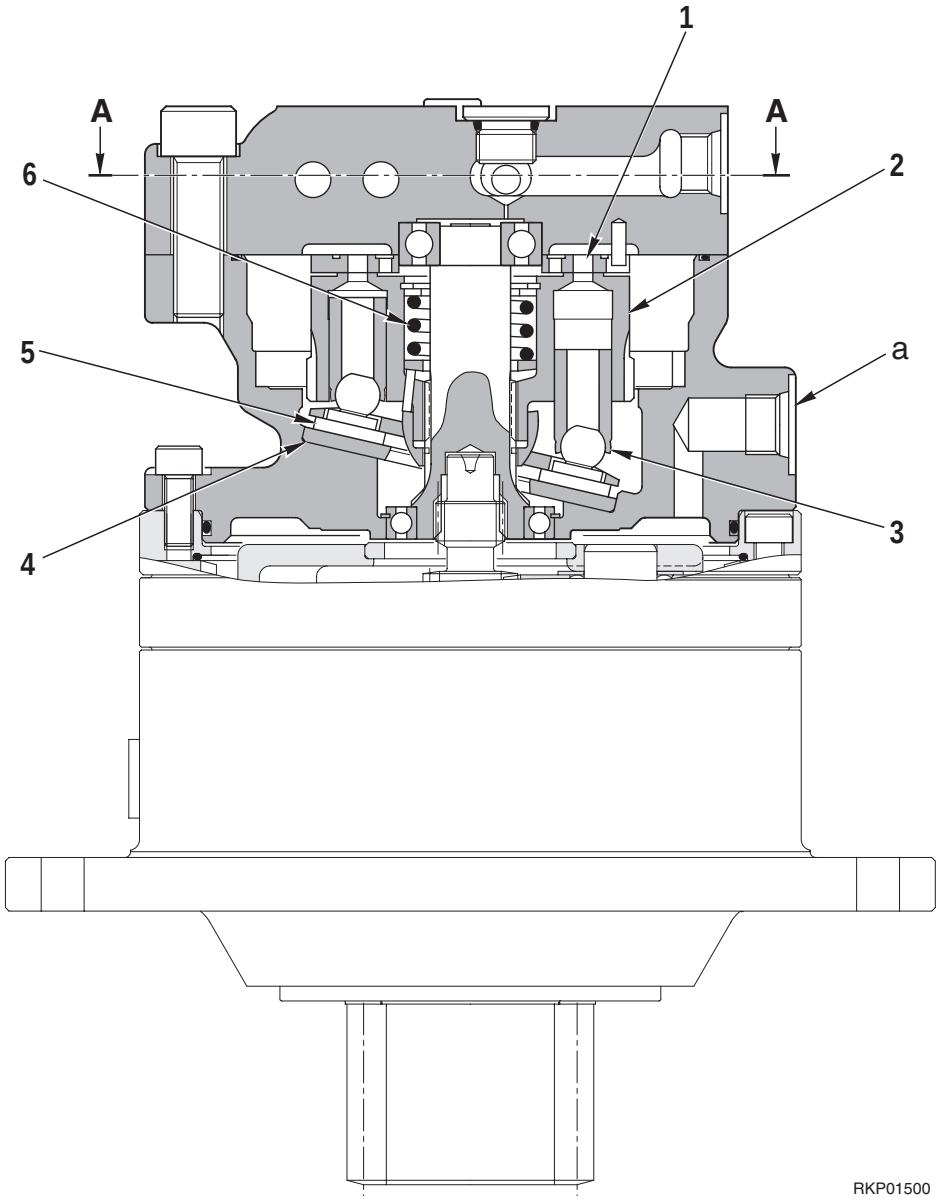


Section B - B

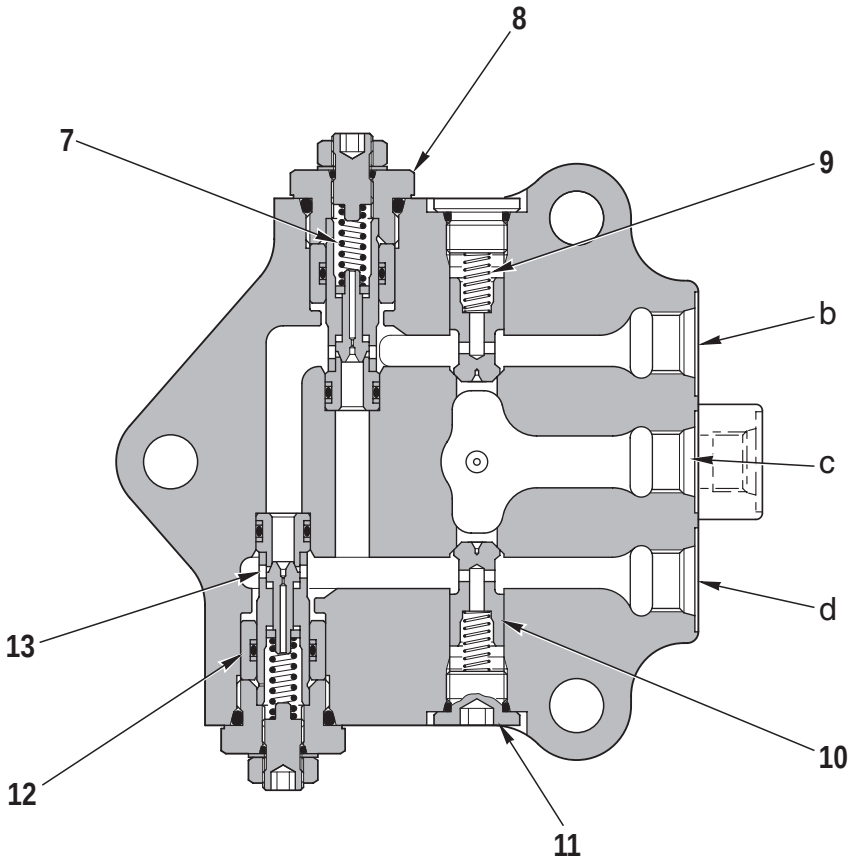
RKP01650

1 - Body
2 - Shaft
3 - Rotor
4 - Valve plate
5 - Valve
6 - Valve housing
7 - Pin
8 - Balancing plate
9 - Ball
10 - Valve drive
11 - Stator
12 - Bearing
13 - Bearing
14 - Pinion
15 - Valve
16 - Cartridge
17 - Spring

PC27R-8



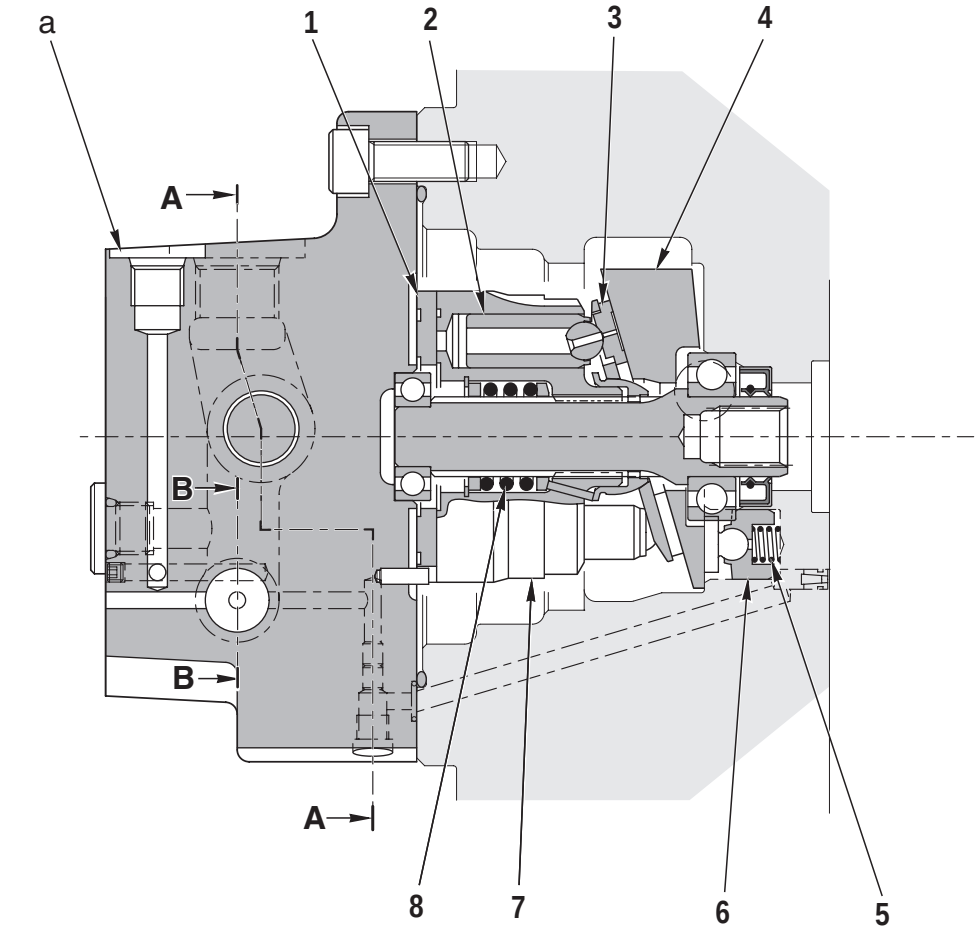
1. Valve plate
2. Cylinder
3. Piston
4. Disc
5. Shoe
6. Spring
7. Safety valve spring
8. Plug
9. Check valve spring
10. Check valve
11. Plug
12. Cylinder
13. Safety valve

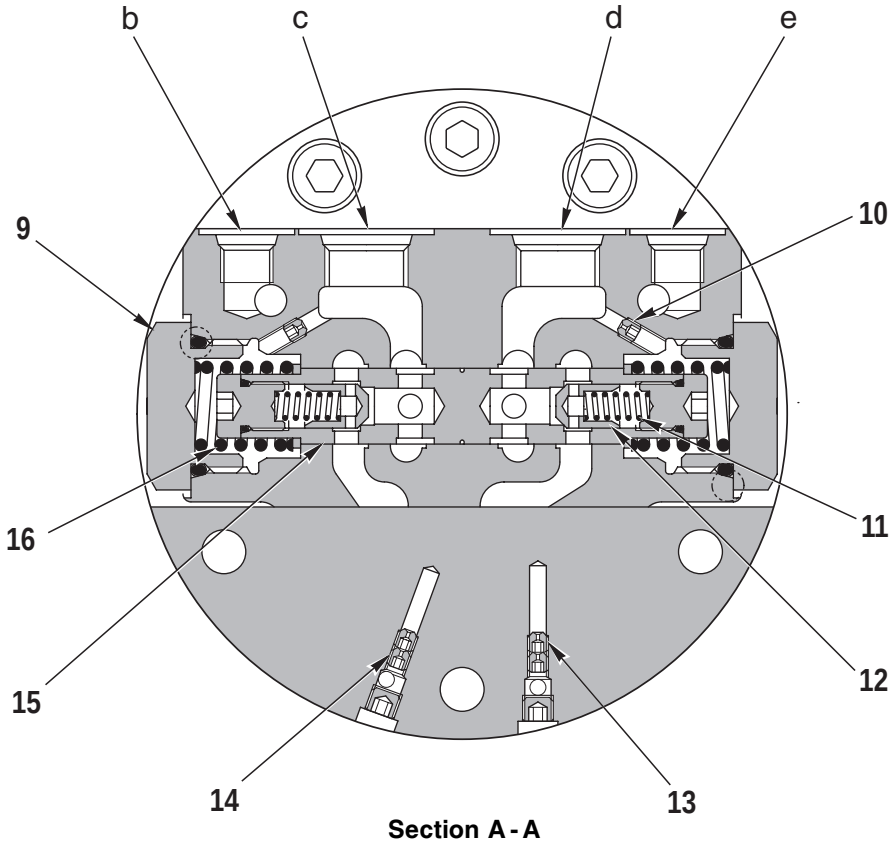


Section A - A RKP01510

a. DB Port - To hydraulic tank
b. A Port - From control valve (A1 port)
c. M Port - To control valve (C port)
d. B Port - From control valve (B1 port)

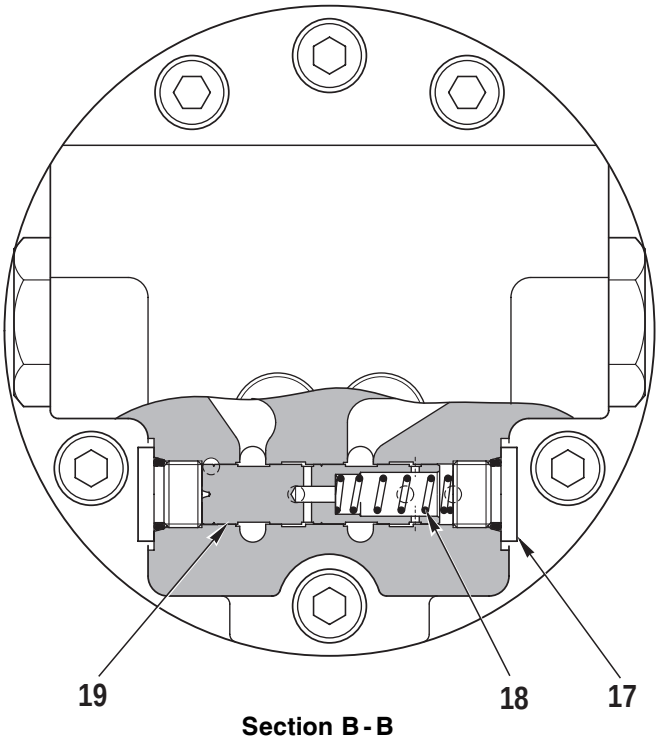
TRAVEL MOTOR





Section A - A

RKP01380



Section B - B

RKP01390

1. Valve plate
2. Piston
3. Shoe
4. Swash plate
5. Piston spring
6. Piston
7. Cylinder
8. Center spring
9. Plug
10. Orifice
11. Check valve
12. Check valve spring
13. Orifice
14. Orifice
15. Counterbalance valve spring
16. Spool return spring
17. Plug
18. Spool return spring (travel increment)
19. Counterbalance valve spring (travel increment)

R.H. motor

a. PS Port - From swivel joint (g Port)
b. T1 Port - Not used
c. P1 Port - From swivel joint (a Port)
d. P2 Port - From swivel joint (c Port)
e. T2 Port - From swivel joint (h Port)

L.H. motor

a. PS Port - From swivel joint (g Port)
b. T1 Port - From swivel joint (h Port)
c. P1 Port - From swivel joint (d Port)
d. P2 Port - From swivel joint (b Port)
e. T2 Port - Not used

SPECIFICATIONS

Nominal pressure: 205.8 bar (210 kg/cm^2)

Displacement:

- High speed: 9.00 cm^3/rev.
- Low speed: 18.00 cm^3/rev.

Swing speed:

- High speed: PC20R-8: 2645 rpm
  PC27R-8: 3275 rpm
- Low speed PC20R-8: 1323 rpm
  PC27R-8: 1637 rpm

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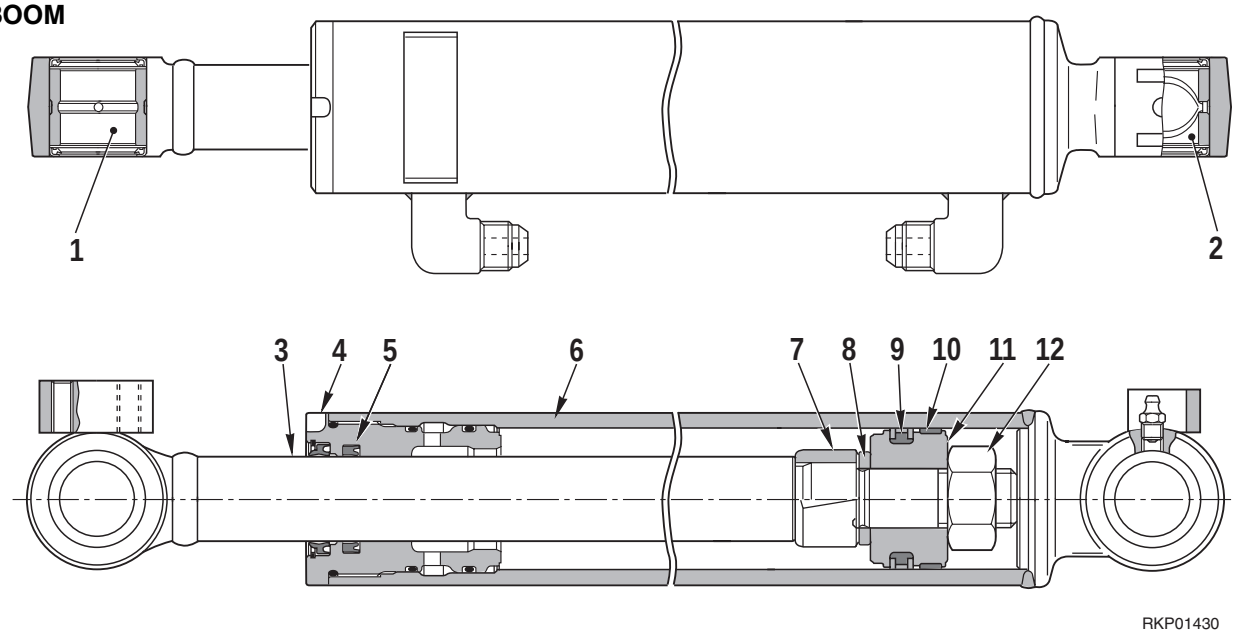
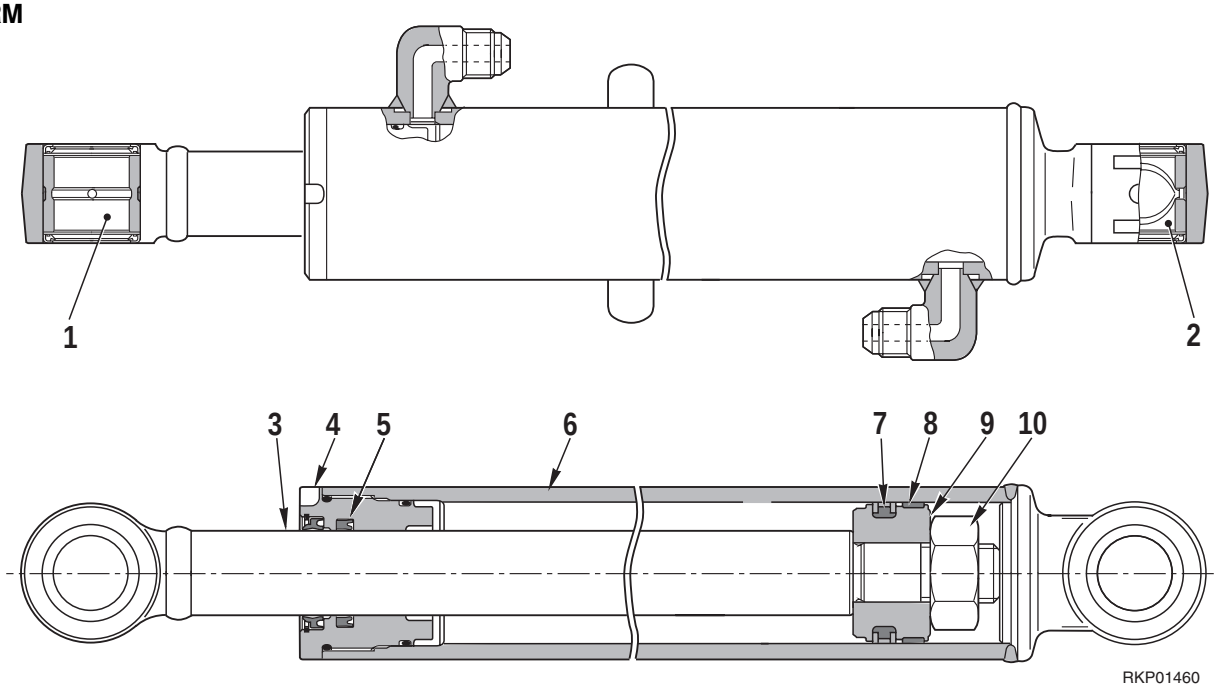
CYLINDER

BOOM



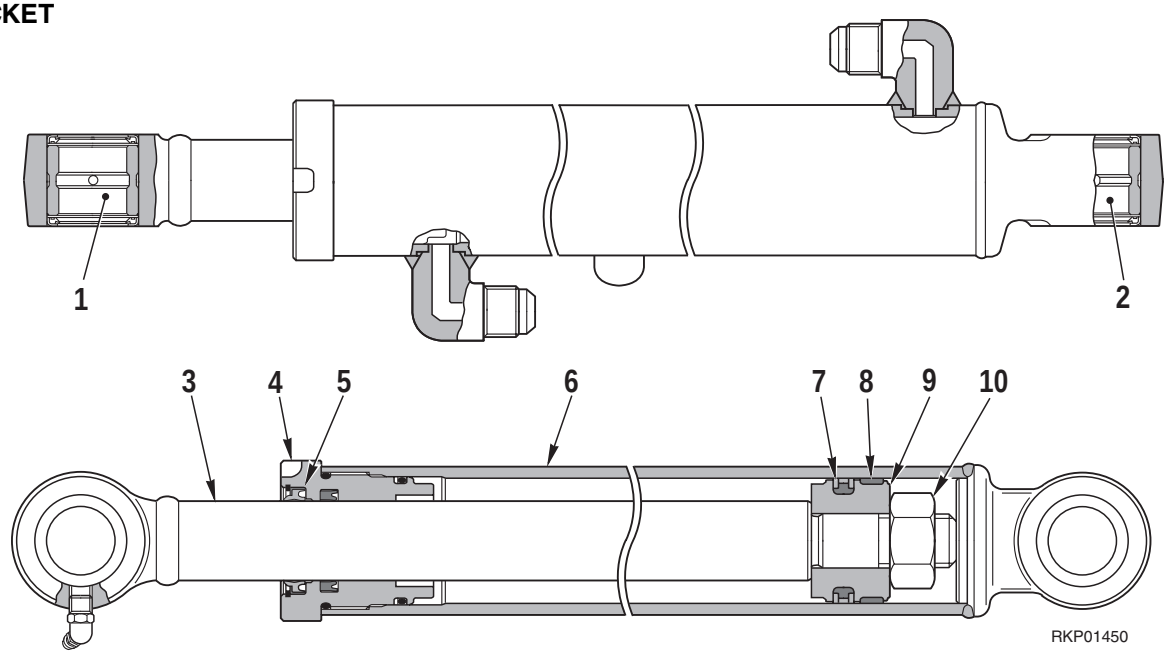
1. Bushing (Head side)
2. Bushing (Bottom side)
3. Rod
4. Head
5. Gasket
6. Cylinder
7. Ring
8. Spacer
9. Piston gasket
10. Ring
11. Piston
12. Nut

ARM



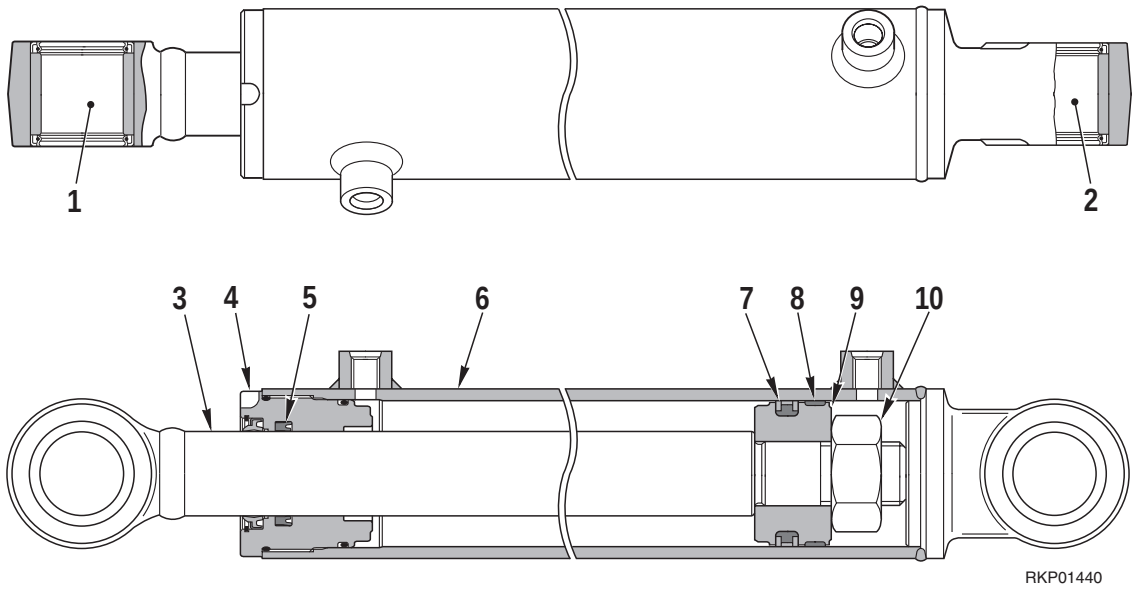
1. Bushing (Head side)
2. Bushing (Bottom side)
3. Rod
4. Head
5. Gasket
6. Cylinder
7. Piston gasket
8. Ring
9. Piston
10. Nut

BUCKET



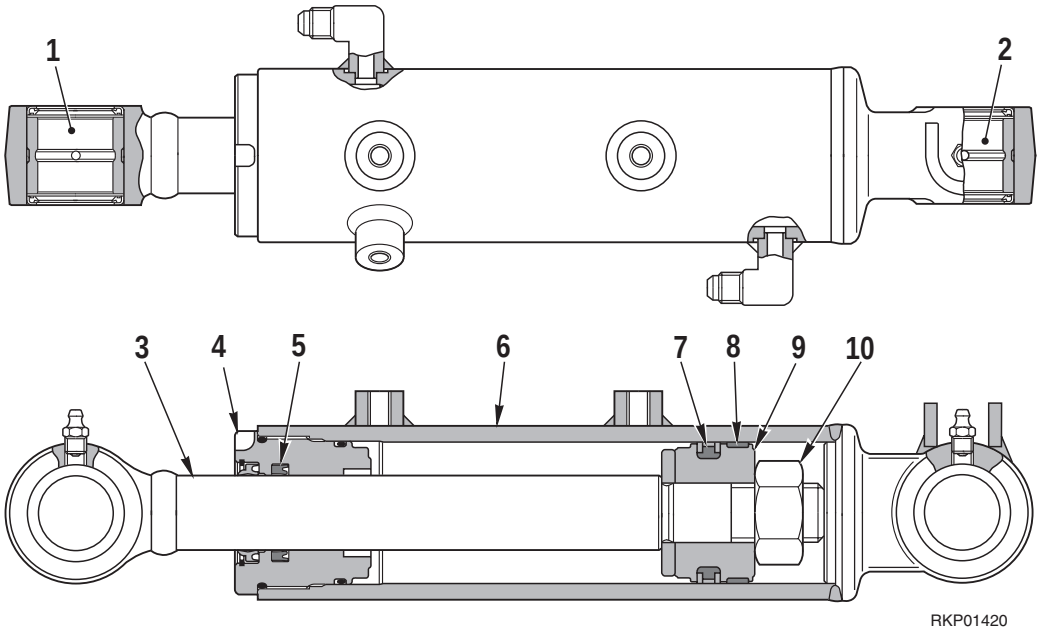
1. Bushing (Head side)
2. Bushing (Bottom side)
3. Rod
4. Head
5. Washer
6. Cylinder
7. Piston gasket
8. Ring
9. Piston
10. Nut

BOOM SWING



1. Bushing (Head side)
2. Bushing (Bottom side)
3. Rod
4. Head
5. Gasket
6. Cylinder
7. Piston gasket
8. Ring
9. Piston
10. Nut

BLADE



1. Bushing (Head side)
2. Bushing (Bottom side)
3. Rod
4. Head
5. Gasket
6. Cylinder
7. Piston gasket
8. Ring
9. Piston
10. Nut

PC20R-8

Cylinder	Boom		Arm	Bucket	Boom swing	Blade
	with canopy	with cabin				
Piston rod diameter	40	40	40	40	40	40
Cylinder inside diameter	65	65	65	55	70	65
Piston stroke	480	455	490	480	445	135
Max. cylinder length	1260	1235	1278	1233	1175	545
Min. cylinder length	780	780	788	753	730	410
Piston nut width across flat	41	41	46	36	46	41

PC27R-8

Cylinder	Boom		Arm	Bucket	Boom swing	Blade
	with canopy	with cabin				
Piston rod diameter	45	45	40	35	40	35
Cylinder inside diameter	75	75	70	60	80	70
Piston stroke	551	519	526	460	495	175
Max. cylinder length	1417	1385	1330	1215	1299	633
Min. cylinder length	866	866	804	755	804	458
Piston nut width across flat	46	46	46	41	46	41

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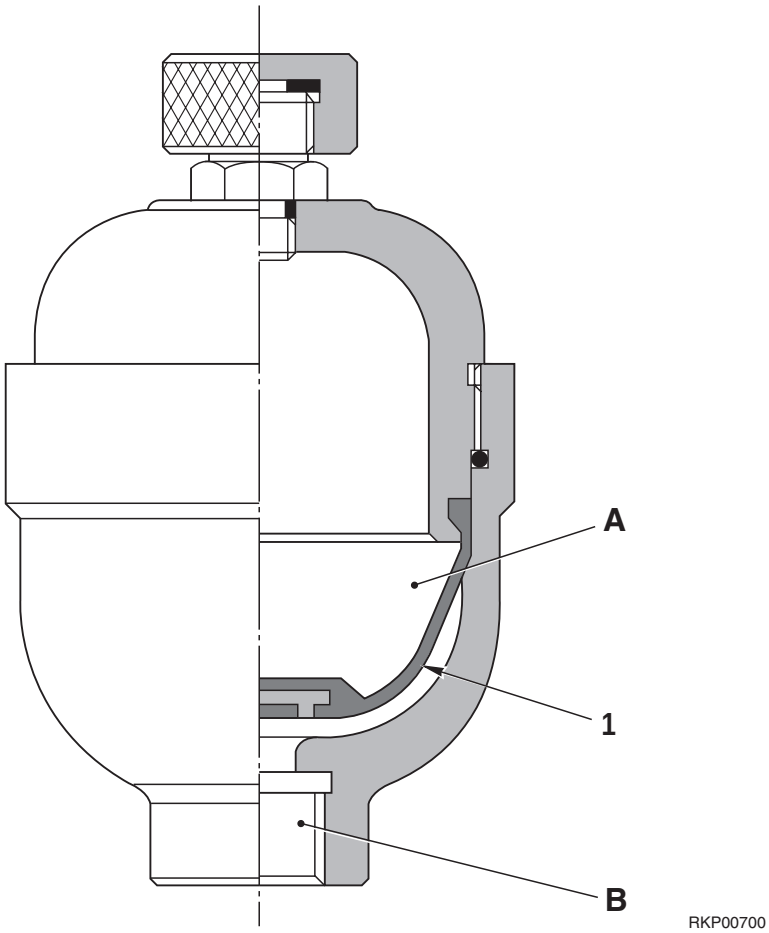
ACCUMULATOR



TECHNICAL DATA

Servocontrol feed unit

Nominal volume:	0.35 ℓ
Pre-loading:	12 bar
Working pressure:	35 – 45 bar

FUNCTION

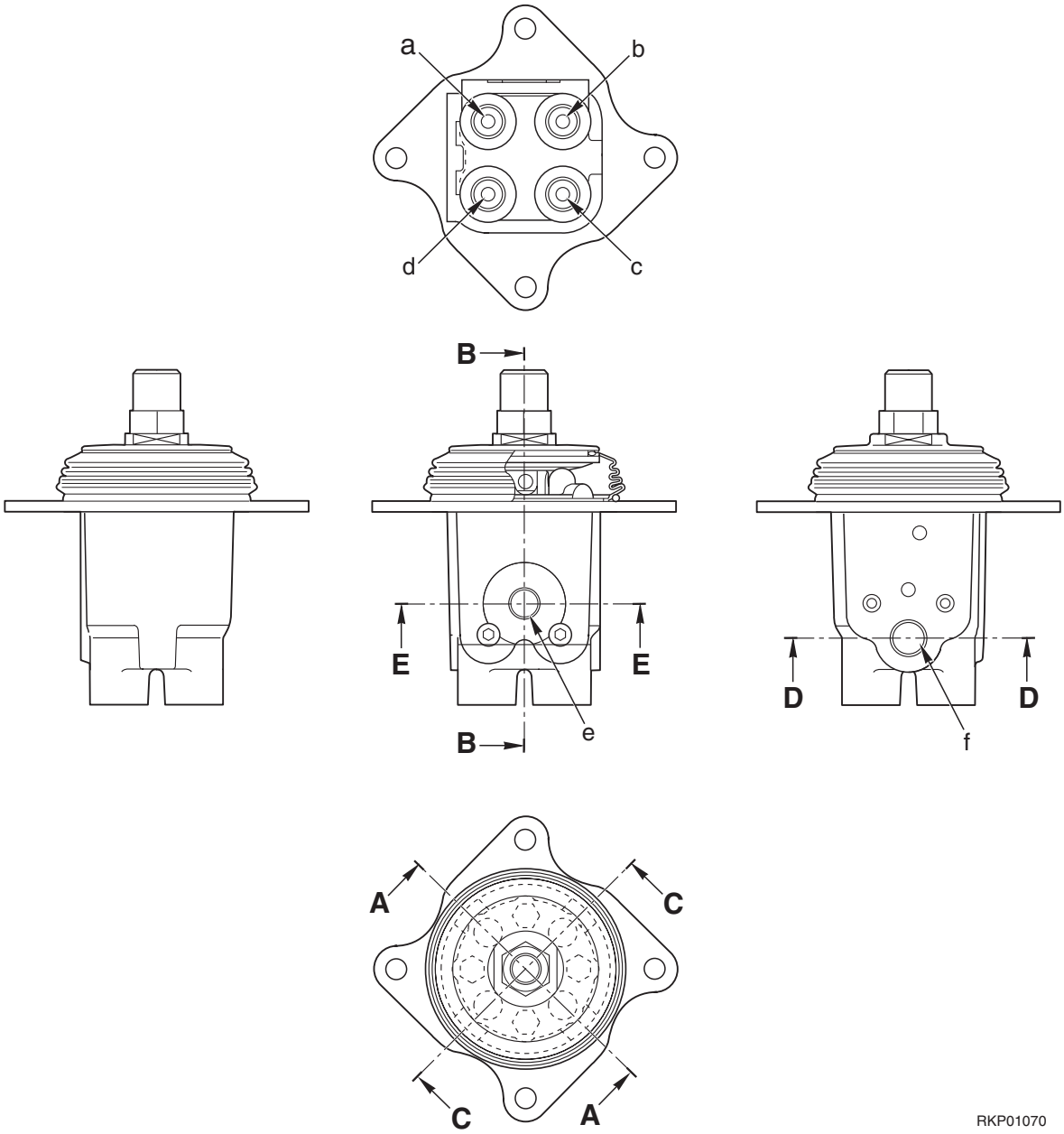
- An elastic rubber bag (1) containing nitrogen is fitted inside the accumulator to maintain oil pressure in the circuit to which the accumulator is connected.

OPERATION

- When the engine is running the chamber **A** of the rubber bag (1) (containing nitrogen) is compressed by oil under pressure coming from line **B**.
- If the oil under in line **B** falls below the maximum calibration pressure (even after intensive use), the rubber bag (1) will expand due to pressure from the nitrogen it.

PPC VALVE

WORK EQUIPMENT

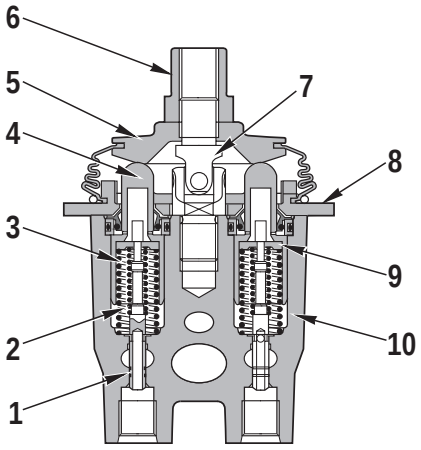


L.H. PPC VALVE

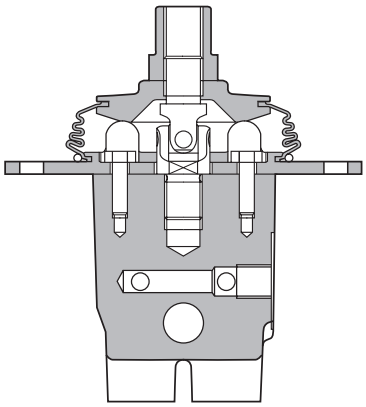
a. P2 Port - To control valve (P_{B6} port)
b. P4 Port - To control valve (P_{B1} port)
c. P1 Port - To control valve (P_{A6} port)
d. P3 Port - To control valve (P_{A1} port)
e. T Port - To ST1 solenoid valve (T port)
f. P Port - From ST1 solenoid valve (A port)

R.H. PPC VALVE

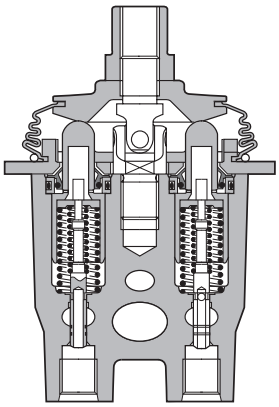
a. P2 Port - To control valve (P_{A7} port)
b. P4 Port - To control valve (P_{B8} port)
c. P1 Port - To control valve (P_{B7} port)
d. P3 Port - To control valve (P_{A8} port)
e. T Port - To control valve (TS port)
f. P Port - From ST1 solenoid valve (A port)



Section A - A



Section B - B



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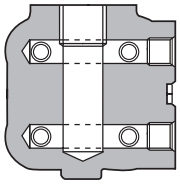
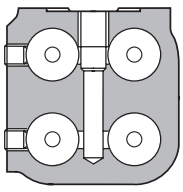


Section D - D



Section E - E

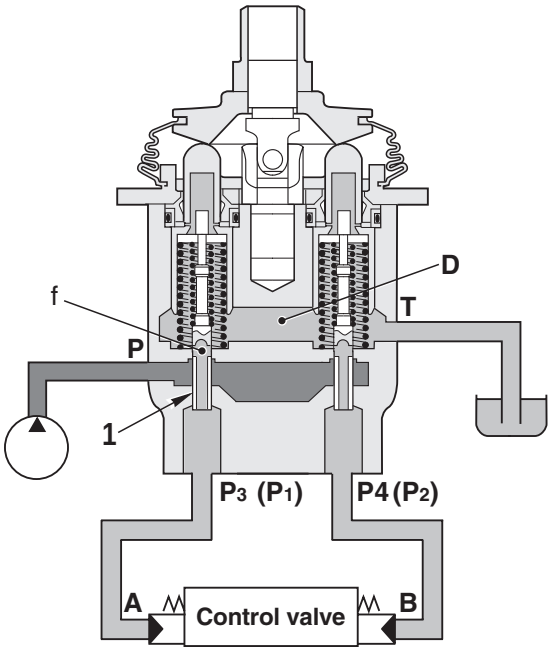
RKP01080

1. Spool
2. Adjusting spring (internal)
3. Return spring (external)
4. Plunger
5. Disc
6. Nut
7. Joint
8. Cover
9. Pin
10. Body

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)



RKP01091

FIG. 1

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)

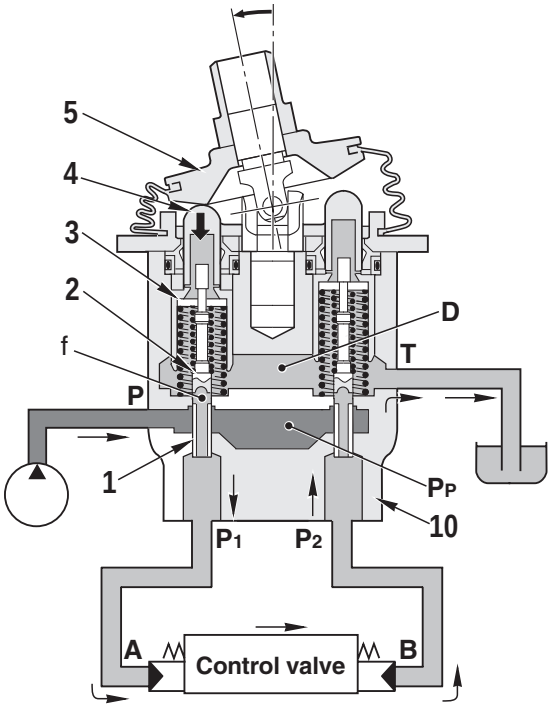


FIG. 2

RKP01101

3. During fine control (when the lever is returned)

When disc (5) starts to be returned, spool (1) is pushed up by the force of centering spring (3) and the pressure at port **P1**.
When this happens, fine control hole **f** is connected to drain chamber **D** and the pressure oil at port **P1** is released.

If the pressure at port **P1** drops too far, spool (1) is pushed down by metering spring (2), and fine control hole **f** is shut off from drain chamber **D**. At almost the same time, it is connected to pump pressure chamber **PP**, and the pump pressure is supplied until the pressure at port **P1** recovers to a pressure that corresponds to the lever position.

When the spool of the control valve returns, oil in drain chamber **D** flows in from fine control hole **f**' in the valve on the side that is not working.
The oil passes through port **P2** and enters chamber **B** to fill the chamber with oil. (Fig. 3)

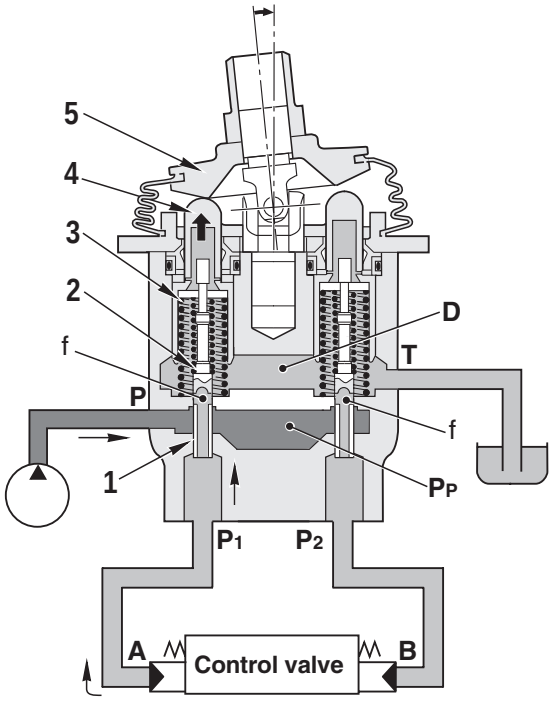


FIG. 3 RKP01111

4. At full stroke

When disc (5) pushes down piston (4), and retainer (7) pushes down spool (1), fine control hole **f** is shut off from drain chamber **D**, and is connected with pump pressure chamber **PP**. Therefore, the pilot pressure from the control pump passes through fine control hole **f** and flows to chamber **A** from port **P1**, and pushes the control valve spool.
The oil returning from chamber **B** passes from port **P2** through fine control hole **f**' and flows to drain chamber **D**. (Fig. 4)

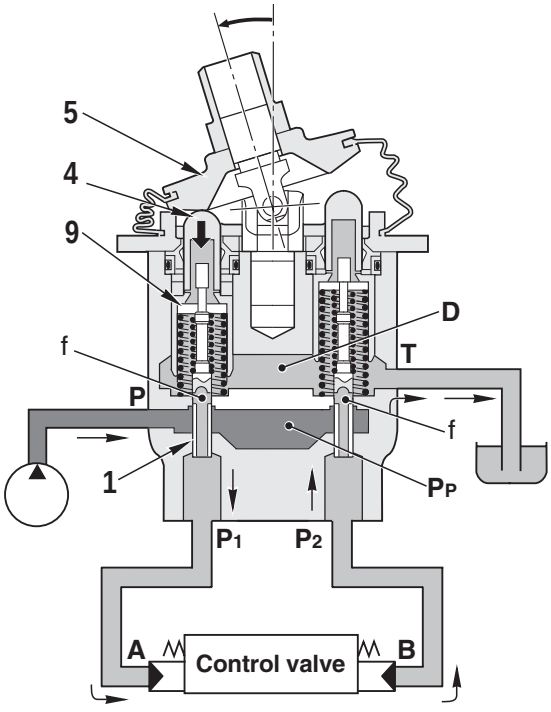
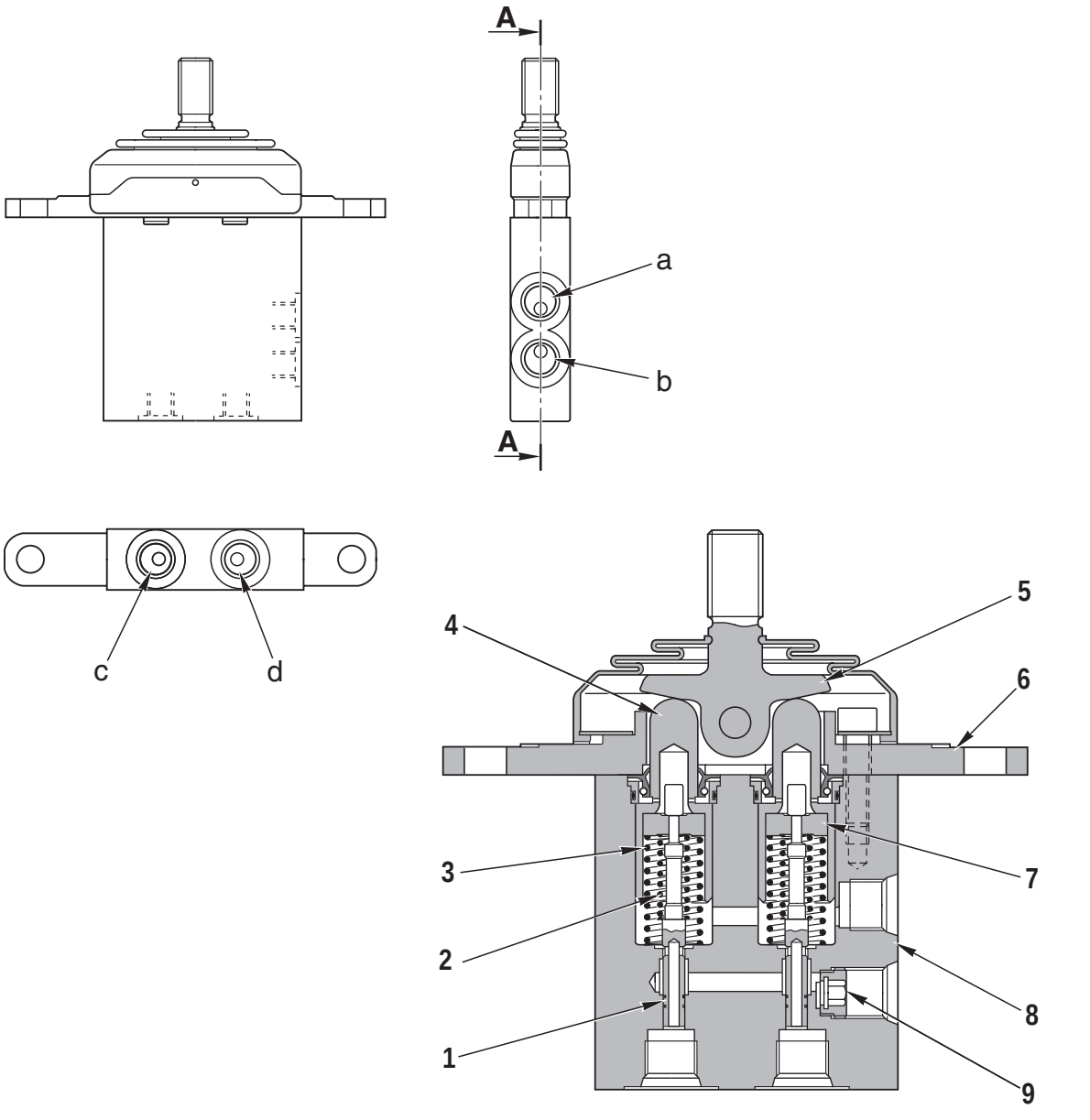


FIG. 4 RKP01121

PPC VALVE

HAMMER



Section A - A

RKP00960

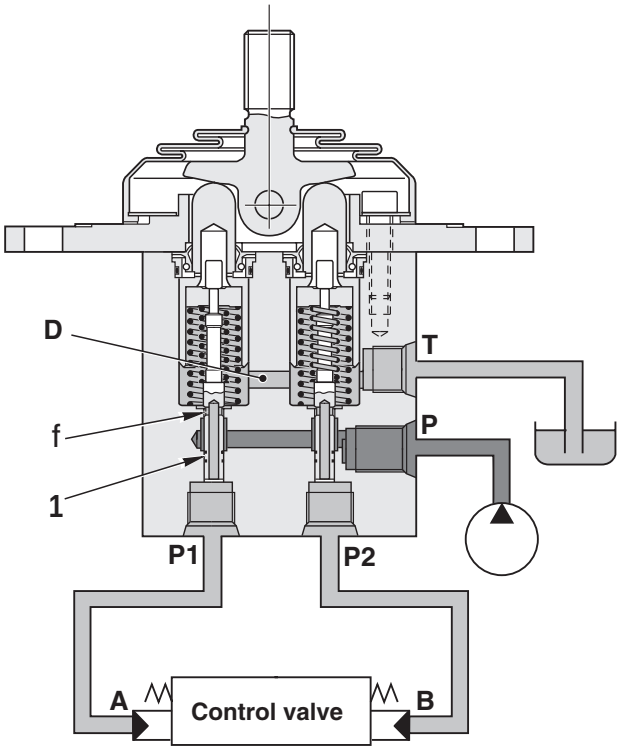
a. T Port - To ST1 solenoid valve (T port)
b. P Port - From ST1 solenoid valve (A port)
c. P1 Port - To control valve (P_{B9} port)
d. P2 Port - To control valve (P_{A9} port)

1. Spring
2. Adjusting spring (internal)
3. Return spring (external)
4. Plunger
5. Lever
6. Cover
7. Stopper
8. Body
9. Filter (100 mesh)

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)



RKP00971

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)

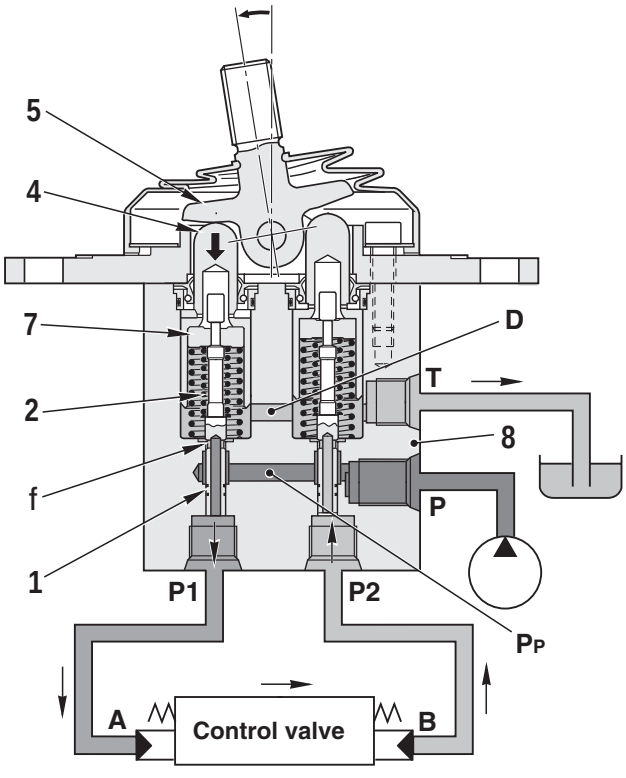


FIG. 2

RKP00981

3. During fine control (when the lever is returned)

When lever (5) starts to be returned, spool (1) is pushed up by the force of centering spring (3) and the pressure at port **P1**.
When this happens, fine control hole **f** is connected to drain chamber **D** and the pressure oil at port **P1** is released.

If the pressure at port **P1** drops too far, spool (1) is pushed down by metering spring (2), and fine control hole **f** is shut off from drain chamber **D**. At almost the same time, it is connected to pump pressure chamber **PP**, and the pump pressure is supplied until the pressure at port **P1** recovers to a pressure that corresponds to the lever position.

When the spool of the control valve returns, oil in drain chamber **D** flows in from fine control hole **f'** in the valve on the side that is not working.
The oil passes through port **P2** and enters chamber **B** to fill the chamber with oil. (Fig. 3)

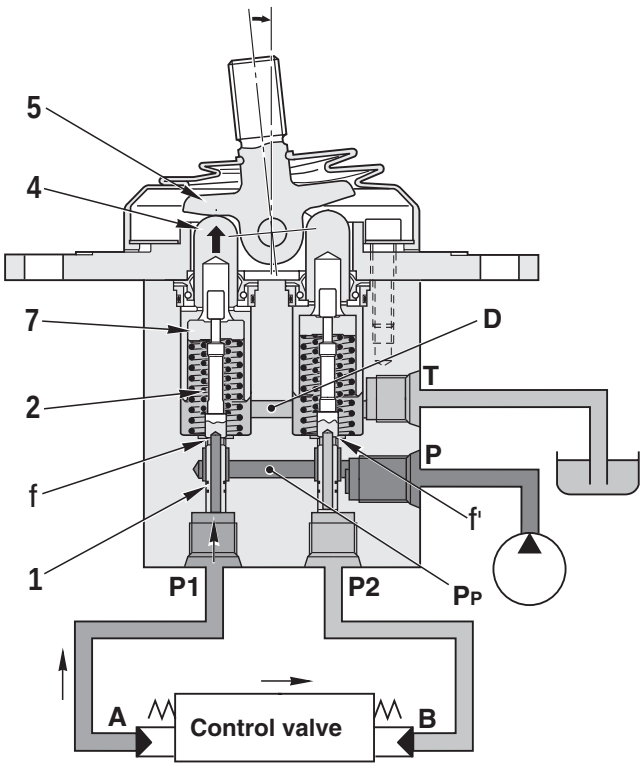


FIG. 3 RKP00991

4. At full stroke

When lever (5) pushes down piston (4), and retainer (7) pushes down spool (1), fine control hole **f** is shut off from drain chamber **D**, and is connected with pump pressure chamber **PP**. Therefore, the pilot pressure from the control pump passes through fine control hole **f** and flows to chamber **A** from port **P1**, and pushes the control valve spool.
The oil returning from chamber **B** passes from port **P2** through fine control hole **f'** and flows to drain chamber **D**. (Fig. 4)

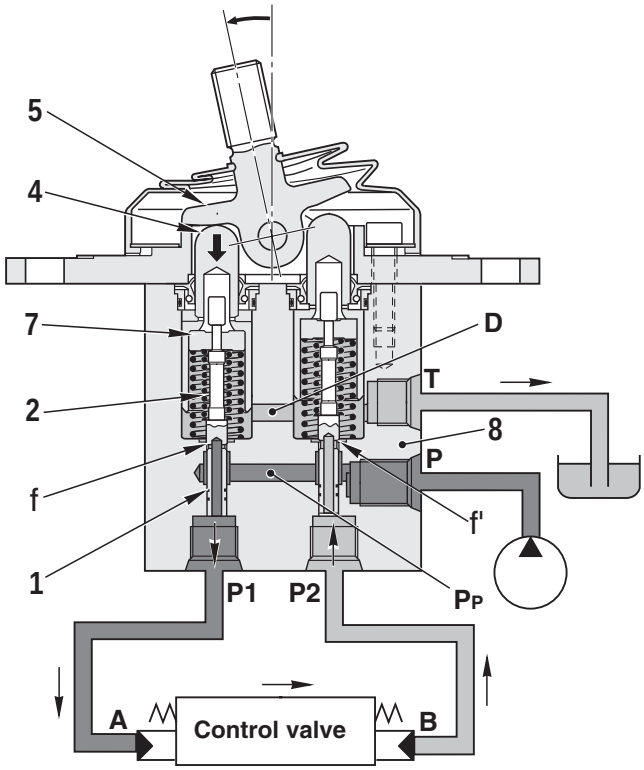
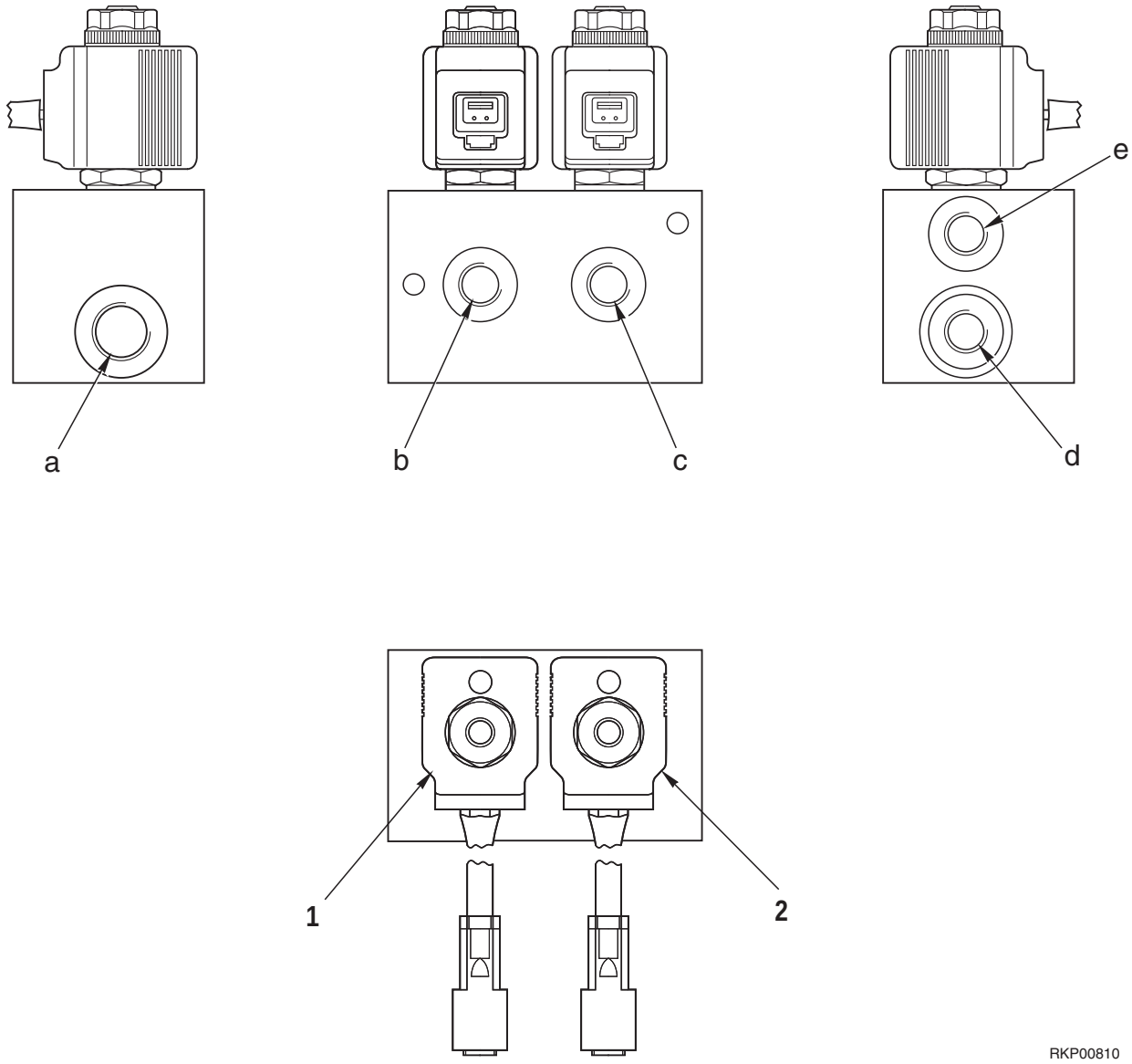


FIG. 4 RKP01001

SOLENOID VALVE

ST1 SERVOCONTROL (TRAVEL INCREMENT)



a. S Port - To accumulator
b. A Port - To PPC valve (P port)
c. B Port - To swivel joint (G port)
d. P Port - From control valve (P_{i2} port)
e. T Port - To hydraulic tank

1. Y2 Servocontrol
2. Y1 Travel increment

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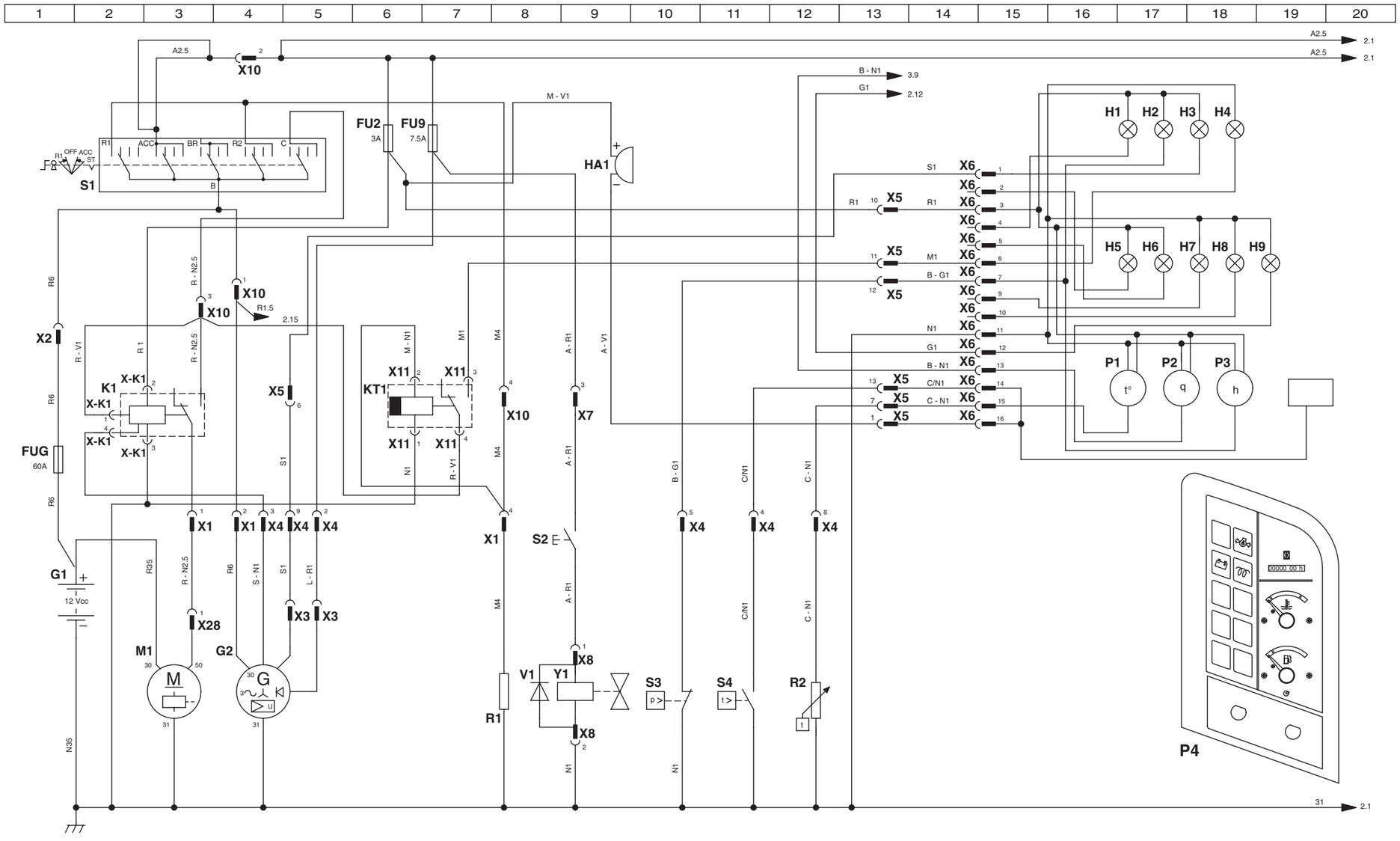
ELECTRICAL DIAGRAM (1/3)



RKP06570

COMPONENTS:

G1	BATTERY
G2	ALTERNATOR
H1	AIR FILTER CLOGGING WARNING LIGHT (NOT USED)
H2	PRESSURE OIL WARNING LIGHT
H3	BATTERY WARNING LIGHT
H4	PRE-HEATER WARNING LIGHT
H5	BRAKE PRESSURE WARNING LIGHT (NOT USED)
H6	OIL LEVEL WARNING LIGHT (NOT USED)
H7	POSITION LIGHT WARNING LIGHT (NOT USED)
H8	DIRECTION INDICATOR WARNING LIGHT (NOT USED)
H9	DASHBOARD LIGHT
HA1	BUZZER
K1	STARTER RELAY
KT1	PRE-HEATER TIMER
M1	STARTER MOTOR
P1	TERMOMETER
P2	LEVEL INDICATOR
P3	COUNTER-HOUR
P4	INSTRUMENT PANEL
R1	PRE-HEATER
R2	WATER TEMPERATURE WATER
S1	DASHBOARD
S2	PUSH-BUTTON
S3	LOW PRESSURE ENGINE OIL PRESSURE SWITCH
S4	HIGH WATER TEMPERATURE TERMOSTAT
V1	TRAVEL INCREMENT SOLENOID VALVE DIODE
Y2	TRAVEL INCREMENT SOLENOID VALVE DIODE

CONNECTORS:

X1	4-WAYS CONNECTOR
X2	2-WAYS CONNECTOR
X3	2-WAYS CONNECTOR
X4	9-WAYS CONNECTOR MARK
X5	13-WAYS CONNECTOR MARK
X6	16-WAYS CONNECTOR FKI INSTRUMENT
X7	5-WAYS CONNECTOR
X8	2-WAYS CONNECTOR DEUTSCH
X10	4-WAYS CONNECTOR
X11	4-WAYS CONNECTOR
X28	1-WAY CONNECTOR
X-K1	4-WAYS CONNECTOR

FUSES:

FU2	FUSE 3A (BUZZER - STARTER RELAY - INSTRUMENT)
FU9	FUSE 7.5 A (ALTERNATOR - TRAVEL INCREMENT SOLENOID VALVE)
FUG	GENERAL FUSE 60A

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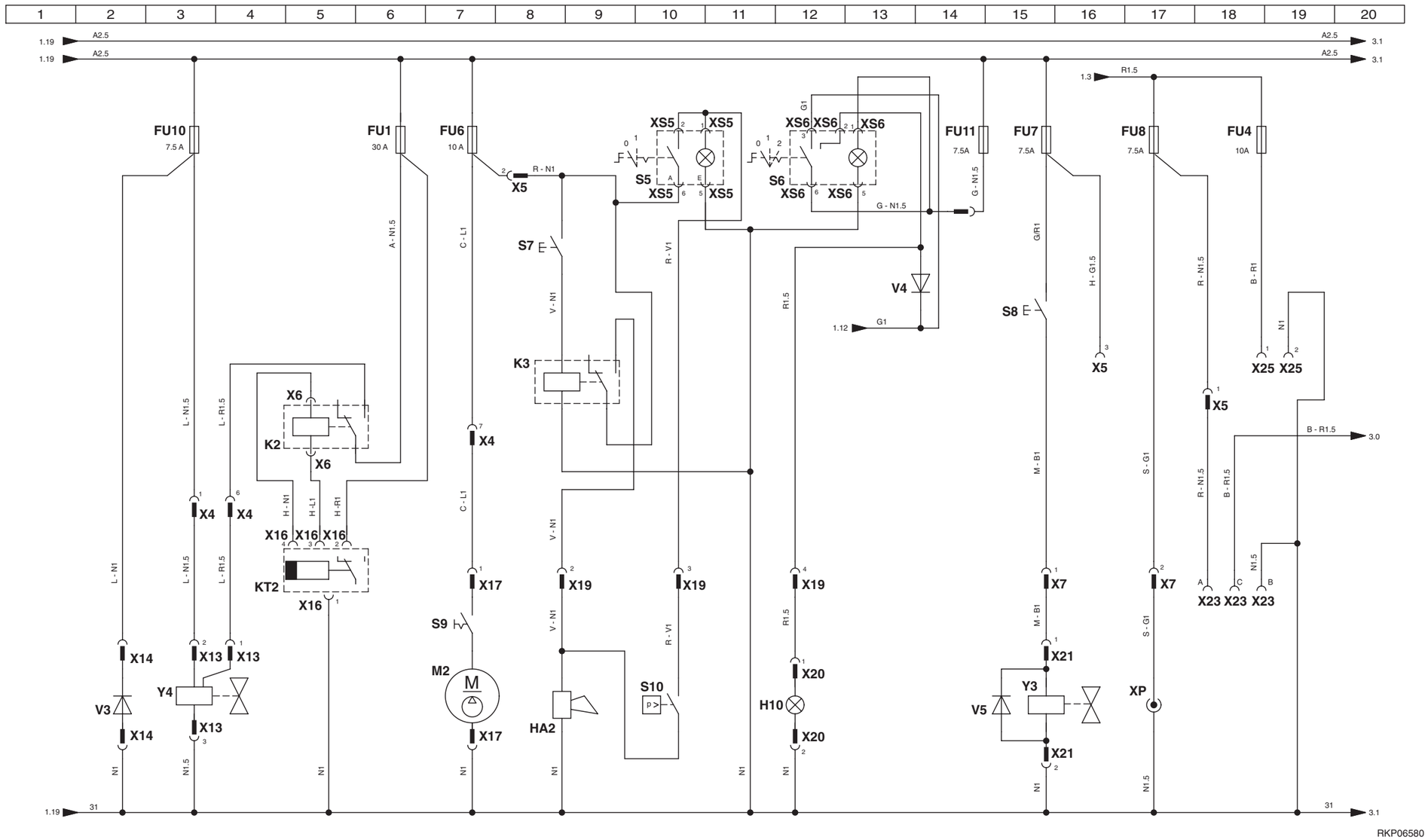
ELECTRICAL DIAGRAM (2/3)



COMPONENTS:

H10	WORKING BEAM
HA2	HORN
K2	STOP MOTOR RELAY
K3	HORN RELAY
M2	FUEL PUMP
S5	OPTIONAL SWITCH (TBG)
S6	LIGHT SWITCH
S7	PUSH-BUTTON
S8	HAMMER SOLENOID VALVE PUSH-BUTTON
S9	N.A. PUSH-BUTTON
S10	PRESSOSTAT
V3	STOP MOTOR DIODE
V4	WARNING LIGHT DIODE
V5	HAMMER SOLENOID VALVE DIODE
XP	ELECTRICAL SOCKET
Y3	HAMMER SOLENOID VALVE
Y4	STOP MOTOR

CONNECTORS:

X4	9-WAYS CONNECTOR MARK
X5	13-WAYS CONNECTOR MARK
X6	16-WAYS CONNECTOR FKI INSTRUMENT
X7	5-WAYS CONNECTOR MARK
X13	3-WAYS CONNECTOR
X14	2-WAYS CONNECTOR
X16	4-WAYS CONNECTOR
X17	2-WAYS CONNECTOR
X19	5-WAYS CONNECTOR MARK
X20	2-WAYS CONNECTOR DEUTSCH
X21	2-WAYS CONNECTOR DEUTSCH
X23	3-WAYS CONNECTOR DEUTSCH
X25	2-WAYS CONNECTOR
XS5	CONNECTOR FOR SWITCH MERIT
XS6	CONNECTOR FOR SWITCH MERIT

FUSES:

FU1	FUSE 30A (STOP MOTOR)
FU4	FUSE 10A (CAR RADIO)
FU6	FUSE 10A (FUEL PUMP - HORN - TBG)
FU7	FUSE 7.5 A (HAMMER SOLENOID VALVE OPTIONAL)
FU8	FUSE 7.5A (ELECTRICAL SOCKET - 30 + CABIN)
FU10	FUSE 7.5A (STOP MOTOR COIL)
FU11	FUSE 7.5A (WORKING BEAM)

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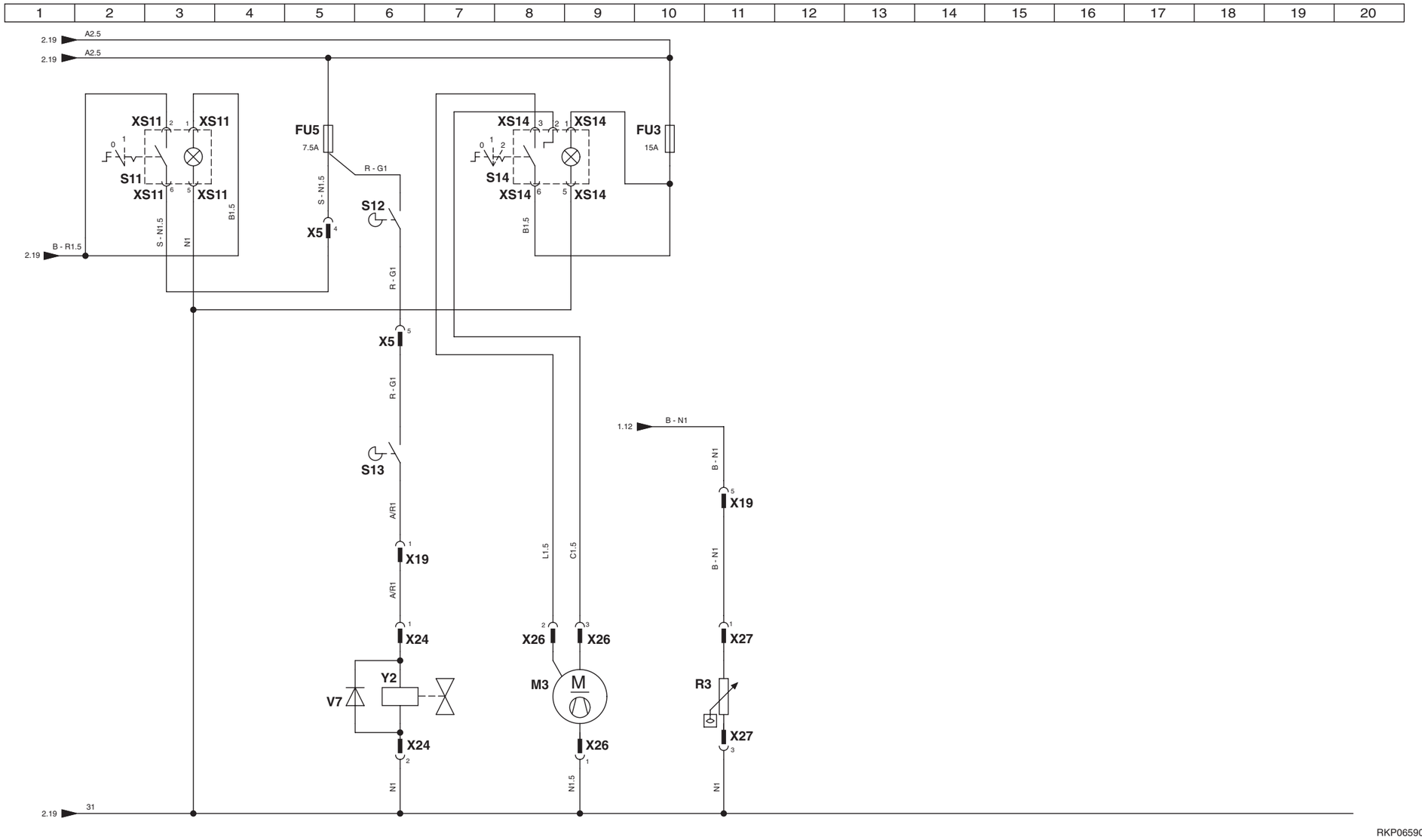
ELECTRICAL DIAGRAM (3/3)



COMPONENTS:

M3 VENTILATOR
R3 FUEL LEVEL INDICATOR
S11 ROTATING BEAM SWITCH
S12 ARM REST MICRO
S13 SERVOCONTROL MICRO
S14 SWITCH A VENTILATOR
V7 SERVOCONTROL SOLENOID VALVE DIODE
Y2 SERVOCONTROL SOLENOID VALVE

CONNECTORS:

X5 13-WAYS CONNECTOR MARK
X19 5-WAYS CONNECTOR MARK
X24 2-WAYS CONNECTOR DEUTSCH
X26 4-WAYS CONNECTOR
X27 3-WAYS CONNECTOR
XS11 CONNECTOR FOR SWITCH MERIT
XS14 CONNECTOR FOR SWITCH MERIT

FUSES:

FU3 FUSE 15A (VENTILATOR)
FU4 FUSE 10 (CAR RADIO)

GRUPPO 20

20 TESTING AND ADJUSTMENTS

⚠ 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).

