

SHOP MANUAL

WB91R-2 WB93R-2 *ADVANCE*

BACKHOE-LOADER

SERIAL NUMBER

WB91R 2 91F20145 and up

WB93R-2 93F23453 and up

KOMATSU
Utility

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IMPORTANT SAFETY NOTICE

Proper service and repair is extremely important for the safe operation of your machine.

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

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



SAFETY

GENERAL PRECAUTIONS

Mistakes in operation extremely dangerous.

Read all the Operation and Maintenance Manual carefully **BEFORE** operating the machine.

1. Before carrying out any greasing or repairs, read all the precautions written on the decals which are 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 wheels to prevent the machine from moving.
8. Before starting work, lower outrigger, bucket or any other work equipment to the ground. If this is not possible, use blocks to prevent the work equipment from falling down. In addition, be sure to lock all the control levers and hang warning sign on them.
9. When disassembling or assembling, support the machine with blocks, jacks or stands before starting work.
10. Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine.
Never jump on or off the machine.
If it is impossible to use the handrails, ladders or steps, use a stand to provide safe footing.

PRECAUTIONS DURING WORK

11. When removing the oil filler cap, drain plug or hydraulic pressure measuring plugs, loosen them slowly to prevent the oil from spurting out.
Before disconnecting or removing components of the hydraulic circuit and engine cooling circuit, first remove the pressure completely from the circuit.
12. The water and oil in the circuits are not hot when the engine 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 wheels.

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 Utility distributor for the latest information.

HOW TO READ THE SHOP MANUAL

VOLUMES

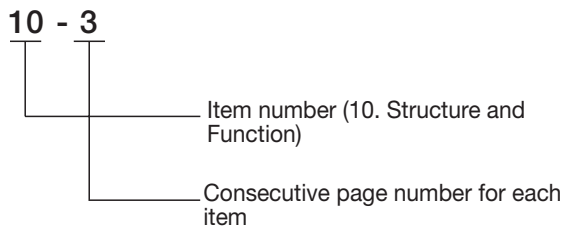
Shop manual are issued as a guide to carry out repairs. These various volumes are designed to avoid duplicating the same information.

DISTRIBUTION AND UPDATING

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

FILING METHOD

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



- 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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REVISED EDITION MARK

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

REVISIONS

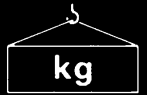
Revised pages are shown on the LIST OF REVISED PAGES between the title page and SAFETY page.

SYMBOLS

In order to make the shop manual greatly 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 or more) must be lifted with a hoist etc. In the **Disassembly and Assembly** section, every part weighing 25 kg or more is clearly indicated with the symbol .

1. If a part cannot be smoothly removed from the machine by hoisting, the following checks should be made:

- Check for removal of all bolts fastening the part to the relative parts.
- Check for any part causing interference with the part to be removed.

2. Wire ropes

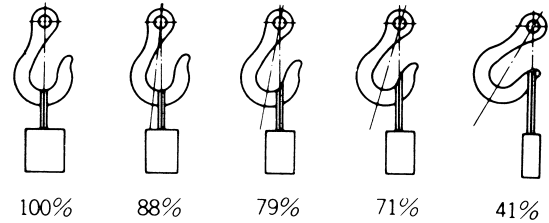
- 1) Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

WIRE ROPES (Standard «S» or «Z» twist ropes without galvanizing)	
Rope diameter (mm)	Allowable load (tons)
10.0	1.0
11.2	1.4
12.5	1.6
14.0	2.2
16.0	2.8
18.0	3.6
20.0	4.4
22.4	5.6
30.0	10.0
40.0	18.0
50.0	28.0
60.0	40.0

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

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

Hooks have maximum strength at the middle portion.



- 3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound on to the load.

! Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can cause dangerous accidents.

- 4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook.

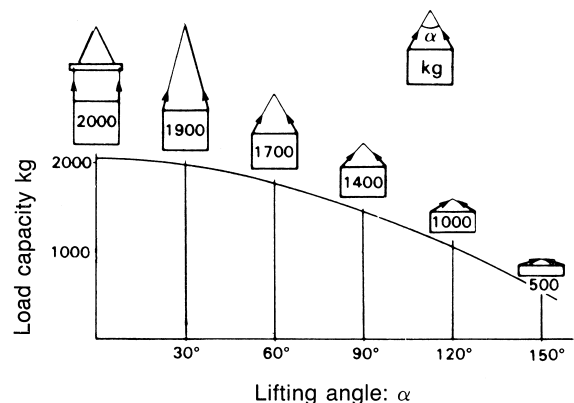
When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles.

The table below shows the variation of allowable load (kg) when hoisting is made with two ropes, each of which is allowed to sling up to 1000 kg vertically, at various 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°.

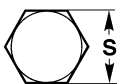




STANDARD TIGHTENING TORQUE

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

1. STANDARD TIGHTENING TORQUE OF BOLTS AND NUT

Thread diameter of bolts (mm)	Pitch of bolts (mm)	Width across flat (mm)		8.8		10.9	
				kgm	Nm	kgm	Nm
6	1	10	8	0.96±0.1	9.5±1	1.3±0.15	13.5±1.5
8	1.25	13	6	2.3±0.2	23±2	3.2±0.3	32.2±3.5
10	1.5	17	8	4.6±0.5	45±4.9	6.5±0.6	63±6.5
12	1.75	19	10	7.8±0.8	77±8	11±1	108±11
14	2	22	12	12.5±1	122±13	17.5±2	172±18
16	2	24	14	19.5±2	191±21	27±3	268±29
18	2.5	27	14	27±3	262±28	37±4	366±36
20	2.5	30	17	38±4	372±40	53±6	524±57
22	2.5	32	17	52±6	511±57	73±8	719±80
24	3	36	19	66±7	644±70	92±10	905±98
27	3	41	19	96±10	945±100	135±15	1329±140
30	3.5	46	22	131±14	1287±140	184±20	1810±190
33	3.5	50	24	177±20	1740±200	250±27	2455±270
36	4	55	27	230±25	2250±250	320±35	3150±350
39	4	60	—	295±33	2900±330	410±45	4050±450

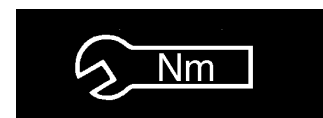
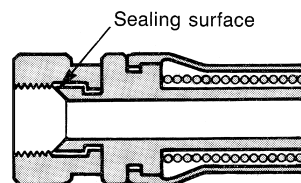
This torque table does not apply to bolts or nuts which have to fasten nylon or other parts non-ferrous metal washer.

★ Nm (newton meter): 1 Nm = 0.102 kgm

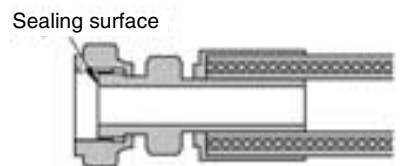
STANDARD TIGHTENING TORQUE

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
1/2" - 20	17	2.6±0.5	25.5±4.9
9/16" - 18	17	4±0.5	39.2±4.9
3/4" - 16	22	6.7±2	65.7±19.6
7/8" - 14	27	8±2	78.5±19.6
1.1/16 - 12	32	9.7±3	95.15±29.4
1.5/16 - 12	38	17±3	166.7±29.4
1.5/8 - 12	50	20±5	196.2±49
22	27	8±2	78.5±19.6
33	41	20±5	196.2±49



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



COATING MATERIALS

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

Nomenclature	Code	Applications
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

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

This wire code table will help you understand WIRING DIAGRAMS.

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

CLASSIFICATION BY THICKNESS

Nominal number	Copper wire			Cable O.D. (mm)	Current rating (A)
	Number strands	Ø of strands (mm)	Cross section (mm)		
0.5	16	0.20	0.35	1.55	3.5
1	14	0.30	0.99	2.80	11
1.5	21	0.30	1.48	3.35	14
2.5	35	0.30	2.47	3.80	20
4	56	0.30	3.95	4.60	28
6	84	0.30	5.93	5.20	37
10	84	0.40	10.55	7.10	53
50	399	0.40	50.11	14	160

CLASSIFICATION BY COLOUR AND CODE

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

COMPOSITION OF THE COLOURS

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

Example: G-V = Yellow-Green with longitudinal colouring

G/V = Yellow-Green with transversal colouring

WEIGHT TABLE

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

Unit: kg

Machine model	WB91R-2	WB93R-2
From serial number	91F20145	93F23453
Engine assembly - Muffler - Exhaust pipe	400	410
Radiator - exchanger	37	37
Hydraulic oil tank (empty)	77	77
Fuel tank (empty)	73	73
Front counterweight	300	300
Engine hood	27	27
Cabin (without seat)	595	595
Seat	34	34
Engine-gear box-pump group	730	740
Piston pump	28	28
Transmission	230	230
Front axle	316	316
Rear axle	511	511
Front wheel	65	65
Rear wheel	163	163
2-spool control valve	24	24
3-spool control valve	30	30
Work equipment	960	960
• Boom	370	370
• Bucket	427	427
• Fulcrum lever	13x4	13x4
• Tilt lever	48x2	48x2
• Raise cylinder	40x2	40x2
• Tilt cylinder	45x2	45x2
Work equipment		
• with standard arm	850	850
• with long arm	885	885
• with jig arm	1030	1030
Boom	323	323
Arm	213	213
Long arm	245	245
Boom swing bracket	133	133
Backframe	237	237
Control valve (6-spool)	47	47
Control valve (7-spool)	53	53
Control valve (8-spool)	59	59
Jig arm	392	392
Outriggers	57	57
Boom cylinder	65	78
Arm cylinder	69	69
Bucket cylinder	49	49
Outriggers cylinder	42	42
Swing cylinder	30	30
Bucket	156	156

TABLE OF OIL AND COOLANT QUANTITIES

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE									CAPACITY (ℓ)		
		− 30	− 20	− 10	0	10	20	30	40	50°C	Specified	Refill	
Crankcase sump	OIL • API CD		SAE 10W			SAE 20W-20			SAE 30		7.9	7.9	
						SAE 40							
Hydraulic circuit	OIL • API CD		SAE 10W-30								150	92	
Hydraulic circuit with biodegradable oil											150	92	
Front axle • Differential	OIL • UTTO FLUID										6.5	6.5	
• Final reduction gear (each.)											1	1	
Rear axle: • Differential											14.5	14.5	
• Final reduction gear (each.)											1.5	1.5	
Hydraulic transmission	OLIO GM DEXRON® II D (DEXRON® is a registered General Motors Corporation)										20	17	
Braking system											0.8	0.8	
Fuel tank	DIESEL OIL		*								130	—	
			ASTM D975 N.2										
Engine coolant system	WATER + ANTI-FREEZE											14	—
	WATER										14	—	
	PERMANENT LIQUID										14	—	

* ASTM D975 N.

ASTM: America Society of Testing and Materials

SAE: Society of Automotive Engineers

API: American Petroleum Institute

MIL: Military Specification

CCMC: Common Market Constructors Committee

First filling quantity:

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

Oil change quantity:

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

TABLE OF OIL AND COOLANT QUANTITIES

NOTE:

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

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

- (2) When starting the engine at temperatures below 0 °C, use engine oil SAE 10W, 20W-20 and 10W-30, even if during the day the temperature increases by 10 °C.
- (3) Use engine oil with CD classification; if oil with CD classification is used, reduce the engine oil change interval by a half.
- (4) Use original products, which have characteristics specifically formulated and approved for the engine, the hydraulic circuit of equipment and for reductions.

CONVERSION TABLE

METHOD OF USING THE CONVERSION TABLE

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

EXAMPLE

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

1. Convert 55 mm into inches.

- 1 - Locate the number 50 in the vertical column at the left side, take this as **(A)**, then draw a horizontal line from **(A)**.
- 2 - Locate the number 5 in the row across the top, take this as **(B)**, then draw a perpendicular line down from **(B)**.
- 3 - Take the point where the two lines cross as **(C)**. This point **(C)** gives the value when converting from millimeters to inches. Therefore, 55 mm = 2.165 in.

2. Convert 550 mm into inches

- 1 - The number 550 does not appear in the table, so divide by 10 (move the decimal point one place to the left) to convert it to 55 mm.
- 2 - Carry out the same procedure as above to convert 55 mm to 2.165 in.
- 3 - The original value (550 mm) was divided by 10, so multiply 2.165 in. by 10 (move the decimal point one place to the right) to return to the original value. This gives 550 mm = 21.65 in.

From millimeters to inches

1 mm = 0.03937 in.

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

CONVERSION TABLE**From mm to in.**

1 mm = 0.03937 in.

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

From kg to lb.

1 kg = 2.2046 lb.

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

CONVERSION TABLE
From liter to U.S. Gall.
 $1 \ell = 0.2642 \text{ U.S. Gall.}$

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

From liter to U.K. Gall.
 $1 \ell = 0.21997 \text{ U.K. Gall.}$

	0	1	2	3	4	5	6	7	8	9
0	0	0.220	0.440	0.660	0.880	1.100	1.320	1.540	1.760	1.980
10	2.200	2.420	2.640	2.860	3.080	3.300	3.520	3.740	3.950	4.179
20	4.399	4.619	4.839	5.059	5.279	5.499	5.719	5.939	6.159	6.379
30	6.599	6.819	7.039	7.259	7.479	7.699	7.919	8.139	8.359	8.579
40	8.799	9.019	9.239	9.459	9.679	9.899	10.119	10.339	10.559	10.778
50	10.998	11.281	11.438	11.658	11.878	12.098	12.318	12.528	12.758	12.978
60	13.198	13.418	13.638	13.858	14.078	14.298	14.518	14.738	14.958	15.178
70	15.398	15.618	15.838	16.058	16.278	16.498	16.718	16.938	17.158	17.378
80	17.598	17.818	18.037	18.257	18.477	18.697	18.917	19.137	19.357	19.577
90	19.797	20.017	20.237	20.457	20.677	20.897	21.117	21.337	21.557	21.777

CONVERSION TABLE**From Nm to lb.ft.**

1 Nm = 0.737 lb.ft.

	0	1	2	3	4	5	6	7	8	9
0	0	0.737	1.474	2.211	2.948	3.685	4.422	5.159	5.896	6.633
10	7.370	8.107	8.844	9.581	10.318	11.055	11.792	12.529	13.266	14.003
20	14.740	15.477	16.214	16.951	17.688	18.425	19.162	19.899	20.636	21.373
30	22.110	22.847	23.584	24.321	25.058	25.795	26.532	27.269	28.006	28.743
40	29.480	30.217	30.954	31.691	32.428	33.165	33.902	34.639	35.376	36.113
50	36.850	37.587	38.324	39.061	39.798	40.535	41.272	42.009	42.746	43.483
60	44.220	44.957	45.694	46.431	47.168	47.905	48.642	49.379	50.116	50.853
70	51.590	52.327	53.064	53.801	54.538	55.275	56.012	56.749	57.486	58.223
80	58.960	59.697	60.434	61.171	61.908	62.645	63.382	64.119	64.856	65.593
90	66.330	67.067	67.804	68.541	69.278	70.015	70.752	71.489	72.226	72.963
100	73.700	74.437	75.174	75.911	76.648	77.385	78.122	78.859	79.596	80.333
110	81.070	81.807	82.544	83.281	84.018	84.755	85.492	86.229	86.966	87.703
120	88.440	89.177	89.914	90.651	91.388	92.125	92.862	93.599	94.336	95.073
130	95.810	96.547	97.284	98.021	98.758	99.495	100.232	100.969	101.706	102.443
140	103.180	103.917	104.654	105.391	106.128	106.865	107.602	108.339	109.076	109.813
150	110.550	111.287	112.024	112.761	113.498	114.235	114.972	115.709	116.446	117.183
160	117.920	118.657	119.394	120.131	120.868	121.605	122.342	123.079	123.816	124.553
170	125.290	126.027	126.764	127.501	128.238	128.975	129.712	130.449	131.186	131.923
180	132.660	133.397	134.134	134.871	135.608	136.345	137.082	137.819	138.556	139.293
190	140.030	140.767	141.504	142.241	142.978	143.715	144.452	145.189	145.926	146.663

CONVERSION TABLE**From Nm to kgm**

1 Nm = 0.102 kgm

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

CONVERSION TABLE
From kgm to lb.ft.

1 kgm = 7.233 lb.ft.

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

CONVERSION TABLE
From bar to psi (lb/in²)

1 bar = 14.503 psi

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

CONVERSION TABLE**TEMPERATURE**

Fahrenheit-Centigrade conversion; a simple way to convert a Fahrenheit temperature reading into a Centigrade temperature reading or vice versa is to enter the accompanying table in the center or boldface column of figures.

These figures refer to the temperature in either Fahrenheit or Centigrade degrees.

If it is desired to convert from Fahrenheit to Centigrade degrees, consider the center column as a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left.

If it is desired to convert from Centigrade to Fahrenheit degrees, consider the center column as a table of Centigrade values and read the corresponding Fahrenheit temperature on the right.

$$1\text{ }^{\circ}\text{C} = 33.8\text{ }^{\circ}\text{F}$$

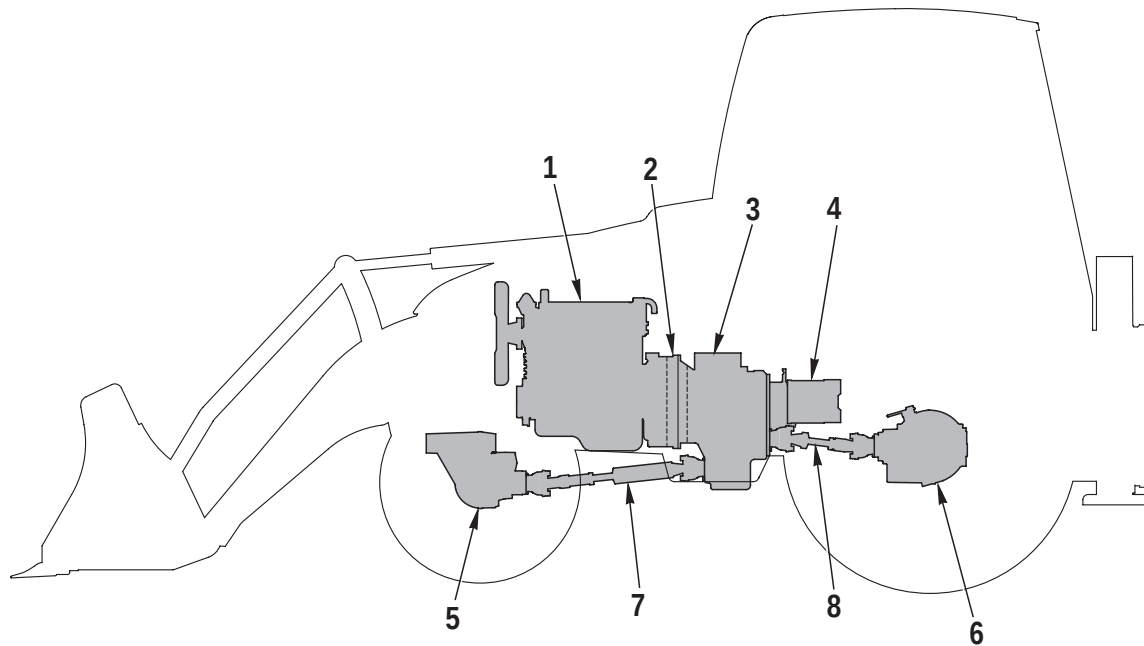
$^{\circ}\text{C}$		$^{\circ}\text{F}$	$^{\circ}\text{C}$		$^{\circ}\text{F}$	$^{\circ}\text{C}$		$^{\circ}\text{F}$	$^{\circ}\text{C}$		$^{\circ}\text{F}$
-40.4	-40	-40.0	-11.7	11	51.8	7.8	46	144.8	27.2	81	117.8
-37.2	-35	-31.0	-11.1	12	53.6	8.3	47	116.6	27.8	82	179.6
-34.4	-30	-22.0	-10.6	13	55.4	8.9	48	118.4	28.3	83	181.4
-31.7	-25	-13.0	-10.0	14	57.2	9.4	49	120.2	28.9	84	183.2
-28.9	-20	-4.0	-9.4	15	59.0	10.0	50	122.0	29.4	85	185.0
-28.3	-19	-2.2	-8.9	16	60.8	10.6	51	123.8	30.0	86	186.8
-27.8	-18	-0.4	-8.3	17	62.6	11.1	52	125.6	30.6	87	188.6
-27.2	-17	1.4	-7.8	18	64.4	11.7	53	127.4	31.1	88	190.4
-26.7	-16	3.2	-7.2	19	66.2	12.2	54	129.2	31.7	89	192.2
-26.1	-15	5.0	-6.7	20	68.0	12.8	55	131.0	32.2	90	194.0
-25.6	-14	6.8	-6.1	21	69.8	13.3	56	132.8	32.8	91	195.8
-25.0	-13	8.6	-5.6	22	71.6	13.9	57	134.6	33.3	92	197.6
-24.4	-12	10.4	-5.0	23	73.4	14.4	58	136.4	33.9	93	199.4
-23.9	-11	12.2	-4.4	24	75.2	15.0	59	138.2	34.4	94	201.2
-23.3	-10	14.0	-3.9	25	77.0	15.6	60	140.0	35.0	95	203.0
-22.8	-9	15.8	-3.3	26	78.8	16.1	61	141.8	35.6	96	204.8
-22.2	-8	17.6	-2.8	27	80.6	16.7	62	143.6	36.1	97	206.6
-21.7	-7	19.4	-2.2	28	82.4	17.2	63	145.4	36.7	98	208.4
-21.1	-6	21.2	-1.7	29	84.2	17.8	64	147.2	37.2	99	210.2
-20.6	-5	23.0	-1.1	30	86.0	18.3	65	149.0	37.8	100	212.0
-20.0	-4	24.8	-0.6	31	87.8	18.9	66	150.8	40.6	105	221.0
-19.4	-3	26.6	0.0	32	89.6	19.4	67	152.6	43.3	110	230.0
-18.9	-2	28.4	0.6	33	91.4	20.0	68	154.4	46.1	115	239.0
-18.3	-1	30.2	1.1	34	93.2	20.6	69	156.2	48.9	120	248.0
-17.8	0	32.0	1.7	35	95.0	21.1	70	158.0	51.7	125	257.0
-17.2	1	33.8	2.2	36	96.8	21.7	71	159.8	54.4	130	266.0
-16.7	2	35.6	2.8	37	98.6	22.2	72	161.6	57.2	135	275.0
-16.1	3	37.4	3.3	38	100.4	22.8	73	163.4	60.0	140	284.0
-15.6	4	39.2	3.9	39	102.2	23.3	74	165.2	62.7	145	293.0
-15.0	5	41.0	4.4	40	104.0	23.9	75	167.0	65.6	150	302.0
-14.4	6	42.8	5.0	41	105.8	24.4	76	168.8	68.3	155	311.0
-13.9	7	44.6	5.6	42	107.6	25.0	77	170.6	71.1	160	320.0
-13.3	8	46.4	6.1	43	109.4	25.6	78	172.4	73.9	165	329.0
-12.8	9	48.2	6.7	44	111.2	26.1	79	174.2	76.7	170	338.0
-12.2	10	50.0	7.2	45	113.0	26.7	80	176.0	79.4	175	347.0

GROUP 10

10 STRUCTURE AND FUNCTION

Power train	2	Safety valve	72
Transmission (4WD)	4	Brake pump	74
Drive shafts	9	Shovel cylinder	75
Control valve block	11	Backhoe cylinder	76
Front axle	12	Air-conditioning unit	80
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Hydraulic pump	20	Electrical diagram (1/6)	83
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Hydraulic circuit	43	Electrical diagram (3/6)	87
Shovel control valve	44	Electrical diagram (4/6)	89
Backhoe control valve	50	Electrical diagram (5/6)	91
CLSS	57	Electrical diagram (6/6)	93
Solenoid valve	71	Electrical diagram (Air conditioning)	95

POWER TRAIN



RKZ01061

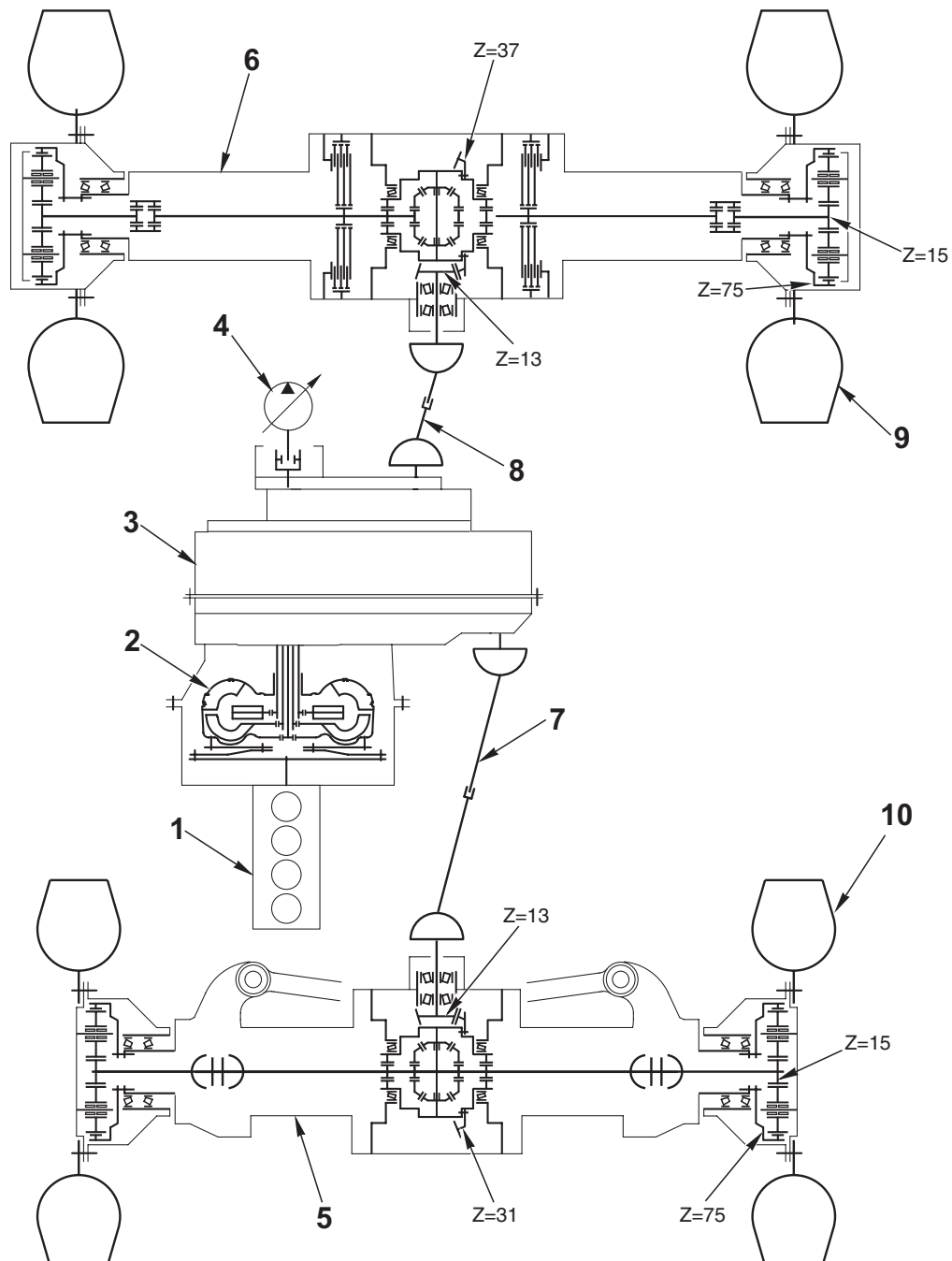
DESCRIPTION

- The driving power for the engine (1) is transmitted through the flywheel to the converter (2). The converter (2) uses hydraulic oil to convert the torque transmitted by the engine (1) into driving power. The converter (2) transmits motion to the drive shaft of the transmission (3) and to the drive shaft of the hydraulic pump (4).
- The transmission (3) has two hydraulically-activated clutches that can be selected by an electrically-controlled gear selector. It also has manual gear selection (four forward gears and four reverse gears).
- The driving power is transmitted from the transmission flanges (3) to the front (5) and rear (6) axles through the Cardan drive shafts (7 and 8).
- The driving power transmitted to the front (5) and rear (6) axles is reduced by the differentials and then transmitted to the planetary gear through the differential shafts.

STRUCTURE AND FUNCTION

POWER TRAIN

Gears	Front axle				Rear axle			
	Transmission	Differential	Planetary	Total	Transmission	Differential	Planetary	Total
1st gear	4.280	2.385	6.000	61.238	5.350	2.846	6.000	91.362
2nd gear	2.372			33.939	2.965			50.633
3rd gear	1.236			17.685	1.544			26.367
4th gear	0.662			9.472	0.827			14.123



RKZ01031

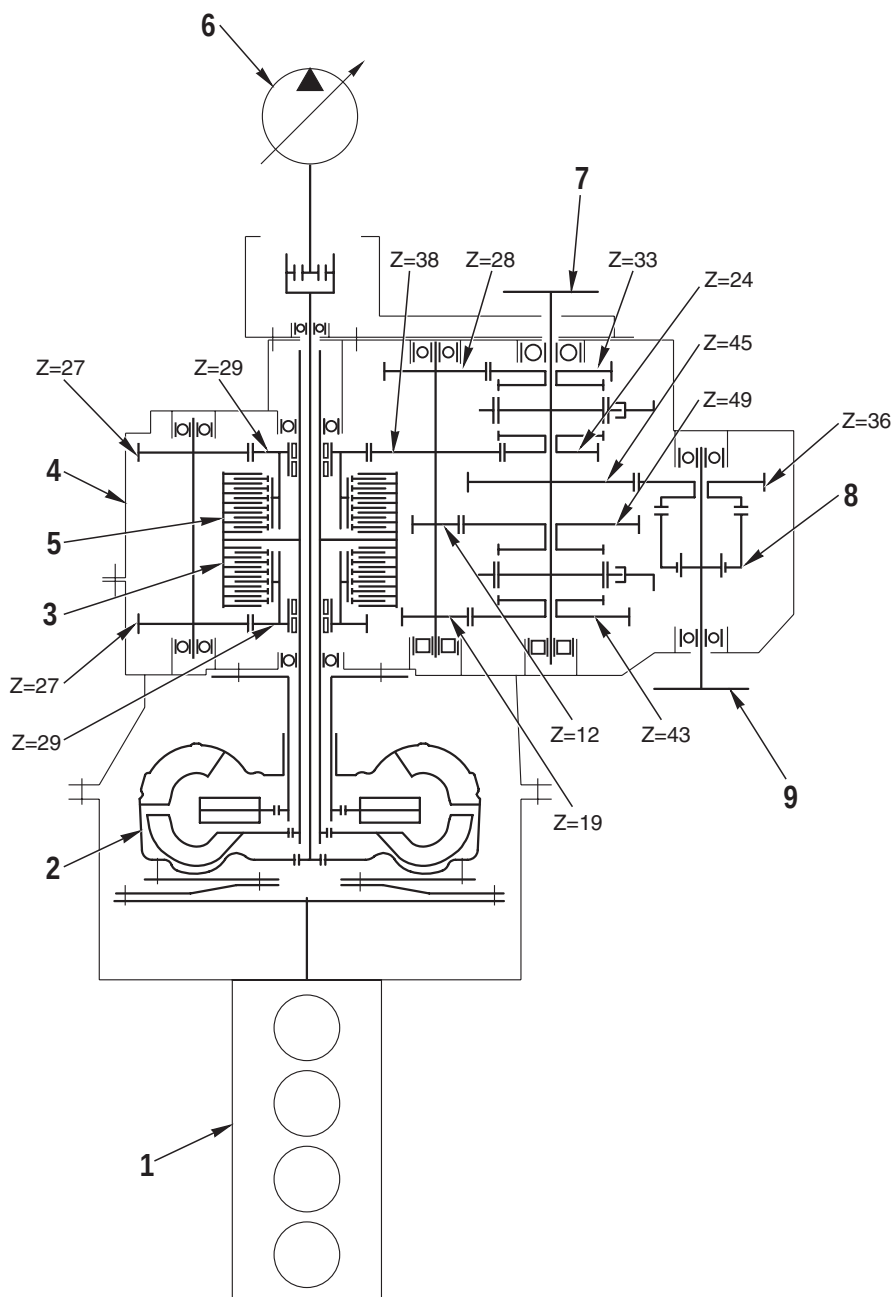
1. Diesel engine
2. Converter
3. Transmission
4. Hydraulic pump

5. Front axle
6. Rear axle
7. Front Cardan drive shaft
8. Rear Cardan drive shaft

9. Rear wheels
10. Front wheels

TRANSMISSION (4WD)

Diagram of the power train

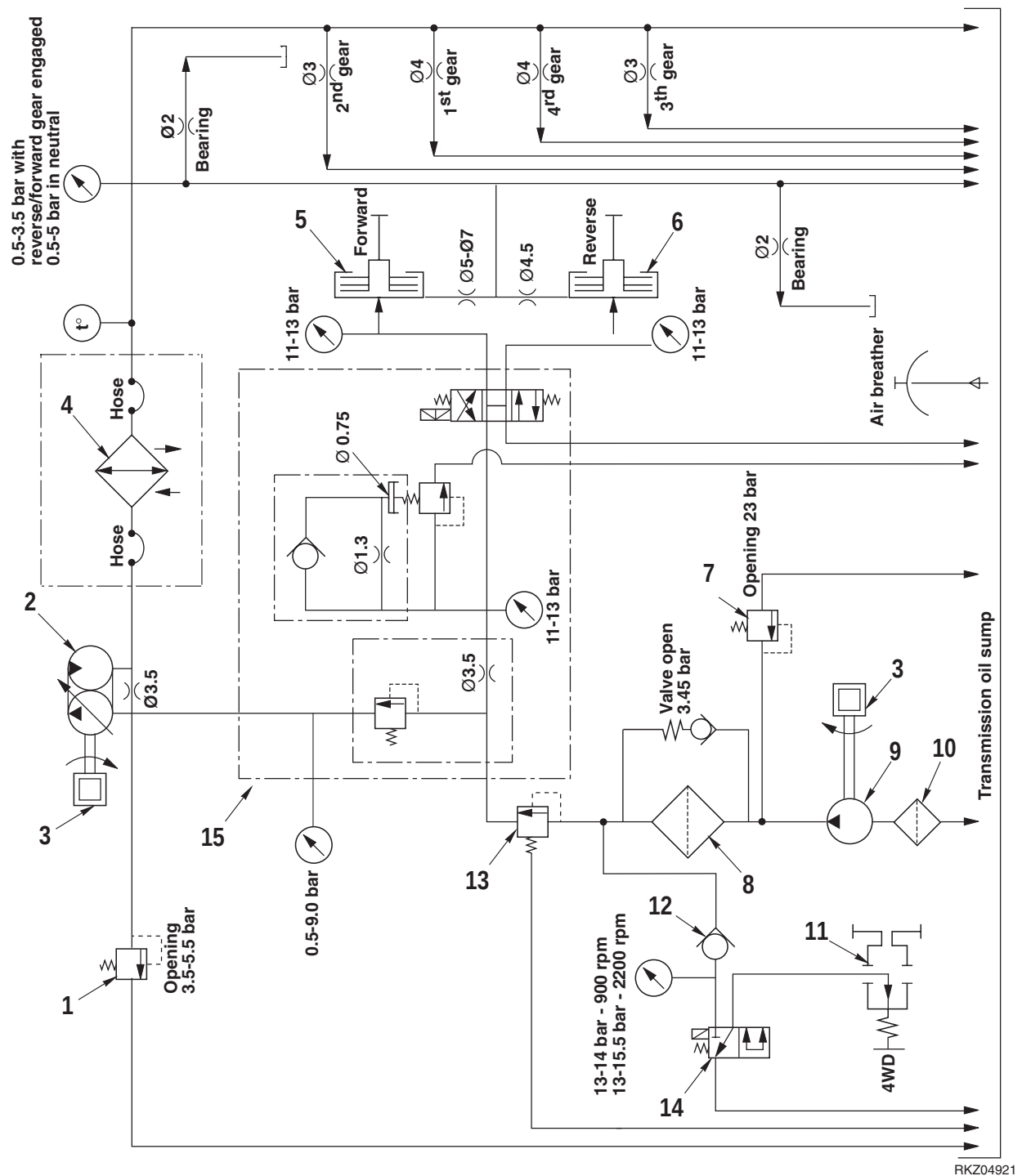


RKZ01040

1. Engine
2. Converter
3. Forward clutch
4. Transmission
5. Reverse clutch

6. Hydraulic pump
7. Rear flange
8. 4WD engagement device
9. Front flange

Hydraulic convertor-transmission circuit diagram

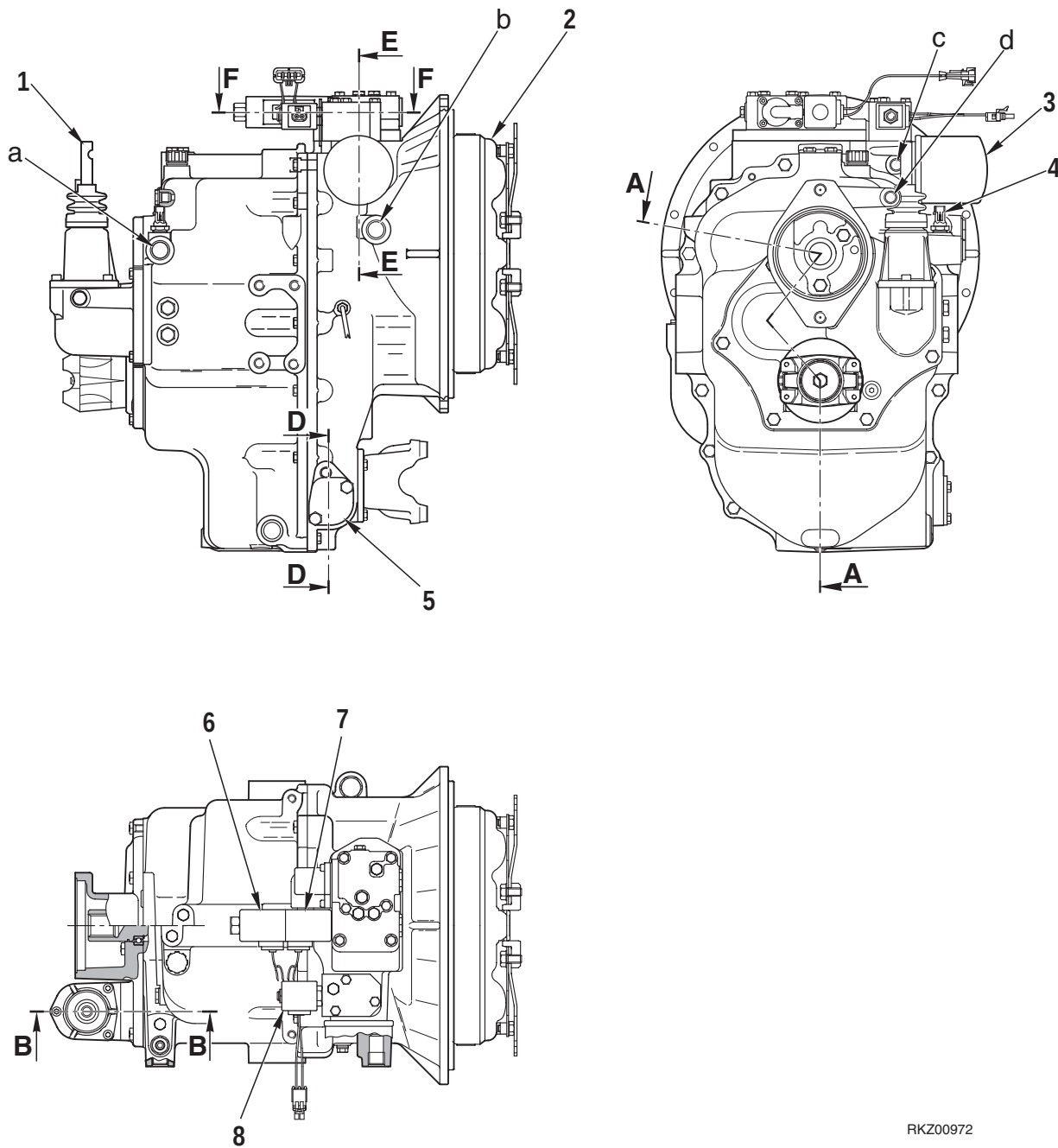


RKZ04921

1. Converter pressurization valve
2. Converter
3. Engine
4. Oil cooler
5. Forward clutch
6. Reverse clutch
7. Max. pressure valve: calib. 23 bar
8. Spin-on filter (15 μ m)

9. Pump
10. Suction filter (250 μ m)
11. 4WD engagement device
12. Check valve
13. Pressure control
14. 4WD engagement solenoid
15. Control valve group

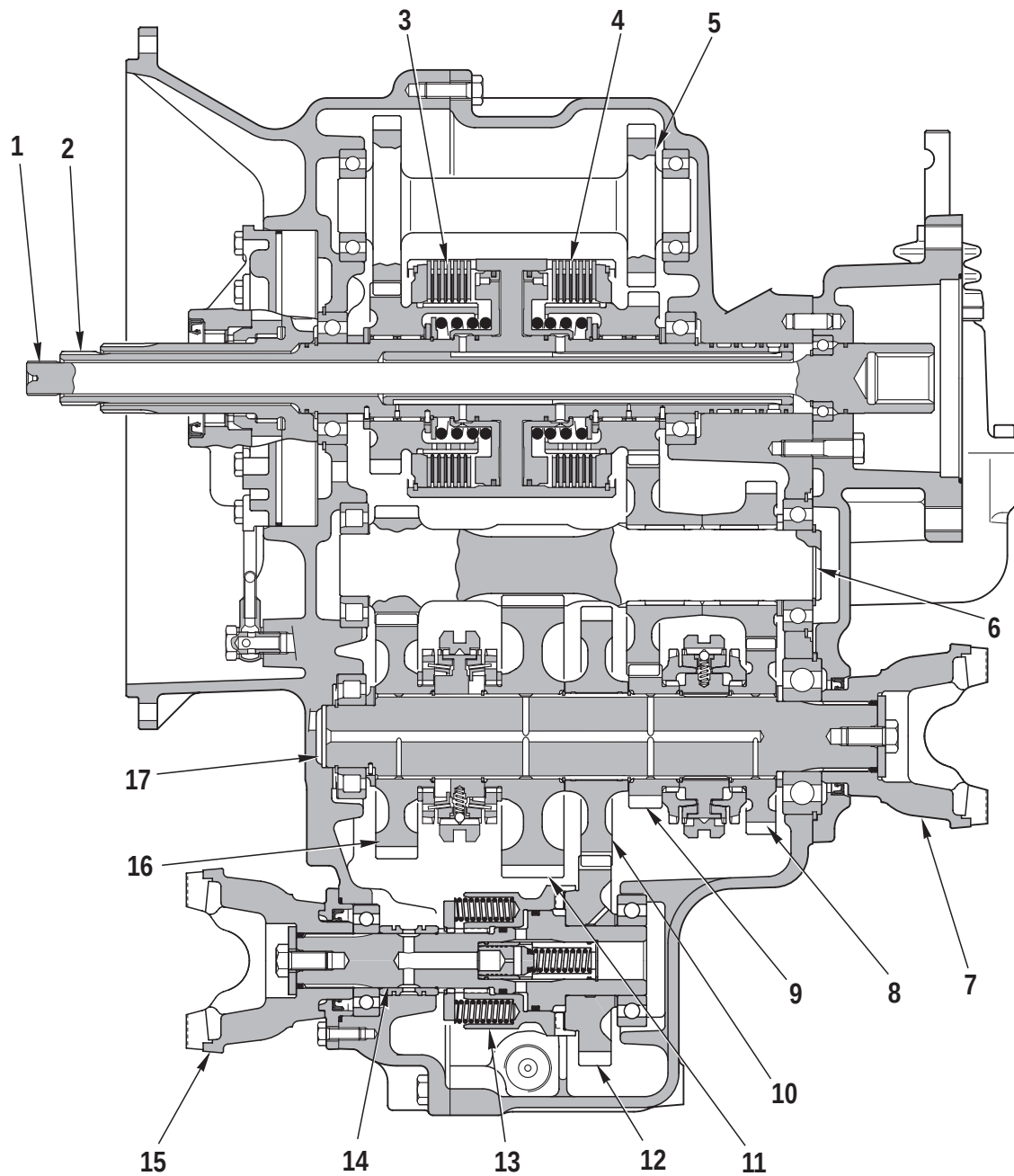
TRANSMISSION



RKZ00972

- a. From the oil cooler
- b. To the oil cooler
- c. To the solenoid valve group ST1 (Port P)
- d. From the solenoid valve group ST1 (Port T)

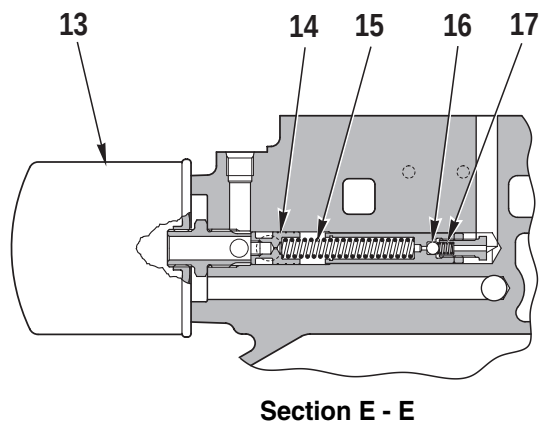
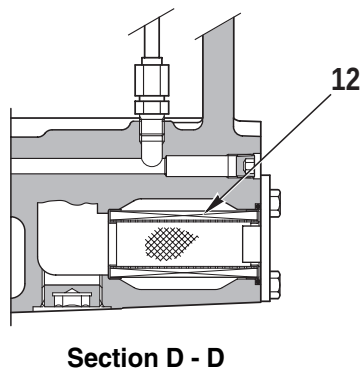
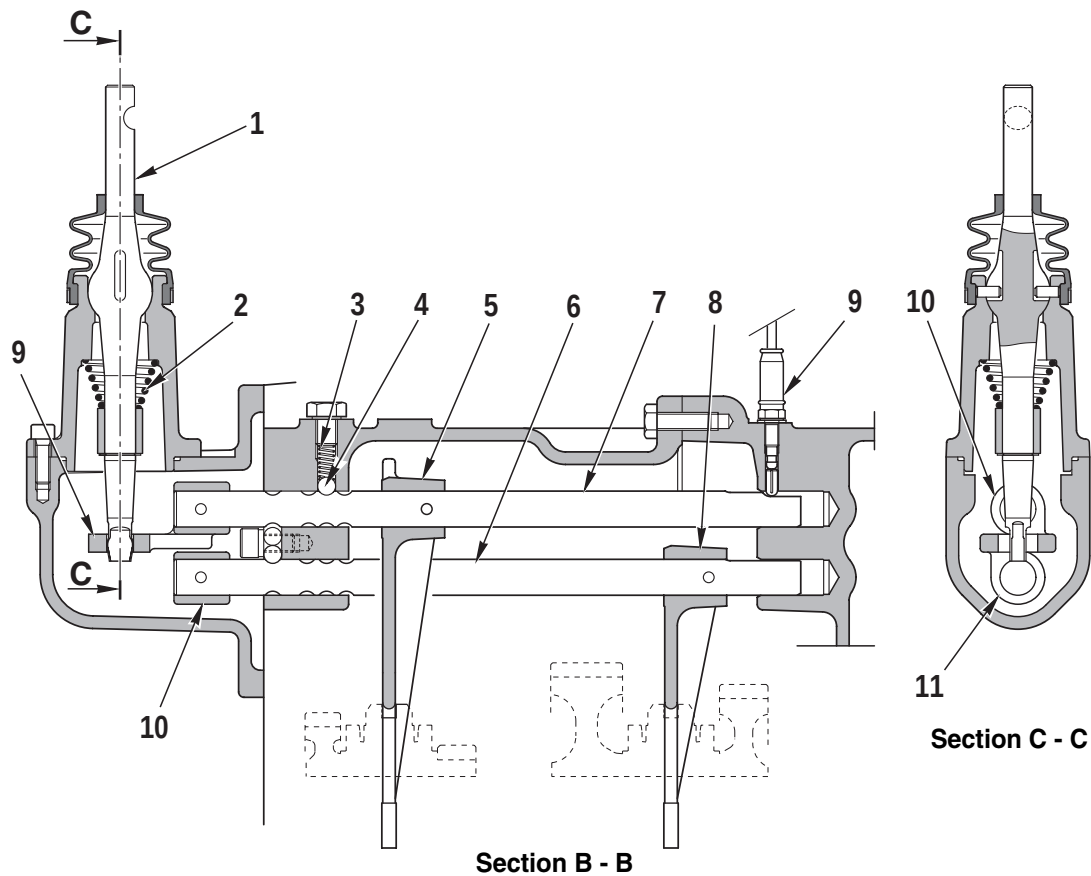
- 1. Gear lever
- 2. Converter
- 3. Filter
- 4. Oil temperature sensor
- 5. Suction filter
- 6. Y5 Reverse gears command solenoid
- 7. Y4 Forward gears command solenoid
- 8. Y2 4WD command solenoid



Section A - A

RKZ04910

- | | |
|---------------------------------|---------------------------|
| 1. Hydraulic pump drive shaft | 10. 4WD drive gear |
| 2. Propeller shaft | 11. 1st gear driven gear |
| 3. Reverse gears command clutch | 12. 4WD driven gear |
| 4. Forward gears command clutch | 13. 4WD engagement device |
| 5. Reverse gears idler shaft | 14. Front output shaft |
| 6. Drive shaft | 15. Flange |
| 7. Flange | 16. 2nd gear driven gear |
| 8. 3rd gear driven gear | 17. Rear output shaft |
| 9. 4th gear driven gear | |



RKZ00991

1. Gear-shift piston

2. Spring

3. Spring

4. Ball

5. 3rd and 4th gear selecting fork

6. 1st and 2nd gear selector piston

7. 3rd and 4th gear selector piston

8. 1st and 2nd gear selecting fork

9. 4th gear selecting sensor

10. 3rd and 4th gear selecting fork

11. 1st and 2nd gear selecting fork

12. Suction filter (250 μ m)

13. Spin-on filter (15 μ m)

14. Valve

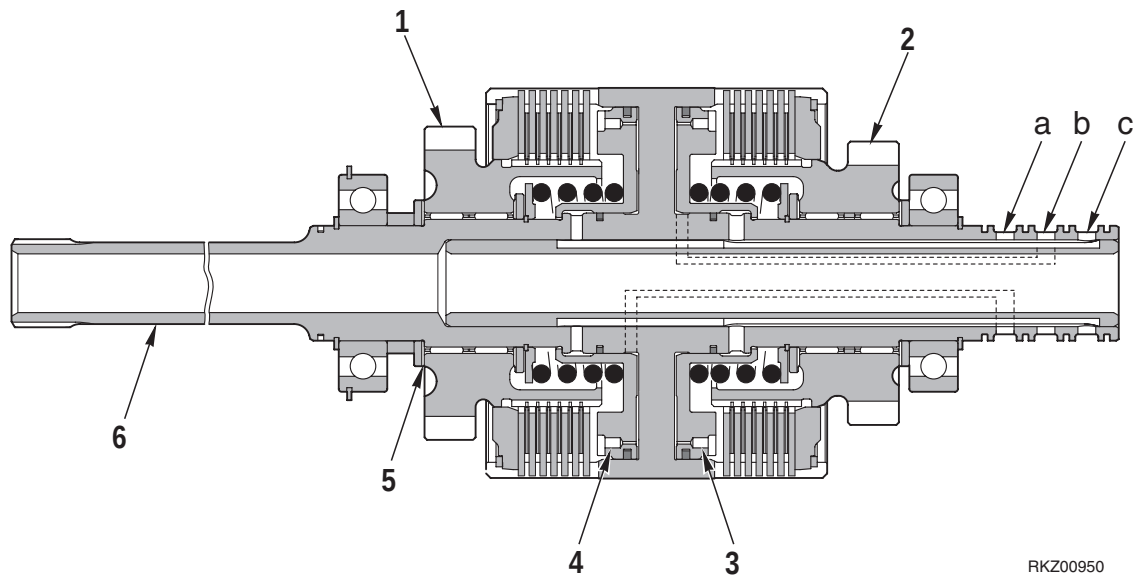
15. Spring

16. Ball

17. Spring

DRIVE SHAFTS

Drive shaft for forward and reverse movement

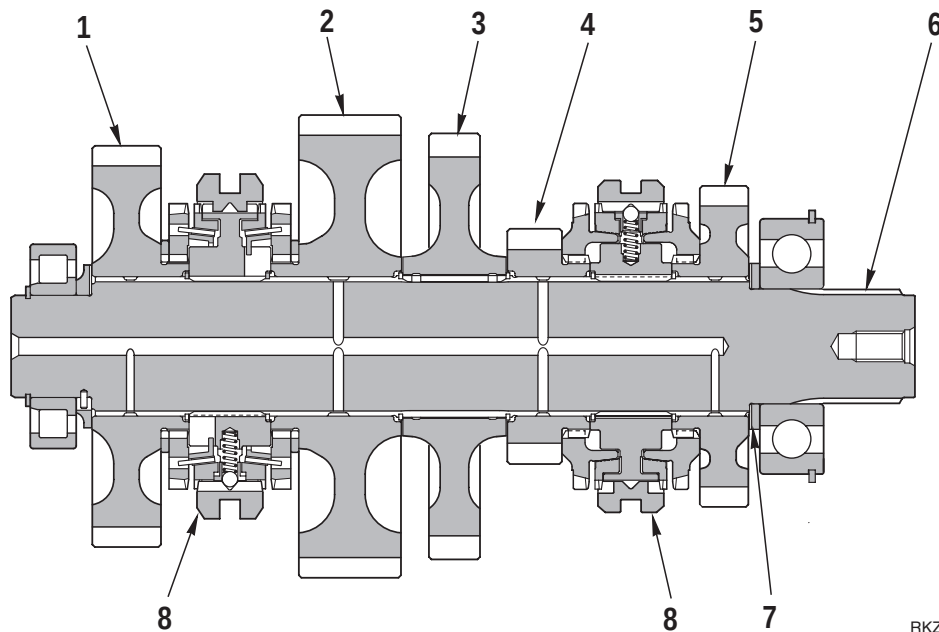


RKZ00950

- a. Port commanding reverse clutch
- b. Port commanding forward clutch
- c. Lubrication port

- 1. Reverse gear clutch (Z=29)
- 2. Forward gear clutch (Z=29)
- 3. Forward clutch piston
- 4. Reverse clutch piston
- 5. Thrust ring
- 6. Driven shaft

Driven gear shaft

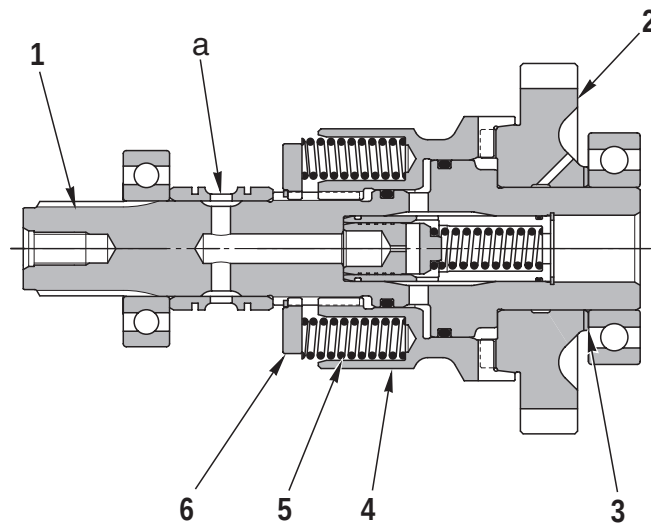


RKZ01010

- 1. Driven gear for 2st gear (Z=43)
- 2. Driven gear for 1st gear (Z=49)
- 3. 4WD drive gear (Z=45)
- 4. Driven gear for 4th gear (Z=24)

- 5. Driven gear for 3rd gear (Z=33)
- 6. Rear output shaft
- 7. Thrust ring
- 8. Synchronizer

4WD driven shaft

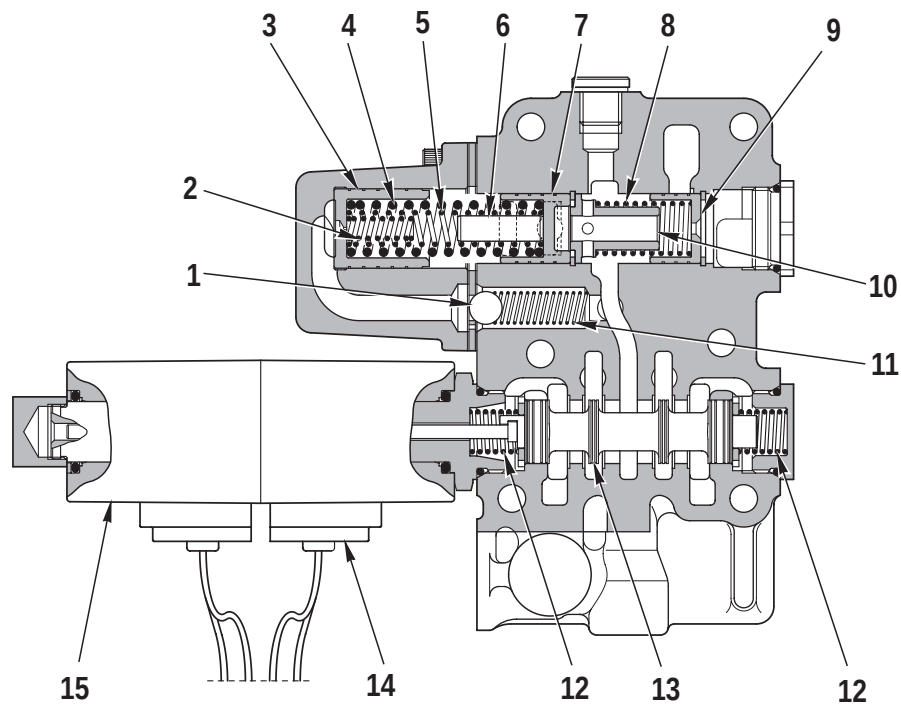


RKZ01021

a. 4WD disengagement command port

1. Front output shaft
2. 4WD driven gear (Z=36)
3. Thrust ring
4. Cylinder
5. Spring
6. Disc

CONTROL VALVE BLOCK



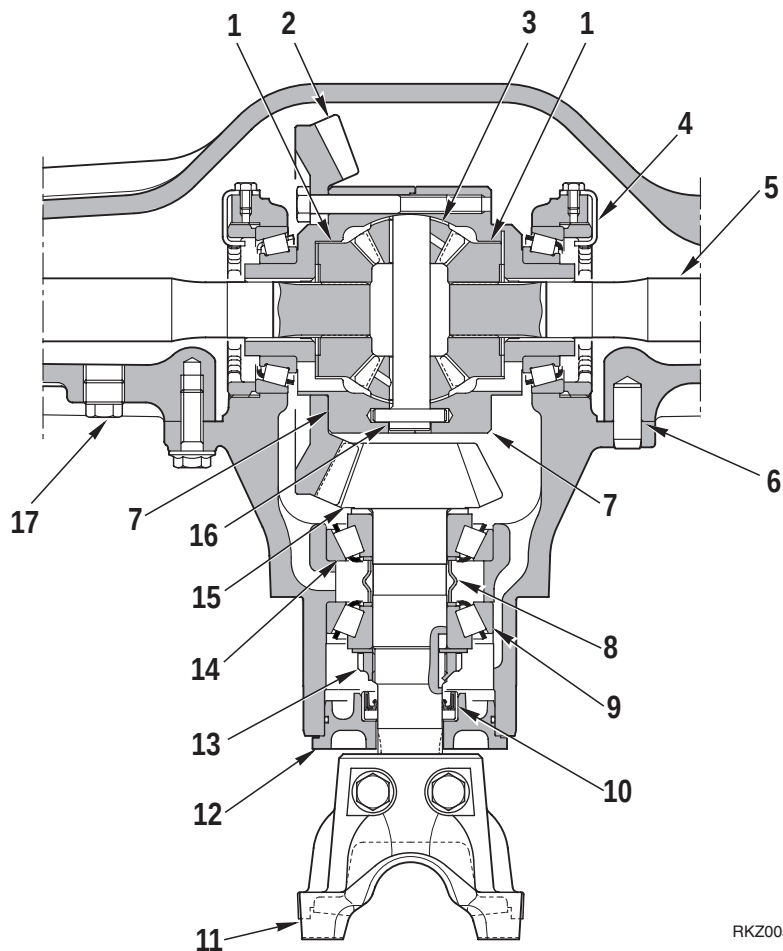
Section F - F

RKZ01000

- | | |
|---------------------|-----------------------------------|
| 1. Ball | 9. Valve |
| 2. Spring | 10. Rod |
| 3. Piston | 11. Spring |
| 4. Spring | 12. Spool return spring |
| 5. Spring | 13. Spool |
| 6. Spring-guide pin | 14. Forward gear command solenoid |
| 7. Valve | 15. Reverse gear command solenoid |
| 8. Spring | |

FRONT AXLE

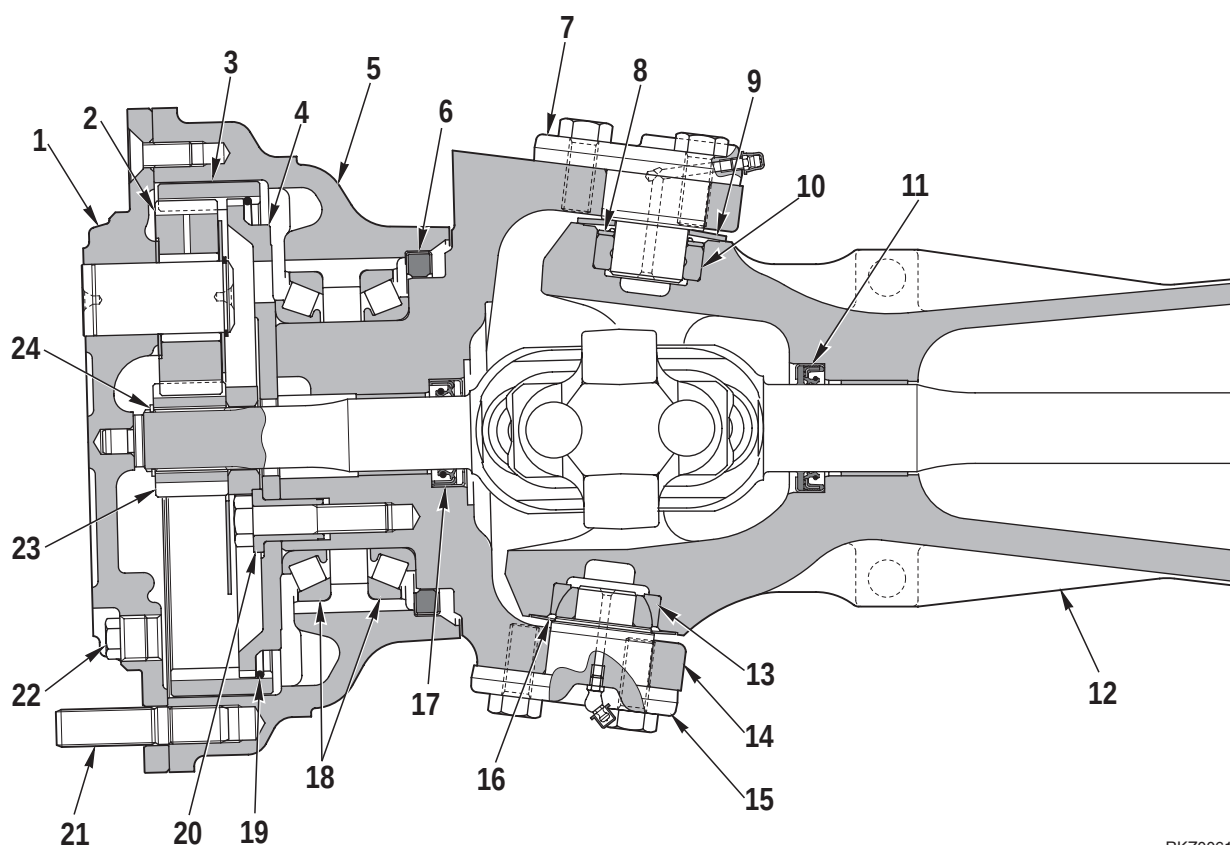
Differential



RKZ00581

- | | |
|---------------------------|-------------------------|
| 1. Planetary gear | 10. Seal |
| 2. Ring bevel gear (Z=31) | 11. Flange |
| 3. Bevel gear | 12. Cover |
| 4. Lock nut | 13. Lock nut |
| 5. Half-axle | 14. Bearing |
| 6. Pin | 15. Bevel pinion (Z=13) |
| 7. Differential housing | 16. Pin |
| 8. Spacer | 17. Oil drain plug |
| 9. Bearing | |

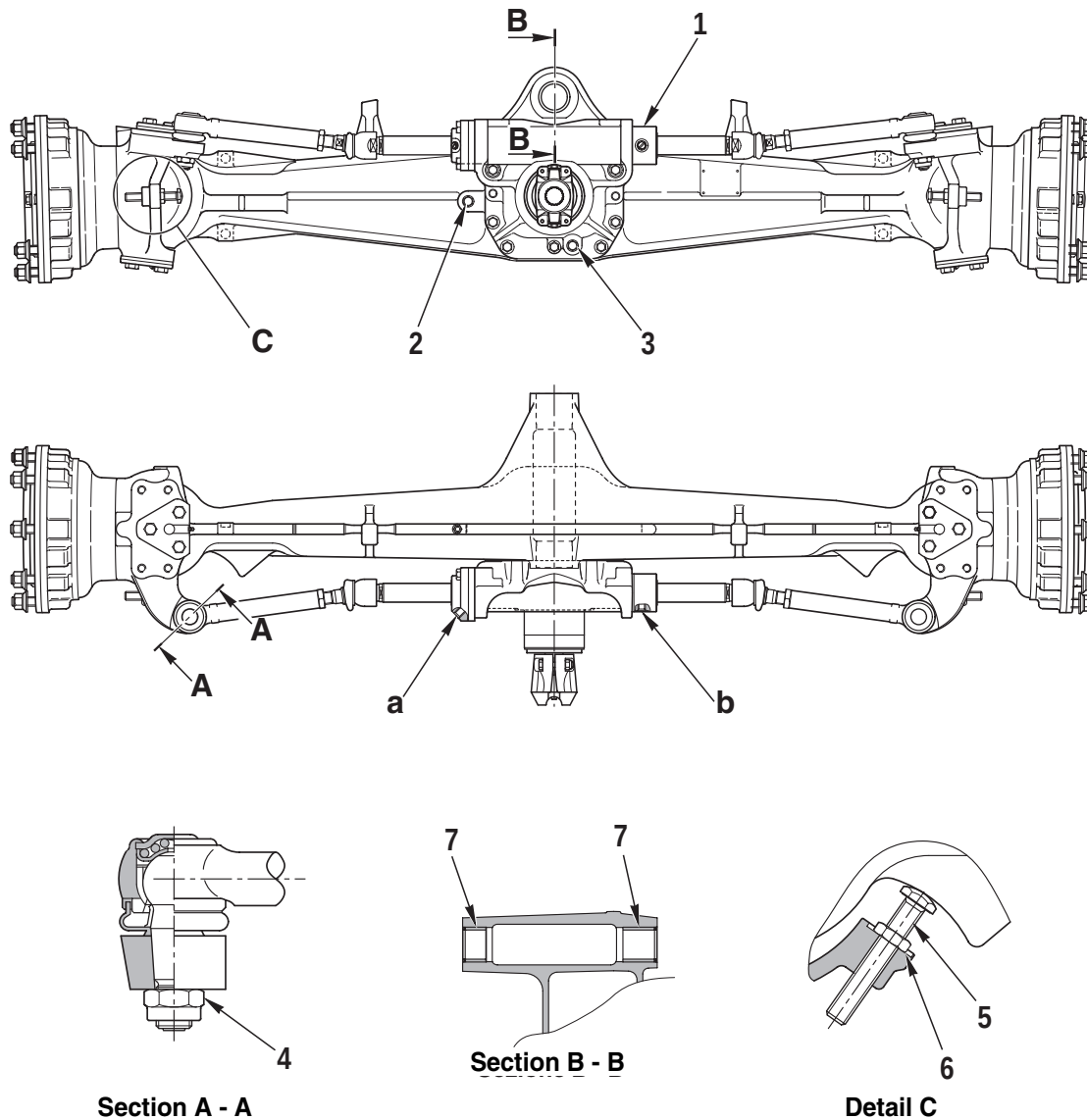
Final reduction - joint



RKZ00611

- | | |
|----------------------|---------------------|
| 1. Planetary carrier | 13. Bearing |
| 2. Planetary (Z =29) | 14. Joint |
| 3. Ring gear (Z=75) | 15. Pin |
| 4. Ring gear carrier | 16. Protection |
| 5. Wheel hub | 17. Seal |
| 6. Seal | 18. Bearing |
| 7. Pin | 19. Snap ring |
| 8. Shim | 20. Steady pin |
| 9. Protection | 21. Stud bolt |
| 10. Bushing | 22. Plug |
| 11. Seal | 23. Sun gear (Z=15) |
| 12. Axle body | 24. Snap ring |

Steering cylinder



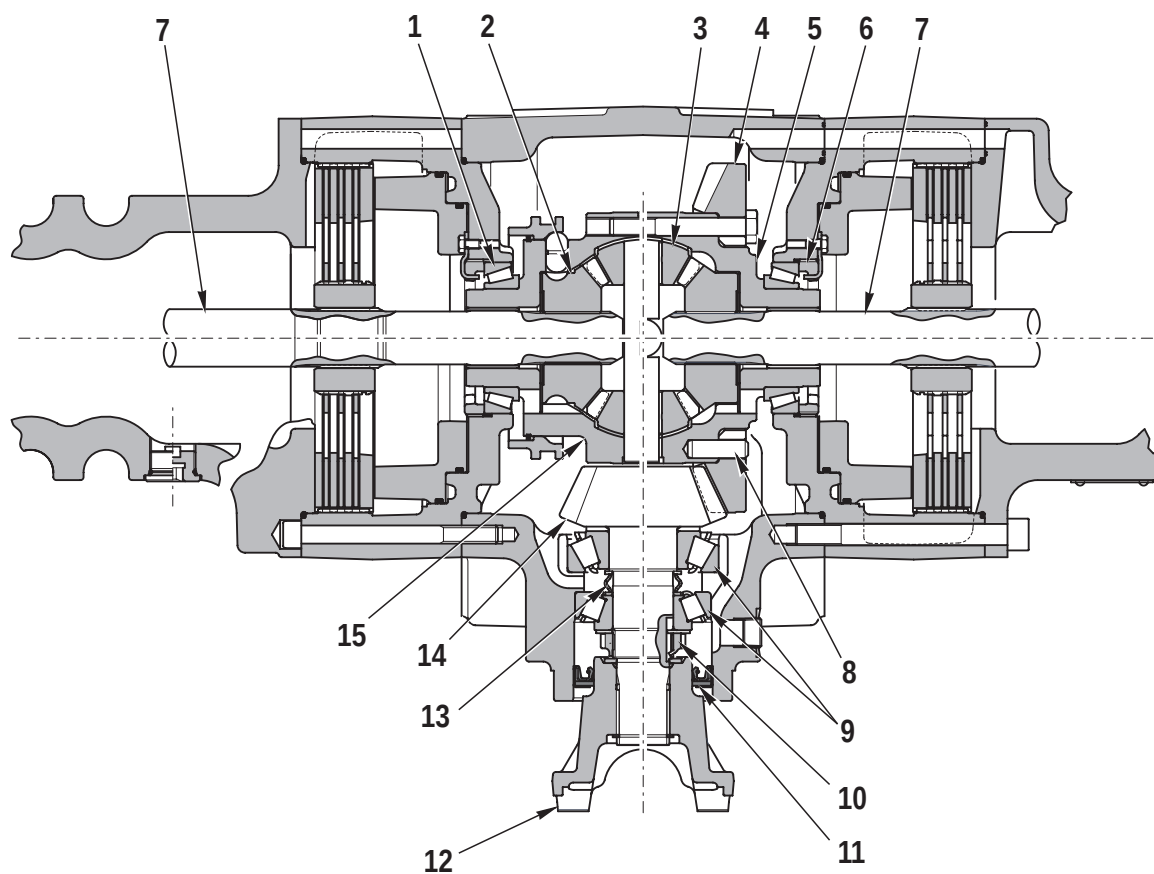
RKZ00591

1. Steering cylinder
2. Oil refilling plug
3. Oil drain plug
4. Nut
5. Adjustment screw
6. Nut
7. Bushing

- a Port - From the steering unit (L Port)
- b Port - From the steering unit (R Port)

REAR AXLE

Differential

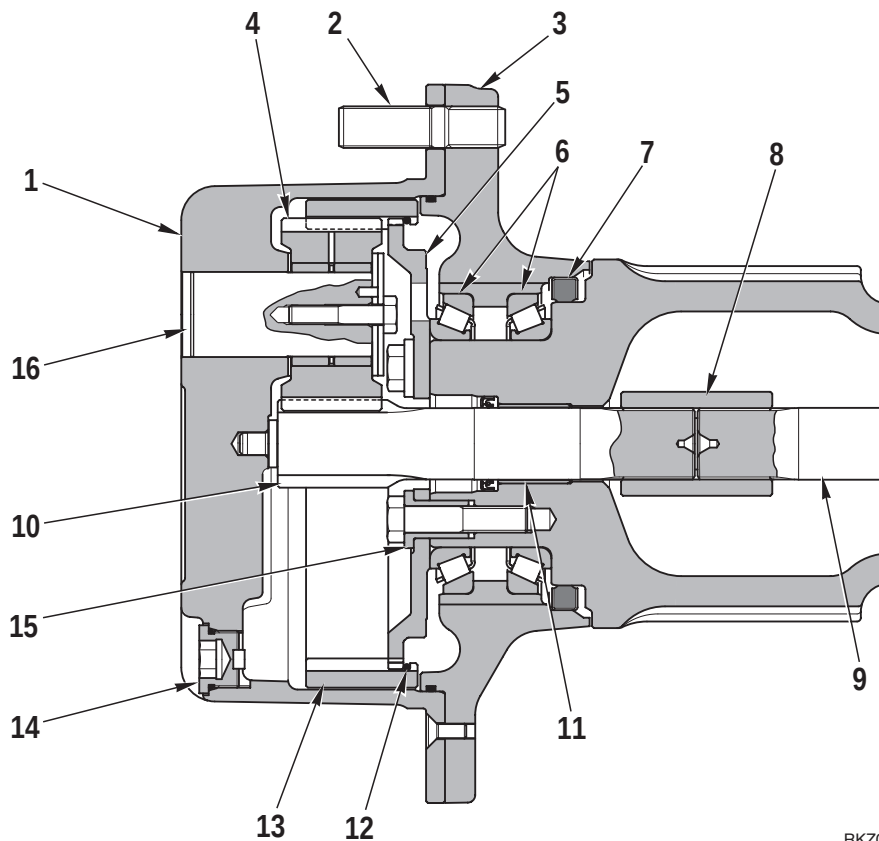


RKZ04970

- 1. Bearing
- 2. Planetary gear
- 3. Bevel gear
- 4. Ring bevel gear (Z=37)
- 5. Differential housing
- 6. Lock nut
- 7. Half-axle
- 8. Pin

- 9. Bearing
- 10. Nut
- 11. Seal
- 12. Flange
- 13. Spacer
- 14. Bevel pinion (Z=13)
- 15. Differential housing

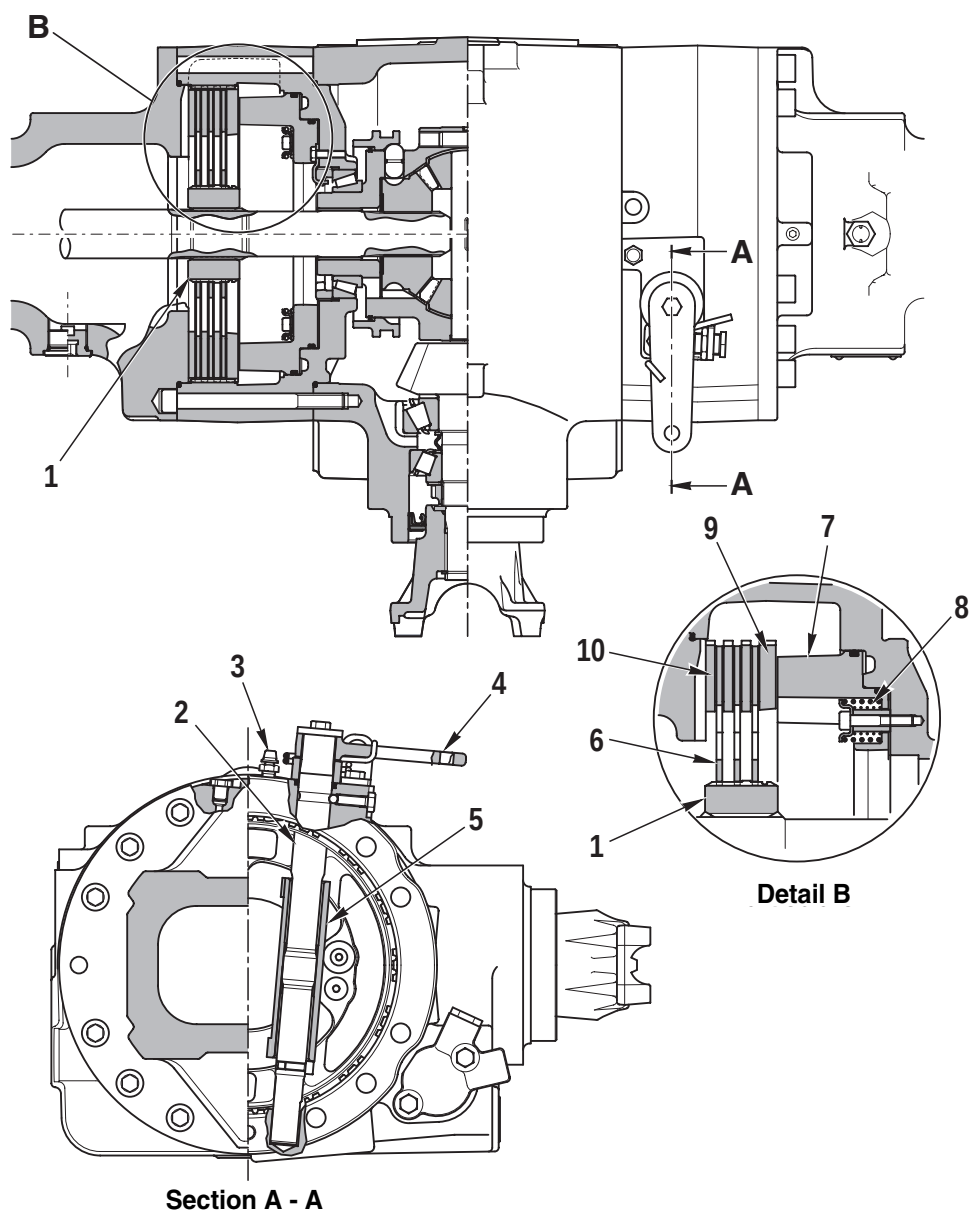
Final reduction



RKZ04980

- | | |
|----------------------------|---------------------------|
| 1. Planetary gear carrier | 10. Planetary gear (Z=15) |
| 2. Stud bolt | 11. Bushing |
| 3. Wheel hub | 12. Snap ring |
| 4. Planetary gears (Z=28) | 13. Ring gear (Z=75) |
| 5. Ring bevel gear carrier | 14. Oil plug |
| 6. Bearing | 15. Steady pin |
| 7. Seal | 16. Pin |
| 8. Joint | |
| 9. Half-axle | |

Brakes

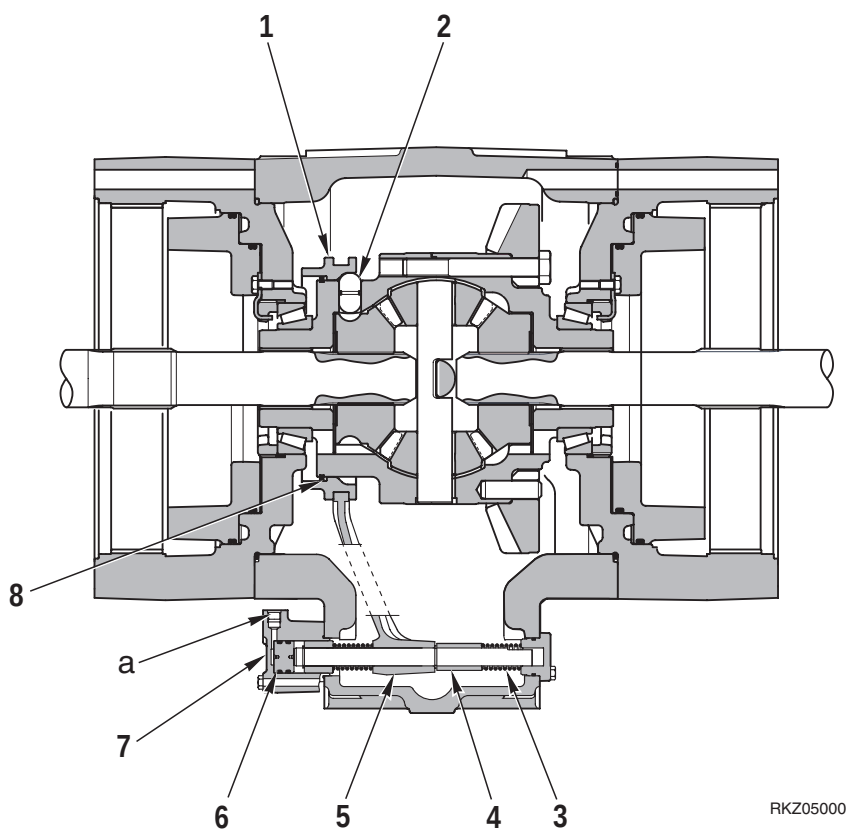


RKZ04990

1. Bushing
2. Parking brake control rod
3. Bleeder valve
4. Parking brake lever
5. Parking brake control cam

6. Brake disk
7. Piston
8. Spring
9. Pressure disk
10. Intermediate disk

Differential locking

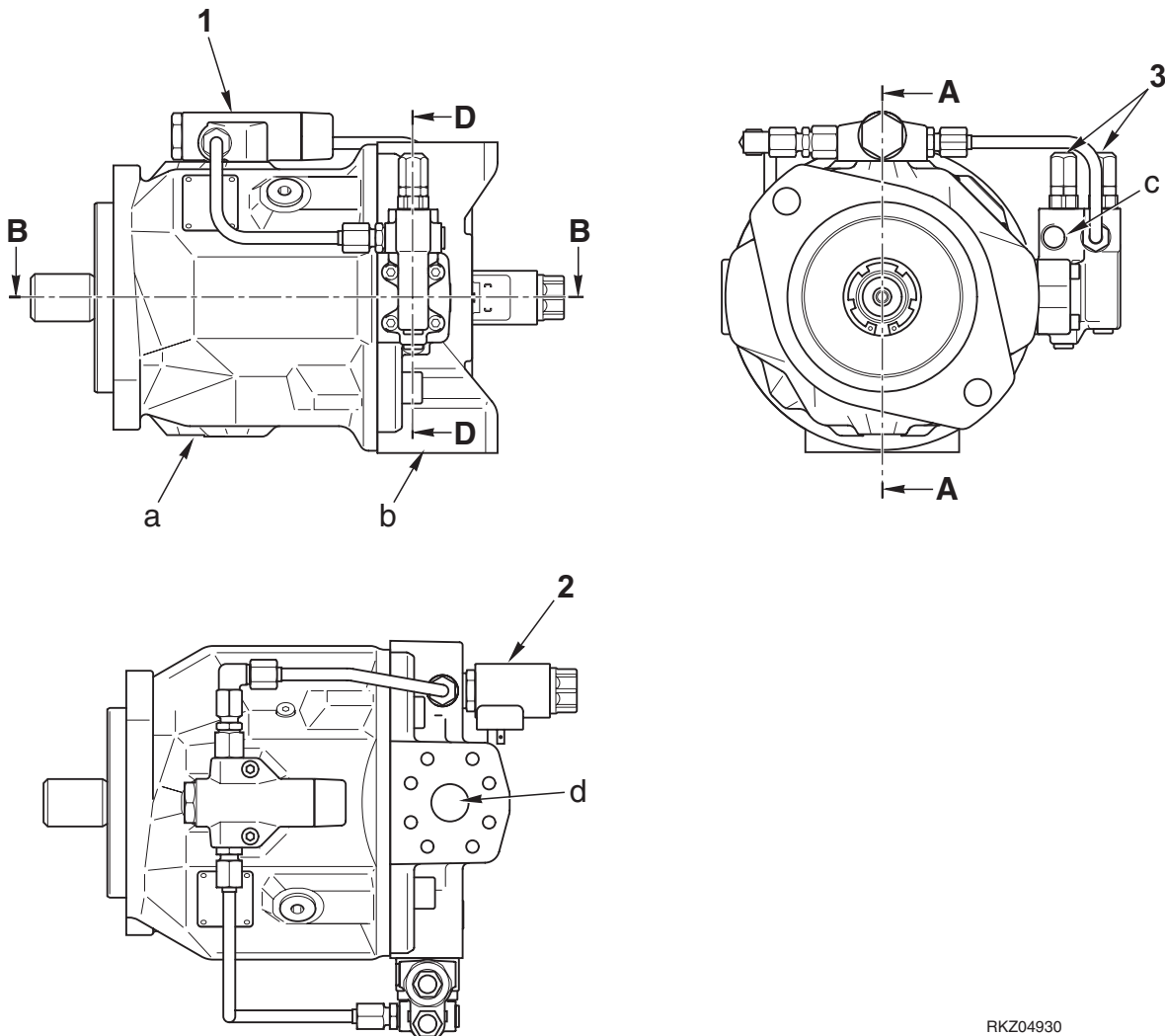


a. From the solenoid valve block ST1 (Port 2)

- 1. Sleeve
- 2. Pin
- 3. Control rod
- 4. Spacer
- 5. Fork
- 6. Piston
- 7. Cover
- 8. Snap ring

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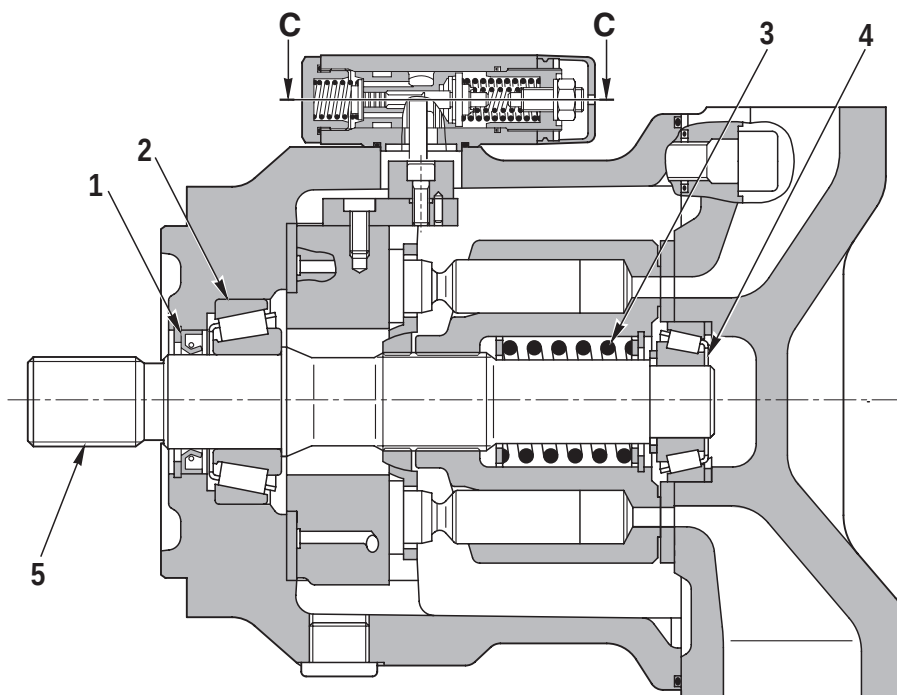
HYDRAULIC PUMP



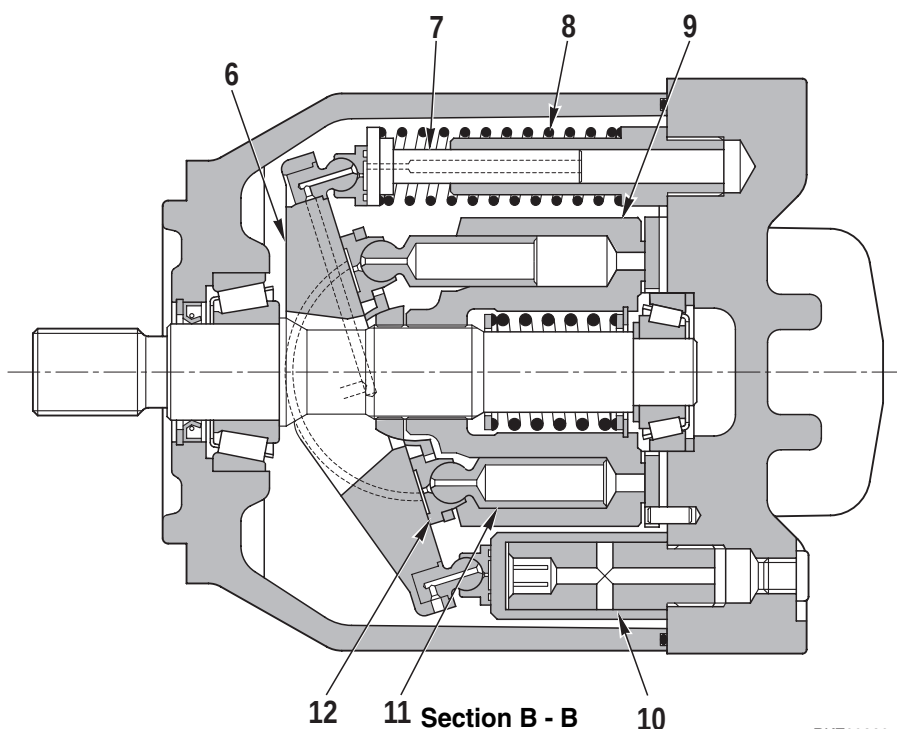
RKZ04930

1. Delivery variation group
2. Y1 solenoid valve working mode
3. Delivery control valve

- a. Port L1 - To the intake flange (Spool Port)
- b. Port B - To the shovel control valve (Port P)
- c. Port X2 - From the shovel control valve (Port LS)
- d. Port L - To the hydraulic oil tank
- e. Port S - To the hydraulic oil tank



Section A - A

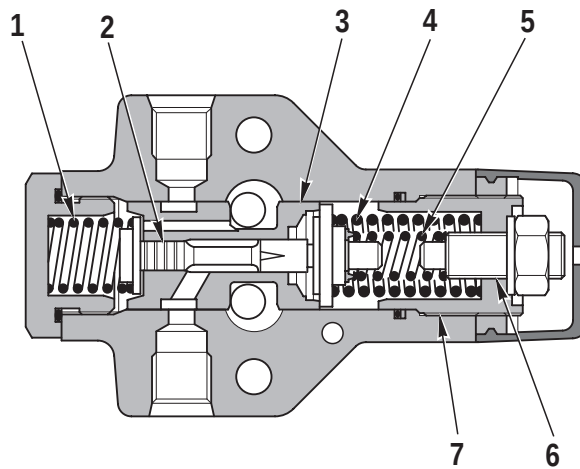


Section B - B

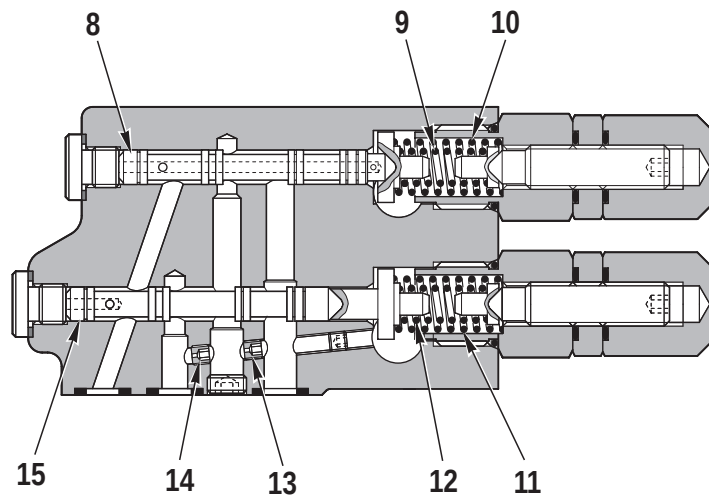
RKZ00380

1. Seal
2. Bearing
3. Central spring
4. Bearing
5. Control rod
6. Swash plate

7. Positioning piston
8. Spring
9. Cylinder block
10. Positioning piston
11. Piston
12. Guide shoe



Section C - C



Section D - D

RKZ00642

POWER GOVERNOR

1. Spring
2. Piston rod
3. Bushing
4. Initial adjustment spring
5. Pressure cut calibration spring
6. Pressure cut calibration screw
7. Initial adjustment calibration screw

PC VALVE

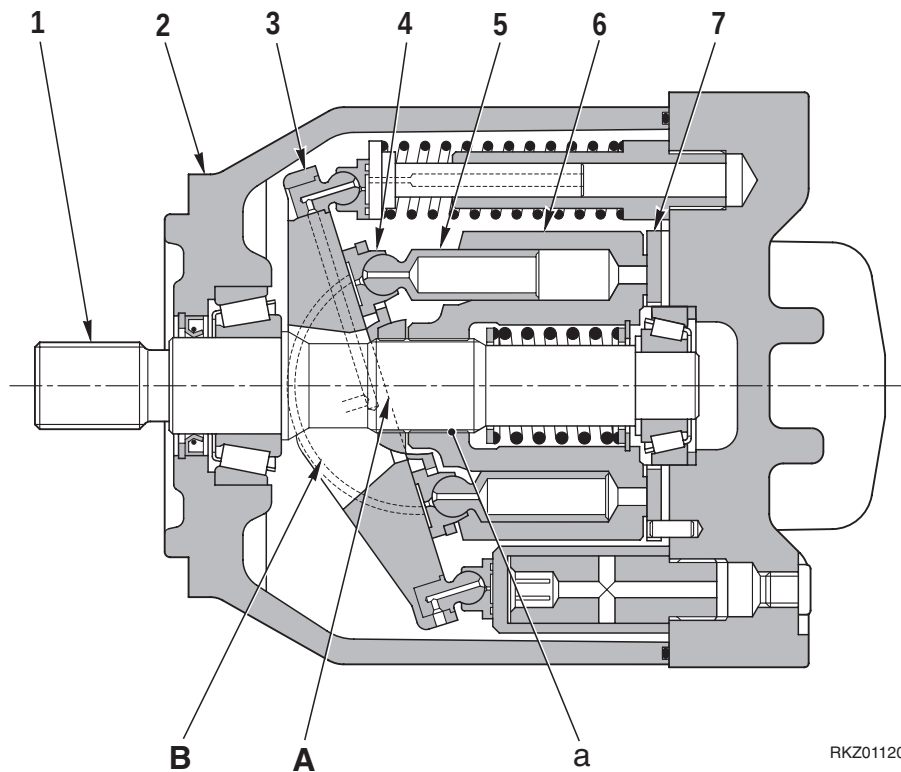
8. Spool
9. Spring (internal)
10. Spring (external)

LS VALVE

11. External spring
12. Internal spring
13. Throttles
14. Throttles
15. Spool

FUNCTION

- The rotation and torque transmitted to the pump shaft is converted into hydraulic energy and pressurized oil is delivered according to the load requirements.
- The amount of oil delivered can be modified by changing the angle of the swash plate.



RKZ01120

STRUCTURE

- The cylinder block (6) is supported and connected to the shaft (1) by the spline **a** and the shaft (1) is supported by the front and rear bearings.
- The tip of the piston (6) is ball-shaped. The shoe (4) is caulked to it to form one unit in such a way that the piston (5) and the shoe (4) together form a spherical bearing.
- The swash plate (3) has a flat surface **A** and the shoe (4) remains pressed against this surface while sliding in a circular movement. The swash plate brings highly pressurized oil onto the cylindrical surface **B** fashioned in the pump body (2), which means that the swash plate (3) slides on a hydrostatically-supported bearing.
- The pistons (5) perform their relative movements in an axial direction, inside cylindrical chambers fashioned in the cylinder block (6).
- The oil is brought up to pressure in the chambers of the cylinder block (6) by the rotatory movement of the block itself. The areas of pressure and suction are determined by the swash plate (7). The surface of the swash plate is so designed that the oil pressure always remains within acceptable limits. The oil in each chamber is drawn in and discharged through holes in the valve plate (7).

OPERATION

1. Pump operation

- 1 - The cylinder block (7) rotates together with the shaft (1) and the shoe (4) slides on the flat surface **A**. The swash plate (3) moves along the cylindrical surface **B**. The angle α formed between the center line of the shaft (1) and the center line **X** of the swash plate (3) changes, thus modifying the axial position of the pistons in relation to the cylinder block.

The angle α is known as the swash plate angle.

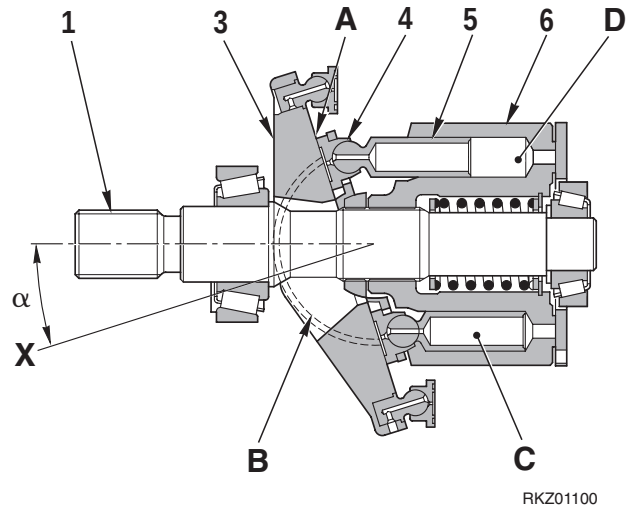
- 2 - When the center line **X** of the swash plate (3) maintains the angle α in relation to the center line of the shaft (1), and hence also of the cylinder block (6), the flat surface **A** acts as a cam for the shoe (4). As the piston (5) rotates and slides inside the cylinder block (6), it therefore creates a difference between the volumes **C** and **D** which provokes intake and discharge of the oil in quantities equal to the difference between the volumes ($D - C = \text{delivery}$).

In other words, as the cylinder block (6) rotates, chamber **D** loses volume while the volume of chamber **C** is increased, thus provoking an intake of oil.

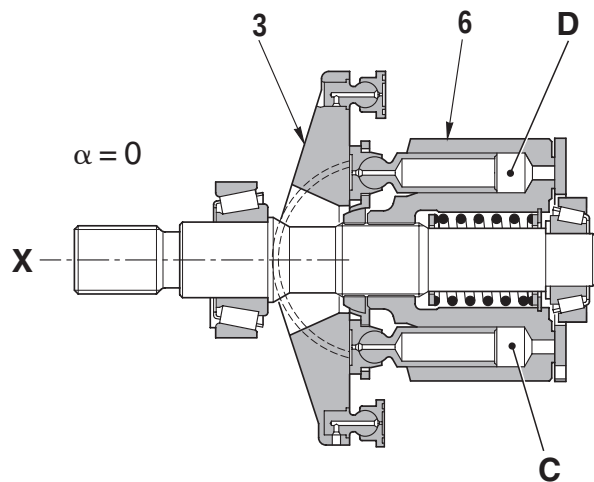
(The figure indicates the state of the pump when the intake of chamber **D** and the delivery of chamber **C** have been completed).

- 3 - When the center line **X** of the swash plate (3) and the center line of the cylinder block (6) are perfectly aligned (the swash plate angle $\alpha = 0$), the difference between the volumes **C** and **D** within the cylinder block (6) becomes 0 and the pump does not take in or deliver any oil. (In practice the swash plate angle α never becomes=0)

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



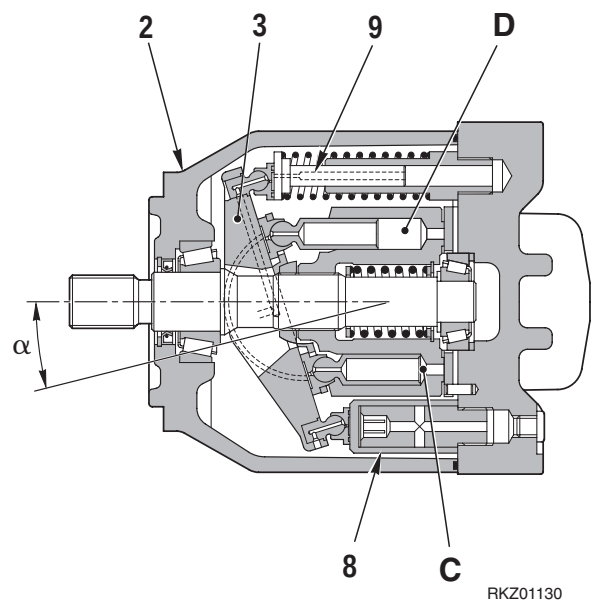
RKZ01100



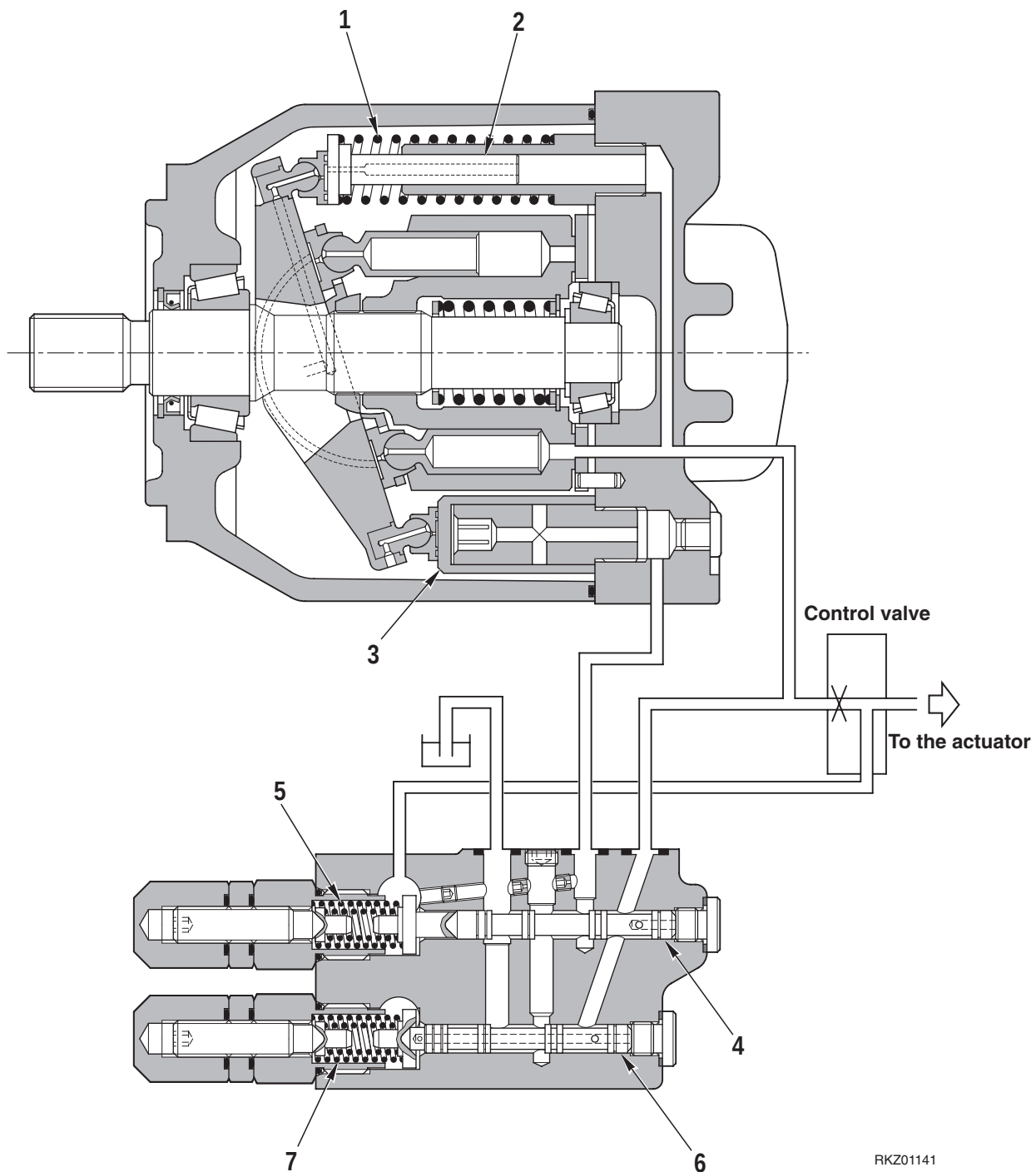
RKZ01110

2. Control of Delivery

- 1 - As the swash plate angle α grows larger, the difference between volumes **C** and **D** increases, and the delivery **Q** also increases.
The swash plate angle is modified by servo-pistons (8) and (9).
- 2 - The servo-piston (8) moves in a reciprocating linear motion ($\longleftrightarrow$) caused by pressure signals from the **PC** and **LS** valves.
The linear movement is transmitted to the swash plate (3), which is supported by the cylindrical surface of the cradle (2). The swash plate therefore has a semi-circular reciprocating movement ($\curvearrowright$).
- 3 - The surfaces of the servo-pistons receiving the pressures **PP** and **LS** are dissimilar. The delivery pressure **PP** of the main pump is always passed into the smaller (upper) pressure chamber, whereas the pressure **PEN** coming from the **LS** valve is passed into the larger (lower) pressure chamber.
The movement of the servo-piston is governed by the relationship between pressures **PP** and **PEN**, as well by the proportions between the surfaces (larger and smaller) of the servo-piston.



