

SHOP MANUAL



PC75R-2

HYDRAULIC EXCAVATOR

SERIAL NUMBER

PC75R-2 22E5200763 and up

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December 2001

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CONTENTS

10 STRUCTURE AND FUNCTION	10-1
20 TESTING AND ADJUSTING.....	20-1
30 REMOVAL AND INSTALLATION	30-1
40 MAINTENANCE STANDARD	40-1

The affected pages are indicated by the use of the following marks. It is requested that necessary actions be taken to these pages according to table below.

Mark	Indication	Action required
○	Page to be newly	Add
●	Page to be replaced	Replace
()	Page to be delete	Discard

Pages having no marks are those previously revised or made additions.

LIST OF REVISED PAGES



Mark	Page	Time of revision	Mark	Page	Time of revision	Mark	Page	Time of revision	Mark	Page	Time of revision	Mark	Page	Time of revision
	00-1			10-25			10-66			10-107			20-30	
	00-2			10-26			10-67			10-108			20-31	
	00-2-1			10-27			10-68			10-109			20-32	
	00-2-2			10-28			10-69			10-110			20-33	
	00-3			10-29			10-70			10-111			20-34	
	00-4			10-30			10-71			10-112			20-35	
	00-5			10-31			10-72			10-113			20-36	
	00-6			10-32			10-73			10-114			20-37	
	00-7			10-33			10-74			10-115			20-38	
	00-8			10-34			10-75			10-116			20-39	
	00-9			10-35			10-76			10-117			20-40	
	00-10			10-36			10-77						20-41	
	00-11			10-37			10-78			20-1			20-42	
	00-12			10-38			10-79			20-2			20-43	
	00-13			10-39			10-80			20-3			20-44	
	00-14			10-40			10-81			20-4			20-45	
				10-41			10-82			20-5			20-46	
	10-1			10-42			10-83			20-6			20-47	
	10-2			10-43			10-84			20-7			20-48	
	10-3			10-44			10-85			20-8			20-49	
	10-4			10-45			10-86			20-9			20-50	
	10-5			10-46			10-87			20-10			20-51	
	10-6			10-47			10-88			20-11			20-52	
	10-7			10-48			10-89			20-12			20-53	
	10-8			10-49			10-90			20-13			20-54	
	10-9			10-50			10-91			20-14			20-55	
	10-10			10-51			10-92			20-15			20-56	
	10-11			10-52			10-93			20-16			20-57	
	10-12			10-53			10-94			20-17			20-58	
	10-13			10-54			10-95			20-18			20-59	
	10-14			10-55			10-96			20-19			20-60	
	10-15			10-56			10-97			20-20			20-61	
	10-16			10-57			10-98			20-21				
	10-17			10-58			10-99			20-22			30-1	
	10-18			10-59			10-100			20-23			30-2	
	10-19			10-60			10-101			20-24			30-3	
	10-20			10-61			10-102			20-25			30-4	
	10-21			10-62			10-103			20-26			30-5	
	10-22			10-63			10-104			20-27			30-6	
	10-23			10-64			10-105			20-28			30-7	
	10-24			10-65			10-106			20-29			30-8	

Mark	Page	Time of revision	Mark	Page	Time of revision	Mark	Page	Time of revision	Mark	Page	Time of revision	Mark	Page	Time of revision
	30-9			30-66			30-123							
	30-10			30-67			30-124							
	30-11			30-68										
	30-12			30-69			40-1							
	30-13			30-70			40-2							
	30-14			30-71			40-3							
	30-15			30-72			40-4							
	30-16			30-73			40-5							
	30-17			30-74			40-6							
	30-18			30-75			40-7							
	30-19			30-76			40-8							
	30-20			30-77			40-9							
	30-21			30-78			40-10							
	30-22			30-79			40-11							
	30-23			30-80			40-12							
	30-24			30-81			40-13							
	30-25			30-82			40-14							
	30-26			30-83			40-15							
	30-27			30-84			40-16							
	30-28			30-85			40-17							
	30-29			30-86			40-18							
	30-30			30-87			40-19							
	30-31			30-88			40-20							
	30-32			30-89			40-21							
	30-33			30-90			40-22							
	30-34			30-91			40-23							
	30-35			30-92			40-24							
	30-36			30-93			40-25							
	30-37			30-94			40-26							
	30-38			30-95			40-27							
	30-39			30-96			40-28							
	30-40			30-97			40-29							
	30-41			30-98			40-30							
	30-42			30-99			40-31							
	30-43			30-100			40-32							
	30-44			30-101			40-33							
	30-45			30-102			40-34							
	30-46			30-103			40-35							
	30-47			30-104			40-36							
	30-48			30-105			40-37							
	30-49			30-106			40-38							
	30-50			30-107										
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	30-58			30-115										
	30-59			30-116										
	30-60			30-117										
	30-61			30-118										
	30-62			30-119										
	30-63			30-120										
	30-64			30-121										
	30-65			30-122										



IMPORTANT SAFETY NOTICE

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

PREPARATIONS FOR WORK

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

PRECAUTIONS DURING WORK

11. When removing the oil filler cap, drain plug or hydraulic pressure measuring plugs, loosen them slowly to prevent the oil from spurting out.
Before disconnecting or removing components of the hydraulic circuit and engine cooling circuit, first remove the pressure completely from the circuit.
12. The water and oil in the circuits are not hot when the engine is 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 particularly 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 care when removing or installing tracks. When removing the track, the track separates suddenly, so never let anyone stand at either end of the track.

FOREWORD

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

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

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

STRUCTURE AND FUNCTION

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

TESTING AND ADJUSTING

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

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

DISASSEMBLY AND ASSEMBLY

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

MAINTENANCE STANDARD

This section gives the judgement standards when inspecting disassembled parts.

NOTE

The specifications contained in this shop manual are subject to change at any time and without any notice.

Contact your Komatsu 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.

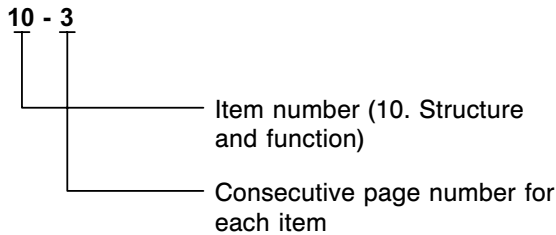
DISTRIBUTION AND UPDATING

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

FILING METHOD

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

Example



3. Additional pages: additional pages are indicated by a hyphen (-) and number after the page number.

File as in the example.

Example:

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

REVISED EDITION MARK

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REVISIONS

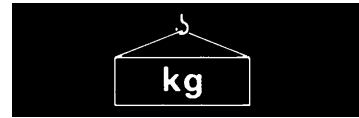
Revised pages are shown on the LIST OF REVISED PAGES between the title page and SAFETY page.


SYMBOLS

In order to make the shop manual greatly helpful, 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 (55.116lb.) 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 

- 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

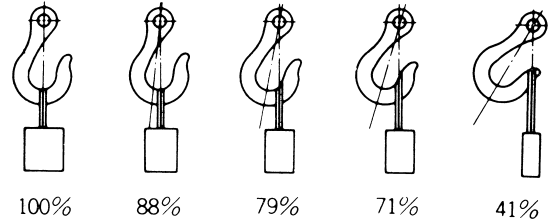
- Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

WIRE ROPES (Standard «S» or «Z» twist ropes without galvanizing)	
Rope diameter (mm)	Allowable load (tons)
10	1.0
11.2	1.4
12.5	1.6
14	2.2
16	2.8
18	3.6
20	4.4
22.4	5.6
30	10.0
40	18.0
50	28.0
60	40.0

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

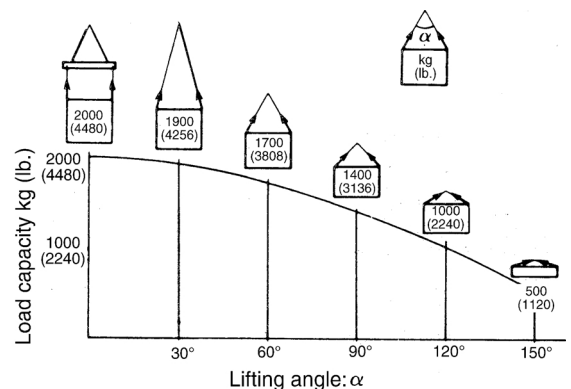
- Sling wire ropes from the middle portion of the hook. Slinging near the edge of the hook may cause the rope to slip off the hook during hoist-

ing, and a serious accident can result. Hooks have maximum strength at the middle portion.



- 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.

- 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 hanging angles. When two ropes sling a load vertically, up to 2000 kg of total weight can be suspended. This weight becomes 1000 kg when two ropes make a 120° hanging angle. On the other hand, two ropes are subjected to an excessive force as large as 4000 kg if they sling a 2000 kg load at a lifting angle of 150°.



STANDARD TIGHTENING TORQUE



STANDARD TIGHTENING TORQUE

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

1. STANDARD TIGHTENING TORQUE OF BOLTS AND NUT

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

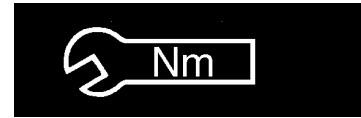
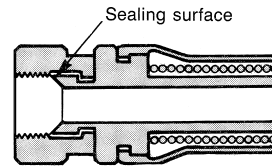
This torque table does not apply to bolts or nuts which have to fasten nylon or other parts non-ferrous metal washer.

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

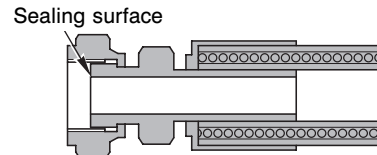
STANDARD TIGHTENING TORQUE

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	lb.ft.
1/2" - 20	17	2.6±0.5	25.5±4.9	18.8±3.6
9/16" - 18	17	4±0.5	39.2±4.9	28.9±3.6
3/4" - 16	22	6.7±2	65.7±19.6	48.4±14.5
7/8" - 14	27	8±2	78.5±19.6	57.9±14.5
1. 1/16" - 12	32	9.7±3	95.15±29.4	70.13±21.7
1. 5/16" - 12	38	17±3	166.7±29.4	122.9±21.7
1. 5/8" - 12	50	20±5	196.2±49	144.6±36
22	27	8±2	78.5±19.6	57.9±14.5
33	41	20±5	196.2±49	144.6±36



Thread diameter of nut part (mm)	Width across flats of nut part (mm)	TIGHTENING TORQUE		
		kgm	Nm	lb.ft.
9/16" - 18	17	2.3 - 2.5	23 - 25	17 - 18.4
11/16" - 16	22	3.4 - 3.9	33 - 38	24.3 - 28
13/16" - 16	24	5.2 - 5.8	51 - 57	37.6 - 42
1" - 14	30	8.2 - 9.2	80 - 90	59 - 66.3
1. 3/16" - 12	36	12.2 - 13.3	120 - 130	88.4 - 95.8
1. 7/16" - 12	41	15.3 - 17.3	150 - 170	110.5 - 125.3
1. 11/16" - 12	50	18.4 - 20.4	180 - 200	132.6 - 147.4
2" - 12	57	20.4 - 24.4	200 - 240	147.4 - 176.8



COATING MATERIALS

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

Nomenclature	Code	Applications
Adhesives	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 262	Used for high resistant of threaded parts that can be removed with normal tools.
	Loctite 270	Used for high resistant locking and for sealing threaded parts, bolts and stud bolts.
	Loctite 542	Used for sealing the union threads for hydraulic tubes.
	Loctite 573	Used for sealing rather exact plane surfaces when the option of possible future dismantling is required.
	Loctite 601	Used for high resistant locking of mechanical components that can be removed only after heating
	Loctite 675	Used to lock cylindrical couplings and for the permanent locking of threaded parts, and also to lock shafts to bearings, gears, pulleys, pins, bushings, etc.
Gasket sealant	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.
	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 WIRE CODE

In the wiring diagrams various colours and symbols are employed to indicate the thickness of wires.

This wire code table will help you understand WIRING DIAGRAMS.

Example: R -N 1.5 indicates a cable having a nominal number 1.5 and red coating with black stripe.

CLASSIFICATION BY THICKNESS

Nominal number	Copper wire			Cable O.D. (mm)	Current rating (A)
	Number strands	ø of strands (mm)	Cross section (mm ²)		
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

CLASSIFICATION BY COLOUR AND CODE

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


COMPOSITION OF THE COLOURS

The coloration of two-colour wires is indicated by the composition of the symbols listed.

Example: R-N = Red-Black with longitudinal colouring.

R/N = Red-Black with transversal colouring.

WEIGHT TABLE

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

Unit: kg (lb.)

Machine model	PC75R-2
From serial no.	22E5200763-
Engine assembly	380 (837)
Radiator - exchanger	35.5 (78.2)
Hydraulic tank (without hydraulic oil)	60 (132.2)
Fuel tank (without fuel)	40 (88.2)
Revolving frame	765 (1685.3)
Counterweight	1050 (2313.2)
Swing circle	89 (196)
Swing machinery assembly	43 (94.7)
Main pump + gear pump	57 (125.6)
Cabin	250 (550.7)
Seat	32 (70.5)
Seat support	14.5 (32)
Platform	51 (112.4)
Control valve	55 (121.2)
Track frame assembly:	979 (2156.8)
• Idler assembly	82 (180.6)
• Sprocket	35 (77.1)
• Final drive	90 (198.2)
• Track roller	16 (35.2)
• Carrier roller	11 (24.2)
Track - shoe assembly (standard)	491 (1081.6)
Engine hood	—
Front hood	—
Swivel joint	36 (79.3)
Swing bracket	170 (374.5)
Boom	300 (661)
1 st boom	245 (540)
2 nd boom	168 (370)
Arm (L = 1700)	125 (275.3)
Arm (L = 2100)	167 (368)
Blade	250 (551)
Work equipment (1-piece boom)	—
Work equipment (2-piece boom)	—

TABLE OF OIL AND COOLANT QUANTITIES

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE									CAPACITY		
		-30 -22	-20 -4	-10 14	0 32	10 50	20 58	30 85	40 104	50°C 122°F	1st filling	Change	
Engine oil pan	OIL ● API CD											9.4 ℓ (2.48 US.gall)	9.4 ℓ (2.48 US.gall)
Hydraulic circuit	OIL ● API CD										138 ℓ (36.43 US.gall)	70 ℓ (18.48 US.gall)	
Final drive (each)	OIL ● API GL5										1.7 ℓ (0.45 US.gall)	1.7 ℓ (0.45 US.gall)	
Swing machinery	OIL ● API GL5										1.5 ℓ (0.40 US.gall)	1.5 ℓ (0.40 US.gall)	
Fuel tank	FUEL		*								100 ℓ (26.41 US.gall)	—	
Engine coolant system	WATER + ANTI-FREEZE										18 ℓ (4.75 US.gall)	—	
	WATER										18 ℓ (4.75 US.gall)	—	
	PERMANENT LIQUID										18 ℓ (4.75 US.gall)	—	

* ASTM D975 N. 1

ASTM: America Society of Testing and Materials

SAE: Society of Automotive Engineers

API: American Petroleum Institute

MIL: USA Military Specification

CCMC: Common Market Constructors Committe

Specified capacity: Total amount of oil including oil for components and oil in piping.

Refill capacity: Amount of oil needed to refill system during normal inspection and maintenance.

NOTE:

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

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

- (2) When starting the engine in weather temperature below 0°C, be sure to use engine oil SAE 10W, SAE 20W-20, even if weather temperature goes up to 10°C day time.
- (3) Use classification CD as engine oil, if use classification CC, reduce the engine oil change interval to half.
- (4) Use original products, which have characteristics specifically formulated and approved for the engine, the hydraulic circuit of equipment and for reductions.

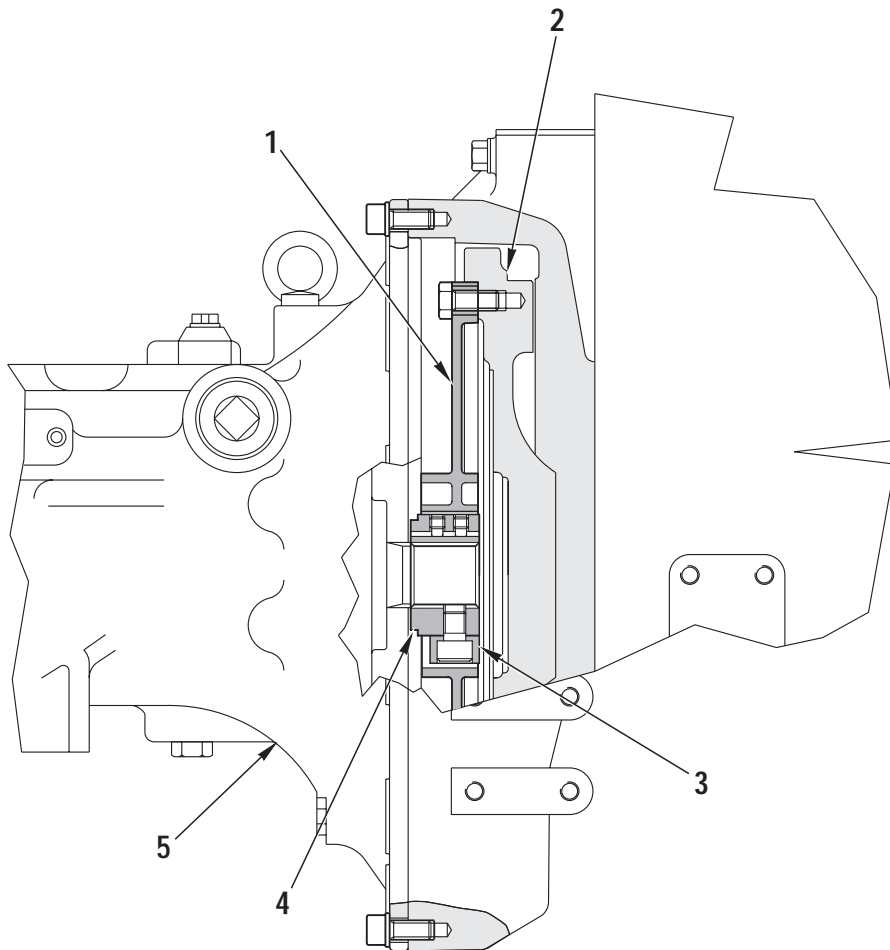
GROUP

10

10 STRUCTURE AND FUNCTION

P.T.O.	2	Brake valve	79
Power train	3	Travel motor	81
Track frame.....	5	Reduction gear	83
Idler and recoil spring	6	Cylinders	84
Track roller.....	7	Servocontrol feed unit	86
Carrier roller	7	Accumulator	91
Track shoe.....	8	PPC Valve	92
Swing circle.....	9	PPC Valve (blade, boom swing, 2-piece boom)	96
Swing machinery.....	10	Travel PPC valve.....	100
Hydraulic circuit diagram (Standard)	11	Boom and arm safety valve	105
Hydraulic circuit diagram (2-Piece boom).....	13	Blade safety valve.....	106
Hydraulic pump	14	2-Piece boom safety valve.....	107
9-Spool control valve (Standard).....	40	Overload sensor switch.....	108
10-Spool control valve (Standard + 2-Piece boom) .	42	Solenoid valve	109
Swing motor	70	Electrical diagram (1/3)	111
Center swivel joint	74	Electrical diagram (2/3)	113
Travel motor	76	Electrical diagram (3/3)	115
Parking brake	78		

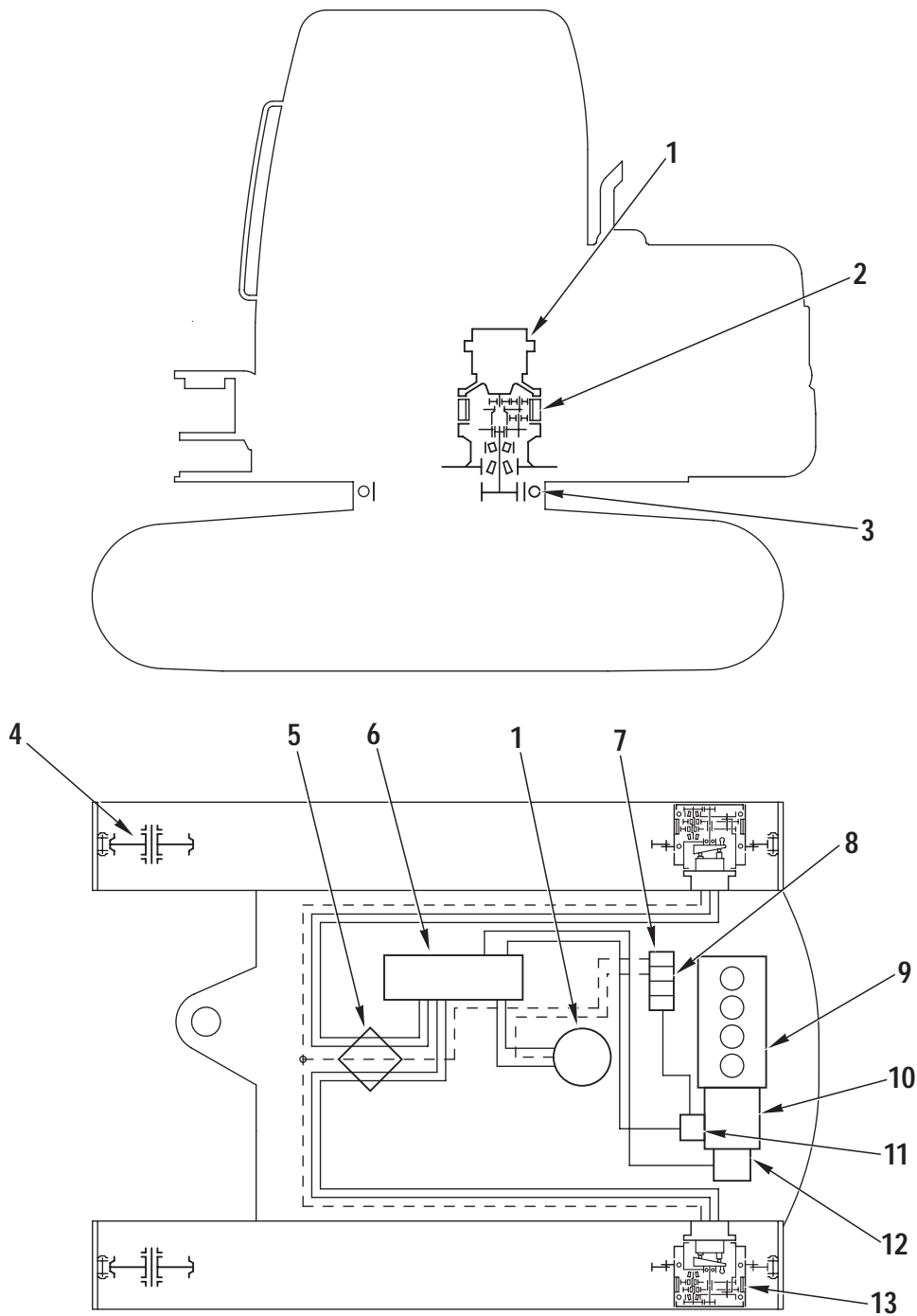
P.T.O.



RKP08290

- 1. Disc
- 2. Flywheel
- 3. Damper (No. 4)
- 4. Hub
- 5. Pump

POWER TRAIN

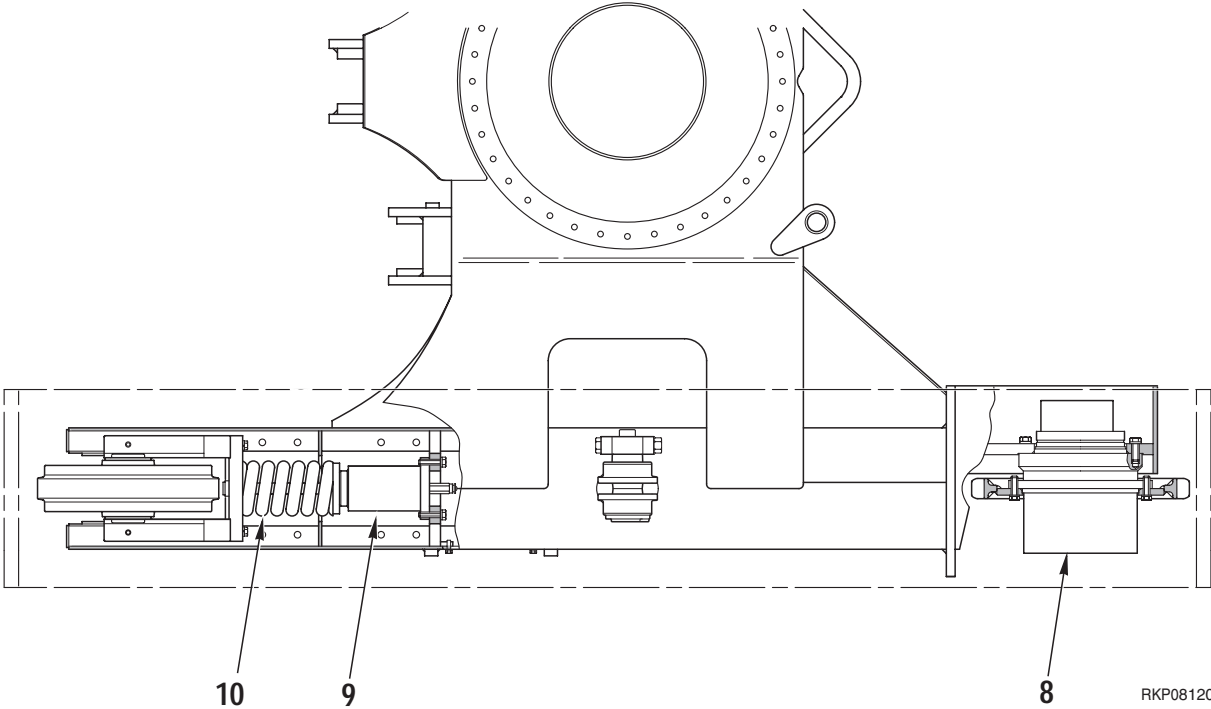
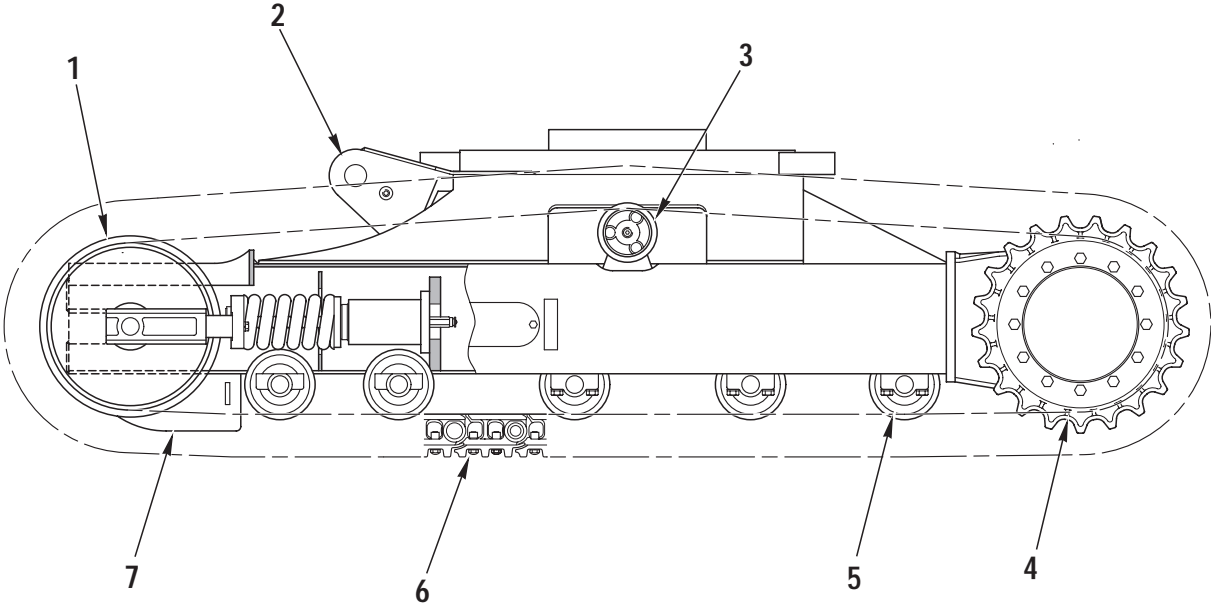


RKP08110

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

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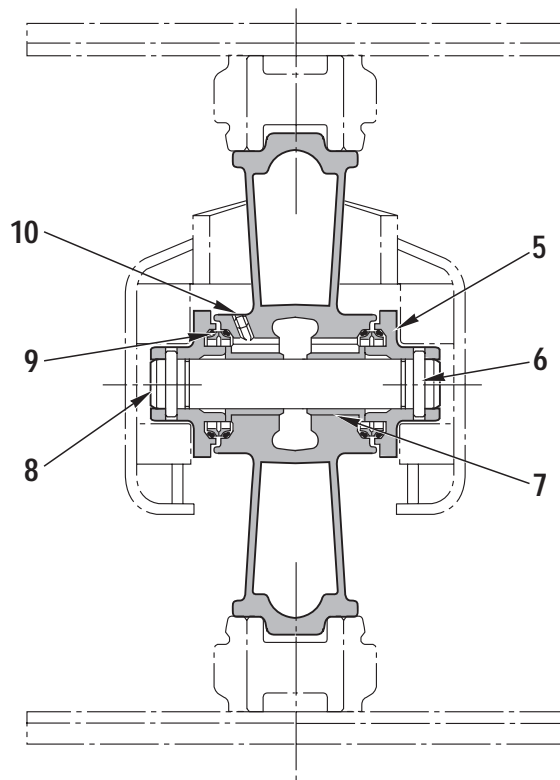
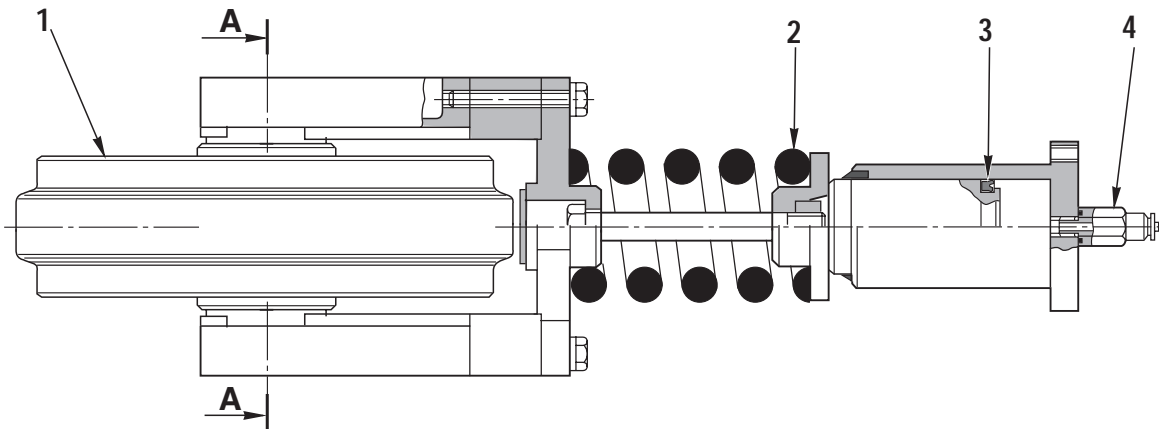
TRACK FRAME



RKP08120

- 1. Idler
- 2. Track frame
- 3. Carrier roller
- 4. Sprocket
- 5. Track roller (No. 5)
- 6. Track shoe
- 7. Guard
- 8. Final drive
- 9. Idler cushion
- 10. Recoil spring

IDLER AND RECOIL SPRING



RKP08130

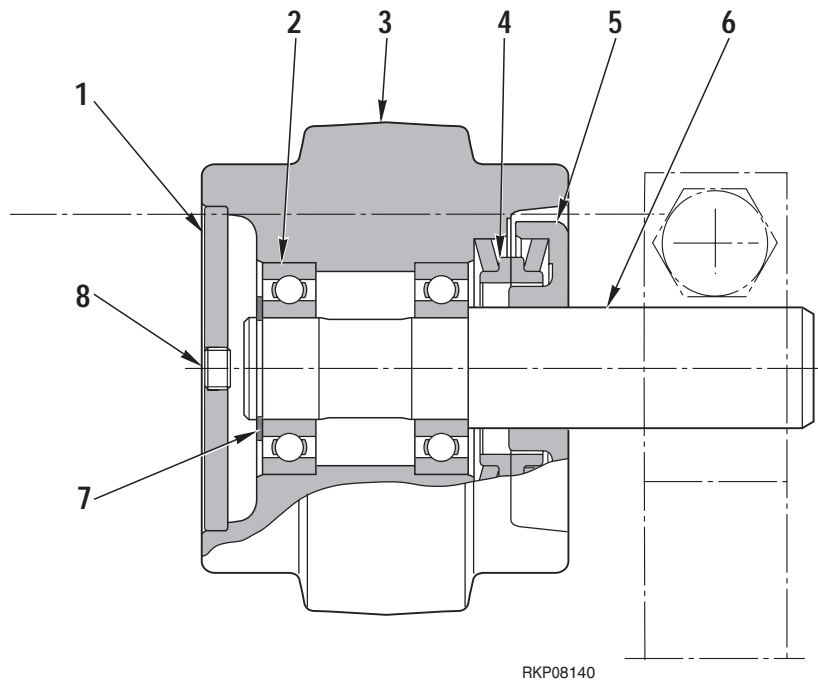
- 1. Idler
- 2. Recoil spring
- 3. Packing
- 4. Lubricator
- 5. Support
- 6. Spring pin

- 7. Bushing
- 8. Shaft
- 9. Floating seal
- 10. Plug

SPECIFICATIONS

Amount of oil: 600 cc

CARRIER ROLLER



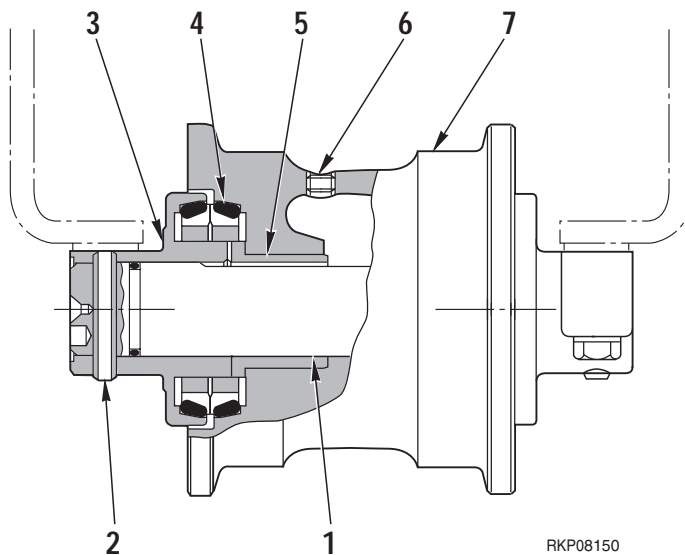
- 1. Cover
- 2. Bearing
- 3. Roller
- 4. Seal
- 5. Ring
- 6. Shaft
- 7. Snap ring
- 8. Lubricating plug

SPECIFICATIONS

Amount of oil: 120 cc

RKP08140

TRACK ROLLER



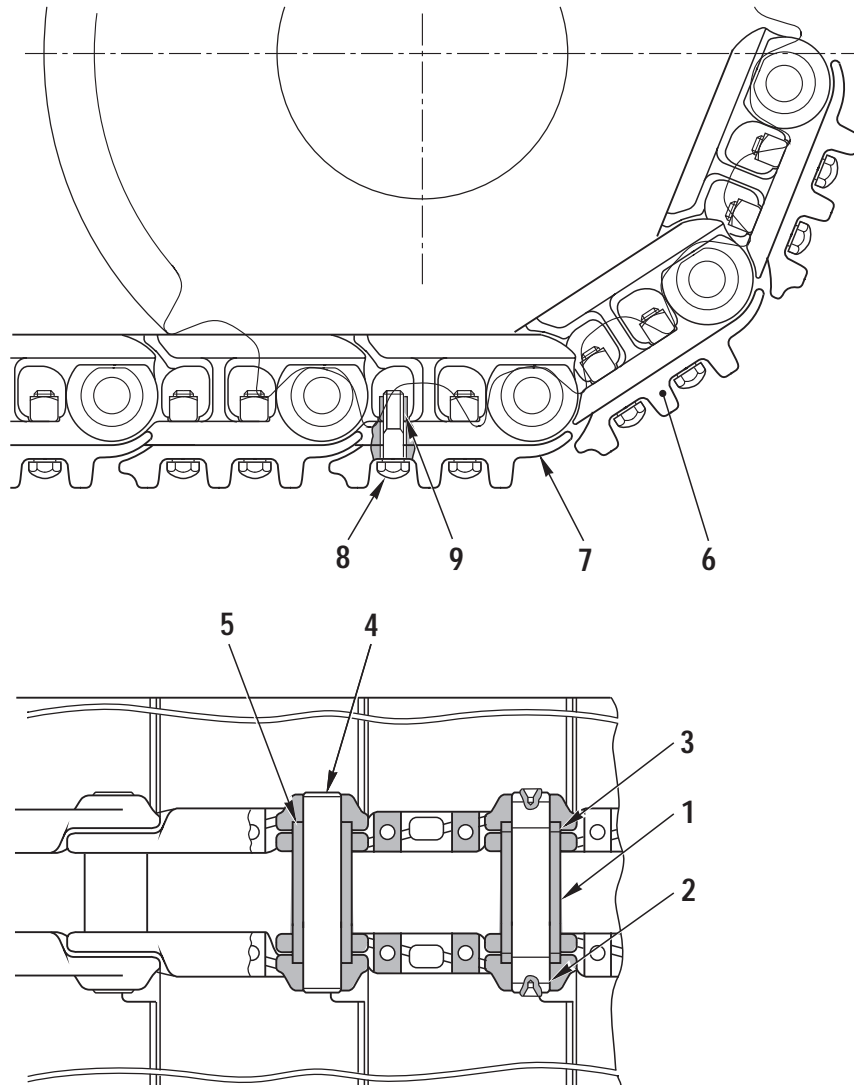
- 1. Shaft
- 2. Pin
- 3. Support
- 4. Seal
- 5. Bushing
- 6. Lubricating plug
- 7. Roller

SPECIFICATIONS

Amount of oil: 250 cc

RKP08150

TRACK SHOE



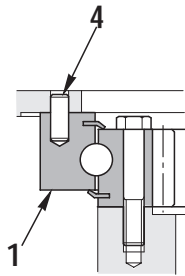
RKP08160

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

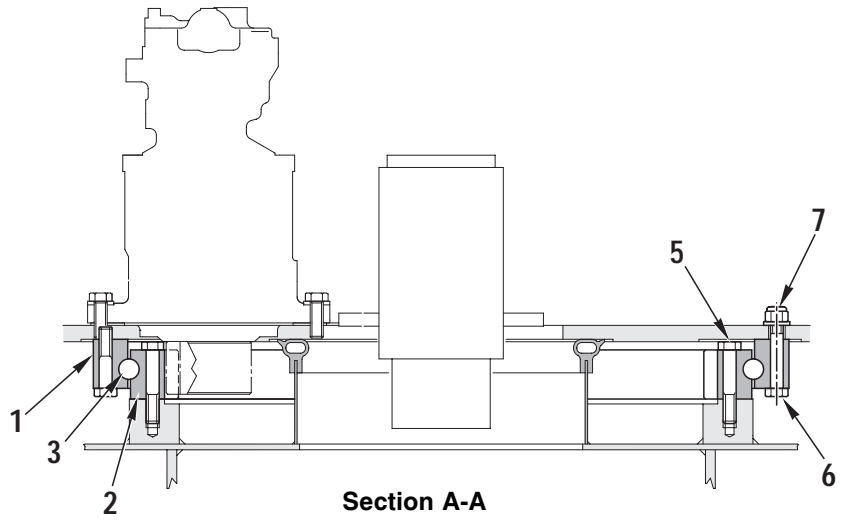
STANDARD SHOE

Width: 450 mm (17.73 in.)
Link pitch: 140 mm (5.516 in.)

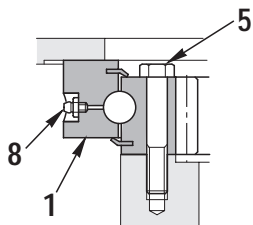
SWING CIRCLE



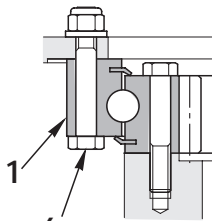
Section B-B



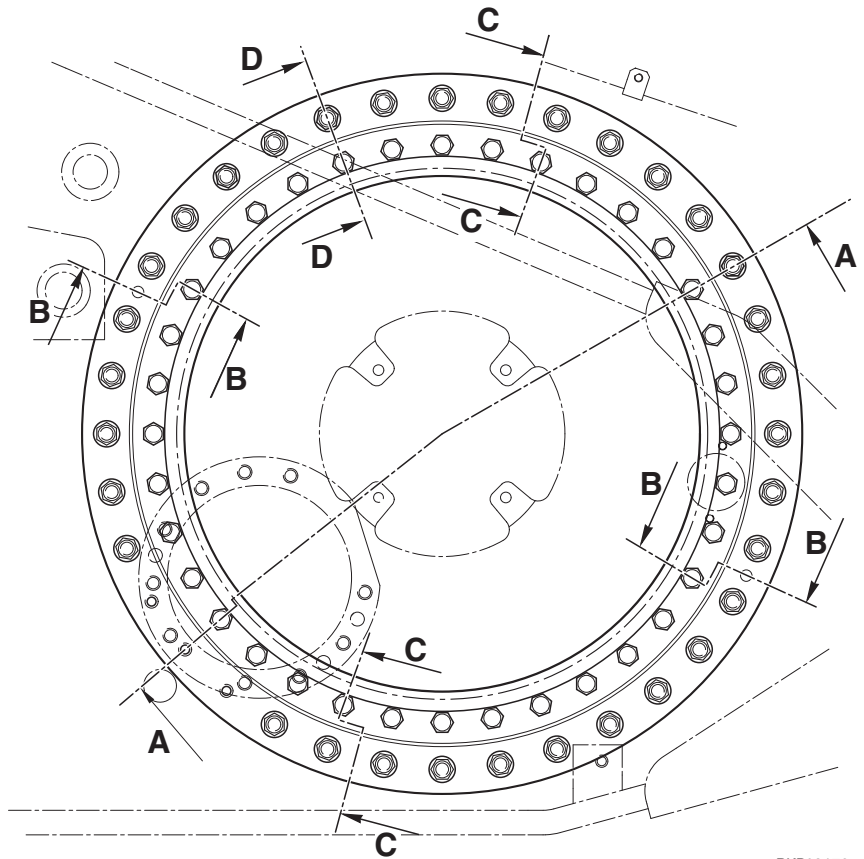
Section A-A



Section C-C



Section D-D



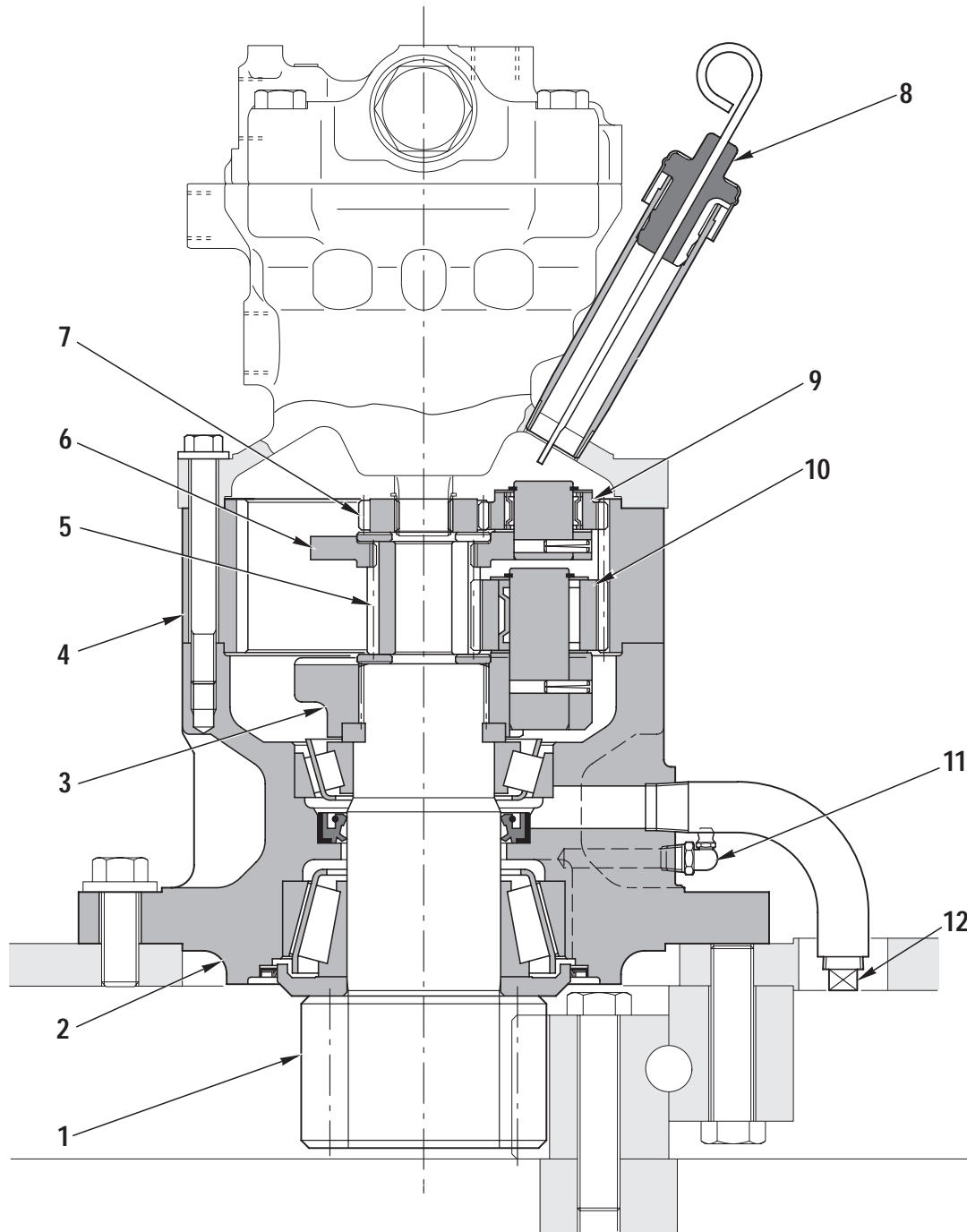
RKP08170

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

SPECIFICATIONS

Reduction ratio: $81/10 = 8.1$

SWING MACHINERY



RKP08180

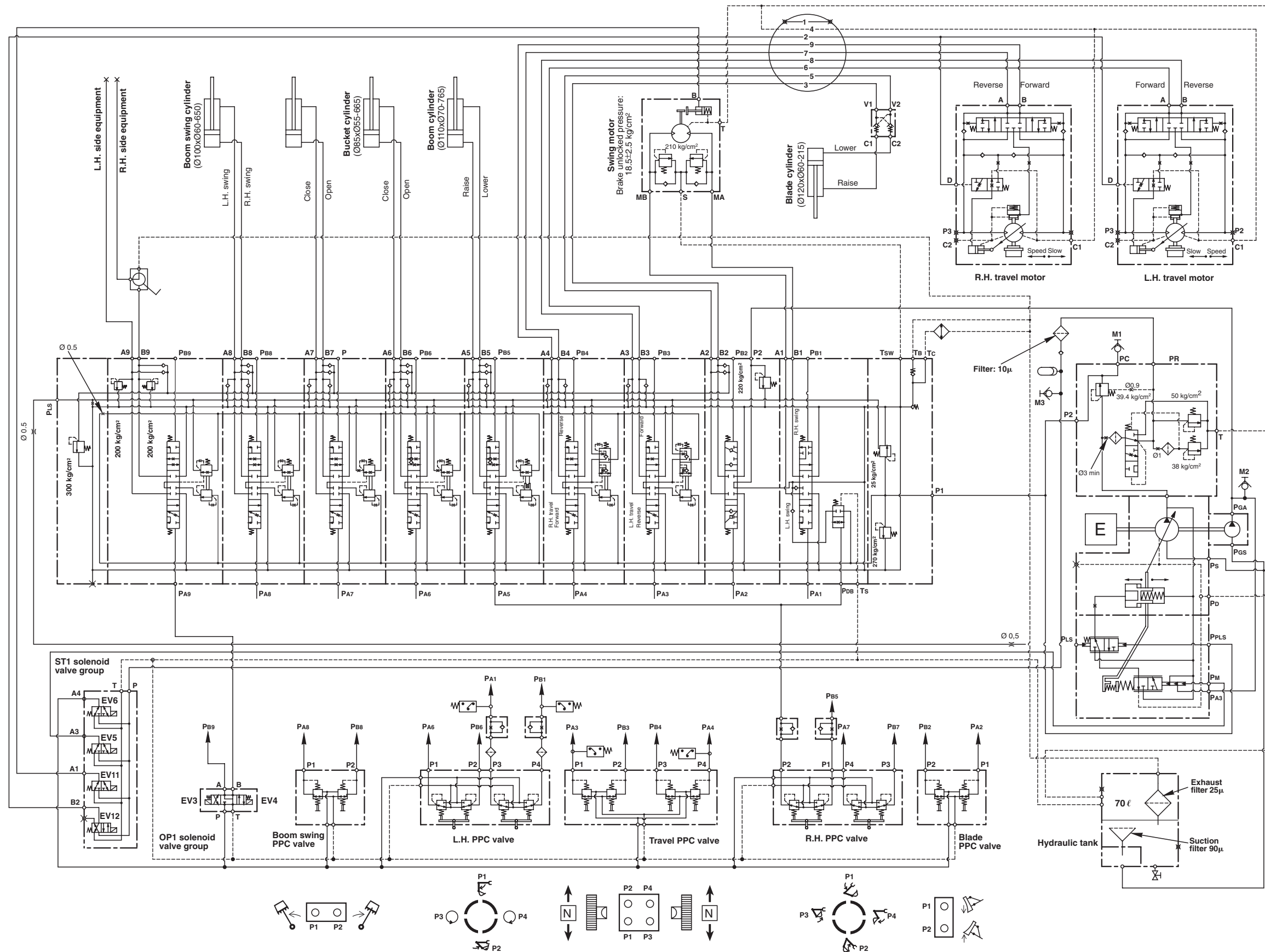
- 1. Swing pinion (Z = 10)
- 2. Housing
- 3. No. 2 planetary carrier
- 4. Ring gear (Z = 68)
- 5. No. 2 sun gear (Z = 19)
- 6. No. 1 planetary carrier
- 7. No. 1 sun gear (Z = 22)
- 8. Level gauge
- 9. No. 1 planetary gear (Z = 23)

- 10. No. 2 planetary gear (Z = 24)
- 11. Bearing lubricator nipple
- 12. Drain plug

SPECIFICATIONS

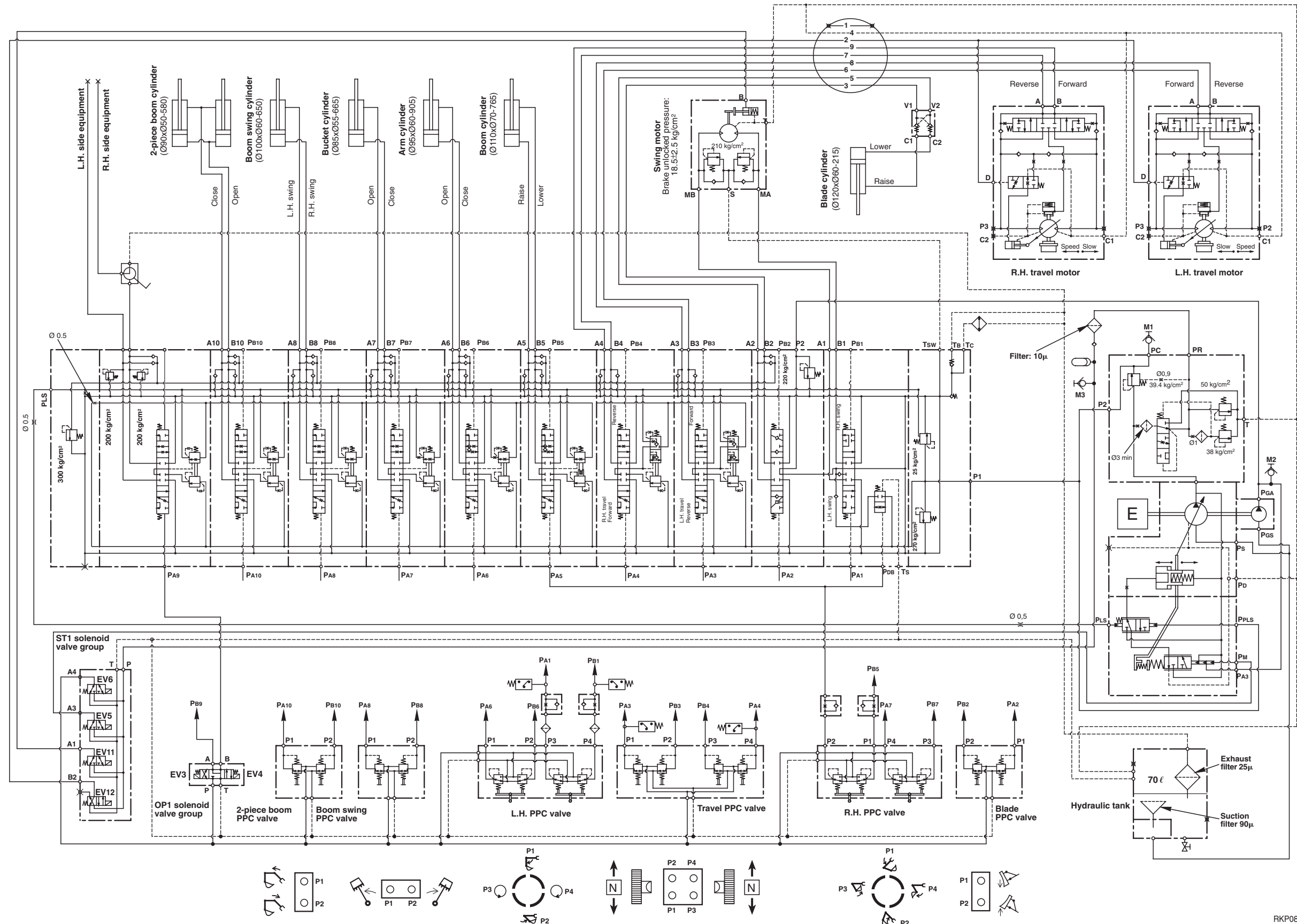
Reduction ratio: $\frac{22 + 68}{22} \times \frac{19 + 68}{19} = 18.732$

HYDRAULIC CIRCUIT DIAGRAM (STANDARD)



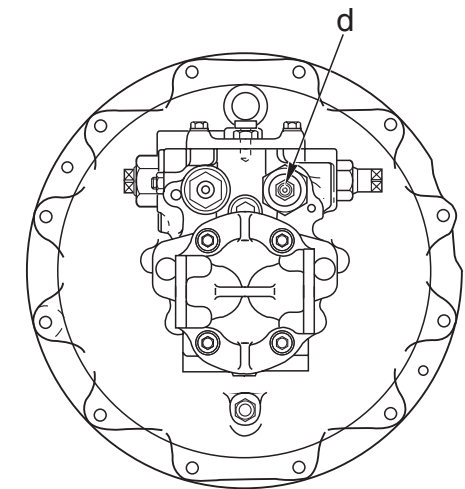
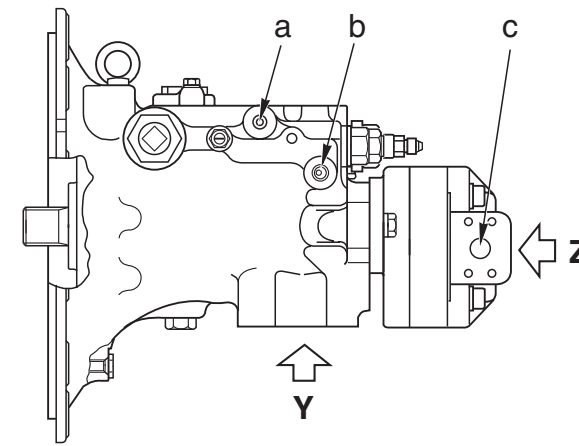
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HYDRAULIC CIRCUIT DIAGRAM (2-PIECE BOOM)

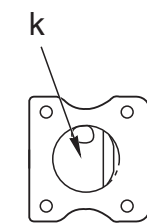
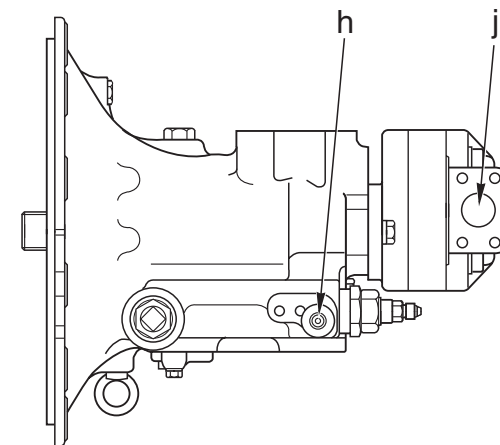
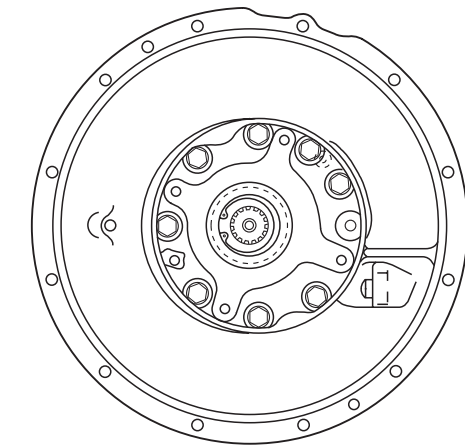
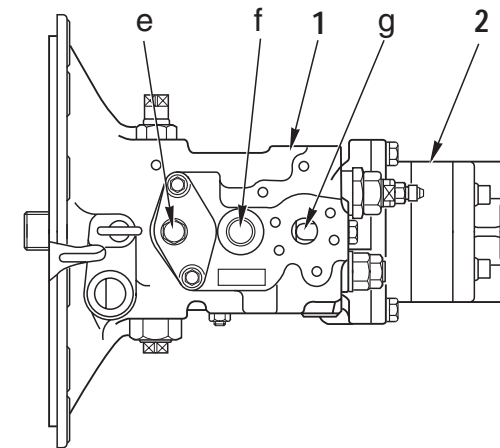


RKP08202

HYDRAULIC PUMP



View Z

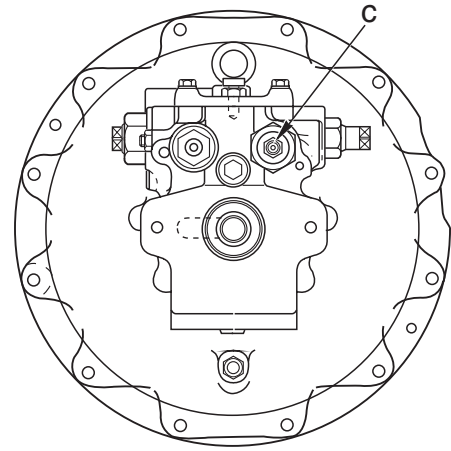
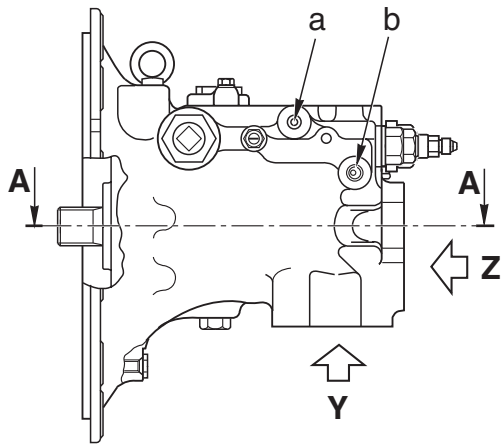


View Y

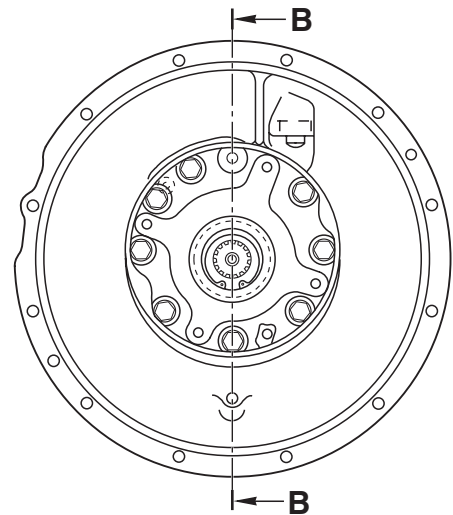
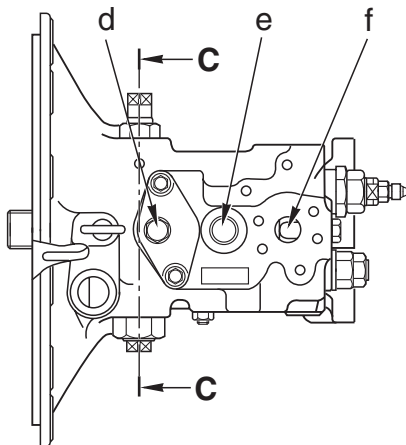
RKP08210

- | | | | |
|--------------|--------------------------------------------------------------------------|-------------------|---------------------------------------|
| a. PPLS Port | - From control valve (PLS Port) | g. PA Port | - To servocontrol feed unit (P1 Port) |
| b. PLS Port | - From control valve (P1 Port) and from servocontrol feed unit (P2 Port) | h. PA3 Port | - From gear pump (PGA Port) |
| c. PGA Port | - From control valve (P2 Port) | j. Pgs Port | - From hydraulic tank |
| d. PM Port | - From ST1 solenoid valve group (A3 Port) | k. Ps Port | - From hydraulic tank |
| e. PDA Port | - Air breeder Port | | |
| f. PD Port | - Main pump drain | | |
| | | 1. Hydraulic pump | |
| | | 2. Gear pump | |

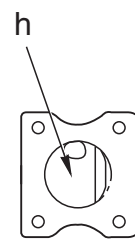
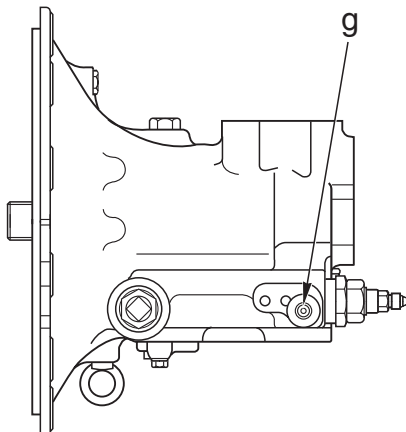
1. MAIN HYDRAULIC PUMP



View Z



View Z

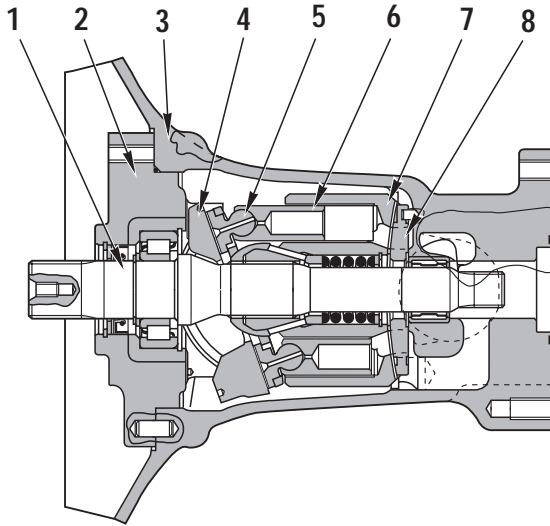


View Y

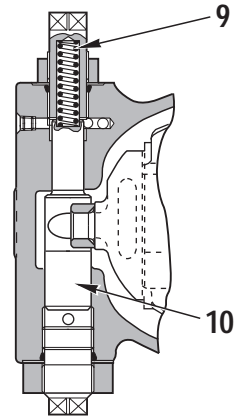
RKP08220

- a. Ps Port - From hydraulic tank
- b. PdA Port - Air breeder Port
- c. Pd Port - Main pump drain
- d. PA Port - To servocontrol feed unit
- e. PLs Port - From control valve (PLs Port)

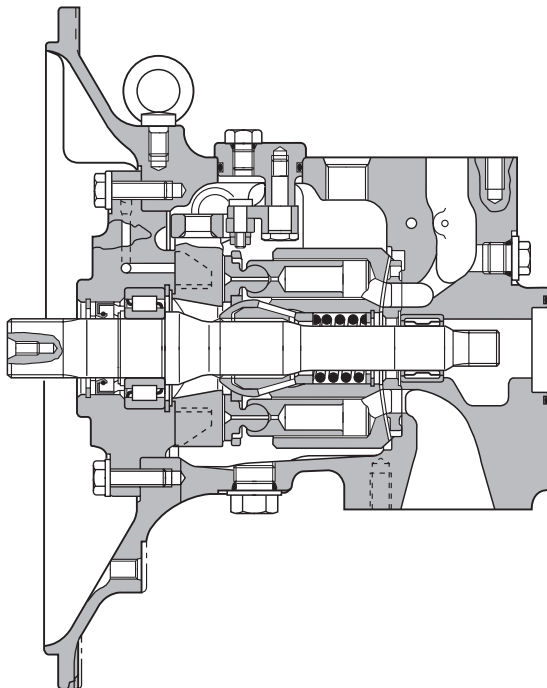
- f. PPLs Port - From control valve (P1 Port) and from servocontrol feed unit (P2 Port)
- g. PA3 Port - From gear pump (PGA Port)
- h. PM Port - From ST1 solenoid valve group (A3 Port)



Section A-A



Section C-C



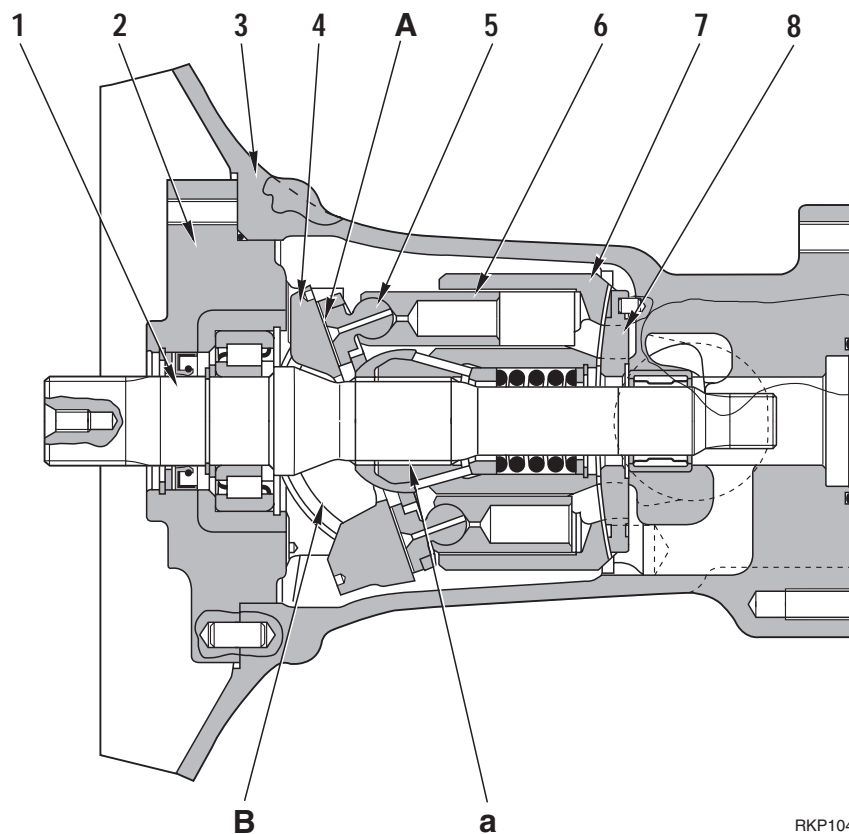
Section B-B

RKP08230

- | | |
|---------------|-------------------|
| 1. Shaft | 6. Piston |
| 2. Cradle | 7. Cylinder block |
| 3. Case | 8. Valve plate |
| 4. Rocker cam | 9. Spring |
| 5. Shoe | 10. Servo piston |

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.



RKP10430

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.

- 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.

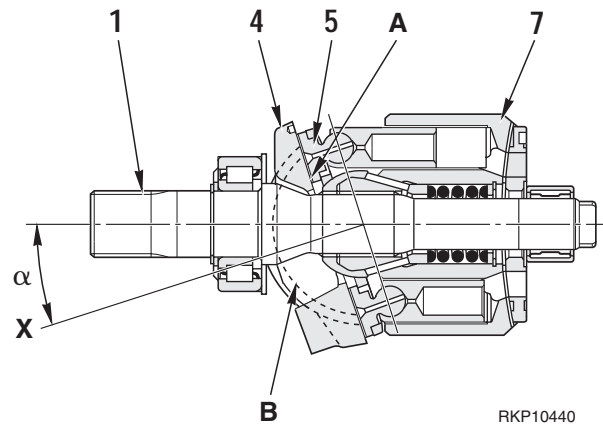
In the mean time, the capacity of the chamber F increases, and the oil is sucked at this process.

(The figure shows the state of the pump when suction of the chamber F and discharge of the chamber E have completed).

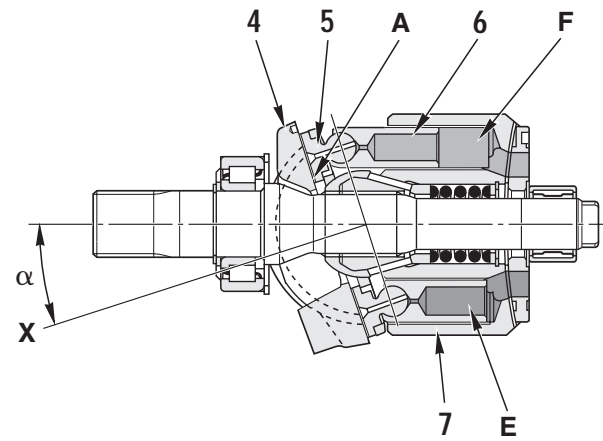
- 3 - When the center line X of the rocker cam (4) becomes in line with the axial direction of the cylinder block (7) (swash plate angle = 0), the difference between capacities of E and F inside the cylinder block (7) becomes 0. so the pump does not carry out any suction or discharge action of oil.

(In actual fact, the swash plate angle never becomes 0).

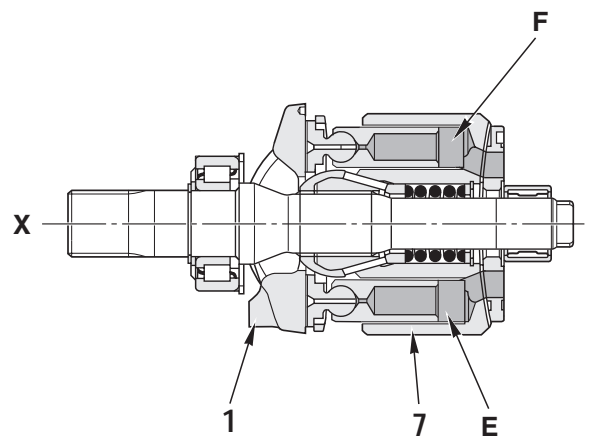
- 4 - In other words, discharge amount of the pump is directly proportional to the swash plate angle « α ».



RKP10440



RKP10450



RKP10460

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 (10).

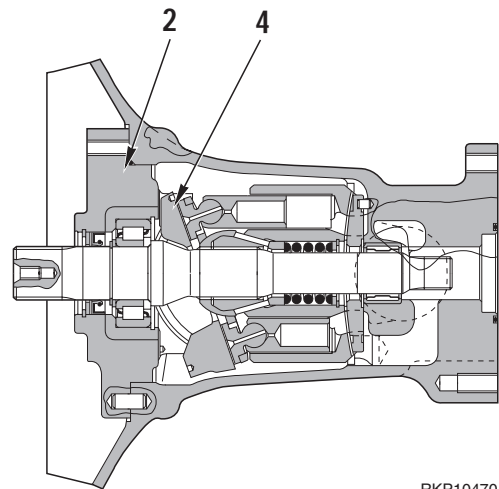
- The servo piston (10) moves in a linear reciprocating motion (\updownarrow) under the signal pressure of **PC** and **LS** valve.

This linear motion is transmitted 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 (\updownarrow).

- The upper and lower pressure receiving area of the servo piston (10) are different from each other, and to the pressure chamber of the smaller piston side (upper), discharge pressure (self pressure) **PP** of the main pump is always introduced.

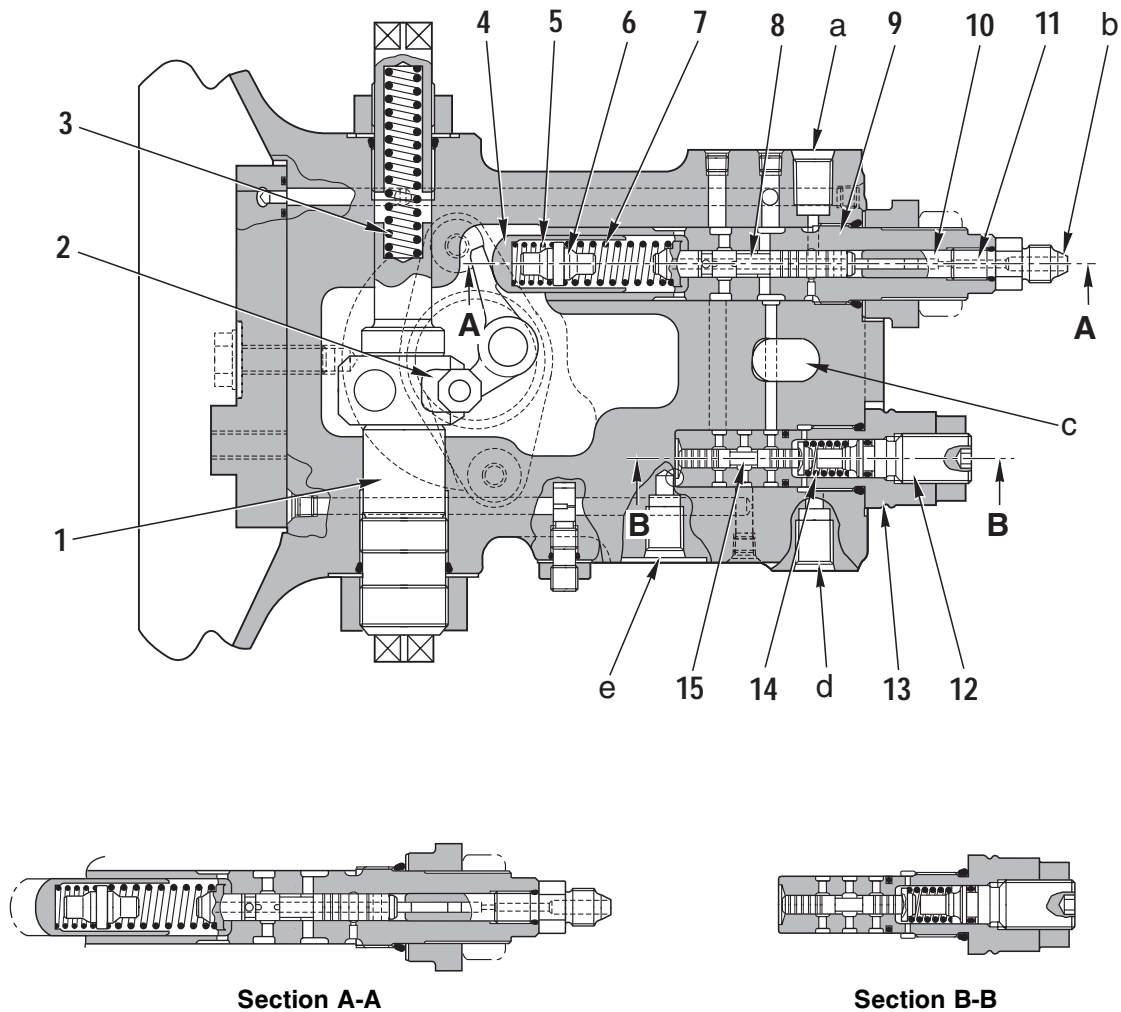
To the pressure chamber of the larger piston side (lower), output pressure **PEN** of the **LS** valve is introduced.

Movement of the servo piston (10) is controlled by the relationship between pressures **PP** and **PEN** and the proportion of the pressure receiving areas of the smaller and larger pistons.



RKP10470

2. PC VALVE, LS VALVE, SERVO PISTON



- a. PA3 Port - From gear pump (PGA Port)
- b. PM Port - From ST1 solenoid valve group (A3 Port)
- c. PA Port - To servocontrol feed unit (P1 Port)
- d. PLS Port - From control valve (P1 Port) and from servocontrol feed unit (P2 Port)
- e. PLS Port - From control valve (PLS Port)

SERVO PISTON

- 1. Servo piston
- 2. Lever
- 3. Spring

PC VALVE

- 4. Piston
- 5. Spring
- 6. Seat
- 7. Spring
- 8. Piston
- 9. Sleeve
- 10. Piston
- 11. Union

LS VALVE

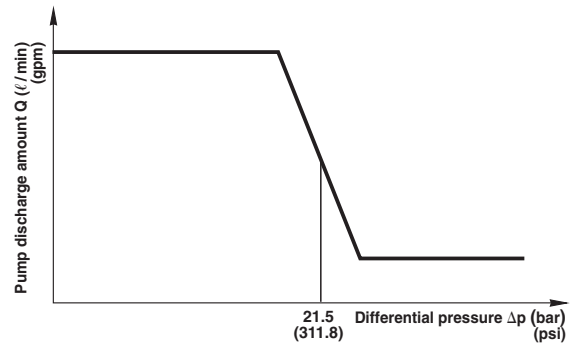
- 12. Plug
- 13. Sleeve
- 14. Spring
- 15. Piston

RKP08240

LS VALVE

FUNCTION

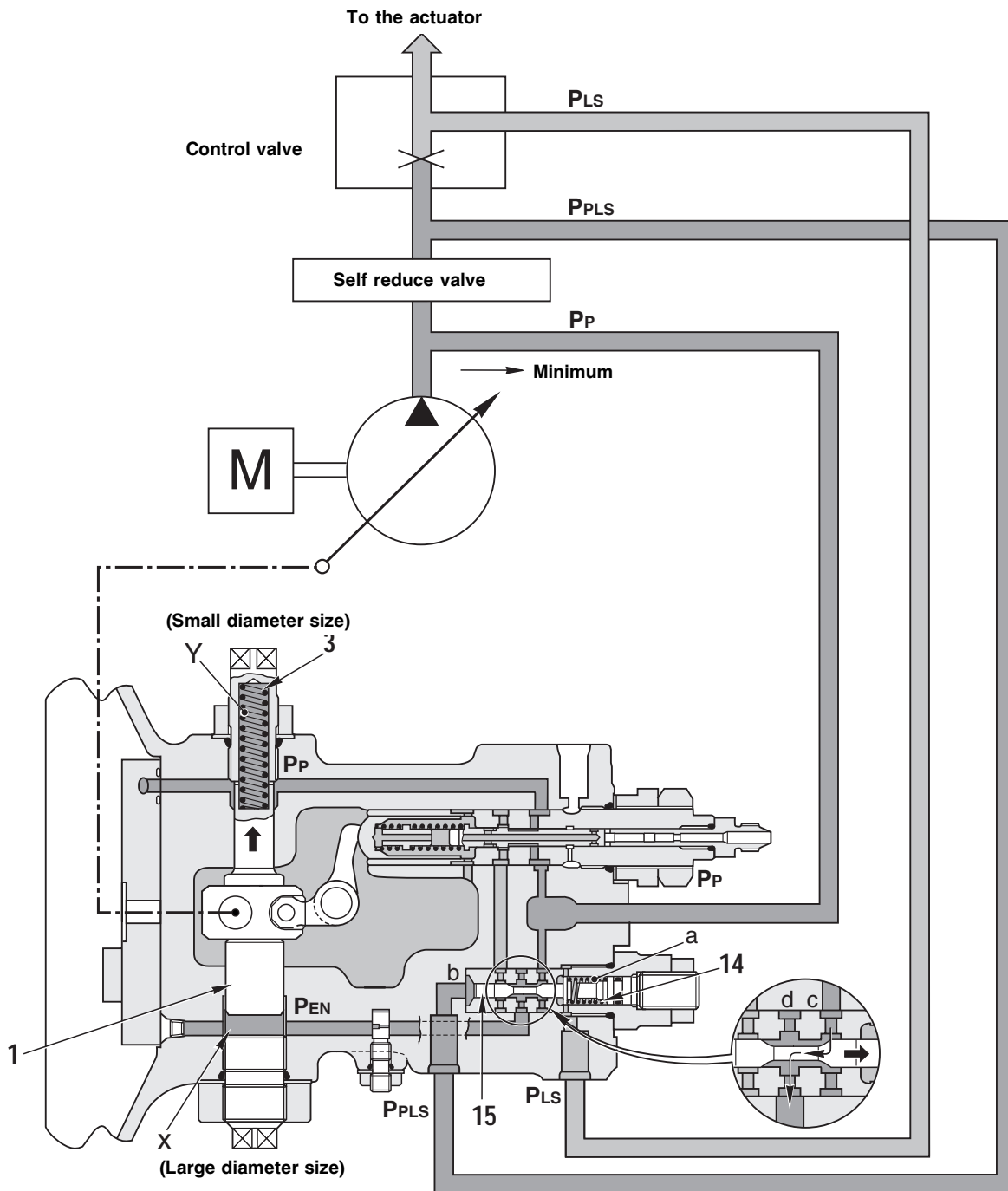
- The **LS** valve control the pump discharge according to the stroke of the control lever, in other words, the flow demand of the actuator.
- The **LS** valve detects the flow demand of the actuator from the differential pressure ΔP_{LS} of the discharge amount of the main pump P_{PLS} (from self valve) and the outlet pressure of the control valve P_{LS} , and controls the discharge amount Q of the main pump. (P_{PLS} , P_{LS} and ΔP_{LS} are the pump pressure, **LS** pressure and **LS** differential pressure respectively).
- In other words, the **LS** valve detects the pressure loss (**LS** differential pressure ΔP_{LS}) generated according to pump flow passing through the opening area of the spool of the control valve, and controls the discharge amount Q of the pump so that the pressure loss becomes constant. Thus, the discharge amount of the pump is kept proper for the demand of the control valve.
- To the **LS** valve, the pump pressure (from self reduce valve) P and **LS** pressure P_{LS} are introduced. The relationship between the **LS** differential pressure ΔP_{LS} and the pump discharge amount Q changes as shown in the right chart.



RKP08251

OPERATION

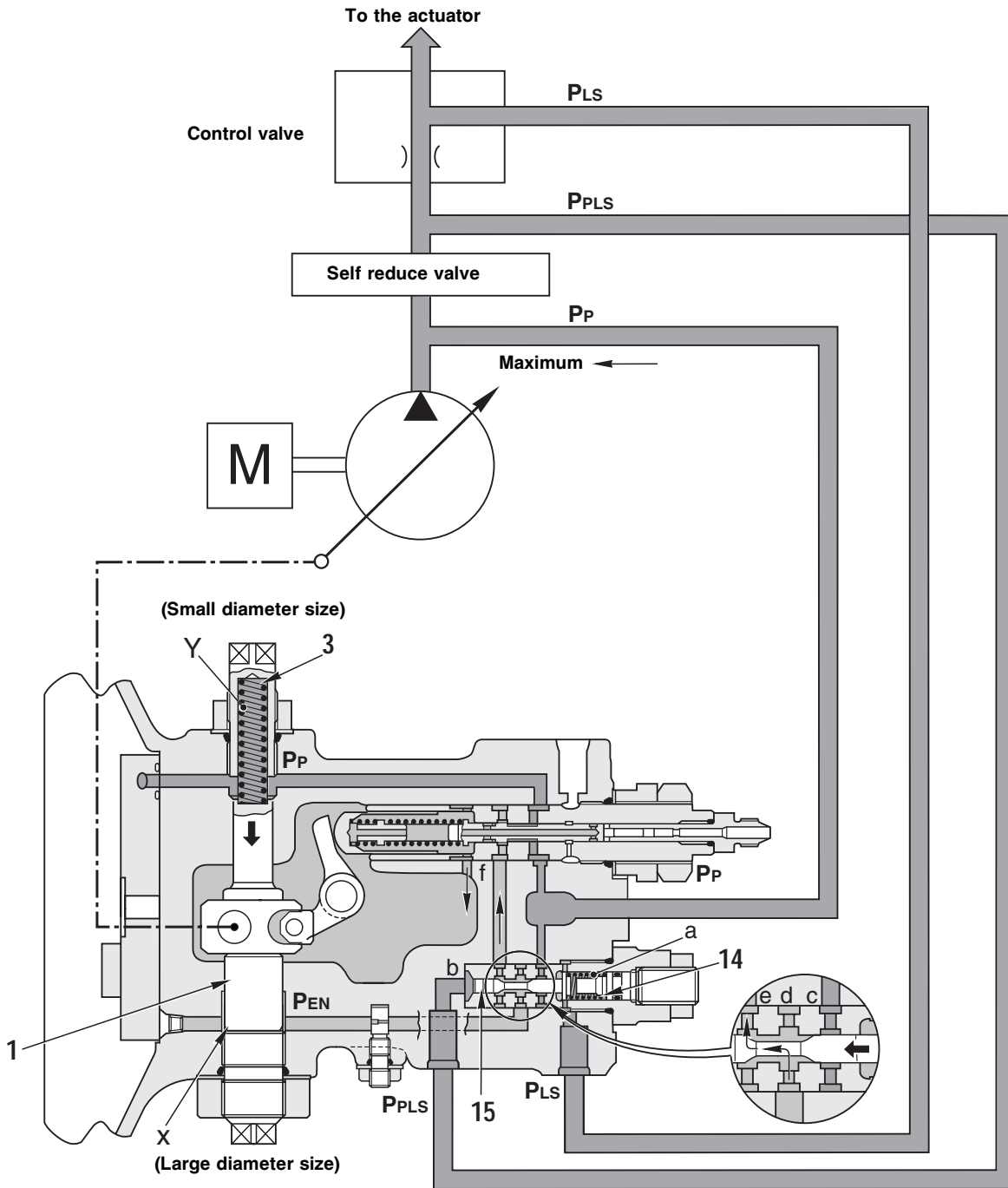
1. When the control valve is at «NEUTRAL» position



RKP08260

- To the spring chamber **a** of the **LS** valve, **LS** pressure **PLs** is introduced from the outlet of the control valve, and to the chamber **b** at the end of the sleeve on the opposite side, pump pressure **PPLs** is introduced through the self reduce valve.
- Position of the piston (15) is determined by the combined force of **LS** pressure **PLs** and force of the spring (14) and the volume of the pump pressure **PPLs**.
- Before the engine is started, the servo piston (1) is pushed to the lower direction (swash plate angle max. side) by the spring (3).
- When the engine is started, if all the control valves are at the «NEUTRAL» positions, the **LS** pressure **PLs** becomes 0 cm/cm² (0 bar (0 psi)) because no pressure oil flows to the outlet side of the control valve.
(The spring chamber **a** is open to the drain circuit through the spool of the control valve).
At the same time, the pump pressure **PPLs** is maintained at the unload pressure of approx. 27 cm/cm² (26 bar (377 psi)).
- Therefore, the piston (15) 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 **X** at the large diameter side of the servo piston from the Port **d**.
- Though the pump pressure **PP** is always introduced to the chamber **Y** of the small diameter side of the servo piston (1), because the force to the large diameter side is larger due to the difference of the areas at two ends of the servo piston (1), the servo piston (1) is moved to the minimum swash plate angle side (↑).

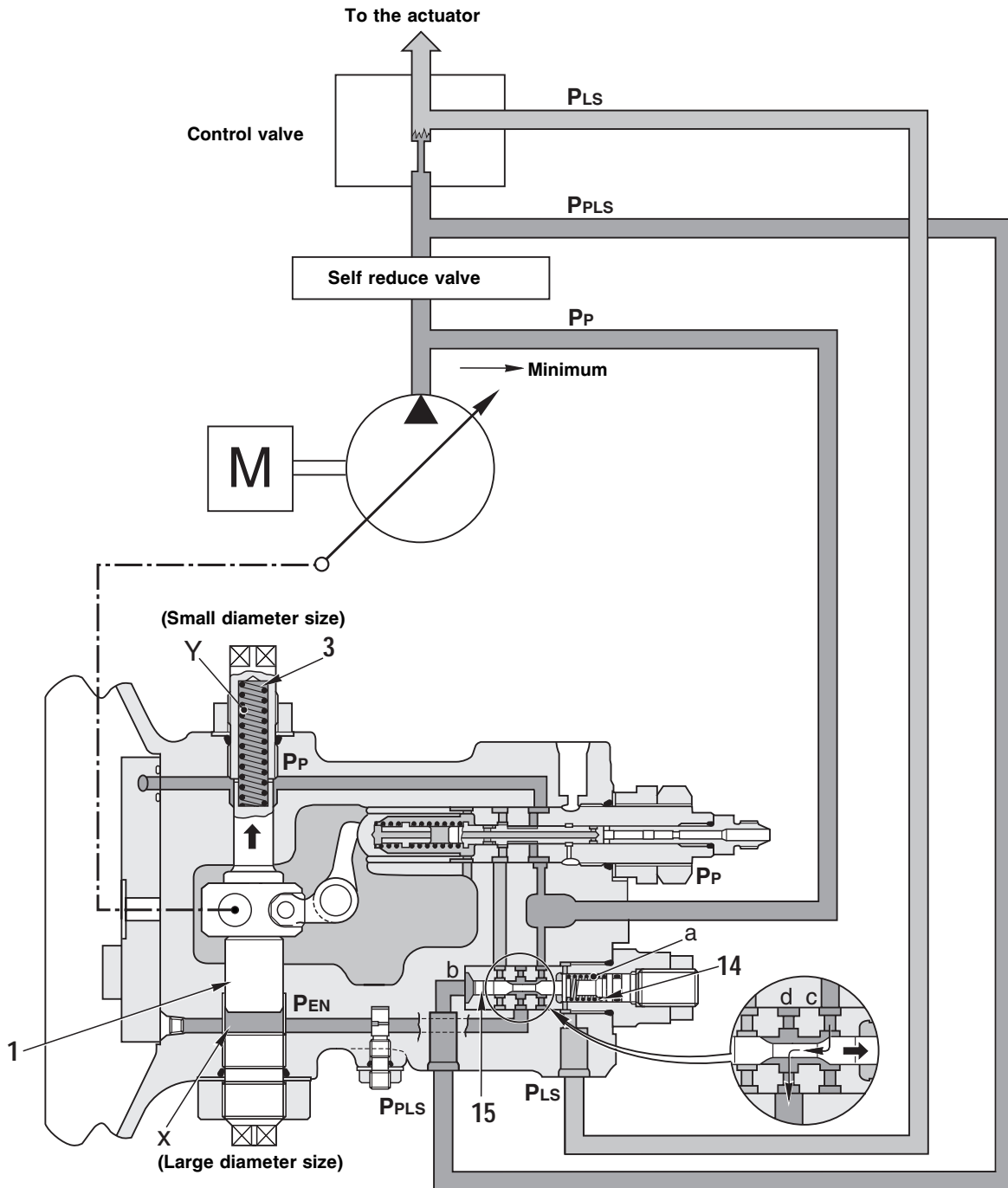
2. When the opening of the control valve is large (lever stroke large)



RKP08270

- 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 P_{PLS} and the **LS** pressure P_{LS} (**LS** differential pressure ΔP_{LS}) becomes smaller.
- **LS** pressure P_{LS} introduced to the spring chamber **a** of the **LS** valve becomes more or less the same as the pump pressure P_{PLS} and the piston (15) is pushed to the left side (←) by the combined force of the **LS** pressure and the spring (14), closing the Port **c** and forming a path between the Ports **d** and **e**.
- Therefore, the pressure oil functioning to the chamber **X** at the large diameter side of the servo piston (1) flows to the Port **e** from the Port **d**, and then to the Port **f** of the **PC** valve.
- At this time, since the Port **f** of the **PS** valve is open to the drain inside the pump case through the inside of the piston, pressure in the chamber **X** of the large diameter side of the servo piston also becomes to the drain pressure.
- By this, the servo piston (1) is moved to the max. swash plate angle side (↓) by the pump pressure P_P functioning to the chamber **Y** at the small diameter side.

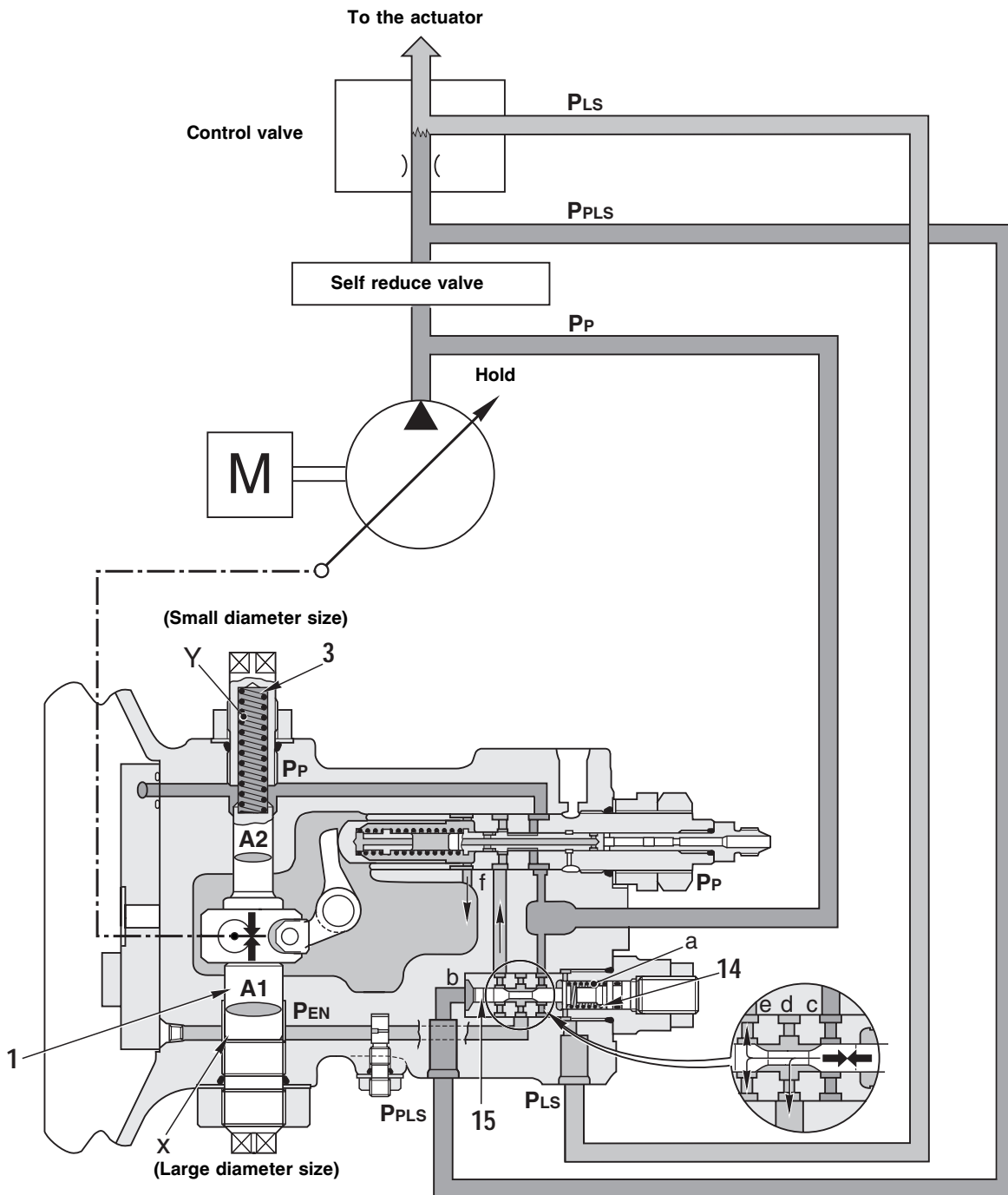
3. When the opening of the control valve is small (lever stroke small)



RKP08280

- When the control lever is fine-controlled or moved to the «NEUTRAL» position, in other words, as the opening area of the control valve becomes small, the difference of the pump pressure **P_{PLS}** and the **LS** pressure **P_{LS}** (**LS** differential pressure **ΔP_{LS}**) becomes larger.
- Function at this time is same as that at "1. When the control valve is at «NEUTRAL» position, that is, the pump pressure **P_{PLS}** pushes the piston (14) to the right side (→) and the servo piston (1) is moved to the minimum swash plate angle side. In other words, when the control valve is in the range from the «NEUTRAL» to the opening area small (fine control), if the **LS** differential pressure **ΔP_{LS}** is 21.5 cm/cm² (21 bar (304.6 psi)) (**LS** setting differential pressure of the **LS** valve) and above, the pump swash plate angle functions to the minimum side, and if the **LS** differential pressure **ΔP_{LS}** becomes below 21.5 cm/cm² (21 bar (304.6 psi)) when the control valve opening becomes larger, the pump swash plate angle functions to the maximum side.

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



RKP08390

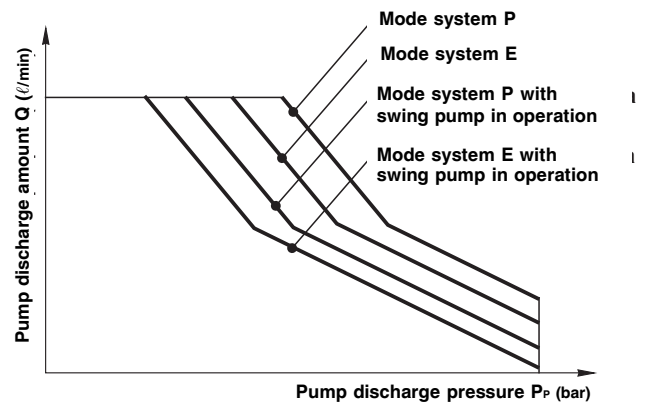
- Let us take the pressure receiving area at the large diameter side of the servo piston (1) as A_1 , pressure receiving area at the small diameter side as A_2 , pressure functioning to the large diameter side as P_{EN} , and the pressure to the small diameter side as P_P .
- When the pump flow rate reaches the flow demand of the control valve, the pump pressure P_{PLS} functioning to the Port **b** of the **LS** valve balances with the combined force of the **LS** pressure P_{LS} functioning to the spring chamber **a** and the spring (14), and the piston (15) stops at the center position.
- By this, Ports **c**, **d** and **e** open almost equally, and while flowing to the Port **d**, a part of the pump pressure from the Port **c** also flows into the chamber **X** at the large diameter side of the servo piston (1) after reduced to about half pressure by partially drained into the tank case from the Port **e**.
- At this time, because the relationship of the pressure receiving areas on the servo piston (1) is $A_2 : A_1 = 1 : 2$, the pressure functioning to two ends of the servo piston (1) becomes $P_P : P_{EN} = 2 : 1$, so the forces to the two ends of the servo piston (1) becomes $1 : 1$, and the servo piston (1) stops at the position, balancing the flow demand of the control valve and the pump discharge.
- Spring force is so adjusted that the piston (15) is balanced when $P_{PLS} - P_{LS} = \Delta P_{LS} = 21.5 \text{ cm/cm}^2$ (21 bar (304.6 psi)).
- In other words, the pump discharge is maintained as the opening area of the control valve by maintaining the **LS** differential pressure ΔP_{LS} as 21.5 cm/cm^2 (21 bar (304.6 psi)) because when the opening area of the control valve is $1/2$, the pump swash plate angle becomes $1/2$, and when the opening area is $1/4$, then the pump swash plate angle becomes also $1/4$.
- For example, if the opening of the control valve is moved to $3/4$ after the piston balanced with the opening of $1/4$, the **LS** differential pressure ΔP_{LS} once lowers.
So, the **LS** valve is activated to increase the pump discharge, and when the pump swash plate angle rises to $3/4$, since the **LS** differential pressure ΔP_{LS} rises to 21.5 cm/cm^2 (21 bar (304.6 psi)), the piston is balanced at this point.

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PC VALVE (Power Control)

FUNCTION

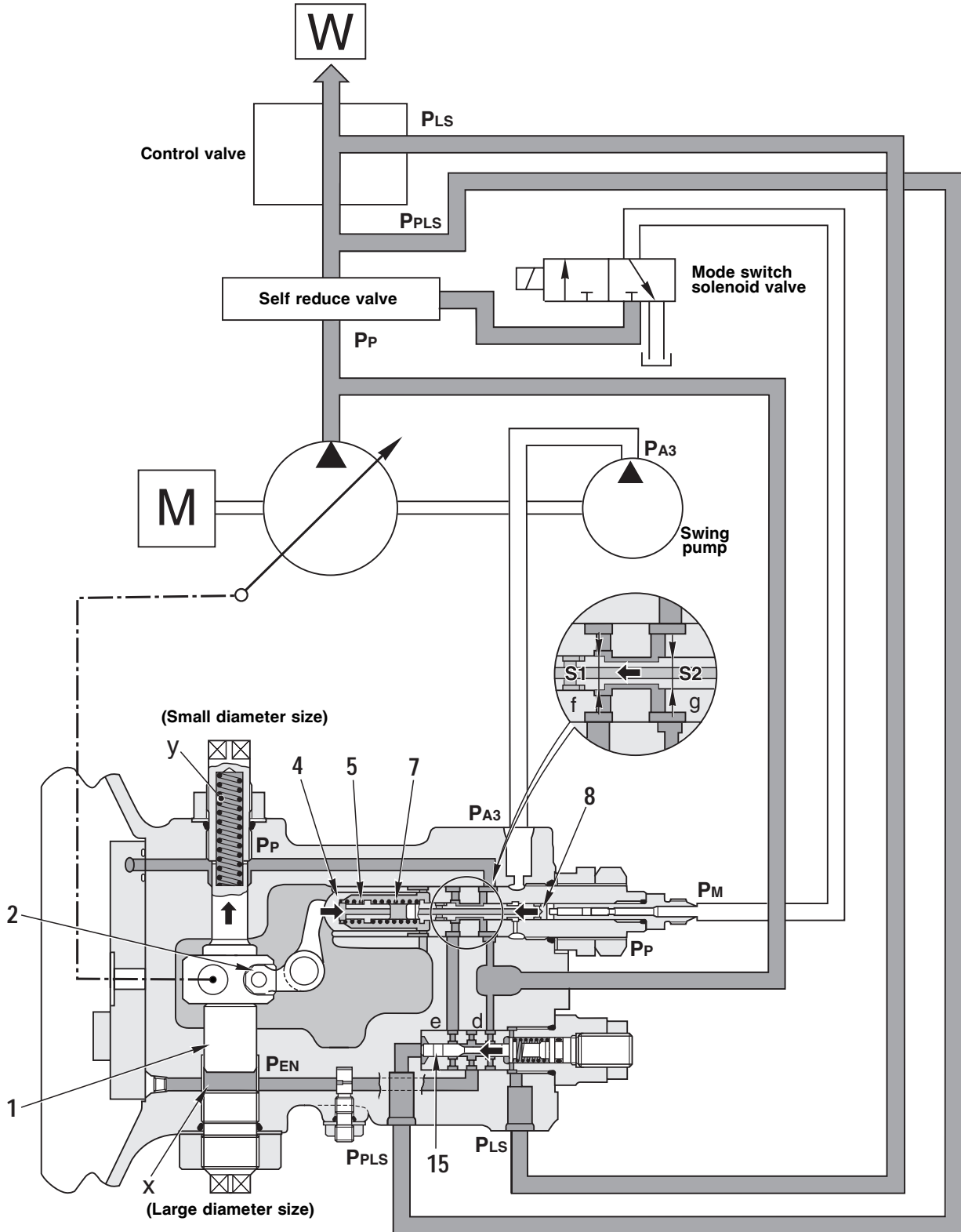
- The **PC** valve carries out an approximate equal horse-power control so that the hydraulic horse-power sucked by the pump does not exceed the engine horse-power by limiting the discharge amount **Q** to a specified amount in relation with the discharge pressure **P_P**, even if the **LS** valve tries to increase the pump discharge amount **Q** when the discharge pressure **P_P** 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 **P_P** rises, the **PC** valve reduces the pump discharge amount **Q**, and when the pump discharge pressure **P_P** lowers, it increases the pump discharge amount **Q**.
- Relationship between the pump discharge pressure **P_P** 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 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%).



RKP08400

FUNCTION

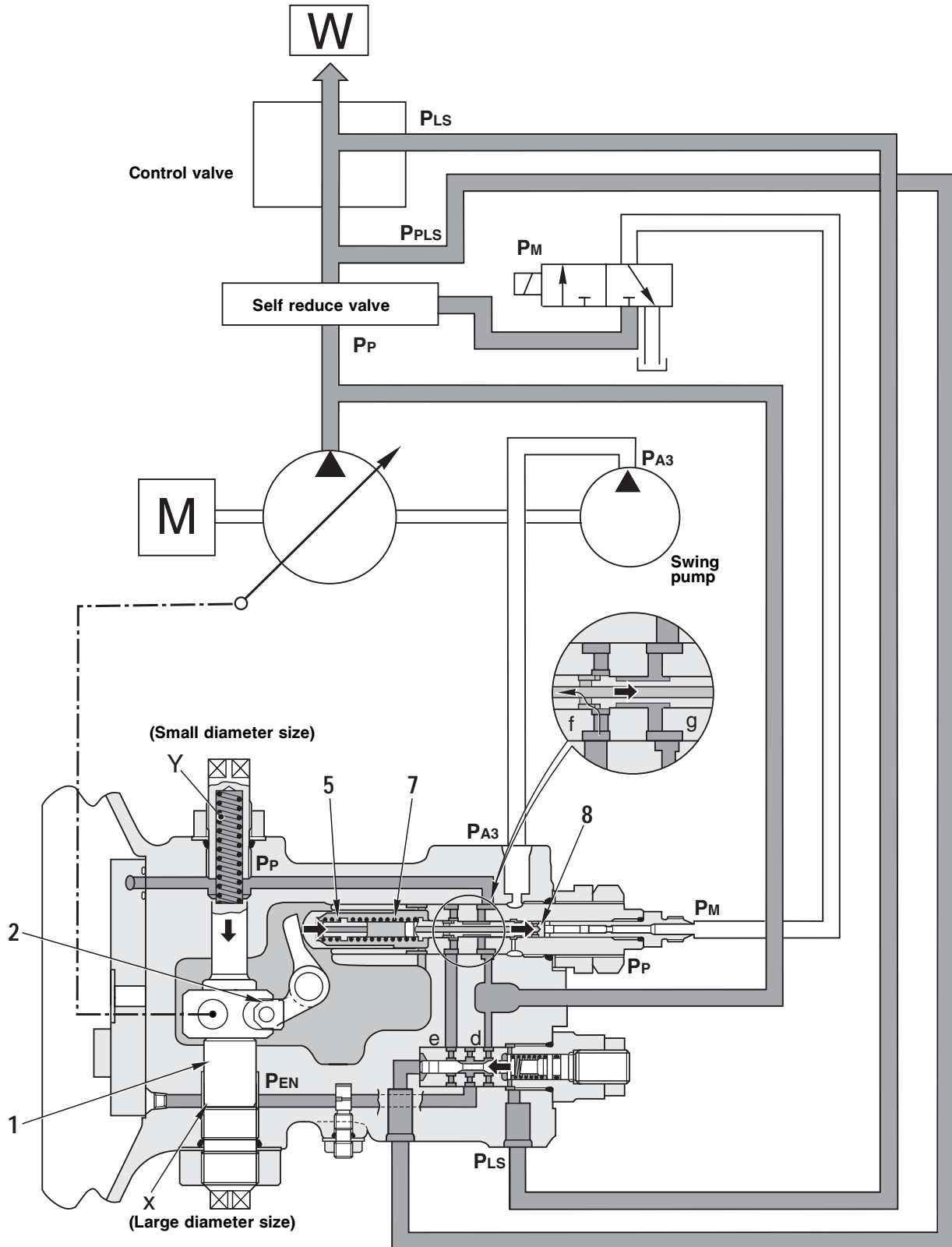
1. When load on the actuator is large (pump discharge pressure is high)



RKP08410

- When a load on the actuator is large and the pump discharge pressure P_P rises, the piston (8) is pushed to the left (\leftarrow) due to the relationship of the section areas of S_1 and S_2 of the piston ($S_1 > S_2$).
- By this action, path is formed between the Ports **f** and **g**, at the same time when the pump pressure P_P of flows to the Port **f** from the Port **g**, when the shut out Port **f** and drain circuit.
- If the **LS** valve works to increase the pump discharge amount, the spool (15) of the **LS** valve is shifted to the left side (\leftarrow) and the path is formed between the Ports **d** and **e**.
- Therefore, the pump pressure P_P from the Port **f** of the **PC** valve flows to the Port **d** from the Port **e** of the **LS** valve, enters into the chamber **X** at the large diameter side of the servo piston (1), and stops the movement of the servo piston (1).
- If the pump discharge pressure P_P rises further, the piston (8) moves to the left side (\leftarrow), and the servo piston (1) is shifted to the minimum swash plate angle side (\uparrow) by the pressure in the chamber **X** at the large diameter side.
- When the servo piston (1) is shifted to the upper (\uparrow), side, the piston (4) is shifted to the right (\rightarrow) side via the lever (2). Because of this, the springs (5) and (7) move to the contraction side, and push back the piston (8) to the right side.
- When the piston (8) is pushed back to the right and the path between the Ports **f** and **g** is shut out, the upward (\uparrow) movement of the servo piston is stopped.
- At this time, the stopping position of the servo piston (1) is higher (close to the minimum swash plate angle side) than that when the pump discharge pressure is lower.

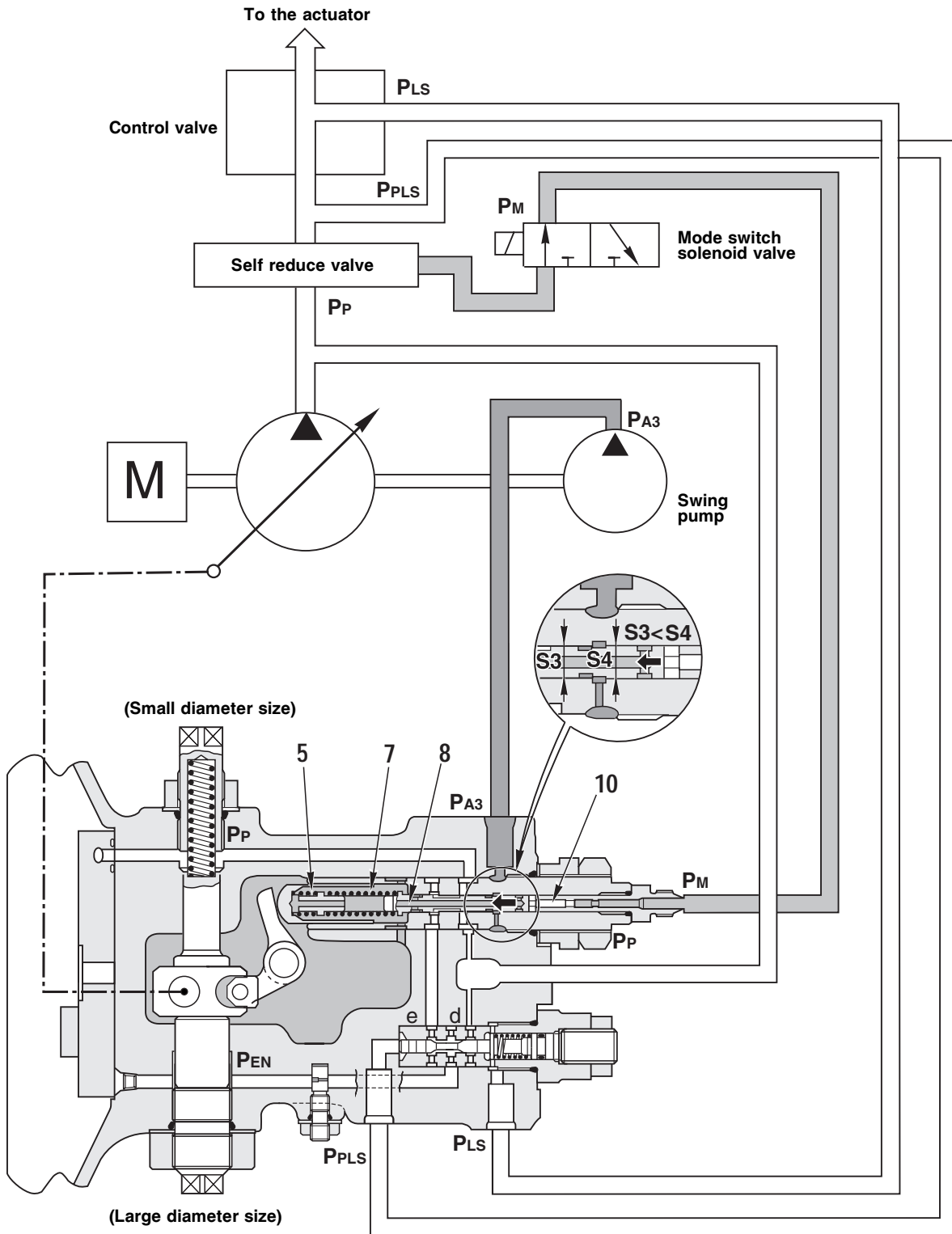
2. When load on the actuator becomes small (pump discharge pressure lowers)



RKP08420

- When the load on the actuator becomes small and the pump discharge pressure **PP** lowers, the piston (8) is pushed to the right (→) side by the spring force of the springs (5) and (7).
- By this action, at the same time when the path between the Ports **g** and **f** is shut out, the Port **f** becomes open to the drain circuit.
- At this time, if the **LS** valve is working to increase the pump discharge amount, because control of the **PC** valve becomes ineffective, pressure oil the chamber **X** of the large diameter side of the servo piston (1) flows from the Port **d** through the Port **e** of the **LS** valve and drains into the drain circuit from the Port **f** of the **PC** valve.
- Therefore, the servo piston (1) is shifted to the maximum swash plate angle (↓) side by the pressure **PP** in the chamber **Y** at the small diameter side.

3. When the signal pressure is inputted from the mode switch solenoid valve
When the swing is operated



RKP08430

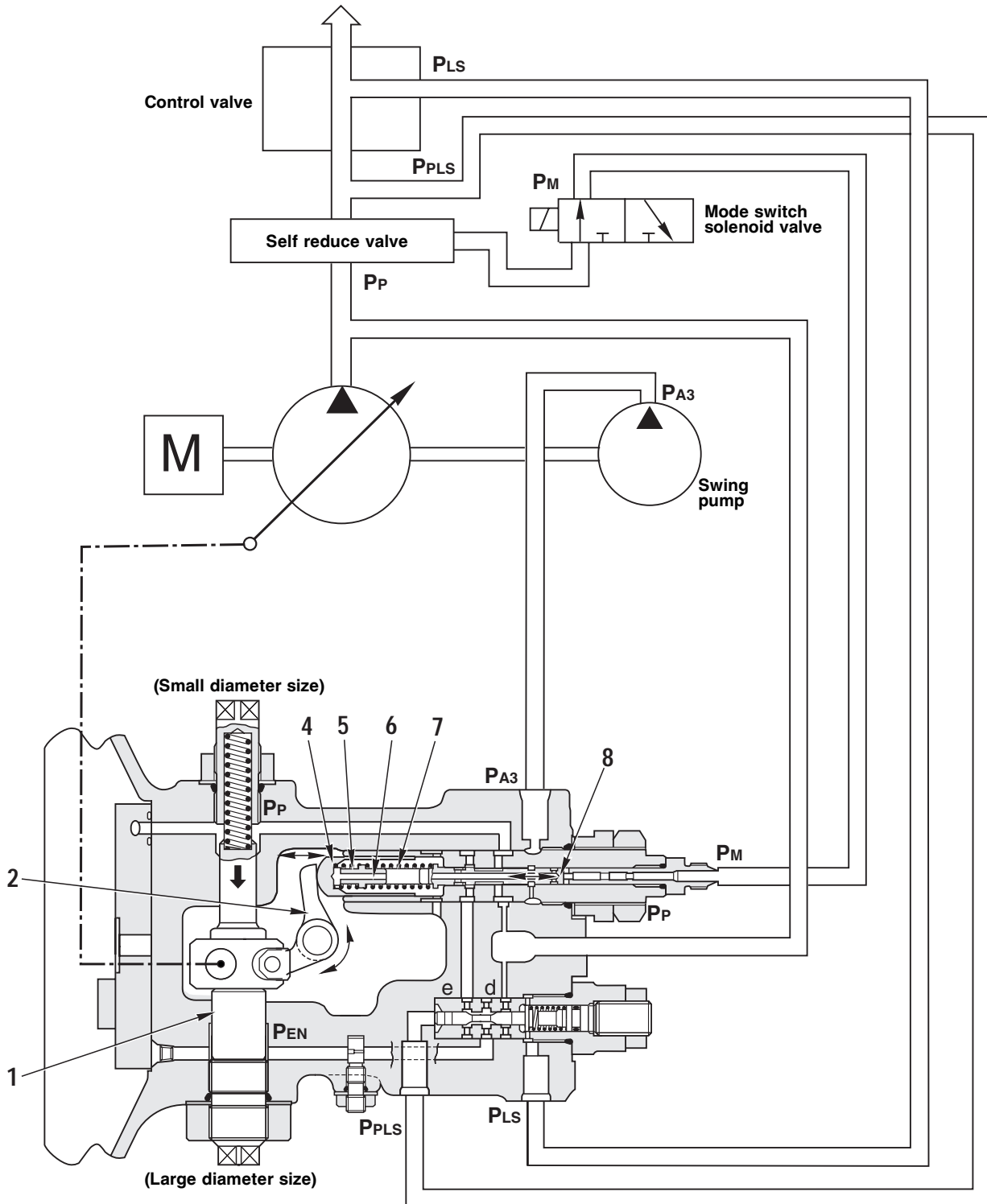
When the signal pressure is inputted from the mode switch solenoid valve

- When the mode switch solenoid valve is turned **ON** and the signal pressure **P_M** is inputted into the Port **P_M**, it activates the piston (10), and the piston (10) pushes the piston (8) to the left (←) side.
- By this action, the springs (5) and (7) are contracted and, because the spring load increases, the pump suction torque lowers by about swing.

When the swing is operated

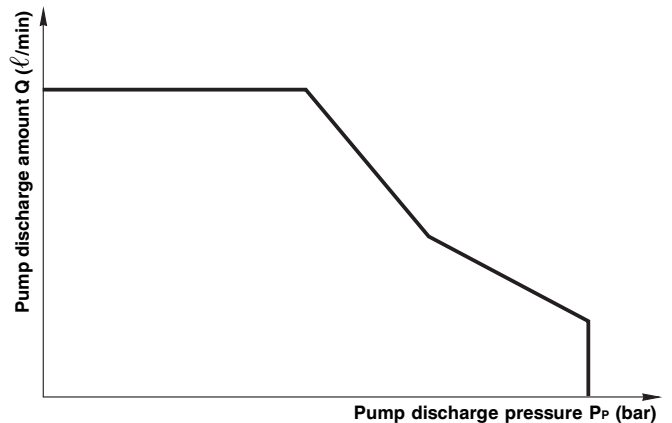
- When the swing is not being used, in other words when no load is applied on the swing pump, the pump suction torque is same as the standard mode or the light-load mode.
- Once the swing is activated, thus, a load is applied on the swing pump, the signal pressure **P_{A3}** is inputted to the Port **P_{A3}**, and the piston (8) is pushed to the left (←) side according to the volume of the signal pressure **P_{A3}**.
- By this action, the springs (5) and (7) are contracted and, because the spring load increases, the pump suction torque lowers according to the volume of the load on the swing pump.

4. Function of the spring

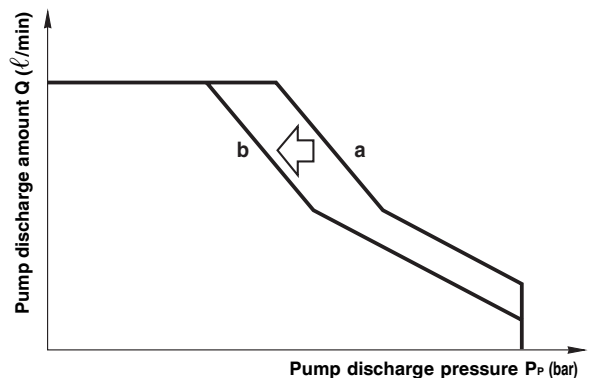


RKP08440

- The spring load of the springs (5) and (7) in the **PC** valve is changed in proportion to the swash plate angle of the pump.
- As the servo piston (1) moves, the lever (2) moves, and then the piston (4) moves according to the semi-rotating movement of the lever (2).
- When the piston (4) moves to the right (\rightarrow) side, the springs (5) and (7) are contracted at first. If the piston (4) moves further to the right (\rightarrow), the spring (5) touches the seat (6), so only the spring (7) functions as a spring.
In other words, the spring load is changed by the piston (4) expanding/contracting the springs (5) and (7).
- The pump absorption torque curve which indicates the relationship between the pump discharge pressure **P_P** and the discharge amount **Q** forms a bent line as shown in the chart because the springs (5) and (7) have separate spring loads.
- Furthermore, when the signal pressure **P_M** of the mode switch solenoid valve is inputted, or when the signal pressure **P_{A3}** of the swing pump changes, since the springs (5) and (7) are pushed from the right side by the piston (8), the spring load changes.
The position where the piston (8) stops, that is the pump absorption torque, is determined as the position where the total pressure of the pump pressure **P_P** which applies onto the piston (8), the mode switch pressure **P_M** and the swing pump signal pressure **P_{A3}** balances with the spring force of the springs (5) and (7).
- In other words, as the pump discharge pressure **P_P** rises, the pump discharge amount **Q** reduces, and as the pump discharge pressure **P_P** lowers, the pump discharge amount **Q** increases.
- The pump absorption torque curve which indicates the relationship between the pump discharge pressure **P_P** and the discharge amount **Q** is shifted in parallel from **a** to **b** as increase of each signal pressure.