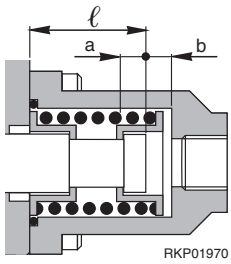
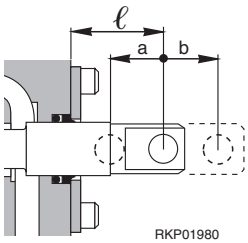
NORMAL OR STANDARD TECHNICAL DATA
• FOR THE ENGINE

Machine model			PC20R-8	
Engine			3D78AE-3FA	
Check item	Test condition	Unit	Standard value	Permissible value
Engine speed	High idling Low idling Rated speed	rpm rpm rpm	2780 950 2600	2755 – 2805 925 – 975 —
Exhaust gas colour	At sudden acceleration At high idling speed	Bosch Index	3.5 Max. 0.5	5.0 Max. 1.0
Valve clearance	Intake valve (20°C) Exhaust valve (20°C)	mm mm	0.20 0.20	— —
Compression pressure (SAE30 oil)	Oil temperature 40-60°C (Engine speed)	kg/cm^2 rpm	32±1 (250)	26±1 (250)
Blow-by pressure (SAE30 oil)	Water temperature in operating range At high idling speed	mm H_2O	—	—
Engine oil pressure	(Water temperature in operating range) At high idling speed (SAE30) At low idling speed (SAE30) At low idling speed (SAE10)	 kg/cm^2 kg/cm^2 kg/cm^2	 $3.7^{-0.5}_{+1}$ Min. 1.0 —	 — — —
Engine oil temperature	Whole speed range	°C	Max. 120	Max. 120
Fuel injection timing	Before top dead center (BTDC)	degrees	14±1	14±1
Fan-belt tension	Deflection when pressed with finger force of approx. 6 Kg	mm	10 – 15	—

• FOR THE ENGINE

PC27R-8					
3D82AE-3FA					
Standard value	Permissible value				
2785 1050 2600	2760 – 2810 1025 – 1075 —				
3.5 Max. 0.5	5.0 Max. 1.0				
0.20 0.20	— —				
31±1 (250)	25±1 (250)				
—	—				
$3.7^{-0.5}_{+1}$ Min. 1.0 —	— — —				
Max. 120	Max. 120				
14±1	14±1				
10 – 15	—				

• FOR THE MACHINE

Machine model				PC20R-8					
Classification	Check item	Test condition	Unit	Standard value			Permissible value		
Engine	Engine speed with one pump at max. pressure	● Boom circuit: max. pressure ● Hydraulic oil temperature: 45 – 55°C ● Cooling circuit: in correct range ● Engine oil pressure: in correct range ★ Measure when pressure has stabilised	rpm	2740			2690 – 2790		
		● Boom and swing circuit: max. pressure ● Hydraulic oil temperature: 45 – 55°C ● Cooling circuit: in correct range ● Engine oil pressure: in correct range ★ Measure when pressure has stabilised		2720			2670 – 2770		
Control valve	Boom control		mm	ℓ	a	b	ℓ	a	b
	Arm control			30	6	6	30	6	6
	Bucket control								
	Swing control								
	Work equipment control								
	Blade control			20	6	6	20	6	6
	Boom swing control								
	Travel control								
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	70			60 – 80		
	Arm control lever		Neutral → Open / Curled	70			60 – 80		
	Bucket control lever		Neutral → Open / Curled	70			60 – 80		
	Swing control lever		Neutral → Swing RH / Swing LH	70			60 – 80		
	Blade control lever		Neutral → Raise / Lower	50			40 – 60		
	Boom swing pedal		Neutral → Swing RH / Swing LH	20			17 – 23		
	Travel control lever		Neutral → Forward / Backward	100			90 – 110		
	Accelerator lever		Min. — Max.	180			160 – 200		
	Play of control lever		Work equipment, swing	Max. 5			Max. 8		
			Travel	Max. 10			Max. 15		

• FOR THE MACHINE

PC27R-8																		
Standard value			Permissible value															
2650			2600 – 2700															
2625			2575 – 2675															
ℓ	a	b	ℓ	a	b													
30	6	6	30	6	6													
20	6	6	20	6	6													
70			60 – 80															
70			60 – 80															
70			60 – 80															
70			60 – 80															
50			40 – 60															
20			17 – 23															
100			90 – 110															
180			160 – 200															
Max. 5			Max. 8															
Max. 10			Max. 15															

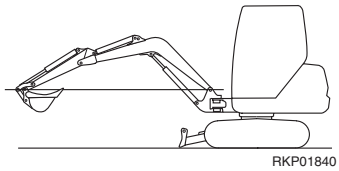
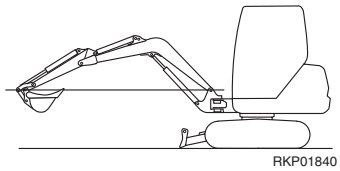
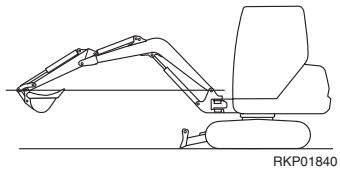
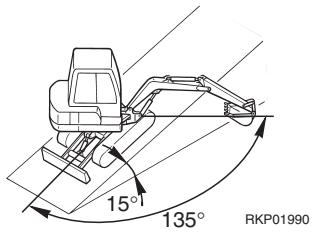
• FOR THE MACHINE

Machine model					PC20R-8	
Classification	Check item	Test condition		Unit	Standard value	Permissible value
Operating force for control of levers and pedals	Boom lever	• Engine speed: high idling • Hydraulic oil temperature: 45 – 55°C • Instrument coupling at centre of control lever knob • Instrument coupling on outside edge (for pedal control) • Reading at end of travel		kg	2.0	1.7 – 2.3
	Arm lever				2.0	1.7 – 2.3
	Bucket lever				2.0	1.7 – 2.3
	Swing lever				2.0	1.7 – 2.3
	Boom swing pedal				8.0	7.0 – 9.0
	Blade lever				3.0	2.5 – 3.5
	Travel control lever				2.0	1.7 – 2.3
	Travel accelerator lever		Min. → Max.		1.5	1.2 – 1.8
			Max. → Min.		1.2	1.0 – 1.4
Hydraulic pressure	Unload pressure	• Engine speed: high idling • Hydraulic oil temperature: 45 – 55°C • All levers at HOLD • Relieve pump outlet pressure		kg/cm^2	Max. 35	Max. 35
	Boom	• Engine speed: high idling • Hydraulic oil temperature: 45 – 55°C • Check one circuit at a time • Relieve pump outlet pressure		kg/cm^2	210^{0}_{+10}	210^{0}_{+10}
	Arm				210^{0}_{+10}	210^{0}_{+10}
	Bucket				210^{0}_{+10}	210^{0}_{+10}
	Servocontrol				30^{0}_{+5}	30^{0}_{+5}
	Boom swing				210^{0}_{+10}	210^{0}_{+10}
	Blade				210^{0}_{+10}	210^{0}_{+10}
	Travel				210^{0}_{+10}	210^{0}_{+10}
	Swing	• For PC27R-8 only: Relieve pressure on swing motor			155^{0}_{+5}	155^{0}_{+5}
	LS differential pressure	• Hydraulic oil temperature: 45 – 55°C • Engine speed: max. • Differential pressure = pump delivery pressure – LS pressure	All levers at HOLD		Max. 35	Max. 35
			Travel rotating freely, travel lever at half-way position			

• FOR THE MACHINE

PC27R-8					
Standard value	Permissible value				
2.0	1.7 – 2.3				
2.0	1.7 – 2.3				
2.0	1.7 – 2.3				
2.0	1.7 – 2.3				
8.0	7.0 – 9.0				
3.0	2.5 – 3.5				
2.0	1.7 – 2.3				
1.5	1.2 – 1.8				
1.2	1.0 – 1.4				
Max. 35	Max. 35				
210^{0}_{+10}	210^{0}_{+10}				
210^{0}_{+10}	210^{0}_{+10}				
210^{0}_{+10}	210^{0}_{+10}				
30^{0}_{+5}	30^{0}_{+5}				
210^{0}_{+10}	210^{0}_{+10}				
210^{0}_{+10}	210^{0}_{+10}				
210^{0}_{+10}	210^{0}_{+10}				
215^{0}_{+5}	215^{0}_{+5}				
Max. 35	Max. 35				

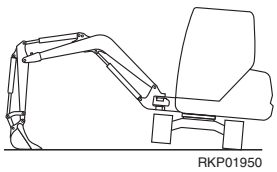
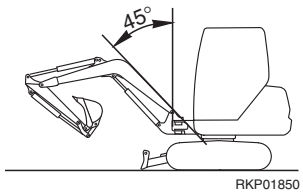
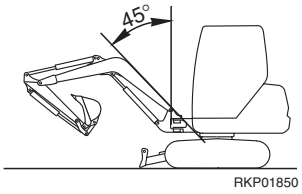
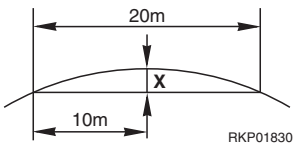
• FOR THE MACHINE

Machine model					PC20R-8	
Classification	Check item	Test condition		Unit	Standard value	Permissible value
Swing	Braking angle	Work equipment at max. reach  RKP01840 ● No load in bucket ● Engine speed: high idling ● Hydraulic oil temperature: 45 – 55°C ● Make centering marks on the outer swing circle rings. Rotate the revolving frame 360° and lock in position. Measure the difference between the marks after stopping.		Degree (mm)	18° (42)	Max. 22° (Max. 51.4)
	Time taken to start swing	Work equipment at max. reach  RKP01840 ● No load in bucket ● Engine speed: high idling ● Hydraulic oil temperature: 45 – 55°C ● Measure the time taken for swings to start from positions at 90° and 180°.	90°	sec	2.0	1.8 – 2.2
			180°		3.8	3.4 – 4.2
	Time taken for to swing	Work equipment at max. reach  RKP01840 ● No load in bucket ● Engine speed: high idling ● Hydraulic oil temperature: 45 – 55°C ● Make one turn to settle machine ● Measure the time taken to make 5 full swings.		sec	34.0	Max. 38.0
	Hydraulic drift of swing	 15° 135° RKP01990 ● Load in bucket: PC20R-8: 126 kg PC27R-8: 135 kg ● Engine switched off ● Hydraulic oil temperature: 45 – 55°C ● Park the machine on a 15° slope and position the boom at 135° with respect to the ground surface. ● On the outer swing circle, mark the position between revolving frame and track frame. After 15 minutes measure the drift.		mm (Degree)	175 (75°)	Max. 210 (Max. 90°)

• FOR THE MACHINE

PC27R-8					
Standard value	Permissible value				
20° (52)	Max. 24° (Max. 62.3)				
1.9	1.7 – 2.1				
3.5	3.1 – 3.9				
34.0	Max. 38.0				
194.7 (75°)	Max. 233.7 (Max. 90°)				

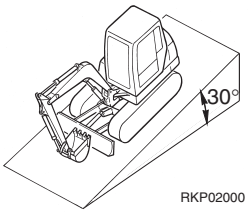
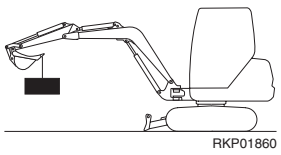
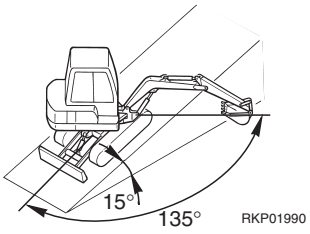
• FOR THE MACHINE

Machine model					PC20R-8	
Classification	Check item	Test condition		Unit	Standard value	Permissible value
Swing	Internal leakage from swing motor	• Engine speed: high idling • Hydraulic oil temperature: 45 – 55°C • Swing lock: engaged • Measure the leakage • Pressurize circuit.		ℓ/min	0.6	Max. 1.0
Travel	Travel motor swing speed (1) (no-load)	Measuring posture  RKP01950 • Engine speed: high idling • Hydraulic oil temperature: 45 – 55°C • Rest the bucket on the ground, raise one track-shoe, rotate one turn, then measure time taken for next.	Low speed	sec	25.0	21 – 29
			High speed		13.0	11 – 15
	Travel speed (2)	Measuring posture  RKP01850 • Engine speed: high idling • Hydraulic oil temperature: 45 – 55°C • On flat ground • Travel for at least 10 metres and then check on the time needed to cover 20 metres	Low speed	sec	33.0	29 – 37
			High speed		16.5	14 – 19
	Travel deviation	 RKP01850 • Engine speed: high idling • Hydraulic oil temperature: 45 – 55°C • Travel 20 metres on flat ground and measure the deviation. ★ The surface must be firm and horizontal.  RKP01830 ★ Measure dimension «X»		mm	Max. 500	Max. 550

• FOR THE MACHINE

PC27R-8					
Standard value	Permissible value				
0.6	Max. 1.0				
30.0	24 – 36				
15.0	12 – 18				
33.0	29 – 37				
16.0	14 – 18				
Max. 500	Max. 550				

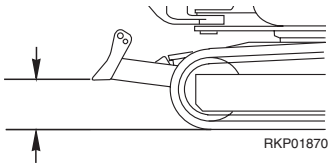
• FOR THE MACHINE

Machine model				PC20R-8	
Classification	Check item	Test condition	Unit	Standard value	Permissible value
Travel	Hydraulic drift of travel motors	Measuring posture  ● Engine stopped. ● Hydraulic oil temperature: 45 – 55°C. ● Machine parked on sloping ground. ● Measure the drift after 5 minutes	mm	Max. 200	Max. 240
	Leakage of travel motor	● Engine speed: high idling ● Hydraulic oil temperature: 45 – 55°C ● Lock shoe	ℓ/min	—	—
Hydraulic drift of working equipment	Total work equipment (Downward movement of tips of bucket teeth)	Measuring posture  ● Bucket: rated load: PC20R-8: 126 kg PC27R-8: 135 kg ● In this position, measure extension or retraction of each cylinder, and any leakages occurring when a load is applied to the tips of the bucket teeth. ● Horizontal and level ground ● Levers: neutral ● Engine: switched off ● Oil temperature: 45 – 55°C. ● Take measurements as soon as the engine stops. ● Measure the variations every 5 minutes and check the total variation after 15 mins.	Short arm	Max. 300	Max. 340
			Long arm	Max. 300	Max. 350
	Boom cylinder (Retraction)		Short arm	Max. 20	Max. 30
			Long arm	Max. 20	Max. 33
	Arm cylinder (Extension)		Short arm	Max. 20	Max. 30
			Long arm	Max. 20	Max. 33
	Bucket cylinder (Retraction)			Max. 10	Max. 20
	Boom swing	 ● Bucket: rated load: PC20R-8: 126 kg PC27R-8: 135 kg ● Engine stopped. ● Hydraulic oil temp.: 45 – 55°C ● In the same position as above, stop the machine on a 15° slope and position the revolving frame at 135°. Measure the extension and retraction of the cylinder after 15 minutes.	Short arm	Max. 15	Max. 20
			Long arm	Max. 15	Max. 22

• FOR THE MACHINE

PC27R-8					
Standard value	Permissible value				
Max. 200	Max. 240				
—	—				
Max. 300	Max. 340				
Max. 300	Max. 350				
Max. 20	Max. 30				
Max. 20	Max. 33				
Max. 20	Max. 30				
Max. 20	Max. 33				
Max. 20	Max. 20				
Max. 15	Max. 20				
Max. 15	Max. 22				

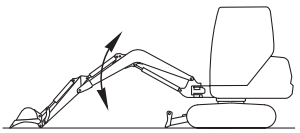
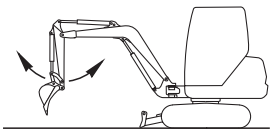
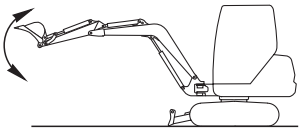
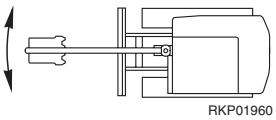
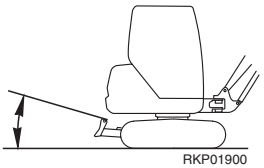
• FOR THE MACHINE

Machine model				PC20R-8	
Classification	Check item	Test condition	Unit	Standard value	Permissible value
Hydraulic drift of working equipment	Blade (measure the downward movement of the edge of the blade)	 RKP01870 ● Engine stopped ● Hydraulic oil temperature: 45 – 55°C ● Raise the blade to its maximum height and measure the height of the edge from the ground. Measure the downward after 15 mins.	mm	Max. 20	Max. 30
Internal cylinder leakage	Boom	● Engine speed: high idling ● Hydraulic oil temperature: 45 – 55°C ● Check leakages: on the cylinder on the side opposite to the one under pressure. ★ Check one cylinder at a time	cm^3/min	2	Max. 5
	Arm			2	Max. 5
	Bucket			2	Max. 5

• FOR THE MACHINE

PC27R-8					
Standard value	Permissible value				
Max. 20	Max. 30				
2	Max. 5				
2	Max. 5				
2	Max. 5				

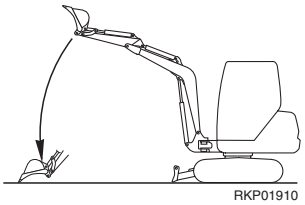
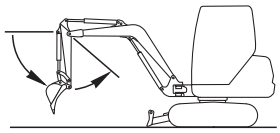
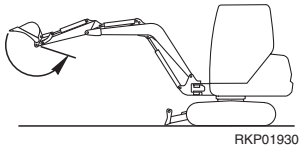
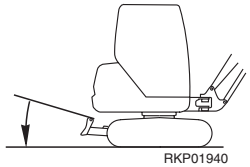
• FOR THE MACHINE

Machine model					PC20R-8	
Classification	Check item	Test condition		Unit	Standard value	Permissible value
Work equipment	Speed	Boom Bucket teeth on the ground ↕ Cylinder fully extended	• Measuring posture  RKP01820 • Engine speed: high idling • Hydraulic oil temperature: 45 – 55°C	Raise	sec.	2.3	1.8 – 2.8
				Lower		2.3	1.8 – 2.8
		Arm Cylinder fully retracted ↕ Cylinder fully extended	• Measuring posture  RKP01880 • Engine speed: high idling • Hydraulic oil temperature: 45 – 55°C	Closed		3.0	2.4 – 3.6
				Inout		3.0	2.4 – 3.6
		Bucket Cylinder fully retracted ↕ Cylinder fully extended	• Measuring posture  RKP01890 • Engine speed: high idling • Hydraulic oil temperature: 45 – 55°C	Dump		2.2	1.7 – 2.7
				Curled		2.2	1.7 – 2.7
		Boom swing Cylinder fully retracted ↕ Cylinder fully extended	• Measuring posture  RKP01960 • Engine speed: high idling • Hydraulic oil temperature: 45 – 55°C	L.H.		7.0	6.0 – 8.0
				R.H.		7.0	6.0 – 8.0
		Blade Blade on the ground ↕ Blade raised to max. height	• Measuring posture  RKP01900 • Engine speed: high idling • Hydraulic oil temperature: 45 – 55°C	Raise		1.2	1.0 – 1.4
				Lower		1.2	1.0 – 1.4

• FOR THE MACHINE

PC27R-8					
Standard value	Permissible value				
2.3	1.8 – 2.8				
2.3	1.8 – 2.8				
3.0	2.4 – 3.6				
3.0	2.4 – 3.6				
2.2	1.7 – 2.7				
2.2	1.7 – 2.7				
7.0	6.0 – 8.0				
7.0	6.0 – 8.0				
1.2	1.0 – 1.4				
1.2	1.0 – 1.4				

• FOR THE MACHINE

Machine model					PC20R-8	
Classification	Check item		Test condition	Unit	Standard value	Permissible value
Work equipment	Time lags	Boom	Measuring posture  RKP01910 • Engine speed: low idling • Hydraulic oil temperature: 45 – 55°C • With the work equipment fully extended, lower the boom and measure the time taken to raise the machine from when the bucket reaches the ground.	sec.	Max. 2	Max. 2
		Arm	Measuring posture  RKP01920 • Engine speed: low idling • Hydraulic oil temperature: 45 – 55°C • Bring the boom into a horizontal position. Retract the arm cylinder completely and then extend it. Measure the time elapsing from when the arm stops at dead centre until it starts to move again.		Max. 2	Max. 2
		Bucket	Measuring posture  RKP01930 • Engine speed: low idling • Hydraulic oil temperature: 45 – 55°C • Bring the boom into a horizontal position. Retract the bucket cylinder completely, then extend it. Measure the time elapsing from when the bucket stops at dead centre until it starts to move again.		Max. 2	Max. 2
		Blade	Measuring posture  RKP01940 • Engine speed: low idling • Hydraulic oil temperature: 45 – 55°C • Raise the blade to its max. height, then lower it. Measure the time that it takes to raise the machine after the blade touches the ground		Max. 1	Max. 1

• FOR THE MACHINE

PC27R-8					
Standard value	Permissible value				
Max. 2	Max. 2				
Max. 2	Max. 2				
Max. 2	Max. 2				
Max. 1	Max. 1				

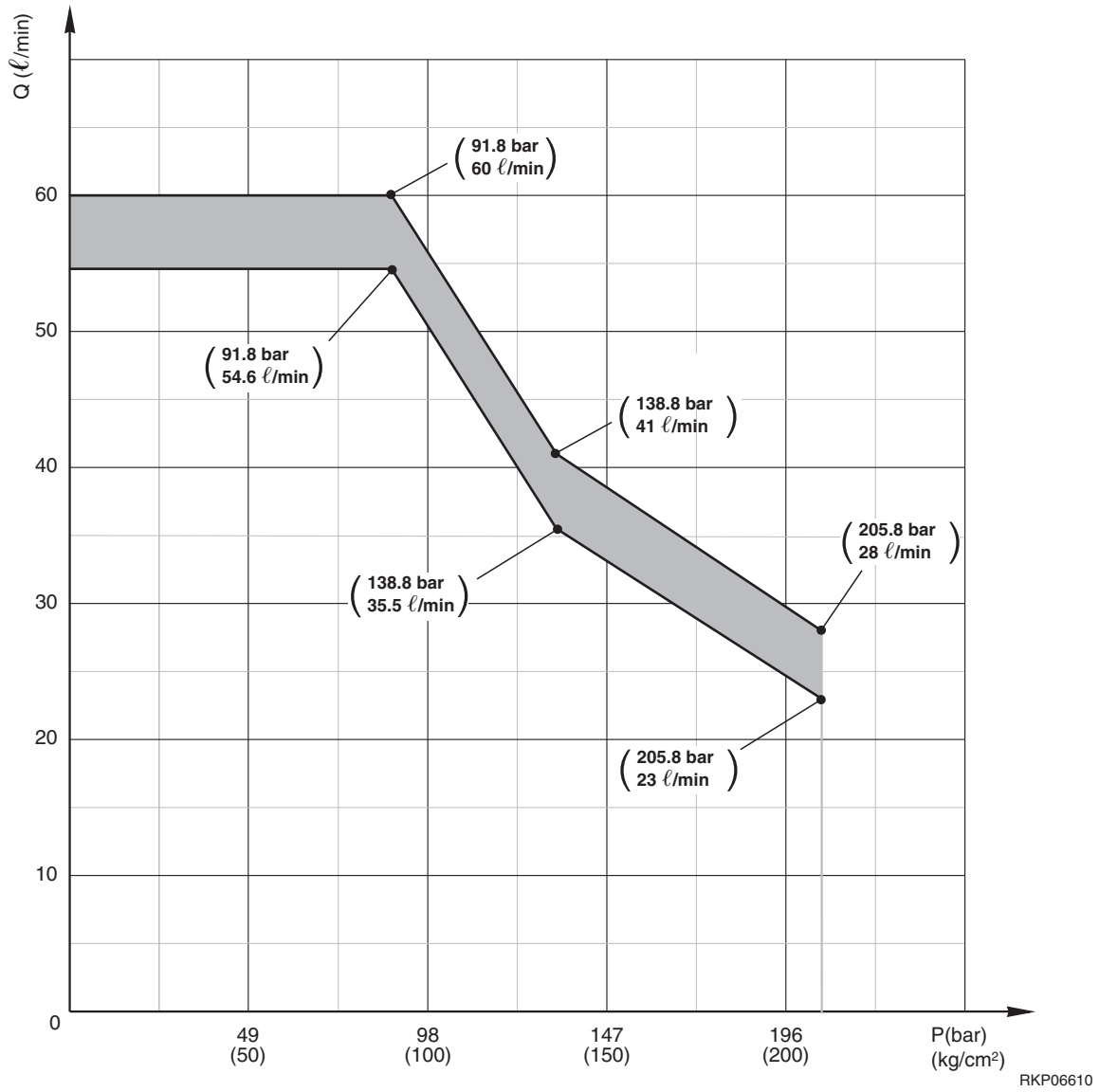
• FOR THE MACHINE

Machine model				PC20R-8	
Classification	Check item	Test condition	Unit	Standard value	Permissible value
Pumps	Gear pump P2	Theoretical flow	cm^3	2.75	
		Motor speed	rpm	2600	
		Test pressure	kg/cm^2	30^{0}_{+5}	
		Nominal capacity • Hydraulic oil temperature: 45 – 55 °C	ℓ/min	6.6	
	Piston pump P1			See next page	

Classification

- Delivery piston pump P1
- Pump speed: 2600 rpm
- Hydraulic oil temperature: 45 – 55°C

Pump characteristics



★ 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: 2525 rpm
- Delivery: 42 ℓ/min

PROPORTIONAL DELIVERY AT 2600 rpm
(42x2600)/2525 = 43.2 ℓ/min

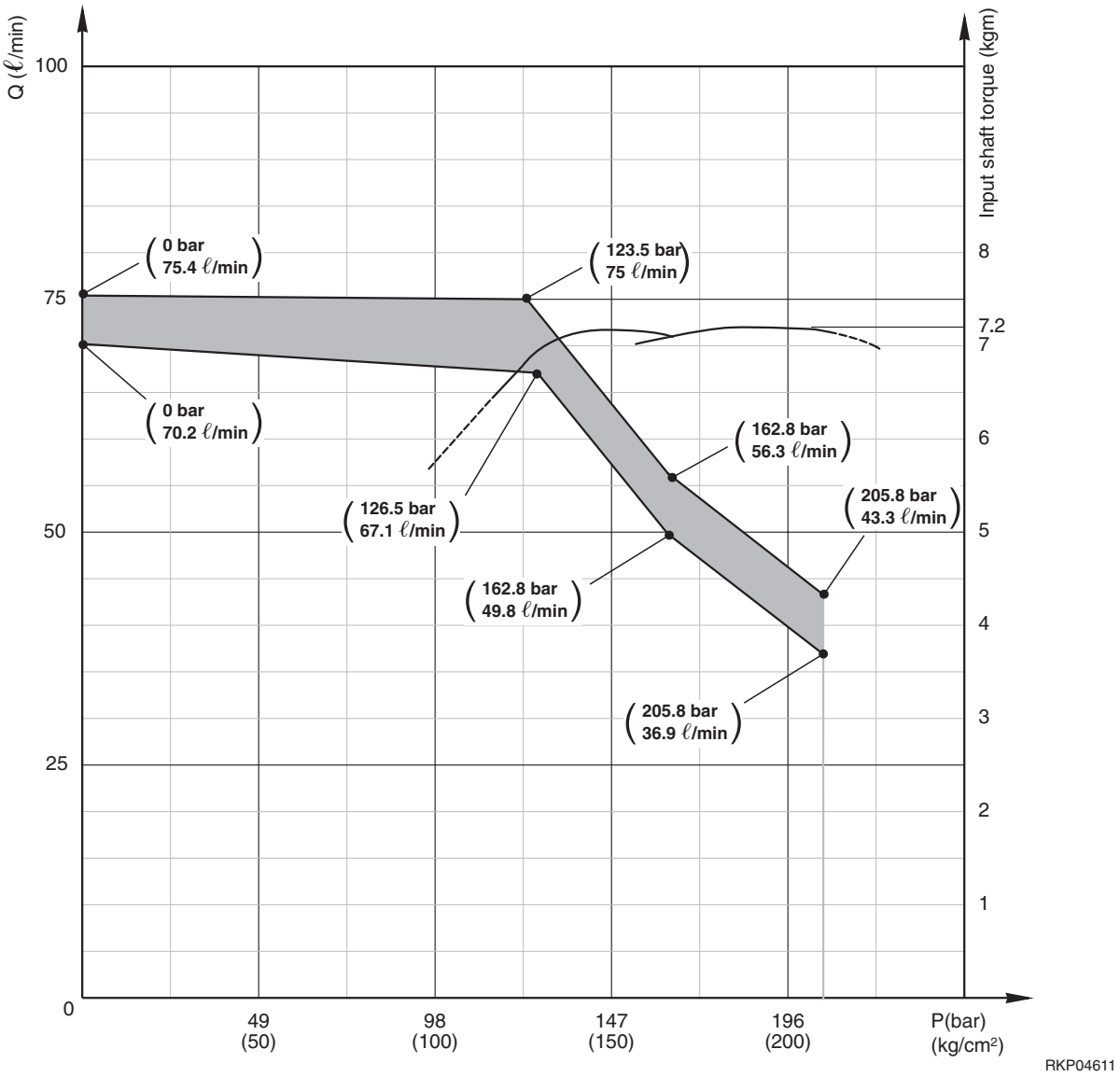
• FOR THE MACHINE

Machine model				PC27R-8	
Classification	Check item	Test condition	Unit	Standard value	Permissible value
Pumps	Gear pump P2	Theoretical flow	cm^3	3.44	
		Motor speed	rpm	2600	
		Test pressure	kg/cm^2	30^{0}_{+5}	
		Nominal capacity • Hydraulic oil temperature: 45 – 55 °C	ℓ/min	8.3	
	Piston pump P1			See next page	

Classification

Pump characteristics

- Delivery piston pump P1
- Pump speed: 2600 rpm
- Hydraulic oil temperature: 45 – 55°C



★ 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: 2525 rpm
- Delivery: 42 ℓ/min

PROPORTIONAL DELIVERY AT 2600 rpm
(42x2600)/2525 = 43.2 ℓ/min

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
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
Track shoe tension	G	1	823001135	Grease nipple	1	Included in the machine tool kit

CHECKING THE ENGINE SPEED

⚠ When checking the engine rpm , always be very careful not to touch parts that reach high temperatures and not to get entangled in rotating elements.

★ Check the engine speed after the following conditions have been reached:
- Temperature of engine cooling water: 68 – 80 °C.
- Temperature of hydraulic oil: 45 – 55 °C.

1 - Mount and connect the tachometer **C1**.
- ★ If the stroboscopic tachometer **C2** is used, make a distinct mark on the engine pulley to facilitate the reading.

2 - Start the engine and check:
- Low idling without load (accelerator lever in "minimum" position).
- High idling without load (accelerator lever in "maximum" position).
  - ★ Low idling:
    PC20R-8: 950±25 rpm
    PC27R-8: 1050±25 rpm
  - ★ High idling:
    PC20R-8: 2780±25 rpm
    PC27R-8: 2785±25 rpm

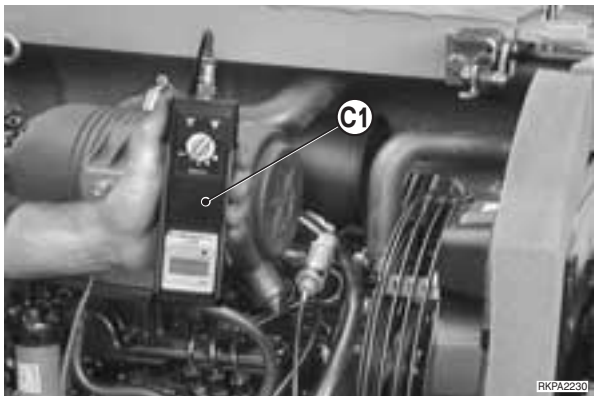
★ If the minimum and maximum speeds do not fall within permissible limits when the engine is without load, check the position locks of the accelerator lever, and the sheathing of the accelerator well, before carrying out any tests under load. (See «ADJUSTMENT OF THE ACCELERATOR LEVER»).

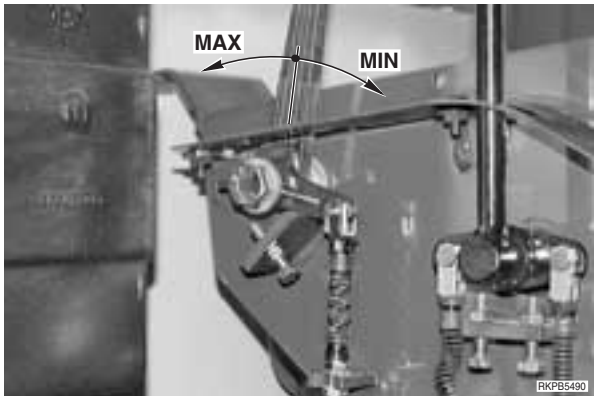
- Engine rpm with the pumps under load.

★ Boom at max. pressure:
PC20R-8: 2740±50 rpm
PC27R-8: 2650±50 rpm

★ Boom and swing at max. pressure:
PC20R-8: 2720±50 rpm
PC27R-8: 2625±50 rpm

★ If engine efficiency does not fall within permissible limits, have the engine checked by an authorised workshop.





ADJUSTMENT OF VALVE CLEARANCE

- Adjust the clearance between valve and rockers to the following values:

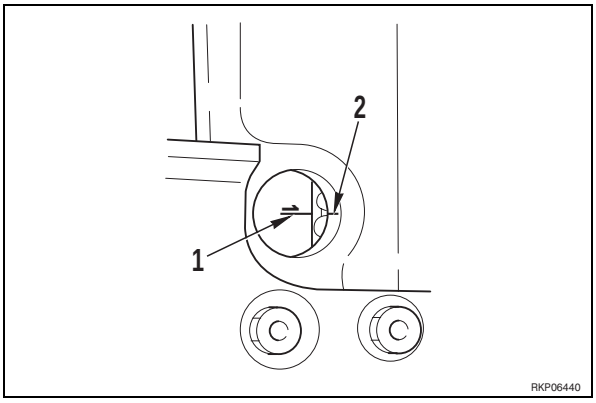
Unit: mm

With engine cold	Suction valves	Exhaust valves
	0.20	0.20

1 - Remove the intake filter and the valve cover.

2 - Turn the drive shaft in the normal direction of rotation until the line (1) marked as no. 1 on the flywheel is in alignment with the reference notch (2) on the flywheel housing.

★ If the cylinder is in a compression stroke, the valves do not move when the drive shaft is rotated slightly.
If the valves do move, rotate the drive shaft by one turn and realign the reference marks (1) and (2).

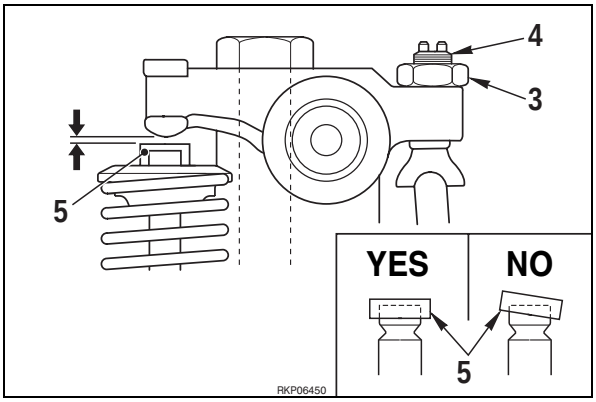


3 - Loosen the lock nut (3) and unscrew the adjustment screw (4) by approximately 1 turn.

★ Check that the valve cap (5) is lying flat on the valve stem and that there is no lop-sided wear.

1 - If the valve caps (5) are damaged, replace them with new ones.

2 - Make sure that the valve caps fit perfectly and are lying flat on the valve stem.



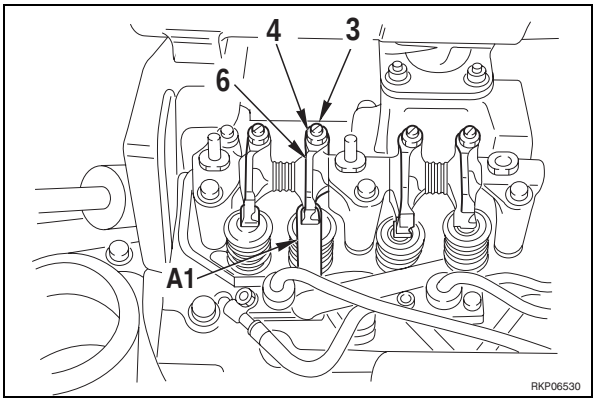
4 - Insert the feeler gauge **A1** between the rocker (6) and the valve cap (5).
Rotate the adjusting screw (4) until it rubs against the feeler gauge **A1**.
Secure this position with the nut (3).

Nm Lock nut: 25.5±2.5 Nm

★ After locking the nut (3), check the valve clearance again.

5 - After adjusting the No. 1 cylinder, rotate the drive shaft 240° each time and adjust the valve clearance of the other cylinders according to the ignition sequence.

★ Ignition sequence: 1 - 3 - 2.

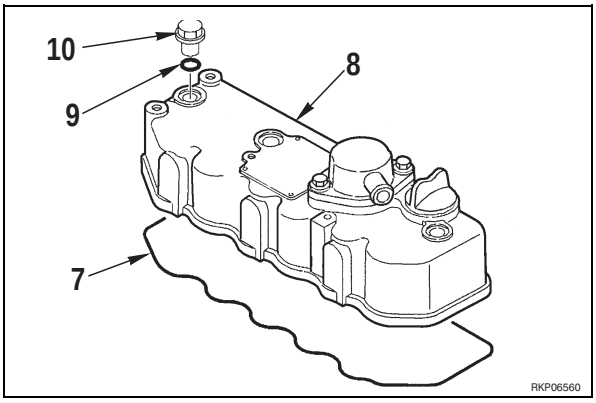


- **Assembly of the valve cover**

1 - Check the condition of the gasket (7) of the valve cover (8), and the O-rings (9). Thoroughly clean the contact surface on the cylinder heads.

2 - Replace the valve cover (8) and mount the O-rings (9) and the lock nuts (10).

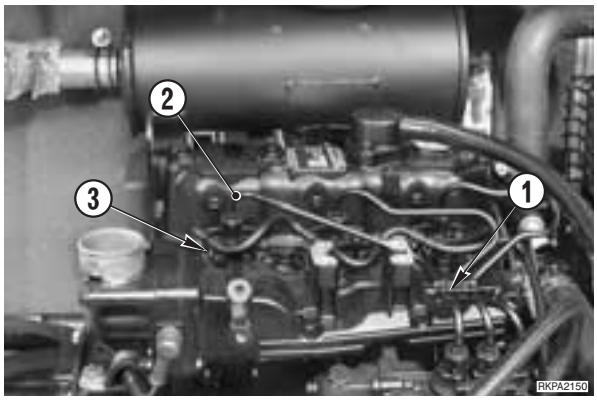
Nm Lock nuts for cover: 25±3 Nm



MEASUREMENT OF THE COMPRESSION PRESSURE

⚠
- While measuring the compression, take care not to get entangled in the cooling fan, the alternator belt, or in other rotating parts.
- Check all cylinders.

★ Test conditions:
- Engine: at working temperature.
- Hydraulic oil: 45 – 55 °C.
- Battery: fully charged.
- Valve clearance: adjusted (See «ADJUSTMENT OF VALVE CLEARANCE»).
- Air filter functioning properly.

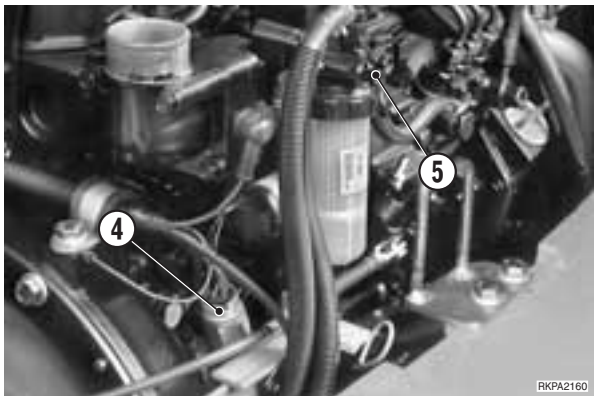


1 - Remove the clamp (1) and disconnect the high-pressure tube (2).

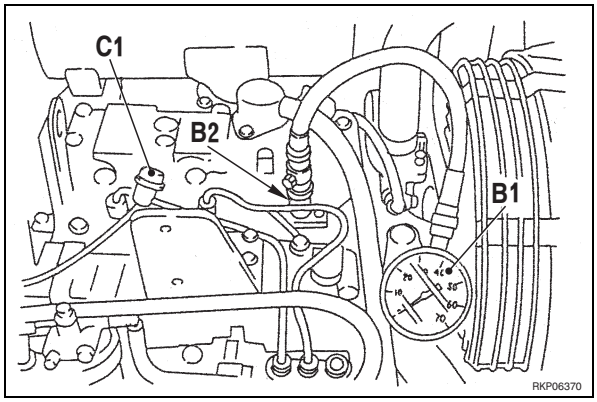
2 - Remove the nozzle holder (3) of the cylinder to be checked.

3 - Disconnect the connector (4) of the engine-stopping solenoid and close the fuel cock (5).

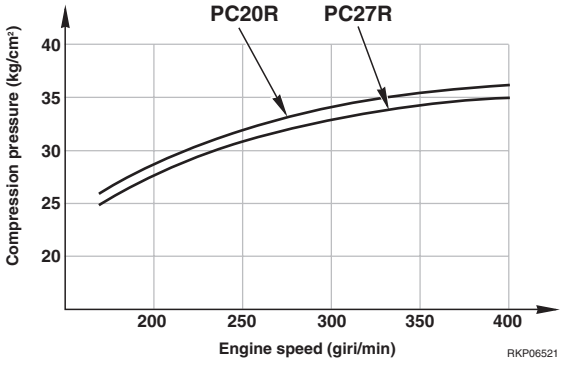
4 - Turn the engine over a few times, using the starting motor.



5 - Mount the adapter **B2** and connect the test pressure gauge **B1**.
- ★ Check that the seal is mounted in the adapter, and that it is undamaged.



6 - Turn the engine using the starting motor and read the compression value.
- ★ Read the compression value when the pressure gauge has stabilised.
- ★ While reading the compression, also check the engine rpm using the tachometer **C1** or **C2**. If the speed does not correspond with the control value, check it against the diagram.
- ★ Compression value:
  Normal: PC20R-8: 32±1 kg/cm^2 at 250 rpm
  PC27R-8: 31±1 kg/cm^2 at 250 rpm
  Minimum permissible:
  PC20R-8: 26±1 kg/cm^2 at 250 rpm
  PC27R-8: 25±1 kg/cm^2 at 250 rpm
- ★ Maximum difference between the cylinders: 2 – 3 kg/cm^2



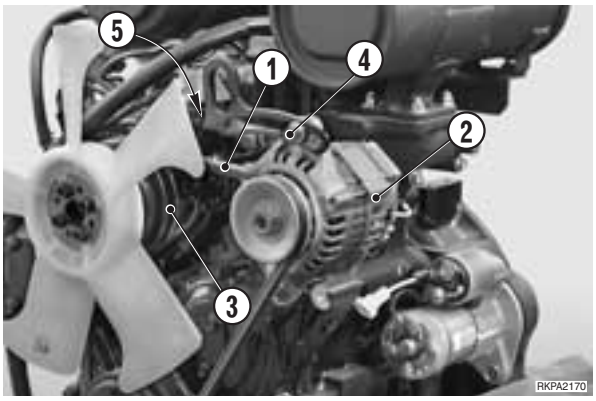
7 - After the reading, re-assemble the nozzle holder (3), and reconnect the high- pressure tube (2) and the connector (4).
- Nm Nut that secures the nozzle: 7.84±0.98 Nm
- Nm High-pressure coupling: 31.85±2.45 Nm

CONTROL AND ADJUSTMENT OF THE TENSION OF THE FAN BELT

1. Checking the tension

1 - Depress the belt (1) at the centre of the section between the alternator (2) and the pulley (3) that drives the water pump. Check the flexion.
At a pressure of 10 kg (98 N) the flexion should be 10 – 15 mm. If this value is not found, adjust the belt tension.

★ With a new belt the flexion should be 7 – 9 mm.



2. Adjusting the belt tension

1 - Loosen the screws (4) that secure the alternator (2) and the screw (5) that secures the belt-tightening stop.

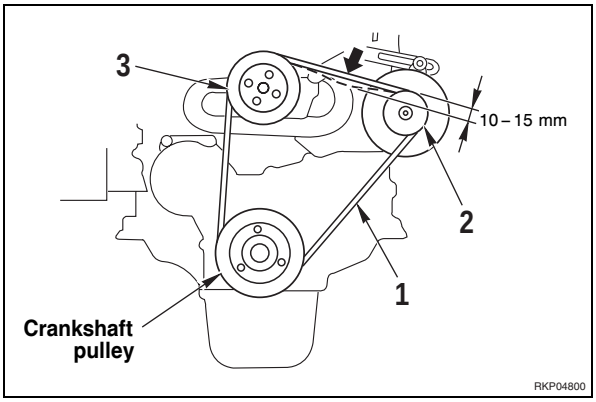
2 - Rotate the alternator (2) to give the belt (1) the correct tension and tighten the screws (4) and (5).

3 - Check the belt (1) tension.

★ If the belt has been replaced with a new one, check the tension again after about 20 hours of operation.

Nm Screws fastening the alternator to the timing system cover: 45 – 54 Nm

Nm Screws locking the support: 25 – 32 Nm



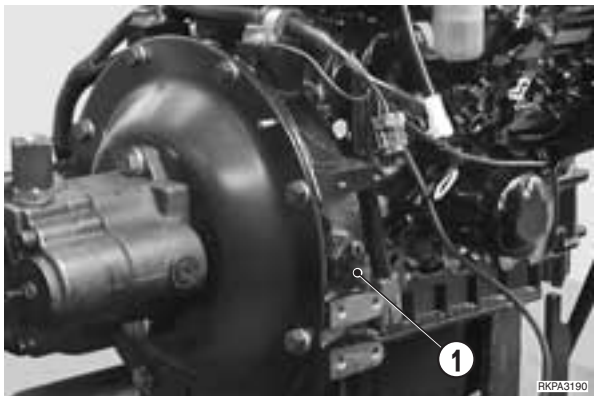
CONTROL AND ADJUSTMENT OF THE INJECTION TIMING

★ Check the injection timing of the No.1 cylinder by means of the No.1 union of the injection pump.

★ The cylinders are numbered 1-2-3 counting from the flywheel side.

★ The spark advance notches of 0º-10º-15º-20º; are also marked on the flywheel. In order to read the intermediate values, sub-divide the sections between the two marks into equal lengths.

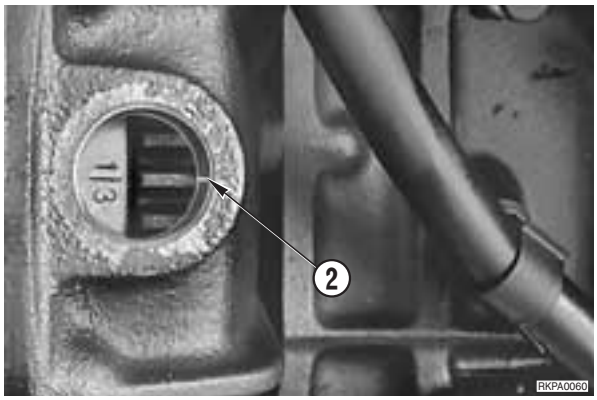
1 - Remove the cap (1) of the flywheel casing.



2 - Pass a screwdriver between the teeth and rotate the flywheel in a counter-clockwise direction (as seen from the flywheel side) until the 1/3 notch of the flywheel is aligned with the notch (2) marked inside the hole in the casing.

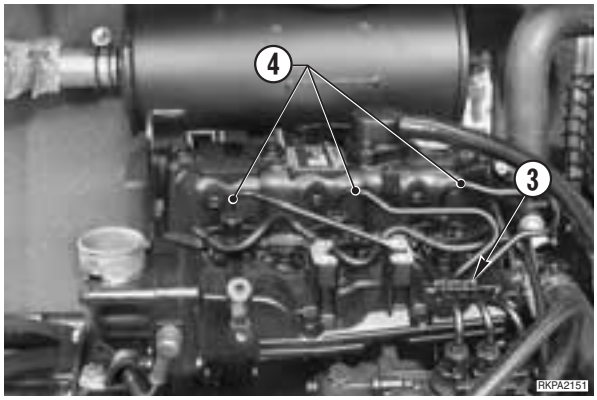
★ In this position, the piston of the No. 1 cylinder is at the top dead centre (B.T.D.C.). Check that the cylinder is in a compression stroke, i.e. that both valves are closed.

★ Once the B.T.D.C. has been ascertained, rotate the drive shaft in a clockwise direction (seen from the flywheel side) for about 25 teeth.



3 - Take off the clamp (3) and disconnect all the fuel delivery tubes (4) from the injection pump.

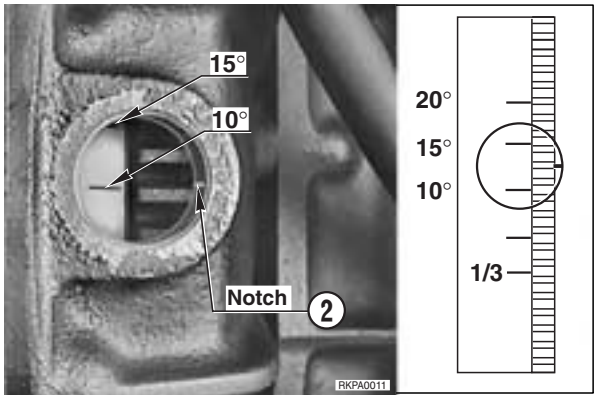
4 - Rotate the flywheel slowly in a counter-clockwise direction (seen from the flywheel side), checking carefully the level of the fuel in the No. 1 union of the injection pump. Stop the rotation when the fuel level starts to rise.



5 - Check the position of the notches at 15º and 10º that appear in the hole in the casing and, in function of the position, establish the true fuel injection timing.

★ In order to determine the degrees of intermediate fuel injection timing, sub-divide the space between 10º and 15º.

★ Normal fuel injection timing: 14±1º

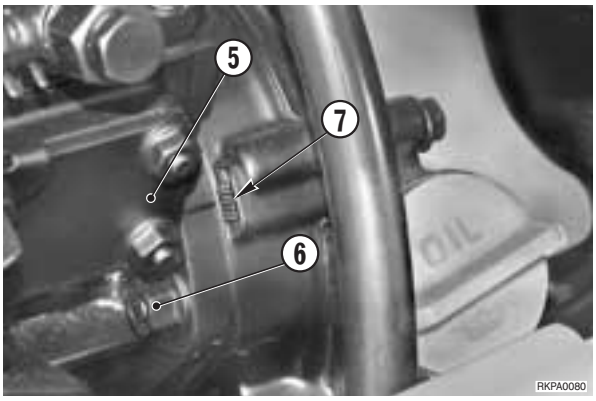


6 - Rotate the injection pump (5) towards the outside or towards the motor, after having loosened the pump (6) retaining nuts.
- To BRING FORWARD the injection, rotate the pump (5) towards the outside.
- To DELAY the injection rotate the pump (6) towards the cylinder block.

★ Check the extent of the movement on the scale (7).

7 - Lock the nuts (6) that fasten the pump to its block.

Nm Pump fastening nuts: 25 – 35 Nm



★ After adjustment of the fuel injection timing:

8 - Connect the fuel delivery tubes (4) to the pump and replace the clamp (3).

Nm Delivery tube couplings: 31.85±2.45 Nm

9 - Bleed any air from the fuel circuit.

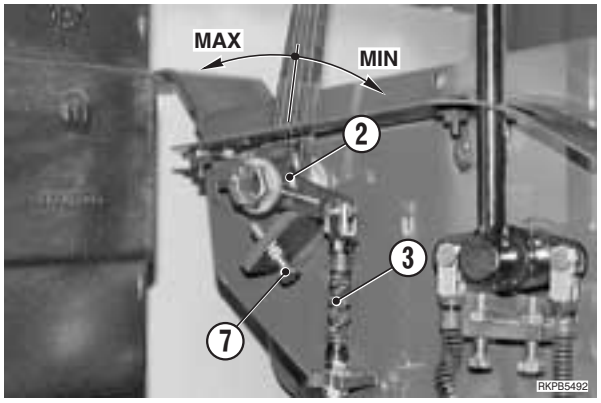
CONTROL AND ADJUSTMENT OF THE ACCELERATOR STROKE

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

1 - Remove the inner cover of the control valve compartment (1).
(For details, see «REMOVAL AND INSTALLATION»).
★ If the sheathing (3) is to be substituted, before proceeding with the adjustments, secure the pump side of the sheathing in the intermediate position.

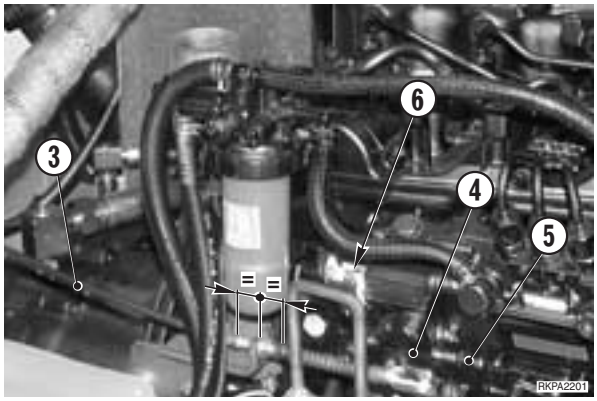
2 - Push the accelerator control lever (2) to the end of its stroke, in the minimum position.

3 - Adjustment the sheathing (3) position on the engine side until lever (4) rests against the minimum-adjustment screw (5).



4 - Push the accelerator control lever (2) to the end of its stroke in the maximum position, until the lever (4) rests against the maximum-adjustment screw (6).

5 - Tighten the screw (6) until it is 0.1 mm from the lever (2) and then tighten the lock-nut.



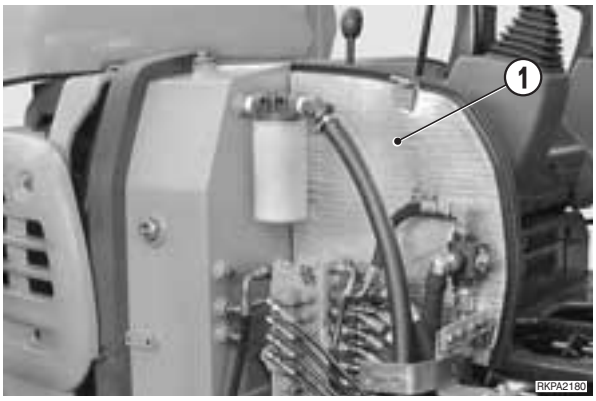
ADJUSTMENT OF THE STROKE OF THE BLADE COMMAND LEVER

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

The adjustment, carried out on the power train, is aimed at restoring the position of the command lever, keeping the neutral position of the valve block spool.

The procedure is as follows:

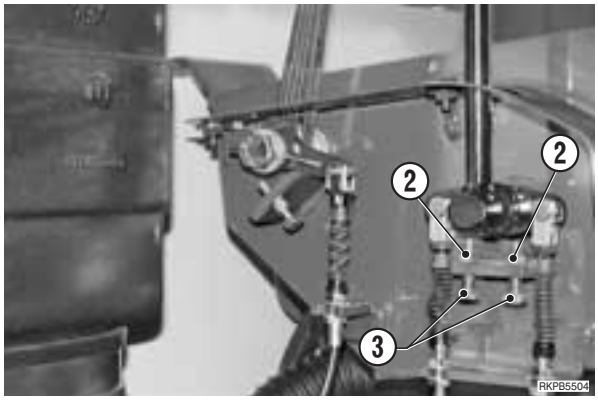
1 - Remove the internal cover of the control valve compartment (1). (For details, see «30. REMOVAL AND INSTALLATION»).



2 - Loosen the nuts (2) and unscrew the screws (3) by a few turns.

3 - Adjust the centering of the lever (4) with respect to the housing (5) by loosening the outside nut (6) of one of the sheathings and tightening the inside nut (7) of the other by the same amount.

4 - Secure the position with the nuts (8) and (9).



5 - Execute a full stroke in one of the two directions with the lever (4).

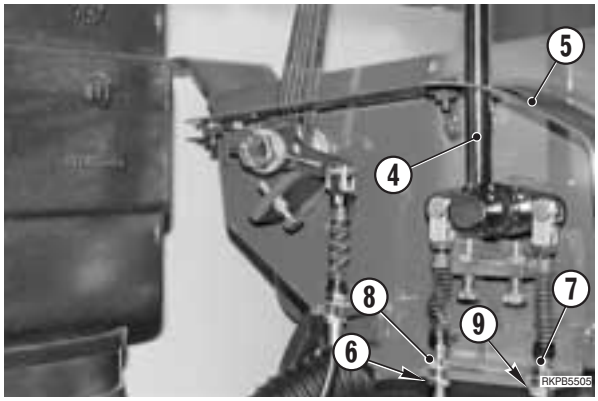
★ Make sure that the valve block spool executes the full stroke.

6 - Tighten the lock-screw (3) until it rests on the lever and then turn it for another half turn. Secure the position with the nut (2).

7 - Repeat this lever adjustment (4) for the other direction.

⚠ Before starting the engine to check the adjustment, make sure that the valve block spool returns to its neutral position each time the lever (4) is released.

8 - Re-assemble the inner cover of the control valve compartment (1).



ADJUSTING THE FLEXIBLE CABLES

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

All adjustments that can be made to the flexible cables are for the purpose of restoring the correct positions of the control levers, while maintaining the neutral positions of the control valve spools.
The procedure is as follows:

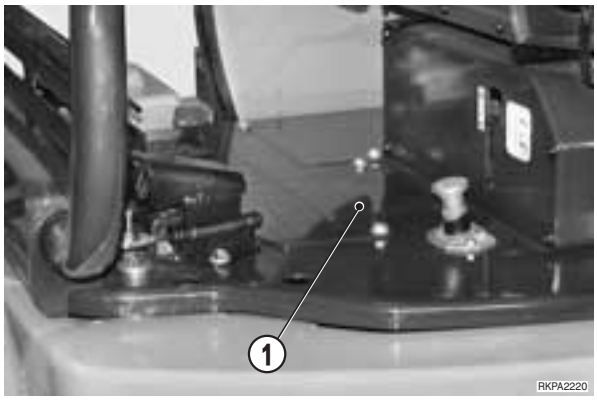
Controls for boom swing and travel

1 - Remove the footboard (1) from the platform.

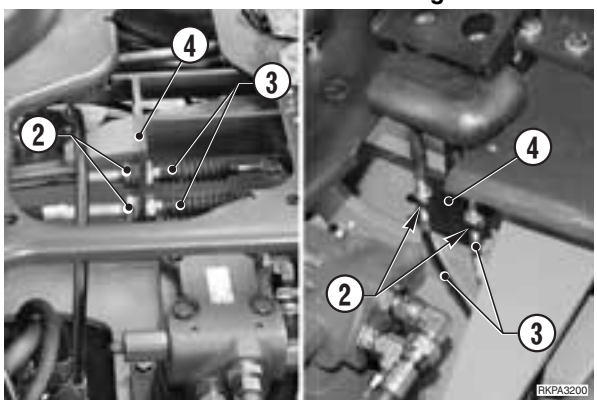
2 - Loosen the nut (2) in the sheath of the drive (3) to be adjusted.

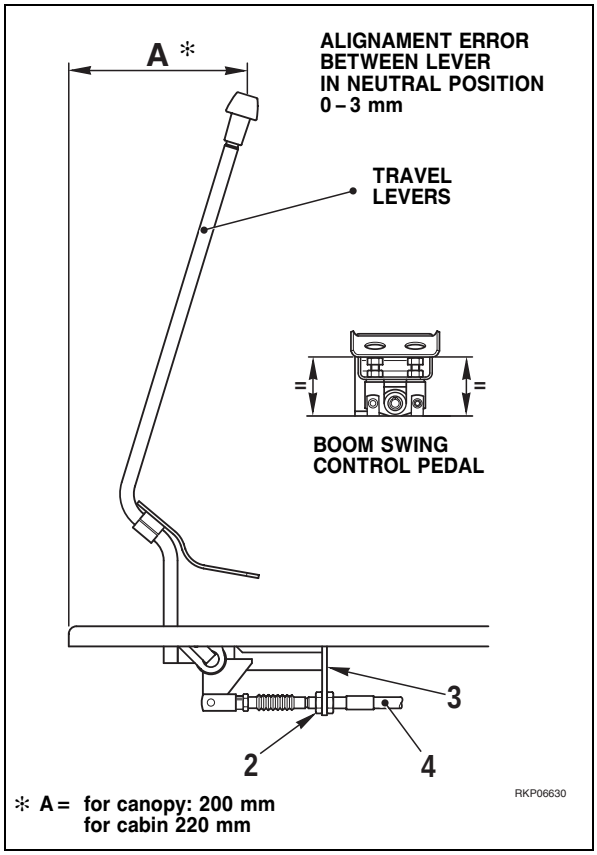
3 - Adjust the locknuts of the sheath until the position of the lever or pedal has been corrected.
★ When the position of the lever or pedal concerned is absolutely correct, the locknuts of the sheath should be behind the bracket (4).

4 - Firmly tighten the nuts (2).



Travel Boom swing

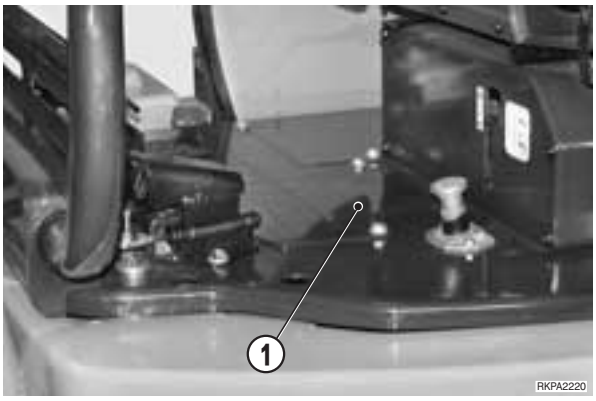




CONTROL AND ADJUSTMENT OF THE STROKE OF THE TRAVEL LEVER

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

1 - Remove the cab floor (1) to gain access to the lever stroke lock-screws.



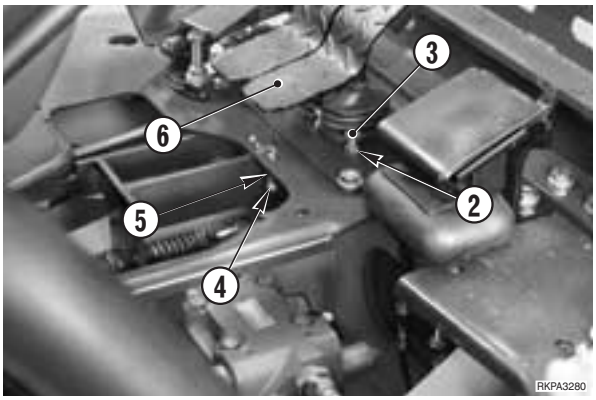
2 - Loosen the nuts (2) and unscrew the lock-screws (3) by a few turns.