PC VALVE, LS VALVE, SERVO PISTON



SERVO-PISTON

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

LS VALVE

4. Piston
5. Spring

PC VALVE

6. Servo-piston
7. Spring

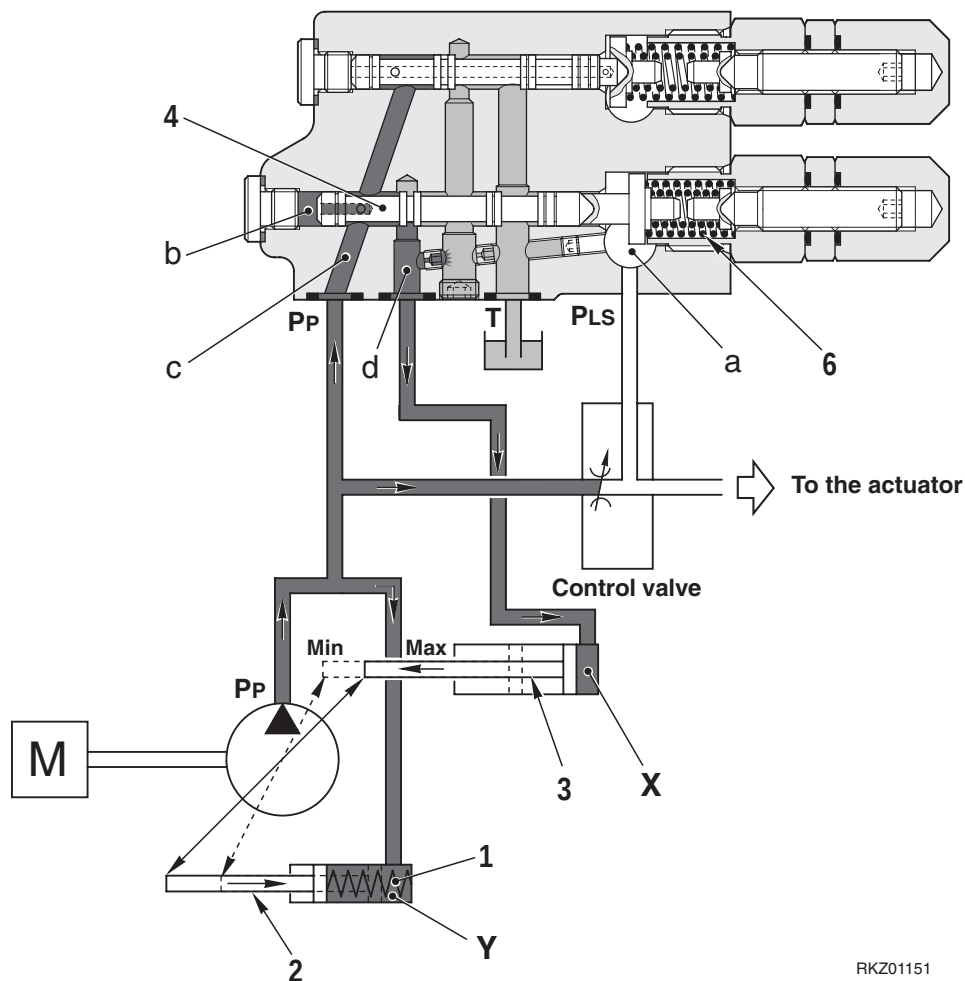
LS VALVE

FUNCTION

- The **LS** valve controls the pump delivery according to the stroke of the control valve level, i.e., in function of the delivery demands made by the actuators.
- The **LS** valve detects the actuator's delivery needs by means of the differential pressure ΔPLS existing between the pump delivery pressure **PP** and the pressure **PLS** coming from the control valve. This reading permits control of the main pump delivery **Q**.
(**PP**, **PLS** and ΔPLS are, respectively, the pump pressure, the Load Sensing pressure, and the difference in pressure between these two values).
- In other words, the **LS** valve detects the pressure difference ΔPLS generated by the passage of the oil flow through the surface freed by the control valve spool, and controls the pump delivery **Q** so as to keep the pressure drop constant.
It can therefore be assumed that the pump delivery is proportional to the demands made known by the control valve.

OPERATION

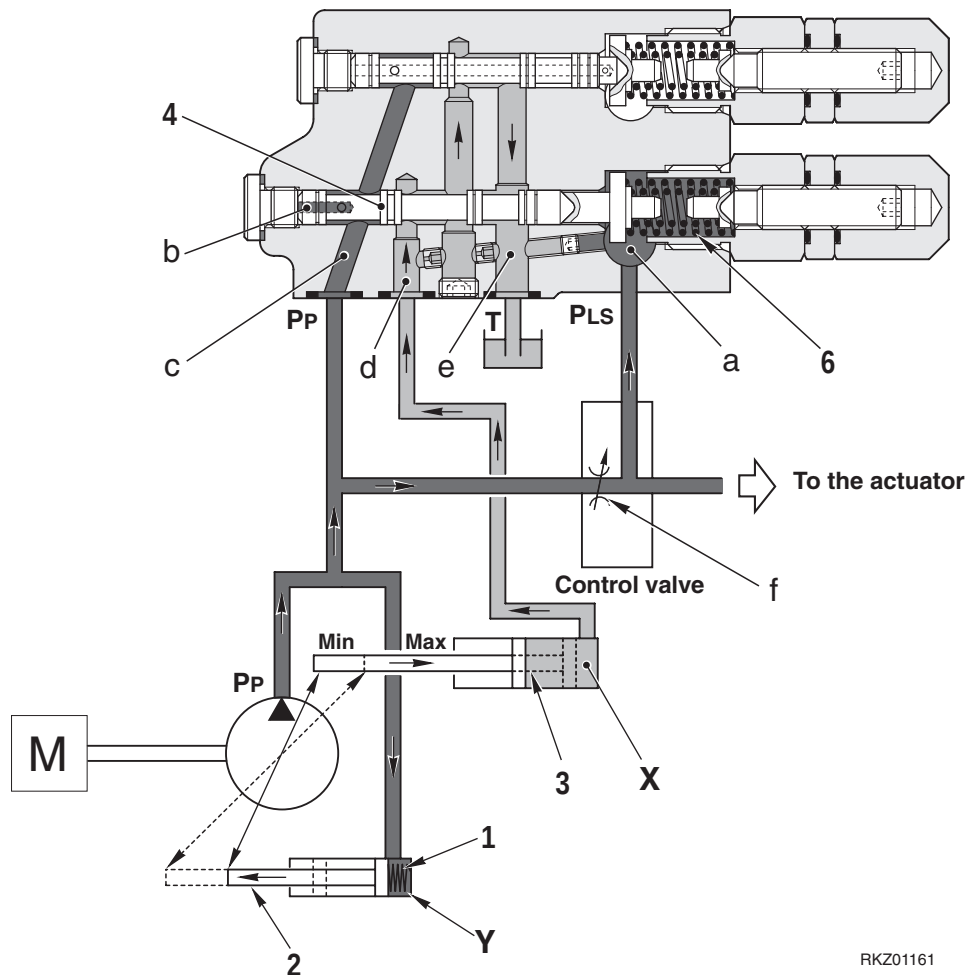
1. When the control valve is in a «NEUTRAL» position



RKZ01151

- The pressure **PLS** of the **LS** coming from the control valve outlet passes into chamber **a** of the spring of the **LS** valve. The pressure **PP** of the pump passes into chamber **b** of the opposite side.
- The piston rod movement (4) is determined by the combination of the force generated by the pressure **PLS**, the force of the spring (6) and the force generated on the side opposite the piston rod by the pressure **PP**.
- Before the engine is started the servo-piston (3) is pushed to the right by the spring (1) (corresponding to the maximum angle of the swash plate).
- If all the control valve spools are in their «NEUTRAL» position when the engine is started, the pressure **PLS** of the **LS** will remain at 6 ± 2 bar because no oil is flowing through the control valve. At the same time the pump pressure **PP** increases and is maintained at a value of about 27 bar.
- For this reason the piston (4) is thrust to the right (→) and a passage is formed between the delivery lines c and d. This opening enables the pump pressure **PP** to enter chamber **X** of the servo-piston (3).
- Although the pump pressure **PP** is always passed into chamber **Y** of the servo-piston (2), since the force exerted by that pressure on piston (3) exceeds the force exerted on piston (2), the servo-piston (1) moves to the right (→), i.e. towards the side of the minimum angle of the swash plate.

2. When a control valve lever is activated

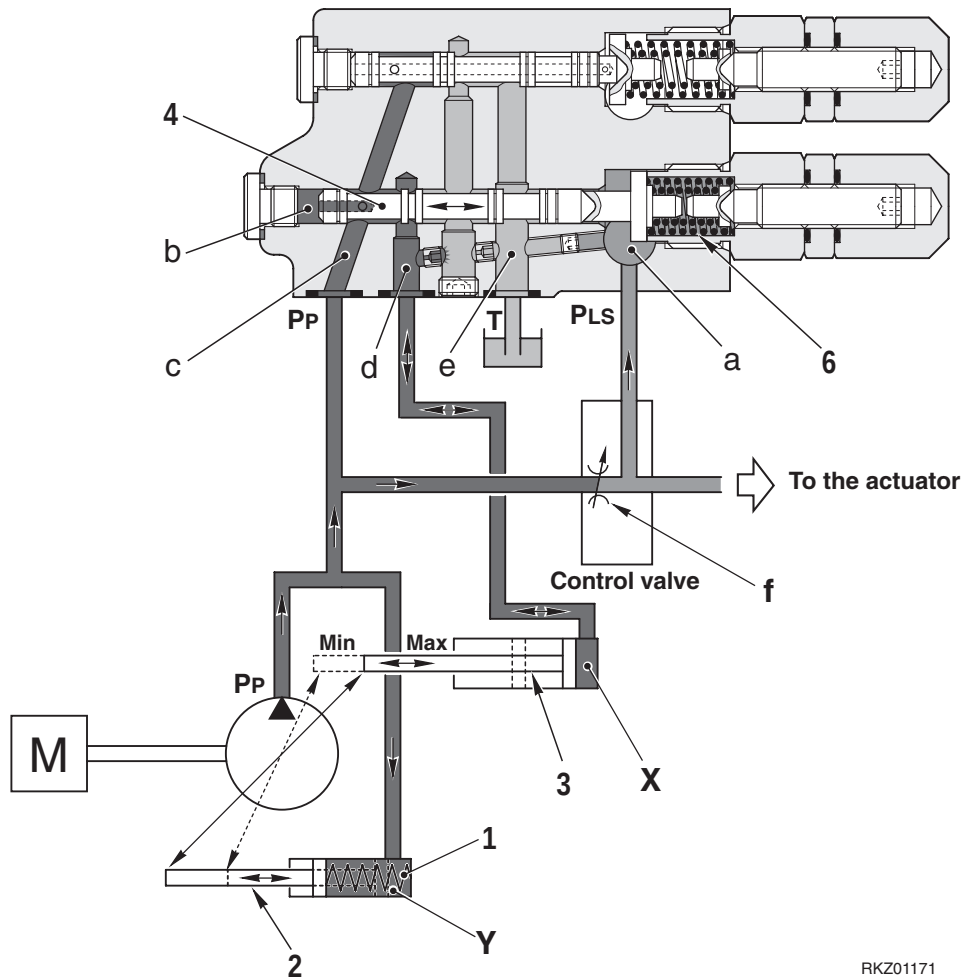


RKZ01161

- When the control valve lever is moved out of its NEUTRAL position, the opening **f** is determined, allowing an **LS** signal to be generated.
- Until the ΔPLS generates a force less than the force exerted by the spring (6) on the spool (4), the system will remain stable.
When the opening **f** is such as to provoke a reduction in ΔPLS , the spool (4) moves to the left (←) to form a passage between delivery lines **d** and **e**. The chamber **X** loses pressure and the servo-piston causes the swash plate to move towards maximum displacement.

- Equilibrium is re-established in the system when the pressure ΔPLS generates on the spool (4) the difference in force exerted by the spring (6), and the passage between delivery lines **c** and **d** is re-opened.

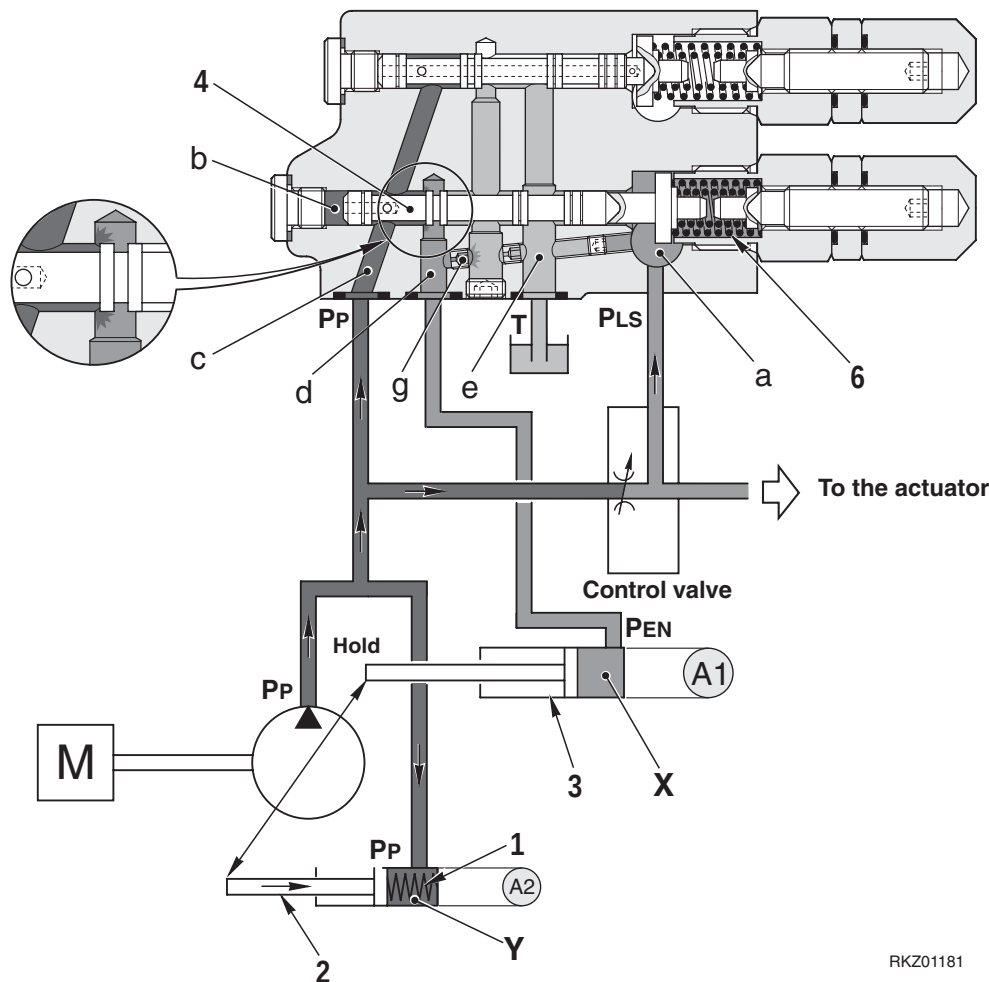
4. When the spool makes very small movements (fine-control)



RKZ01171

- When the control valve lever moves in very small increments towards the «NEUTRAL» position, i.e. when the control valve opening **f** diminishes, the differential pressure ΔPLS between the pump pressure **PP** and the **LS** pressure **PLS** increases.
- If the differential pressure ΔPLS generates on the spool (4) a difference in force that exceeds the force exerted by the spring (6), the spool moves to the right (→) and a passage is formed between the delivery lines **c** and **d**. The pressure **PP** is introduced into the chamber **X** and the swash plate moves towards its minimum angle.
- When the control valve lever performs small movements towards the position of maximum opening, i.e. when the opening **f** of the control valve increases, the differential pressure ΔPLS diminishes.
- If the differential pressure ΔPLS generates on the spool (4) a force difference that does not exceed the force exerted by the spring (6), the spool (4) moves to the left (←) and a passage is formed between the delivery lines **d** and **e**. The chamber **X** loses pressure and the servo-piston provokes a movement of the swash plate towards maximum displacement.
- Equilibrium is re-established in the system when the pressure ΔPLS generates on the spool (4) the difference in force exerted by the spring (6), and hence the passage between delivery lines **c** and **d** is also re-opened.

5. When pump flow matches the demands of the control valve



RKZ01181

- Let **A1** be the surface of the servo-piston (3), **A2** the surface of the servo-piston (2), **PEN** the pressure acting on the piston (1) and **PP** the pressure acting on the piston side (2).
When pump delivery reaches the quantity demanded by the control valve, the pump pressure **PP** in chamber **b** of the **LS** valve is in equilibrium with the combined forces of the **LS** pressure **PLS** in chamber **a**, and the force exerted by the spring (6). Once equilibrium has been reached the piston (4) stops in the central position.
- In this condition the passage from chamber **c** to chamber **d** remains only slightly open in order to maintain pressure in chamber **d**.

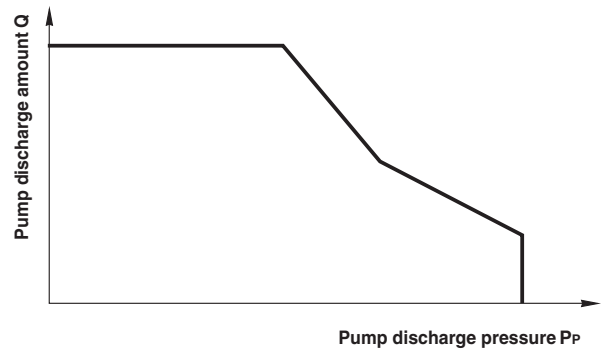
A flow of oil is introduced into the servo-cylinder (3) at a pressure that balances the force generated by the pump pressure **PP** in the cylinder (2).
(PEN x A1 = PP x A2).

- The stability of the equilibrium is guaranteed by a flow stabilized by the throttle **g**.
- The force of the spring (6) is regulated so that the piston (4) is in equilibrium when
PP - PLS = ΔPLS = 18 bar.
- In practice, the pump flow is made proportional to the section of the opening of the control valve, which maintains the differential pressure
ΔPLS = 18 bar.

PC VALVE

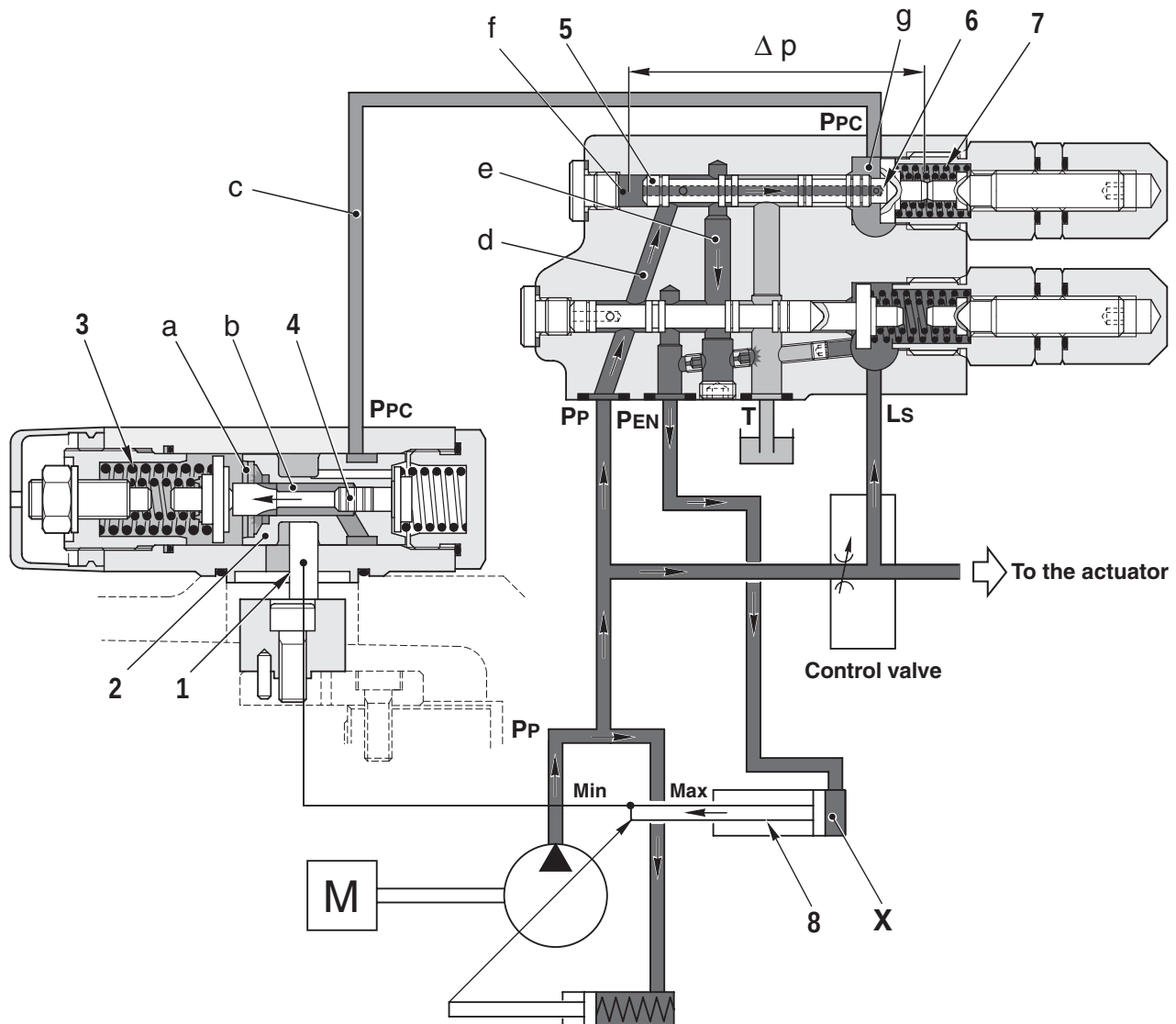
FUNCTION

- The **PC** valve performs an approximate power check, and ensures that the hydraulic horse-power absorbed by the pump does not exceed the horse-power delivered by the endothermal engine. This is achieved by limiting the pump delivery **Q** in function of the delivery pressure **PP**, even if the **LS** valve requests an increase in delivery **Q** due to the larger section freed by the control valve spool, in the presence of high pressure pump delivery.
- In other words, when during operation the delivery **Q** increases and the delivery pressure **PP** also increases simultaneously, the **PC** valve reduces the pump delivery **Q**. When the delivery pressure **PP** decreases, the **PC** valve increases the pump flow.
- The relationships between the pump delivery pressure **PP** and the delivery **Q** are shown in the diagram.



OPERATION

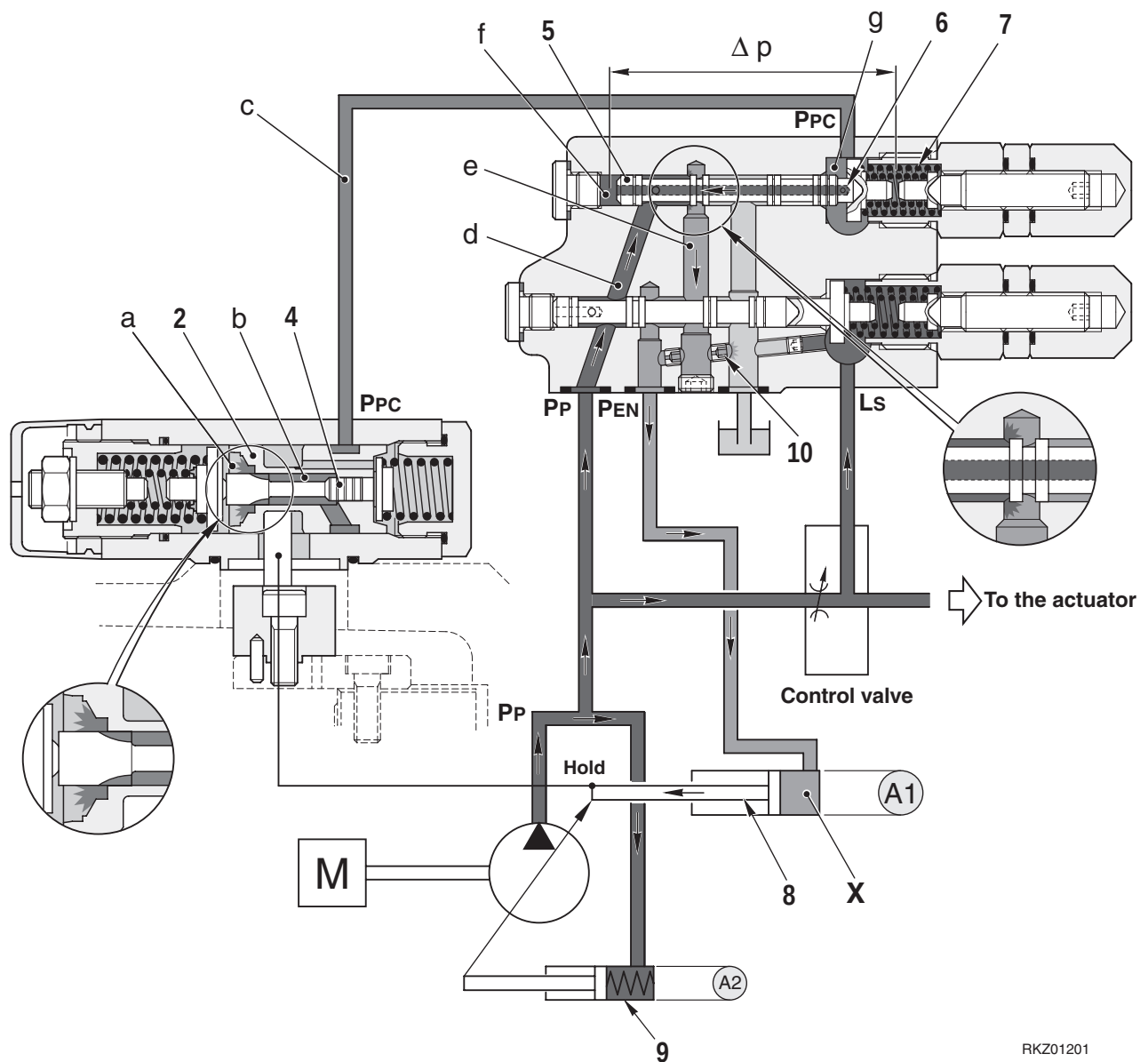
1. When the load on the actuators is heavy (high pump delivery pressure)



RKZ01191

- When a higher delivery is required, the **LS** valve receives a signal from the control valve to bring the pump up to maximum displacement. When the swash plate moves it also moves the bushing (2) joined to it (by the pin (1)), which releases the spring (3).
- As the pressure of the actuators increases, pressure also increases in the delivery line **c**. When the calibrated setting of the spring (3) is reached, the piston rod (4) is thrust to the left (←) and the passage between chamber **b** and the pump drainage chamber **a** is opened.
- The opening of the passage between the chambers **b** and **a** generates a flow of oil and hence, due to the calibrated hole (6), a ΔP is generated between chambers **f** and **g** at the sides opposite the spool (5). ($\Delta P = PP - PPC$)
- When the value of **PP** exceeds the value of the spring loading (7) the spool (5) moves to the right (→) opening the passage between the delivery lines **d** and **e** and sending the pump pressure **PP** towards the servo-cylinder (8).
- The pressure **PP** introduced into chamber **X** of the cylinder (8) pushes it towards the minimum angle of the swash plate (←).

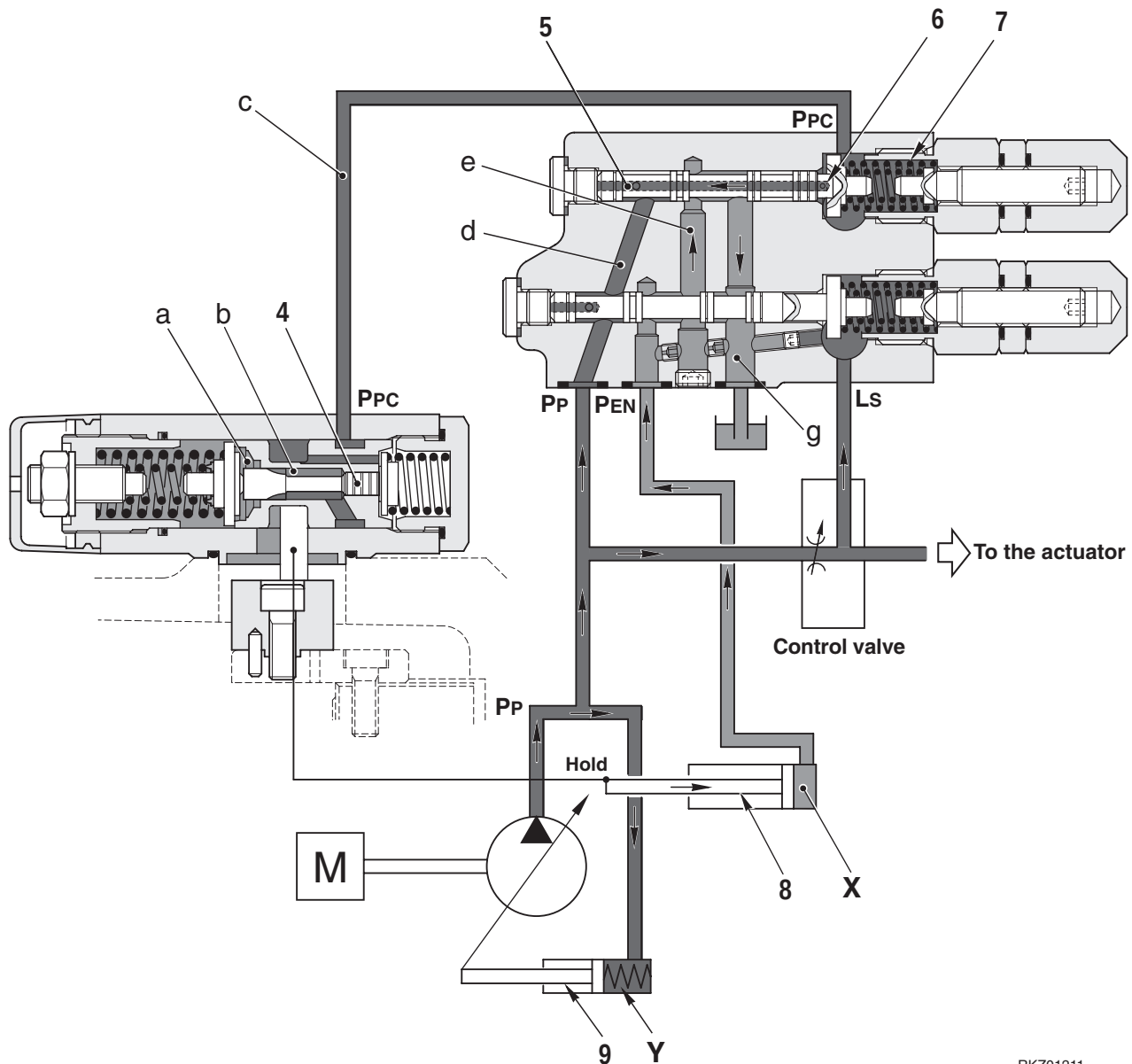
2. When equilibrium has been reached



RKZ01201

- When the piston (8) is pushed to the left () the bushing (2) is also moved. The oil flow between the chambers **b** and **a** is reduced and the **PPC** pressure tends to approach the **PP** pressure value. The ΔP decreases and the spool (5) is pushed to the left () by the force of the spring (7).
- Equilibrium is reached when the force generated by the **PP** pressure, the force generated by the **PPC** pressure, and the force of the spring (7) are all balanced. (The force generated by **PP** = the force generated by the **PPC** + the spring force (7)).
- In this condition the passage from chamber **d** to chamber **e** remains only slightly open in order to maintain pressure in chamber **e**. A flow of oil is introduced into the cylinder (8) at a pressure that balances the force generated by the pump pressure **PP** acting on the cylinder (9). ($PEN \times A1 = PP \times A2$)
- The stability of this equilibrium is generated by a continuous stabilized flow from the throttle (10).

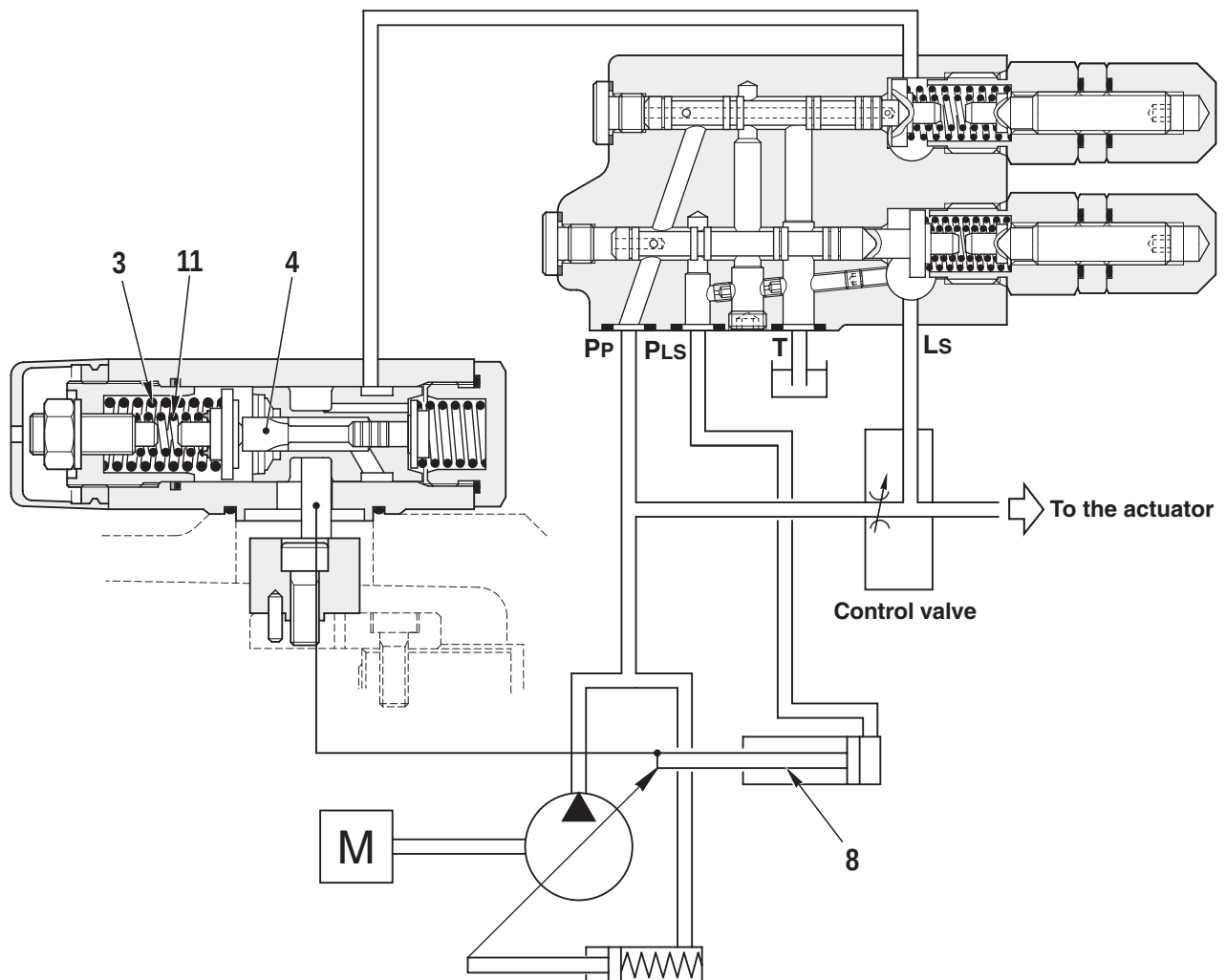
3. When the load on the actuators decreases (pump delivery pressure drops)



RKZ01211

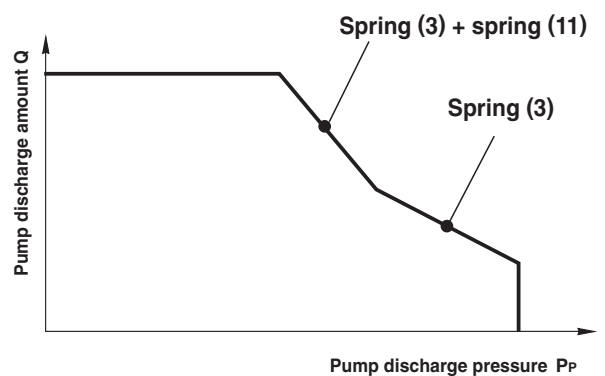
- When the load on the actuators diminishes and the pump delivery pressure **PP** drops, the **PPC** pressure also drops.
- The reduction in the **PPC** causes the spool (4) to move and the passage between chambers **b**, **d** and **a** is closed.
The **PPC** pressure and the **PP** pressure of the pump are equalised due to the interruption of the oil flow through the calibrated hole (6) and hence the ΔP becomes zero ($\Delta P = PP - PPC = 0$).
- The spring (7) pushes the spool (5) to the left (←) closing the passage between the chambers **d** and **e** and opening the passage between chambers **e** and **g**.
- The pressurized oil present in chamber **X** of the servo-cylinder (8) passes through chambers **e** and **g** and reaches the pump drainage chamber, so that the pressure in chamber **X** of the servo-cylinder (7) becomes equal to the drainage pressure.
- Therefore the servo-piston (7) is caused to move by the **PP** pressure in chamber **Y** of the servo-cylinder (9), i.e. in the direction of the increase in the angle of the swash plate.

4. The function of the spring



RKZ01221

- The loading on the springs (3) and (11) of the **PC** valve changes in proportion to the angle of inclination of the pump swash plate.
- The compression of the spring (3) varies with the movements of the servo-piston (8).
- When the piston (8) moves to the left (←), the spring (3) is compressed.
If the piston (8) moves even further to the left (←), the spring (11) comes into action to increase the loading.
In other words, the overall loading of the springs is varied by the piston (8), which either compresses or releases them.
- The pump absorption torque curve, which indicates the relationship between the pump delivery pressure **PP** and the delivery **Q**, is a broken line (as illustrated in the diagram).



RKZ01241

STRUCTURE AND FUNCTION

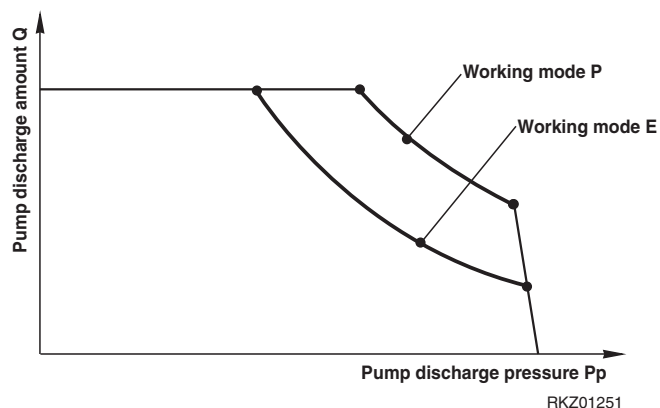
HYDRAULIC PUMP

- The position in which the piston (8) stops, i.e. the pump absorption torque, is determined by the position in which the **PPC** pressure applied to the spool (4) is balanced by the force exerted by the springs (3) and (11).
- In practice, as the pump delivery pressure **PP** increases, the delivery **Q** decreases, and as the pressure **PP** diminishes the pump delivery **Q** increases.

WORKING MODE SOLENOID VALVE

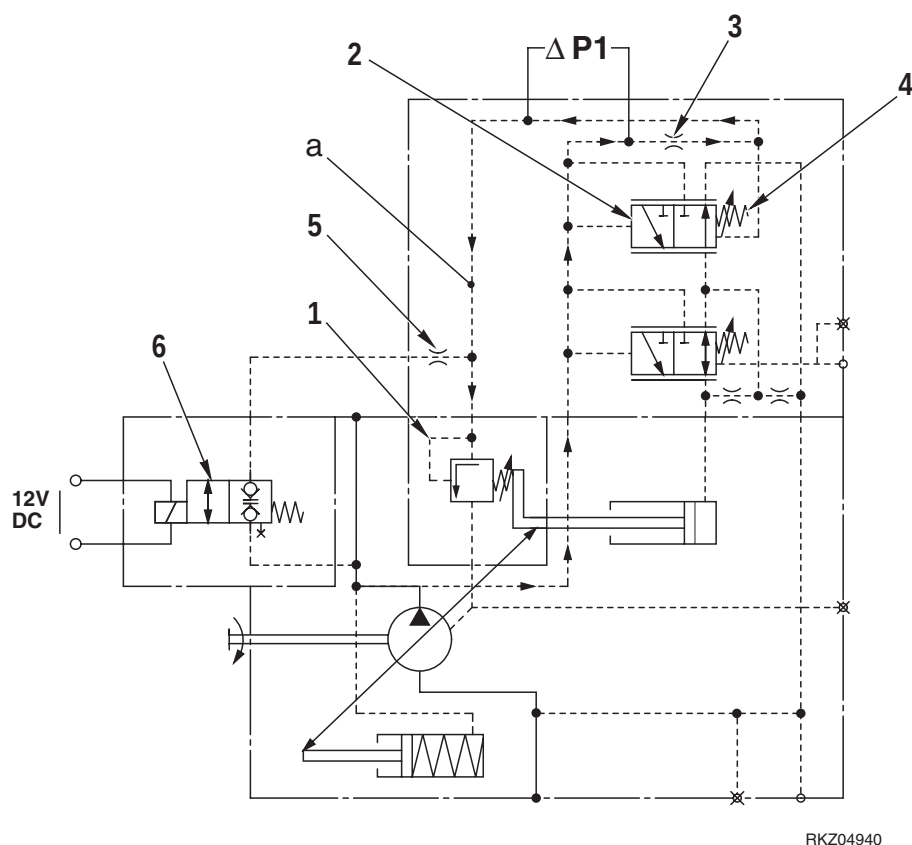
FUNCTION

- Calibration of the pump absorption torque is normally performed for the working mode **E**. When the solenoid valve of the working mode is commutated the absorbed power of the pump is increased, as indicated by the working mode curve.



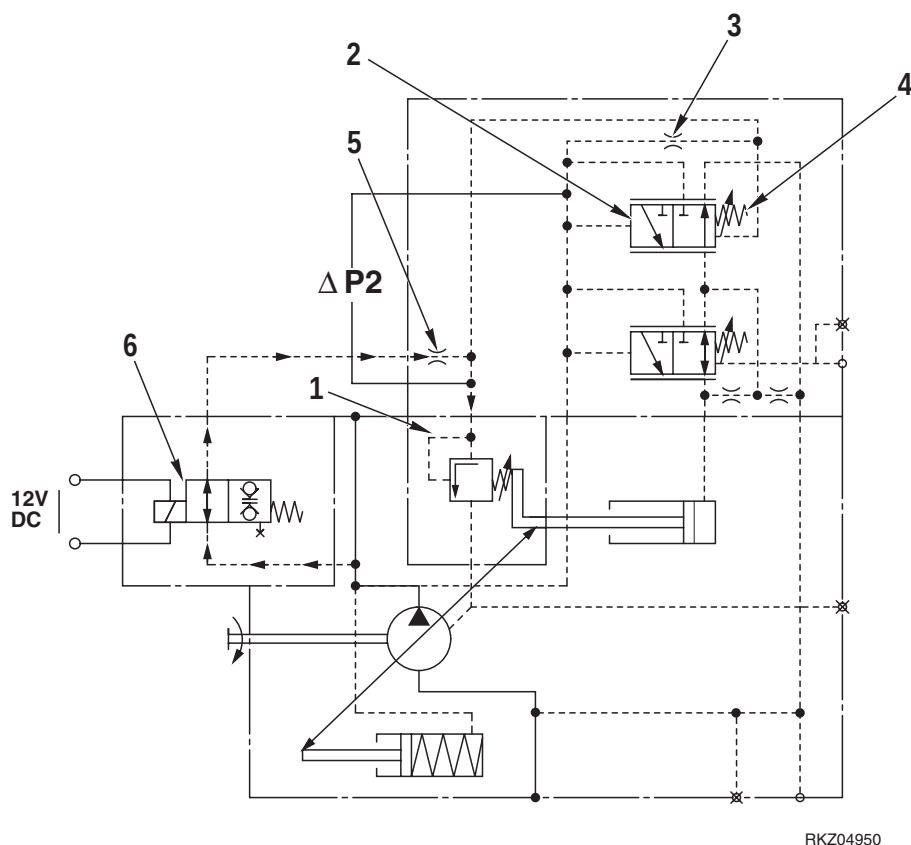
OPERATION

1. WORKING MODE E



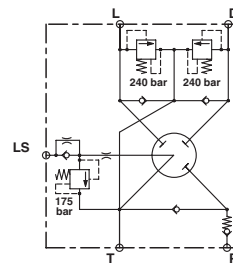
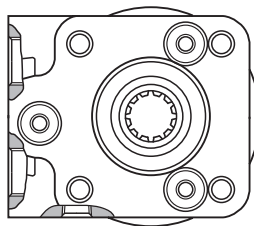
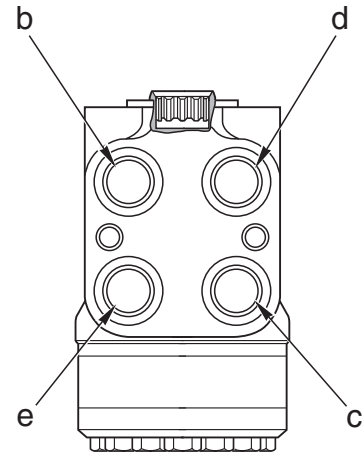
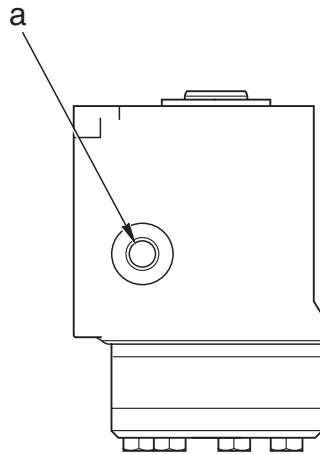
- During normal operation (Working mode **E**), the **PC** valve intervenes when a $\Delta P1$ is generated equal to the loading on the spring (4).
- The $\Delta P1$ is generated by the calibrated hole (3) in the spool of the **PC** valve (2) when, at a determined pump delivery pressure **P1**, the valve (1) puts the delivery line **a** into discharge, thus generating a flow **F1** in the delivery line **a**.

2. WORKING MODE P



- When the solenoid valve (6) is commutated (Working Mode **P**) the pressurized oil coming from the pump changes its route and passes through the throttle (5), which has a larger diameter than the calibrated hole (3).
- Because the throttle (5) has a larger diameter, the $\Delta P2$ generated is less than is needed to overcome the force generated by the spring (4). The spool of the **PC** valve (2) is therefore pushed to the left (←) by the force of the spring (4).
- This shift obliges the pump to increase displacement and hence the delivery (See «PC VALVE: 3. When the load on the actuators decreases» third paragraph).
- The increase in flow causes an increment of the $\Delta P2$ which, when the loading value of the spring is reached, allows the spool to shift to the right (→).
- The pump starts to work in normal fashion once again, and all the valves recommence normal functioning.

STEERING UNIT



RKZ00831

- a. Port LS - From the shovel control valve (Port DLS)
- b. Port T - To the hydraulic oil tank
- c. Port L - To the steering cylinder (Port a)
- d. Port R - To the steering cylinder (Port b)
- e. Port P - From the shovel control valve (Port D)

TECHNICAL DATA

Steering unit type: LAGCSDS160P

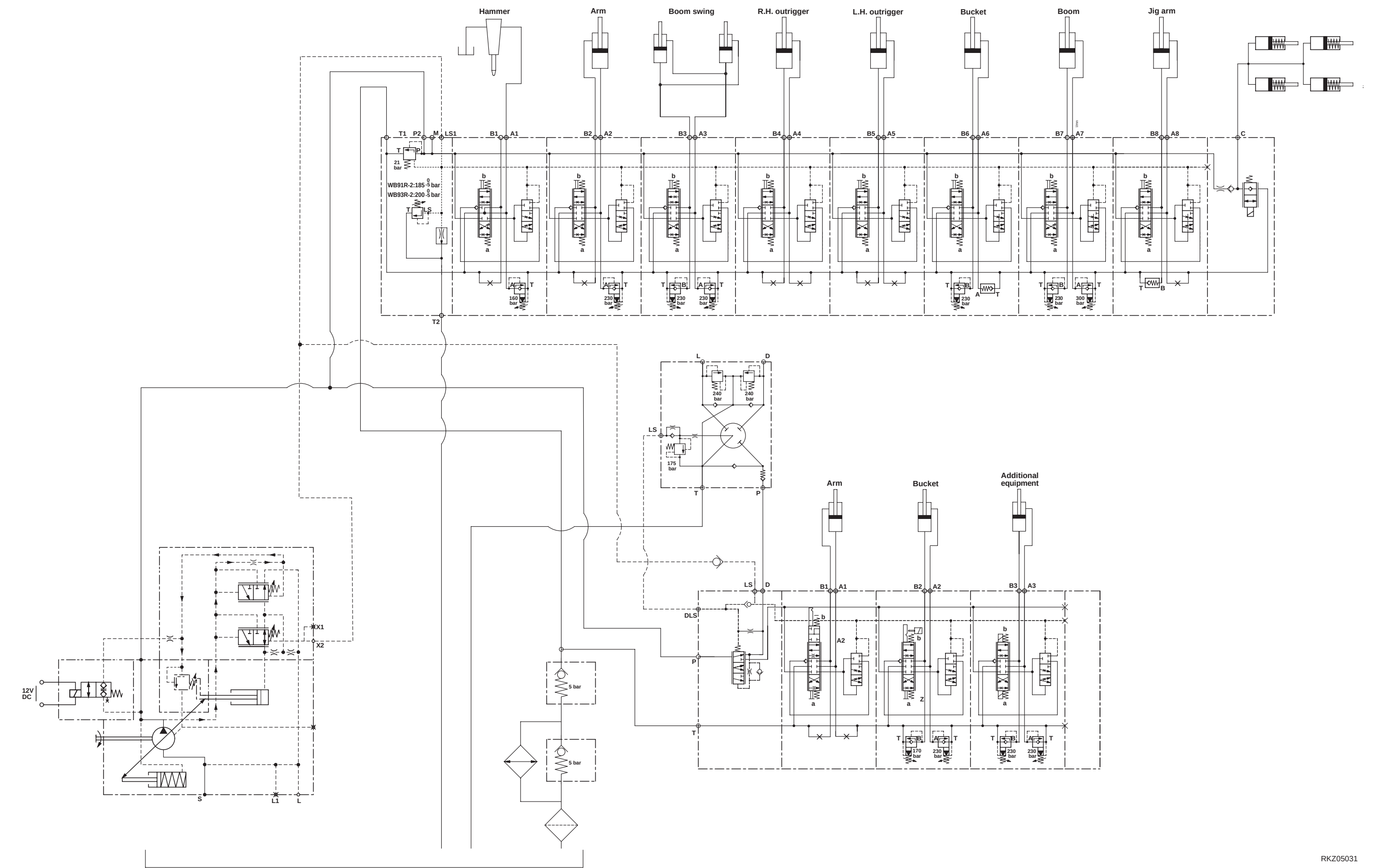
Displacement: 160 cc/rev.

OPERATION

- The steering unit is composed of a control valve and a rotating oil dispenser, and is of the hydrostatic type.
- When the steering wheel is turned, the control valve sends oil from the pump P2 (by means of the rotating oil dispenser) to one of the sides of the steering cylinder.
The rotating dispenser ensures that the volume of oil supplied to the cylinder is proportionate to the angle of rotation of the steering wheel.
- In the event of malfunction, the oil dispenser will function automatically as a hand-pump, thus guaranteeing emergency steering.

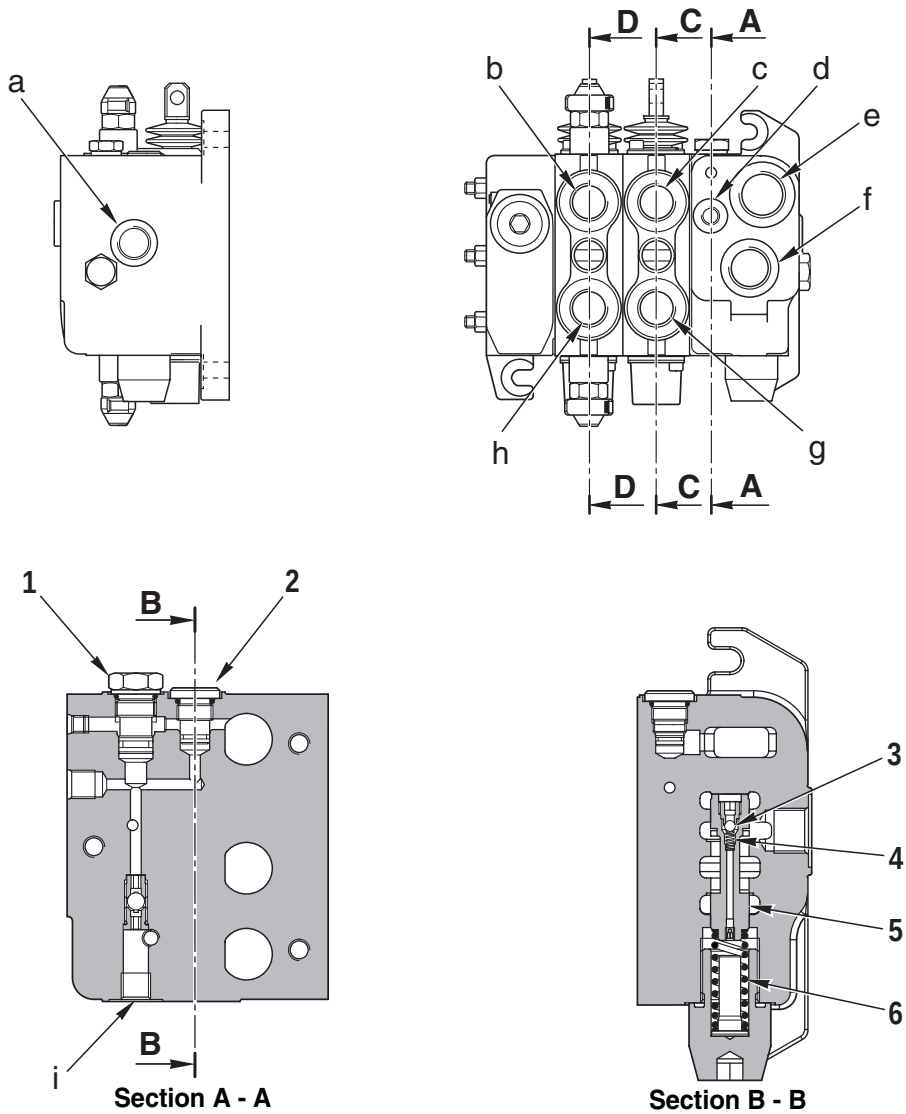
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HYDRAULIC CIRCUIT



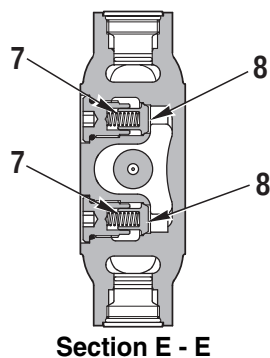
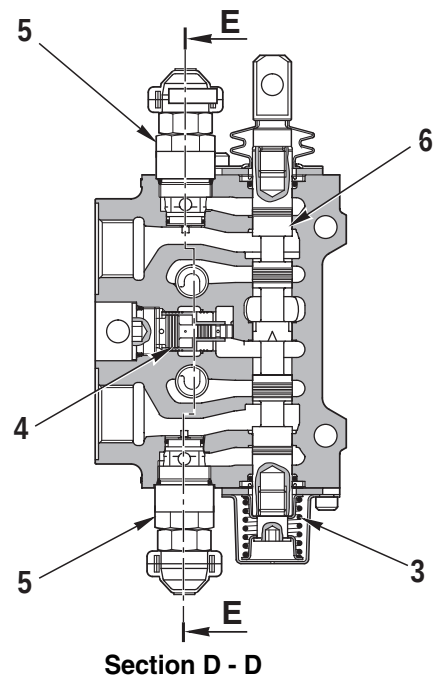
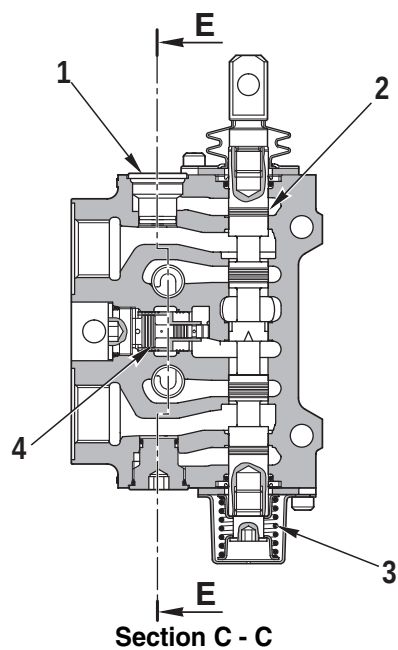
SHOVEL CONTROL VALVE

2 SPOOL



RKZ01082

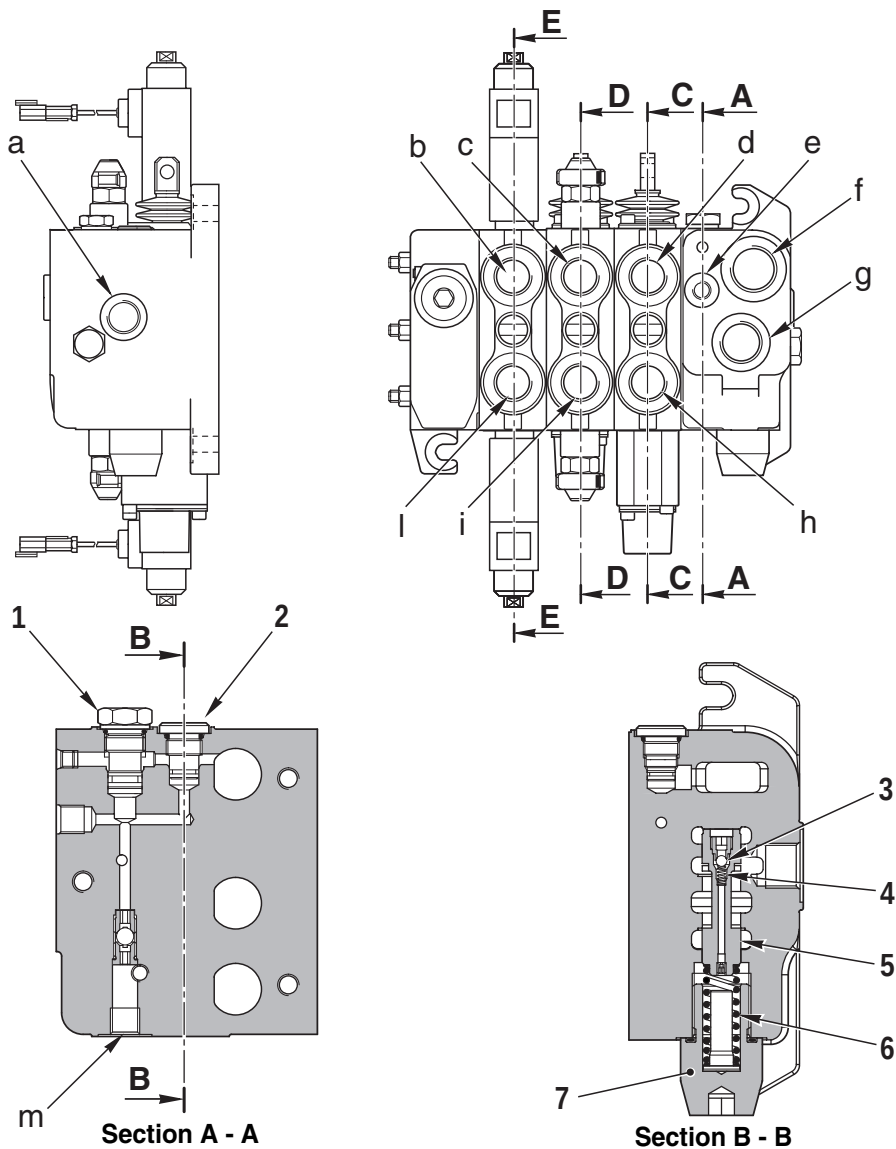
- | | | | | |
|----|----------|---|----|---------------------------|
| a. | Port D | - To the hydraulic steering unit (Port P) | 1. | Plug |
| b. | Port A2 | - To the bucket cylinders (Head side) | 2. | Plug |
| c. | Port A1 | - To the shovel-raising cylinders (Base side) | 3. | Ball |
| d. | Port LS | - To the pump (Port X2) | 4. | Spring |
| e. | Port T | - To the hydraulic oil tank | 5. | Priority valve piston rod |
| f. | Port P | - From the pump (Port B) | 6. | Priority valve spring |
| g. | Port B1 | - To the shovel-raising cylinders (Head side) | | |
| h. | Port B2 | - To the bucket cylinders (Base side) | | |
| i. | Port DLS | - To the hydraulic steering unit (Port LS) | | |



RKZ00660

1. Plug
2. Raising command spool
3. Spool return spring
4. Compensator
5. Antishock/anticavitation valve
6. Bucket dump command spool
7. Spring
8. Check valve

3 SPOOL



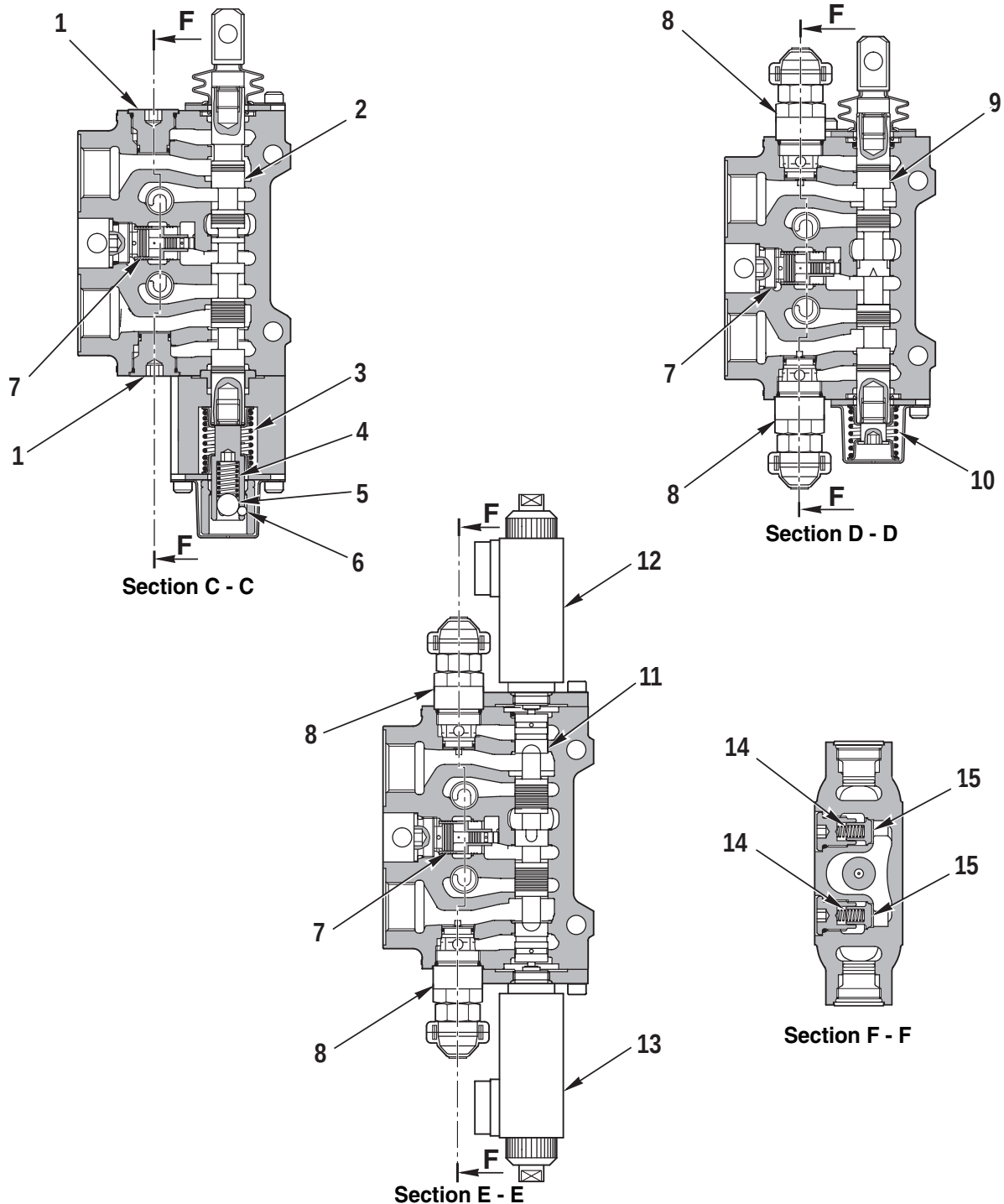
RKZ01072

- a. Port D - To the hydraulic steering unit (Port P)
- b. Port A3 - To the auxiliary equipment (Left side)
- c. Port A2 - To the bucket cylinders (Head side)
- d. Port A1 - To the shovel-raising cylinders (Base side)
- e. Port LS - To the pump (Port X2)
- f. Port T - To the hydraulic oil tank
- g. Port P - From the pump (Port B)
- h. Port B1 - To the shovel-raising cylinders (Head side)
- i. Port B2 - To the bucket cylinders (Base side)
- l. Port B3 - To the auxiliary equipment (Right side)
- m. Port DLS - To the hydraulic steering unit (Port LS)

- 1. Plug
- 2. Plug
- 3. Ball
- 4. Spring
- 5. Priority valve piston rod
- 6. Priority valve spring
- 7. Plug

STRUCTURE AND FUNCTION

SHOVEL CONTROL VALVE



1. Plug
2. Raising command spool
3. Spool return spring
4. Spring
5. Ball
6. Ball
7. Compensator
8. Antishock/anticavitation valve

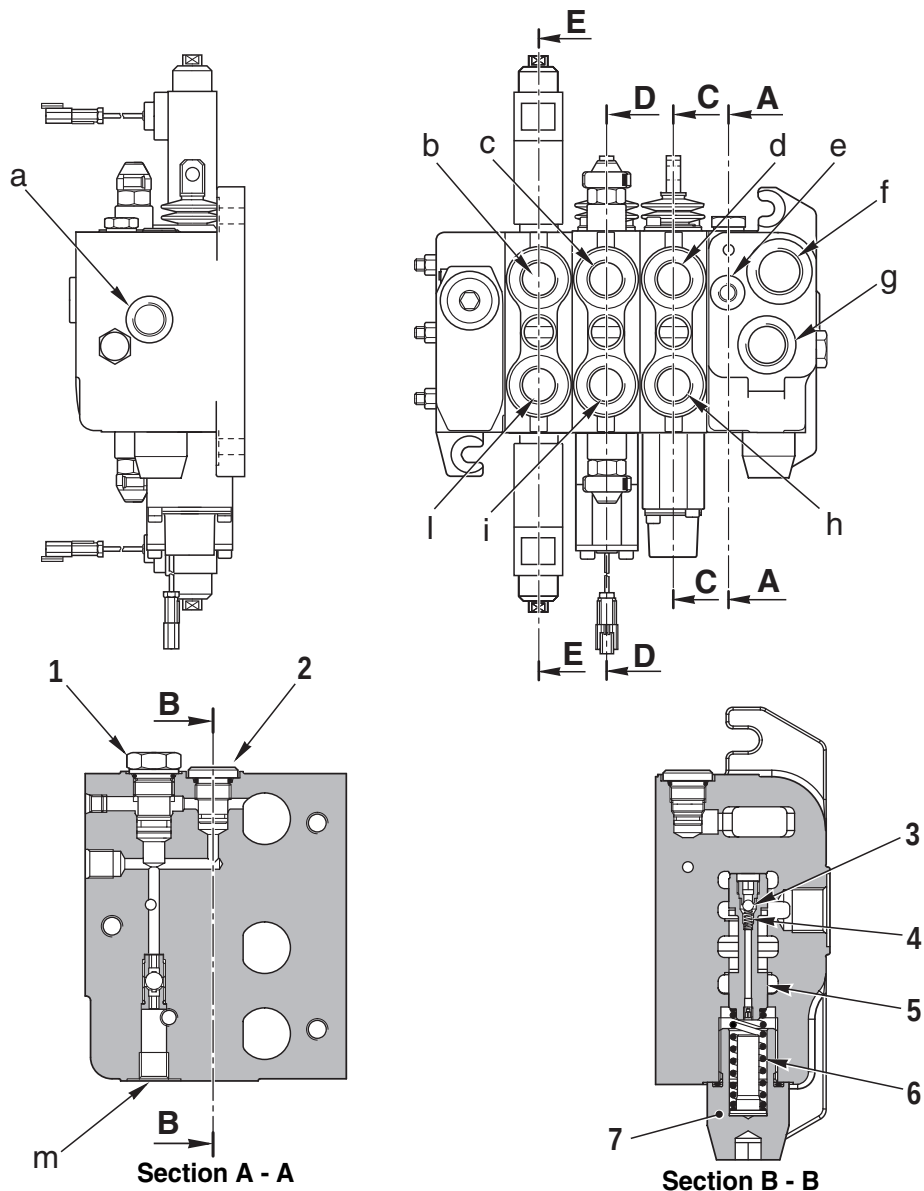
9. Bucket dump command spool
10. Spool return spring
11. Optional equipment command spool
12. EV1 Opened bucket 4 in 1 solenoid valve
13. EV2 Closed bucket 4 in 1 solenoid valve
14. Spring
15. Check valve

RKZ00691

STRUCTURE AND FUNCTION

SHOVEL CONTROL VALVE

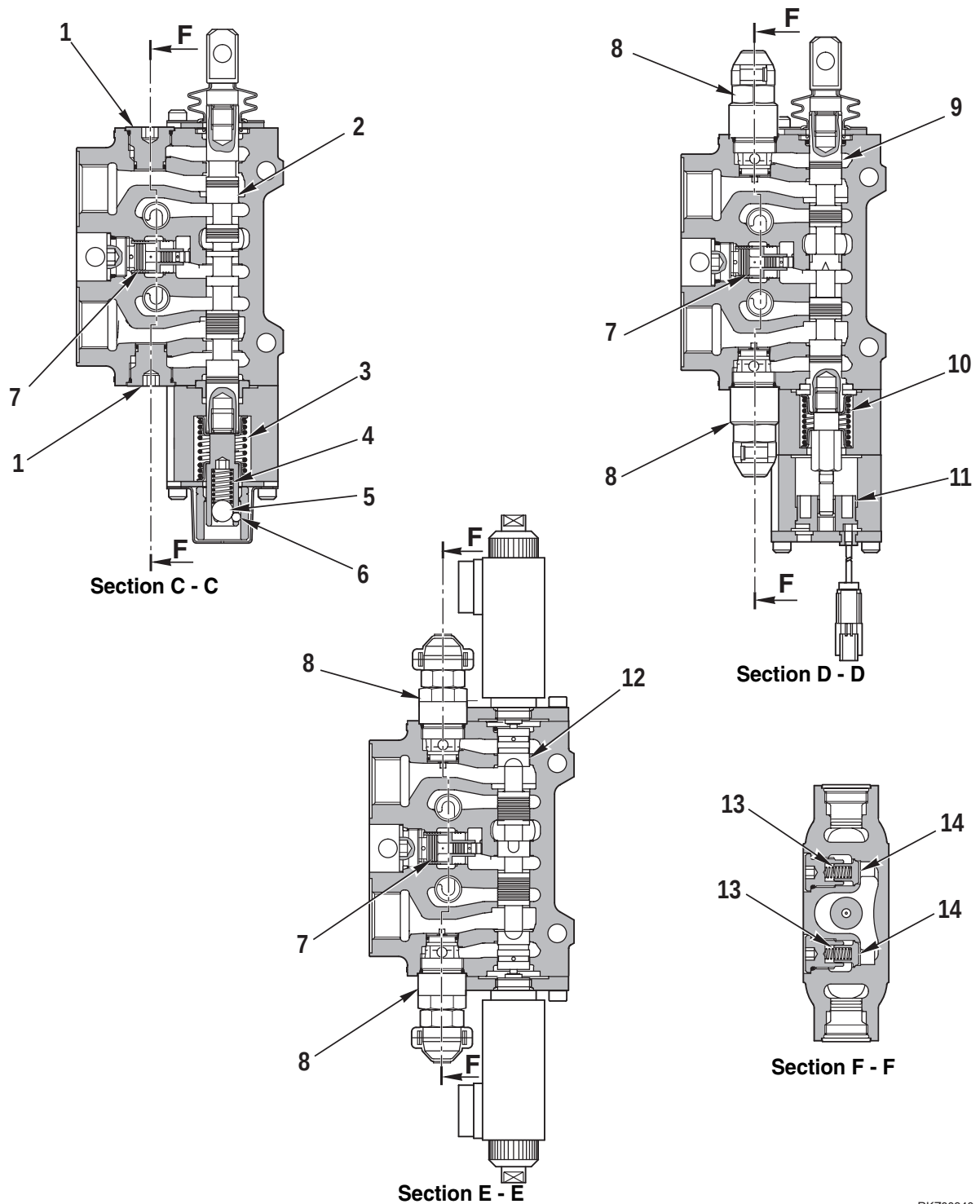
3 SPOOL (WITH RETURN TO DIG)



RKZ01092

- a. Port D - To the hydraulic steering unit (Port P)
- b. Port A3 - To the auxiliary equipment (Left side)
- c. Port A2 - To the bucket cylinders (Head side)
- d. Port A1 - To the shovel-raising cylinders (Base side)
- e. Port LS - To the pump (Port X2)
- f. Port T - To the hydraulic oil tank
- g. Port P - From the pump (Port B)
- h. Port B1 - To the shovel-raising cylinders (Head side)
- i. Port B2 - To the bucket cylinders (Base side)
- l. Port B3 - To the auxiliary equipment (Right side)
- m. Port DLS - To the hydraulic steering unit (Port LS)

- 1. Plug
- 2. Plug
- 3. Ball
- 4. Spring
- 5. Priority valve piston rod
- 6. Priority valve spring
- 7. Plug



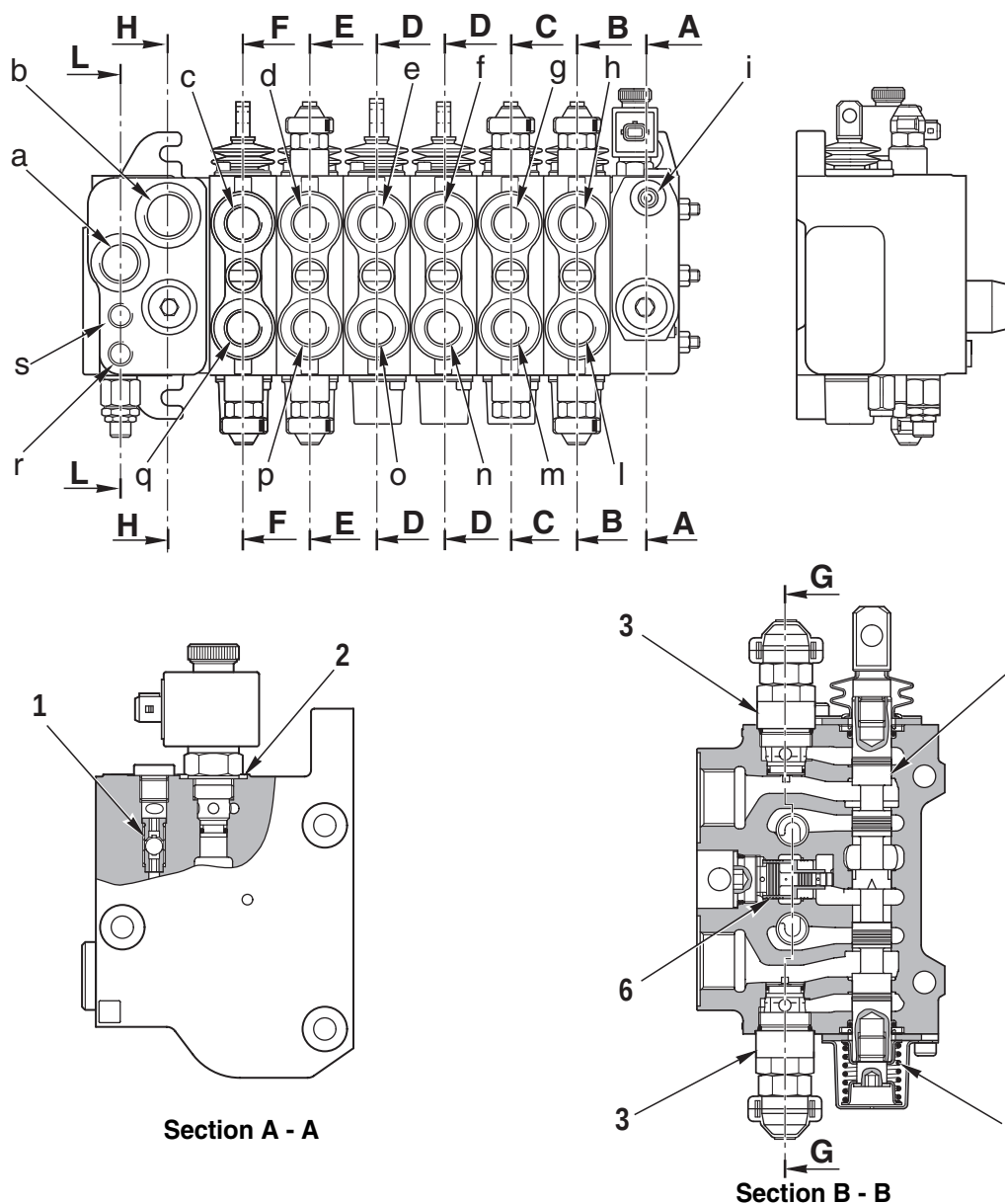
1. Plug
2. Raising command spool
3. Spool return spring
4. Spring
5. Ball
6. Ball
7. Compensator

8. Antishock/anticavitation valve
9. Bucket dump command spool
10. Spool return spring
11. Coil
12. Optional equipment command spool
13. Spring
14. Check valve

RKZ00940

BACKHOE CONTROL VALVE

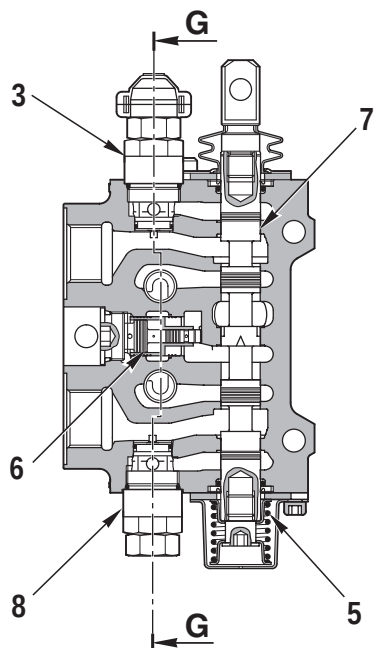
6 SPOOL



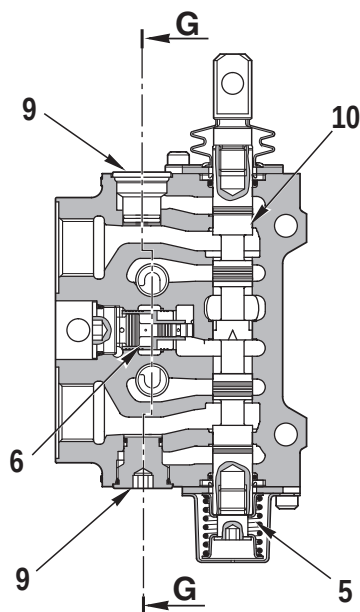
RKZ00230

- a. Port P - From the pump (Port B)
- b. Port T - To the hydraulic oil tank
- c. Port B1 - To the arm cylinder (Base side)
- d. Port B2 - To the arm LH swing cylinder (Base side)
- e. Port B3 - To the RH outrigger cylinder (Base side)
- f. Port B4 - To the LH outrigger cylinder (Base side)
- g. Port B5 - To the bucket cylinder (Base side)
- h. Port B6 - To the boom cylinder (Head side)
- i. Port C - To the backhoe backframe lock cylinders

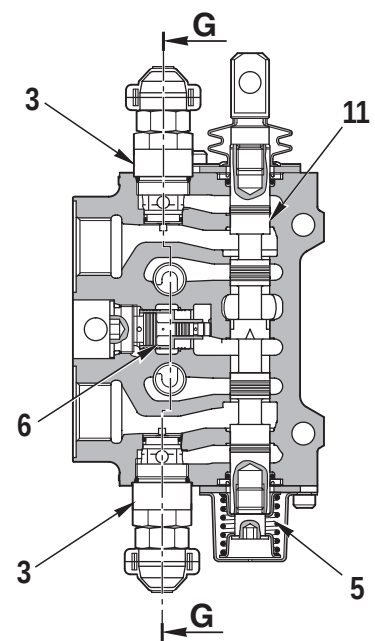
- l. Port A6 - To the boom cylinder (Base side)
- m. Port A5 - To the bucket cylinder (Head side)
- n. Port A4 - To the LH outrigger cylinder (Head side)
- o. Port A3 - To the RH outrigger cylinder (Head side)
- p. Port A2 - To the RH boom swing cylinder (Base side)
- q. Port A1 - To the arm cylinder (Head side)
- r. Port T1 - To the hydraulic oil tank
- s. Port LS - To the pump (Port X2)



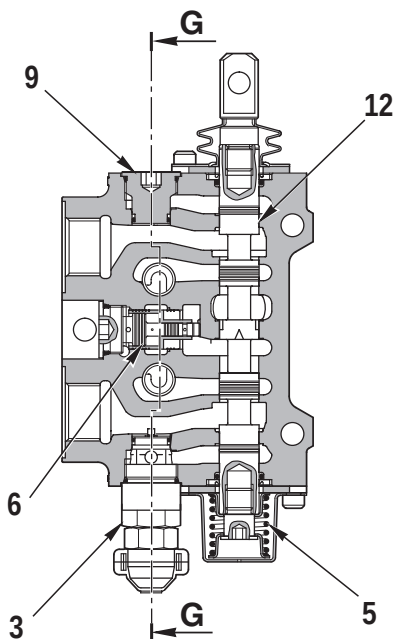
Section C - C



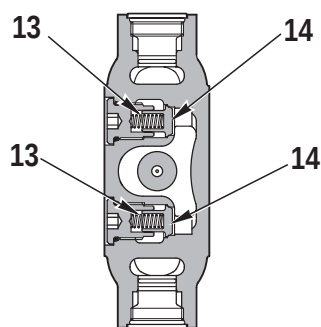
Section D - D



Section E - E



Section F - F



Section G - G

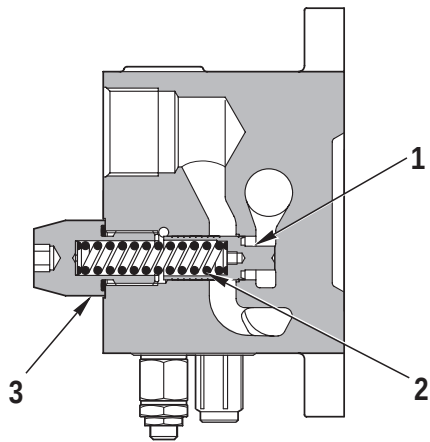
RKZ00760

1. Ball
2. Backhoe backframe lock solenoid valve
3. Antishock/anticavitation valve
4. Boom command spool
5. Spool return spring
6. Compensator
7. Bucket command spool

8. Anticavitation valve
9. Plug
10. Outrigger command spool
11. Boom swing command spool
12. Arm command spool
13. Spring
14. Check valve

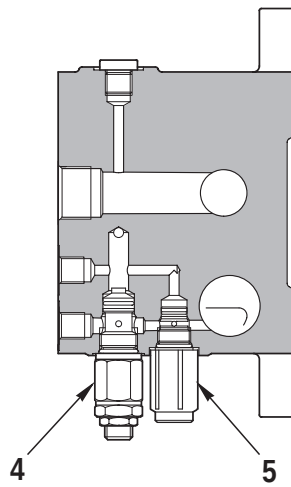
STRUCTURE AND FUNCTION

BACKHOE CONTROL VALVE



Section H - H

- 1. Valve
- 2. Spring
- 3. Plug



Section L - L

- 4. Pressure cut-out valve
- 5. Unloading valve

RKZ00790

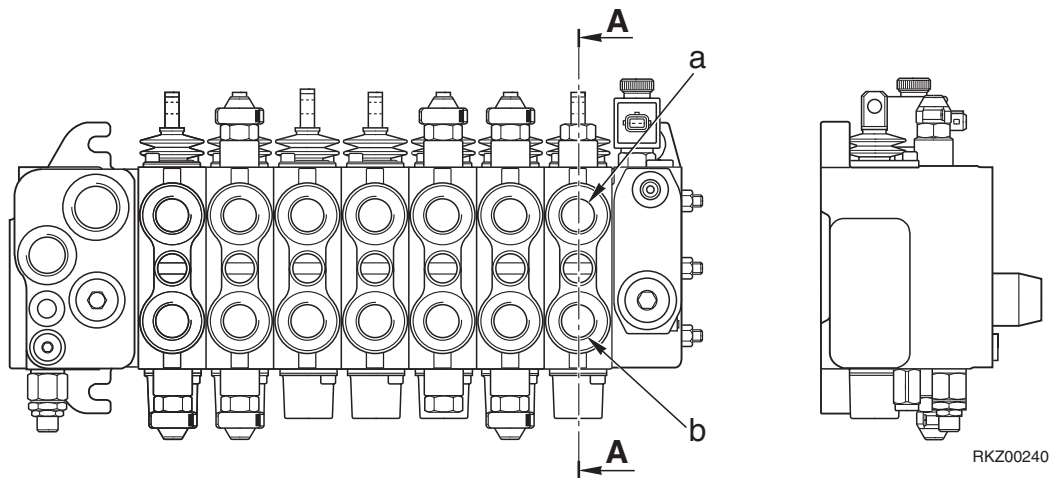
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STRUCTURE AND FUNCTION

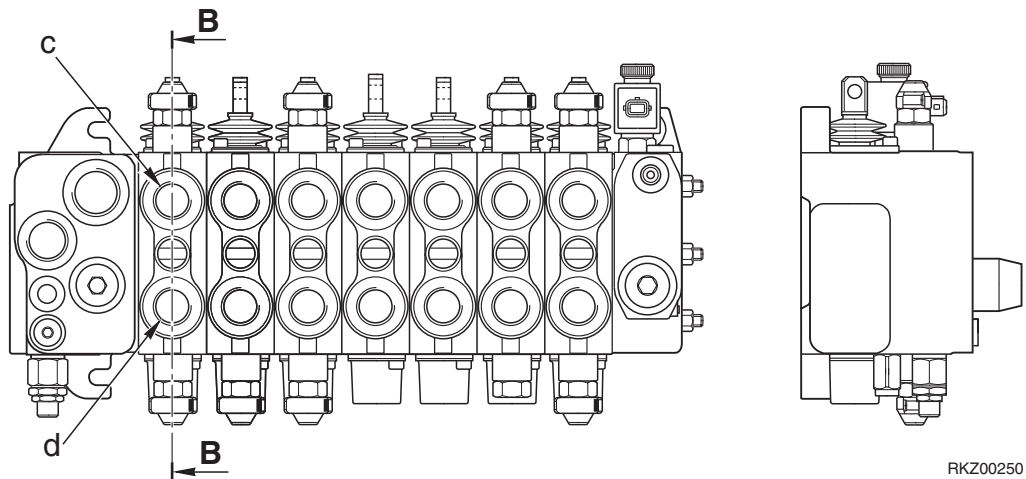
BACKHOE CONTROL VALVE

7 SPOOL

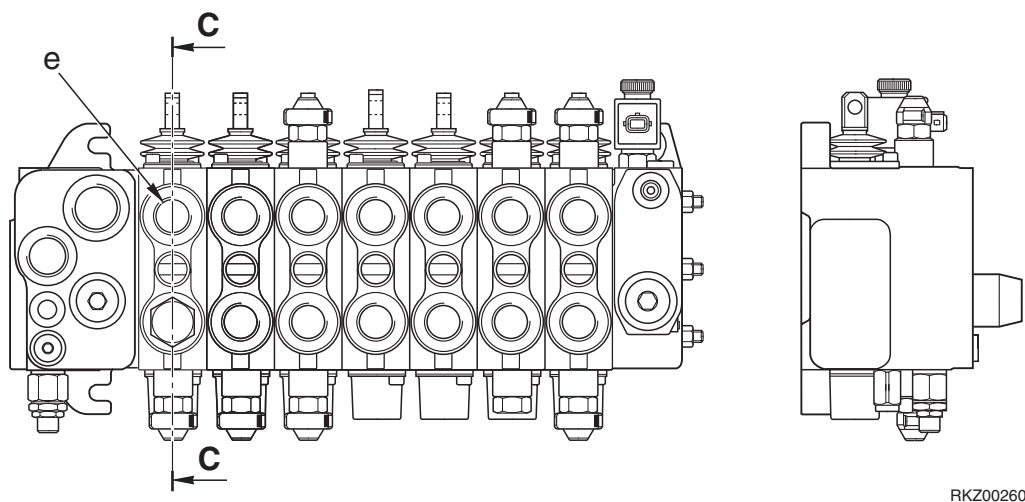
For jig arm



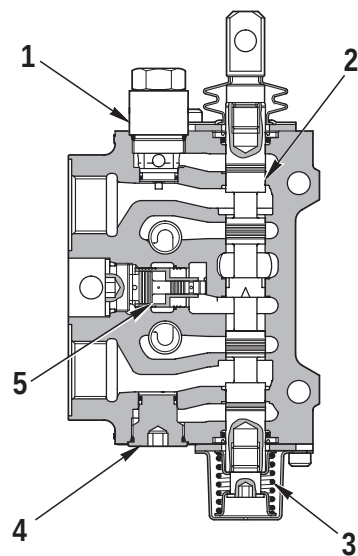
For side digging boom



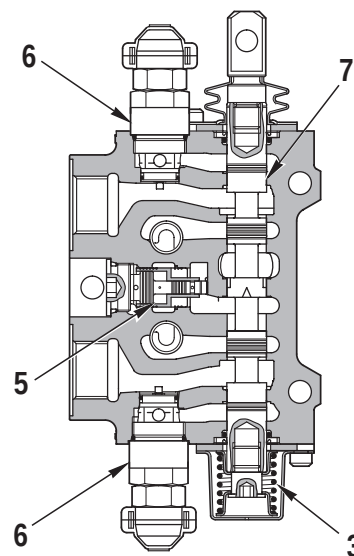
For hammer



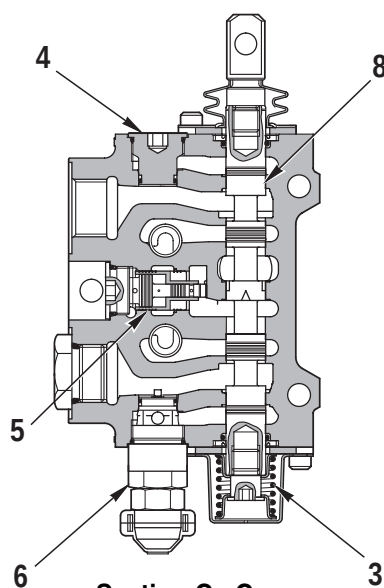
- | | | | |
|------------|---|------------|---|
| a. Port B7 | - To the jig arm cylinder (Base side) | d. Port A7 | - To the side digging boom cylinder (Head side) |
| b. Port A7 | - To the jig arm cylinder (Head side) | e. Port B7 | - To the hydraulic hammer (Left side) |
| c. Port B7 | - To the side digging boom cylinder (Base side) | | |



Section A - A



Section B - B



Section C - C

RKZ00960

- 1. Anticavitation valve
- 2. Jig arm command spool
- 3. Spool return spring
- 4. Plug

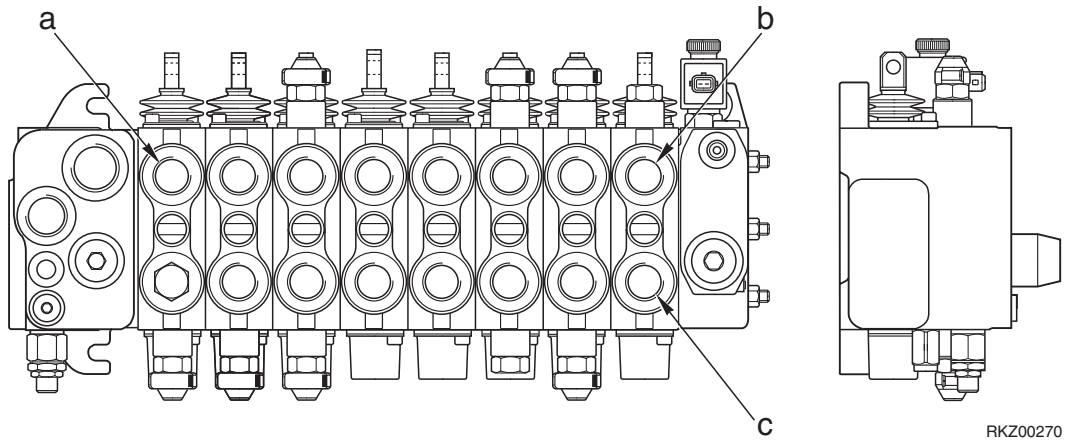
- 5. Compensator
- 6. Anti-shock/anticavitation valve
- 7. Side digging boom command spool
- 8. Hammer command spool

STRUCTURE AND FUNCTION

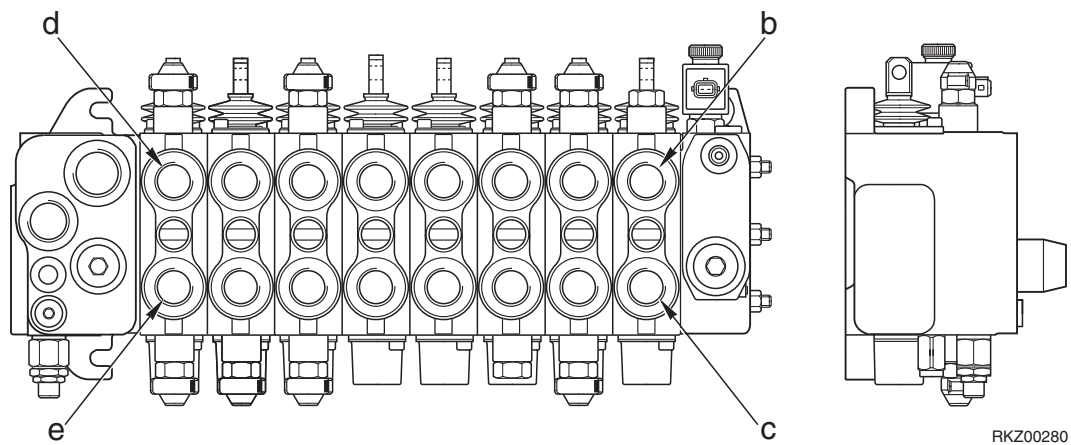
BACKHOE CONTROL VALVE

8 SPOOL

For hammer and jig arm



For side digging boom and jig arm



- a. Port B7 - To the hydraulic hammer (L.H. side)
- b. Port B8 - To the jig arm cylinder (Base side)
- c. Port A8 - To the jig arm cylinder (Head side)
- d. Port B7 - To the side digging boom cylinder (Base side)
- e. Port A7 - To the side digging boom cylinder (Head side)

CLSS (Closed Center Load Sensing System)

1. DESCRIPTION

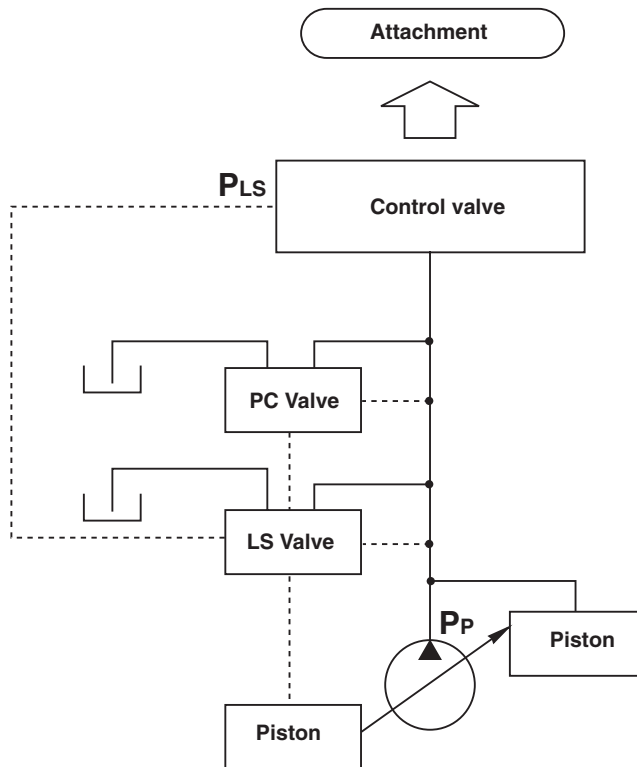
CHARACTERISTICS

The term **CLSS** means Closed Center Load Sensing System, which has the following characteristics:

- High precision control that is independent of the load applied to the movement;
- High precision control of digging action even during delicate manoeuvres;
- Ability to perform complex operations, guaranteed by control of oil flow in function of the aperture surfaces of the shuttles;
- Energy savings guaranteed by control of pump delivery.

STRUCTURE

- The CLSS system includes the variable flow pump, the control valve and the working equipment.
- The pump includes the main pump, the **PC** valve and the **LS** valve.

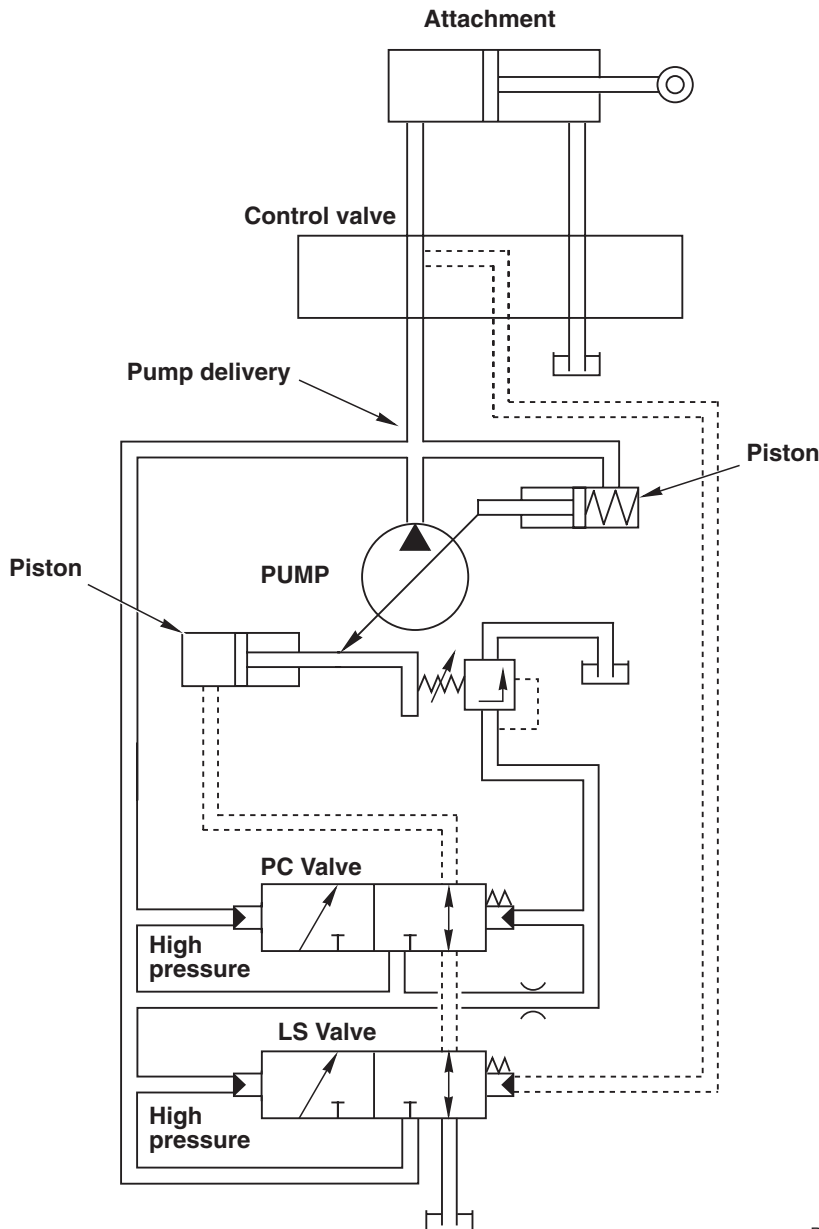


RKZ01711

2. OPERATING PRINCIPLES

1. Control of the angle of the pumping plate.

- The angle of the swash plate (and hence the pump delivery) is controlled in such a way that the differential pressure ΔPLS between the delivery pressure **PP** of the pump and the pressure **PLS** at the outlet of the control valve towards the actuator is maintained at a constant value. ($\Delta PLS = \text{pump delivery pressure } PP - \text{pressure } PLS \text{ of delivery to the actuator}$).
- If the differential pressure ΔPLS becomes lower than the set pressure of the **LS** valve, the angle of the swash plate increases (delivery increasing).
If the differential pressure ΔPLS increases, the angle of the swash plate decreases.
- ★ For details about this movement, see the description of the «HYDRAULIC PUMP».



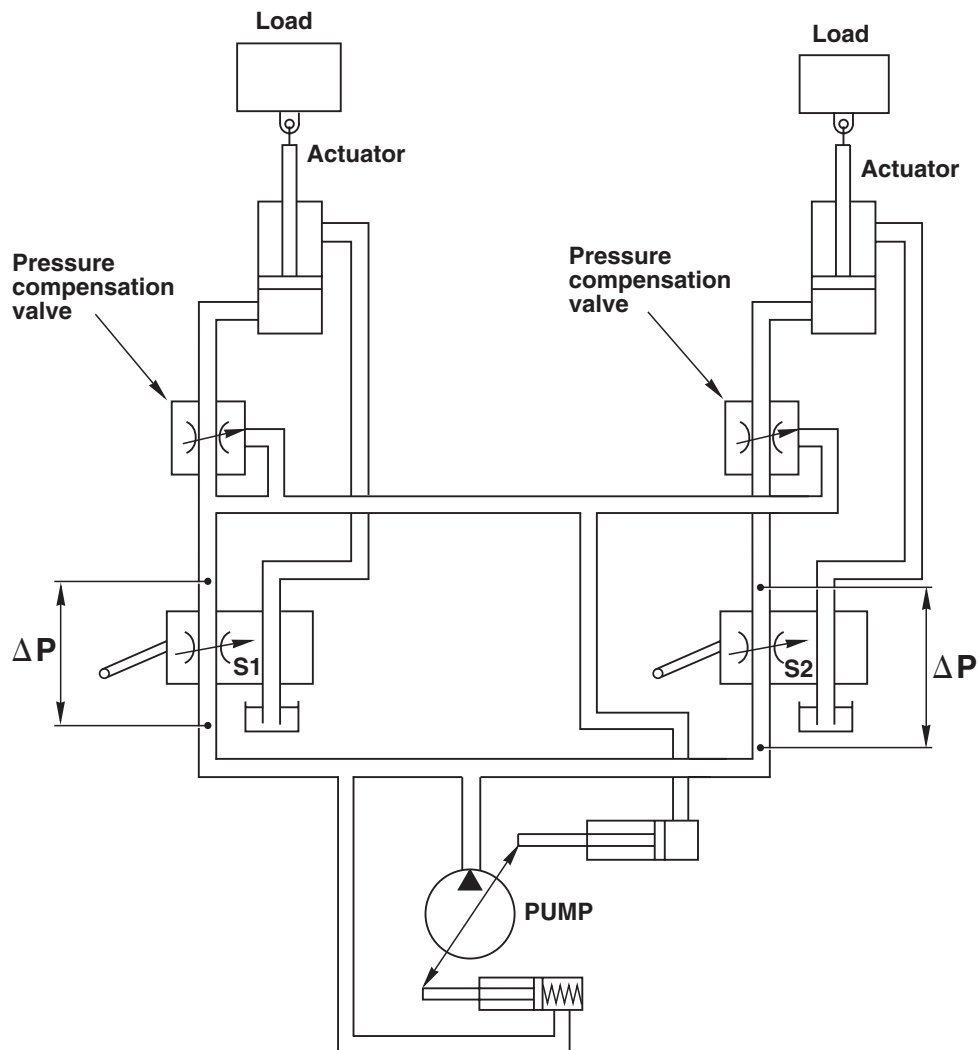
RKZ01721

2. Pressure compensation control

- The pressure compensation valves are installed downstream from the control valve in order to balance the differential pressure between the loads.