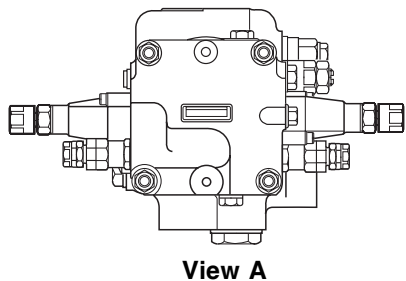
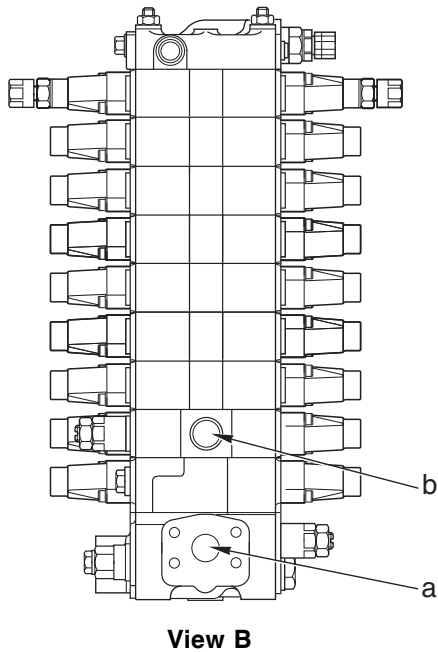
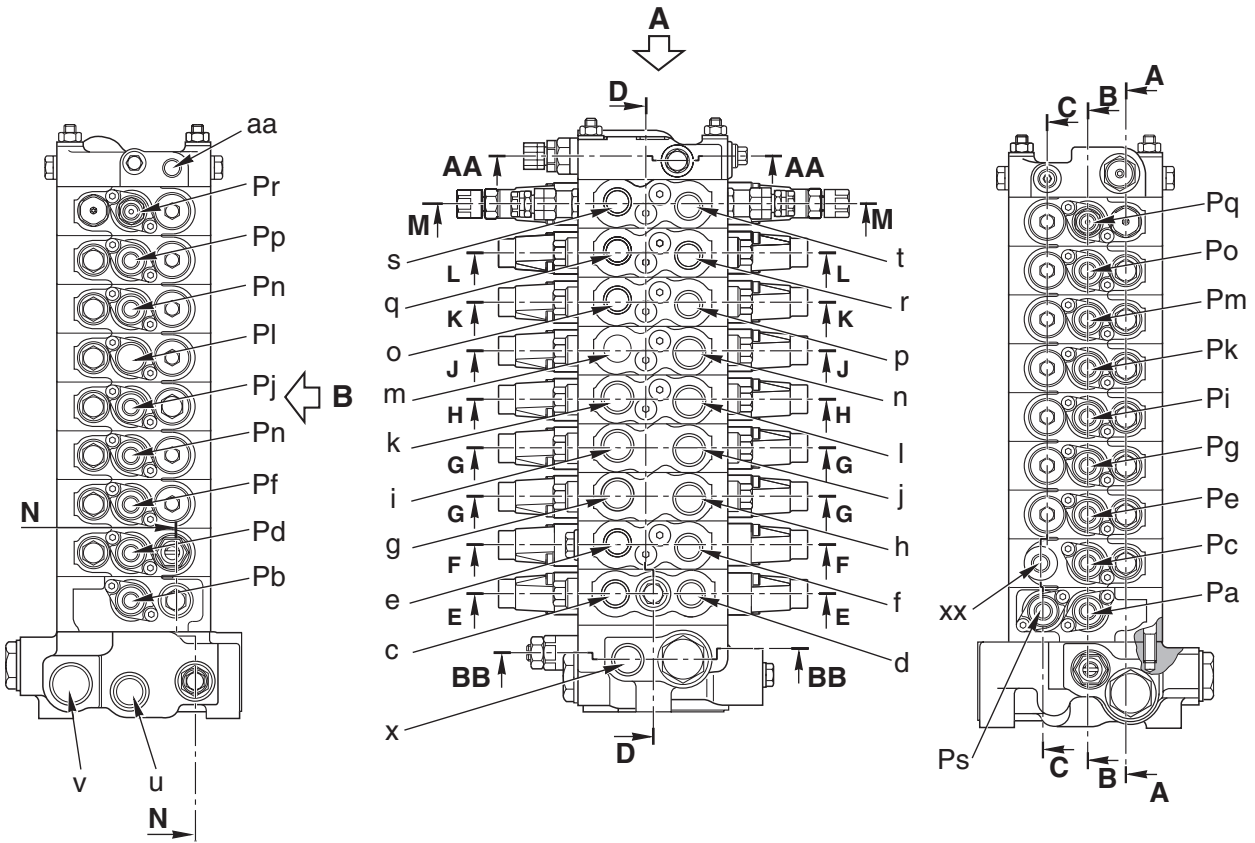


RKP08450



RKP08460

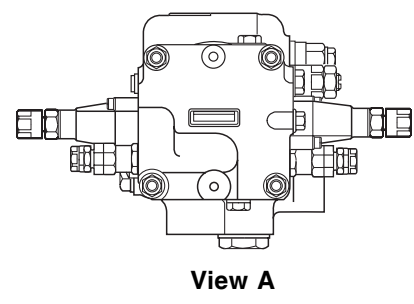
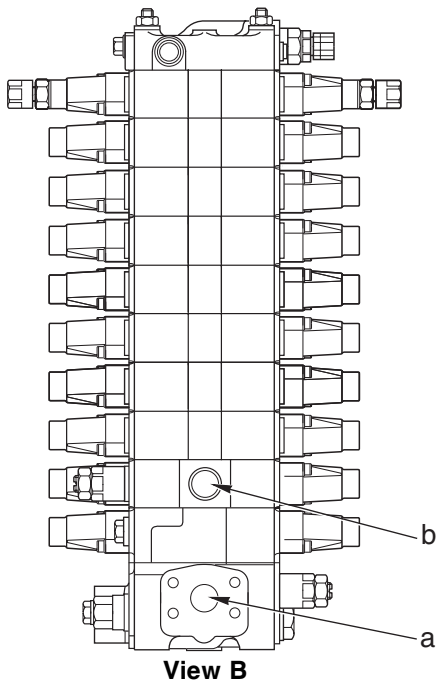
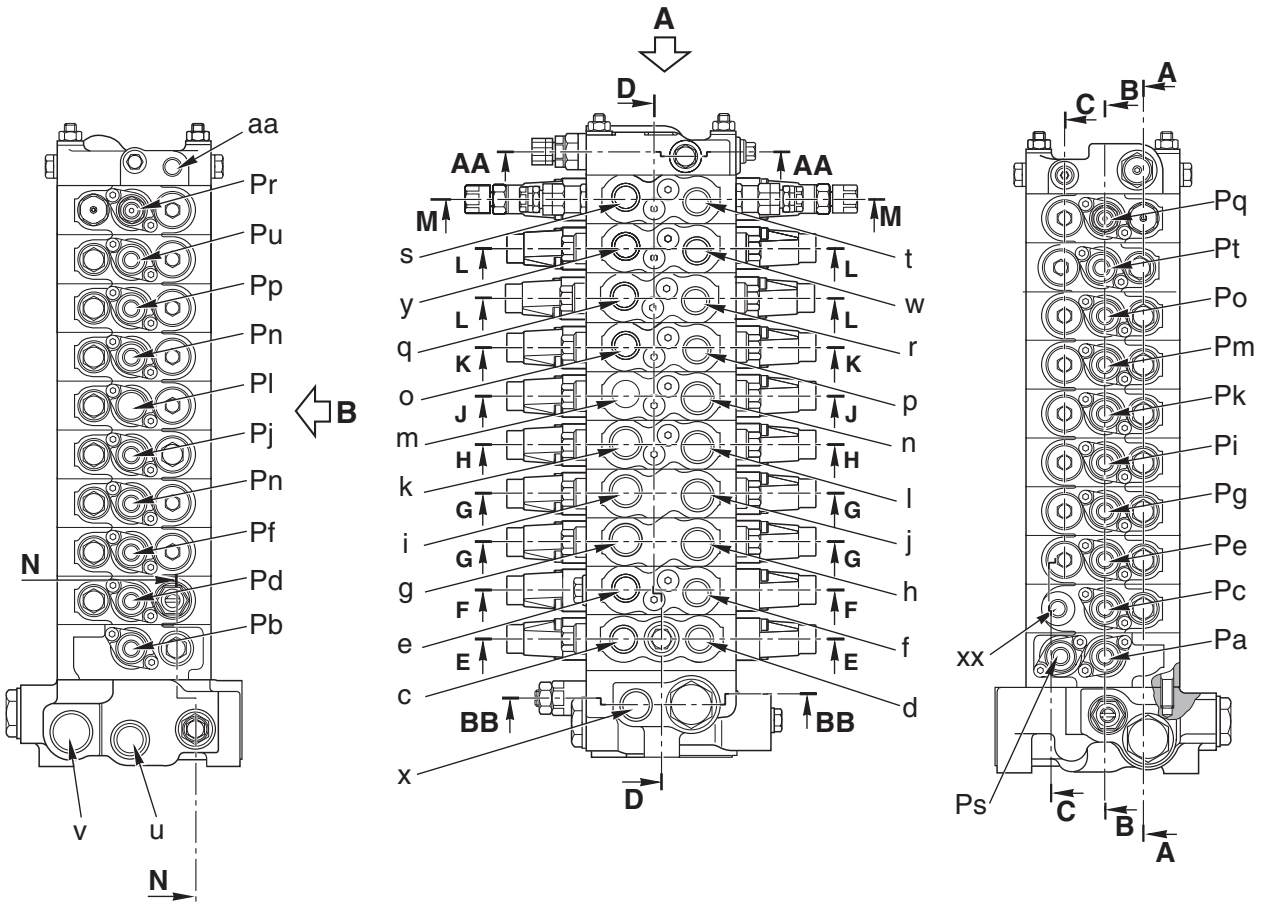
9-SPOOL CONTROL VALVE (STANDARD)



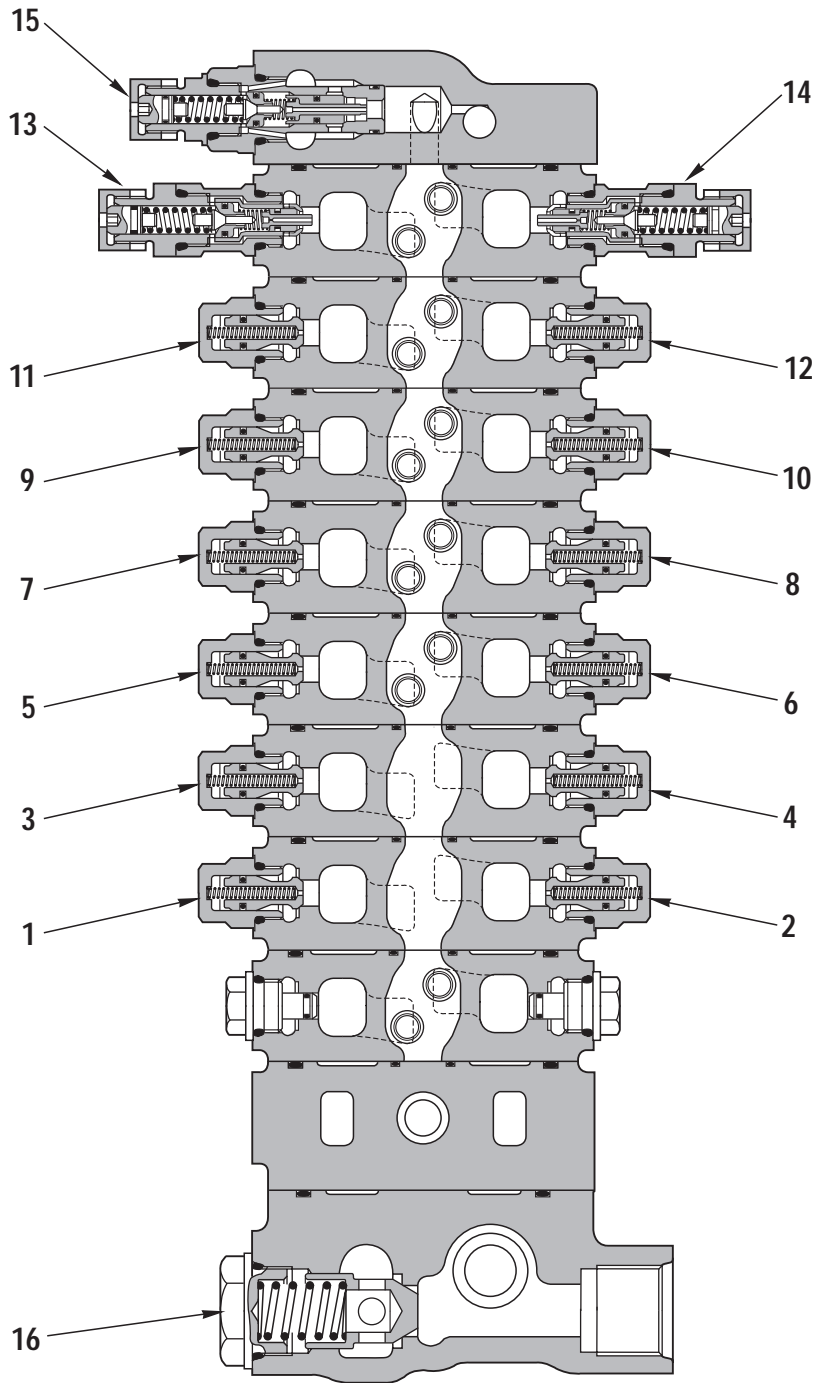
RKP02750

- a. P1 Port - From servocontrol feed unit (P2 Port) and from pump (PLS Port)
- b. P2 Port - From gear pump (PGA Port)
- c. A1 Port - To swing motor (MB Port)
- d. B1 Port - To swing motor (MA Port)
- e. A2 Port - To swivel joint (5 Port)
- f. B2 Port - To swivel joint (3 Port)
- g. A3 Port - To swivel joint (8 Port)
- h. B3 Port - To swivel joint (6 Port)
- i. A4 Port - To swivel joint (9 Port)
- j. B4 Port - To swivel joint (7 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 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. T_B Port - To hydraulic tank
- xx. T_S Port - To hydraulic tank
- aa. PLS Port - To hydraulic pump (PLS Port)
- Pa. PA1 Port - From L.H. PPC valve (P3 Port)
- Pb. PB1 Port - From L.H. PPC valve (p4 Port)
- Pc. PA2 Port - From blade PPC valve (P2 Port)
- Pd. PB2 Port - From blade PPC valve (P1 Port)
- Pe. PA3 Port - From travel PPC valve (P1 Port)
- Pf. PB3 Port - From travel PPC valve (P2 Port)
- Pg. PA4 Port - From travel PPC valve (P4 Port)
- Ph. PB4 Port - From travel PPC valve (P3 Port)
- Pi. PA5 Port - From R.H. PPC valve (P2 Port)
- Pj. PB5 Port - From R.H. PPC valve (P1 Port)
- Pk. PA6 Port - From L.H. PPC valve (P1 Port)
- Pl. PB6 Port - From L.H. PPC valve (P2 Port)
- Pm. PA7 Port - From R.H. PPC valve (P4 Port)
- Pn. PB7 Port - From R.H. PPC valve (P3 Port)
- Po. PA8 Port - From boom swing PPC valve (P2 Port)
- Pp. PB8 Port - From boom swing PPC valve (P1 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 (P2 Port)

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



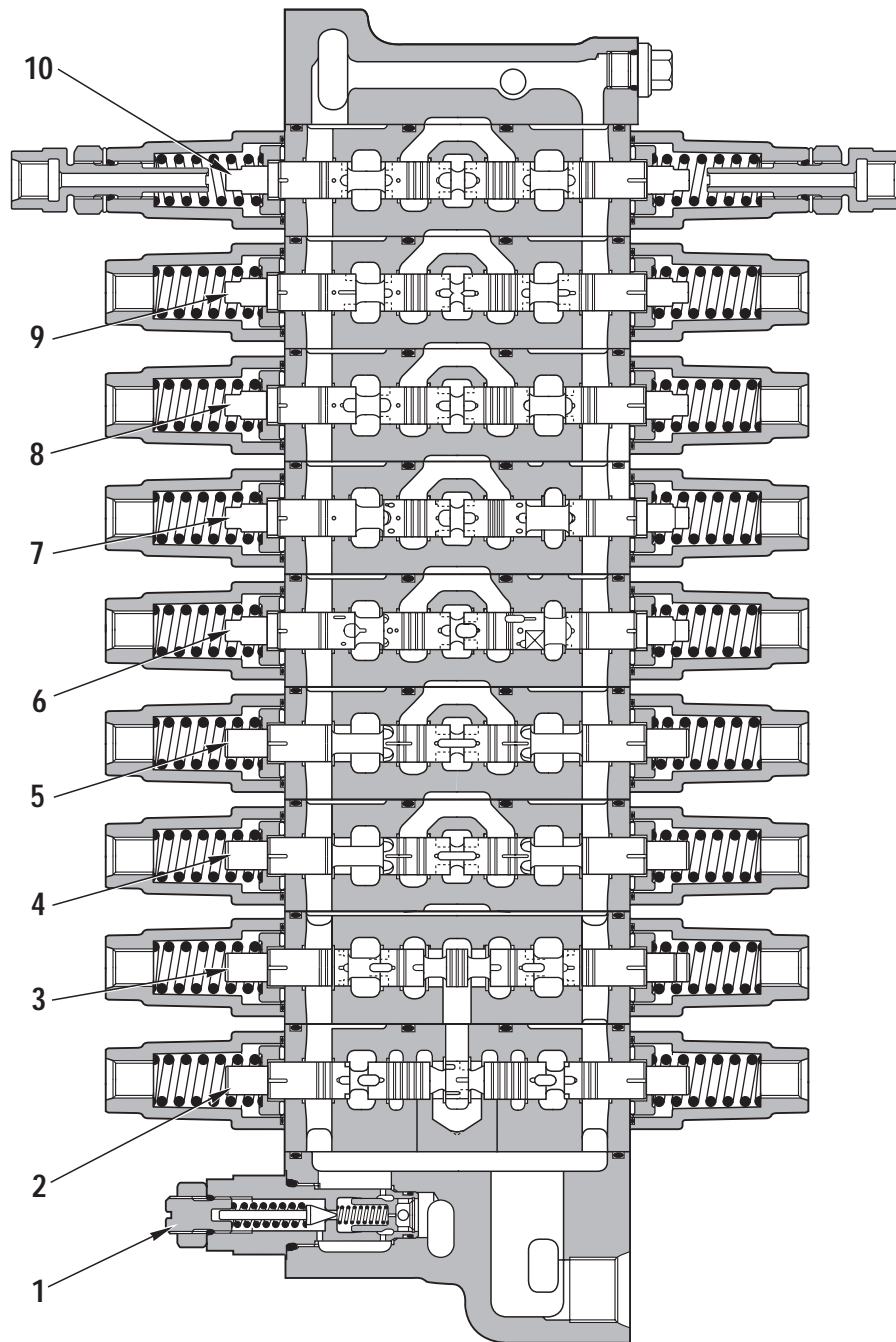
a. P1 Port	- From servocontrol feed unit (P2 Port) and from pump (PLS Port)
b. P2 Port	- From gear pump (PGA Port)
c. A1 Port	- To swing motor (MB Port)
d. B1 Port	- To swing motor (MA Port)
e. A2 Port	- To swivel joint (5 Port)
f. B2 Port	- To swivel joint (3 Port)
g. A3 Port	- To swivel joint (8 Port)
h. B3 Port	- To swivel joint (6 Port)
i. A4 Port	- To swivel joint (9 Port)
j. B4 Port	- To swivel joint (7 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 (S 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 (P3 Port)
Pb. PB1 Port	- From L.H. PPC valve (P4 Port)
Pc. PA2 Port	- From blade PPC valve (P2 Port)
Pd. PB2 Port	- From blade PPC valve (P1 Port)
Pe. PA3 Port	- From travel PPC valve (P1 Port)
Pf. PB3 Port	- From travel PPC valve (P2 Port)
Pg. PA4 Port	- From travel PPC valve (P4 Port)
Ph. PB4 Port	- From travel PPC valve (P3 Port)
Pi. PA5 Port	- From R.H. PPC valve (P2 Port)
Pj. PB5 Port	- From R.H. PPC valve (P1 Port)
Pk. PA6 Port	- From L.H. PPC valve (P1 Port)
Pl. PB6 Port	- From L.H. PPC valve (P2 Port)
Pm. PA7 Port	- From R.H. PPC valve (P4 Port)
Pn. PB7 Port	- From R.H. PPC valve (P3 Port)
Po. PA8 Port	- From boom swing PPC valve (P2 Port)
Pp. PB8 Port	- From boom swing PPC valve (P1 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 (P2 Port)
Pt. PA10 Port	- From 2-piece boom PPC valve (P1 Port)
Pt. PB10 Port	- From 2-piece boom PPC valve (P2 Port)



Section A-A

RKP02770

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

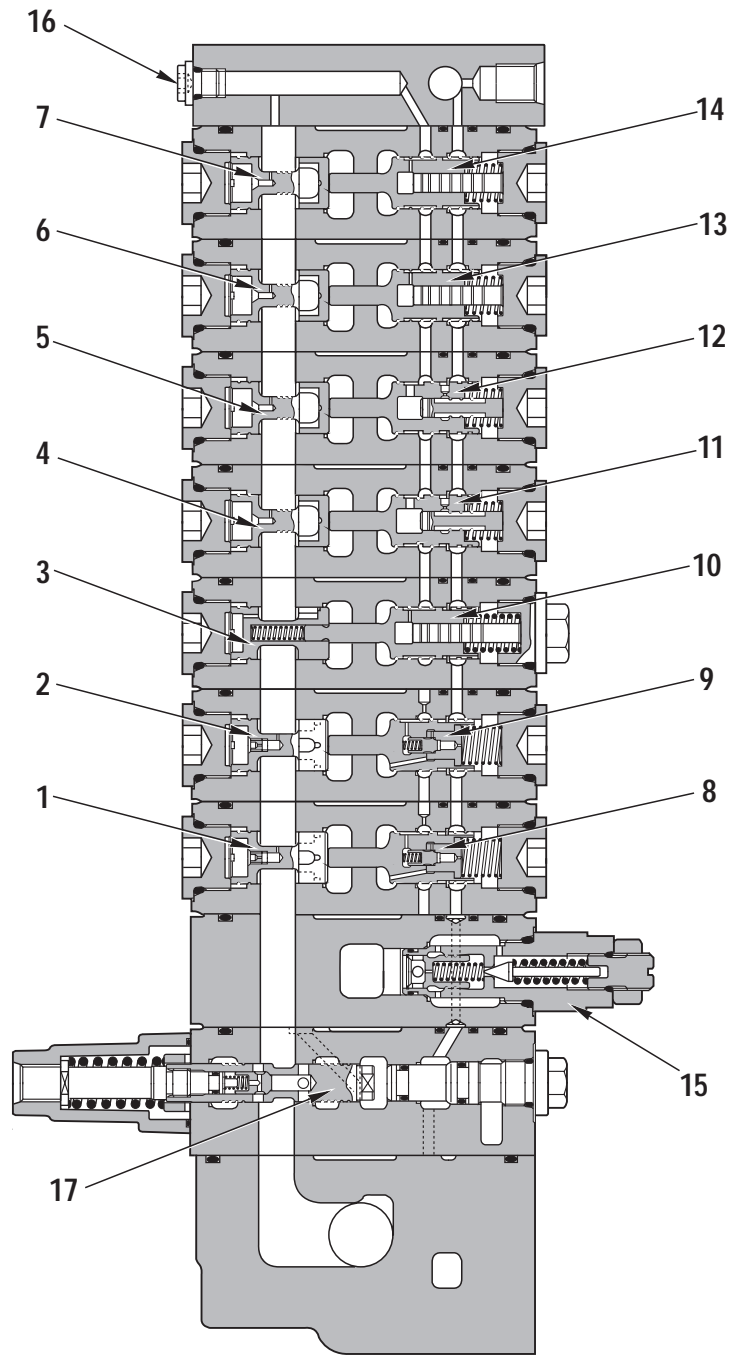


Section B-B

RKP02780

- 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

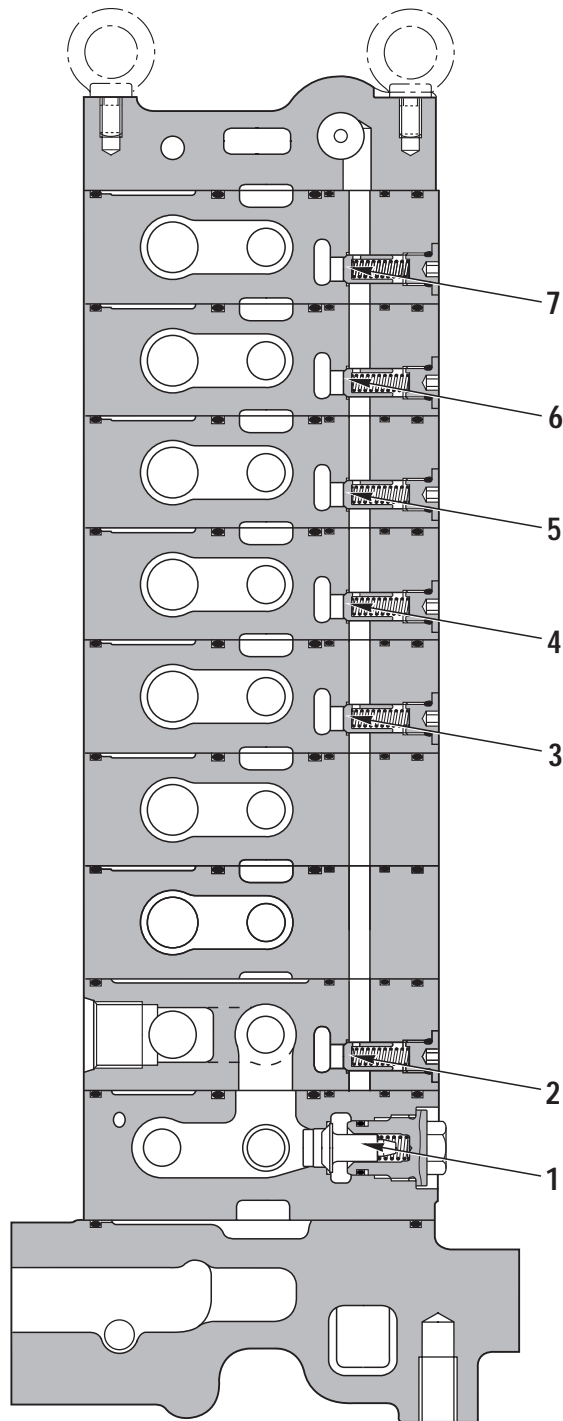
RKP02790

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:

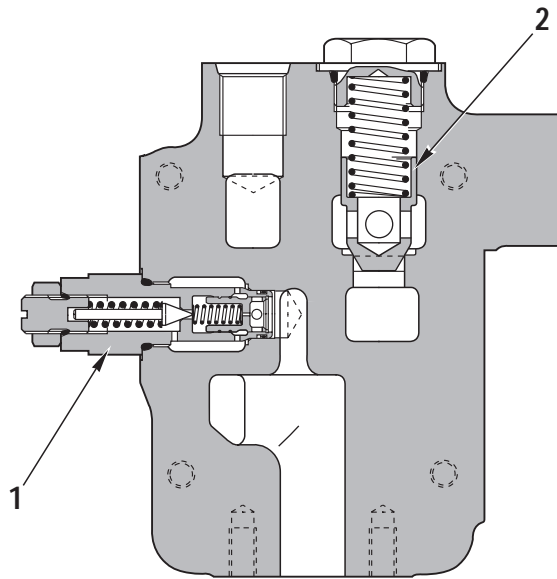
- 8. L.H. travel
- 9. R.H. travel
- 10. Boom
- 11. Arm
- 12. Bucket
- 13. Boom swing
- 14. Attachment
- 15. Main relief valve (P2 Port)
- 16. Plug
- 17. Spool (boom raise at joining pump discharge)



Section D-D

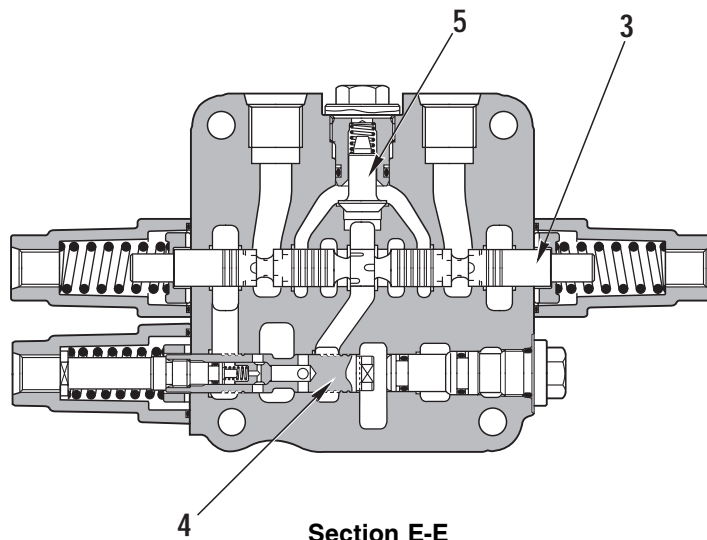
RKP02800

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

RKP02820



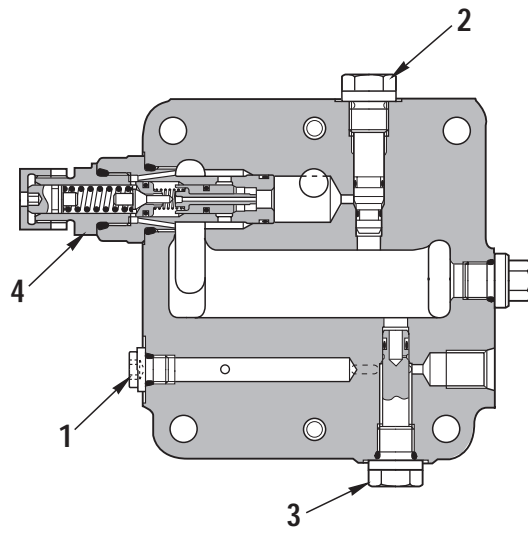
Section E-E

RKP02810

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

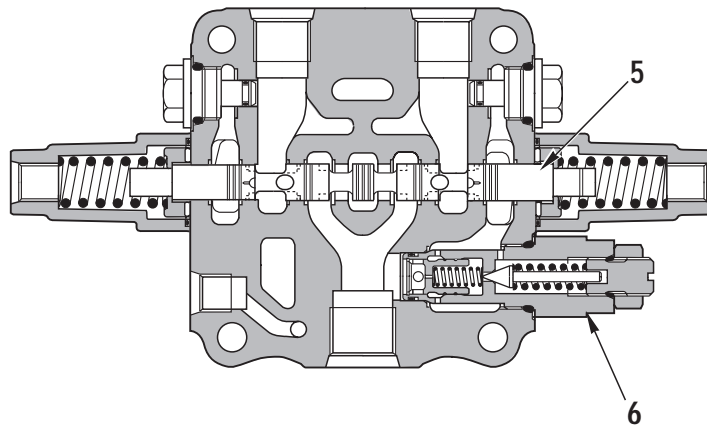
SWING VALVE

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



Section AA-AA₁

RKP02840



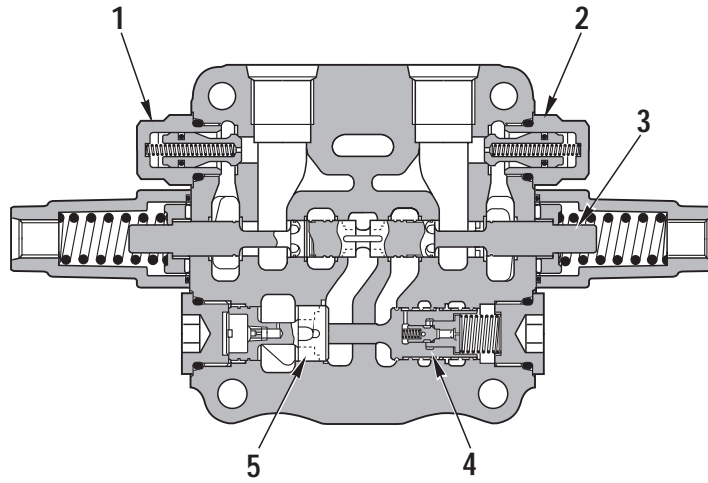
Section F-F

RKP02830

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

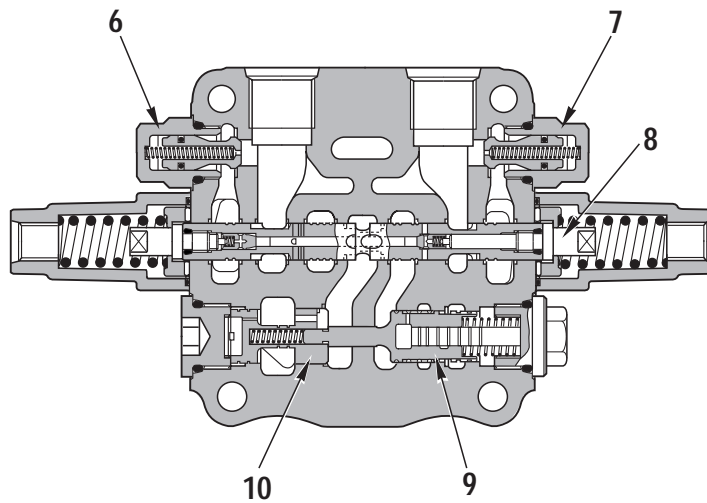
BLADE VALVE

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



Section G-G

RKP02850



Section H-H

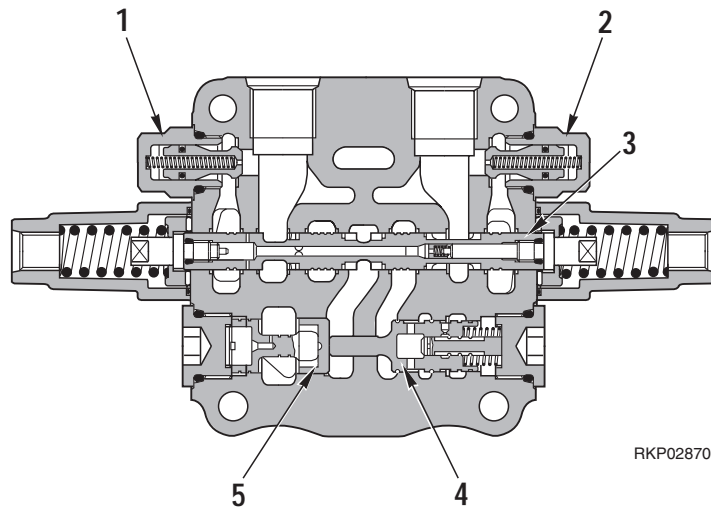
RKP02860

L.H. AND R.H. TRAVEL VALVE

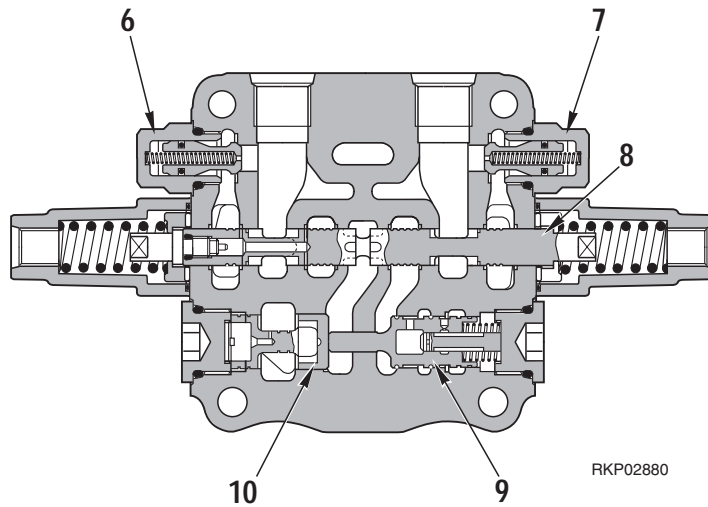
- 1. Suction valve (A3 - A4 Port)
- 2. Suction valve (B3 - B4 Port)
- 3. Spool
- 4. Reducing pressure compensation valve
- 5. Flow compensation valve

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



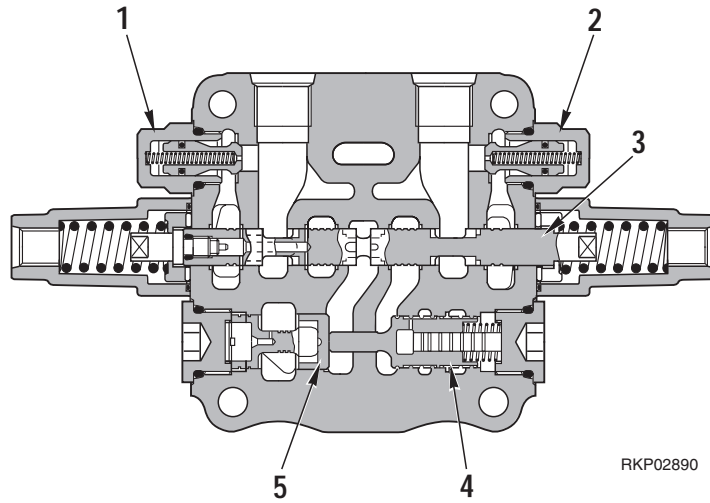
Section K-K

ARM VALVE

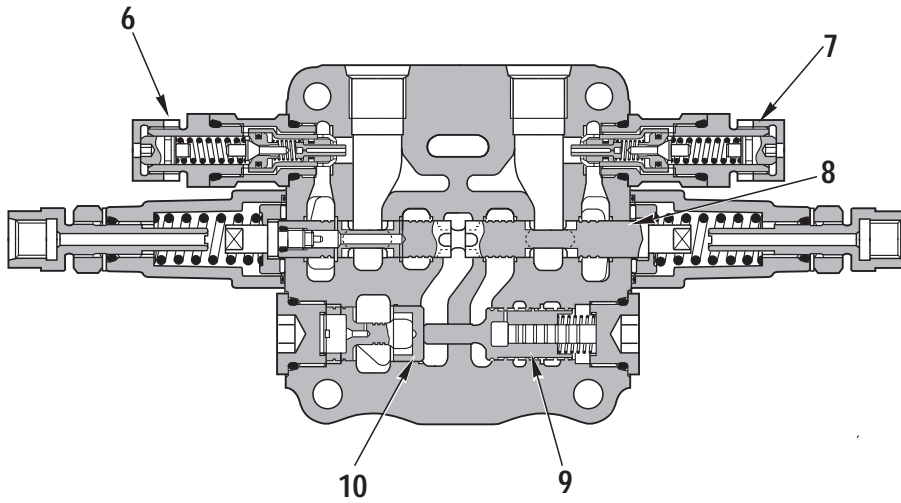
- 1. Suction valve (Head side)
- 2. Suction valve (Bottom side)
- 3. Spool
- 4. Reducing pressure compensation valve
- 5. Flow compensation valve

BUCKET VALVE

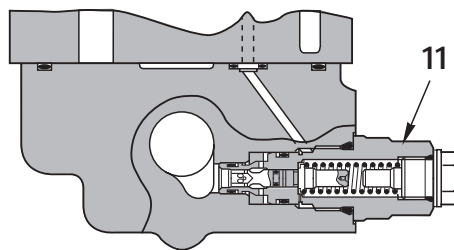
- 6. Safety valve (Head side)
- 7. Safety valve (Bottom side)
- 8. Spool
- 9. Reducing pressure compensation valve
- 10. Flow compensation valve



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

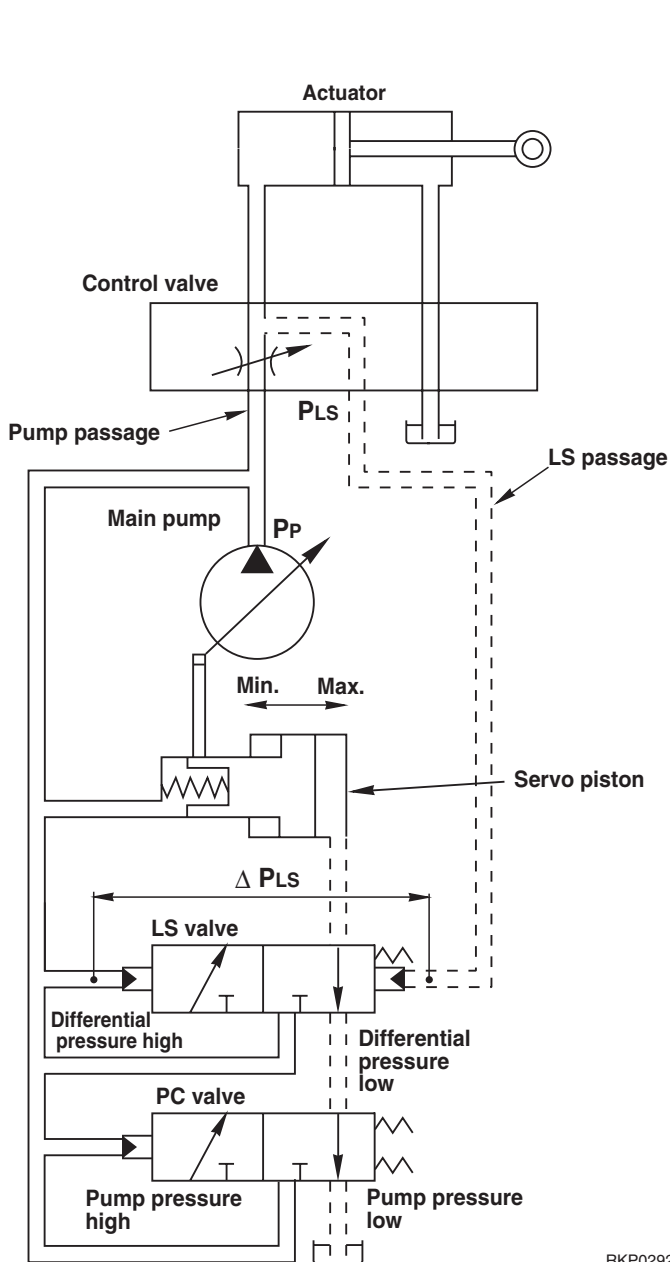
ATTACHMENT VALVE

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

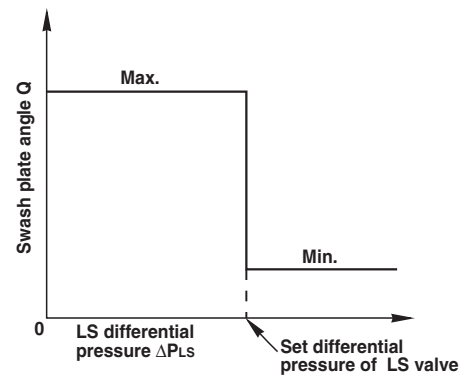
FUNCTION PRINCIPLE

1. Control of pump swash plate angle

- The pump swash plate angle (pump discharge amount) is so controlled that the **LS** differential pressure ΔP_{LS} , which is the difference between the pump discharge pressure P_P and the **LS** pressure P_{LS} at the outlet Port of the control valve (actuator load pressure), is maintained at a constant level.
(**LS** differential pressure ΔP_{LS} = Pump discharge pressure P_P - **LS** pressure P_{LS}).
- If the **LS** differential pressure ΔP_{LS} becomes lower than the setting pressure of the **LS** valve, the pump swash plate angle becomes larger, and if it becomes higher, the pump swash plate angle becomes smaller.
- ★ For the details of this action, refer to the descriptions of "HYDRAULIC PUMP".



RKP02921



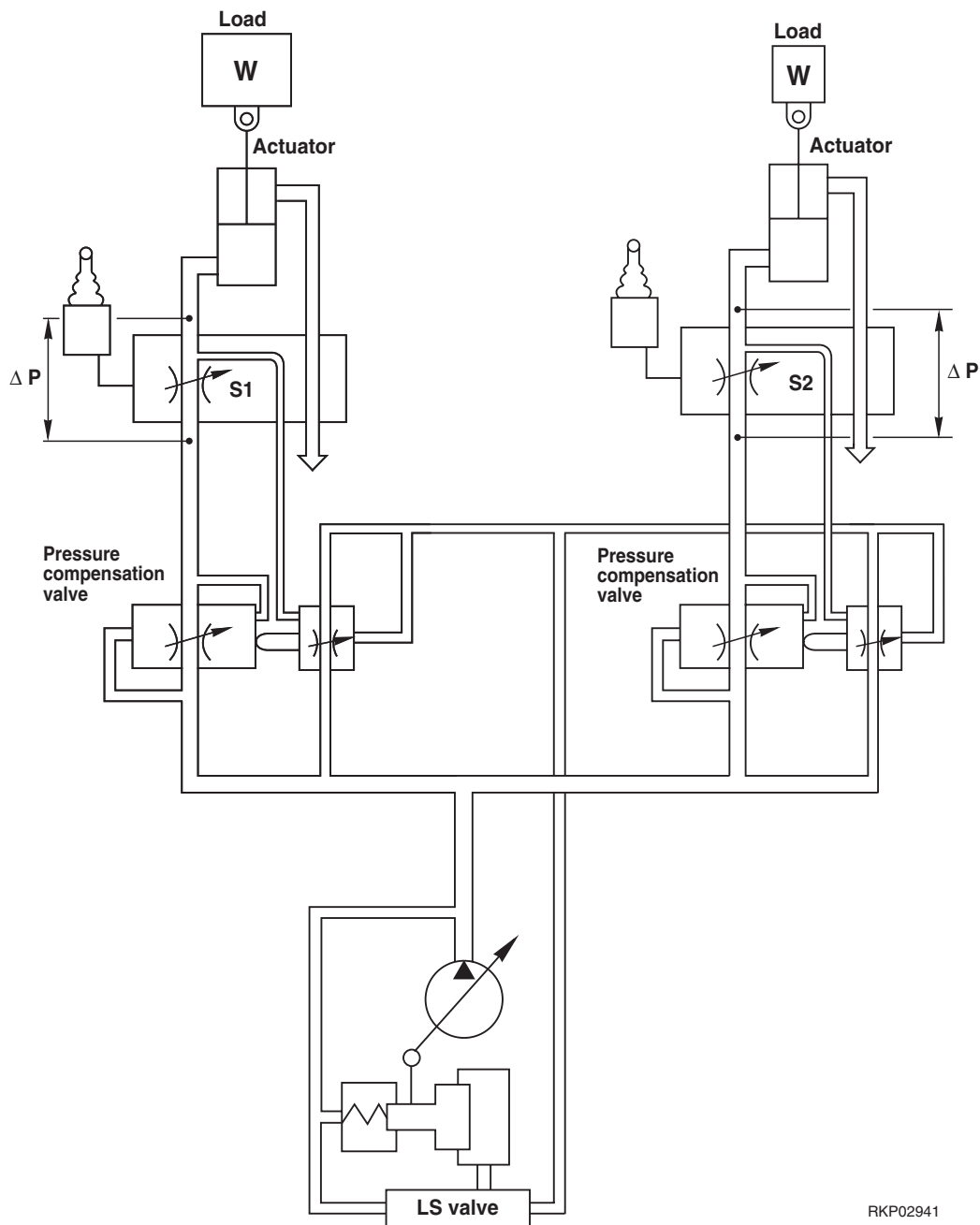
RKP02931

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.

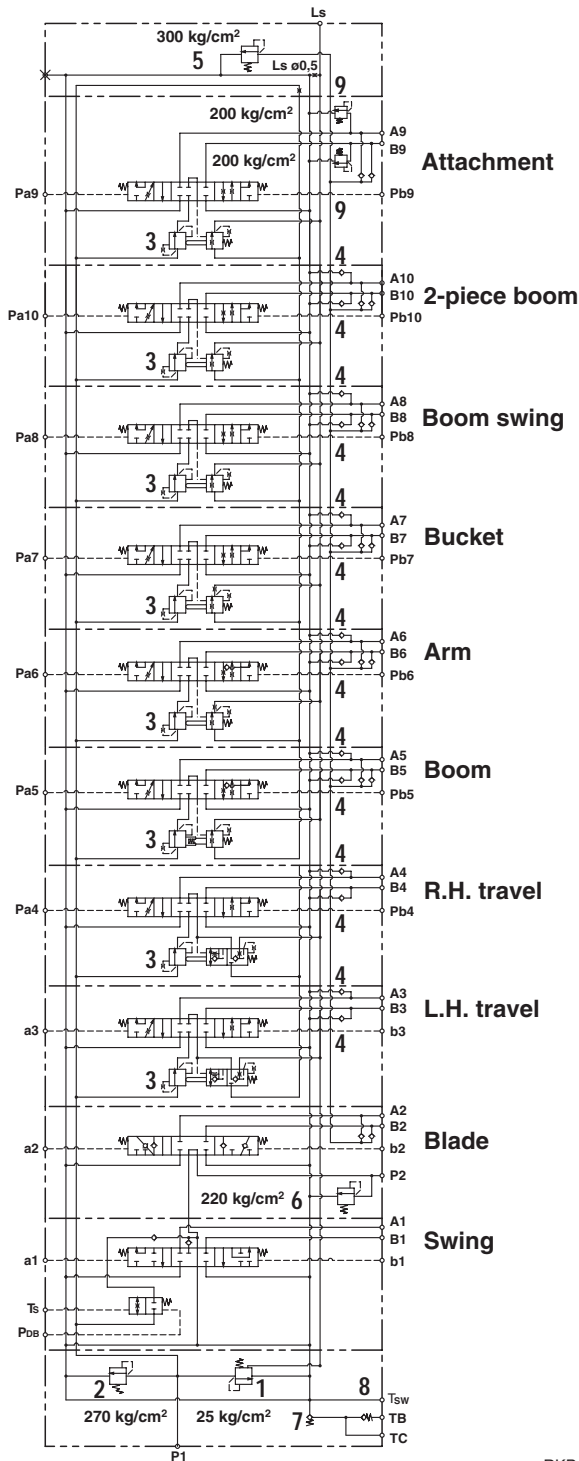
In this way, the flow from the pump are distributed in proportion to the opening areas **S1** and **S2** of each valve.



RKP02941

3. Operation for each function and valve

Hydraulic circuit diagram and names of valves



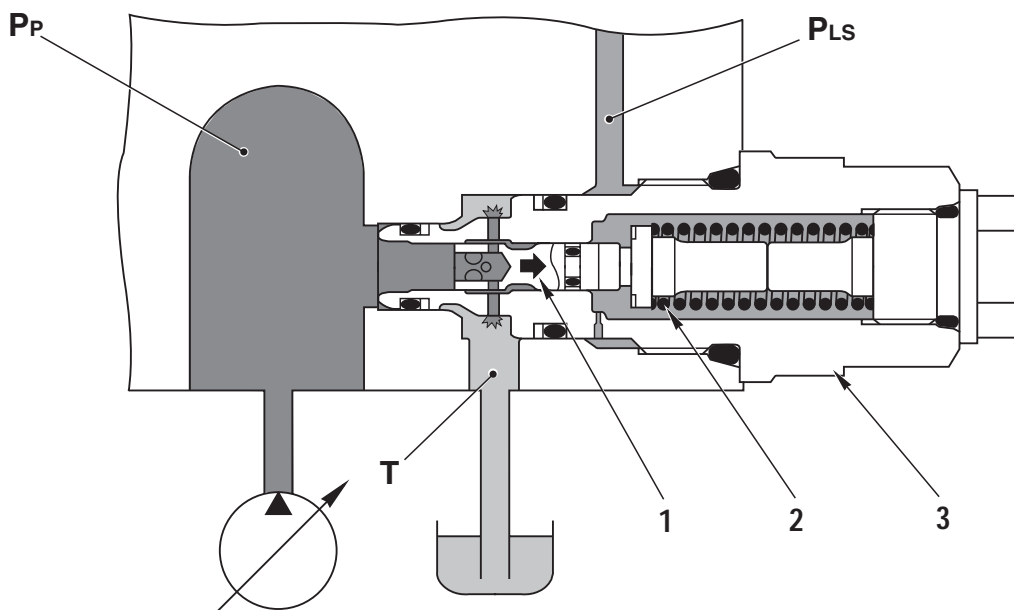
1. Unload valve
LS pressure + 24.5 bar (355.3 psi)
2. Main relief valve (P1 Port)
265 bar (3843.3 psi)
3. Pressure compensation valve
4. Suction valve
5. Safety valve
294 bar (4263.9 psi)
6. Main relief valve (P2 Port): 216 bar (3132.6 psi)
7. Lift check valve
8. Cooler bypass valve
9. Hammer spool safety valve:
196 bar (2842.6 psi)

RKP10111

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 P_P is set at 24.5 bar (355.3 psi) by the spring (2) inside the valve.
(LS pressure $P_{Ls} = 0$ bar (0 psi))

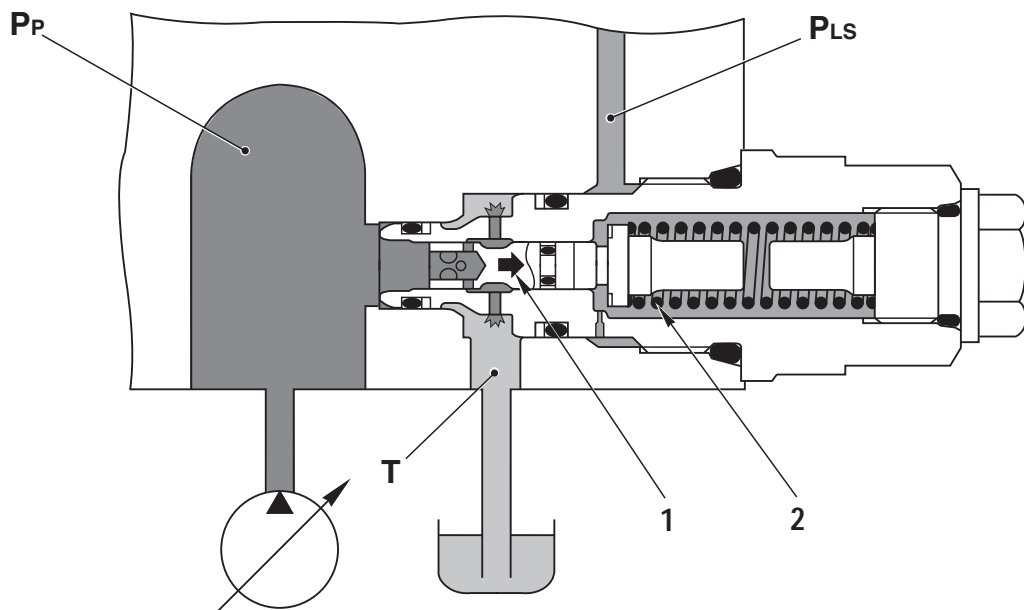


OPERATION

When the control valve is at «NEUTRAL»

- To two end surfaces of the spool (1), the pump discharge pressure P_P is acting on the left and the LS pressure P_{Ls} is acting on the right side.
 - Since no LS pressure P_{Ls} is generated when the control valve is at «NEUTRAL», only the pump discharge pressure P_P is acting, and P_P is set only by the load of the spring (2).
 - As the pump discharge pressure P_P rises and reaches the spring load of the spring (2) (24.5 bar (355.3 psi)), the spool (1) is shifted to the right (→) side and the pump circuit P_P becomes open to the tank circuit T through the drill holes in the sleeve (3).
- In this way, the pump discharge pressure P_P is set to 24.5 bar (355.3 psi).

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 P_P is set to the LS pressure P_{LS} + 24.5 bar (355.3 psi).
 Since the unload valve opens when the differential pressure between the pump discharge pressure P_P and the LS pressure P_{LS} reaches the spring load of the spring (2) (24.5 bar (355.3 psi)), the LS differential pressure ΔP_{LS} at this time becomes 24.5 bar (355.3 psi).



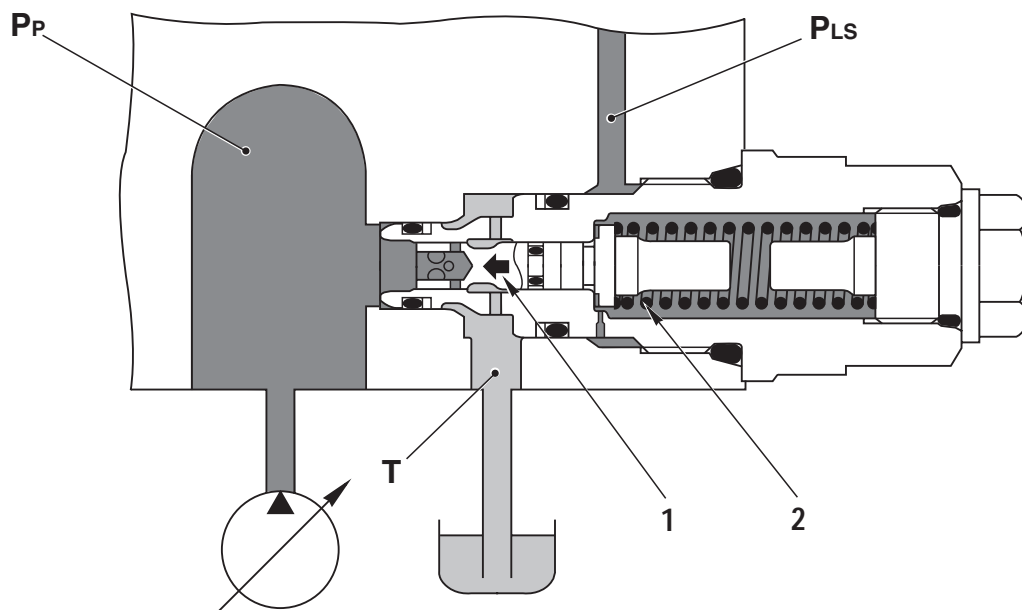
RKP02970

OPERATION

Fine control of the control valve

- When the control valve is fine-controlled, the LS pressure P_{LS} is generated and acts on the right end of the spool (1).
 At this time, since the LS pressure P_{LS} is small because the opening area of the spool of the control valve is small, there is big difference from the pump discharge pressure P_P .
- When the differential pressure between the pump discharge pressure P_P and LS pressure P_{LS} reaches the spring load of the spring (2) (24.5 bar (355.3 psi)), the spool (1) moves to the right (\rightarrow) side and a path is formed between the pump circuit P_P and the tank circuit T .
- Thus, the pump discharge pressure P_P is set to the combined pressure of the spring force (24.5 bar (355.3 psi)) and the LS pressure P_{LS} , and the LS differential pressure ΔP_{LS} becomes 24.5 bar (355.3 psi).

- 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

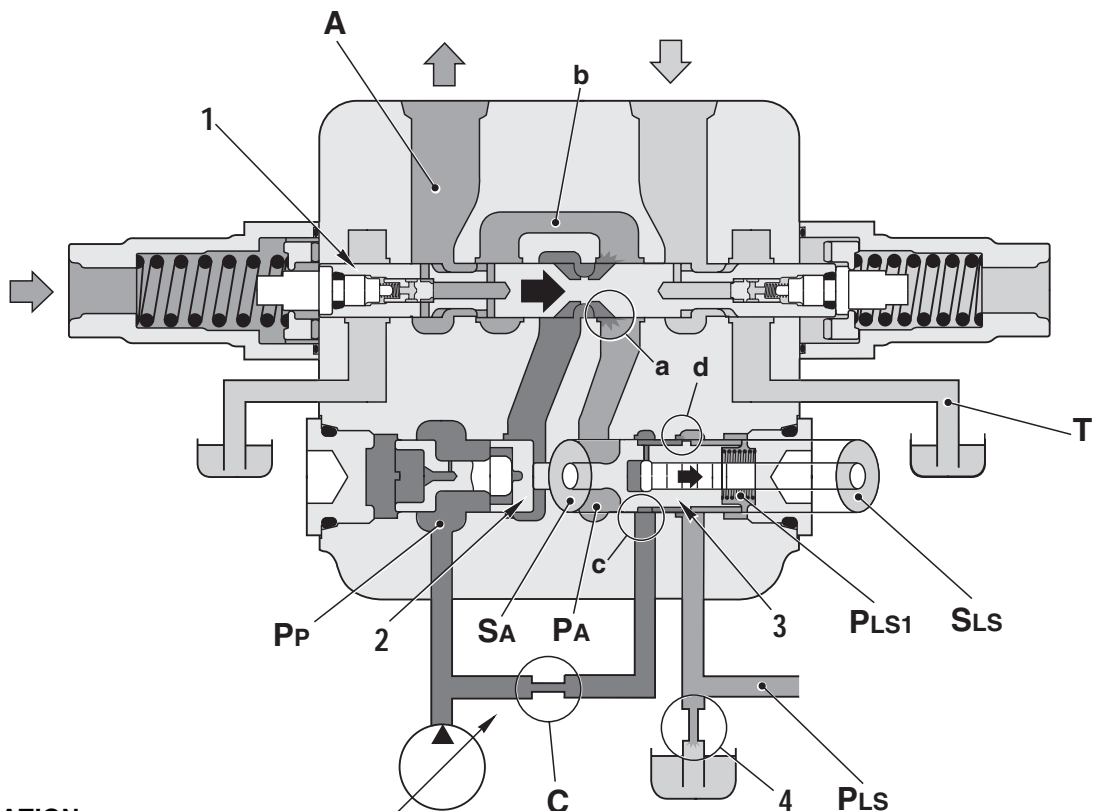
When the control valve is operated

- 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** does not reach the spring load of the spring (2) (24.5 bar (355.3 psi)), 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

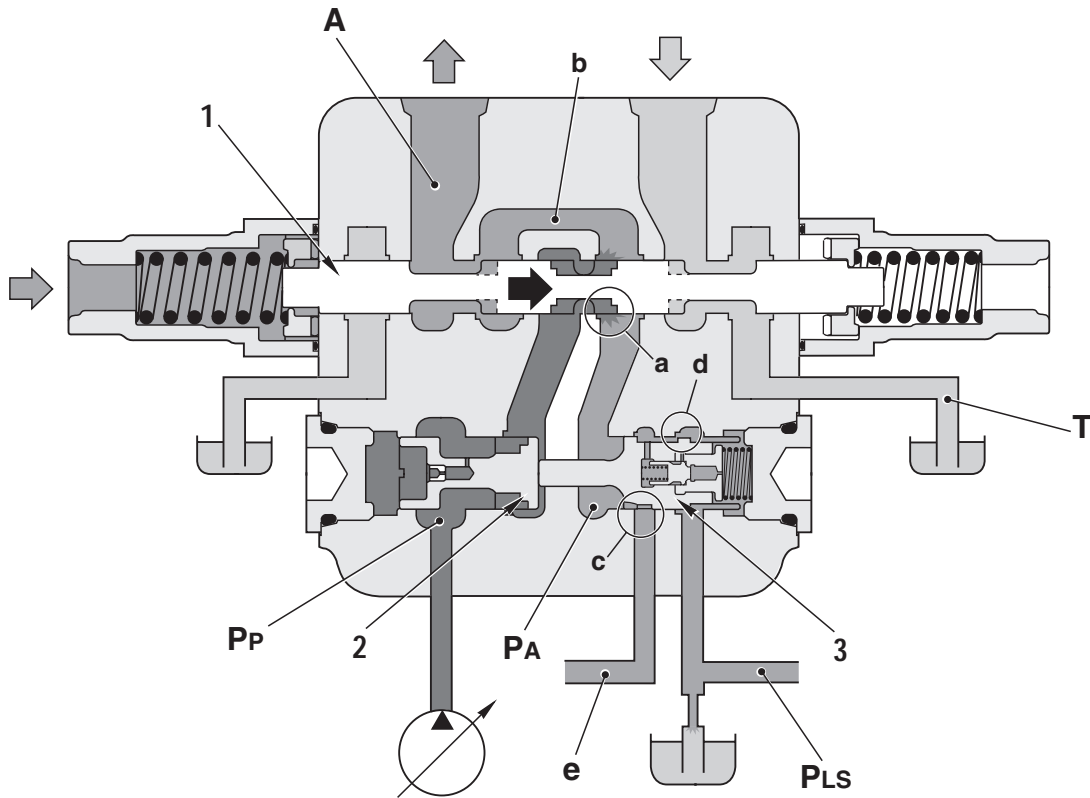
- The **LS** pressure denotes the actuator load pressure at the outlet Port of the control valve.
- Actually, in the control valves, the pump pressure **PP** is reduced to the same pressure of the actuator circuit pressure **A** by the pressure reducing valve (3) in the pressure compensation valve before introducing into the **LS** circuit **PL_S**.
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 **PL_S**.



OPERATION

1. 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 **PL_S**, and then, further introduced to the spring chamber **PL_{S1}**.
- At this time, the **LS** circuit **PL_S** 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 (**S_A = S_{LS}**), and on the **S_A** side, the actuator circuit pressure **P_A** (= **A**) is acting, and on the opposite **S_{LS}** side, the reduced pump pressure **PP** is acting.
- Therefore the pressure reducing valve (3) balances at the point where the actuator circuit pressure **P_A** and the spring chamber pressure **PL_{S1}** are balanced, and the pump pressure **PP** reduced by the notch **d** is introduced to the **LS** circuit **PL_S** as the actuator circuit pressure **A**.



RKP03000

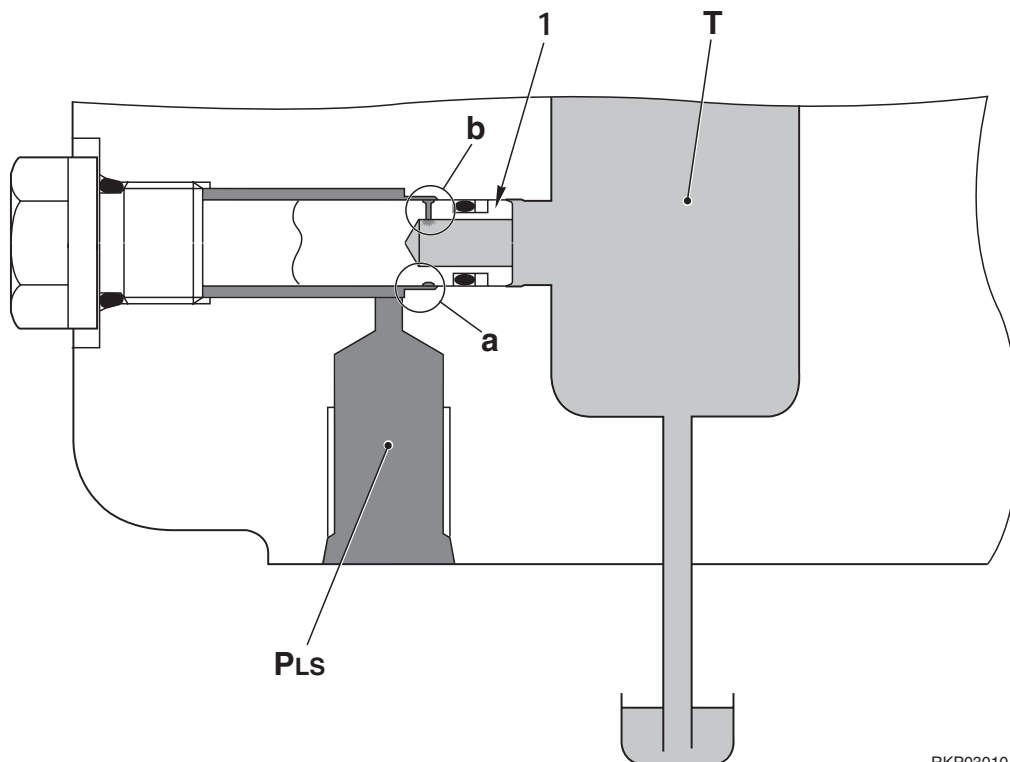
2. Travel valves

- 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**.

3. LS bypass plug

DESCRIPTION

- 1 - The **LS** bypass plug releases the residual pressure of the **LS** pressure P_{LS} .
- 2 - This makes the pressure-rising speed of the **LS** pressure P_{LS} more gentle, and with this discarded throttled flow, it creates 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

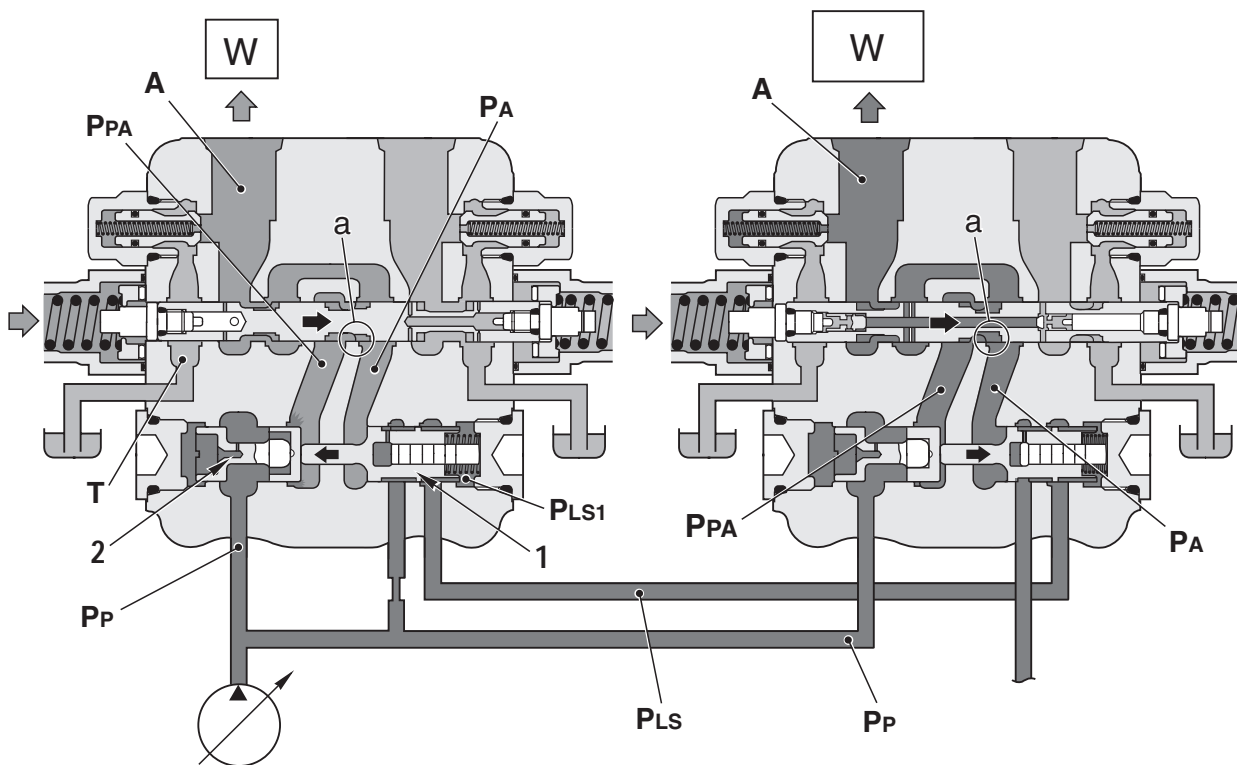
OPERATION

- The pressurized oil in the **LS** circuit P_{LS} 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**.

4. 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 P_{LS} at the other actuator acts on the spring chamber P_{LS1} , and pushes the pressure reducing valve (1) and the flow control valve (2) to the left (\leftarrow) side.
- The flow control valve (2) throttles the opening area between the pump circuit PP and the upstream side of the spool P_{PA} , and generates a pressure loss in between PP and P_{PA} .
- The flow control valve and the pressure reducing valve (1) are balanced at the point where the differential pressure between P_A and P_{LS} , which act on the both end surfaces of the pressure reducing valve (1), becomes equal to the pressure loss in between PP and P_{PA} before and after the flow control valve (2).
- By this operation, the differential pressures between the upstream pressure P_{PA} and the downstream pressure P_A 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.

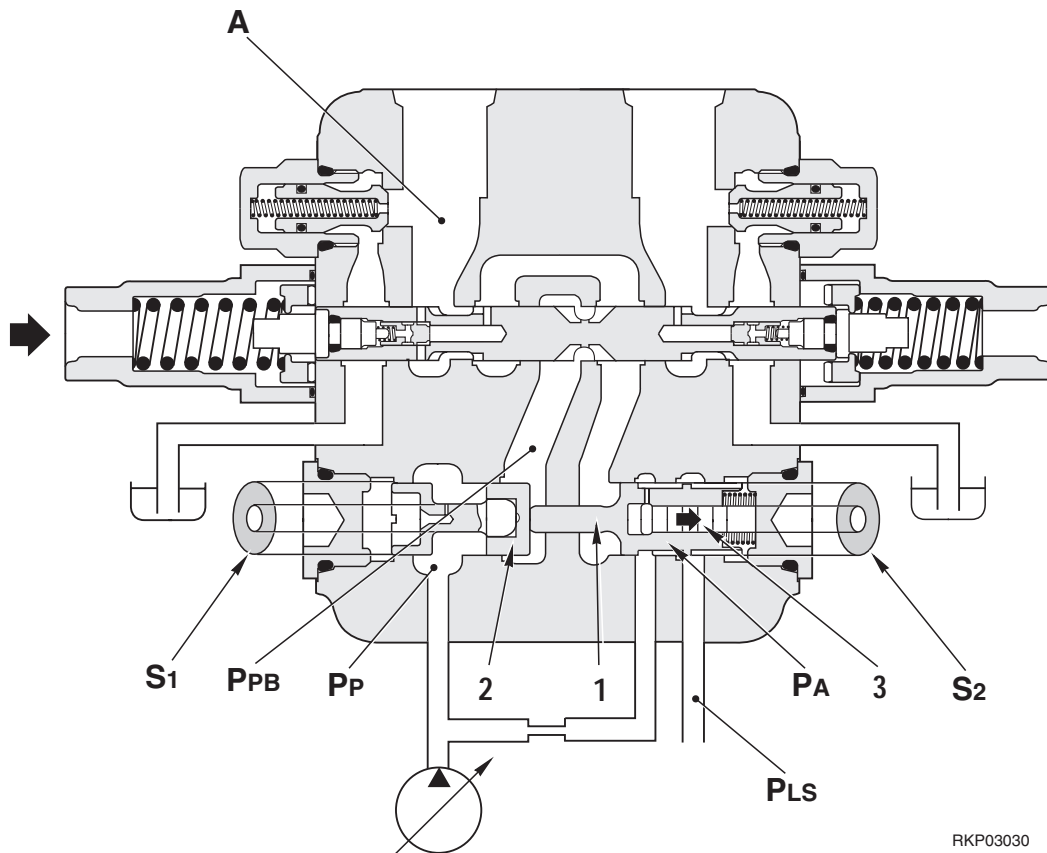
5. Area ratio of pressure compensation valve

FUNCTION

- The pressure compensation valve determines the compensation characteristics by carrying out fine adjustment of the area ratio (S_1/S_2) between the area S_1 of the flow control valve (2) side and the area S_2 of the pressure reducing valve (1) side to match the characteristics of each actuator.

S_1 = Area of the flow control valve (2) – Area of the piston (3)

S_2 = Area of the pressure reducing valve (1) – Area of the piston (3)



RKP03030

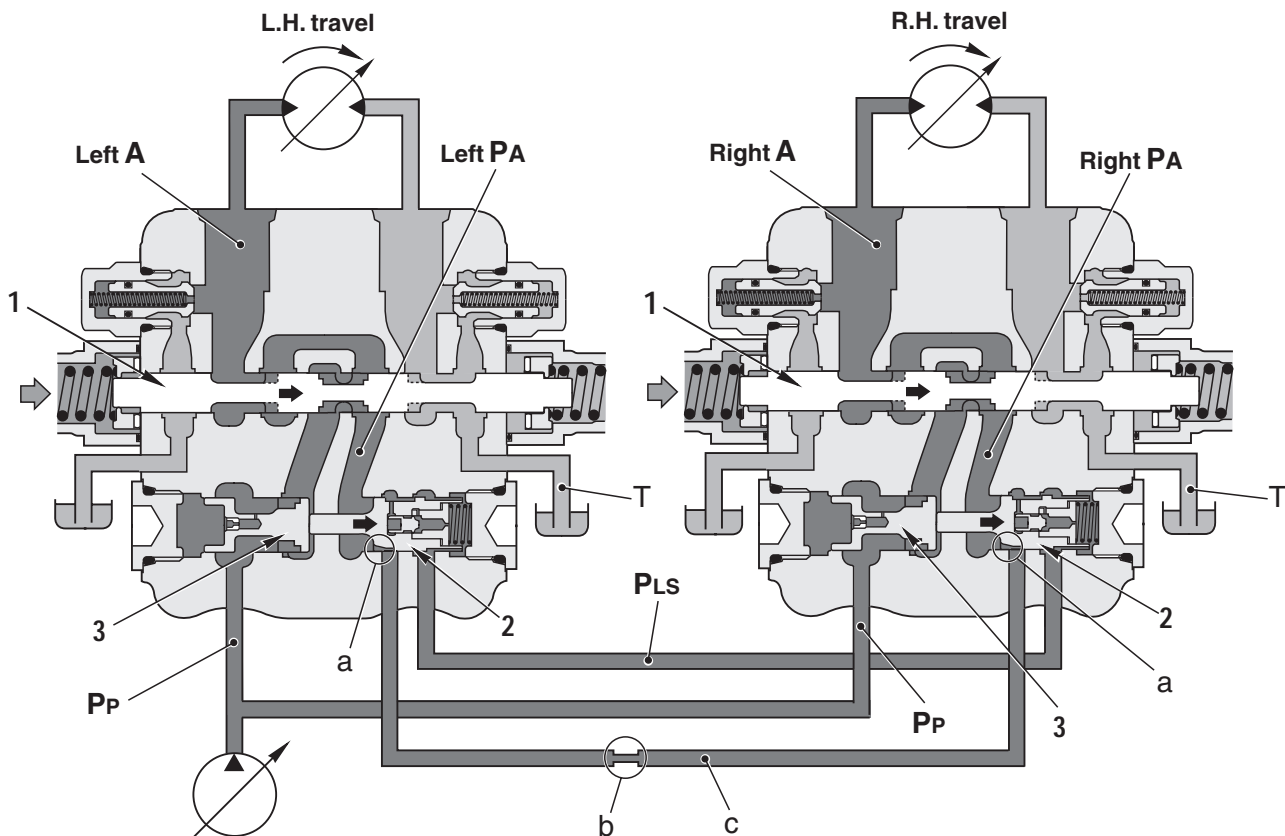
Area ratio (S_1/S_2) and compensation characteristics

- When the ratio is 1.00:
 $[Pump\ pressure\ P_P - Upstream\ pressure\ of\ the\ spool\ notch\ P_{PB}] = [LS\ circuit\ pressure\ P_{LS} - Actuator\ circuit\ pressure\ P_A (= A)]$.
 Thus, the flow is distributed in proportion of opening areas of the spool.
- When the ratio is larger than 1.00 : $P_P - P_{PB} > P_{LS} - P_A (= A)$
 Thus, the flow is divided less than the proportion of opening areas of the spool.
- When the ratio is smaller than 1.00 : $P_P - P_{PB} < P_{LS} - P_A$
 Thus, the flow is divided more than the proportion of opening areas of the spool.

6. 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.

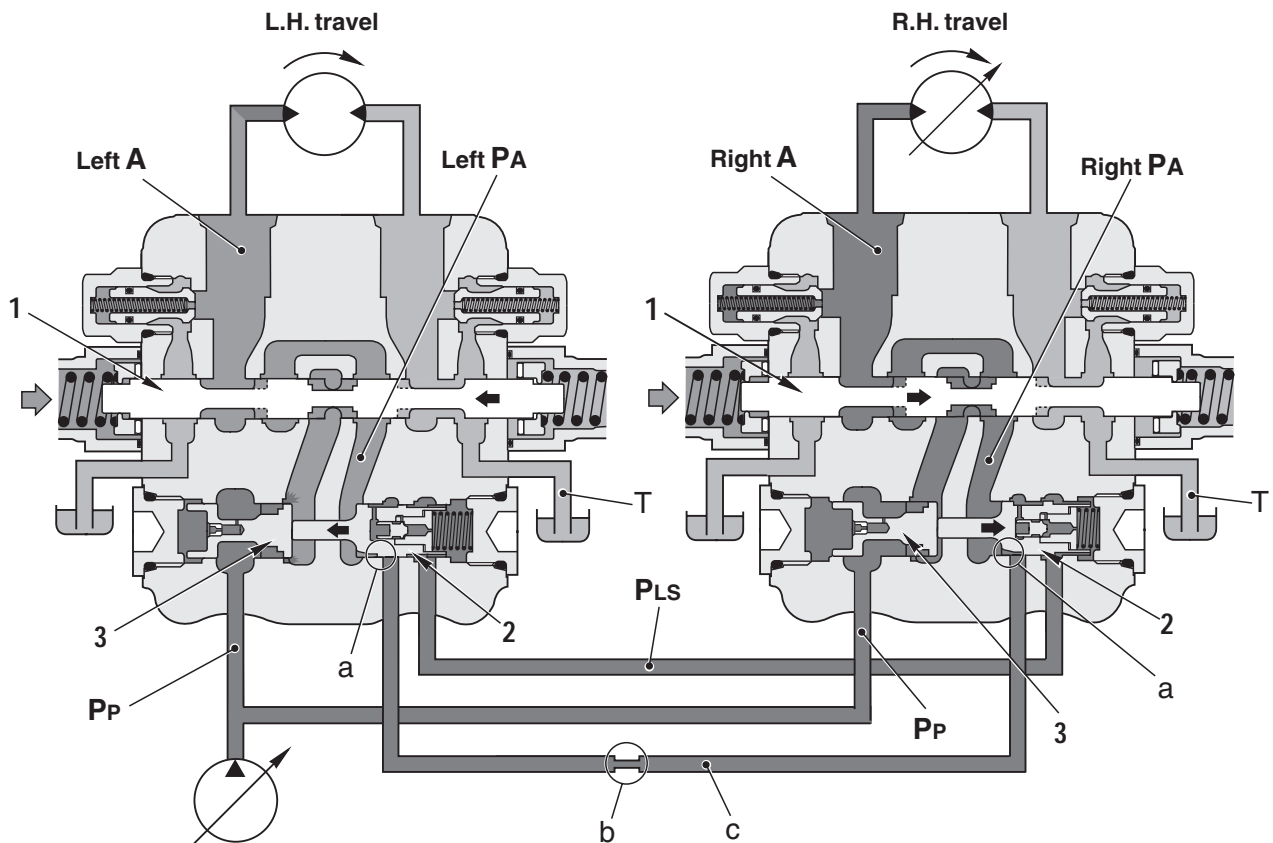


RKP03041

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.



RKP03051

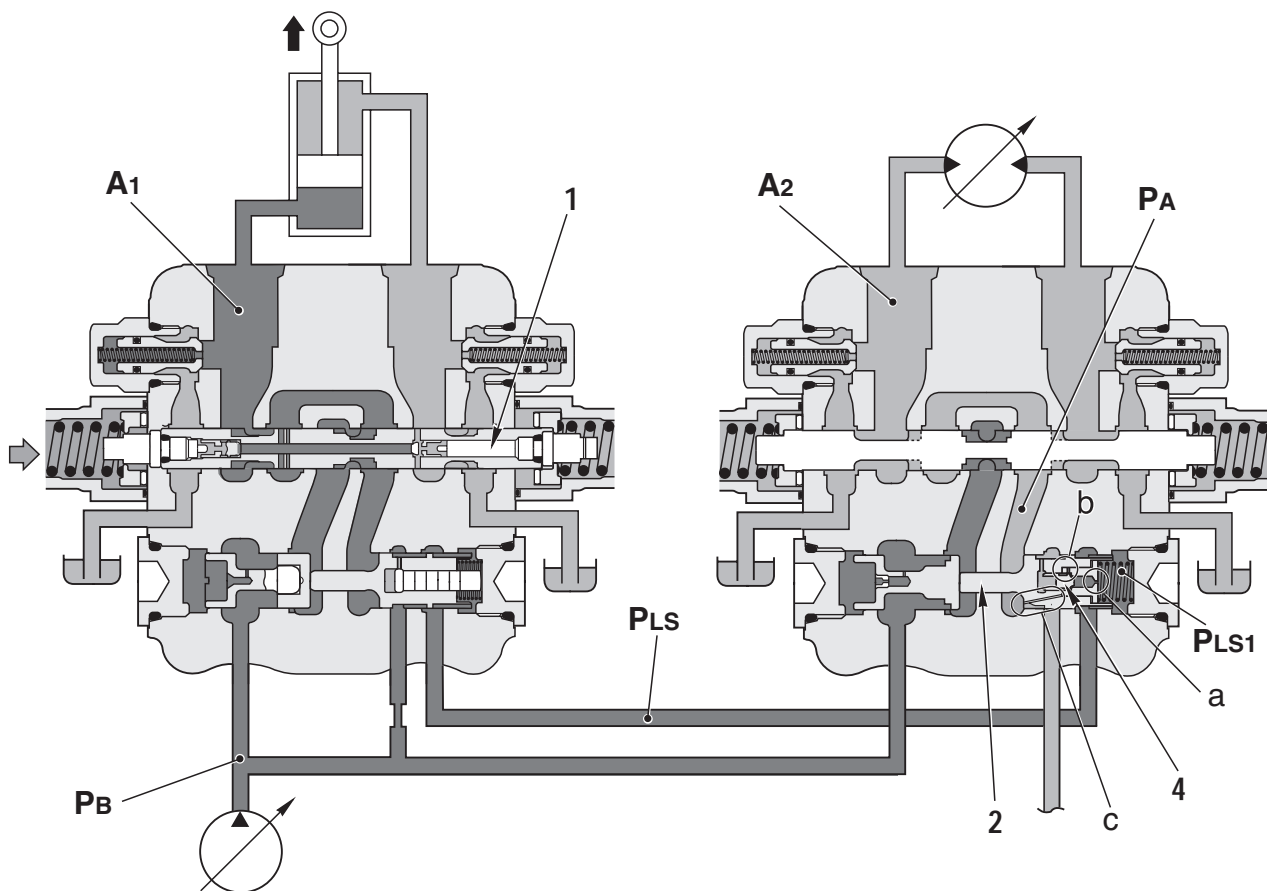
When the travel steering is operated

- 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 P_A 's ($R.H. A > L.H. A$), and the LS pressure P_{LS} 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 (\leftarrow) by the LS circuit P_{LS} , 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, shutting 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.

7. 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 P_{LS} 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.

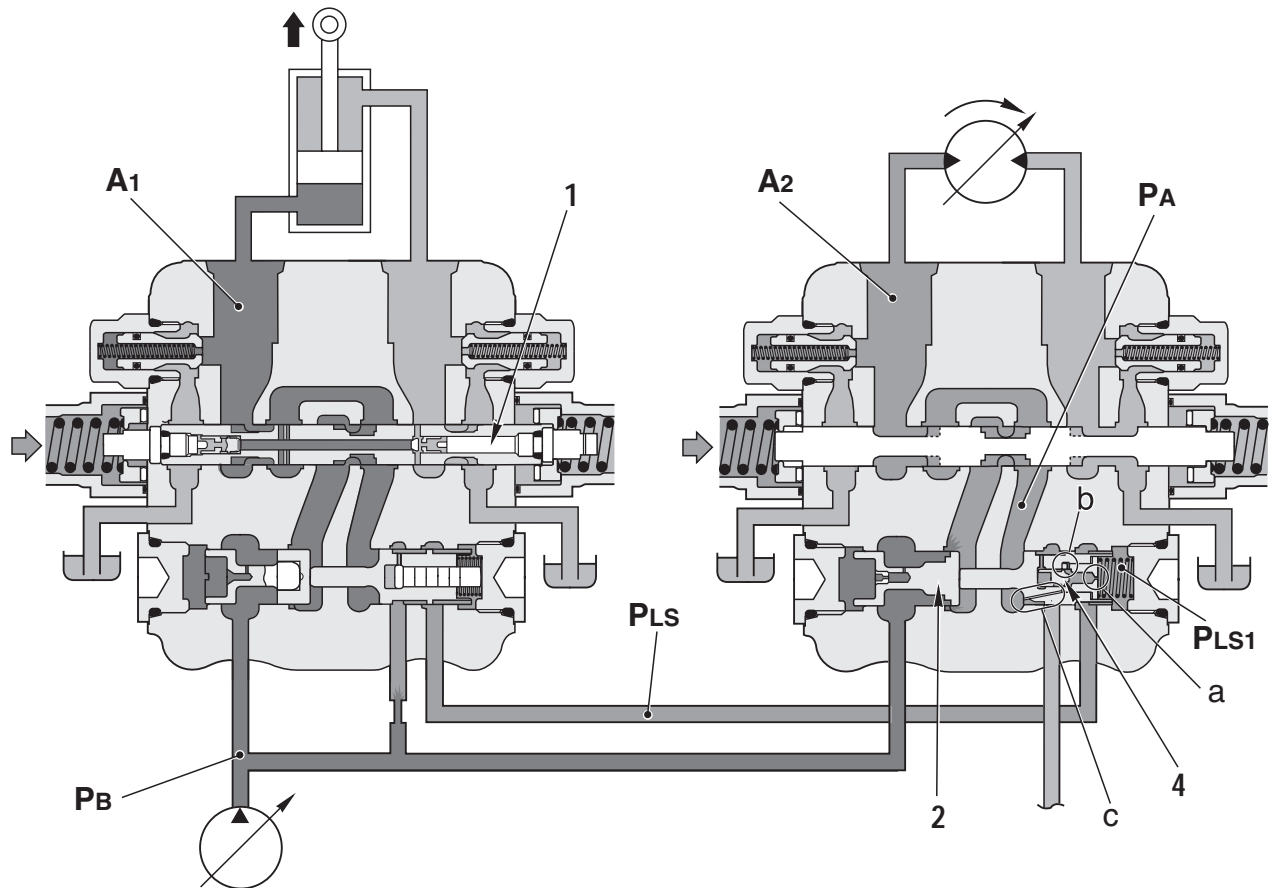


RKP03060

OPERATION

Normal operation

- When the boom spool (1) is operated, the pressure in the **LS** circuit P_{LS} becomes same as the boom circuit pressure A_1 .
- At the same time, the **LS** circuit pressure P_{LS} is also introduced to the spring chamber P_{LS1} 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.



RKP03070

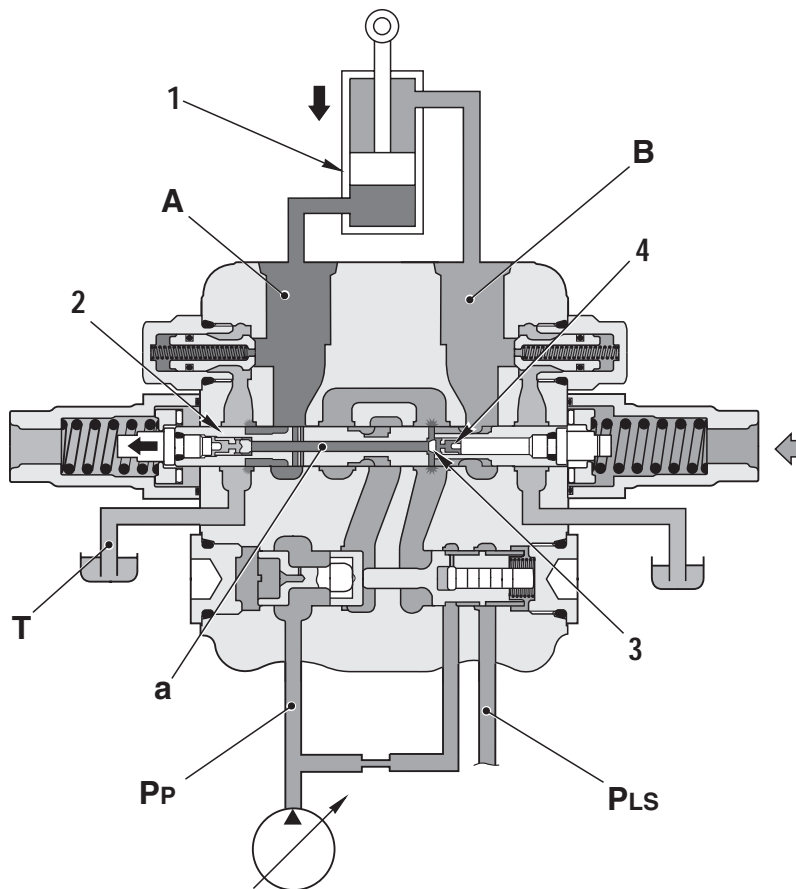
When the travel and another actuator are operated together

- When the boom spool (1) is operated, the pressure in the LS circuit P_{LS} becomes same as the boom circuit pressure A_1 .
- Since the pressure in the boom RAISE actuator circuit is normally higher than that of the travel actuator ($A_1 > A_2$), the pressure in the spring chamber P_{LS1} in the reducing valve (2) at the travel side is higher than the travel circuit pressure (P_A).
- Therefore, the pressure reducing valve (2) moves to the left (\leftarrow) side, and the LS pressure in the spring chamber P_{LS1} from the orifice a pushes and opens the check valve (4), and flows to the travel circuit P_A through the path b and the path c.
- Thus, the LS circuit pressure P_{LS} , which has been the same as the boom circuit pressure A_1 , flows to the travel circuit A_2 and lowers.

8. 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.

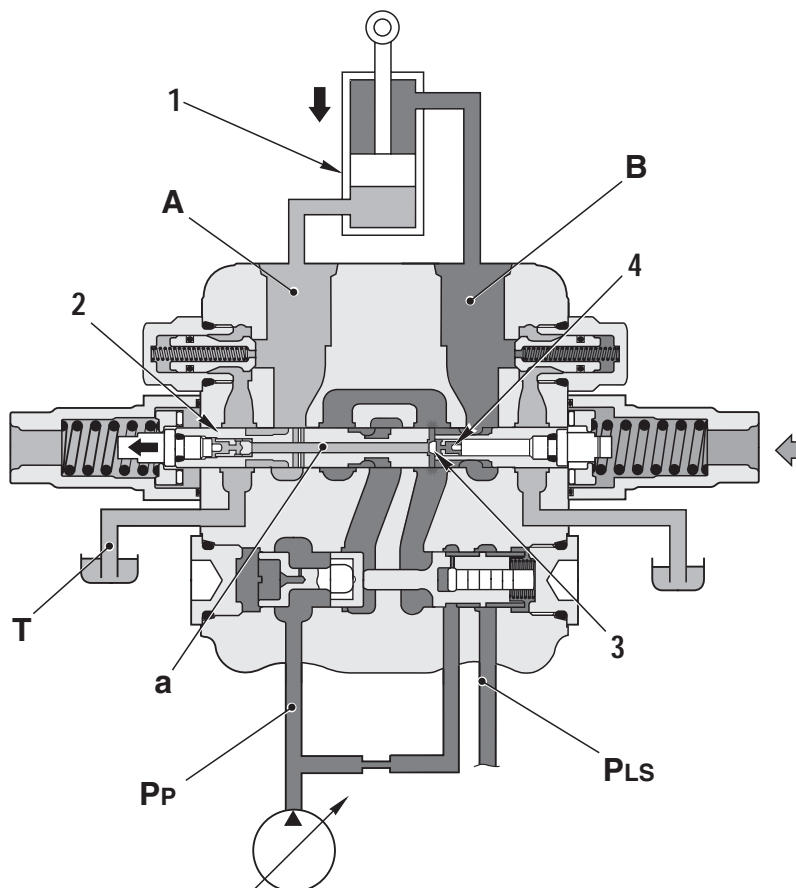


RKP03080

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.

- 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.

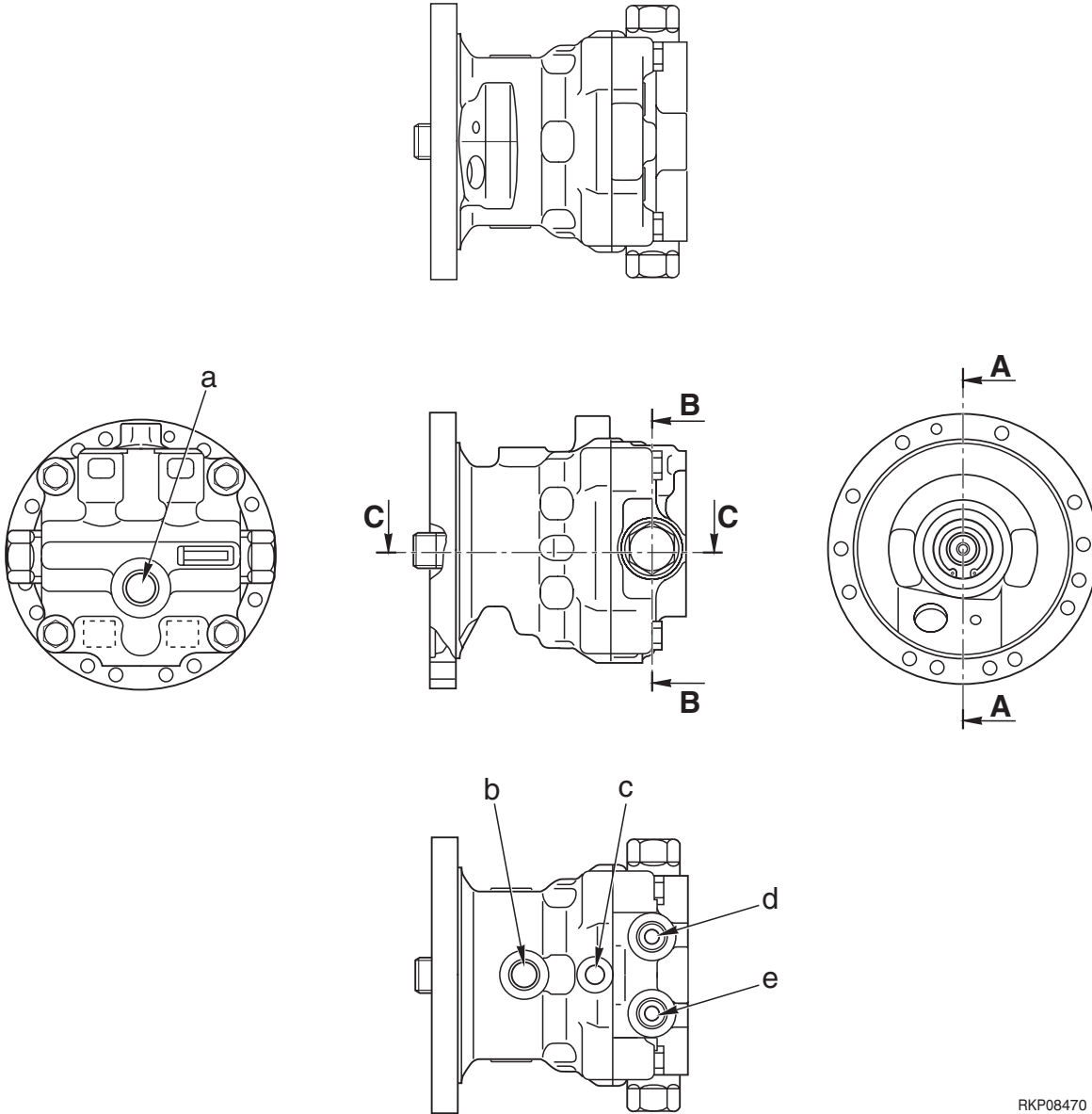


RKP03090

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

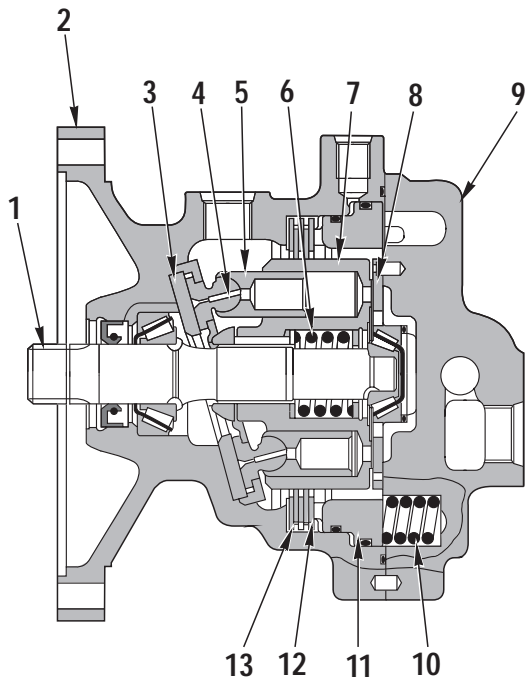


RKP08470

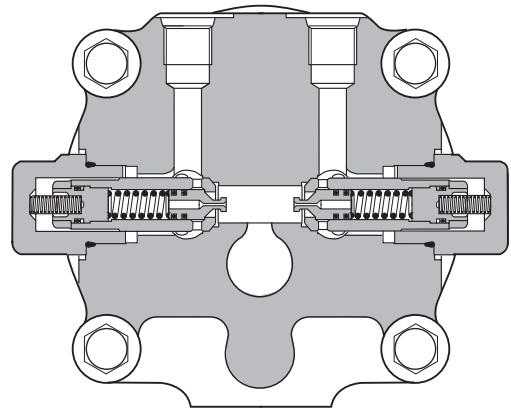
- a. S Port- From control valve (Tsw Port)
- b. T Port - To hydraulic tank
- c. B Port - From ST1 solenoid valve group (A1 Port)
- d. MB Port - From control valve (A1 Port)
- e. MA Port - From control valve (B1 Port)

SPECIFICATIONS

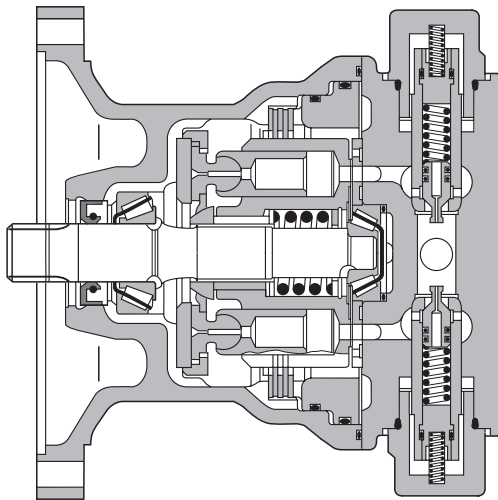
Type: LMF40AB-2
 Motor capacity: 40.8 cc/rev
 Rated speed: 1500 rpm
 Safety valve set pressure: 206 bar
 (2987.6 psi)
 Suction valve cracking pressure: max. 0.3 bar
 (4.35 psi)
 Brake releasing pressure: 18.1±2.5 bar
 (262.5±36.25 psi)



Section A-A



Section B-B



Section C-C

- 1. Output shaft
- 2. Case
- 3. Thrust plate
- 4. Shoe
- 5. Piston
- 6. Center spring
- 7. Cylinder

- 8. Valve plate
- 9. End cover
- 10. Brake spring
- 11. Brake piston
- 12. Disc
- 13. Plate
- 14. Safety valve with suction

RKP08480

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.

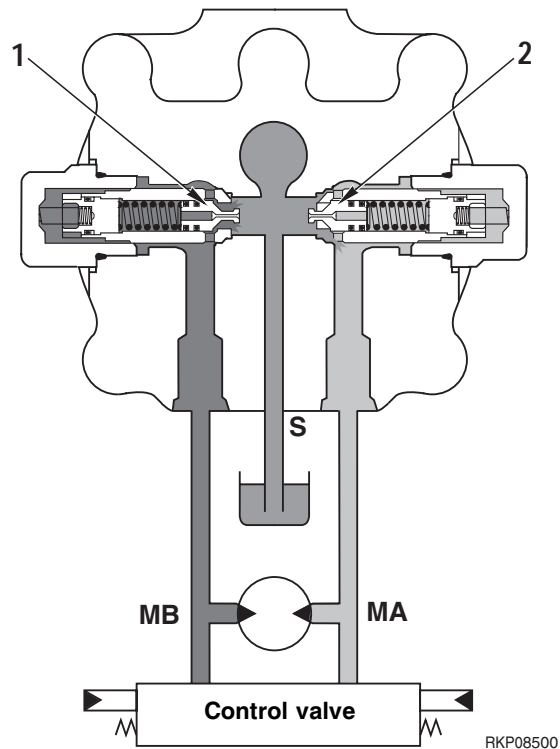
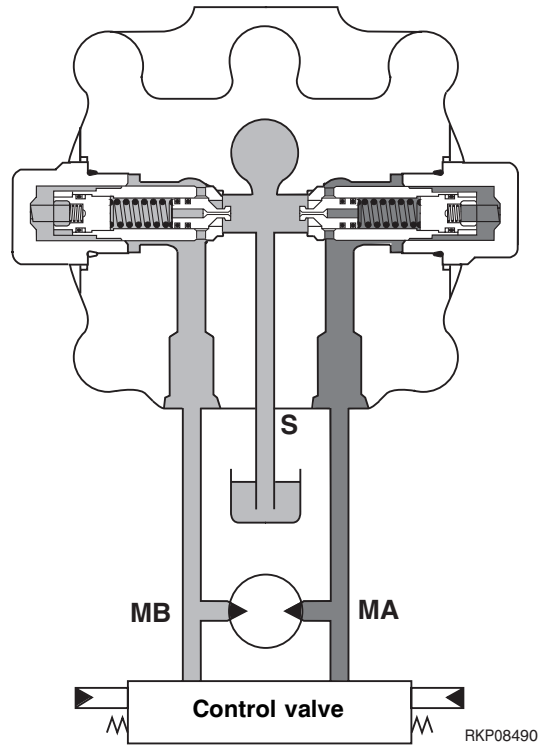
OPERATION

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 **MA** through the control valve.
- By this, pressure in the Port **MA** rises, which generates starting force to the motor, and the motor starts to run.
- Oil coming out of the outlet Port returns to the tank from the Port **MB** through 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 **MA**.
At the same time, return circuit for the oil coming out of the outlet of the motor to the tank is shut off by the control valve.
- At the Port **MB**, pressure rises, which generates rotational resistance to the motor, which then acts as braking force to the motor.
- When the pressure at the Port **MB** reaches the set pressure of the safety valve (1), **B** of the safety valve (1) opens to release the pressure oil in the Port **MB** to the Port **S**.
- At the Port **MA**, 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.

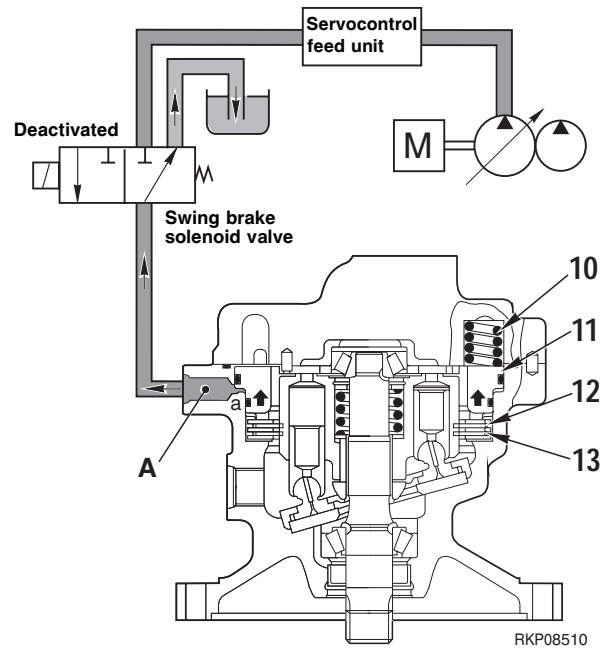


SWING BRAKE

OPERATION

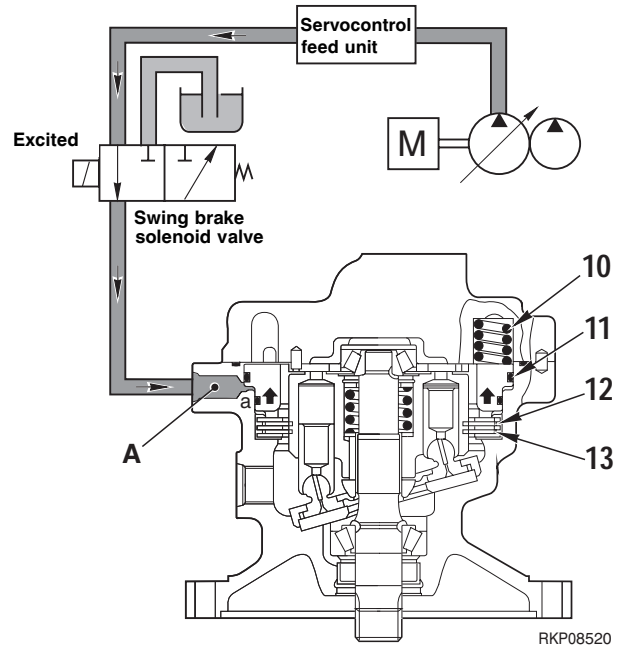
1. When swing brake solenoid valve is deactivated

- When the swing brake solenoid valve is deactivated, the pressurized oil from the servocontrol feed unit is shut off and Port **B** is connected to the tank circuit.
- Because of this, brake piston (11) is pushed down in the direction of the arrow by brake spring (10), so disc (12) and plate (13) are pushed together and the brake is applied.



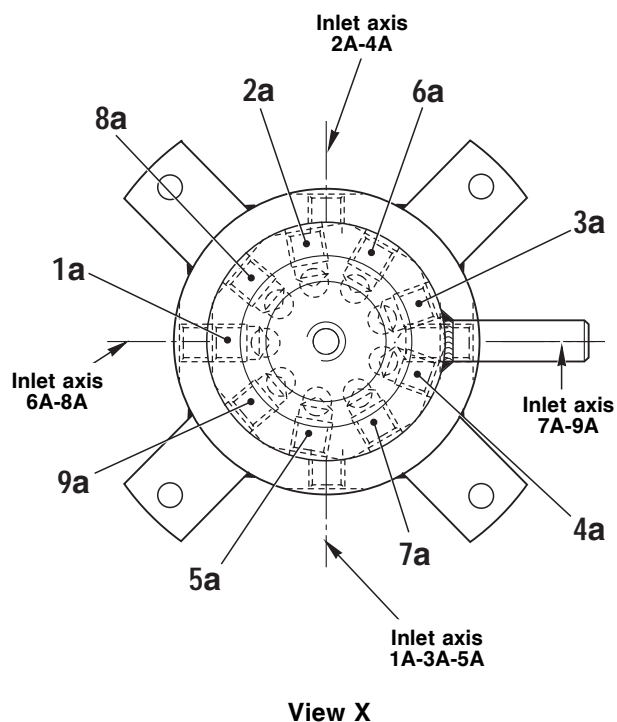
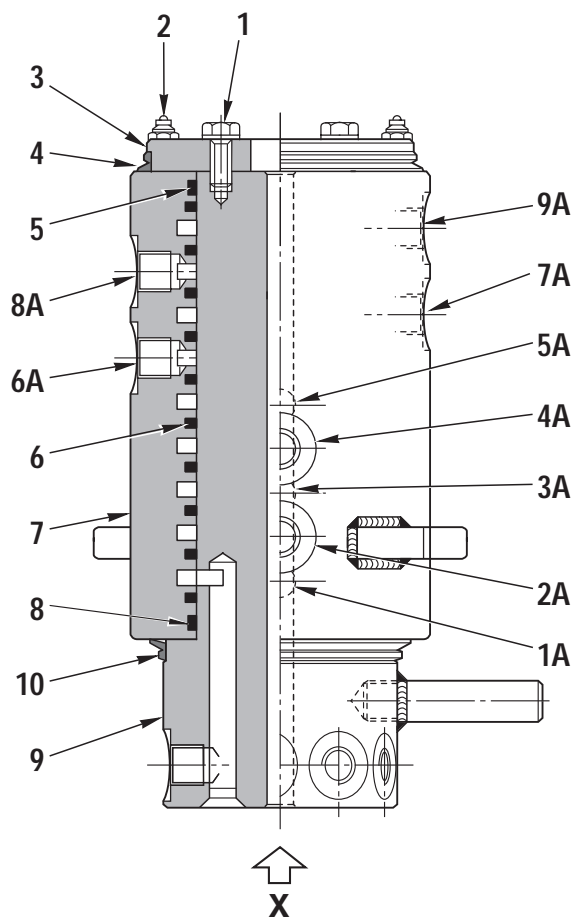
2. When swing brake solenoid valve is excited

- When the swing brake solenoid valve is excited, the valve is switched, and the pressurized oil from the servocontrol feed unit enters Port **B** and flows to brake chamber **a**.
- The pressurized oil entering chamber **a** overcomes the force of brake spring (10), and brake piston (11) is pushed up in the direction of the arrow.
- Because of this, disc (12) and plate (13) separate, and the brake is released.



CENTER SWIVEL JOINT

← Front of machine



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 (B2 Port)
- 3A. From control valve (B2 Port)
- 4A. To hydraulic tank
- 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)

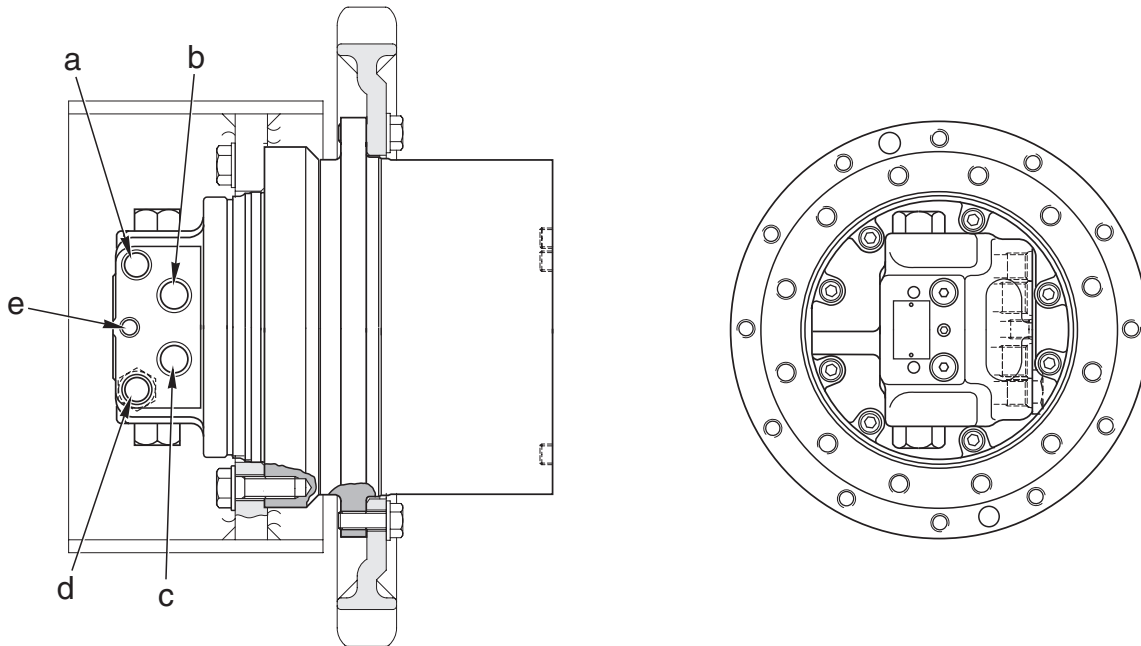
- 1. Screw
- 2. Grease nipple
- 3. Cover
- 4. Guard ring
- 5. O-Ring
- 6. Seal
- 7. Rotor
- 8. O-Ring
- 9. Body
- 10. Guard ring

- 1a. Not used
- 2a. To travel motors (D Port)
- 3a. To blade safety valve (V1 Port)
- 4a. From travel motors (C1 Port)
- 5a. To blade safety valve (V2 Port)
- 6a. To L.H. travel motor (A Port)
- 7a. To R.H. travel motor (A Port)
- 8a. To L.H. travel motor (B Port)
- 9a. To R.H. travel motor (B Port)

RKP10480

**PAGE INTENTIONALLY
LEFT BLANK**

TRAVEL MOTOR



RKP08530

- a. C1 Port - L.H. travel motor:
To swivel joint (4a Port)
- b. A Port - R.H. travel motor:
From swivel joint (7a Port)
L.H. travel motor:
From swivel joint (6a Port)
- c. B Port - R.H. travel motor:
From swivel joint (9a Port)
L.H. travel motor:
From swivel joint (8a Port)
- d. C2 Port - R.H. travel motor:
From swivel joint (4a Port)
- e. D Port - From swivel joint (2a Port)

SPECIFICATIONS

Type: GMO9VL2-B

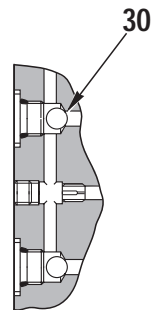
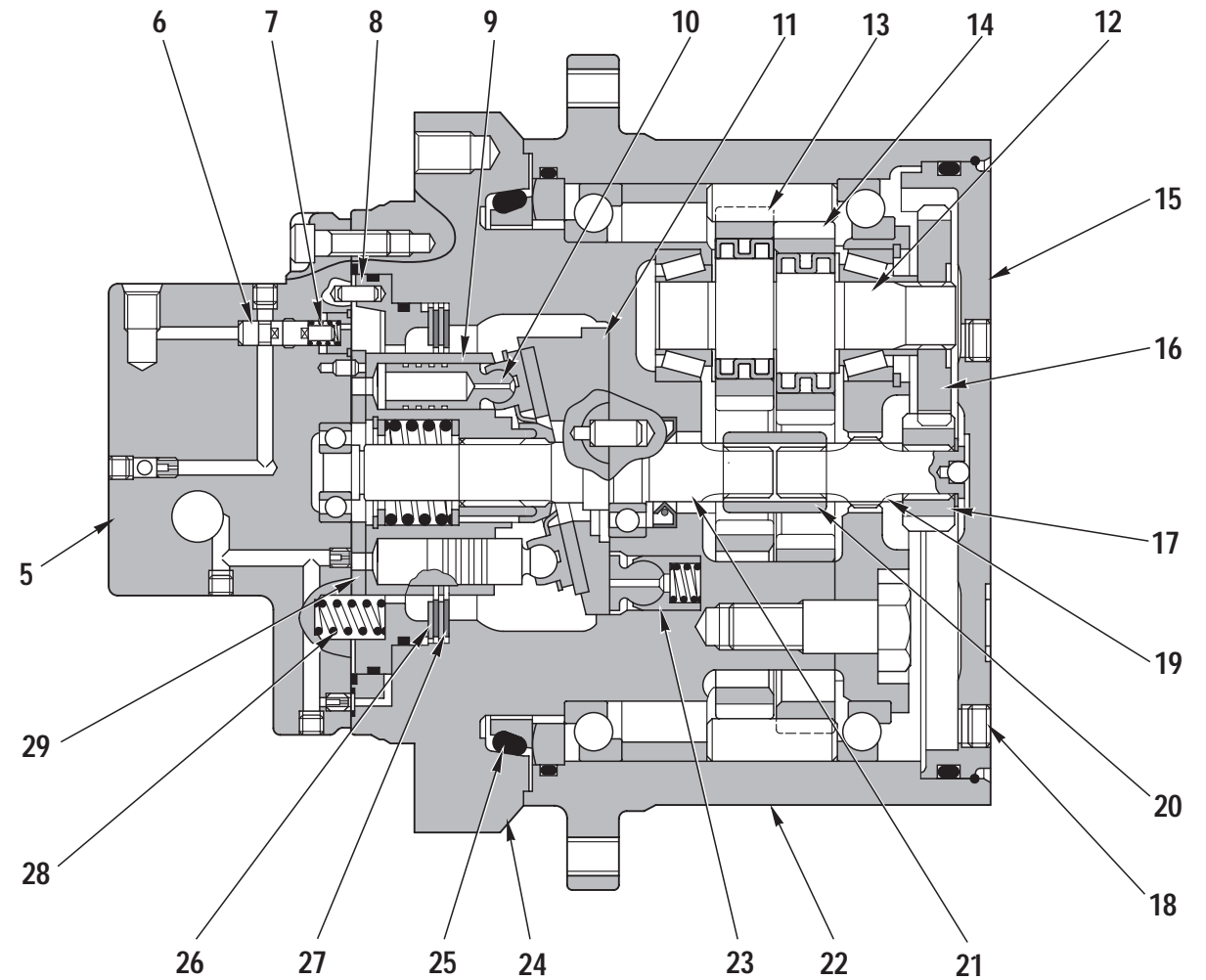
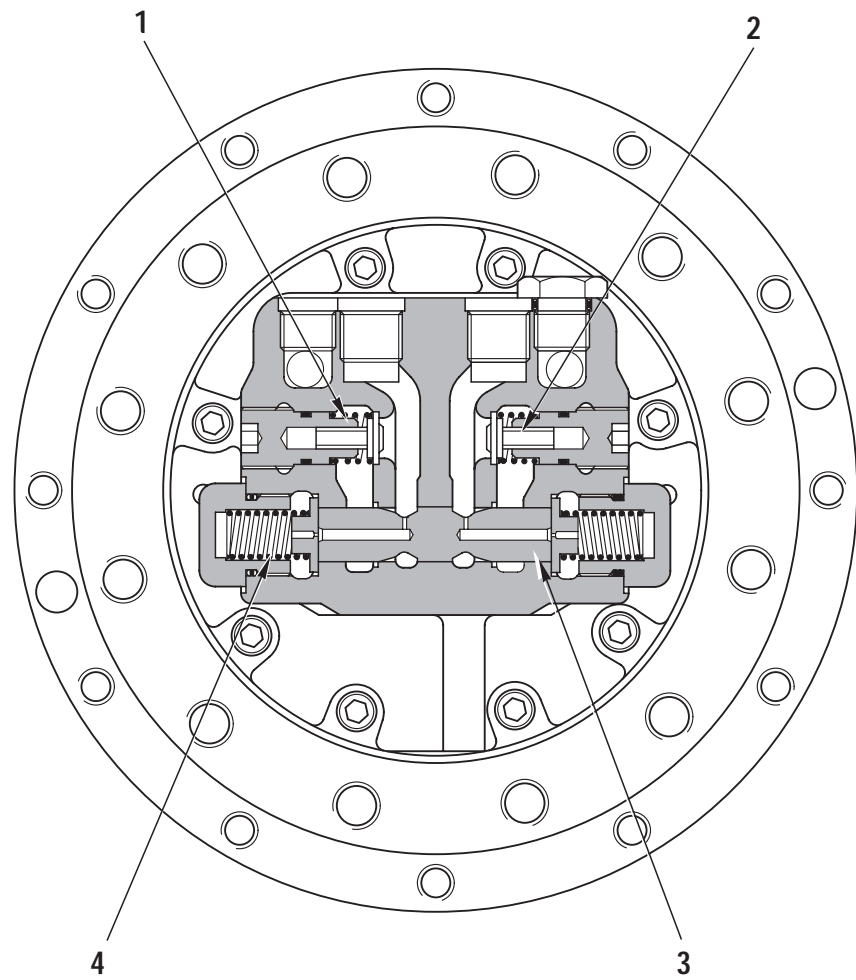
Hydraulic motor

Motor capacity: Hi speed: 26 rev.
Lo speed: 37 rev.