3 - Loosen the nuts (4) and tighten the lock-screws (5) by a few turns.

4 - Pull one of the levers (6) towards the operator's seat. Keep this position and tighten the corresponding lock-screw (3) until it touches the lever. Tighten the screw (3) by another half turn.

5 - Keeping the position of the lever (4), tighten the nut (2).

6 - Repeat the same operations for the other direction and for the other lever.

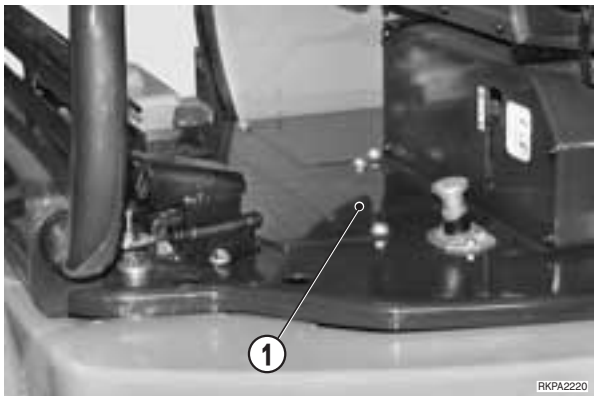


⚠ Before starting the engine, check that the levers and the valve block spools return to their neutral position.

ADJUSTMENT OF THE STROKE OF THE BOOM SWING COMMAND PEDAL

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

1 - Remove the cab floor (1).



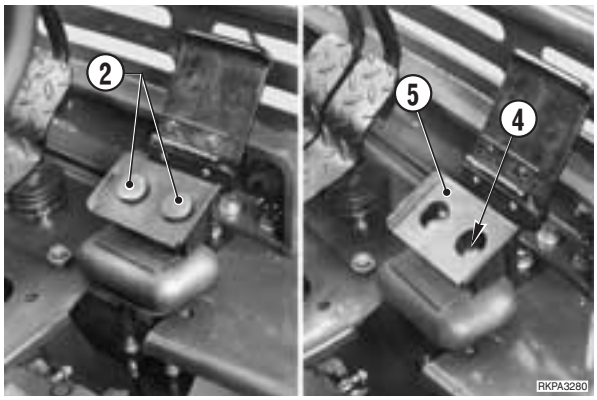
2 - Remove the caps (2) and loosen the nuts (3) and screws (4).

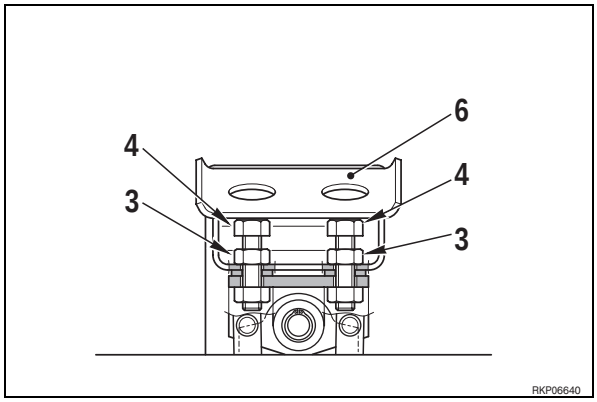
3 - Push the pedal (5) to the end of its stroke in one direction. Keep this position and tighten the screw (4) until it touches the support. Tighten the screw (4) by a final half-turn.

4 - Hold the pedal (5) in position and lock the nut (3).

5 - Repeat the same operations for the other working direction of the pedal.

⚠ Before starting the engine, check that the pedal and control valve spools return to their neutral positions.





ADJUSTMENT OF THE PPC VALVE CLEARANCES

The clearance of the PPC valve (hand and foot) levers is adjusted as follows.

Lower the working equipment to the ground and stop the engine.
Turn the ignition key to the «**I**» position and move the command levers in all directions in order to release all pressure in the hydraulic circuits.
Return the ignition key to the «**O**» (OFF) position and remove it.
Push the lever of the safety device into the «LOCKED» position.
Slowly loosen the oil-tank refuelling cap to eliminate residual pressure.

1 - Remove cap (1).

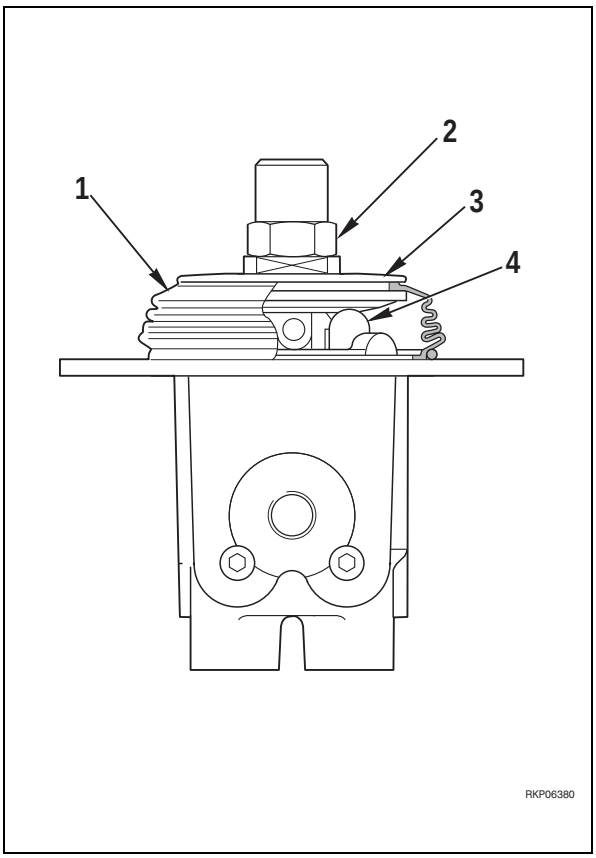
2 - Loosen the nut (2) that retains the disc (3).

3 - Tighten the disc (3) until it makes light contact with the 4 push-rods (4).

★ During this adjustment, take care not to activate any of the push-rods (4) individually.

4 - Secure this position by tightening the retaining nut (2) to the specific torque.

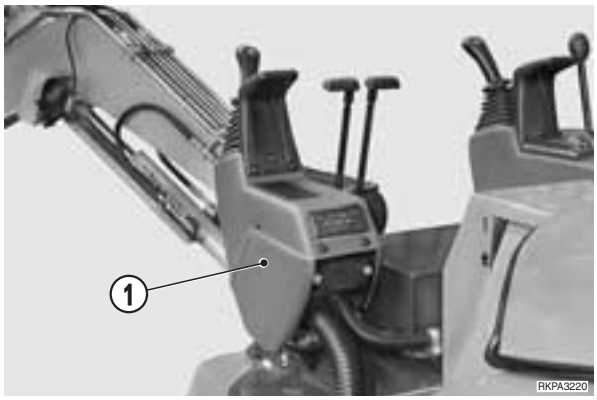
Nm Retaining nut: 113±15 Nm



ADJUSTMENT OF THE RUBBER PAD AND SAFETY MICROSWITCH FOR SERVO-CONTROL ENGAGEMENT

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

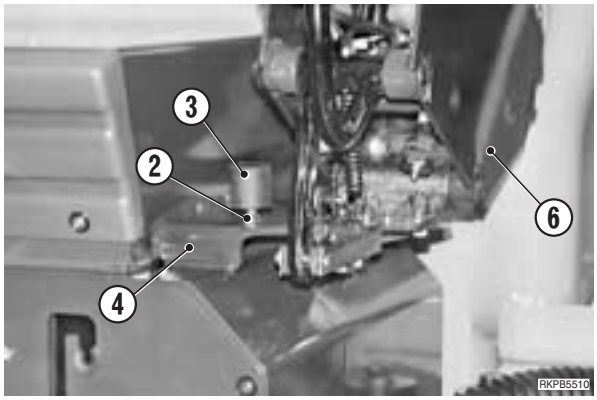
1 - Remove the cover (1).



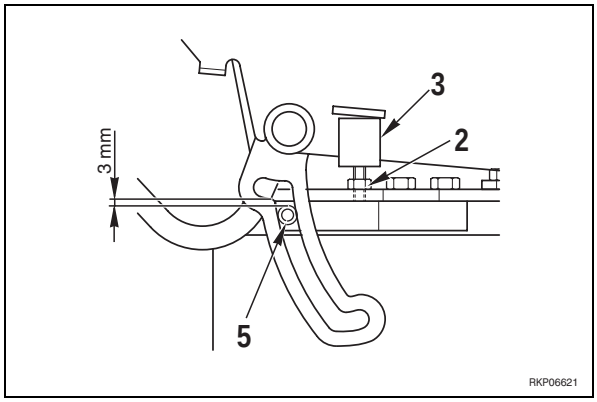
2 - Loosen the nut (2) and tighten the rubber pad (3) in the lower plate (4) by several turns.

3 - Lower the servo-control engagement lever until the pitch point of the roller (5) is roughly 3 mm from the starting point of the cut-off slot.

4 - Keep this position and bring the rubber pad into contact with the console (6).



5 - Release the servo-control engagement lever and secure the rubber pad (3) with the nut (2).



Adjustment of the microswitch

1 - Disconnect the connectors (7).

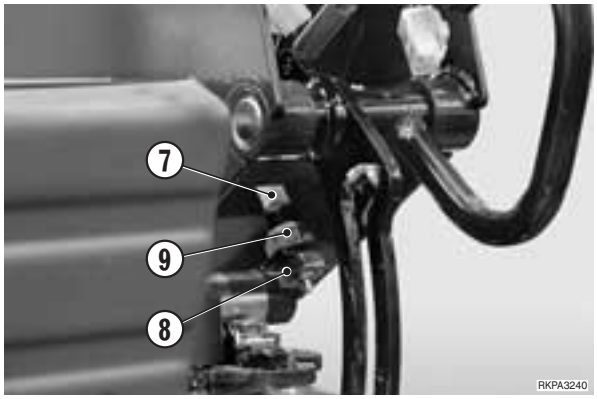
2 - Loosen the nut (8) and unscrew the microswitch (9) by a few turns.

3 - Lower the console (6) into its working position.

4 - Tighten the microswitch (9) until it depresses the push-button by 3±0.5 mm.

5 - Put the console (6) into its 'safe' position and lock the nut (8).

6 - Connect the connectors (7) and replace the cover (1).



CONTROL AND ADJUSTMENT OF THE TRACK-SHOE TENSION

1. Test

★ Test conditions:
- Solid, flat ground.
- Working equipment: resting on the ground.

1 - **Only for machines with rubber track-shoes**
Move the machine backwards and forwards until the track-shoe joint (mark M) is uppermost and halfway between the sprocket wheel and the track-shoe stretcher wheel.

2 - Rotate the revolving frame 90° towards the side of the track-shoe to be checked.

3 - Close the bucket, bring the arm perpendicular to the ground and rest the bucket on the ground.

4 - Force the boom downwards until the track-shoe to be checked is completely raised.

5 - Measure the distance «**A**» in the following positions:
PC20R-8: Between the 2nd sprocket track roller and the track shoe.
PC27R-8: Between the 3rd sprocket track roller and the track shoe.

★ Standard measurements

Model	RUBBER TRACK-SHOE	STEEL TRACK-SHOE
PC20R-8	A = 10 – 15 mm	A = 10 – 30 mm
PC27R-8	A = 10 – 15 mm	A = 10 – 30 mm

2. Adjustment

If the track-shoe tensions do not fall within permissible limits, adjust them as follows:

★ On completion of the adjustment and before engaging the greasing pump **G1**, thoroughly clean the grease nipple and surrounding area.

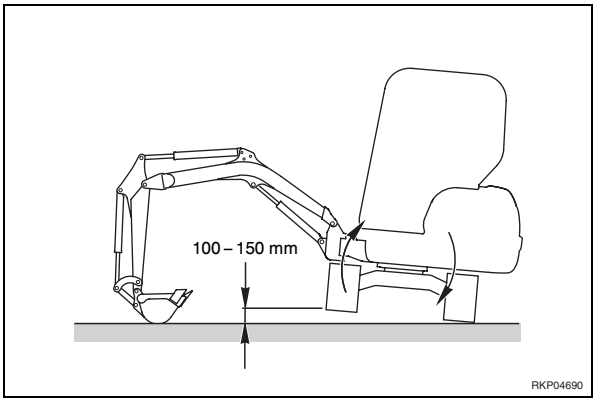
1 - If the tension is too low.
Inject grease through the grease nipple (1) using the grease pump **G1**.

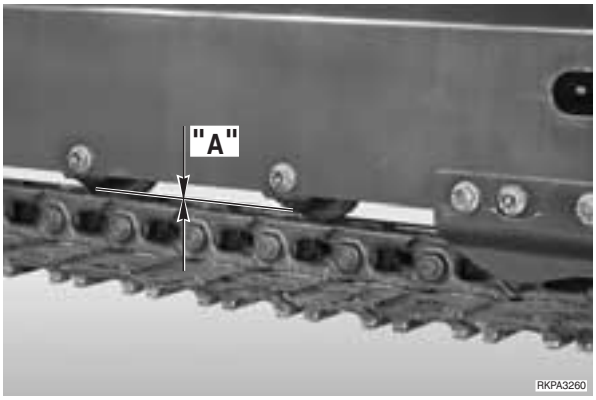
★ If difficulties are found when injecting the grease, move the machine slowly backwards and forwards over a short distance.

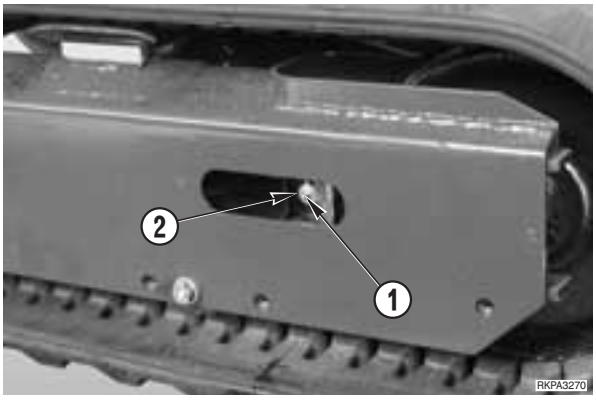
2 - If the tension is too high.
Slowly loosen the union (2) in order to let grease out of the valve.

The grease in the stretcher cylinder is under pressure and could seriously injure the operator. For this reason the valve should not be loosened for more than one turn.

★ If the grease does not come out easily, move the machine slowly backwards and forwards over a short distance.





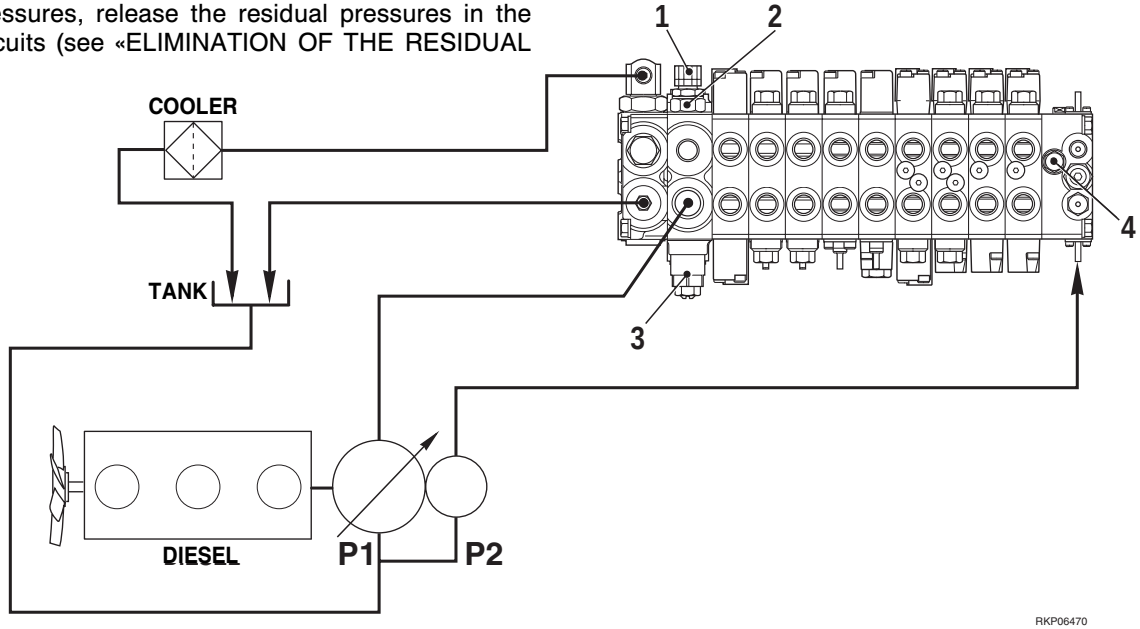


CONTROL AND REGULATION OF THE PRESSURES IN THE HYDRAULIC CIRCUITS

★ Test conditions:
- Engine: at working temperature.
- MIN and MAX. engine speeds: within permissible limits.
- Hydraulic oil: 45 – 55 °C.

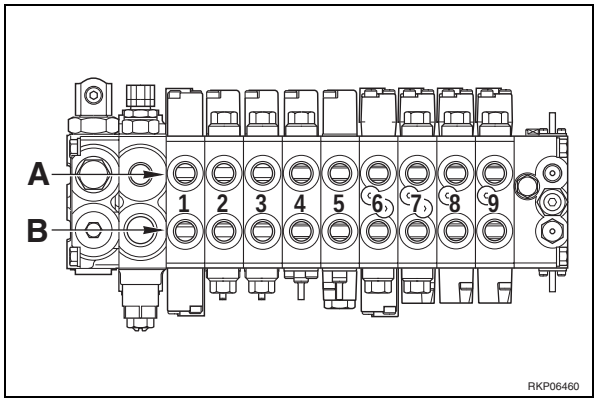
Before removing the plugs in order to measure the pressures, release the residual pressures in the circuits (see «ELIMINATION OF THE RESIDUAL PRESSURES IN THE CIRCUITS AND IN THE TANK») and place the safety engagement levers into their locked positions.

After having connected the pressure gauges, pressurise the tank. For details, see «PRESSURISATION OF THE TANK».



- The control valve consists of the spools that command:

Command	Ports
Swing (R.H. - L.H.)	A1 - B1
Travel motor L.H. (Forwards - Backwards)	A2 - B2
Travel motor R.H. (Forwards - Backwards)	A3 - B3
Boom swing (R.H. - L.H.)	A4 - B4
Blade (Raise - Lower)	A5 - B5
Arm (Close - Open)	A6 - B6
Boom (Lower - Raise)	A7 - B7
Bucket (Dump - Curl)	A8 - B8
Hammer (Suction - Delivery)	A9 - B9



PC20R-8

1. Control of operating pressure (unloading valve)

1 - Remove the plug (1) of pump P1 and mount a pressure adapter.

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

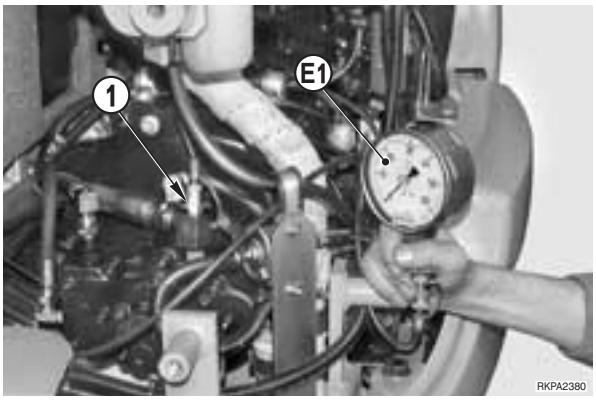
3 - Start the engine and bring it up to high idling with all levers in neutral position.

4 - Check the pressure.

★ Normal pressure:

35 ± 5 kg/cm^2 (34.3 ± 4.9 bar)

⚠ The unloading valve cannot be re-adjusted. If the pressure differs from the normal value the valve must be substituted.



2. Control the operating pressures of the working equipment, machine travel, and swing

1 - Remove the plug (1) of pump P1 and mount a pressure adapter.

2 - Connect a pressure gauge **E2** (400 bar) or **E3** (600 bar).

3 - Start the engine and bring it up to high idling.

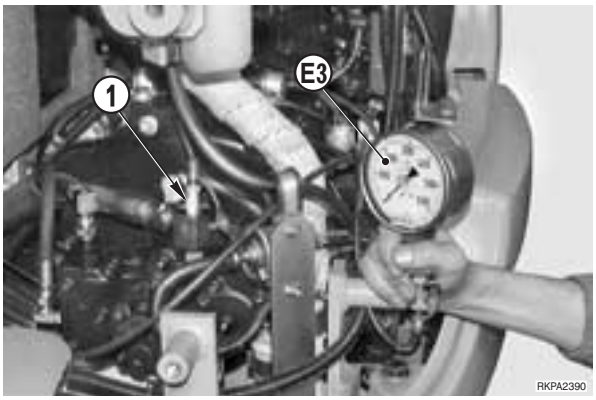
4 - Check the pressure for each movement with the command lever at the end of its stroke and with the pressure stabilised.

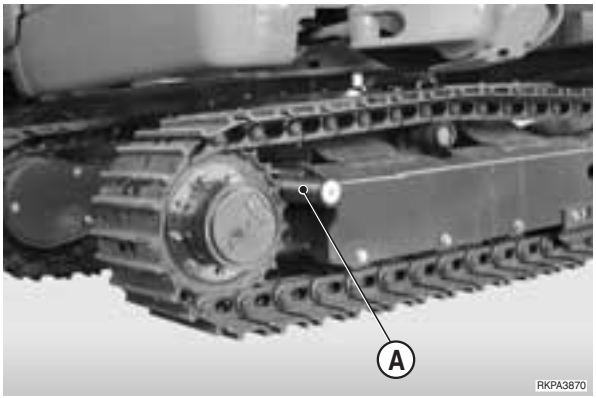
⚠ To check the pressure of the working equipment, push the piston to the end of its stroke.

⚠ To check the pressure of machine travel, insert a block "**A**" between the chassis and the sprocket wheel.

⚠ To check the pressures of the swing, insert the swing lock.

★ Normal pressures:
Working equipment and travel:
$210 \overset{0}{+} 10$ kg/cm^2 ($206 \overset{0}{+} 10$ bar)
Swing: $155 \overset{0}{+} 5$ kg/cm^2 ($151.9 \overset{0}{+} 5$ bar)





PC27R-8

1. Control of operating pressure (unloading valve)

1 - Remove the plug (1) of pump P1 and mount a pressure adapter.

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

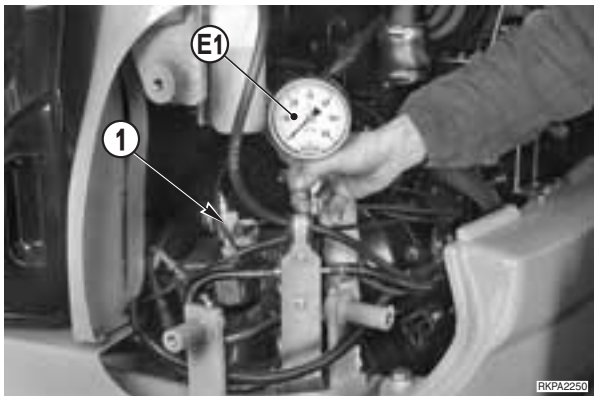
3 - Start the engine and bring it up to high idling with all levers in neutral position.

4 - Check the pressure.

★ Normal pressure:

35 ± 5 kg/cm^2 (34.3 ± 4.9 bar)

⚠ The unloading valve cannot be re-adjusted. If the pressure differs from the normal value the valve must be substituted.



2. Control the operating pressures of the working equipment and machine travel

1 - Remove the plug (1) of pump P1 and mount a pressure adapter.

2 - Connect a pressure gauge **E2** (400 bar) or **E3** (600 bar).

3 - Start the engine and bring it up to high idling.

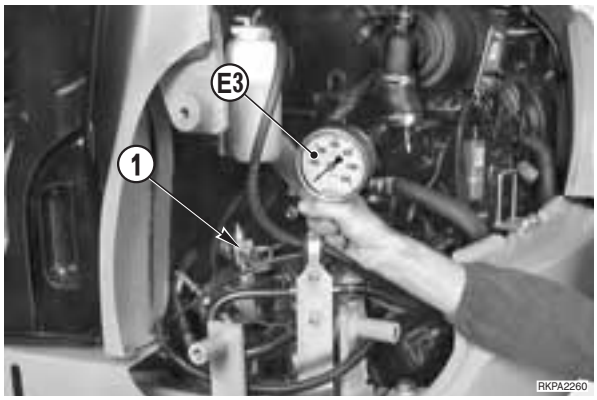
4 - Check the pressure for each movement with the command lever at the end of its stroke and with the pressure stabilised.

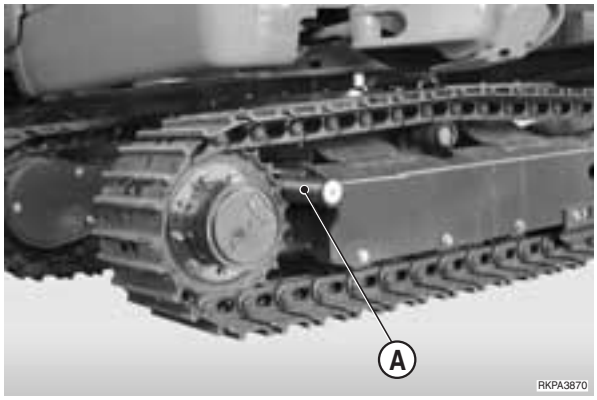
⚠ To check the pressure of the working equipment, push the piston to the end of its stroke.

⚠ To check the pressure of machine travel, insert a block "**A**" between the chassis and the sprocket wheel.

★ Normal pressures:
Working equipment and travel:

$210 \overset{0}{+} 10$ kg/cm^2 ($206 \overset{0}{+} 10$ bar)





3. Check the operating pressure of the turret swing

1 - Set the main relief valve of the control valve to a value higher by 20 bar than the maximum pressure to be checked.

2 - Remove the caps (1) of the swing motor and mount the pressure adapters.

3 - Connect a pressure gauge **E2** (400 bar) or **E3** (600 bar).

⚠ Insert the turret swing locking-pin.

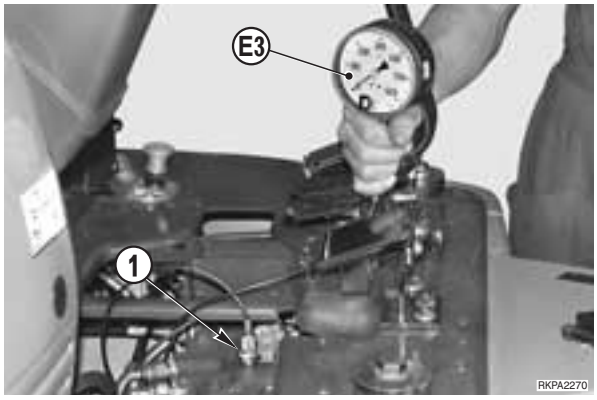
4 - Start the engine and bring it up to high idling.

5 - Check the pressure for a swing to the right and a swing to the left, bringing the lever of the left-hand PPC valve to the end of its stroke and with the pressure stabilized.

★ Normal pressure:

$215 \overset{0}{+} 5$ kg/cm^2 ($211 \overset{0}{+} 5$ bar)

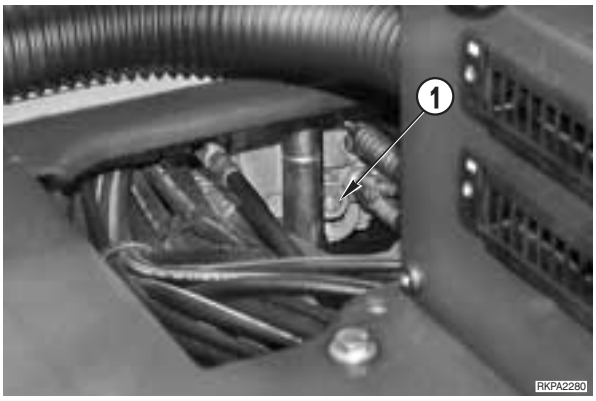
6 - Restore the setting of the main relief valve.



PC20R-8

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).

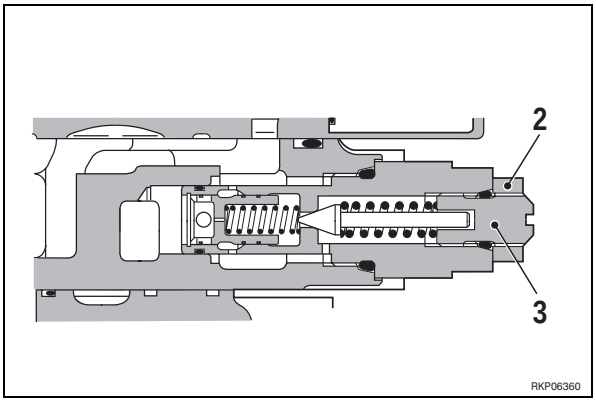
- To INCREASE pressure, turn in a CLOCKWISE direction.
- To DECREASE pressure, turn in a COUNTER-CLOCKWISE direction.

★ Each turn of the adjusting screw (3) varies the pressure by about 125 bar (128 kg/cm^2).

3 - Lock the nut (2).

Nm Nut: 59±10 Nm

★ 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

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:

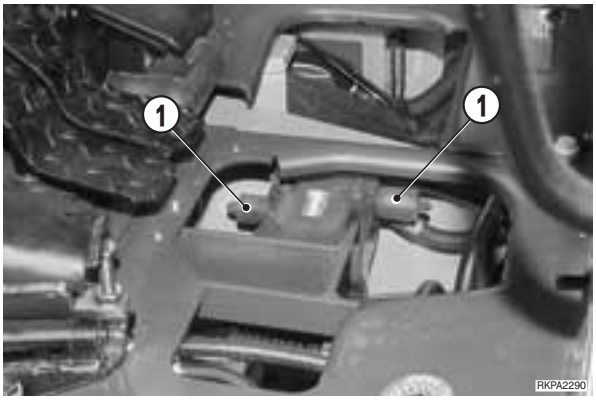
1 - Remove the cap nut (2).

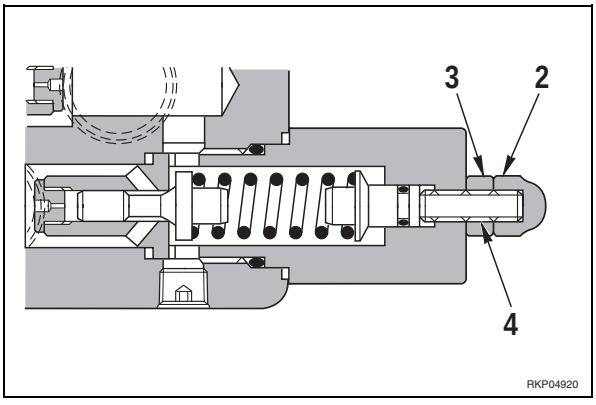
2 - Loosen the lock nut (3) and turn the adjusting screw (4).

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

3 - Lock the nut (3) and replace the cap nut (2).

★ After the adjustments, check the setting of the safety valves following the same procedure used for the measurements.

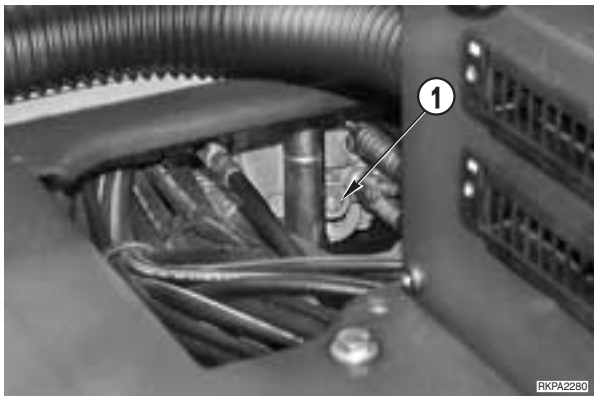




PC27R-8

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:

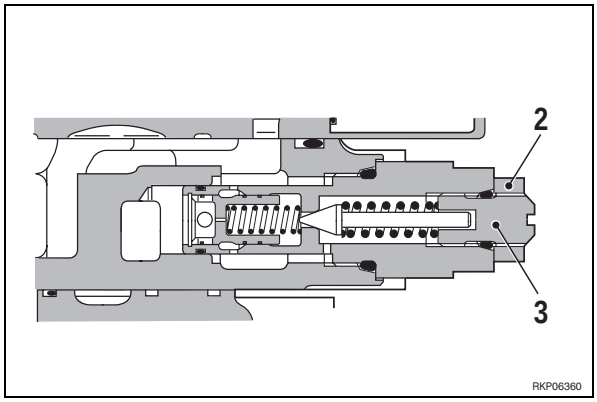
2 - Loosen the lock nut (2) and rotate the adjusting screw (3).
- To INCREASE pressure, turn in a CLOCKWISE direction.
- To DECREASE pressure, turn in a COUNTER-CLOCKWISE direction.

★ Each turn of the adjusting screw (3) varies the pressure by about 125 bar (128 kg/cm^2).

3 - Lock the nut (2).

Nm Nut: 59±10 Nm

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

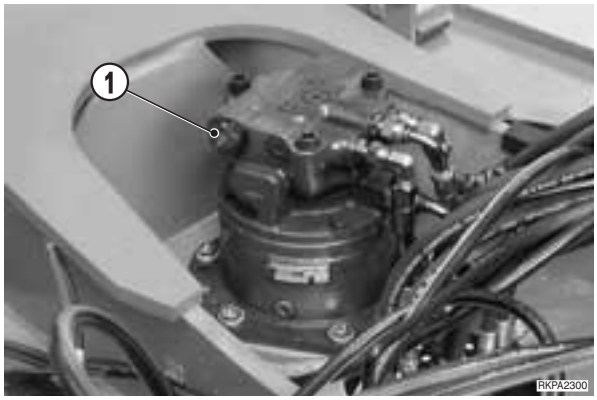


2. Adjustment of the safety valve of the swing motor

⚠ 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:

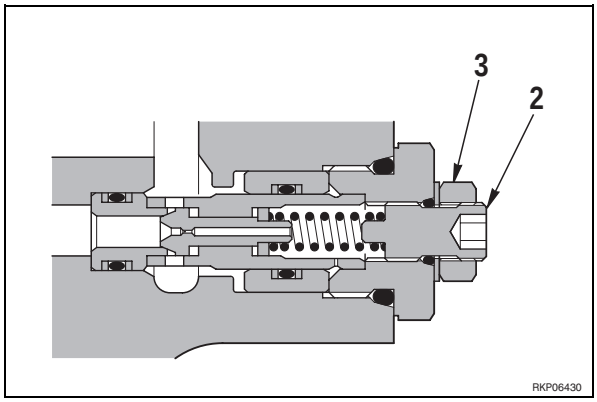


1 - Loosen the lock nut (2) and turn the adjusting screw (3).
- To INCREASE pressure, turn in a CLOCKWISE direction.
- To DECREASE pressure, turn in a COUNTER-CLOCKWISE direction.

★ Each turn of the adjusting screw (3) varies the pressure by about 100 bar (102 kg/cm^2).

2 - Lock the nut (2).

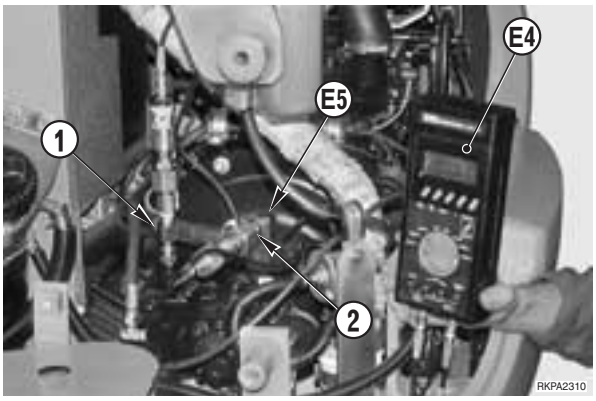
Nm Nut: 8.8±1 Nm



CONTROL AND REGULATION OF THE LS DIFFERENTIAL PRESSURE AND ADJUSTMENT OF THE LS VALVE (PC20R-8)

Test

1. Test method with differential pressure gauge E3



1 - Remove the plugs (1) and (2), mount the elbow **E5** and mount two pressure adapters.

2 - Connect the differential pressure gauge **E4**.

★ Connect the high-pressure side to the adapter (2) and the low-pressure side to the adapter (1).

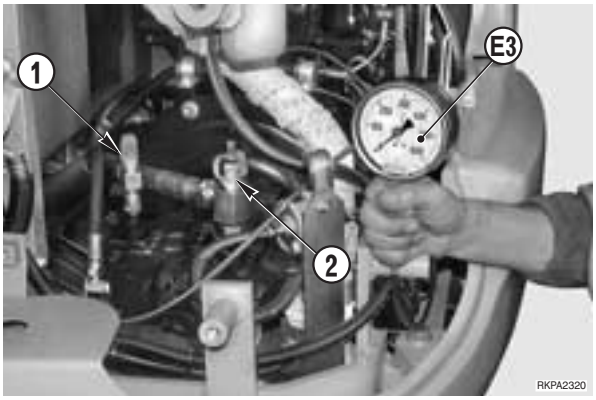
3 - Start the engine and use the working equipment to raise one track-shoe.

4 - Bring the engine up to high idling and check the LS differential pressure according to the test conditions in Table 1.

Table 1

Position of the travel lever	LS differential pressure in bar (kg/cm^2)	NOTES
Neutral	Max. 34.3 (Max. 35)	The LS differential pressure is equal to the pressure given by the unloading valve
Half the stroke (Swing without load)		

2. Test method with pressure gauges E2 or E3



★ The maximum differential pressure is 34.3 bar (35 kg/cm^2). For a precise check use the same pressure gauge together with a decimal scale.

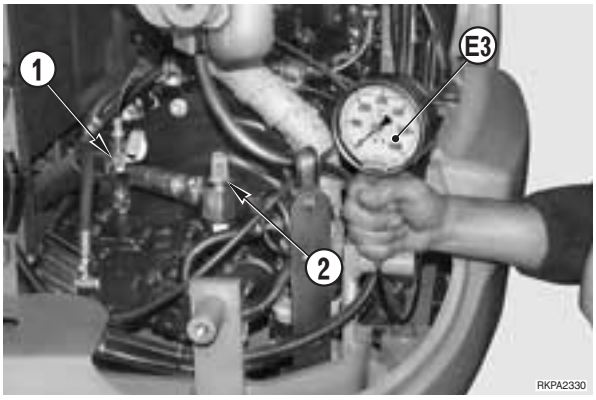
1 - Remove the plugs (1) and (2) and mount two pressure adapters.

2 - Connect pressure gauge **E2** or **E3** to the pressure adapter (2).

3 - Start the engine and use the working equipment to raise one track-shoe.

4 - Bring the engine up to high idling and measure the delivery pressure of pump (**P_P**) in the conditions shown in Table 1. Make a note of the values read.

★ Check the instrument by reading it from the front and making sure that the reading is correct.



5 - Disconnect the pressure gauge **E2** or **E3** from the pump delivery and connect it to the pressure adapter (1).

6 - Measure the **LS** pressure in the same conditions indicated at point 4. Make a note of the value read.

7 - Subtract the **LS** pressure from the delivery pressure of the pump (**P_P**) in order to obtain the differential pressure value **ΔP_{LS}** (**$P_P - LS = \Delta P_{LS}$**)

★ **ΔP_{LS}** normal = 34.3 bar (35 kg/cm^2)

LS valve adjustment

If the **ΔPLS** value is not the one indicated, adjust the **LS** valve (1) as follows:

1 - Disconnect the tube (2).

2 - Loosen the lock nut (3) and turn the adjusting screw (4).

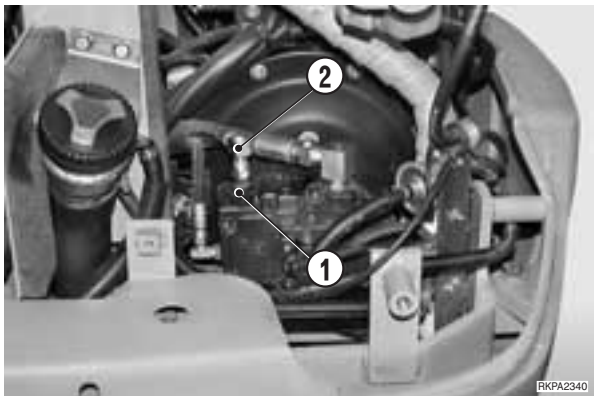
- To INCREASE pressure, turn in a CLOCKWISE direction.
- To DECREASE pressure, turn in a COUNTER-CLOCKWISE direction.

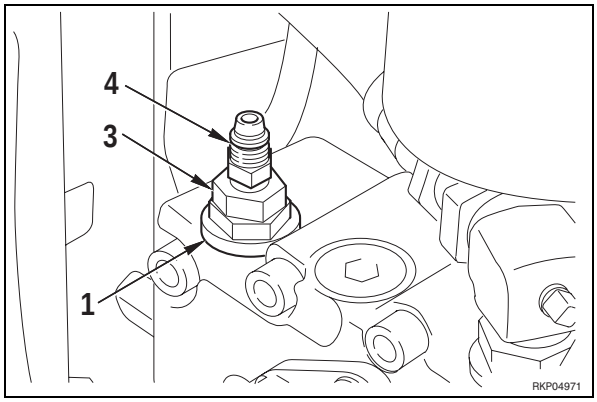
★ Each turn of the adjusting screw (4) varies the pressure by about 13 bar (13 kg/cm^2).

3 - Lock the nut (3).

Nm Nut: 31±3.5 Nm

★ After the adjustment, check the setting of the **LS** valve (1) following the procedure used for the test.





REGULATION OF THE PC VALVE (PC20R-8)

★ If the engine speed decreases when an increase in pressure or delivery is requested, or when the speed of the working equipment is low, even though the engine speed, the delivery pressure and the LS differential pressure are all normal, the PC valve (1) should be regulated as follows:

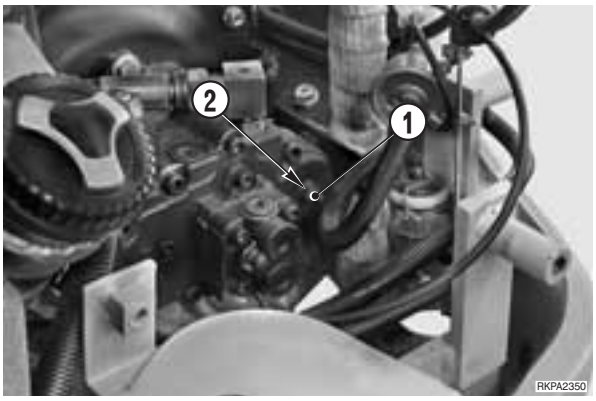
1 - Loosen the check-nut (2).

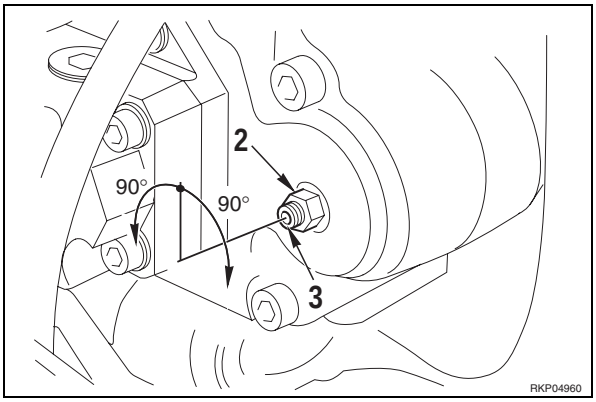
2 - Turn the adjustment screw (3).

- If the working equipment speed is low, turn the screw (3) in a CLOCKWISE direction to INCREASE the torque absorption of the pump.
- If the engine rpm suffer an abnormal drop, turn the screw (3) in a COUNTER-CLOCKWISE direction to DECREASE the torque absorption.

★ Turn the adjusting screw (3) within an adjustment range of 90° either to the right or to the left.

3 - After adjustment, tighten the check-nut (2).

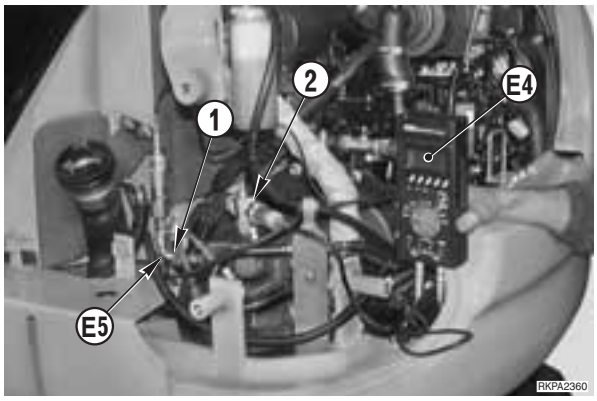




CONTROL AND REGULATION OF THE LS DIFFERENTIAL PRESSURE AND ADJUSTMENT OF THE LS VALVE (PC27R-8)

Test

1. Test method with differential pressure gauge E3



1 - Remove the plugs (1) and (2), mount the elbow **E5** and mount two pressure adapters.

2 - Connect the differential pressure gauge **E4**.

★ Connect the high-pressure side to the adapter (2) and the low-pressure side to the adapter (1).

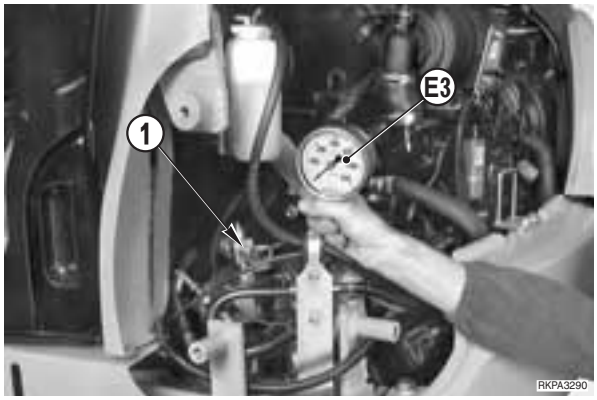
3 - Start the engine and use the working equipment to raise one track-shoe.

4 - Bring the engine up to high idling and check the LS differential pressure according to the test conditions in Table 1.

Table 1

Position of the travel lever	LS differential pressure in bar (kg/cm^2)	NOTES
Neutral	Max. 34.3 (Max. 35)	The LS differential pressure is equal to the pressure given by the unloading valve
Half the stroke (Swing without load)		

2. Test method with pressure gauges E2 or E3



★ The maximum differential pressure is 34.3 bar (35 kg/cm^2). For a precise check use the same pressure gauge together with a decimal scale.

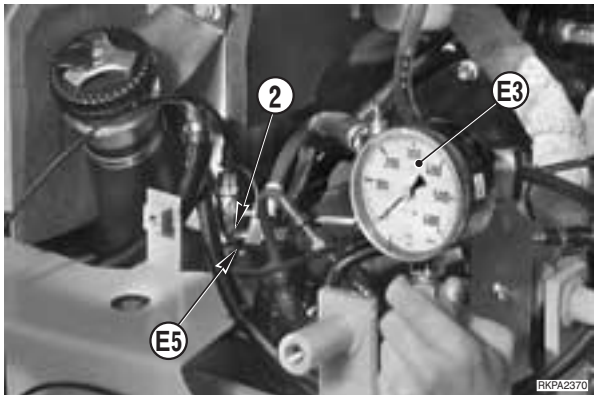
1 - Remove the plugs (1) and (2) and mount two pressure adapters.

2 - Connect pressure gauge **E2** or **E3** to the pressure adapter (2).

3 - Start the engine and use the working equipment to raise one track-shoe.

4 - Bring the engine up to high idling and measure the delivery pressure of pump (**P_P**) in the conditions shown in Table 1. Make a note of the values read.

★ Check the instrument by reading it from the front and making sure that the reading is correct.



5 - Disconnect the pressure gauge **E2** or **E3** from the pump delivery and connect it to the pressure adapter (1).

6 - Measure the **LS** pressure in the same conditions indicated at point 4. Make a note of the value read.

7 - Subtract the **LS** pressure from the delivery pressure of the pump (**P_P**) in order to obtain the differential pressure value **ΔP_{LS}** (**$P_P - LS = \Delta P_{LS}$**)

★ **ΔP_{LS}** normal = 34.3 bar (35 kg/cm^2)

LS valve adjustment

If the **ΔPLS** value is not the one indicated, adjust the **LS** valve (1) as follows:

1 - Disconnect the tube (2).

2 - Loosen the lock nut (3) and turn the adjusting screw (4).

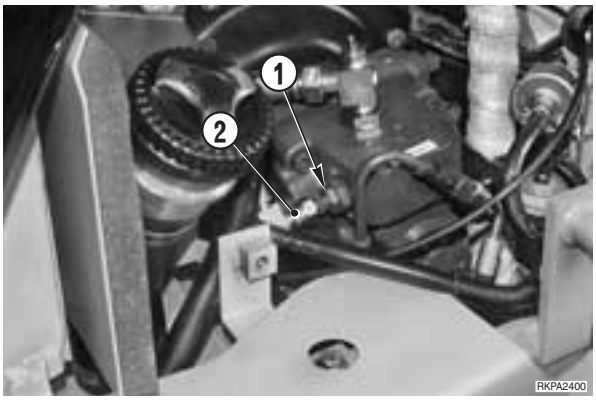
- To INCREASE pressure, turn in a CLOCKWISE direction.
- To DECREASE pressure, turn in a COUNTER-CLOCKWISE direction.

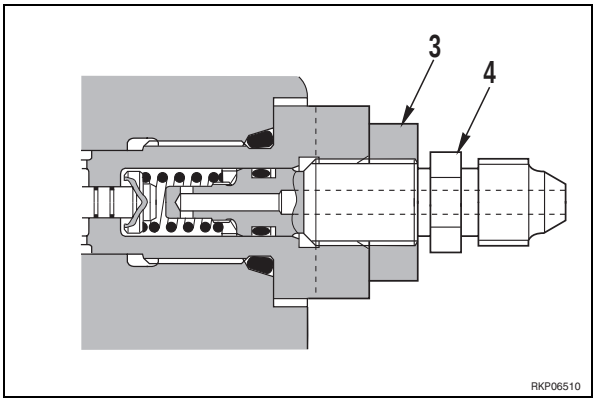
★ Each turn of the adjusting screw (4) varies the pressure by about 13 bar (13 kg/cm^2).

3 - Lock the nut (3).

Nm Nut: 31±3.5 Nm

★ After the adjustment, check the setting of the **LS** valve (1) following the procedure used for the test.





REGULATION OF THE PC VALVE (PC27R-8)

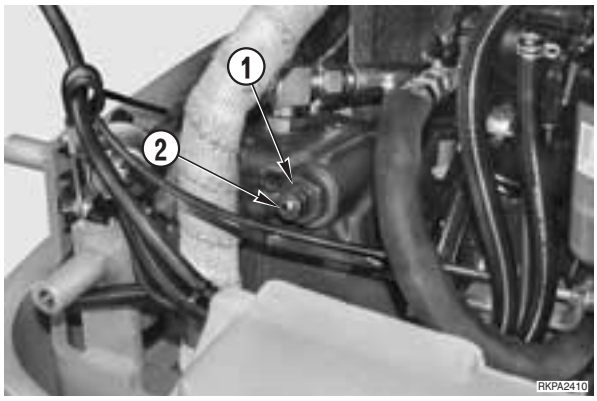
★ If the engine speed decreases when an increase in pressure or delivery is requested, or when the speed of the working equipment is low, even though the engine speed, the delivery pressure and the LS differential pressure are all normal, the PC valve (1) should be regulated as follows:

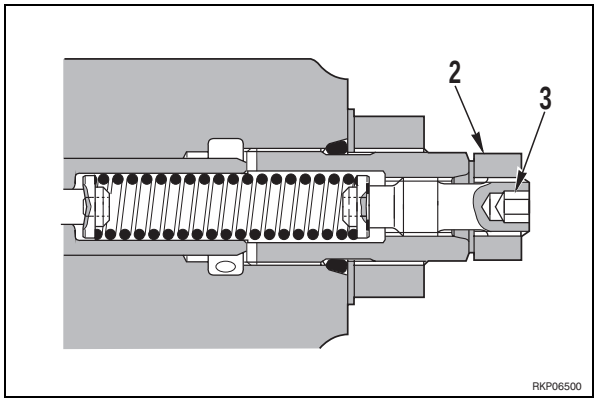
1 - Loosen the check-nut (2).

2 - Turn the adjustment screw (3).

- If the working equipment speed is low, turn the screw (3) in a CLOCKWISE direction to INCREASE the torque absorption of the pump.
- If the engine rpm suffer an abnormal drop, turn the screw (3) in a COUNTER-CLOCKWISE direction to DECREASE the torque absorption.

3 - After adjustment, tighten the check-nut (2).



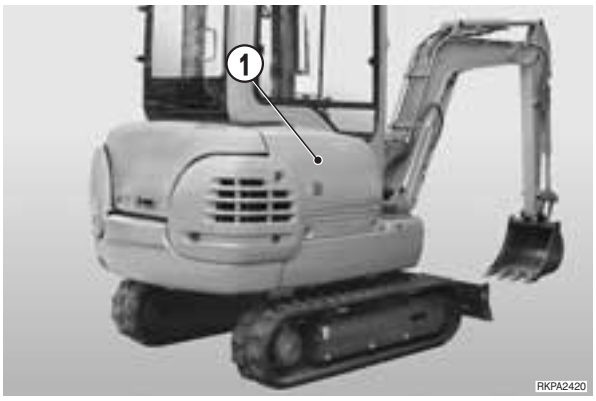


CONTROL AND REGULATION OF THE SERVO-CONTROL POWER SUPPLY

★ Test conditions:
- Engine: at working temperature.
- Hydraulic oil temperature: 45 – 55 °C.

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 R.H. hood (1).

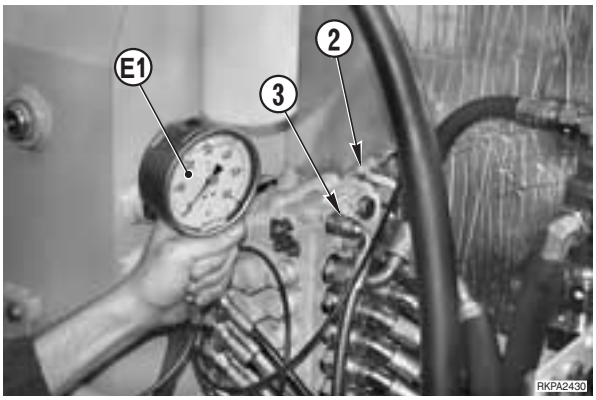
2 - Remove the cap (2) of pump P2 and a pressure adapter.

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

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

5 - Check the pressure.

★ Normal pressure: 29^{0}_{+5} bar (30^{0}_{+5} kg/cm^2)



2. Regulating the servo-control valve

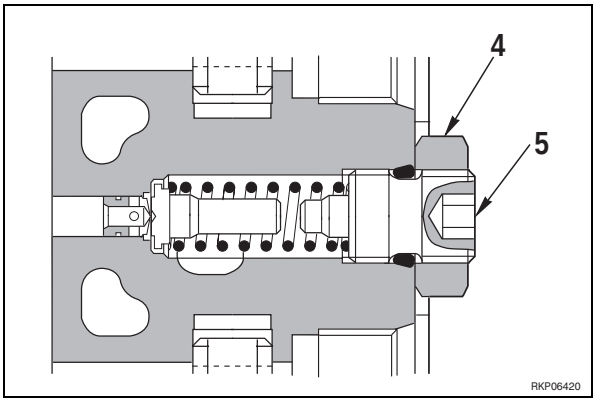
If the pressure value does not fall within the tolerances, regulate the valve (3) as follows:

1 - 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 (55 bar).

2 - Lock the nut (4).

Nm Nut: 22±2.5 Nm



ELIMINATION OF RESIDUAL PRESSURES - PRESSURISATION OF THE TANK

1. Elimination of pressures from the hydraulic circuits.

1 - Rest the working equipment on the ground and stop the engine.

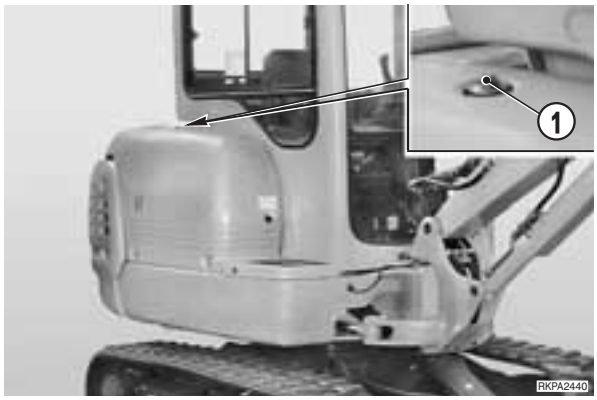
2 - Turn the ignition key to the position «**I**» and move the command lever in all directions to release all pressure in the main hydraulic circuits and the servo-controls .

3 - Return the ignition key to the position «**O**» (OFF) and remove it.

4 - Put the safety device lever into its «LOCKED» position.

2. Elimination of pressure in the tank

⚠ The hydraulic oil tank is of the sealed and pressurised type.
When tubes are to be removed or disconnected for controls or repairs, or when caps are removed, tank pressure must be eliminated using the following method:



1 - Rest the working equipment on the ground and stop the engine.

2 - Slowly loosen the oil-refuelling cap in order to release residual pressure.

3. Pressurising the tank

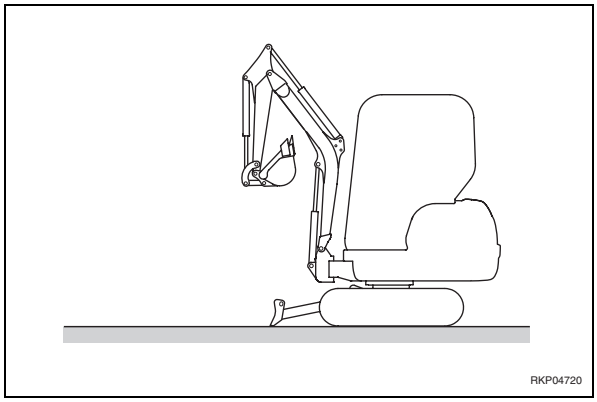
★ This operation should be performed every time the oil-refuelling cap is moved for removal of the tubes or other hydraulic equipment.

1 - Start the engine and position the machine as in the figure.

2 - Stop the engine, loosen the tank cap (1) and then close it again.

★ This operation lets air into the tank when the level of the remaining oil is at minimum.

3 - Start the engine and lower the working equipment to the ground.



BLEEDING AIR FROM THE HYDRAULIC CIRCUITS

Sequence of operations or procedures for bleeding the air

	Procedures for bleeding air						
	1	2	3	4	5	6	7
	Bleeding air from pumps	Starting engine	Bleeding air from cylinders	Bleeding air from swing motor	Bleeding air from travel motor	Pressurising tank	Starting tasks
• Substitution of hydraulic oil • Cleaning tank filter	○ →	○ →	○ →	○ → ★1	○ → ★1	○ →	○
• Substitution filter		○ →				○ →	○
• Repair - substitution pump • Removal of suction tube	○ →	○ →	○ →			○ →	○
• Substitution - repair control valve		○ →	○ →			○ →	○
• Repair-Substitution cylinders • Removal of cylinders tube		○ →	○ →			○ →	○
• Repair - substitution swing motor • Removal of tubes from swing motor		○ →		○ →		○ →	○
• Repair - substitution travel motor - joint • Removal of tubes from travel motor - joint		○ →			○ →	○ →	○

★1: Only bleed air from the swing and travel motors if the engine oil (casing) is to be drained.

1. Bleeding air from the pump

1 - Loosen and remove the cap (1) from the pump body (2).

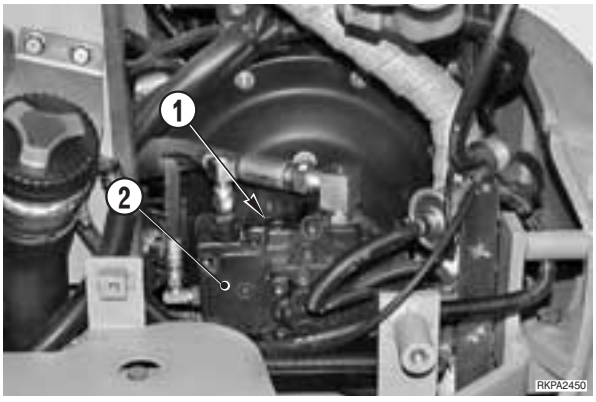
2 - Pour hydraulic oil through the hole until the entire casing is full.

3 - Replace the cap (1).

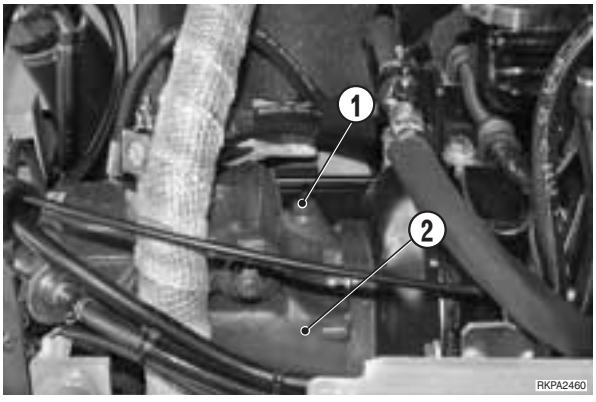
Nm Cap: PC20R-8: 16.7±2.5 Nm
PC27R-8: 63.7±4.9 Nm

★ After filling the casing, start the engine and allow it to run at low idling for about 10 minutes before proceding to bleed the air from the circuits.

PC20R-8



PC27R-8



2. Bleeding air from the cylinders

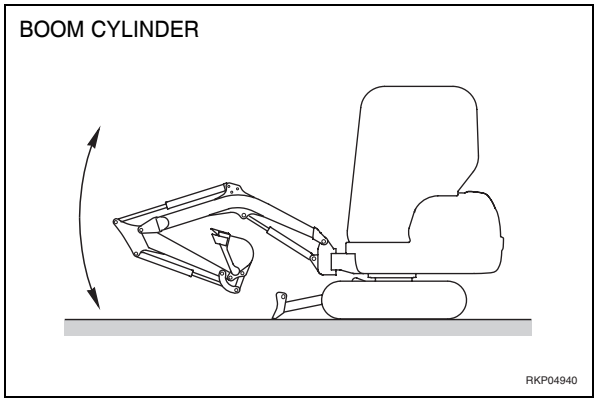
1 - Start the engine and let it run at low idling for about 5 minutes.

2 - Lower and raise the boom 4-5 times.

★ Lower and raise the piston of the boom up to about 100 mm of the end of its stroke.
Every care must be taken to avoid pressurising the circuits.

3 - Bring the engine up to high idling and repeat the operations described in point 2. Return the engine to low idling and pout the piston through its entire stroke until it reaches max. pressure in both directions.

4 - Repeat the operation (starting from point 2) for the arm, bucket, arm swing, and blade cylinders.

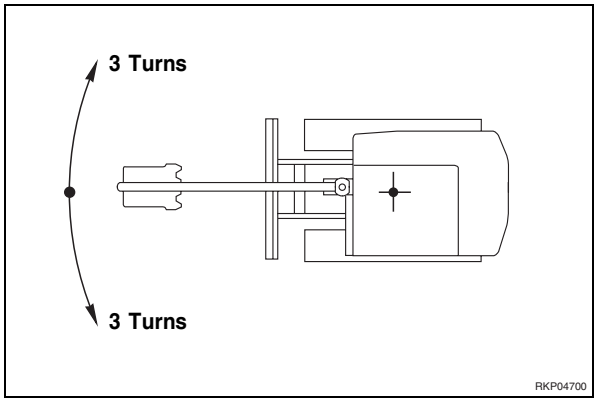


3. Bleeding air from the swing motor

⚠ Make sure that the swing-locking pin is not engaged.

1 - With the engine at low idling, rotate the revolving frame three turns towards the left.

2 - Repeat the same manoeuvre, rotating the revolving frame to the right.



4. Bleeding air from the travel motors

1 - With the engine at low idling, use the working equipment to raise the left-hand track-shoe from the ground.

2 - Let the track-shoe turn for about 30 seconds.

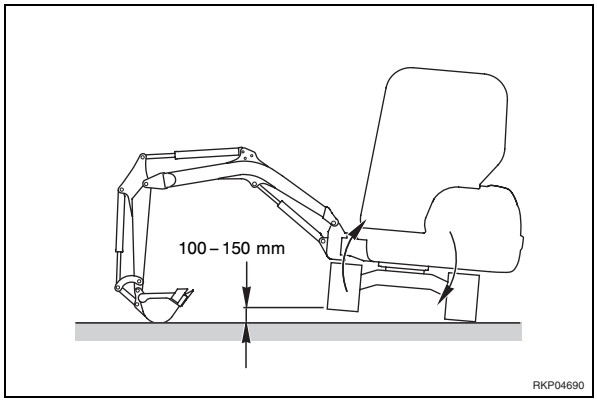
3 - Repeat points 1 and 2 for the right-hand track-shoe.

★ Engage the travel increment for about 10 seconds.

5. Bleeding air from any optional equipment

★ This method must be used for all the optional working equipment, unless otherwise indicated.

1 - Each time an item of optional working equipment is installed, operate the equipment repeatedly, with the engine at low idling, until all air has been completely eliminated.



CONTROL OF HYDRAULIC DRIFTS - ANALYSIS OF THE CAUSES OF A DRIFT

★ Test conditions:
- Machine: in the conditions indicated in the NORMAL TECHNICAL DATA.
- Engine: at working temperature.
- Hydraulic oil: 45 – 55 °C.

1. Test

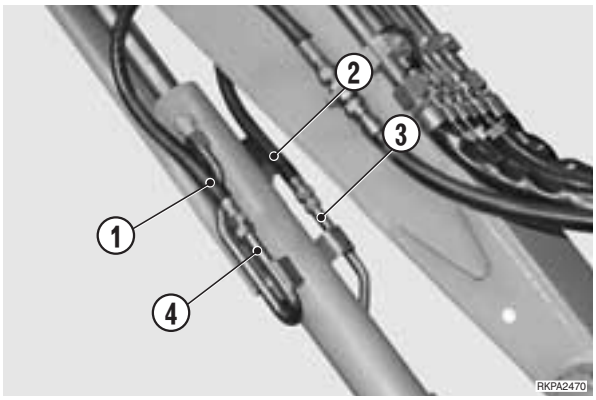
To check on the extent of the hydraulic drifts of individual components and the total hydraulic drift, position the machine and follow the procedures indicated in the «NORMAL TECHNICAL DATA».

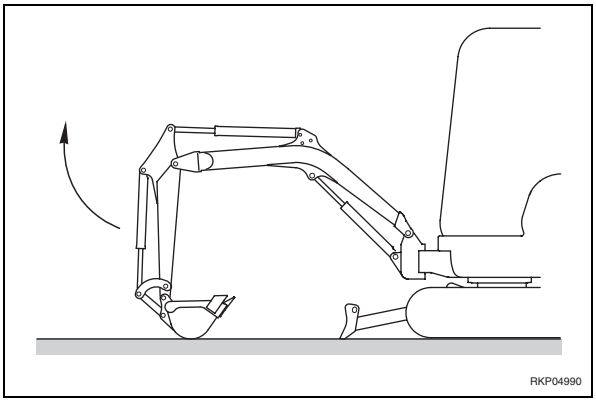
2. Analysis of the causes of hydraulic drifts

Before disconnecting the tubes, release hydraulic pressures in the circuits (see «ELIMINATION OF THE RESIDUAL PRESSURES»).

1. Boom test

1 - Position the machine with the arm vertical and with the back of the bucket resting on the ground.
2 - Stop the engine and release the residual hydraulic pressures.
3 - Disconnect the hoses (1) and (2) that supply the cylinder on the head side and on the base side.
4 - Plug the two hoses to prevent entry of impurities.
5 - Plug the rigid tube (3) that supplies the cylinder on the base side.
6 - In order to catch any oil leakages, attach a tube to the pipe (4) that supplies the head side of the cylinder.
7 - Start the engine and extend the arm completely.
8 - Stop the engine and check the position of the boom for 15 minutes.
- If the boom moves downwards the drift is due to the cylinder gaskets.
- If the boom does not move, the drift is due to the control valve.

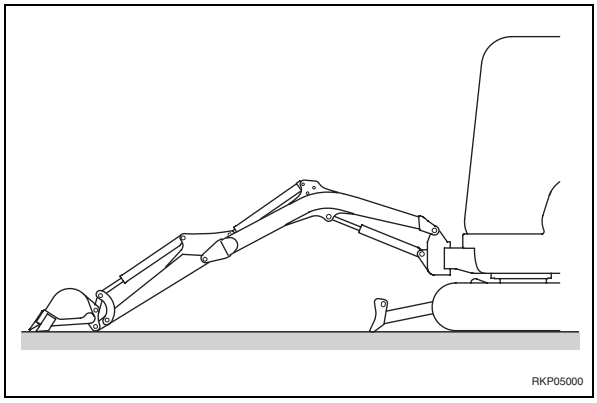




2. Arm test

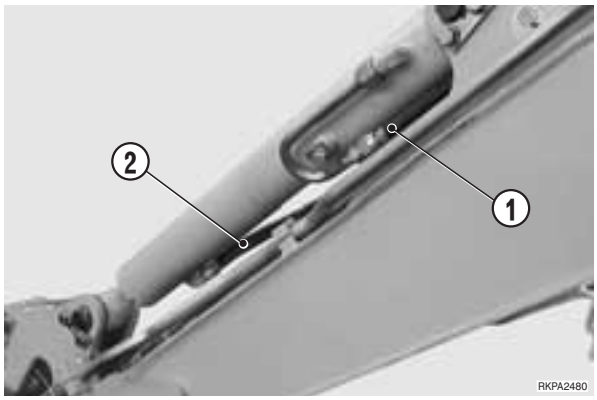
1 - Position the machine with the arm completely extended and with the bucket teeth on the ground.

