WEBM001702

SHOP MANUAL

PC95R-2

HYDRAULIC EXCAVATOR

SERIAL NUMBER

PC95R-2 21D5210001 and up

PC95R-2 21D5220001 and up

KOMATSU

Utility

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IMPORTANT SAFETY

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.

   Fumare solo nelle zone senza divieto o preposte a tale scopo. Non fumare mai durante il lavoro.

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 outrigger, 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.

10. 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.

20. 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.

30. 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.

40. MAINTENANCE STANDARD
This section gives the judgement standards when inspecting disassembled parts.

NOTE

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:

10 - 3

- 10: Item number (10. Structure and Function)
- 3: Consecutive page number for each item

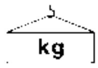
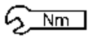
3. Additional pages: additional pages are indicated by a hyphen (–) and number after the page number. Fle as in the example.
   Example:

10-4
10-4-1 — Added pages
10-4-2 — Added pages
10-5

REVISED EDITION MARK
(①②③...)
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

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

2. Wire ropes

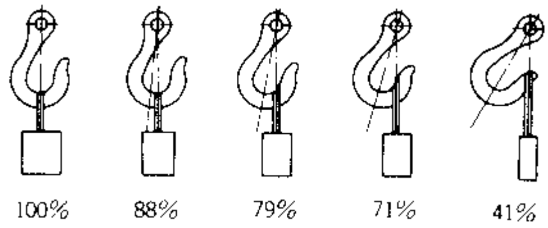
1) Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

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

Rope diameter (mm)	Allowable load (tons)
10.0	1.0
11.2	1.4
12.5	1.6
14.0	2.2
16.0	2.8
18.0	3.6
20.0	4.4
22.4	5.6
30.0	10.0
40.0	18.0
50.0	28.0
60.0	40.0

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

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



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°

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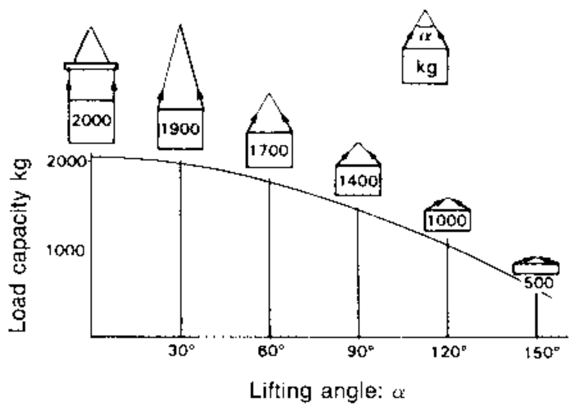


STANDARD TIGHTENING TORQUE

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

1. STANDARD TIGHTENING TORQUE OF BOLTS AND NUT

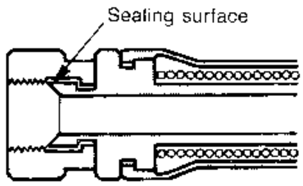
Thread diameter of bolts (mm)	Pitch of bolts (mm)	Width across flat (mm)		8.8		10.9	
		S	S	kgm	Nm	kgm	Nm
6	1	10	8	0,96±0,1	9,5±1	1,3±0,15	13,5±1,5
8	1,25	13	6	2,3±0,2	23±2	3,2±0,3	32,2±3,5
10	1,5	17	8	4,6±0,5	45±4,9	6,5±0,6	63±6,5
12	1,75	19	10	7,8±0,8	77±8	11±1	108±11
14	2	22	12	12,5±1	122±13	17,5±2	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.

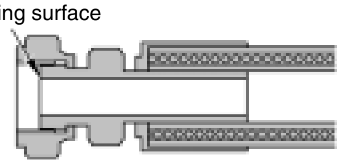
★ **Nm (newton metro): 1 Nm = 0,102 kgm**

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



Thread diameter of nut part (mm)	Width across flats of nut part (mm)	TIGHTENING TORQUE	
		kgm	Nm
9/16” - 18	17	2.3–2.5	23–25
11/16” - 16	22	3.4–3.9	33–38
13/16” - 16	24	5.2–5.8	51–57
1” - 14	30	8.2–9.2	80–90
1.3/16 - 12	36	12.2–13.3	120–130
1.7/16 - 12	41	15.3–17.3	150–170
1.11/16 - 12	50	18.4–20.4	180–200
2” - 12	57	20.4–24.4	200–240

COATING MATERIALS

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

Nomenclature	Code	Applications
	ASL800010	Used to apply rubber pads, rubber gaskets and cork plugs.
	ASL800020	Used to apply resin, rubber, metallic and non-metallic parts when a fast, strong seal is needed.
	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 243	Alternative product to 242; oil tolerant and so can used on lightly lubricated surfaces without prior use of activator.
Adhesives	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.
	ASL800060	Used by itself to seal grease fittings, tapered screw fittings and tapered screw fittings in hydraulic circuits of less than 50 mm in diameter.
Gasket sealant	Loctite 510	Used by itself on mounting flat surface (Clearance between surfaces within 0.2 mm)
	Loctite 518	Used by itself on mounting flat surface (Clearance between surfaces within 0.5 mm
Antifriction compound (Lubricant including Molybdenum disulfide)	ASL800040	Applied to bearings and taper shaft to facilitate press-fitting and to prevent sticking, burning or rusting.
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

ELECTRIC

In the wiring diagrams various colour 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)
	Number strands	Ø of strands (mm)	Cross section (mm)		
0.5	16	0.20	0.35	1.55	3.5
1	14	0.30	0.99	2.80	11
1.5	21	0,30	1.48	3.35	14
2.5	35	0,30	2.47	3.80	20
4	56	0.30	3.95	4.60	28
6	84	0.30	5.93	5.20	37
10	84	0.40	10.55	7.10	53
50	399	0,40	50.11	14	160
70	–	–	–	13.6	192

CLASSIFICATION BY COLOUR AND CODE

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

COMPOSITION OF THE COLOURS

The coloration of two-colour wires is indicated by the composition of the symbol 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	PC95R-2
Engine assembly	350
Radiator - exchanger	37
Hydraulic tank (without hydraulic oil)	62
Fuel tank (without fuel)	43
Revolving frame	1110
Counterweight	1150
Swing circle	124
Swing machinery assembly	87
Main pump + gear pump	97
Cabin	220
Seat	32
Seat support	14.5
Platform	51
Control valve	60
Track frame assembly: • Idler assembly • Sprocket • Final drive • Track roller • Carrier roller	1600
Track - shoe assembly (standard)	976x2
Engine hood	36
Front hood	27
Swivel joint	36
Swing bracket	230
Boom	300
1st boom	292
2nd boom	195
Arm (L=1600)	134
Arm (L=1850)	155
Arm (L=2300)	198
Blade	282
Boom cylinder	117
1-piece boom cylinder	58x2
Arm cylinder	100
Bucket cylinder	89
Boom swing cylinder	90
Blade cylinder	64

TABLE OF OIL AND COOLANT QUANTITIES

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE –30 –20 –10 0 10 20 30 40 50°C –22 –4 –14 32 50 68 86 104 122°F	CAPACITY (ℓ) Specified	Refill
Crankcase sump	OIL • API CD	SAE 10W SAE 30 SAE 40 SAE 15W-30 SAE 5W-30	12.5	12.5
Hydraulic circuit	OIL • API CD	SAE 10W SAE 5W-30	150	74
Hydraulic circuit with biodegradable oil			150	74
Final drive (each)	OIL • API GL5	SAE 85W/90	0.8	0.8
Swing machinery	OIL • API GL5	SAE 85W/90	4	4
Fuel tank	FUEL	✻ ASTM D975 N.2	125	–
Engine coolant system	PERMANENT LIQUID		18	–

✻ ASTM D975 N. 1

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

First filling quantity:
total quantity of oil, including the oil for the components and pipes.

Oil change quantity:
quantity of oil necessary to fill the system or unit during the normal inspection and maintenance operations.

NOTE:

(1) When the diesel oil sulphur content is less then 0.5%, change the engine oil according to the periodic maintenance intervals indicated in the operation and maintenance manual. In the diesel oil sulphur content exceeds 0.5% change the engine oil according to the following table:

Sulphur content	Engine oil change interval
from 0.5 to 1.0%	1/2 of regular interval
over 1.0%	1/4 of regular interval

(2) When starting the engine at temperatures below 0 °C, use engine oil SAE 10W, 20W-20 and 10W-30, even if during the day the temperature increases by 10 °C.

(3) Use engine oil with CD classification; if oil with CD classification is used, reduce the engine oil change interval by a half.

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

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CONVERSION TABLE

METHOD OF USING THE CONVERSION TABLE

The conversion table in this section is provided to enable simple conversion of figures.
For details of the method of using the conversion table, see the example given below.

EXAMPLE

- Method of using the conversion table to convert from millimeters to inches.

1. Convert 55 mm into inches.

1 - Locate the number 50 in the vertical column at the left side, take this as A, then drow a horizontal line from A.

2 - Locate the number 5 in the row across the top, take this as , then draw a perpendicular line down from B.

3 - Take the point where the two lines cross as C. This point C gives the value when converting from millimeters to inches. Therefore, 55 mm =2.165 in.

2. Convert 550 mm into inches

1 - The number 550 does not appear in the table, so divide by 10 (move the decimal point one place to the left) to convert it to 55 mm.

2 - Carry out the same procedure as above to convert 55 mm to 2.165 in.

3 - The original value (550 mm) was divided by 10, so multiply 2.165 in. by 10 (move the decimal point one place to the right) to return to the original value. This gives 550 mm = 21.65 in.

From millimeters to inches

B

1 mm = 0.03937 in.

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

From mm to in.

1 mm = 0.03937 in.

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

From kg to lb.

1 kg = 2.2046 lb.

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

From liter to U.S. Gall.

1 ℓ = 0.2642 U.S. Gall.

	0	1	2	3	4	5	6	7	8	9
0	0	0.264	0.528	0.793	1.057	1.321	1.585	1.849	2.113	2.378
10	2.642	2.906	3.170	3.434	3.698	3.963	4.227	4.491	4.755	5.019
20	5.283	5.548	5.812	6.076	6.340	6.604	6.869	7.133	7.397	7.661
30	7.925	8.189	8.454	8.718	8.982	9.246	9.510	9.774	10.039	10.303
40	10.567	10.831	11.095	11.359	11.624	11.888	12.152	12.416	12.680	12.944
50	13.209	13.473	13.737	14.001	14.265	14.529	14.795	15.058	15.322	15.586
60	15.850	16.115	16.379	16.643	16.907	17.171	17.435	17.700	17.964	18.228
70	18.492	18.756	19.020	19.285	19.549	19.813	20.077	20.341	20.605	20.870
80	21.134	21.398	21.662	21.926	22.190	22.455	22.719	22.983	23.247	23.511
90	23.775	24.040	24.304	24.568	24.832	25.096	25.361	25.625	25.889	26.153

From liter to U.K. Gall.

1 ℓ = 0.21997 U.K. Gall.

	0	1	2	3	4	5	6	7	8	9
0	0	0.220	0.440	0.660	0.880	1.100	1.320	1.540	1.760	1.980
10	2.200	2.420	2.640	2.860	3.080	3.300	3.520	3.740	3.950	4.179
20	4.399	4.619	4.839	5.059	5.279	5.499	5.719	5.939	6.159	6.379
30	6.599	6.819	7.039	7.259	7.479	7.969	7.919	8.139	8.359	8.579
40	8.799	9.019	9.239	9.459	9.679	9.899	10.119	10.339	10.559	10.778
50	10.998	11.281	11.438	11.658	11.878	12.098	12.318	12.528	12.758	12.978
60	13.198	13.418	13.638	13.858	14.078	14.298	14.518	14.738	14.958	15.178
70	15.398	15.618	15.838	16.058	16.278	16.498	16.718	16.938	17.158	17.378
80	17.598	17.818	18.037	12.257	18.477	18.697	18.917	19.137	19.357	19.577
90	19.797	20.017	20.237	20.457	20.677	20.897	21.117	21.337	21.557	21.777

From Nm to lb.ft.

1 Nm = 0.737 lb.ft.

	0	1	2	3	4	5	6	7	8	9
0	0	0.737	1.474	2.211	2.948	3.685	4.422	5.159	5.896	6.633
10	7.370	8.107	8.844	9.581	10.318	11.055	11.792	12.529	13.266	14.003
20	14.740	15.477	16.214	16.951	17.688	18.425	19.162	19.899	20.636	21.373
30	22.110	22.847	23.584	24.321	25.058	25.795	26.532	27.269	28.006	28.743
40	29.480	30.217	30.954	31.691	32.428	33.165	33.902	34.639	35.376	36.113
50	36.850	37.587	38.324	39.061	39.798	40.535	41.272	42.009	42.746	43.483
60	44.220	44.957	45.694	46.431	47.168	47.905	48.642	49.379	50.116	50.853
70	51.590	52.327	53.064	53.801	54.538	55.275	56.012	56.749	57.486	58.223
80	58.960	59.697	60.434	61.171	61.908	82.645	63.382	64.119	64.856	65.593
90	66.330	67.067	67.804	68.541	69.278	70.015	70.752	71.489	72.226	72.963
100	73.700	74.437	75.174	75.911	76.648	77.385	78.122	78.859	79.596	80.333
110	81.070	81.807	82.544	83.281	84.018	84.755	85.492	86.229	86.966	87.703
120	88.440	89.177	89.914	90.651	91.388	92.125	92.862	93.599	94.336	95.073
130	95.810	96.547	97.284	98.021	98.758	99.495	100.232	100.969	101.706	102.443
140	103.180	103.917	104.654	105.391	106.128	106.865	107.602	108.339	109.076	109.813
150	110.550	111.287	112.024	112.761	113.498	114.235	114.972	115.709	116.446	117.183
160	117.920	118.657	119.394	120.131	120.868	121.605	122.342	123.079	123.816	124.553
170	125.290	126.027	126.764	127.501	128.238	128.975	129.712	130.449	131.186	131.923
180	132.660	133.397	134.134	134.871	135.608	136.345	137.082	137.819	138.556	139.293
190	140.030	140.767	141.504	142.241	142.978	143.715	144.452	145.189	145.926	146.663

From Nm to kgm

1 Nm = 0.102 kgm

	0	1	2	3	4	5	6	7	8	9
0	0	0.102	0.204	0.306	0.408	0.510	0.612	0.714	0.816	0.918
10	1.020	1.222	1.224	1.326	1.428	1.530	1.632	1.734	1.836	1.938
20	2.040	2.142	2.244	2.346	2.448	2.550	2.652	2.754	2.856	2.958
30	3.060	3.162	3.264	3.366	3.468	3.570	3.672	3.774	3.876	3.978
40	4.080	4.182	4.284	4.386	4.488	4.590	4.692	4.794	4.896	4.998
50	5.100	5.202	5.304	5.406	5.508	5.610	5.712	5.814	5.916	6.018
60	6.120	6.222	6.324	6.426	6.528	6.630	6.732	6.834	6.936	7.038
70	7.140	7.242	7.344	7.446	7.548	7.650	7.752	7.854	7.956	8.058
80	8.160	8.262	8.364	8.466	8.568	8.670	8.772	8.874	8.976	9.078
90	9.180	9.282	9.384	9.486	9.588	9.690	9.792	9.894	9.996	10.098
100	10.200	10.302	10.404	10.506	10.608	10.710	10.812	10.914	11.016	11.118
110	11.220	11.322	11.424	11.526	11.628	11.730	11.832	11.934	12.036	12.138
120	12.240	12.342	12.444	12.546	12.648	12.750	12.852	12.954	13.056	13.158
130	13.260	13.362	13.464	13.566	13.668	13.770	13.872	13.974	14.076	14.178
140	14.280	14.382	14.484	14.586	14.688	14.790	14.892	14.994	15.096	15.198
150	15.300	15.402	15.504	15.606	15.708	15.810	15.912	16.014	16.116	16.218
160	16.320	16.422	16.524	16.626	16.728	16.830	16.932	17.034	17.136	17.238
170	17.340	17.442	17.544	17.646	17.748	17.850	17.952	18.054	18.156	18.258
180	18.360	18.462	18.564	18.666	18.768	18.870	18.972	19.074	19.176	19.278
190	19.380	19.482	19.584	19.686	19.788	19.890	19.992	20.094	20.196	20.298

From kgm to lb.ft.

1 kgm = 7.233 lb.ft.

	0	1	2	3	4	5	6	7	8	9
0	0	7.2	14.5	21.7	28.9	36.2	43.4	50.6	57.9	65.1
10	72.3	79.6	86.8	94.0	101.3	108.5	115.7	123.0	130.2	137.4
20	144.7	151.9	159.1	166.4	173.6	180.8	188.1	195.3	202.5	209.8
30	217.0	224.2	231.5	238.7	245.9	253.2	260.4	267.6	274.9	282.1
40	289.3	296.6	303.8	311.0	318.3	325.5	332.7	340.0	347.2	354.4
50	361.7	368.9	376.1	383.4	390.6	397.8	405.1	412.3	419.5	426.8
60	434.0	441.2	448.5	455.7	462.9	470.2	477.4	484.6	491.8	499.1
70	506.3	513.5	520.8	528.0	535.2	542.5	549.7	556.9	564.2	571.4
80	578.6	585.9	593.1	600.3	607.6	614.8	622.0	629.3	636.5	643.7
90	651.0	658.2	665.4	672.2	679.9	687.1	694.4	701.6	708.8	716.1
100	723.3	730.5	737.8	745.0	752.2	759.5	766.7	773.9	781.2	788.4
110	795.6	802.9	810.1	817.3	824.6	831.8	839.0	846.3	853.5	860.7
120	868.0	875.2	882.4	889.7	896.9	904.1	911.4	918.6	925.8	933.1
130	940.3	947.5	954.8	962.0	969.2	876.5	983.7	990.9	998.2	1005.4
140	1012.6	1019.9	1027.1	1034.3	1041.5	1048.8	1056.0	1063.2	1070.5	1077.7
150	1084.9	1092.2	1099.4	1106.6	1113.9	1121.1	1128.3	1135.6	1142.8	1150.0
160	1157.3	1164.5	1171.7	1179.0	1186.2	1193.4	1200.7	1207.9	1215.1	1222.4
170	1129.6	1236.8	1244.1	1251.3	1258.5	1265.8	1273.0	1280.1	1287.5	1294.7
180	1301.9	1309.2	1316.4	1323.6	1330.9	1338.1	1345.3	1352.6	1359.8	1367.0
190	1374.3	1381.5	1388.7	1396.0	1403.2	1410.4	1417.7	1424.9	1432.1	1439.4

From bar to psi (lb/in^2)

1 bar = 14.503 psi

	0	1	2	3	4	5	6	7	8	9
0	0	14.5	29.0	43.5	58.0	72.5	87.0	101.5	116.0	130.5
10	145.0	159.5	174.0	188.5	203.0	217.5	232.0	246.5	261.0	275.6
20	290.0	304.6	319.1	333.6	348.1	362.6	377.1	391.6	406.1	420.6
30	435.1	449.6	464.1	478.6	493.1	507.6	522.1	536.6	551.1	565.6
40	580.1	594.6	609.1	623.6	638.1	652.6	667.1	681.6	696.1	710.6
50	725.1	739.6	754.1	768.6	783.2	797.7	812.2	826.7	841.2	855.7
60	870.2	884.7	899.2	913.7	928.2	942.7	957.2	971.7	986.2	1000.7
70	1015.2	1029.7	1044.2	1058.7	1073.2	1087.7	1102.2	1116.7	1131.2	1145.7
80	1160.2	1174.7	1189.2	1203.7	1218.2	1232.7	1247.2	1261.8	1276.3	1290.8
90	1305.3	1319.8	1334.3	1348.8	1363.3	1377.8	1392.3	1406.8	1421.3	1435.8
100	1450.3	1464.8	1479.3	1493.8	1508.3	1522.8	1537.3	1551.8	1566.3	1580.8
110	1595.3	1609.8	1624.3	1638.8	1653.3	1667.8	1682.3	1696.8	1711.3	1725.8
120	1740.4	1754.9	1769.4	1783.9	1798.4	1812.9	1827.4	1841.9	1856.4	1870.8
130	1885.4	1899.9	1914.4	1928.9	1943.4	1957.9	1972.4	1986.9	2001.4	2015.9
140	2030.4	2044.9	2059.4	2073.9	2088.4	2102.9	1217.4	2131.9	2146.4	2160.9
150	2175.4	2189.9	2204.4	2218.9	2233.5	2248.0	2262.5	2277.0	2291.5	2306.0
160	2320.5	2335.0	2349.5	2364.0	2378.5	2393.0	2407.5	2422.0	2436.5	2451.0
170	2465.5	2480.0	2494.5	2509.0	2523.5	2538.0	2552.5	2567.0	2581.5	2596.0
180	2610.5	2625.0	2639.5	2654.0	2668.5	2683.0	2697.7	2712.1	2726.6	2641.1
190	2755.6	2770.0	2784.6	2799.1	2813.6	2828.1	2842.6	2857.1	2871.6	2886.1
200	2900.6	2915.1	2929.6	2944.1	2958.6	2973.1	2987.6	3002.1	3016.6	3031.1
210	3045.6	3060.1	3074.6	3089.1	3103.6	3118.1	3132.6	3147.1	3161.6	3176.1
220	3190.7	3205.2	3219.7	3234.2	3248.7	3263.2	3277.7	3192.2	3306.7	3321.2
230	3335.7	3350.2	3364.7	3379.2	3393.7	3408.2	3422.7	3437.2	3451.7	3466.2
240	3480.7	3495.2	3509.7	3524.2	3538.7	3553.2	3567.7	3582.2	3596.7	3611.2

TEMPERATURE

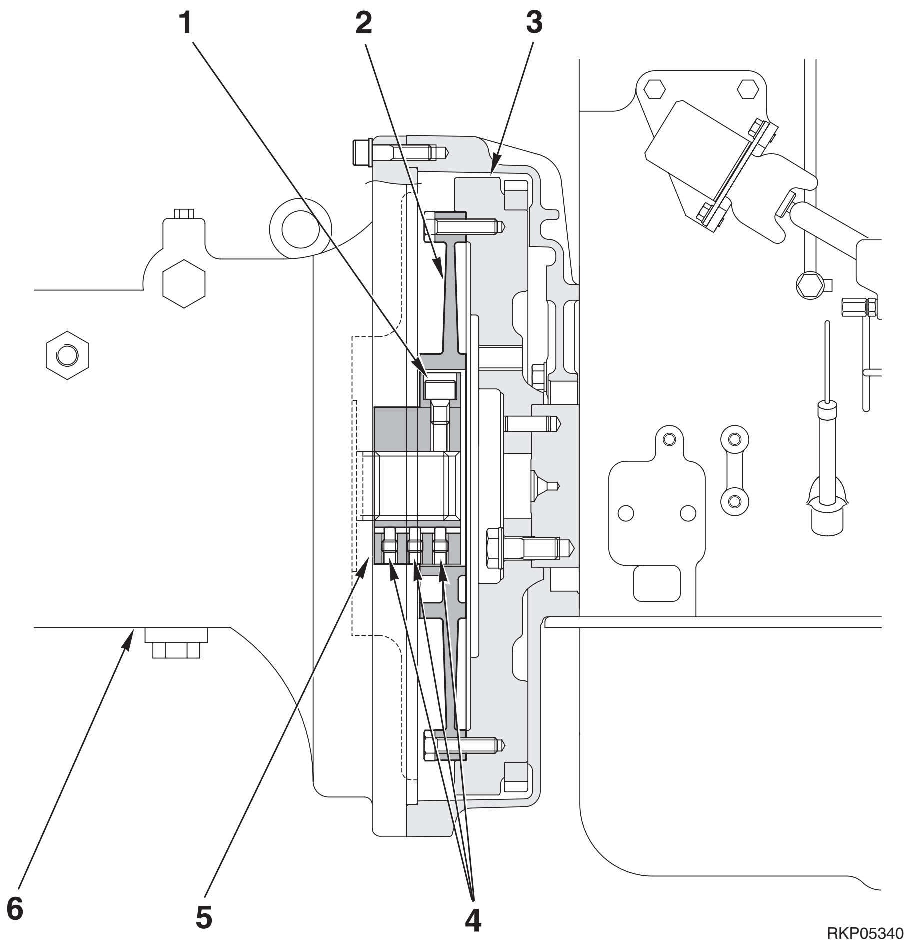
Fahrenheit-Centigrade conversion; a simple way to convert a Fahrenheit temperature reading into a Centigrade temperature reading or vice versa is to enter the accompanying table in the center or boldface column of figures.
These figures refer to the temperature in either Fahrenheit or Centigrade degrees.
If it is desired to convert from Fahrenheit to Centigrade degrees, consider the center column as a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left.
If it is desired to convert from Centigrade to Fahrenheit degrees, consider the center column as a table of Centigrade values and read the corresponding Fahrenheit temperature on the right.

1 °C = 33.8°F

°C		°F	°C		°F	°C		°F	°C		°F
–40.4	**–40**	–40.0	–11.7	**11**	51.8	7.8	**46**	144.8	27.2	**81**	117.8
–37.2	**–35**	–31.0	–11.1	**12**	53.6	8.3	**47**	116.6	27.8	**82**	179.6
–34.4	**–30**	–22.0	–10.6	**13**	55.4	8.9	**48**	118.4	28.3	**83**	181.4
–31.7	**–25**	–13.0	–10.0	**14**	57.2	9.4	**49**	120.2	28.9	**84**	183.2
–28.9	**–20**	–4.0	–9.4	**15**	59.0	10.0	**50**	122.0	29.4	**85**	185.0
–28.3	**–19**	–2.2	–8.9	**16**	60.8	10.6	**51**	123.8	30.0	**86**	186.8
–27.8	**–18**	–0.4	–8.3	**17**	62.6	11.1	**52**	125.6	30.6	**87**	188.6
–27.2	**–17**	1.4	–7.8	**18**	64.4	11.7	**53**	127.4	31.1	**88**	190.4
–26.7	**–16**	3.2	–7.2	**19**	66.2	12.2	**54**	129.2	31.7	**89**	192.2
–26.1	**–15**	5.0	–6.7	**20**	68.0	12.8	**55**	131.0	32.2	**90**	194.0
–25.6	**–14**	6.8	–6.1	**21**	69.8	13.3	**56**	132.8	32.8	**91**	195.8
–25.0	**–13**	8.6	–5.6	**22**	71.6	13.9	**57**	134.6	33.3	**92**	197.6
–24.4	**–12**	10.4	–5.0	**23**	73.4	14.4	**58**	136.4	33.9	**93**	199.4
–23.9	**–11**	12.2	–4.4	**24**	75.2	15.0	**59**	138.2	34.4	**94**	201.2
–23.3	**–10**	14.0	–3.9	**25**	77.0	15.6	**60**	140.0	35.0	**95**	203.0
–22.8	**–9**	15.8	–3.3	**26**	78.8	16.1	**61**	141.8	35.6	**96**	204.8
–22.2	**–8**	17.6	–2.8	**27**	80.6	16.7	**62**	143.6	36.1	**97**	206.6
–21.7	**–7**	19.4	–2.2	**28**	72.4	17.2	**63**	145.4	36.7	**98**	208.4
–21.1	**–6**	21.2	–1.7	**29**	84.2	17.8	**64**	147.2	37.2	**99**	210.2
–20.6	**–5**	23.0	–1.1	**30**	86.0	18.3	**65**	149.0	37.8	**100**	212.0
–20.0	**–4**	24.8	–0.6	**31**	87.8	18.9	**66**	150.8	40.6	**105**	221.0
–19.4	**–3**	26.6	0.0	**32**	89.6	19.4	**67**	152.6	43.3	**110**	230.0
–18.9	**–2**	28.4	0.6	**33**	91.4	20.0	**68**	154.4	46.1	**115**	239.0
–18.3	**–1**	30.2	1.1	**34**	93.2	20.6	**69**	156.2	48.9	**120**	248.0
–17.8	**0**	32.0	1.7	**35**	95.0	21.1	**70**	158.0	51.7	**125**	257.0
–17.2	**1**	33.8	2.2	**36**	96.8	21.7	**71**	159.8	54.4	**130**	266.0
–16.7	**2**	35.6	2.8	**37**	98.6	22.2	**72**	161.6	57.2	**135**	275.0
–16.1	**3**	37.4	3.3	**38**	100.4	22.8	**73**	163.4	60.0	**140**	284.0
–15.6	**4**	39.2	3.9	**39**	102.2	23.3	**74**	165.2	62.7	**145**	2930
–15.0	**5**	41.0	4.4	**40**	104.0	23.9	**75**	167.0	65.6	**150**	302.0
–14.4	**6**	42.8	5.0	**41**	105.8	24.4	**76**	168.8	68.3	**155**	311.0
–13.9	**7**	44.6	5.6	**42**	107.6	25.0	**77**	170.6	71.1	**160**	320.0
–13.3	**8**	46.4	6.1	**43**	109.4	25.6	**78**	172.4	73.9	**165**	329.0
–12.8	**9**	48.2	6.7	**44**	111.2	26.1	**79**	174.2	76.7	**170**	338.0
–12.2	**10**	50.0	7.2	**45**	113.0	26.7	**80**	176.0	79.4	**175**	347.0

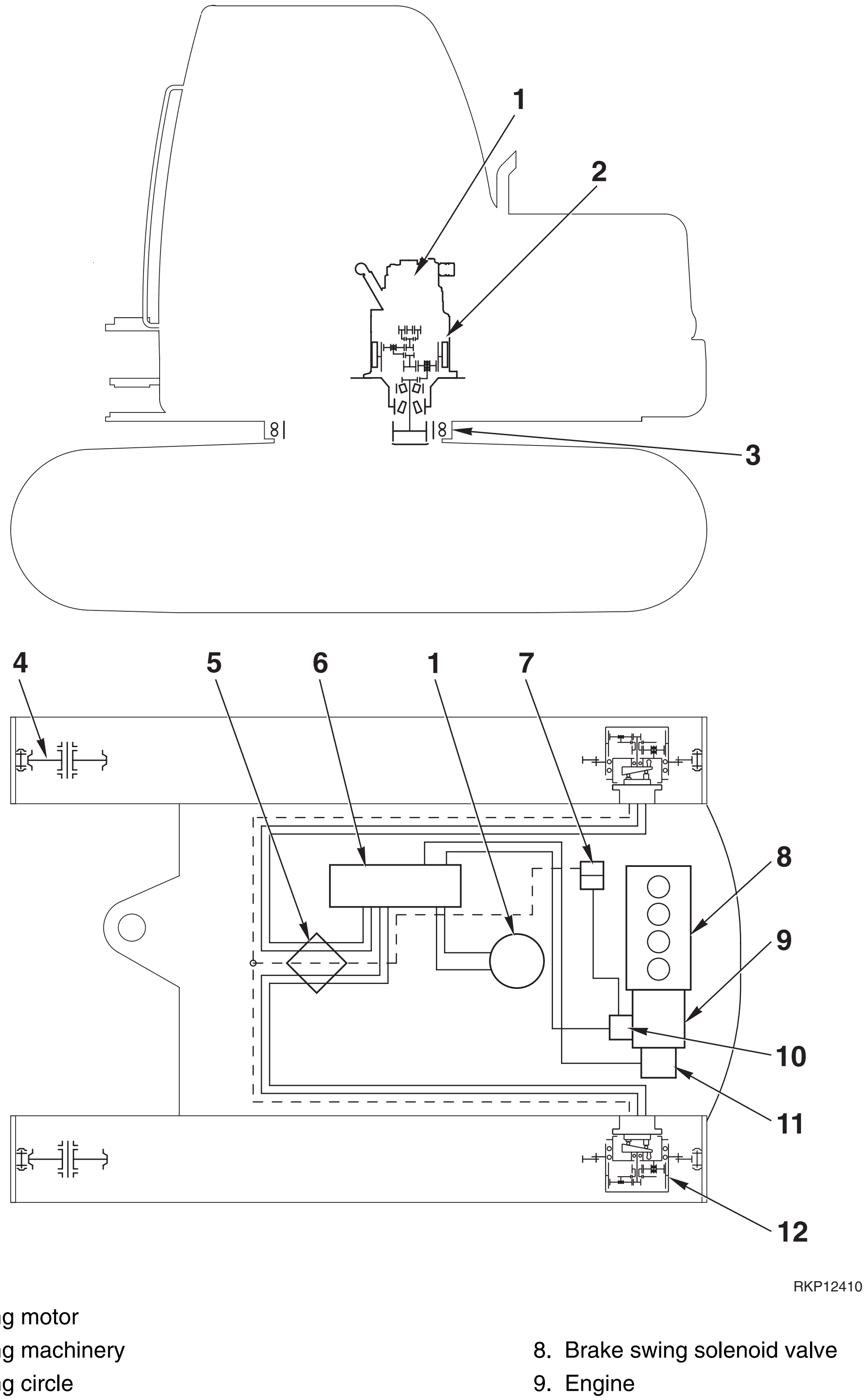
10 STRUCTURE AND FUNCTION

P.T.O.



1. Damper
2. Disc
3. Flywheel
4. Dowel
5. Hub
6. Pump

POWER TRAIN



1. Swing motor
2. Swing machinery
3. Swing circle
4. Idler
5. Center swivel joint
6. Control valve
7. Travel acceleration solenoid valve
8. Brake swing solenoid valve
9. Engine
10. Main hydraulic pump
11. Servocontrol feed unit
12. Gear pump
13. Travel motor

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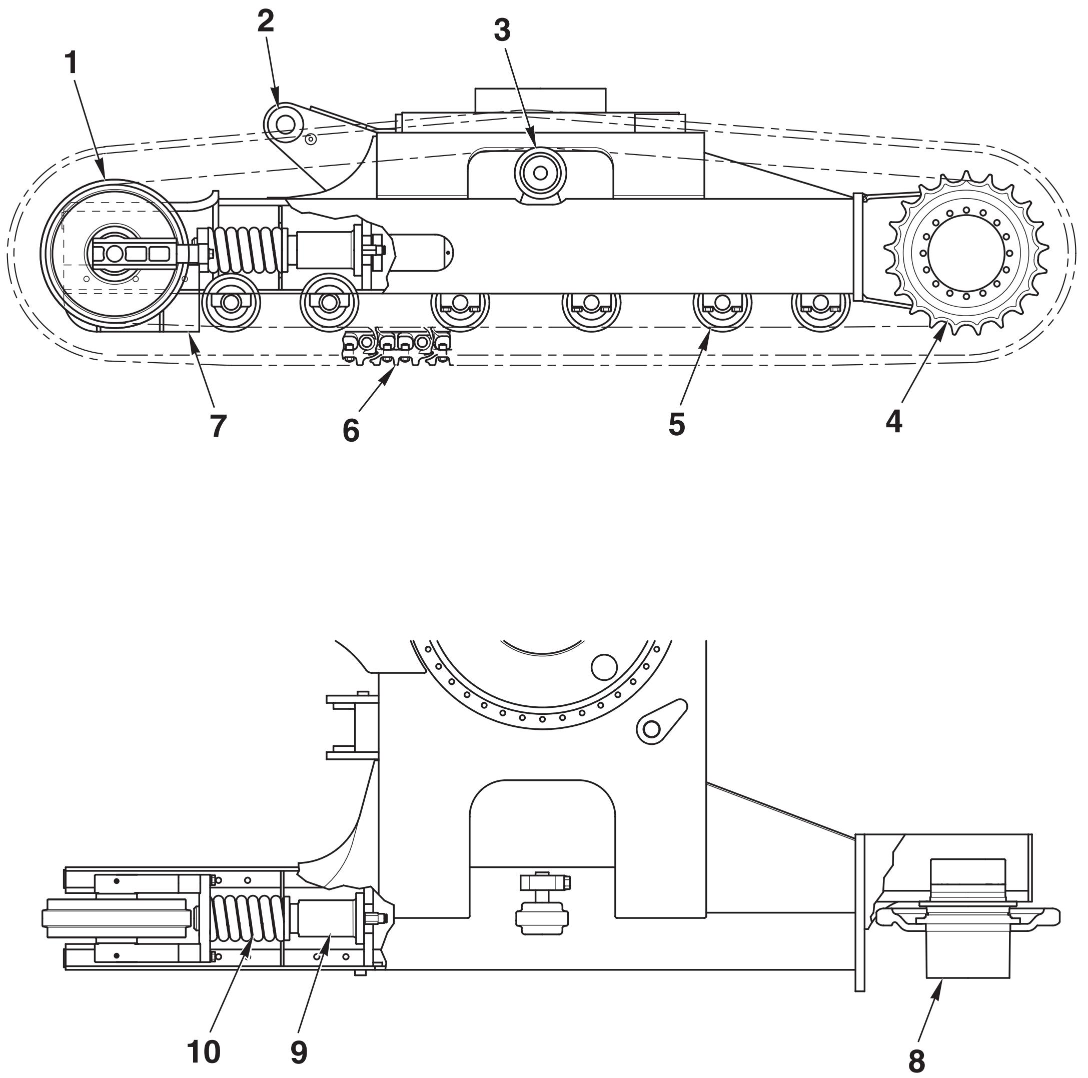
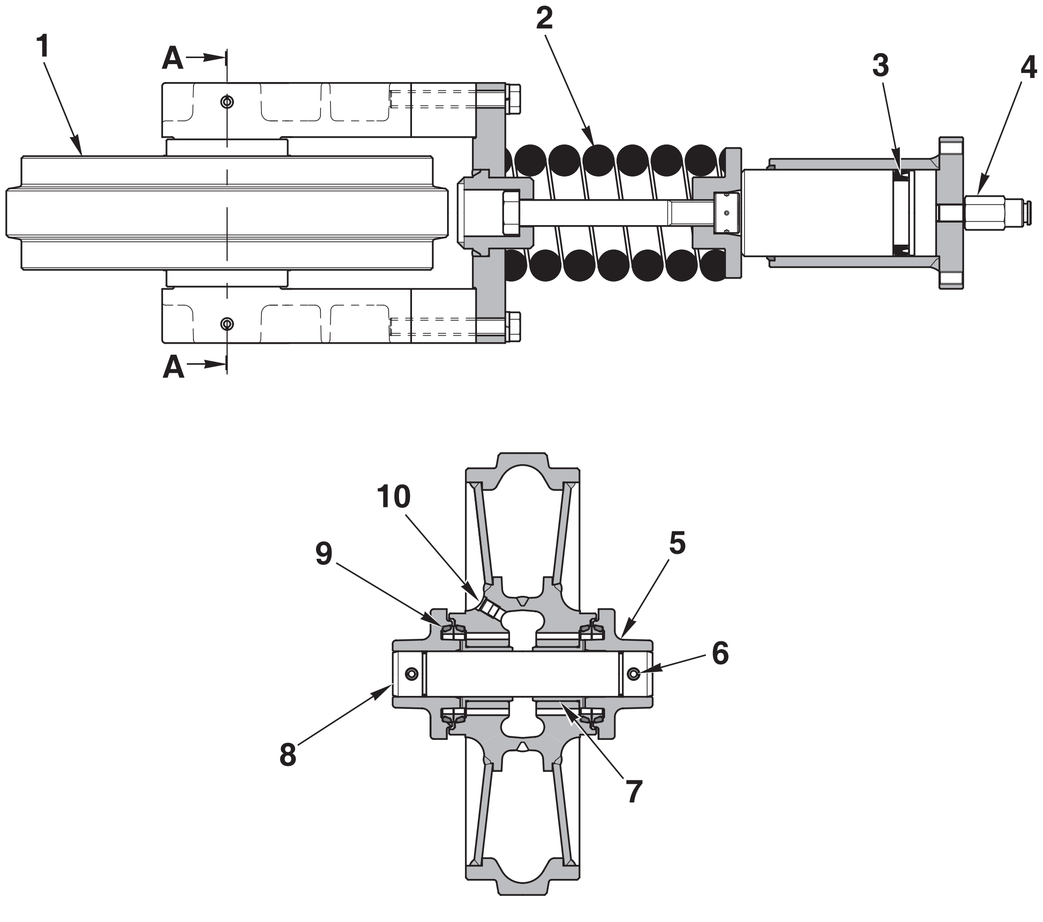
TRACK FRAME



1. Idler
2. Track frame
3. Carrier roller
4. Sprocket
5. Track roller
6. Track shoe
7. Guard
8. Final drive
9. Idler cushion
10. Recoil spring

IDLER AND RECOIL SPRING



Section A - A

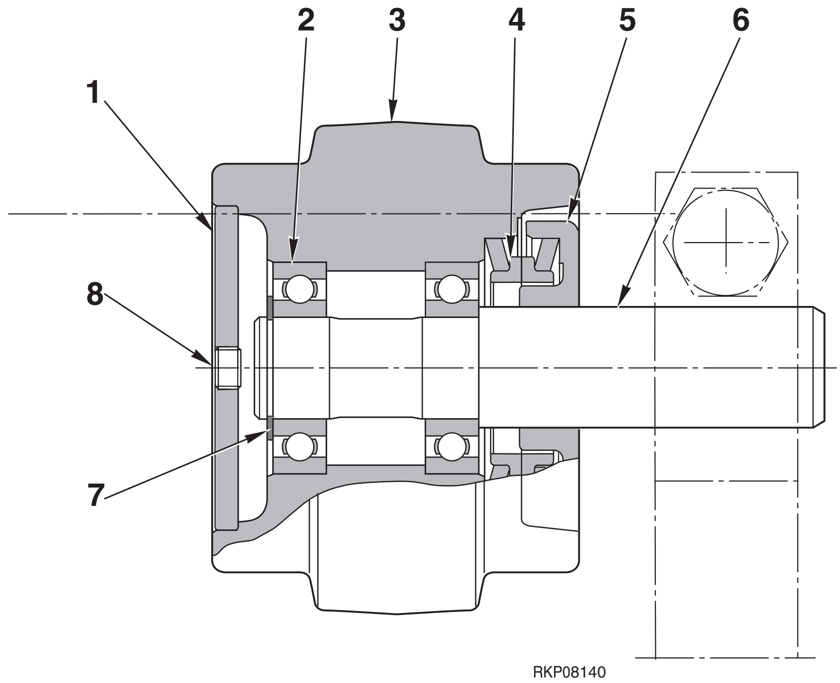
RKP10731

1. Idler
2. Recoil spring
3. Gasket
4. Lubricator
5. Support
6. Spring pin
7. Bushing
8. Shaft
9. Floating seal
10. Plug

SPECIFICATIONS

Amount of oil: 600 cc

CARRIER ROLLER

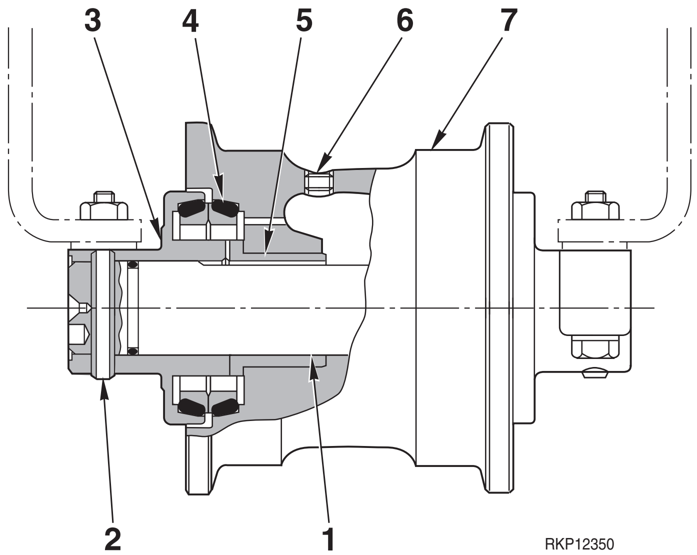


1. Cover
2. Bearing
3. Roller
4. Seal
5. Ring
6. Shaft
7. Snap ring
8. Plug

SPECIFICATIONS

Amount of oil: 120 cc

TRACK ROLLER

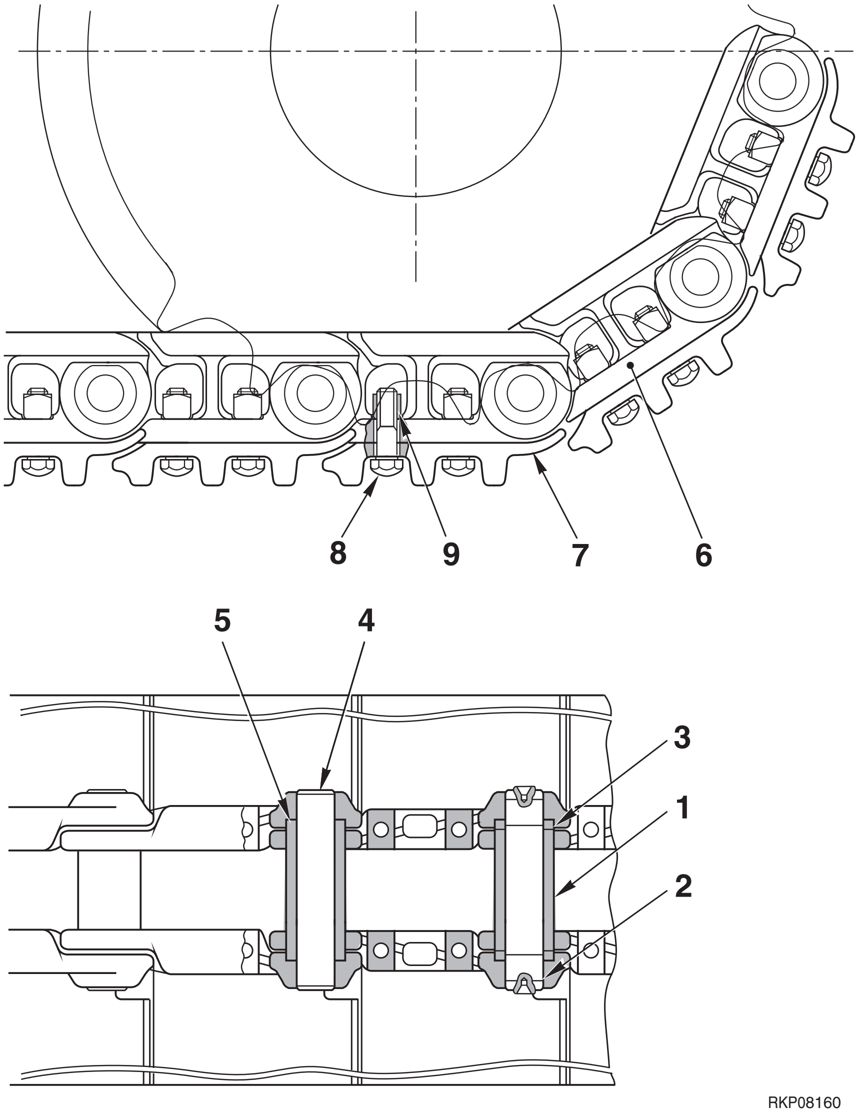


1. Shaft
2. Spring pin
3. Support
4. Seal
5. Bushing
6. Plug
7. Roller

SPECIFICATIONS

Amount of oil: 250 cc

TRACK SHOE



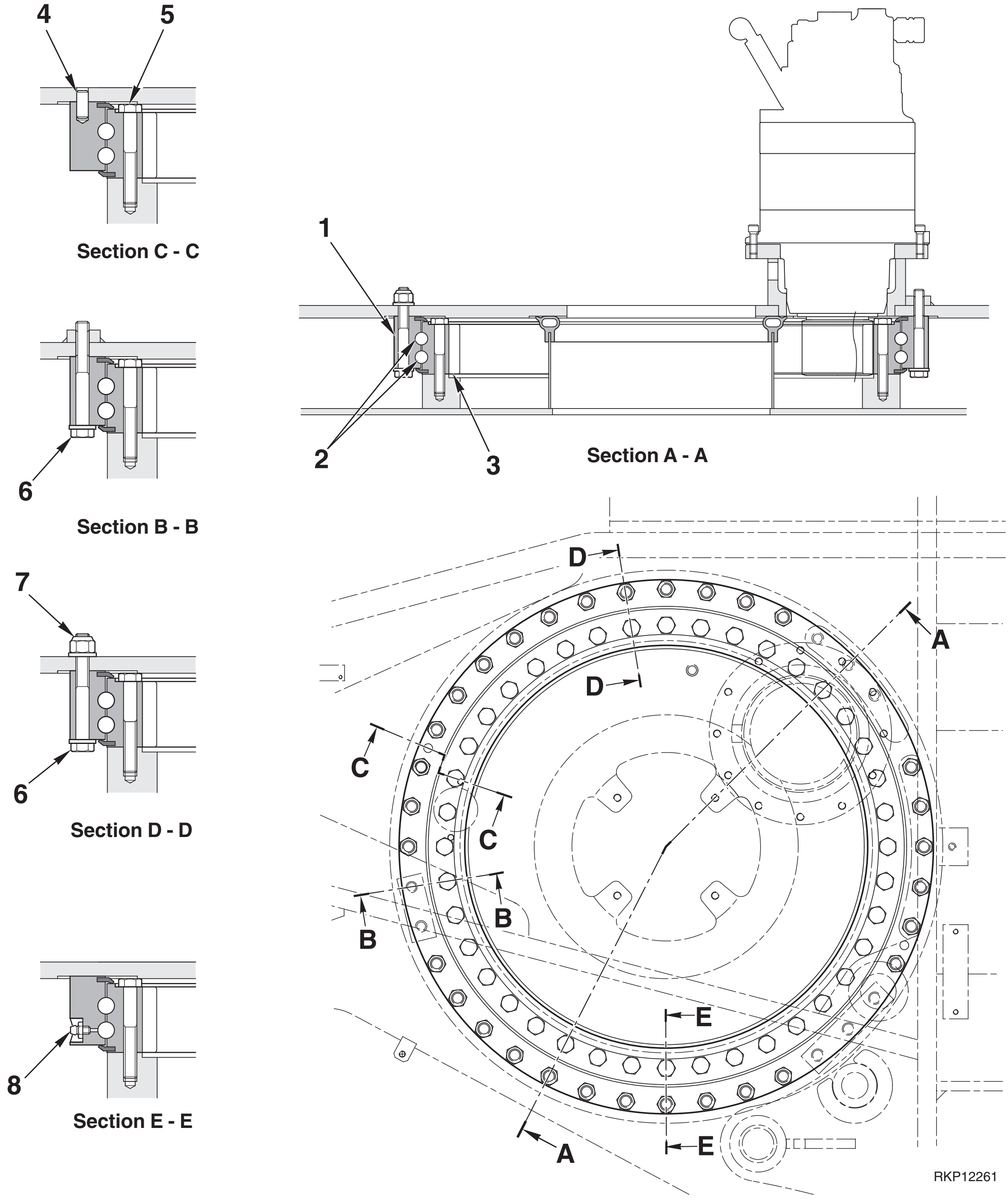
1. Master bushing
2. Master pin
3. Spacer
4. Regular pin
5. Bushing
6. Link
7. Shoe
8. Shoe bolt
9. Shoe nut

STANDARD SHOE

Width: 450 mm

Link pitch: 140 mm

SWING CIRCLE

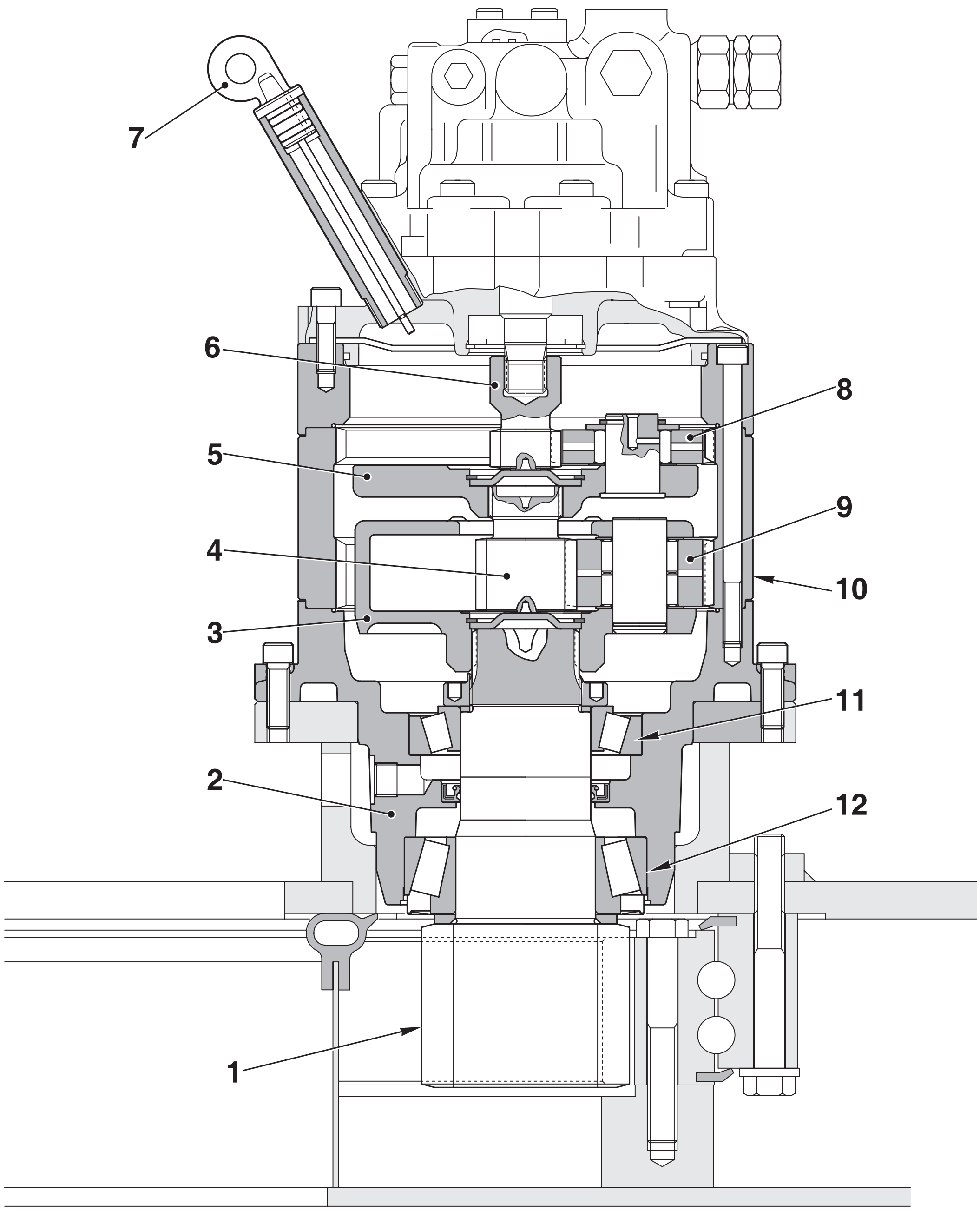


1. Swing circle outer race
2. Ball bearing
3. Swing circle inner race
4. Pin
5. Screw
6. Screw
7. Nut
8. Grease nipple (No. 2)

SPECIFICATIONS

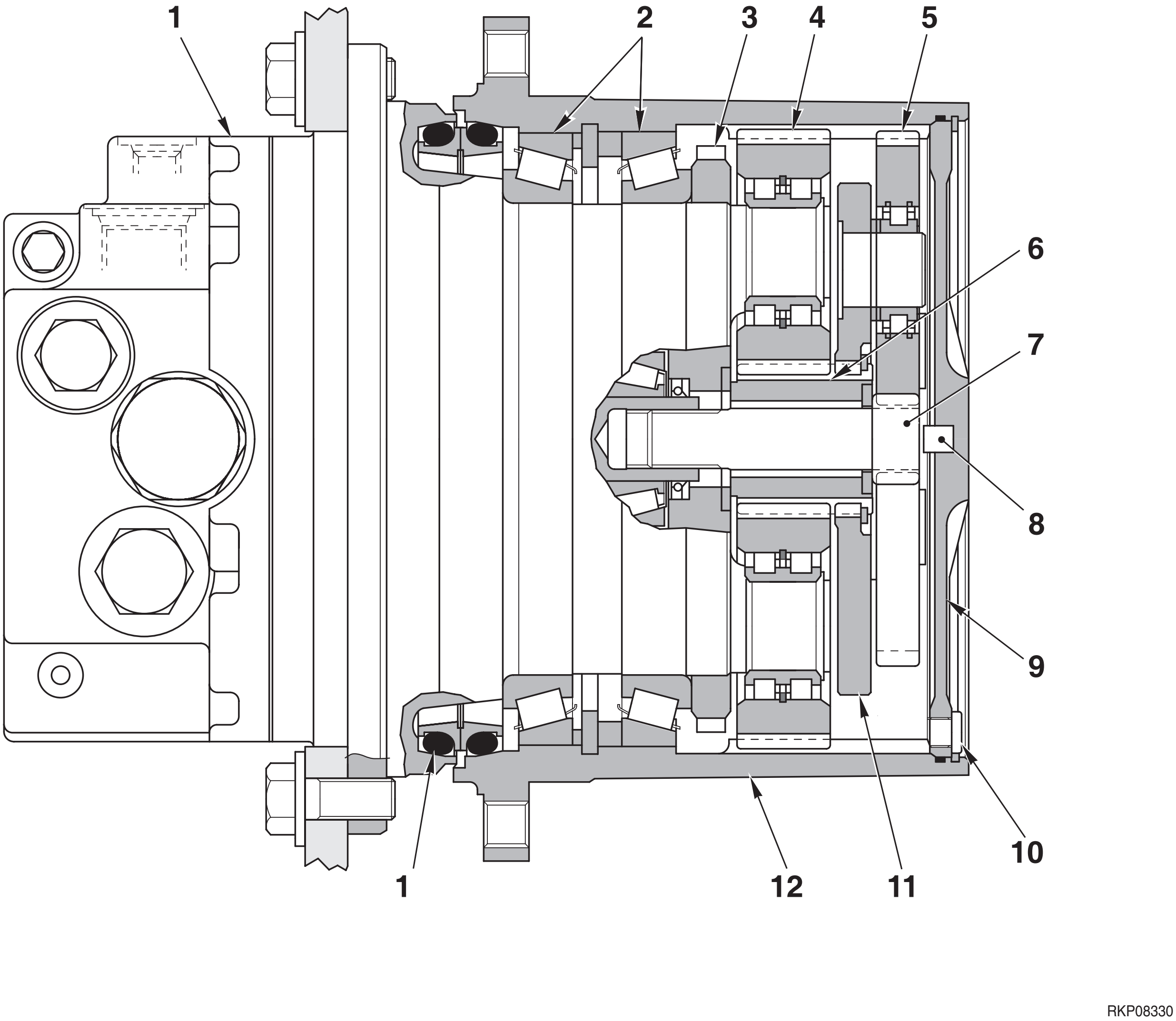
Reduction ratio: 81/11=7,37

SWING MACHINERY



1. Swing pinion (Z=11)
2. Housing
3. No. 2 planetary carrier
4. No. 2 sun gear (Z=18)
5. No. 1 planetary carrier
6. No. 1 sun gear (Z=12)
7. Dipstick
8. No. 1 planetary gear
9. No. 2 planetary gear
10. Ring gear (Z=78)
11. Bearing
12. Bearing

FINAL DRIVE



1. Travel motor
2. Bearing
3. Ring nut
4. No. 2 planetary gear (Z=34)
5. No. 1 planetary gear (Z=39)
6. No. 2 sun gear (Z=19)
7. No. 1 sun gear (Z=10)
8. Pad
9. Cover
10. Plug
11. No. 1 planetary
12. Housing (Z=89)
13. Floating seal

SPECIFICATIONS
Floating seal 1 5–5.27

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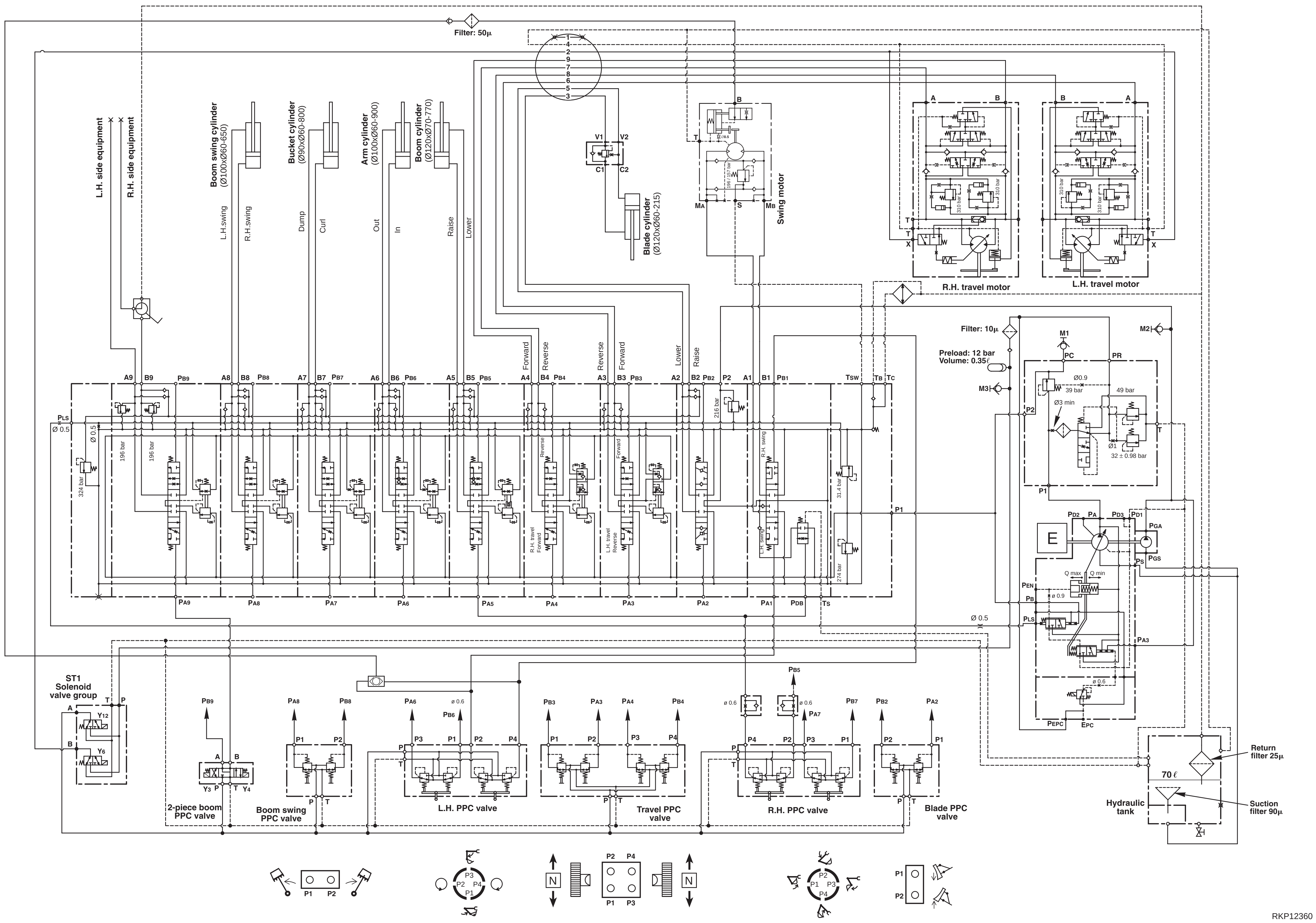
HYDRAULIC DIAGRAM STANDARD



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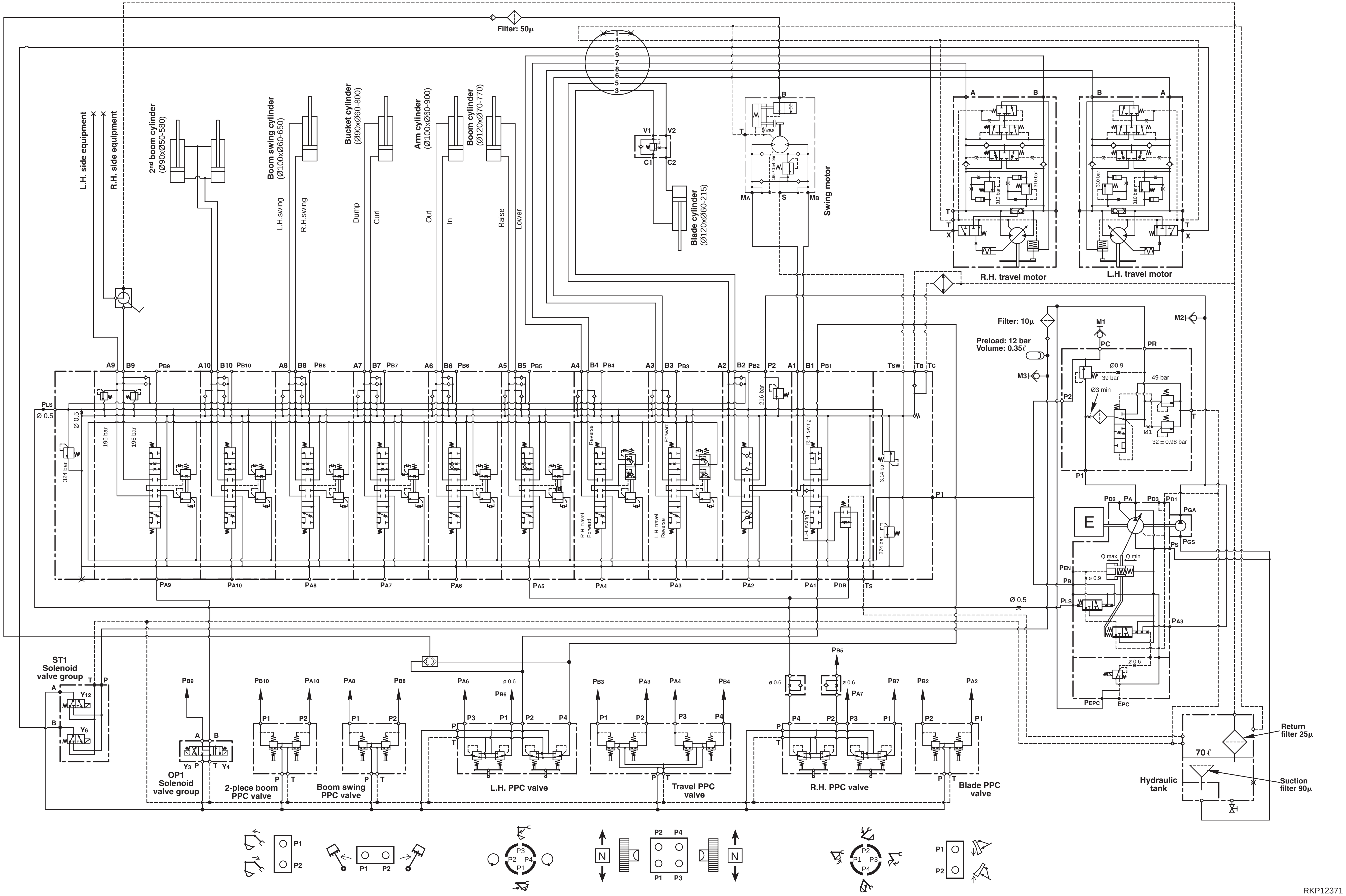
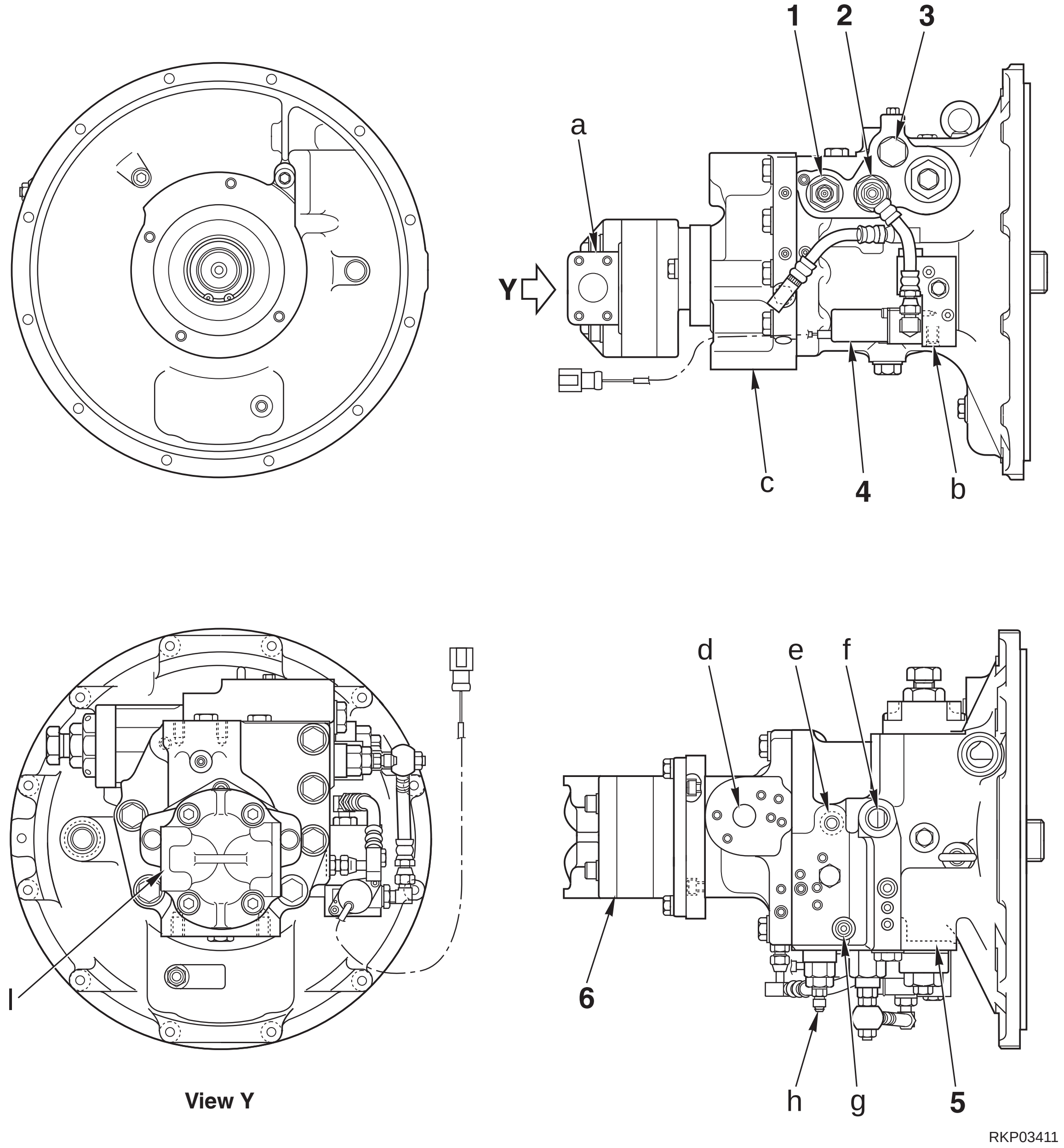
HYDRAULIC DIAGRAM WITH 2-PIECE BOOM



HYDRAULIC PUMP



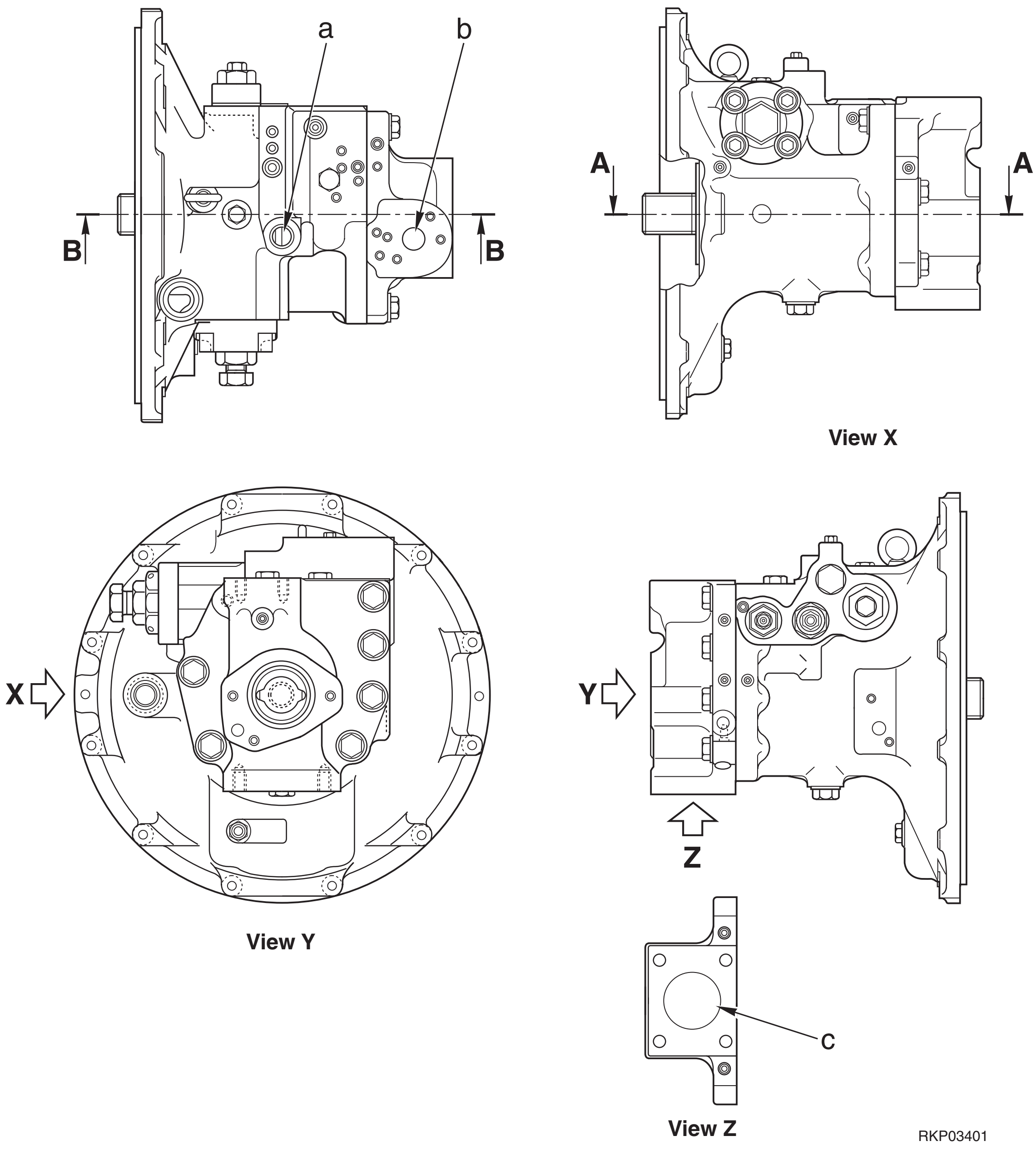
a. PGS Port - From hydraulic tank
b. PEPC Port - From servocontrol feed unit (PR Port)
c. PS Port - From hydraulic tank
d. PA Port - To servocontrol feed unit (P1 Port)
e. PB Port - From control valve (P1 Port)
f. PD Port - To hydraulic tank
g. PA3 Port - From gear pump (PGA Port)
h. PLS Port - From control valve (PLS Port)
l. PGA Port - From control valve (P2 Port)

1. LS valve
2. PC valve
3. Fixed throttle valve
4. Mode System solenoid valve
5. Main pump
6. Gear pump

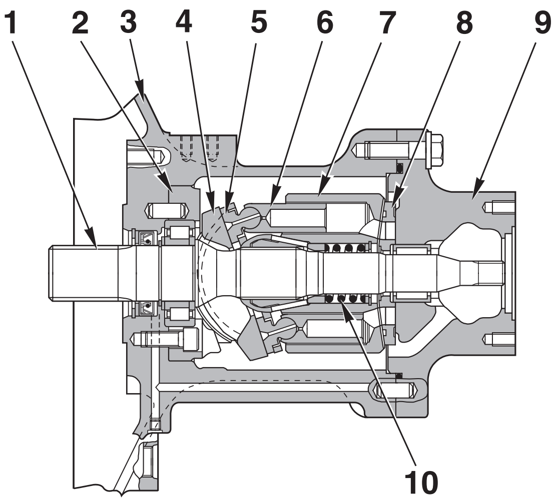
SPECIFICATIONS

Main pump theorical displacement: 85 cc/rev.
Gear pump theorical displacement: 32 cc/rev.

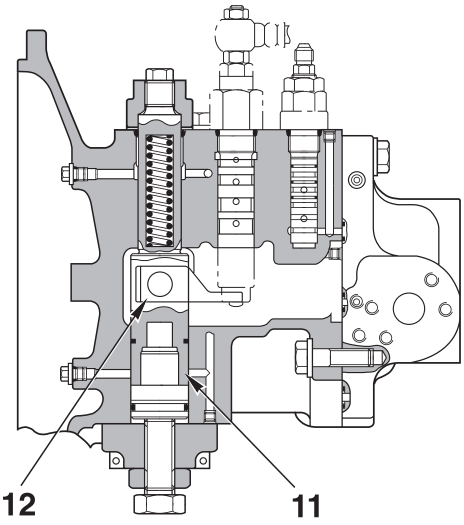
1. MAIN PUMP HPV95



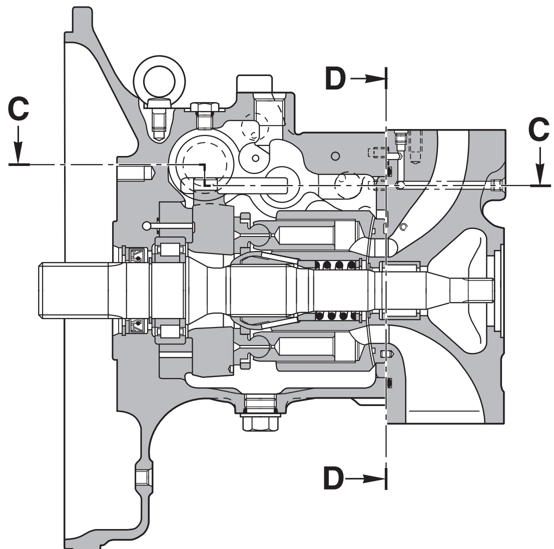
a. PD1 Port -	To hydraulic tank
b. PA Port -	To servocontrol feed unit (P1 Port)
c. PS Port -	From hydraulic tank



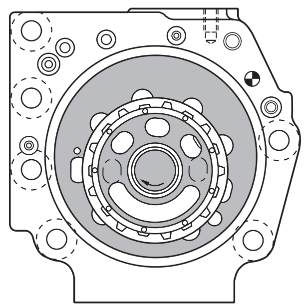
Section A - A



Section C - C



Section B - B



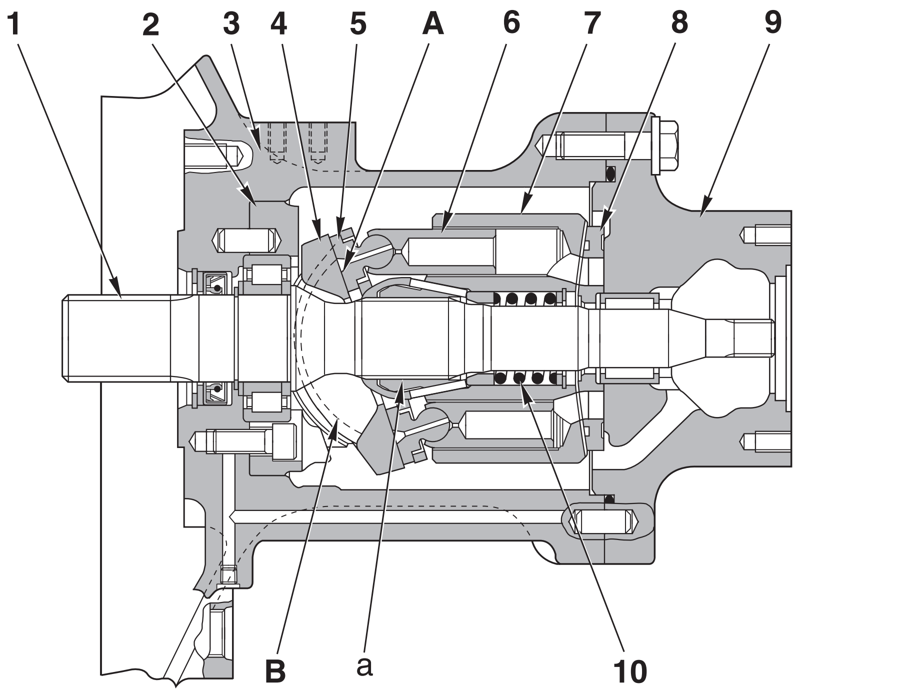
Section D - D

RKP03151

1. Shaft
2. Cradle
3. Case
4. Swash plate
5. Shoe
6. Piston
7. Cylinder block
8. Valve plate
9. Cover
10. Spring
11. Servo piston
12. Lever

FUNCTION

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



Section **A - A**

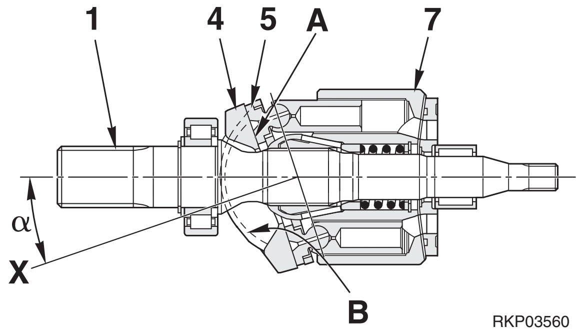
STRUCTURE

- The cylinder block (7) is supported to the shaft (1) by the spline **a**, and the shaft (1) is supported by the front and rear bearings.
- Tip of the piston (6) is a concave ball, and shoe (5) is caulked to it to form one unit. The piston (6) and the shoe (5) form a spherical bearing.
- The rocker cam (4) has a flat surface **A**, and the shoe (5) is always pressed against this surface while sliding in a circular movement.
  The rocker cam (4) brings high pressure oil at the cylindrical surface **B** with the cradle (2), which is secured to the case, and forms a static pressure bearing when it slides..
- The piston (6) carries out relative motion in the axial direction inside each cylinder chamber of the cylinder block (7).
- The cylinder block (7) seals the pressure oil to the valve plate (8), and carries out relative rotation.
  This surface is so designed that the oil pressure balance is maintained at a suitable level.
  And oil inside each cylinder of the cylinder block (7) is sucked in and discharged through the 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.



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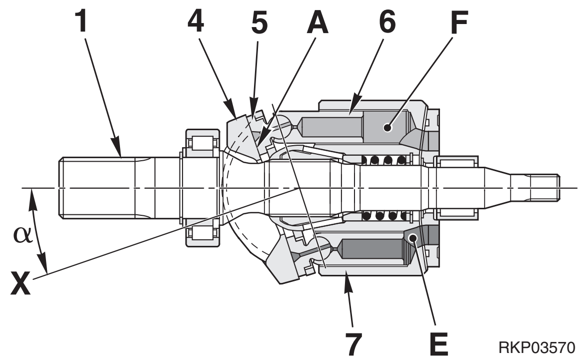
2 - When the center line **X** of the rocker cam (4) maintains the swash plate angle "α" in relation to the axial direction of the cylinder block (7), the flat surface **A** acts as a cam for the shoe (5).
By this, the piston (6) slides on the inside of the cylinder block (7), creates a difference between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



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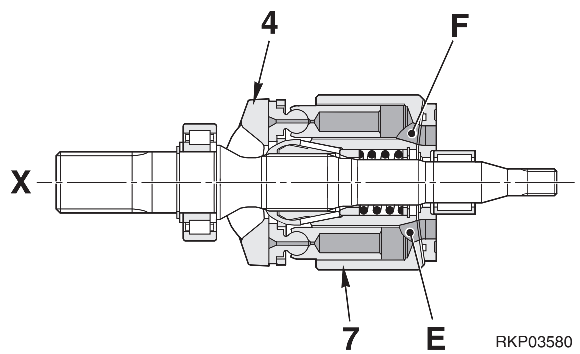
3 - When the center line **X** of the rocker cam (4) becomes in line with the axial direction of the cylinder block (7) (swash plate angle "α"=0), the difference between capacities of **E** and F inside the cylinder block (7) becomes 0, so the pump does not carry out any suction or discharge action of 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".



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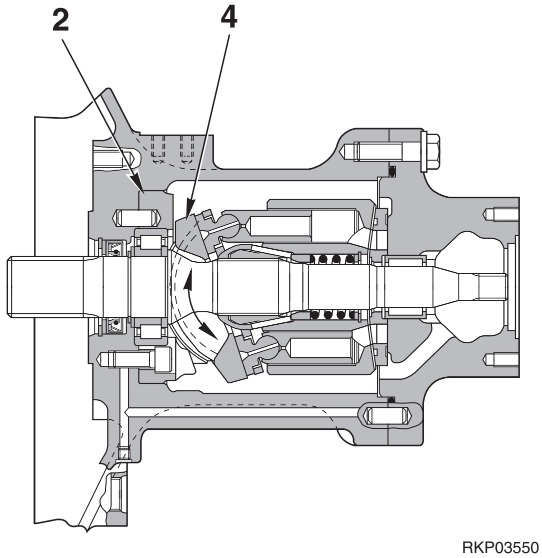
2. **Control of Discharge Amount**

- 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 (11).
- The servo piston (11) moves in a linear reciprocating motion ( ) under the signal pressure of **TVC** and **LS** valve.
  This linear motion is transmitted with the lever (12) to the rocker cam (4), which is supported by the cylindrical surface of the cradle (2), and the rocker cam slides in the semi-circular reciprocating direction ( ).
- The upper and lower pressure receiving area of the servo piston (11) are different from each other, and to the pressure chamber of the smaller piston side (right), discharge pressure (self pressure) **PP** of the main pump is always introduced.
  To the pressure chamber of the larger piston side (left), output pressure **PEN** of the **LS** valve is introduced.
  Movement of the servo piston (11) is controlled by the relationship between pressures **PP** and **PEN** and the proportion of the pressure receiving areas of the smaller and larger pistons (11).



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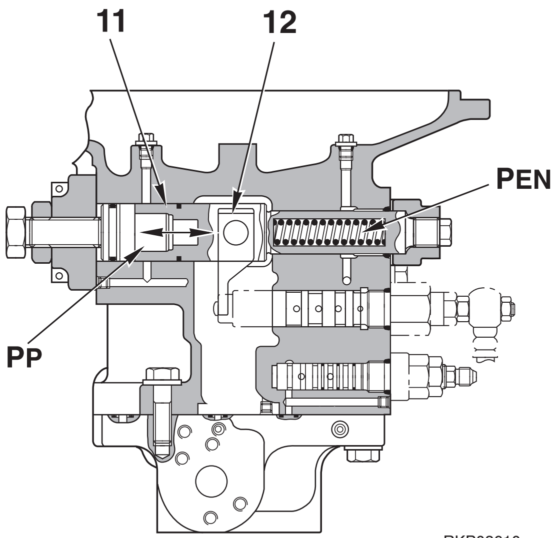

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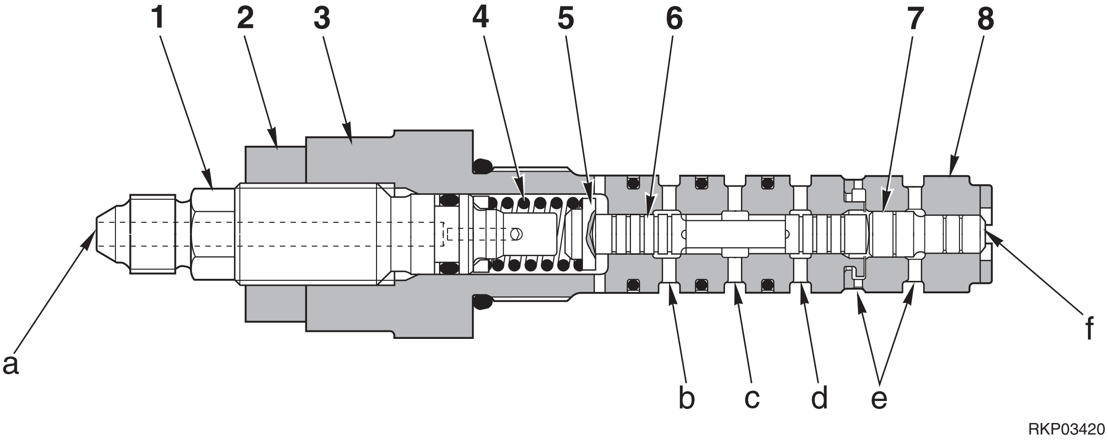
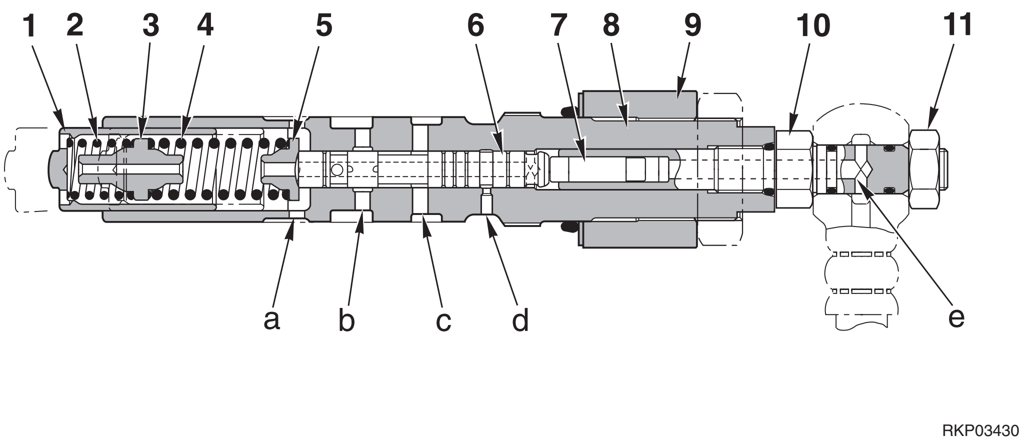
LS VALVE



a. PLS Port - Control valve LS pressure inlet port
b. PA Port - Pump delivery pressure inlet port
c. PLP Port - LS valve signal pressure outlet port
d. PPL Port - PC valve signal pressure inlet port
e. Pa Port - Drain pressure outlet port
f. PA Port - Pump delivery pressure inlet port

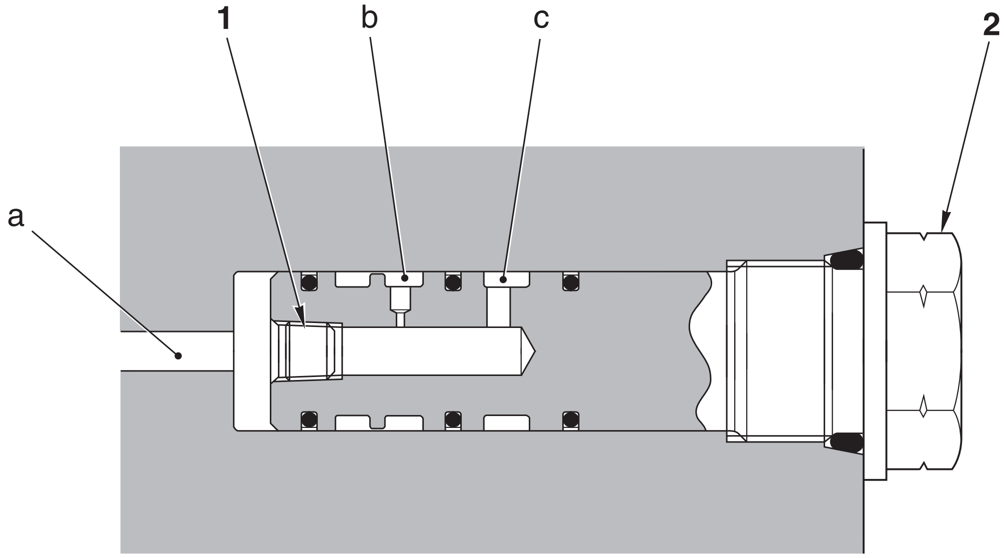
1. Union
2. Nut
3. Sleeve
4. Spring
5. Seat
6. Spool
7. Piston
8. Sleeve

PC VALVE



a. Pa Port - Drain pressure outlet port
b. PPL Port - PC valve signal pressure outlet port
c. PA Port - Pump delivery pressure inlet port
d. PA3 Port - Swing sensing pressure port
a. PM Port - PC mode select pressure inlet port

FIXED THROTTLE VALVE



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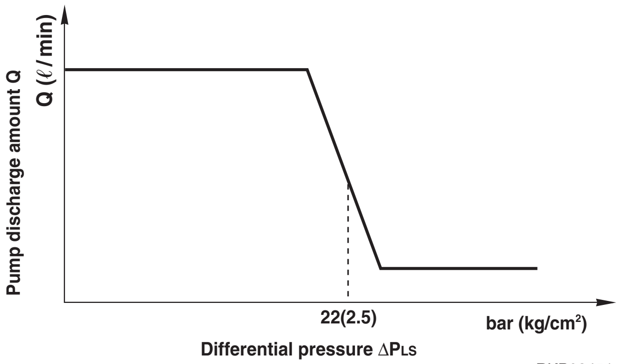
a. Pa Port - Drain pressure outlet port
b. Pout Port - Control pressure outlet port
c. Pin Port - LS valve signal pressure inlet port

1. Plug
2. Plug

LS VALVE

FUNCTION

- The **LS** valve detects the load and controls the discharge amount.
  This valve controls main pump discharge amount **Q** according to differential pressure **ΔPLS** (the differential between main pump pressure **PP** and control valve outlet port pressure **PLS**).
  Main pump pressure **PP** and **PLS** coming from the control valve output, enter this valve.
  The relationship between discharge amount **Q** and differential pressure **ΔPLS**, changes as shown in the diagram on the right.



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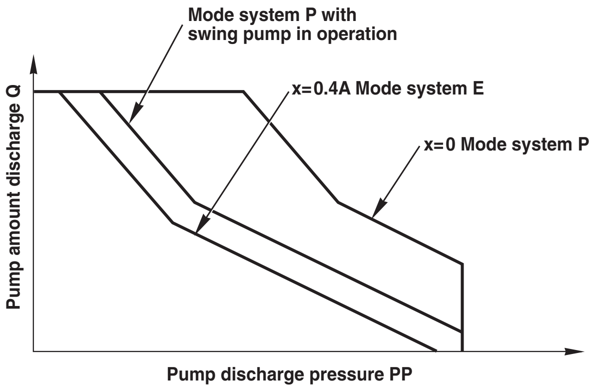
PC VALVE (Power Control)

FUNCTION

- The **PC** valve carries out an approximate equal horse-power control so that the hydraulic horse-power sucked by the pump does not exceed the engine horse-power by limiting the discharge amount **Q** to a specified about in relation with the discharge pressure **PP**, even if the **LS** valve tries to increase the pump discharge amount **Q** when the discharge pressure **PP** becomes high and opening area of the control valve is large.
- In other words, when a load becomes large during operation and the pump discharge pressure **PP** rises, the **PC** valve reduces the pump discharge amount **Q**, and when the pump discharge pressure **PP** lowers, it increases the pump discharge amount **Q**.
- Relationship between the pump discharge pressure **PP** and the pump discharge amount **Q** is as shown in the chart.
  Normally, it is set to the pump suction torque of the standard mode, but when a signal from the **PC-EPC** mode switching solenoid valve is inputted, the pump suction horsepower lowers by approximately 20% as shown by the light-load mode curve.
- Since the swing pump is mounted directly on the main pump, when the swing pump is in operation, suction torque of the main pump is reduced by the amount sucked by the swing pump so that the sum of the main pump suction torque and the swing pump suction torque becomes the total suction torque (100%).



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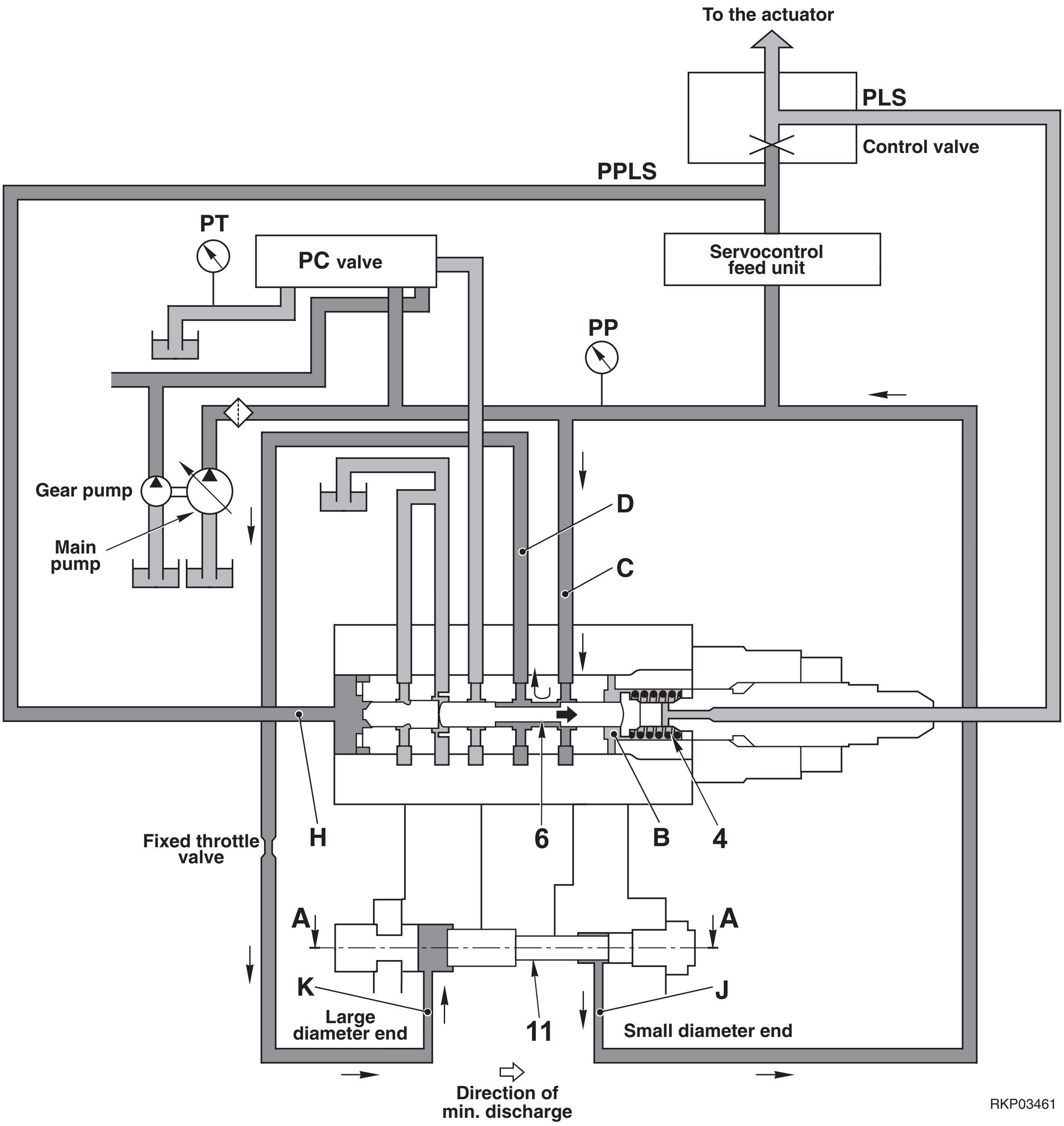
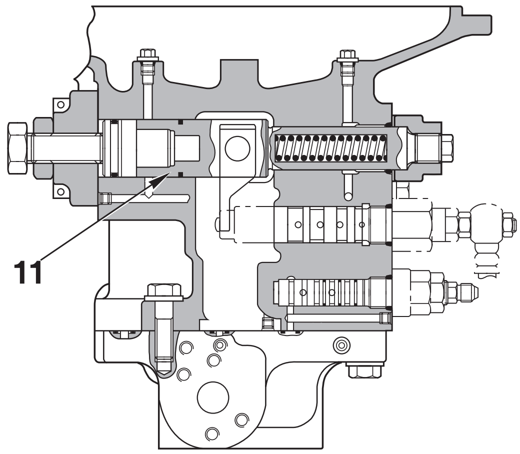
LS VALVE

OPERATION

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



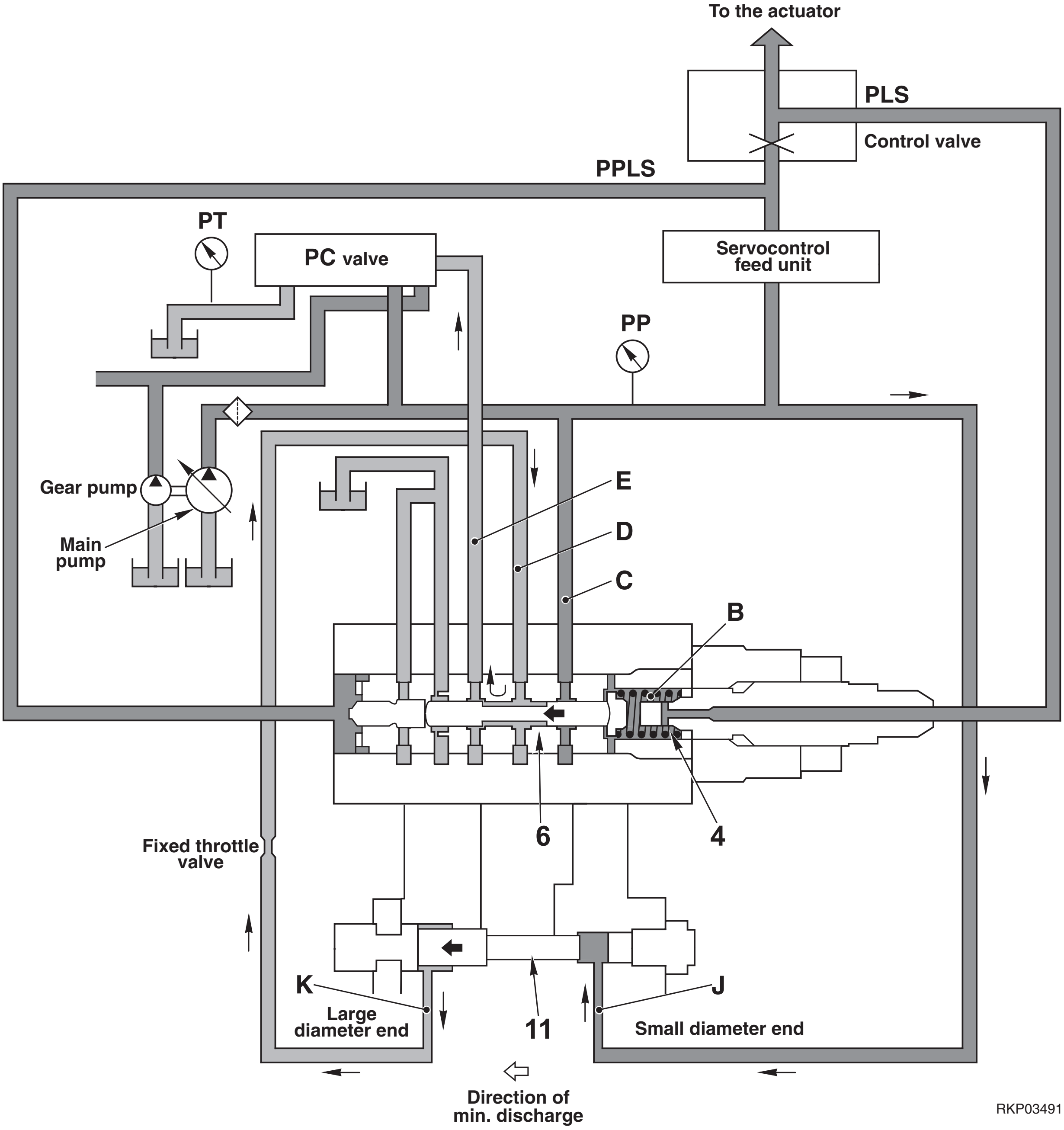
- The **LS** valve is a three-way selector valve, with pressure **PLS** (LS pressure) from the inlet port of the control valve brought to spring chamber **B**, and main pump discharge pressure **PPLS** brought to port **H** of sleeve.
  The size of the force produced by this **LS** pressure **PLS**+force **Z** of spring (4) and the main pump pressure (self-pressure) **PPLS** determines the position of spool (6).
- Before the engine is started, servo piston (11) is pushed to the left (large diameter end).
  (The spring chamber **B** is open to the drain circuit through the spool of the control valve).
- Therefore, the spool (6) is pushed to the right side (→), a path is formed between the Ports **C** and **D**, and then the pump pressure **PP** is led to the chamber **K** at the large diameter side of the servo piston (11).
- Though the pump pressure **PP** is always introduced to the chamber **J** of the small diameter side of the servo piston (11), because the force to the large diameter side is larger due to the difference of the areas at two ends of the servo piston (11), the servo piston (11) is moved to the minimum swash plate angle side (→).



Section A - A

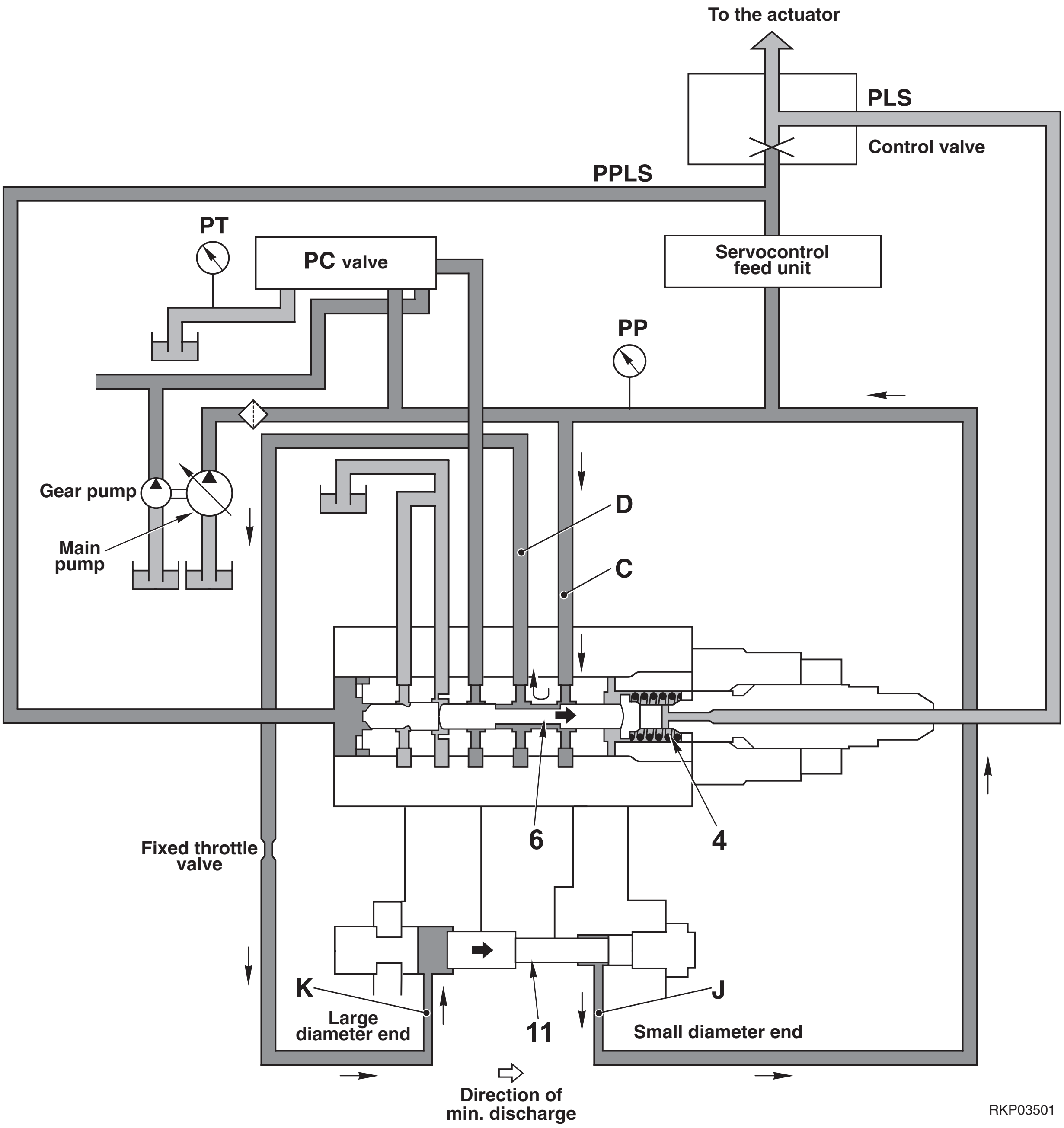
RKP03851

2. When the opening of the control valve is large (lever stroke large)



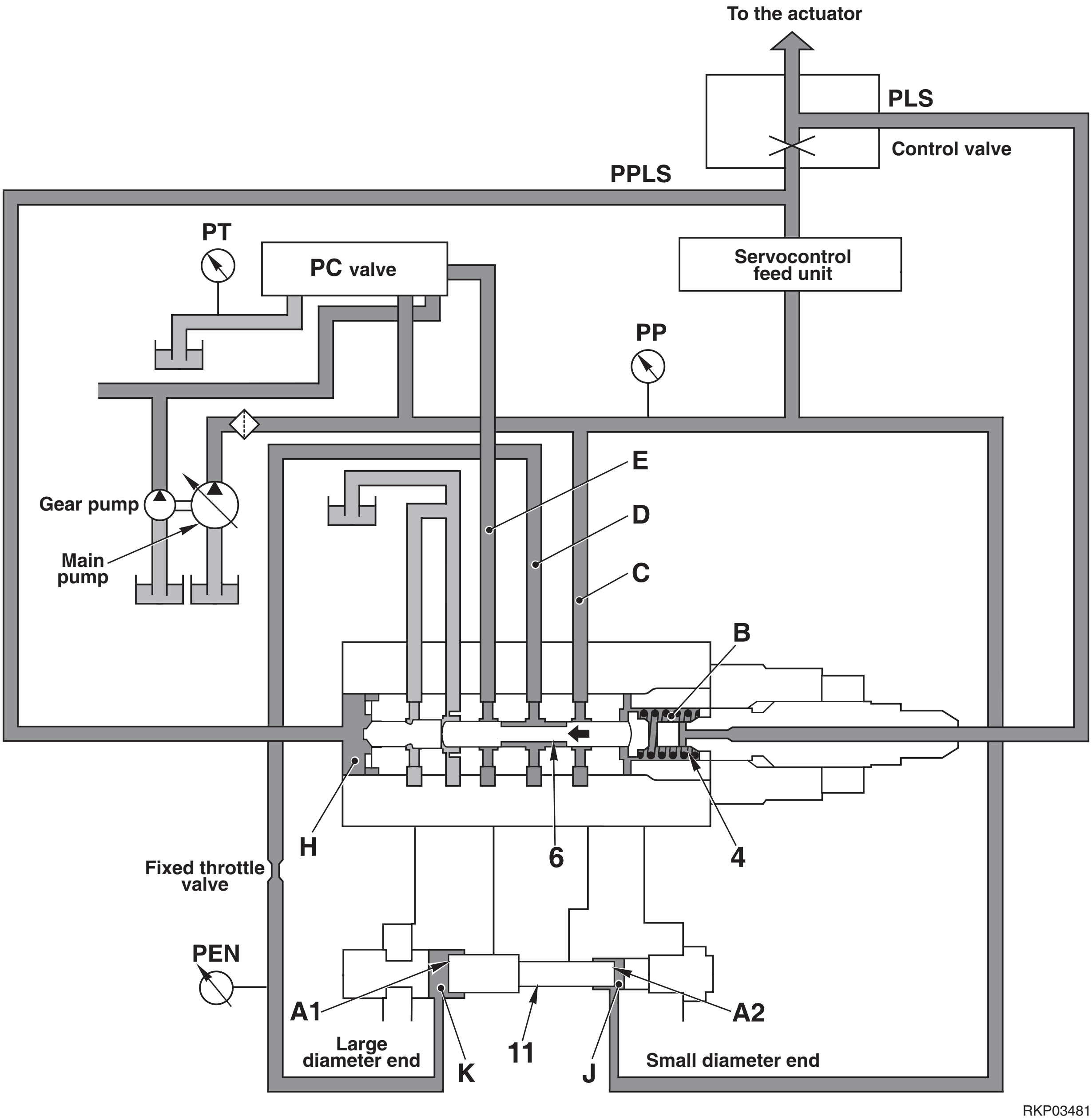
- When the control lever is moved to full-stroke, in other words, as the opening area of the control valve becomes large, the difference of the pump pressure **PPLS** and the **LS** pressure **PLS** (**LS** differential pressure Δ**PLS**) becomes smaller.
- **LS** pressure **PLS** introduced to the spring chamber **B** of the **LS** valve becomes more or less the same as the pump pressure **PPLS** and the spool (6) is pushed to the left side (←) by the combined force of the **LS** pressure and the spring (4), closing the Port **C** and forming a path between the Ports **D** and **E**.
- Therefore, the pressure oil functioning to the chamber **K** at the large diameter side of the servo piston (11) flows to the Port **D** from the Port **E**, and then to the **PC** valve.
- At this time, since the Port **E** of the **PC** valve is open to the drain inside the pump case through the inside of the piston, pressure in the chamber **K** of the large diameter side of the servo piston (11) also becomes to the drain pressure.
- By this, the servo piston (11) is moved to the max. swash plate angle side (←) by the pump pressure **PP** functioning to the chamber **J** at the small diameter side.

3. When pump delivery reduces



- The following explains the situation if servo piston (11) moves to the left (the discharge amount becomes smaller). When **LS** differential pressure **ΔPLS** becomes larger (for example, when the area of opening of the control valve becomes smaller and pump pressure **PPLS** rises), the force produced by pump pressure **PPLS** pushes spool (6) to the (→).
- When spool (6) moves, main pump pressure **PP** flows from port **C** to port **D**, and it enters the large diameter end of the piston (11) from port **K**.
- Main pump pressure **PP** also enters port **J** at the smaller diameter end of the piston, but because of the difference in area between the large diameter end and the small diameter end of servo piston (11), servo piston (11) is pushed to the (→). As a result, the swash plate moves in the direction to make angle smaller.

4. When the pump flow is proper the demand of the control valve

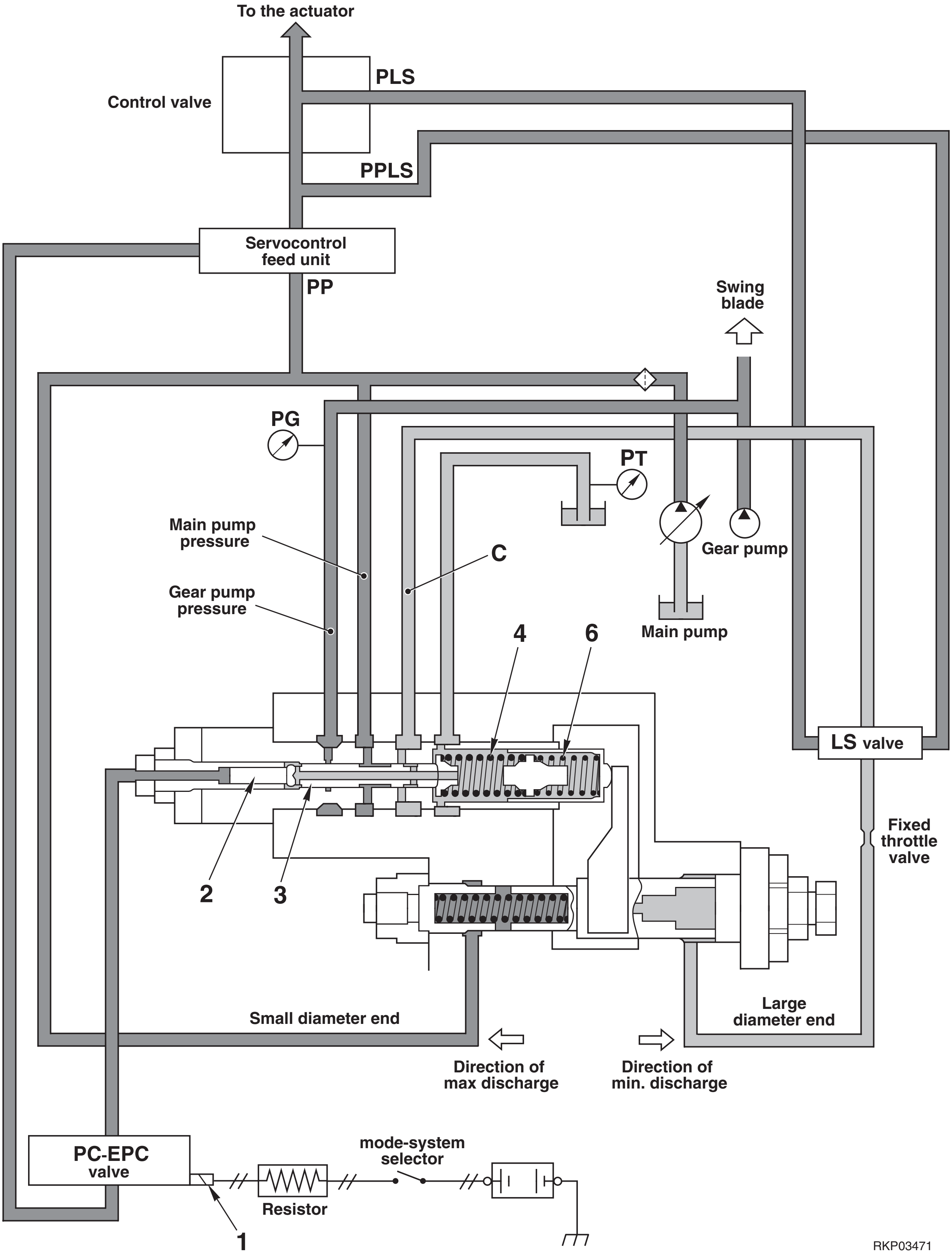


- Let us take the pressure receiving area at the large diameter side of the servo piston (11) as **A1**, pressure receiving area at the small diameter side as **A2**, pressure functioning to the large diameter side as **PEN**, and the pressure to the small diameter side as **PP**.
- When the pump flow rate reaches the flow demand of the control valve, the pump pressure **PPLS** functioning to the Port **H** of the **LS** valve balances with the combined force of the **LS** pressure **PLS** functioning to the spring chamber **B** and the spring (4), and the piston (6) stops at the intermediate position. (It will stop at a position where the openings of the throttle from port **D** to port **E** and from port **C** to port **D** of spool (6) are approximately the same).
- At this time, because the relationship of the pressure receiving areas on the servo piston (11) is $A_2 : A_1 = 1 : 11.75$, the pressure functioning to two ends of the servo piston (11) becomes $P_P : P_{EN} = 1.75 : 1$; so the forces to the two ends of the servo piston (11) becomes 1:1, and the servo piston (11) stops at the position, balancing the flow demand of the control valve and the pump discharge.
- Spring force is so adjusted that the piston (6) is balanced when $P_{PLS} - P_{LS} = \Delta P_{LS} =$ 22 bar.

PC VALVE (Power Control)

FUNCTION

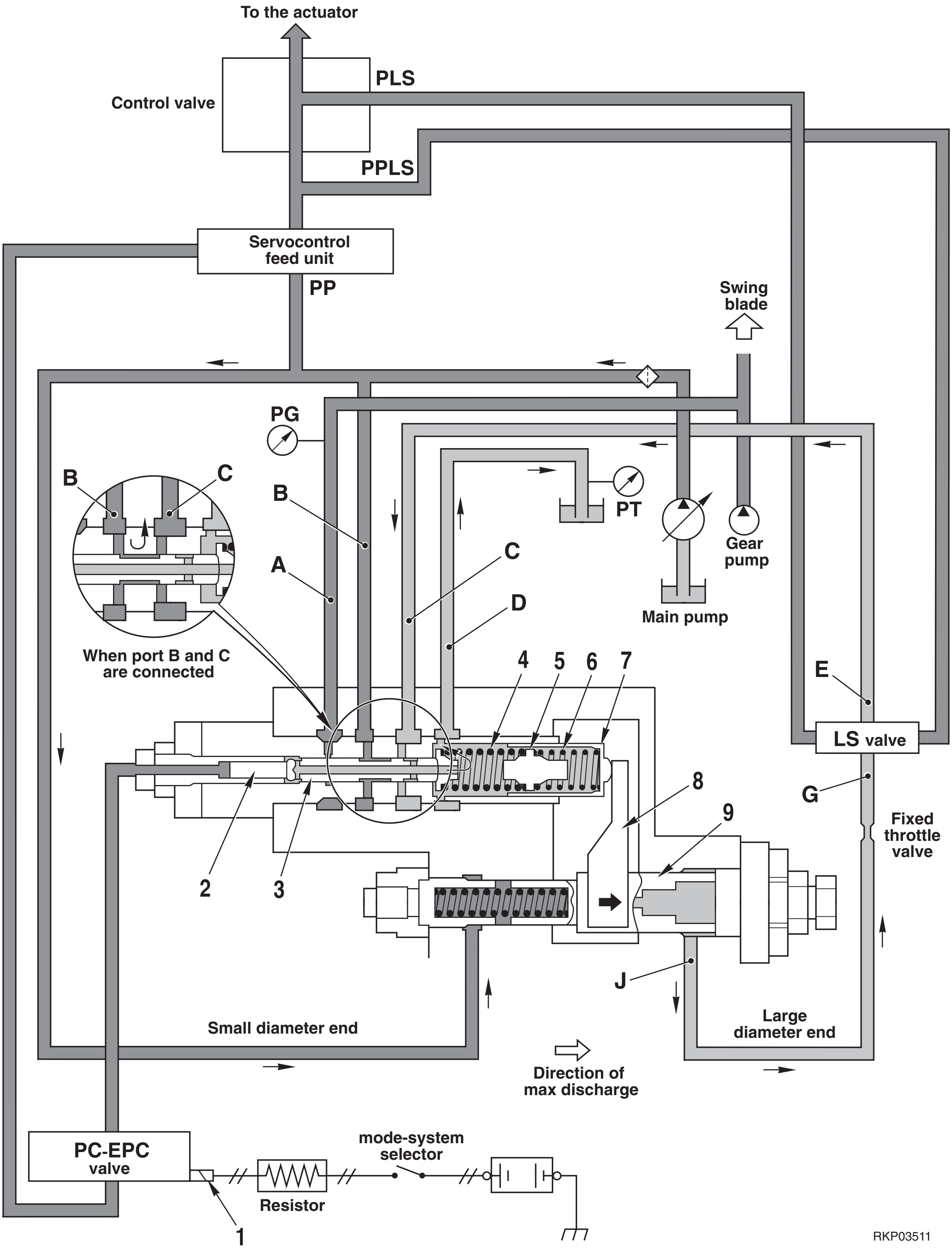
1. When load on the actuator becomes small (pump discharge pressure lowers)



a) Action of PC-EPC solenoid

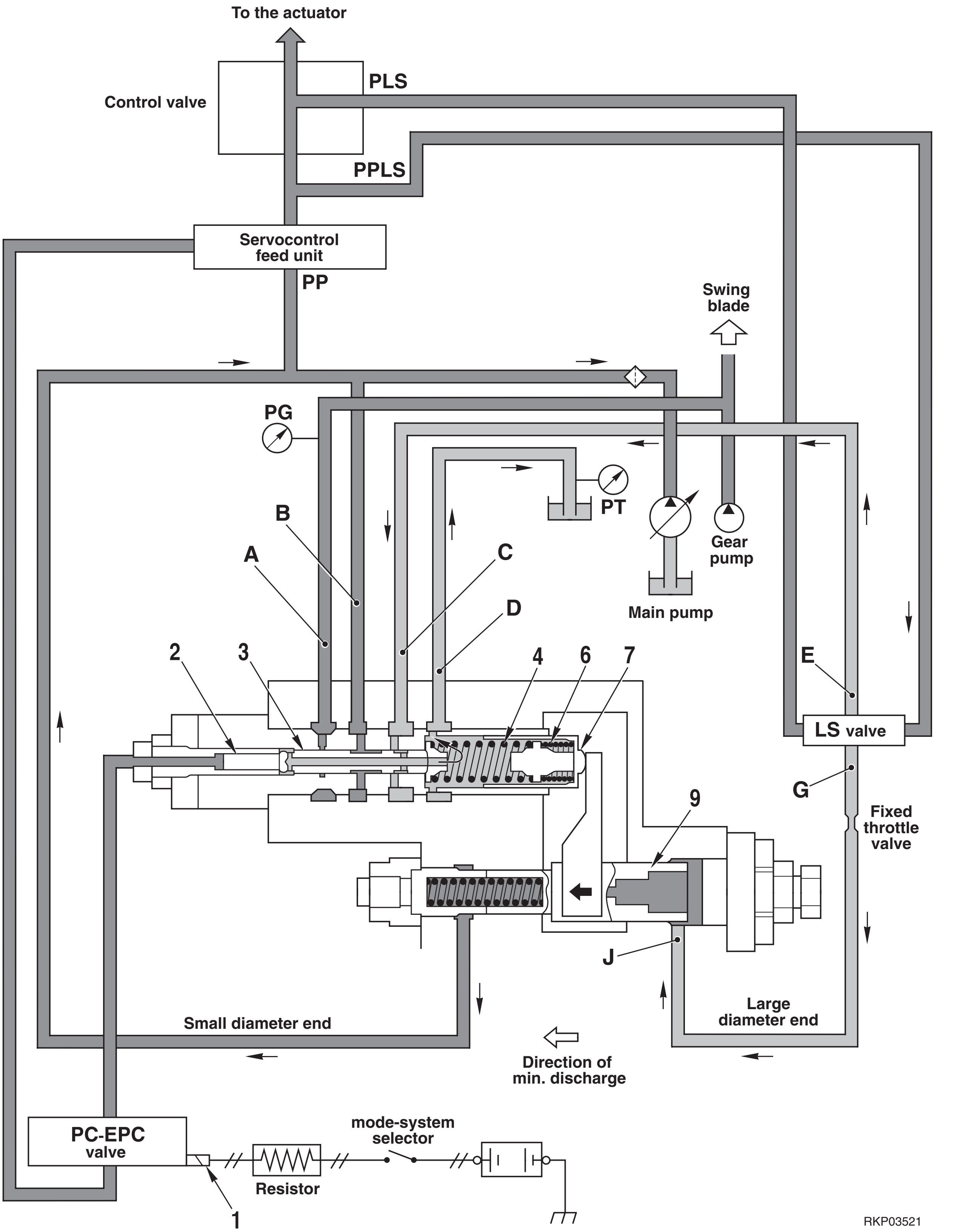
- The command current from resistor flows to **PC-EPC** solenoid (1).
  This command current acts on the **PC-EPC** valve and outputs the signal pressure.
  When this signal pressure is received, the force pushing piston (2) is changed.
- On the opposite side to this force pushing piston (2) is the spring set pressure of springs (4) and (6) and pump pressure **PP** pushing spool (3). Spool (3) stops at a position where the combined force pushing spool (3) is balanced, and the pressure (pressure of port **C**) output from the **CP** valve.

b) Function of the spring

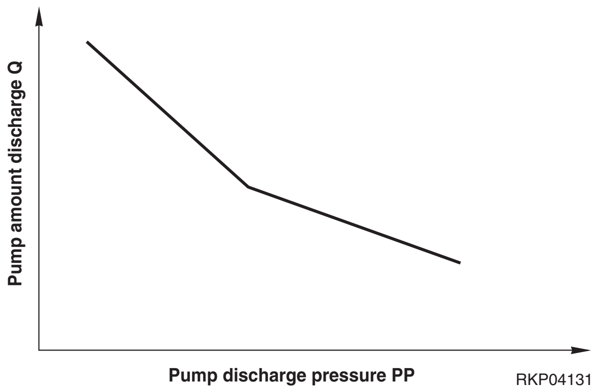


- Port **C** of the **PC** valve is connected to port **E** of the **LS** valve (see (1) **LS** valve). Self-pressure **PP** enters port **B**, the small diameter end of servo piston (9), and port **A**.
- The spring load of springs (4) and (6) in the **PC** valve is determined by the swash plate position.
- When servo piston (9) moves, piston (7), which is connected to slider (8), also moves to the right or left.
- If piston (7) moves to the left, spring (6) is compressed, and if it moves further to the left, spring (6) contacts seat (5) and is fixed in position.
  From this point, only spring (4) is actuated. In other words, the spring load is changed by piston (7) extending or compressing springs (4) and (6).
- If the command current input to **PC-EPC** valve solenoid (1) changes further, the force pushing piston (2),changes. The spring load of springs (4) and (6) also changes according to the value of the **PC-EPC** valve solenoid command current.
- When pump pressure **PP** is small, spool (3) is on the left. At this point, port **C** and **D** are connected, and the pressure entering the **LS** valve becomes drain pressure **PT**. If port **E** and **G** of the **LS** valve are connected (see (1) LS valve), the pressure entering the large diameter end of the piston from port **J** becomes drain pressure **PT**, and servo piston (9) moves to the right. In this way, the pump discharge amount moves in the direction of increase.
- As servo piston (9) moves further, piston (7) is moved to the right by slider (8). Spring (4) and (6) expand and the spring force becomes weaker.
  When the spring force becomes weaker, spool (3) moves to the right, so the connection between port **C** and port **D** is cut, and the pump discharge pressure ports **B** and **C** are connected. As a result, the pressure at port **C** rises, and the pressure at the large diameter end of the piston also rises, so the movement of piston (9) to the right is topped.
  In other words, the stop position for piston (9) (=pump discharge amount) is decided at the point where the force of springs (4) and (6) and the pushing force from the **PC-EPC** valve solenoid and the pushing force created by pressure **PC** acting on spool (3) are in balance.