Max. working pressure: 314 bar (4554 psi)
Brake releasing pressure: 4.5 bar (65.3 psi)
Hi-Lo switching pressure: 38.5 bar (558.4 psi)

Final drive

Number of revolution: 1 – 62.4



- 1. Check valve spring
- 2. Check valve
- 3. Counterbalance valve
- 4. Return spring
- 5. End cap
- 6. Regulator valve
- 7. Spring
- 8. Brake piston
- 9. Cylinder
- 10. Piston

- 11. Swash plate
- 12. Crank shaft
- 13. RVA gear
- 14. RVB gear
- 15. Cover
- 16. Driven gear
- 17. Drive gear
- 18. Drain plug
- 19. Shaft
- 20. Coupling

- 21. Center shaft
- 22. Case
- 23. Regulator piston
- 24. Spindle
- 25. Floating seal
- 26. Plate
- 27. Disc
- 28. Brake spring
- 29. Valve plate
- 30. Check valve

RKP08540

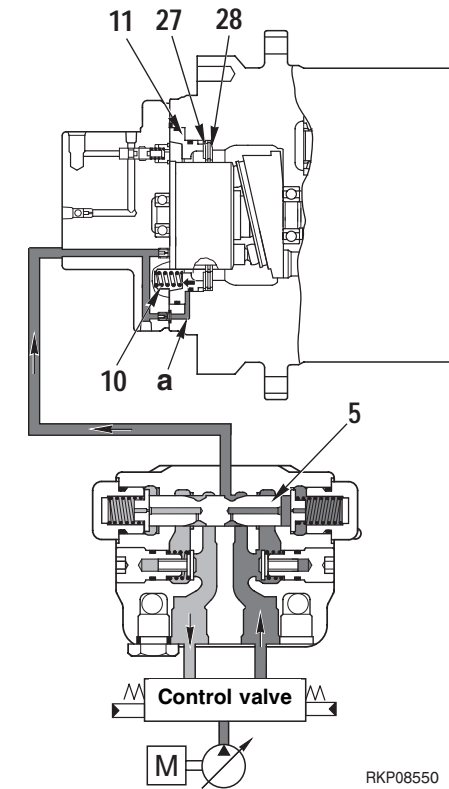
PARKING BRAKE

OPERATION

1. When starting to travel

When the travel lever is operated, the pressurized oil from the pump actuates counterbalance valve spool (5), the circuit to the parking brake is opened, and opened check valve and the oil flows into chamber a of brake piston (11), overcomes the force of spring (10), and pushes piston (11) to the left (←) in the direction of the arrow.

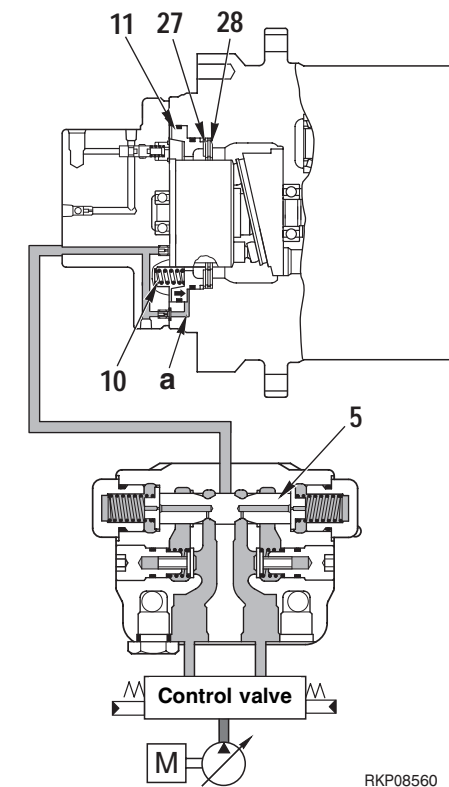
When this happens, the force pushing plate (27) and disc (28) together is lost, so plate (27) and disc (28) separate and the brake is released.



2- When stopping travel

When the travel lever is placed in neutral, counterbalance valve spool (5) returns to the neutral position and the circuit to the parking brake is closed. The pressurized oil in chamber a of brake piston (11) is drained to the case from the orifice of check valve in the brake piston, and brake piston (11) is pushed to the right (→) in the direction of the discs (27) and (28).

As a result the brake is applied.



BRAKE VALVE

- The brake valve consist of a check valve and counterbalance valve in a circuit as shown in the diagram on the right. (Fig. 1)
- The function and operation of each component is as given below.

1. Counterbalance valve, check valve

FUNCTION

- When travelling down a slope, the weight of the machine makes it try to travel faster than the speed of the motor.
As a result, if the machine travels with the engine at low speed, the motor will rotate without load and will run away, which is extremely dangerous.
To prevent this, these valves act to make the machine travel according to the engine speed (pump discharge volume).

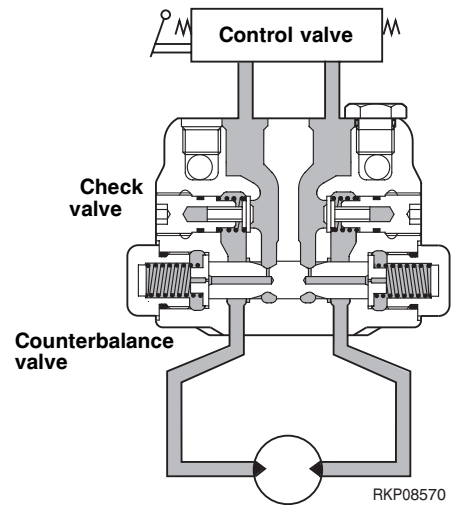


Fig. 1

Operation when pressure is supplied

- When the travel lever is operated, the pressurized oil from the control valve is supplied to Port **PA**. It pushes open check valve (2a) and flows from motor inlet Port **MA** to motor outlet Port **MB**.
However, the motor outlet Port is closed by check valve (2b) and spool (5), so the pressure at the supply side rises. (Fig. 2).
- The pressurized oil at the supply side flows from orifice **E1** in spool (5) to chamber **S1**, and when the pressure in chamber **S1** goes above the spool switching pressure, spool (5) is pushed to the right in the direction of the arrow.
As a result, Port **MB** and Port **PB** are connected, the outlet Port side of the motor is opened, and the motor starts to rotate. (Fig. 3).

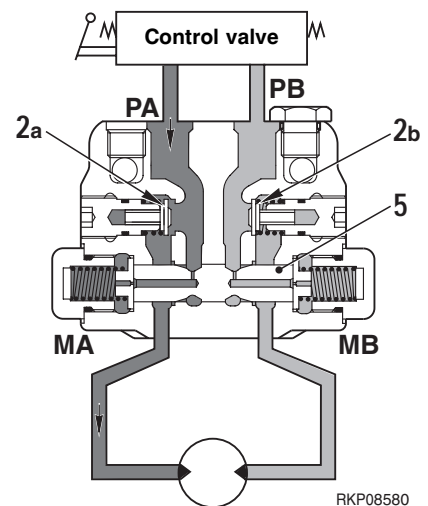


Fig. 2

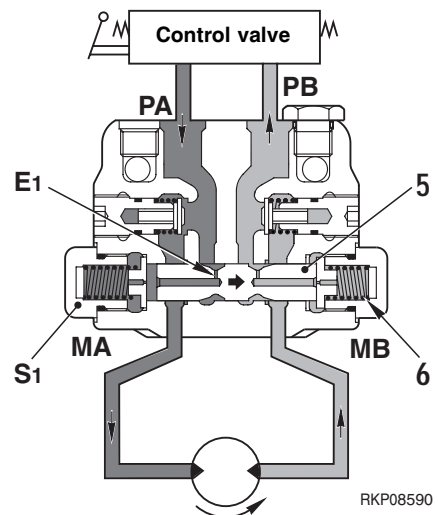


Fig. 3

Operation of brake when travelling downhill

- If the machine tries to run away when travelling downhill, the motor will turn under no load, so the pressure at the motor inlet Port will drop, and the pressure in chamber **S1** through orifice **E1** will also drop.

When the pressure in chamber **S1** drops below the spool switching pressure, spool (5) is returned to the left in the direction of the arrow by spring (6), and outlet Port **MB** is throttled.

As a result, the pressure at the outlet Port side rises, resistance is generated to the rotation of the motor, and prevents running away.

In other words, the spool is moved to a position where the pressure at outlet Port **MB** balances the pressure at the inlet Port and the force generated by the weight of the machine.

It throttles the outlet Port circuit and controls the speed according to the discharge volume of the pump.

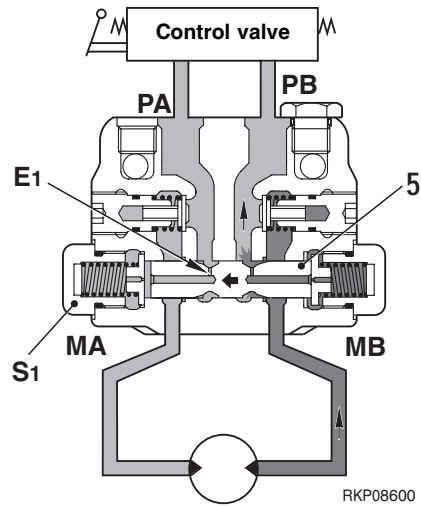
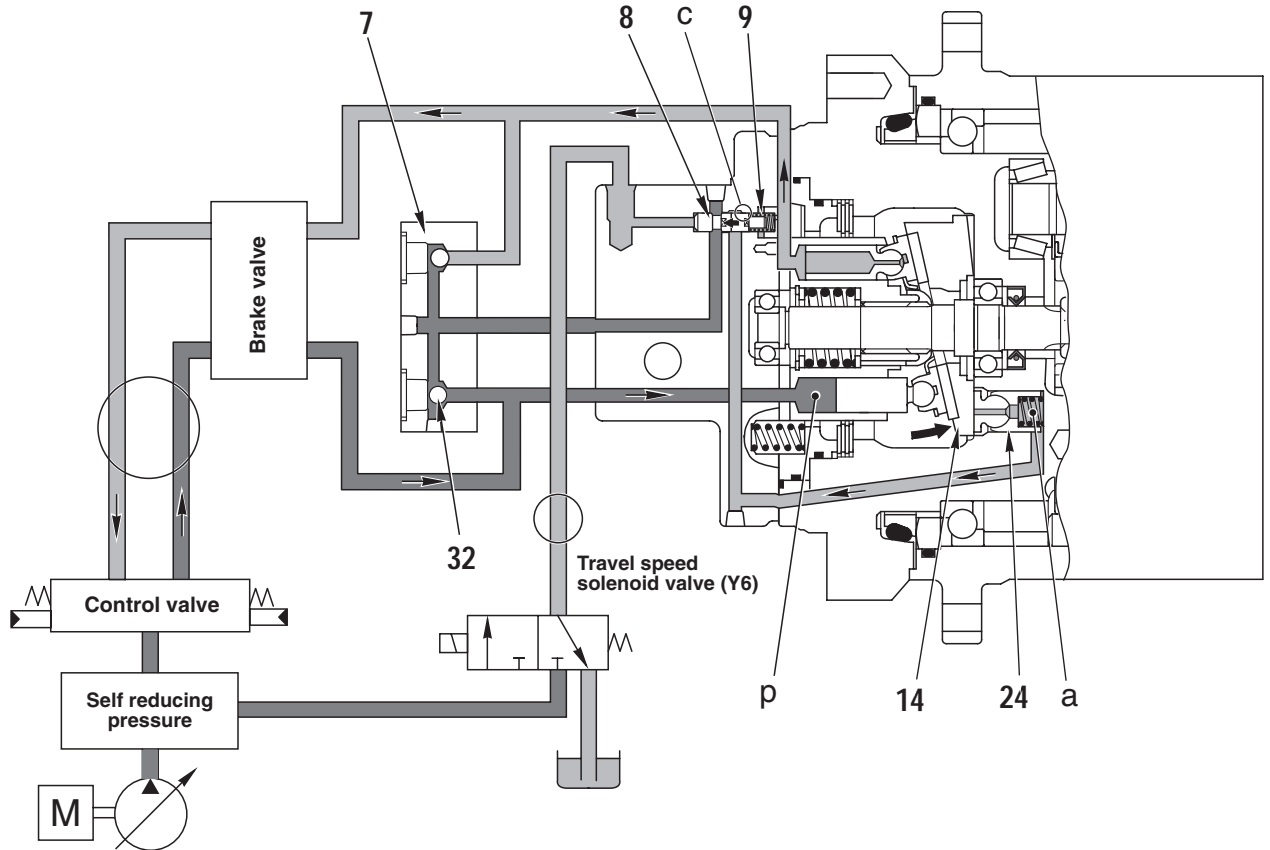


Fig. 4

TRAVEL MOTOR

OPERATION

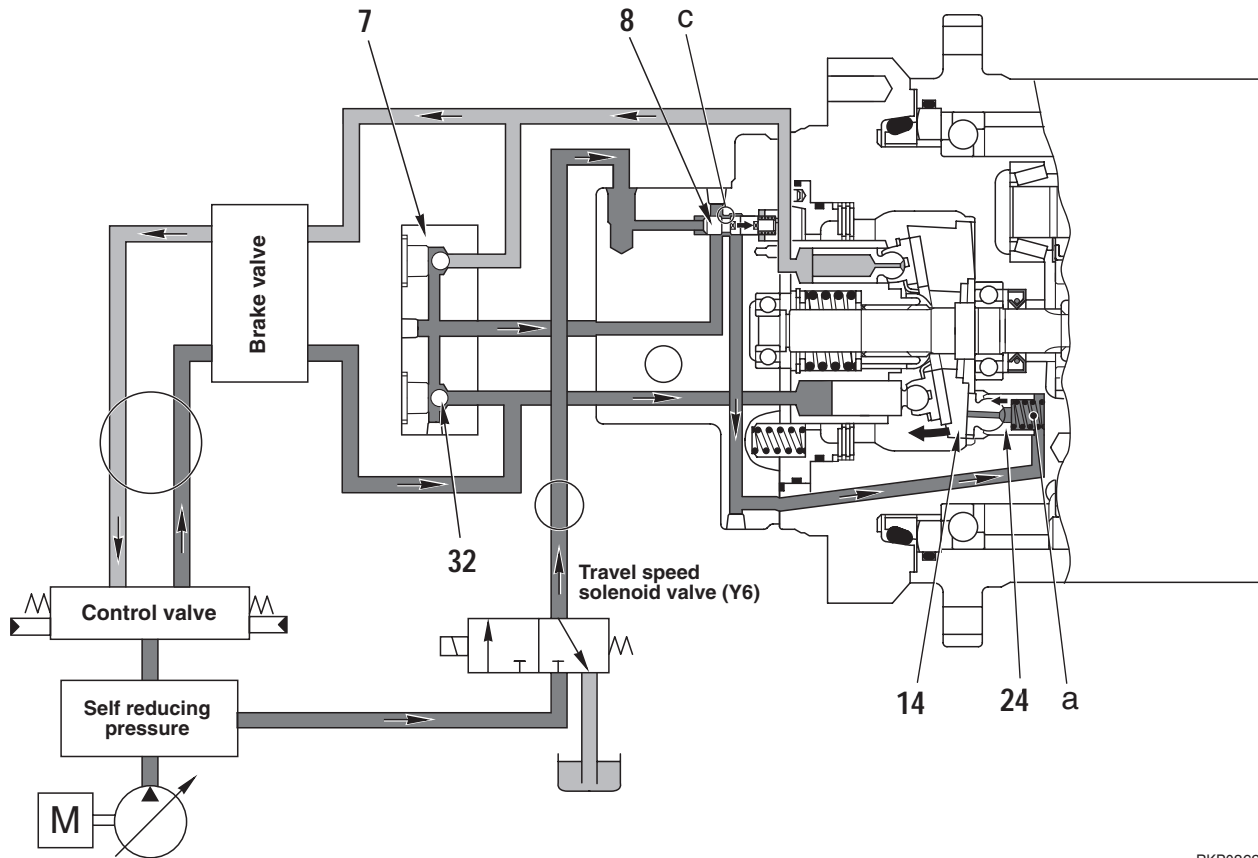
1) At lo speed (motor rocker cam angle at maximum).



RKP08611

- The solenoid valve Y6 is deactivated, so the pilot pressure oil from the self reducing valve does not flow to Port D.
For this reason, regulator valve (8) is pushed to the left in the direction of the arrow by spring (9). Because of this, it pushed check valve (32), and the main pressure oil from the control valve to end cover (7) is closed for regulator valve (8).
- The pressurized oil in chamber a at regulator piston (24) at the bottom passes through orifice b in regulator valve (8) and is drained to the motor case.

2) At High speed (motor rocker cam angle at minimum)



RKP08621

- The solenoid valve Y6 is excited, so the pilot pressure oil from the charging pump flows to Port **D**, and pushed regulator valve (8) is pushed to the right in the direction of the arrow.
- Because of this, the main pressure oil from the control valve passes through passage **c** in regulator valve (8), enters regulator piston (24) at the bottom, and pushes regulator piston (24) to the left in the direction of the arrow.
- As a result, rocker cam (14) moves in the minimum swash plate angle direction, the motor capacity becomes minimum, and the system is set to Hi speed.

REDUCTION GEAR

FUNCTION

This reduction gear is composed of spur reduction gears (First Reduction) and differential reduction gears (Second Reduction).

OPERATING PRINCIPLE

1. First Reduction

Function

At the below and left figure, the rotating motion on hydraulic motor is transmitted to the input gear (2) of First Reduction. Then three spur gears (3) engaged with the input gear (2) rotate with reducing the rotating speed. Gear ratio of First Reduction is described as the following.

$$i_1 = - Z_i / Z_s$$

Z_i = No, of teeth if input gear

Z_s = No, of teeth of spur gear

2. Second reduction

Three spur gears are connected severally to the three crank shaft (4). These crank shafts are input of Second Reduction..

RV gear (5) (6) are fitted up the eccentric crank shaft through bearings. According to rotating of the crank shaft, RV gears revolve (eccentric motion) along pin-gears (7) within hub. As these crank shafts are supported by spindle, hub rotates with reducing the speed. Gear ratio of Second Reduction is described as the following.

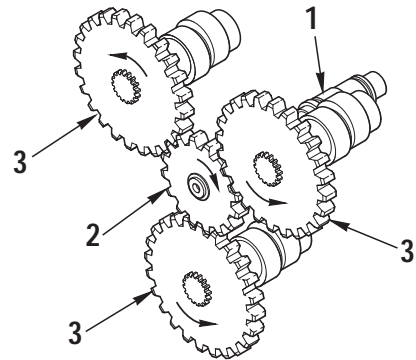
$$i_2 = (Z_P - Z_R) / Z_P$$

Z_P = No, of pin

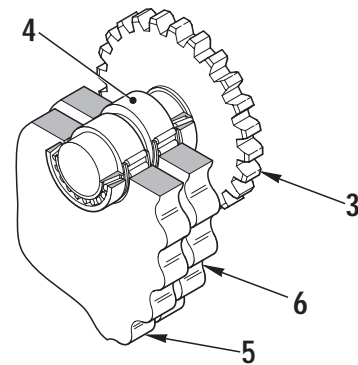
Z_R = No, of teeth of RV gear

Total gear ratio of this reduction gear is described as the following.

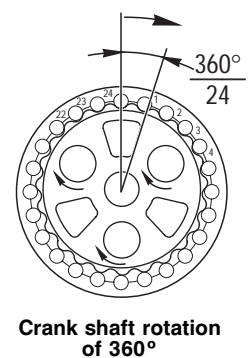
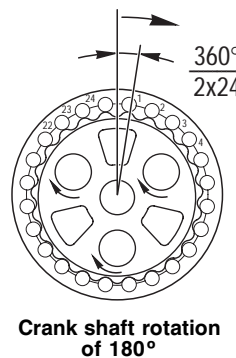
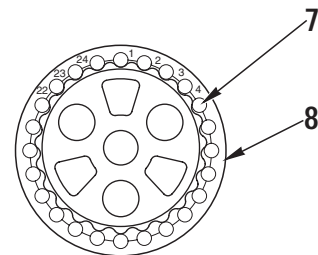
$$i = i_1 \times i_2 = - Z_i / Z_s \times (Z_P - Z_R) / Z_P$$



RKP08630



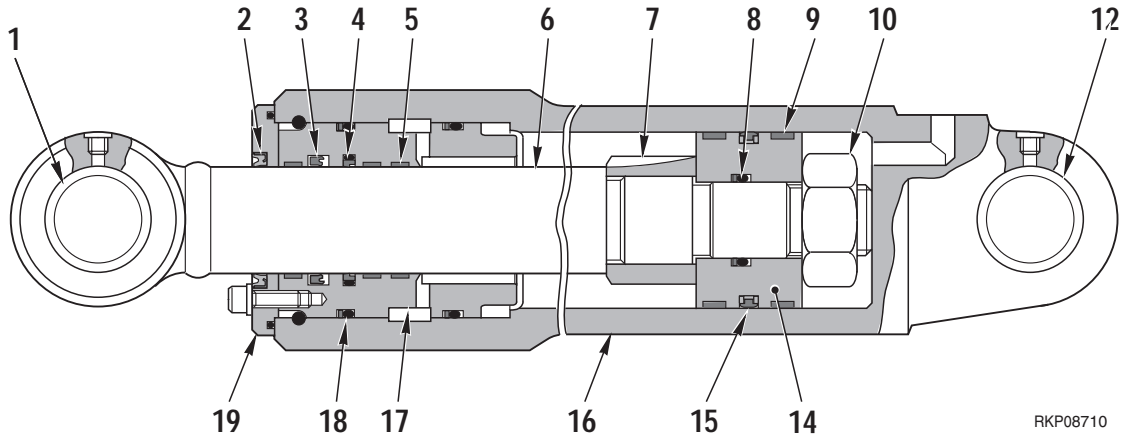
RKP08840



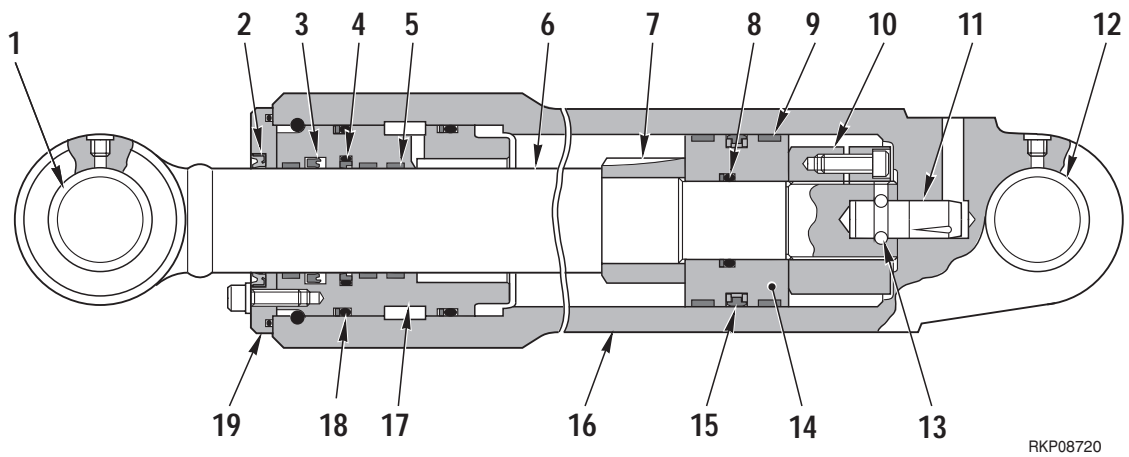
RKP08650

CYLINDERS

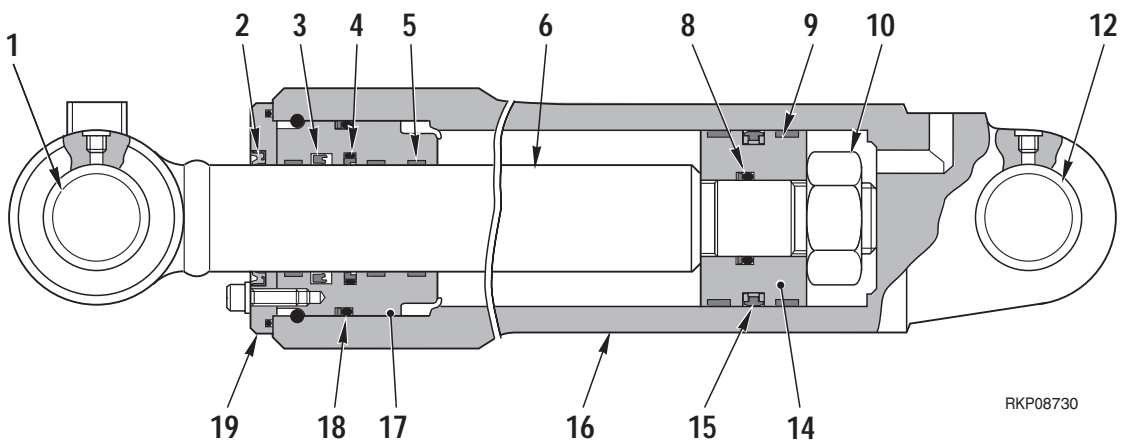
BOOM



ARM

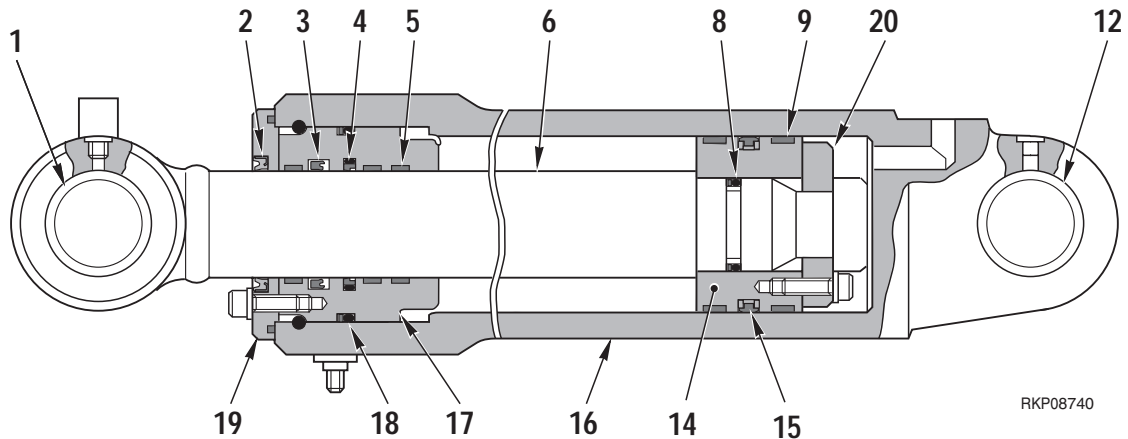


BUCKET



BOOM SWING, BLADE, 2-PIECE BOOM

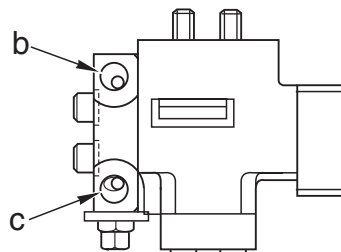
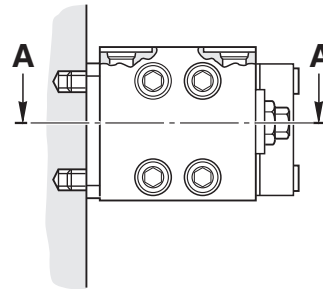
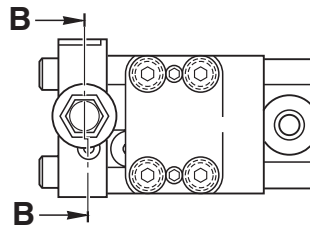
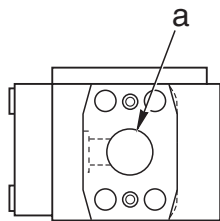
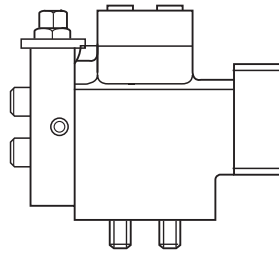
(★ The figure shows the blade cylinder)



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

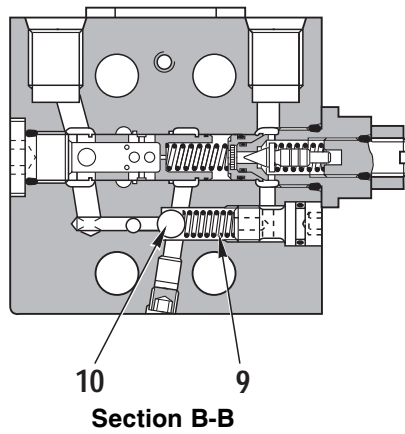
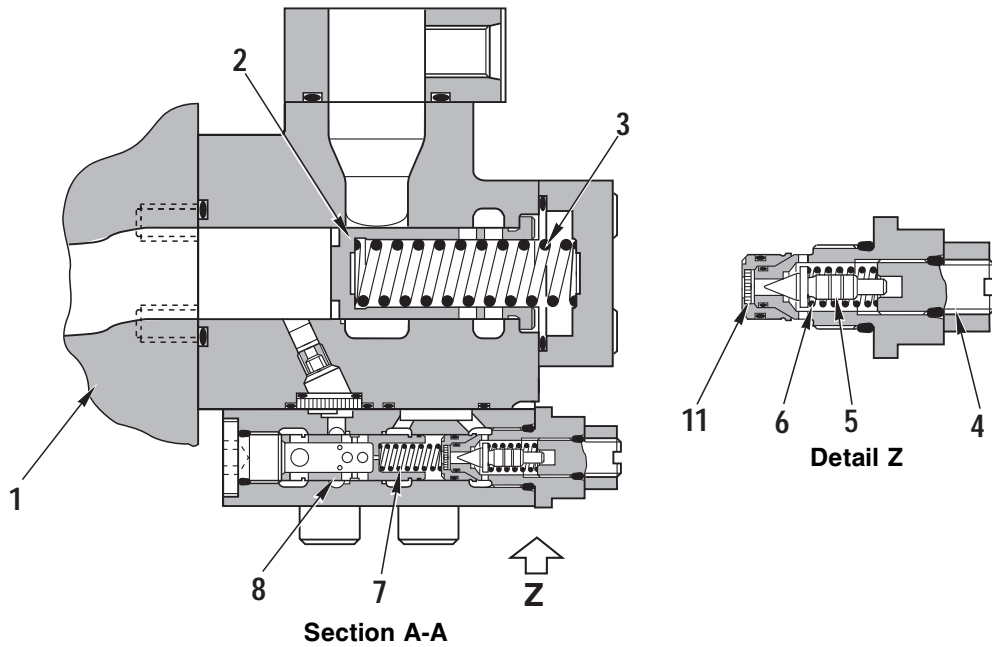
Cylinder	Boom	2-piece boom	Arm	Bucket	Boom swing	Blade
Piston rod diameter	70 mm (2.758 in.)	50 mm (1.97 in.)	60 mm (2.364 in.)	55 mm (2.167 in.)	60 mm (2.364 in.)	60 mm (2.364 in.)
Cylinder inside diameter	110 mm (4.334 in.)	90 mm (3.546 in.)	95 mm (3.743 in.)	85 mm (3.349 in.)	100 mm (3.94 in.)	120 mm (4.728 in.)
Piston stroke	765 mm (30.141 in.)	580 mm (22.852 in.)	905 mm (35.657 in.)	730 mm (28.762 in.)	650 mm (25.61 in.)	215 mm (8.471 in.)
Max. cylinder length	1965 mm (77.421 in.)	1510 mm (59.494 in.)	2245 mm (88.453 in.)	1810 mm (71.314 in.)	1650 mm (65.01 in.)	790 mm (31.126 in.)
Min. cylinder length	1200 mm (47.28 in.)	930 mm (36.642 in.)	1340 mm (52.796 in.)	1080 mm (42.552 in.)	1000 mm (39.4 in.)	575 mm (22.655 in.)
Piston nut width across flat	70 mm (2.758 in.)	—	—	55 mm (2.167 in.)	—	—

SERVOCONTROL FEED UNIT



RKP03960

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



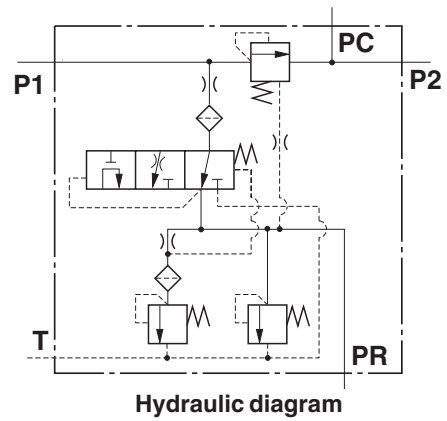
- 1. Pump case
- 2. Valve
- 3. Spring
- 4. Screw
- 5. Poppet
- 6. Spring (reducing valve pilot)
- 7. Spring (reducing valve main)
- 8. Spool (reducing valve)
- 9. Spring (safety valve)
- 10. Ball
- 11. Filter

RKP03970

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)



RKP03861

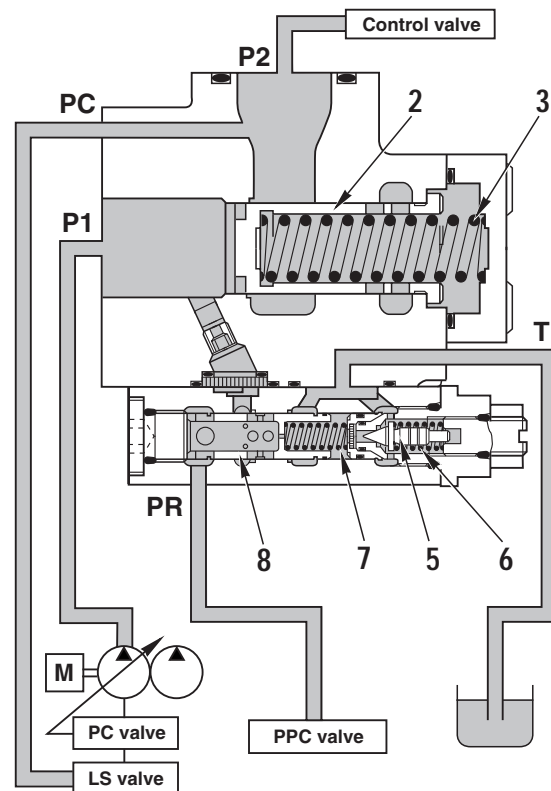


Fig. 1

RKP03871

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 (0 psi)).

However, when hydraulic oil flows in from Port **P1**, the pressure is balanced so that pressure **P1** = force of spring (3) + (area $\varnothing d$ 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)

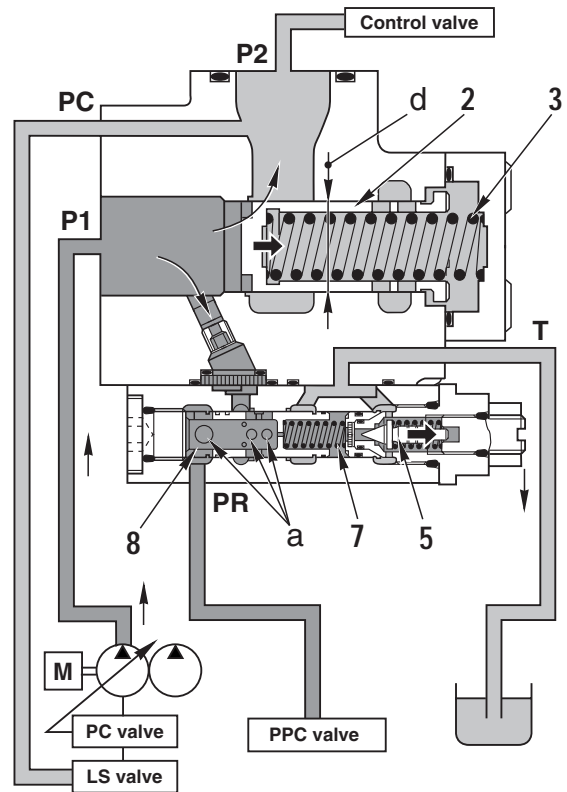


Fig. 2

RKP03881

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 $\varnothing d$ 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) → 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. 3)

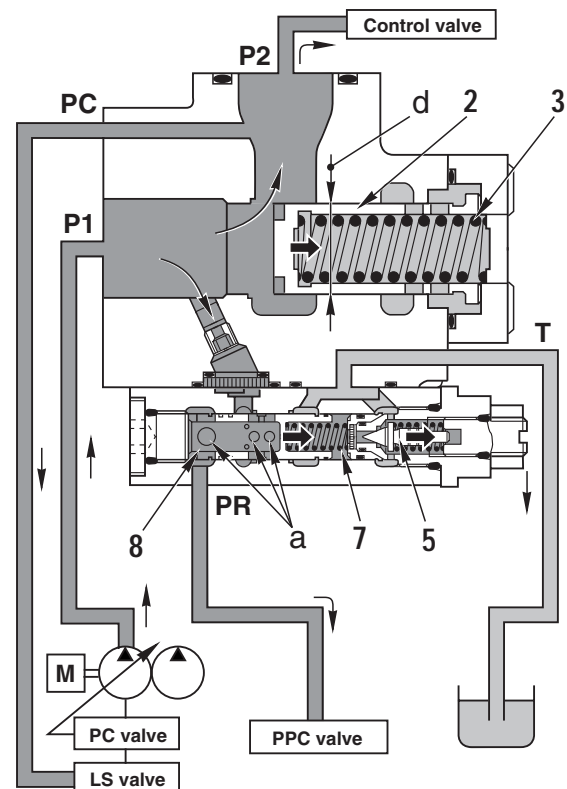


Fig. 3

RKP03891

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)

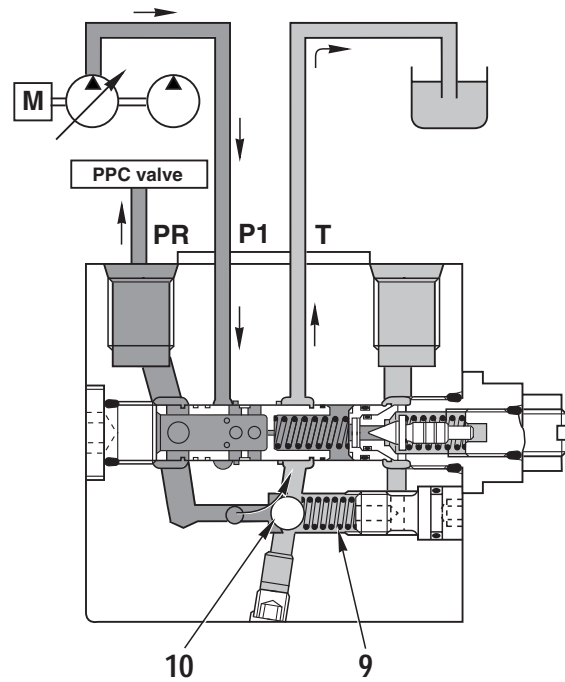
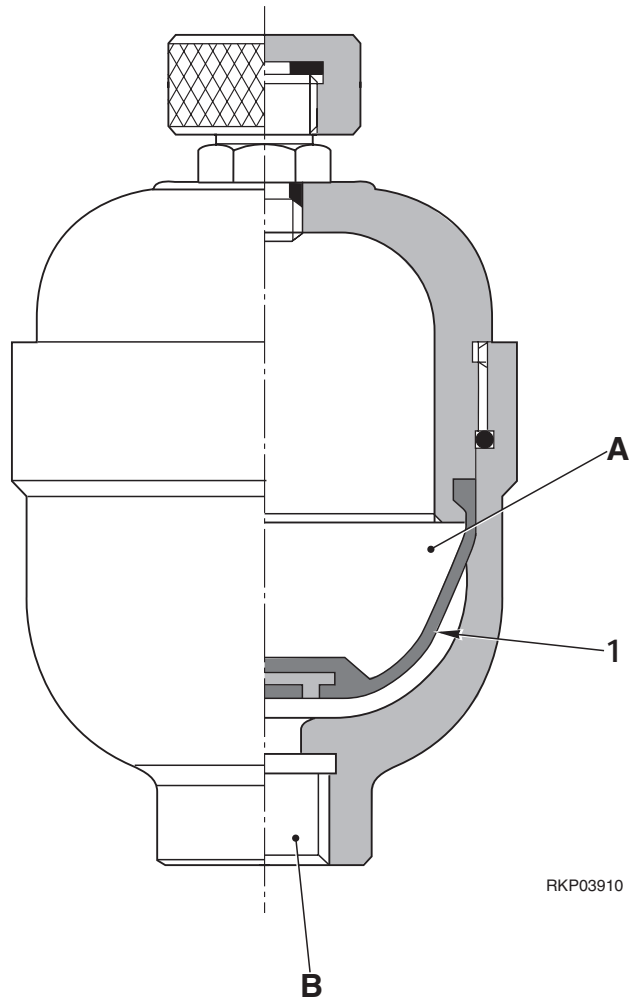


Fig. 4

RKP03901

ACCUMULATOR



TECHNICAL DATA

Servocontrol feed group:

Nominal volume: 0.35 ℓ
Pre-set pressure: 12^{0}_{+1} kg/cm²
Working pressure: 35 – 45 kg/cm²

FUNCTION

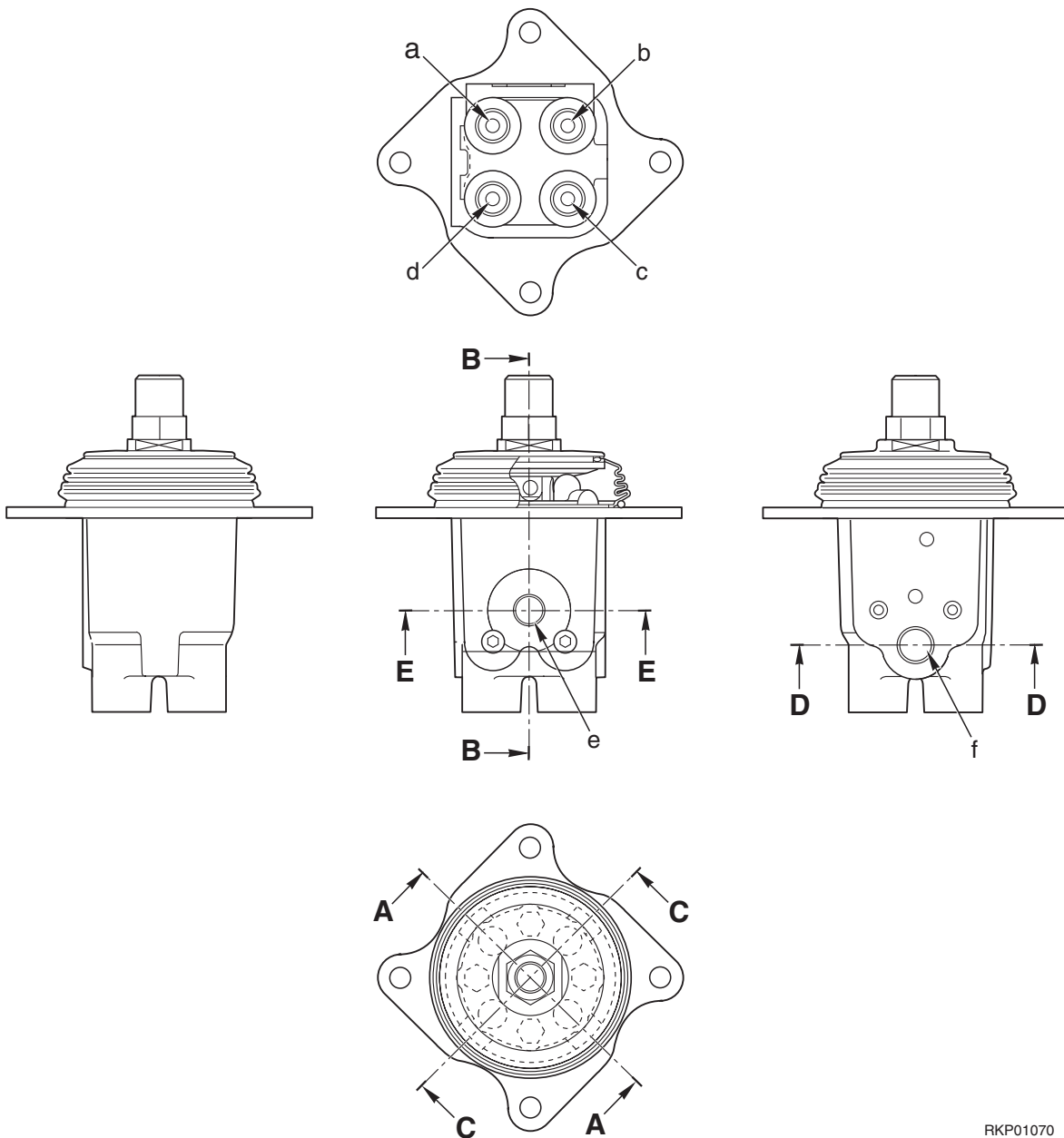
- A rubber bag (1) containing nitrogen gas is used in the accumulator. Its function is to maintain oil pressure in the circuit to which the accumulator is connected.

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.

PPC VALVE

WORK EQUIPMENT



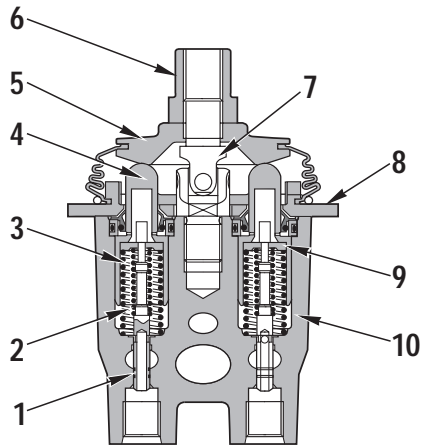
RKP01070

L.H. PPC VALVE

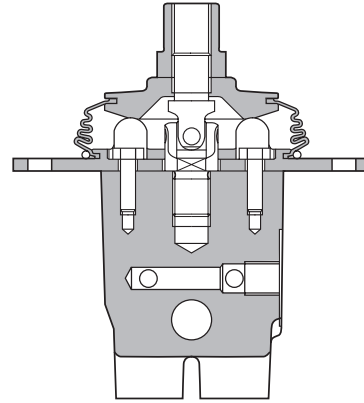
- a. P2 Port - To control valve (PB6 port)
(arm close)
- b. P4 Port - To control valve (PB1 port)
(R.H. swing)
- c. P1 Port - To control valve (PA6 port)
(arm open)
- d. P3 Port - To control valve (PA1 port)
(L.H. swing)
- e. T Port - To ST1 solenoid valve
(T port)
- f. P Port - From ST1 solenoid valve
(A4 port)

R.H. PPC VALVE

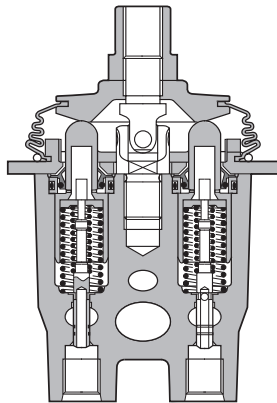
- a. P2 Port - To control valve (PA5 port)
(boom raise)
- b. P4 Port - To control valve (PA7 port)
(bucket open)
- c. P1 Port - To control valve (PB5 port)
(boom lower)
- d. P3 Port - To control valve (PB7 port)
(bucket close)
- e. T Port - To ST1 solenoid valve
(T port)
- f. P Port - From ST1 solenoid valve
(A4 port)



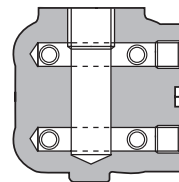
Section A-A



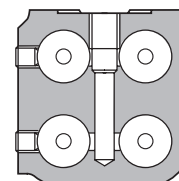
Section B-B



Section C-C



Section D-D



Section E-E

- 1. Spool
- 2. Adjusting spring (internal)
- 3. Return spring (external)
- 4. Plunger
- 5. Disc
- 6. Nut

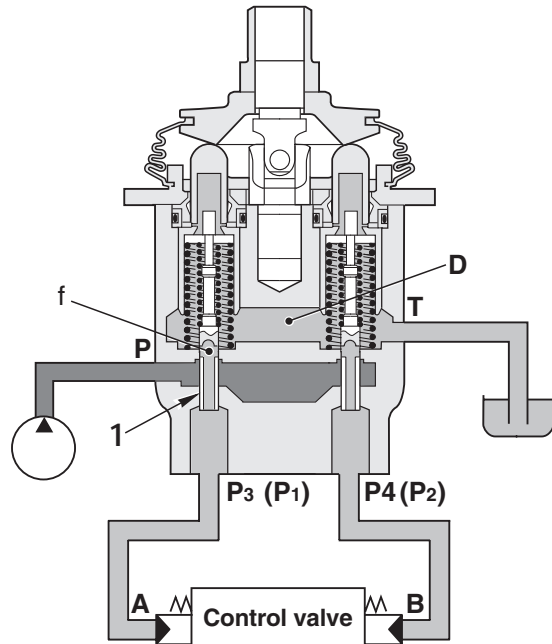
- 7. Joint
- 8. Cover
- 9. Pin
- 10. Body

RKP01080

FUNCTION

1. At neutral

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



RKP01091

Fig. 1

2. During fine control (NEUTRAL → fine control)

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

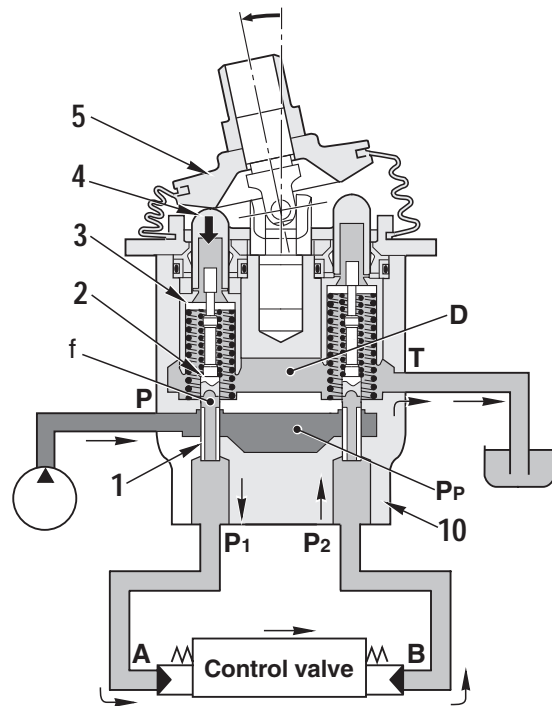
When this happens, fine control hole **f** is shut off from drain chamber **D**, and at almost the same time, it is connected to pump pressure chamber **Pp**, so pilot pressure oil from the control pump passes through fine control hole **f** and goes from port **P1** to port **A**.

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)



RKP01101

Fig. 2

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

When disc (5) starts to be returned, spool (1) is pushed up by the force of centering spring (3) and the pressure at port **P1**.

When this happens, fine control hole **f** is connected to drain chamber **D** and the pressure oil at port **P1** is released.

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

When the spool of the control valve returns, oil in drain chamber **D** flows in from fine control hole **f** in the valve on the side that is not working.

The oil passes through port **P2** and enters chamber **B** to fill the chamber with oil. (Fig. 3)

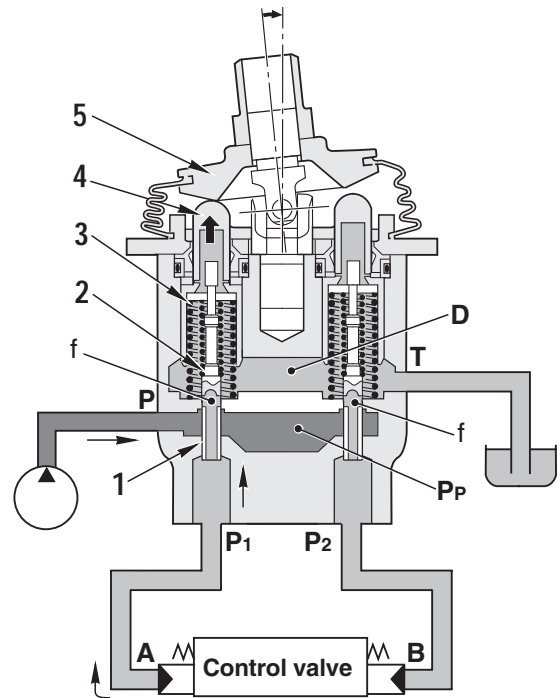


Fig. 3

RKP01111

4. At full stroke

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

The oil returning from chamber **B** passes from port **P2** through fine control hole **f** and flows to drain chamber **D**. (Fig. 4)

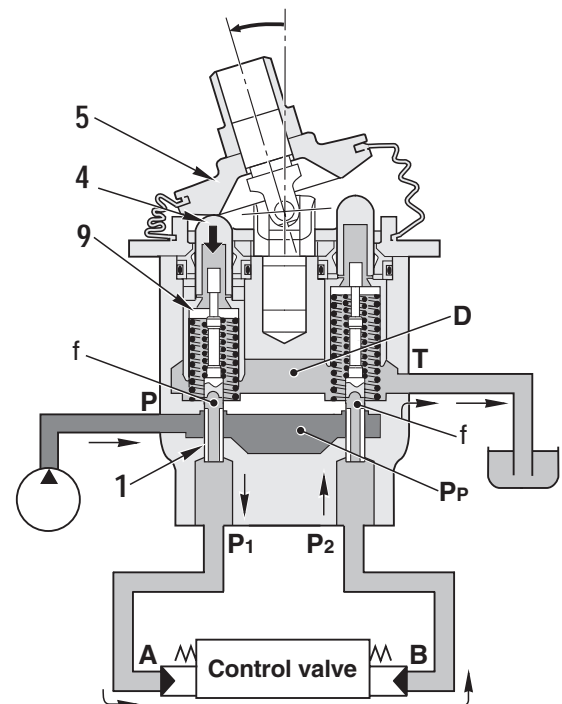
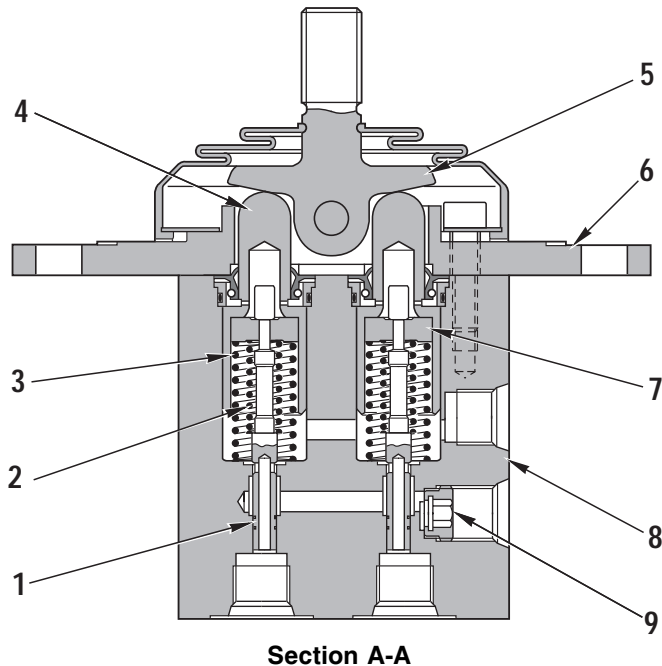
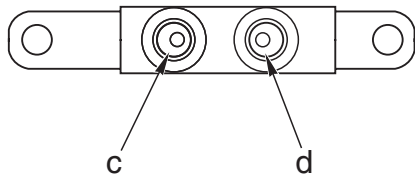
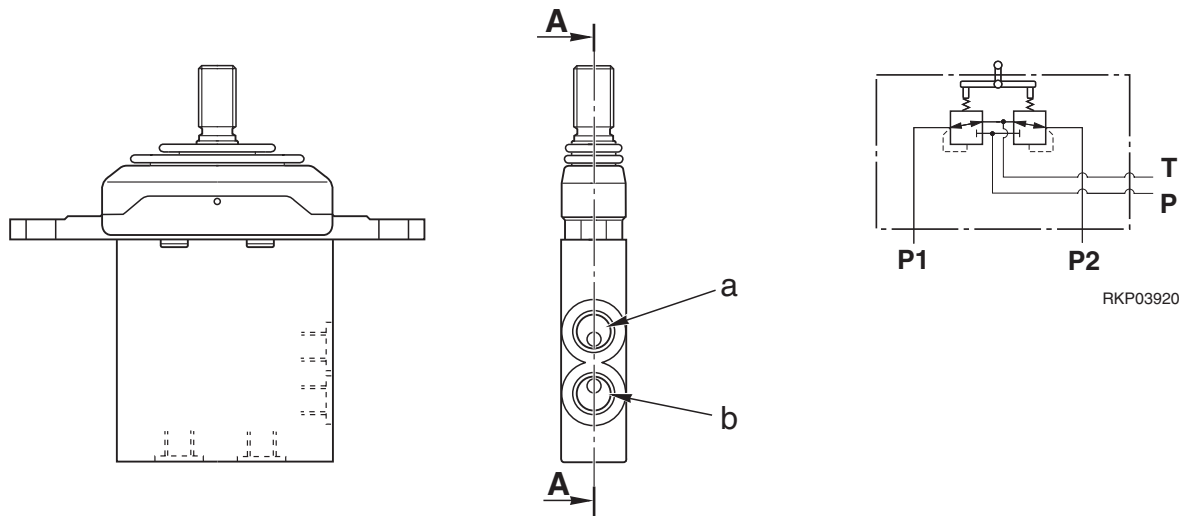


Fig. 4

RKP01121

PPC VALVE (Blade, boom swing, 2-piece boom)



Section A-A

RKP00960

- a. T port - To hydraulic tank
- b. P port - From ST1 solenoid valve group (A4 port)
- c. P1 port - For boom swing: to control valve (PA8 port)
For 2-piece boom: to control valve (PA10 port)
For blade: to control valve (PA2 port)
- d. P2 port - For boom swing: to control valve (PB8 port)
For 2-piece boom: to control valve (PB10 port)
For blade: to control valve (PB2 port)

1. Spool
2. Metering spring (internal)
3. Centering spring (external)
4. Plunger
5. Lever
6. Plate
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)

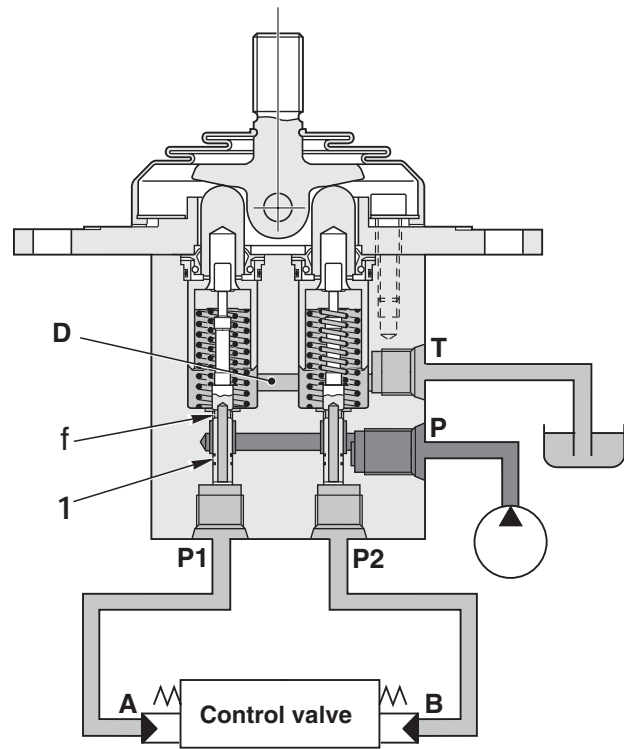


Fig. 1

RKP00971

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)

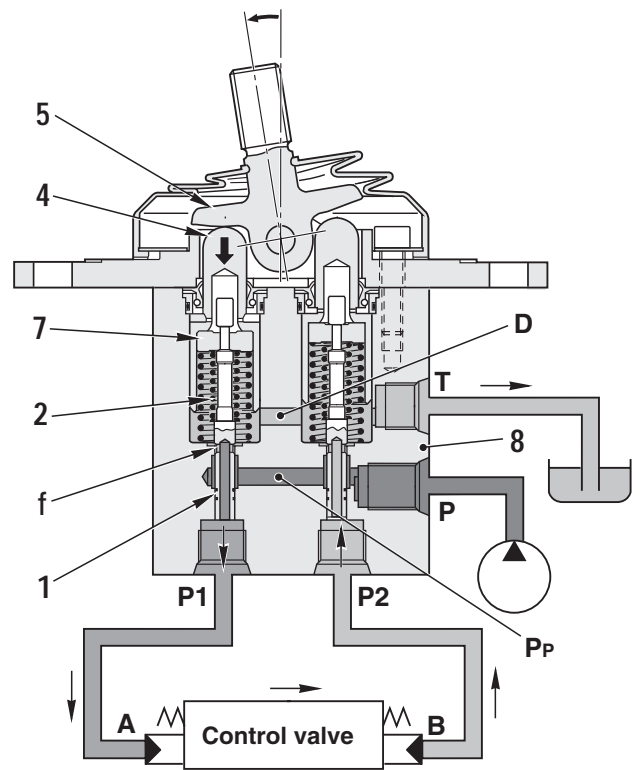


Fig. 2

RKP00981

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

When lever (5) starts to be returned, spool (1) is pushed up by the force of centering spring (3) and the pressure at port **P1**.

When this happens, fine control hole **f** is connected to drain chamber **D** and the pressure oil at port **P1** is released.

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

When the spool of the control valve returns, oil in drain chamber **D** flows in from fine control hole **f'** in the valve on the side that is not working.

The oil passes through port **P2** and enters chamber **B** to fill the chamber with oil. (Fig. 3)

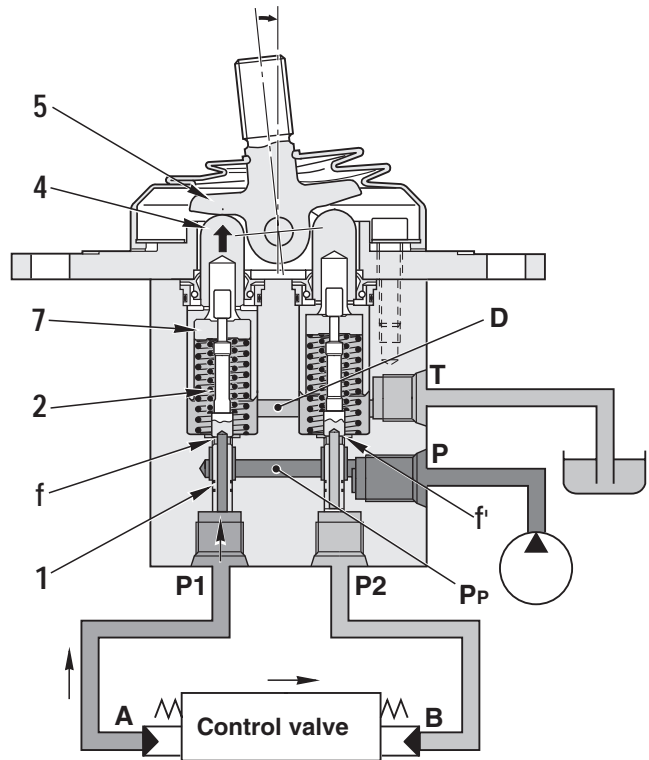


Fig. 3

RKP00991

4. At full stroke

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

The oil returning from chamber **B** passes from port **P2** through fine control hole **f'** and flows to drain chamber **D**. (Fig. 4)

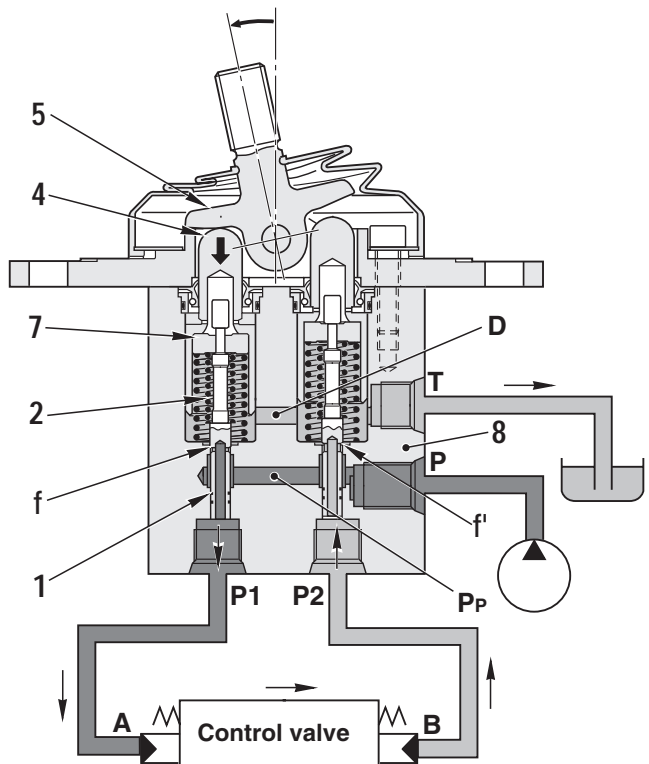
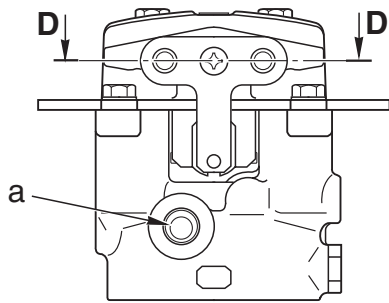


Fig. 4

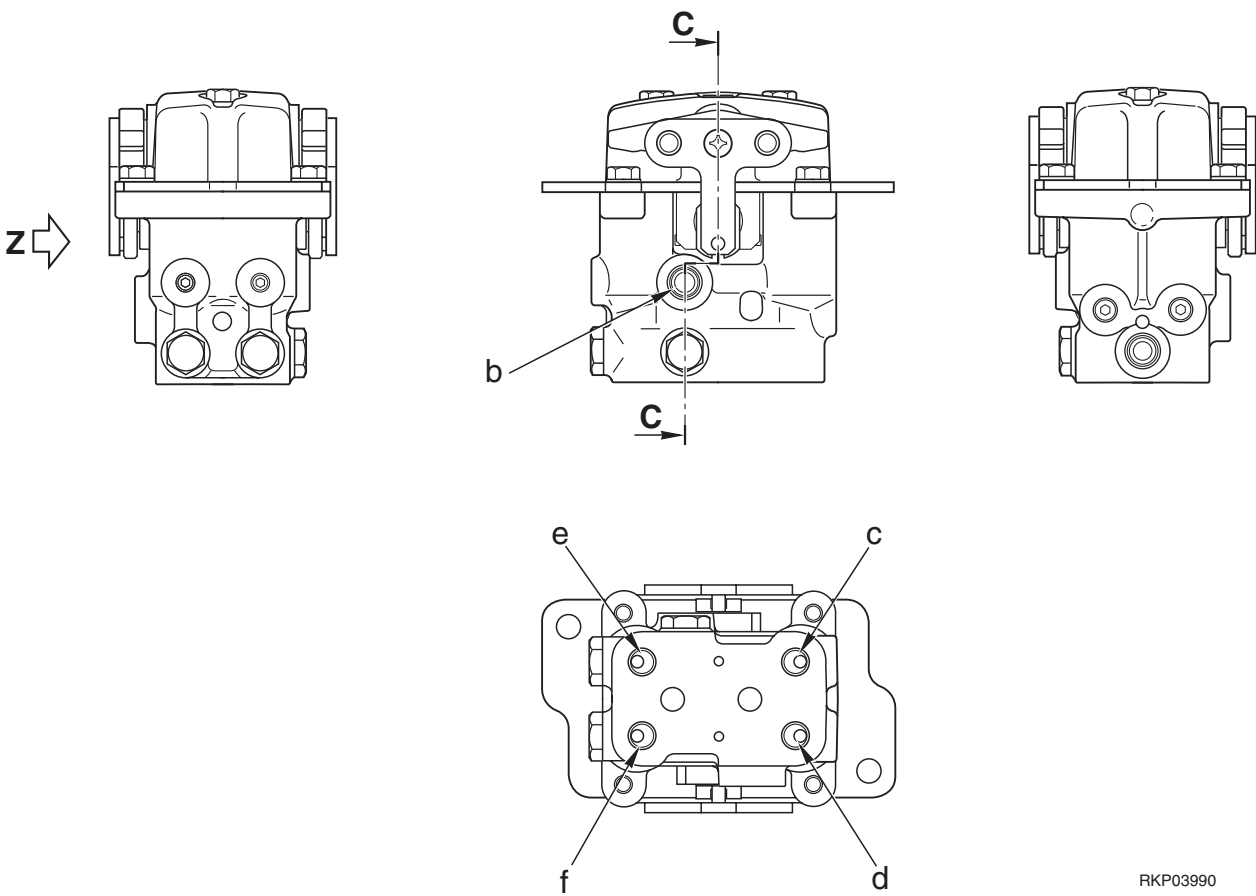
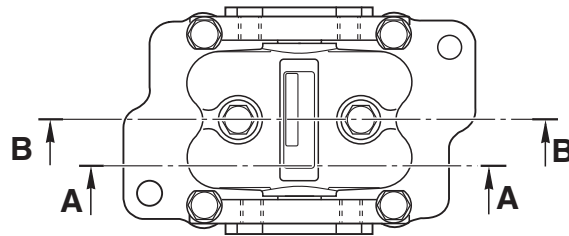
RKP01001

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TRAVEL PPC VALVE



View Z

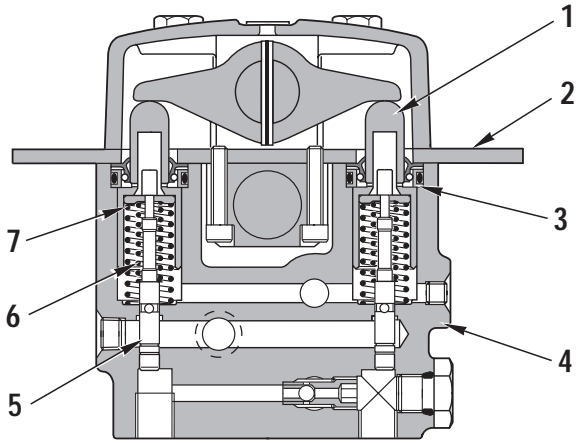


RKP03990

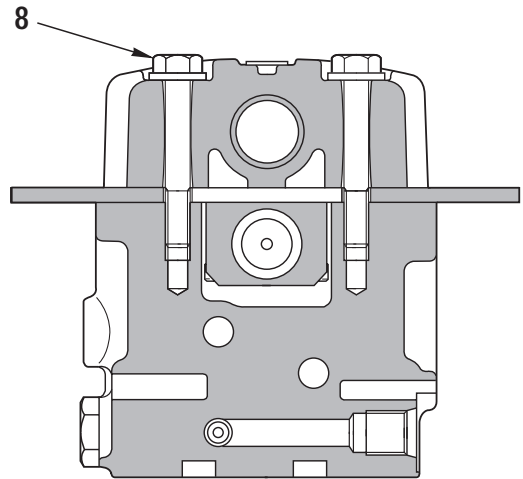
- a. P port - From ST1 solenoid valve group (A4 port)
- b. T port - To hydraulic tank
- c. P1 port - To control valve (PA3 port)
- d. P3 port - To control valve (PB7 port)
- e. P2 port - To control valve (PB3 port)
- f. P4 port - To control valve (PA7 port)

FUNCTIONS

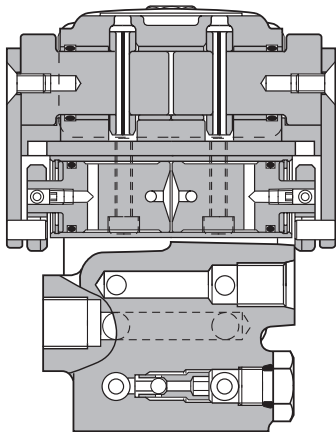
- P1 port - L.H. travel (Reverse)
- P2 port - L.H. travel (Forward)
- P3 port - R.H. travel (Reverse)
- P4 port - R.H. travel (Forward)



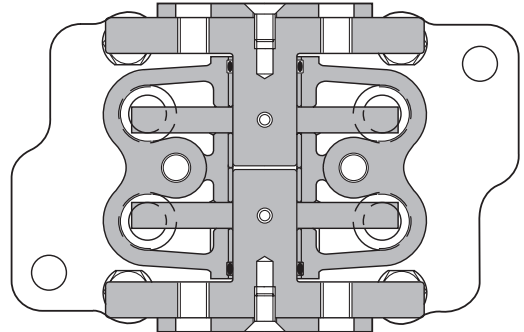
Section A-A



Section B-B



Section C-C



Section D-D

RKP04000

- 1. Piston
- 2. Plate
- 3. Collar
- 4. Body
- 5. Valve
- 6. Measuring spring (internal)
- 7. Centering spring (external)
- 8. Bolt

OPERATION

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).

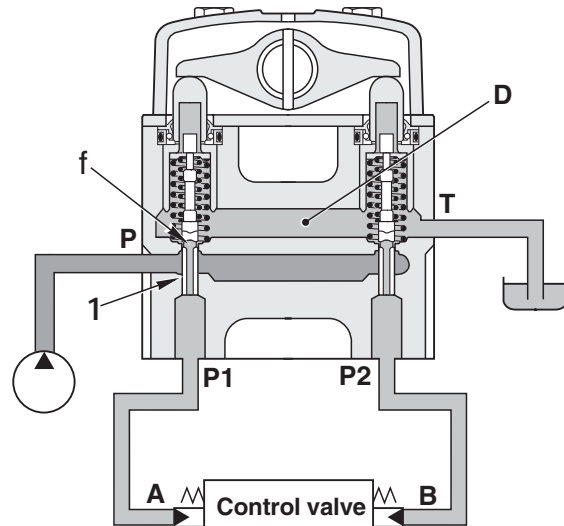


Fig. 1

RKP04011

2. During fine control (NEUTRAL → Fine control)

When the piston (4) starts to be pushed by lever (5), retainer (9) is pushed, valve (1) is also pushed by metering spring (2), and moves down.

When this happens, the 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 charging pump passes through fine control hole **f** and goes from port **P1** to port **A**.

When the pressure at port **P1** becomes higher, valve (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, valve (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 valve (1) and body (10) (fine control hole **f** is at a point midway between drain hole **D** and pump pressure chamber **PP**) does not change until retainer (9) contacts valve (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 the pressure at port **P1**) and the force of the control valve spool return spring are balanced. (Fig. 2)

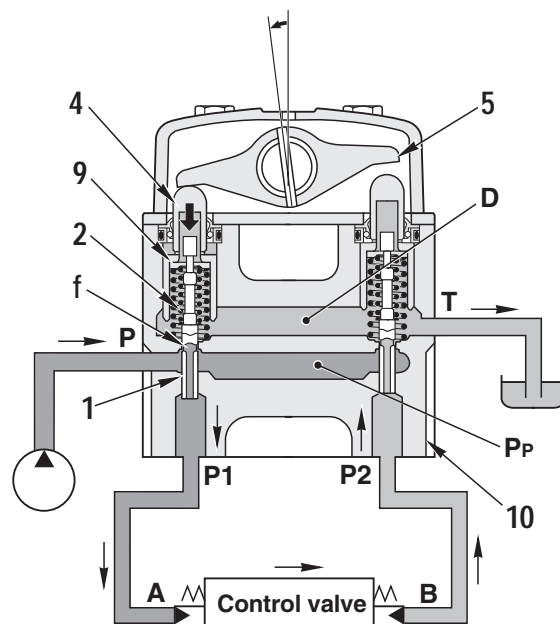


Fig. 2

RKP04021

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

When lever (5) starts to be returned, valve (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, valve (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).

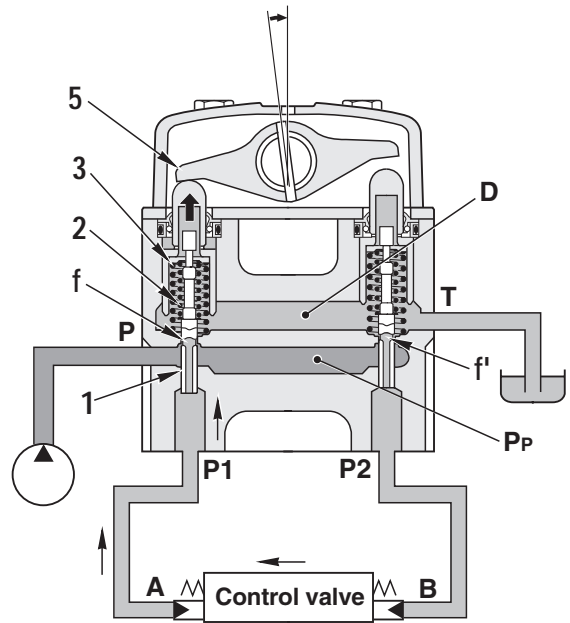


Fig. 3

RKP04031

4. At full stroke

When lever (5) pushes down piston (4), and retainer (9) pushes down valve (1), fine control hole **f** is shut off from drain chamber **D**, and is connected with pump pressure chamber **Pp**.

Therefore, the pilot pressure oil from the charging 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)

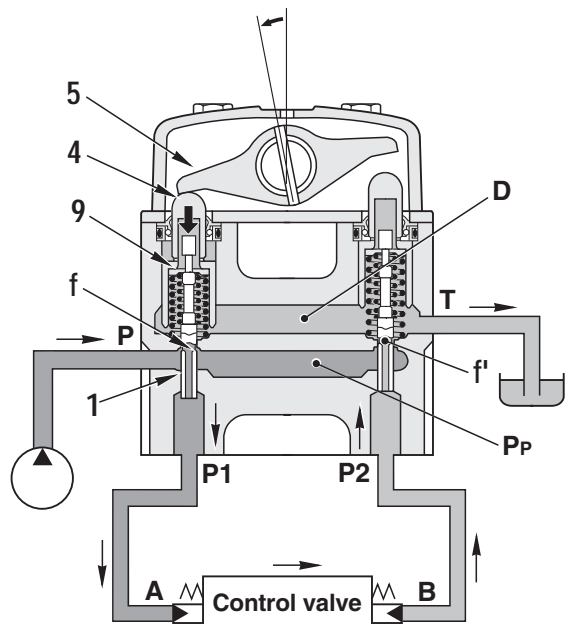
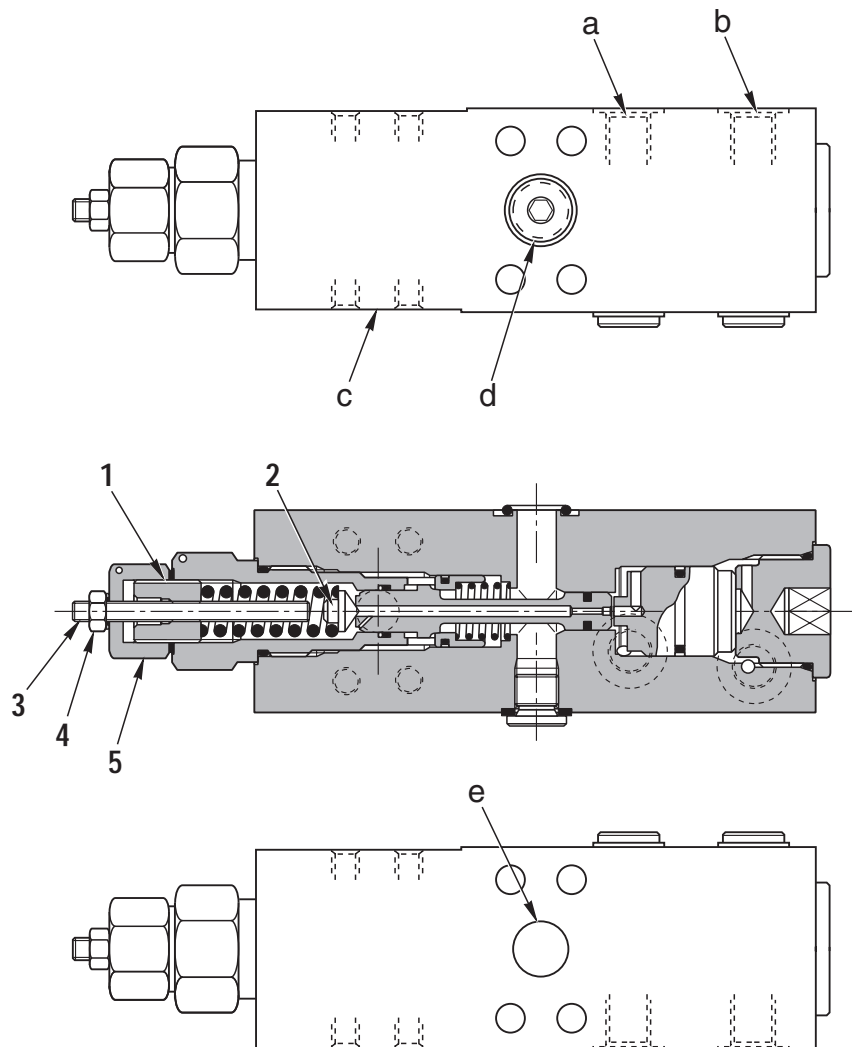


Fig. 4

RKP04041

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BOOM AND ARM SAFETY VALVE



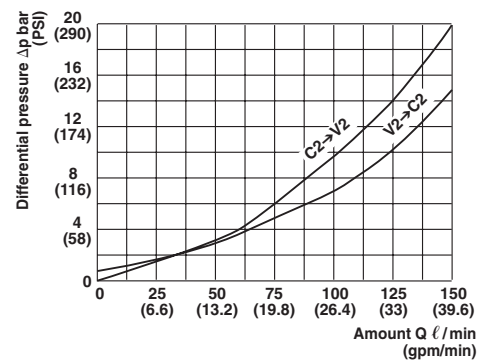
RKP04170

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

SPECIFICATIONS

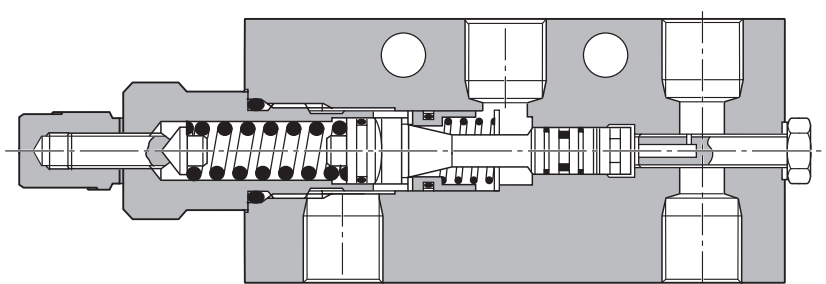
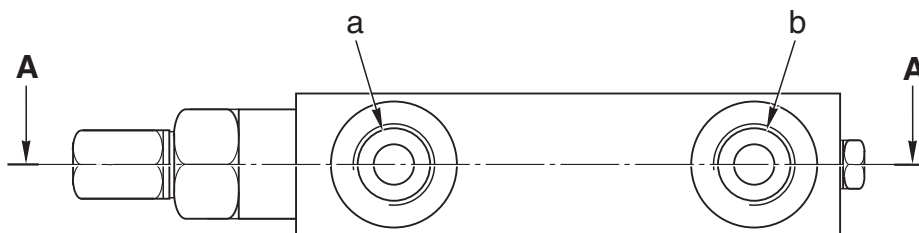
Pilot ratio: 22 : 1

- 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. C2 Port - For boom: To the cylinder (Bottom side)
For arm: To the cylinder (Head side)
- e. M Port - For boom: To the overload sensor switch

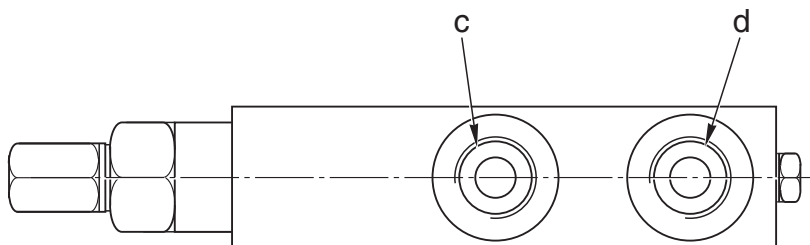


RKP04162

BLADE SAFETY VALVE



Section A-A

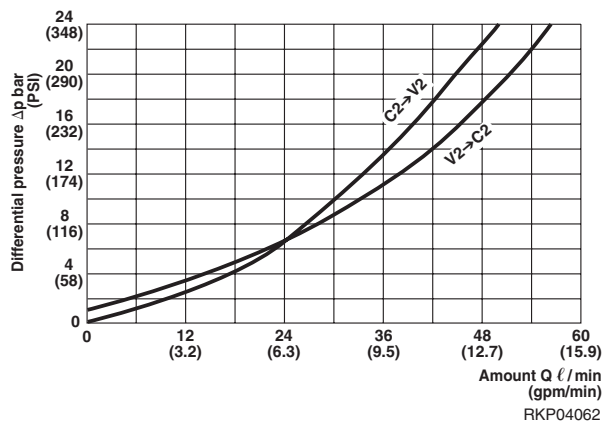


RKP04140

- a. V2 Port - From swivel joint (5a Port)
- b. V1 Port - From swivel joint (3a Port)
- c. C2 Port - To blade cylinder (Bottom side)
- d. C1 Port - To blade cylinder (Head side)

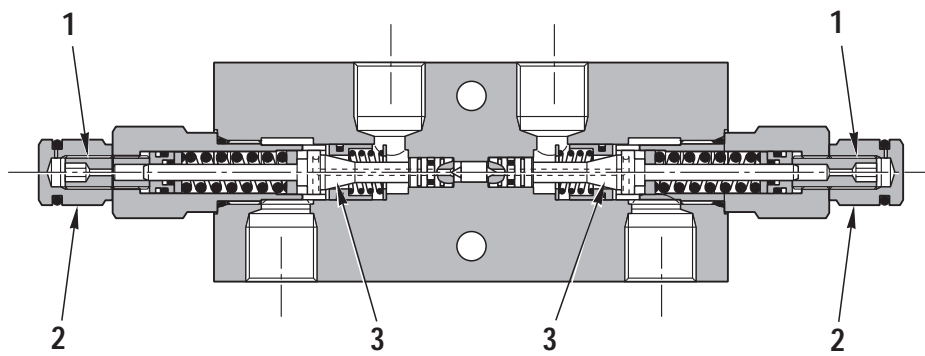
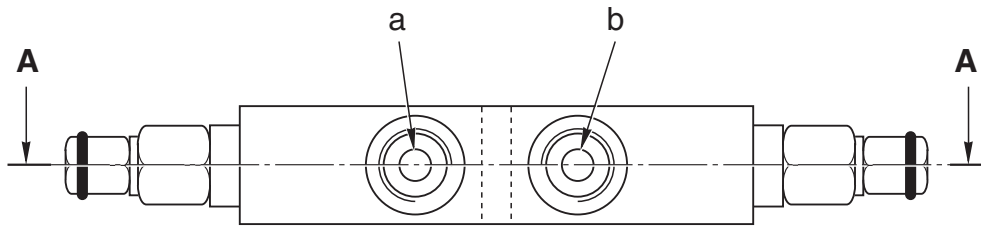
SPECIFICATIONS

Start opening: 8 bar (116 psi)

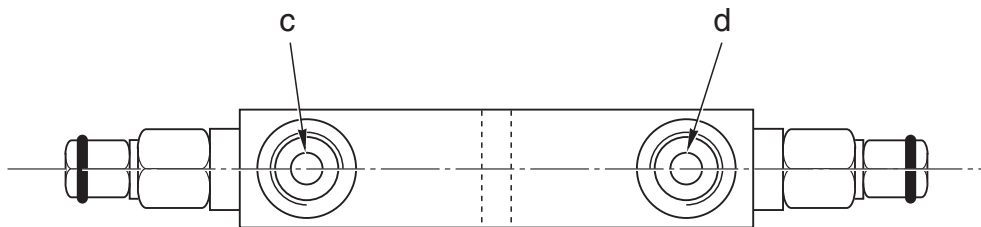


RKP04062

2-PIECE BOOM SAFETY VALVE



Section A-A



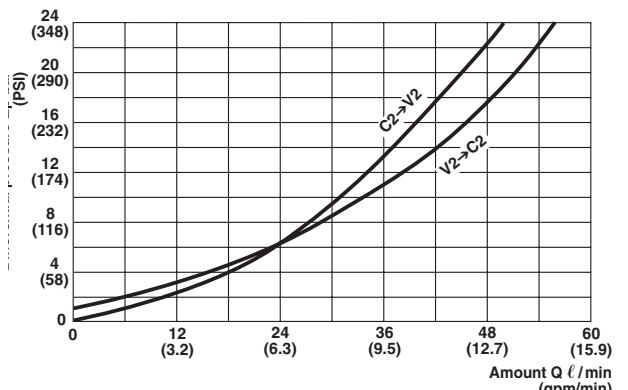
RKP04070

- 1. Screw
- 2. Plug
- 3. Valve

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

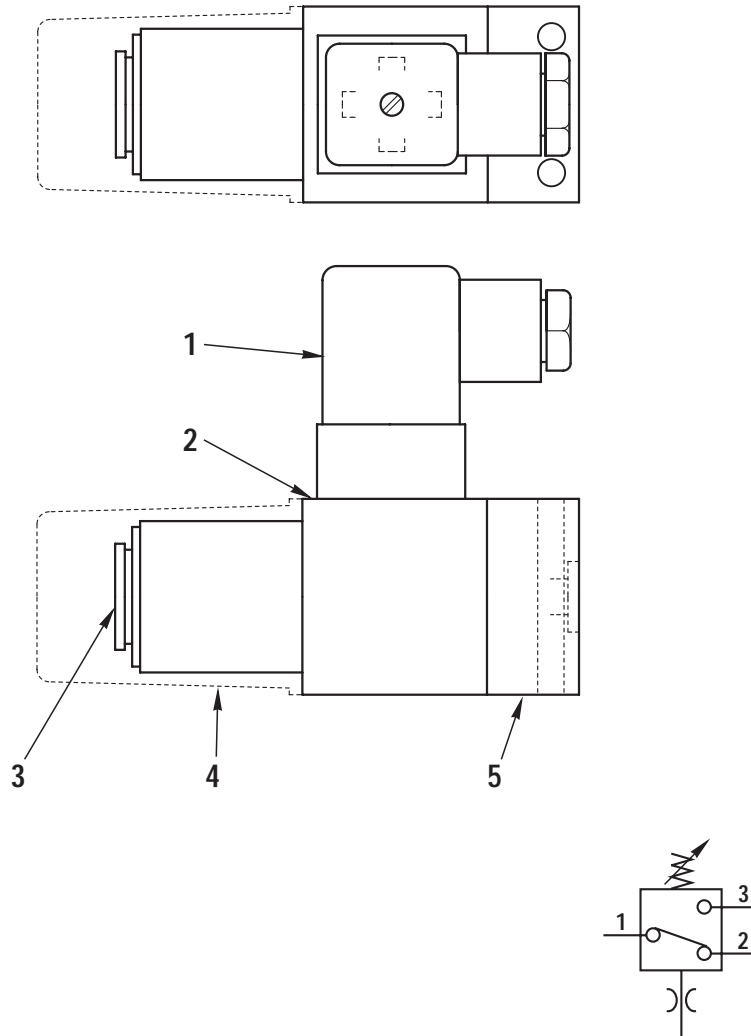
SPECIFICATIONS

Pilot ratio: 4.25 : 1



RKP08681

OVERLOAD SENSOR SWITCH



RKP11580

a. From boom safety valve (M Port)

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

TECHNICAL DATA

Setting valve: 130 bar (1885.4 psi)

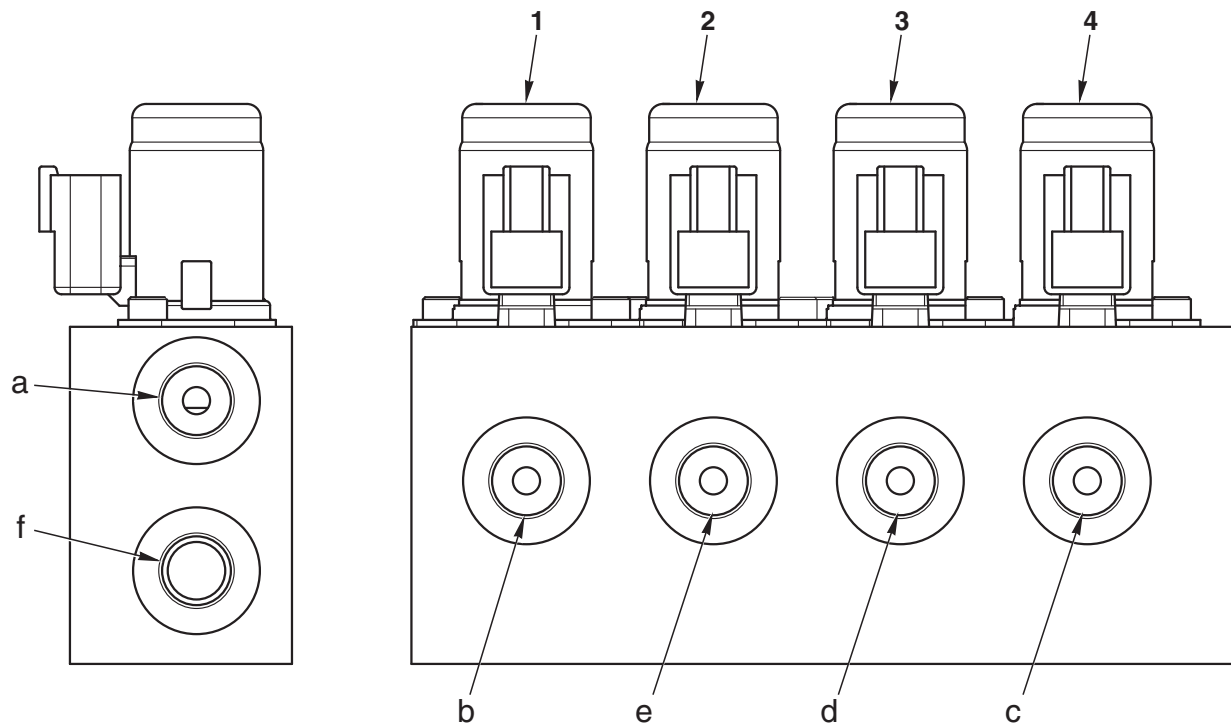
FUNCTION

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 activates the horn.

SOLENOID VALVE

Solenoid valve group ST1

Swing brake, travel speed acceleration, working mode, servocontrol



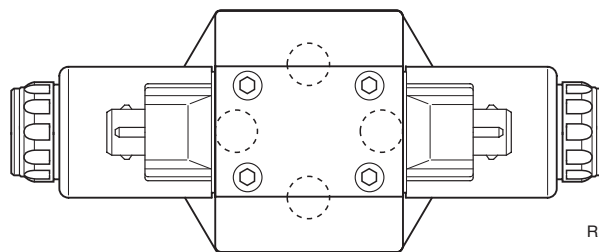
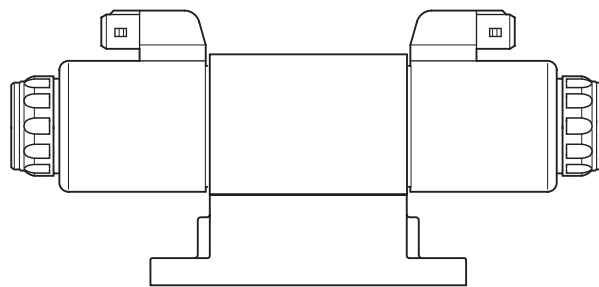
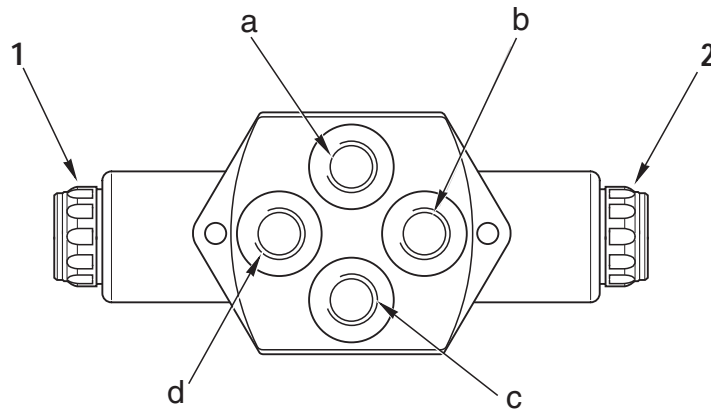
RKP11570

- a. P Port - From servocontrol feed unit (PR Port)
- b. B2 Port - To swivel joint (2 Port)
- c. A4 Port - To hydraulic tank
- d. A3 Port - To hydraulic pump (PM Port)
- e. A1 Port - To swing motor (B Port)
- F. T Port - To hydraulic tank

- 1. Y6 Travel speed acceleration
- 2. Y5 Swing brake
- 3. Y11 Working mode
- 4. Y12 Servocontrol

Solenoid valve group OP1 (Y3-Y4)

Braker, rotating and cutting bucket



RKP03940

1. Y4 - R.H. attachment control

2. Y3 - L.H. attachment control

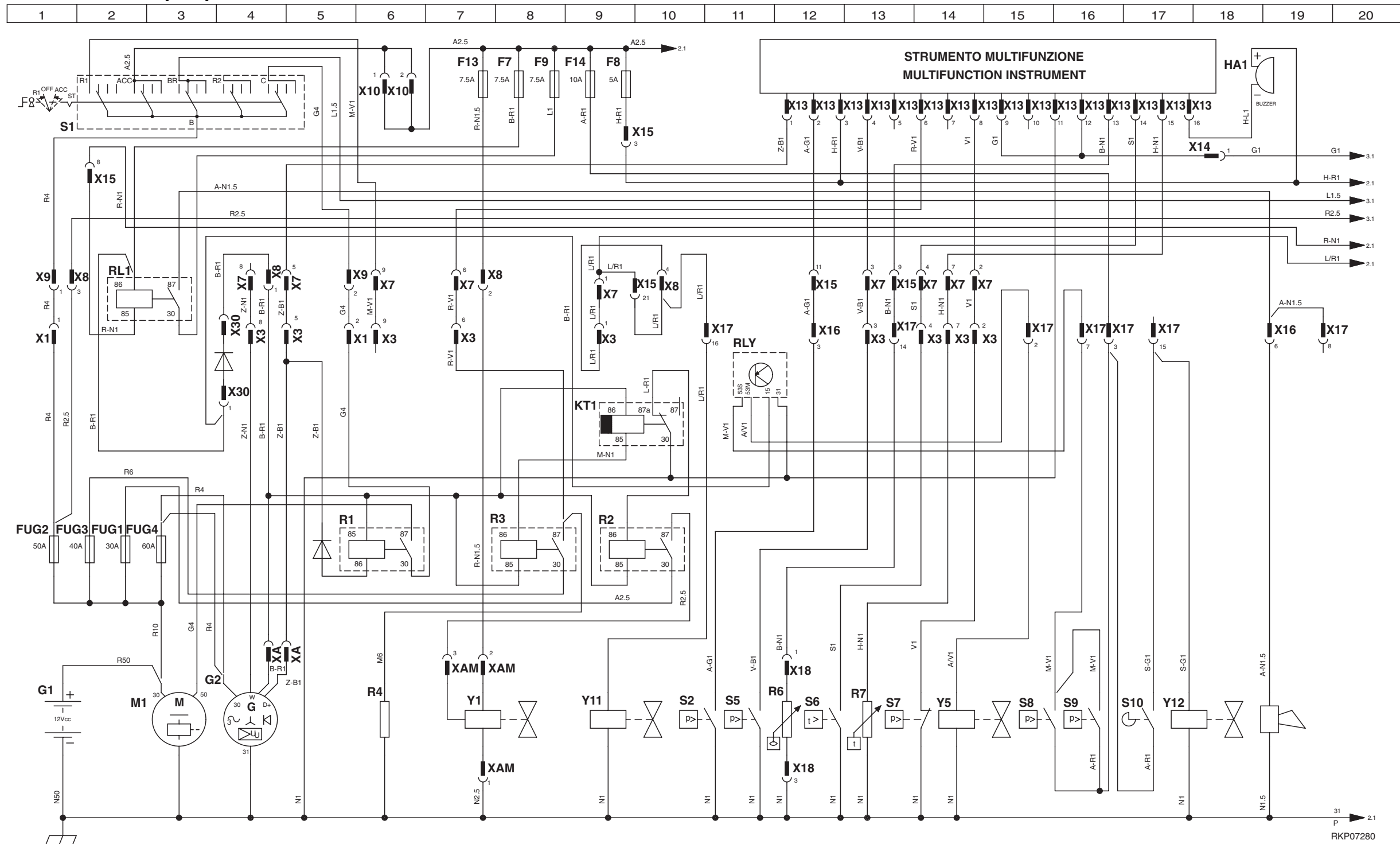
a. T Port - To hydraulic tank

b. A Port - To control valve (PB9 Port)

c. P Port - From ST1 solenoid valve group
(A4 Port)

d. B Port - To control valve (PA9 Port)

ELECTRICAL DIAGRAM (1/3)



COMPONENTS

- G1 - Battery
- G2 - Generator
- HA1 - Buzzer
- M1 - Starter motor
- R4 - Heating start
- R6 - Fuel level sender
- R7 - Engine water temperature sender
- RL1 - Horn relay
- RLY - Rotation timer
- S1 - Starting switch
- S2 - Brakes pressure switch

- S5 - Air filter blocked switch
- S6 - Engine water high temperature switch
- S7 - Engine oil low pressure switch
- S8 - 2nd rotation pressure switch
- S9 - 1st rotation pressure switch
- S10 - Arm micro switch
- Y1 - Fuel shut off solenoid valve
- Y5 - Rotation brake solenoid valve
- Y11 - Solenoid valve mode system
- Y12 - Servocontrol solenoid valve

FUSES

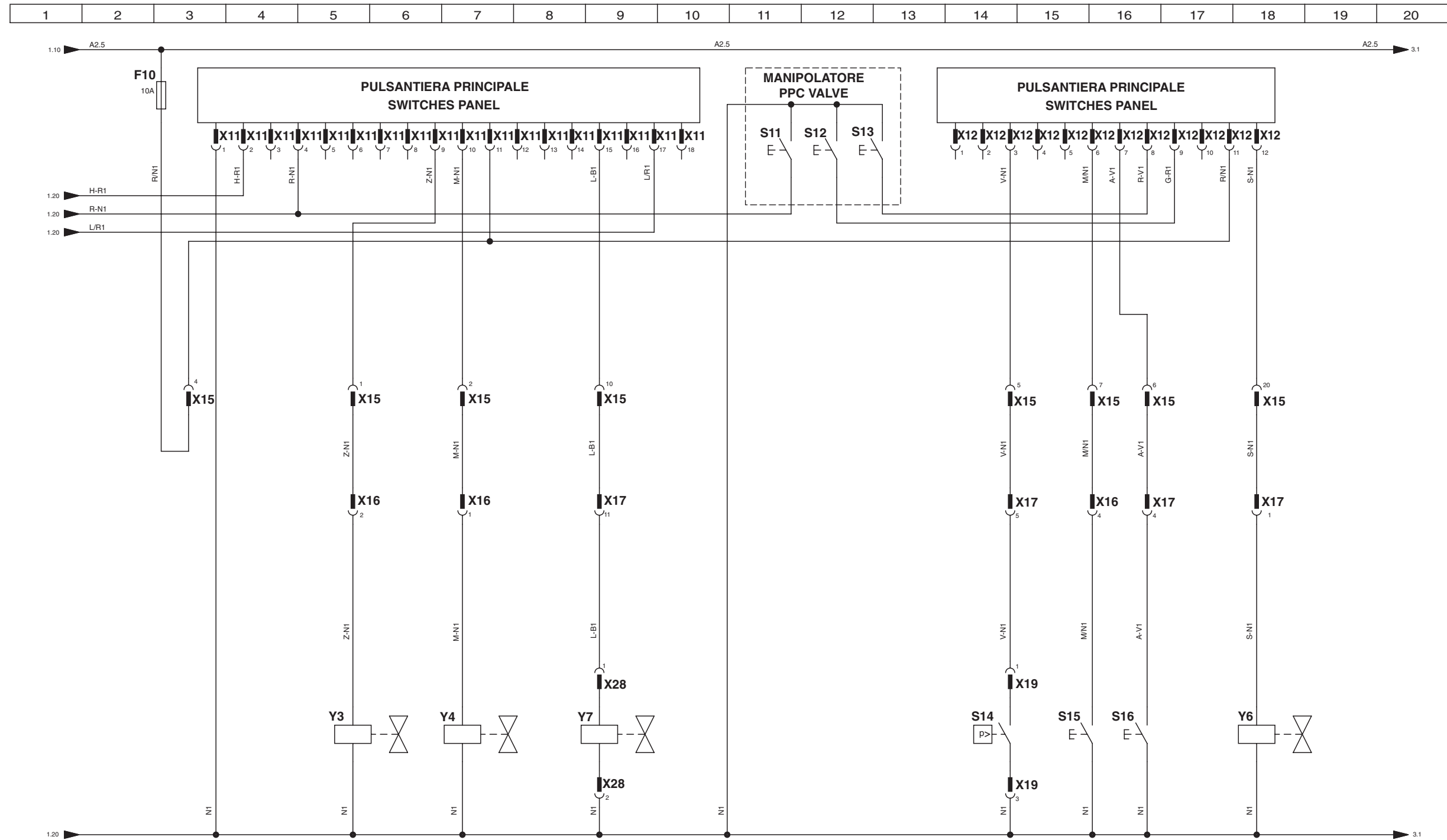
- F7 - /5 sec. Timer fuse 7.5A
- F8 - Multifunction instrument power fuse 5A
- F9 - Horn fuse 7.5A
- FUG1- Fuel shut off fuse 30A
- FUG2- General fuse 50A
- FUG3- Preheating fuse 40A
- FUG4- Generator fuse 60A
- F13 - Fuel shut off fuse 7.5A
- F14 - Servocontrol valve fuse 10A

CONNECTOR

- X1 - Power 3 way connector
- X3 - Engine line 9 way connector
- X7 - Right lateral dashboard line 9 way connector
- X8 - Central unit line 4 way connector
- X9 - Power 3 way connector
- X10 - Power (+ 15) 2 way connector
- X13 - Multifunction instrument 16 way connector
- X14 - 1 way connector
- X15 - Right lateral dashboard 21 way connector
- X16 - Left front light 11 way connector
- X17 - Valves and right front light line 17 way connector
- X18 - Fuel level sender 3 way connector
- X30 - 2 way connector
- XA - Generator 2 way connector
- XAM - Fuel shut off 3 way connector

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ELECTRICAL DIAGRAM (2/3)



RKP07290

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
- Y3 - Biting grab solenoid valve
- Y4 - Hammer solenoid valve
- Y6 - Acceleration solenoid valve
- Y7 - Optional pliers solenoid valve

CONNECTOR

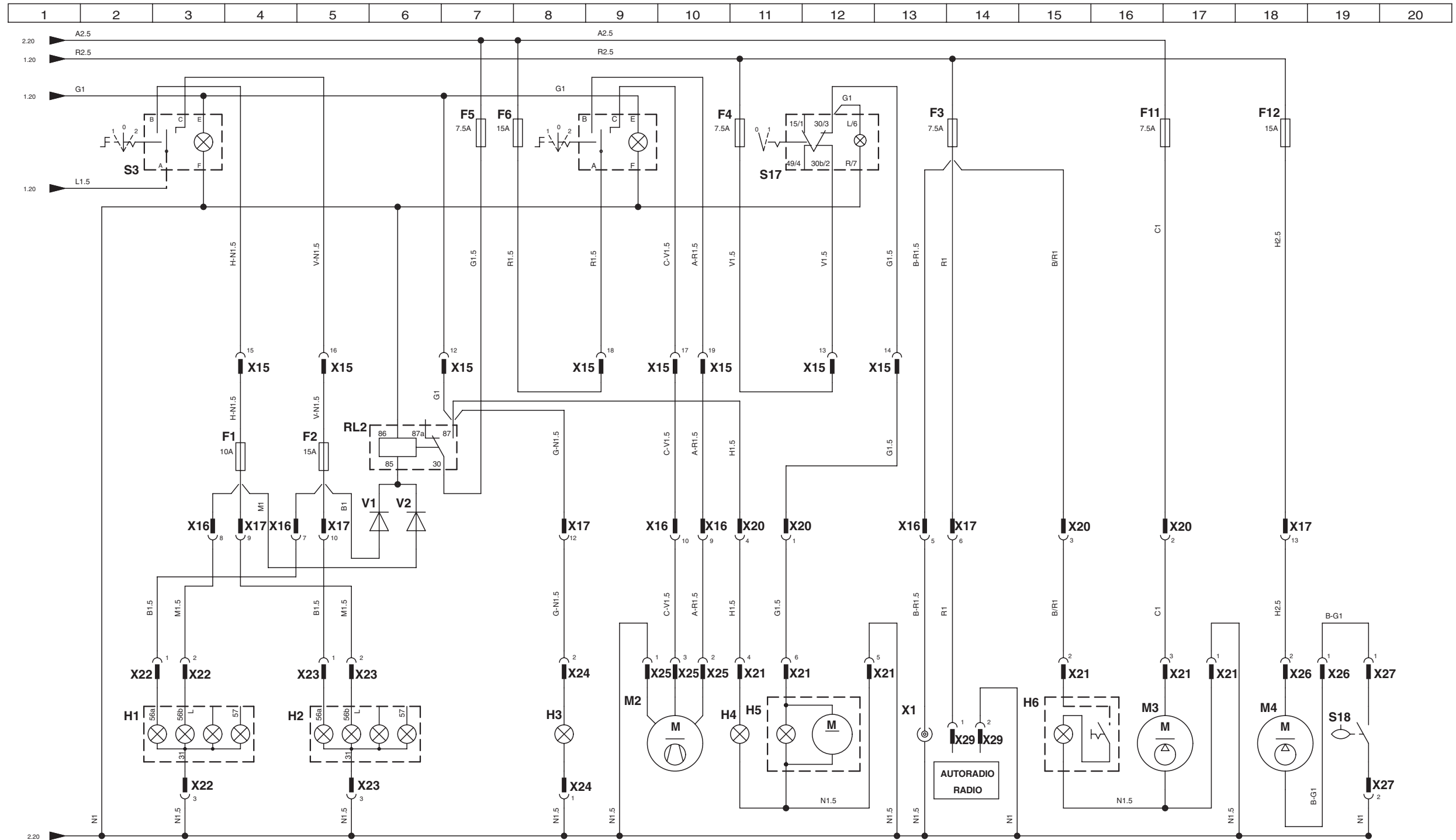
- X11 - Switches panel 18 way connector
- X12 - Switches panel 12 way connector
- X15 - Right lateral dashboard 21 way connector
- X16 - Left front light line 11 way connector
- X17 - Valves and right front light line 17 way connector
- X19 - Anti overturning pressure switch 4 way connector
- X28 - Optional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

FUSE

- F10 - Switch panel relays fuse 10A

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ELECTRICAL DIAGRAM (3/3)



COMPONENTS

- H1 - Front left light
- H2 - Front right light
- H3 - Working light
- H4 - Working light
- H5 - Beacon lamp
- H6 - Cabin lamp
- M2 - Blower motor
- M3 - Washer motor
- M4 - Transfer pump
- RL2 - Arm working light relay
- S17 - Rotating lamp switch

- S18 - Transfer pump sender
- S3 - Lights switch
- V1 - Diode
- V2 - Diode

FUSES

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

CONNECTOR

- X1 - Power 3 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
- 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
- X25 - Left front light line 4 way connector
- X26 - Transfer pump 2 way connector
- X27 - Transfer pump sender 4 way connector
- X29 - Radio power 2 way connector

RKP07260

GROUP 20

20 TESTING AND ADJUSTMENTS

Normal or standard technical data	2	Adjusting PC valve	39
Equipment for testing, adjusting, and identifying faults.....	19	Measuring LS differential pressure and adjusting LS valve	40
Measuring the engine speed.....	21	Checking and adjusting pressures in the servocontrol feed unit	42
Adjusting valve clearance	22	Measuring pumps delivery and flow control starting point pump P1.....	43
Measuring compression pressure	23	Measuring travel deviation	45
Testing and adjusting fuel injection timing	24	Adjusting the maximum speed of the travel motors	46
Testing and adjusting fan belt tension	26	Measuring inner oil leakage of travel motor	47
Adjusting the stroke of the accelerator lever	27	Adjusting boom and arm safety valves.....	48
Adjusting ppc valves clearance.....	28	Adjusting 2 nd boom safety valves.....	49
Adjusting the safety microswitch	29	Measuring and setting of pressure switch signal overload operation	50
Measuring the swing circle axial clearance.....	30	Measurement of internal oil leakages in the swing motor	51
Testing and adjusting track-shoe tension.....	31	Checking for leakages inside the swivel joint.....	52
Air bleeding from hydraulic circuits	32	Analysis of the causes of hydraulic drifts	54
Releasing residual pressure from the circuits	35		
Checking and regulating pressure in the hydraulic circuits	36		
Testing and setting of main valves	37		

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

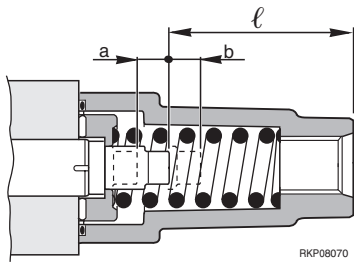
NORMAL OR STANDARD TECHNICAL DATA

• FOR ENGINE

Machine model			PC75R-2	
Engine			4D98E-1FB	
Check item	Test Conditions	Unit	Standard value	Permissible value
Engine speed	High idling	rpm	2470	2470 ± 50
	Low idling	rpm	1000	$1000 \begin{smallmatrix} 0 \\ -50 \end{smallmatrix}$
	Set speed	rpm	2300	—
Exhaust gas colour	Sudden acceleration	Index	0.9	1.5
	At high idling speed	Bosch	0.5	0.8
Valve clearance	Intake valve (20°C) (68°F)	mm (in.)	0.20 (0.0078)	—
	Exhaust valve (20°C) (68°F)	mm (in.)	0.20 (0.0078)	—
Compression pressure (SAE30 oil)	Oil temperature 69 – 72°C (156.2 – 161.6°F) (Engine speed)	kg/cm ² (psi)	35 ± 1 (497.7 ± 14.2)	28 ± 1 (398.2 ± 14.2)
		rpm	250	250
Blow-by pressure (SAE30 oil)	Water temperature in operating range At high idling speed	mm H ₂ O	—	—
Engine oil pressure	Max. idling (in cold state)	kg/cm ² (psi)	max. 6 (max. 85.32)	—
	With water temperature in operating range High idling	kg/cm ² (psi)	3 – 4 (42.66 – 56.88)	—
	At low idling	kg/cm ² (psi)	min. 0.6 (min. 8.532)	—
Oil temperature	Entire speed range	°C (°F)	120 (248)	Max. 120 (Max. 248)
Fuel injection timing	B.T.D.C.	degrees	10 – 12	—
Fan-belt tension	Deflection when pressed with finger force of approx. 10 kg (22 lb.)	mm (in.)	10 – 15 (0.394 – 0.591)	—

● **FOR MACHINE**

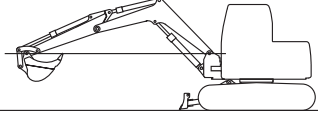
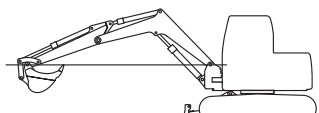
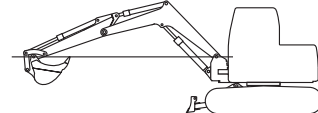
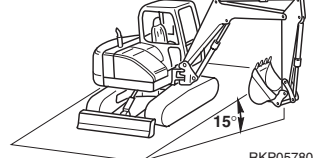
All tests, if not otherwise specified, should be performed with **WORKING MODE** in position **P**

Machine model			PC75R-2							
Classification	Check item	Test conditions	Unit	Standard value			Permissible value			
Engine	Engine speed with pump P1 at max. pressure	<ul style="list-style-type: none"> Hydraulic oil temp.: 45 – 55°C (113 – 131°F) 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 boom Max. pressure P2: with arm and swing boom 	rpm	2296			2296 – 50			
	Engine speed with pumps P1 and P2 at max. pressure			2285			2285 – 50			
	Engine speed with pump P2 at max. pressure			2300			2300 – 50			
	Engine speed when pumps P1-P2 are at max. pressure and the WORKING MODE selector is in pos. E			2250			2250 – 50			
Spool travel	Boom control valve		mm (in.)	ℓ	a	b	ℓ	a	b	
	Arm control valve			45 (1.773)	6.5±0.3 (0.256±0.0118)	6.5±0.3 (0.256±0.0118)	45 (1.773)	6.5±0.3 (0.256±0.0118)	6.5±0.3 (0.256±0.0118)	
	Bucket control valve									
	Swing control valve									
	Blade control valve									
	Boom swing control valve									
	2 nd boom control valve									
	Right travel control valve									
Travel of levers and pedals	Boom control lever	<ul style="list-style-type: none"> At centre of lever knob Reading at end of travel Engine stopped Equipment on the ground 	mm (in.)	Neutral → Raise Lower	80 (3.152)			60 – 100 (2.364 – 3.94)		
	Arm control lever			Neutral → Extended Retracted	80 (3.152)			60 – 100 (2.364 – 3.94)		
	Bucket control lever			Neutral → Open Curled	80 (3.152)			60 – 100 (2.364 – 3.94)		
	Swing control lever			Neutral → Swing right Swing left	80 (3.152)			60 – 100 (2.364 – 3.94)		
	Blade control lever			Neutral → Raise Lower	50 (1.97)			38 – 62 (1.497 – 2.443)		
	Boom swing pedal			Neutral → Swing right Swing left	20 (0.788)			15 – 25 (0.591 – 0.985)		
	2 nd boom pedal			Neutral → Open Closed	30 (1.182)			25 – 35 (0.985 – 1.379)		
	Travel control pedal (right-left)			Neutral → Forward Backward	120 (4.728)			90 – 150 (3.546 – 5.910)		
	Fuel control lever			Min. → Max.	150 (5.910)			130 – 170 (5.122 – 6.698)		