2 - Stop the engine and release the residual hydraulic pressures.



3 - Disconnect the hoses (1) and (2) from the arm cylinder and plug them to prevent the entry of impurities.

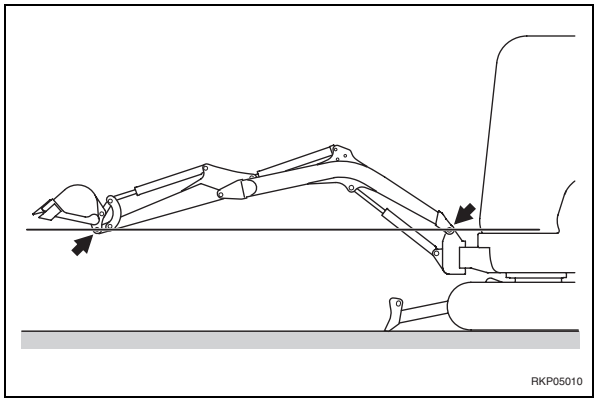
4 - Plug the hole of the arm cylinder on the head side and attach a provisional tube on the base side to catch any oil leakages.



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 moves downwards the drift is due to the cylinder gaskets.
- If the arm does not move, the drift is due to the control valve.



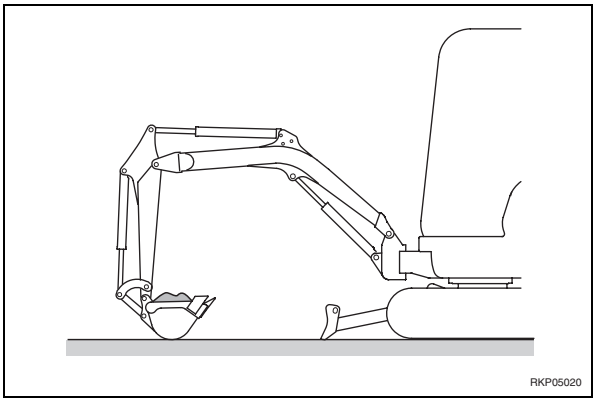
3. Bucket test

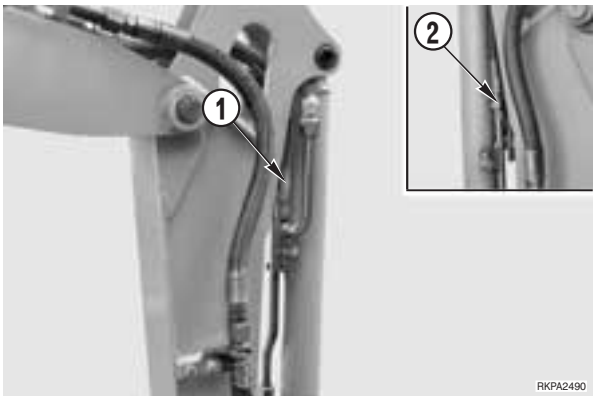
1 - Position the machine with the arm vertical and the bucket resting on the ground in a horizontal position. Put a weight in the bucket, or fill it with earth.

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.

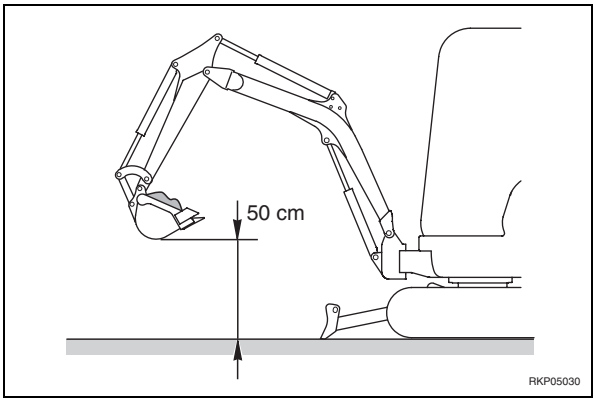




5 - Start the engine and raise the boom.

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

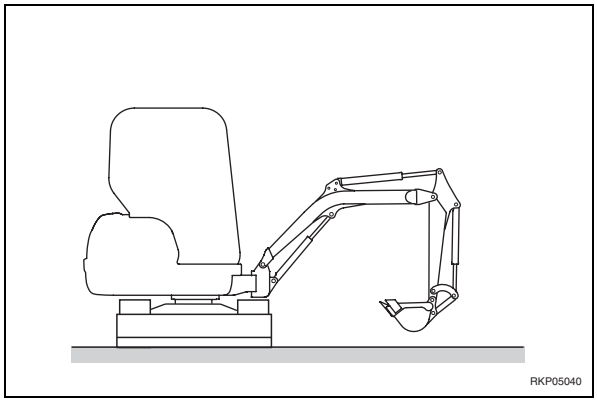
- If the bucket makes an opening movement the drift is due to the cylinder gaskets.
- If the bucket does not move, the drift is due to the control valve.



4. Boom swing test

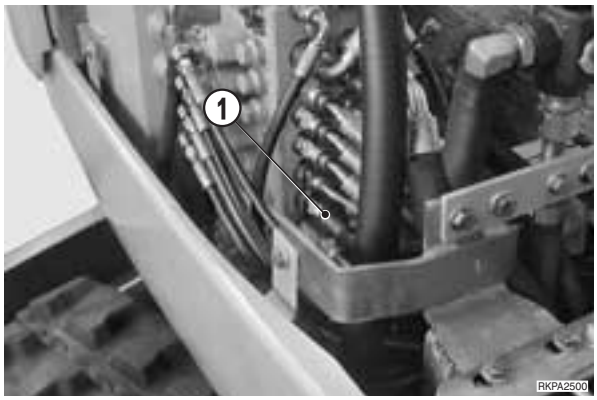
1 - Position the machine with the boom, arm and bucket raised and with the revolving frame turned 135° to the left.

2 - Stop the engine and release the residual hydraulic pressures.



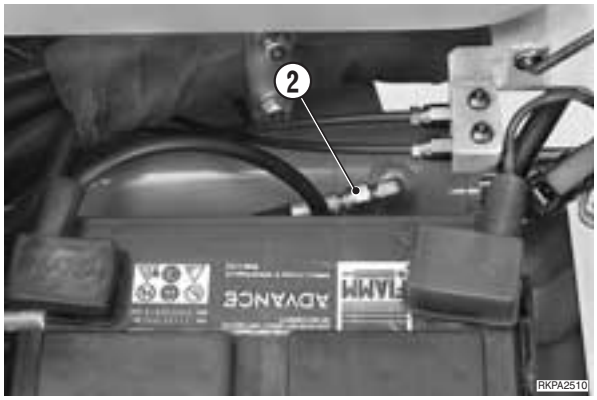
3 - Disconnect from control valve the pipe (1) and plug it.

★ Plug the control valve union to prevent entry of impurities



4 - Disconnect the boom swing cylinder hose (2) and plug it.

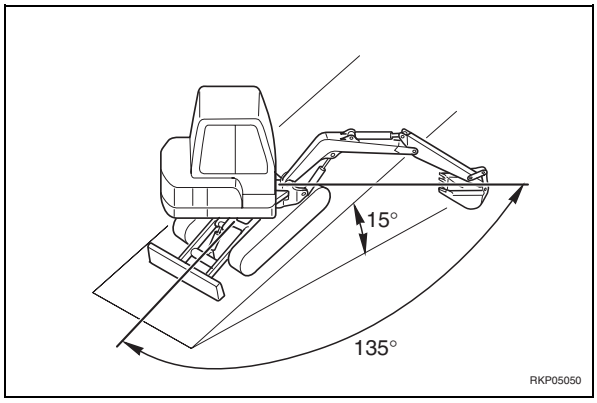
5 - Attach a provisional tube on the head side to catch any oil leakages.



6 - Start the engine and move the machine to a 15° slope.

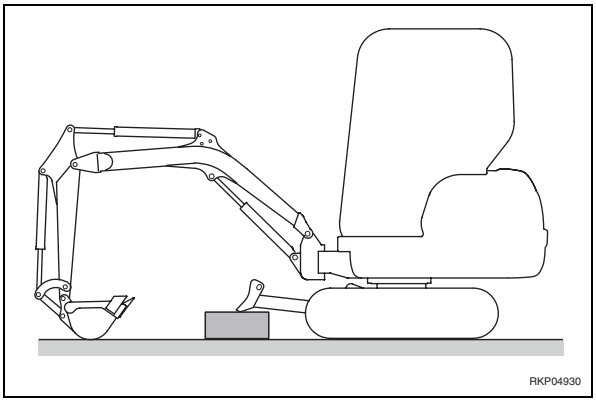
7 - Stop the engine and check the position of the boom for 15 minutes.

- If the boom makes a rotating movement the drift is due to the cylinder gaskets.
- If the boom does not move, the drift is due to the control valve.



5. Blade test

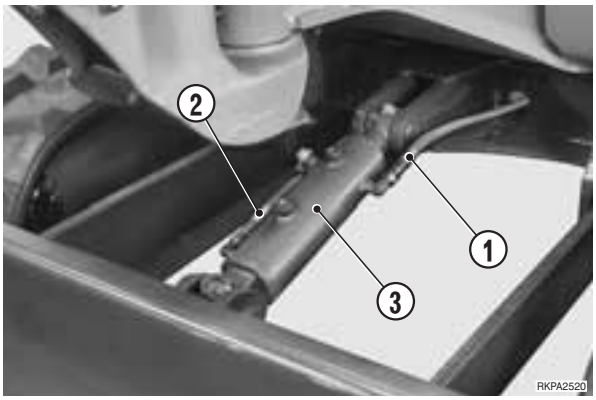
1 - Position the machine with the arm resting vertically on the ground and with the bucket resting on its back.
2 - Raise the blade completely and support it on a centrally-positioned block.
3 - Stop the engine and release the residual hydraulic pressures.



4 - Disconnect the hoses (1) and (2) of the blade cylinder (3) and plug them.
5 - Plug the hole of the blade cylinder on the head side and attach a provisional tube on the base side to catch any oil leakages.
6 - Start the engine and force the boom down to raise the machine in order to remove the block on which the blade is resting.
7 - Lower the blade and stop the engine.
8 - Check the position of the blade for 15 minutes.

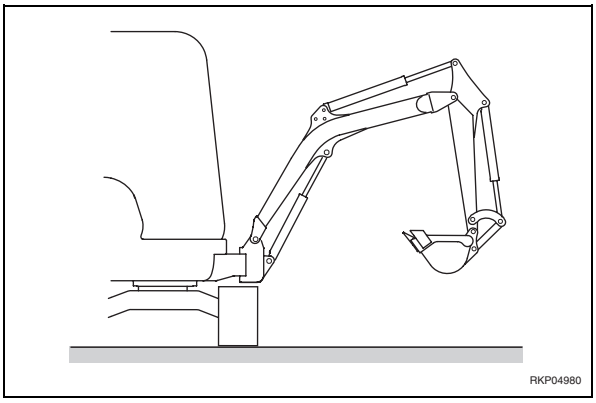
- If the blade moves downwards the drift is due to the cylinder.
- If the blade does not move downwards, the drift is due to the safety valve.

★ In order to check whether the drift is due to the swivel joint, see: «CHECKING LEAKAGES INSIDE THE SWIVEL JOINT».



6. Swing motor test

1 - Position the machine with boom, arm and bucket raised as in the figure and with the revolving frame turned 135° to the left.
2 - Stop the engine and release the residual hydraulic pressures.



3 - Disconnect the hoses (1) and (2) from the motor and plug them to prevent entry of impurities. Attach provisional tubes to the motor to catch any oil leakages.

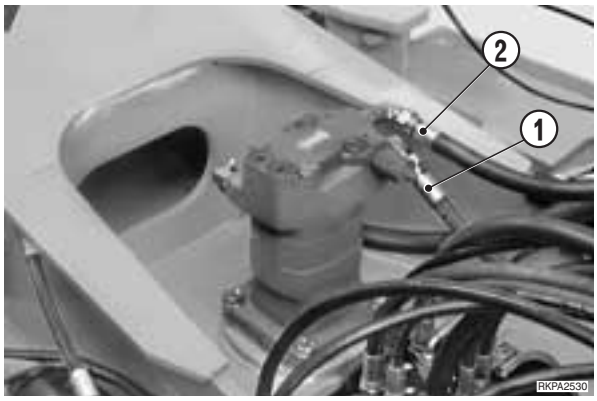
4 - Start the engine, move the machine to a 15º slope, and stop the engine.

5 - Mark the position between revolving frame and lower track-frame on the swing circle and for 15 minutes check whether or not the revolving frame rotates.

- If the revolving frame rotates the drift is due to either the safety valve or the control valve.

★ To establish the cause of the drift, install a new safety valve.

PC20R-8



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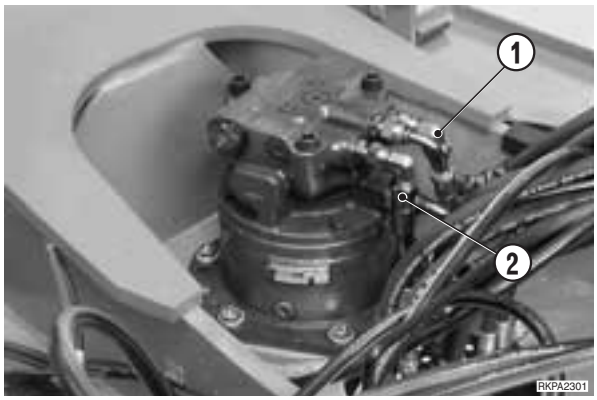
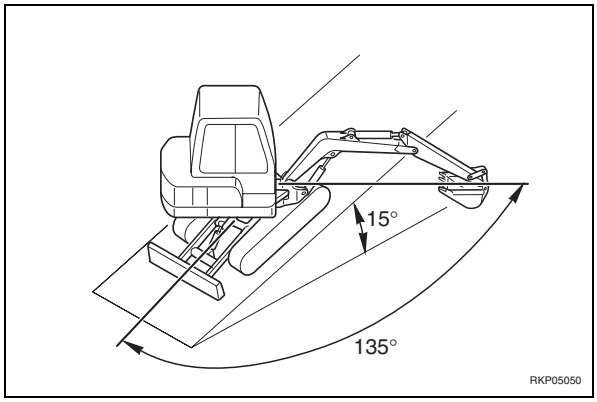




CHECKING FOR ANY LEAKAGES INSIDE THE WORKING EQUIPMENT CYLINDERS

★ Test conditions:
- Engine: at working temperature.
- Hydraulic oil: 45 – 55 °C.

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

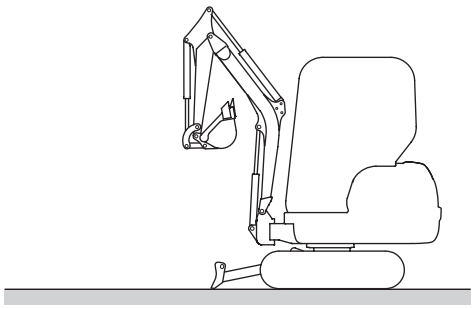
2 - Disconnect the tube from the head side of the cylinder and bind it to the structure.

⚠ 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.

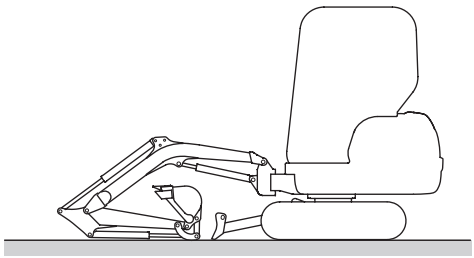
4 - After 30 seconds, wait for a full minute to collect any leakages from the free tube.

POSITION FOR THE BOOM TEST



RKP04720

POSITION FOR THE ARM AND BUCKET TEST



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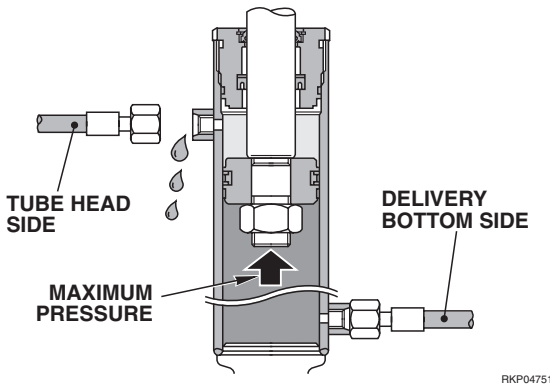

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CHECKING FOR ANY LEAKAGES INSIDE THE SWING MOTOR

★ Test conditions:
- Engine: at working temperature.
- Hydraulic oil: 45 – 55°C.
- Turret: locked in place with the swing-locking pin.

1 - Disconnect the drainage tube (1) of the motor (2) and plug it.

2 - Attach a provisional tube to catch the drainage oil.

3 - Start the motor and bring it up to maximum swing.

4 - Make sure that the turret is locked in place and push the swing command lever to the end of its stroke.

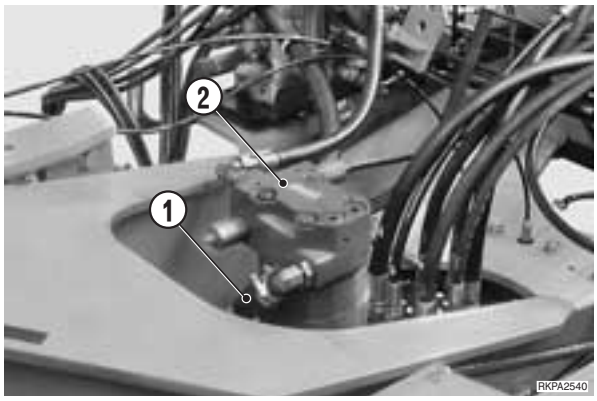
5 - Hold it in this position for 15 seconds and then measure the leakage for the next full minute.

6 - Bring the motor back to low speed and repeat the reading for the other direction of swing.

7 - Check that the average between the two readings falls within normal values (See «TECHNICAL DATA»).

8 - Re-assemble the hydraulic drainage circuit.

PC20R-8



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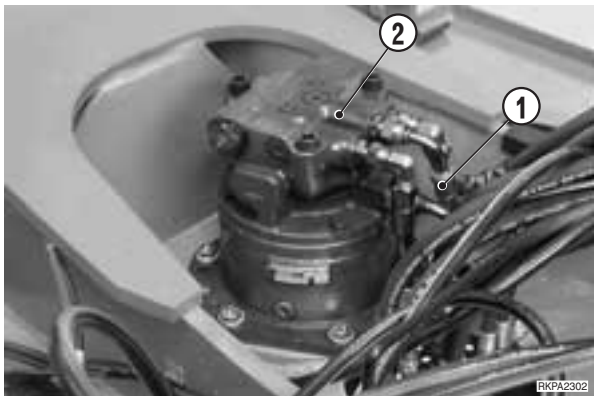


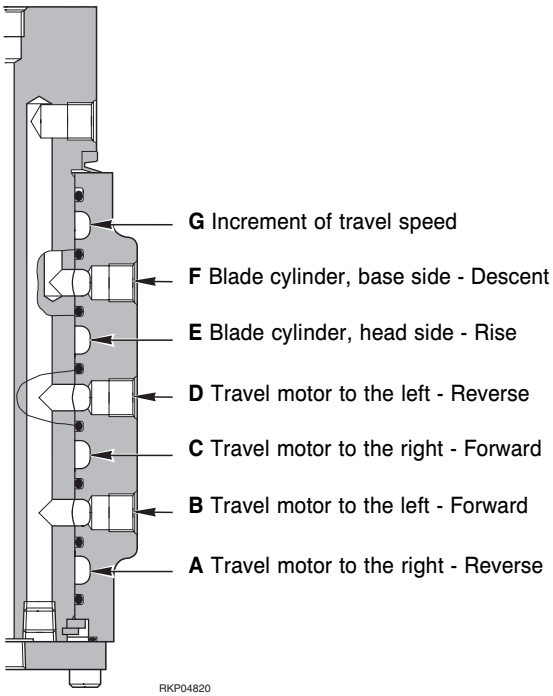
METHODS FOR TESTING FOR LEAKAGES INSIDE THE SWIVEL JOINT

★ Test conditions:
- Engine: at working temperature.
- Hydraulic oil: 45 – 55°C.

1. Functionality test

1 - When a lower actuator (blade, travel motor, travel increment) is found to be defective, one of the possible causes of failure is the swivel joint.

2 - In order to ascertain the cause of the defect it is sufficient to by-pass the joint by connecting (using a length of additional tubing) the input and output tubes of the joint of the line to be checked.
If this corrects the defect, it is certainly due to the swivel joint.
If the defect persists, it can be ascribed to other causes, but definitely not to the swivel joint.



2. Looking for a defective seal

⚠ These controls are to be carried out only on those lines subjected to working pressures. The drainage line is therefore not included in these tests.

The test method consists of pressurising the line to be checked and measuring any leakages from the adjacent lines according to the following tables:

TABLE A

Symbol	Line to be controlled (under pressure)	Adjacent line (possible leakages)	Sym.
A	Travel motor to the right - Reverse	Travel motor to the left - Forward	**B**
		External leak (visible)	**—**
B	Travel motor to the left - Forward	Travel motor to the right - Forward	**C**
		Travel motor to the right - Reverse	**A**
C	Travel motor to the right - Forward	Travel motor to the left - Reverse	**D**
		Travel motor to the left - Forward	**B**
D	Travel motor to the left - Reverse	Blade cylinder, head side - Rise	**E**
		Travel motor to the right - Forward	**C**
E	Blade cylinder, head side - Rise	Blade cylinder base side - Descent	**F**
		Travel motor to the left - Forward	**D**
F	Blade cylinder base side - Descent	Descent Passage not used	**G**
		Blade cylinder, head side - Rise	**E**

⚠ The symbols correspond to the symbols stamped onto the input and output ports of the swivel joint.

3. Preparation for the testing:

- **Travel motor**
- **Travel increment**

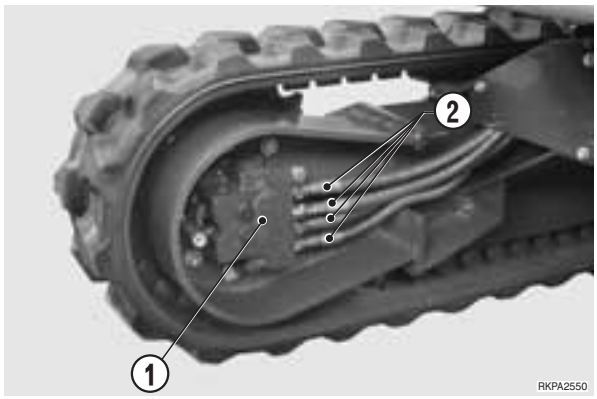
1 - Release all residual hydraulic pressures. (See «ELIMINATION OF THE RESIDUAL PRESSURES FROM THE CIRCUITS»).

2 - Disconnect from the travel motor (1) the tube (2) corresponding to the line to be checked and seal it. Also plug the motor to prevent entry of impurities.

3 - Disconnect from the relative actuators the tubes that correspond to the lines adjacent to the one being checked. Plug the disconnected tubes to prevent entry of impurities.

★ To identify the lines adjacent to the line being checked, please refer to Table **A**.

4 - Wait a few minutes to give the oil in the tubes time to drain out.



4. Preparation for testing the blade

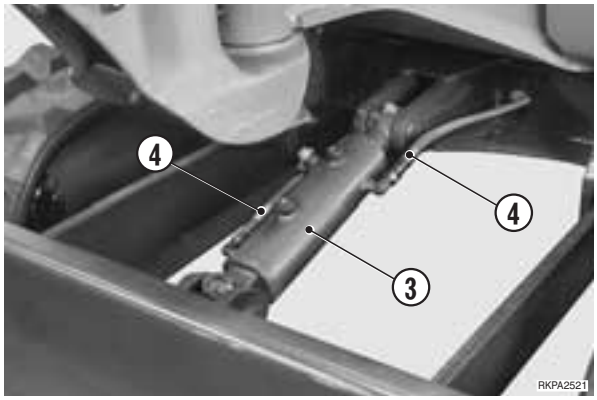
1 - Release all residual hydraulic pressures. (See «ELIMINATION OF THE RESIDUAL PRESSURES FROM THE CIRCUITS»).

2 - Disconnect from the blade cylinder (3) the tube (4) corresponding to the line to be checked and seal it. Also plug the holes in the actuators to prevent entry of impurities.

3 - Disconnect from the relative actuators the tubes that correspond to the lines adjacent to the one being checked. Plug the disconnected tubes to prevent entry of impurities.

★ To identify the lines adjacent to the line being tested, please refer to Tables **A** and **B**.

4 - Wait a few minutes to give the oil in the tubes time to drain out.



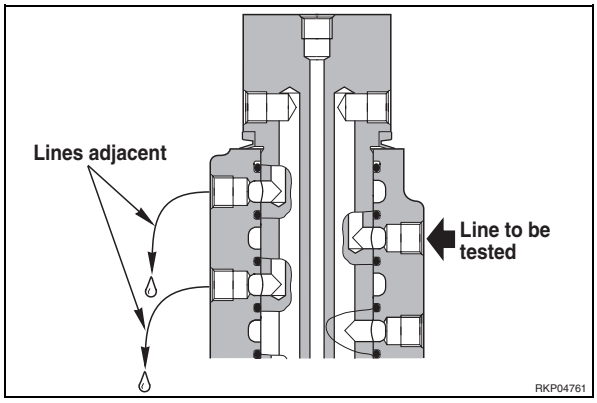
5. Checking the leaktightness

1 - Start the motor and bring it up to the testing speed for each group of components.

2 - Pressurise the line to be tested.

3 - After 30 seconds, then for the next full minute check to see if there are any leakages.

★ If oil leaks out of one of the two tubes of the actuators (adjacent lines), it means that there is a leakage of the intermediate gasket between the high pressure line and the adjacent line.



GRUPPO 30

30 REMOVAL AND INSTALLATION

HOW TO READ THE MANUAL

1. Removal and Installation of the groups

(1) The procedures and information needed to carry out the work of removing or Installing units or groups are given in the removal procedure. The sequence of operations is not repeated in the installation procedure.

(2) Information needed for installation is marked with the symbol [※1]. The same symbol is repeated at the end of each removal procedure for the same item, to indicate to which installation item it refers.

(Example)

REMOVAL GROUP : ○○○ : ..... Title of operation

⚠ :..... Safety precautions to be followed when carrying out the operation.

1 - Remove XXXX (1):..... Step in removal procedure.

★ :..... Technique or important point to remember when removing XXXX (1)

2 - △△△ (2): ..... [※1] This sign means that information is given for the installation procedure

3 - Remove □□□□ (3):

..... ℓ: ..... Recovery of oil or water, and the quantity to be recovered.

INSTALLATION GROUP ○○○ :..... Title of operation.

- To install, reverse removal procedure.

  [※1] :..... Technique to be used for installation.

  ★ :..... Technique or important point to remember when removing △△△ (2).

- Addition of water or oil: ..... Step in removal procedure.

  ★ :..... Point to remember when adding water or oil.

2. To the precautions to be taken during the removal or installation of the groups, must be added the specific «PRECAUTIONS TO BE TAKEN DURING THE OPERATIONS».
Always make sure that these precautions are taken.

3. List of special tools.

(1) For details of the descriptions, codes and quantities of each tool (**A1**; **A2** etc.) mentioned in the operational procedures, see the list «SPECIAL TOOLS» supplied in this section.

4. List of the tightening torques and weights, and the quantities oil, liquids or grease needed to fill tanks and containers

(1) In the operating procedures, you will find the symbols Nm, kg, , . In the following order, these represent the values of «TIGHTENING TORQUES», «WEIGHT OF PARTS OR GROUPS», «QUANTITIES OF OIL OR LIQUIDS TO BE INTRODUCED», «SCREW LOCKING MATERIAL, SEALANTS AND LUBRICATION», «LUBRICATING GREASE».

NOTE
If no symbol is indicated, the values to be used are those given in the introductory sections of this manual.

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.

SPECIAL TOOLS

Nature of work	Symbol		Code	Description	Q.ty	Notes
Removal - installation of steel track shoe	A	1	ATR200460	Equipment	1	For master pin
Disassembly - assembly recoil spring	B	1	ATR200720	Equipment	1	Removal - installation recoil spring
Disassembly - assembly cylinders	C	1	ATR200620	Equipment for disassembly - assembly cylinders	1	All cylinders
		2	ATR800190	Dynamometric wrench with multiplier	1	Max. 400 kg (400 dNm)
		3	ATR200730	Pliers for mounting gaskets	1	All cylinders
		4	ATR200740	Plunger Øi 30	2	Mounting bushings on cylinders and piston rod
			ATR200750	Plunger Øi 35	2	
		5		Wrench for cylinder Ø 65	1	Removal - installation of head
				Wrench for cylinder Ø 70	1	
				Wrench for cylinder Ø 75	1	
				Wrench for cylinder Ø 80	1	
		6		6-point socket wrench (30)	1	Removal - installation of piston
				6-point socket wrench (32)	1	
				6-point socket wrench (36)	1	
			ATR200870	6-point socket wrench (41)	1	
		7		Plunger for piston rod Ø 30	1	Mounting ring on the head
				Plunger for piston rod Ø 35	1	
		8		Plunger for cylinder Ø 50	1	Mounting piston gasket
				Plunger for cylinder Ø 55	1	
				Plunger for cylinder Ø 60	1	
				Plunger for cylinder Ø 70	1	
		9		Gauge for cylinder Ø 50	1	Gauging piston gasket
				Gauge for cylinder Ø 55	1	
			ATR200990	Gauge for cylinder Ø 60	1	
			ATR201000	Gauge for cylinder Ø 70	1	
		10		Bushing for piston rod Ø 30	1	Mounting head
			ATR201150	Bushing for piston rod Ø 35	1	

SPECIAL TOOLS

Nature of work	Symbol		Code	Description	Q.ty	Notes
Disassembly - assembly cylinders	C	11		Bushing for piston Ø50	1	Assembling piston - cylinder
				Bushing for piston Ø55	1	
			ATR201190	Bushing for piston Ø60	1	
			ATR201200	Bushing for piston Ø70	1	

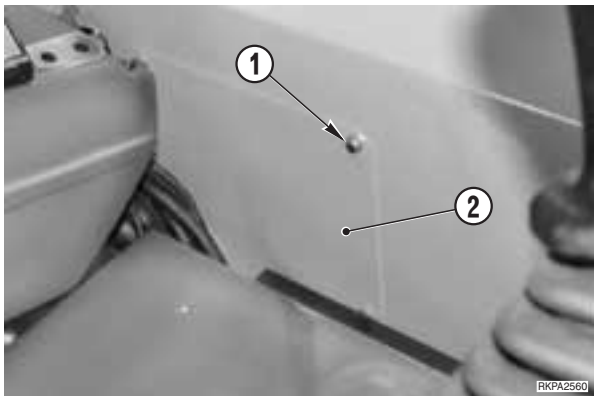
REMOVAL OF THE STARTER MOTOR

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

1 - Remove cabin.
(For details, see «REMOVAL OF CABIN»).

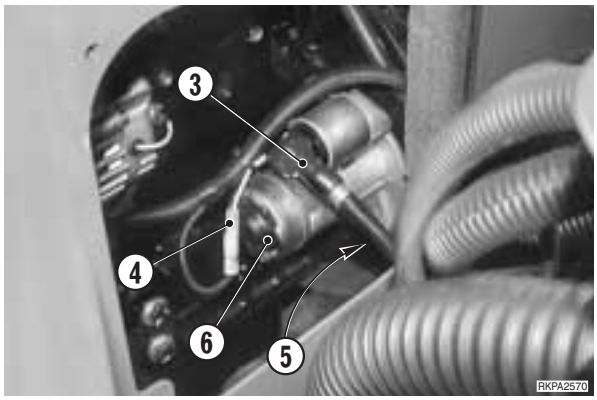
2 - Move the operator's cab forwards complete.

3 - Loosen bolts (1) and remove the cover (2).



3 - Disconnect cable (3) and connector (4).

4 - Loosen bolts (5) and remove starter motor (6). ※1



INSTALLATION OF THE STARTER MOTOR

- To install, reverse the removal procedure.

※1

Nm Screw:..... Nm

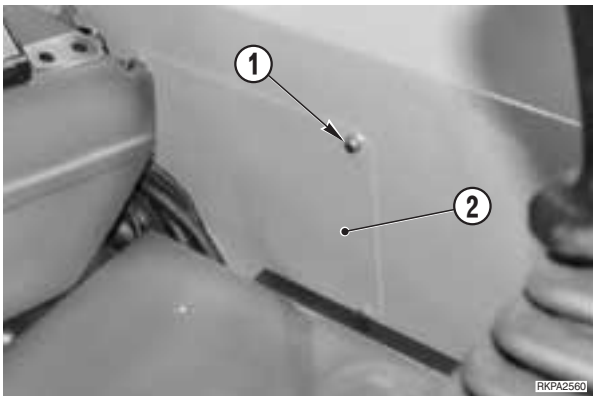
REMOVAL OF THE ALTERNATOR

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

1 - Remove cabin.
(For details, see «REMOVAL OF CABIN»).

2 - Move the operator's cab forwards complete.

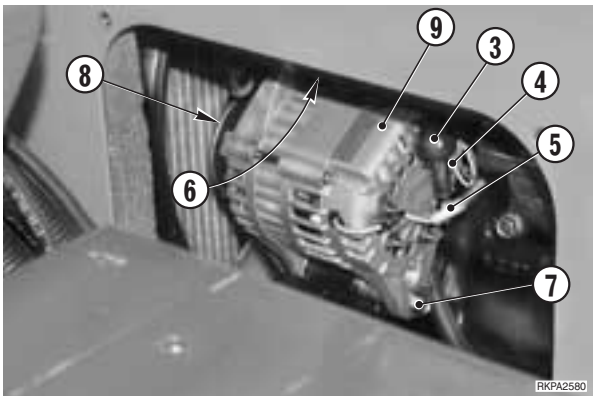
3 - Loosen bolts (1) and remove the cover (2).



4 - Disconnect cable (3) and connectors (4) and (5).

5 - Loosen bolts (6) and (7) sufficiently to allow the alternator to be rotate.

6 - Free the pulley (8) from the fan-belt and remove alternator (9). ※1



INSTALLATION OF THE ALTERNATOR

- To install, reverse the removal procedure.

※1

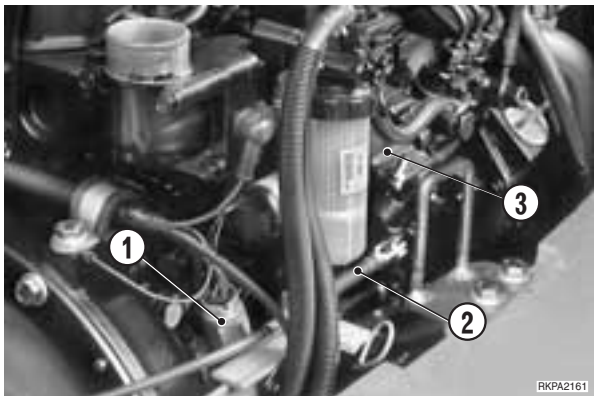
★ Adjust the tension of the fan belt. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

REMOVAL OF INJECTION PUMP

⚠
- Disconnect the negative terminal cable (–) from the battery.
- Close the cock of separator to prevent fuel leakage.

1 - Remove oil-cooler - radiator group.
(For details, see «REMOVAL OF THE OIL-COOLER - RADIATOR GROUP»).

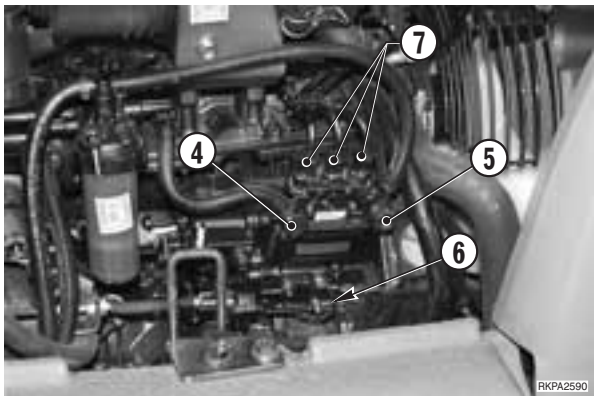
2 - Disconnect connector (1) and accelerator cable (2).
※1



3 - Disconnect from injection pump (3) fuel feeding pipes (4) and return pipes (5).

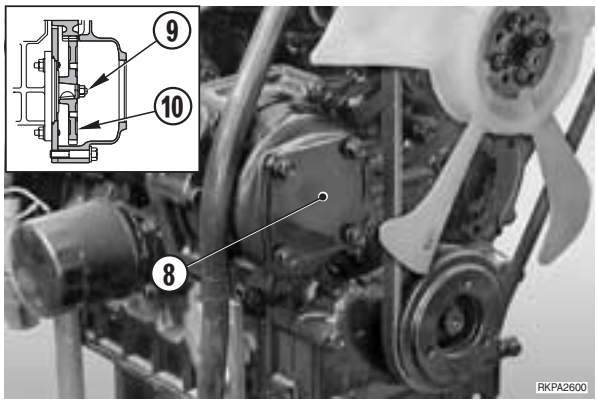
4 - Disconnect injection pump (3) lubricating pipe (6).

5 - Disconnect high pressure pipes (7) from injection pump (3). ※2

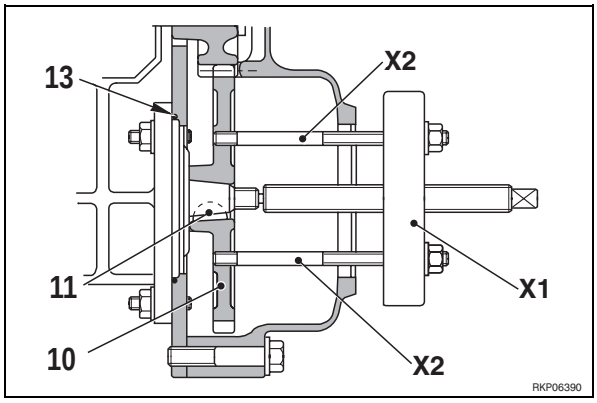


6 - Remove the inlet cover (8) to ignition gear system.

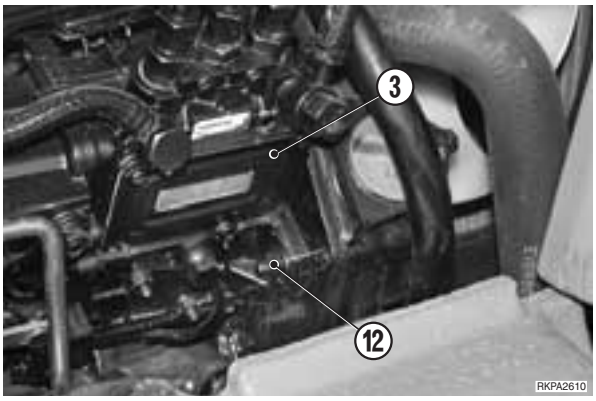
7 - Loosen and remove nut (9) and lock washer (10) of pump driving gear. ※3
★ Be careful not let nut (9) and lock washer drop in the housing.



8 - Remove pump (10) driving gear (3).
★ Before removing pump driving gear, mark position compared to idling gear.
★ For removal, use a puller (X1) and tighten its screws (X2) directly in the gear (10).
★ During removal be careful not let key drop (11) in the housing.



9 - Loosen nuts (12) (No. 3) and remove injection pump (3) with O-rings (13). ※4



INSTALLATION OF INJECTION PUMP

- To install, reverse the removal procedure.

※1

★ Check accelerator stroke lever.
(For details, see «20. CONTROLS AND ADJUSTMENTS»).

※2

Nm Feed and return pipes: 31.85±2.45 Nm

※3

★ Align marks among gears before to install pump and nut.

Nm Nuts:..... Nm

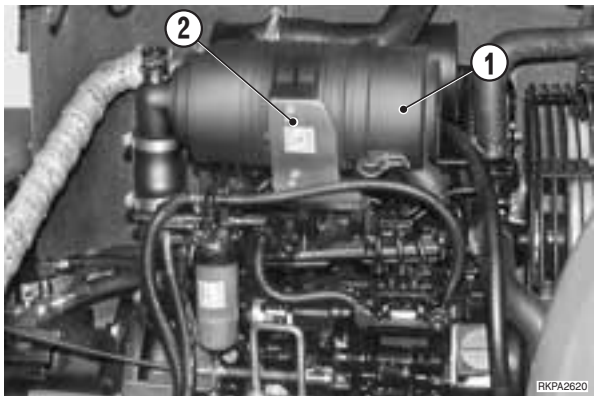
※4

Nm Pump lock nuts: 25.5 Nm

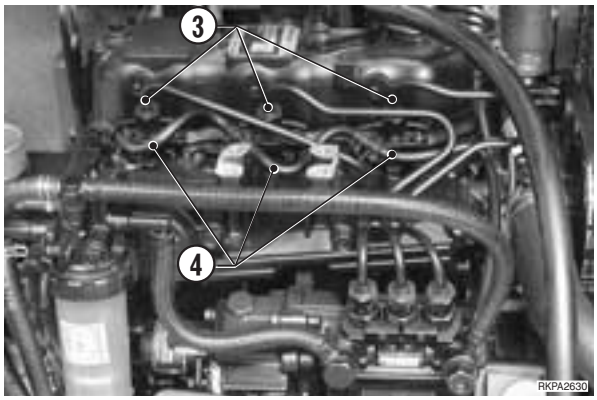
1 - Check fuel injection timing.
(For details, see «20. CONTROLS AND ADJUSTMENTS»).

REMOVAL OF THE NOZZLE HOLDER

1 - Remove the suction filter (1) and the supporting bracket (2).

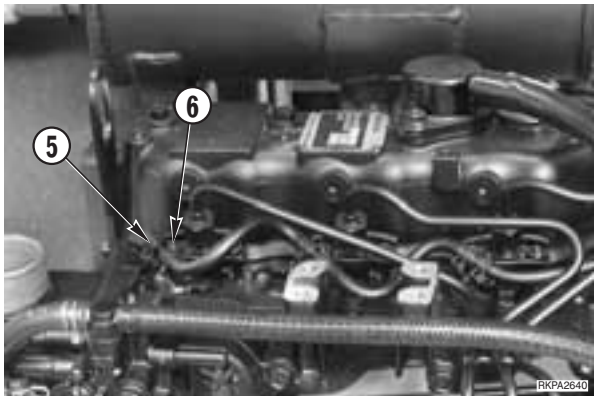


2 - Remove the high-pressure pipes (3) and the fuel return tubes (4). ※1



3 - Loosen nuts (5) and remove clips (6). ※2

4 - Remove the complete injection nozzles.



INSTALLATION OF THE NOZZLE HOLDER

- To install, reverse the removal procedure.

※1

Nm High-pressure pipe union: 31.85±2.45 Nm

※2

Nm Nuts: 7.84±0.98 Nm

REMOVAL OF WATER COOLANT PUMP

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

★ Drain the engine coolant.

Coolant: Approx. 4 ℓ

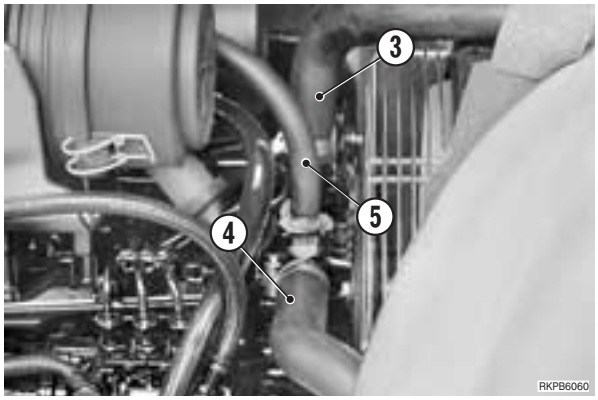
※1

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

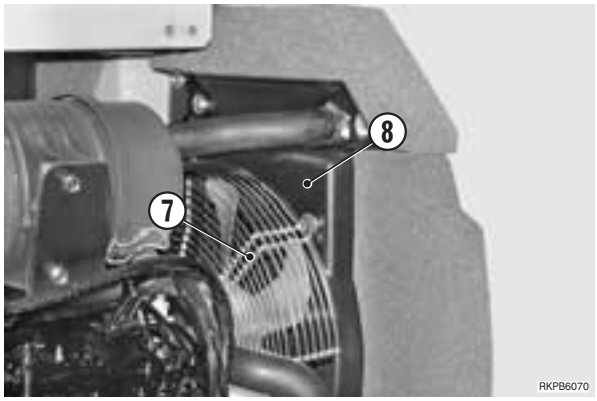
kg R.H. lateral counterweight: 37 kg ※2

2 - Disconnect the tube (3) and (4).

★ **Only for cabin version.** Disconnect the cooling circuit tube (5).
Disconnect the connectors (6).

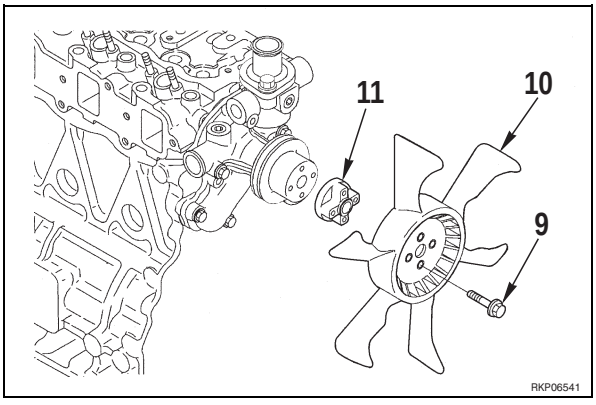


3 - Remove from the radiator the fan cover (7) and disconnect the fan-cooling conveyor (8).



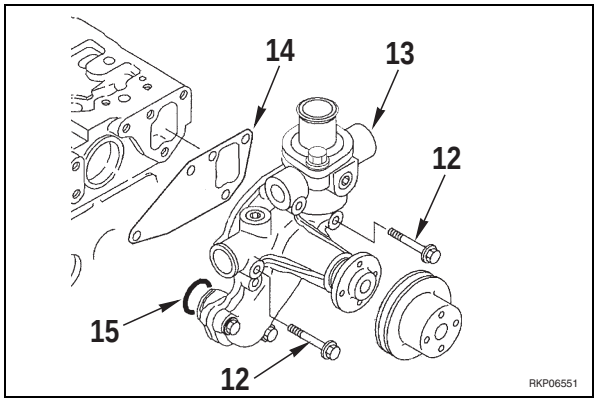
4 - Loosen the screws (9), remove the cooling fan (10) and the spacer (11). Take out the fan-cooling conveyor (8).
Loosen the alternator drive belt and disengage the pulley of the water pump.

※3



5 - Loosen the screws (12) and remove the complete pump (13), gasket (14) and O-ring (15).

※4



INSTALLATION OF WATER COOLANT PUMP

- To install, reverse the removal procedure.

※1

1 - Fill up the cooling circuit.

Coolant: approx. 4 ℓ

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

★ **Only for cabin version.** Make sure that the heating cock is open.

※2

Nm R.H. lateral counterweight screws: 180 Nm

1 - To install the engine hood.
(For details, see «REMOVAL OF ENGINE HOOD»).

※3

★ Adjust belt tension. (For details, see «20. CONTROLS AND ADJUSTMENTS - Control and adjustments of the fan belt»).

Nm Fan screws: ..... Nm

※4

★ Check the gaskets:

Nm Pump screws: ..... Nm

REMOVAL OF THE CYLINDER HEAD

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

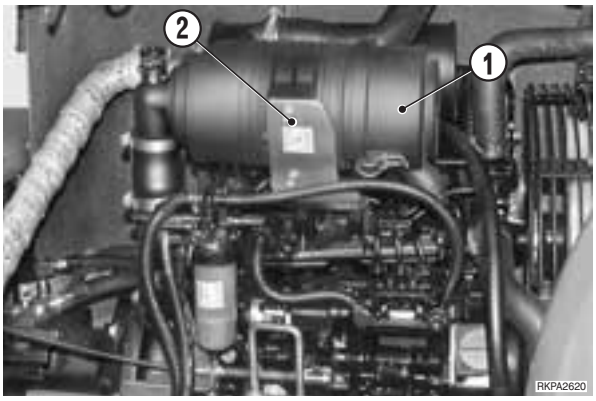
★ Drain the engine coolant.

Coolant: Approx. 4 ℓ

※1

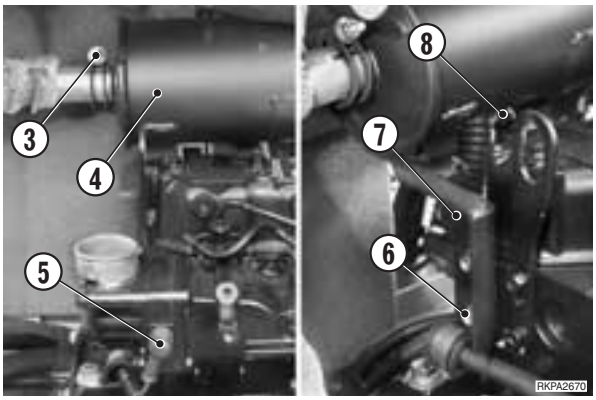
1 - Remove the water coolant pump. (For details, see «REMOVAL OF WATER COOLANT PUMP»).

2 - Remove filter (1) and bracket (2).



3 - Loosen clips (3) and disconnect exhaust pipe from muffler (4) .
Disconnect pre-heating cable (5).

4 - Loosen the screws (6) from support (7) and nuts (8) from muffler.
Remove muffler (4). ※2



5 - Remove the fuel filter (9) without disconnecting the tubes. Put it to rear side of machine.

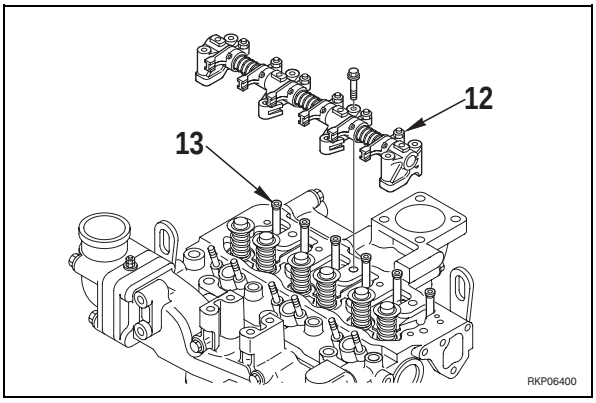
6 - Remove nozzle holder (10). (For details, see «REMOVAL OF THE NOZZLE HOLDER»).

7 - Remove the valves cover (11). ※3

8 - Remove the rocker-arm shaft (12). ※4

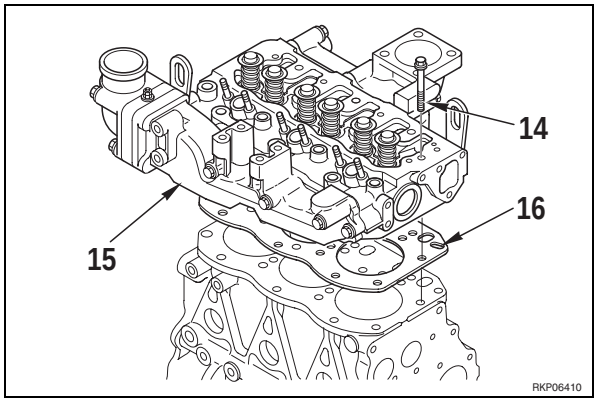
★ Loosen the lock nuts and unscrew the valve tappets by 2-3 turns. ※5

9 - Take out the rocker-arm control rods (13).



10 - Take out the screws (14) in the sequence indicated and remove the complete cylinder head (15). ※6

★ The cylinder head gasket (16) must be substituted every time it is dismantled.



INSTALLATION OF THE CYLINDER HEAD

- To install, reverse the removal procedure.

※1

1 - Fill up the cooling circuit.

Coolant: approx. 4 ℓ

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

★ **Only for cabin version.** Make sure that the heating cock is open.

※2

Screws:..... Nm

Nuts: ..... Nm

※3

Nut: ..... Nm

※4

Screw:..... Nm

※5

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

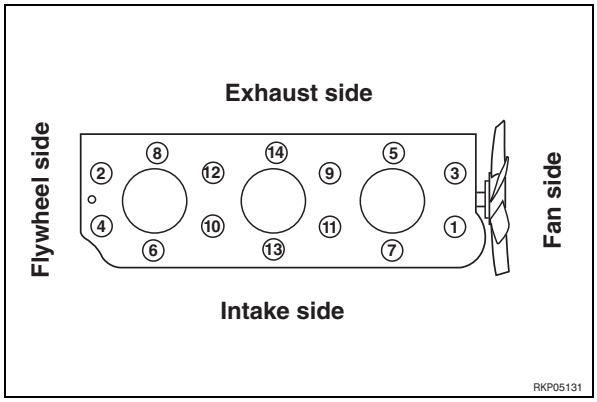
※6

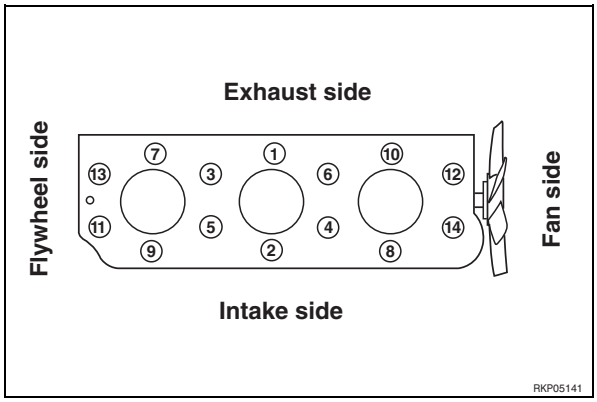
★ Raise the cylinder head, keeping it horizontal, and place it on the gasket without shifting anything.

★ Lubricate the screw-threadings with engine oil.

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

Cylinder head screws: 68.6±1.96 Nm

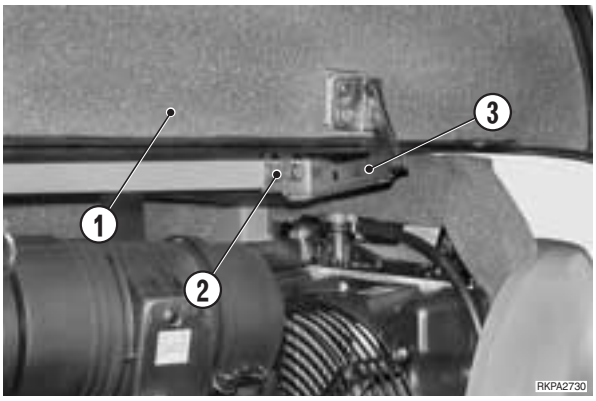




REMOVAL OF THE ENGINE HOOD

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

1 - Block the engine hood (1) in its raised position, take out the screws (2) that fasten the hinge (3) to the frame and remove the hood. ※1

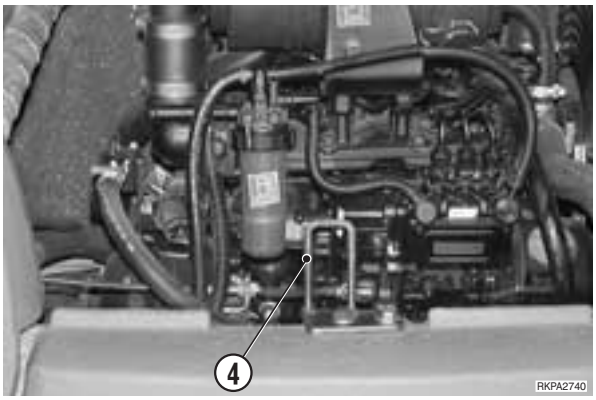


INSTALLATION OF THE ENGINE HOOD

- To install, reverse the removal procedure.

※1

★ Check the alignment of the outside edges, the centering and the adjustment of the closing mechanism (4).



REMOVAL OF CANOPY

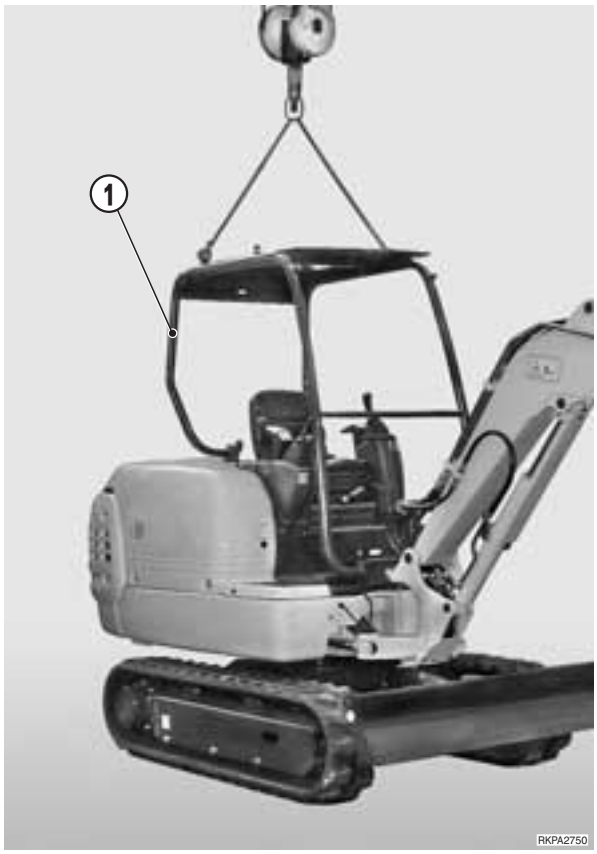
⚠ Completely lower the working equipment until it is resting on the ground and stop the engine and take out the ignition key.

1 - Attach the canopy (1) to some hoisting tackle.

2 - Loosen and remove the screws (2) and (3). ※1

3 - Remove the canopy.

kg Canopy: 73 kg



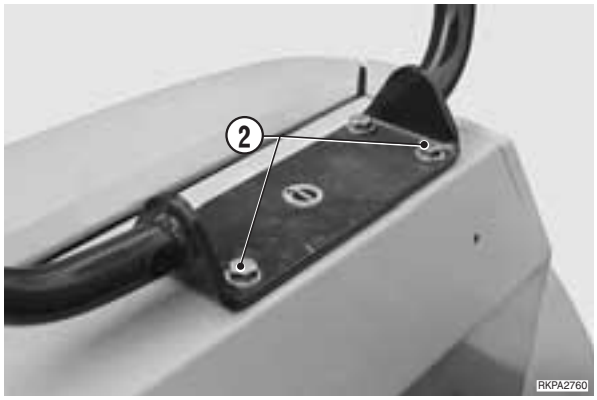
INSTALLATION OF CANOPY

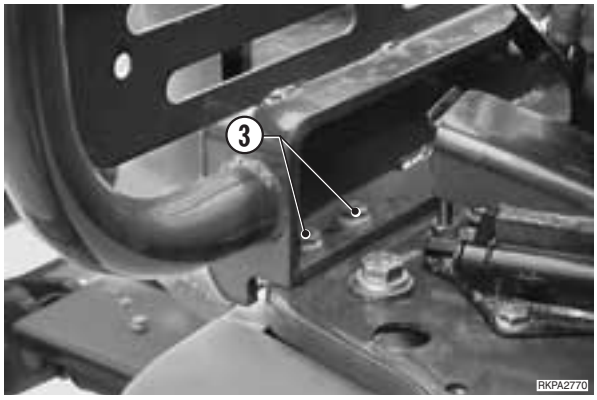
- To install, reverse the removal procedure.

※1

Nm Screw (2): 180 Nm

Nm Screw (3): 67 Nm



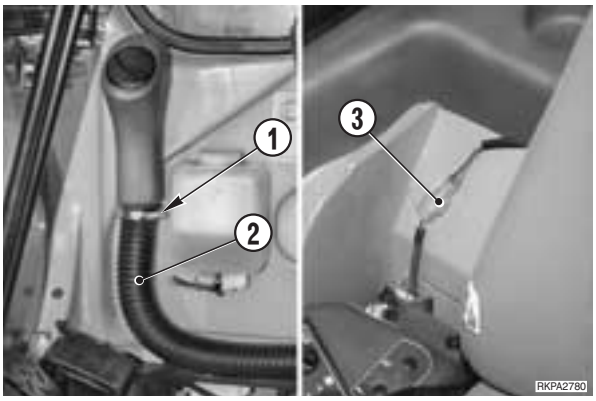


REMOVAL OF CAB

⚠ 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). ※1

5 - Take out the cab (4).

kg Cab: 208 kg

INSTALLATION OF CAB

- To install, reverse the removal procedure.

※1

Nm Screw: 67 Nm

REMOVAL OF THE HEATING FAN

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

★ Drain the engine coolant.

Coolant: approx. 4 ℓ ※1

1 - Remove the floor mat.

2 - Remove screws (1).

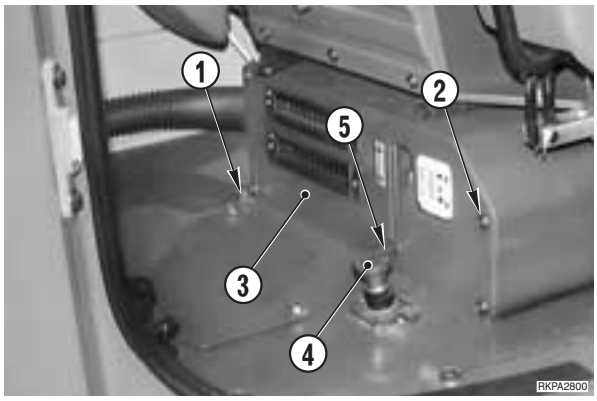
3 - Loosen screws (2) and take out the cover (3).

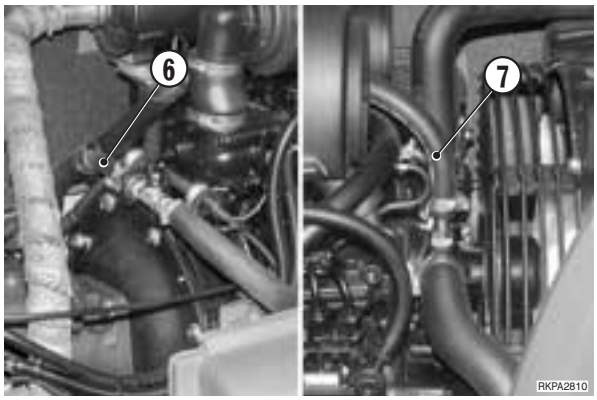
4 - Remove the travel increment pedal (4).

5 - Remove the L.H. lower cover (for details, see «REMOVAL OF THE L.H. LOWER COVER») and remove the swivel pin (5).

6 - Disconnect the return tube (6) and delivery tube (7) to heating fan.

★ Plug the tubes to prevent entry of impurities.



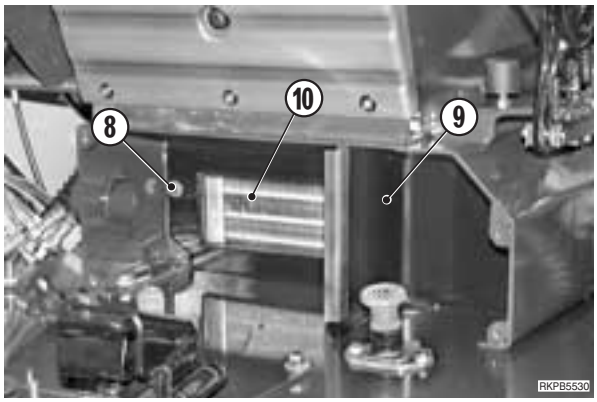


7 - Loosen screws (8) (No. 2), remove cover (9) and remove the complete fan (10).

★ Accompany the tubes (6) and (7) to avoid to damage them.

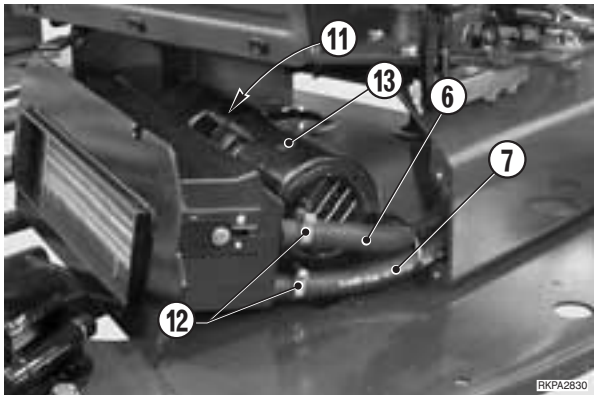
★ Take care not to take out completely the tube (6) and (7) from engine box.

8 - Disconnect the connector (11).



9 - Loosen the clips (12) and take out the tubes (6) and (7).

10 - Remove the heating fan (13).



INSTALLATION OF THE HEATING FAN

- To install, reverse the removal procedure.

※1

1 - Make sure that the heating cock is fully open.

2 - Fill up the coolant circuit.


Coolant: approx. 4 ℓ

3 - Start the engine to circulate the coolant and check that there are no leaks.

4 - Stop the engine and top up the level.

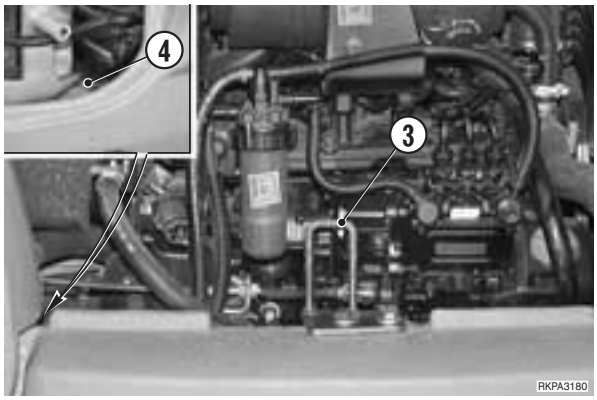
REMOVAL OF THE COUNTERWEIGHT

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

1 - Remove the lateral counterweight (1) and (2). ※1

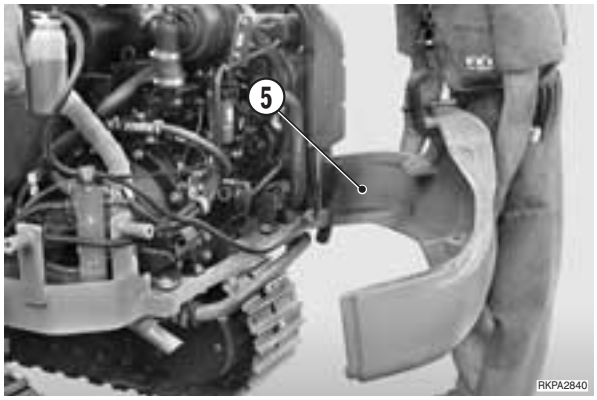
kg R.H. counterweight: 37 kg
L.H. counterweight: 29 kg

2 - Remove the hood fastener (3).



3 - Loosen the counterweight screws (4) to eliminate the tightening torque. ※2

4 - Attach the counterweight (5) to some hoisting tackle, remove the screws, and pull out the counterweight (5).



INSTALLATION OF THE COUNTERWEIGHT

- To install, reverse the removal procedure.

※1

Nm Lateral counterweight screws: 180 Nm

※2

Counterweight screws: Loctite 262
Nm Counterweight screws: 300 Nm

REMOVAL OF FUEL TANK

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

★ Drain the fuel.

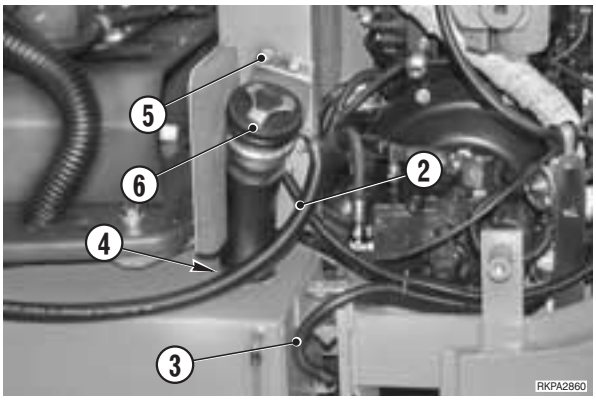
Fuel: max. 35 ℓ

1 - Remove the hood (1). (For details, see «REMOVAL OF LATERAL LOWER COVER»).

2 - Disconnect the tube (2) and suction tubes (3).

★ Mark the tubes to avoid exchanging them during re-installation.

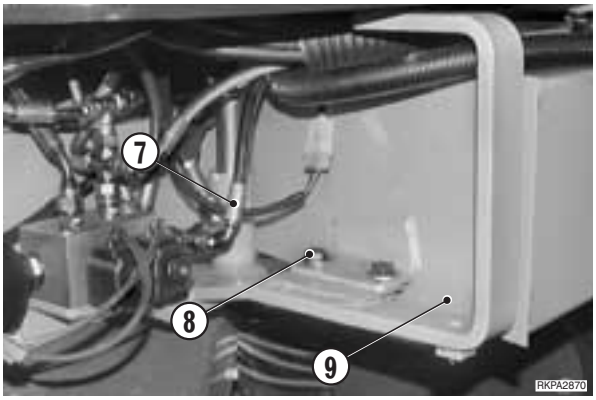
3 - Loosen the clip (4), the screws (5) and take out the fuel filling (6).



4 - Disconnect the connector (7) and loosen lock screws (8) (No. 4) of the fuel tank (9).

5 - Remove the fuel tank (9).

kg Fuel tank: 14 kg



INSTALLATION OF THE FUEL TANK

- To install, reverse the removal procedure.

1 - Fill up the tank.

Tank: max. 35 ℓ

2 - Bleed the air from the fuel pipes and start the engine.