2. When load on the actuator is large (pump discharge pressure is high)

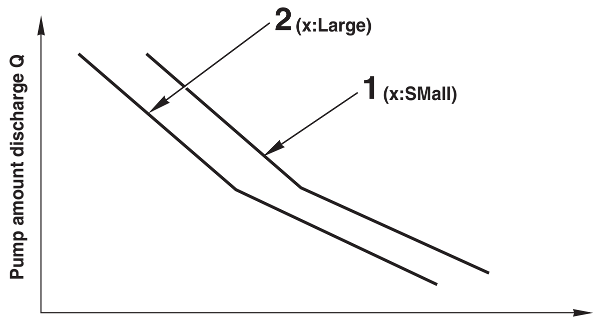


- When the load is large and pump discharge pressure **PP** is high, the force pushing spool (3) to the left becomes larger and spool (3) moves to the position shown in the diagram above.
  When this happens, as shown in the diagram above, part of the pressurized oil from port **X** passes through the **LS** valve, flows out from port **C** to port **D**, and the pressurized oil flowing from port **C** to the **LS** valve becomes approximately 3/5 of main pump pressure PP.
- When port **E** and port **G** of the **LS** valve are connected (see (1) **LS** valve), the pressure from port **J** enters the large diameter end of servo piston (9), and servo piston (9) stops.
- If main pump pressure **PP** increases further and spool (3) moves further to the right, main pump pressure **PP** flows to port **B** and port **C** and acts to make the discharge amount the minimum. When piston (9) moves to the left, piston (7) is moved to the left. For this reason, springs (4) an(6) are compressed and push back spool (3).
  When spool (3) moves to the left, the opening of port **C** and port **D** becomes larger. As a result, the pressure at port **C** (=**J**) drops, and piston (9) stops moving to the left. The position in which piston (9) stops when this happens is further to the left than the position when pump pressure **PP** is low.
- The relation of pump pressure **PP** and the position of servo piston (9) forms a bent line because of the double-spring effect of springs (6) and (4).
  The relationship between pump pressure **PP** and pump discharge amount **Q** is shown in the figure on the right.



RKP04131

- If command current **X** sent to solenoid (1) increases further, the relationship between pump pressure **PP** and pump discharge amount **Q** is proportional to the pushing force of the **PC-EPC** valve of output pressure. In other words, if the pushing force of output pressure is added to the force pushing to the left because of the pump pressure applied to the piston (2), the relationship between **PP** and **Q** moves from 1 to 2 in accordance with the increase.



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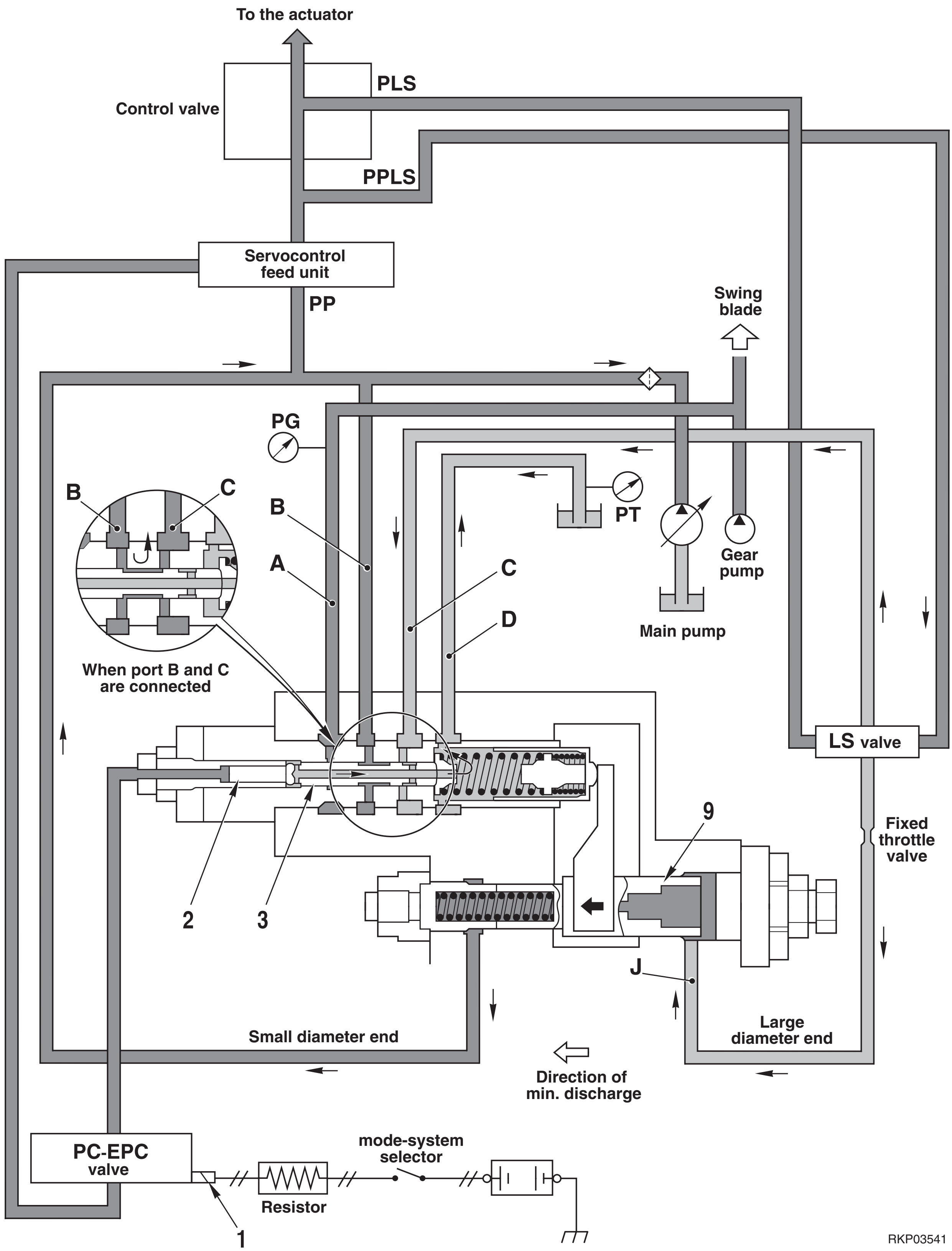
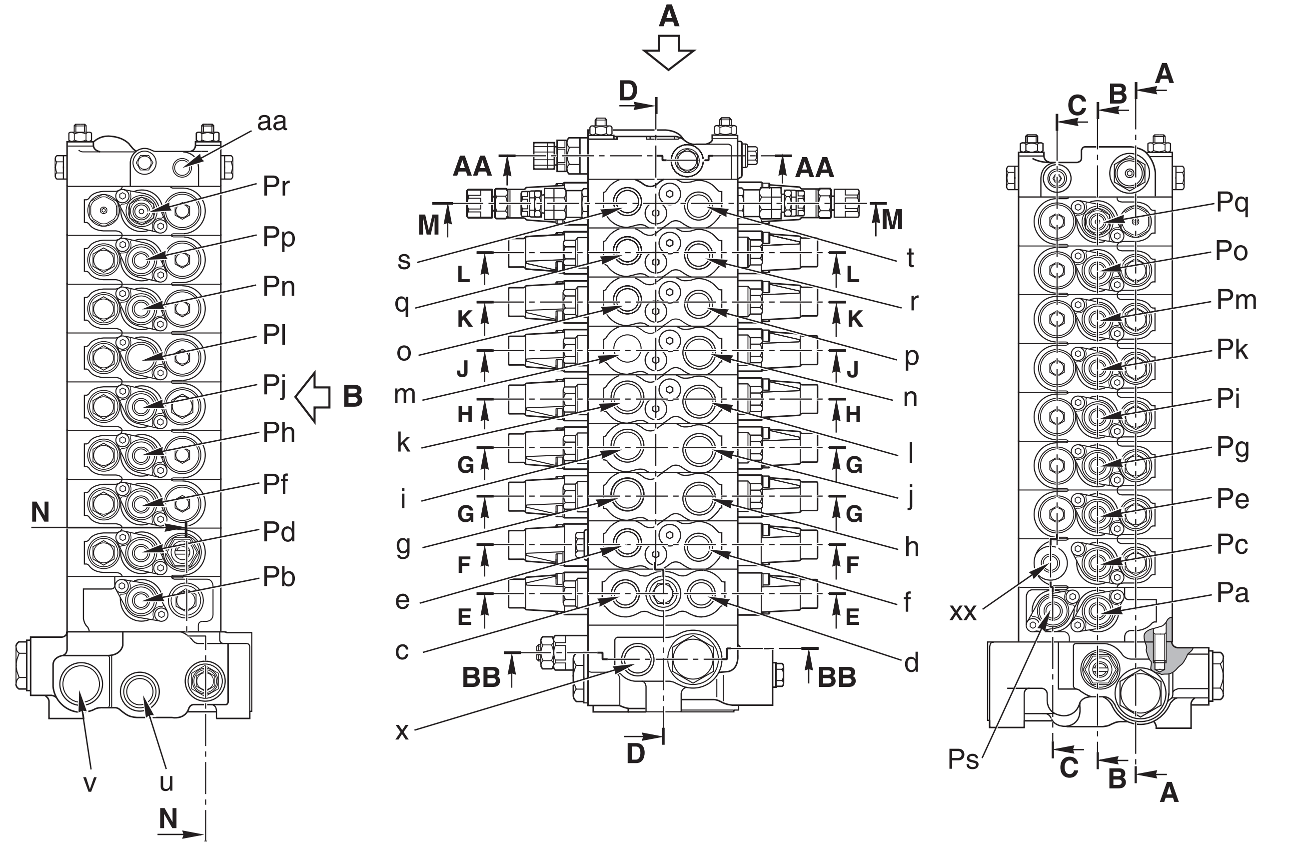
3. When the swing is operated

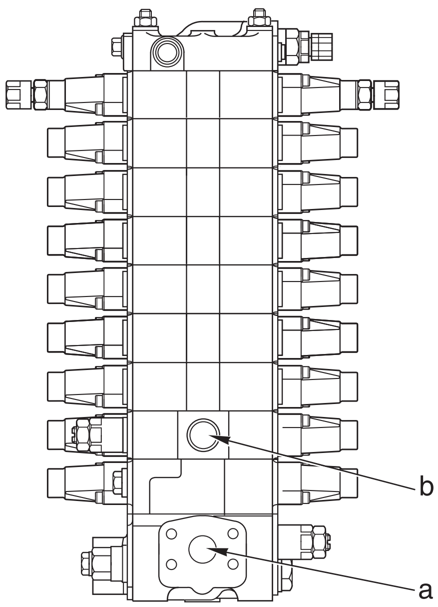


When the swing is operated

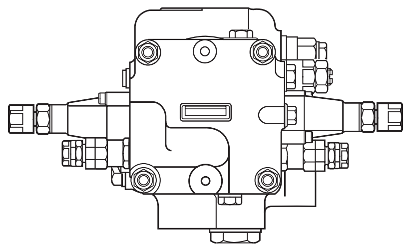
- When the swing is not being used, in other words when no load is applied o the swing pump, the pump suction torque is same as the standard mode or the light-load mode.
- Once the swing is activated, thus, a load is applied on the swing pump, the signal pressure **PG** is putted t the port **A** and the piston (9) is pushed to the left (→) side according to the volume of the signal pressure.
- By this action, the springs (4) and (6) are contracted and, because the spring load increases, the pump suction torque lowers according to the volume of load on the swing pump.

9-SPOOL CONTROL VALVE (STANDARD)





View B

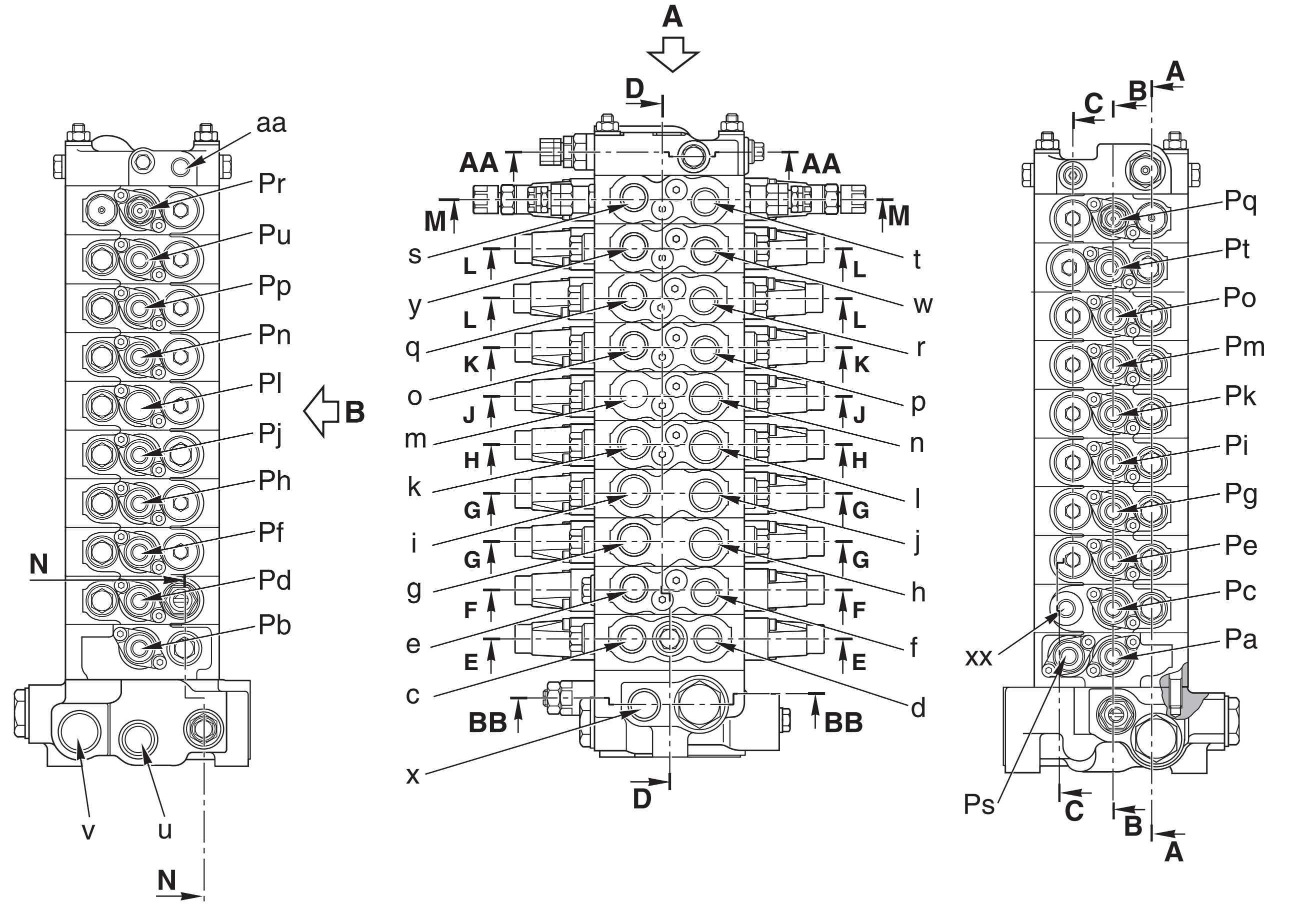


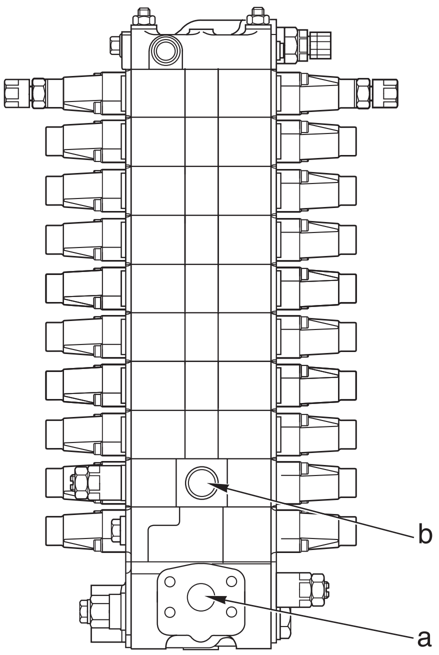
View A

RKP02751

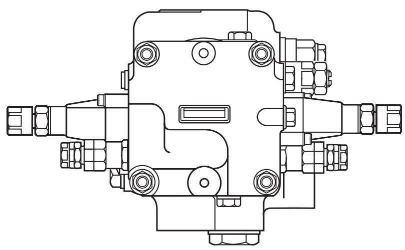
a. P1 Port - From servocontrol feed unit (P2 Port) and pump (PPLS Port)
b. P2 Port - From gear pump (PGA Port)
c. A1 Port - To swing motor (MA Port)
d. B1 Port - To swing motor (MB Port)
e. A2 Port - To swivel joint (5A Port)
f. B2 Port - To swivel joint (3A Port)
g. A3 Port - To swivel joint (8A Port)
h. B3 Port - To swivel joint (6A Port)
i. A4 Port - To swivel joint (9A Port)
j B4 Port - To swivel joint (7A Port)
k A5 Port - To boom cylinder (Bottom side)
l. B5 Port - To boom cylinder (Head side)
m. A6 Port - To arm cylinder (Head side)
n. B6 Port - To arm cylinder (Bottom side)
o. A7 Port - To bucket cylinder (Head side)
p. B7v - To bucket cylinder (Bottom side)
q. A8 Port - To boom swing cylinder (Head side)
r. B8 Port - To boom swing cylinder (Bottom side)
s. A9 Port - To attachment (L.H. side)
t. B9 Port - To attachment (R.H. side)
u. TSW Port - To swing motor (S Port)
v. TC Port - To oil cooler
x. TB Port - To hydraulic tank
xx. TS Port - To hydraulic tank
aa. PLS Port - To hydraulic pump (PLS Port)
Pa. PA1 Port - From L.H. PPC valve (P2 Port)
Pb. PB1 Port - From L.H. PPC valve (P4 Port)
Pc. PA2 Port - From blade PPC valve(P1 Port)
Pd. PB2 Port - From blade PPC valve (P2 Port)
Pe. PA3 Port - From travel PPC valve (P2 Port)
Pf. PB3 Port - From travel PPC valve (P1 Port)
Pg. PA4 Port - From travel PPC valve (P3 Port)
Ph. PB4 Port - From travel PPC valve (P4 Port)
Pi. PA5 Port - From R.H. PPC valve (P4 Port)
Pj. PB5 Port - From R.H. PPC valve (P2 Port)
Pk. PA6 Port - From L.H. PPC valve (P3 Port)
Pl. PB6 Port - From L.H. PPC valve (P1 Port)
Pm. PA7 Port - From R.H. PPC valve (P3 Port)
Pn. PB7 Port - From R.H. PPC valve (P1 Port)
Po. PA8 Port - From boom swing PPC valve (P1 Port)
Pp. PB8 Port - From boom swing PPC valve (P2 Port)
Pq. PA9 Port - From OP1 solenoid valve group (B Port)
Pr. PB9 Port - From OP1 solenoid valve group (A Port)
Ps. PDB Port - From R.H. PPC valve (P4 Port)

10-SPOOL CONTROL VALVE (STANDARD 2-PIECE BOOM)





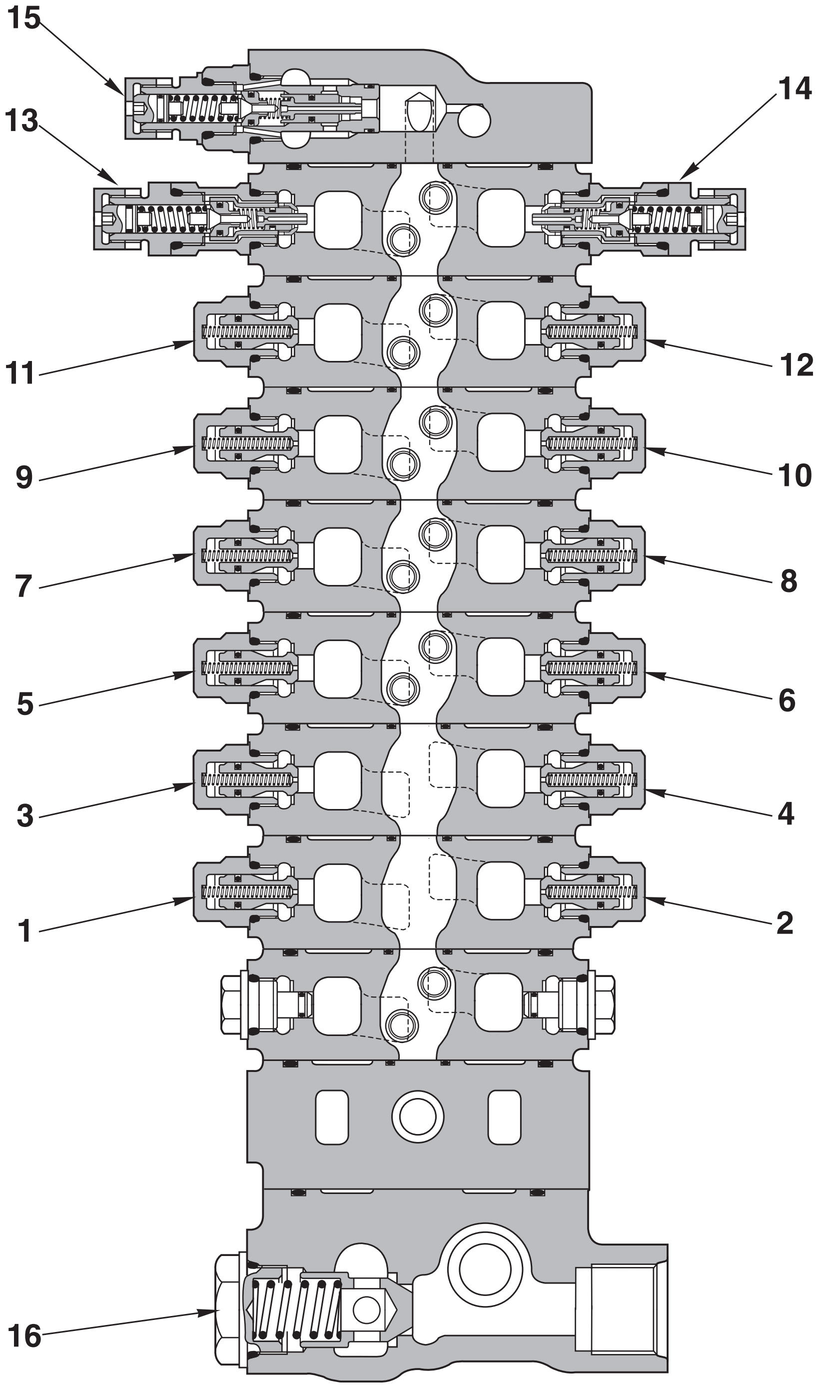
View B



View A

RKP02761

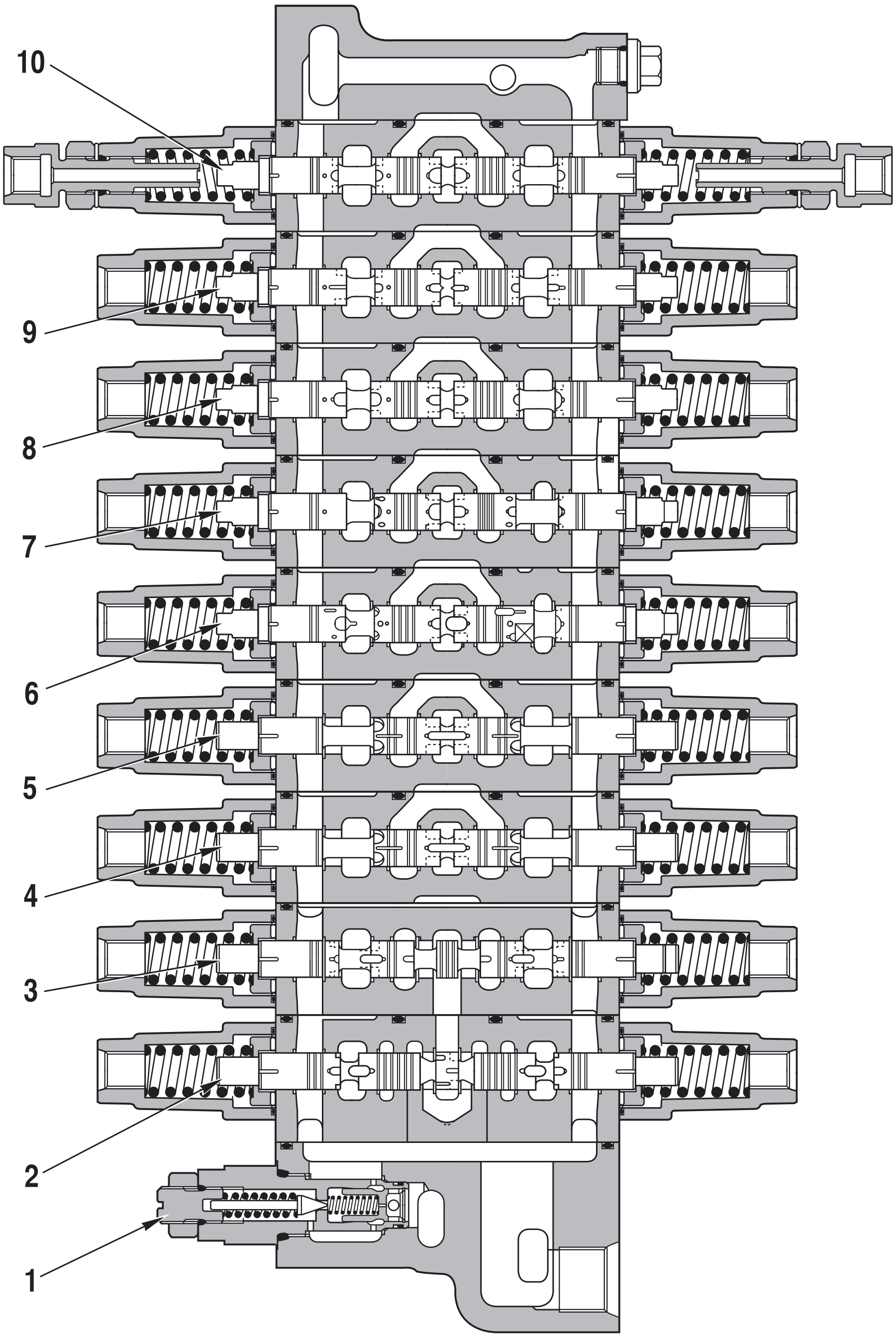
a.	P1 Port	- From servocontrol feed unit (P2 Port) and pump (PPLS Port)
b.	P2 Port	- From gear pump (PGA Port)
c.	A1 Port	- To swing motor (MA Port)
d.	B1 Port	- To swing motor (MB Port)
e.	A2 Port	- To swivel joint (5A Port)
f.	B2 Port	- To swivel joint (3A Port)
g.	A3 Port	- To swivel joint (8A Port)
h.	B3 Port	- To swivel joint (6A Port)
i.	A4 Port	- To swivel joint (9A Port)
j	B4 Port	- To swivel joint (7A Port)
k	A5 Port	- To boom cylinder (Bottom side)
l.	B5 Port	- To boom cylinder (Head side)
m.	A6 Port	- To arm cylinder (Head side)
n.	B6 Port	- To arm cylinder (Bottom side)
o.	A7 Port	- To bucket cylinder (Head side)
p.	B7 Port	- To bucket cylinder (Bottom side)
q.	A8 Port	- To boom swing cylinder (Head side)
r.	B8 Port	- To boom swing cylinder (Bottom side)
s.	A9 Port	- To optional attachment (L.H. side)
t.	B9 Port	- To optional attachment (R.H. side)
u.	TSW Port	- To swing motor (S1 Port)
v.	TC Port	- To oil cooler
x.	TB Port	- To hydraulic tank
y.	A10 Port	- To 2-piece boom cylinder (Head side)
w.	B10 Port	- To 2-piece boom cylinder (Bottom side)
xx.	TS Port	- To hydraulic tank
aa.	PLS Port	- To hydraulic pump (PLS Port)
Pa.	PA1 Port	- From L.H. PPC valve (P2 Port)
Pb.	PB1 Port	- From L.H. PPC valve (P4 Port)
Pc.	PA2 Port	- From blade PPC valve (P1 Port)
Pd.	PB2 Port	- From blade PPC valve (P2 Port)
Pe.	PA3 Port	- From travel PPC valve (P2 Port)
Pf.	PB3 Port	- From travel PPC valve (P1 Port)
Pg.	PA4 Port	- From travel PPC valve (P3 Port)
Ph.	PB4 Port	- From travel PPC valve (P4 Port)
Pi.	PA5 Port	- From R.H. PPC valve (P4 Port)
Pj.	PB5 Port	- From R.H. PPC valve (P2 Port)
Pk.	PA6 Port	- From L.H. PPC valve (P3 Port)
Pl.	PB6 Port	- From L.H. PPC valve (P1 Port)
Pm.	PA7 Port	- From R.H. PPC valve (P3 Port)
Pn.	PB7 Port	- From R.H. PPC valve (P1 Port)
Po.	PA8 Port	- From boom swing PPC valve (P1 Port)
Pp.	PB8 Port	- From boom swing PPC valve (P2 Port)
Pq.	PA9 Port	- From OP1 solenoid valve group (B Port)
Pr.	PB9 Port	- From OP1 solenoid valve group (A Port)
Ps.	PDB Port	- From R.H. PPC valve (P4 Port)
Pt.	PA10 Port	- From 2-piece boom PPC valve (P2 Port)
Pu.	PB10 Port	- From 2-piece boom PPC valve (P1 Port)



Section A - A

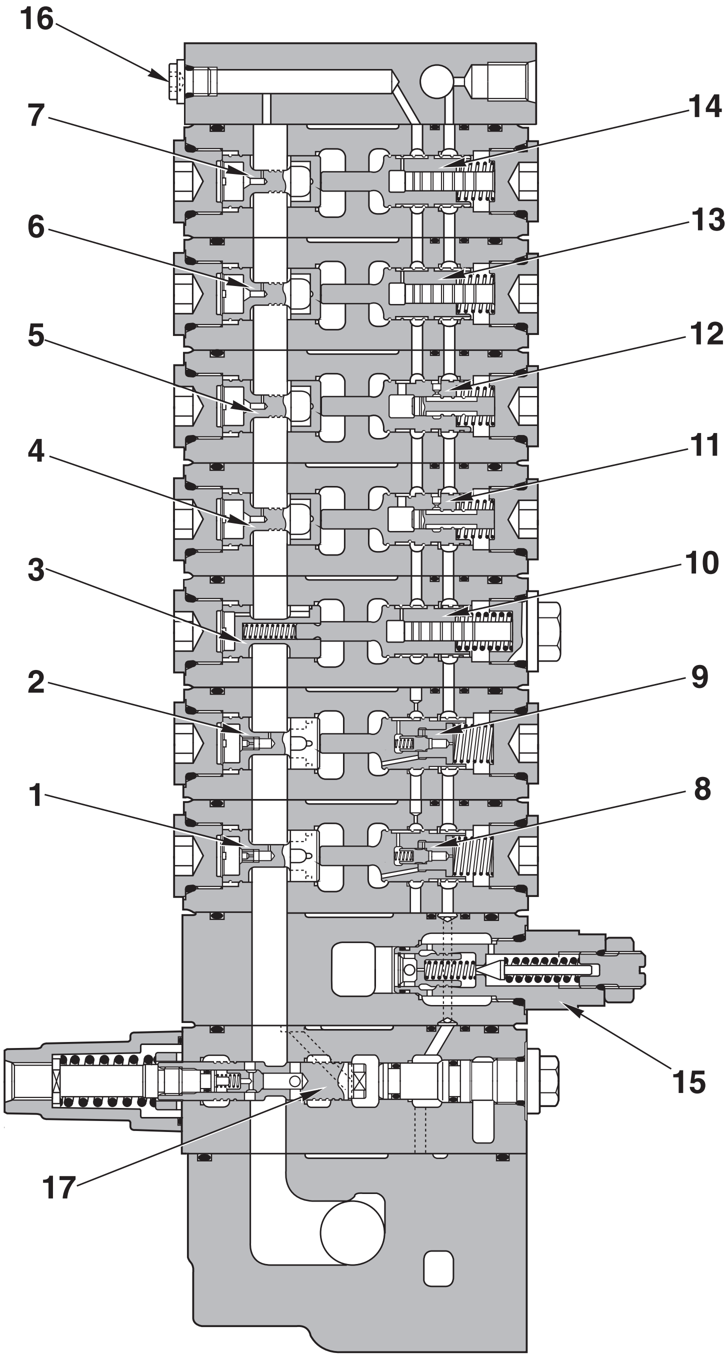
RKP02771

1. L.H. travel suction valve (A3 Port)
2. L.H. travel suction valve (B3 Port)
3. R.H. travel suction valve (A4 Port)
4. R.H. travel suction valve (B4 Port)
5. Boom suction valve (Bottom side) (A5 Port)
6. Boom suction valve (Head side) (B5 Port)
7. Arm suction valve (Head side) (A6 Port)
8. Arm suction valve (Bottom side) (B6 Port)
9. Bucket suction valve (Head side) (A7 Port)
10. Bucket suction valve (Bottom side) (B7 Port)
11. Boom swing suction valve (Head side) (A8 Port)
12. Boom swing suction valve (Bottom side) (B8 Port)
13. Attachment safety valve (L.H. side) (A9 Port)
14. Attachment safety valve (R.H. side) (B9 Port)
15. Safety valve
16. Lift check valve



Section B - B RKP02782

1. Main relief valve (P1 Port)
2. Spool (swing)
3. Spool (blade)
4. Spool (L.H. travel)
5. Spool (R.H. travel)
6. Spool (boom)
7. Spool (arm)
8. Spool (bucket)
9. Spool (boom swing)
10. Spool (attachment)



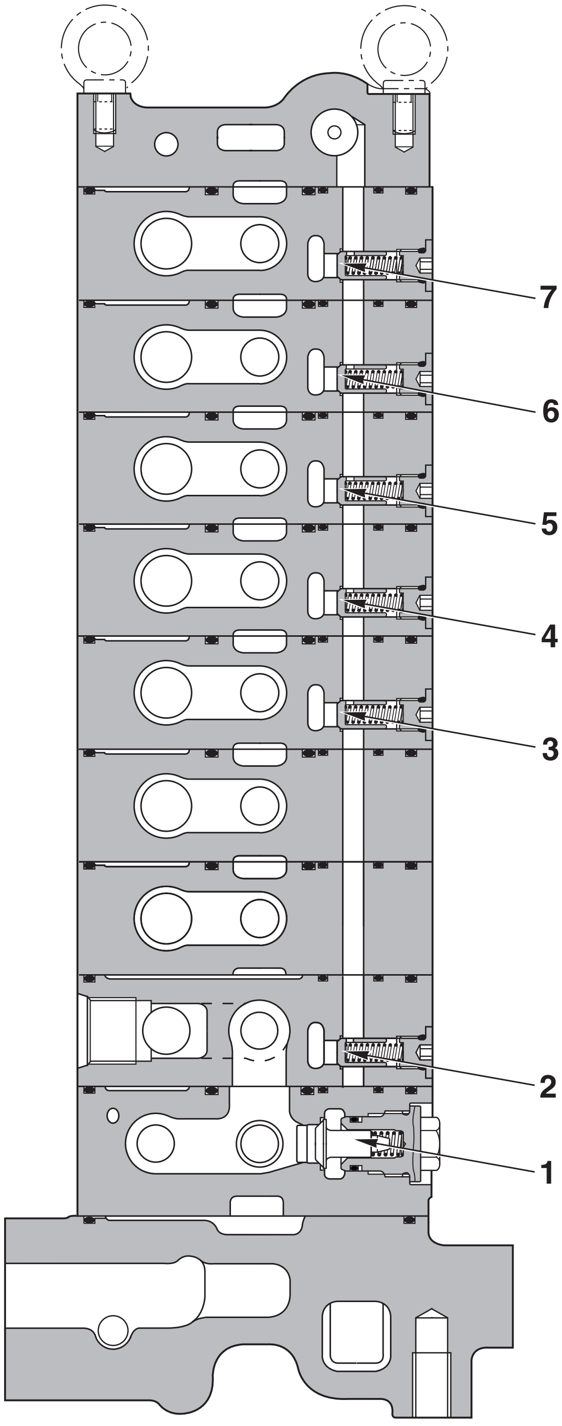
Section C - C RKP02791

Flow compensation valve:

1. L.H. travel
2. R.H. travel
3. Boom
4. Arm
5. Bucket
6. Boom swing
7. Attachment

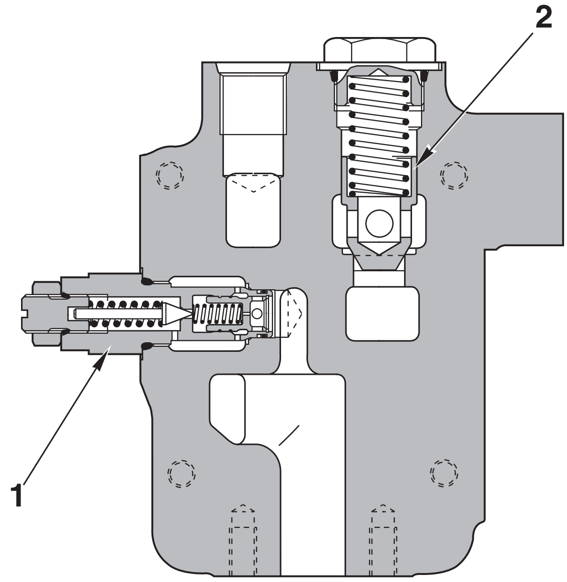
Reducing pressure compensation valve:

8. L.H. travel
9. R.H. travel
10. Boom
11. Arm
12. Bucket
13. Boom swing
14. Attachment
15. Main relief valve (P2 Port)
16. Plug
17. Spool (boom raise at joining pump discharge)

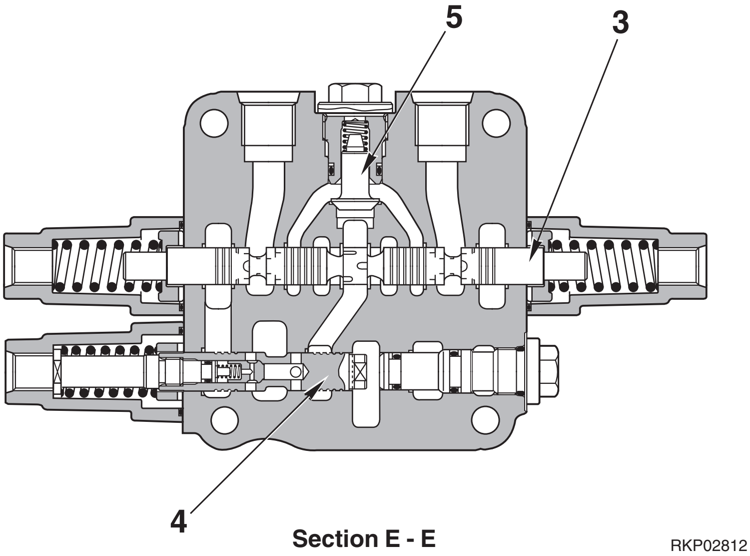


Section D - D

1. Swing check valve
2. Blade check valve
3. Boom check valve
4. Arm check valve
5. Bucket check valve
6. Boom swing check valve
7. Attachment check valve



Section BB - BB



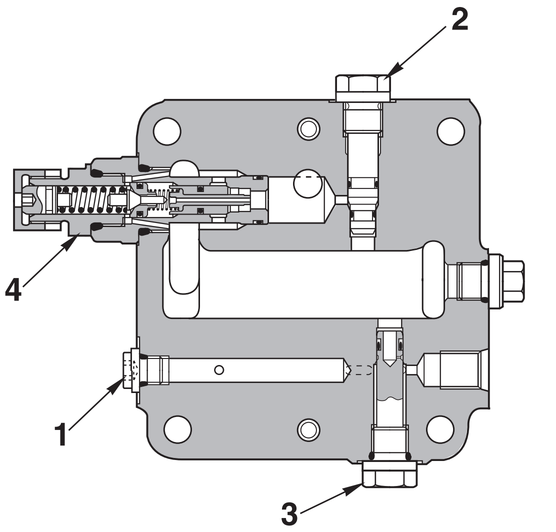
Section E - E

1. Main relief valve (P1 Port)
2. Lift check valve

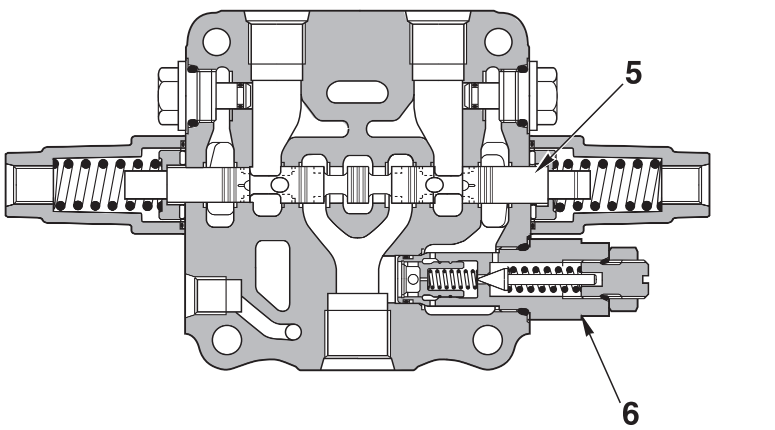
SWING VALVE

3. Spool (swing)
4. Spool (boom raise at joining pump discharge)
5. Check valve (swing)

BLADE VALVE



Section AA - AA

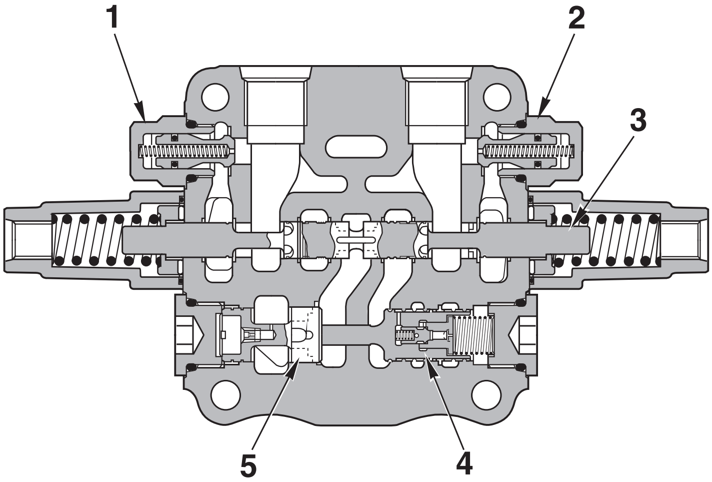


Section F - F

1. Pump pressure detection plug
2. Pressure relief plug
3. LS bypass plug
4. Safety relief valve

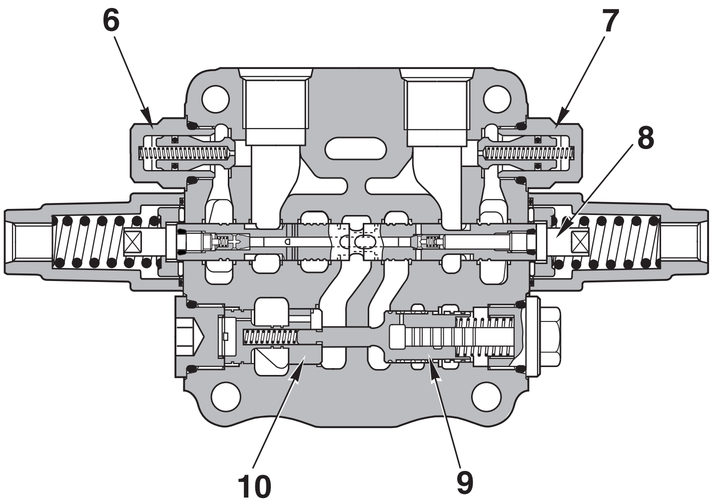
BLADE VALVE

5. Spool (blade)
6. Main relief valve (P2 Port)



Section G - G

RKP02852



Section H - H

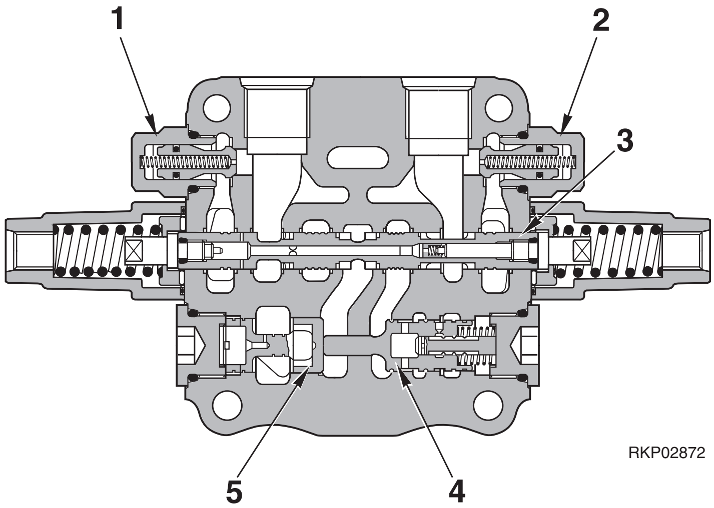
RKP02862

L.H. AND R.H. TRAVEL VALVE

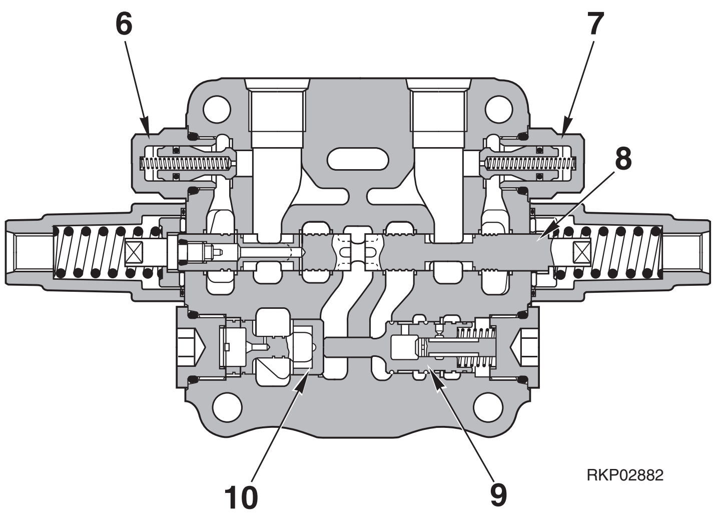
1. Suction valve (A3 - A4 Port)
2. Suction valve (B3 - B4 Port)
3. Spool
4. Reducing pressure compensation valve
5. Flow compensation valve

BOOM VALVE

6. Suction valve (Head side)
7. Suction valve (Bottom side)
8. Spool
9. Reducing pressure compensation valve
10. Flow compensation valve



Section J - J



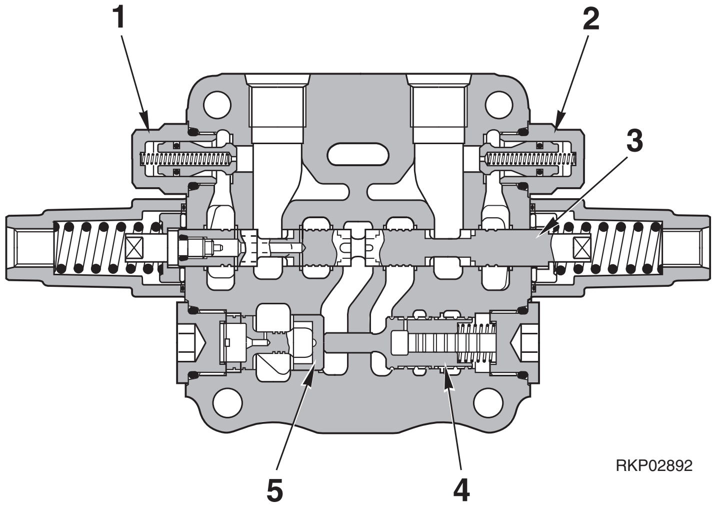
Section K - K

ARM VALVE

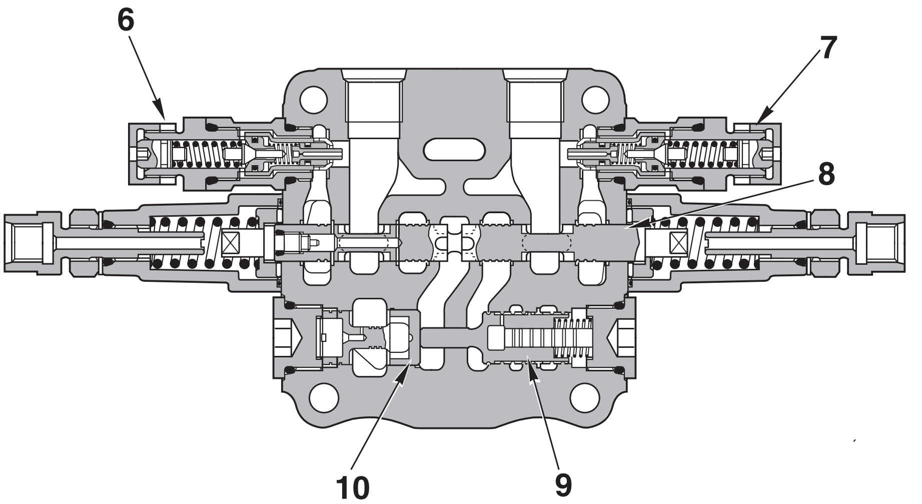
1. Suction valve (Head side)
2. Suction valve (Bottom side)
3. Spool
4. Reducing pressure compensation valve
5. Flow compensation valve

BUCKET VALVE

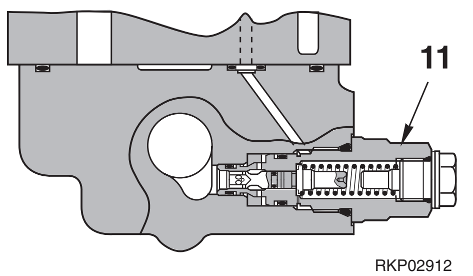
6. Suction valve (Head side)
7. Suction valve (Bottom side)
8. Spool
9. Reducing pressure compensation valve
10. Flow compensation valve



Section L - L



Section M - M



Section N - N

BOOM SWING VALVE (2-PIECE BOOM VALVE)

1. Suction valve (Head side)
2. Suction valve (Bottom side)
3. Spool
4. Reducing pressure compensation valve
5. Flow compensation valve

ATTACHMENT VALVE

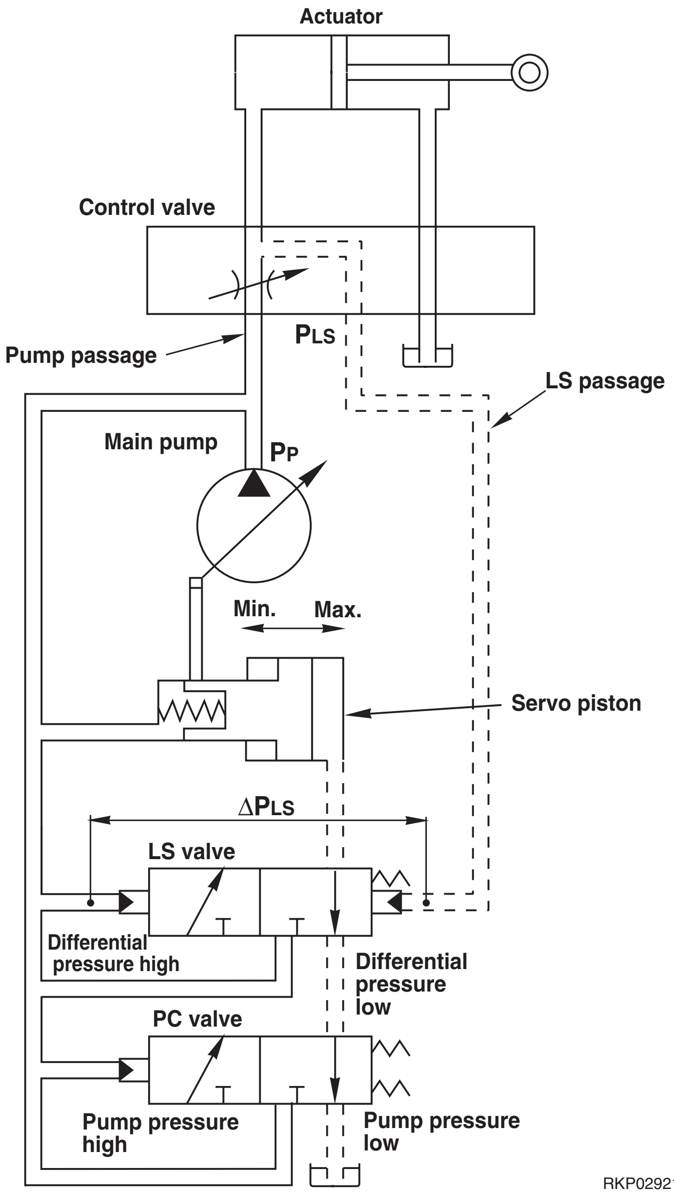
6. Safety valve (R.H. side)
7. Safety valve (L.H. side)
8. Spool
9. Reducing pressure compensation valve
10. Flow compensation valve
11. Unload valve

FUNCTION PRINCIPLE

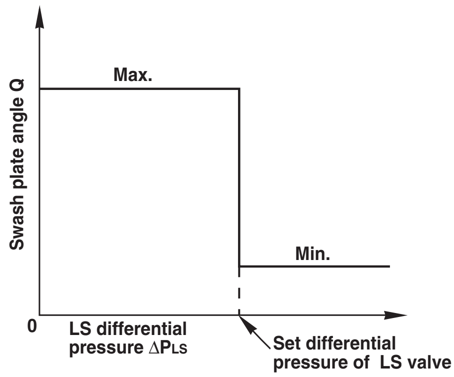
1. Control of pump swash plate angle

- The pump swash plate angle (pump discharge amount) is so controlled that the **LS** differential pressure **ΔPLS**, which is the difference between the pump discharge pressure **PP** and the **LS** pressure **PLS** at the outlet Port of the control valve (actuator load pressure), is maintained at a constant level.
(**LS** differential pressure **ΔPLS**=Pump discharge pressure **PP – LS** pressure **PLS**).
- If the **LS** differential pressure **ΔPLS** 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"..



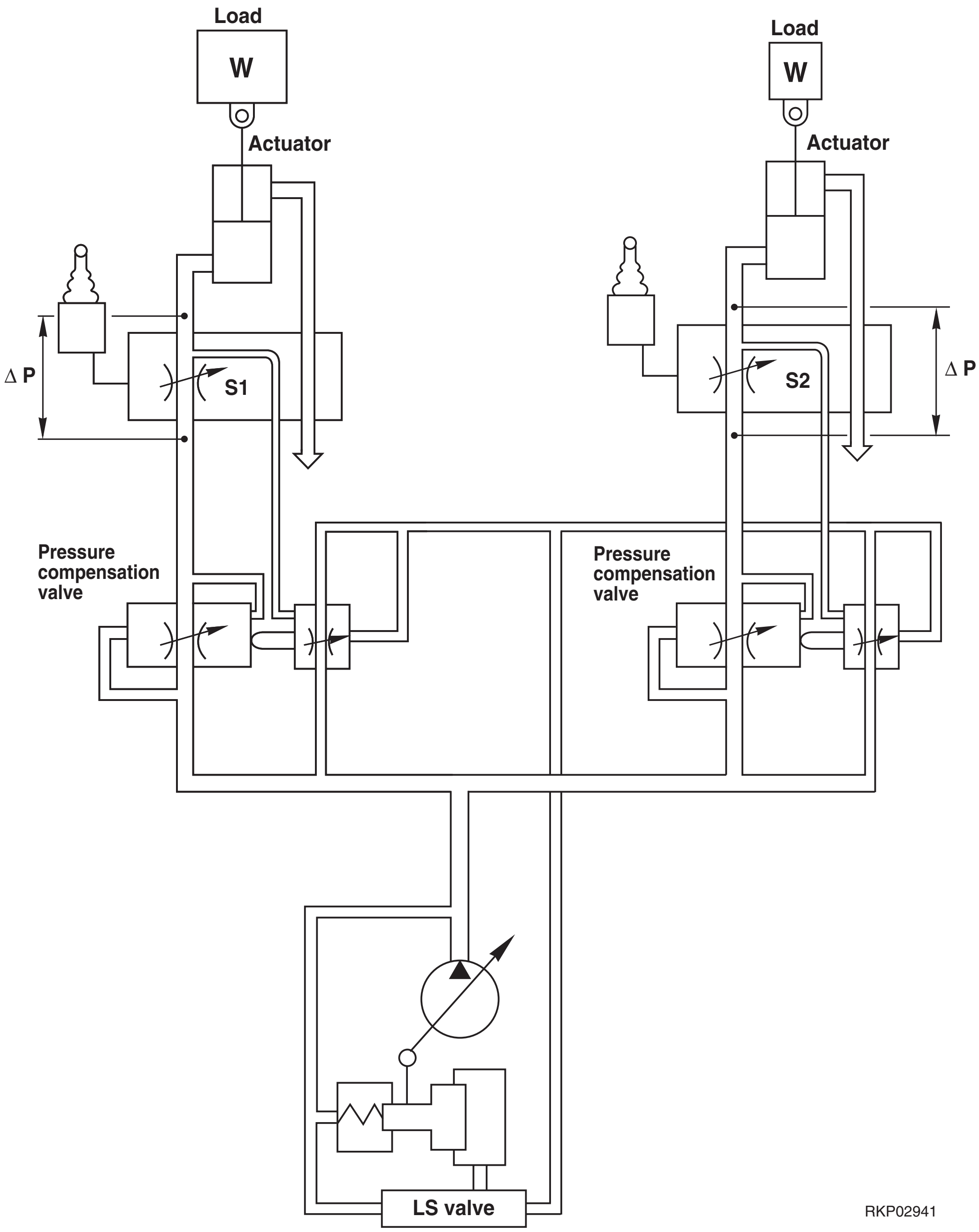
RKP02921



RKP02931

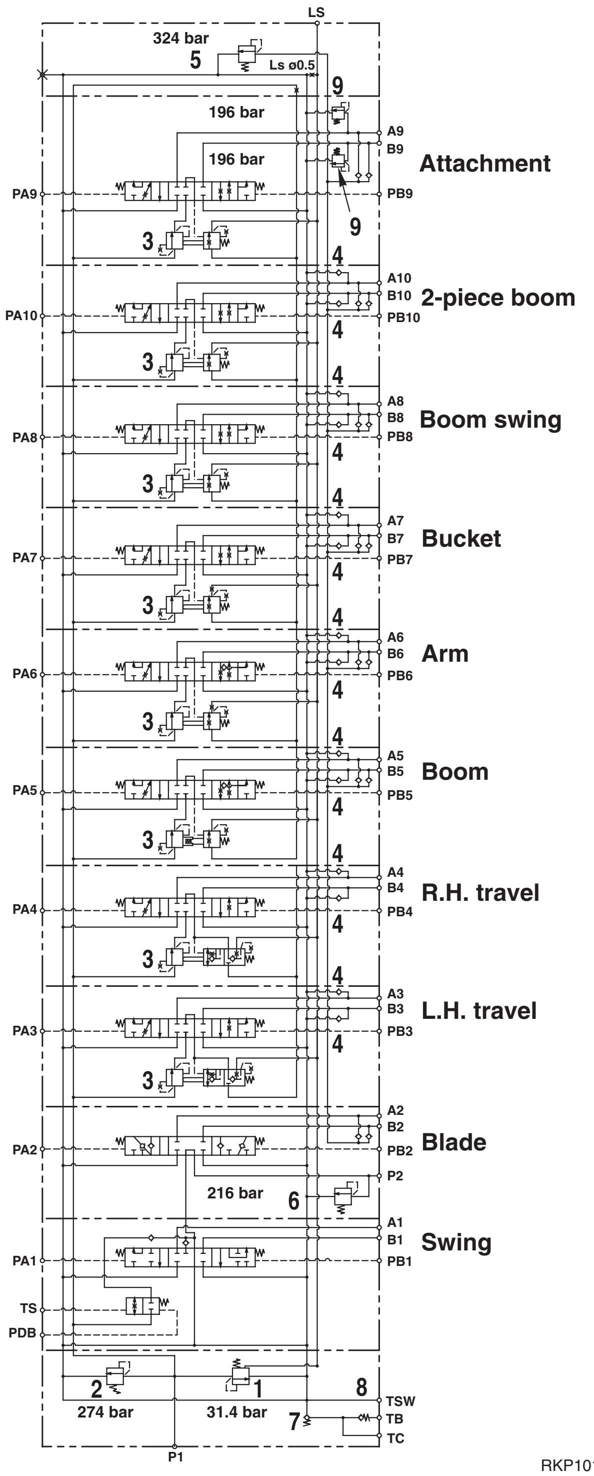
2. Pressure compensation control

- 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. Operation for each function and valve

Hydraulic circuit diagram and names of valves



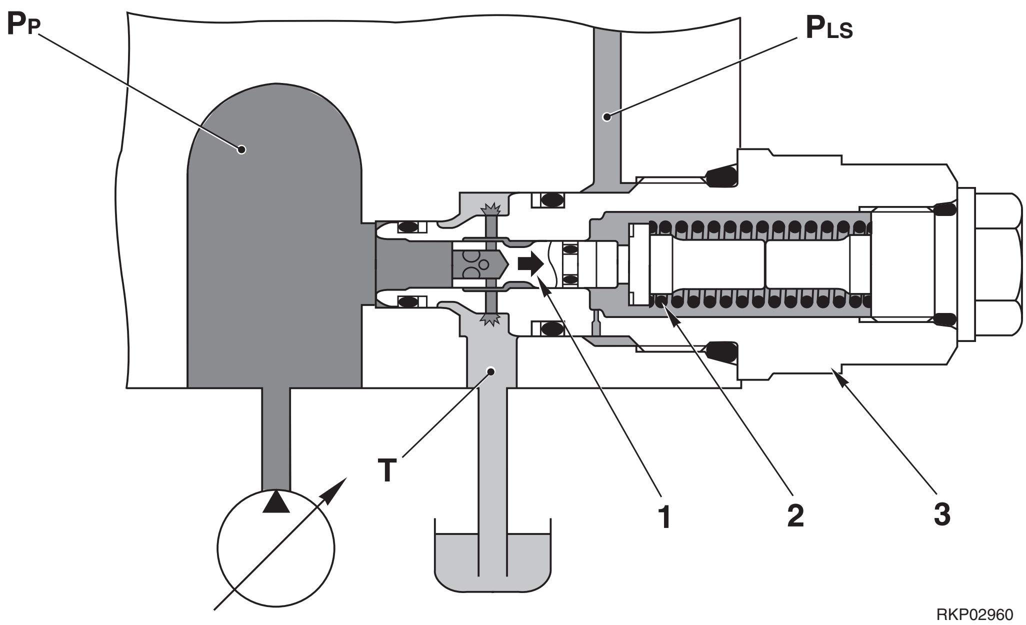
RKP10103

1. Unload valve: **LS** pressure+31.4 bar
2. Main relief valve (P1 Port) 274 bar
3. Pressure compensation valve
4. Suction valve
5. Safety valve: 324 bar
6. Main relief valve (P2 Port): 216 bar
7. Lift check valve
8. Cooler bypass valve
9. Safety valve (attachment): 196 bar

1. Unload valve

FUNCTION

1. When the control valve is at NEUTRAL, pump discharge amount **Q** for the minimum swash plate angle is released to the tank circuit.
   At this time, the pump discharge pressure **PP** is set at 31.4 bar by the spring (2) inside the valve.
   (**LS** pressure **PLS** = 0 bar)

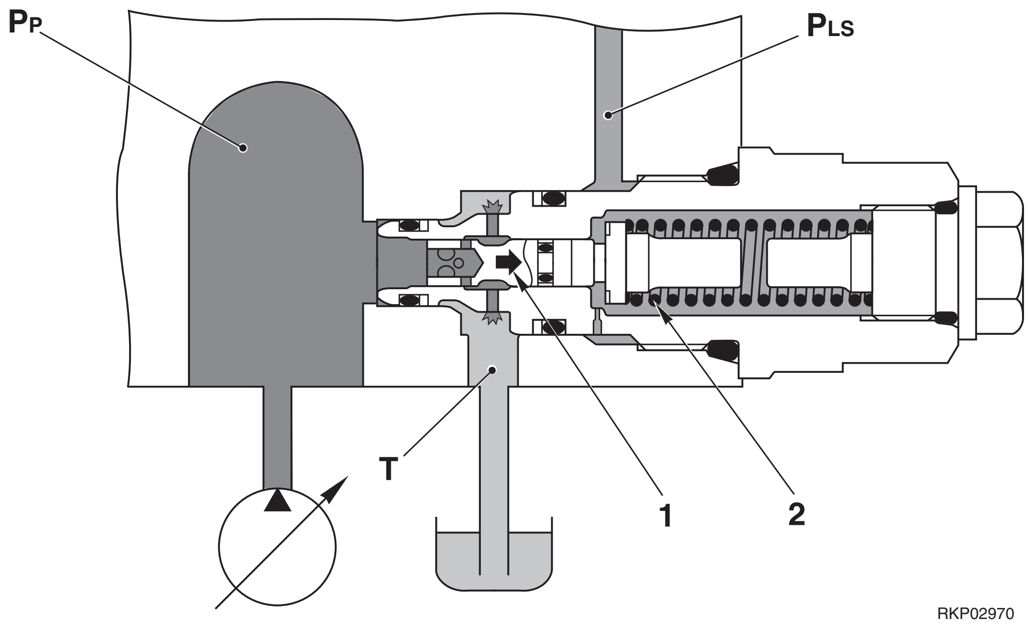


OPERATION

When the control valve is at NEUTRAL

- To two end surfaces of the spool (1), the pump discharge pressure **PP** is acting on the left and the **LS** pressure **PLS** is acting on the right side.
- Since no **LS** pressure **PLS** is generated when the control valve is at NEUTRAL, only the pump discharge pressure **PP** is acting, and **PP** is set only by the load of the spring (2)
- As the pump discharge pressure **PP** rises and reaches the spring load of the spring (2) (31.4 bar), the spool (1) is shifted to the right (→) side and the pump circuit **PP** becomes open to the tank circuit **T** through the drill holes in the sleeve (3).
- In this way, the pump discharge pressure **PP** is set to 31.4 bar.

2. When the flow demand from the actuator is within the discharge amount for the pump minimum swash angle plate during fine control of the control valve, the pump discharge pressure **PP** is set to the **LS** pressure **PLS** +31.4 bar. Since the unload valve opens when the differential pressure between the pump discharge pressure **PP** and the **LS** pressure **PLS** reaches the spring load of the spring (2) (31.4 bar), the **LS** differential pressure Δ**PLS** at this time becomes 31.4 bar



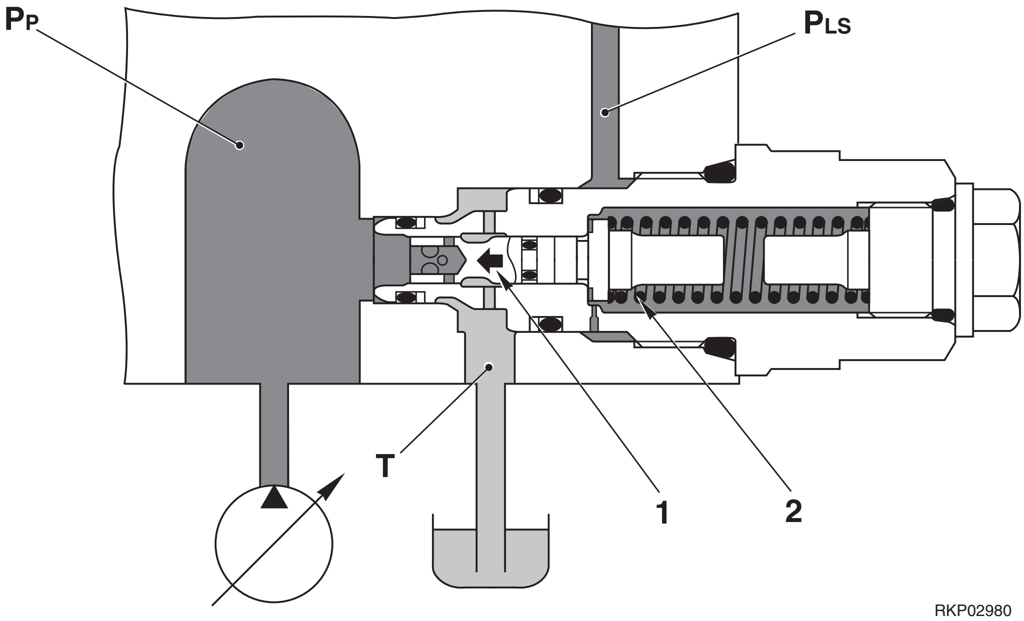
RKP02970

OPERATION

Fine control of the control valve

- When the control valve is fine-controlled, the **LS** pressure **PLS** is generated and acts on the right end of the spool (1).
  At this time, since the **LS** pressure **PLS** is small because the opening area of the spool of the control valve is small, there is big difference from the pump discharge pressure **PP**.
- When the differential pressure between the pump discharge pressure **PP** and **LS** pressure **PLS** reaches the spring load of the spring (2) (31.4 bar), the spool (1) moves to the right (➡) side and a path is formed between the pump circuit **PP** and the tank circuit **T.**
- Thus, the pump discharge pressure **PP** is set to the combined pressure of the spring force (31.4 bar) and the **LS** pressure **PLS**, and the **LS** differential pressure Δ**PLS** becomes 31.4 bar.

3. When the flow demand from the actuator becomes greater than the pump flow for the minimum swash plate angle during operation of the control valve, the flow to the tank circuit **T** is cut off, and all the pump discharge **Q** flows into the actuator circuit.



RKP02980

OPERATION

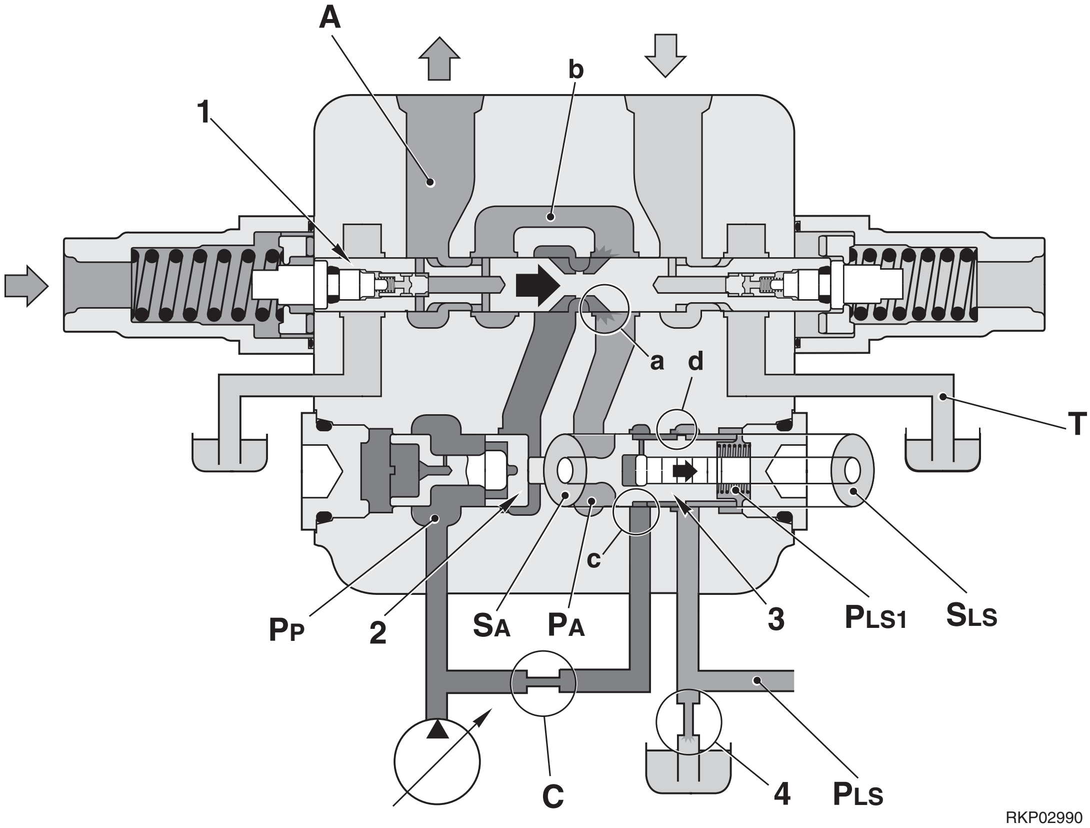
When the control valve is operated

- When the control valve is operated to a bigger stroke, the **LS** pressure **PLS** is generated and acts on the right end surface of the spool (1).
  At this time, since the opening area of the spool of the control valve is large, the difference between the **LS** pressure **PLS** and the pump discharge pressure **PP** is small.
- For this reason, because the differential pressure between the pump discharge pressure **PP** and the **LS** pressure **PLS** noes not reach the spring load of the spring (2) (31.4 bar), the spool (1) is pushed to the left (←) side by the spring (2).
- As the result, the path between the pump circuit **PP** and the tank circuit **T** is shut off, and whole pump discharge **Q** flows to the actuator circuit.

2. Introduction of LS pressure

Function

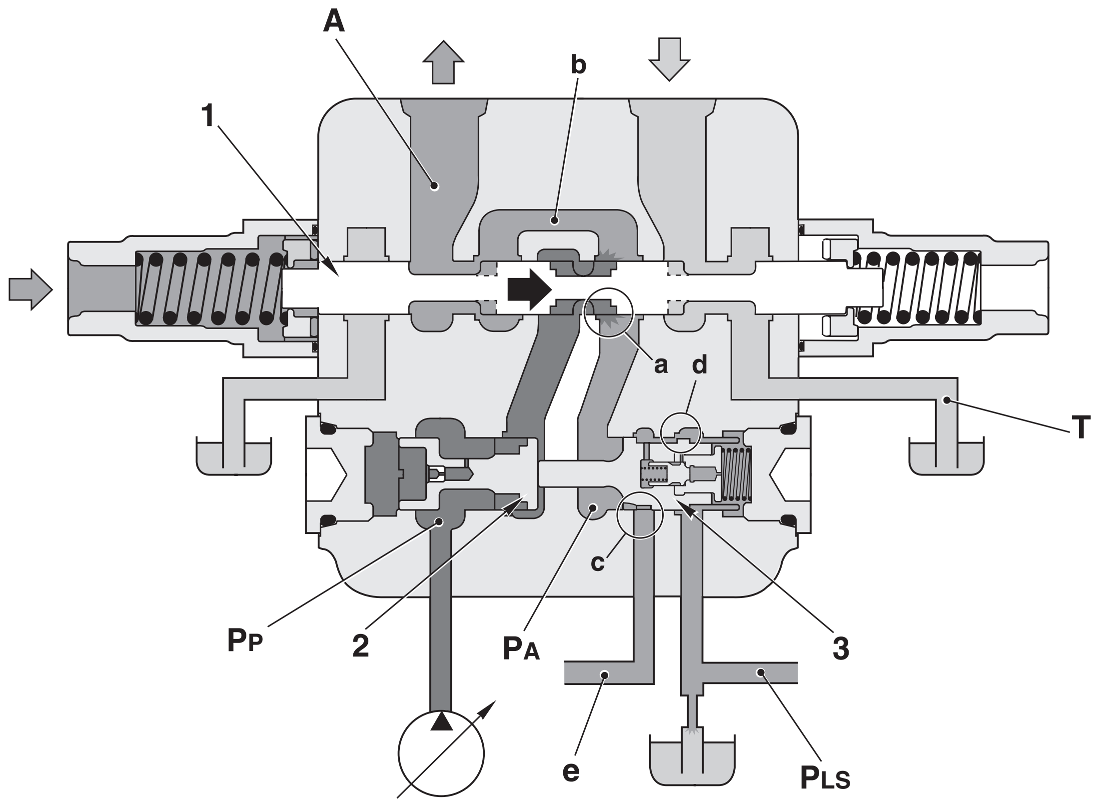
- The **LS** pressure denotes the actuator load pressure at the outlet Port of the control valve.
- Actually, in the control valves, the pump pressure **PP** is reduced to the same pressure of the actuator circuit pressure **A** by the pressure reducing valve (3) in the pressure compensation valve before introducing into the **LS** circuit **PLS**. Furthermore, the orifice **C** is provided in the middle of the circuit from the pump circuit **PP** to the pressure reducing valve (3) for damper function.
- In the travel valves, the actuator circuit pressure **A** is directly introduced into the **LS** circuit **PLS**.



OPERATION

Control valves (boom, arm, bucket, boom swing, attachment)

- When the spool (1) is operated, the pump pressure **PP** starts to flow to the actuator circuit **A** from the flow control valve (2) and the spool notch **a** through the bridge path **b**.
- At the same time, the pressure reducing valve (3) moves to the right (→) side, so the pump pressure **PP** introduced from the orifice **c** is depressurized by the pressure loss at the notch **d** and introduced to the **LS** circuit **PLS**, and then, further introduced to the spring chamber **PLS1**.
- At this time, the **LS** circuit **PLS** is open to the tank circuit **T** through the **LS** bypass plug (4) (refer to the description of the **LS** bypass plug).
- Areas of the both ends of the pressure reducing valve (3) are same (**SA**=**SLS**), and on the **SA** side, the actuator circuit pressure **PA** (=**A**) is acting, and on the opposite **SLS** side, the reduced pump pressure **PP** is acting.
- Therefore the pressure reducing valve (3) balances at the point where the actuator circuit pressure **PA** and the spring chamber pressure **PLS1** are balanced, and the pump pressure **PP** reduced by the notch **d** is introduced to the **LS** circuit **PLS** as the actuator circuit pressure **A**.



RKP03000

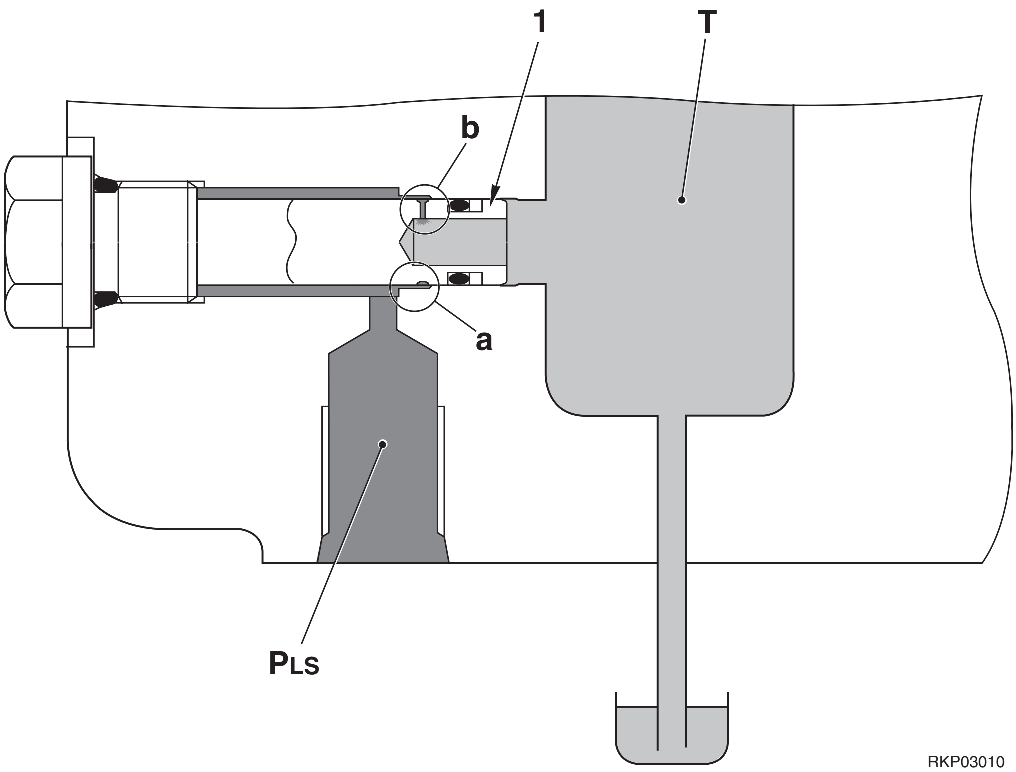
Travel valves

- When the spool (1) is operated, the pump pressure **PP** starts to flow to the actuator circuit **A** from the flow control valve (2) and the spool notch a through the bridge path **b**.
- At the same time, the pressure reducing valve (3) is moved to the right (→) side by the actuator circuit **PA**, and paths are made between the notches **c** and **d** to the travel path circuit e and the **LS** circuit **PLS** respectively.
- By this, the actuator circuit pressure **PA** (=**A**) is introduced to the **LS** circuit **PLS** from the notch **c** through the notch **d.**

★ In the travel circuits, unlike the work equipment circuits, the actuator circuit pressure **PA** is directly introduced to the **LS** circuit **PLS.**

LS bypass plug
DESCRIPTION

1 - The **LS** bypass plug releases the residual pressure of the **LS** pressure **PLS**.
2 - This makes the pressure-rising speed of the **LS** pressure **PLS** more gentle, and with this discarded throttled flow, it creases a pressure loss in the throttled amount of the spool or shuttle valve and increases the stability to lowering the effective **LS** differential pressure.



RKP03010

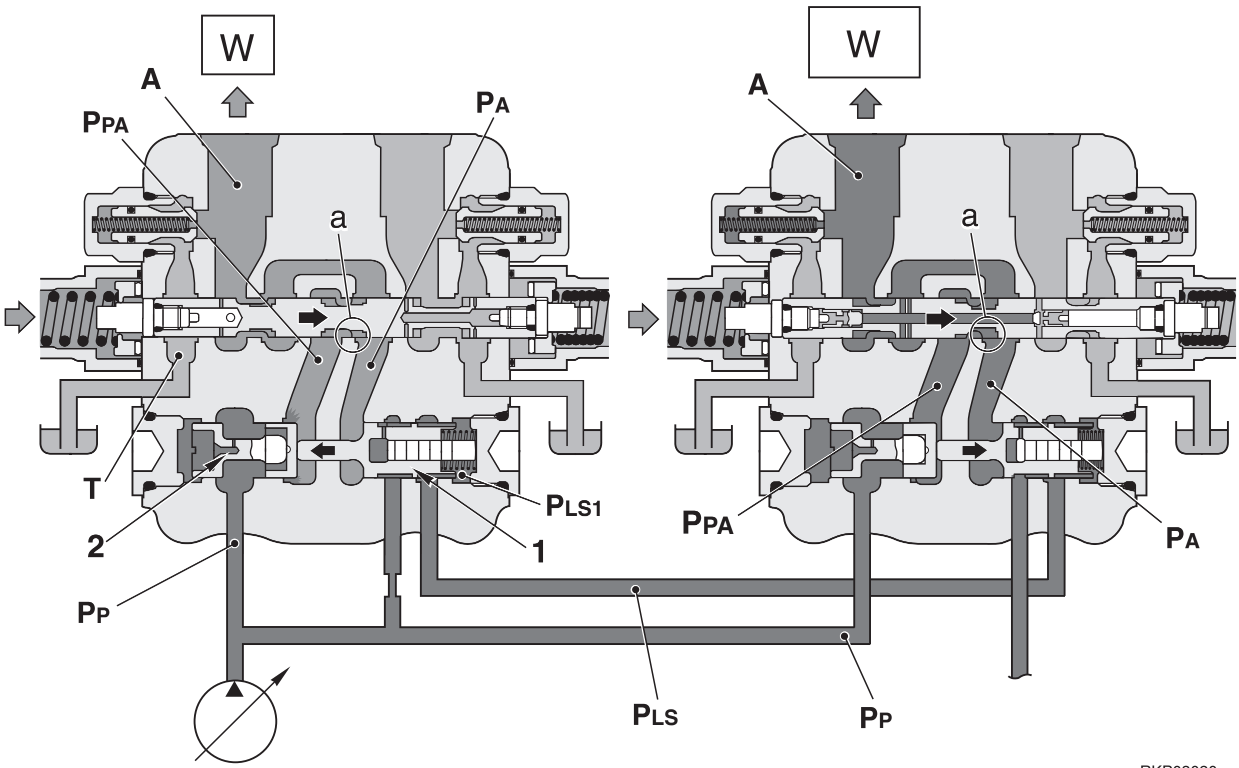
OPERATION

- The pressurized oil in the **LS** circuit **PLS** flows from the clearance filter **a**, which is formed by the clearance between the **LS** bypass plug (1) and the body, to the tank circuit **T** through the orifice **b.**

Pressure compensation valve

FUNCTION

1. During complex operation, if the load pressure at one side becomes lower than that of the other actuator and the oil flow is about to increase, pressure compensation is carried out.
   (In this case, the other actuator (right side) of the complex operation has higher load pressure than that of this side (left side).



RKP03020

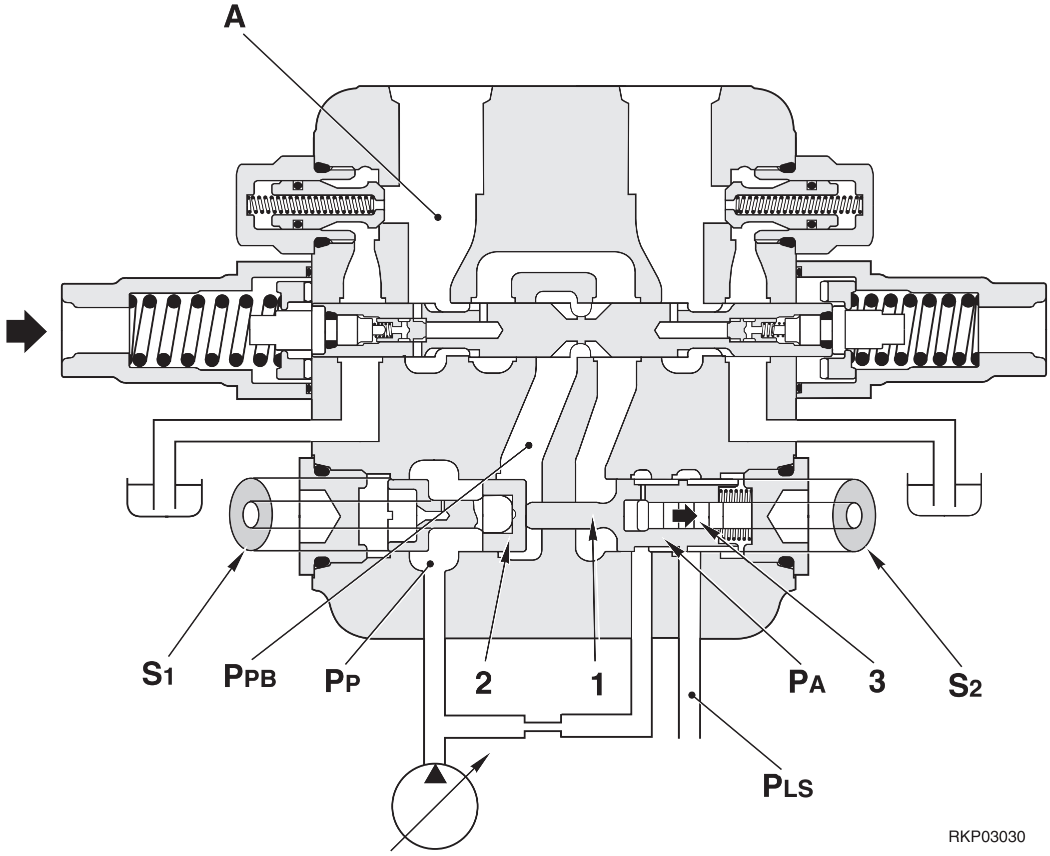
OPERATION

- During complex operation, when the load pressure of the other actuator side (right side) becomes higher, the flow in the actuator circuit **A** at this (left) side tends to increase.
- In this case, the **LS** pressure **PLS** at the other actuator acts on the spring chamber **PLS1**, and pushes the pressure reducing valve (1) and the flow control valve (2) to the left (←).
- The flow control valve (2) throttles the opening area between the pump circuit **PP** and the upstream side of the spool **PPA**, and generates a pressure loss in between **PP** and **PPA**.
- The flow control valve and the pressure reducing valve (1) are balanced at the point where the differential pressure between **PA** and **PLS**, which act on the both end surfaces of the pressure reducing valve (1), becomes equal to the pressure loss in between **PP** and **PPA** before and after the flow control valve (2).
- By this operation, the differential pressures between the upstream pressure **PPA** and the down stream pressure **PA** of both spools in the complex operation are made same, and the pump flow is distributed in proportion to the opening areas of notches a of each spool.

Area ratio of pressure compensation valve

FUNCTION

- The pressure compensation valve determines the compensation characteristics by carrying out fine adjustment of the area ratio (**S1/S2**) between the area **S1** of the flow control valve (2) side and the area **S2** of the pressure reducing valve (1) side to match the characteristics of each actuator.
  S1= Area of the flow control valve (2) **–** Area of the piston (3)
  S2= Area of the pressure reducing valve (1) **–** Area of the piston (3).



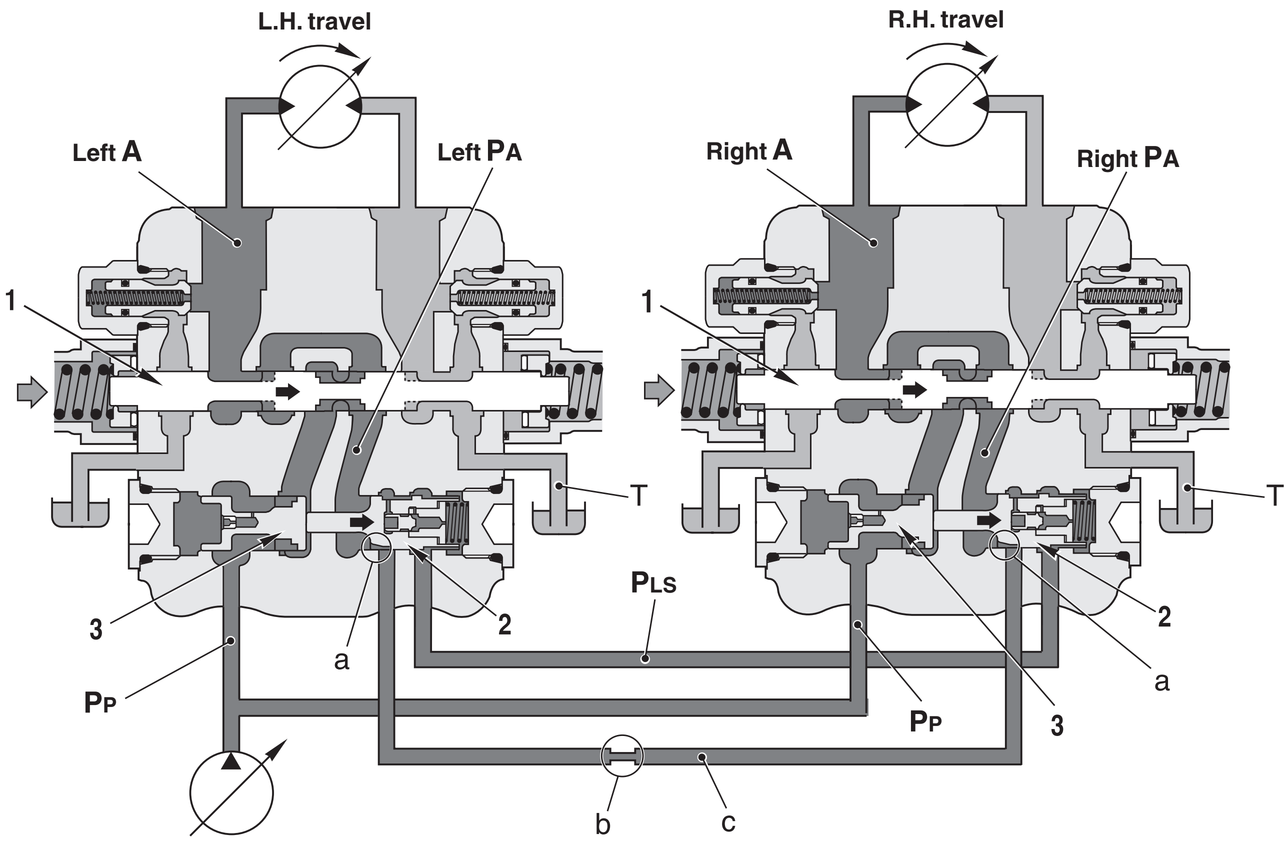
Area ratio (S1/S2) and compensation characteristics

- When the ratio is 1.00 :
  [Pump pressure **PP –** Upstream pressure of the spool notch **PPB**]≒[**LS** circuit pressure **PLS** – Actuator circuit pressure **PA** (=**A**)]
  Thus, the flow is distributed in proportion of opening areas of the spool.
- When the ratio is larger than 1.00 : **PP – PPB>PLS – PA (=A)**
  Thus, the flow is divided less than the proportion of opening areas of the spool.
- When the ratio is smaller than 1.00 : **PP – PPB<PLS – PA**
  Thus, the flow is divided more than the proportion of opening areas of the spool.

L.H. and R.H. travel path circuit

FUNCTION

- In order to compensate the flow difference between the L.H. and R.H. travel circuits at a time of straight travel, the path will open between the circuits by operating the L.H. and R.H. travel spools.
  By this operation, the flow to the L.H. and R.H. travel motors at a time of straight travel are maintained almost equal, eliminating curving.
- When the steering is operated, the pressure reducing valve of the travel valve inside the steering is returned by the difference between the load pressures, the path is closed, enabling the steering operation.

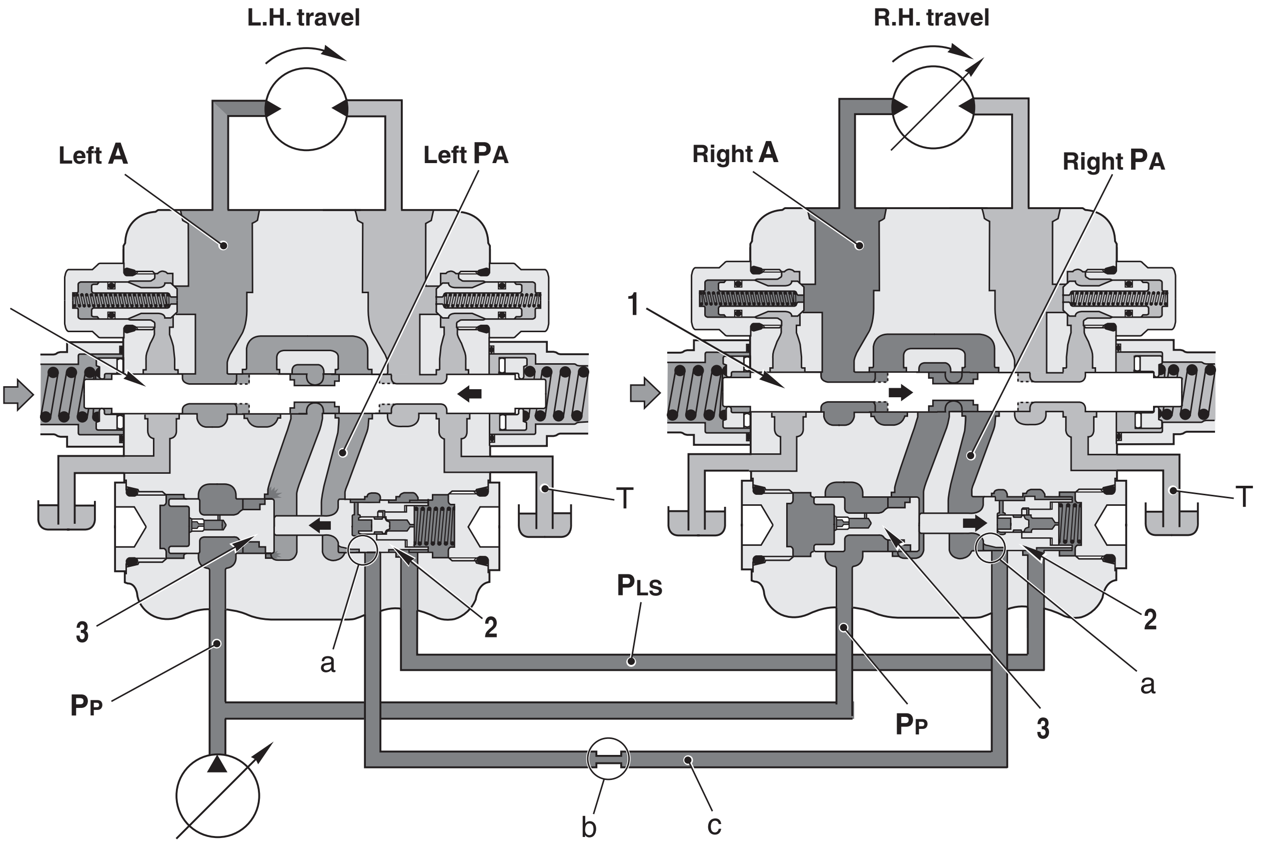


RKP03041

OPERATION

Straight travel

- By operating the L.H. and R.H. travel spools (1), the pump discharge flows from the pump circuit **PP** and the circuit **PA** to the actuator circuit **A**.
- When the travel straight is operated, since the actuator circuits **PA**'s are made equal pressure, the left and right pressure reducing valves (2) are pushed to the right (→) side by the same stroke, and the notch a and the path circuit are made open.
- By this, the L.H. and R.H. travel actuator circuits are connected by the path, and when a difference is generated in the flows to the L.H. and R.H. travel motors, the difference is compensated to prevent curving.



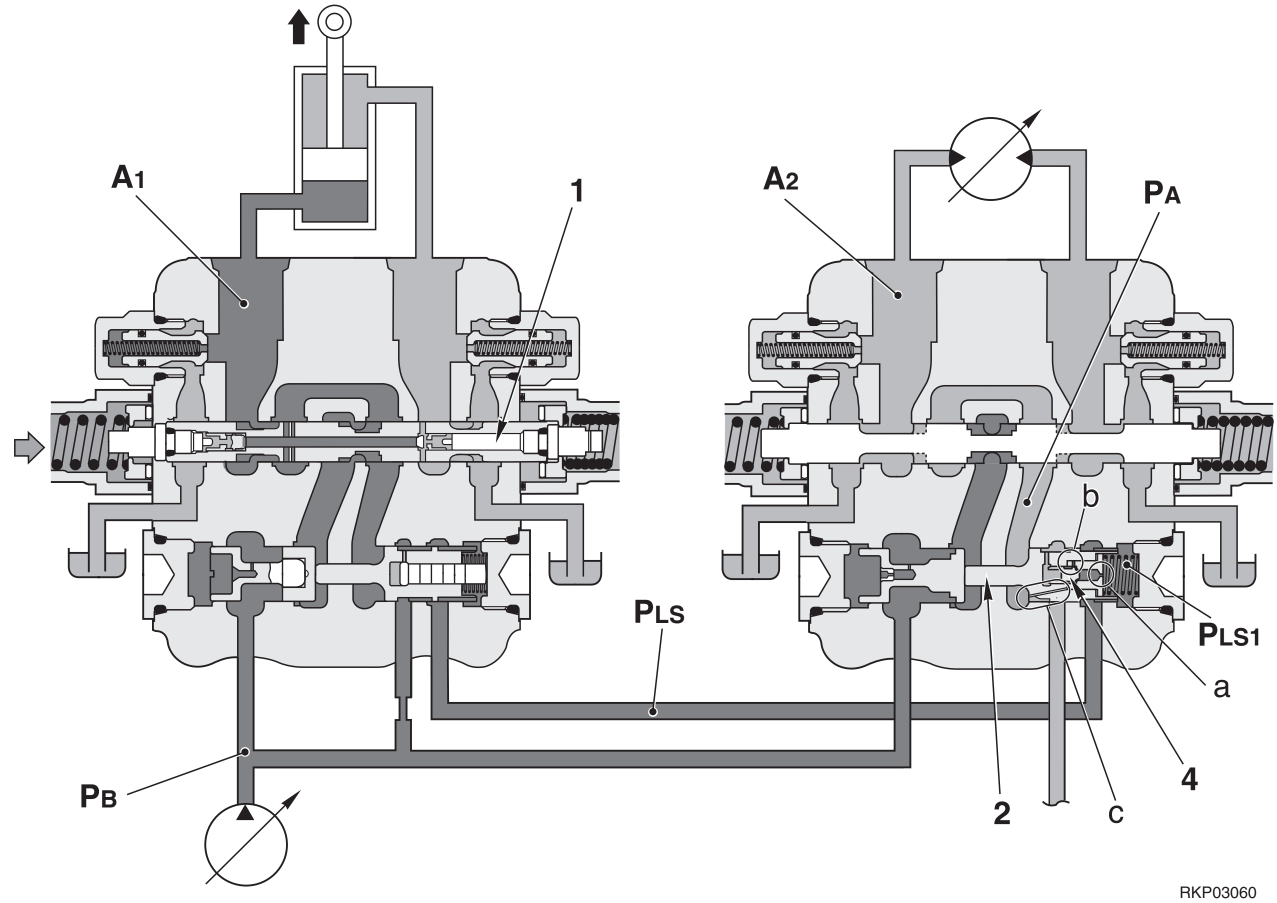
When the travel steering is operated

- During the straight travel status, if the L.H. travel spool (L.H. 1) is returned to the NEUTRAL side to operate the steering, difference is generated between the L.H. and R.H. travel actuator circuits **PA**'s (R.H. **A** > L.H. **A**), and the **LS** pressure **PLS** becomes the same as R.H.
  A which has the higher load pressure.
- By this action, the flow control valve (3) at the L.H. travel side is pushed to the left ( ) by the **LS** circuit PLS, i.e. the load pressure R.H. A of the R.H. travel, and the opening of the notch a at the left side is closed, shuttling off the path between the L.H. and R.H. travel circuits, enabling steering operation.
- Furthermore, the damper b is provided to ease the transient characteristics of rapid opening/closing of the path circuit when the spool is rapidly operated.

Travel LS bypass circuit

FUNCTION

- When the travel and another actuator are operated at the same time, by increasing the **LS** throttle amount in the **LS** circuit **PLS** which is discarded, and relaxing the pressure compensation precision in the travel circuit, drop in the travel speed is minimized.
- The bypass circuit is closed when the travel or another actuator is operated individually

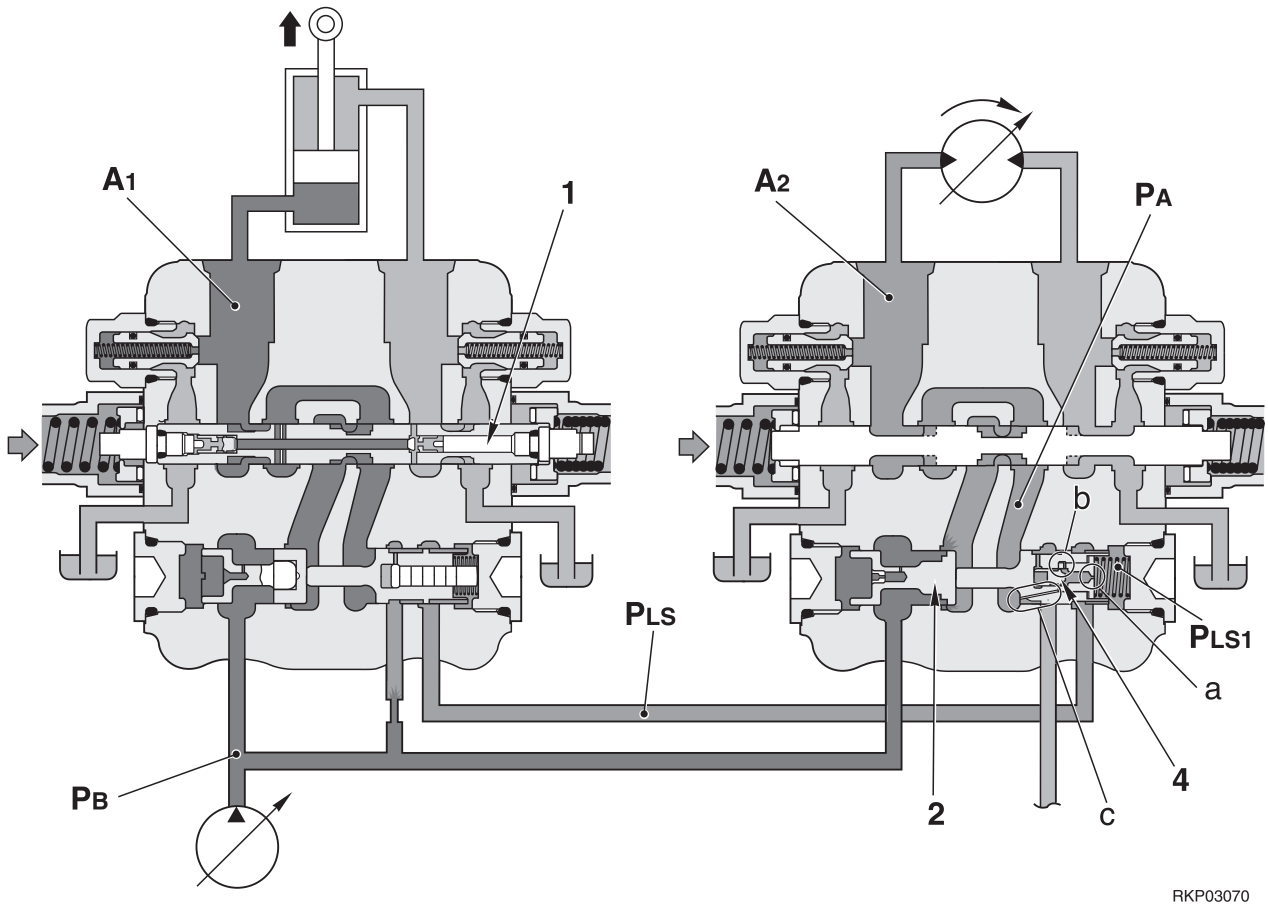


RKP03060

OPERATION

Normal operation

- When the boom spool (1) is operated, the pressure in the **LS** circuit **PLS** becomes same as the boom circuit pressure **A1**.
- At the same time, the **LS** circuit pressure **PLS** is also introduced to the spring chamber **PLS1** of the pressure reducing valve (2) in the travel valve.
- Since the travel spool is not operated, the travel actuator circuit is closed, and the check valve (4) in the reducing valve (2) is also closed.
- Thus, during individual operation of the boom, the travel **LS** bypass circuit is closed.



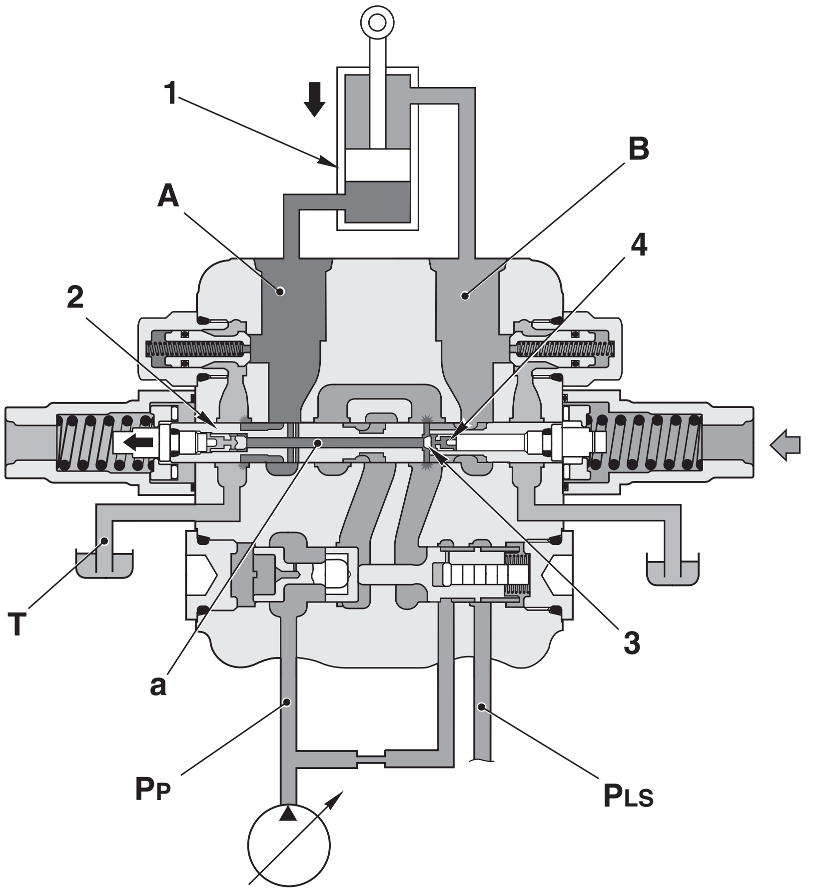
When the travel and another actuator are operated together

- When the boom spool (1) is operated, the pressure in the **LS** circuit **PLS** becomes same as the boom circuit pressure **A1**.
- Since the pressure in the boom RAISE actuator circuit is normally higher than that of the travel actuator (**A1**>**A2**), the pressure in the spring chamber **PLS1** in the reducing valve (2) at the travel side is higher than the travel circuit pressure (**PA**).
- Therefore, the pressure reducing valve (2) moves to the left (←) side, and the **LS** pressure in the spring chamber **PLS1** from the orifice a pushes and opens the check valve (4), and flows to the travel circuit **PA** through the path **b** and the path **c.**
- Thus, the **LS** circuit pressure **PLS**, which has been the same as the boom circuit pressure **A1**, flows to the travel circuit **A2** and lowers.

Boom and arm regeneration circuit

FUNCTION (Explanation by boom)

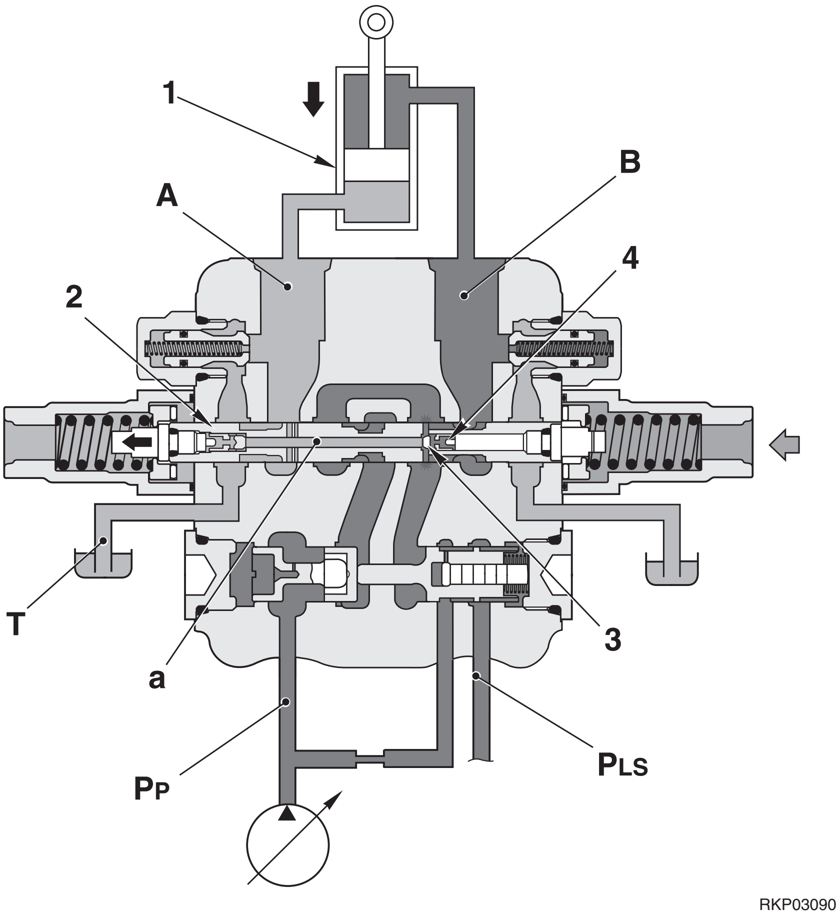
1. When the boom is being lowered, if the bottom pressure **A** of the cylinder (1) is higher than the head pressure **B**, and there is hydraulic drift, this sends the return flow at the bottom end to the head end to increase the cylinder speed by that amount.



OPERATION

- When there is hydraulic drift when lowering the boom, the pressure **A** at the bottom end of the boom cylinder (1) becomes higher than the pressure **B** at the head end.
- At this time, a part of the return flow at the bottom end passes the regeneration passage **a** of the boom spool (2), pushes the check valve (3) open, and flows to the head end.
- As the result, the boom lowering speed is increased.

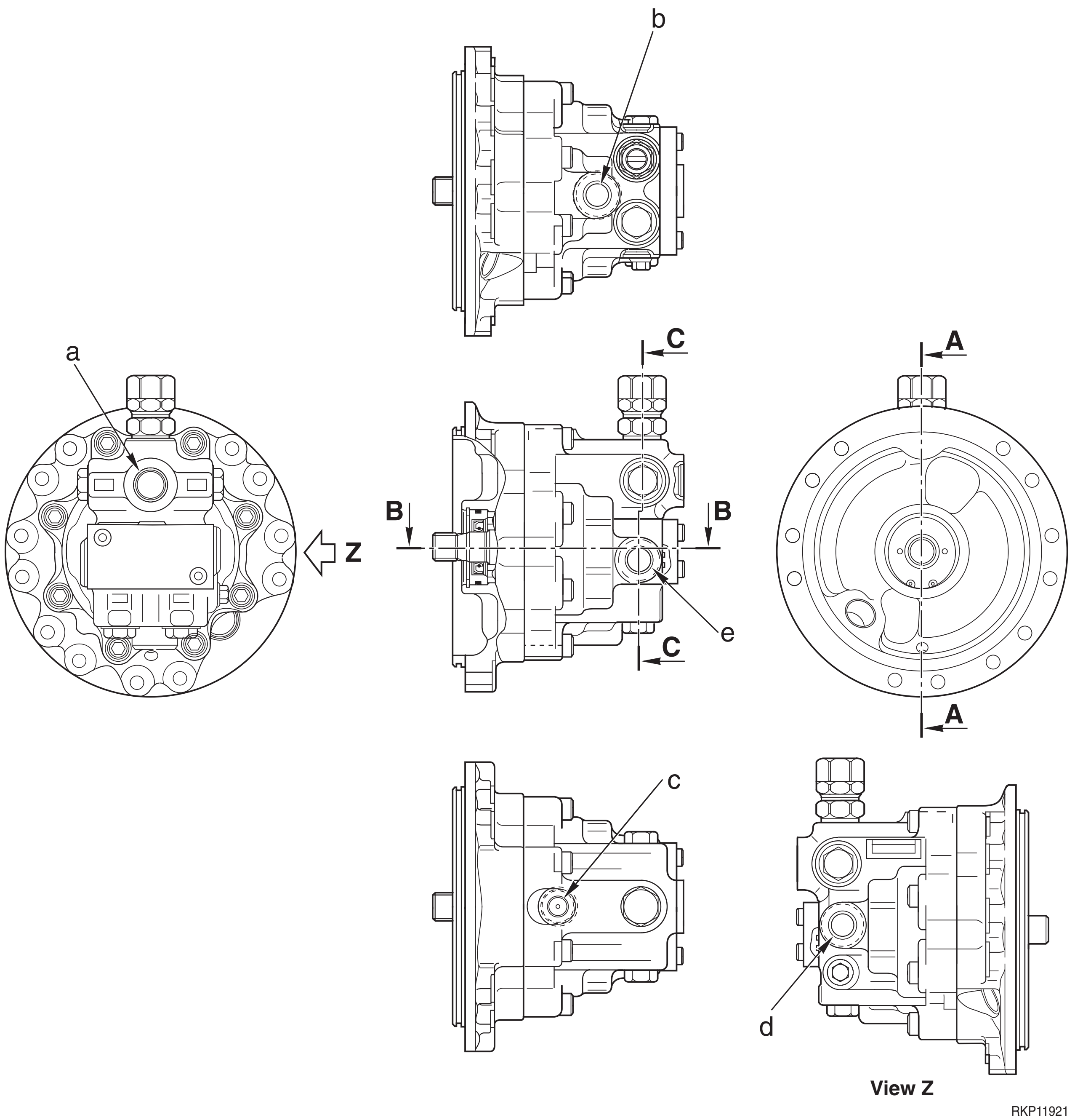
2. When lowering the boom, if the head pressure **B** of the cylinder (1) is greater than the bottom pressure **A**, and the operation is in the load process, the check valve (3) closes to shut off the circuit between the head and the bottom sides.



OPERATION

- During a load process such as lowering the boom, etc., the pressure **B** at the head side of the boom cylinder (1) becomes higher than the pressure **A** at the bottom side.
- At this time, the check valve (3) is closed by the pressure **B** at the head side and the spring (4), and the passage between the head circuit and the bottom circuit is shut off.

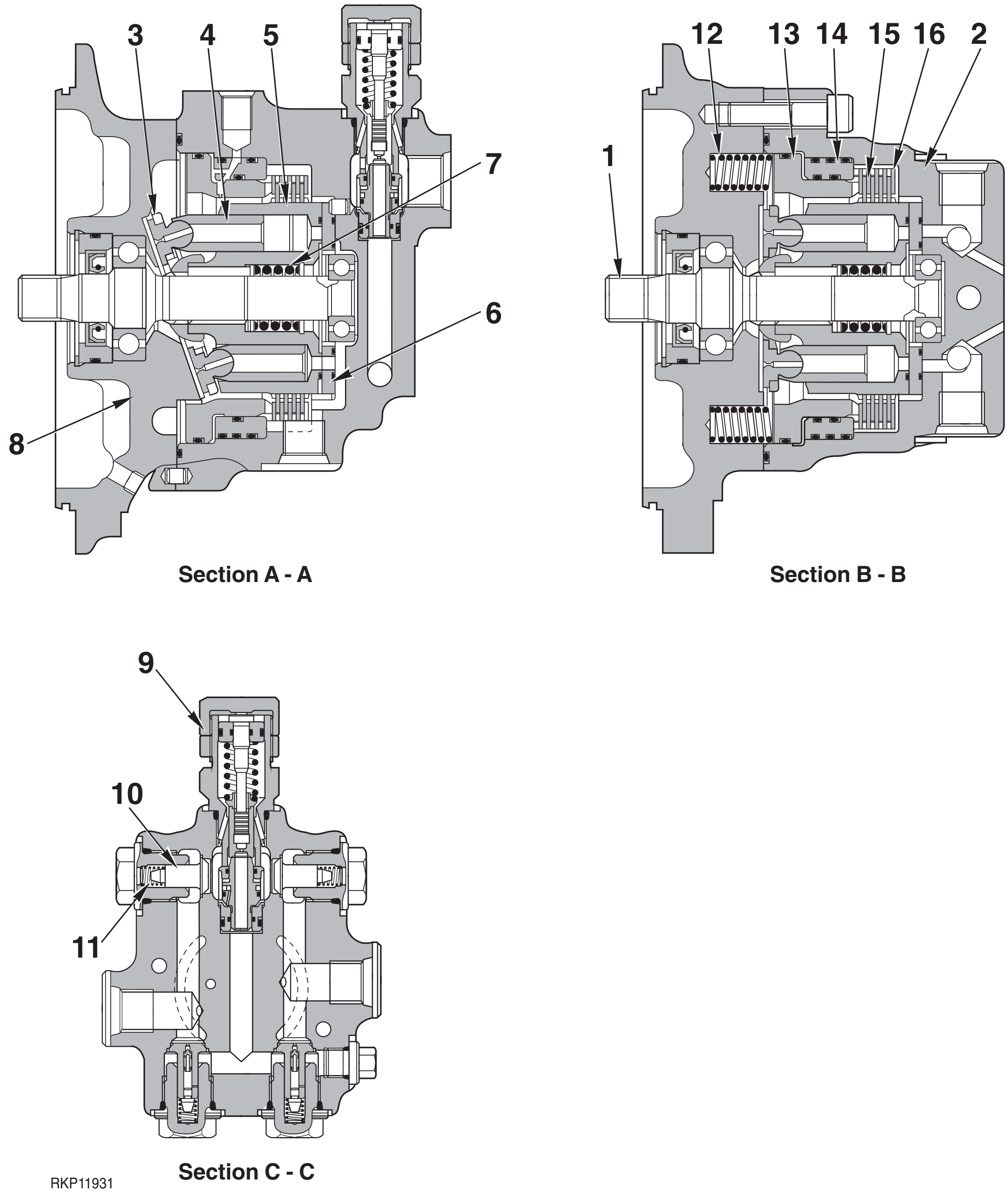
SWING MOTOR



a. S Port - From control valve (TSW Port)
b. T Port - To hydraulic tank
c. B Port - From shutthe valve (B Port)
d. MB Port - From control valve (B1)
e. MA Port - From control valve (A1)

SPECIFICATIONS

Type: LMF30AB
Motor capacity: 31 cc/rev.
Rated speed: 2260 rpm
Safety valve set pressure: 196 bar
Suction valve cracking pressure: max. 0.3 bar
Brake releasing pressure: 5.5±0.7 bar



Section A - A

Section B - B

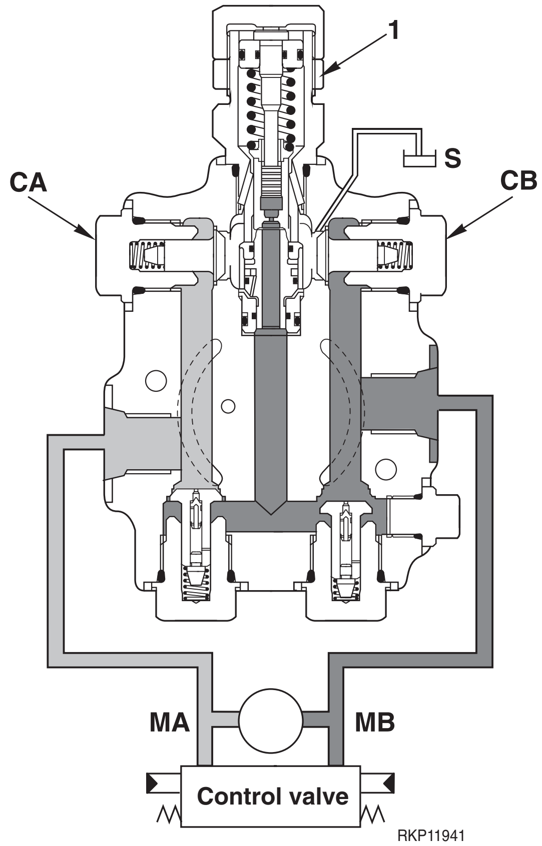
Section C - C

1. Output shaft
2. Housing
3. Shoe
4. Piston
5. Cylinder block
6. Valve plate
7. Spring
8. Swash plate
9. Safety valve
10. Check valve
11. Spring
12. Spring
13. Brake piston
14. Ring
15. Disc
16. Plate

SAFETY VALVE WITH SUCTION

FUNCTION

- When swing operation is stopped, outlet circuit of the motor is closed by the control valve. However, the motor will run for a while by inertial force, so pressure at the outlet side of the motor will abnormally rise, which may cause damage to the motor.
- To avoid such danger, the safety valve releases the abnormally high pressure oil from the outlet side of the motor to the Port **S**, as well as performing swing brake function.
- The suction valve supplies oil of equivalent amount to the oil released by the safety valve from the Port **S** to the inlet side of the motor to avoid cavitation.



RKP11941

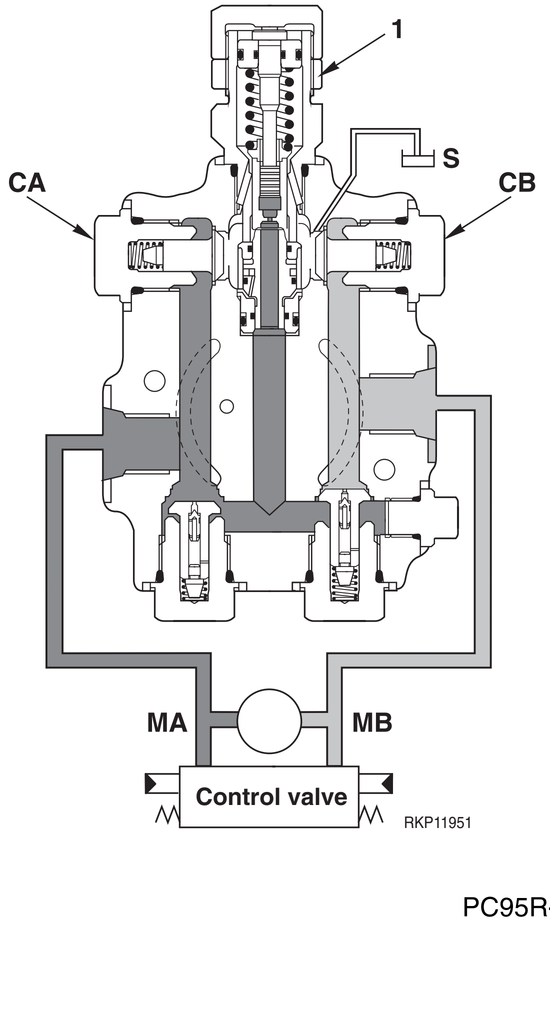
OPERATION

1. When swing starts

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

2. When swing stops

- When the swing control lever is returned to the NEUTRAL position, pressure oil from the control valve is not sent to the Port **MB**.
- At the Port **MA**, pressure rises, which generates rotational resistance to the motor, which then acts as braking force to the motor.
- When the pressure at the Port **MA** reaches the set pressure of the safety valve (1), the valve (1) opens to release the pressure oil in the Port **MA** to the Port **S**.
- At the Port **MB**, since the motor runs without being supplied with pressure oil, negative pressure will be generated.
  When this negative pressure lowers to the set pressure of the suction valve (2), the suction valve (2) opens and oil is sent from the Port **S** to avoid cavitation.