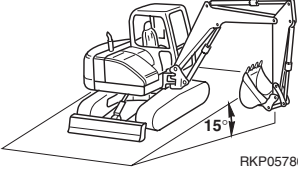
● FOR MACHINE

		Machine model	PC75R-2			
Classification	Check item	Test conditions	Unit	Standard value	Permissible value	
Operating force for control of levers and pedals	Raise boom	<ul style="list-style-type: none"> Engine speed: high idling Oil temperature: 45–55°C (113–131°F) Instrument coupling at centre of control lever knob Instrument coupling on outside edge of pedal control 	kg (lb.)	2.0 (4.4)	1.5 – 2.5 (3.3 – 5.5)	
	Lower boom			2.0 (4.4)	1.5 – 2.5 (3.3 – 5.5)	
	Bucket curled-open			1.5 (3.3)	1.1 – 1.9 (2.4 – 4.2)	
	Arm open-close			2.0 (4.4)	1.5 – 2.5 (3.3 – 5.5)	
	Swing (R.H.-L.H.)			1.5 (3.3)	1.1 – 1.9 (2.4 – 4.2)	
	Blade			2.0 (4.4)	1.5 – 2.5 (3.3 – 5.5)	
	Boom swing pedal			10 (22)	7.5 – 12.5 (16.5 – 27.5)	
	2 nd boom pedal			10 (22)	7.5 – 12.5 (16.5 – 27.5)	
	Travel control lever (R.H.-L.H.)			Lever (centre)	2.5 (5.5)	1.9 – 3.1 (4.2 – 6.8)
				Pedal	9.0 (19.8)	8 – 10 (17.6 – 22)
	Travel accelerator control pedal			9.0 (19.8)	8 – 10 (17.6 – 22)	
Fuel control levers	3.0 (6.6)	2.5 – 3.5 (5.5 – 7.6)				
Main valve pressure	P1 pump (Safety)	<ul style="list-style-type: none"> Engine speed: max. Oil temperature: 45–55°C (113–131°F) Check one circuit at a time 	bar (psi)	300 (4351)	$0 \begin{smallmatrix} + \\ - \end{smallmatrix} 7$ (101.5)	
	P2 pump (Safety)			300 (4351)	$0 \begin{smallmatrix} + \\ - \end{smallmatrix} 7$ (101.5)	
	Servocontrols (Safety)			30/50 (435.1/725)	±3 (43.5)	
Hydraulic pressure	Boom	Raise	bar (psi)	270 (3916)	$0 \begin{smallmatrix} + \\ - \end{smallmatrix} 7$ (101.5)	
		Lower		270 (3916)	$0 \begin{smallmatrix} + \\ - \end{smallmatrix} 7$ (101.5)	
	Arm	<ul style="list-style-type: none"> Engine speed: max. Oil temperature: 45–55°C (113–131°F) Check one circuit at a time 		270 (3916)	$0 \begin{smallmatrix} + \\ - \end{smallmatrix} 7$ (101.5)	
	Bucket			270 (3916)	$0 \begin{smallmatrix} + \\ - \end{smallmatrix} 7$ (101.5)	
	Swing			210 (3046)	$0 \begin{smallmatrix} + \\ - \end{smallmatrix} 7$ (101.5)	
	Blade			210 (3046)	$0 \begin{smallmatrix} + \\ - \end{smallmatrix} 7$ (101.5)	
	Boom swing			270 (3916)	$0 \begin{smallmatrix} + \\ - \end{smallmatrix} 7$ (101.5)	
	2 nd boom			270 (3916)	$0 \begin{smallmatrix} + \\ - \end{smallmatrix} 7$ (101.5)	
	Travel			270 (3916)	$0 \begin{smallmatrix} + \\ - \end{smallmatrix} 7$ (101.5)	
	Attachments			270 (3916)	$0 \begin{smallmatrix} + \\ - \end{smallmatrix} 7$ (101.5)	
	Servocontrols			30 (435.1)	±3 (43.5)	
	LS differential pressure			<ul style="list-style-type: none"> Engine: high idling Oil temperature: 45–55°C (113–131°F) 	Levers at NEUTRAL	25–39 (362.6–565.6)
<ul style="list-style-type: none"> Travel speed: Hi Travel lever: at the end of stroke Track shoe: raised 			21±1 (304.6±14.5)		—	

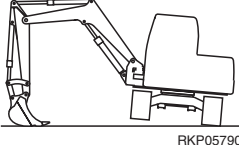
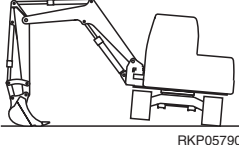
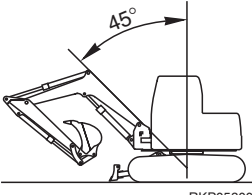
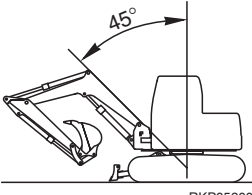
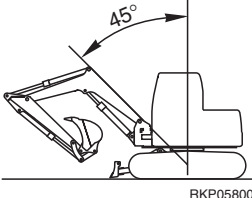
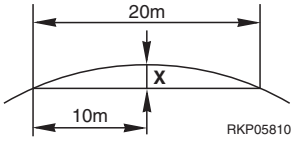
● FOR MACHINE

Machine model				PC75R-2	
Classification	Check item	Test conditions	Unit	Standard value	Permissible value
Swing	Braking angle	<p>Work equipment at max. reach</p>  <p>RKP05770</p> <ul style="list-style-type: none"> • Load in the bucket: 475 kg (1047 lb.) • Engine speed: high idling. • Oil temperature: 45–55°C (113–131°F) • Make centring marks on the outer swing circle rings. Rotate the upper turret 360° and stop. Measure the difference between the marks after stopping. 	Degree (mm)	Max. 60° (400)	90° (600)
	Time taken to start swing	<p>Working equipment at max. reach</p>  <p>RKP05770</p> <ul style="list-style-type: none"> • Engine speed: high idling • Oil temperature: 45–55°C (113–131°F) • Time taken also from starting position to swing 90° and 180°. 	90°	—	—
			180°	Max. 5	Max. 5.5
	Time taken to swing	<p>Working equipment at max. reach</p>  <p>RKP05770</p> <ul style="list-style-type: none"> • Engine speed: high idling • Oil temperature: 45–55°C (113–131°F) • Make one turn to settle machine. • Measure the time taken to make 5 full swings 	sec	33	31 – 35
Hydraulic drift of swing	 <p>RKP05780</p> <ul style="list-style-type: none"> • Engine stopped • Oil temperature: 45–55°C (113–131°F) • Brake disengaged (with specific tool) • Park the machine on a 15° slope and set the boom at 90° 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. 	mm (in.)	0 (0)	—	

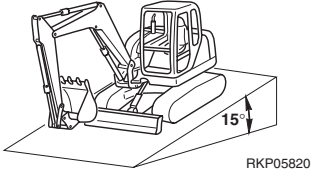
● FOR MACHINE

Machine model				PC75R-2	
Classification	Check item	Test conditions	Unit	Standard value	Permissible value
Swing	Hydraulic drift of swing	 <ul style="list-style-type: none"> ● Engine stopped ● Oil temperature: 45–55°C (113–131°F) ● Park the machine on a 15° slope and set the boom at 90° 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. 	mm (in.)	0 (0)	0 (0)
Swing	Internal leakage from swing motor	<ul style="list-style-type: none"> ● Engine speed: high idling ● Oil temperature: 45–55°C (113–131°F) ● Swing block: engaged ● Measure the leakage 	ℓ/min (US.gpm)	0.70 (0.185)	Max. 1.5 (Max. 0.396)

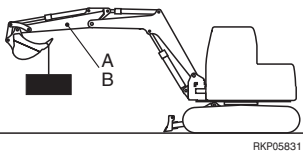
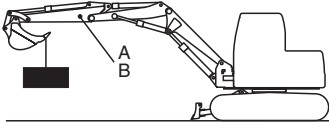
● FOR MACHINE

Machine model				PC75R-2		
Classification	Check item	Test conditions	Unit	Standard value	Permissible value	
Travel	Travel motor swing speed (1) (no-load)	Measuring posture  <ul style="list-style-type: none"> ● Engine speed: high idling ● Oil temperature: 45–55°C (113–131°F) ● 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 	Low speed	rpm	20	Min. 17
		Measuring posture  <ul style="list-style-type: none"> ● Engine speed: high idling ● Oil temperature: 45–55°C (113–131°F) ● 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 	High speed		32	Min. 28
	Travel speed (2)	Measuring posture  <ul style="list-style-type: none"> ● Engine speed: high idling ● Oil temperature: 45–55°C (113–131°F) ● On flat ground ● Travel for at least 10 metres and then check on the time needed to cover 20 metres 	Low speed	sec	24	Max. 27 Min. 21
Measuring posture  <ul style="list-style-type: none"> ● Engine speed: high idling ● Oil temperature: 45–55°C (113–131°F) ● On flat ground ● Travel for at least 10 metres and then check on the time needed to cover 20 metres 	High speed	14	Max. 16 Min. 12			
Travel deviation	Measuring posture  <ul style="list-style-type: none"> ● Engine speed: high idling ● Oil temperature: 45–55°C (113–131°F) ● Travel 20 metres on flat ground and measure the deviation. ★ The surface must be hard and horizontal.  ★ Measure dimension «X»		mm (in.)	200 (7.874)	Max. 250 (Max. 9.843)	

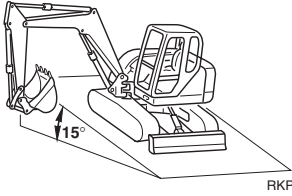
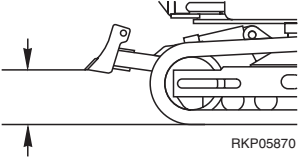
● FOR MACHINE

Machine model				PC75R-2	
Classification	Check item	Test conditions	Unit	Standard value	Permissible value
Travel	Hydraulic drift of travel motors	<p>Measuring posture</p>  <ul style="list-style-type: none"> ● Engine: switched off ● Oil temperature: 45 – 55°C (113 – 131°F) ● Stop machine on a slope with blade raised and sprocket facing straight up the slope ● Measure the drift after 5 minutes 	mm (in.)	0 (0)	0 (0)
	Leakage of travel motors	<ul style="list-style-type: none"> ● Engine speed: high idling ● Oil temperature: 45 – 55°C (113 – 131°F) ● Lock shoes and check leakage ★ Measure one motor at a time 	ℓ/min (US.gpm)	13 (3.43)	Max. 25 (Max. 6.6)

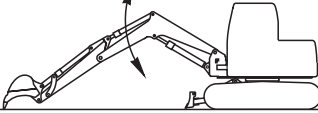
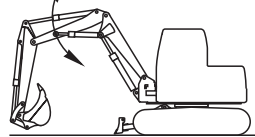
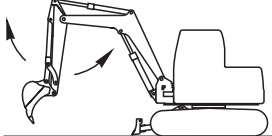
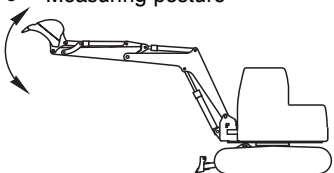
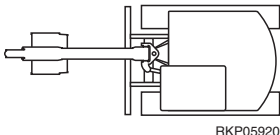
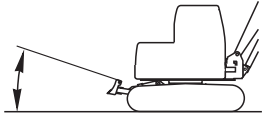
● FOR MACHINE

Machine model				PC75R-2	
Classification	Check item	Test conditions	Unit	Standard value	Permissible value
Hydraulic drift of working equipment	Total work equipment (Standard boom) (Downward movement bucket teeth tips)		Boom A	400 (15.748)	500 (19.685)
			Boom B	400 (15.748)	500 (19.685)
	Boom cylinder (Retraction)	<ul style="list-style-type: none"> 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. 	Boom A	75 (2.953)	90 (3.543)
			Boom B	80 (3.150)	100 (3.937)
	Arm cylinder (Extension)	<ul style="list-style-type: none"> Horizontal levelled ground Bucket: rated load 475 kg (1047 lb.) Levers: neutral Engine: switched off Oil temperature: 45–55°C (113–131°F) Safety valve disengaged 	Boom A	50 (1.968)	60 (2.362)
			Boom B	60 (2.362)	75 (2.953)
	Bucket cylinder (Retraction)	<ul style="list-style-type: none"> Take measurements as soon as the engine stops Measure the variations every 5 minutes and check the total variation after 15 mins. 		30 (1.181)	40 (1.575)
	Total work equipment (Downward movement of tips of bucket teeth) (2-piece boom)		Boom A	600 (23.622)	800 (31.496)
			Boom B	600 (23.622)	800 (31.496)
	Boom cylinder (Retraction)	<ul style="list-style-type: none"> 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. 	Boom A	80 (3.150)	100 (3.937)
			Boom B	90 (3.543)	115 (4.528)
	2 nd boom cylinders (Retraction)	<ul style="list-style-type: none"> Horizontal levelled ground Bucket: rated load 475 kg (1047 lb.) Levers: neutral Engine: switched off Oil temperature: 45–55°C (113–131°F) Safety valve disengaged 	Boom A	60 (2.362)	75 (2.953)
			Boom B	75 (2.953)	100 (3.937)
	Arm cylinder (Extension)	<ul style="list-style-type: none"> Take measurements as soon as the engine stops 	Boom A	50 (1.968)	60 (2.362)
Boom B			60 (2.362)	75 (2.953)	
Bucket cylinder (Retraction)	<ul style="list-style-type: none"> Measure the variations every 5 minutes and check the total variation after 15 mins. 		30 (1.181)	40 (1.575)	

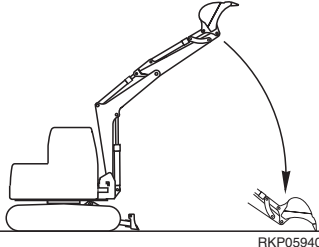
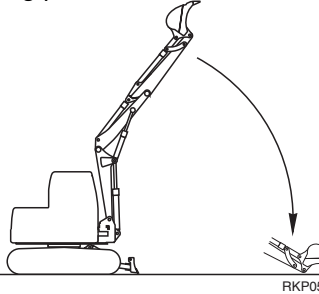
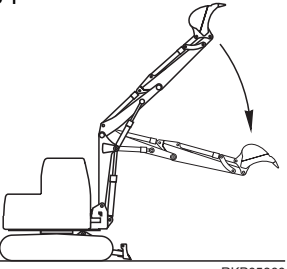
● FOR MACHINE

Machine model				PC75R-2	
Classification	Check item	Test conditions	Unit	Standard value	Permissible value
Hydraulic drift of working equipment	Boom swing (Standard boom)	 <ul style="list-style-type: none"> ● Engine: switched off ● Oil temperature: 45–55°C (113–131°F) ● In the same position as above, park the machine on a 15° slope and bring the turret round to 90°. Measure the extension and retraction of the cylinder after 15 mins. 	Boom A	30 (1.181)	35 (1.378)
			Boom B	35 (1.378)	40 (1.575)
	Boom swing (boom and 2-piece boom)		Boom A	40 (1.575)	45 (1.772)
			Boom B	45 (1.772)	50 (1.969)
Blade (measure the downward movement of the edge of the blade)	 <ul style="list-style-type: none"> ● Engine: switched off ● Oil temperature: 45–55°C (113–131°F) ● Safety valve disengaged ● Raise the blade and measure the height of the edge from the ground. Measure the downward after 15 mins. 	mm (in.)	6 (0.236)	10 (0.394)	
		mm (in.)	6 (0.236)	10 (0.394)	
Internal cylinder leakage	Boom	<ul style="list-style-type: none"> ● Engine speed: high idling ● Oil temperature: 45–55°C (113–131°F) ● 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. 3.5	Max. 12
	2 nd boom (2 cylinders)			Max. 2.2 (each cylinder)	Max. 8
	Arm			Max. 2.2	Max. 8
	Bucket			Max. 2.2	Max. 8
	Boom swing			Max. 2.5	Max. 10
	Blade			Max. 3.5	Max. 12

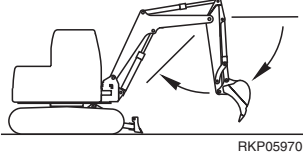
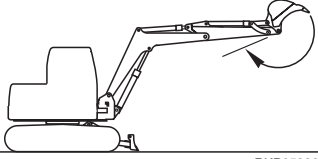
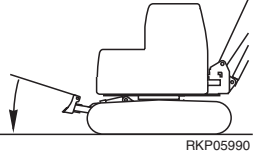
● FOR MACHINE

		Machine model			PC75R-2	
Classifi- cation	Check item	Test conditions	Unit	Standard value	Permissible value	
Work equipment	Boom Bucket teeth on the ground ↕	<ul style="list-style-type: none"> Measuring posture 	Raise	sec	2.1	1.9 – 2.3
		<ul style="list-style-type: none"> Engine speed: high idling Oil temperature: 45 – 55°C (113 – 131°F) 	Lower		2.5	2.2 – 2.8
	2 nd boom Cylinders completely retracted ↕	<ul style="list-style-type: none"> Measuring posture 	Closed		2.1	1.9 – 2.3
		<ul style="list-style-type: none"> Engine speed: high idling Oil temperature: 45 – 55°C (113 – 131°F) 	Inout		2.5	2.2 – 2.8
	Arm Cylinder completely retracted ↕	<ul style="list-style-type: none"> Measuring posture 	Closed		3.5	3.1 – 3.9
		<ul style="list-style-type: none"> Engine speed: high idling Oil temperature: 45 – 55°C (113 – 131°F) 	Inout		2.6	2.3 – 2.9
	Bucket Cylinder completely retracted ↕	<ul style="list-style-type: none"> Measuring posture 	Curled		3.0	2.7 – 3.3
		<ul style="list-style-type: none"> Engine speed: high idling Oil temperature: 45 – 55°C (113 – 131°F) 	Dump		2.2	1.9 – 2.5
	Boom swing Cylinder completely retracted ↕	<ul style="list-style-type: none"> Measuring posture 	L.H.		6.0	5.4 – 6.6
		<ul style="list-style-type: none"> Engine speed: high idling Oil temperature: 45 – 55°C (113 – 131°F) 	R.H.		6.0	5.4 – 6.6
	Blade Blade on the ground ↕	<ul style="list-style-type: none"> Measuring posture 	Raise		1.3	1.1 – 1.5
		<ul style="list-style-type: none"> Engine speed: high idling Oil temperature: 45 – 55°C (113 – 131°F) 	Lower		1.4	1.2 – 1.6

● FOR MACHINE

Machine model				PC75R-2	
Classifi- cation	Check item	Test conditions	Unit	Stand- ard value	Permissible value
Work equipment	Time lags	Measuring posture  <ul style="list-style-type: none"> ● Engine speed: low idling ● Oil temperature: 45 – 55°C (113 – 131°F) ● 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
		Measuring posture  <ul style="list-style-type: none"> ● Engine speed: low idling ● Oil temperature: 45 – 55°C (113 – 131°F) ● Retract fully the cylinders of the arm and bucket. Extend the 2 nd boom fully. Lower bucket to ground and measure time taken for chassis to rise from ground.		Max. 2	Max. 3
		Measuring posture  <ul style="list-style-type: none"> ● Engine speed: low idling ● Oil temperature: 45 – 55°C (113 – 131°F) ● Check valve: 60$\frac{0}{5}$ bar (852.2$\frac{0}{71}$ psi) ● Retract fully the cylinders of the arm and bucket. Extend the 2 nd boom fully. Bring the boom into a vertical position. Close completely the 2 nd boom and measure the time taken increase the pressure.		Max. 2	Max. 3

● FOR MACHINE

		Machine model	PC75R-2		
Classification	Check item	Test conditions	Unit	Standard value	Permissible value
Work equipment	Time lags	<p>Measuring posture</p>  <p style="text-align: right;">Boom A</p>	sec	Max. 2	Max. 3
		<p>Measuring posture</p> <ul style="list-style-type: none"> ● Engine speed: low idling ● Oil temperature: 45–55°C (113–131°F) ● 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. <p style="text-align: right;">Boom B</p>		Max. 2	Max. 3
	<p>Measuring posture</p>  <p style="text-align: right;">RKP05980</p> <ul style="list-style-type: none"> ● Engine speed: low idling ● Oil temperature: 45–55°C (113–131°F) ● 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. 	Max. 2		Max. 3	
	Blade	<p>Measuring posture</p>  <p style="text-align: right;">RKP05990</p> <ul style="list-style-type: none"> ● Engine speed: low idling ● Oil temperature: 45–55°C (113–131°F) ● 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. 	Max. 1	Max. 2	

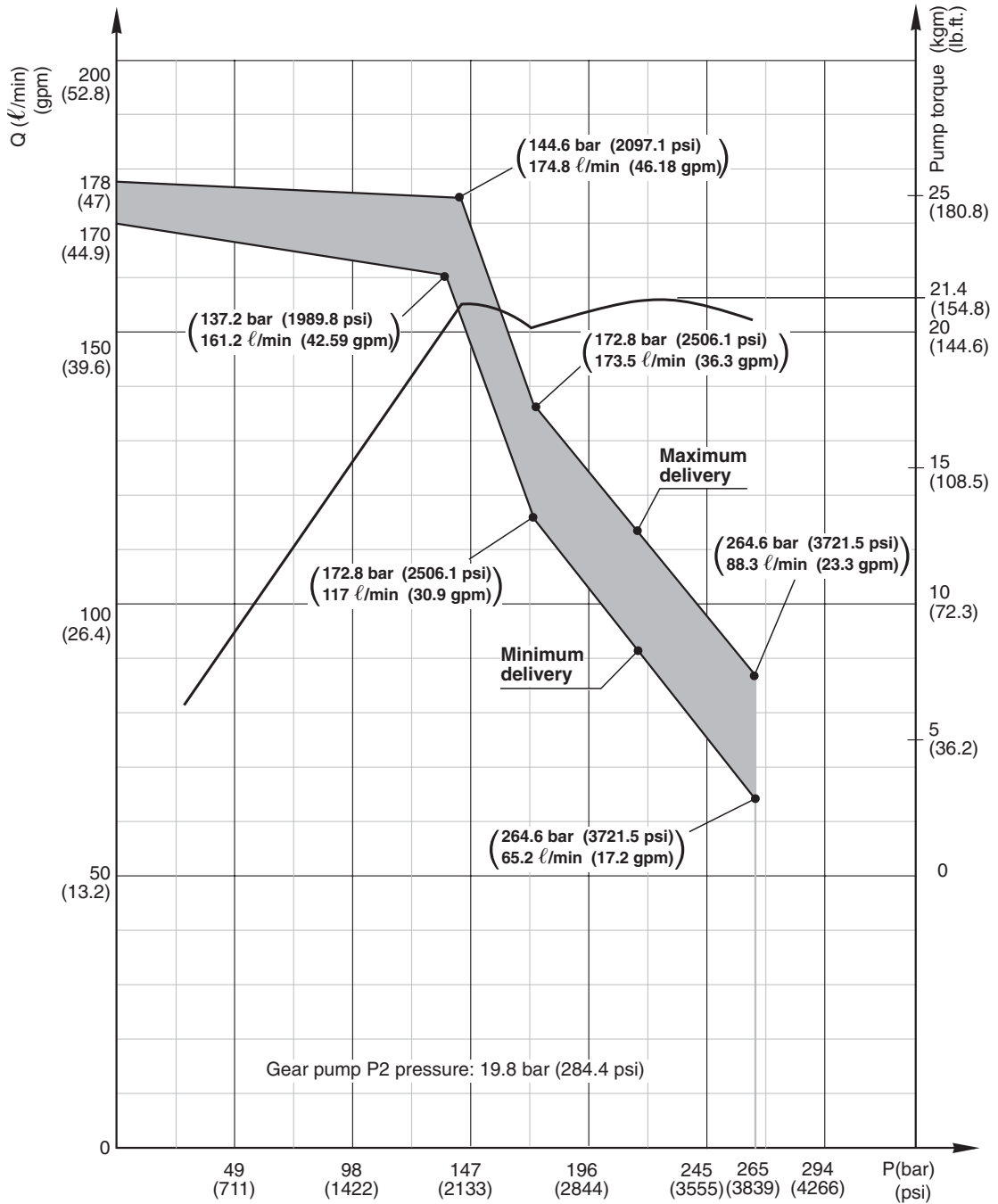
● FOR MACHINE

Machine model				PC75R-2		
Classification	Check item		Test conditions	Unit	Standard value	Permissible value
Pumps	Pump delivery	Gear pump P2	<ul style="list-style-type: none"> Oil temperature: 45–55°C (113–131°F) Measure with engine at rated speed At relief valve set pressure (29.4 bar (417.6 psi)) 	ℓ/min (US.gpm)	64.4 (17.013)	Min. 58 (Min. 15.322)
		Piston pumps P1				

Classification

- Delivery of individual piston pumps P1
- WORKING MODE selector: position P
- Pump speed: 2300 rpm.
- Oil temperature: 45 – 55°C (113 – 131°F)

Pump characteristics



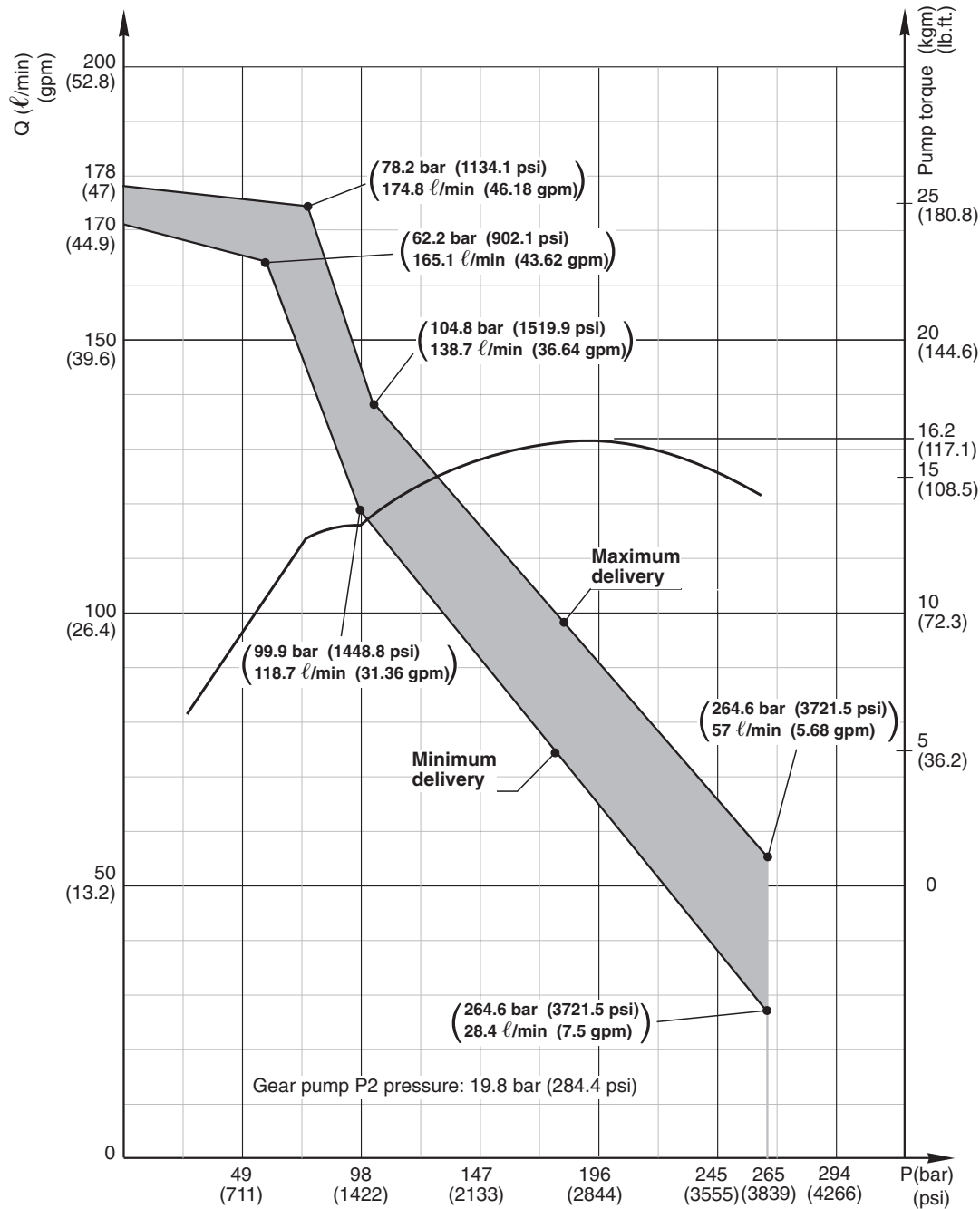
RKP08062

- ★ When measuring the deliveries with the pumps mounted on the machine, it becomes difficult to use the accelerator to set the number of engine rpm corresponding to the test speed prescribed for the pump. Measure the delivery with the engine set to 2300 rpm, and perform a proportional calculation to find the delivery value required for the test.

Classification

- Delivery of individual piston pumps P1
- WORKING MODE selector: position E
- Pump speed: 2300 rpm.
- Oil temperature: 45 – 55°C (113 – 131°F)

Pump characteristics



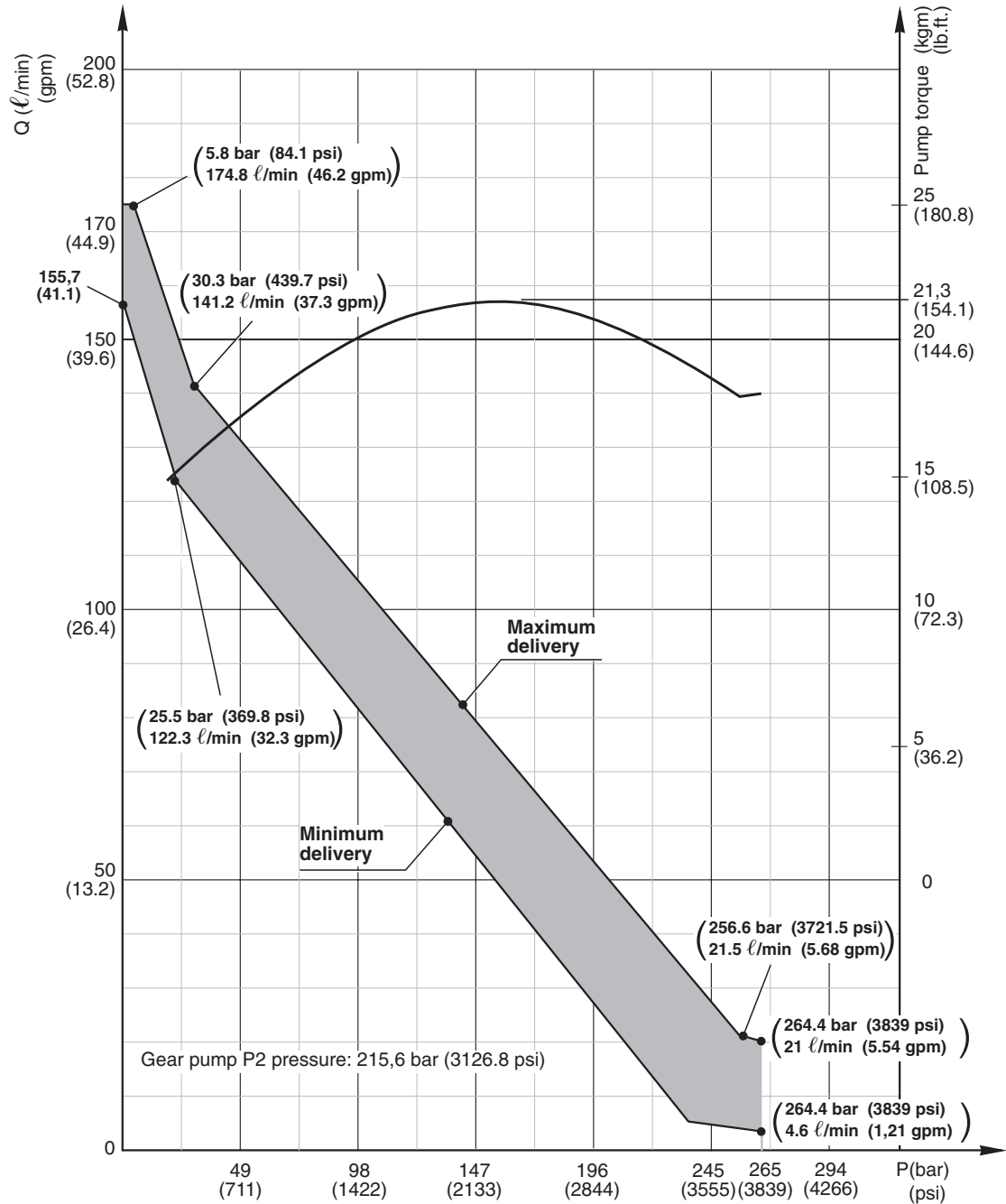
RKP08051

- ★ When measuring the deliveries with the pumps mounted on the machine, it becomes difficult to use the accelerator to set the number of engine rpm corresponding to the test speed prescribed for the pump. Measure the delivery with the engine set to 2300 rpm, and perform a proportional calculation to find the delivery value required for the test.

Classification

- Delivery of individual piston pumps P1 with swing acting
- WORKING MODE selector: position P
- Pump speed: 2300 rpm.
- Oil temperature: 45 – 55°C (113 – 131°F)

Pump characteristics



RKP08041

- ★ When measuring the deliveries with the pumps mounted on the machine, it becomes difficult to use the accelerator to set the number of engine rpm corresponding to the test speed prescribed for the pump.
Measure the delivery with the engine set to 2300 rpm, and perform a proportional calculation to find the delivery value required for the test.

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SPECIAL TOOLS

Measurement check points	Symbol		Code	Name	Q.ty	Remarks
Valve clearance	A	1	Commercially available	Feeler gauge	1	—
Compression pressure	B	1	ATR800090	Compression gauge	1	Kit Yanmar TOL-97190080
		2	ATR800130	Adapter	1	
Engine speed	C	1	Commercially available	Multi-scale tachometer	1	20 - 4000 rpm
		2	ATR800060	Stroboscopic tachometer	1	6 - 30000 rpm
Water and oil temperature	D	1	Commercially available	Digital temperature gauge	1	- 50 - 1200 °C
Hydraulic pressure	E	1	Commercially available	Pressure gauge	2	Scale 60 bar
		2	Commercially available	Pressure gauge	1	Scale 250 bar
		3	Commercially available	Pressure gauge	1	Scale 400 bar
		4	Commercially available	Pressure gauge	1	Scale 600 bar
		5	ATR800200	Kit servocontrol Digital differential pressure	1	0-1000 bar
	F	1		Flowmeter	1	Delivery 0-300 ℓ/min.
		F	2	Tube union kit	1	—
Drift Test	G	1		Instrument for swing brake unlocking	1	—
		2		Union kit	1	—
Track shoe tension	H	1	21D-98-11650	Grease nipple	1	Included in the machine tool kit
Hydraulic drift of boom and arm cylinders	L	1	21D-62-15530	Flange	1	Mount with O-Ring code 21D-09-69870

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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:

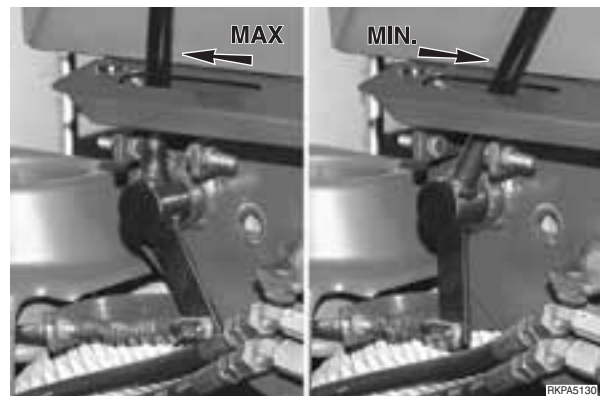
- Engine cooling water temperature:
68–80°C (154.4 – 176 °F)
- Hydraulic system oil temperature:
45–55°C (113 –131°F)

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 1000^{0}_{-50} rpm
 - ★ High idling 2160 ± 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:
 2290 ± 50 rpm
- ★ Max. speed with the P1 and P2 pumps working:
 2285 ± 50 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:

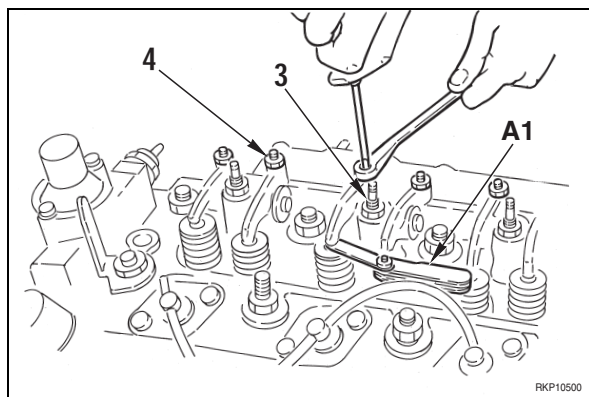
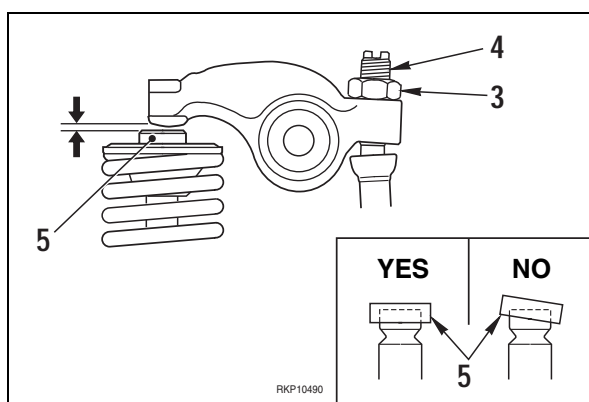
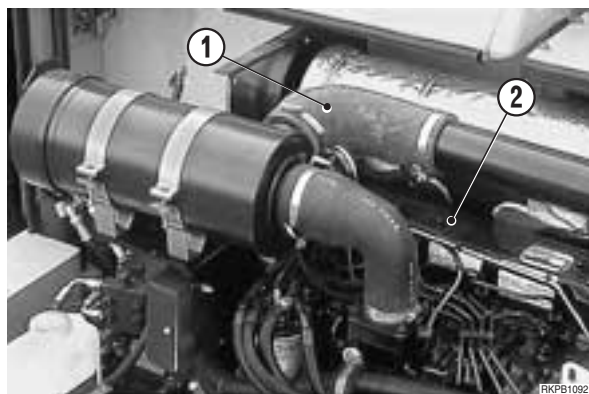
Unit: mm (in.)

	Intake valve	Exhaust valve
At cold engine	0.20 (0.0078)	0.20 (0.0078)

- ★ Ignition order 1-3-4-2-1.....
- ★ Normal rotation sense: counterclockwise from fly-wheel view.

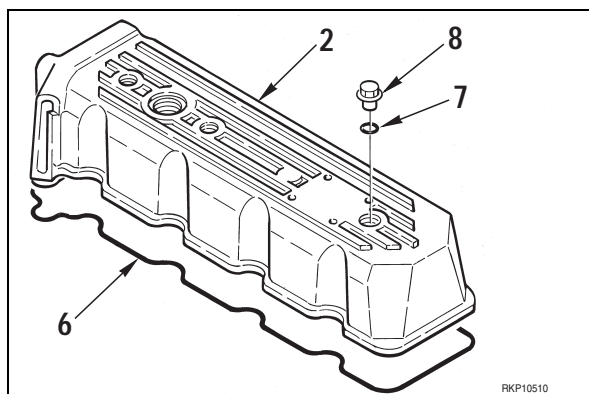
Adjusting procedure

- 1 - Remove the suction pipe (1) and the valves cover (2).
- 2 - Rotate crankshaft in normal direction as long as cylinder piston to be checked is at compression Top Dead Center (PMS).
 - ★ In this position intake and exhaust valves are closed.
- 3 - Loose lock nut (3) and unscrew tappet (4) of about 1 turn.
 - ★ Check that valve insert (5) is laying flat on valve stem and that it is not worn askew.
 - 1 - If valve inserts (5) 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 (4) until touching **A1** feeler gauge. Tight tappet (4) with lock nut (3).
 - ★ 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 (2), gasket (6), O-Rings (7) and lock nuts (8); clean carefully contact surface on cylinder head.
- 2 - Install valves cover (2), fit O-Rings (7) and lock nuts (8).
 - 🔧 Cover lock nut: 25±3 Nm (18.4±2.2 lb.ft.)



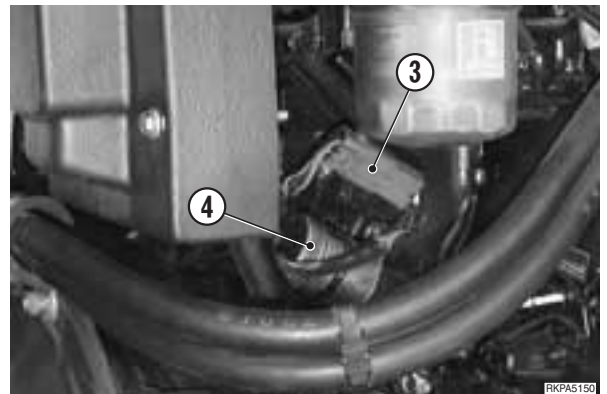
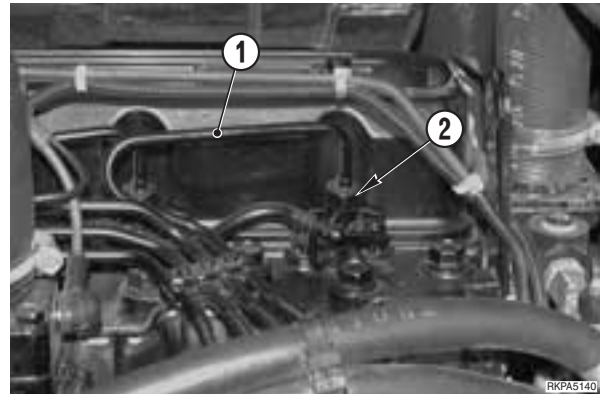
MEASURING COMPRESSION PRESSURE

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

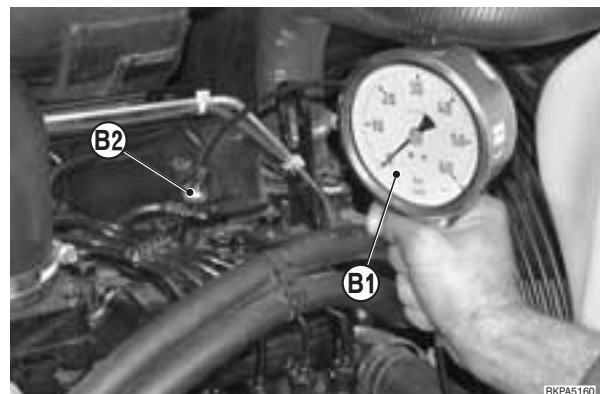
★ Test condition:

- Engine: at operating temperature
- Hydraulic oil: 55 – 60°C (131 – 140°F)
- 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).
- 4 - Crank engine with starting motor.




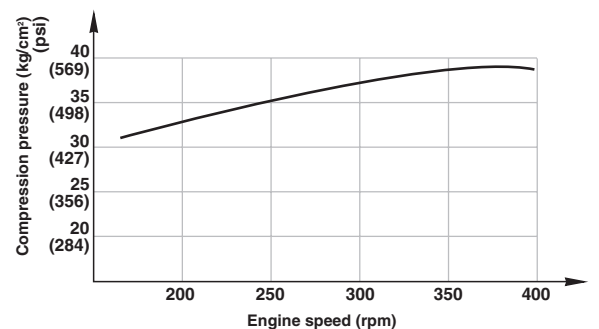
- 5 - Install **B2** adapter and connect **B1** pressure gauge.
 - ★ Check that seal is installed in the adapter and that it is not damaged.
- 6 - Crank engine with starting motor and measure compression pressure.
 - ★ Compression value:
 Normal: $35 \pm 1 \text{ kg/cm}^2$ ($497.7 \pm 14.2 \text{ psi}$)
 Minimum permissible $28 \pm 1 \text{ kg/cm}^2$ ($398.1 \pm 14.2 \text{ psi}$) at 250 rpm
 - ★ Difference between cylinders: $2 - 3 \text{ kg/cm}^2$ ($28.4 - 42.6 \text{ psi}$)



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

 Nozzle holder collar bolts: 6.9 – 8.8 Nm (5.1 – 6.5 lb.ft.)

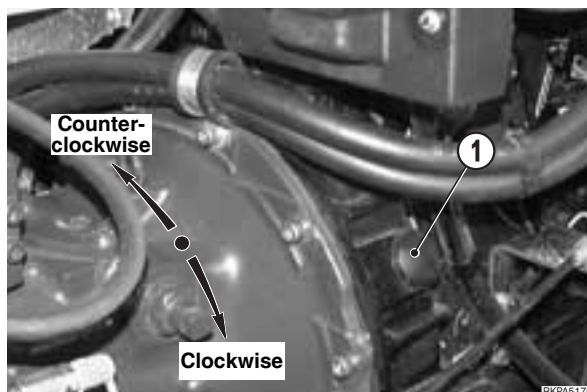
 High pressure union: 19.6 – 24.5 Nm (14.4 – 18 lb.ft.)



TESTING AND ADJUSTING FUEL INJECTION TIMING

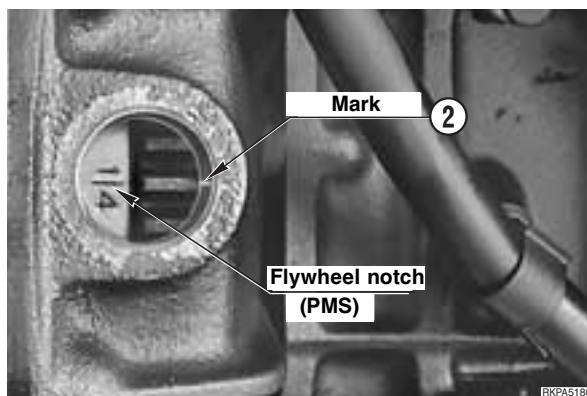
- ★ Check fuel injection timing of N.1 cylinder by means of N.1 delivery valve of injection pump.
- ★ Cylinders are numbered 1-2-3-4 starting from flywheel side.
- ★ On the flywheel there are marked the notches corresponding to injection time of 0° - 10° - 15° - 20°; to note the intermediate values, divide in equal parts the sector between two notches.

1 - Remove plug (1) from flywheel housing.



2 - Using a screwdriver putted between teeth, rotate the crankshaft in clockwise direction (from flywheel side view) until to align the mark on flywheel with mark (2) located inside the inner housing hole.

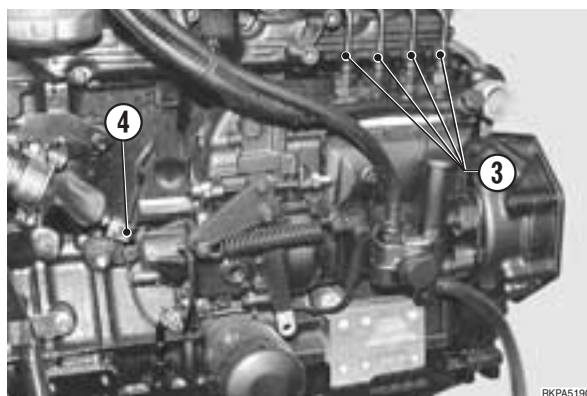
- ★ In this position, N. 1 and N. 4 cylinder pistons are both at Top Dead Centre (TDC); check that N.1 cylinder is at the end of compression stroke, with both intake and exhaust valves closed. If valves are not closed, rotate the crankshaft of 1 turn.
- ★ After recognition of TDC, rotate the crankshaft in clockwise direction (from flywheel side view) of about 25 teeth.



3 - Disconnect all fuel delivery pipes (3) from injection pump.

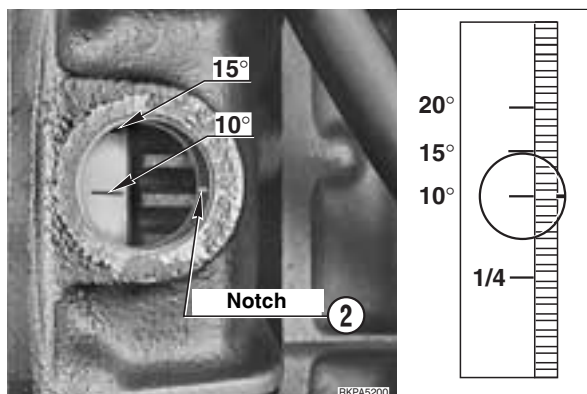
4 - Move externally the stop engine lever (4) and fix the position with a temporary string.

5 - Rotate crankshaft slowly in counterclockwise direction (from flywheel side view), checking carefully fuel level into the N. 1 delivery union of injection pump; stop the rotation as soon as fuel level starts to increase.



6 - Check the 10° ignition timing notch position on flywheel against the notch on housing hole. If both notches are aligned, the injection timing is of 10°; if the notch on flywheel exceeds the notch of hole, the injection timing value is lower.


- ★ Standard fuel injection timing: 10-12°




7 - If injection timing is not within standard value, rotate the injection pump (5) toward external or toward engine after loosening pump nuts (6) and bolt (7) fixing the bracket to injection pump.


- To RETARD injection, rotate the pump (5) toward external.
- To ADVANCE injection, rotate the pump (5) toward cylinders block.

8 - Tight the pump lock nuts (6) at cylinder block and the bolt (7) fixing injection pump to bracket (8).

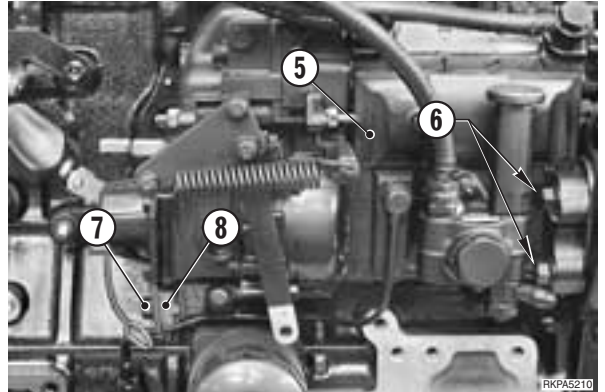
 Nm Nuts: 34.2 – 44.1 Nm (25.2 – 32.5 lb.ft.)

 Nm Bracket bolt: 44.1 – 53.9 Nm (32.5 – 39.7 lb.ft.)

9 - Connect fuel delivery pipes (3) to pump.

 Nm Delivery pipe unions: 19.6 – 24.5 Nm
(14.4 – 18 lb.ft.)

10 - Release the stop engine lever and carry out air bleeding.



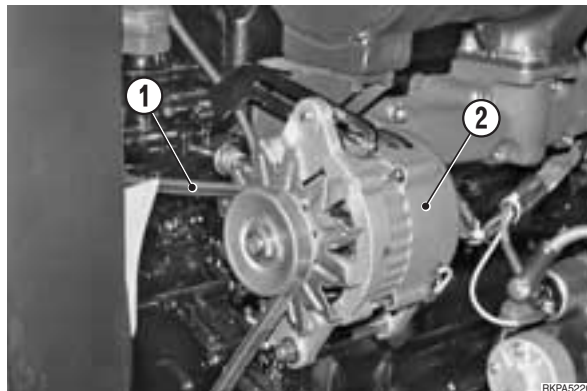
TESTING AND ADJUSTING FAN BELT TENSION

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 10 kg (22 lb.), deflection should be of 10 – 15 mm (0.4 – 0.6 in.); if this value is not reached, tension fan belt.

★ With new belt, deflection must be of 7 – 9 mm (0.3 – 0.35 in.).




2. Fan belt tension


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

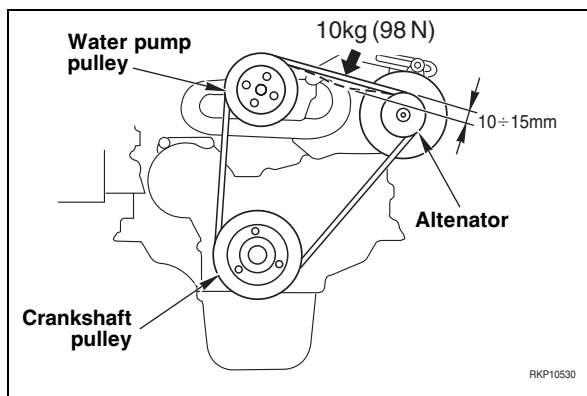
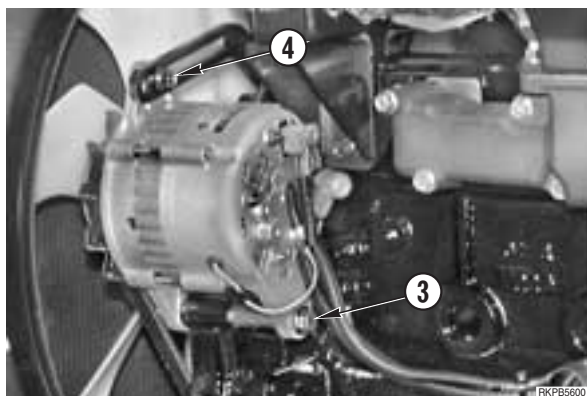
2 - Rotate the alternator (2) to give correct tension to fan belt (1) and tighten mounting bolts (3) and (4).

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 (32.5 – 39.7 lb.ft.)

 Mounting bolt (4):
22.5 – 28.4 Nm (0.88 – 1.11 lb.ft.)

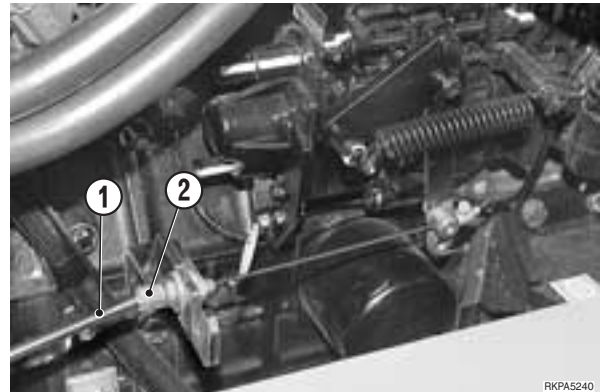


ADJUSTING THE STROKE OF THE ACCELERATOR LEVER

★ Test conditions:

- Engine: Switched off, but at working temperature.
- Low idling: within correct range.
- Hydraulic oil: 45 – 55°C (113 – 131°F)
- 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.

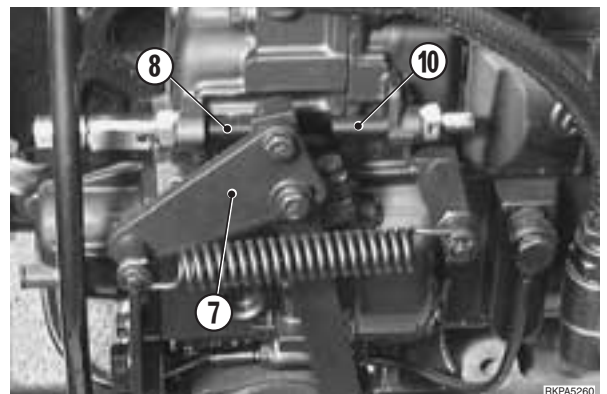
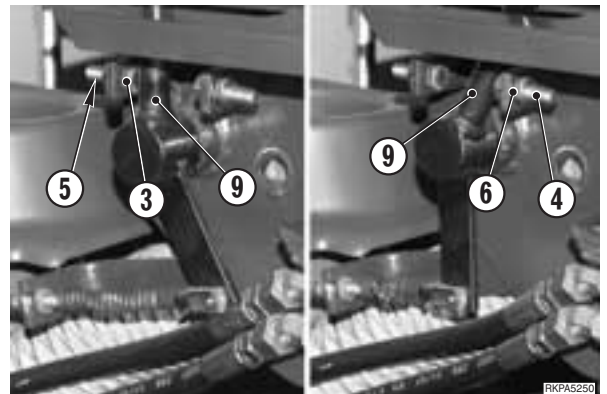
4 - Move the accelerator lever (9) slowly towards low idling position. Stop this movement when the lever (7) on the cover of the injection pump comes into contact with the low idling adjustment screw (8).

5 - Adjust the screw (3) until it is 0.1 mm (0.004 in.) 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 (0.004 in.) 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.



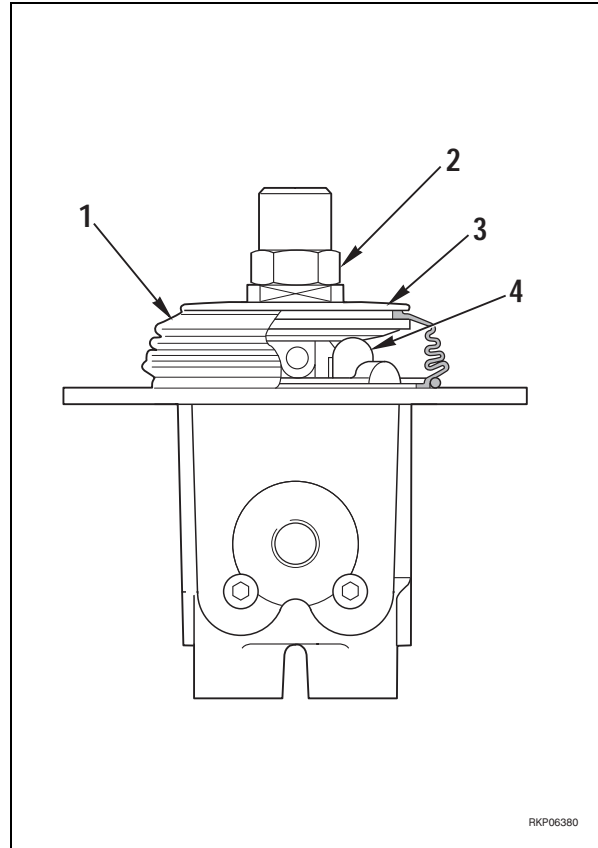
ADJUSTING PPC VALVES CLEARANCE

Adjust PPC valve levers clearance as follows.

- ⚠ Rest the work equipment on the ground and stop the engine.
- Turn the ignition key to position «I» and move the control levers in all directions to relieve all pressure in the hydraulic circuits.
- Turn the ignition key to position «O» (OFF) and remove it.
- Put the safety device lever in its «ENGAGED» position.
- Slowly unscrew the filling-cap of the oil-tank to release any residual pressure.

1. Front equipment and swing PPC valves

- 1 - Unscrew the retaining nut (1) of the disk (2).
- 2 - Screw the disk (2) down until it comes into light contact with the four plungers (3). Tighten it for another 1/8th of a turn (45°).
 - ★ During this adjustment, take care not to activate the plungers (3).
- 3 - Secure the position with the retaining nut, tightened to the specific torque.
 - 🔧 Retaining nut: 30 ± 3 Nm (22.1 ± 2.2 lb.ft.)



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ADJUSTING THE SAFETY MICROSWITCH

★ Test conditions:

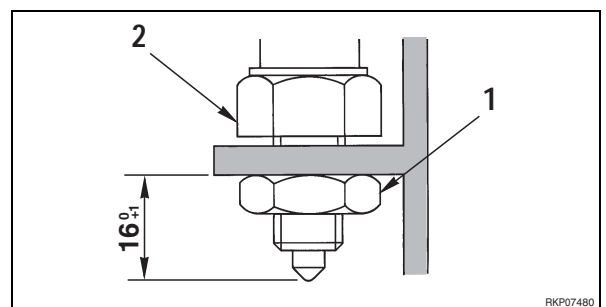
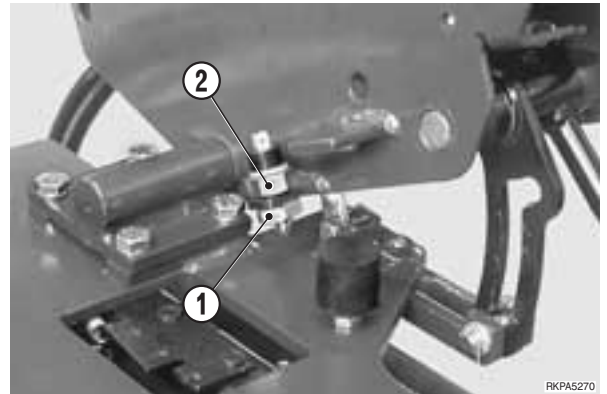
- Engine: switched off but at working temperature.
- Hydraulic oil: 45–55°C (113–131°F)

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 ($0.63^{0}_{+0.04}$ in.)

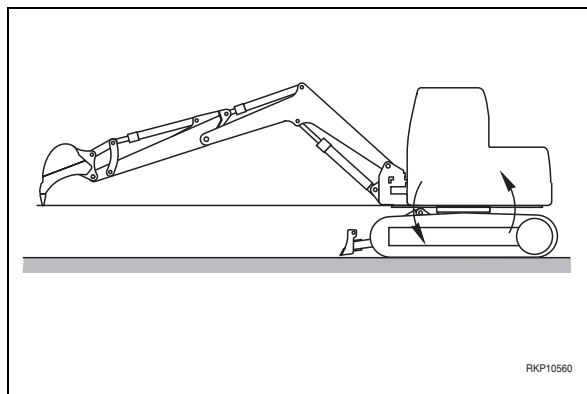
3 - Secure it in position with the nut (1).



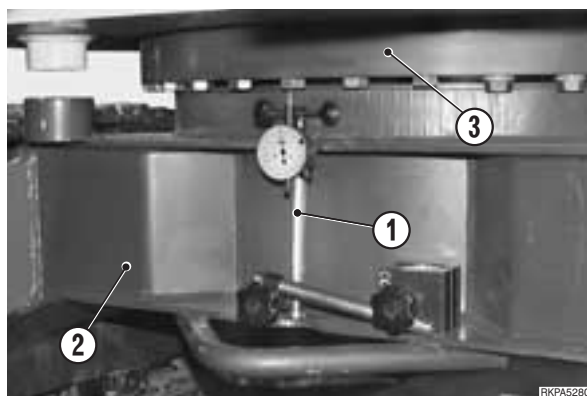
MEASURING THE SWING CIRCLE AXIAL CLEARANCE

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 (0.118 in.) and set this measurement to zero.

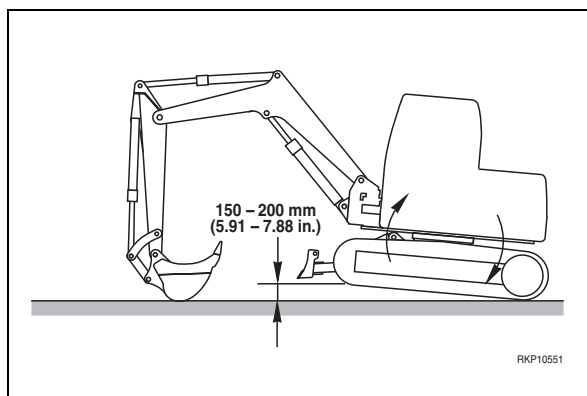


- 5 - Close the bucket, position the arm perpendicular to the ground and rest the back of the bucket on the ground.
- 6 - Push down with the boom until the front of the machine rises, transferring the weight of the track frame onto the sprocket.
- 7 - Check the movement of the comparator (1) in these 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.



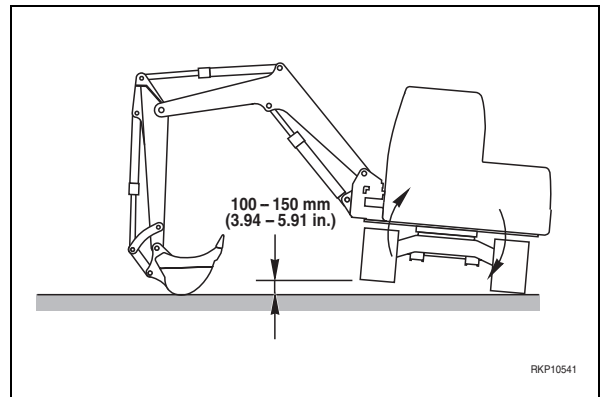
TESTING AND ADJUSTING TRACK-SHOE TENSION

1. Test

★ Test conditions:

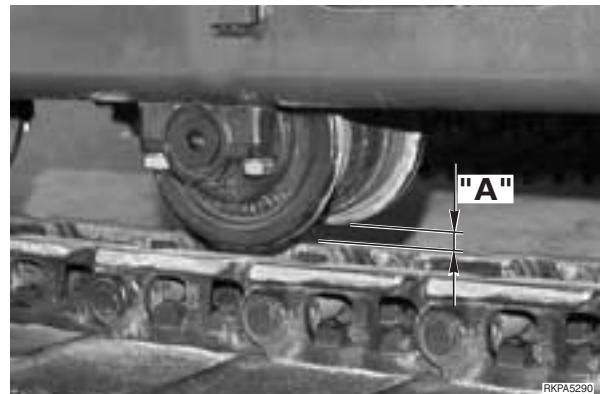
- Firm, flat ground.
- Work equipment resting on the ground.

- 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 (0.79 – 0.98 in.)



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.

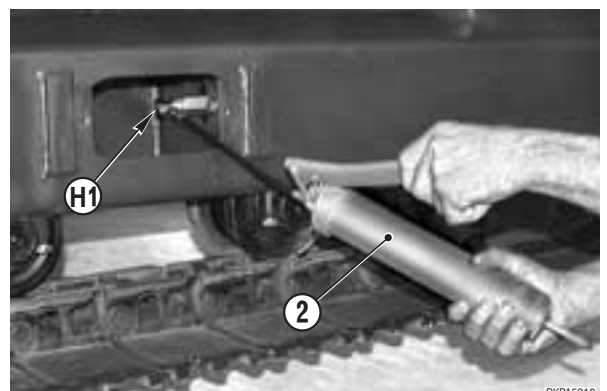
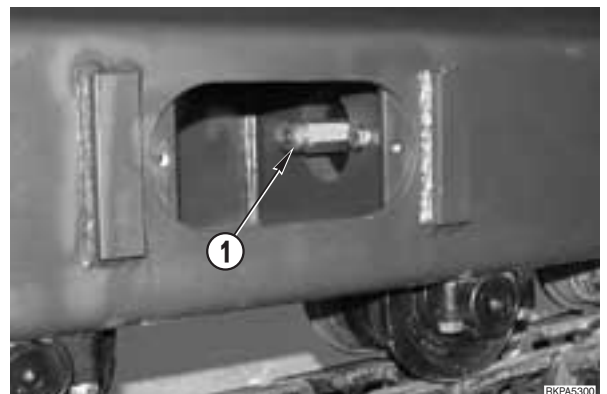
- 1 - If the tension is too slack.
Inject grease through the grease nipple (1), using the grease nipple H1.

- ★ If the grease proves difficult to inject, slowly move the machine backwards and forwards 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

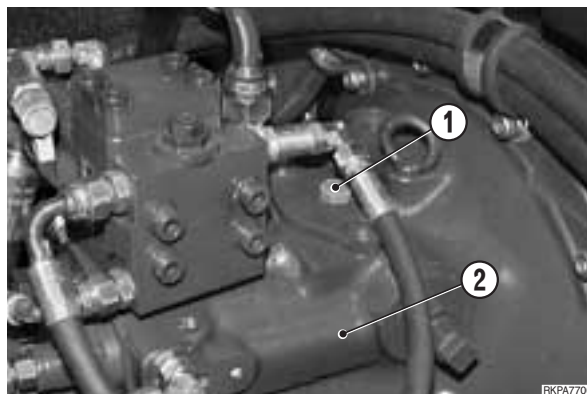
Air bleeding item Nature of work	Air bleeding procedure					
	1	2	3	4	5	6
	Bleeding air from pump	Start engine	Bleeding air from cylinder	Bleeding air from swing motors	Bleeding air from travel motor	Start operations
<ul style="list-style-type: none"> • Replace hydraulic oil • Clean strainer 	○ →	○ →	○ →	○ → ★1	○ → ★1	○
<ul style="list-style-type: none"> • Replace return filter element 		○ →				○
<ul style="list-style-type: none"> • Replace, repair pump • Remove suction piping 	○ →	○ →	○ →			○
<ul style="list-style-type: none"> • Replace, repair control valve 		○ →	○ →		○ →	○
<ul style="list-style-type: none"> • Replace cylinder • Remove cylinder piping 		○ →	○ →			○
<ul style="list-style-type: none"> • Replace swing motor • Remove swing motor piping 				○ →		○
<ul style="list-style-type: none"> • 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 bled 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).
 ⚙ Nm Plug: 7.35 ± 1.47 Nm (5.42 ± 1.08 lb.ft.)
- 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»)

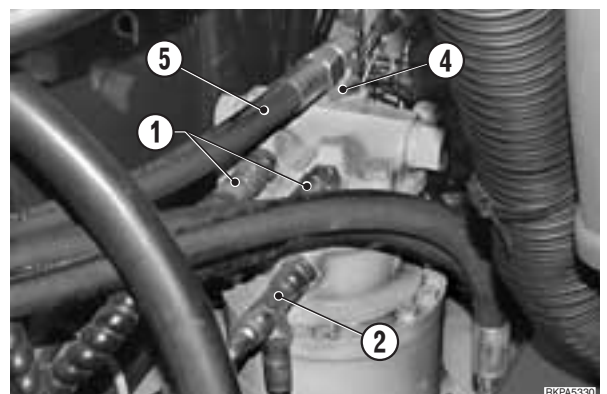
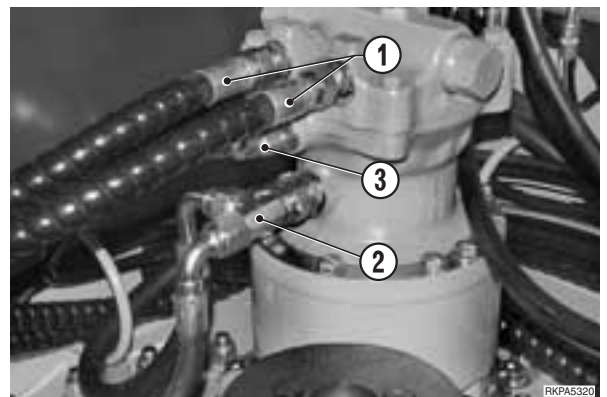


2. Bleeding air from hydraulic cylinders

- ★ Once the hydraulic cylinders or the tubes connected to them have been removed, the air must be bled 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 (3.94 in.) 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.

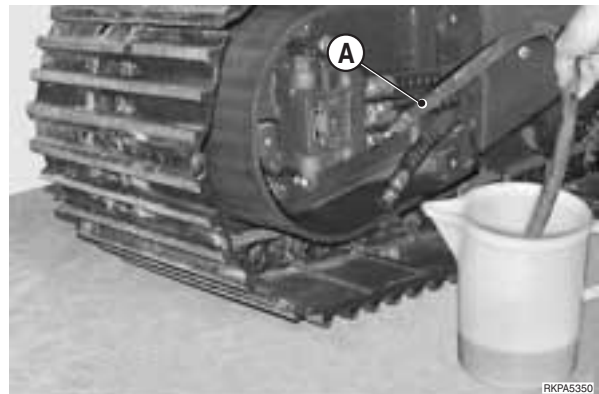
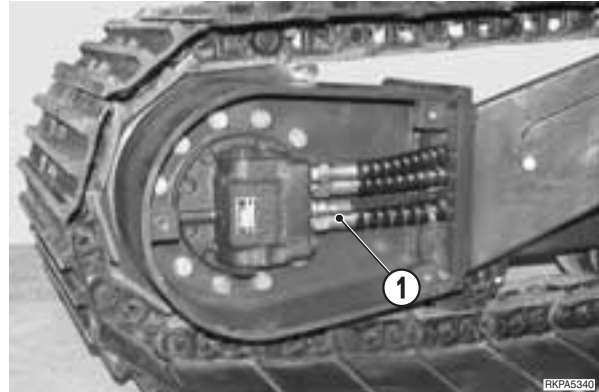
3. Bleeding air from swing motor

- 1 - Connect hoses (1), drain hose (2) and brake swing release hose (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.



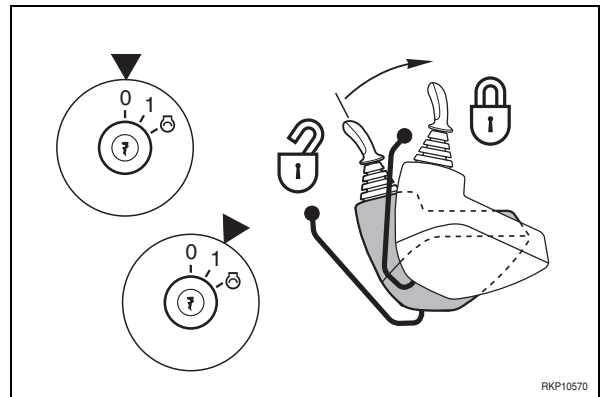
4. Air bleeding from travel motors

- 1 - Apply on drain union (1) a temporary hose «A» 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.

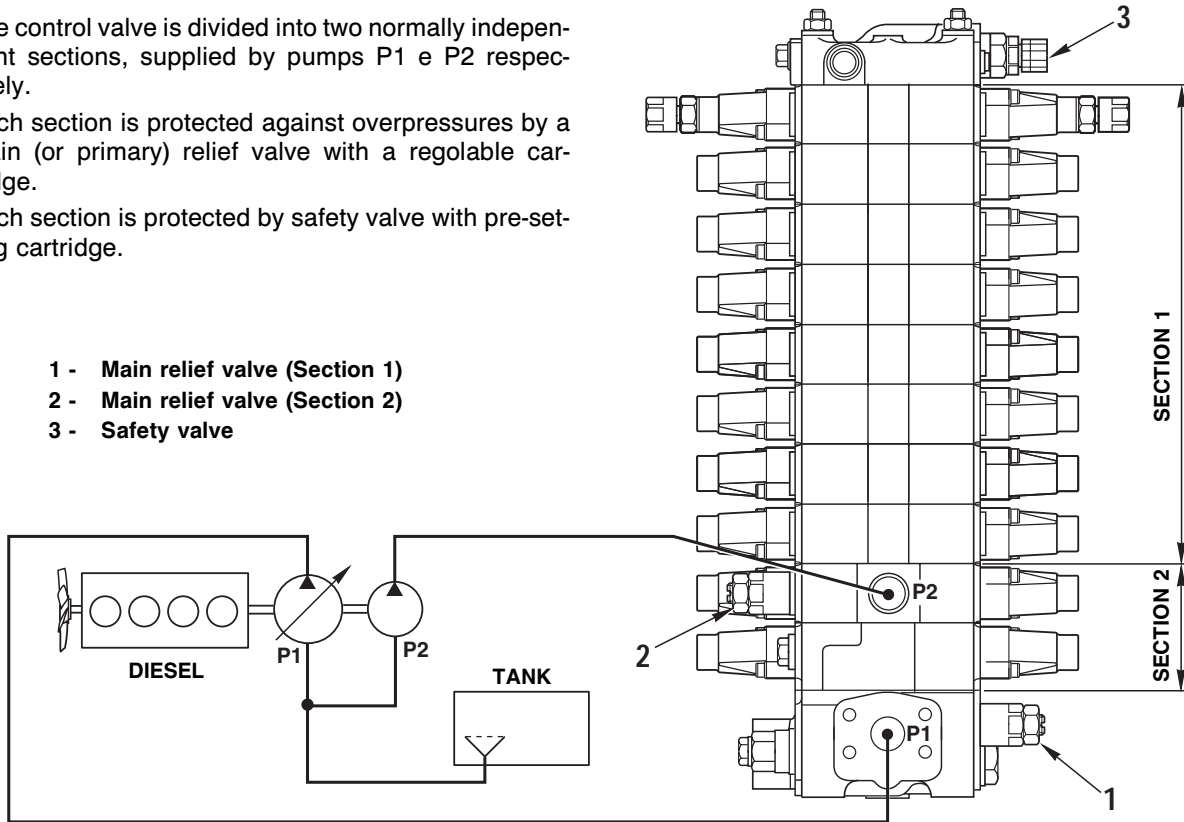


CHECKING AND REGULATING PRESSURE IN THE HYDRAULIC CIRCUITS

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 regulable 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

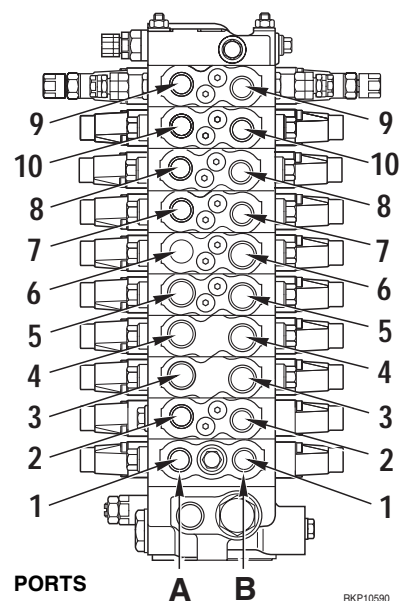


RKP10580

- The sections consist of the spools that govern:

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


* Optional



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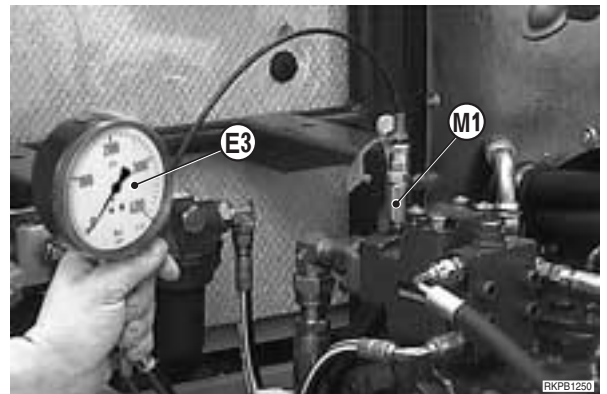
TESTING AND SETTING OF MAIN VALVES

- ★ Check condition:
 - Engine: at working temperature
 - Engine idling MIN. and MAX.: within standard values
 - Hydraulic oil: 45–55°C (113–131°F)
 - WORKING MODE selector: position P
 - Swing lock pin: applied.

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

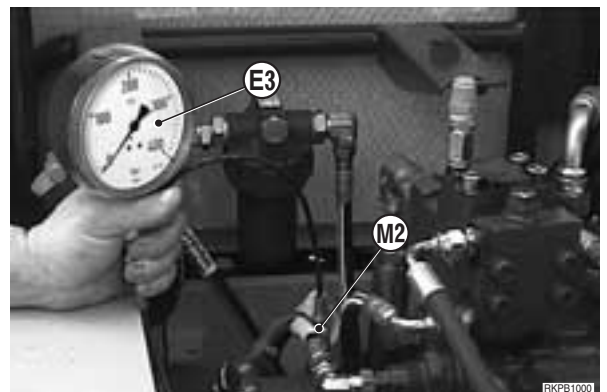
1. Main valve Section 1

- 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 265 ± 5 bar (3842.3 ± 72.5 psi).
- ★ If the reading values on gauge are not the same as shown, proceed to main valves setting.




2. Main valve Section 2

- 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 - Raise the blade up to the end of stroke and check that the gauge connected to port **M2** shows a pressure of 206 ± 5 bar (2987.6 ± 72.5 psi).
 - 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 206 ± 5 bar (2987.6 ± 72.5 psi).
- ★ If the pressure values are lower than the value shown, check the safety valves of swing motor.




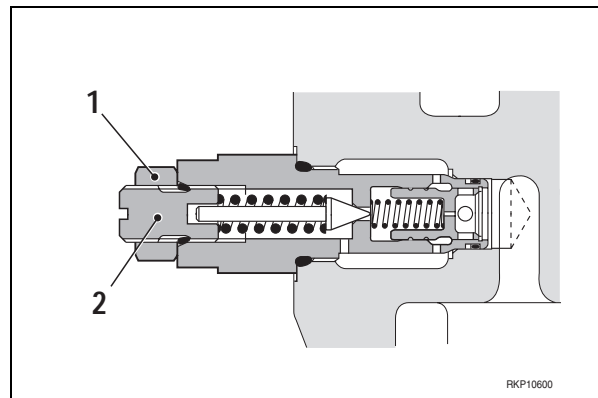
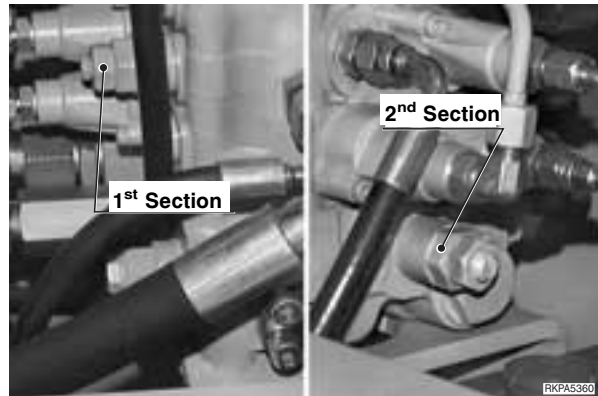
3. Main valves setting

 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 (36.1 – 43.5 lb.ft.)




ADJUSTING PC VALVE

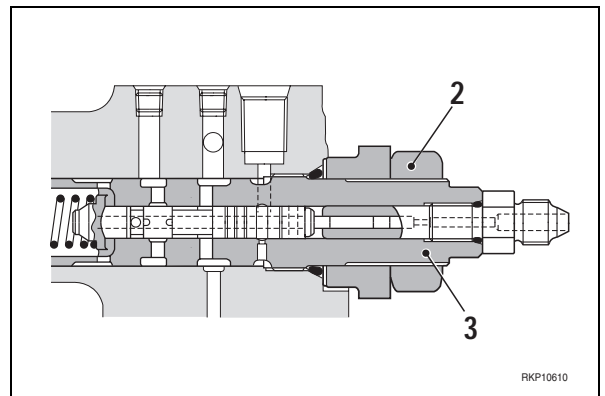
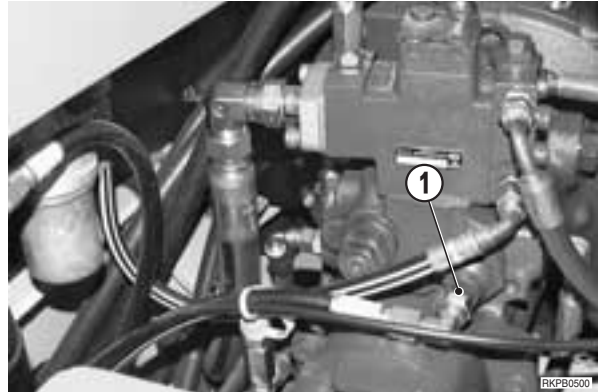
- ★ In case the engine speed lowers as a load becomes larger, or in case the work equipment speed is slow even though the engine speed, pump discharge pressure and LS differential pressure are normal, adjust the **PC** (1) valve according to the following procedure.

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 absorption 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).

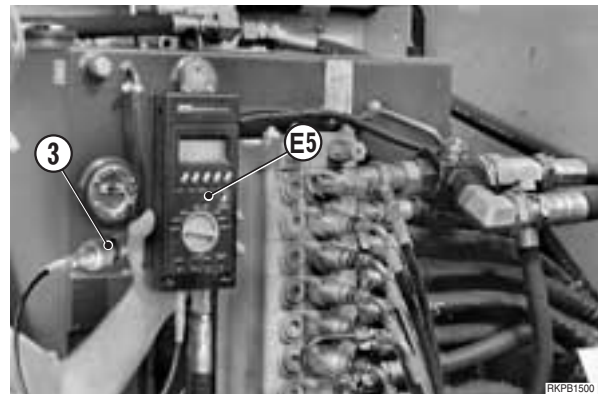
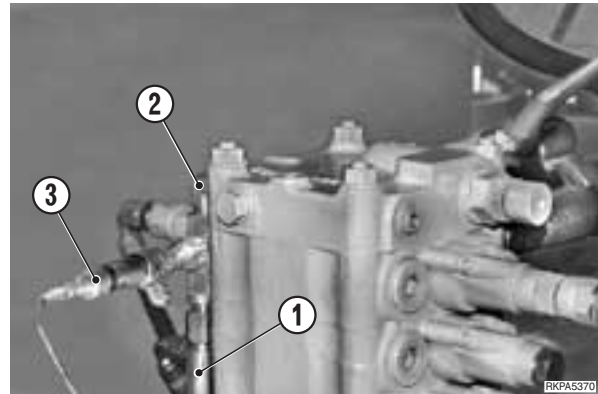
 Nm Lock nut: 100.5 ± 12.3 Nm (74 ± 9.06 lb.ft.)



MEASURING LS DIFFERENTIAL PRESSURE AND ADJUSTING LS VALVE

1. Measuring ΔP_L s differential pressure

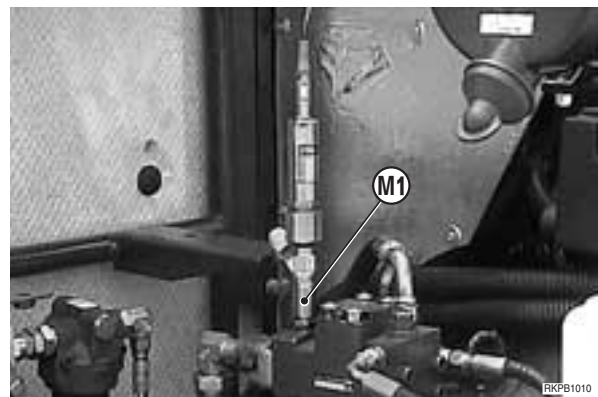
- i) Disconnect pipe (1) and connect a Tee on the union (2); screw an adapter (3) on the Tee. Connect pipe (1).



- ii) Connect the pressure gauge **E5** to adapter (3) on control valve and to adapter **M1** (delivery pump P1).
- iii) Measure the ΔP_L s differential pressure according to the conditions shown in table 1.

Table 1

Work mode	Fuel lever	Operation	Differential pressure bar (psi)
P	Full	Lever at NEUTRAL	25 - 39 (362.5 - 565.6)
P	Full	Vehicle speed with increment Travel idling (lever full)	21 ± 1 (304.6 ± 14.5)



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 (3) according to the following procedure.

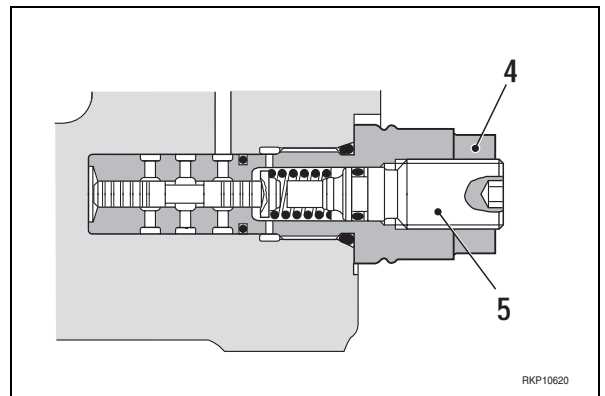
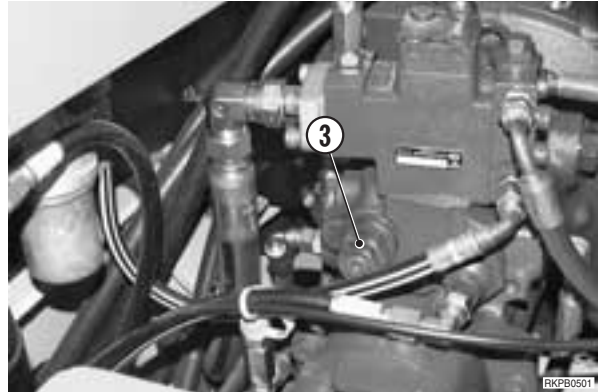
1 - Loosen the lock nut (4) and turn the screw (5) to adjust.

- Turn the screw:
CLOCKWISE to increase the differential pressure;
COUNTERCLOCKWISE to decrease the differential pressure.
- Adjusting amount for one turn of the screw:
 13.2 kg/cm^2 (187.7 psi).

2 - After-the adjustment finished, tighten the locknut (4).

 Lock nut: $56.4 \pm 7.4 \text{ Nm}$ ($41.6 \pm 5.45 \text{ lb.ft.}$)

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



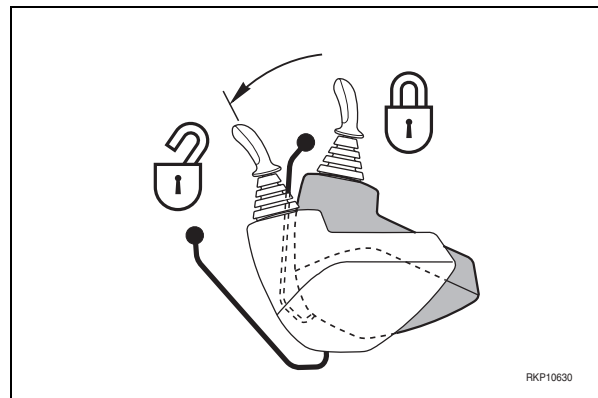
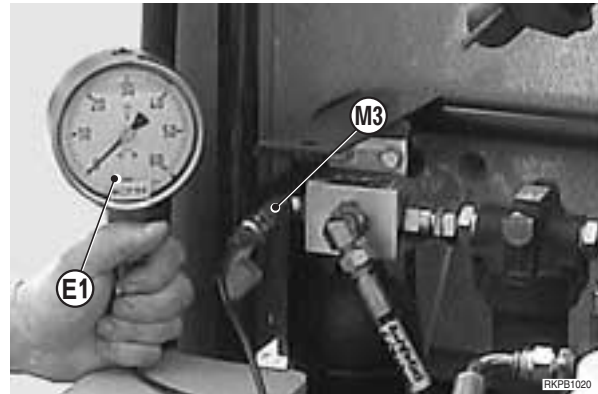
CHECKING AND ADJUSTING PRESSURES IN THE SERVOCONTROL FEED UNIT

★ Test conditions:

- Hydraulic oil: 45–55°C (113–131°F)

⚠ 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: 29 ± 3.5 bar (420.6 – 50.8 psi)
 - ★ If the working pressure is lower than 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 (113 – 131°F)
- 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: 2275 rpm

Delivery: 108.80 ℓ/min (28.744 US.gpm)

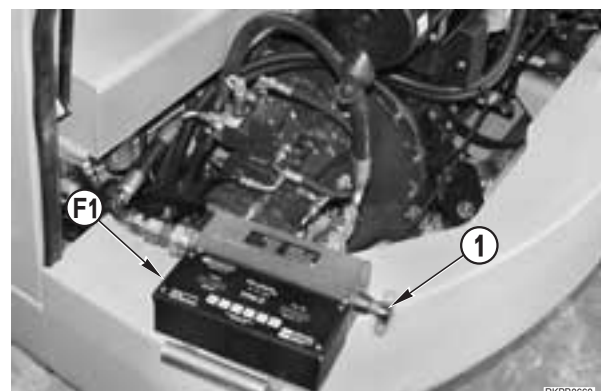
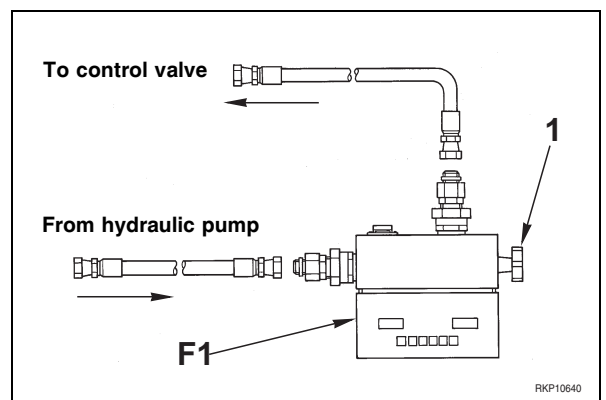
PROPORTIONAL DELIVERY AT 2300 rpm

$$\frac{108.80 \times 2300}{2275} = 110 \text{ ℓ/min}$$

$$\frac{28.744 \times 2300}{2275} = 29.059 \text{ US.gpm}$$

2. Measurement for pump P1

- 1 - Start the engine and bring it up to a speed of 2300 rpm.
- 2 - Adjust the delivery pressure with the flowmeter knob (1) and measure the effective delivery of the pump.
 - ★ Perform this test several times, varying the pressure to cover the entire duty range (max. 265 bar (3843 psi)).
 - ★ Measure the flow values at each 9.8 bar (142.1 psi) of pressure variation.



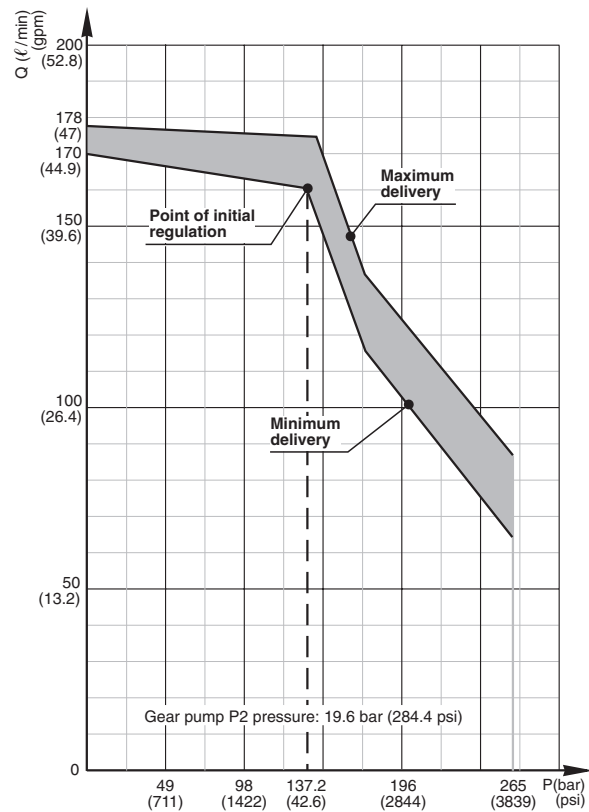
3 - Check the flow – pressure values against the values of «P MODE» diagram as shown on «TECHNICAL SPECIFICATION» making if necessary, the proportional calculating to obtain the flow values referred to 2300 rpm/min. necessary to make the control.

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

NOTE: Making the flow readings each 9.8 bar (142.1 psi), also the initial pump regulation is made, that, in the operating mode «P», corresponds to a pressure of 137 ± 4 bar (1987 ± 58 psi).

4 - Turn the WORKING MODE selector on position **E** and repeat the checks comparing the flow values with «E MODE» curve.

5 - Raise the working attachments, turn the WORKING MODE selector on position **S** and start the upper structure rotation; keeping the lever to the end of stroke, make the flow-pressure measurements and compare the values with the «S MODE» curve.



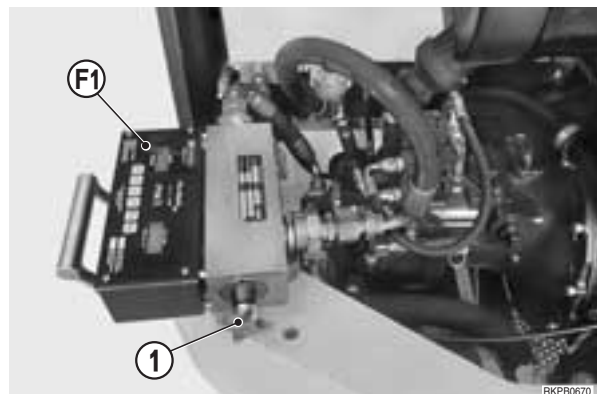
3. Measurement of pump P2

1 - Start the engine and bring it at idling of 2300 rpm/min.

2 - Adjust the delivery pressure with flowmeter **F1** knob (1) at 29.4 bar (426.4 psi).

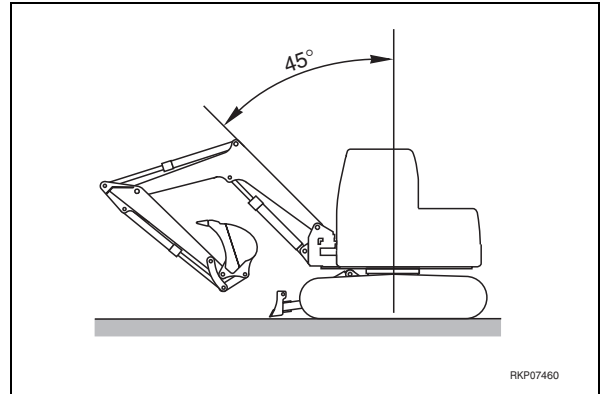
3 - Check the flow – pressure values against the values shown on «TECHNICAL SPECIFICATION» making if necessary, the proportional calculating to obtain the flow values referred to 2300 rpm/min necessary to make the control.

⚠ If the measured value is lower than that permissible, it is necessary to overhaul or to replace the pump.



MEASURING TRAVEL DEVIATION

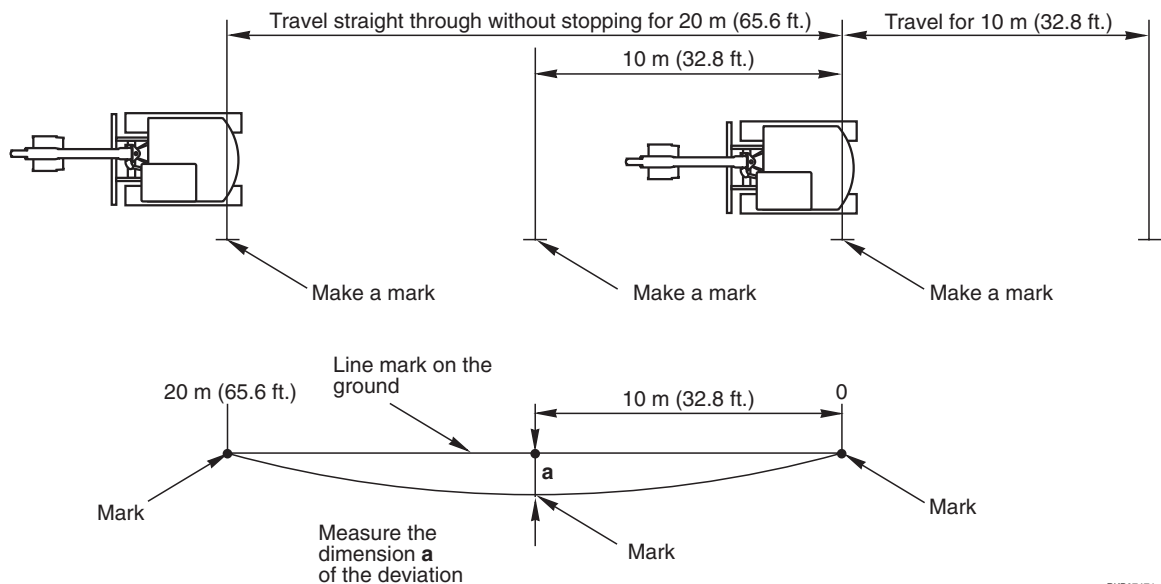
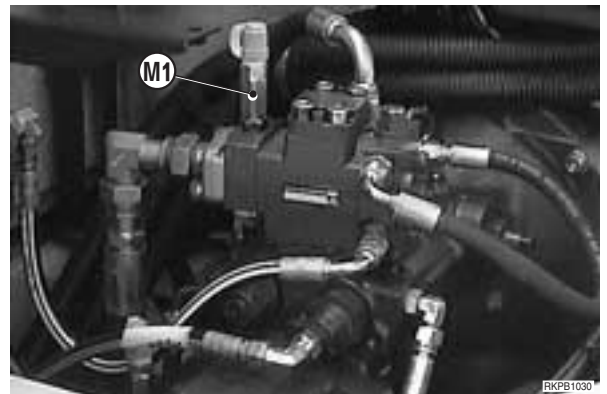
- ★ Test conditions:
 - Engine: at working temperature.
 - Hydraulic oil: 45 – 55°C (113 – 131°F)
 - WORKING MODE selector: position P.
 - Track-shoe tension: within the correct range
- ★ Let the machine travel over a firm, flat surface.



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**.
 - 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 10 metres (32.8 ft.) and then measure the deviation accomplished by the machine over the next 20 metres (65.6 ft.).
- ★ 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 (113 – 131°F)
- 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**.

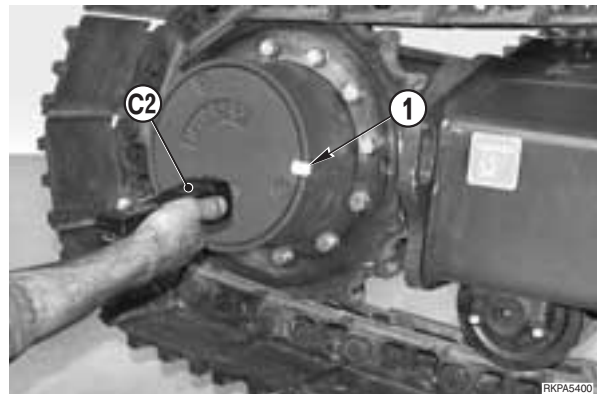
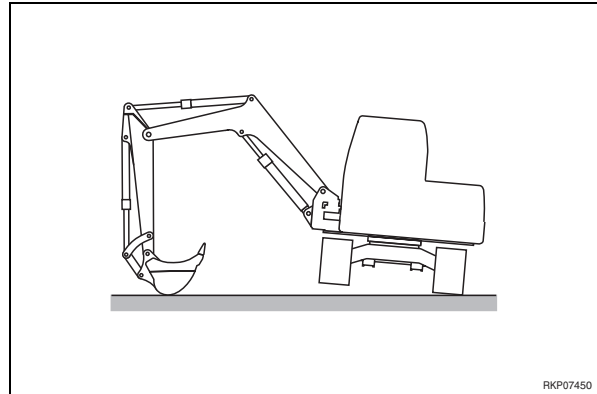
★ Low speed: 34 ± 2 rpm

- 7 - Change to high speed travelling and check again.

★ High speed: 57.6 ± 2 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

⚠ When measuring oil leakage from the travel motor, mistaken operation of the levers can lead to accidents.

Make this works using two persons and always follow agreed signals when measuring.

★ Check condition:

- Hydraulic oil: 45 – 55°C (113 – 131°F)
- 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.

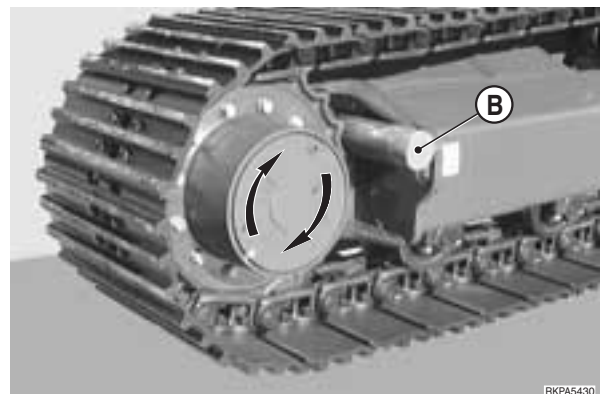
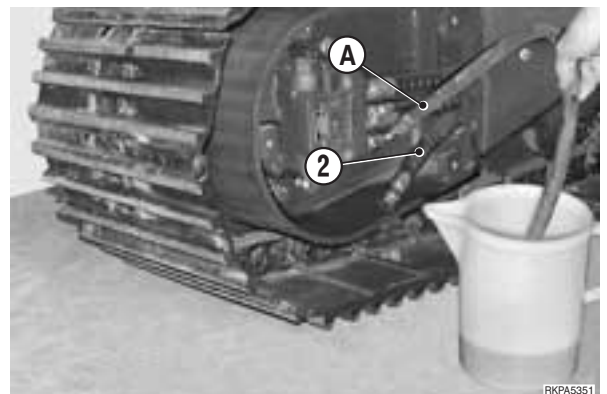
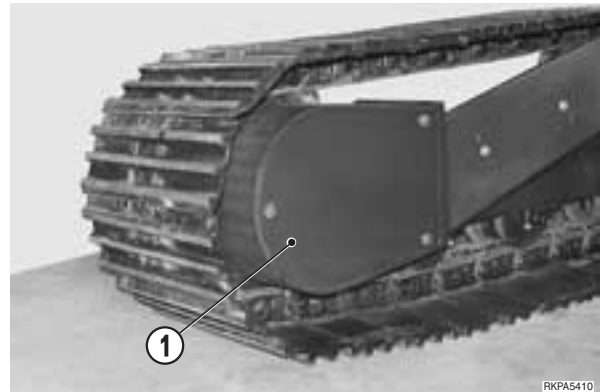
4 - Put a steel bar «B» of 70 mm (2.758 in.) diameter between sprocket and frame.

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.

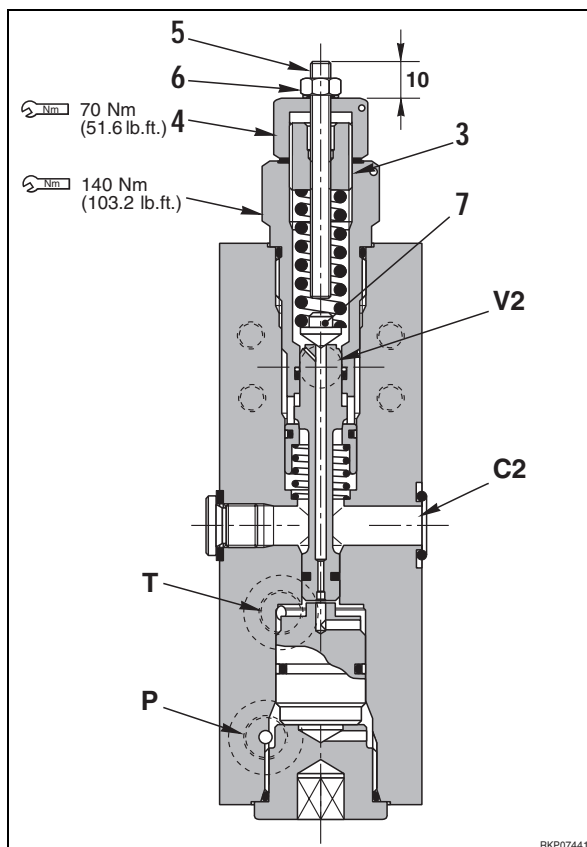
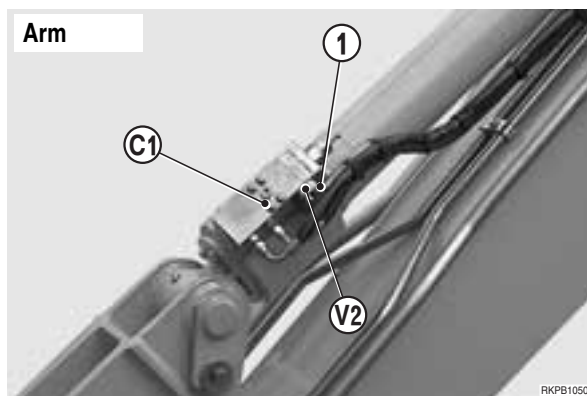
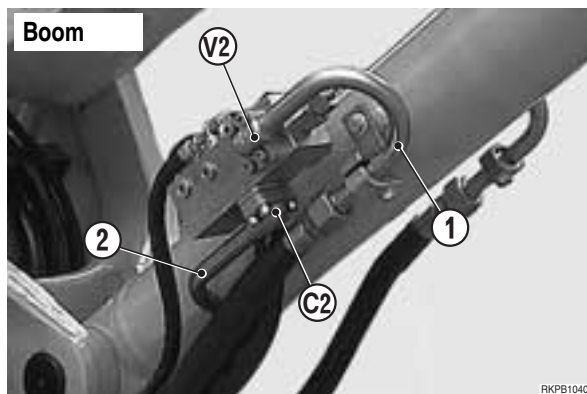


ADJUSTING BOOM AND ARM SAFETY VALVES

★ Test conditions

- Engine: at working temperature
- Hydraulic oil: 45 – 55°C (113 – 131°F)
- 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 (3916 psi)), 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 (1595.3 psi).
- 9 - Block the screw (3) in position with the nut (4).
 - ⚙️ Locknut: 70 Nm (51.6 lb.ft.)
- 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 (113 – 131°F)
- 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 a COUNTER-CLOCKWISE direction.


★ Every turn of the screw changes the pressure by 165 bar (2393 psi).

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

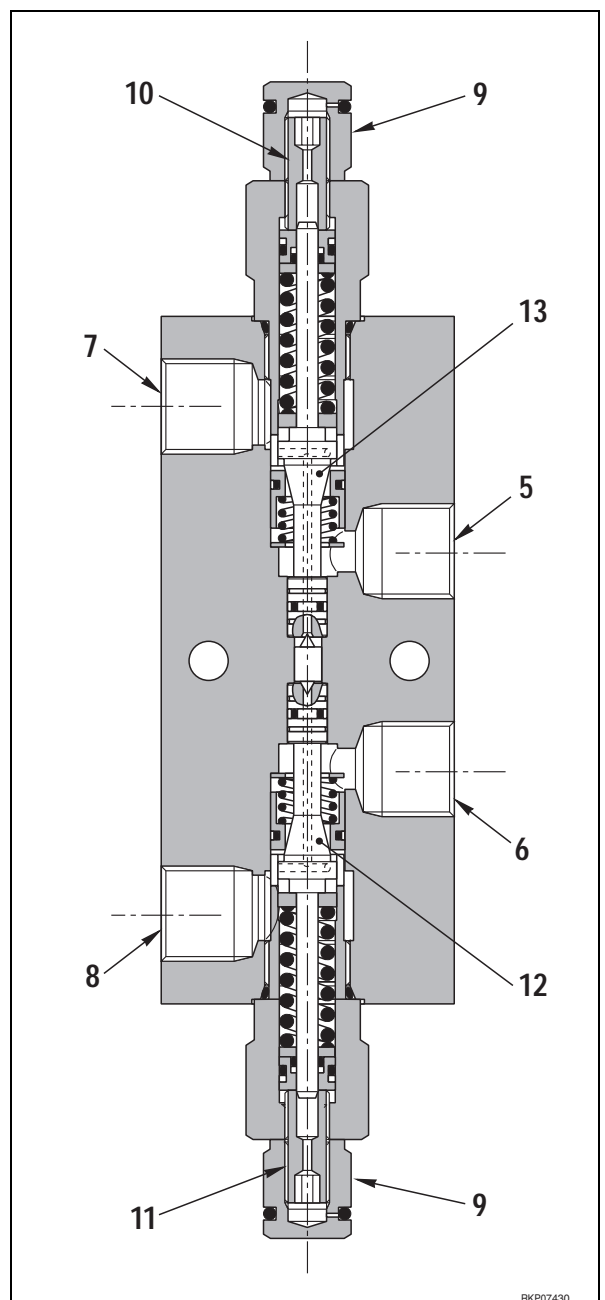
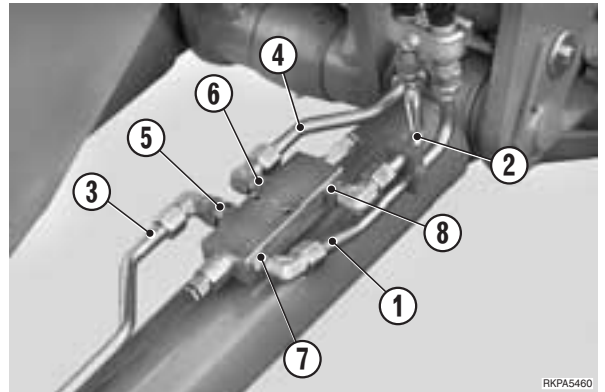
10 - Using the procedure indicated in point 8 adjust the valve (13) until a slight leakage of oil is visible from the port (7).

11 - Stop the engine and release any residual pressures.

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

 Locknut 20 Nm (14.74 lb.ft.)

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



MEASURING AND SETTING OF PRESSURE SWITCH SIGNAL OVERLOAD OPERATION

NOTE: The illustration shows the pressure switch without guard.

★ Check condition:

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

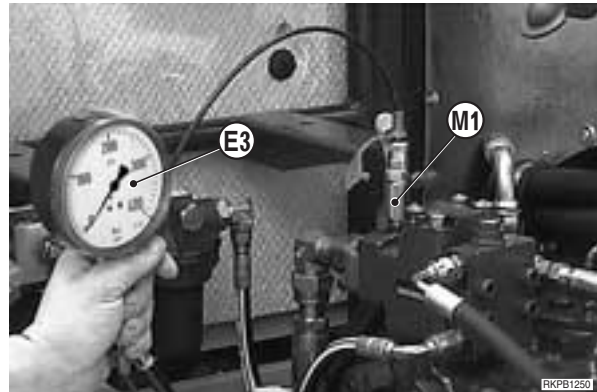
1 - Connect to pressure port **M1** the gauge **E3** (400 bar).

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 slowly the pressure; check the pressure value when appear the overload signal.

- ★ Standard operating pressure: 130 bar
(1885.4 psi)



Setting

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

1 - Remove cover (2).

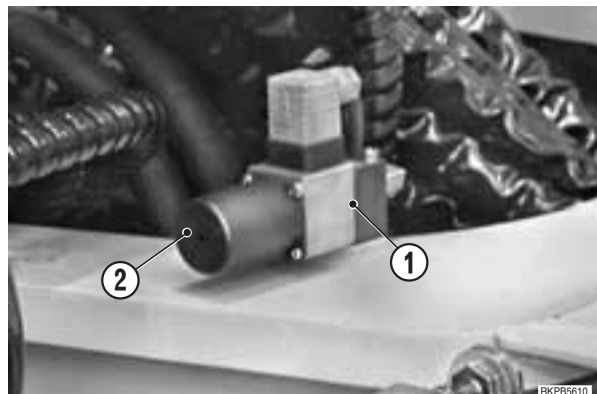
2 - Raise the boom checking on gauge **E3** that hydraulic cylinder approach the operating pressure.

3 - Loosen 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 (1).

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

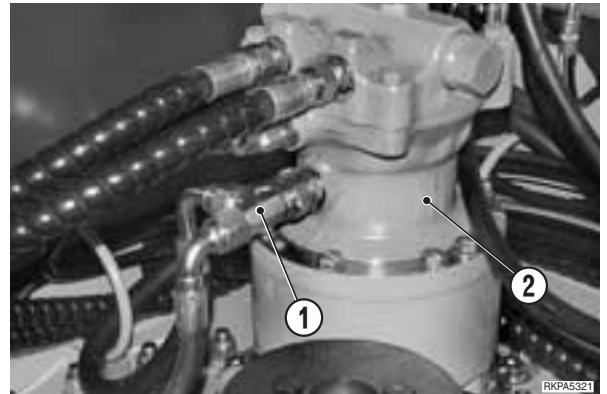


MEASUREMENT OF INTERNAL OIL LEAKAGES IN THE SWING MOTOR

★ Test conditions:

- Engine: at working temperature
- Hydraulic oil: 45–55°C (113–131°F)
- 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 - Re-assemble the hydraulic drainage circuit.



CHECKING FOR LEAKAGES INSIDE THE SWIVEL JOINT

★ Test conditions:

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

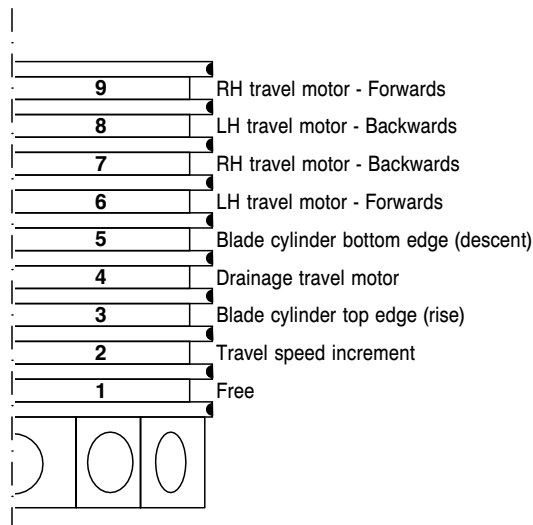
If the defect disappears, it is certainly due to the swivel joint.

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)	N°
9	RH travel motor - Forwards	External leakage (visible)	-
		LH travel motor - Backwards	8
8	LH travel motor - Backwards	RH travel motor - Forwards	9
		RH travel motor - Backwards	7
7	RH travel motor - Backwards	LH travel motor - Backwards	8
		LH travel motor - Forwards	6
6	LH travel motor - Forwards	RH travel motor - Backwards	7
		Blade cylinder bottom edge (descent)	5
5	Blade cylinder bottom side (descent)	LH 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 top edge (rise)	3
		Free	1
1	Free	-	2
		-	-

! 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»).

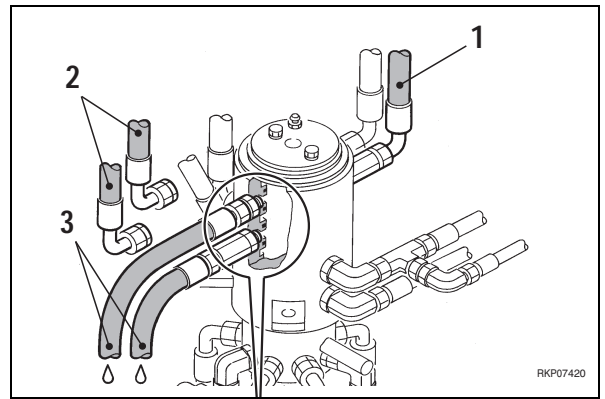
2 - Identify the branch involved in the test (1).

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.

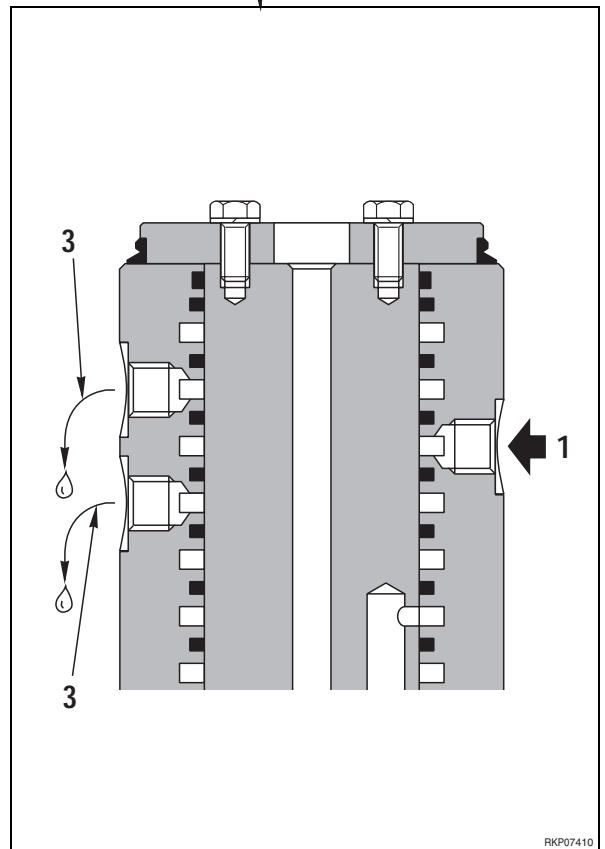
4 - Cap the valve to prevent entry of impurities.

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.

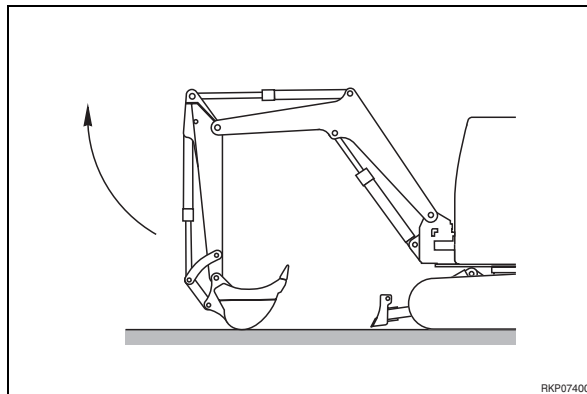
2 - Pressurise the branch to be tested.

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.

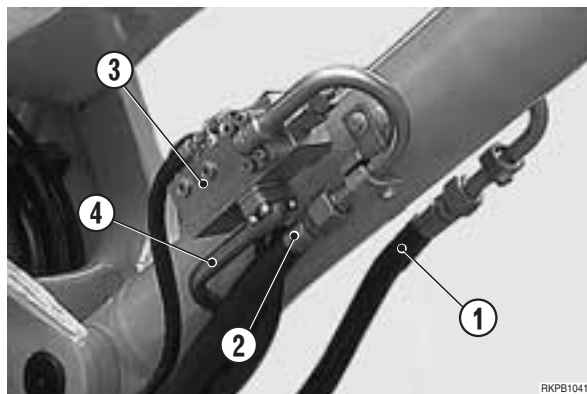
ANALYSIS OF THE CAUSES OF HYDRAULIC DRIFTS

- ★ 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 (113–131°F)
 - Removal and connection of tubes only after relief of residual pressures. (See «RELEASING RESIDUAL PRESSURES FROM THE CIRCUITS»).



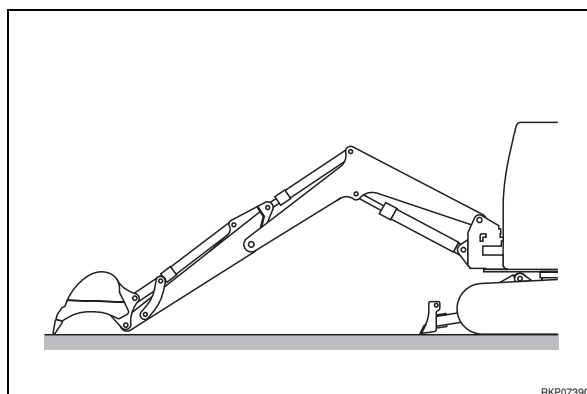
1. Boom test

- 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 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.



2. Arm test

- 1 - Position the machine with the arm completely extended and the bucket teeth on the ground.
- 2 - Stop the engine and release any residual hydraulic pressure.



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

Standard

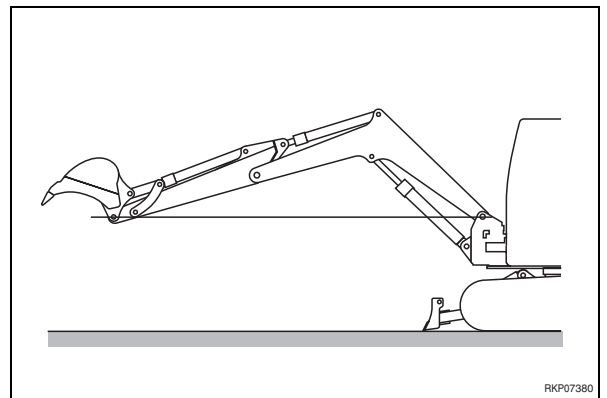
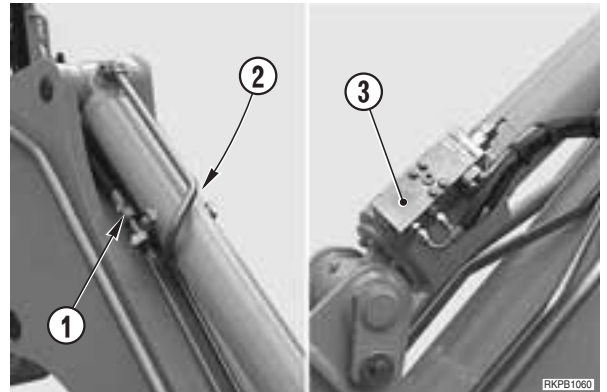
- 4 - Plug the hose (1) feeding the cylinder on the head side and connect a provisional hose on the bottom side to collect any leaking oil.

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 L1.