REMOVAL OF THE HYDRAULIC TANK

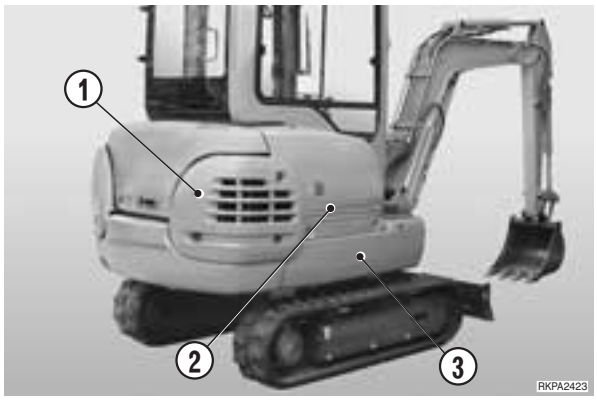
Completely lower the working equipment until it is resting on the ground and stop the engine.

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

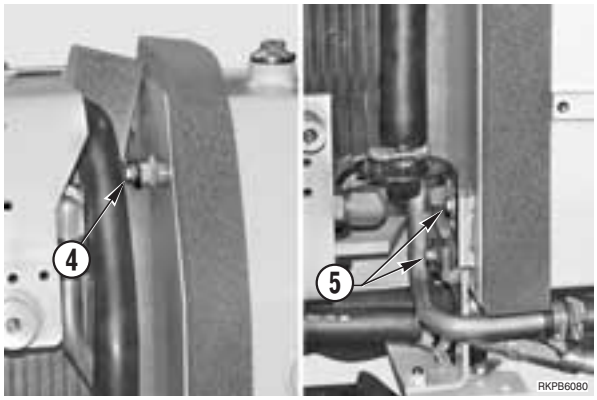
★ Drain out the hydraulic oil.

Hydraulic oil: approx. 29 ℓ ※1

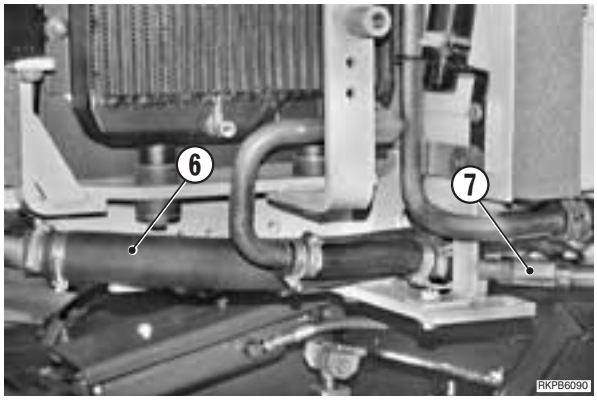
1 - Open the R.H. counterweight (1), the R.H. lateral cover (2) the R.H. lower cover (3). (For details, see the single removal). ※2



2 - Loosen the screws (4) and (5).



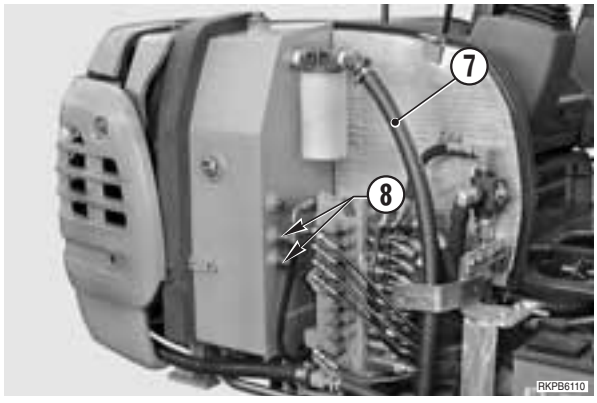
3 - Remove the pipe (6) from oil cooler and exhaust pipe (8).



4 - Remove the exhaust pipe (8) (PC20R-8 No.2 - PC27R-8 No. 3) in the tank.

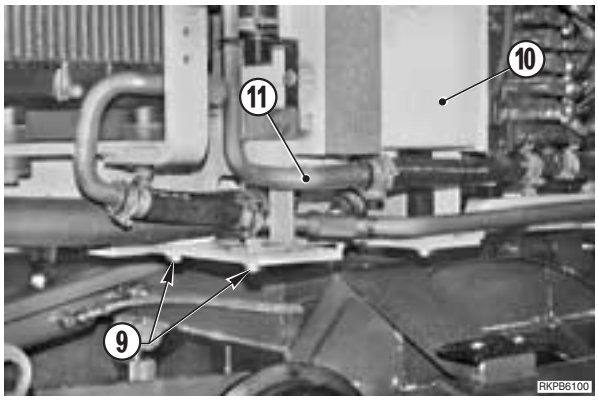
★ Mark the tubes to avoid exchanging them during re-installation.

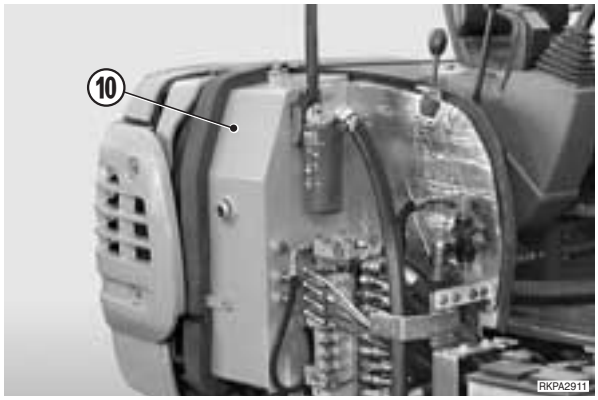
★ Plug the tubes to prevent entry of impurities.



5 - Loosen the screws (9).

6 - Attach the tank (10) to some hoisting tackle, remove the screws and take out the tank (10).
★ Take care not to damage the pipe (11)
★ Take care of position and quantities of shims (12).
kg Hydraulic tank: 30 kg





INSTALLATION OF THE HYDRAULIC TANK

- To install, reverse the removal procedure.

※1

1 - Fill the hydraulic oil tank to maximum level.
Hydraulic oil needed: approx. 29 ℓ

※2

Nm Counterweight screws: 180 Nm

2 - Start the engine at low idling to circulate the oil throughout the system.

3 - Pressurise the tank and bleed air from all circuits. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

REMOVAL OF THE OIL-COOLER - RADIATOR GROUP

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»).

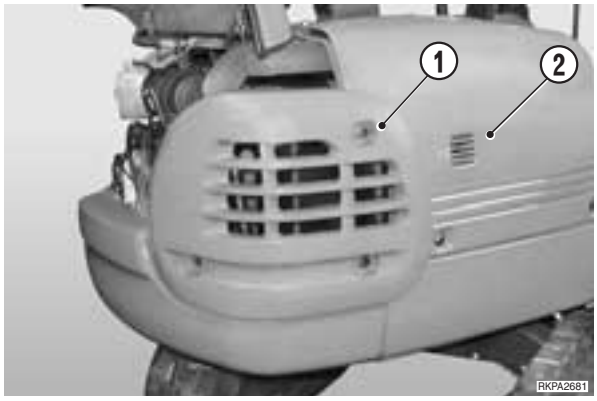
★ Drain out the hydraulic oil.

Hydraulic oil: approx. 29 ℓ

★ Drain the coolant.

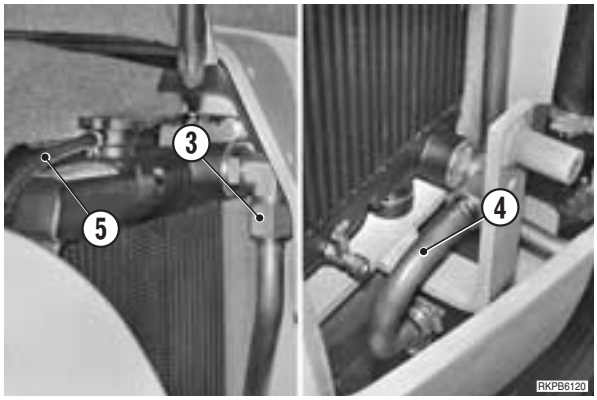
Coolant: approx. 4 ℓ ※1

1 - Open the R.H. counterweight (1) and remove the hood (2). ※2

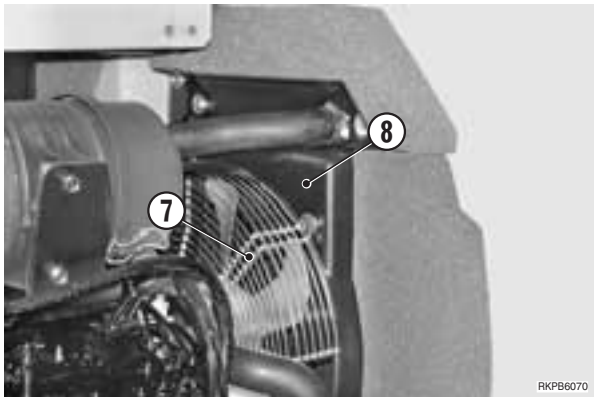


2 - Disconnect pipes (3) and (4) and drain the hydraulic oil from exchager and from drainage pipes.

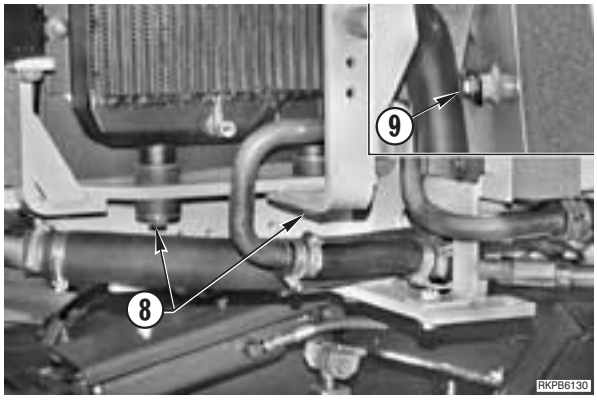
3 - Disconnect pipe (5).



4 - Disconnect the delivery and drainage coolant pipes (6) and (7).



5 - Loosen the lower screws (8) and upper screws (9) and remove them.



INSTALLATION OF THE OIL-COOLER - RADIATOR GROUP

- To install, reverse the removal procedure.

※1

★ Fill the hydraulic oil tank with oil up to its maximum level.


Hydraulic oil required: approx. 29 ℓ

★ Fill the coolant up to its maximum level.


Coolant: approx. 4 ℓ

※2


Side counterweight screw: 180 Nm

1 - Start the engine to circulate the coolant throughout the system.

★ Make sure that the heating cock is fully open in the cab version.

2 - Pressurise the tank and bleed air. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

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

REMOVAL OF ENGINE-PUMP GROUP

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»).

Disconnect the negative terminal cable (–) from the battery.

★ Drain out the hydraulic oil.

Hydraulic oil: approx. 29 ℓ

★ Drain the engine coolant.

Engine coolant: approx. 4 ℓ

1 - Remove the engine hood, the lateral counterweights, the counterweight, the oil-cooler - radiator group. (For details, see the single removal).

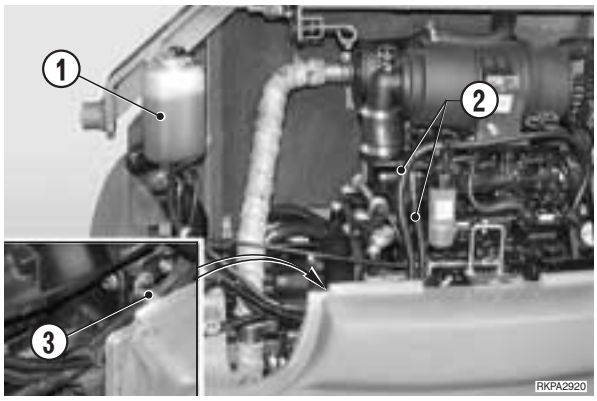
2 - Remove the expansion chamber (1).

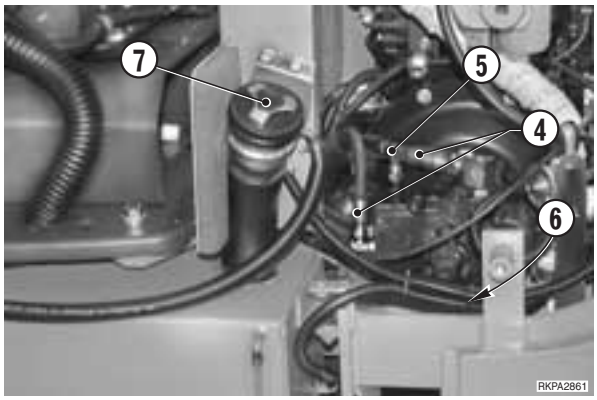
3 - Disconnect the tubes (2) and remove the clip (3).

★ Plug the tubes to prevent entry of impurities.

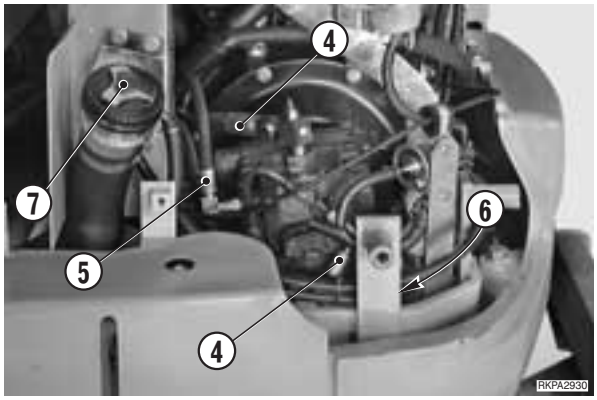
4 - Disconnect from the pumps the Load Sensing tube (5) the delivery tube (4) and the suction tube (6) .

★ Plug the tubes and the unions to prevent entry of impurities.





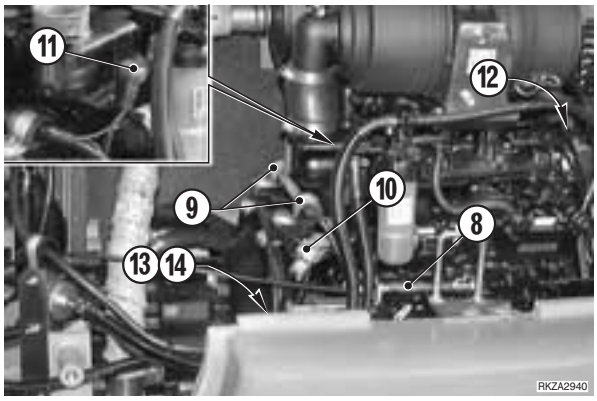
5 - Disconnect the fuel filling (7).



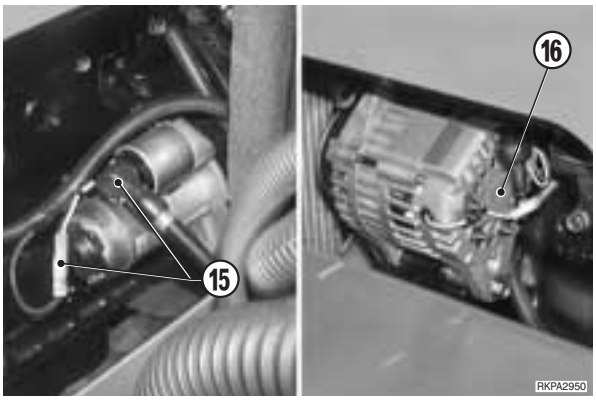
6 - Disconnect the accelerator cable (16) and its sleeve.

※1

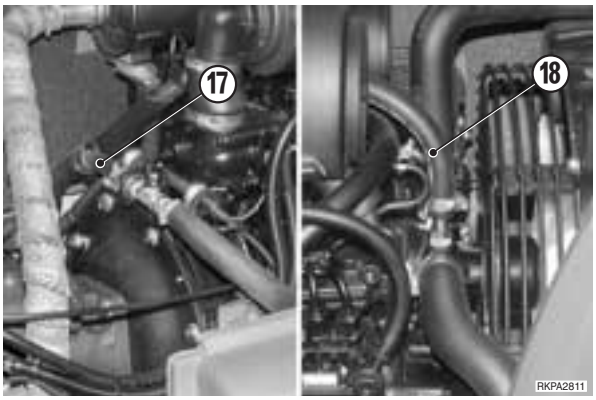
7 - Disconnect the clips (9), the connector (10), the preheating cable (11), the temperature sensor cables (12), the oil pressure indicator (13) and the grounding plait (14).



8 - Disconnect the cables (15) and (16) from the starter motor and from the alternator.



9 - **Only for with cab version.**
Disconnect the pipes (17) and (18).



10 - Loosen the lock screws (nº 3) of the fixed hood (19).

⚠ Remove the screw starting from engine box to the fixed hood (19).

11 - Attach the fixed hood (19) to hoisting tackle and take out it.

★ Check that the motor swings completely free while it is being raised, and that no other parts are damaged.

kg Fixed hood: 60 kg

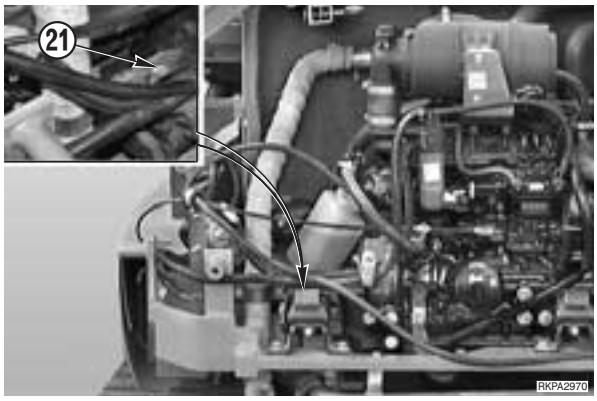
12 - Remove the exhaust terminal (20).

13 - Attach the engine hoisting hook to some hoisting tackle and apply a slight tension to the cable.

14 - Take out the nuts (21) and the four washers (22), 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: 180 kg



INSTALLATION OF THE ENGINE-PUMP GROUP

- To install, reverse the removal procedure.

※1

★ Adjust the accelerator stroke. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

※2

Nm Vibration-damping nuts: 56 Nm

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

⚠ While filling the tank, bleed air from the pump. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

Hydraulic oil required: approx. 29 ℓ

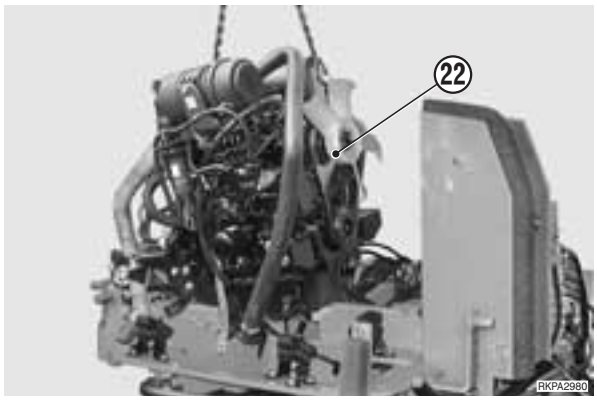
2 - Fill the cooling circuit up to its maximum level.

Coolant: approx. 4 ℓ

3 - Start the engine to circulate the oil and coolant and check that there are no leaks.

4 - Stop the engine, check the levels and, if necessary, top them up.

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



REMOVAL OF THE PUMP

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

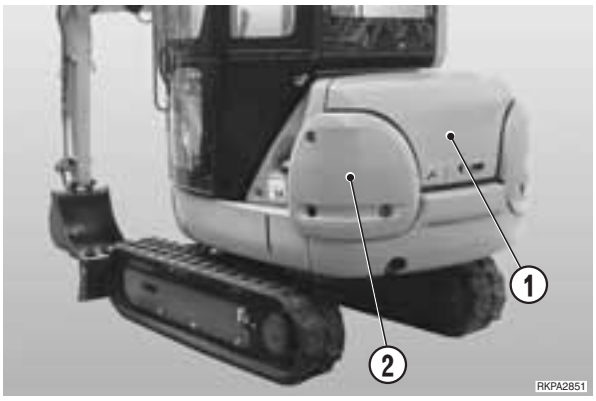
Release all residual pressures from the circuits and the tank. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

★ Drain the hydraulic oil.

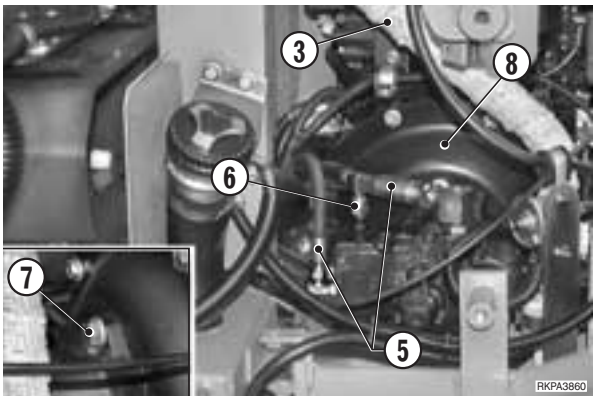
1 - Remove the engine hood (1). (For details, see «REMOVAL OF THE ENGINE HOOD»).

2 - Remove the L.H. side counterweight (2).

kg L.H. side counterweight: 29 kg



PC20R-8



3 - Remove the exhaust pipe (3).

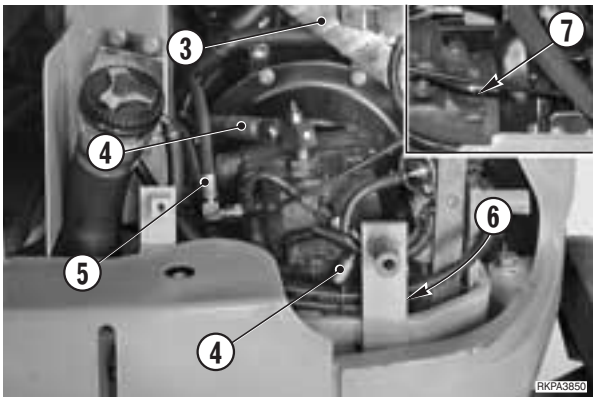
4 - Disconnect from the pump the Load Sensing tube (5), the delivery tube (4) and the suction tube (6).

5 - Attach the pump to some hoisting tackle and apply a slight tension to the cable.

6 - Loosen the screws (7) (PC20R-8 nº 2 - PC27R-8 nº 4) and remove the pump (8). ※1

kg Pump: PC20R-8 19 kg
PC27R-8 22 kg

PC27R-8



INSTALLATION OF THE PUMP

- To install, reverse the removal procedure.

※1

Pump screws: Loctite 262

Nm Pump screws: 75 Nm

Pump shaft: Molikote

1 - Fill the hydraulic oil tank to maximum level.

Hydraulic oil needed: approx. 29 ℓ

Bleed the air from the pump. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

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

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

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

REMOVAL OF ENGINE-PUMP COUPLING

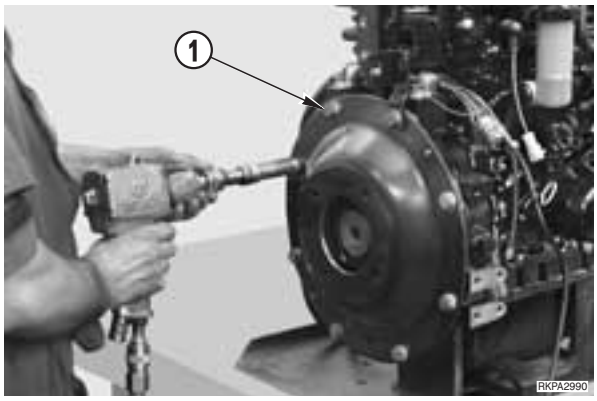
⚠ Lower the working equipment until it is resting on the ground and stop the engine.

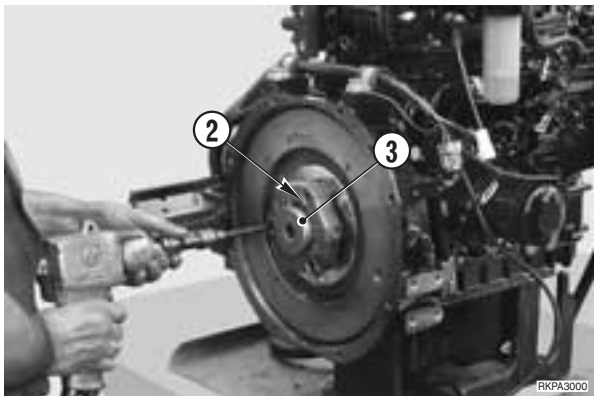
1 - Remove the pump. (For details, see «REMOVAL OF THE PUMP»).

2 - Remove the flywheel cover (1). (8 screws). ※1

3 - Take out the screws (2) and remove the coupling (3). ※2

★ Replace screw every removal.





INSTALLATION OF THE ENGINE-PUMP COUPLING

- To install, reverse the removal procedure.

※1

Nm Flywheel cover screws: 55 Nm

※2

Nm Coupling screws: 55 Nm

1 - Fill the tank up to its maximum level.

Hydraulic oil required: approx. 22 ℓ

⚠ Bleed the air from the pump. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

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

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

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

REMOVAL OF THE LATERAL LOWER COVER

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

1. Remove L.H. cover

1 - Remove cover (1) (No. 3 screws).

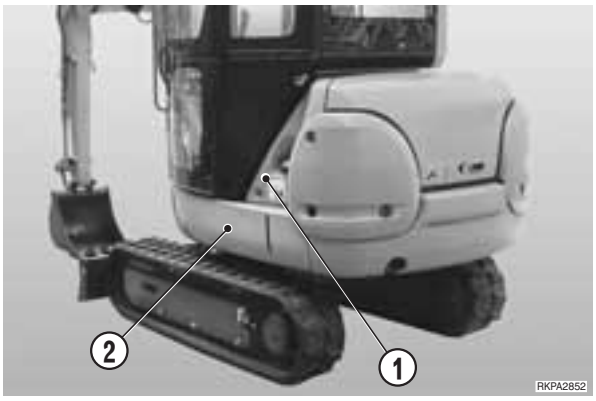
2 - Loosen the lock screws of the cover (2).

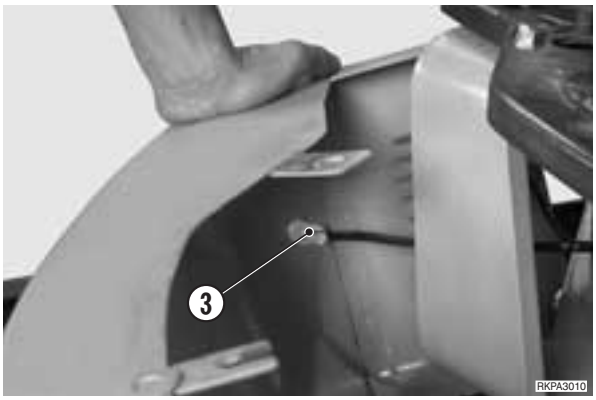
★ Screws: No. 3 upper
No. 2 lower
No. 1 rear

3 - Move away the cover (2).

★ Take care not to damage the electrical socket wiring harness.

4 - Disconnect the electrical socket connectors (3) and take out the cover (2).



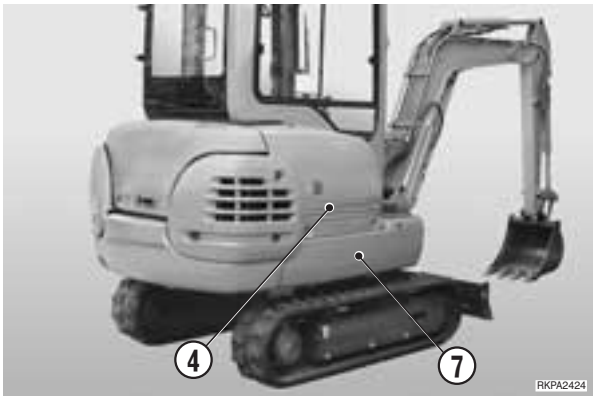


2. Remove R.H. cover

1 - Remove cover (4) (No. 4 screws).

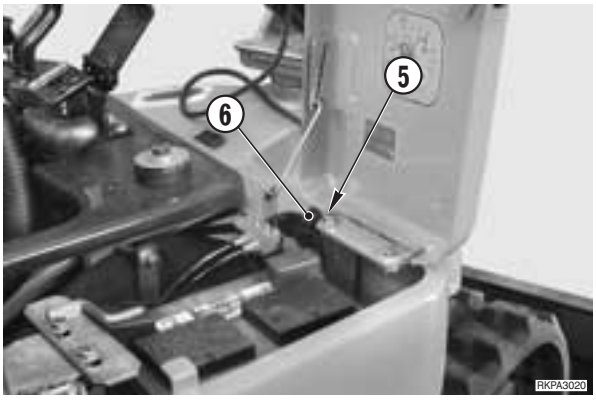
2 - Loosen the screw (5) and take out the general fuse (6).

3 - Loosen the lock screws (No. 6) and take out the cover (7).



INSTALLATION OF THE LATERAL LOWER COVER

- To install, reverse the removal procedure.



REMOVAL OF INNER CONTROL VALVE BOX COVER

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

1 - Remove the R.H. side panels (1). (For details, see «REMOVAL OF THE LATERAL PANELS»).

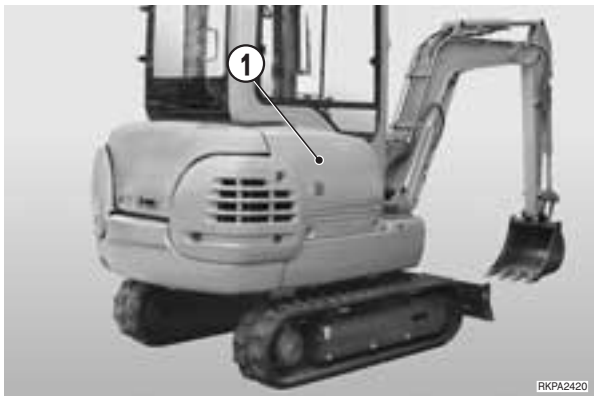
2 - **Only for cabin version.**
Remove the cabin.
(For details, see «REMOVAL OF CABIN»).

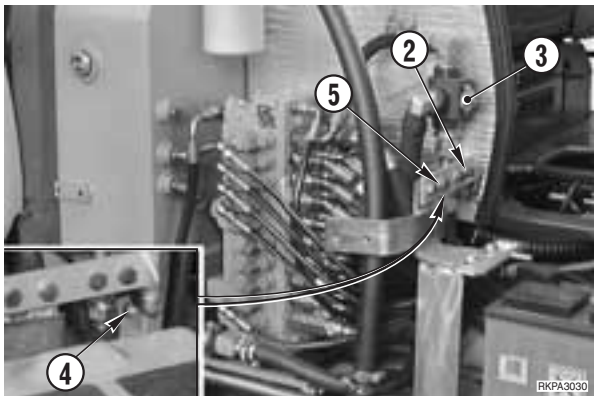
3 - Remove the screws (2) and move away the cock (3) from bracket.

4 - Loosen the screws (4). ※1

5 - Loosen screws (5).

6 - Loosen screws (6) and remove the cover (7).



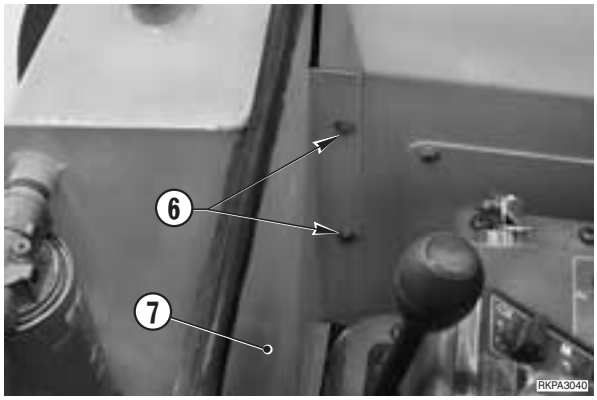


INSTALLATION OF INNER CONTROL VALVE BOX COVER

- To install, reverse the removal procedure.

※1

1 - Fixed the control block cylinder support and make sure that the travel control lever, blade control lever and boom swing control pedal are locked.



REMOVAL OF THE CONTROL VALVE

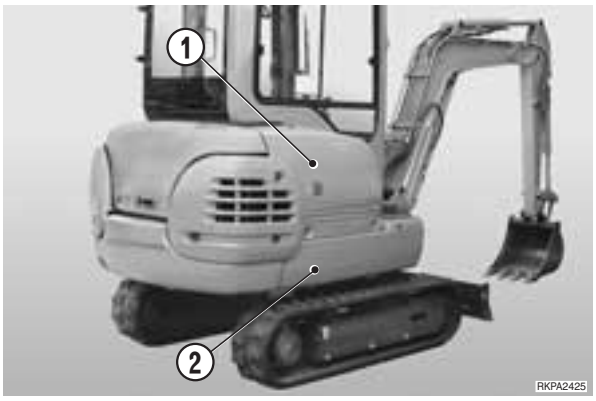
Completely lower the working equipment until it is resting on the ground and stop the engine.

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. 29 ℓ ※1

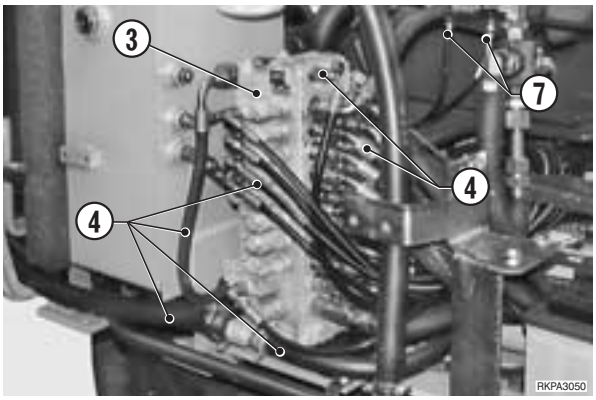
1 - Remove control valve cover (1), lateral lower cover (2) and inner control valve box cover. (For details, see the single removal).



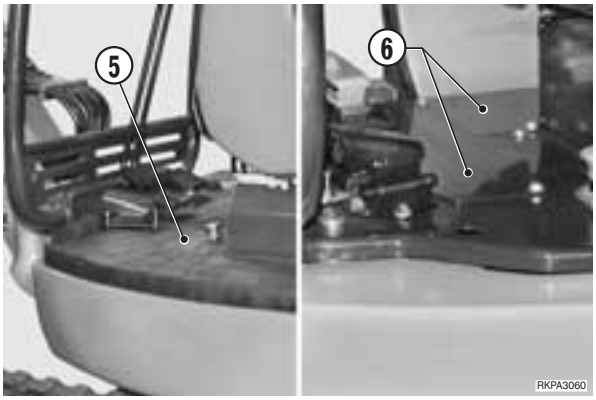
2 - Disconnect all the servo-control, function, delivery and exhaust pipes (4) from control valve (3).

★ Mark the tubes to avoid exchanging them during re-assembly.

★ Plug the tubes to prevent entry of impurities.

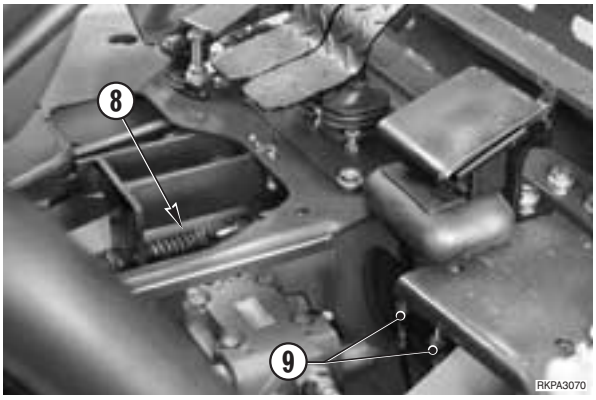


3 - Remove the floor mat (5) and the covers (6).



4 - Disconnect the lever command cable from the cables (7).

5 - Disconnect the cables (8) and (9) from travel control lever, from boom swing control pedal and from bracket. ※2



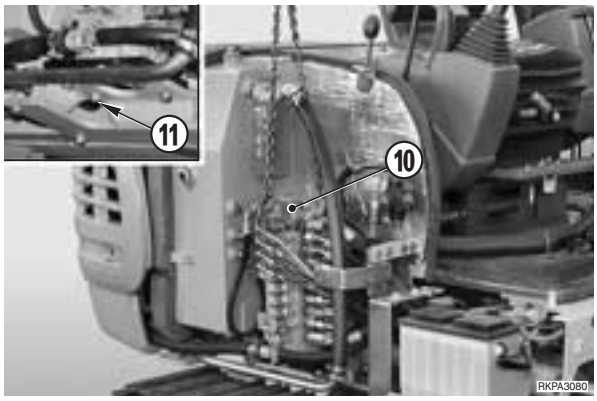
6 - Put a sling around the control valve group (10) and connect it to some hoisting tackle.

7 - Take out the screws (11) and remove the control valve group complete with its support.

⚠ Accompany the command cable.

★ Mark the cable to avoid exchanging them during re-assembly.

kg Control valve group: 31 kg



INSTALLATION OF THE CONTROL VALVE

- To install, reverse the removal procedure.

※1

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

Hydraulic oil: approx. 29 ℓ

2 - Start the engine at low idling to circulate the oil throughout the system.

3 - Pressurise the tank and bleed air from all circuits. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

※2

★ Adjust the travel control lever, blade control lever and boom swing control pedal stroke.
(For detail, see 20. CONTROLS AND ADJUSTMENTS).

REMOVAL OF LEFT-HAND PPC VALVE (ARM-BUCKET)

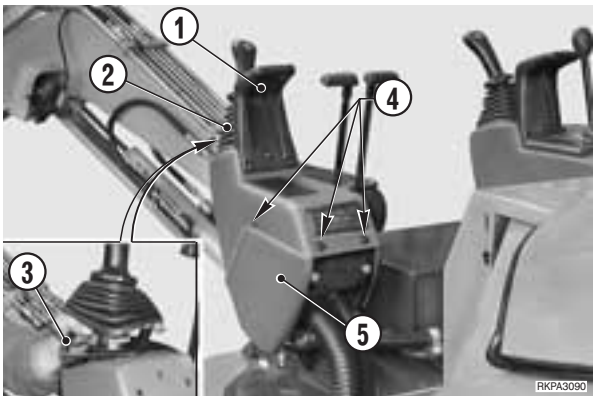
Lower the working equipment until it is resting on the ground, stop the engine and remove the ignition key.

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

1 - Take off the arm-rest (1).

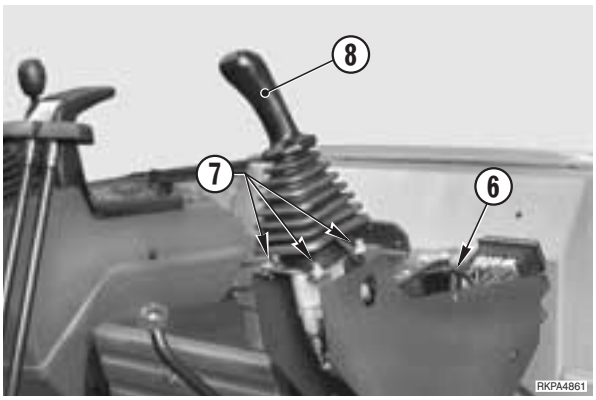
2 - Disconnect cap (2).

★ Take great care not to damage the frame (3).



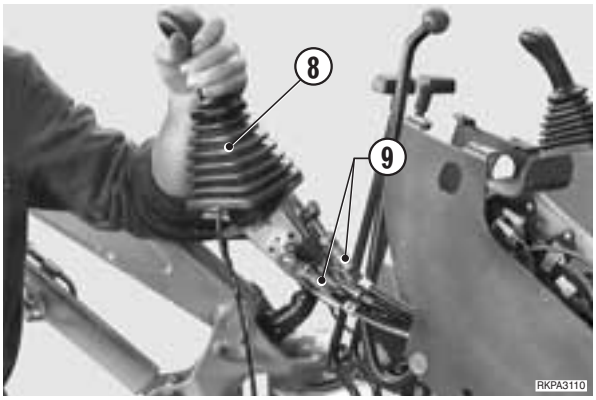
3 - Take out the screws (4) and remove the L.H. cover (5).

4 - Remove the hose-clamp (6), remove the screws (7) and remove the PPC valve (8).



5 - Disconnect the six PPC valve tubes (9) and plug them to prevent entry of impurities.

★ Check that the tubes are marked to avoid exchanging them during re-assembly. ※ 1



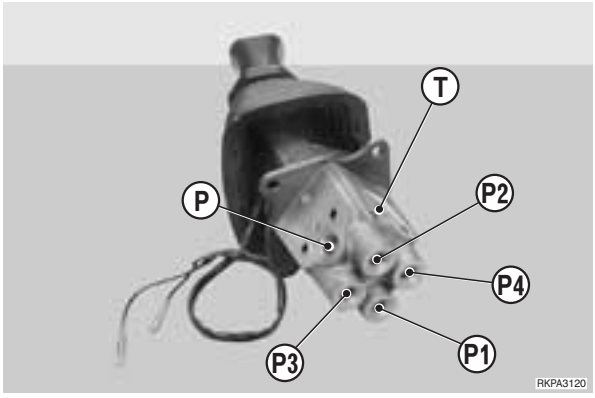
INSTALLATION OF LEFT-HAND PPC VALVE (ARM-BUCKET)

- To install, reverse the removal procedure.

※ 1

★ Check carefully the positions for re-connecting the tubes.

Position					
P	**T**	**P1**	**P2**	**P3**	**P4**
White S	White M	Green A	Green C	Blue L	Blue R



If the couplings are removed from the PPC valves, make sure that the coupling with a filter is mounted on input **P**.

REMOVAL OF RIGHT-HAND PPC VALVE (BOOM-BUCKET)

Lower the working equipment until it is resting on the ground, stop the engine and remove the ignition key.

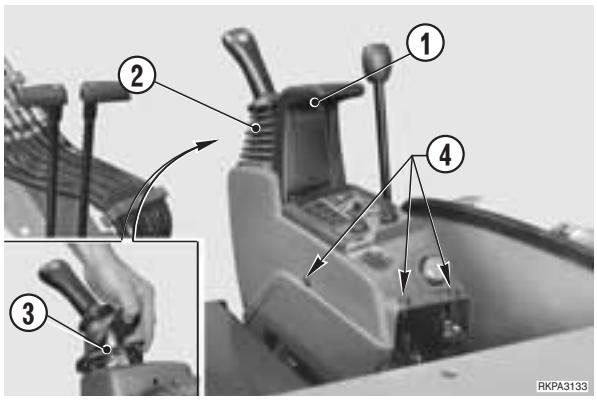
Release all residual pressures from all circuits and from the tank. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

1 - Take off the arm-rest (1).

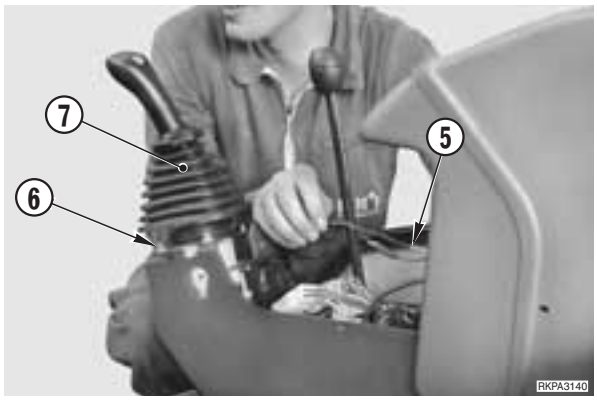
2 - Disconnect cap (2).

★ Take great care not to damage the frame (3).

3 - Take out the screws (4) e overturn the cover toward engine hood.



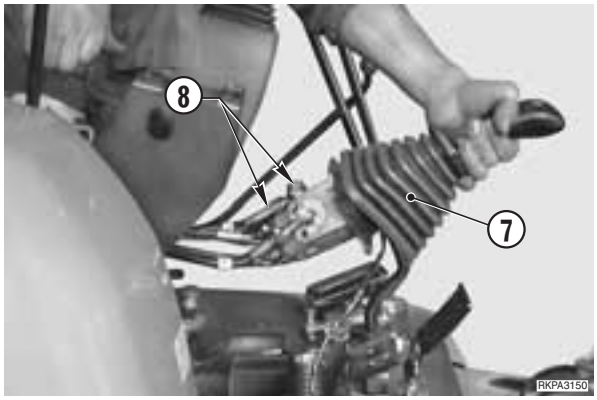
4 - Disconnect the horn connector (5).



5 - Take out the screws (6) and remove the PPC valve (7).

6 - Disconnect the six PPC valve tubes (7) and plug them to prevent entry of impurities.

★ Check that the tubes are marked to avoid exchanging them during re-assembly. ※1



INSTALLATION OF RIGHT-HAND PPC VALVE (BOOM-BUCKET)

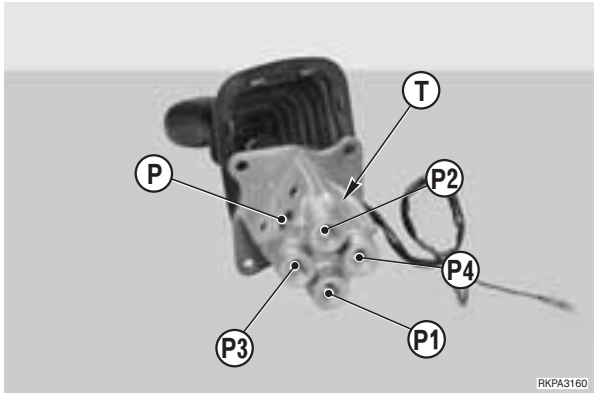
- To install, reverse the removal procedure.

※1

★ Check carefully the positions for re-connecting the tubes.

Position					
P	**T**	**P1**	**P2**	**P3**	**P4**
White M	White S	Red D	Red S	Yellow C	Yellow A

If the couplings are removed from the PPC valves, make sure that the coupling with a filter is mounted on input **P**.

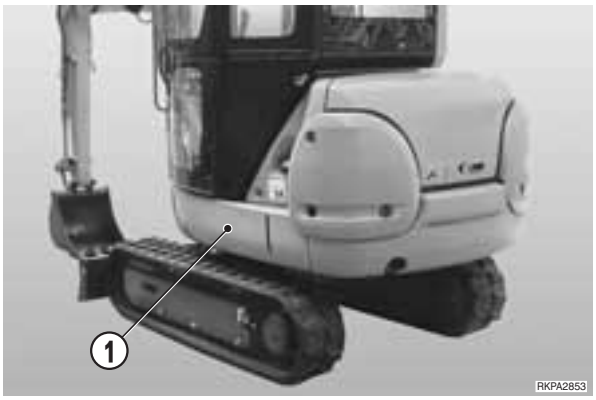


REMOVAL OF THE SERVOCONTROL SOLENOID GROUP

Lower the working equipment until it is resting on the ground, and stop the engine.

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

1 - Remove the L.H. side lower panels (1).
(For details, see «REMOVAL OF THE SIDE LOWER PANELS»).

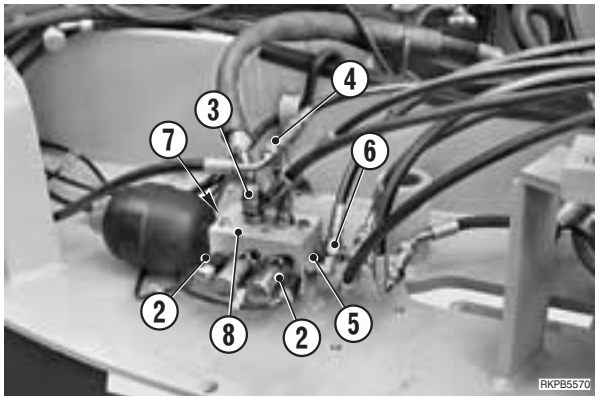


2 - Disconnect the connector (2).
★ Mark the connectors to avoid exchanging them during re-assembly.

3 - Disconnect in sequence:
- the travel increment control pipe (3);
- the union (4);
- the solenoid valve pipe (5);
- the union (6).

★ Plug the tubes to prevent entry of impurities.

4 - Take out the screws (7) and remove the solenoid group (8) complete with accumulator.



INSTALLATION OF THE SERVOCONTROL SOLENOID GROUP

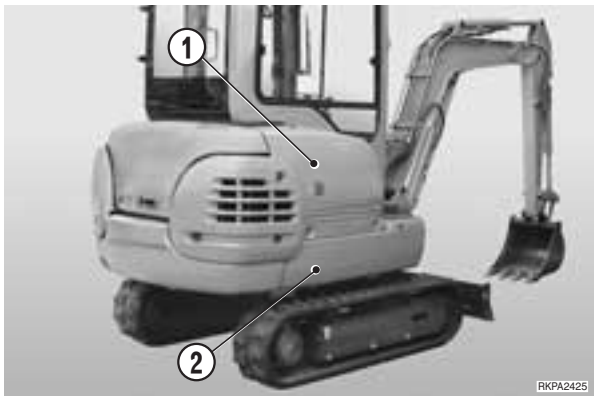
- To install, reverse the removal procedure.

REMOVAL OF THE PLATFORM

Lower the working equipment until it is resting on the ground, and stop the engine.

Release all residual pressures from all circuits and from the tank. (For details, see «20. CONTROLS AND ADJUSTMENTS»). ※1

1 - Remove the canopy or the cab.
(For details, see the removal of the each component).

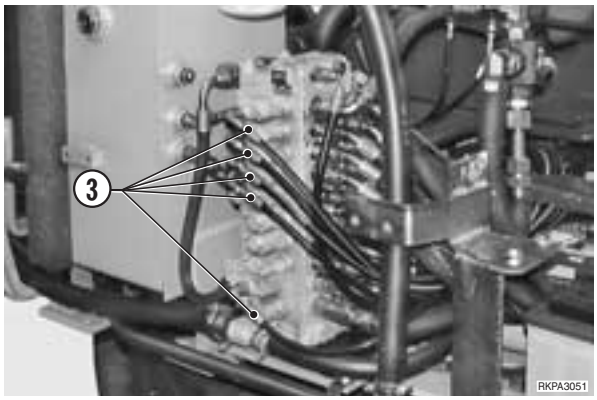


2 - Remove the R.H. lateral cover (1), the lateral lower covers (2) and the inner control valve box cover. (For details, see the single removal).

3 - Disconnect the servo-controls tubes (3) (No. 10).

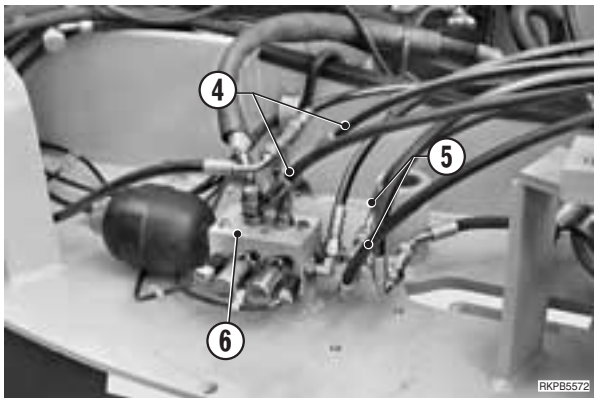
★ Mark the tubes to avoid exchanging them during re-assembly.

★ Plug the tubes and raccords to prevent entry of impurities.

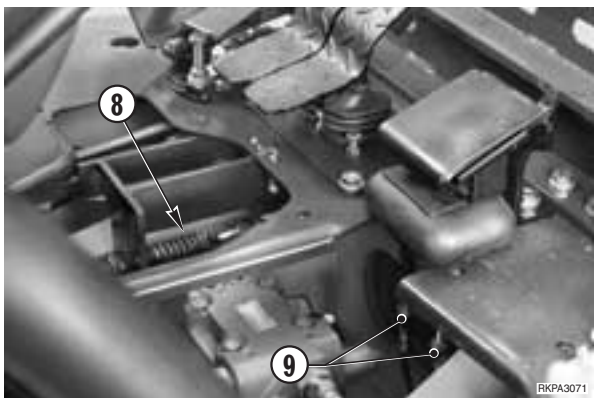


4 - Disconnect (4) and (5) from EV solenoid valve (6).

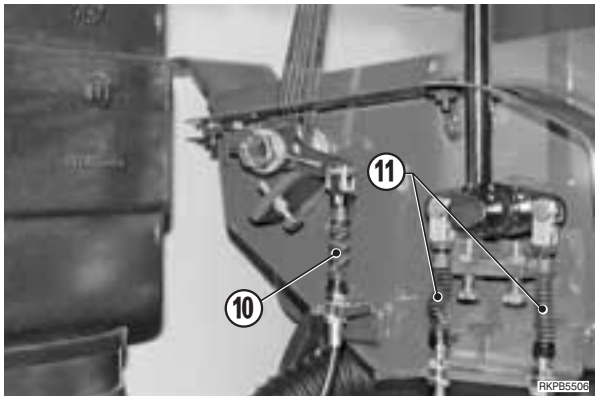
★ Disconnect the connectors travel increment pedal control and the equipment PPC valve pipes.



5 - Disconnect the cables (8) and (9) of the travel motor command e boom swing. ※2



6 - Disconnect the cables (10) and (11) of accelerator and blade command. ※3

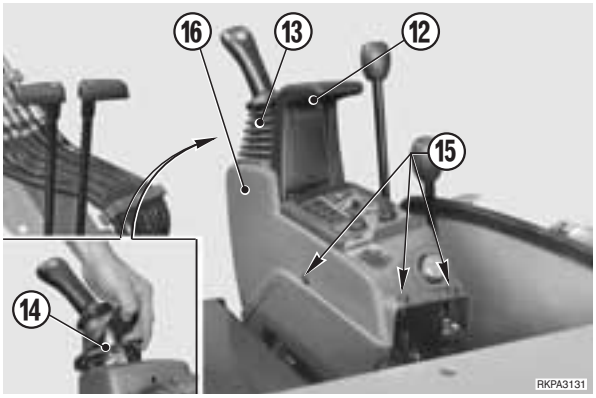


7 - Take off the arm-rest (12).

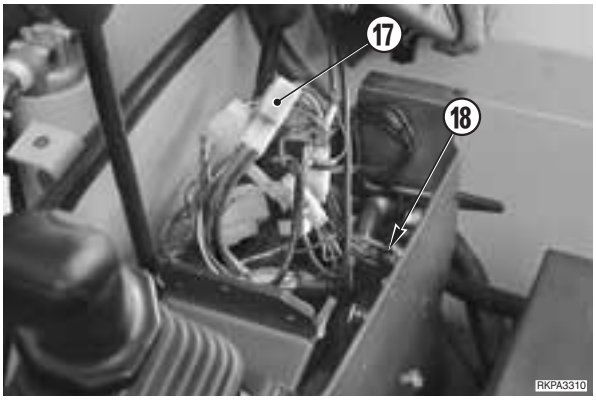
8 - Disconnect cup (13).

★ Take great care not to damage the frame (14).

9 - Take out the screws (15) overturn the cover (16) toward engine hood.



10- Disconnect the connectors (17) and ground cables (18).



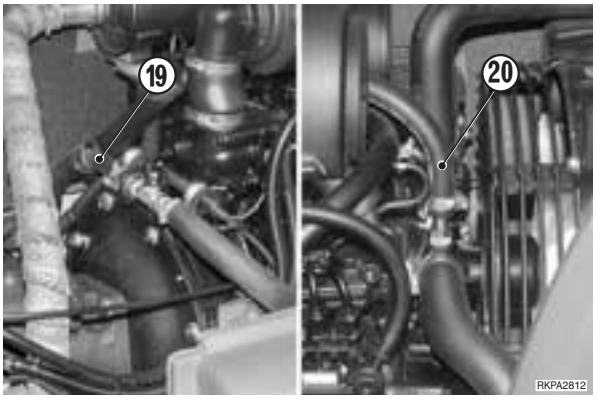
11 - **Only for cabin version.**

★ Drain the coolant.

Coolant: Approx.4 ℓ

12 - Disconnect the return and delivery pipes (19) and (20) to the heating fan.

★ Plug the tubes to prevent entry of impurities.



13 - **Only for canopy version.** Loosen the screws (21) and remove the cover (22).

14 - Attach the platform (23) to some hoisting tackle and apply a slight tension to the cables.

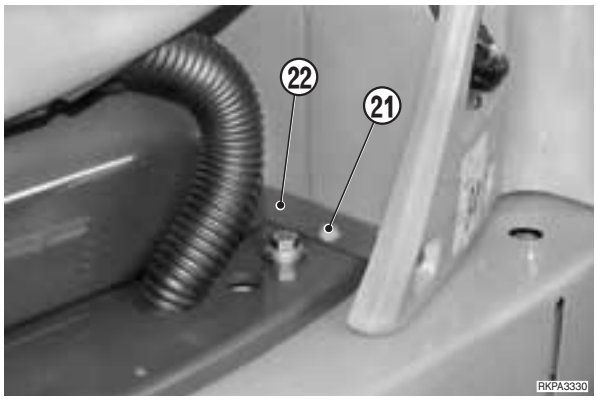
15 - Loosen lock platform screws (24) and remove it.

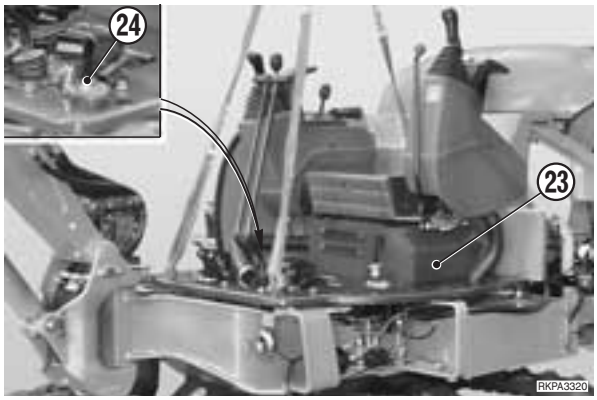
※4

★ Accompany the tubes and wiring harness to avoid damaging them.

★ Check that the platform completely free while it is being raised and that no other parts are damaged.

kg Platform: 40 kg





INSTALLATION OF THE PLATFORM

- To install, reverse the removal procedure.

※1

★ Fill the tank with hydraulic oil up to the maximum level.

Hydraulic oil: approx. 29 ℓ

Only for cabin version.

★ Fill the tank with coolant.

Coolant: approx. 4 ℓ

★ Make sure that the fan cock is fully open.

1 - Start the engine to circulate the oil and coolant and check that there are no leaks.

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

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

※2

★ Adjust the travel control lever and boom swing control pedal stroke (For details, see «20. CONTROLS AND ADJUSTMENTS»).

※3

★ Adjust accelerator control lever and blade control lever stroke (For details, see «20. CONTROLS AND ADJUSTMENTS»).

※4

Nm Platform screws: 320 Nm

REMOVAL OF THE SWIVEL JOINT

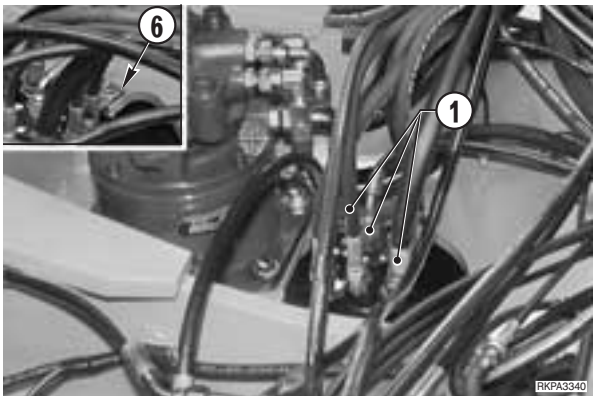
Lower the working equipment until it is resting on the ground, and stop the engine.

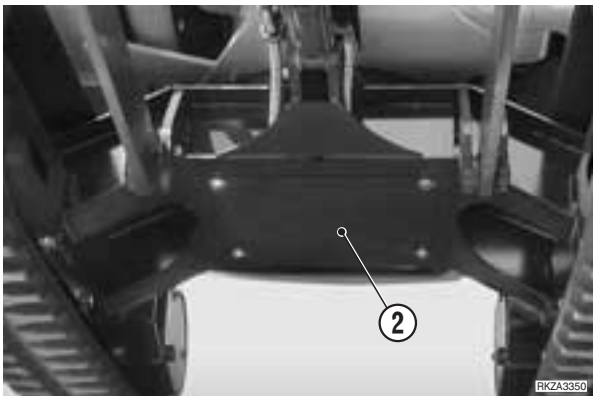
Release all residual pressures from all circuits and from the tank. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

1 - Remove the floor-mat complete.
(For details, see «REMOVAL OF THE PLATFORM»).

2 - Disconnect the upper tubes (3) from the swivel joint (1) (No. 8).
- ★ Mark the tubes to avoid exchanging them during re-assembly.
- ★ Plug the tubes to prevent entry of impurities.

3 - Remove the protective cover (2) from the lower track-frame.

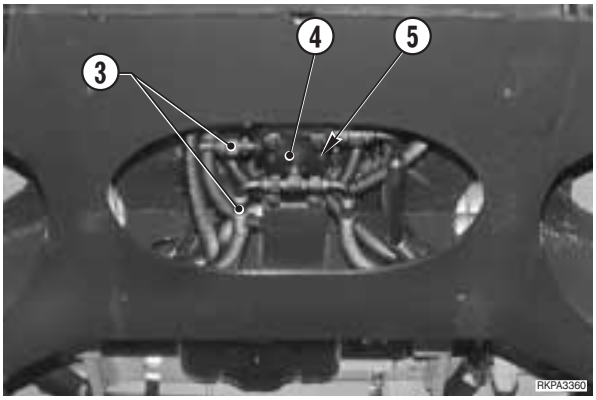




4 - Disconnect the tubes (3) from the swivel joint (4).
- ★ Mark the tubes to avoid exchanging them during re-assembly.
- ★ Plug the tubes to prevent entry of impurities.

5 - Loosen the screws (5) and remove the swivel joint (4).

※ 1



INSTALLATION OF SWIVEL JOINT

- To install, reverse the removal procedure.

★ Make sure that the swivel joint is correctly positioned and that the rotor pin is engaged properly in the bracket.

※ 1

Nm Bracket screws: 85 Nm

1 - Start the engine to circulate the oil, bleed air from the lower circuits and check that tubes are leaktight.

2 - Stop the engine and check the level of the tank.

3 - Pressurise the tank.

REMOVAL OF SWING MACHINERY

⚠ insert the locked swing, lower the working equipment until it is resting on the ground, and stop the engine.

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

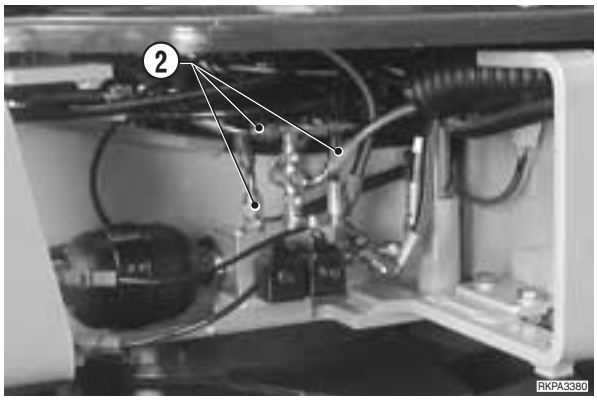
★ Drain out the hydraulic oil.

Hydraulic oil: approx. 29 ℓ

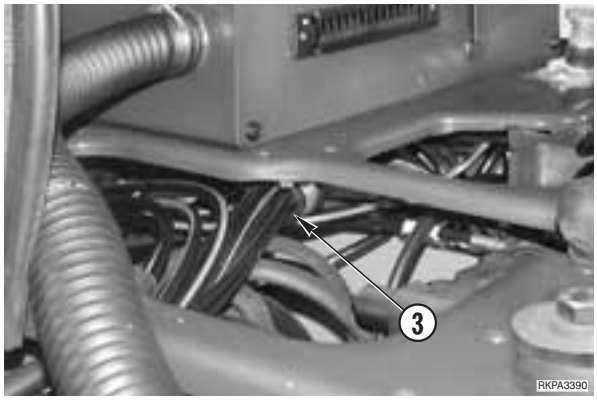
1 - Remove the canopy or the cab. (For details, see the removal of the each component).

2 - Remove the L.H. side lower panels (1). (For details, see «REMOVAL OF THE SIDE LOWER PANELS»).

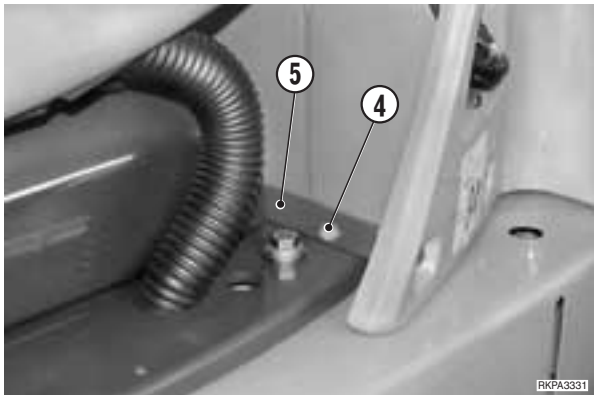
3 - Disconnect the tubes (2) (No. 3)



4 - Remove the hose-clamp (3).



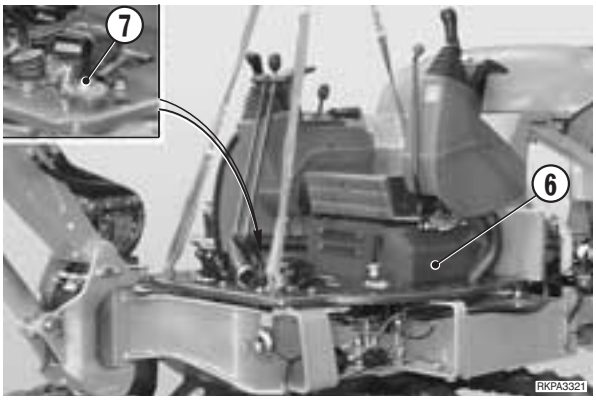
5 - **Only for canopy version.** Loosen the screws (4) and remove the cover (5).



6 - Attach the platform (6) to some hoisting tackle and apply a slight tension to the cables.

7 - Loosen lock platform screws (24) and raise it. ※1

★ Check that the platform completely free while it is being raised, and that no other parts are damaged.



8 - Place a block "**A**" (approx. 15 cm).

★ Keep the hoisting cables connected to platform with slight tension.

PC20R-8

9 - Disconnect the pipes (8) and the drainage pipe (9).

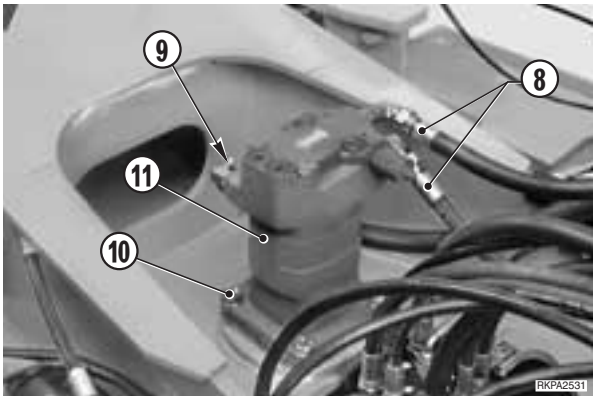
★ Mark the tubes to avoid exchanging them during re-assembly.

★ Plug the tubes to prevent entry of impurities.

10 - Take out the screws (10) and remove the swing machinery (11). ※2

kg Swing machinery: 27 kg

PC20R-8



PC27R-8

11 - Disconnect the delivery pipe (12), the exhaust pipe (13) and the drainage pipe (14).

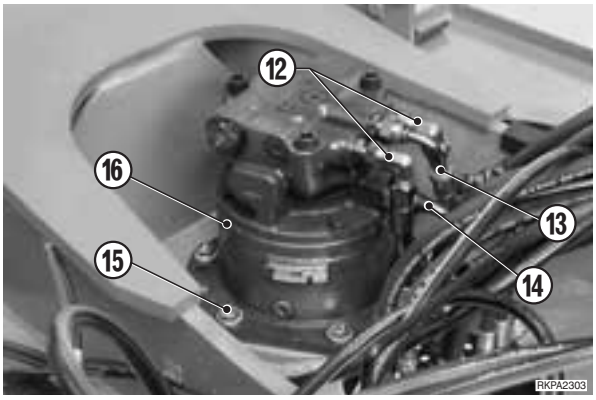
★ Mark the tubes to avoid exchanging them during re-assembly.

★ Plug the tubes to prevent entry of impurities.

10 - Take out the screws (15) (No. 6) and remove the swing machinery (16). ※3

kg Swing machinery: 32 kg

PC27R-8



INSTALLATION OF SWING MACHINERY

- To install, reverse the removal procedure.

※1

Nm Platform screws: 130 Nm

Viti: Loctite 262

※2

※3

Nm Swing machinery screws: 130 Nm

Viti: Loctite 262

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

Hydraulic oil needed: approx. 22 ℓ

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

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

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

REMOVAL OF REVOLVING FRAME

Fully extend the arm and open completely the bucket, lower the equipment until it rests on the ground; stop the engine.

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

★ Drain the hydraulic oil and the fuel.

Hydraulic oil: approx. 29 ℓ

Fuel: max. 35 ℓ

1 - Remove the work equipment.
(For details, see «REMOVAL OF THE WORK EQUIPMENT»).

2 - Removal the boom cylinder. (For details, see «REMOVAL OF BOOM CYLINDER»).

3 - Remove the side lower panels.
(For details, see «REMOVAL OF THE SIDE LOWER PANELS»).

4 - Remove the accumulator (1).

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

5 - Remove the rear counterweight. (For details, see «REMOVAL OF THE REAR COUNTERWEIGHT»).

6 - Remove the platform. (For details, see «REMOVAL OF THE PLATFORM»).

7 - Disconnect the swing circle lubrication tube (2) and remove the coupling (3).

8 - Remove the swing machinery (4). (For details, see «REMOVAL OF SWING MACHINERY»).