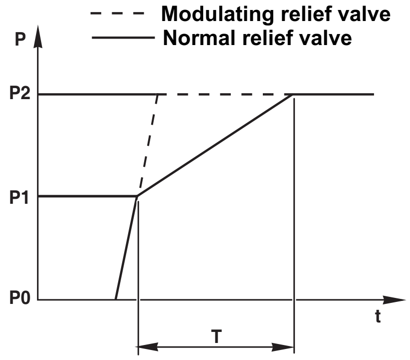


RKP11951

OPERATION OF THE MODULATING RELIEF VALVE

FUNCTION

- The relief valve for the swing motor has the properties to suppress the rapid increase of the relief pressure as per shown in the figure right, and serves to reduce the shock at the time of start and stop of swing.



RKP11970

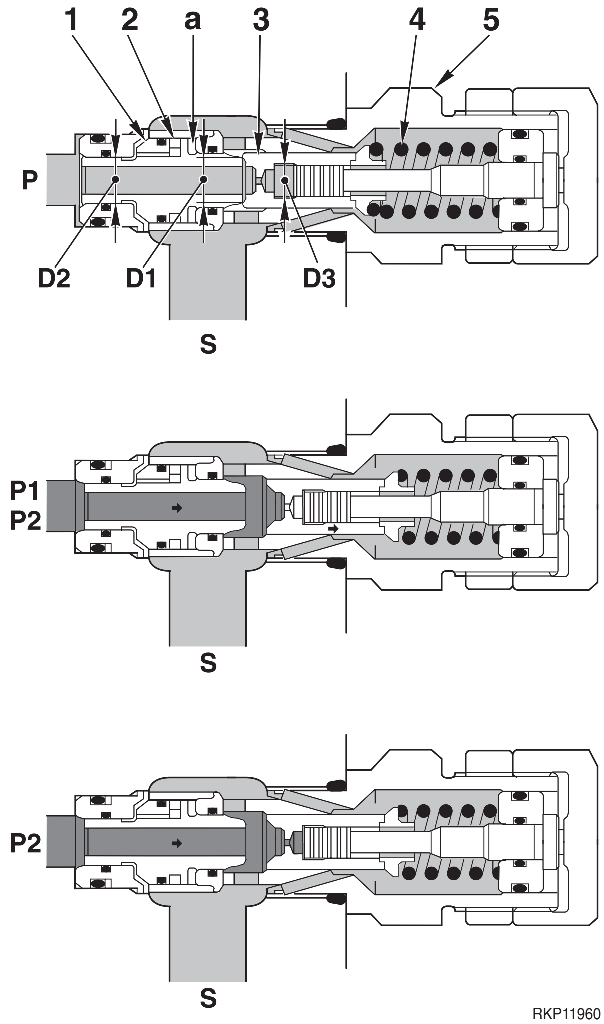
OPERATION

When the circuit pressure is P0

- The relief valve does not operate.

When the circuit pressure has rapidly increased

- When the circuit pressure increases to **P1,** the valve (3) starts to open bacause the oil pressure acts on the difference in area between **D1** and **D3** (**D1>D3**), thus pressing the spring (4).
  On this occasion, the seat (1) tries to follow the valve (3) because the pressure acts on the difference in area between **D1** and **D2** (**D1<D2**).
  However, the route that the oil in the chamber **a** compressed by the movement of the seat (1) can flow to the **S** port has been throttled by the ball (2), so that the movement of the seat (1) is slower than that of the valve (3).
  Therefore, during the time **T** until the seat (1) makes contact with the sleeve (5), the relief pressure gradually increases from **P1** to **P2**.

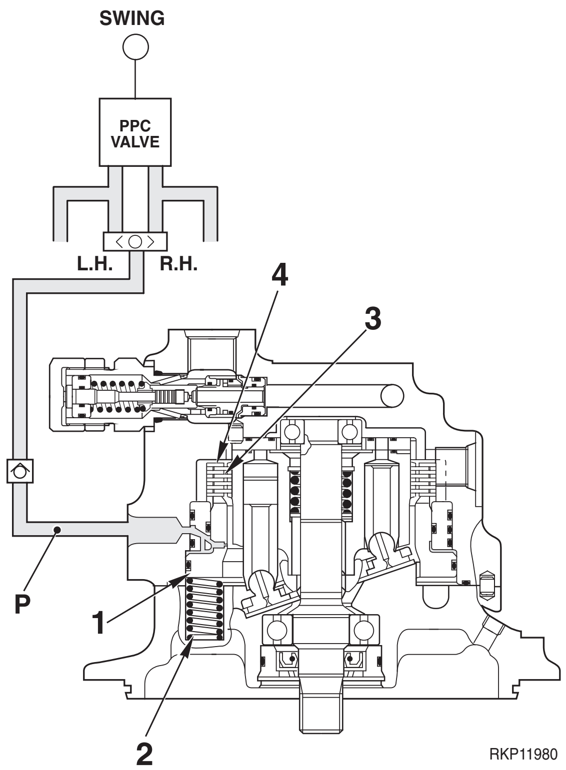


RKP11960

OPERATION OF SWING BRAKE

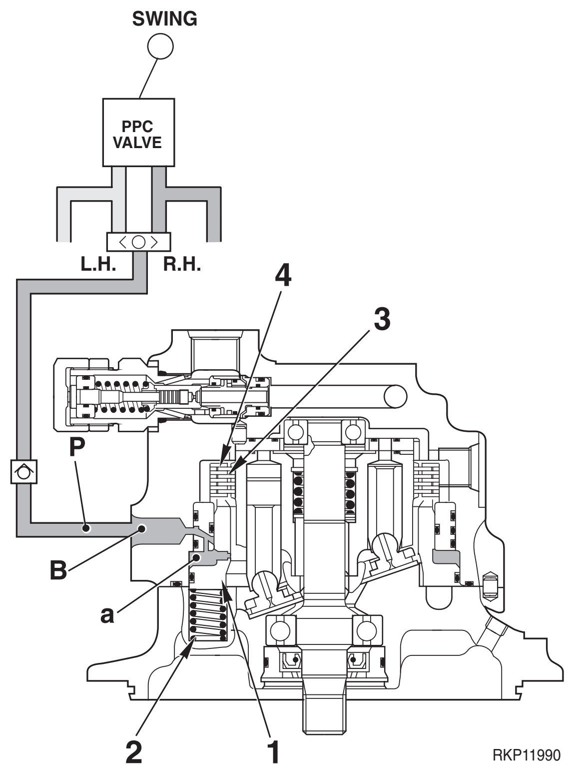
1. PPC valve (swing) at HOLD

- When the PPC valve (swing) is at HOLD, the PPC output pressure **P** is 0 bar
- For this reason, brake piston (1) is pushed up by brake spring (2), and disc (3) and plate (4) are pushed together to apply the brake.



2. PPC valve (swing) actuated

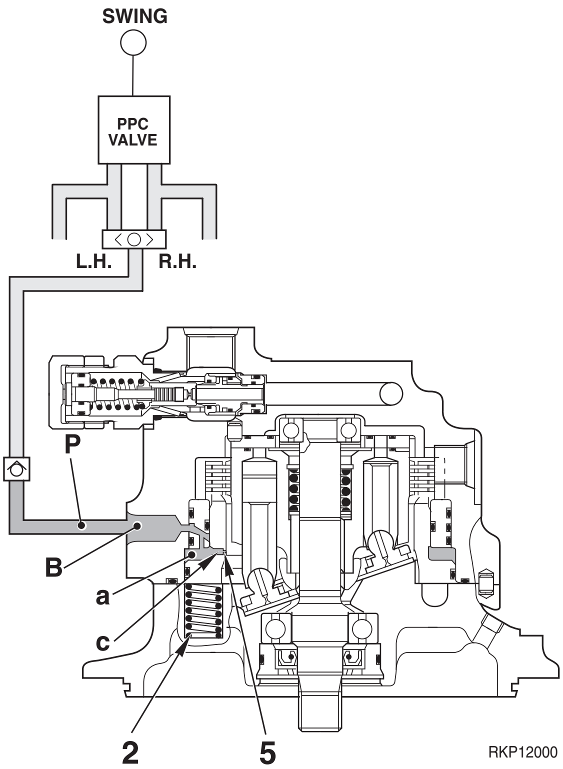
- When the PPC valve is actuated, PPC output pressure **P** enters port **B** and flows to brake chamber **a**.
- The pressurized oil entering chamber **a** overcomes brake spring (2) and pushed braked piston (1) down. As a result, disc (3) and plate (4) separate and the brake is released.



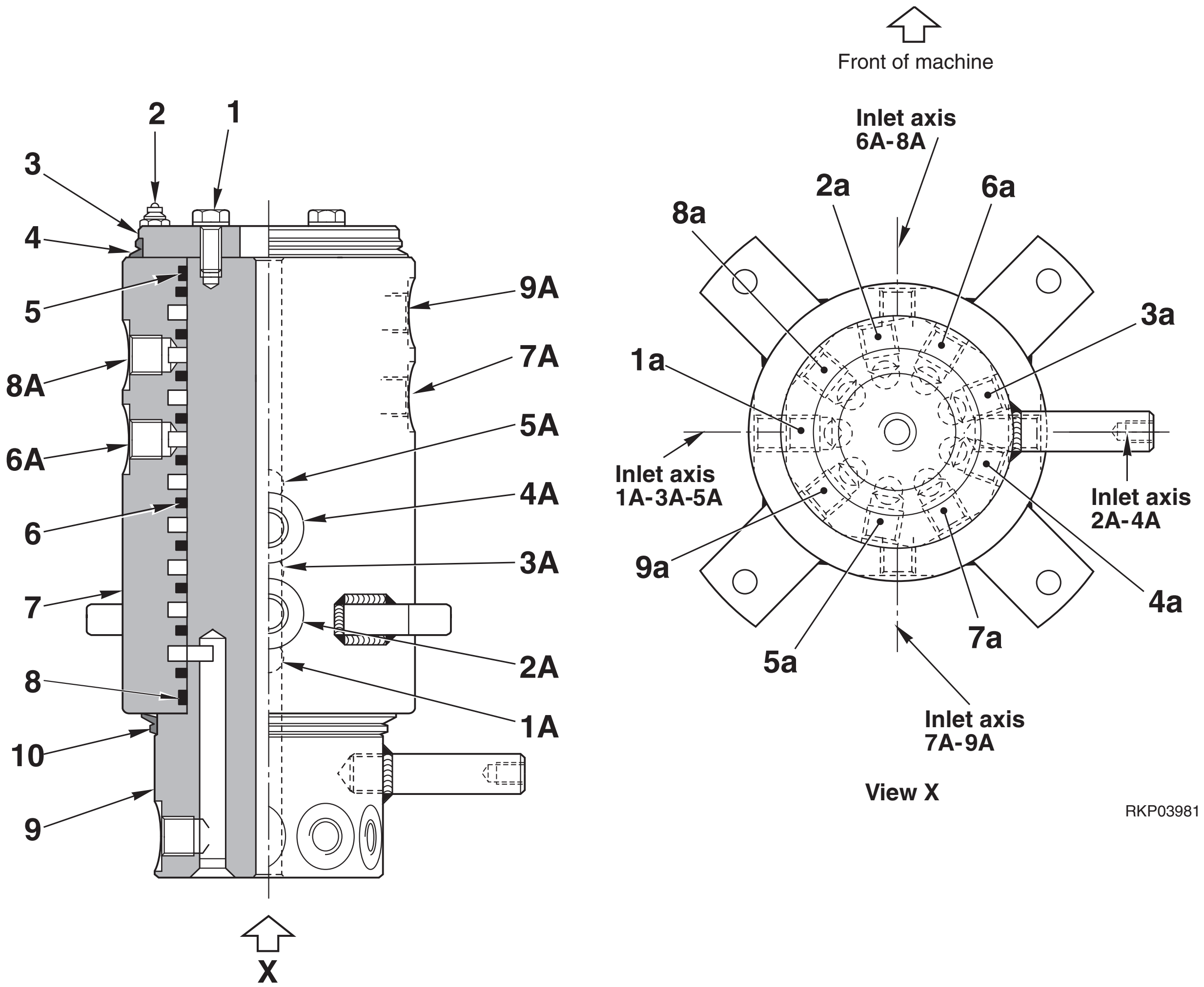
ACTUATION OF HYDRAULIC TIMER VALVE

FUNCTION

- The hydraulic timer acts to delay the start of the swing brake effect in order to ensure smooth deceleration and to prevent damage to the parts of the motor if the swing brake is applied suddenly when stopping the swing motor.
- When the PPC valve (swing) is actuated, PPC output pressure **P** goes to chamber **a** and the swing brake is released.
  In this condition, if the PPC valve is returned to HOLD, the supply of pressure oil to port **B** stops and the pressure in chamber **a** drops.
  As a result, the oil in chamber **a** is pushed out by brake spring (2).
- There is a check valve in the PPC valve circuit at the port **B** side, so the oil flow is stopped and it flows out to passage **c**.
  However, the passage of the flow is throttled by orifice (5) in the hydraulic timer valve, so the oil inside chamber **a** flows out only slowly, and this delays the actuation of the swing brake by the determined amount.



SWIVEL JOINT



FUNCTION

1. Not used
2. Travel acceleration
3. Blade raise
4. Drain
5. Blade lower
6. L.H. travel forward
7. R.H. travel reverse
8. L.H. travel reverse
9. R.H. travel forward

1A. Not used
2A. From ST1 solenoid valve group (B Port)
3A. From control valve (B2 Port)
4A. To swing motor (T Port)
5A. From control valve (A2 Port)
6A. From control valve (B3 Port)
7A. From control valve (B4 Port)
8A. From control valve (A3 Port)
9A. From control valve (A4 Port)

1. Screw
2. Grease nipple
3. Cover
4. Guard ring
5. O-Ring
6. Seal
7. Rotor
8. O-Ring
9. Stator
10. Guard ring

1a. Not used
2a. To travel motors (PS Port)
3a. To blade safety valve (V1 Port)
4a. From travel motors (T1 Port)
5a. To blade safety valve (V2 Port)
6a. To L.H. travel motor (P1 Port)
7a. To R.H. travel motor (P1 Port)
8a. To L.H. travel motor (P2 Port)
9a. To R.H. travel motor (P2 Port)

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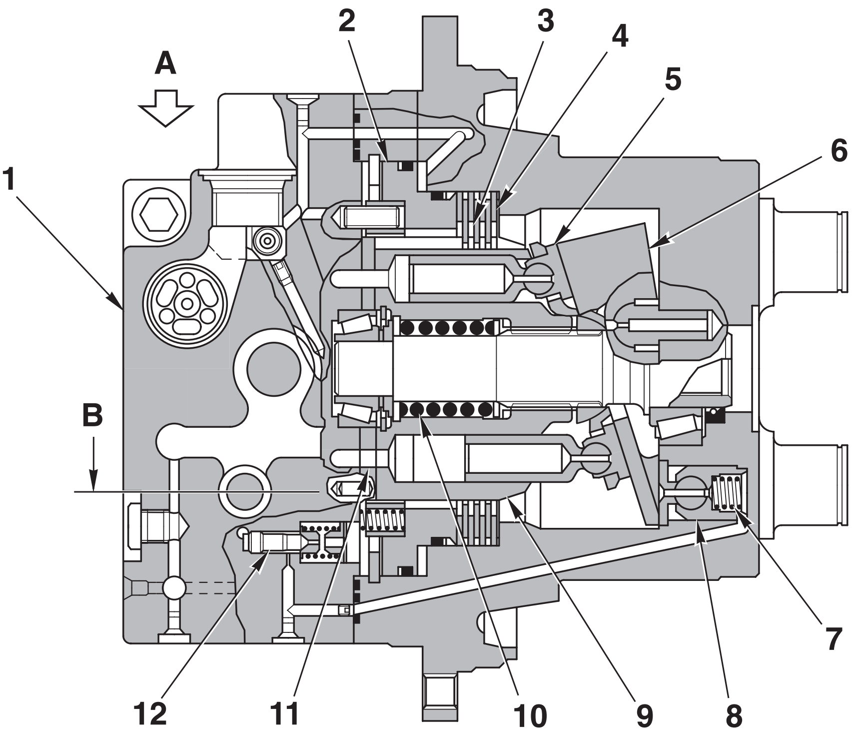
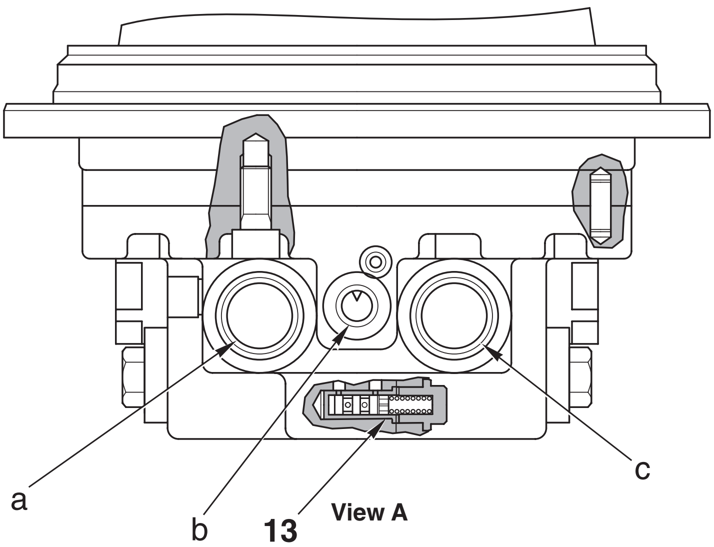
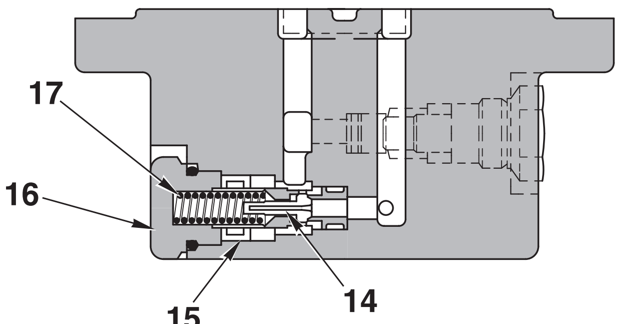
TRAVEL MOTOR



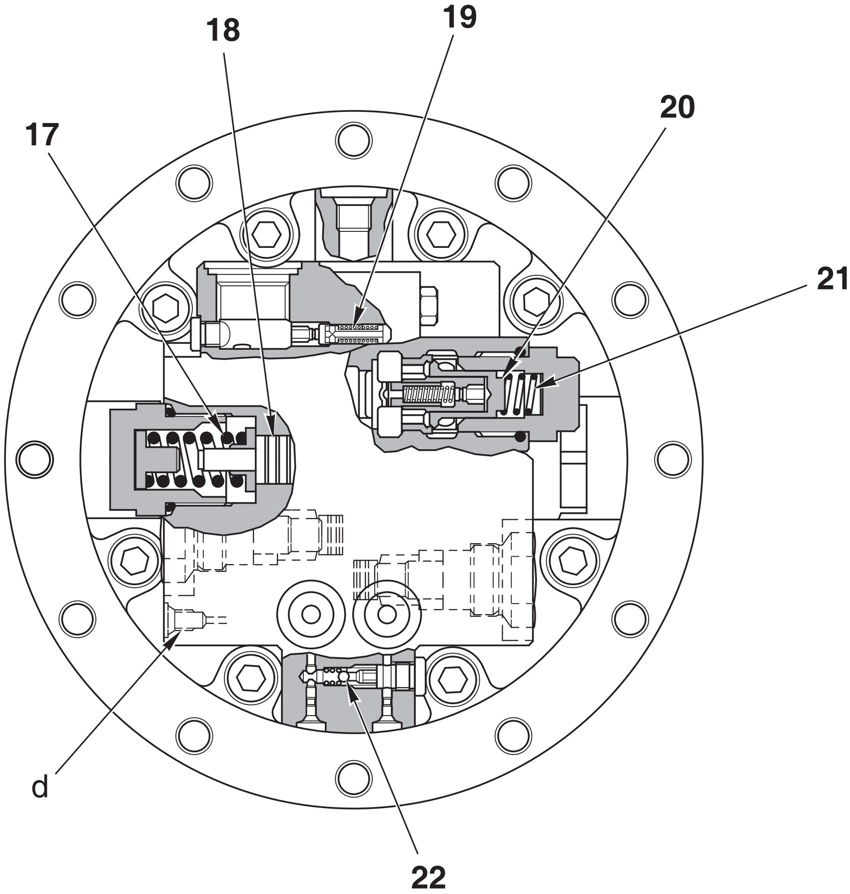


View A



Section B - B

RKP0



1. Cover
2. Piston
3. Brake disc
4. Steel disc
5. Shoe
6. Swash plate
7. Piston spring
8. Piston
9. Cylinder
10. Spring
11. Plate
12. Travel increment spool
13. Brake unlocking valve
14. Safety valve
15. Snap ring
16. Plug
17. Spring
18. Floating spool
19. Brake unlocking feeding valve
20. Check valve spring
21. Check valve
22. Ball

R.H. Motor

a. A Port - From swivel joint (9a Port)
b. T Port - From swivel joint (4a Port)
c. B Port - From swivel joint (7a Port)
d. X Port - From swivel joint (2a Port)

L.H. Motor

a. A Port - From swivel joint (8a Port)
b. T Port - From swivel joint (4a Port)
c. B Port - From swivel joint (6a Port)
d. X Port - From swivel joint (2a Port)

SPECIFICATIONS

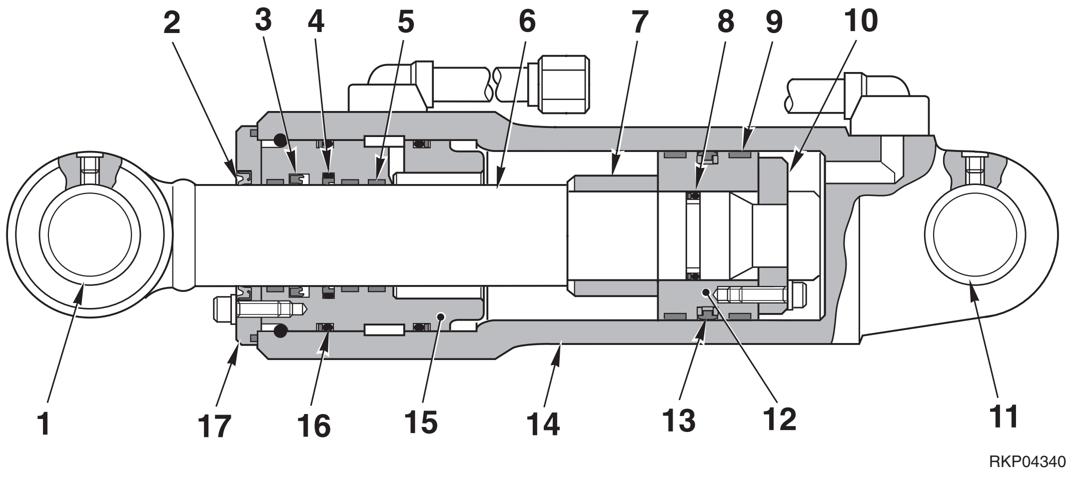
Max. pressure: 275 bar

Displacement

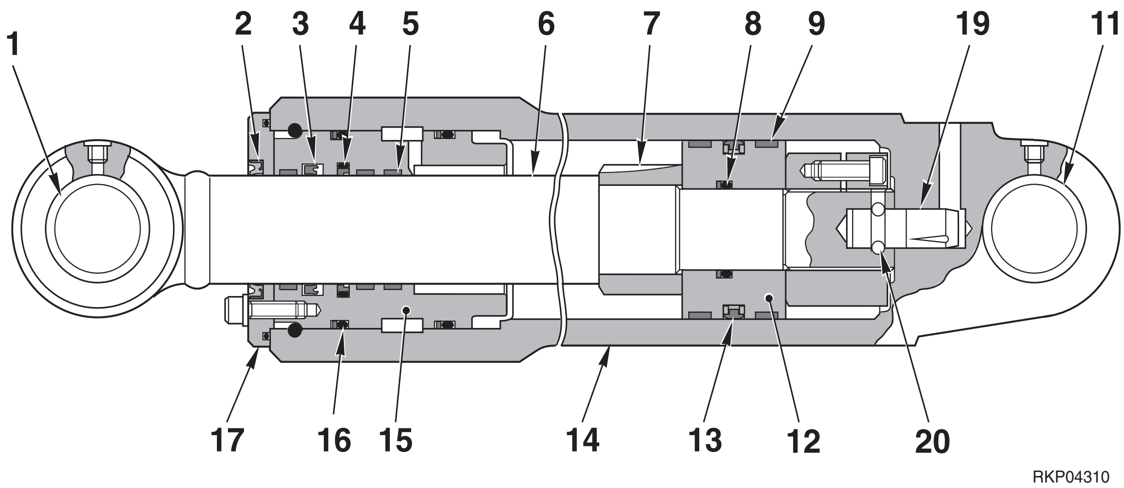
- Hi speed: 29.4 cm^3/rev.
- Lo speed: 44 cm^3/rev.

CYLINDERS

BOOM

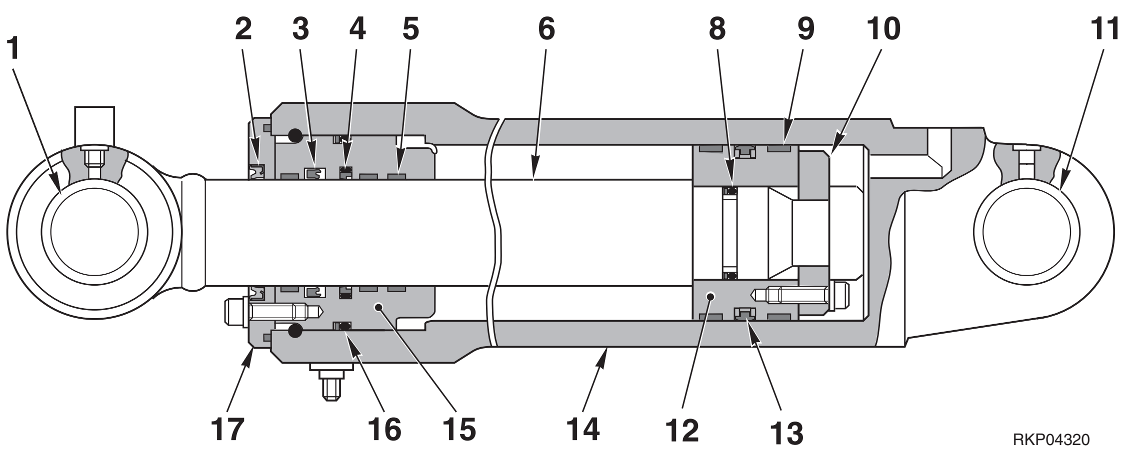


ARM

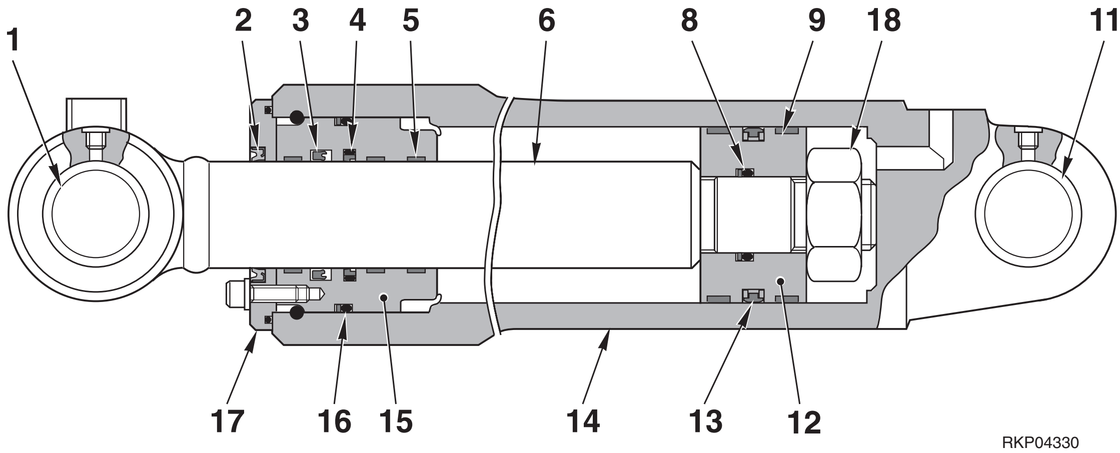


BUCKET, BOOM SWING, BLADE

(★ The figure shows the blade cylinder)



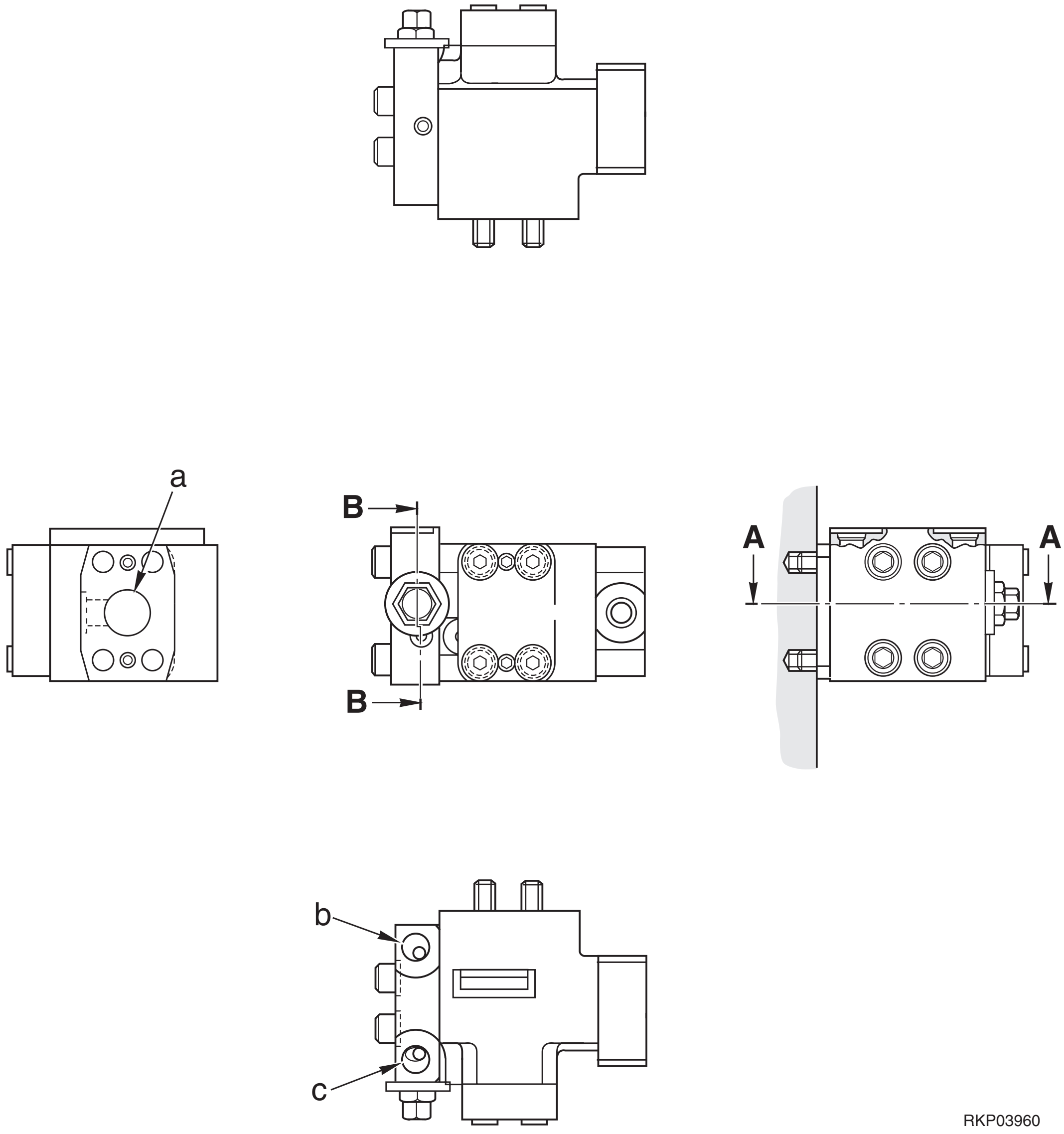
2-PIECE BOOM



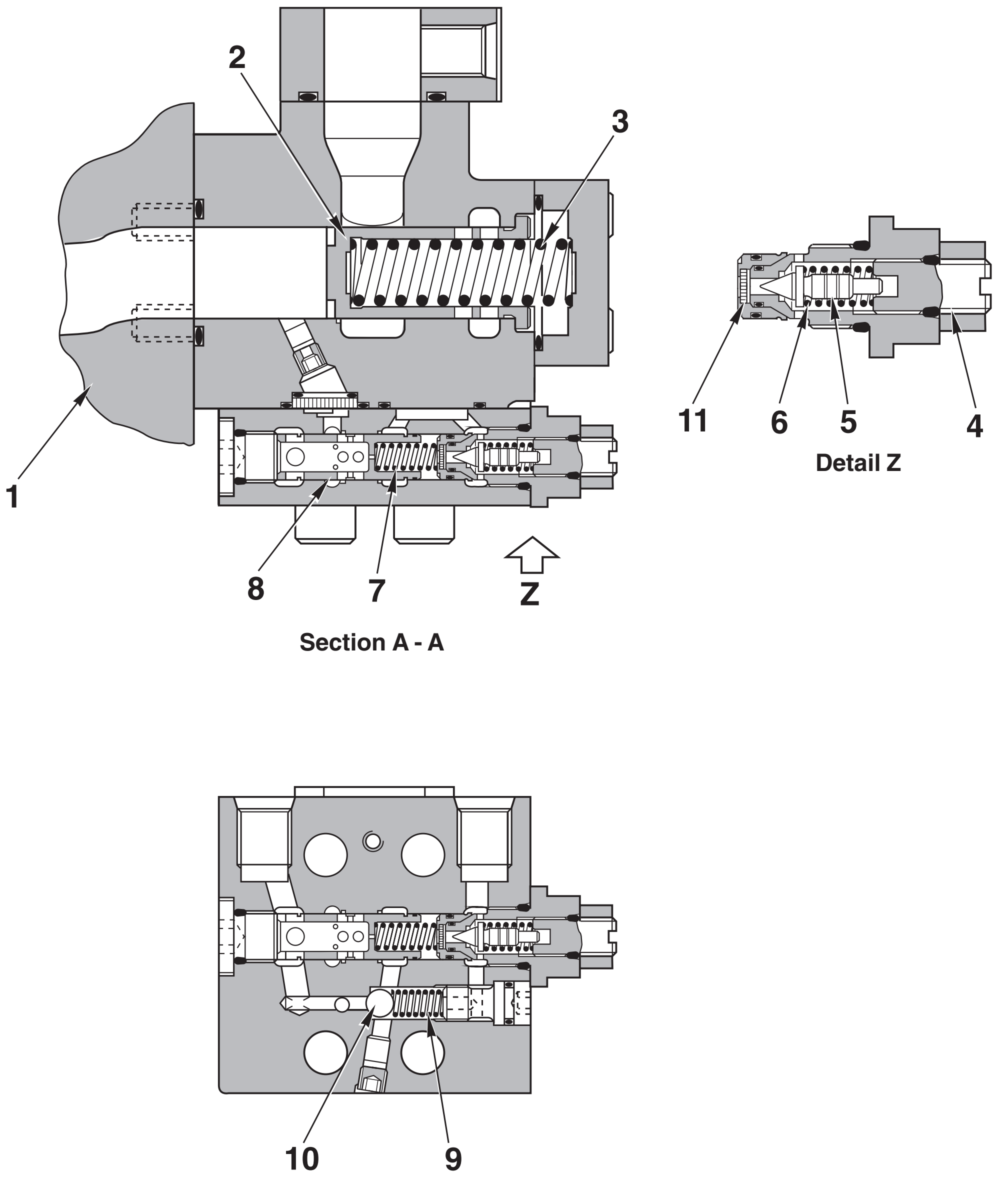
1. Head side bushing
2. Guard ring
3. Washer
4. Washer
5. Wear ring
6. Piston rod
7. Head cushion plunger
8. Washer
9. Wear ring
10. Half flange (No. 2)
11. Bottom side bushing
12. Piston
13. Washer
14. Cylinder
15. Head-piece
16. Washer
17. Coupling flange
18. Nut
19. Bottom cushion
20. Ball (No. 12)

Cylinder	Boom	2-piece boom	Arm	Bucket	Boom swing	Blade
Piston rod diameter	70	50	60	60	60	60
Cylinder inside diameter	120	90	100	90	100	120
Piston stroke	770	580	898	800	650	215
Max. cylinder length	1990	1510	2230	1970	1650	790
Min. cylinder length	1220	930	1332	1170	1000	575
Piston nut width across flat	–	60	–	–	–	–

SERVOCONTROL FEED UNIT



a. P2 Port - To control valve (P1 Port)
b. PR Port - To ST1 solenoid valve group (P Port)
c. T Port - To hydraulic tank



Section A - A

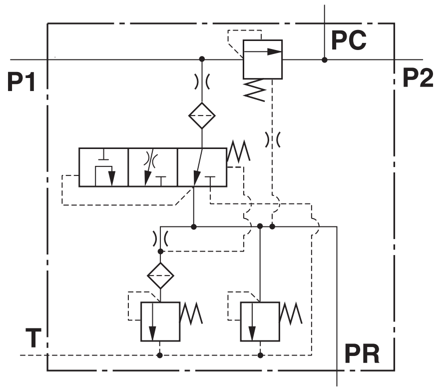
Section B - B

1. Hydraulic pump
2. Valve
3. Spring
4. Screw
5. Poppet
6. Spring (reducing valve pilot)
7. Spring (reducing valve)
8. Spool (reducing valve)
9. Spring (safety valve)
10. Ball
11. Filter

OPERATION

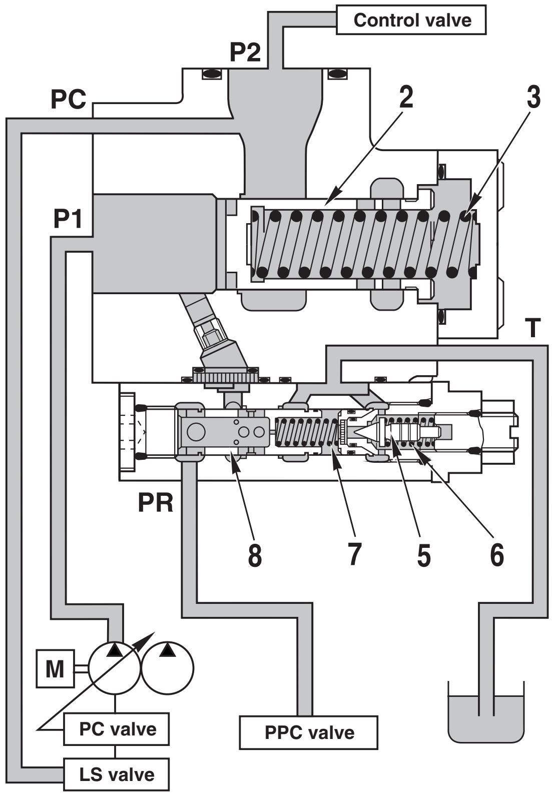
1. When engine is stopped

- Poppet (5) is pushed against the seat by spring (6), and the passage from Port **PR** → **T** is closed.
- Valve (8) is pushed to the left by spring (7), and the passage from Port **P1** → **PR** is open.
- Valve (2) is pushed to the left by spring (3), so the passage between Port **P1** → **P2** is closed.
  (See Fig. 1)



Hydraulic diagram

RKP03861



RKP03871

Fig. 1

2. **At neutral**

3. **When load pressure P2 is low (when moving down under own weight boom LOWER or arm IN)**

Note: When load pressure **P2** is lower than output pressure **PR** of the self-reducing pressure valve.

- Valve (2) receives force in the direction to close the passage from Port **P1** → **P2** from spring (3) and pressure **PR** (when the engine is stopped, the pressure is 0 bar).
  However, when hydraulic oil flows in from Port **P1**, the pressure is balanced so that pressure **P1** ≒ force of spring (7) + (area **Ød** x pressure **PR**), and the opening from Port **P1** → **P2** is adjusted so that pressure **P1** is kept at a certain value above pressure **PR**.
- When pressure **PR** goes above the set pressure, poppet (5) opens, and the hydraulic oil flows in the following circuit: Port **PR** hole **a** → inside spool (8) opening of poppet (5) → tank Port **T**.
  As a result, a pressure difference is created on both sides of hole **a** inside spool (8), so spool (8) moves in the direction to close the opening from Port **P1** → **PR**.
  Pressure **P1** is reduced to a certain pressure (set pressure) by the amount of opening at this point, and is supplied as pressure **PR**. (See Fig. 2)

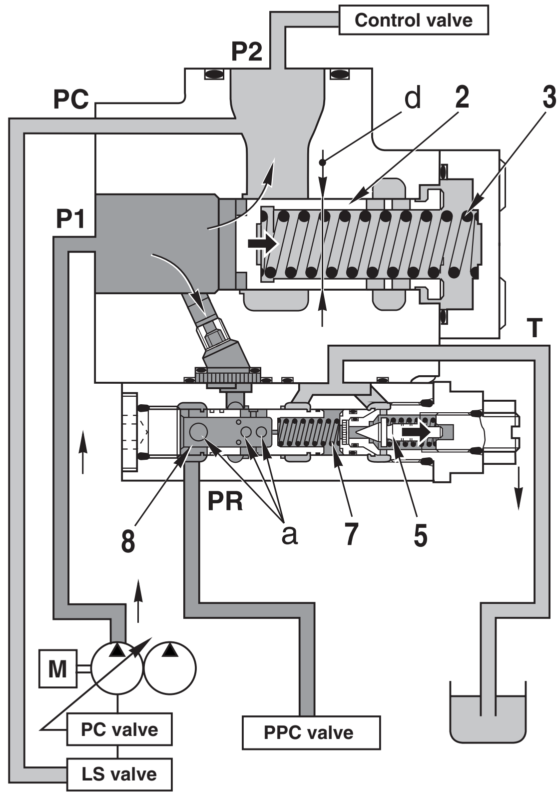


Fig. 2

4. **When load pressure P2 is high**

- If load pressure **P2** increases and the pump discharge amount also increases because of digging operations, pressure **P1** also increases (pressure **P1**> force of spring (7) + (area **Ød** x pressure **PR**), so valve (2) moves to the right to the end of the stroke.
  As a result, the amount of opening from Port **P1** → **P2** increases and the resistance in the passage is reduced, so the loss of engine horsepower is reduced.
- If pressure PR goes above the set pressure, poppet (5) opens and the hydraulic oil flows in the following circuit: Port **PR** → hole a inside spool (8) **a** → opening of poppet (5) → tank Port T.
  As a result, a pressure difference is created on both sides of hole a is inside spool (8), so spool (8) moves in the direction to close the opening from Port **P1** → **PR**.
  Pressure P1 is reduced to a certain pressure (set pressure) by the amount of opening at this point, and is supplied as pressure PR (See Fig. 3)

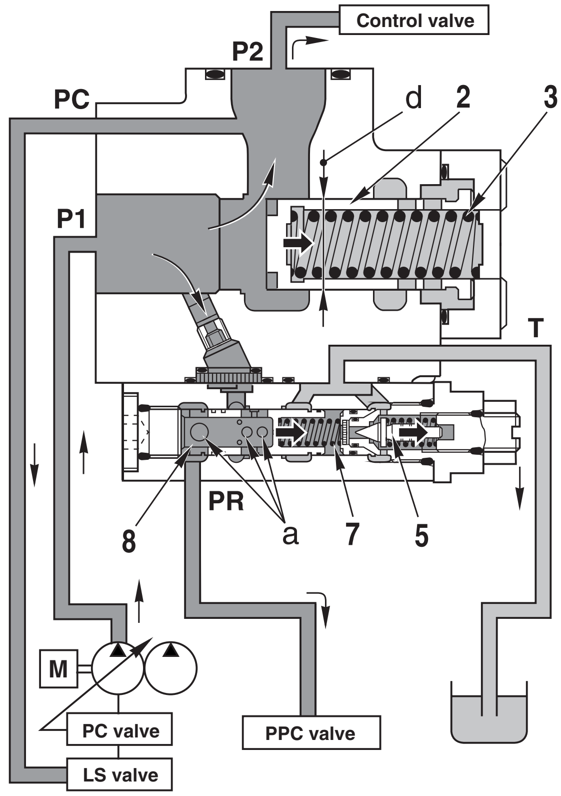


Fig. 3

5. When there is abnormal high pressure

- When pressure **PR** of the self-reducing pressure valve becomes abnormally high, ball (10) pushes against the force of spring (9), separates from the seat, and allows hydraulic oil to flow from output Port **PR** → **T**, so pressure **PR** goes down.
  This action protects the equipment at the destination for the hydraulic pressure supply (PPC valve, electromagnetic valve, etc.) from abnormally high pressure. (See Fig. 4)

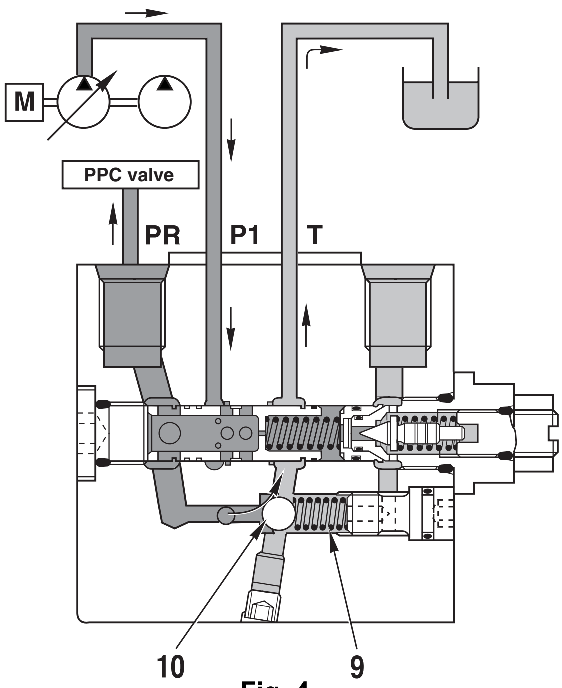
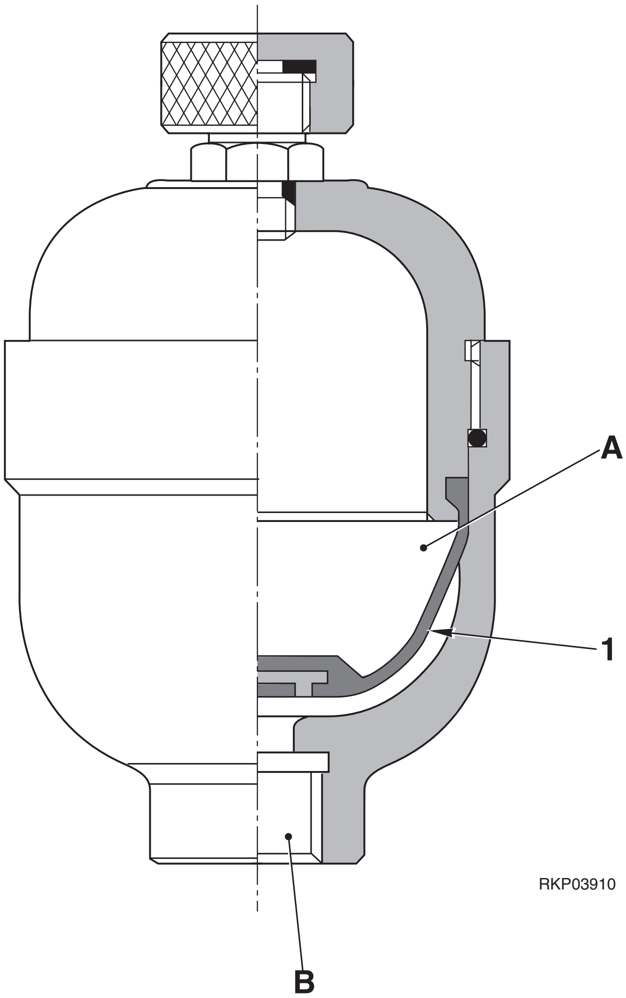


Fig. 4 RKP03901

ACCUMULATOR



TECHNICAL DATA

Servocontrol feed group:

Nominal volume: 0.35 ℓ

Pre-set pressure: $12^{\,0}_{+1}$ bar

Working pressure: 35–45 bar

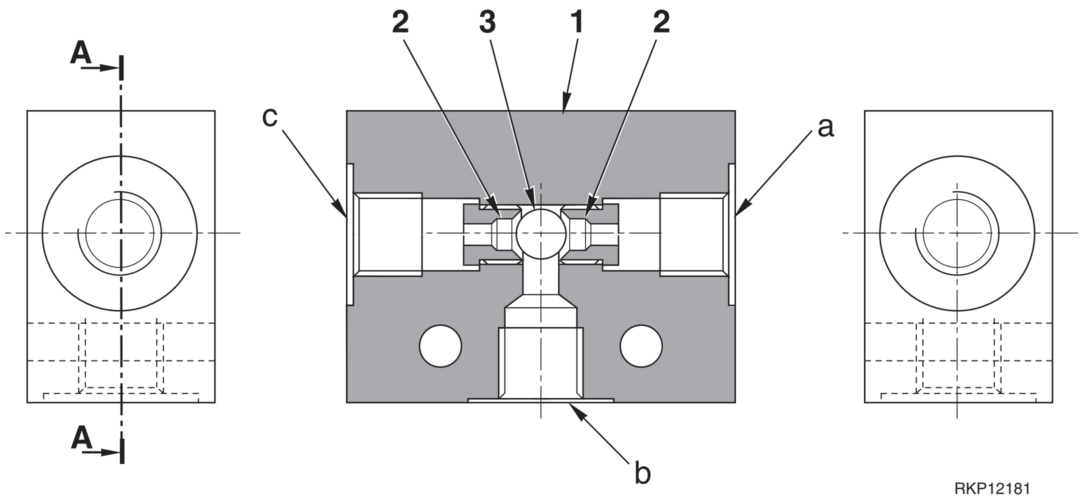
FUNCTION

- A rubber bag (1) containing nitrogen gas is used in the accumulator. Its function is 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 the pressurized oil from line **B**.
  If the oil pressure in line **B** falls below the maximum calibration pressure (even after intensive use), the rubber bag (1) will expand due to the pressure of the nitrogen inside it.

SHUTTLE VALVE



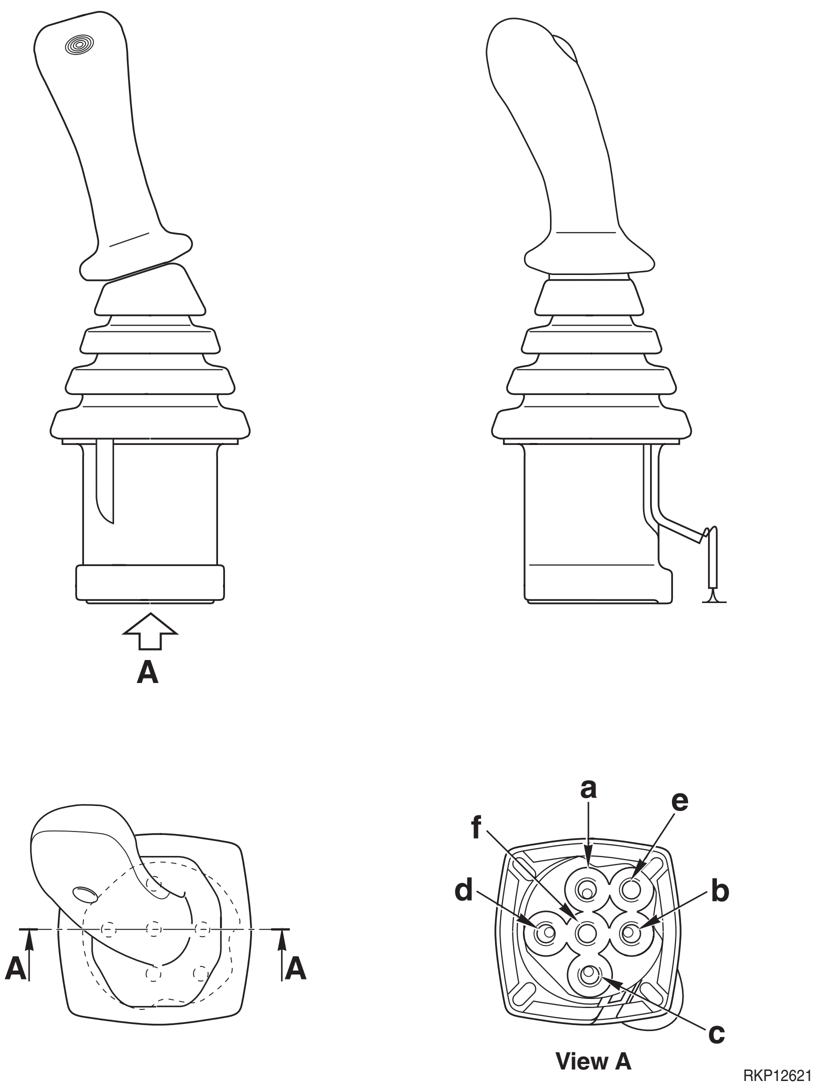
Section A - A

1. Body valve
2. Seat valve
3. Ball

a. A Port - From L.H. PPC valve (P4 Port)
b. B Port - To swing motor (B Port)
c. C Port - From L.H. PPC valve (P2 Port)

PPC VALVES

ATTACHMENT

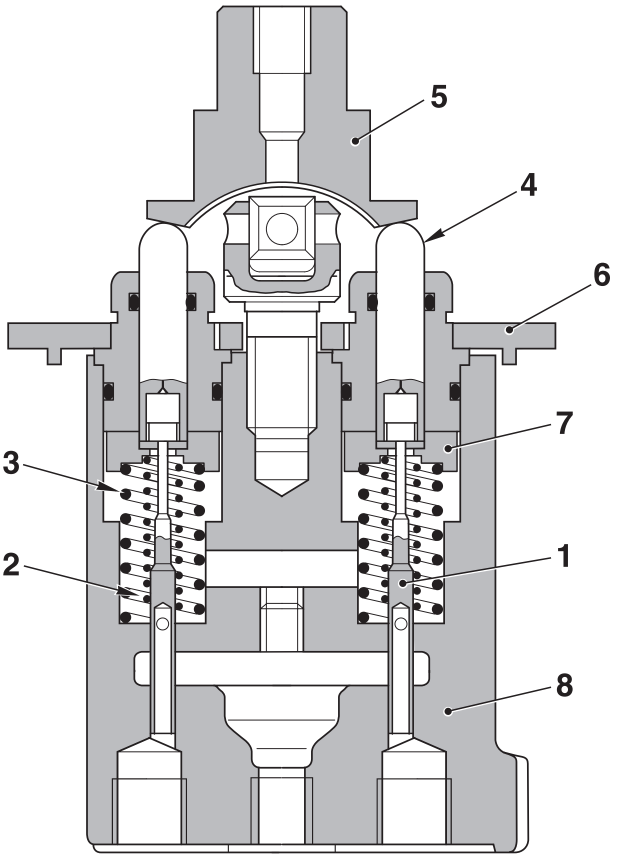


L.H. PPC VALVE

a. P1 Port - To control valve (PB6 Port) (Close arm)
b. P4 Port - To control valve (PB1 Port) (R.H. swing)
c. P3 Port - To control valve (PA6 Port) (Open arm)
d. P2 Port - To control valve (PA1 Port) (L.H. swing)
e. T Port - To hydraulic tank
f. P Port - From ST1 solenoid valve group (A Port)

R.H. PPC VALVE

a. P4 Port - To control valve (PA5 Port) (Raise boom)
b. P3 Port - To control valve (PA7 Port) (Open bucket)
c. P2 Port - To control valve (PB5 Port) (Lower boom)
d. P1 Port - To control valve (PB7 Port) (Close bucket)
e. T Port - To hydraulic tank
f. P Port - From ST1 solenoid valve group (A Port)



Section A - A

1. Spool
2. Metering spring
3. Centering spring
4. Plunger
5. Joint
6. Cover
7. Retainer
8. 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)

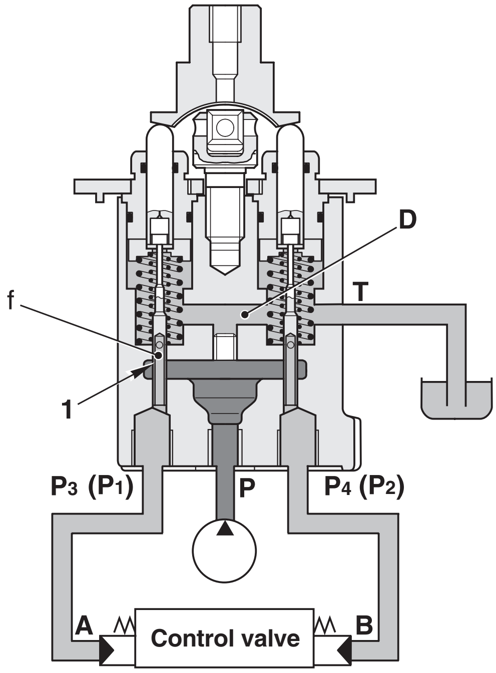


Fig. 1

RKP12841

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 disc (5), so the pressure at Port **P1** also rises in proportion to the travel of the disc (5). 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)

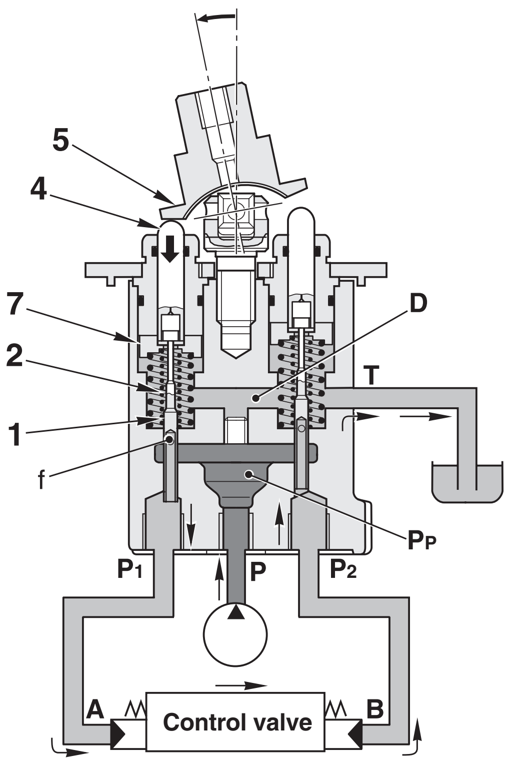


Fig. 2

RKP12851

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)

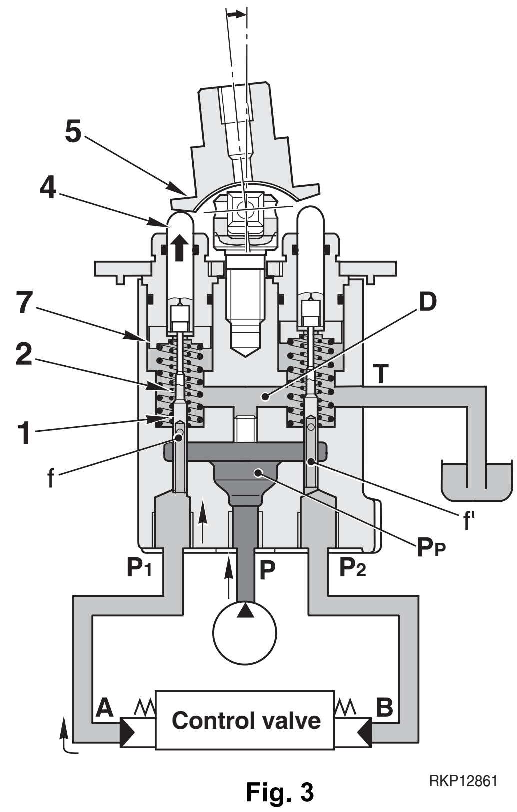


Fig. 3

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)

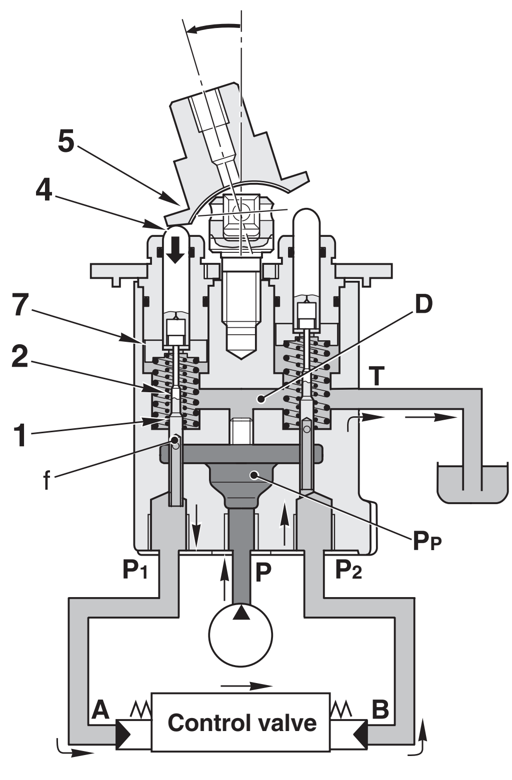
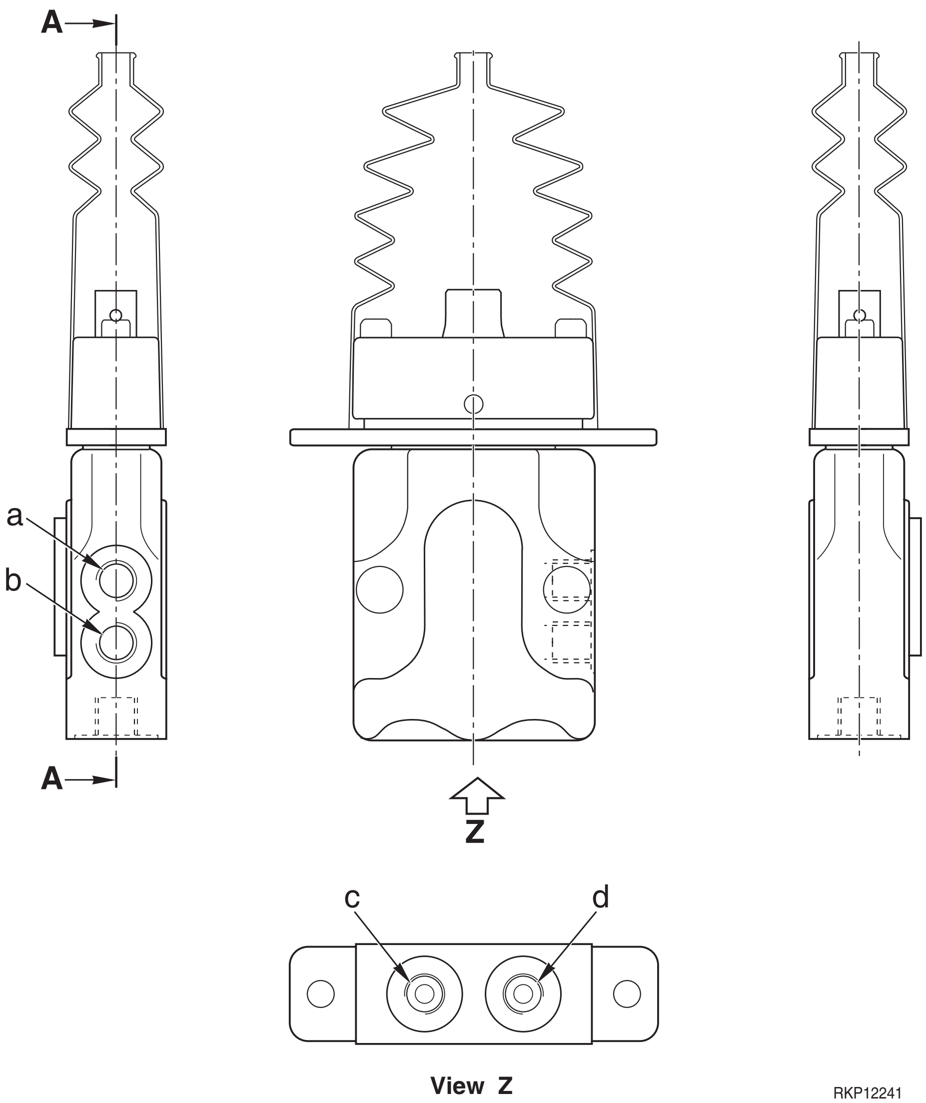
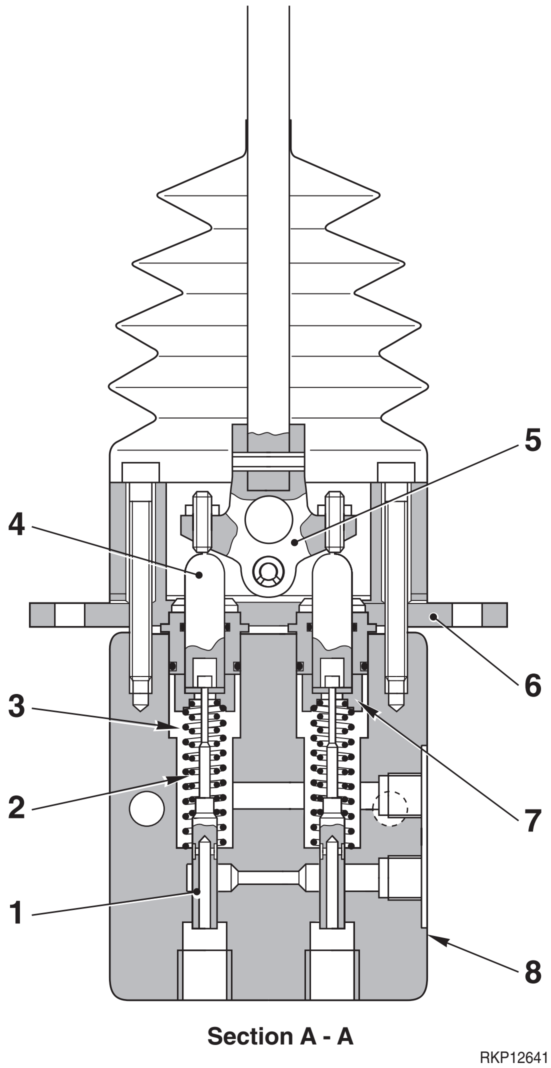


Fig. 4

BLADE PPC VALVE



a. T Port - To hydraulic tank
b. P Port - From solenoid valve group (A Port)
c. P1 Port - To control valve (PA2 Port)
d. P2 Port - To control valve (PB2 Port)



Section A - A

1. Spool
2. Metering spring
3. Centering spring
4. Plunger
5. Lever
6. Cover
7. Retainer
8. 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)

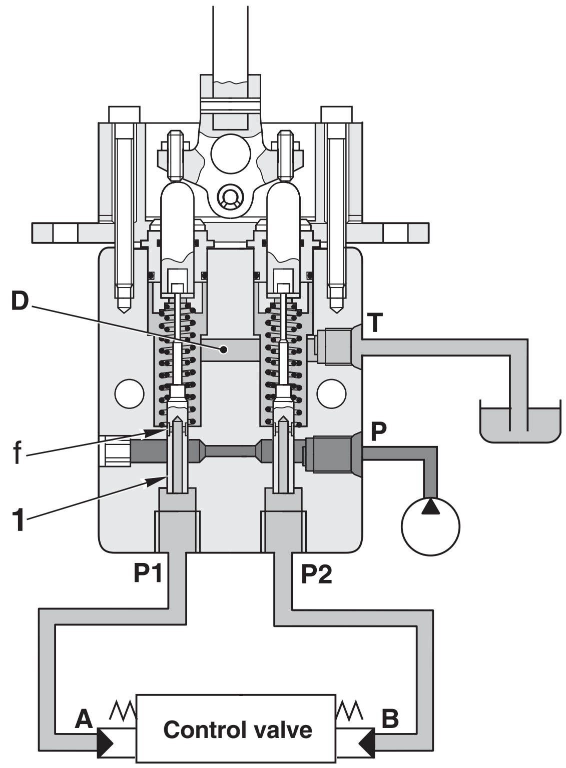


Fig. 1

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 **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)

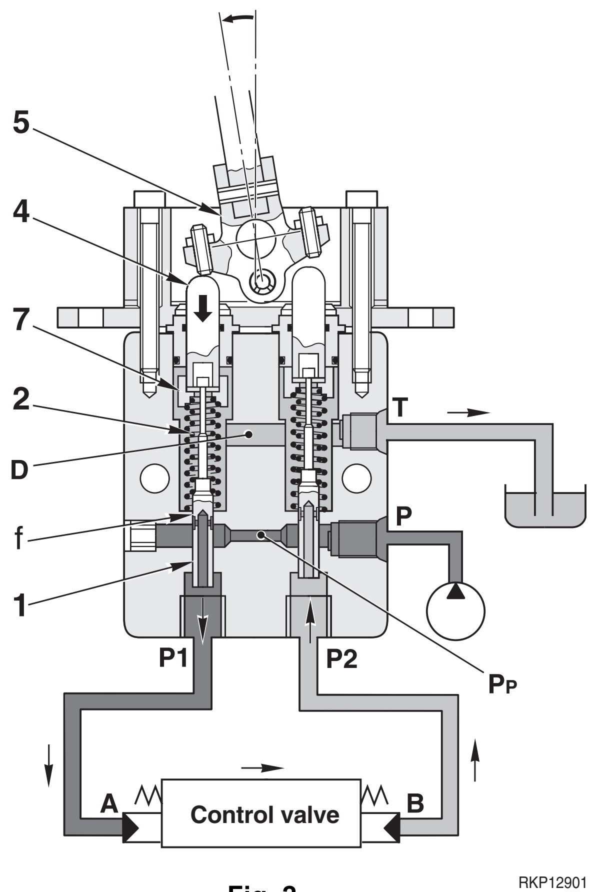


Fig. 2

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)

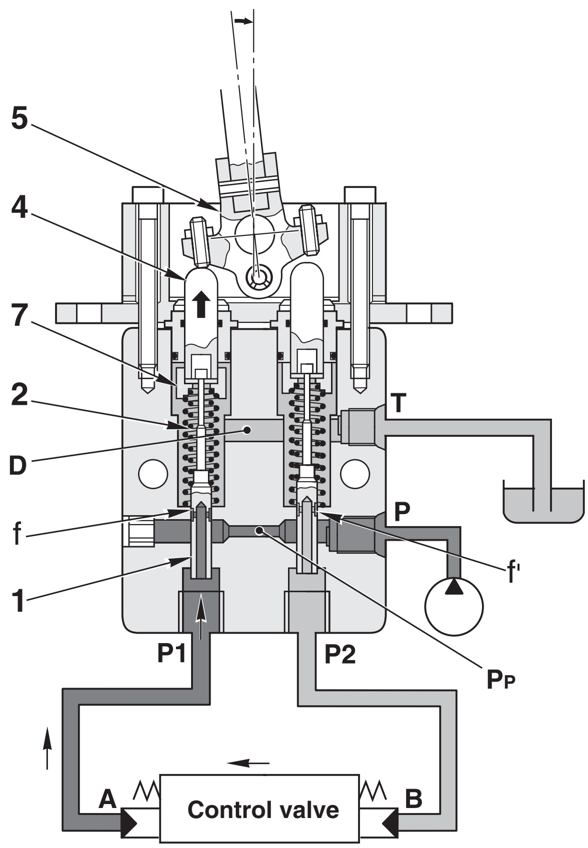


Fig. 3 RKP12891

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)

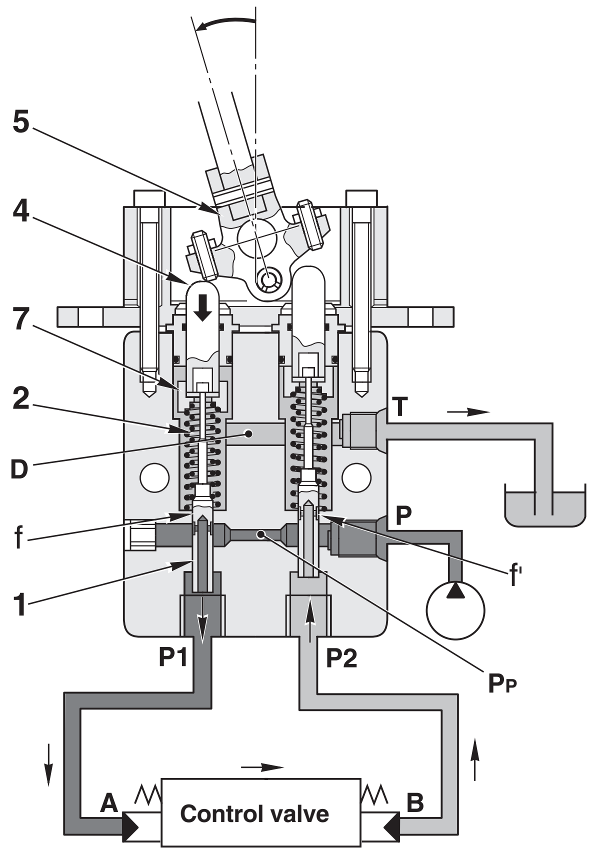
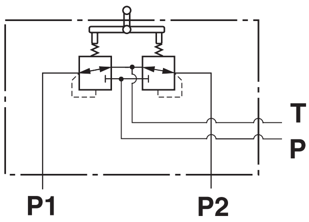
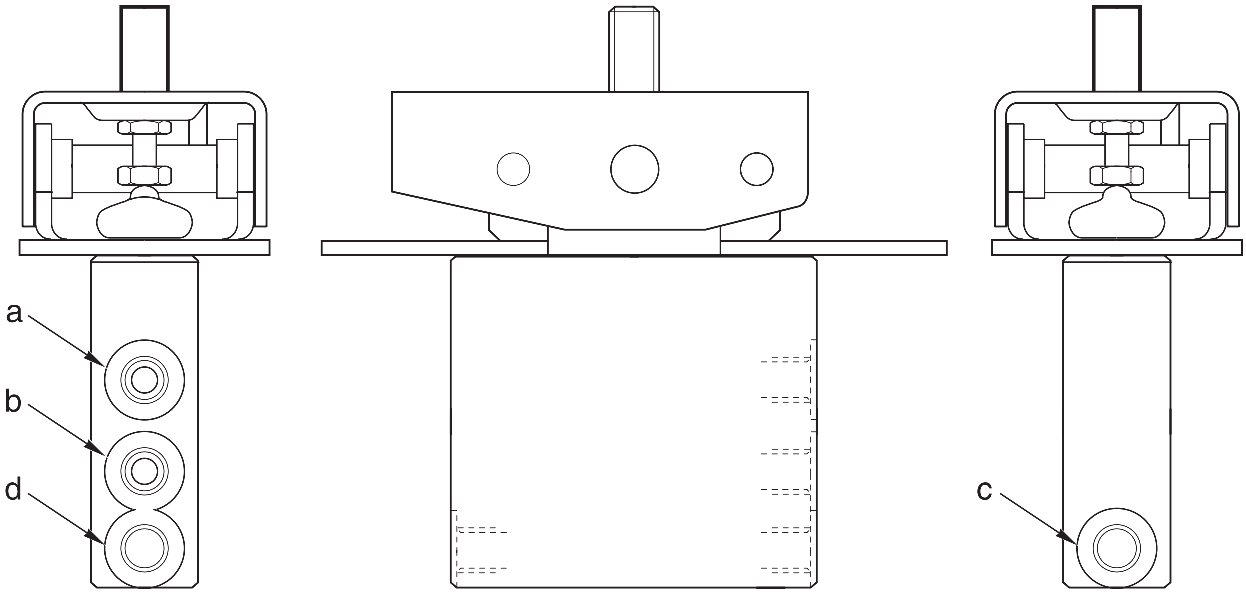


Fig. 4 RKP12881

PPC VALVE BOOM SWING, 2-PIECE BOOM



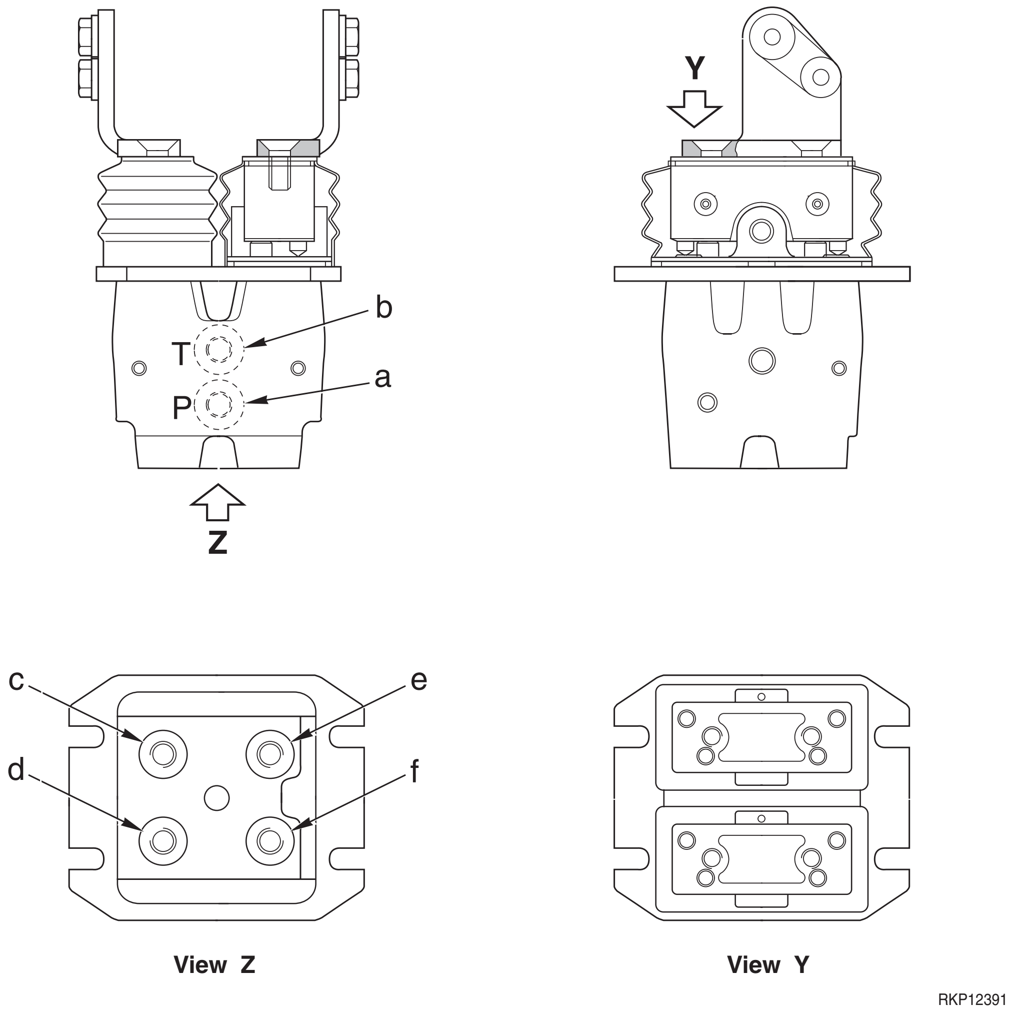
RKP03920



RKP12250

a.	T Port	- To hydraulic tank
b.	P Port	- From ST1 solenoid group valve (A Port)
c.	P1 Port	- For boom swing: to control valve (PA8 Port) For 2-piece boom: to control valve (PB10 Port)
d.	P2 Port	- For boom swing: to control valve (PB8 Port) For 2-piece boom: to control valve (PA10 Port)

TRAVEL PPC VALVE

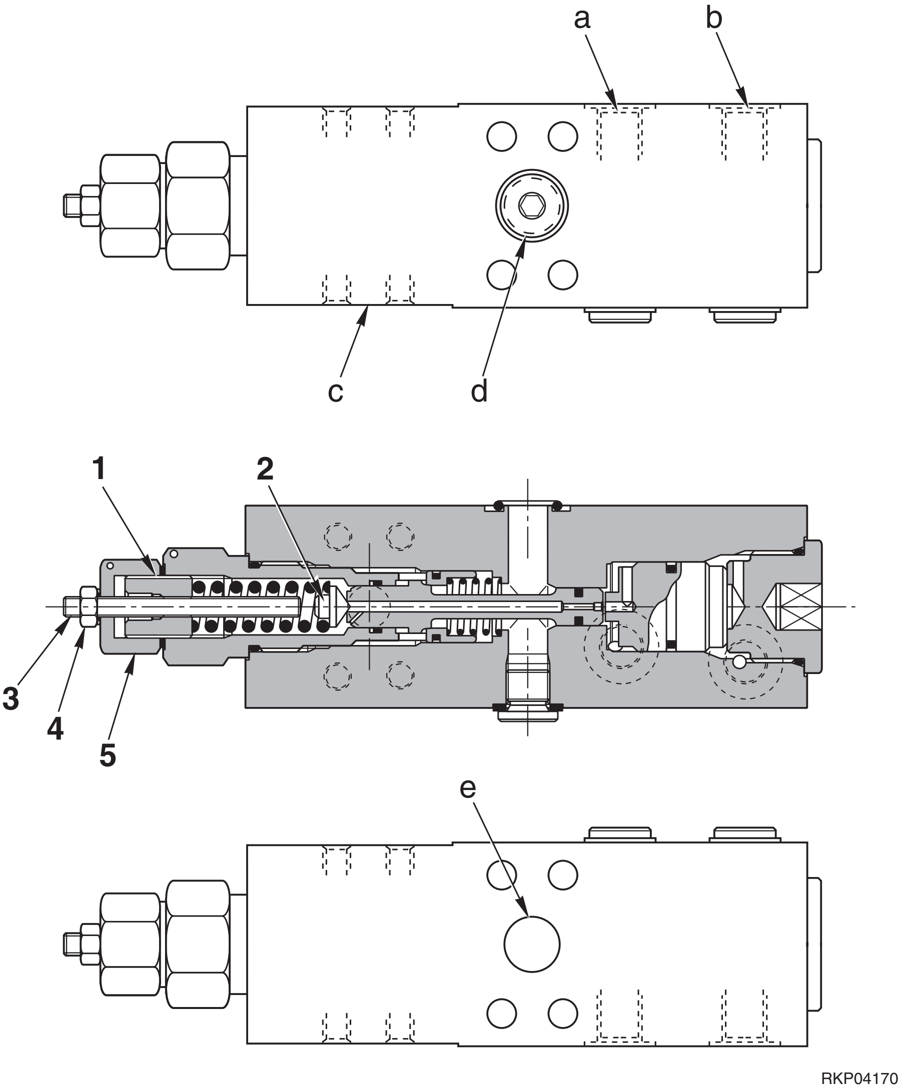


a. P Port - From ST1 solenoid group valve (A Port)
b. T Port - To hydraulic tank
c. P1 Port - To control valve (PB3 Port)
d. P3 Port - To control valve (PA4 Port)
e. P2 Port - To control valve (PA3 Port)
f. P4 Port - To control valve (PB4 Port)

FUNZIONI

P1 Port - L.H. travel (reverse)
P2 Port - L.H. travel (forward)
P3 Port - R.H. travel (reverse)
P4 Port - R.H. travel (forward)

BOOM AND ARM SAFETY VALVE

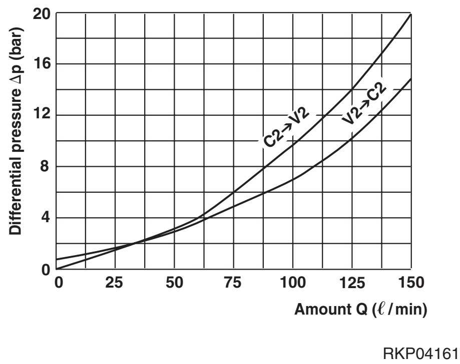


1. Screw
2. Valve
3. Rod
4. Nut
5. Nut

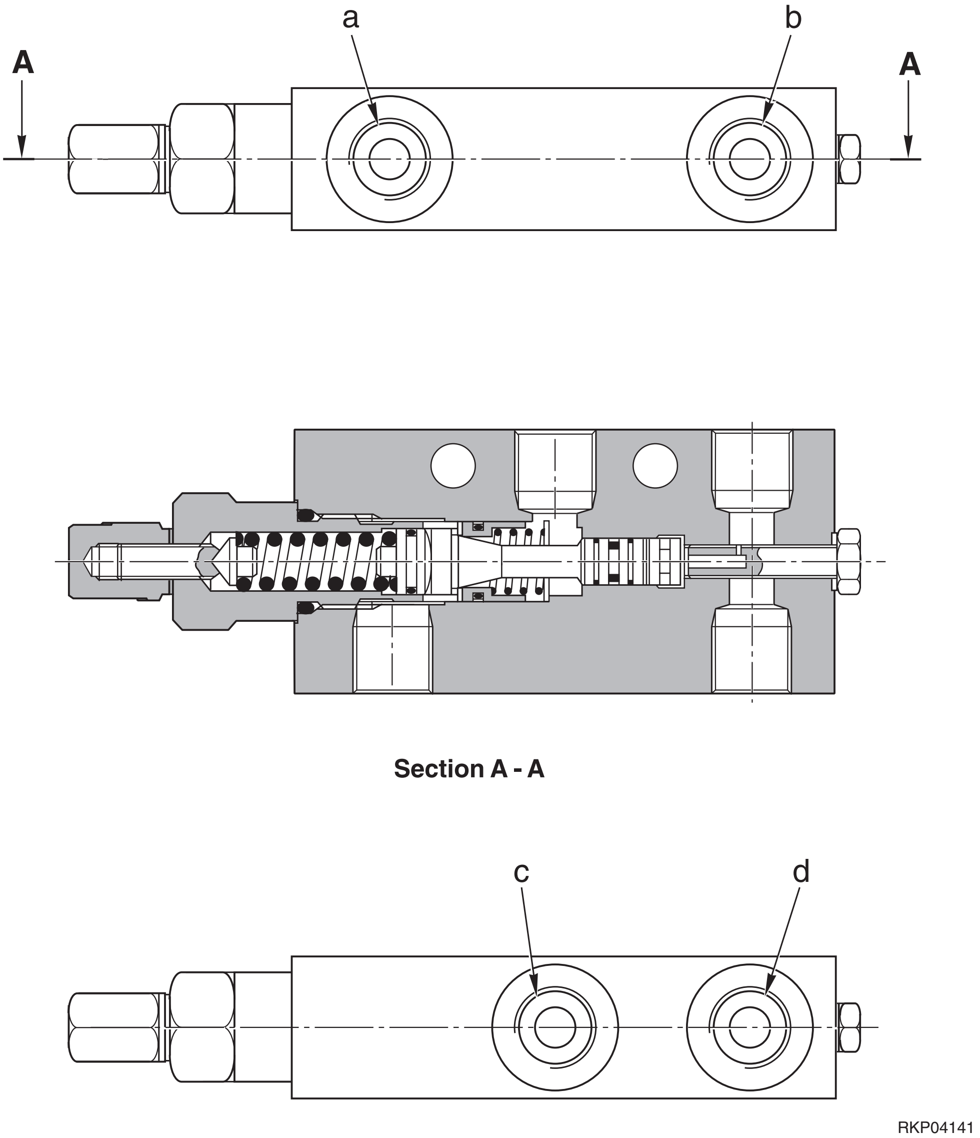
a. T Port - To hydraulic tank
b. P Port - For boom:
From control valve (PB5 Port)
For arm
From control valve (PB6 Port)
c. V2 Port - For boom:
From control valve (A5 Port)
For arm:
From control valve (A6 Port)
d. M Port - For boom: To the overload sensor switch
e. C2 Port - For boom: To the cylinder (Bottom side)
For arm: To the cylinder (Head side)

SPECIFICATIONS

Pilot ratio: 22 : 1



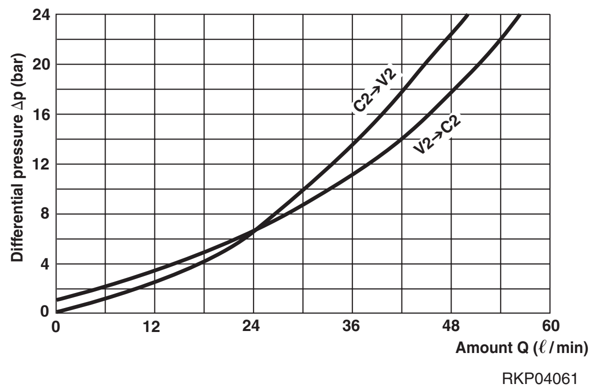
BLADE SAFETY VALVE



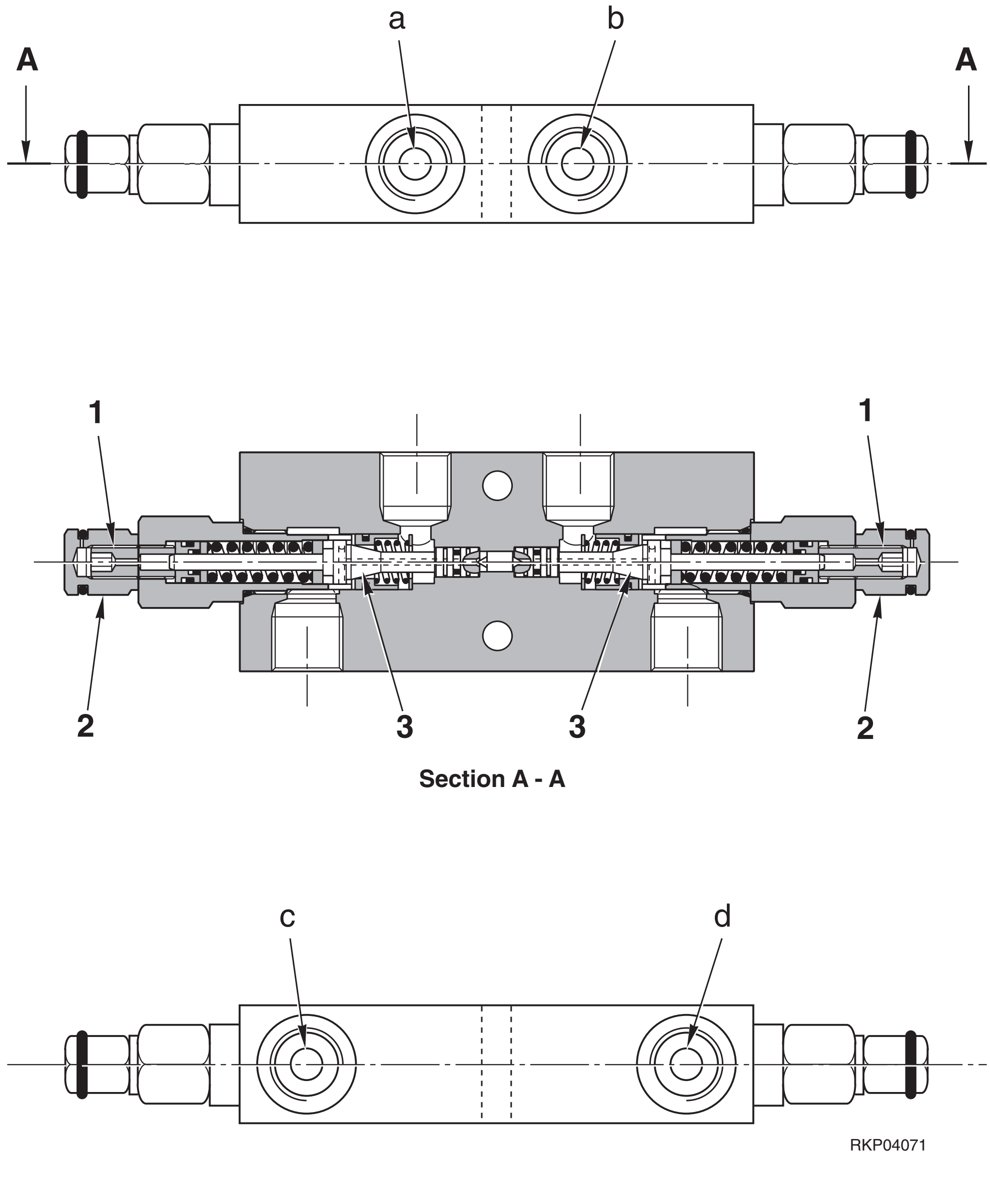
a. V2 Port - From swivel joint (1a Port)
b. V1 Port - From swivel joint (5a Port)
c. C2 Port - To blade cylinder (Bottom side)
d. C1 Port - To blade cylinder (Head side)

SPECIFICATIONS

Pilot ratio: 4.2:1



2-PIECE BOOM SAFETY VALVE

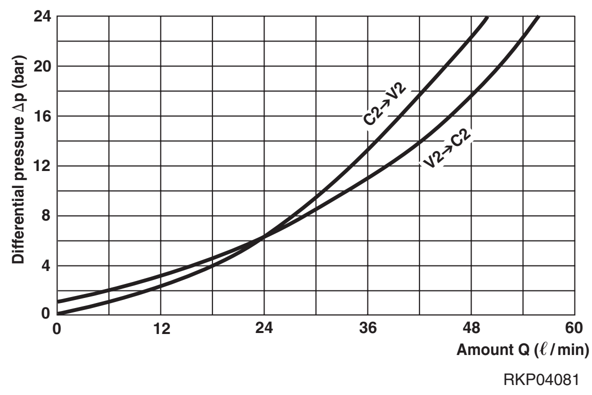


1. Screw
2. Plug
3. Valve

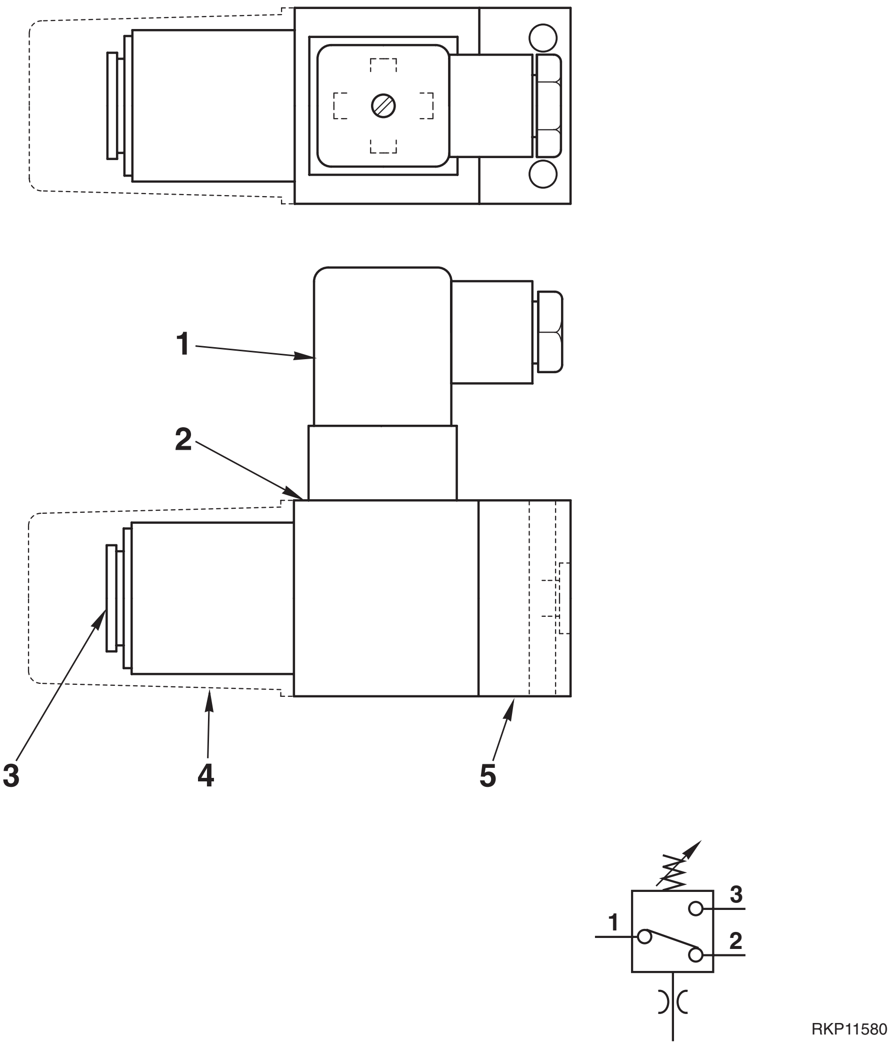
a. C1 - Port To 2-piece boom cylinder (Head side)
b. C2 - Port To 2-piece boom cylinder (Bottom side)
c. V1 - Port From control valve (A10 Port)
d. V2 - Port From control valve (B10 Port)

SPECIFICATIONS

Pilot ratio: 4.25 : 1



OVERLOAD SENSOR SWITCH



a. From boom safety valve (M Port)

1. Connector
2. Pressure sensor switch
3. Adjusting screw
4. Protection
5. Connection plate

TECHNICAL DATA

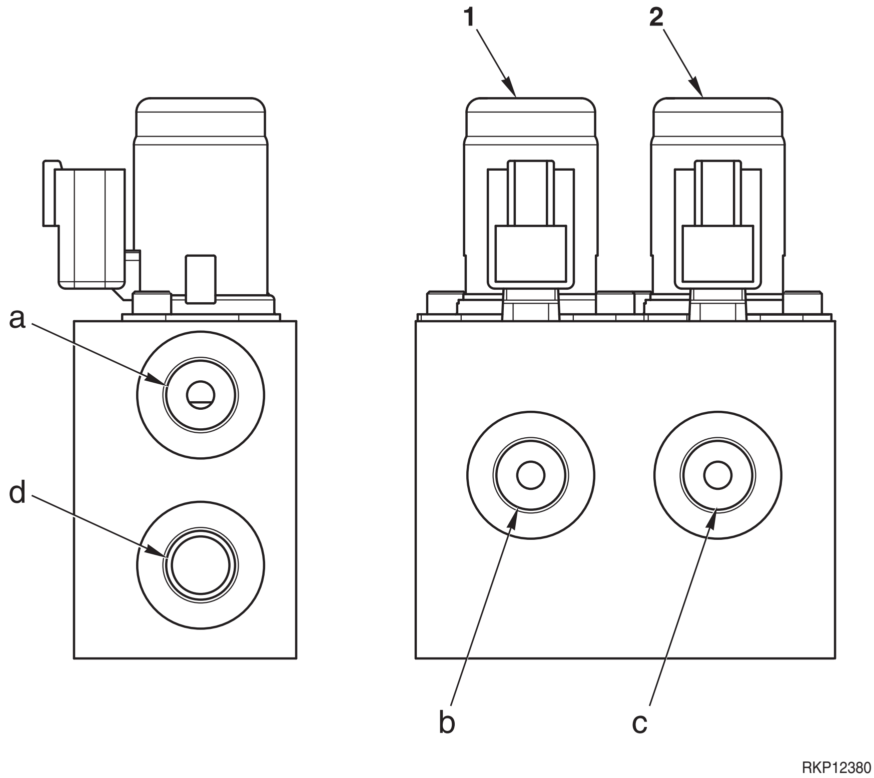
Setting valve: 130 bar

FUNCTION

The overload sensor switch is connected through the boom safety valve to boom cylinder (bottom side).
When the pressure rises over the setting valve, the sensor close the electrical circuit and the actives the horn.

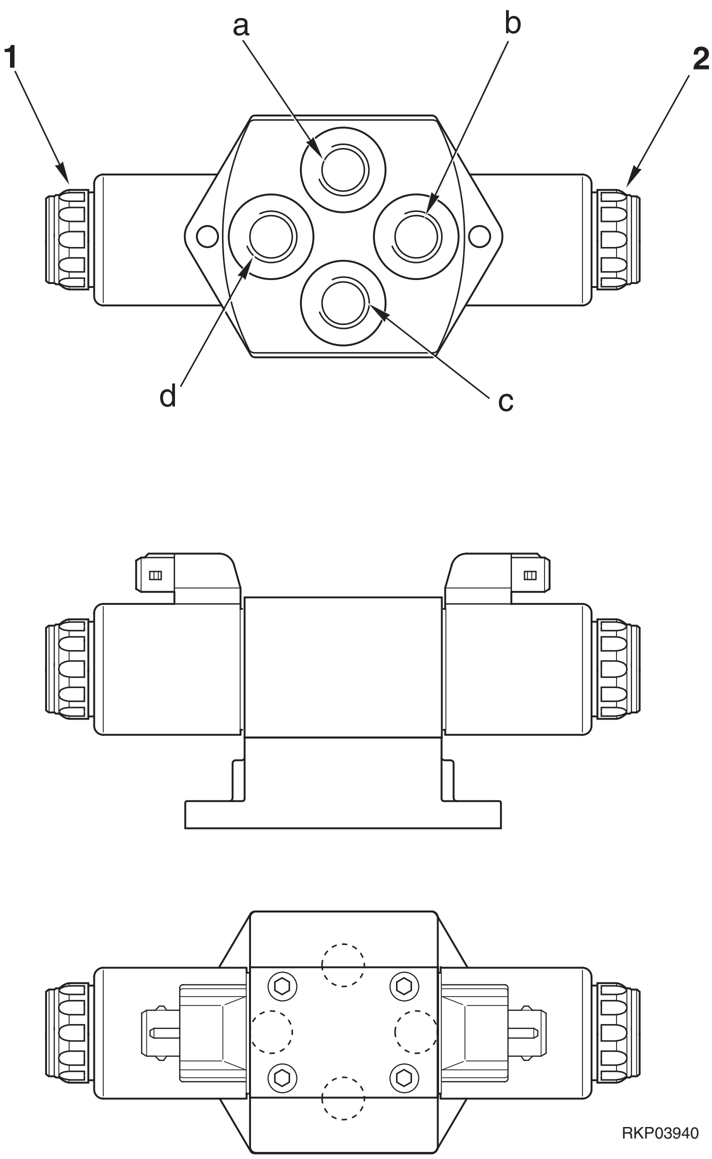
SOLENOID VALVES

SOLENOID VALVE GROUP ST1



a.	P Port	- From servocontrol feed unit (PR Port)	1.	Y4 Travel speed increment
b.	B Port	- To swivel joint (2A Port)	2.	Y7 Servocontrol
c.	A Port	- To servocontrol		
d.	T Port	- To hydraulic tank		

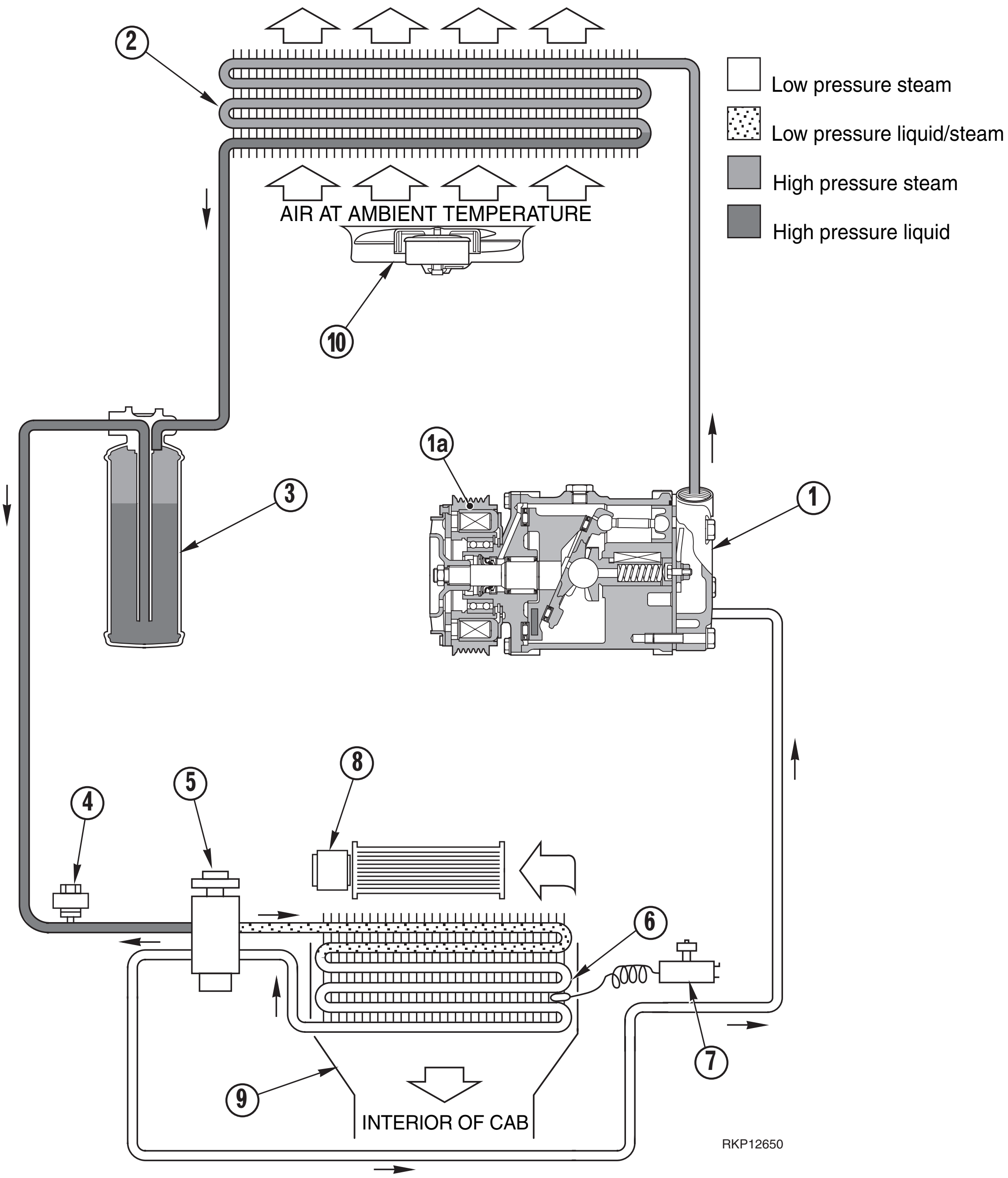
SOLENOID VALVE GROUP OP1



1. Y19 - Y19 - R.H. attachment control
2. Y20 - L.H. attachment control

a. T Port - To hydraulic tank
b. A Port - To control valve (PB9 Port)
c. P Port - From ST1 solenoid valve group (A Port)
d. B Port - To control valve (PA9 Port)

AIR-CONDITIONING UNIT



1. Compressor
2. Condenser
3. Drying-filter tank
4. Safety pressure
5. Expansion valve
6. Evaporator
7. Thermostatic clutch control sensor
8. Air-circulation fan in cab
9. Air conveyor
10. Condenser ventilator

TECHNICAL DATA

Operating pressure in circuit with engine at 2500 rpm and ambient temperature at 25–30°C:

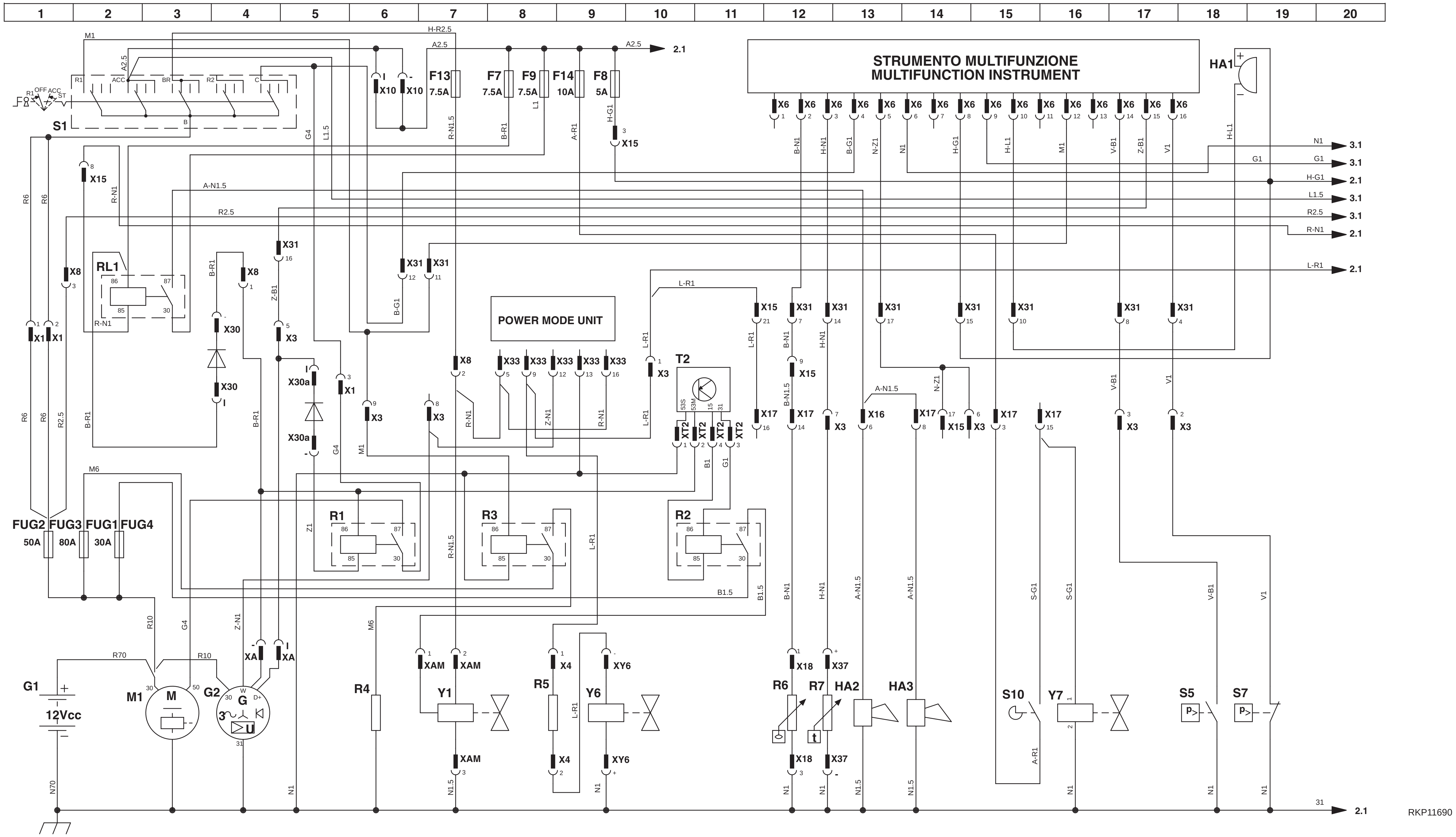
Normal pressure: 15–17 bar
Low pressure: 1.6–1.8 bar

Safety pressures:
High pressure: 20 bar
Low pressure: 2.5 bar
Coolant fluid: R134a
Quantity of coolant: 1100^{-30}_{+50} g

HOW THE AIR-CONDITIONING UNIT FUNCTIONS

The compressor (1) is driven directly by the engine shaft by means of a belt, and made to rotat by a pulley fitted with an electromagnetically-engaged clutch (1a).
A thermostatic sensor (7) controls the engagement and disengagement of the clutch. It disengages the clutch when the evaporator reaches the lower temperature limit and engages the clutch when the evaporator reaches the upper temperature limit.
The coolant fluid (in gaseous phase) is drawn into the compressor where it is subjected to compression and an intense heating process. In these conditions the fluid is then sent into the condenser (2) where, due to the heat extracted by ambient temperature air flowing over fins, it reaches condensation temperature, and passes into a high-pressure liquid state.
Subsequently the coolant passes into the drying-filter group (3) which performs three functions: it filters out impurities, absorbs any moisture present in the circuit and, finally, also functions as a reserve tank.
The coolant in its liquid state is then transferred to the evaporator (6), first passing through an expansion valve (5). The task of this valve is the constant metering of the quantity of fluid in order to maintain optimum evaporation.
In the evaporator the coolant fluid is subjected to expansion, bringing it up to the critical evaporation point at a temperature of approximately – 8°C.
The flow of air generated by centrifugal fan (8) which passes through the evaporator (6) at ambient temperature is considerably warmer than – 8°C. For this reason it yields heat to the coolant fluid, bringing it up to boiling point and complete evaporation.
On leaving the evaporator (6) the coolant is drawn once more into the compressor (1) and a new cycle commences.
The yielding of heat from the atmosphere in which the evaporator is positioned leads to the condensation of the water suspended in the air, and hence to dehumidification. The condensate is deposited on the evaporator fins where, if a temperature higher than 0°C is not maintained, it freezes and inhibits the functioning of the evaporator.
The task of keeping the temperature of the evaporator above 0°C (and thus within the optimum limits for heat exchange) is entrusted to a thermostatic sensor (7).
The condensate that forms on the evaporator fins (6) also contains dust, pollens and particles suspended in the air. Continual condensation therefore effectively purifies the air, and the droplets of condensate are discharged to the exterior.
A fixed quantity of anti-freeze oil is also introduced into the circuit, with the function of lubricating all the mechanical parts of the unit. A percentage of this oil circulates constantly throughout the unit in nebulized form, lubricating the compressor (pistons and bearings) and the expansion valve.
A pressure switch (4) has been inserted in the electrical control circuit to protect the unit in the case of a lack of coolant fluid or if the quantity becomes insufficient due to leakages. This switch will inhibit the engagement of the electromagnetic clutch and hence the functioning of the air-conditioning unit.

ELECTRICAL DIAGRAM (1/5)



COMPONENTS
- **G1** Battery
- **G2** Generator
- **HA1** Buzzer
- **HA2** Left front horn
- **HA3** Right front horn
- **M1** Starter motor
- **R1** Starter relay
- **R2** Fuel shut off pull relay
- **R3** Preheating relay
- **R4** Heating start
- **R5** Resistor
- **R6** Fuel level sender
- **R7** Engine water temperature sender
- **RL1** Horn relay
- **RL2** Arm working light relay
- **S1** Starting switch
- **S5** Air filter blocked switch
- **S7** Engine oil low pressure switch
- **S10** PPC enable micro switch
- **T2** Fuel shut off pull solenoid timer
- **Y1** Fuel shut off solenoid valve
- **Y6** Mode System solenoid valve
- **Y7** Servocontrol solenoid valve

CONNECTORS
- **X1** Power 4 way connector
- **X3** Engine line 9 way connector
- **X4** Engine line 2 way connector
- **X6** Multifunction instrument 16 way connector
- **X8** Central unit line 4 way connector
- **X10** Power (+15) 2 way connector
- **X15** Right lateral dashboard 21 way connector
- **X16** Left front light line 11 way connector
- **X17** Valves and right front light line 17 way connector
- **X18** Fuel level sender 3 way connector
- **X30** 2 way connector
- **X30a** 2 way connector
- **X31** 17 Way connector front dashboard line
- **X33** 17 Way connector Power Mode
- **XA** Generator 2 way connector
- **XAM** Fuel shut off 3 way connector
- **XR7** Water temperature sensor 2 way connector
- **XT2** Fuel shut off timer 4 way connector
- **XY6** Mode System solenoid valve 2 way connector

FUSES
- **F7** 5 sec timer fuse 7.5
- **F8** Multifunction instrument fuse 5A
- **F9** Horn fuse 7.5A
- **F13** Fuel shut off fuse 7.5A
- **F14** Servocontrol solenoid valve fuse 10A
- **FUG1** Fuel shut off pull solenoid fuse 30A
- **FUG2** General fuse 50A
- **FUG3** Preheating power fuse 80A

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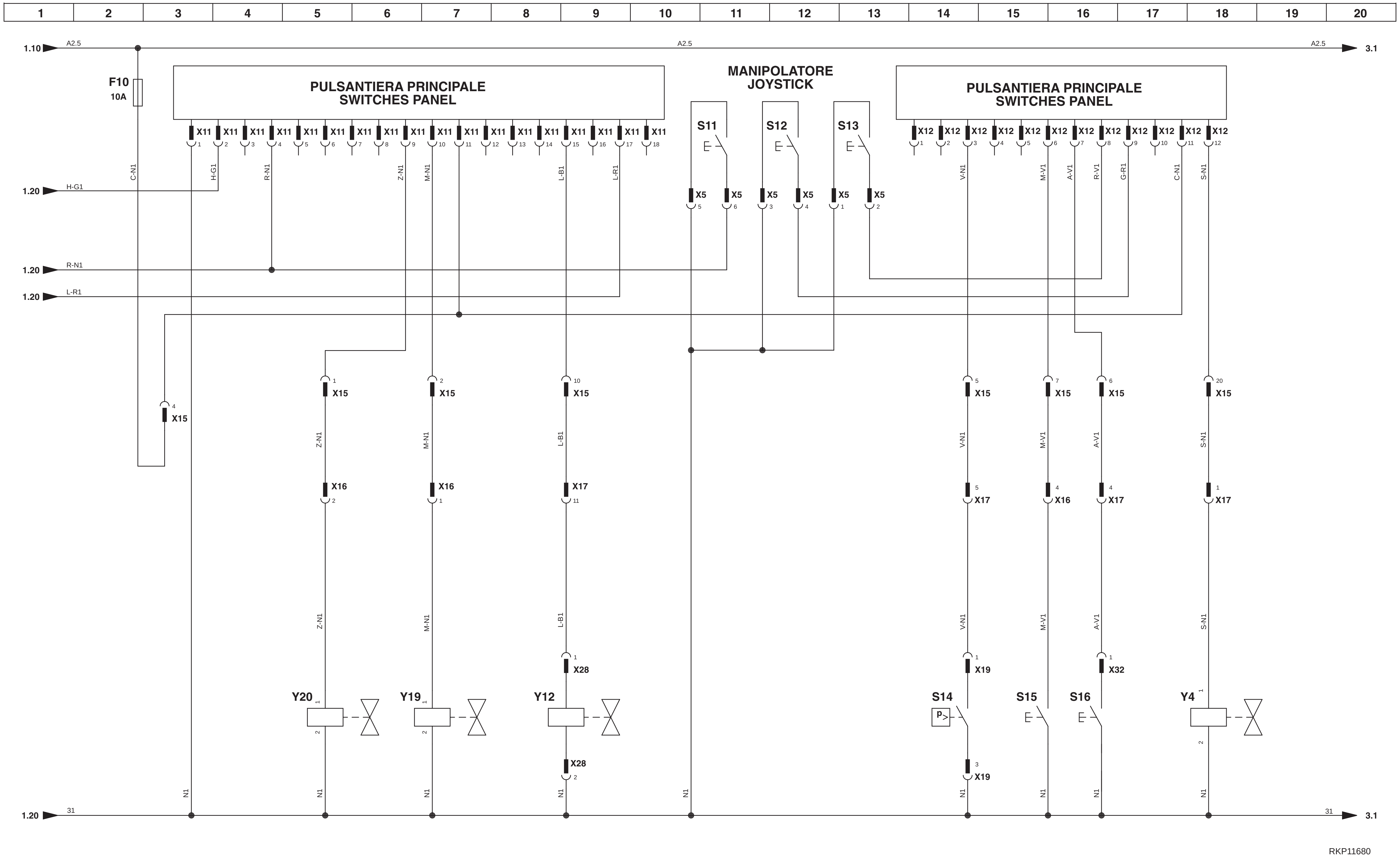
ELECTRICAL DIAGRAM (2/5)



COMPONENTS
S11 Joystick horn button
S12 Joystick grab button
S13 Joystick hammer button
S14 Anti overturning pressure switch
S15 Hammer pedal button
S16 Pliers button
Y4 Acceleration solenoid valve
Y12 Optional pliers solenoid valve
Y19 Hammer solenoid valve
Y20 Biting grab solenoid valve

CONNECTORS
X5 Joystick 6 way connector
X11 Switches panel 18 way connector
X12 Switches panel 12 way connector
X15 Right lateral dashboard 21 way connector
X16 Left front light line 11 way connector
X17 Valves and right front light line 17 way connector
X19 Anti overturning pressure switch 4 way connector
X28 Optional pliers solenoid valve 2 way connector

FUSES
F10 Switches panel relais fuse 10A

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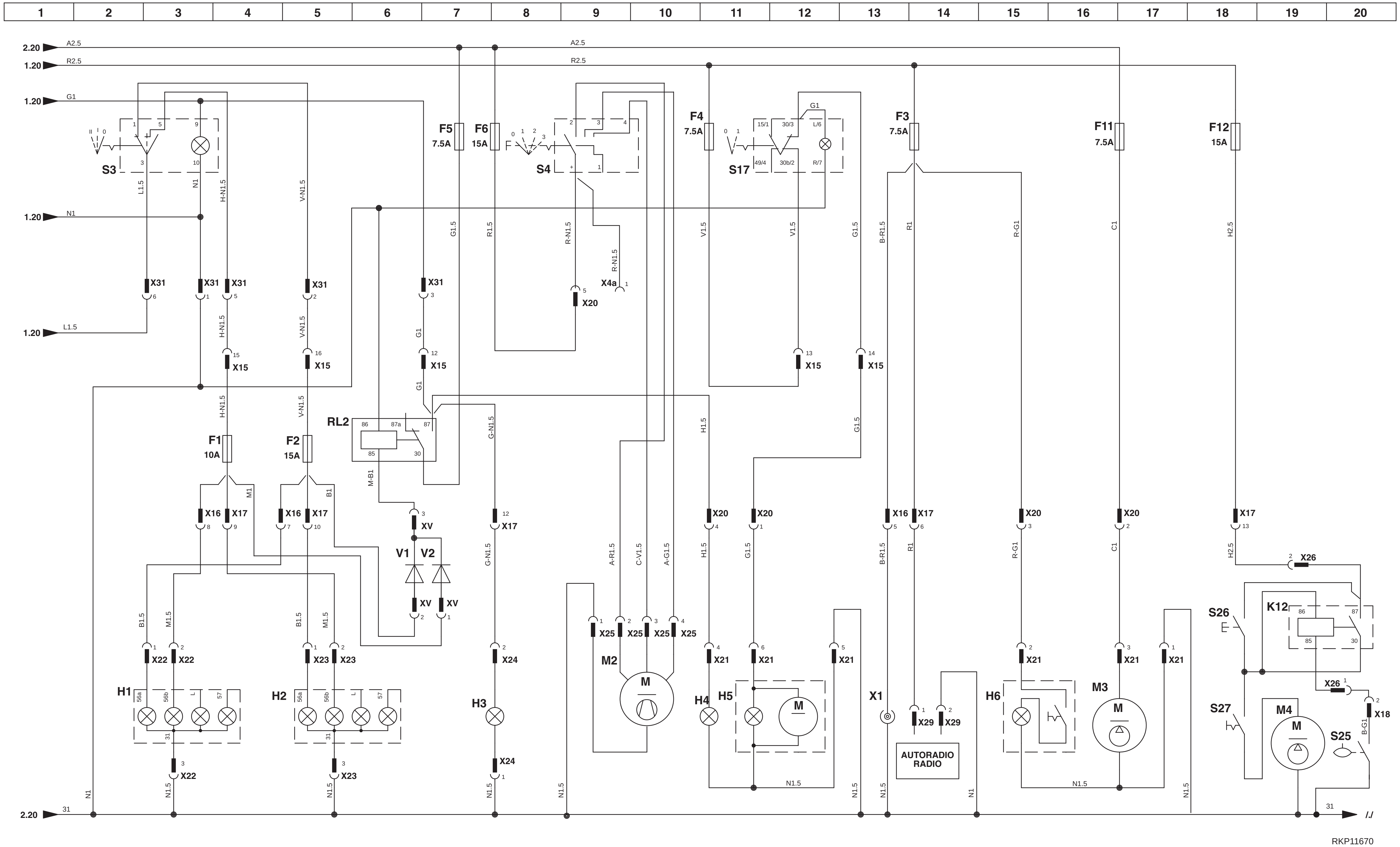
ELECTRICAL DIAGRAM (3/5)



COMPONENTS

H1	Front left light
H2	Front right light
H4	Working light
H5	Beacon lamp
H6	Cabin lamp
K12	Transfer pump relay
M2	Blower motor
M3	Washer motor
M4	Transfer pump
RL1	Horn relay
RL2	Arm working light relay
S3	Lights switch
S4	Blower motor switch
S17	Beacon switch (optional)
S25	Fuel tank full sensor
S26	Transfer pump start button
S27	Transfer pump switch
V1	Diode
V2	Diode
X1	Current intake

CONNECTORS

X15	Right lateral dashboard 21 way connector
X16	Left front light line 11 way connector
X17	Valves and right front light line 17 way connector
X18	Fuel level sender 3 way connector
X20	Left front light line 5 way connector
X21	Cabin 7 way connector
X22	Left front light 3 way connector
X23	Right front light 3 way connector
X24	Working light 2 way connector
X25	Heater 4 way connector
X26	Transfer pump 2 way connector
X29	Radio power 2 way connector
X31	17 Way connector front dashboard line
XV	Diodes 3 way connector

FUSES

F1	Low beam fuse 10A
F2	Main beam fuse 15A
F3	Cabin lamp,radio and current intake 7.5A
F4	Beacon fuse 7.5A
F5	Working light fuse 7.5A
F6	Blower motor fuse 15A
F11	Cabin power fuse 7.5A
F12	Transfer pump fuse 15A

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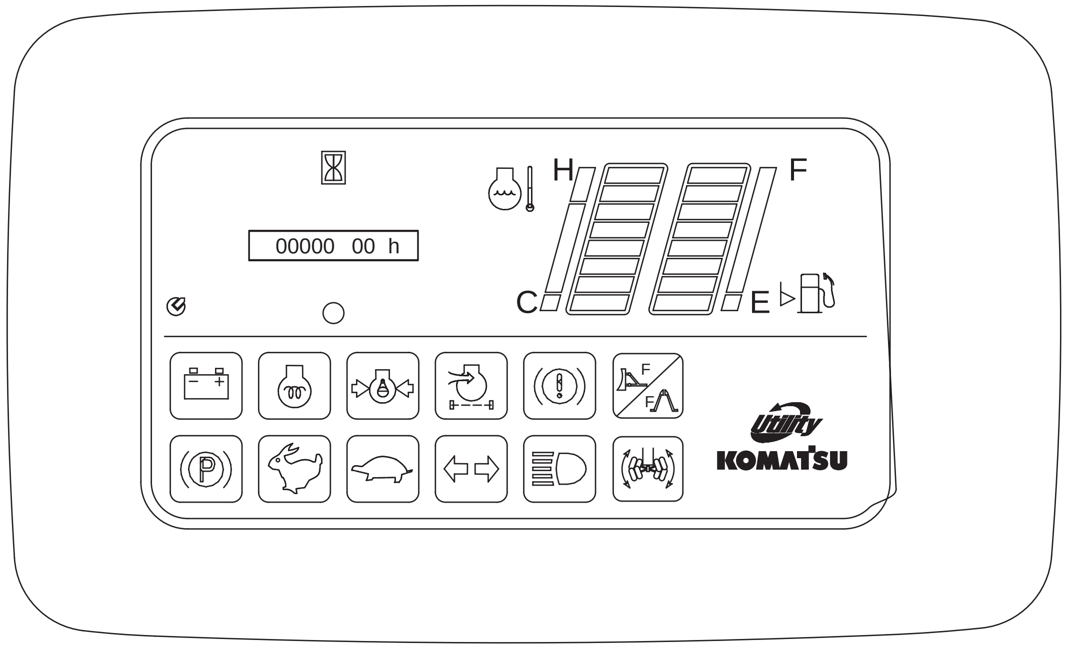
ELECTRICAL DIAGRAM (4/5)

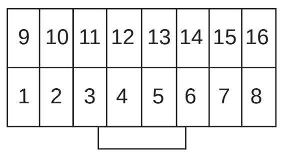
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

STRUMENTO MULTIFUNZIONALE MULTIFUNCTION



X6

PIN	FUNZIONE CONNESSA	COMANDO	COLORE FILO
1	COMUNE SPIE LENTA/VELOCE COMMON W/L SLOW/FAST GEAR	NEGATIVO	
2	STRUMENTO IND. LIV. CARB. FUEL LEVEL GAUGE	ohm	
3	STRUMENTO TEMPERATURA COOLANT TEMP. GAUGE	ohm	
4	SEGNALE DI START START SIGNAL	+50	
5			
6	MASSA GROUND	GND	
7	SPIA PALA-STABILIZZATORI (giallo) W/L SHOVEL-STABILIZER (yellow)	NEGATIVO	
8	POSITIVO ALIMENTAZIONE (+12V) POWER SUPPLY (+12V)	+15	
9	ILLUMINAZIONE NOTTURNA NIGHTLIGHT	+LUCI	
10	USCITA BUZZER BUZZER O/P	NEGATIVO	
11	SPIA AVARIA FRENI (rosso) W/L BRAKE SYSTEM FAILURE (red)	NEGATIVO	
12	SPIA PRERISCALDO (giallo) W/L PREHEAT (yellow)	POSITIVO	
13	SPIA BLOCCAGGIO PONTE (giallo) W/L AXLE BLOCKED (yellow)	NEGATIVO	
14	SPIA FILTRO ARIA (rosso) W/L AIR FILTER (red)	NEGATIVO	
15	SPIA GENERATORE (rosso) W/L CHARGE (red)	NEGATIVO	
16	SPIA PRESS. OLIO MOTORE (rosso) W/L ENGINE OIL PRESS. (red)	NEGATIVO	



LATO FILI
WIRE SIDE VIEW

RKP11650

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ELECTRICAL DIAGRAM (5/5)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

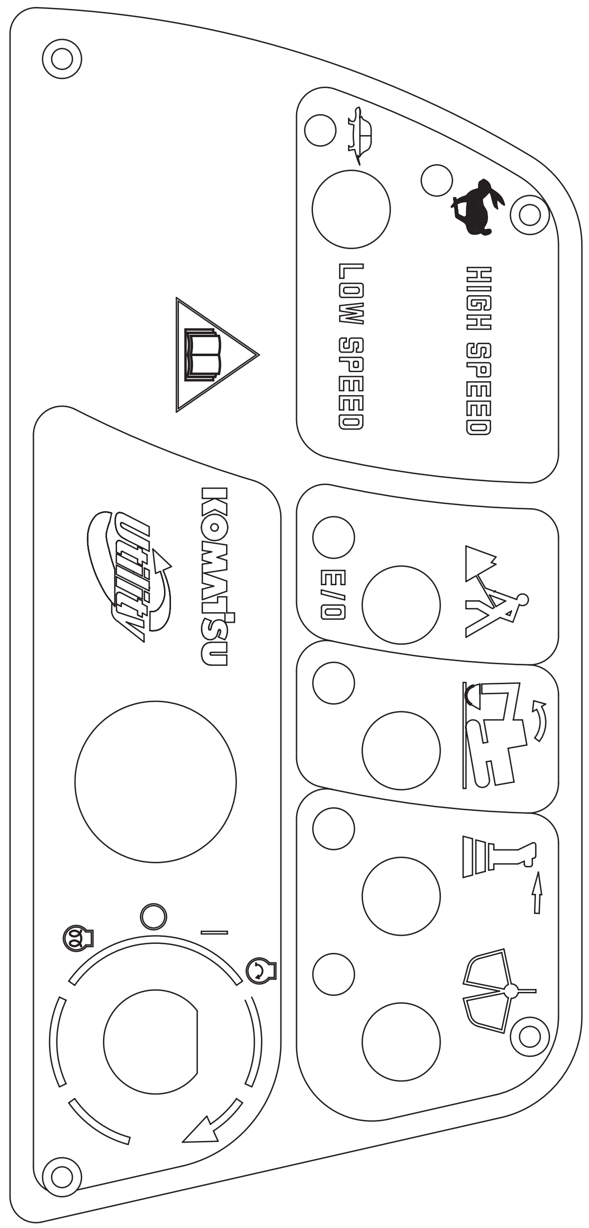
PULSANTIERA /SWITCHES PANEL

X11

POS	DESCRIZIONE FUNZIONE	DESCRIZIONE FUNZIONE
1	MASSA	GROUND
2	ALIMENTAZIONE SCHEDA/PULS.	PANEL POWER SUPPLY
3	N.C.	N.C.
4	AVV. ACUSTICO ANTIRIBALTAMENTO	ANTI OVERTURNING BUZZER
5	N.C.	N.C.
6	N.C.	N.C.
7	N.C.	N.C.
8	N.C.	N.C.
9	OUT E/V BENNA	GRAB SOLENOID VALVE OUT SIGNAL
10	OUT E/V MARTELLO	HAMMER SOLENOID VALVE OUT SIGNAL
11	ALIMENTAZIONE RELE'	RELAIS POWER
12	N.C.	N.C.
13	N.C.	N.C.
14	N.C	N.C
15	RELE' PINZA	PLIERS RELAY
16	N.C	N.C
17	OUT E/V WORKING MODE	WORKING MODE VALVE OUT SIGNAL
18	N.C	N.C

X12

POS	DESCRIZIONE FUNZIONE	DESCRIZIONE FUNZIONE
1	N.C	N.C
2	N.C	N.C
3	SEGNALE PRESS. ANTIRIBALTAMENTO	ANTI OVERTURNING PRESSURE SWITCH SIGNAL
4	N.C.	N.C.
5	N.C.	N.C.
6	PULSANTE PEDALE MARTELLO	HAMMER PEDAL BUTTON
7	PULSANTE PINZA	PLIERS BUTTON
8	P. MARTELLO / CHIUSURA BENNA MORDENTE	HAMMER OR CLOSE GRAB BUTTON
9	PULSANTE APRI BENNA MORD.	OPEN GRAB BUTTON
10	N.C.	N.C.
11	ALIMENTAZIONE RELE'	RELAIS POWER
12	OUT E/V INCREMENTO DI VELOCITA'	SPEED INCREASE VALVE OUT SIGNAL



RKP11660

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 ENGINE

Machine model			PC95R-2	
Engine			4D106-1FB	
Check item	Test Conditions	Unit	Standard value	Permissible value
Engine speed	High idling Low idling Set speed	rpm rpm rpm	2400 1100 2200	2400±50 1100±50 –
Exhaust gas colour	Sudden acceleration At high idling speed	Bosch index	≤4.5 ≤2.5	≤4.5 ≤2.5
Valve clearance	Intake valve (20°C) Exhaust valve (20°C)	mm mm	0.30±0.05 0.30±0.05	Max. 0.35 Max. 0.35
Compression pressure (SAE30 oil)	Oil temperature 69–72°C (Engine speed)	bar rpm	35±1 250	28±1 250
Blow-by pressure (SAE30 oil)	Water temperature in operating range At high idling speed	mm H_2O	– –	– –
Engine oil pressure	Max. idling (in cold state) High idling At low idling	 bar bar	 4.4–5.4 Min. 0.6	 4.4–5.4 Min. 0.6
Oil temperature	Entire speed range	°C	120	Max. 120
Fuel injection timing	B.T.D.C.	degrees	13–15	13–15
Fan-belt tension	Deflection when pressed with finger force of approx. 10 kg	mm	Max. 10	10–15

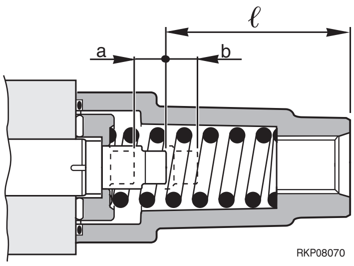
FOR ENGINE

Machine model			PC95R-2	
Engine			4D106-1FB1	
Check item	Test Conditions	Unit	Standard value	Permissible value
Engine speed	High idling Low idling Set speed	rpm rpm rpm	2400 1100 2200	2400±50 1100±50 –
Exhaust gas colour	Sudden acceleration At high idling speed	Bosch index	≤5,0 ≤2.5	≤5,0 ≤2.5
Valve clearance	Intake valve (20°C) Exhaust valve (20°C)	mm mm	0.30±0.05 0.30±0.05	Max. 0.35 Max. 0.35
Compression pressure (SAE30 oil)	Oil temperature 69–72°C (Engine speed)	bar rpm	35±1 250	28±1 250
Blow-by pressure (SAE30 oil)	Water temperature in operating range At high idling speed	mm H_2O	– –	– –
Engine oil pressure	Max. idling (in cold state) High idling At low idling	 bar bar	 4.4–5.4 Min. 0.6	 4.4–5.4 Min. 0.6
Oil temperature	Entire speed range	°C	120	Max. 120
Fuel injection timing	B.T.D.C.	degrees	13–15	13–15
Fan-belt tension	Deflection when pressed with finger force of approx. 10 kg	mm	Max. 10	10–15

FOR MACHINE

★ All tests, if not otherwise specified, should be performed with WORKING MODE in position P.