All version

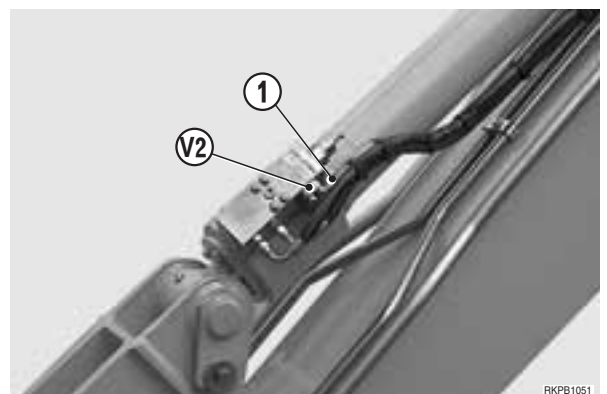
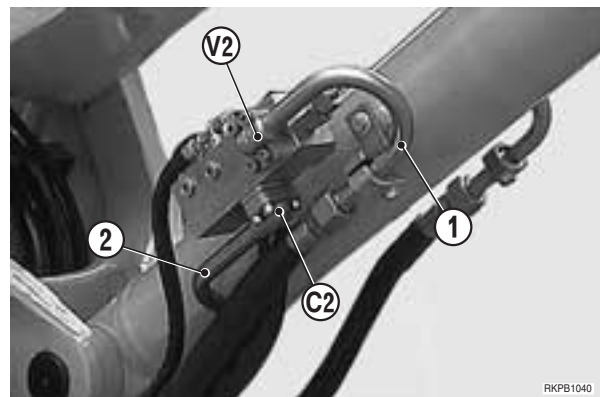
- 7 - Start the engine and raise the boom.
- 8 - Stop the engine and check the position of the arm for 5 minutes.
 - If the arm drops, the drift is due to the cylinder gasket.
 - If the arm does not drop, the drift is due to the control valve.



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

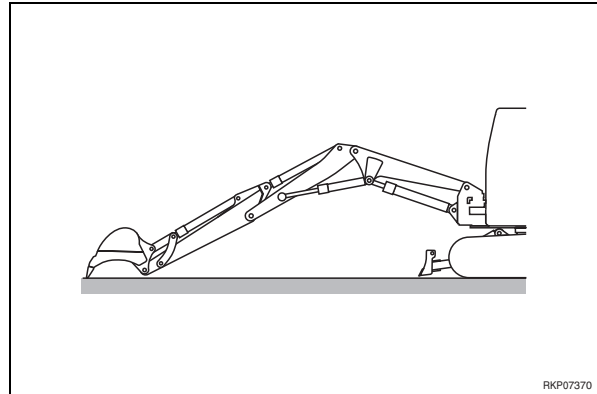
★ This test should be carried out after having checked that the drift is not due to the cylinder gaskets (See «BOOM TEST» and «ARM TEST»), and after having checked the valve settings (See «ADJUSTING BOOM AND ARM SAFETY VALVES»).

- 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.

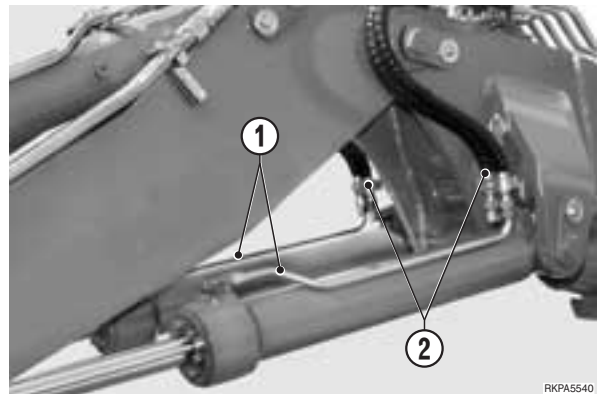


4. 2nd boom test

- 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.



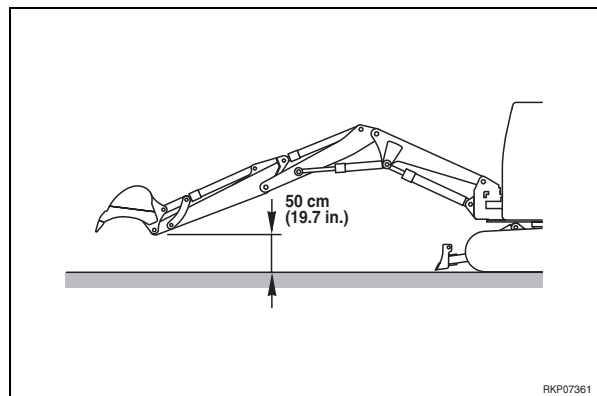
- 3 - Disconnect the two pipes (1) and (2) and cap them to prevent entry of impurities.
 - ★ If a safety valve has been installed, remove it.
- 4 - Cap the cylinder couplings on the bottom side and attach provisional hoses on the head side to collect any leaking oil.



- 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.

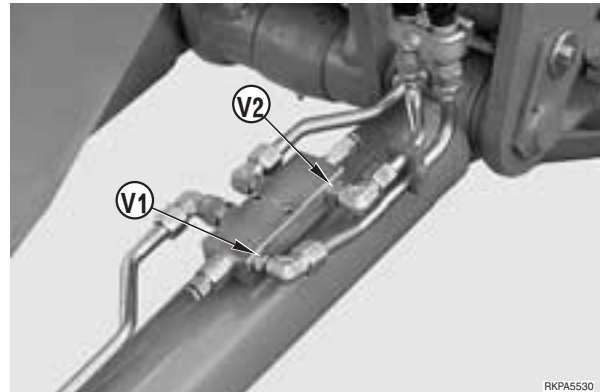
To check one cylinder at a time, proceed as follows:

- 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.

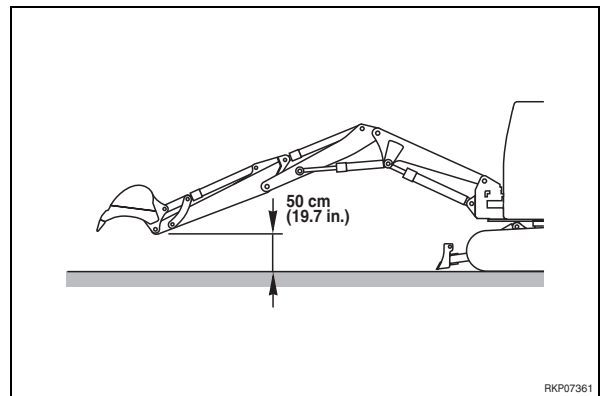


5. Testing the functionality of the 2nd boom safety valves

- ★ 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.



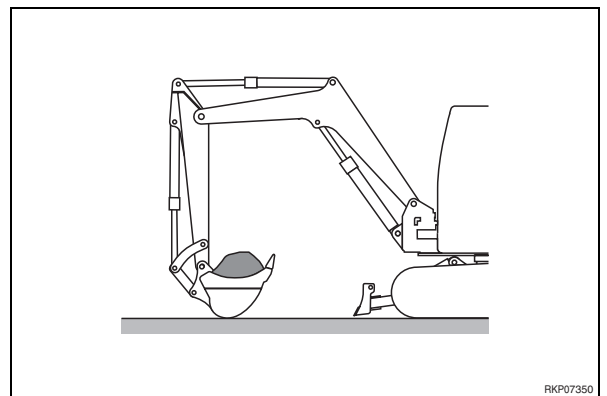
RKPA5530



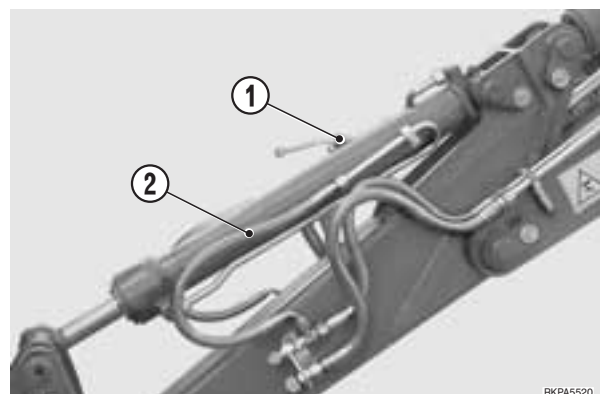
RKP07361

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.

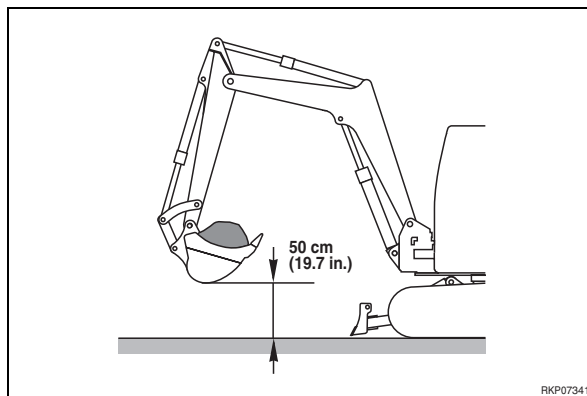


RKP07350



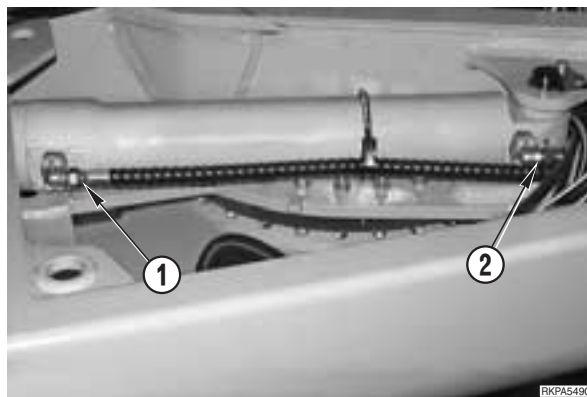
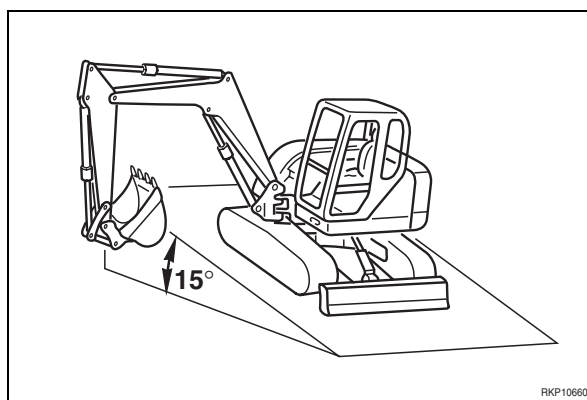
RKPA5520

- 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.



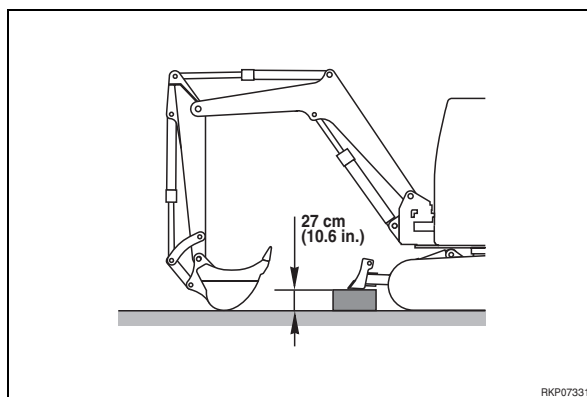
7. Boom swing test

- 1 - Position the machine with the boom, arm and bucket raised and with the revolving frame turned 90° 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 5 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.

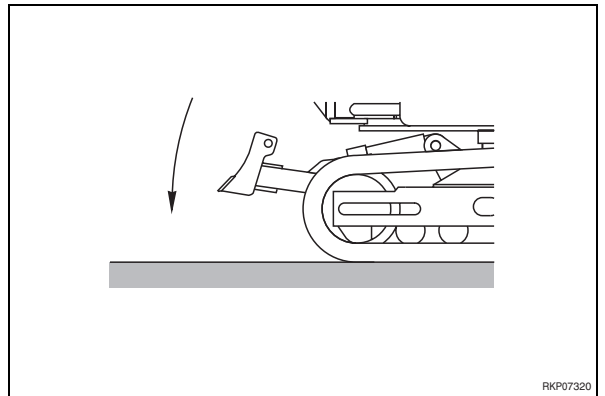
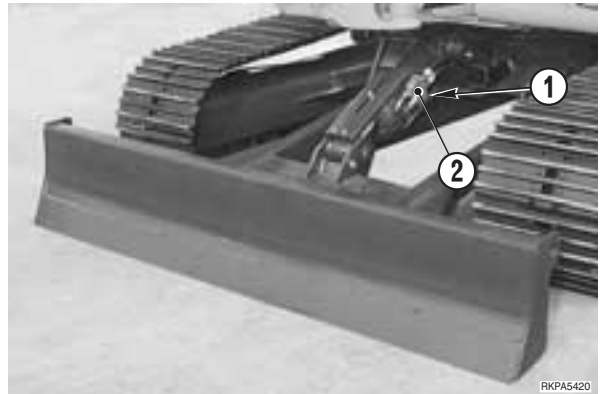


8. Blade test

- 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.

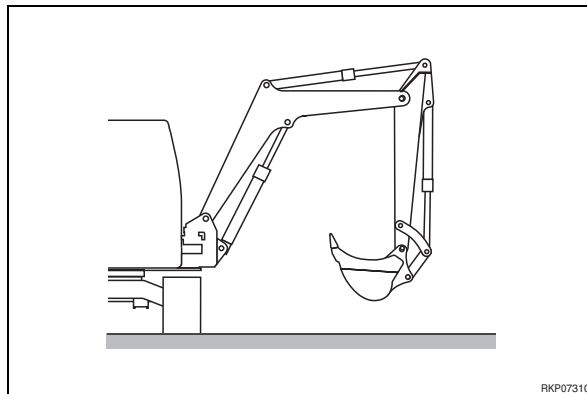


- 4 - Disconnect the pipe (1) and the safety valve (2) from the blade cylinder and cap them to prevent entry of dust or foreign bodies.
- 5 - Cap the hole in the blade cylinder on the head side and attach a provisional hose to the bottom side of the cylinder to collect any oil leakages.
- 6 - Start the 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».

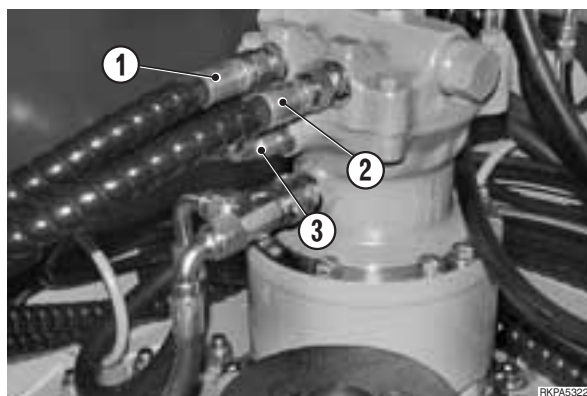


9. Swing motor test

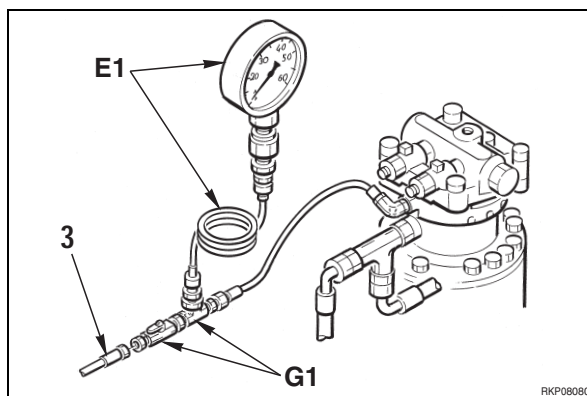
- 1 - Position the machine with boom, arm and bucket raised as in the figure, and with the revolving frame turned 90°.
- 2 - Stop the engine and release any residual hydraulic pressure.



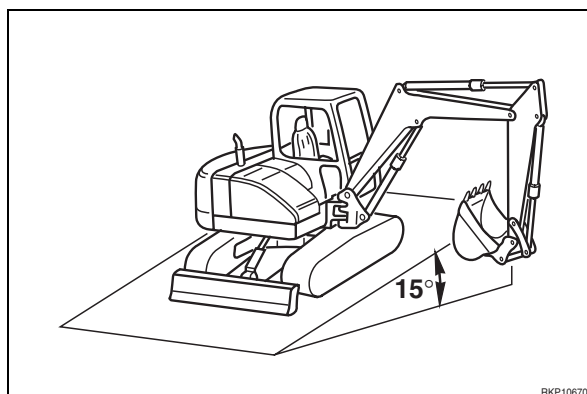
- 3 - Disconnect the hoses (1 and 2) from the motor and cap them to prevent entry of impurities. Attach some provisional hoses to the motor to collect any oil leakages.
- 4 - Disconnect brake swing hose (3) from motor.
- 5 - Connect equipment G1 between motor and hose (3). Check that cock is open and near the hose (3).



- 6 - Connect gauge E1 to the equipment G1.
- 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 (435 psi)) close the cock of the equipment G1.



- 9 - Let the machine travel onto a 15° slope, and stop the engine.
- 8 - Mark the position between revolving frame and track frame on the swing circle. Check on any swinging movement of the revolving frame for 5 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 (~ 261 psi).



GROUP 30


30 DISASSEMBLY AND ASSEMBLY

HOW TO READ THE MANUAL.....	3	ENGINE-PUMP COUPLING JOINT	
PRECAUTIONS TO BE TAKEN WHILE		Removal and installation.....	33
WORKING	4	MAIN PUMP INPUT SHAFT OIL SEAL	
SPECIAL TOOLS	5	Removal and installation.....	34
STARTER MOTOR		GEAR-PUMP	
Removal and installation	7	Removal and installation.....	35
ALTERNATOR		SWIVEL JOINT	
Removal and installation	8	Removal and installation.....	36
INJECTION PUMP		SWING MOTOR	
Removal.....	9	Removal and installation.....	37
Installation	12	SWING MACHINERY	
NOZZLE HOLDER		Removal and installation.....	38
Removal and installation	13	Disassembly	39
CYLINDER HEAD		Assembly	42
Removal.....	14	CONTROL VALVE	
Installation	16	Removal and installation.....	45
SEAT		REVOLVING FRAME	
Removal and installation	17	Removal	46
CABIN		Installation.....	47
Removal and installation	18	COUNTERWEIGHT	
ENGINE HOOD		Removal and installation.....	48
Removal and installation	19	SWING CIRCLE	
FRONT HOOD		Removal and installation.....	49
Removal and installation	20	TRACK SHOES	
HEATING FAN		Removal and installation.....	50
Removal and installation	21	SPROCKET	
RADIATOR		Removal and installation.....	51
Removal.....	22	TRAVEL MOTOR	
Installation	23	Removal and installation.....	52
FUEL TANK		Disassembly	53
Removal.....	24	Assembly	68
Installation	25	BALL BEARING PRELOAD	
HYDRAULIC OIL TANK		Adjusting	83
Removal and installation	26	AXIAL CLEARANCE ON TAPERED ROLLER	
ENGINE-PUMP GROUP		BEARINGS	
Removal.....	27	Adjusting	84
Installation	30	IDLER AND RECOIL SPRING ASSEMBLY	
PUMP GROUP		Removal and installation.....	85
Removal.....	31	IDLER	
Installation	32	Disassembly and assembly.....	86

RECOIL SPRING GROUP		BOOM SWING CYLINDER	
Disassembly and assembly	87	Removal and installation	104
TRACK ROLLER		BLADE CYLINDER	
Removal and installation	88	Removal and installation	105
CARRIER ROLLER		WORK EQUIPMENT CYLINDER	
Removal and installation	89	Disassembly	106
R.H. PPC VALVE (BOOM-BUCKET)		Assembly	107
Removal	90	WORK EQUIPMENT (1-piece boom version)	
Installation	91	Removal and installation	111
L.H. PPC VALVE (ARM-SWING)		WORK EQUIPMENT (2-piece boom version)	
Removal	92	Removal	112
Installation	93	Installation	113
BLADE PPC VALVE		BUCKET	
Removal and installation	94	Removal and installation	114
TRAVEL PPC VALVE		ARM	
Removal and installation	95	Removal	115
BOOM SWING PPC VALVE		Installation	117
Removal and installation	96	2-PIECE BOOM	
BOOM CYLINDER (1-piece boom)		Removal	118
Removal and installation	97	Installation	119
BOOM CYLINDER (2-piece boom)		BOOM (1-piece boom version)	
Removal	98	Removal and installation	120
Installation	99	BOOM (2-piece boom version)	
2-PIECE BOOM CYLINDER		Removal	121
Removal	100	Installation	122
Installation	101	SWING SUPPORT	
ARM CYLINDER		Removal and installation	123
Removal and installation	102	BLADE	
BUCKET CYLINDER		Removal and installation	124
Removal and installation	103		




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 . 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):  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.
 -  : 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 revolving frame Installation of swing machinery for revolving frame	A	1	ATR201320	Coupling for brake and swing release	1	—
		2	ATR200400	Rear raising equipment	1	—
		3	ATR200410	Front raising equipment	1	—
Removal/Installation of counterweight Disassembly/Assembly of cylinder nut	B	1	ATR800230	Dynamometric wrench with multiplier	1	Max. 700 kgm (700 dNm)
Removal/Installation of track-shoes	C	1	ATR200460	Pin removing tool	1	For track-shoe joint pin - idler
		2	ATR200450	Raising equipment		For idlers
Removal/Installation of swing circle	D	1	ATR200420	Swing circle raising equipment	1	—
Disassembly/Assembly the recoil spring group	E	1	ATR200430	Press equipment	1	—
Disassembly/Assembly the cylinders	F	1	ATR200470	Pliers for mounting gaskets	1	All cylinders
		2	ATR200480	Ø 50 calibrator	1	To calibrate piston rod gaskets
			ATR201330	Ø 55 calibrator	1	
			ATR200490	Ø 60 calibrator	1	
			ATR200500	Ø 70 calibrator	1	
		3	ATR201030	Ø 85 plunger	1	To assemble piston gaskets
			ATR200510	Ø 90 plunger	1	
			ATR200520	Ø 100 plunger	1	
			ATR201340	Ø 110 plunger	1	
			ATR200530	Ø 120 plunger	1	
		4	ATR201030	Ø 85 calibrator ring	1	To calibrate piston gaskets
			ATR200540	Ø 90 calibrator ring	1	
			ATR200550	Ø 100 calibrator ring	1	
			ATR201350	Ø 110 calibrator ring	1	
			ATR200560	Ø 120 calibrator ring	1	
		5	ATR200570	Ø 50 insertion bushing for piston rod	1	To mount flange and head
			ATR201360	Ø 55 insertion bushing for piston rod	1	
			ATR200580	Ø 60 insertion bushing for piston rod	1	
			ATR200590	Ø 70 insertion bushing for piston rod	1	
		6	ATR200600	Pliers for mounting snap-ring	1	All cylinders
		7	ATR800240	Socket wrench (6-point 55)	1	Bucket cylinders
			ATR800250	Socket wrench (6-point 70)	1	Boom and arm cylinder
		8	ATR200610	Tool for disassembly and assembly cylinders	1	All cylinders

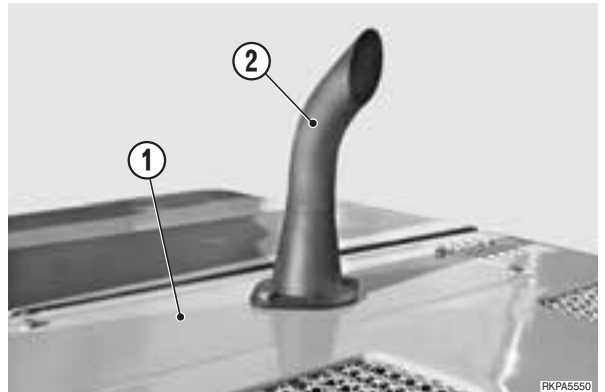
Type of work	Symbol	Code	Description	Q.ty	Notes	
Replace of pump seal	G	1	796T-267-1110	Plunger	1	Replace of pump seal
		2	790-201-2730	Spacer	1	
Disassembly/Assembly the swing bracket	H	1	ATR201370	Raising equipment	1	—
Disassembly/Assembly swing machinery	L	1	ATR501340	Plunger	1	Removal ring
		2	ATR501350	Support	1	Removal pinion
		3	ATR501360	Plunger	1	Removal pinion
		4	ATR501370	Plunger	1	Removal bearing
		5	ATR501380	Plunger	1	Mounting seal
		6	ATR501390	Plunger	1	Mounting ring
		7	ATR501400	Plunger	1	Mounting bearing
		8	ATR501410	Plunger	1	Mounting bearing
		9	ATR501420	Dynamometer	1	Full scale 20 kg
		10	ATR501430	Plunger	1	Place of pinion
		11	ATR501440	Plunger	1	Mounting guard
Disassembly/Assembly travel motor	M	1	ATR501450	Bench	1	Disassembly and assembly
		2	ATR501460	Clamp	3	—
		3	ATR501470	Plunger	1	Mounting spring
		4	ATR501480	Bushing	1	Removal and mounting shaft bearing
		5	ATR501490	Plunger	1	Mounting gasket
		6	ATR501500	Plunger	1	Mounting gear group
		7	ATR501510	Guide	1	Mounting bearing
		8	ATR501520	Eyebolt	2	M14
		9	ATR501530	Eyebolt	2	M16
		10	ATR501540	Thickness gauge	1	—

REMOVAL OF STARTER MOTOR

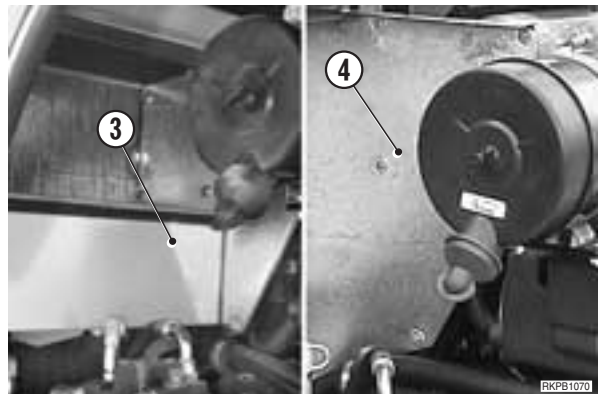
⚠ Disconnect the lead from the negative (-) battery terminal.

1 - Remove upper cover (1) with exhaust pipe (2).

2 - Remove lower guard.



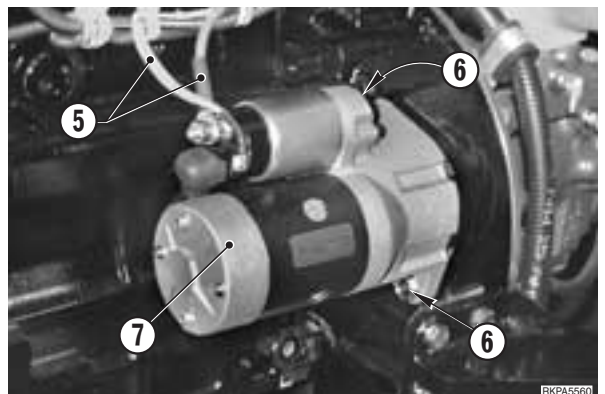
3 - Remove tool box (3) and heat-guard (4).



4 - Disconnect electrical cable (5).

5 - Remove screw (6) and starter motor (7).


※ 1



INSTALLATION OF STARTER MOTOR

- To install, reverse the removal procedure.

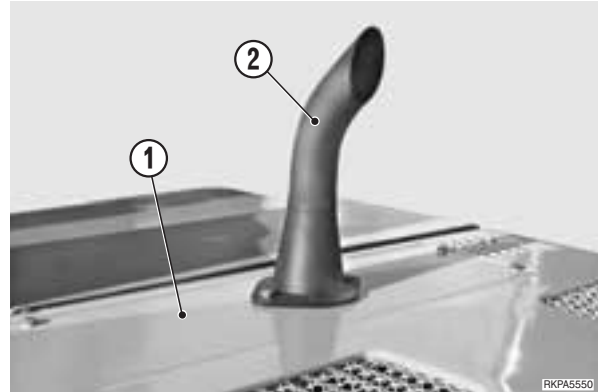
※ 1

 Screw: 78.4 – 98 Nm (57.78 – 72.23 lb.ft.)

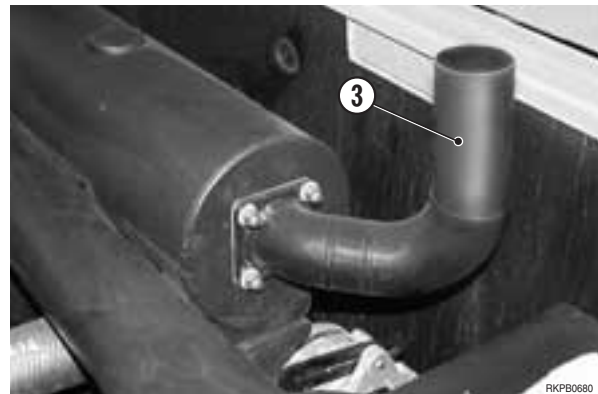
REMOVAL OF ALTERNATOR

⚠ Disconnect the lead from the negative (-) battery terminal.

1 - Remove upper cover (1) with exhaust pipe (2).



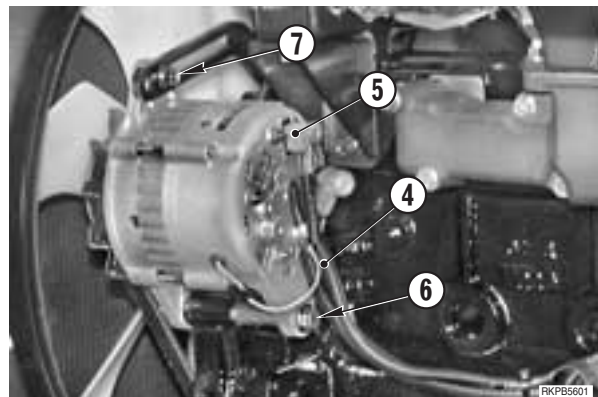
2 - Remove union (3) of the exhaust pipe. ※1



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

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

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



INSTALLATION OF ALTERNATOR

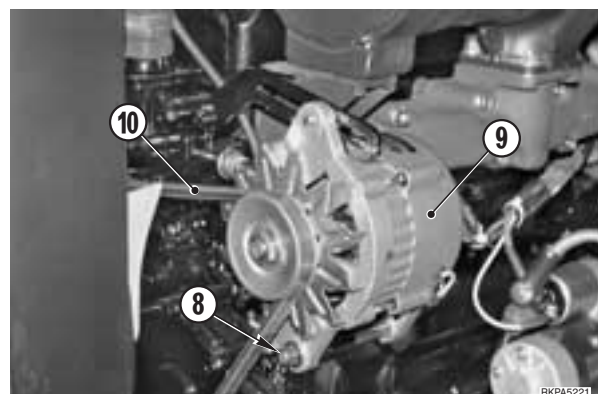
• To install, reverse the removal procedure.

※1

★ Check the union gasket of exhaust pipe.

※2

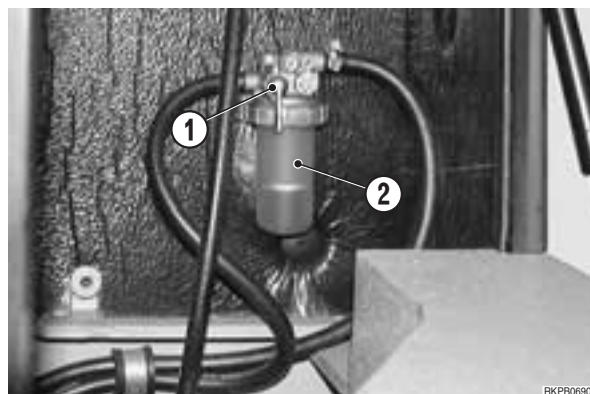
★ Adjusting of the fan-belt (For details, see «20. TESTING AND ADJUSTMENTS»).



REMOVAL OF INJECTION PUMP

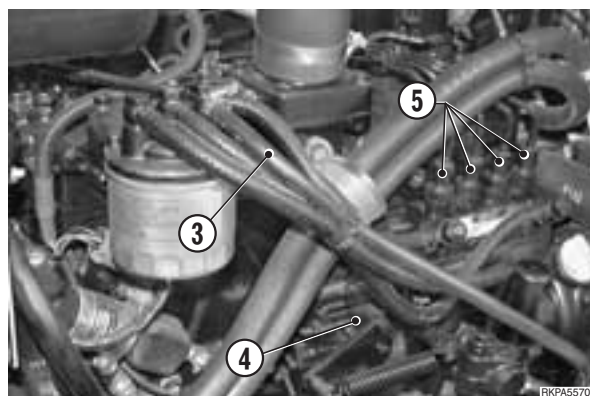
⚠ Disconnect the cable from accumulator negative terminal (-).

- ★ Close the cock (1) of separator (2) to prevent fuel leakage.
- ★ Plug removed or disconnected pipes to avoid impurity entry.

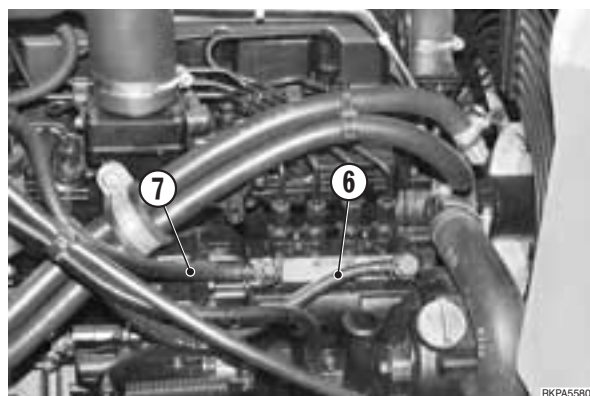


1 - Disconnect pipe (3) from fuel filter.

2 - Disconnect high pressure pipes (5) from injection pump (4). ※ 1

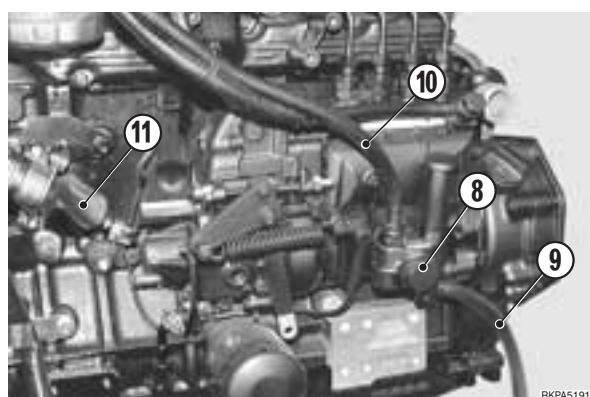


3 - Disconnect from injection pump (4) fuel feeding pipes (6) and return pipes (7). ※ 2

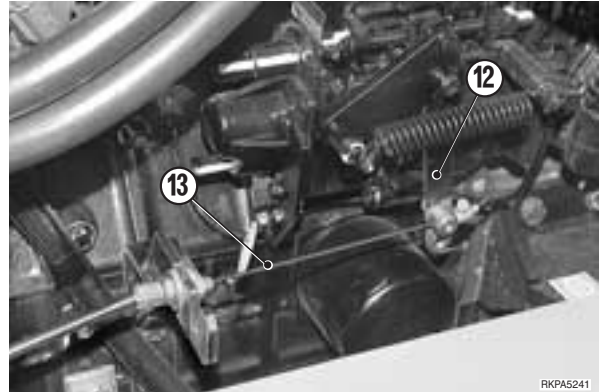


4 - Disconnect pipes (9) and (10) from fuel feed-pump (8).

5 - Disconnect the engine stop solenoid (11) from injection pump (4) and remove the complete unit. ※ 3



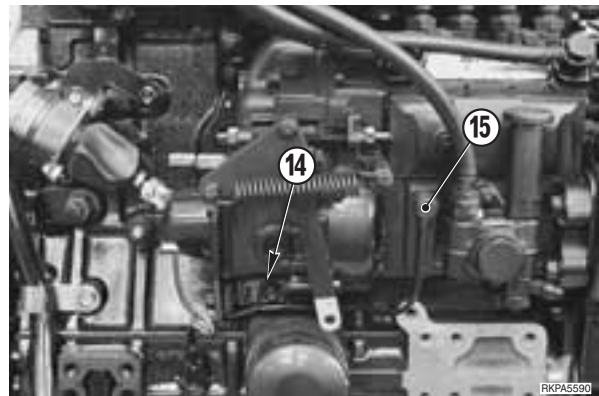
6 - Disconnect control cable (13) from accelerator lever (12).



RKPA5241

7 - Remove the bolt and bracket (14) of injection pump lubricating pipe.

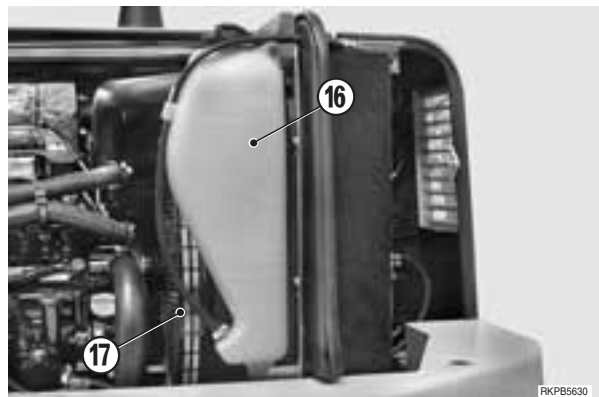
8 - Remove injection pump lubricating pipe (15). ※4



RKPA5590

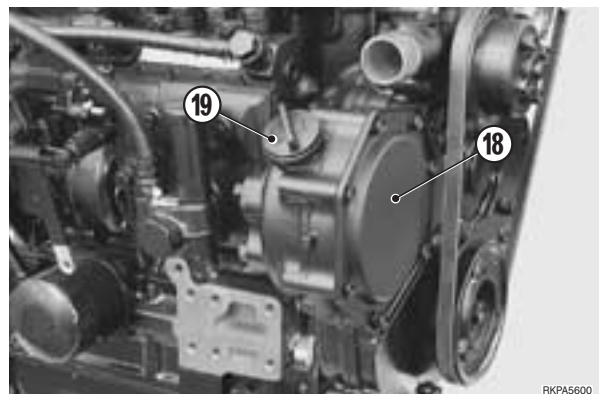
9 - Remove screw locking coolant tank (16).

10 - Remove fan guard (17).



RKPB5630

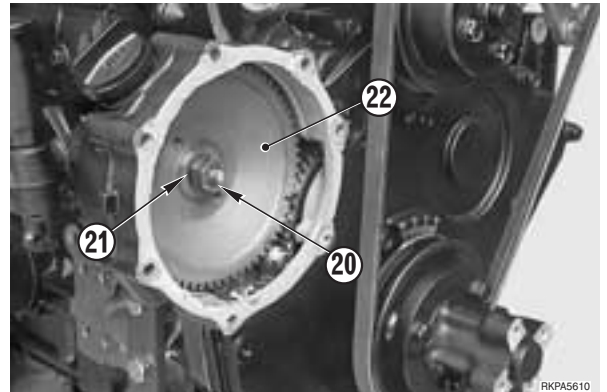
11 - Remove the inlet cover (18) to ignition gear system and the filler oil plug (19). ※5



RKPA5600

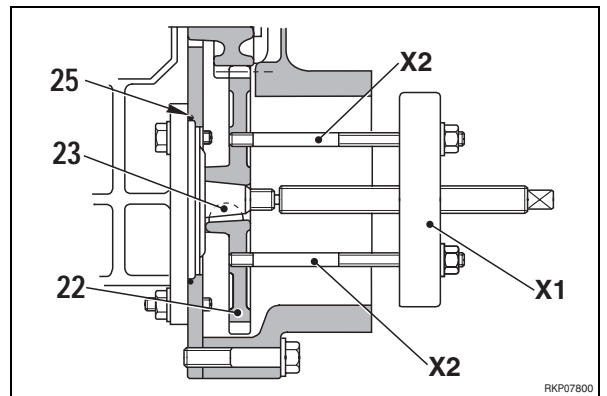
12 - Loosen and remove nut (20) and lock washer (21) of pump driving gear (22). ※ 6

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

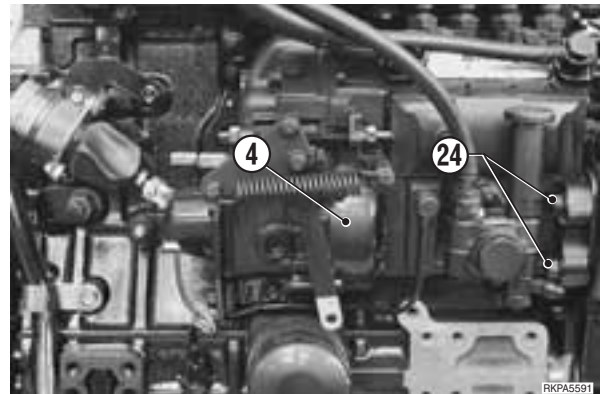


13 - Remove pump (4) driving gear (22).

- ★ 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 (22).
- ★ Be careful not to damage pump shaft thread.
- ★ During removal be careful not to let key drop (23) in the housing.




14 - Remove nuts (24) (No. 4) and injection pump (4) with relative OR rings (25). ※ 7




INSTALLATION OF INJECTION PUMP

- To install, reverse the removal procedure.

※ 1

 Feed and return pipes: 19.6 – 24.5 Nm
(14.45 – 18 lb.ft)


※ 2


 High pressure pipes: 19.6 – 24.5 Nm
(14.45 – 18 lb.ft)


※ 3

- ★ Replace safety cotter pin.


※ 4


 Lubrication pipe pump side: 9.8 – 12.7 Nm
(7.22 – 9.36 lb.ft)

 Lubrication pipe cylinders side: 12.7 – 16.7 Nm
(9.36 – 12.31 lb.ft.)

 Stiffening bolt: 22.5 – 28.4 Nm
(16.58 – 20.94 lb.ft.)


※ 5

 Cover gasket: Loctite 518


 Timing gear system cover bolts: 17.6 – 22.5 Nm
(12.97 – 16.58 lb.ft.)

※ 6

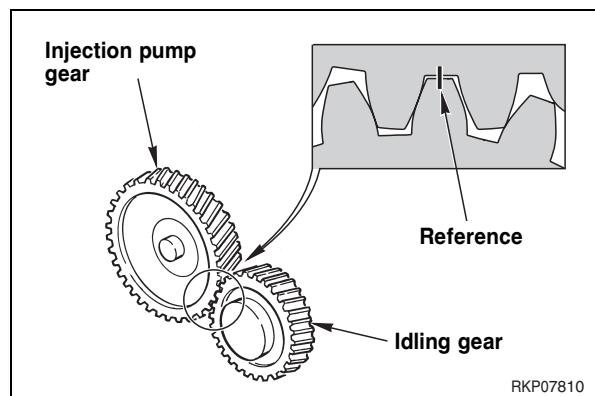
- ★ Align marks among gears before to install pump and nut.

 Gear lock nut: 83.3 – 93.1 Nm
(61.4 – 68.6 lb.ft.)

※ 7

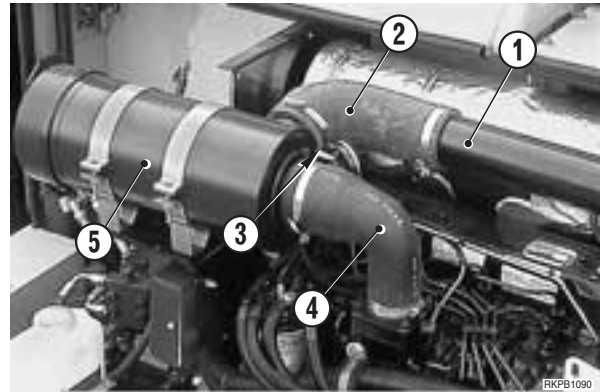
 Pump lock nuts: 34.3 – 44.1 Nm
(25.3 – 32.5 lb.ft.)

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

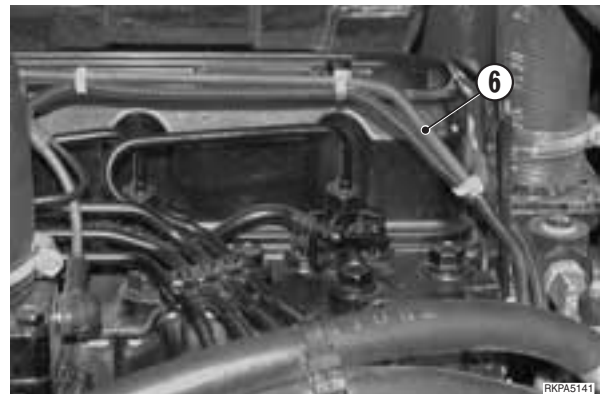


REMOVAL OF NOZZLE HOLDER

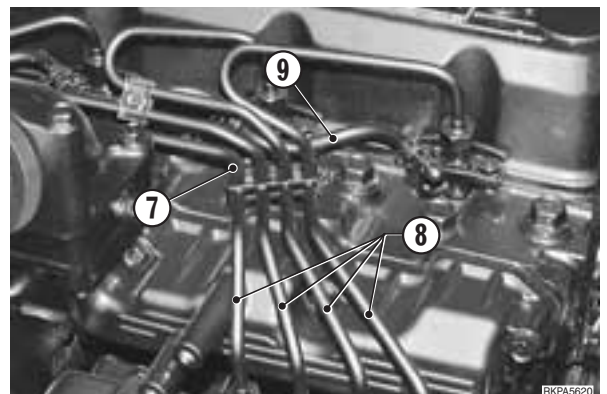
- 1 - Remove suction pipe (1) with union (2).
- 2 - Disconnect connector (3) of clogging indicator and remove union (4) and filter (5).



- 3 - Remove electrical cable bridge (6).



- 4 - Loosen clips (7) and remove high pressure pipes (8) and fuel recovery pipes (9). ※ 1




- 5 - Remove collar (11) lock nut (10) and remove nozzle holder (12), seat (13) and guard (14). ※ 2


INSTALLATION OF NOZZLE HOLDER

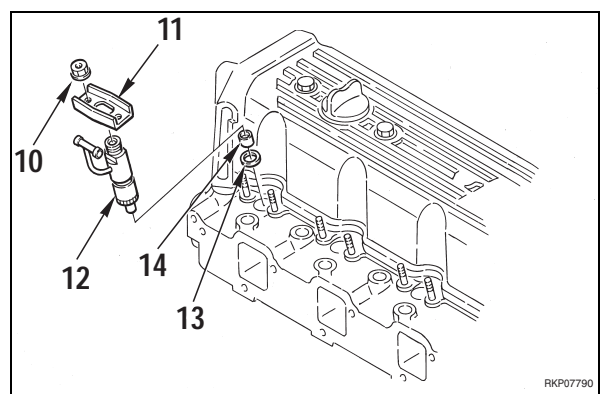
- To install, reverse the removal procedure.

※ 1

 High pressure pipe fittings: 19.6 ~ 24.5 Nm (14.45 ~ 18 lb.ft.)

※ 2


 Collar lock nuts: 6.9 ~ 8.8 Nm (5.1 ~ 6.48 lb.ft.)



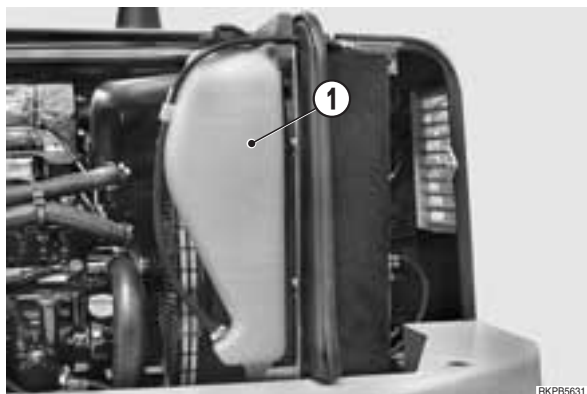
REMOVAL OF CYLINDER HEAD

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

★ Drain the coolant liquid.

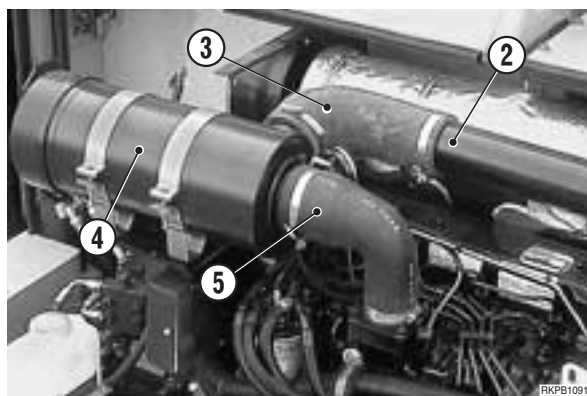
 Coolant liquid: 18 ℓ (4.75 US.gall) ※1

1 - Remove coolant tank (1).



2 - Remove suction pipe (2) with air filter union (3).


3 - Remove air filter (4) with union (5)

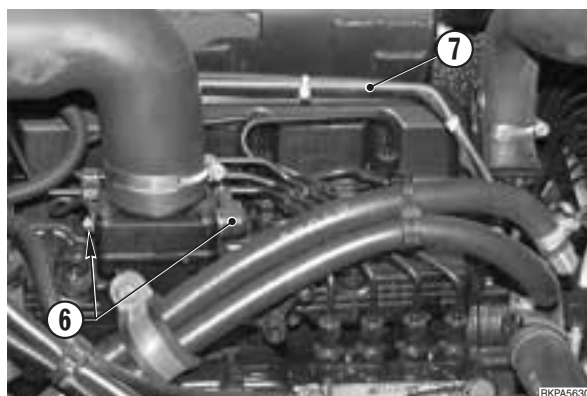


4 - Disconnect the cable (6) from the thermostat.

5 - Remove the fastening screws of both electrical cable bridge (7) and lifting brackets; turn the assembly over towards the piston pump. ※2

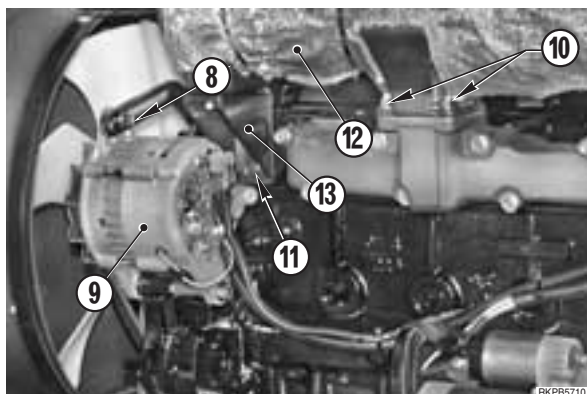
6 - Re-position the previously removed screws and tighten them up.

 Screw: 22.5 – 28.4 Nm (16.58 – 20.93 lb.ft.)

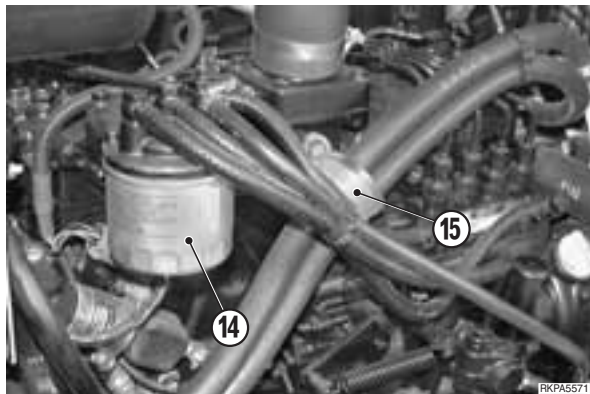


7 - Remove the alternator adjustment bracket (8); disengage the belt and rotate the alternator (9) towards the stationary hood. ※3

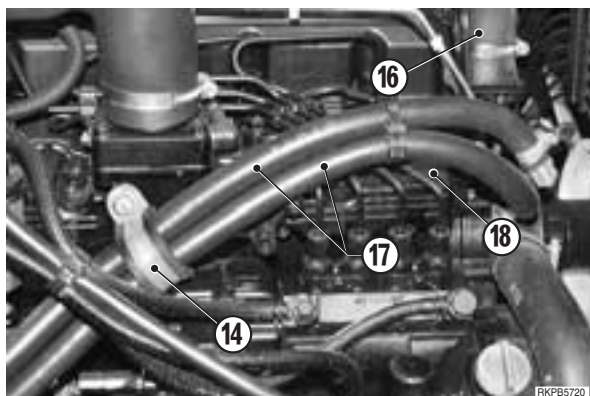
8 - Remove nut (10), screw (11) and remove muffler (12) with support (13). ※4



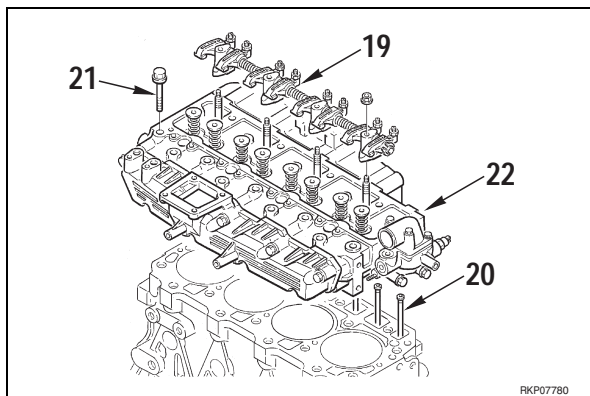
- 9 - Remove fuel filter (14).
- 10 - Remove clip (15).



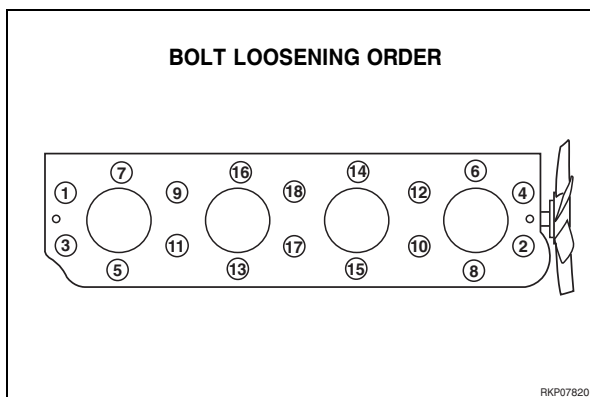
- 11 - Disconnect coolant pipe (16) and heating pipe (17) from cylinder head.
- 12 - Remove nozzle holder. (For details, see «REMOVAL OF NOZZLE HOLDER»).



- 13 - Remove the valve-tappets cover (18). ※ 5
- 14 - Remove the rocker shaft (19).
 - ★ Loosen lock nut and unscrew valve tappets of 2-3 turns. ※ 6
- 15 - Remove the push rods (20).



- 16 - Remove screw (21) and the cylinder head (22) following the indicated order for bolts loosening. ※ 7
 - ★ Bolts loosening order: see illustration
 - ⚠ Loosen cylinder head bolts in two stages.



INSTALLATION OF CYLINDER HEAD

- To install, reverse the removal procedure.

※ 1

1 - Fill the cooling circuit.



Coolant liquid: 18 ℓ (4.75 US.gall)

2 - Start engine to allow liquid circulation in all circuits; stop the engine and check the level.

※ 2

Screw: 22.5 – 28.4 Nm (16.58 – 20.93 lb.ft.)

※ 3

★ Adjust fan belt tension (for details see «20. TESTING AND ADJUSTMENTS»).

※ 4

★ Replace exhaust pipe gasket.

Nut and screw: 22.5 – 28.4 Nm
(16.58 – 20.93 lb.ft.)

※ 5

3 - Check the condition of valves cover gasket and of lock nuts OR rings, clean carefully contact surface on cylinders head.

Cover lock nuts: 25±3 Nm (18.42±2.21 lb.ft.)

※ 6

★ Check that tappets are firmly engaged in the rods and that the valves collar are correctly assembled.

★ Start the rocker shaft tightening starting from the center to external.

Rocker shaft bolts: 44.1 – 53.9 Nm
(32.5 – 39.7 lb.ft.)

★ Adjust valves clearance. (For details, see «20. TESTING AND ADJUSTMENTS»).

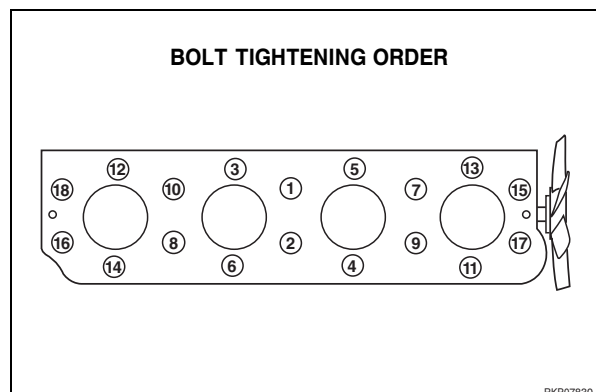
※ 7

★ Assemble a new gasket.

★ Lubricate with engine oil bolts thread and cylinder block.

★ Tighten screws, first manually and after in two stages, according to assigned order.


Cylinder head bolts.
1st Tightening: 49 – 59 Nm (36.1 – 43.5 lb.ft.)
Final tightening: 103 – 113 Nm
(75.9 – 83.3 lb.ft.)



REMOVAL OF SEAT

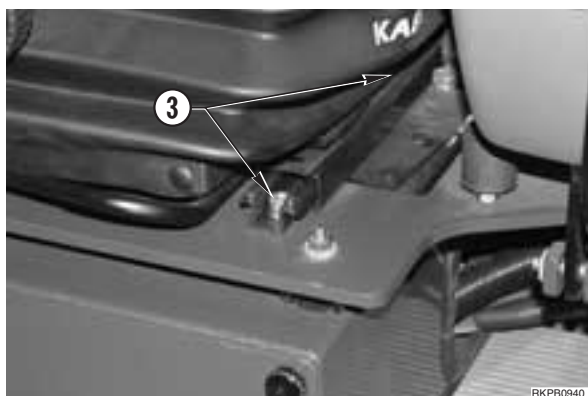
⚠ Lower the work equipment until it is resting on the ground, switch off the engine and remove the ignition key.

- 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.
 - ★ Slide the seat forwards and backwards in order to reach the screws.
- 4 - Remove the seat.

 Seat: 32 kg (70.5 lb.)

INSTALLATION OF SEAT


- To install, reverse the removal procedure.

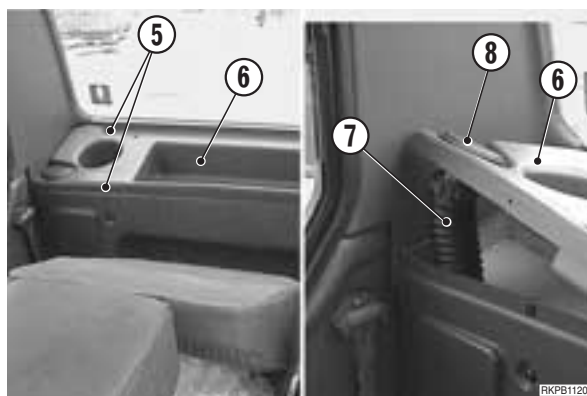
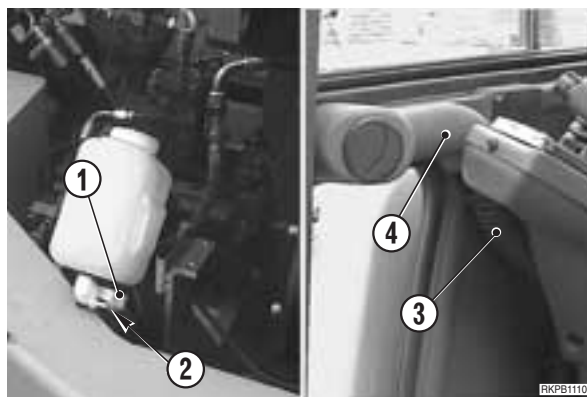


REMOVAL OF CABIN

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

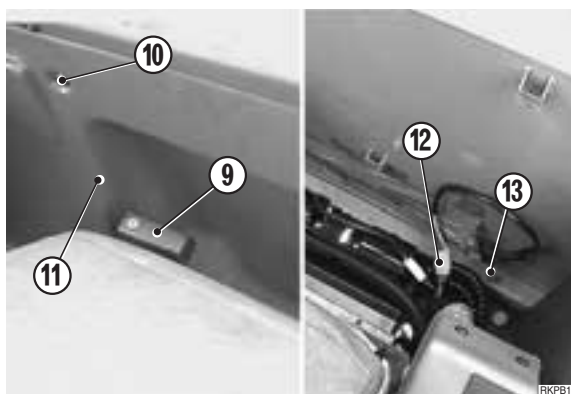
- 1 - Disconnect the connector (1) and hose (2) from the windshield-washer tank and remove all the clamps fixing them.
- 2 - Disconnect the heating hose (3) from the diffuser (4).
- 3 - Move the back of the operator's seat completely forward and remove the panel (6) fixing screw (5).
- 4 - Raise the pane (6), disconnect the heating hose (7) from the diffuser (8) and remove the panel (6).
- 5 - Remove the knob (9), remove the screws (10) (N° 3) and remove the panel (11).
- 6 - Disconnect the connector (12).
- 7 - Remove the cable fixing screws (13) (n° 7).
- 8 - Remove the upper protective caps and mount the hoisting eyebolts (7).
- 9 - Attach the eyebolts (7) to the hoisting tackle and move the cabin.

 Cabin: 250 kg (551 lb.)



INSTALLATION OF CABIN

- To install, reverse the removal procedure.
 - ★ Make sure that the short screw (8) is placed on the LH side.




REMOVAL OF ENGINE HOOD

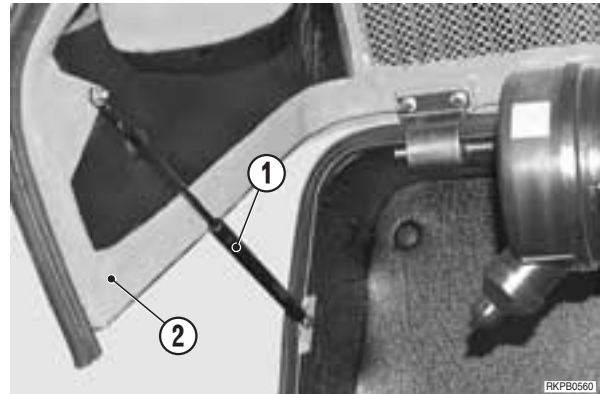
! Lower the work equipment until it is resting on the ground and switch off the engine.

- 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: 60 kg (132 lb.)



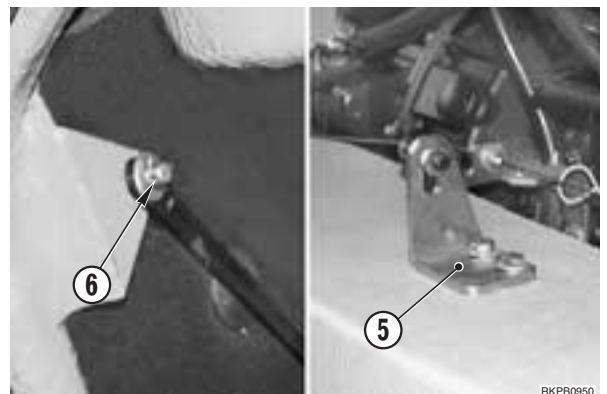
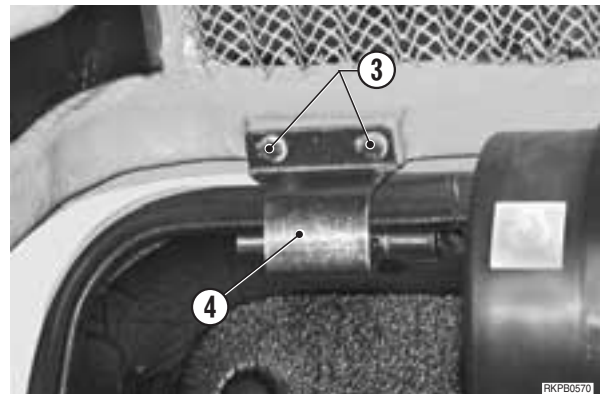
INSTALLATION OF ENGINE HOOD

- To install, reverse the removal procedure.

※ 1

- ★ Check the centering and adjustment of the closing hook (5).
- ★ Position any shims.

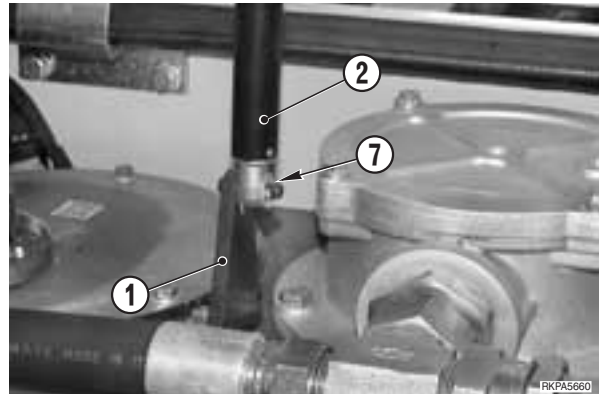
! Replace the cotter pins (6).



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).

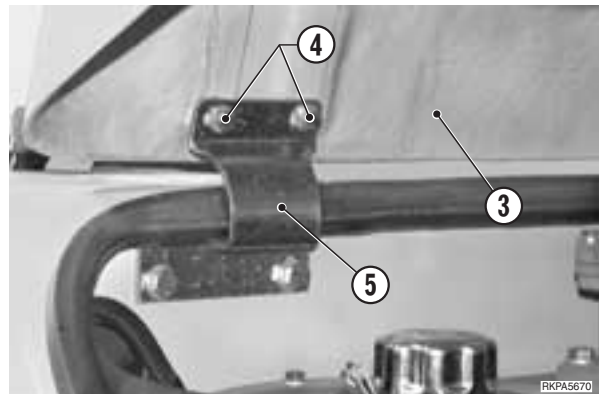


2 - While holding up the engine hood (3), remove the screws (4) that attach (5) the hood to the hinges (3).

※ 1

★ Mark the position of any shims.

 Engine hood:kg (..... lb.)



INSTALLATION OF FRONT HOOD

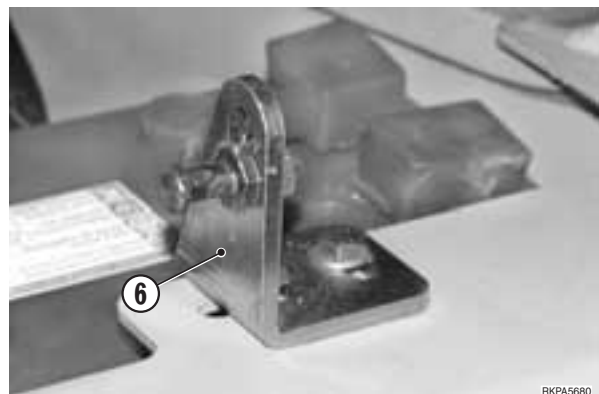
• To install, reverse the removal procedure.

※ 1




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

★ Position any shims.

! Replace the cotter pins (7).



REMOVAL OF HEATING FAN

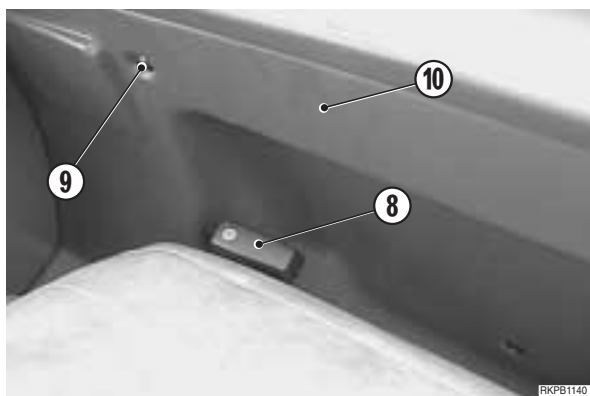
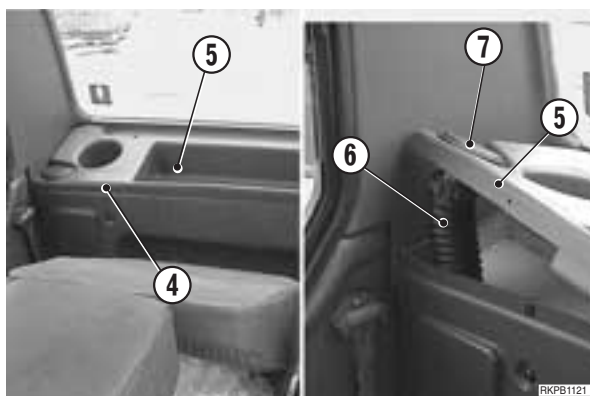
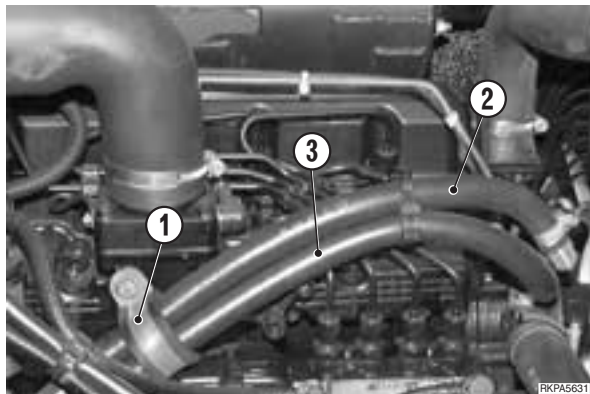
-  Lower the work equipment until it is resting on the ground and switch off the engine.
-  Disconnect the cable from accumulator negative terminal (-).
-  Drain the coolant liquid to a level below that of the connecting tubes (2-3) between the engine and the heating fan.

 Cooling liquid: approx. 5 ℓ (1.32 US.gall)


- 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.

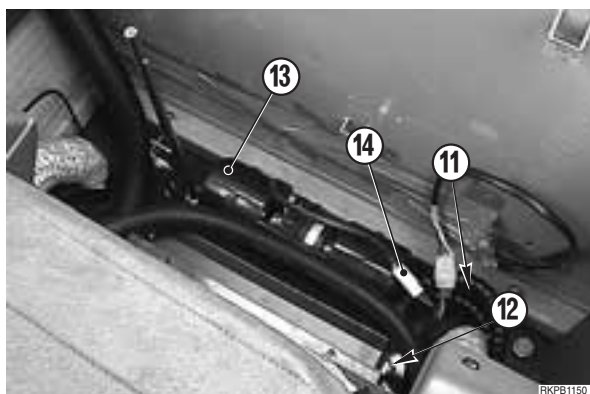
 Cooling liquid: approx. 1.5 ℓ (0.396 US.gall)

- 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), remove screw (9) (n° 3) and remove the panel (10).
- 5 - Move the seat forwards as far as it will go.
- 6 - Disconnect the pipes (11), remove the side screws (12) that lock the fan unit (13) and disconnect the connector (14).
- 7 - Extract the fan unit (9) backwards.



INSTALLATION OF HEATING FAN

- 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 (1.98 US.gall)
- 3 - Start the engine to circulate the coolant liquid.
 - 3 - Switch off the engine and top up the level.




REMOVAL OF RADIATOR

! 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»).

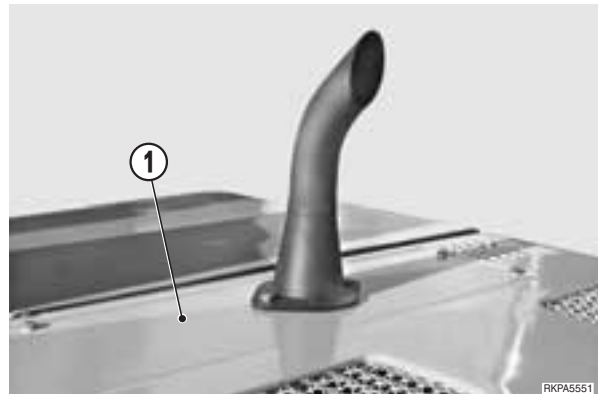
! Drain the engine coolant liquid and the hydraulic oil.

 Coolant liquid needed: 18 ℓ (4.75 US.gall)

 Quantity of oil: 70 ℓ (18.5 US.gall)

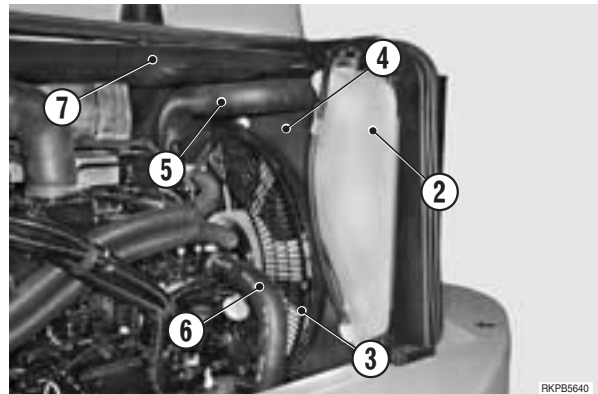
1 - Remove the engine hood. (For details, see «REMOVAL OF ENGINE HOOD»).

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

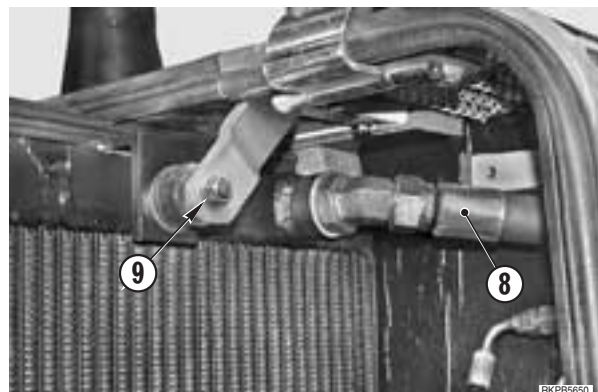


3 - Remove tank (2) and fan guard (3).

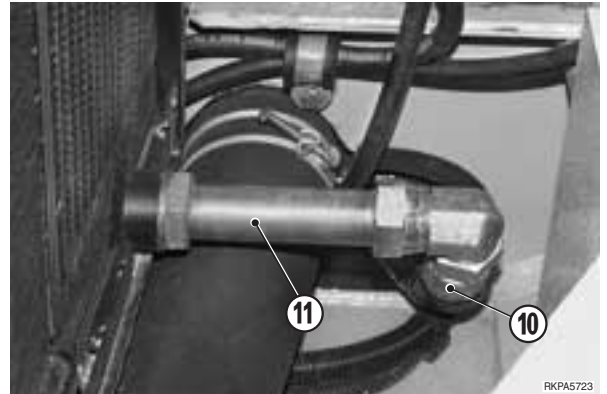
4 - Disconnect the engine cooling pipes (5) and (6) from the radiator (4) and the suction pipe (7).



5 - Disconnect the upper pipe (8) from the radiator (4); loosen nut (9).



- 6 - Disconnect the lower pipe (10) from the radiator (4) and remove the union (11).



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



INSTALLATION OF RADIATOR

- To install, reverse the removal procedure.

- 1 - Refill the coolant liquid circuit.



Coolant liquid needed: 18 ℓ (4.75 US.gall)

※ 1

- ★ Refill the hydraulic oil tank.



Quantity of oil: 70 ℓ (18.5 US.gall)

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

- 3 - Stop the engine and top up all levels.

- 4 - Bleed the hydraulic circuits.

(For details see: «20. TESTING AND ADJUSTMENTS»).

REMOVAL OF FUEL TANK

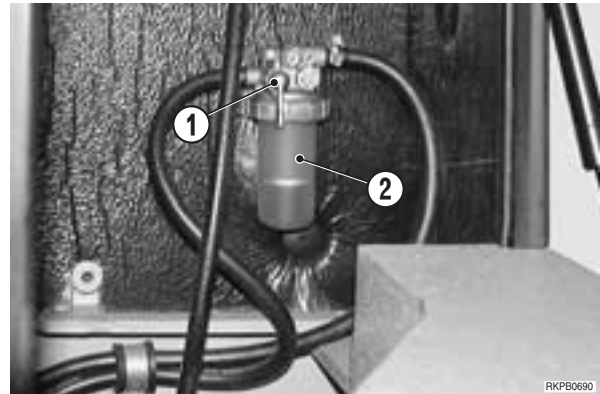
! Lower the work equipment until it is resting on the ground and switch off the engine.

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

★ Turn the turret by 45° towards the right.

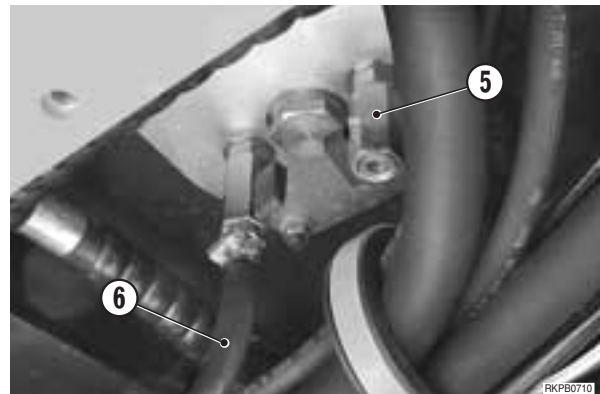
1 - Remove the front hood (for details, see «REMOVAL OF FRONT HOOD») and the bottom right guard of the turret.

2 - Close the cock (1) of the separator (2).

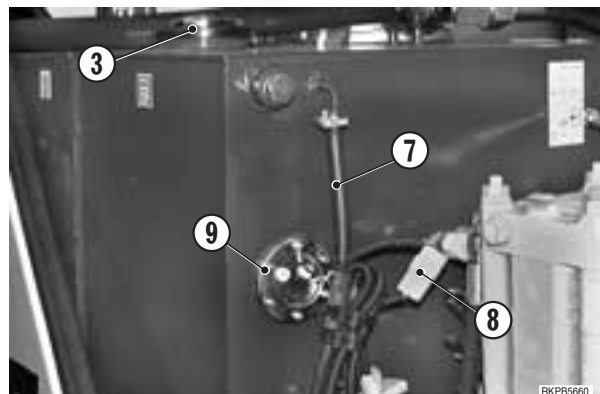


3 - Remove the cap of the fuel tank, open the tank drainage cock (5), and drain the fuel.

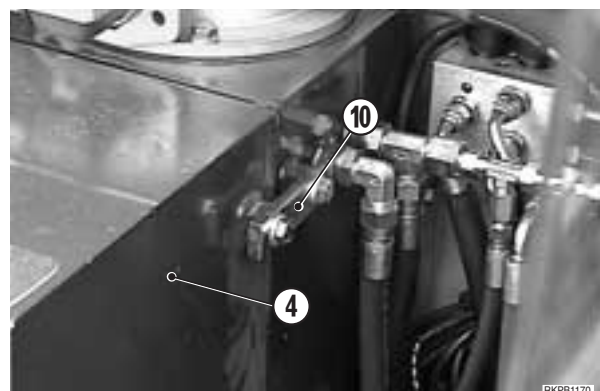
4 - Disconnect the fuel suction pipe (6).



5 - Disconnect the fuel return pipe (7) and the connector (8) of the level gauge (9).




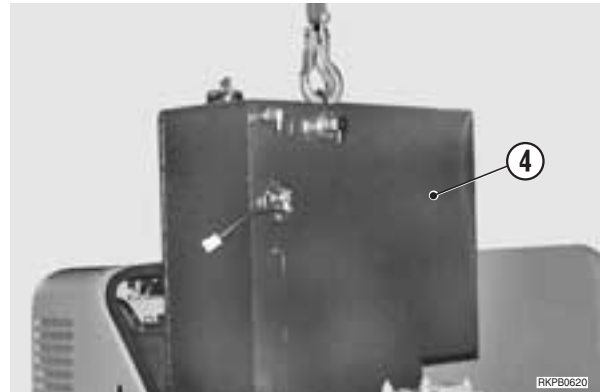
6 - Disconnect the plate (10) that joins the tanks.



7 - Hook the tank (4) to the hoisting equipment and slightly put the rope under tension.

8 - Remove the screws and remove the tank.

 Fuel tank: 40 kg (88.2 lb.)



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. 70 ℓ (18.5 US.gall)

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

2 - Disconnect the exhaust pipe (1).


3 - Disconnect the drain pipes (2) and (3).

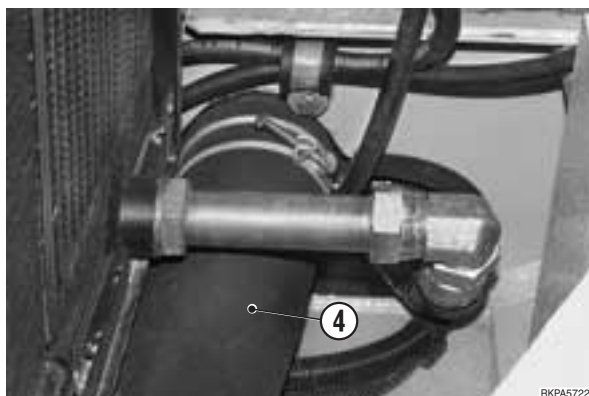
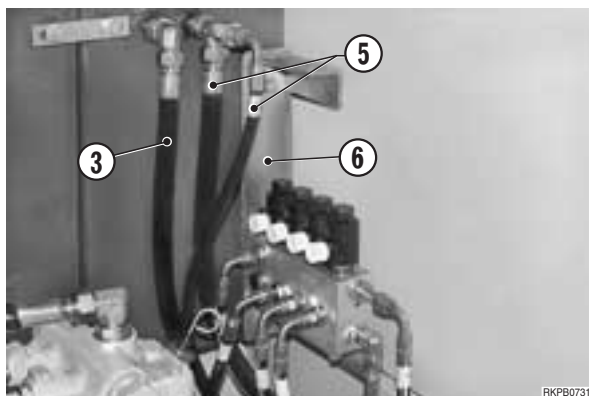
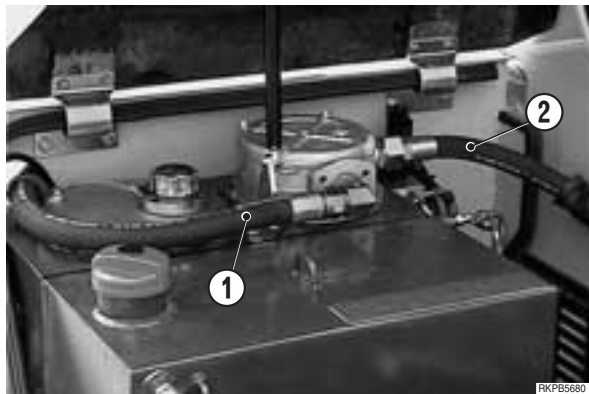
4 - Disconnect the coupling (4) of the pump suction pipe and the pipes (5).

5 - Remove the bracket (6) of the solenoid valves.

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

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

 Oil tank: 60 kg (132.2 lb.)




INSTALLATION OF HYDRAULIC OIL TANK

- To install, reverse the removal procedure.

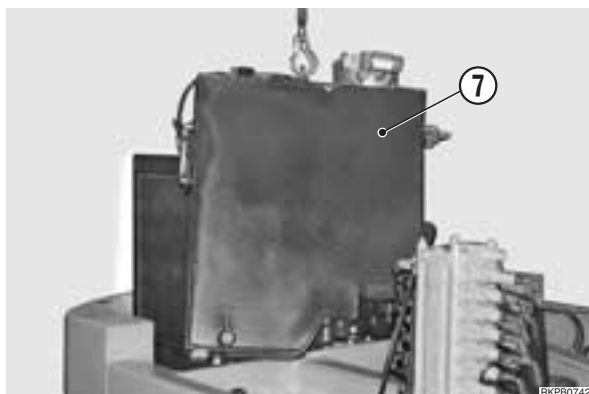
1 - Fill the hydraulic oil tank to maximum level.

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

 Hydraulic oil needed: approx. 70 ℓ (18.5 US.gall)

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 lead from the negative (-) battery terminal.

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

- Drain the hydraulic oil.



Quantity of oil: approx. 70 ℓ (18.5 US.gall)

- Drain the engine coolant liquid.



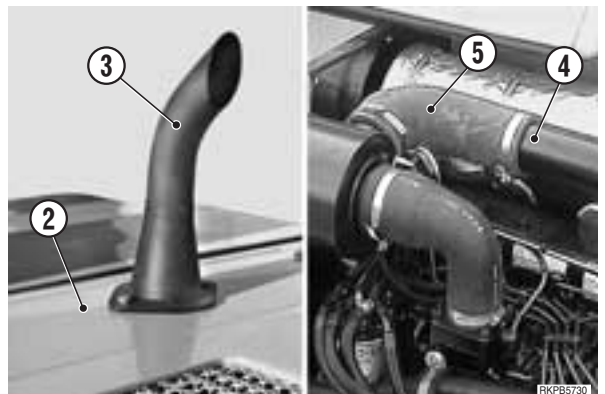
Quantity of coolant liquid: 18 ℓ (4.75 US.gall)

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

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

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

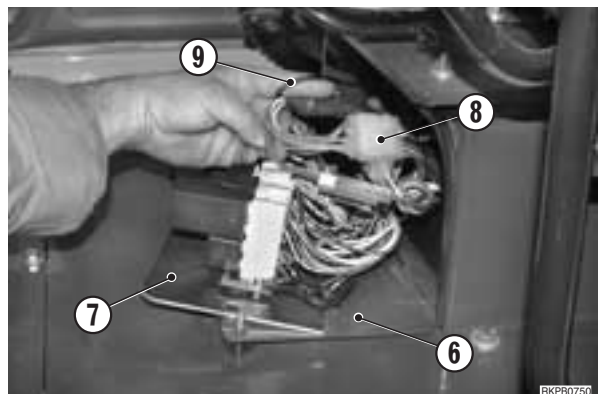
3 - Remove the suction pipe (4) complete with the rubber elbow (5) for filter connection.



4 - Remove bottom left and bottom rear guards.

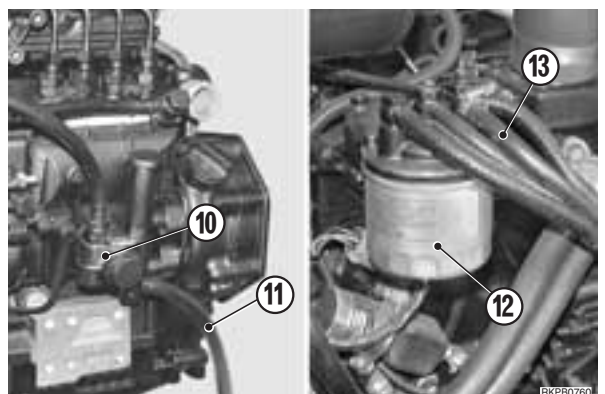
5 - Open the door (6) of the electric board, remove the panel (7) and disconnect the engine cable connector (8) and the earth cable (9).

- ★ Free the engine cable from any clip placed between the board and the flywheel.

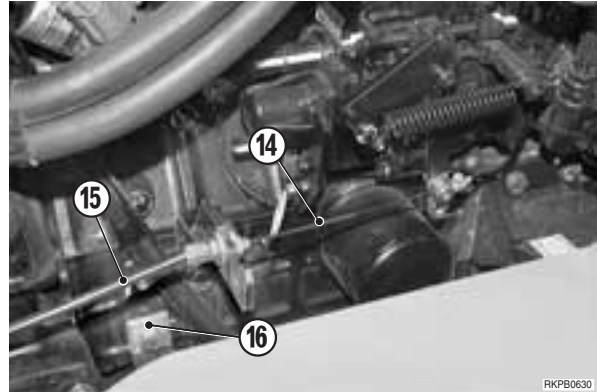


6 - Disconnect the pipe (11) coming from the separator from the fuel pump (10).

7 - Disconnect the return tube (13) from the fuel filter (12).



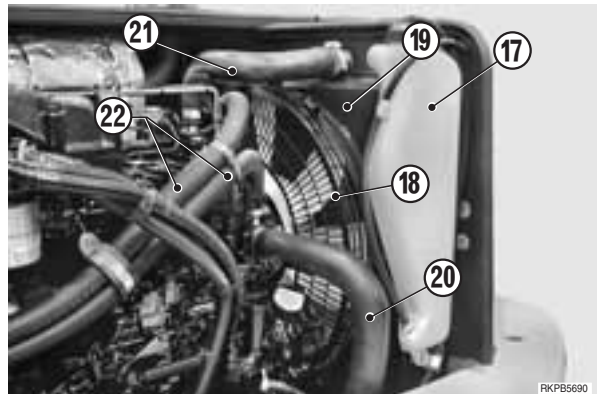
8 - Disconnect the cable (14) and the sheathing (15) of the accelerator as well as the earth plait (16) from the engine.



9 - Remove the compensating tank (17) and move it to one side.

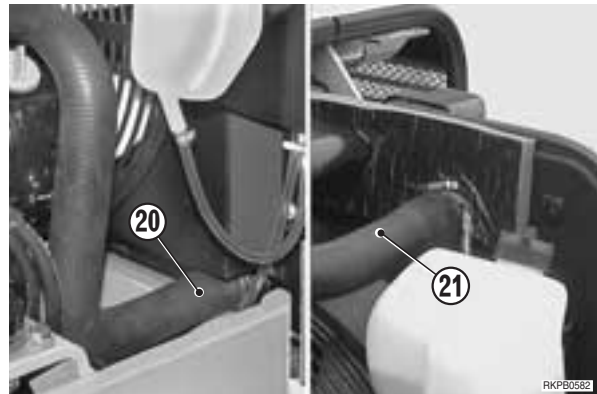
10 - Remove the fan guard (18).

11 - Remove the fastening screws (19) of the conveyor. Push the conveyor towards the engine in order to disengage it from the radiator supports.

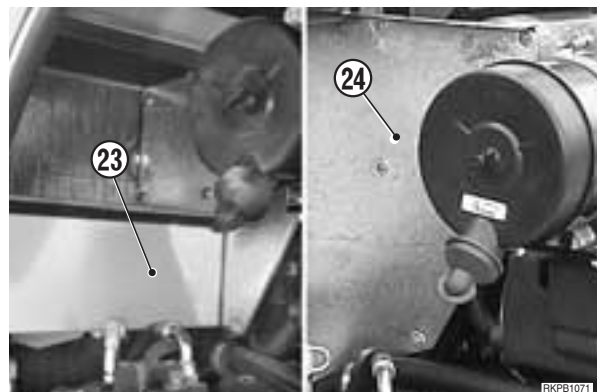


12 - Disconnect the pipes (20) and (21) that connect to the radiator and the heating pipes (22) from the engine.

13 - Disconnect the supporting and guiding clamps of the heating pipes (22) from the engine and extract the pipes from the left opening.

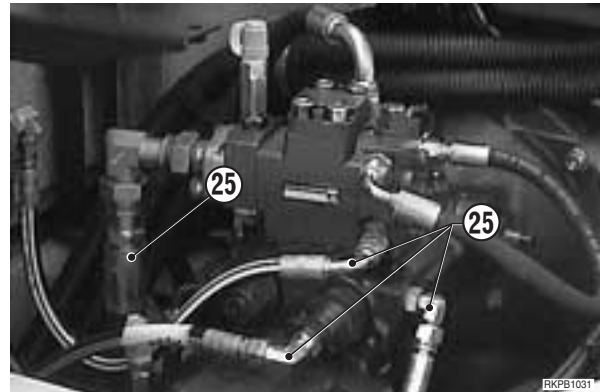


14 - Remove the tool box (23) and the heat guard (24).

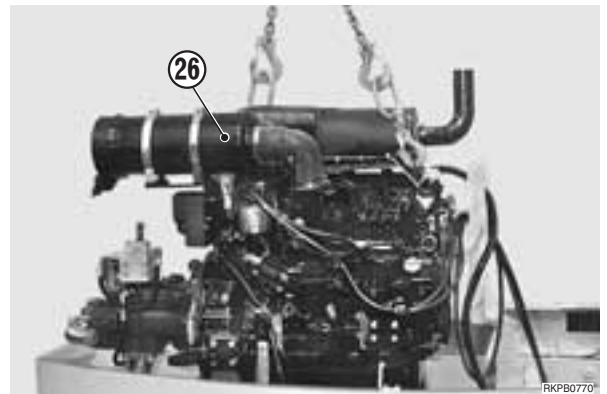


14 - Disconnect the flanges of the suction pipes and all delivery pipes (25) from pumps. ※ 1

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



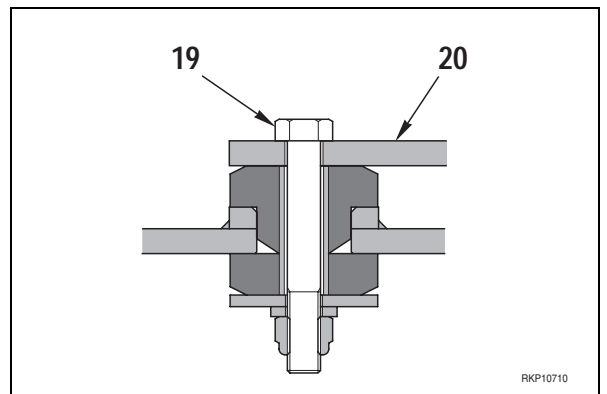
15 - Hook the engine (26) to the hoisting equipment using the specific brackets and slightly put the chains under tension.



16 - Remove the central screws (27) (No. 4) of the engine supports (28). ※ 2

17 - Slowly lift the unit drawing cables and pipes to and remove the engine (28).

kg Engine - pumps: 460 kg (1013.4 lb.)





INSTALLATION OF ENGINE-PUMP GROUP

- To install, reverse the removal procedure.


※ 1

- ★ Before connecting the flanges, check the state of seals and keep them in position by applying grease ASL800050.


 Piston pump flange screws: 63 ± 6.5 Nm
(46.3 ± 0.44 lb.ft.)


 Gear pump flange screws: 35 ± 3.5 Nm
(2.65 ± 2.58 lb.ft.)

※ 2


 Support bolt: 157 Nm (115.7 lb.ft.)

- 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. 70 ℓ
(18.5 US.gall)

- 2 - Fill the cooling circuit.

 Coolant liquid needed: approx. 18 ℓ
(4.75 US.gall)

- 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.

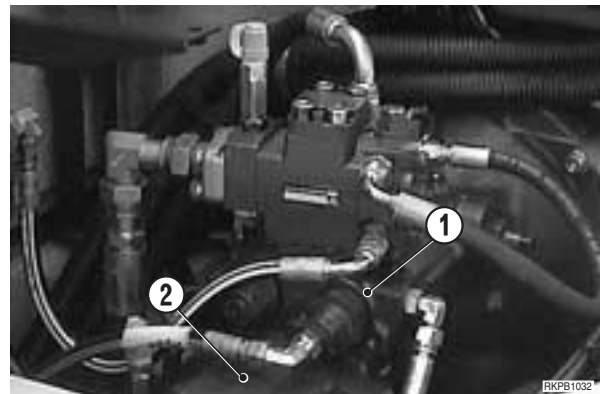
 Quantity of oil: approx. 70 ℓ (18.5 US.gall)

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.

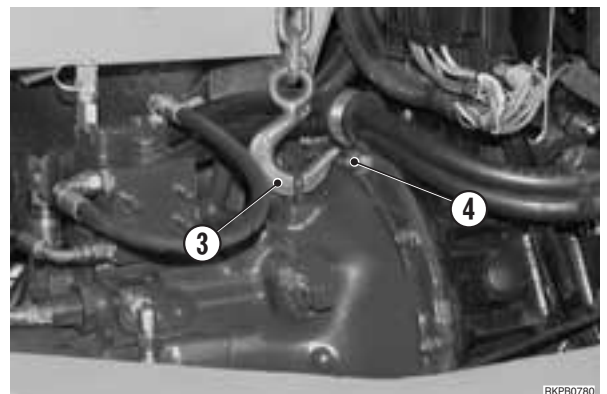


6 - Hook the assembly to the eyebolt (3) placed on the piston pump and slightly put the rope under tension.

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

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

 Pump group: approx. 57 kg (125.6 lb.)





INSTALLATION OF PUMP GROUP

- To install, reverse the removal procedure.

※ 1


- ★ Before connecting the suction flanges, check the condition of seals and keep them in position applying grease ASL800050


 Piston pump flange screws: 63 ± 6.5 Nm
(46.3 ± 0.44 lb.ft.)


 Gear pump flange screws: 35 ± 3.5 Nm
(2.65 ± 2.58 lb.ft.)

※ 2


- ★ Coat the coupling surfaces thinly.


 Coupling surfaces: ASL800050

 Pump check screws: Loctite 262

 Pump check screws: 50 ± 5 Nm
(36.8 ± 0.37 lb.ft.)

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: 70 ℓ (18.5 US.gall)

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

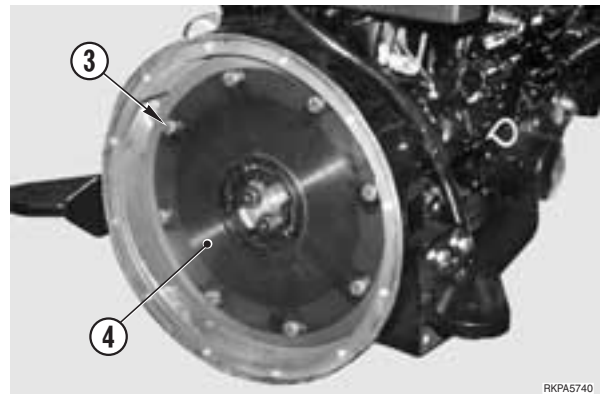
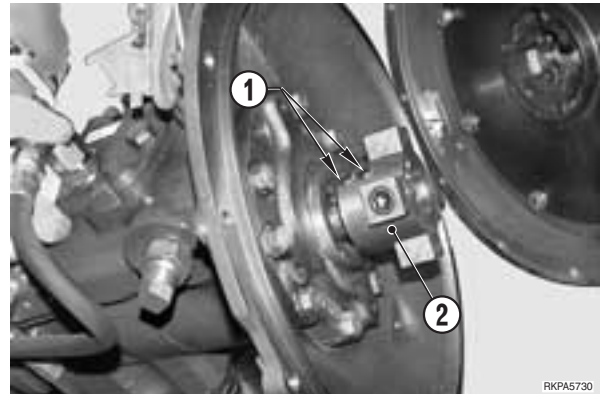
- 2 - Loosen dowel pin (1) fixing half joint (2) in more stages and alternatively. **※1**

★ heat dowel pins to 85–100 °C (185–212°F)

- 3 - Remove pump half joint (2).
★ If necessary, use a puller.

Half joint on flywheel

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





※2

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
(36.8 lb.ft.)


※2

 Drive flange bolts: Loctite 262

 Drive flange bolts: 50 Nm (36.8 lb.ft.)

- 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: 70 ℓ (18.5 US.gall)

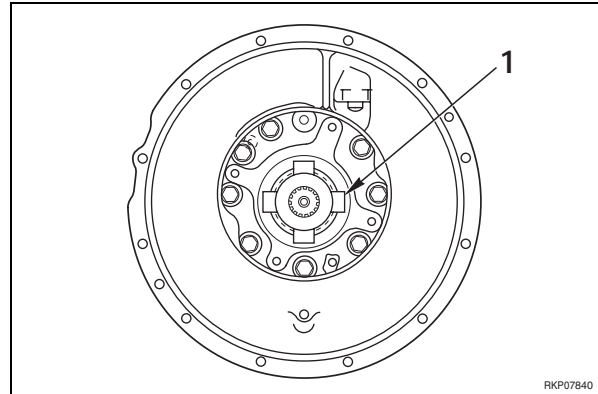
- 2 - Start the engine to allow oil circulation in all systems and check the seals.
- 3 - Stop the engine and, if necessary, restore oil level in the tank.

REMOVAL OF MAIN PUMP INPUT SHAFT OIL SEAL

- 1 - Remove main pump assembly. (For details, see «REMOVAL OF MAIN PUMP ASSEMBLY»).
- 2 - Remove PTO assembly (1). (For details, see «REMOVAL OF ENGINE - PUMP COUPLING JOINT»).
- 3 - Remove snap ring (2), then remove spacer (3).
- 4 - Lever up oil seal (4) with a screwdriver to remove.

※ 1

- ★ When removing the oil seal, be extremely careful not to damage the shaft.



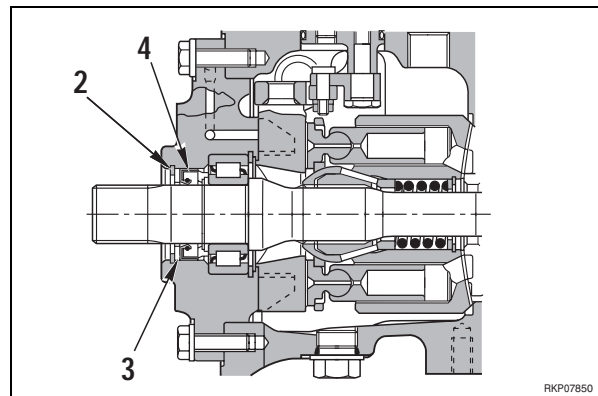
RKP07840

INSTALLATION OF MAIN PUMP INPUT SHAFT OIL SEAL

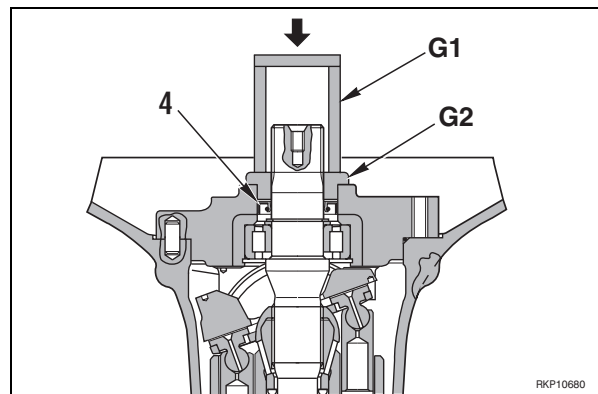
- To install, reverse the removal procedure.

※ 1

- ☞ Lip of oil seal: ASL800050
- ☞ Coat the outside circumference of the oil seal thinly with ASL800050, then press fit.
- ★ Use tools **G1** e **G2** to press fit oil seal (4).



RKP07850



RKP10680

REMOVAL OF GEAR-PUMP

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

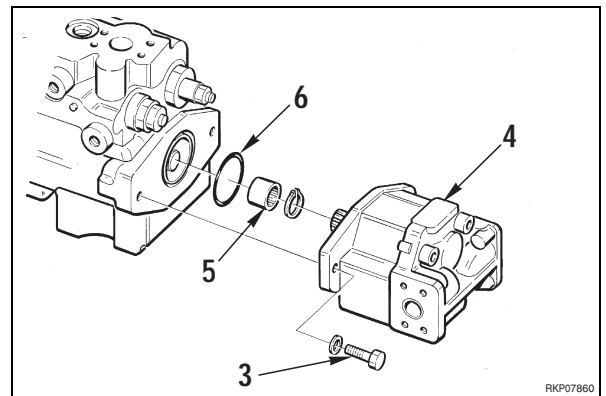
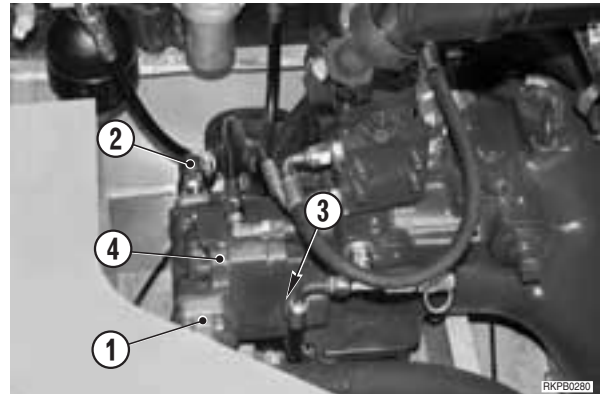
! Release residual pressures from all circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).

- Drain the hydraulic oil.

 Quantity of oil: approx. 70 ℓ (18.5 US.gall)

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 (2.65 ± 2.58 lb.ft.)


※ 2

 Joint: ASL800050

 Pump fastening screws: 98 – 123 Nm
(72.2 – 90.6 lb.ft.)

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. 70 ℓ
(18.5 US.gall)

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.

2 - Disconnect the tubes (1) on the lower side of the joint (2) and plug them.


★ Mark the tubes before disconnecting them, to avoid errors when re-assembling. **※1**

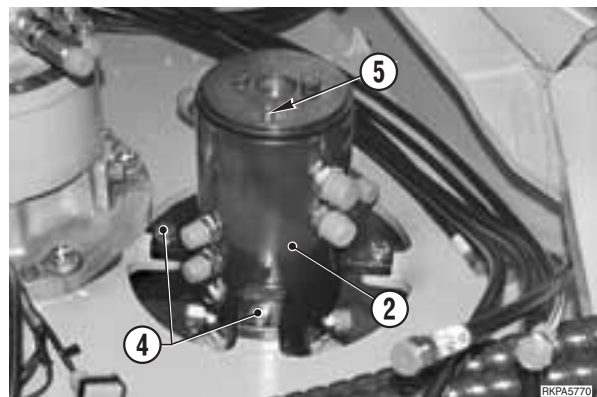
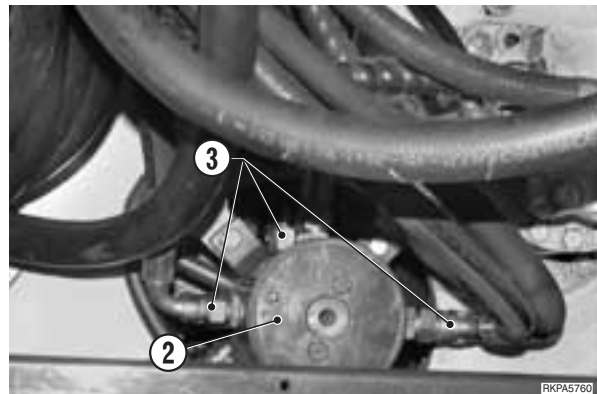
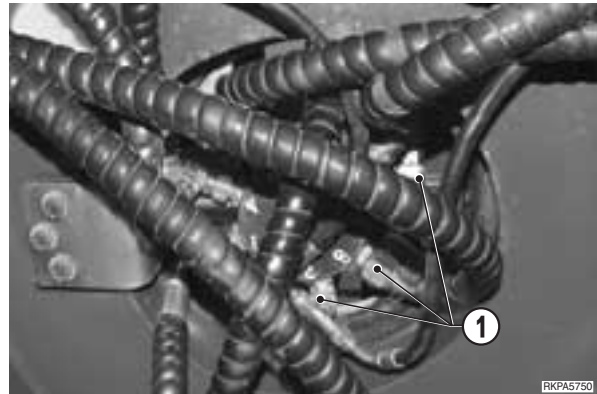
3 - Disconnect the tubes (3) on the top of the joint (2) and plug them.

★ 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 (79.3 lb.)



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

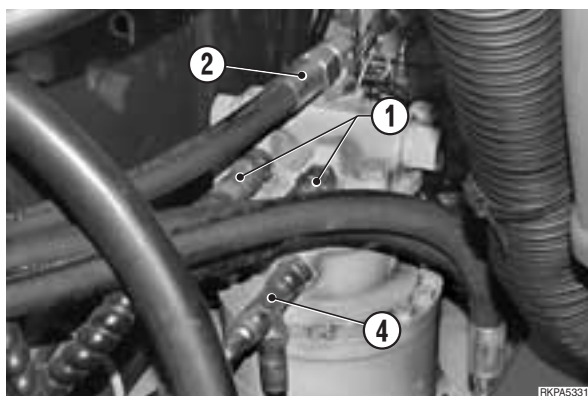
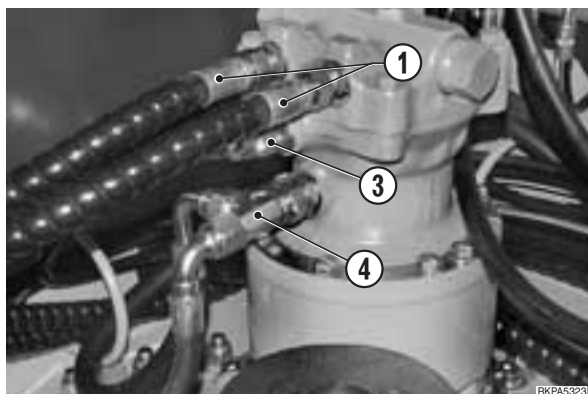
2 - Remove the screws (5) (No. 14) that attach the motor (6) to the swing machinery (7).

※2

3 - Fasten two screws in the holes opposite to each other (8) and remove the motor.

※3

 Motor: 22 kg (48.5 lb.)




INSTALLATION OF SWING MOTOR

• To install, reverse the removal procedure.


※1

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

※2

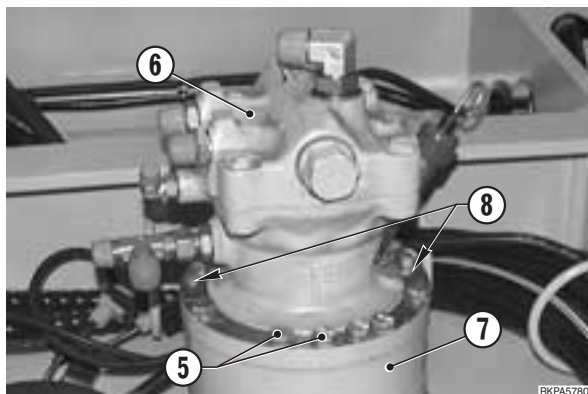
 Screw: 58.8 – 73.5 Nm (43.3 – 54.2 lb.ft.)

※3

 Coupling surface: ASL800070

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

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

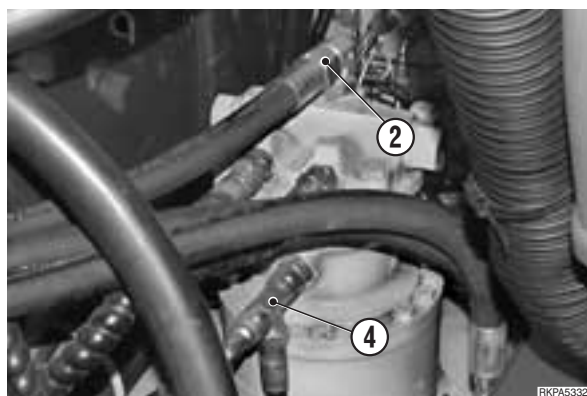
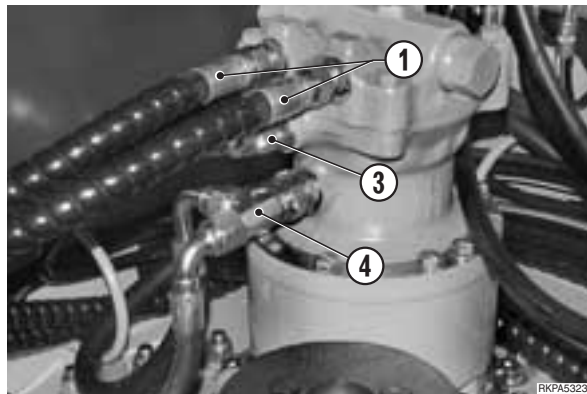
3 - Remove the check screws (5) (No. 10) of the reduction gear (6). ※2

4 - Fasten two screws into the holes opposite to each other and remove the reduction gear. ※3

5 - 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: 43 kg (94.7 lb.)




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 tool **A1** 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 the motor with hydraulic oil through the drain line connection (2) and lubricate the bearings through the lubricating nipple (7).

 Bearing: ASL800050

※2

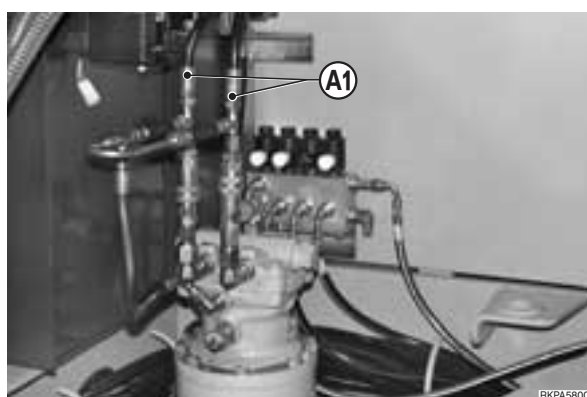
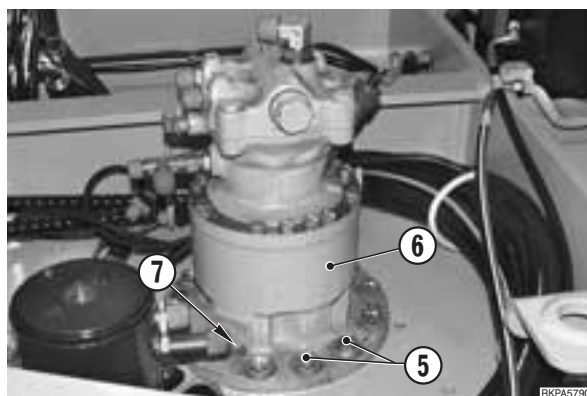
 Screw: 58.8 – 73.5 Nm (43.3 – 54.2 lb.ft.)

※3

 Coupling surface: ASL800070


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

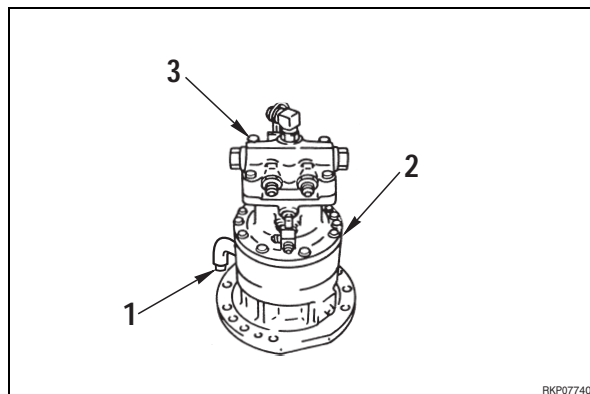
2 - Bleed the air from engine (For details, see «20. TESTING AND ADJUSTMENTS»).



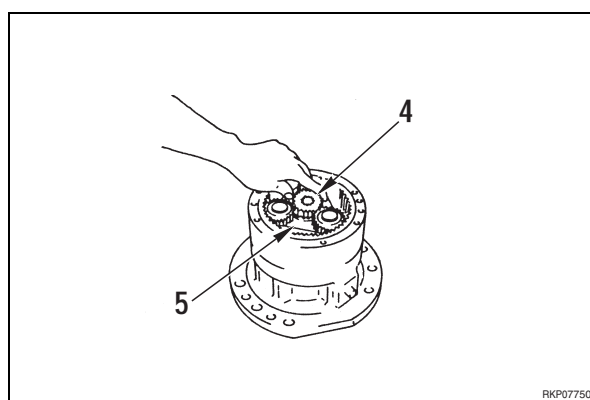
DISASSEMBLY SWING MACHINERY

- 1 - Remove drain plug (1) and drain oil from swing machinery case.
Remove screws (2) (No. 12) and remove swing motor assembly (3).

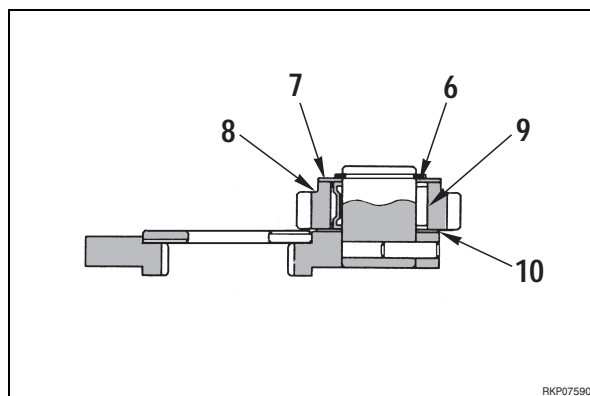
 Swing machinery case: approx. 1.5 ℓ
(0.4 US.gall.)



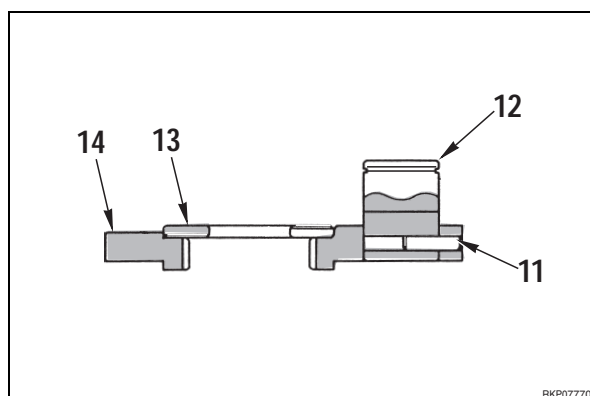
- 2 - Remove No. 1 sun gear (4) and No. 1 carrier (5).



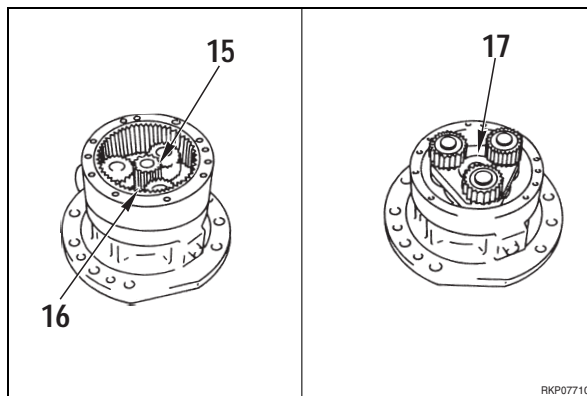
- 3 - Remove snap ring (6), then remove thrust washer (7), gear (8), bearing (9) and thrust washer (10).



- 4 - knock in pin (11) and remove shaft (12).
★ After removing the shaft (12), remove pin (11).
Remove thrust washer (13) from carrier (14).

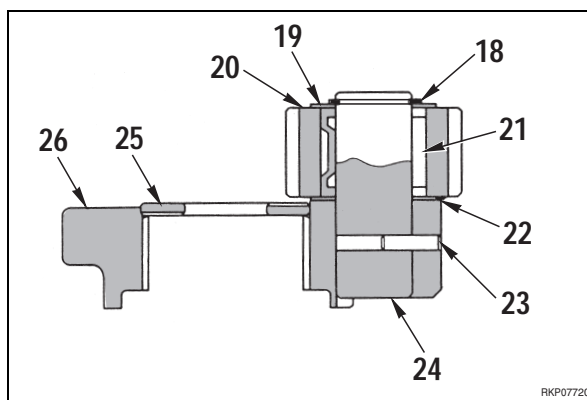


5 - Remove No. 2 sun gear (15), ring gear (16) and remove No. 2 carrier assembly (17).



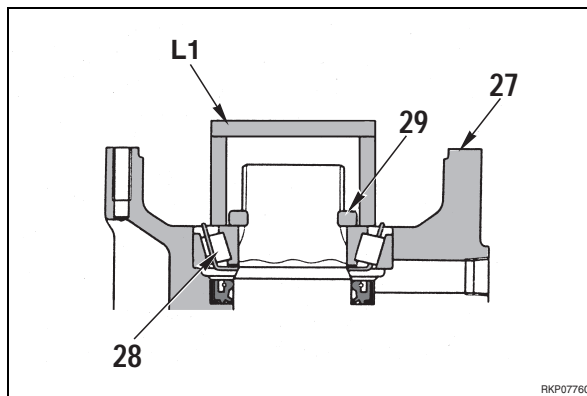
6 - Remove snap ring (18), then remove thrust washer (19), gear (20), bearing (21) and thrust washer (22). Knock in pin (23) and remove shaft (24).

★ After removing the shaft (24), remove pin (23). Remove thrust washer (25) from carrier (26).



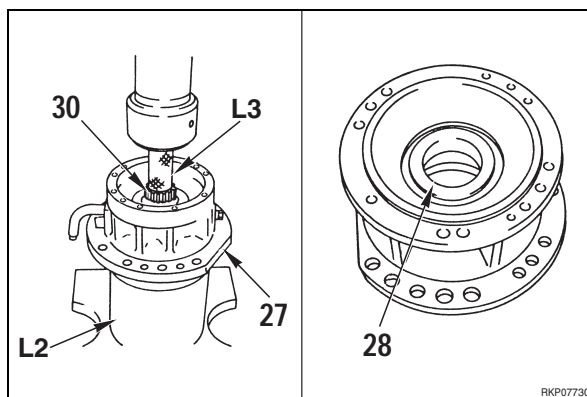
7 - Set shaft and case assembly (27) to press, and push bearing (28) with tool L1.

★ Operate the press slowly and push the bearing to a point where the split collar (29) can be removed. Remove split collar (29).

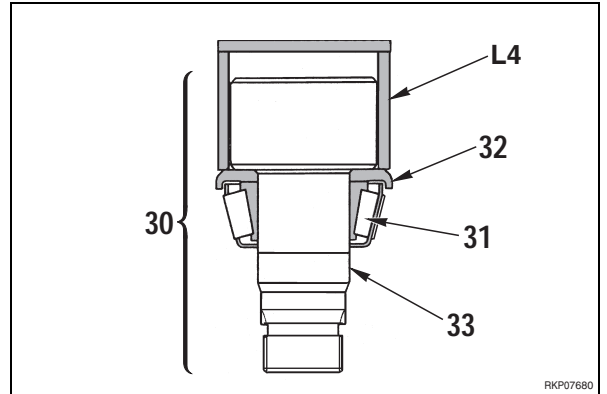


8 - Set block L2 to shaft and case assembly (27), and using push tool L3, remove shaft assembly (30) with press.