When two or more movements (cylinders) are activated simultaneously, the pressure differences ΔP between the delivery at the control valve inlet and outlets of the control valve are compensated by these valves.

We obtain the distribution of the pump flow in proportion to the areas of passage **S1** and **S2** of each valve.

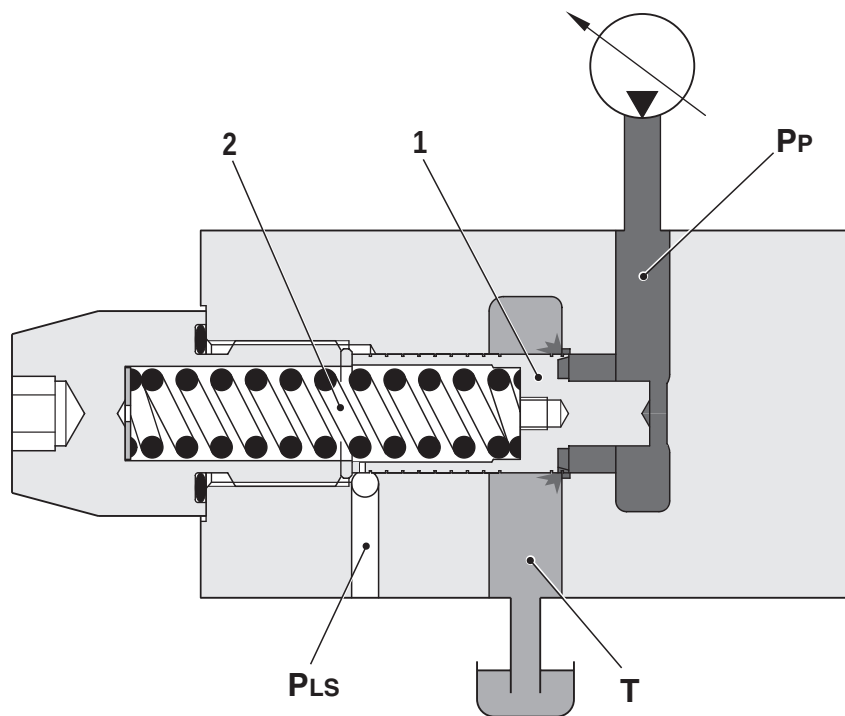


RKZ01731

3. UNLOADING VALVE

FUNCTION

1. When the control valve is in «NEUTRAL» position, the flow **Q** of the pump (due to the swash plate being in the minimum angle position) is sent to the control valve.
In these conditions, the pump delivery pressure **PP** is regulated to 27 bar by the spring (2) inside the valve.
(**PP**=**PLS** + spring load with **PLS**=6 bar)



RKZ01740

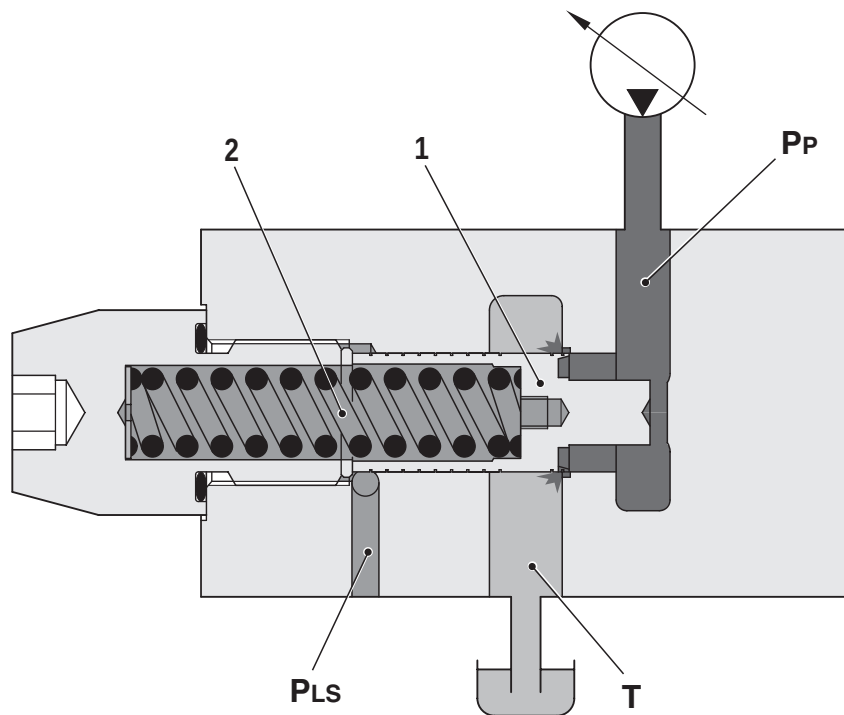
OPERATION

When the control valve is in «NEUTRAL» position

- On the two surfaces of the shuttle (1), the pump pressure **PP** acts on the right-hand side, while the **LS** signal with pressure **PLS** acts on the left-hand side.
- Because a **LS** signal is generated with a pressure **PLS** 6 ± 2 bar, when the control valve is in «NEUTRAL» position, the pump delivery pressure **PP** is regulated by the combination of the pressure provided by the spring and by the **LS** pressure **PLS**.
- While the pump delivery pressure **PP** increases until it compensates for the loading on the spring (2) and for the **LS** pressure 27 bar, the shuttle (1) moves to the left (←) and the **PP** circuit is put into communication with the tank circuit **T**.
- This system ensures that the pump delivery pressure **PP** stays regulated at 27 bar.

2. If, during the precision regulations of the control valve, the request for oil flow to the actuators is equal or less than the delivery values given by the minimum angle of the swash plate, the pump delivery pressure **PP** is regulated by the pressure **PLS**+21 bar.

Because the unloading valve opens when the differential pressure between the pump delivery pressure **PP** and the **PLS** pressure becomes equivalent to the loading of the spring (2) (21 bar), the differential **LS** pressure ΔPLS becomes 21 bar.



RKZ01750

OPERATION

Final control of control valve

- When final control are performed with the control valve, a pressure **PLS** is generated that pressurizing the spring chamber, acts on the left-hand extremity of the valve (1). The actuator pressure is introduced into the **LS** circuit and then into the spring chamber. As a result, the pump pressure **PP** tends to increase.
- When the differential pressure between the pump delivery pressure **PP** and the **LS** pressure **PLS** has the same value as the loading on the spring (2) (21 bar), the shuttle (1) moves to the left (←) and the pump circuit **PP** puts itself into communication with the tank circuit **T**.

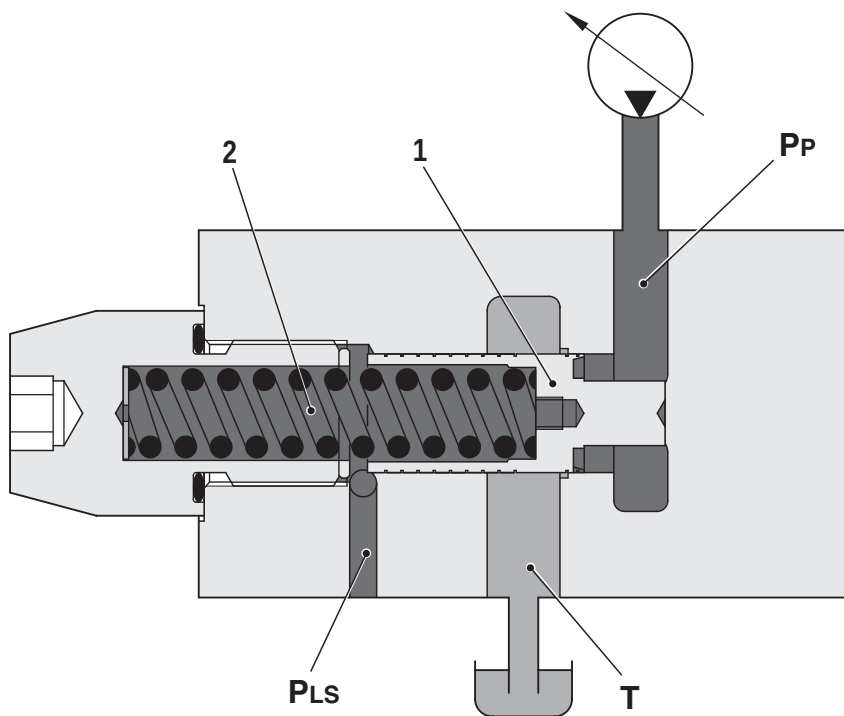
Consequently the exceeding pump delivery **Q**, relative to the actuator request, is sent to the tank circuit.

- The pump delivery pressure **PP** is regulated by the combination of the pressure provided by the spring (21 bar) and by the **LS** pressure **PLS**, i.e. when the pressure differential ΔPLS reaches the value of 21 bar.

STRUCTURE AND FUNCTION

CLSS (Closed Center Load Sensing System)

- When the request for oil flow from the actuators exceeds the minimum delivery of the pump during use of the control valve, the connection to the tank circuit is eliminated and the entire pump delivery **Q** is sent to the actuators.



RKZ01760

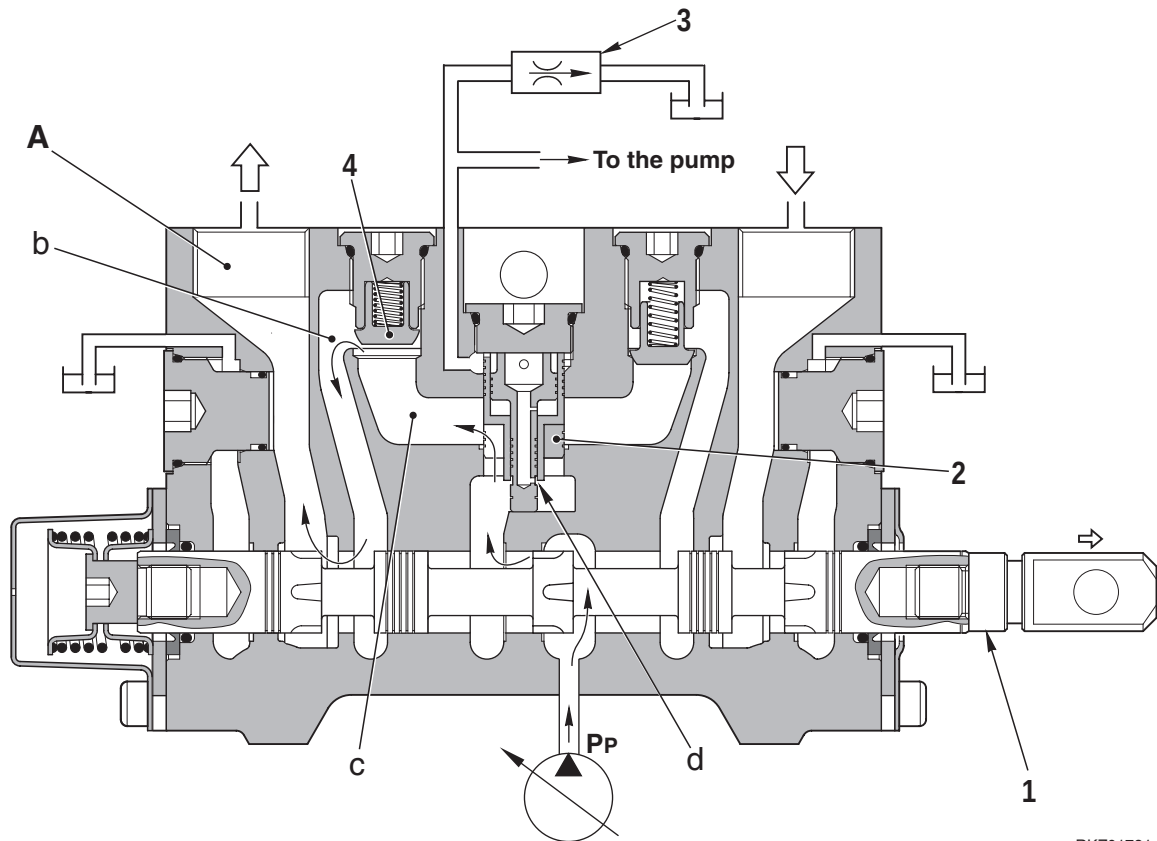
OPERATION

When the control valve is in use

- When the control valve shuttle is operated to execute a bigger stroke, the opening section of spool becomes bigger and consequently the controlled delivery. Because the control valve passage is large, the difference between the **LS** pressure **PLS** and the pump delivery pressure **PP** is reduced up to 18 bar (**LS** pump valve setting).
- Because the differential pressure between the pump delivery pressure **PP** and the **LS** pressure **PLS** is not equal to the pressure given by the spring loading (2) (21 bar), the shuttle (1) is pushed to the right (→) of the spring (2).
- The result is that the connection between the pump delivery circuit **PP** and the tank circuit **T** is excluded and the entire pump delivery **Q** is sent to the actuators.

4. INTRODUCTION OF THE LS PRESSURE

- The **LS** pressure is the pressure generated by external forces acting on the actuators at the outlet of the control valve.



RKZ01781

OPERATION

- When the shuttle (1) is activated, the pump pressure PP starts to flow into the actuator circuit **A** through the duct **b**.
- At the same time the compensator (2) moves upwards (↑) so that the flow controlled by spool (1) can flow towards the actuator **A**.
(Check valve (4) do not allow any flow up to when pressure in chamber **c** is higher than pressure in chamber **b**).
Pressure downstream spool (1) flows in the **PLS** circuit downstream the compensator valve through the orifice **d**.
- The **PLS** circuit of the **LS** is thus in communication with the tank circuit **T** by means of the **LS** decompression valve (3).
(See the description of the **LS** decompression valve).
- The system stabilizes when a pressure difference of 18 bar is generated across the shuttle (1) between pump pressure **PP** and **PLS** pressure.

5. DELIVERY COMPENSATION

INTRODUCTION

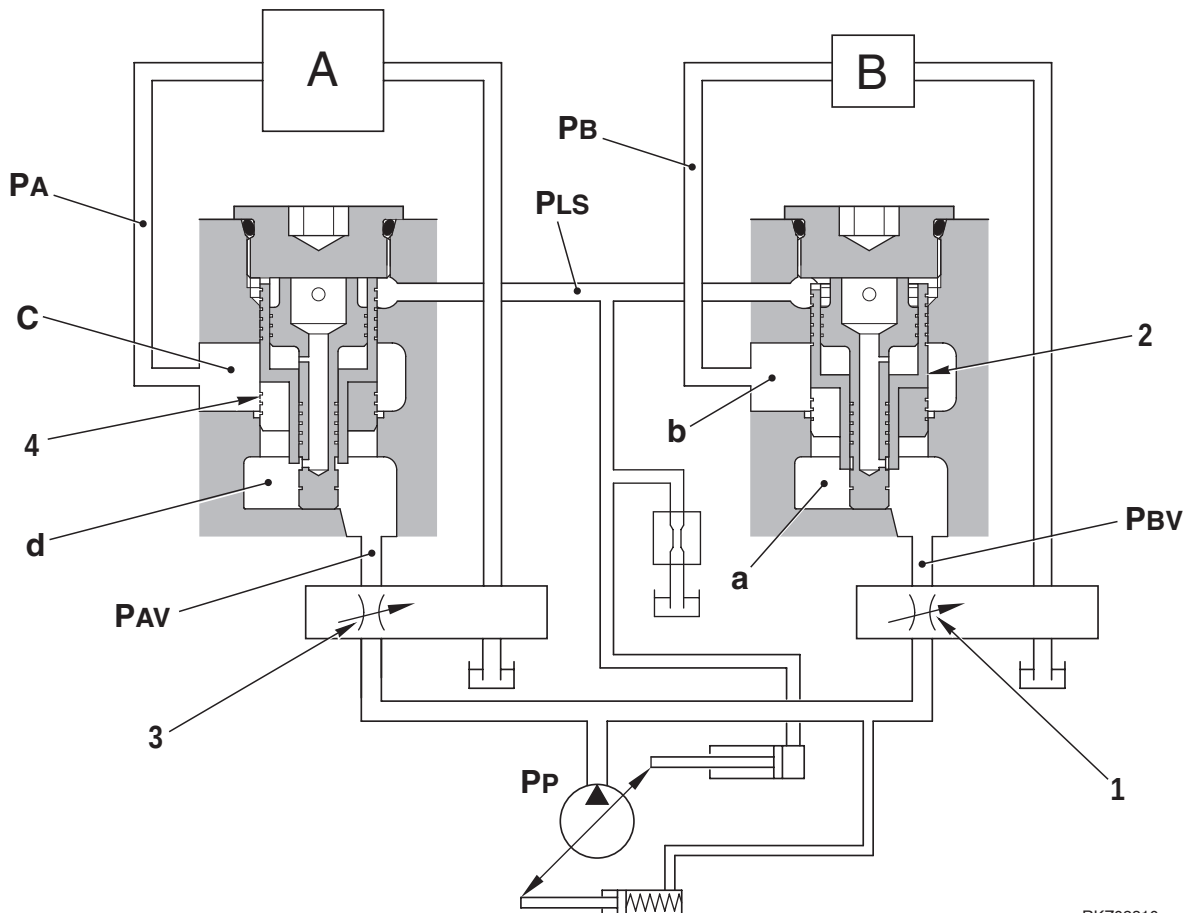
The flow sent to each actuator is controlled by the opening area of each spool.

While performing complex control, in traditional control valves the difference between actuators pressure might cause sudden and unexpected movements acceleration in those actuators operat at lower pressure.

The adoption of the pressure compensation valve allow to control those situation guaranting the proportionality between each actuator.

FUNCTION

Compensation of actuator deliveries occurs when, during the simultaneous activation of two or more movements, the pressure of one actuator drops lower than that of the other, and pump delivery, if not controlled, tends to be supplied the actuator operating at lower. (In the diagram the actuator on the left is requesting higher pressure).



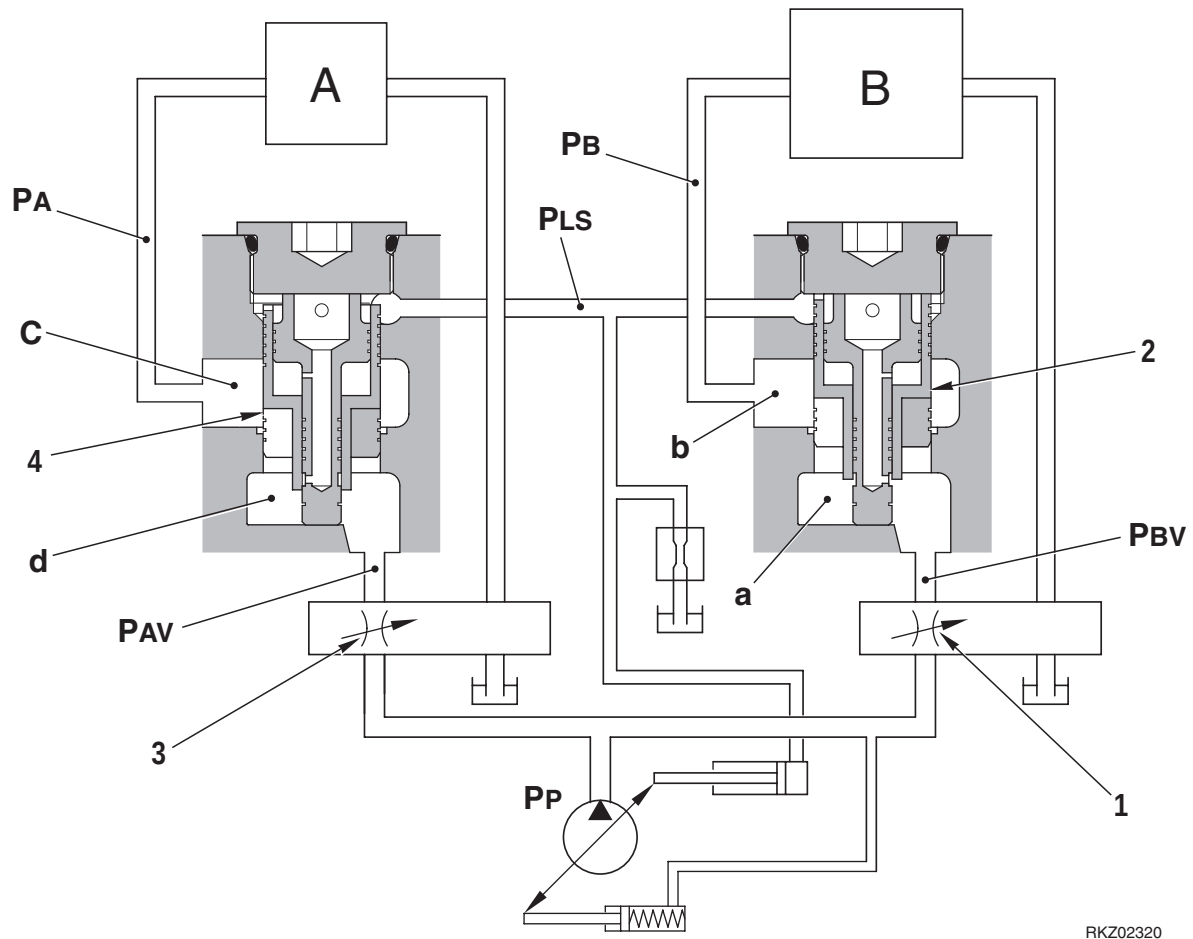
RKZ02310

OPERATION

1. When activating an actuator at a pressure lower than the one already working. (While operating actuator A starts operating actuator B)

- Until the pressure **PBV** downstream from the shuttle (1) reaches the same value requested by actuator **B**, no oil passes.
 - When the pressure requested by actuator **B** is exceeded, movement can commence. This creates a flow that adding to the one controlled by spool (3) reduces the pressure upstream of spool (1) and (3) and therefore the ΔP between **PLS** and **PP**.
 - The pump compares the delivery pressures **PP** and **PLS** and senses that the difference $\Delta P < 18$ bar. This variation in ΔP causes an increase in oil flow increasing the swash plate angle.
 - Until the pump does not realize a ΔP of 18 bar, i.e. until the increase in oil flow compensates the requirements of the two actuators, the pump will continue to increase delivery.
 - ΔP of 18 bar will stabilize as soon as it is restored to.
 - The compensator (2) is moved upwards by the oil flow and stops when the aperture between the chambers **a** and **b** reduces the passage sufficiently to reduce the pressure in chamber **b** to be sent to the actuator.
- (For the detail see «Hydraulic pump»).

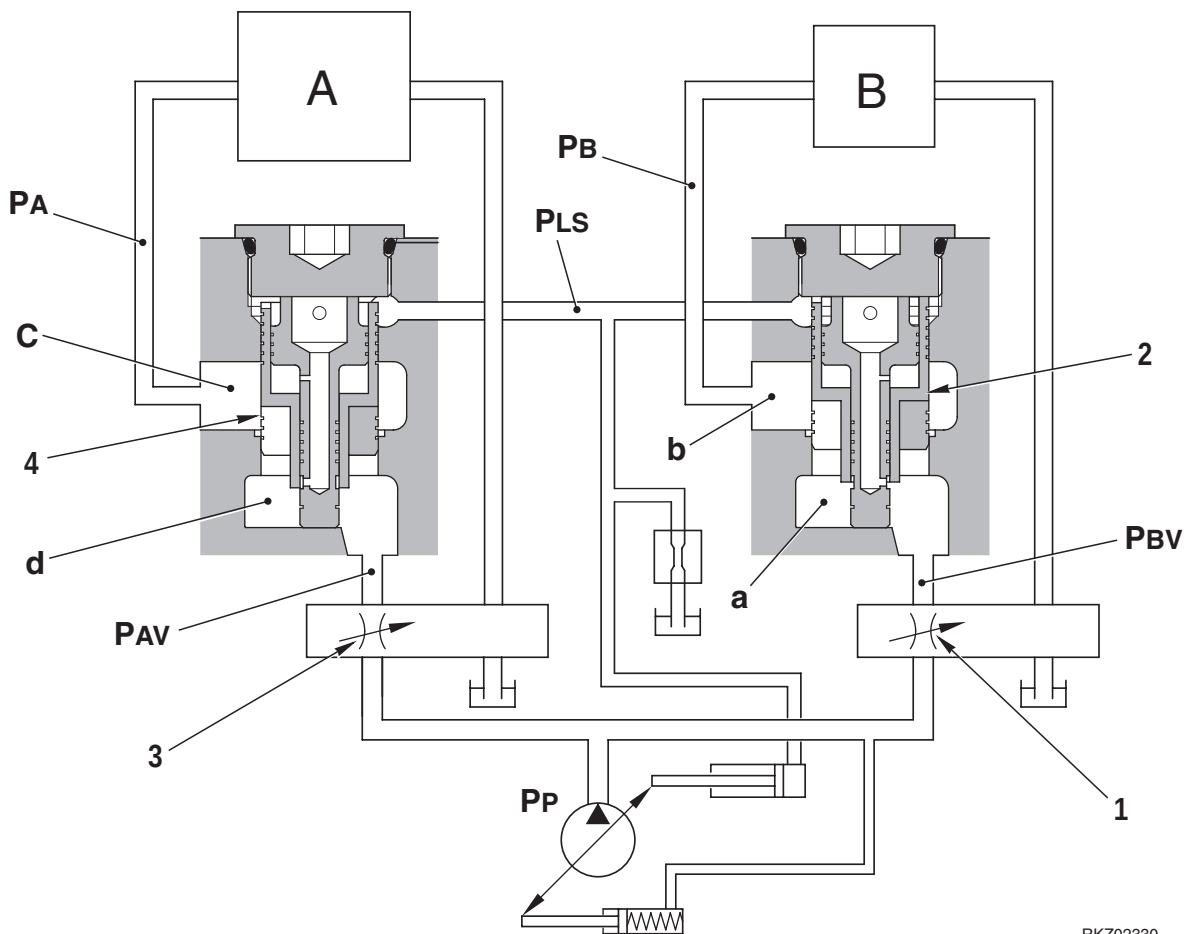
2. When a low pressure actuator needs to work at a higher pressure than the other



RKZ02320

- If the actuator **B** needs to work at a higher pressure ($P_B > P_A$), the pressure **PB** will start to increase.
- Since pressure **PB** is increasing, the compensator (2) moves upwards to restore the ΔP between the chambers **a** and **b**, and therefore the ΔP does not vary upstream or downstream from the shuttle (1).
- When pressure **PB** exceeds pressure **PA**, the compensator (2) is fully open and the pressure **PB** is introduced into the **LS** circuit.
- The increase in pressure in the **LS** circuit obliges the pump to increase delivery until the ΔP is restored to 18 bar.
- Simultaneously the increase in pressure upstream from the shuttle (3) generates an increase in ΔP upstream and downstream from the shuttle. ($PAV < PLS < PP$)
- Because the pressure **PLS** which is equal to the pressure **PB** acts on the upper side of the compensator (4), and since the pressure **PAV** is lower, the compensator (4) is pushed downwards.
- The compensator stops when the aperture between the chambers **c** and **d** generates a reduction of the passage sufficient to reduce the pressure to be sent to the actuator, and to increase the pressure **PAV** until the ΔP is restored to the 18 bar necessary for equilibrium.

3. When an increase in delivery is required by an actuator

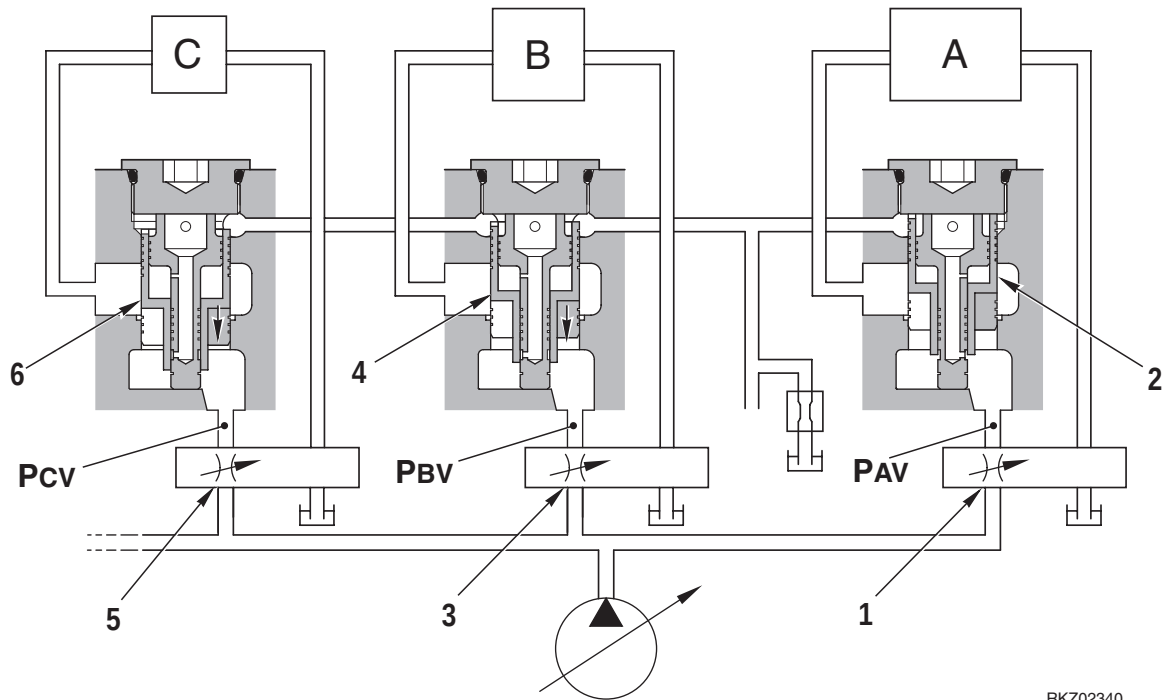


RKZ02330

- When an increased delivery is required by actuator **A**, i.e. when the shuttle (3) is asked to execute a bigger movement, the section of the aperture increases.
- The increase in aperture provokes a drop in ΔP between the two sides of the shuttles (2) and (3), because the flow, which has remained unchanged until now, is divided between both the actuators.
- At the same time the pump senses the variation in ΔP and increases the oil flow until the ΔP is restored to ΔP of 18 bar between the two sides of the shuttle (1) and the compensator (4) changes position in order to restore the ΔP upstream and downstream from the shuttle (3).

6. "LIFD" CONTROL SYSTEM FUNCTION

- The Load Independence Flow Divider (LIFD) intervenes automatically when the oil-flow requested by the actuators exceeds the maximum delivery guaranteed by the pump. In this case, the oil-flow is divided between the various actuators in proportion to their requirements.



RKZ02340

OPERATION

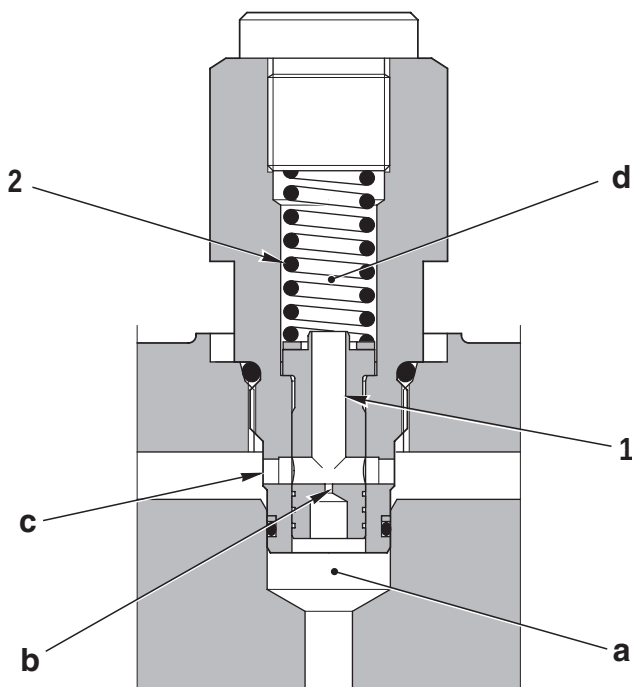
- When, during the simultaneous operation of more than one actuator, one of them needs a higher pressure and the characteristics of the pump are exceeded, the pump guarantees a delivery limited by its calibration curve.
- At this point less oil than requested is distributed to all the actuators.
- Because the sections of the apertures remain unchanged, the pressure upstream and downstream from the shuttles drops. Since the position of the compensator (4) is determined by the pressure of the **LS** signal, by the pressure **PBV** downstream from the shuttle (3) and by the flow of oil needed for the movement, the compensator is pushed downwards by the higher pressure in the upper chamber until the pressure **PBV** downstream from the shuttle becomes equal to the pressure **PAV** downstream from the shuttle (1). This equalizes the pressure ΔP of the shuttle (1).
- Thus the flow of each actuator is reduced by a percentage equal to the reduction or absence of pump delivery.
- In other words, when the request for performance is excessive, the system can nevertheless guarantee proportionality and graduality for the movements in any load conditions.
- If an increase in delivery is requested, rather than an increase in pressure, and the characteristics of the pump are exceeded, the system will function in the same way as described for the above case.

7. LS DECOMPRESSION VALVE

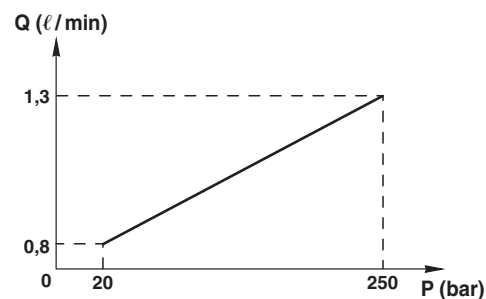
DESCRIPTION

The **LS** decompression valve is a throttle that continuously releases a small quantity of oil from the **LS** circuit and that, when the shuttles are brought back to a neutral position, releases the residual **LS** pressure.

This continued flow renders the **PLS** pressure increment more gentle and gradual, and increases stability and control during the phases of reducing the **LS** pressure..



RKZ02350



RKZ02360

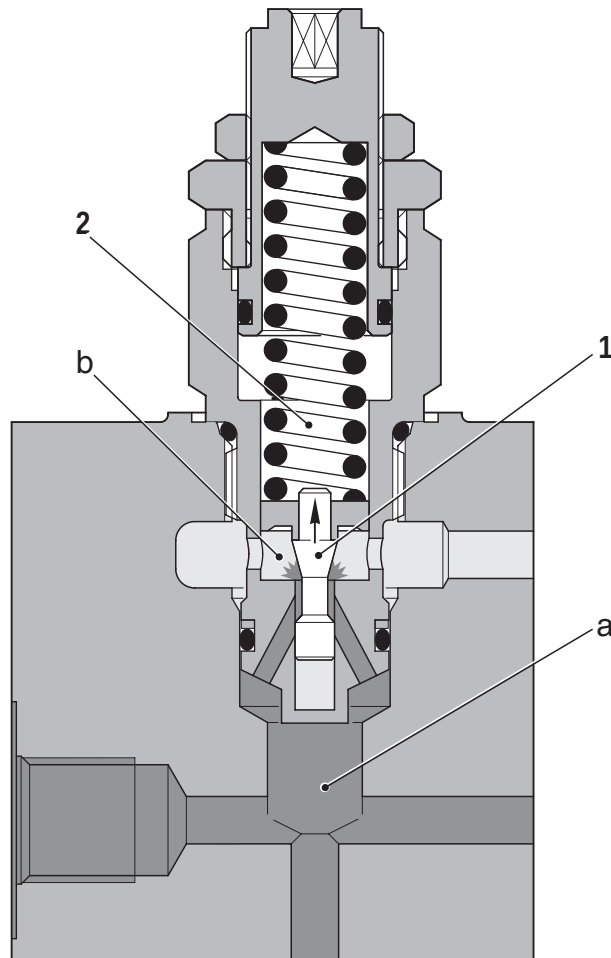
OPERATION

- When the **LS** pressure reaches chamber a of the valve, it generates a force that opposes the force of the spring (2).
- Until the force generated by the **LS** pressure exceeds the force of the spring (2) (**LS** pressure low) the shuttle (1) remains «at rest» and oil flows through the calibrated orifice b in the tank circuit.
- When the force generated by the **LS** pressure exceeds the force of the spring (2), the shuttle is pushed upwards (↑) and the passages c are closed. Oil continues to flow into the chamber d until the force generated by the pressure contained in chamber d, together with the force of the spring (2), exceeds the force generated by the **LS** pressure.
- The shuttle is pushed downwards (↓) and passage c is opened.
- The system is in equilibrium (i.e. the shuttle is at rest), when the quantity of oil allowed to flow into the tank circuit is equivalent to the quantity that generates a pressure difference ΔP such that $(PLS \times S) = [(PLS1 \times S) + F]$ where:
PLS=**LS** pressure
PLS1=**LS** pressure contained in chamber d
S=section of the shuttle
F=force of the spring

8. PRESSURE CUT-OFF VALVE

DESCRIPTION

The function of the pressure cut-off valve is to regulate the maximum pressure of the Load Sensing signal and hence also the pressure of the pump.



RKZ01770

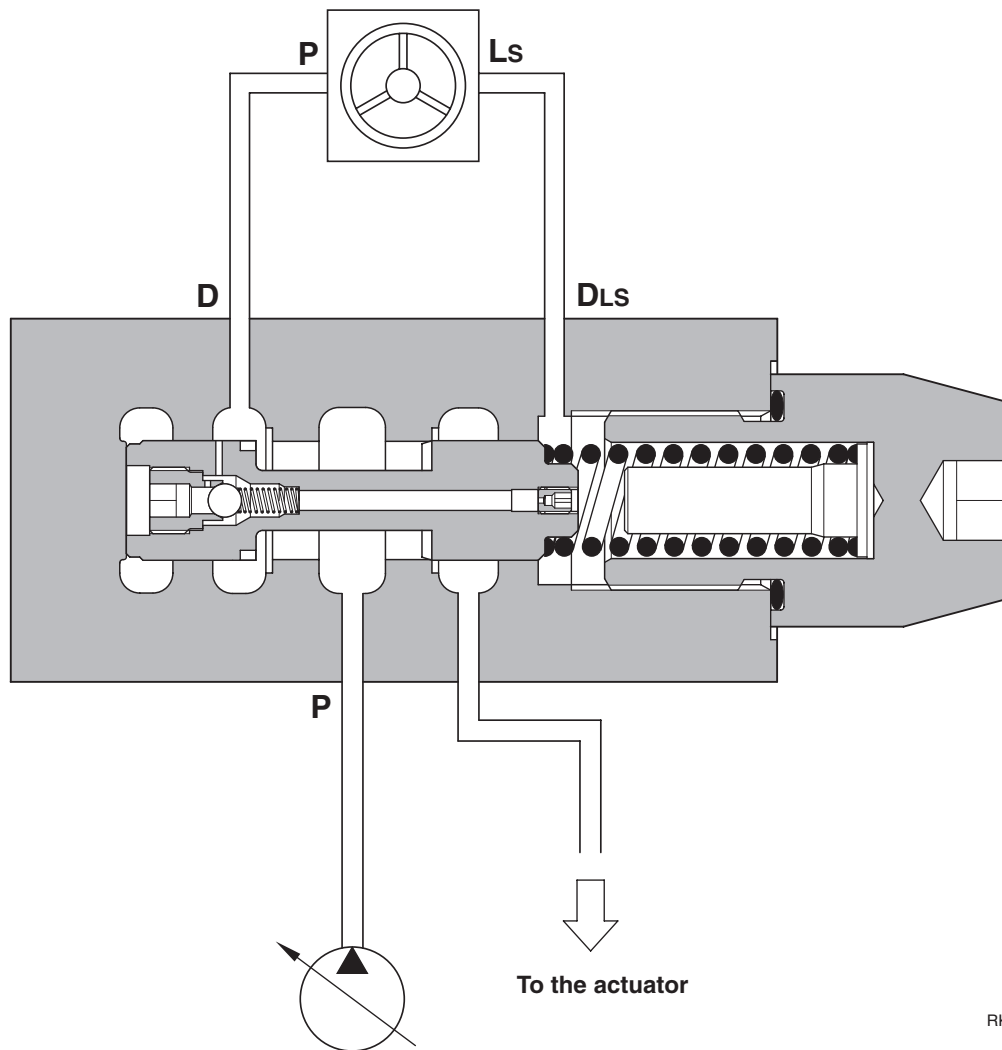
OPERATION

- The pressurized oil of the **LS** reaches the chamber **a** of the valve.
- When the force generated by the **LS** pressure on the valve (1) exceeds the force of the spring (2), the valve (1) is pushed upwards (↑) opening the passage between the chamber **a** and the tank circuit.

9. PRIORITY VALVE (ONLY FOR THE 2-3 SPOOL CONTROL VALVE)

FUNCTION

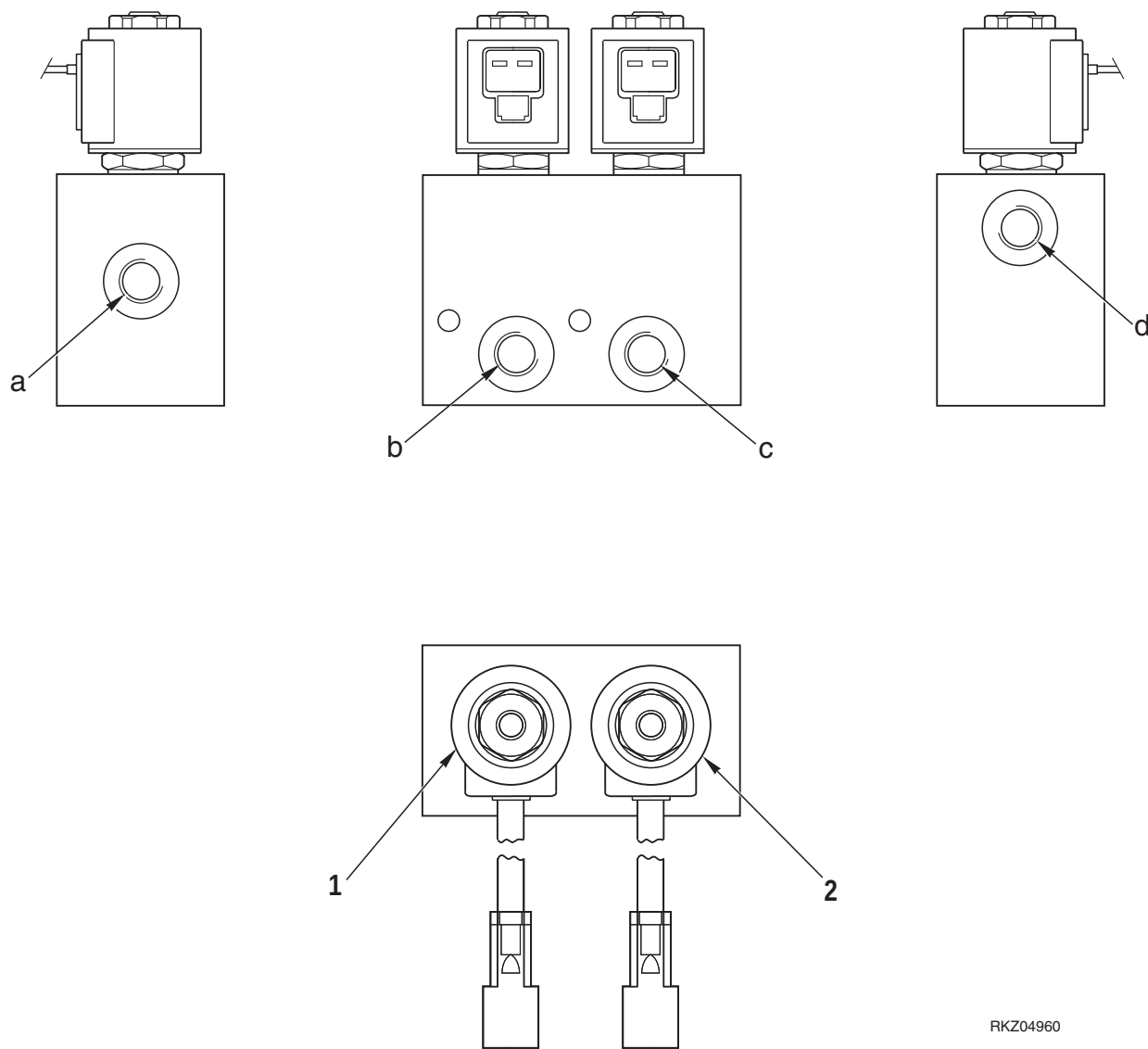
The function of the priority valve is to distribute oil to the steering unit and to the other hydraulic components. Distribution is determined by the position of the valve of the priority valve in function of the **LS** signal, oil delivery from the pump, the pressure of the steering unit and the pressure of the hydraulic circuit. The position of the valve is such as to guarantee that delivery to the steering unit will always correspond to the actual need.



RKZ02371

SOLENOID VALVE

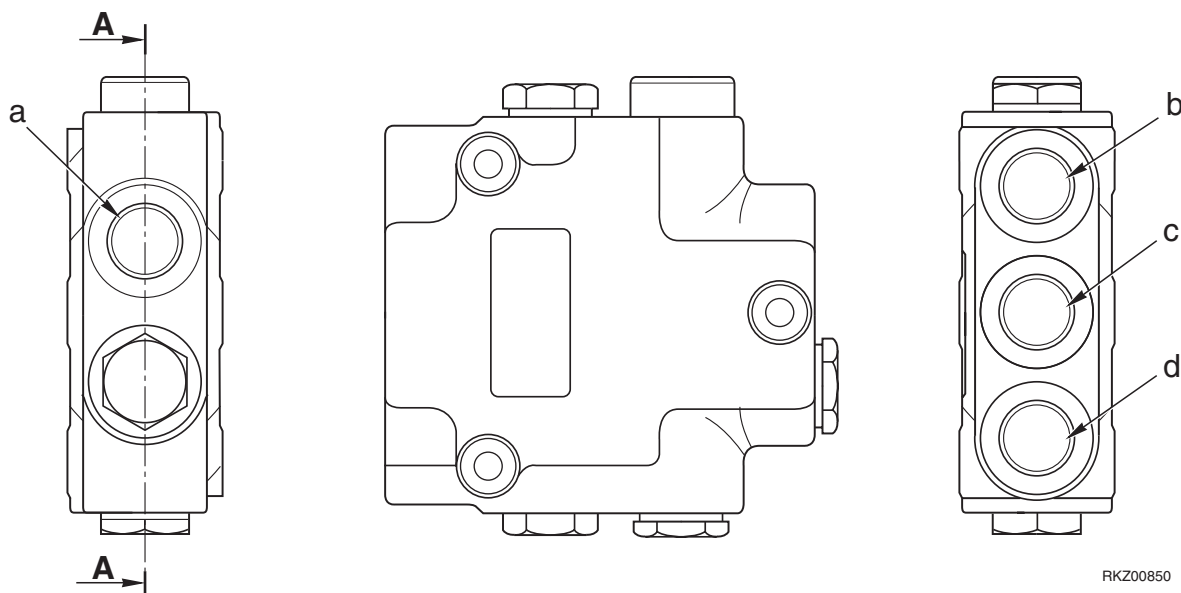
Solenoid valve block ST1 - Differential locking - Backhoe boom locking



RKZ04960

1. EV4 - Backhoe boom locking
2. EV3 - Differential locking
- a. Port T - To the transmission
- b. Port 1 - Boom-locking cylinder
- c. Port 2 - To the rear axle
- d. Port P - From the transmission

SAFETY VALVE



Shovel raise

- a. Port Y - to the raising cylinders (Head side)
- b. Port A - From the shovel control valve (Port A1)
- c. Port X - To the raising cylinders (Base side)
- d. Port B - From the shovel control valve (Port B1)

Bucket Dump

- a. Port Y - To the dump cylinders (Head side)
- b. Port A - From the shovel control valve (Port B2)
- c. Port X - To the dump cylinders (Base side)
- d. Port B - From the shovel control valve (Port A2)

Boom

- a. Port Y - To the boom cylinder (Head side)
- b. Port A - From the backhoe control valve (Port A6)
- c. Port X - To the boom cylinder (Base side)
- d. Port B - From the backhoe control valve (Port B6)

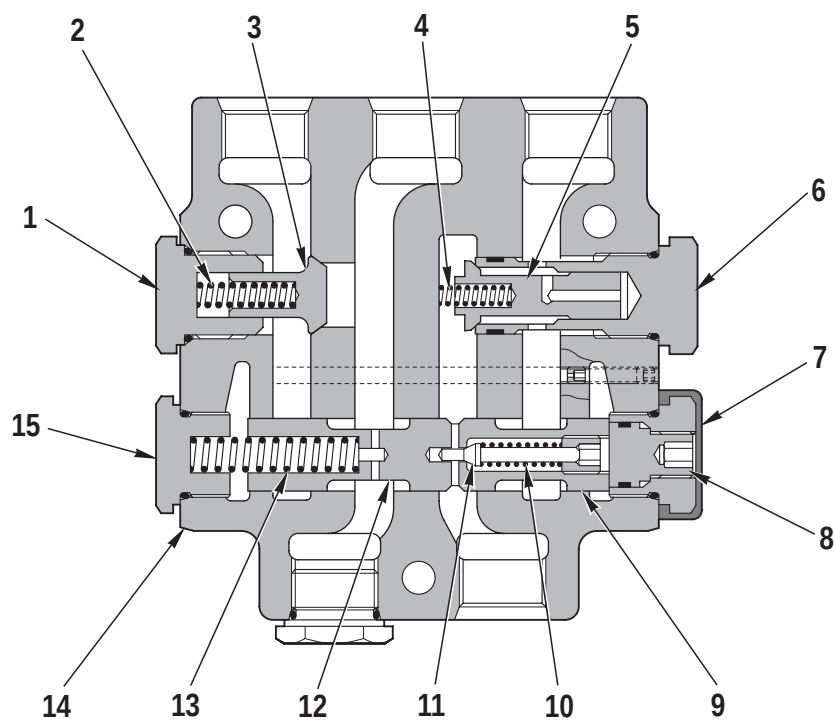
Arm

- a. Port Y - To the arm cylinder (Head side)
- b. Port A - From the backhoe control valve (Port B1)
- c. Port X - To the arm cylinder (Base side)
- d. Port B - From the backhoe control valve (Port A1)

CHARACTERISTICS

Safety valve calibration
 Shovel dump: 230 bar
 Boom: 350 bar
 Arm: 230 bar

★ The drawing shows boom safety valve

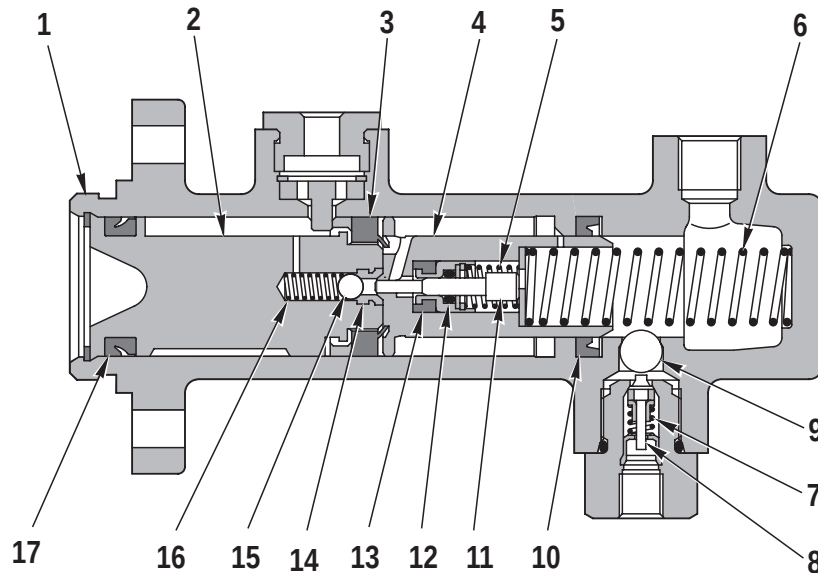


Section A - A

RKZ01050

- | | |
|-----------------------------|-------------------------|
| 1. Plug | 10. Safety valve spring |
| 2. Check valve spring | 11. Safety valve |
| 3. Check valve | 12. Spool |
| 4. Check valve spring | 13. Spring |
| 5. Check valve | 14. Housing |
| 6. Plug | 15. Plug |
| 7. Protection | |
| 8. Over-ride screw (Safety) | |
| 9. Spool | |

BRAKE PUMP



RKZ00932

1. Pump body
2. Main piston
3. Seal
4. Differential piston
5. Spring
6. Pump spring
7. Spring
8. Check valve
9. Ball
10. Seal
11. Pin
12. Seal
13. Seal
14. Seal
15. Ball
16. Spring
17. Seal

CHARACTERISTICS:

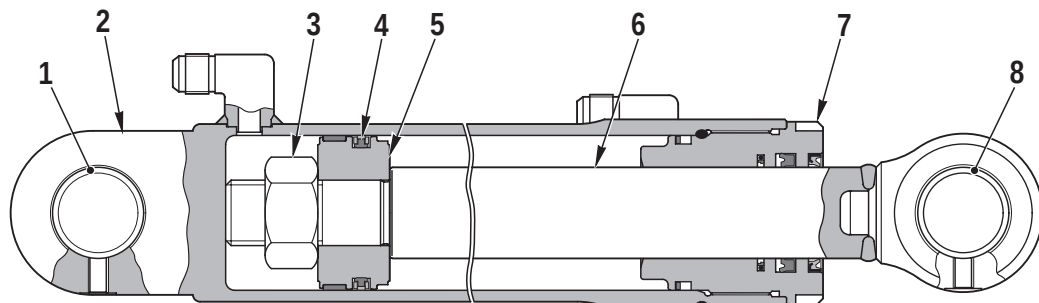
Stroke: 36 mm

Displacement: 15 – 28 cc

Max. pressure: 150 bar

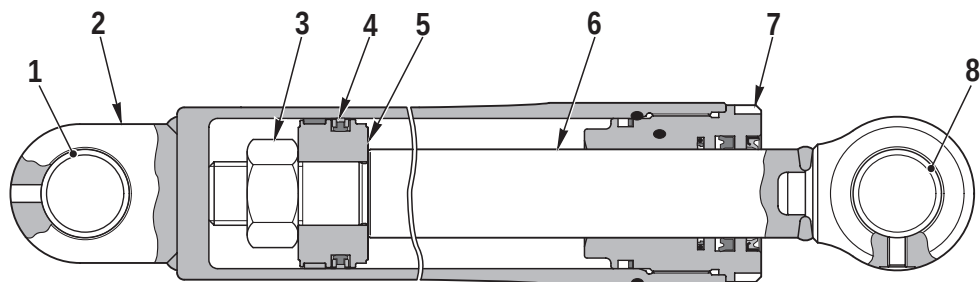
SHOVEL CYLINDERS

RAISING CYLINDER



RKZ00310

DUMPING CYLINDER



RKZ00300

1. Bushing, base side
2. Cylinder
3. Nut

4. Piston seal
5. Piston
6. Piston rod

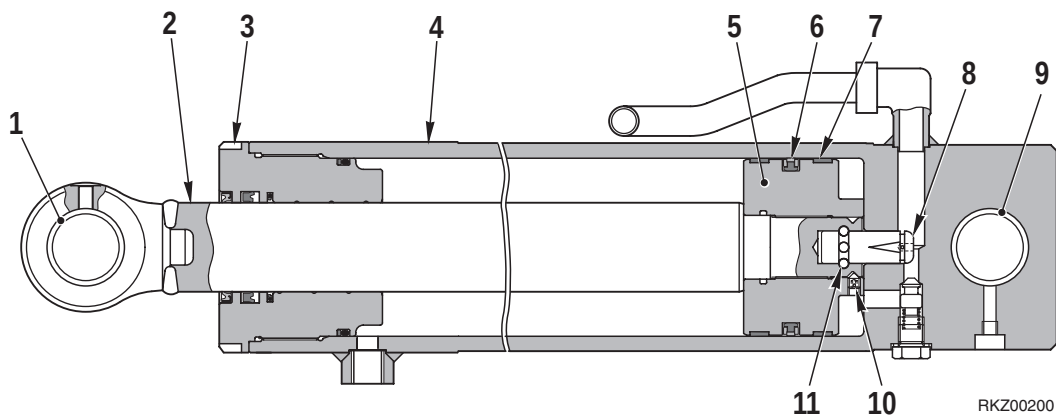
7. Cylinder
8. Bushing, head side

CHARACTERISTICS

Cylinder	Raising	Dumping
Piston rod diameter	50	50
Internal cylinder diameter	85	85
Piston stroke	730	755
Max. cylinder length	1880	2145
Min. cylinder length	1150	1390
Key size for piston safety nut	55	55

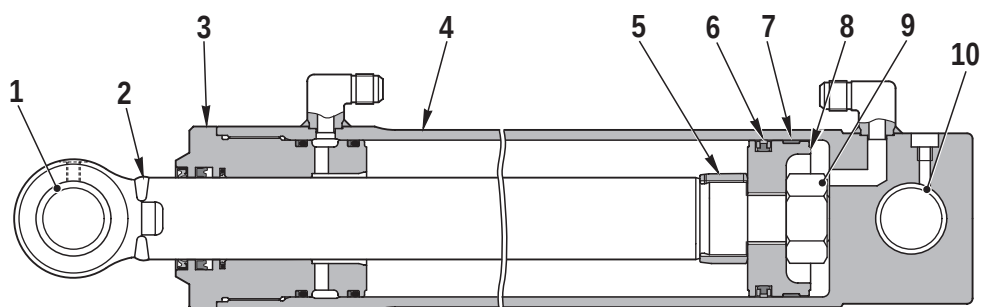
BACKHOE CYLINDERS

BOOM



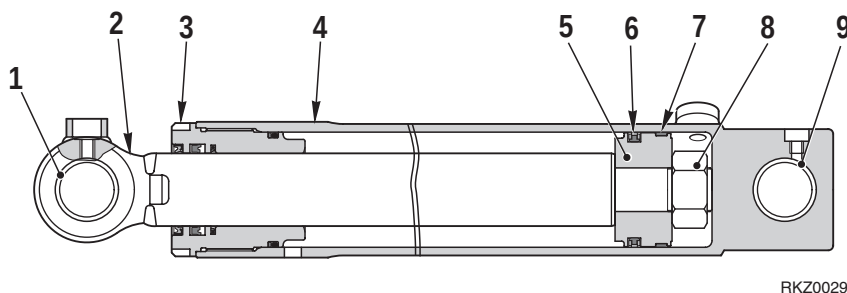
- | | | |
|----------------------------------|--------------------|-----------------------|
| 1. Head bushing, piston rod side | 5. Piston | 9. Bottom bushing |
| 2. Piston rod | 6. Piston ring | 10. Dowel bolt |
| 3. Cylinder head | 7. Guide ring | 11. Ball-bearings (9) |
| 4. Cylinder | 8. Cushion plunger | |

ARM



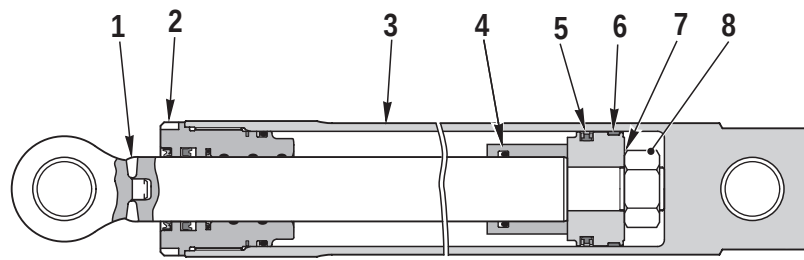
- | | | |
|------------------|----------------|--------------------|
| 1. Head bushing | 5. Bushing | 9. Nut |
| 2. Piston rod | 6. Piston ring | 10. Bottom bushing |
| 3. Cylinder head | 7. Guide ring | |
| 4. Cylinder | 8. Piston | |

BUCKET



- | | | |
|------------------|----------------|-------------------|
| 1. Head bushing | 4. Cylinder | 7. Guide ring |
| 2. Piston rod | 5. Piston | 8. Nut |
| 3. Cylinder head | 6. Piston ring | 9. Bottom bushing |

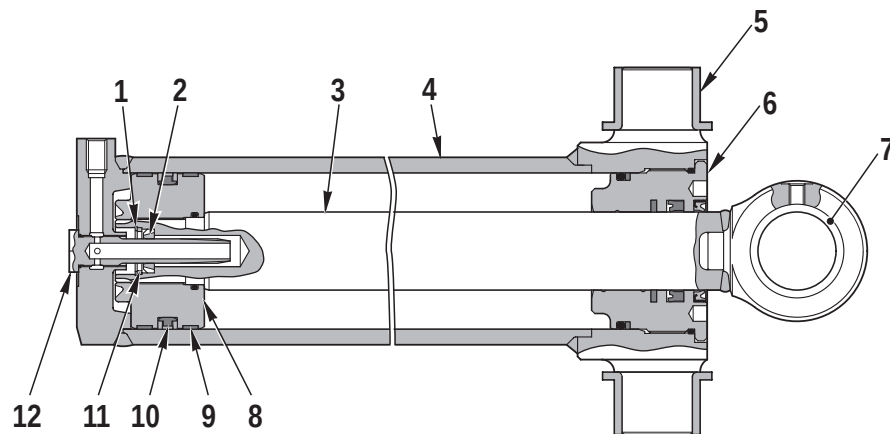
OUTRIGGERS



RKZ00410

- | | | |
|------------------|----------------|-----------|
| 1. Piston rod | 4. Spacer | 7. Piston |
| 2. Cylinder head | 5. Piston ring | 8. Nut |
| 3. Cylinder | 6. Guide ring | |

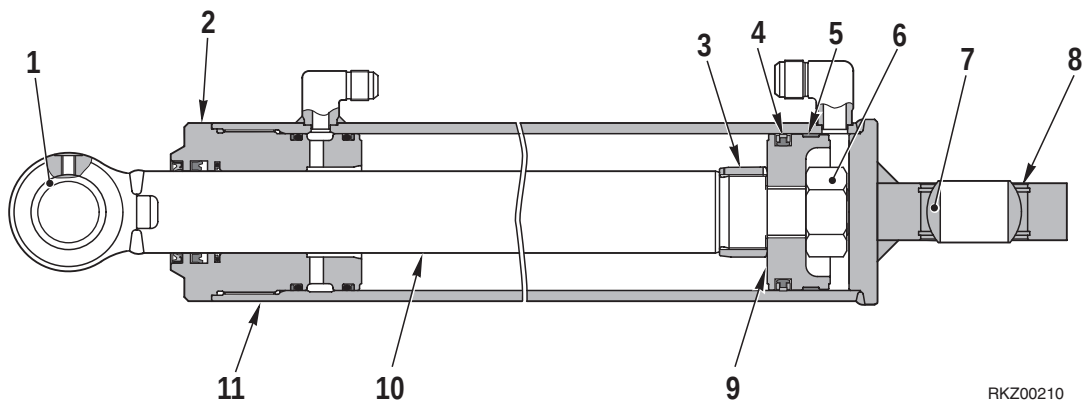
BOOM SWING



RKZ00360

- | | | |
|--------------------|------------------|---------------------|
| 1. Retaining ring | 5. Swing bushing | 9. Guide ring |
| 2. Throttling ring | 6. Cylinder head | 10. Piston ring |
| 3. Piston rod | 7. Head bushing | 11. Spacer |
| 4. Cylinder | 8. Piston | 12. Cushion plunger |

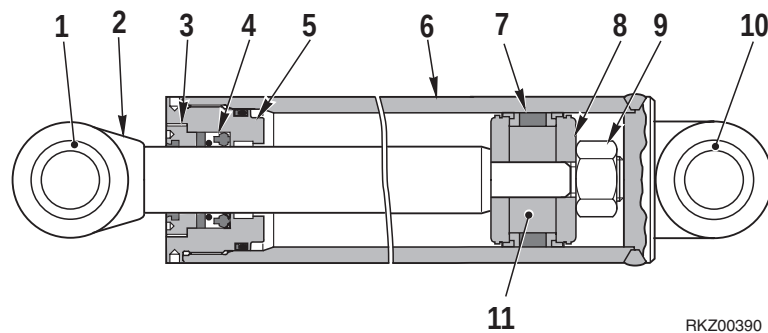
ARM (FOR SIDE DIGGING BOOM)



RKZ00210

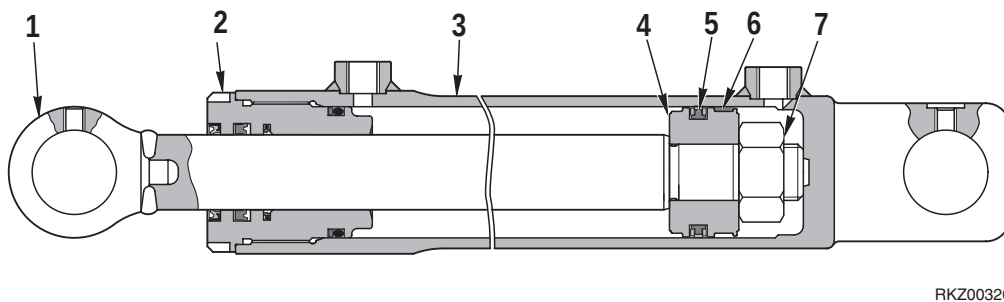
- | | | |
|------------------|---------------|----------------|
| 1. Head bushing | 5. Guide ring | 9. Piston |
| 2. Cylinder head | 6. Nut | 10. Piston rod |
| 3. Bushing | 7. Bearing | 11. Cylinder |
| 4. Piston ring | 8. Snap ring | |

SIDE DIGGING BOOM



- | | | |
|-----------------|------------------|--------------------|
| 1. Head bushing | 5. Cylinder head | 9. Nut |
| 2. Piston rod | 6. Cylinder | 10. Bottom bushing |
| 3. Ring nut | 7. Piston ring | 11. Spacer |
| 4. Gasket | 8. Ring | |

JIG ARM



- | | | |
|------------------|----------------|--------|
| 1. Piston rod | 4. Piston | 7. Nut |
| 2. Cylinder head | 5. Piston ring | |
| 3. Cylinder | 6. Guide ring | |

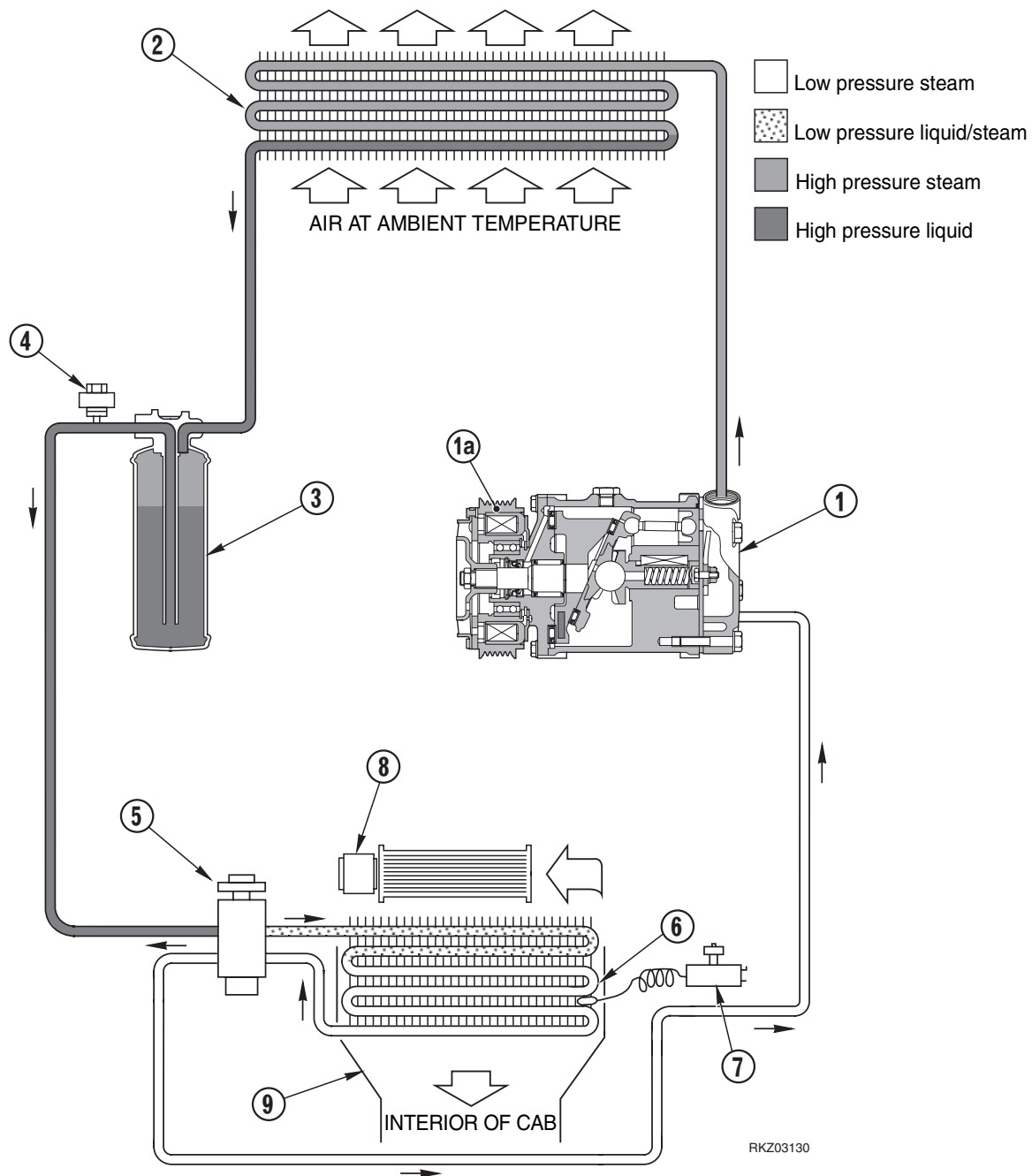
STRUCTURE AND FUNCTION
BACKHOE CYLINDERS
CHARACTERISTICS

Cylinder	Boom	Arm		Bucket
		Standard	With side digging boom	
Piston rod diameter	55	60	60	60
Internal cylinder diameter	115	110	110	95
Piston stroke	849	920	910	765
Max. cylinder length	2049	2175	2170	1850
Min. cylinder length	1200	1255	1260	1085
Key size for piston safety nut	65	55	55	55

CHARACTERISTICS

Cylinder	Outriggers	Boom swing	Side digging boom	Jig arm
Piston rod diameter	40	50	45	40
Internal cylinder diameter	80	100	85	70
Piston stroke	635	230	365	1140
Max. cylinder length	1690	319	830	2590
Min. cylinder length	1055	89	565	1450
Key size for piston safety nut	46	–	46	46

AIR-CONDITIONING UNIT



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

TECHNICAL DATA

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

Normal pressure: 15 –17 bar

Low pressure: 1.6 –1.8 bar

Safety pressures:

High pressure: 26 bar

Low pressure: 2.5 bar

Coolant fluid: R134a

Quantity of coolant: 2250±150 g

HOW THE AIR-CONDITIONING UNIT FUNCTIONS

The compressor (1) is driven directly by the engine shaft by means of a belt, and made to rotate by a pulley fitted with an electromagnetically-engaged clutch (1a).

A thermostatic sensor (7) controls the engagement and disengagement of the clutch. It disengages the clutch when the evaporator reaches the lower temperature limit and engages the clutch when the evaporator reaches the upper temperature limit.

The coolant fluid (in gaseous phase) is drawn into the compressor where it is subjected to compression and an intense heating process. In these conditions the fluid is then sent into the condenser (2) where, due to the heat extracted by ambient temperature air flowing over fins, it reaches condensation temperature, and passes into a high-pressure liquid state.

Subsequently the coolant passes into the drying-filter group (3) which performs three functions: it filters out impurities, absorbs any moisture present in the circuit and, finally, also functions as a reserve tank.

The coolant in its liquid state is then transferred to the evaporator (6), first passing through an expansion valve (5). The task of this valve is the constant metering of the quantity of fluid in order to maintain optimum evaporation.

In the evaporator the coolant fluid is subjected to expansion, bringing it up to the critical evaporation point at a temperature of approximately -8°C .

The flow of air generated by centrifugal fan (8) which passes through the evaporator (6) at ambient temperature is considerably warmer than -8°C . For this reason it yields heat to the coolant fluid, bringing it up to boiling point and complete evaporation.

On leaving the evaporator (6) the coolant is drawn once more into the compressor (1) and a new cycle commences.

The yielding of heat from the atmosphere in which the evaporator is positioned leads to the condensation of the water suspended in the air, and hence to dehumidification. The condensate is deposited on the evaporator fins where, if a temperature higher than 0°C is not maintained, it freezes and inhibits the functioning of the evaporator.

The task of keeping the temperature of the evaporator above 0°C (and thus within the optimum limits for heat exchange) is entrusted to a thermostatic sensor (7).

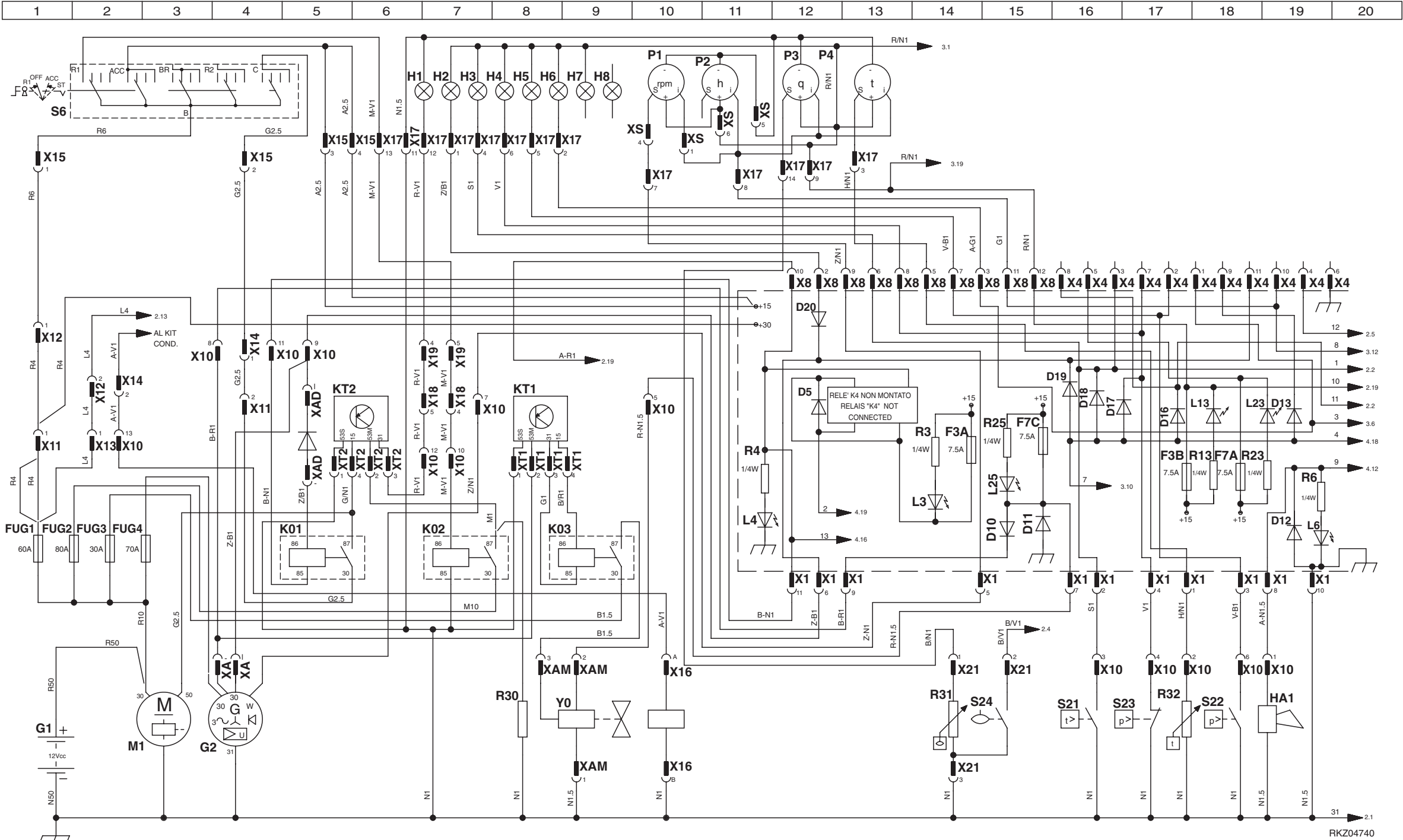
The condensate that forms on the evaporator fins (6) also contains dust, pollens and particles suspended in the air. Continual condensation therefore effectively purifies the air, and the droplets of condensate are discharged to the exterior.

A fixed quantity of anti-freeze oil is also introduced into the circuit, with the function of lubricating all the mechanical parts of the unit. A percentage of this oil circulates constantly throughout the unit in nebulized form, lubricating the compressor (pistons and bearings) and the expansion valve.

A pressure switch (4) has been inserted in the electrical control circuit to protect the unit in the case of a lack of coolant fluid or if the quantity becomes insufficient due to leakages. This switch will inhibit the engagement of the electromagnetic clutch and hence the functioning of the air-conditioning unit.

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ELECTRICAL DIAGRAM (1/6)



COMPONENTS

- G1 - Battery
- G2 - Generator
- H1 - Preheating warning light
- H2 - Generator warning light
- H3 - Engine water high temperature warning light
- H4 - Air filter warning lamp
- H5 - Hydraulic oil filter warning lamp
- H6 - Optional warning lamp
- H7 - Optional warning lamp

- H8 - Optional warning lamp
- HA1 - Horn
- K01 - Starter relay
- K02 - Preheating relay
- K03 - Fuel shut off relay
- KT1 - Fuel shut off timer
- KT2 - Preheating timer
- M1 - Starter motor
- P1 - Rpm instrument
- P2 - Hour counter
- P3 - Fuel level indicator

- P4 - Water temperature instrument
- R30 - Heating start
- R31 - Fuel level sender
- R32 - Water temperature sender
- S6 - Starting switch
- S21 - Engine water high temperature switch
- S22 - Air filter blocked switch
- S23 - Engine oil low pressure switch
- S24 - Fuel gauge
- Y0 - Fuel shut off solenoid valve

CONNECTORS

- X1 - Front line (engine) 11 way connector
- X4 - Monitor 11 way connector
- X8 - Lateral dashboard 17 way connector
- X10 - Front line-engine line 13 way connector
- X11 - Power 3 way connector
- X12 - Front line-cross line 3 way connector
- X13 - Front line-engine line 2 way connector
- X14 - Front line-cross line 4 way connector
- X15 - Start key 4 way connector
- X16 - Conditioner clutch 2 way connector

- X17 - Lateral dashboard 21 way connector
- X18 - Power box 5 way connector
- X19 - Front dashboard 9 way connector
- X21 - Fuel level indicator 3 way connector
- XA - Generator 2 way connector
- XAD - Diode 2 way connector
- XAM - Fuel shut off valve 3 way connector
- XS - Multifunction instrument 16 way connector
- XT1 - Fuel shut off timer 4 way connector
- XT2 - Preheating timer 4 way connector

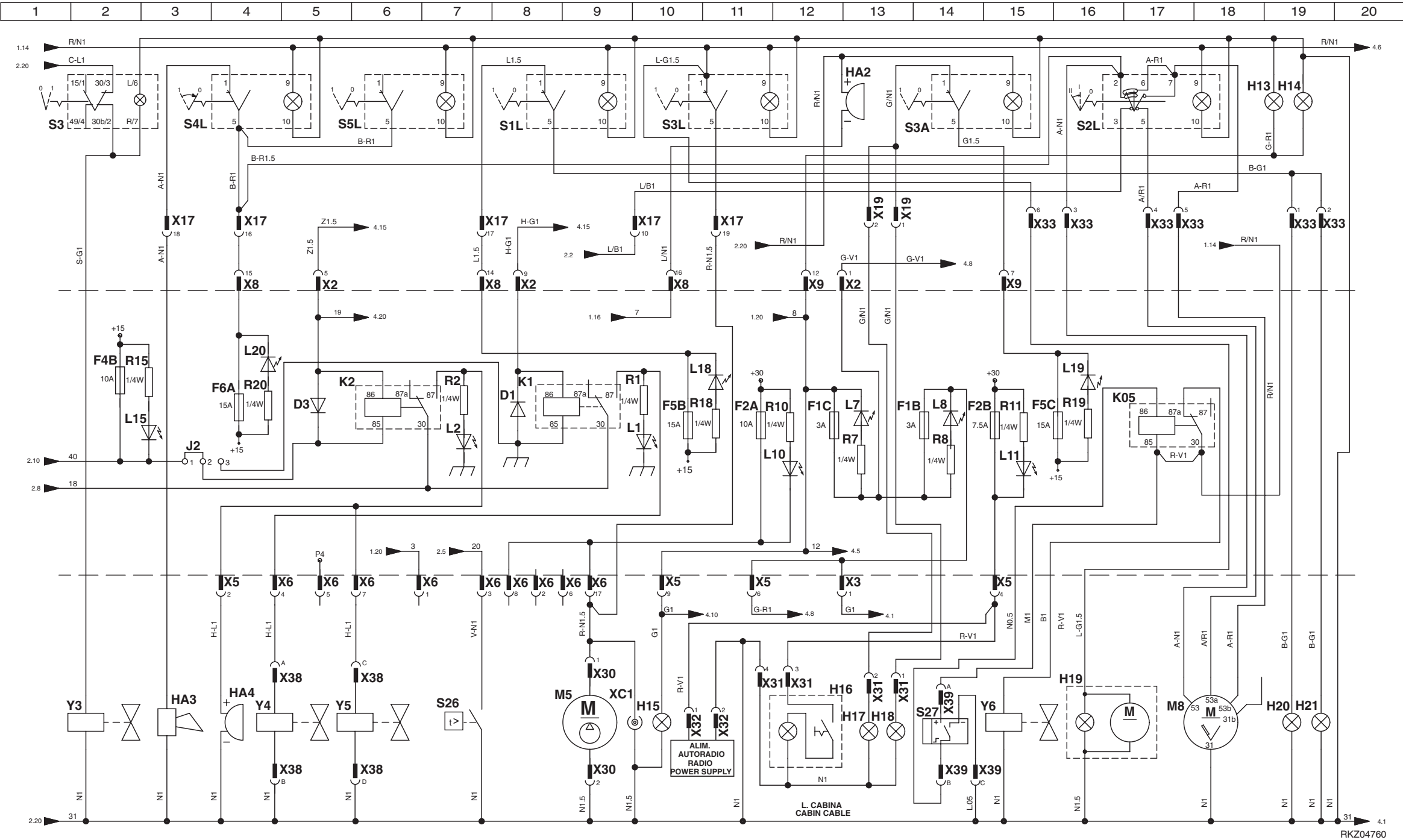
FUSES

- F3A - Starting fuse 7.5A
- F3B - Switch+warning light+ return to dig fuse 7.5A
- F7A - Monitor power fuse 7.5A
- F7C - Fuel shut off fuse 7.5A
- FUG1- General fuse 60A
- FUG2- Preheating fuse 80A
- FUG3- Fuel shut off power fuse 30A
- FUG4- Generator fuse 70A

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ELECTRICAL DIAGRAM (3/6)



COMPONENTS

- H13 - Dashboard light
- H14 - Dashboard light
- H15 - Cigarette lighter lamp
- H16 - Cabin lamp
- H17 - Front working lamp
- H18 - Front working lamp
- H19 - Beacon
- H20 - Rear working light
- H21 - Rear working light
- HA2 - Buzzer
- HA3 - Rear horn

HA4 - Buzzer

- K05 - Return to dig relay
- K1 - Forward speed relay
- K2 - Reverse speed relay
- M5 - Fuel pump
- M8 - Windshield wiper motor
- XC1 - Current intake 12V
- S3 - Plate lock switch
- S26 - Convert. oil high temperature switch
- S27 - Npn Sensor
- S3A - Front working light switch on front dashboard
- S1L - Rear working light switch on lat. dashboard

- S2L - Windshield wiper-washer switch on lat. dashboard
- S3L - Beacon switch on lat. dashboard
- S4L - Horn switch on lat. dashboard
- S5L - Optional switch on lat. dashboard
- Y3 - Plate unlock solenoid valve
- Y4 - Forward speed solenoid valve
- Y5 - Reverse speed solenoid valve
- Y6 - Return to dig solenoid valve

CONNECTORS

- X2 - Lights switch and gear shift line 9 way connector
- X3 - Front line 11 way connector
- X5 - Cabin command 11 way connector
- X6 - Solenoid valves line 9 way connector
- X8 - Lateral dashboard 17 way connector
- X9 - Front dashboard 17 way connector
- X17 - Lateral dashboard 21 way connector
- X19 - Front dashboard 9 way connector
- X30 - Fuel pump 2 way connector
- X31 - Cabin 5 way connector
- X32 - Radio power 2 way connector

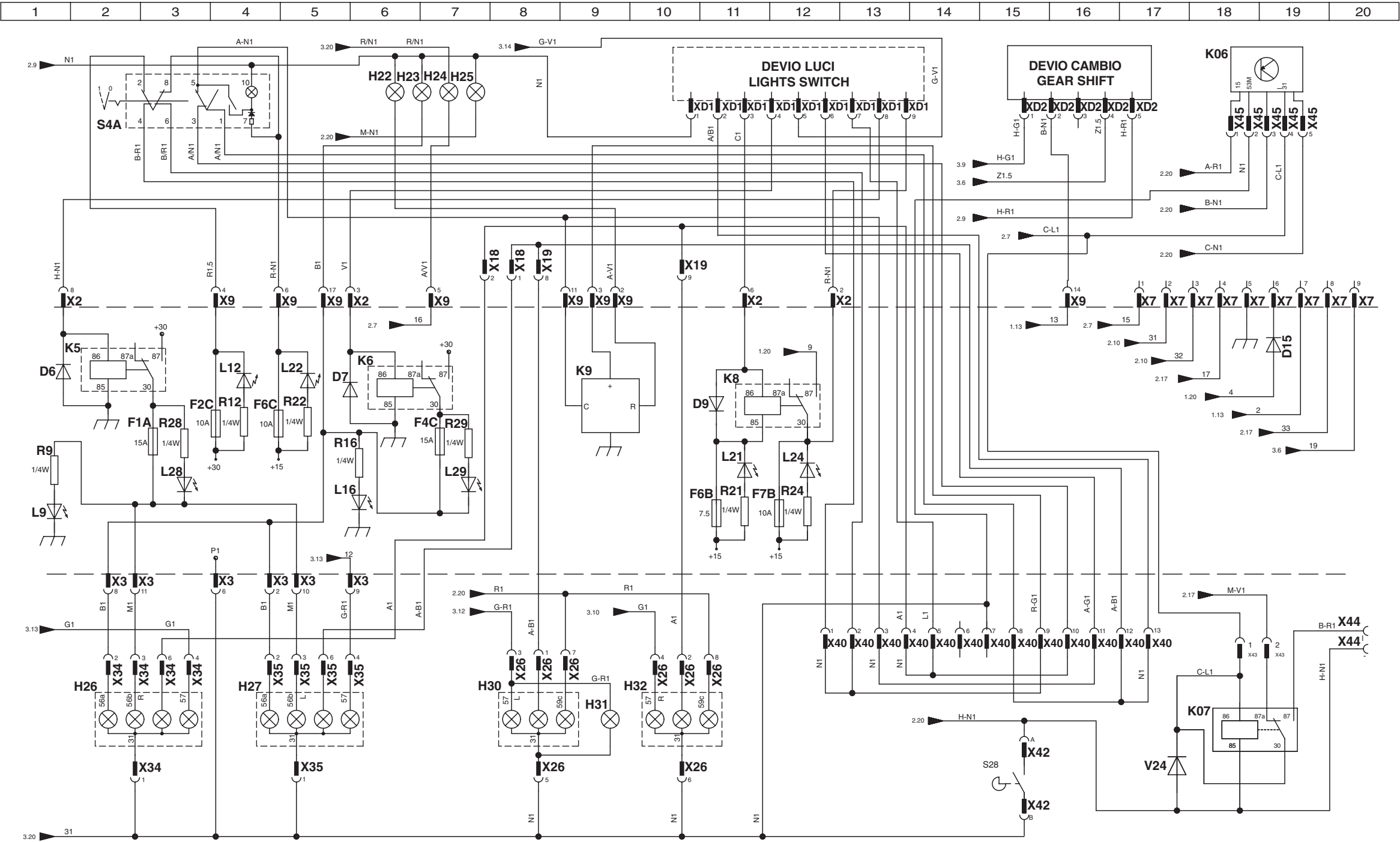
- X33 - Windshield wiper and beacon 7 way connector
- X38 - Forward-reverse speed valves 4 way connector
- X39 - Proximity 3 way connector

FUSES

- F1B - Right traffic light fuse 3A
- F1C - Left traffic light 3A
- F2A - Beacon fuse 10A
- F2B - Radio cabin lamp fuse 7.5A
- F4B - Forward-reverse speed fuse 10A
- F5B - Rear working light switch fuse 15A
- F5C - Front working light switch fuse 15A
- F6A - Windshield wiper-washer switch fuse 15A

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ELECTRICAL DIAGRAM (4/6)



COMPONENTS

- H22 - Indicators warning light
- H23 - Main beam warning light
- H24 - Low level brake oil warning light
- H25 - Differential lock warning light
- H26 - Right front lamp
- H27 - Left front lamp
- H30 - Left rear lamp
- H31 - Number plate lamp
- H32 - Right rear lamp
- K5 - Low beam relay
- K6 - Main beam relay

- K8 - Horn relay
- K9 - Flasher unit
- S28 - Gear switch
- S4A - Warning switch on front dashboard

CONNECTORS

- X2 - Lights switch and gear shift line 9 way connector
- X3 - Front line 11 way connector
- X7 - Not connected 9 way connector
- X9 - Front dashboard 17 way connector
- X18 - Power box 5 way connector
- X19 - Front dashboard 9 way connector
- X26 - Rear line 8 way connector
- X34 - Right front light 6 way connector
- X35 - Left front light 6 way connector
- X40 - Flasher unit 13 way connector
- X42 - Switch gear 2 way Packard connector

- X43 - Differential gear lock wiring 2 way connector
- X44 - Switch gear 2 way connector
- X45 - Power economy unit connector
- XD1 - Lights switch 9 way connector
- XD2 - Gear shift 5 way connector

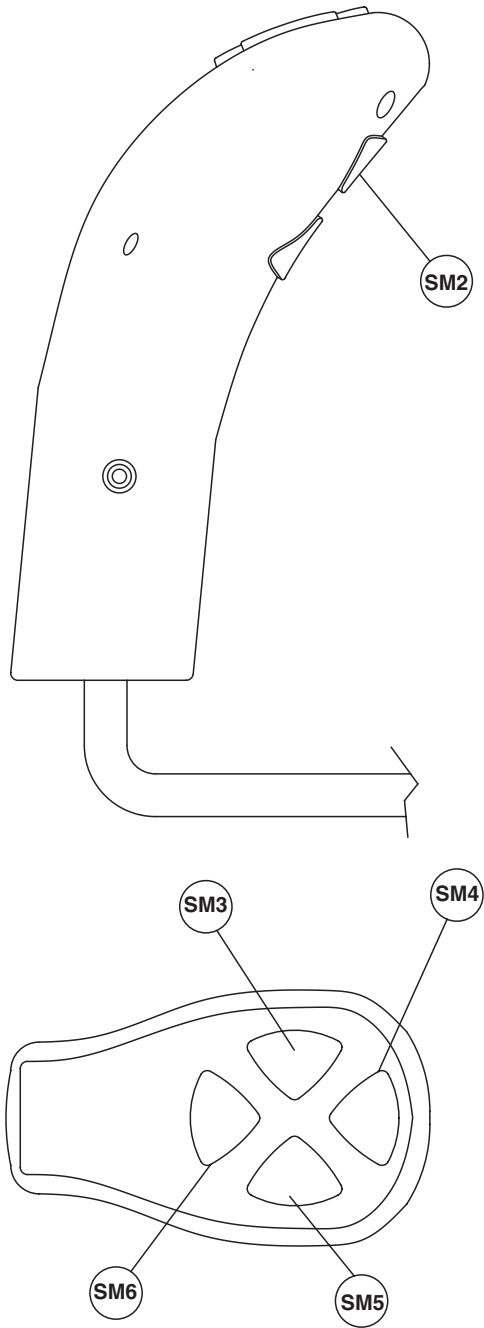
FUSES

- F1A - Low beam fuse 15A
- F2C - Warning fuse 10A
- F4C - High beam fuse 15A
- F6B - Lights switch power fuse 7.5A
- F7B - Horn fuse 10A

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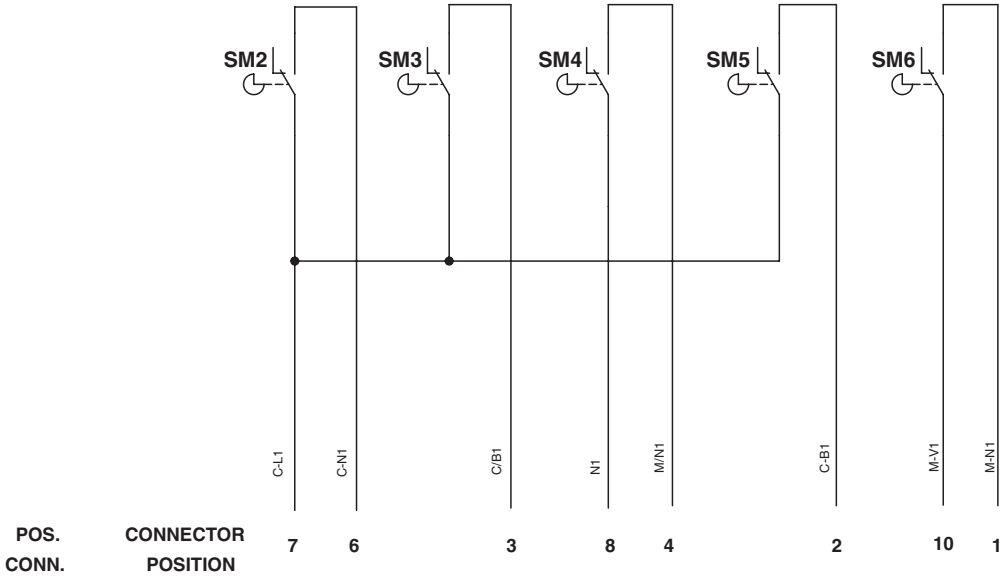
ELECTRICAL DIAGRAM (5/6)

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

POS	DESCRIZIONE/DESCRIPTION	FILO COMUNE COM. WIRE	FILO CONT. N.A. N.O. CONTACT WIRE	FILO CONT. N.C. N.C. CONTACT WIRE
SM2	CONTROL-SQUARE	C-L1	C-N1	
SM3	BENNA CHIUDE/CLOSED GRAB	C-L1	C/B1	
SM4	STACCO CONVERTITORE/CONVERTER DETACHMENT	N1	M/N1	
SM5	BENNA APRE/OPENED GRAB	C-L1	C-B1	
SM6	BLOCCAGGIO DIFFERENZIALE/DIFFERENTIAL LOCK	M-V1	M-N1	



RKZ04780

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ELECTRICAL DIAGRAM (6/6)

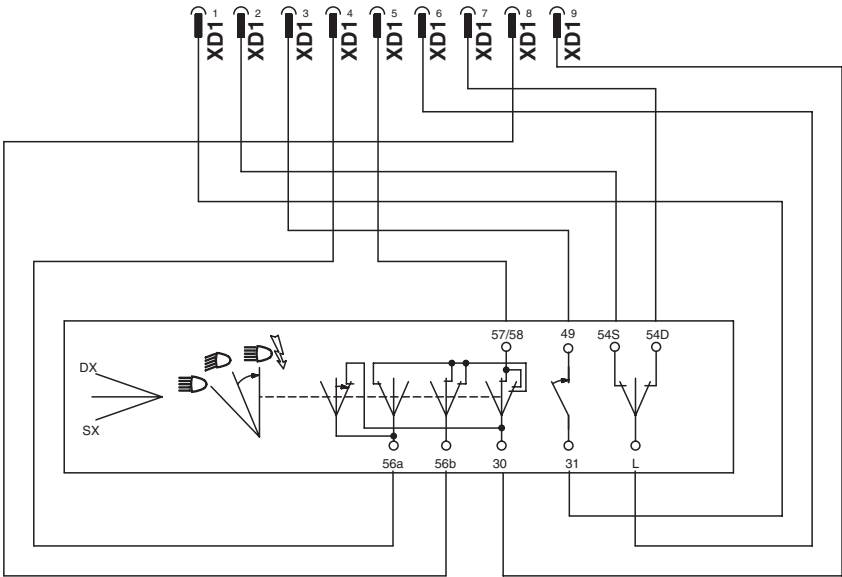
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
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XD1

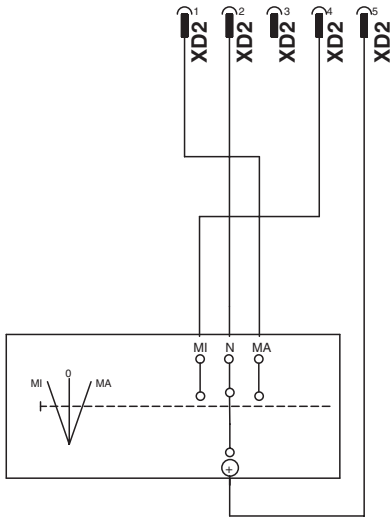
POS	DESCRIZIONE FUNZIONE	FUNCTION DESCRIPTION
1	MASSA AVV. ACUSTICO	HORN GROUND
2	SEGNALE IND. DIREZIONE SX	LEFT INDICATOR SIGNAL
3	ALIMENTAZIONE AVV. ACUSTICO	HORN POWER SUPPLY
4	SEGNALE ABBAGLIANTI	HIGH BEAM SIGNAL
5	SEGNALE LUCI DI POSIZIONE	TRAFFIC LIGHT SIGNAL
6	ALIMENTAZIONE INDICATORI DIREZIONE	DIRECTION INDICATORS POWER
7	SEGNALE IND. DIREZIONE DX	RIGHT INDICATOR SIGNAL
8	SEGNALE ANABBAGLIANTI	LOW BEAM SIGNAL
9	ALIMENTAZIONE DEVIO	POWER

XD2

POS	DESCRIZIONE FUNZIONE	FUNCTION DESCRIPTION
1	SEGNALE MARCIA AVANTI	FORWARD SPEED
2	FOLLE	NEUTRAL
3	N.C.	N.C.
4	SEGNALE MARCIA INDIETRO	REVERSE SPEED
5	ALIMENTAZIONE DEVIO	POWER



DEVIO LUCI
LIGHTS SWITCH



DEVIO CAMBIO
GEAR SHIFT

RKZ04790

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GROUP 20

20 TESTING AND ADJUSTMENTS

Normal or standard technical data	2	Testing and adjusting of unloading valve	47
Special tools	26	Checking unloading valve functionality	48
Measuring engine speed	27	Testing priority valve operation	49
Adjusting valve clearance	28	Testing and setting steering control system pressure	50
Measuring compression pressure	29	Testing brake system	51
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Checking and tightening the fan - belt	32	Testing pressures in the power train group	55
Checking and tightening the compressor fan - belt .	33	Testing the correct functioning of the power train clutches	57
Measuring accelerator pedal operating travel and accelerator lever	34	Adjusting the sensor for return to dig device	58
Adjusting brake pedal travel, brake alignment, microswitches	36	Analysis of causes hydraulic drift	59
Air bleeding - releasing residual pressure	37	Testing the air-conditioning unit	64
Checking and setting pressure in the attachments hydraulic circuit	40	Emptying the air-conditioning unit	66
Testing and adjusting of load sensing signal (LS valve)	46	Troubleshooting	67

-  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			WB91R-2	
Engine			4D106-1FA	
Check item	Test conditions	Unit	Standard value	Permissible value
Engine speed	High idling	rpm	2375±50	2325–2425
	Low idling	rpm	1050±50	1000–1100
	Set speed	rpm	2200	–
Exhaust gas colour	Sudden acceleration	Bosch index	0.9	1.2
	At high idling speed		0.5	0.8
Valve clearance	Intake valve (20°C)	mm	0.30±0.05	Max. 0.35
	Exhaust valve (20°C)	mm	0.30±0.05	Max. 0.35
Compression pressure (SAE30 oil)	Oil temperature 69–72°C (Engine speed)	bar	34.3±1	27.5±1
		rpm	250	250
Blow - by pressure (oil SAE30)	Water temperature in operating range At high idling speed	mm H ₂ O	–	–
			–	–
Engine oil pressure	Max. idling (in cold state)	bar	Max. 5.8	Max. 5.8
	At set speed	bar	4.4	3.9–4.9
	At low idling	bar	1	Min. 1
Oil temperature	Entire speed range	°C	120	Max. 120
Fuel injection timing	B.T.D.C.	degrees	12.5	11.5–13.5
Fan belt tension	Deflection when pressed with finge force of approx. 10 kg	mm	10	10–15

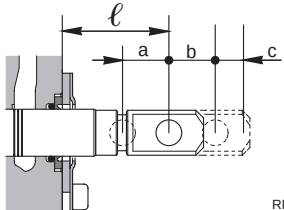
TESTING AND ADJUSTMENTS
NORMAL OR STANDARD TECHNICAL DATA
FOR ENGINE

WB93R-2					
S4D106-1FA					
Standard value	Permissible value				
2375 $\pm$ 50 1050 $\pm$ 50 2200	2325–2425 1000–1100 –				
0.9 0.5	1.5 1.0				
0.30 $\pm$ 0.05 0.30 $\pm$ 0.05	Max. 0.35 Max. 0.35				
34.3 $\pm$ 1 250	27.5 $\pm$ 1 250				
– –	– –				
Max. 5.8 4.4 1	Max. 5.8 3.9–4.9 Min. 1				
120	Max. 120				
12.5	11.5–13.5				
10	10–15				

TESTING AND ADJUSTMENTS

NORMAL OR STANDARD TECHNICAL DATA

FOR MACHINE

Machine model				WB91R-2								
Classification	Check item	Test conditions	Unit	Standard value				Permissible value				
Engine speed	Accelerator pedal	• Hydraulic oil temperature: 45 –55 °C • Converter oil temperature: 80 °C • Engine oil temperature cooling circuit: in the limits	Max.	rpm	2375±50				2325 –2425			
		Min.	1050±50				1000 –1100					
	Accelerator fuel	• Hydraulic oil temperature: 45 –55 °C • Converter oil temperature: 80 °C • Engine oil temperature cooling circuit: in the limits	Max.		1900±50				1850 –1950			
		Min.	1050±50				1000 –1100					
Control valve	All controls (front bucket and backhoe)	 RKZ02580	mm	ℓ	a	b	c	ℓ	a	b	c	
	41.5			8	8	–	–	–	–	–		
	For front shovel arm command only (with floating arm)			41.5	8	8	–	–	–	–	–	
Travel of levers and pedals	Front bucket tilt lever control	• Engine stopped • At the centre of knob lever • Valve reading at the end of working stroke • Attachments on the ground	Neutral → Raise Lower	mm	80				60 –110			
	Front bucket control lever		Neutral → Dump Curled		115				90 –140			
	Boom backhoe control lever		Neutral → Raise Lower		100				80 –120			
	Arm backhoe control lever		Neutral → Opening Closing		100				80 –120			
	Bucket backhoe control lever		Neutral → Opening Closing		100				80 –120			
	Boom swing backhoe control lever		Neutral → Right Left		100				80 –120			
	Outriggers control lever		Neutral → Up Down		50				35 –65			
	Fuel control lever		Min. → Max.		70				50 –90			
	Jig arm control pedal		Neutral → Out In		15 30				10 –20 20 –40			
	Breaker and side digging boom control pedal		Neutral → Right Left		15 30				10 –20 20 –40			

TESTING AND ADJUSTMENTS
NORMAL OR STANDARD TECHNICAL DATA
FOR MACHINE

WB93R-2											
Standard value				Permissible value							
2375±50				2325–2425							
1050±50				1000–1100							
1900±50				1850–1950							
1050±50				1000–1100							
<i>ℓ</i>	a	b	c	<i>ℓ</i>	a	b	c				
41.5	8	8	–	–	–	–	–				
41.5	8	8	–	–	–	–	–				
80				60–110							
115				90–140							
100				80–120							
100				80–120							
100				80–120							
100				80–120							
50				35–65							
70				50–90							
15 30				10–20 20–40							
15 30				10–20 20–40							

TESTING AND ADJUSTMENTS
NORMAL OR STANDARD TECHNICAL DATA
FOR MACHINE

Machine model				WB91R-2	
Classification	Check item	Test conditions	Unit	Standard value	Permissible value
Travel of levers and pedals	Accelerator pedal	- Engine stopped - At the centre of knob lever - Valve reading at the end of working stroke - Attachments on the ground Min. → Max.	mm	80	60–100
	Wheel swing	Right → Left Left → Right	rev.	Max. 2.5	2.2–2.5
Force for levers and pedals operation	Front bucket tilt lever control	- Engine speed: max. - Oil temperature: 45–55 °C - Tool connection at the centre of knob (for levers) - Tool connection on edge (for pedals)	kg	2.5	2–3
	Front bucket control lever			2.5	2–3
	Boom control lever			1.5	1–2
	Arm control lever			1.5	1–2
	Bucket control lever			1.5	1–2
	Boom swing control lever			1.5	1–2
	Outriggers control lever			3	2.5–3.5
	Fuel control lever			12	10–14
	Jig arm control pedal			4	3–4
	Breaker and side digging boom control pedal			8	6–10
	Accelerator pedal			3	2–4
	Brake pedal			30	Max. 60

TESTING AND ADJUSTMENTS
NORMAL OR STANDARD TECHNICAL DATA
FOR MACHINE

WB93R-2					
Standard value	Permissible value				
80	60–100				
Max. 2.5	2.2–2.5				
2.5	2–3				
2.5	2–3				
1.5	1–2				
1.5	1–2				
1.5	1–2				
1.5	1–2				
3	2.5–3.5				
12	10–14				
4	3–4				
8	6–10				
8	6–10				
3	2–4				
30	Max. 60				

TESTING AND ADJUSTMENTS
NORMAL OR STANDARD TECHNICAL DATA
FOR MACHINE

Machine model				WB91R-2	
Classification	Check item	Test conditions	Unit	Standard value	Permissible value
Main valve pressure	2-3-Spool control valve	• Engine speed: max. • Oil temperature: 45 – 55 °C • Without steering	bar	185	185±7
	6-7-8-Spool control valve			185	185±7
	Steering unit	• Engine speed: 1500±50 rpm		175	175±7
Pressures of secondary valves circuits	Front bucket (curled)	• Engine speed: min. • Oil temperature: 45 – 55 °C • Check one circuit at the time	bar	235	235±7
	Front bucket (dump)			175	175±7
	Attachment (3rd spool)			235	235±7
	Boom (raising) *			305	305±7
	Boom (lowering)			235	235±7
	Arm (Closing)			235	235±7
	Boom swing			245	245±7
	Bucket (curled)			235	235±7
	Side digging boom (right-left)			275	275±7
	Breaker (delivery)			165	165±7
	Steering unit (safety) *			240	240±7
		*Check on test bench			

TESTING AND ADJUSTMENTS**NORMAL OR STANDARD TECHNICAL DATA****FOR MACHINE**

WB93R-2					
Standard value	Permissible value				
200	200±7				
200	200±7				
175	175±7				
235	235±7				
175	175±7				
235	235±7				
305	305±7				
235	235±7				
235	235±7				
245	245±7				
235	235±7				
275	275±7				
165	165±7				
240	240±7				

TESTING AND ADJUSTMENTS

NORMAL OR STANDARD TECHNICAL DATA

FOR MACHINE

Machine model				WB91R-2	
Classification	Check item	Test conditions	Unit	Standard value	Permissible value
Engine speed (with load) - Converter	With converter	• Engine speed (without load): 2375±50 • Hydraulic oil temperature: 45 – 55 °C • Converter oil temperature: 80°C • Machine in 4th gear • Working brakes applied	rpm	2100±50	2050–2150
	With converter and hydraulic circuit	• Engine speed (without load): 2375±50 • Hydraulic oil temperature: 45 – 55 °C • Converter oil temperature: 80°C • Machine in 4th gear • Working brakes applied • Front bucket curled stop • Steering at the end of stroke		1975±50	1925–2025
	With converter (TBG version)	• Engine speed (without load): 2375±50 • Hydraulic oil temperature: 45 – 55 °C • Converter oil temperature: 80°C • Machine in 3rd gear • Working brakes applied		2100±50	2050–2150
	With converter and hydraulic circuit (TBG version)	• Engine speed (without load): 2375±50 • Hydraulic oil temperature: 45 – 55 °C • Converter oil temperature: 80°C • Machine in 3rd gear • Working brakes applied • Front bucket curled stop		1975±50	1925–2025

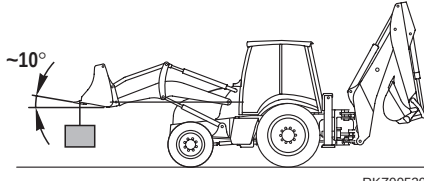
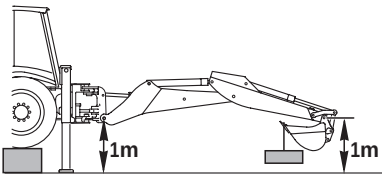
TESTING AND ADJUSTMENTS**NORMAL OR STANDARD TECHNICAL DATA****FOR MACHINE**

WB93R-2					
Standard value	Permissible value				
2275±50	2225–2325				
2250±50	2200–2300				
2100±50	2050–2150				
1975±50	1925–2025				

TESTING AND ADJUSTMENTS
NORMAL OR STANDARD TECHNICAL DATA

- ★ The technical data of follow table are referred to a machine with max 500 kg shovel bucket, 600 mm (max. 160 kg) backhoe bucket and standard arm (or telescopic arm) closed.