Machine model				PC95R-2	
Classification	Check item	Test conditions	Unit	Standard value	Permissible value
Engine	Engine speed with pump P1 at max. pressure	• Oil temperature: 45–55 °C • Engine oil pressure: in correct range • Cooling water temp.: in correct range • Swing lock pin inserted • Max. pressure P1: with boom • Max. pressure P1-P2: with boom and swing • Max. pressure P2: with arm and swing • Working Mode: P position	rpm	2150^{-50}_{+150}	2150^{-50}_{+150}
	Engine speed with pumps P1 and P2 at max. pressure			2100^{-50}_{+200}	2100^{-50}_{+200}
	Engine speed with pumps P2 at max. pressure			2300±50	2300±50
	Engine speed when pumps P1-P2 are at max. pressure and the WORKING MODE selector is in pos. E			2310±50	2310±50

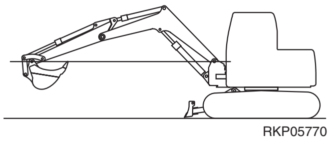
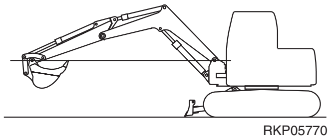
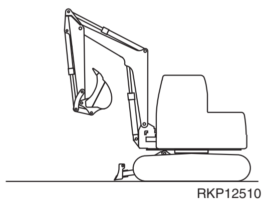
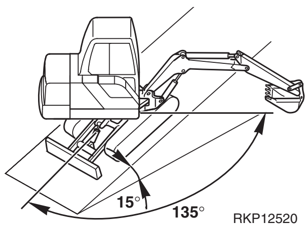
Classification	Check item	Test conditions	Unit	Standard value ℓ	Standard value a	Standard value b	Permissible value ℓ	Permissible value a	Permissible value b
Spool travel	Boom control valve		mm	45	6.5±0.3	6.5±0.3	45	6.5±0.3	6.5±0.3
	Arm control valve								
	Bucket								
	Swing control valve								
	Blade control valve								
	Boom swing control valve								
	2nd boom control valve								
	R.H. travel control valve								
	L.H. travel control valve								
	Double speed: boom and arm								
	Attachment control valve								

Classification	Check item	Test conditions		Unit	Standard value	Permissible value
Travel of levers and pedals	Boom control lever	• At the and off lever knob and at 90° of lever • Reading at end of travel adding helf stroke • Engine stopped • Equipment on the ground	Neutral → Raise / Lower	mm	75±8	65±85
	Arm control lever		Neutral → Extended / Retracted		75±8	65±85
	Bucket control lever		Neutral → Open / Curled		75±8	65±85
	Swing control lever		Neutral → Swing right / Swing left		75±8	65±85
	Blade control lever		Neutral → Raise / Lower		100±10	85±115
	Boom swing pedal		Neutral → Swing right / Swing left		14±4	8±20
	2nd boom pedal		Neutral → Open / Closed		25±5	18±32
	Travel control lever (right-left)		Neutral → Forward / Backward		130±12	110±155
	Fuel control lever		Min. → Max.		140±15	115±165

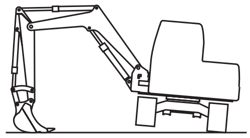
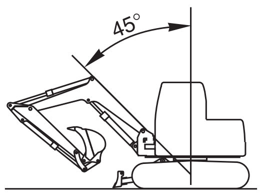
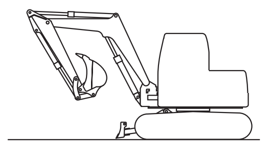
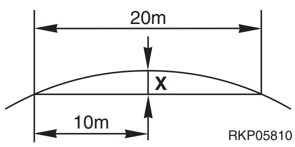
FOR MACHINE

Machine model				PC95R-2	
Classification	Check item	Test conditions	Unit	Standard value	Permissible value
Operaring force for control of levers and pedals	Raise boom	• Engine speed: low idling • Oil temperature: 45–55 °C • Instrument coupling at 70 mm from bottom lever knob and perpendicular. Read value 10 mm before end of stroke • For control pedal: Instrument coupling on outside edge. Read value 10 mm before end of stroke. • For levers: Instrument coupling at centre of knob. Read value 10 mm before end of stroke.	kg	1±0.4	0.5–1.5
	Lower boom			1±0.4	0.5–1.5
	Bucket curled-open			1±0.4	0.5–1.5
	Arm open-close			1±0.4	0.5–1.5
	Swing (R.H.-L.H.)			1±0.4	0.5–1.5
	Blade			1.2±0.3	0.7–1.7
	Boom swing pedal			6.5±2.5	3.5–9.5
	2nd boom pedal			2±0.5	1.2–2.8
	Travel control lever (R.H.-L.H.)			1.4±0.5	0.7–2.1
	Fuel control levers			4±1	2.5–5.5
Main valve pressure	P1 pump (Safety)	• Engine speed: high idling • Oil temperature: 45–55 °C • Check one circuit at a time • P1 pressure: boom control • P2 pressure: blade control	bar	275^{0}_{+20}	275^{0}_{+20}
	P2 pump (Safety)			216^{0}_{+20}	$^{0}_{+20}$
Hydraulic pressure	Boom	Raise	bar	275^{0}_{+20}	275^{0}_{+20}
		Lower		275^{0}_{+20}	275^{0}_{+20}
	Arm	• Engine speed: high idling • Oil temperature: 45–55 °C • Check one circuit at a time		275^{0}_{+20}	275^{0}_{+20}
	Bucket			275^{0}_{+20}	275^{0}_{+20}
	Swing			157/198±10	157/198±10
	Blade			216^{0}_{+20}	216^{0}_{+20}
	Boom swing			275^{0}_{+20}	275^{0}_{+20}
	2nd boom			275^{0}_{+20}	275^{0}_{+20}
	Travel			275^{0}_{+20}	275^{0}_{+20}
	Attachments			275^{0}_{+20}	275^{0}_{+20}
	Servocontrols			32^{-2}_{+1}	Max. 33
	LS differential pressure	• Engine speed: high idling • Oil temperature: 45–55 °C • Levers at NEUTRAL	bar	–	–
		• Engine speed: high idling • Oil temperature: 45–55 °C • Travel speed: Hi • Travel lever: at the end of stroke • Track shoe: raised		21.5^{0}_{+3}	$21.5^{0}_{+24.5}$

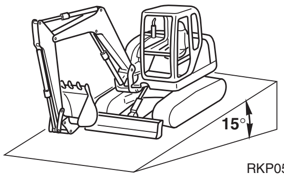
FOR MACHINE

<table>
<tr><th colspan="4">Machine model</th><th colspan="2">PC95R-2</th></tr>
<tr><th>Classifi-cation</th><th>Check item</th><th>Test conditions</th><th>Unit</th><th>Standard value</th><th>Permissible value</th></tr>
<tr><td rowspan="6">Swing</td><td>Braking angle</td><td>Work equipment at max. reach

• Working Mode: P
• Load in the bucket: 630 kg
• Engine speed: high idling
• Oil temperature: 45–55 °C</td><td>sec.</td><td>0.7–2</td><td>0.7–2</td></tr>
<tr><td rowspan="2">Time taken to start swing</td><td>Working equipment at max. reach

90°</td><td rowspan="2">sec.</td><td>33±3</td><td>Max. 38</td></tr>
<tr><td>180°
• Engine speed: high idling
• Oil temperature: 45–55 °C
• Time taken also from starting position to swing 90° and 180°.</td><td>–</td><td>–</td></tr>
<tr><td>Time taken to swing</td><td>
• Working Mode: P position
• Engine speed: high idling
• Oil temperature: 45–55 °C
• Measure the time taken to make 5 full swings
• Check all the direction of swing</td><td>sec.</td><td>33±3</td><td>Max. 38</td></tr>
<tr><td>Deriva meccanica della torretta
(Controllo freno motore di rotazione)</td><td>
• Load in the bucket: 540 kg
• Engine: stopped
• Oil temperature: 45–55 °C
• Park the machine on a 15° slope and set the boom at 135° with respect to the ground surface.
• On the outer swing circle, mark the position between turret and track frame.
• After 15 minutes measure the drift.</td><td>degrees</td><td>0</td><td>–</td></tr>
<tr><td>Internal leakage from swing motor</td><td>• Engine speed: high idling
• Oil temperature: 45–55 °C
• Swing block: engaged
• Measure the leakage</td><td>ℓ/min</td><td>Max. 0.608</td><td>Max. 1.3</td></tr>
</table>

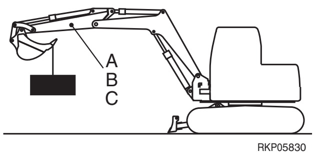
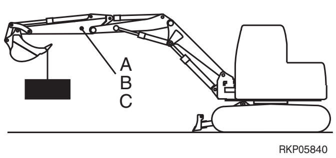
FOR MACHINE

Machine model					PC95R-2	
Classification	Check item	Test conditions		Unit	Standard value	Permissible value
Travel	Travel motor swing speed (1) (no-load)	Measuring posture  RKP05790 • Working Mode: P position • Engine speed: high idling • Oil temperature: 45–55 °C • Rest the bucket on the ground, raise one track-shoe and mark a position on the reduction unit. Measure the rotating speed of the sprocket wheel. Repeat for the 2nd track-shoe.	Normal	rpm	36^{-4}_{+2}	30÷40
			With increment		55^{-6}_{+3}	46÷60
	Travel speed (2)	Measuring posture  RKP05800 • Engine speed: high idling • 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.	Normal	sec.	$23.2^{-1.7}_{+0.8}$	Max. 26 Min. 20
			With increment		$15.0^{-1}_{+0.7}$	Max. 17 Min. 13
	Travel deviation	 RKP12530 • Working Mode: P position • Engine speed: high idling • Oil temperature: 45–55 °C • Travel 20 metres on flat ground and measure the deviation. ★The surface must be hard and horizontal  ★Measure dimension «X»		mm	Max. 200	Max. 300

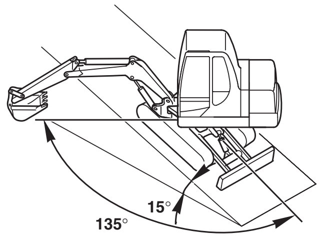
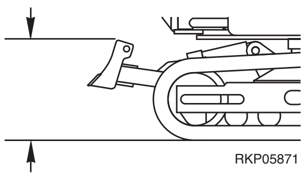
FOR MACHINE

Machine model				PC95R-2	
Classification	Check item	Test conditions	Unit	Standard value	Permissible value
Travel	Hydraulic drift of travel motors	Measuring posture  RKP05820 • Engine: stopped • Oil temperature: 45–55 °C • Stop machine on a slope with blade raised and sprocket facing straight up the slope. • Measure the drift after 5 minutes	mm	0	–
	Leakage of travel motors	• Engine speed: high idling • Oil temperature: 45–55 °C • Lock shoes and check leakage • Measure one motor at a time	ℓ/min	12.8	Max. 25

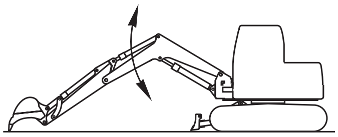
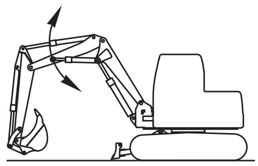
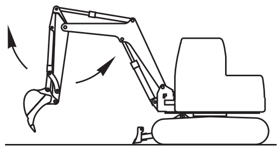
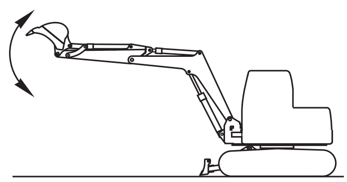
FOR MACHINE

Classification	Check item	Test conditions		Unit	PC95R-2 Standard value	PC95R-2 Permissible value
Hydraulic drift of working equipment	Total work equipment (Standard boom) (Downward movement bucket teeth tips)	Measuring posture  • 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 levelled ground • Bucket rated load: 540 kg • Levers: neutral • Engine: switched off • Oil temperature: 45–55 °C • Safety valve disengaged. • Take measurements as soon as the engine stops. • Measure the variations every 5 minutes and check the total variation after 15 mins.	Boom A L=1600	mm	Max. 400	Max. 600
			Boom B L=1850		Max. 400	Max. 600
			Boom C L=2300		Max. 400	Max. 600
	Boom cylinder (Retraction)		Boom A L=1600		Max. 40	Max. 60
			Boom B L=1850		Max. 40	Max. 60
			Boom C L=2300		Max. 40	Max. 60
	Arm cylinder (Extension)		Boom A L=1600		Max. 40	Max. 60
			Boom B L=1850		Max. 40	Max. 60
			Boom C L=2300		Max. 40	Max. 60
	Bucket cylinder (Retraction)				Max. 15	Max. 22
	Total work equipment (2-piece boom) (Downward movement of tips of bucket teeth)	Measuring posture  • In this position, measure extension and retraction of each cylinder, and any leakages when a load is applied to the tips of the bucket teeth. • Horizontal levelled ground • Bucket rated load: 480 kg • Levers: neutral • Engine: switched off • Oil temperature: 45–55 °C • Safety valve disengaged • Take measurements as soon as the engine stops. • Measure the variations every 5 minutes and check the total variation after 15 mins..	Boom A L=1600		Max. 400	Max. 600
			Boom B L=1850		Max. 400	Max. 600
			Boom C L=2300		Max. 400	Max. 600
	Boom cylinder (Retraction)		Boom A L=1600		Max. 40	Max. 60
			Boom B L=1850		Max. 40	Max. 60
			Boom C L=2300		Max. 40	Max. 60
	2nd boom cylinders (Retraction)		Boom A L=1600		Max. 10	Max. 15
			Boom B L=1850		Max. 10	Max. 15
			Boom C L=2300		Max. 10	Max. 15
	Arm cylinder (Extension)		Boom A L=1600		Max. 40	Max. 60
			Boom B L=1850		Max. 40	Max. 60
			Boom C L=2300		Max. 40	Max. 60
	Bucket cylinder (Retraction)				Max. 15	Max. 22

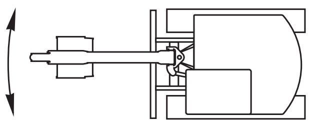
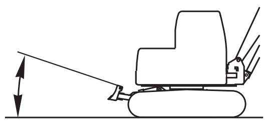
FOR MACHINE

Machine model					PC95R-2	
Classification	Check item	Test conditions		Unit	Standard value	Permissible value
Hydraulic drift of working equipment	Boom swing (Standard boom)		Boom A L=1600	mm	Max. 12	Max. 18
			Boom B L=1850		Max. 15	Max. 22
			Boom C L=2300		Max. 18	Max. 27
	Boom swing (2-piece boom)	• Bucket rated load: 540 kg (with 1-piece boom) 480 kg (with 2-piece boom) • Engine: switched off • Oil temperature: 45–55 °C • In the same position as above, park the machine on a 15° slope and bring the turret round to 135°. Measure the extension and retraction of the cylinder after 15 mins.	Boom A L=1600		Max. 12	Max. 20
			Boom B L=1850		Max. 15	Max. 25
			Boom C L=2300		Max. 18	Max. 30
	Blade (measure the downward movement of the edge of the blade)	 • Engine: switched off • Oil temperature: 45–55 °C • Safety valve disengaged • Raise the blade and measure the height of the edge from the ground. Measure the downward after 15 mins.		mm	10	Max. 12
Internal cylinder leankage	Boom	• Engine speed: high idling • 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 • For the 2-piece boom check the two cylinders individually but simultaneously.		cc/min	Max. 3.3	Max. 13.0
	2nd boom (2 cylinders)				Max. 2.0 (each cylinder)	Max. 8.0 (each cylinder)
	Arm				Max. 2.4	Max. 9.6
	Bucket				Max. 2.0	Max. 8.0
	Boom swing				Max. 2.4	Max. 9.6
	Blade				Max. 3.3	Max. 13.0

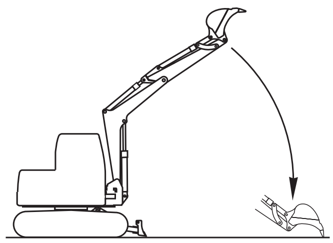
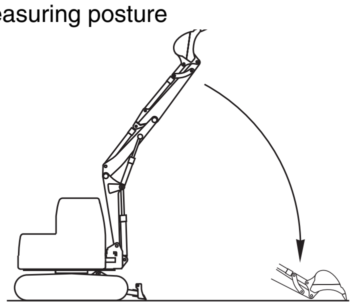
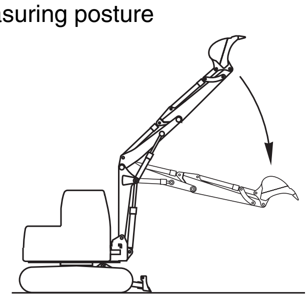
FOR MACHINE

Machine model						PC95R-2	
Classification	Check item		Test conditions		Unit	Standard value	Permissible value
Work equipment	Speed	Boom Bucket teeth on the ground ↕ Cylinders completely extended	Measuring posture  RKP05880 • Working Mode: P position • Engine speed: high idling • Oil temperature: 45–55 °C	Raise	sec.	2.3±0.3	Max. 3
				Lower		2.3±0.3	Max. 3
		2nd boom Cylinders completely retracted ↕ Cylinder completely extended	Measuring posture  RKP05890 • Working Mode: P position • Engine speed: high idling • Oil temperature: 45–55 °C	Closed		4.5±0.4	Max. 5.5
				Inout		5±0.6	Max. 6.5
		Arm Cylinder completely retracted ↕ Cylinders completely extended	Measuring posture  RKP05900 • Working Mode: P position • Engine speed: high idling • Oil temperature: 45–55 °C	Closed		$3.2^{0}_{+0.8}$	Max. 4.5
				Inout		$2.5^{0}_{+0.6}$	Max. 3.5
		Bucket Cylinder completely retracted ↕ Cylinders completely extended	Measuring posture  RKP05910 • Working Mode: P position • Engine speed: high idling • Oil temperature: 45–55 °C	Curled		$3^{-0.2}_{+0.4}$	Max. 4
				Dump		2.2±0.3	Max. 3

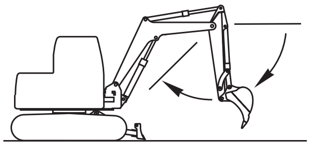
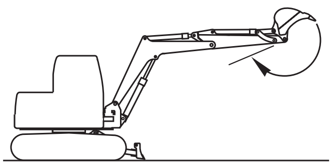
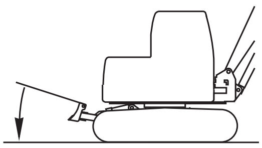
FOR MACHINE

Machine model						PC95R-2	
Classification	Check item		Test conditions		Unit	Standard value	Permissible value
Work equipment	Speed	Boom swing Cylinder completely retracted ↕ Cylinders completely extended	Measuring posture  RKP05920 • Attachment at maximum extension • Engine speed: high idling • Oil temperature: 45–55 °C • Working Mode: P position	L.H.	sec.	$6^{-1}_{+0.2}$	Max. 6.5
				R.H.		$6^{-1}_{+0.2}$	Max. 6.5
		Blade Blade on the ground ↕ Blade raised to max. height	Measuring posture  RKP05930 • Working Mode: P position • Engine speed: high idling • Oil temperature: 45–55 °C	Raise		1±0.2	Max. 1.5
				Lower		0.9±0.2	Max. 1.5

FOR MACHINE

Classification		Check item	Test conditions	Unit	Standard value	Permissible value
Machine model					PC95R-2	
Work equipment	Time lags	Boom (Standard)	Measuring posture  RKP05940 • Engine speed: low idling • Oil temperature: 45–55 °C • Retract fully the cylinders of the arm and bucket. Lower bucket to ground and measure time taken for chassis to rise from ground.	sec.	Max. 2	Max. 3
		Boom (2-piece boom)	Measuring posture  RKP05950 • Engine speed: low idling • Oil temperature: 45–55 °C • Retract fully the cylinders of the arm and bucket. Extend the 2nd boom fully. Lower bucket to ground and measure time taken for chassis to rise from ground.		Max. 2	Max. 3
		2nd boom	Measuring posture  RKP05960 • Engine speed: low idling • Oil temperature: 45–55 °C • Retract fully the cylinders of the arm and bucket. Extend the 2nd boom fully. Bring the boom into a vertical position. Close completely the 2nd boom and measure the time taken increase the pressure.		Max. 2	Max. 3

FOR MACHINE

<table>
<tr><th colspan="5">Machine model</th><th colspan="2">PC95R-2</th></tr>
<tr><th>Classification</th><th colspan="2">Check item</th><th>Test conditions</th><th>Unit</th><th>Standard value</th><th>Permissible value</th></tr>
<tr><td rowspan="5">Work equipment</td><td rowspan="5">Time lags</td><td rowspan="3">Arm</td><td rowspan="3">Measuring posture

RKP05970
• Engine speed: low idling
• Oil temperature: 45–55 °C
• Bring the boom into a horizontal position.
Retract the cylinder of the arm completely and then extend it.
Amount of time when arm stops for a moment.</td><td rowspan="5">sec.</td><td>Boom A L=1600: Max. 2.0</td><td>Max. 3.0</td></tr>
<tr><td>Boom B L=1850: Max. 2.0</td><td>Max. 3.0</td></tr>
<tr><td>Boom C L=2300: Max. 2.0</td><td>Max. 3.0</td></tr>
<tr><td>Bucket</td><td>Measuring posture

RKP05980
• Engine speed: low idling
• Oil temperature: 45–55 °C
• Bring the boom into a horizontal position.
Retract the bucket cylinder completely, then extend it.
Measure the time that elapses between the bucket stopping at dead centre and then starting to move again.</td><td>Max. 2.0</td><td>Max. 3.0</td></tr>
<tr><td>Blade</td><td>Measuring posture

RKP05990
• Engine speed: low idling
• Oil temperature: 45–55 °C
• Raise the blade to its max. height, then lower it.
Measure the time it takes for the rear of the machine to be lifted off the ground, starting from the time the blade contacts the ground.</td><td>Max. 1.0</td><td>Max. 2.0</td></tr>
</table>

FOR MACHINE

Machine model						PC95R-2	
Classification	Check item		Test conditions		Unit	Standard value	Permissible value
Pumps	Pumps delivery	Gear pump and piston pump	• Engine: 2200±10 rpm with pump under load • Oil temperature: 45–55 °C	Working Mode P position	ℓ/min	115–160	Min. 115
				Working Mode E position		80–143	Min. 80

SPECIAL TOOLS

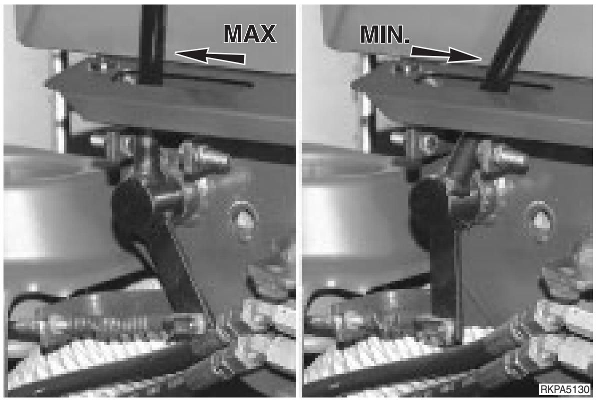
Measurement check points	Symbol		Code	Name	Q.ty	Remarks
Valve clearance	A	1	Commercially available	Feeler gauge	1	–
Compression pressure	B	1	–	Pressure gauge	1	Kit Yanmar TOL-97190080
		2		Adapter	1	
Engine speed	C	1	Commercially available	Multi-scale tachometer	1	20 - 4000 rpm
		2	Commercially available	Stroboscopic tachometer	1	6 - 30000 rpm
Water and oil temperature	D	1	Commercially available	Digital temperature gauge	1	– 50 - 1200°C
Hydraulic pressure	E		823001279	Pressure gauge kit	1	–
		1	–	Pressure gauge	2	Scale 60 bar
		2	–	Pressure gauge	1	Scale 250 bar
		3	–	Pressure gauge	1	Scale 400 bar
		4	–	Pressure gauge	1	Scale 600 bar
		5	878000473	Servocontrol kit Digital differential pressure gauge	1	0–1000 bar
	F	1		Flowmeter	1	Delivery 0–300 ℓ/min
Track shoe tension	G	1	21D-98-11650	Grease nipple	1	Included in the machine tool kit
Hydraulic drift of boom	H	1	21D-62-15530	Flange	1	Mount with O-Ring code 21D-09-69870
Air conditioning unit	L	1	Commercially available	Maintenance station	1	For coolant R134a
		2	Commercially available	Thermometer-hygrometer	1	Sampling every 15 seconds
		3	Commercially available	Leak detector	1	For coolant R134a

MEASURING THE ENGINE SPEED

⚠ When measuring the speed (rpm) of the engine, do not touch heated parts and take care not to become entangled in rotating elements.

★ Do not start to measure engine speed until the following conditions have been met:
- Engine cooling water temperature: 68–80°C
- Hydraulic system oil temperature: 45–55°C.

1 - Install and connect the tachometer **C1**.
   ★ If a stroboscopic tachometer **C2** is used, make a distinct mark on the motor 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: 1100±50 rpm
   ★ High idling: 2400±50 rpm

★ If the minimum and maximum engine speeds without load do not fall within the correct range, check the position stops of the accelerator lever and the accelerator cable sheathing (See «ACCELERATOR LEVER ADJUSTMENT») before performing the stress tests.

- Engine rpm with the pumps working.

★ Max. speed with the **P1** pump working: 2150^{-50}_{+150} rpm

★ Max. speed with the **P1** and **P2** pumps working: 2100^{-50}_{+200} rpm

★ If the efficiency is not within the permissible limits, call the Authorised Repair Shop to come and give the engine a diagnostic check.

ADJUSTING VALVE CLEARANCE

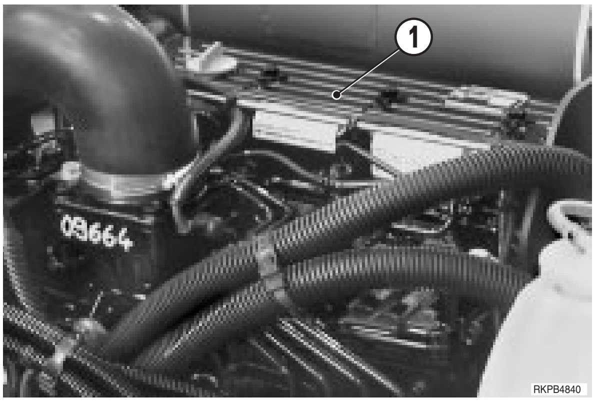
★ Adjust clearance between valves and rocker levers as follows:

Unit: mm

At cold engine	Intake valve	Exhaust valve
	0.30±0.05	0.30±0.05

★ Ignition order: 1-3-4-2-1.....

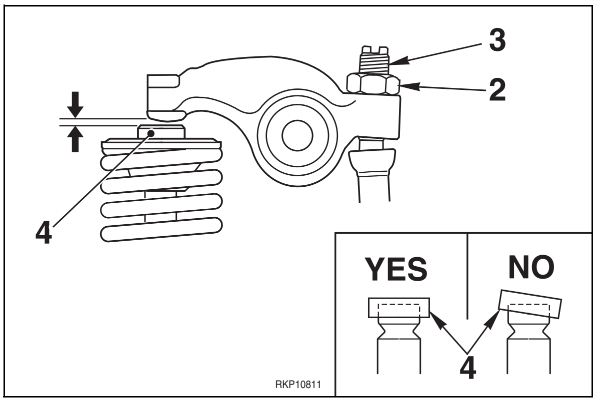
★ Normal rotation sense: counterclockwise from flywheel view.



- **Adjusting procedure**

1 - Remove the cover valves (1).

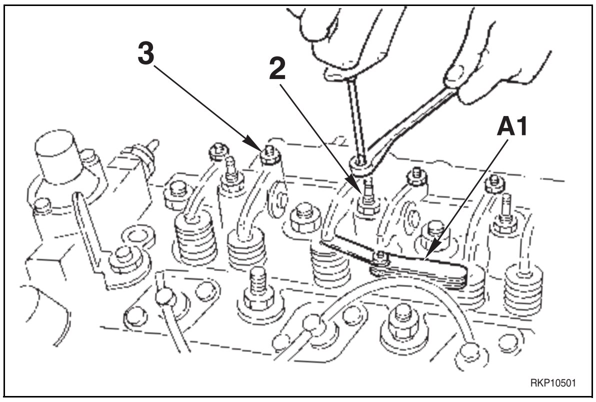
2 - Rotate crankshaft in normal direction as long as cylinder piston to be checked is at compression Top Dead Center (TDC).
★ In this position intake and exhaust valves are closed.



3 - Loose lock nut (2) and unscrew tappet (3) of about 1 turn.
★ Check that valve insert (4) is laying flat on valve stem and that it is not worn askew.
1 - If valve inserts (4) are damaged, replaced them with new ones.
2 - Make sure that inserts feet and lay flat on valve stem.

4 - Connect **A1** feeler gauge between insert and rocker lever to adjust; rotate the tappet (3) until touching **A1** feeler gauge.
Tight tappet (3) with lock nut (2).
★ After tightening the lock nut, check the clearance again.

5 - Adjust with same procedures second cylinder valve and repeat same operation for the other cylinders, according to the ignition order.

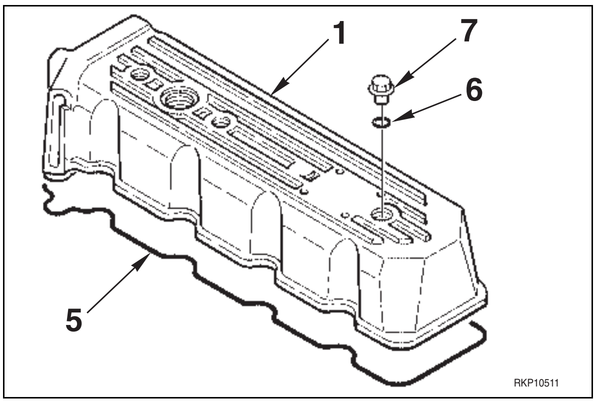


- **Cover valves installation**

1 - Check condition of cover valves (1), gasket (5), O-Rings (6) and lock nuts (7); clean carefully contact surface on cylinder head.

2 - Install valves cover (1), fit O-Rings (6) and lock nuts (7).

Cover lock nut: 25±3 Nm

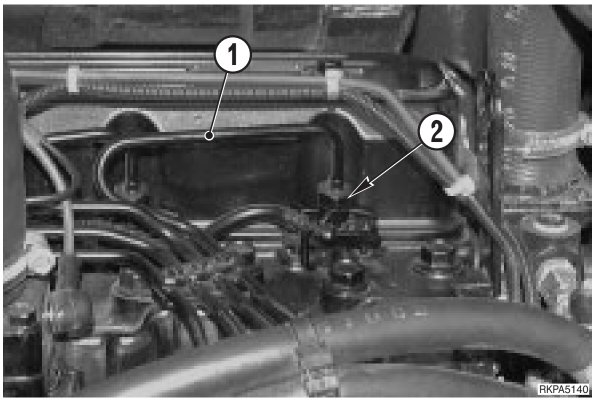


MEASURING COMPRESSION PRESSURE

⚠ When measuring the compression pressure be careful not to get caught in cooling fan, in the alternator belt or in other rotating parts.

★ Test condition:
- Engine: at operating temperature
- Hydraulic oil: 55–60°C.
- Battery: at full charge
- Valve clearance: adjusted (see «ADJUSTING VALVE CLEARANCE»)

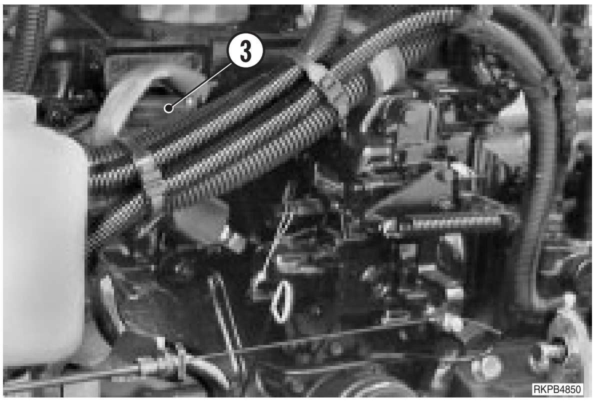
1 - Disconnect high pressure pipe (1).



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

3 - Disconnect connector (3) of fuel cut-off solenoid valve.

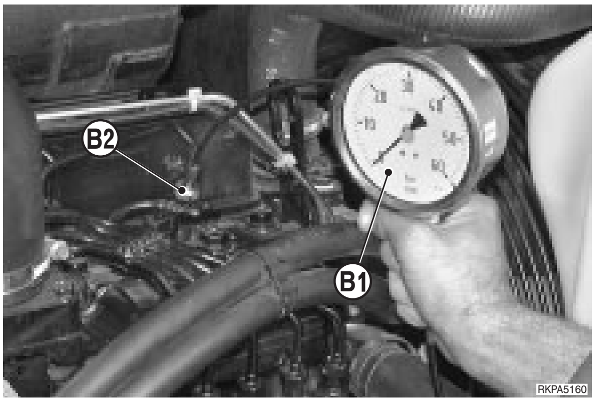
4 - Crank engine with starting motor.



5 - Install **B2** adapter and connect **B1** pressure gauge.
  ★ Check that seal is installed in the adapter and that it is not damaged.

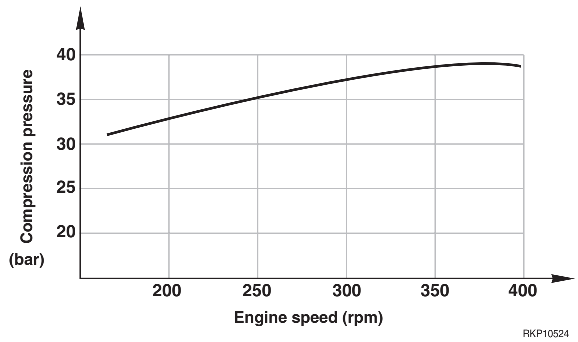
6 - Crank engine with starting motor and measure compression pressure.
  ★ Compression value:
  Normal: 35±1 bar
  Minimum permissible: 28±1 bar at 250 rpm
  ★ Difference between cylinders: 2–3 bar

7 - After measuring, install the nozzle holder assembly (2), connect high pressure pipe (1) feedback pipe and connector (3).



Nm Nozzle holder collar bolts: 6.9–8.8 Nm

Nm High pressure union: 19.6–24.5 Nm

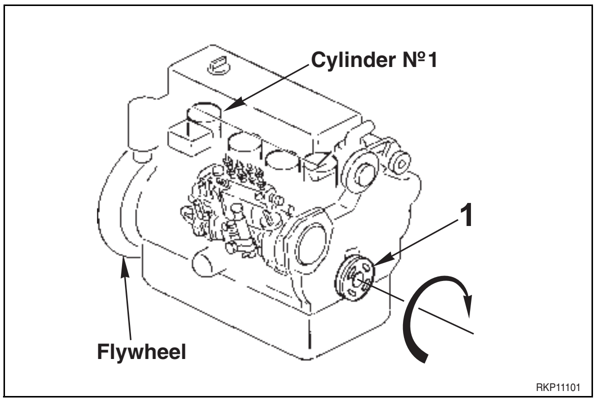


TESTING AND ADJUSTING FUEL INJECTION TIMING

★ Check fuel injection timing of N.1 cylinder by means of N.1 delivery valve of injection pump.

★ Cylinders are numbered 1-2-3-4 starting from flywheel side.

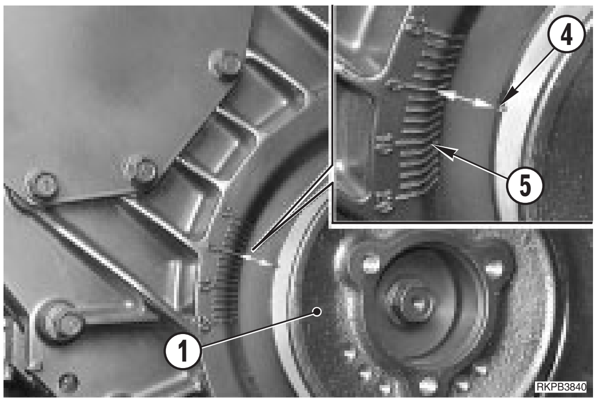
1 - Rotate crankshaft using engine pulley and put N. 1cylinder piston at top dead centre (TDC).



★ Top dead centre (TDC) is shown by notch (4) on pulley (1) positioned on «zero» of the scale (5) and by closing of both cylinder N. 1 valves.

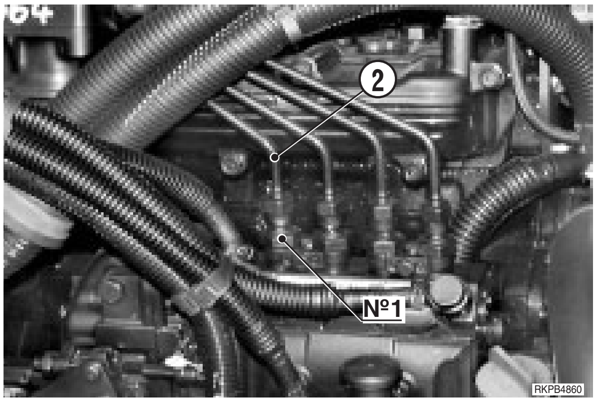
★ If the notch (4) of pulley (1) is in «zero» position on the scale (5) but cylinders N. 1 valves are not closed, rotate the crankshaft of 1 turn.

★ After recognition of TDC, rotate the crankshaft in counterclockwise direction (from pulley side view) of about 20°.

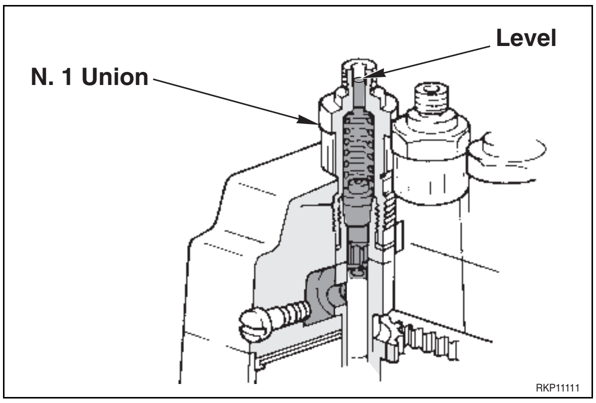


2 - Disconnect cylinder N.1 high pressure pipe (2) from injection pump.

3 - Rotate crankshaft slowly in clockwise direction from pulley side view, checking fuel level into the N. 1 delivery of injection pump.

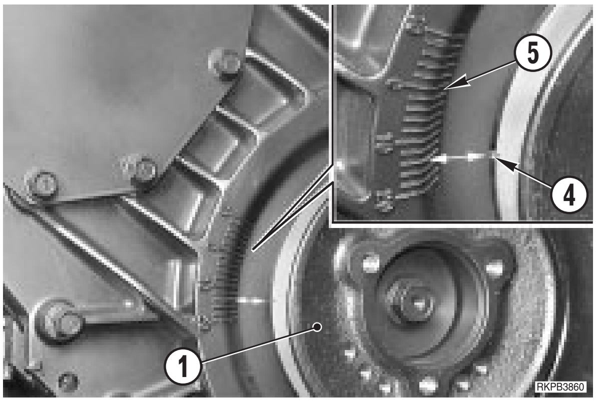


4 - Stop pulley (1) rotation as soon as fuel level starts to increase.

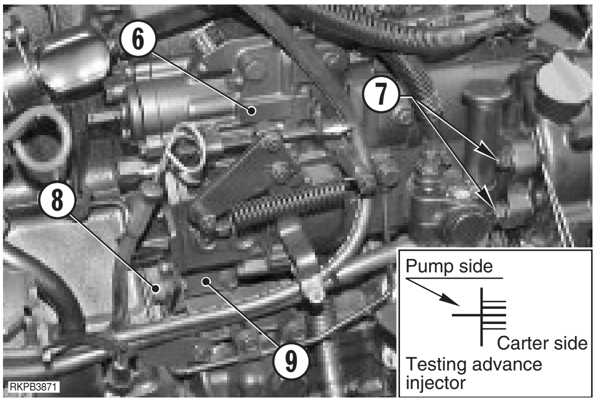


5 - Check notch (4) position on crankshaft pulley (1) compared with scale (5); reading value corresponds to angle of fuel injection timing.
   ★ With new belt, deflection must be of 13°– 15°

   NOTE. Repeat checking more than once.



6 - If injection timing is not on standard value, rotate injection pump (6) toward external or toward engine after loosening pump nuts (7) (quantity 4) and pump lock nuts (8) fixing the bracket (9) to injection pump.
   - To RETARD injection, rotate the pump (6) toward external.
   - To ADVANCE injection, rotate the pump (6) toward cylinders block.



7 - Tight the pump lock nuts (7) at cylinder block and the nut (8) fixing injection pump to bracket (9).

   Nuts: 34.2–44.1 Nm

   Bracket nut: 44.5.1–53.9 Nm

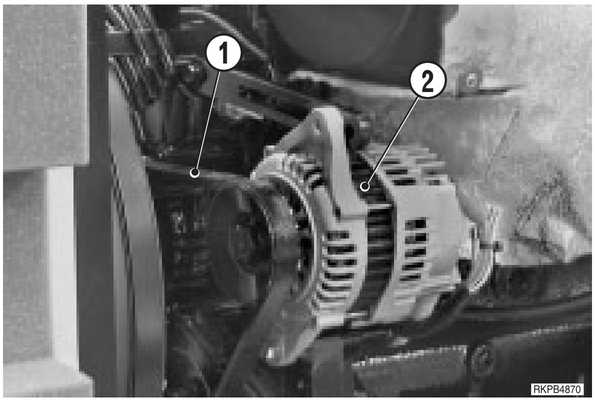
8 - Connect fuel delivery pipes (2) to pump.

   Delivery pipe unions: 19.6–24.4.5 Nm

TESTING AND ADJUSTING FAN BELT TENSION

1. Tension check

1 - Push fan belt (1) at midway point between alternator (2) and pulley operating water pump; check the deflection. With a pressure of 98 N, deflection should be of 10–15 mm; if this value is not reached, tension fan belt.
★ With new belt, deflection must be of 7–9 mm.



2. Fan belt tension

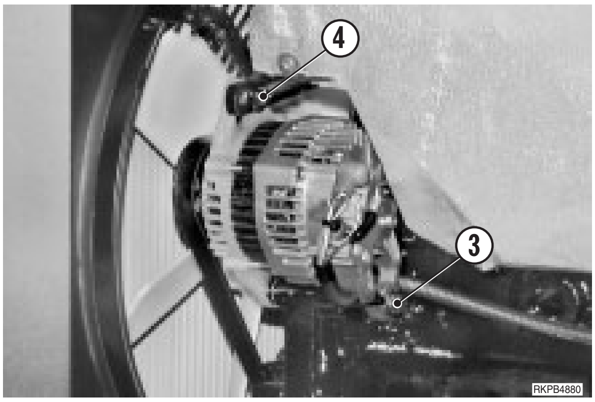
1 - Loosen mounting bolt (3) of the alternator (2) and mounting bolt (4) of adjustment plate.

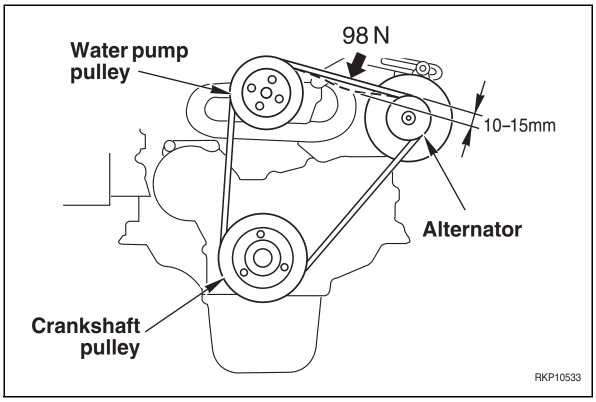
2 - Rotate the alternator (2) to give correct tension to fan belt (1) and tighten mounting bolts (3) and (4).

3 - Check fan belt (1) tension.
★ If belt has been replaced, check tension again after about 20 operating hours.

Mounting bolt (3): 44.1–53.9 Nm

Mounting bolt (4): 22.5–28.4 Nm

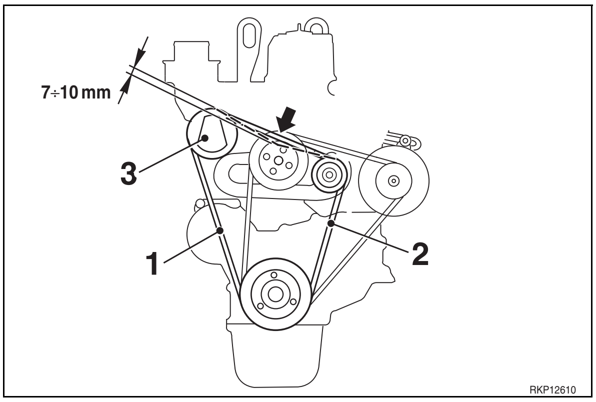




CHECKING AND TIGHTENING THE COMPRESSOR FAN-BELT

1. Checking tension

1 - Push fan belt (1) at midway point between compressor (2) and pulley (3). Check the deflection.
With a pressure of 98 N, deflection should be of 7–10 mm; if this value is not reached, tension fan belt.
★ With new belt, deflection must be of 4–6 mm.



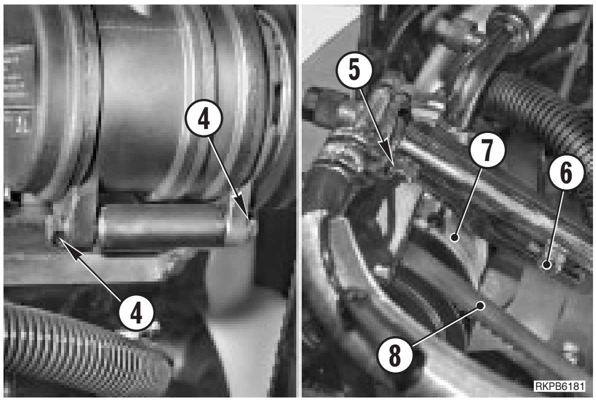
2. Fan belt tension

1 - Loosen bolts (4), (5) and (6) to leave free the compressor (7) to rotate.

2 - Rotate the compressor (7) for tension the belt (8) and lock the position with bolts (4), (5) and (6).

3 - Check fan belt (1) tension
★ If belt has been replaced, check tension again after about 20 operating hours.

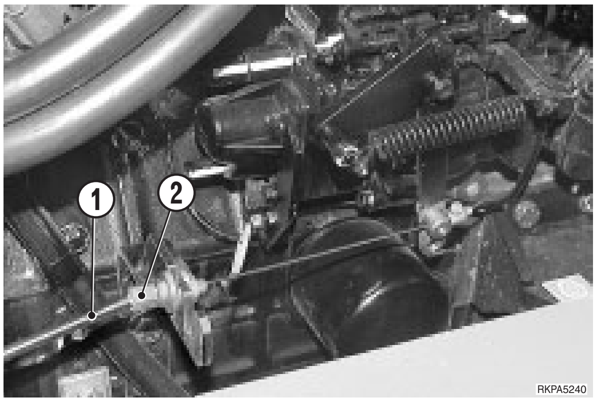
Bolt: 22.5–28.4 Nm



ADJUSTING THE STROKE OF THE ACCELERATOR LEVER

★ Test conditions:
- Engine: Switched off, but at working temperature.
- Low idling: within correct range.
- Hydraulic oil: 45–55°C
- Accelerator lever at the mid-point of its stroke.

1 - Use the stretcher (2) to eliminate clearance in the jacket (1).

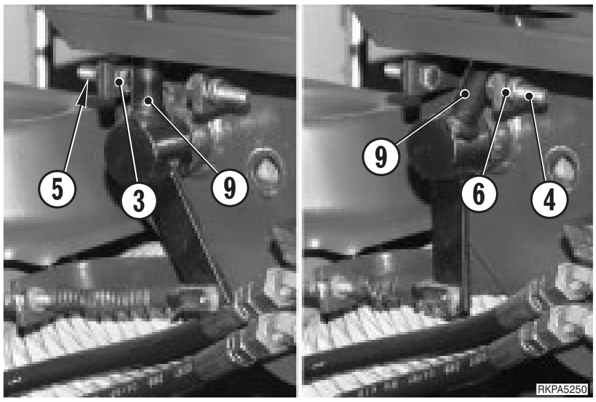


2 - Raise the right-hand cover in order to reach the screws (3) and (4).

3 - Unscrew the nuts (5) and (6) and tighten the screws (3) and (4) in the support.

4 - Move the accelerator lever (9) slowly towards low idling position. Stop this movement when the lever (7) on the cover of the injection pump comes into contact with the low idling adjustment screw (8).

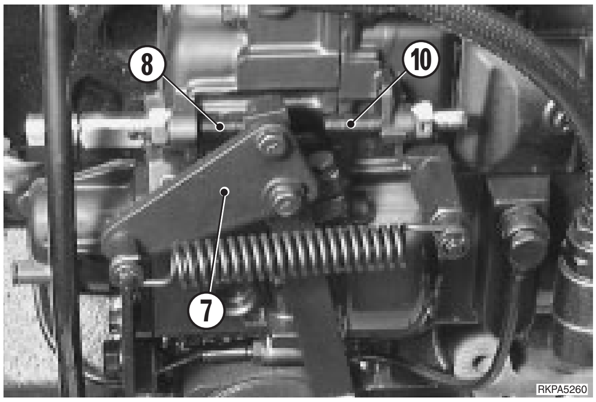
5 - Adjust the screw (3) until it is 0.1 mm from the lever (9) and lock it in this position with the nut (5).



6 - Move the lever (9) towards the high idling position. Stop this movement when the lever (7) on the cover of the injection pump rests against the lead-sealed high idling adjustment screw (10).

7 - Adjust the screw (4) to 0.1 mm from the lever (9) and lock it in this position with the nut (6).

★ After adjustment, replace the right-hand cover and check that the aperture does not impede the movement of the lever (9) towards its extreme positions.



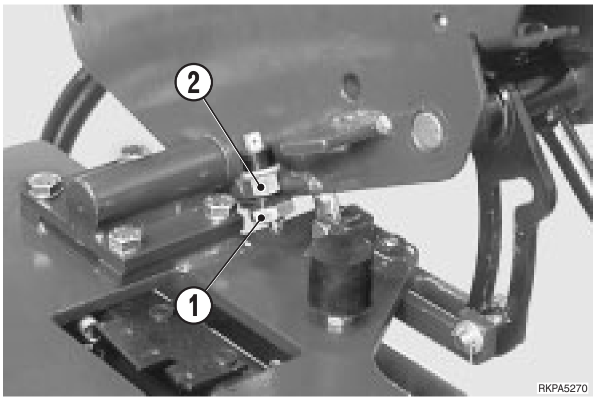
ADJUSTING THE SAFETY MICROSWITCH

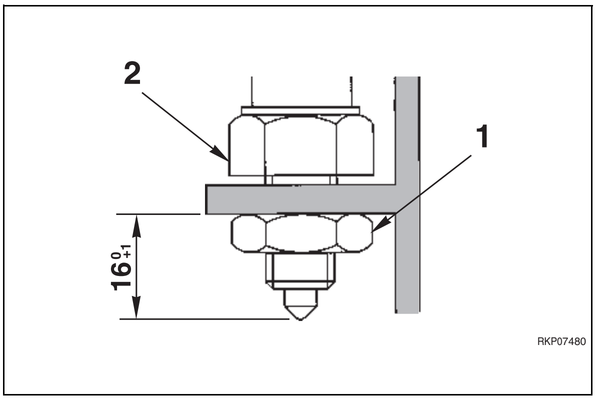
★ Test conditions:
- Engine: switched off but at working temperature.
- Hydraulic oil: 45–50°C.

1 - Unscrew the nut (1) that secures the microswitch (2).

2 - Tighten or unscrew the microswitch (2) to the extent indicated.
★ Projection of microswitch: 16^{0}_{+1} mm

3 - Secure it in position with the nut (1).



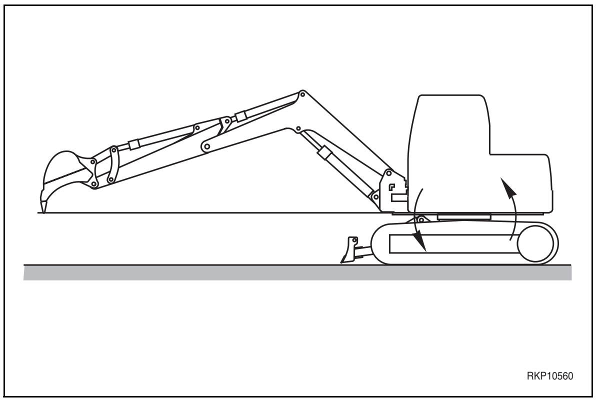


MEASURING THE SWING CIRCLE AXIAL CLEARANCE

1. Test procedure

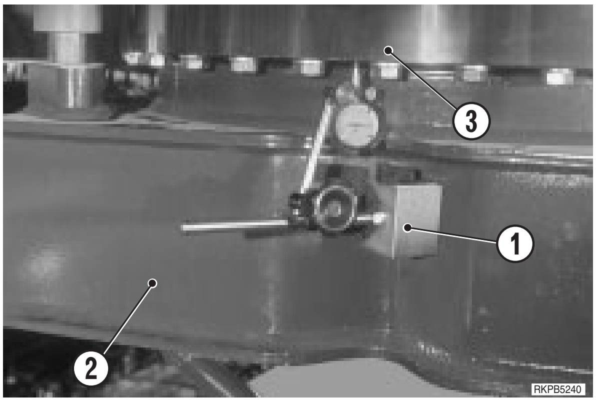
1 - Park the machine on firm, flat ground, revolving frame aligned with the track shoe.

2 - Extend the boom, the arm and the bucket, in such a way that they cover the maximum radius of action when the teeth of the bucket are at the same height as the lower platform of the revolving frame.



3 - Attach a comparator with a magnetic base (1) to the rear of the track frame (2), and so that the tracer rests below the outside ring of the swing circle (3).

4 - Preload the comparator by about 3 mm and set this measurement to zero.



5 - Close the bucket, position the arm perpendicular to the ground and rest the back of the bucket on the ground.

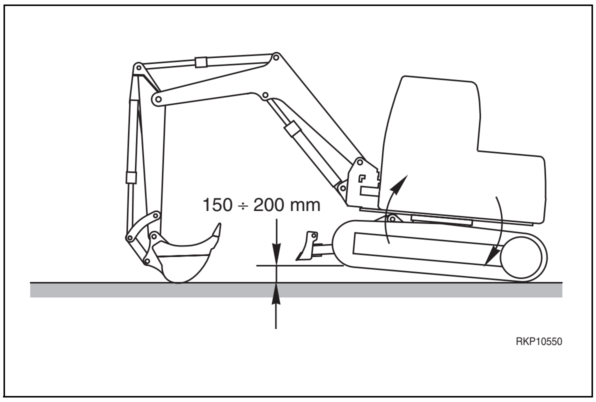
6 - Push down with the boom until the front of the machine rises, transferring the weight of the track frame onto the sprocket.

7 - Check the movement of the comparator (1) in these conditions. The value read corresponds to the value of the swing circle axial clearance.

★ For the standard value of the clearance, see «STANDARD MAINTENANCE».

⚠ While the machine is off the ground, take care not to put hands or feet beneath the track shoes.

8 - Return the machine to phase 2 conditions and check that the comparator returns to «zero». If it does not, repeat the test, starting at phase 4.



TESTING AND ADJUSTING TRACK-SHOE TENSION

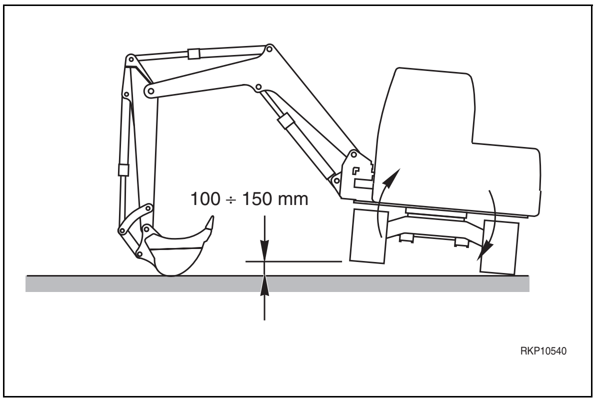
1. Test

★ Test conditions:
- Firm, flat ground.
- Work equipment resting on the ground.

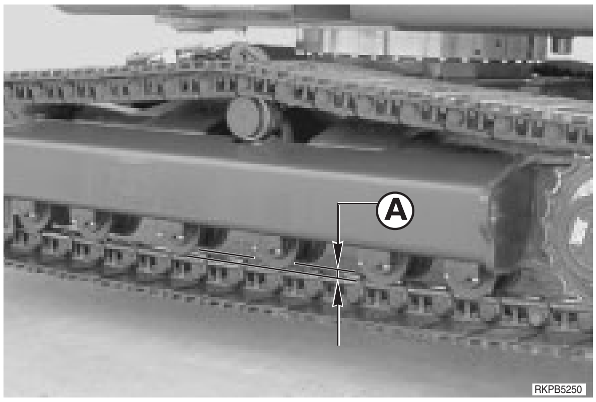
1 - Swing the turret 90° to the side of the track to be tested.

2 - Close the bucket, position the arm perpendicular to the ground and rest the bucket on the ground.

3 - Push down with the boom until the track-shoe to be tested has been raised completely from the ground.



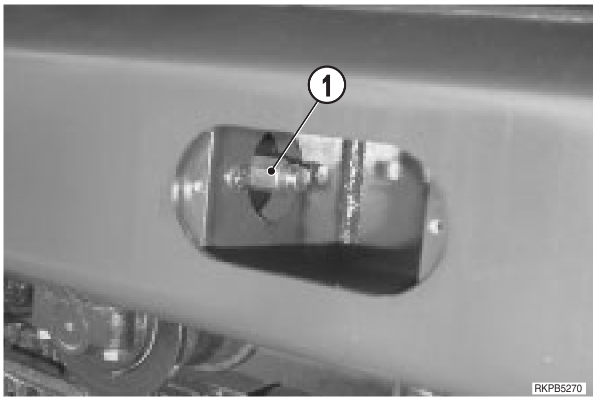
4 - Measure the distance between the track-shoe race and the central track rollers.
★ Measure «**A**» between track roller and track-shoe: 20–25 mm



2. Adjustment
If track-shoe tension is not within permissible limits, adjust them as follows.

★ Before introducing the grease-pump (2), and on completion of the adjustment, thoroughly clean the grease nipple and the surrounding area.

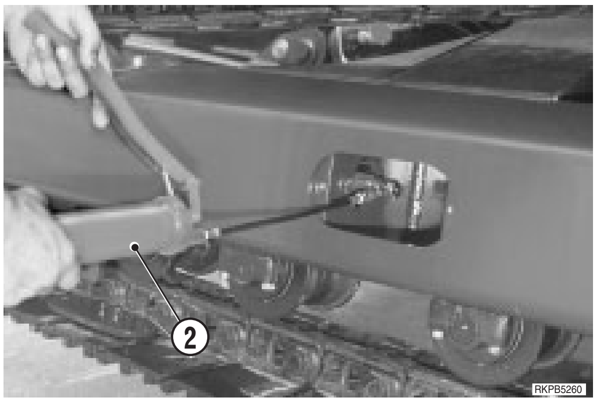
1 - If the tension is too slack.
Inject grease through the grease nipple (1).
★ If the grease proves difficult to inject, move the machine backwards and forwards slowly over a short stretch.



2 - If the tension is too tight.
Loosen the grease nipple (1) slowly to allow grease to flow out of the valve.

⚠ The grease contained in the stretching cylinder is under pressure and could injure the operator.
For this reason the valve should not be loosened by more than one turn.

★ If the grease does not flow easily, move the machine backwards and forwards slowly over a short stretch.



AIR BLEEDING FROM HYDRAULIC CIRCUITS

Order for operations and procedure for bleeding air

Air bleeding item / Nature of work	Lavori eseguitl					
	1	2	3	4	5	6
	Bleeding air from pump	Start engine	Bleeding air from cylinder	Bleeding air from swing motors	Bleeding air from travel motor	Start operations
• Replace hydraulic oil • Clean strainer	❍	❍	❍	❍ ★1	❍ ★1	❍
• Replace return filter element		❍				❍
• Replace, repair pump • Remove suction piping	❍	❍	❍			❍
• Replace, repair control valve		❍	❍		❍	❍
• Replace cylinder • Remove cylinder piping		❍	❍			❍
• Replace swing motor • Remove swing motor piping				❍		❍
• Replace travel motor, swivel • Remove travel motor, swivel piping					❍	❍

★1 Bleed the air from the swing motors or travel motors only when the oil inside the motor case has been drained

1. Bleeding air from pump P1

★ When the hydraulic oil tank is drained, or when the main pumps are removed for revision or replacement, air must be bleed from the intake circuit as follows:

1 - Loosen air bleed plug (1) from body pump (2).

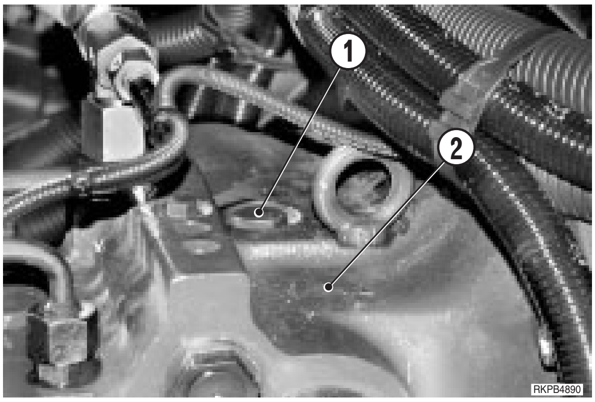
2 - Fill the tank with oil up to the level of the hole in the plug (1).

3 - Tighten plug (1).

Plug: 17.2±2.5 Nm

4 - Continue to fill the tank until the maximum level is reached.

5- Starting the engine and run the engine at low idling for 10 minutes. (See «BLEEDING AIR FROM HYDRAULIC CYLINDERS»).



2. Bleeding air from hydraulic cylinders

★ Once the hydraulic cylinders or the tubes connected to them have been removed, the air must be bleed as follows:

1 - Start the engine and run at idling for approx. 5 minutes.

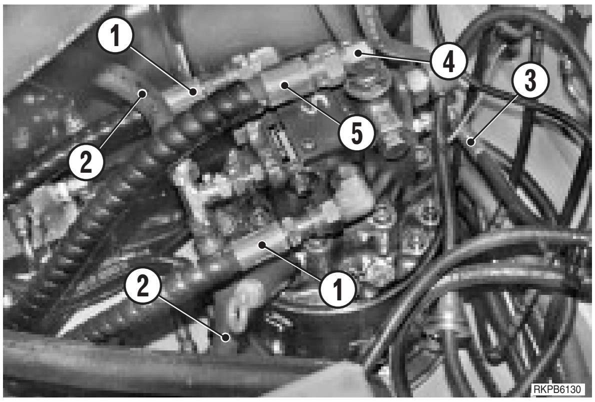
2 - Run the engine at low idling, then raise and lower the boom 4-5 times in succession.
   ★ Operate the piston rod to approx. 100 mm before the end of its stroke.

3 - Increase engine speed to high idling and repeat the operations described at point 2. Reduce engine speed to low idling and take the piston through its entire stroke until the hydraulic pump has reached maximum pressure.

4 - Repeat the operations (starting from point 2) for the cylinders of the 2nd boom, the arm and the bucket.

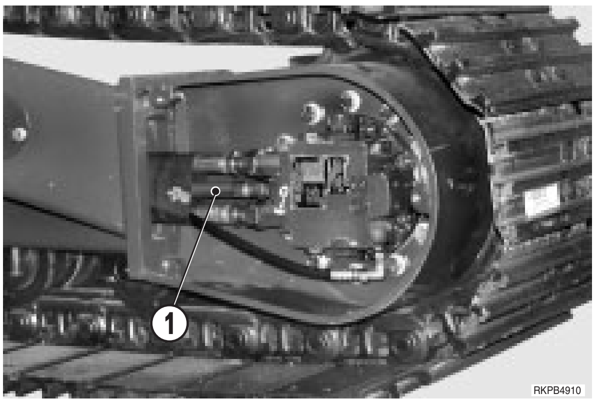
3. Bleeding air from swing motor

1 - Connect the supply pipe (1), the drainage pipes (2), the swing brake release pipe (3).
2 - Fill the swing motor case with hydraulic oil from union (4).
3 - Connect hose (5).
4 - Start engine at low idling for approx. 10 minutes.
5 - Slowly swing in both direction few times.



4. Air bleeding from travel motors

1 - Apply on drain union (1) a temporary hose to catch oil leakage.
2 - Start the engine and bring it to low idling speed for few minutes.
3 - Turn the upper structure of 90° and, pushing with boom on the bucket, raise the chain track from the ground.
4 - Slowly turn the raised chain track on both direction until from oil drain hose the oil comes out without air bubbles.
5 - Stop the engine and connect the drain hose (1).
6 - Repeat the drain operation also for the other chain track.



RELEASING RESIDUAL PRESSURE FROM THE CIRCUITS

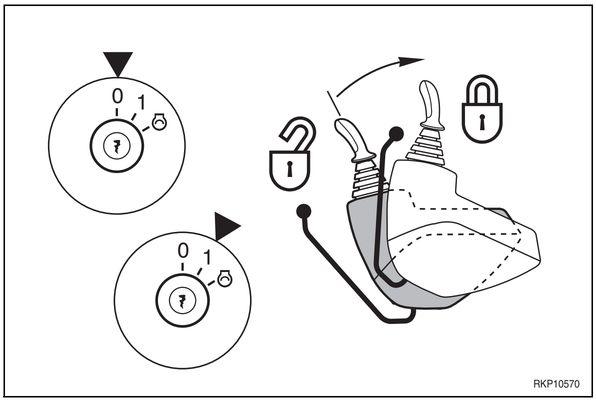
1 - Rest the work equipment on the ground and stop the engine.

2 - Put the ignition key at position «**I**» and move the control lever in all directions to relieve all pressure in the main hydraulic circuits and the PPC valves.

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

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

5 - Slowly loosen the oil-tank filler-cap to release any residual pressure.

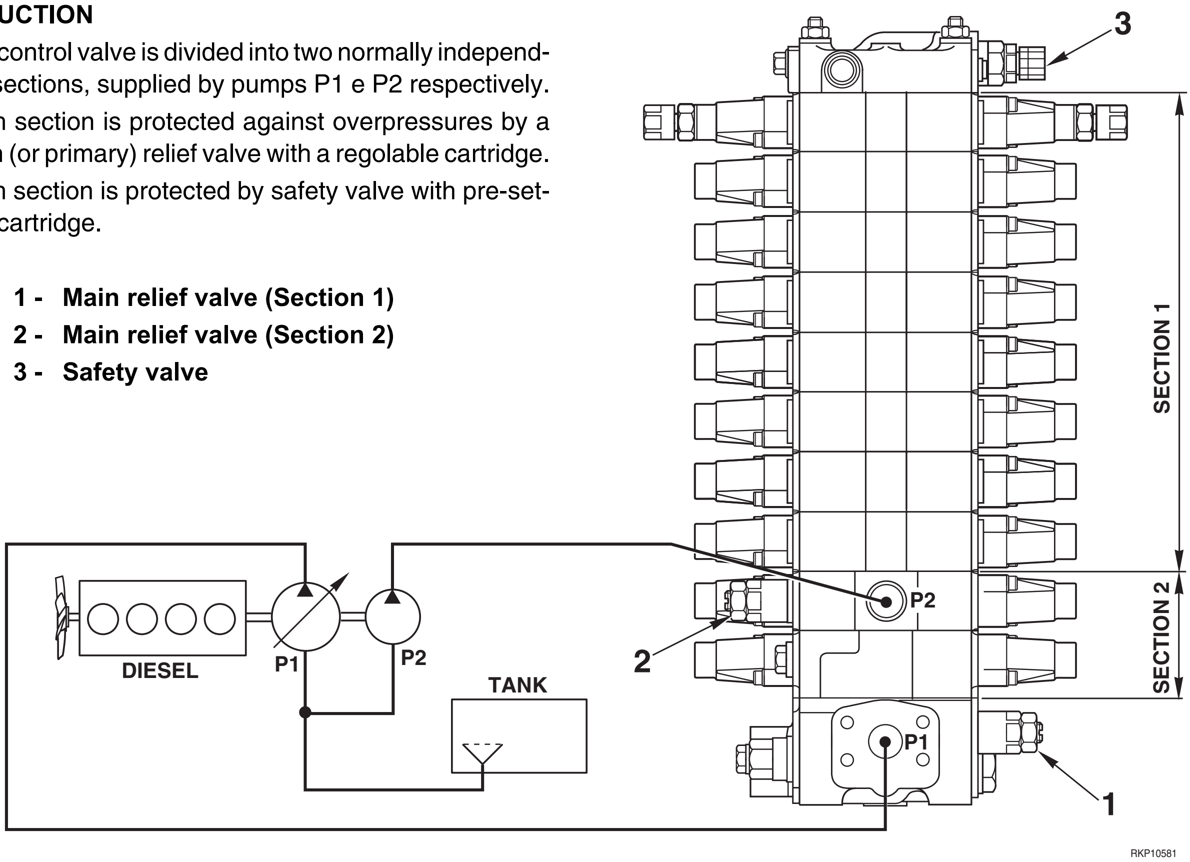


CHECKING AND REGULATING PRESSURE IN THE HYDRAULIC CIRCUITS

INTRODUCTION

- The control valve is divided into two normally independent sections, supplied by pumps P1 e P2 respectively.
- Each section is protected against overpressures by a main (or primary) relief valve with a regolable cartridge.
- Each section is protected by safety valve with pre-setting cartridge.

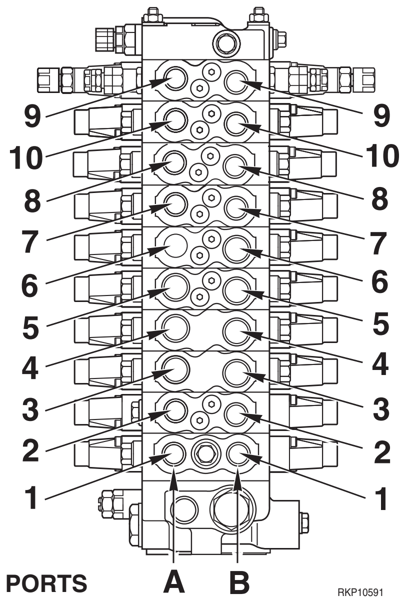
1 - Main relief valve (Section 1)
2 - Main relief valve (Section 2)
3 - Safety valve



- The sections consist of the spools that govern:

Section	Control	Ports
2	Swing (Left-Right)	A1 - B1
	Blade (Down-Up)	A2 - B2
1	L.H. travel motor (Forward-Backward)	A3 - B3
	R.H. travel motor (Backward-Forward)	A4 - B4
	Boom (Raise-Lower)	A5 - B5
	Arm (Open-Close)	A6 - B6
	Bucket (Curl-Dump)	A7 - B7
	Boom swing (Left-Right)	A8 - B8
	Attachment (L.H. side - R.H. side)	A9 - B9
	✻ 2-piece boom	A10 - B10

✻ Optional



TESTING AND SETTING OF MAIN VALVES

★ Check condition:
- Engine: at working temperature
- Engine idling MIN. and MAX.: within standard values
- Hydraulic oil: 45–55°C
- WORKING MODE selector: position P
- Swing lock pin: applied.

Release the remain pressure from circuits.
(See «REMAIN PRESSURE REMOVAL FROM CIRCUITS»).

1. Main valve Section 1

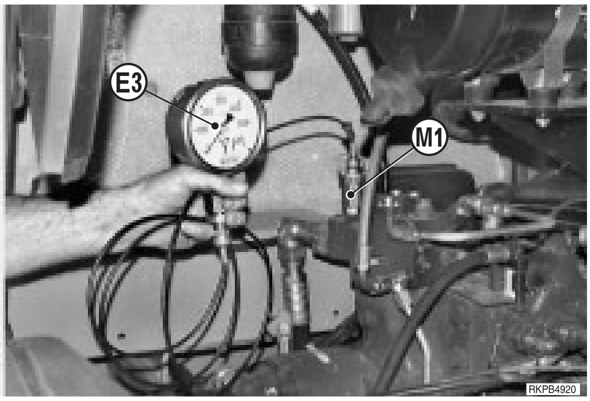
Release the remain pressure from circuits.
(See «REMAIN PRESSURE REMOVAL FROM CIRCUITS»).

1 - Connect to pressure port **M1** the gauge **E3** (400 bar).

2 - Start the engine and bring the accelerator on high idling speed position.

3 - Acting on one of upper attachments (boom, arm, bucket) bring the piston rod at the end of its stroke and check that the pressure value reading on gauge is 275±20 bar.

★ If the reading values on gauge are not the same as shown, proceed to main valves setting.



2. Main valve Section 2 and swing motor safety valve

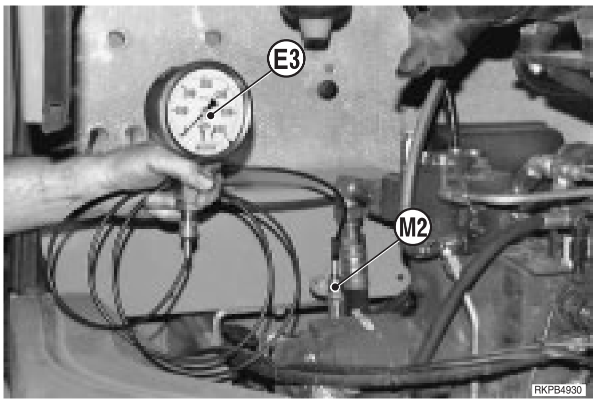
1 - Connect to pressure port **M2** the gauge **E3** (400 bar).

2 - Start the engine and bring the accelerator on high idling speed position.

3 - Raise the blade up to the end of stroke and check that the gauge connected to port **M2** shows a pressure of 216±20 bar.

4 - Put the blade on the ground and make the upper structure swing on both directions; check that the gauge connected to port **M2** shows a pressure value of 216±20 bar.

★ If the pressure values are lower than the value shown, check the safety valves of swing motor.



3. Main valves setting

To make the valve setting, prepare the machine in the same way as for pressure testing.

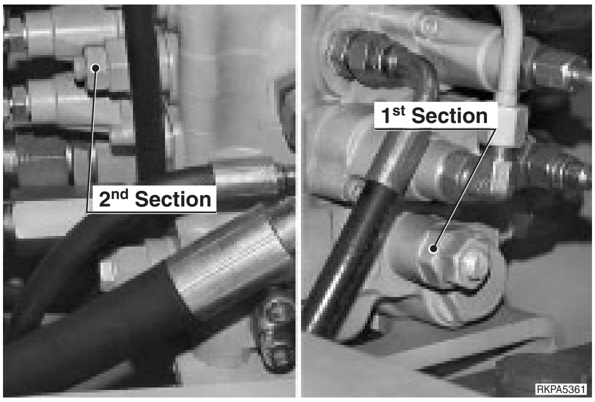
1 - Loosen the locking nut (1).

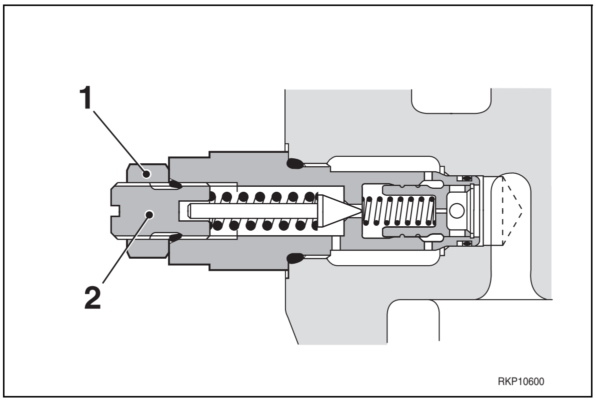
2 - Adjust the pressure with screw (2).

- To INCREASE the pressure turn in CLOCKWISE direction.
- To DECREASE the pressure turn in COUNTER-CLOCKWISE direction.

3 - Lock the position with nut (1).

Locking nut: 49–59 Nm





ADJUSTING PC VALVE

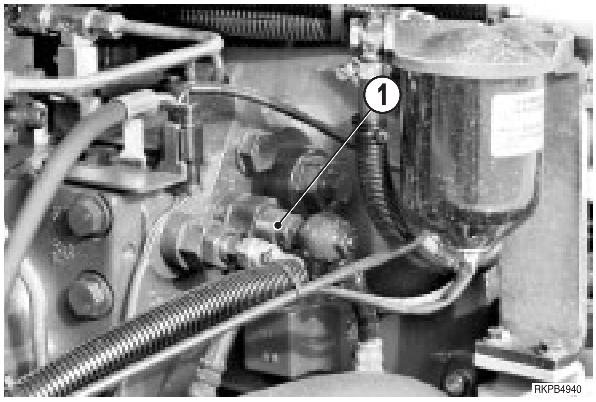
★ In case the engine speed lowers as a load becomes larger, or in case the work equipment speed is slow even though the engine speed, pump discharge pressure and LS differential pressure are normal, adjust the PC (1) valve according to the following procedure.

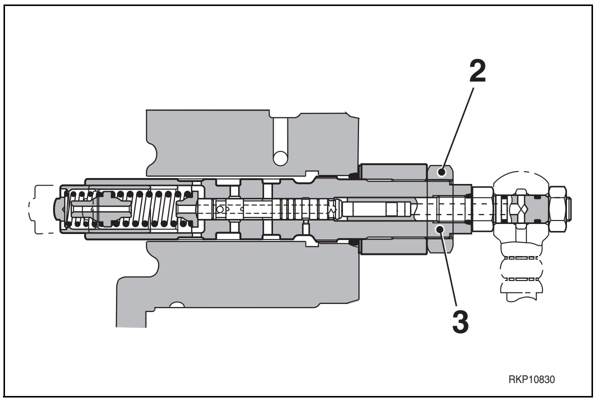
1 - Loosen the lock nut (2). For the cases of slow speed, turn the sleeve (3) clockwise, and for the cases of lowering of engine speed, turn the sleeve counterclockwise.

  ★ Clockwise rotation of the sleeve «increases» the suction torque of the pump, and counterclockwise rotation «decreases» the absurption torque.

★ Rotation range of the sleeve (3) shall be within 180° for both clockwise and counterclockwise.

2- After adjustment finished, tighten the lock nut (2).

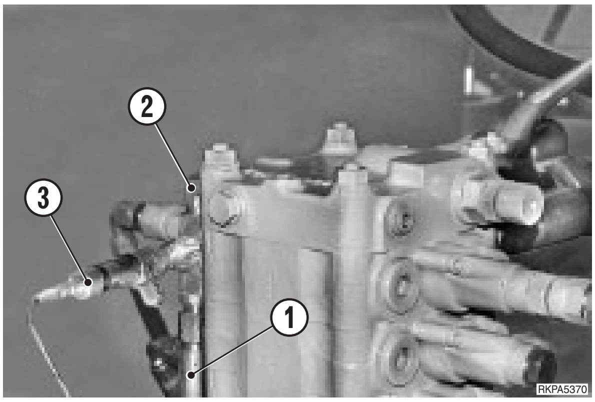


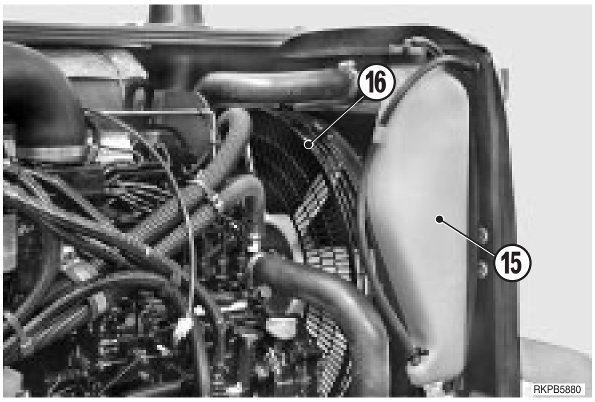


MEASURING LS DIFFERENTIAL PRESSURE AND ADJUSTING LS VALVE

1. Measuring ΔP_{LS} differential pressure

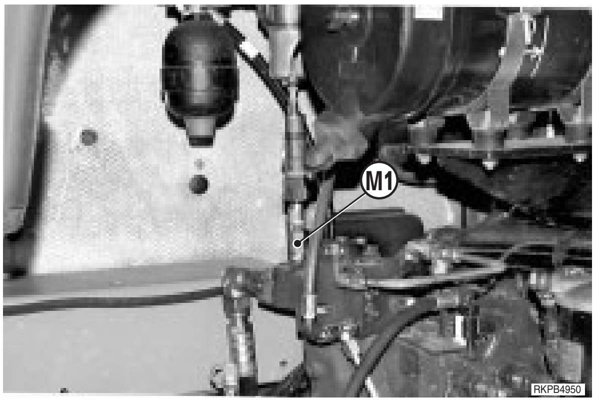
i) Disconnect pipe (1) and connect a Tee on the union (2); screw an adapter (3) on the Tee.
Connect pipe (1).





ii) Connect the pressure gauge **E5** to adapter (3) on control valve and to adapter **M1** (delivery pump P1).

iii) Measure the ΔP_{LS} differential pressure according to the conditions shown in table 1.



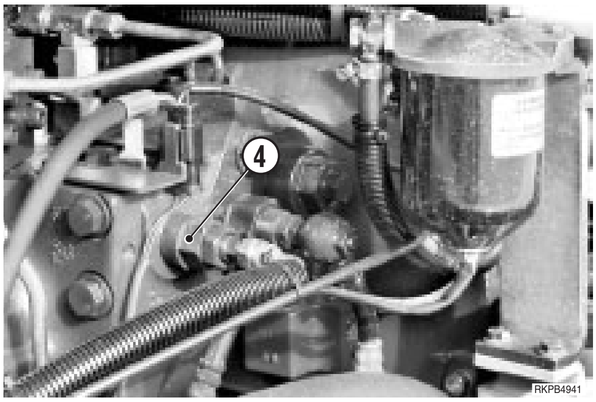
TTable 1

Work mode	Fuel lever	Operation	Differential pressure
P	Full	Lever at NEUTRAL	–
p	Full	Vehicle speed with increment Travel idling (lever full)	$21.5^{0}_{+}3$

NOTE: Travel idling at one side

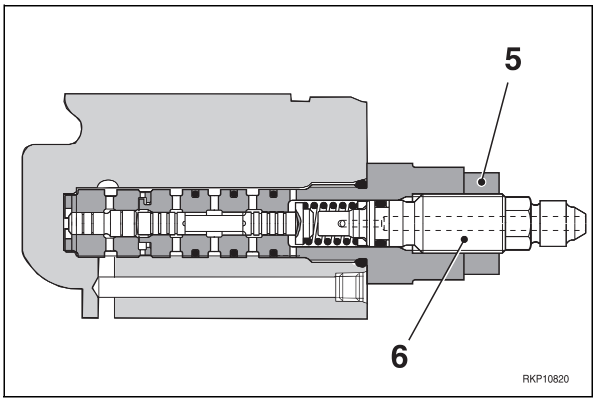
2. Adjusting of the LS valve

If the values obtained during the measurement of the differential pressure according to the foregoing conditions are not in the standard value range, adjust the LS valve (4) according to the following procedure.



1 - Loosen the lock nut (5) and turn the screw (6) to adjust.

- Turn the screw:
  CLOCKWISE to increase the differential pressure;
  COUNTERCLOCKWISE to decrease the differential pressure.



2 - After the adjustment finished, tighten the locknut (5).

NOTE: Make sure to adjust the LS valve with measuring the differential pressure.

CHECKING AND ADJUSTING PRESSURES IN THE SERVOCONTROL FEED UNIT

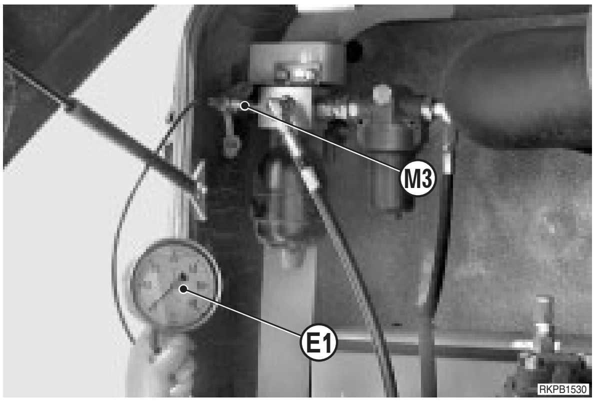
★ Test conditions:
- Hydraulic oil: 45–55°C.

Release any residual pressures from the circuits (See «RELEASING RESIDUAL PRESSURES FROM THE CIRCUITS»).

1 - Connect the pressure gauge **E1** to the adapter **M3**.

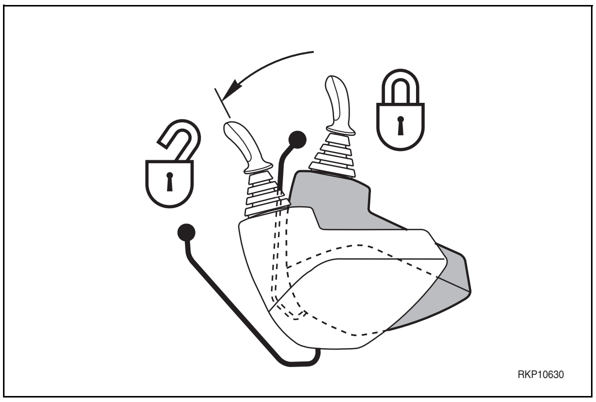
2 - Start the engine and move the accelerator into its maximum position.

3 - Put the lever of the safety device in its working position, (UNLOCKED).



4 - Bring a servocontrol circuit up to pressure by operating the work equipment (i.e. bucket).

5 - Check the working pressure on the pressure gauge **E1**
★ Working pressure: 32^{-2}_{+1} bar
★ If the working pressure is lower that the permissible value, check servocontrol feed unit valve.



MEASURING PUMPS DELIVERY AND FLOW CONTROL STARTING POINT PUMP P1

★ Test conditions:

- Engine: at working temperature.
- Hydraulic oil: 45–55°C
- WORKING MODE selector: position P.
- Work equipment on the ground and made safety.
- Swing lock pin inserted

1. Connecting the flowmeter

1 - Disconnect the delivery tube of the pump to be tested.

2 - Connect the delivery outlet of the pump to the inlet port of the flowmeter **F1**.

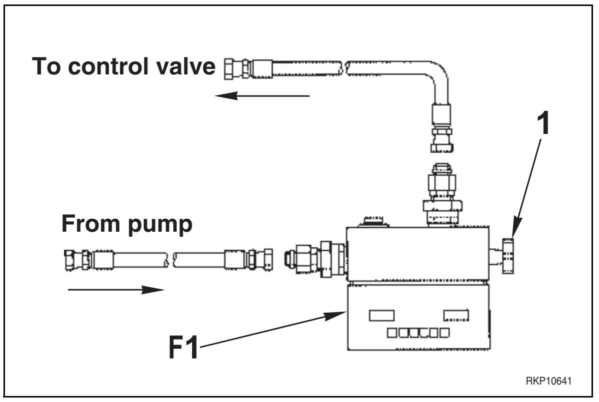
3 - Connect the discharge port of the flowmeter to the tube disconnected in phase 1.

4 - Mount a rev. counter (**C1** or **C2**) to measure that the delivery from the tested pump is within the tolerances allowed for the rated engine rpm.

★ If an electronic pressure-transducer type rev. counter is installed on a diesel supply tube to the nozzle, make sure that it is mounted at a distance from the hose-clamps.

★ 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: 1950 rpm
Delivery: 108.80 ℓ/min
PROPORTIONAL DELIVERY AT 2000 rpm

$$\frac{108.80}{1950} \times 2000 = 111.6\ \ell/\text{min}$$



2. Measurement for pump P1

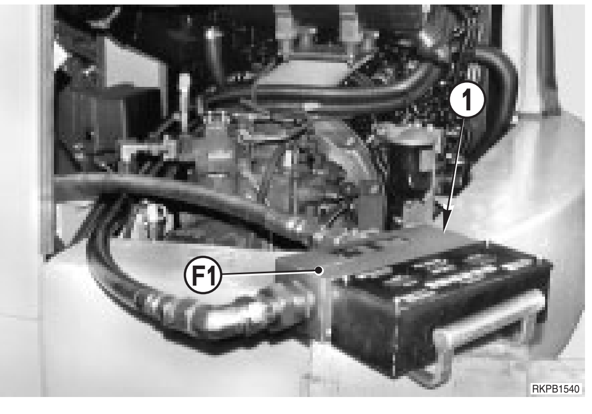
1 - Start the engine and bring it up to a speed of 2200±10 rpm with pump under load and WORKING MODE in **P** position.

2 - Start the low speed travel and adjust the delivery pressure with the flowmeter **F1** knob (1) regulated at 200±1 bar.

3 - Check the flow with the value of «TECHNICAL DATA» and making if necessary, the proportional calculating to obtain the flow values referred to 2200±10 rpm necessary to make the control.

If the measured values are lower than those permissible, it is necessary to overhaul or to replace the pump.

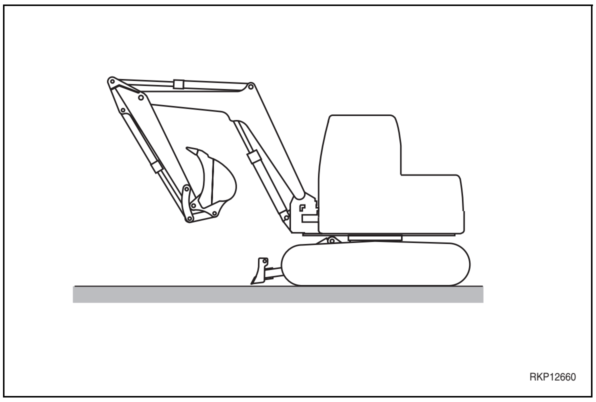
4 - Turn the WORKING MODE selector on position **E,** reduce the pressure with flowmeter knob at 100±1 bar and repeat the checks comparing the flow values with «TECHNICAL DATA».



MEASURING TRAVEL DEVIATION

★ Test conditions:
- Engine: at working temperature
- Hydraulic oil: 45–55°C
- WORKING MODE selector: position P.
- Track-shoe tension: within the correct range
- Engine speed: high idling

★ Let the machine travel over a firm, flat surface.

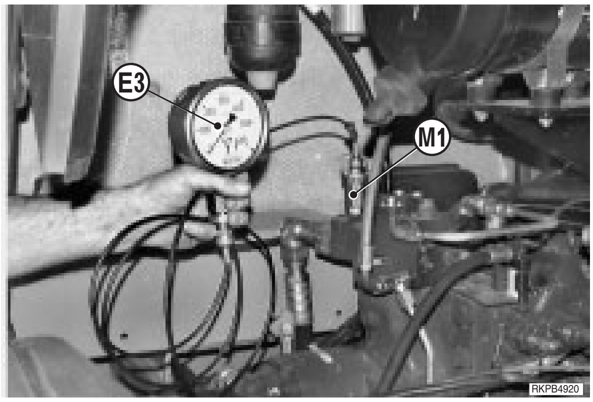


1. Measuring the deviation

Release any residual pressures. (See «RELEASING RESIDUAL PRESSURES FROM THE CIRCUITS»).

1 - Connect the pressure gauge **E3** (400 bar) to adapter **M1**

★ Place the pressure gauge in the cab for consulting during the travel.



2 - For this measurement the boom, arm and bucket must be folded into the appropriate travelling positions.

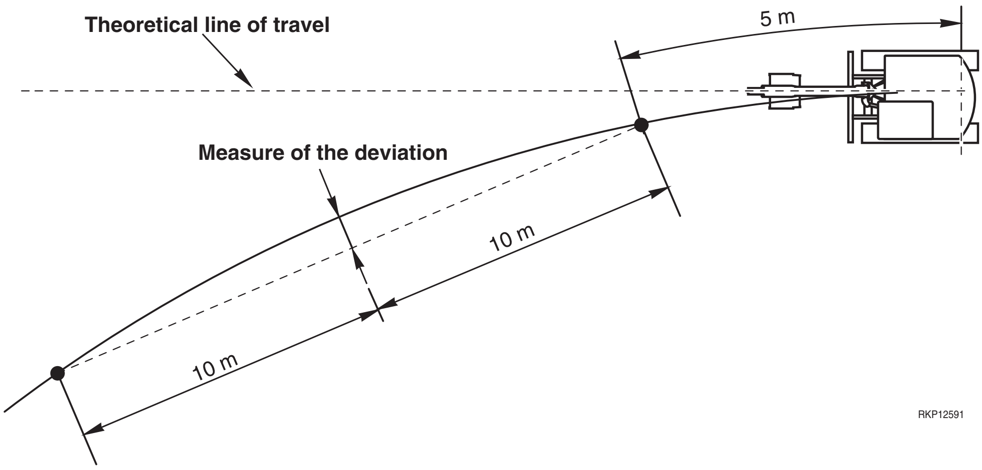
★ Fully extend the cylinder of the arm and bucket, and position the boom at 45°.

3 - Bring the engine up to high idling speed.

4 - Push the travel lever forwards to the end of its stroke.

5 - Travel for 5 metres and then measure the deviation accomplished by the machine over the next 20 metres.

★ During travel operation check discharge pressure of pump P1.



ADJUSTING THE MAXIMUM SPEED OF THE TRAVEL MOTORS

★ Test conditions:
- Engine: at working temperature.
- Hydraulic oil: 45–55°C
- WORKING MODE selector: position P.
- Track-shoe tension: within the correct range

1. Test

1 - Swing the revolving frame 90° towards the track-shoe to be checked, and position the arm perpendicular to the ground.

2 - Rest the back of the bucket on the ground and, pushing down with the boom and the arm, raise the machine until the track-shoe is at least 10 cm above the ground.

3 - Make a distinct mark (1) for the test.

4 - Bring the engine up to high idling speed.

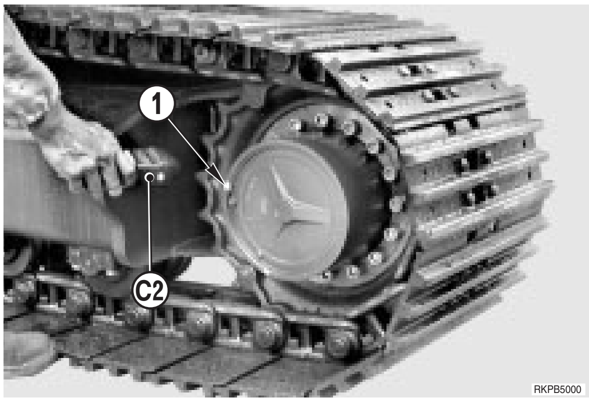
5 - Move forwards the travel lever of the travel motor to be tested and press the speed increment pedal.

6 - Measure the rotation speed of the driving wheel with the tachometer **C2**.
★ Low speed: 36^{-4}_{+2} rpm

7 - Change to high speed travelling and check again.
★ High speed: 55^{-6}_{+3} rpm

8 - Make this measurement in both directions of rotation and for both track shoes.

⚠ The rotation speed should be the same for both motors.

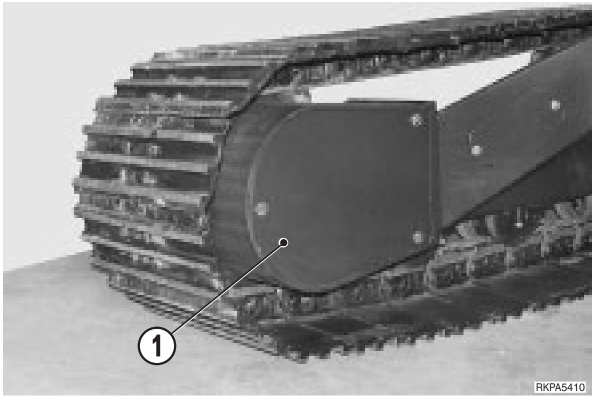


MEASURING INNER OIL LEAKAGE OF TRAVEL MOTOR

★ ⚠ Check condition:
- Hydraulic oil: 45–55°C
- WORKING MODE selector: position P
- Tracks tension: within the permissible values
- Upper structure: turned of 180°.

1 - Remove the covers (1).

2 - Disconnect drain hose (2) from the travel motor to check and fit a blind plug at the hose end.



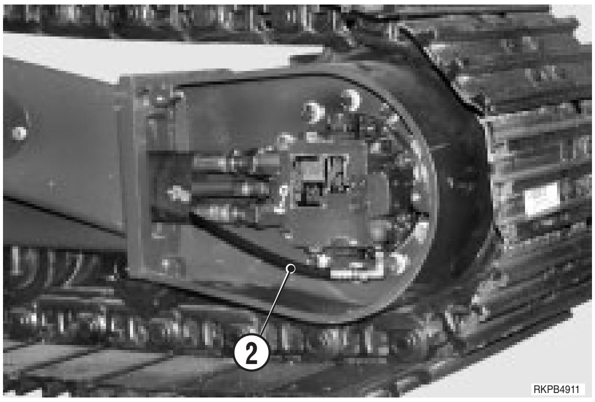
3 - Connect to travel motor a temporary hose «**A**» to catch possible oil leakages.

4 - Put a steel bar «**B**» of 70 mm diameter between sprocket and frame.

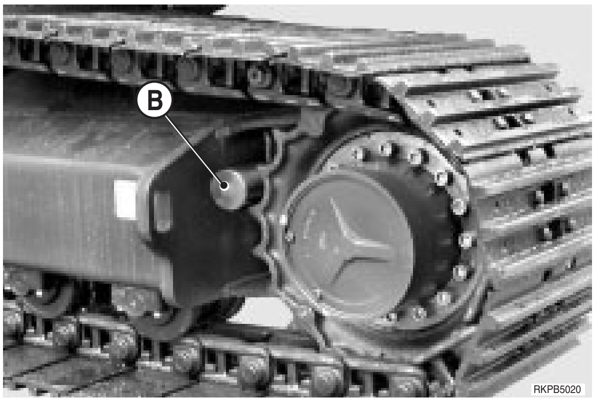
5 - Run the engine and start to rotate the blocked sprocket; bring gradually the engine at full throttle and bring the travel lever control to the end of its stroke.

6 - Relieve the circuit for 30 seconds and then measure the leakage for the next minute.

★ When measuring, move the motor slightly (move the position \of the valve plate and cylinder, and piston and cylinder), and measure several times.



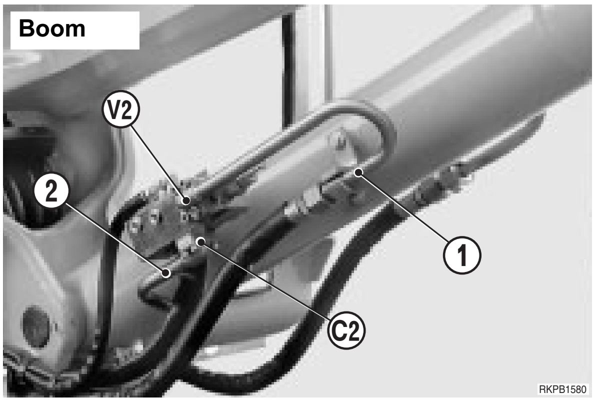
7 - Stop the engine and, with the same procedure, make the measuring for the other travel motor.



ADJUSTING BOOM AND ARM SAFETY VALVES

★ Test conditions:
- Engine: at working temperature
- Hydraulic oil: 45–55°C
- WORKING MODE selector: position P
- Secondary valves: set to normal values. (See «SETTING OF PRIMARY AND SECONDARY VALVES»).

1 - Rest the work equipment on the ground, stop the engine and release any residual pressures. (See «RELEASING RESIDUAL PRESSURES FROM THE CIRCUITS»).

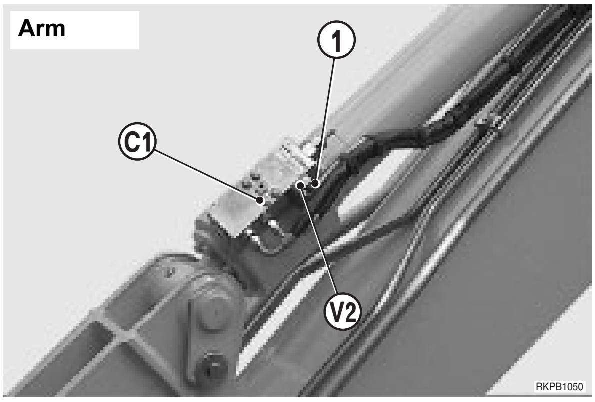


2 - Disconnect the pipe (1) from the coupling **V2** and the pipe (2) from coupling **C2**.
★ Disconnect the safety valve from the arm cylinder.

3 - Cap the pipe (2) to prevent entry of impurities.
★ For the arm, cap the cylinder.

4 - Connect the tube (1) to the coupling **C2**.
★ For the arm, connect the flange **V2** to the coupling **C2**.

5 - Unscrew the nut (6) and remove the threaded rod (5) and the nut (4).



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

7 - Bring the boom cylinder bottom side or the arm cylinder head side slowly up to maximum pressure (270 bar), checking that no oil leaks out of the valve.

8 - Maintaining pressure, adjust the valve with the screw (3), until a slight leakage of oil (just a few drops every minute) is seen coming from the flange **V2**.
- To INCREASE pressure, turn in a CLOCKWISE direction.
- To DECREASE pressure, turn in an COUNTER-CLOCKWISE direction.

★ Every turn of the screw (3) changes the pressure by 110 bar.

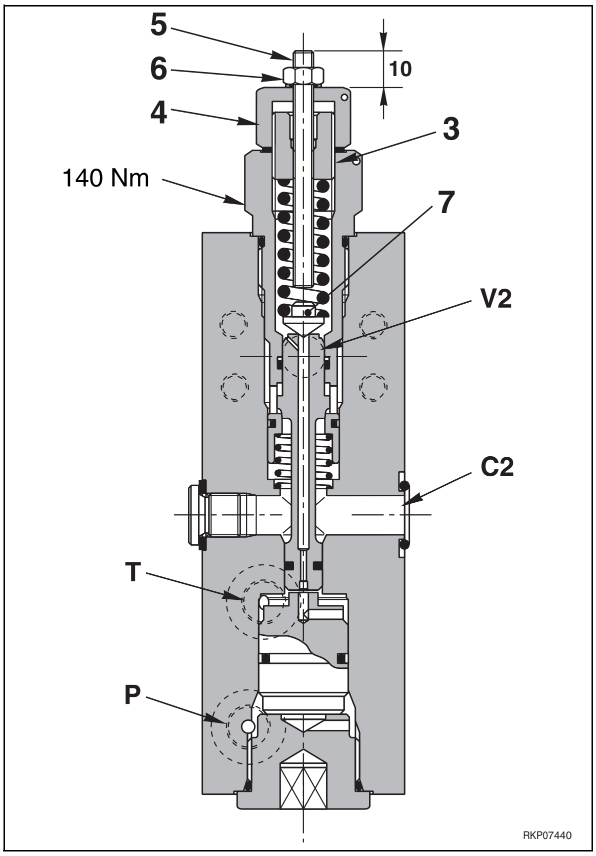
9 - Block the screw (3) in position with the nut (4).

Lock nut (4): 70 Nm

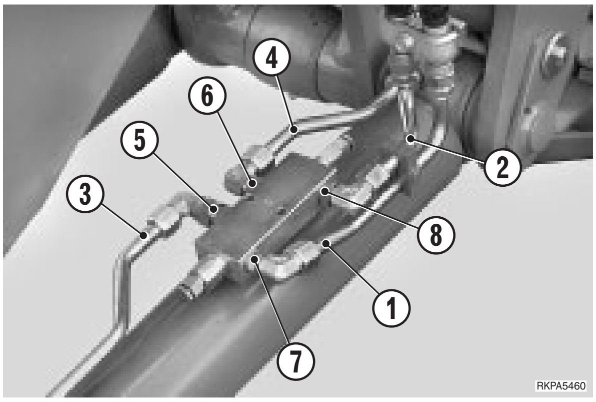
10 - Screw the rod in (5) until it comes into contact with the retaining element (7) and then turn it back for 5-6 turns. Secure it in position with the nut (6).

11 - Rest the equipment on the ground, stop the engine, and release any residual pressures.

12 - Re-assemble the valve connections.



ADJUSTING 2nd BOOM SAFETY VALVES



★ Test conditions:
- Engine: at working temperature
- Hydraulic oil: 45–55°C
- WORKING MODE selector: position P
- Secondary valves: set to normal values. (See «SETTING OF PRIMARY AND SECONDARY VALVES»).

1 - Rest the work equipment on the ground, stop the engine and release any residual pressures (See «RELEASING RESIDUAL PRESSURES FROM THE CIRCUITS»).
★ Adjust the valves of one cylinder at a time.

2 - Disconnect the pipes (1), (2), (3) and (4).

3 - Use hoses of equal section to connect up the pipes in the following manner:
pipe (1) port (5).
pipe (2) port (6)

4 - Cap pipes (3) and (4) to prevent entry of any impurities.

5 - Remove the access caps (9) to the adjustment screws (10) and (11).

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

7 - Move the 2nd boom pedal to the end of its opening stroke.

8 - Adjust the valve (12) until a slight leakage of oil can be seen from the flange (8).
- To INCREASE pressure, turn in a CLOCKWISE direction.
- To DECREASE pressure, turn in an COUNTER-CLOCKWISE direction.

★ Every turn of the screw changes the pressure by 165 bar.

9 - Move the 2nd boom pedal to the end of its closing stroke.

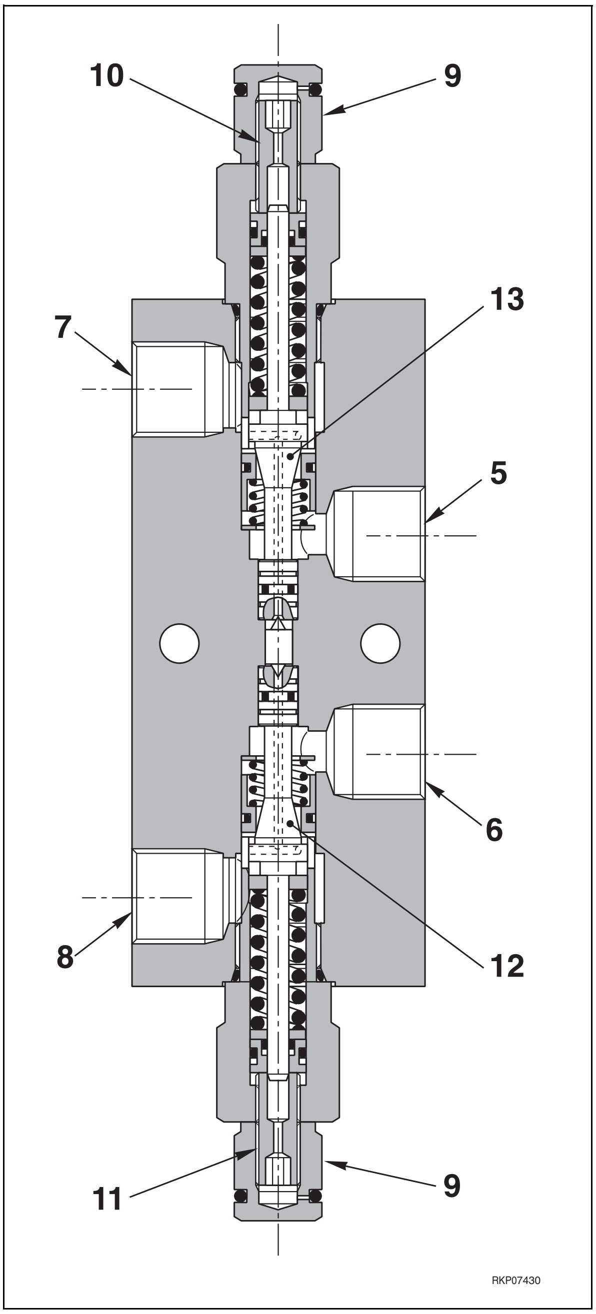
10 - Using the procedure indicated in point 8 adjust the valve (13) until a slight leakage of oil is visible from the port (7).

11 - Stop the engine and release any residual pressures.

12 - Replace the caps (9) and re-assemble the hydraulic circuits.

Lock nut: 20 Nm

13 - Repeat the same regulation operations for the valves of the other cylinder.



MEASURING AND SETTING OF PRESSURE SWITCH SIGNAL OVERLOAD OPERATION

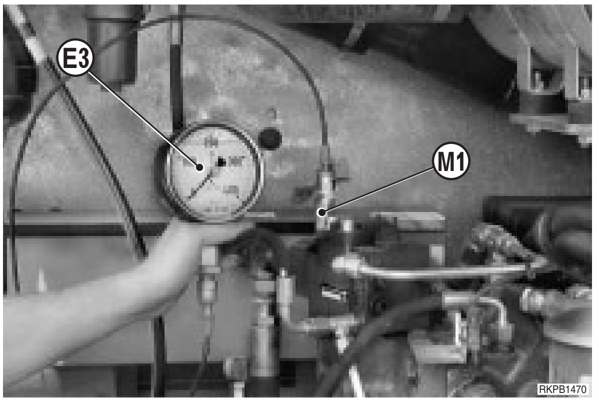
★ Check condition:
- Engine: at working temperature
- Hydraulic oil: 45–55°C

1 - Connect to pressure port **M1** the gauge **E3** (400 bar).

2 - Start the engine and bring it at medium throttle.

3 - Apply the overload alarm.

4 - Raise boom until the lift end of stroke and increase lowly the pressure; check the pressure value when appear the overload signal.
  ★ Standard operating pressure: 130 bar



Setting
If the operating pressure in not within the standard limits, make the pressure switch (1) setting as follows:

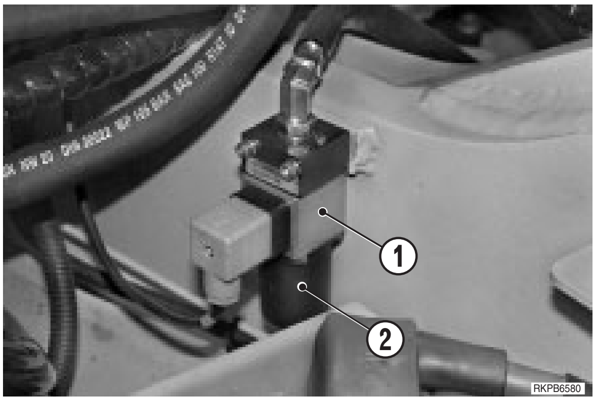
1 - Remove cover (2).

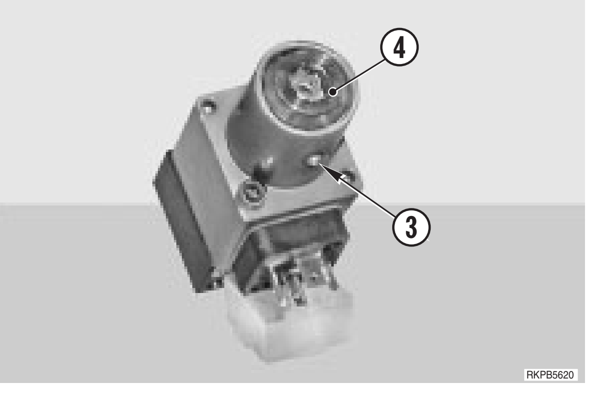
2 - Raise the boom checking on gauge **E3** that hydraulic cylinder approach the operating pressure.

3 - Loose the dowel (3) and turn the adjusting screw (4) until to obtain the overload alarm signal.
- To INCREASE the operating pressure, turn the screw in CLOCKWISE direction.
- To DECREASE the operating pressure, turn the screw in COUNTERCLOCKWISE direction.

4 - Lock the position with dowel (3).

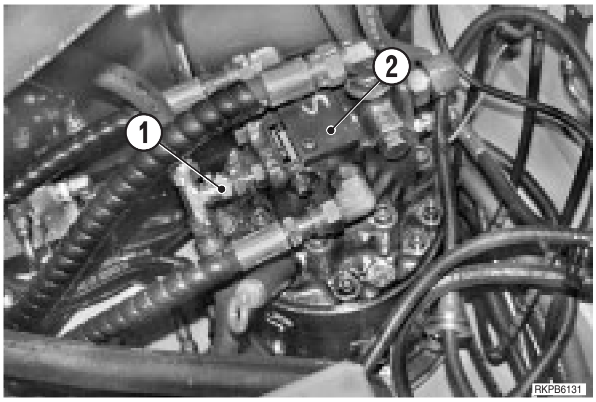
5 - Release the pressure and repeat several times the measuring to check the setting stability.





MEASUREMENT OF INTERNAL OIL LEAKAGES IN THE SWING MOTOR

★ Check condition:
- Engine: at working temperature
- Hydraulic oil: 45–55°C
- WORKING MODE selector: position P
- Revolving frame: secured by the rotation-blocking pin.



1 - Disconnect the drainage hose (1) of the motor (2).

2 - Attach a provisional hose to collect the drainage oil.

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

4 - Push the swing control lever as far as it will go.

5 - Hold it in this position for 30 seconds and then measure the oil leakage for the next minute.

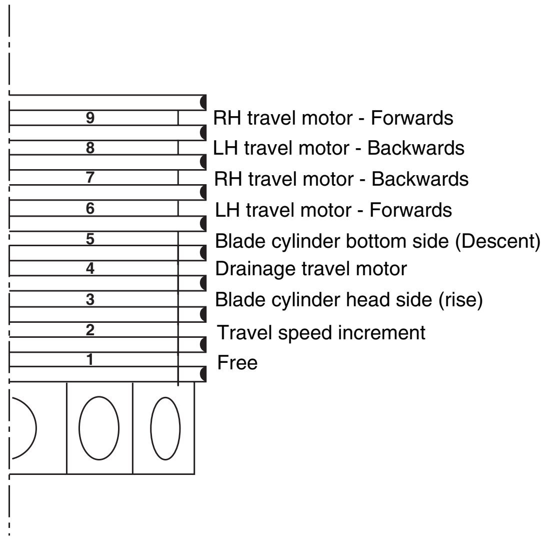
6 - Reduce motor speed to low idling, swing the revolving frame 180° and repeat the measurement.

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

8 - Reassemble the hydraulic drainage circuit.

CHECKING FOR LEAKAGES INSIDE THE SWIVEL JOINT

★ Check condition:
- Engine: at working temperature
- Hydraulic oil: 45–55°C
- WORKING MODE selector: position P.



1. Functionality test

1 - When one of the lower-level tools (blade, travel motors, speed increment, brakes) is found to be defective, one of the causes of the failure may be the swivel joint.

2 - To confirm the defect it is sufficient to by-pass the joint by connecting (using an additional length of tubing) the input and output hoses of the joint of the branch to be checked.
If the defect disappears, it is certainly due to the swivel joint.
If the defect remains, it can be due to other causes, but not to the swivel joint.

2. Identification of defective seal

⚠ These tests should be performed on those branches subjected to working pressures. Tests on unstressed or unused branches are therefore excluded.

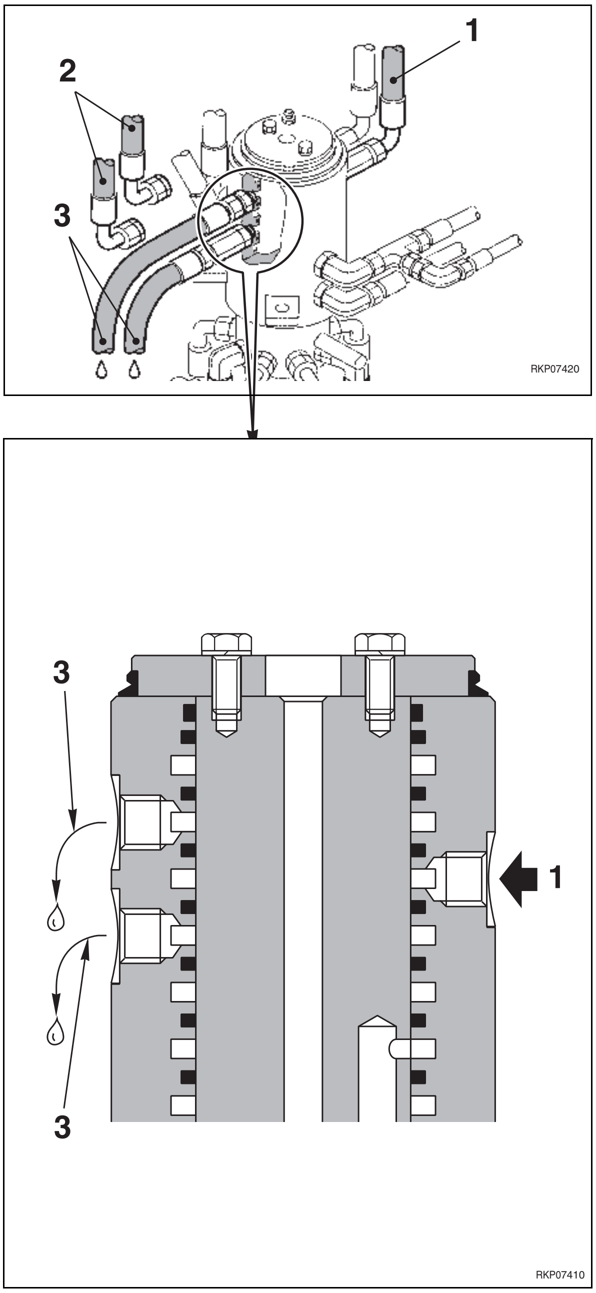
The test method consists in pressurising the branch under examination and measuring any leakage from adjacent branches, as set out in the following table:

N°	Branch to be tested (under pressure)	Adjacent parts (Leakages)	Mark
9	R.H. travel motor - Forwards	External leakage (visible)	–
		L.H. travel motor - Backwards	8
8	L.H. travel motor - Backwards	R.H. travel motor - Forwards	9
		R.H. travel motor - Backwards	7
7	R.H. travel motor - Backwards	L.H. travel motor - Backwards	8
		L.H. travel motor - Forwards	6
6	L.H. travel motor - Forwards	L.H. travel motor - Backwards	7
		Blade cylinder bottom side - Descent	5
5	Blade cylinder bottom side (descent)	L.H. travel motor - Forwards	6
		Drainage travel motor	4
3	Blade cylinder head side (rise)	Drainage travel motor	4
		Travel speed increment	2
2	Travel speed increment	Blade cylinder head side - (rise)	3
		Free	1
1	Free	–	–
		–	–

⚠ The numbers correspond to the numbers stamped on the input and output ports of the swivel joint.