9 - Disconnect the upper tubes (5) (No. 8) from the swivel joint.

★ Mark the tubes to avoid exchanging them during re-assembly.

10 - Remove the bracket (6) of the joint.

11 - Loosen and remove the screws (7) that secure the revolving frame. ※1

★ Leave two opposite screws in position for safety.

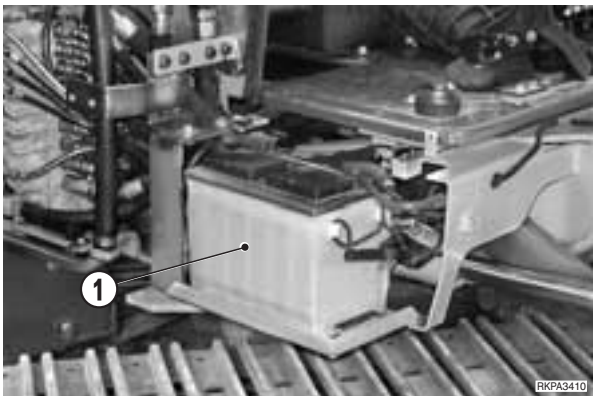
12 - Attach the revolving frame (8) to some hoisting tackle and apply a slight tension to the cables.

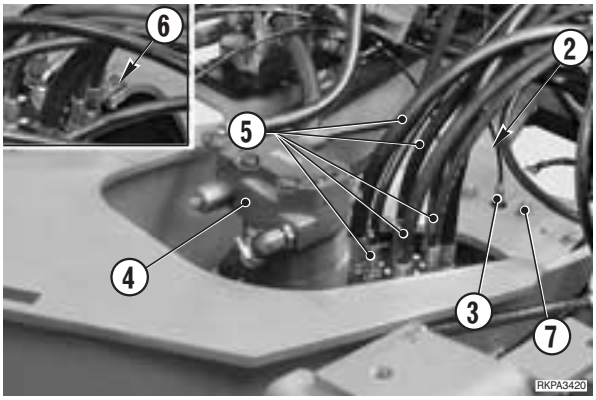
★ Adjust the length of the cables to balance the group.

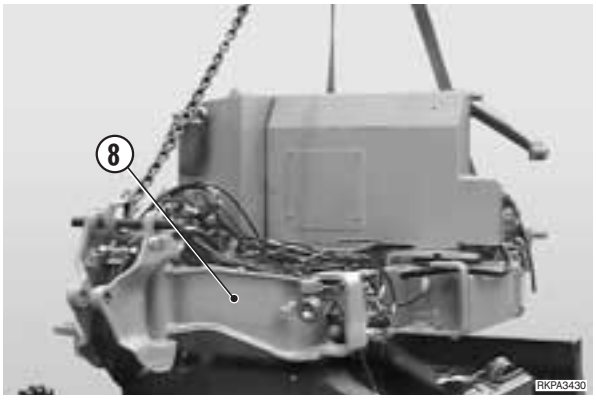
13 - Loosen and remove the two turret screws (7) left in position for safety.

14 - Remove the revolving frame (8). ※2

kg Revolving frame: PC20R-8: 1000 kg
PC27R-8: 1400 kg







INSTALLATION OF REVOLVING FRAME

- To install, reverse the removal procedure.

※1

Turret screws: Loctite 262

Turret screws: 130 Nm

※2

★ Take great care not to damage the reference pins and the swivel joint.

Swing circle lubrication: ASL800050

1- Refill the hydraulic oil tank.

Hydraulic oil: approx. 29 ℓ

2 - Refill the fuel tank.

Fuel tank: max. 35 ℓ

3 - Start the engine to circulate the oil and check that tubes are leaktight.

★ **Only for cab version.**
Make sure that the heating cock is fully open.

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

5 - Stop the engine, check the levels and cooling circuit and eventually top them up.

6 - Pressurise the hydraulic oil tank. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

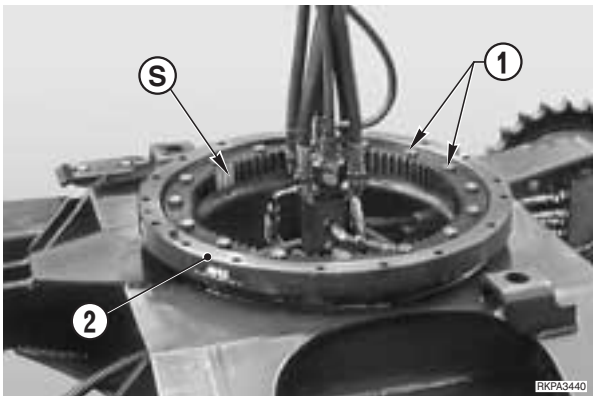
REMOVAL OF THE SWING CIRCLE

1 - Remove the evolving frame (For details, see «REMOVAL OF THE REVOLVING FRAME»).

2 - Take out the screws (1) that secure the swing circle (2). ※1

3 - Remove the swing circle (2). ※2

kg Swing circle: PC20R-8: 25 kg
PC27R-8: 33 kg



INSTALLATION OF THE SWING CIRCLE

- To install, reverse the removal procedure.

※1

★ Before attaching the swing circle, check that the area marked with an «**S**» is placed to the right of the frame.

Screws: Loctite 262

Nm Screws: 130 Nm

※2

Swing circle: ASL800050

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.

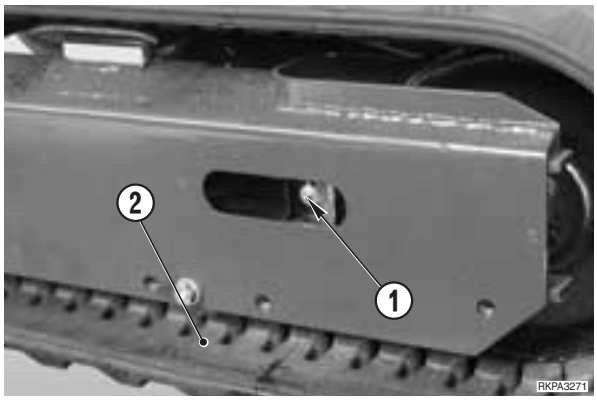
★ If the grease does not run out easily, move the machine slowly backwards and forwards.

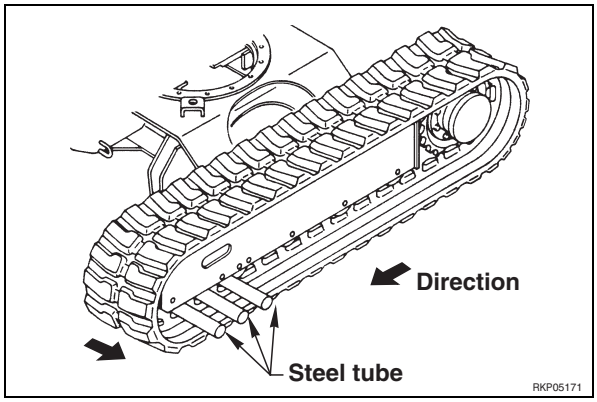
3 - Force the boom downwards to raise the machine.

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: PC20R-8: 88 kg
PC27R-8: 117 kg





INSTALLATION OF RUBBER TRACK-SHOES

- To install, reverse the removal procedure.

※1

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

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 (1) 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).

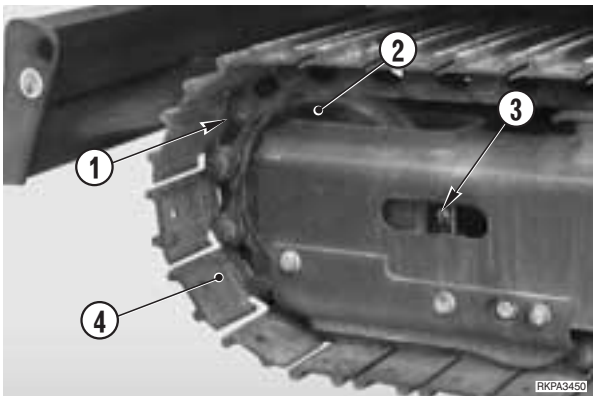
★ First remove the safety cotter-pin.

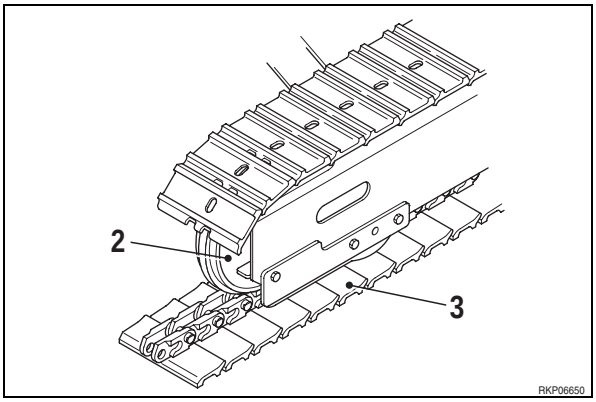
★ While dismantling the track-shoe, support the part of the track-shoe that is wound round the idler with a block placed under the shoe-ribbing. Once the track shoe has been unfastened, lay it on the ground.

4 - Keeping the horizontal end-piece of the track-shoe raised, move the machine in order to remove the track-shoe (4) 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 (4).

kg Track-shoe: PC20R-8: 159 kg
PC27R-8: 172 kg





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 (3).

REMOVAL OF THE SPROCKET WHEEL

1 - Remove the track-shoe. (For details, see «REMOVAL OF TRACK-SHOES»).

2 - Rotate the turret 90° away from the side of the wheel to be removed.

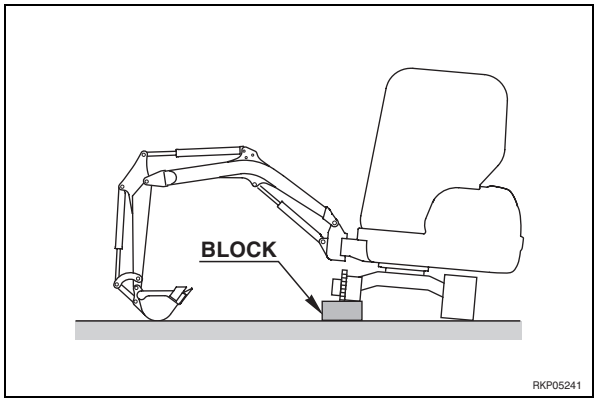
3 - Push down with the boom perpendicular to the ground and raise the lower track-frame.

⚠ Insert safety blocks underneath the track-frame.

4 - Take out the screws (1) and their washers.

5 - Remove the sprocket wheel (2). ※1

kg Sprocket wheel: 7 kg



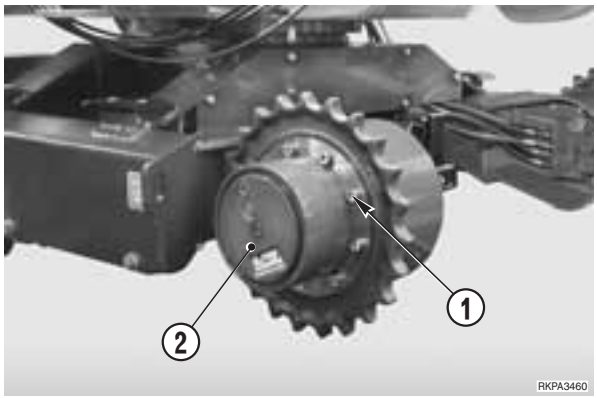
INSTALLATION OF THE SPROCKET WHEEL

- To install, reverse the removal procedure.

※1

Screws: Loctite 262

Nm Screws: 120 Nm



REMOVAL OF THE FINAL DRIVE

1 - Remove the sprocket wheel. (For details, see «REMOVAL OF THE SPROCKET WHEEL»).

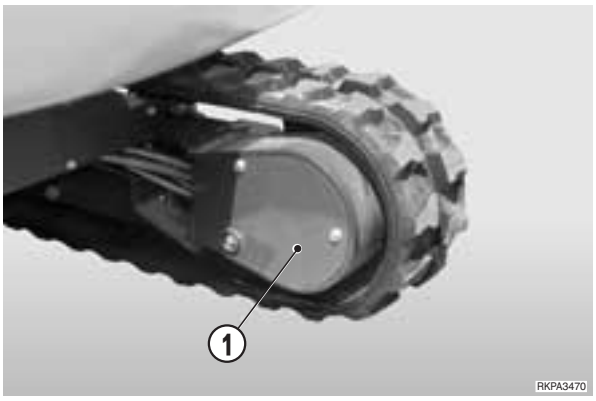
2 - Remove the protective cover (1).

3 - Disconnect the tubes (2) from the travel motor. Plug the tubes and the motor fittings to prevent entry of impurities.

4 - Take out the screws (3). ※1

5 - Remove the final drive (3).

kg Complete final drive: 35 kg



INSTALLATION OF THE FINAL DRIVE

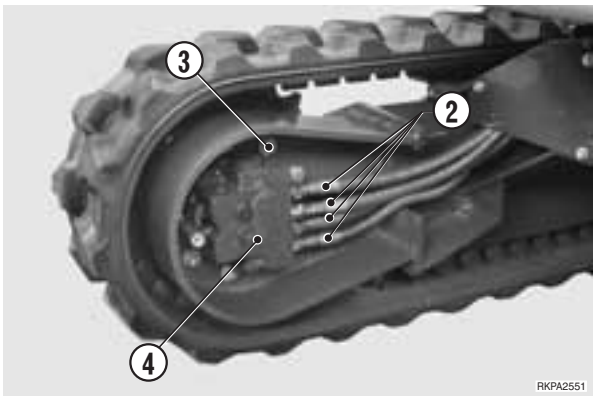
- To install, reverse the removal procedure.

※1

Final drive screws: Loctite 262

Nm Final drive screws: 120 Nm

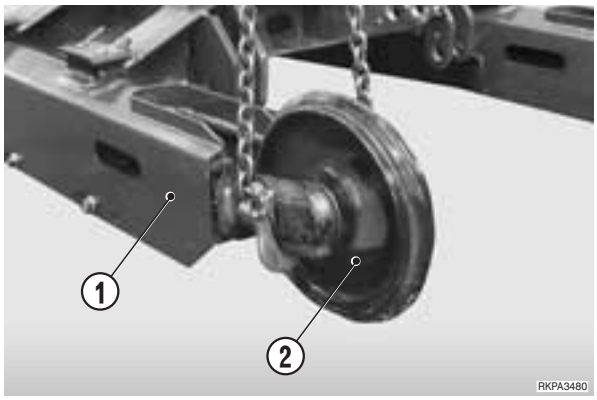
1 - Start the engine and bleed air from the travel motors. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

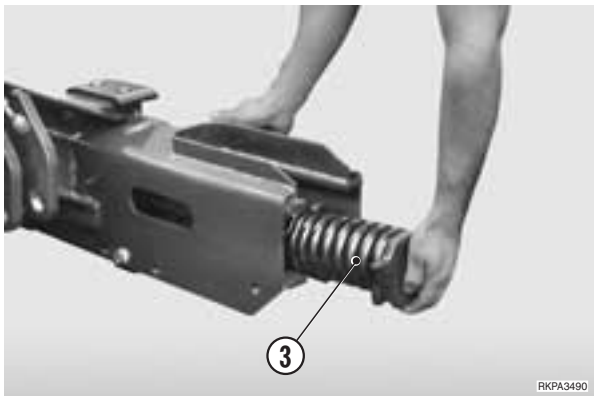


REMOVAL OF IDLER AND RECOIL SPRING

1 - Remove the track-shoe (For details, see «REMOVAL OF RUBBER TRACK-SHOES» or «REMOVAL OF STEEL TRACK-SHOES»). ※1

2 - Pull the idler (2) and recoil spring (3) out of the lower track-frame (1).





INSTALLATION OF IDLER AND RECOIL SPRING

- To install, reverse the removal procedure.

※1

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

DISASSEMBLY AND ASSEMBLY OF THE SPRING RECOIL AND THRUST CYLINDER GROUPS

1 - Spring recoil group

Disassembly

1 - Place the group (1) beneath a press on which the tool **B1** is mounted.

⚠ The spring is mounted with a strong pre-loading. Make sure that the group is well-centred and that it is standing perfectly flat.

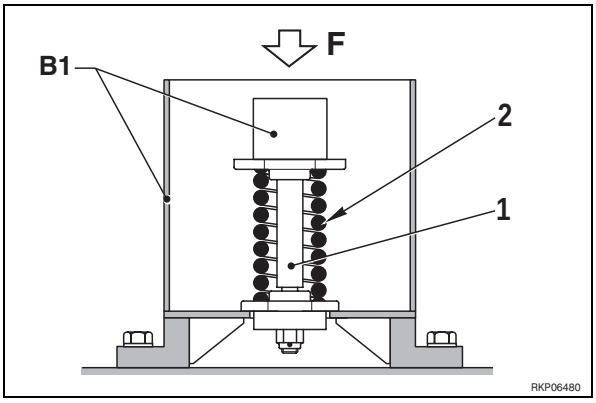
2 - Increase pressure slowly and compress the spring (2).

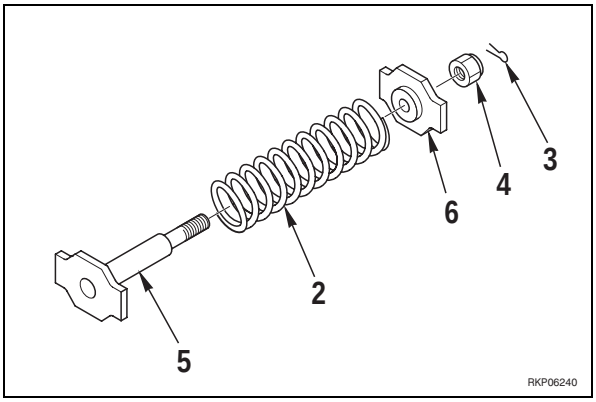
3 - Maintaining pressure, remove the cotter pin (3) and the nut (4). ※1

4 - Slowly release pressure until the spring is completely released.

★ Length of released spring: 248 mm

5 - In sequence remove the tic-rod (5), the spring (2) and the plate (6).





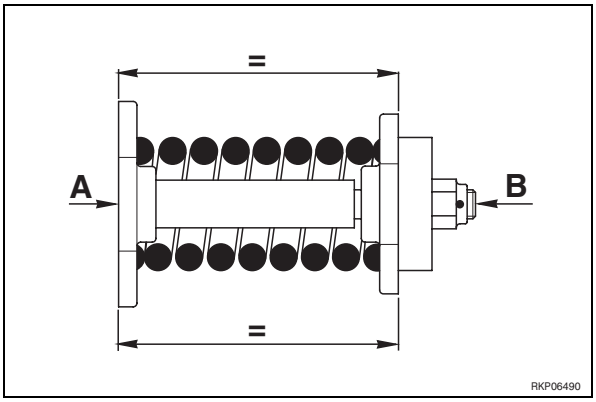
Assembly

- To re-assemble, reverse the dismantling procedure.

※1

★ Tighten the nut (4) up to the indicated length of the spring. (See «40. STANDARD MAINTENANCE»). Mount the cotter pin (3).

★ After assembly, check that the parallelism error between the faces A and B is less than 0.5 mm.



2 - Thrust cylinder

Disassembly

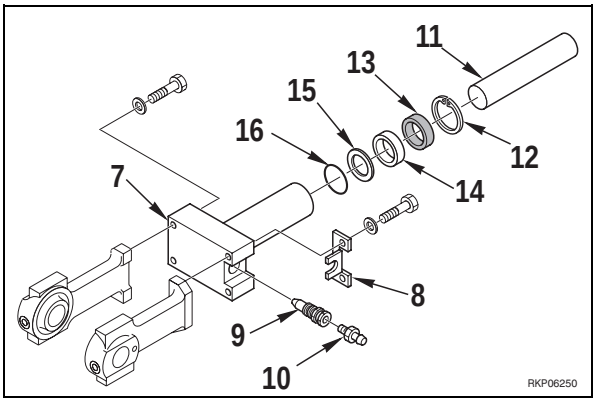
1 - Take out plate (8), valve 89) and nipple (10) from cylinder (7).

2 - Take out the piston (11) out of the cylinder.

3 - Take out the snap ring (12), the gasket (13), the spacer (14), the anti-extrusion ring (15), and the O-ring (16).

Assembly

- To re-assemble, reverse the dismantling procedure.

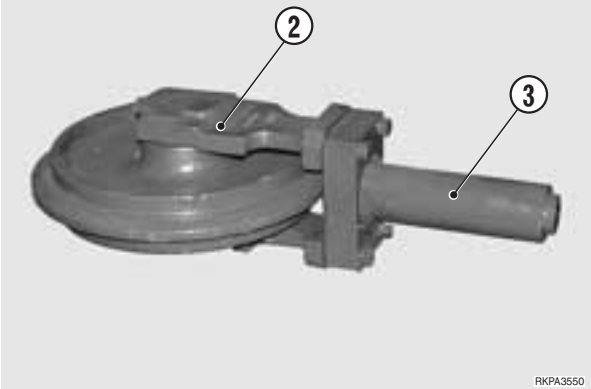


DISASSEMBLY OF THE IDLER

★ When dismantling the idlers, all seals must be substituted.

★ Remove the cap (1) and drain the oil.

Quantity of oil: approx. 70 cc.

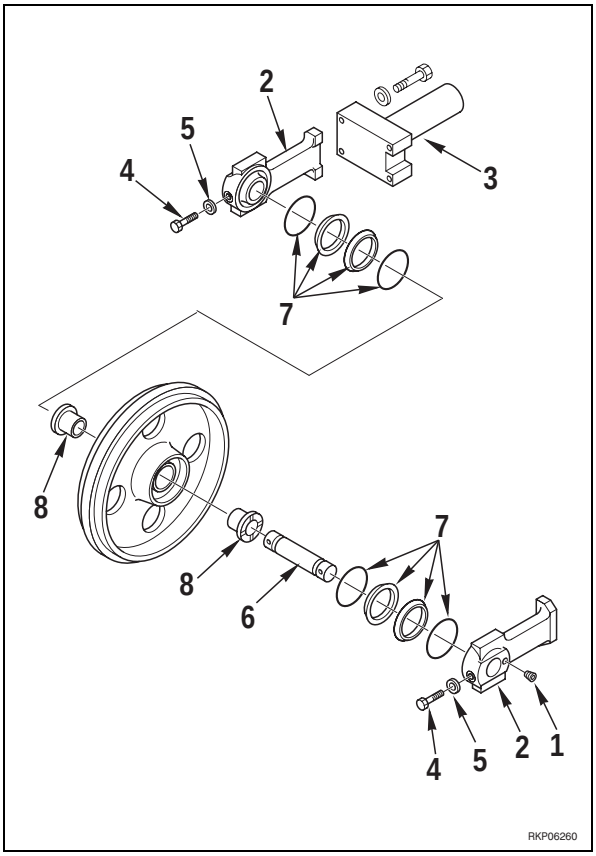


1 - Disconnect the group (3) from the supports (2).

2 - Remove the screws (5) and their washers (5).

3 - Using a press, take out the pin (6) and remove the supports (2) and the lateral seals (7). ※1

4 - Remove the bushings (8).



ASSEMBLY OF THE IDLER

• To re-assemble, reverse the dismantling procedure.

※1

★ Use a press for the final assembly.

1 - Fill up with oil.

Oil: 70 cc.

2 - Tightening the cap (1).

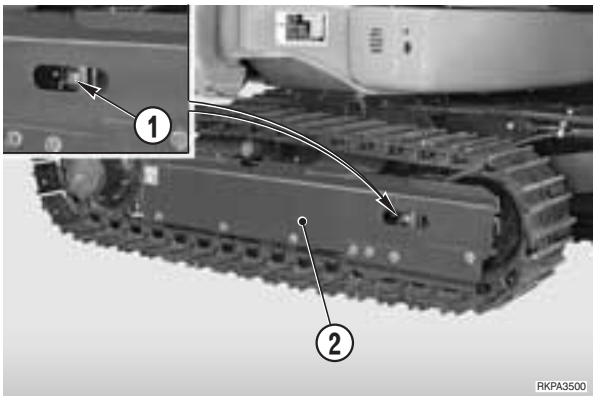
REMOVAL OF THE TRACK ROLLERS

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

The grease contained in the cylinder is under pressure and could seriously injure the Operator. For this reason, the valve should not be loosened for more than one turn.

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

※1

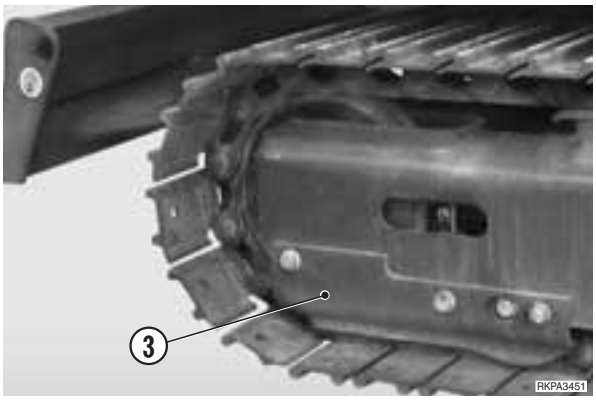


2 - Rotate the turret 90° towards the removal side and force the boom down to raise the lower track-frame (2).

3 - **Only for steel track-shoes**
Remove the guard (3).

4 - Loosen the screws (4) and remove the rollers (5).

※2



INSTALLATION OF THE TRACK ROLLERS

- To install, reverse the removal procedure.

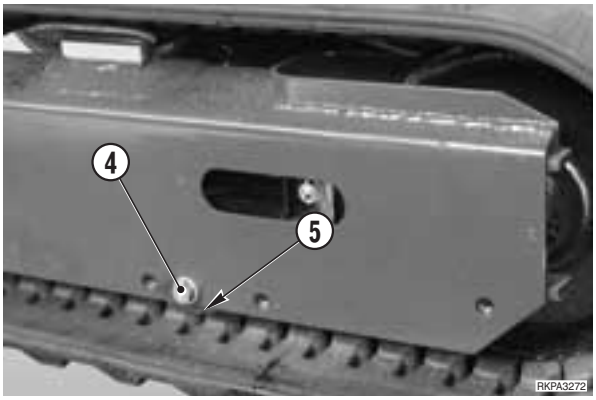
※1

★ With the lower track-frame (2) raised, install the idler rollers (5), and slightly tighten the screws (4).

★ Slowly lower the lower track-frame (2) until the rollers (5) rest fully on the track-shoe, then finish tightening the screws (4).

Roller screws: Loctite 262

Nm Roller screws: 170 Nm



※2

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

REMOVAL OF BOOM CYLINDER

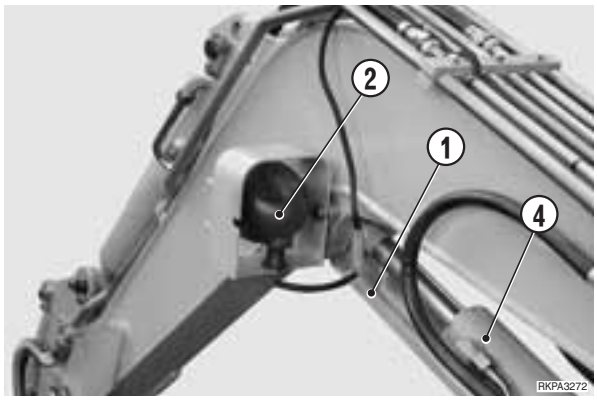
⚠ Fully extend the arm and open the bucket completely. Lower the equipment until it rests on the ground.

1 - Remove the protection (1) and the relative shoes. ※1

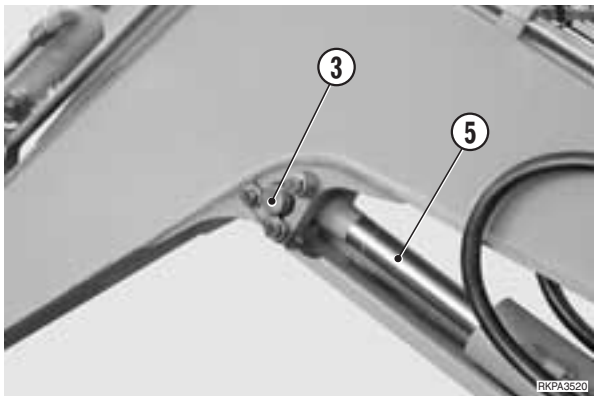
2 - Remove the working beam (2).

3 - Stop the engine, release the pressures in the cylinder by moving the right-hand PPC valve lever several times.

※5



4 - Remove the pin (3). ※2 ※3



5 - Lower the cylinder (4) until it rests on a stand «A».

6 - Start the engine to retract the piston (5).

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

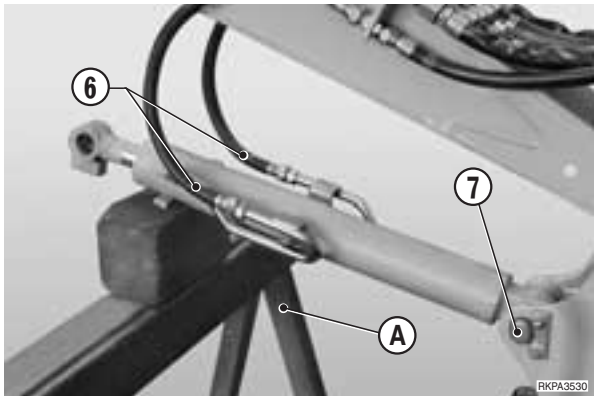
7 - Stop the engine and release the residual hydraulic pressures. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

7 - Disconnect the tubes (6) and plug them. Also plug the holes in the cylinder to prevent entry of impurities. ※5

9 - Remove the pin (7). ※3 ※4

10 - Remove the cylinder (4).

kg Boom cylinder: PC20R-8: 20 kg
PC27R-8: 25 kg



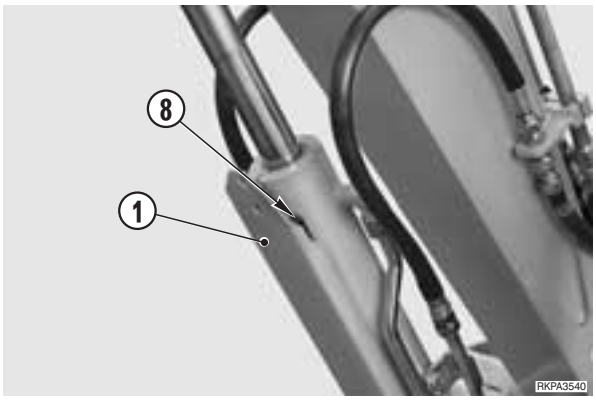
INSTALLATION OF THE BOOM CYLINDER

- To install, reverse the removal procedure.

※1

★ Check the centering and the smooth movement of the protection (1) on the shoes (7).

Shoes and guides: ASL800050

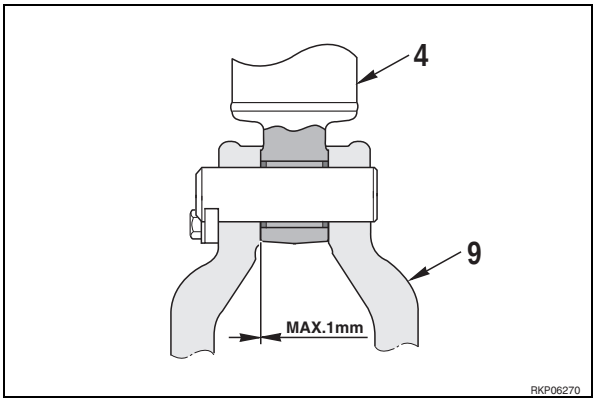


※2

★ Adjust the shim thickness so that the clearance between cylinder (4) and swing bracket (9) is below 1 mm.

※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

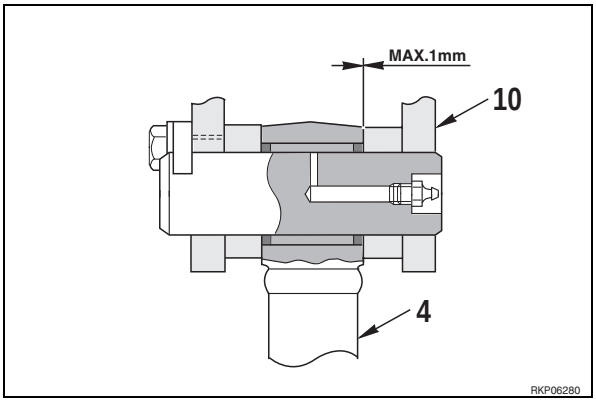
★ Adjust the shim thickness so that the clearance between cylinder (4) and boom (10) is below 1 mm.

※5

Internal bushings: ASL800050

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

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



REMOVAL OF THE ARM CYLINDER

⚠ Lower the working equipment to the ground with all safety devices engaged. Rest the back of the bucket on the ground with the arm in a vertical position.

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

2 - Place a block «A» beneath the cylinder (1).

3 - Remove the pin (2). ※1 ※2

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

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

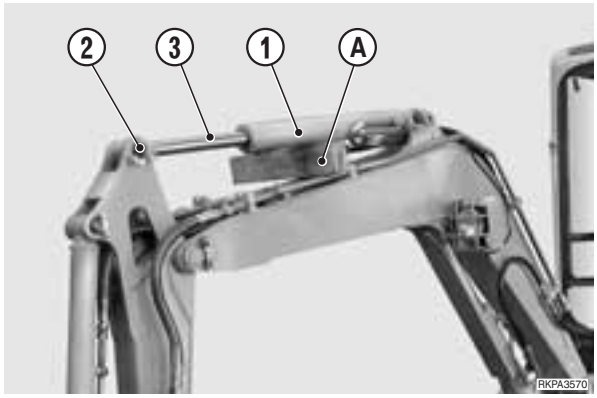
5 - Stop the engine and release any residual hydraulic pressures. (For details, see «20. CONTROLS AND ADJUSTMENTS»).

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

7 - Remove the pin (5). ※1 ※2

8 - Remove the cylinder (1).

kg Arm cylinder: PC20R-8: 20 kg
PC27R-8: 28 kg



INSTALLATION OF THE ARM CYLINDER

- To install, reverse the removal procedure.

⚠ 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.

※1

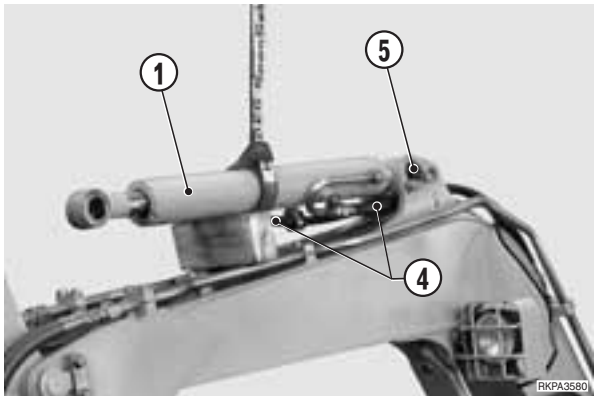
★ Adjust the shim thickness so that the clearance between cylinder and arm is below 1 mm.

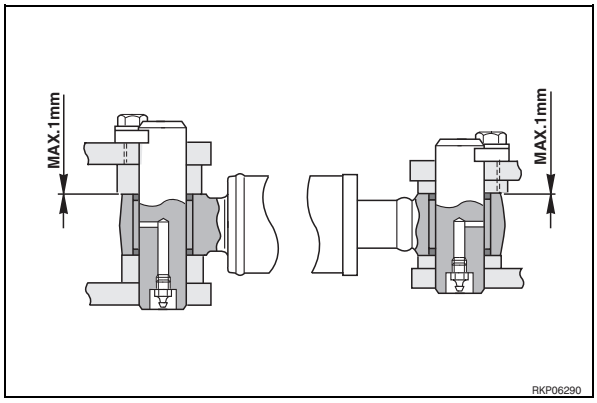
※2

Internal bushings: ASL800040

- 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.

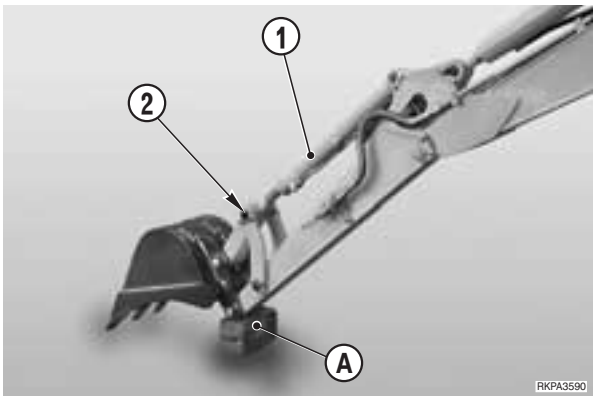




REMOVAL OF THE BUCKET CYLINDER

⚠ 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.



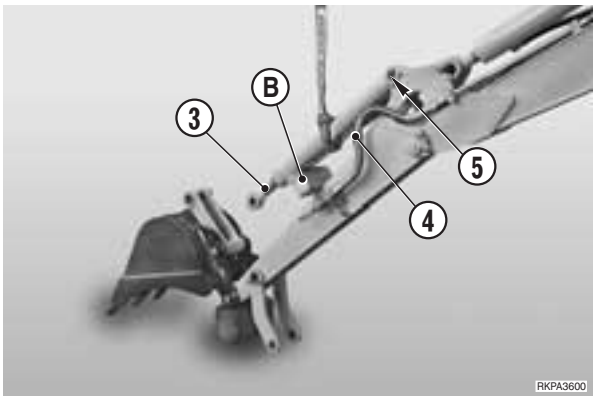
2 - Place a block «B» beneath the cylinder (1) and remove the pin (2). ※2 ※3

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.

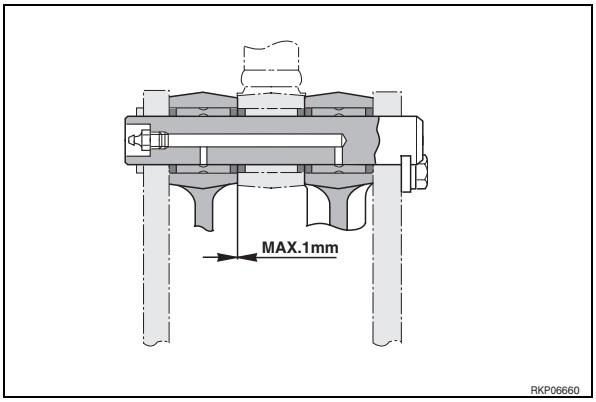


6 - Put a sling round the cylinder (1).

7 - Remove the pin (5). ※2 ※3 ※4

8 - Remove the cylinder (1).

kg Bucket cylinder: PC20R-8: 11 kg
PC27R-8: 12 kg



INSTALLATION OF THE BUCKET CYLINDER

- To install, reverse the removal procedure.

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

※1

★ Adjust the shim thickness so that the clearance between cylinder and bucket link and between arm and bucket link is below 1 mm.

※2

Internal bushings: ASL800040

- 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.

REMOVAL OF THE BOOM SWING CYLINDER

⚠ Swing the work equipment approx. 45° to the left and extend completely the boom swing cylinder. Lower the working equipment to the ground with all safety devices engaged. Rest the back of the bucket on the ground with the arm in a vertical position.

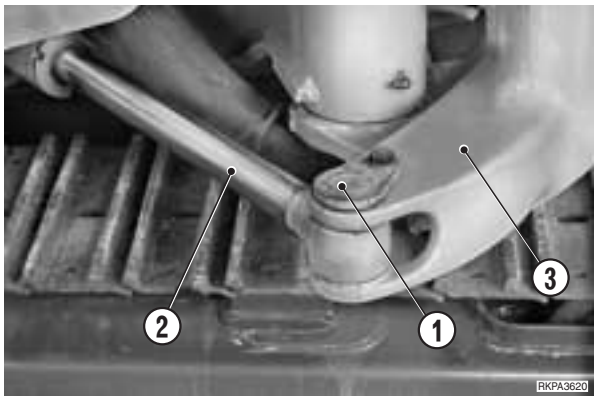
1 - Stop the engine and move the command pedal boom swing cylinder several times to release residual pressures.

2 - Remove the pin (1) and disengage the piston rod (2) from swing support (3). ※1 ※2 ※3

3 - Start the engine and retract the piston rod (4) completely.

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

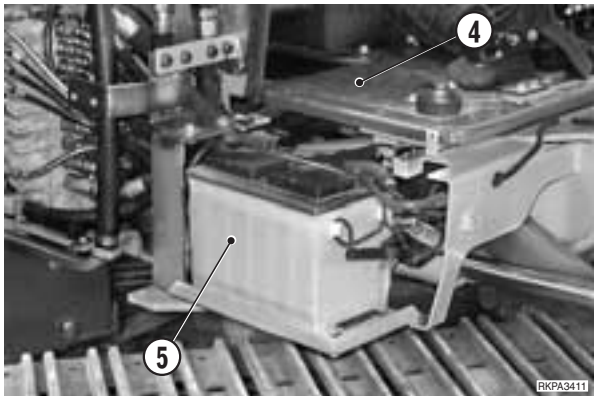
4 - Stop the engine and move the command pedal boom swing cylinder several times to release residual pressures. (For details, see «20. CONTROLS AND ADJUSTMENTS»).



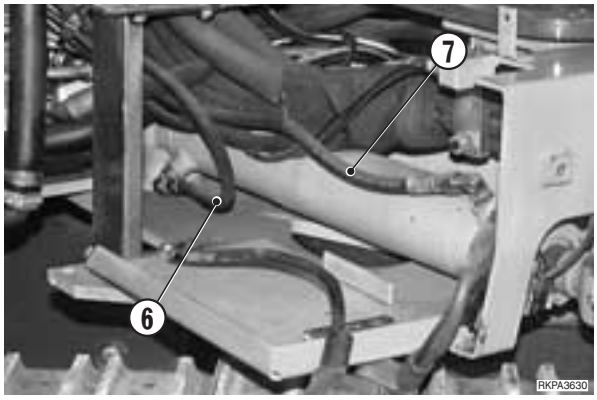
5 - **Only for cab version.**
Remove the cab floor (4). (For details, see «REMOVAL OF CAB»).

6 - Remove the accumulator (5).

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



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



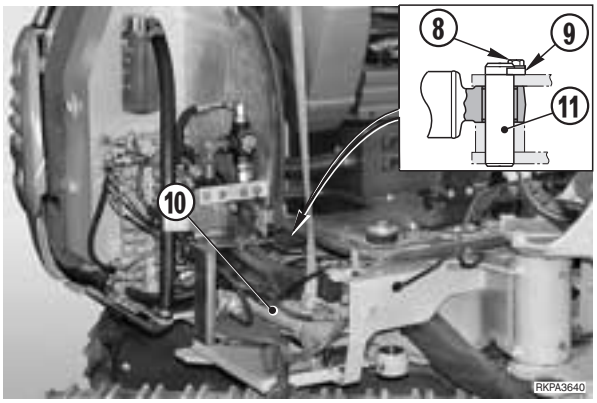
8 - Loosen the screws (8) and remove the plate (9).

9 - Put a sling round the cylinder (10) and apply a slight tension to the cables.

10 - Take out the pin (11) and remove the cylinder (10).

※2 ※3 ※4

kg Boom swing cylinder: PC20R-8: 17 kg
PC27R-8: 22 kg

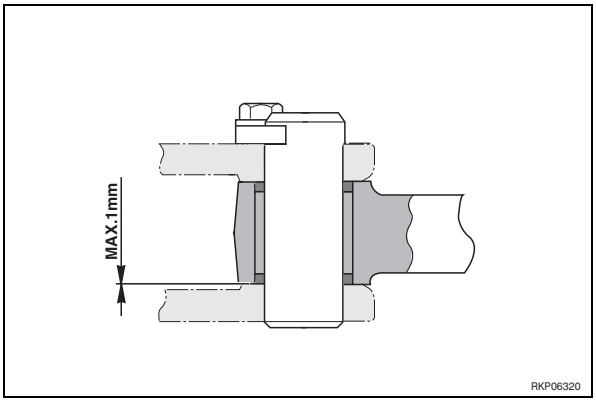


INSTALLATION OF THE BOOM SWING CYLINDER

- To install, reverse the removal procedure.

※1

★ Adjust the shim thickness so that the clearance between cylinder (10) and swing bracket (2) is below 1 mm.



※2

⚠ 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.

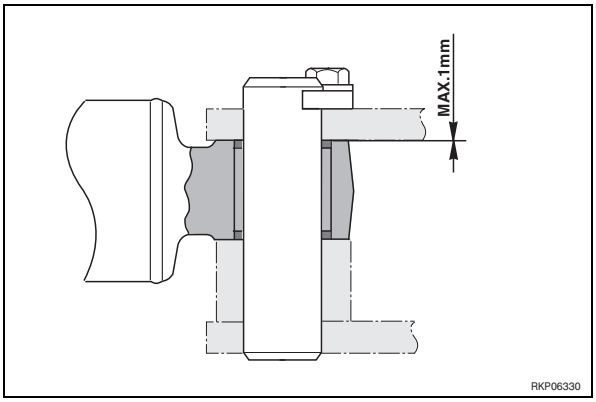
※3

Internal bushings: ASL800050

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

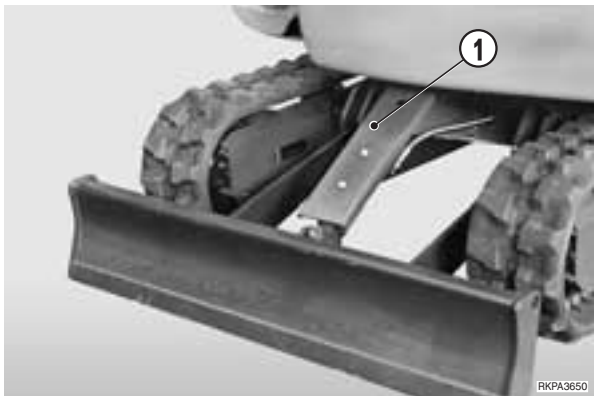
※4

★ Adjust the shim thickness so that the clearance between cylinder (10) and revolving frame is below 1 mm.



REMOVAL OF THE BLADE CYLINDER

⚠ Lower the working equipment to the ground with all safety devices engaged. Rest the back of the bucket on the ground with the arm in a vertical position.

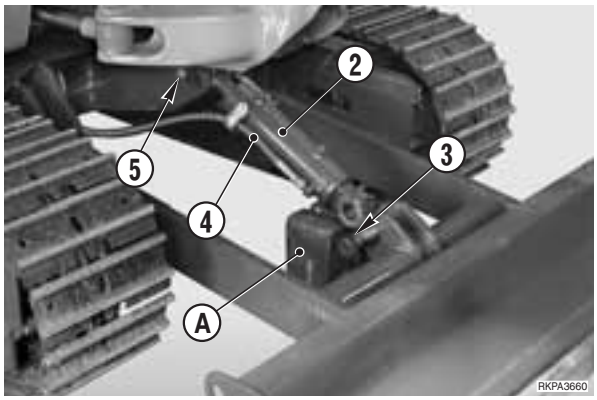


1 - Remove the protection (1).
   ★ Place a supporting block «A» beneath the cylinder.

2 - Stop the engine, release the pressures in the cylinder (2) by moving the command lever several times in both directions.

3 - Remove the pin (3). ※2

4 - Start the engine to retract the piston (4). ※1
   ★ Bind the piston rod with wire to secure the fully retracted position.



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

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

7 - Remove the pin (7). ※1 ※2

8 - Remove the cylinder (2).
   kg Blade cylinder: 13 kg

INSTALLATION OF THE BLADE CYLINDER

- To install, reverse the removal procedure.

※1

⚠ 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.

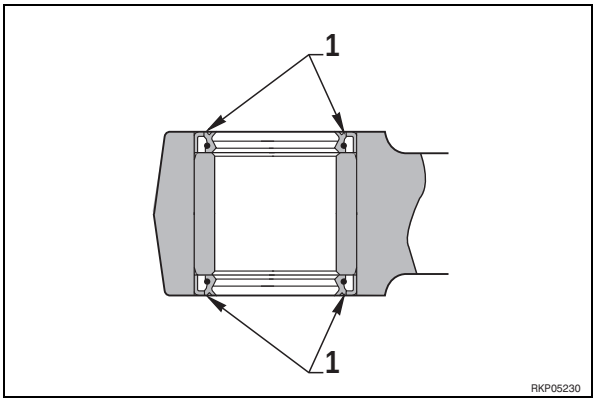
※2

Internal bushings: ASL800040

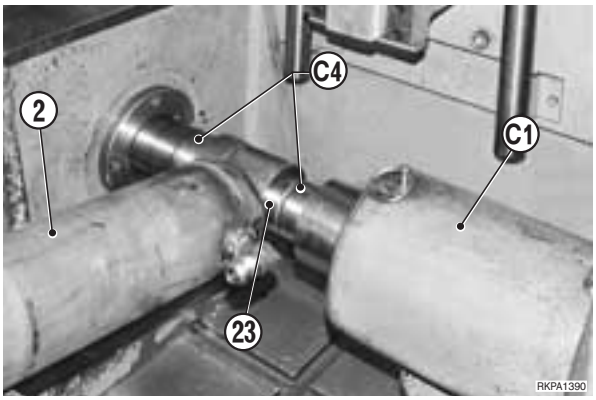
- Start the engine and bleed the air from the cylinder. (For details, see «20. CONTROLS AND ADJUSTMENTS»).
   ★ After bleeding the air, check the oil level in the tank.

DISASSEMBLY OF THE WORK EQUIPMENT CYLINDERS

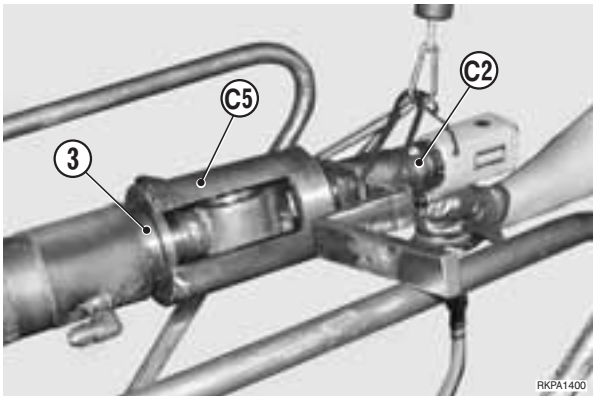
1 - Take off the guard rings (1) from both sides of the cylinder and from the piston rod.
★ Make sure that the tube unions are not plugged.



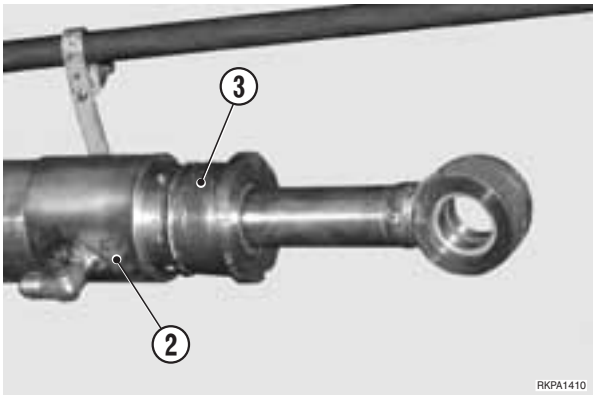
2 - Place the cylinder (2) on the apparatus **C1**. Engage the cylinder in the tools **C4**, having the same bushing diameter.



3 - Attach the special wrench **C5** (adjusted to fit the cylinder) to the head (3) and apply the dynamometric tool **C2**.



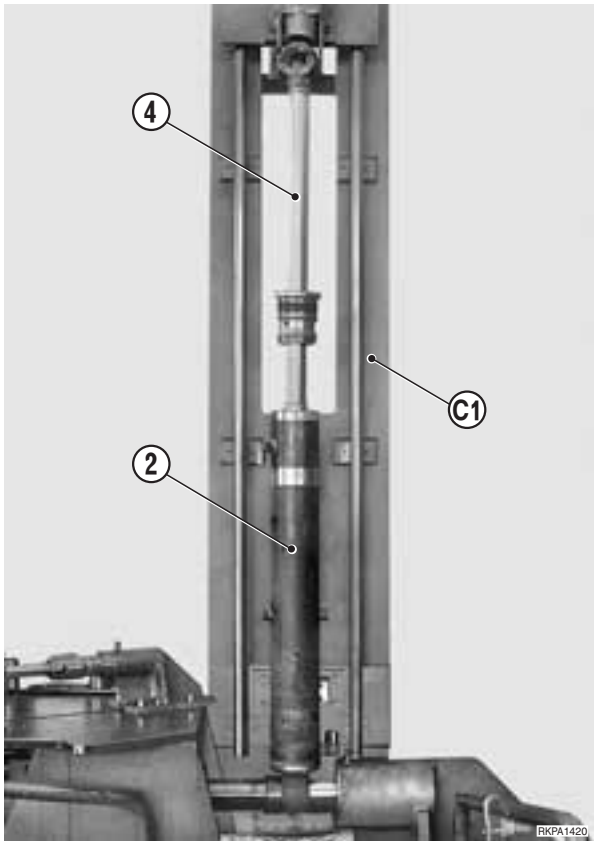
4 - Unscrew the head (3) and extract it completely from the cylinder (2).



5 - Raise the cylinder and hook the piston rod to the mobile group of the tool **C1**.

6 - Extract the piston rod group (4) from the cylinder.

7 - Remove the cylinder (2) and the piston rod group.



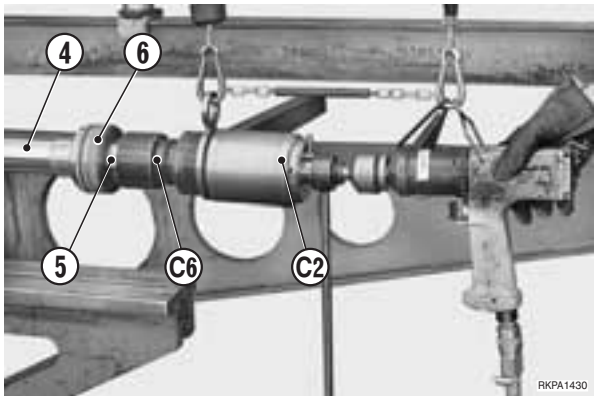
8 - Lock the complete piston rod (4) onto the apparatus **C1**.

9 - Attach the socket wrench **C6** to the lock nut (5) of the piston (6) and, using the dynamometric tool with a multiplier **C2**, remove the nut.

★ Socket wrench measurement:

Unit: mm

Cylinder / Model	Boom	Arm	Bucket	Boom swing	Blade
PC20R-8	41	46	36	46	41
PC27R-8	46	46	41	46	41



10 - Take all the groups to pieces and remove all the seals, guard rings and guide rings.

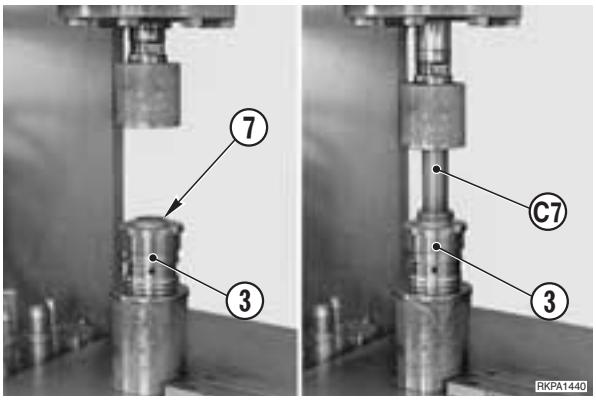
⚠ The seals, guard rings, and guide rings cannot be used again.

ASSEMBLY OF THE WORK EQUIPMENT CYLINDERS

★ Take great care not to damage the seal and the sliding surfaces.
★ Prepare each individual component before commencing the final assembly.

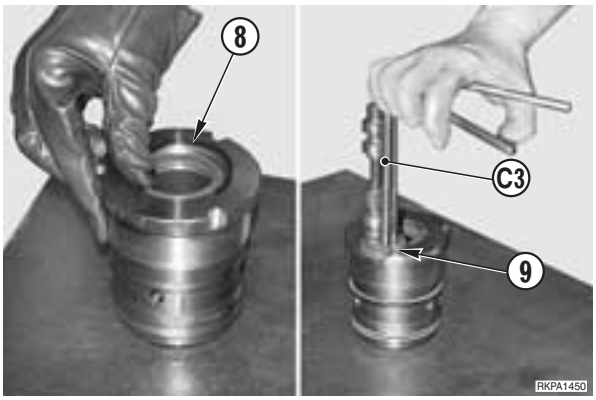
1. Assembly of the cylinder head

1 - Position the guard ring (7) and, using a press and the push rod **C7**, press it home in the head (3).
★ Check the orientation carefully.

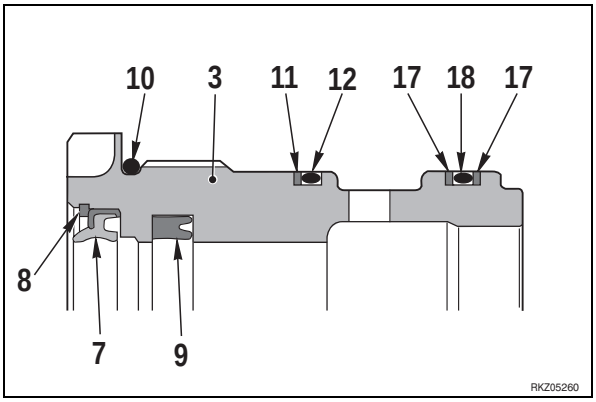


2 - Mount the snap ring (8).

3 - Using the tool **C3**, mount the lip-seal (9).
★ Check that the lips face into the cylinder.

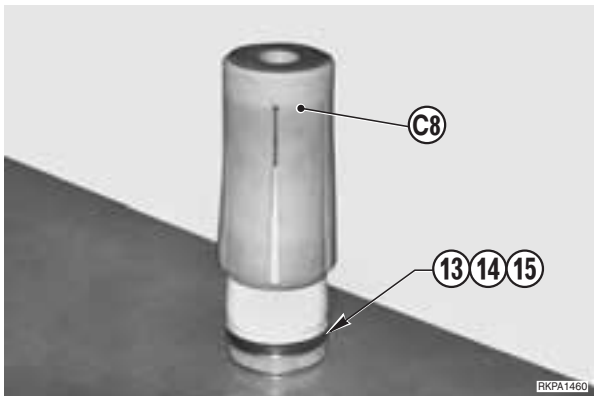


4 - Mount the O-ring (10), the anti-extrusion ring (11) and the O-ring (12) onto the cylinder head (3).
★ **Only for the boom cylinders.**
In sequence mount the anti-extrusion ring (17), the O-ring (18) and the 2nd anti-extrusion ring (17).



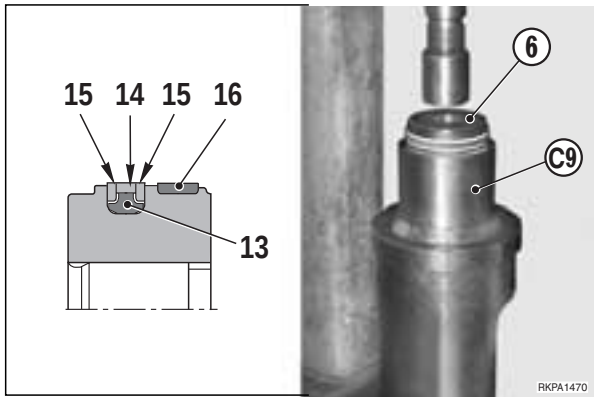
2. Piston assembly

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).

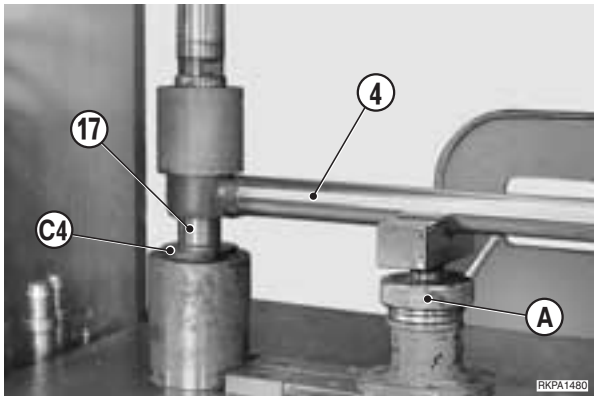
3 - Calibrate the diameter of the gasket (14) of the piston (6), mounting the group beneath the press and using the calibrating ring **C9** adapted to fit the piston diameter.



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).

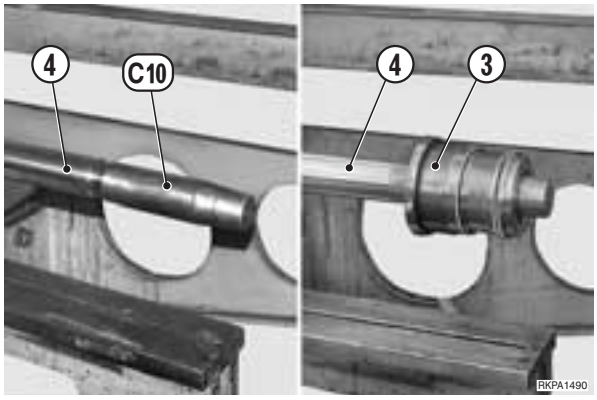
2 - Insert the support «A» beneath the piston rod.



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.

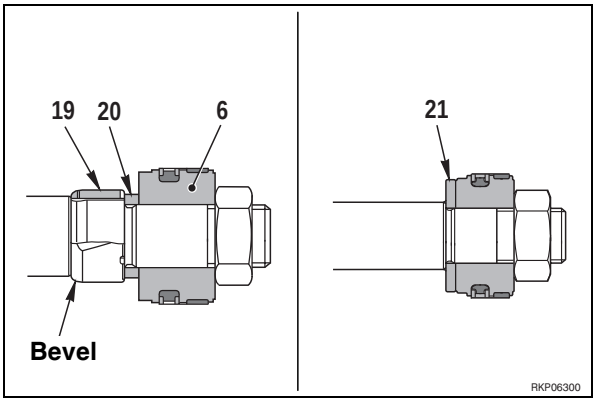


6 - **For the boom cylinders.**
Mount the brake bushing (19).

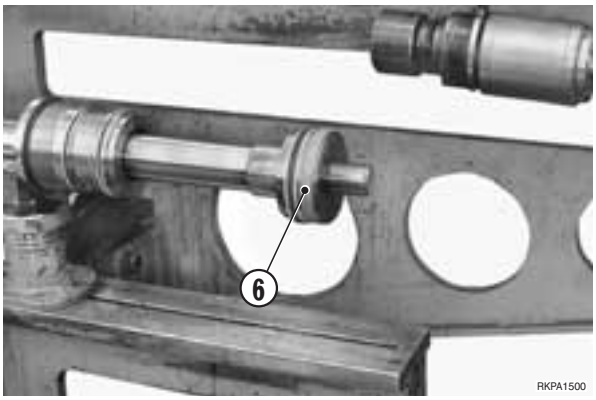
★ For the boom cylinder for the PC20R-8, also mount the spacer (20).

★ Carefully check the orientation of the chamfer on the brake bushing.

★ **For the PC27R-8 bucket cylinder and PC20R-8/ PC27R-8 blade cylinder**: mount only the spacer (21).



7 - Mount the complete piston (6).



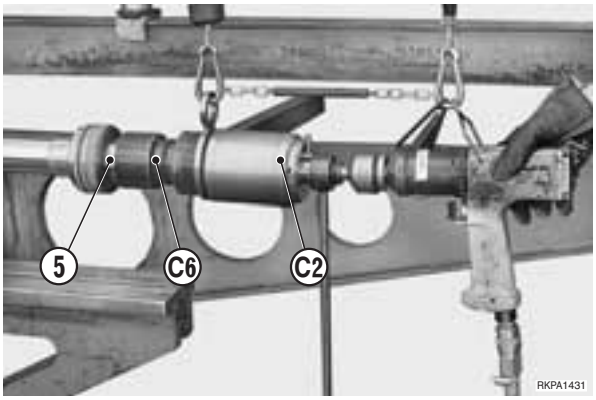
8 - Mount the nut (5) that secures the piston and tighten it with the socket wrench **C6** and the dynamometric tool with a multiplier **C2**.

Nut: Loctite 262

Nm Nut:

Unit: mm

Cylinder / Model	Boom	Arm	Bucket	Boom swing	Blade
PC20R-8	618±62	785±78	412±41	539±54	618±62
PC27R-8	785±78	785±78	618±62	912±91	618±62

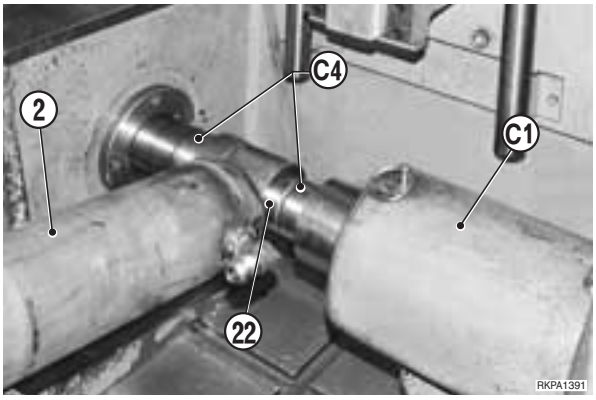


4. Cylinder assembly

1 - Mount the tools **C4** onto the apparatus **C1**.

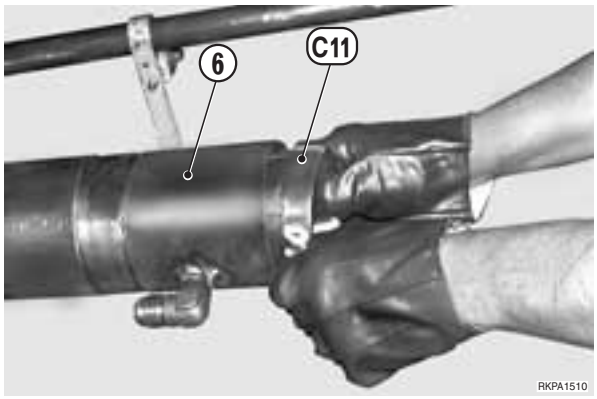
2 - Position the bushing (22) and mount it onto the cylinder (2).

★ Leave the cylinder in position, ready for the next assembly operation.



3 - Lubricate the threading and the first part of the cylinder (2).
Cylinder: ASL800050

4 - Mount the two halves of the tool **C11**, adapted to the diameter, onto the mouthpiece of the cylinder (2).

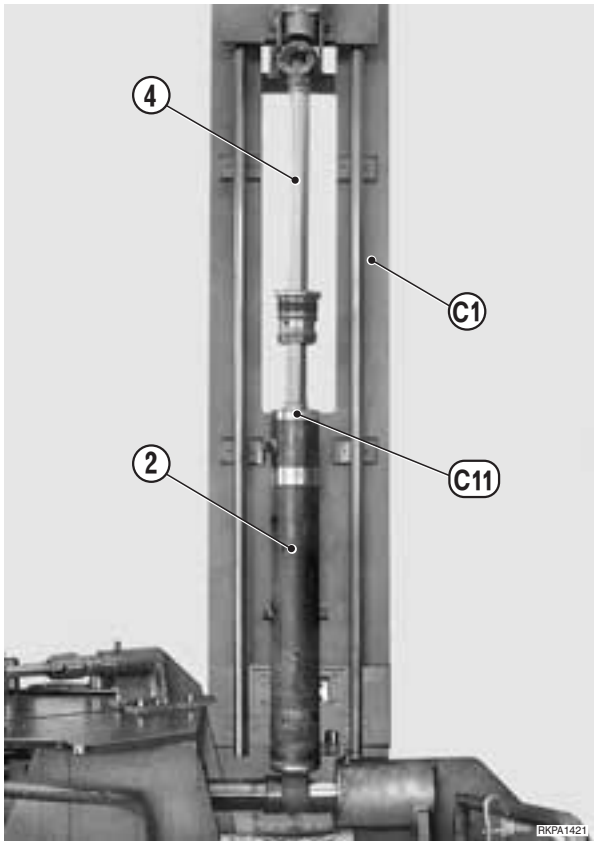


5 - Mount the piston rod group (4) onto the tool **C1** and raise the mobile part up to the end of its stroke.

6 - Put the cylinder (2) into a vertical position and guide the piston into the tool **C11**.

7 - Lower the apparatus supporting the piston rod (4) in order to insert the piston into the cylinder liner (2).

8 - Remove the tool **C11** from the cylinder and then lower the apparatus **C1** even further, until the head (3) and the piston rod approach the cylinder.



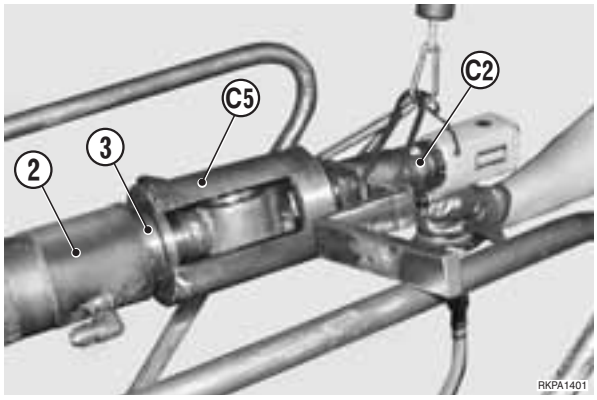
9 - Place the cylinder (2) in position for screwing in the head (3).

10 - Insert the head into the cylinder and screw it in by hand for a few turns.

11 - Attach the special wrench **C5** to the dynamometric tool **C2** and screw the head (3) fully home.
Nm Head:

Unit: mm

Cylinder / Model	Boom	Arm	Bucket	Boom swing	Blade
PC20R-8	490±49	490±49	412±41	539±54	490±49
PC27R-8	490±49	490±49	412±41	539±54	490±49



12 - Mount the guard rings (1) on both sides of the cylinder and the piston rod.