FOR MACHINE

Machine model				WB91R-2	
Classifi- cation	Check item	Test conditions	Unit	Standard value	Permissible value
Hydraulic drift working equipment	Front bucket	Measuring posture	mm		
		Complete working equipment (Tip lowering of bucket teeth)		250	400
					
	Cylinders (cylinder in)			30	45
	Bucket cylinder (cylinder in)	- In this position check in feedback of each cylinder and the leakage with applied load on the tip of bucket teeth. - Ground level. - Bucket: normal load (1500 kg) - Engine stopped - Oil temperature: 45 –55°C - Check measures as soon as engine stops. - Check changes every 5 min. and the total change in 15 min		15	25
	Backhoe	Measuring posture	mm	300	450
		Complete working equipment (Tip lowering of bucket teeth)			
		Boom cylinders (cylinder out)		35	50
					
	Arm cylinder (cylinder out)	- In this position check the extension of each cylinder and the leakage with normal load on the bucket. - On level ground. - Bucket: normal load (450 kg) - Engine stopped - Oil temperature: 45 –55°C - Check measures as soon as engine stops. - Check changes every 5 min. and the total change in 15 min.		15	25
	Bucket cylinder (Cylinder in)			10	15

TESTING AND ADJUSTMENTS
NORMAL OR STANDARD TECHNICAL DATA

★ The technical data of follow table are refered to a machine with max 500 kg shovel bucket, 600 mm (max. 160 kg) backhoe bucket and standard arm (or telescopic arm) closed.

FOR MACHINE

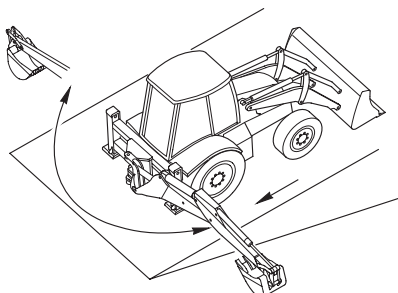
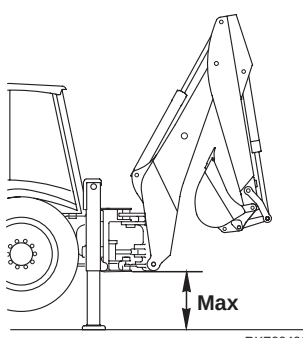
WB93R-2					
Standard value	Permissible value				
250	400				
30	45				
15	25				
300	450				
35	50				
15	25				
10	15				

TESTING AND ADJUSTMENTS

NORMAL OR STANDARD TECHNICAL DATA

- ★ The technical data of follow table are referred to a machine with max 500 kg shovel bucket, 600 mm (max. 160 kg) backhoe bucket and standard arm (or telescopic arm) closed.

FOR MACHINE

Machine model				WB91R-2	
Classifi- cation	Check item	Test conditions	Unit	Standard value	Permissible value
Hydraulic drift working equipment	Backhoe	Measuring posture  RKZ02670 • Oil temperature: 45 –55 °C • Backhoe balanced on the guides bucket in transport condition. • Arm and bucket cylinder in. Put the bucket link pin at 1 meter from ground and swing at end of boom stroke in one of the two direction. • Move the machine on a chute of 15° and apply the parking brake. • Stop the engine and, after 1 minute, check the cylinder feed back opposite to the boom every 5 min. for a total of 15 minutes.	mm	15	25
	Outriggers	Measuring posture  RKZ00490 • Oil temperature: 45 –55 °C • Backhoe balanced. • Boom and arm cylinders in, bucket cylinder out • Outriggers at maximum extension. • Engine stopped. • Check the frame lowering for each side every 5 min. for a total of 15 minutes.		15	25

TESTING AND ADJUSTMENTS**NORMAL OR STANDARD TECHNICAL DATA**

★ The technical data of follow table are refered to a machine with max 500 kg shovel bucket, 600 mm (max. 160 kg) backhoe bucket and standard arm (or telescopic arm) closed.

FOR MACHINE

WB93R-2					
Standard value	Permissible value				
15	25				
15	25				

TESTING AND ADJUSTMENTS

NORMAL OR STANDARD TECHNICAL DATA

★ The technical data of follow table are referred to a machine with max 500 kg shovel bucket, 600 mm (max. 160 kg) backhoe bucket and standard arm (or telescopic arm) closed.

FOR MACHINE

Machine model					WB91R-2	
Classifi- cation	Check item		Test conditions	Unit	Standard value	Permissible value
Cylinder leaking	Front bucket	Boom	• Engine: Max. speed • Oil temperature: 45--55°C • Leaking check: on the cylinder opposite side to the pressure one. • Check 1 cylinder at a time. • For tilt front bucket, front bucket and for swing, check the two cylinders separately.	cm ³ / min	2.0 (each cylinder)	Max. 8.0
		Bucket			1.6 (each cylinder)	Max. 6.0
	Backhoe	Boom			3.3	Max. 13.5
		Arm			3.0	Max. 12.0
		Bucket			2.4	Max. 9.5
		Boom swing			3.2	Max. 13.0
		Outrigger			3.3	Max. 13.5
		Side digging boom			2.0	Max. 8.0
		Jig arm			1.6	Max. 6.0

TESTING AND ADJUSTMENTS**NORMAL OR STANDARD TECHNICAL DATA**

- ★ The technical data of follow table are refered to a machine with max 500 kg shovel bucket, 600 mm (max. 160 kg) backhoe bucket and standard arm (or telescopic arm) closed.

FOR MACHINE

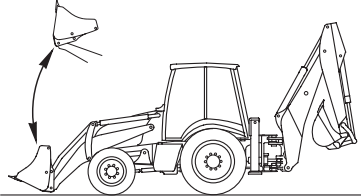
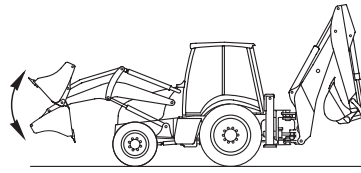
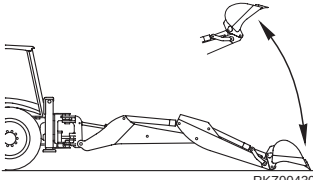
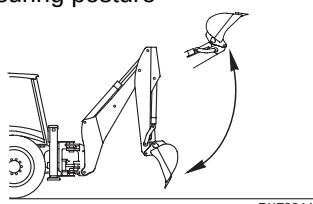
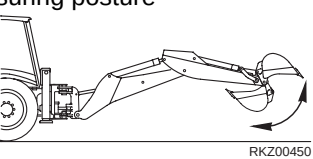
WB93R-2					
Standard value	Permissible value				
2.0 (each cylinder)	Max. 8.0				
1.6 (each cylinder)	Max. 6.0				
3.3	Max. 13.5				
3.0	Max. 12.0				
2.4	Max. 9.5				
3.2	Max. 13.0				
3.3	Max. 13.5				
2.0	Max. 8.0				
1.6	Max. 6.0				

TESTING AND ADJUSTMENTS

NORMAL OR STANDARD TECHNICAL DATA

★ The technical data of follow table are referred to a machine with max 500 kg shovel bucket, 600 mm (max. 160 kg) backhoe bucket and standard arm (or telescopic arm) closed.

FOR MACHINE

Machine model				WB91R-2	
Classifi- cation	Check item	Test conditions	Unit	Standard value	Permissible value
Work equipment speed	Front bucket	Measuring posture  RKZ007510	Raised	3.6	3.1–4.1
		Cylinders extended out ↕ Bucket on level ground	Lowered	2.5	2.1–2.9
		Measuring posture  RKZ00510	Curled	2.6	2.2–3.0
		Cylinder out ↕ Cylinder in	Dump	3.5	3.0–4.0
	Backhoe	Measuring posture  RKZ00430	Lifting ●	2.6	2.2–3.0
		Cylinder in ↕ Teeth bucket on level ground	Lowered	1.9	1.6–2.2
		Measuring posture  RKZ00440	Opening	3.6	3.1–4.1
		Cylinder in ↕ Cylinder out	Closing ●	4.5	3.9–5.1
		Measuring posture  RKZ00450	Dump	2.6	2.2–3.0
		Cylinder in ↕ Cylinder out	Curled	2.1	2.7–3.5
		• Engine speed: Max. • Oil temperature: 45–55°C • Speed up			
		• Engine speed: 1700 $\pm$ 50 rpm • Oil temperature: 45–55°C • Backhoe balanced • Power mode			
		• Engine speed: 1700 $\pm$ 50 rpm • Oil temperature: 45–55°C • Backhoe balanced • Power mode			

TESTING AND ADJUSTMENTS**NORMAL OR STANDARD TECHNICAL DATA**

★ The technical data of follow table are referred to a machine with max 500 kg shovel bucket, 600 mm (max. 160 kg) backhoe bucket and standard arm (or telescopic arm) closed.

FOR MACHINE

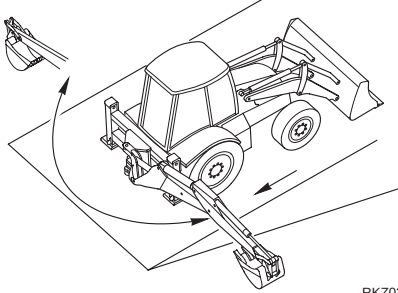
WB93R-2					
Standard value	Permissible value				
3.6	3.1–4.1				
2.5	2.1–2.9				
2.6	2.2–3.0				
3.5	3.0–4.0				
2.6	2.2–3.0				
1.9	1.6–2.2				
3.6	3.1–4.1				
4.5	3.9–5.1				
2.6	2.2–3.0				
2.1	2.7–3.5				

TESTING AND ADJUSTMENTS

NORMAL OR STANDARD TECHNICAL DATA

- ★ The technical data of follow table are referred to a machine with max 500 kg shovel bucket, 600 mm (max. 160 kg) backhoe bucket and standard arm (or telescopic arm) closed.

FOR MACHINE

Machine model				WB91R-2	
Classifi- cation	Check item	Test conditions	Unit	Standard value	Permissible value
Work equipment speed	Backhoe	Measuring posture  • Engine speed: 1700$\pm$50 rpm • Oil temperature: 45–55°C • Arm horizontal • Power mode	Right ●	3.5	3.1–3.9
			Left ●	3.5	3.1–3.9

- This time are referred to the cylinder stroke whitout the brake phase.

NOTE. The engine speed (1700 $\pm$ 50 rpm) has to be checked with the procedure described at paragraph «MEASURING ENGINE SPEED» in this section.

TESTING AND ADJUSTMENTS

NORMAL OR STANDARD TECHNICAL DATA

★ The technical data of follow table are refered to a machine with max 500 kg shovel bucket, 600 mm (max. 160 kg) backhoe bucket and standard arm (or telescopic arm) closed.

FOR MACHINE

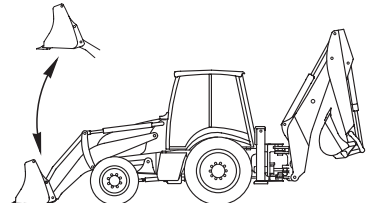
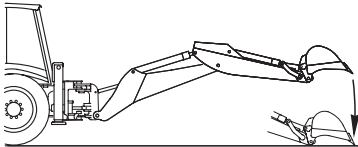
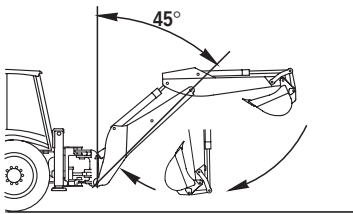
WB93R-2					
Standard value	Permissible value				
3.5	3.1-3.9				
3.5	3.1-3.9				

TESTING AND ADJUSTMENTS

NORMAL OR STANDARD TECHNICAL DATA

- ★ The technical data of follow table are referred to a machine with max 500 kg shovel bucket, 600 mm (max. 160 kg) backhoe bucket and standard arm (or telescopic arm) closed.

FOR MACHINE

Machine model				WB91R-2	
Classifi- cation	Check item	Test conditions	Unit	Standard value	Permissible value
Work equipment speed	Time lags	Measuring posture  • Engine speed: Min. • Oil temperature: 45 – 55°C • Check the time necessary to lift bucket from level ground.	sec.	0	Max. 2
		Measuring posture  • Engine speed: Min. • Oil temperature: 45 – 55°C • With attachments fully extended, lower the boom and check the necessary time from the beginning of machine lifting until bucket is on level ground.		0	Max. 2
		Measuring posture  • Engine speed: Min. • Oil temperature: 45 – 55°C • Put boom at 45°, open completely the arm with curled bucket. Extend arm cylinder and check the time passing between arm stop at dead centre and the restart movement.		0	Max. 2

TESTING AND ADJUSTMENTS**NORMAL OR STANDARD TECHNICAL DATA**

★ The technical data of follow table are referred to a machine with max 500 kg shovel bucket, 600 mm (max. 160 kg) backhoe bucket and standard arm (or telescopic arm) closed.

FOR MACHINE

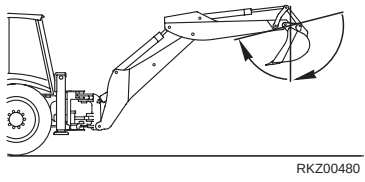
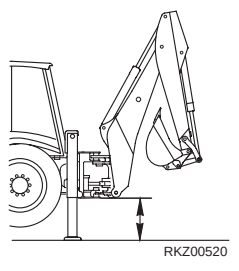
WB93R-2					
Standard value	Permissible value				
0	Max. 2				
0	Max. 2				
0	Max. 2				

TESTING AND ADJUSTMENTS

NORMAL OR STANDARD TECHNICAL DATA

- ★ The technical data of follow table are referred to a machine with max 500 kg shovel bucket, 600 mm (max. 160 kg) backhoe bucket and standard arm (or telescopic arm) closed.

FOR MACHINE

Machine model				WB91R-2	
Classifi- cation	Check item	Test conditions	Unit	Standard value	Permissible value
Work equipment	Time lags	Measuring posture  • Engine speed: Min. • Oil temperature: 45 – 55°C • Put arm in horizontal position. Tilt back bucket cylinder and then extend it. Check the time passing between bucket stop at dead centre and the restart movement.	sec.	0	Max. 2
		Measuring posture  • Engine speed: Min. • Oil temperature: 45 – 55°C • Boom, arm and bucket fully retracted and putted in machine centre position. • Check the time necessary for outriggers to raise the machine from when they lean on level ground. • Check each outrigger at a time.		0	Max. 2

TESTING AND ADJUSTMENTS

NORMAL OR STANDARD TECHNICAL DATA

★ The technical data of follow table are refered to a machine with max 500 kg shovel bucket, 600 mm (max. 160 kg) backhoe bucket and standard arm (or telescopic arm) closed.

FOR MACHINE

WB93R-2					
Standard value	Permissible value				
0	Max. 2				
0	Max. 2				

TESTING AND ADJUSTMENTS

SPECIAL TOOLS

SPECIAL TOOLS

Measurement check point	Symbol		Code	Name	Q.ty	Note
Valve clearance	A	1	Commercially available	Feeler gauge	1	—
Compression pressure	B	1	ATR800280	Compression gauge	1	Kit Yanmar TOL-97190080
		2		Adapter	1	
Engine speed	C	1	Commercially available	Multiscale tachometer	1	20 - 4000 rpm
		2	ATR800060	Stroboscopic tachometer	1	6 - 30000 rpm
Oil and water temperature	D	1	Commercially available	Digital thermometer	1	−50 - 1200 °C
Hydraulic pressure	E	1	Commercially available	Pressure gauge	2	Full scale 60 bar
		2	Commercially available	Pressure gauge	1	Full scale 250 bar
		3	Commercially available	Pressure gauge	1	Full scale 400 bar
		4	Commercially available	Pressure gauge	1	Full scale 600 bar
		5	ATR800200	Servocontrol kit	1	0 – 1000 bar
		6		Differential digital pressure gauge		
	F	1	ATR800200	Flow-meter	1	Delivery 0 – 300 ℓ/min.
		2		Pipe fitting kit	1	—
Air bleeding	G	1	ATR201490	Tank cap	1	Pump air bleeding
Hand brake	L	1	Commercially available	Spring dynamometer	1	Full scale 20 kg
Air-conditioning unit	M	1	Commercially available	Maintenance station	1	For coolant R134a
		2	Commercially available	Thermometer-hygrometer	1	Sampling every 15 seconds
		3	Commercially available	Leak detector	1	For coolant R134a

MEASURING ENGINE SPEED

! When checking engine speed, be careful not to touch high temperature parts and not to get caught in rotating parts.

★ Check speed when following condition are reached:

- Engine water cooling temperature: 68 – 80 °C.
- Hydraulic oil temperature: 45 – 55 °C.

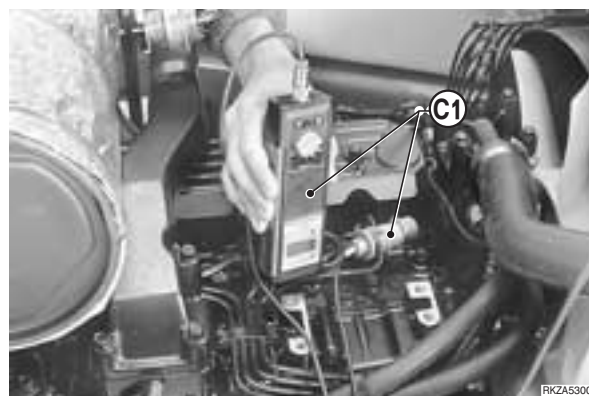
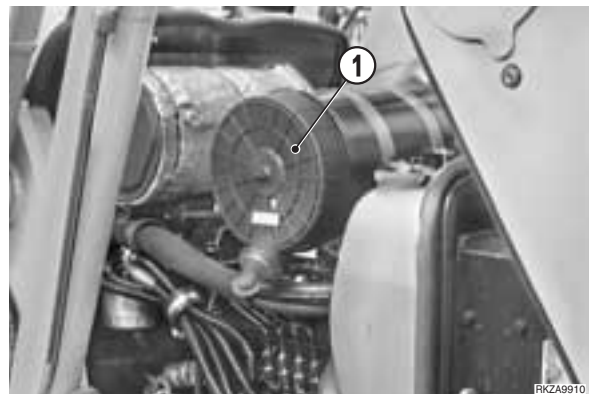
1 - Remove the air filter (1).

2 - Install and connect **C1** tachometer.

- ★ If using **C2** stroboscopic tachometer, mark a light notch on, engine pulley for an easier reading.

3 - Start engine and check:

- Low idling speed without load (accelerator pedal and hand accelerator released in «minimum» position).
- High idling speed without load (accelerator pedal at the travel end).
 - ★ Low idling speed: 1050 ± 50 rpm
 - ★ High idling speed: 2375 ± 50 rpm
- ★ If low and high idling speed with engine without load are not within permissible value, before going on with other operations, check accelerator pedal stoppers and wiring sheathings. (See «ACCELERATOR LEVER ADJUSTING»).



ADJUSTING VALVE CLEARANCE

- ★ Engine: in cold state.
- ★ Adjust clearance between valves and rocker levers as follows:

Unit: mm		
At cold engine	Engine	Intake-exhaust
	4D106-1FA	0.30±0.05
	S4D106-1FA	0.30±0.05

- ★ Firing order: 1-3-4-2-1..... at 180° step.
- ★ Normal rotation sense: counterclockwise from flywheel
- ★ The cylinder N° 1 is on the opposite fan side.

Adjusting procedure

- 1 - Remove air cleaner (1), muffler (2) and valves cover (3).
- 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 (4) and unscrew tappet (5) of about 1 turn.
 - ★ Check that valve insert (6) is laying flat on valve stem and that it is not worn askew.
 - If valve inserts (6) are damaged, replaced them with new ones.
 - 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 (5) until touching **A1** feeler gauge. Tight tappet (5) with lock nut (4).

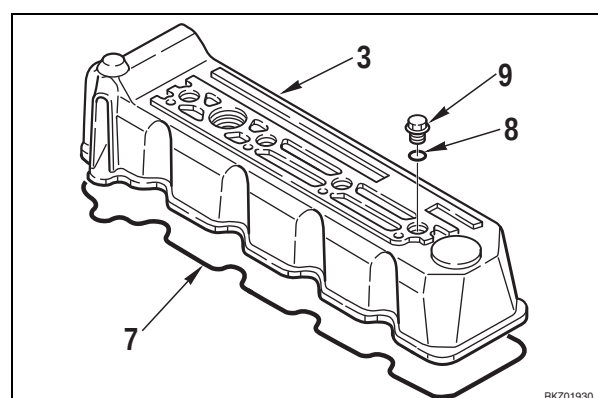
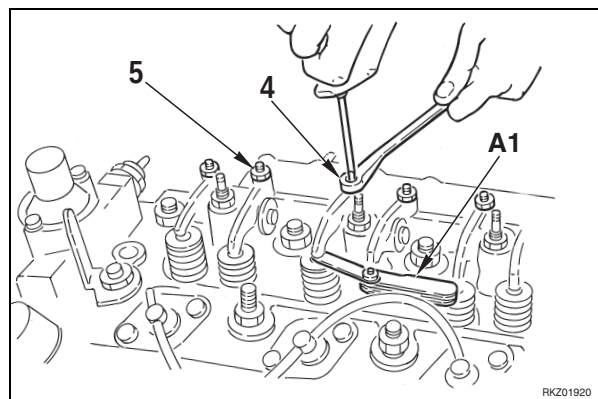
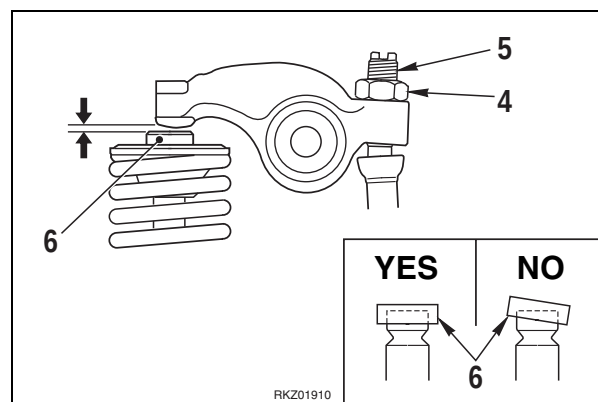
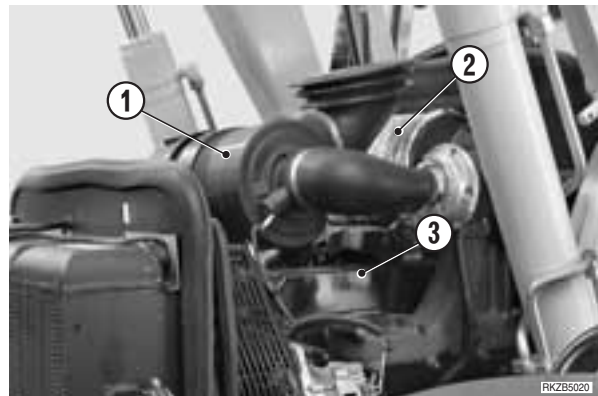
 Nut: 14.7 – 19.6 Nm

 - ★ 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 firing order.

Cover valves installation

- 1 - Check condition of cover valves (3), gasket (7), O-Rings (8) and lock nuts (9); clean carefully contact surface on cylinder head.
- 2 - Install valves cover (3), fit O-Rings (8) and lock nuts (9).

 Cover lock nut: 25±3 Nm



MEASURING COMPRESSION PRESSURE

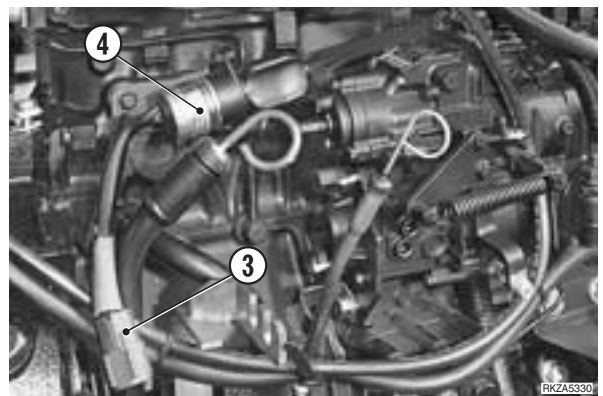
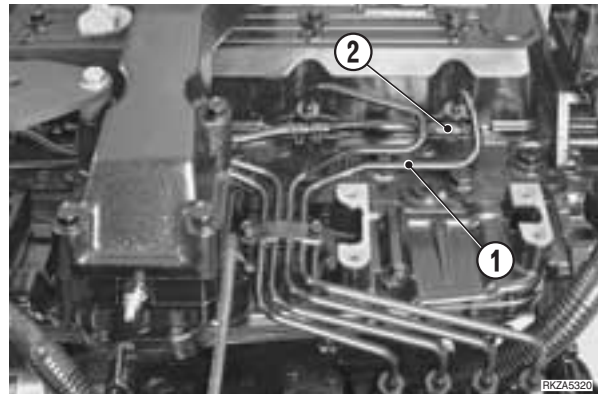
! When measuring the compression pressure be careful not to get caught in cooling fan, in the alternator belt or in other rotating parts.

For this measurement the engine should be up to working temperature. Take every precaution against burns. Check all cylinders.

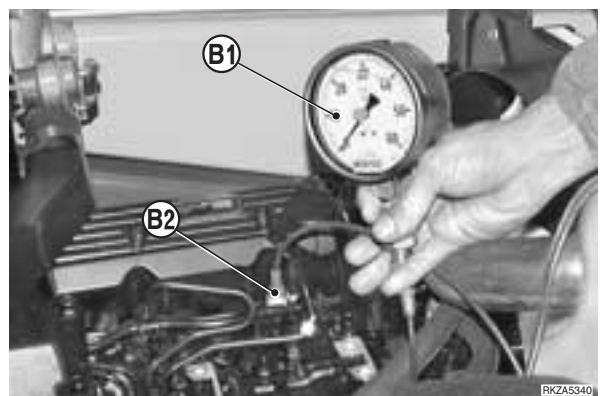
★ Test condition:

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

- 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.



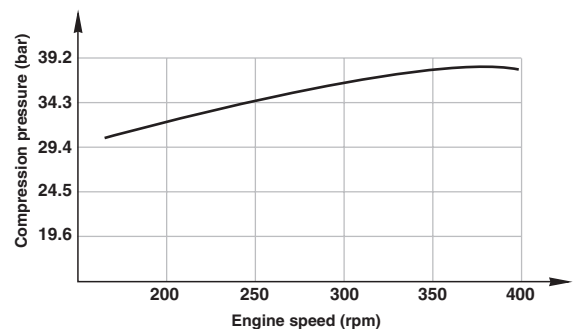
- 5 - Install **B2** adapter and connect **B1** pressure gauge.
 - ★ Check that seal is installed in the adapter and that it is not damaged.
- 6 - Crank engine with starting motor and measure compression pressure.
 - ★ Measure the compression pressure at the point where the pressure gauge indicator remains steady.
 - ★ When measuring the compression pressure, check also engine speed with **C2** stroboscopic tachometer; if speed is not within the specified range, refer to diagram.
 - ★ Compression value:
 - Normal: 34.3 ± 1 bar at 250 rpm
 - Minimum permissible: 27.5 ± 1 bar at 250 rpm
 - ★ Difference between cylinders: 2 – 2.9 bar



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

 Nm Nozzle holder collar bolts: 9.8 – 11.8 Nm

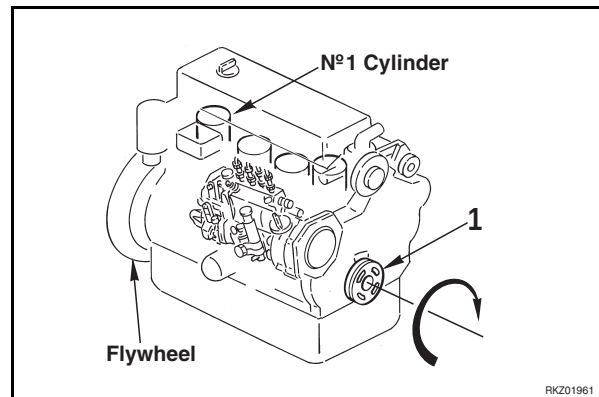
 Nm High pressure union: 19.6 – 24.5 Nm



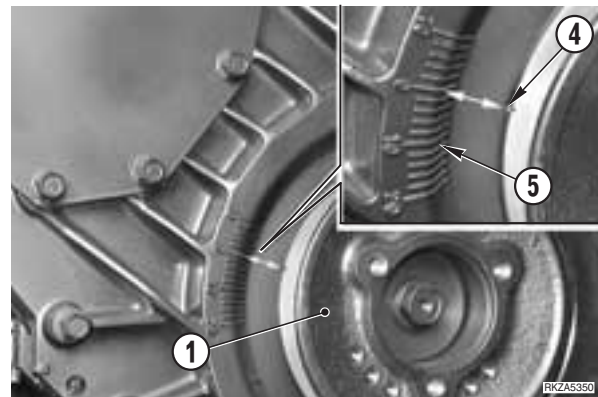
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TESTING AND ADJUSTING FUEL INJECTION TIMING

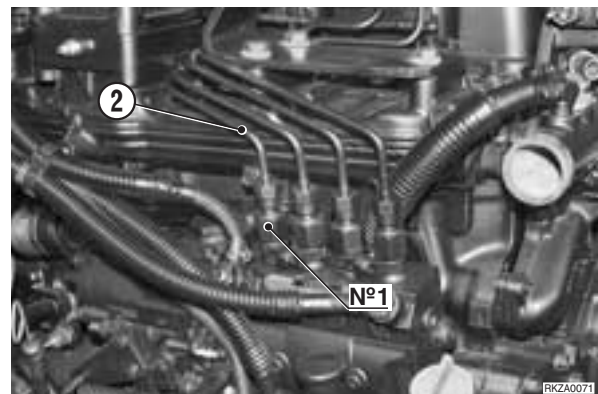
- ★ Check fuel injection timing of N.1 cylinder by means of N.1 delivery valve of injection pump.
 - ★ Cylinders are numbered 1-2-3-4 starting from flywheel side.
- 1 - Rotate crankshaft using engine pulley and put N. 1 cylinder piston at top dead centre (PMS).



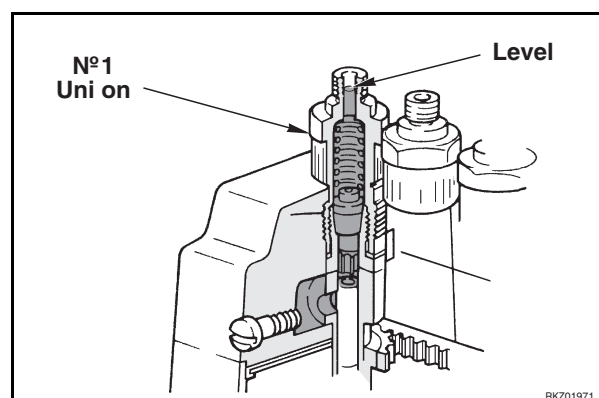
- ★ Top dead centre (PMS) is shown by notch (4) on pulley (1) positioned on «zero» of the scale (5) and by closing of both cylinder N. 1 valves.
- ★ If the notch (4) of pulley (1) is in «zero» position on the scale (5) but cylinders N. 1 valves are not closed, rotate the crankshaft of 1 turn.
- ★ After recognition of PMS, rotate the crankshaft in counterclockwise direction (from pulley side view) of about 20°.



- 2 - Disconnect cylinder N.1 high pressure pipe (2) from injection pump.
- 3 - Rotate crankshaft slowly in clockwise direction from pulley side view, checking fuel level into the N. 1 delivery of injection pump.



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



TESTING AND ADJUSTMENTS

TESTING AND ADJUSTING FUEL INJECTION TIMING

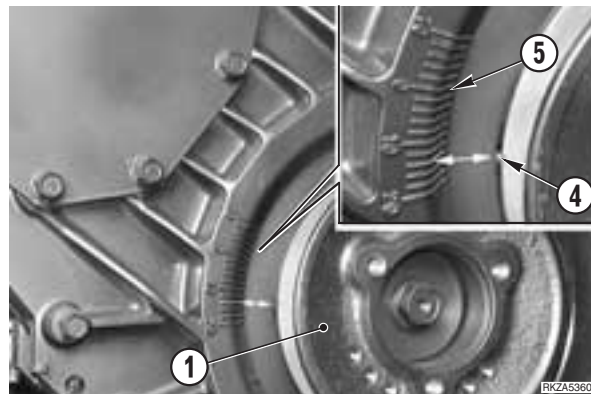
- 5 - Check notch (4) position on crankshaft pulley (1) compared with scale (5); reading value corresponds to angle of fuel injection timing.

★ Standard fuel injection timing:

4D106-1FA: $12.5^{\circ} \pm 1^{\circ}$

S4D106-1FA: $12.5^{\circ} \pm 1^{\circ}$

NOTA. Repeat checking more than once.



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

- To RETARD injection, rotate pump (6) toward external.
- To ADVANCE injection, rotate pump (6) toward cylinders block.

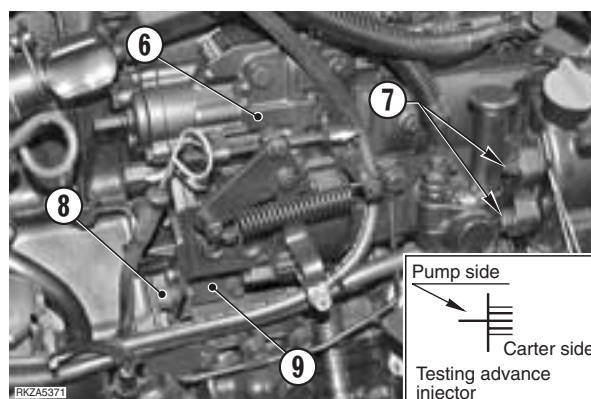
- 7 - Tight the pump lock nuts (7) at cylinder block and pump lock nut (8) at bracket (9).

 Nuts: 34.2 – 44.1 Nm

 Bracket lock nut: 44.1 – 53.9 Nm

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

 Delivery pipe union: 19.6 – 24.5 Nm



CHECKING AND TIGHTENING THE FAN - BELT

1. Tension check

- 1 - Push fan belt (1) at midway point between alternator (2) and pulley (3) operating water pump; check the deflection.

With a pressure of 10 kg, deflection should be of 10 – 15 mm; if this value is not reached, tension fan belt.

★ With new belt, deflection must be of 7 – 9 mm.



2. Fan belt tension

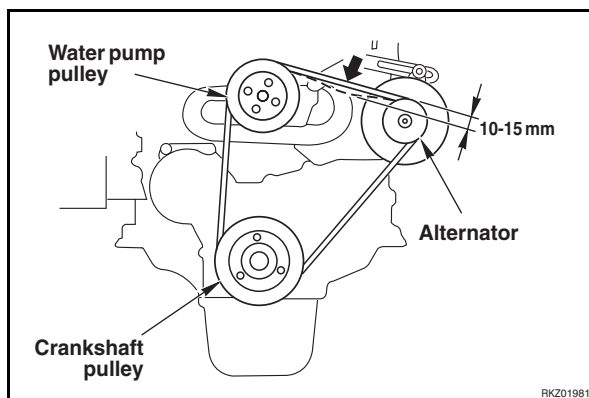
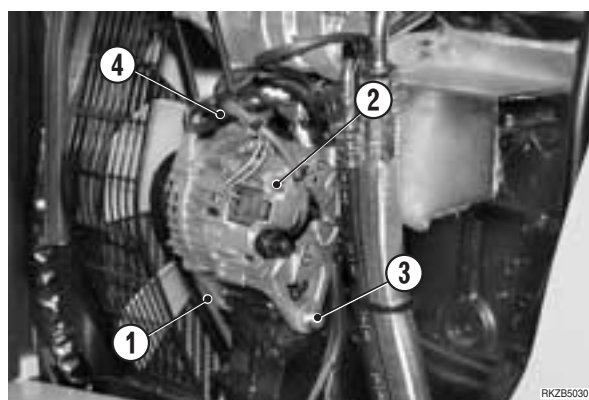
- 1 - Loosen mounting bolt (4) of the alternator (2) and mounting bolt (5) of adjustment plate.
- 2 - Rotate the alternator (2) to give correct tension to fan belt (1) and tighten mounting bolts (4) and (5).

- 3 - Check fan belt (1) tension.

★ If belt has been replaced, check tension again after about 20 operating hours.

 Bolts (4): 44.1 – 53.9 Nm

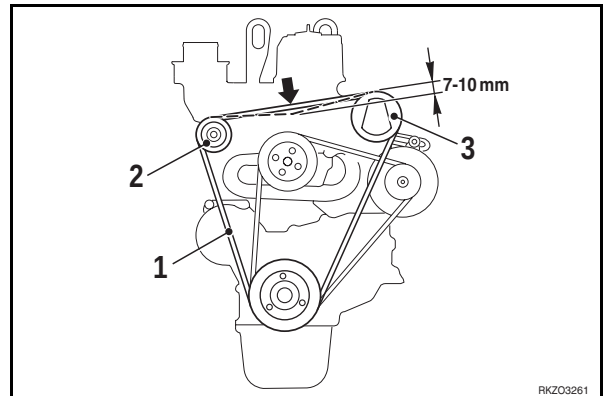
 Bolts (5): 22.5 – 28.4 Nm



CHECKING AND TIGHTENING THE COMPRESSOR FAN - BELT

1. Checking tension

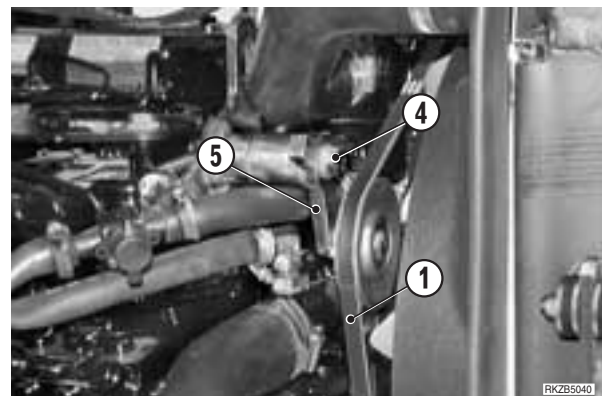
- 1 - Push fan belt (1) at midway point between compressor (2) and pulley (3). Check the deflection.
With a pressure of 10 kg, deflection should be of 7 – 10 mm;
★ With new belt, deflection must be of 4 – 6 mm.



2. Fan belt tension

- 1 - Loosen mounting bolt (4) of the eccentric (5).
- 2 - Apply tube on eccentric (5), give correct tension to fan belt and lock with bolt (4).
- 3 - Check fan belt (1) tension.
★ If belt has been replaced, check tension again after about 20 operating hours.

 Nm Bolt: 123 Nm



MEASURING ACCELERATOR PEDAL OPERATING TRAVEL AND ACCELERATOR LEVER

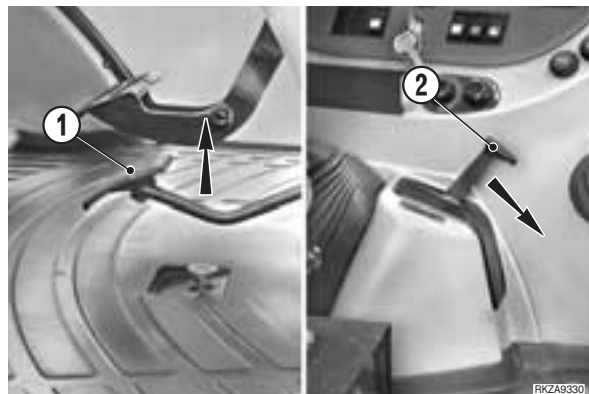
★ Work condition:

- Machine: in safety conditions.
- Engine stopped and at working temperature.
- Low and high idling speed: within permissible value.

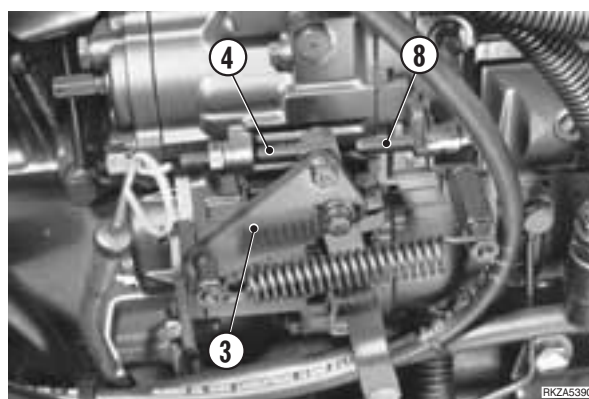
★ In order to check high speed engine idling, push the accelerator pedal (1) manually.

1. Accelerator pedal travel adjusting

1 - Make sure that accelerator pedal (1) is fully raised and accelerator lever (2) is at minimum stroke.

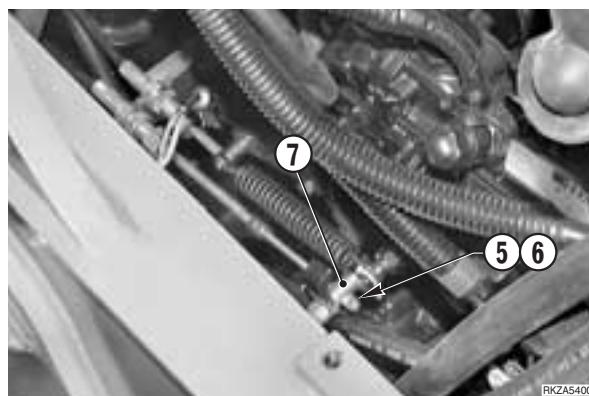


2 - Check that accelerator lever (3) is in contact with low idling speed adjusting screw (4).



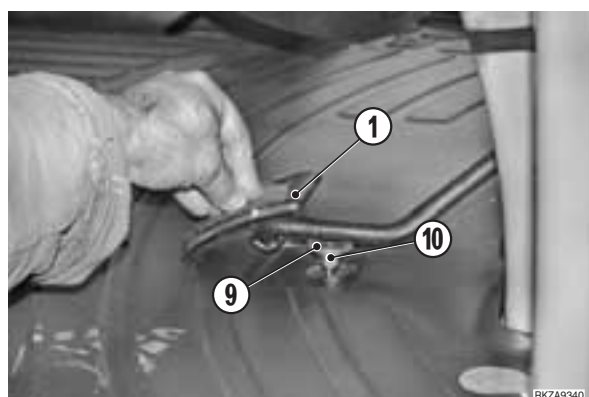
3 - Adjust nut (5) and lock nut (6) of accelerator pedal cables and hand accelerator at a distance of 0.2 – 0.3 mm from lever (7).

4 - Push accelerator pedal until accelerator lever (3) contacts the high idling adjusting screw (8).



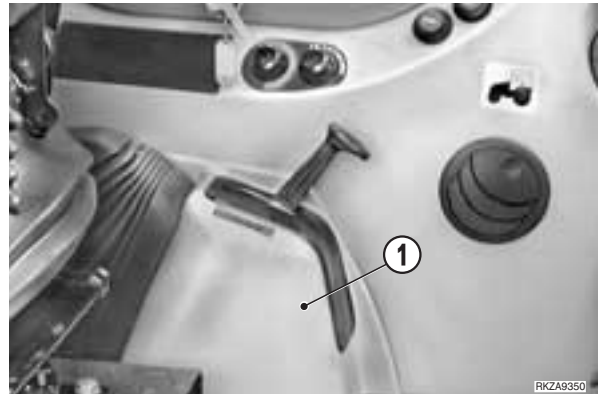
5 - Adjust the end travel stopper (9) of accelerator pedal (1) in this position and lock it with nut (10).

6 - Release the accelerator pedal (1).



2. Accelerator lever travel adjusting

1 - Remove mat and lateral cover (1).



2 - Loosen nut (2) and tight the end lever travel bolt (3) of some turns.

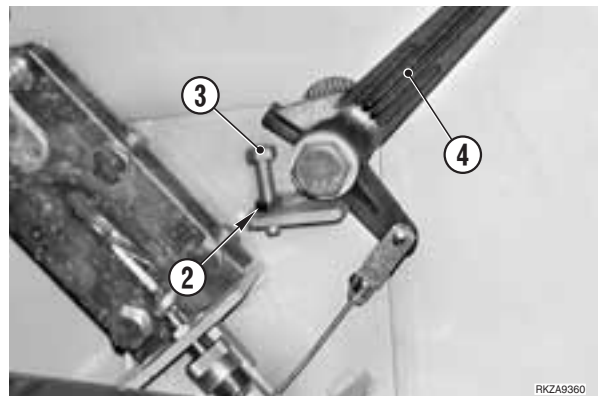
3 - Start engine and, with lever (4), bring it to the defined idling speed for hand accelerator.

★ Check using the stroboscopic tachometer **C2**.

★ Engine idling speed: 1900 ± 50 rpm

4 - Loosen end lever travel bolt (3) up to it is in contact with lever (4) and locked with nut (2).

5 - Bring engine at low idling and check accelerator lever idling speed again pushing lever at end stroke.



ADJUSTING BRAKE PEDAL TRAVEL, BRAKE ALIGNMENT, MICROSWITCHES

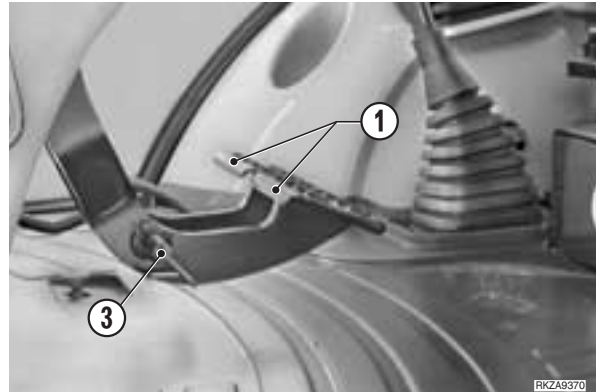
★ Working condition:

- Engine stopped
- Machine with attachments on ground level

1 - Check that pedal (1) is near to the stopper (2) and the pedals side are at "A" measure from cab level.
If necessary, adjust height acting on the stopper (2).

★ "A" measure: 313 ± 3 mm

★ Check that pin (3) can freely run and lock the pedals (1).



Master cylinder rod adjustment

2 - Loosen nut (4) locking the adjusting rod (5) and loosen until it touches the brake pump piston seat.

3 - Tighten the adjusting rod (5) of one turn (360°) and lock it with nut (4).

4 - Repeat operations 3. and 4. for the other pedal.

★ After tightened nuts (4), check that the adjusting rod (5) touch the brake pump piston seat simultaneously.

Microswitches adjustment

5 - Loosen microswitches (7) locking nuts (6).

6 - Adjust microswitches (7) paying attention to guarantee (at pedals in neutral position) a minimum clearance (about 1 mm) between microswitches body and the pedal.

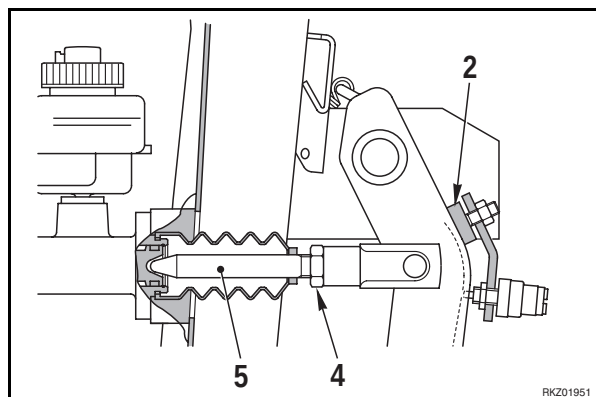
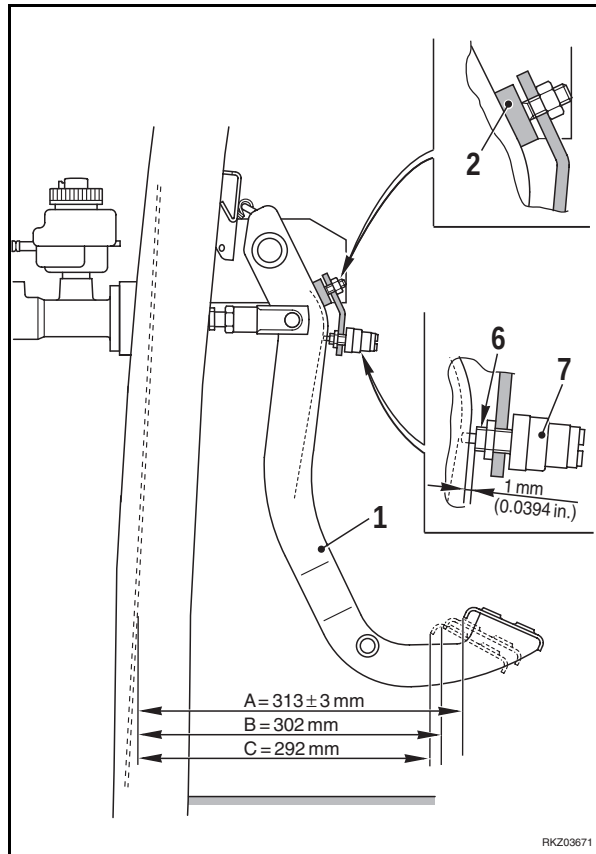
Checking adjustment

7 - Verify measure like shown in figure.

"A" measure: at pedal in neutral position

"B" measure: at master cylinder rod touching the pump

"C" measure: at pedal touching the microswitch



AIR BLEEDING - RELEASING RESIDUAL PRESSURE

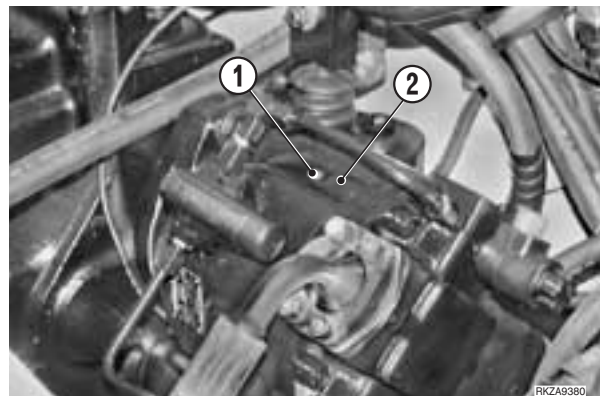
1. Air bleeding from pump

- ★ Air bleeding from pump (that means the filling of pump body) is necessary:

- 1 - When removing pump.
- 2 - When removing or replacing connection hoses between pump and hydraulic tank.
- 3 - When replacing hydraulic oil and hydraulic tank overhaul.

The air bleeding is obtained as follows:

- 1 - Carry out tank oil filling and close hydraulic tank with plug **G1**.
- 2 - Remove plug (1) of breather pipe (2).
- 3 - Connect plug **G1** to low pressure air compressed connection.
- 4 - Introduce slowly and intermittently air compressed in the hydraulic tank until when flows out oil without air bubbles.
 - ★ Max. pressure in tank: 0.5 bar
- 5 - Mount plug (1) and lock it.
- 6 - Depressurize slowly hydraulic tank, check level and, if necessary, refill tank oil at correct level.
- 7 - Start engine and run it for few minutes before bleeding air from the whole system.



2. Air bleeding from cylinders

- ★ When hydraulic cylinders or pipe fitting have been removed, it is necessary to bleed air before to use again the machine.
- ★ Operate on a movement at a time starting from main cylinders (lifting).

- 1 - Start engine and run it at high idling speed for about 5 min. to worm up oil and to pressurise hydraulic system.
- 2 - Return engine at low idling speed, extend and retract the interested piston 4-5 times.
 - ★ Extend, lower and retract pistons until about 100 mm from their end of stroke.
- 3 - Bring again the engine at high idling speed and repeat operation of point 2; return the engine at low idling speed and make a complete travel of piston until the hydraulic pump reaches its maximum pressure.
- 4 - Repeat above operation (starting from point 2) for all cylinders.

TESTING AND ADJUSTMENTS

AIR BLEEDING - RELEASING RESIDUAL PRESSURE

3. Air bleeding from oil tank

- 1 - Put the machine in oil level check position and remove the tank plug.
 - ★ If necessary add oil until reaching the correct level.
- 2 - After stopping the engine wait for some minutes, until air bubbles on oil surface are fully disappeared.
- 3 - Install tank plug.

4. Hydraulic oil tank pressurization

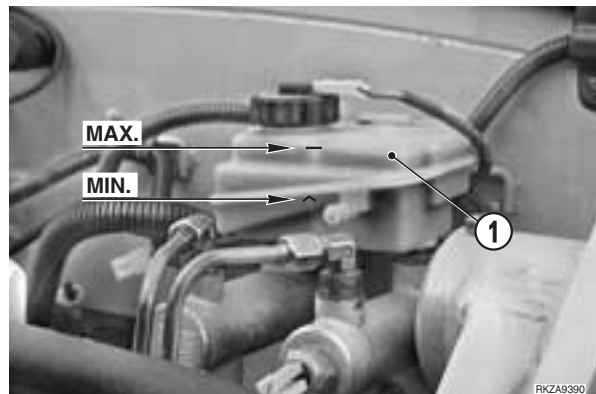
- 1 - With engine at low idling speed extend slowly, up to end of stroke, all cylinders.
- 2 - Stop the engine and remove tank plug.
- 3 - Check the condition of gasket and reassemble plug.
 - ★ Avoid to increase the engine speed before completing all air bleeding procedures and after the pressurization of oil tank.
 - ★ After air bleeding procedures, operate engine at low idling speed for about 10 minutes before starting to work.

5. Releasing residual pressure from the circuits

- 1 - Put work attachments on level ground, stop the engine.
- 2 - Move all control levers in all directions to release completely cylinders and main circuit remain pressure.
- 3 - Loosen slowly oil filler tank to remove remain pressure.

6. Air bleeding from braking circuit

- ★ Above operation is to be carried out every time maintenance is made on braking circuit to remove or replace a component, or when air entered into the circuit.
 - ★ Machine must be stopped with attachments on level ground.
- 1 - Make sure that oil in brake system tank (1) is at maximum level.
 - 2 - Remove pedal lock pin.



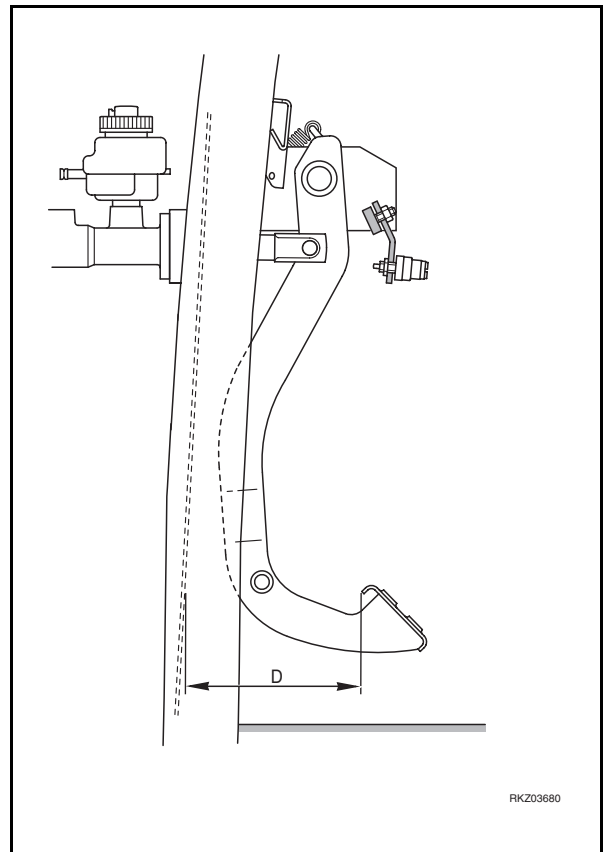
- 3 - Remove safety plugs and applied to bleeding screws (2) a vinyl hose to catch oil.
- 4 - Push brake pedals to bottom and, keeping it pushed, loosen bleeding screw (2) of the left braking unit until the pedals reach end of their stroke.
- 5 - Keeping pedal at the end stroke, tighten bleeding screw (2).



- 6 - Release brake pedals, wait for few seconds and repeat above operations two or three times until from bleeding screw, oil flows out without air bubbles.
- 7 - Repeat same operations for the right braking unit.
- 8 - Disconnect pedal lock pin.
- 9 - Push one brake pedal to bottom and, keeping it pushed, loosen bleeding screw (2) of one of two braking units until the pedal reaches end of its stroke.
 - ★ Check that oil flows out without air bubbles from bleeding screw (2).
- 10 - Repeat same operations for the other braking unit.
 - ★ Check frequently the oil level in the tank and carry out filling every time level approaches to minimum.
 - ★ After air bleeding apply on screws (2) safety plugs.

7. Checking air bleeding from braking circuit

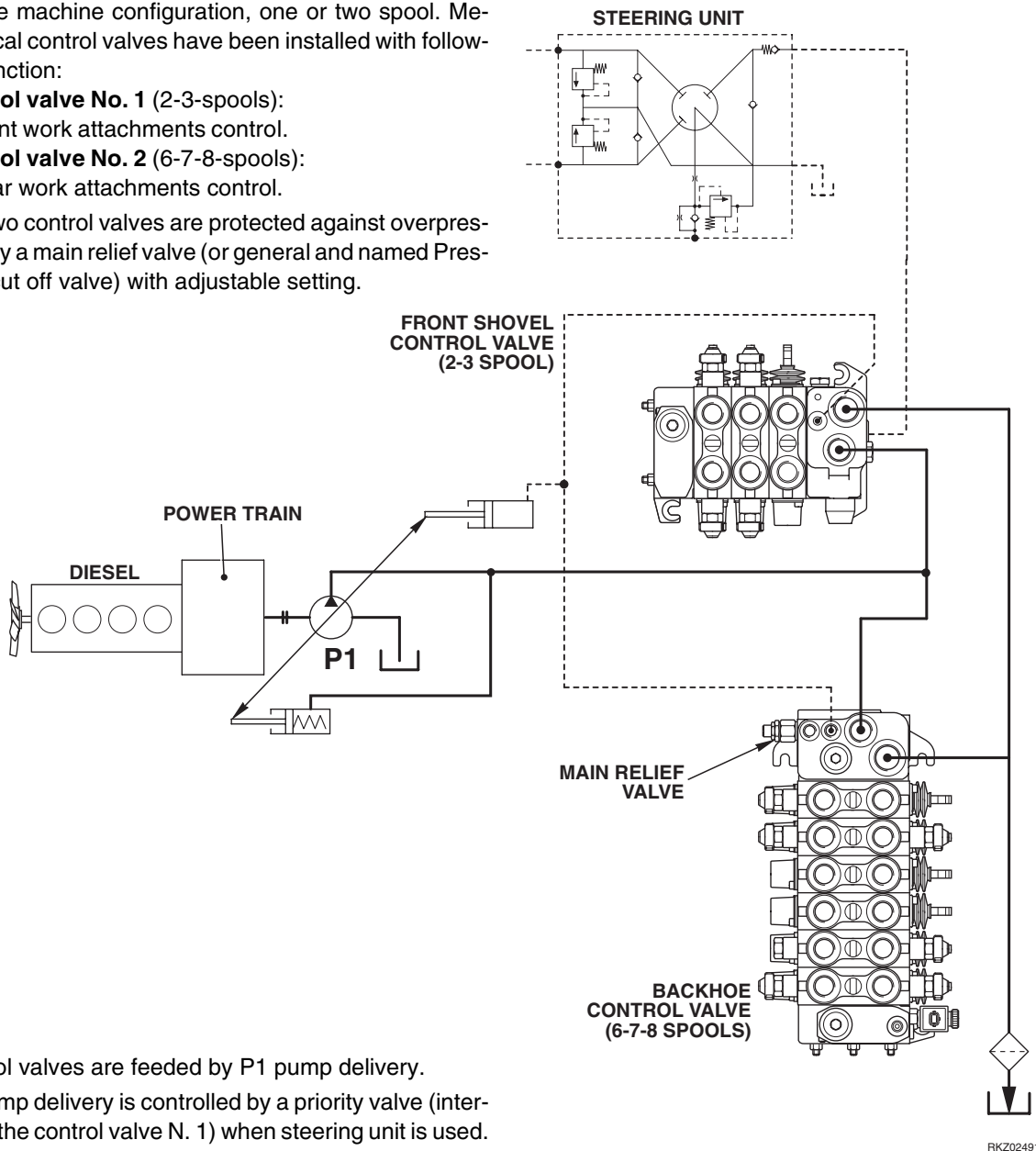
- 1 - Start engine and lower the backhoe outrigger and force them downwards in order to raise the rear wheels.
- 2 - Engage forward/reverse gear in order to move wheels.
- 3 - Return the machine in neutral and lower it and stop the engine.
- 4 - Apply 50 kg on the pedal and verify measure "D".
- 5 - Insert pedal lock pin and applying the same mass verify the measure "D".
 - ★ "D" measure with one pedal pushed: not less than 165 mm
 - ★ "D" measure with both pedal pushed: not less than 170 mm



CHECKING AND SETTING PRESSURE IN THE ATTACHMENTS HYDRAULIC CIRCUIT

1. Introduction

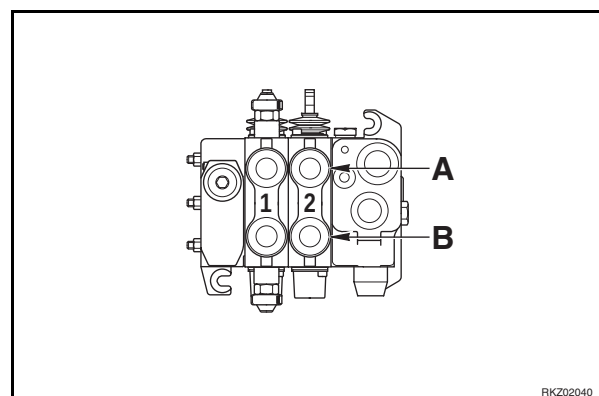
- On the machine configuration, one or two spool. Mechanical control valves have been installed with following function:
Control valve No. 1 (2-3-spools):
 for front work attachments control.
Control valve No. 2 (6-7-8-spools):
 for rear work attachments control.
- The two control valves are protected against overpressure by a main relief valve (or general and named Pressure cut off valve) with adjustable setting.



- Control valves are fed by P1 pump delivery.
- P1 pump delivery is controlled by a priority valve (internal to the control valve N. 1) when steering unit is used.
- Control valves include spools with following functions:

2-SPOOL CONTROL VALVE

Control	Port
Loader arm (lifting - lowering)	A1 - B1
Front bucket (curled - dump)	A2 - B2

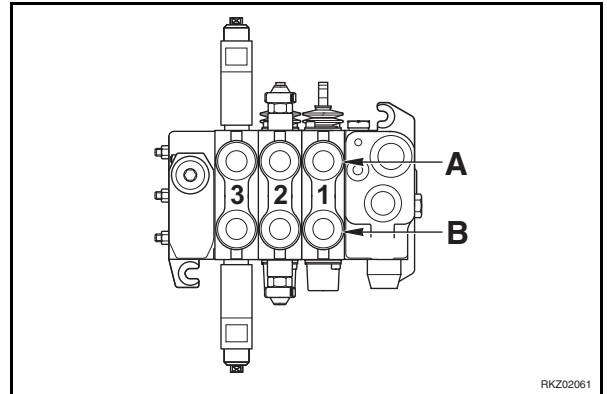


TESTING AND ADJUSTMENTS

CHECKING AND SETTING PRESSURE IN THE ATTACHMENTS HYDRAULIC CIRCUIT

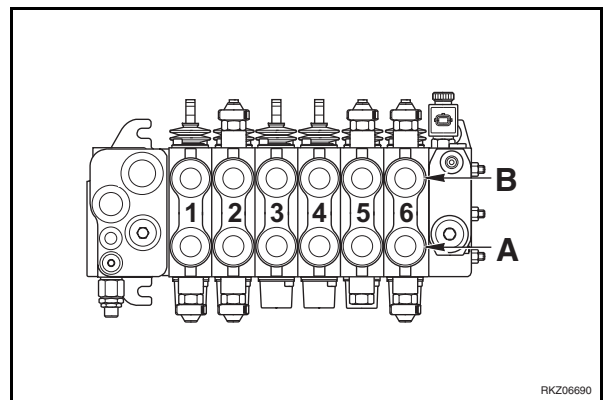
3-SPOOL CONTROL VALVE

Control	Port
Loader arm (lifting - lowering)	A1 - B1
Front bucket (curled - dump)	A2 - B2
Optional attachment	A3 - B3



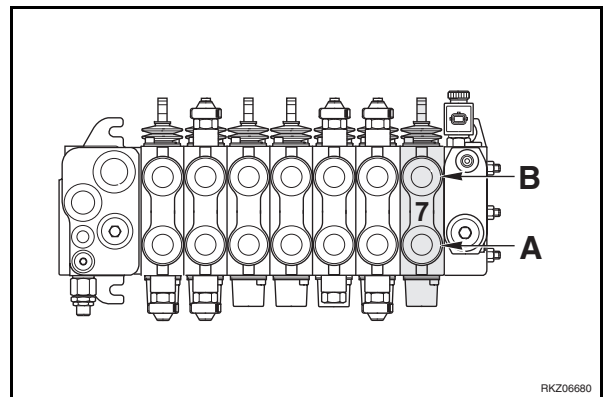
6-SPOOL CONTROL VALVE

Control	Port
Arm (closing - opening)	A1 - B1
Boom swing (left - right)	A2 - B2
L.H. outrigger (up - down)	A3 - B3
R.H. outrigger (up - down)	A4 - B4
Bucket (dump - curled)	A5 - B5
Boom (lifting - lowering)	A6 - B6



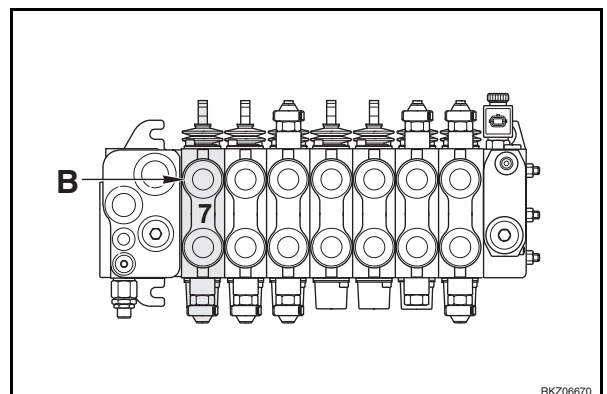
7-SPOOL CONTROL VALVE (For jig arm)

Control	Port
Jig arm (in - out)	A7 - B7



7-SPOOL CONTROL VALVE (For breaker - side digging boom)

Control	Port
Breaker (L.H. side)	B7
Side digging boom (left - right)	A7 - B7

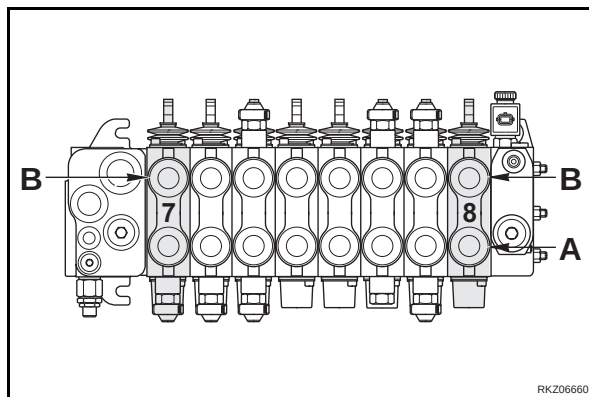


TESTING AND ADJUSTMENTS

CHECKING AND SETTING PRESSURE IN THE ATTACHMENTS HYDRAULIC CIRCUIT

8-SPOOL CONTROL VALVE (For breaker and jig arm)

Control	Port
Breaker (L.H. side)	B7
Jig arm (in - out)	A8 - B8



2. Testing and setting general valves (Pressure cut off valve)

★ Test condition:

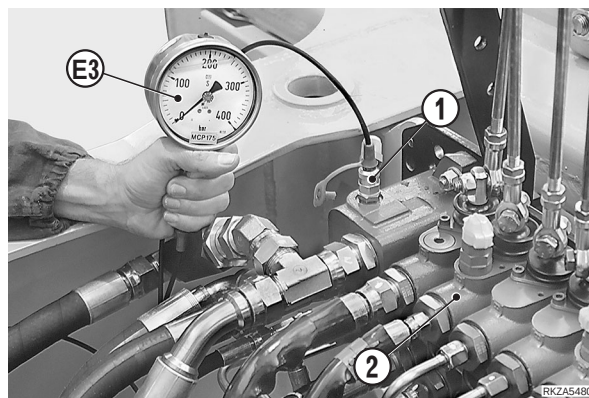
- Engine: at operating temperature
- Hydraulic oil: 45 – 55 °C
- Working brakes applied

1 - Connect the pressure gauge **E3** (400 bar) to the pressure adapter (1) of the front shovel control valve (2).

2 - Start the engine, bring the hand accelerator lever up to max speed and check the nominal pressure of the main relief valve (pressure cut-off valve) by forcing the front bucket to rise to the end of its stroke.

- ★ Nominal pressure: WB91R-2: 185±7bar
WB93R-2: 200±7 bar

- ★ If the main relief valve pressure do not correspond to the nominal values, they must be re-set (See «SETTING THE MAIN RELIEF VALVES AND THE REDUCING VALVES»).



3. Testing and setting secondary valves

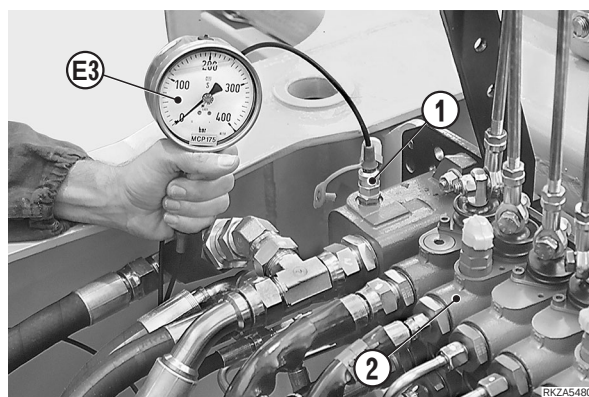
★ Test condition:

- Engine: at operating temperature.
- Hydraulic oil: 55 – 60 °C.
- Parking brake: applied.

- ★ The pressure readings are to be operated from the same check point.

1 - Connect the pressure gauge **E3** (400 bar) to the pressure adapter (3) of the backhoe control valve (4).

2 - Start the engine and bring the hand accelerator lever up to 1050 rpm.



TESTING AND ADJUSTMENTS

CHECKING AND SETTING PRESSURE IN THE ATTACHMENTS HYDRAULIC CIRCUIT

3 - Set the main relief valve (pressure cut-off valve) to a value 30 bar higher than the maximum pressure to be tested.

4 - Check the single movements pressure.

 The secondary valve of backhoe boom lifting, must be checked and **settled on test bench only**.

Setting 2-spool control valve secondary valves

Unit: bar

Cylinder and movement		Port	Setting WB91R-2	Setting WB93R-2
Front bucket	Lifting	A1	—	—
	Lowering	B1	—	—
Front bucket	Curled	A2	235±7	235±7
	Dump *	B2	175±7	175±7

* This setting can be carried without modifying the general valve pressure.

Setting 3-spool control valve secondary valves

Unit: bar

Cylinder and movement		Port	Setting WB91R-2	Setting WB93R-2
Front bucket	Lifting	A1	—	—
	Lowering	B1	—	—
Front bucket	Curled	A2	235±7	235±7
	Dump *	B2	175±7	175±7
Optional attachment		A3	235±7	235±7
		B3	235±7	235±7

* This setting can be carried without modifying the general valve pressure.

Setting 6-spool control valve secondary valves

Unit: bar

Cylinder and movement		Port	Setting WB91R-2	Setting WB93R-2
Arm	Closing	A1	235±7	235±7
	Opening	B1	—	—
Boom swing	Left	A2	245±7	245±7
	Right	B2	245±7	245±7
Right outrigger	Up	A3	—	—
	Down	B3	—	—
Left outrigger	Up	A4	—	—
	Down	B4	—	—
Bucket cylinder	Curled	A5	—	—
	Dump	B5	235±7	235±7
Boom cylinder	Lifting *	A6	305±7	305±7
	Lowering	B6	235±7	235±7

* The setting must be carried on test bench only.

TESTING AND ADJUSTMENTS**CHECKING AND SETTING PRESSURE IN THE ATTACHMENTS HYDRAULIC CIRCUIT**

**Nominal values of the reducing valves of the 7-8 element control valve
(for the other settings, please refer to the 6-element control valve).**

Unit: bar

No. of spools	Cylinder and movement		Port	Setting WB91R-2	Setting WB93R-2
7	Breaker	Right	A7	165±7	165±7
		Left *	B7	—	—
	Side digging boom	Right	A7	275±7	275±7
		Left	B7	275±7	275±7
	Jig arm	In	A7	—	—
		Out	B7	—	—
8	Breaker	Right	A7	165±7	—
		Left *	B7	—	—
	Jig arm	In	A8	—	—
		Out	B8	—	—

- * This setting can be carried without modifying the general valve pressure.
- ★ If valve setting pressure do not correspond to the indicated ones, provide to set them (see «SETTING MAIN AND SECONDARY VALVES»).

4 - Set the general valve pressure to the standard value.

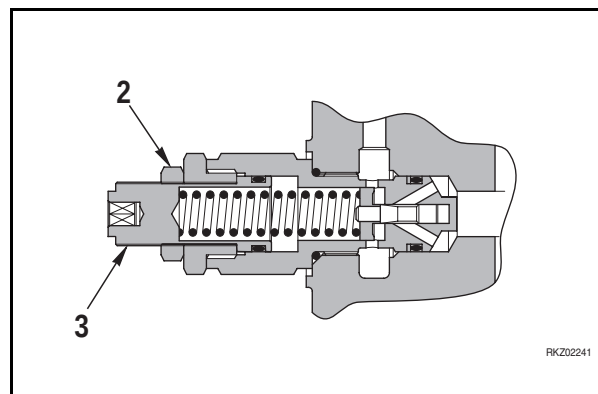
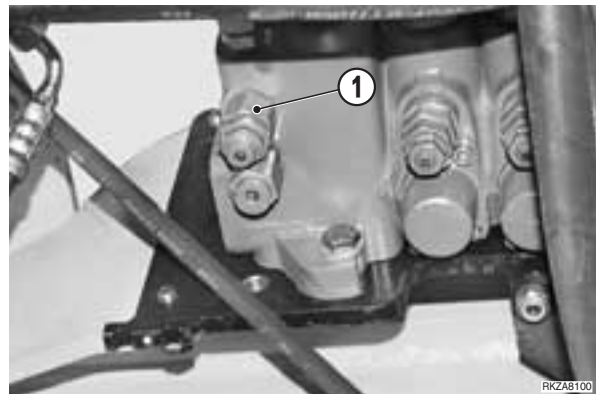
4. Main and secondary valves setting

• General valves (Pressure cut off valve (1))



For setting, prepare machine as per pressure testing.

- 1 - Loosen lock nut (2).
- 2 - Force to the end of its stroke the lever commanding whichever movement is being used for the tests.
- 3 - Adjust pressure with adjusting screw (2).
 - To INCREASE pressure, rotate in CLOCKWISE direction.
 - To DECREASE pressure, rotate in COUNTER-CLOCKWISE direction.
- 4 - Lock position with nut (2).



- **Secondary valves**

! For setting, prepare machine as per pressure testing.

- ★ This setting is valid for all the secondary valve and has to be carried forcing the movement to be checked at its end of stroke.

1 - Loosen lock nut (1).

2 - Adjust pressure with adjusting screw (2).

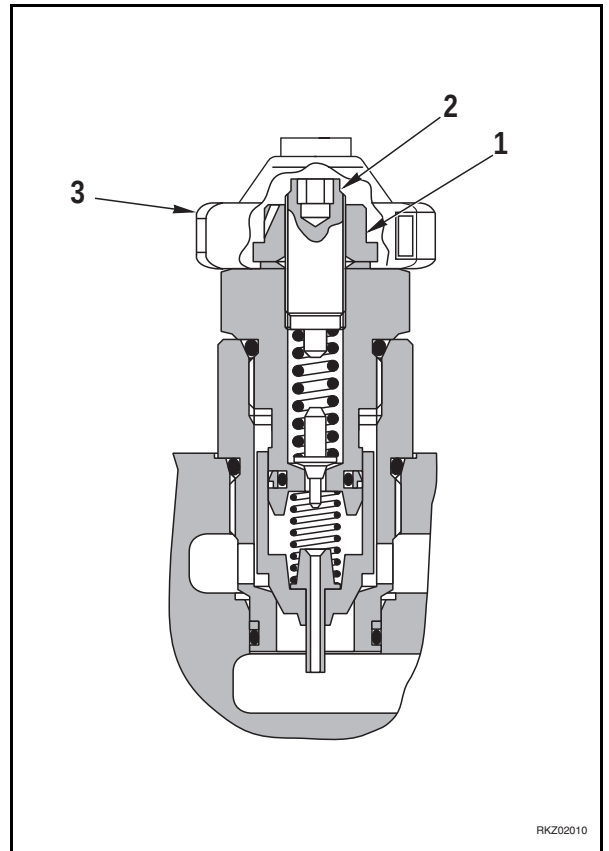
- To INCREASE pressure, rotate in CLOCKWISE direction.
- To DECREASE pressure, rotate in COUNTER-CLOCKWISE direction.

3 - Lock position with nut (1).

 Nm Lock nut: 10±1 Nm

! When terminated the setting, Apply safety plug (3) to avoid not authorised tamperings.

4 - Set the general valve pressure to the standard value.



TESTING AND ADJUSTING OF LOAD SENSING SIGNAL (LS VALVE)

★ Testing conditions:

- Engine: stopped but at working temperature.
- Hydraulic oil: 45 – 55 °C.
- Machine: front equipment on the ground, parking brake applied and boom and arm fully extended.
- Working mode: Power

1 - Disconnect hose (1) from the Load Sensing line. Install an tee and reconnect hose (1).

2 - Remove plug (2) and install a pressure adapter (M8x1).

3 - Connect the pressure gauge **E5** to adapter.

4 - Start the engine and bring it to 1050±50 rpm and, without any movement (lever in neutral position), read the ΔP pressure.

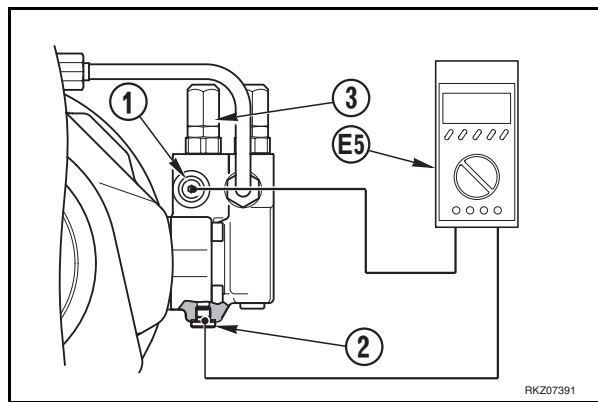
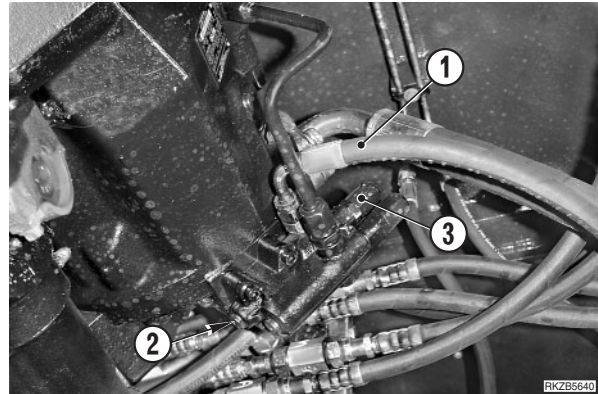
Normal value: 21±1 bar

- ★ If the ΔP value is not inside the limits, adjusting the Unloading valve.
(For details see «TESTING AND ADJUSTING OF UNLOADING VALVE»).

5 - Raise boom up to end of stroke and read the ΔP pressure.

Normal value: 18±1 bar

- ★ If the ΔP value is not inside the limits, carry out the Load Sensing valve (3) setting.



1. Adjusting of the Load Sensing valve

1 - Remove nut (4).

2 - Loosen nut (5).

3 - Adjust pressure using adjusting screw (6).

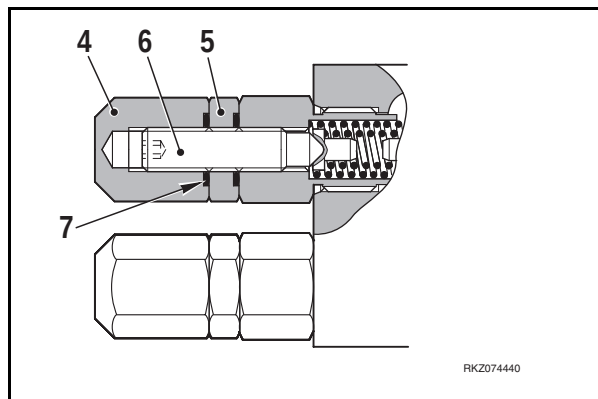
- To INCREASE pressure, rotate in CLOCKWISE direction.
- To DECREASE pressure, rotate in COUNTER-CLOCKWISE direction.

4 - Lock the position with nut (5).

 Lock nut: 21 Nm

5 - Check gasket (7) and mount nut (4).

 Nut: 21 Nm



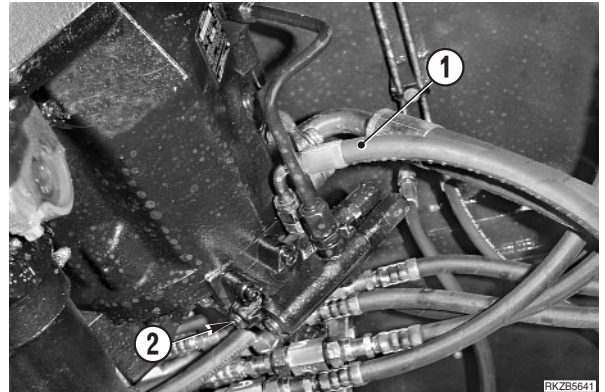
TESTING AND ADJUSTING OF UNLOADING VALVE

★ Testing conditions:

- Engine: stopped but at working temperature.
- Hydraulic oil: 45 – 55 °C.
- Machine: front equipment on the ground, parking brake applied and boom and arm fully extended.
- Working mode: Power

1 - Disconnect hose (1) from the Load Sensing line. Install an tee and reconnect hose (1).

2 - Remove plug (2) and install a pressure adapter (M8x1).

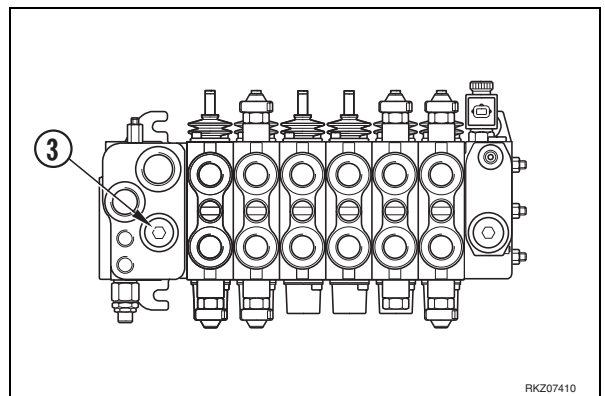
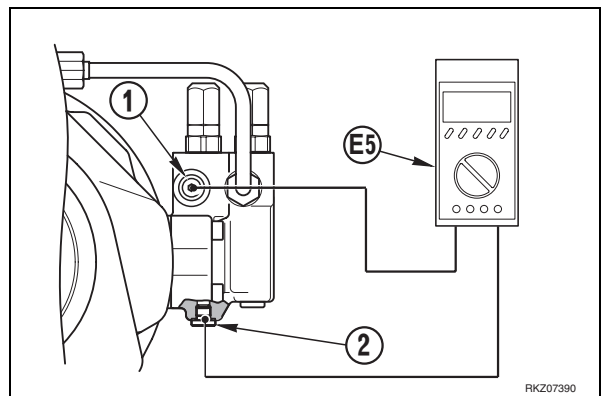


3 - Connect the pressure gauge **E5** to adapter.

4 - Start the engine and bring it to 1050±50 rpm and, without any movement (lever in neutral position), read the ΔP pressure.

Normal value: 21±1 bar

- ★ If the ΔP value is not inside the limits, adjusting the Unloading valve (3).



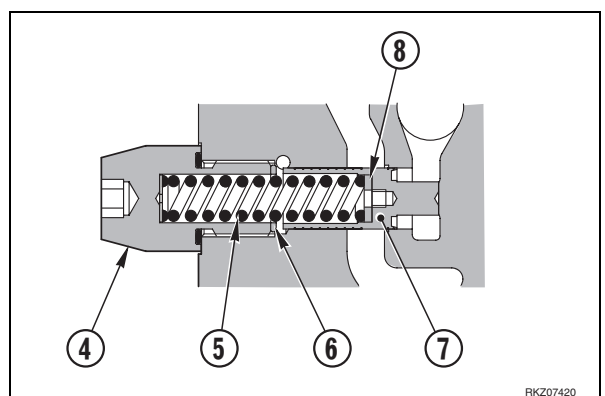
1. Adjusting the unloading valve

1 - Remove plug (4), spring (5), washers (6) and body valve (7).

2 - Place a shim (8) under the spring (5) and mount the valve.

- One shim of 1 mm increase pressure ΔP of 3 bar.

 Nm Plug: 100 Nm



CHECKING UNLOADING VALVE FUNCTIONALITY

★ Test condition:

- Engine: stopped but at working temperature.
- Low idling: in the permissible limit.
- Hydraulic oil: 45 – 55 °C.
- Machine: in safety condition, parking brake applied.
- Control valve lever at neutral position.

1 - Disconnect hose (1) from the Load Sensing line. Install an tee (2) and reconnect hose (1).

2 - Connect to tee (2) a pressure port and gauge **E1** (60 bar).

3 - Connect gauge **E1** (60 bar) to rear control valve pressure port (3).

4 - Start the engine at low idling and without any movement check pressure on both gauges.

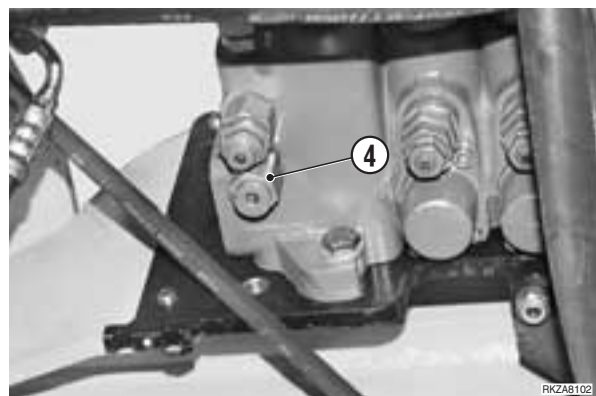
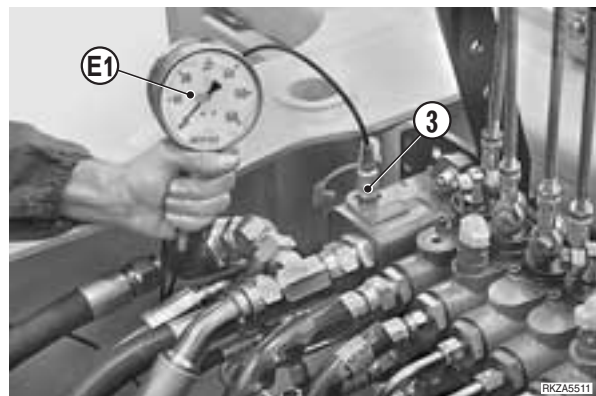
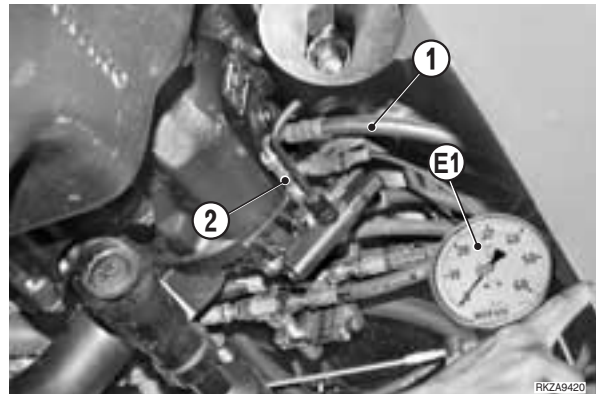
- ★ Normal pressure (P) control valve gauge: 27 ± 3 bar
- ★ Normal pressure Load Sensing line gauge (PLS): 6 ± 2 bar
(This value is due to the influence of the counter-pressure present in the steering circuit).
- ★ If any variations are found, they do not represent a problem provided that the difference of 21 ± 1 bar between the two readings is respected.

5 - If the difference between the two readings is higher than 21 ± 1 bar, stop the engine and release residual pressures.

6 - Thoroughly clean the valve (4) and re-install it.

 Valve: 20 Nm

7 - If, in spite of cleaning the valve (4), the value of 21 ± 1 bar still does not fall within the tolerance limits, install a new valve.



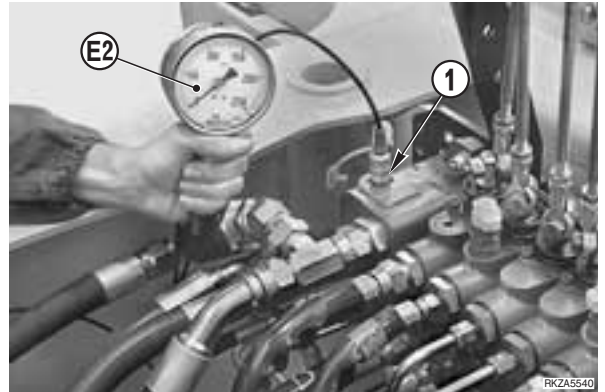
TESTING PRIORITY VALVE OPERATION

★ Test condition:

- Engine: operating temperature.
- Hydraulic oil: 55 – 60 °C.
- Parking brakes: applied.

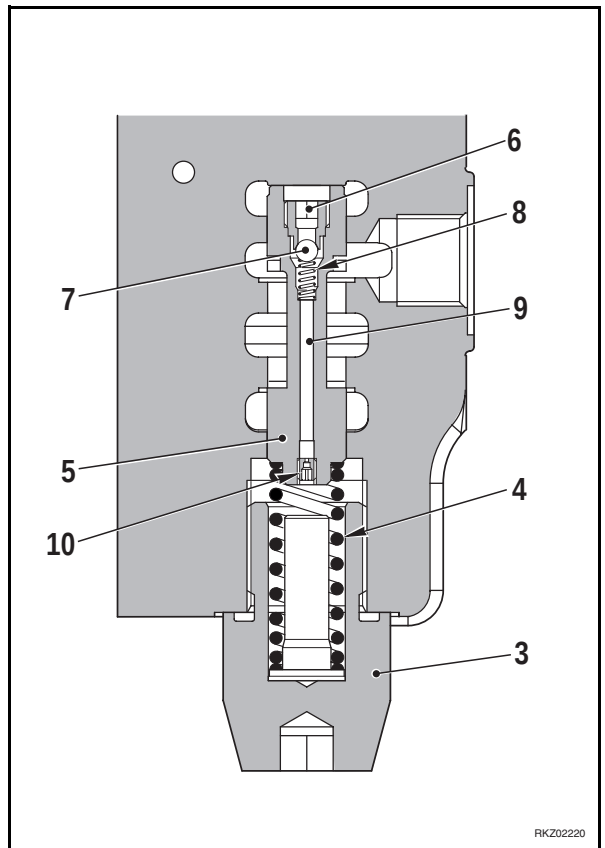
1. Testing priority valve operation

- 1 - Connect a pressure gauge **E2** (250 bar) to the pressure adapter (1) of the backhoe control valve.
- 2 - Start the engine and bring it to idle speed of 1500±50 rpm.
- 3 - Check on gauge **E2** pressure value with stopped steering wheel (21 bar).
- 4 - Start a slight steering and check that pressure increases.
- 5 - Continue the steering up to end of stroke and check that, forcing the steering wheel, pressure increases till normal value.
 - ★ Normal pressure: 175±7 bar.
 - ★ If the pressure does not reach the normal value, reset the pressure of the steering unit
 - ★ If turning the steering wheel the pressure shown by gauge does not change and stress on steering wheel necessary to carry out steering is high, clean the priority valve (2).



2. Cleaning priority valve

- 1 - Remove priority valve plug (3), spring (4) and rod (5)
 - ★ Check and make notes on the direction of assembly.
- 2 - Dismantle the plug (6) and remove the ball (7) of the inside valve and the spring (8).
- 3 - Check that the hole (9) and the nozzle (10) are perfectly clean.
- 4 - Replace the spring (8), the ball (7) and the plug (6).
 -  Plug: Loctite 542
 -  Plug: 20 Nm
 - ★ Do not allow any Loctite to enter the hole (9).
 - ★ Remove all excess Loctite from the rod (5).
- 5 - Lubricate the rod (5) and mount it in its seating, ensuring that it slides freely.
- 6 - Insert the spring (4) and mount the plug (3).
 -  Plug: 100 Nm.
- 7 - Start the motor, execute several steering manoeuvres and, if the fault is not corrected, replace the complete steering column with a new one.



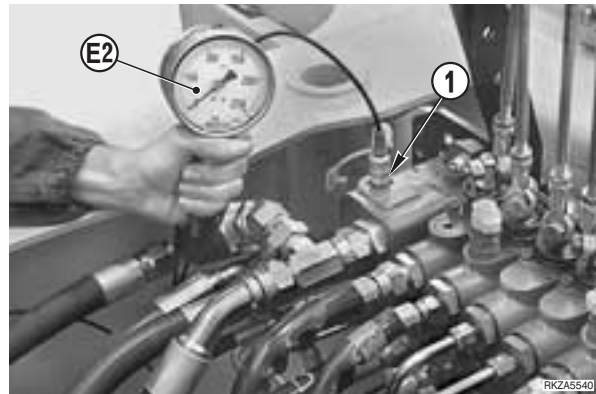
TESTING AND SETTING STEERING CONTROL SYSTEM PRESSURE

★ Test condition:

- Engine: operating temperature
- Hydraulic oil: 55 – 60 °C

Testing

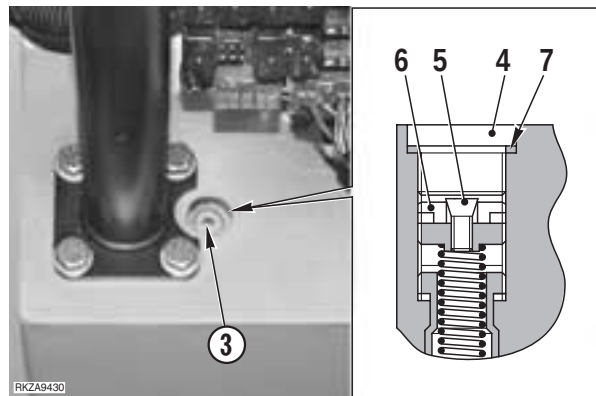
- 1 - Connect a pressure gauge **E2** (250 bar) to the pressure adapter (1) of the backhoe control valve.
- 2 - Start the engine and bring it to idle speed 1500 ± 50 rpm and carry out a total steering.
- 3 - Forcing the steering wheel at the end of stroke, check pressure.
 - ★ Normal pressure: 175 ± 7 bar
- 4 - Check for the other steering direction too.



Setting

If pressure is not within permissible value, carry out setting acting on upper valve (3) of the steering unit.

- 1 - Remove plug (4).
- 2 - Insert a wrench of 4 mm and loosen screw (5).
- 3 - Adjust pressure with screw (6).
 - To INCREASE pressure rotate in CLOCKWISE direction.
 - To DECREASE pressure rotate in COUNTER-CLOCKWISE direction.
- 4 - Stop engine, lock the adjusting screw (6) position tightening screw (5).
- 5 - Reassemble plug (4) checking that gasket (7) is on its seat.



TESTING BRAKE SYSTEM

★ Test condition:

- Engine: stopped
- Machine: on solid and level ground, with equipment raised and safety devices engaged.
- Brake pedals: independent, with the container level at maximum.

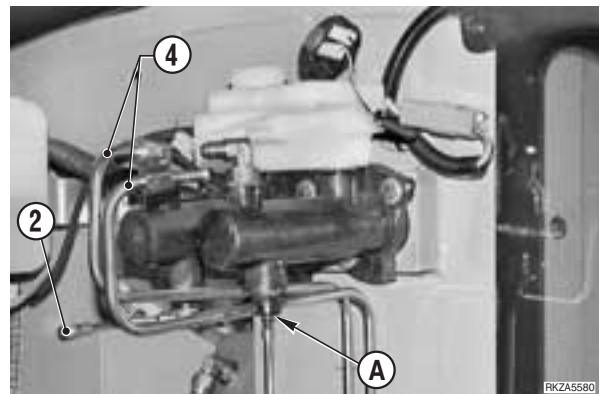
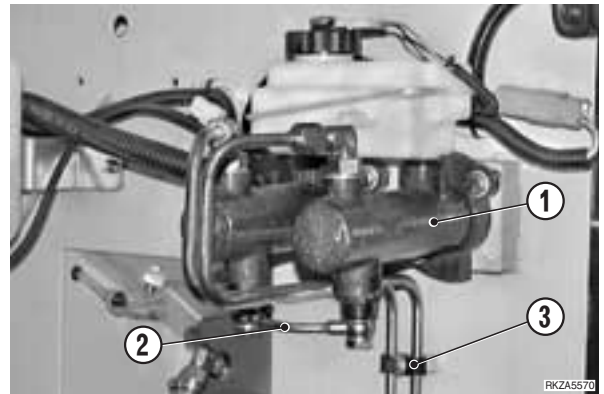
The system testing provides in two stages:

- 1 - Testing circuit and brake pump tightness.
- 2 - Leaktightness test of the braking group.

⚠ If both the tests give a positive result, the leaks must be sought in the pipelines of the braking system

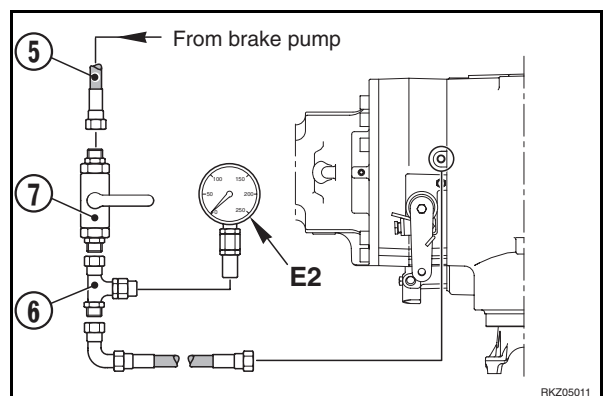
1. Testing circuit and brake pump tightness

- 1 - Disconnect the connecting pipe (2) of the equalizers from the brake pumps (1) of the circuit to be tested.
- 2 - Securely plug the equalizer orifice (plug A).
- 3 - Remove the clamp (3) and disconnect the delivery lines (4) from the pumps. Connect a pressure gauge **E2** (250 bar) to the pump (1) being tested.
- 4 - Move the brake pedal corresponding to the pump and bring the circuit up to a pressure of approximately 120 bar.
 - ★ Do not exceed maximum permissible value that is of 150 ± 5 bar.
- 5 - Keep the pedal pushed for at least 2 minutes and check that pedal pressure and position remain steady.
 - ★ If the position of the pedal must be changed to maintain pressure, the pressure loss is due to leakages inside the pump. This can be confirmed by checking the oil. If there are leakages, it will show signs of mixing.
- 6 - Repeat test for the other brake pump.