3. Preparation for testing:
- **travel motors**
- **travel brakes**
- **speed increment**

1 - Relieve all residual hydraulic pressures (See «RELEASING RESIDUAL PRESSURES FROM THE CIRCUITS»).
2 - Identify the branch involved in the test (1).
3 - Disconnect the hoses (2) from the branches adjacent to the part to be tested and cap them tightly.
⚠ Make sure that the detached tubes are securely sealed, to prevent jets of high-pressure oil escaping if circuits that are not undergoing tests should accidentally become pressurised.
★ The tubes of the adjacent branches must be disconnected from the upper parts of the swivel joint.
4 - Provisional hoses (3) for collecting any oil leakages should be connected to the inlets of the branches adjacent to the one being tested.



4. Preparation for testing the blade

1 - Relieve all residual hydraulic pressures (See «RELEASING RESIDUAL PRESSURES FROM THE CIRCUITS»).
2 - Identify the branch involved in the test.
3 - Disconnect the tube corresponding to the branch to be tested from the safety valve input and cap it.
⚠ Make sure that the detached tubes are securely sealed, to prevent the escape of jets of oil at high pressure.
4 - Cap the valve to prevent entry of impurities.
5 - Disconnect from the swivel joint the hoses (2) of the branches adjacent to the branch to be tested, and cap them tightly.
⚠ Make sure that the detached hoses are securely sealed, to prevent jets of high-pressure oil escaping if the circuits that are not undergoing tests should accidentally become pressurised.
★ The tubes of adjacent branches must be disconnected from the upper parts of the swivel joint.
6 - Provisional hoses (3) to collect any leaking oil should be connected to the inlets of the branches adjacent to the one being tested.

5. Test

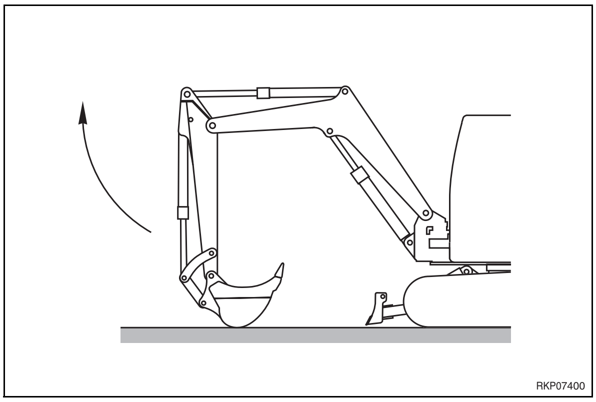
1 - Start the engine and bring it up to the test speed described for each group or component.
2 - Pressurise the branch to be tested.
3 - After 30 seconds, watch for another minute if there are any leakages.
★ If oil leaks out of one of the two provisional hoses, it means that there is a leakage in the intermediate gasket between the branch connected to the provisional hose and the pressurised branch.

ANALYSIS OF THE CAUSES OF HYDRAULIC DRIFTS

★ If hydraulic drift occurs in the work equipment, a check must be carried out to see if the cause is due to a cylinder gasket or to the control valve.

★ Conditions for all checks:
- Engine: at working temperature.
- Hydraulic oil: 45–55°C

★ Removal and connection of tubes only after relief of residual pressures. (See «RELEASING RESIDUAL PRESSURES FROM THE CIRCUITS»).



RKP07400

1. **Boom test**

1 - Position the machine with the arm vertical and the bucket on the ground, resting on its back.

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

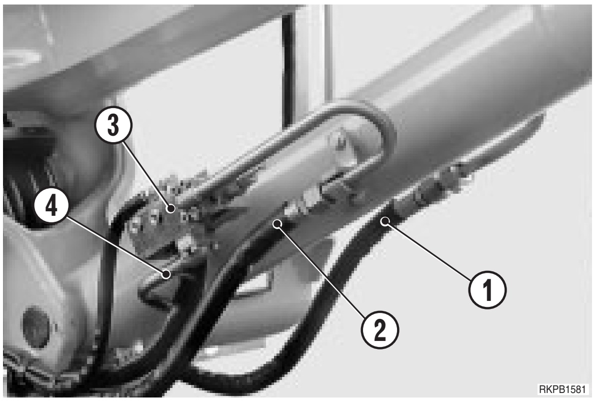
3 - Disconnect the hose (1) that feeds the cylinder on the head side.
★ Plug the hose to keep out impurity.

4 - Disconnect the hose (2) and plug it to keep out impurity.

5 - Remove safety valve (3) together with the pipe (4) and plug the bottom side under port using flange **L1**.
★ Plug the pipe (4) to keep out impurity.

6 - Start the engine and extend the arm completely.

7 - Stop the engine and check the position of the boom for 5 minutes.
- If the boom drops, the drift is due to the cylinder gasket.
- If the boom does not drop, the drift is due to the control valve.

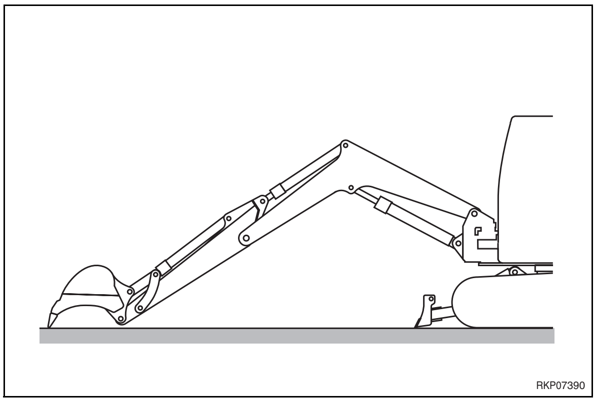


RKPB1581

2. **Arm test**

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

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



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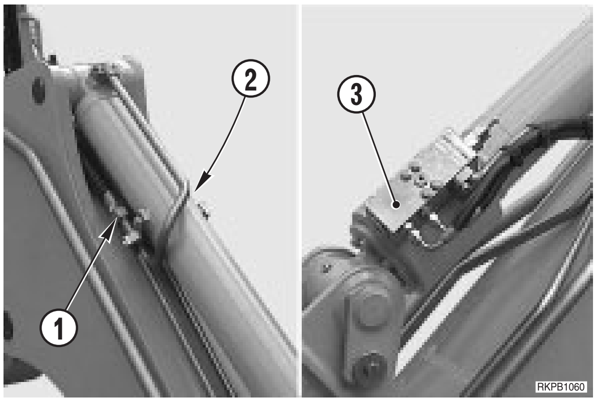
3 - Disconnect the hoses (1) and (2) from the pipes and plug them to keep out impurity.



Standard

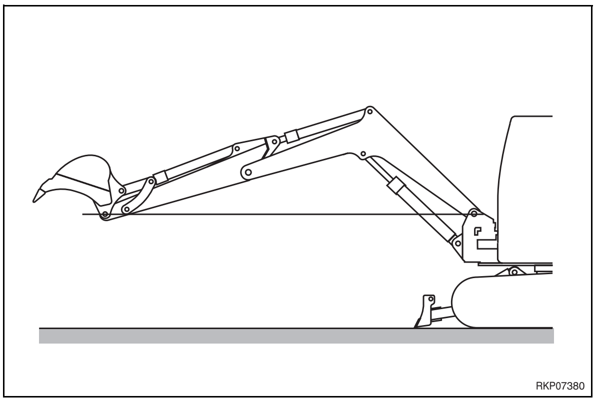
4 - Plug the hose (1) feeding the cylinder on the head side and connect a provisional hose on the bottom side to collect any leating oil.

Safety valve version

5 - Remove the safety valve (3) from the cylinder and plug it to keep out impurity.

6 - Plug the head side cylinder port using flange **H1**.

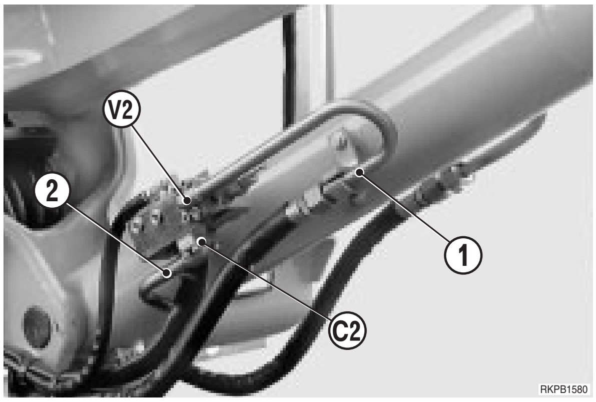
All version



7 - Start the engine and raise the boom.

8 - Stop the engine and check the position of the arm for 5 minutes.
- If the arm drops, the drift is due to the cylinder gasket.
- If the arm does not drop, the drift is due to the control valve.

3. Testing the functionality of the boom and arm safety valve.

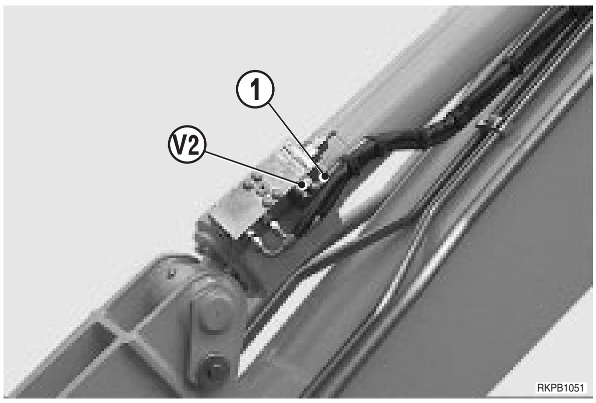


★ This test should be carried out after having checked that the drift is not due to the cylinder gaskets (See «BOOM TEST» and «ARM TEST»), and after having checked the valve settings (See «ADJUSTING BOOM AND ARM SAFETY VALVES»).

1 - Depending upon which valve is to be checked, position the machine as for the «Boom test» or for the «Arm test».

2 - Disconnect the hose (1) that supplies the valve (port V2).

3 - Disconnect:
For the boom, the head side pipe.
For the arm, the bottom side pipe.



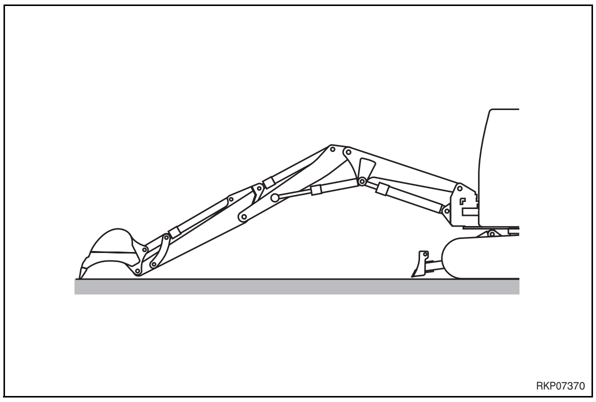
4 - Start the engine and extend the arm completely for the «Boom test», or raise the boom for the «Arm test».

5 - Stop the engine and check for leakages from the valve for 5 minutes.
- If there is any leakage, the valve is defective.

4. 2nd boom test

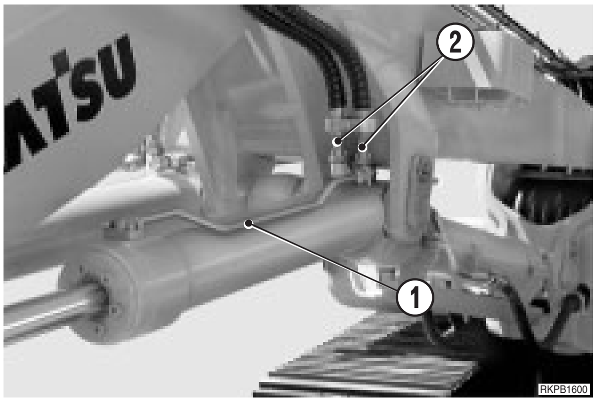
1 - Position the machine with the arm and the 2nd boom completely extended. Rest the bucket teeth on the ground.

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



3 - Disconnect the two pipes (1) and (2) and cap them to prevent entry of impurities.
★ If a safety valve has been installed, remove it.

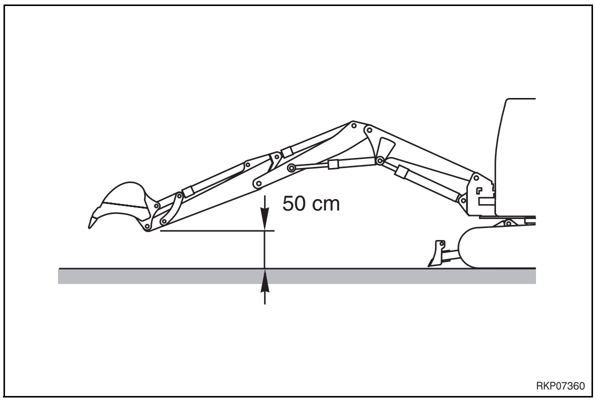
4 - Cap the cylinder couplings on the bottom side and attach provisional hoses on the head side to collect any leaking oil.



5 - Start the engine and raise the boom.

6 - Stop the engine and check the position of the 2nd boom for 5 minutes.

- If the 2nd boom closes, the drift is due to the cylinder gasket.
- If the 2nd boom does not close, the drift is due to the control valve.



To check one cylinder at a time, proceed as follows:

7 - Rest the bucket on the ground and release any residual hydraulic pressures.

8 - From one cylinder remove the cap mounted on the bottom side during phase 4.

9 - Start the engine, raise the boom and then stop the engine.

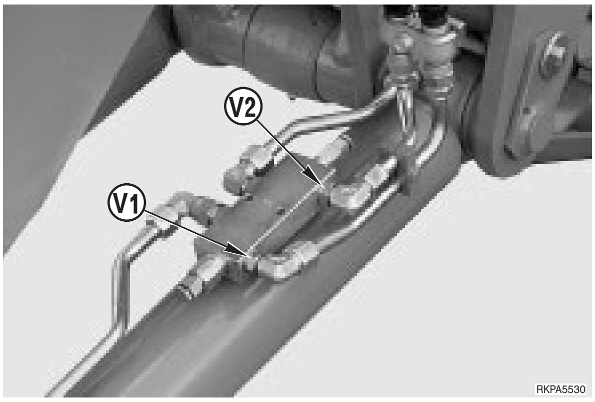
10 - Check the position of the 2nd boom for 5 minutes.

- If the 2nd boom closes, the drift is due to the gaskets of the cylinder that has been capped.

11 - Repeat the operation from phase 8 to phase 10 to test the other cylinder.

5. **Testing the functionality of the 2nd boom safety valves**

★ This test should be performed after having ascertained that the drift is not due to the cylinders. (See «2nd BOOM TEST») and after having checked the adjustment of the safety valves (See «ADJUSTING 2nd BOOM SAFETY VALVES»).



1 - Position the machine with the arm and 2nd boom fully extended. Rest the bucket teeth on the ground.

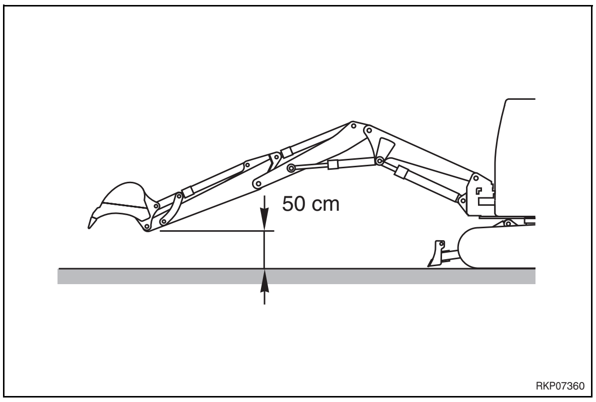
2 - Stop the engine and relieve any residual hydraulic pressures.

3 - Disconnect the connecting tubes of the safety valves (two pipes of ports **V1** and **V2** for each valve).

4 - Start the engine and raise the boom.

5 - Stop the engine and check the position of the 2nd boom for 5 minutes.

- If the 2nd boom tends to close, both safety valves are defective.



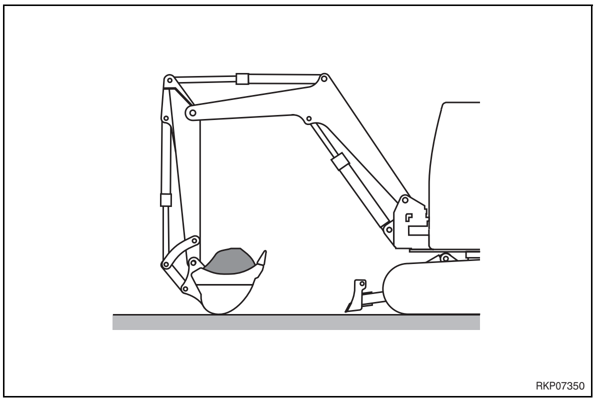
6. **Bucket test**

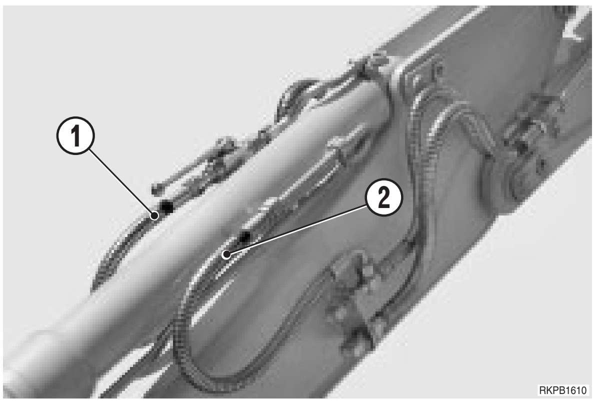
1 - Position the machine with the arm vertical and the bucket horizontal and resting on the ground.
Put a weight in the bucket, or fill it with earth.

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

3 - Disconnect the pipes (1 and 2) of the bucket cylinder and cap them to prevent entry of impurities.

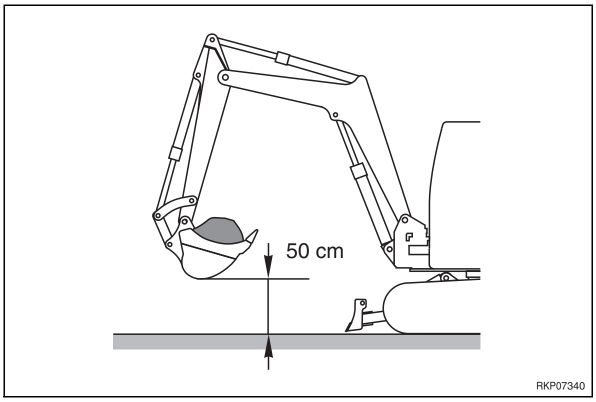
4 - Cap the hole in the bucket cylinder on the bottom side and attach a provisional hose on the head side to collect any oil leakages.





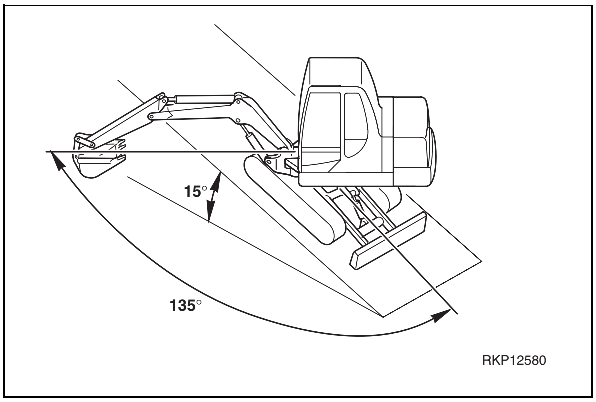
5 - Start the engine and raise the boom.

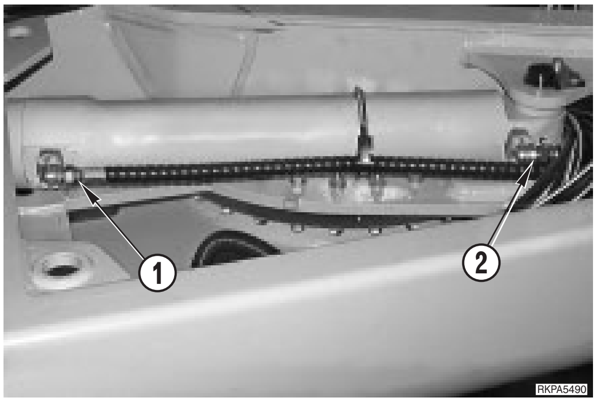
6 - Stop the engine and check the position of the bucket for 5 minutes.
- If the bucket tends to open, the drift is due to the cylinder gasket.
- If the bucket does not tend to open, the drift is due to the control valve.



7. Boom swing test

1 - Position the machine with the boom, arm and bucket raised and with the revolving frame turned 135° to the right.
2 - Stop the engine and release any residual hydraulic pressure.
3 - Disconnect the pipes (1 and 2) of the boom swing cylinder and cap them.
4 - Cap the hole in the boom swing cylinder on the bottom side and attach a provisional hose to the head side to collect any oil leakages.
5 - Start the engine and move the machine onto a 15° slope.
6 - Stop the engine and check the position of the boom for 15 minutes.
- If the boom tends to swing, the drift is due to the cylinder gasket.
- If the boom does not tend to swing, the drift is due to the control valve.



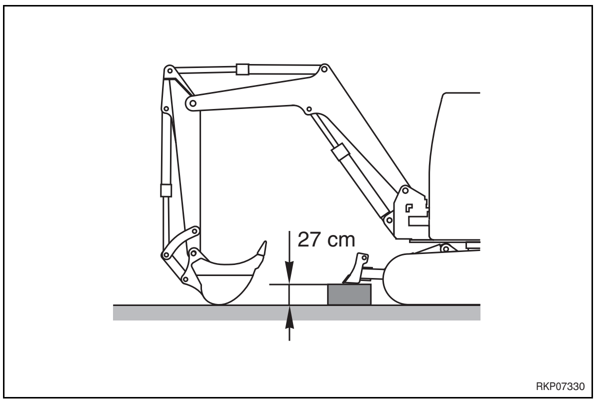


8. Blade test

1 - Position the machine with the arm vertical and resting on the ground, and with the bucket resting on its back.

2 - Bring the blade to roughly half its potential stroke and rest it on a centrally placed block.

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

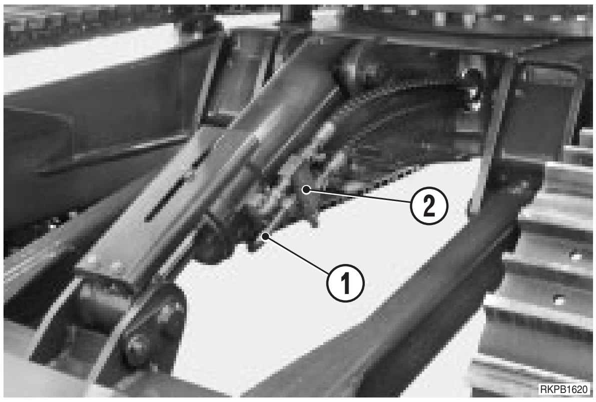


4 - Disconnect the pipe (1) and the safety valve (2) from the blade cylinder and cap them to prevent entry of dust or foreign bodies.

5 - Cap the hole in the blade cylinder on the head side and attach a provisional hose to the bottom side of the cylinder to collect any oil leakages.

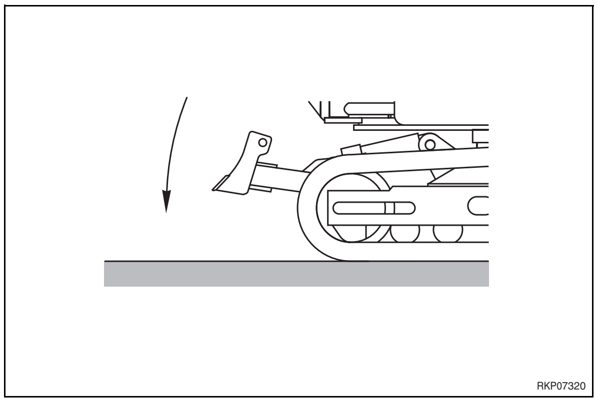
6 - Start the engine, push down with the boom to raise the machine in order to remove the block on which the blade is resting.

7 - Lower the machine and stop the engine.



8 - Check the position of the blade for 5 minutes.
- If the blade tends to sink, the drift is due to the cylinder.
- If the blade does not tend to sink, the drift is due to the safety valve group.

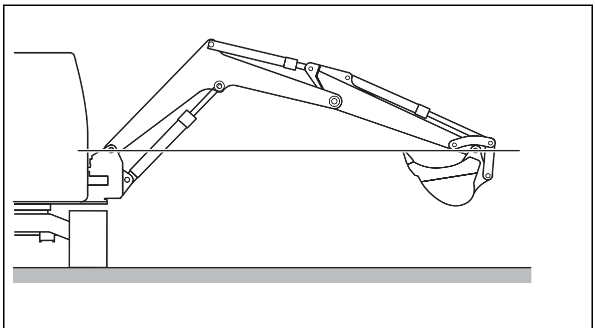
★ To discover whether or not the drift is due to the swivel joint, see «CHECKING FOR LEAKAGES INSIDE THE SWIVEL JOINT - BLADE CIRCUITS».



9. Swing motor test

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

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



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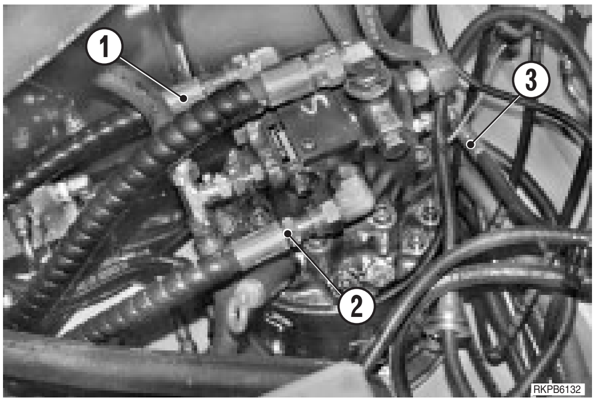
3 - Disconnect the hoses (1 and 2) from the motor and cap them to prevent entry of impurities. Attach some provisional hoses to the motor to collect any oil leakages.

4 - Disconnect brake swing hose (3) from motor.

5 - Connect unlocking brake cock "**A**" between motor and hose (3).
Check that cock is open and near the hose (3).



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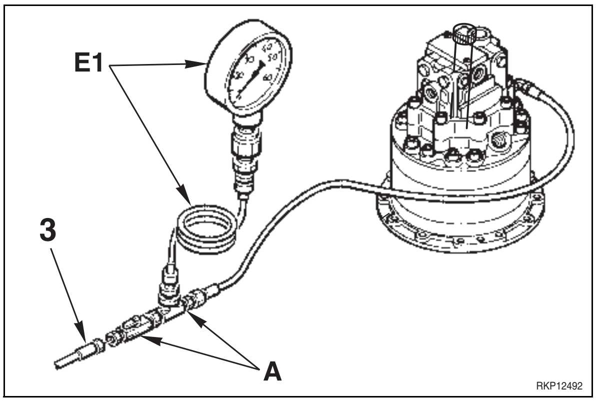
6 - Connect gauge **E1** to the cock "**A**".

7 - Start engine and start swing.
★ In this way the swing brake will be disengaged.

8 - With the swing brake circuit under pressure (30 bar) close the cock "**A**".



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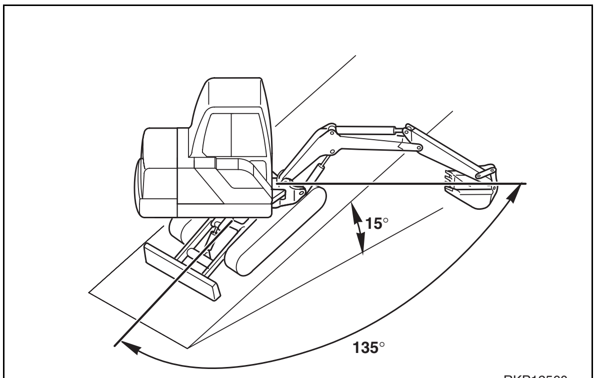
9 - Let the machine travel onto a 15° slope, and stop the engine.

10 - Mark the position between revolving frame and track frame on the swing circle. Check on any swinging movement of the revolving frame for 15 minutes.

- If the revolving frame tends to swing, the drift is due to the swing motor.
- If the revolving frame does not tend to swing, the drift is due to the control valve

★ During this test, the pressure indicated on the pressure gauge **E1** should not drop below the limit value of 18 bar.



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TESTING THE AIR-CONDITIONING UNIT

★ Test conditions:
- Machine on level ground with the working equipment raised and in safety conditions

1. Testing the working temperature

1 - Connect the maintenance station **L1** to the high pressure valve (H.P.) and the low pressure valve (L.P.)

2 - Start the engine and bring it up to a speed of 1500 rpm.

3 - Switch on the A/C unit using the switch in the cab.

4 - Select an intermediate ventilation speed inside the cab.

5 - Use the thermometer/hygrometer **L2** to check that the temperature inside the cab is equal to or lower than the ambient temperature.
★ If the temperature of the cab is higher than the ambient temperature, open the doors and widows and wait until the cab temperature stabilizes at the outside value.

6 - Close the doors and windows and let the A/C unit operate in these conditions for 5 - 10 minutes.

7 - Use the thermometer **L2** to check the temperature of the air at the central outlets.
★ Position the probe as close as possible to the air outlets.

8 - Compare the average value of the measured temperatures using the following table

Ambient temperature (°C)	20	25	30	35
Outgoing air temperature (°C)	6 – 8	8 – 10	8 – 12	9 – 14

9 - If the average value of the temperature measured does not fall within the values given in the table, it will be necessary to thoroughly check the unit.

2. Checking the unit

Check the unit after the point 1., 2., 3., 4., and 6. of the precedent paragraph.
A diagnosis of faults in the unit is based on the working pressures.
When the pressures do not fall within the values given in the following table, the causes must be sought by checking the high-pressure (H.P.) and low pressure (L.P.) pressure gauges.

Outside Temperature (°C)	Unit with R134a			
	L.P. (kg/cm²)		H.P. (kg/cm²)	
	Min.	Max	Min.	Max
20	1.2	2.5	6.0	9.0
25	1.0	2.5	7.5	10.5
30	1.1	2.4	9.5	13.0
35	1.3	2.4	12.0	15.5
40	1.5	1.8	18.0	18.8
45	1.8	1.9	21.5	22.0

The following conditions may be found:

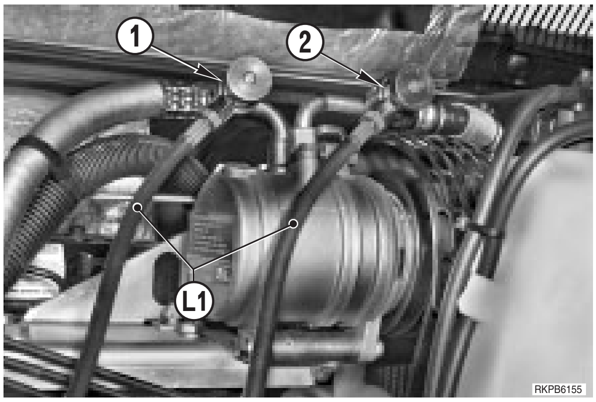
Conditions	Causes - Faults
L.P. high - H.P. normal or low	• Electromagnetic pulley that slips or does not engage correctly • Expansion valve blocked in open position • Compressor damaged
L.P. low - A.P. high or normal	• Expansion valve blocked in closed position or obstructed • Filter saturated with moisture • Obstruction in the L.P. line or in the H.P. line between the filter and the evaporator L.P.
L.P. normal - H.P. normal	• Infiltration of hot air into the evaporator group, the pipes or the cab • Hot air circulating in the heating group • Formation of ice on the evaporator
L.P. high - H.P. high	• Normal condition with very high ambient temperature (higher than 43°C) • Excess coolant (30 - 35% more) • Overheating of condenser • Air present in the unit • Obstruction in the H.P. line between the compressor and the condenser-filter tube, behind the measurement point of the H.P.
L.P. normal or low - H.P. low	• Normal condition with very low temperature (lower than 5°C) • Lack of coolant (70 - 75% less) (probable leakages) • Obstruction in the H.P. line between the compressor and the condenser-filter tube, before the measurement point of the H.P. • Compressor damaged
L.P. roughly equal to H.P.	• Compressor belt missing • Electromagnetic pulley that slips or does not engage • Compressor damaged

EMPTYING THE AIR-CONDITIONING UNIT

1 - Connect the maintenance station **L1** to the service valves (1) and (2) and follow the specific maintenance station instructions relative to the drainage of the unit.

2 - Disconnect the group to be substituted or reconditioned immediately after switching off the maintenance station. **Plug the removed or disconnected connection tubes tightly and with a minimum of delay.**

3 - Carefully check the quantity of anti-freeze oil recovered and contained in the disassembled parts, since the same quantity must be replaced when the air-conditioning unit is refilled.



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 , , , . 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 WHEN WORKING

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

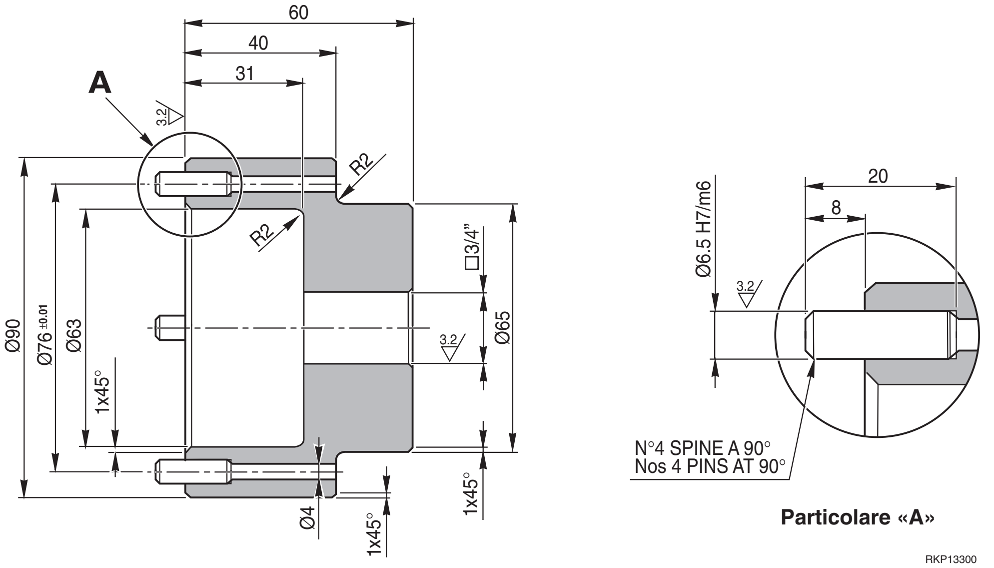
1. **Precautions for removal operations**
   - If not otherwise indicated, lower the work equipment until it rests on the ground.
   - If the coolant liquid contains an anti-freeze substance, follow the instructions given for drainage.
   - After having removed flanges and tubes, insert plugs to prevent 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.

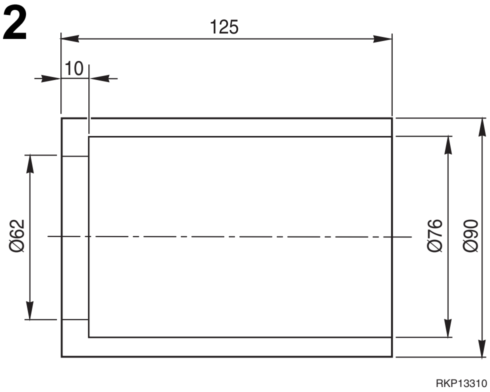
SPECIAL TOOLS

Nature of work	Symbol		Code	Description	Q.ty	Notes
Removal/Installation of counterweight Disassembly/Assembly of cylinder nut	A	1	Commercially available	Dynamometric wrench with multiplier	1	Max. 700 kgm (700 dNm)
Disassembly/Assembly the cylinders- idler	B	1	791-600-2001 791-685-8005	Compressor (A) Compressor (B)	1	
			791-635-3160	Extension	1	
			790-201-2800	Kit, plunger	1	
			790-101-1600	Cylinder (70 ton)	1	
			790-101-1102	Pump	1	
		2	790-201-1500	Kit, plunger	1	To mount ring
		3	791-675-1510	Plunger	1	To mount floating ring
Disassembly/Assembly of swing machinery	C	1	–	Wrench	1	Te remove and mount lock-nut
		2	–	Plunger	3	To remove inside ring from pinion bearing
		3	–	Plunger	1	To assemble inside bearing ring
		4	–	Plunger	1	To mount outside bearing ring
Air conditioning unit	D	1	Commercially available	Maintenance station	1	

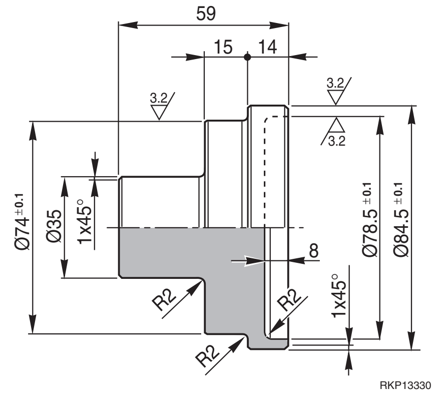
C1


60
40
31
A
3.2
R2
R2
□3/4"
Ø90
Ø76 ±0.01
Ø63
1x45°
3.2
Ø65
Ø4
1x45°
1x45°
Ø6.5 H7/m6
20
8
3.2
N°4 SPINE A 90°
Nos 4 PINS AT 90°
Particolare «A»
RKP13300

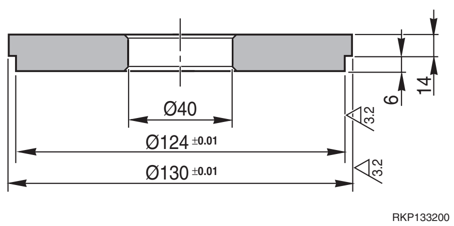
C2


125
10
Ø62
Ø76
Ø90
RKP13310

C3


59
15
14
3.2
3.2
3.2
Ø74 ±0.1
Ø35
1x45°
8
Ø78.5 ±0.1
Ø84.5 ±0.1
R2
R2
R2
1x45°
RKP13330

C4


Ø40
Ø124 ±0.01
Ø130 ±0.01
3.2
3.2
6
14
RKP133200

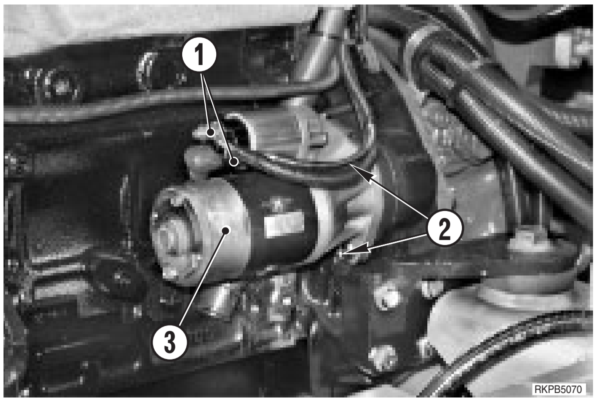
REMOVAL OF STARTER MOTOR

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

1 - To install, reverse the removal procedure. Remove lower guard.

2 - Disconnect electrical cable (1).

3 - Remove screw (2) and starter motor (3). ※ 1



INSTALLATION OF STARTER MOTOR

- To install, reverse the removal procedure.

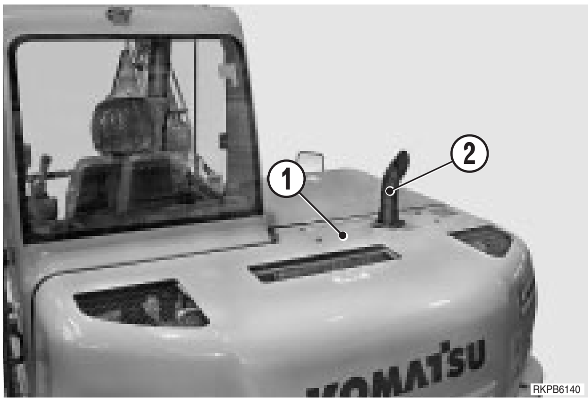
※ 1

Screw: 78.4–98 Nm

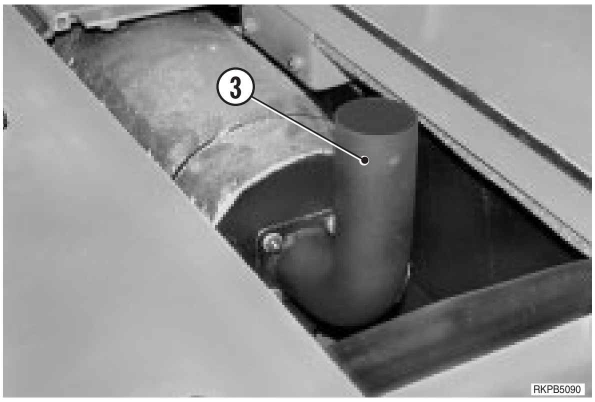
REMOVAL OF ALTERNATOR

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

1 - Remove upper cover (1) (No. 5 screws) with exhaust pipe (2).



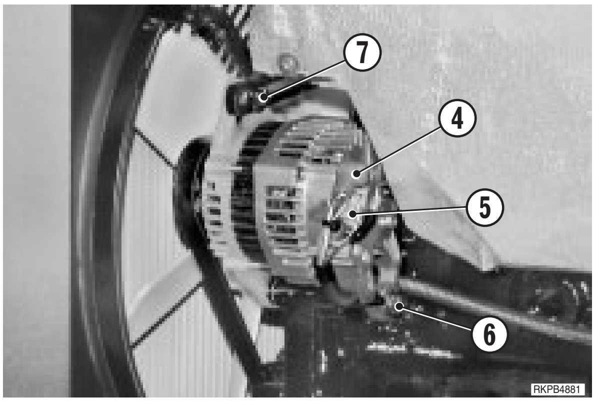
2 - Remove union (3) of the exhaust pipe. ※ 1



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

4 - Loosen bolts (6), (7) and (8) sufficiently to allow the alternator (9) to rotate.

5 - Free the pulley from the fan-belt (10) and remove alternator (9). ※ 2



INSTALLATION OF ALTERNATOR

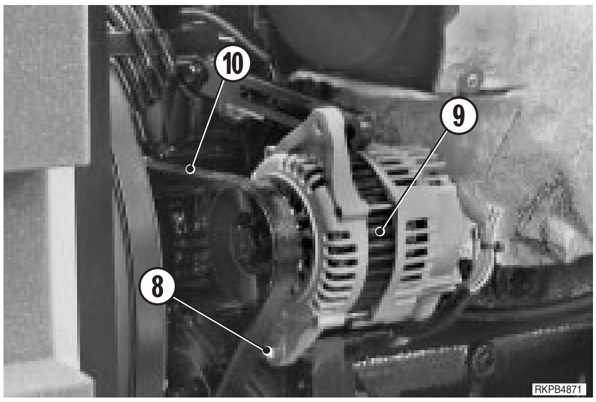
- To install, reverse the removal procedure.

※ 1

★ Check the union gasket of exhaust pipe.

※ 2

★ Adjusting of the fan-belt. (For details, see «20. TESTING AND ADJUSTMENTS»).



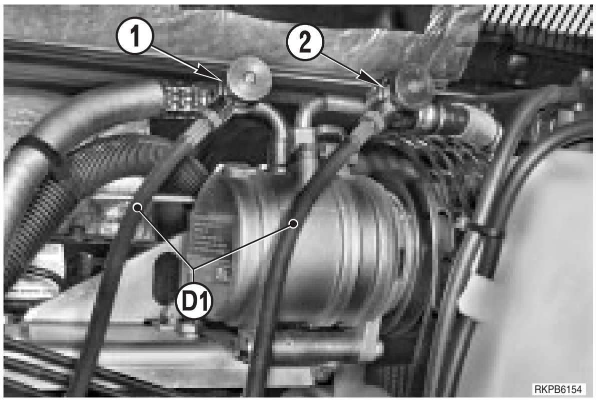
REMOVAL OF THE AIR-CONDITIONING UNIT COMPRESSOR

(Only for machines equipped with an air-conditioning unit)

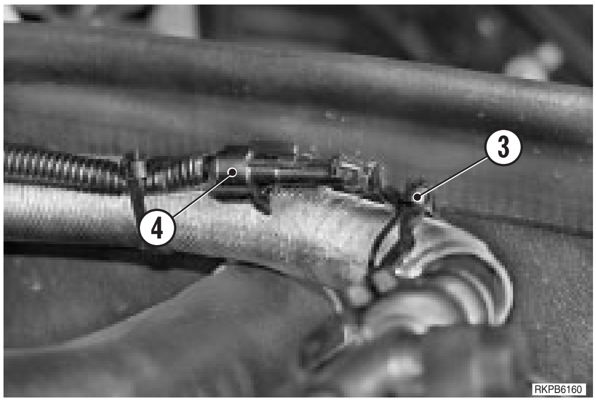
⚠ Disconnect the cable from accumulator negative terminal (–).

1 - Connect the outlets (1) and (2) to the maintenance station for air-conditioning units **D1** and drain the cooling fluid.

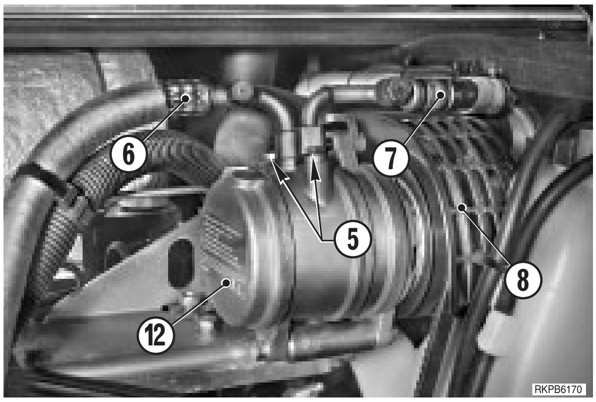
Quantity of fluid R134a: 1100 $^{-30}_{+50}$ g



2 - Remove the clamp (3) and disconnect the connector (4).

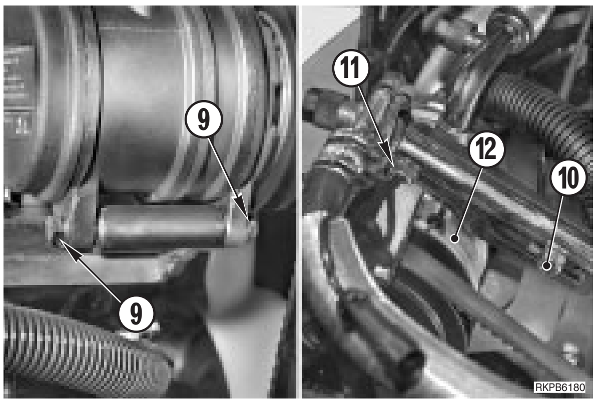


3 - Loosen screw (5) and remove return (6) and delivery (7) pipes. ※1



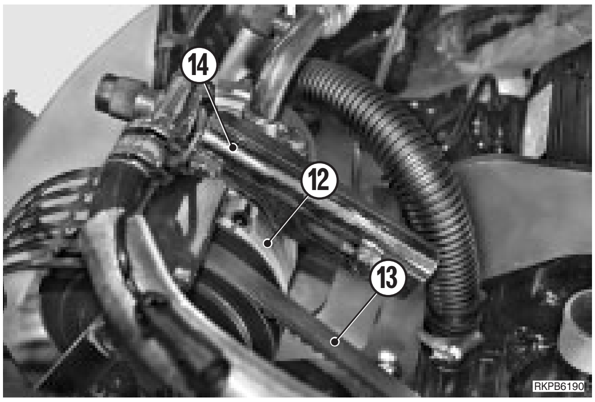
4 - Remove the fan guard (8). ※2

5 - Loosen screws (9), (10) and (11) to leave free the compressor (12).



6 - Release the pulley from belt (13) and remove bracket (14).

7 - Remove the compressor (12). ※ 3



INSTALLATION OF THE AIR-CONDITIONING UNIT COMPRESSOR

- To install, reverse the removal procedure.

※ 1

Screw: 22.5–28.4 Nm

※ 2

Screw: 22.5–28.4 Nm

※ 3

★ Apply tension to the compressor belt.
(For detail, see «TESTING AND APPLYING TENSION TO THE COMPRESSOR BELT».

1 - Connected the unit to the maintenance station **D1** and refill it.

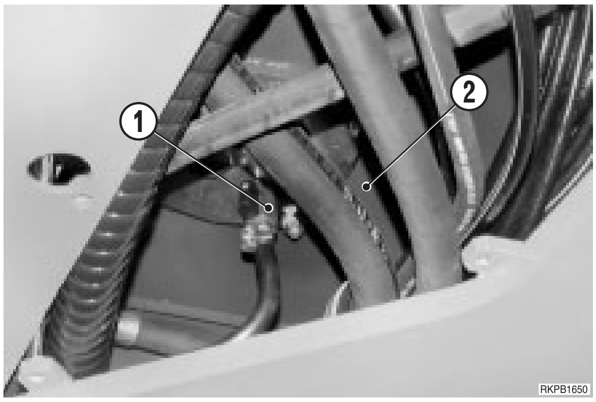
Quantity of fluid: 1100^{-30}_{+50} g

REMOVAL OF INJECTION PUMP

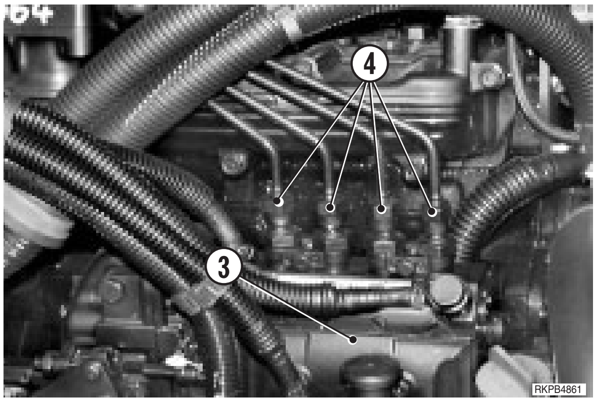
⚠ Disconnect the cable from accumulator negative terminal (–).

★ Close the cock (1) of separator (2) to prevent fuel leakage.

★ Plug removed or disconnected pipes to avoid impurity entry.



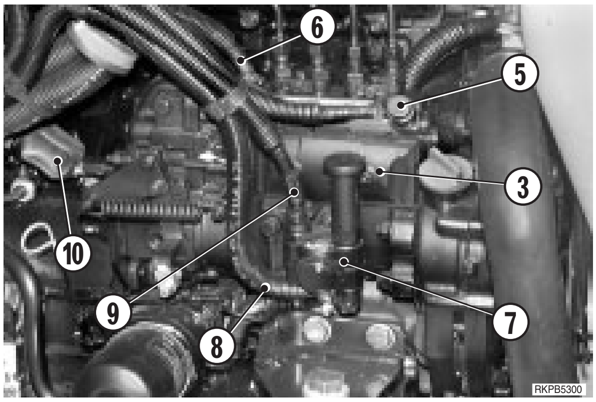
1 - Disconnect high pressure pipes (4) from injection pump (3). ※ 1



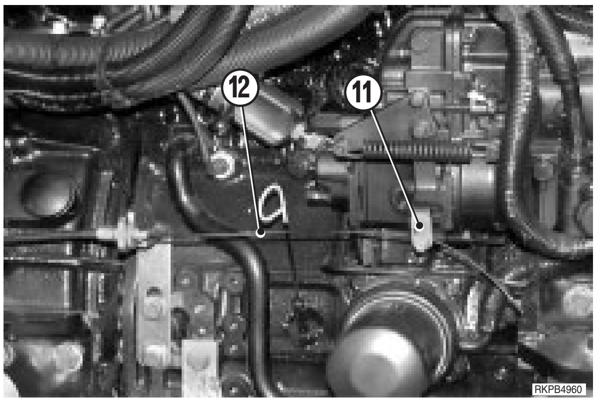
2 - Disconnect from injection pump (3) fuel feeding pipes (6) and return pipes (5). ※ 2

3 - Disconnect pipes (8) and (9) from fuel feed-pump (7).

4 - Disconnect the engine stop solenoid (10) from injection pump (3) and remove the complete unit. ※ 3

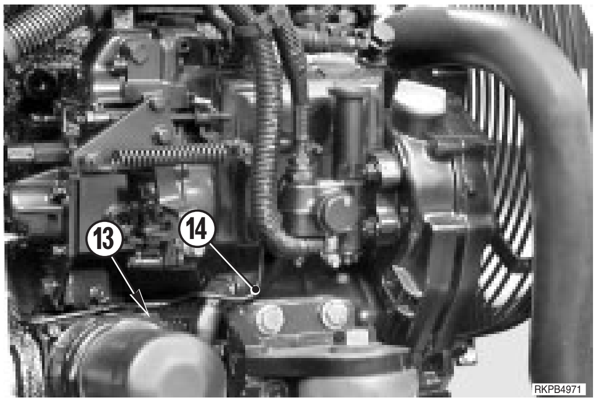


5 - Disconnect control cable (12) from accelerator lever (11).



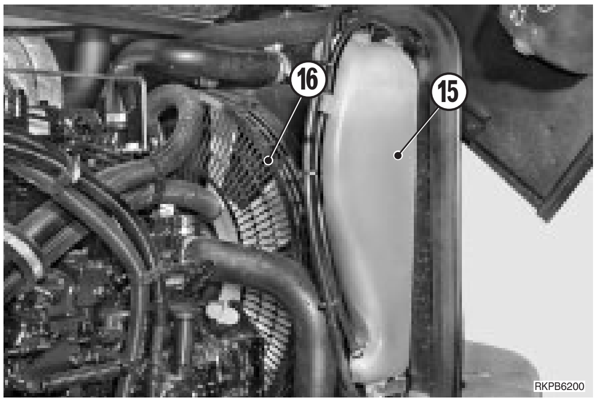
6 - Remove the bolt (13) and bracket of injection pump lubricating pipe.

7 - Remove injection pump lubricating pipe (14).

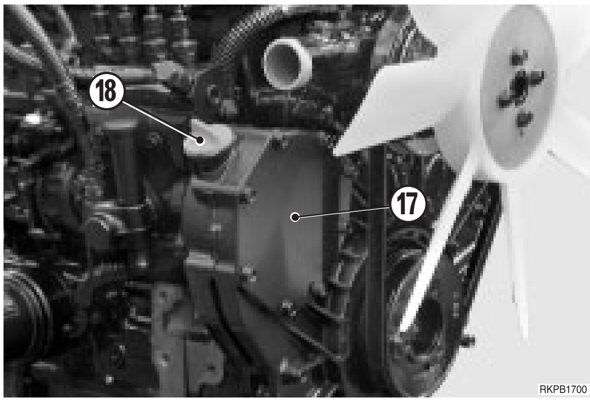


8 - Remove coolant tank (15).

9 - Remove fan guard (16).

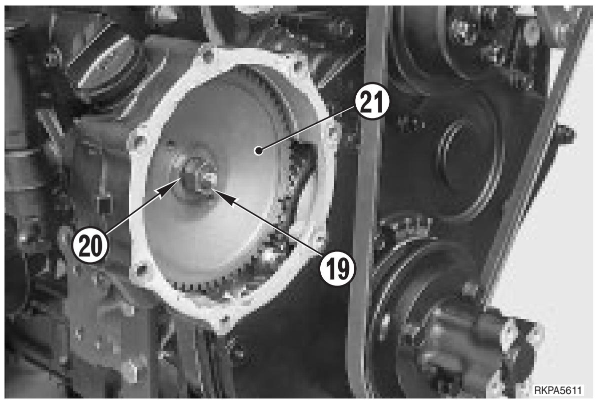


10 - Remove the inlet cover (17) to ignition gear system and the filler oil plug (18). ※ 4

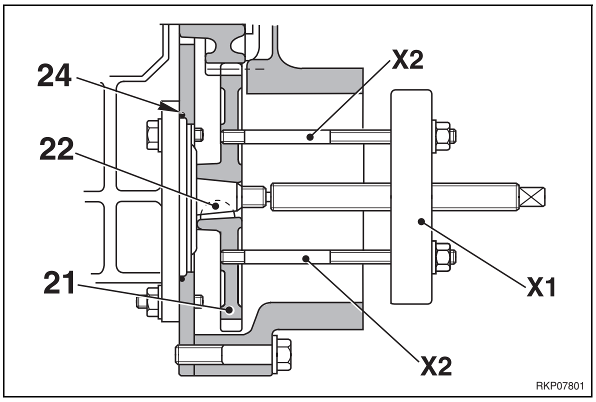


11 - Loosen and remove nut (19) and lock washer (20) of pump driving gear (21). ※ 5

★ Be careful not to let lock washer drop in the housing.

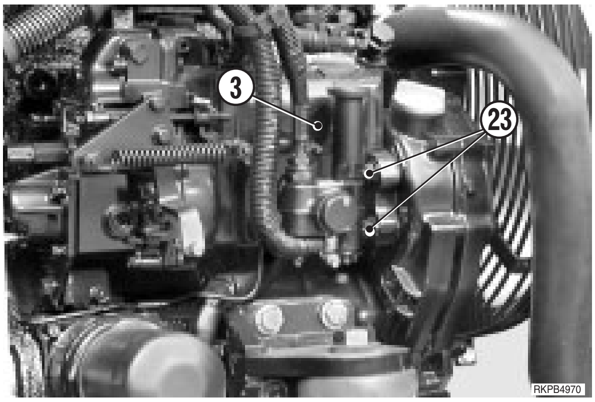


12 - Remove pump (3) driving gear (21).
- ★ Before removing pump driving gear, mark position compared to idling gear.
- ★ For removal, use a puller (X1) and tighten its screws (X2) directly in the gear (21).
- ★ Be careful not to damage pump shaft thread.
- ★ During removal be careful not to let key drop (22) in the housing.



13 - Remove nuts (23) (No. 4) and injection pump (3) with relative OR rings (24).

※ 6



INSTALLATION OF THE INJECTION PUMP

- To install, reverse the removal procedure.

※ 1

Feed and return pipes: 24.5–34.3 Nm

※ 2

High pressure pipes: 24.5–34.3 Nm

※ 3

★ Replace safety cotter pin.

※ 4

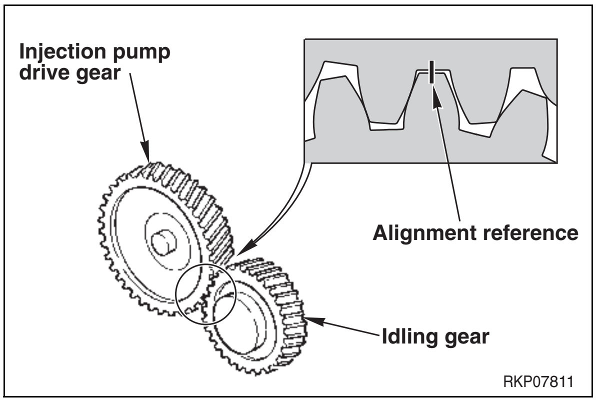
Cover gasket: ASL800070

Timing gear system cover bolts: 18 Nm

※ 5

★ Align marks between gears before installing pump and nut.

Gear lock nut: 83.3–93.1 Nm



※ 6

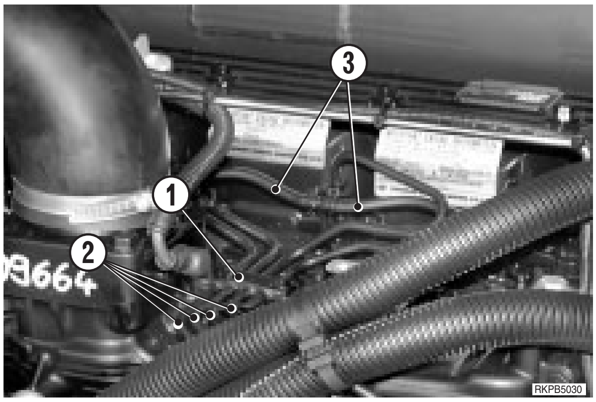
Pump lock nuts: 35.2–43.1 Nm

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

REMOVAL OF INJECTION NOZZLE

1 - Loosen the clamps (1) and remove the high pressure pipes (2) and fuel return pipes (3). ※ 1

2 - Loosen the nuts (4) that secure the collar (5). Remove the injector (6), the seat (7) and the protection sleeve (8). ※ 2



INSTALLATION OF THE INJECTION NOZZLES

- To install, reverse the removal procedure.

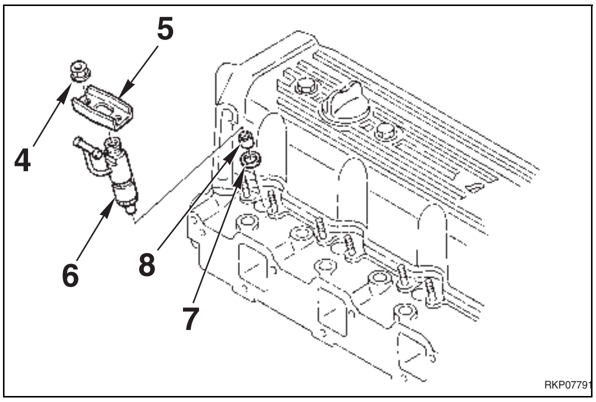
※ 1

High pressure pipe fittings: 24.5–35.3 Nm

Hose clamp screws: 9.8–11.8 Nm

※ 2

Collar lock nuts: 9.8–11.8 Nm



REMOVAL OF THE THERMOSTAT

Disconnect the cable from accumulator negative terminal (–).

★ Drain the engine cooling liquid.

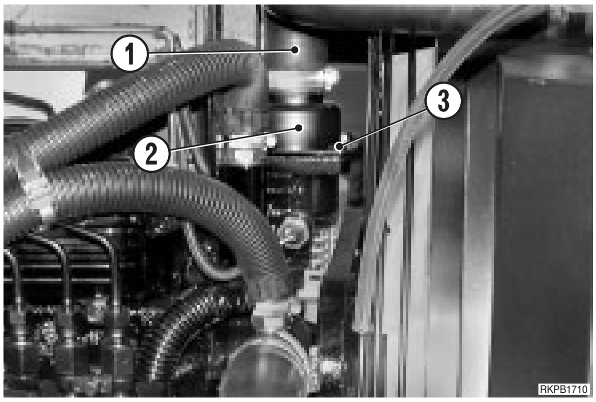
Cooling liquid: 18 ℓ

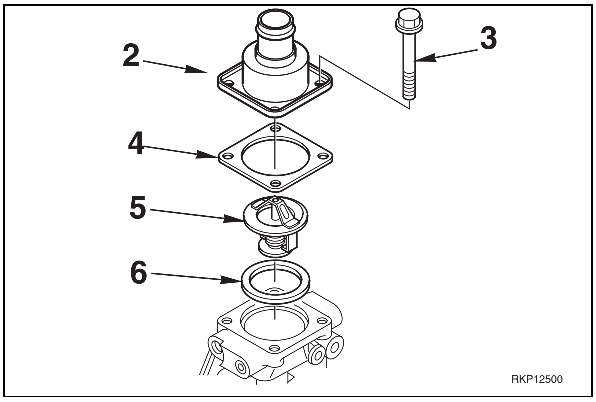
1 - Disconnect the radiator hose (1) from the thermostat cover (2).

2 - Remove the thermostat cover screws (3). ※ 2

3 - Remove the gasket (4), the thermostat (5) and the ring seal (6).

Replace all gasket and seals.





INSTALLATION OF THE THERMOSTAT

- To install, reverse the removal procedure.

1 - Refill the coolant liquid tank.

Coolant liquid: 18 ℓ

2 - Start the engine at low idling to circulate the coolant liquid through all circuits.

3 - Accelerate gradually up to 1700 rpm. After about one minute, stop the engine and check or top up the level in the container.
★ Check that there are no leaks.

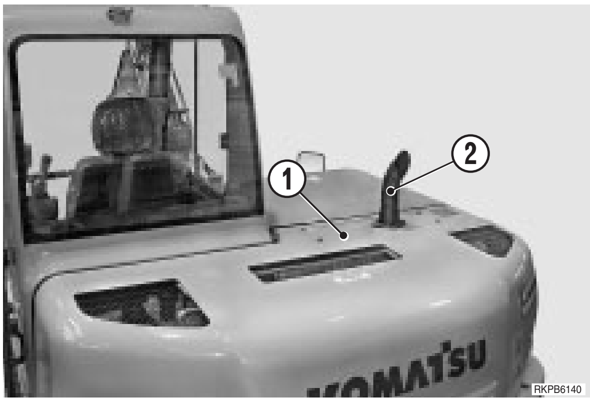
※ 2

Cover screws: 22–27.8 Nm

REMOVAL OF THE MUFFLER

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

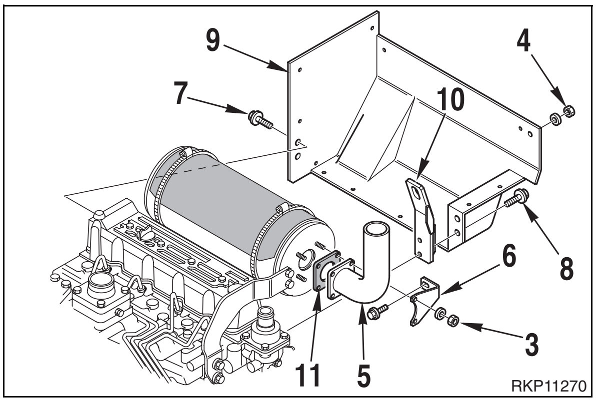
1 - Remove the cover (1) (No. 5 screws) together with the exhaust pipe (2).



2 - Loose the nuts (3), nut (4) and remove the exhaust pipe (5) and bracket (6).

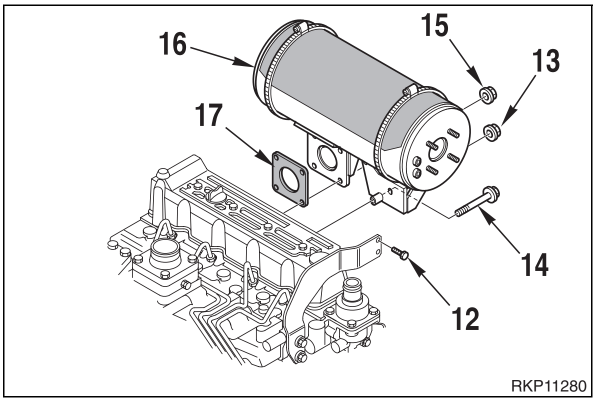
3 - Loosen screws (7) and (8) and remove protection (9) from L.H. side.

★ Pay attention not to drop the engine-hoisting lug (10).



4 - Loosen screws (12), two nuts (13) and screw (14).

5 - Loosen nuts (15) and remove muffler (16) from L.H. side.



INSTALLATION OF THE MUFFLER

- To install, reverse the removal procedure.

  ★ Replace the sealing gasket (11) and (17).

Nut (14): 46±2 Nm

Screws (13), (11) and nuts (12): 27±2 Nm

Screws (8): 46±2 Nm

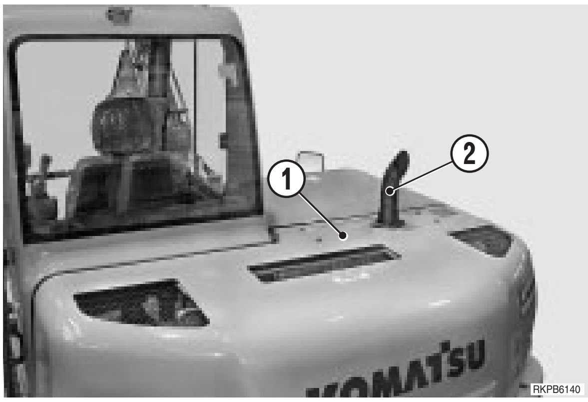
REMOVAL OF THE CYLINDER HEAD

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

★ Drain the cooling liquid.

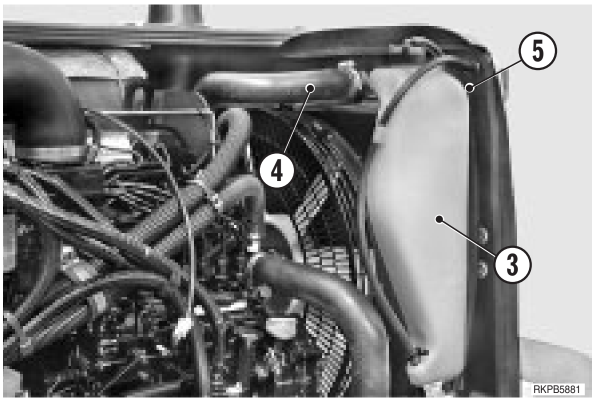
Cooling liquid: 18 ℓ

※ 1



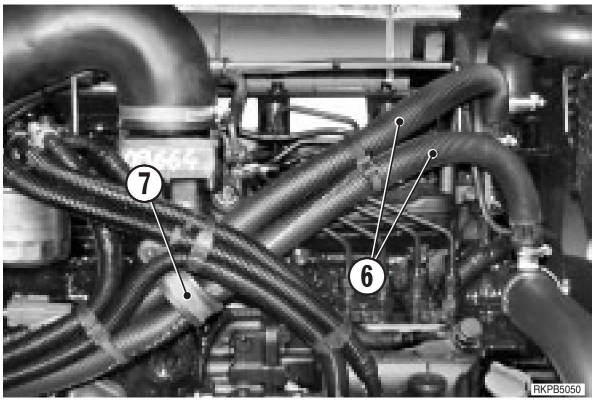
1 - Remove the engine hood.
(For details see: «REMOVAL OF ENGINE HOOD»).

2 - Remove cover (1) (No. 5 screws) together with the exhaust pipe (2).



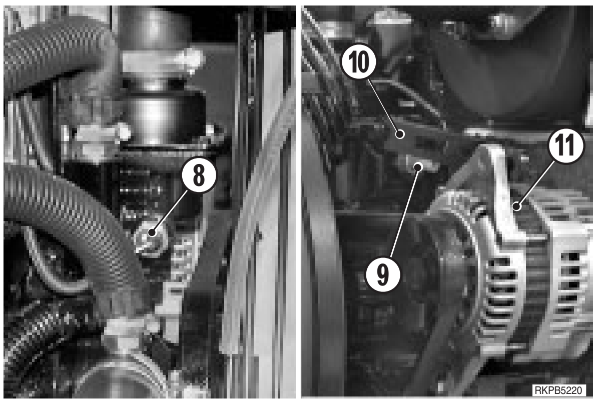
3 - Remove the coolant tank (3).

4 - **Only for machines equipped with an air-conditioning unit.**
Remove the compressor.
(For details, see «REMOVAL OF THE AIR-CONDITIONING UNIT»).



5 - Remove hose (4) from the radiator (5) and disconnect the heater pipes (6).

6 - Loosen the clamp (7).



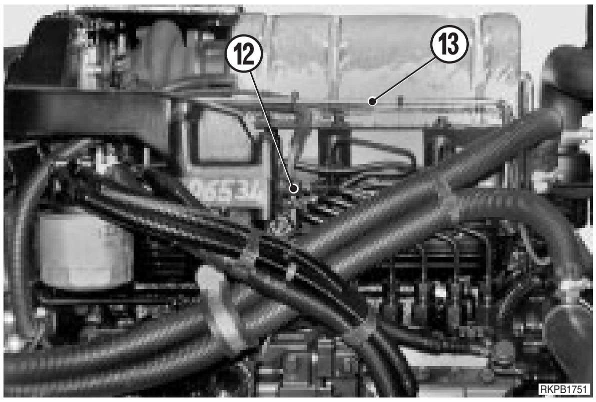
7 - Disconnect the water temperature sensor cable (8) and the water temperature alarm sensor cable (9).

8 - Disconnect the alternator (11) support bracket (10).

9 - Disconnect the pre-heater cable (12) and remove the support (13).

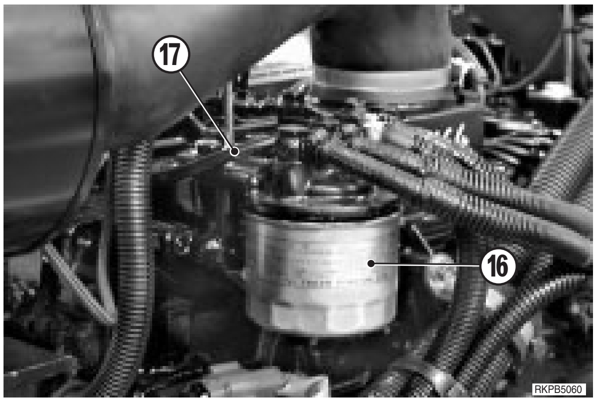
10 - Disconnect the coupling sleeve (14).

11 - Remove the muffler (15).
(For details see «REMOVAL OF THE EXHAUST PIPE-MUFFLER»).



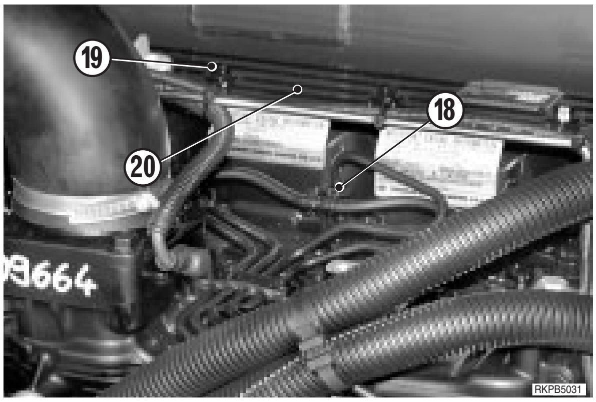
12 - Remove the fuel filter (18).

13 - Disconnect the fuel return hose (17) from the injectors.



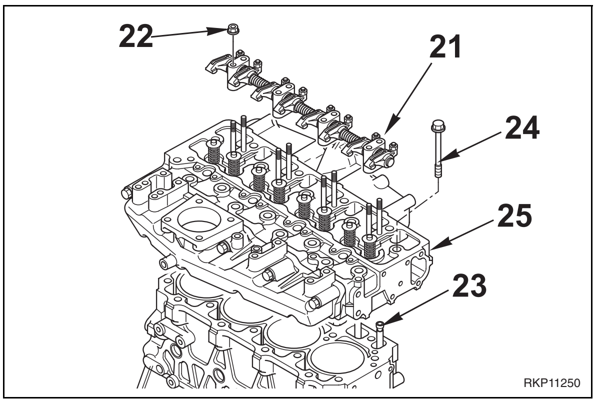
14 - Remove the injectors (18).
(For details see: «REMOVAL OF THE NOZZLE INJECTORS») ※ 2 ※ 3

15 - Loosen the nuts (19) and remove the tappet cover (20). ※ 4



16 - Remove the valve rocker-arm(21).
★ Loosen the nuts (22) and unscrew the tappets by 2-3 turns. ※ 5

17 - Take out the rocker arm control arms (23).

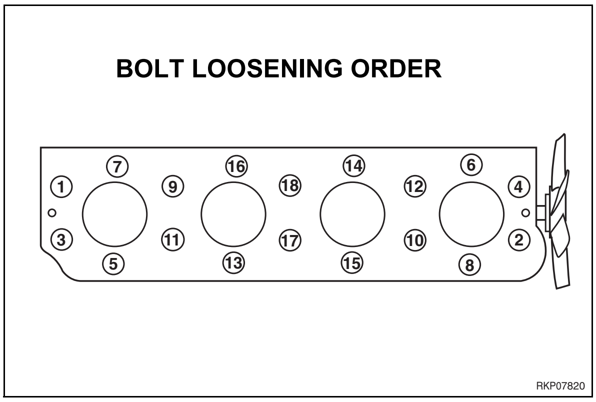


18 - Remove the cylinder head (25) screws (24) follow the indicated sequence to loosen the screws.

※ 6

★ Loosen the cylinder head retaining screws in two stages.

⚠ Keep two positioning screws inserted and tightened 2-3 turns.



19 - Attach the cylinder head (25) to a hoist and apply tension to the hoisting cables.

⚠ Ensure that the cylinder head is detached from the engine block and that all tubes and cables are disconnected.

⚠ Attach the hoisting cables to the lifting logs and the muffler. Ensure that the cylinder head remains level while hoisting.

20 - Remove the complete cylinder head (25) and place it on a work-bench.

INSTALLATION OF THE CYLINDER HEAD

- To install, reverse the removal procedure.

※ 1

★ Fill up the cooling circuit.

Cooling liquid: 18 ℓ

★ Check carefully that there are no leaks.

※ 2

High-pressure pipe fittings: 24.5–34.3 Nm

※ 3

Collar lock nuts: 9.8–11.8 Nm

※ 4

★ Check the condition of the seals of the tappet cover and the O-rings of the fastening nuts.
Thoroughly clean the contact surfaces on the cylinder heads.

Cover fastening nuts: 25±3 Nm

※ 5

★ Check that the tappets are firmly engaged in their rods and that the valve collars are correctly assembled.

Rods - tappets: Engine oil

★ Start tightening the rocker-arm shaft from the center towards the outside.

Screws and nuts for the rocker-arm shaft:
22.5–28.4 Nm

★ Adjust the valve clearances (For details, see «20. TESTING AND ADJUSTMENTS»).

※ 6

★ Install a new gasket.

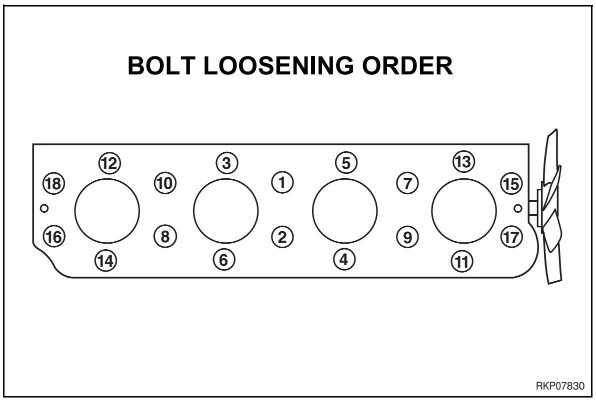
Bolt and cylinder block threadings: Engine oil.

★ Tighten the screws, manually at first, and then in two stages, following the sequence indicated.

Cylinder head bolts.
First tightening: 88.3–98.1 Nm
Final tightening: 181.4–191.2 Nm

1 - Start the engine at low idling to circulate the coolant liquid through all circuits.

2 - Accelerate gradually up to 1700 rpm. After about one minute, stop the engine and check or top up the level in the container.



REMOVAL OF SEAT

⚠ Lower the work equipment until it is resting on the ground, switch off the engine and remove the ignition key.

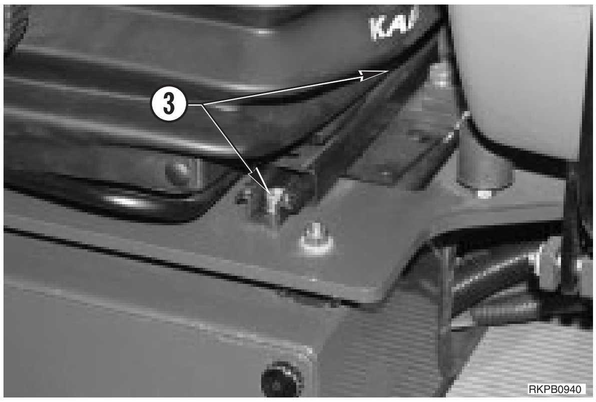
1 - Raise the front window (1) completely.

2 - Remove the lower window (2) and place it in the supports provided at the back of the cabin.

3 - Remove the four screws (3) that secure the seat (No. 4).
 ★ Slide the seat forwards and backwards in order to reach the screws.

4 - Remove the seat.

 kg Seat: 32 kg



INSTALLATION OF SEAT

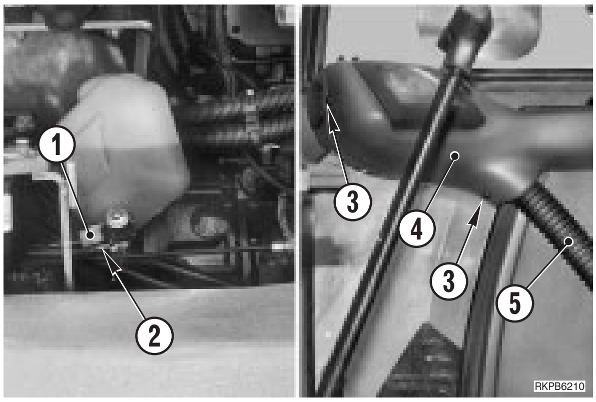
- To install, reverse the removal procedure.

REMOVAL OF CABIN

⚠ Lower the work equipment until it is resting on the ground, switch off the engine and remove the ignition key.

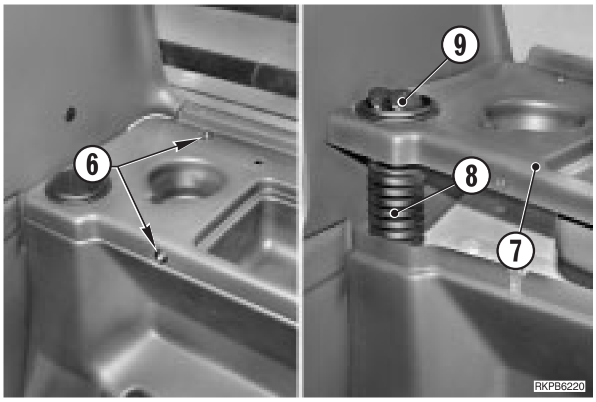
1 - Disconnect the connector (1) and hose (2) from the windshield-washer tank and remove all the clamps fixing them.

2 - Remove screws (3), dashboard (4) and disconnect heating pipe (5).



3 - Move the back of the operator's seat completely forward and remove the panel (7) fixing screws (6).

4 - Raise the panel (7), disconnect the heating hose (8) from the diffuser (9) and remove the panel (7).

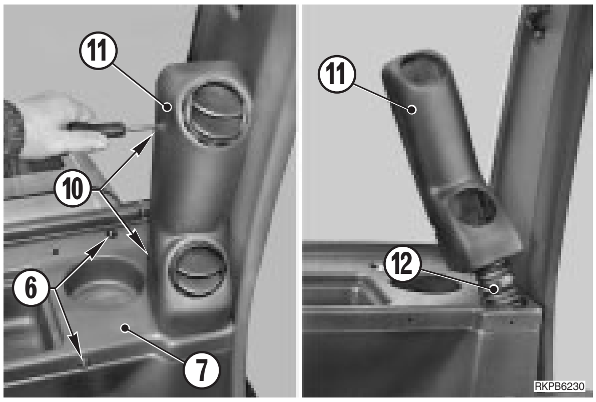


Only for machine equipped with an air conditioning unit

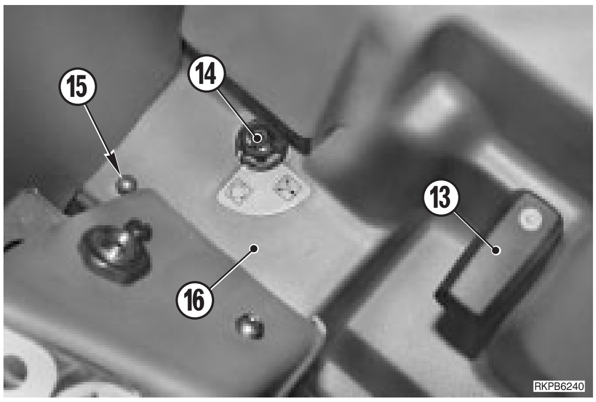
5 - Remove screws (10).

6 - Raise air duct (11) and disconnect pipe (12).

7 - Lower completely the seat, remove screws (6) and hood (7).

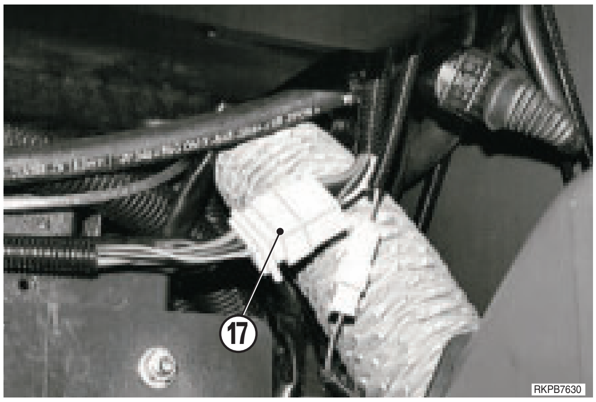


8 - Remove knob (13) and (14), screws (15) and hood (16).



Only for machine equipped with an air conditioning unit

9 - Disconnect the connecter (17).

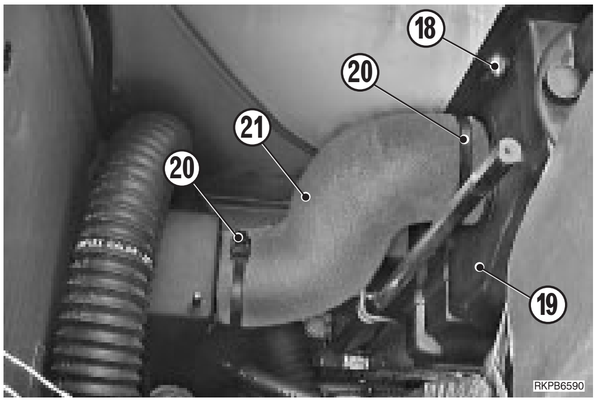


10 - Remove the heater (19) screw (18).

11 - Remove clamps (20) and sleeve (21).

12 - Remove screws (22) (n°7).

13 - Remove the upper protection cap and mount the eyebolts (23).



14 - Attach the eyebolts (23) to the hoisting tackle and remove the cabin.

Cabin: 220 kg

INSTALLATION OF CABIN

- To install, reverse the removal procedure.
  - ★ Make sure that the short screw (24) is placed on the LH side.

REMOVAL OF ENGINE HOOD

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

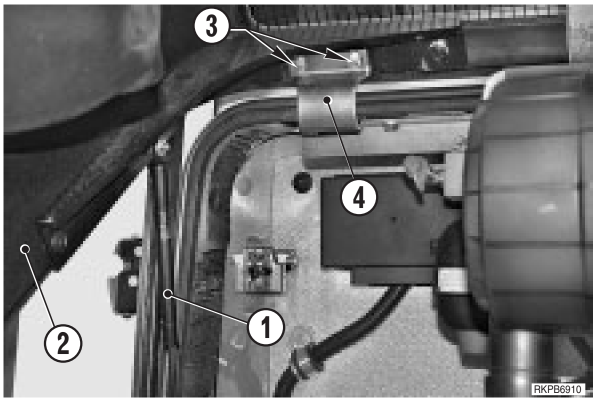
1 - Detach the gas cylinder (1) from the engine hood (2).

2 - While holding up the engine hood (2) remove the screws (3) that attach the hood to the hinges (4).

※ 1

★ Mark the position of any shims.

Engine hood: 36 kg



INSTALLATION OF ENGINE HOOD

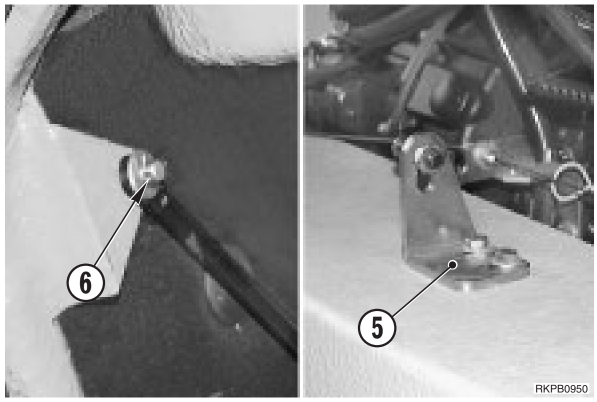
- To install, reverse the removal procedure.

※ 1

★ Position any shims.

★ Check the centering and adjustment of the closing hook (5).

⚠ Replace the cotter pins (6).



REMOVAL OF CONDENSER UNIT

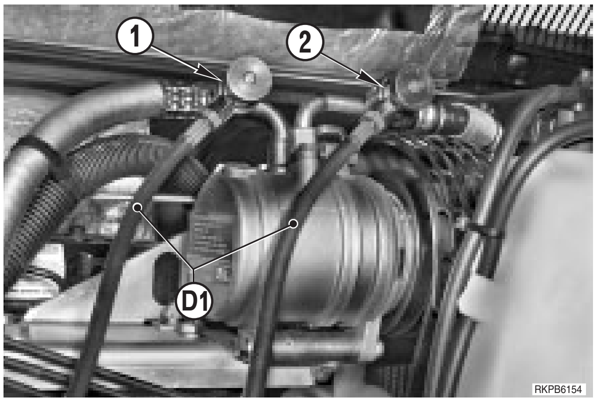
(Only for machine equipped with an air conditioning unit)

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

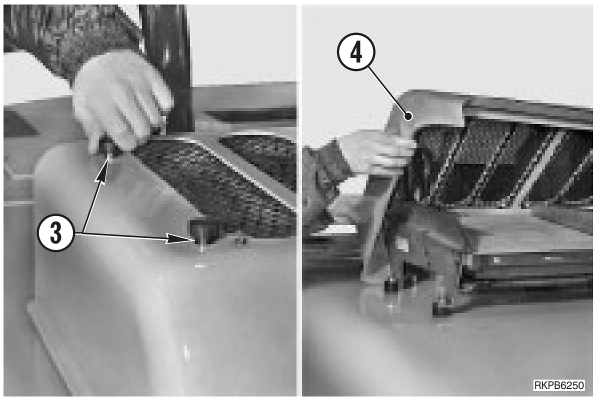
⚠ Lower the work equipment until it is resting on the ground and switch off the engine.

1 - Connect the outlets (1) and (2) to the maintenance station for air-conditioning units **D1** and drain the cooling fluid.

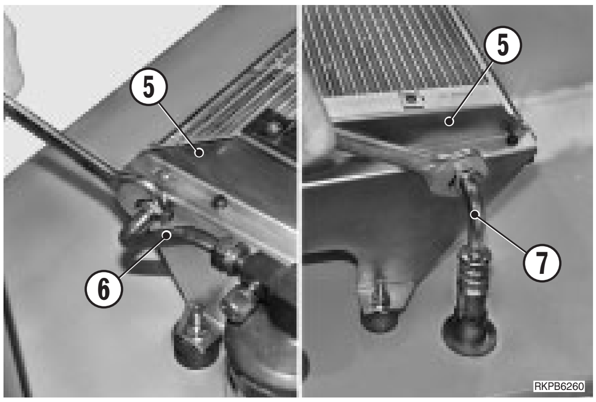
Quantity of fluid R134a: 1100 $^{-30}_{+50}$ g



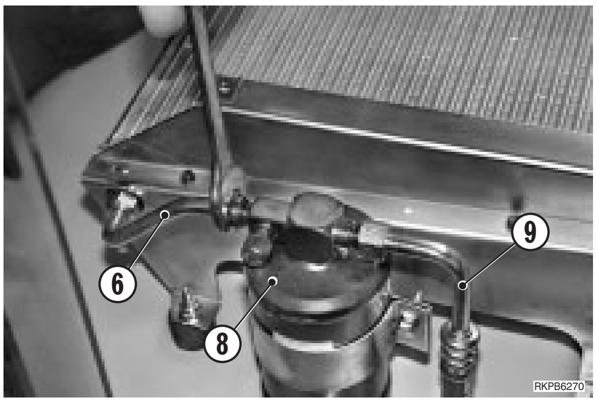
2 - Loosen the knobs (3) and remove the hood (4).



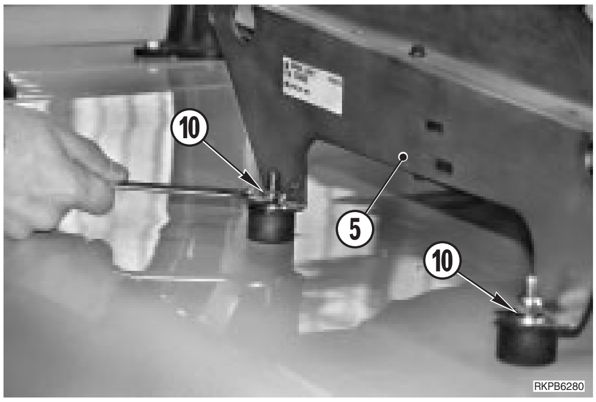
3 - Disconnect pipes (6) and (7) from condenser unit (5).



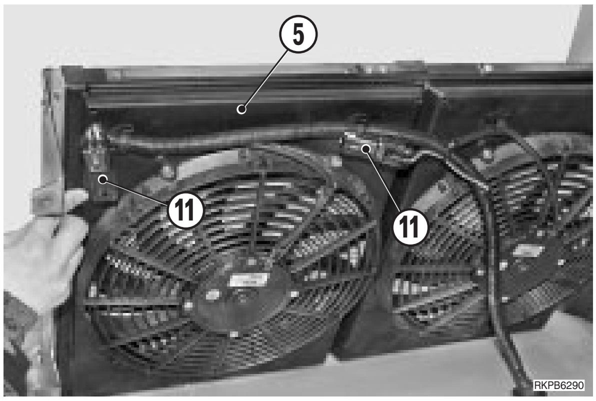
4 - Disconnect pipes (6) and (9) from filter (8).



5 - Remove nuts (10). ※ 1



6 - Raise condenser unit (5), disconnect the connectors (11) and remove the group.



INSTALLATION OF CONDENSER UNIT

- To install, reverse the removal procedure.

※ 1

Nut: 22.5–28.4 Nm

1 - Connect the unit to the maintenance station **D1** and refill it.

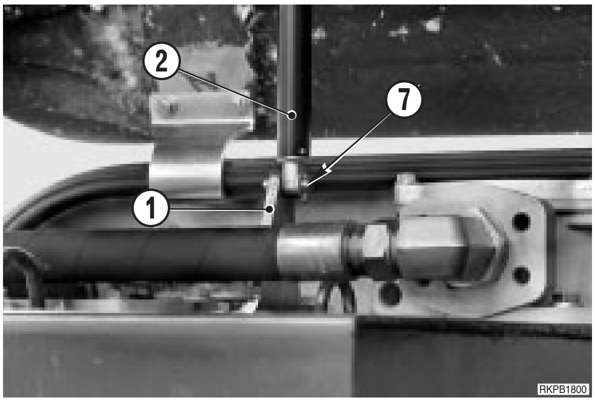
Quantity of fluid: 1100^{-30}_{+50} g

REMOVAL OF FRONT HOOD

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

1 - Detach the gas cylinder (2) from the support (1).

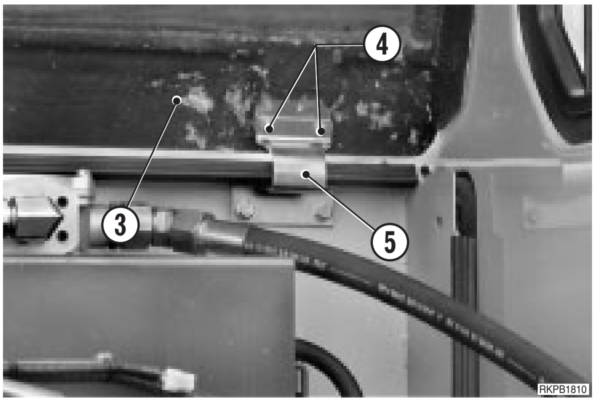
2 - **Only for machine equipped with an air conditioning unit:** remove the condenser unit.
(For detail see «REMOVAL OF CONDENSER UNIT»).



3 - While holding up the engine hood (3), remove the screws (4) that attach the hood to the hinges (5).
※ 1

★ Mark the position of any shims.

Engine hood: 27 kg



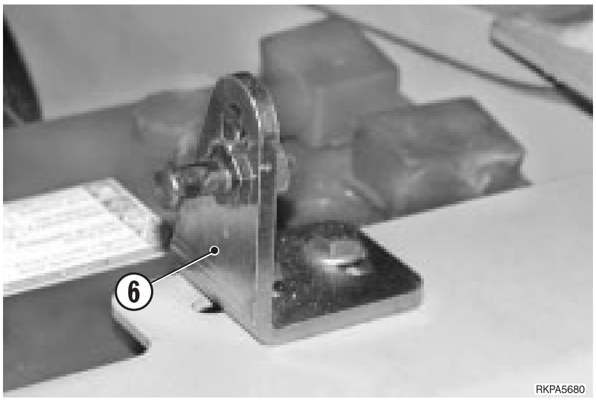
INSTALLATION OF FRONT HOOD

- To install, reverse the removal procedure.

※ 1

★ Position any shims.
★ Check the centering and adjustment of the closing hook (6).

⚠ Replace the cotter pins (7).



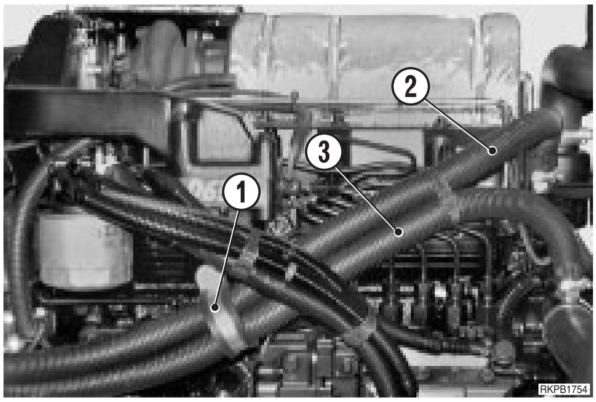
REMOVAL OF HEATING FAN UNIT

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

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

⚠ Drain the coolant liquid to a level below that of the connecting pipes (2) and (3) between the engine and the heating fan.

Cooling liquid: approx. 5 ℓ

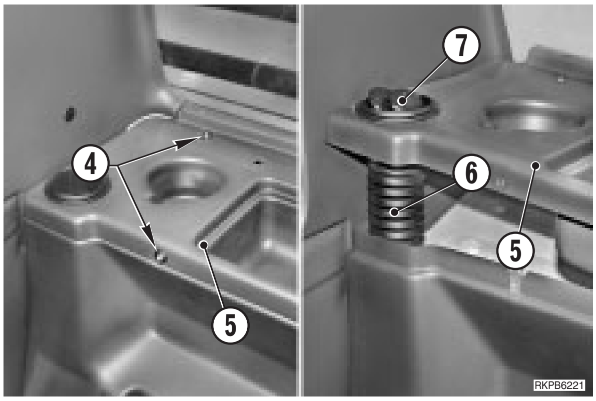


1 - Disconnect clamp (1) and pipes (2) and (3) from the engine and lower the terminals so as to thoroughly drain the liquid from the heating radiator.

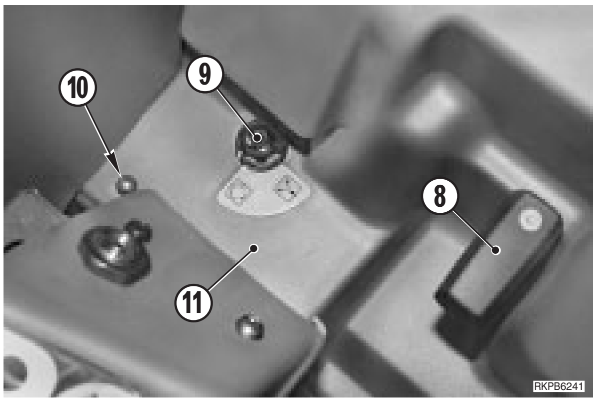
Cooling liquid: approx. 1.5 ℓ

2 - Move the back of the operator's seat completely forward and remove the panel (5) fixing screws (4).

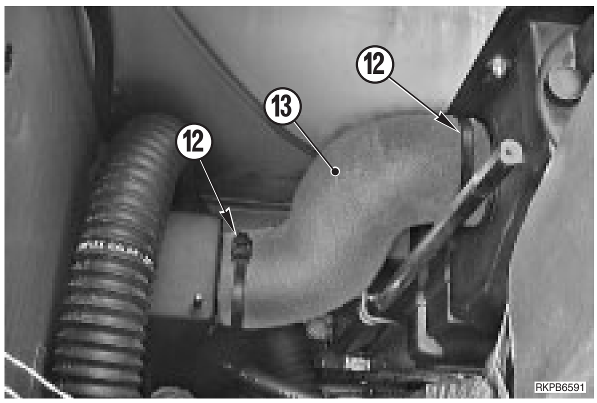
3 - Raise the panel (5), disconnect the heating hose (6) from the diffuser (7).



4 - Remove the knob (8) and (9), loosen the screw (10) and remove the hood (11).

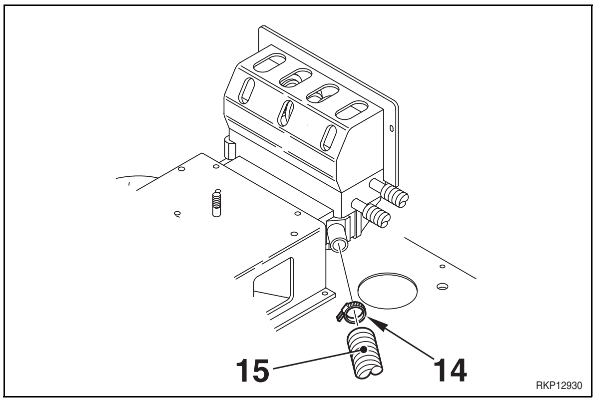


5 - Remove the clamps (12) and the sleeve (13).



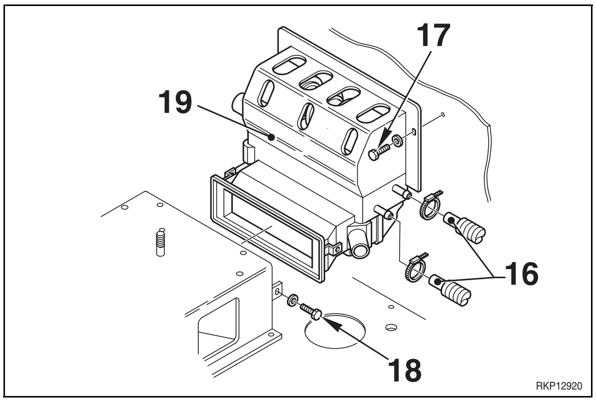
6 - Move forward the seat and disconnect the heater connectors.

7 - Remove the clamps (14) and disconnect the sleeve (15).



8 - Disconnect the pipes (16), remove screws (17) and lateral screws (18).

9 - Move backward the heating fan unit (19).



INSTALLATION OF HEATING FAN UNIT

- To install, reverse the removal procedure.

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

2 - Fill up with coolant liquid.

Quantity of coolant liquid: approx. 7.5 ℓ

3 - Start the engine to circulate the coolant liquid.

4 - Switch off the engine and top up the level.

REMOVAL OF AIR CONIDTIONING FAN UNIT

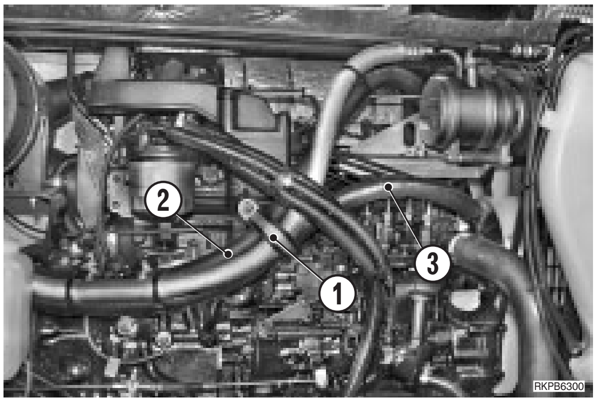
(Only for machine equipped with an air conditioning unit)

⚠ Disconnected the cable from accumulator negative terminal (–)

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

1 - Drain the coolant liquid a level below that of the connecting pipes (2) and (3) between the engine and the heating fan.

Cooling liquid: approx. 5 ℓ

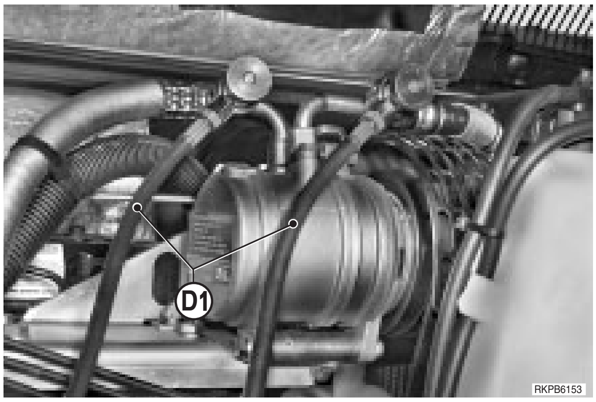


2 - Connect the outlets to the maintenance station **D1** for air conditioning unit and drain the cooling fluid

Quantity of fluid R134a: 1100^{-30}_{+50} g

3 - Disconnect clamp (1) and pipes (2) and (3) from the engine and lower the terminals so as to throughly drain the liquid from the heating radiator.

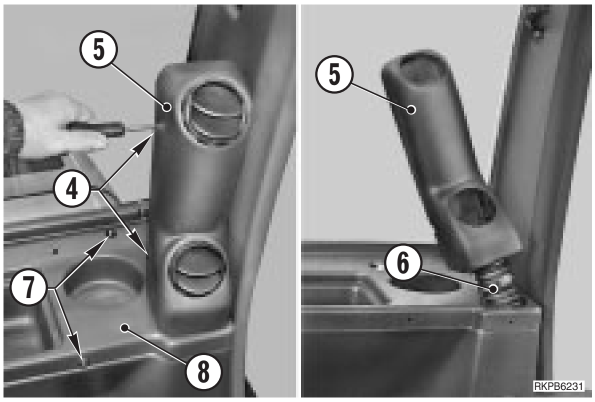
Cooling liquid: approx. 1.5 ℓ



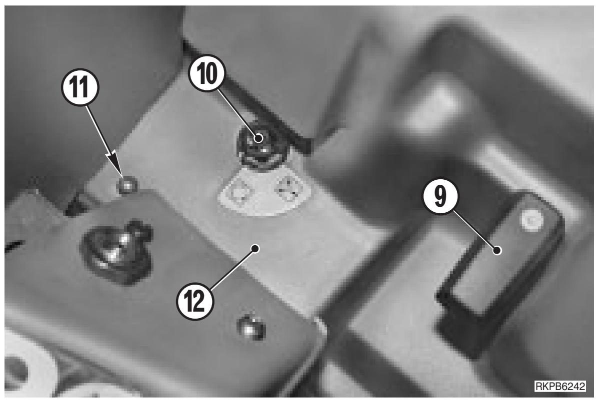
4 - Remove screws (4) fixing air conduct (5).

5 - Raise conduct air (5) and disconnect pipe (6).

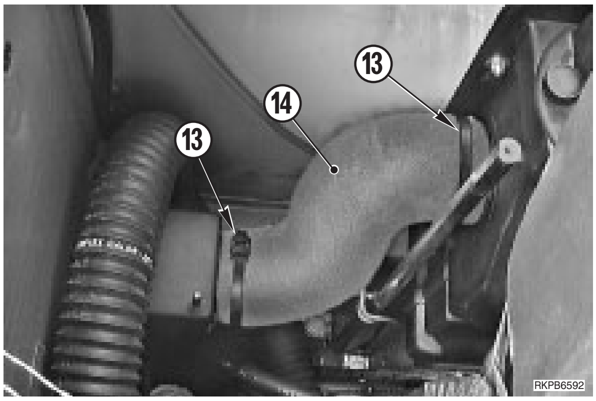
6 - Move the back of the operator's seat completely forward, remove the screws (7) and the hood (8).



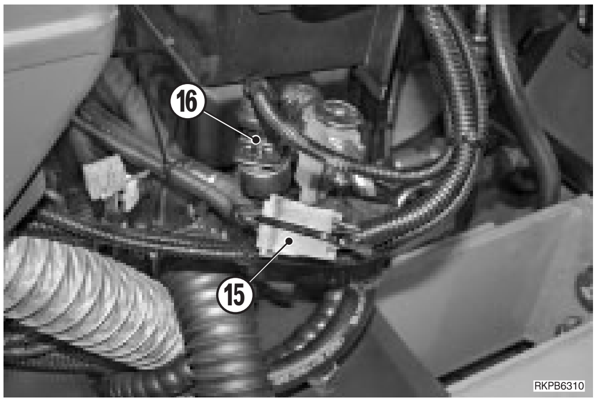
7 - Remove the knobs (9) and (10), the screws (11) and the hood (12).



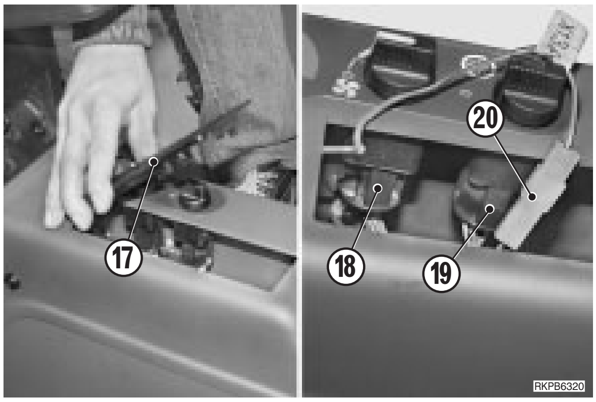
8 - Remove the clamps (13) and the sleeve (14).



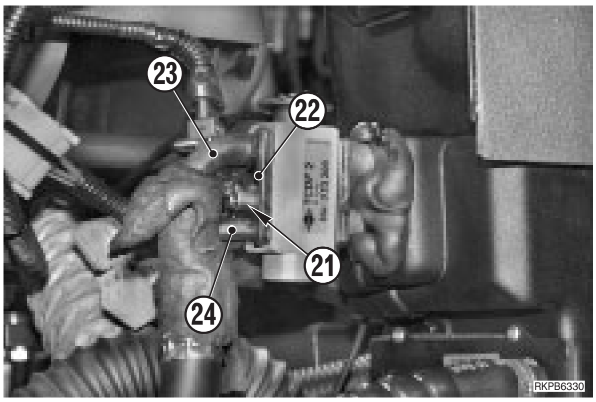
9 - Disconnect the connectors (15) and (16).



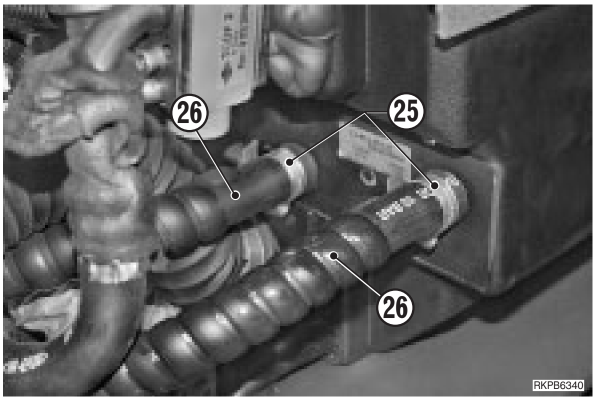
10 - Remove the plug (17) and disconnect the connectors (18), (19) and (20).
★ Mark the position of connectors.



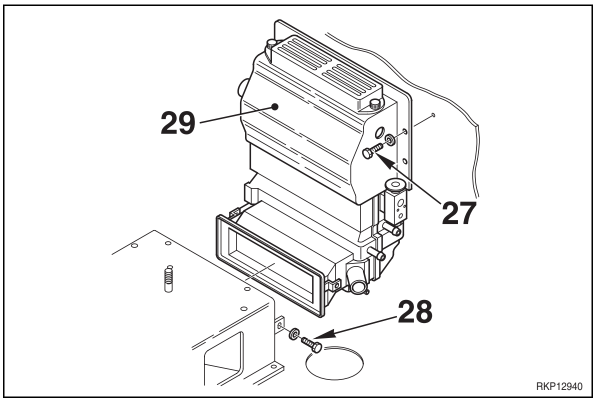
11 - Remove the screw (21) retaining flange (22), disconnect the return pipe (23) and pipe (24). ※ 1



12 - Loosen the clamps (25) and remove the pipes (26).



13 - Remove screws (27), (28) and move backward the air conditioning unit (29).



INSTALLATION OF AIR CONDITIONING FAN UNIT

- To install, reverse the removal procedure.

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

2 - Fill up with coolant liquid.

Quantity of coolant liquid: approx. 7.5 ℓ

3 - Start the engine to circulate the coolant liquid.

4 - Switch off the engine and top up the level.

※ 1

★ Film the valve and union with anticondensate mastic.

5 - Connect the unit to the maintenance station **D1** and refill it.

Quantity of fluid R134a: 1100 $^{-30}_{+50}$ g

REMOVAL OF RADIATOR

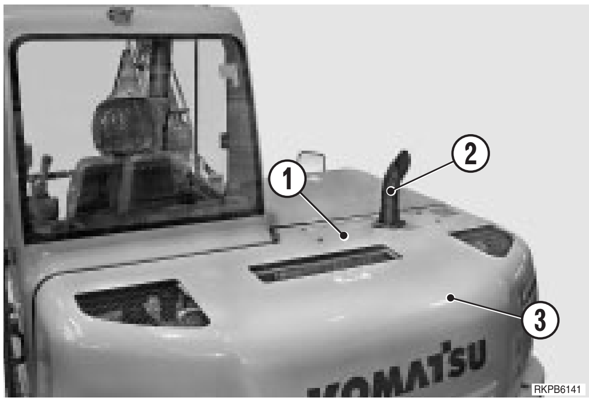
Lower the work equipment until it is resting on the ground and switch off the engine.

Completely eliminate all residual pressures in all circuits. (For details see: «20. TESTING AND ADJUSTMENTS»).

Drain the engine coolant liquid.

Cooling liquid: 18 ℓ

Hydraulic oil: 74 ℓ

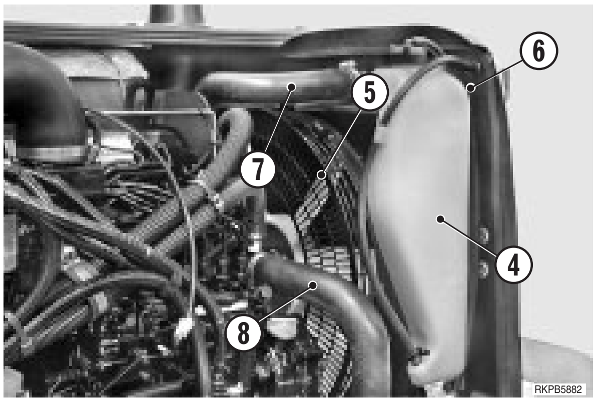


1 - Remove the cover (1) together with the exhaust pipe (2).

2 - Remove the engine hood (3).
(For details see: «REMOVAL OF ENGINE HOOD»).

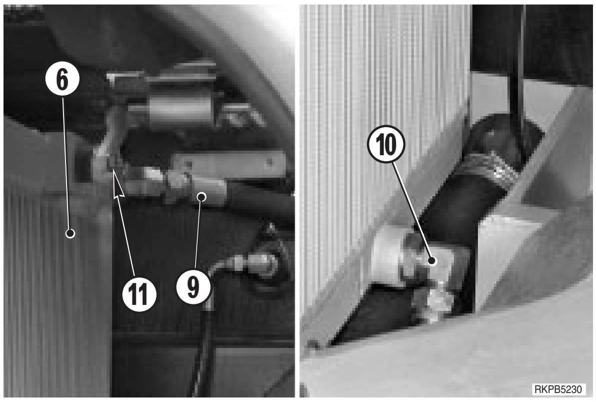
3 - Remove the coolant container (4) and the fan guard (5).

4 - Disconnect the engine coolant circuit hoses (7) and (8) from the radiator (6).



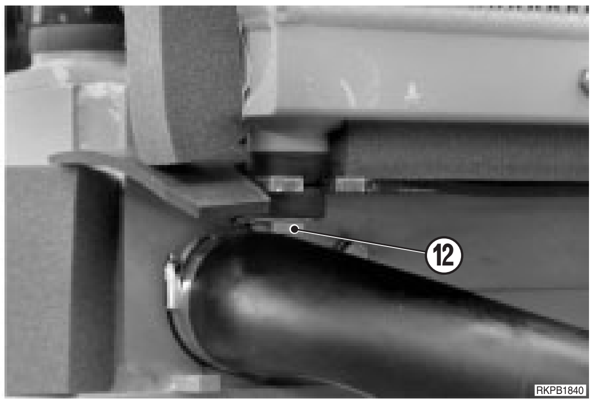
5 - Disconnect the hydraulic oil supply pipe (9) and the return pipe (10).

6 - Loosen the nut (11).



7 - Loosen the radiator retaining screws (12) and remove the radiator.

Radiator: 37 kg



INSTALLATION OF RADIATOR

- To install, reverse the removal procedure.

1 - Refill the coolant liquid circuit.

Cooling liquid: 18 ℓ

2 - Refill the hydraulic oil tank.

Hydraulic oil: 74 ℓ

3 - Start the engine at low idling to circulate all the fluids and to fill up the oil coolers.

4 - Stop the engine and top up all levels (coolant liquid and hydraulic oil).

5 - Bleed the hydraulic circuits.
(For details see «20. TESTING AND ADJUSTMENTS»).

REMOVAL OF FUEL TANK

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

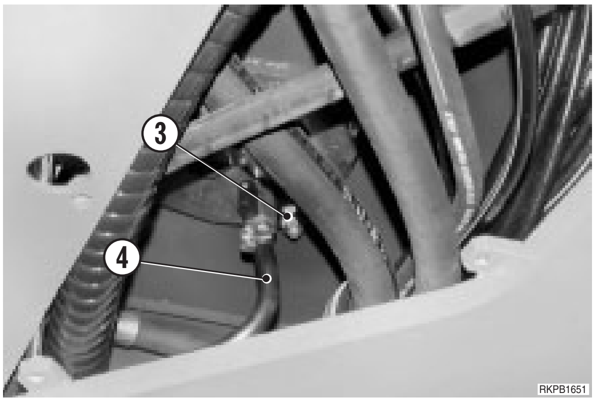
⚠ Disconnect the cable from accumulator negative terminal (–).

★ Turn the turret 45° towards the right.

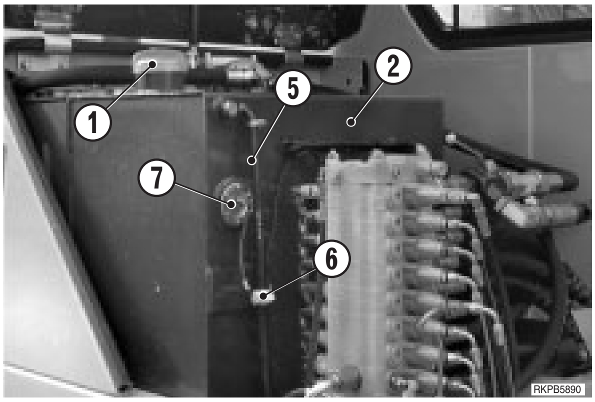
1 - Remove the front hood (for details, see «REMOVAL OF FRONT HOOD») and the bottom right guard of the turret.

2 - Remove the cap (1) of the fuel tank (2), open the tank drainage cock (3), and drain the fuel.

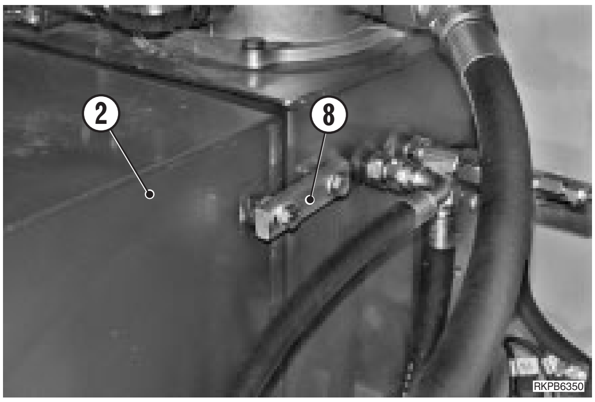
3 - Disconnect the fuel suction pipe (4).



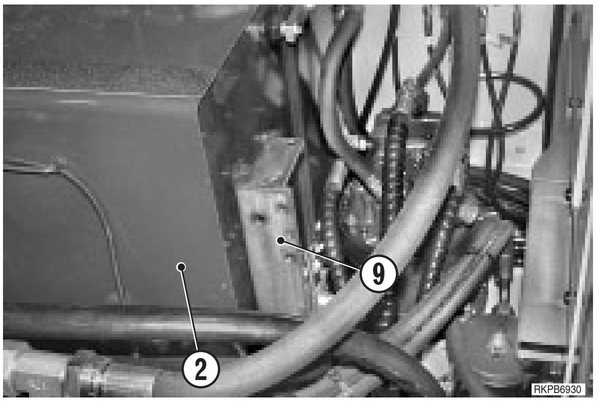
4 - Disconnect the fuel return pipe (5) and the connector (6) of the level gauge (7).



5 - Disconnect the plate (8) that joins the tanks.



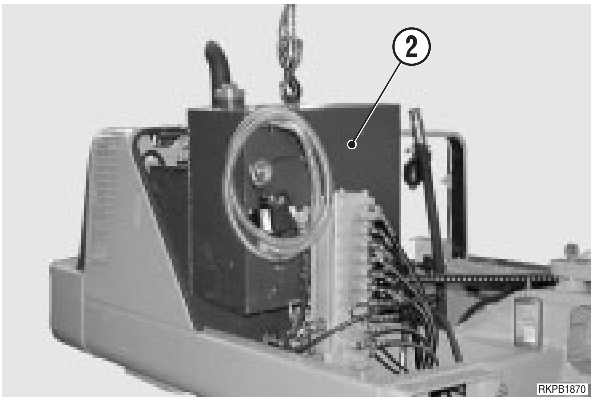
6 - Disconnect from tank (2) the solenoid valve support (9).



7 - Hook the tank (2) to the hoisting equipment and slightly put the rope under tension.

8 - Remove the screws and remove the tank.

kg Fuel tank: 43 kg



INSTALLATION OF FUEL TANK

- To install, reverse the removal procedure.

★ Fill the fuel tank and start the engine.

REMOVAL OF HYDRAULIC OIL TANK

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

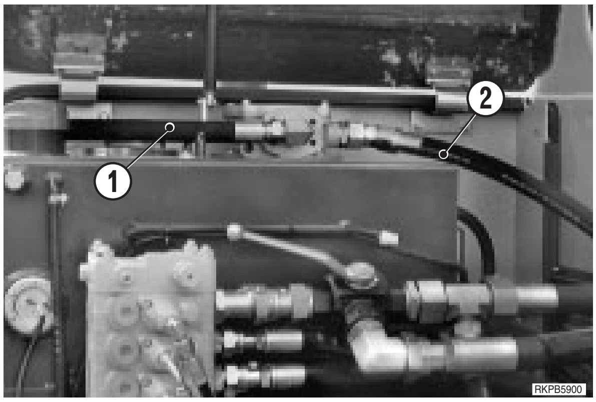
Release residual pressures from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

- Drain the hydraulic oil.

  Quantity of oil: approx. 74 ℓ

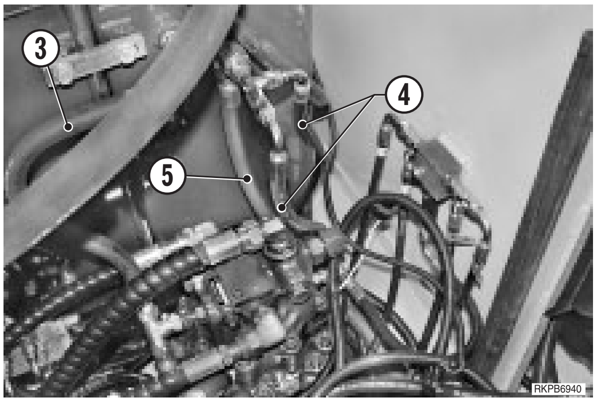
1 - Remove the fuel tank.
(For details, see «REMOVAL OF FUEL TANK»).

2 - Disconnect the return pipe (1) and (2).



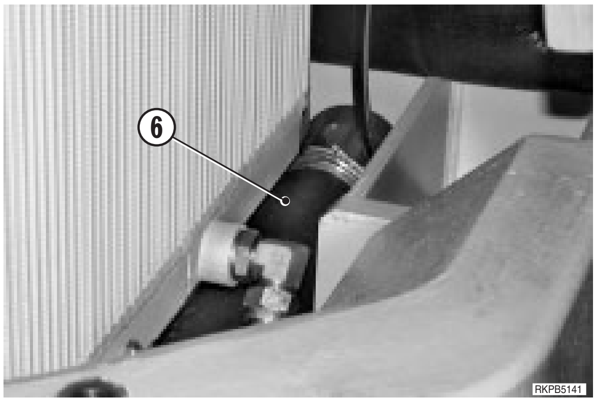
3 - Disconnect the drain pipes (3) and (4).

4 - **With arm safety valve:**
Disconnect the drain pipe (5) from safety valve.



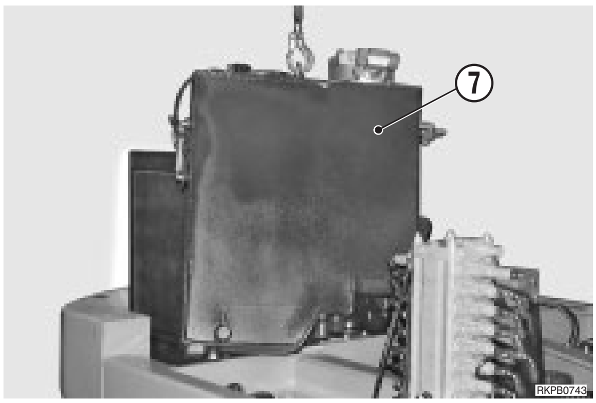
5 - Disconnect the coupling of the pump suction tube and the pipe (6).

6 - Hook the tank to the hoisting equipment and slightly put the rope under tension.



7 - Remove the bolts and the oil tank (7).

kg Oil tank: 62 kg



INSTALLATION OF HYDRAULIC OIL TANK

- To install, reverse the removal procedure.

1 - Fill the hydraulic oil tank to maximum level.