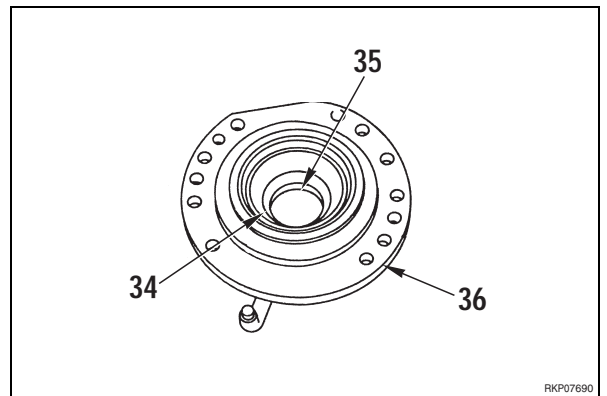
Remove bearing (28).



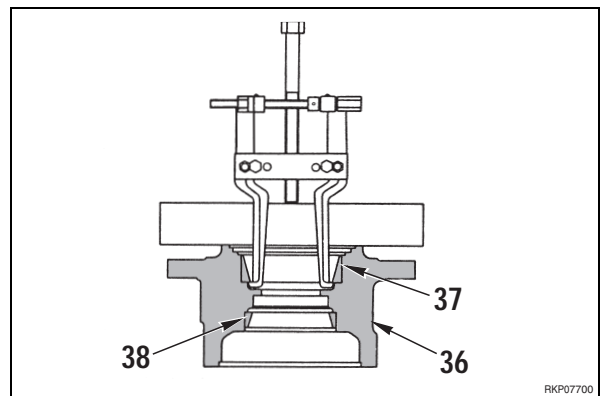
9 - Set shaft assembly (30) to press, and using push tool L4, remove bearing (31), and collar (32) from shaft (33).



10 - Remove dust seal (34) and oil seal (35) from case (36).




11 - Using puller, remove bearing outer races (37) and (38) from case (36).



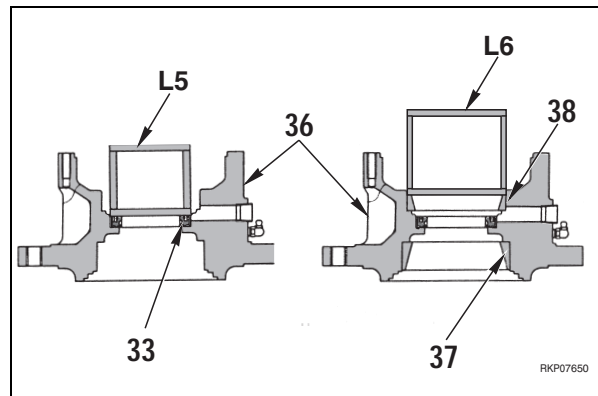
ASSEMBLY SWING MACHINERY

- ★ Clean all parts, and check for dirt or damage.
- ★ Coat the sliding surfaces of all parts with engine oil before installing.
- ★ Replace the oil seal with a new part.

1 - Using push tool **L5**, press fit oil seal (35) to case (36).

 Lip of oil seal: ASL800050

2 - Using push tool **L6**, press fit outer races (37) and (38) to case (36).



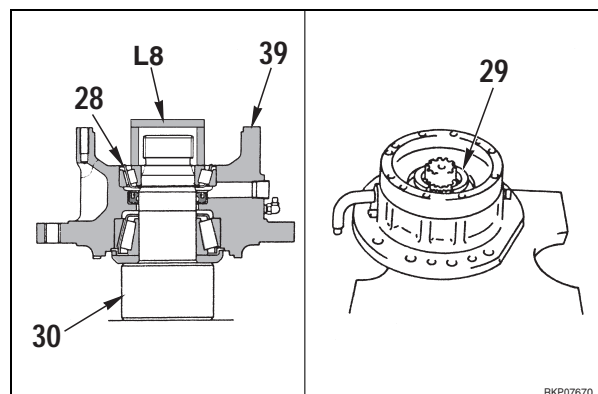
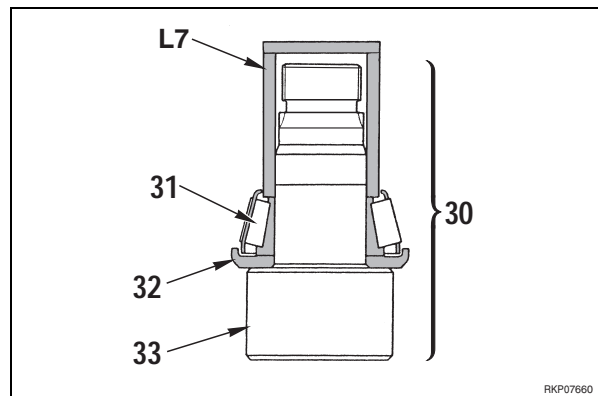
3 - Install collar (32) to shaft (33).

Using the tool **L7**, press fit bearing (31) with press. Set case assembly (39) to shaft assembly (30).

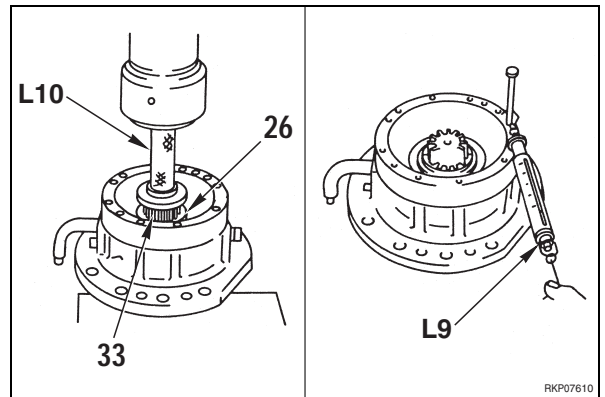
Using push tool **L8**, press fit bearing (28) to a point where split collar (29) can be inserted.

- ★ Press fitting force: 11768 N (1200 kg)
- ★ Rotate the case and gradually press fit the bearing.

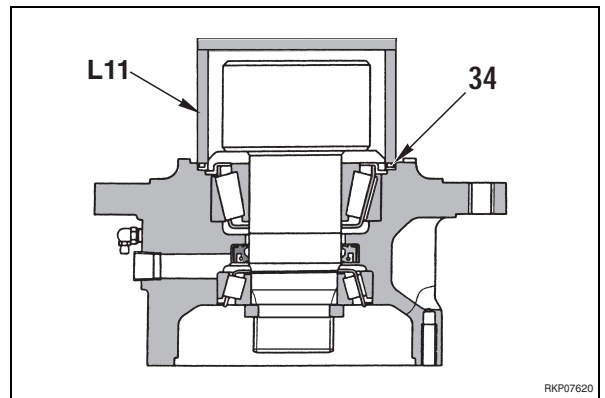
Install split collar (29).



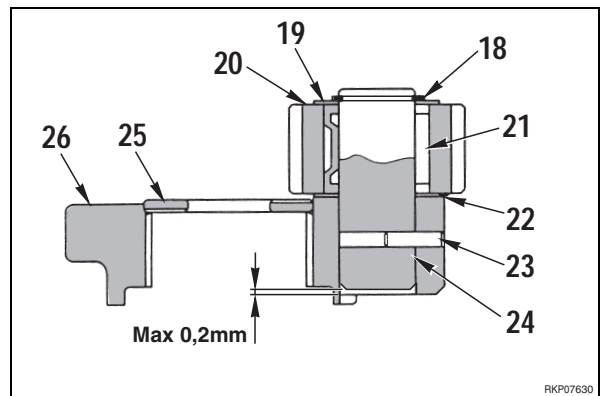
- 4 - Using push tool **L10**, press fit shaft (30) with press until split collar (29) is fixed in position.
 Screw bolt (thread $\varnothing = 10 \text{ mm}$ (0.394 in.), pitch = 1.5 mm (0.059 in.) in case, and using push-pull scale **L9**, measure tangential force in direction of rotation.
- ★ Tangential force: Max. 147 N (15 kg)
 - ★ The tangential force is the maximum reading when starting rotation.




- 5 - Using push tool **L11**, press fit dust seal (34).

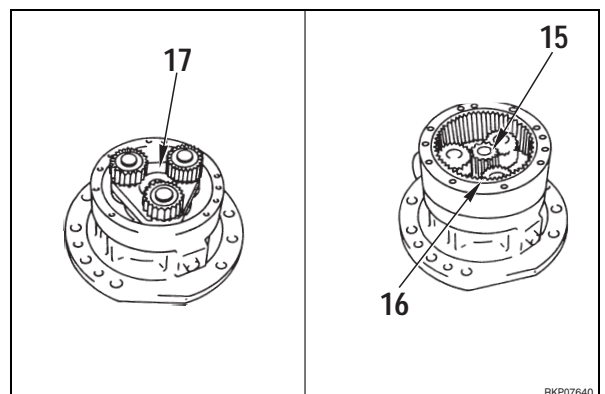


- 6 - Install thrust washer (25) to carrier (26).
 Align position of pin holes of shaft (24) and carrier (26), then tap with a plastic hammer to install shaft (24) and insert pin (23).
- ★ After inserting the pin (23), caulk the pin portion of the carrier.
 - ★ Check that the stepped difference between the shaft (24) and carrier (26) is less than 0.2 mm (0.0079 in.).

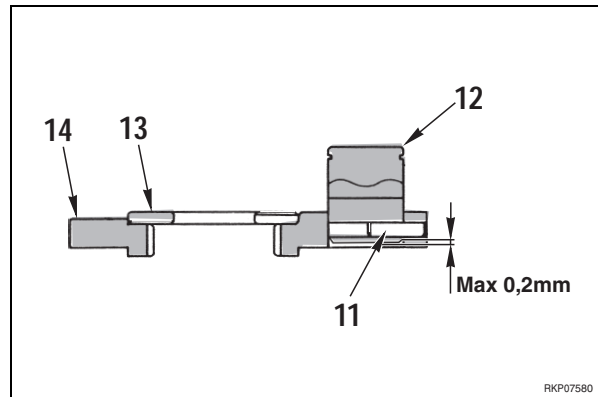


Assemble thrust washer (22), bearing (21), gear (20) and thrust washer (19), then install snap ring (18).
 Install No. 2 carrier assembly (17) to shaft and case assembly.

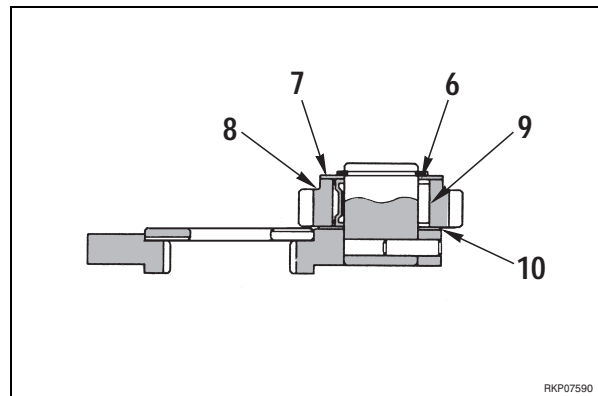
- 7 - Install ring gear (16).
 Ring gear mating surface: Loctite 510
 Install No. 2 sun gear (15).



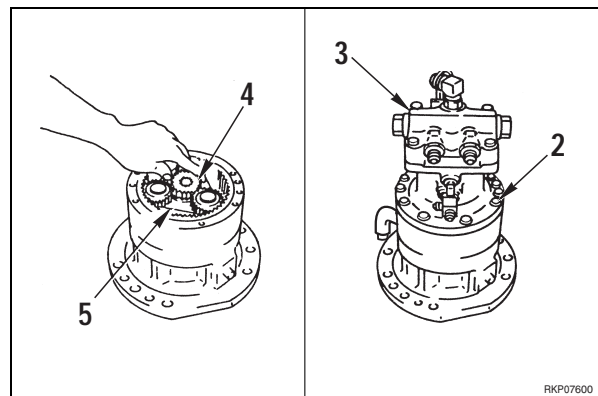
- 8 - Install thrust washer (13) to carrier (14).
 Align position of pin holes of shaft (12) and carrier (14), then tap with a plastic hammer to install shaft (12).
 Insert pin (11).
 ★ After inserting the pin (11) caulk the pin portion of the carrier.
 ★ Check that the stepped difference between the shaft (14) and carrier (12) is less than 0.2 mm (0.0079 in.).



- 9 - Assemble thrust washer (7), bearing (9), gear (8) and thrust washer (10), then install snap ring (6).



- 10 - Install No. 1 carrier assembly (5).
 Install No. 1 sun gear (4).
 Install swing motor assembly (3) and tighten screws (2) (No. 12).
 Tighten drain plug and add oil through oil filter.
- Mounting bolt: 66.2±7.4 Nm (48.8±5.45 lb.ft.)
 - Motor mating surface: Loctite 510
 - Swing machinery case: approx. 1.5 ℓ (0.4 US.gall.)
 - Swing machinery case: ASL800050 (approx. 110 cc)



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), exhaust 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 distributor.


※ 1

 Complete distributor: approx. 55 kg (121.2 lb.)

INSTALLATION OF CONTROL VALVE

• To install, reverse the removal procedure.

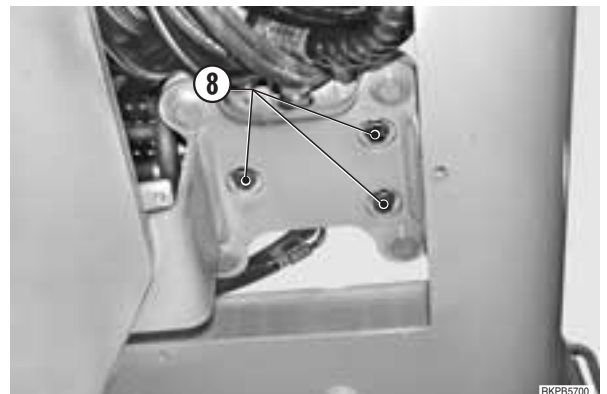
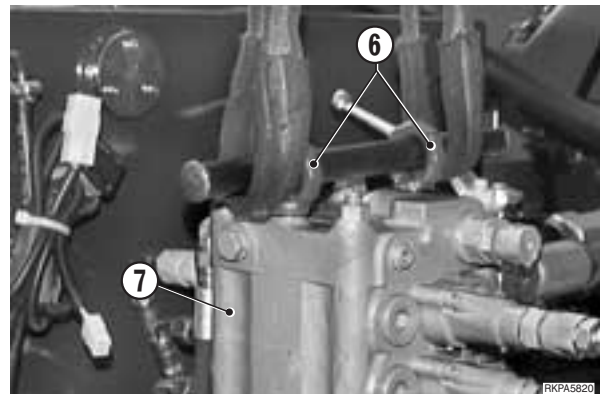
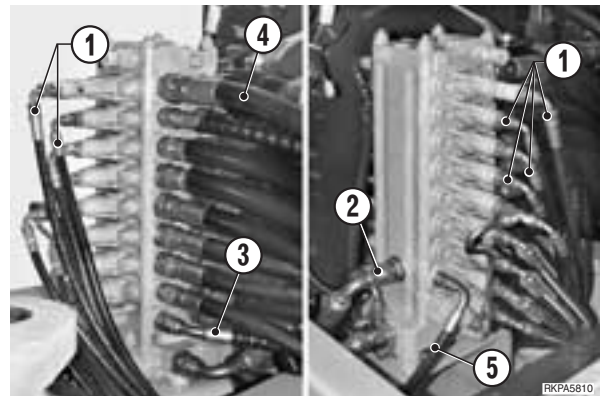
※ 1

 Distributor check screws: 190 Nm (140 lb.ft.)

 Distributor 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.

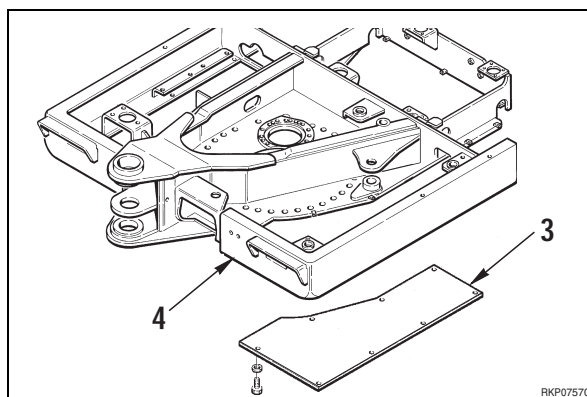
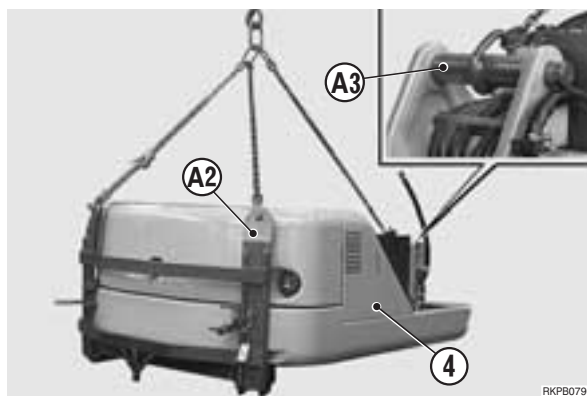
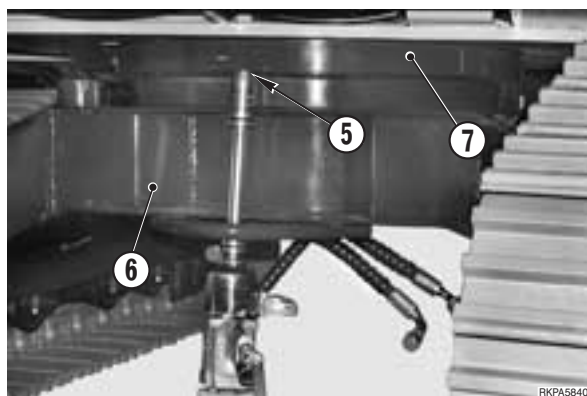
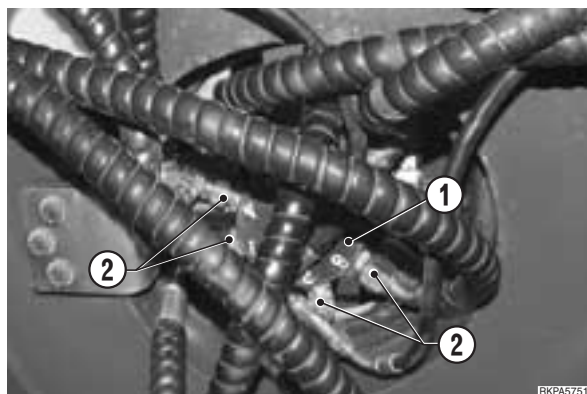
- 1 - Remove the upper work equipment (For details, see «REMOVING UPPER WORK EQUIPMENT»).
- 2 - Remove the front hood. (For details, see «REMOVAL OF FRONT HOOD»).
- 3 - Remove the cabin and the seat. (For details, see «REMOVAL OF CABIN AND REMOVAL OF THE SEAT»).
- 4 - Remove the boom cylinder. (For details, see «REMOVAL OF BOOM CYLINDER»).
- 5 - Disconnect all the lower tubes (2) from the swivel joint (1) and plug them. Also plug the fittings left on the joint. ※3
- 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 (3) 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. 34).

⚠ Leave two screws in position for reasons of safety, one at the front and one at the rear.

- 10 - Using the equipment **A2** and **A3** attach the revolving frame to a hoisting tackle and apply slight tension to the chains. ※1
- 11 - Loosen and disengage the two screws, leaving them inserted in the bearing ring (7).
- 12 - Raise the revolving frame (4) slowly. ※2

★ While raising the revolving frame, take great care not to damage the swivel joint.



 Revolving frame: 3300 kg (7270 lb.)





INSTALLATION OF REVOLVING FRAME

- To install, reverse the removal procedure.

※ 1

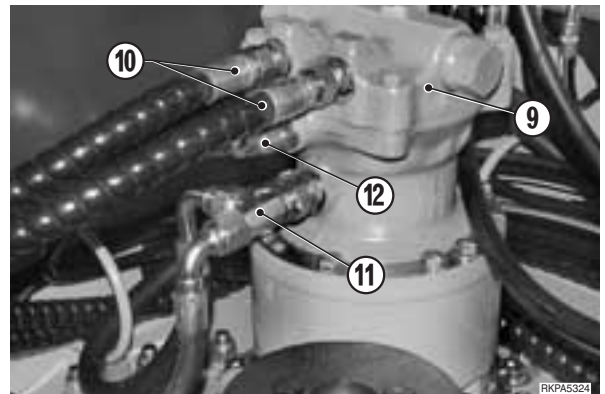
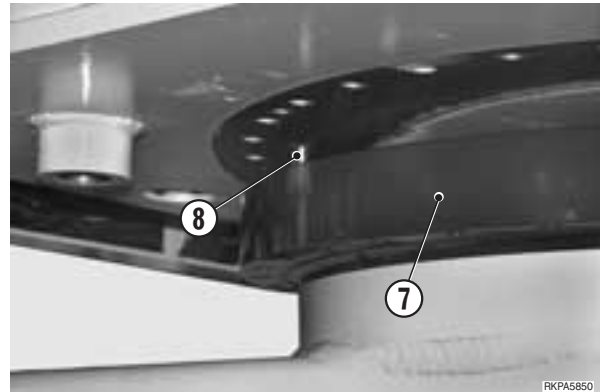
-  Revolving frame attachment screws
(without nut): Loctite 262
-  Revolving frame attachment screws: 314 Nm
(231.4 lb.ft.)

※ 2


- ★ Align the two positions corresponding to the centering pins (8), then assemble.
-  Sealant and swing circle platform gaskets:
ASL800050
-  Internal swing circle grease:
approx. 25 kg (55 lb.)

※ 3

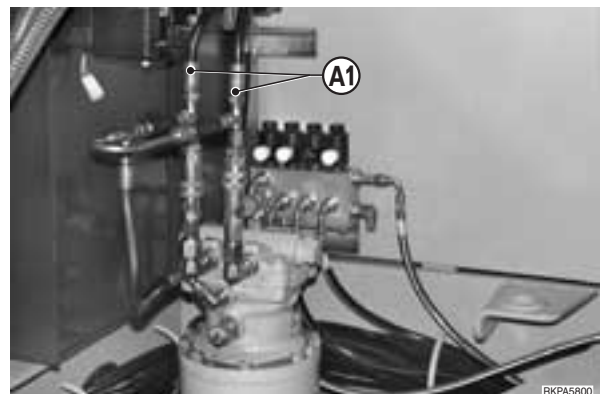
- ★ After connecting up all the hydraulic tubes, start the engine and move all parts of the equipment several times to bleed air from the circuits, while checking for leakages.
- ★ Switch off the engine and check level of the hydraulic oil.



Installation Procedure

-  In order to swing the revolving frame for centering the reference pins (8), 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 tool **A1** and slowly rotate the turret until correct centring is obtained.
- 3 - Insert the two screws (5) 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 **B1**, loosen the screws (3) and their safety washers. ※ 1
- 6 - Remove the counterweight (4).

 Counterweight: 1050 kg (2313 lb.)

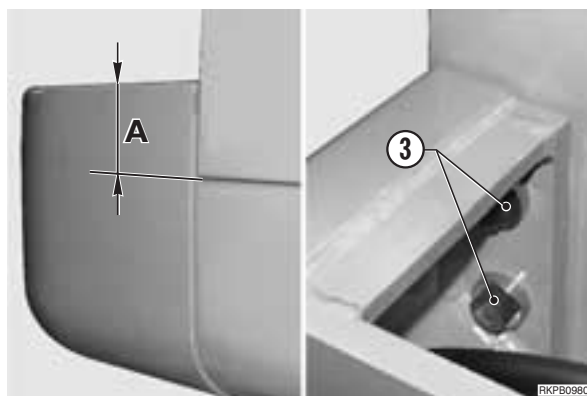
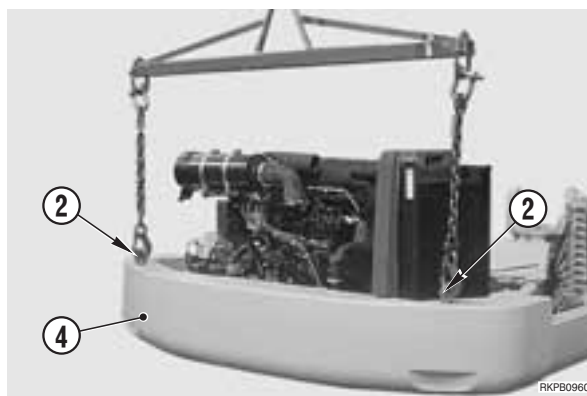
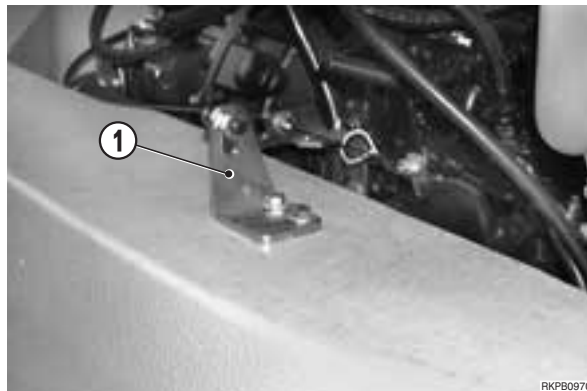
INSTALLATION OF COUNTERWEIGHT

- To install, reverse the removal procedure.

※ 1

-  Counterweight screws: Loctite 262
-  Counterweight screws: 580 Nm (427.5 lb.ft.)


- ★ Carefully check that the vertical positioning measurement «A» is 100 ± 2 mm (3.94 ± 0.08 in.) with respect to the revolving frame.

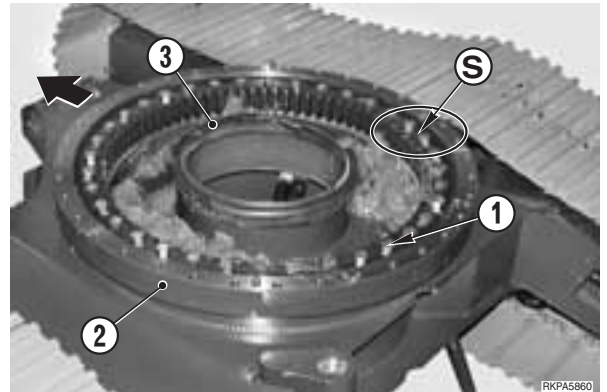


REMOVAL OF SWING CIRCLE

- 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 the tool D1.


※ 1

 Swing circle: 89 kg (196 lb.)



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.

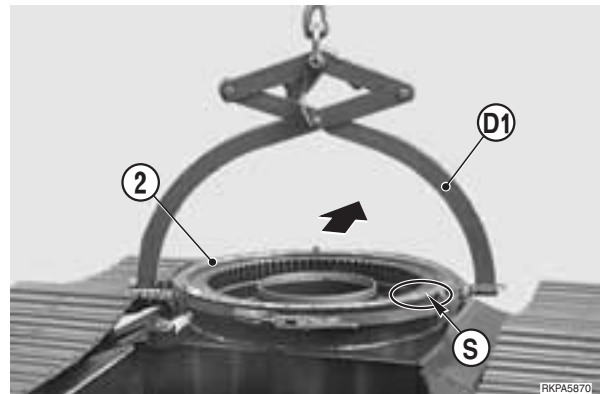
※ 1

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

 Attachment screws: 314 Nm (231.4 lb.ft.)

 Lubricating grease: approx. 25 kg (55 lb.)



REMOVAL OF TRACK SHOES

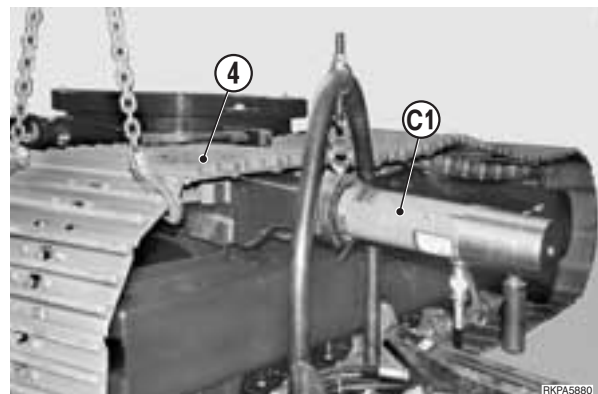
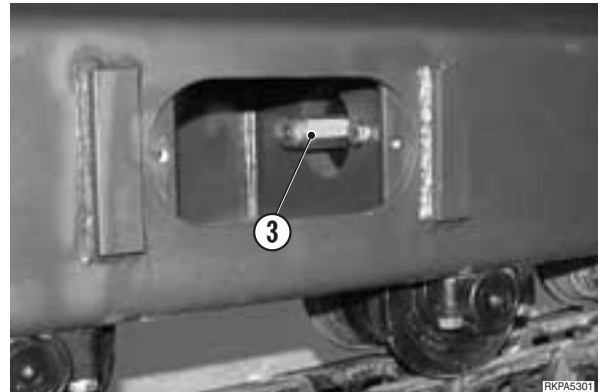
- 1 - Move the machine until the master pin (1) on the track shoe idler (2) is in its highest position.
- 2 - Slowly loosen the lubricator (3) to let out the grease and relieve track shoe tension.

※ 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 the tool C1.
- 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

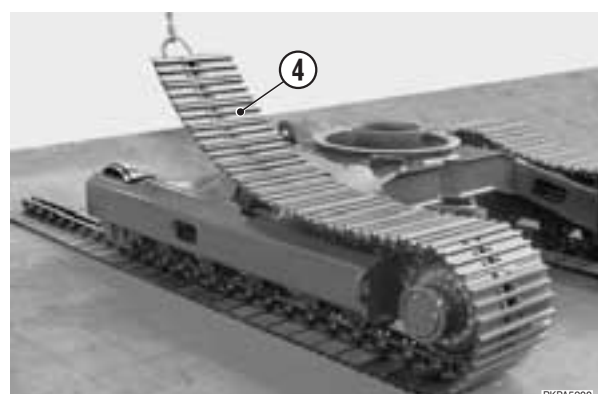
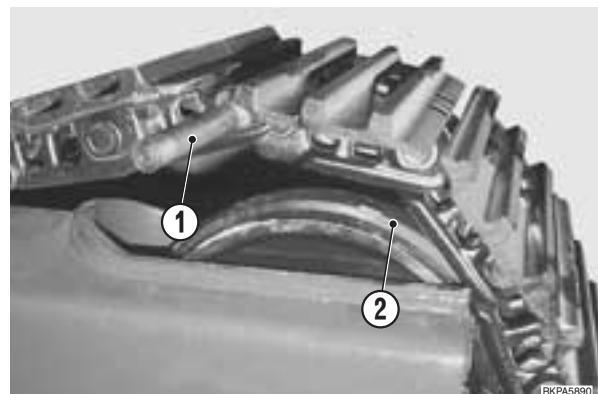
- To install, reverse the removal procedure.

※ 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 tool C1.



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.



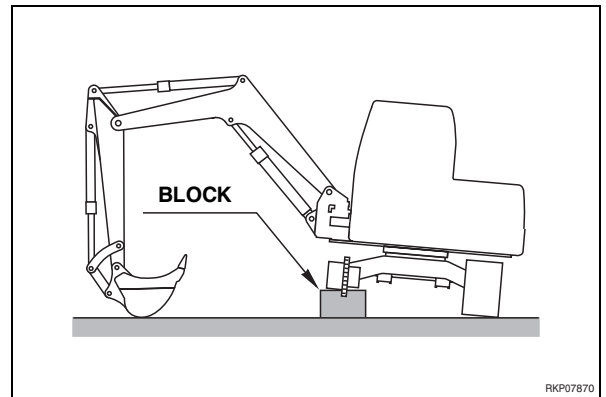
Insert safety blocks beneath the chassis.

- 4 - Remove the screws (1) and their washers.
- 5 - Remove the sprocket assembly (2).

※ 1




Sprocket assembly: 35 kg (77.1 lb.)




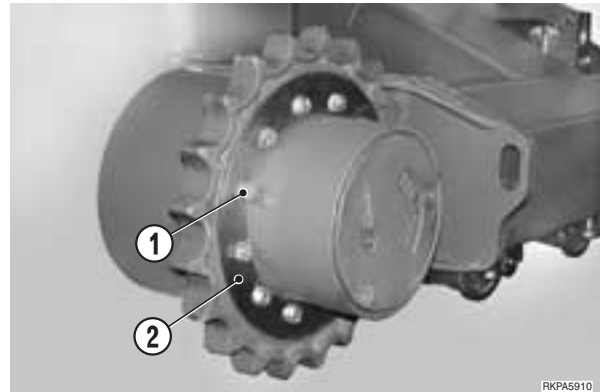
INSTALLATION OF SPROCKET ASSEMBLY

- To install, reverse the removal procedure.

※ 1

 Attachment screws: Loctite 262

 Attachment screws: 163 ± 24.5 Nm
(119.6 ± 18.1 lb.ft.)



REMOVAL OF TRAVEL GEARED MOTOR

! 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 driving wheel. (For details, see «REMOVAL OF THE DRIVING WHEEL»).
- 3 - Disconnect the 4 pipes (2) from the engine and then remove the 4 connections (3).
 - ★ Plug all pipes to keep out impurity.
- 4 - Pull out the screws (4) and remove the assembly (5).

※ 1



Travel assembly: 90 kg (198.3 lb.)

INSTALLATION OF THE TRAVEL GEARED MOTOR

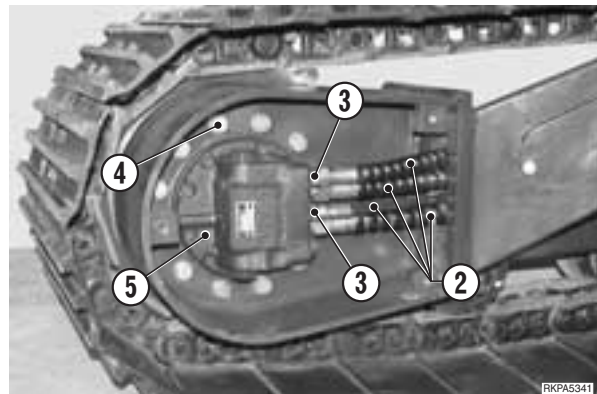
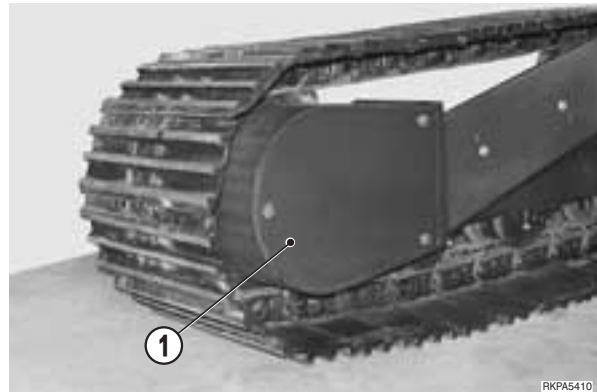
- To install, reverse the removal procedure.

※ 1

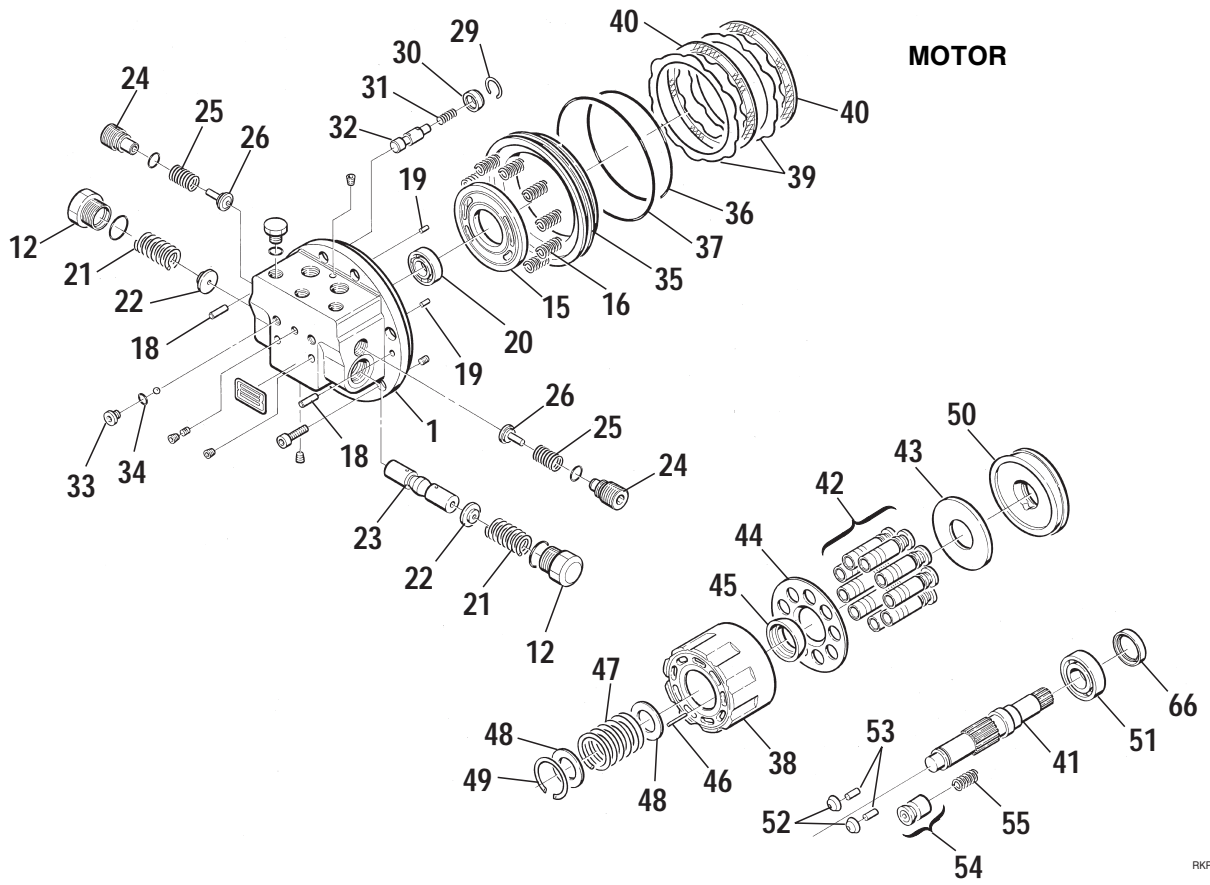
Check screws: Loctite 262

Check screws: 252 ± 39.2 Nm
(185.7 ± 28.9 lb.ft.)

- ★ Bleed air form the travel motor (see «20. TESTING AND ADJUSTMENTS»).

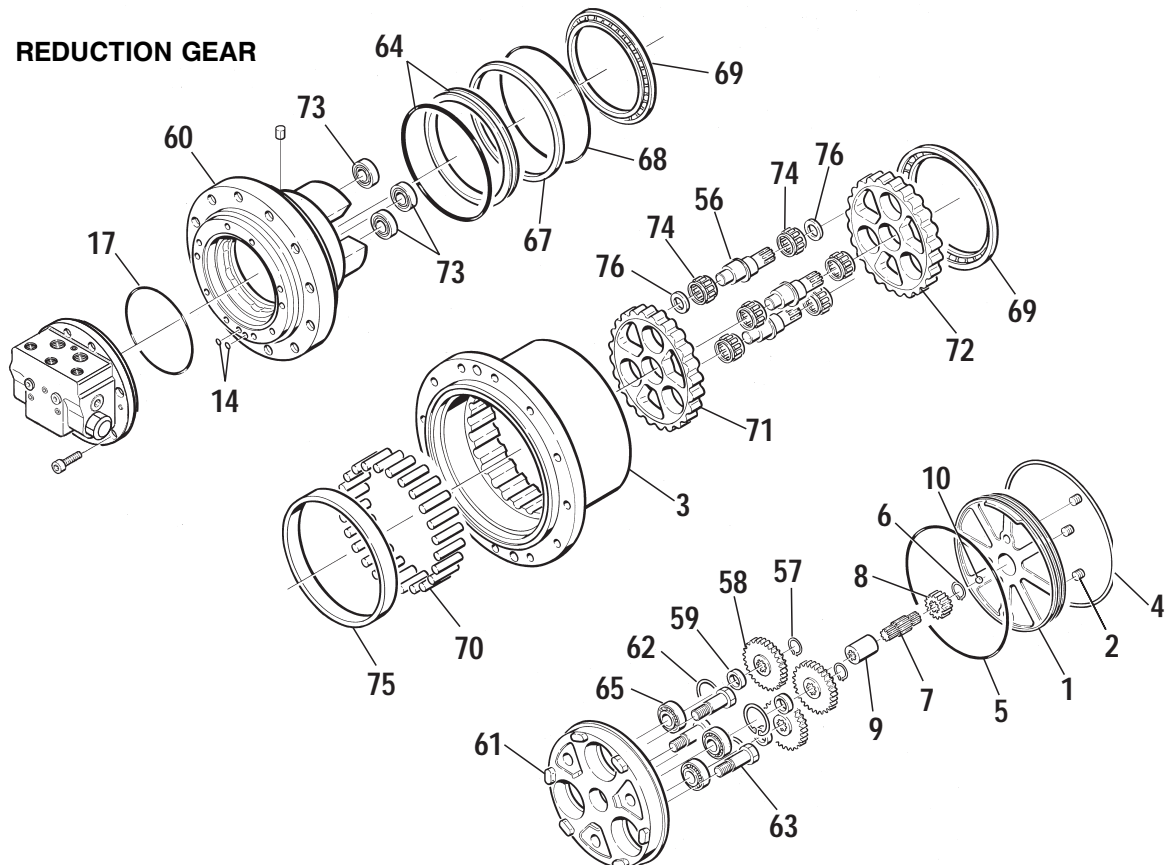


DISASSEMBLY OF TRAVEL GEARED MOTOR



RKP07550

REDUCTION GEAR



RKP07560

Washing the geared motor

- 1 - Wash the complete motor.
 - ★ Close the holes of the hydraulic motor and install two **M8** eye-bolts in the body of the pump so that they are placed diametrically opposite to each other.



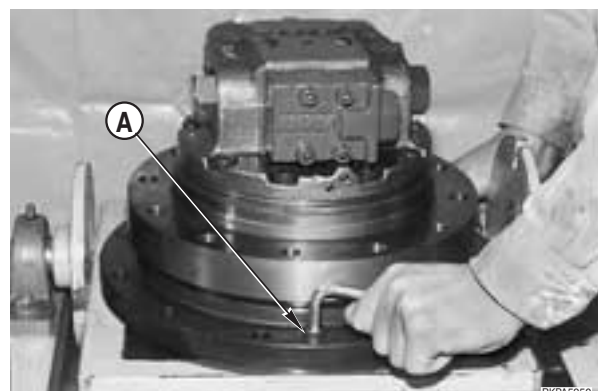
- 2 - When washing, brush the unit so as to eliminate any trace of dust.

**2. Setting the geared motor**

- 3 - Set the geared motor unit on the work bench **M1**.




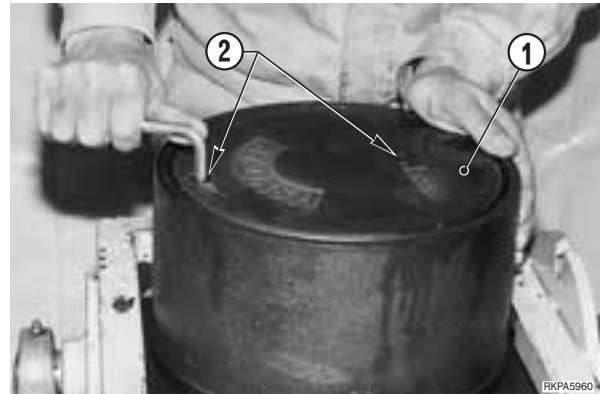
- 4 - Bolt the unit to the revolving cradle on the work bench using two hex. socket bolts **A**.



3. Draining gear oil

- 5 - Turn the unit upside down and partially extract the three plugs (2) from the cover (1).
Turn the unit upside down again and remove the plugs (2) to drain the gear oil.

 Reduction gear oil: approx. 1.7 ℓ (0.45 US.gall)

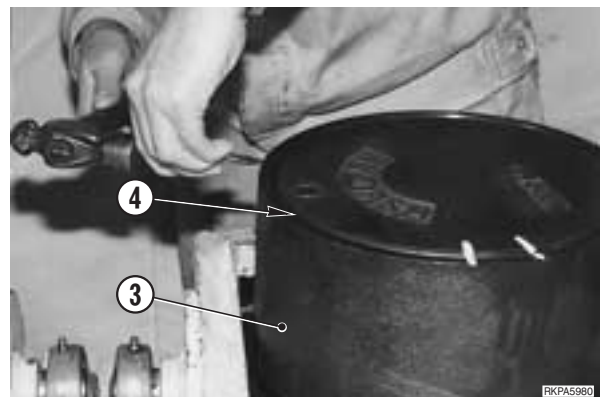
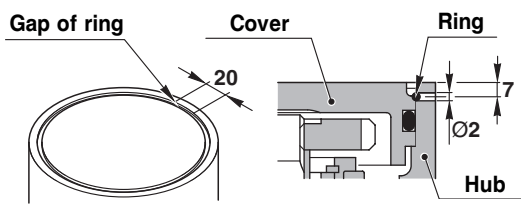


4. Removing cover

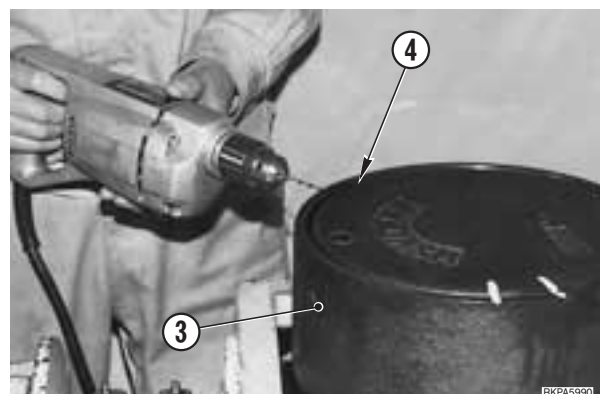
- 6 - Turn the unit upside down bringing the cover (1) to top side.
Scribe match marks between the hub (3) and the cover (1) by using a paint marker.



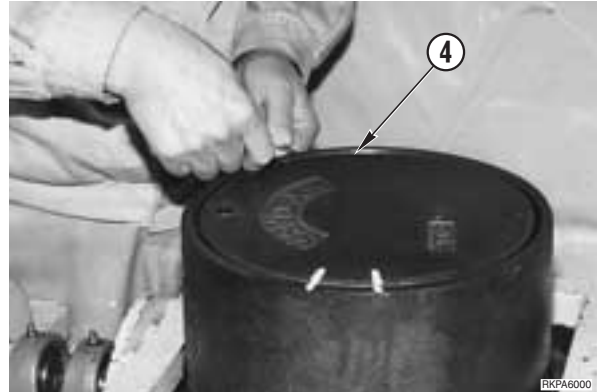
- 7 - Locate the gap of ring (4).
Using a punch, make a mark on the hub (3) at a point about 20 mm (0.788 in.) from ring (4) end and at 7 mm (0.276 in.) from the surface of the hub (3).



- 8 - Using an electric drill, make a 2 mm (0.079 in.) diameter hole at the punch mark as shown at point 7.
- ★ Make sure that the hole is parallel to the surface of the hub (3) and keep drilling until reaching the ring (4).
 - ★ After drilling, wipe off chippings and cinders completely.



9 - Insert a steel rod into the drilled hole and push it in to make the front portion the ring (4) come out.

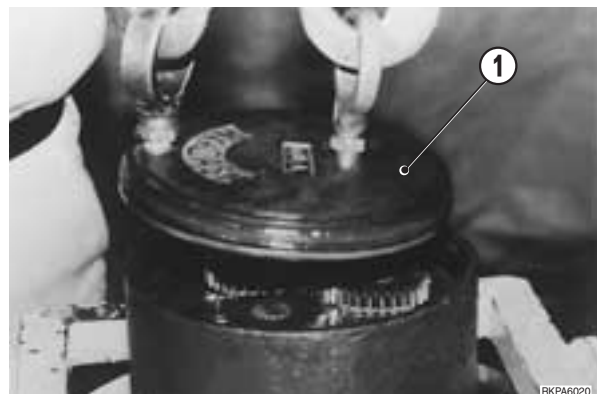


10 - Pick the end portion of ring (4) and pull it out to remove the ring off the groove.



11 - Tighten two (3/8") eyebolts into the plug holes (2) and remove the cover (1) using a piece of hoisting equipment.

★ If the O-ring (5) prevents lifting of the cover (1), put the hoisting ropes under tension and tap on the cover using a plastic mallet so that the cover will slide out without cocking.

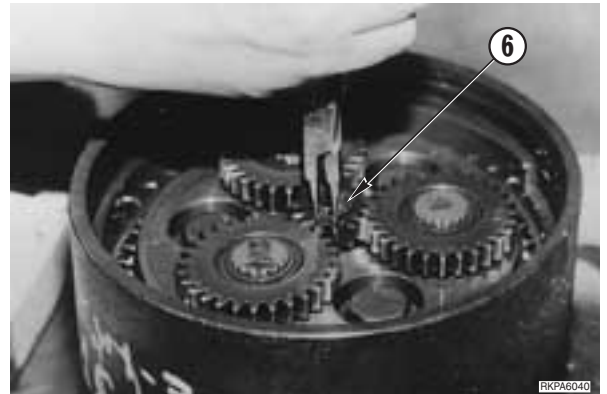


12 - Remove the O-ring (5) from the cover and dispose of it.

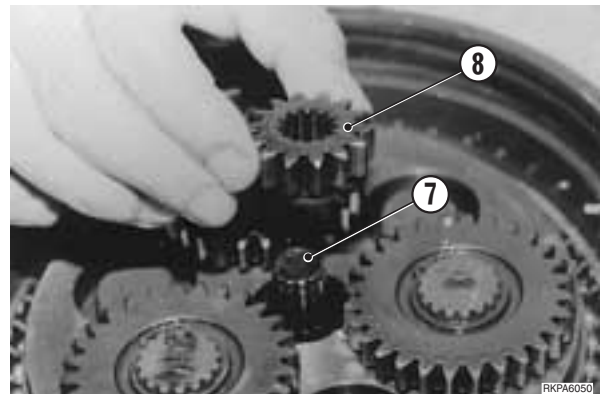


5. Removing input gear

13 - Remove the snap ring (6) from the shaft (7).

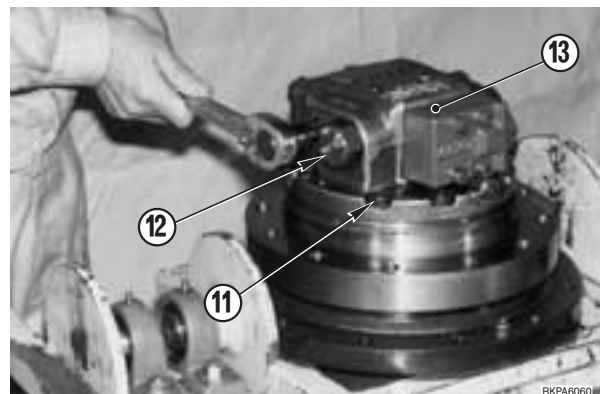


14 - Remove the input gear (8) from the first reduction, remove the shaft (7) the coupling (9) and the steel ball (10).



15 - Turn the unit upside down and remove the screws (11).

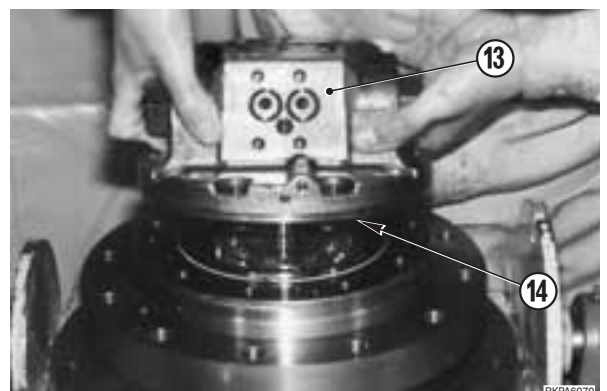
- ★ If the brake valves of the motor (13) are to be disassembled too, loosen the plugs (12) before removing the screws (11).



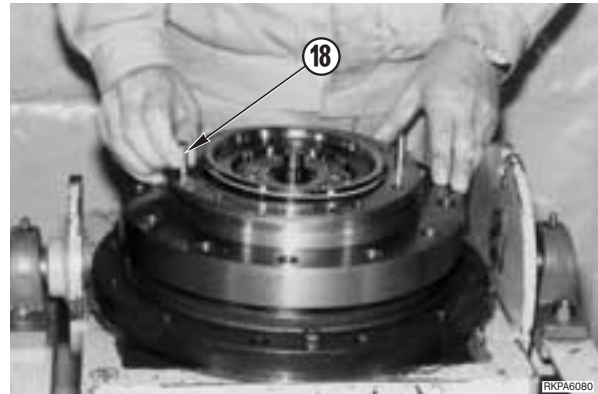
6. Removing rear flange

16 - Remove the motor (13) together with the O-rings (14).

- ★ Lift motor (13) straight up holding it with both hands to avoid dropping the valve plate (15) which is to remain attached to the motor.



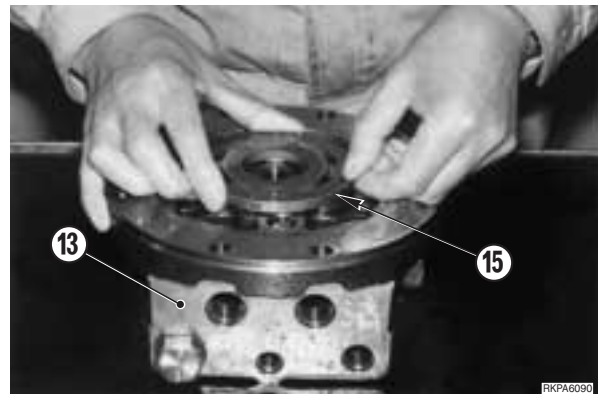
17 - Remove the springs (16), the O-ring (17) and the pins (18).



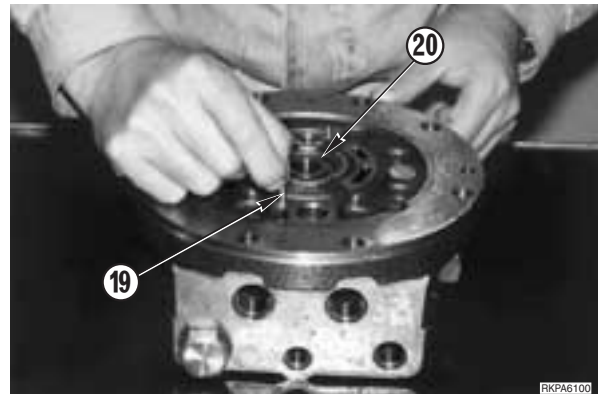
7. Removing parts from rear flange

18 - Remove the valve plate (15) from the motor (13).

- ★ To separate valve plate (15) from the motor (13), never use sharp cornered or pointed tools or the faces will be scratched and suffer serious damage. Gently slide the valve plate to one side whilst prising it.

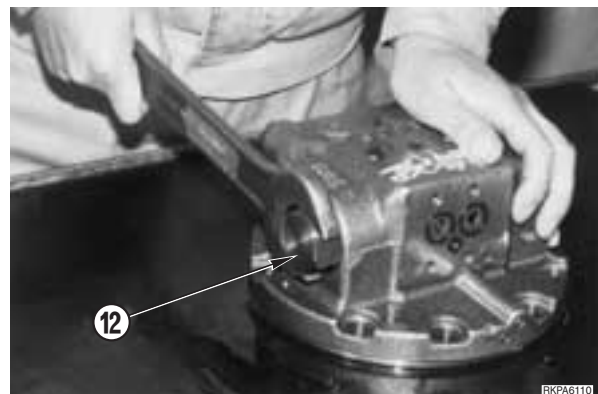


19 - Pull out the pins (19) and the ball bearing (20).

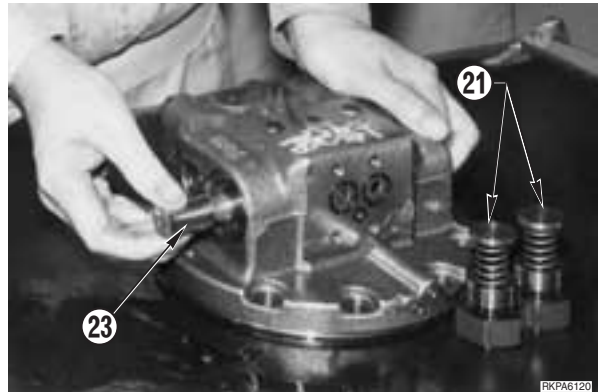


8. Disassembling brake valves

20 - Remove the two plugs (12) of the brake valves.



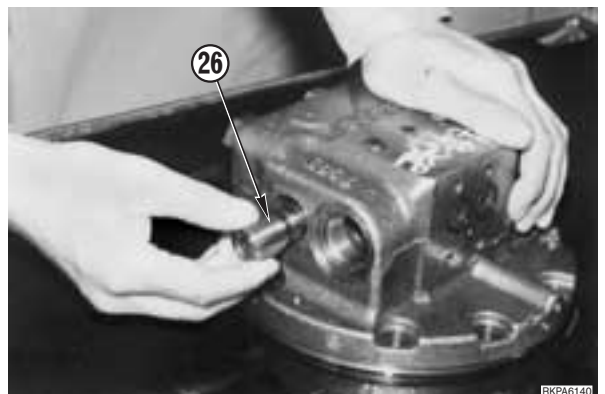
21 - Take out the springs (21), the spring housings (22) and the spools (23).



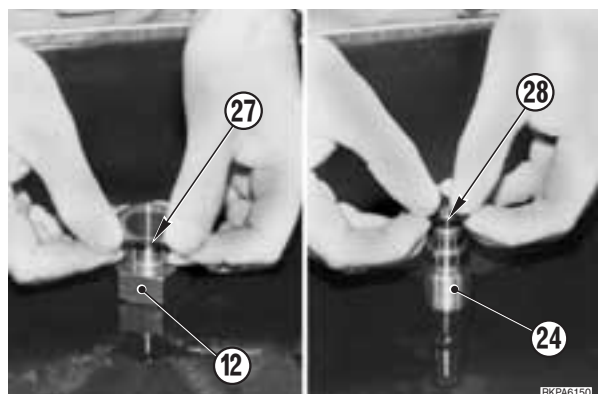
22 - Remove the two plugs (24).



23 - From each plug opening (24), remove the springs (25) and the valves (26).



24 - Remove the O-rings (27) and (28) from the plugs (12) and (24) and dispose of them.

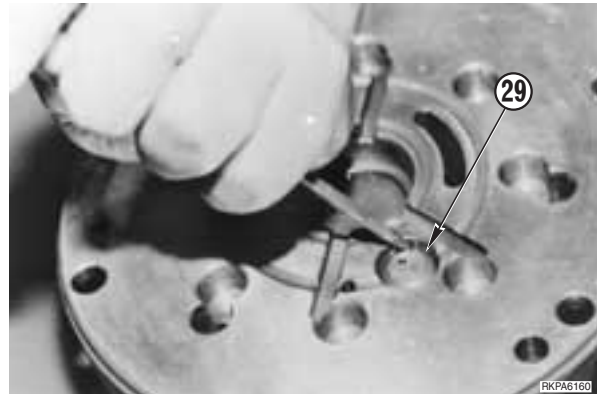


9. Disassembling pilot valve

25 - Remove the snap ring (29) of the pilot valve and discard it. Then, remove the stopper (30), spring (31) and valve (32).

- ★ Do not remove the snap ring (29) if valve (32) is not to be replaced; if the snap ring is removed, then it must be replaced.
- ★ If inverting the motor does not cause the valve to come out, carefully apply compressed air through the speed change port to remove it.

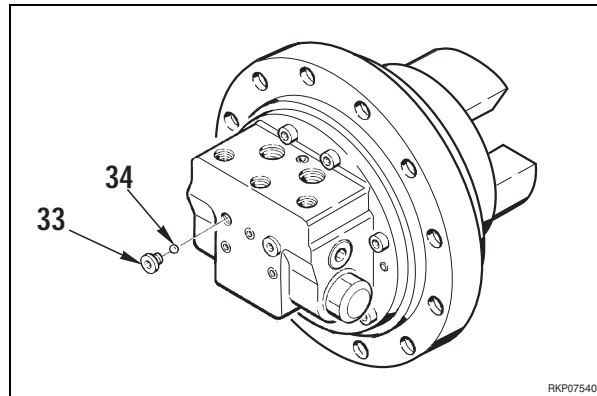
! To ensure your safety, use a protective cover.



10. Disassembling plug

26 - Remove the plug (33).

- ★ Do not remove the plug (33) unless absolutely necessary.
- ★ When removing plug to clean the gates, pay particular attention not to drop the steel ball (34).

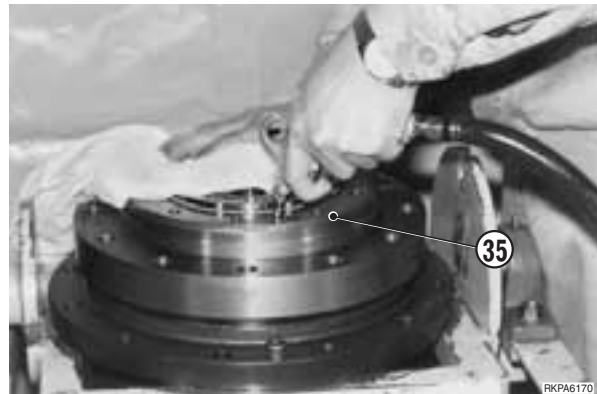


11. Disassembling parking brake

27 - Remove the piston (35) of the parking brake.

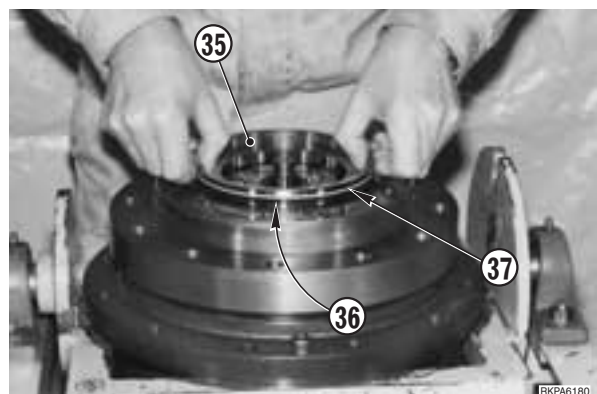
- ★ Carefully inject compressed air through the parking brake access hole to facilitate removal.

! To ensure your safety, apply a protective cover.



28 - Remove the O-rings (36) and (37) from the piston (35) and dispose of them.

! Do not reuse O-rings (36) and (37).



12. Disassembling hydraulic motor

29 - Turn the geared motor by 90° and drain the oil.



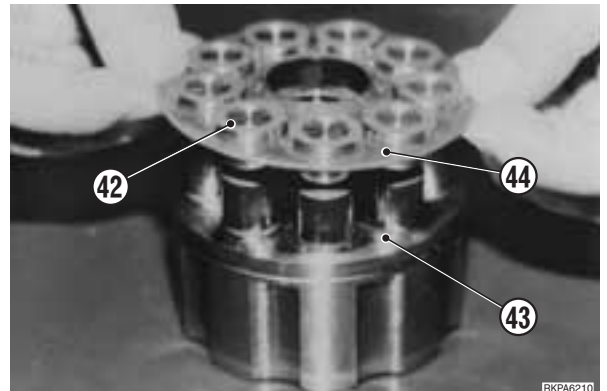
30 - Slowly pull the cylinder block (38) off the motor shaft (41) together with the friction plates (39) and (40).

- ★ Before pulling, rock the cylinder block to and fro several times to facilitate the separation of piston shoes (42) from the sliding face (43).

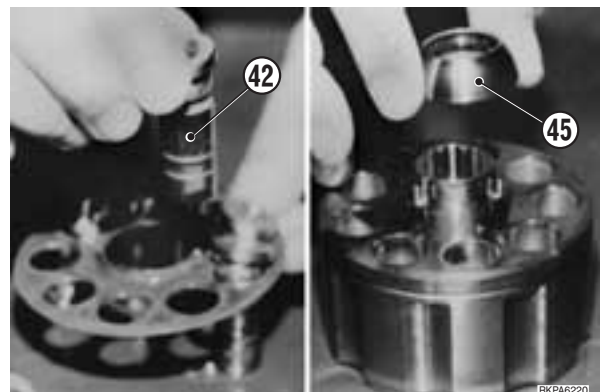


31 - Remove the piston kit (42) from the cylinder block (38) by lifting it together with the retainer plate (44).

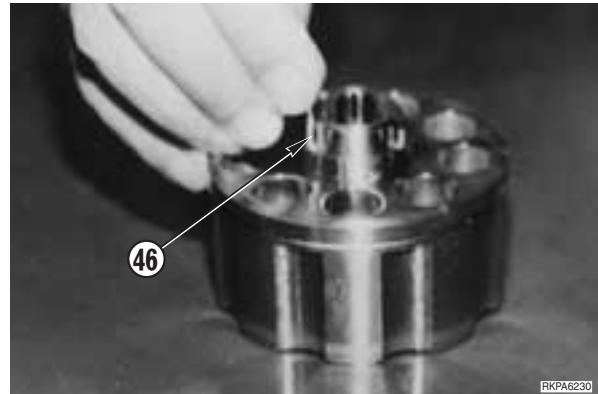
- ★ If any piston or shoe is damaged, the entire kit must be replaced.



32 - Remove each single piston (42) from the retainer plate (44) and the thrust ball (45) from the cylinder block (38).



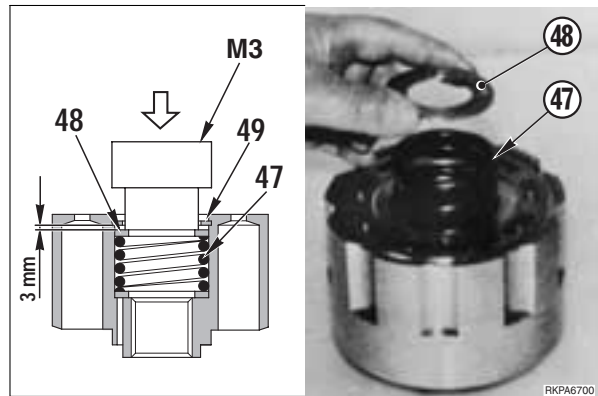
33 - Remove the three dowel pins (46) of the thrust ball (45) from the cylinder block (38).



13. Removing spring from cylinder block

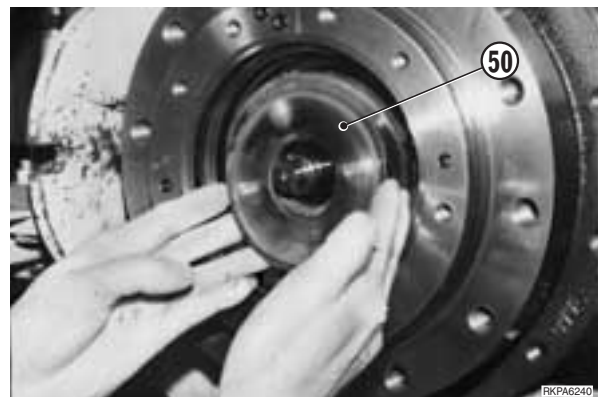
34 - Using tool **M3** and a press, remove the spring (47) and the washers (48) from the cylinder block (38) after picking the snap ring (49) out.

- ★ Do not remove the spring if it is not to be replaced.
- ★ Compress the spring just as much as needed to engage the snap ring (39) with the snap ring pliers (approx. 3 mm (0.118 in.)).
- ★ Protect the surface of the cylinder block to avoid any possible damage.



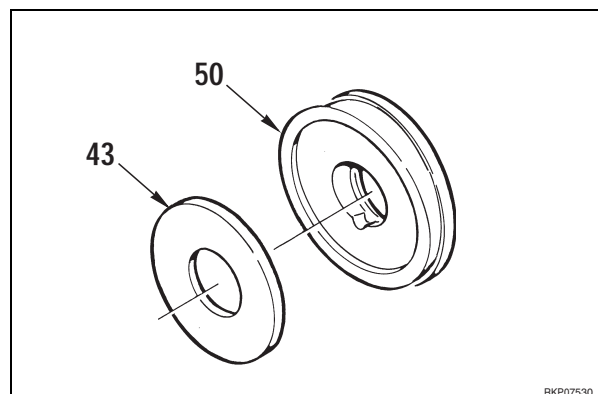
14. Removing motor shaft

35 - Remove the swash plate (50) together with the thrust plate (43) from the motor shaft.



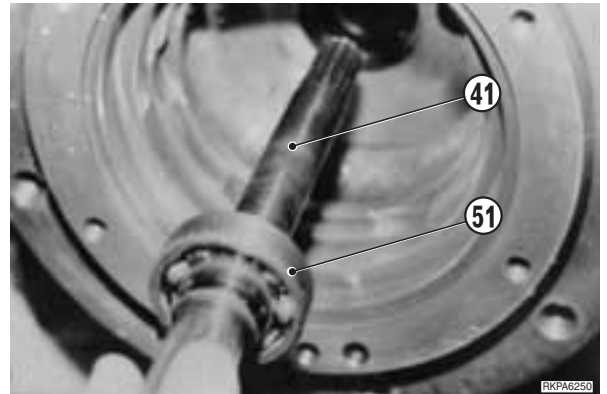
36 - Separate the thrust plate (43) from the swash plate (50).

- ★ If the thrust plate is stuck to the swash plate due to thick oil between them, slide them apart.



37 - Remove the shaft (41) together with the ball bearing (51).

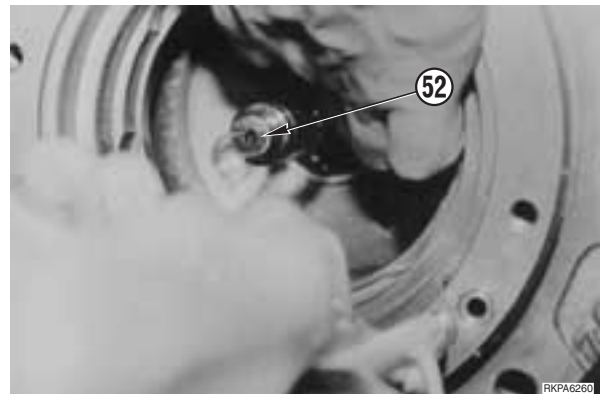
- ★ To remove the shaft (41), lightly kick the shaft end on the reduction gear side with a plastic hammer.



38 - Remove the two pivots (52), pins (53), piston (54) and spring (55).

- ★ Carefully apply low-pressure compressed air to remove the units.

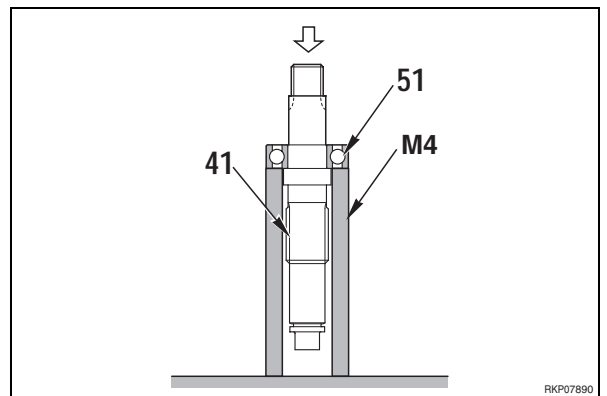
⚠ For your own safety, use a protective cover.



15. Removing bearing from motor shaft

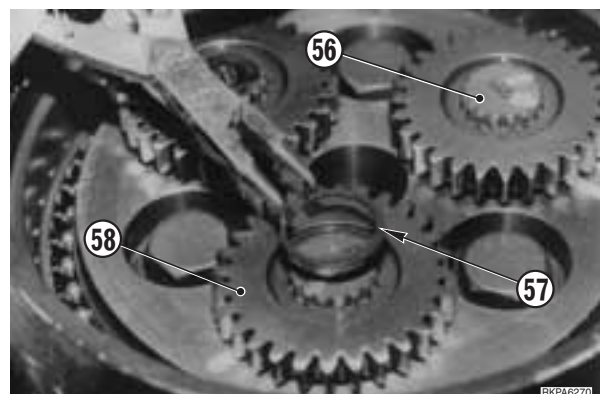
39 - Using tool M4 and a press, remove ball the bearing (51) from the shaft (41).

- ★ Do not remove the ball bearing (51) unless it is to be replaced.
- ★ Do not reuse the removed ball bearing.



16. Removing planetary gears

40 - Turn the motor upside down, bringing the planetary gears to top side and remove the snap rings (57) and gears (58) from the shafts (56).



41 - Remove the distance pieces (59).



17. Removing hold flange

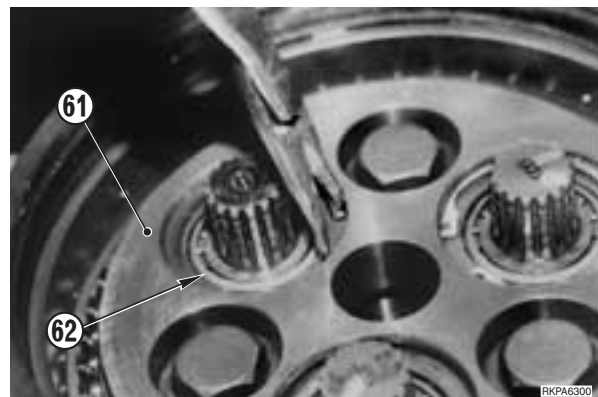
42 - Install two clamps **M2** between the hub (3) and the reduction gear support (60). Tighten the bolts into the respective threaded holes.

- ★ This clamping is necessary to prevent the hub from falling when removing the hold flange (61).



43 - Remove the three snap rings (62).

- ★ Make position match marks across the hold flange (61) and each snap ring (62) by using a paint marker. This is done to ensure that the parts are in their correct position when reassembled.



44 - Loosen the three reamer bolts (63) securing the hold flange (61) to the reduction gear support.

- ★ Loctite 638 is used on screw threads of these bolts. When loosening them, turn the torque wrench back and forth to break the Loctite 638. Repeat this process until each bolt becomes loose enough to be run out by bare hand.



18. Removing flange

45 - Remove the flange (61) from the reduction gear support (60).

- ★ Make match marks across hold flange (61) and reduction gear support (60) by using a paint marker. This to ensure that the parts are in their correct position when re-assembled.

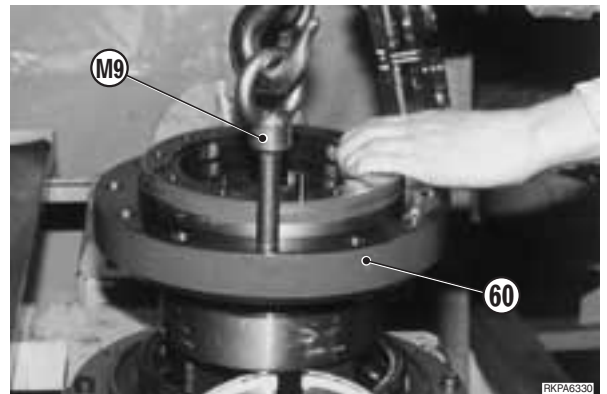
- ⚠ The holes for reamer bolts (63) in the flange (61) are machined with the hold flange attached to the reduction gear support; if one of the parts is damaged, replace the entire assembly at the same time.



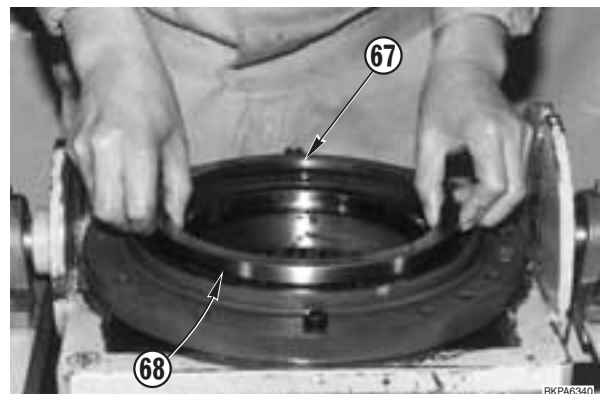
19. Removing reduction gear support

46 - Remove the two clamps **M2** applied at point (42) and after screwing two eye-bolts **M9** into two opposing screw-holes, remove the reduction gear support (60) and the floating seal (64), the outer race of bearing (65) and the seal (66).

- ★ The removed floating seal must be disposed of.



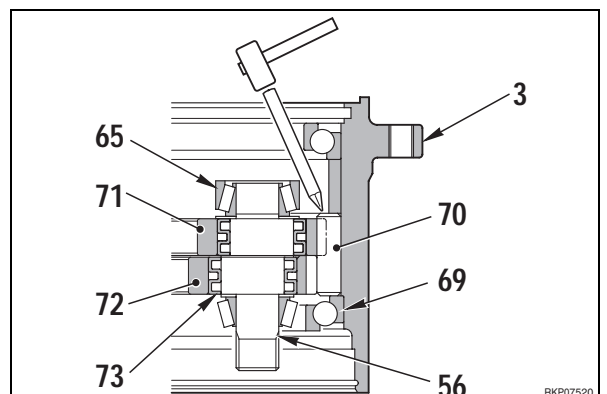
47 - Remove the distance piece (67) and the O-ring (68).



20. Removing ball bearings, gears and pins

48 - Remove the ball bearing (69) from the hub (3) by simultaneously taking out the pins (70) using a pin punch and a hammer.

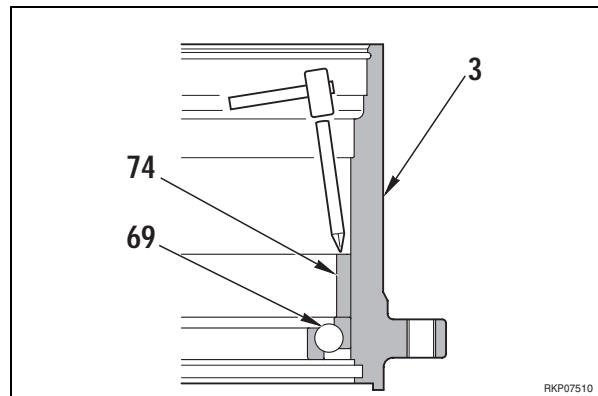
Through this process, the RV gear assembly is also removed. The RV gear assembly consists of gear A (71), gear B (72), crankshafts (56), tapered-roller bearings (65) and needle-roller bearings (73).



- ★ When removing ball bearing (69), move the pin punch 120° at a time in order to keep the distortion of the ball bearing down to a minimum.
- ★ In order to prevent denting of the parts, place a rubber mat under the RV gear assembly.
- ⚠ RV gear assembly can now be disassembled; do not remove needle-roller bearings (73) and distance pieces (75) from the crankshafts (56).

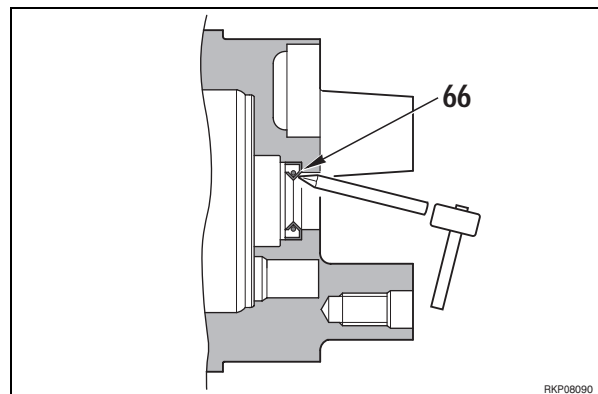
21. Removing ball bearing and distance piece

- 49 - Remove the ball bearing (69) still positioned in its seat by applying a pin punch to the distance piece (74) and hammering the punch.
- ★ Place a rubber mat under the RV gear assembly to prevent denting of parts.

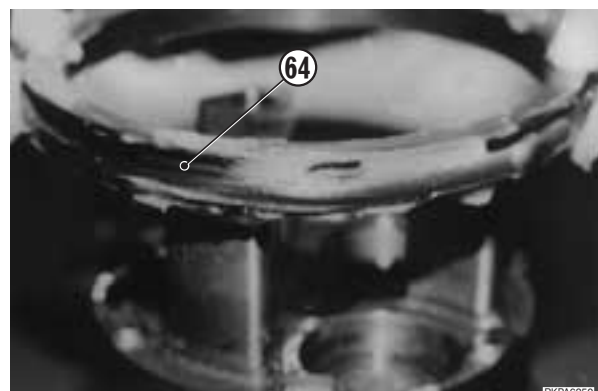


22. Removing central seal

- 50 - Remove seal (66) from reduction gear support (60) and dispose of it.



- 51 - Remove floating seals (64) from the reduction gear support (60).



23. Disassembling hold flange

52 - Remove the outer races of tapered-roller bearings (65) from the reduction gear support (60).

**24. Washing parts**

53 - Wash all parts and dry them out using soft cloths.

54 - Protect all unpainted surfaces from oxidation by coating them with oil.

ASSEMBLY OF TRAVEL GEARED MOTOR

NOTES

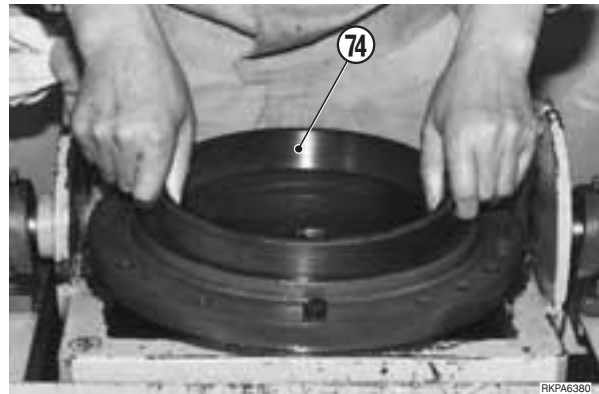
- 1 - If any of the hub (3), reduction gear support (60), hold flange (61), distance piece (74), ball bearings (69) is replaced, adjust the ball bearing (69) preload.
- 2 - If any of the hub (3), reduction gear support (60), hold flange (61), RV gear assembly, bearings (65) is replaced, adjust the preload of tapered-roller bearings (65).
- 3 - For bearing preload adjustment, refer to the sections found at the end of assembly procedures.
- 4 - If all removed parts can be re-used in assembly due to their complying with the required tolerances, follow the assembly procedure below:

1. Hub

- 1 - Bolt hub (3) to the revolving cradle on the work bench M1.




- 2 - Install the distance piece (74) into the hub (3).

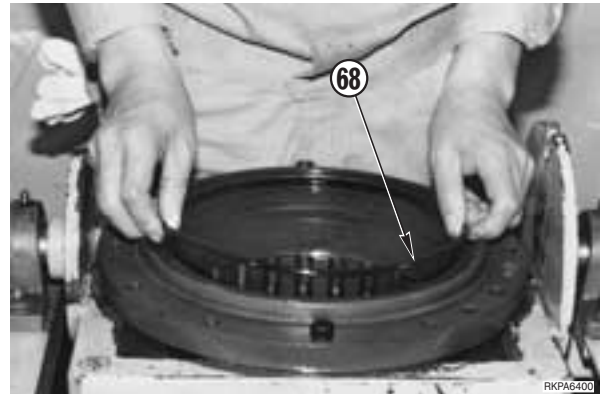


- 3 - Press the ball bearing (69) into the hub (3) by using an aluminium rod and hammer.
 - ★ Shift the aluminium rod around the rim of bearing to keep it flat; tap around to prevent distortion and to keep the bearing flat.



- 4 - Lightly grease the O-ring (68) and fit it into the groove in the hub (3).

 Seal: ASL800050

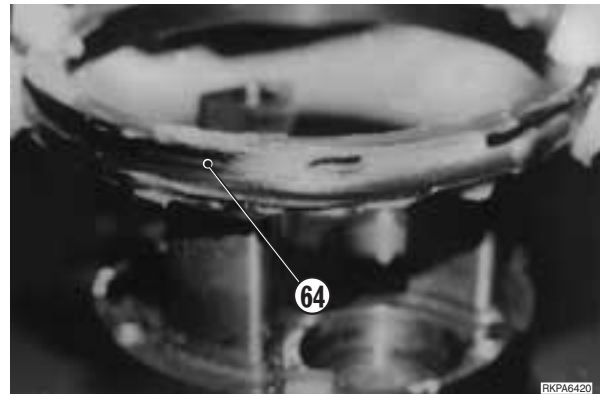


- 5 - Fit distance piece (67) to hub (3), holding it with both hands and lowering it slowly into position.
- ★ As necessary, tap around on distance piece (67) with a plastic hammer.
 - ★ Be careful not to damage the O-ring (68) already in place.

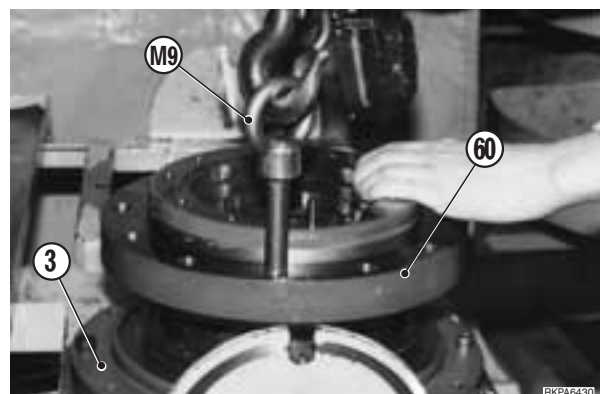


2. Reduction gear support

- 6 - Lightly grease the floating seals O-rings (64) and install them in the reduction gear support (60).
- ★ Separate the O-ring part of the floating seal and grease the seat; fit the O-ring again and make sure that it fits perfectly into the seat. Check that the floating seal is perfectly inserted into its seat.



- 7 - Install the two **M9** eye-bolts into the reduction gear support (60), lift the support with a crane and lower it into the hub (3).



- 8 - Remove the two eye-bolts **M9** and apply two clamps **M2** to hold hub (3) and support (60) together.
 ★ Tighten the two clamps equally.



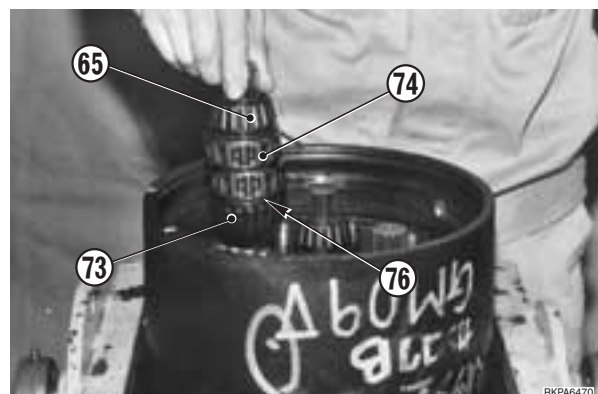
- 9 - Turn over the revolving cradle of work stand **M1** and insert the outer races of the tapered-roller bearings (65).



- 10 - Install the RV gear A (71) into the hub (3).




- 11 - Install the crankshafts (56) complete with needle roller bearings (74), distance pieces (76) and bearings (65) into the outer races of the tapered roller bearings.



12 - Install RVgear B (72) into the hub (3), making sure to align the locating holes.



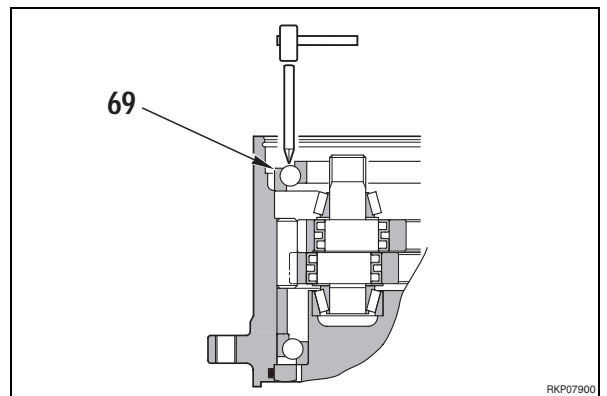
13 - Apply gear oil to the pins (70) and insert them in between the RV gear assembly and the hub.

 Pins: reduction gear oil.




14 - Press ball bearing (69) into the hub by using an aluminium pin punch and a hammer.

- ★ Shift the pin punch around the bearing to keep it flat; tap around to prevent distortion and to keep the bearing flat.



3. Hold flange

15 - Lubricate the seat of the hold flange (61) and install it into the hub (3) by centring the inner race of the ball bearing (69); if necessary, hammer the hold flange lightly with a plastic hammer.


 Flange seat: ASL800040


- ★ Install the hold flange in the same position as before disassembly, referring to the marks made during disassembly.

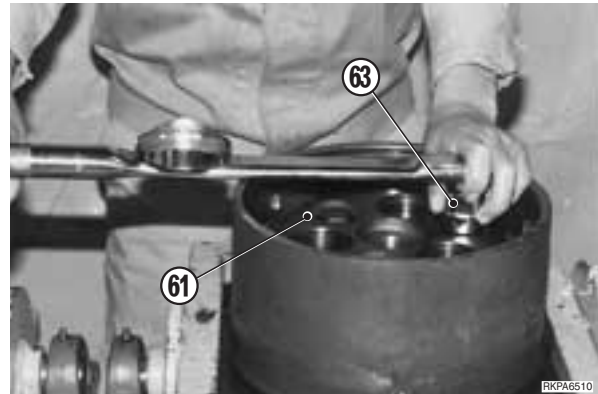


4. Tightening reamer bolts

16 - Thoroughly remove grease from the reamer bolts (63), apply adhesive to the threaded portion and a thin coat of anti-seize lubricant to the shank. Screw the three reamer bolts (63) until the hold flange (61) completely enters in the ball bearing (69).


 Threaded portion: Loctite 638

 Anti-seize lubricant: ASL800040



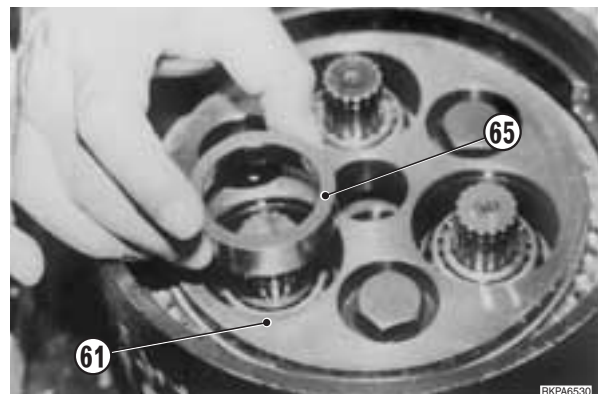
17 - Tighten the three reamer bolts (63) using a dynamometric wrench.

★ Tighten a little at a time increasing the torque so that the tightening force is evenly distributed among the bolts.

 Final torque: 42 ± 6.5 kgm (303.8 ± 47 lb.ft.)

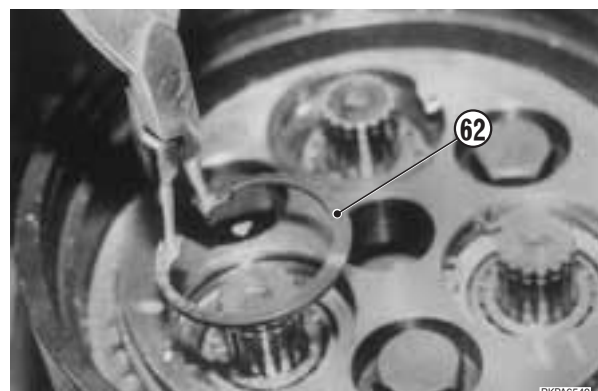


18 - Install the outer races of the tapered roller bearings (65) into the hold flange (61).

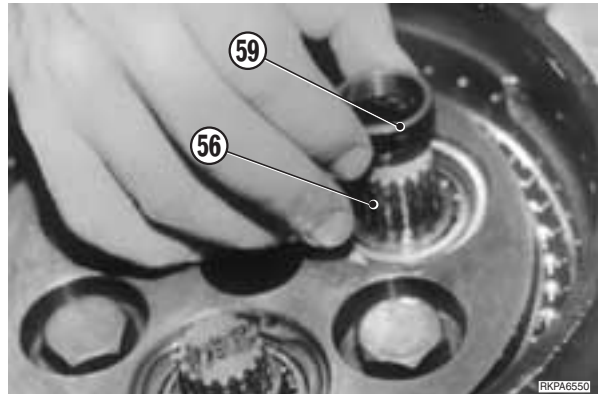


19 - Install the snap rings (62) into the snap ring grooves in hold flange (61).

★ If any of the parts needing preload adjustment is replaced, see adjustment procedure illustrated in the end sections.



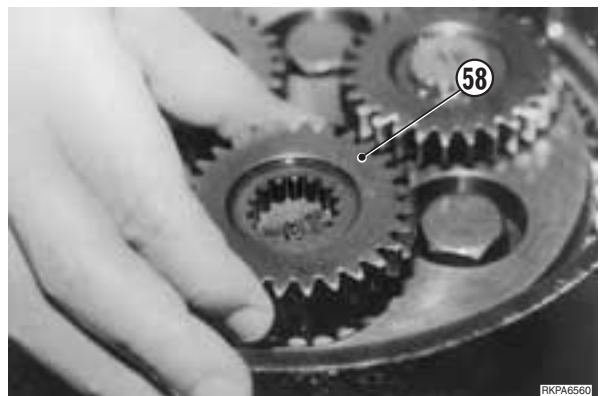
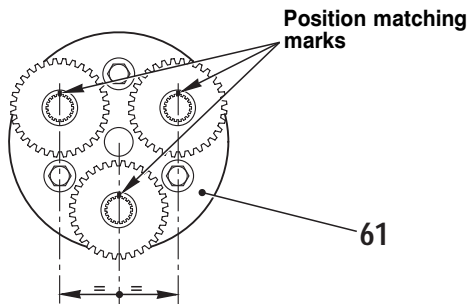
20 - Install the three distance pieces (59) onto each crankshaft (56).



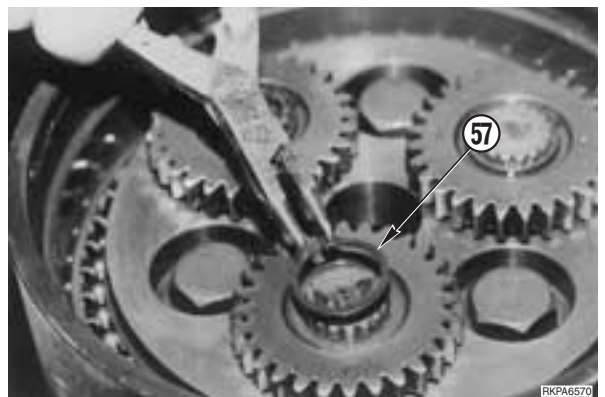
6. Planetary gear

21 - Install the three gears (58) to the crankshafts (56).

- ★ Install the gears in the same angular position defined by the matching marks, as illustrated here.




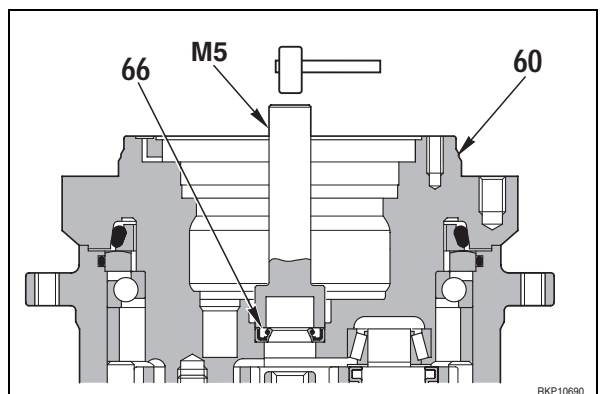
22 - Install the three snap rings (57) into the snap ring grooves in the crankshafts (56).



7. Seals

23 - Turn over the unit under assembly, apply grease to the lip portion of seal and to the outer part of seal (66); force it into the bore of the reduction gear support (60) by driving with the retainer M5 and hammer.

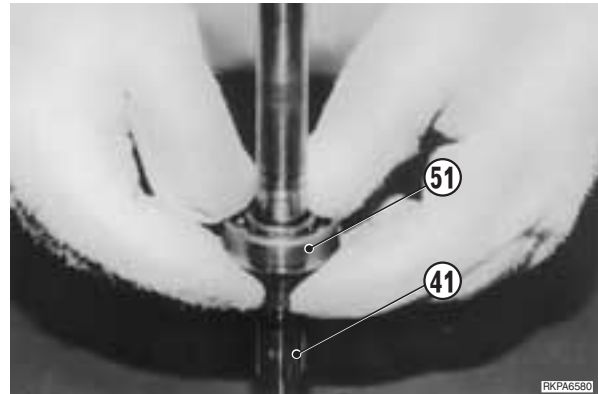
 Seal: ASL800050



8. Motor shaft

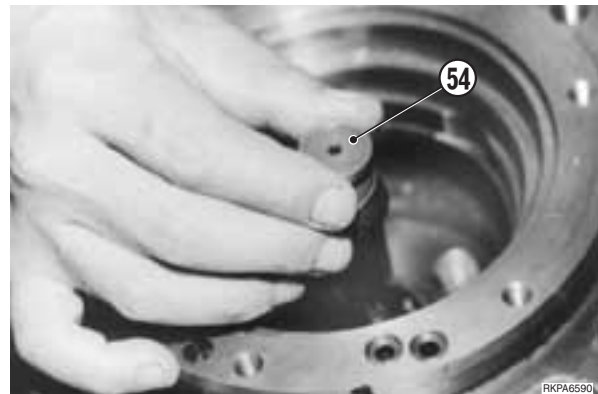
24 - Install the ball bearing (51) onto the motor shaft (41).

- ★ Heat ball bearing (51) by keeping it immersed in oil bath held at $100\pm 10^{\circ}\text{C}$ ($212\pm 50^{\circ}\text{F}$) for 10 minutes.
- ★ Be sure that the inner race sits on the shoulder.



25 - Lubricate the pivots (52), pins (53) and piston (54) and insert them into the reduction gear support (60).

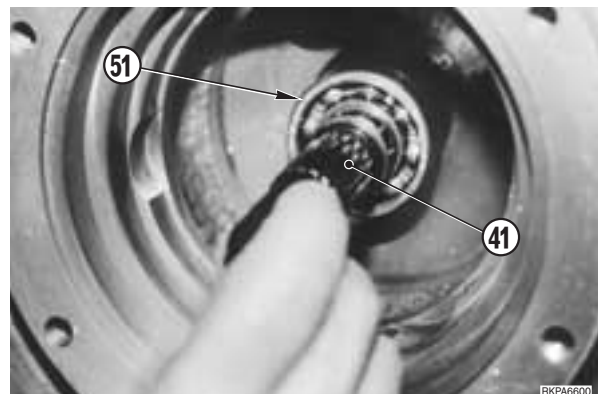
- 🔧 Pins, piston pivot: ASL800050



26 - Turn over the unit by 90° , lubricate the outer race of bearing (51) and slowly insert it into the reduction gear support (60).

- 🔧 Bearing: ASL800040

- ★ Take care not to scratch or damage the lip portion of seal (66) with the splined end of shaft (41).



27 - Lubricate the splines of shaft (41) and the swash plate (50) where matching the surface of reduction gear support.

- 🔧 Shaft and swash plate: ASL800040

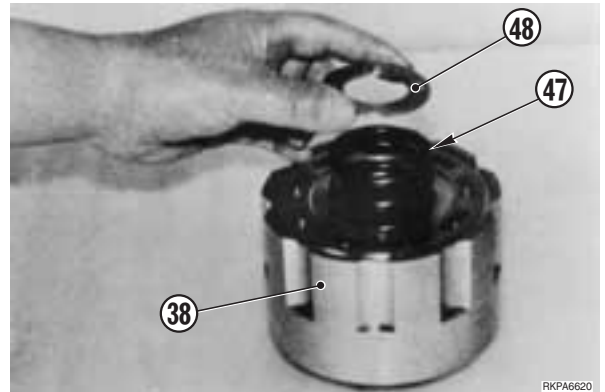
Insert the swash plate into the reduction gear support (60).

- ★ Make sure that the locating pivot of the reduction gear support centers the grooves of the swash plate.



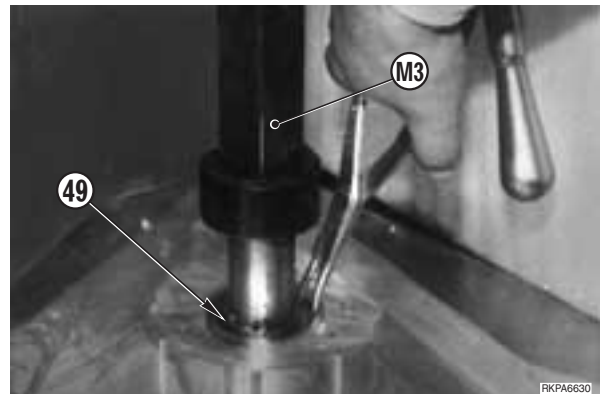
9. Cylinder block

28 - Insert washer (48), spring (47), the second washer (48) and the snap ring (49) into the cylinder block.



29 - Place the block under a press and using a retainer **M3** centred on the outer washer (48), press the spring until the snap ring groove becomes cleared. Fit the snap ring.

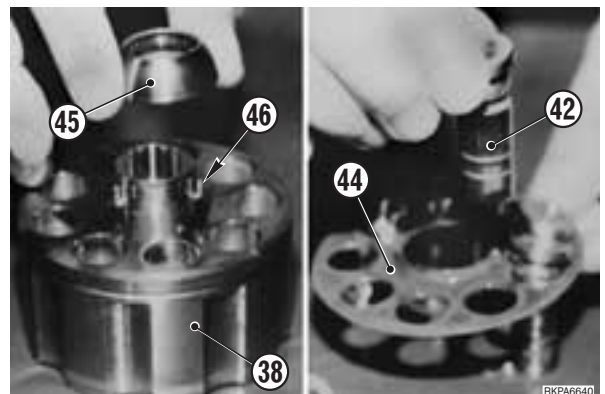
- ★ Protect the surface of the cylinder block to prevent any damage.



10. Hydraulic motor parts

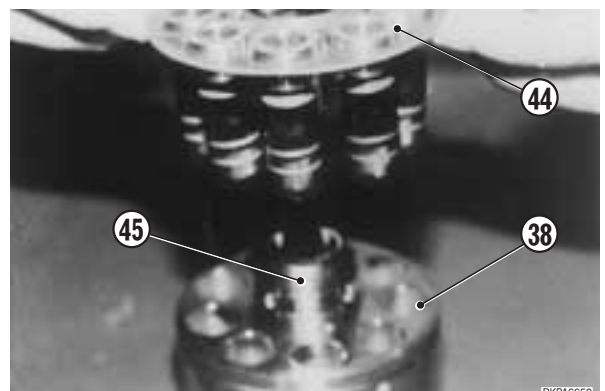
30 - Insert the three dowel pins (46) into the pin holes of the cylinder block (38). Install the thrust ball (45) onto the dowel pins (46).

31 - Insert the 9 pistons (42) into the retainer plate (44) and immerse the sub-assembly in hydraulic oil.

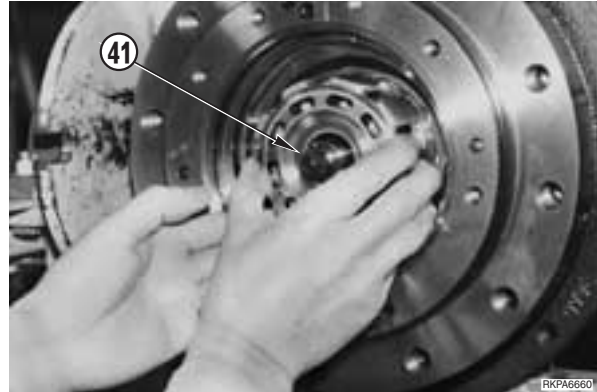


32 - Install the sub-assembly consisting of pistons and retainer-plate into the cylinder block (38).

- ★ Check that the retainer plate (44) fits snugly to the thrust ball (45).



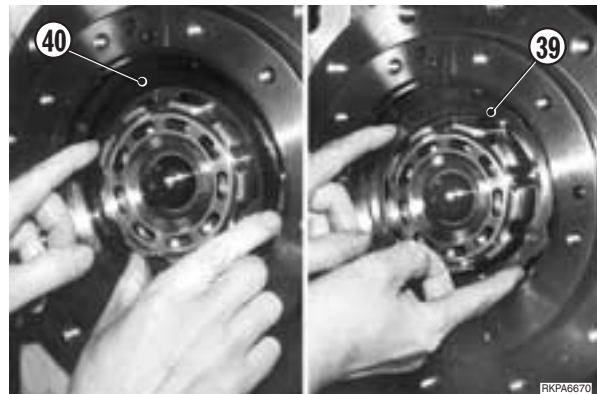
33 - Install the complete cylinder block to the motor shaft (41).



11. Parking brake

34 - Fit the friction unit into the grooves of the cylinder block (38) by installing first a friction plate (40) then a mating plate (39), the second friction plate (40) and then the final mating plate.

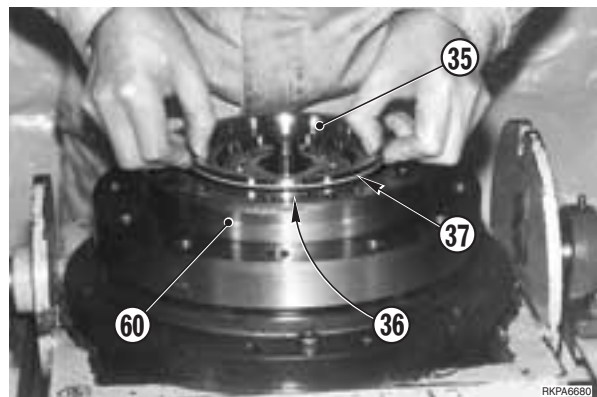
★ Immerse the friction plates (40) in hydraulic oil before fitting them.



35 - Lubricate O-rings (37) and (36) and fit them onto the piston (35).
Fit the piston (35) into the reduction gear support (60) taking care not to damage the seals.

🔧 Seals: ASL800050

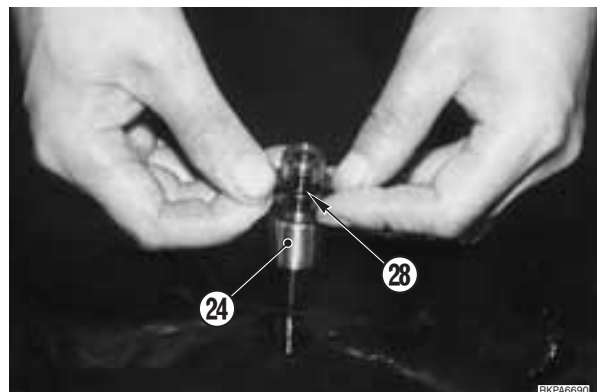
★ If necessary, tap all around the edge with a plastic mallet.



12. Braking valve (in rear flange)

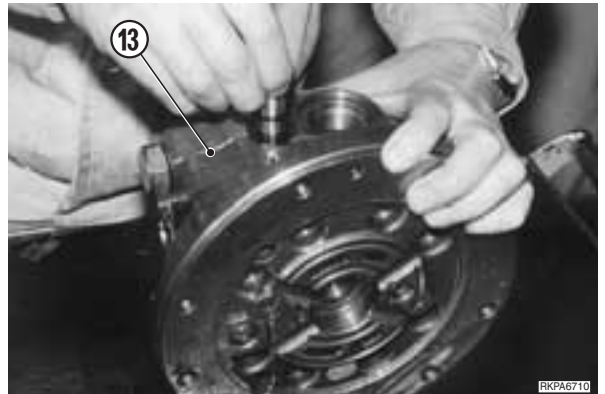
36 - Grease the O-rings (28), the springs (25) and the valves (26) and fit each single part into the plugs (24).

🔧 Seals, springs and valves: ASL800050




37. Insert the complete valve assemblies into the rear flange (13).

- ★ Fit the valve assemblies preventing valves (26) and springs (25) from cocking.



38 - Tighten valve plugs (24).


 Plugs: 13 kgm (94 lb.ft.)

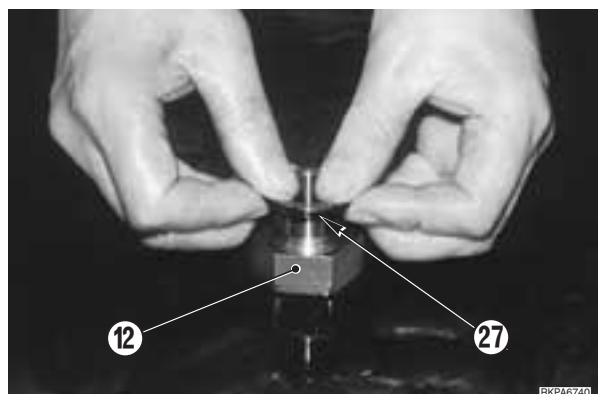


39 - Lubricate the spools (23) and insert them into the rear flange (13).



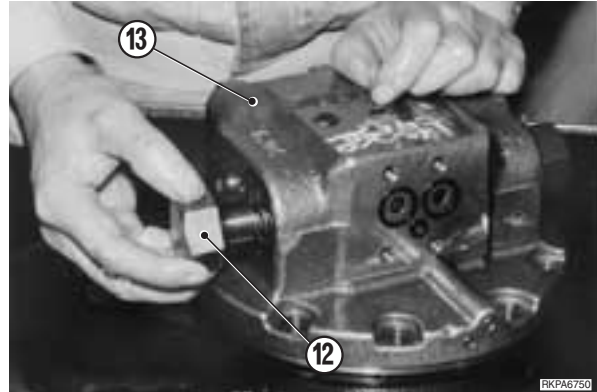
40 - Lightly lubricate the O-rings (27) and fit them onto the plugs (12).

 O-rings: ASL800050




41 - Grease and fit springs (21) and spring retainers (22) into plugs (12); screw the two assemblies into the rear flange (13).

 Springs and spring retainers: ASL800050



42 - Tighten valve plugs (12).

 Plugs: 36 kgm (260.4 lb.ft.)



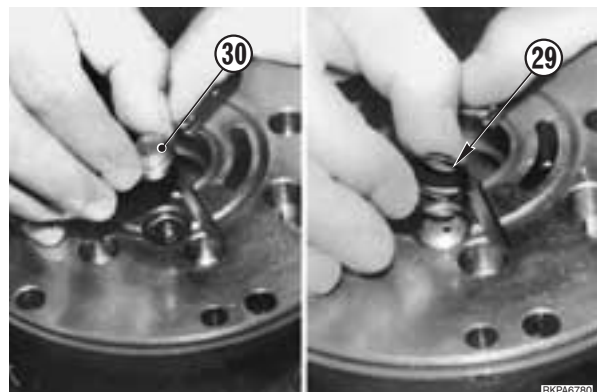
13. Rear flange

43 - Lubricate the valve (32) with hydraulic oil and insert it into the rear flange (13).



44 - Fit the spring (31) and the stopper (30) into valve (32) and finally install the ring (29) that holds the subassembly together.

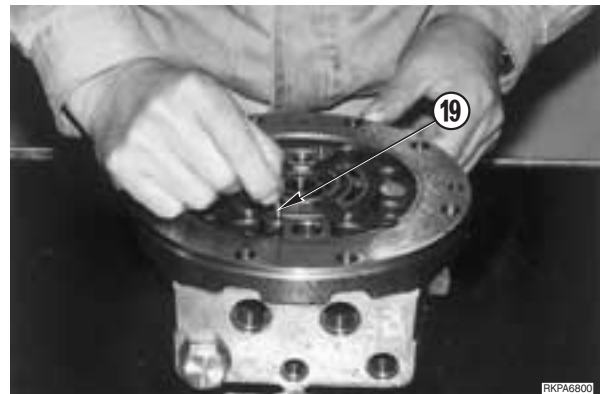
★ The ring (29) must be a new one.



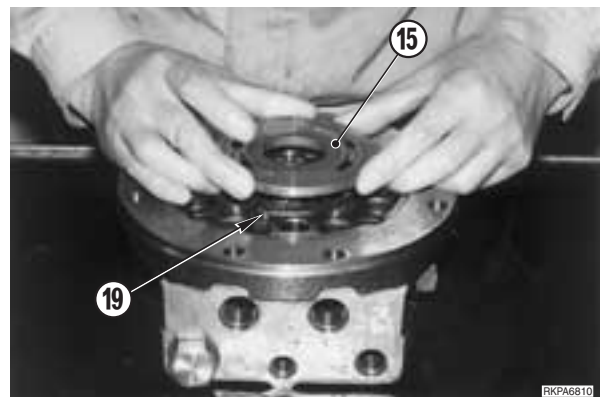
45 - Lubricate the ball bearing (20) and fit it into the rear flange (13).



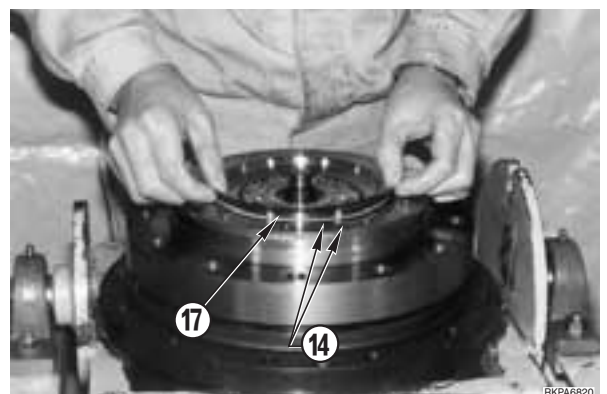
46 - Insert the pins (19) into the rear flange (13).




47 - Lightly grease the surface of the valve plate (15) and fit it to the rear flange (13) taking care to centre the pins (19).

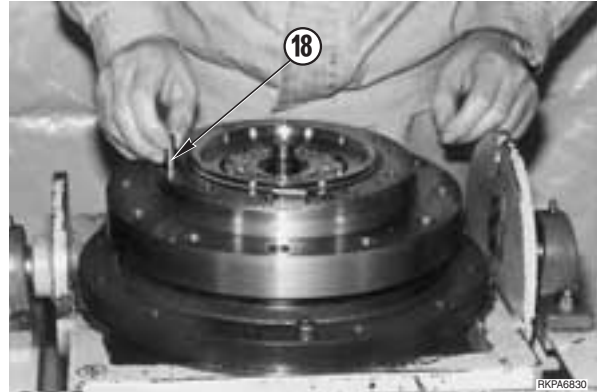


48 - Fit the O-rings (14) and (17) into the grooves provided in the reduction gear support (60).
 ★ Do not lubricate seals.

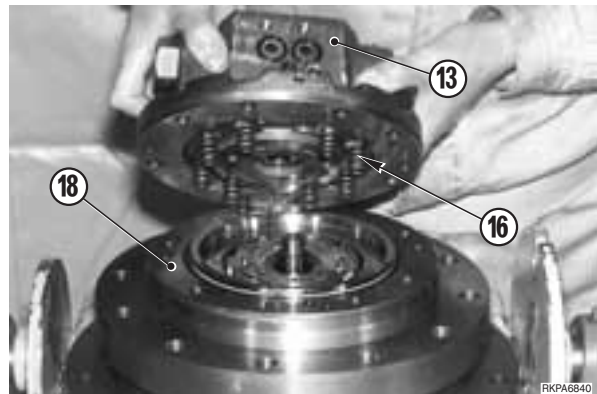


49 - Fit the pins (18) into the reduction gear support (60) and pour hydraulic oil in the support.


 Hydraulic oil: 0.55 ℓ (0.145 US.gall)

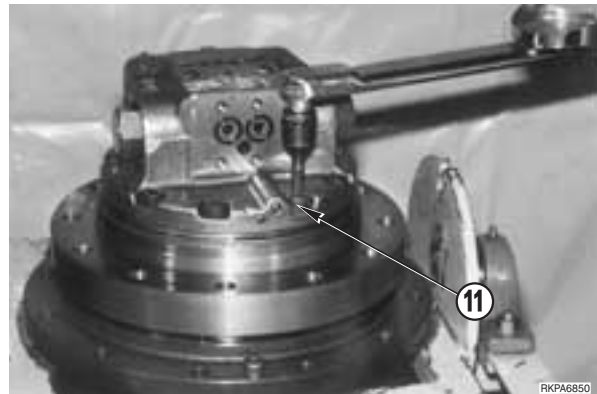


50 - Generously apply grease to the springs (16) and insert them into the rear flange (13). Turn the rear flange (13) upside down and fit it to the reduction gear support (60) so that it centres the pins (18).




51 - Fasten the subassembly with the screws (11).

 Fastening screws: 5.9±1 kgm (42.7±7.23 lb.ft.)




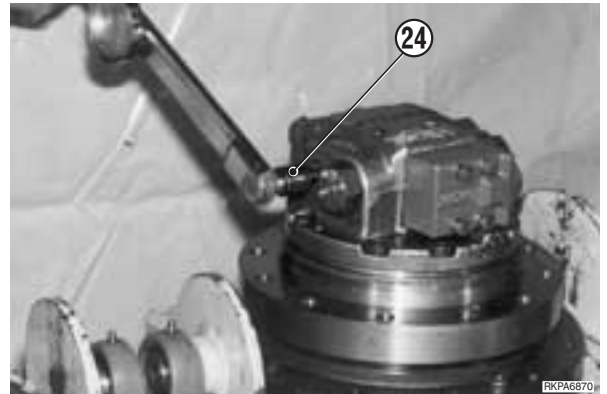
52 - Fasten the two valve plugs (12).

 Valve plugs: 36±4 kgm (260.4±29 lb.ft.)



53 - Lock the valve plugs (24).

 Valve plugs: 13±1.5 kgm (94±10.8 lb.ft.)




15. Input gear

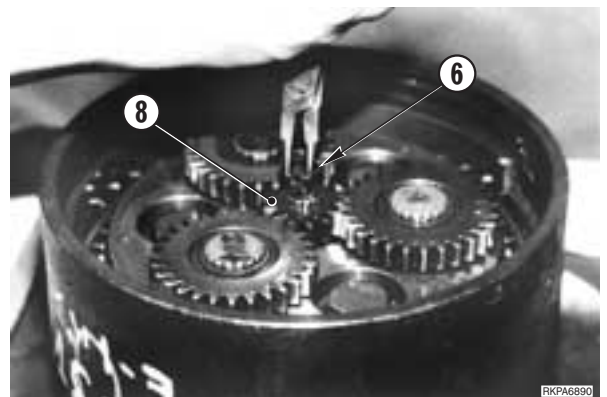
54 - Install the coupling (9) and the input gear (8) onto the motor shaft (41).

★ The teeth of input gear (8) should mesh smoothly with the gears (58); if not, it means that the sub-assembly is improperly reassembled. In such case, check for the cause.




55 - Fit the snap ring (6) to lock the input gear (8) into position. Grease the steel ball (10) and position it in the shaft (7).

 Steel ball: ASL800050




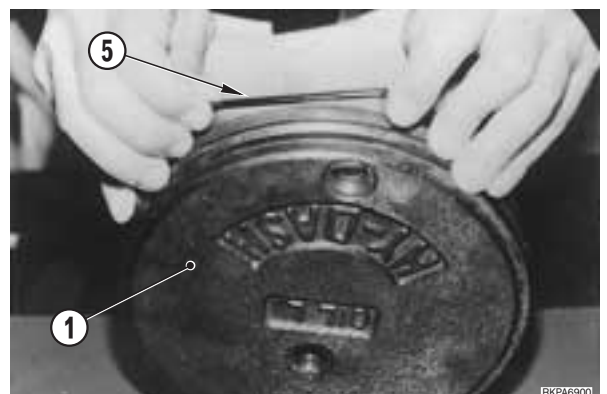
16. Cover

56 - Pour gear oil into the hub (3).

 Oil for hub: 1.7 ℓ (0.45 US.gall)

57 - Grease the O-ring (5) and fit it on the cover (1).

 O-ring: ASL800050

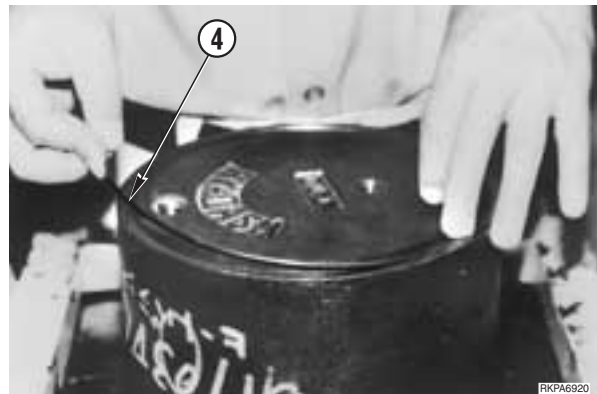


58 - Fit the cover (1) on the reduction gear support (60) matching the marks made during disassembly.


- ★ After positioning the cover, force it in lightly by tapping with a plastic hammer on and around its rim.



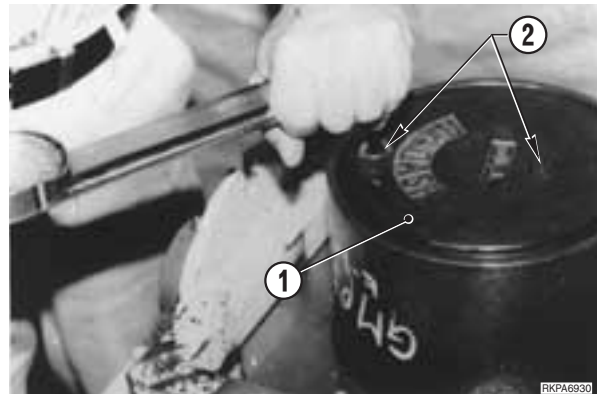
59 - Lock cover in place by installing ring (4).



60 - Apply sealant to the plugs (2), run them into the cover (1) and tighten.

 Plugs: ASL800060

 Plugs: 4 ± 1.5 kgm (29 ± 10.8 lb.ft.)