2. Testing braking group leaktightness

- 1 - Disconnect the delivery tube (5) of the braking group being tested.
- 2 - Connect the suitable tool between the delivery line (5) and the braking group.
 - ★ Check that the pressure adapter (6) is inserted between the braking group and the exclusion valve (7).
- 3 - Connect a pressure gauge **E2** (250 bar) to the pressure adapter of the suitable tool and open the cock (7).



4 - Operate brake pump to feed pressure into the circuit to maximum pressure of 150 ± 5 bar.

5 - Maintaining pressure, close the valve (7) to maintain pressure in the braking group being tested.

6 - Release the brake pedal and check for 2 minutes the pressure indicated by gauge **E2**.

★ If the pressure value shows a negative change, it means that the braking piston seals are defective.

 Further confirmation of the leak can also be obtained by an increase in the oil level in the axle, which leads to a mixing of the oils. Change all the sealing rings between the axle sections, and carry out a complete lubrication oil change.

7 - Repeat the test for the other braking group, following the same method.

8 - Re-assemble the braking circuit

 After testing and possible repairs, bleed air from brake units (see «AIR BLEEDING OF BRAKE CIRCUIT»).

CONTROL OF THE ENGINE SPEED UNDER LOAD

★ Test conditions:

- Engine: stopped but at working temperature.
- Hydraulic oil: 45 – 55 °C
- Power train oil: up to working temperature.
- Brake pedals: connected by a cotter-pin.
- Machine: on solid and level ground with the equipment raised and safety devices engaged.

Two tests must be performed:

- 1 - Speed test with the torque converter under stress.
- 2 - Speed test with the torque converter and the hydraulic system under stress.

- ★ The tests must be performed after a no-load test of the engine speed.
(For details, see «ENGINE SPEED TESTS»).

⚠ During the following tests, while accelerating the engine with the gear engaged, the condition of the brake disks can also be checked.

If, while force is being exerted on the brake pedals, the machine starts to travel (even slowly)

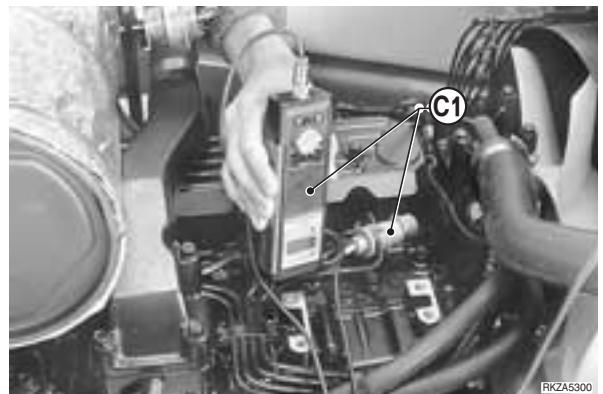
- a - Release the accelerator immediately and stop the engine.
- b - Check the wear on the brake disks and change them before completing the tests (See: «30. DISMANTLING AND ASSEMBLY - REAR AXLE»).

1. Preparing the machine

- 1 - Prepare the rev. counter **C1** to measure the engine rpm.

- ★ If mounting an electronic pressure transducer rev. counter on a diesel delivery line to the injection nozzles, make sure that it is placed far away from the clamp.
- ★ If using a stroboscopic tachometer **C2**, make a clearly visible notch on the engine pulley to facilitate the reading.

⚠ Make sure that the brake pedals are fastened together by the cotter pin (1).



2. Testing with the torque converter under stress

- 1 - Start the motor at MIN. Engage the highest FORWARD gear and brake hard.
- 2 - Keeping the machine on the brake, accelerate the engine gradually up to high idling and measure the speed reached.
 - ★ Speed: WB91R-2: 2100 ± 50 rpm
WB93R-2: 2275 ± 50 rpm
- 3 - Release the accelerator pedal and move on to the next test.

3. Testing the torque converter and hydraulic system under stress

- 1 - Start the motor at MIN. Engage the highest FORWARD gear and brake hard.
 - 2 - Keeping the machine on the brake, engage the upper FORWARD gear, accelerate the engine gradually and at the same time act on the front bucket closed (curled) command control valve lever, steer and maintain the steering at the end of stroke.
 - 3 - Once the maximum engine speed and the maximum pressure of the bucket circuit have been reached, measure the speed reached by the engine.
 - ★ Speed: WB91R-2: 1975 ± 50 rpm
WB93R-2: 2250 ± 50 rpm
- If the revs of the engine are higher than the permissible limit, in both tests, check the pressure of delivery to the converter and the clutch pressures. (See «TESTING PRESSURES OF THE POWER TRAIN GROUP»).
 - If the revs of the engine are lower than the permissible limit, check the condition of the air filter, and the conditions of the engine compression, the timing, the injection pump, and the valve clearances.

TESTING PRESSURES IN THE POWER TRAIN GROUP

The power train group can be used to perform pressure tests on the internal hydraulic circuit. These are useful for identifying malfunctions.

Specifically, the tests involve:

- 1 - Converter oil pressure.
- 2 - Clutch engagement pressures for both directions of travel.

★ Test conditions:

- Engine: stopped.
- Brake pedals: connected by a cotter pin.
- Machine: on solid and level ground with the equipment raised and safety devices engaged.

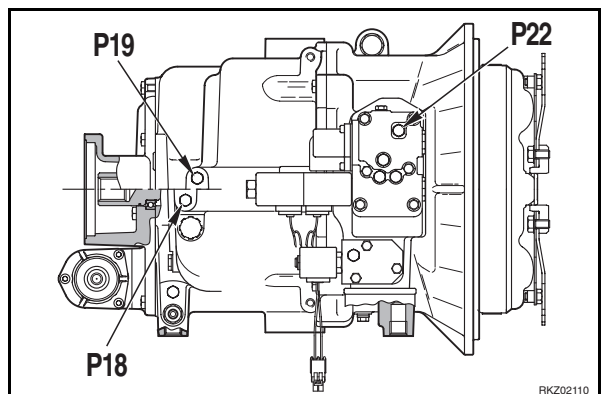
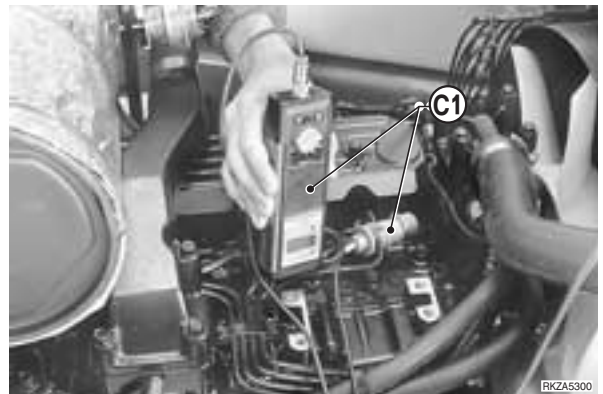
1. Preparing the machine

- 1 - Prepare the rev. counter **C1** to measure the engine rpm.
 - ★ If mounting an electronic pressure transducer rev. counter on a diesel delivery line to the injection nozzles, make sure that it is placed far away from the line-clamp.
 - ★ If using a stroboscopic tachometer **C2**, make a clearly visible notch on the engine pulley to facilitate the reading.

⚠ Make sure that the brake pedals are fastened together by the cotter pin (1).

2. Converter oil pressure

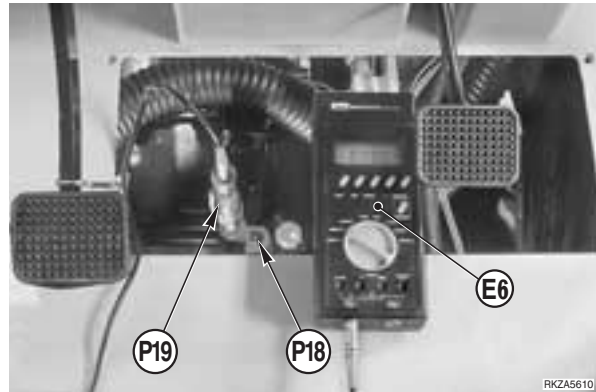
- 1 - Remove the plug (P22) and connect the pressure gauge **E6**.
- 2 - Start the engine and heat the engine and all the fluids up to working temperature. In particular make sure that the power train oil reaches a temperature of 80 ± 5 °C.
- 3 - With the engine at MIN, check the pressure on the pressure gauge **E6**.
 - ★ Normal pressure: Min. 0.5 bar
- 4 - Gradually increase the rev speed to MAX. Take a new reading from the pressure gauge **E6**.
 - ★ Normal pressure: 9 bar
- 5 - Bring the engine back to MIN and compare the pressure with the normal value.
 - ★ Normal pressure: Min. 0.5 bar
 - ★ If the maximum pressure value drops to below the permissible lower limit, the power train pump needs an overhaul.



3. Clutch engagement pressure

- 1 - Remove the cab floor.
- 2 - Remove the plug (P19) and connect the pressure gauge **E6**.
- 3 - Start the engine and heat the engine and all the fluids up to working temperature. In particular make sure that the power train oil reaches a temperature of 80 ± 5 °C.
- 4 - Bring the engine up to MIN (idling) and check the pressure on the pressure gauge **E6**.
 - ★ Normal pressure: Max. 0.3 bar
- 5 - Insert REVERSE gear and gradually increase the rev speed up to MAX. Take a new reading from the pressure gauge **E6**.
 - ★ Normal pressure: 11 – 13 bar
- 6 - Bring the engine back to MIN and the trasmission in neutral position; compare the pressure with the normal value.
 - ★ Normal pressure: Max. 0.3 bar
- 7 - Remove the pressure adapter and replace the plug (P19).

 Cap: 23 Nm
- 8 - Repeat the same test for the FORWARD gear, reading the pressure from the orifice protected by the plug (P18).
 - If the pressures are different for the two travel directions, there is a loss of pressure on the clutch piston with lower pressure.



TESTING THE CORRECT FUNCTIONING OF THE POWER TRAIN CLUTCHES

★ Test conditions:

- Engine: stopped.
- Brake pedals: connected by a cotter pin.
- Machine: on solid and level ground with the equipment raised and safety devices engaged.
- ★ This test must be performed after having checked the pressures of the power train group.

1. Preparation of the machine

1 - Prepare a rev. counter **C1** to measure the engine rpm.

- ★ If mounting an electronic pressure transducer rev. counter on a diesel delivery line to the injection nozzles, make sure that it is placed far away from the line-clamp.
- ★ If using a stroboscopic tachometer **C2**, make a clearly visible notch on the engine pulley to facilitate the reading.

⚠ Make sure that the brake pedals are fastened together by the cotter pin (1).

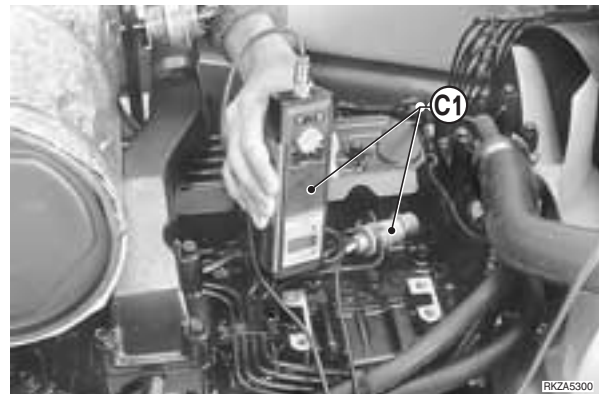
⚠ During the following tests, during the engine acceleration phase with the gear engaged, the condition of the brake disks can also be checked

If, while force is being exerted on the brake pedals, the machine starts to travel (even slowly):

- a - Release the accelerator immediately and stop the engine.
- b - Check the wear on the brake disks and change them before completing the tests.
(See: «30. DISMANTLING AND ASSEMBLY - REAR AXLE»).

2. Testing

- 1 - Start the engine and heat the engine and all the fluids up to working temperature. In particular make sure that the power train oil reaches a temperature of 80 ± 5 °C.
- 2 - With the engine in idling condition, accelerate to MAX. and check that in this condition the revs remain within permissible limits. (See «TESTING ENGINE SPEED»).
- 3 - Brake hard and bring the engine up to MAX.
- 4 - Maintaining the braking action and the acceleration, engage the FORWARD gear and check that the engine speed decreases until it is once again within permissible limits (See «TESTING THE ENGINE SPEED UNDER STRESS»).
- 5 - Repeat this test in REVERSE gear.
 - ★ If the revs are high than the permissible limits, the clutches are worn, and must be replaced.



ADJUSTING THE SENSOR FOR RETURN TO DIG DEVICE

★ Adjustment conditions:

- Machine: on solid and level ground.
- Engine: stopped.
- Hydraulic oil: 45 – 55 °C
- Parking brake: engaged.

1 - Rest the bucket on the ground, making sure that the bottom is perfectly parallel to the surface.



2 - Stop the engine and remove the sensor guard (1).



3 - Check that there is a distance 3–4 mm between the sensor (2) and the rod (3)

If necessary loosen the nuts (4) and adjust the distance, until the indicated measurement is obtained, and secure that position.

4 - Loosen the screw (5) and move the bracket (6) towards the rear, until the sensor is completely free of the rod (3).

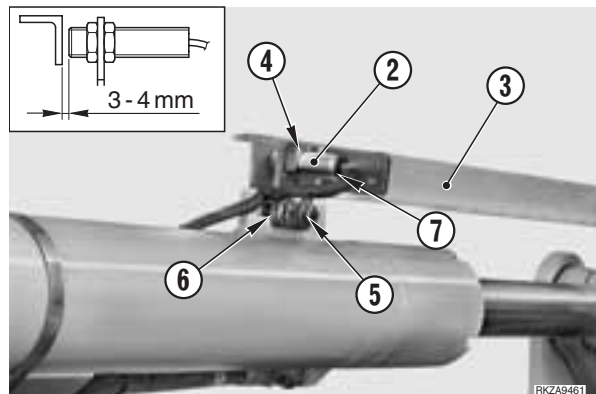
5 - Start the engine and allow to idle.

Adjust the position of the bracket (6) until the sensor (2) is engaged.

★ When the rod contacts the sensor, the warning lamp (7) will be activated.

6 - Lock bracket (6) position.

7 - Perform several tests by raising the bucket and simulating some dumping manoeuvres. If the bucket is able to rest flat on the ground, replace the sensor guard (1).



ANALYSIS OF CAUSES HYDRAULIC DRIFT

- ★ If working attachments have a hydraulic drift, it is necessary to check if reason is due to cylinders gaskets or to control valve.
- ★ All testing conditions:
 - Engine: at operating temperature
 - Hydraulic oil: 45 – 55 °C
 - Removal and installation of pipes only after remain pressure removal.
(See «REMOVAL OF REMAIN PRESSURE FROM CIRCUIT»)

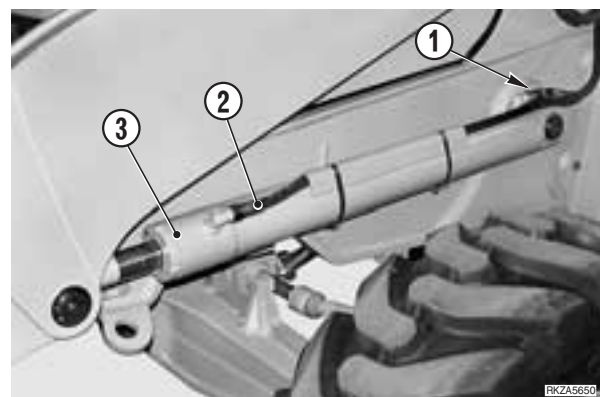
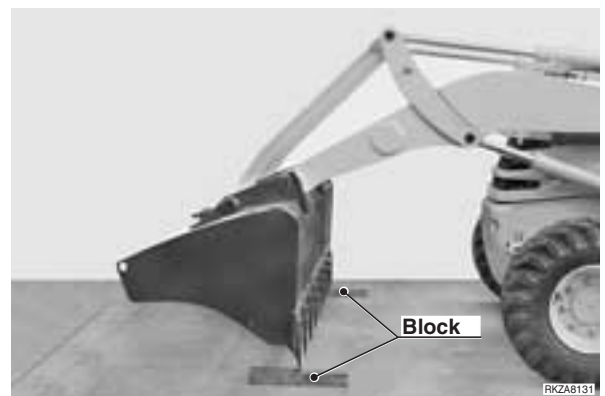
FRONT EQUIPMENT

1. Testing of front bucket lifting

- 1 - Put the machine with bucket teeth on blocks of about 10 cm and in vertical position compared to ground.
- 2 - Stop the engine and remove the remain hydraulic pressure.
- 3 - Disconnect pipes (1) and (2) from lift cylinders (3) and plug them.
- 4 - Plug cylinders, base side, and apply a temporary pipe, head side, to catch possible oil leakage.
- 5 - Start the engine and retract the bucket until to bring the teeth in tilt position of about 15°.
- 6 - Stop the engine and check bucket link position for 5 minutes.
 - If bucket link has no lowering movement, drift is due to control valve.

To check each cylinders, proceed as follow:

- 7 - Carry out with bucket a dump movement to let teeth lean on ground in vertical position.
- 8 - Remove from one of cylinders the plug as installed on base side at stage 4.
- 9 - Start the engine and retract the bucket until to bring teeth in tilt position of about 15° towards upper.
- 10 - Stop the engine and check the bucket position for 5 minutes.
 - If bucket link has a lowering movement, drift is due to gaskets of plugged cylinder.
- 11 - Repeat operation from stage 8 to stage 10 to check the other cylinder.



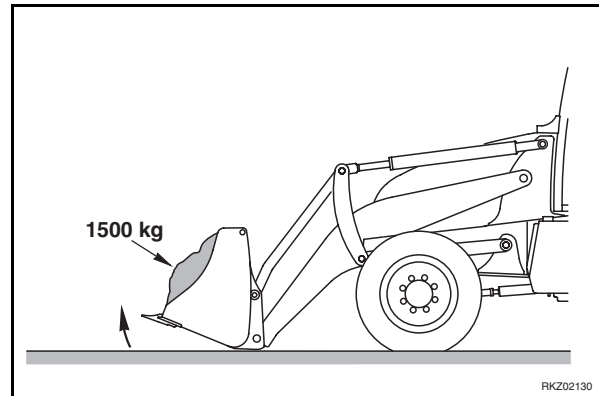
TESTING AND ADJUSTMENTS

ANALYSIS OF CAUSES HYDRAULIC DRIFT

2. Testing of front bucket dumping

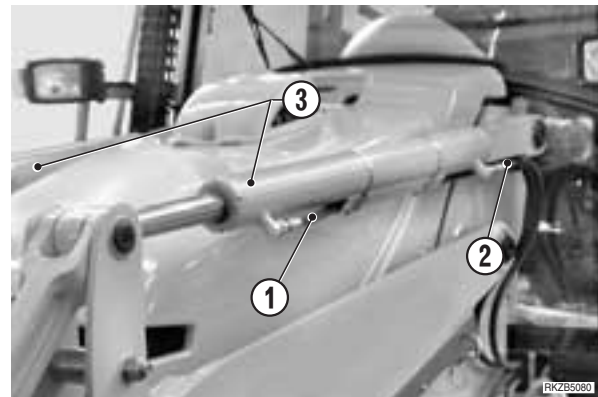
- 1 - Put the machine with bucket on level ground and teeth tilted of about 15°.

Put in the bucket a weight of 1500 kg.



- 2 - Disconnect pipes (1) and (2) from dump cylinder (3) and plug them to avoid impurity inlet.

- 3 - Plug dump cylinder hole, base side, and apply a temporary pipe on head side to catch possible oil leakage.



- 4 - Start the engine and raise the bucket up to the alignment of the bucket hinge and shovel arm hinge.

- 5 - Stop the engine and check bucket teeth position for 5 minutes.

- If bucket has no swing movement, drift is due to control valve.

To test the individual cylinders, proceed as follows:

- 6 - Lower the bucket to the ground.

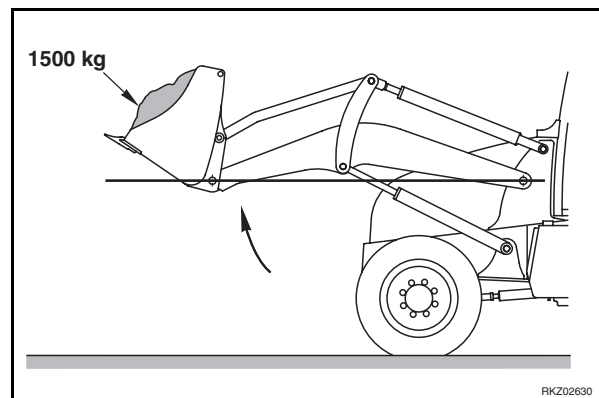
- 7 - Remove from one of the cylinders the plug fitted on the cylinder bottom side in Phase 3.

- 8 - Start the engine and raise the bucket as indicated in phase 4.

- 9 - Stop the engine and check the position of the bucket teeth for 5 minutes.

- If the bucket teeth turn, the drift is due to the gasket seals of the plugged cylinder.

- 10 - Repeat the operations from phase 6 to phase 9 in order to test the other cylinder.



TESTING AND ADJUSTMENTS

ANALYSIS OF CAUSES HYDRAULIC DRIFT

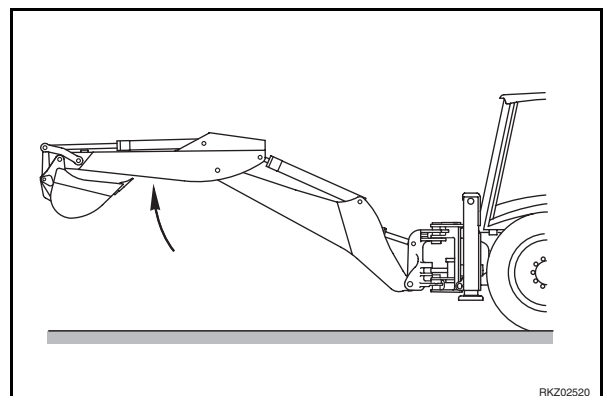
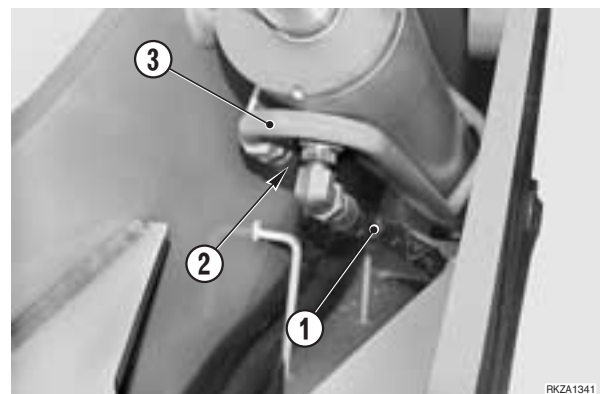
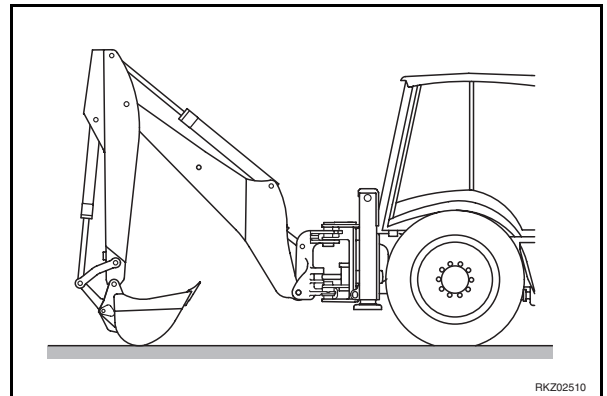
BACKHOE

★ Test condition:

- Backhoe aligned
- Lifted outriggers

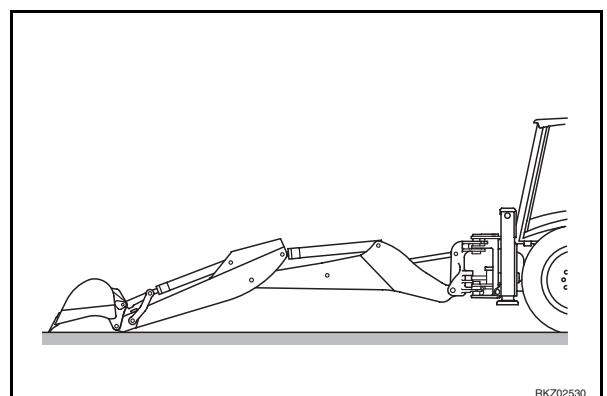
1. Boom testing

- 1 - Set the machine with arm in vertical position and with bucket on level ground leaned on the side.
- 2 - Stop the engine and remove the remain hydraulic pressure.
- 3 - Disconnect hoses (1) and (2) that feed cylinder (3).
- 4 - Plug the two hoses to avoid impurity inlet.
- 5 - Plug the cylinder head side.
- 6 - Apply a temporary pipe on pipe (3) base side to catch possible oil leakage.
- 7 - Start the engine and extend completely the arm.
- 8 - Stop the engine and check the boom position for 5 minutes.
 - If boom has a lowering movement, drift is due to cylinder gaskets.
 - If boom has no lowering movement, drift is due to control valve.



2. Arm testing

- 1 - Set the machine with arm fully extended and with bucket teeth on ground.
- 2 - Stop the engine and remove the remain hydraulic pressure.



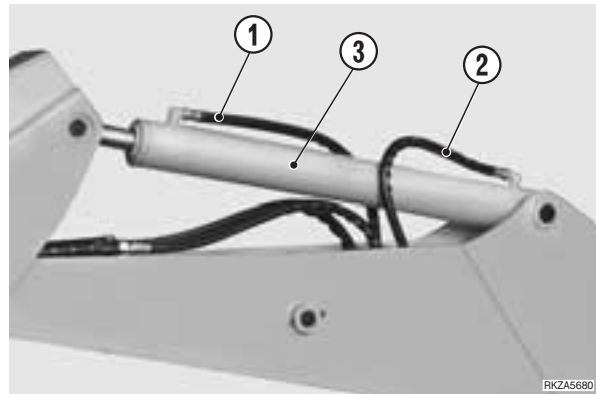
TESTING AND ADJUSTMENTS

ANALYSIS OF CAUSES HYDRAULIC DRIFT

3 - Disconnect pipes (1) and (2) pipes from arm cylinder (3) and plug them to avoid impurity inlet.

★ If safety valve is fitted, provide to removal.

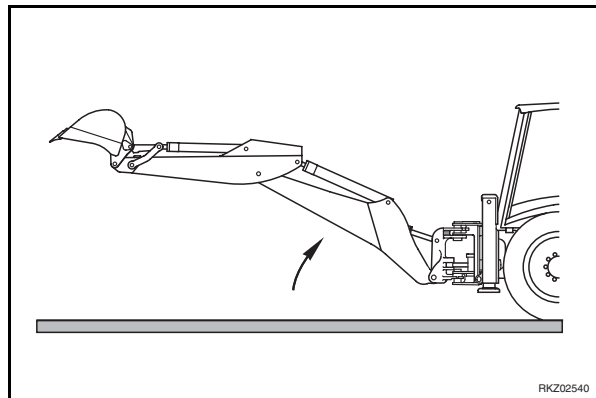
4 - Plug arm cylinder hole on head side and fit a temporary pipe on base side to catch possible oil leakage.



5 - Start the engine and raise the boom.

6 - Stop the engine and check the arm position for 5 minutes.

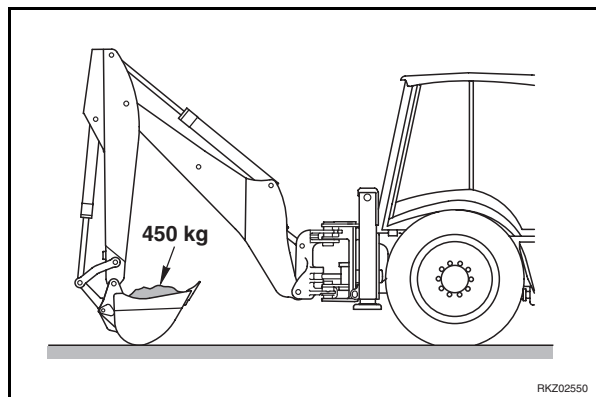
- If arm has a lowering movement, drift is due to cylinder gaskets.
- If arm has no movement, drift is due to control valve.



3. Bucket testing

1 - Set the machine with vertical arm and horizontal bucket leaned at level ground on the side.

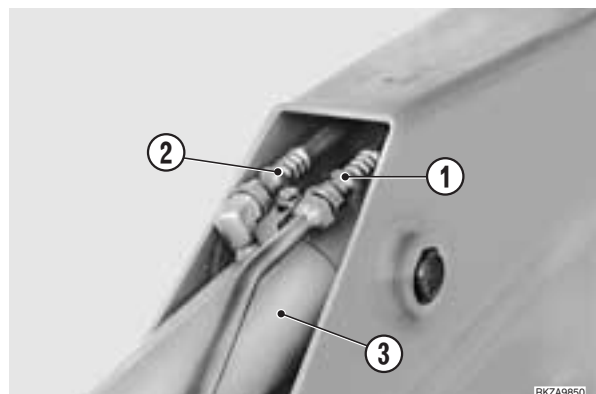
Put in the bucket a weight of 450 kg or fill it with earth.



2 - Stop the engine and remove the remain hydraulic pressures.

3 - Disconnect bucket cylinders (3) pipes (1) and (2) and plug them to avoid impurity inlet

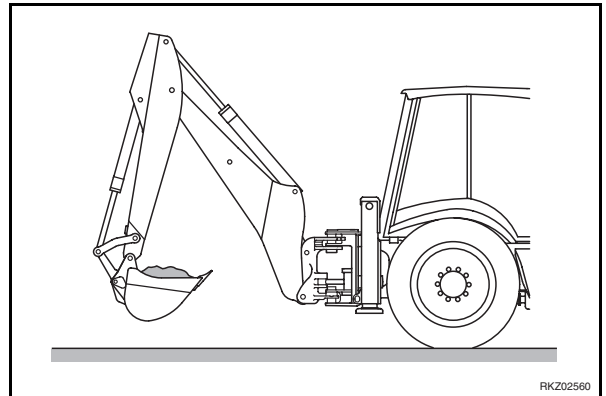
4 - Plug bucket cylinder hole on base side and fit a temporary pipe on head side to catch possible oil leakage.



TESTING AND ADJUSTMENTS

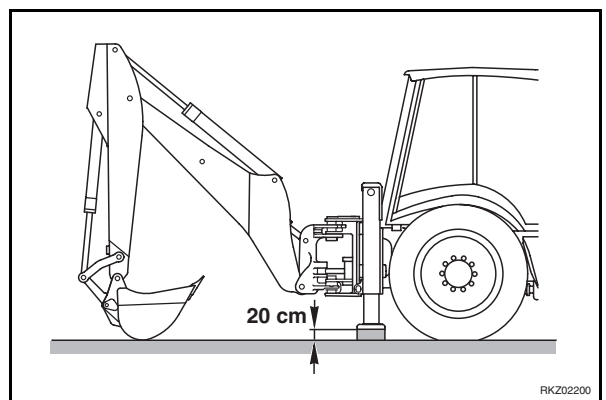
ANALYSIS OF CAUSES HYDRAULIC DRIFT

- 5 - Start the engine and raise the boom.
- 6 - Stop the engine and check the bucket position for 5 minutes.
 - If bucket has an opening movement, drift is due to cylinder gaskets.
 - If bucket has no movement, drift is due to control valve.

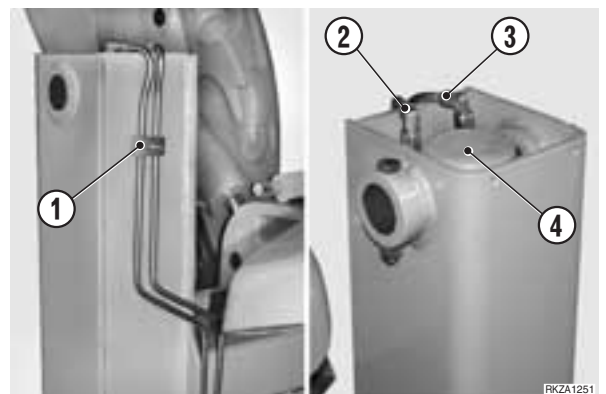


4. Outriggers testing

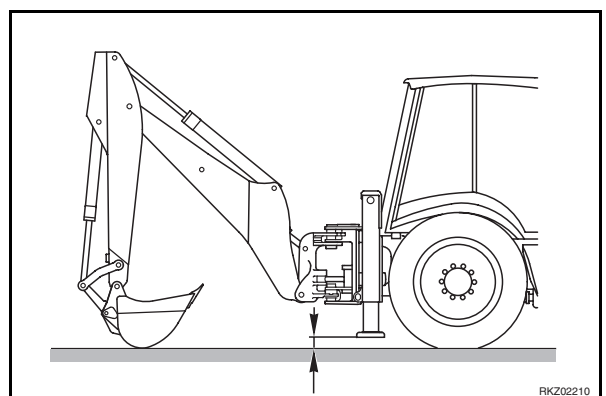
- 1 - Set machine with vertical arm and with bucket leaned at ground on the side.
- 2 - Put blocks of about 20 cm under the outriggers.
- 3 - Without forcing them, lower the outriggers onto the trestles.



- 4 - Stop the engine and release residual hydraulic pressures.
- 5 - Remove clamp (1) and disconnect from cylinders (4) the pipes (2) and (3).
- 6 - Plug cylinders pipes (2) base side and apply on head sides temporary pipes to catch possible oil leakage.
- 7 - Start the engine, use force on the boom to raise the machine, and remove the trestles supporting the outriggers.



- 8 - Lower the machine and stop the engine.
- 9 - Check the outriggers position for 5 minutes.
 - If one or both outriggers have a lowering movement, drift is due to single or both cylinders.
 - If there is no lowering, drift is due to control valve.



TESTING THE AIR-CONDITIONING UNIT

★ Test conditions:

- Machine on level ground with the working equipment raised and in safety conditions
- Parking brake engaged

1. Testing the working temperature

- 1 - Connect the maintenance station to the high pressure valve (H.P.) and the low pressure valve (L.P.)
- 2 - Start the engine and bring it up to a speed of 1500 rpm.
- 3 - Switch on the A/C unit using the switch in the cab.
- 4 - Select an intermediate ventilation speed inside the cab.
- 5 - Use the thermometer/hygrometer **M2** to check that the temperature inside the cab is equal to or lower than the ambient temperature.
 - ★ If the temperature of the cab is higher than the ambient temperature, open the doors and windows and wait until the cab temperature stabilizes at the outside value.
- 6 - Close the doors and windows and let the A/C unit operate in these conditions for 5 - 10 minutes.
- 7 - Use the thermometer **M2** to check the temperature of the air at the central outlets.
 - ★ Position the probe as close as possible to the air outlets.
- 8 - Compare the average value of the measured temperatures using the following table

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

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



TESTING AND ADJUSTMENTS**TESTING THE AIR-CONDITIONING UNIT****2. Checking the unit**

Check the unit after the point 1., 2., 3., 4. and 6. of the precedent paragraph.

A diagnosis of faults in the unit is based on the working pressures.

When the pressures do not fall within the values given in the following table, the causes must be sought by checking the high-pressure (H.P.) and low pressure (L.P.) pressure gauges.

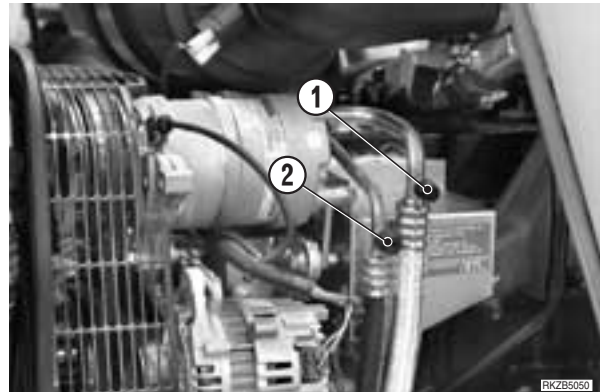
Outside Temperature (°C)	Unit with R134a.			
	L.P. (kg/cm ²)		H.P. (kg/cm ²)	
	Min.	Max	Min.	Max
20	1.2	2.5	6.0	9.0
25	1.0	2.5	7.5	10.5
30	1.1	2.4	9.5	13.0
35	1.3	2.4	12.0	15.5
40	1.5	1.8	18.0	18.8
45	1.8	1.9	21.5	22.0

The following conditions may be found:

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

EMPTYING THE AIR-CONDITIONING UNIT

- 1 - Connect the maintenance station **M1** to the service valves (1) and (2) and follow the specific maintenance station instructions relative to the drainage of the unit.
- 2 - Disconnect the group to be substituted or reconditioned immediately after switching off the maintenance station.
Plug the removed or disconnected connection tubes tightly and with a minimum of delay.
- 3 - Carefully check the quantity of anti-freeze oil recovered and contained in the disassembled parts, since the same quantity must be replaced when the air-conditioning unit is refilled.



TROUBLESHOOTING

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FRONT AXLE TROUBLESHOOTING

Wheel vibration; front tyre resistance; halfshaft breakage	
CAUSES	REMEDY
Incorrect installation	Correct installation
Defective axle	Replace the differential in case it does not survive any one of the test phases
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
Different rotation radius of the tyres	Replace the tyre or adjust pressure to have same radius on both tyre
Bent halfshaft	Replace halfshaft

Steering is difficult; vehicle goes straight while its turning.	
CAUSES	REMEDY
Incorrect installation	Correct installation
Defective axle	Replace the differential in case it does not survive any one of the test phases
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
Different rotation radius of the tyres	Replace the tyre or adjust pressure to have same radius on both tyre
Broken halfshaft	Replace halfshaft

No differential action; jamming while steering.	
CAUSES	REMEDY
Incorrect installation	Correct installation
Defective axle	Replace the differential in case it does not survive any one of the test phases
Broken halfshaft	Replace halfshaft
Bent halfshaft	Replace halfshaft

Excess of noise	
CAUSES	REMEDY
Incorrect installation	Correct installation
Defective axle	Replace the differential in case it does not survive any one of the test phases
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
Different rotation radius of the tyres	Replace the tyre or adjust pressure to have same radius on both tyre
Bent or broken halfshaft	Replace halfshaft
Incorrect wheel adjustment	Verify group integrity and wheel side bearings.
Contamination in the axle box or incorrect assembly of parts	Look for foreign particles. Check assembly of the various parts of the axle.

TROUBLESHOOTING

FRONT AXLE

Uneven wear of tyre	
CAUSES	REMEDY
Incorrect installation	Correct installation
Defective axle	Replace the differential in case it does not survive any one of the test phases
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
Different rotation radius of the tyres	Replace the tyre or adjust pressure to have same radius on both tyre
Bent or broken halfshaft	Replace halfshaft
Blocked halfshaft: • Abnormal functioning of the differential or breakage/ blockage of command device. • Vehicles with wide steering angle may proceed with kicks, have steering difficulty or cause pneumatic wearing at sharp turns.	• Verify assembly and all components • Reduce the steering angle to minimum and decelerate when the vehicle begins to kick.
Incorrect wheel adjustment	Verify group integrity and wheel side bearings.

Friction noise	
CAUSES	REMEDY
Incorrect installation	Correct installation
Defective axle	Replace the differential in case it does not survive any one of the test phases
Bent or broken halfshaft	Replace halfshaft
Spoiled or worn out axle parts	Check the condition of ring gear, pinion gear, bearings etc. Replace when ever necessary.
Contamination in the axle box or incorrect assembly of parts	Look for foreign particles. Check assembly of the various parts of the axle.
Incorrect adjustment of bevel gearset: Parts of the transmission worn out. (transmission gears, U joints, etc.)	Replace or adjust as required.

Vibration during forward drive, intermittent noise	
CAUSES	REMEDY
Incorrect installation	Correct installation
Defective axle	Replace the differential in case it does not survive any one of the test phases
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
Bent halfshaft	Replace halfshaft
Different rotation radius of the tyres	Replace the tyre or adjust pressure to have same radius on both tyre

TROUBLESHOOTING

FRONT AXLE

Noise while driving	
CAUSES	REMEDY
Excessive backlash between pinion and ring gear	Adjust
Worn out pinion and gear ring	Replace
Worn out pinion bearings	Replace
Pinion bearings loosened	Adjust
Excessive axial pinion backlash	Adjust
Worn out differential bearings	Replace
Differential bearings loosened	Adjust
Ring gear out of roundness	Replace
Low lubricant level	Oil level
Poor or wrong lubricant	Replace
Bent halfshaft	Replace

Noise while driving in neutral	
CAUSES	REMEDY
Noise coming from axle are usually heard when vehicle moves in neutral gear but are not loud.	Replace or adjust (see above)
Incorrect backlash between pinion and ring (sound heard while decelerating disappears while increasing the speed)	Replace
Pinion or input flange worn out	Adjust

Intermittent noise	
CAUSES	REMEDY
Ring gear damaged	Replace bevel gear set
Differential box bolts loosened	Tighten to torque

Constant noise	
CAUSES	REMEDY
Ring gear teeth or pinion damaged	Replace bevel gear set
Worn out bearings	Replace
Pinion spline worn out	Replace
Bent halfshaft	Replace

Noise while steering	
CAUSES	REMEDY
Worn out differential gears	Replace
Worn out differential box or spider	Replace
Differential thrust washers worn out	Replace
Half shaft spline worn out	Replace

TROUBLESHOOTING

FRONT AXLE

Ring gear tooth broken at the outer side	
CAUSES	REMEDY
Excessive gear load compared to the one foreseen	Replace bevel gear set Follow carefully the recommended operations for the adjustment of bevel gear set free backlash
Incorrect gear adjustment (excessive backlash)	
Pinion nut loosened	
Ring gear tooth broken side	
CAUSES	REMEDY
Load bump	Replace bevel gear set Adjust bevel gear set freebacklash
Incorrect gear adjustment (insufficient backlash)	
Pinion nut loosened	
Pinion or ring gear teeth or worn	
CAUSES	REMEDY
Insufficient lubrication; contaminated oil; incorrect lubrication or depleted additives	Replace bevel gear set Follow carefully the recommended operations for the adjustment of bevel gear set freeplay Use correct lubricants, fill up to the right levels and replace according to the recommended program.
Worn out pinion bearings	
Overheated ring and pinion teeth	
CAUSES	REMEDY
Prolong ed functioning at high temperatures	Replace bevel gear set. Use proper lubrication, fill up to right level and replace at recommended program.
Insufficient lubrication; contaminated oil; incorrect lubrication	
Pinion teeth pitting	
CAUSES	REMEDY
Excessive use	Replace bevel gear set. Use correct lubrication, fill up to the right level and substitute at recommended intervals
Insufficient lubrication	
Axle beam body bent	
CAUSES	REMEDY
Vehicle over loaded	Replace axle beam body
Vehicle's accident	
Load bump	
Worn out or pitted bearings	
CAUSES	REMEDY
Insufficient lubrication; contaminated oil	Replace bearings. Use correct lubrication fill up, to the right level and replace at recommended intervals
Excessive use	
Normal wear out	
Pinion nut loosened	

TROUBLESHOOTING

FRONT AXLE

Oil leakage form gaskets and seals	
CAUSES	REMEDY
Prolonged functioning at high temperature of the oil	Replace the gasket or seal and matching surface if damaged Use correct lubrication and replace at recommended intervals
Oil gasket assembled incorrectly	
Seal lip damaged	
Contaminated oil	
Excessive wearing out of input flange spline	
CAUSES	REMEDY
Exhaustive use	Replace the flange
Pinion nut loosened	Check that the pinion spline is not excessively worn out
Pinion axle backlash	Replace bevel gear set if required
Fatigue failure of pinion teeth	
CAUSES	REMEDY
Exhaustive use	Replace bevel gear set
Continuous overload	
Pinion and ring teeth breakage	
CAUSES	REMEDY
Crash load of differential components	Check and/or replace other differential components
Side gear spline worn out	
CAUSES	REMEDY
Excessive use	Replace differential gear group. Replace halfshaft if required
Thrust washer surface worn out or scratched	
CAUSES	REMEDY
Insufficient lubrication; contaminated oil; incorrect lubrication	Use correct lubrication and fill up to right level. Replace at intervals recommended. Replace all scratched washers and those with 0,1mm thickness lower than the new ones
Inner diameter of tapered roller bearing worn out	
CAUSES	REMEDY
Excessive use axial pinion	Replace bearing.
Excessive pinion axial backlash	Check pinion axial backlash.
Insufficient lubrication; contaminated oil	Use proper lubrication, fill up to right level and replace at recom- mended intervals.
Bent or broken halfshaft or halfshaft broken at wheel side	
CAUSES	REMEDY
Vehicle intensively operated or overloaded	Replace. Check that wheel support is not worn out or wrongly adjusted.
Wheel support loosened	
Beam body bent	

REAR AXLE TROUBLESHOOTING

Wheel vibration; front tyre resistance; halfshaft breakage	
CAUSES	REMEDY
Incorrect installation	Correct installation
Defective axle	Replace the differential in case it does not survive any one of the test phases
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
Different rotation radius of the tyres	Replace the tyre or adjust pressure to have same radius on both tyre
Bent halfshaft	Replace halfshaft

Steering is difficult; vehicle goes straight while its turning.	
CAUSES	REMEDY
Incorrect installation	Correct installation
Defective axle	Replace the differential in case it does not survive any one of the test phases
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
Different rotation radius of the tyres	Replace the tyre or adjust pressure to have same radius on both tyre
Broken halfshaft	Replace halfshaft

No differential action; jamming while steering.	
CAUSES	REMEDY
Incorrect installation	Correct installation
Defective axle	Replace the differential in case it does not survive any one of the test phases
Broken halfshaft	Replace halfshaft
Bent halfshaft	Replace halfshaft

Excess of noise	
CAUSES	REMEDY
Incorrect installation	Correct installation
Defective axle	Replace the differential in case it does not survive any one of the test phases
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
Different rotation radius of the tyres	Replace the tyre or adjust pressure to have same radius on both tyre
Bent or broken halfshaft	Replace halfshaft
Incorrect wheel adjustment	Verify group integrity and wheel side bearings.
Contamination in the axle box or incorrect assembly of parts	Look for foreign particles. Check assembly of the various parts of the axle.

TROUBLESHOOTING

REAR AXLE

Uneven wear of tyre	
CAUSES	REMEDY
Incorrect installation	Correct installation
Defective axle	Replace the differential in case it does not survive any one of the test phases
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
Different rotation radius of the tyres	Replace the tyre or adjust pressure to have same radius on both tyre
Bent or broken halfshaft	Replace halfshaft
Blocked halfshaft: - Abnormal functioning of the differential or breakage/ blockage of command device. - Vehicles with wide steering angle may proceed with kicks, have steering difficulty or cause pneumatic wearing at sharp turns.	- Verify assembly and all components - Reduce the steering angle to minimum and decelerate when the vehicle begins to kick.
Incorrect wheel adjustment	Verify group integrity and wheel side bearings.

Friction noise	
CAUSES	REMEDY
Incorrect installation	Correct installation
Defective axle	Replace the differential in case it does not survive any one of the test phases
Bent or broken halfshaft	Replace halfshaft
Spoiled or worn out axle parts	Check the condition of ring gear, pinion gear, bearings etc. Replace when ever necessary.
Contamination in the axle box or incorrect assembly of parts	Look for foreign particles. Check assembly of the various parts of the axle.
Incorrect adjustment of bevel gearset: Parts of the transmission worn out. (transmission gears, U joints, etc.)	Replace or adjust as required.

Vibration during forward drive, intermittent noise	
CAUSES	REMEDY
Incorrect installation	Correct installation
Defective axle	Replace the differential in case it does not survive any one of the test phases
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
Bent halfshaft	Replace halfshaft
Different rotation radius of the tyres	Replace the tyre or adjust pressure to have same radius on both tyre

TROUBLESHOOTING

REAR AXLE

Noise while driving	
CAUSES	REMEDY
Excessive backlash between pinion and ring gear	Adjust
Worn out pinion and gear ring	Replace
Worn out pinion bearings	Replace
Pinion bearings loosened	Adjust
Excessive axial pinion backlash	Adjust
Worn out differential bearings	Replace
Differential bearings loosened	Adjust
Ring gear out of roundness	Replace
Low lubricant level	Oil level
Poor or wrong lubricant	Replace
Bent halfshaft	Replace

Noise while driving in neutral	
CAUSES	REMEDY
Noise coming from axle are usually heard when vehicle moves in neutral gear but are not loud.	Replace or adjust (see above)
Incorrect backlash between pinion and ring (sound heard while decelerating disappears while increasing the speed)	Replace
Pinion or input flange worn out	Adjust

Intermittent noise	
CAUSES	REMEDY
Ring gear damaged	Replace bevel gear set
Differential box bolts loosened	Tighten to torque

Constant noise	
CAUSES	REMEDY
Ring gear teeth or pinion damaged	Replace bevel gear set
Worn out bearings	Replace
Pinion spline worn out	Replace
Bent halfshaft	Replace

Noise while steering	
CAUSES	REMEDY
Worn out differential gears	Replace
Worn out differential box or spider	Replace
Differential thrust washers worn out	Replace
Half shaft spline worn out	Replace

TROUBLESHOOTING

REAR AXLE

Ring gear tooth broken at the outer side	
CAUSES	REMEDY
Excessive gear load compared to the one foreseen	Replace bevel gear set Follow carefully the recommended operations for the adjustment of bevel gear set free backlash
Incorrect gear adjustment (excessive backlash)	
Pinion nut loosened	
Ring gear tooth broken side	
CAUSES	REMEDY
Load bump	Replace bevel gear set Adjust bevel gear set freebacklash
Incorrect gear adjustment (insufficient backlash)	
Pinion nut loosened	
Pinion or ring gear teeth or worn	
CAUSES	REMEDY
Insufficient lubrication; contaminated oil; incorrect lubrication or depleted additives	Replace bevel gear set Follow carefully the recommended operations for the adjustment of bevel gear set freeplay Use correct lubricants, fill up to the right levels and replace according to the recommended program.
Worn out pinion bearings	
Overheated ring and pinion teeth	
CAUSES	REMEDY
Prolong ed functioning at high temperatures	Replace bevel gear set. Use proper lubrication, fill up to right level and replace at recommended program.
Insufficient lubrication; contaminated oil; incorrect lubrication	
Pinion teeth pitting	
CAUSES	REMEDY
Excessive use	Replace bevel gear set. Use correct lubrication, fill up to the right level and substitute at recommended intervals
Insufficient lubrication	
Axle beam body bent	
CAUSES	REMEDY
Vehicle over loaded	Replace axle beam body
Vehicle's accident	
Load bump	
Worn out or pitted bearings	
CAUSES	REMEDY
Insufficient lubrication; contaminated oil	Replace bearings. Use correct lubrication fill up, to the right level and replace at recommended intervals
Excessive use	
Normal wear out	
Pinion nut loosened	

TROUBLESHOOTING

REAR AXLE

Oil leakage form gaskets and seals	
CAUSES	REMEDY
Prolonged functioning at high temperature of the oil	Replace the gasket or seal and matching surface if damaged Use correct lubrication and replace at recommended intervals
Oil gasket assembled incorrectly	
Seal lip damaged	
Contaminated oil	
Excessive wearing out of input flange spline	
CAUSES	REMEDY
Exhaustive use	Replace the flange
Pinion nut loosened	Check that the pinion spline is not excessively worn out
Pinion axle backlash	Replace bevel gear set if required
Fatigue failure of pinion teeth	
CAUSES	REMEDY
Exhaustive use	Replace bevel gear set
Continuous overload	
Pinion and ring teeth breakage	
CAUSES	REMEDY
Crash load of differential components	Check and/or replace other differential components
Side gear spline worn out	
CAUSES	REMEDY
Excessive use	Replace differential gear group. Replace halfshaft if required
Thrust washer surface worn out or scratched	
CAUSES	REMEDY
Insufficient lubrication; contaminated oil; incorrect lubrication	Use correct lubrication and fill up to right level. Replace at intervals recommended. Replace all scratched washers and those with 0,1mm thickness lower than the new ones
Inner diameter of tapered roller bearing worn out	
CAUSES	REMEDY
Excessive use axial pinion	Replace bearing.
Excessive pinion axial backlash	Check pinion axial backlash.
Insufficient lubrication; contaminated oil	Use proper lubrication, fill up to right level and replace at recom- mended intervals.
Bent or broken halfshaft or halfshaft broken at wheel side	
CAUSES	REMEDY
Vehicle intensively operated or overloaded	Replace. Check that wheel support is not worn out or wrongly adjusted.
Wheel support loosened	
Beam body bent	

TRANSMISSION TROUBLESHOOTING

Vehicle does not move	
CAUSES	REMEDY
Faulty supply to solenoid valves	Check/Replace
Damaged wiring connections between transmission and vehicle	Repair/Replace
Oxidised contacts in electrical wiring	Clean
Break in electric cable	Replace
Damaged solenoids	Replace
Damaged sensors	Replace
Short circuits or false contacts	Check/replace fuses
Incorrect oil level	Top up
Check for leaks	Repair/Top up
Blocked intake filter	Clean
Damaged oil pump	Replace
Damaged oil pump relief valve	Replace oil pump
Blocked/damaged transmission filter	Replace
Damaged/jammed control valve	Replace
Damaged converter	Replace
Oil temperature below 0°C	Wait for oil to reach working temperature (stall test)
Damaged rotary seals	Replace
Damaged synchronisers	Replace
Blocked reverser lever	Repair
Worn clutch unit	Replace/Repair clutch unit
No drive transmission (broken gears, shafts, bearings, etc.)	Check/Repair/Replace

Vehicle has reduced power transmission	
CAUSES	REMEDY
Incorrect oil temperature	Wait for oil to reach working temperature (stall test)
Transmission oil overheating	Restore acceptable temperature values
Incorrect operating pressure	Check hydraulic circuit and replace (oil pump, filters, control valve)
Damaged converter	Replace
Incorrect oil level	Top up
Worn clutch unit	Replace/Repair
4WD clutch failure	Repair/Replace 4WD shaft group
Overheating solenoids	Replace
Damaged transmission and vehicle wiring connections	Repair/Replace
Damaged sensors	Replace

TROUBLESHOOTING

TRANSMISSION

Overheating	
CAUSES	REMEDY
Damaged hydraulic cooling system	Repair
Dirty heat exchanger	Clean
Parking brake inadvertently activated	Release
Excessive dirt on axle wheel hubs	Clean
Seizing (broken gears, shafts, bearings, etc.)	Check/Repair/Replace
Braking force outside transmission: irregular axle operation	Check/Repair axle
Clutch plate drag	Repair/Replace
Damaged converter	Replace
Damaged oil thermostat	Replace
Incorrect oil level	Top up
Worn oil pump	Replace

Wheels rotate when vehicle is raised	
CAUSES	REMEDY
Clutch plate drag	Repair/Replace
Low oil temperature (high oil viscosity)	Wait for oil to reach working temperature (stall test)
Incorrect oil specifications	Replace oil and filters
Damaged control valve	Replace
Faulty reverser locking	Repair/Replace

Noise	
CAUSES	REMEDY
Damaged converter	Replace
Damaged oil pump	Replace
Aeration/Cavitation	Check oil level / Check oil specifications
Seizing (broken gears, shafts, bearings, etc.)	Check/Repair/Replace
Worn clutch plates	Replace

Irregular actuation	
CAUSES	REMEDY
Damaged control valve	Replace
Electrical system fault	Repair/Replace
Worn clutch plates	Replace
Damaged converter	Replace
Low oil temperature (high oil viscosity)	Wait for oil to reach working temperature (stall test)
Overheating	See "overheating"
Damaged hydraulic system	Repair/Replace

TROUBLESHOOTING

TRANSMISSION

Gear remains engaged	
CAUSES	REMEDY
Damaged/jammed shuffleshaft lever	Repair/Replace
Electrical system fault	Repair/Replace
Damaged control valve	Replace
Damaged hydraulic system	Repair/Replace
Damaged clutch unit	Repair/Replace
Damaged gear lever rod	Replace
Damaged synchroniser	Replace
No 4WD power transmission	
CAUSES	REMEDY
Damaged 4WD clutch	Replace
Hydraulic system fault	Repair/Replace
Damaged control valve	Replace
Faulty brake sensor	Check/Replace
Electrical system fault	Repair/Replace
Gear shift won't engage	
CAUSES	REMEDY
Damaged shifter	Replace
Damaged synchroniser	Replace

GROUP 30

30 REMOVAL AND INSTALLATION

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HOW TO READ THE MANUAL

1. Removal and Installation of the groups

- (1) The procedures and information needed to carry out the work of removing or Installing units or groups are given in the removal procedure. The sequence of operations is not repeated in the installation procedure.
- (2) Information needed for installation is marked with the symbol  1 ; The same symbol is repeated at the end of each removal procedure for the same item, to indicate to which installation item it refers.

(Example)

REMOVAL GROUP ● ● ● : Title of operation



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

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

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

2 - ▲ ▲ ▲ (2):  1 This sign means that information is given for the installation procedure

3 - Remove ■ ■ ■ (3):



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

INSTALLATION GROUP ● ● ● : Title of operation

- To install, reverse removal procedure.

 1 : Technique to be used for installation

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

- Addition of water or oil: Step in removal procedure

★: Point to remember when adding water or oil.

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

3. List of special tools

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

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

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

NOTE

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

PRECAUTIONS TO BE TAKEN WHILE WORKING

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

1. Precautions for removal operations

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

2. Precautions to be taken during installation

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

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

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

REMOVAL AND INSTALLATION

SPECIAL TOOLS

SPECIAL TOOLS

Nature of work	Symbol	Code	Description	Q.ty	Notes
Disassembly and assembly cylinder	A	1 ATR200620 See 960119000	Attachment	1	Cylinder disassembly - assembly
		2 Hydraulic press Commercially available	Plunger Ø 40	2	Assembly cylinder and rod bushings
			Plunger Ø45	2	
			Plunger Ø50	2	
			Plunger Ø75	2	
		3 See 960117005	Bushing	1	To calibrate piston gasket
			See 960117006	1	
		4 Commercially available	Notched wrench for cylinders Ø70	1	Disassembly-assembly head cylinder
			Notched wrench for cylinders Ø80	1	
			Notched wrench for cylinders Ø85	1	
			Notched wrench for cylinders Ø95	1	
			Notched wrench for cylinders Ø115-120	1	
			Notched wrench for cylinders Ø110	1	
		5	Notched wrench for boom cylinders	1	Disassembly ring nut boom cylinder Boom swing head disassembly-assembly
		6 ATR200300	Notched wrench	1	
		7 Commercially available	Socket wrench (6-point 46)	1	Removal - installation of piston
			Socket wrench (6-point 55)	1	
			Socket wrench (6-point 65)	1	
		8 Hydraulic press Commercially available	Plunger Ø40	1	Dust seal assembly
			Plunger Ø50	1	
			Plunger Ø55	1	
			Plunger Ø60	1	
		9 See 960117002 960117003 960030002	Expander Ø70	1	Piston gaskets assembly
			Expander Ø80	1	
			Expander Ø85	1	
			Expander Ø95	1	
			Expander Ø100	1	
			Expander Ø110	1	
			Expander Ø115	1	

REMOVAL AND INSTALLATION

SPECIAL TOOLS

Nature of work	Symbol		Code	Description	Q.ty	Notes
Disassembly and assembly cylinder	A	10	See 960117001	Bushing for rod Ø40	1	Head assembly on rod
				Bushing for rod Ø45	1	
				Bushing for rod Ø50	1	
				Bushing for rod Ø55	1	
				Bushing for rod Ø60	1	
		11	See 960117004	Bushing for rod Ø70	1	Piston-cylinder assembly
				Bushing for rod Ø80	1	
				Bushing for rod Ø85	1	
				Bushing for rod Ø95	1	
				Bushing for rod Ø100	1	
	Bushing for rod Ø110			1		
	Bushing for rod Ø115			1		
Air conditioning unit	B	1	Commercially available	Maintenance station	1	Draining and refilling the unit
Disassembly and assembly front axle	D	1	CA715027	Plunger	1	Measurament shim for pinion
		2	CA119030	Wrench	1	
		3	CA119099	Wrench	1	
		4	CA715022	Wrench	1	
		5	CA119225	Plunger	1	
		6	CA715023	False pinion	1	
		7	CA119206	False differential holder	1	
		8	CA119182	Ring nut	1	
		9	CA715021	Plunger	1	
		10	CA119230	Plunger	1	
		11	CA715087	Plunger	1	
		12	CA715163	Plunger	1	
		13	CA715164	Plunger	1	
		14	CA715034	Plunger	1	
		15	CA119055	Plunger	1	
		16	CA715396	Plunger	1	
		17	CA119043	Plunger	1	
		18	CA715087	Plunger	1	
		19	CA715035	Plunger	1	
		20	CA715026	Plunger	1	
		21	CA119143	Plunger	1	
Disassembly and assembly rear axle	E	1	CA715027	Plunger	1	
		2	CA715265	Wrench	1	
		3	CA119099	Wrench	1	
		4	CA715022	Wrench	1	

REMOVAL AND INSTALLATION
SPECIAL TOOLS

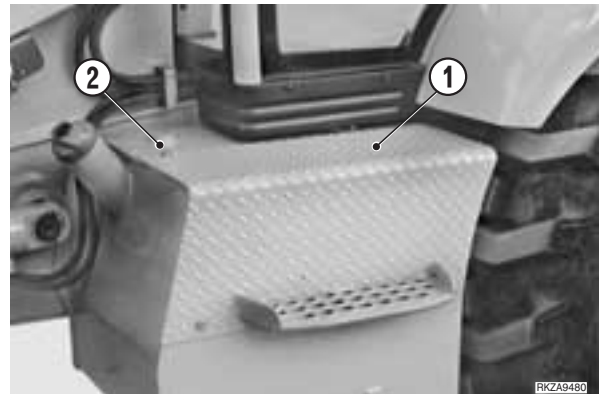
Nature of work	Symbol	Code	Description	Q.ty	Notes
Disassembly and assembly rear axle	E	5	CA715380	Kit	1
		6	CA715128	False pinion	1
		7	CA715388	False differential box	1
		8	CA715167	Plunger	1
		9	CA715028	Plunger	1
		10	CA715391	Plunger	1
		11	CA119033	Interchangeable handle	1
		12	CA715056	Kit	1
		13	CA715055	Kit	1
		14	CA715466	Plunger	1
		15	CA119187	Plunger	1
		16	CA715467	Plunger	1
		17	CA715026	Plunger	1
		18	CA119143	Plunger	1
Disassembly and assembly transmission	F	1	CA715354	Plunger	1
		2	CA715501	Plunger	1
		3	CA715358	Tool	1
		4	CA715004	Plunger	1
		5	CA715149	Plunger	1
		6	CA715410	Press	1
		7	CA715409	Plunger	1

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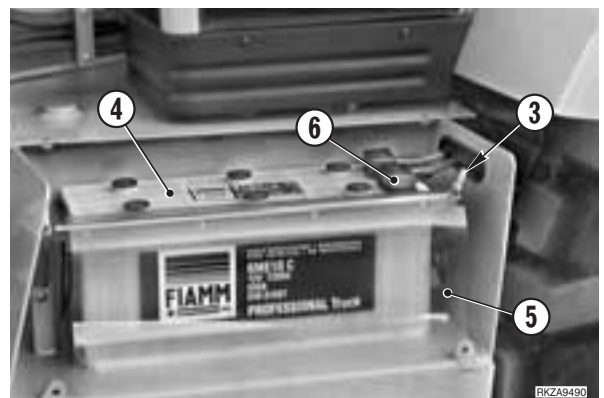
REMOVAL OF STARTING MOTOR

! Fully raise the front working equipment and engage the safety stop.

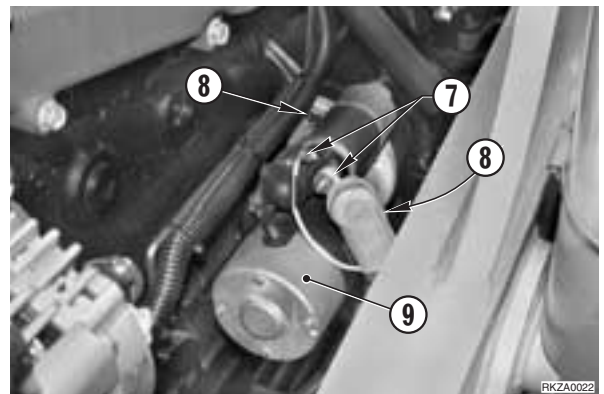
- 1 - Stop the engine and engage the parking brake.
- 2 - Remove guard (1) from tank (2).



- 3 - Loosen the rods (3), move battery (4) outwards and lift the protection (5).
Disconnect the clamp (6) from battery (4) negative terminal (-).



- 4 - Disconnect the electric wiring (7).
- 5 - Loosen the two screws (8) and remove the starting motor (9).



INSTALLATION OF THE STARTING MOTOR

- To install, reverse the removal procedure.



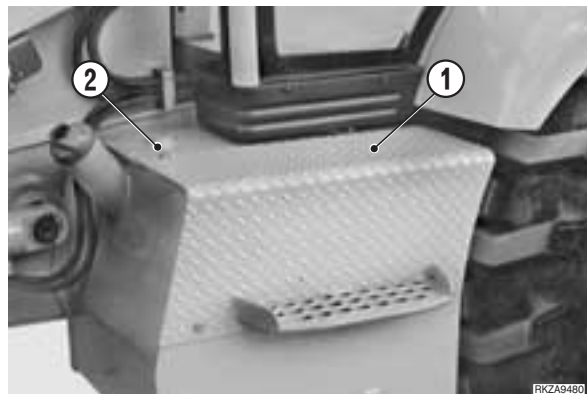
 Starting motor mounting screws: 8.4–98 Nm

REMOVAL OF THE ALTERNATOR

! Fully raise the front working equipment and engage the safety stop.

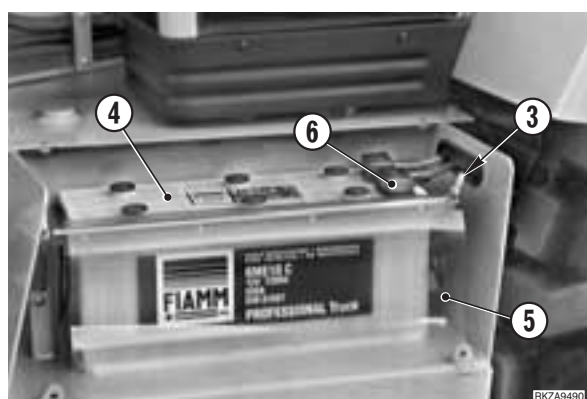
1 - Stop the engine and engage the parking brake.

2 - Remove guard (1) from tank (2).

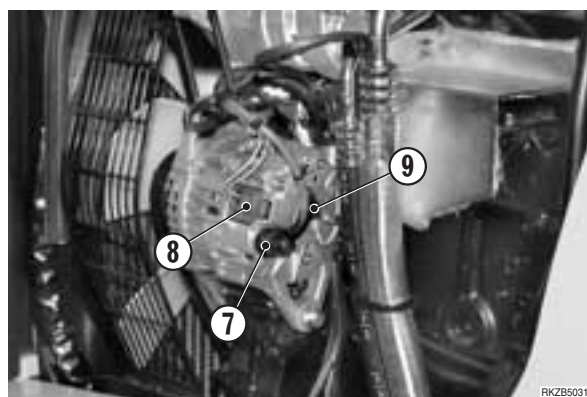


3 - Loosen the rods (3), move battery (4) outwards and lift the protection (5).

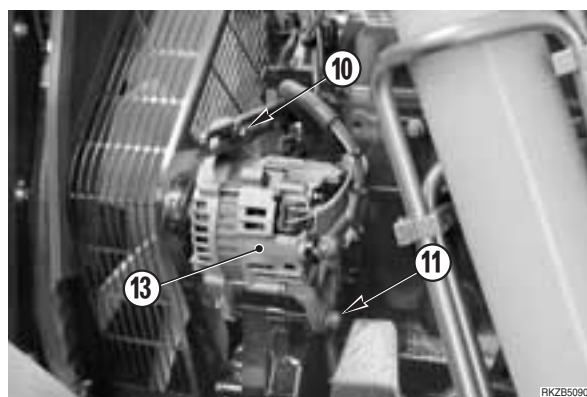
Disconnect the clamp (4) from battery (6) negative terminal (-).



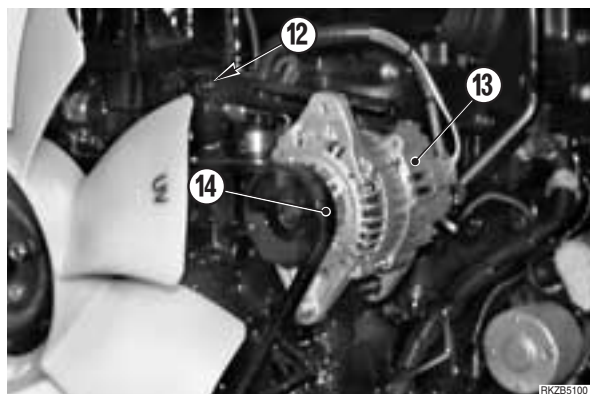
4 - Disconnect the cable (7), the connector (8) and the cotter pin (9).



5 - Loosen the screws (10), (11) and (12) to leave the alternator (13) free to rotate.



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



INSTALLATION OF THE ALTERNATOR

- To install, reverse the removal procedure.



- ★ Adjust the fan-belt tension.
(For details, see «20. TESTING AND ADJUSTMENTS - Fan-belt tension»).

REMOVAL OF THE AIR-CONDITIONING UNIT COMPRESSOR

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

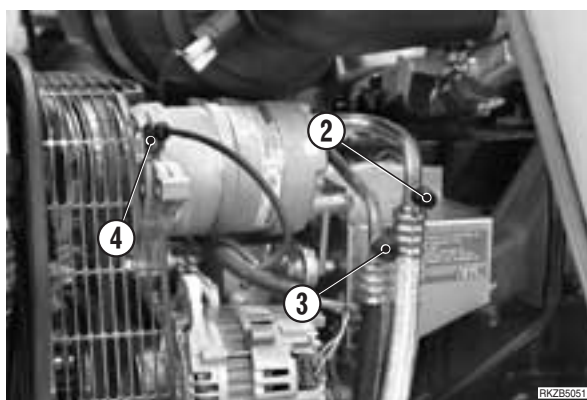
⚠ Disconnect the cable from battery negative terminal (-).

1 - Remove lateral guard (1).

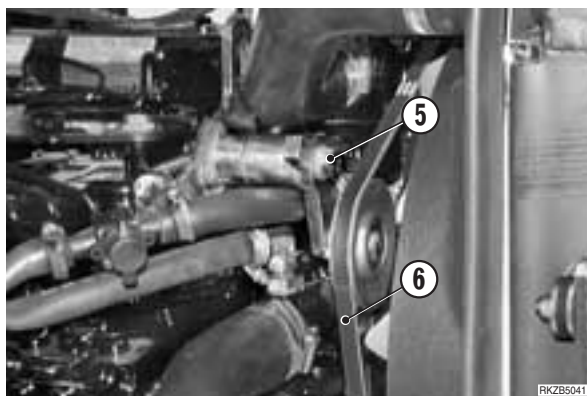


2 - Connect the outlets (2) and (3) to the maintenance station for air-conditioning units **B1** and drain the cooling fluid.

3 - Disconnect the connector (4).



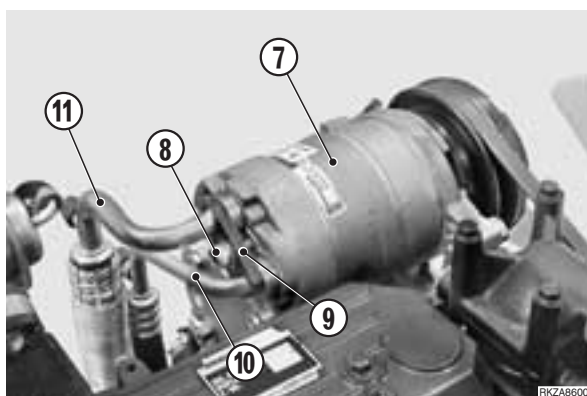
4 - Loosen the screw (5) and remove the belt (6) that drives the compressor (7).



5 - Loosen and remove the screw (8) that holds the bracket (9) that supports the delivery and suction lines (10), (11).



★ Be careful to avoid damaging the seals.

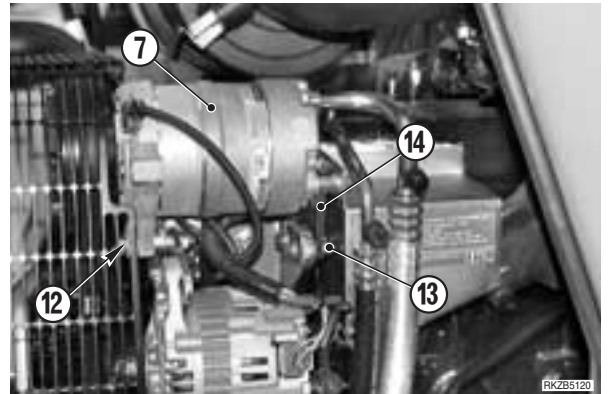


REMOVAL AND INSTALLATION

AIR-CONDITIONING UNIT COMPRESSOR

- 6 - Remove the front screws (12), the rear nuts (13) and lift out the compressor (7) complete with its support (14).

※ 3



INSTALLATION OF THE AIR-CONDITIONING UNIT COMPRESSOR

- To install, reverse the removal procedure.

※ 1



Belt-tightening screw: 123 Nm

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

※ 2

- ★ Tighten until the flanges rest on the compressor.

※ 3



Compressor retaining screws: 32 Nm

- 1 - Connect the unit to the maintenance station **B1** and refill it.



Quantity of fluid: 2250±150 g

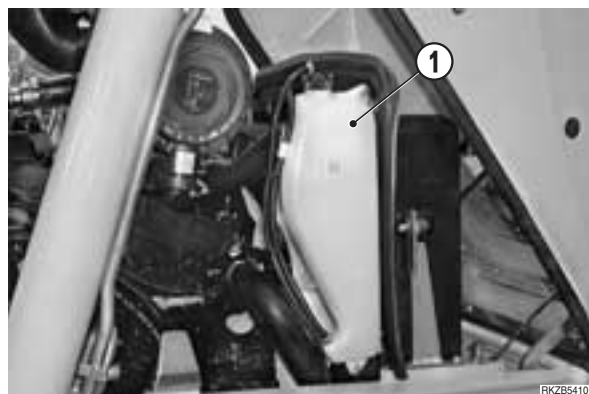
REMOVAL OF THE INJECTION PUMP

⚠ Fully raise the front working equipment and engage the safety stop. Also make the backhoe safe.

⚠ Raise the engine hood and disconnect the cable from battery negative terminal (-).

★ Plug all tubes that have been removed or disconnected to prevent entry of impurities.

1 - Remove the engine coolant liquid container (1).

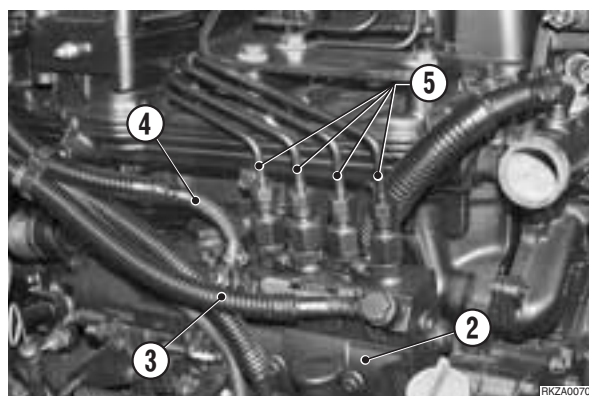


2 - Disconnect the fuel supply (3) and flow-back (4) hoses from the injection pump (2).

✖ 1

3 - Disconnect the high-pressure pipes (5).

✖ 2



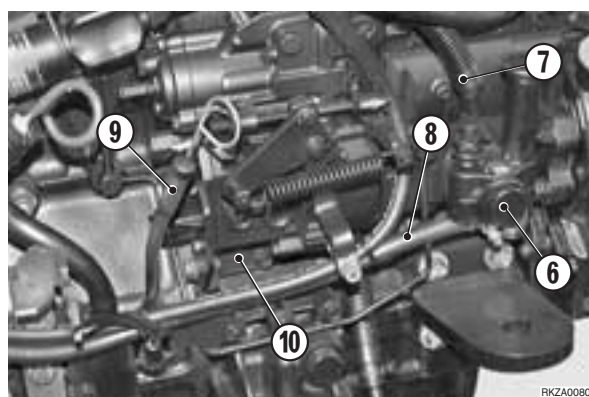
4 - Disconnect the fuel feed hose (7) and delivery tube (8) from the feed pump (6).

✖ 1

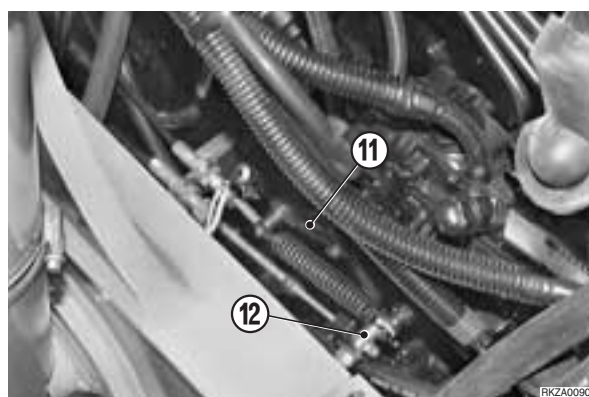
5 - Disconnect the tube (9) from the oil level dip-stick and remove it.

✖ 3

6 - Remove the support-bracket (10) of the pump.



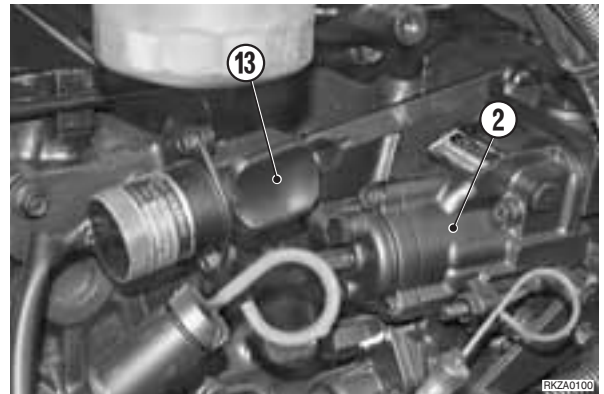
7 - Disconnect the accelerator control cable support (12) from the lever (11).



REMOVAL AND INSTALLATION

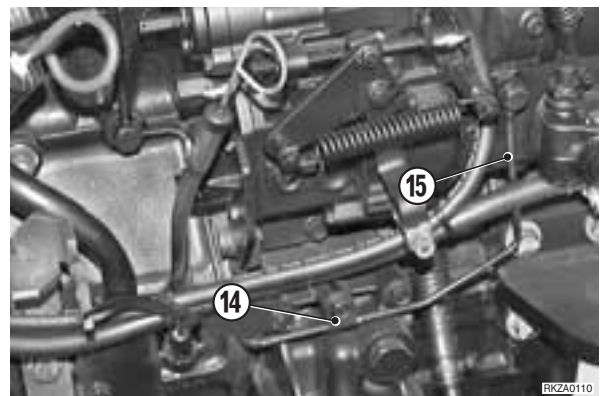
INJECTION PUMP

- 8 - Disconnect the engine-stopping solenoid (13) from the injection pump (2). Lift out the entire group.  4

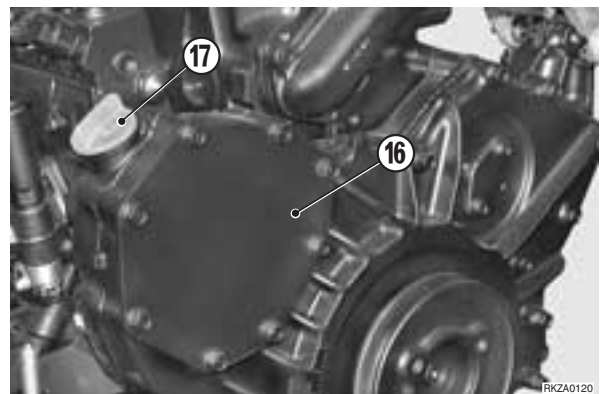


- 9 - Remove the retaining clip (14) of the injection pump lubrication tube.

- 10 - Disconnect the lubrication tube (15).

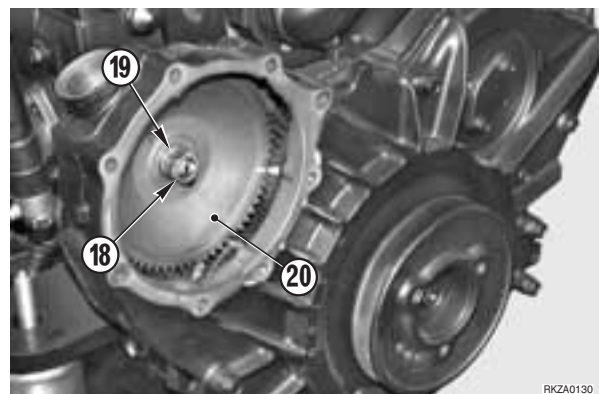


- 11 - Remove the cover (16) that gives access to the distribution gear and the oil filler plug (17).  5



- 12 - Loosen and lift off the retaining nut (18) and safety washer (19) of the pump driving gear (20).  6

- ★ Take great care not to drop the safety washer (19) into the pump casing.

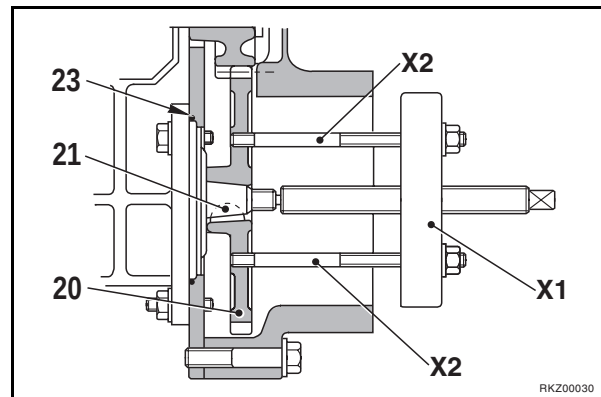


REMOVAL AND INSTALLATION

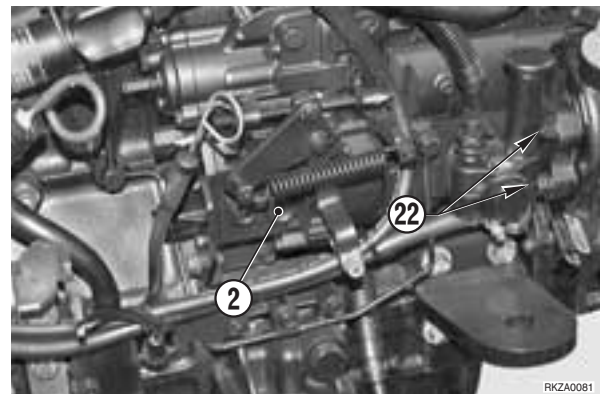
INJECTION PUMP

13 - Remove the driving gear (20) of the pump (2).

- ★ Before removing the pump driving gear, mark its position with respect to the idling gear.
- ★ For removal use a puller (X1). The puller screws (X2) screw directly into the gear (20). Take great care not to damage the pump shaft thread
- ★ During removal, be careful not to let the wrench (21) drop into the housing.



14 - Take out the four nuts (22) and remove the injection pump (2) with its O-ring seal (23). 



INSTALLATION OF THE INJECTION PUMP

- To install, reverse the removal procedure.

❖ 1



Fuel feed hoses: 24.5–34.3 Nm

❖ 2



High pressure hoses: 24.5–34.3 Nm

❖ 3



Bolt screw, pump side: 44.1–53.9 Nm



Bolt screw, engine side: 22.5–8.4 Nm

❖ 4

- ★ Put in a new safety cotter pin.

❖ 5



Cover gasket: ASL800070



Cover bolts for ignition gear system: 18 Nm

❖ 6

- ★ Align the marks between the gears before installing the pump and mounting the nut.



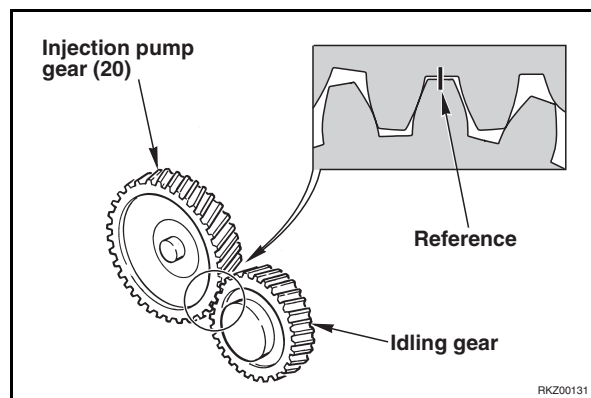
Gear-locking nut: 83.3–93.1 Nm

❖ 7



Pump-locking nut: 35.2–43.1 Nm

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



REMOVAL OF THE INJECTION NOZZLES

! Fully raise the front working equipment and engage the safety stop. Also make the backhoe safe.

! Raise the engine hood and disconnect the cable from battery negative terminal (–).

1 - Disconnect the sensor (1) for a clogged air-filter.

2 - Remove the air-filter (2), the supporting bracket (3) and the intake sleeve (4). 

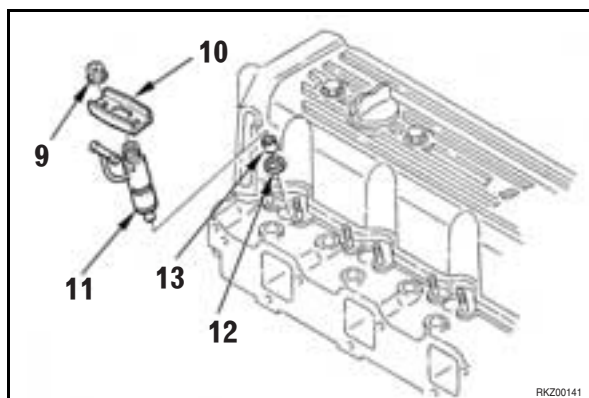
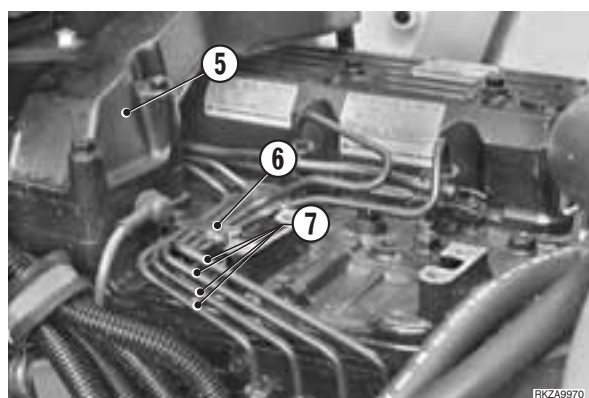
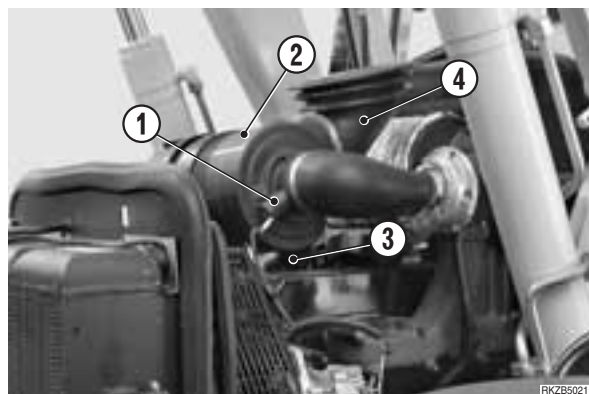
3 - Remove the muffler.
(For details, see «REMOVAL OF THE MUFFLER»).

4 - Remove the intake duct (5). 

5 - Loosen the clip (6) and remove the high-pressure pipes (7). 

6 - Disconnect the fuel flow-back pipes (8).

7 - Take out the nuts (9) that secure the collar (10) and take out the injector (11), the seating (12) and the protection piece (13). 



INSTALLATION OF THE INJECTION NOZZLES

- To install, reverse the removal procedure.

 1



Bracket screw: Loctite 262

 2



Duct screw: 45–55Nm



Bracket screw: Loctite 262

 3



High-pressure pipes: 24.5–4.3 Nm



Hose-clamp screws: 9.8–11.8 Nm

 4



Collar lock nuts: 9.8–11.8 Nm

REMOVAL OF THE THERMOSTAT

! Fully raise the front working equipment and engage the safety stop.

Also make the backhoe safe.

! Raise the engine hood and disconnect the cable from battery negative terminal (-).

★ Drain the engine coolant liquid.



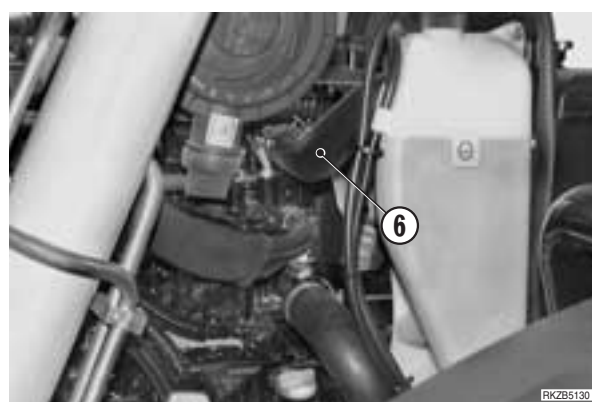
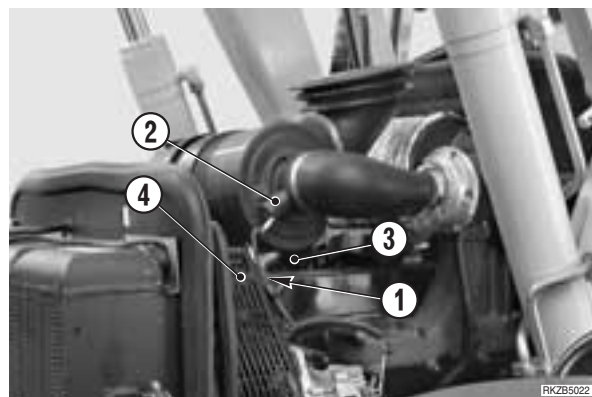
Coolant liquid: 18 ℓ

1 - Disconnect the cable (1) of the clogged filter indicator (2) and remove the entire suction filter (3).

2 - Remove the fan guard (4).

3 - Disconnect the radiator connection sleeve (6) from the thermostat cover (5).

4 - Take out the screws and remove the thermostat cover (5).



5 - Remove the gasket (7), the thermostat (8) and the ring seal (9).



Put in new seals.

INSTALLATION OF THE THERMOSTAT

• To install, reverse the removal procedure.



1 - Refill the coolant liquid tank.



Coolant liquid: 18 ℓ

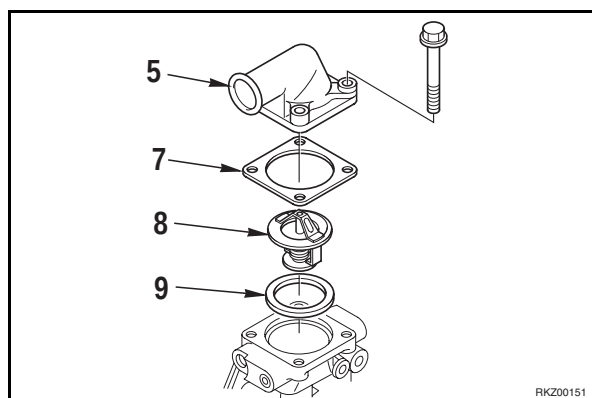
2 - Start the engine at low idling to circulate the coolant liquid through all circuits.

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

★ Check that there are no leaks.



Cover screws: 22–27.8 Nm



REMOVAL OF THE COOLING LIQUID PUMP

⚠ Fully raise the front working equipment and engage the safety stop. Also make the backhoe safe.

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

★ Drain the engine coolant liquid.



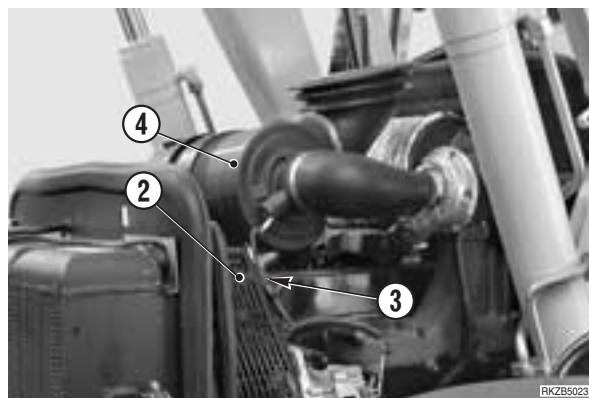
Coolant liquid: 18 ℓ

1 - Remove the engine coolant liquid container (1).

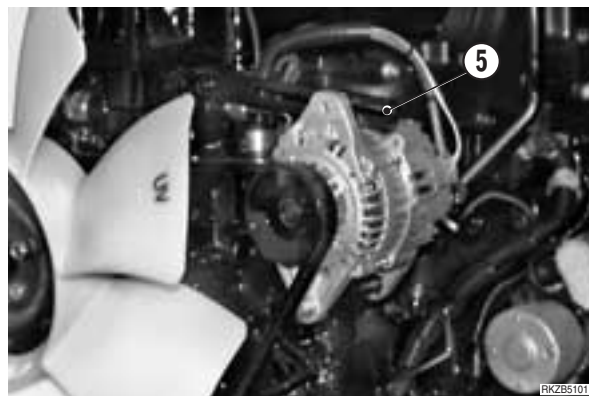


2 - Remove the fan guard (2).

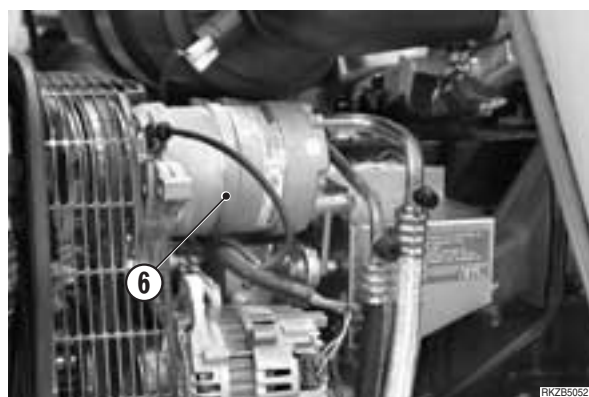
3 - Disconnect the cable (3) of the clogged filter indicator and remove the air filter (4).



4 - Remove the alternator and its support (5).
(For details, see «REMOVAL OF THE ALTERNATOR»).



5 - **Only for machines equipped with a compressor**
Remove the air-conditioning unit compressor (6) and its supports. Put the compressor to one side.
(For details, see «REMOVAL OF THE AIR-CONDITIONING UNIT COMPRESSOR»).



REMOVAL AND INSTALLATION

COOLING LIQUID PUMP

- 6 - Disconnect the cab heating pipes (7).
- 7 - Disconnect the temperature sensor cables (8) and (9).
- 8 - Remove the radiator/oil-cooler group.
(For details, see «REMOVAL OF THE RADIATOR - OIL COOLERS»).
- 9 - Remove the fan (10), the spacer (11) and the pulley (12).

✱ 2

- 10 - Remove the four screws (13) and then the complete pump (14).

✱ 3

! Replace all seals with new ones.

INSTALLATION OF THE COOLANT LIQUID PUMP

- To install, reverse the removal procedure.

✱ 1

 Nm Locking screws for alternator support:
22.5–28.4 Nm

- ★ Apply tension to the alternator belt.
(For details, see «20. TESTING AND ADJUSTMENTS»).

✱ 2

 Nm Locking screws for pulley and fan:
44.1–53.9 Nm

✱ 3

 Nm Pump screws: 22.5–28.4 Nm

✱ 4

 Nm Locking screw for compressor: 64 Nm

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

- 1 - Refill the coolant liquid circuit.

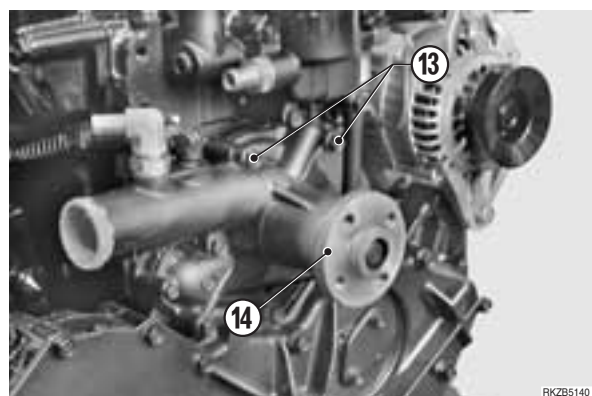
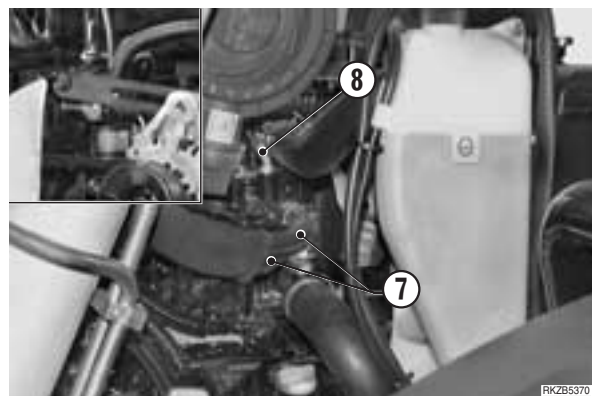


Coolant liquid: 18 ℓ

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

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

- ★ Check that there are no leaks.



REMOVAL OF THE TURBOCOMPRESSOR

⚠ Fully raise the front working equipment and engage the safety stop.
Also make the backhoe safe.

⚠ Raise the engine hood and disconnect the cable from battery negative terminal (-).

1 - Disconnect the clogged air-filter indication (2) cable (1) and remove the entire suction filter (3).

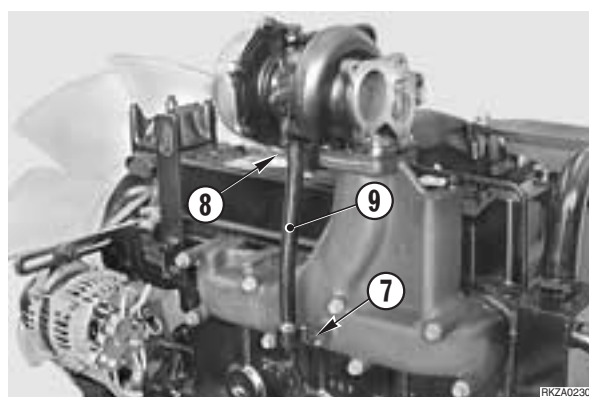
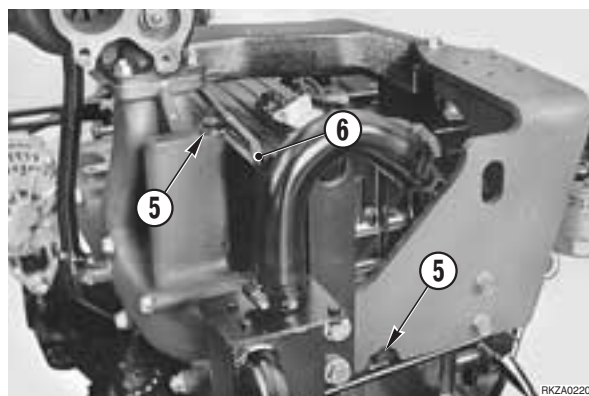
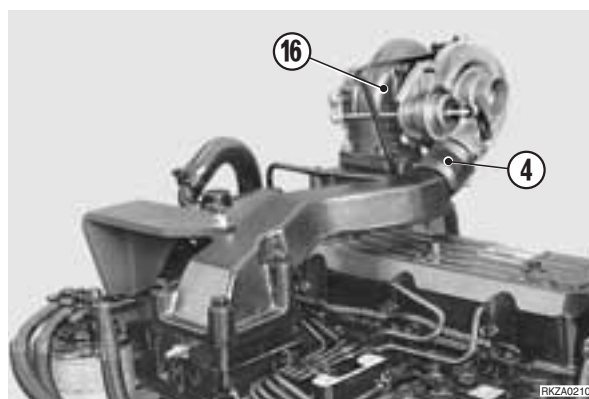
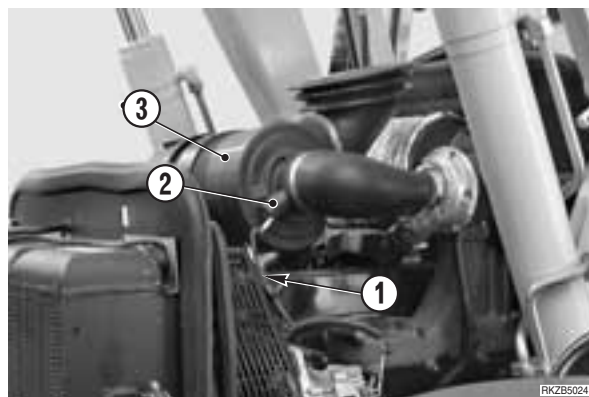
2 - Remove the muffler
(For details, see «REMOVAL OF THE MUFFLER»).

3 - Disconnect the turbocompressor delivery coupling sleeve (4) from the suction manifold.

4 - Take the screws out of the clips (5) and disconnect the tube (6) that delivers the turbocompressor lubrication oil.

5 - Take out the tube-retaining screws (7) and the two screws (8) that secure the flange of the lubrication oil drainage tube (9).

※ 1



REMOVAL AND INSTALLATION

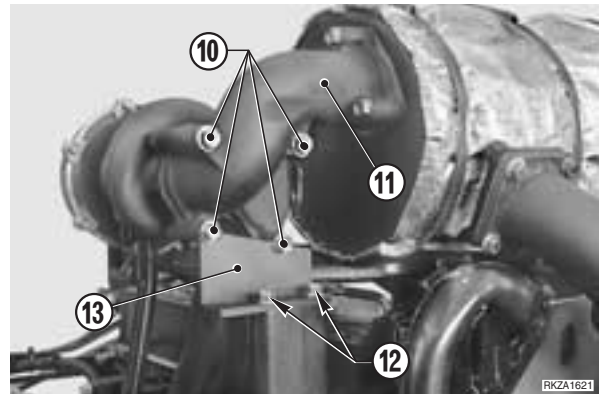
TURBOCOMPRESSOR

- 6 - Take out the screws (10) that join the turbocompressor to the couplingsleeve, and remove the couplingsleeve (11).

✖ 2

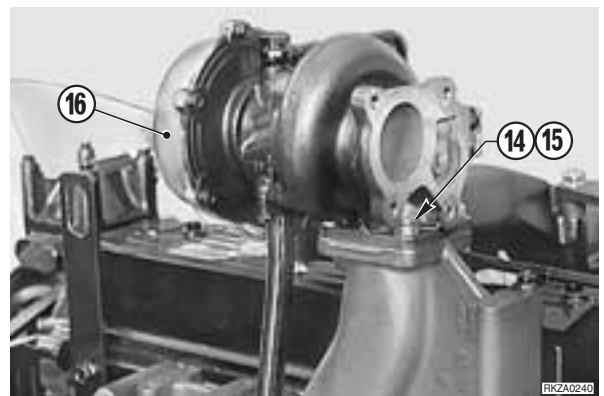
- 7 - Take out the screws (12) and remove the bracket (13).

✖ 3



- 8 - Take out the nuts (14), and the washers (15) and lift off the turbocompressor (16).

- ★ Carefully check the state of all the sealing gaskets. Replace them if there is any sign of damage.



INSTALLATION OF THE TURBOCOMPRESSOR

- To install, reverse the removal procedure.

✖ 1

 Nm Tube retaining screws: 22.5–28.4 Nm

 Nm Flange screws: 8–9 Nm

✖ 2

 Nm Coupling joint screws: 22.5–28.4 Nm

✖ 3

 Nm Bracket screws: 22.5–28.4 Nm

- 1 - Start the engine and check that there are no leaks in the turbocompressor lubrication tubes.

REMOVAL OF THE CYLINDER HEAD

⚠ Fully raise the front working equipment and engage the safety stop.

Also make the backhoe safe

⚠ Raise the engine hood and disconnect the cable from battery negative terminal (-).

★ Drain the engine coolant liquid.



Coolant liquid: 18 ℓ

※ 1

1 - Remove the container (1).