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

Hydraulic oil needed: approx. 74 ℓ

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

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

REMOVAL OF ENGINE-PUMP GROUP

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

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

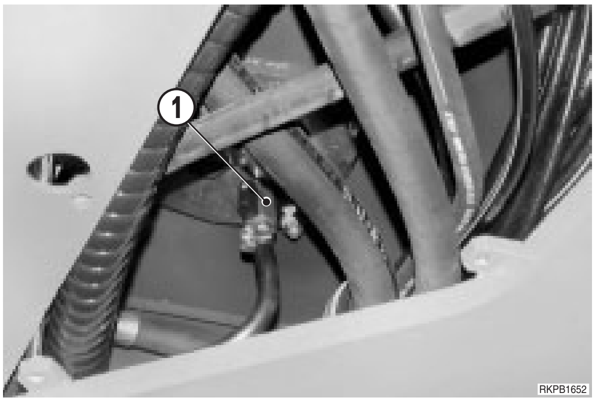
⚠ Release residual pressures from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

- Drain the hydraulic oil.

  Quantity of oil: approx. 74 ℓ

- Drain the engine coolant liquid.

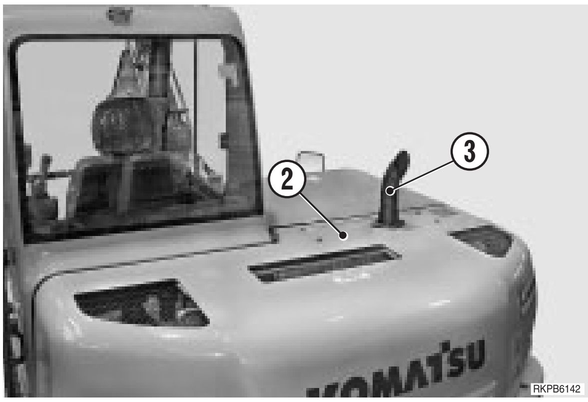
  Quantity of coolant liquid: 18 ℓ



- Close the feed cock of fuel tank (1).

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

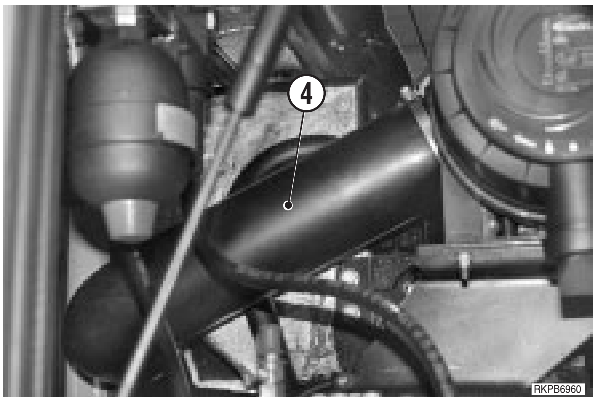
2 - Remove the top cover (3) complete with the exhaust pipe (2).



3 - Remove the rubber air filter elbow (4).

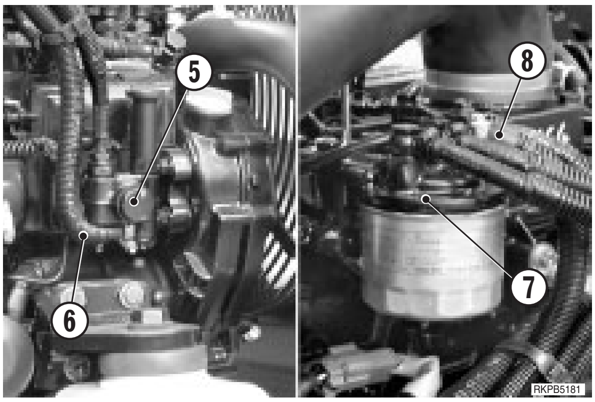
4 - Remove the rear lower protection.

5 - Disconnect from engine all connectors.



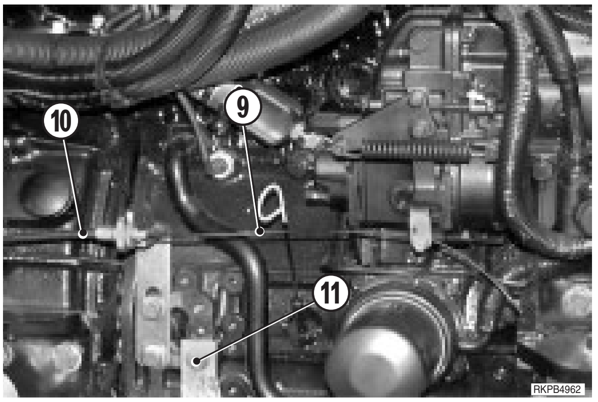
6 - Disconnect the pipe (6) coming from the separator from the fuel pump (5).

7 - Disconnect the return tube (8) from the fuel filter (7).

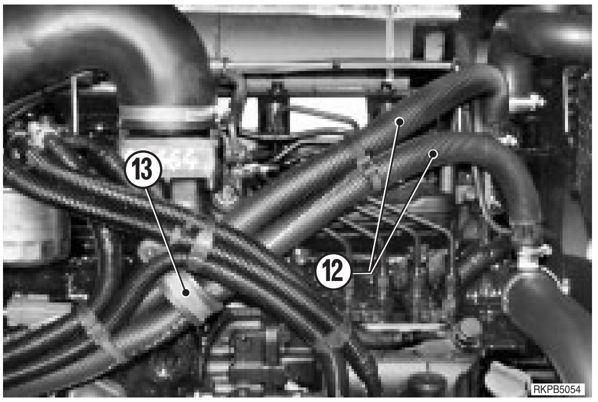


8 - Disconnect the cable (9) and the sheathing (10) of the accelerator as well as the earth plait (11) from the engine.

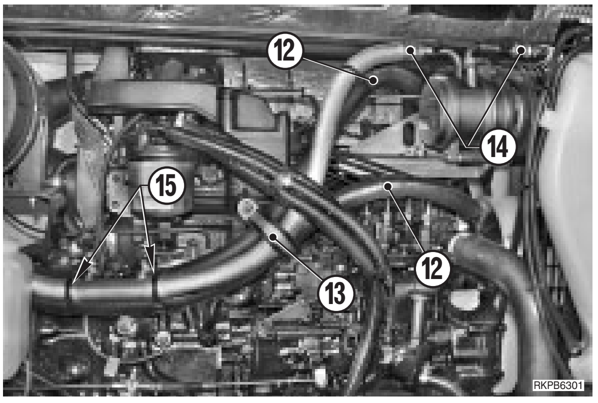
9 - Remove the radiator.
(For detail see «REMOVAL OF THE RADIATOR»).



10 - Loosen the clamp (12) and disconnect the heating pipes (13) from the engine.

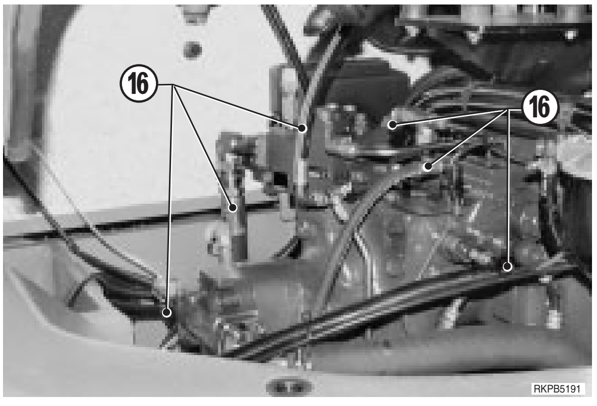


11 - **Only for machine equipped with an air conditioning unit.**
Disconnected from engine the heating pipe (12) and from air conditioning compressor the pipes (14), the clamps (13) and (15).

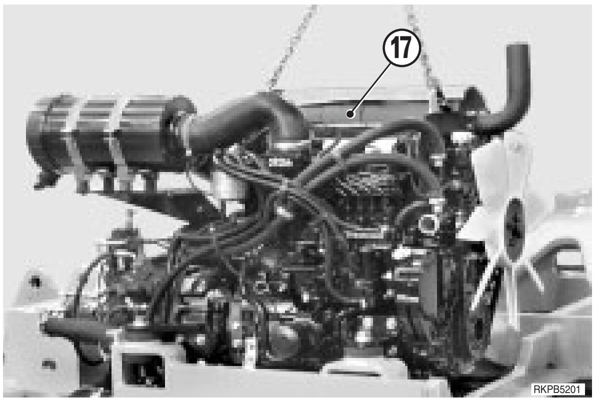


12 -Disconnect the flanges of the suction pipes and all delivery pipes (16) from pumps.

★ Mark the position of Load Sensing, Mode System and servo-control feed pipes in order to avoid mixing them up during installation.



13 - Hook the engine (17) to the hoisting equipment using the specific brackets and slightly put the chains under tension.

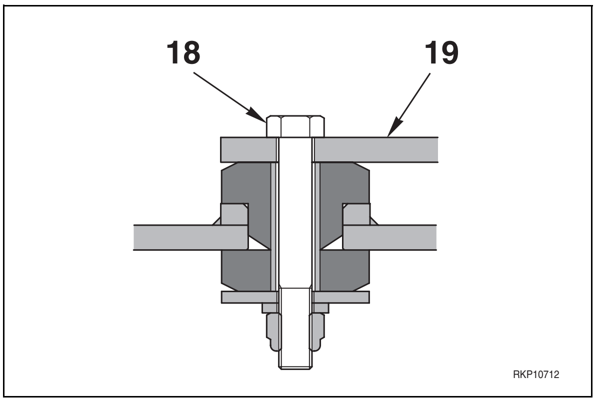


14 -Remove the screws (18) (No. 4) of the engine supports (19). ※ 2

15 - Slowly lift the unit and remove the engine (17).

kg Engine - pumps: 500 kg

⚠ Ensure that the engine-pump group is not in any way caught or fastened to the frame and that all pipes and cables are disconnected.



INSTALLATION OF ENGINE-PUMP GROUP

- To install, reverse the removal procedure.

1 - Fill the hydraulic oil tank to maximum level.

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

Hydraulic oil needed: approx. 74 ℓ

2 - Fill the cooling circuit.

Cooling liquid: approx. 18 ℓ

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

4 - Switch off the engine, check the level and, if necessary, top it up.

REMOVAL OF PUMP GROUP

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

Release residual pressures from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

- Drain the hydraulic oil.

Quantity of oil: approx. 74 ℓ

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

2 - Remove left and centre rear guards.

3 - Disconnect the suction flanges and all delivery pipes from the pumps (1) and (2).

★ Mark the position of Load Sensing, Mode System and servo-control feed pipes in order to avoid mixing them up during installation.

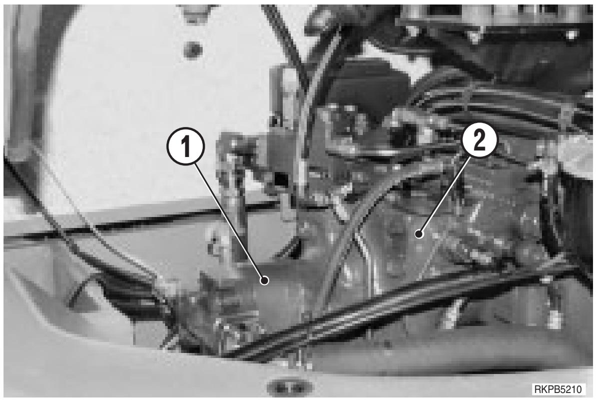
4 - Remove the air filter (3) together the support.

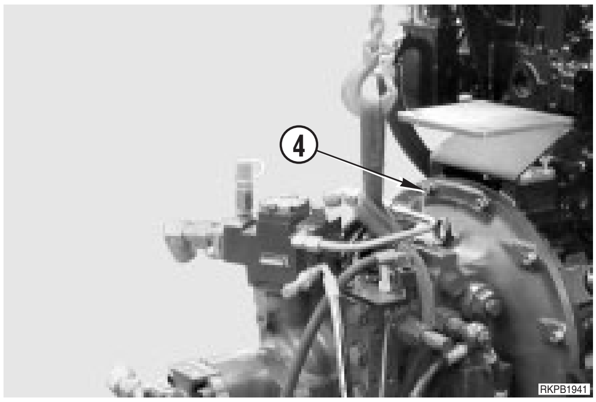
5 - Attach the pump group to a hoist keeping the cables under slight tension.

★ Pass a harness under the gear pump to prevent tilting of the unit.

6 - Pull out the screws (4) and remove the pump group; disengage the group from the coupling joint shifting it to one side ※1

Pump group: approx. 97 kg





INSTALLATION OF PUMP GROUP

- To install, reverse the removal procedure.

※1

★ Coat the coupling surfaces thinly.

Coupling surfaces: ASL800050

Pump check screws: Loctite 262

Pump check screws: 50±5 Nm

1 - Fill the hydraulic oil tank to maximum level.

While filling, bleed air from the main pump piston. (For details, see «20. TESTING AND ADJUSTMENTS»).

Hydraulic oil: 74 ℓ

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

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

REMOVAL OF ENGINE-PUMP COUPLING JOINT

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

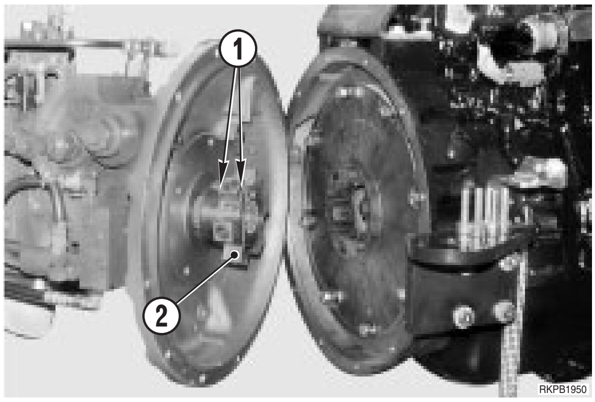
1 - Remove the piston pump.
(For details, see «REMOVAL OF PISTON PUMP»).

Half joint pump

2 - Loosen dowel pin (1) fixing half joint (2) in more stages and alternatively. ※ 1
★ Heat dowel pins to 85–100 °C

3 - Remove pump half joint (2).

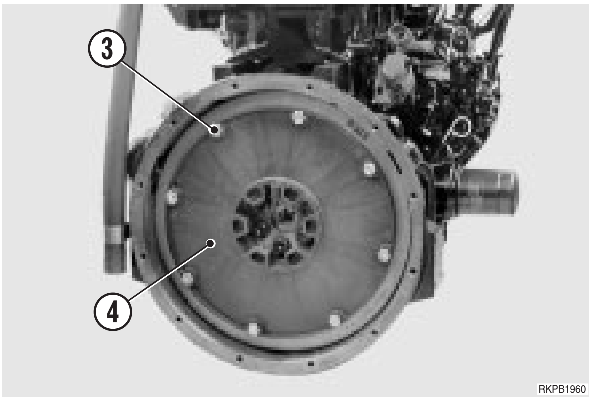
If necessary, use a puller.



RKPB1950

Half joint on flywheel

4 - Remove bolts (3) and flywheel cover (4). ※ 2



RKPB1960

INSTALLATION OF ENGINE-PUMP COUPLING JOINT

- To install, reverse the removal procedure.

※ 1

Pump flange joint mounting bolts: Loctite 262

Pump flange joint mounting bolts: 50 Nm

※ 2

Drive flange bolts: Loctite 262

Drive flange bolts: 50 Nm

1 - Fill up tank unit maximum level.

⚠ During the filling operation, bleed air from the piston pump (For details, see «20. TESTING AND ADJUSTMENTS»).

Hydraulic oil: 74 ℓ

2 - Start the engine to allow oil circulation in all systems and check the seals.

3 - Stop the engine and, if necessary, restore oil level in the tank.

REMOVAL OF GEAR-PUMP

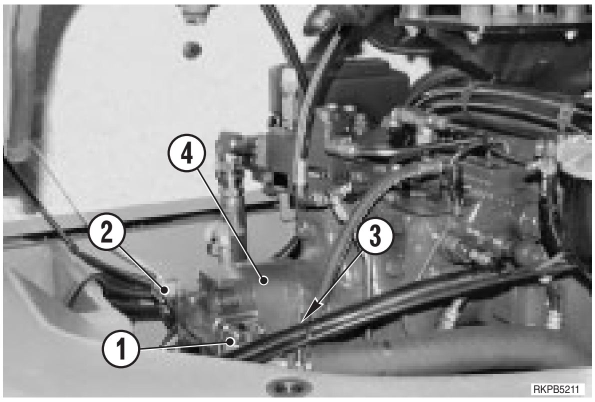
Lower the work equipment until it is resting on the ground and switch off the engine.

Release residual pressures from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

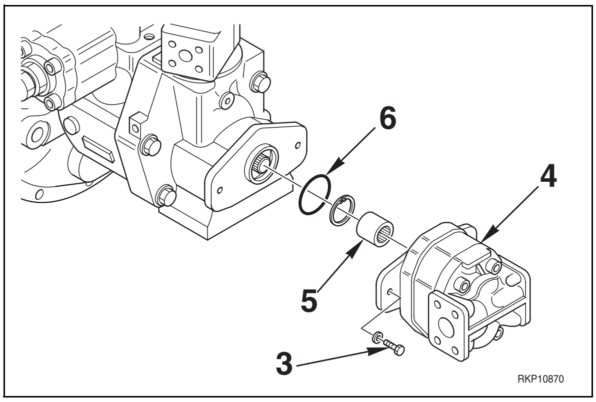
- Drain the hydraulic oil.

Quantity of oil: approx. 74 ℓ

1 - Disconnect the suction flange (1) and the delivery pipe (2) from the pump. ※ 1



2 - Remove the bolts (3) and the pump (4), the joint (5) and the gasket (6). ※ 2



INSTALLATION OF GEAR-PUMP

- To install, reverse the removal procedure.

※ 1

★ Before connecting the suction flange, check the condition of the seal and keep it in its seat by applying grease ASL800050.

Flange screws: 35±3.5 Nm

※ 2

Joint: ASL800050

Pump fastening screws: 98–123 Nm

1 - Fill the hydraulic oil tank to maximum level.

While filling, bleed air from the main pump piston. (For details, see «20. TESTING AND ADJUSTMENTS»).

Hydraulic oil needed: approx. 74 ℓ

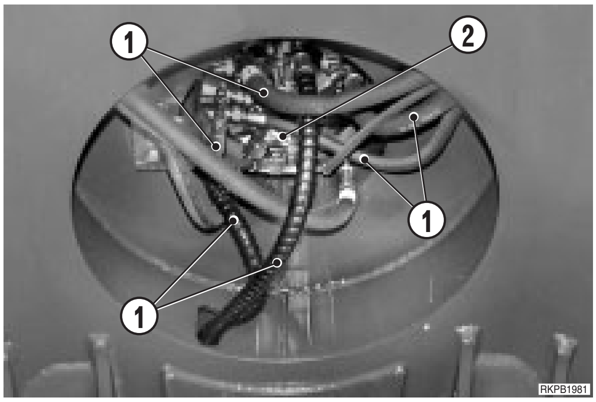
2 - Start the engine to circulate the oil and check that there are no leakages.
3 - Switch off the engine, check the level and, if necessary, top it up.

REMOVAL OF SWIVEL JOINT

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

Release residual pressures from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

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

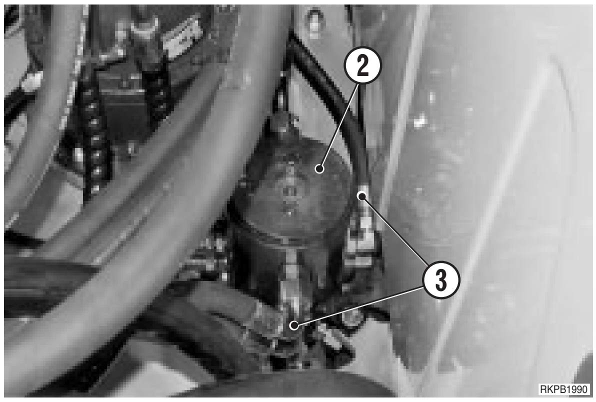


1 - Remove the distributor hood. (For details see «REMOVAL OF FRONT HOOD»).

2 - Disconnect the tubes (1) on the lower side of the swivel joint (2) and plug them.
   ★ Mark the tubes before disconnecting them, to avoid errors when re-assembling. ※1

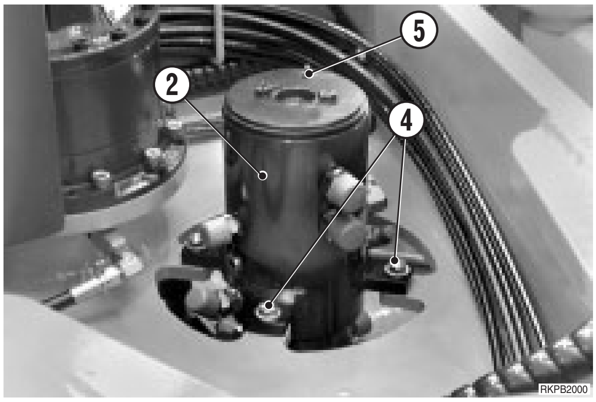
3 - Disconnect the tubes (3) on the top of the joint (2) and plug them.
   ★ Mark the tubes before disconnecting them, to avoid errors when re-assembling.

4 - Unscrew and remove the screws (4) of the swivel joint.



5 - Hook the joint (2) to the hoisting equipment and remove it. ※2

   Swivel joint: 36 kg



INSTALLATION OF SWIVEL JOINT

- To install, reverse the removal procedure.

※1

★ Before connecting the top pipes, introduce hydraulic oil in the chambers of the branch that is not in use and in the drain branch (branches 1 and 4).

※2

★ Grease friction points through the lubricating nipple (5).

   Swivel joint: ASL800050

1 - Start the engine, move the machine in both directions and move the blade several times to bleed all air from the circuits.

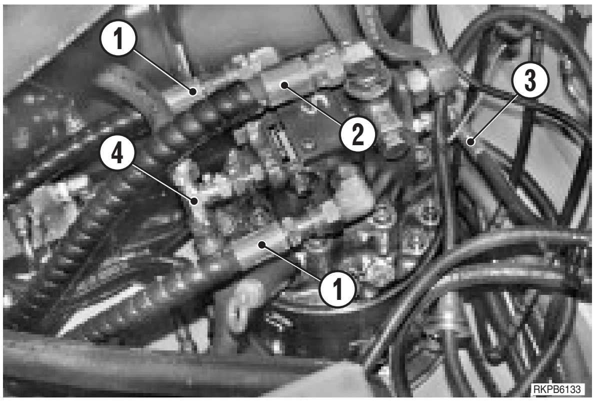
2 - Switch off the engine and top up the oil in the hydraulic tank.

REMOVAL OF SWING MOTOR

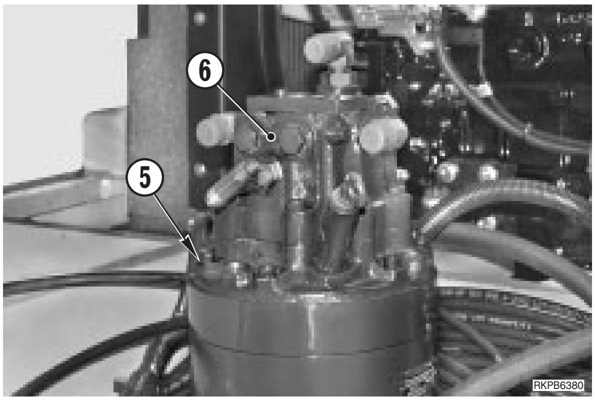
⚠ Lower the work equipment until it is resting on the ground and switch off the engine.

⚠ Release residual pressures from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

1 - Disconnect the supply (1), return (2), the brake release pipe (3) and the drain line connection (4). ※1



2 - Remove the screws (5) and remove the motor (6).



INSTALLATION OF SWING MOTOR

- To install, reverse the removal procedure.

※1

★ Fill the motor with hydraulic oil through the top drain line connection.

1 - Start the engine to allow oil circulation in all systems and check the seals.

2 - Bleed the air from engine. (For details, see «20. TESTING AND ADJUSTMENTS»).

REMOVAL OF SWING MACHINERY

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

Release residual pressures from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

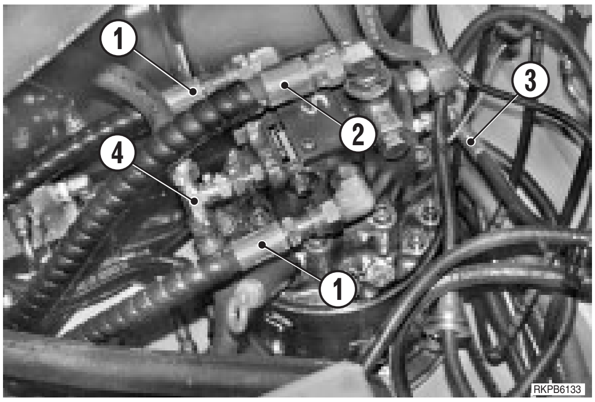
1 - Drain the reduction gear hydraulic oil.

Quantity of oil: approx. 4 ℓ

2 - Remove the front hood (For details, see «REMOVAL OF FRONT HOOD»).

3 - Disconnect the feed pipes (1), the exhaust pipe (2), the brake release pipe (3) and the drain line connection (4).

※ 1



4 - Remove the drain extension tube (5).

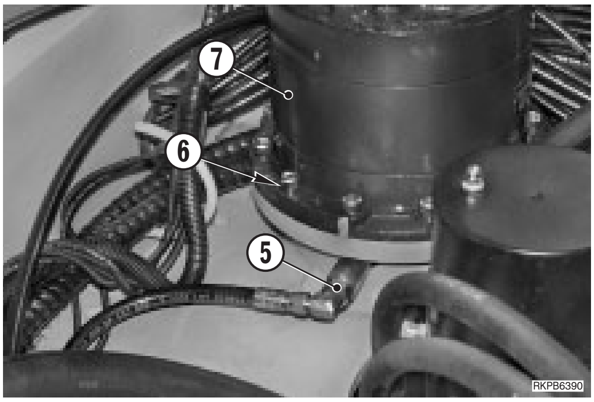
5 - Remove the check screws (6) (No. 12) of the reduction gear (7). ※ 2

6 - Fasten two screws into the holes opposite to each other and remove the reduction gear

7 - Sling the complete assembly and remove it.

★ During removal, slowly lift the assembly and pay particular attention not to damage the pipes or other parts.

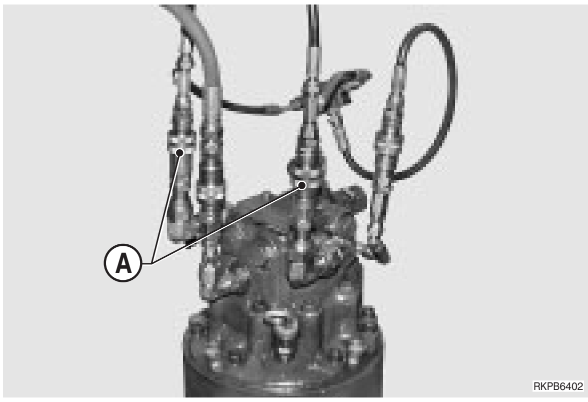
Complete group: approx. 87 kg



INSTALLATION OF THE SWING MACHINERY

- To install, reverse the removal procedure.

★ In order to centre the holes of the pins and of the fastening screws, connect a hydraulic power unit "**A**" to the hydraulic motor and slowly rotate the motor until the correct angle for the positioning of the reduction gear has been obtained.



※ 1

★ Fill with hydraulic oil through the breather (8).

※ 2

Screws: 294 Nm

1 - Start the engine to allow oil circulation in all systems and check the seals.

2 - Bleed the air from engine. (For details, see «20. TESTING AND ADJUSTMENTS»).

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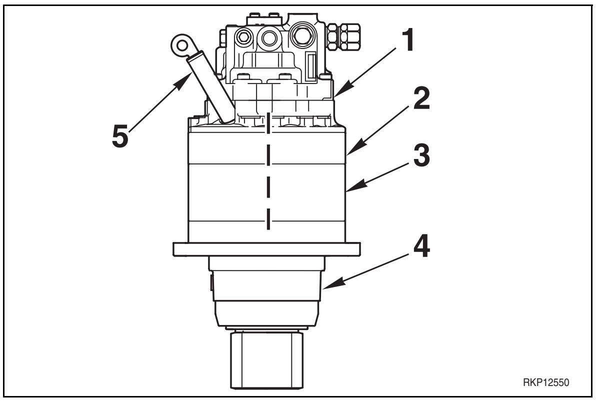
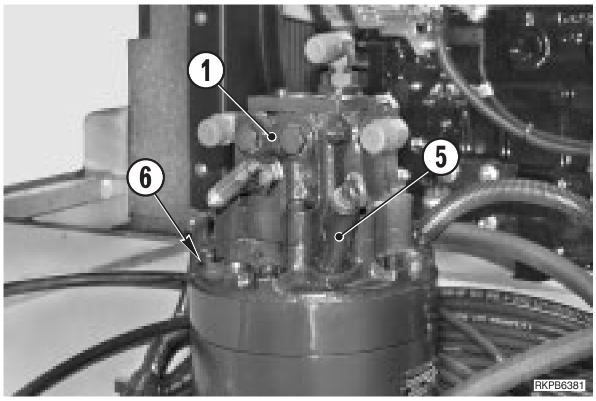
DISASSEMBLY OF THE SWING MACHINERY

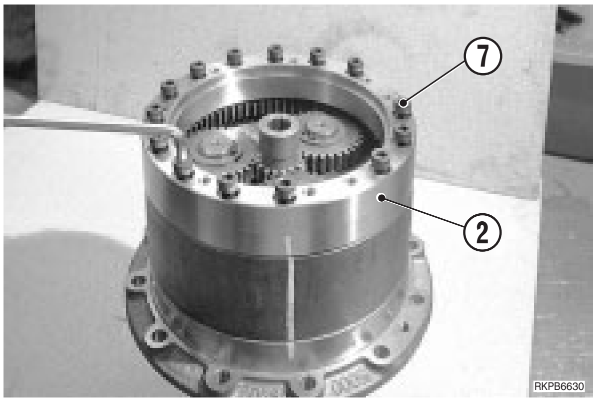
★ Before dismantling the swing machinery mark the position of the hydraulic motor (1) in relation to the flange (2), in relation to the flange (2), in relation to the flange (2) and ring gear (3) and gear housing (4).



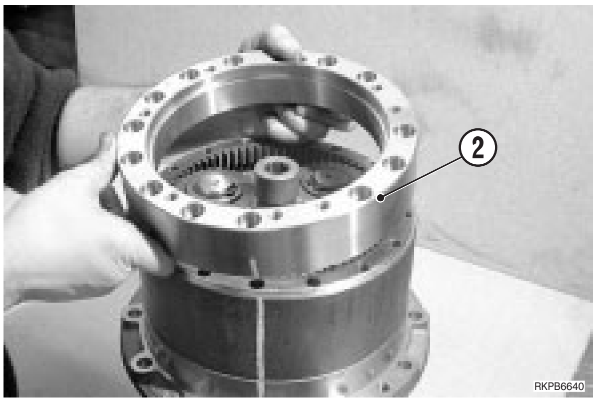
1 - Remove the oil drain plug (5) and remove the screw (6) and hydraulic motor (1).



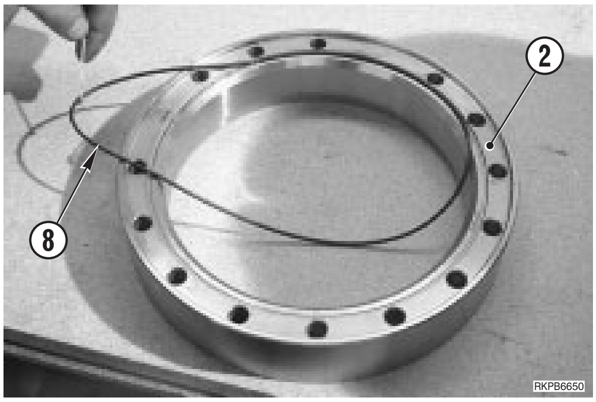
2 - Remove the screw (7) (No. 14) fixing flange (2).



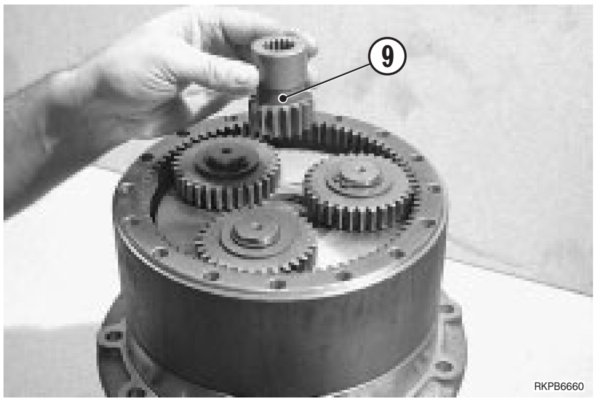
3 - Remove the flange (2).



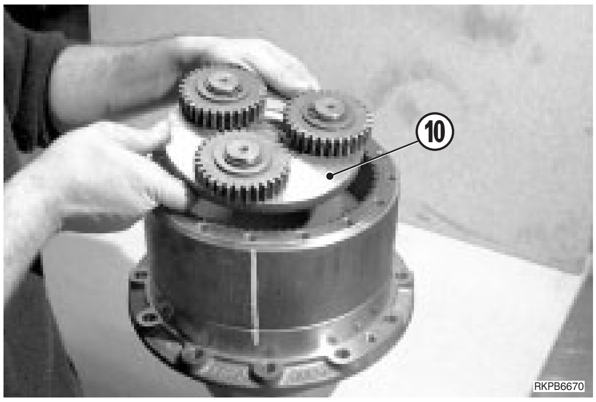
4 -Take out the O-ring (8) from flange (2).



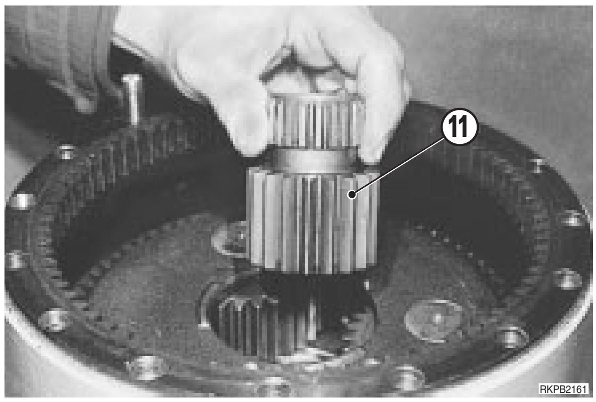
5 - Remove 1st reduction sun gear (9).



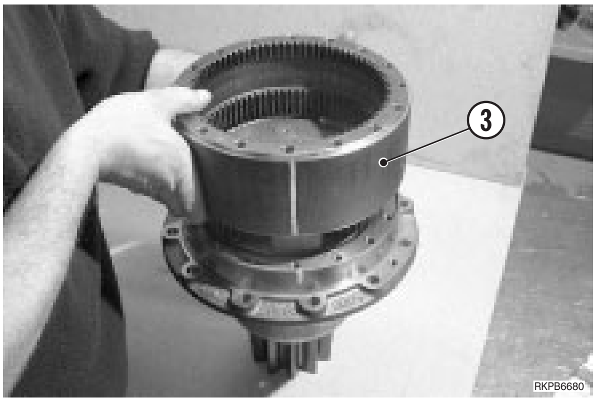
6 - Remove the planetary carrier (10).



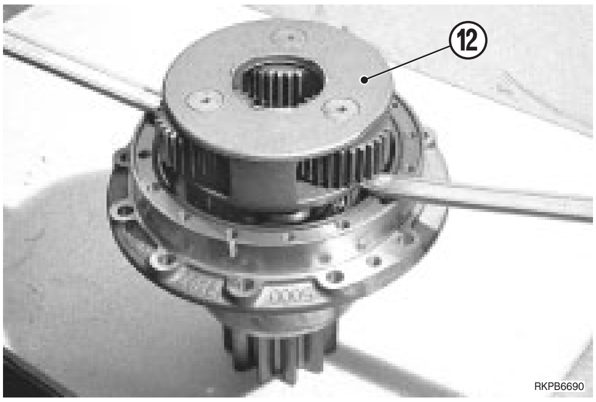
7 - Remove 2nd reduction sun gear (11).



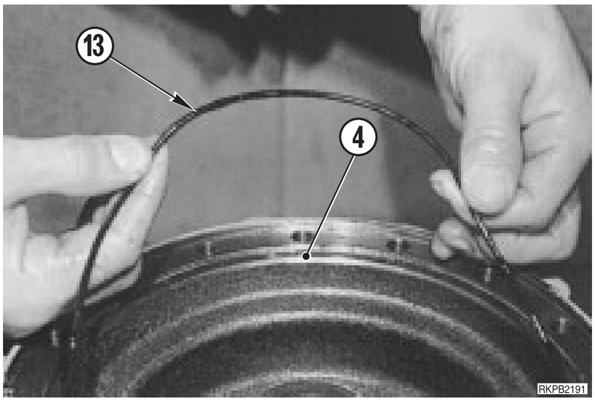
8 - Take out the toothed ring (3).



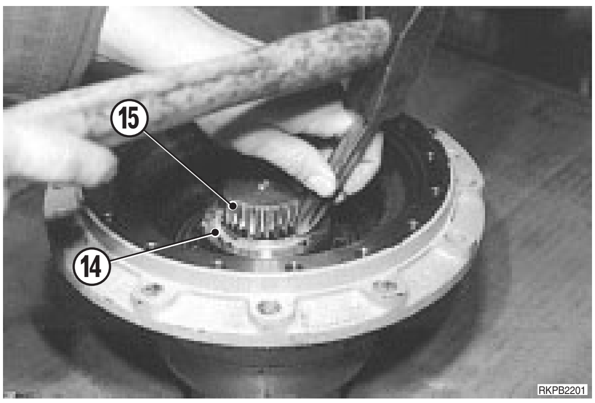
9 - Using levers, remove the planetary carrier (12).



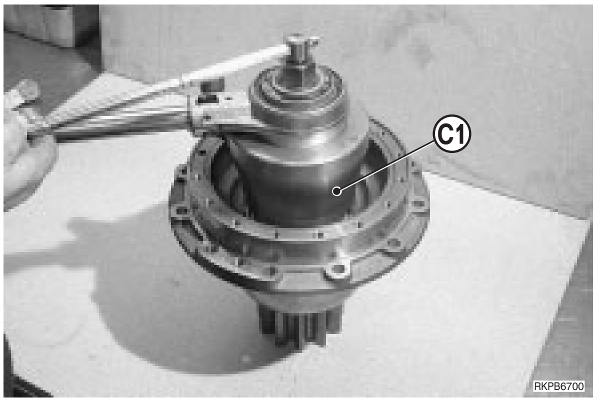
10 - Remove the O-ring (13) from gearbox housing (4).



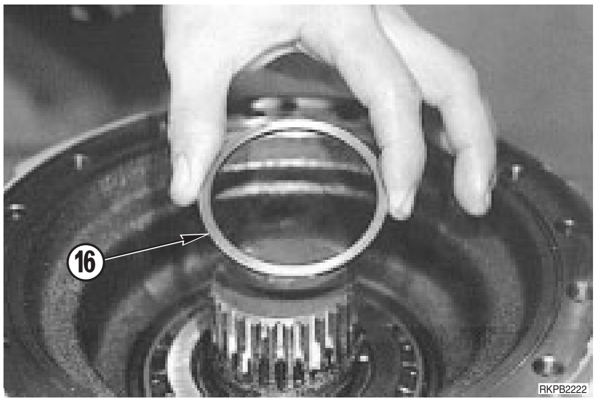
11 - Lift the staking of the ring nut (14).



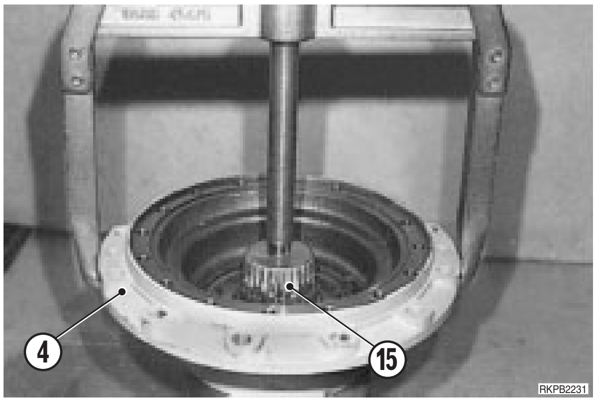
12 - Using the special tool **C1** and a dynamometric wrench, remove the ring nut (14).



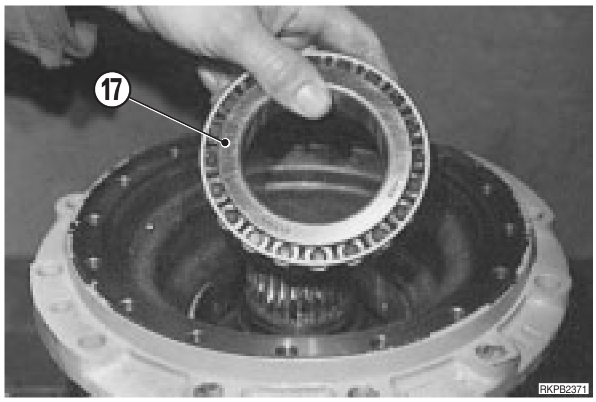
13 - Remove the spacer (16).



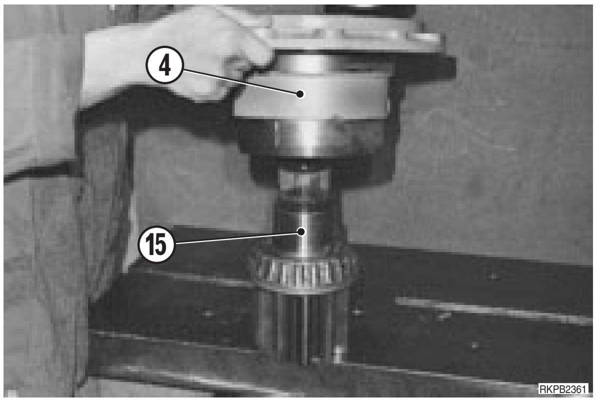
14 - Using a puller, remove the swing pinion shaft (15) from gearbox housing (4).



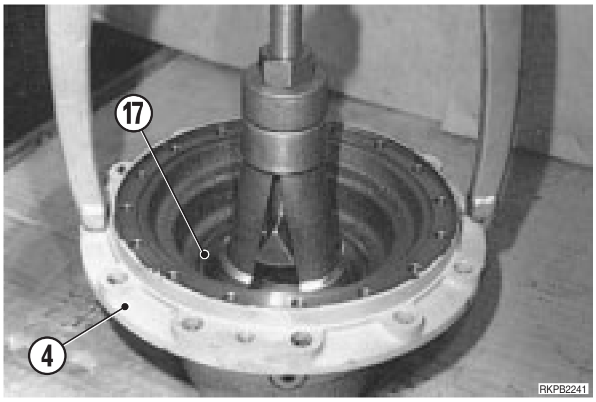
15 - Remove the bearing inner ring (17).



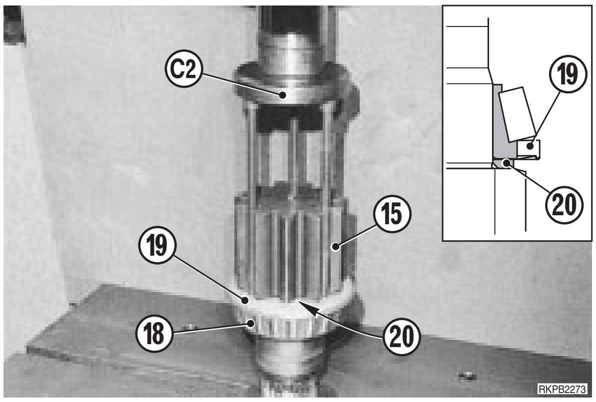
16 - Remove the gearbox housing (4) from swing pinion shaft (15).



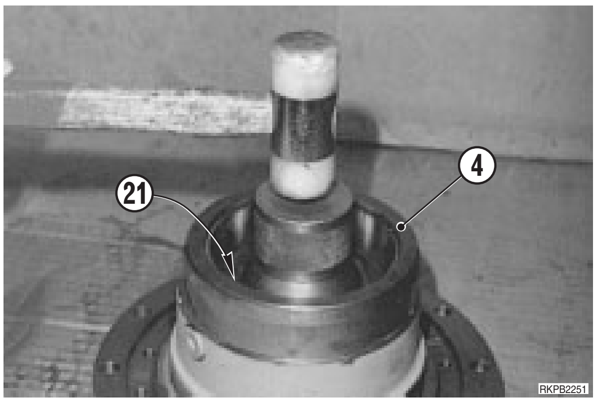
17 - Using a puller, remove the bearing outer ring (17) from gearbox housing (4).



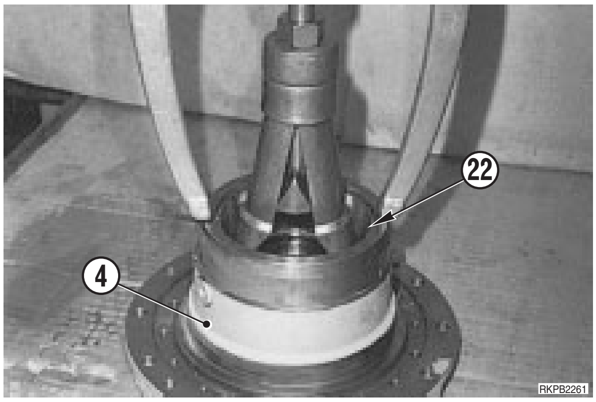
18 - Using the special tool **C2** and a press, remove the bearing inner ring (18), the seal ring (19) and the spacer (20) from swing pinion shaft (15).



19 - Overturn the gearbox housing (4) and remove the seal ring (21).



20 - Using a puller, remove the bearing outer ring (22) from gearbox housing (4).



ASSEMBLY OF SWING MACHINERY

1. IMPORTANT REMARKS

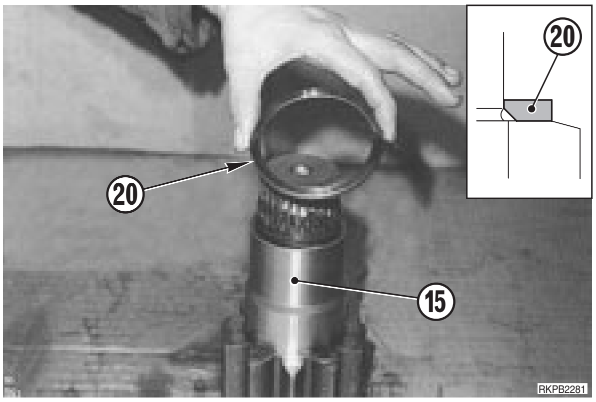
When installing the swing machinery, some fundamental rules must be followed:

a - In the case of a damaged sun gear, the entire reduction unit must be substituted, not just the single sun gear.

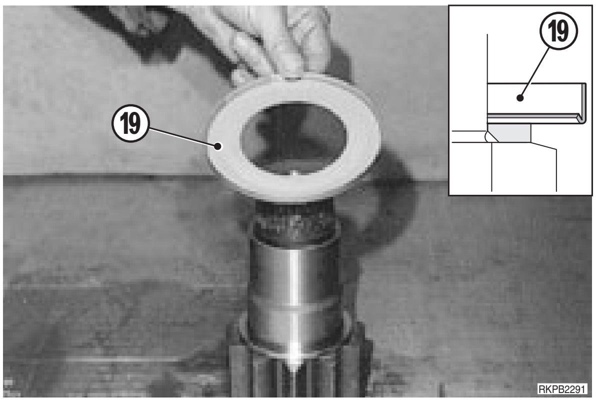
b - Always fit a new O-ring with the part to be replaced, after thoroughly cleaning the installation seating and after having spread a film of grease (ASL800050) over the seatings and the seals to facilitate installation.

2. INSTALLATION

1 - Mount the spacer (20) on the swing pinion shaft (15).
★ Check that the chamfered part rests on the pinion.

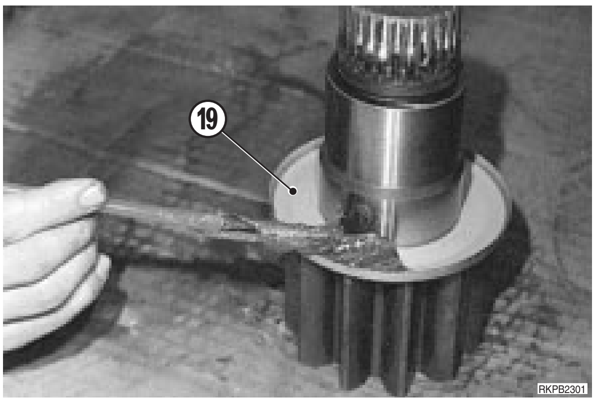


2 - Mount the metal sealing ring (19).
★ Take care to the orientation of seal ring



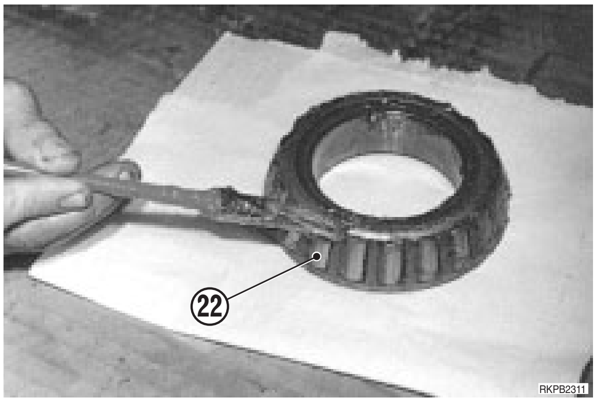
3 - Fill the metal sealing ring (19) with grease.

Metal sealing ring: ASL800050

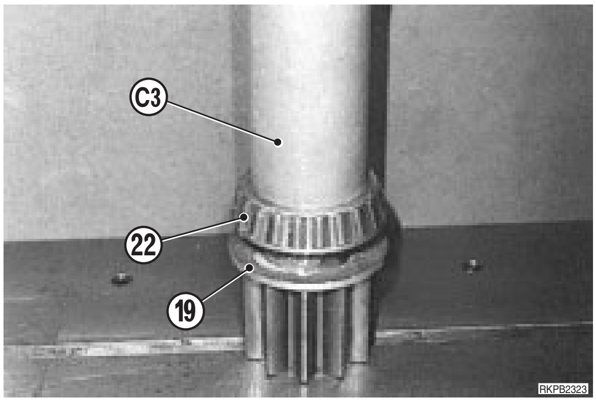


4 - Apply a layer of grease over the inside bearing ring (22).

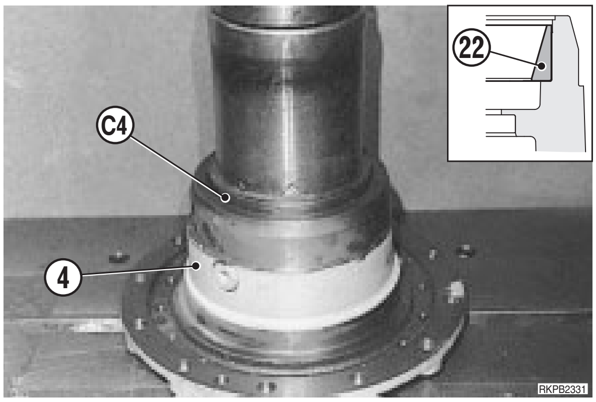
Bearing: ASL800050



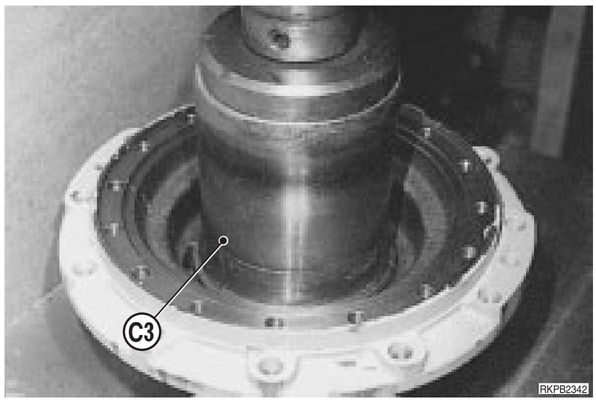
5 - Using the tool **C3** and a press, drive the inside bearing ring (19) down over the spacer (19).



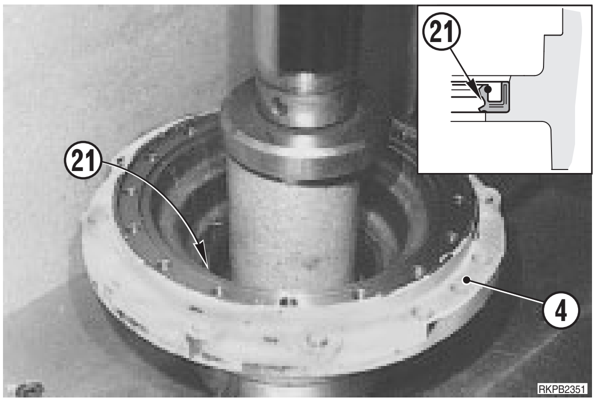
6 - Using the tool **C4** and a press, drive the outside bearing ring (22) down over the gearbox housing (4).



7 - Using the same method as above, mount the outside ring of the other bearing (17) in the gearbox housing.

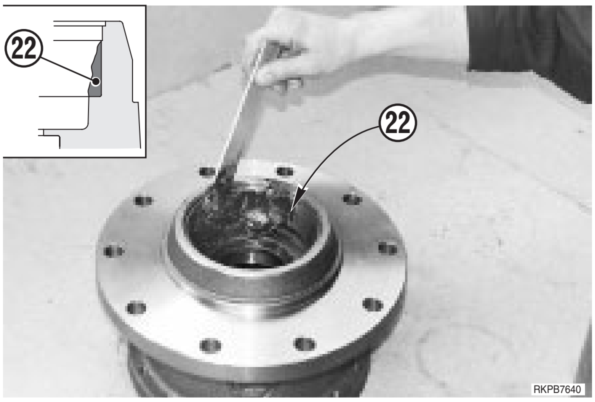


8 - Mount the sealing ring (21) in the gearbox housing (4).

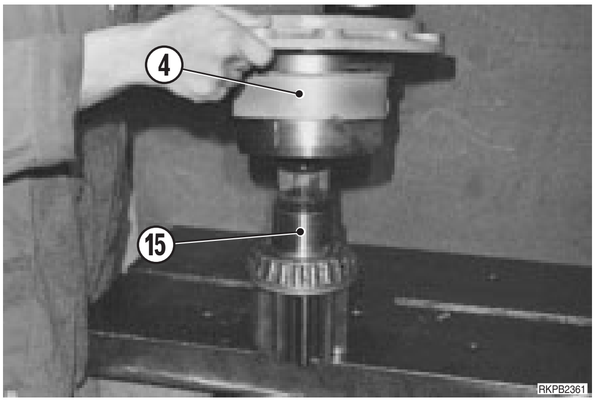


9 - Fill with grease the bearing (22) seat.

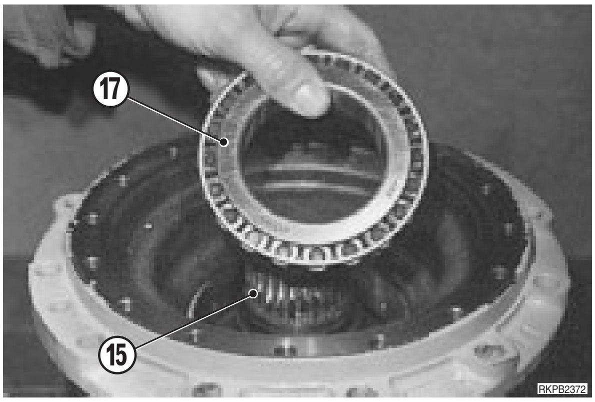
Bearing: ASL800050



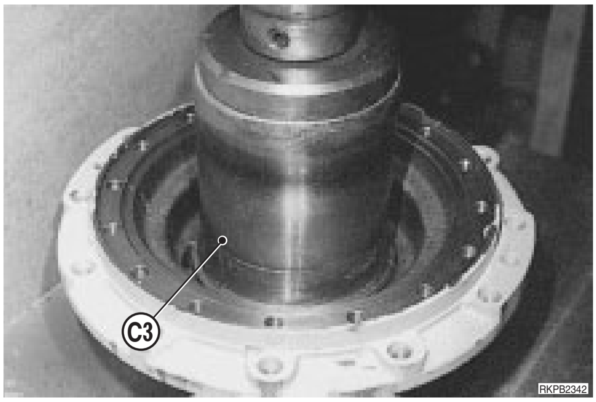
10 - Position the gearbox housing (4) over the swing pinion (15).



11 - Mount the inside bearing ring (17) on the swing pinion (15).

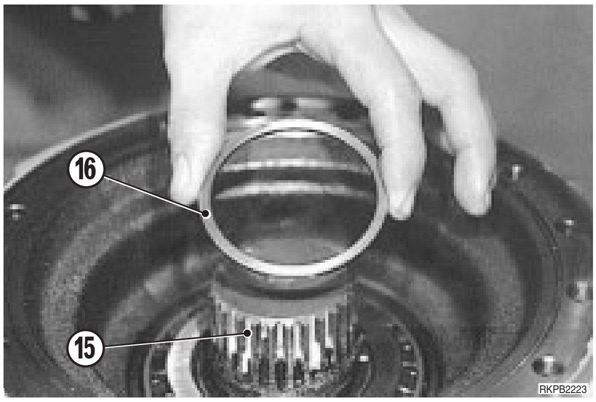


12 - Using the tool **C3** and a rubber hammer, drive the bearing (17).



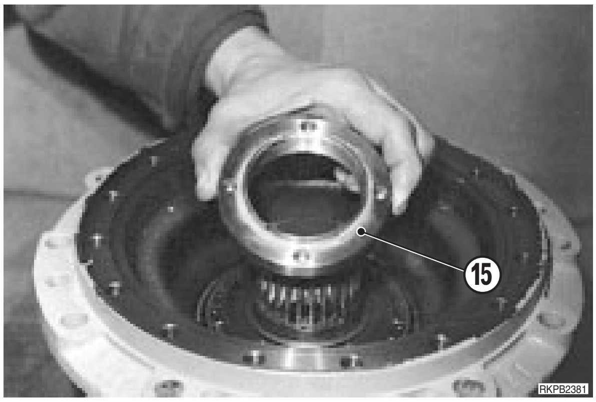
13 - Mount the spacer (16) over the swing pinion shaft (15).

⚠ In the case of replacing bearings (17) and (22) of the swing pinion shaft (15) or the gearbox housing (4), before continue to assembly check the rotation torque of the swing pinion shaft.
(For detail see «Check rotation torque of pinion shaft»).

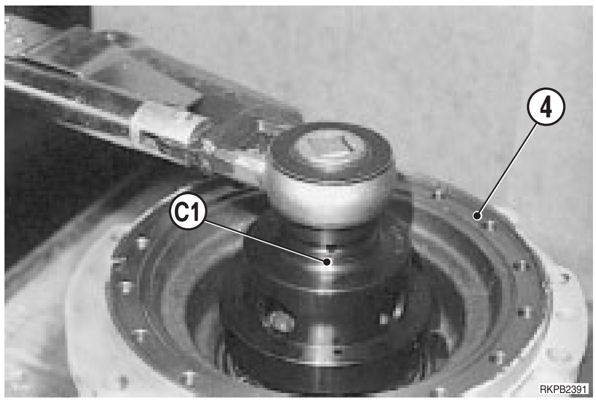


14 - Tighten the lock-nut (14).
★ Use a new lock-nut.

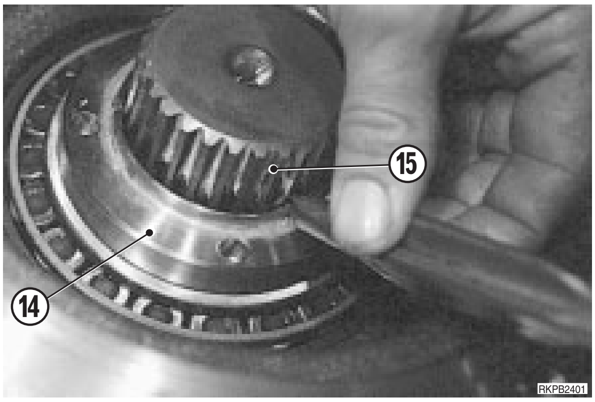
Lock-nut: Loctite 243



15 - Use the special wrench **C1** and a dynamometric wrench to tighten the lock-nut (14).

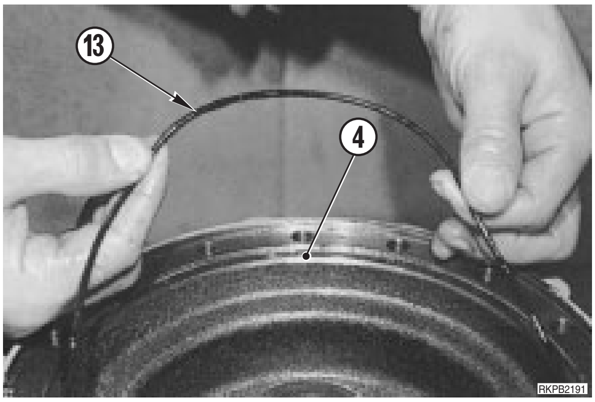


16 - Lock the position of the lock-nut (14) with 6 safety caulkings, corresponding to the grooves in the pinion shaft (15).

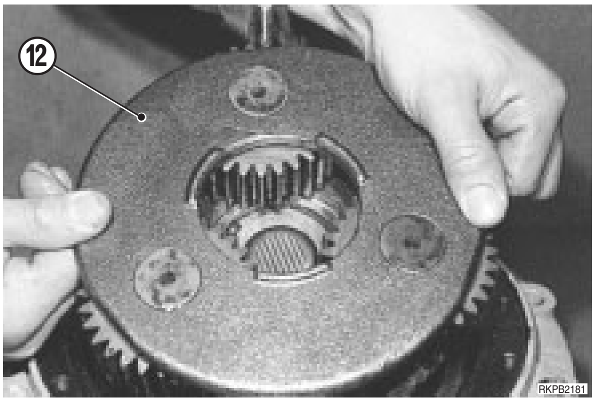


17 - Lubricate the O-ring seating of the gearbox housing (4) and mount the seal (13).

Seating: ASL800050

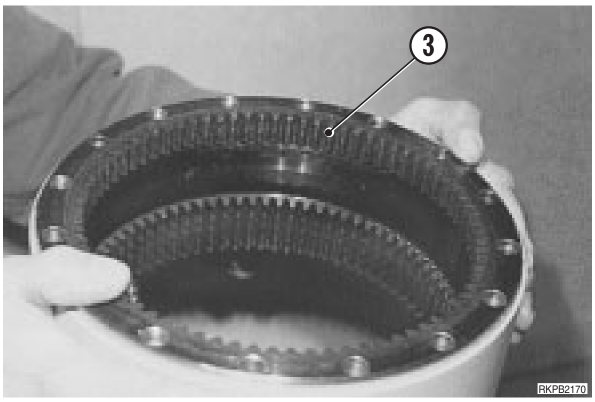


18 - Install the 2nd sun gear groups (12).

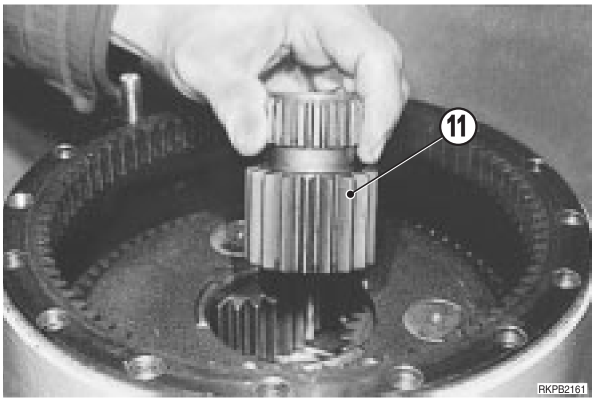


19 - Mount the toothed ring (3).

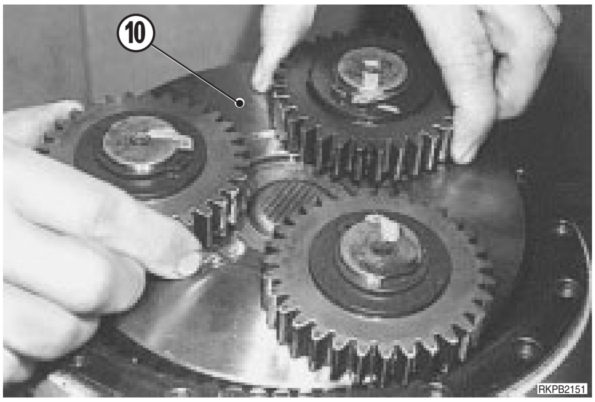
★ Check the position against the marks made before dismantling.



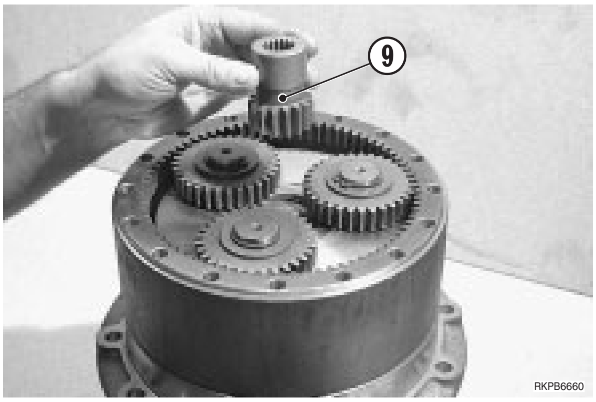
20 - Mount the pinion (11) of the 2nd sun gear.



21 - Mount the 1st sun gear (10).

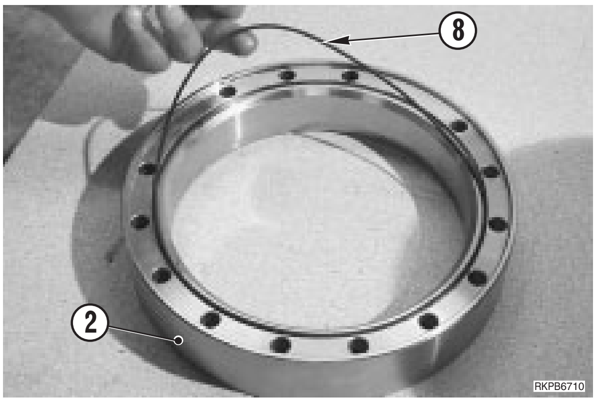


22 - Mount the pinion (9) of the 1st sun gear.

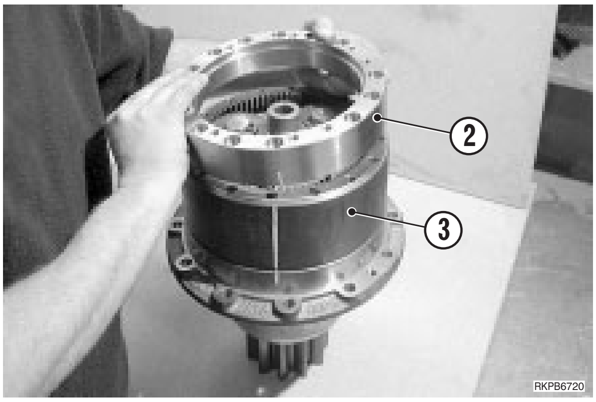


23 - Lubricate the O-Ring seat and mount the O-Ring (8) in the flange (2).

Seat: ASL800050

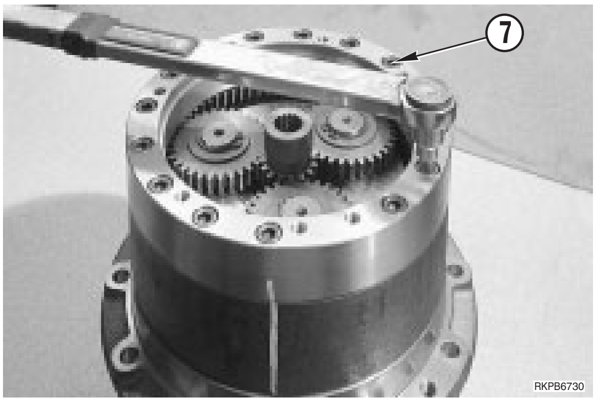


24 - Mount the flange (2) on the toothed ring (3).
★ Check the position.

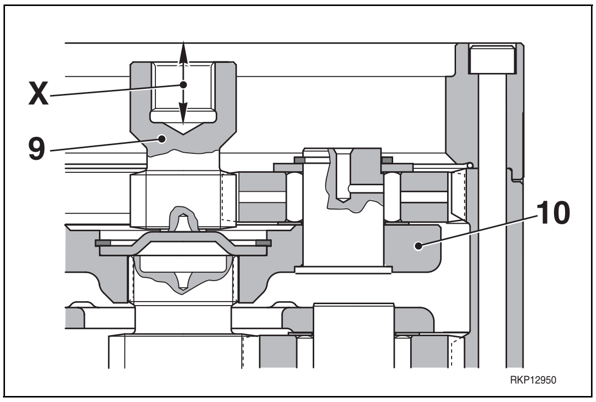


25 - Using a dynamometric wrench tighten the screws (7).

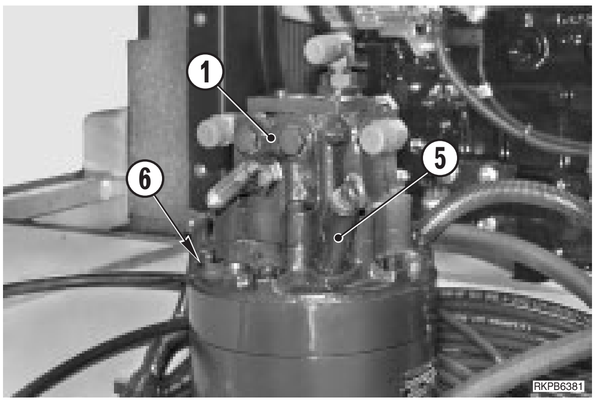
Screws: 85 Nm



26 - Using a caliper verify the correct assembly of the gearbox checking the axial quota **X**.
X= 28.9–29.5 mm
★ If the value is higher, reduce the sun gear (9) width in the axial direction flattening the support plane (reduction side).
★ If the value is lower, insert adjusting spacer between sun gear (9) and planetary carrier (10).



27 - Place the swing machinery (1), tighten the screws (6) and mount the oil drain plug (5).



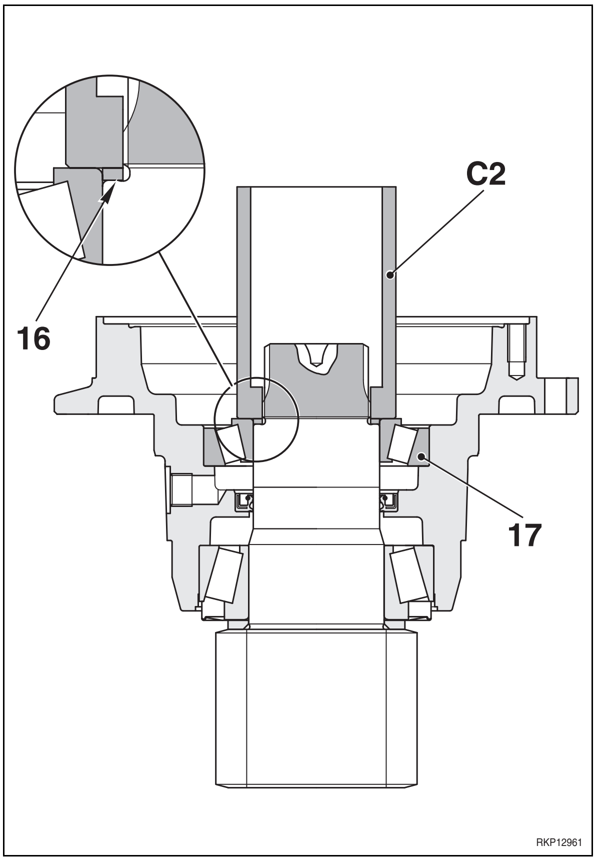
Check rotation torque of pinion shaft

1 - Position the special tool **C2** on the bearing (17) and, with press, apply a force of 2500–3060 kg.

2 - Using a dynamometric wrench, verify that the torque of gearbox housing is 5–6 Nm

★ If the torque is higher, **increase** the thickness of shim (16).

★ If the torque is lower, **decrease** the thickness of shim (16).



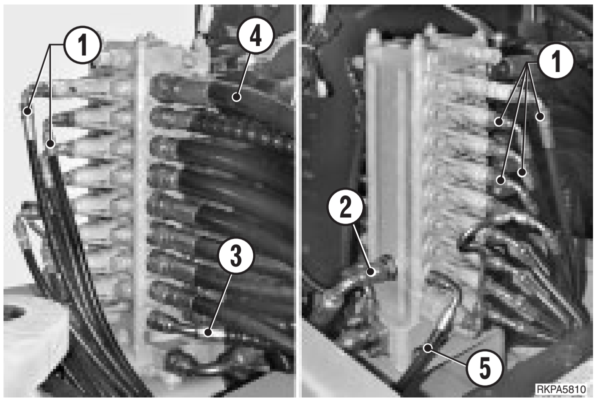
REMOVAL OF CONTROL VALVE

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

Release residual pressures from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

★ Mark all pipes before removal.

1 - Disconnect pipes in the following sequence: servo control pipes (1), feed pipes (2), return pipes (3), function pipes (4) and LS pipes (5).
  ★ Plug all holes so as to keep out impurities.

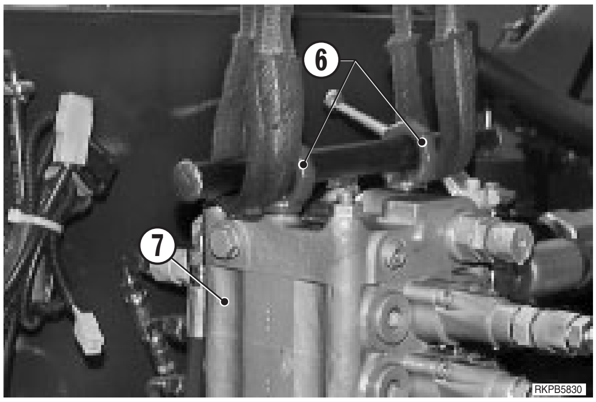


2 - Fit the unit with two eyebolts (6). (M8x1.25)

3 - Hook the unit (7) to the hoisting equipment and slightly put the ropes under tension.

4 - Remove screws (8) (No. 3) and remove the control valve. ※1

Complete control valve: approx. 60 kg



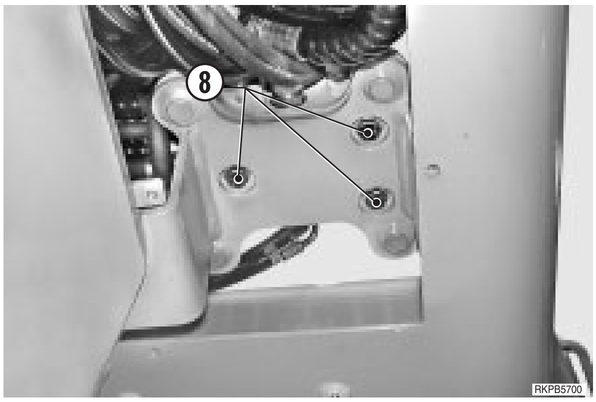
INSTALLATION OF CONTROL VALVE

- To install, reverse the removal procedure.

※1

Control valve check screws: 190 Nm

Control valve check screws: Loctite 262



1 - Check the level of the tank; start the engine to allow oil to circulate to all parts of the equipment.
Switch off the engine and top up the oil level.

2 - Bleed air from all parts of the equipment. (For details, see «20. TESTING AND ADJUSTMENTS»).

REMOVAL OF REVOLVING FRAME

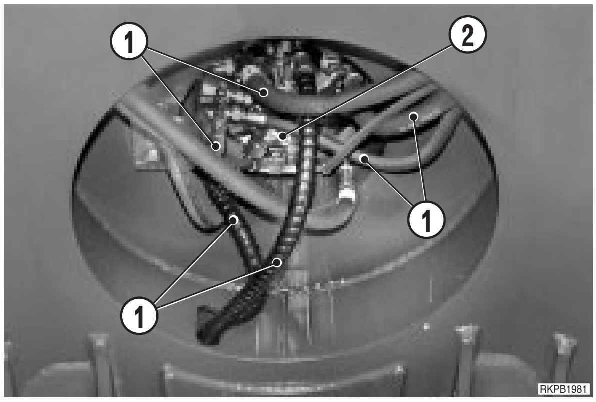
⚠ Disconnect the lead from the negative (–) battery terminal.

1 - Remove the upper work equipment.
(For details, see «REMOVING UPPER WORK EQUIPMENT»).

2 - Remove the front hood. (For details, see «REMOVAL OF FRONT HOOD»).

3 - Remove the cabin and the seat. (For details, see «REMOVAL OF CABIN AND REMOVAL OF THE SEAT»).

4 - Remove the boom cylinder. (For details, see «REMOVAL OF BOOM CYLINDER»).



5 - Disconnect all the lower tubes (1) from the swivel joint (2) and plug them. Also plug the fittings left on the joint. ※1

6 - Remove the lower left-hand protective casing (3) of the revolving frame (4) to gain access to the retaining nuts of the LH area.

7 - Start the engine and swing the revolving frame (4) until a screw (5) in the rear extraction compartment of the track frame (6) has been centred.

8 - Remove the screw (5).

9 - Repeat the same operations for the other screws (No. 39).

⚠ Leave two screws in position for reasons of safety, one at the front and one at the rear.

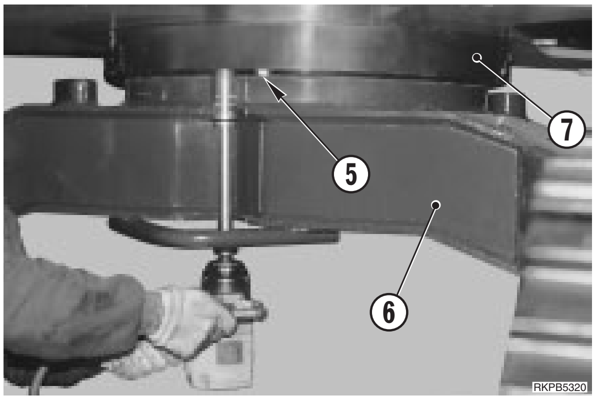
10 - Using the raising hooks **B** and **C** attach the revolving frame to a hoisting tackle and apply slight tension to the chains. ※2

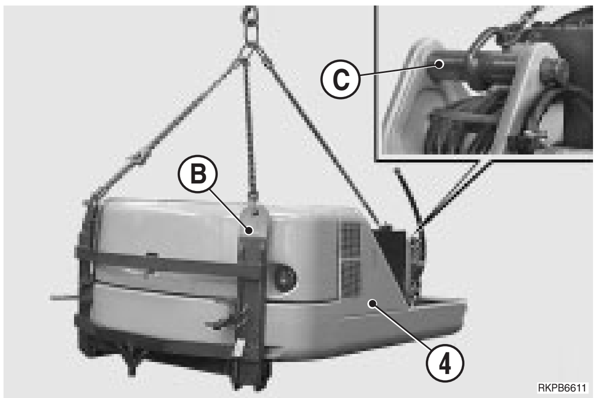
11 - Loosen and disengage the two screws, leaving them inserted in the bearing ring (7).

12 - Raise the revolving frame (4) slowly. ※3

★ While raising the revolving frame, take great care not to damage the swivel joint.

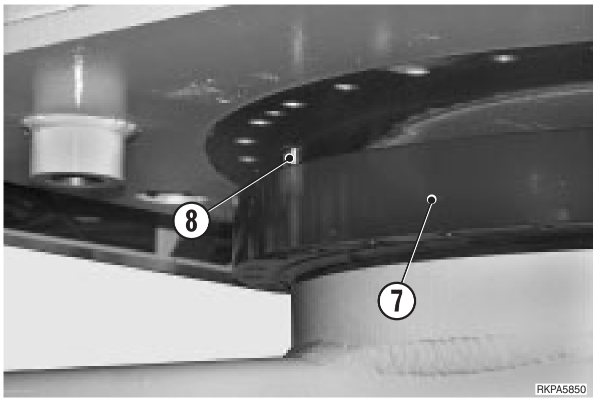
kg Revolving frame: approx. 3500 kg





INSTALLATION OF REVOLVING FRAME

- To install, reverse the removal procedure.



※ 1

★ After connecting up all the hydraulic tubes, start the engine and move all parts of the equipment several times to bleed air from the circuits, while checking for leakages.

★ Switch off the engine and check level of the hydraulic oil.

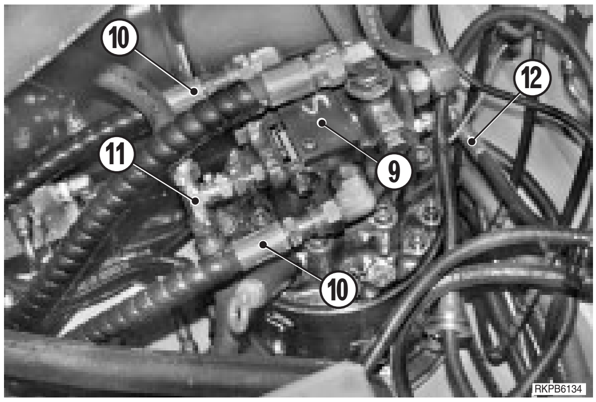
※ 2

★ Align the two positions corresponding to the centering pins (8), then assemble.

Sealant and swing circle platform gaskets: ASL800050

※ 3 I

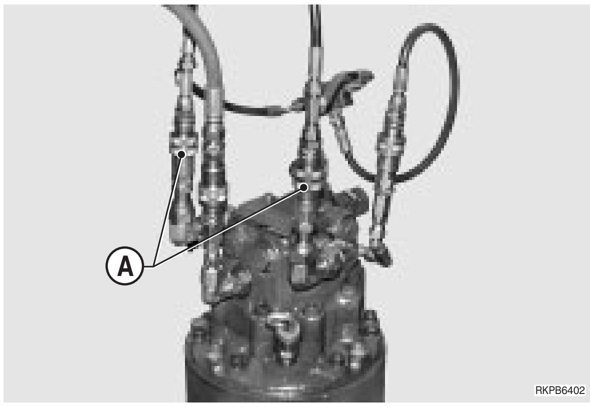
Revolving frame attachment screws (without nut): Loctite 262



Installation Procedure

In order to swing the revolving frame for centering the reference pins (8), and the pinion-swing circle coupling:

1 - Disconnect the feed pipes (10), the drain line connection (11) and the brake release tube (12) from the swing motor (9).
   ★ Plug connections to avoid impurity entry.



2 -Connect a hydraulic power unit "**A"** and slowly rotate the turret until correct centring is obtained.

3 - Insert the two screws left in the swing circle (7) and secure them.

4 - Insert all the other screws (5).

5 - After having secured all the screws that joint the swing circle to the revolving frame, reconnect the delivery tubes (10) of the swing motor (9), and the brake release tube (12) and the drain line connection.

6 - Detach the hoisting tackle.

REMOVAL OF COUNTERWEIGHT

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

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

2 - Remove the engine-hood hook support (1).

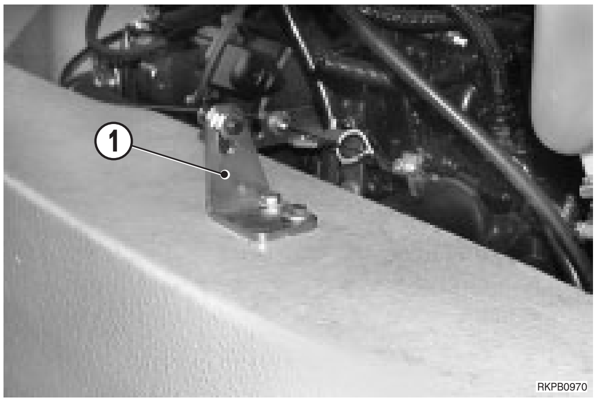
3 - Remove the protective caps and firmly tighten the hoisting eyebolts (2).

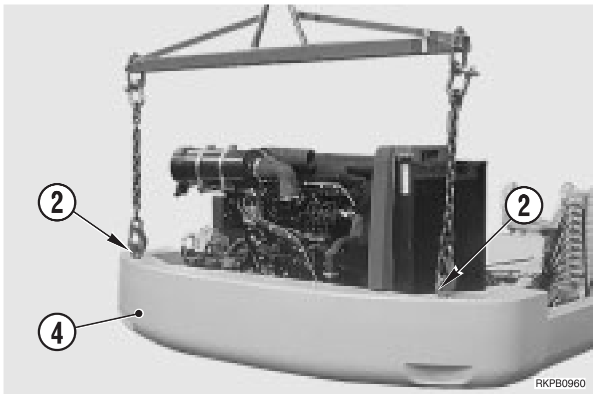
4 - Attach the hoisting tackle and apply slight tension to the cables.

5 - Using the tool **A1**, loosen the screws (3) and their safety washers. ※ 1

6 - Remove the counterweight (4).

Counterweight: 1150 kg





INSTALLATION OF COUNTERWEIGHT

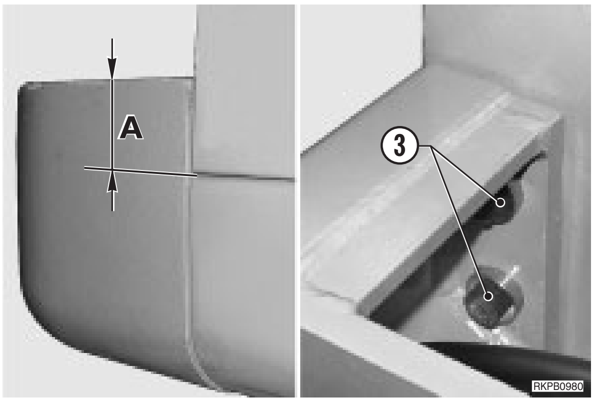
- To install, reverse the removal procedure.

※ 1

Counterweight screws: Loctite 262

Counterweight screws: 580 Nm

★ Carefully check that the vertical positioning measurement «**A**» is 100±2 mm with respect to the revolving frame.

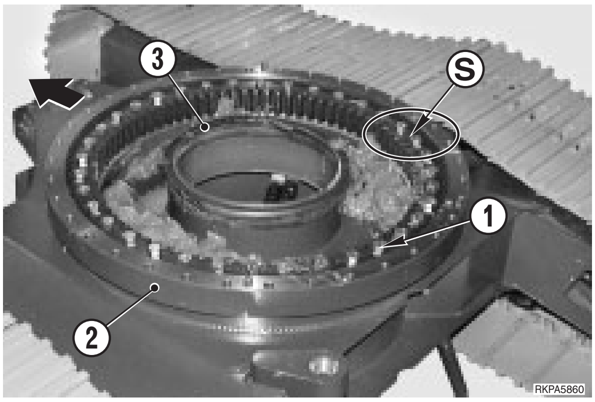


REMOVAL OF SWING CIRCLE

1 - Remove the upper revolving frame. (For details, see «REMOVAL OF UPPER REVOLVING FRAME»).

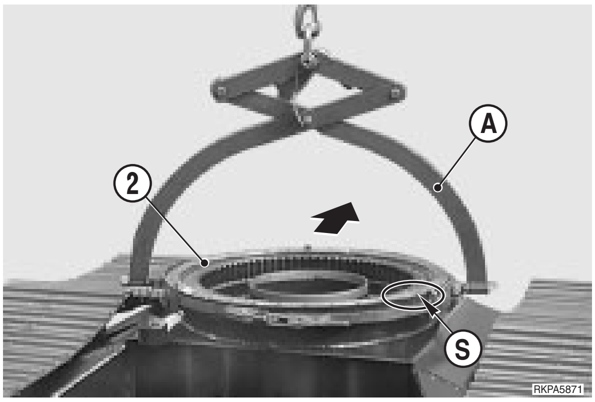
2 - Completely remove all contaminated grease.

3 - Remove the screws (1) that secure the swing circle (2).



4 - Remove the swing circle (2) using a lifting equipment "**A**". ※ 1

kg Swing circle: 124 kg



INSTALLATION OF SWING CIRCLE

★ Before installing the swing circle, check the condition of the central gasket (3).

⚠ For reasons of safety, when installing the swing circle, insert two screws into the front and back holes in the frame.

- To install, reverse the removal procedure.

※ 1

Before attaching the swing circle, check that the area marked with an «**S**» is positioned on the right-hand side of the chassis.

Attachment screws: Loctite 242

Nm Attachment screws: 314 Nm

Lubricating grease: approx. 25 kg

REMOVAL OF TRACK SHOES

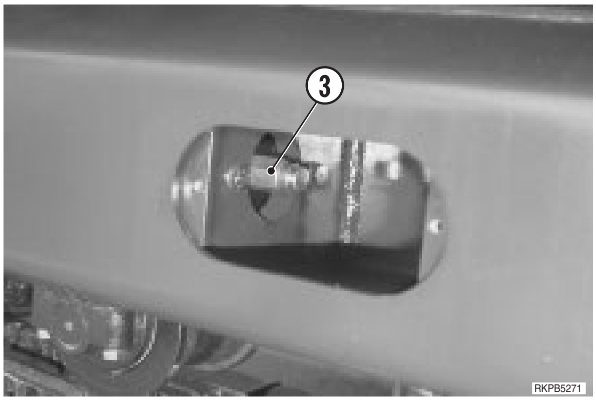
1 - Move the machine until the master pin (1) on the track shoe idler (2) is in its highest position.

2 - Slowly loosen the lubricator (3) to let out the grease and relieve track shoe tension.

※ 1

⚠ The grease contained in the track shoe stretching cylinder is under pressure and could cause serious injury to the operator. For this reason the valve should not be loosened by more than one turn.

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

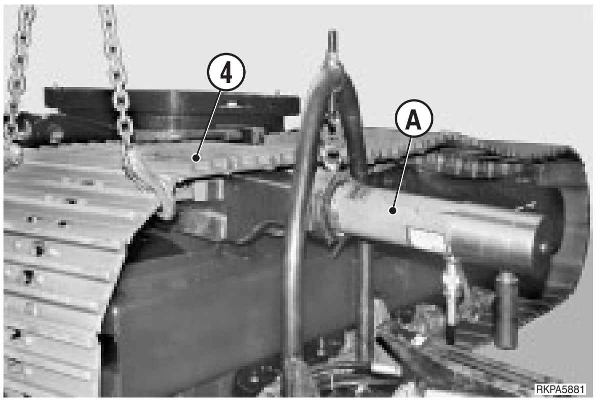


3 - Remove the master pin (1) using a link piston "**A**".

4 - Raise the end-piece of the track-shoe (4) with a crane.

5 - Reverse the machine to remove the track shoe (4), then lay it out on the ground. ※ 2

6 - Force the boom down to raise the lower chassis and lift the track shoe away.



INSTALLATION OF TRACK SHOES

- To install, reverse the removal procedure.

※ 1

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

※ 2

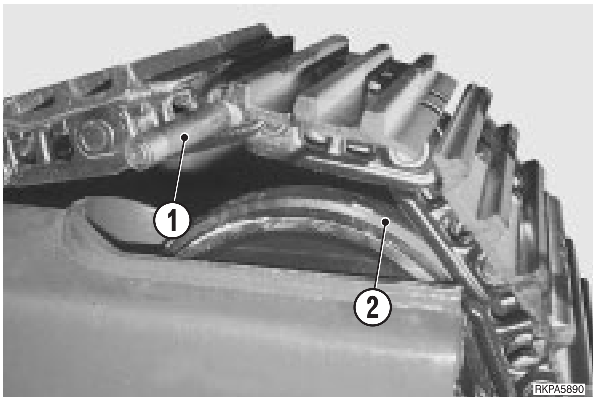
1 - Rotate the revolving frame 90° towards the side on which the track shoe is to be mounted. Force the boom down to raise the lower frame.

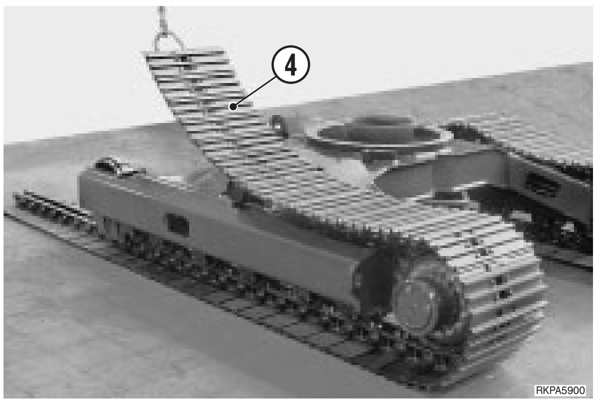
2 - Lay the track shoe out on the ground beneath the lower rollers. Let down the lower frame.

3 - Attach the first joint to the sprocket assembly and move the machine forwards until the articulation is above the sprocket.

4 - Attach a crane to the end-piece of the track shoe in order to keep it raised.

5 - Insert the master pin (1) using the piston "**A**".





REMOVAL OF SPROCKET ASSEMBLY

1 - Remove the track shoe assembly. (For details, see «REMOVAL OF TRACK SHOE ASSEMBLY»).

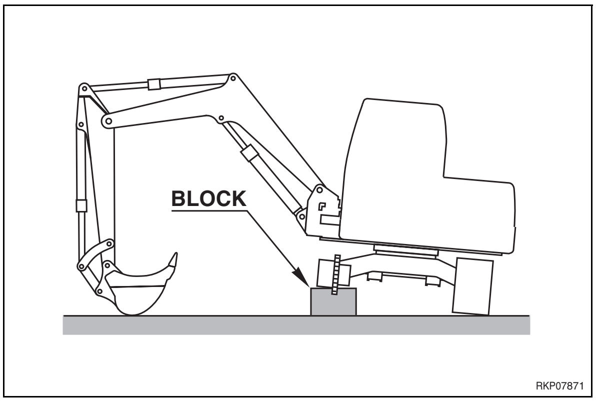
2 - Turn the revolving frame 90° towards the sprocket assembly to be removed.

3 - Force the boom down perpendicular to the ground and raise the lower chassis.

⚠ Insert safety blocks beneath the chassis.

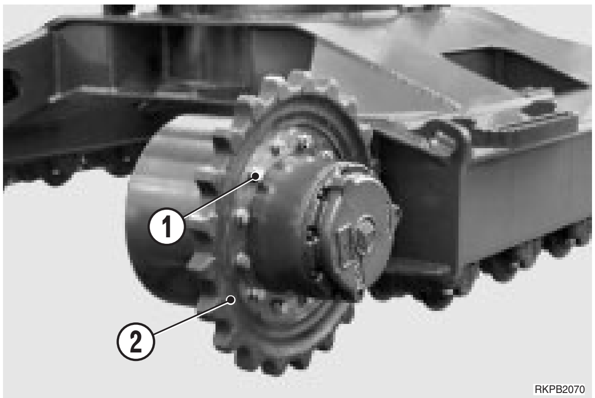
4 - Remove the screws (1) and their washers.

5 - Remove the sprocket assembly (2). ※1



INSTALLATION OF SPROCKET ASSEMBLY

- To install, reverse the removal procedure.



※1

Attachment screws: Loctite 262

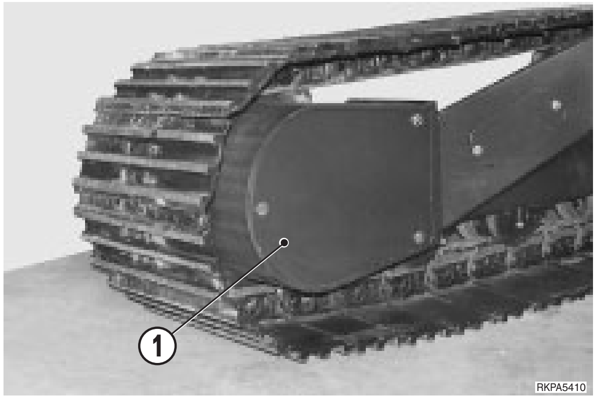
REMOVAL OF THE FINAL DRIVE

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

Release all residual pressure from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

1 - Remove the protection cover (1).

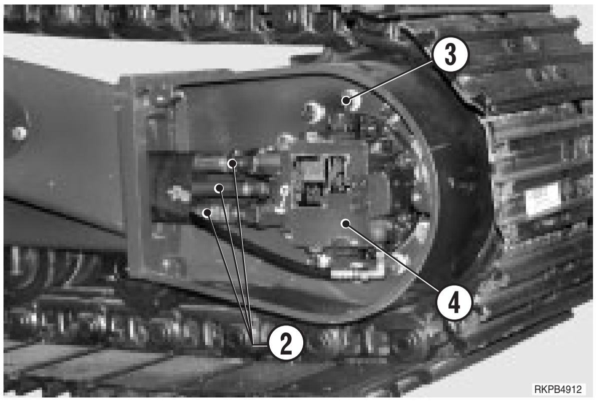
2 - Remove the sprocket. For details, see «REMOVAL OF THE SPROCKET ASSEMBLY»).



3 - Disconnect the 4 pipes (2).
★ Plug all pipes to keep out impurity.

4 - Pull out the screws (3) and remove the assembly (4).
※1

Travel assembly: 70 kg



INSTALLATION OF THE FINAL DRIVE

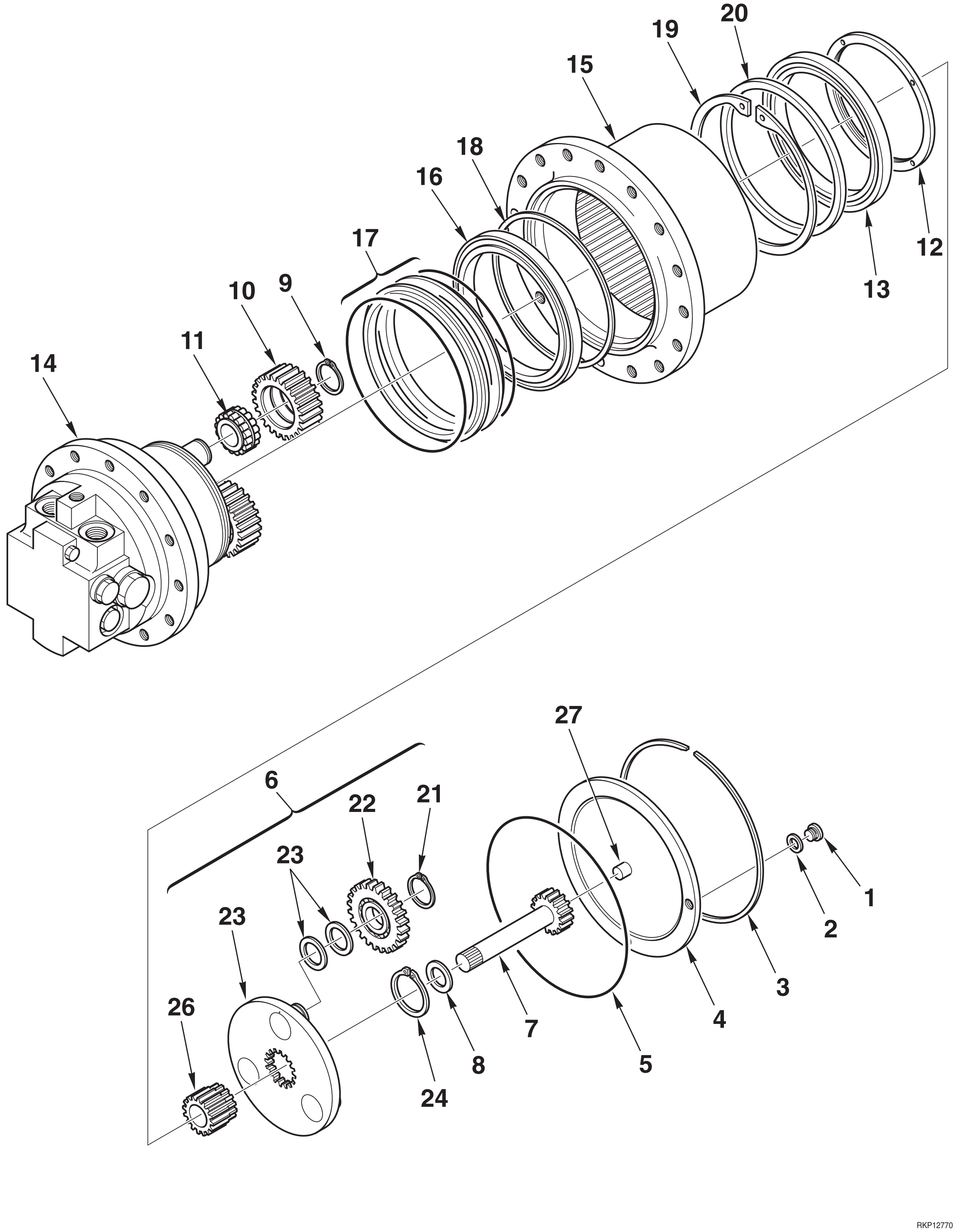
- To install, reverse the removal procedure.

※1

Check screws: Loctite 262

★ Bleed air form the travel motor (see «20. TESTING AND ADJUSTMENTS»).

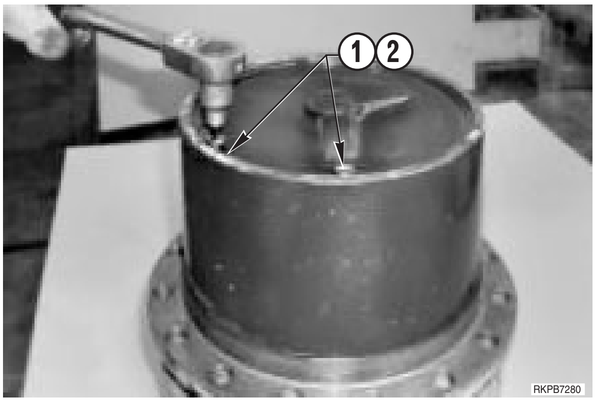
DISASSEMBLY OF THE FINAL DRIVE



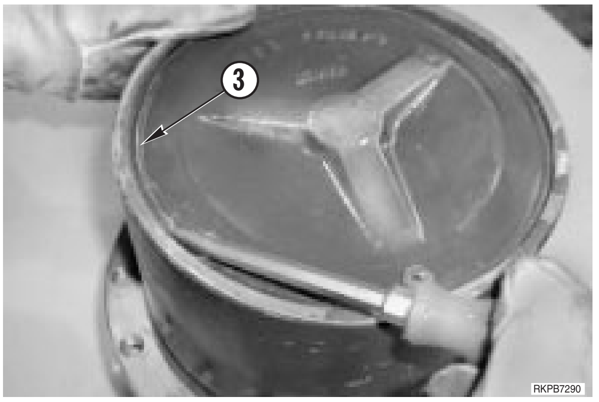
1 - Remove screw plus (1) and gaskets (2) and drain the oil.

Oil: 0.8 ℓ

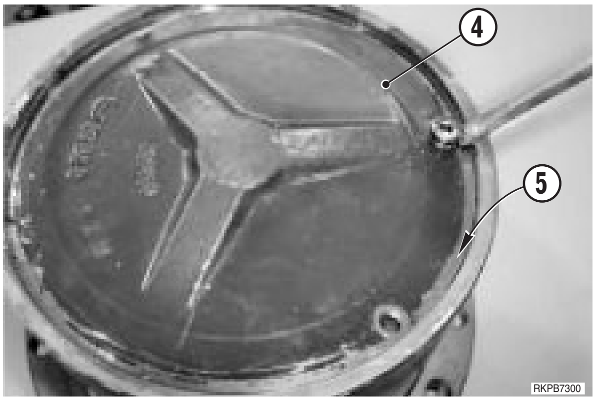
★ Replace the gasket.



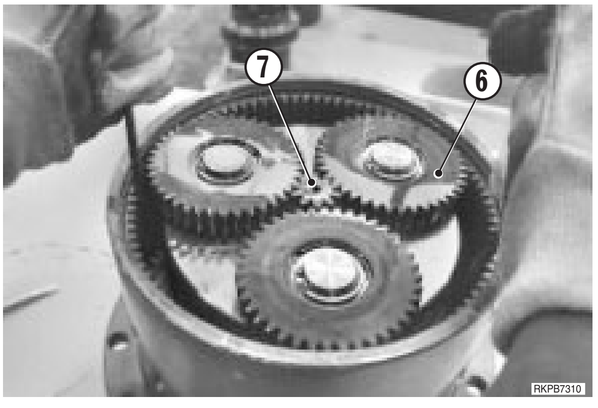
2 - Remove snap ring (3).
★ Replace snap ring.



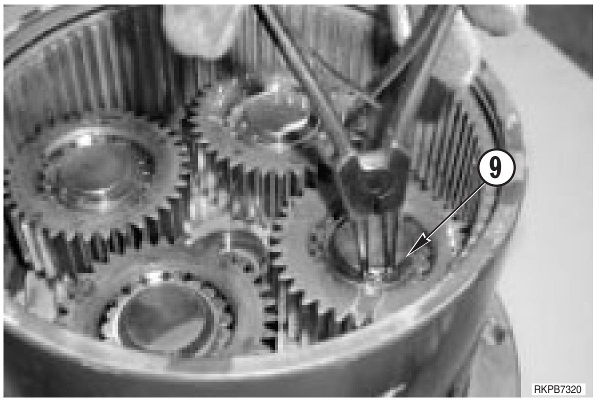
3 - Remove cover (4) and O-ring (5).



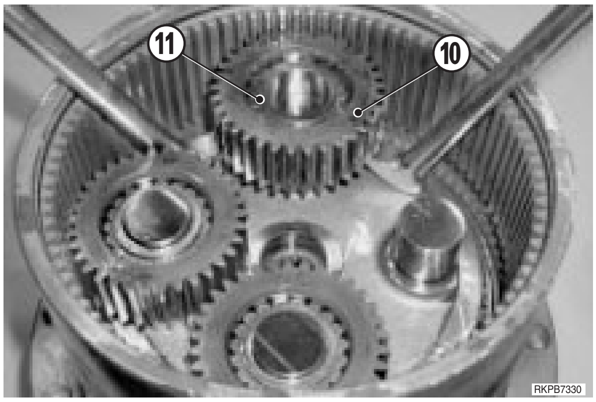
4 - Remove complete planetary stage (6) with sun gear (7) and spacer (8).



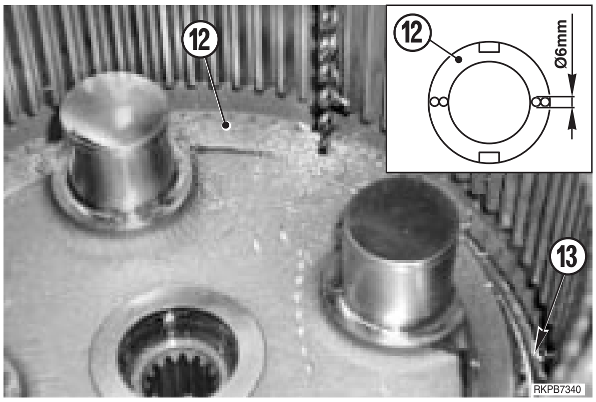
5 - Remove snap ring (9).
★ Replace snap ring.



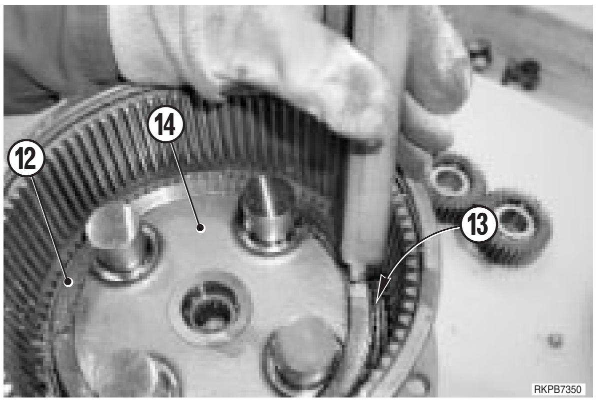
6 - Remove planetary gear (10) (no. 4) with bearing (11).



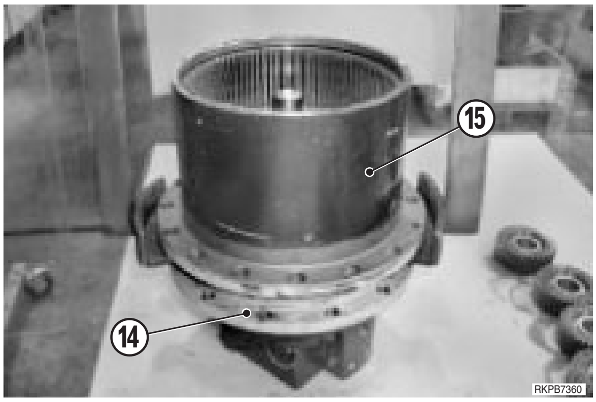
7 - Drill two holes Ø 6 mm into the shaft nut (12) at 180° spacing.
Take care to not damage the bearing (13).
★ After the drill, remove the chips using a magnet.
★ Shaft nut (12) height: max. 13 mm



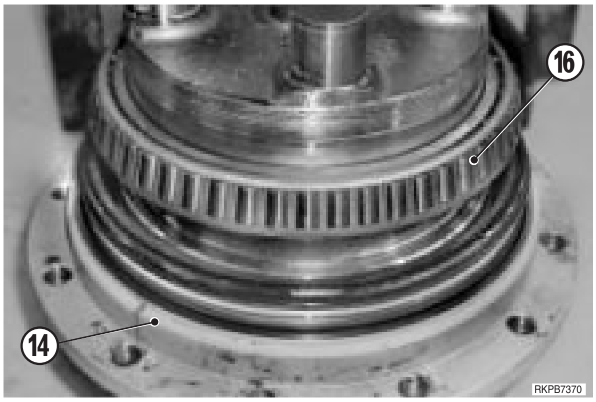
8 - Using a chisel, split the shaft nut (12).
★ Take care to not damage the cage of bearing (13).



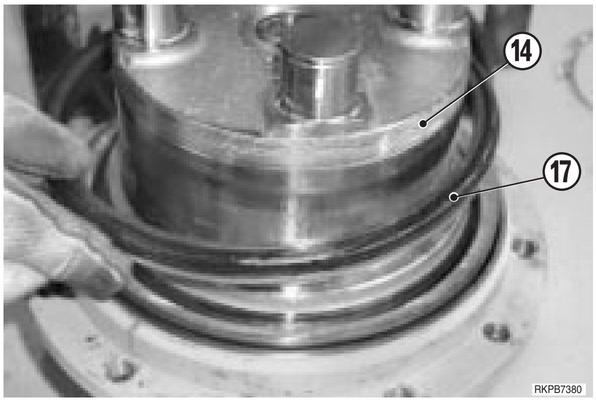
9 - Remove ring gear (15) from splindle (14).



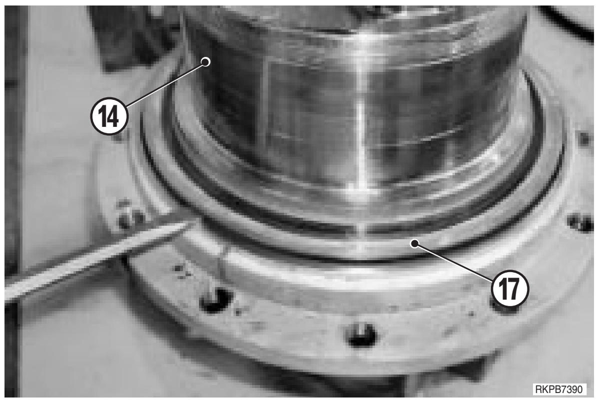
10 - Using a extractor, remove inner ring of bearing (16) from the splindle (14).



11 - Remove 1st ring of the gasket seal (17) from splindle (14).

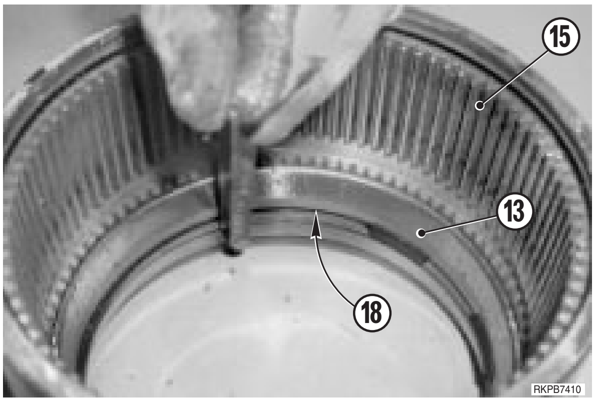


12 - Remove 2nd ring of the gasket seal (17) from splindle (14).

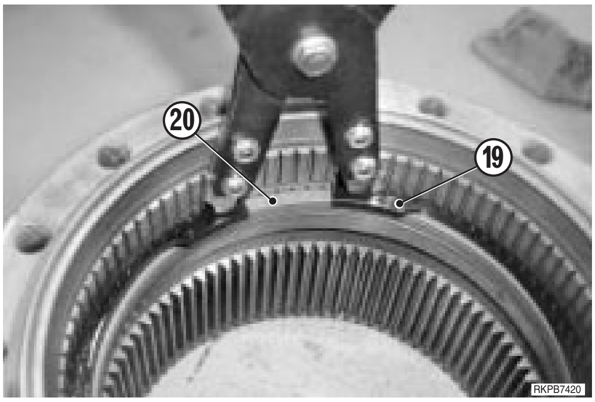


13 - Remove inner ring of bearing (13) from reduction body (15).

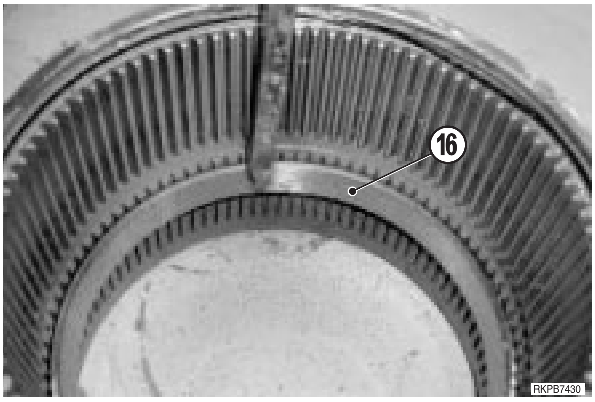
14 - Remove outer ring of bearing (13) and spacer (18).



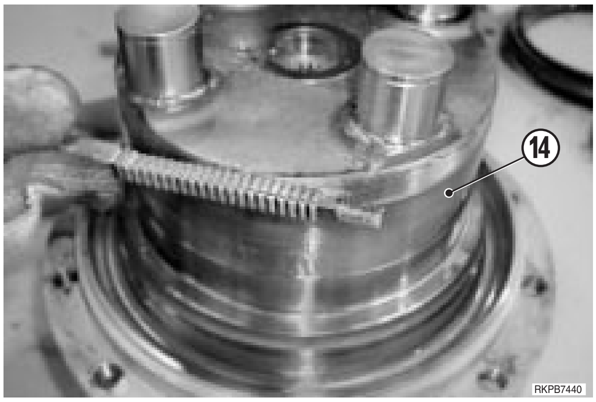
15 - Remove snap ring (19) and spacer (20).



16 - Remove outer ring of bearing (16).

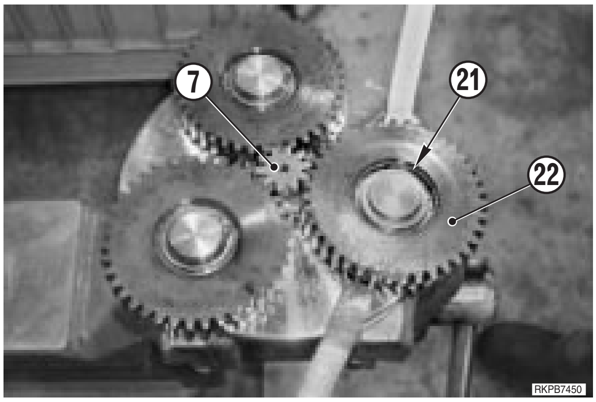


17 - Clean the thread of the travel motor (14).



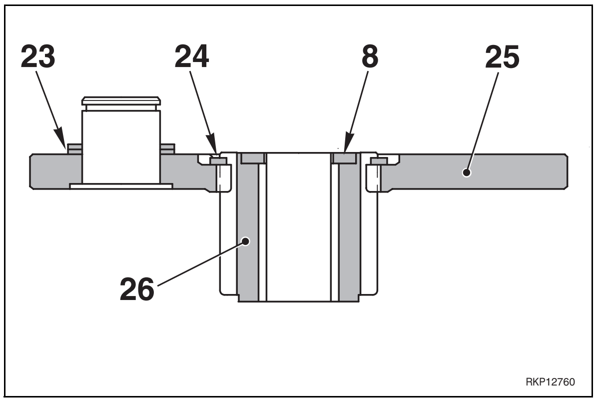
18 - Remove snap rings (21) ad planetary gear (22).
★ Replace snap ring (21).

19 - Remove sun gear (7).



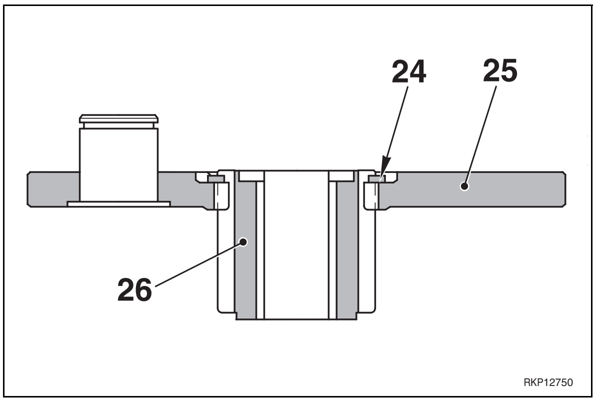
20 - Remove spacers (23) and roller (8).

21 - Remove snap ring (24) and separate the planetary carrier (25) from sun gear (26).
★ Replace snap ring.

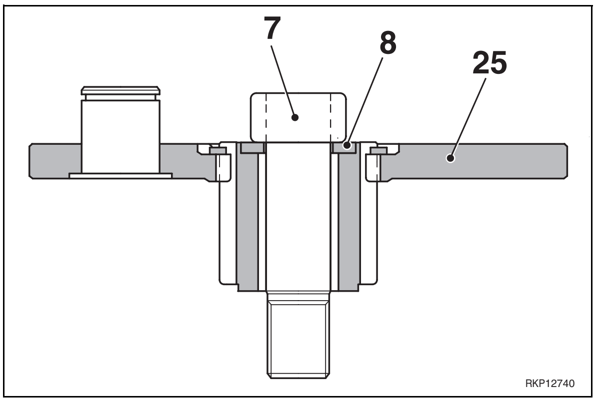


ASSEMBLY OF THE FINAL DRIVE

1 - Insert the planetary carrier (25) into sun gear (26) and lock it with a new snap ring (24).

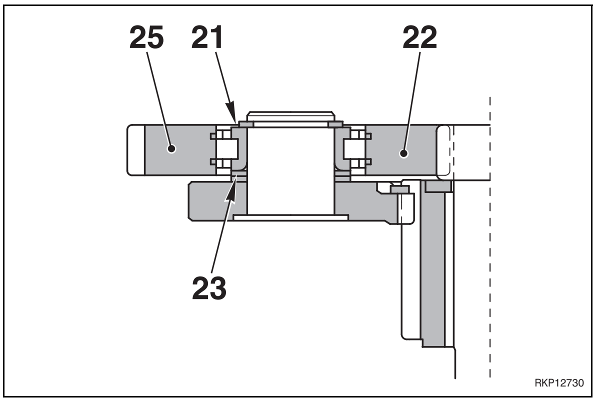


2 - Mount on the planetary carrier the roller (8) and sun gear (7).



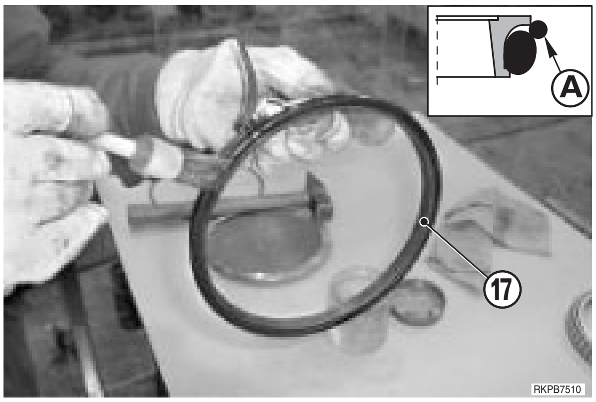
3 - Mount on the planetary carrier (25) the spacers (23) and the planetary gear (22).
   - ★ Heat the planetary gear to approx. 70°C to ease the mounting.
   - ★ Take care to the orientation of the planetary gear.

4 - Lock the planetary gear (21) with new snap rings (22).

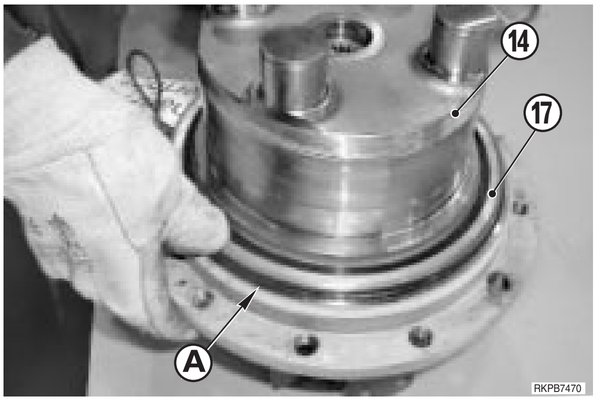


5 - Degrease and dry the cavities for the seal gasket (17).

6 - To ease the next step, insert O-ring (A) (200x3) between steel ring and rubber ring.

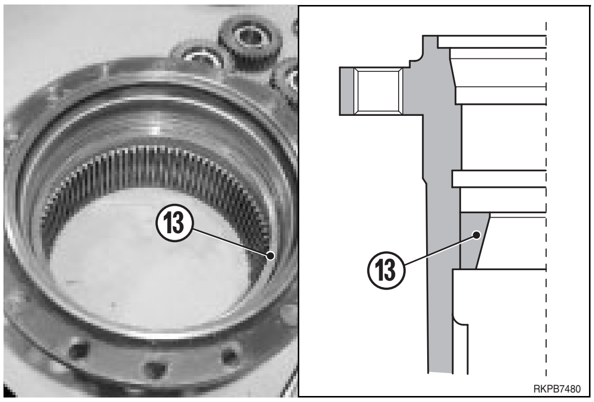


7 - Mount the 1st ring of the seal gasket (17) on the travel motor (14) and remove the O-ring (A).

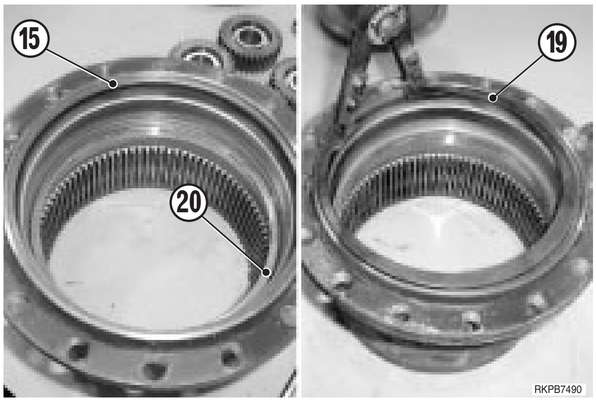


8 - Using the nitrogen, cool the outer ring of the bearings (13) and (16).

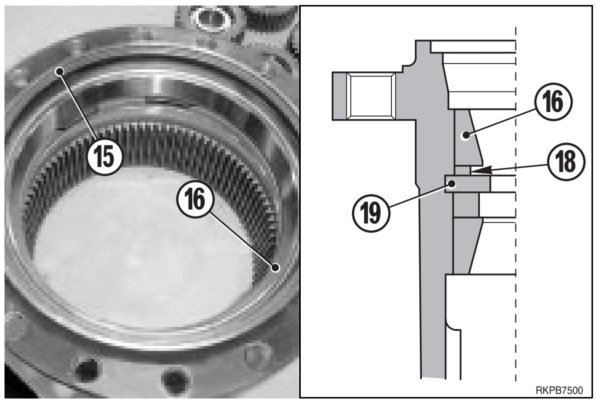
9 - Insert the outer ring of bearing (13) in the housing (15).
★ Take care to the orientation of the outer ring.



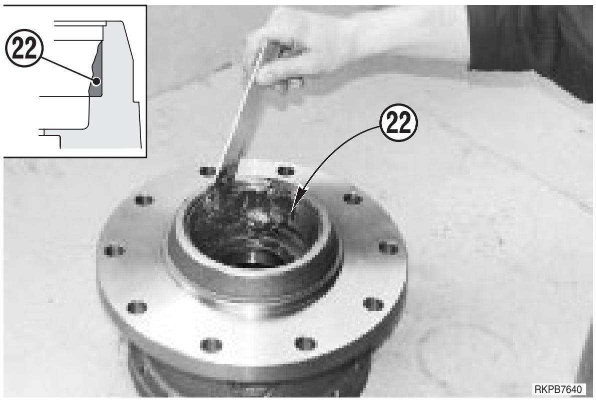
10 - Mount spacer (20) and snap ring (19).



11 - Mount the spacer (18) and the outer ring of bearing (16).

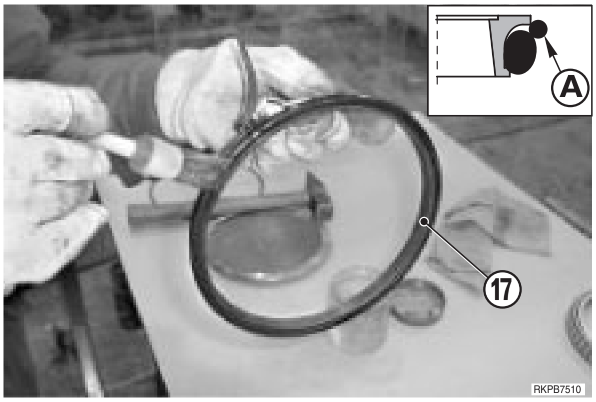


12 - Mount the inner ring of bearing (16).

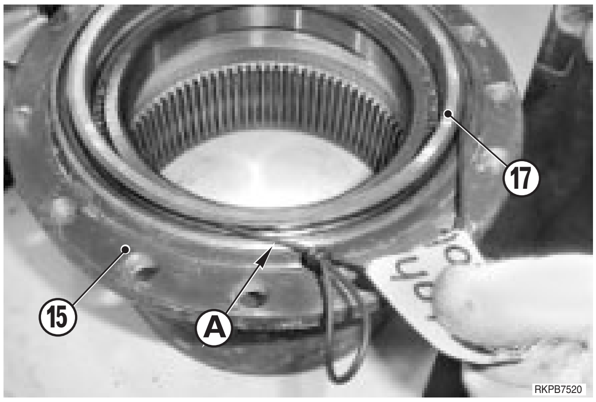


13 - Degrease with spirit the rubber ring of the seal gasket (17).

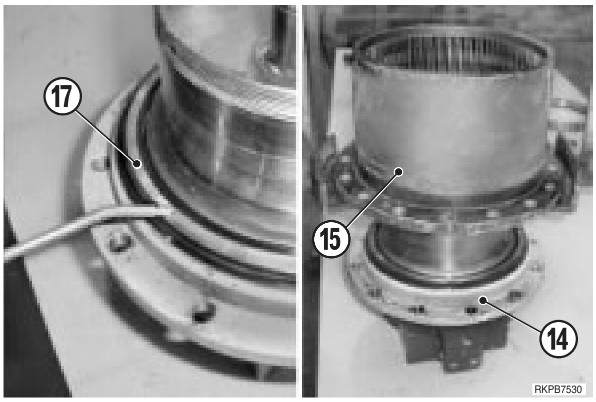
14 - To ease the next step, insert O-ring (A) (200x3) between steel ring and rubber ring.