REMOVAL OF THE UPPER WORK EQUIPMENT

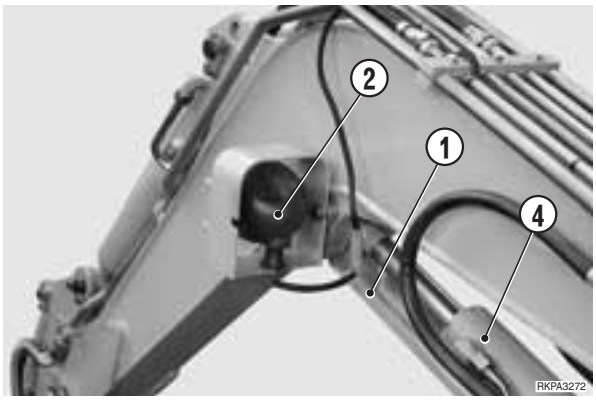
⚠ Fully extend the arm and open the bucket completely. Lower the equipment until it rests on the ground.

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

1 - Remove the protection (1) and the relative shoes.

※1

2 - Remove the working beam (2).



3 - Stop the engine, release the pressures in the cylinder by moving the PPC valve lever several times.

3 - Remove the pin (3). ※2

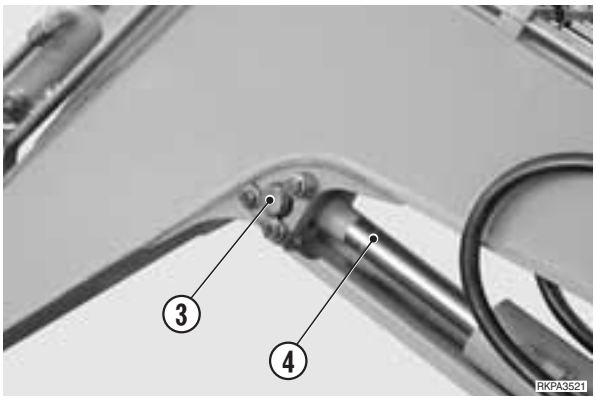
5 - Lower the cylinder (2) until it rests on a stand «A».

6 - Start the engine to retract the piston (4).

※3

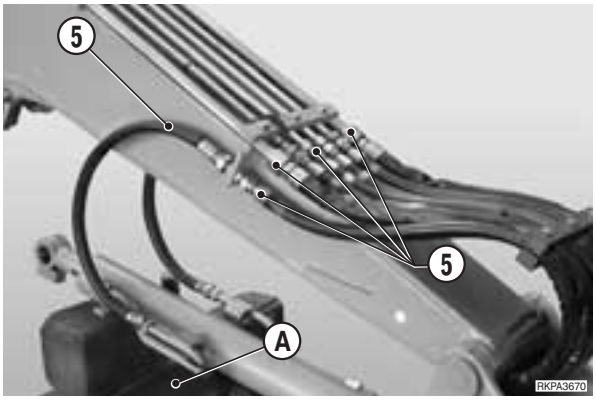
★ Bind the piston rod with wire to secure the fully retracted position.

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



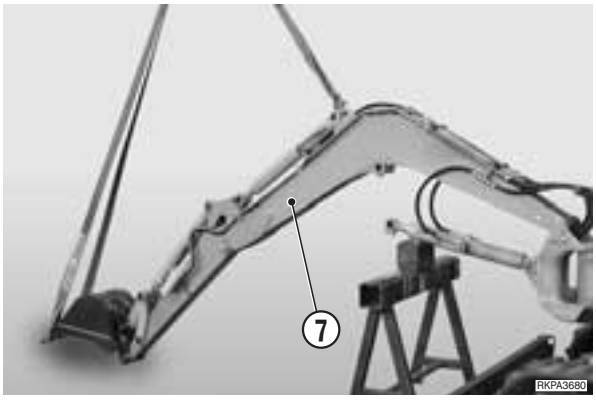
8 - Disconnect the hoses (5) (No. 10); plug the tubes to prevent entry of impurities.

★ Remove the fixed working beam clips.



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

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



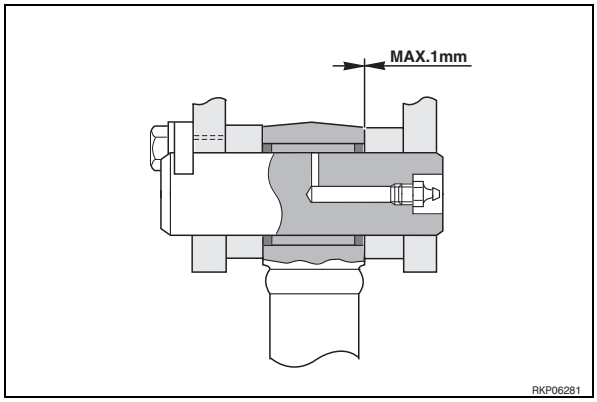
10 - Take away the pin (8). Remove the working equipment (9).
★ Check and make a note of the position of the shim. ※4
kg Working equipment: PC20R-8: 230 kg
PC27R-8: 310 kg

INSTALLATION OF THE UPPER WORK EQUIPMENT

- To install, reverse the removal procedure.

※1
★ Check the centering and the smooth movement of the protection (1).
Shoes and guides: ASL800050

※2
★ Adjust the shim thickness so that the clearance between cylinder and boom is below 1 mm.



※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

- 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.

REMOVAL OF THE BUCKET

⚠ Position the bucket on the ground on a flat surface, and resting on its back.

1 - Take out the safety pin (1) and remove the connecting pin (2) between the bucket (3) and the tie-rods (4).

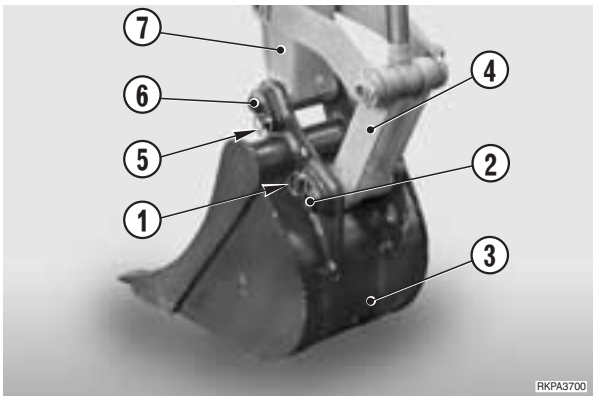
※1 ※2 ※3

2 - Take out the safety pin (5) and remove the pin (6) that connects the bucket (3) to the arm (7).

※2 ※3

3 - Remove the bucket (3). ※4

kg Bucket: PC20R-8: 40 kg
PC27R-8: 50 kg



INSTALLATION OF THE BUCKET

- To install, reverse the removal procedure.

※1

★ Adjust the shim thickness so that the clearance between bucket (3) and link (4) is below 1 mm.

※2

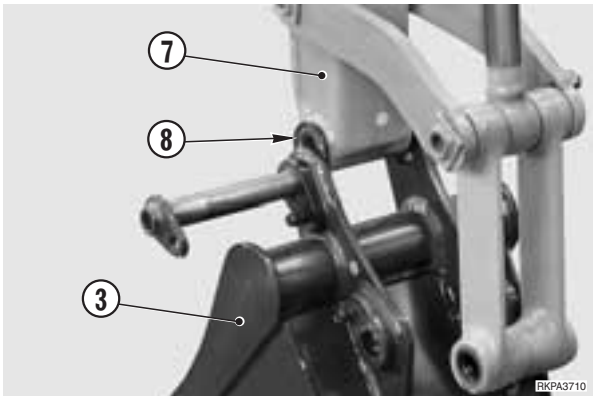
⚠ When aligning the positions between the hole and the pin, turn the engine over at low idling.
Do not insert fingers in the holes to check alignment.

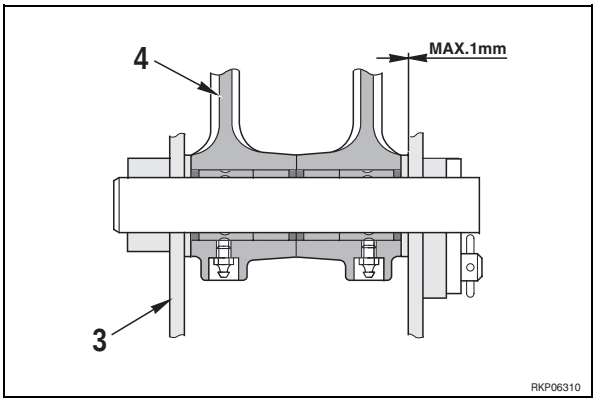
※3

Internal bushings: ASL800040

※4

★ Insert O-ring (8) on both sides between the bucket (3) and the arm (7).



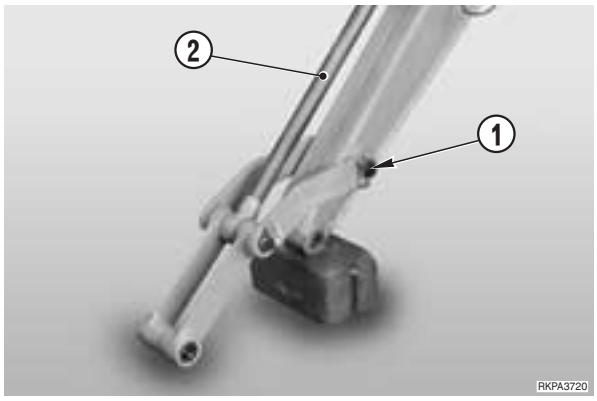


REMOVAL OF THE ARM

1 - Remove the bucket. (For details, see «REMOVAL OF THE BUCKET»).

2 - Remove the pin (1) and completely retract the piston rod (2). ※1

3 - Put the arm (2) into a vertical position and rest the boom on a block.



4 - Disconnect the R.H. and L.H. brackets (3).

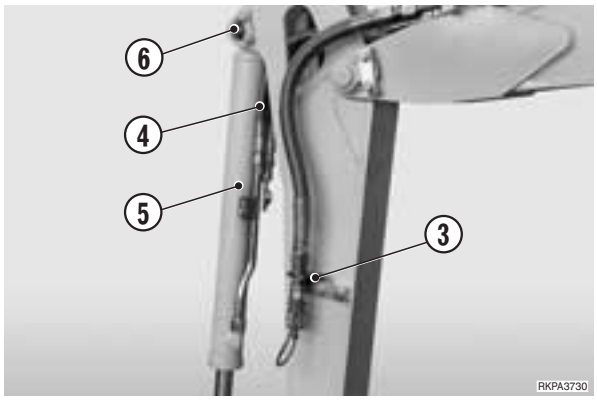
5 - Disconnect the tubes (4) of bucket cylinder command (5).

★ Plug the tubes and the holes on the cylinder to prevent entry of impurities.

6 - Put a sling round the cylinder (5).

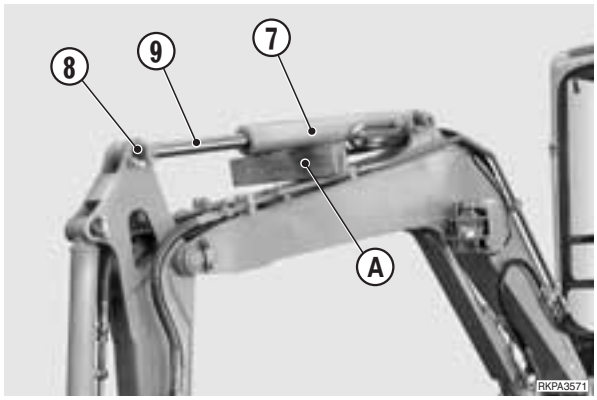
7 - Remove the pin (6) and take out the cylinder (5) completely of levels. ※2

kg Complete cylinder: 35 kg



8 - Position a block «A» beneath the arm cylinder command (7).

9 - Remove the pin (8) completely retract the piston rod (9). ※3



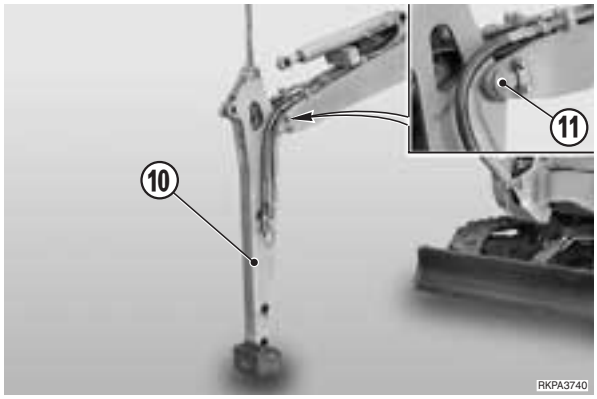
10 - Put a sling round the arm (10) and apply a slight tension to the cables.

11 - Remove the pin (11) and take out the arm (10).

※4

kg Arm: PC20R-8: 35 kg
PC27R-8: 50 kg

kg Long arm: PC20R-8: 48 kg
PC27R-8: 70 kg



INSTALLATION OF THE ARM

- To install, reverse the removal procedure.

※1

★ Insert shims between link and arm.

※2

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

★ Insert shims on base sides of the piston rod.

Internal bushings: ASL800050

※3

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

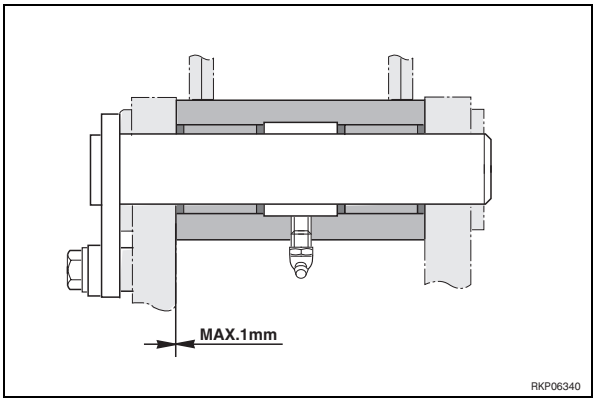
⚠ When aligning the positions between the hole and the pin, turn the engine over at low idling.
Do not insert fingers in the holes to check alignment.

Internal bushings: ASL800050

★ Adjust the shim thickness so that the clearance between arm and boom is below 1 mm.

⚠ 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.



REMOVAL OF THE ARM ASSEMBLY

⚠ Lower the working equipment to the ground with all safety devices engaged with the arm in a vertical position and the bucket curled.

1 - Stop the engine and release the pressures from bucket cylinder and from optional working equipment circuit.

2 - Attach a block «a» beneath the cylinder (1) and remove the pin (2).

3 - Start the engine and retract the piston (3). ※1

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

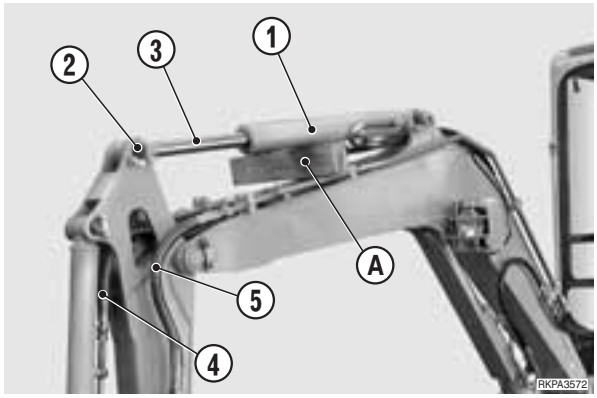
5 - Disconnect the tubes (4) of bucket cylinder command.
★ Plug the tube and the holes on the cylinder to prevent entry of impurities.

6 - Disconnect the delivery and exhaust equipment tubes (5).
★ Plug the tubes to prevent entry of impurities.

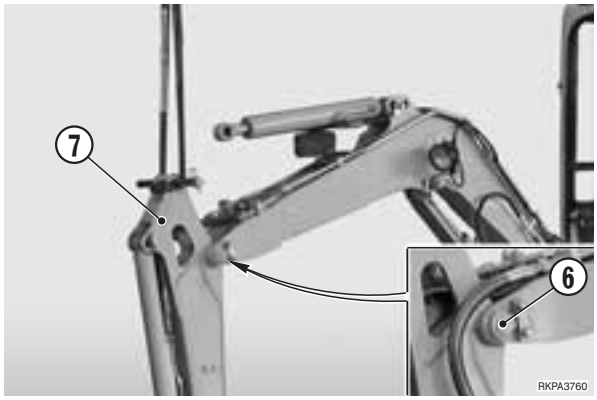
7 - Remove the pin (6) and take out the arm complete (7).

※2

kg Arm complete: PC20R-8: 115 kg
PC27R-8: 160 kg



INSTALLATION OF THE ARM ASSEMBLY



- To install, reverse the removal procedure.

※1

Internal bushings: ASL800040

★ 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.

※2

★ 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.

REMOVAL OF THE BOOM

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

1 - Remove the arm assembly. (For details, see «REMOVAL OF THE ARM ASSEMBLY»).

2 - Remove the arm cylinder. (For details, see «REMOVAL OF THE ARM CYLINDER»).

3 - Remove the working beam (1).

4 - Stop the engine, and rest the boom (2) on a block «A».

5 - Stop the engine and move the PPC valve several times to release pressures in the cylinder.

6 - Place a stand «B» beneath the cylinder (3).

7 - Remove the pin (4) and rest the cylinder on a stand.

※1

8 - Start the engine and completely retract the piston rod (5).

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

10 - Put a sling round the boom (2) and apply a slight tension to the cables.

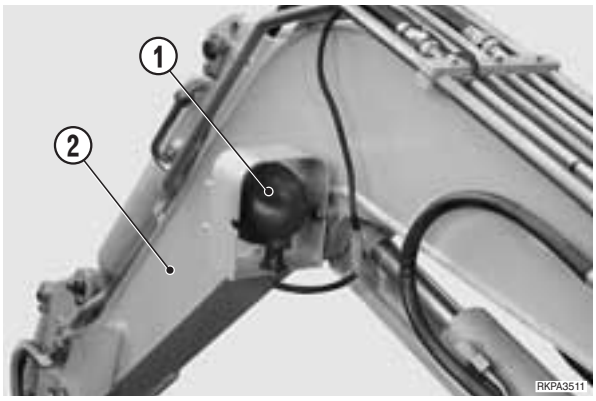
11 - Disconnect the hoses (6) (No. 10); plug the tubes to prevent entry of impurities.

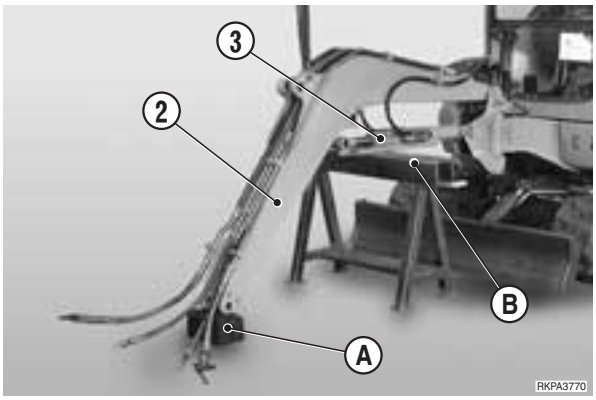
★ Remove the wiring harness lock clips.

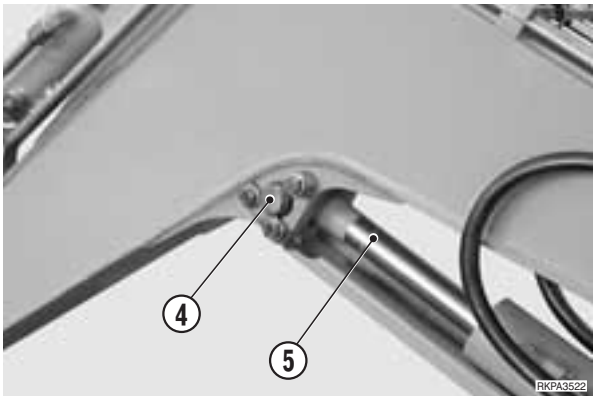
12 - Remove the pin (7) and remove the boom (2).

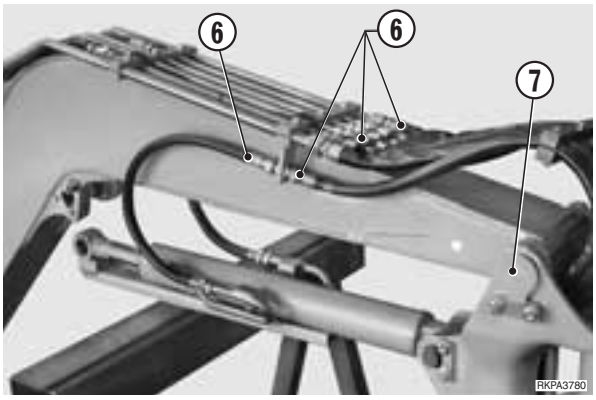
※2

kg Boom: PC20R-8: 80 kg
PC27R-8: 126 kg









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.

REMOVAL OF THE BOOM SWING SUPPORT

⚠ Extend the working equipment completely and rest it on the ground.

1 - Remove the front working equipment. (For details, see «REMOVAL OF THE UPPER WORKING EQUIPMENT»).

2 - Remove the boom cylinder. (For details, see «REMOVAL OF THE BOOM»).

3 - Disconnect the boom swing cylinder (1). (For details, see «REMOVAL OF THE BOOM SWING CYLINDER»).

4 - Remove the protection (2).

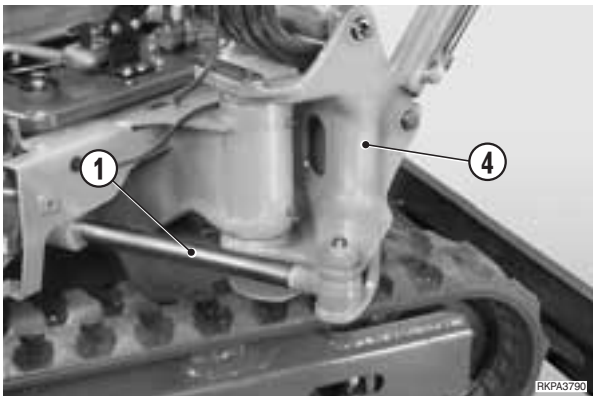
5 - Disconnect the bracket (3) from the boom swing support.

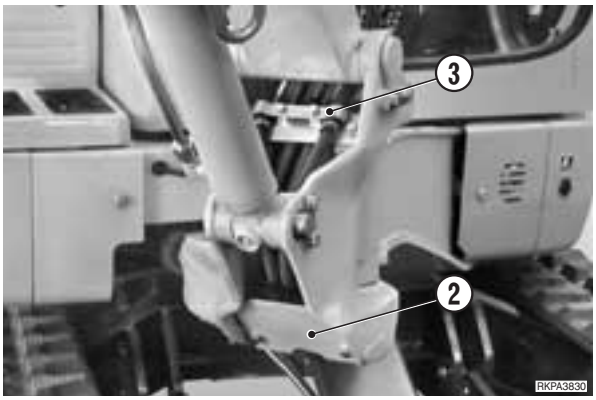
6 - Attach the boom swing support (2) to some hoisting tackle and apply a slight tension to the cable.

7 - Take out the bracket (5), remove the pin (6) and remove the boom swing support (4). ※1

★ Make a note of the position of the spacer (7) and the quantity of shims (8).

kg Boom swing support: PC20R-8: 37 kg
PC27R-8: 52 kg





INSTALLATION OF THE BOOM SWING SUPPORT

• To install, reverse the removal procedure.

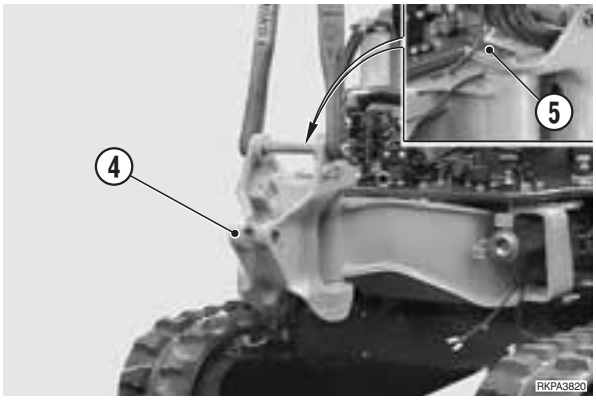
※1

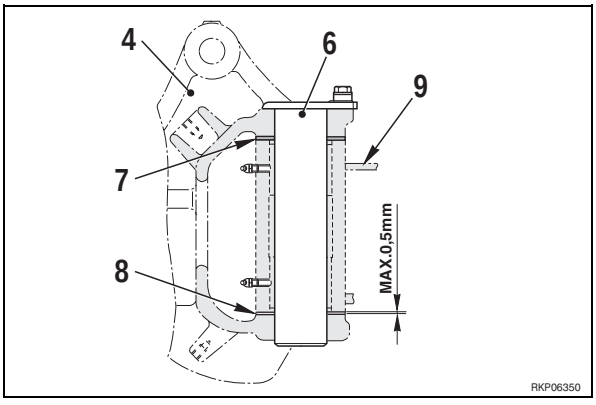
⚠ When aligning the positions between the hole and the pin, do not insert fingers in the holes to check alignment.

Pins: ASL800050

★ Adjust the shim thickness so that the clearance between swing bracket (4) and frame (9) is below 0.5 mm.

Supporting surfaces and shims: ASL800050





REMOVAL OF THE BLADE

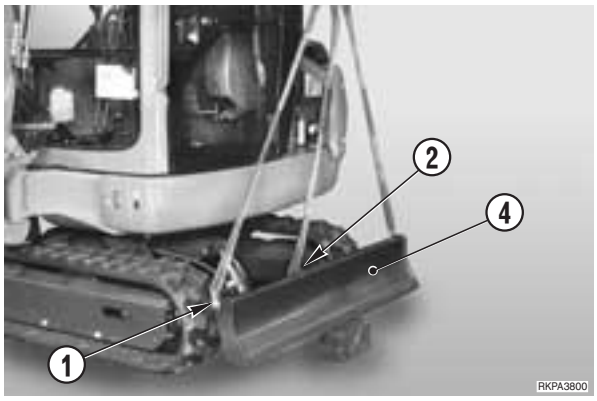
1 - Rotate the turret 90° and rest the working equipment on the ground.

2 - Disconnect the cylinder from the blade. (For details, see «REMOVAL OF THE BLADE CYLINDER»).

3 - Attach the blade to some hoisting tackle, using the lateral holes provided (1) and the cylinder attachment (2).

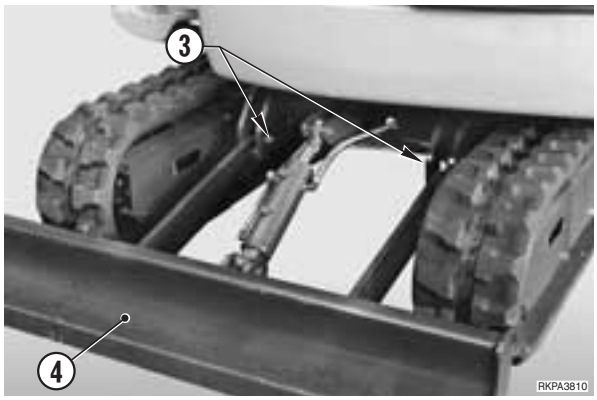
★ Adjust the length of the cables to balance the group.

4 - Take out the pin (3). ※1 ※2



5 - Remove the blade (4).

kg Blade: PC20R-8: 100 kg
PC27R-8: 137 kg



INSTALLATION OF THE BLADE

- To install, reverse the removal procedure.

※1

Internal bushings: ASL800050

※2

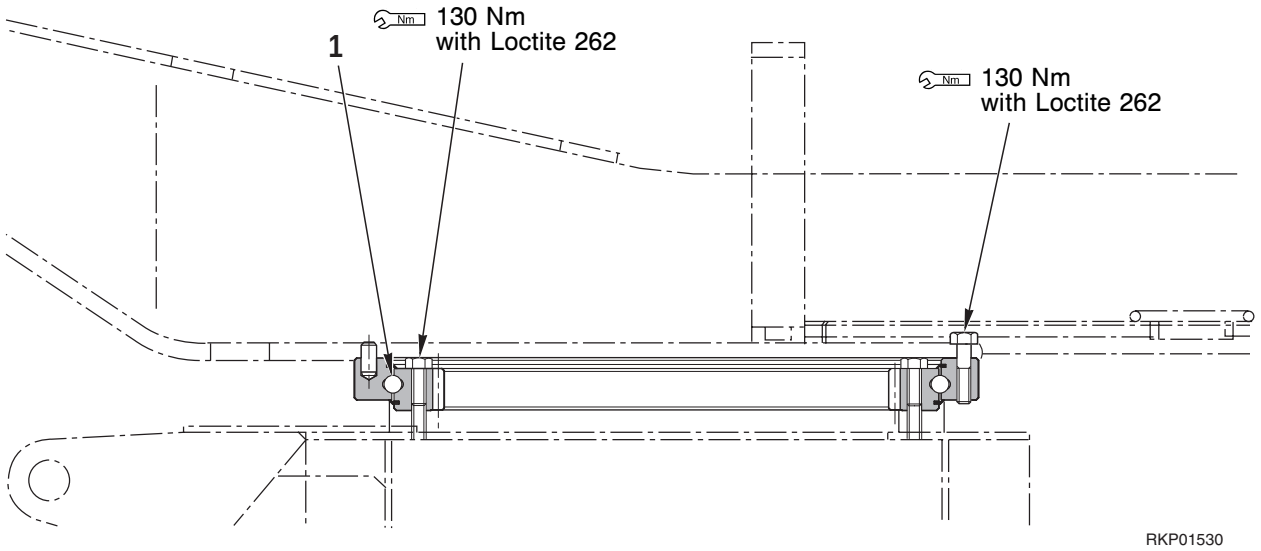
When aligning the positions between the hole and the pin, turn the engine over at low idling.
Do not insert fingers in the holes to check alignment.

GRUPPO 40

40 STANDARD MAINTENANCE

SWING CIRCLE

★ The figure represent PC20R-8

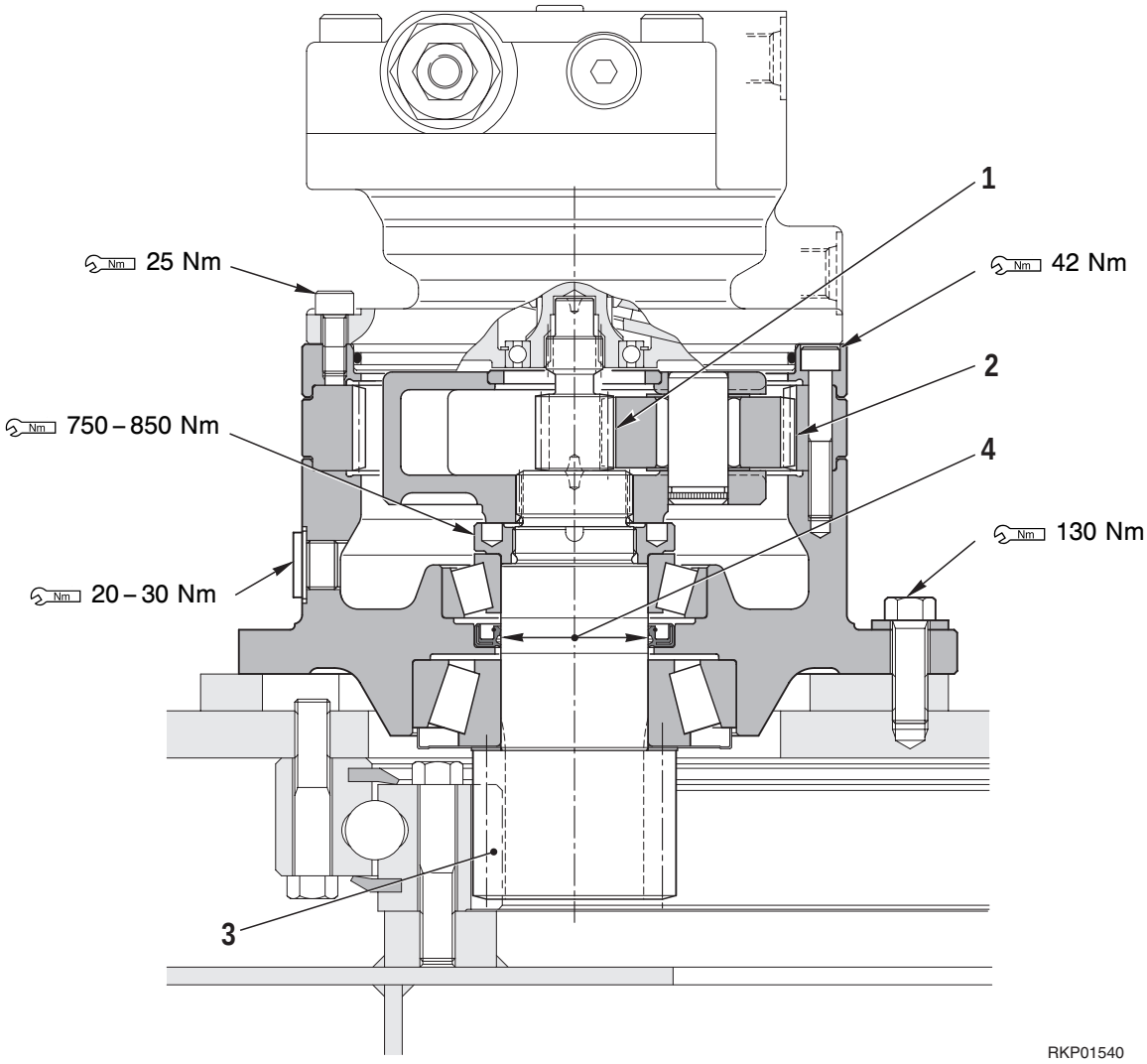


Unit: mm

No.	Check item	Criteria		Remedy
1	Axial bearing clearance	Standard clearance	Clearance limit	Replace
		0.3	1.3	

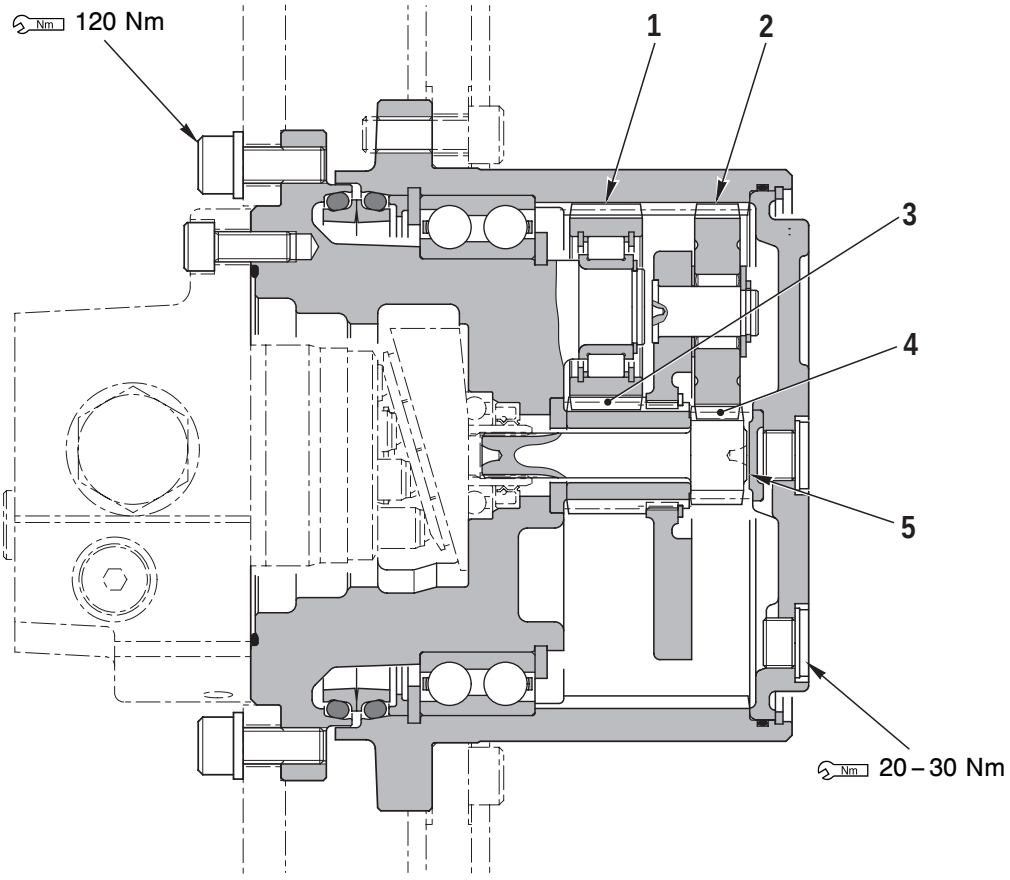
SWING MACHINERY

PC27R-8



Unit: mm

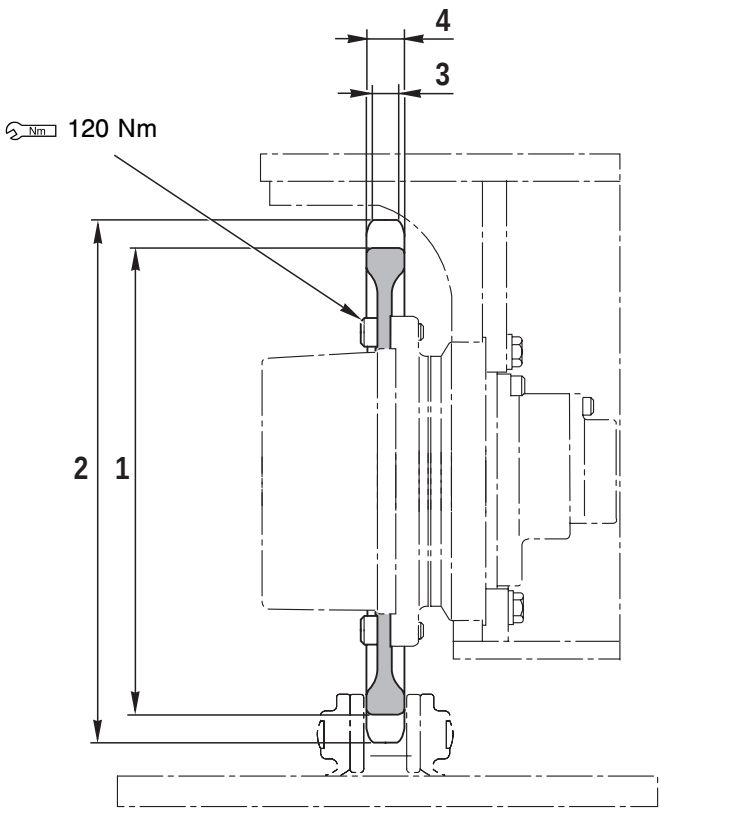
No.	Check item	Criteria		Remedy
1	Clearance between sun gear and planetary gear	Standard clearance	Clearance limit	Replace
		0.10	0.30	
2	Clearance between planetary gear and ring gear	0.15	0.35	
3	Clearance between pinion and swing circle teething	0.30	0.70	
4	Size of pinion in the zone of contact with the sealing ring	Standard size	Repair limit	
		$50^{0}_{-0.19}$	49.5	



Unit: mm

No.	Check item	Criteria		Remedy
1	Backlash between No. 2 planetary gear and housing	Standard clearance	Clearance limit	Replace
		0.15	0.35	
2	Backlash between No. 1 planetary gear and housing	0.10	0.35	
3	Backlash between No. 2 sun gear and No. 2 planetary gear	0.10	0.30	
4	Backlash between No. 1 sun gear and No. 1 planetary gear	0.10	0.30	
5	Axial play of sun gear	0.5 – 1.5	2.5	

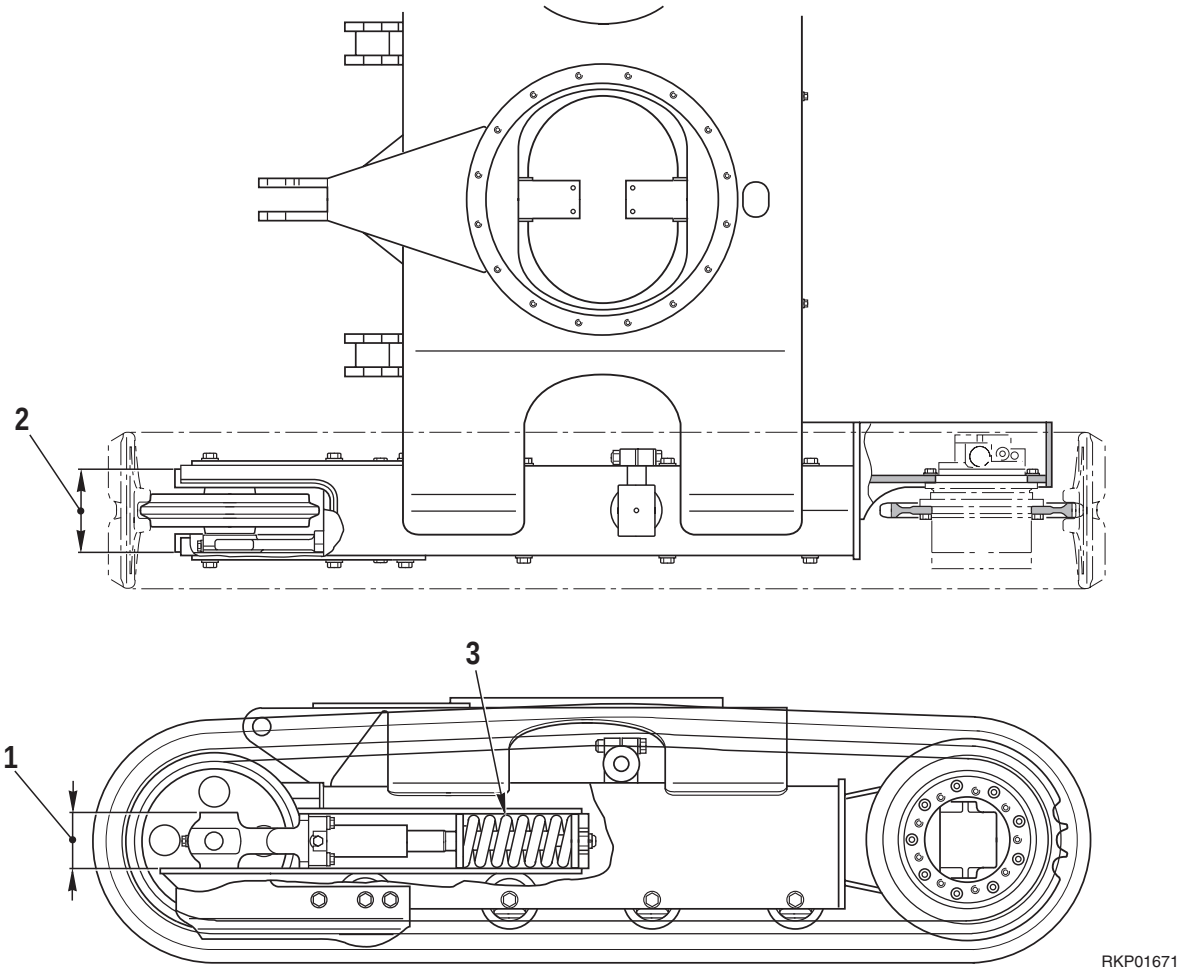
SPROCKET



Unit: mm

No.	Check item	Criteria			Remedy
		Standard size	Tolerance	Repair limit	
1	Wear at roots of sprocket teeth	344.3	+1 −2	332	Build up by solder or replace
2	Wear at tips of sprocket teeth	386.2	±1.5	374	
3	Face width at tips of sprocket teeth	20	—	18	
4	Face width at base of sprocket teeth	27	+0.5 −1	25	

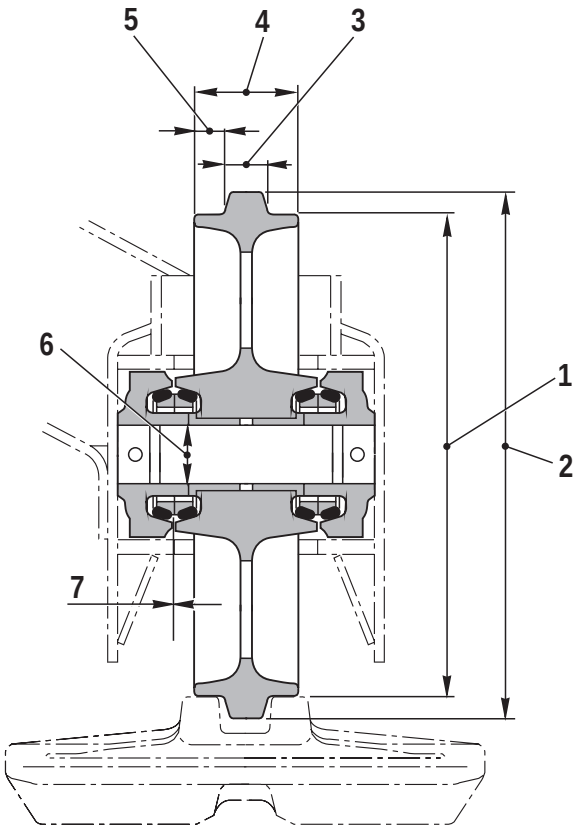
TRACK FRAME AND RECOIL SPRING



Unit: mm

No.	Check item		Criteria					Remedy
1	Vertical width of idler guide		Item		Standard size	Repair limit		Build up by welding
			Track frame		108	112		
			Idler support		106	102		Build up by welding or replace
2	Horizontal width of idler guide		Track frame		161	165		Build up by welding
			Idler support		159	155		Build up by welding or replace
3	Recoil spring		Standard size		Repair limit			Replace
			Free length	Preloaded length	Installed load	Free length	Installed load	
		Steel shoe	248	206.4	2000 kg	241.8	1780 kg	
		Rubber shoe	248	188.4	2860 kg	241.8	2625 kg	

IDLER



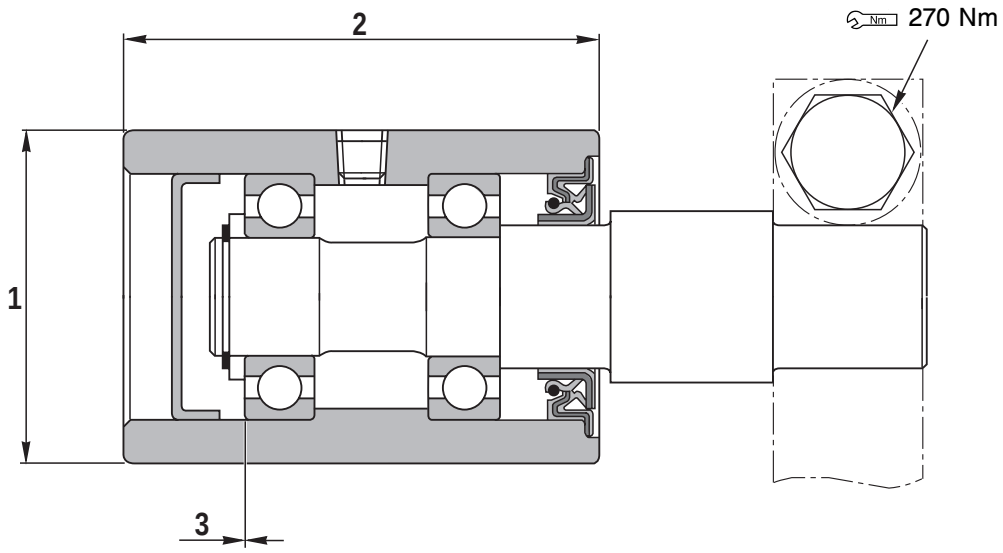
RKP01720

Unit: mm

No.	Check item	Criteria				Remedy
1	Outer diameter of track shoe guide	Standard size		Repair limit		Build up by welding or replace
		338		330		
2	Outer diameter of tread	300		292		
3	Width of track shoe guide	28		20		
4	Total width	64		59		
5	Width of tread	18		22		
6	Clearance between bushing and idler	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole		
		35	– 0.025 – 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.5	
7	Clearance between shaft and support	Standard size		Repair limixt		
		0.25		1.0		

CARRIER ROLLER

PC27R-8

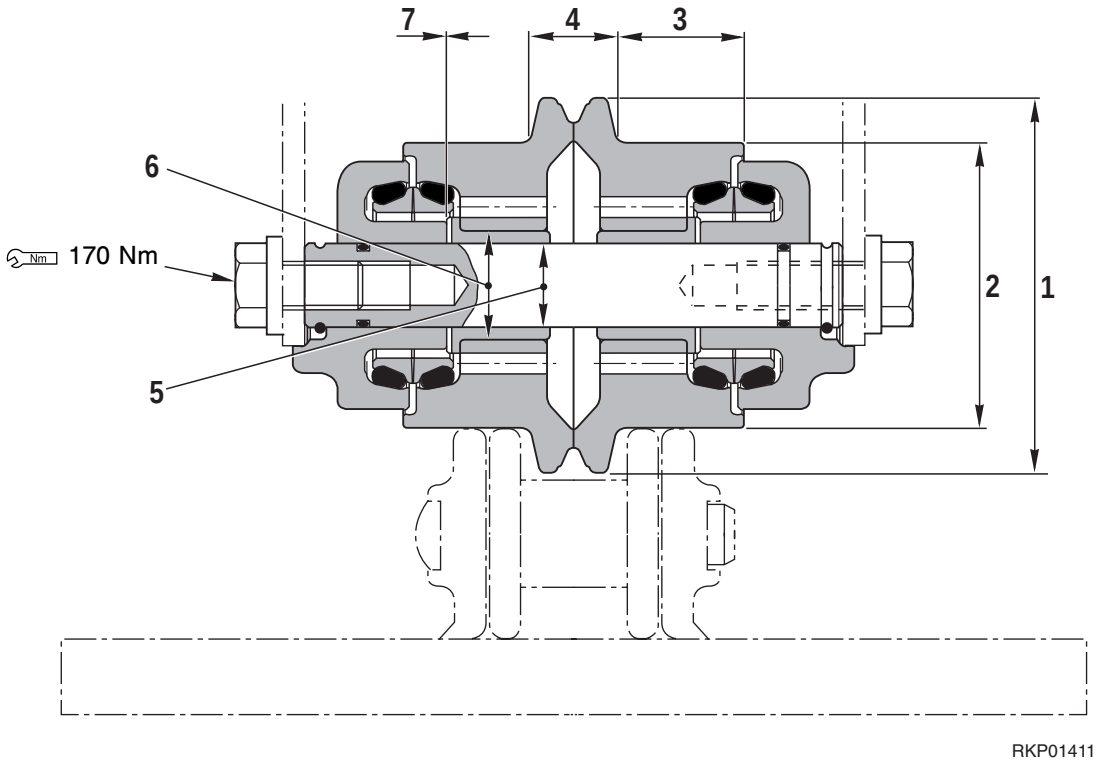


RKP01401

Unit: mm

No.	Check item	Criteria		Remedy
1	Outer diameter of tread	Standard size	Repair limit	Replace
		70	60	
2	Width of tread	100	—	
3	Axial play of roller	Standard tolerance	Clearance limit	Replace
		0 – 0.5	1	

TRACK ROLLER



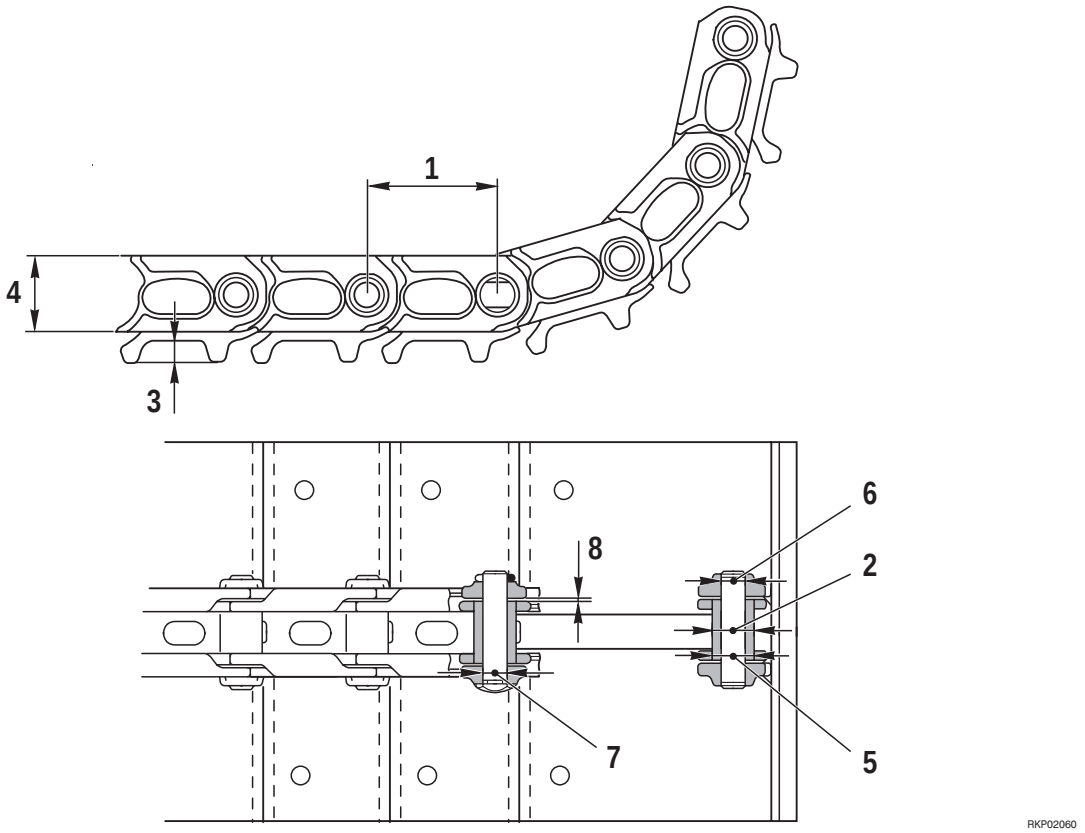
RKP01411

Unit: mm

No.	Check item	Criteria				Remedy
1	Outer diameter of thread	Standard size		Repair limit		Replace
		112		104		
2	Outer diameter of protusion	85		77		
3	Width of thread	36		39		
4	Width of protusion	30		18		
5	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace bushing
			Shaft	Hole		
		25	0 – 0.013	+ 0.183 + 0.144	0.2	0.3
6	Interference between roller and bushing	Standard size	Tolerance		Standard interference	Interference limit	
			Shaft	Hole		
		32	+ 0.073 + 0.048	+ 0.039 + 0	0.021	0.085
7	Axial play of roller	Standard size		Repair limit		Replace
		0 – 1.17		1.17		

TRACK SHOE

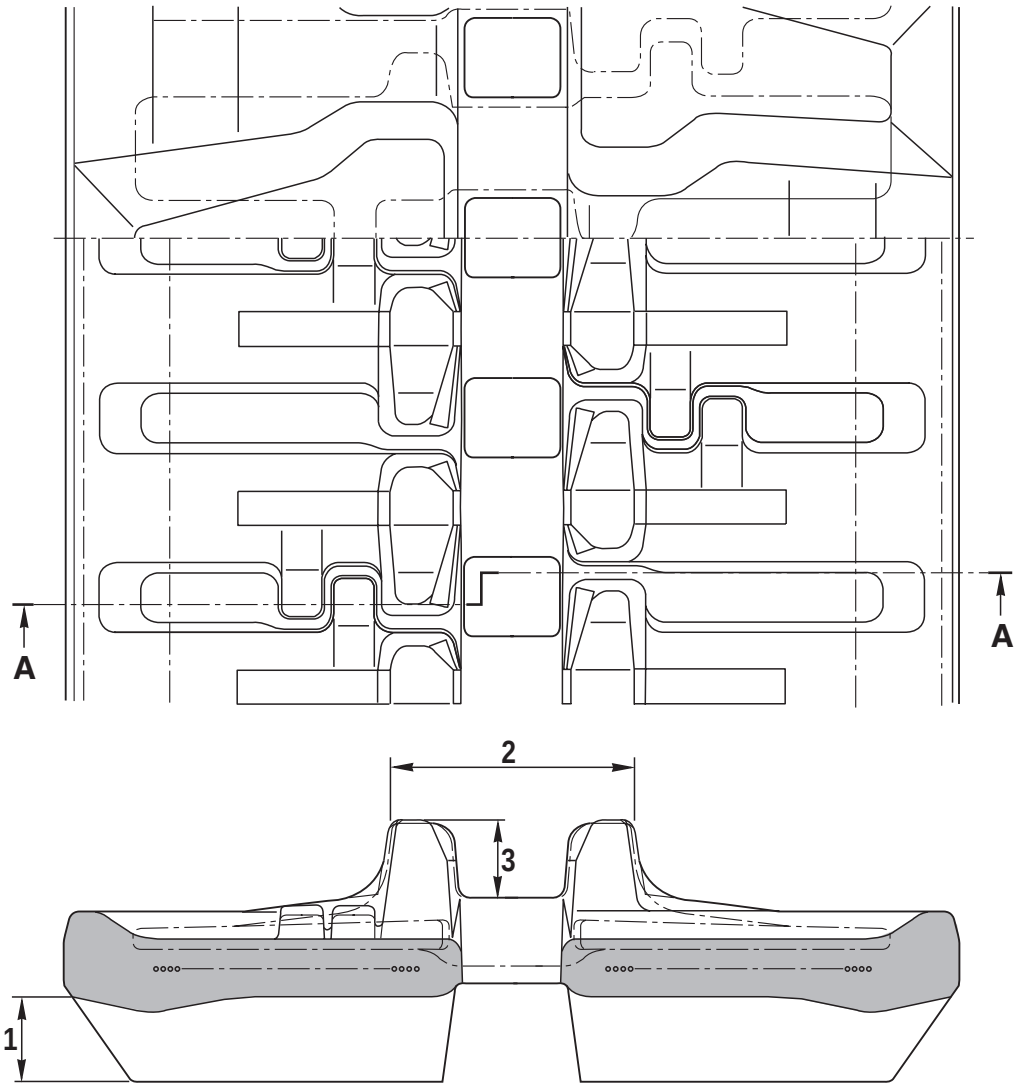
STEEL SHOE



Unit: mm

No.	Check item	Criteria					Remedy
1	Link pitch	Standard size			Repair limit		Rotate pin or replace
		101.6			—		
					104		Replace
2	Outer diameter of bushing	15			30		Rotate bushing or replace
					28		Replace
3	Grouser height	16.5			8.5		Build up by welding or replace
4	Link height	61			5		
5	Interference between regular pin and link	Standard size	Tolerance		Standard interference	Interference limit	Replace
			Shaft	Hole			
		32	+0.22 +0.12	0 +0.05	0.07	0.22	
6	Interference between pin and link	19	+0.15 +0.12	0 +0.05	0.07	0.15	
7	Interference between master pin and link	19	+0.02 +0.07	0 +0.05	0.02	0.12	
8	Clearance between link joint faces	Standard size			Clearance limit		
		0.6			1.2		

RUBBER SHOE



Section A – A

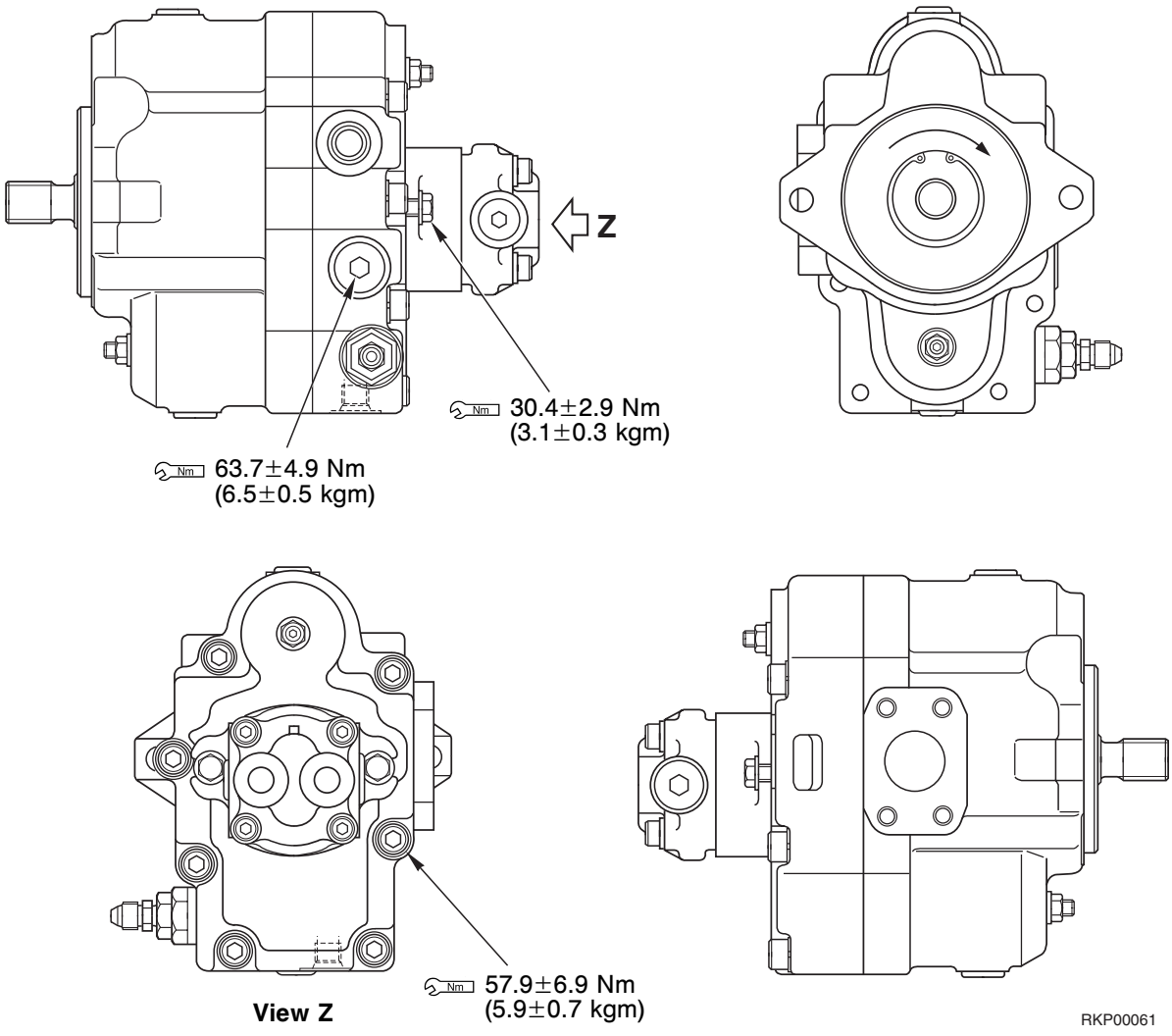
RKP01730

Unit: mm

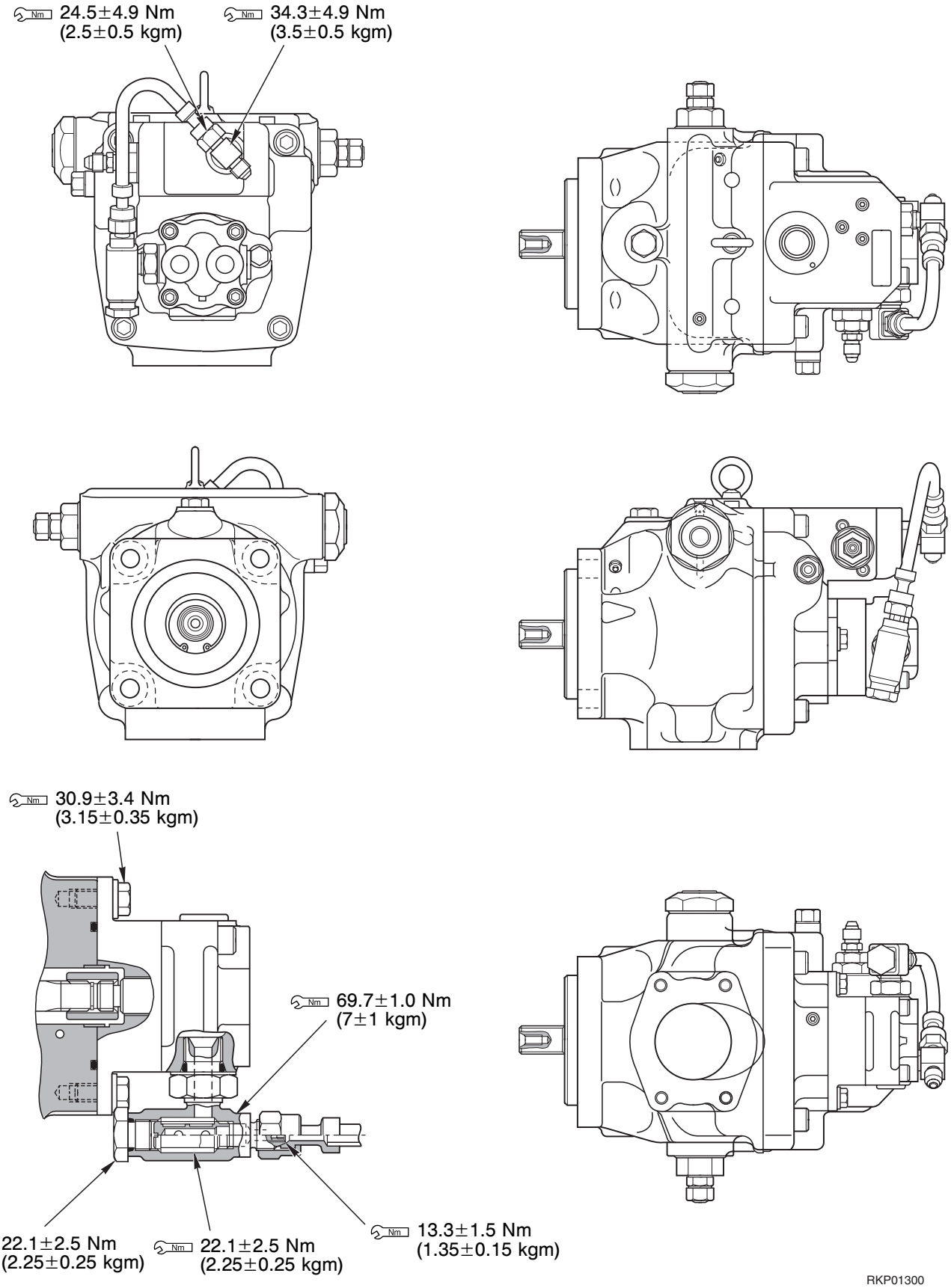
No.	Check item	Criteria		Remedy
1	Wear of lug height	Standard size	Repair limit	Replace
		25	5	
2	Wear of roller guard portion	71	65	
3	Wear of meshing portion of sprocket	23	27	