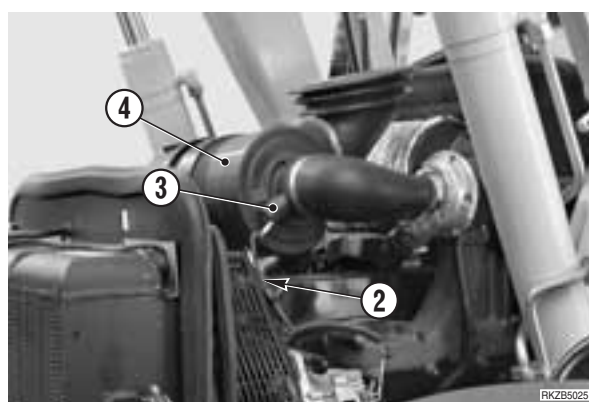


2 - Disconnect the cable (2) of the clogged air-filter sensor and remove the entire suction filter (4) and its support.

※ 2

Only for WB93R-2

★ Remove the turbocompressor.
(For details, see «REMOVE THE TURBOCOMPRESSOR»).

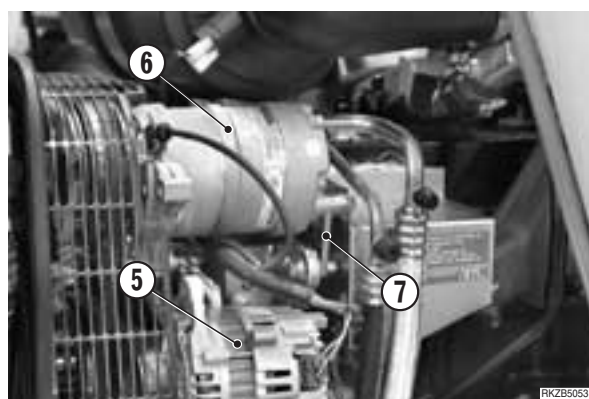


3 - **Only for machines equipped with an air-conditioning unit**

Remove the alternator (5), the compressor (6) and the supporting bracket (7).

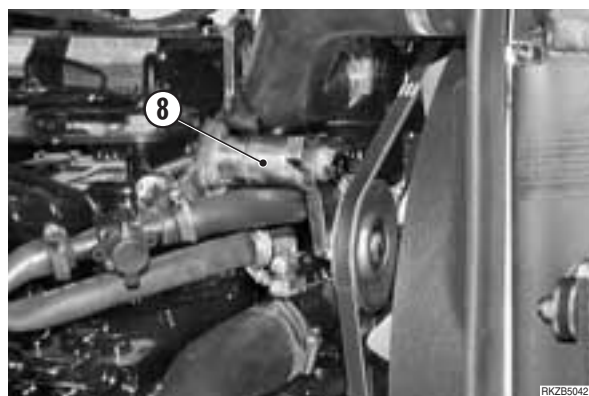
(For details, see «REMOVAL OF THE ALTERNATOR» and «REMOVAL OF THE AIR-CONDITIONING UNIT»).

※ 3



4 - Remove the support (8).

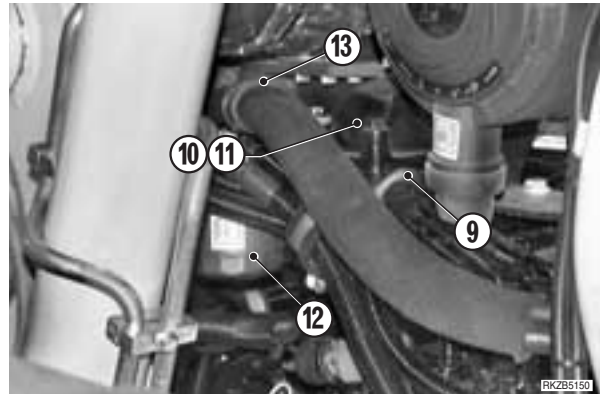
※ 4



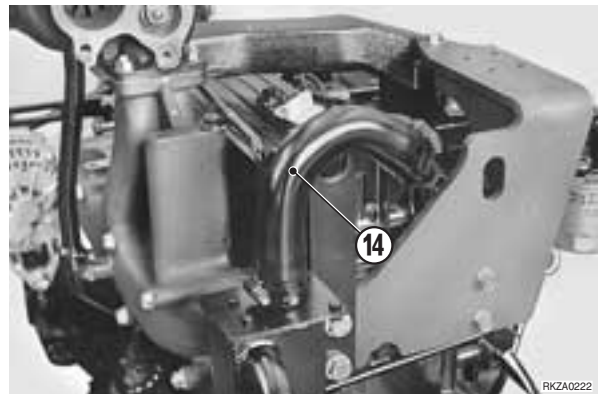
REMOVAL AND INSTALLATION

CYLINDER HEAD

- 5 - Disconnect the cable (9) of the cold-start equipment.
- 6 - Remove the suction manifold (10) and the cold-start equipment (11). 
- 7 - Remove the diesel fuel filter (12) and place it to one side.
- 8 - Disconnect the clips (13) that secure the heating pipes.

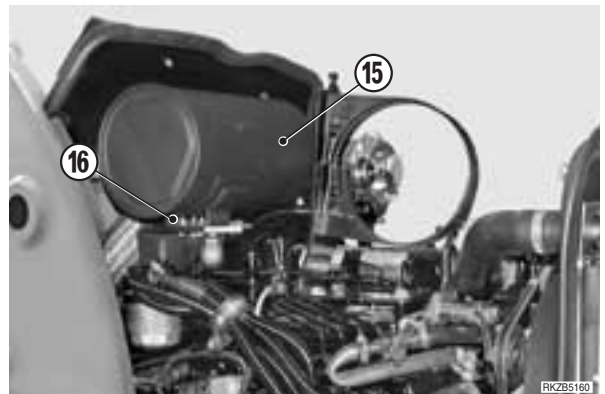


- 9 - Disconnect the breather tube (14) from the engine head.

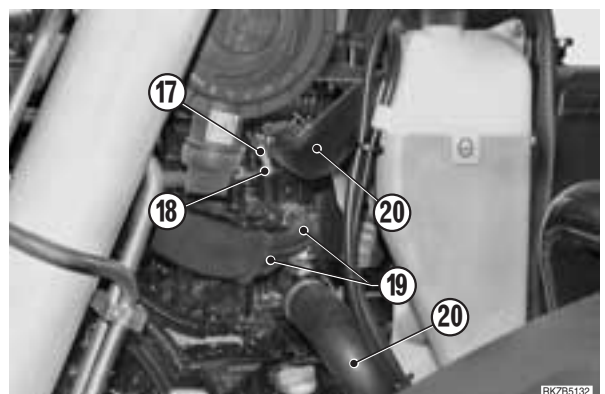


- 10 - Remove the muffler (15).
(For details, see «REMOVAL OF THE MUFFLER»).
- 11 - Remove the muffler support bracket (16).

 6



- 12 - Disconnect the cables (17) from the temperature sensors (18).
- 13 - Disconnect the heating pipes (19).
- 14 - Remove the radiator connection pipes (20).
- 15 - Remove the coolant liquid pump. (For details, see «REMOVAL OF THE COOLANT LIQUID PUMP»).



REMOVAL AND INSTALLATION

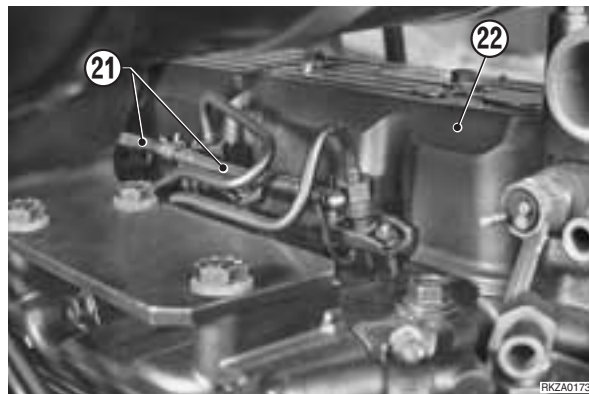
CYLINDER HEAD

- 16 - Disconnect the fuel return hose (21) from the injector nozzles and remove the nozzles.
(For details, see «REMOVAL OF THE INJECTOR NOZZLES»).

✖ 6 ✖ 7

- 17 - Remove the cover of the tappets (22).

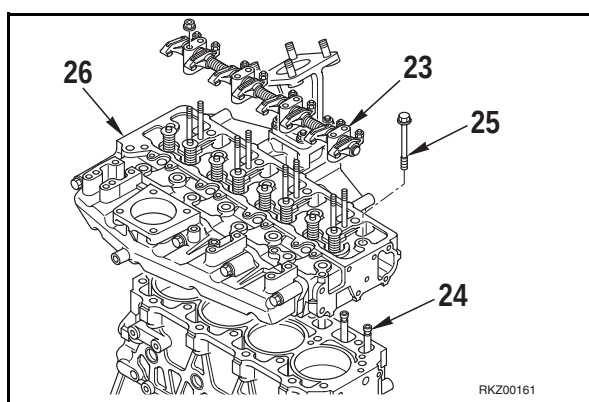
✖ 8



- 18 - Remove the valve rocker-arm shaft (23).

- ★ Loosen the nuts and unscrew the tappets by 2-3 turns

- 19 - Take out the rocker-arm control rods (24).

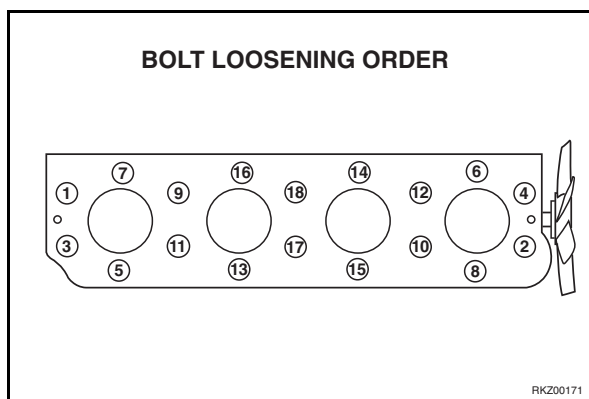


- 20 - Take out the screws (25) and remove the entire cylinder head (26). Follow the indicated sequence for loosening the screws.

✖ 10

- ★ Sequence to be followed: see drawing.

- ⚠ Loosen the cylinder head retaining screws in two stages.



INSTALLATION OF THE CYLINDER HEAD

- To install, reverse the removal procedure.

✖ 1

- ★ Fill up the cooling circuit.



Coolant liquid: 18 ℓ

- ★ Check carefully that there are no leaks.

REMOVAL AND INSTALLATION**CYLINDER HEAD**

❖ 2



Support screws: 35.2 Nm

❖ 3



Frontal screw (M8): 32 Nm



Lateral screws (M10): 64 Nm

❖ 4



Frontal screws (M10): 64 Nm



Lateral screw (M8): 32 Nm

❖ 5



Bracket screws: 45–55 Nm



Screws for intake line: Loctite 262



Screws for intake line: 45–55 Nm

❖ 6



High-pressure pipe fittings: 24.5–34.3 Nm

❖ 7



Collar lock nuts: 9.8–11.8 Nm

❖ 8

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

Cover fastening nuts: 25 ± 3 Nm

❖ 9

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



Rods - tappets: Engine oil

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



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

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

❖ 10

- ★ Assemble a new gasket.



Bolt and cylinder block threadings: Engine oil.

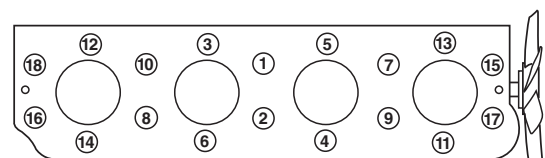
- ★ Tighten the screws, manually at first, and then in two stages, following the sequence indicated.



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

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

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

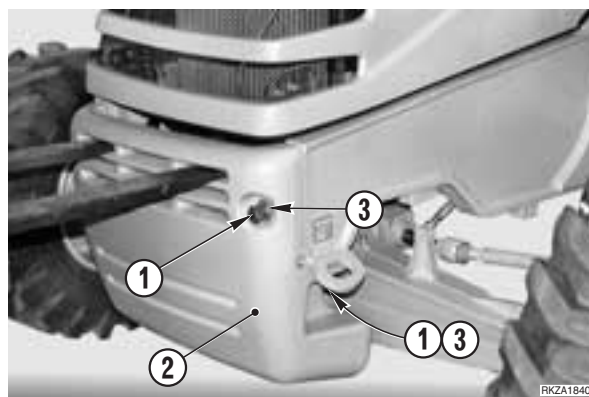
BOLTS TIGHTENING ORDER

RKZ00181

REMOVAL OF THE FRONT COUNTERWEIGHT

! Fully raise the front working equipment and engage the safety stop.
Also make the backhoe safe.

- 1 - Partially loosen the screws (1) to eliminate the tightening torque, and thus to facilitate the subsequent dismantling procedure.



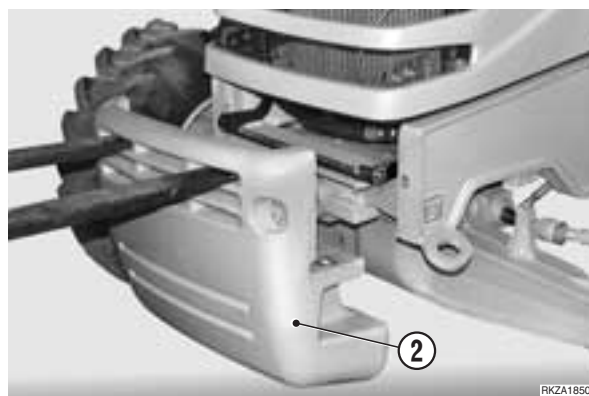
- 2 - Insert the prongs of a fork-lift truck into the ventilation slits, and force them gently upwards to compensate for the weight of the counterweight (2).

- 3 - Remove the screws (1) and the washers (3).

- 4 - Remove the Front counterweight (2).



Counterweight: 300 kg



INSTALLATION OF THE FRONT COUNTERWEIGHT

- To install, reverse the removal procedure.



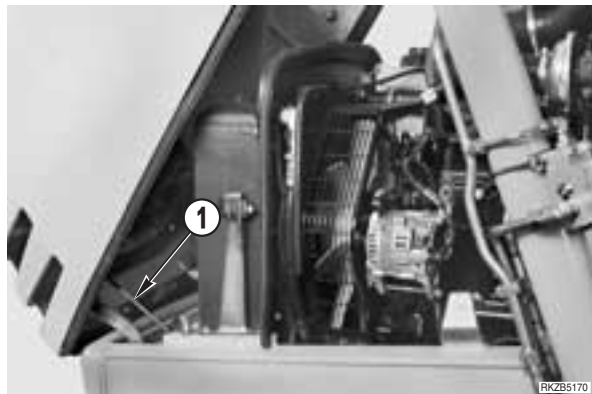
Screws: 300±30 Nm

REMOVAL OF THE RADIATOR GROUP

⚠ Fully raise the front working equipment and engage the safety stop.
Also make the backhoe safe.

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

- 1 - Disconnect the safety gas cylinders (1) for opening the engine hood. Remove the engine hood.
(For details, see «REMOVAL OF ENGINE HOOD»).



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

★ Drain the cooling liquid.

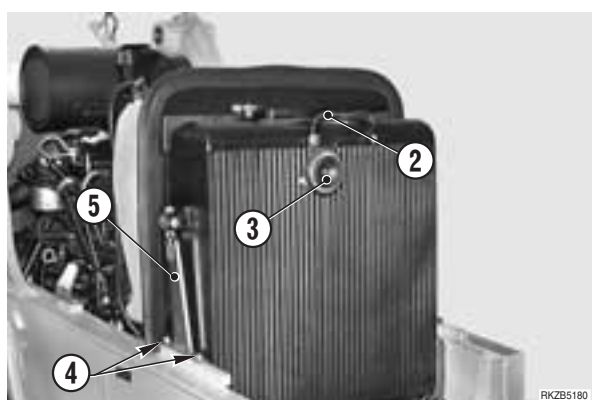
⚠ Cooling liquid: 18 ℓ

❌ 1

- 2 - Disconnect the cable (2) from the acoustic alarm (3).

- 3 - Loosen bracket (4) screw (5).

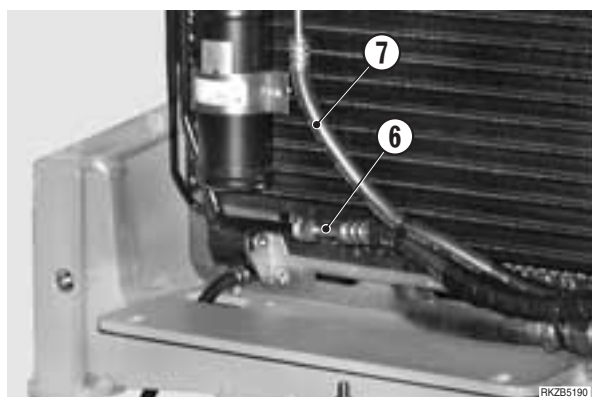
❌ 3



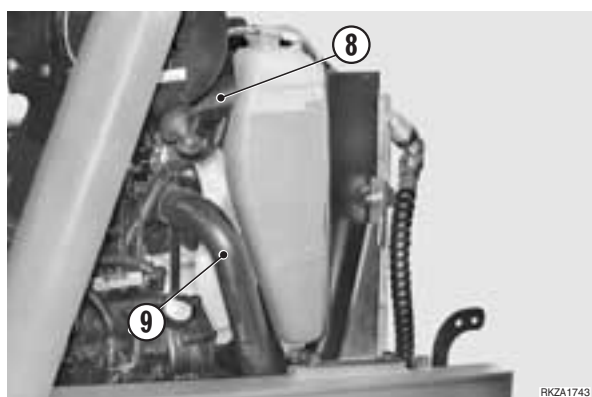
- 4 - **Only for machines equipped with an air-conditioning unit**

Drain the air conditioning unit, and disconnect the tubes (6), (7). (For details, see «20. TESTING AND ADJUSTMENTS»).

❌ 2



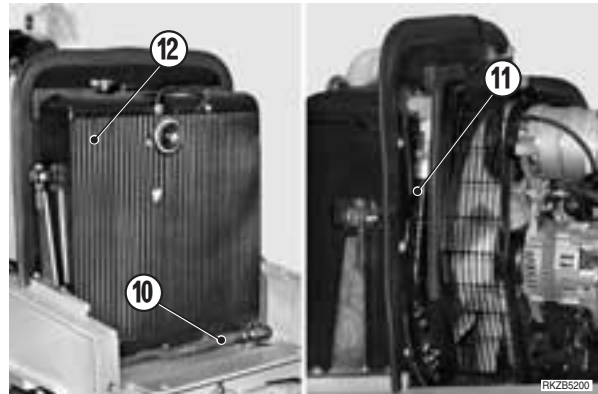
- 5 - Disconnect the engine hoses (8) and (9) from the radiator (9).



REMOVAL AND INSTALLATION

RADIATOR GROUP

- 6 - Slowly loosen the hoses (10) and (11) to drain the hydraulic oil from the radiator (12). When the oil is fully drained, complete disconnection of the hoses, and plug them to prevent entry of impurities.  4

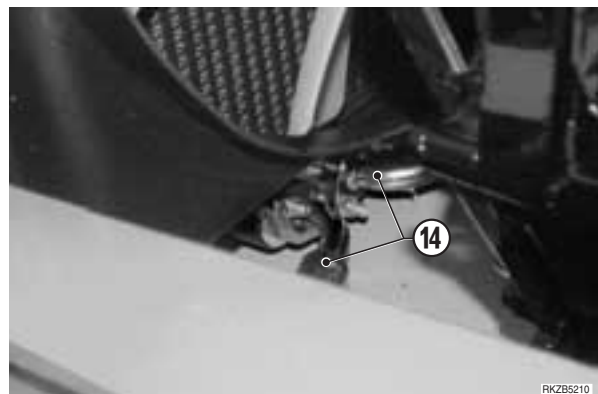


- 7 - Loosen radiator (12) nut (13).



- 8 - Disconnect the hoses (14) and plug them to prevent entry of impurities.  5

- 9 - Take out the nuts (13) of the lower anti-vibration units and remove the entire radiator group (12).



INSTALLATION OF THE RADIATOR GROUP

- To install, reverse the removal procedure.

❖ 1

- ★ Refill the coolant liquid circuit.



Coolant liquid: 18 ℓ

❖ 2

- ★ Refill the air-conditioning unit.



Quantity of fluid (R134a): 2250±150 g

Quantity of oil: See the amount recovered.

❖ 3

- ★ Align the radiator with the fan and make sure that the fan is inserted in the inner of conveyor for 2/3 of the blade width.

❖ 4

- ★ Ensure that the level of hydraulic oil in the tank is at maximum.

❖ 5

- ★ Ensure that the level of transmission oil is at maximum.

1 - Start the engine at low idling to circulate all the fluids and to fill up the systems.

2 - Accelerate gradually up to 1700 rpm. After about one minute, stop the engine and top up all levels.

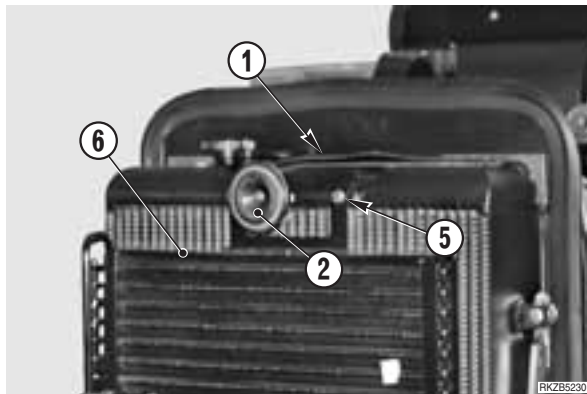
- ★ Check carefully that there are no leaks.

REMOVAL OF THE CONDENSER

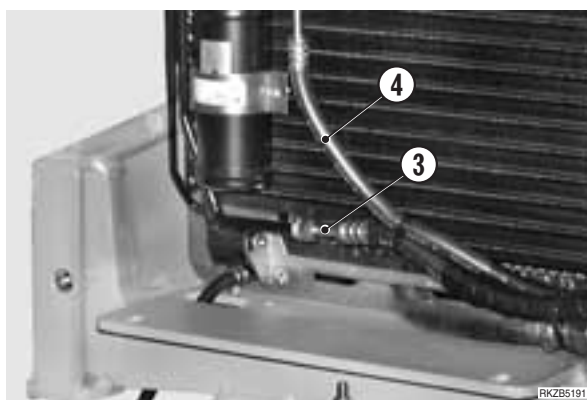
(Only for machines equipped with an air-conditioning unit)

- !** Completely raise the front working equipment and engage the parking brake.
Also place the backhoe in its secure position.

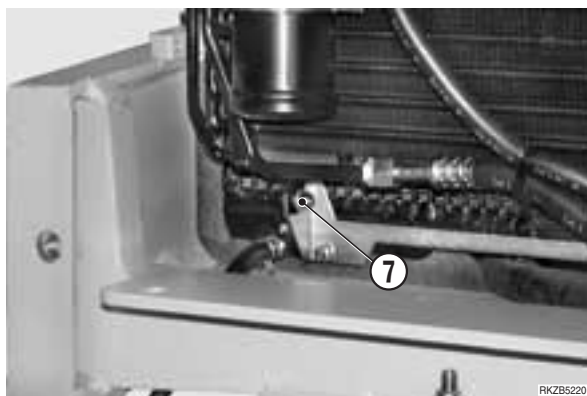
- 1 - Drain the air-conditioning unit.
(For details, see «20. TESTING AND ADJUSTMENTS»).
- 2 - Disconnect the cable (1) and remove the klaxon (2).



- 3 - Disconnect the tubes (3) and (4)
 - ★ Immediately plug the tubes and the condenser tightly to prevent moisture from entering into the air-conditioning circuit.
- 4 - Loosen the upper retaining screw (5) of the condenser (6), leaving it in position for reasons of safety.



- 5 - Loosen the screws (7) and remove the locknuts.
- 6 - Remove the screws (5) and (7) and take out the condenser.



INSTALLATION OF THE CONDENSER

- To install, reverse the removal procedure.

- 1 - Refill the air-conditioning unit.

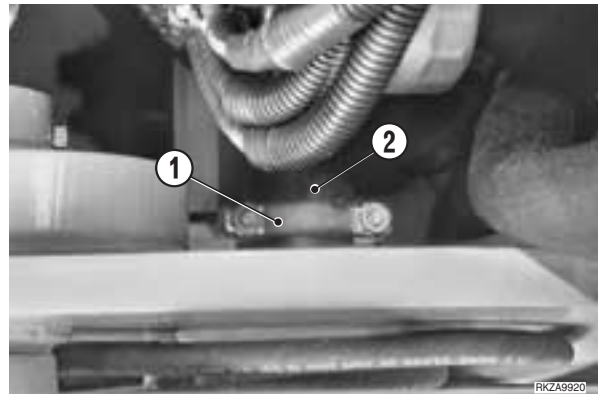


Quantity of fluid (R134a): 2250±150 g
Quantity of oil: see the amount recovered.

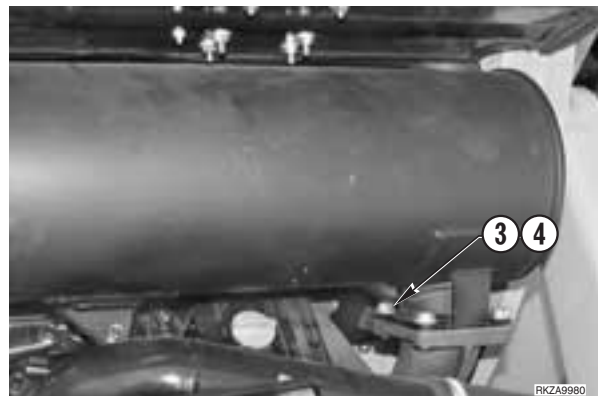
REMOVAL OF THE MUFFLER

! Fully raise the front working equipment and engage the safety stop.
Also make the backhoe safe.

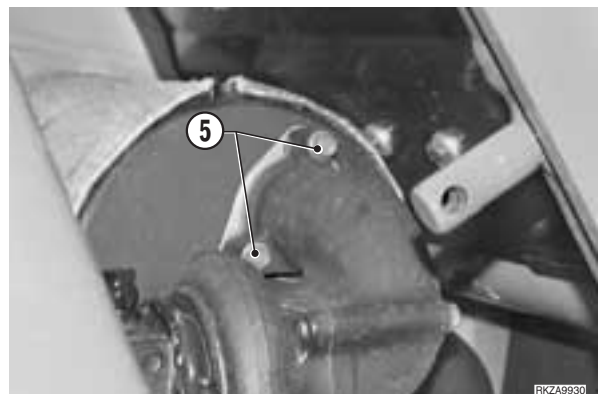
1 - Loosen the retaining clip (1) of the hose (2) and disconnect it from frame.



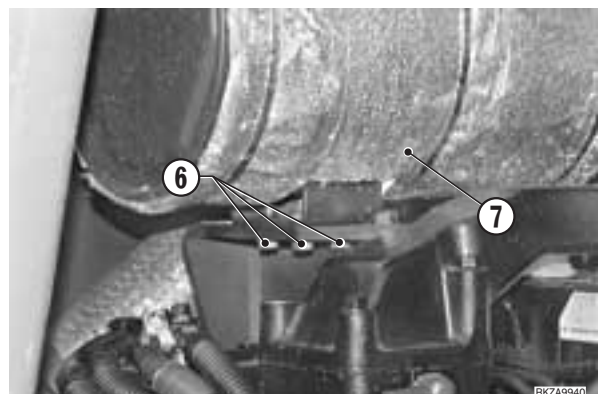
2 - **Only for WB91R-2**
Take out nuts (3) and washers (4).



3 - **Only for WB93R-2**
Take out screws (5).



4 - Take out the four screws (6) and remove the complete muffler (7).



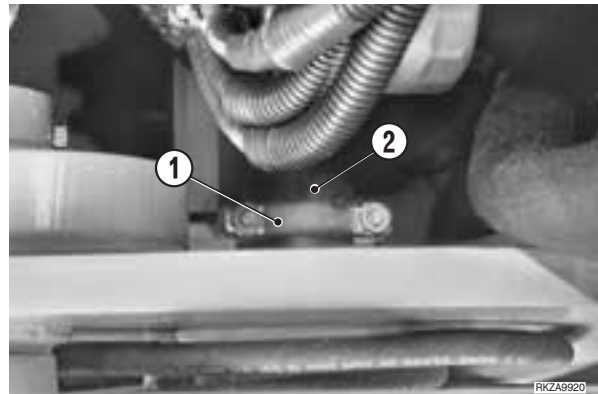
INSTALLATION OF THE MUFFLER

- To install, reverse the removal procedure.

★ Put in a new sealant.

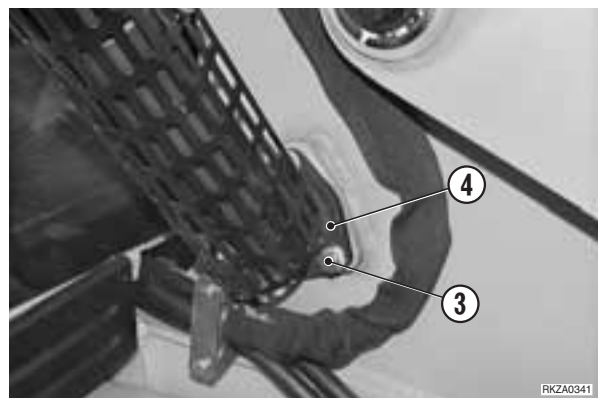
REMOVAL OF THE EXHAUST PIPE

1 - Loosen the clip (1) and disconnect the flexible hose (2).



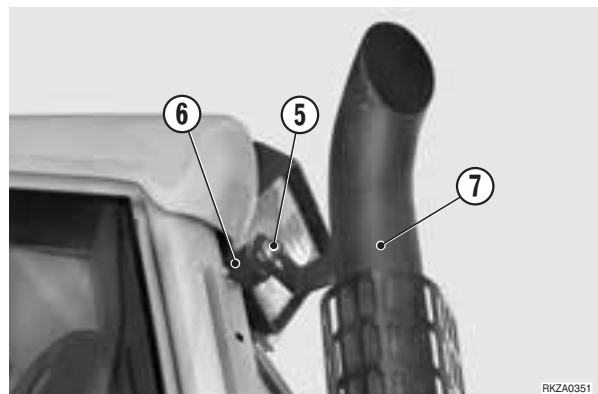
2 - Take out two of the three lower screws (3) of the connecting flange (4).

★ Loosen the third screw and leave it in place for safety.



3 - Take out the nut (5) and the washer of the upper anti-vibration unit (6).

4 - Take out the last screw (3) and remove the exhaust pipe (7).



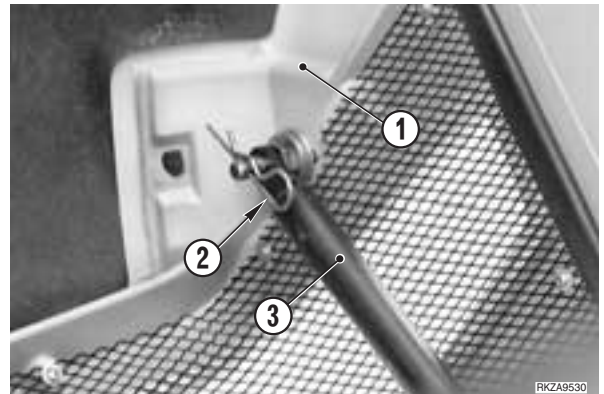
INSTALLATION OF THE EXHAUST PIPE

- To install, reverse the removal procedure.

REMOVAL OF THE ENGINE HOOD

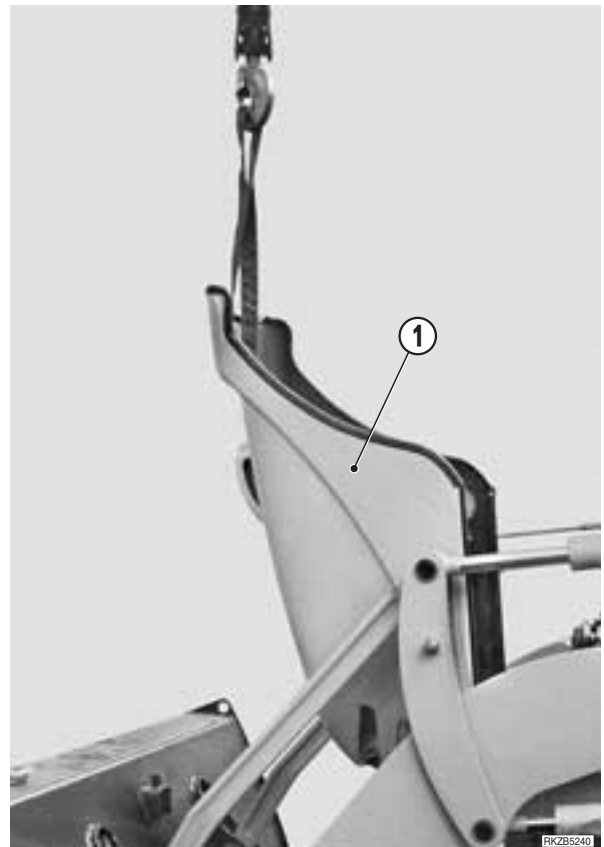
! Lower the working equipment completely until it is resting on the ground. Stop the engine and remove the ignition key.

- 1 - Open the engine hood (1) take out the safety pins (2) and disconnect the hood from the gas cylinders (3).



- 2 - Raise the hood (1) to a vertical position and attach it to some hoisting tackle.

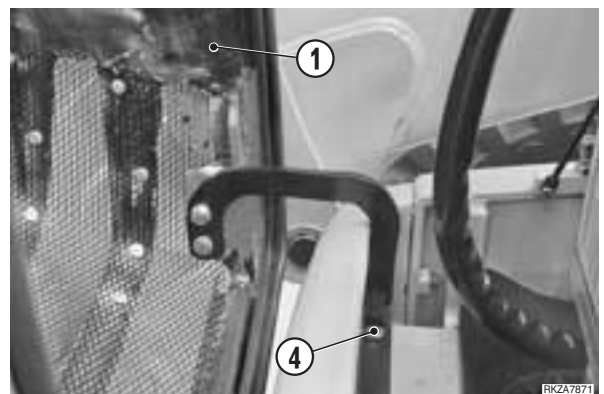
★ To attach it, use the hole in the opening cavity.



- 3 - Take out the two screws (4) and remove the hood (1).

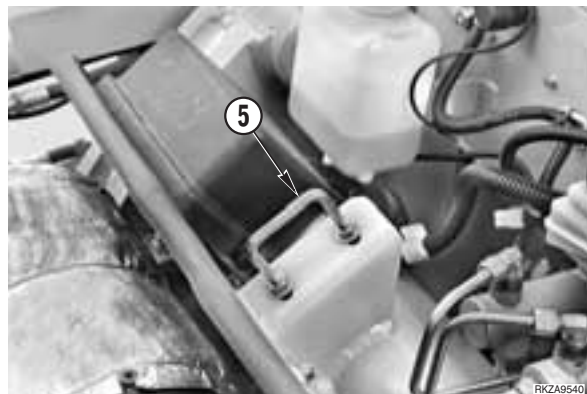


Engine hood: 27 kg



INSTALLATION OF THE ENGINE HOOD

- To install, reverse the removal procedure.
- ★ Check that the hood (1) closes perfectly, and re-attach the screws (5).



REMOVAL OF THE CAB

⚠ Lower the working equipment completely until it rests on the ground and stop the engine and remove the ignition key.

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

⚠ Release all residual pressure in all circuits.

★ **Only for machines equipped with an air-conditioning unit**

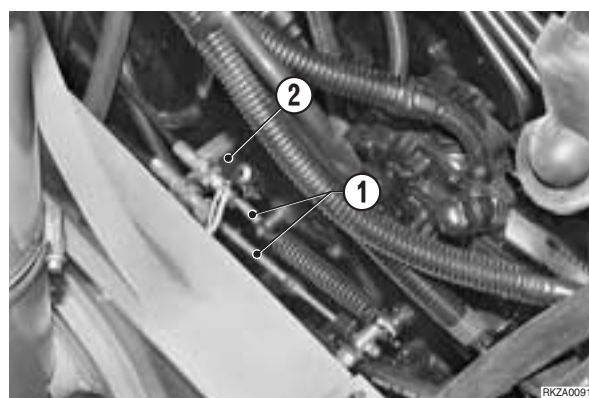
Drain the air conditioning unit.

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

※ 1

1 - Disconnect the pedal accelerator and hand accelerator cables (1) from the injection pump. Disengage the sheathings from the support (2).

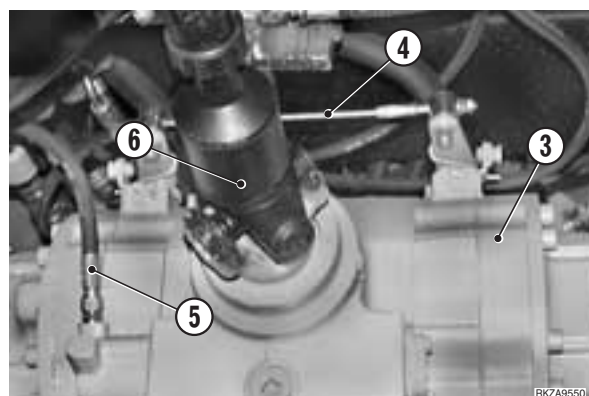
※ 2



2 - Disconnect the braking circuit pipes (4) and the differential lock tube (5) from the rear axle (3).

※ 3

★ Plug the pipes and pipe-fittings to prevent entry of impurities.

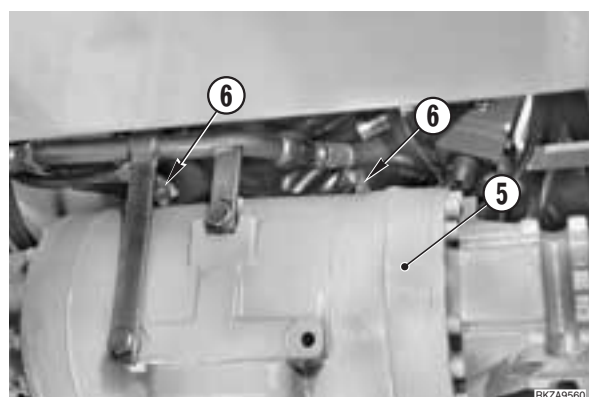


3 - Disconnect the steering cylinder pipes (5) from the rear axle.

★ Mark the positions of the pipes to prevent exchanging positions when reconnecting.

★ Plug the pipes and pipe-fittings to prevent entry of impurities.

※ 4



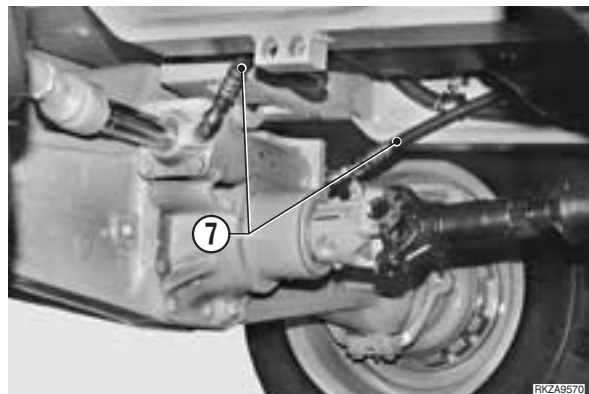
REMOVAL AND INSTALLATION

CAB

- 4 - Disconnect the steering cylinder pipes (7) from the front axle.

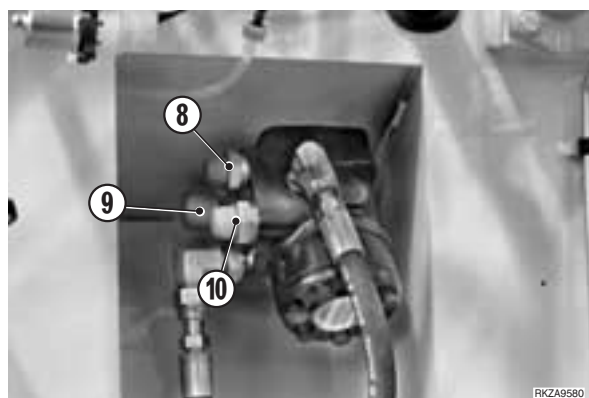
※ 5

- ★ Mark the positions of the pipes to prevent exchanging positions when reconnecting.
- ★ Plug the pipes and pipe-fittings to prevent entry of impurities.



- 5 - Disconnect the pipes of the L-T-P ports (8, 9 and 10) from the steering unit.

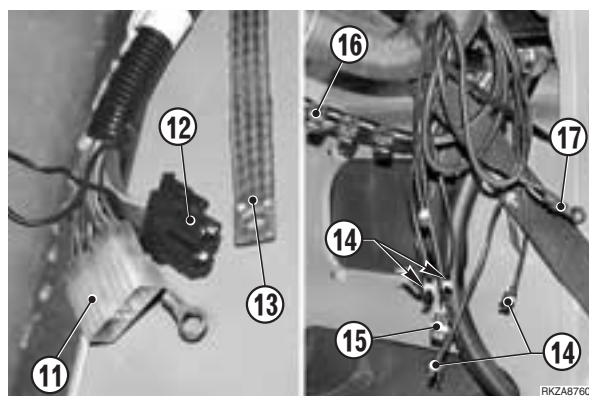
- ★ Mark the positions of the pipes to prevent exchanging positions when reconnecting.
- ★ Plug the pipes and pipe-fittings to prevent entry of impurities.



- 6 - Disconnect from gearbox the connectors (11) and (12) and the grounding cable (13).

- 7 - Disconnect the five connectors (14) of sensor, the control speed connector (15) and the solenoid connector (16) from the transmission.

- 8 - Disconnect from grounding stud two connectors (17).

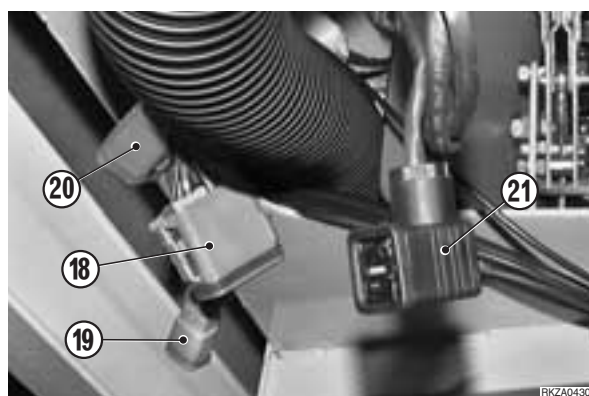


- 9 - Disconnect the connector (18) of the auxiliary controls set into the bucket control lever.

- 10 - Disconnect the converter disengagement connector (19) set into the gear lever.

- 11 - Disconnect the connector (20) of the differential disengagement and backhoe boom disengagement solenoids.

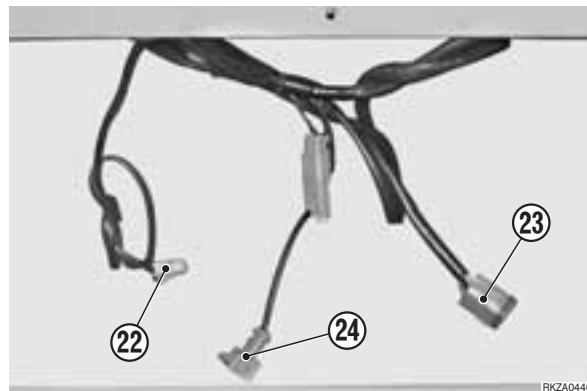
- 12 - Disconnect the power increment solenoid connector (21) installed on the piston pump.



REMOVAL AND INSTALLATION

CAB

- 13 - Disconnect the connectors (22) of the rear acoustic alarm, the connector (23) of the rear lights and finally the connector (24) of the solenoid of the backhoe control valve.

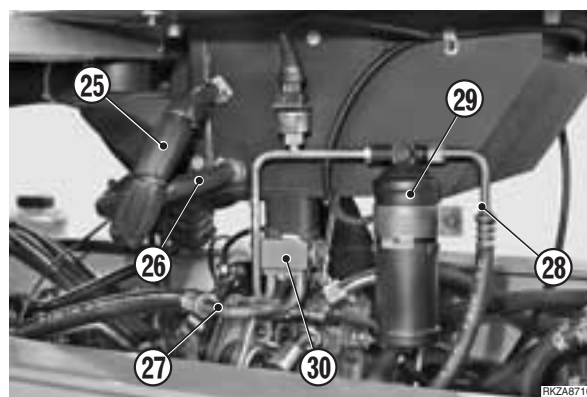


- 14 - Disconnect the heating unit tubes (25) and (26).
(For details, see «REMOVAL OF THE CAB HEATING GROUP»).

- 15 - **Only for machines equipped with an air-conditioning unit.**

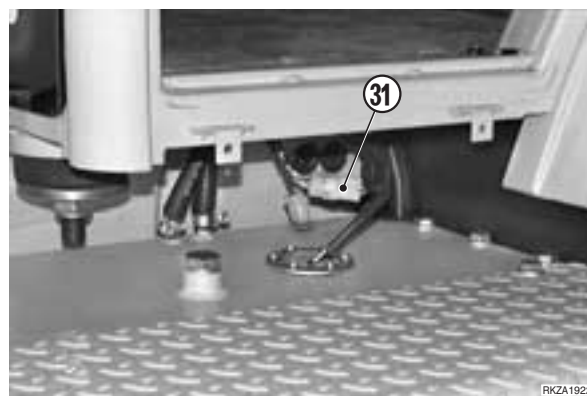
Disconnect the tubes (27), (28) connecting the unit to the drying filter (29) and the expansion valve (30).

- ★ Immediately plug the tubes and the orifices tightly to prevent moisture from entering into the air-conditioning circuit.



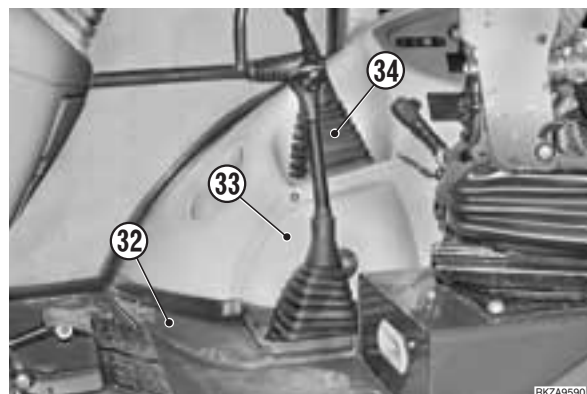
- 16 - Lift off the lower left-hand guard of the cab and disconnect the connector (31) of the fuel level indicator and the connector of the self-supply pump, if any.

- 17 - Also lift off the lower right-hand guard.



- 18 - Remove the floor-mat (32) and remove the lateral cover (33).

- ★ Push the protective sleeve (34) of the gearbox lever down into the side cover (33).



REMOVAL AND INSTALLATION

CAB

19 - Remove the grips (35) of the outrigger control levers and lift off the cover (36) of the control levers.

20 - Remove the self-locking nuts (37) and the four screws that secure the cab. 

21 - Disconnect the hoses (38) and (39) from control valve (40).

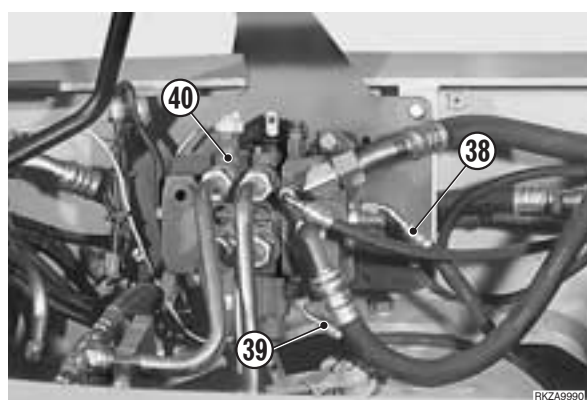
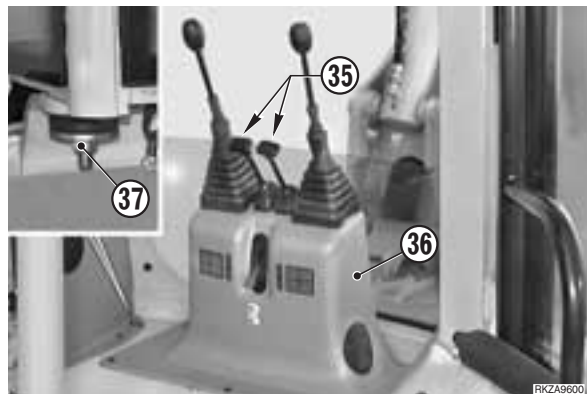
22 - Remove the protective plugs and screw two eyebolts "A" into the holes supplied for hoisting purposes. Attach the cab (41) to the hoisting tackle and apply a slight tension.

23 - Slowly raise the cab, directing its movement in such way that the gear lever slides out.

- ★ Make sure that all the electrical leads and the accelerator cables are free.



Cab: circa 630 kg



INSTALLATION OF THE CAB

- To install, reverse the removal procedure.

 1

- ★ Drain and refill the air-conditioning unit



Quantity of fluid (R134a): 2250±150 g
Quantity of oil: see the amount recovered.

 2

- ★ Check and adjust the stroke of the hand and pedal accelerators. (For details, see «20. TESTING AND ADJUSTMENTS»).

 3

- ★ Adjust the stroke of the parking brake lever. (For details, see «20. TESTING AND ADJUSTMENTS»).

 4

- ★ Bleed the air from the braking circuit. (For details, see «20. TESTING AND ADJUSTMENTS»).

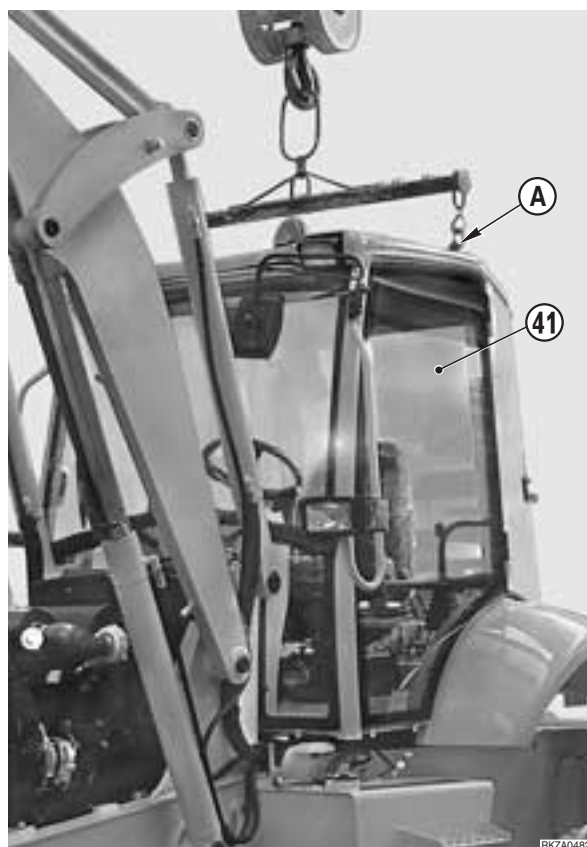
 5

- ★ Bleed the air from the steering circuit. (For details, see «20. TESTING AND ADJUSTMENTS»).

 6



Cab retaining screws: 169–9,8 Nm



REMOVAL OF THE HEAT AND AIR-CONDITIONING GROUP

NOTE If no air-conditioning unit is included, perform only those operations relating to the heating unit.

⚠ Lower the working equipment completely until it rests on the ground, and stop the engine.

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

★ Drain the engine cooling liquid.



Coolant liquid: 18 ℓ

1 - Drain the air-conditioning unit.
(For details, see «20. TESTING AND ADJUSTMENTS»).

2 - Disconnect the flexible hose (1) of the heating water cock.

3 - Disconnect the connector of the power-supply cabling (2) and the clamp (3).

4 - Disconnect the connector (5) from the pressure switch (4).

5 - Disconnect the delivery pipe (7) and the return pipe (8) from the expansion valve (6).

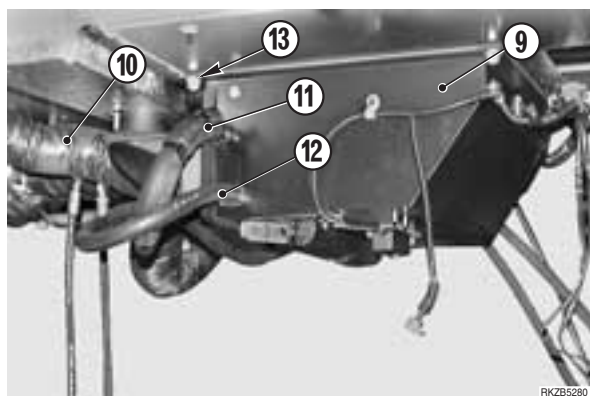
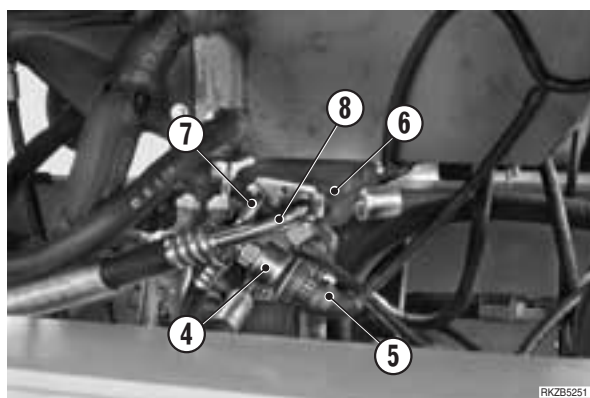
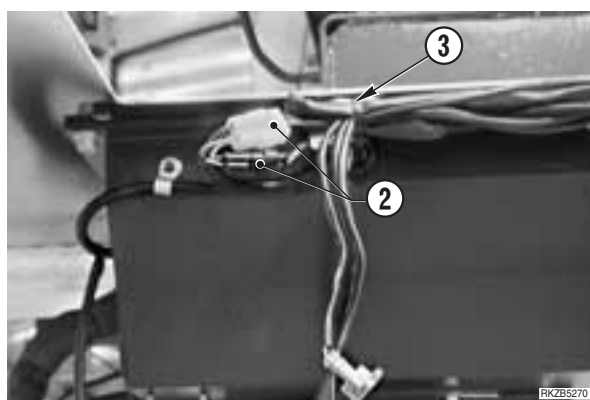
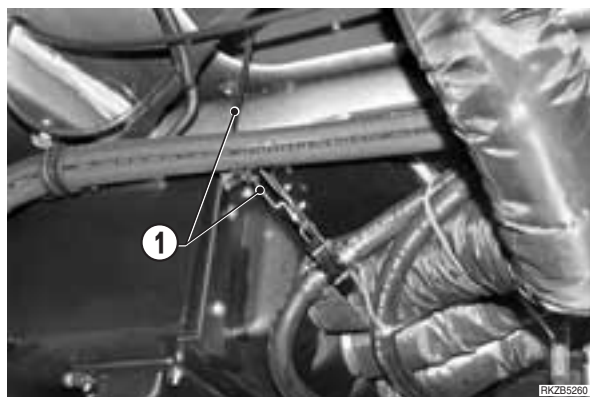
★ Immediately plug the tubes and the orifices tightly to prevent moisture from entering into the air-conditioning circuit.

★ Re-use the O-ring.

6 - Disconnect the pipes (10) from the fan-cooler (9).

7 - Disconnect the tubes (11) and (12) that connect with the engine.

8 - Remove the four nuts (13) and remove the group (9).



INSTALLATION OF THE HEATING AND AIR-CONDITIONING GROUP

- To install, reverse the removal procedure.

1 - Refill the cooling liquid.



Coolant liquid: 18 ℓ

2 - Drain and refill the air-conditioning unit.



Quantity of fluid (R134a): 2250±150 g

Quantity of oil: See the amount recovered.

3 - Start the engine and use a leak detector to check the leaktightness of the air-conditioning unit.

REMOVAL OF THE FUEL TANK

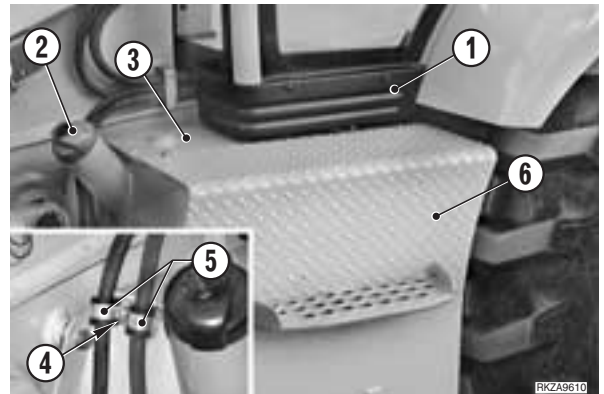
! Lower the working equipment completely until it rests on the ground and stop the engine.

- 1 - Remove the lower left-hand guard (1) of the cab.
- 2 - Take the cap (2) off the filling inlet of the fuel tank (3) and remove also the bottom plug in order to drain the fuel.



Fuel: max. 130 ℓ

- 3 - Remove the nut (4) in order to free the clips (5).

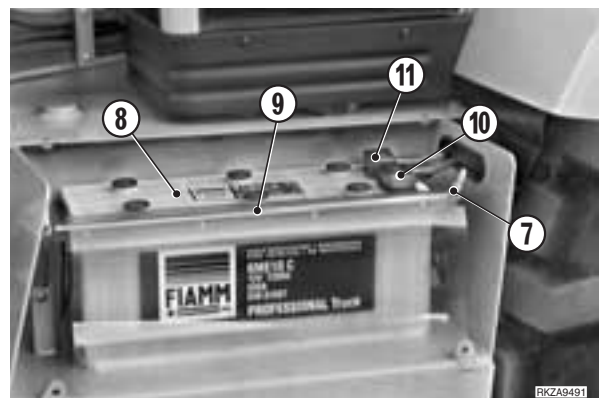


- 4 - Remove the guard (6), loosen the rods (7) until the battery (8) is free (8) from the bracket (9). Disconnect the clamps (10) and (11) and remove the battery (8).



First remove the clamp of the negative battery terminal (8) (-).

- 5 - Disconnect the connector (12) of the level indicator (13) and the connector (14) of the self-supply pump, if fitted.
- 6 - Disconnect the fuel suction and flow-back hoses (15) and (16) and the pipe of the self-supply pump, if fitted.
 - ★ Plug the pipes to prevent entry of impurities.
 - ★ Mark the pipes to avoid exchanging them during installation.



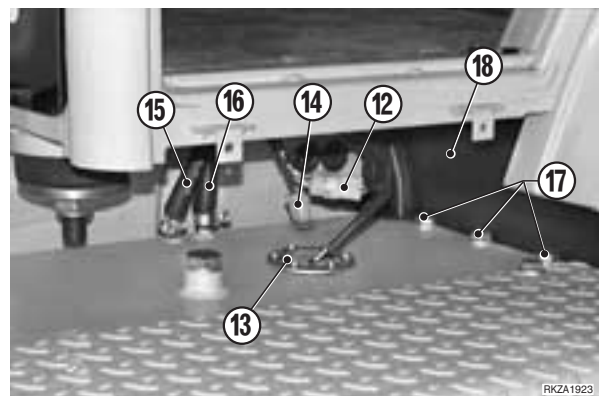
- 7 - Remove the screws (17) and the guard (18).
- 8 - Support the fuel tank (3) with hoisting tackle and remove the four retaining screws (19).



- 9 - Remove the fuel tank (3).



Fuel tank: 73 kg



INSTALLATION OF THE FUEL TANK

- To install, reverse the removal procedure.



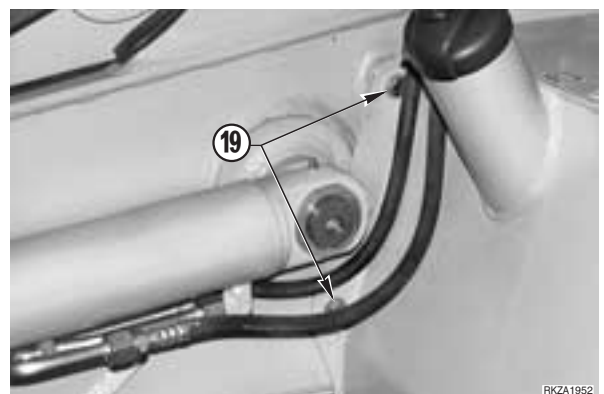
Retaining screws for fuel tank: 120 Nm

- 1 - Refill the fuel tank.



Fuel: max. 130 ℓ

- 2 - Bleed the air from the fuel circuit.
- 3 - Start the engine.



REMOVAL OF HYDRAULIC OIL TANK

⚠ Lower the working equipment completely until it rests on the ground and stop the engine.

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

1 - Take off the lower right-hand guard (1) of the cab.

2 - Remove the guard (2).

3 - Remove the oil drainage cap (3).

★ Drain the hydraulic oil.

🛢 Hydraulic oil: 92 ℓ

4 - Disconnect the lower suction (5) and drainage (6) hoses from the tank (1).

★ Plug the hoses to prevent entry of impurities.

5 - Disconnect the upper pipes (7), (8) and (9), remove the check valve (10) and the T-piece (11).

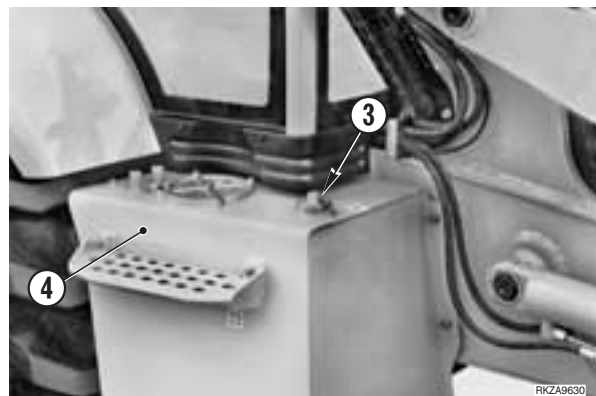
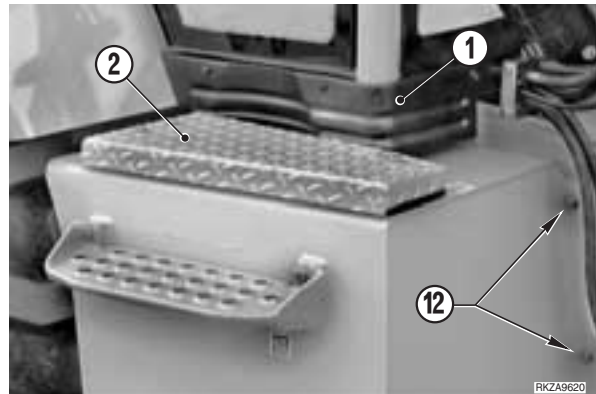
★ Make a note of the assembly sequence.

6 - Support the tank (4) with hoisting tackle and remove the four retaining screws (12).



7 - Remove the tank (4).

📊 Oil for the tank: 77 kg



INSTALLATION OF THE HYDRAULIC OIL TANK

• To install, reverse the removal procedure.



🔧 Tank retaining screws: 120 Nm

1 - Refill the tank.

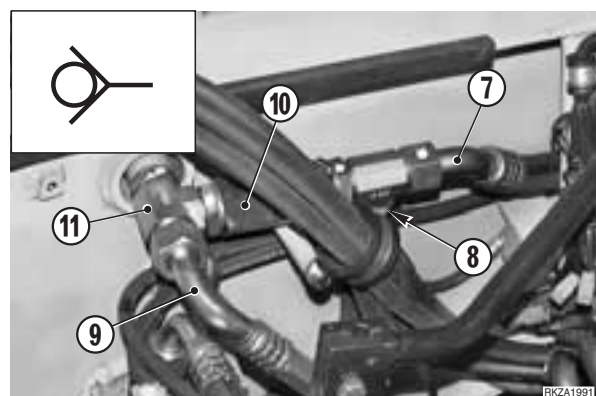
🛢 Hydraulic oil: 92 ℓ

2 - Refill the pump (For details, see «20. TESTING AND ADJUSTMENTS»).

3 - Start the engine to let the oil circulate through all the hydraulic systems and check for leaks.

4 - Bleed the air from the hydraulic systems.
(For details, see «20. TESTING AND ADJUSTMENTS»).

5 - Stop the engine, check the oil level in the tank, and top it up if necessary.



REMOVAL OF THE ENGINE-GEARBOX-PUMP GROUP

⚠ Lower the working equipment completely until it rests on the ground, and stop the engine.

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

⚠ Release all residual pressure in all circuits.
↑ (For details, see «20. TESTING AND ADJUSTMENTS»).

★ Drain the hydraulic oil.

🛢 Hydraulic oil: 92 ℓ

★ Drain the engine cooling liquid.

🛢 Coolant liquid: 18 ℓ

★ Drain the oil from the gearbox.

🛢 Gearbox oil: 16 ℓ

1 - **Only for machines equipped with an air-conditioning unit.**

Drain the air conditioning unit.
(For details, see «20. TESTING AND ADJUSTMENTS»).

2 - Remove the front working equipment.
(For details, see «REMOVAL OF THE FRONT WORKING EQUIPMENT»).

3 - Take off the engine hood.
(For details, see «REMOVAL OF THE ENGINE HOOD»).

4 - Take out the screws (1) and remove the front counterweight (2). (For details, see «REMOVAL OF THE FRONT COUNTERWEIGHT»).

※ 1

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

6 - Lift the protection (3), disconnect connector (4) and remove transmission lever (5).

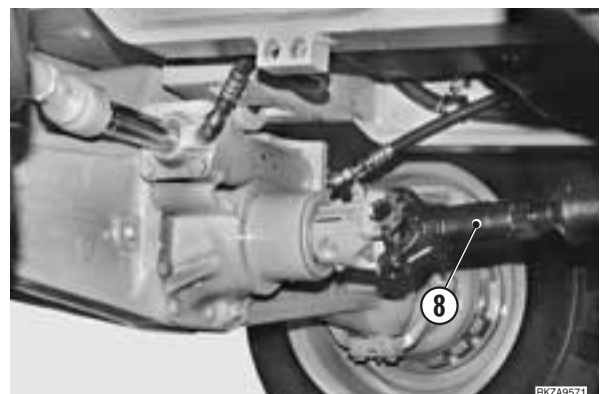
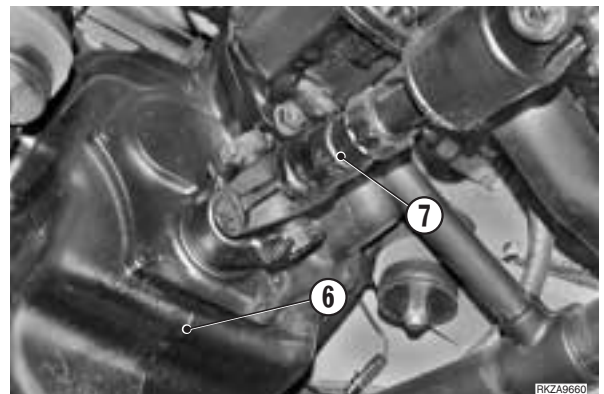
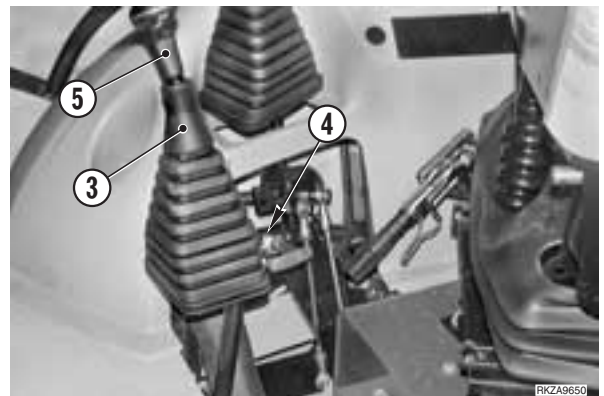
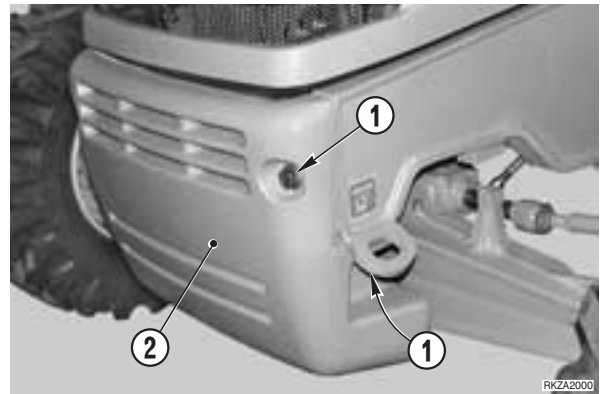
※ 2

7 - Disconnect rear cardan shaft (7) from transmission (6).

※ 3

8 - Remove front cardan shaft (8).

※ 3



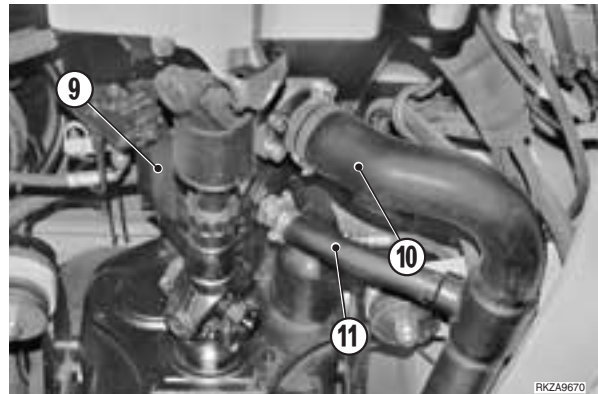
REMOVAL AND INSTALLATION

ENGINE-GEARBOX-PUMP GROUP

- 9 - Disconnect the suction hose (10) and the drainage pipe (11) from the pump (9).
Disconnect also the power increment solenoid connector.

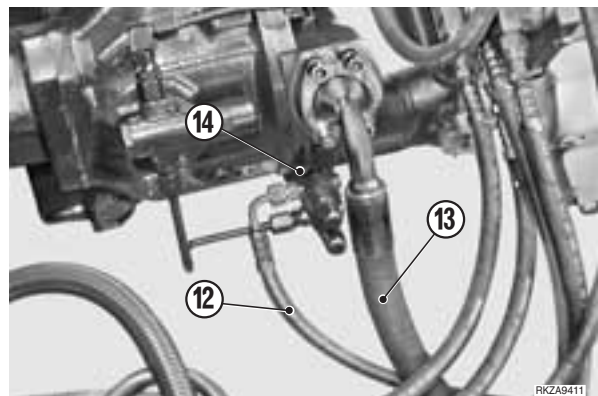


★ Plug the pipes to prevent entry of impurities.



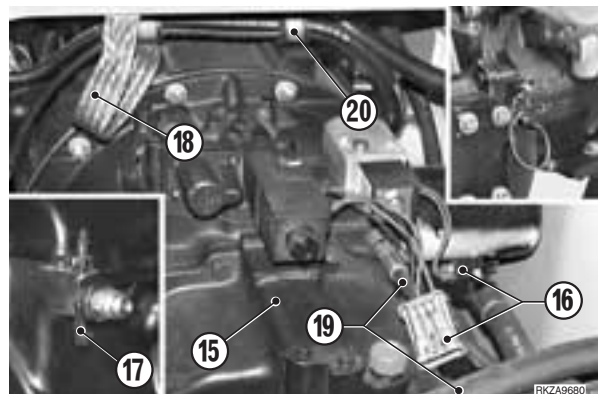
- 10 - Disconnect the Load Sensing signal pipe (12) and the delivery pipe (13) from valve (14).

★ Plug the pipes to prevent entry of impurities.



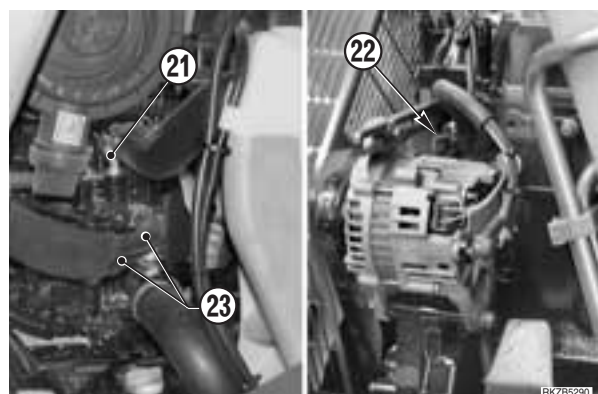
- 11 - Disconnect from the transmission (15) the solenoid valve (17) connectors (16), the hearth-strap (18), the oil cooling circuit pipes (19) and the clamp (20).

★ Plug the pipes to prevent entry of impurities.



- 12 - Disconnect the coolant liquid temperature sensors (21) and (22) from the engine.

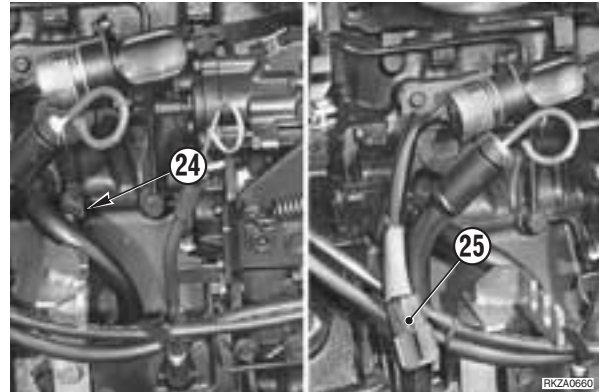
- 13 - Disconnect the cab heating pipes (23) from the coolant pump.



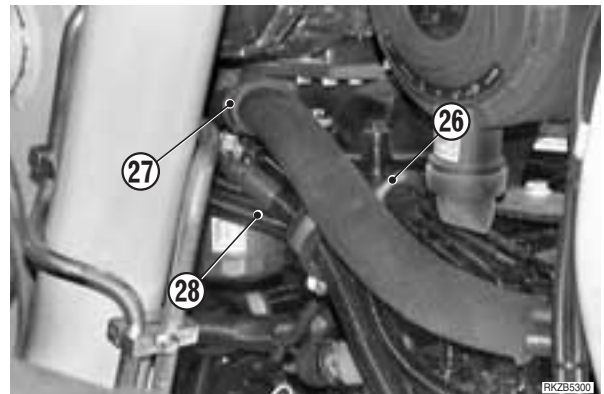
REMOVAL AND INSTALLATION

ENGINE-GEARBOX-PUMP GROUP

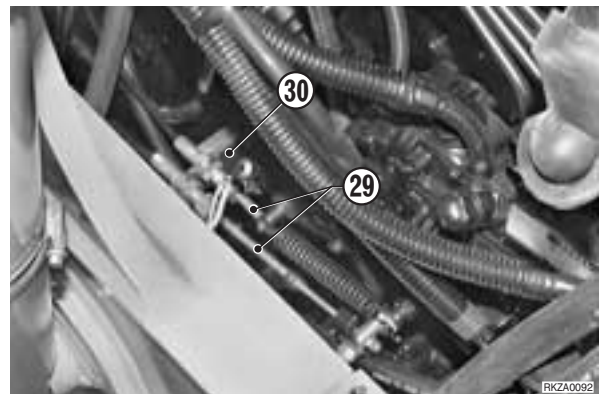
- 14 - Disconnect the connector (24) of the oil pressure sensor and the connector (25) of the solenoid that stops the engine.



- 15 - Disconnect the cable (26) of the cold-start equipment, the cab heating-pipe support clip (27), and the fuel tank flow-back hose (28).  5

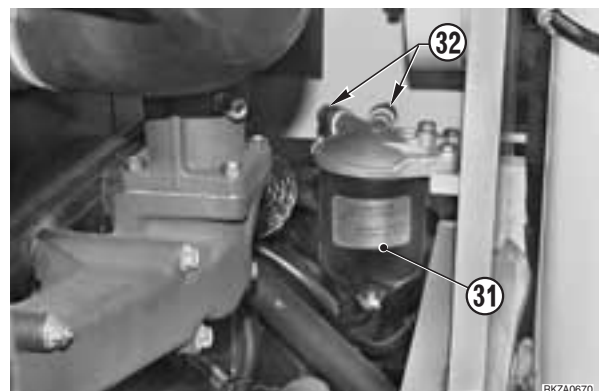


- 16 - Disconnect the cables (29) of the pedal and hand accelerators. Disengage the support sheathing (30).



- 17 - Disconnect the fuel lines (32) from the separator (31) and plug them.

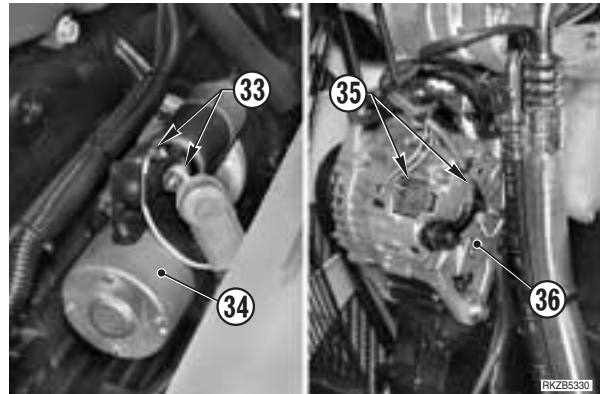
- 18 - Remove the separator



REMOVAL AND INSTALLATION

ENGINE-GEARBOX-PUMP GROUP

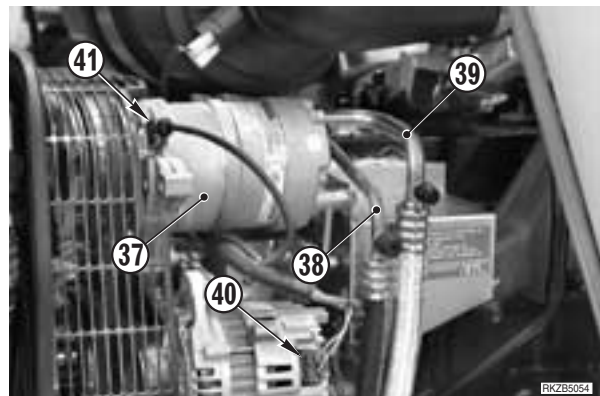
- 19 - Disconnect the cables (33) from the starting motor (34) and the cables (35) from the alternator (36).



- 20 - **Only for machines equipped with an air-conditioning unit.**

Save the coolant R134a and disconnect the delivery tubes (38) and suction tubes (39) from the compressor (37).

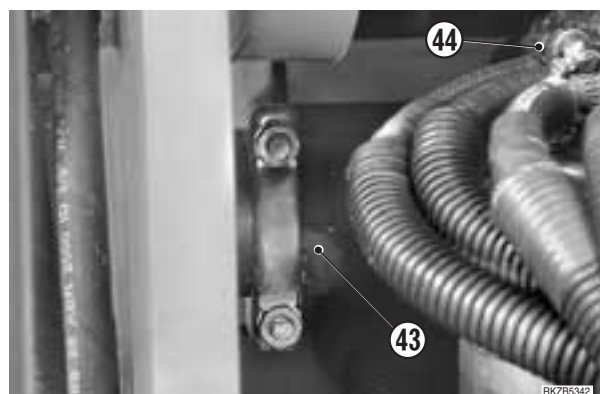
- ★ Immediately plug the tubes and orifices tightly to prevent moisture from entering into the air-conditioning circuit.
- ★ Disconnect the air-conditioning unit connectors (40) and (41).



- 21 - Remove the plate (42) and push it towards the back of the machine.



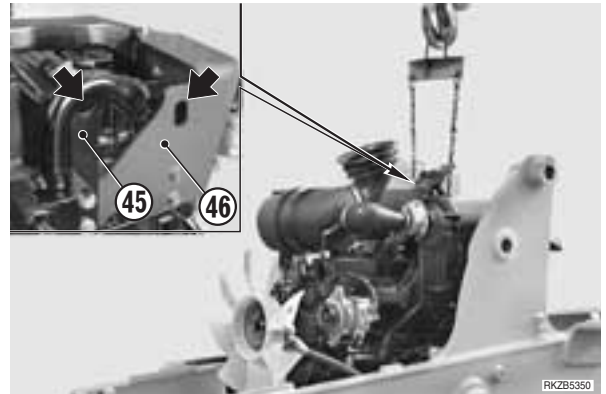
- 22 - Loosen the clamp (43) and disconnect the flexible hose (44).



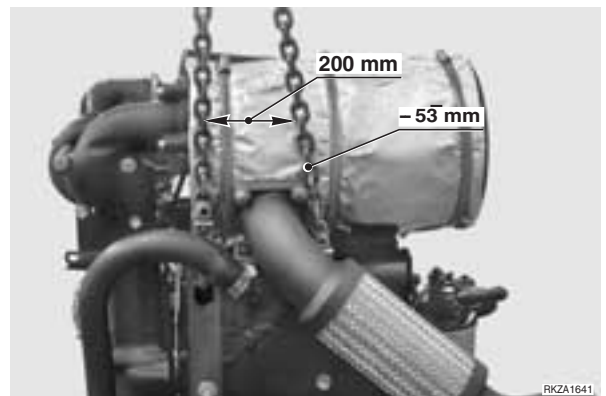
REMOVAL AND INSTALLATION

ENGINE-GEARBOX-PUMP GROUP

23 - Attach the entire group to some hoisting tackle using the engine bracket (45) and the muffler support (46). Apply a slight tension to the hoisting chains.



- ★ The chains should have a total length of about 800 mm and a difference between the arms of 53 mm.
- ★ The shortest length should be attached to the bracket (45).
- ★ When under tension the cables should be about 200 mm apart at the height of the muffler.



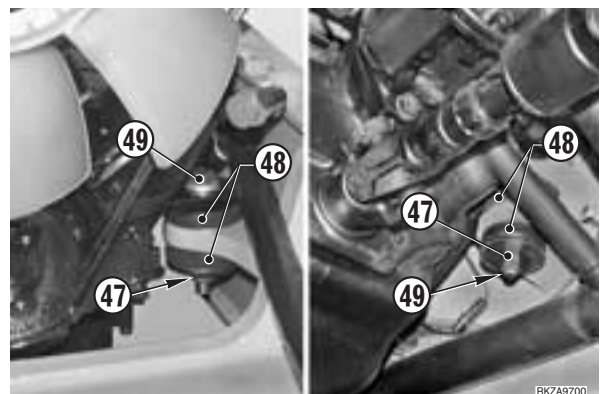
24 - Loosen and remove the nuts (47) of the anti-vibration supports (48) of the engine and gearbox, and take out the screws (49).



25 - Raise the entire group until the chassis supports are disengaged, and then accompany the group in order to slide it away from the front part of the chassis.



Engine-gearbox-pump group: 740 kg



INSTALLATION OF THE ENGINE GEARBOX-PUMP GROUP

- To install, reverse the removal procedure.

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



Hydraulic oil: 92 ℓ

2 - Fill the gearbox up to its maximum level.



Gearbox oil: 16 ℓ

3 - Refill the coolant liquid.



Coolant liquid: 18 ℓ

4 - Drain and refill the air-conditioning unit.



Quantity of fluid (R134a): 2250±150 g

Quantity of oil: see the amount recovered.

※ 1



Screws for front counterweight: 300±30 Nm

※ 2



Screws on gearbox side: 70 Nm



Screws on gearbox side: Loctite 262

※ 3



Nut on axle side: 70 Nm

※ 4

- ★ Fill up the pump casing and the pump, to bring the tank up to pressure.

For the method see «20. TESTING AND ADJUSTMENTS».

※ 5

- ★ Bleed the air from the fuel lines.

※ 6



Nuts from the anti-vibration supports:

196±19,6 Nm

4 - Start the engine to circulate the oil and coolant liquid.
Check that there are no leaks.

5 - Use a leak detector to check the leaktightness of the delivery and return pipes of the air-conditioning unit compressor.

6 - Bleed the air from the working equipment circuits.
(For details, see «20. TESTING AND ADJUSTMENTS»).

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

REMOVAL OF THE PISTON PUMP

⚠ Lower the working equipment completely until it rests on the ground, and stop the engine.

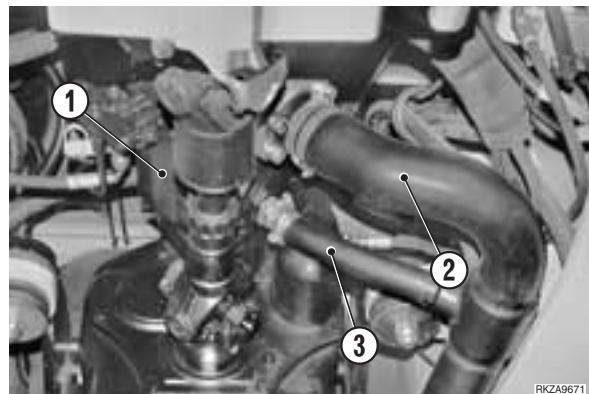
⚠ Release residual pressure fully in all circuits.
(For details, see «20. TESTING AND ADJUSTMENTS»).

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

★ Drain the hydraulic oil.



Quantity of oil: 92 ℓ

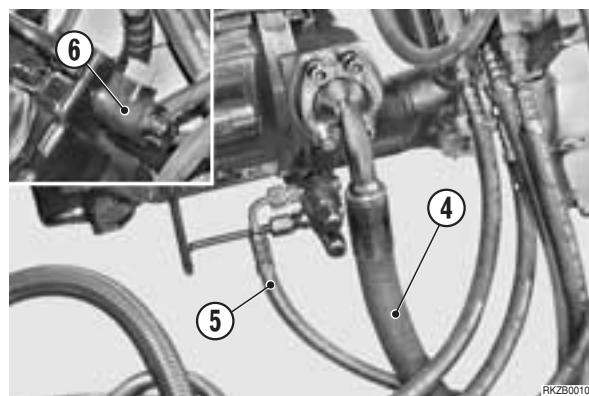


1 - Disconnect the suction hose (2) and the drainage pipe (3) from piston pump (1). 

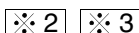
2 - Disconnect the delivery pipe (4) and the Load Sensing signal line (5).

★ Plug the pipes to prevent entry of impurities.

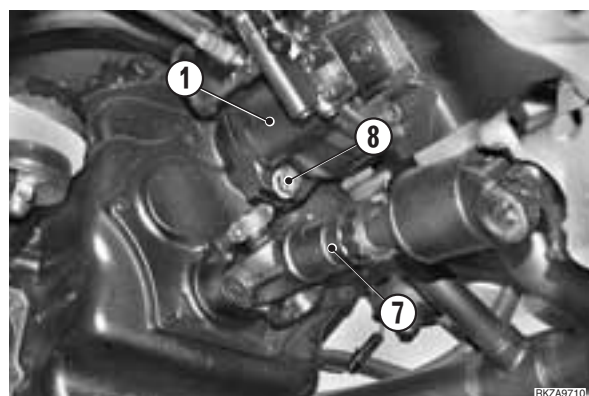
3 - Disconnect the solenoid connector (6)



4 - Take out the rear cardan shaft (7).



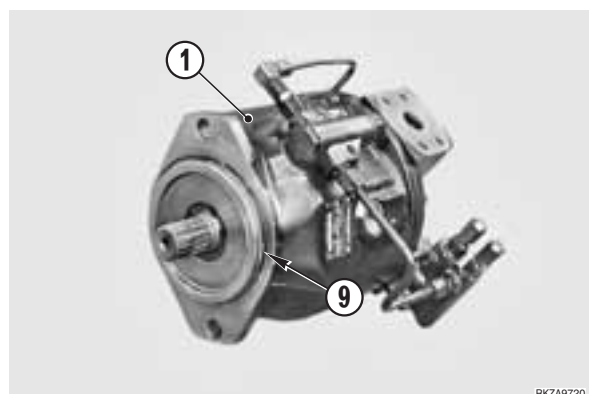
5 - Attach under pump (1) a pit jack and a suitable support.



6 - Take out the two screws (8) and remove the pump (1) complete with its O-ring (9). 



Pump: 40 kg



INSTALLATION OF THE PISTON PUMP

- To install, reverse the removal procedure.

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



Hydraulic oil: 92 ℓ

- ★ Fill the pump body and the pump, bringing the tank up to pressure.
For the method, see «20. TESTING AND ADJUSTMENTS».

❖ 1



Screws for suction flange: 100 Nm



Screws for delivery flange: 60 Nm

❖ 2



Screws on gearbox side: Loctite 262



Screws on gearbox side: 70 Nm



Nut on axle side: 70 Nm

❖ 3



Pump retaining screws: Loctite 262



Pump retaining screws: 220 Nm

2 - Start the engine to circulate the oil in all hydraulic circuits.

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

REMOVAL OF THE TRANSMISSION

⚠ Lower the working equipment completely until it rests on the ground, and stop the engine.
Make the backhoe safe.

⚠ Raise the engine hood and disconnect the cable from battery negative terminal (-).

⚠ Release all residual pressure in all circuits.
↑ (For details, see «20. TESTING AND ADJUSTMENTS»).

★ Drain the hydraulic oil.

⌘ 1



Hydraulic oil: 92 ℓ

★ Drain the oil from the gearbox.

⌘ 2



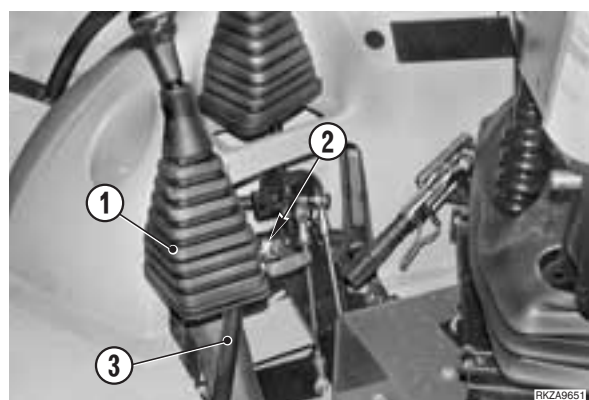
Gearbox oil: 16 ℓ

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

⌘ 3

2 - Raise the protective sleeve (1), disconnect the connector (2) of the transmission disengagement and remove the gear lever (3).

⌘ 4

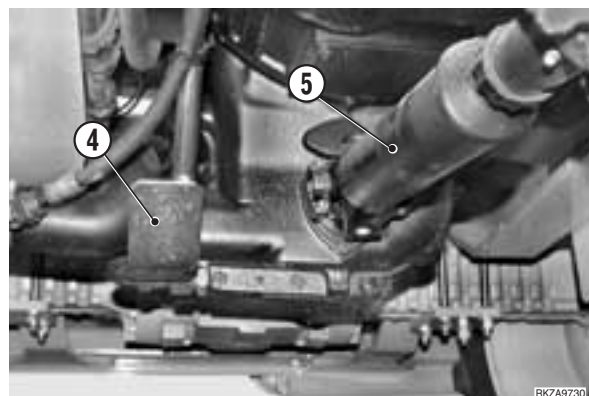


3 - Disconnect the pipe (4) that fills the gearbox with oil.

⌘ 5

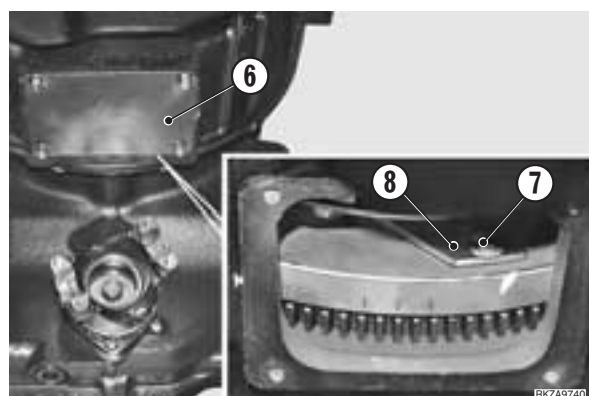
4 - Take out the front cardan shaft (5).

⌘ 6



5 - Take off the cover (6) of the flywheel oil-sump and take out the six retaining screws (7) of the converter coupling flange (8).

⌘ 7

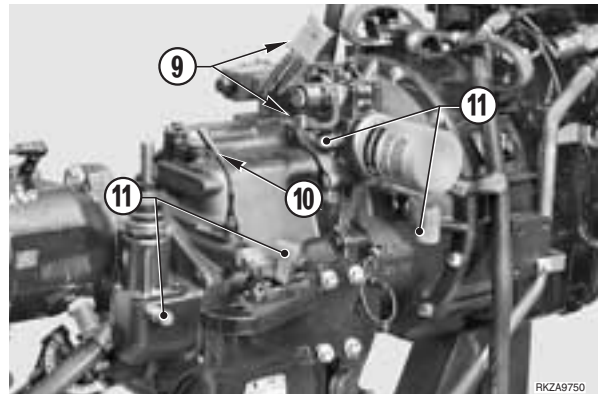


REMOVAL AND INSTALLATION

TRANSMISSION

6 - Disconnect the connectors (9) of the solenoids and the temperature sensor (10).

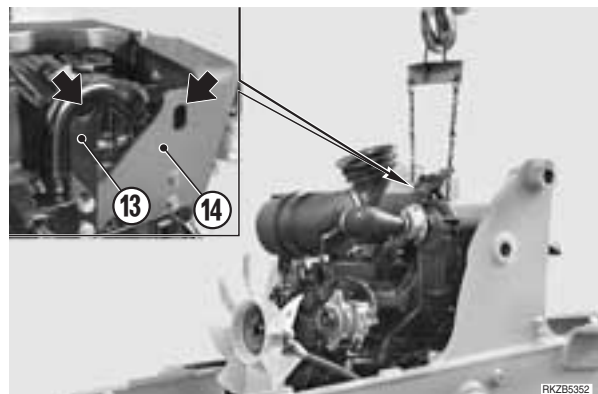
7 - Disconnect the four tubes (11) for oil circulation and controls.



8 - Remove the plate (12) and push it towards the back of the machine.

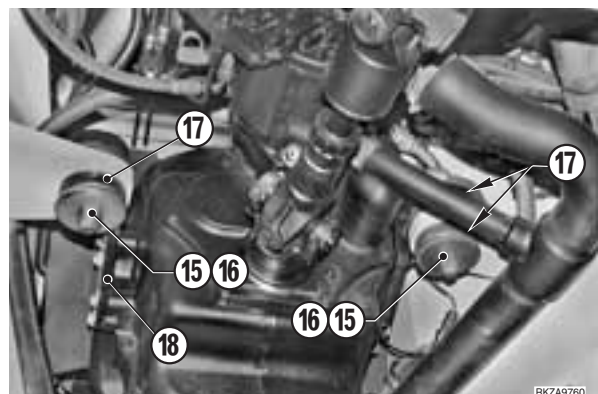


9 - Attach the engine-gearbox group to the hoisting tackle using the engine bracket (13) and the muffler support (14). Apply tension to the hoisting chains.



10 - Loosen and remove the nuts (15), and screws (16) and the anti-vibration nuts (17).  8

11 - Remove the gearbox supports (18).  9

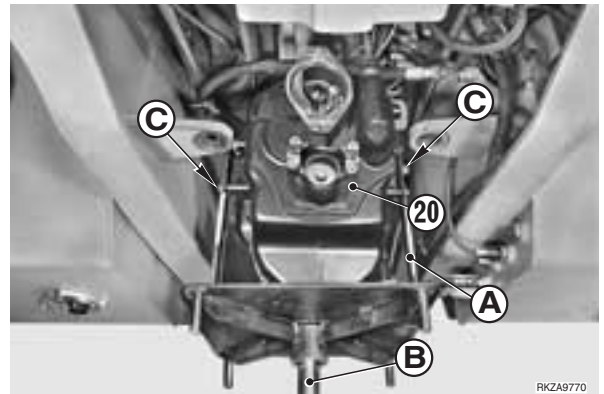


REMOVAL AND INSTALLATION

TRANSMISSION

12 - Attach in the place of the supports (18) a support with spacer "A" and mounted it on a pit jack "B" which can be lowered by approx. 60 cm.

★ Secure the support with the screws "C".



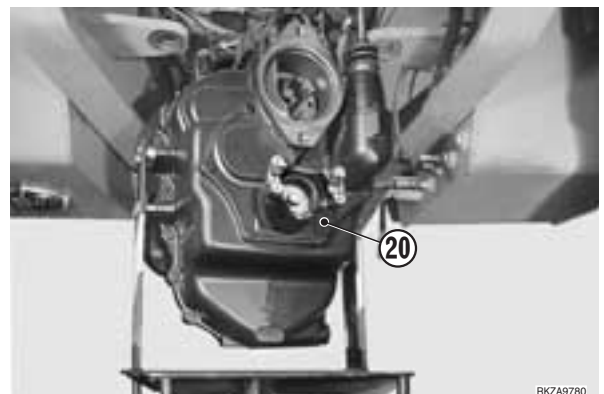
13 - Loosen and remove the twelve screws (19) that hold the engine and gearbox together.  10



14 - Remove the entire gearbox, (20) by shifting it towards the back of the machine in order to disengage the converter. Lower it slowly and turn the group in a clockwise direction to disengage it from the chassis in order to extract it.



Transmission: 230 kg



INSTALLATION OF THE TRANSMISSION

- To install, reverse the removal procedure.

※ 1



Hydraulic oil: 92 ℓ

※ 2



Gearbox oil: 16 ℓ

※ 3

- ★ Fill the pump body and the pump in order to pressurise the tank.
For the method, see «20. TESTING AND ADJUSTMENTS».

※ 4



Screws for securing lever: 120 Nm

※ 5



Screws: Loctite 262

※ 6



Screws on gearbox side: 70 Nm

※ 7



Flange screws: Loctite 262



Flange screws: 70 Nm

※ 8



Anti-vibration nuts: 196 ± 19.6 Nm

※ 9



Support screws: Loctite 262



Support screws: 90 Nm

※ 10



Engine-gearbox screws: Loctite 262

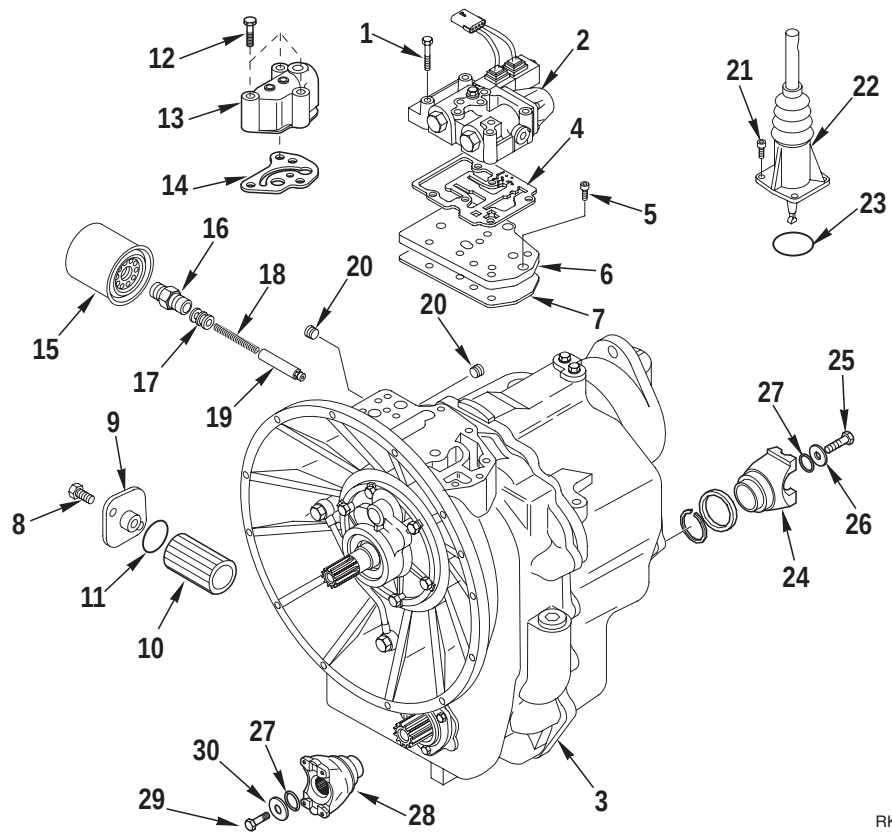


Engine-gearbox screws: 90 Nm

- 1 - Start the engine to circulate the oil. Check that there are no leaks.
- 2 - Bleed the air from the working equipment circuits. (For details, see «20. TESTING AND ADJUSTMENTS»).
- 3 - Stop the engine, check the levels and, if necessary, top them up.

OVERHAULING THE TRANSMISSION

1. Dismantling the external group



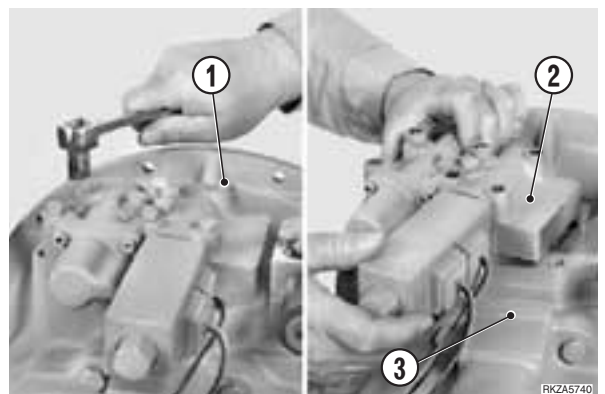
RKZ07460

- 1 - Attach the transmission group to some equipment that allows the group to rotate.



RKZA5730

- 2 - Take out the screws (1) and remove the distributor (2).



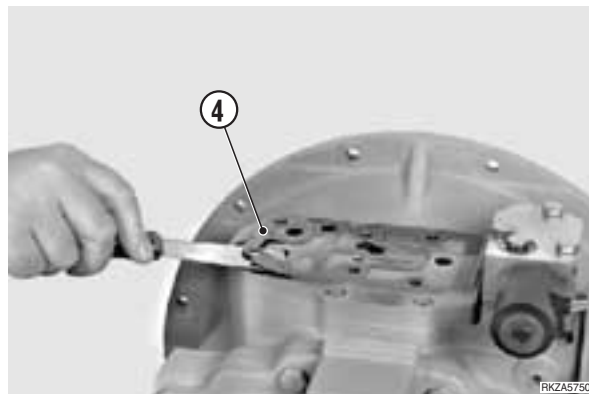
RKZA5740

REMOVAL AND INSTALLATION

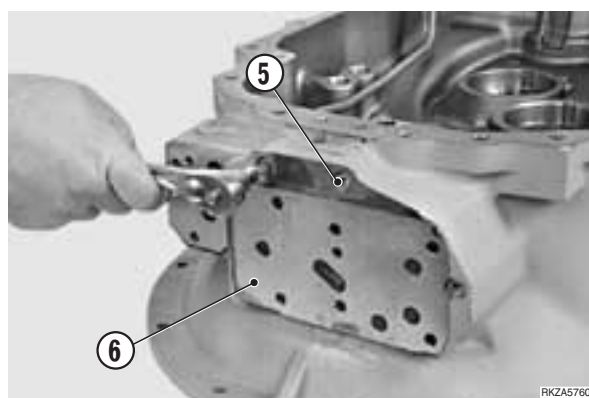
TRANSMISSION

3 - Remove the gasket (4).

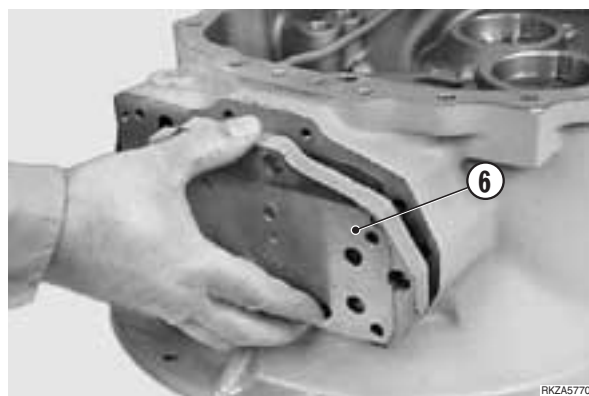
- ★ A new gasket must be fitted every time it is dismantled.



4 - Remove the three screws (5) that fasten the plate (6).

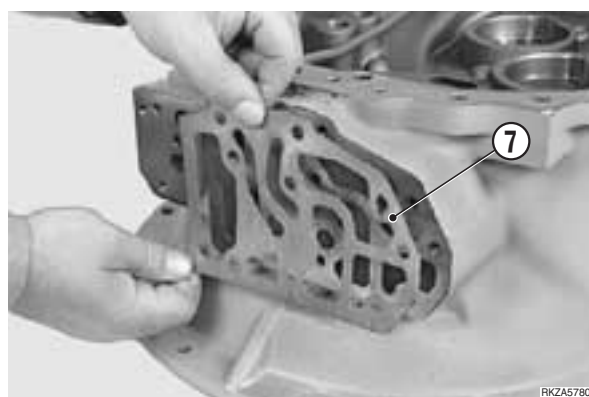


5 - Remove the plate (6).



6 - Remove the gasket (7).

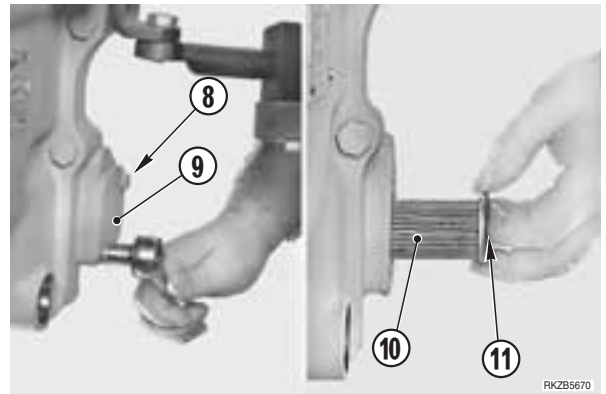
- ★ A new gasket must be fitted every time it is dismantled.