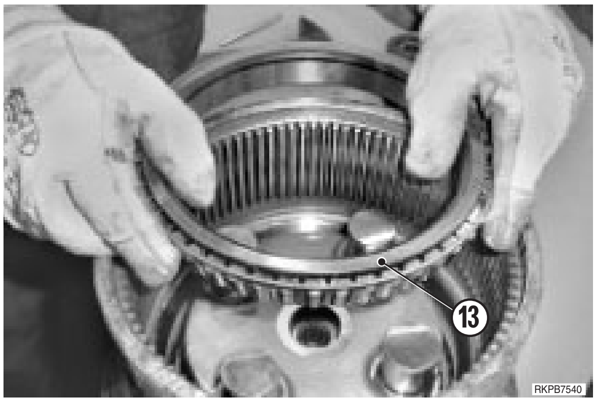
15 - Mount the 2nd ring of the seal gasket (17) on the housing (15) and remove the O-ring (A).



16 - Wet with oil the surface of the seal gasket (17) and mount the housing (15) on the travel motor (14).



17 - Mount the inner ring of bearing (13).



18 - Apply the coat on the shaft nut (12).

Shaft nut: Loctite 270

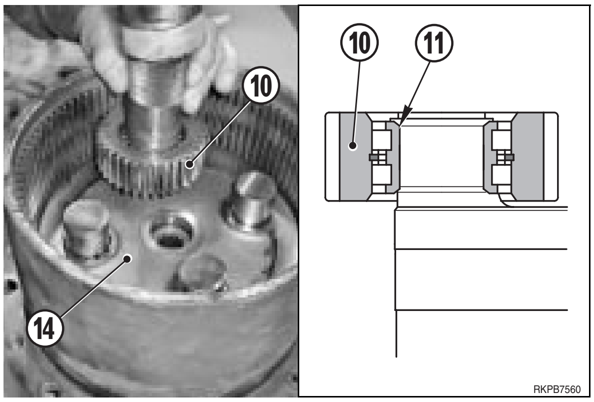
19 - Tighten the shaft nut (12).

Shaft nut: 1750 Nm

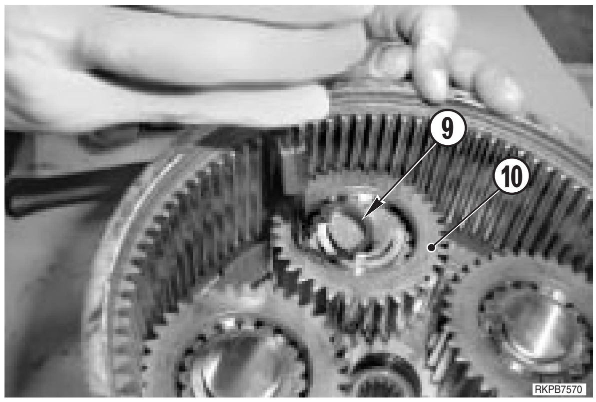
★ Tighten shaft nut (12) in one direction only when setting the bearings (13) and (16).

20 - Mount the planetary gear (10) with bearing (11) on the travel motor (14).

★ Take care to the orientation of the planetary gear.

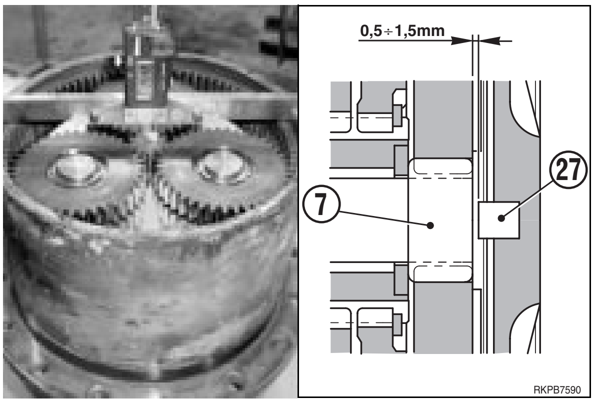


21 - Lock the planetary gear (10) with new snap ring (9).



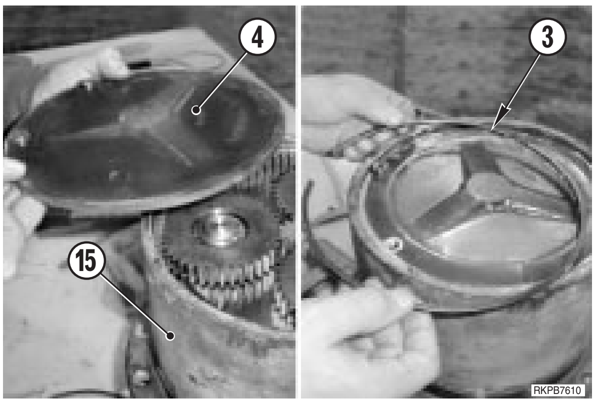
22 - Mount the planetary carrier (25) with the housing (15).

23 - Check the clearance between sun gear (7) and spacer (27).
- Standard clearance: 0.5–1.5 mm



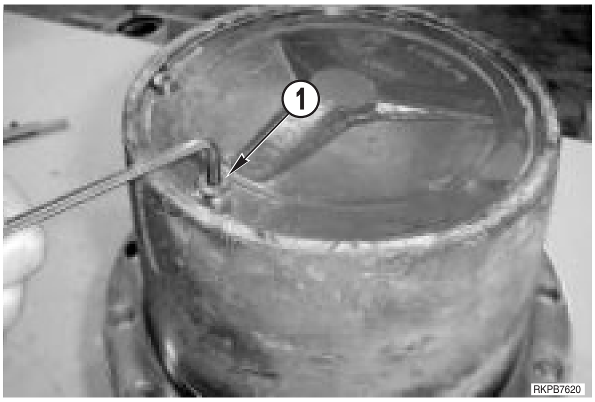
24 - Mount new O-ring (5) in the housing (15).

25 - Mount the cover (4) and lock it with a new snap ring (3).



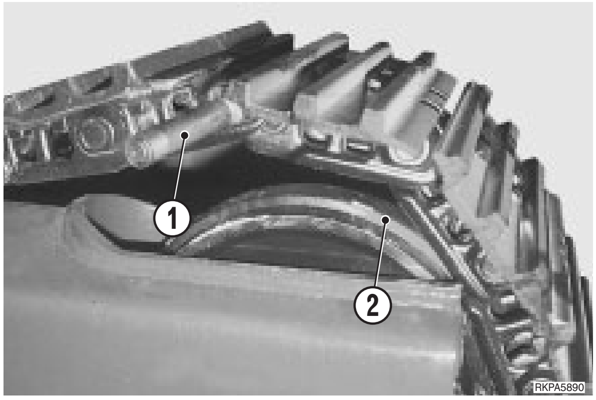
26 - Refill with oil and tighten the plugs (11).

Oil: 0.8 ℓ



REMOVAL OF IDLER AND RECOIL SPRING ASSEMBLY

1 - Position the master pin (1) of the track shoe above the idler (2).



2 - Slowly loosen the grease nipple (3) to let the grease out and release the track-shoe tension.

The grease contained in the track-shoe idler is under pressure and could cause serious injury to the operator. For this reason the valve should not be loosened for more than one turn.

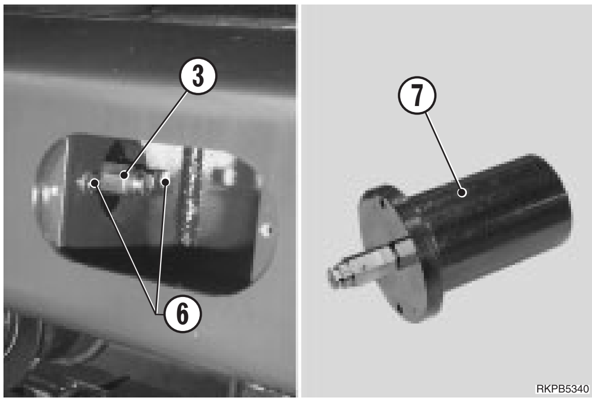
★ If the grease does not run out easily, slowly move the machine backwards and forwards. ※ 1

Rest the work equipment on the ground and switch off the engine.

3 - Remove the master pin (1) using a link piston.

★ While dismantling the track shoe, support the part of the shoe that encircles the idler by placing a block beneath the shoe ribbing.

4 - Lay the track shoe out on the ground.



5 - Support the group (4) and slide it out of the guide frame (5).

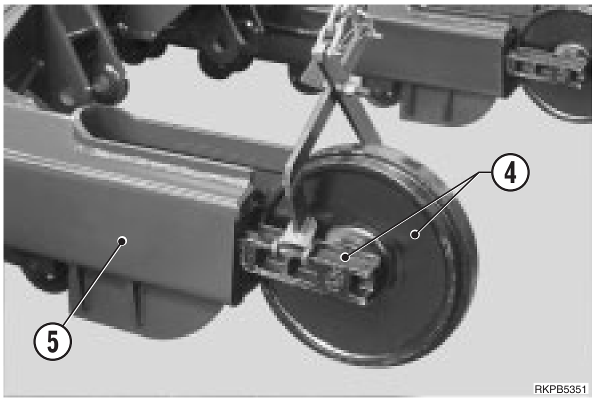
kg Complete group: 75 kg

6 - Loose and remove screws (6) and the cylinder (7).

★ Take care to not damage the grease nipple (3).

7 - Set the group (4) down firmly on a flat surface, support the track shoe idler (2) and remove the screws (8) that join the track shoe idler group (4) to the recoil spring group (9).

★ Before removing the screws (8) mark the connecting bracket (10) and the spacers.

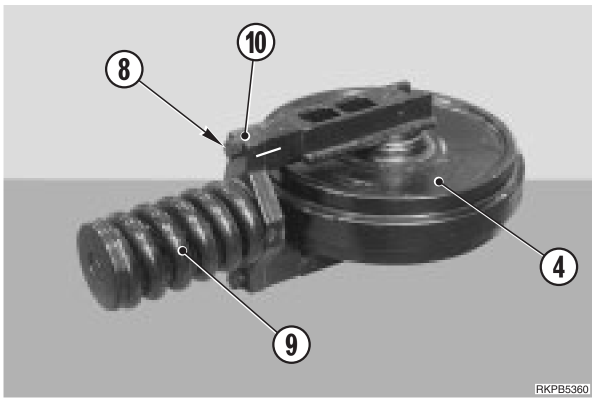


INSTALLATION OF IDLER AND RECOIL SPRING ASSEMBLY

- To install, reverse the removal procedure.

※ 1

★ Adjust the tension of the track shoe. (For details see «20. TESTING AND ADJUSTMENTS»).



DISASSEMBLY OF IDLER

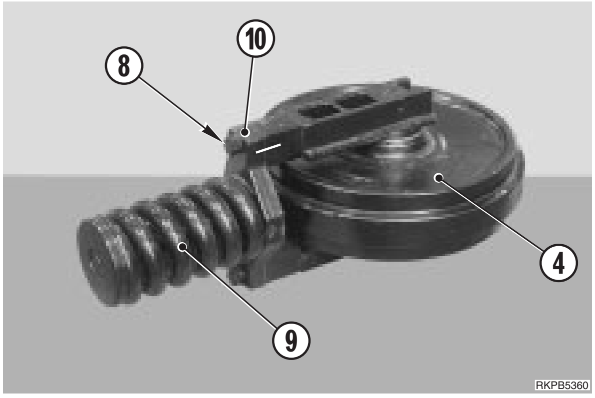
★ When dismantling the idlers, fit all new seals.

★ Remove the cap (10) and drain the oil.

Track shoe idler: approx. 0.6 ℓ

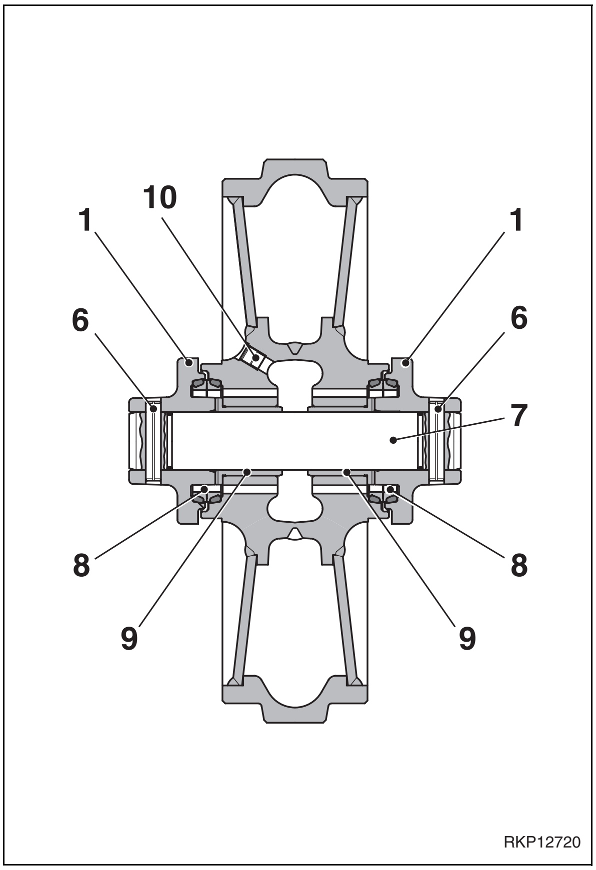
1 - Detach the recoil spring assembly (2) from the supports (1) of the idler.
  ★ Before removing the screws (3), mark the joint support (4) and the spacers (5).

2 - Take away the pins (6).



3 - Using a press, extract the pin (7) and remove the supports (1) and the lateral seals (8). ※1

4 - Remove the bushings (9).



ASSEMBLY OF IDLER

• To install, reverse the removal procedure.

※1
  ★ Use a press for the final assembly.
  ★ Line up the holes and the supports before inserting the pins.

1 - Fill up with oil and replace the cap (10).

Track shoe idler: 0.6 ℓ

Oil cap: 55±5 Nm

DISMANTLING AND RE-ASSEMBLING THE RECOIL SPRING GROUP AND CYLINDER

1. Recoil spring

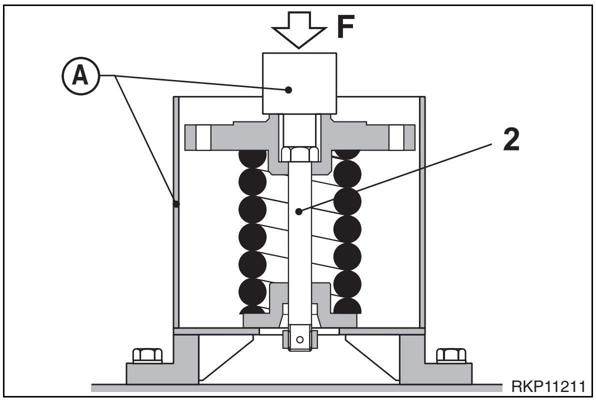
Disassembly

1 - Remove the welded base (1).

2 - Position the group (2) beneath the press and centre the tool "**A**".

⚠ The spring is mounted under a high installed load, so make sure that the group is well-centred.

3 - Apply pressure and, once the spring (3) is fully compressed, remove the safety pin (4) and the ring nut (5).



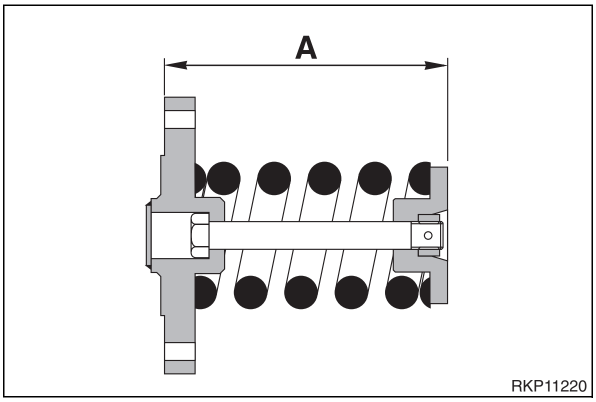
RKP11211

4 - Slowly reduce pressure to free the spring.

※ 1

★ Free spring length: 233 mm

5 - Dismantle the internal tie-rod (6), the spring (3) and the flange (7).



RKP11220

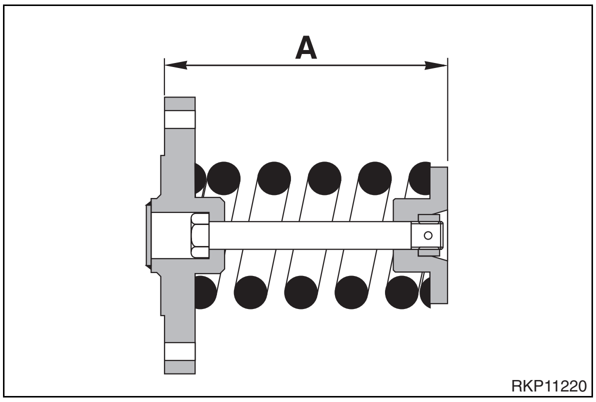
Assembly

- To install, reverse the removal procedure.

※ 1

★ Check the total length of the group.
  - Total length "**A**": 245±1 mm
  - Spring pre-loading: 4000 kg
  - Length of spring when pre-loaded: 203 mm

★ Check that the base (1) is tightly welded.



RKP11220

2. Cylinder

Disassembly

1 - Remove the lubricator (1) and the washer (2).

2 - Draw the piston (3) out of the cylinder (4).

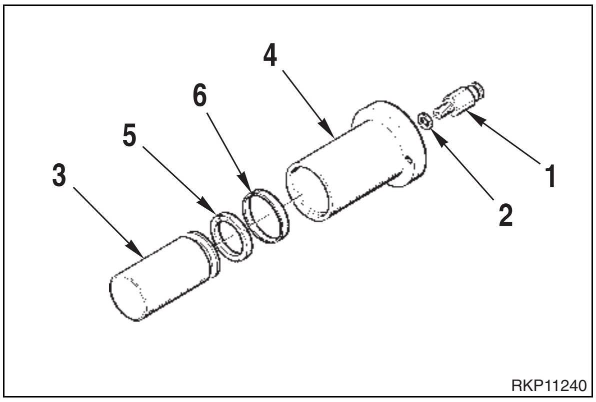
3 - Remove the ring (5).

4 - Remove the seal (6) from the piston (3).

Assembly

- To re-assemble, reverse the removal procedure.

Piston and sealants: ASL800050



RKP11240

REMOVAL OF TRACK ROLLER

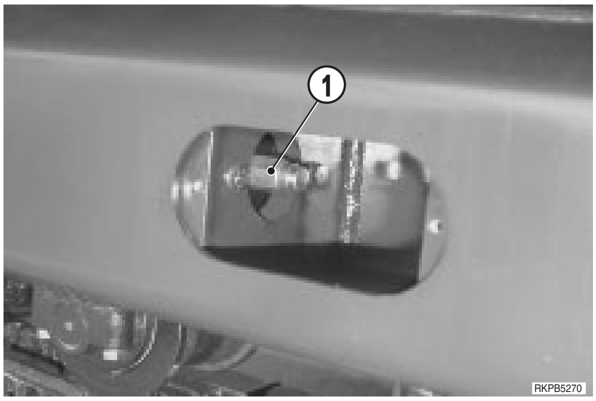
1 - Slowly unscrew the lubricator (1) to let out the grease and relieve tension on the track shoe.

The grease contained in the track shoe cylinder is pressurised and could cause serious injury to the operator. For this reason the valve should not be loosened by more than one turn.

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

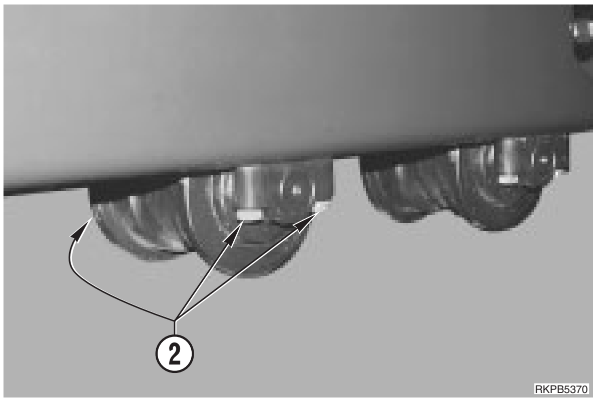
※ 1

2 - Loosen the screws (2) that hold the track roller (4).



3 - Rotate the revolving frame 90° towards the removal side. Force the boom down to raise the lower frame (3).

4 - Remove the track roller (4). ※ 2



INSTALLATION OF TRACK ROLLER

- To install, reverse the removal procedure.

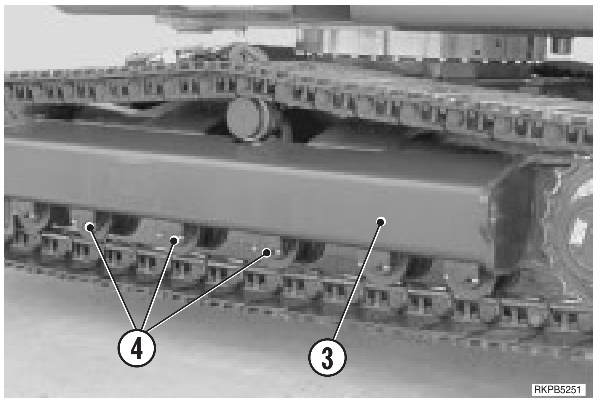
※ 2

★ With the lower frame (4) raised, install the track rollers (3) and lightly fasten the attachment screws (2).

Track rollers attachment screws: Loctite 242

★ Slowly lower frame (3) until the idlers (4) rest completely on the track shoe and then tighten the screws (2) firmly.

Track rollers attachment screws: 118 Nm



※ 1

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

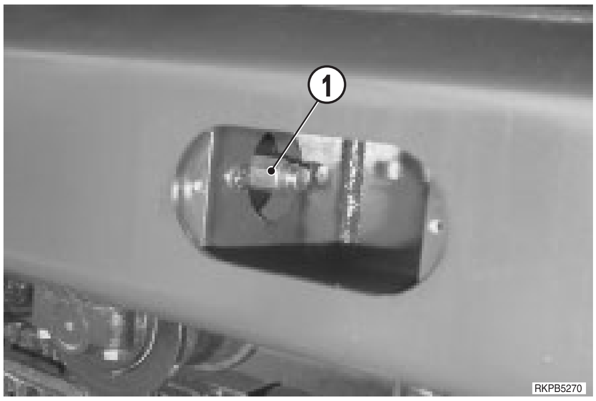
REMOVAL OF CARRIER ROLLER

1 - Slowly unscrew the lubricator (1) to let out the grease and relieve tension on the track shoe.

The grease contained in the track shoe stretching cylinder is under pressure and could cause serious injury to the operator. For this reason the valve should not be loosened by more than one turn.

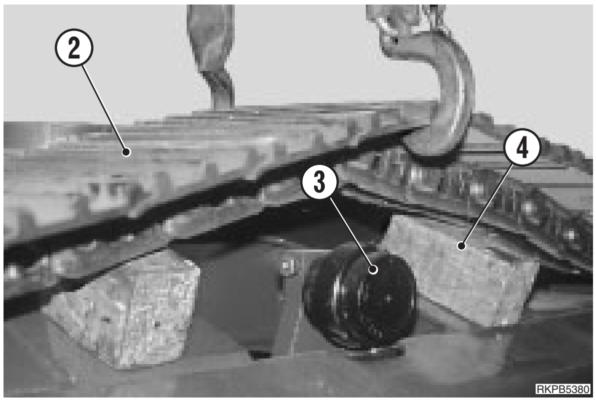
★ If the grease does not flow out easily, move the machine backwards and forwards slowly.

Lower the work equipment to the ground and switch off the engine.



2 - Raise the track shoe (2) to a height that leaves the idler (3) free. For reasons of safety, position some blocks (4).

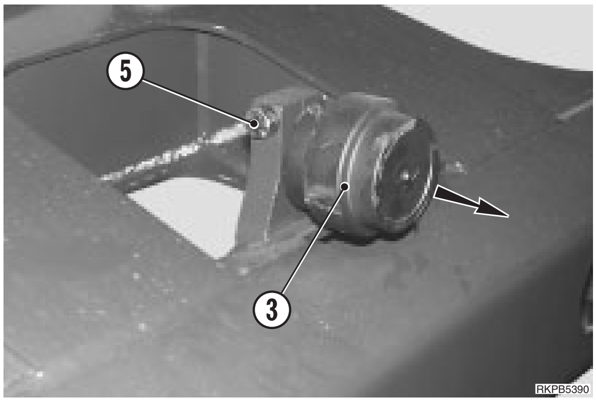
3 - Loosen the retaining screw (5) and remove the carrier roller (3).



INSTALLATION OF CARRIER ROLLER

- To install, reverse the removal procedure.

1 - Adjust track shoe tension. (For details, see «20. TESTING AND ADJUSTMENTS»).



REMOVAL OF R.H. PPC VALVE (BOOM-BUCKET)

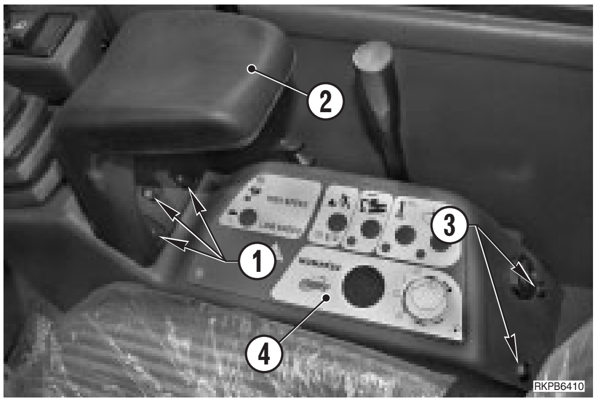
Lower the work equipment until it is resting on the ground and switch off the engine, and remove the starting key.

Release residual pressures from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

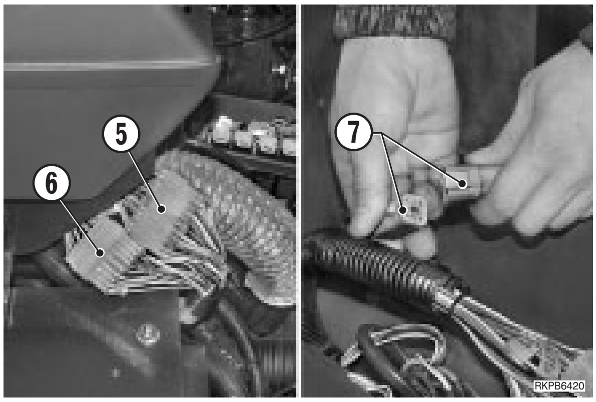
Disconnect the lead from the negative (–) battery terminal.

1 - Loosen screws (1) and remove armrest (2).

2 - Loosen retaining screws (3) (n. 3) of R.H. console (4).
  ★ To remove the inside screw, lower the seat and push it right back.



3 - Disconnect the connectors (5), (6) and the PPC valve connector (7).
  ★ Mark the position to avoid errors during the assembly.



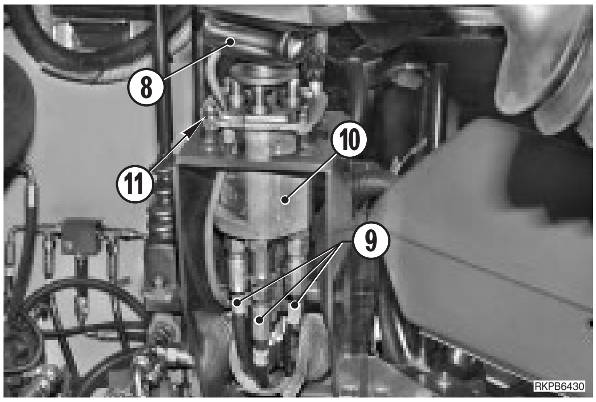
4 - Detach the cover (8) from the R.H. console (4).

5 - Remove screws (11) and remove the PPC valve (10)

6 - Move backward the R.H. console. Disconnect hoses (9) from the PPC valve (10) (n° 6 pipes) and plug them to prevent entry of impurities.
  ★ Mark the position to avoid errors during assembly.

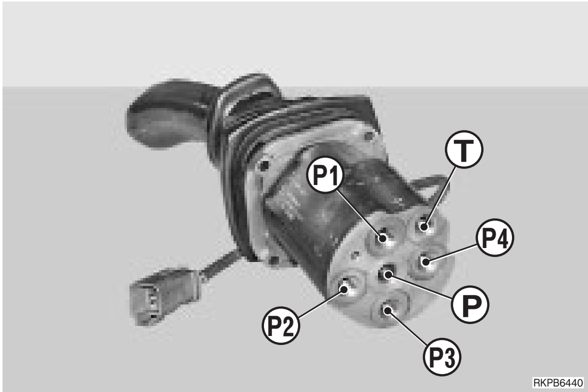
※ 1

If there is a slack on the control lever, adjust the unit (See «20: TESTING AND ADJUSTMENTS - Adjustment of manual control slacks»)



INSTALLATION OF R.H. PPC VALVE (BOOM-BUCKET)

- To install, reverse the removal procedure.



※ 1

★ Check the positions carefully when reconnecting the tubes.

P - Pressure

T - Unload

P1 - L.H. swing

P2 - Arm opening

P3 - R.H. swing

P4 - Arm closing

1 - Start the engine to circulate the oil and check the seals.

REMOVAL OF L.H. PPC VALVE (ARM-SWING)

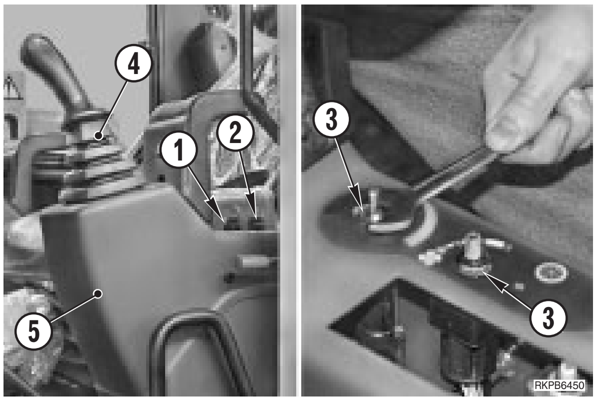
⚠ Lower the work equipment until it is resting on the ground and switch off the engine.

⚠ Release residual pressures from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

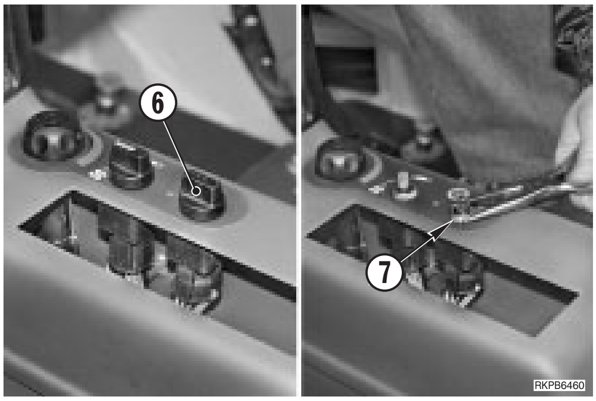
⚠ Disconnect the lead from the negative (–) battery terminal.

1 - Remove the control heating knob (1) the fan control knob (2) and loosen the nut (3).

2 - Disconnect the cover (4) from console.

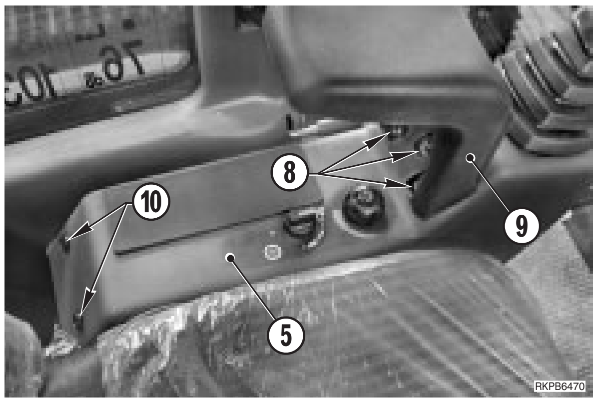


3 - **Only for machine equipped with air conditioning unit:** remove the air conditioning control knob (6) and loosen the retainer nut (7).



4 - Remove the arm rest (9) fixing screws (8).

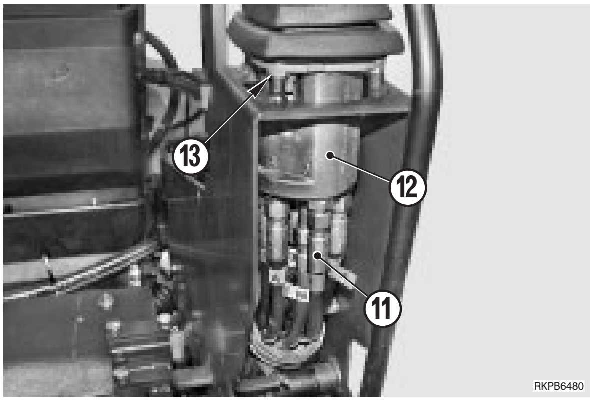
5 - Loosen screws (10) and remove L.H. console (5).
★ To remove the inside screw, lower the seat and push it right back.



6 - Disconnect the six tubes (11) from the PPC valve (12) and plug them to prevent entry of impurities.
  ★ Mark the positions to avoid errors during assembly.
  ※1

7 - Remove screws (13) and remove PPC valve (12).

  ⚠ If there is a slack on the control lever, adjust the unit (See «20. TESTING AND ADJUSTMENTS - Adjustment of manual control slacks»)

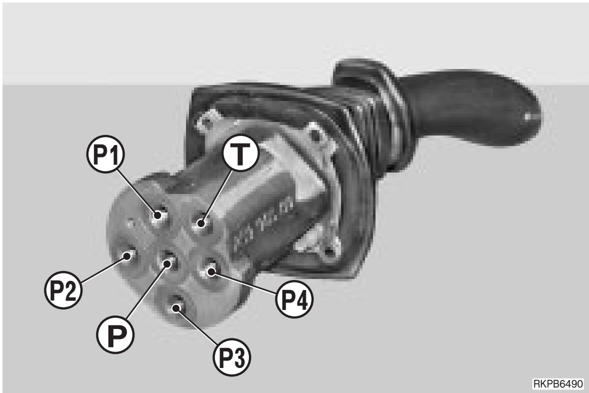


INSTALLATION OF PPC VALVE (ARM-SWING)

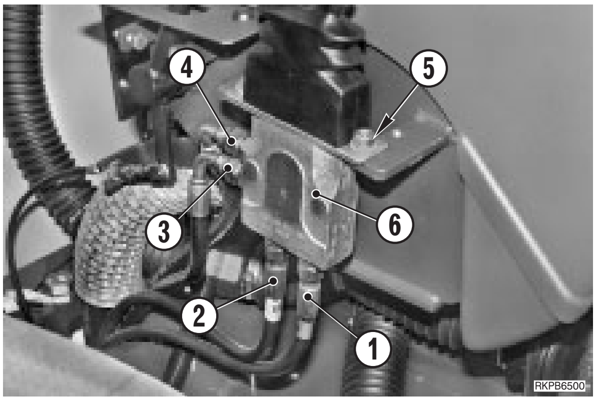
- To install, reverse the removal procedure.

※1
  ★ Check the positions carefully when reconnecting the tubes.
  P - Pressure
  T - Unload
  P1 - Arm closing
  P2 - L.H. swing
  P3 - Arm opening
  P4 - R.H. swing

1 - Start the engine to circulate the oil and check the seals.



REMOVAL OF BLADE PPC VALVE



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

⚠ Release residual pressures from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

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

2 - Disconnect the tubes (1), (2), (3) and (4) and plug them.
  ★ Make an identifying mark on the pipes to avoid mixing them up during installation.

4 - Remove the screw (5) and the PPC valve (6).

INSTALLATION OF BLADE PPC VALVE

- To install, reverse the removal procedure.

1 - Start the engine to circulate the oil.

2 - Bleed air from the blade cylinder. (For details, see «20. TESTING AND ADJUSTMENTS»).

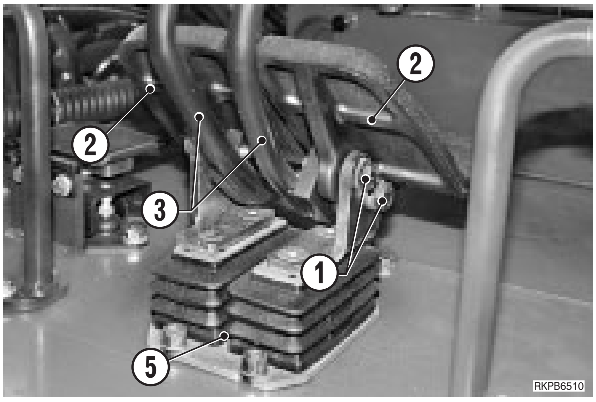
REMOVAL OF TRAVEL PEDAL CONTROL

- Rotate the turret 90° to the left.

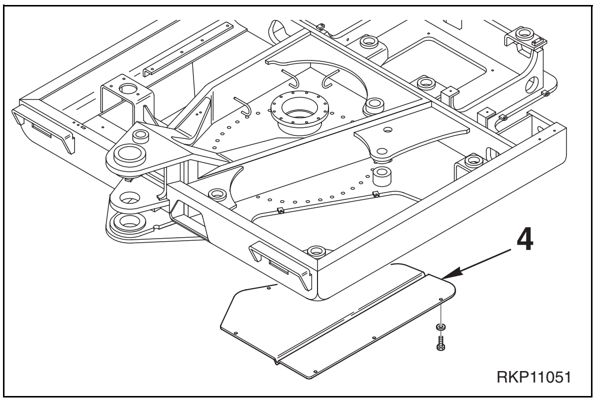
Lower the work equipment until it is resting on the ground and switch off the engine.

Release residual pressures from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

1 - Pull out the screws (1) and remove pedals (2) and levers (3). ※ 1

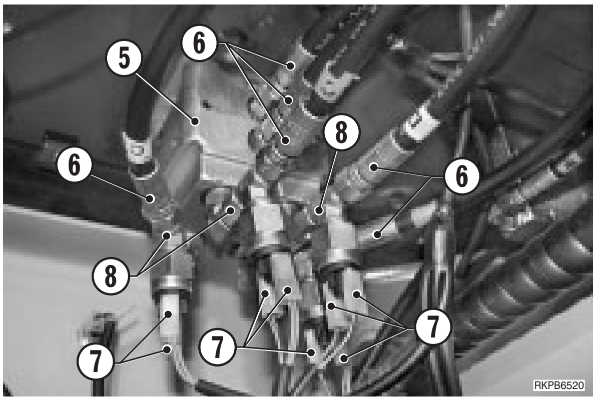


2 - Remove the bottom left casing (4).

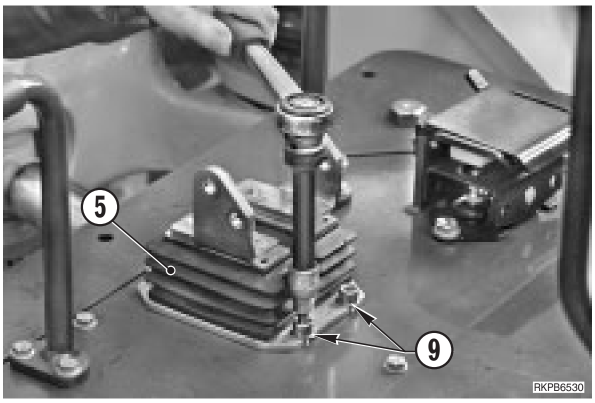


3 - Disconnect the pipes (6) (No. 6) from pedal (5) and the connectors (7).
  ★ Mark the position to avoid errors during the assembly.

4 - Remove the side connections (8) (No. 2) from the pedal control.



5 - Pull out the screws (9) and remove the pedal control (5). ※ 2



INSTALLATION OF TRAVEL PEDAL CONTROL

- To install, reverse the removal procedure.

1 - Start the engine to circulate the oil.

2 - Bleed air form the travel motors (For details, see «20. TESTING AND ADJUSTMENTS»).

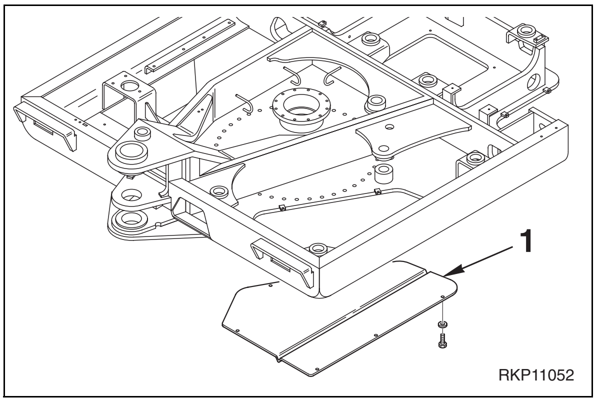
REMOVAL OF BOOM SWING PEDAL CONTROL

- Rotate the turret 90° to the left.

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

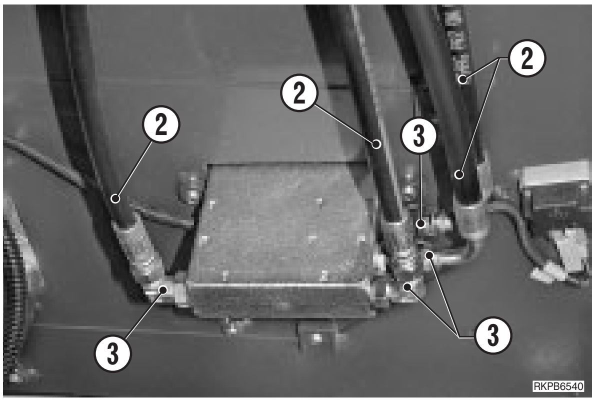
Release residual pressures from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

1 - Remove the bottom left cover (1).

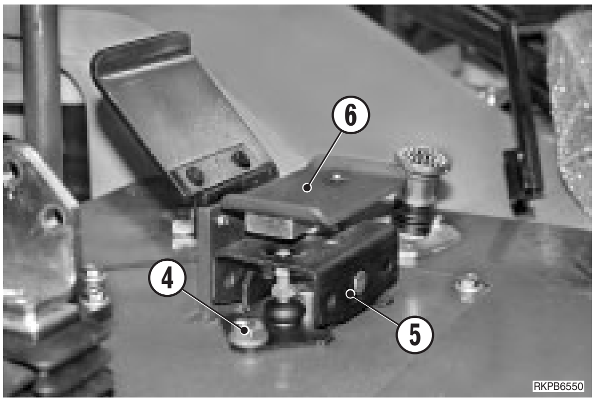


2 - Disconnect the pipes (2) (No. 4 tubes) from the pedal control.
   ★ Place an identifying mark on the pipes to avoid mixing them up during installation.

3 - Remove the connections (3) from the pedal control.



4 - Pull out the screws (4) and remove the pedal control (5) with the operation pedal (6).



INSTALLATION OF BOOM SWING PEDAL CONTROL

- To install, reverse the removal procedure.

1 - Start the engine to circulate the oil.

2 - Bleed air from the front boom swing cylinder. (See «20. TESTING AND ADJUSTMENTS»).

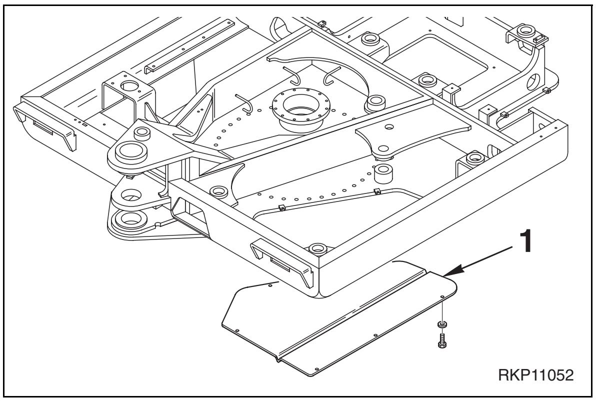
REMOVAL OF 1st BOOM PEDAL CONTROL

- Rotate the turret 90° to the left.

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

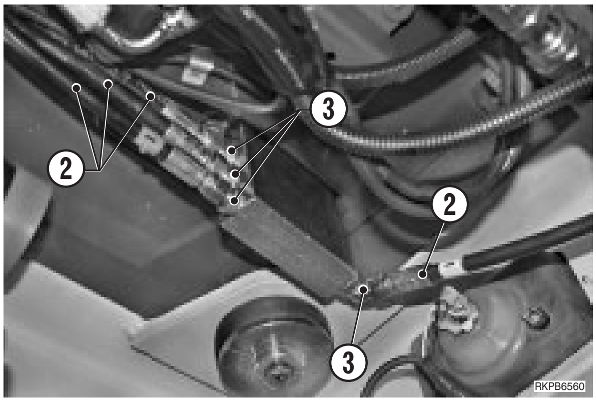
⚠ Release residual pressures from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

1 - Remove the bottom left cover (1).

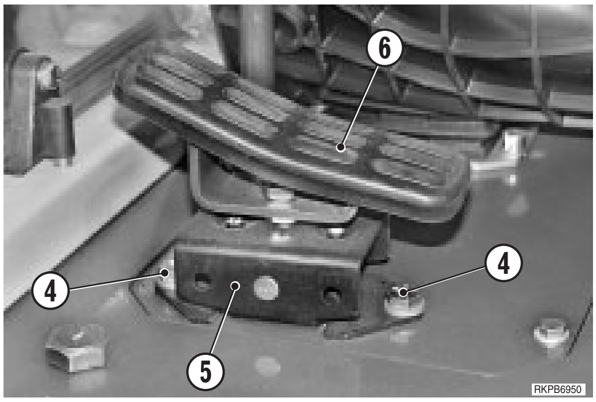


2 - Disconnect the pipes (2) (No. 4 tubes) from the pedal control.
   ★ Place an identifying mark on the pipes to avoid mixing them up during installation.

3 - Remove the connections (3) from the pedal control.



4 -Pull out the screws (4) and remove the pedal control (5) with the operation pedal (6).



INSTALLATION OF 1st BOOM PEDAL CONTROL

- To install, reverse the removal procedure.

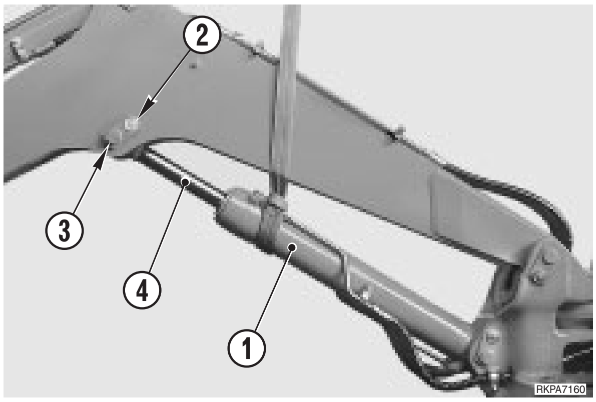
1 - Start the engine to circulate the oil.

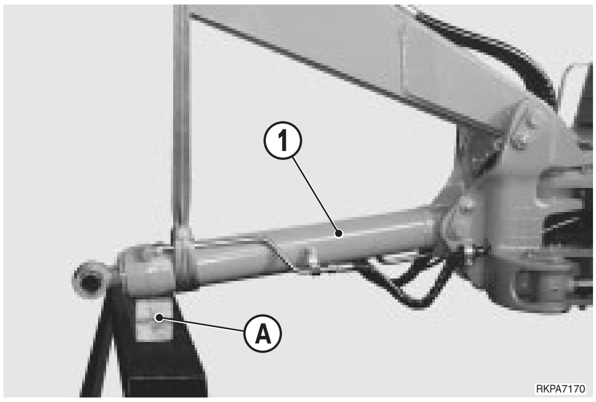
2 - Bleed air from the front boom swing cylinder. (See «20. TESTING AND ADJUSTMENTS»).

REMOVAL OF BOOM CYLINDER (For 1-piece boom)

⚠ Extend the arm fully and open the bucket completely. Lower the work equipment until it is resting on the ground.

1 - Put a sling around the cylinder (1).
2 - Switch off the engine, release pressure in the cylinder by moving the RH PPC valve lever several times.
3 - Remove the screw (2) and draw out the pin (3).
※ 1 ※ 3
4 - Start the engine to retract the piston (4).
※ 2
5 - Lower the cylinder (1) until it rests on a stand «**A**».
   ★ To hold the piston rod in its fully retracted position tie it with wire.
6 - Switch off the engine and release any residual hydraulic pressures. (For details, see «20. TESTING AND ADJUSTMENTS»).
7 - Disconnect the tubes (5 and 6) and plug them. Also plug the holes in the safety valve to avoid entry of impurities.
8 - Remove pipe (7) and plug the cylinder port and the pipe to keep out impurities.
9 - Remove the screw (8) and safety valve (9).
10 - Remove screw (10) and draw out the pin (11).
※ 2 ※ 3 ※ 4
11 - Remove cylinder (1).





INSTALLATION OF BOOM CYLINDER (For 1-piece boom)

- To install, reverse the removal procedure.

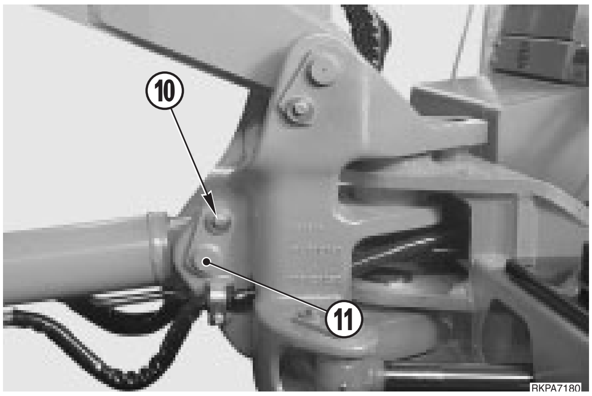
※ 1
   ★ Insert the spacers to a given clearance (distributed on both sides of the cylinder rod) until a clearance of 1–2 mm is obtained.

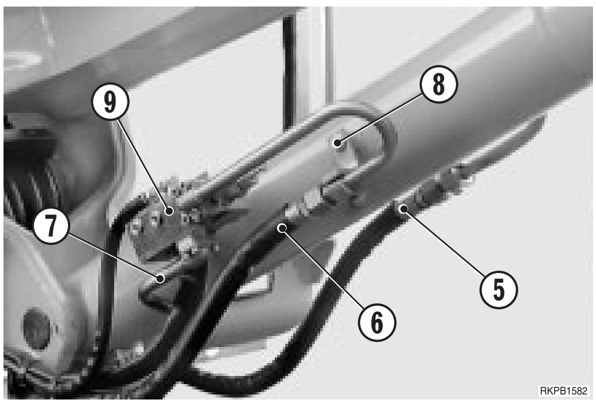
※ 2
   ⚠ When aligning the positions between hole and pin, let the engine run at minimum idling. Do not insert fingers into the hole to check the alignment.

※ 3
   Inside bushings: ASL800050

※ 4
   ★ Insert the spacers to a given clearance (distributed on both sides of the piston rod) until a clearance of 0.5–1 mm is obtained.

- Start the engine and bleed air from the cylinder. (For details, see «20. TESTING AND ADJUSTMENTS»).
   ★ After bleeding the air, check the oil level in the tank.

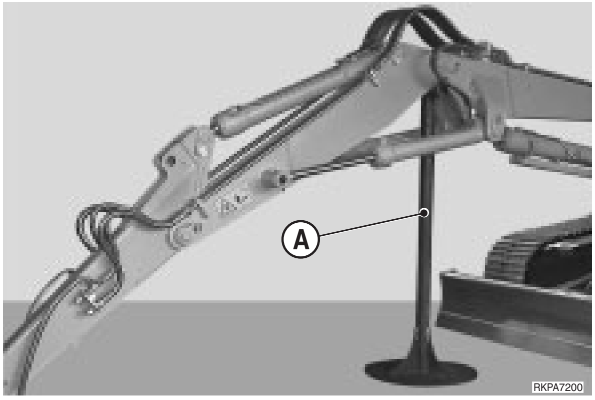




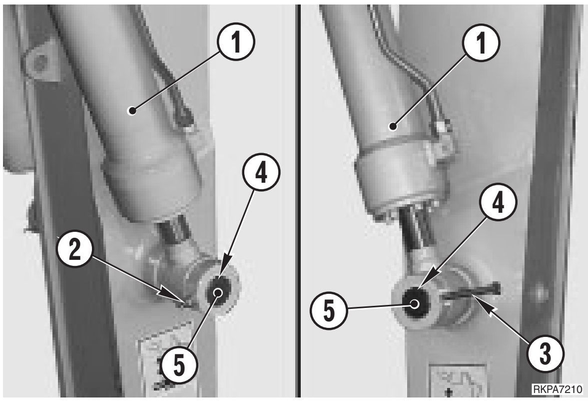
REMOVAL OF BOOM CYLINDER (For 2-piece boom)

1 - Fully extend the front work equipment, raise the boom and 2-piece boom and position a supporting stand (**A**) between them.
★ The stand should be 1.60 m high.

2 - Manoeuvre the arm until the bucket is resting on the ground. Switch off the engine.



3 - Put a sling round the RH 2nd boom cylinder (1) of the 2-piece boom and remove the self-locking nut (2), the screw (3) and the spacer (4). ※ 1

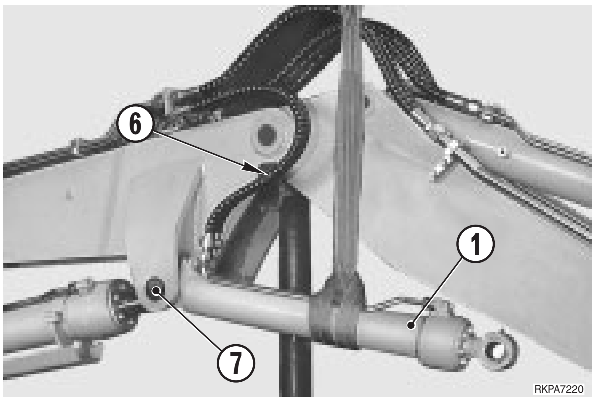


4 - Slide off the pin (5) that connects the RH 2nd boom cylinder (1) to the 2-piece boom, until the piston rod is completely disconnected. ※ 2 ※ 3 ※ 5

5 - Start the motor and retract the RH cylinder piston. ※ 3
★ To secure the piston rod in this position, tie it with wire and switch off the engine.

6 - Disconnect the tubes (6) from the RH cylinder (1) and plug them.

7 - Slide out the pin (7) until the cylinder (1) is free and remove it. ※ 2 ※ 4

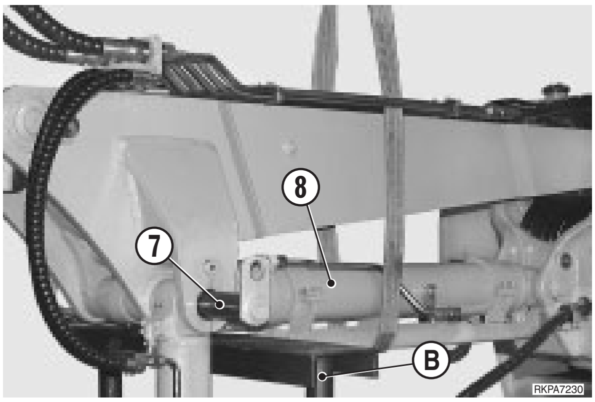


8 - Put the boom cylinder (8) in a sling.

9 - Slide the pin (7) out until the boom cylinder piston rod (8) is disconnected. ※ 3 ※ 4
★ To hold the piston rod in its fully retracted position, tie it with wire and switch off the engine.

10 - Start the engine and retract the piston.

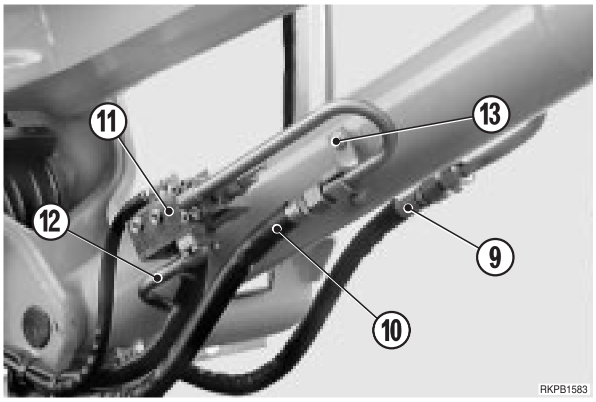
11 - Lower the cylinder (8) and rest it on a stand (B).



12 - Disconnect the tubes (9) and (10) and plug them. Also plug hole in the safety valve (11) to prevent impurities from entering.

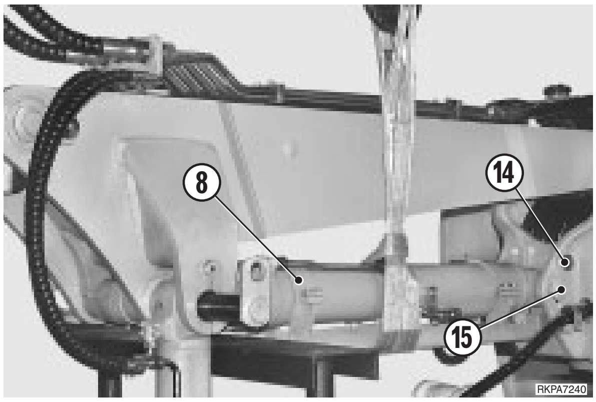
13 - Remove pipe (12) and plug the cylinder port and the pipe to keep out impurities.

14 - Remove the screw (13) and remove safety valve (11).



15 - Loosen the screws (14) and remove the pin (15).
※ 2 ※ 3 ※ 4

16 - Remove the cylinder (8).



INSTALLATION OF THE BOOM CYLINDER (For 2-piece boom)

- To install, reverse the removal procedure.

※ 1

Self-locking nut: 118 Nm

※ 2

Inside bushings: ASL800050

※ 3

When aligning the positions between hole and pin, run the engine at minimum idling.
Do not insert fingers in the holes to check the alignment.

※ 4

★ Insert the spacers to a given clearance (distributed on both sides of the piston rod) until a clearance of 0.5–1 mm is obtained.

※ 5

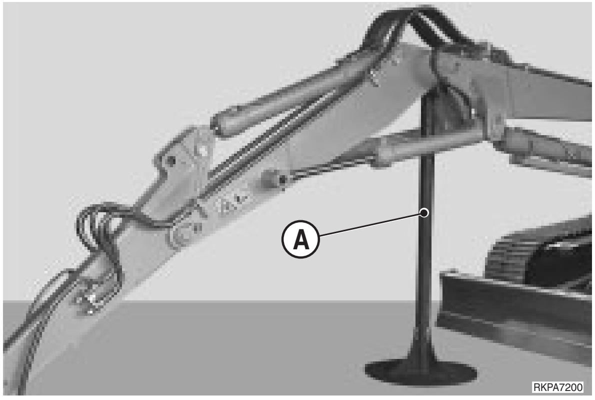
★ Insert the spacers to a given clearance (distributed on both sides of the cylinder) until a clearance of 0.5–1 mm is obtained.

- Start the engine and bleed the air from the cylinders (For details, see «20. TESTING AND ADJUSTMENTS»).
  ★ After bleeding the air, check the level of the oil tank.

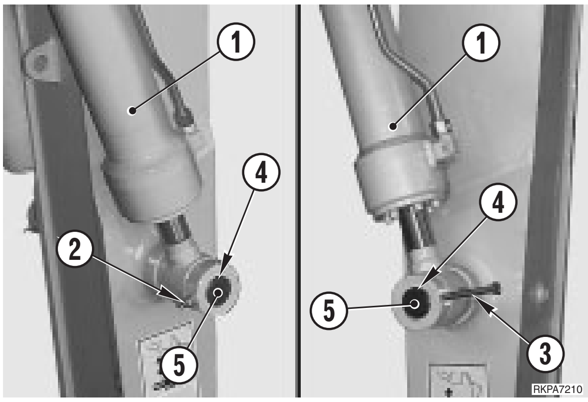
REMOVAL OF 2nd BOOM CYLINDERS

1 - Fully extend the front work equipment, raise the boom and 2-piece boom and position a supporting stand (A) between them.
  ★ The stand should be 1.60 m high.

2 - Manoeuvre the arm until the bucket is resting on the ground. Switch off the engine.



3 - Put a sling round the RH cylinder (1) of the 2-piece boom and remove the self-locking nut (2), the screw (3) and spacer (4). ※1

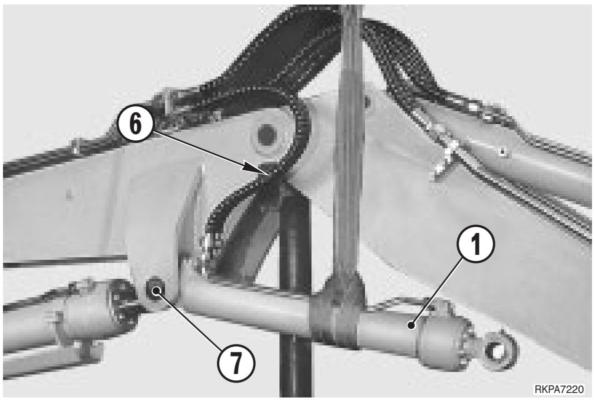


4 - Slide off the pin (5) that connects the RH cylinder (1) to the 2-piece boom, until the piston rod is completely disconnected. ※2 ※3 ※5

5 - Start the motor and retract the RH cylinder piston.
  ★ To hold the rod in its fully retracted position, tie it with wire and switch off the engine.

6 - Disconnect the tubes (6) from the RH cylinder (1) and plug them.

7 - Slide out the pin (7) to free the cylinder (1) and remove it. ※2 ※4

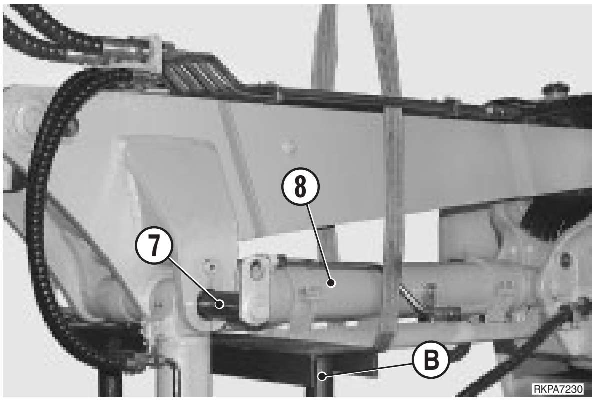


8 - Put the boom cylinder (8) in a sling.

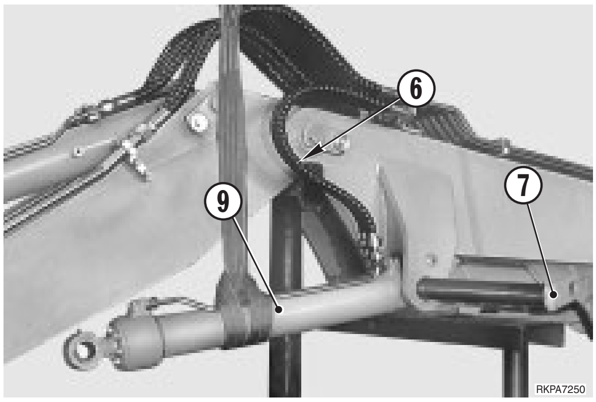
9 - Slide the pin (7) out to disconnect the boom cylinder piston rod (8). ※2

10 - Start the engine and retract the piston.
  ★ To hold the rod in its fully retracted position, tie it with wire and switch off the engine. ※3

11 - Lower the cylinder (8) and rest it on a stand (B).



12 - Repeat the procedure from points 3-7 to remove the LH cylinder (9) of the 2-piece boom.



INSTALLATION OF 2nd BOOM CYLINDERS

- To install, reverse the removal procedure.

※ 1

Self-locking nut: 118 Nm

※ 2

Inside bushings: ASL800050

※ 3

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

※ 4

★ Insert the spacers to a given clearance (distributed on both sides) until a clearance of 0.5–1 mm is obtained for each cylinder.

※ 5

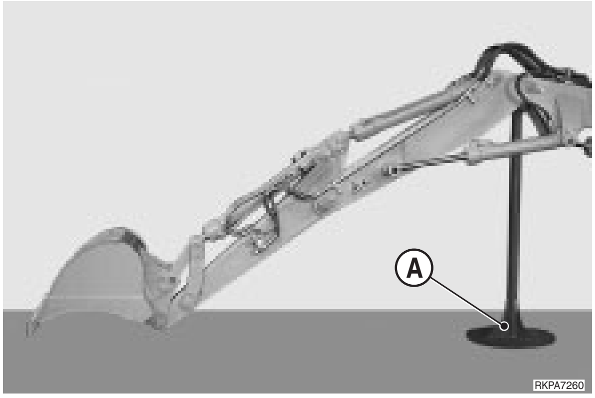
★ Insert the spacers to a given clearance (distributed on both sides of the cylinder) until a clearance of 0.5–1 mm is obtained.

- Start the engine and bleed the air from the cylinders (For details, see «20. TESTING AND ADJUSTMENTS»).
  ★ After bleeding the air, check the level of the oil tank.

REMOVAL OF ARM CYLINDER

⚠ Open the front work equipment completely, then raise it and place a supporting stand between the boom and the 2-piece boom.

★ The stand should be 1.60 m high.



1 - Manoeuvre the bucket until its teeth are resting on the ground, together with the arm.
2 - Put a sling around the cylinder (1).
3 - Switch off the engine, release pressure in the cylinder by moving the LH PPC valve lever several times.
4 - Remove the screw (2) and draw out the pin (3).

※1 ※3

5 - Start the engine to retract the piston (4).

★ To hold the piston in its fully retracted position, tie the rod with wire.

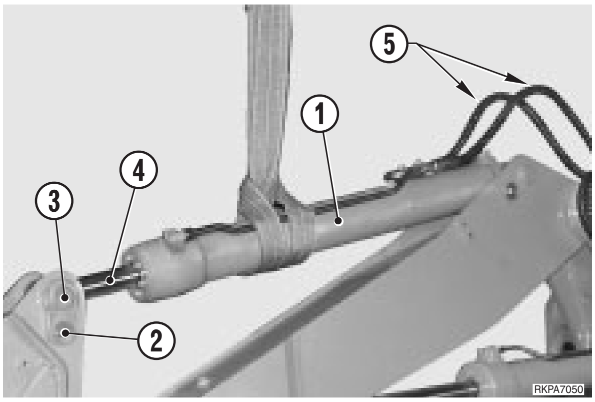
6 - Switch off the engine and release any residual hydraulic pressures. (For details, see «20. TESTING AND ADJUSTMENTS»).
7 - Disconnect the tubes (5) and plug them.

⚠ If a safety valve has been installed, disconnect the tubes (6-7) from the valve.

8 - Remove the screw (8) and draw out the pin (9).

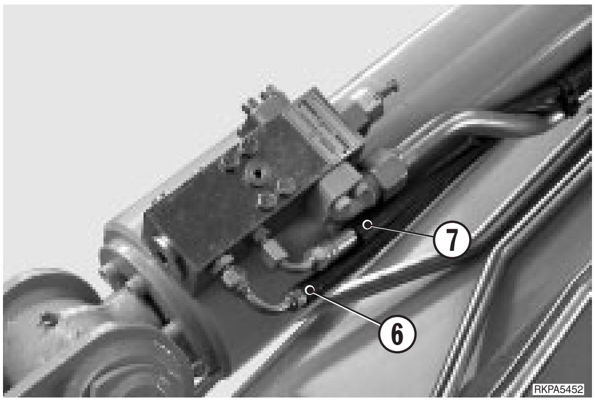
※2 ※3 ※4

9 - Lift out the cylinder (1).



INSTALLATION OF ARM CYLINDER

- To install, reverse the removal procedure.



※1

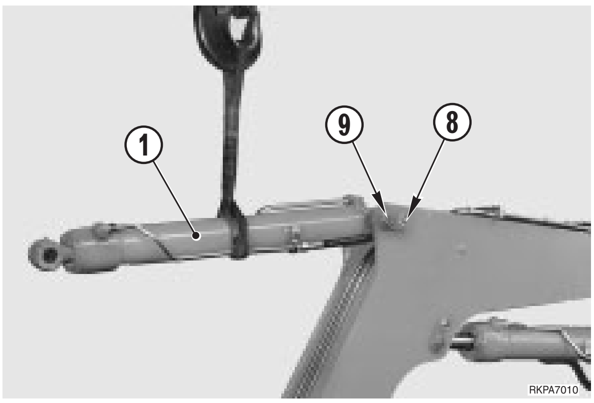
★ Insert the spacers to a given clearance (distributed on both sides of the piston rod) until a clearance of 1–2 mm is obtained.

※2

⚠ When aligning the positions between hole and pin, let the engine run at minimum idling. Do not insert fingers into the hole to check the alignment.

※3

Inside bushings: ASL800050



※4

★ Insert the spacers to a given clearance (distributed on both sides of the cylinder) until a clearance of 0.5–1 mm is obtained.

- Start the engine and bleed air from the cylinder. (For details, see «20. TESTING AND ADJUSTMENTS»).
  ★ After bleeding the air, check the oil level in the tank.

REMOVAL OF BUCKET CYLINDER

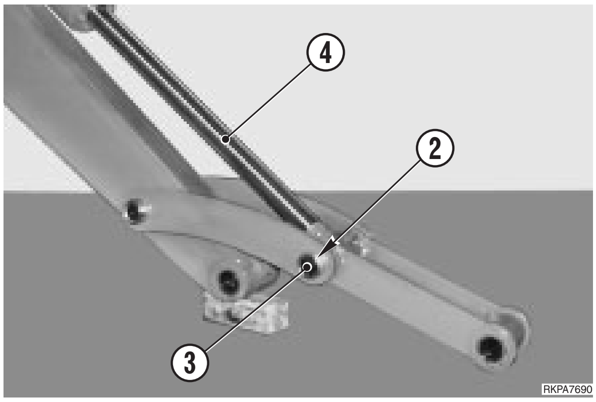
⚠ Extend the arm fully and open the bucket completely. Lower the work equipment until it is resting on the ground.

1 - Switch off the engine and release pressure in the cylinder by moving the RH PPC valve lever several times.

2 - Remove the ring nut (2) and draw out the pin (3).
※1 ※2 ※3

3 - Switch off the engine and retract the piston rod (4).

To hold the piston rod in its fully retracted position, tie it with wire.



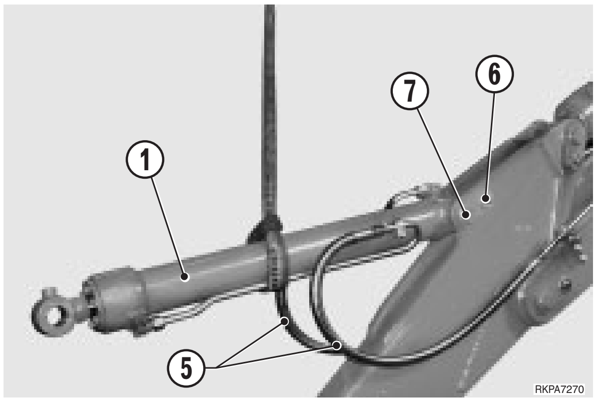
4 - Switch off the engine and release any residual hydraulic pressures. (For details, see «20. TESTING AND ADJUSTMENTS»).

5 - Disconnect the hoses (5) and plug them. Also plug the holes of the rigid tubes to avoid entry of impurities.

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

7 - Remove the screw (6) and draw out the pin (7).
※2 ※3 ※4

8 - Lift out the cylinder (1).



INSTALLATION OF BUCKET CYLINDER

- To install, reverse the removal procedure.

※1

★ Insert the spacers to a given clearance (distributed on both sides of the piston rod) until a clearance of 1–2 mm is obtained.

※2

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

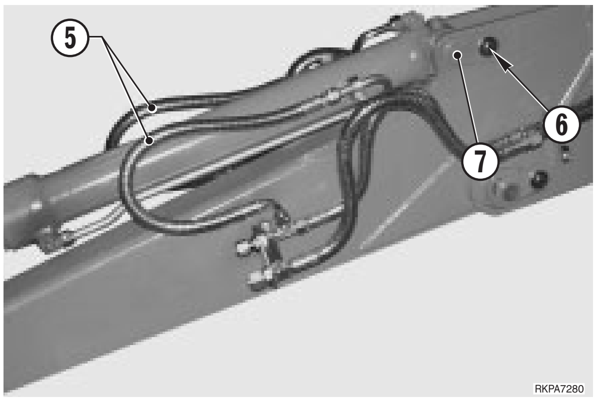
※3

Inside bushings: ASL800050

※4

★ Insert the spacers to a given clearance (distributed on both sides of the cylinder) until a clearance of 0.5–1 mm is obtained.

- Start the engine and bleed air from the cylinder. (For details, see «20. TESTING AND ADJUSTMENTS»).
  ★ After bleeding the air, check the oil level in the tank



REMOVAL OF BOOM SWING CYLINDER

1 - Swing the boom to the right to extend the cylinder fully.

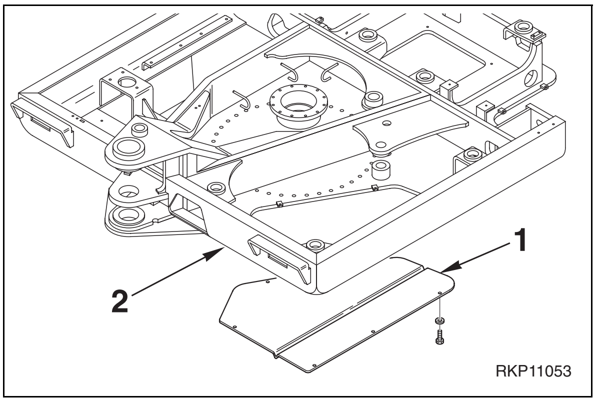
2 - Swing the revolving frame 45° and rest the work equipment on the ground.

3 - Switch off the engine and move the PPC valve several times to release all residual pressures.

4 - Remove the RH front guard (1) from the revolving frame (2).

5 - Disconnect the tubes (3) from the cylinder and plug them. Also plug the flanges (4) of the cylinder (5).

6 - Disconnect the lubricator tube (6).

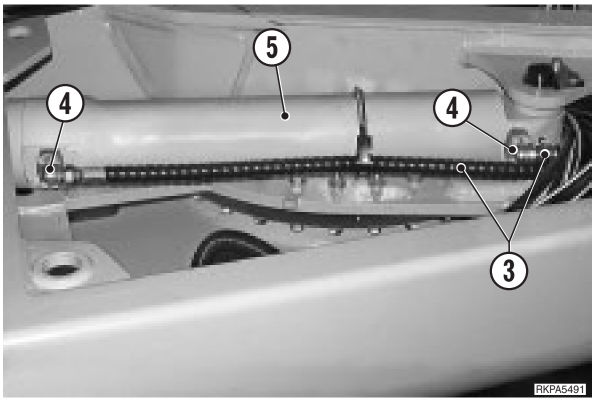


7 - Place a block beneath the cylinder head to prevent the edge of the frame making dents in the piston rod. Also place a support beneath the cylinder.

8 - Remove the screw (7), draw out the pin (8) and detach the piston rod from its support (9). ※1 ※2

9 - Remove the screws (10) and draw out the stop (11) and the pin (12). ※2 ※3 ※4

10 - Slide the cylinder out partially from the front and, as soon as possible, put it in a sling and lift it off.
   ★ During this operation take great care not to dent the piston rod.



INSTALLATION OF BOOM SWING CYLINDER

- To install, reverse the removal procedure.

※1

★ Insert the spacers to a given clearance (distributed on both sides of the piston) until a clearance of 1–2 mm is obtained.

※2

⚠ When aligning the positions between hole and pin, let the engine run at minimum idling. Do not insert fingers into the hole to check the alignment.

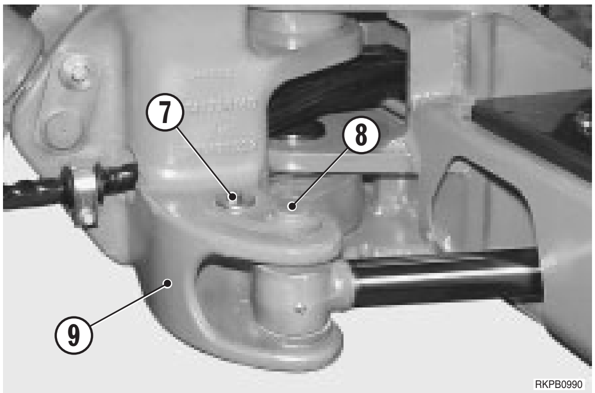
※3

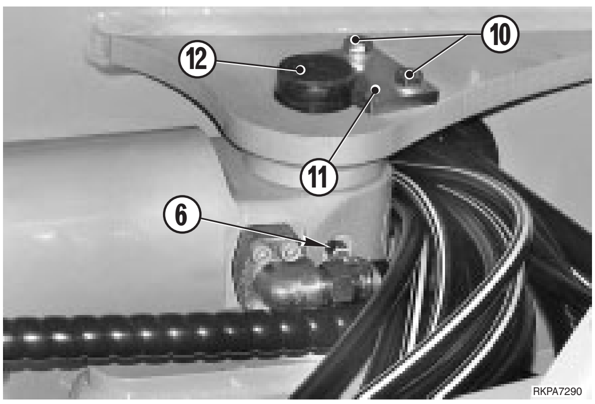
Inside bushings: ASL800050

※4

★ Insert the spacers to a given clearance (distributed on both sides of the cylinder) until a clearance of 0.5–1 mm is obtained.

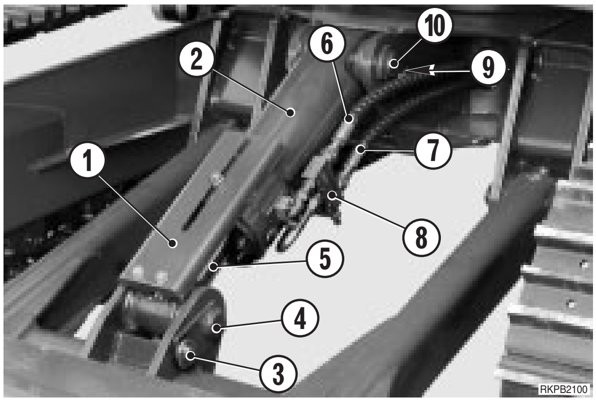
- Start the engine and bleed air from the cylinder. (For details, see «20. TESTING AND ADJUSTMENTS»).
   ★ After bleeding the air, check the oil level in the tank.





REMOVAL OF BLADE CYLINDER

⚠ Swing the upper revolving frame 90° to the right and lower the blade and the work equipment to the ground in their safe positions.



1 - Remove the protection (1).
2 - Put the blade cylinder (2) in a sling and put the cable under slight tension.
3 - Switch off the engine and release pressures in the cylinder by moving the lever of the blade PPC valves several times in both directions.
4 - Take out the screw (3) and remove the pin (4). ※1 ※3
5 - Start the engine and retract the piston (5). ※2
   ★ To hold the piston in its completely retracted position, tie it with wire.
6 - Stop the motor and release any residual hydraulic pressures. (For details, see «20. TESTING AND ADJUSTMENTS»).
7 - Disconnect the tubes (6 and 7) from the safety valve (8). Plug the tubes and the safety valves to prevent entry of impurities.
8 - Take away the screw (9) and remove the pin (10). ※2 ※3
9 - Remove the blade cylinder (2).

INSTALLATION OF BLADE CYLINDER

- To install, reverse the removal procedure.

※1

★ Insert the spacers to a given clearance on both sides of the piston.

※2

⚠ When aligning the hole and pin, let the engine run at minimum idling. Do not insert fingers into the hole to check the alignment.

※3

Inside bushings: ASL800050

※4

★ Insert the spacers to a given clearance on both sides of the piston.

- Start the engine and bleed air from the cylinder. (For details, see «20. TESTING AND ADJUSTMENTS»).
   ★ After bleeding the air, check the level of oil in the tank.

DISASSEMBLY OF WORK EQUIPMENT CYLINDERS

1. All cylinders

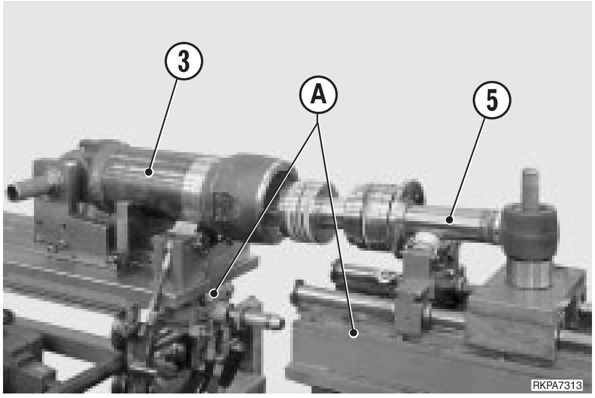
1 - Place the cylinder on the tool "**A**" and partially extract the piston.

2 - Loosen the retaining screws of the flange (1) that secures the head (2) and take it away. Move the flange (1) towards the piston rod.

3 - Push the head (2) into the cylinder (3) and remove the snap ring (4).

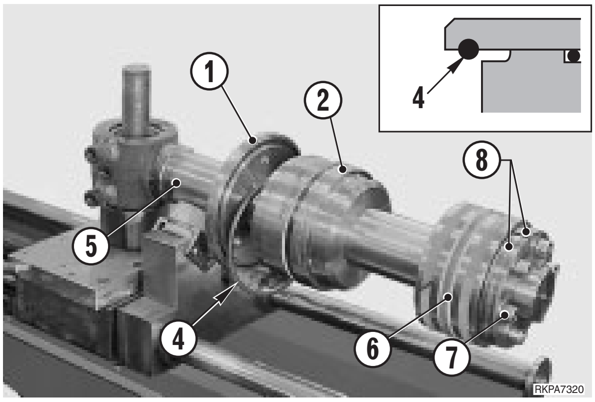
★ Take great care not to damage the inside of the cylinder.

4 - Slide the piston rod (5) out of the cylinder (3), complete with the flange (1), the snap ring (4), the head (2) and the piston (6).



2. Boom, bucket, boom swing and blade cylinders:

5 - Remove the screws (7) and remove the two half-flanges (8).



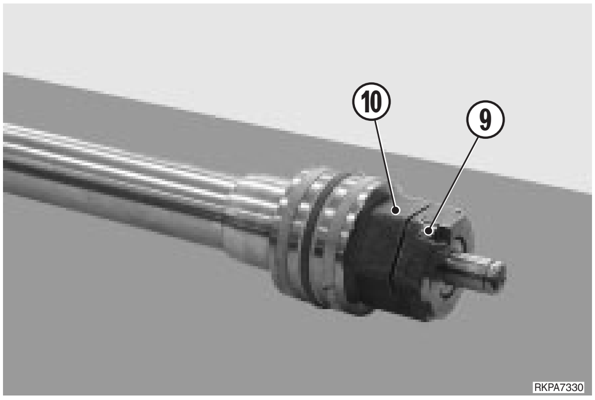
3. 2nd boom and arm cylinders

1 - Heat the end nut (10) to a temperature of 140–150 °C

2 - **Only for arm cylinder**: loosen and remove the safety screw (9).

3 - Loosen and remove the nut (10). Use the tool and the dynamometric tool **A1**.

★ Before continuing with the dismantling operations, allow the piston rod to cool down.

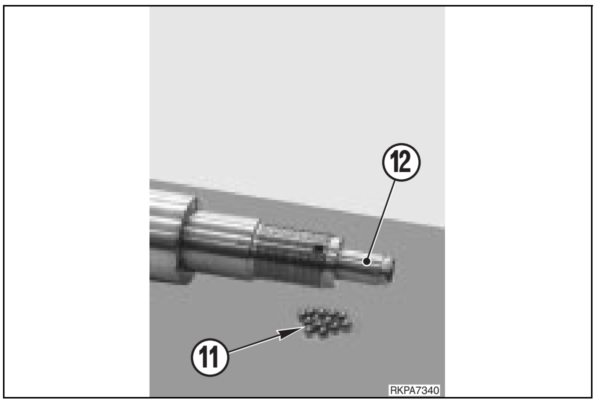


4. All cylinders

1 - Dismantle the assembly.

⚠ For the arm cylinder, first remove the thirteen brake pin (12) retaining balls (11) (No. 12).

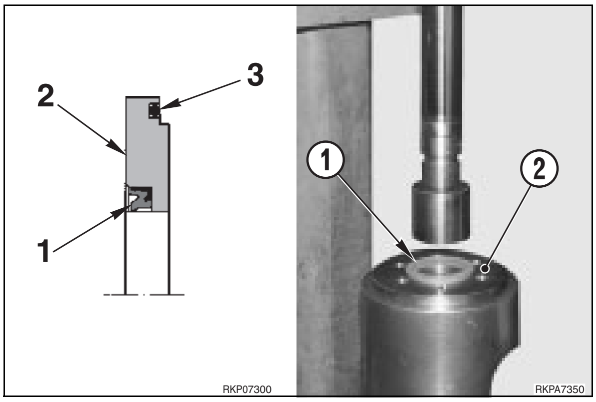
2 - Remove the seals from the piston rod.



ASSEMBLY OF THE WORK EQUIPMENT CYLINDERS

★ Take care not to damage the seals or the sliding surfaces.

★ Prepare each individual component before final assembly.

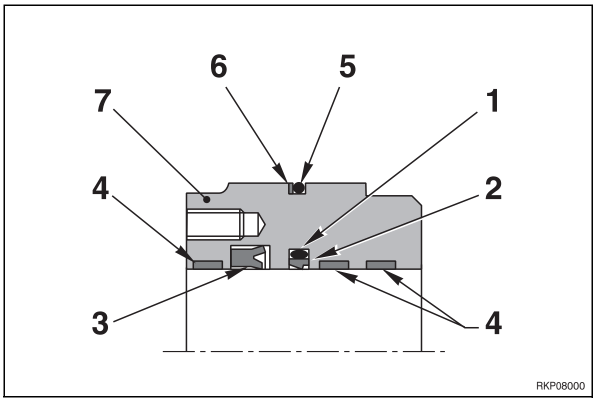


1. Assembly of the head-retaining flange.

1 - Mount the scraper (1) in the external seating of the flange (2), making sure that it is positioned correctly. Drive home the scraper using a press.

2 - Mount the O-ring seal (3).
★ Use grease to hold the washer in place.

Sealant: ASL800050



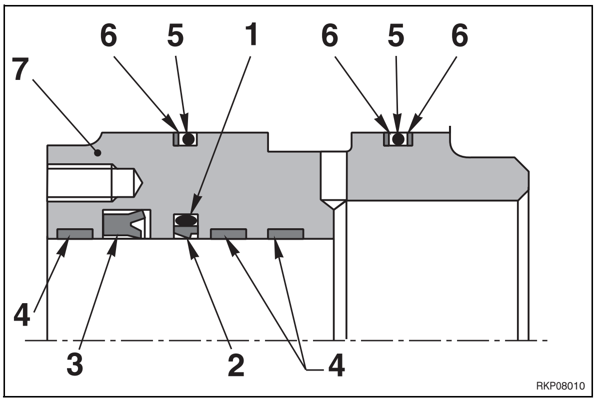
2. Head assembly

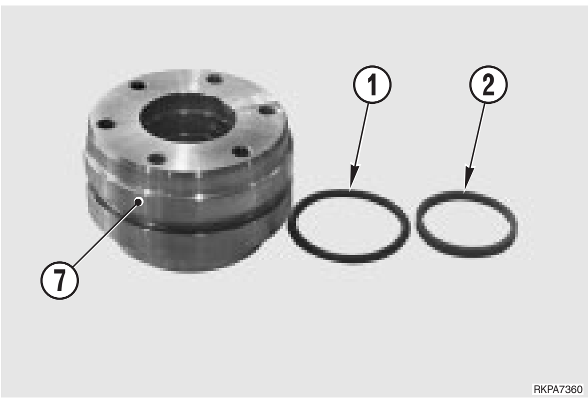
1 - Mount the internal central retaining ring, positioning first the O-ring (1) and then the sealing ring (2).
★ Make sure that the chamfered edge of the retaining ring is turned towards the inside of the cylinder.

2 - Use the plier "**B**", mount the lip seal (3).
★ Check that the lips are facing towards the inside of the cylinder.

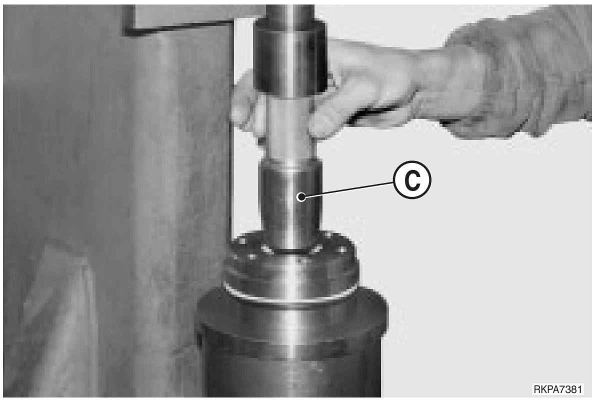
3 - Mount the guide rings (4).

4 - Mount the O-rings (5) and relative anti-extrusion rings (6) on the outside of the head (7).
★ Check the position of the anti-extrusion rings (6).





5 - Gauge the diameter of the internal seals, mounting the group underneath a press and using the specific gauging knuckle pin “**C**” for the diameter of the piston rod.

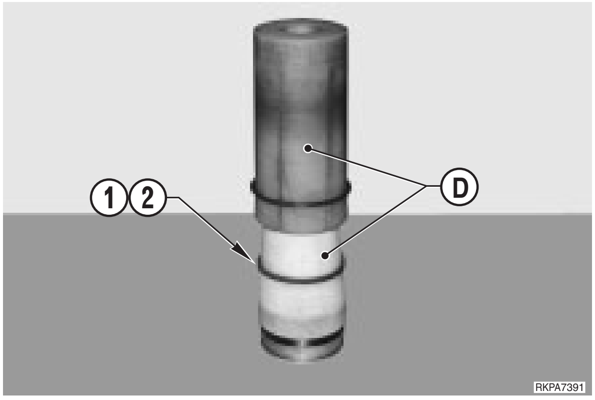


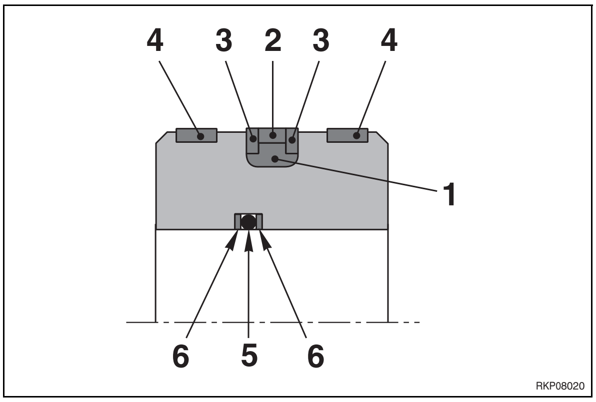
3. Piston assembly

1 - Using the suitable plunger **D**, mount the piston seal. Mount in the correct sequence the rubber ring (1), the external seal (2), and the anti-extrusion rings (3).

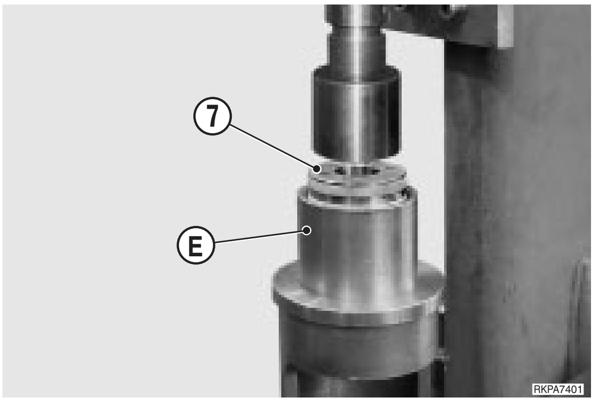
2 - Mount the guide rings (4).

3 - **For the arm and 2nd boom piston only:** Mount the O-ring (5) and the anti-extrusion rings (6) for the sealing between piston rod and piston.





4 - Cauge the diameter of the seal (2) of the piston (7), mounting the group under a press and use the specific gauging ring “**E**” for the piston diameter.

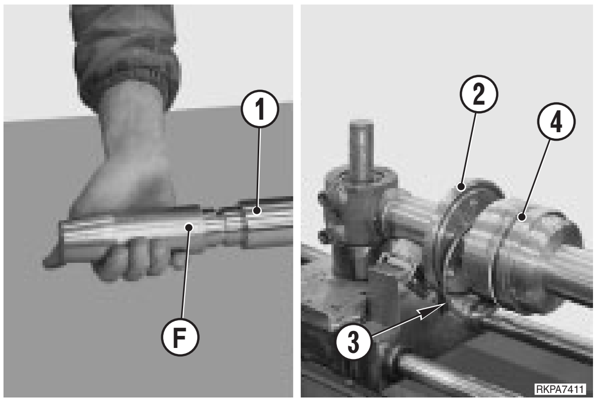


4. Piston rod group assembly

1 - Mount on the end of the piston rod (1) the bushing **F** of the correct diameter.

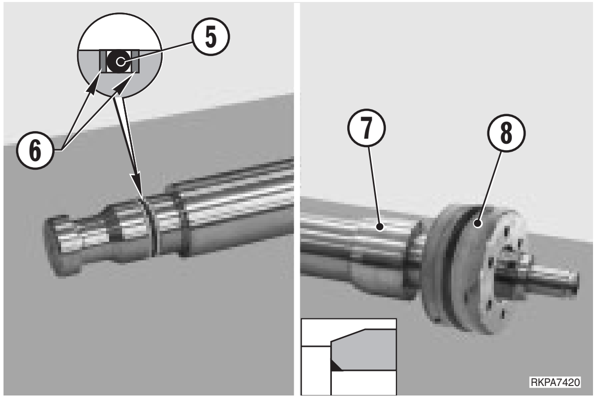
2 - Slide the head-retaining flange (2), the snap ring (3) and the head (4) onto the piston rod.
★ Check carefully the positioning of the head-retaining flange.

3 - Remove the bushing **F** from the end of the piston.



4 - Mount the O-ring (5) and the rings wear (6) in the end-seating, for the sealing between the piston ring and piston.
★ For boom, arm and bucket piston ring, the seal is housed in the piston itself.

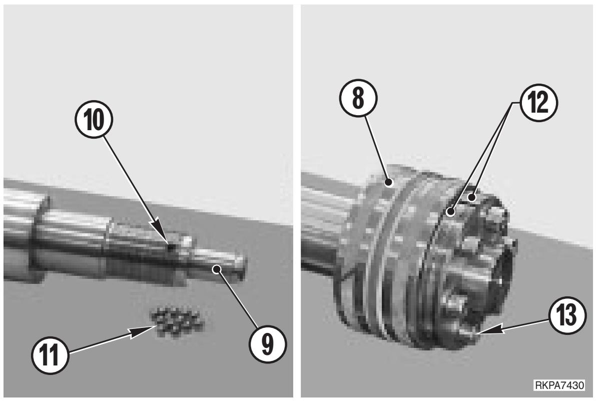
5 - Mount in the correct sequence the brake bushing (7) (for the boom and arm cylinders only) and the piston (8).



6 - **For the arm piston only**: mount the brake pin (9) and slide the thirteen retaining balls (11) (No. 12) into the hole (10).

7 - Mount the half-flanges (12) that hold the piston (8) in place, and secure them with the screws (13).

Flange retaining screws: 49±5 Nm



For the arm and 2nd boom piston only

1 - Mount the nut (14) that holds the piston (8) in place, and tighten with the socket wrench and the dynamometric tool with multiplier **A1**.

Piston retaining nut: Loctite 262

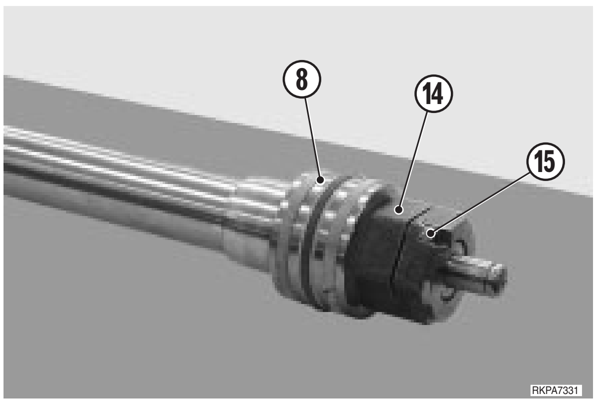
Piston retaining nut:
Arm: 294±19.5 daNm
2nd boom: 393±28.4 daNm

Only for arm:

2 - Mount the safety screw (15).

Safety screws: Loctite 262

Safety screws: 88±8.8 Nm



5. Cylinder assembly

1 - Place the cylinder (1) and the piston rod group (2) on the equipment "**A**" and align their axes.

2 - Lubricate the external seals and insert the piston (3) in the cylinder (1).

Piston sealants: Grease ASL800050

★ Before inserting the piston, check that the seals are not damaged and that they fit perfectly in their seatings.

3 - Lubricate the external seals of the head (4) and insert it completely into the cylinder (1).

Head sealants: Grease ASL800050

★ Before inserting the head, check that the seals are not damaged and that they fit perfectly in their seatings.

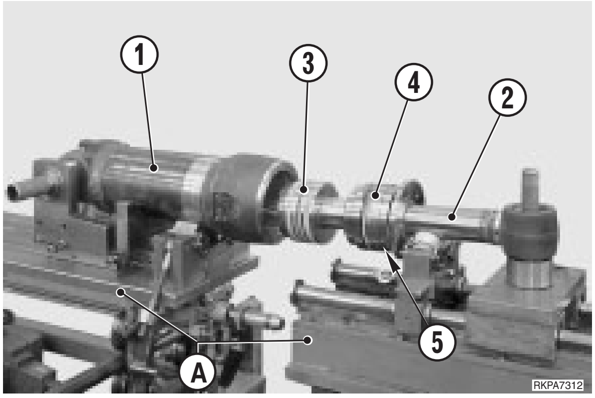
4 - Using the plier **G**, position the snap ring (5) that holds the head (4) in the cylinder seating.

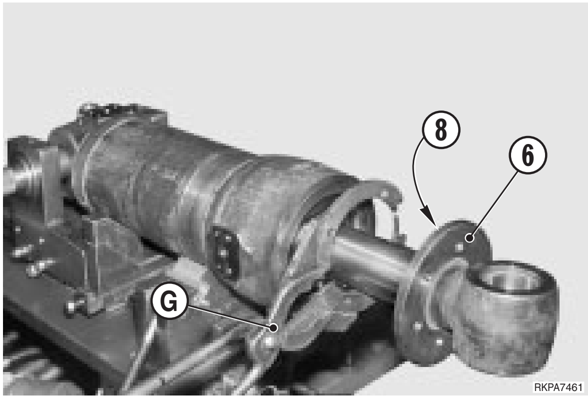
★ Check that the snap ring is completely inserted in the seating.

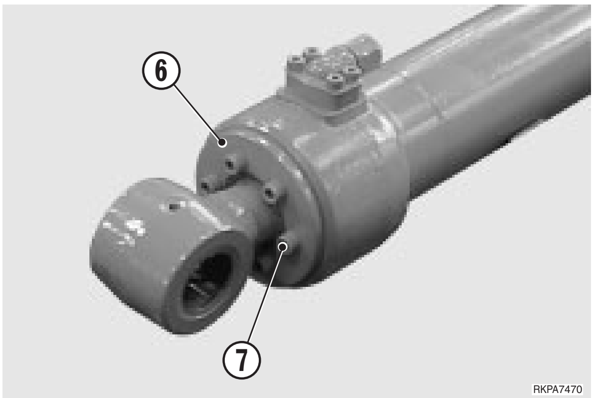
5 - Position the flange (6) that holds the head in place, and secure it with the screws (7).

★ Before positioning the flange, check that the O-ring flange seal (8) is in its seating.

Flange blocking screws: 49±5 Nm







REMOVAL OF WORK EQUIPMENT
(For 1-piece boom)

⚠ Extend the arm fully and open the bucket completely. Lower the work equipment until it is resting on the ground.

1 - Put a sling around the cylinder (1) of the boom.

2 - Switch off the engine, release pressure in the cylinder by moving the PPC valve lever several times.

3 - Remove the screw (2) and draw out the pin (3). ※1 ※3

4 - Start the engine to retract the piston (4). ※2

★ To hold the piston in its fully retracted position, tie it with wire.

5 - Lower the cylinder (1) until it comes to rest on blocks (A).

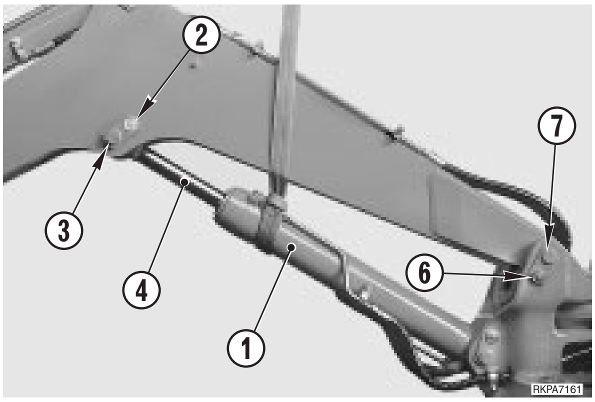
6 - Switch off the engine and release any residual hydraulic pressures. (For details, see «20. TESTING AND ADJUSTMENTS»).

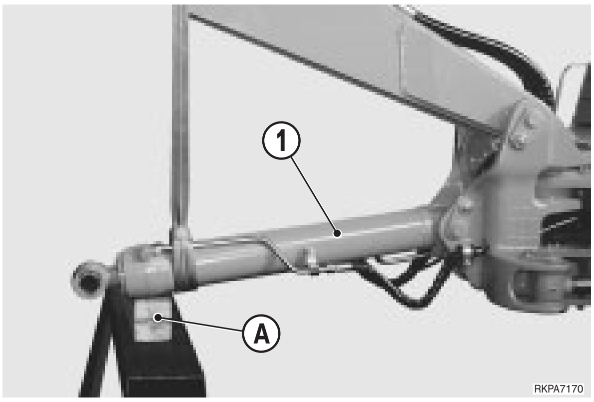
7 - Disconnect the hoses (5) and plug them. Also plug the rigid tubes.

8 - Put the equipment in a sling and apply slight tension to the cables.

9 - Remove the screw (6) and the pin (7). Lift off the work equipment (8). ※3 ※4

Work equipment: 1300 kg





INSTALLATION OF WORK EQUIPMENT (For 1-piece boom)

- To install, reverse the removal procedure.

※1

★ Insert the spacers to a given clearance (distributed on both sides of the piston) until a clearance of 1–2 mm is obtained.

※2

⚠ When aligning the positions between holes and pin, let the engine run at minimum idling. Do not insert fingers into the hole to check the alignment.

※3

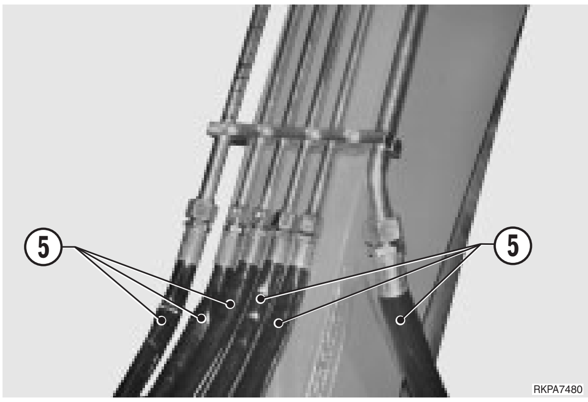
Inside bushings: ASL800050

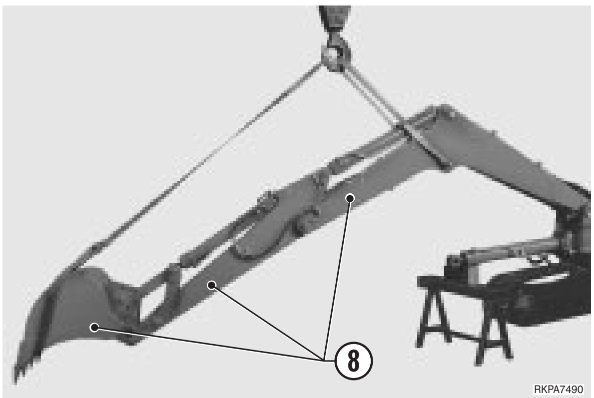
※4

★ Insert the spacers to a given clearance (distributed on both sides of the arm) until a clearance of 0.5–1 mm is obtained.

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

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

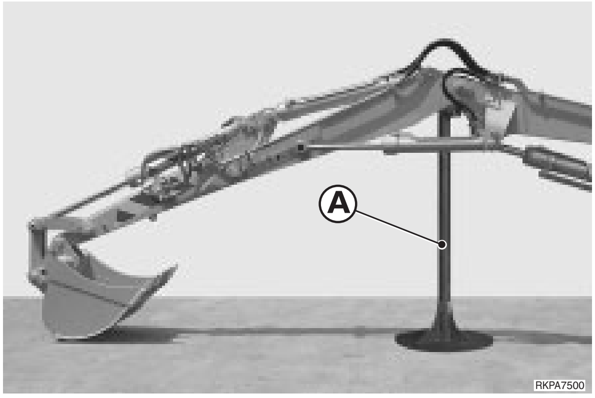




REMOVAL OF WORK EQUIPMENT
(For 2-piece boom)

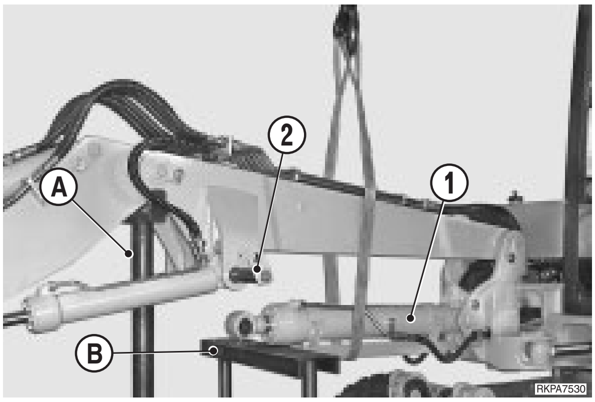
Fully extend the arm and the 2-piece boom and completely curl up the bucket. Position a stand (A) (height 1.60 m.) between the boom and the 2-piece boom, and rest the back of the bucket on the ground.
Stabilise the machine by resting the blade and/or the stabilisers on the ground.

Completely eliminate residual pressures from all the circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

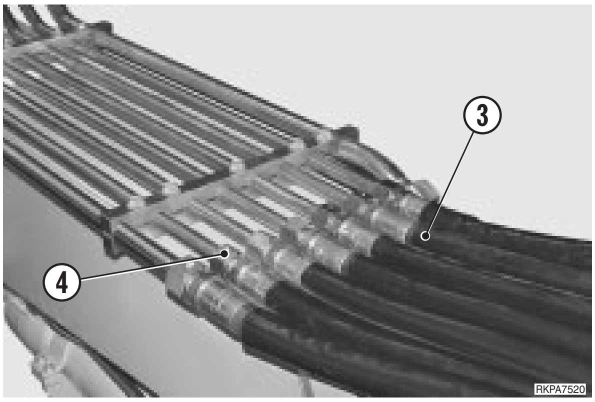


1 - Disconnect the boom cylinder (1) from the 2-piece boom and rest it on a stand (B).
   ★ In order to disconnect the boom cylinder, it is necessary to remove the RH cylinder of the 2-piece boom. (See «REMOVAL OF 2-PIECE BOOM CYLINDERS up to point 11).

   After having disconnected the boom cylinder, reassemble the RH cylinder of the 2-piece boom with the pin (2) and fasten it with its own screws.



2 - Disconnect the eight hoses (3) (No. 8) that control the front work equipment cylinders, and plug them. Also plug the union fittings of the hoses (4).

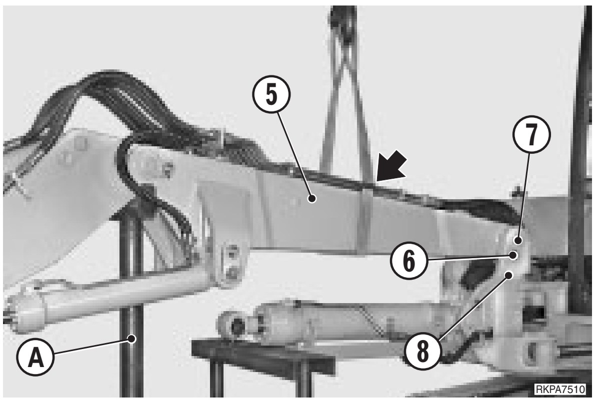


3 - Put the boom (5) in a sling and apply slight tension to the cables.
   ★ Pass the cables through the rigid tubes to avoid distortion.

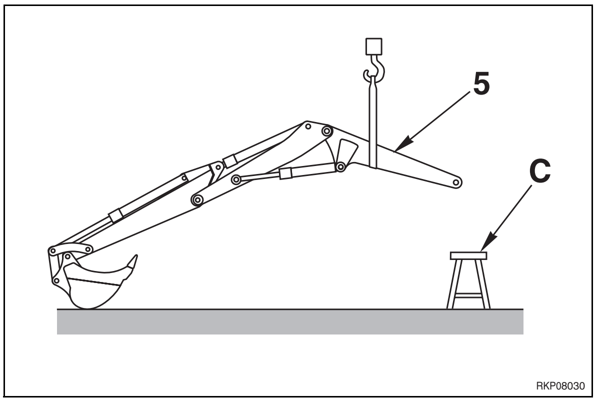
4 - Remove the screws (6) and take out the pin (7).
※2 ※3 ※4

5 - Raise the boom (5) until it is disengaged from the swivel support (8) and take away the stand (A).

Work equipment: 1650 kg



6 - Swing the group to the side of the machine and rest the boom on a stand (C).



INSTALLATION OF THE WORKEQUIPMENT
(For 2-piece boom)

- To install, reverse the removal procedure.

※ 1

★ Insert the spacers (distributed on both sides of the top of the cylinder) until a clearance of 1–2 mm is obtained.

※ 2

When aligning the positions between holes and pin, let the engine run at minimum idling. Do not insert fingers into the hole to check the alignment.

※ 3

Inside bushings: ASL800050

※ 4

★ Insert the shims (distributed on both sides of the top of the piston rod) until a clearance of 1–2 mm is obtained.

- Start the engine to circulate the oil, and bleed air from the cylinder. (For details, see «20. TESTING AND ADJUSTMENTS»).
  - ★ After bleeding the air, switch off engine and check oil level in the tank

REMOVAL OF BUCKET

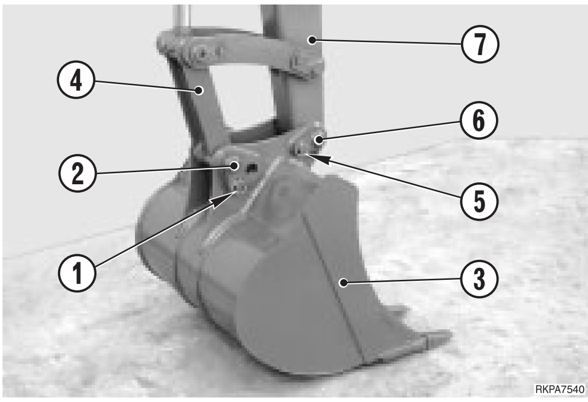
⚠ Lower the bucket to the ground, resting with its back on a flat surface.

1 - Take out the safety pin (1) and the connecting pin (2) between bucket (3) and tie-rod (4).

※1 ※2 ※3

2 - Take out the safety pin (5) and the pin (6) that connects the bucket to the arm (7).

※2 ※3 ※4



INSTALLATION OF BUCKET

- To install, reverse the removal procedure.

※1

★ Insert the spacers to a given clearance between bucket (3) and tie-rod (4).

※2

⚠ When lining up the hole and the pin, let the engine turn at low idling speed. Do not insert fingers into the holes to check alignment.

※3

Inside bushings: ASL800050

※4

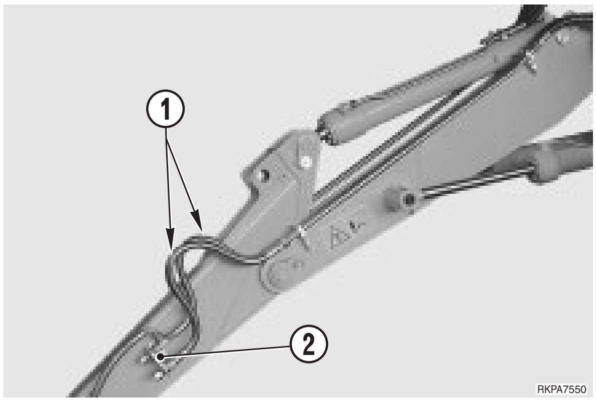
★ Insert the spacers to a given clearance (on both sides) between the bucket (3) and the arm (7), until a play of 0.5–1 mm is obtained.

REMOVAL OF ARM

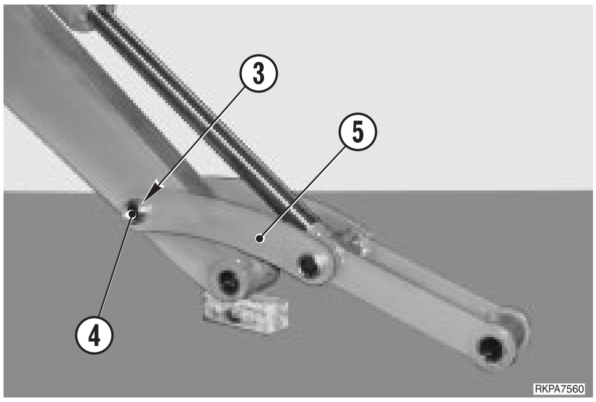
1 - Remove the bucket. (For details, see «REMOVAL OF BUCKET»).

2 - Remove the bucket cylinder. (For details, see «REMOVAL OF BUCKET CYLINDER»).

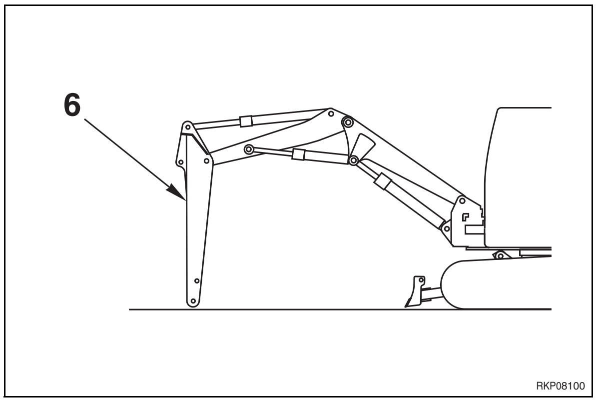
3 - If the machine is designed for the application of optional front equipment, disconnect the boom (or the 2-piece boom), the tubes (1) and remove the supports (2).



4 - Loosen the ring nut (3) and pin (4) and remove the thrust lever (5). ※ 1 ※ 2



5 - Raise the boom and bring the arm (6) into a vertical position and then lower it to the ground.

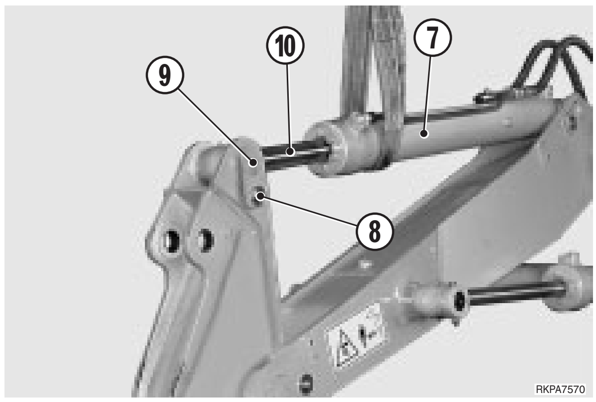


6 - Switch off the engine and release residual pressures.

7 - Put the arm cylinder (7) in a sling, remove the screw (8) and take out the pin (9).

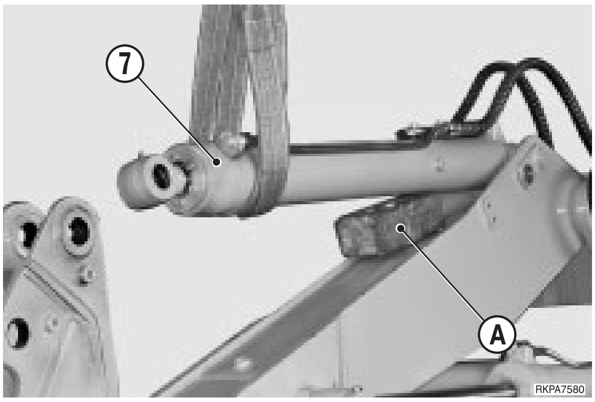
8 -Start the engine and fully retract the piston (10). ※ 3

★ To hold the piston rod in its fully retracted position, tie it with wire.



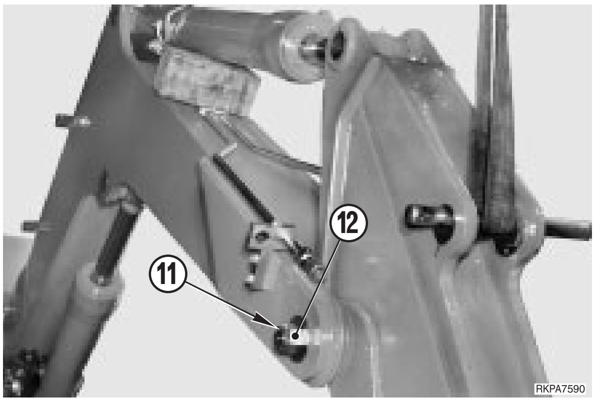
9 - Rest the cylinder (7) on a block (A).

10 - Switch off the engine.



11 - Connect the arm (6) to the hoisting tackle and apply slight tension to the cable.

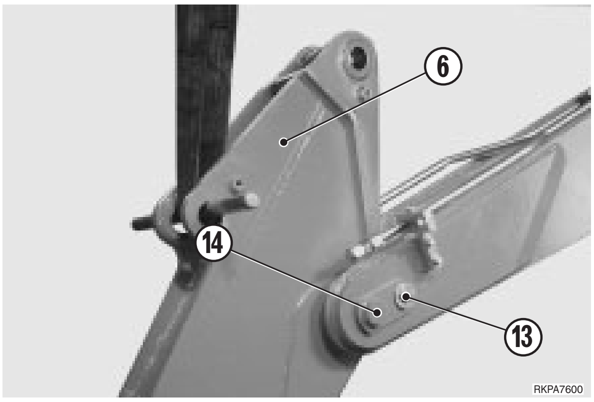
12 - Remove the cotter-pin (11) and the nut (12). ※ 4



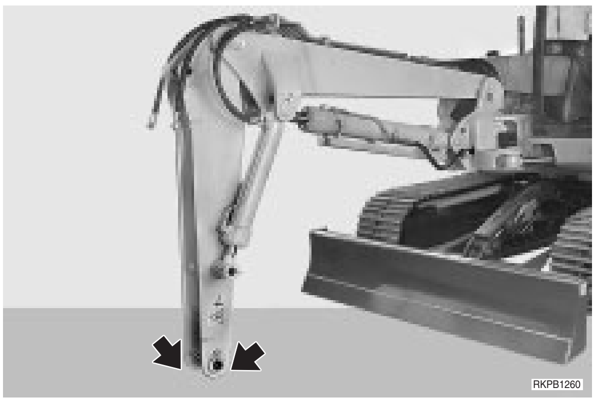
13 - Take out the screw (13) and pull out the pin (14).

14 - Lift off the arm (6).

kg
Arm L=1600: 134 kg
Arm L=1850: 155 kg
Arm L=2300: 198 kg



15 - Start the engine and, for reasons of safety, lower the boom or 2-piece boom until it rests on the ground.



INSTALLATION OF ARM

- To install, reverse the removal procedure.

※ 1

Inside bushings: ASL800050

★ Insert shim.

※ 2

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

※ 3

★ Insert the spacers to a given clearance (distributed on both sides of the piston) until a clearance of 1–2 mm is obtained.

When aligning the positions between holes and pin, let the engine run at minimum idling. Do not insert fingers into the holes to check the alignment.

※ 4

Inside bushings: ASL800050

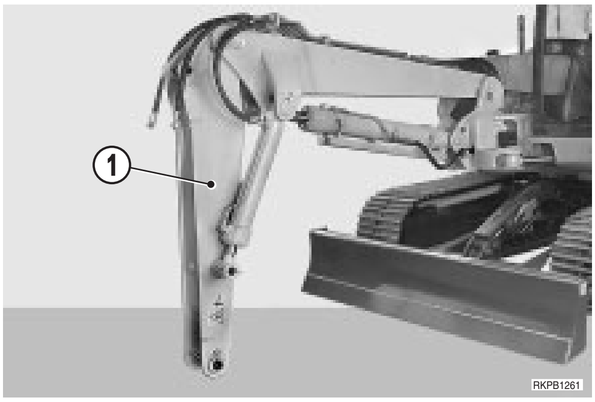
★ Insert the spacers to a given clearance (distributed on both sides) until a clearance of 0.5–1 mm is obtained.

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

REMOVAL OF 2nd BOOM

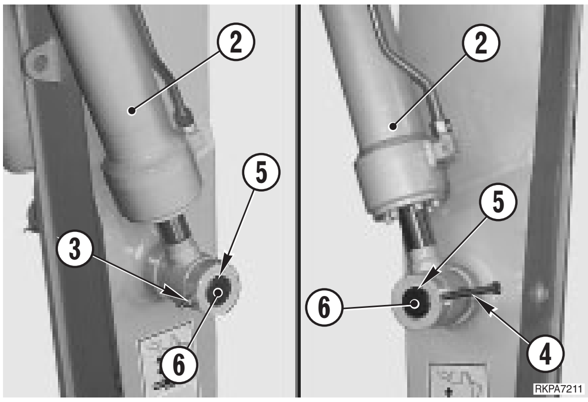
1 - Remove the bucket, the bucket cylinder, the arm cylinder and the arm. For details see:
- REMOVAL OF BUCKET
- REMOVAL OF BUCKET CYLINDER
- REMOVAL OF ARM CYLINDER
- REMOVAL OF ARM

2 - Start the engine and bring the 2-piece boom (1) into a vertical position. Lower it until it rests on the ground and switch off the engine.



3 - Put a sling round the RH cylinder (2) of the 2-piece boom and remove the nut (3), the screw (4) and the shim (5). ※1

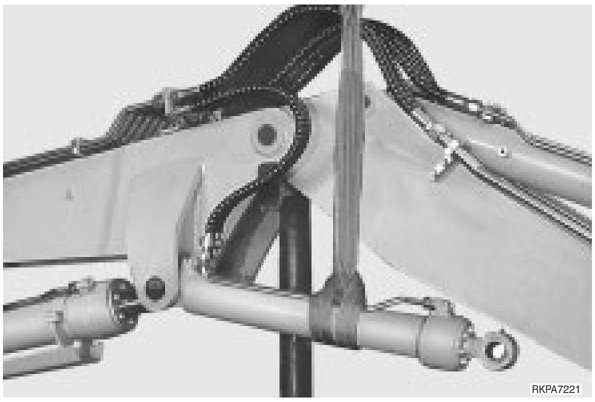
4 - Slide out the pin (6) that connects the RH cylinder (2) to the 2-piece boom (1) until the piston rod is completely disconnected. ※2 ※3



5 - Start the engine and completely retract the piston rod of the RH cylinder.
★ To hold the piston rod in a fully retracted position, tie it with wire and switch off the engine.

6 - Lower the cylinder until it is in a vertical position, leaving the boom tied up.

7 - Repeat these operations from point 3 to point 6 in order to disconnect the LH cylinder (7). ※2 ※3

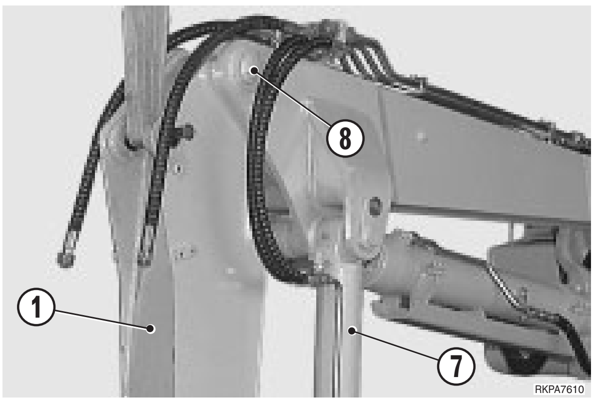


8 - Hook the 2-piece boom to the hoisting tackle.

9 - Remove the screws and take out the pin (8). ※2 ※3 ※4

10 - Take off the 2-piece boom.

kg 2-piece boom: 195 kg



INSTALLATION OF 2nd BOOM

- To install, reverse the removal procedure.

※ 1

Self-locking nut: 118 Nm

※ 2

Inside bushings: ASL800050

※ 3

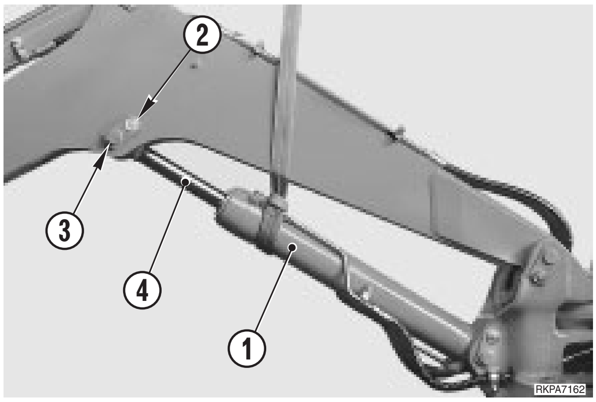
When aligning the positions between holes and pin, let the engine run at minimum idling. Do not insert fingers into the hole to check the alignment.

※ 4

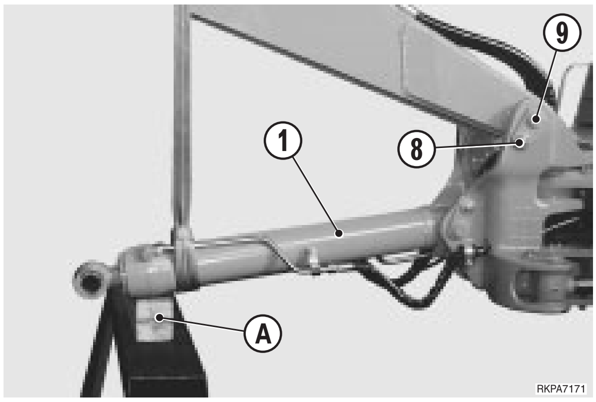
- Insert the spacers (distributed on both sides of the boom) until a clearance of 0.5–1 mm is obtained.
- Start the engine to circulate the oil, and bleed air from the cylinder. (For details, see «20. TESTING AND ADJUSTMENTS»).