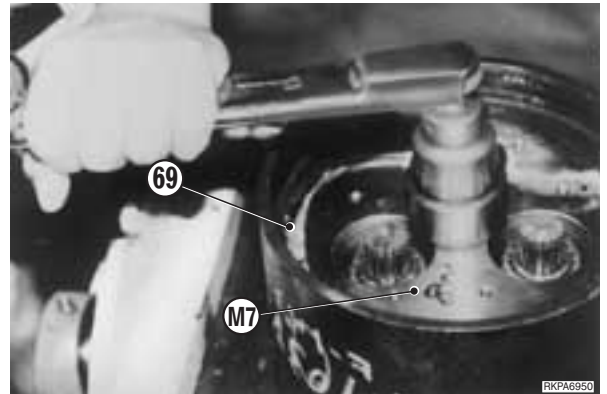
61 - Remove the complete geared motor from the cradle of the work bench **M1**.



ADJUSTING BALL BEARING PRELOAD

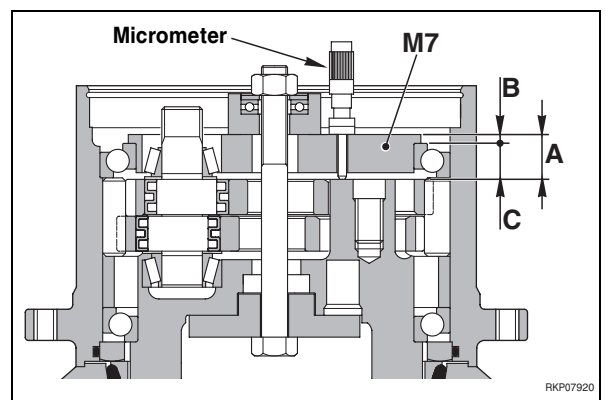
- 1 - Fit the hub (3) onto the tool **M7** for adjusting the preload of the main bearing (69); press fit the ball bearing (69) into the hub, install the flange of the tool and tighten the nut.

 Nut: 4 kgm (17 lb.ft.)



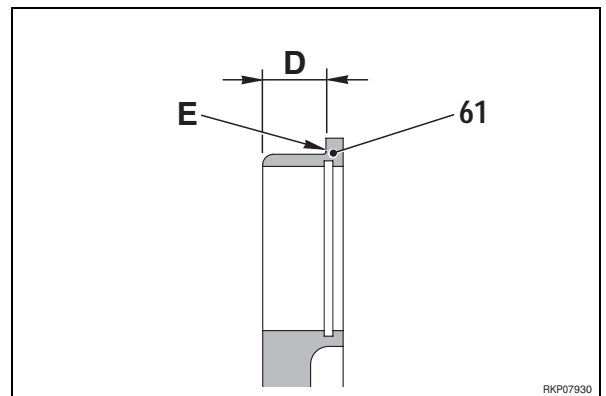
- 2 - Insert a depth micrometer through the hole provided in tool **M7** in order to determine value «**A**». Since «**B**» is a known dimension of tool **M7**, clearance of bearing can be determined as follows:

$C = A - B$ where **A** = measured value
B = tool dimension
C = clearance of preloaded bearing



- 3 - Check dimension **D** of the hold flange (61):

- a - If measured dimension **D** is smaller than the required value **C**, lower the surface **E** of the hold flange (61).
- b - If measured dimension **D** matches the required value **C**, use the flange as it is.
- c - If measured dimension **D** is greater than the required value **C**, replace the complete reduction gear support assembly.
 - ★ Dimension **D** of the new hold flange (61) allows for adjustment.

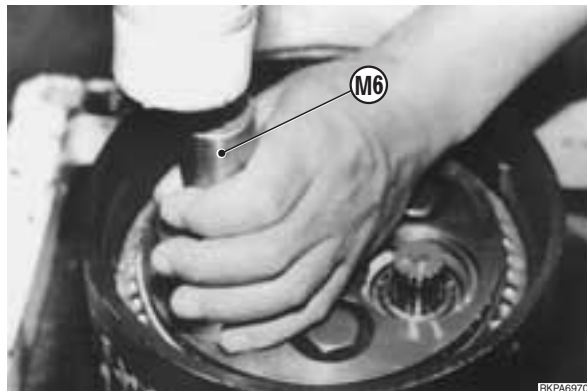


- 4 - Remove tool **M7** from the reduction gear support and proceed with the usual assembly procedure.



ADJUSTING AXIAL CLEARANCE ON TAPERED ROLLER BEARINGS

1 - Apply retainer **M6** to the outer races of tapered roller bearings (65) on the crankshafts (56); lightly hammer the retainer to facilitate the insertion of the RV gears (71) and (72) into the reduction gear support (69).



2 - Fit the least thick snap rings (62) in the grooves provided in the hold flange (61).

★ Snap rings (12) come in 12 different types of thickness, each one varying by 0.05 mm (0.002 in.) from the other.

3 - Using the thickness gauge **M10**, measure the clearance between the snap rings (62) and the tapered roller bearings (65).

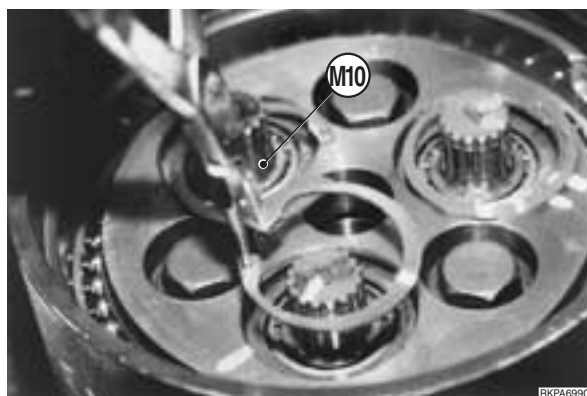
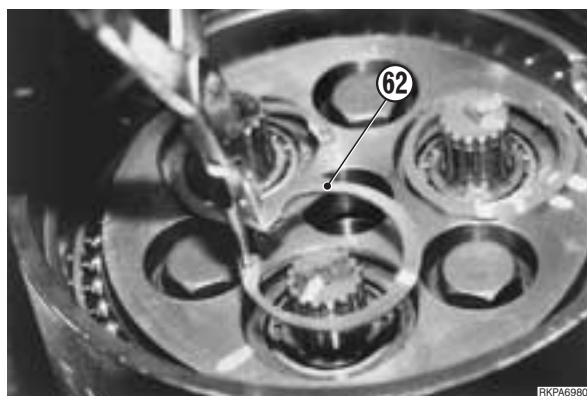
4 - Determine whether the thickness of the snap ring is within the tolerances required, as follows:

$$\text{MAX} = \text{thickness gauge thickness} + \text{snap ring thickness}$$

$$\text{MIN} = \text{thickness gauge thickness} + \text{snap ring thickness} - 0.05 \text{ mm (0.002 in.)}$$

5 - Select the suitable snap ring by choosing the correct thickness among the values reported in the table below:


Group	Dimension t (mm)
A	Over 1.90 and up to 1.95
B	Over 1.95 and up to 2.00
C	Over 2.00 and up to 2.05
D	Over 2.05 and up to 2.10
E	Over 2.10 and up to 2.15
F	Over 2.15 and up to 2.20
G	Over 2.20 and up to 2.25
H	Over 2.25 and up to 2.30
I	Over 2.30 and up to 2.35
J	Over 2.35 and up to 2.40
K	Over 2.40 and up to 2.45
L	Over 2.45 and up to 2.50



REMOVAL OF IDLER AND RECOIL SPRING ASSEMBLY


1 - Position the connecting 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 connecting pin (1) using the tool **C1**.

★ While taking the track shoe to pieces, 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 - Using the tool **C2**, put a sling around the group (4) and draw it out of the track-frame guides (5).

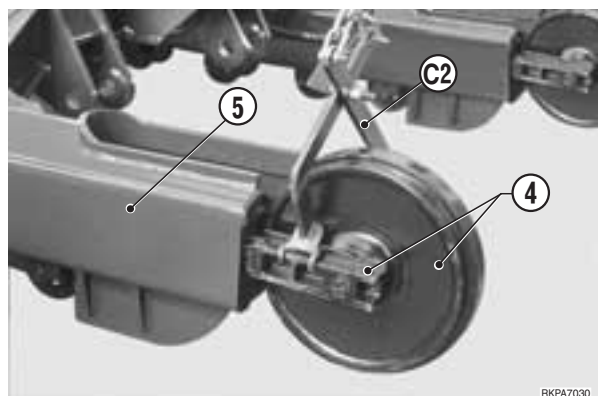
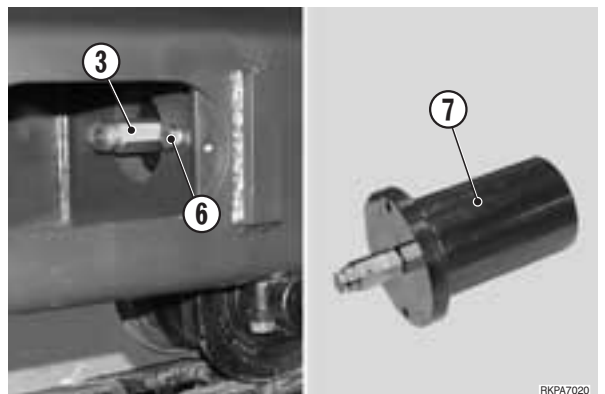
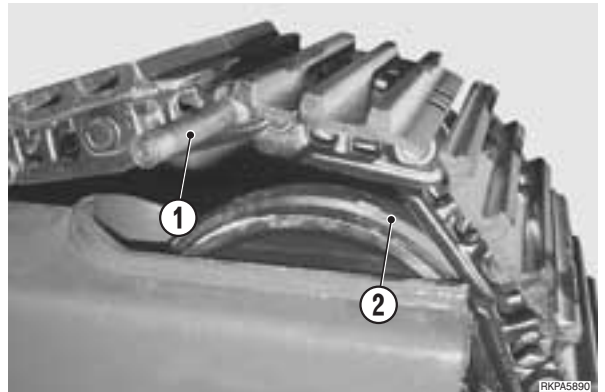
 Complete group: 75 kg (165.2 lb.)

6 - Unscrew and take out the screws (6) and remove the cylinder (7).

★ Take care not to damage the grease nipple (3).

7 - Set the group 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.

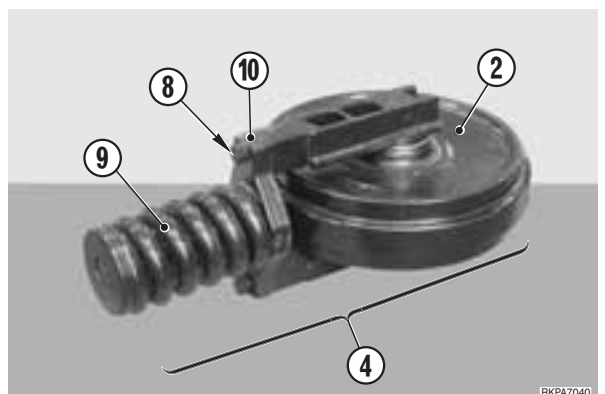


INSTALLATION OF IDLER AND RECOIL SPRING ASSEMBLY


● 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. 600 ℓ (158.4 US.gall.)

1 - Detach the recoil spring assembly (2) from the supports (1) of the idler.

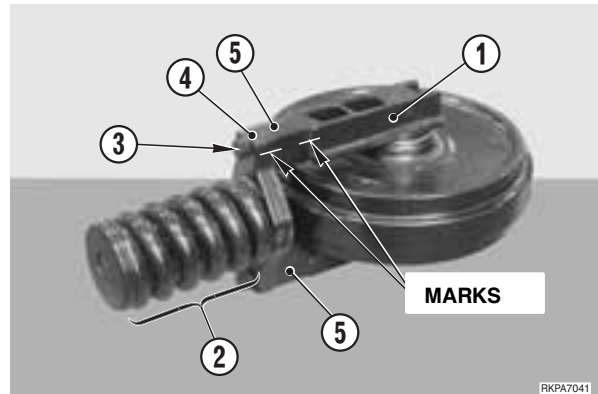
- ★ Before removing the screws (3), mark the joint support (4) and the spacers (5).

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

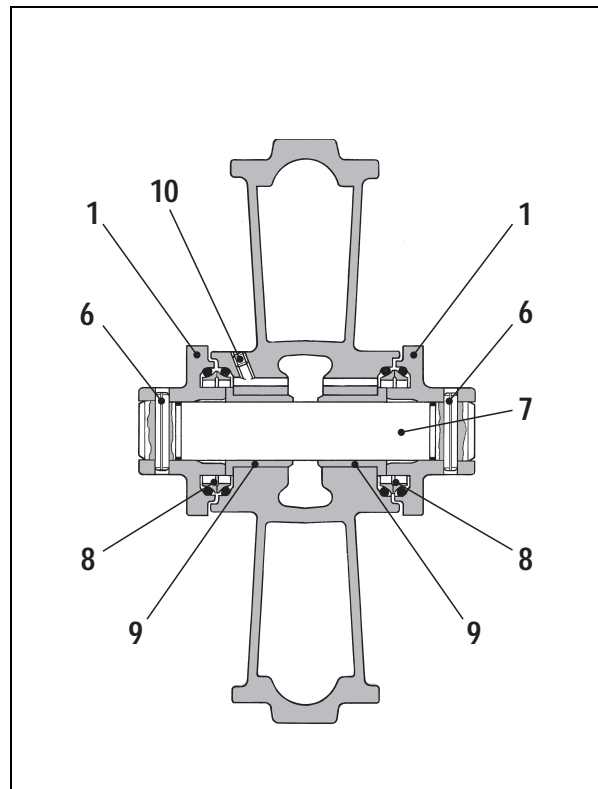
- ★ Use a press for the final assembly.
- ★ Line up the holes and the supports before inserting the pins.

1 - Fill up with oil and replace the cap (10).



Track shoe idler: 600 cc

 Oil cap: 55±5 Nm (40.5±3.7 lb.ft.)



DISMANTLING AND RE-ASSEMBLING THE RECOIL SPRING GROUP AND CYLINDER

1. Recoil spring

Disassembly

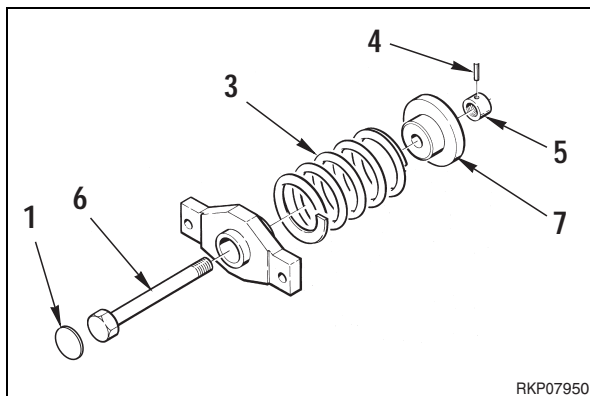
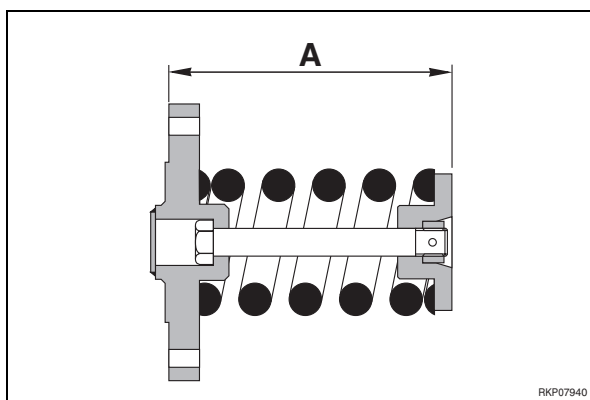
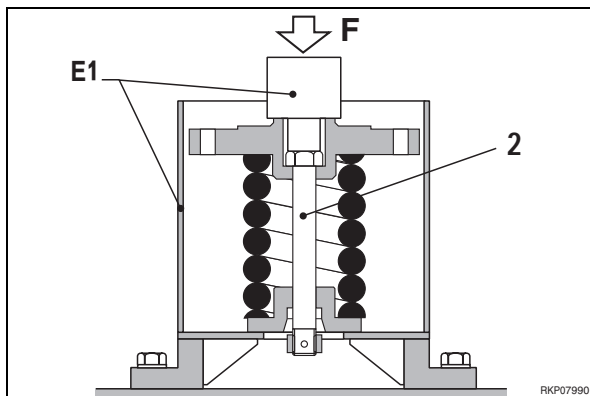
- 1 - Remove the welded base (1).
- 2 - Position the group (2) beneath the press and centre the tool E1.
 - ⚠ The spring is mounted under a high installed load, so make sure that the group is well-centred.
- 3 - Apply pressure and, once the spring (3) is fully compressed, remove the safety pin (4) and the ring nut (5).
- 4 - Slowly reduce pressure to free the spring.
 - ※ 1
 - ★ Free spring length: 233 mm (9.18 in.)
- 5 - Remove rod (6), spring (3) and plate (7).

Assembly

- To install, reverse the removal procedure.

※ 1

- ★ Check the total length of the group.
 - Total length «A»: 245 ± 1 mm (9.653 ± 0.0394 in.)
 - Spring pre-loading: 4000 kg
 - Length of spring when pre-loaded: 203 mm (8 in.)
- ★ Check that the base (1) is tightly welded.



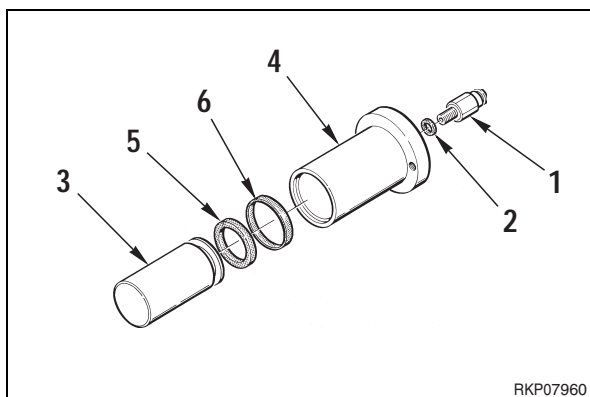
2. Cylinder

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.




REMOVAL OF TRACK ROLLER

1 - Slowly unscrew the lubricator (1) to let out the grease and relieve tension on the track shoe.

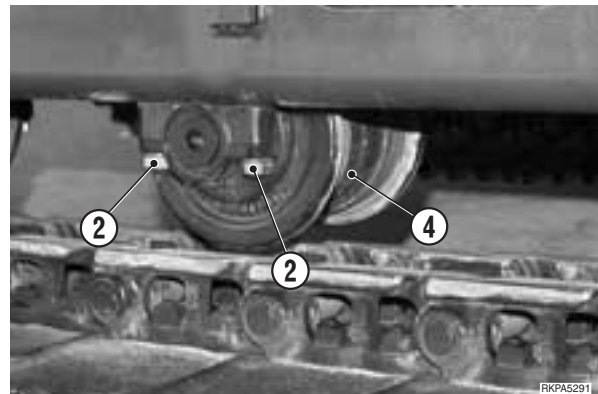
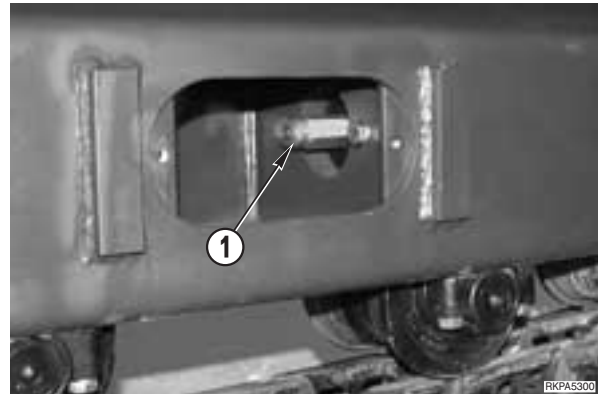
 The grease contained in the track shoe cylinder is pressurised and could cause serious injury to the operator. For this reason the valve should not be loosened by more than one turn.

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

2 - Loosen the screws (2) that hold the idlers (4).

3 - Rotate the revolving frame 90° towards the removal side. Force the boom down to raise the lower chassis (3). 

4 - Remove the track roller (4).




INSTALLATION OF TRACK ROLLER


• To install, reverse the removal procedure.



★ With the lower chassis (3) raised, install the idlers (4) and lightly fasten the attachment screws (2).

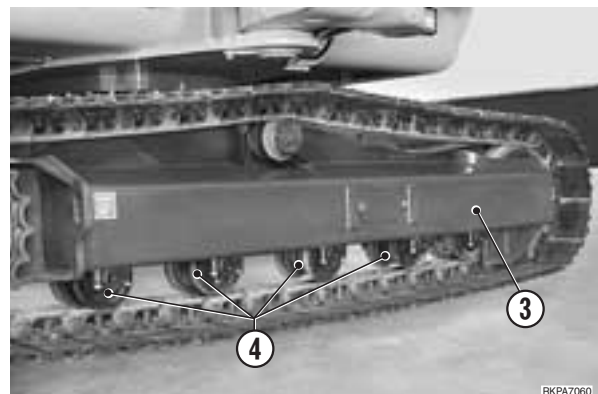
 Idler attachment screws: Loctite 262

★ Slowly let down the lower frame (3) until the idlers (4) rest completely on the track shoe and then tighten the screws (2) firmly.

 Idler attachment screws: 118 Nm (87 lb.ft.)




★ 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.

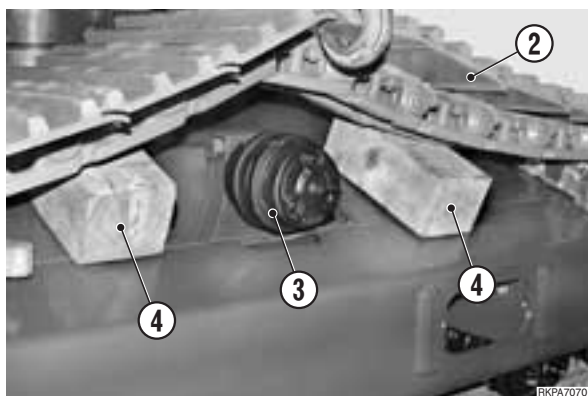
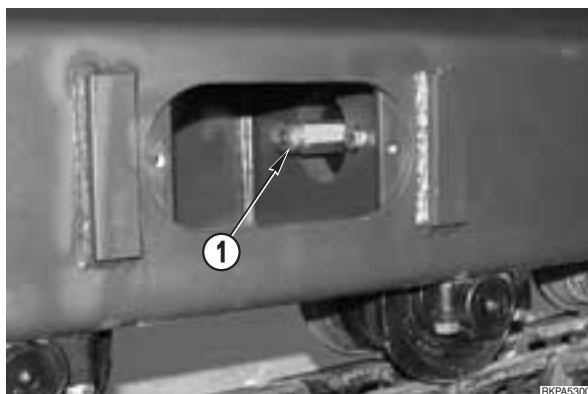
 The grease contained in the track shoe stretching cylinder is under pressure and could cause serious injury to the operator. For this reason the valve should not be loosened by more than one turn.

★ 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. 




INSTALLATION OF CARRIER ROLLER

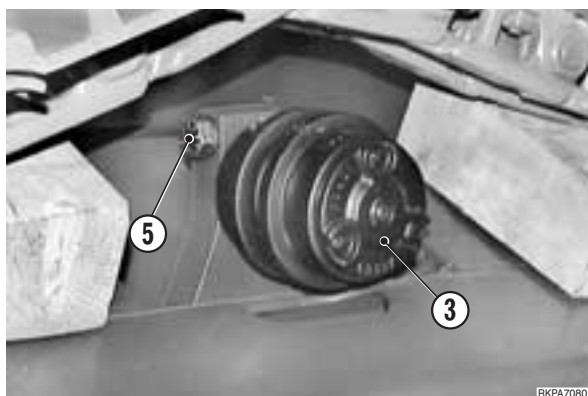
• To install, reverse the removal procedure.

1 - Adjust track shoe tension (For details, see «20. TESTING AND ADJUSTMENTS»).

2 - Before finally securing the retaining screws, lower the track shoe (2) and check that the idler (3) is perfectly centred.



 Screw: 580 Nm (427.5 lb.ft.)



REMOVAL OF R.H. PPC VALVE (BOOM-BUCKET)

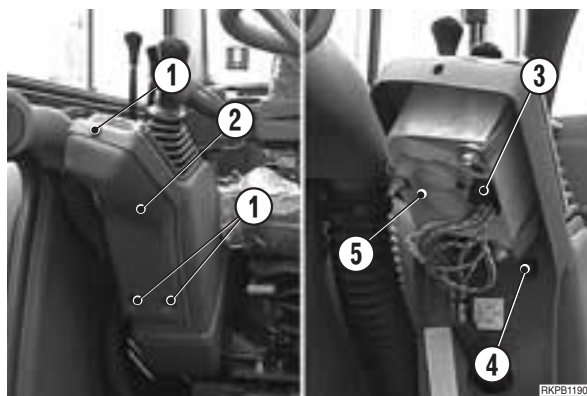
! Lower the work equipment until it is resting on the ground and switch off the engine, and remove the starting key.

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

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

1 - Remove screws (1) and remove cover (2)

2 - Disconnect connectors (3), remove screws (4) and remove the dashboard (5).

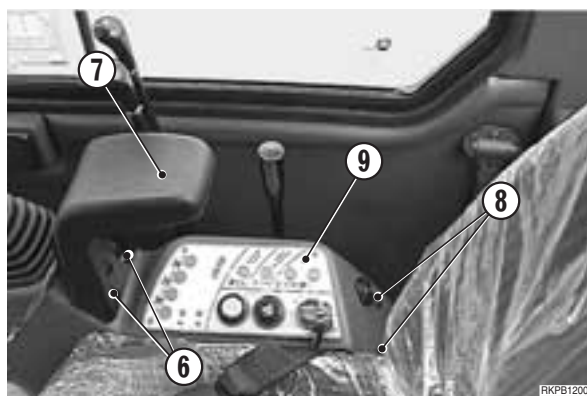


3 - Remove screws (6) and armrest (7).

4 - Remove retaining screws (8) (n° 3) of R.H. dashboard (9).

★ To remove the inside screw, lower the seat and push it right back.

5 - Disconnect the cath (10) from the R.H. dashboard (9).

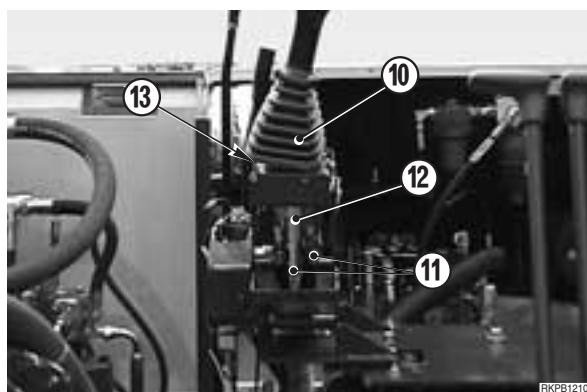


6 - Move backward the R.H. dashboard. Disconnect hoses (11) (n° 6) from the PPC valve (12) and plug them to prevent entry of impurities.

★ Mark the position to avoid errors during assembly.

7 - Remove screws (13) and remove the 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 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

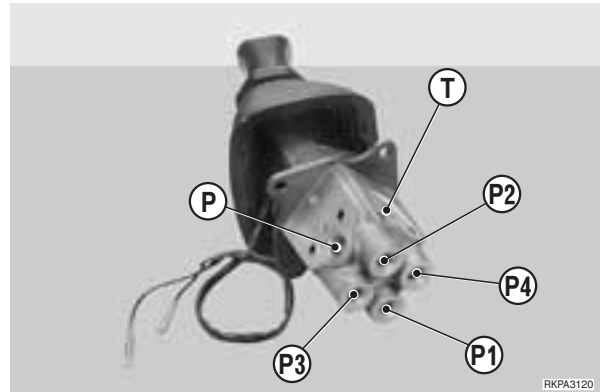
P1 - Arm opening

P4 - R.H. swing

P2 - Arm closing

P3 - L.H. swing

- 1 - Start the engine to circulate the oil and check the seals.

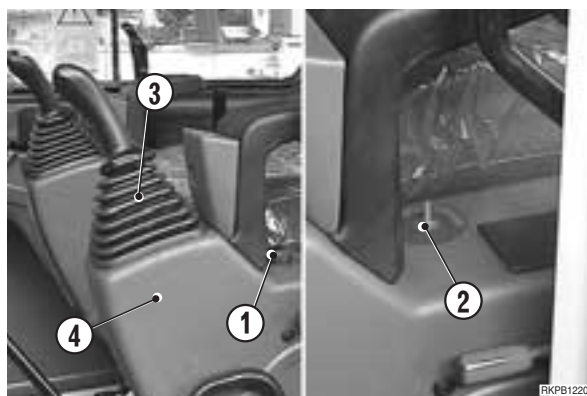


REMOVAL OF L.H. PPC VALVE (ARM-SWING)

- !** 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 knob (1) and loosen the heating control fixing nut (2)

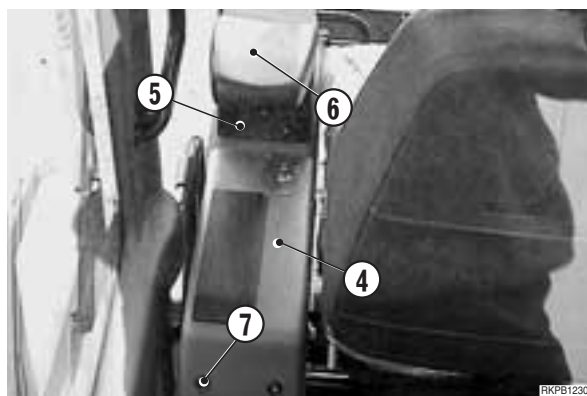
2 - Disconnect the catch (3) from the L.H. dashboard (4).



3 - Remove the arm rest (6) fixing screws (5).

4 - Remove screws (7) and L.H. dashboard (4).

- ★ To remove the inside screw, lower the seat and push it right back.

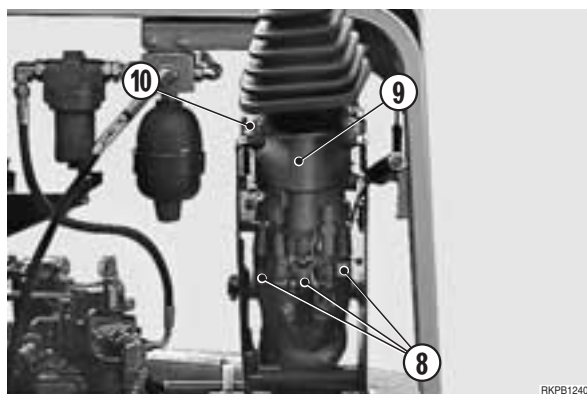


5 - Disconnect the six tubes (8) from the PPC valve (9) and plug them to prevent entry of impurities.

- ★ Mark the positions to avoid errors during assembly. ※ 1

6 - Remove screws (10) and remove PPC valve (9).

- !** 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

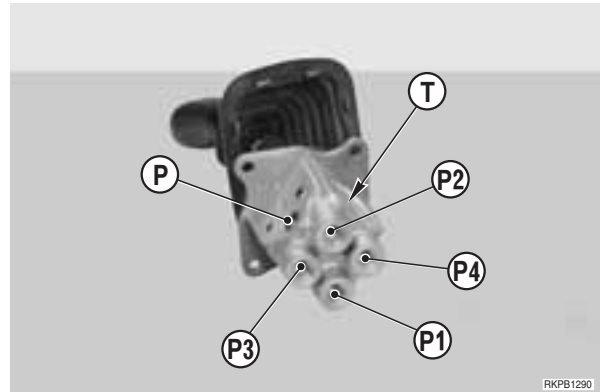
P1 - Arm opening

P4 - R.H. swing

P2 - Arm closing

P3 - L.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»).

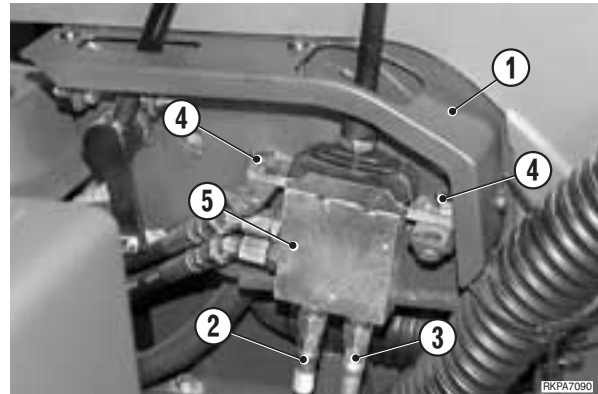
1 - Remove the cabin (For details, see «REMOVAL OF CABIN»).

2 - Remove the casing (1) from right-hand manual control support.

3 - Disconnect the tubes (2) and (3) and plug them.

★ Make an identifying mark on the pipes to avoid mixing them up during installation.

4 - Remove the screw (4) and the PPC valve (5).



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

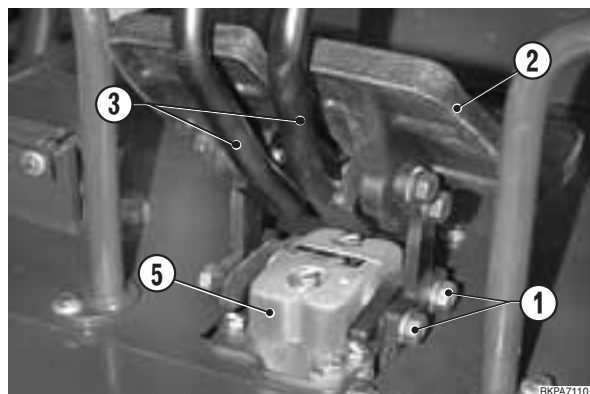
- Rotate the turret by 90° to the left.

⚠ 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).

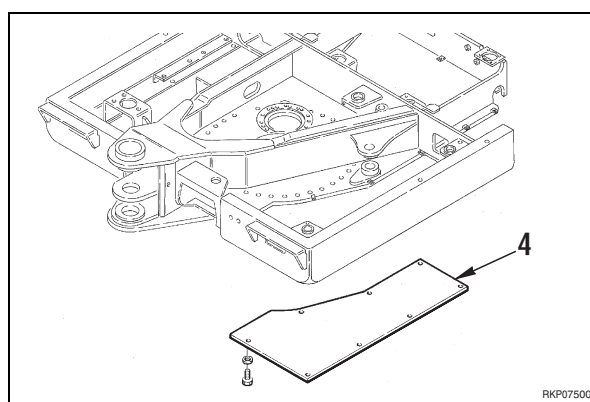
- 3 - Disconnect the pipes (6) (No. 6) from the pedal control.

★ Make an identifying mark on the pipes to avoid mixing them up during installation.

- 4 - Remove the side connections (7) (No. 2) from the pedal control.

- 5 - Pull out the screws (8) and remove the pedal control (5).

※ 2



INSTALLATION OF TRAVEL PEDAL CONTROL

- To install, reverse the removal procedure.

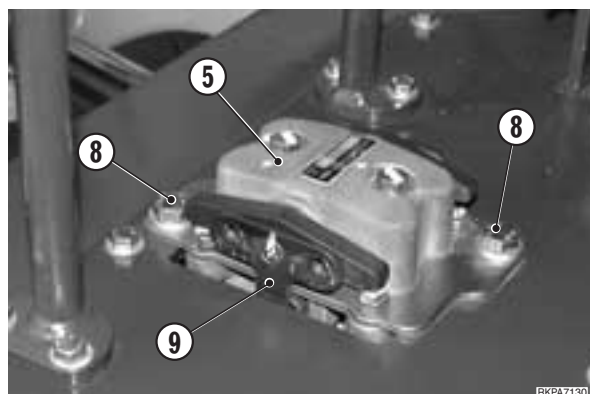
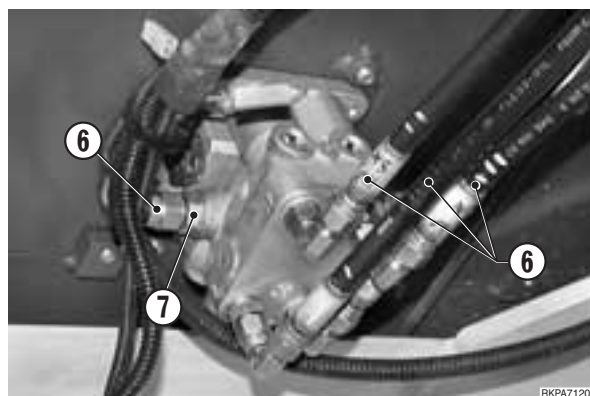
※ 1

★ Before proceeding to the final locking of pedals and levers, check the centring of shifting and the alignment in the neutral position.

⚠ To equalise shifting, shift the lever (9).

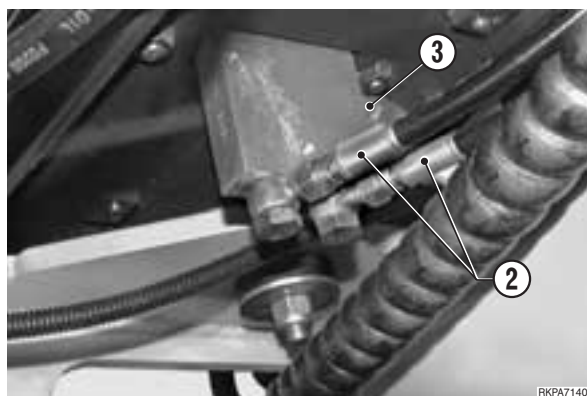
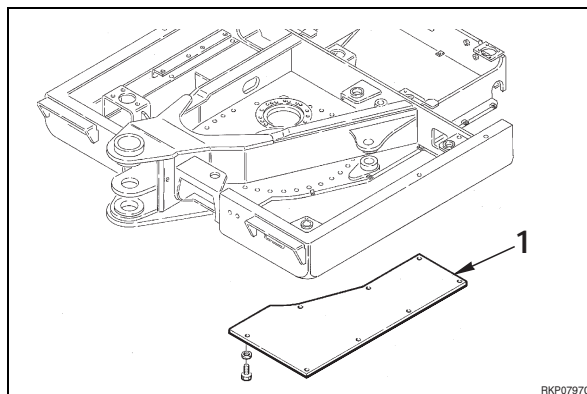
- 1 - Start the engine to circulate the oil.

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



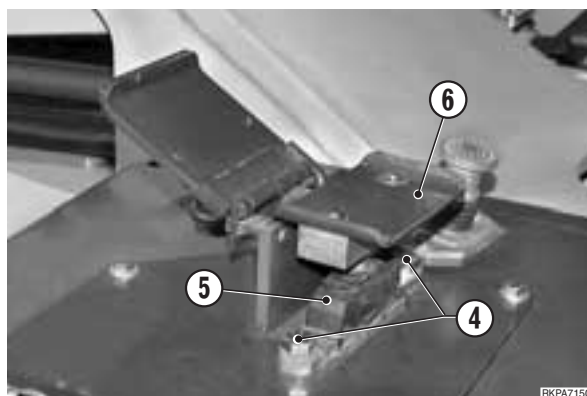
REMOVAL OF 1st BOOM SWING PEDAL CONTROL

- Rotate the turret by 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 SWING PEDAL CONTROL

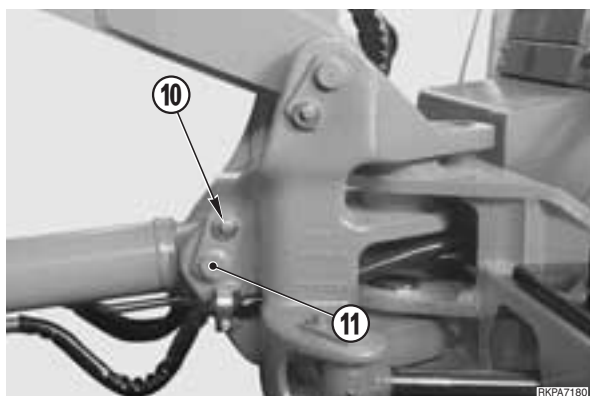
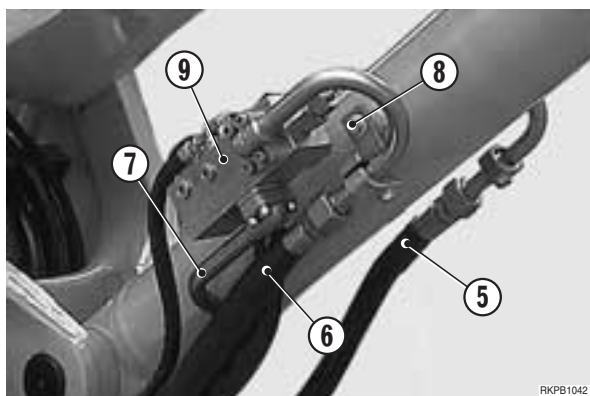
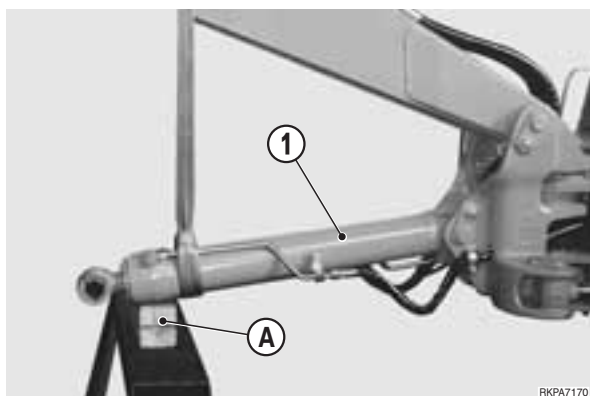
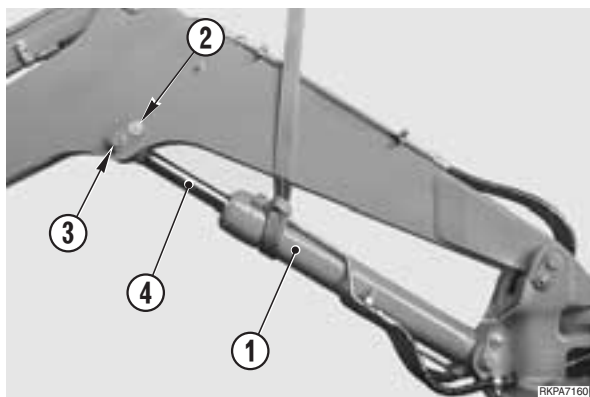
- To install, reverse the removal procedure.
- 1 - Start the engine to circulate the oil.
 - 2 - Bleed air from the front boom swing cylinder. (See «20. TESTING AND ADJUSTMENTS»).



REMOVAL OF 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 (5-6) 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).
※2 ※3 ※4
- 10 - Remove screw (10) and draw out the pin (11).
- 11 - Remove cylinder (1).



INSTALLATION OF BOOM CYLINDER (For 1-piece boom)

- To install, reverse the removal procedure.

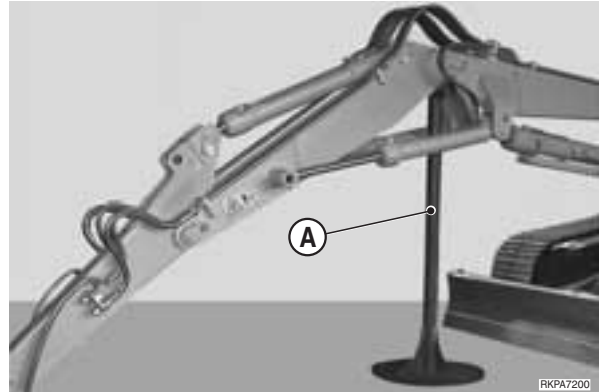
- ※1
 - ★ Insert the adjustments to a given clearance (distributed on both sides of the cylinder rod) until a clearance of 1 – 2 mm (0.0394 – 0.0788 in.) is obtained.
- ※2
 - !** When aligning the positions between hole and pin, let the engine run at minimum idling. Do not insert fingers into the hole to check the alignment.
- ※3
 -  Inside bushings : ASL800050
- ※4
 - ★ Insert the adjustments to a given clearance (distributed on both sides of the piston rod) until a clearance of 0.5 – 1 mm (0.0197 – 0.0394 in.) 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.

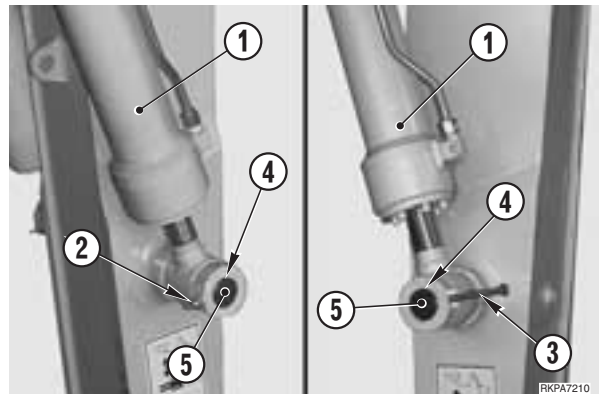
★ The stand should be 1.60 m (63.04 in.) high.

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 the adjustment to a given clearance (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.

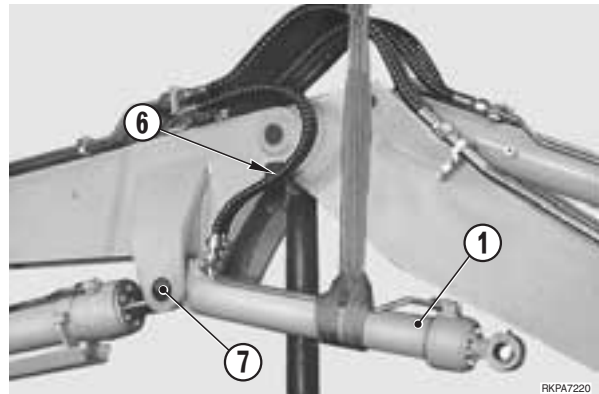
※ 3

★ 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 in a sling.

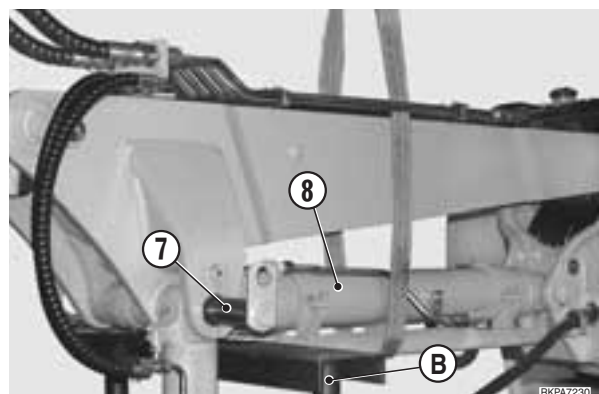
9 - Slide the pin (7) out until the boom cylinder piston rod (8) is disconnected.

※ 3 ※ 4

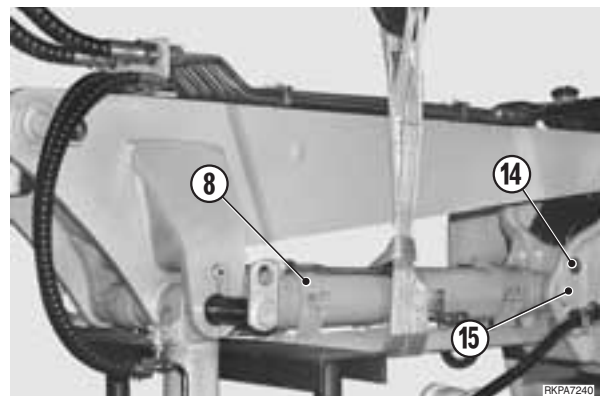
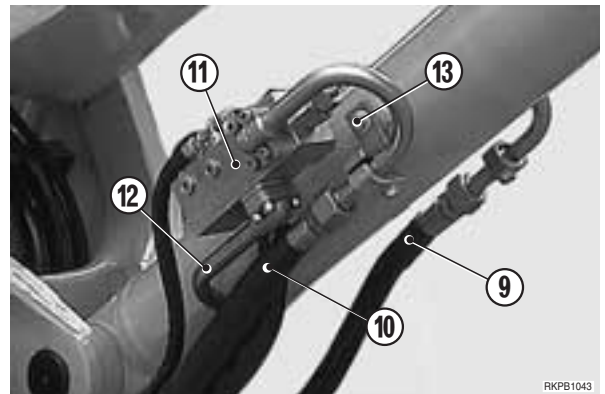
★ To hold the piston rod in its fully retracted position, tie it with wire and switch off the engine.

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 (12) to keep out impurities.
 - 14 - Remove the screw (13) and take out safety valve (11)
 - 15 - Remove the screws (14) and take out the pin (15).
- ※2 ※3 ※4
- 16 - Remove the cylinder.



INSTALLATION OF THE BOOM CYLINDER (For 2-piece boom)

- To install, reverse the removal procedure.

※1

 Self-locking nut: 118 Nm (87 lb.ft.)

※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 adjustments to a given clearance (distributed on both sides of the piston rod) until a clearance of (0.0197 – 0.0394 in.) is obtained.

※5

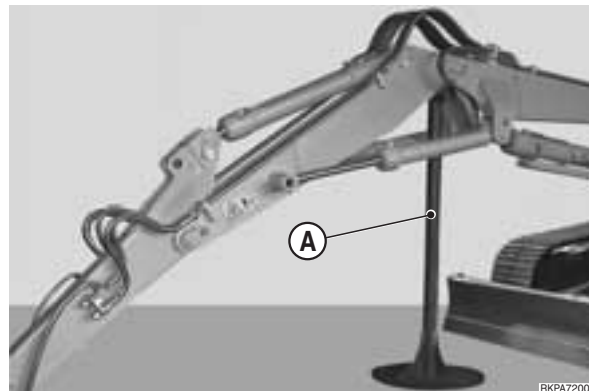
- ★ Insert the adjustments to a given clearance (distributed on both sides of the cylinder) until a clearance of (0.0197 – 0.0394 in.) is obtained.
- Start the engine and bleed the air from the cylinders (For details, see «20. TESTING AND ADJUSTMENTS»).
- ★ After bleeding the air, check the level of 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.

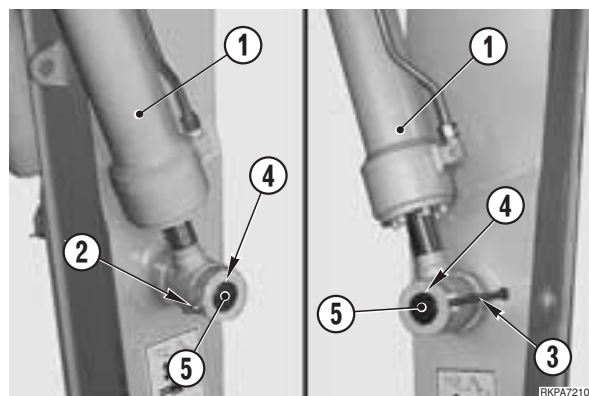
★ The stand should be 1.60 m (63.04 in.) high.

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 the adjustment to a given clearance (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 in a sling.

9 - Slide the pin (7) out to disconnect the boom cylinder piston rod (8).

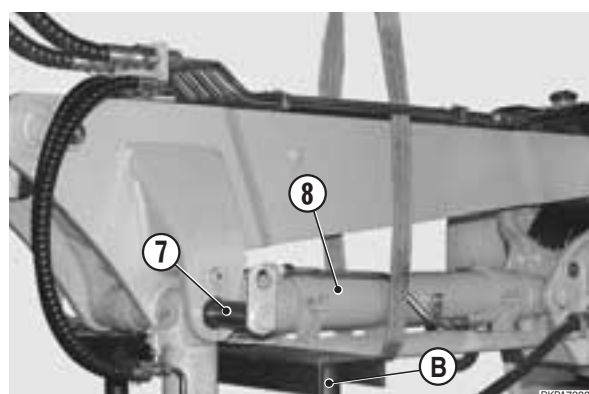
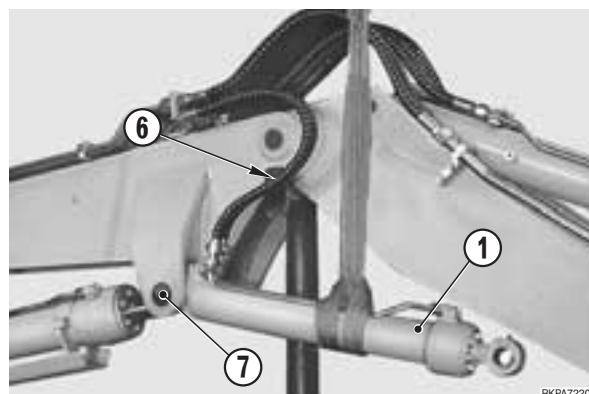
※2

10 - Start the engine and retract the piston.

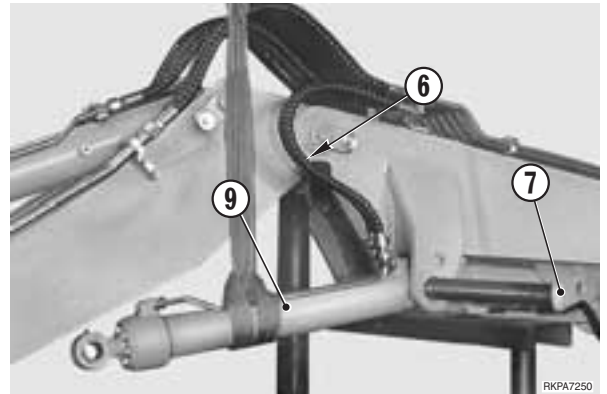
★ To hold the rod in its fully retracted position, tie it with wire and switch off the engine.

※3

11 - Lower the cylinder and rest it on a stand (B).




- 12 - Repeat the procedure from points 3-7 to remove the LH cylinder of the 2-piece boom.




INSTALLATION OF 2nd BOOM CYLINDERS

- To install, reverse the removal procedure.

※ 1

 Self-locking nut: 118 Nm (87 lb.ft.)

※ 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 adjustments to a given clearance (distributed on both sides) until a clearance of 0.5 – 1 mm (0.0197 – 0.0394 in.) is obtained for each cylinder.

※ 5

- ★ Insert the adjustments to a given clearance (distributed on both sides of the cylinder) until a clearance of 0.5 – 1 mm (0.0197 – 0.0394 in.) 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 (63.04 in.) 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»).

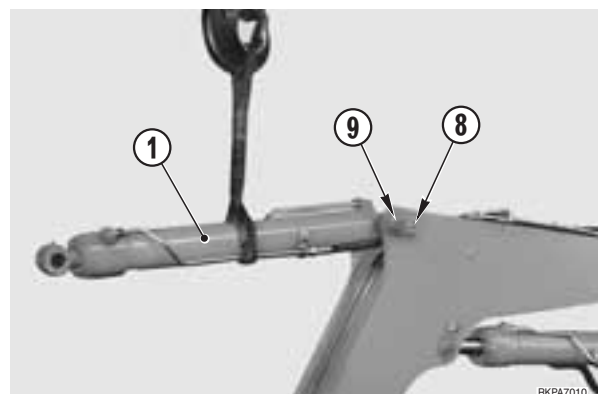
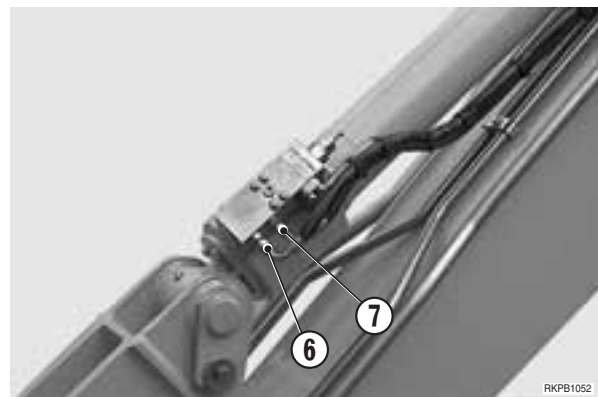
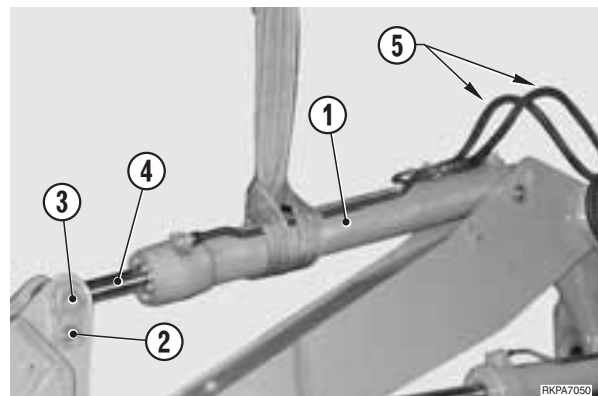
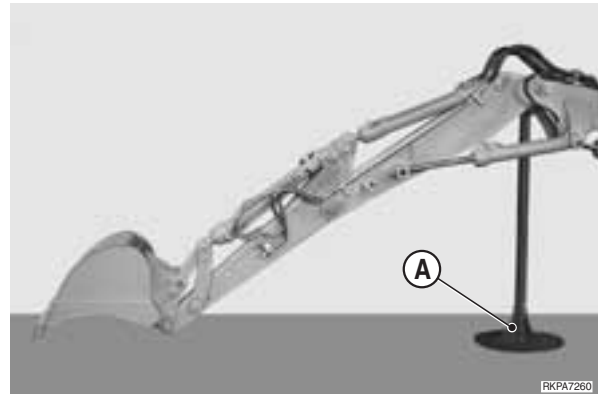
7 - Disconnect the tubes (5) and plug them.

! 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 adjustments to a given clearance (distributed on both sides of the piston rod) until a clearance of 1 – 2 mm (0.0394 – 0.0788 in.) 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 adjustments to a given clearance (distributed on both sides of the cylinder) until a clearance of 0.5 – 1 mm (0.0197 – 0.0394 in.) is obtained.

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

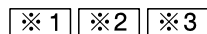
★ After bleeding the air, check the oil level in the tank.

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).



3 - Switch off the engine and retract the piston rod (4).

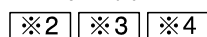
★ To hold the piston rod in its fully retracted position, tie it with wire.

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

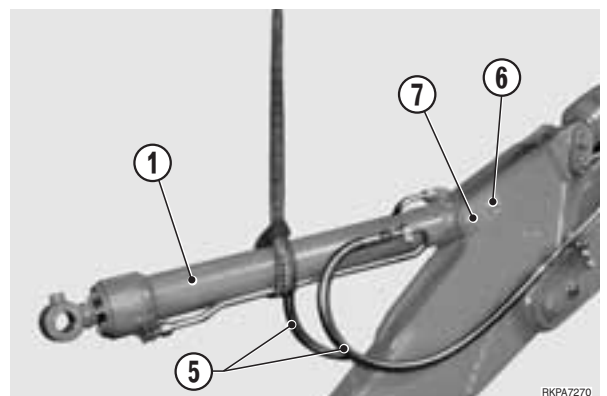
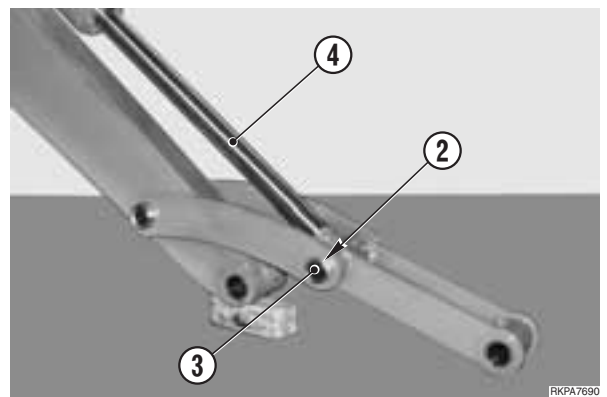
5 - Disconnect the hoses (5) and plug them. Also plug the holes of the rigid tubes to avoid entry of impurities.

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

7 - Remove the screw (6) and draw out the pin (7).



8 - Lift out the cylinder (1).



INSTALLATION OF BUCKET CYLINDER

• To install, reverse the removal procedure.

※ 1

★ Insert the adjustments to a given clearance (distributed on both sides of the piston rod) until a clearance of 1 – 2 mm (0.0394 – 0.0788 in.) is obtained.

※ 2

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

※ 3

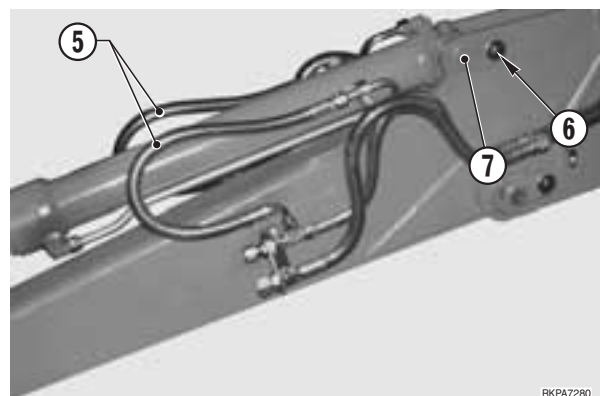
 Inside bushings: ASL800050

※ 4

★ Insert the adjustments to a given clearance (distributed on both sides of the cylinder) until a clearance of 0.5 – 1 mm (0.0197 – 0.0394 in.) is obtained.

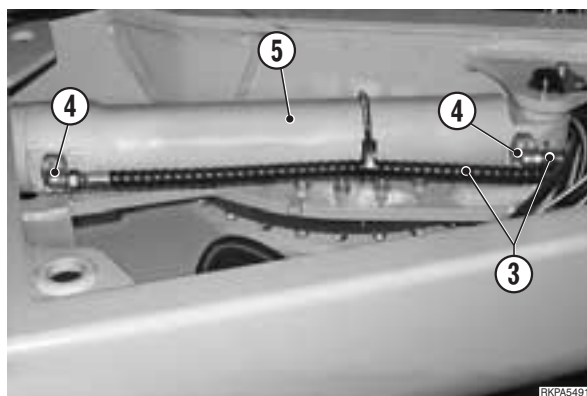
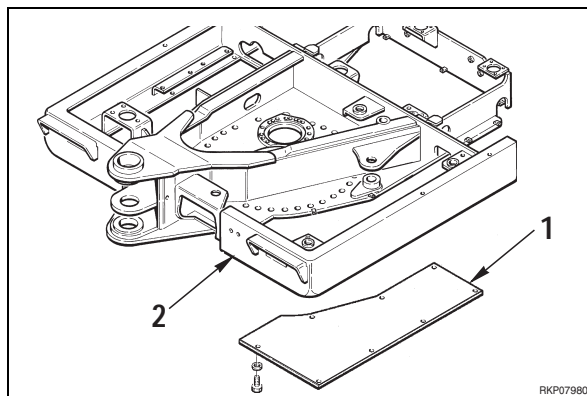
• Start the engine and bleed air from the cylinder. (For details, see «20. TESTING AND ADJUSTMENTS»).

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



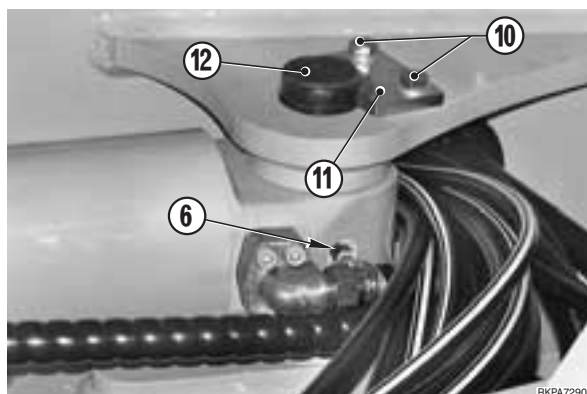
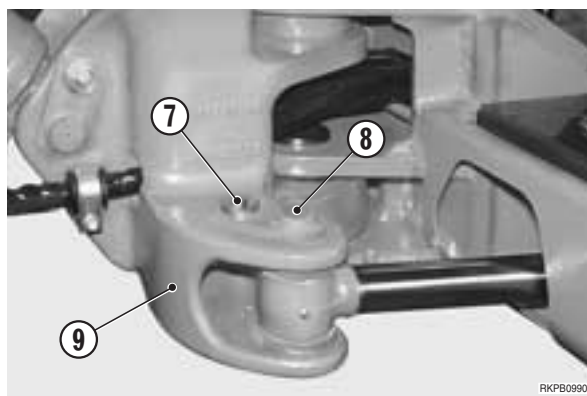
REMOVAL OF BOOM SWING CYLINDER

- 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

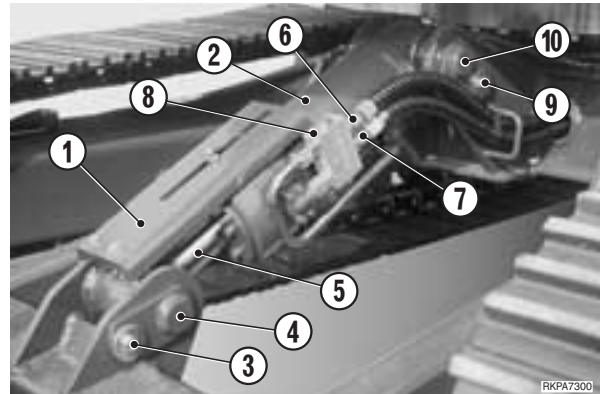
- To install, reverse the removal procedure.
- ※1
- ★ Insert the adjustments to a given clearance (distributed on both sides of the piston) until a clearance of 1 – 2 mm (0.0394 – 0.0788 in.) is obtained.
- ※2
- ⚠ When aligning the positions between hole and pin, let the engine run at minimum idling. Do not insert fingers into the hole to check the alignment.
- ※3
- 🔧 Inside bushings: ASL800050
- ※4
- ★ Insert the adjustments to a given clearance (distributed on both sides of the cylinder) until a clearance of 0.5 – 1 mm (0.0197 – 0.0394 in.) 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 (6-7) 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).



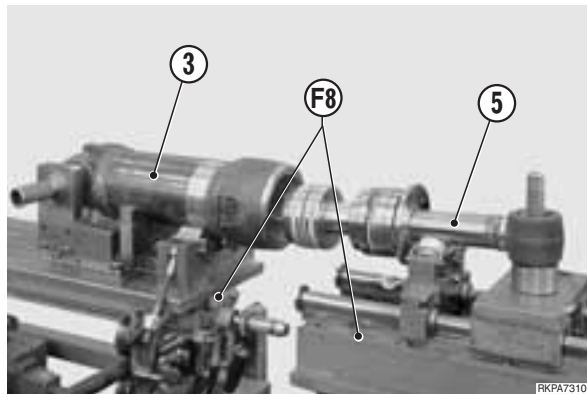
INSTALLATION OF BLADE CYLINDER

- To install, reverse the removal procedure.
 - ※1
 - ★ Insert the adjustments 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 adjustments 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

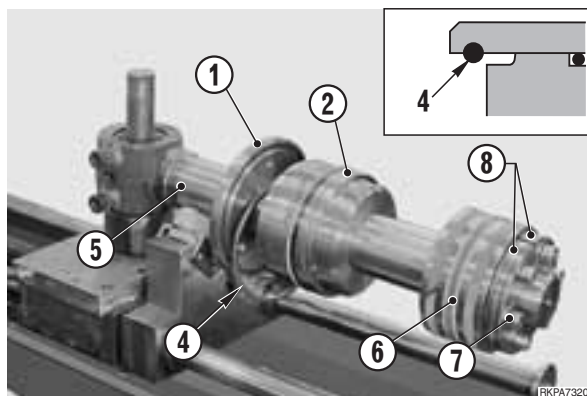
1. All cylinders

- 1 - Place the cylinder on the tool **F8** 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).



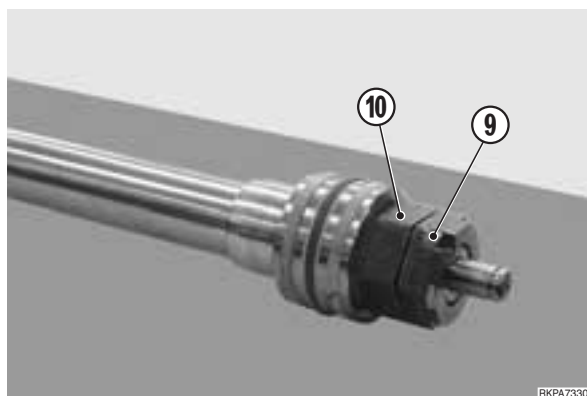
2. 2nd boom, boom swing and blade cylinders:

- 5 - Remove the screws (7) and remove the two half-flanges (8).



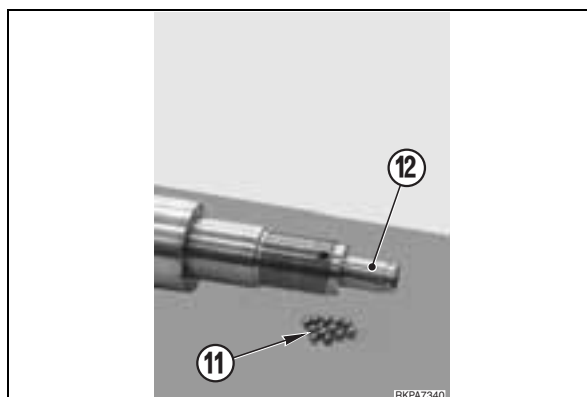
3. Boom, arm and bucket cylinders

- 1 - Heat the safety valve (9) and the end nut (10) to a temperature of 140 – 150 °C (284 – 302 °F).
- 2 - **Only for arm cylinder:** loosen and remove the safety screw (9).
- 3 - Loosen and remove the nut (10). Use the key **F7** and the dynamometric key **B1**.
- ★ Before continuing with the dismantling operations, allow the piston rod to cool down.



3. All cylinders

- 1 - Take the group to pieces.
 - ⚠ For the arm cylinder, first take away the thirteen brake pin (12) retaining balls (11) (n° 12).
- 7 - Remove the seals from the piston rod, the piston, the head and the flange.

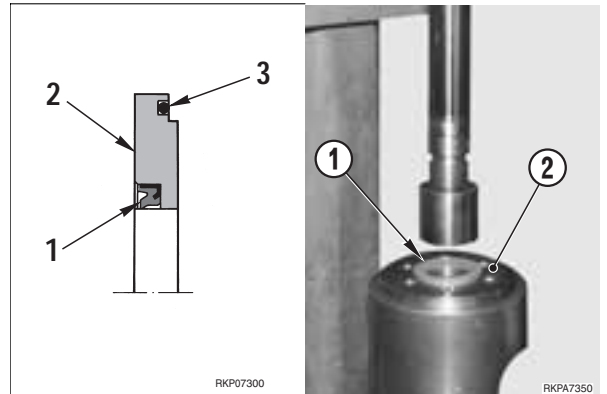


ASSEMBLY OF THE WORK EQUIPMENT CYLINDERS

- ★ Take care not to damage the seals or the sliding surfaces.
- ★ Prepare each individual component before final assembly.

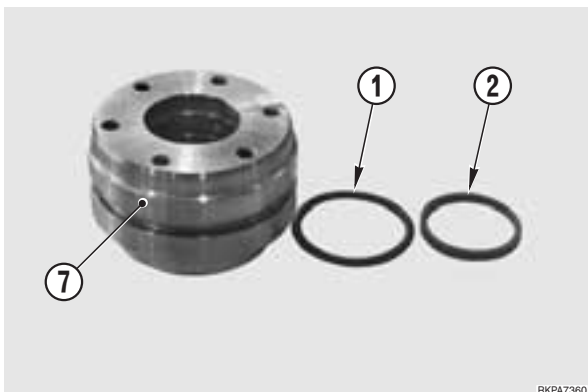
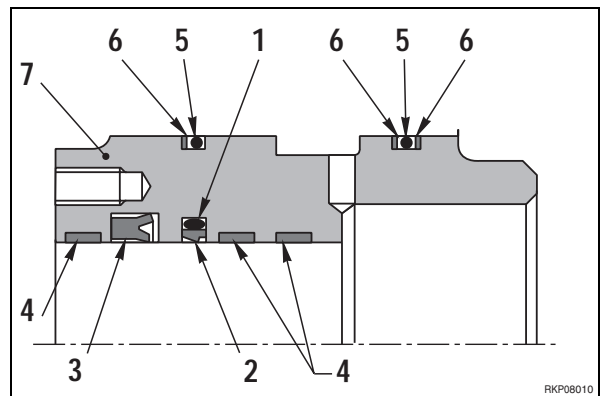
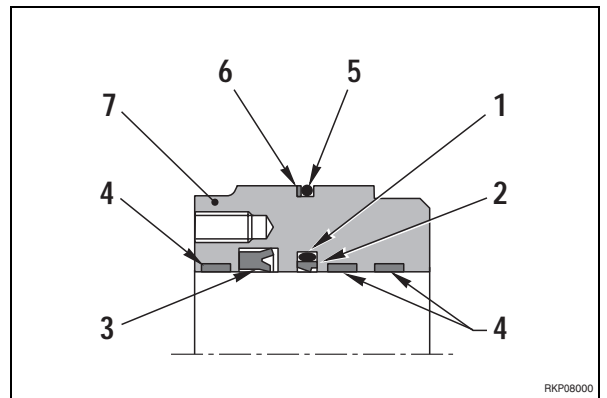
1. Assembly of the head-retaining flange.

- 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 the press.
- 2 - Mount the O-ring seal (3).
 - ★ Use grease to hold the washer in place.
 - 🔧 Sealant: ASL800050

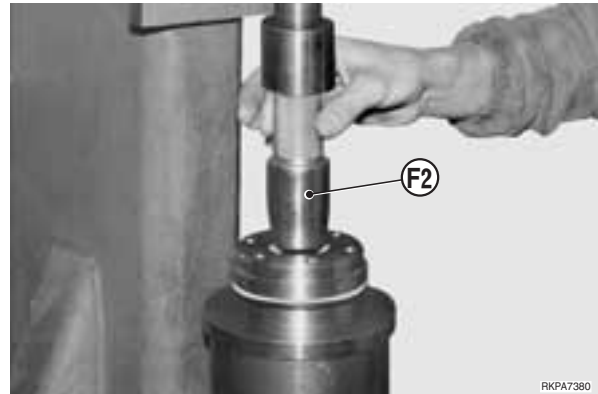


2. Head assembly

- 1 - Mount the internal central retaining ring, positioning first the O-ring (1) and then the sealing ring (2).
 - ★ Make sure that the lowering of the retaining ring is turned towards the inside of the cylinder.
- 2 - Use the tool **F1**, 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).

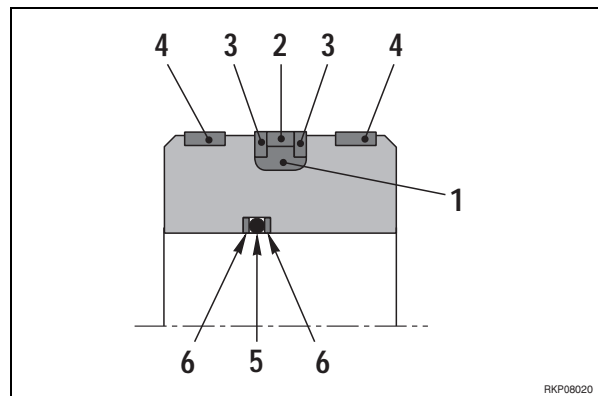
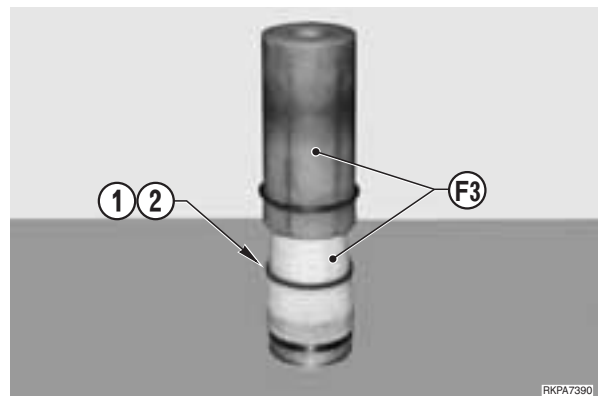


5 - Gauge the diameter of the internal seals, mounting the group underneath the press and using the specific gauging knuckle pin **F2** for the diameter of the piston rod.

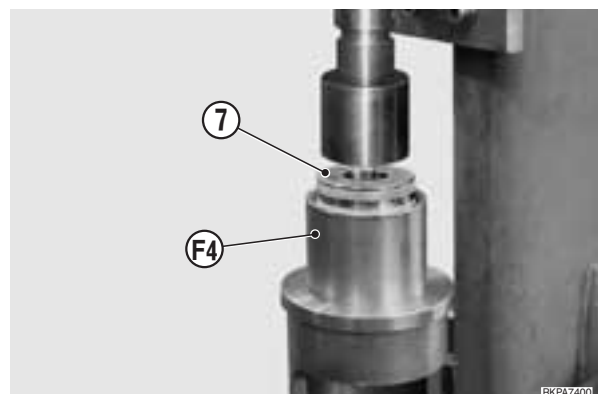


3. Piston assembly

- 1 - Using the tool **F3**, mount the piston seal. Mount in the correct sequence the rubber ring (1), the external seal (2), and the rings wear (3).
- 2 - Mount the guide rings (4).
- 3 - **For the arm piston only:** Mount the O-ring (5) and the rings wear (6) for the sealing between piston rod and piston.

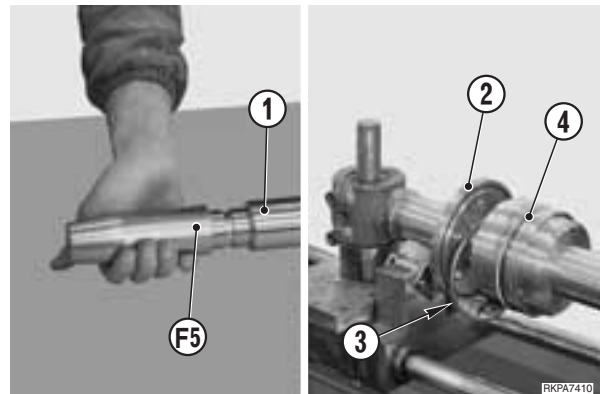


4 - Gauge the diameter of the seal (2) of the piston (7), mounting the group under the press and using the specific gauging ring **F4** for the piston diameter.

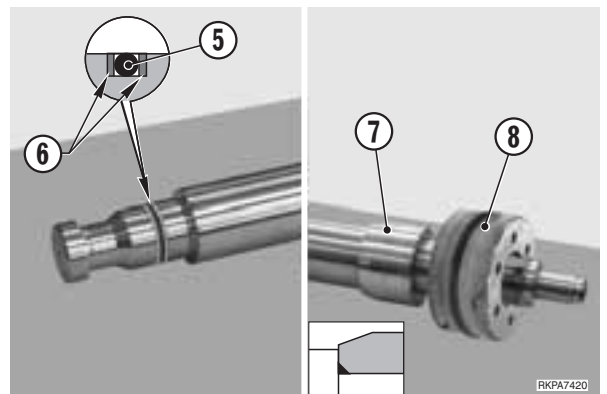


4. Piston rod group assembly


- 1 - Mount on the end of the piston rod (1) the bushing **F5** 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 **F5** from the end of the piston.

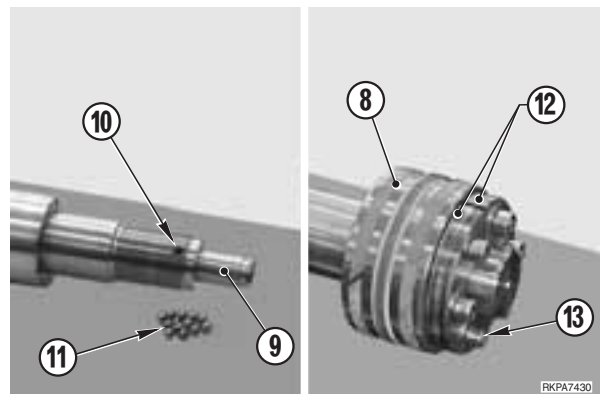


- 4 - Mount the O-ring (5) and the rings wear (6) in the end-seating, for the sealing between the piston ring and piston.
 - ★ For boom, arm and bucket piston ring, the seal is housed in the piston itself.
- 5 - Mount in the correct sequence the brake bushing (7) (for the boom and arm cylinders only) and the piston (8).




- 6 - **For the arm piston only:** mount the brake pin (9) and slide the thirteen retaining balls (11) (n° 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: $49 \pm 5 \text{ Nm}$
 $(36.1 \pm 3.7 \text{ lb.ft.})$





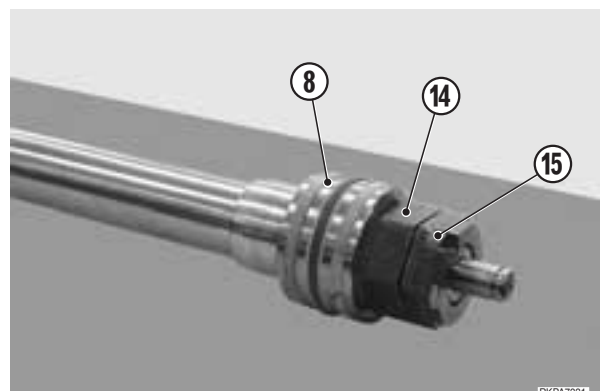
For the arm piston only:

- 1 - Mount the nut (14) that holds the piston (8) in place, and tighten with the socket wrench **F7** and the dynamometric tool with multiplier **B1**.

 Piston retaining nut: Loctite 262

 Piston retaining nut:
 Boom: $530 \pm 53 \text{ kgm}$ ($3833.5 \pm 383.35 \text{ lb.ft.}$)
 Arm: $300 \pm 20 \text{ kgm}$ ($2170 \pm 144.7 \text{ lb.ft.}$)
 Bucket: $290 \pm 29 \text{ kgm}$ ($2097.5 \pm 209.7 \text{ lb.ft.}$)

- 2 - Mount the safety screw (15).
-  Safety screws: Loctite 262
-  Safety screws: $9 \pm 0.9 \text{ kgm}$ ($65.1 \pm 6.5 \text{ lb.ft.}$)



5. Cylinder assembly


1 - Place the cylinder (1) and the piston rod group (2) on the equipment **F8** 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.

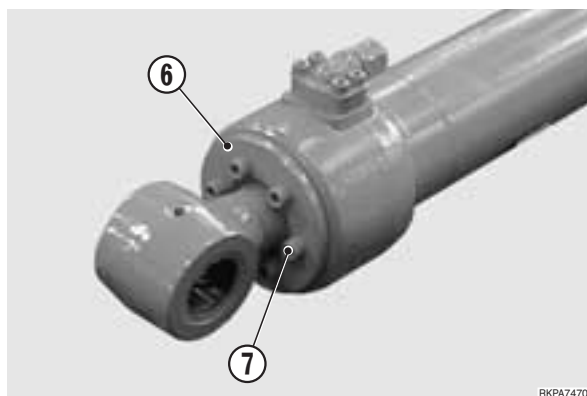
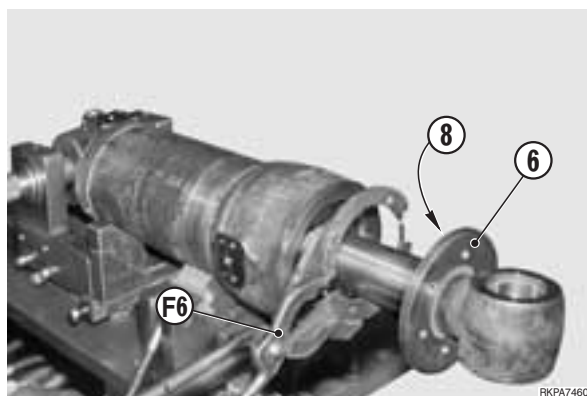
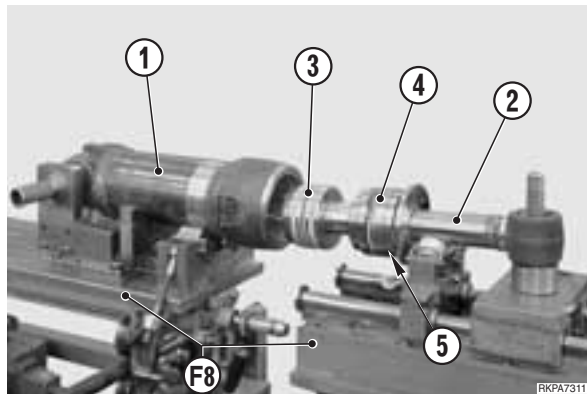
4 - Using the tool **F6**, position the snap ring (5) that holds the head (4) in the cylinder seating.

★ 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: 5 ± 0.5 kgm
(36.2 ± 3.7 lb.ft.)



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 - Remove the overload sensor (For details, see «REMOVAL OF OVERLOAD SENSOR»).

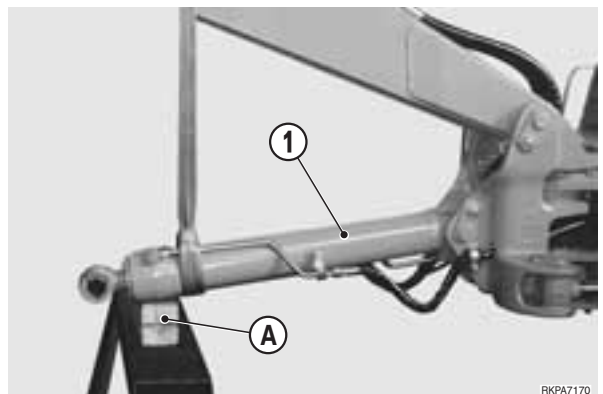
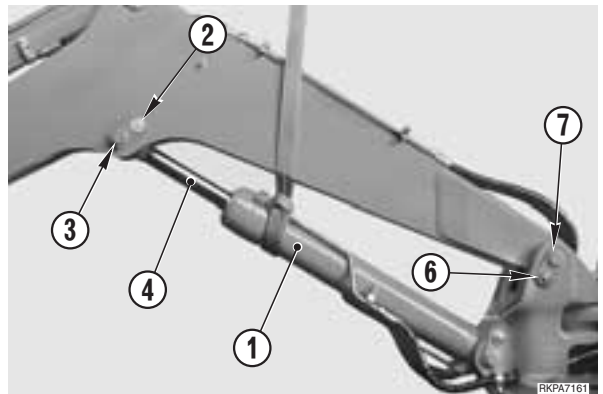
- 8 - Disconnect the hoses (5) and plug them. Also plug the rigid tubes.

- 9 - Put the equipment in a sling and apply slight tension to the cables.

- 10 - Remove the screw (6) and the pin (7). Lift off the work equipment (8).

※3 ※4

 Work equipment: 950 kg (2093 lb.)



INSTALLATION OF WORK EQUIPMENT (For 1-piece boom)

- To install, reverse the removal procedure.

※1

- ★ Insert the adjustments to a given clearance (distributed on both sides of the piston) until a clearance of 1 – 2 mm (0.0394 – 0.0788 in.) 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

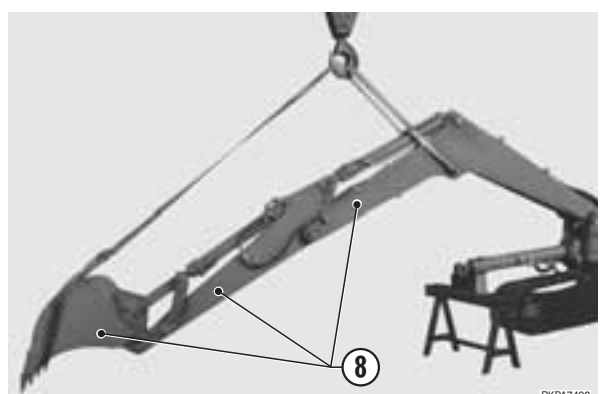
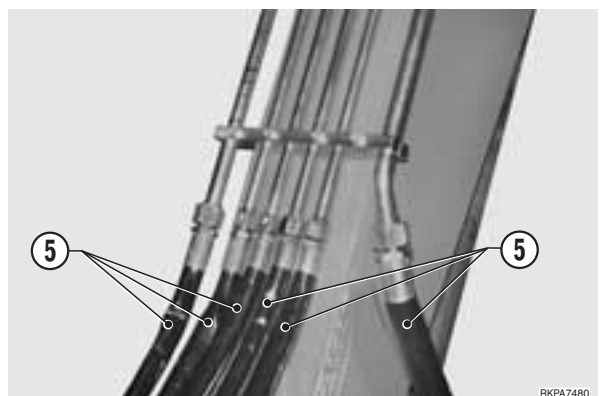
 Inside bushings: ASL800050.

※4

- ★ Insert the adjustments to a given clearance (distributed on both sides of the arm) until a clearance of 0.5 – 1 mm (0.0197 – 0.0394 in.) is obtained.

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

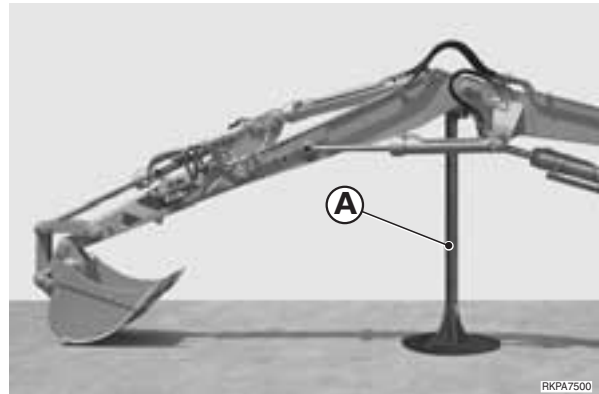
- ★ After bleeding the air, switch off the engine and check oil level in the tank.



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 (63.04 in.)) 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.

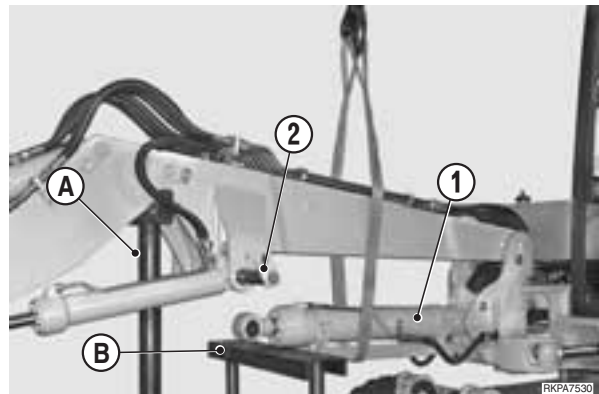
- ⚠ Completely eliminate residual pressures from all the circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).



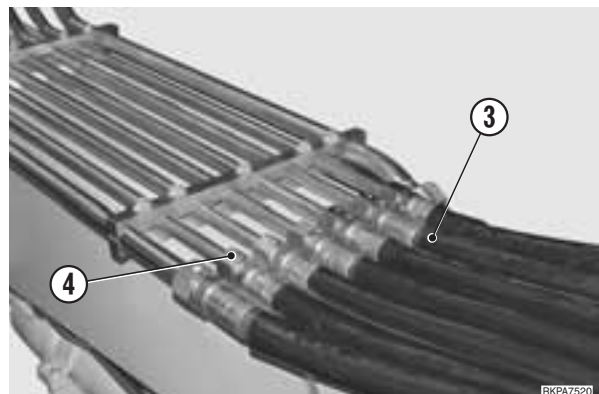
- 1 - Disconnect the boom cylinder (1) from the 2-piece boom and rest it on a stand (B).

- ★ 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.



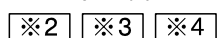
- 2 - Disconnect the eight hoses (3) (n° 8) that control the front work equipment cylinders, and plug them. Also plug the union fittings of the hoses (4).




- 3 - Put the boom (5) in a sling and apply slight tension to the cables.

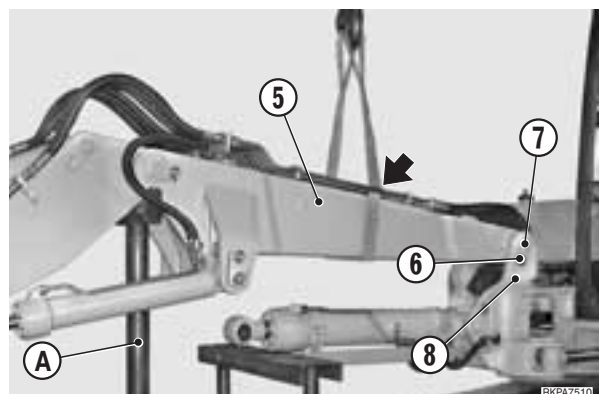
- ★ Pass the cables through the rigid tubes to avoid distortion.

- 4 - Remove the screws (6) and take out the pin (7).

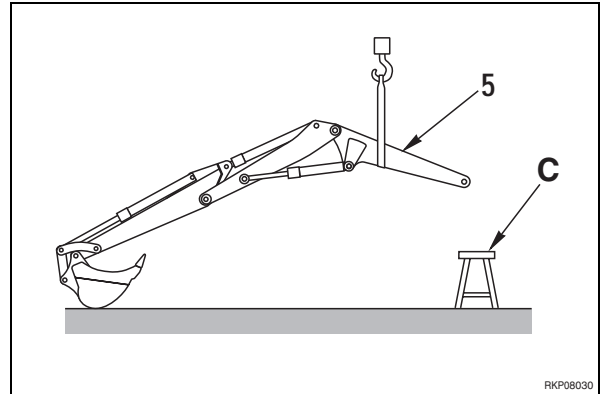


- 5 - Raise the boom (5) until it is disengaged from the swivel support (8) and take away the stand (A).

 Equipment: 1300 kg (2864 lb.)



- 6 - Swing the group to the side of the machine and rest the boom on a stand (C).



INSTALLATION OF THE WORK EQUIPMENT (For 2-piece boom)

- To install, reverse the removal procedure.

※1

- ★ Insert the shims (distributed on both sides of the top of the cylinder) until a clearance of 1 – 2 mm (0.0394 – 0.0788 in.) 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 (0.0394 – 0.0788 in.) 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

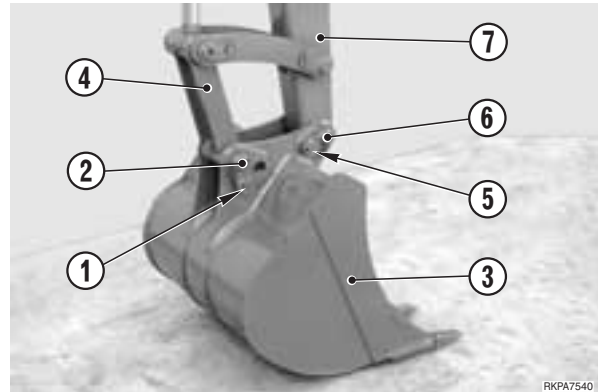
! Lower the bucket to the ground, resting with its back on a flat surface.

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 adjustments 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

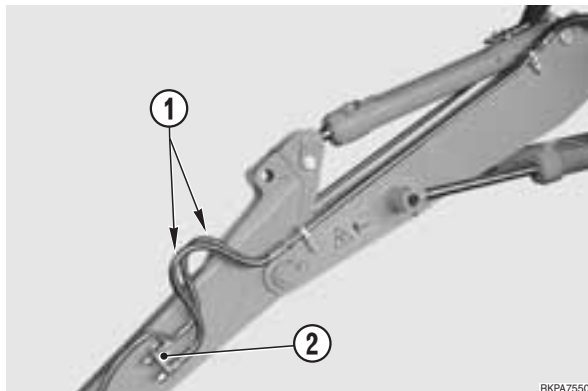
 Inside bushings: ASL800050

※4

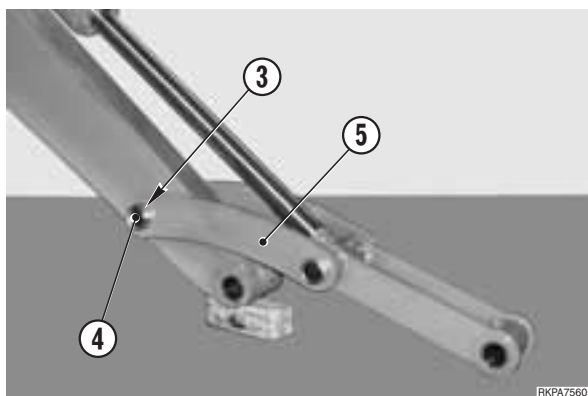
★ Insert the adjustments to a given clearance (on both sides) between the bucket (3) and the arm (7), until a play of 0.5 – 1 mm (0.0197 – 0.0394 in.) is obtained.

REMOVAL OF ARM

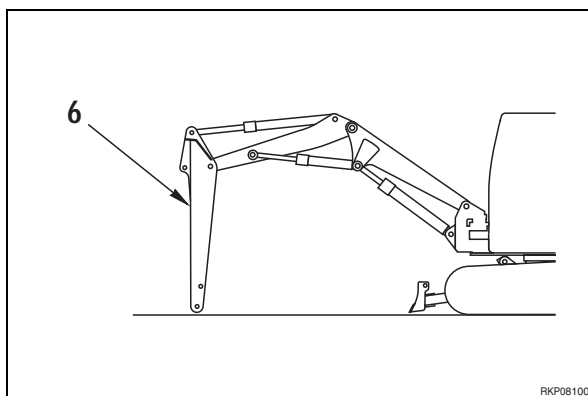
- 1 - Remove the bucket (For details, see «REMOVAL OF BUCKET»).
- 2 - Remove the bucket cylinder. (For details, see «REMOVAL OF BUCKET CYLINDER»).
- 3 - If the machine is designed for the application of optional front equipment, disconnect the boom (or the 2-piece boom), the tubes (1) and remove the supports (2).



- 4 - Loosen the ring nut (3) and pin (4) and remove the thrust lever (5). ※1 ※2

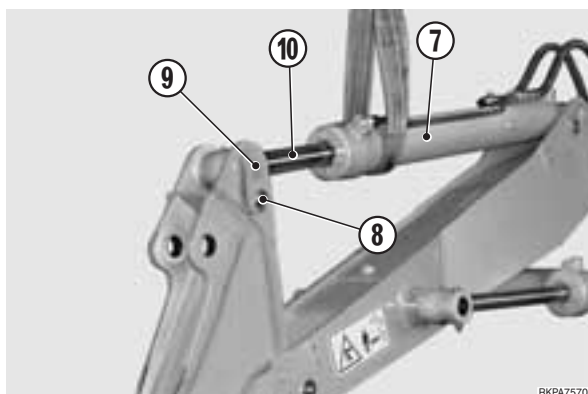


- 5 - Raise the boom and bring the arm (6) into a vertical position and then lower it to the ground.

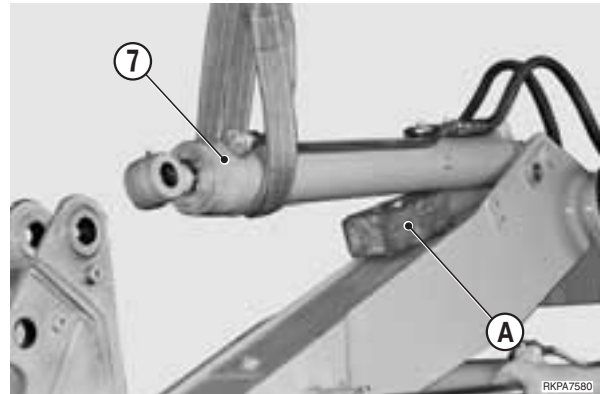


- 6 - Switch off the engine and release residual pressures.
- 7 - Put the arm cylinder (7) in a sling, remove the screw (8) and take out the pin (9).
- 8 - Start the engine and fully retract the piston (10). ※3

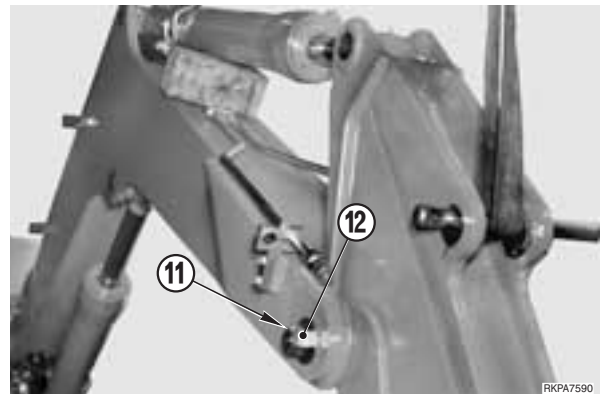
- ★ To hold the piston rod in its fully retracted position, tie it with wire.



- 9 - Rest the cylinder (7) on a block (A).
- 10 - Switch off the engine.



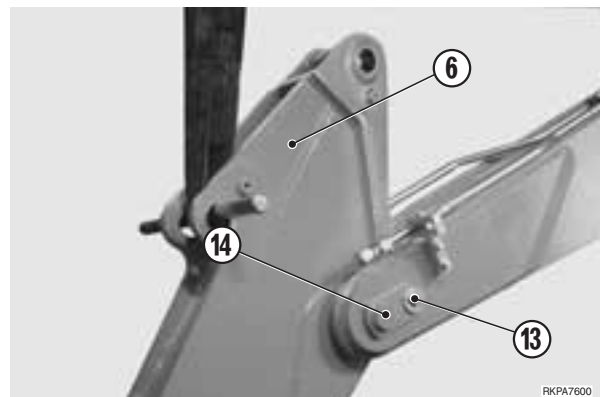
- 11 - Connect the arm (7) to the hoisting tackle and apply slight tension to the cable.
- 12 - Remove the cotter-pin (11) and the nut (12). ※4



- 13 - Take out the screw (13) and pull out the pin (14).
- 14 - Lift off the arm (6).



Arm: 125 kg (275.4 lb.)
 Long arm: 167 kg (368 lb.)




- 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 adjustments to a given clearance (distributed on both sides of the piston) until a clearance of 1 – 2 mm (0.0394 – 0.0788 in.) 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 adjustments to a given clearance (distributed on both sides) until a clearance of 0.5 – 1 mm (0.0197 – 0.0394 in.) is obtained.

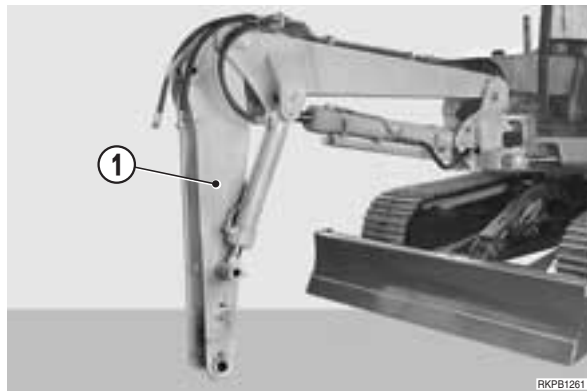
 When aligning the positions between hole and pin, do not insert fingers into the holes to check the alignment.

REMOVAL OF 2nd BOOM

1 - Remove the bucket, the bucket cylinder, the arm cylinder and the arm. For details see:

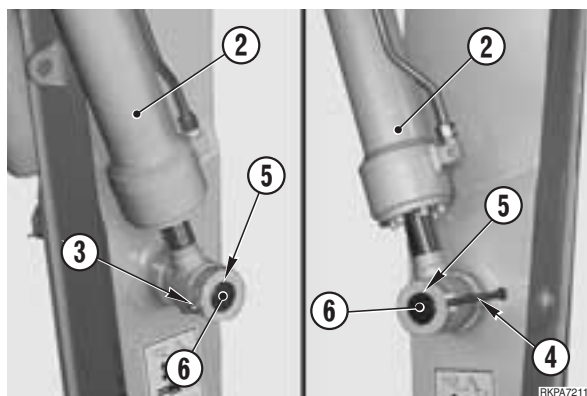
- REMOVAL OF BUCKET
- REMOVAL OF BUCKET CYLINDER
- REMOVAL OF ARM CYLINDER
- REMOVAL OF ARM

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



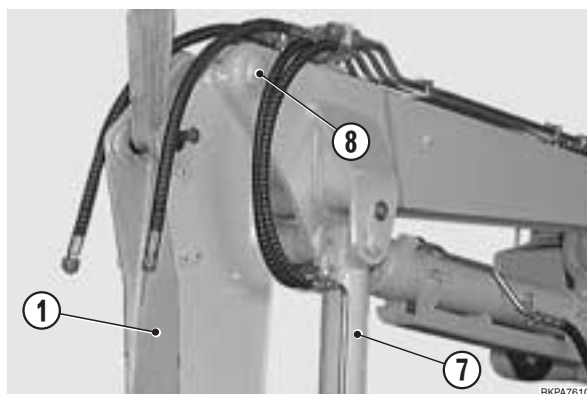
8 - Hook the 2-piece boom to the hoisting tackle.

9 - Remove the screws and take out the pin (8).

※2 ※3 ※4

10 - Take off the 2-piece boom.


 2-piece boom: 162 kg (357 lb.)




INSTALLATION OF 2nd BOOM

- To install, reverse the removal procedure.

※1

 Self-locking nut: 118 Nm (87 lb.ft.).

※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 shims (distributed on both sides of the boom) until a clearance of 0.5 – 1 mm (0.0197 – 0.0394 in.) 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.

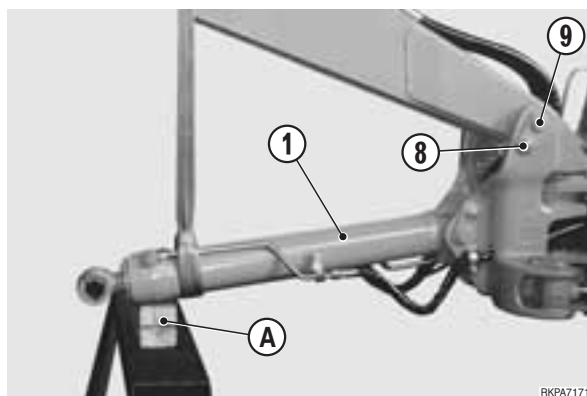
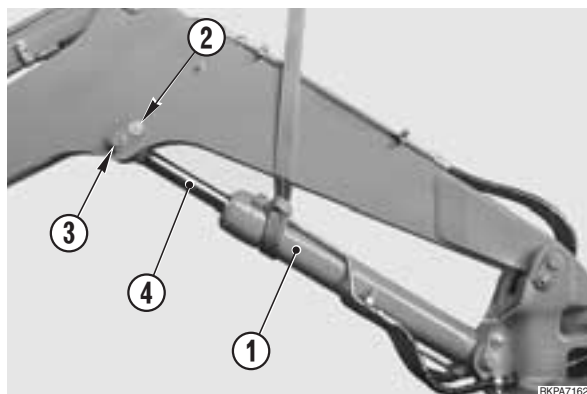
- 12 - Disconnect the front equipment hoses (6) and plug them. Also plug the rigid tubes (7).

- 13 - Take out the screw (8) and pull out the pin (9).

- 14 - Lift off the boom (5).

 Boom: 300 kg (661 lb.)

※3 ※4




INSTALLATION OF BOOM (For 1-piece boom)

- To install, reverse the removal procedure.

※1

★ Insert the adjustments to a given clearance (distributed on both sides of the piston rod) until a clearance of 1 – 2 mm (0.0394 – 0.0788 in.) 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

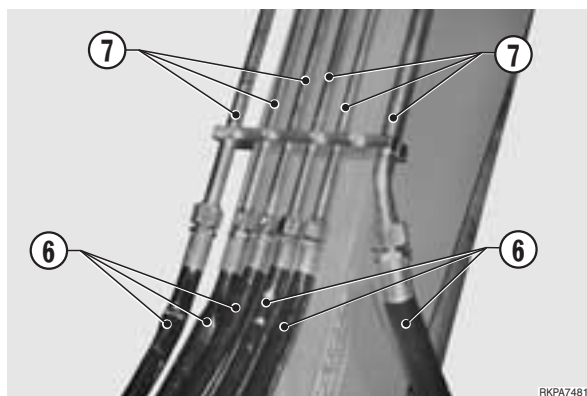
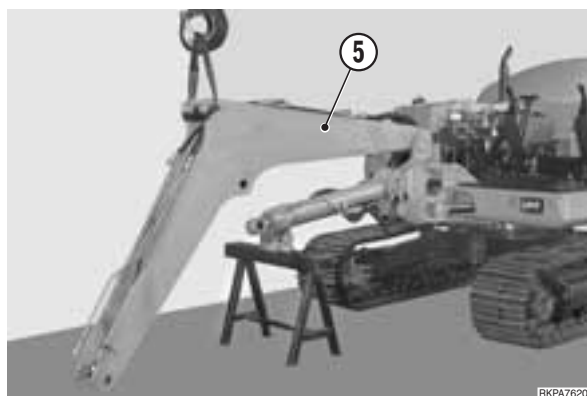
 Inside bushings: ASL800050

※4

★ Insert the adjustments to a given clearance (distributed on both sides of the boom) until a clearance of 0.5 – 1 mm (0.0197 – 0.0394 in.) 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 1st BOOM

1 - Remove the bucket, the bucket cylinder, the arm cylinder, the arm, and the 2-piece boom. For details see:

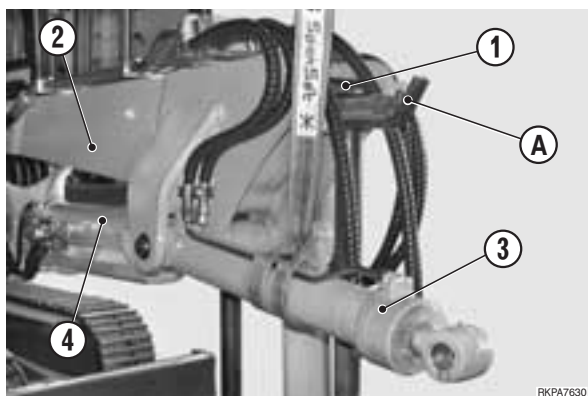
- REMOVAL OF BUCKET
- REMOVAL OF BUCKET CYLINDER
- REMOVAL OF ARM CYLINDER
- REMOVAL OF ARM
- REMOVAL OF 2-PIECE BOOM

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 (63.04 in.) high.

4 - Switch off the engine and release any residual pressures in the boom cylinder.

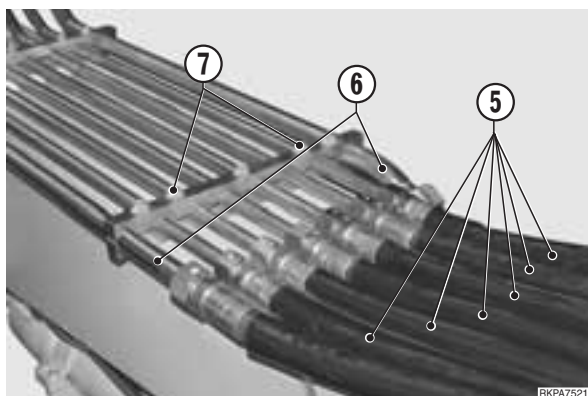
5 - Remove the 2-piece boom cylinders (3) and let the boom cylinder (4) rest on a stand. (For details, see «REMOVAL OF 2-PIECE BOOM CYLINDER»).



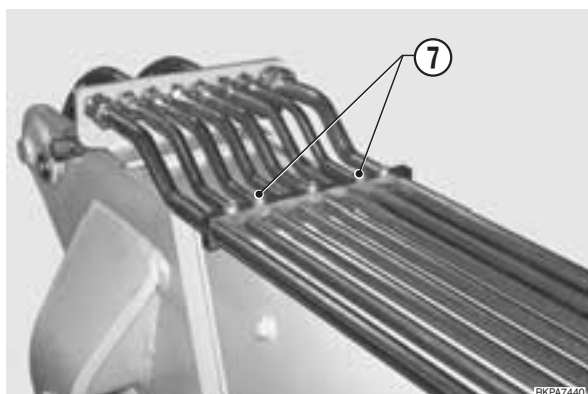
6 - Remove the overload sensor. (For details, see «REMOVAL OF OVERLOAD SENSOR»).

7 - Disconnect the six connecting hoses of the front work equipment cylinders (5) (n° 6) and the two tubes (6) of the optional equipment (n° 2).

★ Plug the hoses and rigid tubes to prevent entry of impurities.



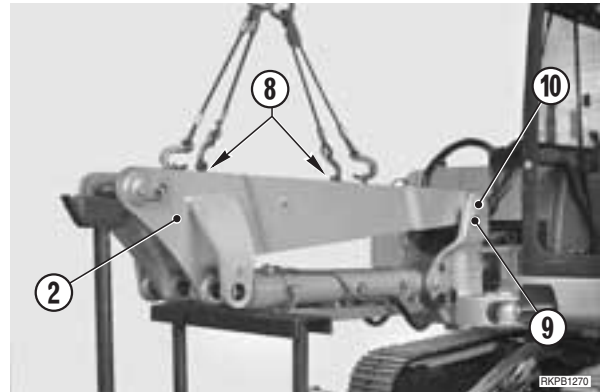
8 - Take out the four screws (7) (n° 4) and lift away the complete rack of tubes.



- 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).



Boom: 245 kg (540 lb.)



INSTALLATION OF 1ST 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 shims on both sides of the boom, until a clearance of 0.5 – 1 mm (0.0197 – 0.0394 in.) 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 BRACKET

⚠ 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 tackle H1 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

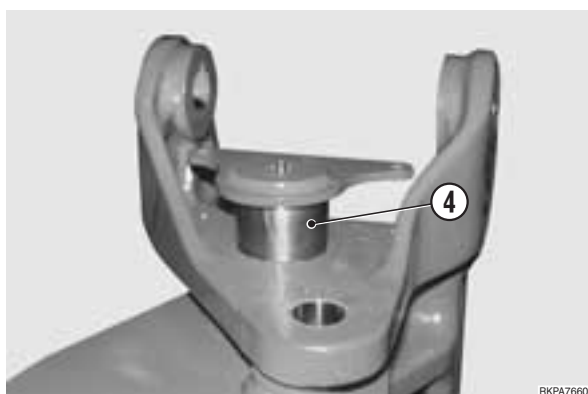
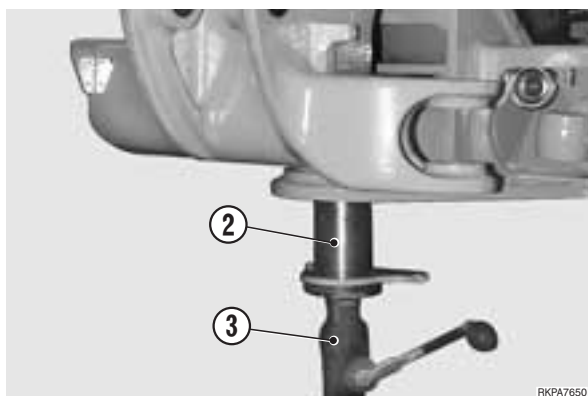
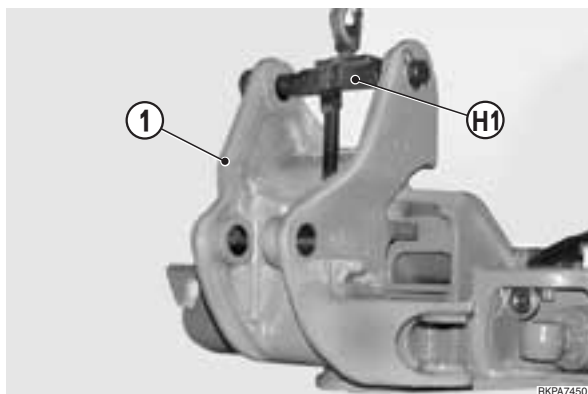
7 - Take out the retaining screws and, with the help of a lever, pull out the upper pin (4).

※2

8 - Lift out the swing bracket (1).

※3


 Swing bracket: 170 kg (374.5 lb.)



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.	Thick-ness	Quantity
1	21D-09-39170	5	2
2	21D-09-39160	0.5	2

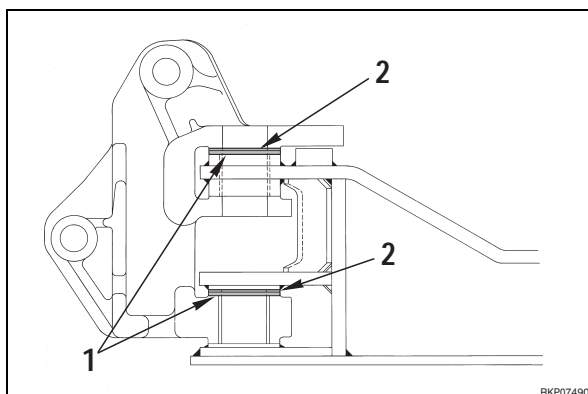
 Supporting surfaces and adjustments to a given clearance: ASL800050

※4

★ Insert the adjustments to a given clearance (distributed on both sides of the eyes piston) until a clearance of 1 – 2 mm (0.0394 – 0.0788 in.) 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.

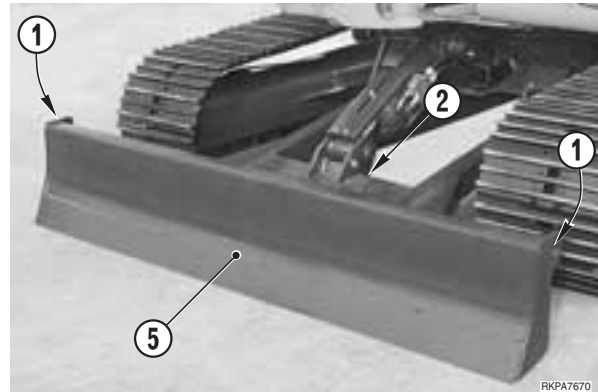


REMOVAL OF BLADE

- 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).


 Blade: 250 kg (551 lb.)




INSTALLATION OF BLADE

- To install, reverse the removal procedure.

※ 1

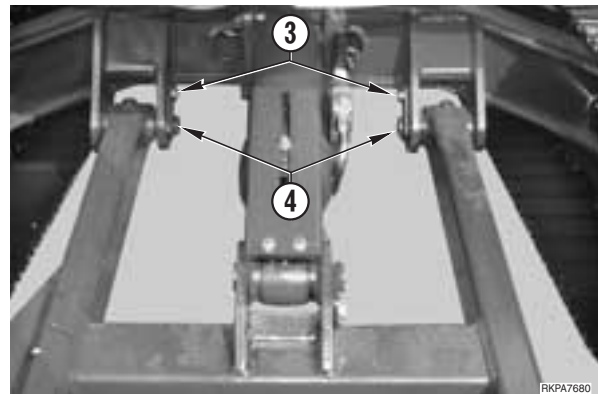
 Inside bushings: ASL800050

※ 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 adjustments to a given clearance (distributed on both sides of the fulcrum bushings).



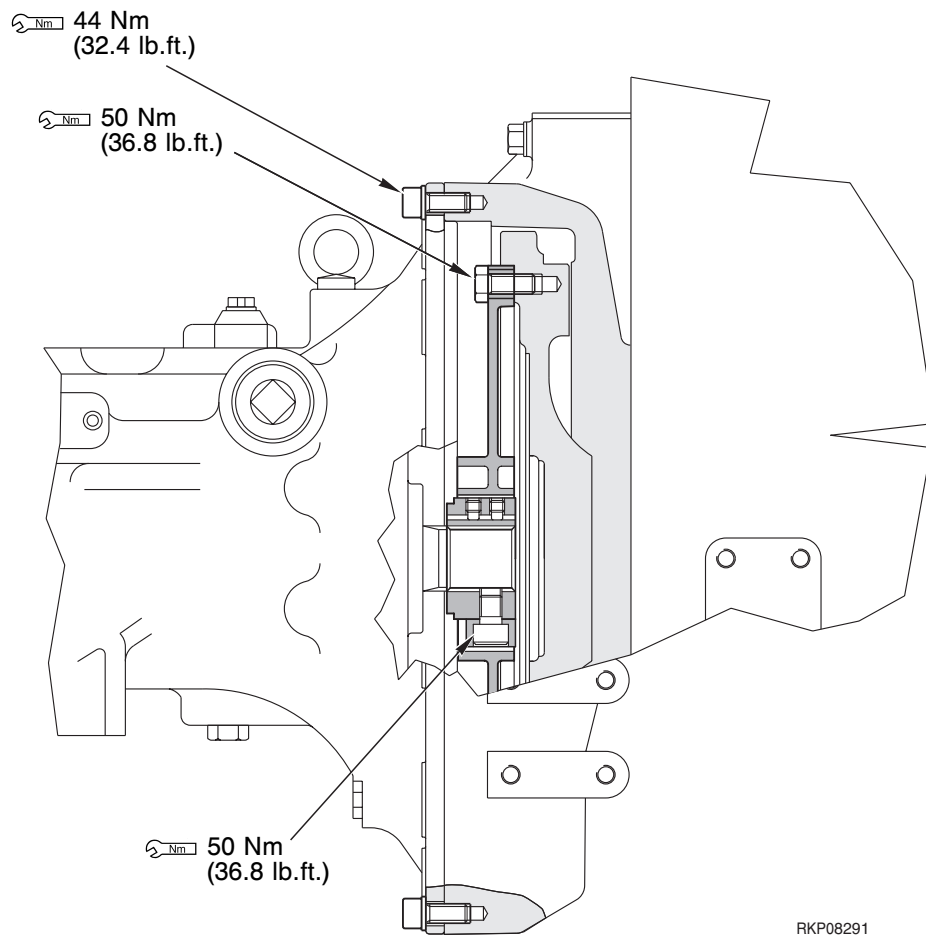
GROUP

40

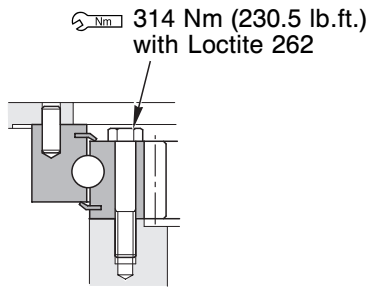
40 MAINTENANCE STANDARD

P.T.O.	2	Swing motor	22
Swing circle.....	3	Swivel joint.....	23
Track frame.....	4	Travel motor	24
Idler	5	Servocontrol feed unit	26
Carrier roller	6	Travel PPC valve.....	27
Track roller.....	7	PPC valve.....	28
Track shoe.....	8	Blade safety valve.....	30
Sprocket	9	Cylinders	32
Swing machinery.....	10	Work equipment (1-piece boom)	34
Hydraulic pump	11	Work equipment (2-piece boom)	36
Control valve	12		

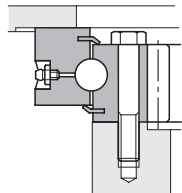
P.T.O.