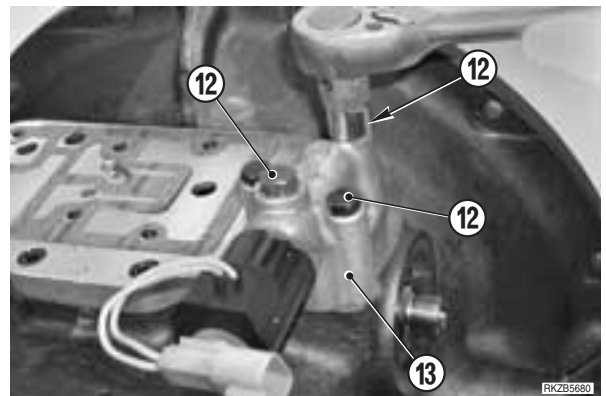
REMOVAL AND INSTALLATION

TRANSMISSION

- 7 - Remove the screws (8) that secure the cover (9) and take of the filter (10) complete with the O-ring (11).

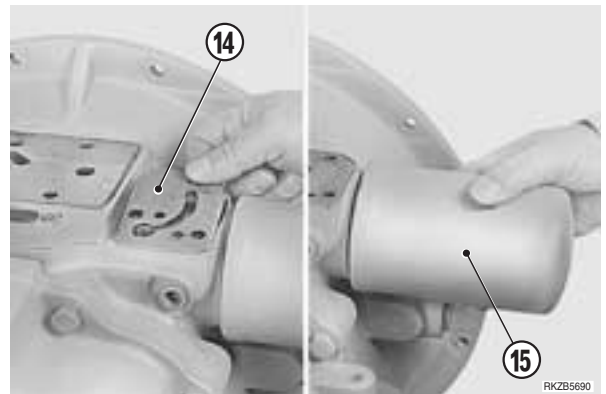


- 8 - Take out the screws (12) and remove the solenoid valve (13).



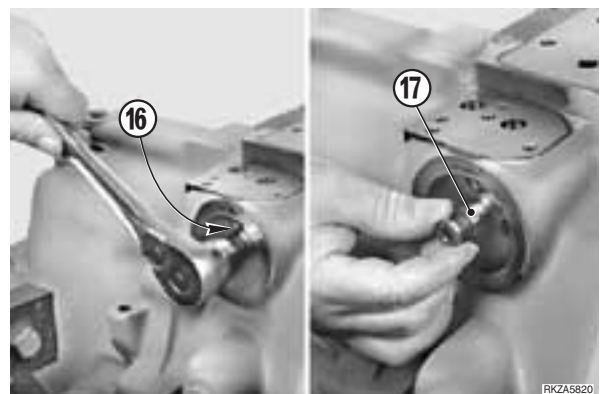
- 9 - Remove the gasket (14).
★ A new gasket must be fitted every time it is dismantled.

- 10 - Remove the filter (15).



- 11 - Remove the filter attachment fitting (16).

- 12 - Remove the valve spool (17).



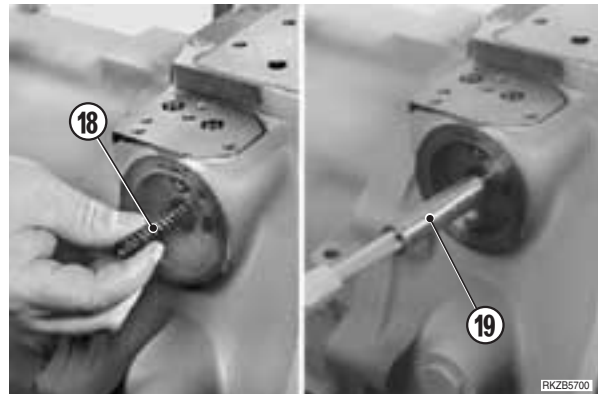
REMOVAL AND INSTALLATION

TRANSMISSION

13 - Take out the spring (18).

14 - Use a puller for blind holes to extract the priority valve (19).

! The priority valve is calibrated in the factory and should not be modified. If it appears to be damaged, replace it with a new one.

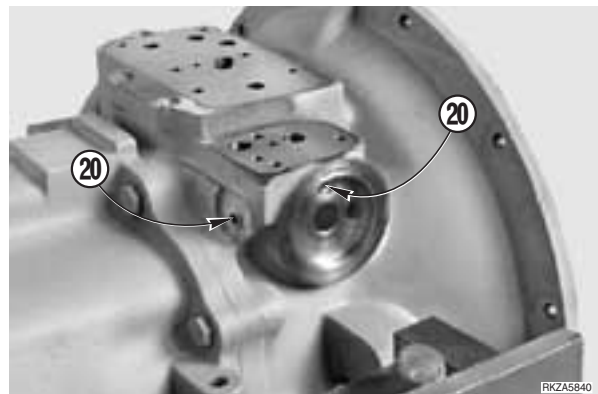


Only if necessary

15 - Remove the two caps (20).

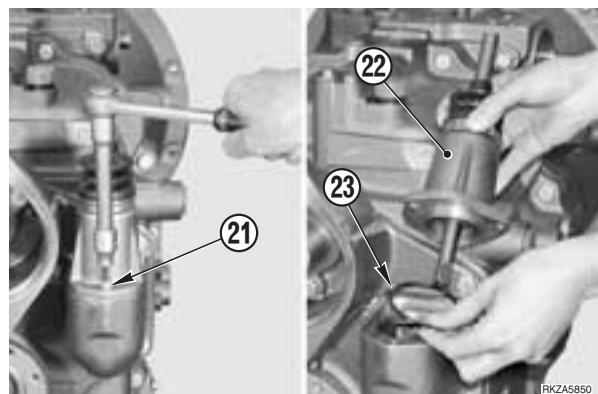
★ The caps should only be removed if there are leak-ages.

 Caps: Loctite 542

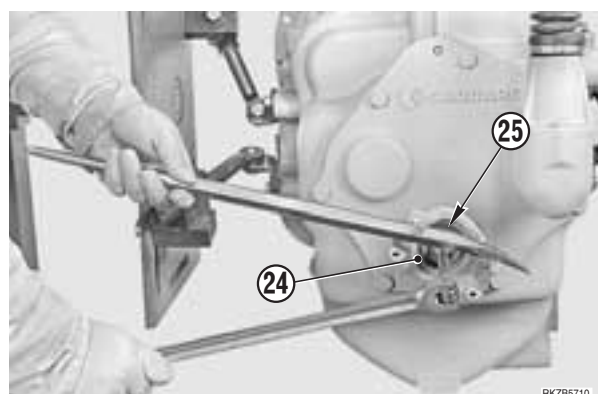


16 - Loosen and take out the screws (21) that secure the shifter group (22).

17 - Remove the group (22) and the O-ring (23).



18 - Mount two screws in the holes in the flange (24) and, holding the flange steady, remove the central screw (25).



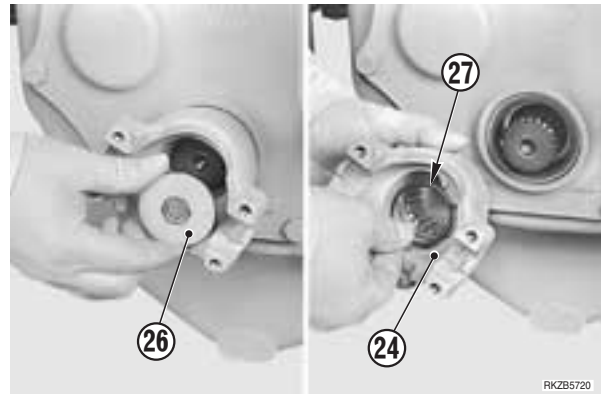
REMOVAL AND INSTALLATION

TRANSMISSION

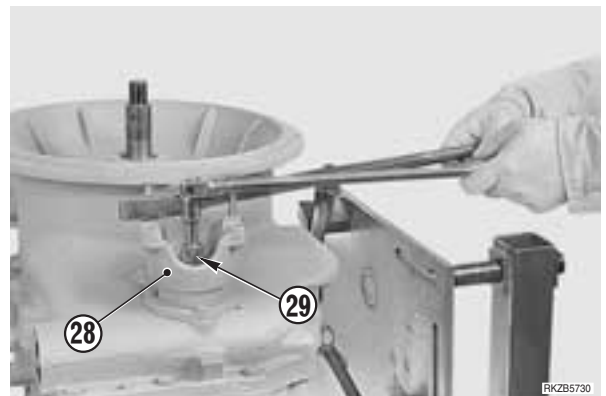
19 - Remove the washer (26).

20 - Remove the O-ring (27) and the flange (24).

- ★ The O-ring (27) must be replaced every time it is dismantled.



21 - Mount two screws in the flange (28) holes and, holding the flange steady, remove the central screw (29).

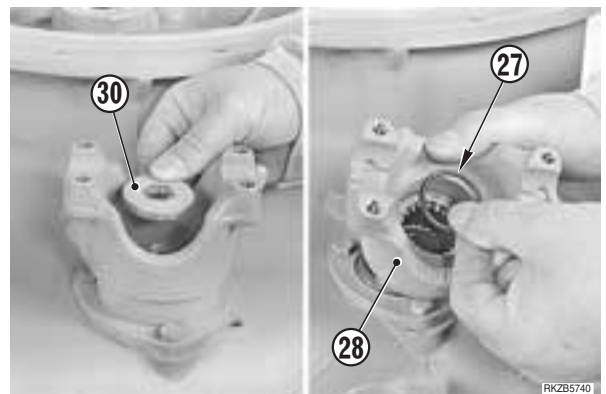


22 - Remove the washer (30).

23 - Remove the flange (28).

24 - Remove the internal O-ring (27).

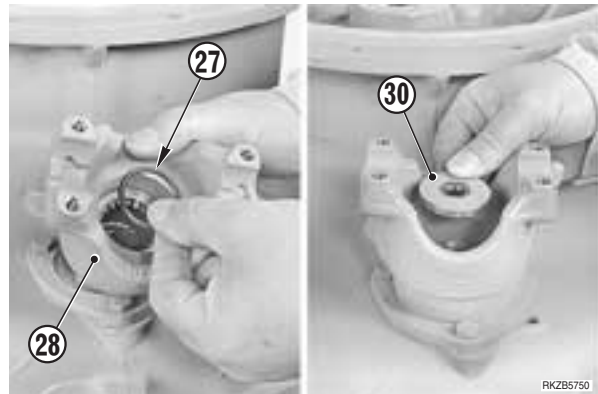
- ★ The O-ring (27) must be replaced every time it is dismantled.



2. Assembly of the external groups

1 - Insert O-ring (27) in the flange and mount flange on the shaft (75).

2 - Mount the washer (30).

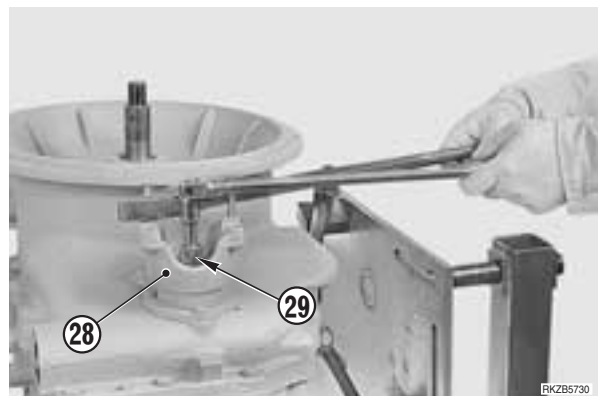


3 - Screw the screws (29) home by hand.

4 - Mount two screws in the flange (28).

5 - Holding the flange steady, tighten the screw (29).

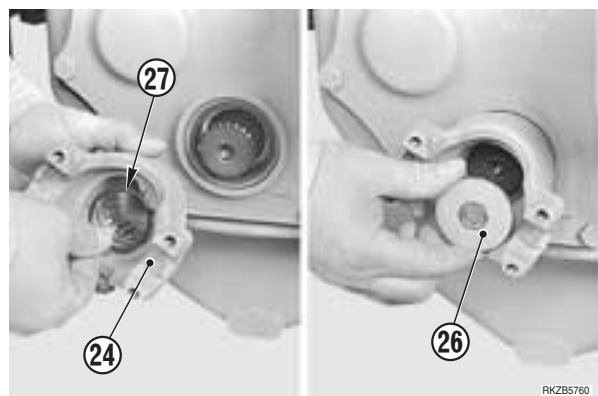
 Screw: 139 Nm



6 - Mount the flange (24) of the secondary shaft.

7 - Mount the O-ring (27).

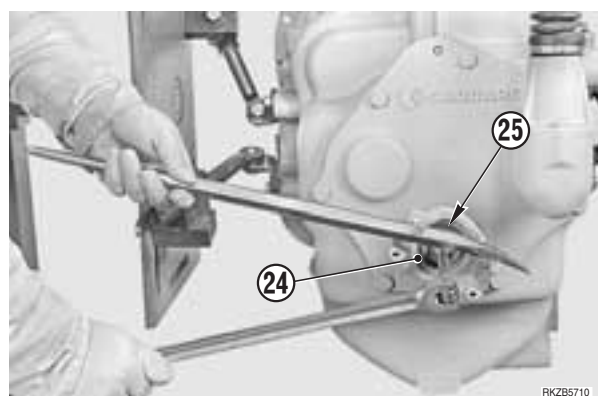
8 - Mount the washer (26) and the screw (25). Screw the screw (25) home by hand.



9 - Mount two screws in the flange (24).

10 - Holding the flange steady, tighten the screw (25).

 Screw: 139 Nm



REMOVAL AND INSTALLATION

TRANSMISSION

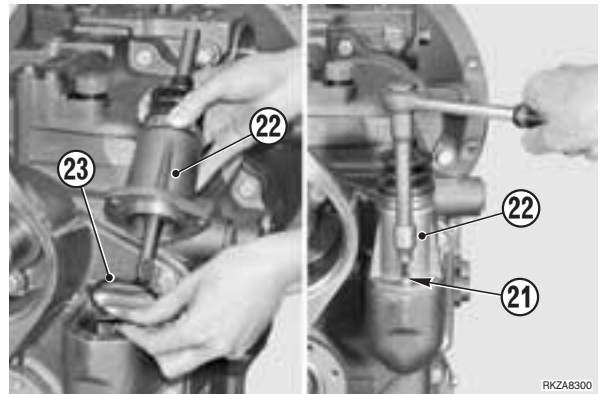
11 - Mount the O-ring (23) in the rear housing.

 O-ring: ASL800050

12 - Lubricate the levers and the shifter levers' end (22).

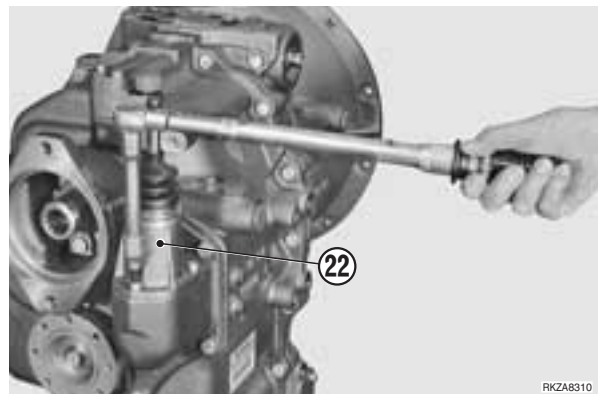
 Shifter and levers: ASL800040

13 - Mount the shifter group (22) and the screws (21).



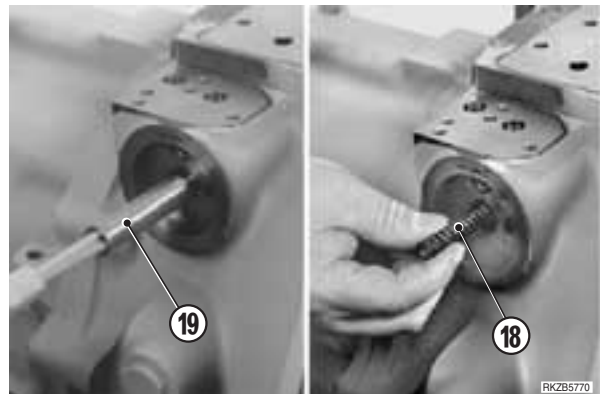
14 - Secure the shifter group (22).

 Nm Screws: 23 Nm



15 - Mount the priority valve (19).

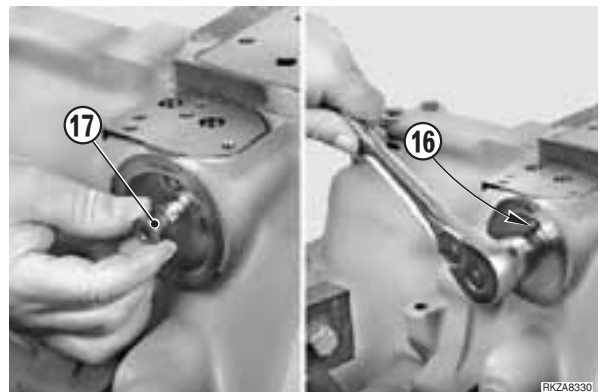
16 - Mount the spring (18).



17 - Mount the spool (17).

18 - Mount and tighten the fitting (16).

 Nm Fitting: 50 Nm

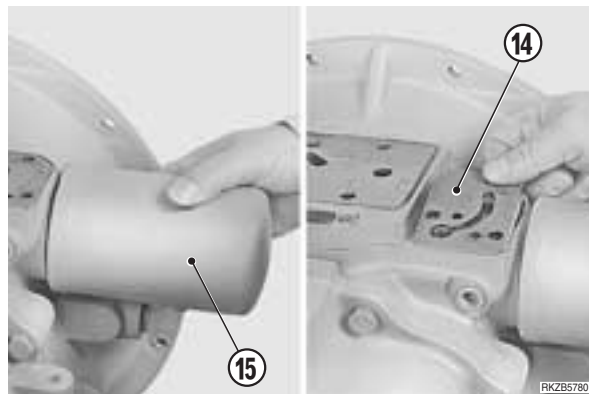


REMOVAL AND INSTALLATION

TRANSMISSION

19 - Lubricate the gasket and mount the filter (15).

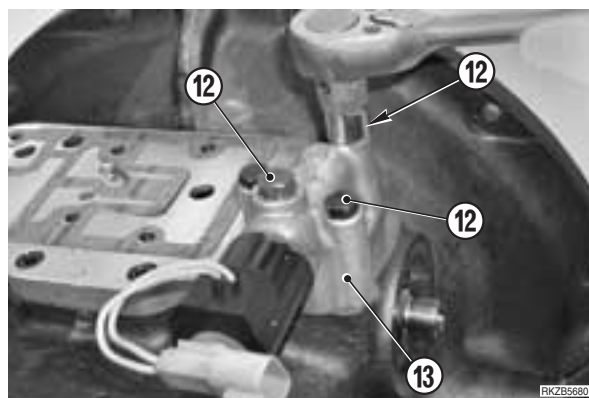
20 - Mount the gasket (14).



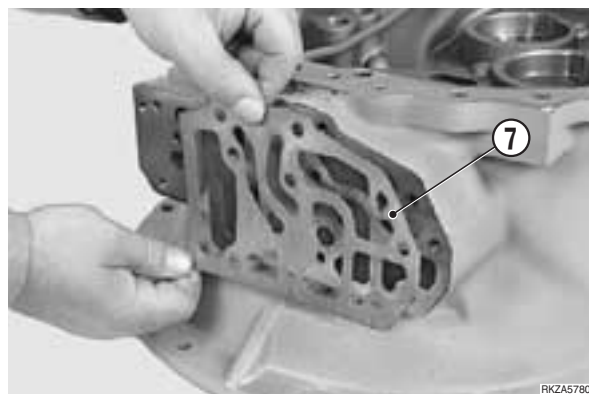
21 - Mount the solenoid valve (13) and secure it with the screws (12).



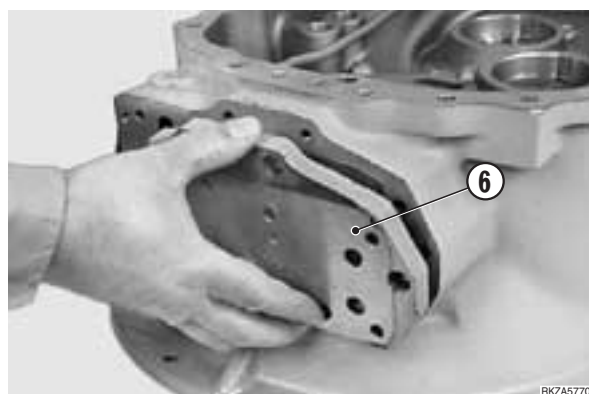
Screws: 23 Nm



22 - Mount the gasket (7).



23 - Mount the plate (6).

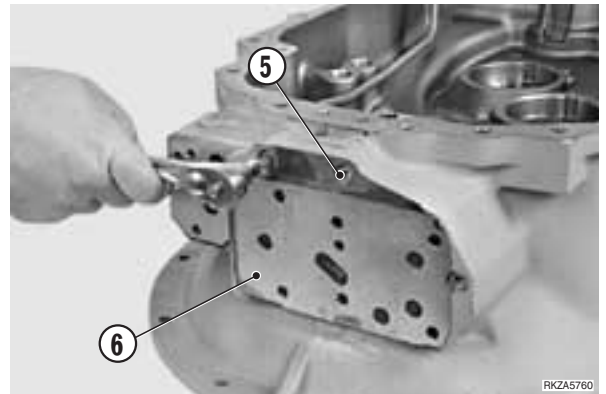


REMOVAL AND INSTALLATION

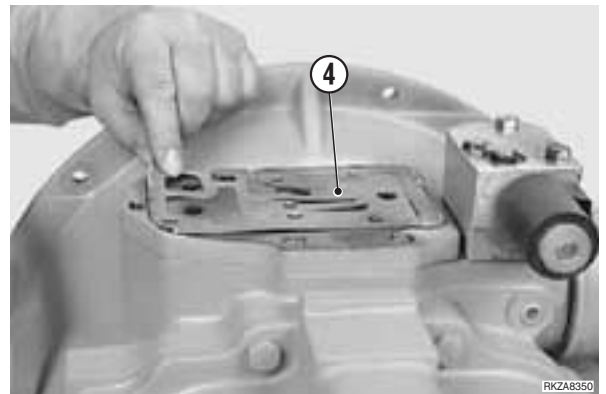
TRANSMISSION

24 - Attach the plate (6) with the screws (5), using the alternating crosswise method.

 Nm Screws: 23 Nm



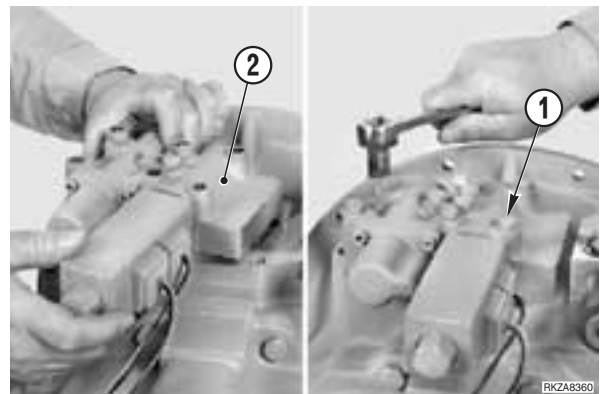
25 - Place the gasket (4) of the distributor (2) in position.



26 - Place the distributor (2) in position and secure it with the screws (1).

★ Tighten the screws starting in the centre and moving towards the outside, using the alternating crosswise method.

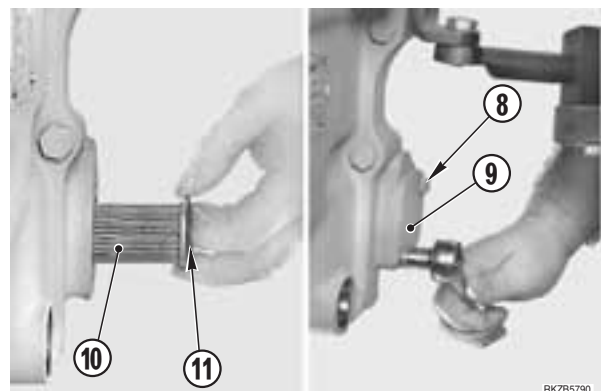
 Nm Screws: 23 Nm



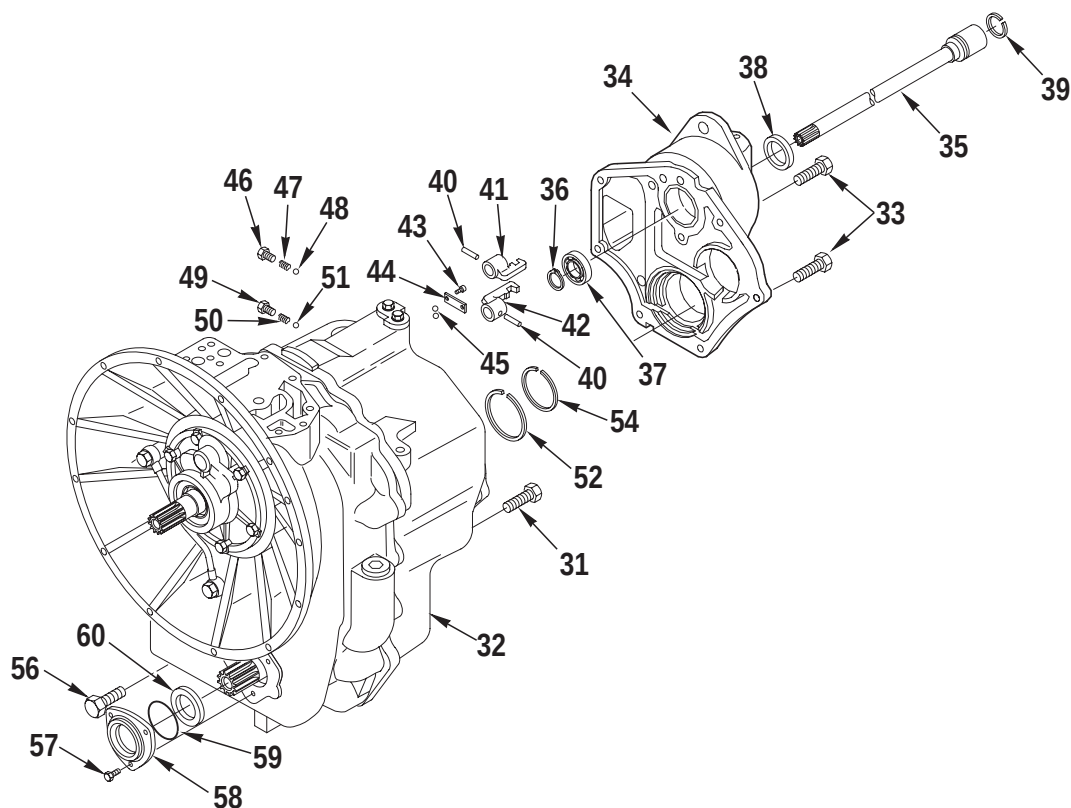
27 - Insert the filter (10) complete with O-ring (11).

28 - Mount the cover (9) and secure it with the screws (8).

 Nm Screws: 23 Nm

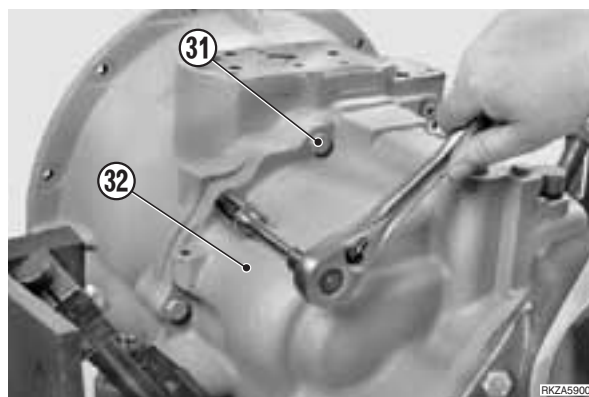


3. Dismantling the transmission



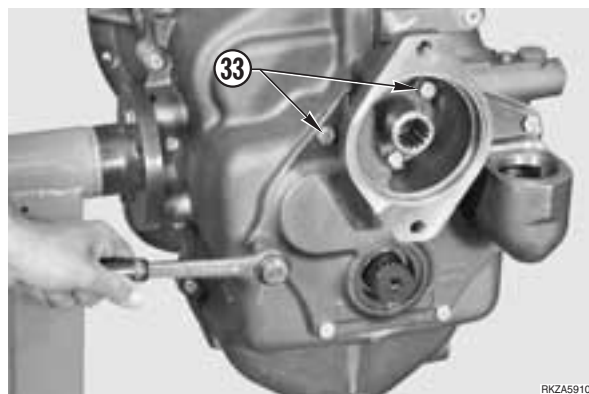
RKZ07500

1 - Loosen and take out the screws (31) that secure the rear housing (32).



RKZA5900

2 - Loosen and take out the screws (33).

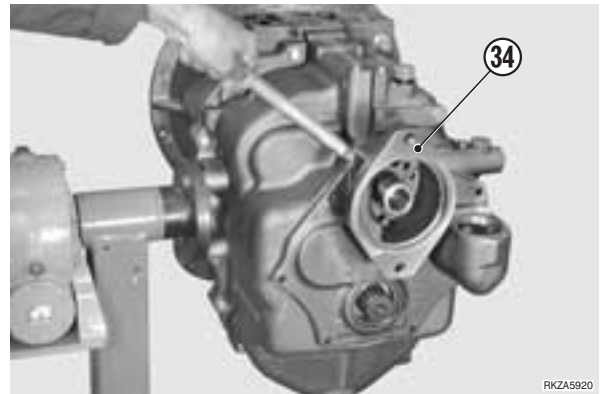


RKZA5910

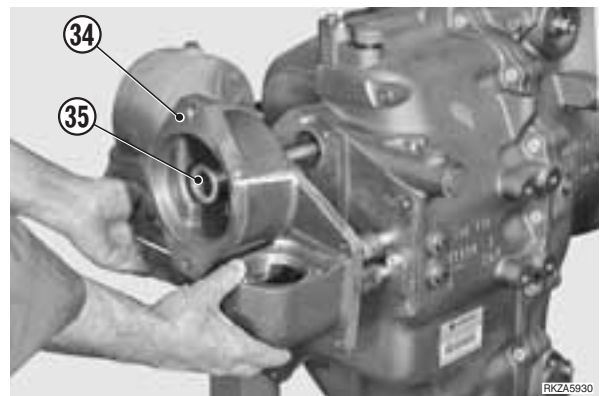
REMOVAL AND INSTALLATION

TRANSMISSION

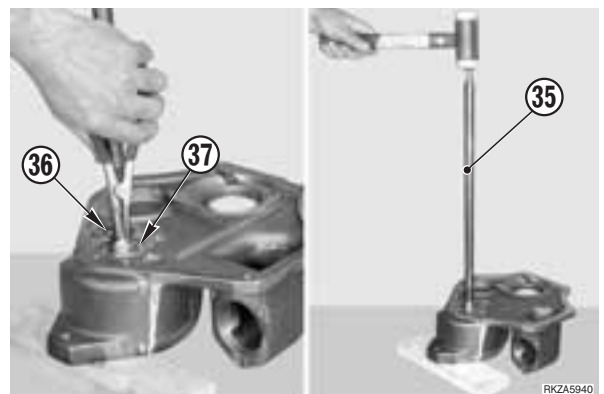
- 3 - Use a lever inserted into the opposing cavities to disconnect the cover (34) of the transmission housing.



- 4 - Remove the cover (34) complete with the hydraulic pump drive shaft (35).



- 5 - Remove the snap ring (36) that secures the shaft (35).
6 - Use a plastic mallet to extract the shaft (35) from the bearing (37).



- 7 - Extract the bearing (37) from the cover (34).
8 - Turn the cover (34) upside down and take out the seal ring (38).
★ A new seal ring must be substituted.



REMOVAL AND INSTALLATION

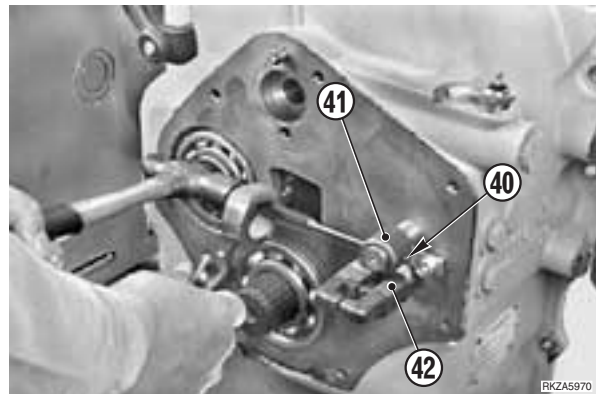
TRANSMISSION

9 - Remove the sealing rings (39) from the shaft (35).

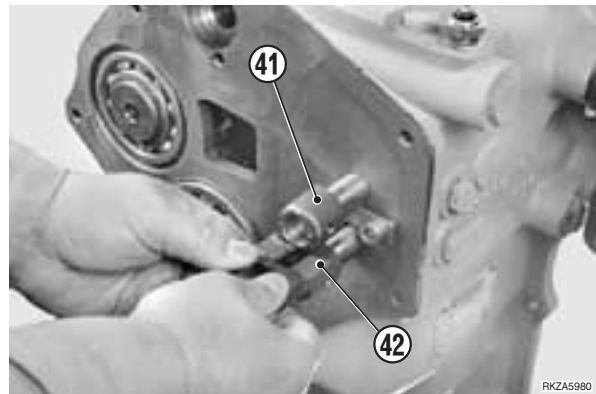
- ★ The two extremities must be unhooked in order to remove it.



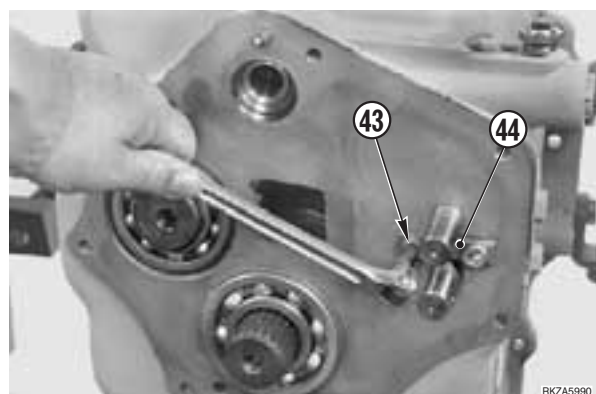
10 - With a punch, remove the pins (40) that fasten the differential lock rings (41) and (42) of the shifter rods.



11 - Remove the differential lock rings (41) and (42).



12 - Remove the screws (43) that secure the plate (44).

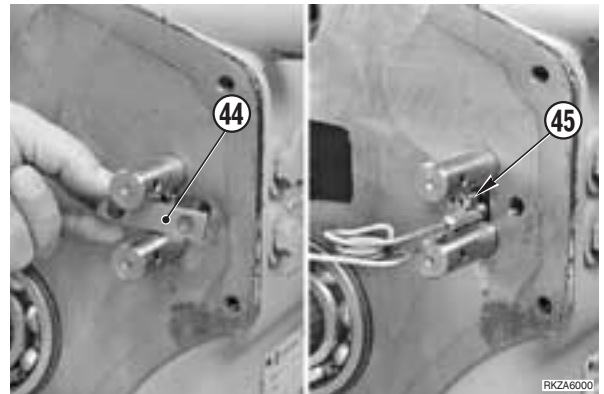


REMOVAL AND INSTALLATION

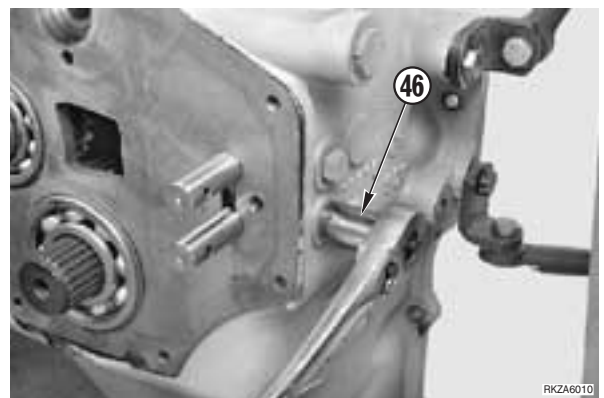
TRANSMISSION

13 - Remove the plate (44).

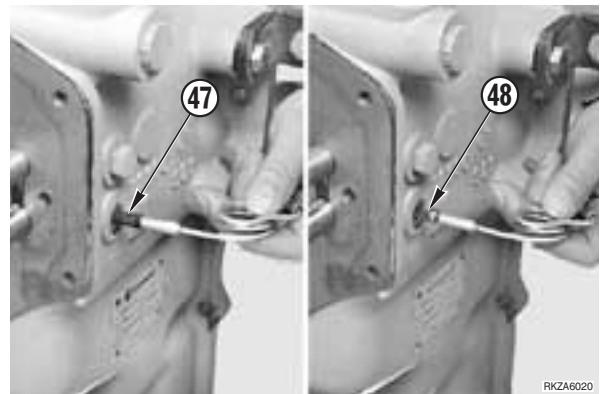
14 - Use a magnet to remove the two balls (45) from the hole between the two shifter rods.



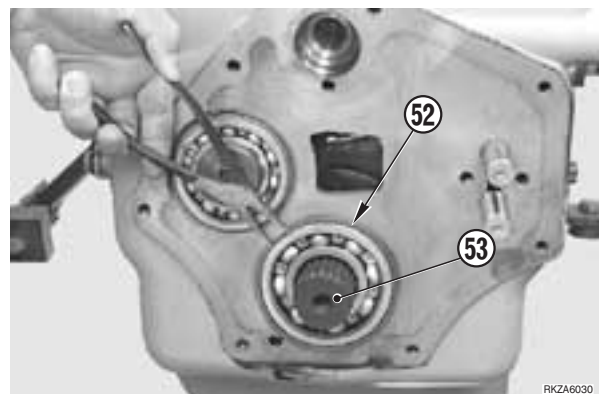
15 - Remove the cap (46).



16 - Use a magnet to extract the spring (47) and the ball (48).
★ Repeat phases 15 and 16 for the other cap.



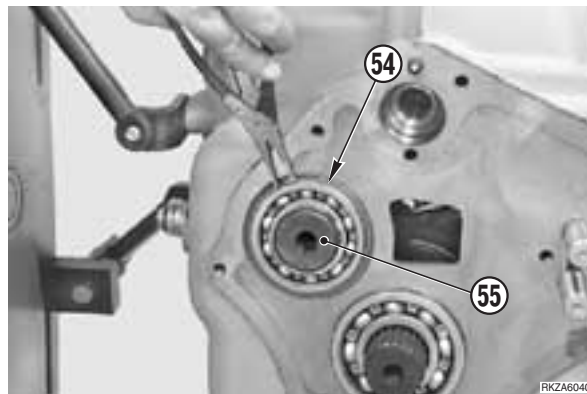
17 - Remove the bearing-retaining snap ring (52) of the secondary shaft (53).



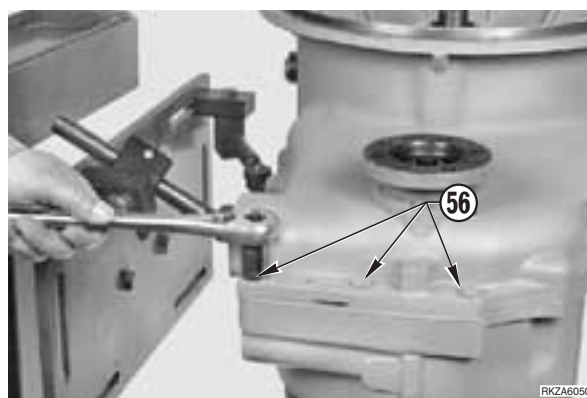
REMOVAL AND INSTALLATION

TRANSMISSION

- 18 - Remove the bearing-retaining snap ring (54) of the main shaft (55).



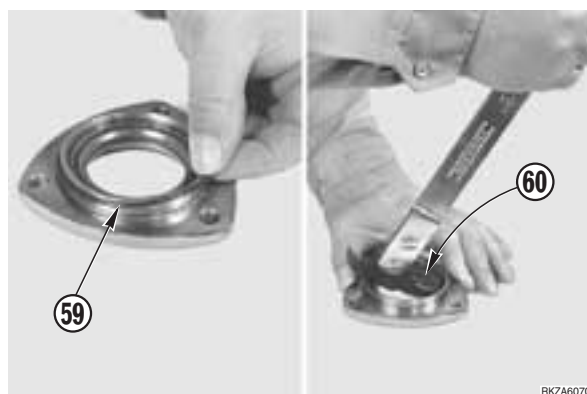
- 19 - Turn the transmission upside down and remove the three screws (56).

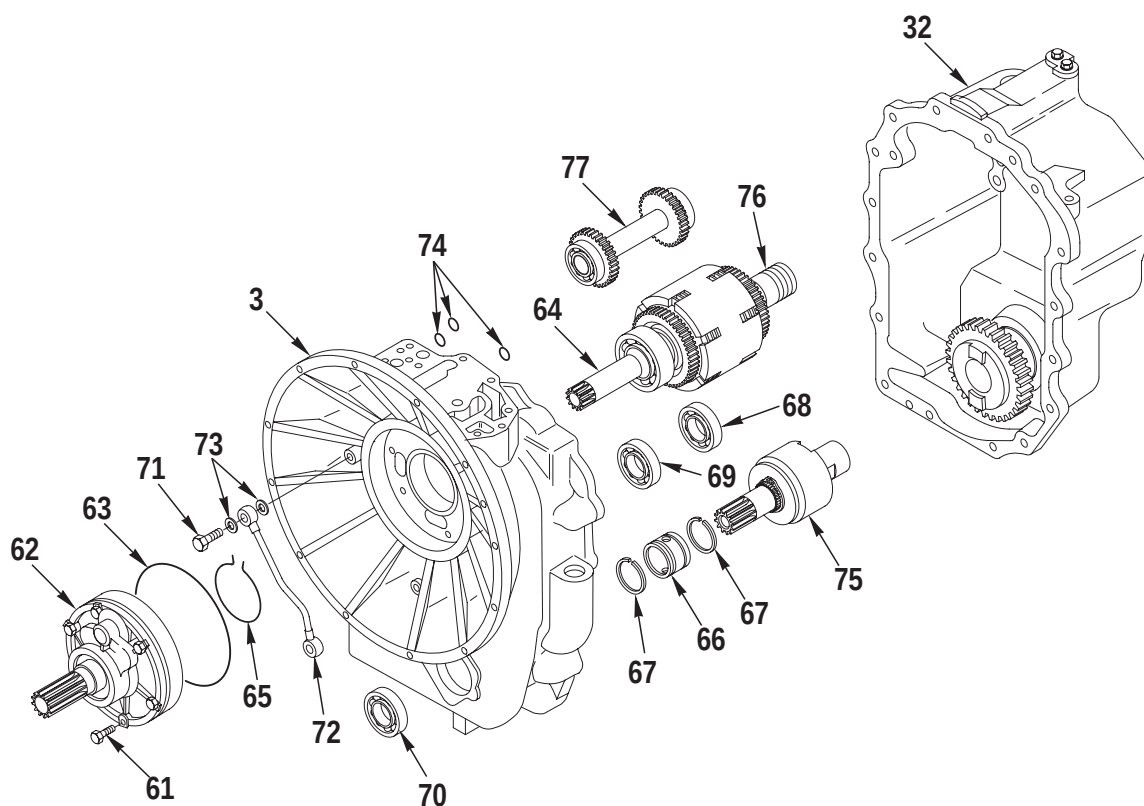


- 20 - Remove the screws (57) and remove the cover (58).



- 21 - Remove the O-ring (59) and the seal ring (60) from the cover.





RKZ02761

22 - Loosen and remove the retaining screws (61) of the pump (62).



RKZA6080

23 - Using two levers opposite to each other, raise the pump (62) smoothly.

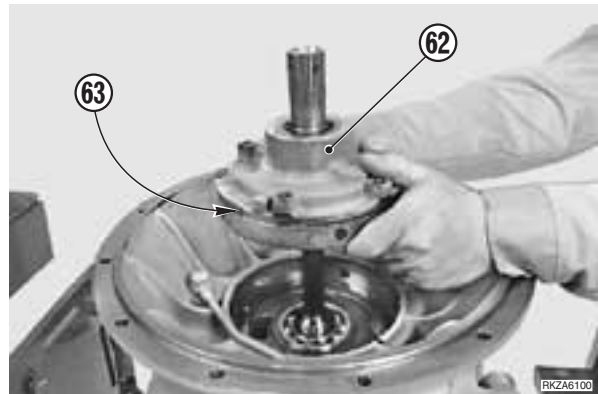


RKZA6090

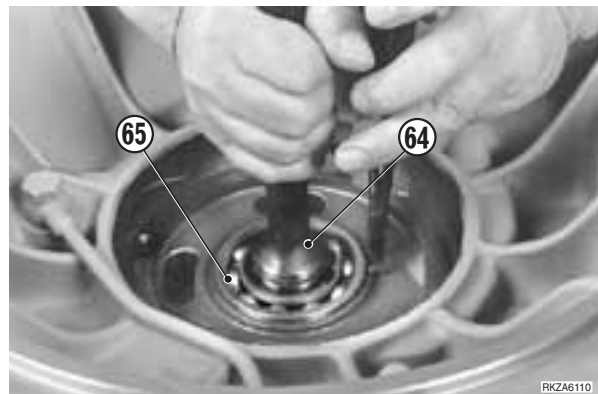
REMOVAL AND INSTALLATION

TRANSMISSION

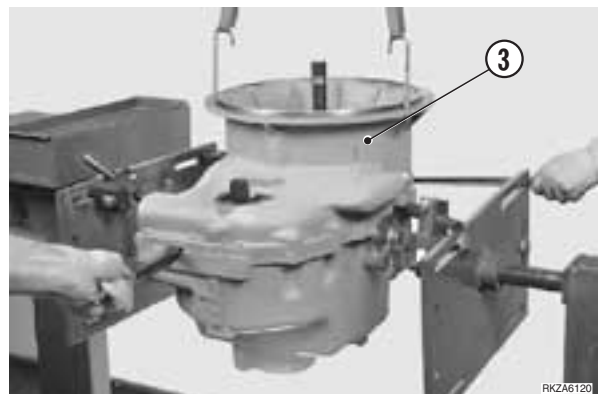
24 - Take out the pump (62) complete with its seal ring (63).



25 - Slightly raise the input shaft (66) and remove the bearing-retaining snap ring (65).



26 - Attach some hoisting tackle to the front flange (3) of the transmission and apply a slight tension. Using two levers opposite to each other, separate the flange (3) from the transmission housing.



27 - Slowly raise the front flange (3), keeping it horizontal.

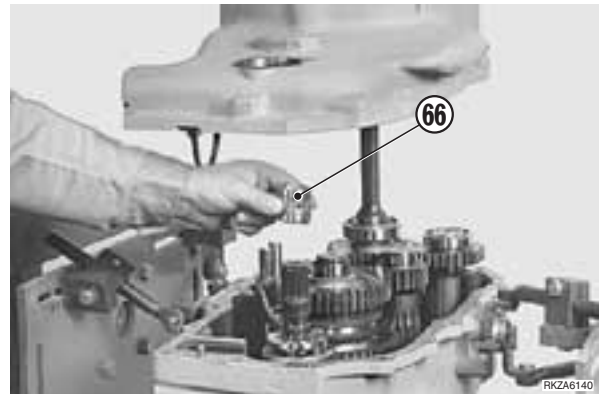
- ★ If necessary, assist the raising operation with a lever and also by knocking on the shaft of the front drive with a plastic mallet.



REMOVAL AND INSTALLATION

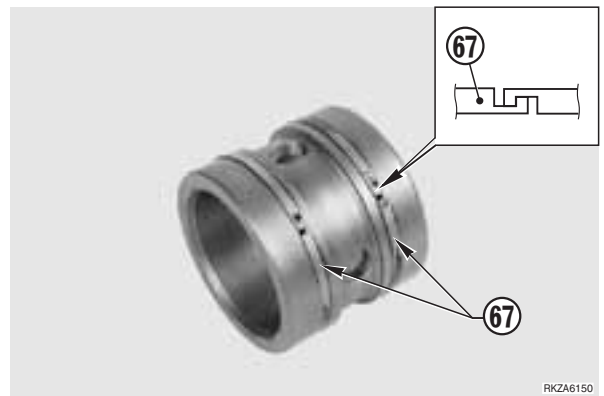
TRANSMISSION

28 - Remove the differential lock ring (66) complete with the sealing rings (67).



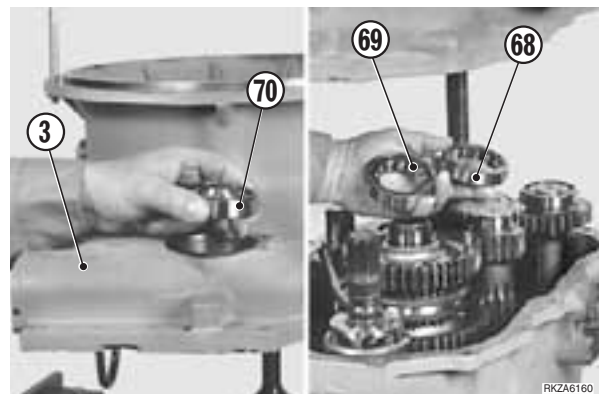
29 - Remove the two sealing rings (67) from the differential lock ring.

- ★ They can be removed by unhooking the two extremities.
- ★ New sealing rings (67) must be substituted each time they are dismantled.

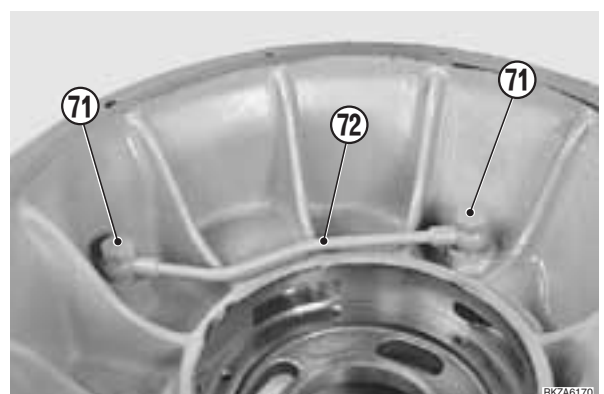


30 - Remove the bearing (68) of the main shaft and the bearing (69) of the secondary shaft.

31 - Remove the bearing (70) from the seating of the front flange (3).



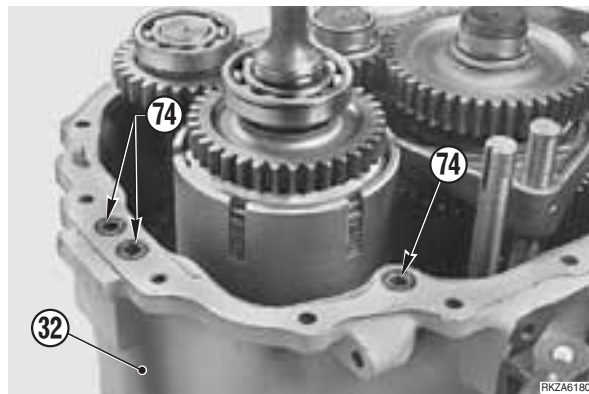
32 - Remove the fittings (71) and take out the pipe (72) complete with the copper washers (73).



REMOVAL AND INSTALLATION

TRANSMISSION

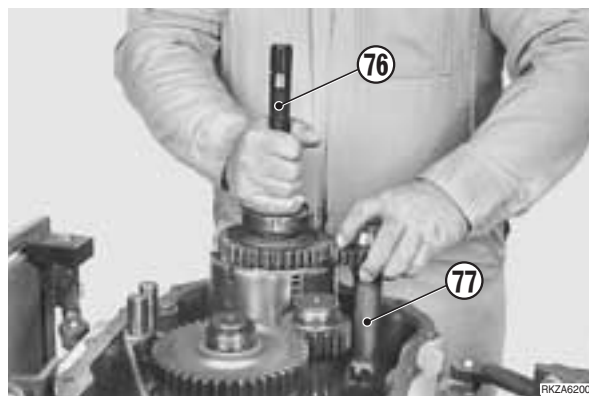
33 - Remove the O-rings (74) that form a seal between the front housing and the transmission housing (32).

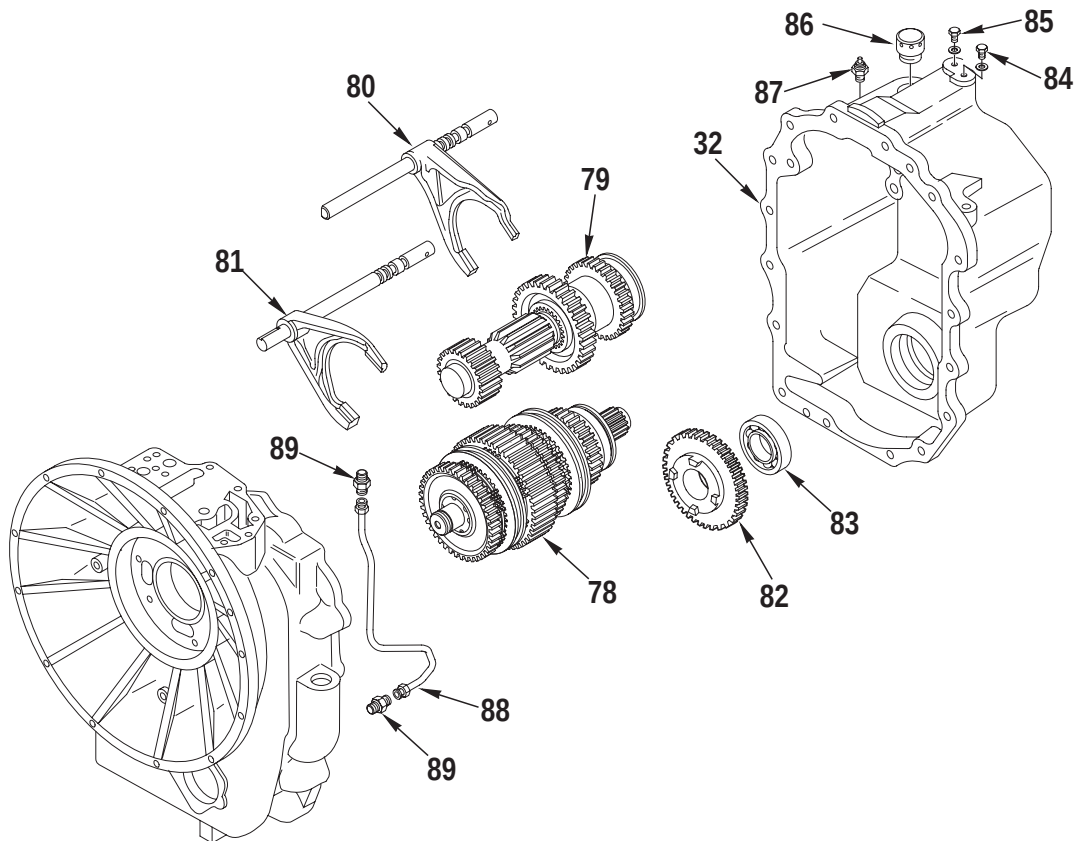


34 - Remove the shaft (75) of the 4-wheel drive.



35 - Remove the input shaft (76) and the reverse shaft (77).





RKZ07470

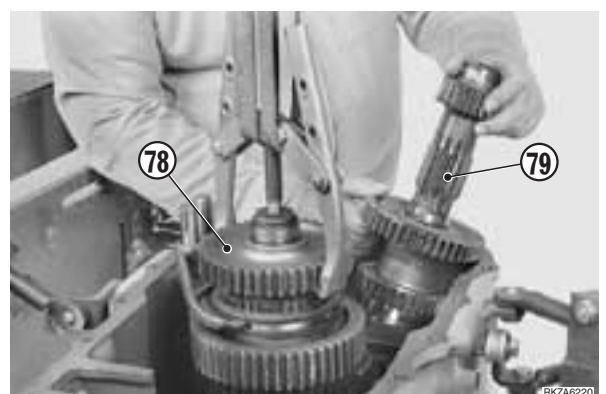
36 - Turn the transmission upside down. Connect it to some hoisting tackle suitable for the upper gears.



RKZA6210

37 - Raise the secondary shaft (78) with the hoisting tackle and at the same time raise the main shaft by hand.

- ★ The forks and the shifters for 1st/2nd and 3rd/4th gears are also raised at the same time. If any parts remain stuck, they can be separated by tapping them with a plastic mallet.

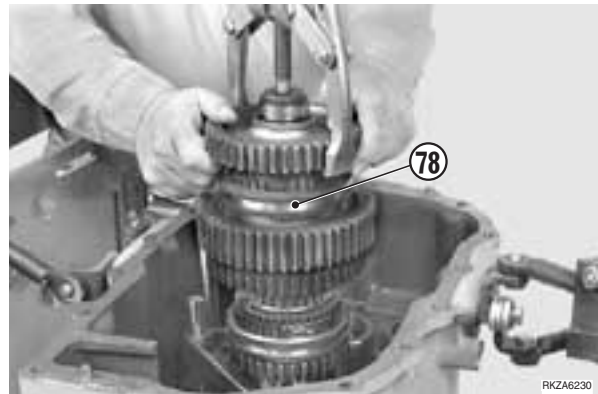


RKZA6220

REMOVAL AND INSTALLATION

TRANSMISSION

38 - Raise the secondary shaft (78) until the shifter fork (80) and (81) can be moved. Then remove the shaft.

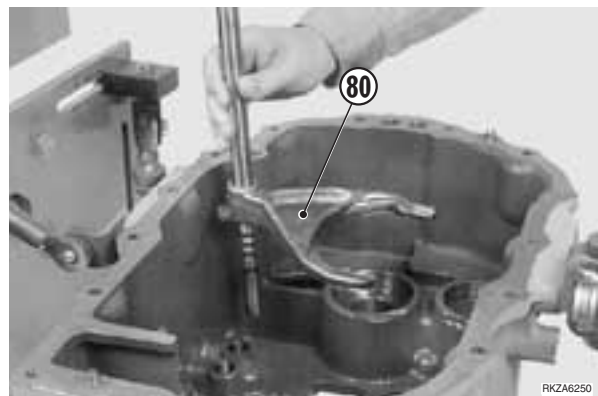


39 - Remove the shifter fork (81) for the 1st/2nd gears.



40 - Remove the shifter fork (80) for the 3rd/4th gears.

- ★ Make a note that this fork fits in the upper hole of the transmission housing.



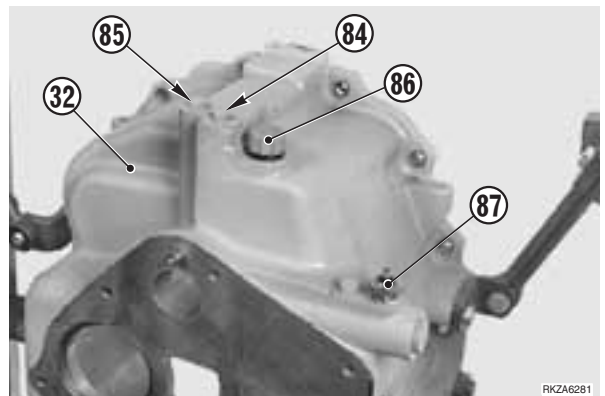
41 - Remove from the transmission housing (32) the 4-wheel drive clutch gear (82).



42 - Remove the bearing (83).

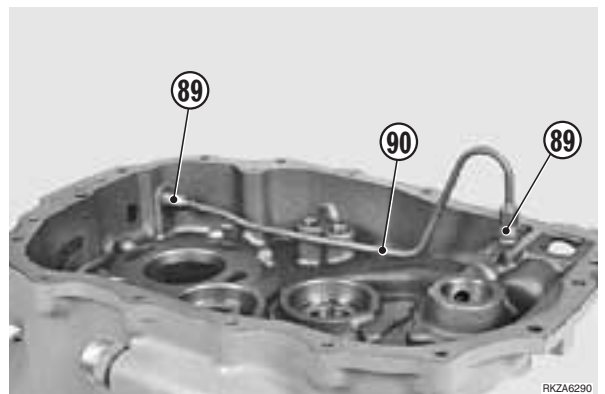


43 - Remove the caps (84) and (85) for the pressure adapters, the vent plug (86) and the temperature sensor (87).



Only if necessary

44 - Remove the fittings (89) and the pipe (90) of the 4-wheel drive clutch.



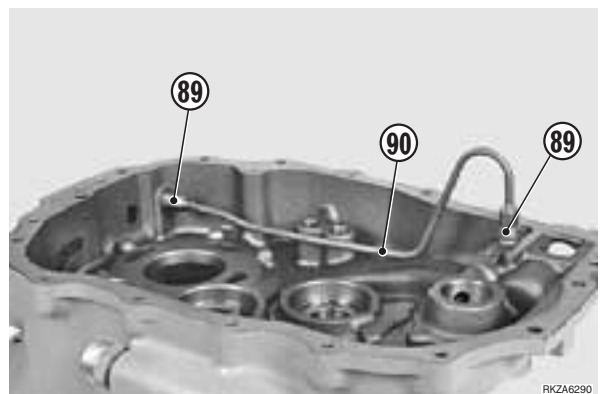
4. Assembly of transmission

Only if it has been removed

1 - Mount the clutch pipe (90) and lock it in place with the fittings (89).



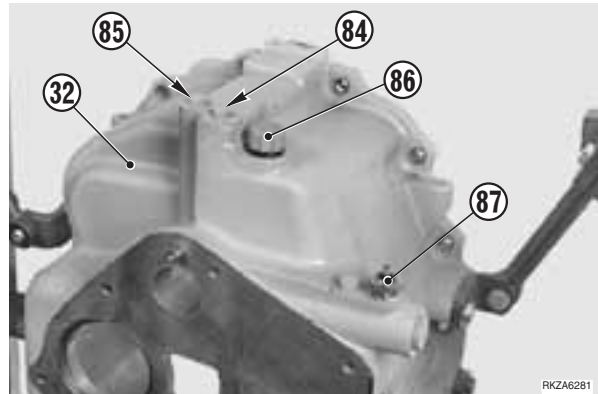
Nm Fittings: 40 Nm



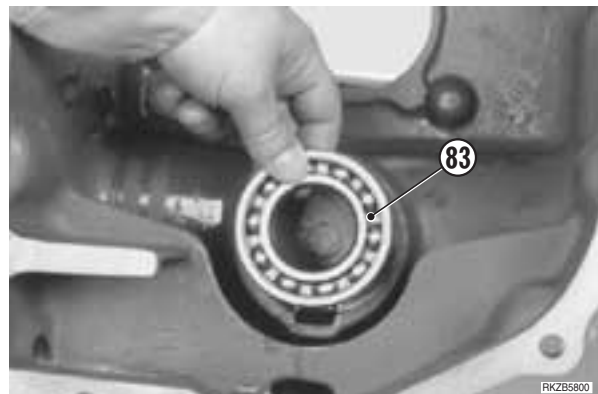
REMOVAL AND INSTALLATION

TRANSMISSION

- 2 - Mount on the housing (32) the temperature sensor (87), the vent plug (86) and the caps for the pressure adapters (85) and (84).



- 3 - Mount the bearing (83).



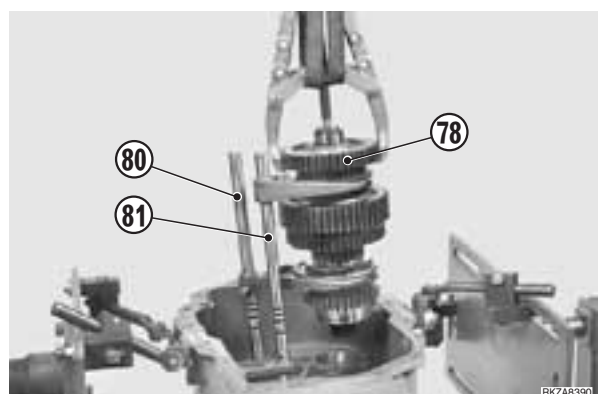
- 4 - Install the gear (82).

- ★ The side with the raised areas must face towards the inside of the transmission.



- 5 - Connect a hoisting tackle to the upper gear of the secondary shaft (78) and position it above its seating. Engage the forks (80) and (81) in the synchronizer rings.

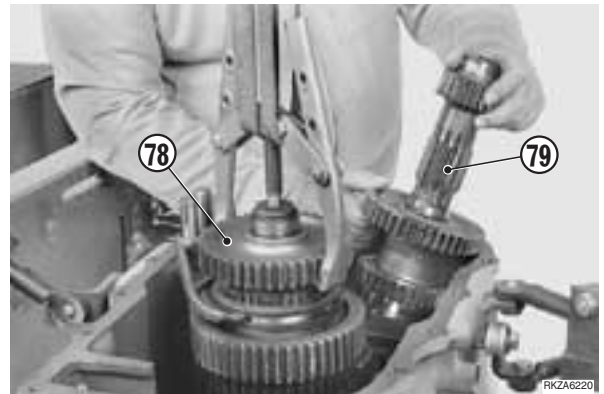
- ★ The forks for the 3rd and 4th gears must be placed in the upper hole.



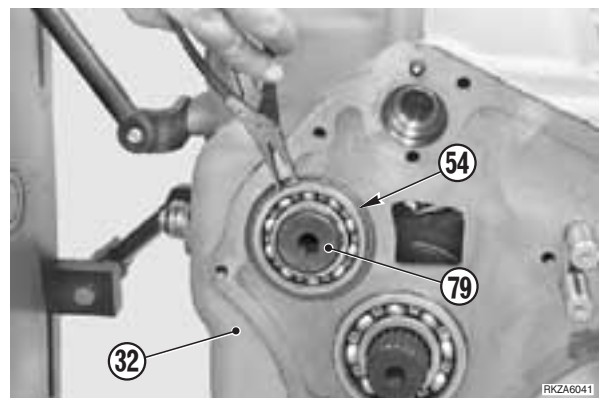
REMOVAL AND INSTALLATION

TRANSMISSION

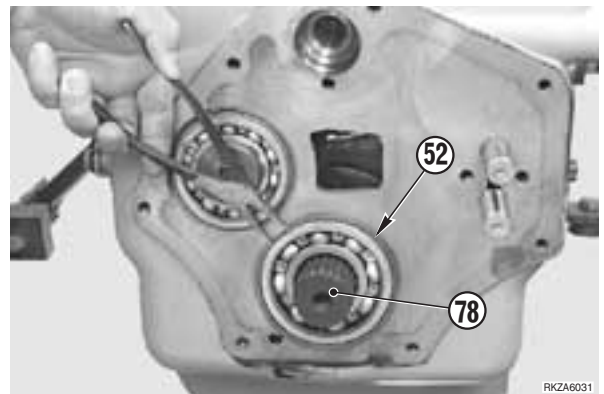
- 6 - Lower the entire group, centering the individual pieces in their respective seatings. At the same time, slide in the main shaft (79), taking great care with the mating of the gears.



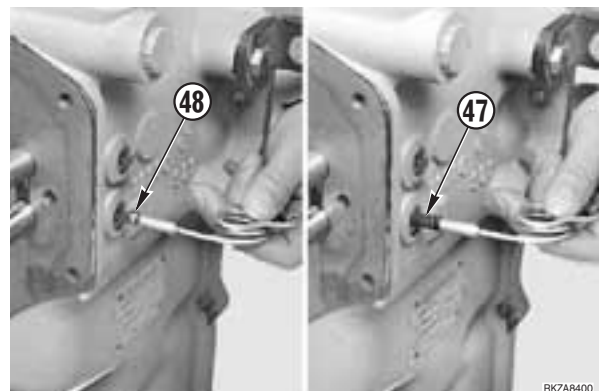
- 7 - Rotate the housing (32) by 90° and install the snap ring (54) on the bearing of the main shaft (79).
★ After mounting the snap ring, push the main shaft home.



- 8 - Install the snap ring (52) on the bearing of the secondary shaft (78).
★ After mounting the snap ring, push the secondary shaft home.



- 9 - Mount the balls (48) and the springs (47) in the housing (32).

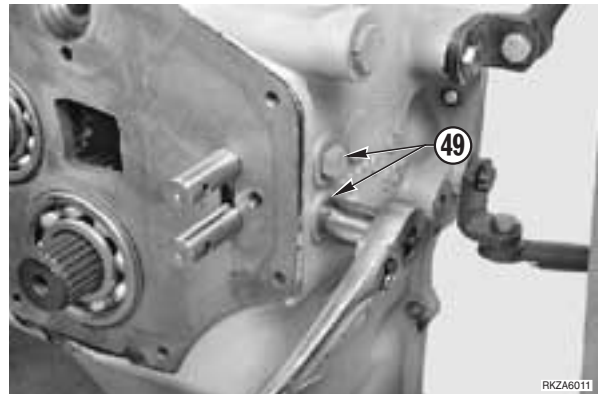


REMOVAL AND INSTALLATION

TRANSMISSION

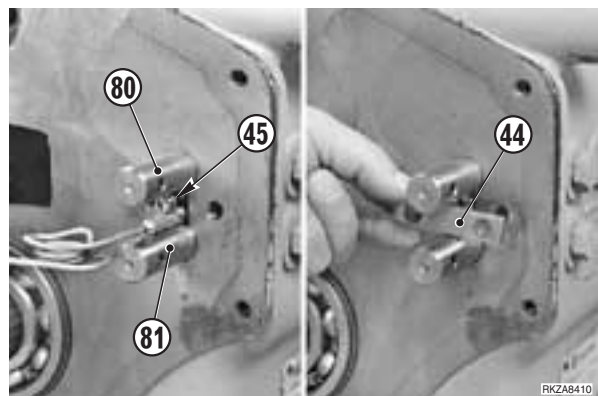
- 10 - Mount the caps (49) complete with the copper washers and tighten them.

 Caps: 80 Nm



- 11 - Insert the two balls (45) into the hole between the shifter rods (80) and (81).

- 12 - Position the plate (44).



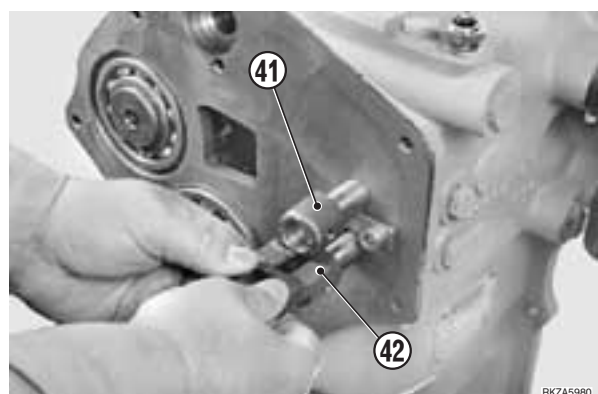
- 13 - Secure the plate (44) with the screws (43).

 Screws: Loctite 542

 Screws: 50 Nm



- 14 - Mount the differential lock rings (41) and (42) on the shifter rods (80) and (81).

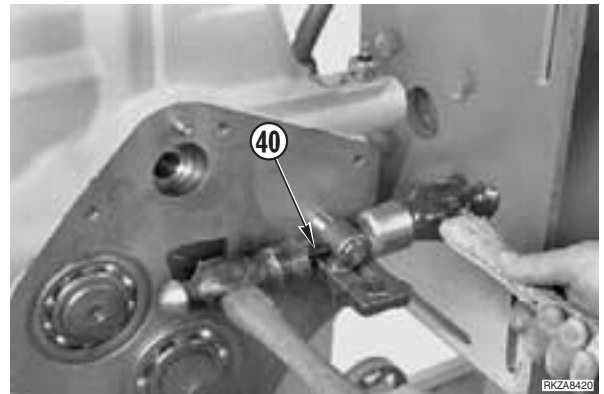


REMOVAL AND INSTALLATION

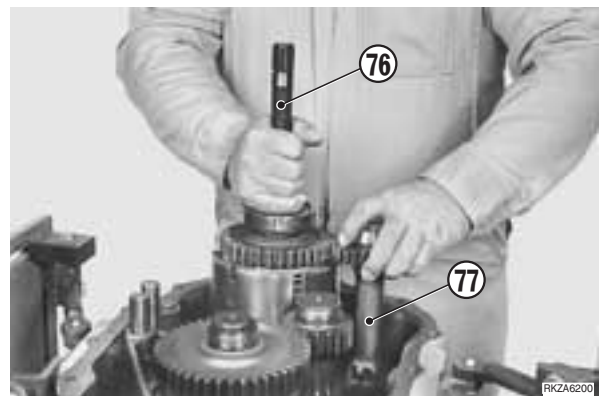
TRANSMISSION

15 - Insert the pins (40).

- ★ Deaden the blows on the shaft by using a hammer in the place of an anvil.



16 - At the same time install the input shaft (76) and the reverse shaft (77).



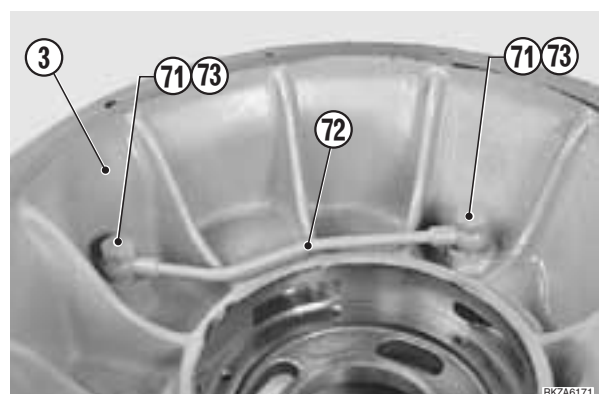
17 - Install the drive shaft for the 4th gear (75).

- ★ Make sure that the shaft (75) has engaged with the gears (82), the bearing ring (83) and the bearing (84).



18 - If it has been removed, install the pipe (72) on the front housing (3). Secure it with the fittings (71) and the copper washers (73).

 Nm Fittings: 40 Nm



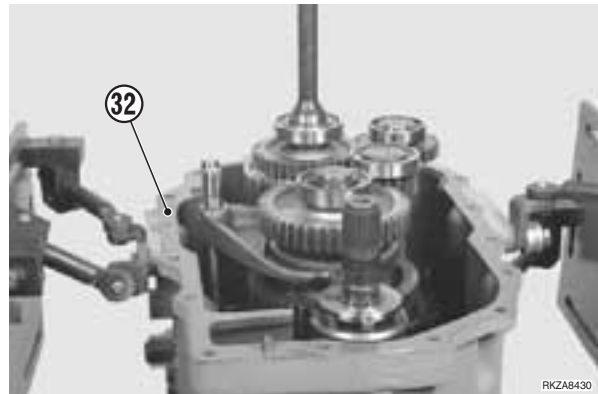
REMOVAL AND INSTALLATION

TRANSMISSION

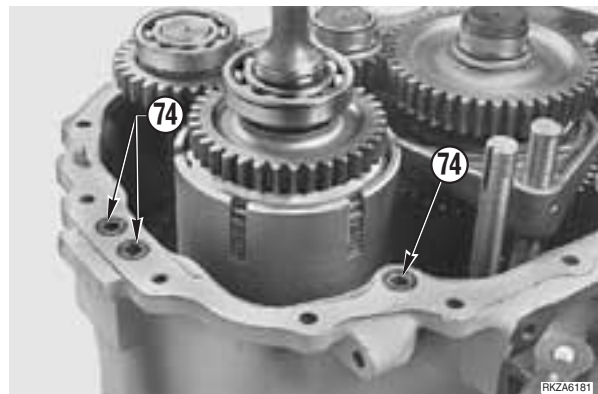
19 - Degrease the sealing surface of the housing (32) and coat it evenly with a sealant.

 Housing: Loctite 510

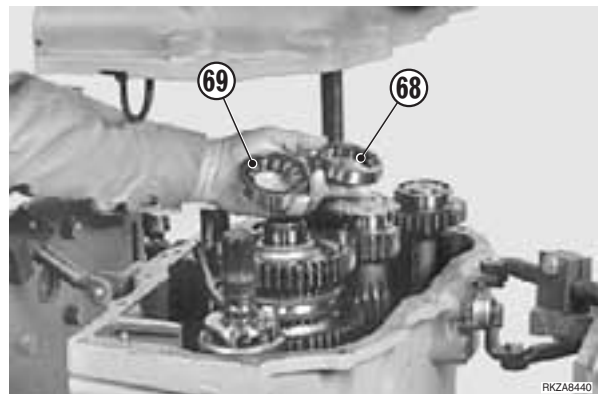
- ★ Do not allow any of the sealant to penetrate anywhere where oil flows or into the seatings of the O-rings (74).



20 - Position the three O-rings (74).



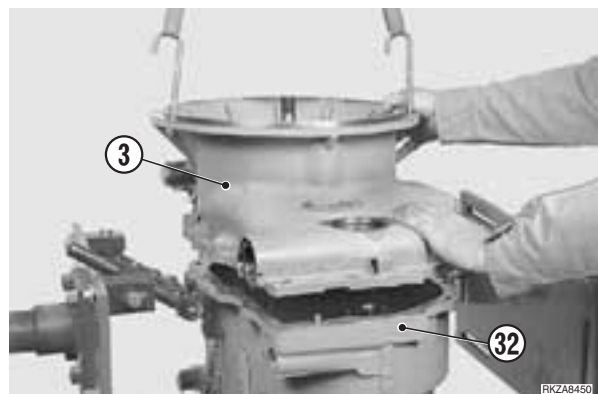
21 - Lubricate the bearings (69) and (68) and mount them on the main and secondary shafts.



22 - Install the front housing (3) on the rear housing (32).

- ★ Make sure that all the bearings have settled correctly into their seatings in the front housing (3).

23 - Push the two housings home.



REMOVAL AND INSTALLATION

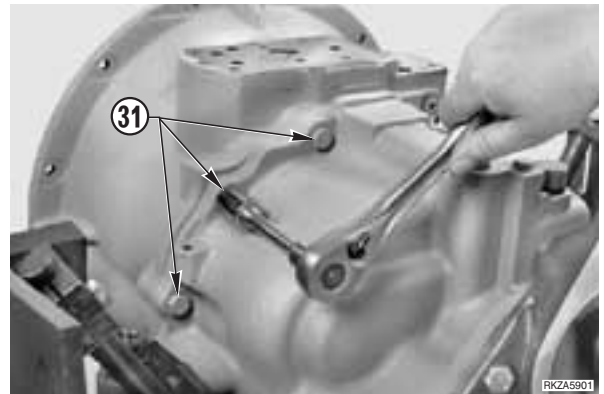
TRANSMISSION

24 - Screw in all the screws by (31) by hand.

25 - Tighten the screws using the alternating crosswise method.



Screws: 50 Nm

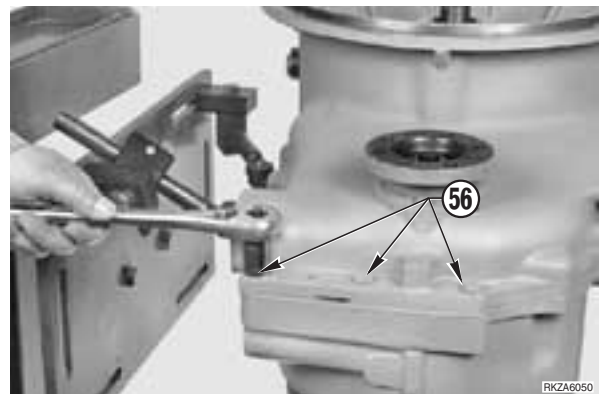


26 - Screw in the screws (56) by hand.

27 - Tighten the screws using the alternating crosswise method, starting from the centre.

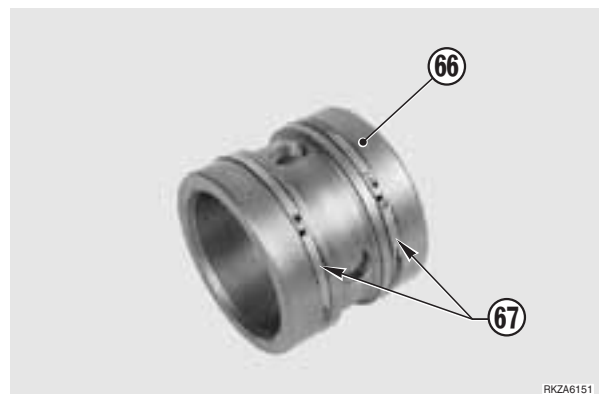


Screws: 50 Nm



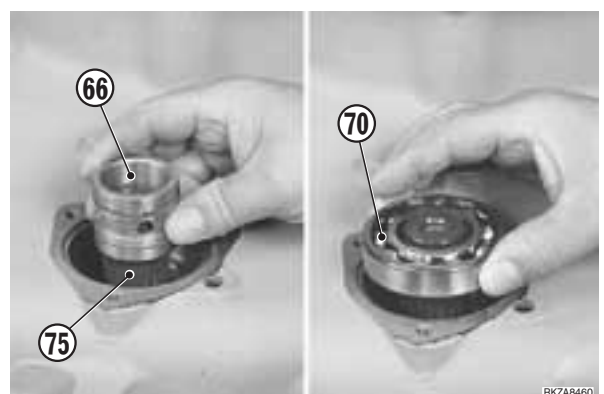
28 - Mount the new sealing rings (67) on the differential lock ring (66).

- ★ Hook up the extremities and position them 180° apart.



29 - Lubricate the differential lock ring (66) and mount it on the 4-wheel drive shaft (75).

30 - Mount the bearing (70) on the shaft (75).

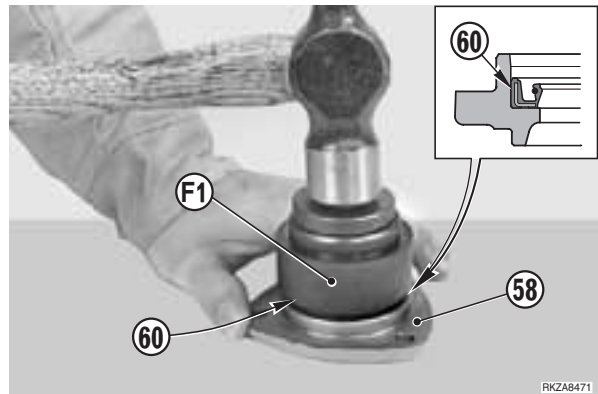


REMOVAL AND INSTALLATION

TRANSMISSION

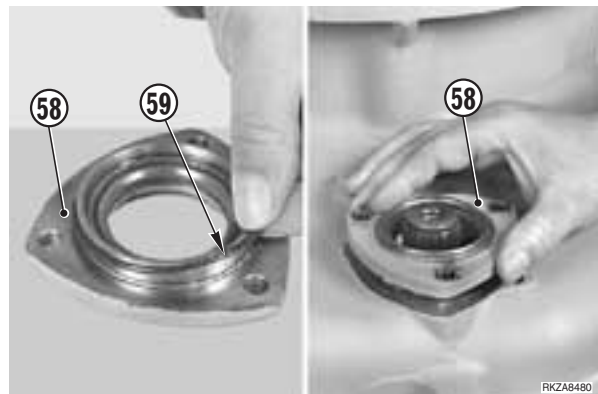
31 - Lubricate the seal ring (60) and, using the tool **F1**, install it in the cover (58).

★ Pay careful attention to the direction of assembly.



32 - Mount the O-ring (59) on the cover (58).

33 - Lubricate the seal rings (59) and (60) and mount the group on the housing (3).

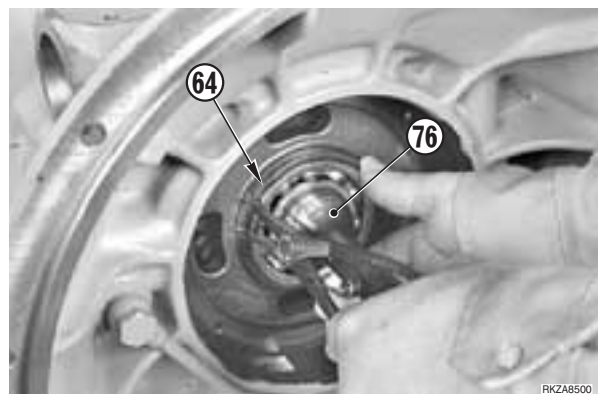


34 - Mount the screws (57) and tighten them.

 Nm Screws: 23 Nm



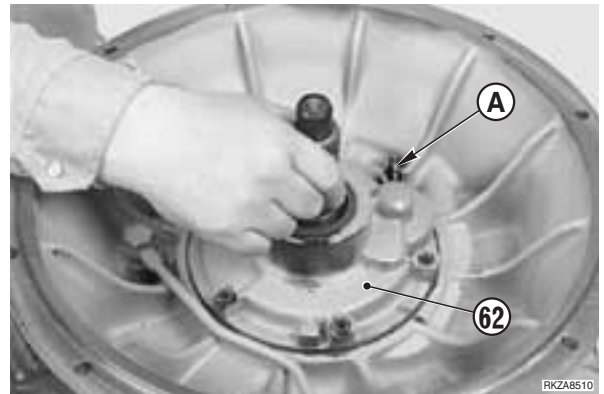
35 - Pull the shaft (76) towards the front of the transmission and mount the snap ring (64) on the bearing.



REMOVAL AND INSTALLATION

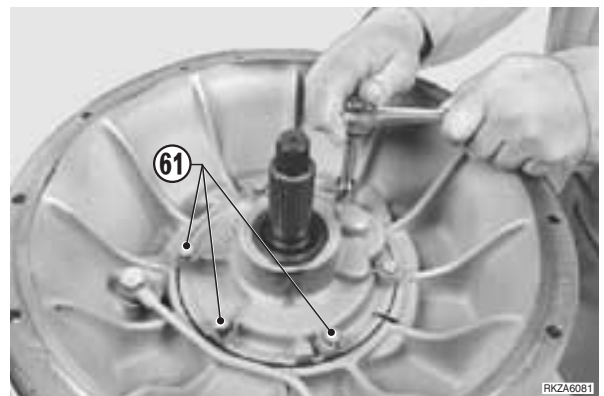
TRANSMISSION

- 36 - Lubricate the O-ring (63) of the pump (62) and, using a guiding stud bolt "A", install the pump.



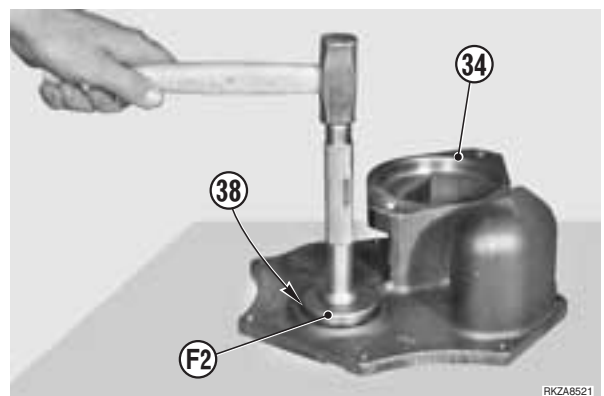
- 37 - Take out the guiding stud bolt "A" and secure the pump with the screws (69).

 Screws: 23 Nm



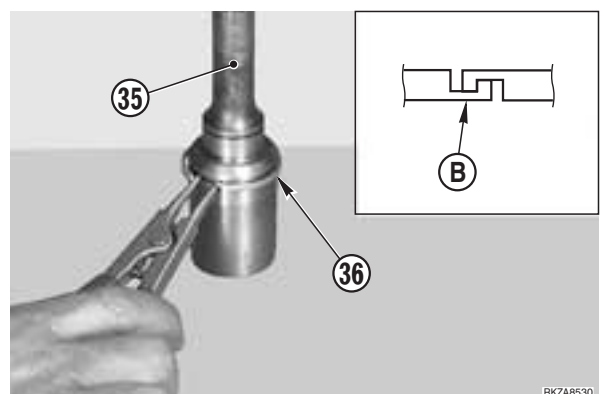
- 38 - Use the tool F2 to mount the seal ring (38) in the cover (34).

★ Pay careful attention to the direction of assembly.



- 39 - Mount the sealing ring (39) on the shaft (35).

★ The ring is secured by hooking up the two extremities "B".

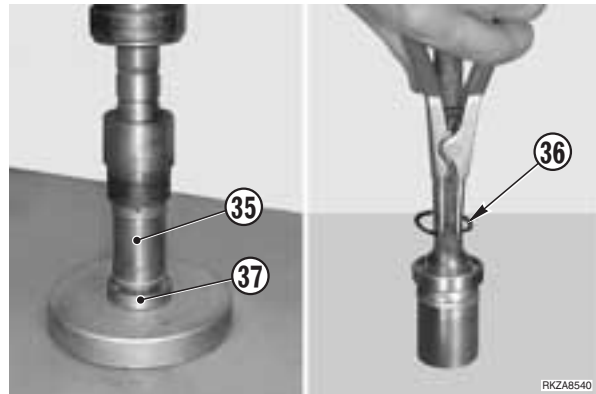


REMOVAL AND INSTALLATION

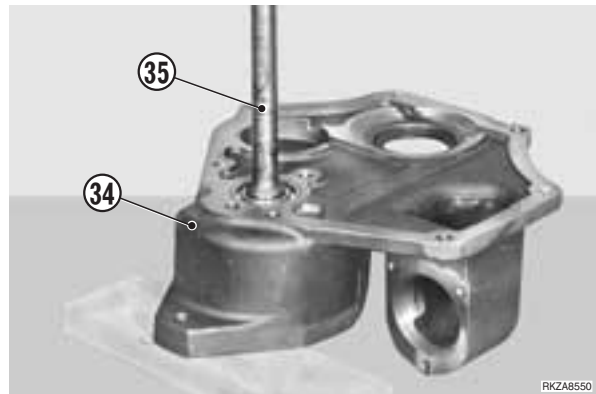
TRANSMISSION

40 - Use a press and a plunger to mount the bearing (37) on the shaft (35).

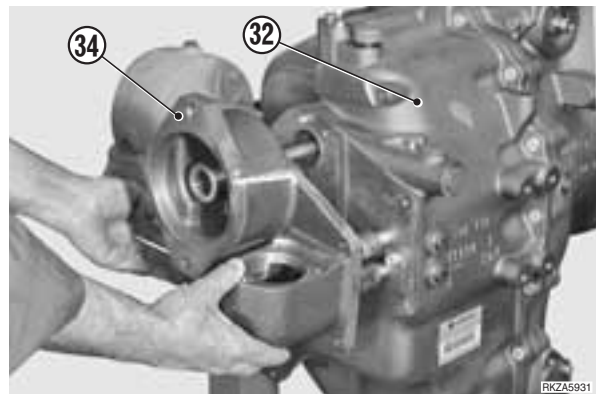
41 - Mount the snap ring (36).



42 - Lubricate the sealing rings and mount the complete shaft (35) in the housing (34).

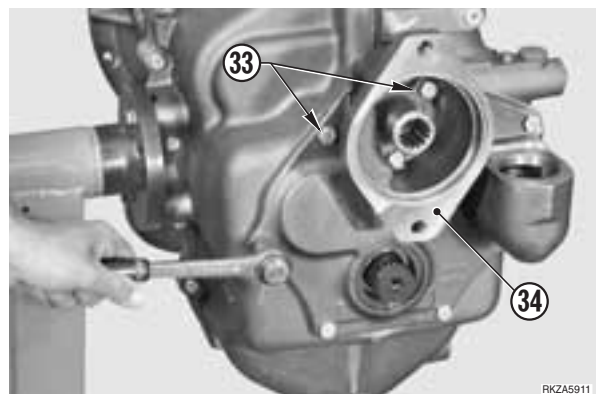


43 - Mount the housing (34) on the transmission and push it home.

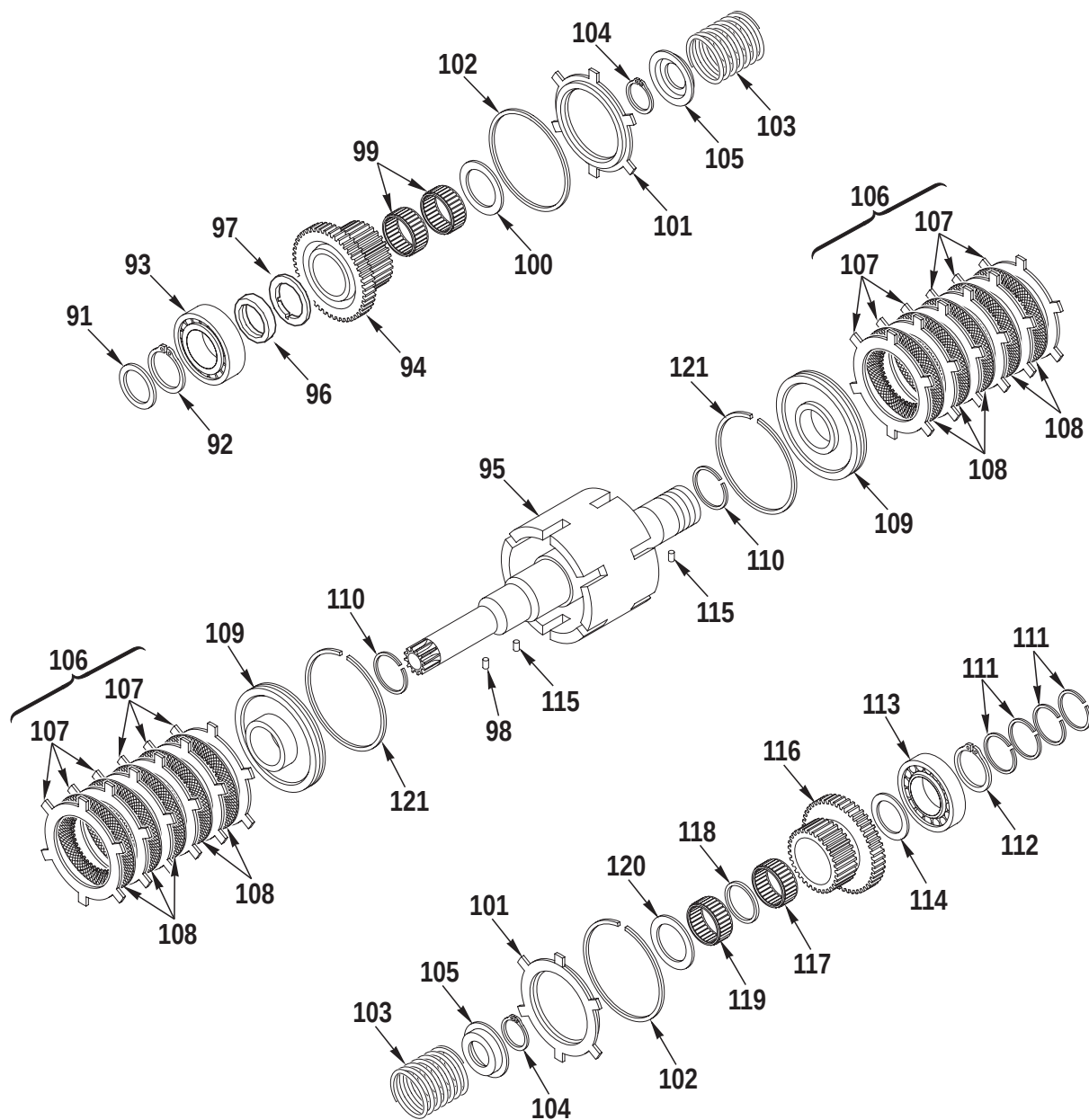


44 - Mount the screws (33) and secure the housing (34).

 Screws: 50 Nm



5. Dismantling the input shaft



RKZ07490

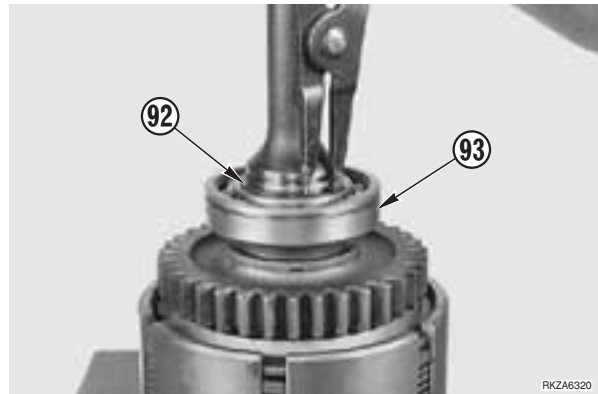
1 - Remove the seal ring (91).



REMOVAL AND INSTALLATION

TRANSMISSION

- 2 - Remove the snap ring (92) that holds the bearing (93) in place.

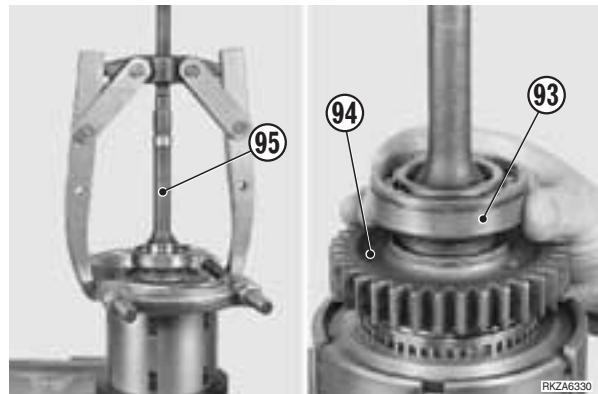


- 3 - Use a separator applied beneath the gear (94) and a puller, to force the bearing (93) out of the seating of the shaft (95).

 Shaft seating: ASL800040

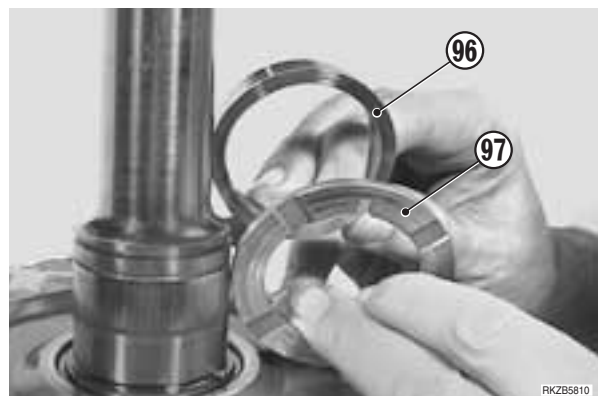
- ★ Use a protective cap on the head of the shaft.

- 4 - Remove the bearing (93).

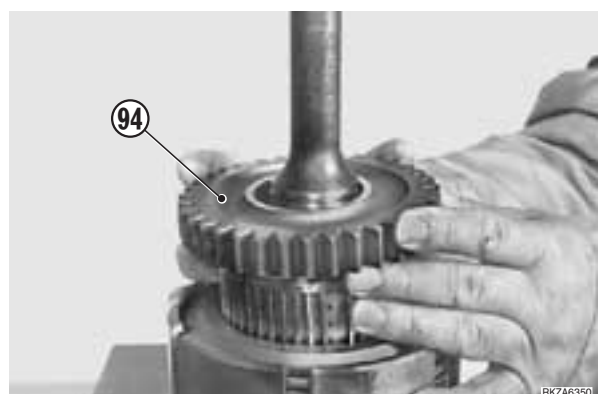


- 5 - Remove the spacer (96).

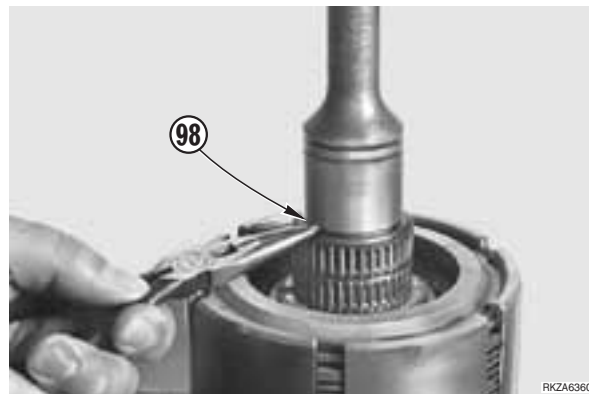
- 6 - Remove the bearing ring (97).



- 7 - Remove the gear (94).

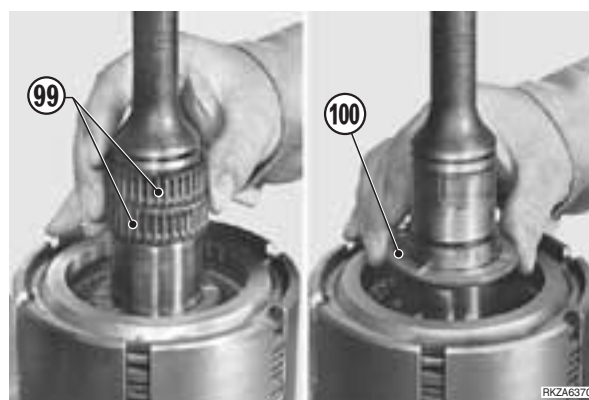


8 - Remove the spring pin (98).

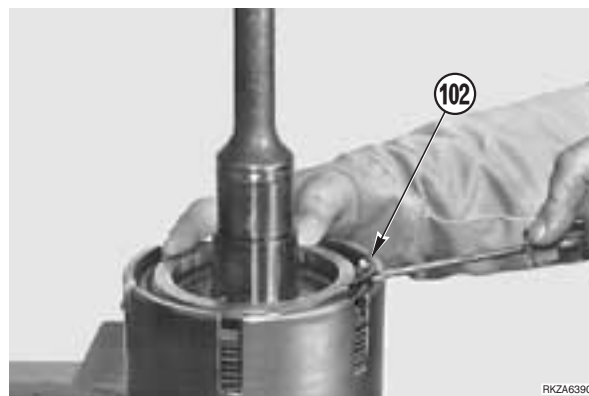


9 - Remove the roller bearings (99).

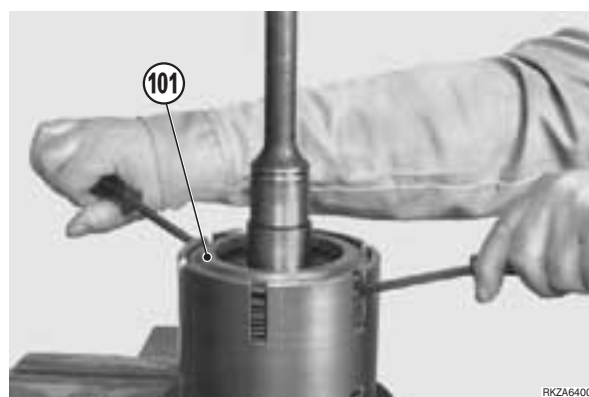
10 - Remove the bearing ring (100).



11 - Remove the retainer ring (102).



12 - Use two levers to remove the bearing (101).



REMOVAL AND INSTALLATION

TRANSMISSION

13 - Remove the spring pin (115).



14 - Install the upper part of the tool **F3** and the three threaded tie-rods complete with nuts, used to fasten the component parts of the tool between them.



15 - Gradually and evenly tighten the nuts in order to compress the spring (103) and to gain access to the snap ring (104).



16 - Remove the snap ring (104).

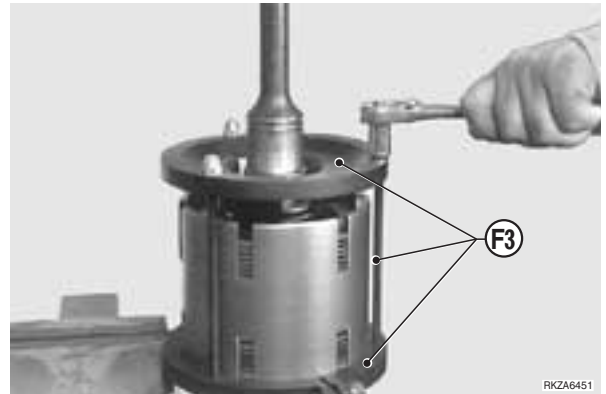


REMOVAL AND INSTALLATION

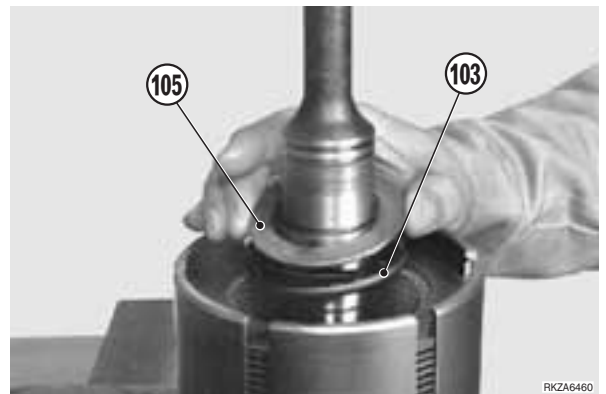
TRANSMISSION

17 - Gradually and evenly loosen the nuts and the tie-rods on the tool **F3** until the thrust of the spring (103) has been eliminated.

Remove the upper part of the tool **F3** and the tie-rods.



18 - Remove the spring retainer plate (105) and the spring (103).