HYDRAULIC PUMP

PC20R-8

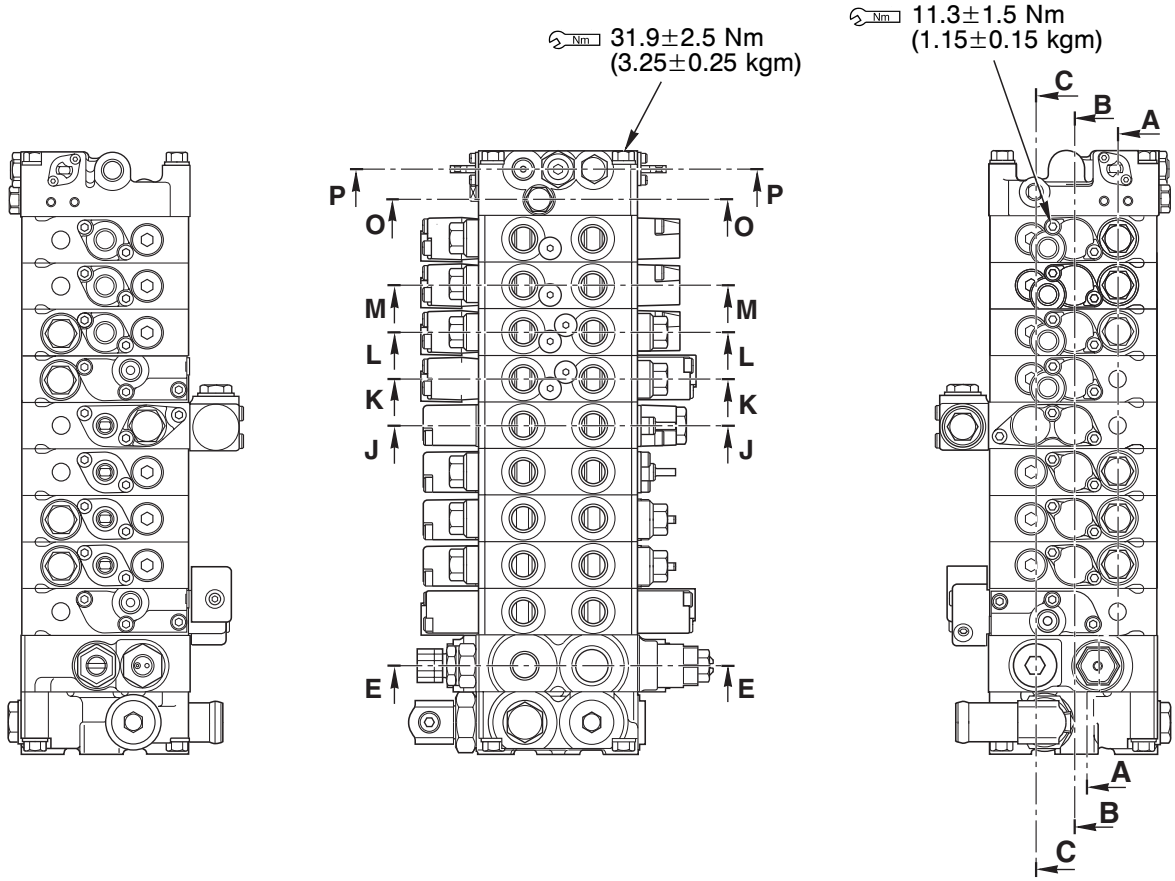


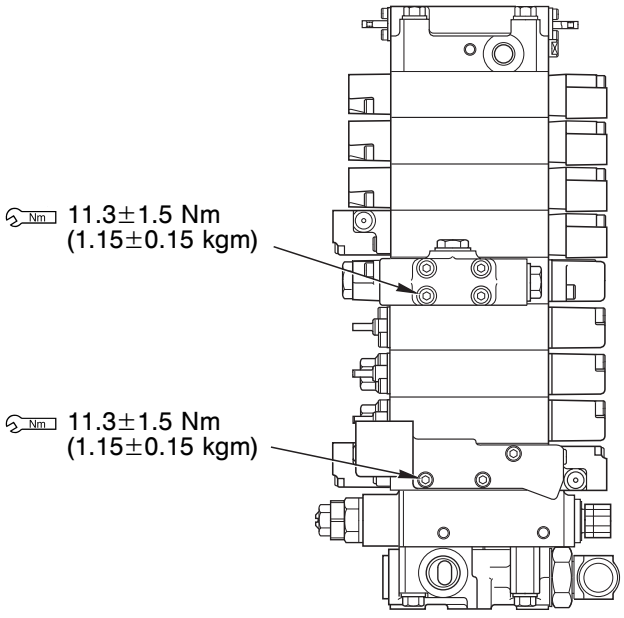
PC27R-8



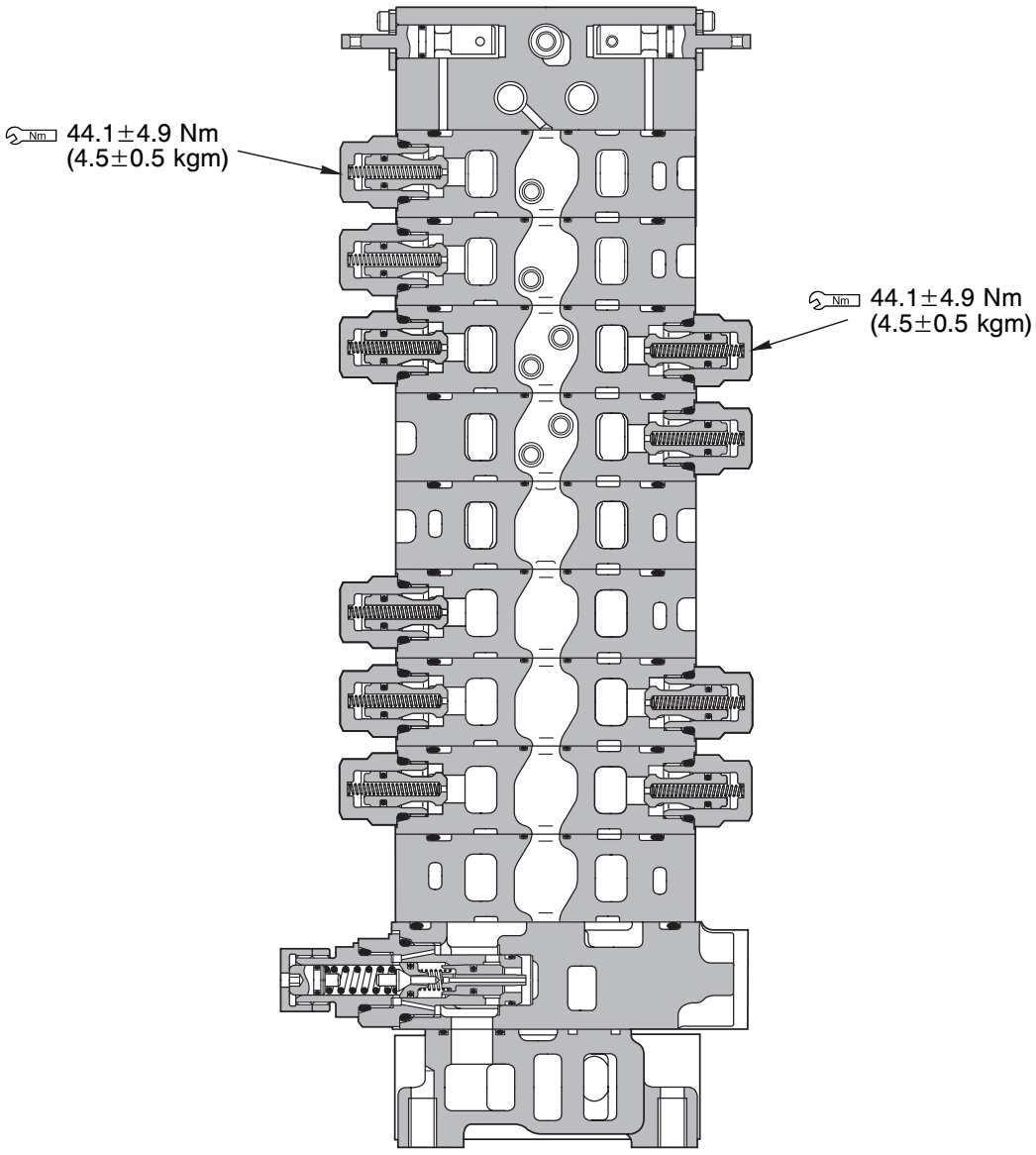
RKP01300

CONTROL VALVE



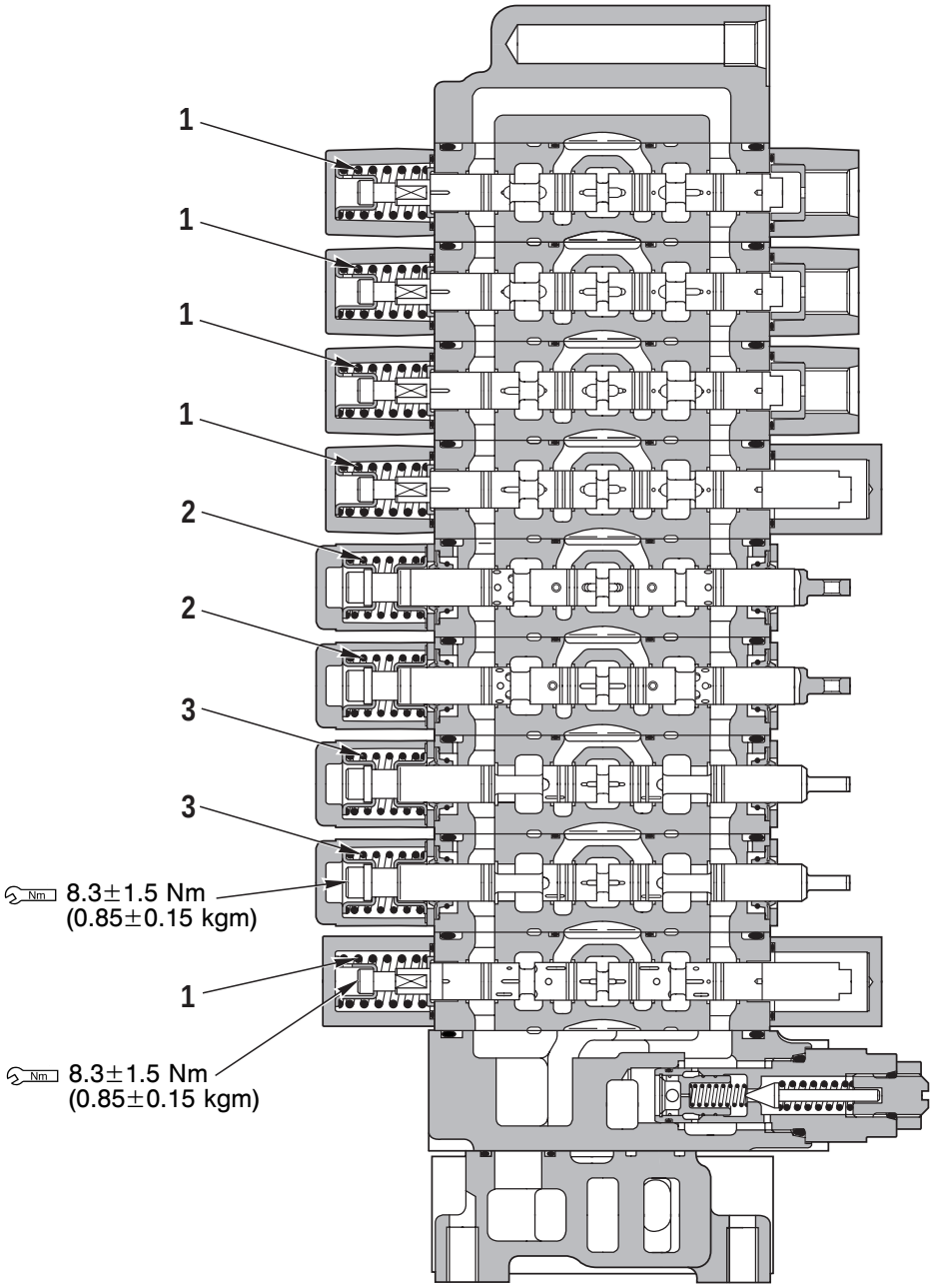


RKP01591



Section A – A

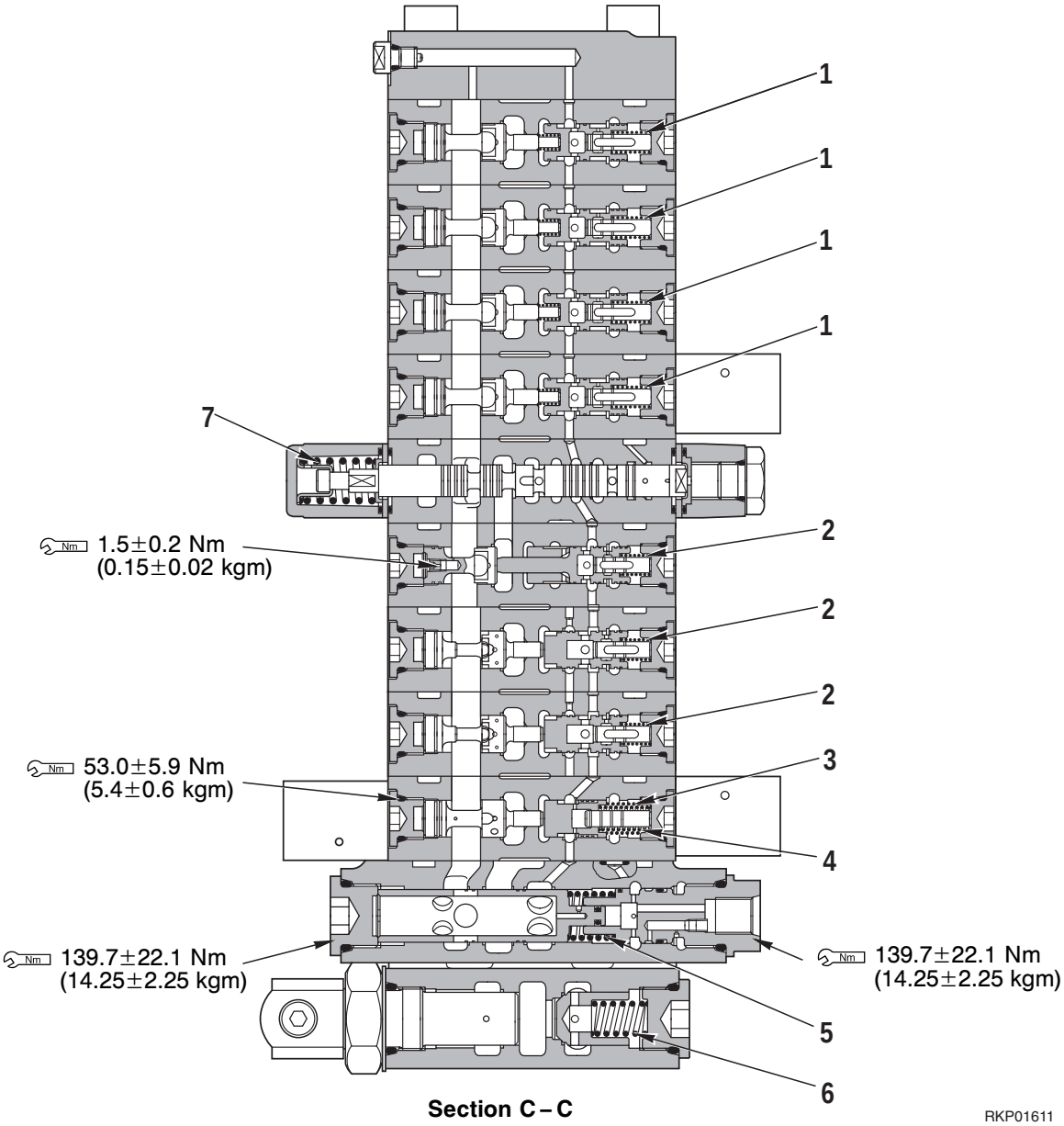
RKP01661



Section B – B RKP01621

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Spool return spring (arm, swing, arm, bucket)	Free length x Ø.D.	Installed length	Installed load	Free length	Installed load	When damage or deformation is found, replace the spring
		29x17.5	28.5	22.6 N (2.3 kg)	—	18.1 N (1.84 kg)	
2	Spool return spring (boom, blade)	46.2x20	25.4	98 N (10 kg)	—	78.4 N (8 kg)	
3	Spool return spring (travel)	42x20	25.4	74.5 N (7.6 kg)	—	59.6 N (6.1 kg)	

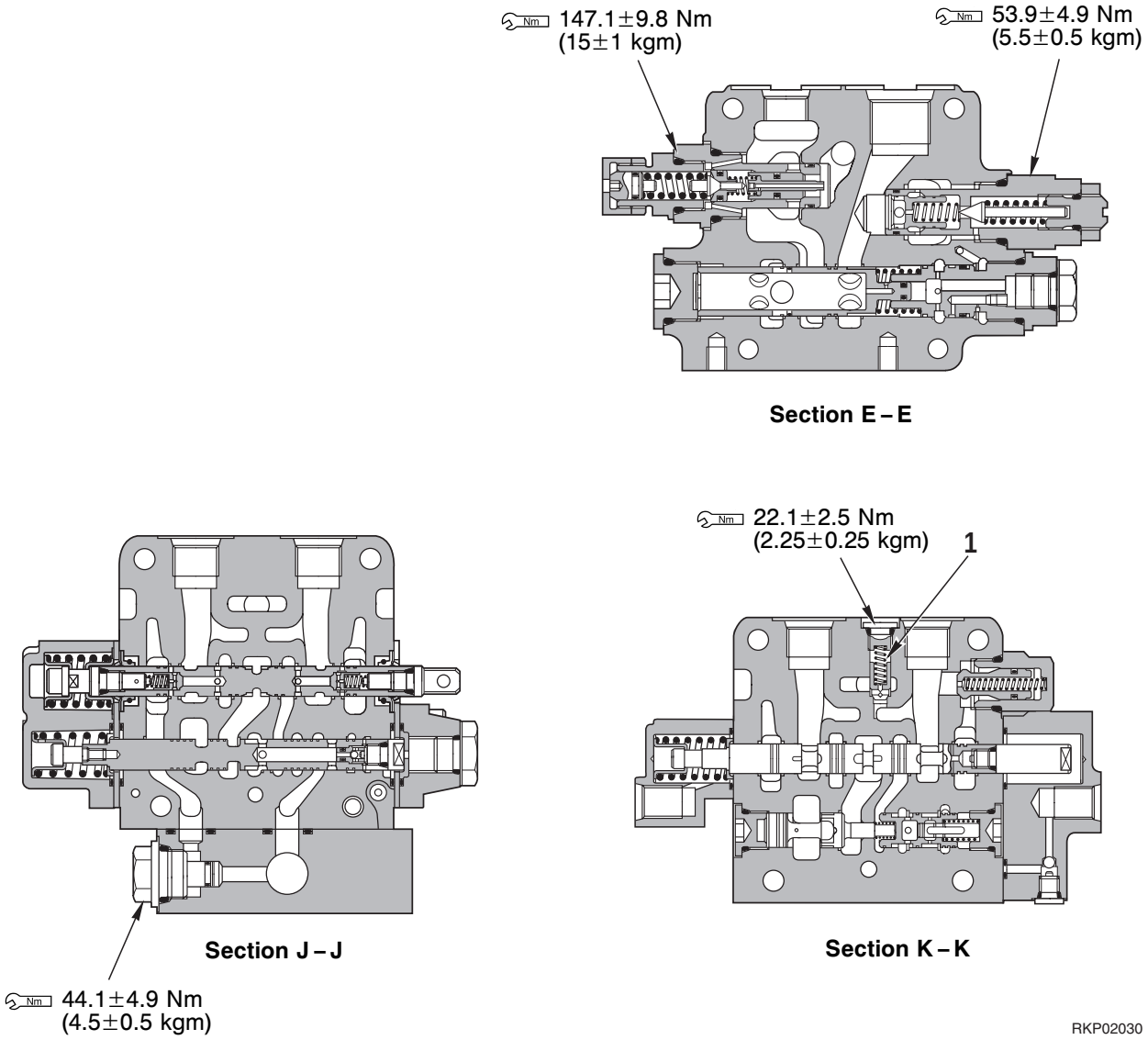


Section C – C

RKP01611

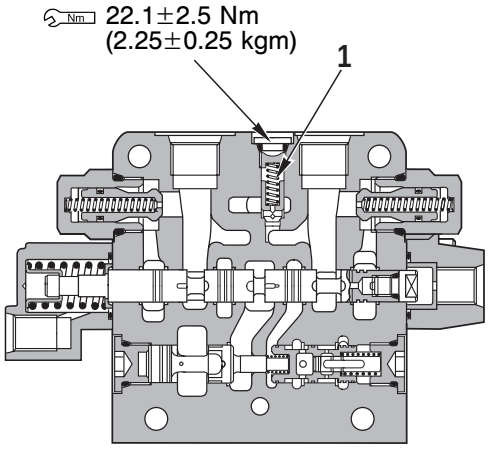
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Pressure compensation valve spring	Free length x Ø.D.	Installed length	Installed load	Free length	Installed load	When damage or deformation is found, replace the spring
		16.8x8.4	15	7.64 N (0.78 kg)	—	6.11 N (0.62 kg)	
2	Pressure compensation valve spring	20x8.4	12	6.86 N (0.7 kg)	—	5.49 N (0.56 kg)	
3	Unload valve spring	28.94x11.8	13	22.5 N (2.3 kg)	—	18 N (1.84 kg)	
4	Pressure compensation valve spring	38.2x9.2	20	30.4 N (3.1 kg)	—	24.3 N (2.5 kg)	
5	Cooler check valve spring	29.1x18.7	18	82.4 N (8.4 kg)	—	65.9 N (6.7 kg)	
6	Back pressure check valve spring	27.2x13.2	21	78.8 N (8.04 kg)	—	63 N (6.43 kg)	
7	Spool return spring (hammer)	29x17.5	28.5	22.6 N (2.3 kg)	—	18.1 N (1.84 kg)	

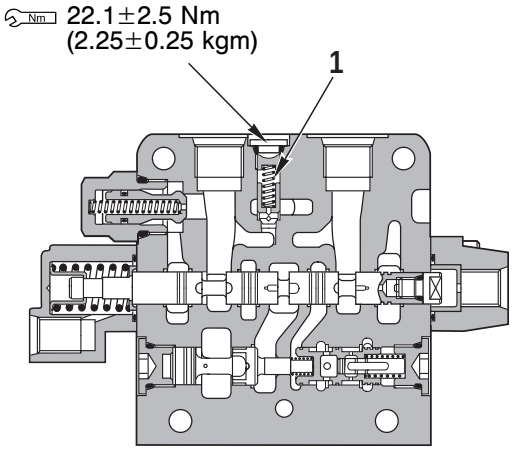


Unit: mm

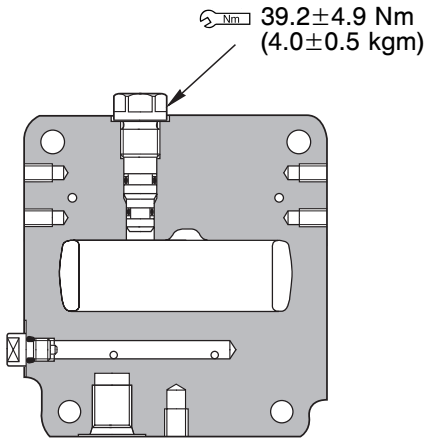
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Check valve spring (arm)	Free length x Ø.D.	Installed length	Installed load	Free length	Installed load	When damage or deformation is found, replace the spring
		21.9x5	15.8	1.96 N (0.2 kg)	—	1.57 N (0.16 kg)	



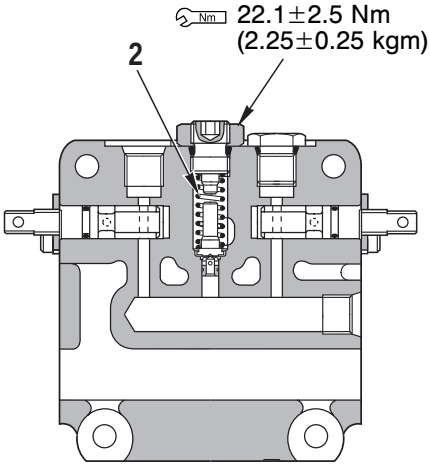
Section L – L



Section M – M



Section O – O



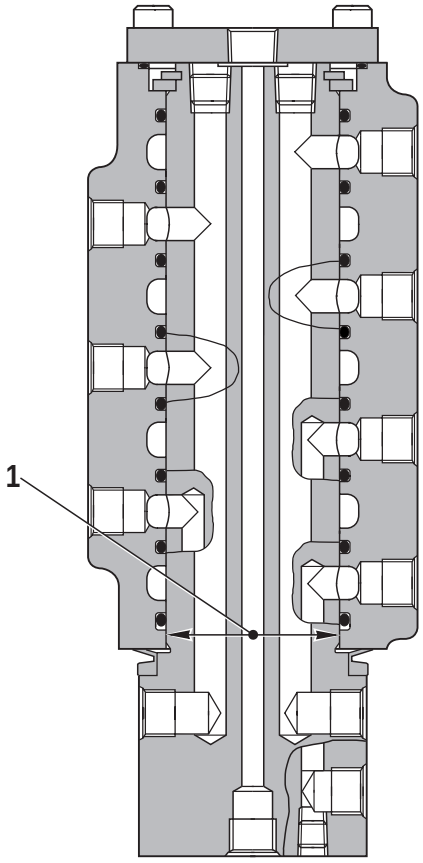
Section P – P

RKP02040

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Check valve spring	Free length x Ø.D.	Installed length	Installed load	Free length	Installed load	When damage or deformation is found, replace the spring
		21.9x5	15.8	1.96 N (0.2 kg)	—	1.57 N (0.16 kg)	
2	Pilot relief valve spring	32.4x10.4	27	83.3 N (8.5 kg)	—	66.6 N (6.8 kg)	

SWIVEL JOINT



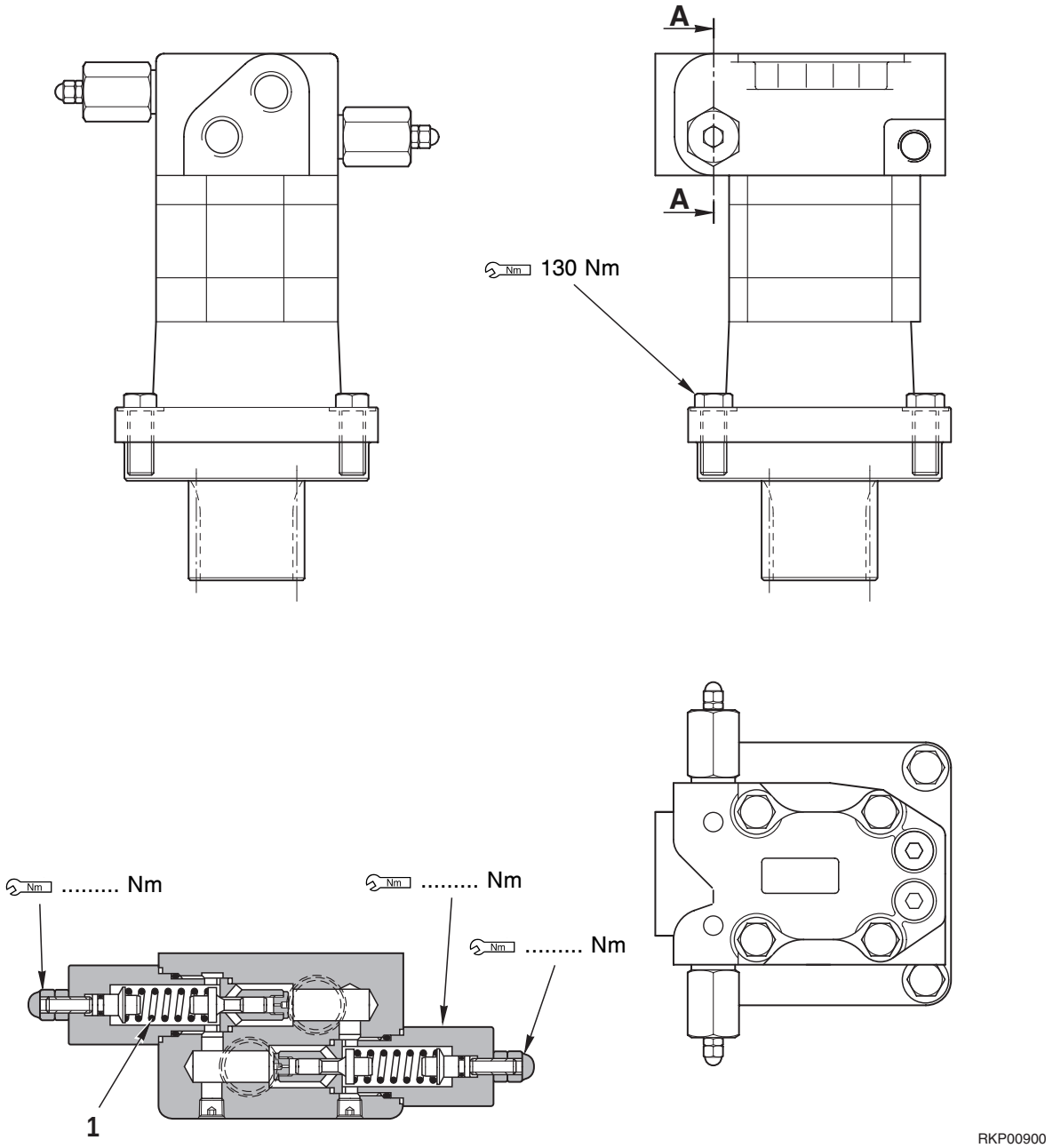
RKP00500

Unit: mm

No.	Check item	Criteria			Remedy
1	Clearance between rotor and shaft	Standard size	Standard clearance	Clearance limit	Replace
		45	0.055 – 0.085	0.090	

SWING MOTOR

PC20R-8

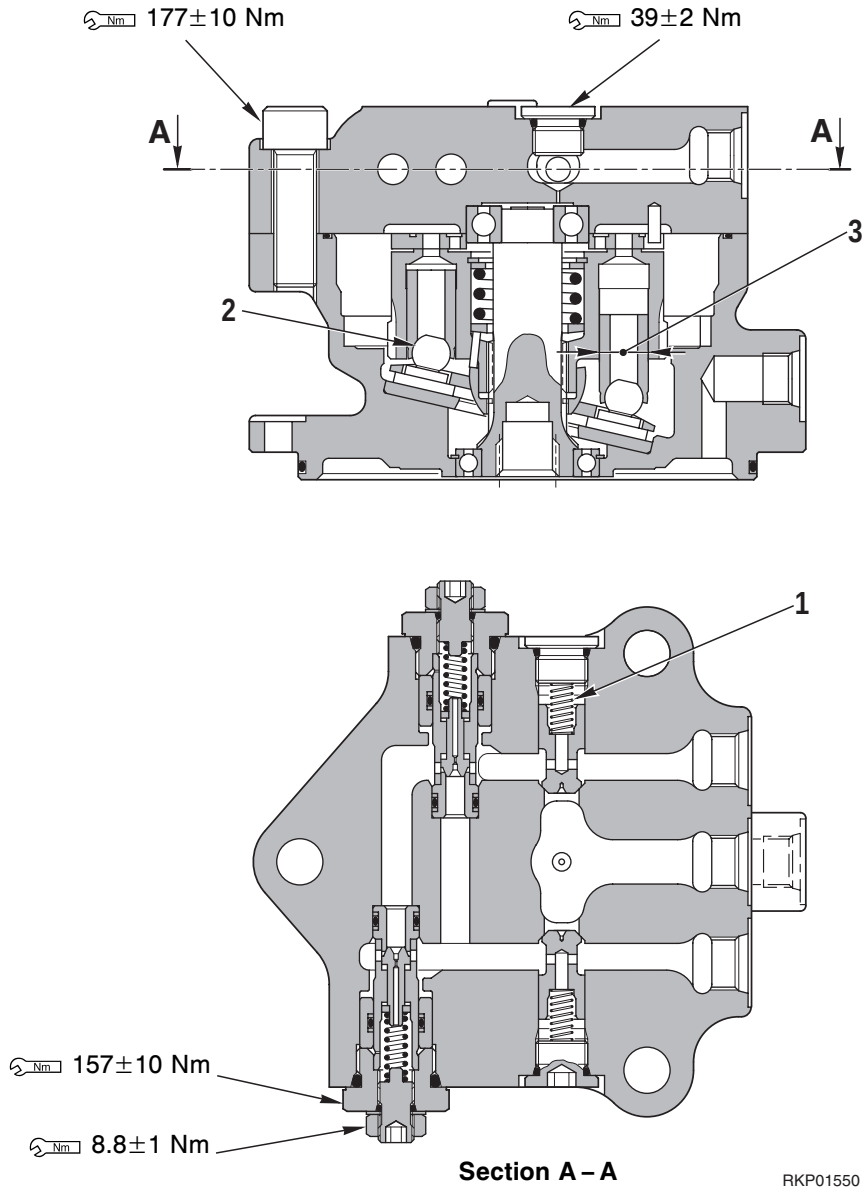


Section A – A

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Suction valve spring	Free length x Ø.D.	Installed length	Installed load	Free length	Installed load	When damage or deformation is found, replace the spring

PC27R-8



Section A – A

RKP01550

Unit: mm

No.	Check item	Criteria					Remedy
1	Check valve spring	Standard size			Repair limit		When damage or deformation is found, replace the spring
		Free length	Installed length	Installed load	Free length	Installed load	
		30.1	15.7	2.3 N	25.5	1.6 N	
2	Clearance between piston and cylinder	Standard clearance		Clearance limit			Replace
		0.03 – 0.15		0.4			
3	Clearance between shoe and piston	0.01 – 0.02		0.4			

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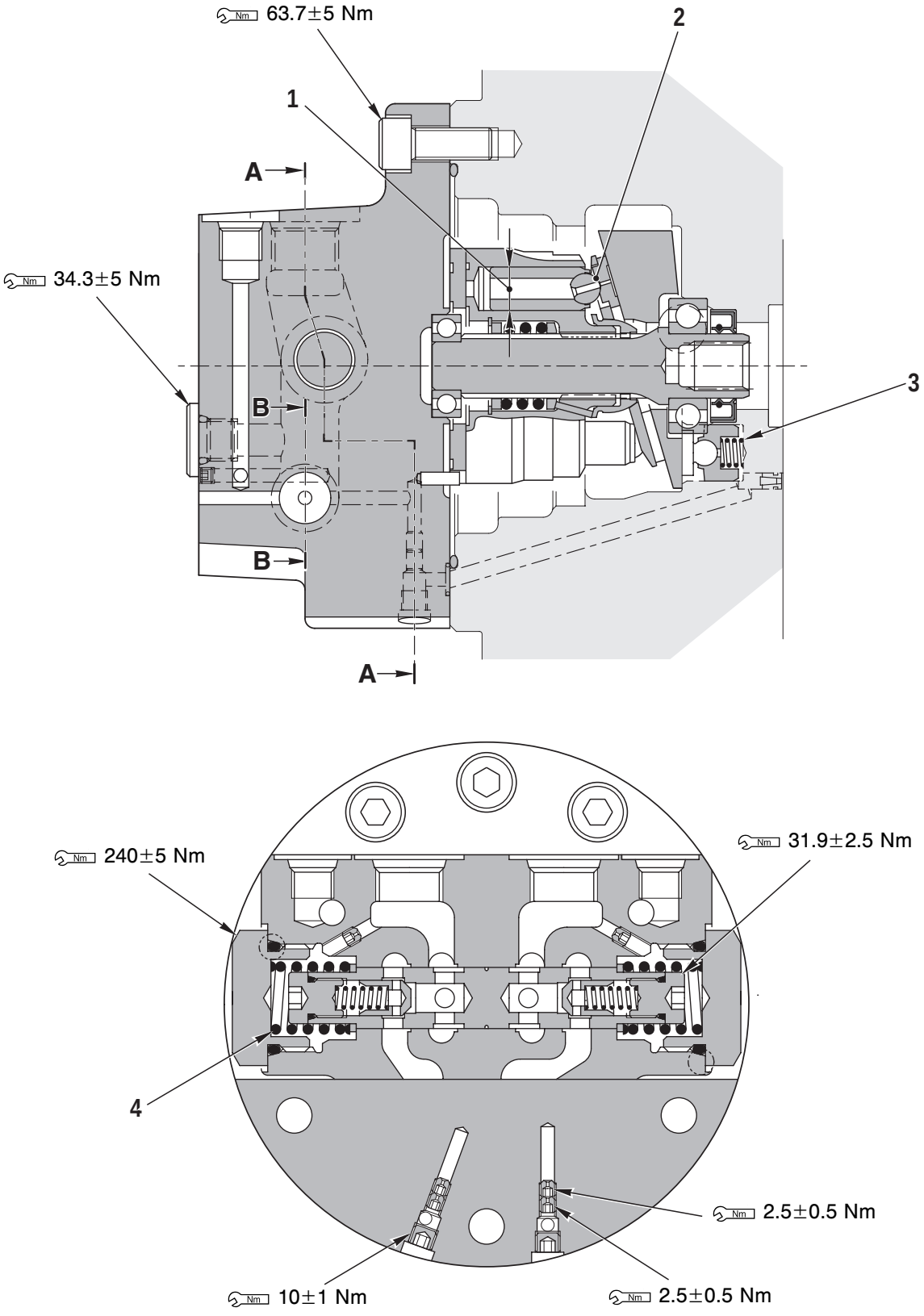
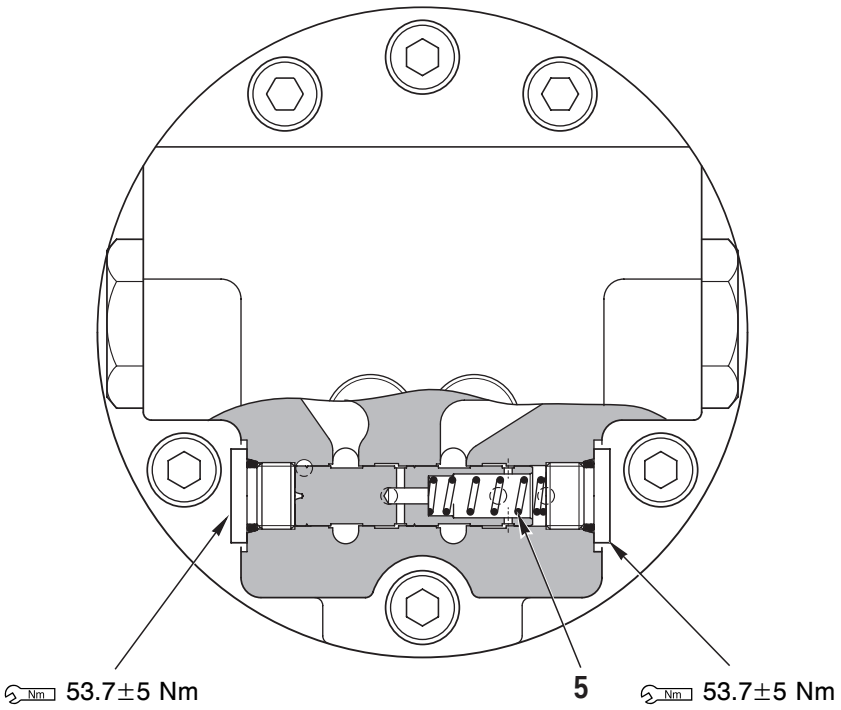
TRAVEL MOTOR



Section A – A

RKP01381



Section B – B

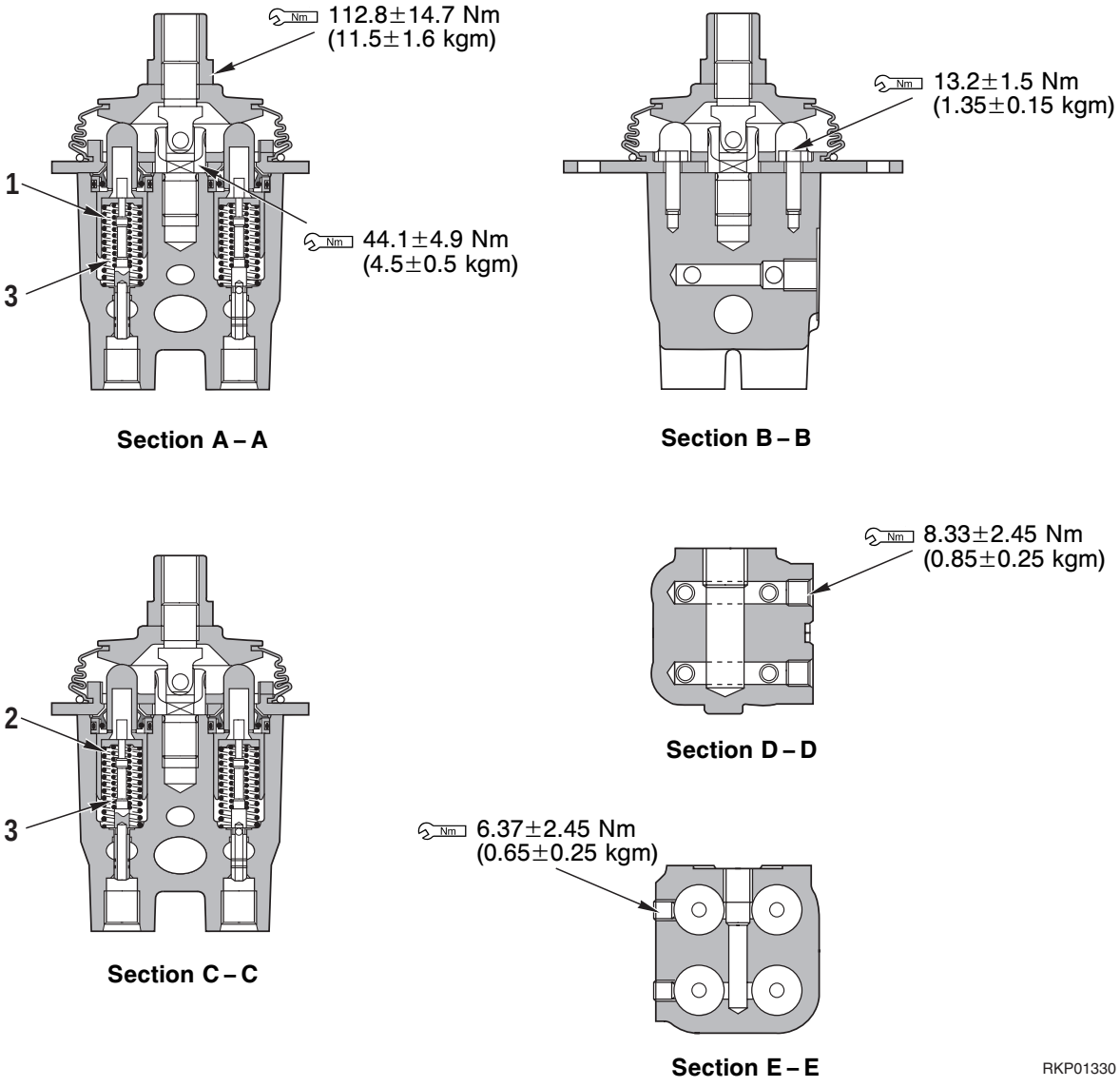
RKP01391

Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between piston and cylinder	Standard clearance			Clearance limit		Replace
		0.01 – 0.02			0.4		
2	Clearance between shoe and piston	0.03 – 0.15			0.4		
3	Travel increment piston spring	Standard size			Repair limit		When damage or deformation is found, replace the spring
		Free length	Installed length	Installed load	Free length	Installed load	
		15.7	7	7.8 N	13.9	6.3 N	
4	Braking valve return spring	29	24.7	60 N	28.1	48 N	
5	Travel increment spool return spring	36	29.5	68 N	34.7	54 N	

PPC VALVE

FOR BOOM, ARM, BUCKET, SWING

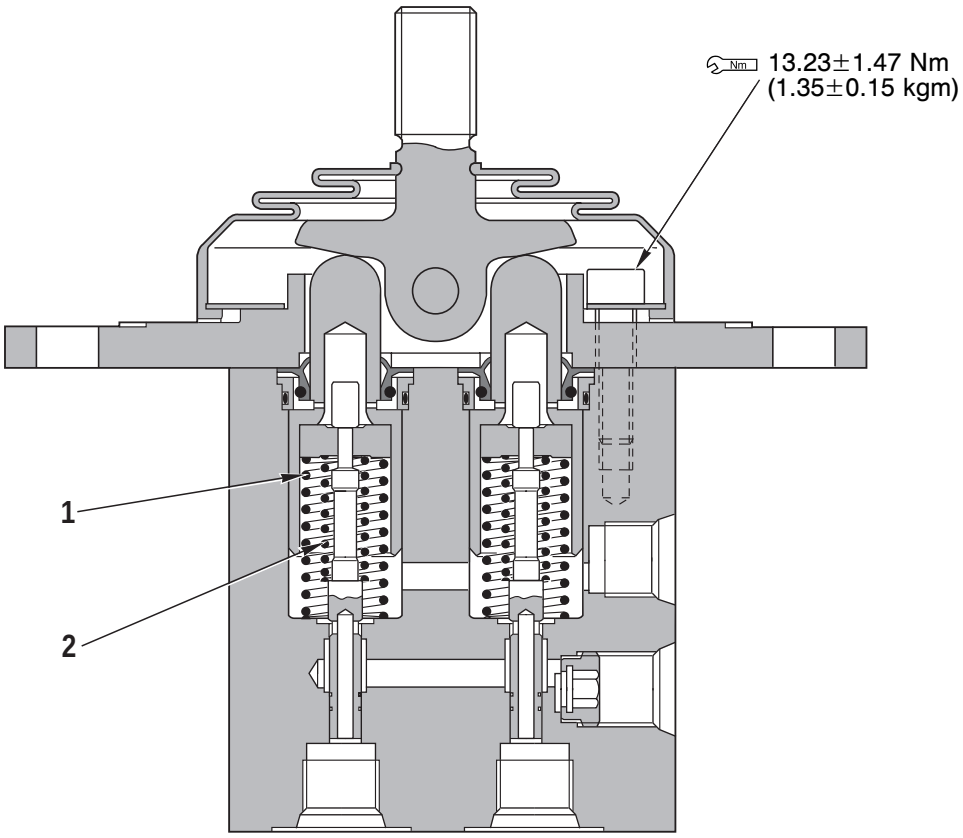


Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Centering spring (P3 and P4 port)	Free length x Ø.D.	Installed length	Installed load	Free length	Installed load	When damage or deformation is found, replace the spring
		38.7x15.5	34	9.8 N (1.0 kg)	—	7.8 N (0.8 kg)	
2	Centering spring (P1 and P2 port)	42.5x15.5	34	17.7 N (1.8 kg)	—	14.1 N (1.44 kg)	
3	Metering spring	26.5x9.2	24.9	16.7 N (1.7 kg)	—	13.7 N (1.4 kg)	

PPC VALVE

FOR HAMMER



RKP01710

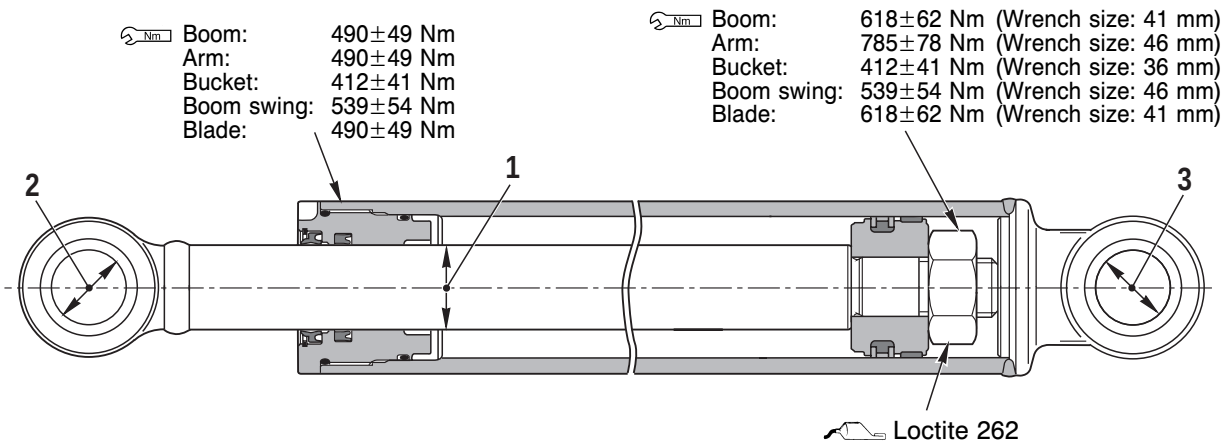
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Centering spring	Free length x Ø.D.	Installed length	Installed load	Free length	Installed load	Replace
		54.4x21.2	40.5	308.7 N (31.5 kg)	53.1	277.5 N (28.3 kg)	
2	Metering spring	25.9x11.0	25.0	24.5 N (2.5 kg)	25.8	21.6 N (2.2 kg)	

CYLINDER

PC20R-8

★ The figure represent arm cylinder

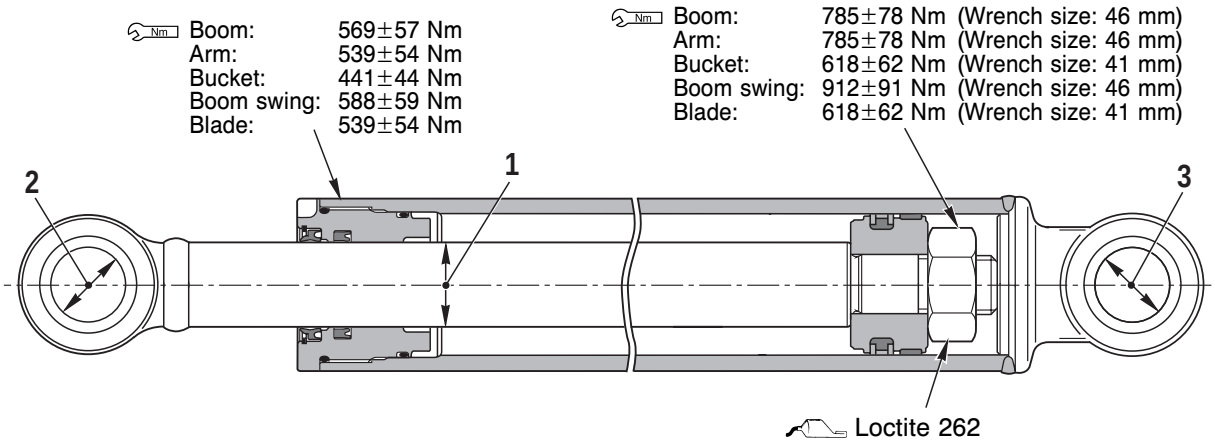


RKP01480

Unit: mm

No.	Check item		Criteria					Remedy
		Cylinder	Standard size	Tolerance		Standard clearance	Limit clearance	
				Shaft	Hole			
1	Clearance between piston rod and cylinder	Boom	40	−0.025 −0.087	+0.039 0	0.025 – 0.126	0.426	Replace cylinder head
		Arm	40	−0.025 −0.087	+0.039 0	0.025 – 0.126	0.426	
		Bucket	35	−0.025 −0.087	+0.039 0	0.025 – 0.126	0.426	
		Boom swing	40	−0.025 −0.087	+0.039 0	0.025 – 0.126	0.426	
		Blade	35	−0.025 −0.087	+0.039 0	0.025 – 0.126	0.426	
2	Clearance between cylinder head bushing and pin	Boom	35	−0.090 −0.130	+0.142 +0.080	0.170 – 0.272	1.0	Replace bushing
		Arm	35	−0.090 −0.130	+0.142 +0.080	0.170 – 0.272	1.0	
		Bucket	30	−0.090 −0.130	+0.117 +0.080	0.170 – 0.247	1.0	
		Boom swing	40	−0.010 −0.050	+0.134 +0.072	0.082 – 0.184	1.0	
		Blade	35	−0.090 −0.130	+0.142 +0.080	0.170 – 0.272	1.0	
3	Clearance between cylinder bottom bushing and pin	Boom	35	−0.090 −0.130	+0.142 +0.080	0.170 – 0.272	1.0	
		Arm	35	−0.090 −0.130	+0.142 +0.080	0.170 – 0.272	1.0	
		Bucket	30	−0.090 −0.130	+0.117 +0.080	0.170 – 0.247	1.0	
		Boom swing	40	−0.010 −0.050	+0.134 +0.072	0.082 – 0.184	1.0	
		Blade	35	−0.090 −0.130	+0.142 +0.080	0.170 – 0.272	1.0	

★ The figure represent arm cylinder

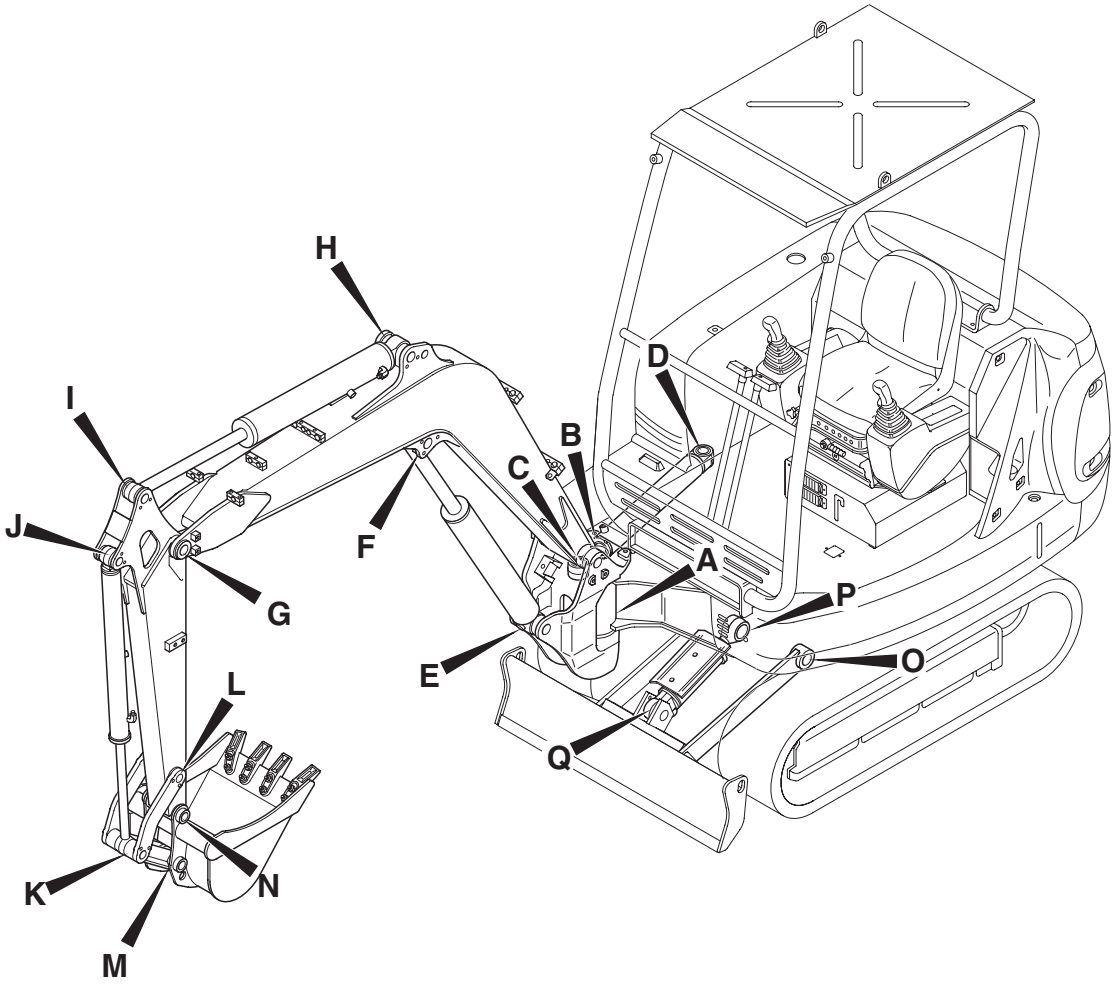


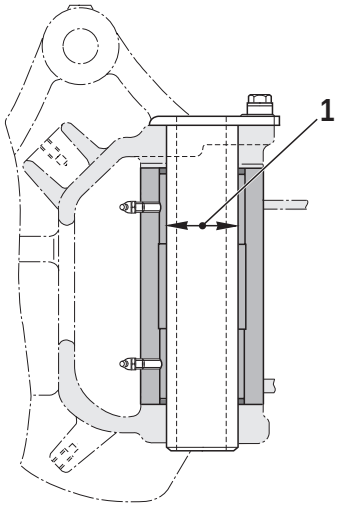
RKP01470

Unit: mm

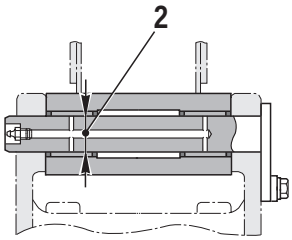
No.	Check item		Criteria					Remedy
		Cylinder	Misura standard	Tolerance		Standard clearance	Limit clearance	
				Shaft	Hole			
1	Clearance between piston rod and cylinder	Boom	45	−0.025 −0.087	+0.039 0	0.025 – 0.126	0.426	Replace cylinder head
		Arm	40	−0.025 −0.087	+0.039 0	0.025 – 0.126	0.426	
		Bucket	35	−0.025 −0.087	+0.039 0	0.025 – 0.126	0.426	
		Boom swing	40	−0.025 −0.087	+0.039 0	0.025 – 0.126	0.426	
		Blade	35	−0.025 −0.087	+0.039 0	0.025 – 0.126	0.426	
2	Clearance between cylinder head bushing and pin	Boom	40	−0.025 −0.064	+0.142 +0.080	0.105 – 0.206	1.0	Replace bushing
		Arm	35	−0.090 −0.130	+0.142 +0.080	0.170 – 0.272	1.0	
		Bucket	35	−0.090 −0.130	+0.142 +0.080	0.170 – 0.272	1.0	
		Boom swing	40	−0.010 −0.050	+0.134 +0.072	0.082 – 0.184	1.0	
		Blade	35	−0.090 −0.130	+0.142 +0.080	0.170 – 0.272	1.0	
3	Clearance between cylinder bottom bushing and pin	Boom	40	−0.025 −0.064	+0.142 +0.080	0.105 – 0.206	1.0	
		Arm	35	−0.090 −0.130	+0.142 +0.080	0.170 – 0.272	1.0	
		Bucket	35	−0.090 −0.130	+0.142 +0.080	0.170 – 0.272	1.0	
		Boom swing	40	−0.010 −0.050	+0.134 +0.072	0.082 – 0.184	1.0	
		Blade	35	−0.090 −0.130	+0.142 +0.080	0.170 – 0.272	1.0	

PC20R-8

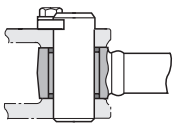




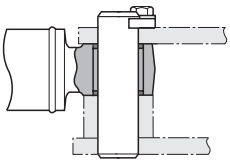
Section A – A



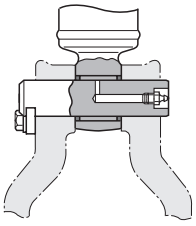
Section B – B



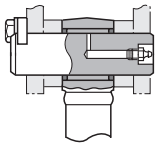
Section C – C



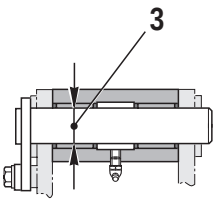
Section D – D



Section E – E

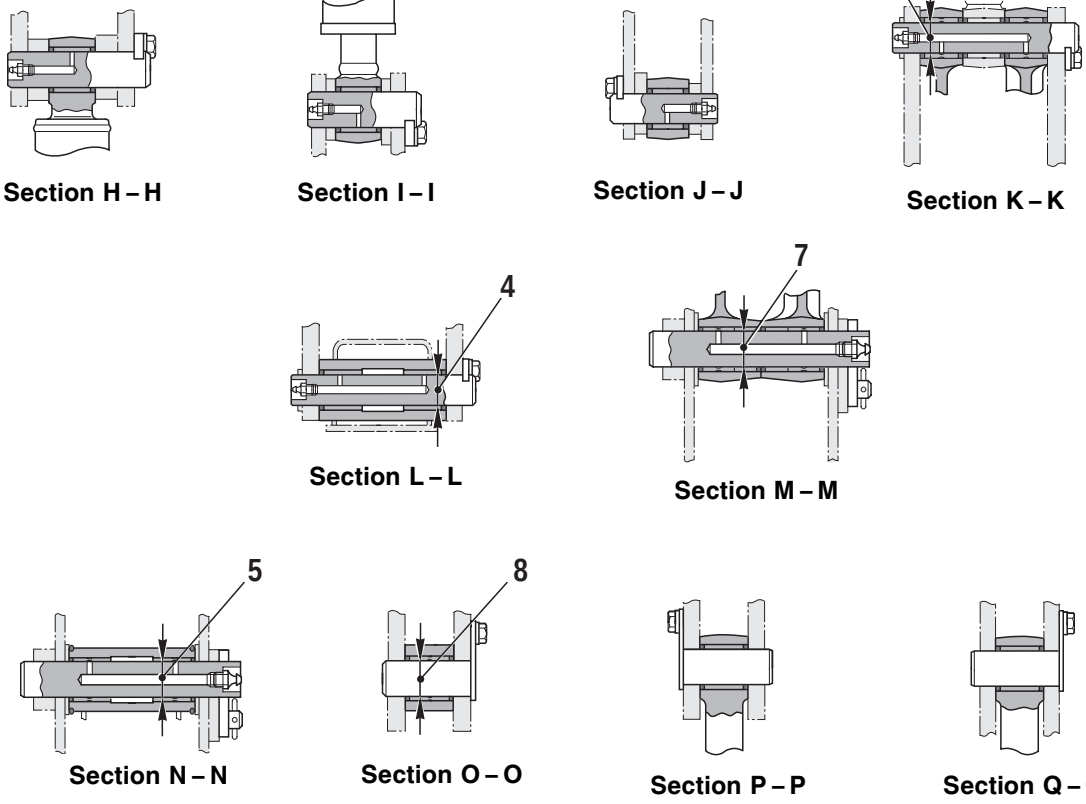


Section F – F



Section G – G

RKP01750



Unit: mm

No.	Check item	Criteria					Remedy
		Misura standard	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between bushing and mounting pin of boom swing bracket and revolving frame	70	– 0.030 – 0.076	+ 0.148 + 0.087	0.117 – 0.226	1.0	Replace
2	Clearance between bushing and mounting pin of boom swing bracket and boom	35	– 0.025 – 0.064	+ 0.100 + 0.048	0.073 – 0.164	1.0	
3	Clearance between bushing and mounting pin of arm and boom	35	– 0.090 – 0.130	+ 0.142 + 0.080	0.170 – 0.272	1.0	
4	Clearance between bushing and mounting pin of link and arm	30	– 0.090 – 0.130	+ 0.117 + 0.080	0.170 – 0.247	1.0	
5	Clearance between bushing and mounting pin of bucket and arm	30	– 0.090 – 0.130	+ 0.117 + 0.080	0.170 – 0.247	1.0	
6	Clearance between bushing and mounting pin of link and link	30	– 0.090 – 0.130	+ 0.117 + 0.080	0.170 – 0.247	1.0	
7	Clearance between bushing and mounting pin of bucket and link	30	– 0.090 – 0.130	+ 0.117 + 0.080	0.170 – 0.247	1.0	
8	Clearance between bushing and mounting pin of track frame and blade	35	– 0.090 – 0.130	+ 0.145 + 0.080	0.170 – 0.275	1.0	

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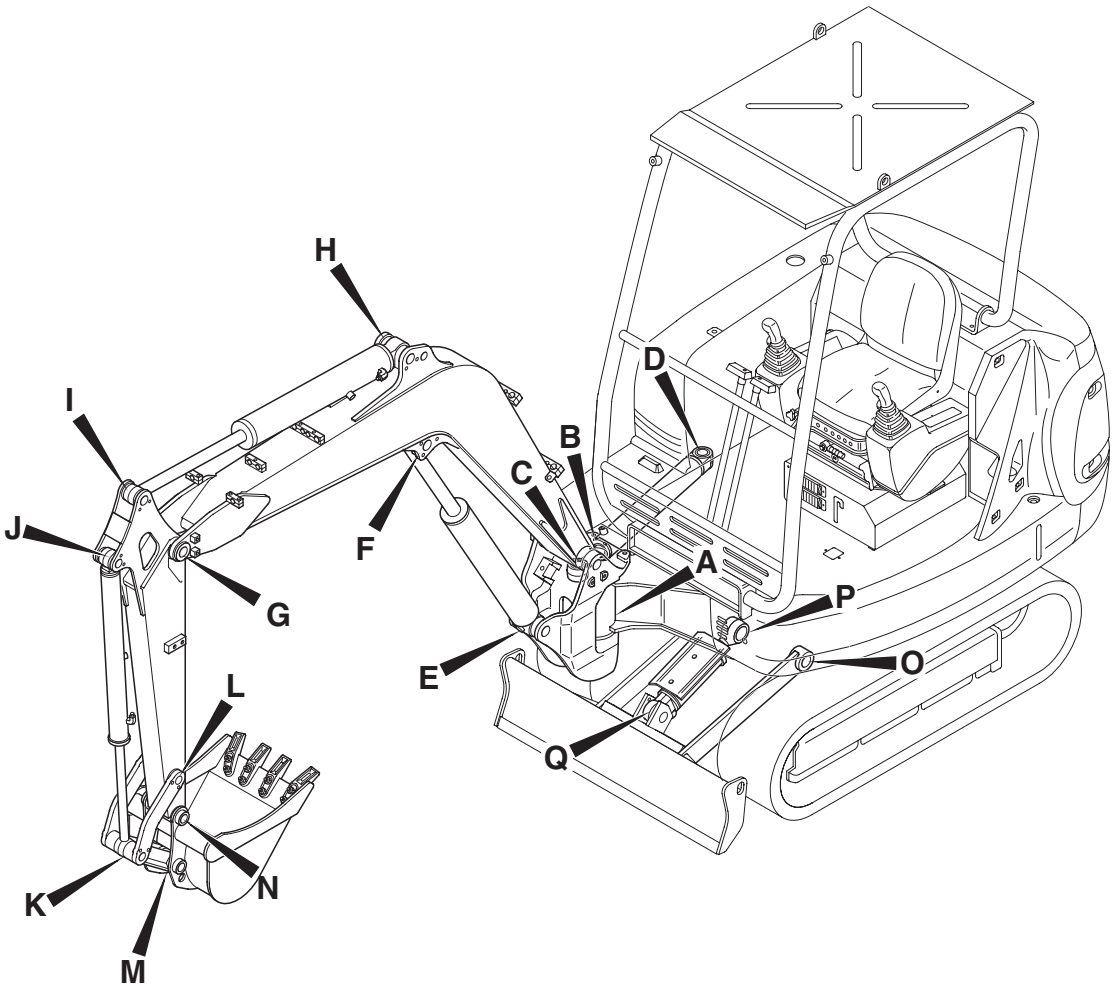
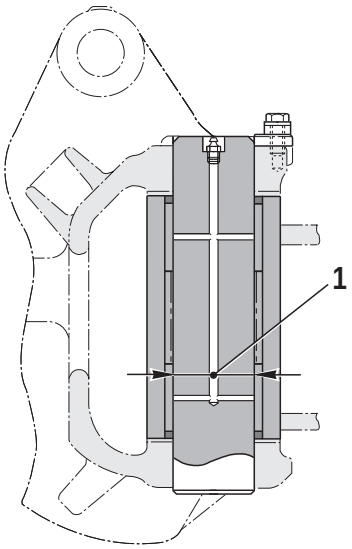
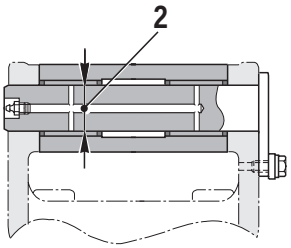
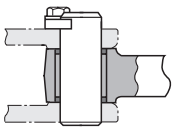




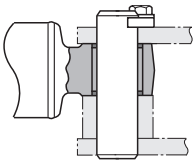
Section A – A



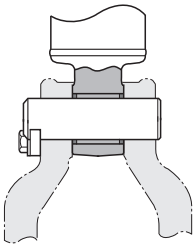
Section B – B



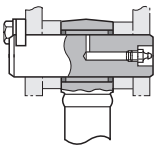
Section C – C



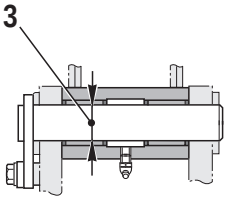
Section D – D



Section E – E

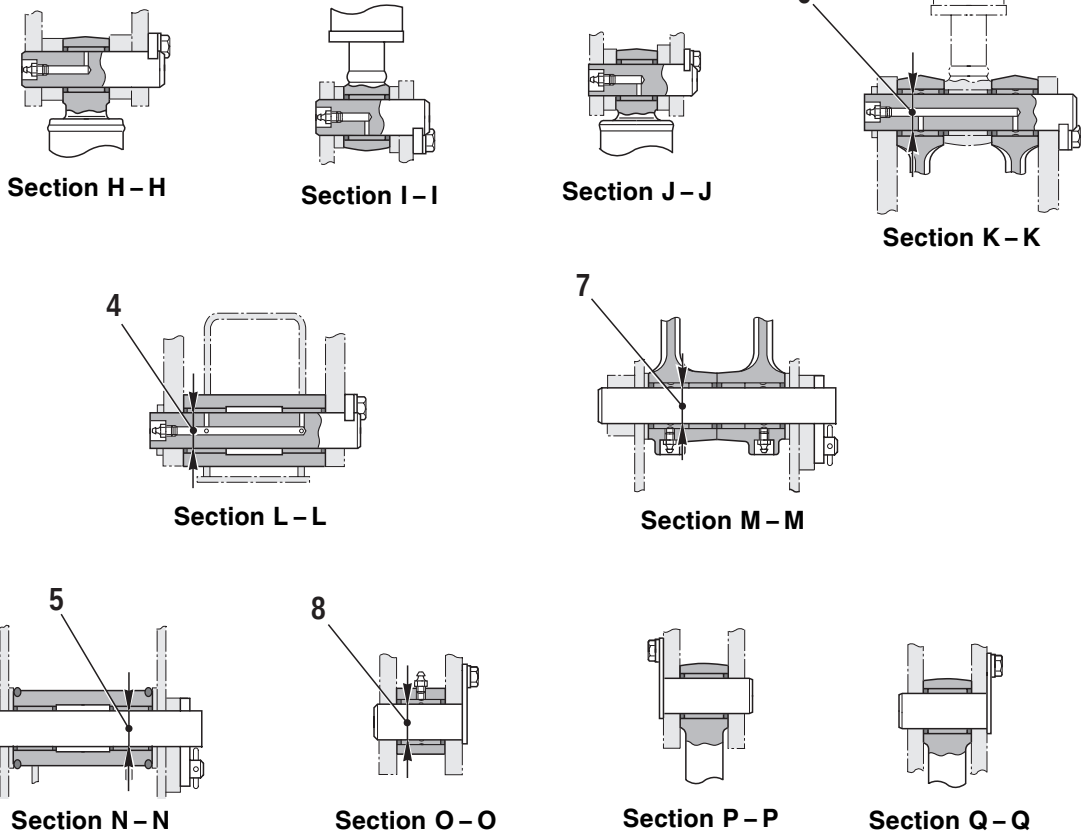


Section F – F



Section G – G

RKP01740



RKP01760

Unit: mm

No.	Check item	Criteria					Remedy
		Misura standard	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between bushing and mounting pin of boom swing bracket and revolving frame	80	– 0.030 – 0.076	+ 0.155 + 0.082	0.118 – 0.245	1.0	Replace
2	Clearance between bushing and mounting pin of boom swing bracket and boom	45	– 0.025 – 0.064	+ 0.128 + 0.075	0.100 – 0.192	1.0	
3	Clearance between bushing and mounting pin of arm and boom	35	– 0.090 – 0.130	+ 0.142 + 0.080	0.170 – 0.272	1.0	
4	Clearance between bushing and mounting pin of link and arm	35	– 0.090 – 0.130	+ 0.142 + 0.080	0.170 – 0.272	1.0	
5	Clearance between bushing and mounting pin of bucket and arm	35	– 0.090 – 0.130	+ 0.142 + 0.080	0.170 – 0.272	1.0	
6	Clearance between bushing and mounting pin of link and link	35	– 0.090 – 0.130	+ 0.142 + 0.080	0.170 – 0.272	1.0	
7	Clearance between bushing and mounting pin of bucket and link	35	– 0.090 – 0.130	+ 0.142 + 0.080	0.170 – 0.272	1.0	
8	Clearance between bushing and mounting pin of track frame and blade	35	– 0.090 – 0.130	+ 0.142 + 0.080	0.170 – 0.272	1.0	