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

REMOVAL OF BOOM (For 1-piece boom)

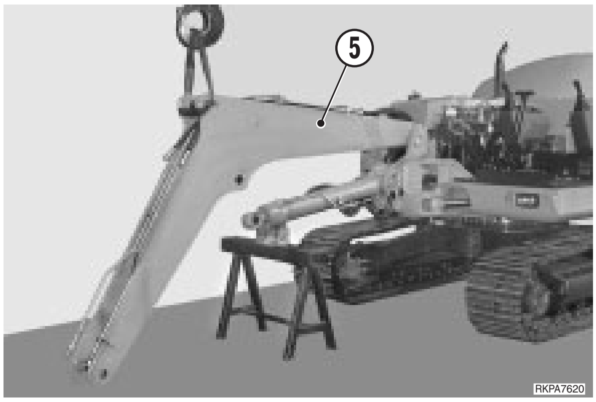


1 - Remove the arm.
(For details, see «REMOVAL OF ARM»).
2 - Remove the arm cylinder.
(For details, see «REMOVAL OF ARM CYLINDER»).
3 - Start the engine and lower the boom to the ground.
4 - Switch off the engine and move the PPC valve several times to release pressures in the cylinder.
5 - Put the boom cylinder in a sling (1).
6 - Take out the screw (2) and pull out the pin (3).
※1 ※3
7 - Start the engine and fully retract the piston (4). ※2
★ To hold the piston rod in its fully retracted position, tie it with wire.
8 - Switch off the engine and release all pressures. (For details, see «20. TESTING AND ADJUSTMENTS»).



9 - Lower the piston until it is resting on blocks (A).
10 - Remove the overload sensor. (For details, see «REMOVAL OF OVERLOAD SENSOR»).
11 - Put the boom (5) in a sling, using the attachment hole in the arm cylinder. Apply slight tension to the cable.
12 - Disconnect the front equipment hoses (6) and plug them. Also plug the rigid tubes (7).
13 - Take out the screw (8) and pull out the pin (9).
14 - Lift off the boom (5).

Boom: 300 kg ※3 ※4



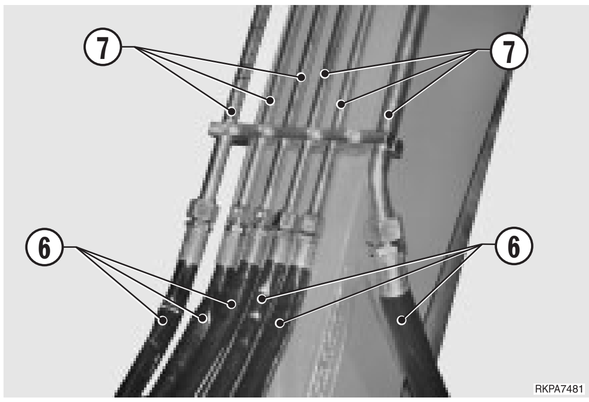
INSTALLATION OF BOOM
(For 1-piece boom)

- To install, reverse the removal procedure.

※1
★ Insert the spacers to a given clearance (distributed on both sides of the piston rod) until a clearance of 1–2 mm is obtained.

※2
When aligning the positions between holes and pin, let the engine run at minimum idling. Do not insert fingers into the hole to check the alignment.

※3
Inside bushings: ASL800050



※4
★ Insert the spacers to a given clearance (distributed on both sides of the boom) until a clearance of 0.5–1 mm is obtained.

- Start the engine to circulate the oil and bleed air from the cylinders.
  ★ After bleeding the air, switch off the engine and check the oil level in the tank.

REMOVAL OF BOOM (For 2-piece boom)

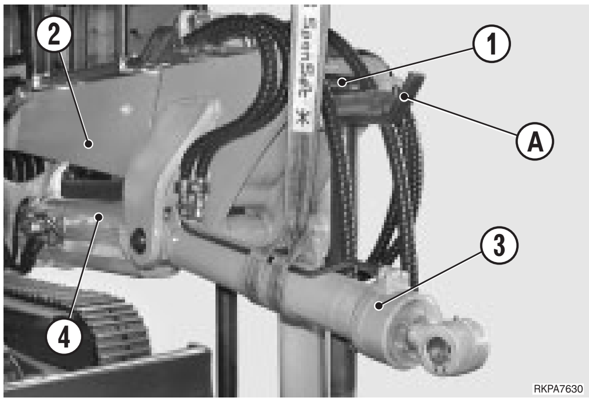
1 - Remove the bucket, the bucket cylinder, the arm cylinder, the arm, and the 2-piece boom.
For details see:
- REMOVAL OF BUCKET
- REMOVAL OF BUCKET CYLINDER
- REMOVAL OF ARM CYLINDER
- REMOVAL OF ARM
- REMOVAL OF 2-PIECE BOOM

2 - Replace the fulcrum pin (1) of the 2-piece boom and secure it with the proper screws.

3 - Manoeuvre the boom (2) until the fulcrum pin is resting on a stand (A), 1.60 m high.

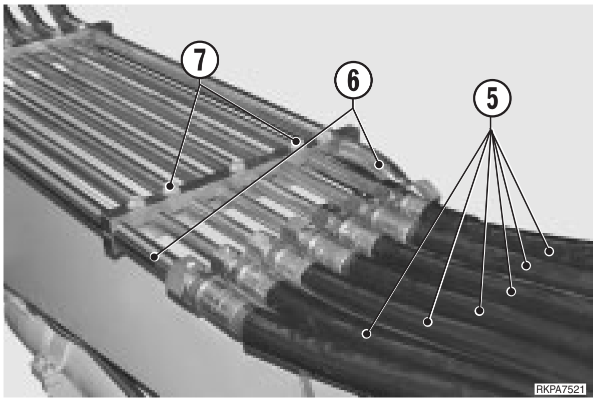
4 - Switch off the engine and release any residual pressures in the boom cylinder.

5 - Remove the 2-piece boom cylinders (3) and let the boom cylinder (4) rest on a stand.

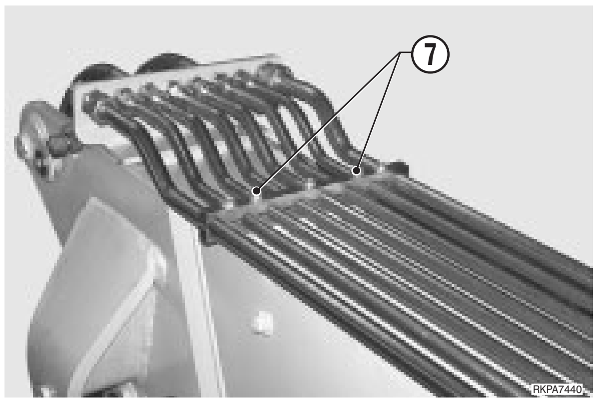


6 - Remove the overload sensor. (For details, see «REMOVAL OF OVERLOAD SENSOR»).

7 - Disconnect the six connecting hoses of the front work equipment cylinders (5) (No. 6) and the two tubes (6) of the optional equipment (No. 2).
★ Plug the hoses and rigid tubes to prevent entry of impurities.



8 - Take out the four screws (7) (No. 4) and lift away the complete rack of tubes.



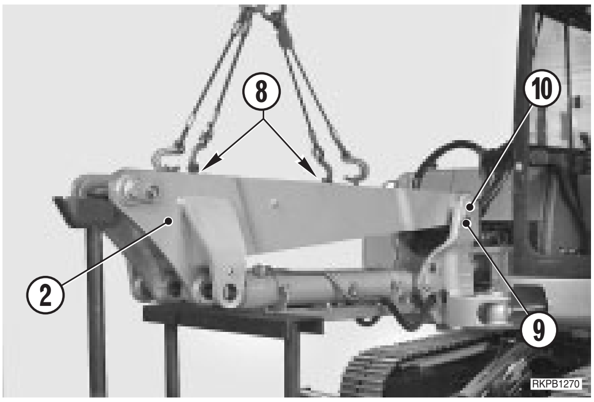
9 - Screw four M10 UNI 2947 eyebolts (8) as far as they will go into the holes of the rack of tubes.

10 - Attach the hoisting tackle to the eyebolts and apply slight tension to the cables.

11 - Take out the screws (9) and remove the pin (10).

12 - Lift away the entire boom (2).

kg Boom: 292 kg



INSTALLATION OF BOOM
(For 2-piece boom)

- To install, reverse the removal procedure.

※ 1

Inside bushings: ASL800050

※ 2

Do not insert fingers in the holes in order to check the alignment.

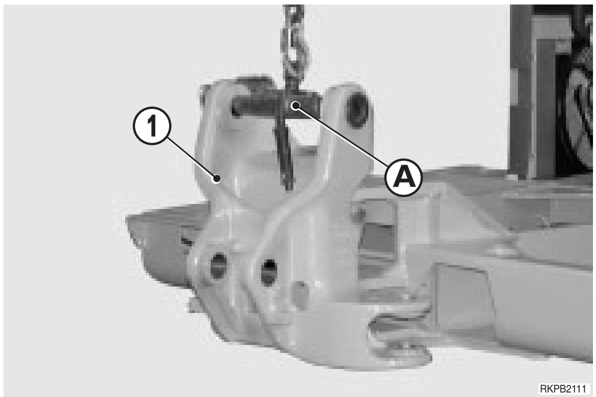
※ 3

★ Insert spacers on both sides of the boom, until a clearance of 0.5–1 mm is obtained.

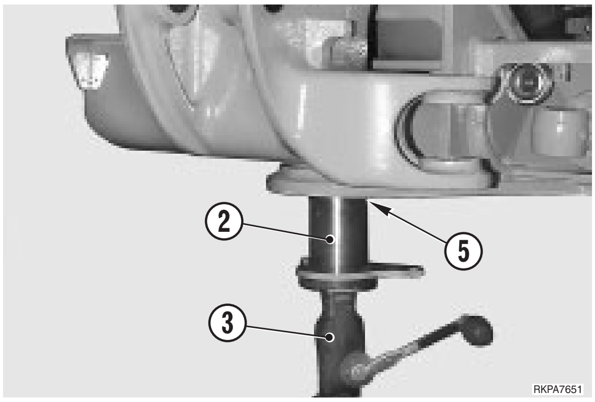
- Start the engine to let the oil circulate and bleed air from the cylinders.
  ★ After bleeding the air, switch off the engine and check the level in the oil tank.

REMOVAL OF SWING SUPPORT

⚠ Extend the work equipment fully and rest it on the ground.



1 - Remove the front work equipment. (For details see «REMOVAL OF WORK EQUIPMENT»).
2 - Remove the boom cylinder (For details, see «REMOVAL OF BOOM CYLINDER»).
3 - Take out the screws and remove the pins (4). ※4 ※5
4 - Attach the swing bracket (1) to the hoisting hook "**A**" and apply slight tension to the cable.
5 - Place a jack (3) beneath the lower pin (2).
6 - Take out the retaining screws and pull out the pin (2). ※1



7 - Take out the retaining screws and, with the help of a lever, pull out the upper pin (4). ※2
8 - Lift out the swing bracket (1). ※3

kg Swing bracket: 230 kg

9 - If necessary, replace bushings (5).

INSTALLATION OF SWING SUPPORT

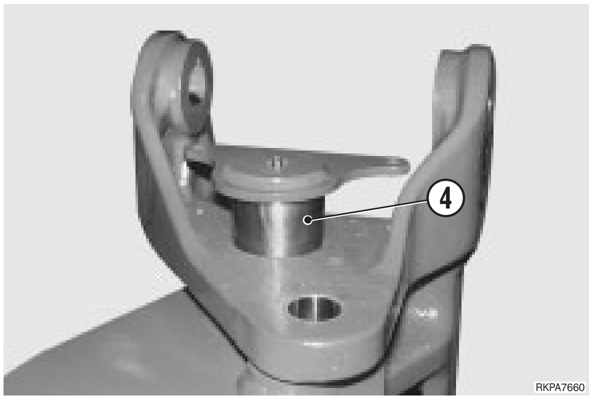
- To install, reverse the removal procedure.

※1

Lower pin: ASL800050

※2

Upper pin: ASL800050



※3

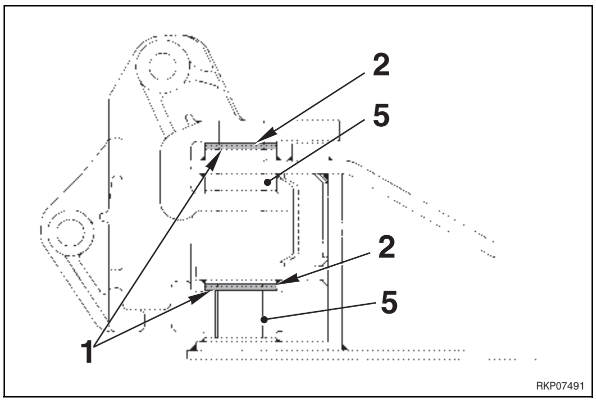
★ Insert the adjustments to a given clearance between the chassis and the support.

Unit: mm

Pos.	Code No.	Thickness	Quantity
1	21D-09-39140	5	2
2	21D-09-39130	0.5	2

※4

★ Insert the spacers to a given clearance (distributed on both sides of the eyes piston) until a clearance of 1–2 mm is obtained.

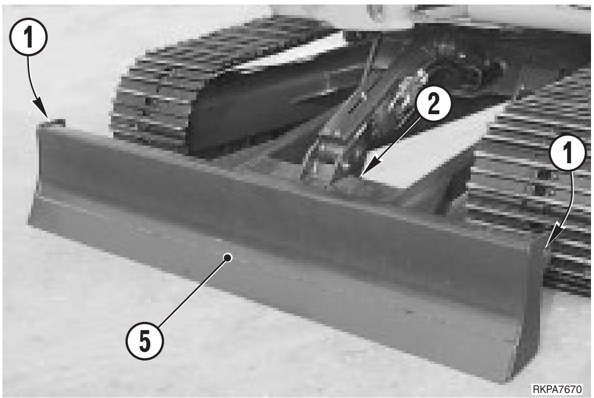


※5

⚠ When aligning the positions between hole and pin, run the engine at idling. Do not introduce hand fingers in the holes to check the alignment.

REMOVAL OF BLADE

1 - Remove the blade cylinder (For details, see «REMOVAL OF BLADE CYLINDER»).
2 - Attach the hoisting tackle to the blade, using the holes provided on the sides (1) and the piston coupling (2).
  ★ Adjust the length of the chains to keep the group in equilibrium.
3 - Loosen the screws (3) and remove the pin (4).
※1 ※2 ※3
4 - Remove the blade (5).
  kg Blade: 282 kg



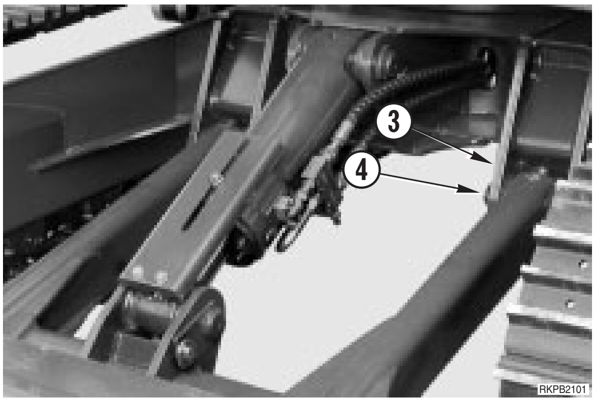
INSTALLATION OF BLADE

- To install, reverse the removal procedure.

※1
  Inside bushings: ASL800050

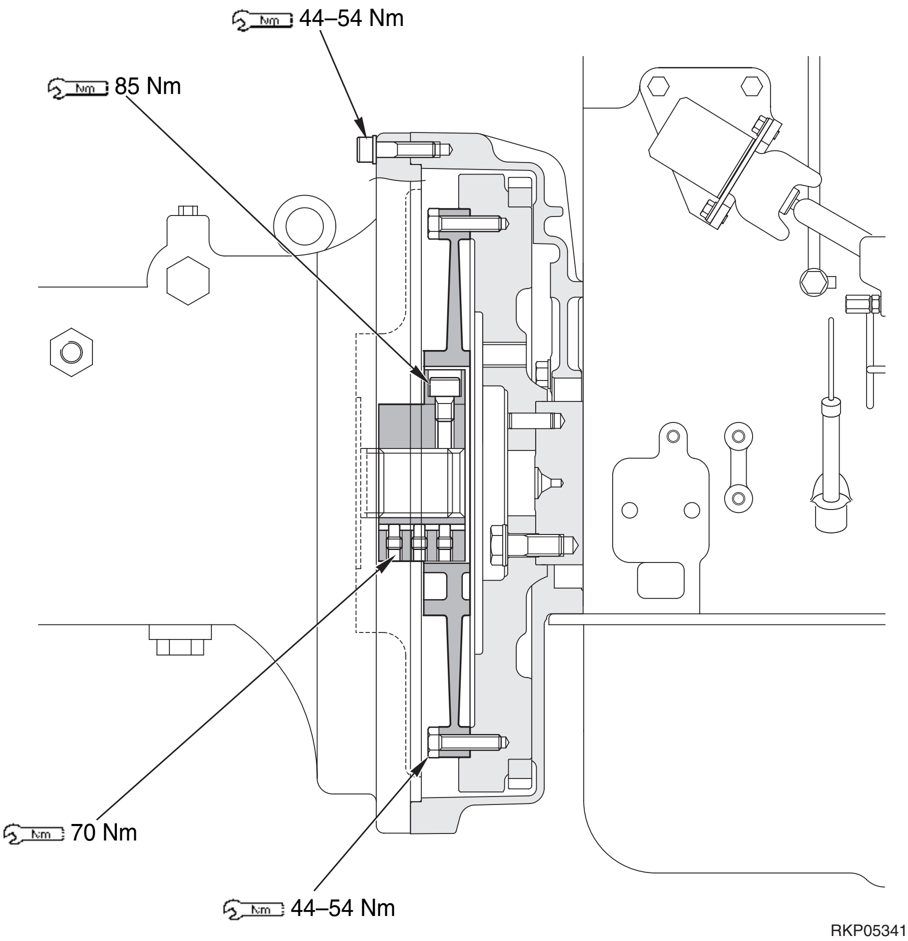
※2
  When aligning the positions between hole and pin, run the engine at minimum idling. Do not insert fingers in the holes to check the alignment.

※3
  ★ Insert the spacers to a given clearance (distributed on both sides of the fulcrum bushings).

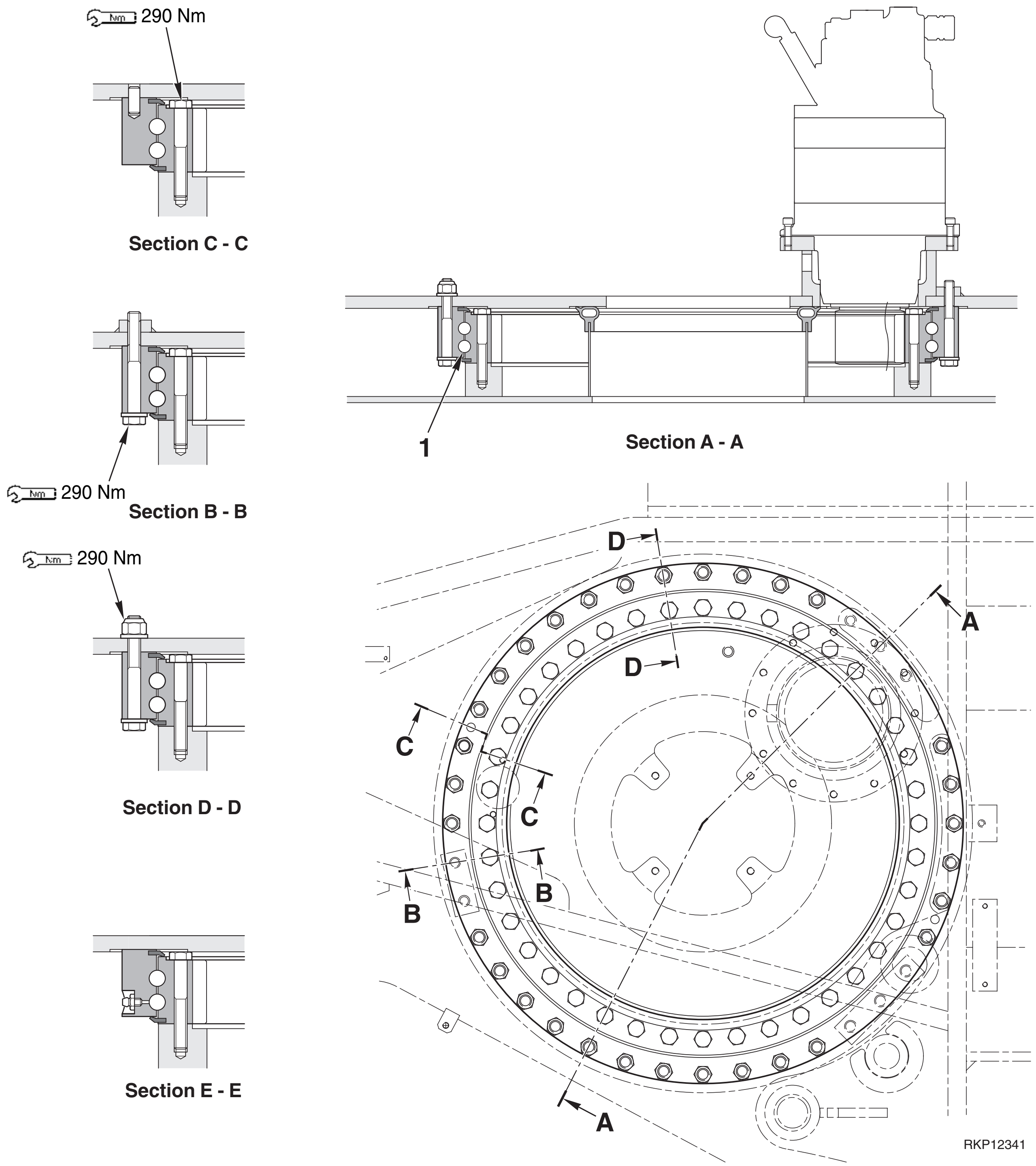


40 STANDARD MAINTENANCE

P.T.O.



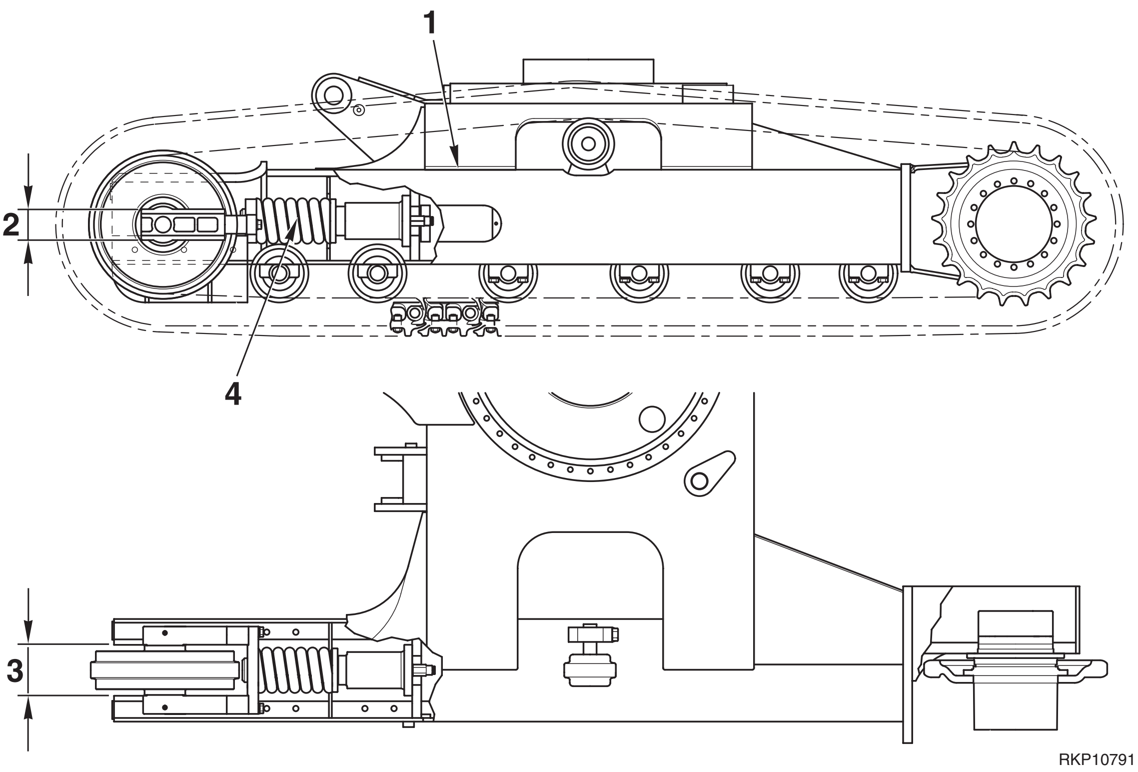
SWING CIRCLE



Unit: mm

No.	Check item	Criteria		Remedy
1	Axial clearance	Standard clearance	Clearance limit	
		0.3–1.2	3	Replace

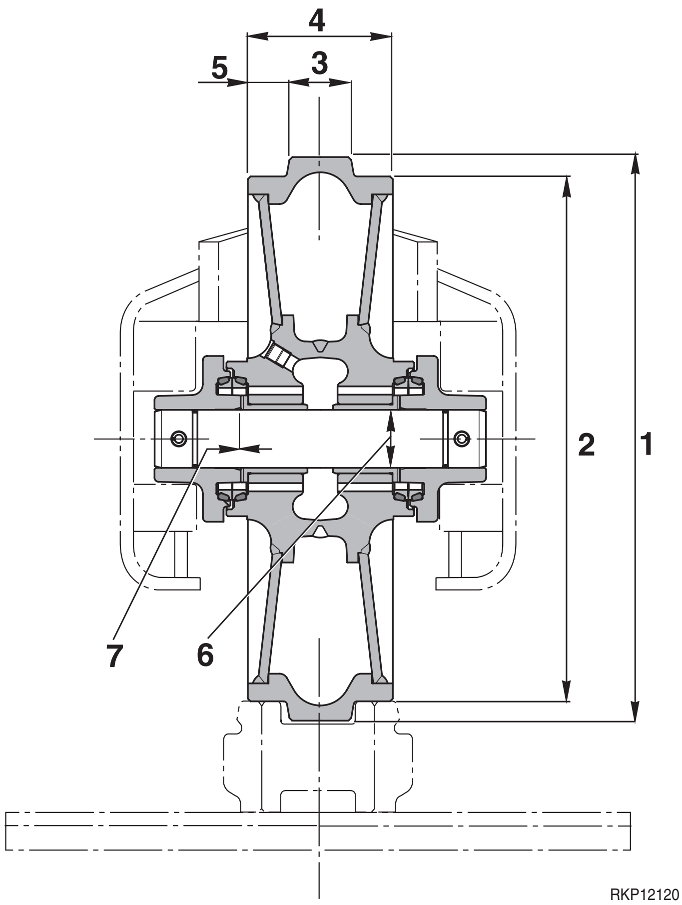
TRACK FRAME



Unit: mm

No.	Check item	Criteria			Remedy
1	Deformation of frame	Item	Repair limit		Rebuild
		Curvature	5 (for 1000 mm)		
		Torsion	5 (for 300 mm)		
		Opening of idler portion	5		
2	Vertical width of idler guide	Item	Standard size	Size limit	Build up welding or replace
		Track frame	61	66	
		Idler support	60	57	
3	Horizontal width of idler guide	Track frame	161	166	
		Idler support	160	155	
4	Recoil spring	Standard size			Replace
		Free length	Installed length	Installed load	
		–	–	–	

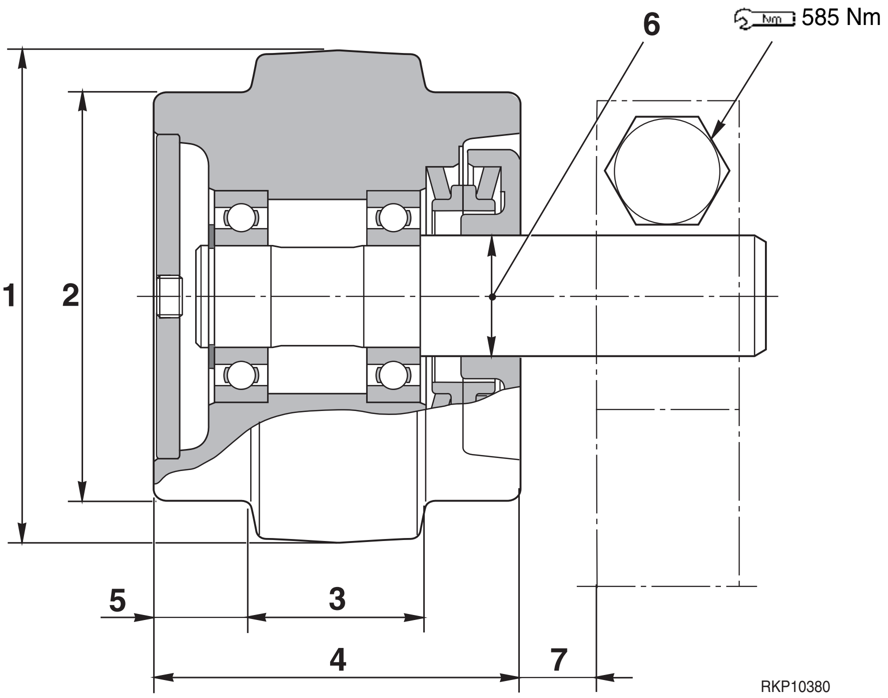
IDLER



Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="5">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outer diameter of protrusion</td><td colspan="2">Standard size</td><td colspan="3">Repair limit</td><td rowspan="6">Build up welding or replace</td></tr>
<tr><td colspan="2">408</td><td colspan="3">398</td></tr>
<tr><td>2</td><td>Outer diameter of tread</td><td colspan="2">380</td><td colspan="3">370</td></tr>
<tr><td>3</td><td>Width of protrusion</td><td colspan="2">49</td><td colspan="3">40</td></tr>
<tr><td>4</td><td>Total width</td><td colspan="2">105</td><td colspan="3">96</td></tr>
<tr><td>5</td><td>Width of tread</td><td colspan="2">28</td><td colspan="3">32.5</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Clearance between shaft and bushing</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="5">Replace</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>42</td><td>+ 0
– 0.025</td><td>+ 0.133
+0.237</td><td>0.133–
0.262</td><td>1.5</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">End play of idler</td><td colspan="2">Standard size</td><td colspan="3">Repair limit</td></tr>
<tr><td colspan="2">–</td><td colspan="3">–</td></tr>
</table>

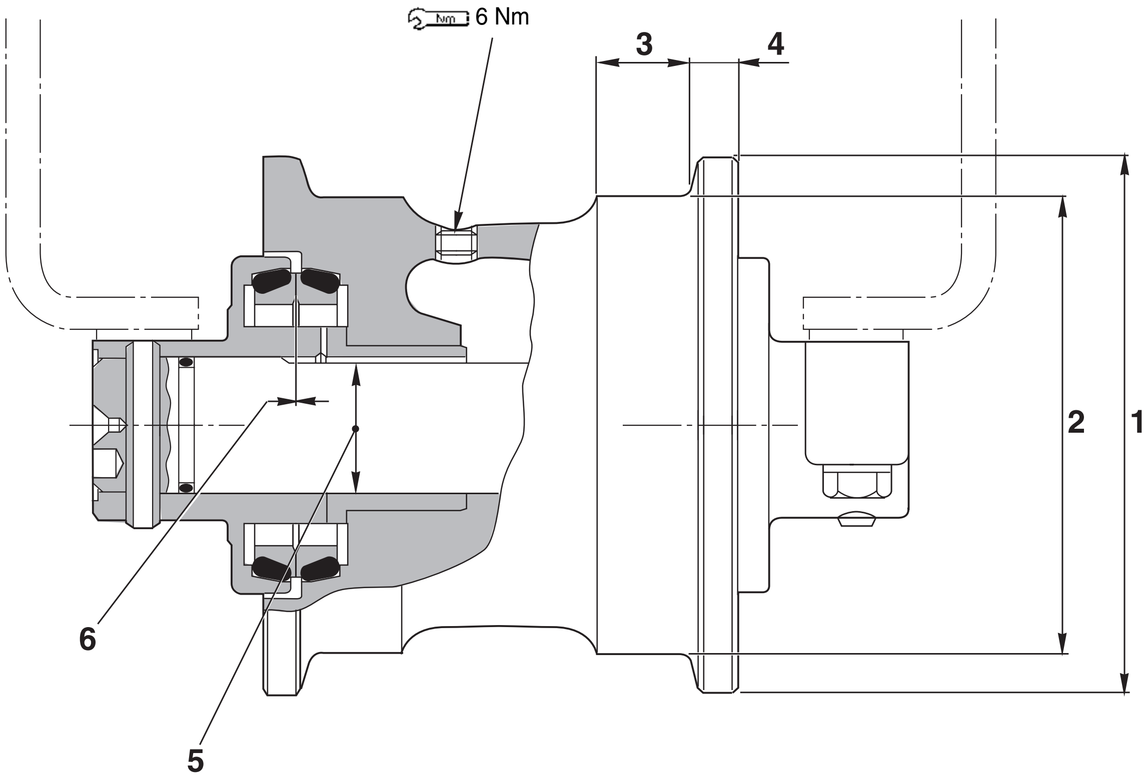
CARRIER ROLLER



Unit: mm

<table>
<tr><td>No.</td><td>Check item</td><td colspan="5">Criteria</td><td>Remedy</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outer diameter of tread</td><td colspan="2">Standard size</td><td colspan="3">Repair limit</td><td rowspan="11"></td></tr>
<tr><td colspan="2">145</td><td colspan="3">136</td></tr>
<tr><td>2</td><td>Outer diameter of protrusion</td><td colspan="2">120</td><td colspan="3">111</td></tr>
<tr><td>3</td><td>Width of protrusion</td><td colspan="2">49</td><td colspan="3"></td></tr>
<tr><td>4</td><td>Total width</td><td colspan="2">110</td><td colspan="3">102</td></tr>
<tr><td>5</td><td>Width of tread</td><td colspan="2">30.5</td><td colspan="3"></td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Interference between shaft and collar</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard interference</td><td rowspan="2">Interference limit</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>36</td><td>+0.085
– 0.060</td><td>+ 0.039
– 0</td><td>0.085–
0.021</td><td>0.015
0.01</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">End play of roller</td><td colspan="2">Standard size</td><td colspan="3">Repair limit</td></tr>
<tr><td colspan="2">0.1–0.6</td><td colspan="3">1.2</td><td></td></tr>
</table>

TRACK ROLLER

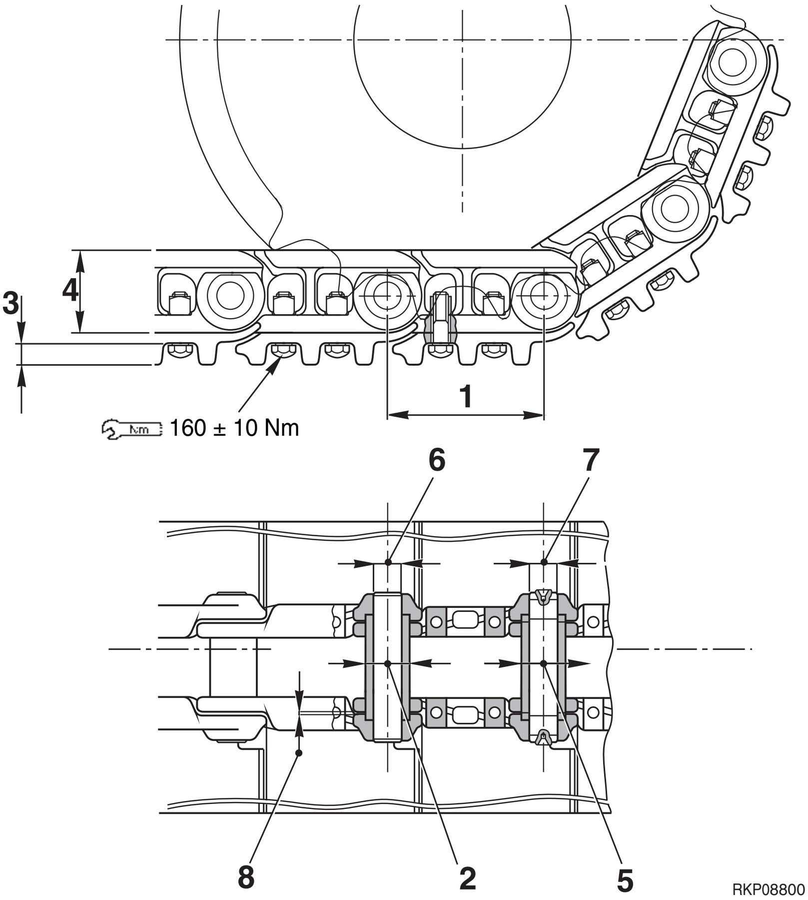


RKP08811

Unit: mm

No.	Check item	Criteria					Remedy
1	Flange (outside) outer diameter	Standard size		Repair limit			Build up welding or replace
		160		150			
2	Tread outside diameter	135		125			
3	Tread width	28		32			
4	Flange width	14		10			
5	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		40	$^{0}_{-0.025}$	$^{+0.189}_{+0.075}$	0.075–0.214	1.5	
6	End play of idler	Standard tolerance		Clearance limit			
		0.2–1.2		2			

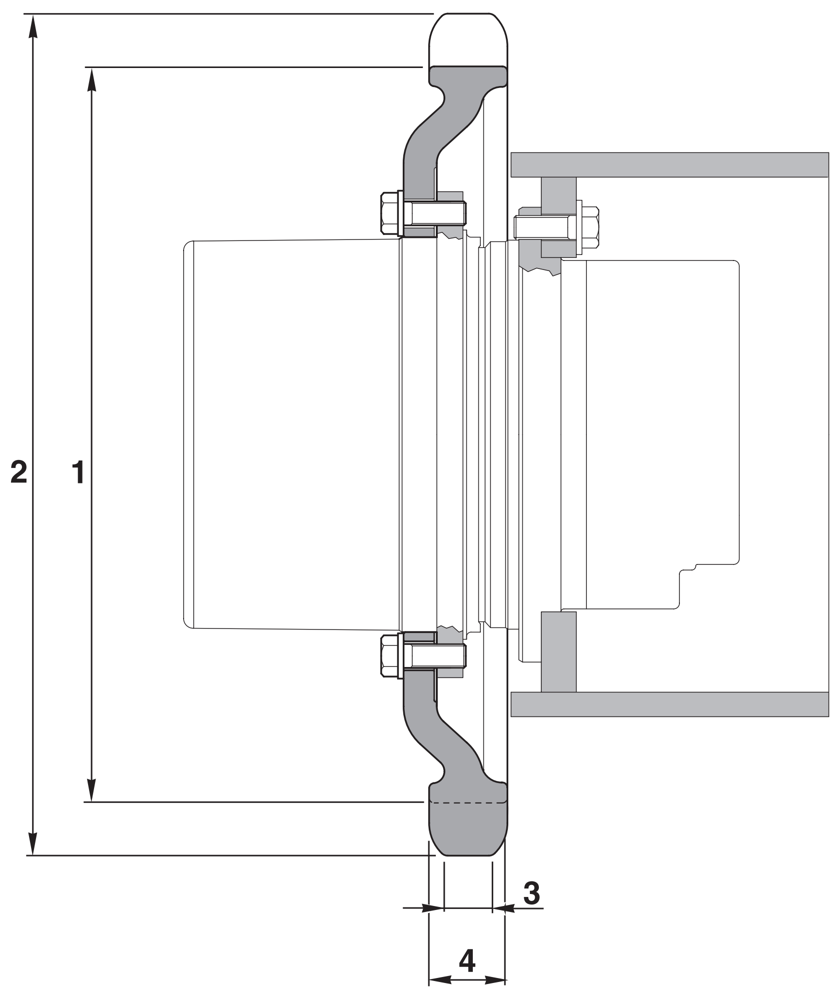
TRACK SHOE



Unit: mm

No.	Check item	Criteria					Remedy
1	Link pitch	Standard size			Repair limit		Turn or replace
		140			143.6		
2	Bushing outside diameter	42			36.8		Turn or replace
3	Grouser height	27			15		Build up welding or replace
4	Link height	78			73.4		Rebuild or replace
5	Interference between bushing and link	Standard size	Tolerance		Standard interf.	Interfer. limit	Replace
			Shaft	Hole			
6	Interference between regular pin and link						
7	Interference between master pin and link						
8	Clearance between link joint surface	Tolerance normale			Clearance limit		
		–			–		

SPROCKET

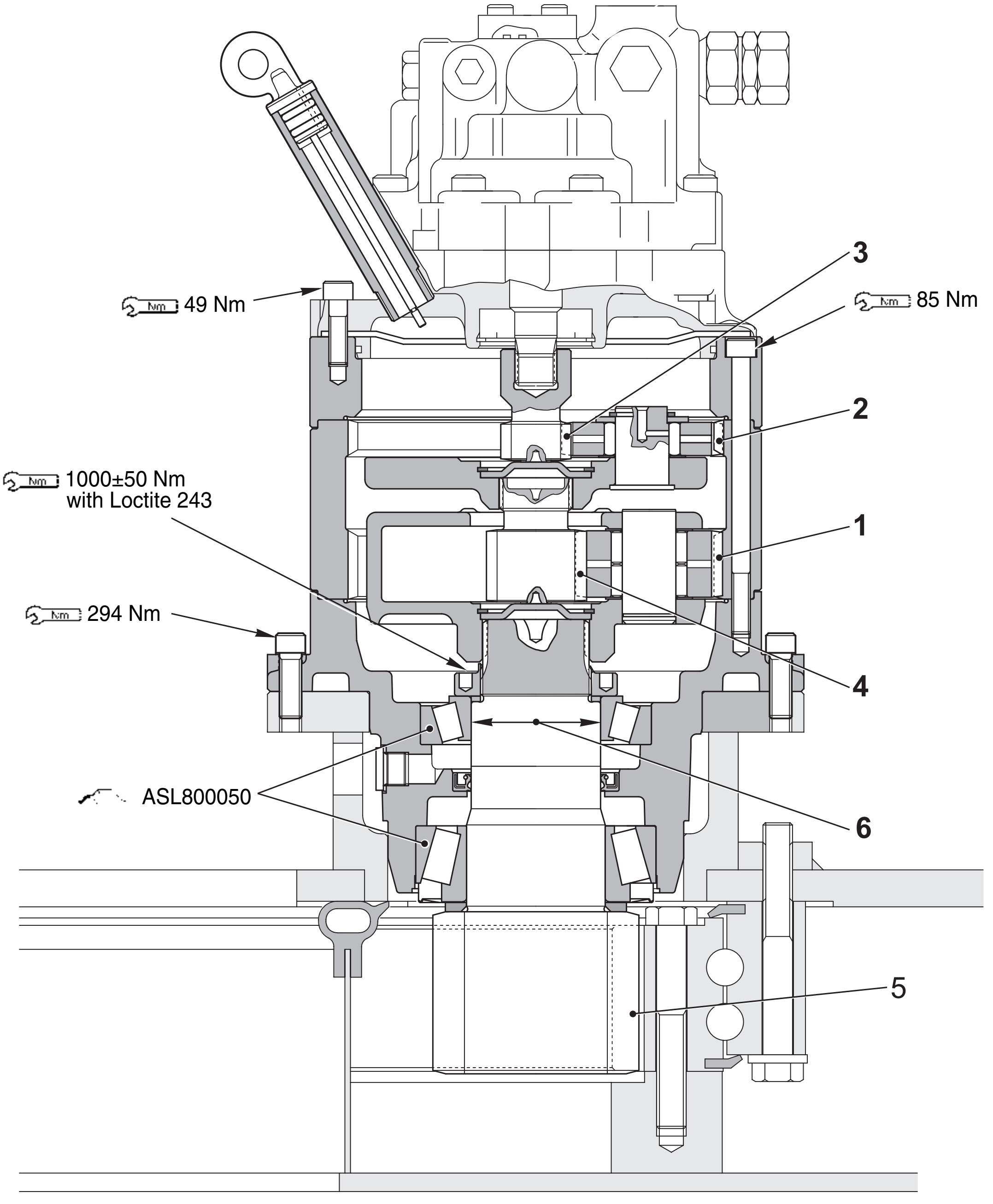


RKP10800

Unit: mm

No.	Check item	Criteria			Remedy
		Standard size	Tolerance	Repair limit	
1	Wear of roots of sprocket teeth	433	$^{+1}_{-3.5}$	420	
2	Wear of tips of sprocket teeth	495	$^{0}_{-3}$	482	
3	Face width of sprocket teeth	28	–	–	
4	Face width of sprocket teeth	45	–	–	

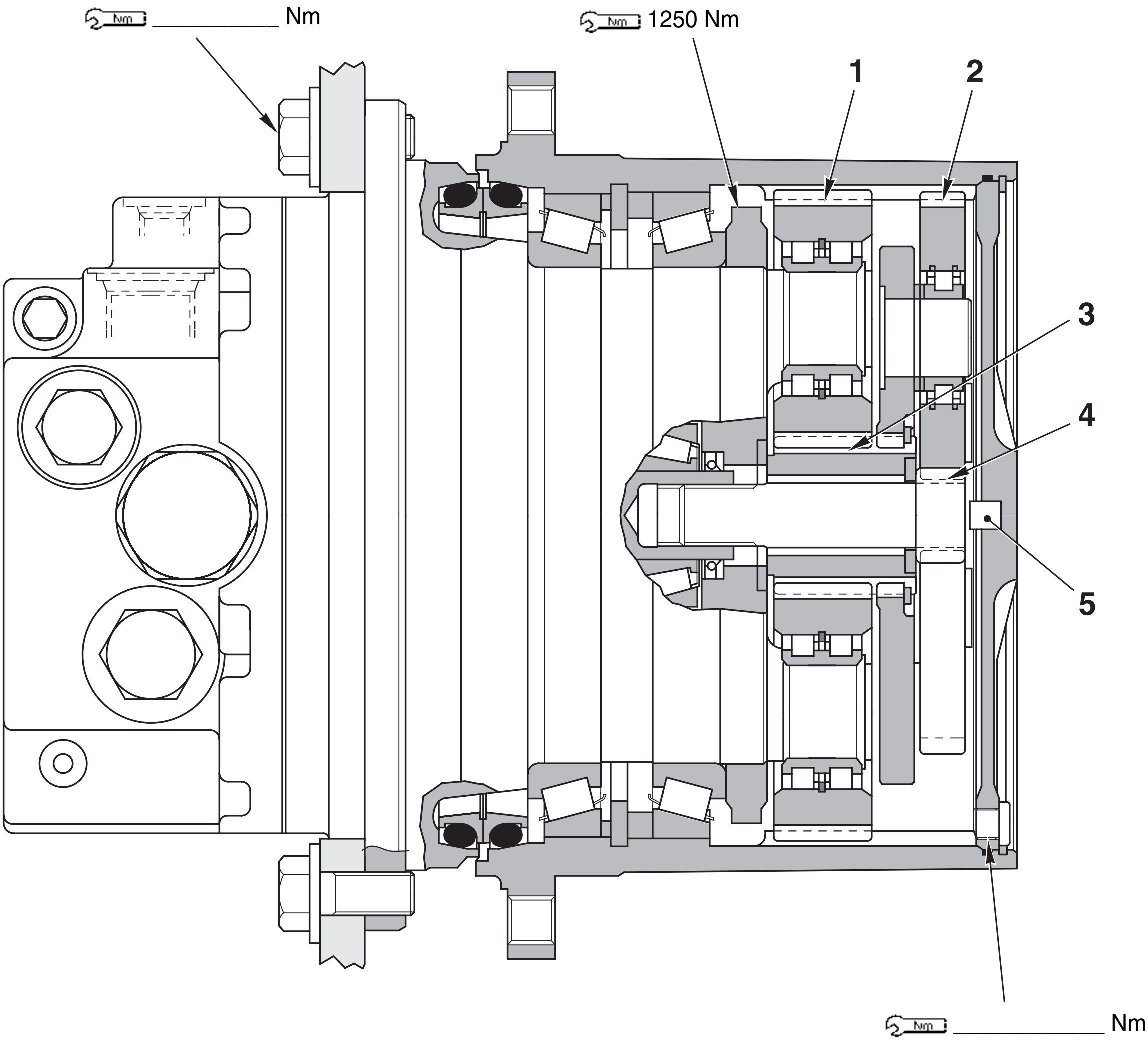
SWING MACHINERY



Unit: mm

No.	Check item	Criteria		Remedy
		Standard clearance	Clearance limit	
1	Backlash between No. 2 planetary gear and housing			Replace
2	Backlash between No. 1 planetary gear and housing			
3	Backlash between No. 1 sun gear and No. 1 planetary gear			
4	Backlash between No. 2 sun gear and No. 2 planetary gear			
5	Backlash between swing pinion and swing circle gear			
		Standard size	Size limit	
6	Wear of swing pinion shaft surface contacting with oil seal			

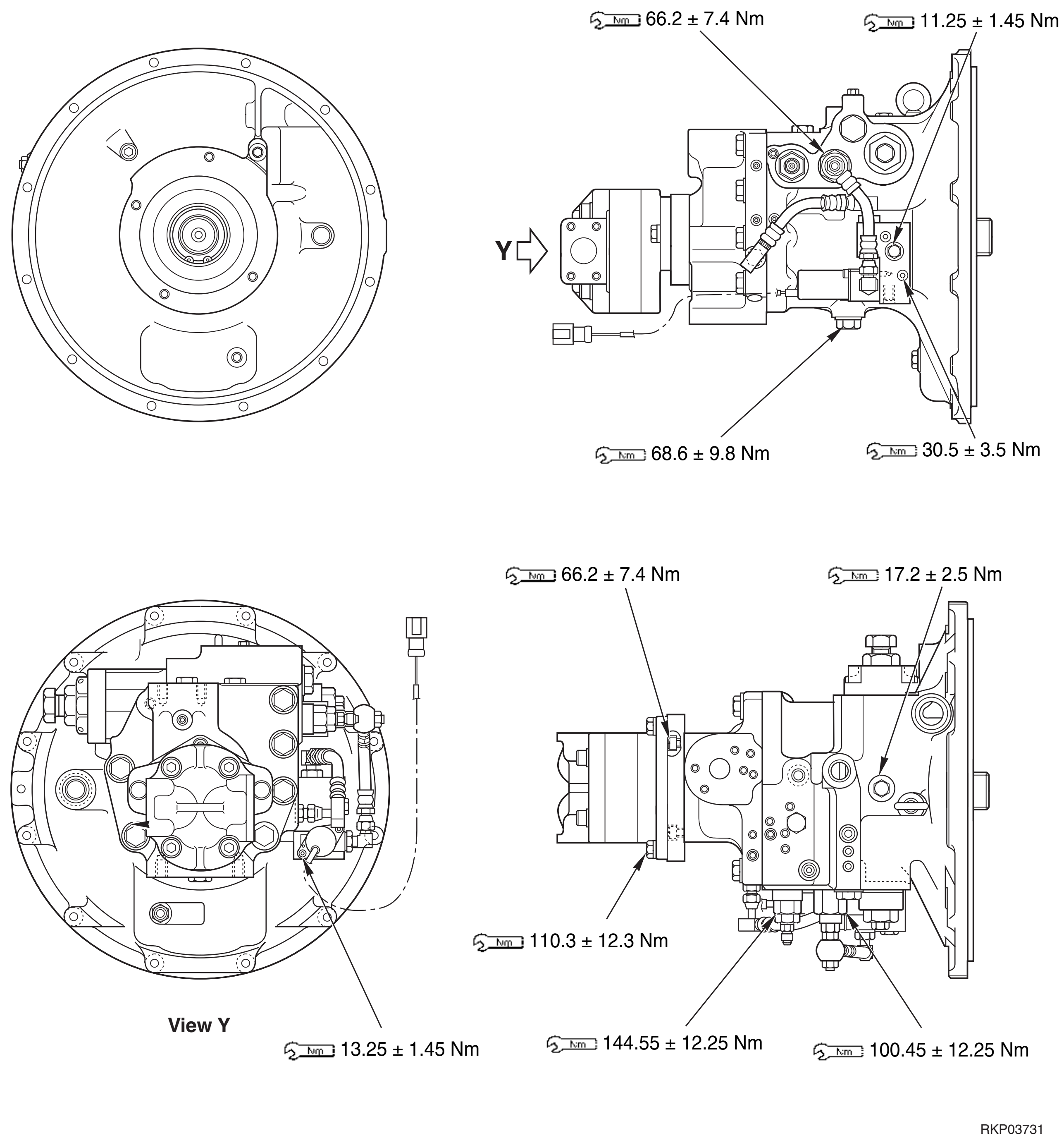
FINAL DRIVE



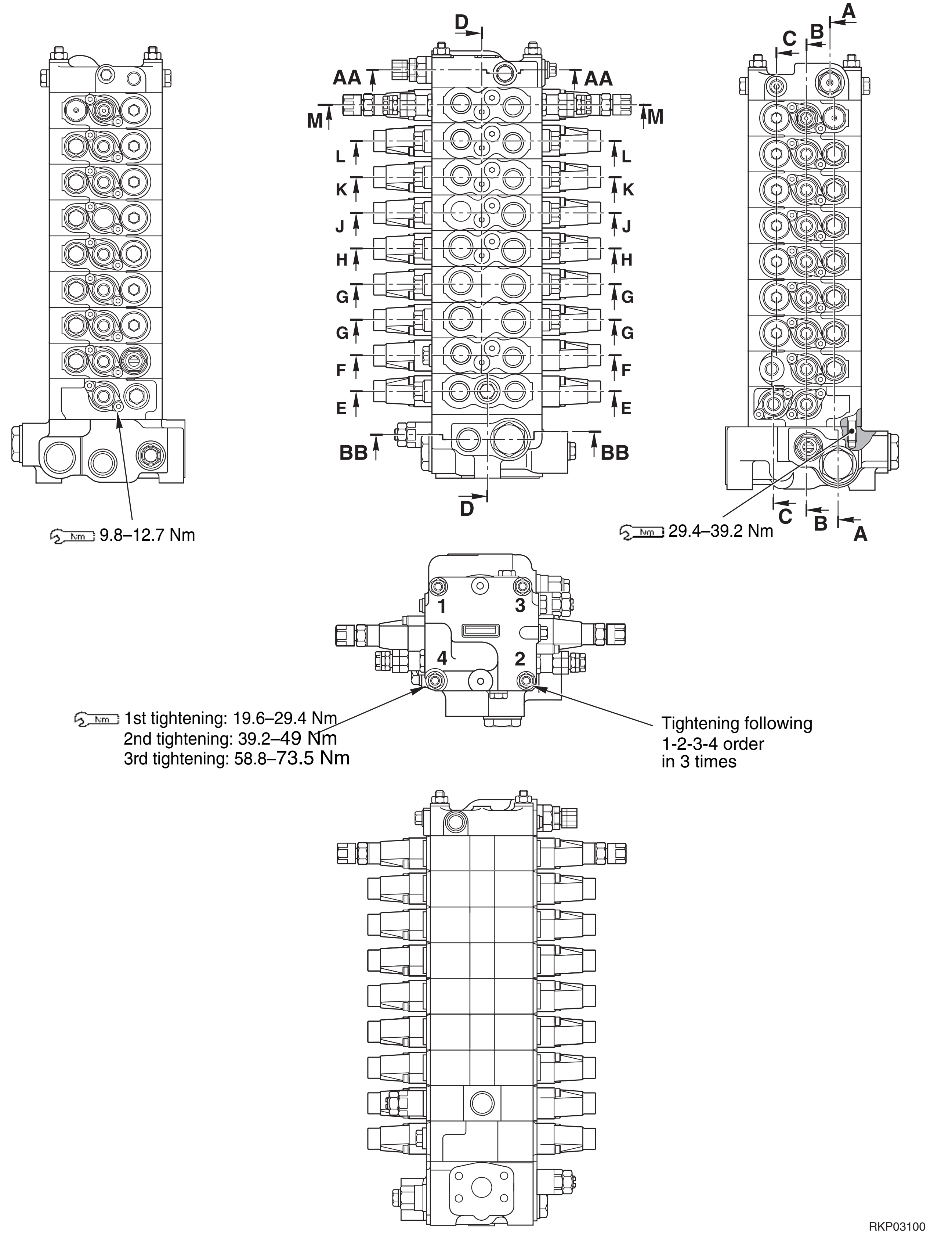
Unit: mm

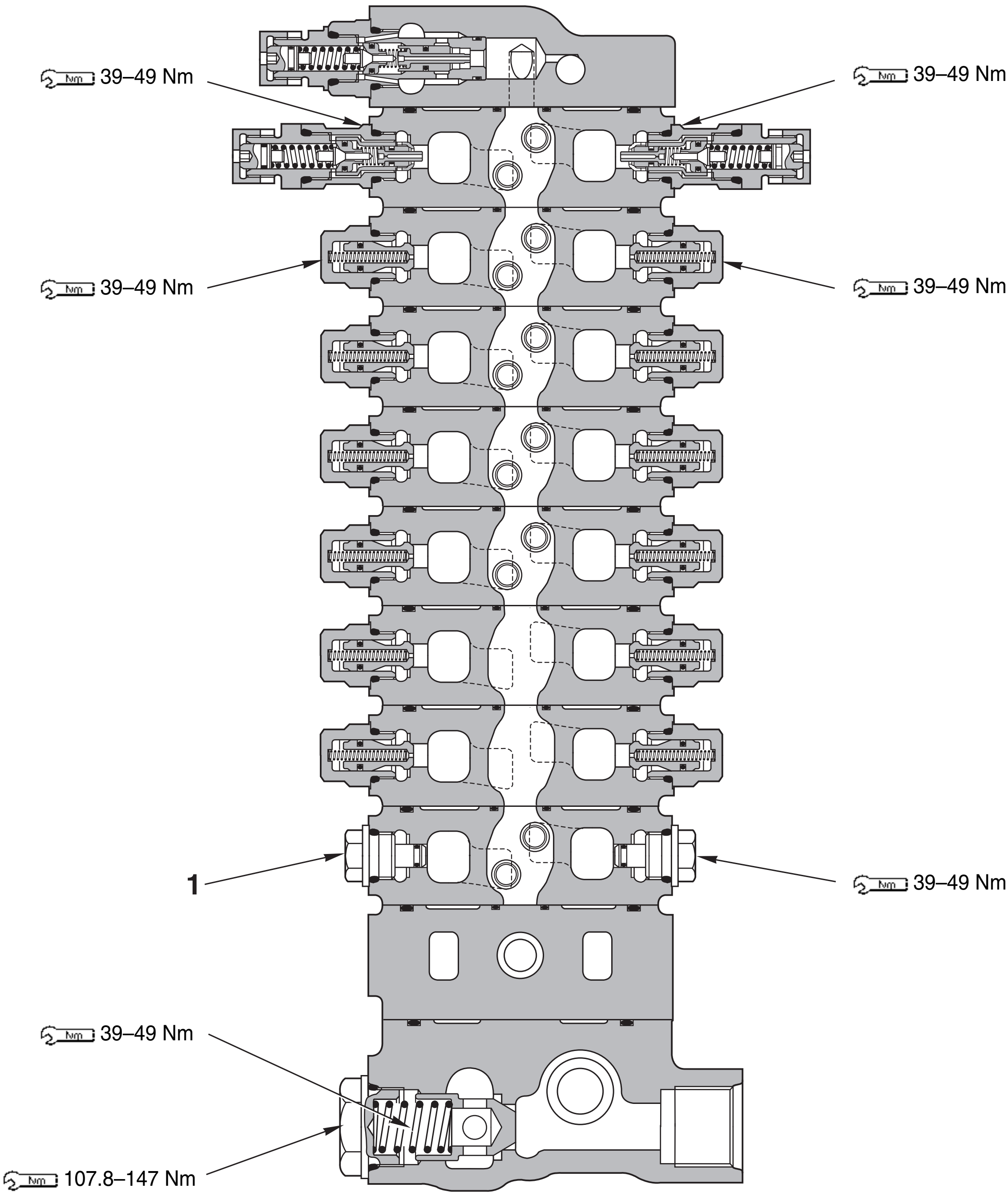
No.	Check item	Criteria		Remedy
1	Backlash between No. 2 planetary gear and housing	Standard clearance	Clearance limit	Replace
2	Backlash between No. 1 planetary gear and housing			
3	Backlash between No. 2 sun gear and No. 2 planetary gear			
4	Backlash between No. 1 sun gear and No. 1 planetary gear			
5	Backlash between No. 1 sun gear and disc	0.5–1.5		

HYDRAULIC PUMP



CONTROL VALVE



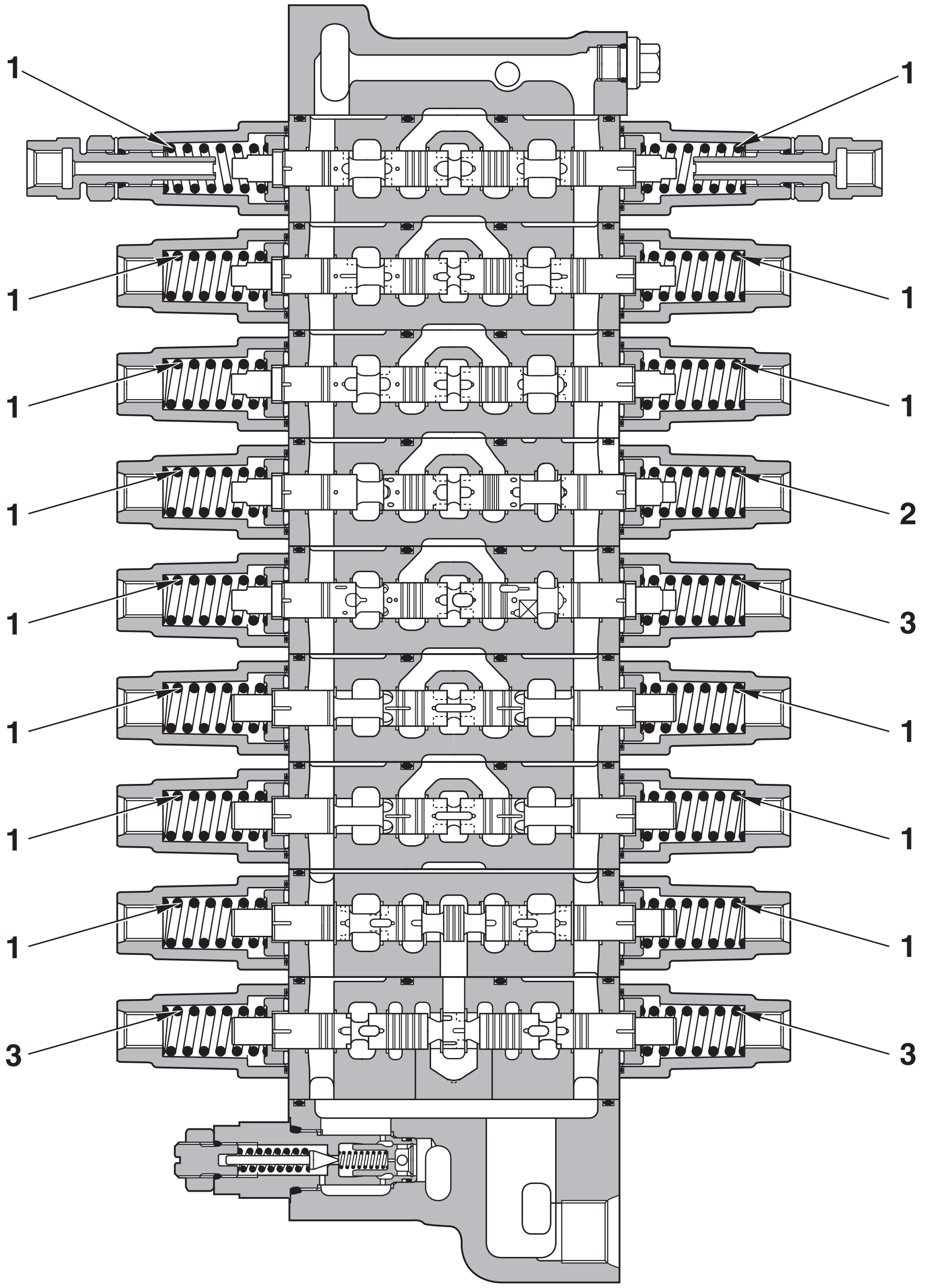


Section A - A

RKP03111

Unit: mm

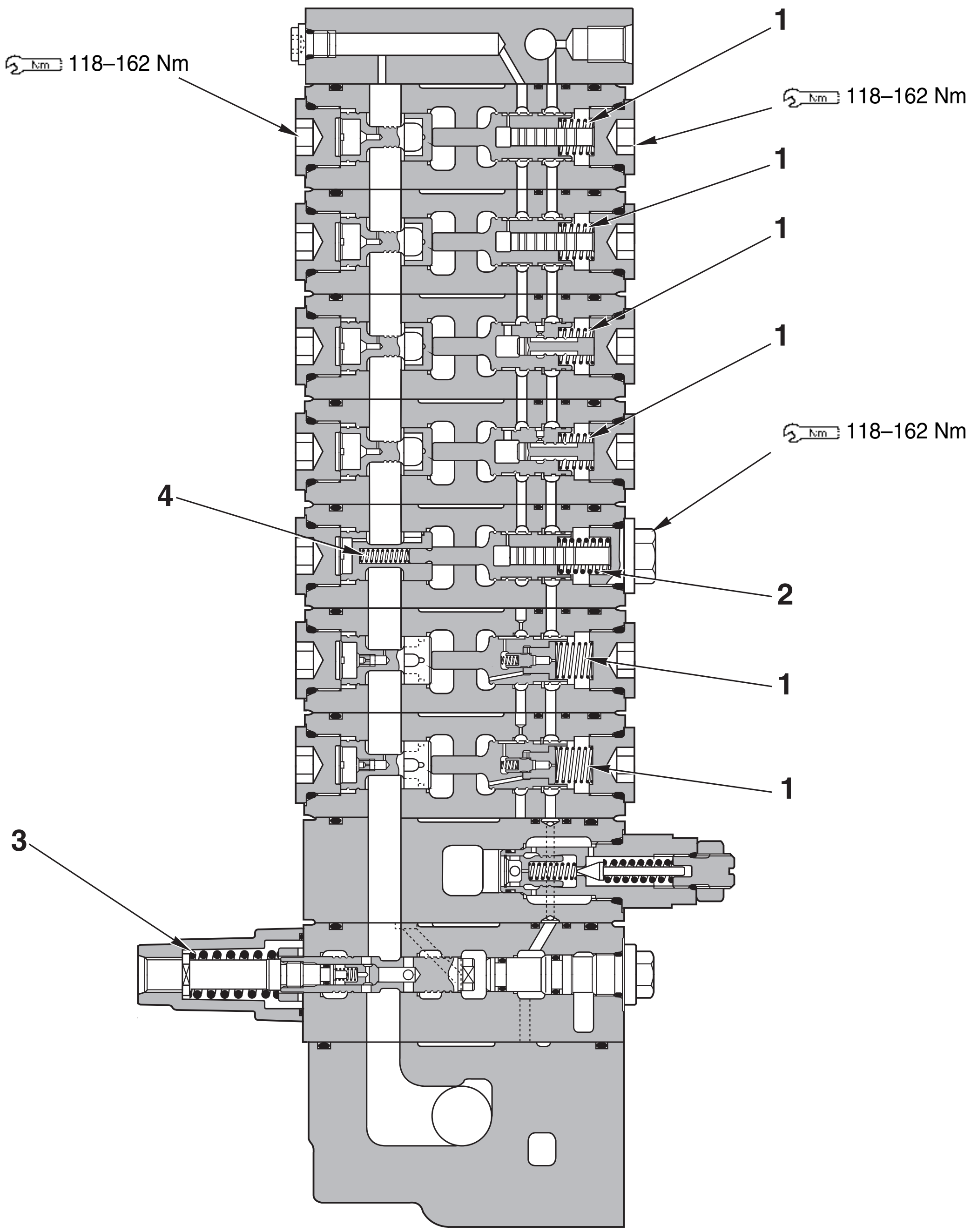
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length x O.D.	Installed length	Installed load	Free length x O.D.	Installed load	
1	Cooler by-pass valve spring	–	33	231.4 N	–	–	Replace



Section B - B

Unit: mm

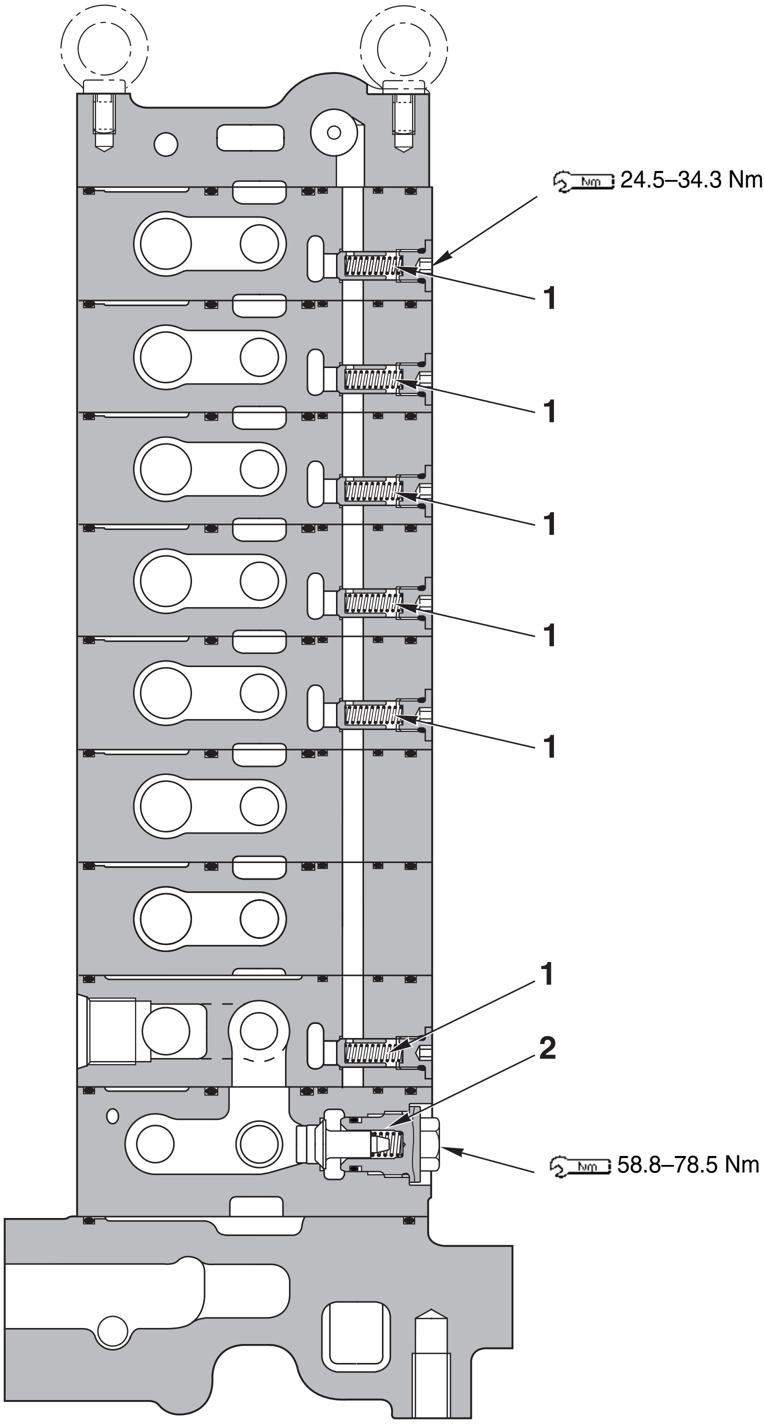
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Spool return spring (Work equipment, swing boom, arm, bucket, boom swing, blade, travel, equipment)	Free length x O.D.	Installed length	Installed load	Free length x O.D.	Installed load	Replace
		–	40.5	34.7 N	–	–	
2	Spool return spring (Arm)	–	40.5	54.6 N	–	–	
3	Spool return spring (Boom, swing)	–	40.5	4.9 N	–	–	



Section C - C

Unit: mm

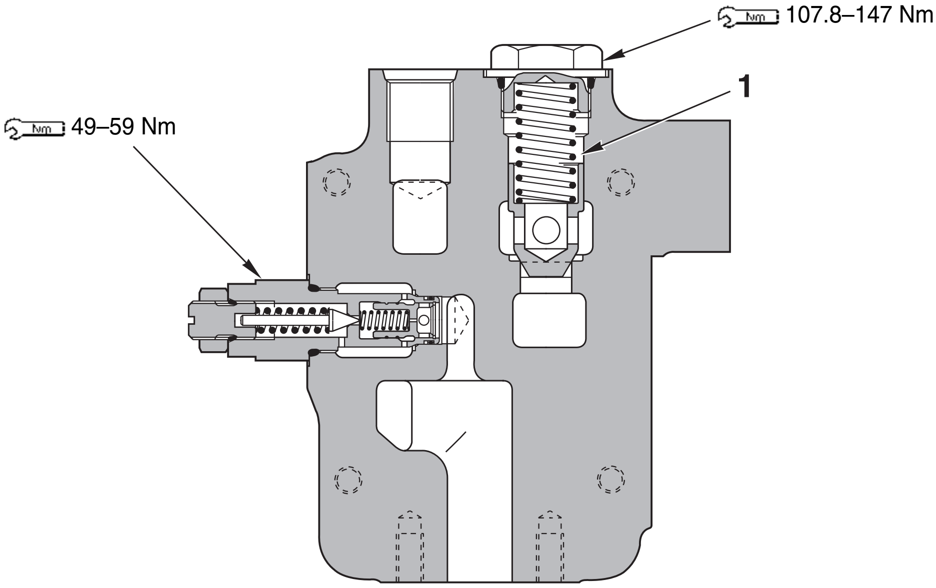
<table>
<tr><th>No.</th><th>Check item</th><th colspan="5">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Pressure compensation valve spring</td><td colspan="3">Standard size</td><td colspan="2">Repair limit</td><td rowspan="6">Replace</td></tr>
<tr><td>Free length x O.D.</td><td>Installed length</td><td>Installed load</td><td>Free length x O.D.</td><td>Installed load</td></tr>
<tr><td>–</td><td>14.5</td><td>13.72 N</td><td>–</td><td>–</td></tr>
<tr><td>2</td><td>Pressure compensation valve spring (boom)</td><td>–</td><td>21.5</td><td>55.9±3 N</td><td>–</td><td>–</td></tr>
<tr><td>3</td><td>Spool (boom raise at joining pump discharge)</td><td>–</td><td>36</td><td>238.3 N</td><td>–</td><td>–</td></tr>
<tr><td>4</td><td>Flow compensation valve spring (boom)</td><td>–</td><td>20</td><td>27.6 N</td><td>–</td><td>–</td></tr>
</table>



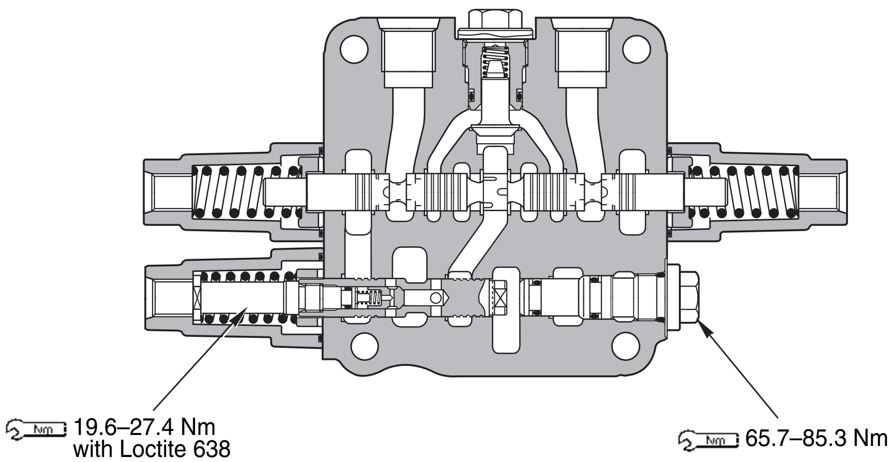
Section D - D

Unit: mm

No.	Check item	Criteria					Remedy
1	Check valve spring	Standard size			Repair limit		Replace
		Free length x O.D.	Installed length	Installed load	Free length x O.D.	Installed load	
		–	22	3.92 N	–	–	
2	Check valve spring (Swing)	–	11.5	13.7 N	–	–	



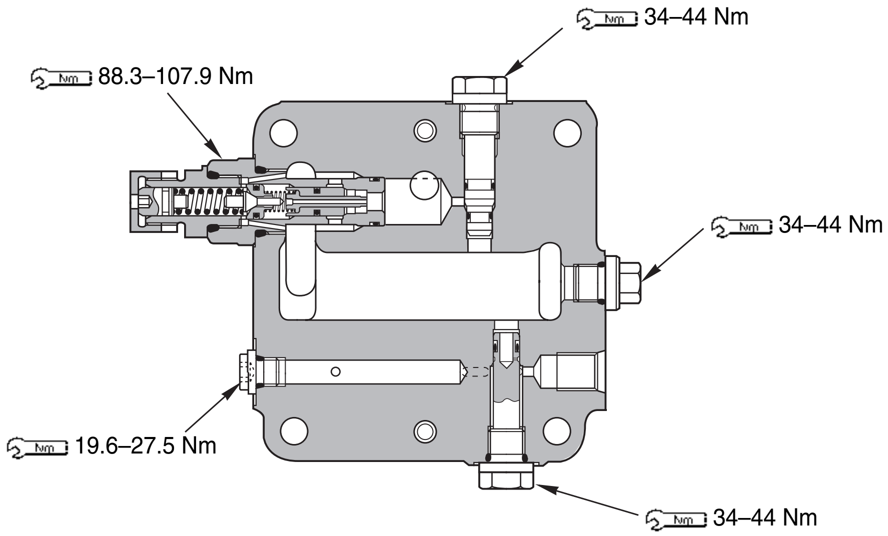
Section BB - BB RKP02823



Section E - E RKP02813

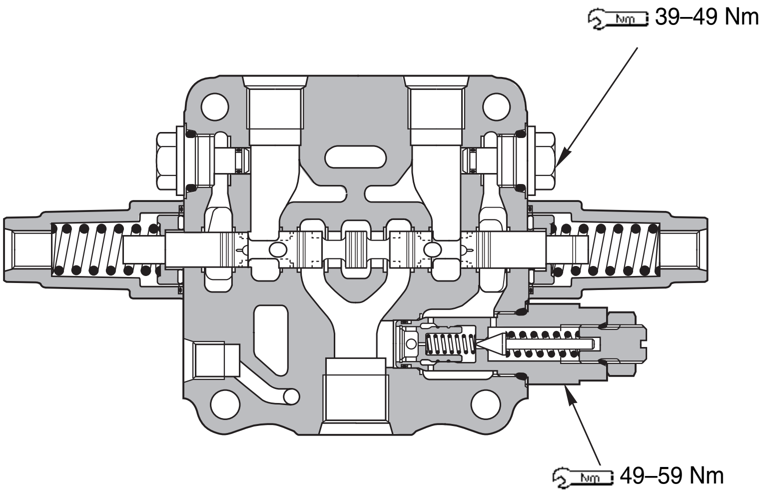
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Lift check valve spring	Free length x O.D.	Installed length	Installed load	Free length x O.D.	Installed load	Replace
		–	46.4	138 N	–	–	



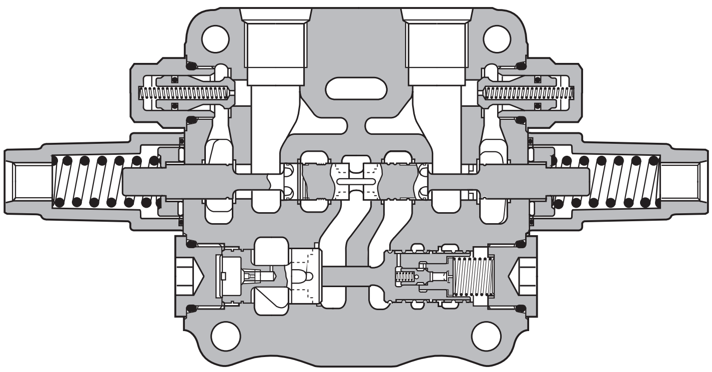
Section AA - AA

RKP02843



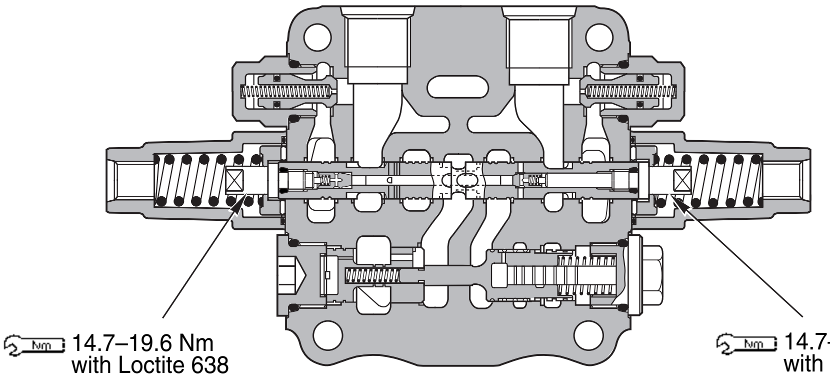
Section F - F

RKP02833



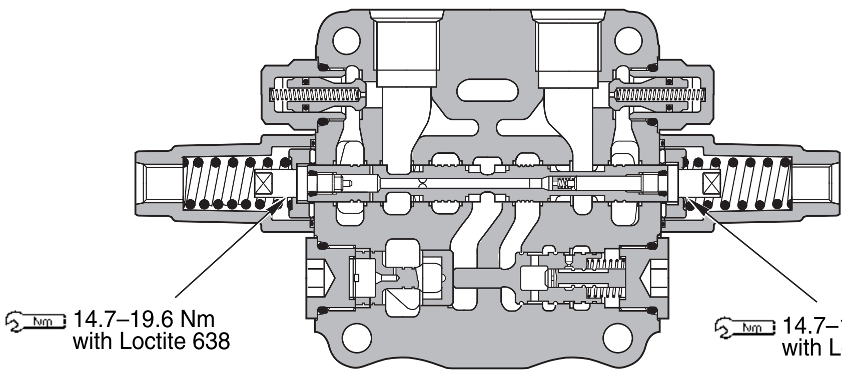
RKP02853

Section G - G



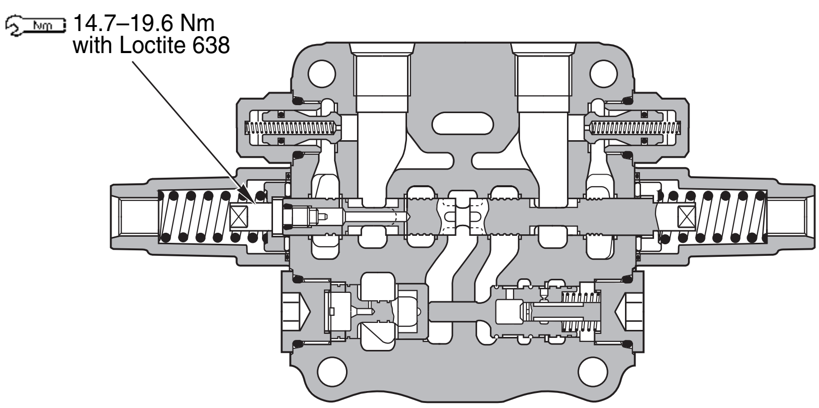
Section H - H

RKP02863



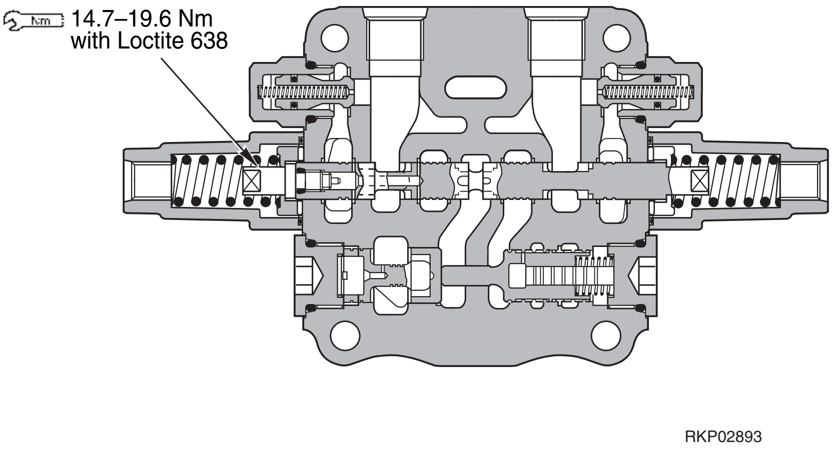
Section J - J

RKP02873

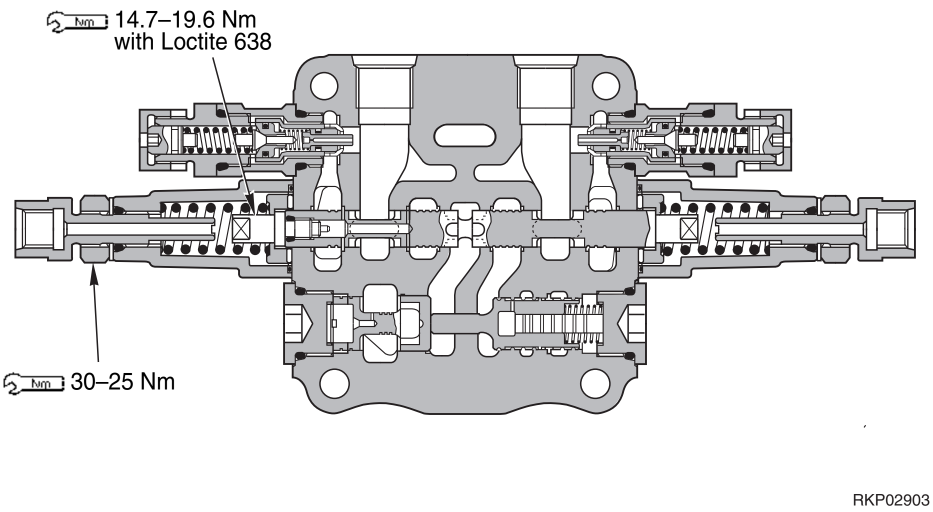


Section K - K

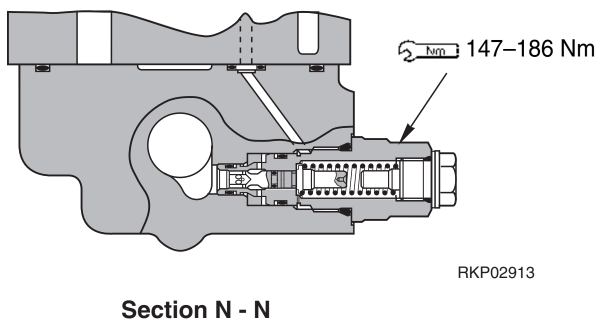
RKP02883



Section L - L

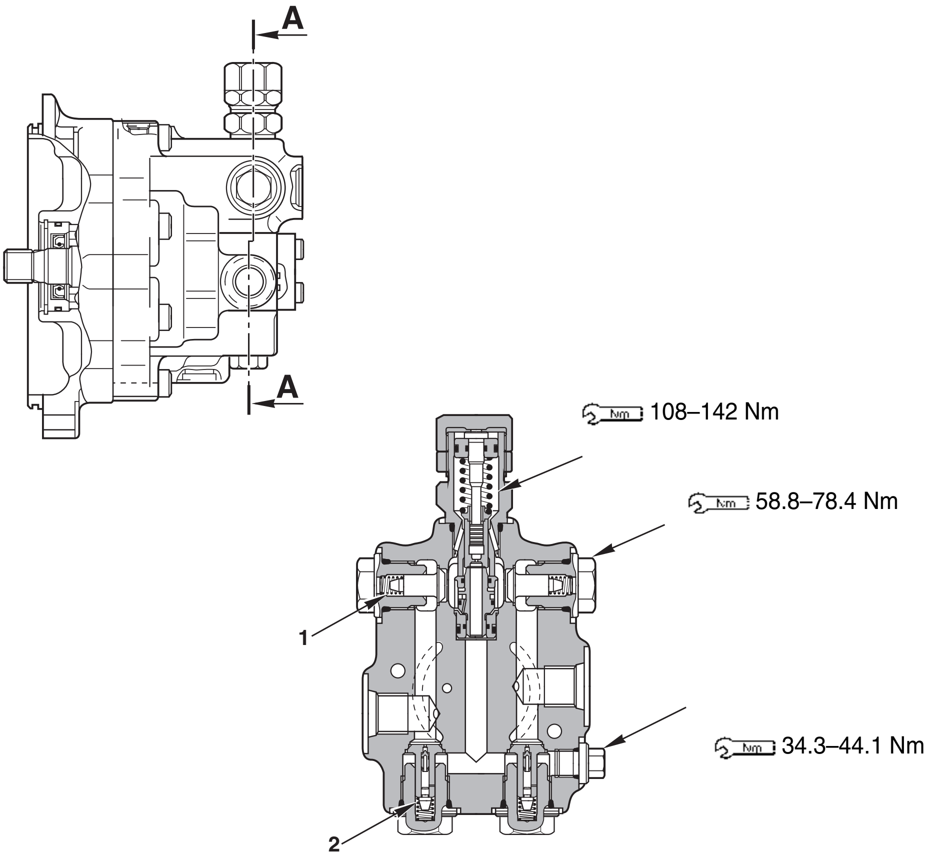


Section M - M



Section N - N

SWING MOTOR

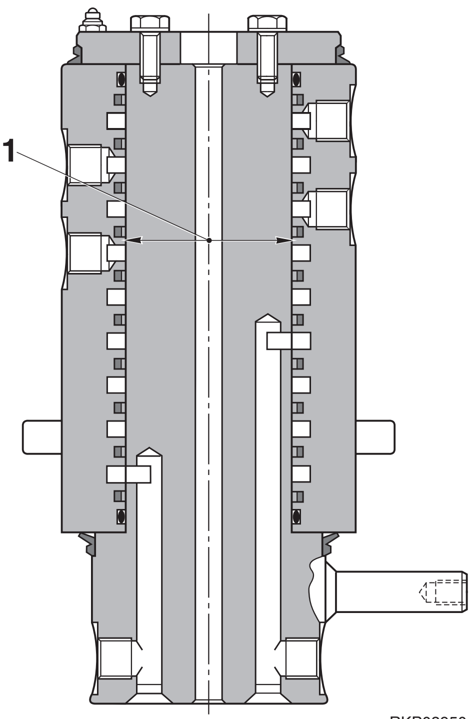


Section A - A

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Suction valve spring	Free length x O.D.	Installed length	Installed load	Free length x O.D.	Installed load	Replace
		–	11.5	0.9 N	–	–	
2	Shuttle valve spring	–	19.5	1.8 N	–	–	

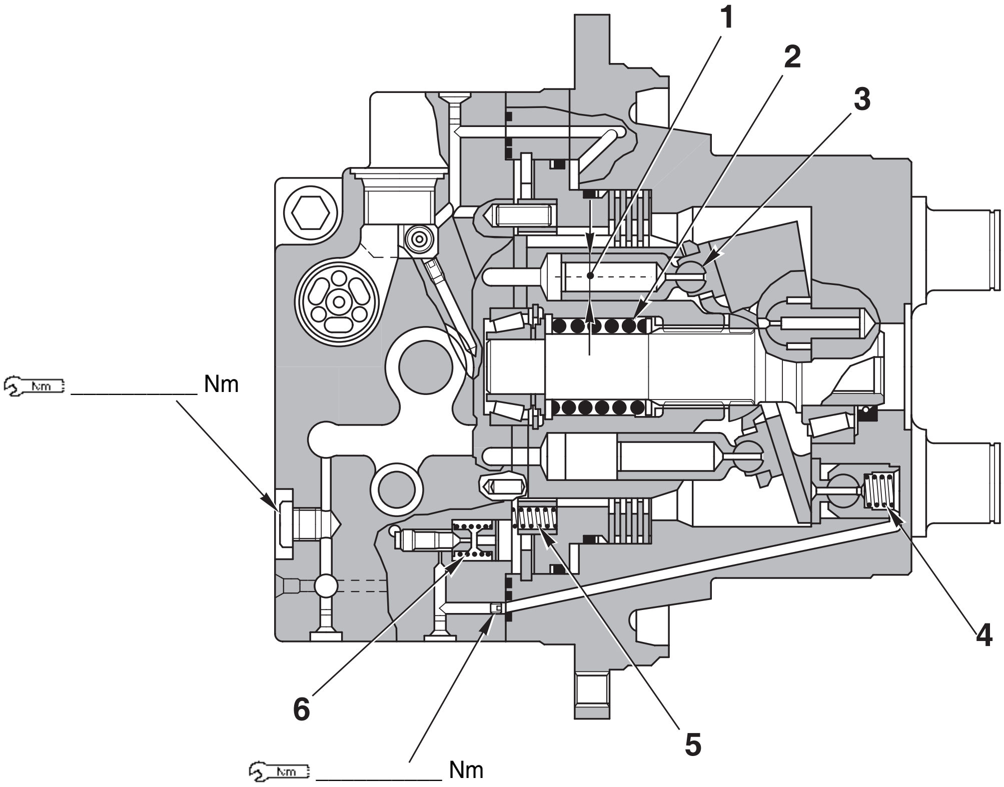
SWIVEL JOINT

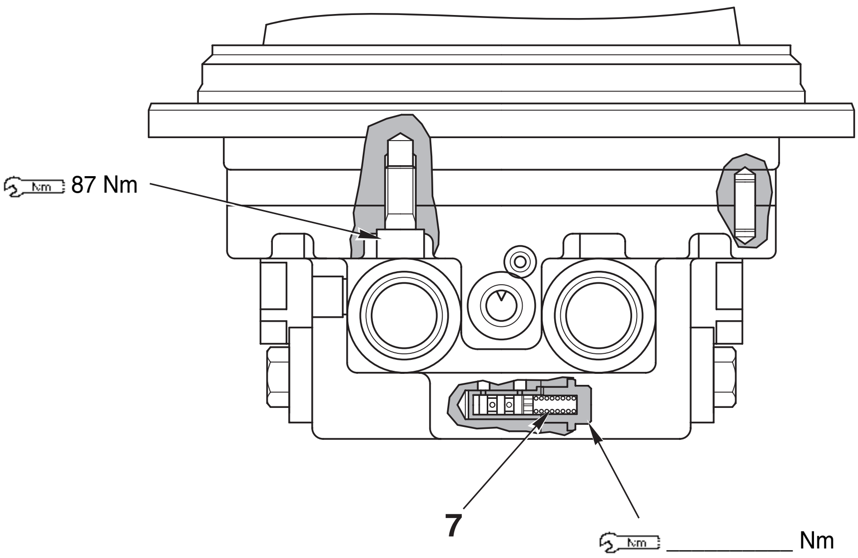


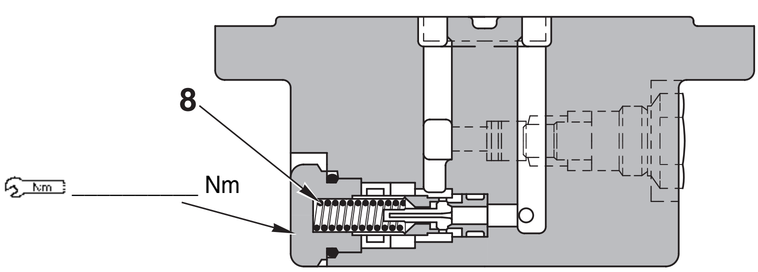
Unit: mm

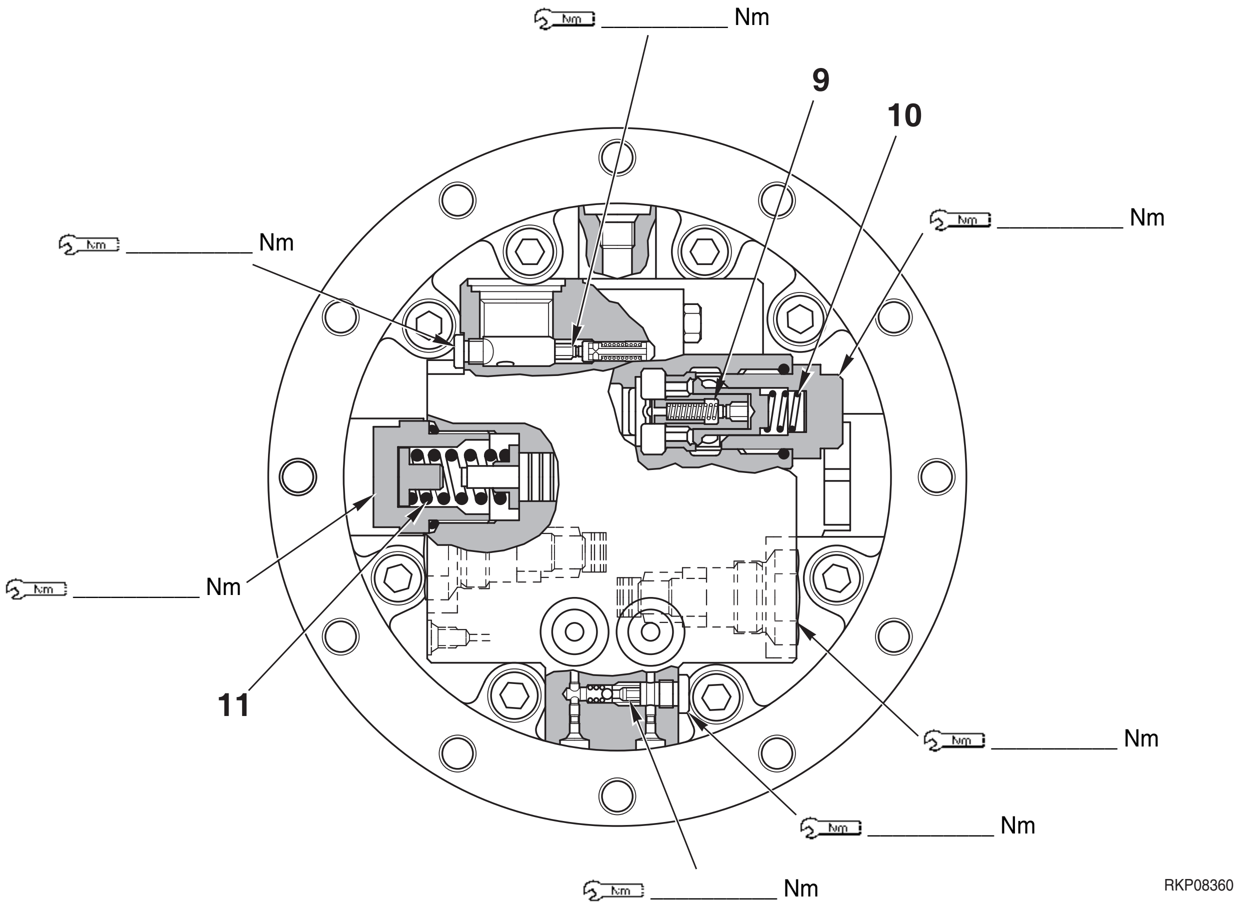
No.	Check item	Criteria						Remedy
1	Clearance between shaft and rotor	Standard size	Tolerance		Standard clearance	Clearance limit		Replace
		85	Shaft	– 0.02 – 0.05	0.12–0.20	0.25		
			Hole	+ 0.10 + 0.15				

TRAVEL MOTOR





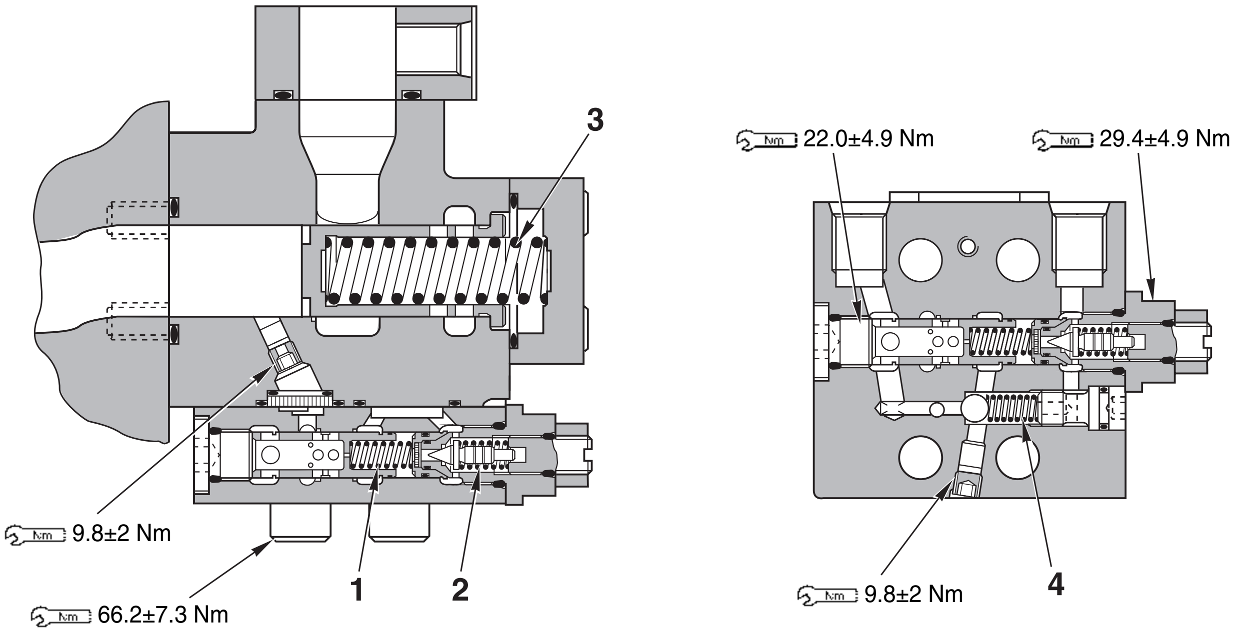




Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between piston and cylinder	Standard size			Repair limit		Replace
		–			–		
2	Clearance between shoe and piston	–			–		
3	Brake spring	Standard size			Repair limit		Replace if damaged or deformed
		Free length	Installed length	Installed load Nm	Free length	Installed load Nm	
4	Piston spring						
5	Center spring						
6	Travel increment spool spring						
7	Travel increment spool spring						
8	Safety valve spring						
9	Suction valve spring						
10	Suction valve spring						

SERVOCONTROL FEED UNIT



Section A - A

Section B - B

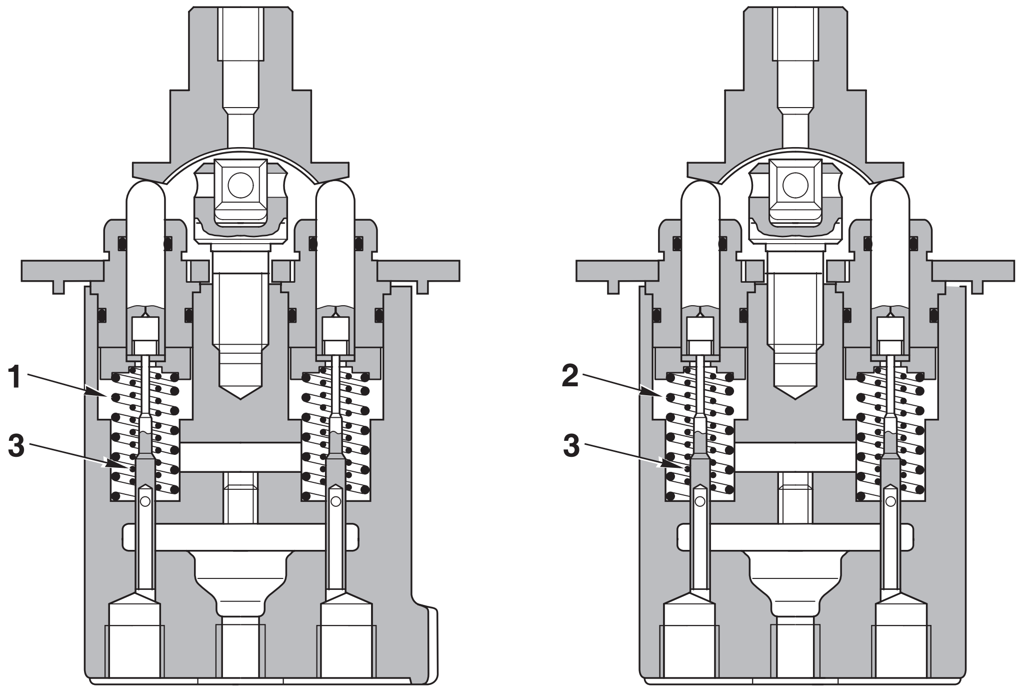
RKP04091

Unit: mm

No.	Check item	Criteria					Remedy
1	Reducing valve main spring	Standard size			Repair limit		Replace
		Free length x O.D.	Installed length	Installed load	Free length x O.D.	Installed load	
		19.2x7.2	16.1	19.6 N	–	17.7 N	
2	Reducing valve pilot spring	16.5x7.2	12.7	20.6 N	–	18.6 N	
3	Spring	71x18	59	199.8 N	–	186.2 N	
4	Safety valve spring	16.1x7.8	13.4	61.7 N	–	58.8 N	

PPC VALVES

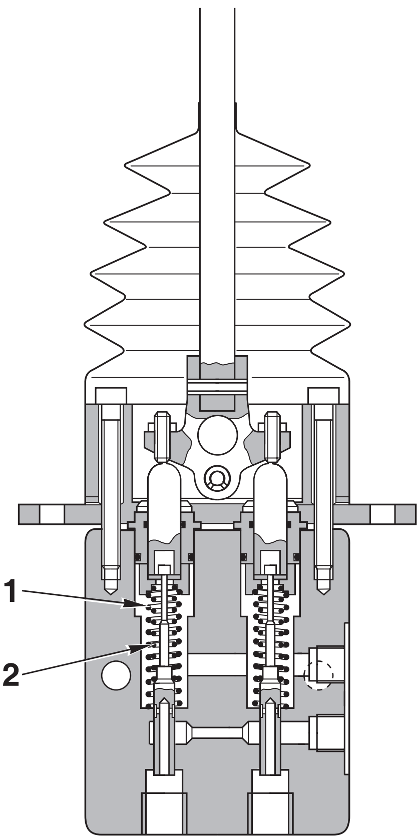
BOOM, ARM, BUCKET, SWING



Unit: mm

No.	Check item	Criteria					Remedy
1	Centering spring (for P2 and P4 port)	Standard size			Repair limit		Replace
		Free length x O.D.	Installed length	Installed load	Free length x O.D.	Installed load	
2	Metering spring (For P1 and P3 port)						
3	Checking spring						

BLADE

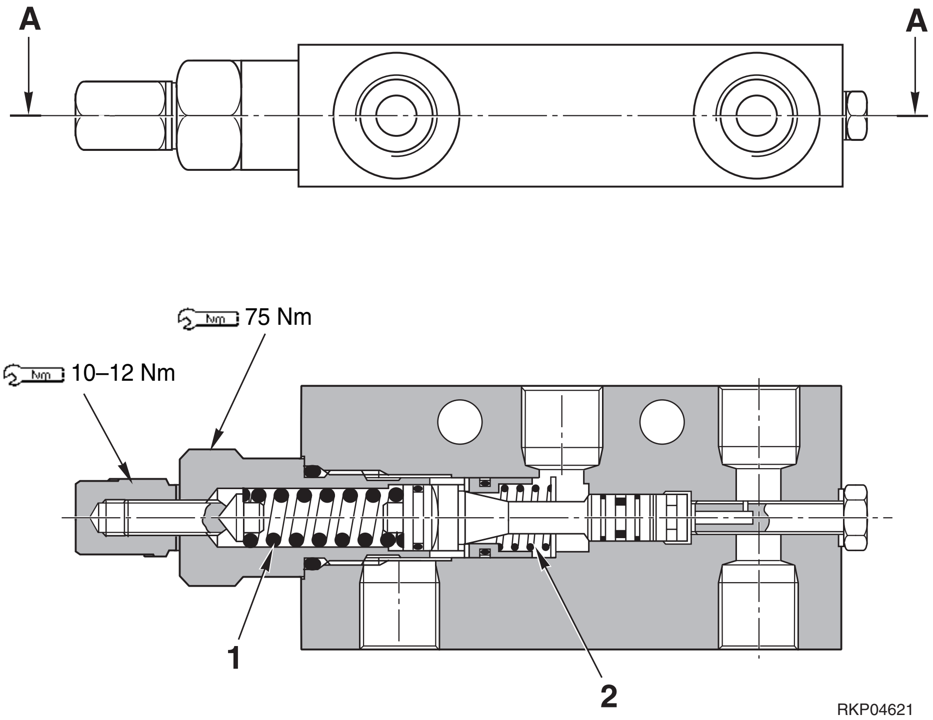


Section A - A RKP12681

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Centering spring	Free length x O.D.	Installed length	Installed load	Free length x O.D.	Installed load	Replace
2	Metering spring						

SAFETY VALVE



Section A - A

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length x O.D.	Installed length	Installed load	Free length x O.D.	Installed load	
1	Spring	31.2x6.10	28.05	52.2 kg	30.2x12.1	52.2 kg	Replace
2	Spring	14x10.7	9.7	4.3 kg	13x13.5	3.3 kg	

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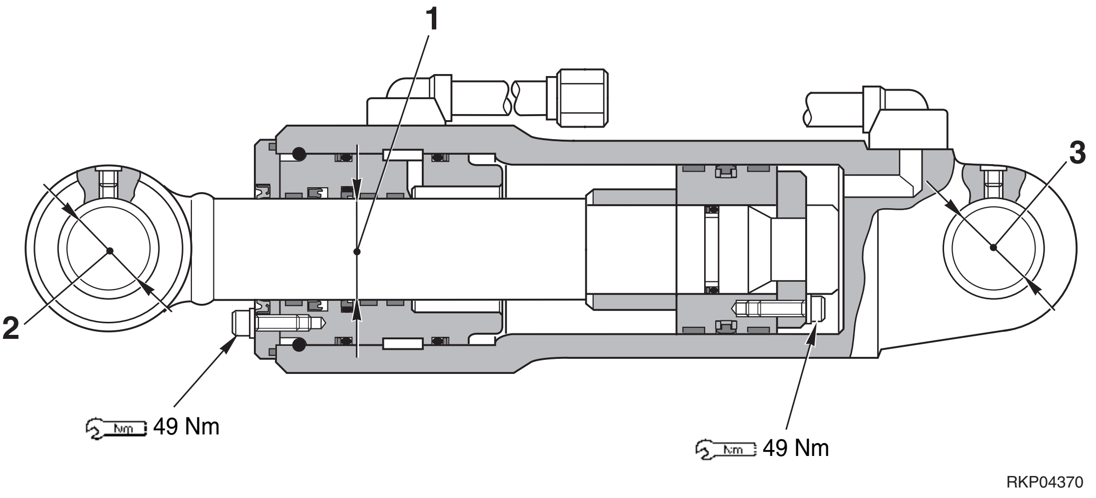
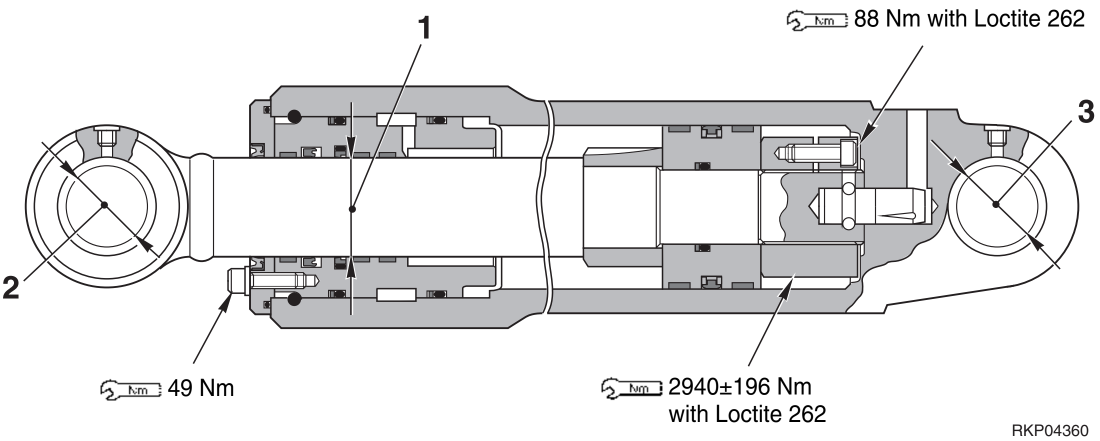
CYLINDERS

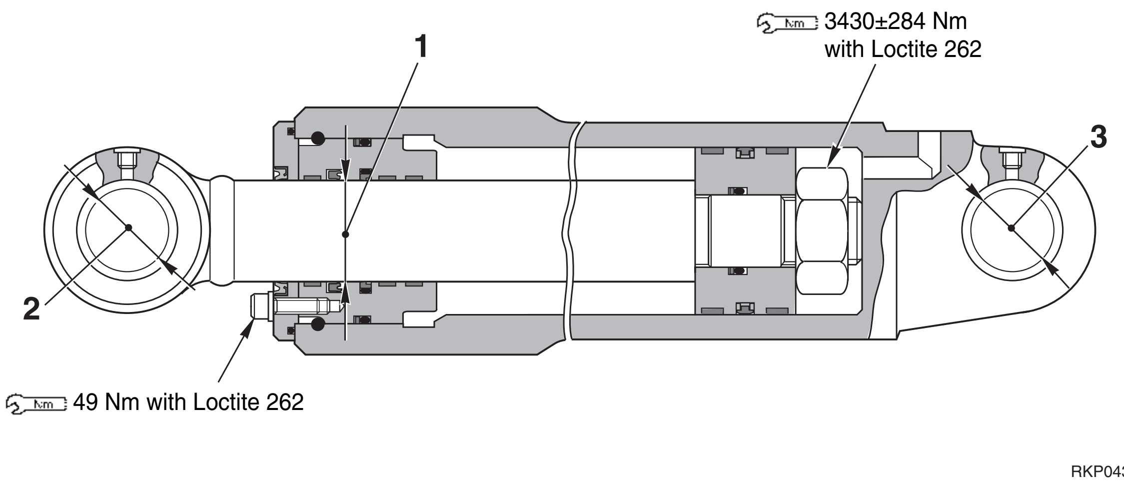
BOOM, BUCKET, BOOM SWING, BLADE



ARM



2-PIECE BOOM

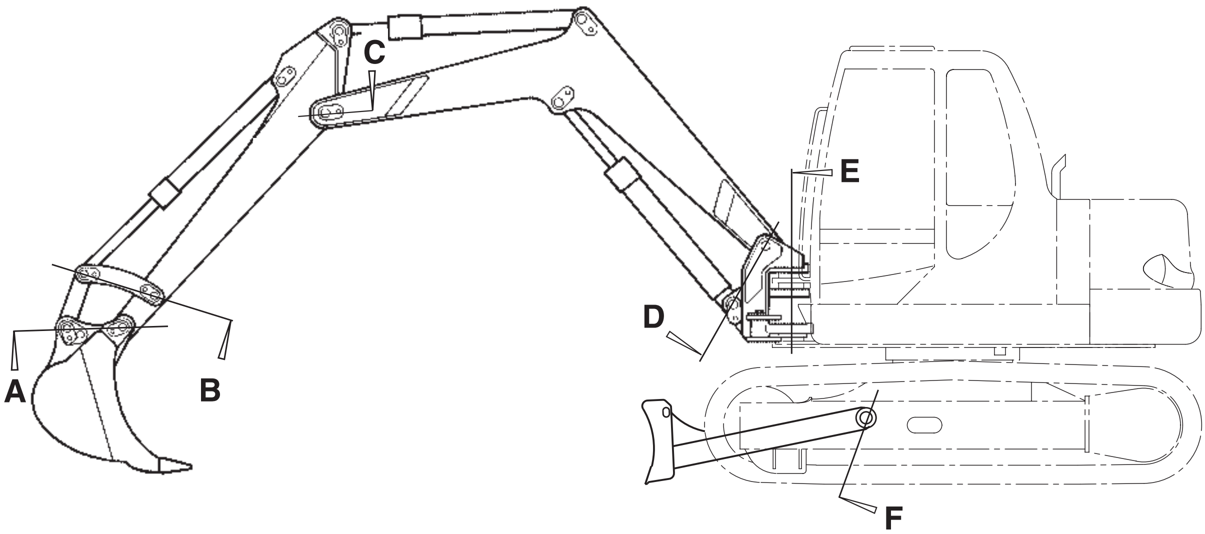


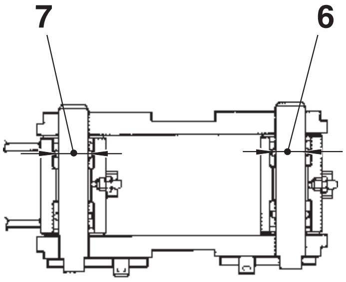
Unit: mm

No.	Check item	Cylinder	Standard size	Tolerance Shaft	Tolerance Hole	Standard clearance	Clearance limit	Remedy
1	Clearance between piston rod and bushing	Bucket	70	– 0.03 – 0.06	0 + 0.166	0.030 0.226	0.326	
		2-piece boom	50	– 0.05 –0.050	0 + 0.166	0.225 0.216	0.316	
		Boom swing	60	– 0.03 – 0.06	0 + 0.166	0.030 0.226	0.326	
		Blade	60	– 0.03 – 0.06	0 + 0.166	0.030 0.226	0.326	
		Boom	60	– 0.03 – 0.06	0 + 0.166	0.030 0.226	0.326	
		Arm	60	– 0.03 – 0.06	0 + 0.166	0.030 0.226	0.326	
2	Clearance between cylinder head bushing and pin	Bucket	60	– 0.060 – 0.106	+ 0.1 +0.146	0.16–0.252	1	
		2-piece boom	50	– 0.050 – 0.089	+ 0.08 + 0.119	0.13–0.208	1	
		Boom swing	50	– 0.050 – 0.089	+ 0.08 + 0.119	0.13–0.208	1	
		Blade	50	– 0.050 – 0.089	+ 0.08 + 0.119	0.13–0.208	1	
		Boom	50	– 0.050 – 0.089	+ 0.08 + 0.119	0.13–0.208	1	
		Arm	50	– 0.050 – 0.089	+ 0.08 + 0.119	0.13–0.208	1	
3	Clearance between cylinder bottom bushing and pin	Bucket	60	– 0.060 – 0.106	+ 0.1 +0.146	0.16–0.252	1	
		2-piece boom	60	– 0.060 – 0.106	+ 0.1 +0.146	0.16–0.252	1	
		Boom swing	50	– 0.050 – 0.089	+ 0.08 + 0.119	0.13–0.208	1	
		Blade	50	– 0.050 – 0.089	+ 0.08 + 0.119	0.13–0.208	1	
		Boom	50	– 0.050 – 0.089	+ 0.08 + 0.119	0.13–0.208	1	
		Arm	50	– 0.050 – 0.089	+ 0.08 + 0.119	0.13–0.208	1	

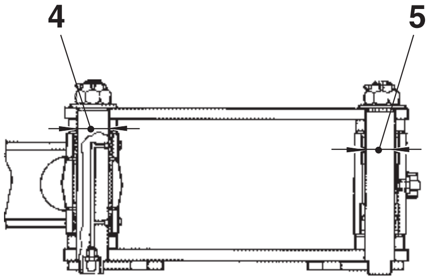
WORK EQUIPMENT

1-PIECE BOOM

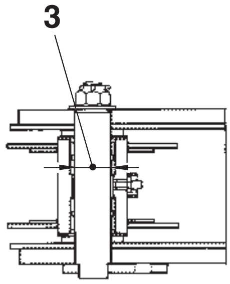




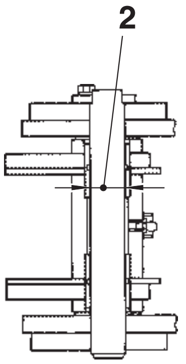
Section A - A



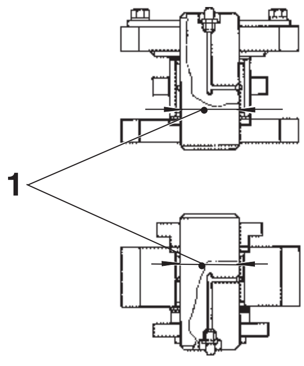
Section B - B



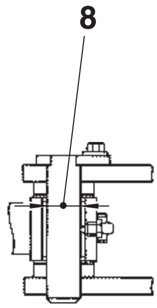
Section C - C



Section D - D



Section E - E



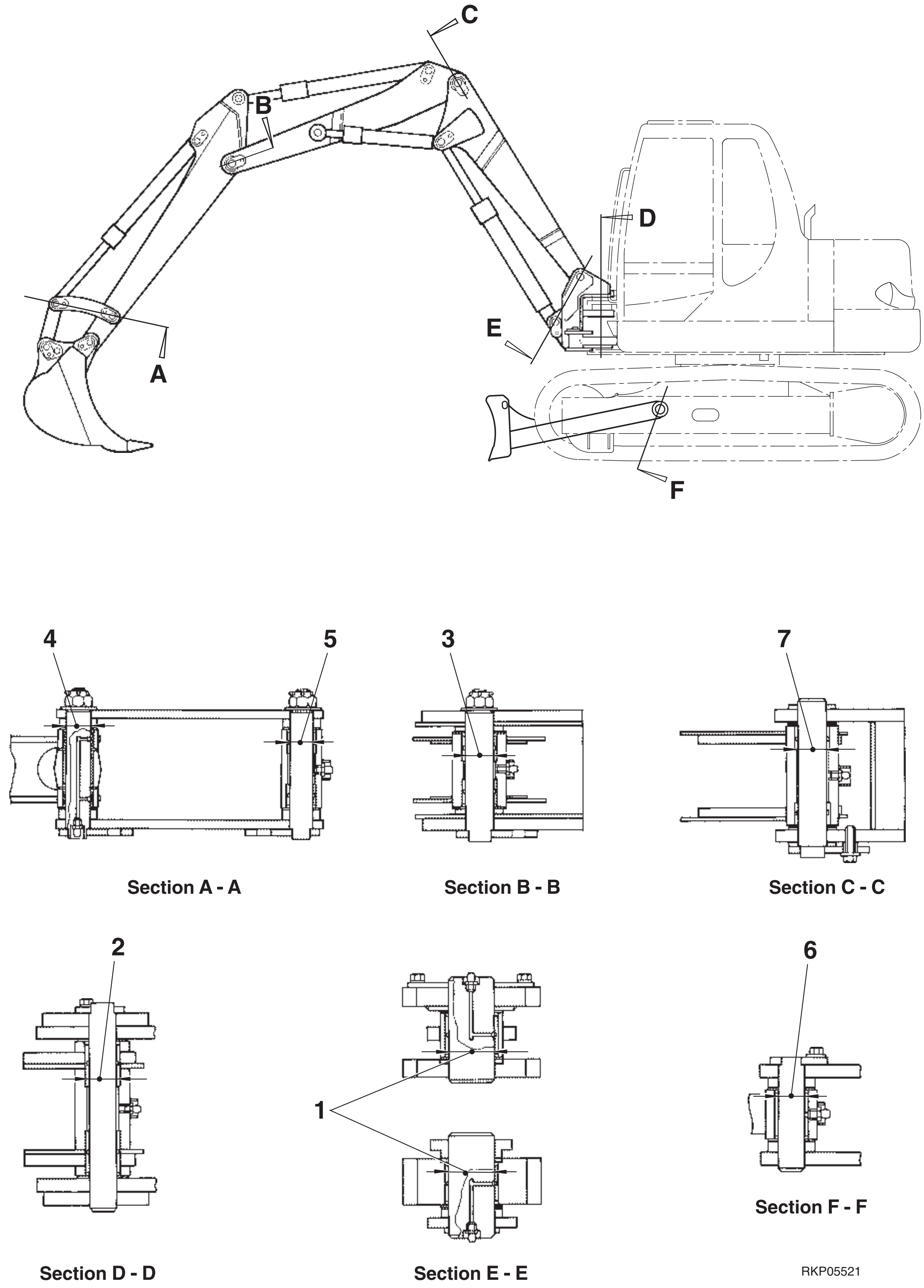
Section F - F

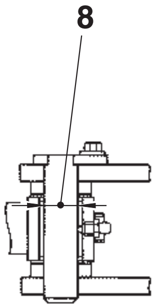
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Tolerance limit	
			Shaft	Hole			
1	Clearance between swing bracket-to-revolving frame mounting and pin bushing	100	– 0.072 – 0.126	+ 0.145 + 0.044	0.271– 0.116	0.8	Replace
2	Clearance between boom-to-swing bracket mounting pin and bushing	60	– 0.060 –0.106	+ 0.047 + 0.127	0.107– 0.233	0.8	
3	Clearance between boom-to-arm mounting pin and bushing	60	– 0.060 –0.106	+ 0.047 + 0.127	0.107– 0.233	0.8	
4	Clearance between bucket cylinder-to-link mounting pin and link bushing	50	– 0.050 – 0.089	+ 0.095 + 0.016	0.184– 0.066	1	
5	Clearance between arm-to-link mounting pin and bushing	50	– 0.050 – 0.089	+ 0.095 + 0.016	0.184– 0.066	1	
6	Clearance between bucket-to-arm mounting pin and bushing	50	– 0.050 – 0.089	+ 0.095 + 0.016	0.184– 0.066	1	
7	Clearance between bucket-to-link mounting pin and bushing	50	– 0.050 – 0.089	+ 0.095 + 0.016	0.184– 0.066	1	
8	Clearance between blade mounting pin and bushing	50	– 0.050 – 0.089	+ 0.095 + 0.016	0.184– 0.066	1.5	

WORK EQUIPMENT

2-PIECE BOOM





Section G - G

RKP05531

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Tolerance limit	
			Shaft	Hole			
1	Clearance between swing bracket-to-revolving frame mounting and pin bushing	100	– 0.072 – 0.126	+ 0.145 + 0.044	0.271– 0.116	0.8	Replace
2	Clearance between boom- to-swing bracket mounting pin and bushing	60	– 0.060 –0.106	+ 0.047 + 0.127	0.107– 0.233	0.8	
3	Clearance between boom-to-arm mounting pin and bushing	60	– 0.060 –0.106	+ 0.047 + 0.127	0.107– 0.233	0.8	
4	Clearance between bucket cylinder-to-link mounting pin and link bushing	50	– 0.050 – 0.089	+ 0.095 + 0.016	0.184– 0.066	1	
5	Clearance between arm-to-link mounting pin and bushing	50	– 0.050 – 0.089	+ 0.095 + 0.016	0.184– 0.066	1	
6	Clearance between bucket-to-arm mounting pin and bushing	50	– 0.050 – 0.089	+ 0.095 + 0.016	0.184– 0.066	1	
7	Clearance between bucket-to-link mounting pin and bushing	50	– 0.050 – 0.089	+ 0.095 + 0.016	0.184– 0.066	1	
8	Clearance between blade fulcrum pin and bushing	50	– 0.050 – 0.089	+ 0.095 + 0.016	0.184– 0.066	1.5	
9	Clearance between bushing and mounting pin of 2nd boong	60	– 0.060 –0.106	+ 0.047 + 0.127	0.107– 0.233	0.8	