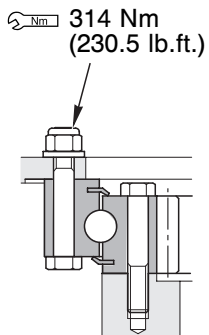
SWING CIRCLE



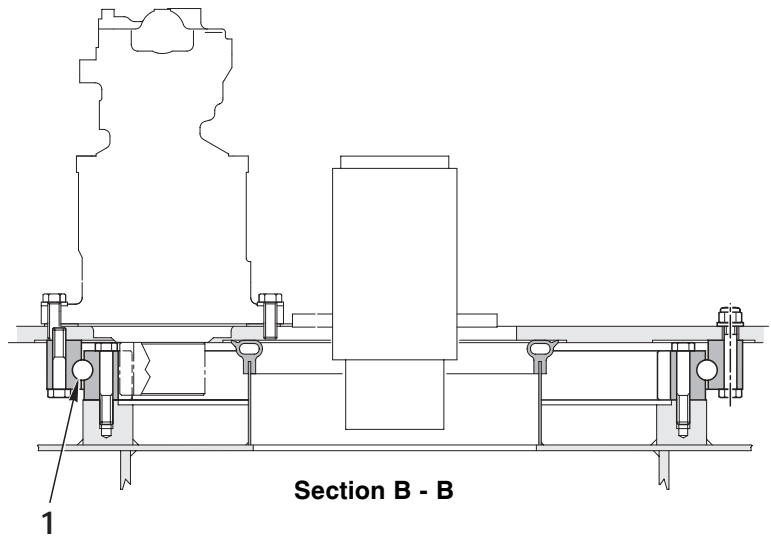
Section A - A



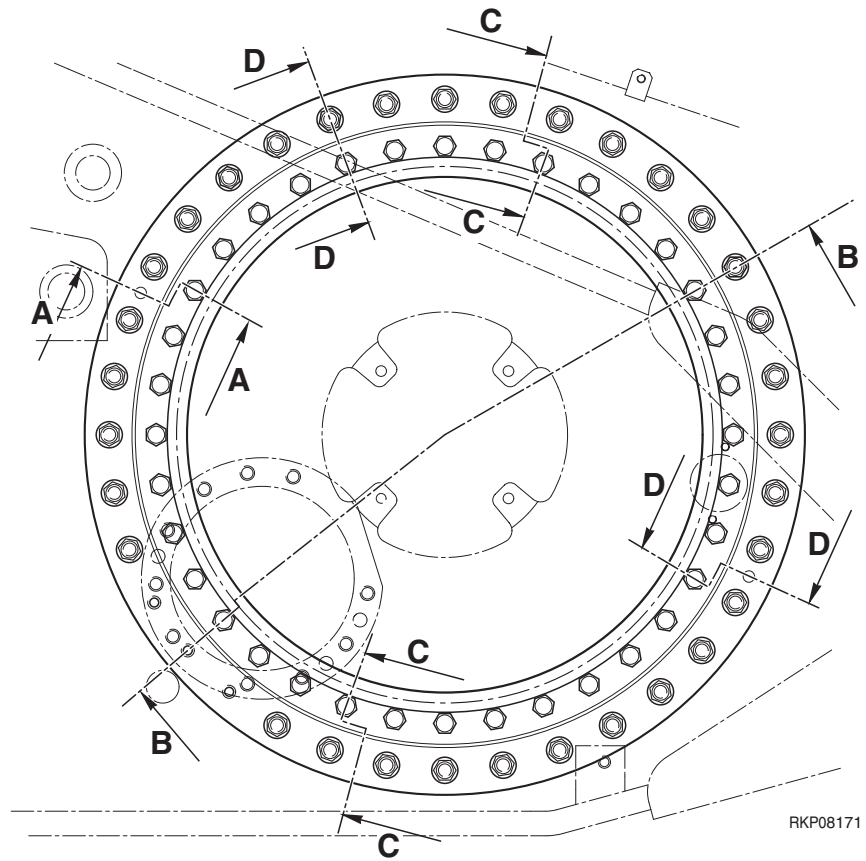
Section C - C



Section D - D



Section B - B

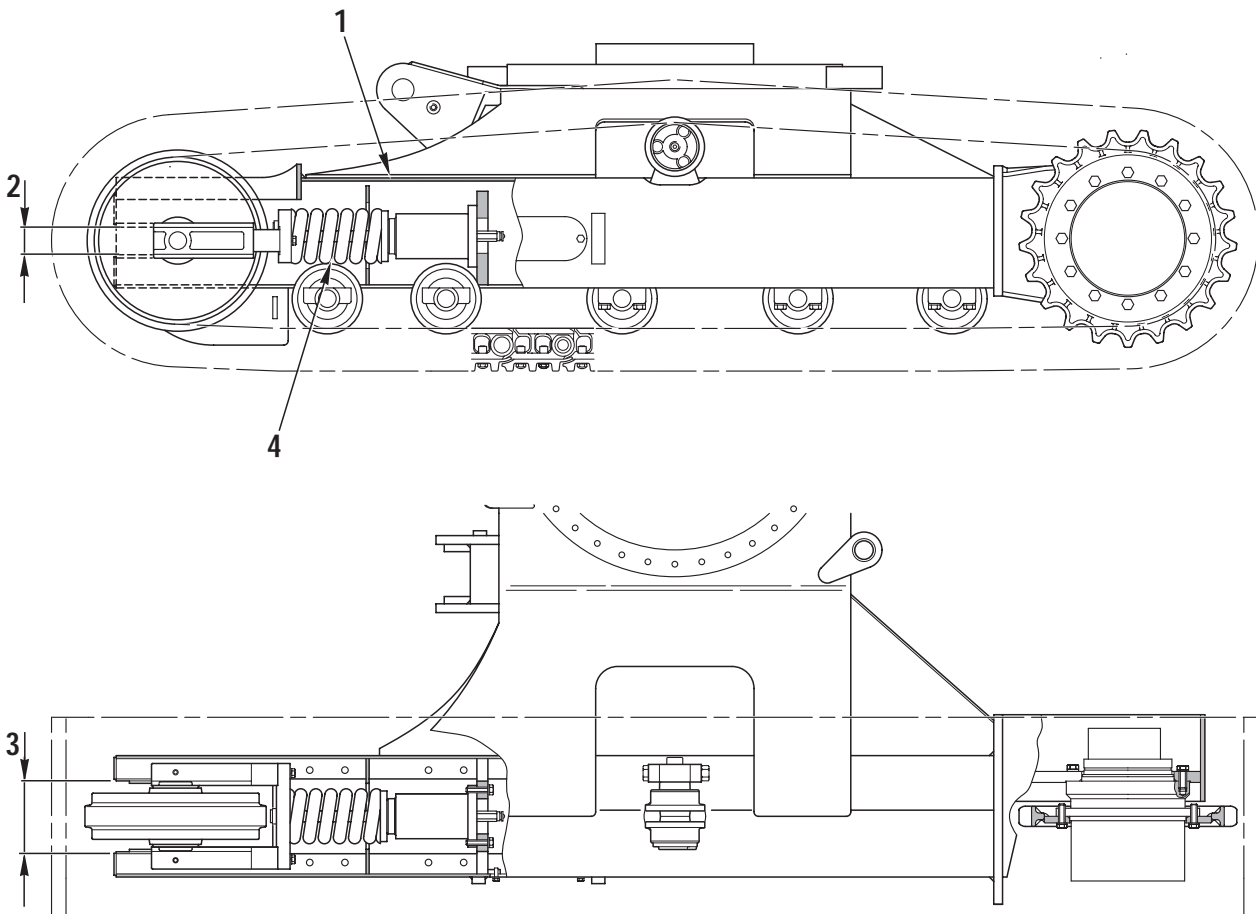


RKP08171

Unit: mm (in.)

No.	Check item	Criteria		Remedy
		Standard clearance	Clearance limit	
	Axial clearance	0.04 - 0.20 (0.0016 - 0.0078)	0.50 (0.02)	Replace

TRACK FRAME

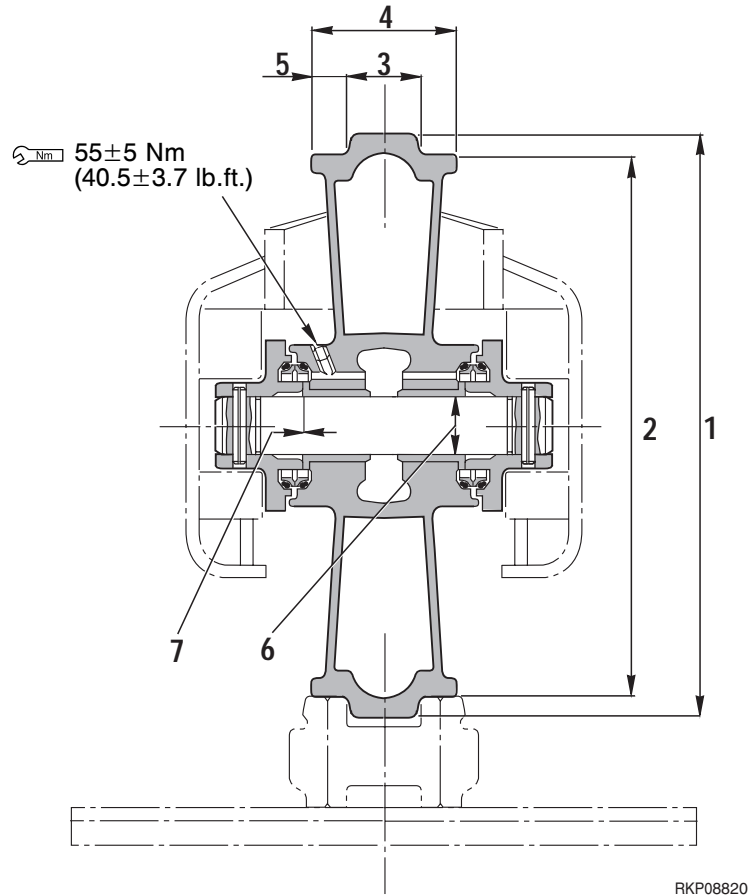


RKP08121

Unit: mm (in.)

No.	Check item	Criteria			Remedy
		Item	Repair limit		
1	Deformation of frame	Curvature	5 (for 1000 mm) (0.197 for 39.4 in.)		Rebuild
		Torsion	5 (for 300 mm) (0.197 for 11.8 in.)		
		Opening of idler portion	5 (0.197)		
2	Vertical width of idler guide	Item	Standard side	Limit side	Build up welding or replace
		Track frame	61 (2.403)	66 (2.600)	
		Idler support	60 (2.184)	57 (2.127)	
3	Horizontal width of idler guide	Track frame	161 (6.343)	166 (6.540)	Build up welding or replace
		Idler support	160 (6.304)	155 (6.107)	
4	Recoil spring	Standard side			Replace
		Free length	Installed length	Installed load	
		233 (9.180)	203 (7.998)	4000 kg (8.812 lb.)	

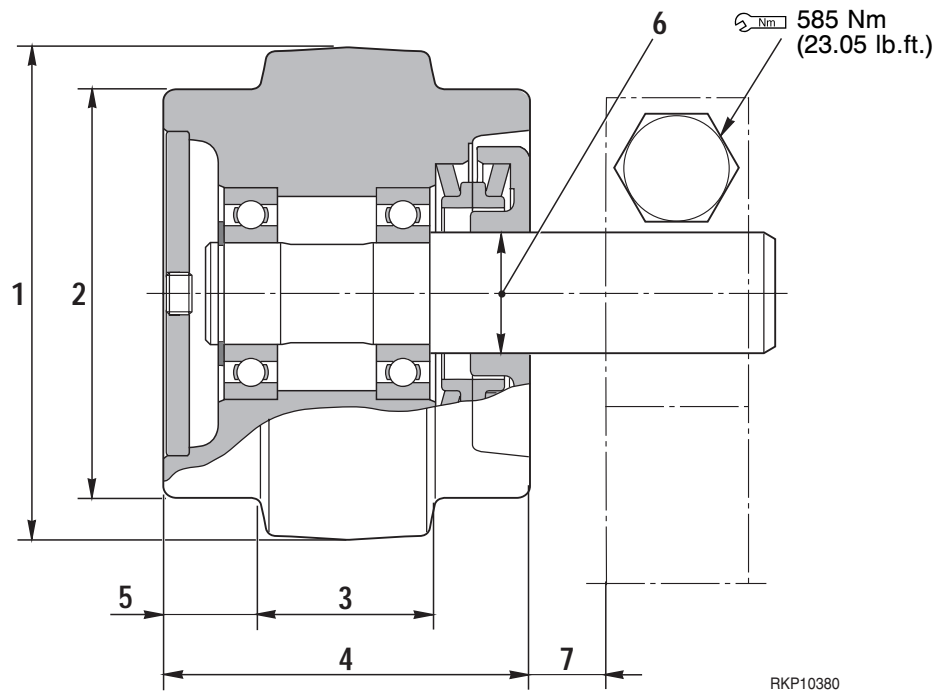
IDLER



Unit: mm (in.)

No.	Check item	Criteria				Remedy	
1	Outer diameter of protrusion	Standard size		Repair limit		Build up welding or replace	
		408 (16.1)		398 (15.7)			
2	Outer diameter of tread	380 (13.79)		370 (14.578)			
3	Width of protrusion	54 (2.127)		45 (1.773)			
4	Total width	105 (4.137)		96 (3.782)			
5	Width of tread	25.5 (1.005)		30 (1.182)			
6	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
		42 (1.654)	Shaft	Hole	(0.0052)		
			+ 0 - 0.025 (- 0.001)	+ 0.133 (+ 0.0052) - 0.025 (-0.001)	0.133 (0.0052) 0.262 (0.01)	1.5 (0.06)	
7	End play of idler	Standard size		Repair limit			
		0.65 - 1.2 (0.026 - 0.047)		2 (0.0788)			

CARRIER ROLLER

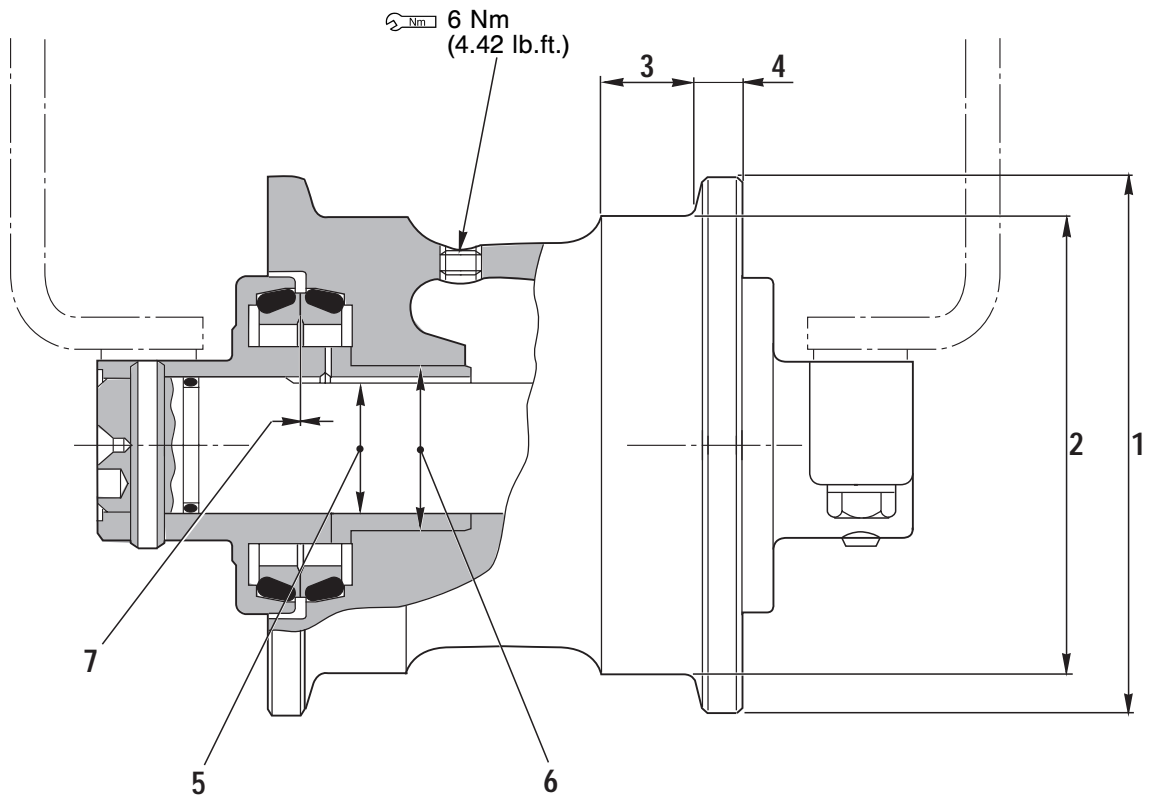


RKP10380

Unit: mm (in.)

No.	Check item	Criteria				Remedy	
1	Outer diameter of tread	Standard size		Repair limit		Build up welding or replace	
		145 (5.713)		136 (5.358)			
2	Outer diameter of protrusion	120 (4.728)		111 (4.373)			
3	Width of protrusion	53 (2.088)		45 (1.773)			
4	Total width	110 (4.334)		102 (4.018)			
5	Width of tread	28.5 (1.122)		32.5 (1.280)			
6	Interference between shaft and ring	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
		36 (1.418)	Shaft	Hole	0.085 – 0.021 (0.0033 – 0.0008)	0.015 (0.0006) – 0.010 (0.0004)	
+ 0.085 (+0.0033) – 0.060 (-0.0023)	+ 0.039 (+0.0015) – 0						
7	End play of idler	Standard size		Repair limit			
		0.1 – 0.6 (0.0039 - 0.0024)		1.2 (0.047)			

TRACK ROLLER

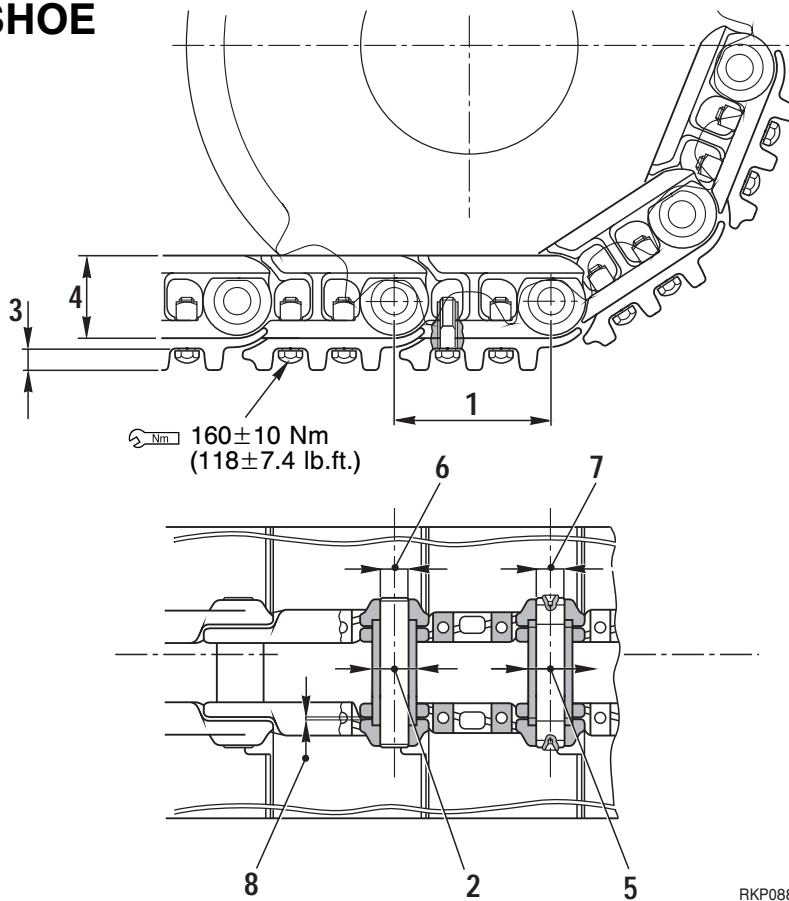


RKP08810

Unit: mm (in.)

No.	Check item	Criteria				Remedy	
		Standard size	Tolerance		Repair limit		
1	Outer diameter of tread	160 (6.30)			150 (5.91)		
		135 (5.32)			125 (4.92)		
2	Tread outside diameter	28 (1.103)			32 (1.26)		
3	Tread width	14 (0.55)			10 (0.394)		
4	Flange width	Standard size	Tolerance		Standard clearance		Clearance limit
		40 (1.57)	Shaft	Hole	0.075 – 0.214 (0.0030 – 0.0084)		1.5 (0.059)
5	Clearance between shaft and bushing	48 (1.89)	Shaft	Hole	Standard clearance		Interfer. limit
		48 (1.89)	+ 0.07 (0.0028) + 0.095 (0.0037)	0 + 0.039 (0.0015)	0.095 – 0.031 (0.0037 – 0.0012)	0.015 (0.0006)	
6	Interference between roller and bushing	Standard tolerance	Clearance limit				
		0.2 – 1.2 (0.0079 – 0.047)	2 (0.0788)				
7	End play of idler						

TRACK SHOE

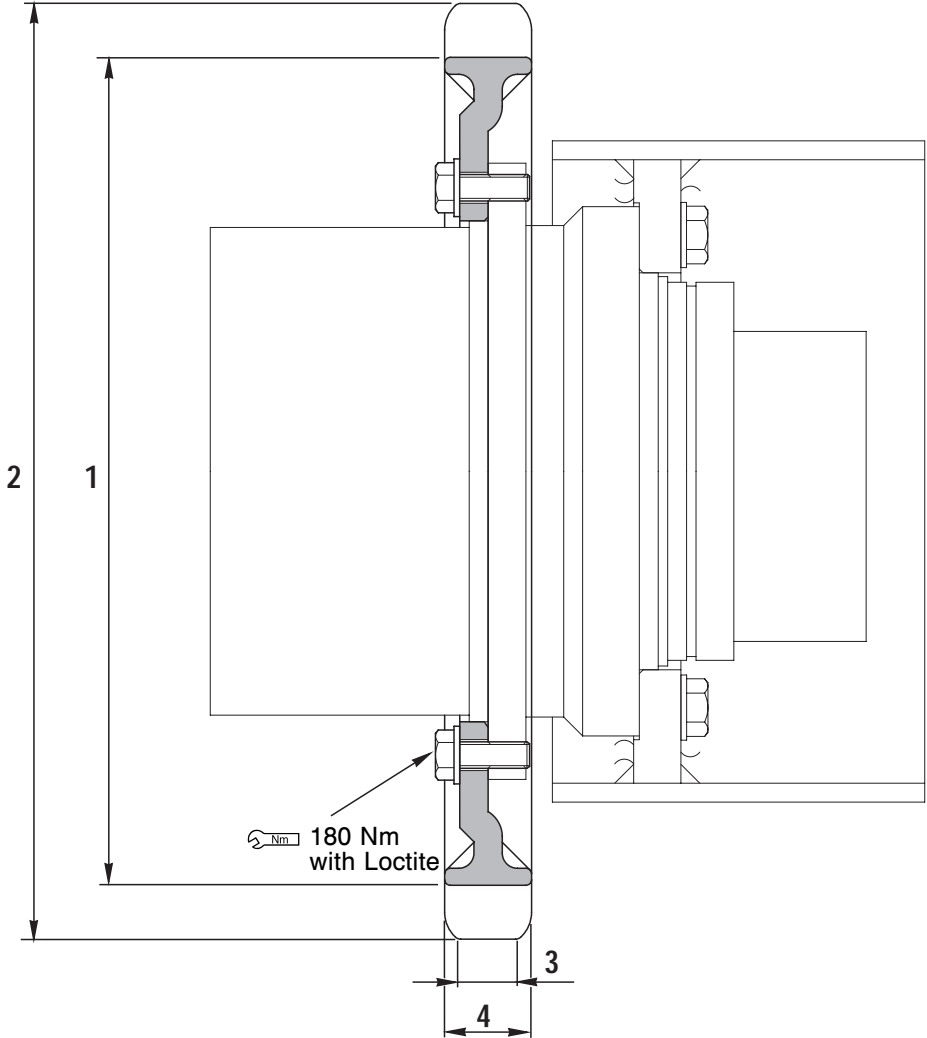


RKP08800

Unit: mm (in.)

No.	Check item	Criteria				Remedy
		Standard size	Tolerance		Repair limit	
1	Link pitch	140 (5.52)			143.6 (5.66)	Turn or replace
2	Bushing outside diameter	37 (1.46)			34 (1.34)	Turn or replace
3	Grouser height	18 (0.71)			6 (0.24)	Lud welding rebuild or replace
4	Link height	70 (2.76)			66 (2.60)	Rebuild or replace
5	Interference between bushing and link	Standard size 37 (1.46)	Tolerance		Standard interf. 0.33 - 0.13 (0.119 - 0.0051)	Interfer. limit —
			Shaft 37.5 ⁺⁰ _{-0.1} (1.48 ⁺⁰ _{-0.004})	Hole 36.72 ^{+0.1} _{-0.1} (1.45 ^{+0.004} _{-0.004})		
6	Interference between regular pin and link	25 (0.98)	25 ⁰ _{±0.1} (0.98 ^{+0.004})	24.70 ^{+0.1} _{-0.1} (0.97 ^{+0.004} _{-0.004})	0.4 - 0.2 (0.0157 - 0.0079)	Replace
7	Interference between master pin and link	25 (0.98)	24.88±0.03 (0.098±0.0012)	24.70 ^{+0.1} _{-0.1} (0.97 ^{+0.004} _{-0.004})	0.21 - 0.05 (0.0083 - 0.0197)	—
8	Clearance between link joint surface	Standard tolerance			Clearance limit	Replace
		1 (0.0394)			—	

SPROCKET

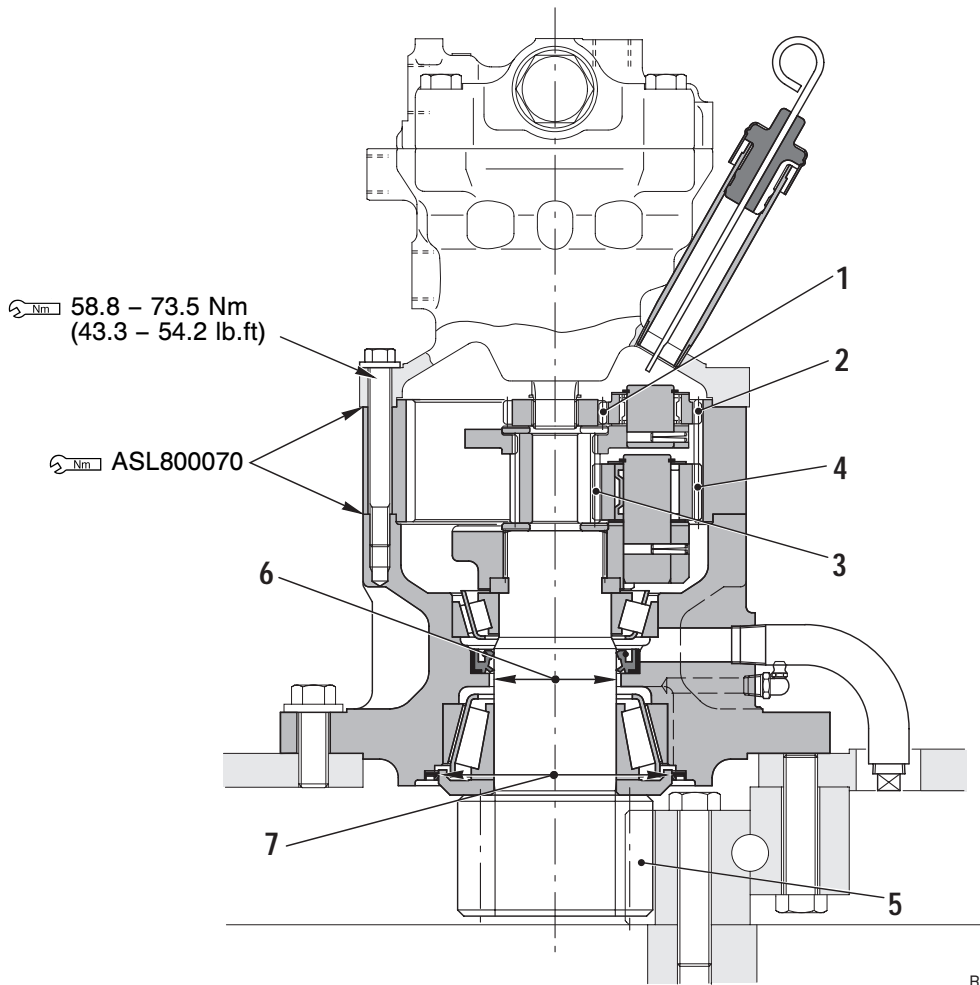


RKP08790

Unit: mm (in.)

No.	Check item	Criteria			Remedy
		Standard size	Tolerance	Repair limit	
1	Wear of roots of sprocket teeth	438 (17.14)	$^0_3 (^0_{-} 0.12)$	425 (16.74)	
		495 (19.5)	$^0_2 (^0_{-} 0.079)$	482 (18.99)	
3	Face width of sprocket teeth (teeth crest)	32 (1.26)	—	29 (1.14)	
4	Face width of sprocket teeth (bottom land)	46 (1.81)	$^0_{+1.5} (^0_{+} 0.059)$	42 (1.65)	

SWING MACHINERY

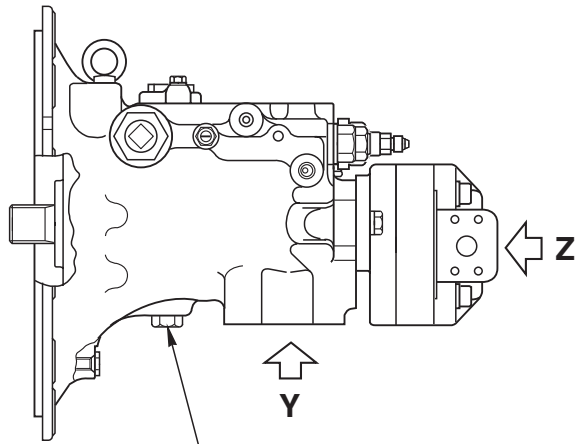


RKP08780

Unit: mm (in.)

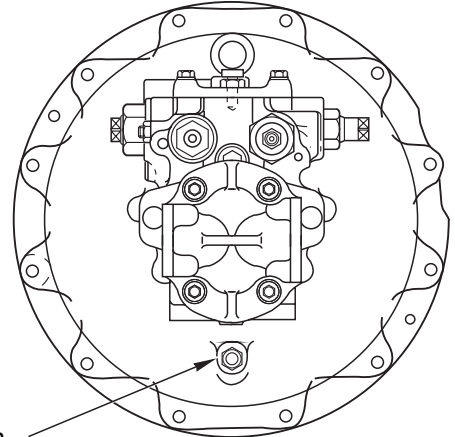
No.	Check item	Criteria			Remedy
		Standard clearance	Clearance limit		
1	Backlash between No. 1 sun gear and No. 1 planetary gear	0.11 - 0.31 (0.0043 - 0.0122)	0.6 (0.0236)		Replace
		0.12 - 0.40 (0.0047 - 0.0157)	0.6 (0.0236)		
2	Backlash between No. 1 planetary gear and ring gear	0.11 - 0.31 (0.0043 - 0.0122)	0.6 (0.0236)		
3	Backlash between No. 2 and gear and No. 2 planetary gear	0.12 - 0.40 (0.0047 - 0.0157)	0.6 (0.0236)		
4	Backlash between No. 1 planetary gear and ring gear	0.22 - 0.85 (0.0087 - 0.0335)	2.0 (0.0787)		
6	Wear of swing pinion shaft surface contacting with oil seal	Standard side	Tolerance	Repair limit	Repair hard chrome plating or replace
		65 (2.56)	0 - 0.074 (0.0029)	64.8 (2.55)	
7	Wear of swing pinion collar surface contacting with dust seal	125 (4.92)	- 0.043 (0.0017) - 0.106 (0.0042)	124.8 (4.914)	

HYDRAULIC PUMP

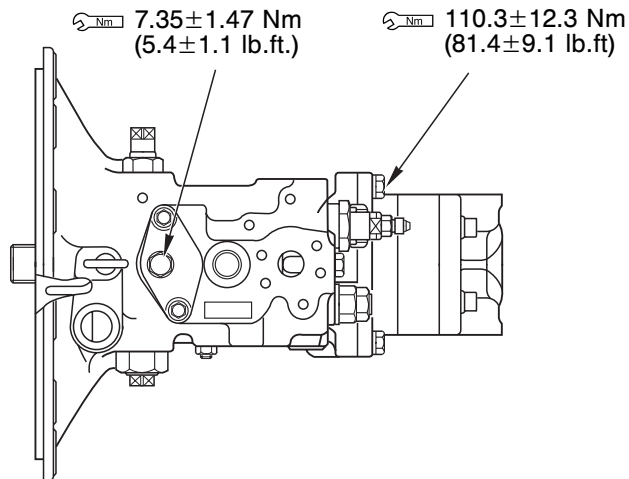


Nm 68.6±9.8 Nm
(50.6±0.737 lb.ft.)

Nm 17.2±2.5 Nm
(12.7±1.8 lb.ft.)

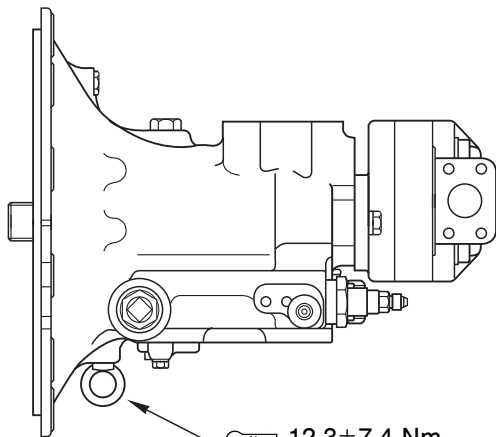
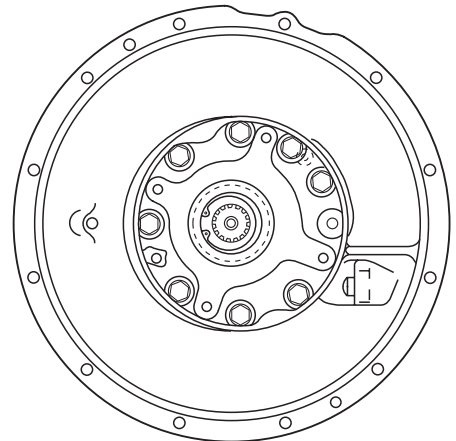


View Z

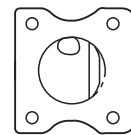


Nm 7.35±1.47 Nm
(5.4±1.1 lb.ft.)

Nm 110.3±12.3 Nm
(81.4±9.1 lb.ft.)



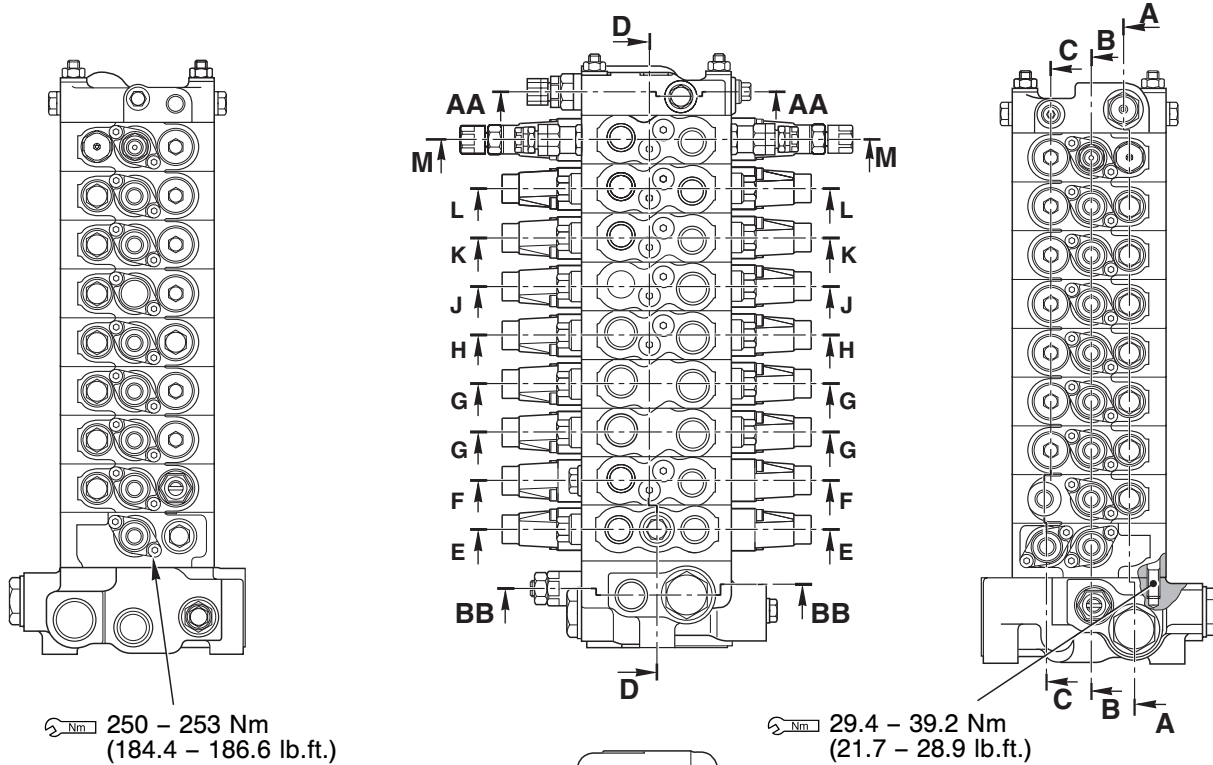
Nm 12.3±7.4 Nm
(9.1±5.5 lb.ft.)




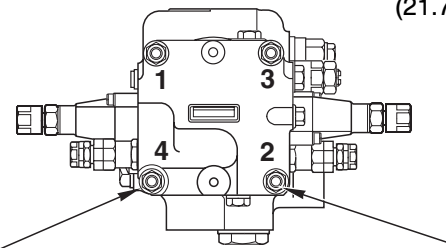
View Y

RKP08211

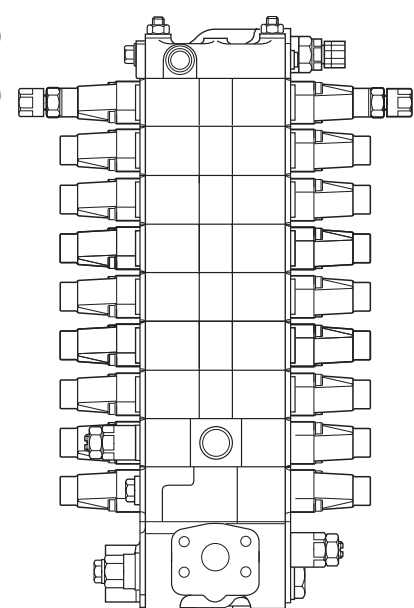
CONTROL VALVE



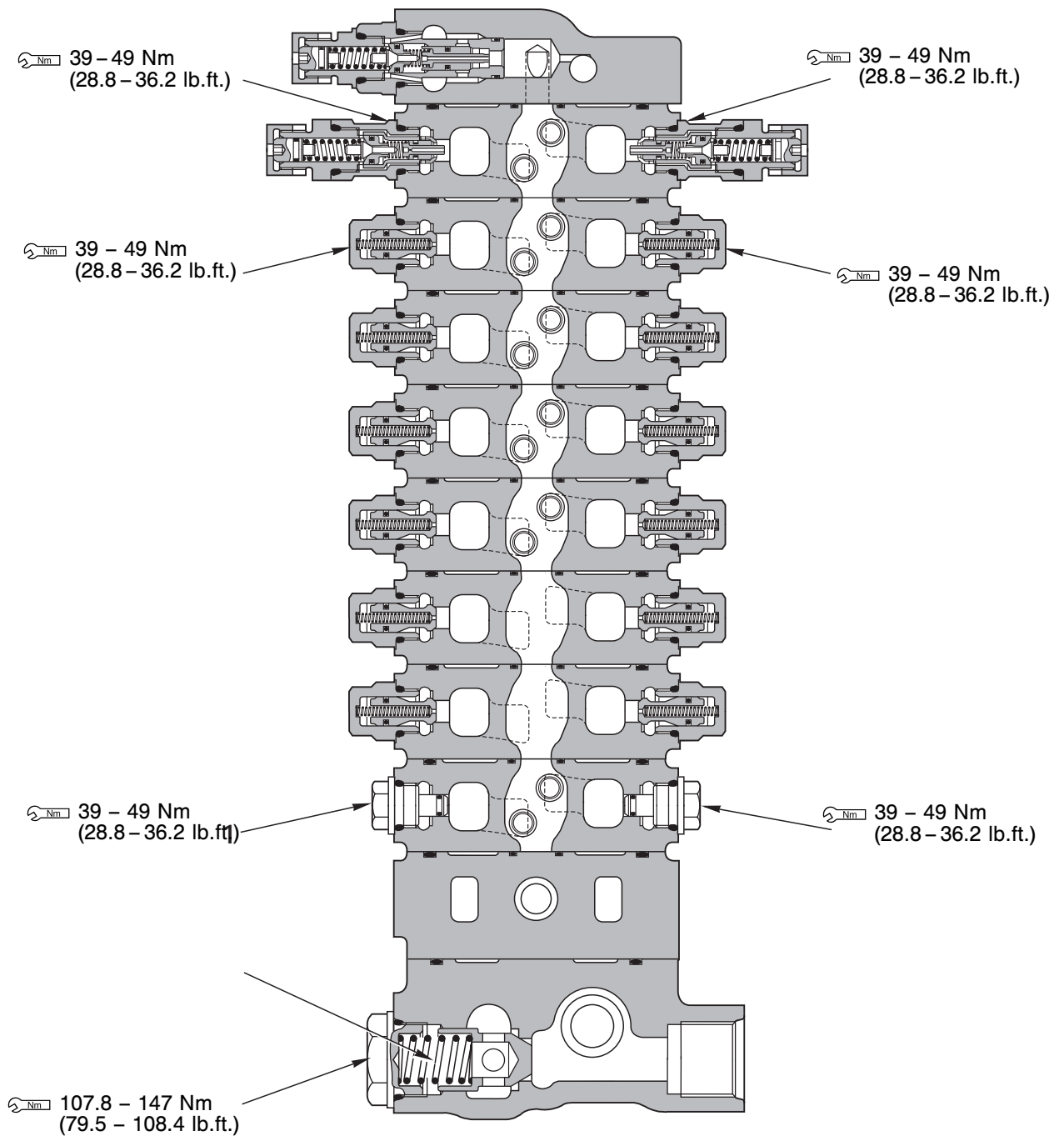
-  1st tightening: 19.6 – 29.4 Nm (14.5 – 21.7 lb.ft.)
- 2nd tightening: 39.2 – 49 Nm (28.9 – 36.2 lb.ft.)
- 3rd tightening: 58.8 – 73.5 Nm (43.4 – 54.2 lb.ft.)



Tightening following 1-2-3-4 order in 3 times



RKP03100

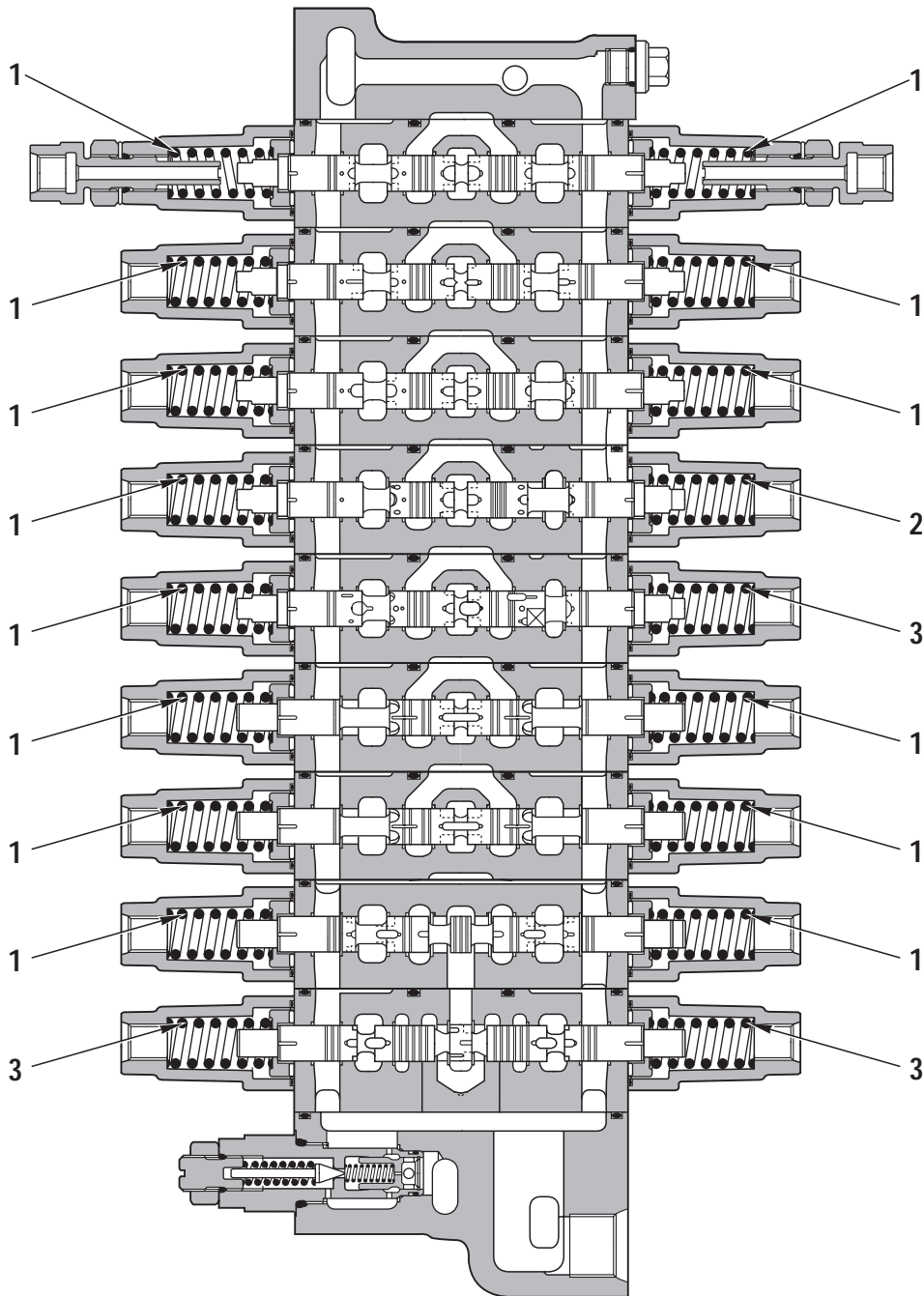


Section A - A

RKP03110

Unit: mm (in.)

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 (1.3)	231.4 N (23.6 kg)	—	—	Replace

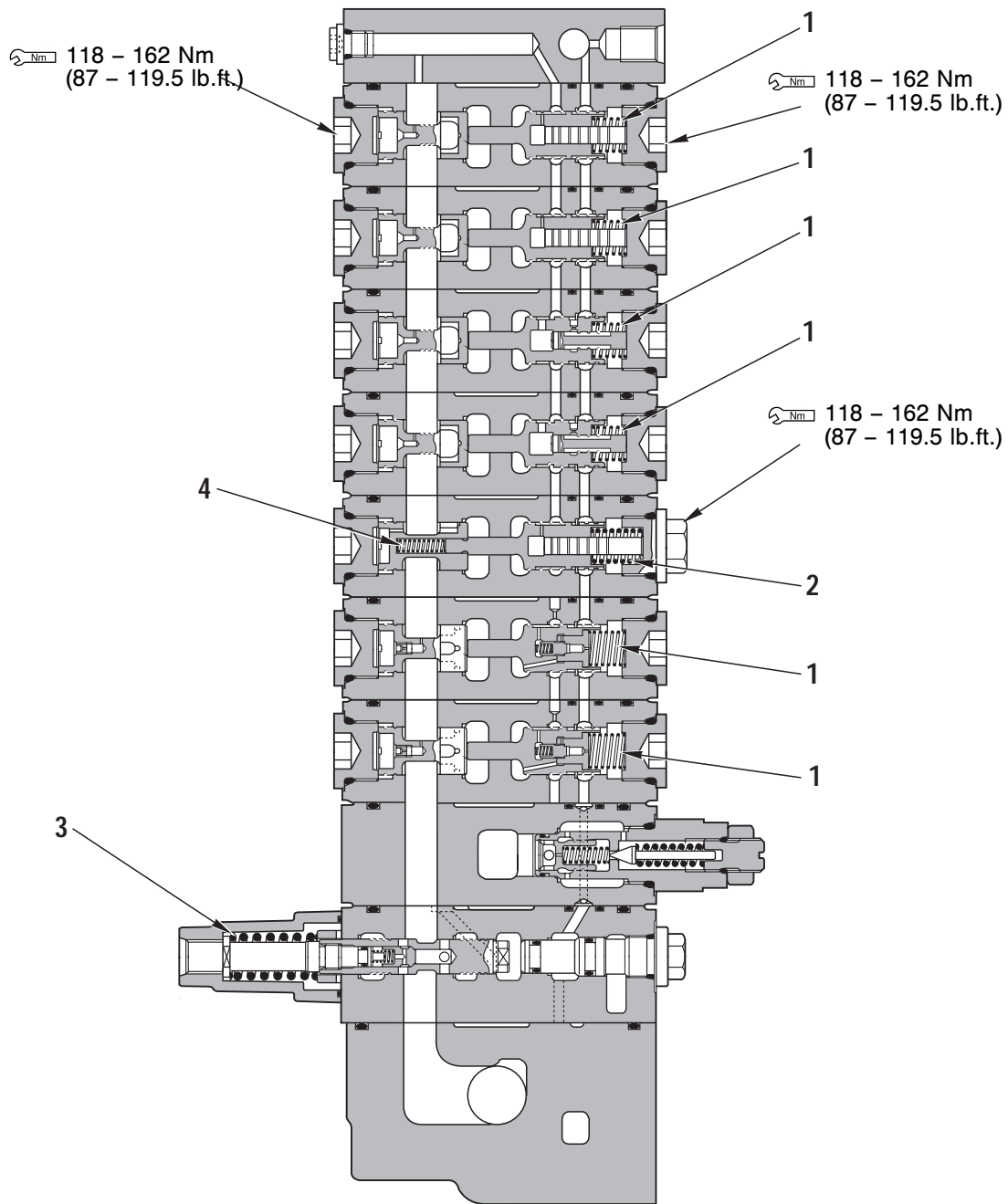


Section B - B

RKP02781

Unit: mm (in.)

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	Spool return spring (Work equipment, swing, boom, arm, bucket, boom swing, blade, travel, equipment)	—	40.5 (1.6)	34.7 N (3.5 kg)	—	—	Replace
2	Spool return spring (Arm)	—	40.5 (1.6)	54.6 N (5.6 kg)	—	—	
3	Spool return spring (Boom, swing)	—	40.5 (1.6)	4.9 N (5 kg)	—	—	

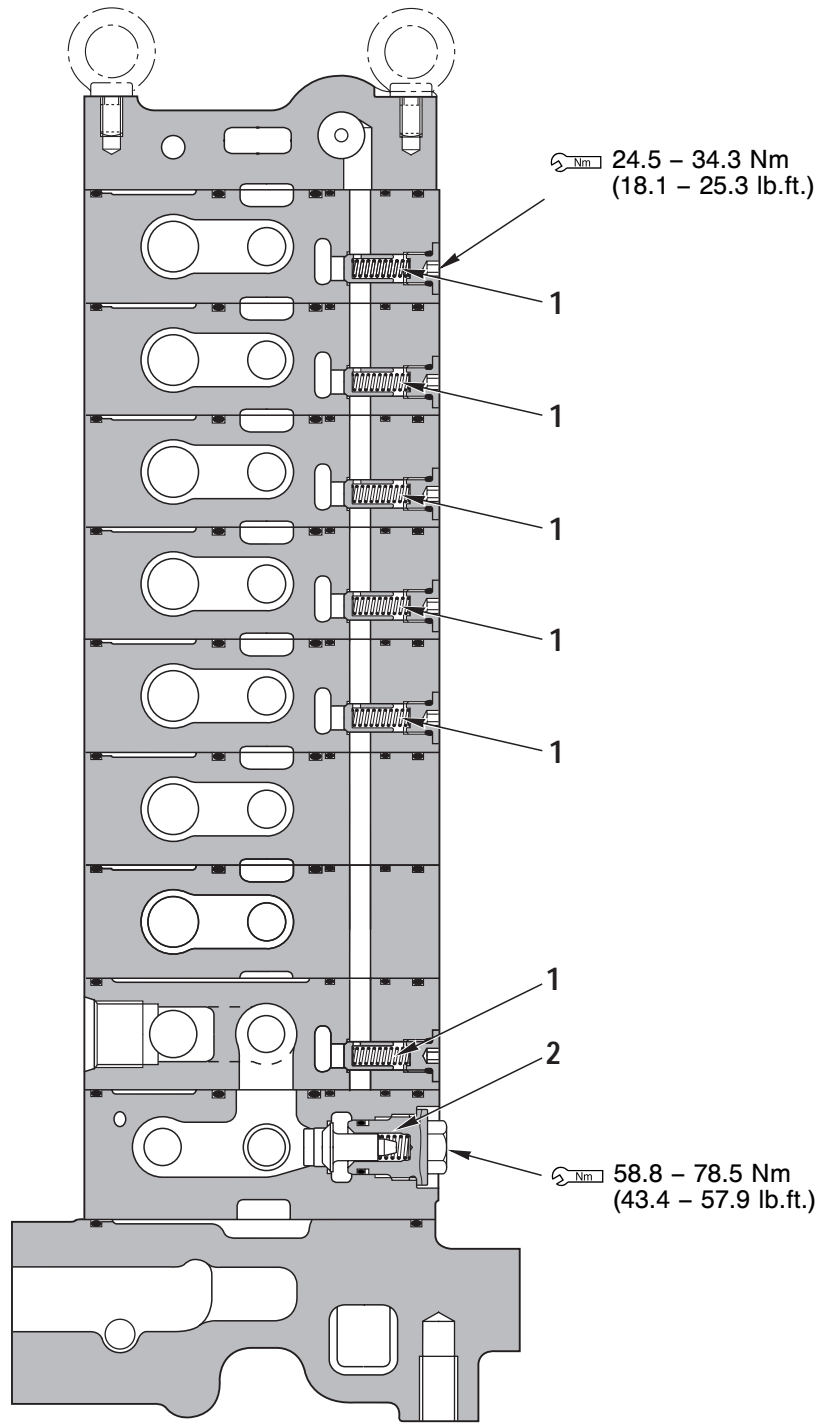


Section C - C

RKP02791

Unit: mm (in.)

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	Pressure compensation valve spring	—	14.5 (0.57)	13.72 N (1.4 kg)	—	—	Replace
2	Pressure compensation valve spring (boom)	—	21.5 (0.85)	55.9±3 N (5.7±0.34 kg)	—	—	
3	Spool (boom raise at joining pump discharge)	—	36 (1.42)	238.3 N (24.3 kg)	—	—	
4	Flow compensation valve spring (boom)	—	20 (0.79)	27.6 N (2.82 kg)	—	—	

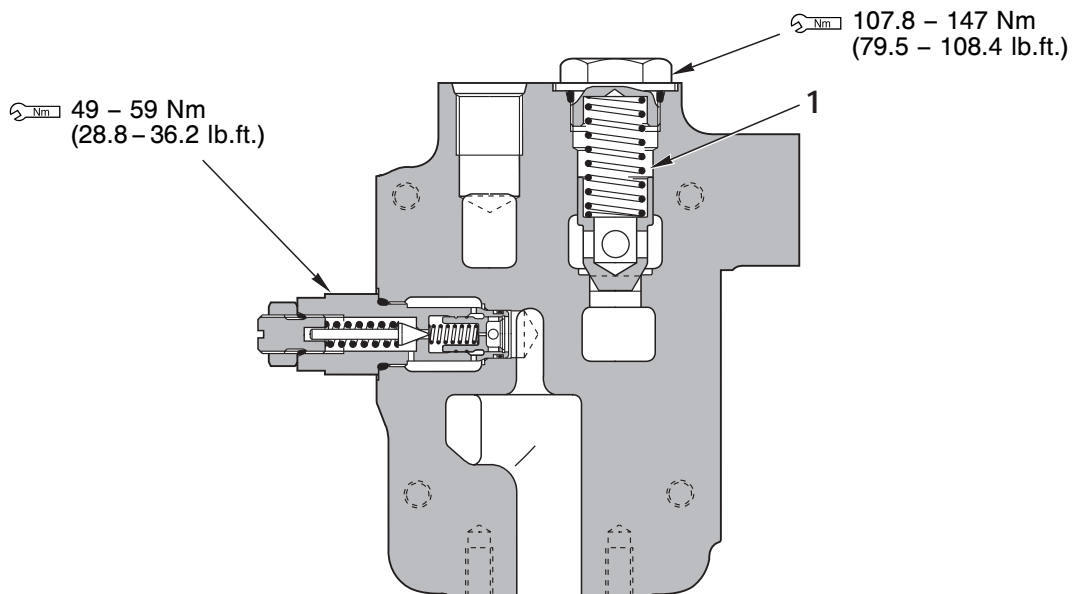


Section D - D

RKP02801

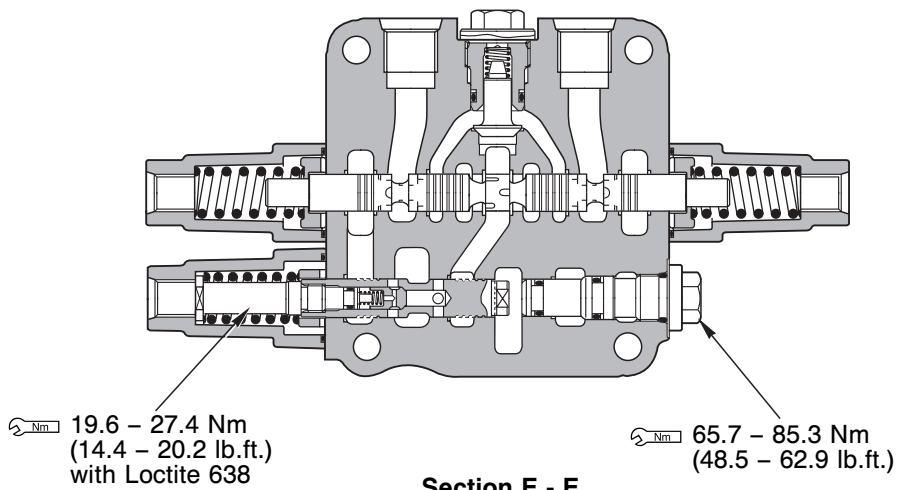
Unit: mm (in.)

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	Check valve spring	—	22 (0.876)	3.92 N (0.4 kg)	—	—	Replace
2	Check valve spring (Swing)	—	11.5 (0.453)	13.7 N (1.4 kg)	—	—	



Section BB - BB

RKP02821

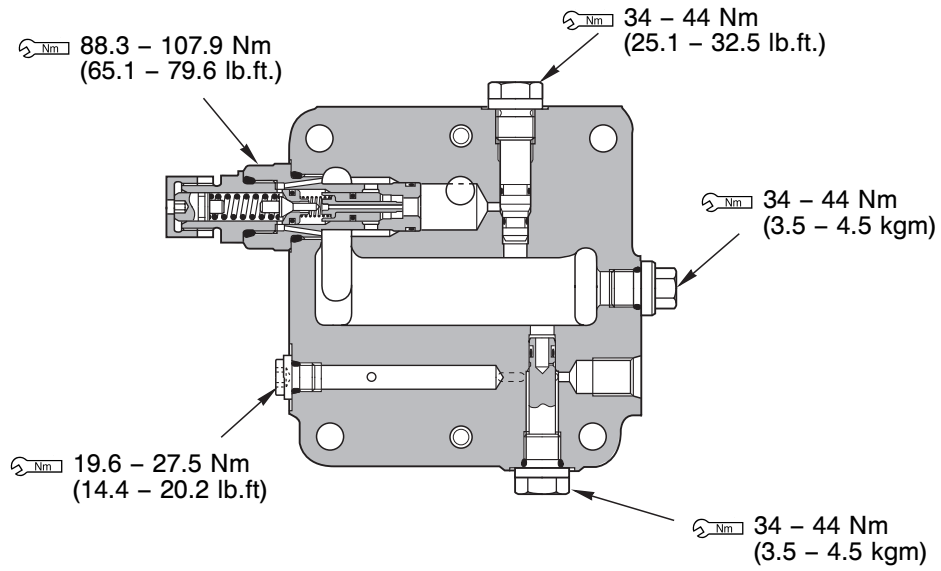


Section E - E

RKP02811

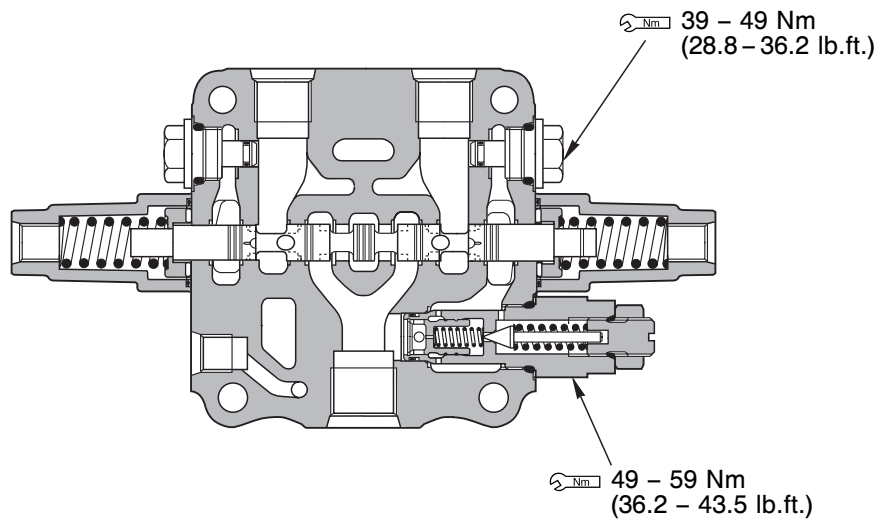
Unit: mm (in.)

No.	Check item	Criteria					Remedy
		Free length x O.D.	Installed length	Installed load	Free length x O.D.	Installed load	
1	Lift check valve spring	—	44.9 (1.768)	36,3 N (3.7 kg)	—	—	Replace



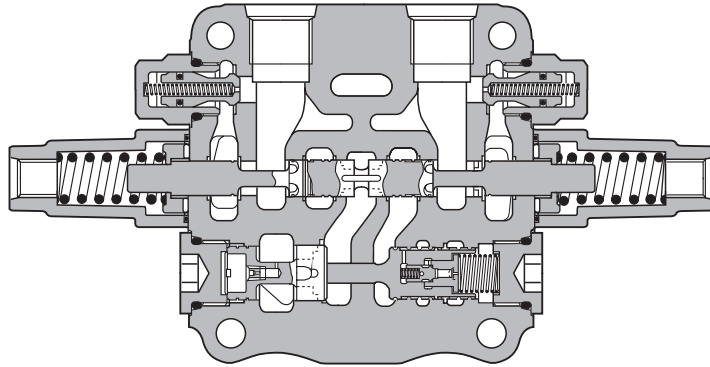
Section AA - AA

RKP02841



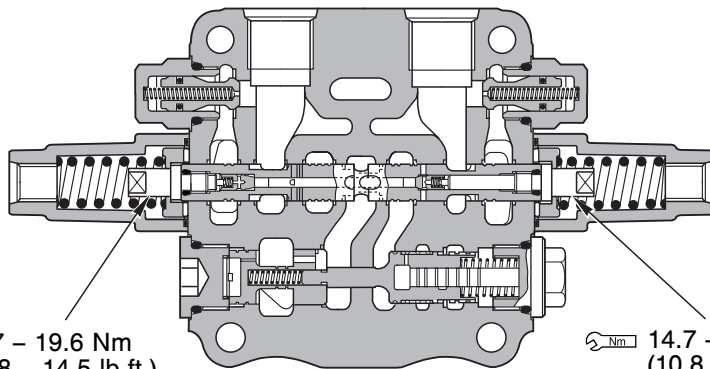
Section F - F


RKP02831




RKP02851

Section G - G

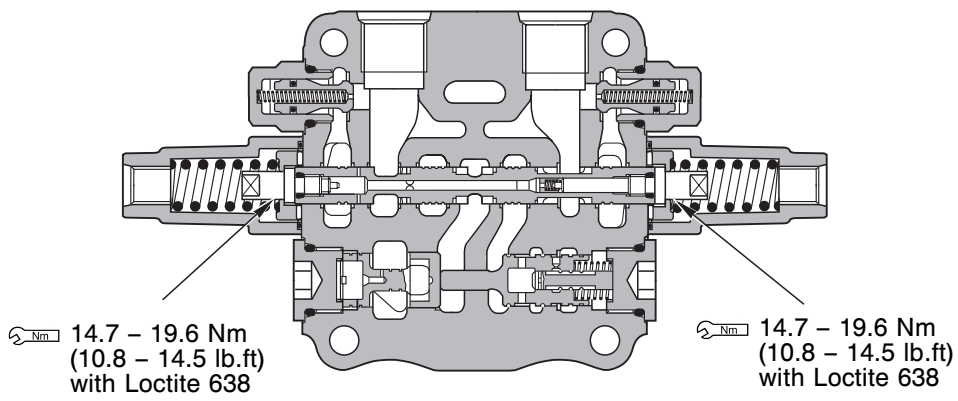


 **14.7 – 19.6 Nm**
(10.8 – 14.5 lb.ft.)
 with Loctite 638

 **14.7 – 19.6 Nm**
(10.8 – 14.5 lb.ft.)
 with Loctite 638

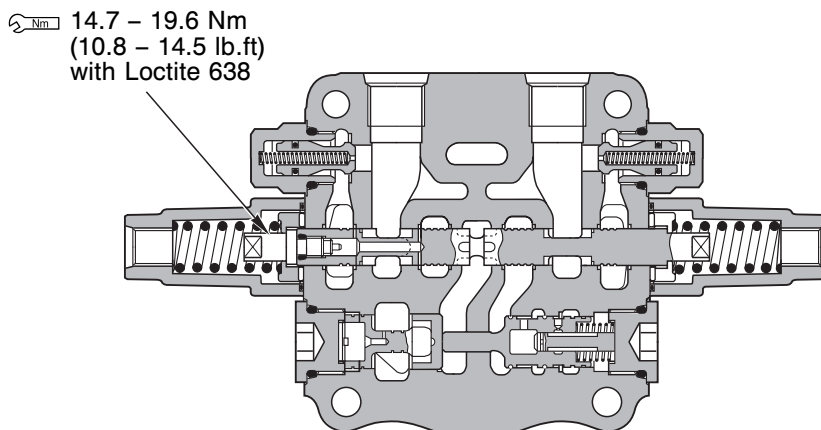
Section H - H

RKP02861



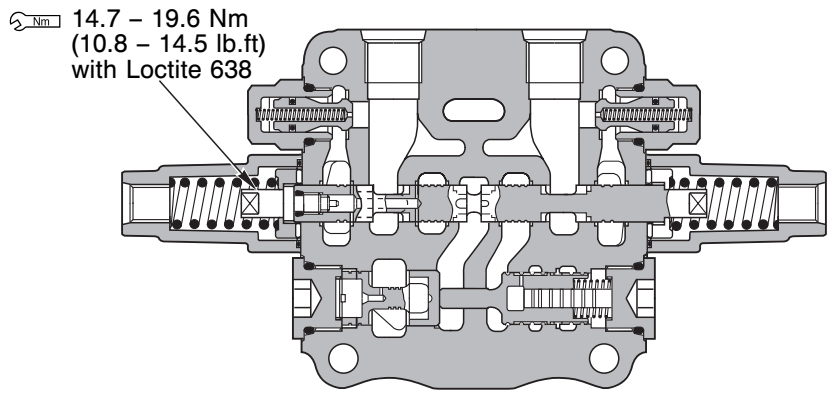
Section J - J

RKP02871



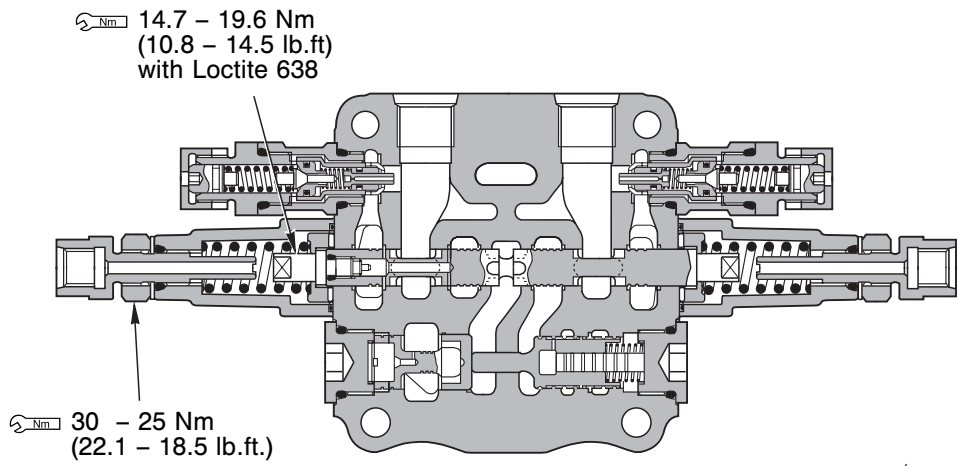
Section K - K

RKP02881



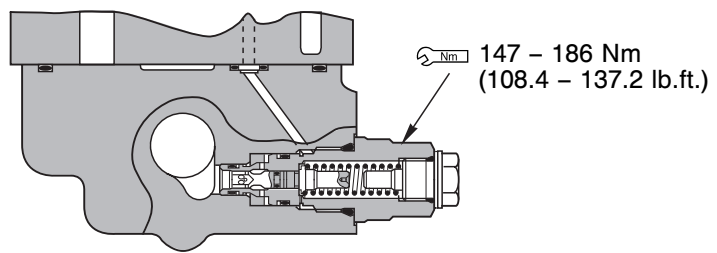
Section L - L

RKP02891



Section M - M

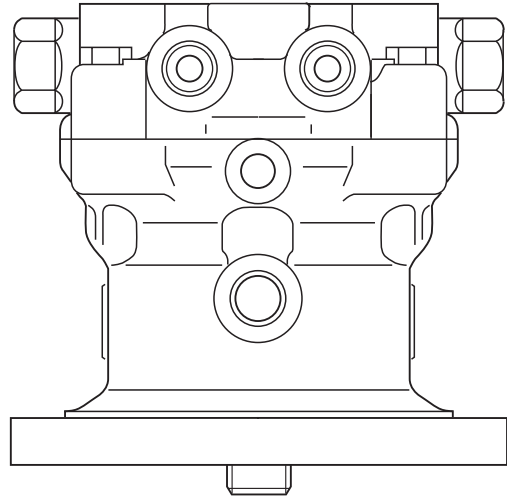
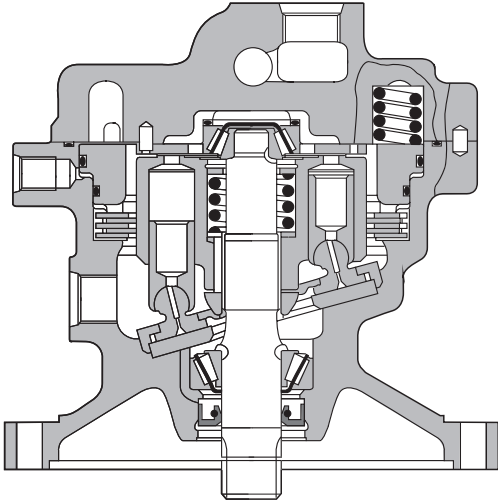
RKP02901




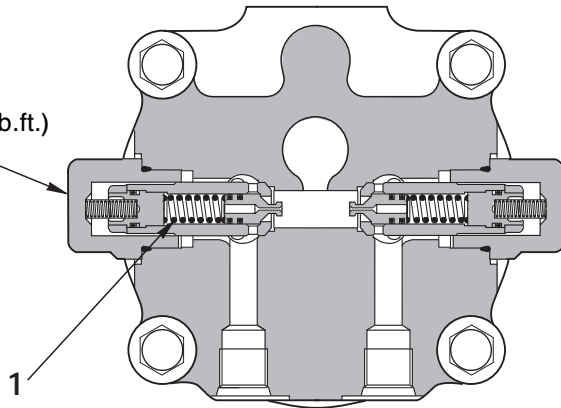
Section N - N

RKP02911

SWING MOTOR



 250 – 253 Nm
(184.4 – 186.6 lb.ft.)

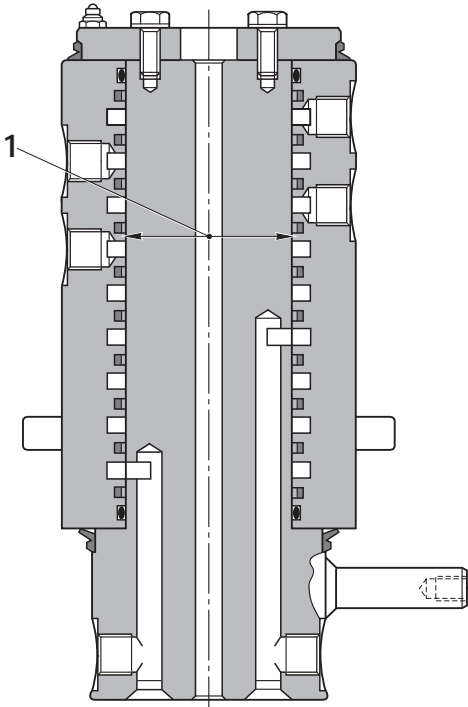


RKP10390

Unit: mm (in.)

No.	Check item	Criteria					Remedy
		Free length x O.D.	Installed length	Installed load	Free length x O.D.	Installed load	
1	Suction valve spring	—	21.9 (0.862)	3.42 N (0.35 kg)	—	—	Replace

SWIVEL JOINT

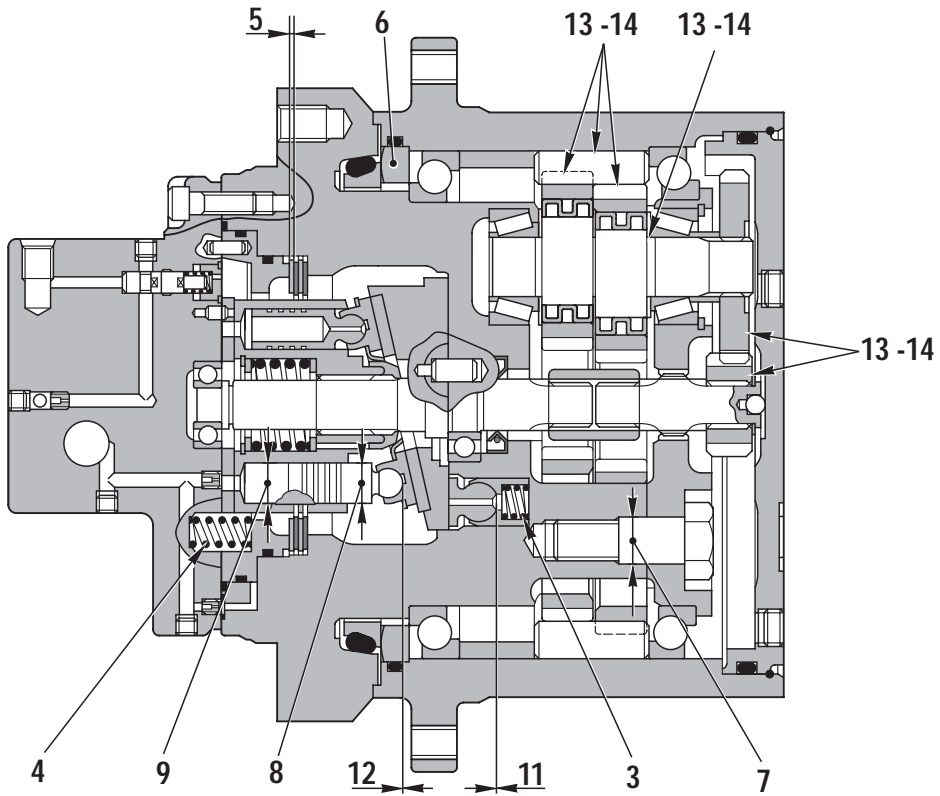
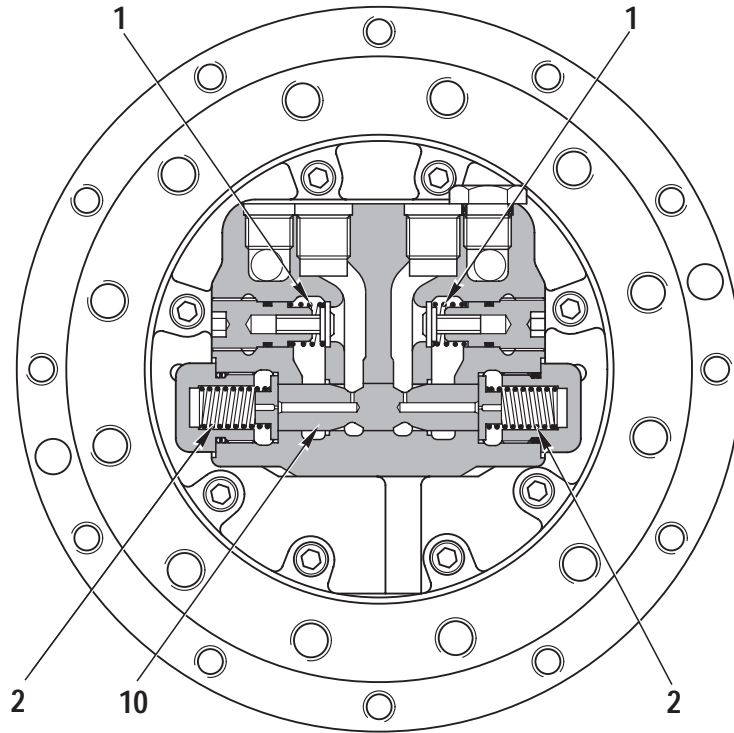


RKP03950

Unit: mm (in.)

No.	Check item	Criteria				Remedy	
		Standard size	Tolerance		Standard clearance		Clearance limit
1	Clearance between shaft and rotor	85 (3.346)	Shaft	- 0.02 (-0.0008) - 0.05 (-0.002)	0.12 - 0.20 (0.005 - 0.008)	0.25 (0.009)	Replace
			Hole	+ 0.10 (+ 0.004) + 0.15 (+ 0.006)			

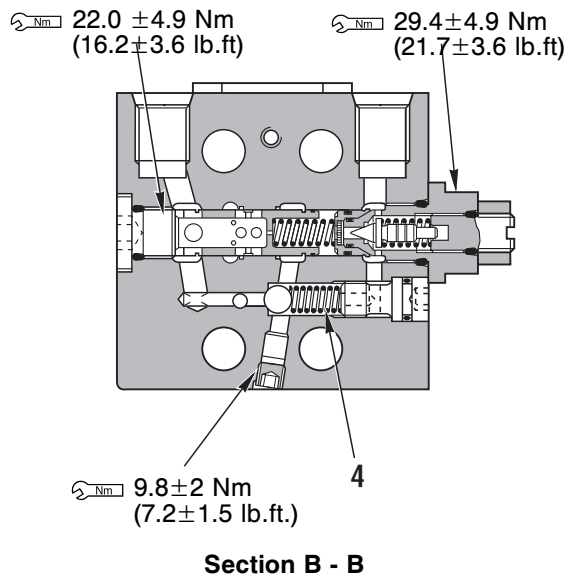
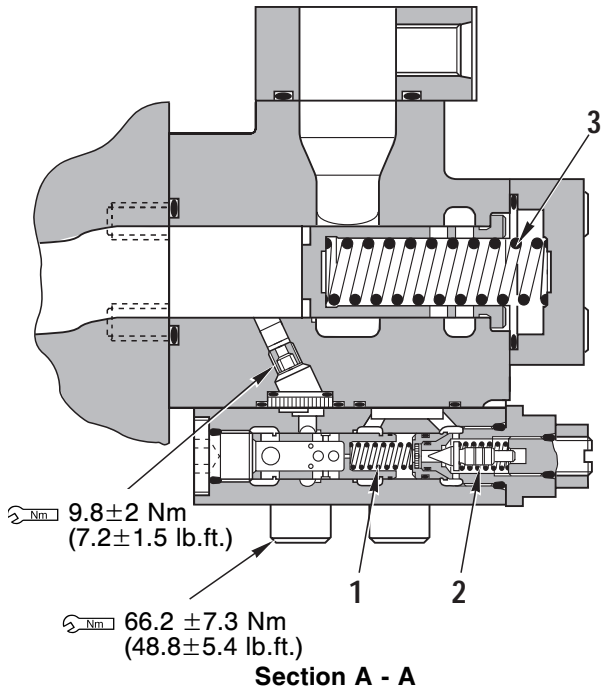
TRAVEL MOTOR



RKP08690

No.	Check item	Criteria					Remedy
		Free length	Installed length	Installed load	Free length	Installed load	
1	Check valve spring	—	—	—	—	—	Replace
2	Spool return spring	—	—	—	—	—	
3	Piston spring	—	—	—	—	—	
4	Brake spring	—	—	—	—	—	
5	Friction plate	Standard size			Limit size		Replace
		2.8 (0.110)			2.5 (0.098)		
6	Sealing surface distance piece	—			0.2 (0.008)		
7	Diameter of reamed holes	20.5 (0.807)			20.521 (0.808)		Replace spindle
8	Piston diameter	16.995 (0.669)			16.985 (0.668)		Replace
9	Cylinder bore diameter	17.004 (0.669)			17.014 (0.670)		
10	Radial clearance of spool	0.012 – 0.018 (0.0005 – 0.0007)			0.023 (0.0009)		Replace spool
11	Play of piston ball in shoe	0.1 (0.004)			0.2 (0.008)		Replace
12	Play of piston ball in shoe	Standard clearance			Clearance limit		
		0.05 (0.002)			0.15 (0.006)		
13	Flacking of trochoid tooth surface RV-A gear, RV-B gear, input gear, spur gear, crankshaft, pins.	Normal value			Limit value		Replace
		—			Max. 6.5 mm ²		
14	Pitting of trochoid tooth surface of RV-A gear, RV-B gear, input gear, spur gear, crankshaft.	—			Max. 1 mm ²		

SERVOCONTROL FEED UNIT

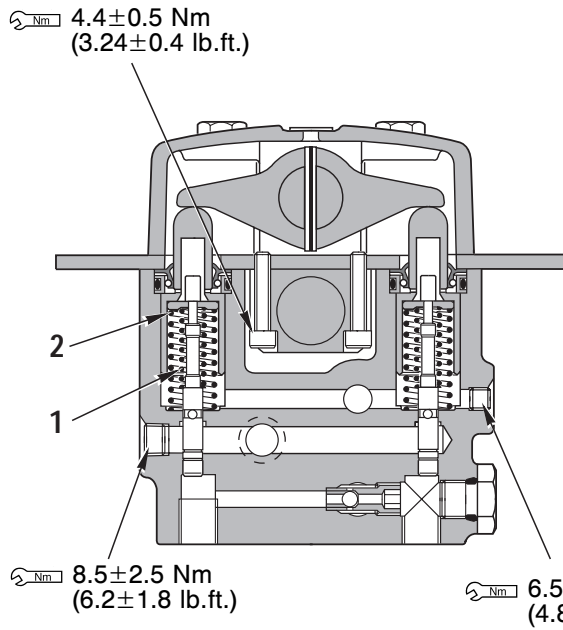


RKP04090

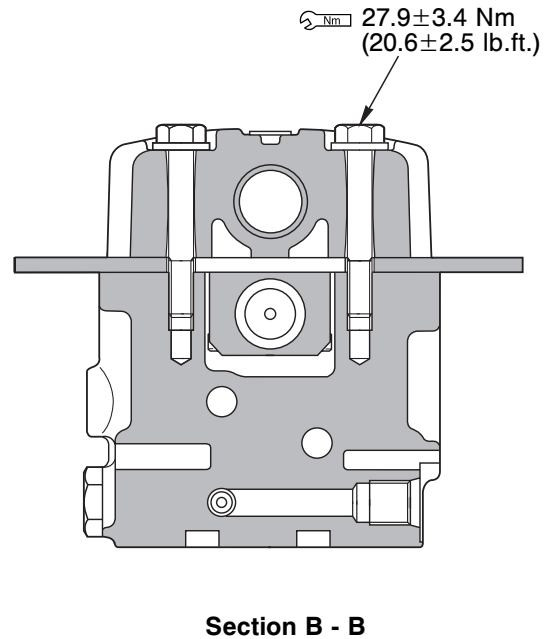
Unit: mm (in.)

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	Reducing valve main spring	19.2x7.2 (0.756x0.283)	16.1 (0.634)	19.6 N (2 kg)	—	17.7 N (1.8 kg)	Replace
2	Reducing valve pilot spring	16.5x7.2 (0.649x0.283)	12.7 (0.500)	20.6 N (2.1 kg)	—	18.6 N (1.9 kg)	
3	Spring	71x18 (2.795x0.709)	59 (2.323)	199.8 N (20.4 kg)	—	186.2 N (19 kg)	
4	Spring	16.1x7.8 (0.634x0.307)	13.4 (0.527)	61.7 N (6.3 kg)	—	58.8 N (6 kg)	

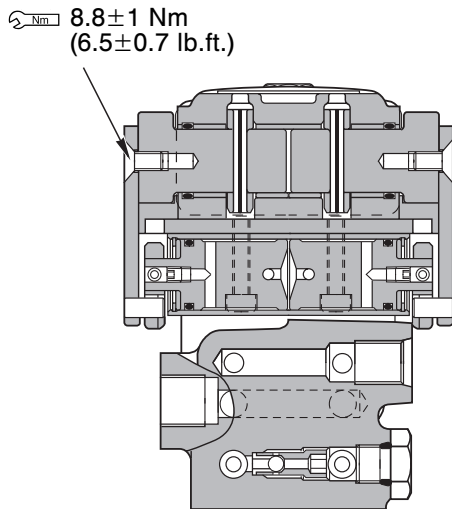
TRAVEL PPC VALVE



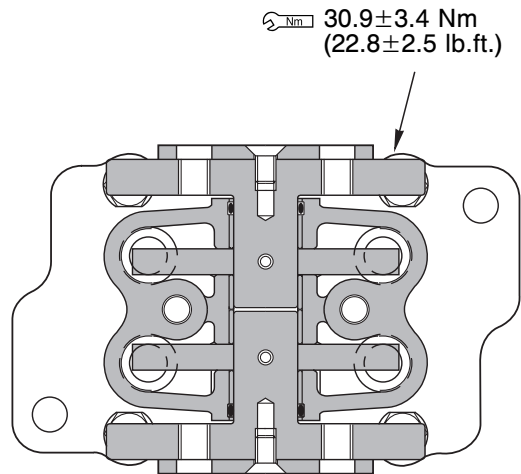
Section A - A



Section B - B



Section C - C



Section D - D

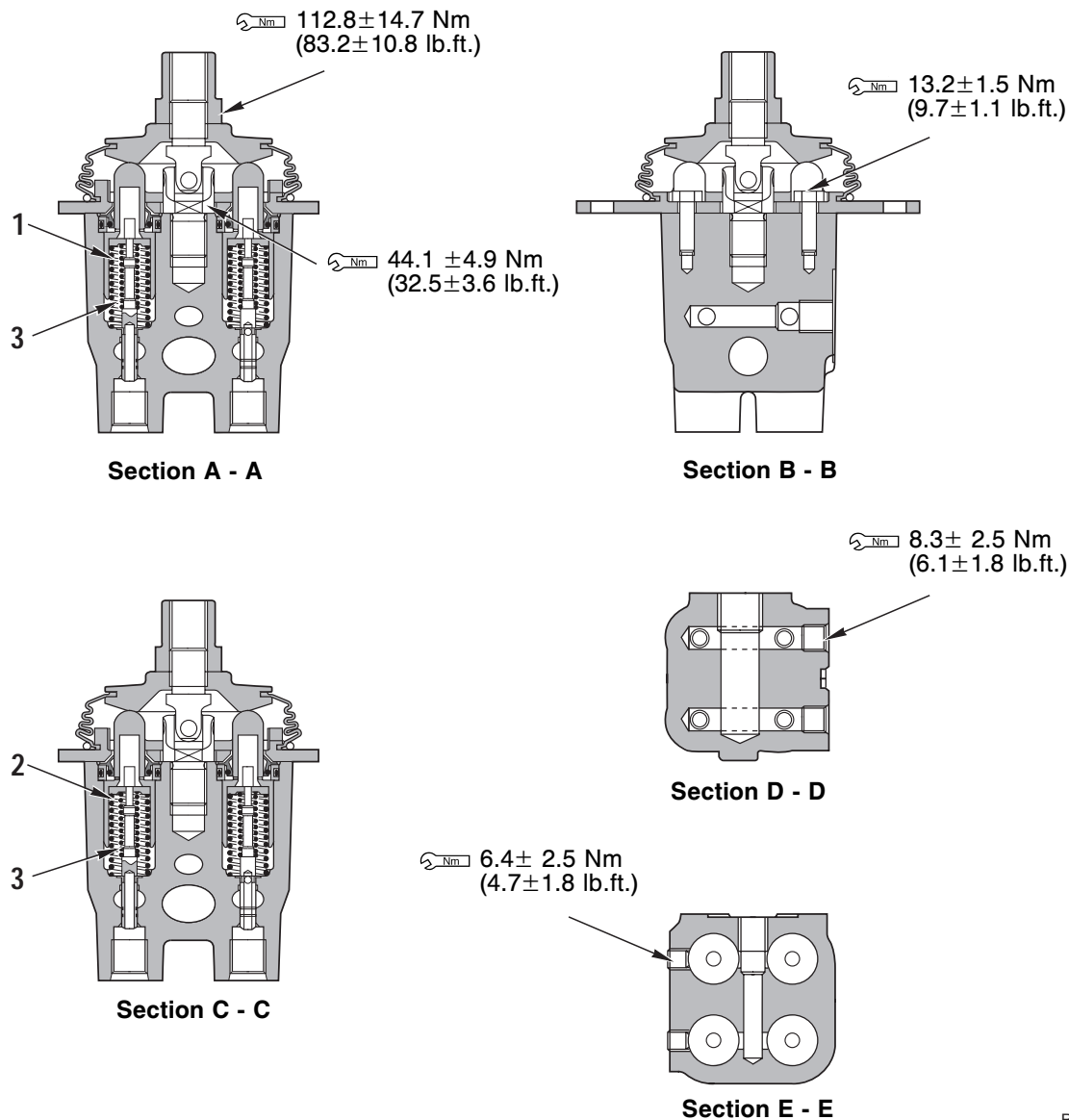
RKP04100

Unit: mm (in.)

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	Centering spring	26.5x8.15 (1.043x0.321)	24.9 (0.980)	16,7 N (1.7 kg)	—	13.7 N (1.4 kg)	Replace
2	Metering spring	48.1x15.5 (1.894x0.610)	32.5 (1.279)	107.8 N (11 kg)	—	86,2 N (8.8 kg)	

PPC VALVE

Boom, arm, bucket, swing



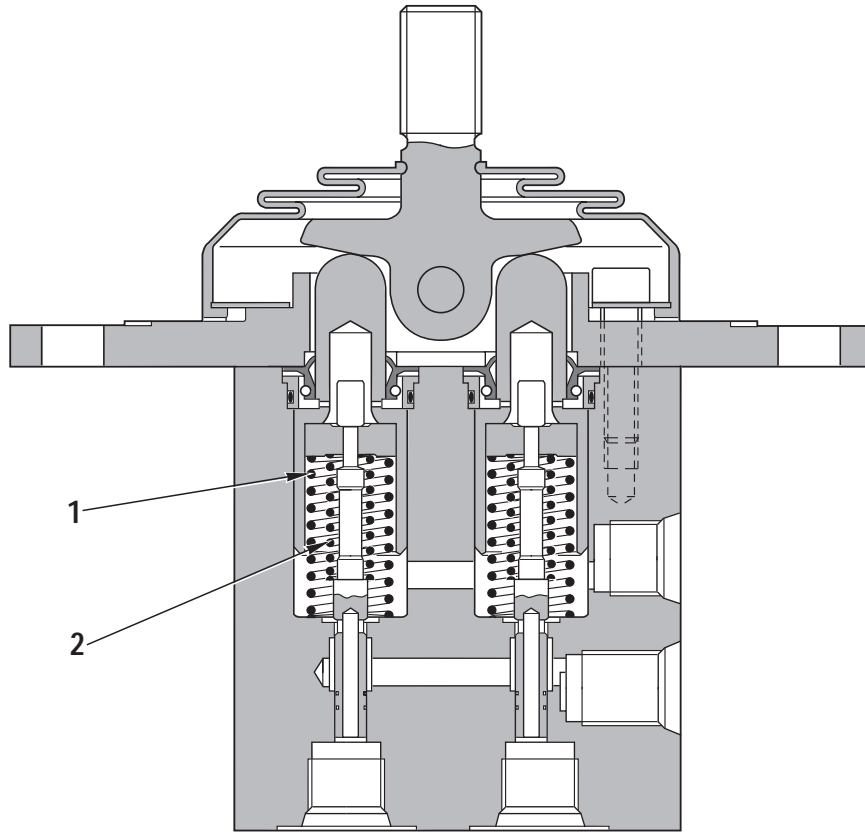
RKP01331

Unit: mm (in.)

No	Check item	Criteria				Remedy	
		Standard size			Repair limit		Replace if damaged or deformed
		Free length x O.D.	Installed length	Installed load	Free length x O.D.	Installed load	
1	Metering spring (For P3 and P4 port)	38.7x15.5 (1.524x0.610)	34 (1.339)	9.8 N (1.0 kg)	—	7.8 N (0.8 kg)	
2	Centering spring (For P1 and P2 port)	42.5x15.5 (1.673x0.610)	34 (1.339)	17.6 N (1.8 kg)	—	13.7 N (1.4 kg)	
3	Metering spring	26.1x8.2 (1.028x0.323)	24.7 (0.972)	15.2 N (1.55 kg)	—	11.8 N (1.2 kg)	

PPC VALVE

Blade, boom swing, 2-piece boom

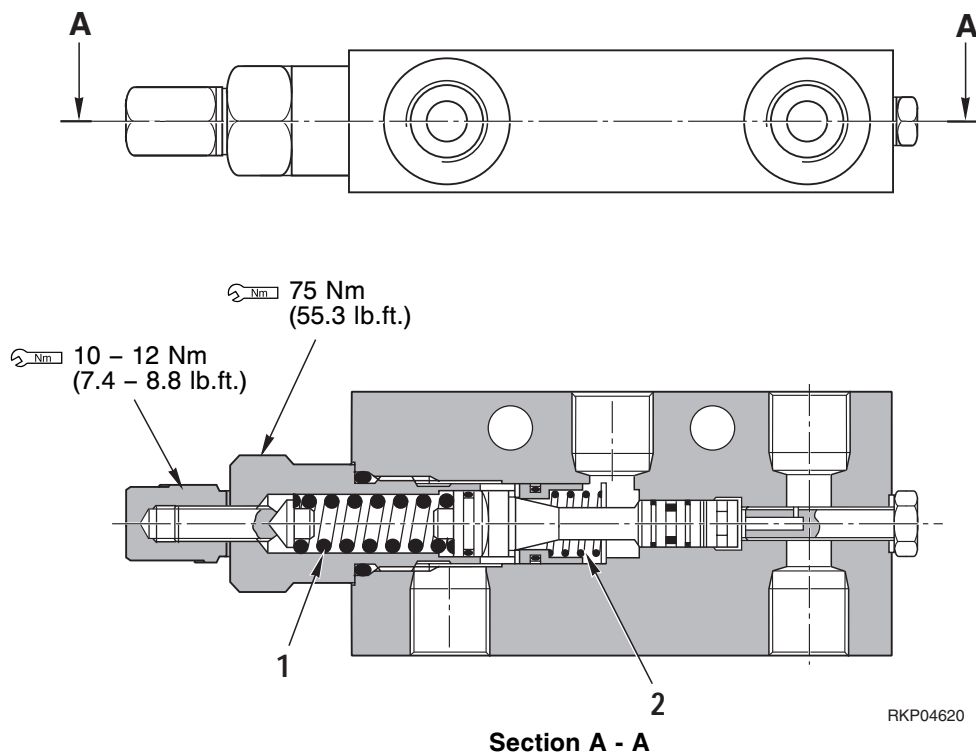


RKP04110

Unit: mm (in.)

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	Metering spring	33.9x15.3 (1.335x0.602)	28.4 (1.118)	124.5 N (12.7 kg)	—	100.0 N (10.2 kg)	
2	Centering spring	22.7x8.1 (0.894x0.319)	22.0 (0.866)	16,7 N (1.7 kg)	—	13.7 N (1.4 kg)	

BLADE SAFETY VALVE



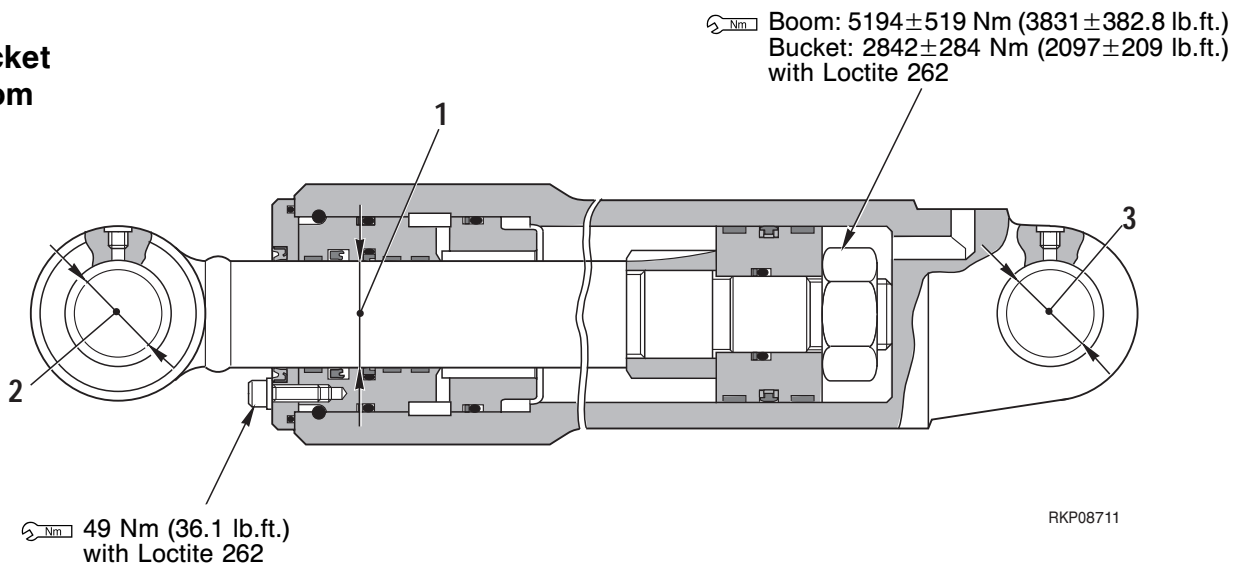
Unit: mm (in.)

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 (1.228x0.240)	—	—	—	—	Replace if damaged or deformed
2	Spring	14x10.7 (0.551x0.421)	—	—	—	—	

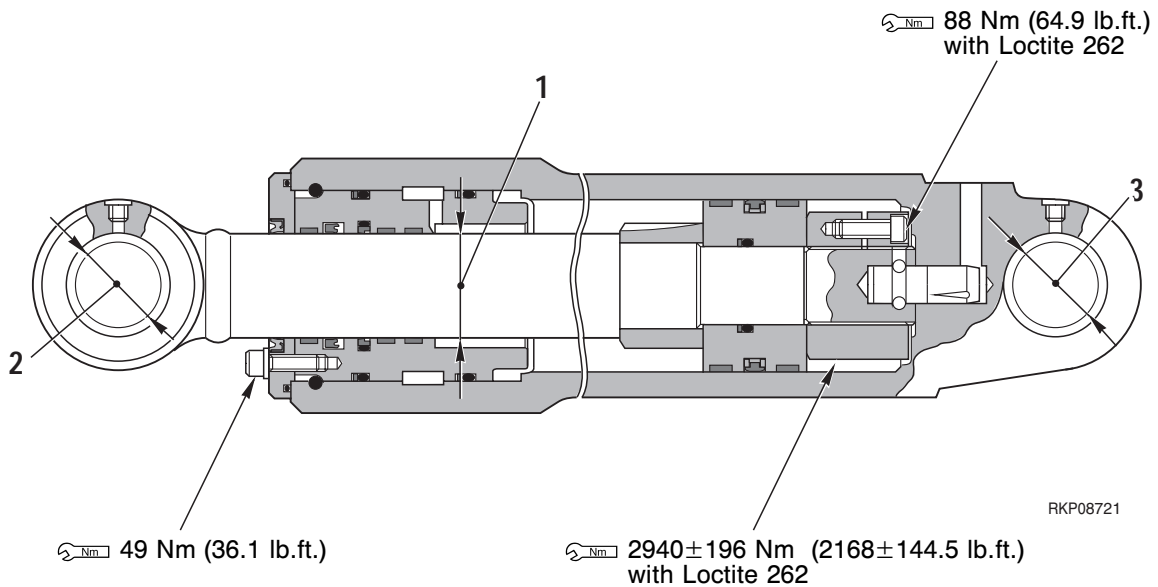
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CYLINDERS

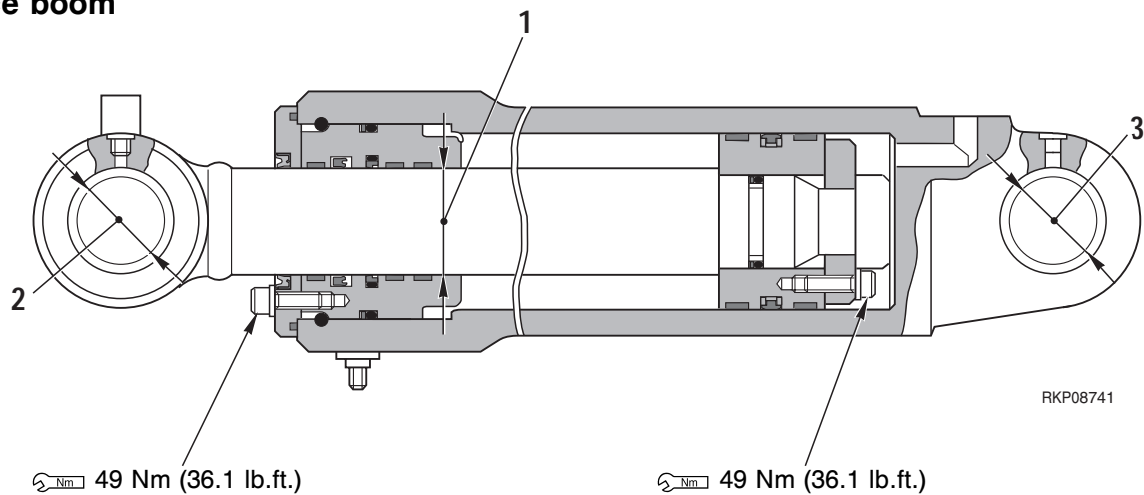
Bucket Boom



Arm

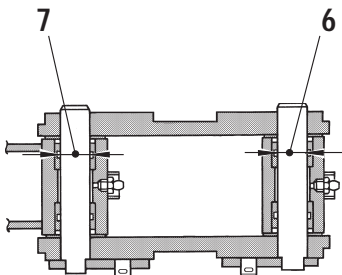
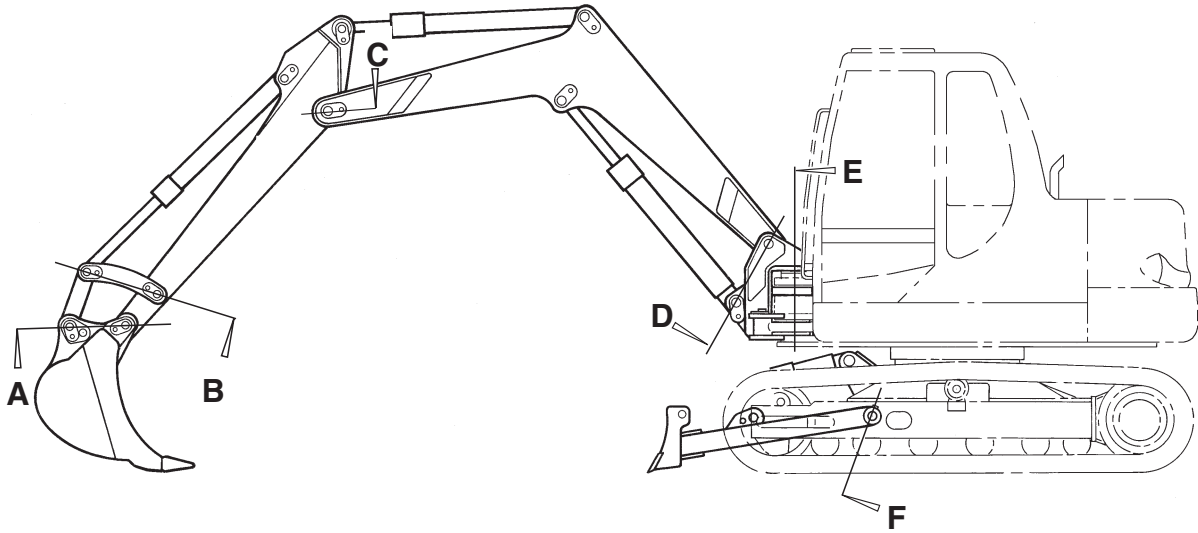


Boom swing 2-piece boom Blade

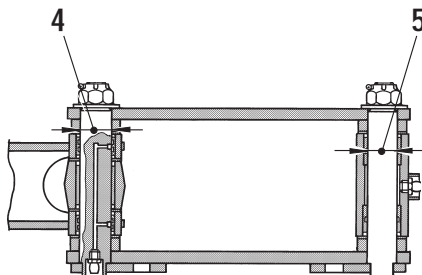


No.	Check item	Criteria					Remedy	
		Cylinder	Standard size	Tolerance		Standard clearance		Clearance limit
				Shaft	Hole			
1	Clearance between piston rod and bushing	Boom	70 (2.756)	-0.03 (-0.0012) -0.06 (-0.0024)	+ 0.2 (0.0079) + 0.3 (0.0118)	0.23 - 0.36 (0.009 - 0.142)	0.46 (0.0181)	
		2 nd boom (2 pieces)	50 (1.968)	-0.025 (-0.001) -0.05 (0.002)	+ 0.2 (0.0079) + 0.3 (0.0118)	0.225-0.35 (0.0089-0.0138)	0.45 (0.0177)	
		Arm	60 (2.362)	-0.03 (-0.0012) -0.06 (-0.0024)	+ 0.2 (0.0079) + 0.3 (0.0118)	0.23 - 0.36 (0.009 - 0.142)	0.46 (0.0181)	
		Bucket	55 (2.165)	-0.03 (-0.0012) -0.06 (-0.0024)	+ 0.2 (0.0079) + 0.3 (0.0118)	0.23 - 0.36 (0.009 - 0.142)	0.46 (0.0181)	
		Boom swing	60 (2.362)	-0.03 (-0.0012) -0.06 (-0.0024)	+ 0.2 (0.0079) + 0.3 (0.0118)	0.23 - 0.36 (0.009 - 0.142)	0.46 (0.0181)	
		Blade	60 (2.362)	-0.03 (-0.0012) -0.06 (-0.0024)	+ 0.2 (0.0079) + 0.3 (0.0118)	0.23 - 0.36 (0.009 - 0.142)	0.46 (0.0181)	
		2	Clearance between cylinder head bushing and pin	Boom	60 (2.362)	-0.06 (-0.0024) -0.106 (0.0042)	+ 0.1 (0.0039) + 0.146 (0.0057)	0.16-0.252 (0.0063-0.0099)
2 nd boom (2 pieces)	50 (1.968)			-0.05 (0.002) -0.089 (-0.0035)	+ 0.08 (0.0031) + 0.119 (0.0047)	0.13-0.208 (0.0051-0.0082)	1 (0.0394)	
Arm	50 (1.968)			-0.05 (0.002) -0.089 (-0.0035)	+ 0.08 (0.0031) + 0.119 (0.0047)	0.13-0.208 (0.0051-0.0082)	1 (0.0394)	
Bucket	50 (1.968)			-0.05 (0.002) -0.089 (-0.0035)	+ 0.08 (0.0031) + 0.119 (0.0047)	0.13-0.208 (0.0051-0.0082)	1 (0.0394)	
Boom swing	50 (1.968)			-0.05 (0.002) -0.089 (-0.0035)	+ 0.08 (0.0031) + 0.119 (0.0047)	0.13-0.208 (0.0051-0.0082)	1 (0.0394)	
Blade	50 (1.968)			-0.05 (0.002) -0.089 (-0.0035)	+ 0.08 (0.0031) + 0.119 (0.0047)	0.13-0.208 (0.0051-0.0082)	1 (0.0394)	
3	Clearance between cylinder bottom bushing and pin	Boom	60 (2.362)	-0.06 (-0.0024) -0.106 (0.0042)	+ 0.1 (0.0039) + 0.146 (0.0057)	0.16-0.252 (0.0063-0.0099)	1 (0.0394)	
		2 nd boom (2 pieces)	60 (2.362)	-0.06 (-0.0024) -0.106 (0.0042)	+ 0.1 (0.0039) + 0.146 (0.0057)	0.16-0.252 (0.0063-0.0099)	1 (0.0394)	
		Arm	50 (1.968)	-0.05 (0.002) -0.089 (-0.0035)	+ 0.08 (0.0031) + 0.119 (0.0047)	0.13-0.208 (0.0051-0.0082)	1 (0.0394)	
		Bucket	50 (1.968)	-0.05 (0.002) -0.089 (-0.0035)	+ 0.08 (0.0031) + 0.119 (0.0047)	0.13-0.208 (0.0051-0.0082)	1 (0.0394)	
		Boom swing	50 (1.968)	-0.05 (0.002) -0.089 (-0.0035)	+ 0.08 (0.0031) + 0.119 (0.0047)	0.13-0.208 (0.0051-0.0082)	1 (0.0394)	
		Blade	50 (1.968)	-0.05 (0.002) -0.089 (-0.0035)	+ 0.08 (0.0031) + 0.119 (0.0047)	0.13-0.208 (0.0051-0.0082)	1 (0.0394)	

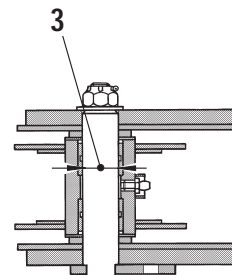
WORK EQUIPMENT (1-piece boom)



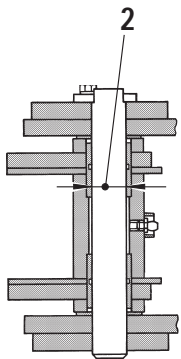
Section A - A



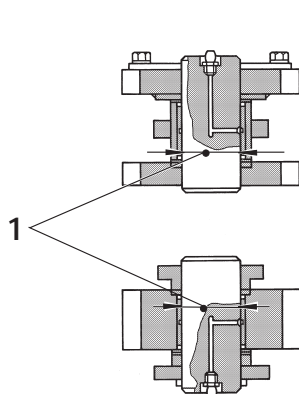
Section B - B



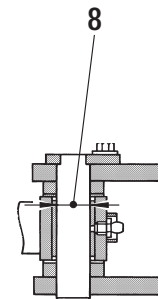
Section C - C



Section D - D



Section E - E



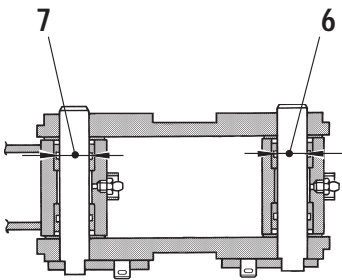
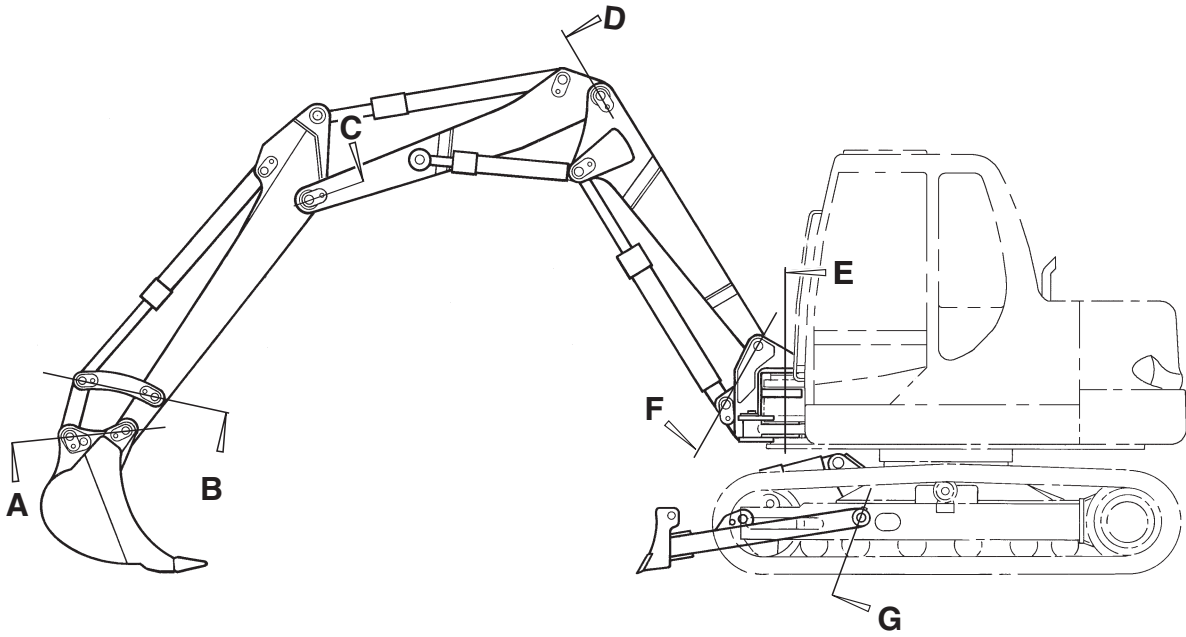
Section F - F

RKP08750

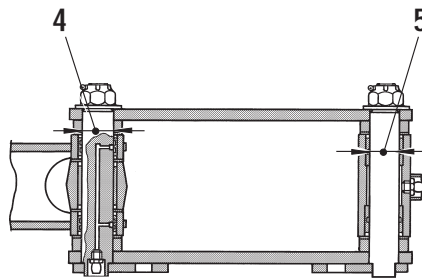
Unit: mm (in.)

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 (3.937)	-0.072 (-0.0028) -0.126 (-0.005)	+0.145 (+0.0057) +0.044 (+0.0017)	0.271- 0.116 (0.0107- 0.0046)	0.8 (0.0315)	Replace
2	Clearance between boom-to-swing bracket mounting pin and bushing	60 (2.362)	-0.060 (-0.0024) -0.106 (-0.0042)	+0.047 (+0.0019) +0.127 (0.005)	0.107- 0.233 (0.0042- 0.0092)	0.8 (0.0315)	
3	Clearance between boom-to-arm mounting pin and bushing	60 (2.362)	-0.060 (-0.0024) -0.106 (-0.0042)	+0.047 (+0.0019) +0.127 (0.005)	0.107- 0.233 (0.0042- 0.0092)	0.8 (0.0315)	
4	Clearance between bucket cylinder-to-link mounting pin and link bushing	50 (1.968)	-0.050 (-0.0197) -0.089 (-0.0035)	+0.095 (0.0374) +0.016 (+0.0006)	0.184- 0.066 (0.0072- 0.0026)	1 (0.0394)	
5	Clearance between arm-to-link mounting pin and bushing	50 (1.968)	-0.050 (-0.0197) -0.089 (-0.0035)	+0.095 (0.0374) +0.016 (+0.0006)	0.184- 0.066 (0.0072- 0.0026)	1 (0.0394)	
6	Clearance between bucket-to-arm mounting pin and bushing	50 (1.968)	-0.050 (-0.0197) -0.089 (-0.0035)	+0.095 (0.0374) +0.016 (+0.0006)	0.184- 0.066 (0.0072- 0.0026)	1 (0.0394)	
7	Clearance between bucket-to-link mounting pin and bushing	50 (1.968)	-0.050 (-0.0197) -0.089 (-0.0035)	+0.095 (0.0374) +0.016 (+0.0006)	0.184- 0.066 (0.0072- 0.0026)	1 (0.0394)	
8	Clearance between blade mounting pin and bushing	50 (1.968)	-0.050 (-0.0197) -0.089 (-0.0035)	+0.095 (0.0374) +0.016 (+0.0006)	0.184- 0.066 (0.0072- 0.0026)	1.5 (0.0591)	

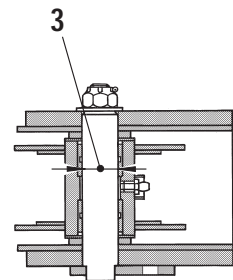
WORK EQUIPMENT (2-piece boom)



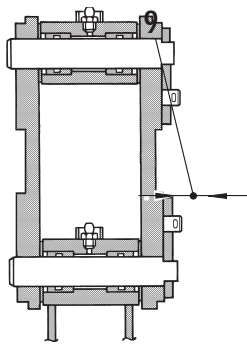
Section A - A



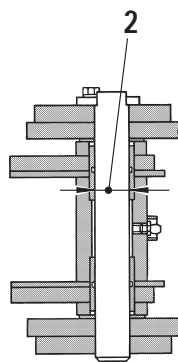
Section B - B



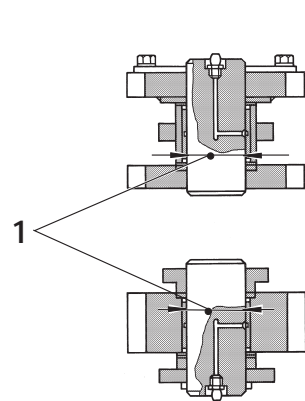
Section C - C



Section D - D

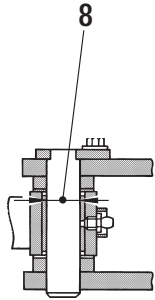


Section E - E



Section F - F

RKP08760



Section G - G

RKP08770

Unit: mm (in.)

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 (3.937)	-0.072 (-0.0028) -0.126 (-0.005)	+ 0.145 (+ 0.0057) + 0.044 (+ 0.0017)	0.271- 0.116 (0.0107- 0.0046)	0.8 (0.0315)	Replace
2	Clearance between boom-to-swing bracket mounting pin and bushing	60 (2.362)	-0.060 (-0.0024) -0.106 (-0.0042)	+ 0.047 (+ 0.0019) + 0.127 (0.005)	0.107- 0.233 (0.0042- 0.0092)	0.8 (0.0315)	
3	Clearance between boom-to-arm mounting pin and bushing	60 (2.362)	-0.060 (-0.0024) -0.106 (-0.0042)	+ 0.047 (+ 0.0019) + 0.127 (0.005)	0.107- 0.233 (0.0042- 0.0092)	0.8 (0.0315)	
4	Clearance between bucket cylinder-to-link mounting pin and link bushing	50 (1.968)	-0.050 (-0.0197) -0.089 (-0.0035)	+ 0.095 (0.0374) + 0.016 (+ 0.0006)	0.184- 0.066 (0.0072- 0.0026)	1 (0.0394)	
5	Clearance between arm-to-link mounting pin and bushing	50 (1.968)	-0.050 (-0.0197) -0.089 (-0.0035)	+ 0.095 (0.0374) + 0.016 (+ 0.0006)	0.184- 0.066 (0.0072- 0.0026)	1 (0.0394)	
6	Clearance between bucket-to-arm mounting pin and bushing	50 (1.968)	-0.050 (-0.0197) -0.089 (-0.0035)	+ 0.095 (0.0374) + 0.016 (+ 0.0006)	0.184- 0.066 (0.0072- 0.0026)	1 (0.0394)	
7	Clearance between bucket-to-link mounting pin and bushing	50 (1.968)	-0.050 (-0.0197) -0.089 (-0.0035)	+ 0.095 (0.0374) + 0.016 (+ 0.0006)	0.184- 0.066 (0.0072- 0.0026)	1 (0.0394)	
8	Clearance between blade fulcrum pin and bushing	50 (1.968)	-0.050 (-0.0197) -0.089 (-0.0035)	+ 0.095 (0.0374) + 0.016 (+ 0.0006)	0.184- 0.066 (0.0072- 0.0026)	1.5 (0.0591)	
9	Clearance between bushing and mounting pin of 2 nd boom	60 (2.362)	-0.060 (-0.0024) -0.106 (-0.0042)	+ 0.047 (+ 0.0019) + 0.127 (0.005)	0.107- 0.233 (0.0042- 0.0092)	0.8 (0.0315)	