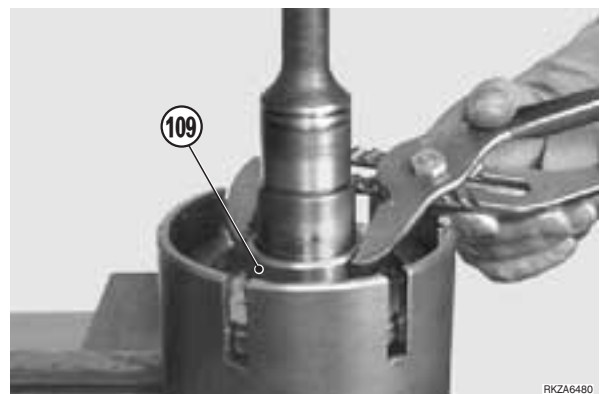
19 - Remove the clutch pack (106).

- ★ Make a note of the assembly sequence of the disks.
- ★ Make a mark on the assembly side of the clutch pack.
- ★ If the friction disks (108) have a thickness of less than 1.65 mm, they must be replaced.



20 - Remove the piston (109).

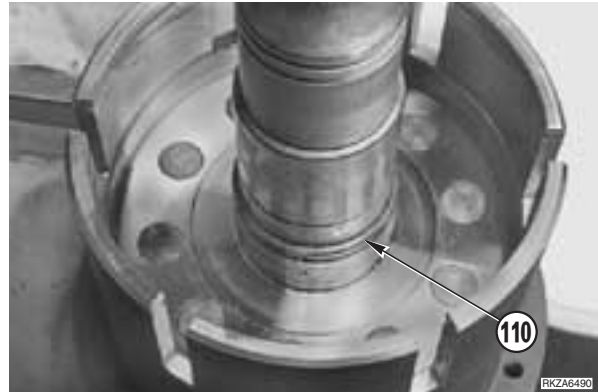
- ★ Take great care not to damage the surfaces and edges of the piston.



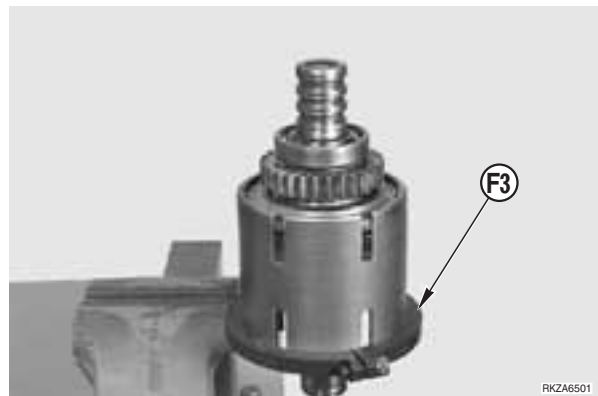
REMOVAL AND INSTALLATION

TRANSMISSION

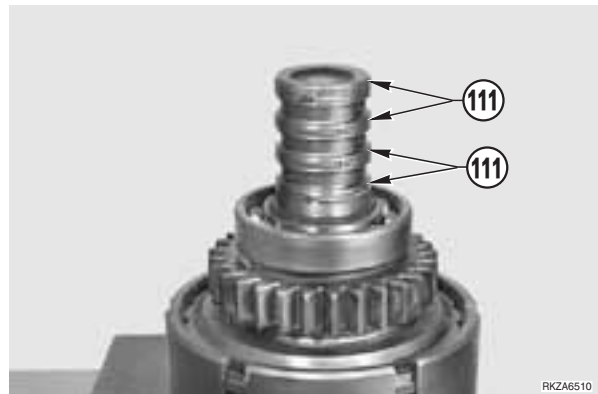
21 - Remove the seal ring (110).



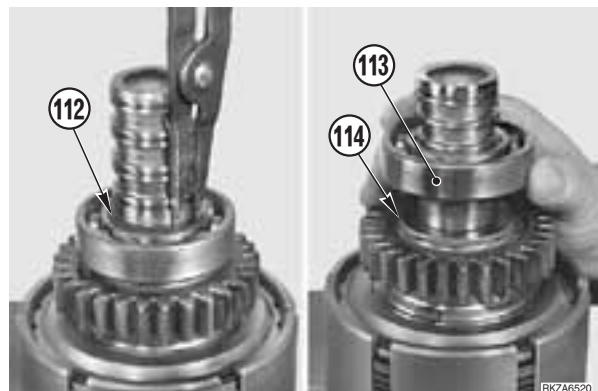
22 - Apply the tool **F3** to the other side of the shaft group (forward gear clutch in the upper position). Secure the tool in a vise as indicated.



23 - Remove the seal rings (111).



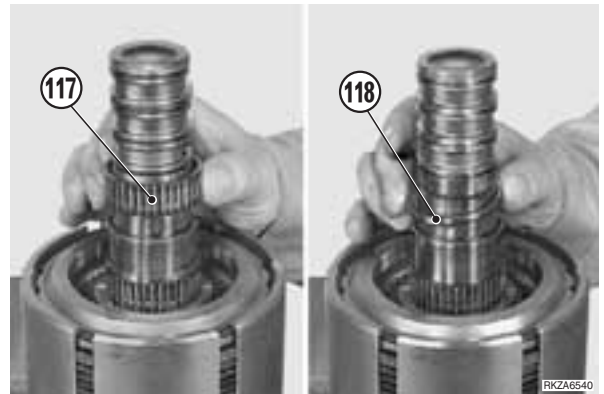
24 - Repeat also for this side the operations performed from phase 2 to phase 8 for the removal of the snap ring (112), the bearing (113), the bearing ring (114) the spring pin (115) and the gear (116).



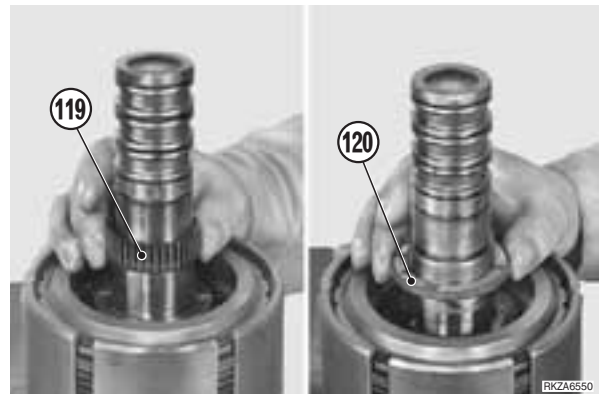
REMOVAL AND INSTALLATION

TRANSMISSION

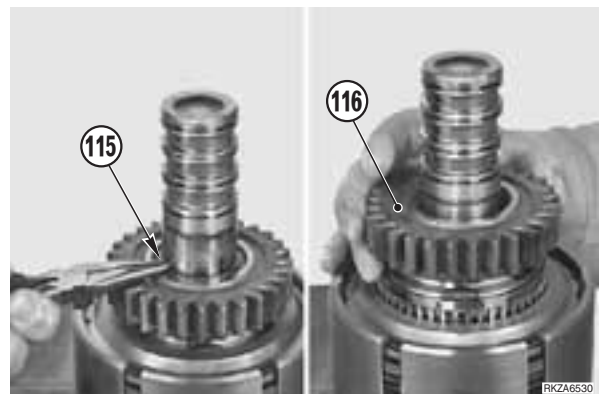
25 - Take out the 1st roller bearing (117) and the spacer (118).



26 - Remove the second roller bearing (119) and the bearing ring (120).



27 - Repeat the phases from 11 to 21 to complete the dismantling of the input shaft.

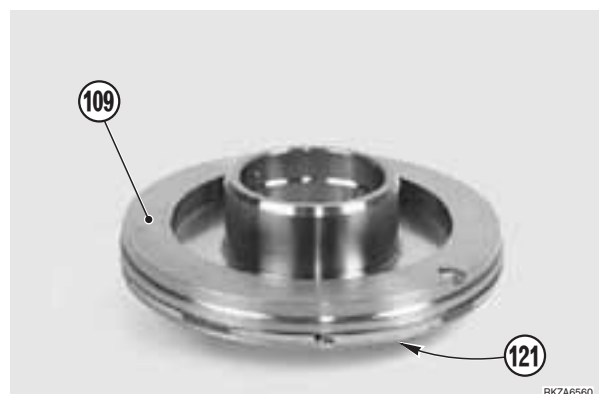


28 - Remove the seal rings (121) from the pistons (109).

- ★ New seal rings must be installed each time they are dismantled.

29 - Check carefully for splines in the shaft, the rotating parts, and in the bearings and the gears. If there are obvious signs of wear, pitting or scoring, change the components.

- ★ All seal rings should be changed for new, even if they appear to be in good condition.



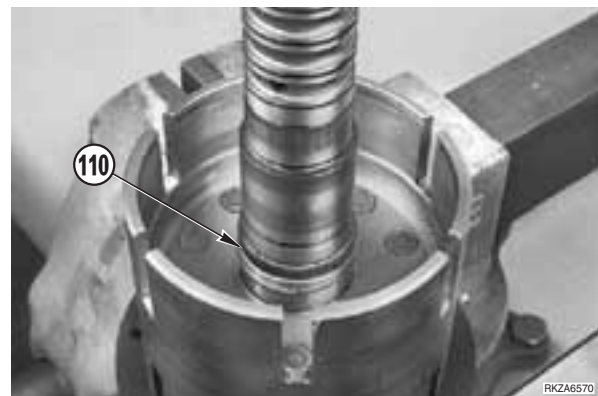
6. Assembly of the input shaft.

! Unless otherwise specified, the pieces being re-assembled should be lubricated with transmission oil.

1 - Lubricate the seal rings (121) and mount them on the pistons (109).



2 - Mount the seal ring (110) to the rear of the input shaft.



3 - Lubricate the seating of the shaft (95) and the complete piston (109). Mount the piston.



4 - Mount the spring (103) and the spring retainer plate (105).

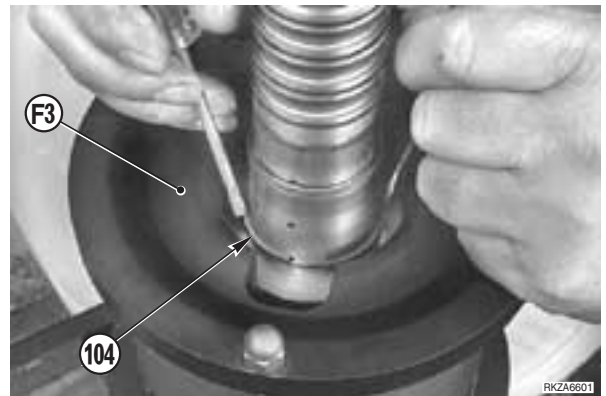
★ The collar of the spring retainer plate must center the spring.



REMOVAL AND INSTALLATION

TRANSMISSION

- 5 - Mount the upper part of the tool **F3** and fasten the two parts together with tie-rods. Tighten them equally and evenly as much as necessary to be able to install the snap ring (104).

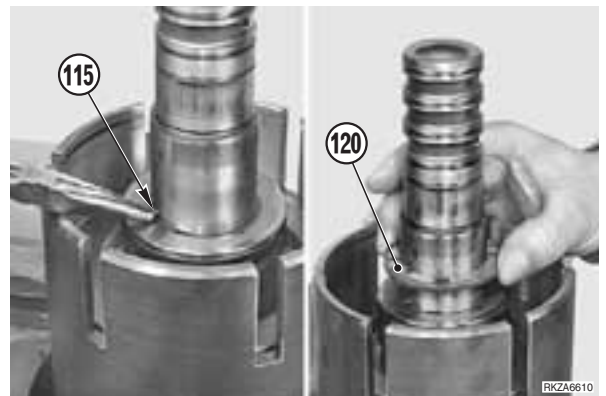


- 6 - Mount the spring pin (115).

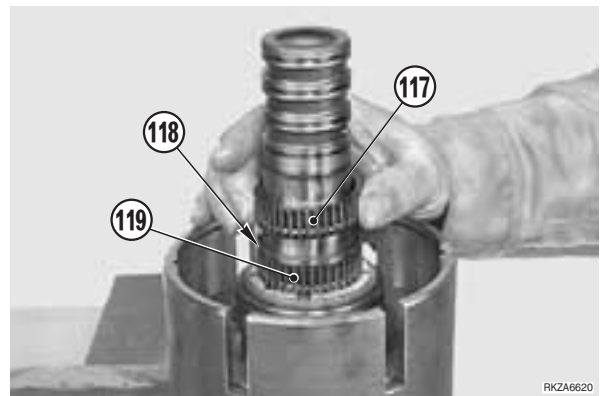
- 7 - Lubricate and mount the bearing ring (120).

- ★ The chamfer on the bearing ring must face upwards and the bearing ring must be engaged on the spring pin.

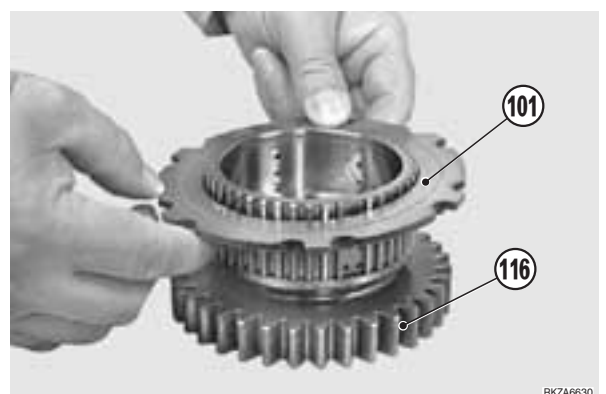
- 8 - Remove the tool **F3**.



- 9 - Lubricate and install the first roller bearing (119), the spacer (118) and the second bearing (117).



- 10 - Mount the bearing (101) on the gear (116).

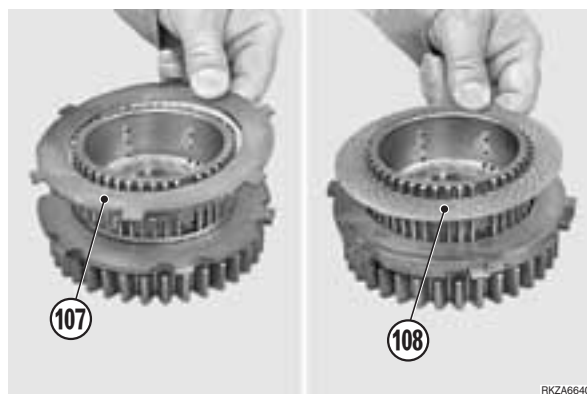


REMOVAL AND INSTALLATION

TRANSMISSION

11 - Mount in sequence a steel disk (107) and a friction disk (108) until the clutch pack is complete.

- ★ Immerse the clutch disks in oil before assembling them.



12 - Align the tongues of the steel disks (108) and turn the gear-clutch group upside down. Using two screwdrivers as a support, position the clutch group in its seating.



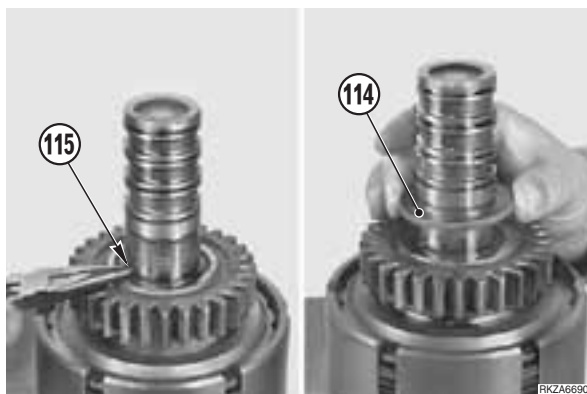
13 - Mount the snap ring (102).



14 - Mount the spring pin (115).

15 - Lubricate the bearing ring (114) and mount it on the shaft.

- ★ The lubrication holes must face towards the gear.
- ★ Make sure that the spring pin is engaged in the seating of the bearing ring (114).

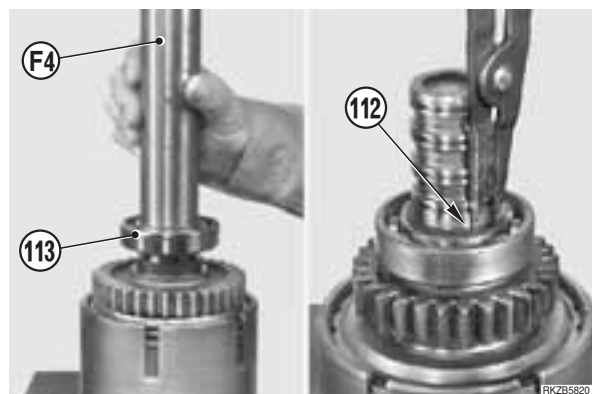


REMOVAL AND INSTALLATION

TRANSMISSION

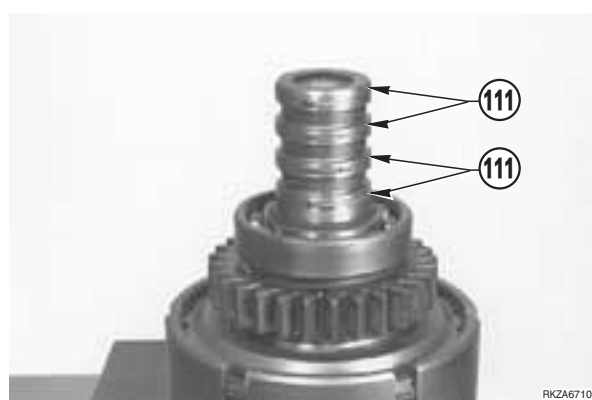
16 - Heat at 80–100 °C the bearing (113) and with tool **F4** mount it behind the bearing ring (114).

17 - Mount the snap ring (112).



18 - Lubricate the seal rings (111) and mount them on the shaft.

★ Position the notches on the seal rings 120° apart.



19 - Turn the input shaft upside down and repeat the phases from 1 to 13 in order to mount the rear clutch.

★ For the rear clutch, phase 9 does not envisage installation of the spacer (118).



20 - Install the spring pin (98).

21 - Lubricate the bearing ring (100) and mount it on the shaft (95).

★ Make sure that the lubrication slots face downwards and that the spring pin is engaged in the seating of the bearing ring (100).

22 - Mount the spacer (96).

23 - Heat at 80–100 °C the bearing (93) and using tool **F4** mount it behind the spacer.

★ The seating for the snap ring groove must face upwards.

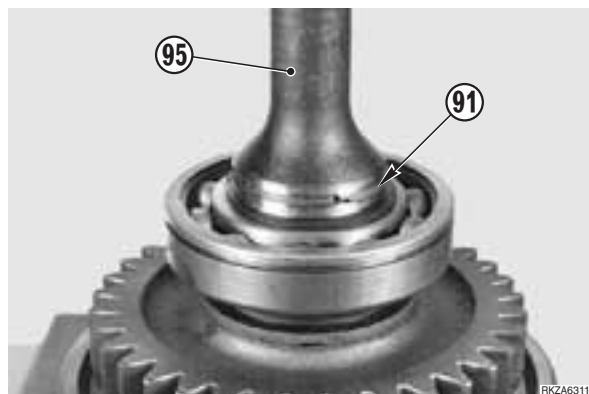
24 - Mount the snap ring (92).



REMOVAL AND INSTALLATION

TRANSMISSION

25 - Lubricate the seal ring (91) and mount it on the shaft.



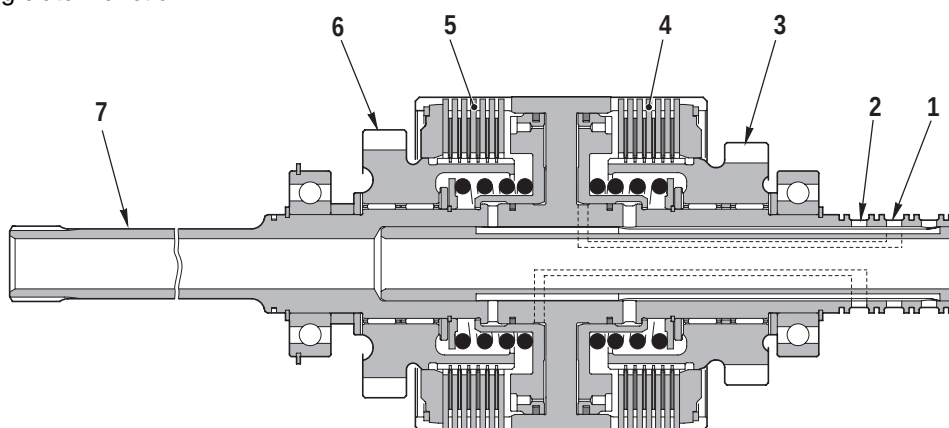
26 - Check the clearance of each clutch group using a thickness calliper "C" inserted between the thrust bearing ring and the first steel disk.

★ Clearance limits: 2.3–4.3 mm

If the clearance does not fall within these tolerances, it is very probable that the group has been incorrectly assembled.



27 - Checking clutch function.

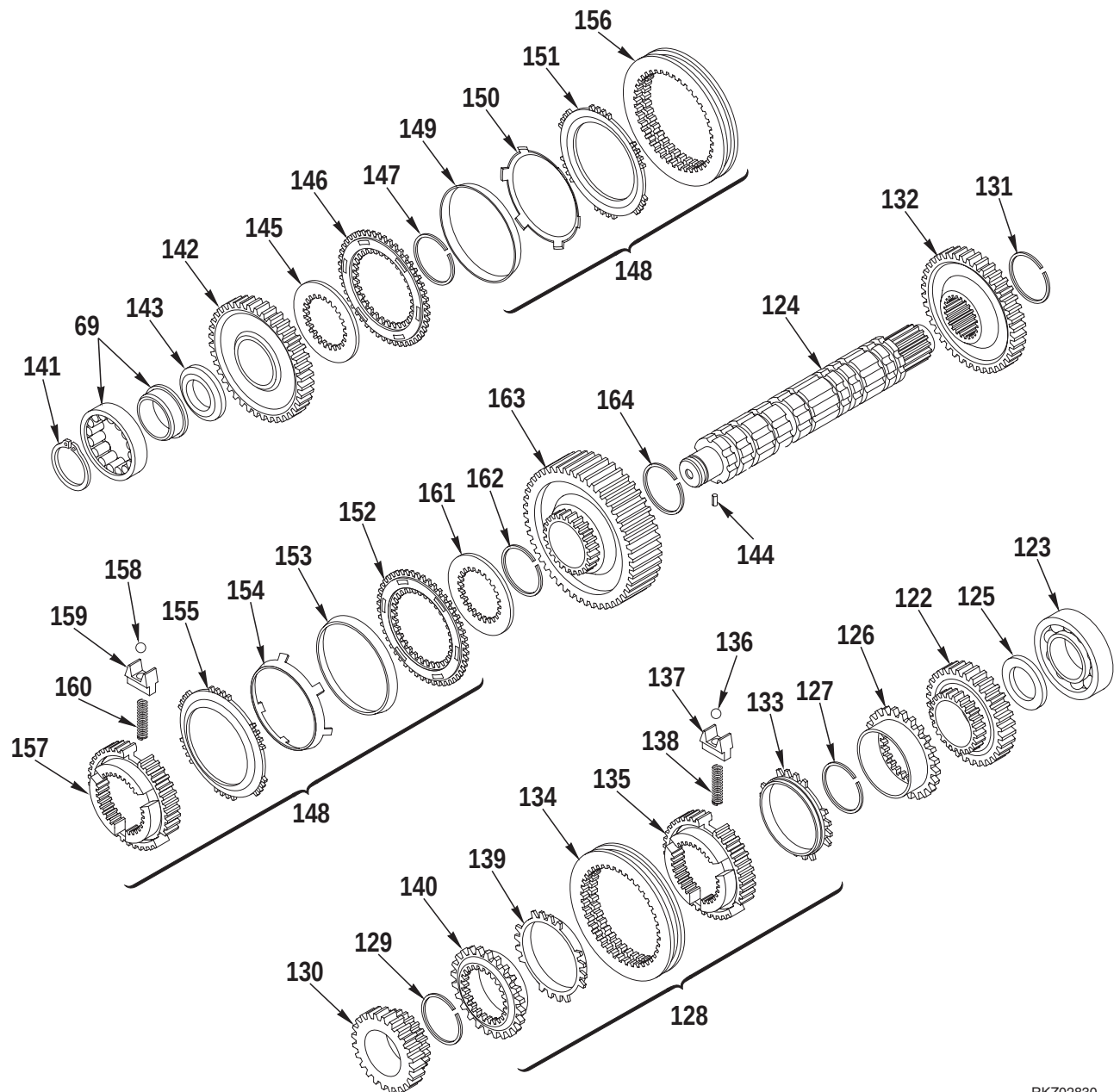


- Slowly insert compressed air up to about 6 bar (90 psi) into the clutch duct (1) for the forward gear. Listen for the piston movement that should block the clutch. In this condition, the forward gear (3) should be blocked while the reverse gear should be able to rotate freely on the input shaft (7).
- Repeat the test for the passage (2). In this condition the forward gear (3) should rotate freely on the input shaft (7) while the reverse gear (6) should be blocked.

★ If the conditions described are not found, dismantle the group and look for the causes of the malfunction.

- 1 - Clutch duct FORWARD gear
- 2 - Clutch duct REVERSE gear
- 3 - FORWARD gear
- 4 - Clutch pack FORWARD gear
- 5 - Clutch pack REVERSE gear
- 6 - REVERSE gear
- 7 - Drive input shaft

7. Dismantling the secondary shaft



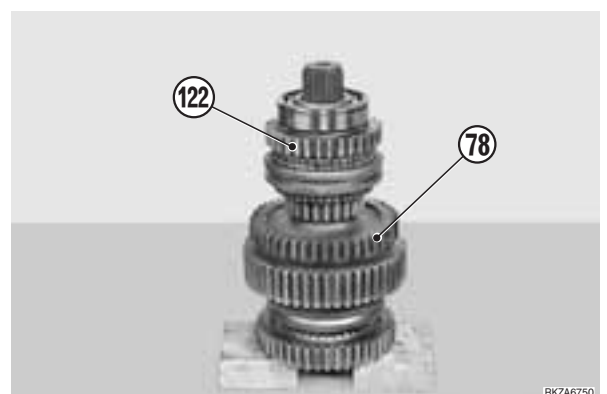
RKZ02830

1 - Position the secondary shaft group (78) on plastic blocks, as illustrated.

★ Do not use wooden blocks.

2 - Position a separator beneath the gear (122) with the conical edge facing downwards.

★ Do not force the separator against the synchronizer assembly.



RKZA6750

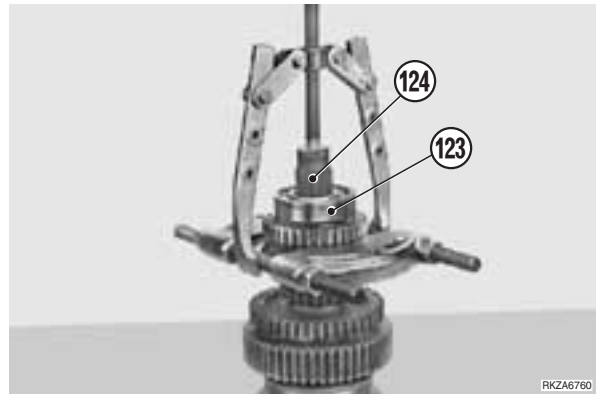
REMOVAL AND INSTALLATION

TRANSMISSION

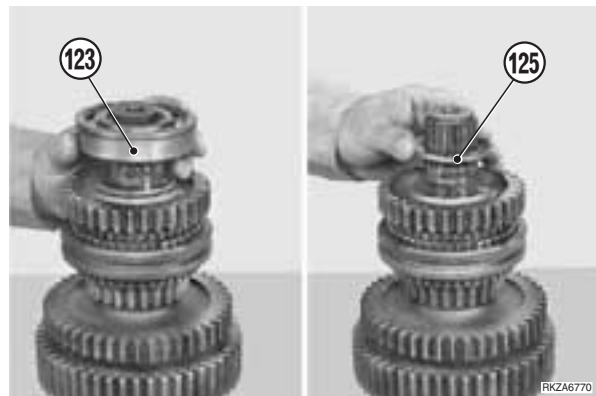
- 3 - Position a puller and force the bearing (123) until it can be detached from the seating of the shaft (124).

 Shaft seating: ASL800040

- ★ Use a protective cap on the head of the shaft.

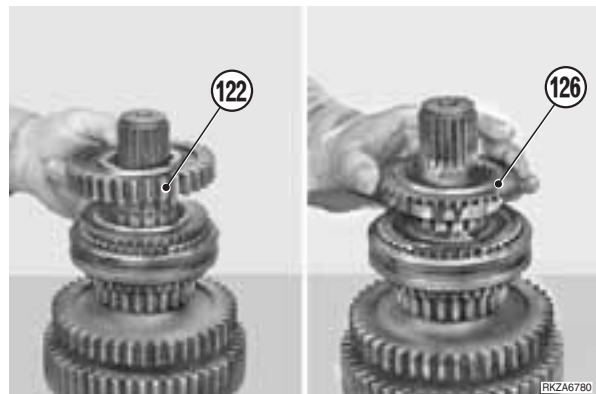


- 4 - Remove the bearing (123) and the bearing ring (125).



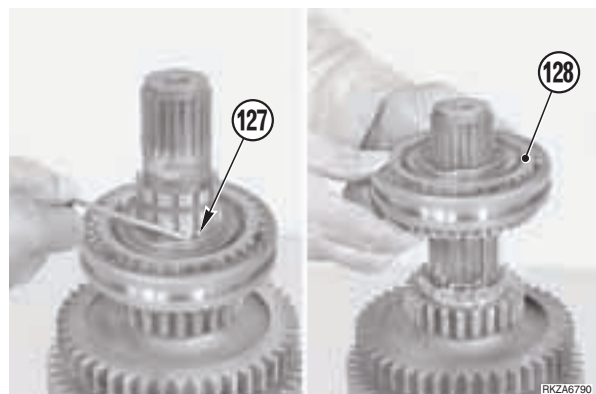
- 5 - Remove the gear (122) of the 3rd speed.

- 6 - Remove the synchronizer ring (126) of the 3rd and 4th synchronizer assembly in order to reach the snap ring (127).



- 7 - Remove the snap ring (127).

- 8 - Remove the synchronizer assembly (128) and put it to one side.

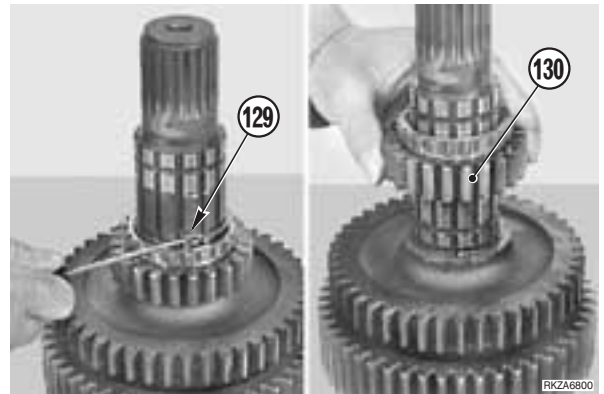


REMOVAL AND INSTALLATION

TRANSMISSION

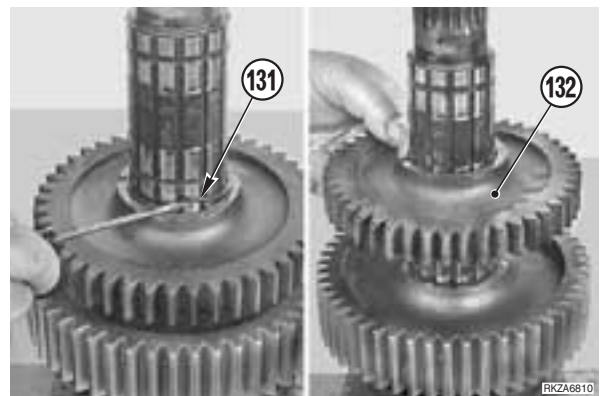
9 - Remove the snap ring (129).

10 - Remove the 4th speed gear (130).



11 - Remove the snap ring (131).

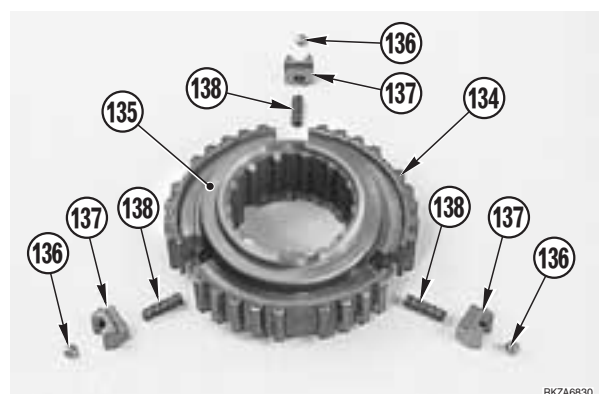
12 - Remove the gear (132) of the 4-wheel drive gear.



13 - Remove the bronze ring (133).



14 - Arrange the sleeve (134) on some plastic blocks inside a container. Using a plunger, extract the hub (135), the balls (136), the springs (137) and the blocks (138).



REMOVAL AND INSTALLATION

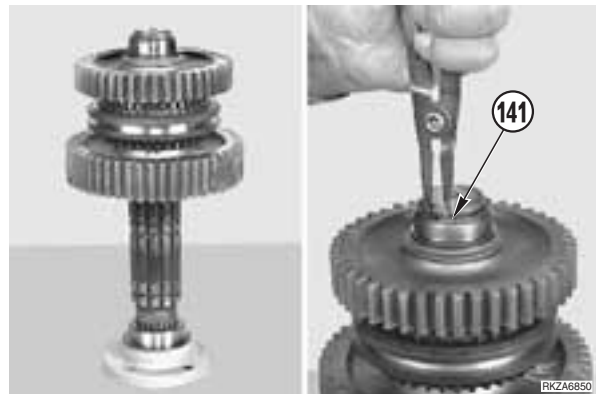
TRANSMISSION

- 15 - Remove the 2nd bronze ring (136) from the synchronizer ring (140).



- 16 - Turn the group upside down so that the 2nd speed gear faces upwards.

- 17 - Remove the snap ring (141).



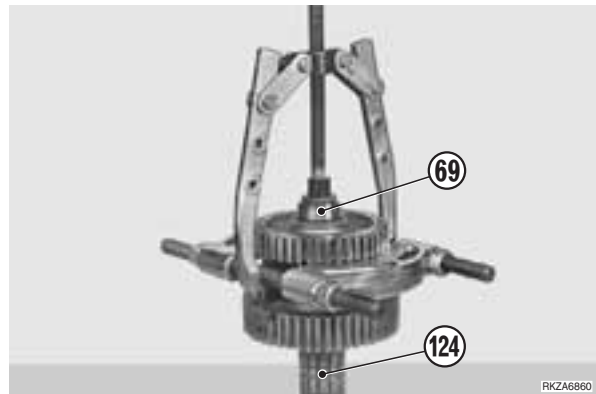
- 18 - Position a separator beneath the gear (142) with the conical edge facing downwards.

- ★ Do not force the separator against the synchronizer assembly.

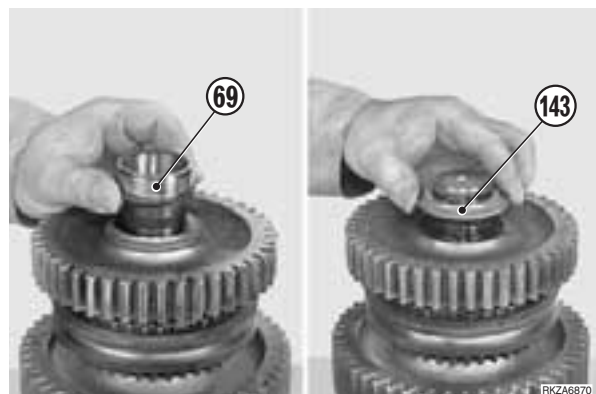
- 19 - Position a puller and force the ring into the bearing (69) until it can be detached from the seating of the shaft (124).

 Shaft seating: ASL800040

- ★ Use a protective cap on the head of the shaft.



- 20 - Remove the ring inside the bearing (69) and the bearing ring (143).

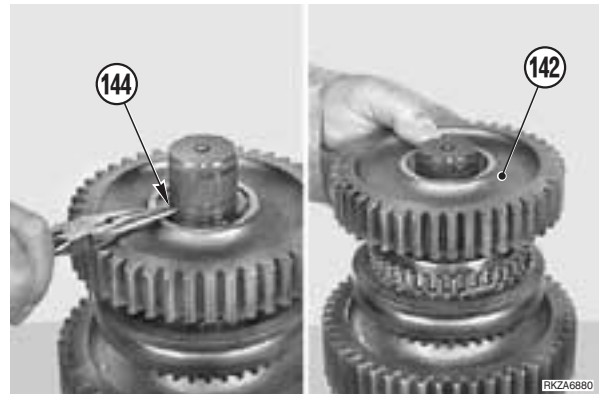


REMOVAL AND INSTALLATION

TRANSMISSION

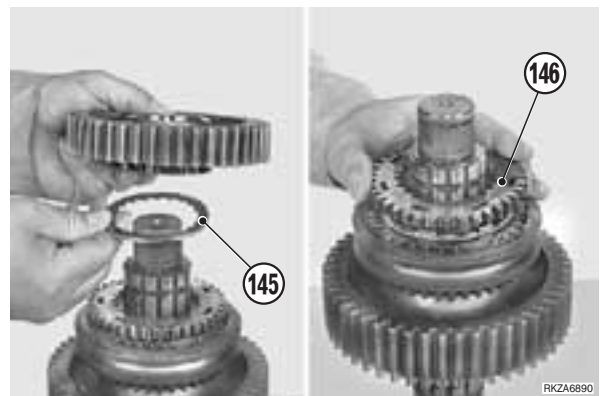
21 - Remove the pin (144).

22 - Remove the 2nd speed gear (142).



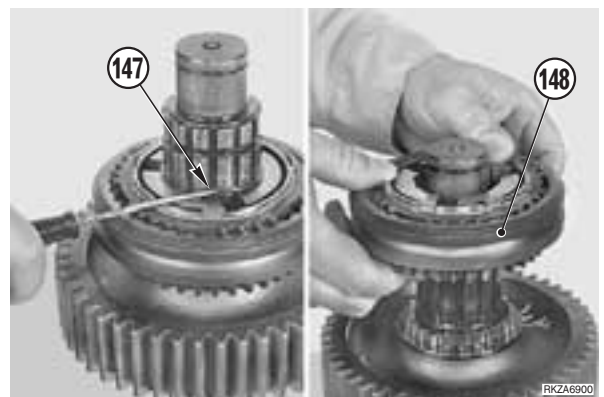
23 - Remove the spacer (145).

24 - Remove the synchronizer ring (146) from the 1st and 2nd speed synchronizer assembly in order to reach the snap ring (147).

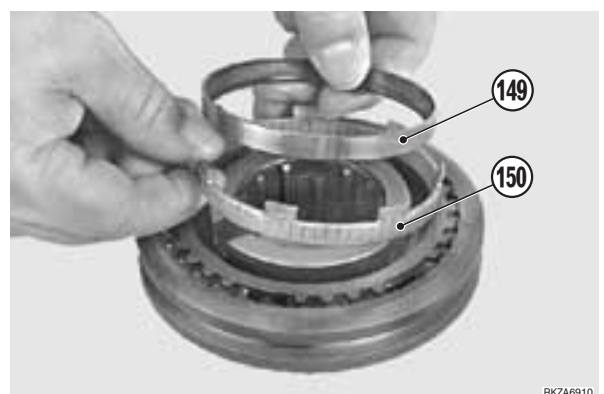


25 - Remove the snap ring (147).

26 - Remove the synchroniser assembly (148).



27 - Remove the steel ring (149) and the bronze ring (150) from the synchronizer assembly.



REMOVAL AND INSTALLATION

TRANSMISSION

28 - Remove the tapered friction ring (151).

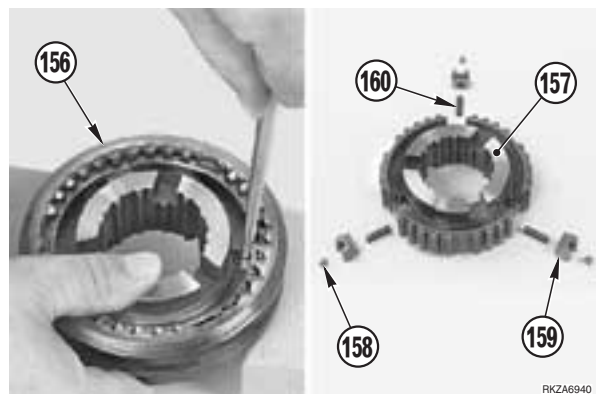


29 - Turn the synchronizer assembly upside down and remove the other synchronizer ring (152).

30 - Remove the steel rings (153) and bronze rings (154). Remove also the tapered friction ring (155). For details, see phases 27 and 28.

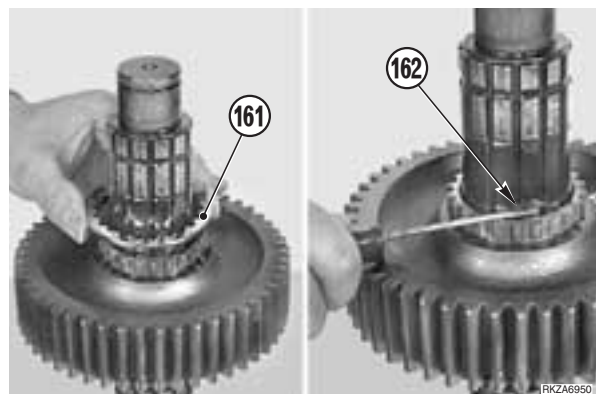


31 - Place the sleeve (156) on some plastic blocks inside a container. Using a plunger, extract the hub (157), the balls (158), the springs (159) and the blocks (160).



32 - Remove the spacer (161).

33 - Remove the snap ring (162).



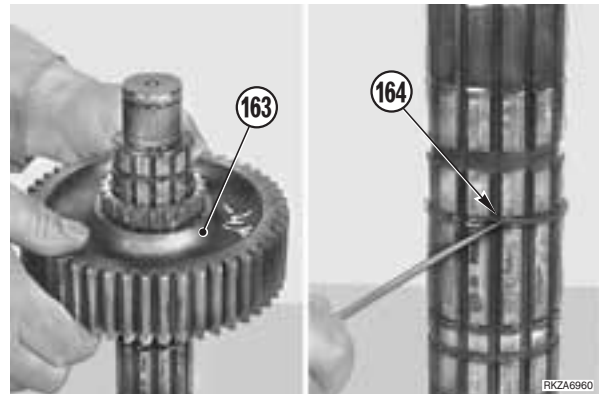
REMOVAL AND INSTALLATION

TRANSMISSION

34 - Remove the 1st speed gear (163).

35 - Remove the last snap ring (164).

36 - Check that all component parts have been dismantled and, if there is any damage to the gears, the inner or outer tooth bases, or to the bearings, replace them with new ones.

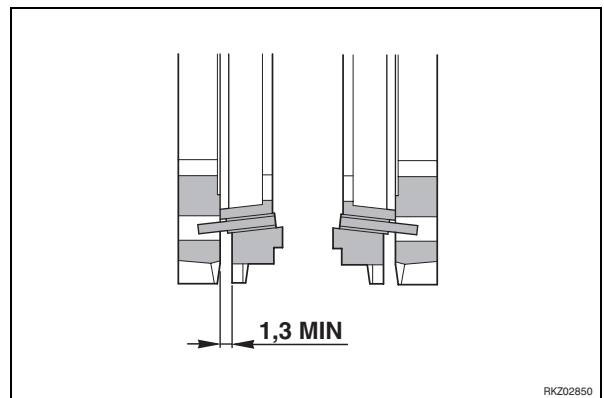


37 - Check the clearance of the synchronizer assemblies at three different points, 120° apart. For this test use the thickness calliper.

★ Minimum clearance permissible: 1.3 mm

If the clearance is less than this, put in new synchronizer assemblies.

38 - Carefully check the secondary shaft, especially where bearing inner races will be installed. No wear or scoring (even if only localised) can be allowed. Check the springs of the synchronization assembly. Cracks, heat distortion, or wear mean that the piece must be changed.



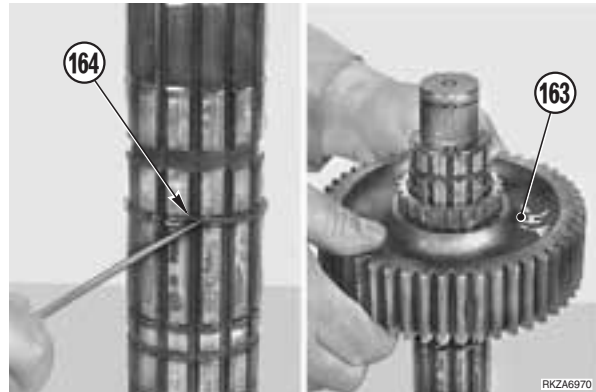
REMOVAL AND INSTALLATION

TRANSMISSION

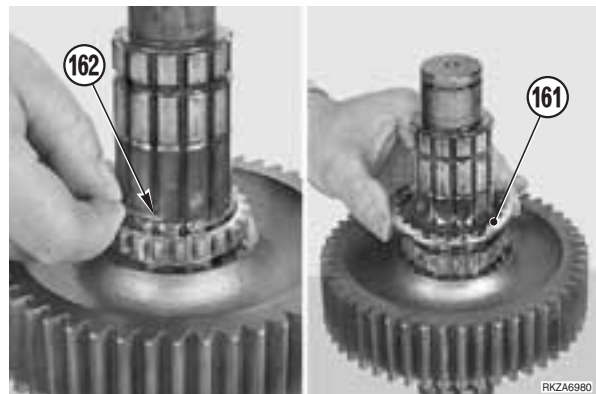
8. Re-assembly of the secondary shaft

- ★ If not otherwise indicated, lubricate the pieces with transmission oil.

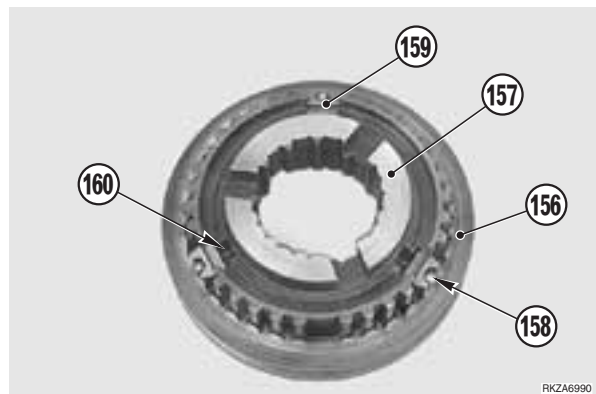
- 1 - Mount the snap ring (164) on the secondary shaft (124)
- 2 - Mount the 1st speed gear (163).



- 3 - Mount the snap ring (162).
- 4 - Mount the spacer (161).



- 5 - Position the hub (157) on the sleeve (158). Mount the springs (160), the blocks (159) and the balls (158) into the hub (157).



- 6 - Use a screwdriver or a plunger to push the balls (158) into the blocks (159). Press on the hub to engage the balls in the sleeve (156) until they are engaged in the central seating of the sleeve (156).



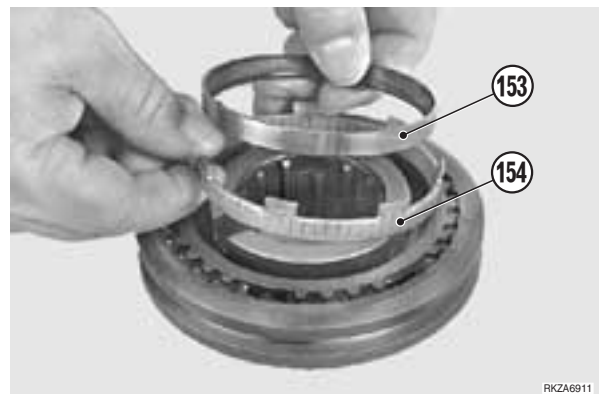
REMOVAL AND INSTALLATION

TRANSMISSION

- 7 - Install the tapered friction ring (155) on the synchronizer assembly.



- 8 - Install the bronze ring (154) and the steel ring (153).



- 9 - Install the synchronizer ring (152).
★ The flat surface of the teeth should face upwards.



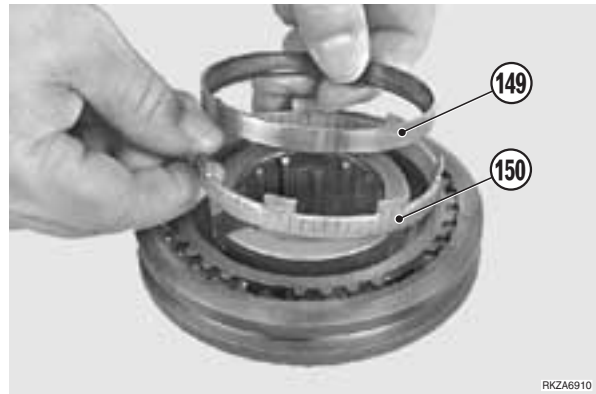
- 10 - Turn the group upside down and install the tapered friction ring (151) on the synchronizer assembly.



REMOVAL AND INSTALLATION

TRANSMISSION

11 - Install the bronze ring (150) and the steel ring (149).



12 - Mount the synchronizer assembly (148) on the shaft (124).

- ★ The side with the seating for the snap ring must face downwards.



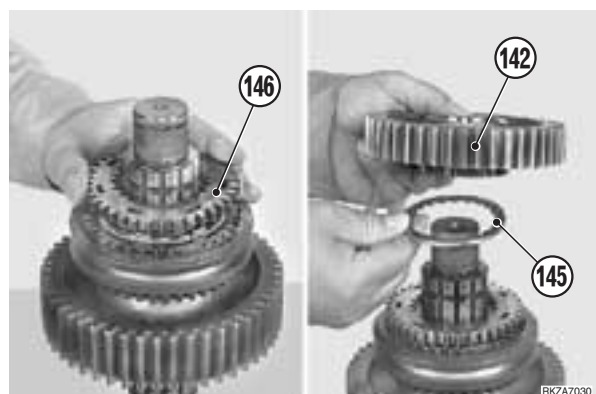
13 - Mount the snap ring (147).



14 - Mount the upper synchronizer ring (146).

- ★ The flat surface of the teeth must face upwards.

15 - Install the spacer (145) and the gear (142) of the 2nd speed.



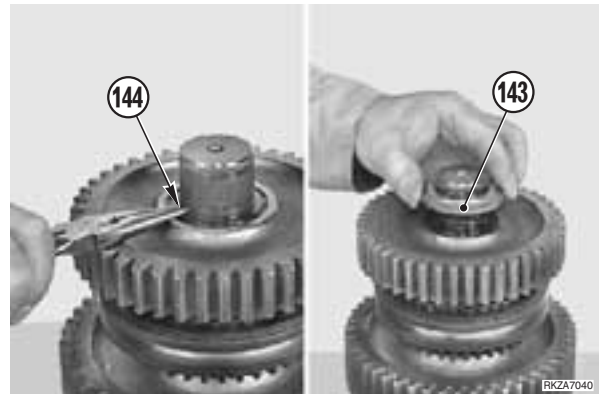
REMOVAL AND INSTALLATION

TRANSMISSION

16 - Mount the pin (144).

17 - Lubricate the bearing ring (143) and mount it.

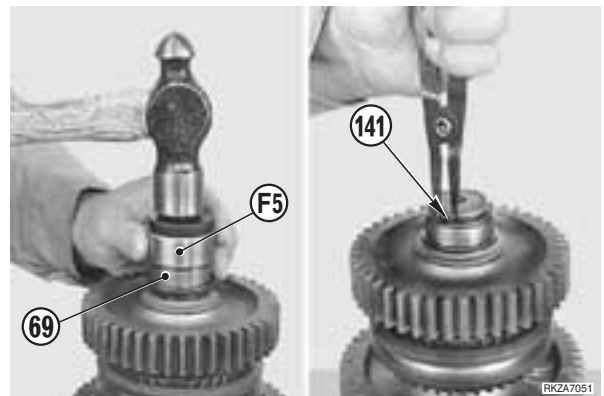
- ★ The lubrication slots should face downwards and the pin should be engaged in the cavity.



18 - Heat at 80–100 °C the inner bearing ring of the bearing (69) and with tool **F5** mount and knock it home on the bearing ring (143).

- ★ The wide base of the bearing ring (69) should face downwards.

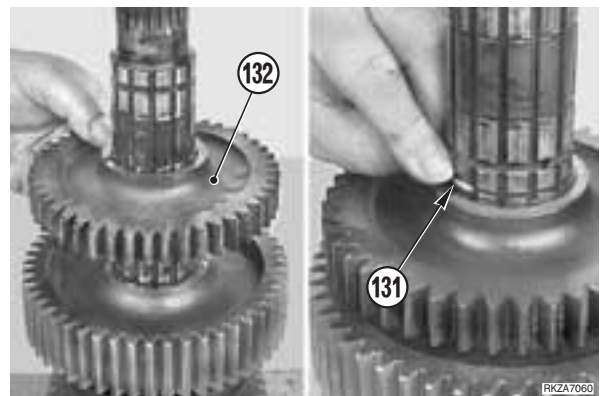
19 - Mount the snap ring (141).



20 - Turn the group upside down and install the gear (132) for the 4-wheel drive.

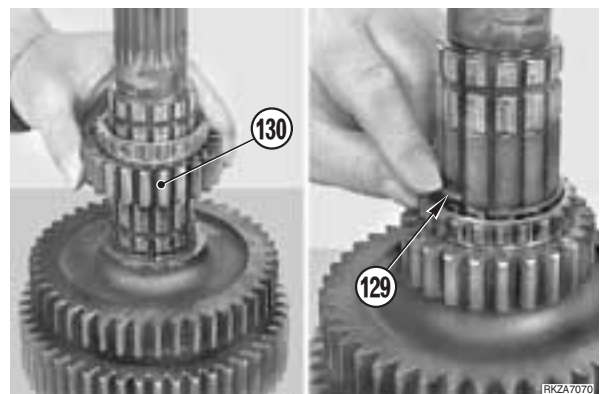
21 - Mount the snap ring (131).

- ★ The ring (131) must be mounted in the lowest seating and behind the gear (132).



22 - Mount the gear (130) of the 4th speed.

23 - Mount the snap ring (129).



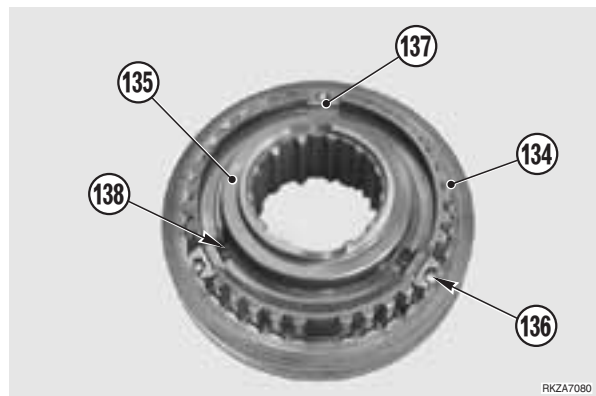
REMOVAL AND INSTALLATION

TRANSMISSION

24 - Mount the bronze ring (139) on the synchronizer ring (140).



25 - Position the sleeve (134) and the hub (135). Mount the springs (138) the blocks (137) and the balls (136) in the hub (135).



26 - Use a screwdriver or a plunger to push the balls (136) into the blocks (137). Press on the hub to engage the balls in the sleeve (134) until they are engaged in the central seating of the sleeve (134).



27 - Mount the 2nd bronze ring (133).

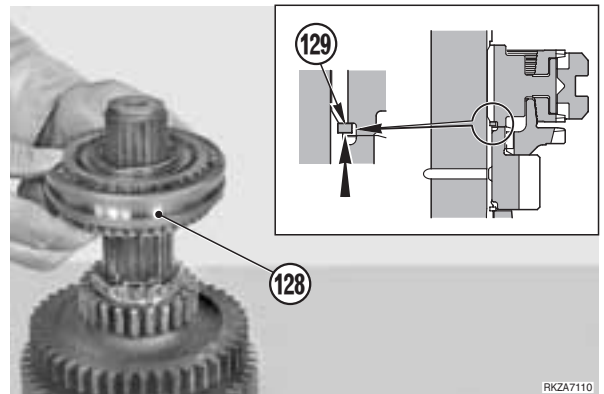


REMOVAL AND INSTALLATION

TRANSMISSION

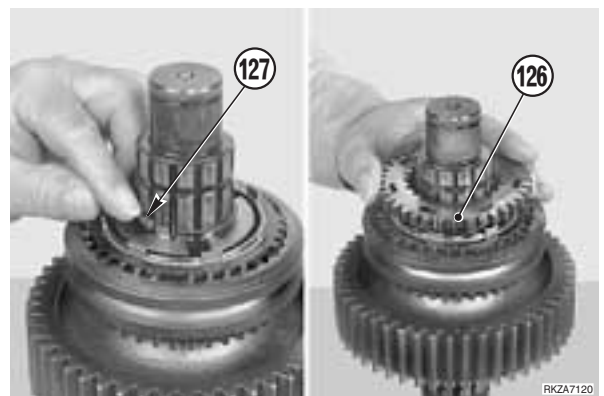
28 - Install the synchronizer assembly (128) for the 3rd and 4th speeds.

- ★ The side with the seating for the snap ring (129) should face downwards.



29 - Mount the snap ring (127).

30 - Mount the synchronizer ring (126).



31 - Mount the gear (122) of the 3rd speed.

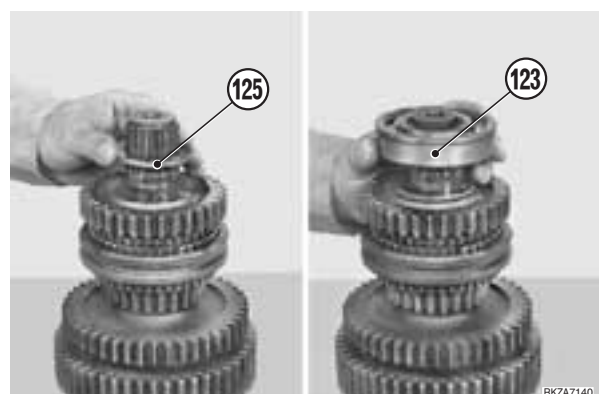


32 - Mount the bearing ring (125).

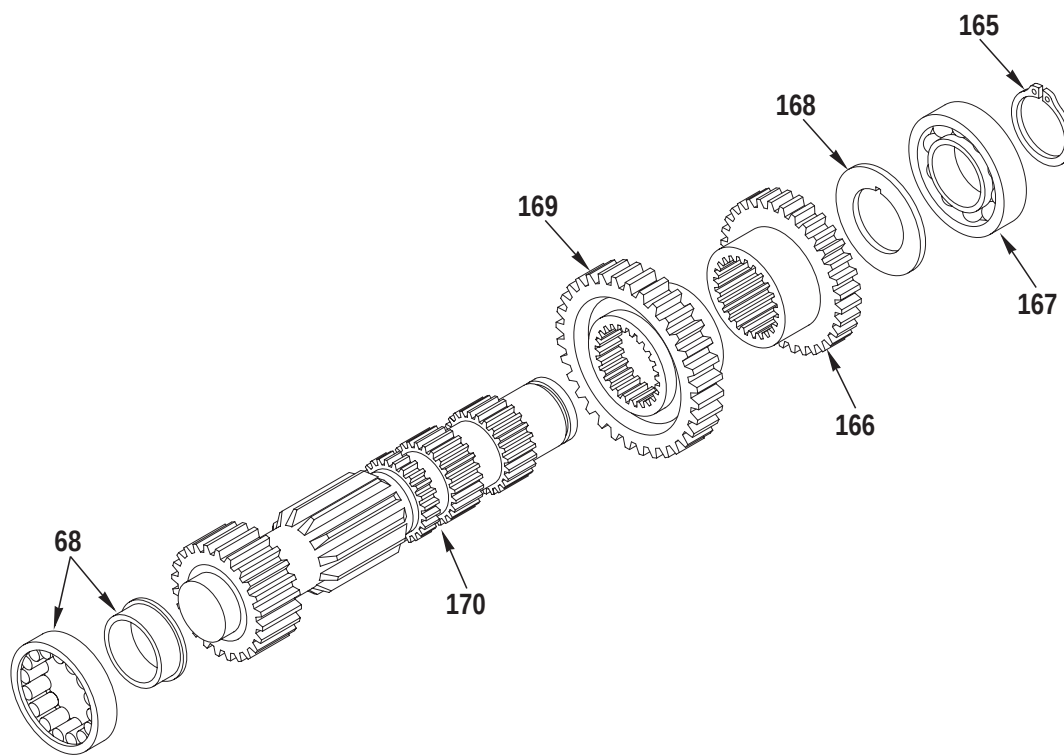
- ★ Make sure that the lubrication slots are facing downwards.

33 - Heat at 80–100 °C the bearing (123) and using tool **F4** mount it.

- ★ Check that the snap ring groove on the outside of the bearing is facing upwards.



9. Dismantling the main shaft



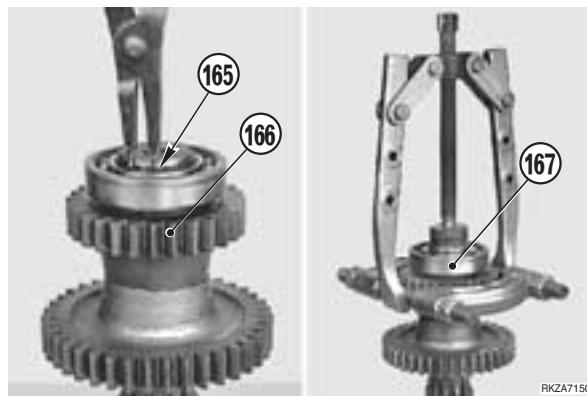
RKZ02780

★ Mark the gears and the main shaft to avoid exchanging the component parts.

1 - Position the group with the bearing upwards and remove the snap ring (165).

2 - Position a separator beneath the gear (166) with the conical edge facing downwards. Position a puller and force the bearing (167) until it can be detached from the seating.

★ Use a protective cap on the head of the shaft.



RKZA7150

3 - Remove the bearing (167).

4 - Remove the bearing ring (168).



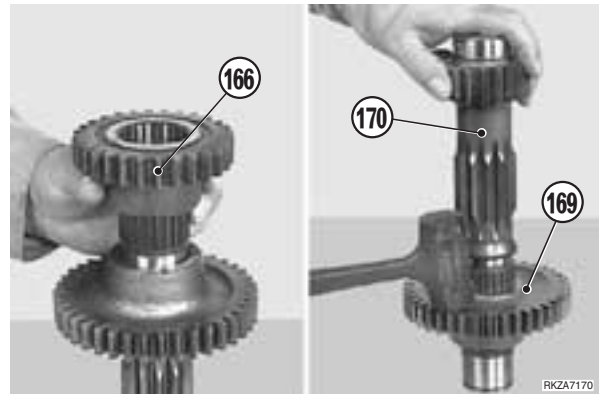
RKZA7160

REMOVAL AND INSTALLATION

TRANSMISSION

5 - Remove the gear (166).

6 - Turn the group upside down and, with a plastic mallet, slide the gear (169) off the shaft (170).



7 - Position a separator beneath the inner bearing ring of the bearing (63). Position a puller and force the bearing ring (68) until it can be extracted from the shaft (170).

- ★ Use a protective cap on the head of the shaft.
- ★ Make a note of the direction of assembly.



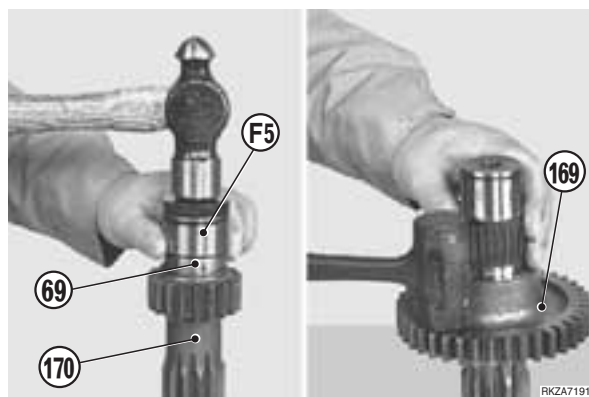
10. Re-assembly of the main shaft

★ Put in new bearings.

1 - Heat at 80–100 °C the inner bearing ring for the bearing (69) and with tool **F5** mount it on the shaft (170).

★ Check the direction of assembly.

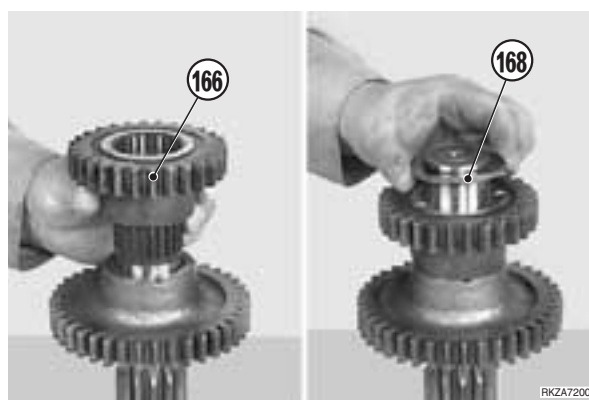
2 - Turn the shaft (170) upside down and, using a plastic mallet, mount the gear (169).



3 - Mount the gear (166).

4 - Lubricate the bearing ring (168) and mount it.

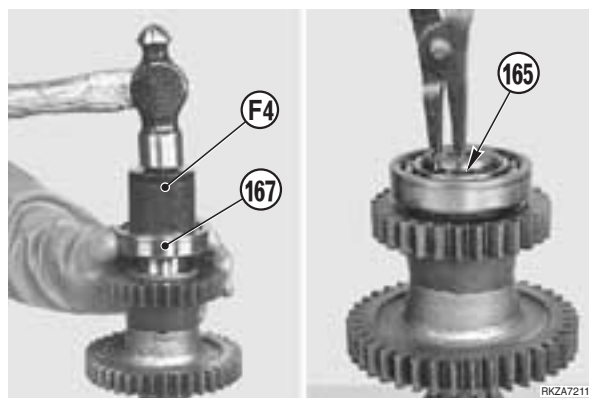
★ The lubrication slots must face downwards.



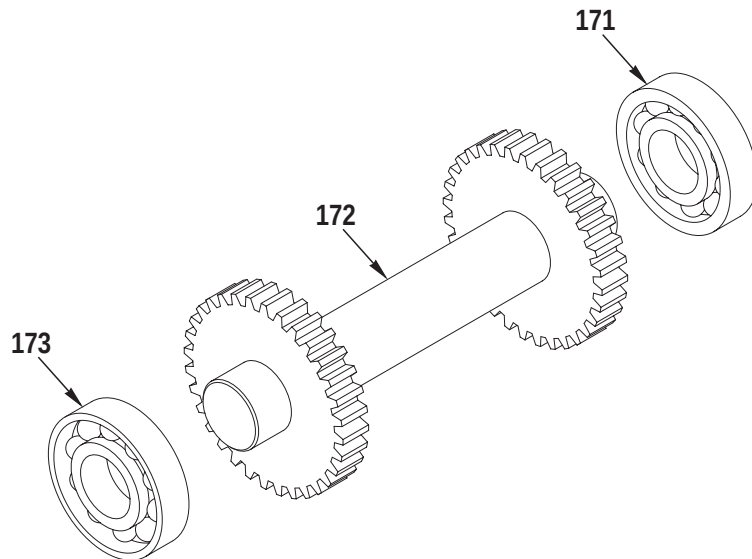
5 - Heat at 80–100 °C the bearing (167) and using tool **F4** mount it.

★ The snap ring groove on the outside of the bearing must be facing upwards.

6 - Mount the snap ring (165).



11. Dismantling the reverse shaft

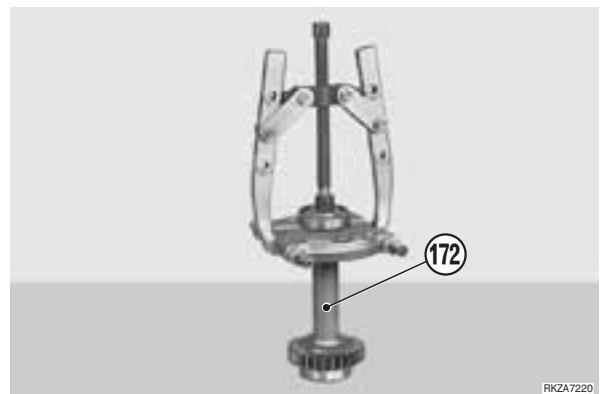


RKZ02790

- 1 - Position a separator beneath the bearing (171) with the conical edge facing downwards. Position a puller and force the bearing (171) until it can be detached from its seating.

★ Use a protective cap on the head of the shaft (172).

- 2 - Turn the group upside down and repeat the same operations for the bearing (173).



12. Re-assembling the reverse shaft

- 1 - Assemble the group by reversing the dismantling sequence.

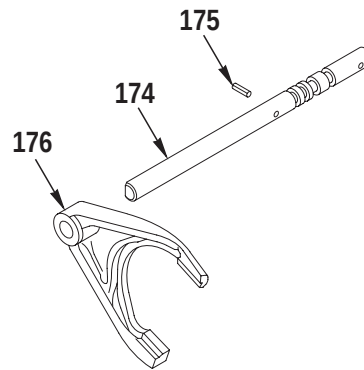
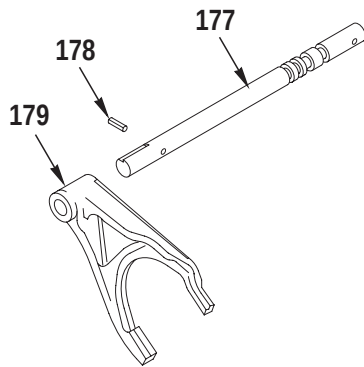
★ Use a plunger to install the bearings.



REMOVAL AND INSTALLATION

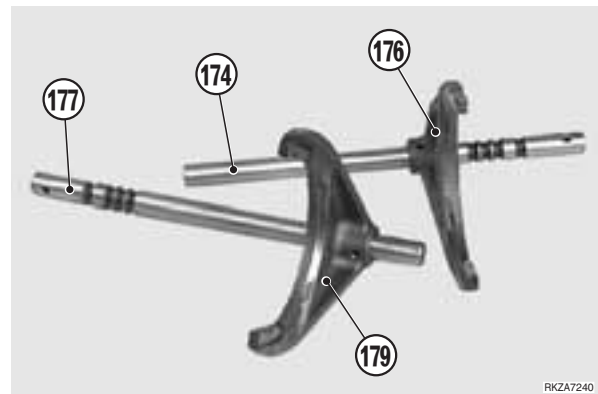
TRANSMISSION

13. Dismantling the shifter group, shafts and forks.



RKZ02710

- ★ Make accurate notes of the sequence of assembly of the shafts and forks.
 - ★ The forks and shifter rods must be replaced with new ones every time the synchronizer assembly is changed.
- 1 - Dismantling is simply a question of extracting the pins (175) and (178) between the shafts (174) and (177) and the forks (176) and (179).

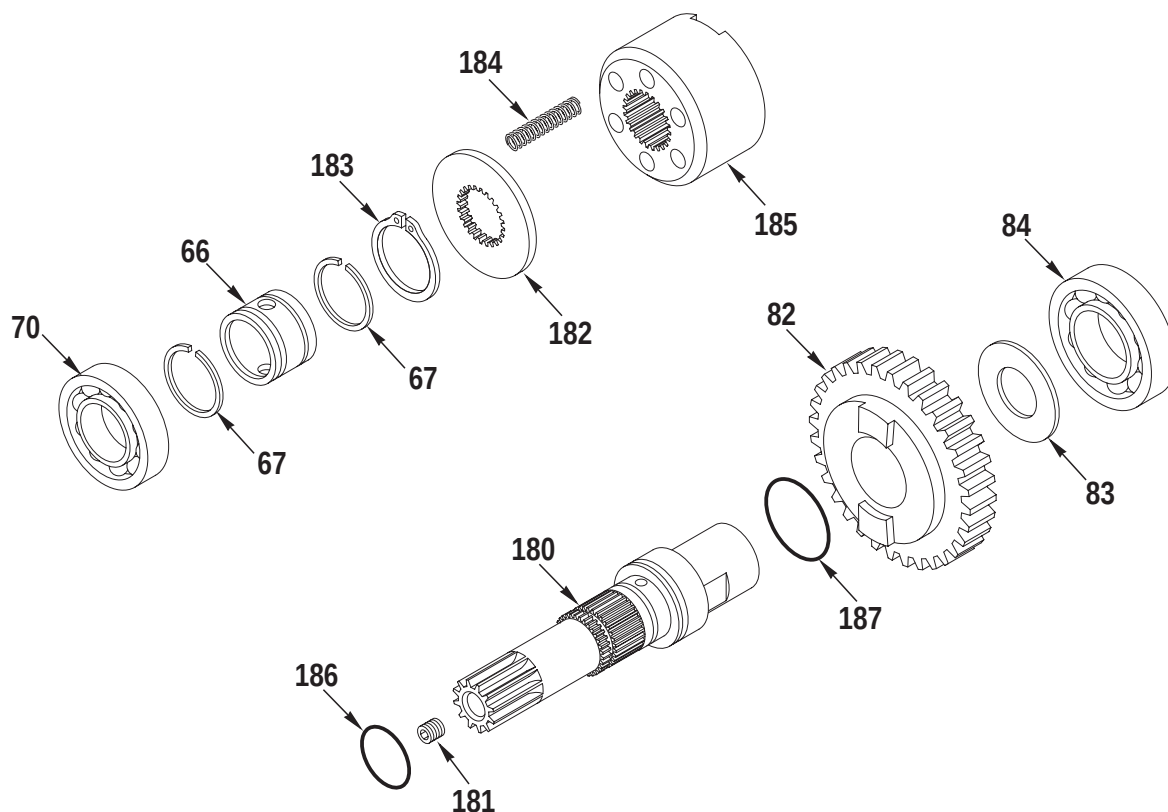


RKZA7240

14. Re-assembly of the shifter group, shafts and forks

- To re-assemble, reverse the dismantling procedure.

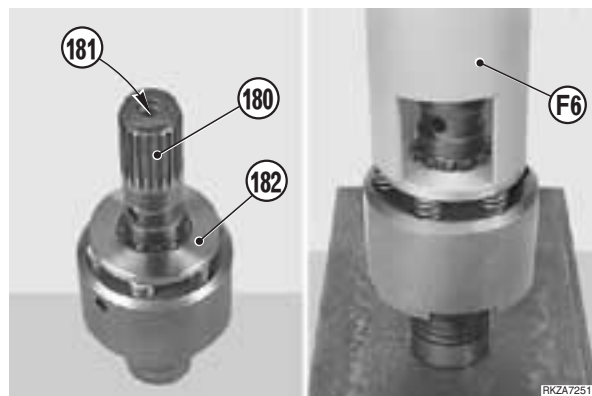
15. Dismantling the drive shaft for the 4th speed.



RKZ02730

★ A plug (181) sealed with Loctite 542 is mounted in the central hole of the shaft (180). **Do not remove** this plug unless it is absolutely necessary.

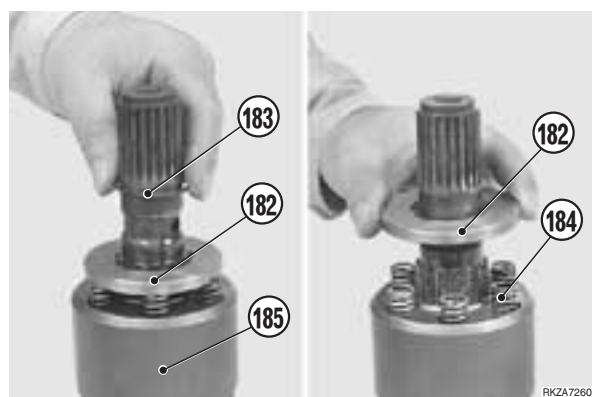
1 - Using tool **F6**, press the spring retainer (182) until the snap ring (183) can be released. Release the pressure slowly.



2 - Remove the snap ring (183).

3 - Remove the spring retainer (182) and spring (184).

4 - Remove the sleeve (185).



REMOVAL AND INSTALLATION

TRANSMISSION

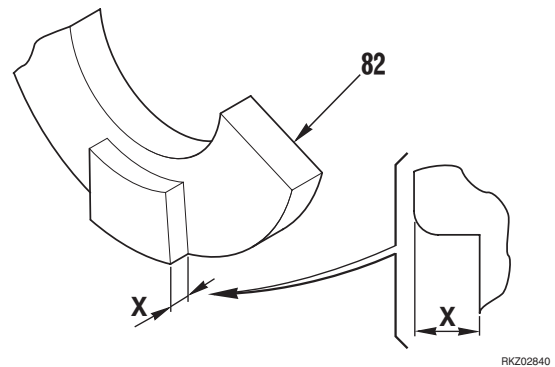
- 5 - Remove the O-rings (186) and (187) from the shaft (180).



- 6 - Check the thickness "X" of the lugs on the sleeve of the clutch command of the 4th speed (82).

Minimum "X" permissible: 3.52 mm

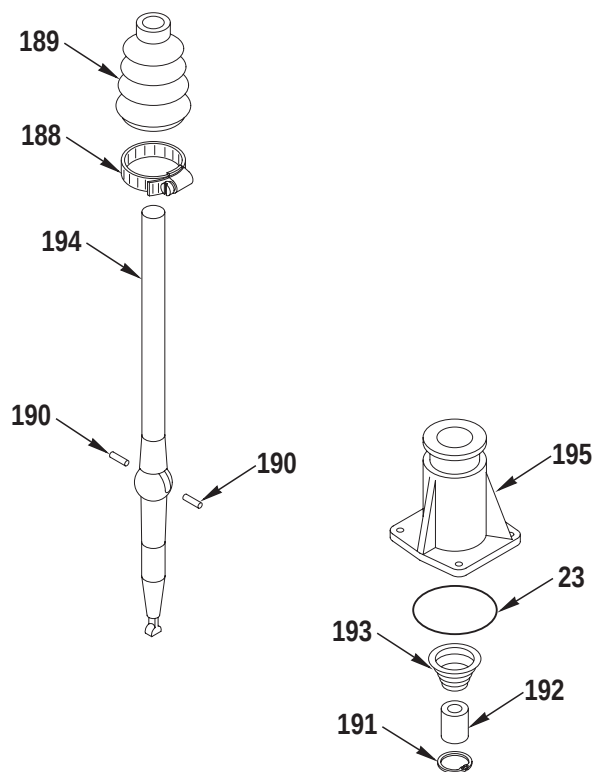
- ★ If the projections are worn, also check the 4-wheel drive clutch gear.
(See «Dismantling the housing»).



16. Re-assembly of the 4th speed drive shaft

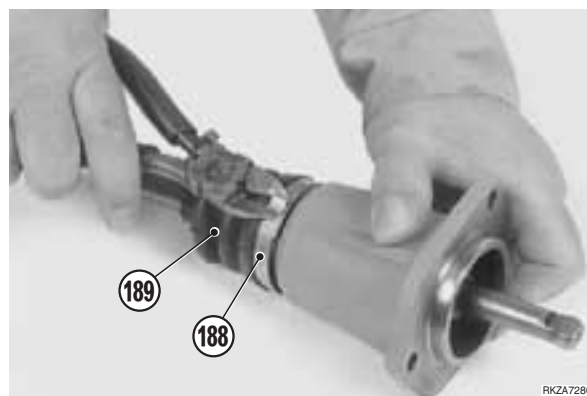
- To re-assemble, reverse the dismantling procedure.
- ★ Lubricate the O-rings (186) and (187) with transmission oil.
- ★ Check that the spring retainer (182) is mounted with the seating for the snap ring (183) facing upwards.

17. Dismantling the shifter housing



RKZ02800

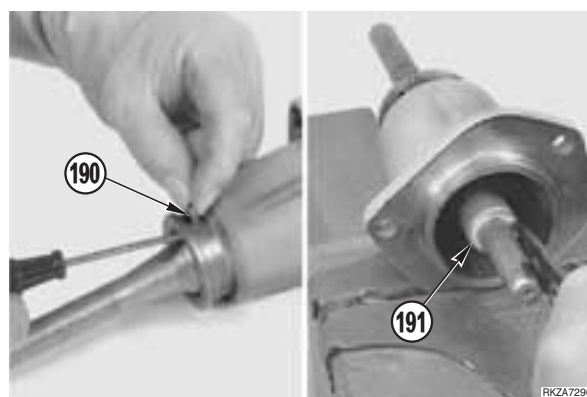
1 - Undo the retaining clamps (188) and remove the protection (189).



RKZA7280

2 - Remove the two pins (190).

3 - Remove the snap ring (191).



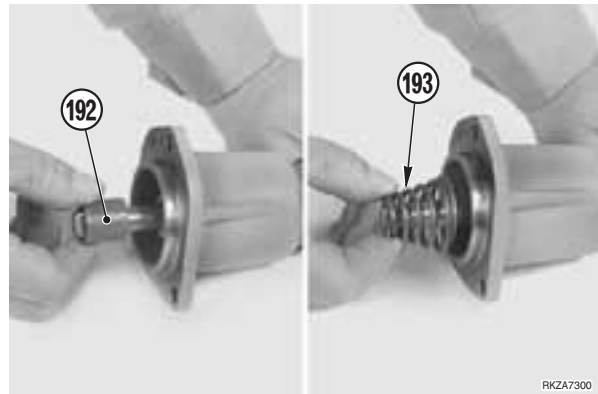
RKZA7290

REMOVAL AND INSTALLATION

TRANSMISSION

4 - Remove the bushing (182).

5 - Remove the spring (193).



6 - Remove the shift lever (194).

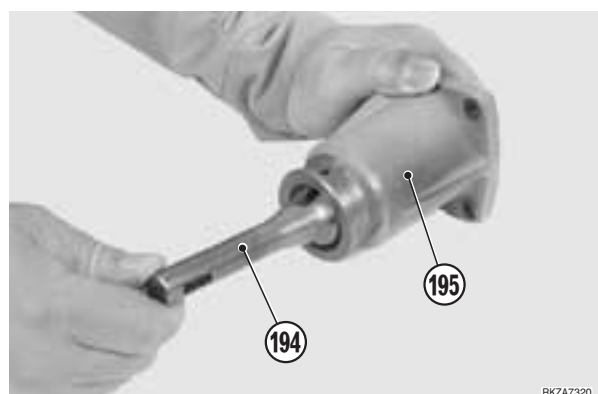


18. Re-assembling the shifter housing

1 - Lubricate the ball of the shift lever (194) and mount the lever in its seating (195).



2 - Align the shift lever (7) with its seating (195). The flat surface "A" of the lever must be parallel to the side "B" of the housing and the grooves "C" must match with the holes "D" in the housing.

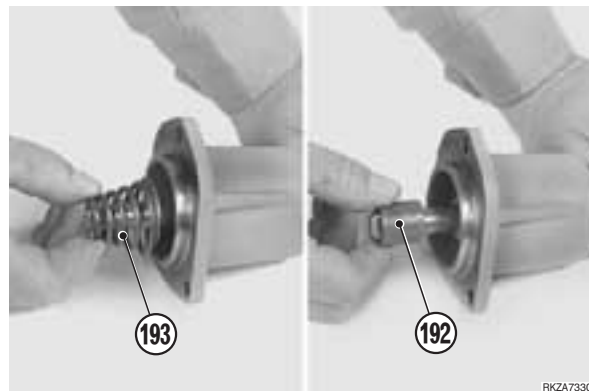


REMOVAL AND INSTALLATION

TRANSMISSION

3 - Mount the spring (193).

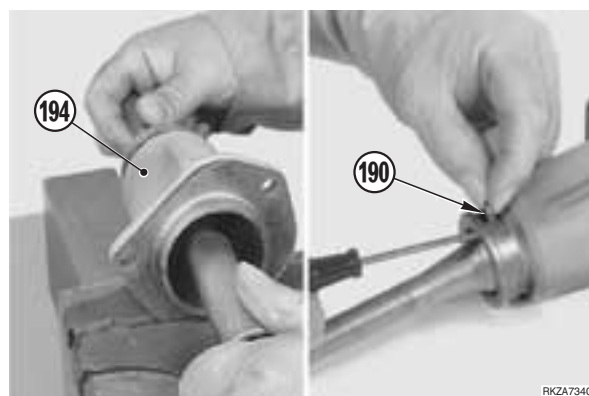
4 - Mount the bushing (192).



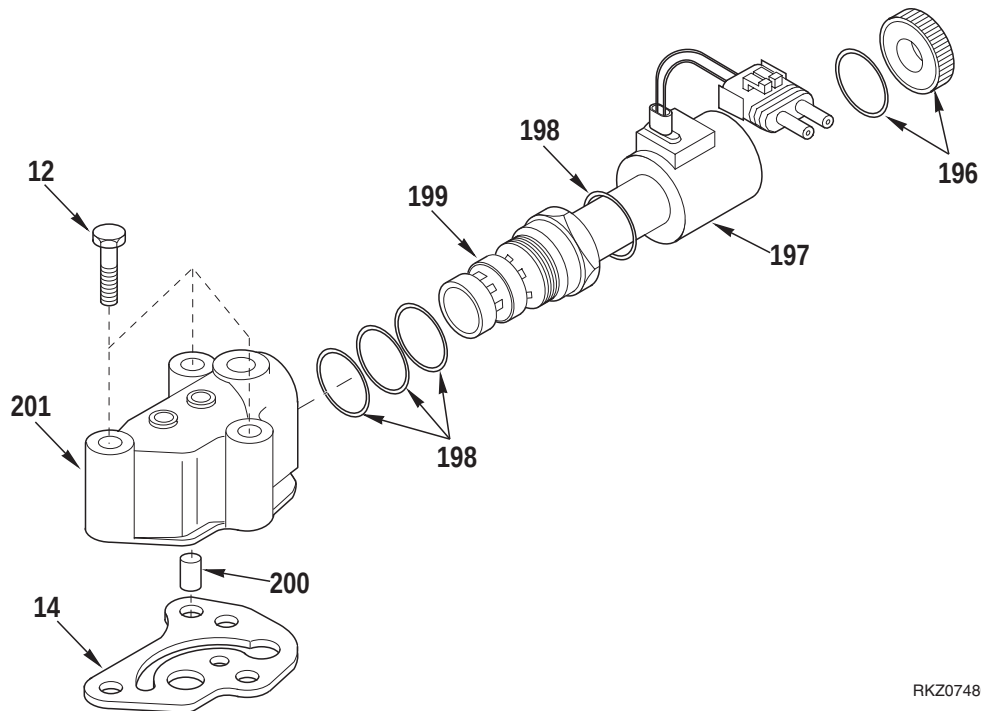
5 - Push the snap ring (191) with the push-rod until it is engaged in the seating of the lever (194).

6 - Install the pins (190).

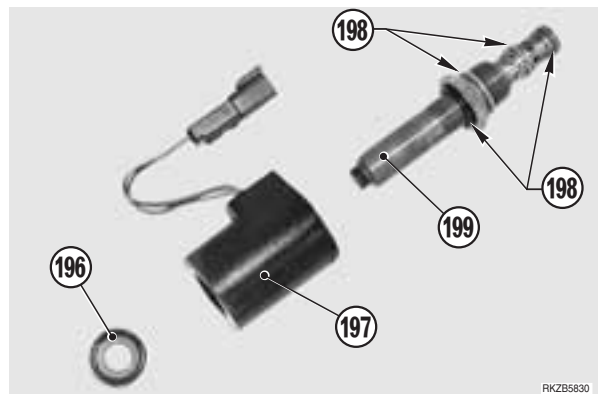
7 - Mount the protection (189) and secure it with the clamp (188).



19. Dismantling the 4th speed solenoid valve



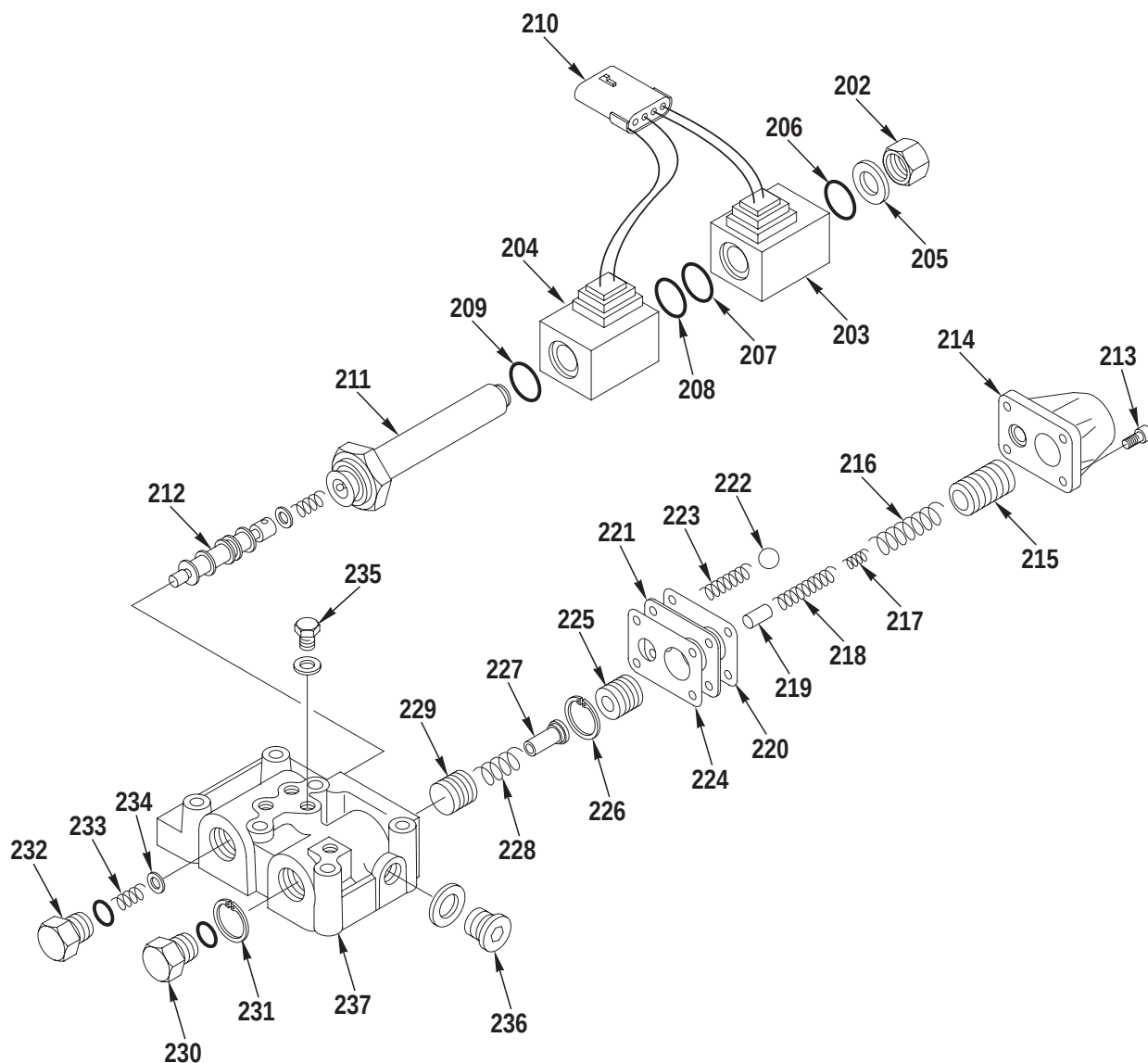
- 1 - Remove nut (196) with O-ring.
Remove solenoid (197) and cartridge (199).
Remove O-rings (198) from the cartridge if it is to be replaced.



20. Re-assembly of the 4th speed solenoid valve

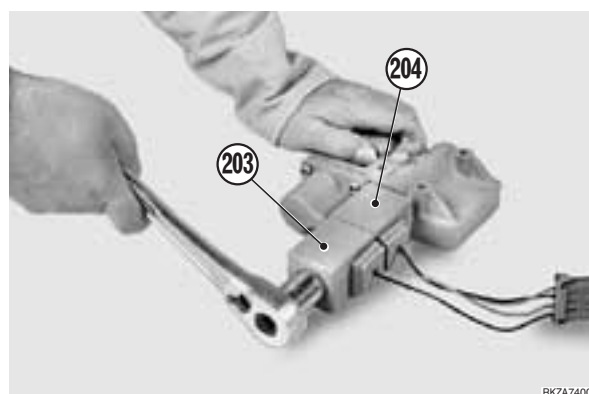
- To re-assemble, reverse the dismantling procedure.

21. Dismantling the distributor



RKZ02820

- 1 - Remove the retaining nut (202) of the coils (203) and (204).

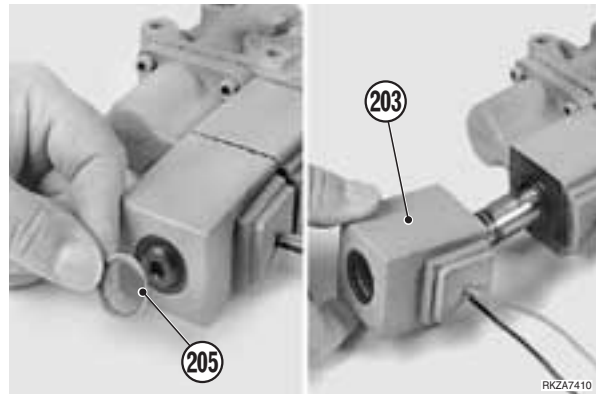


REMOVAL AND INSTALLATION

TRANSMISSION

2 - Remove the copper washers (205).

3 - Remove the outer coil (205).



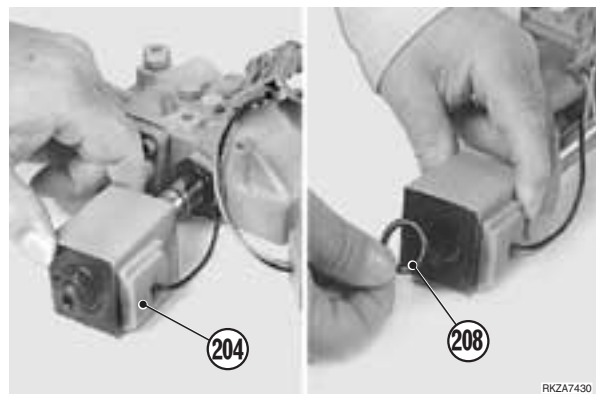
4 - Remove the O-ring (206) from the outer coil (203).

5 - Remove the intermediate O-ring (207).



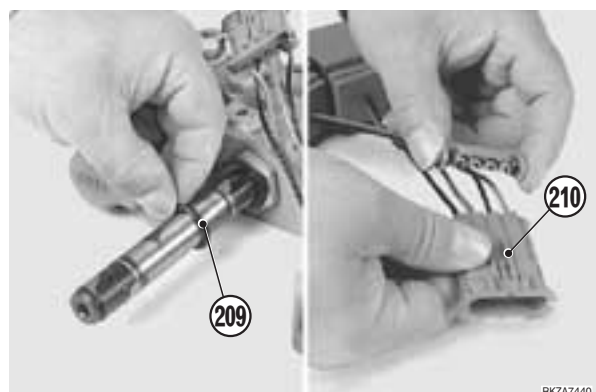
6 - Remove the intermediate O-ring (204).

7 - Remove the O-ring (208) from the internal coil.



8 - Remove the last O-ring (209).

9 - Do not dismantle the rear check device of the coil connector (210). This check device must only be dismantled when substituting a coil.



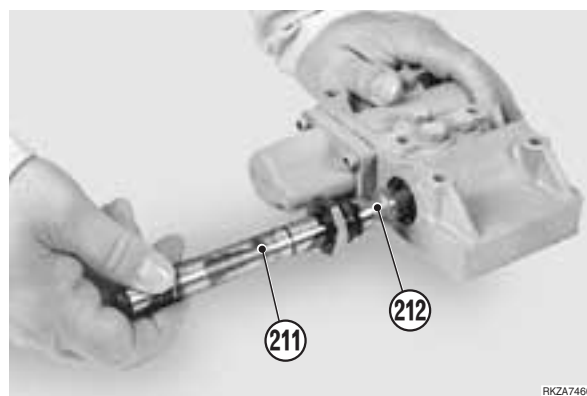
REMOVAL AND INSTALLATION

TRANSMISSION

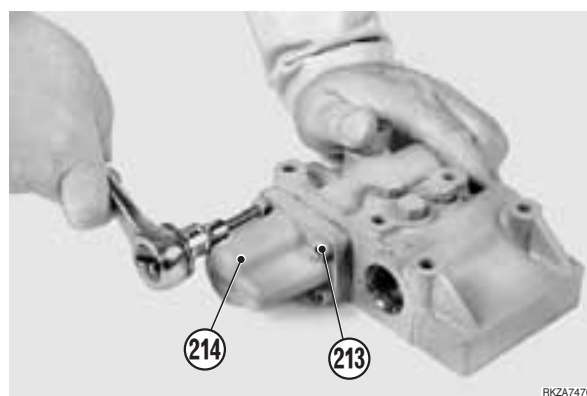
10 - Loosen the complete valve group (211).



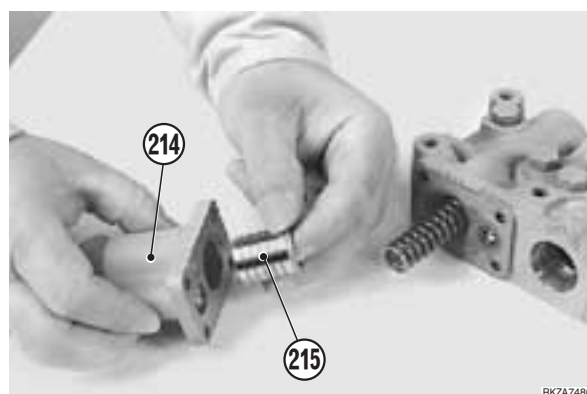
11 - Remove the valve group (211) complete with spool (212).



12 - Take out the screws (213) and remove the cover (214).



13 - Extract the outer modulation piston (215) from the cover (214).

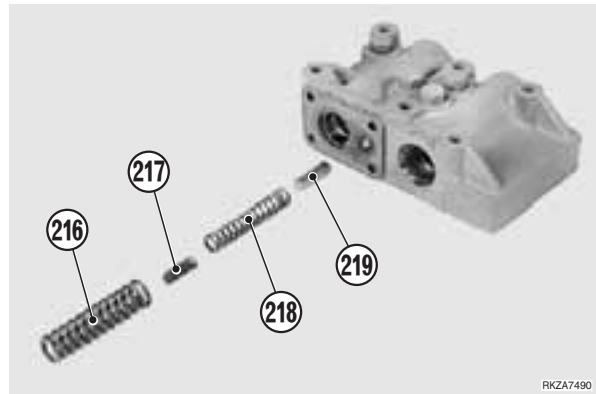


REMOVAL AND INSTALLATION

TRANSMISSION

- 14 - Remove in sequence the spring (216), the spring (217), the spring (218) and the pin (219).

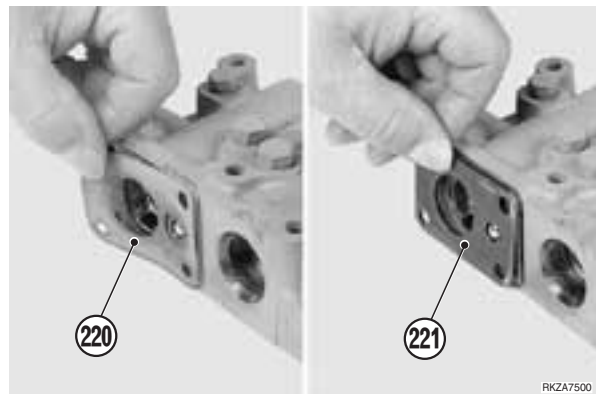
★ Replace the springs.



- 15 - Remove the first gasket (220).

★ Throw the gasket away.

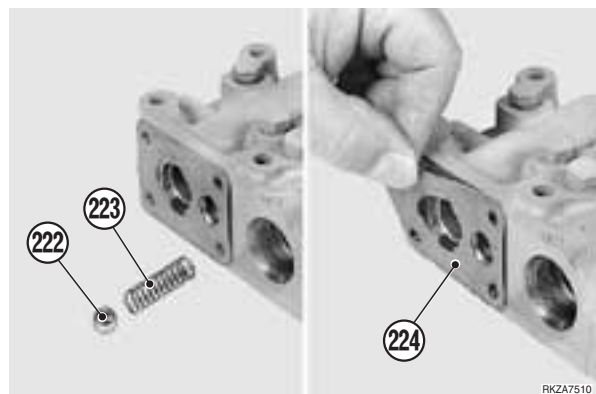
- 16 - Remove the plate (221).



- 17 - Remove the ball (222) and the spring (223).

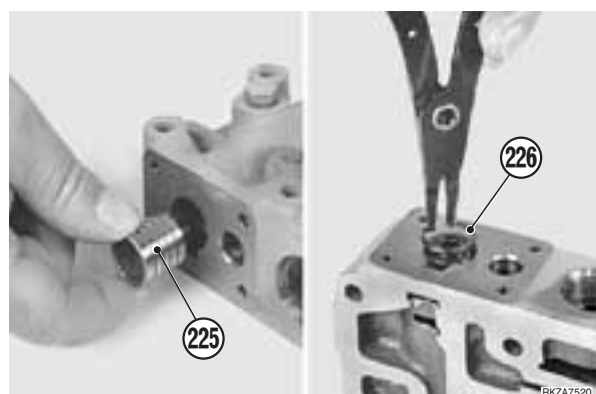
- 18 - Remove the second gasket (224).

★ Throw the gasket away.



- 19 - Remove the inner modulation piston (225).

- 20 - Remove the snap ring (226).



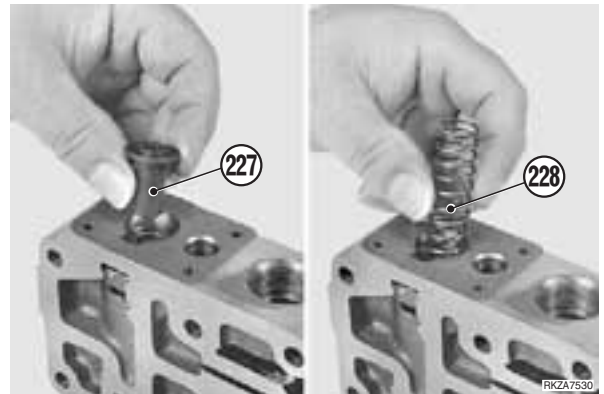
REMOVAL AND INSTALLATION

TRANSMISSION

21 - Remove the flow regulator (227).

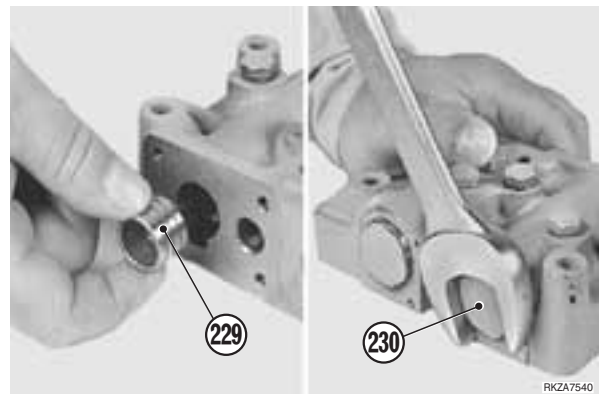
22 - Remove the spring (228).

★ Put in a new spring.



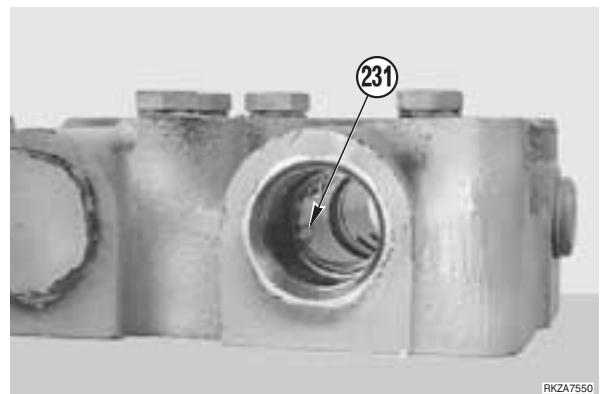
23 - Remove the flow regulator piston (229).

24 - Remove the cap (230).



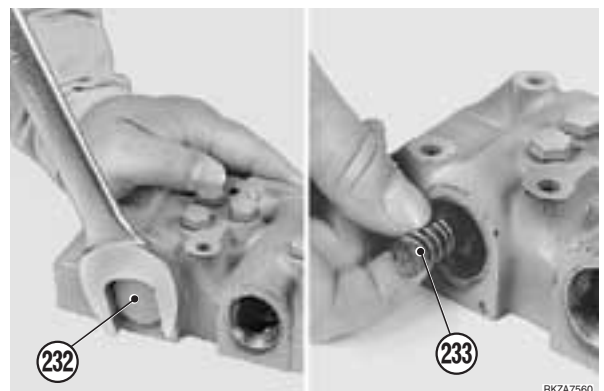
Only if necessary

25 - Remove the snap ring (231).

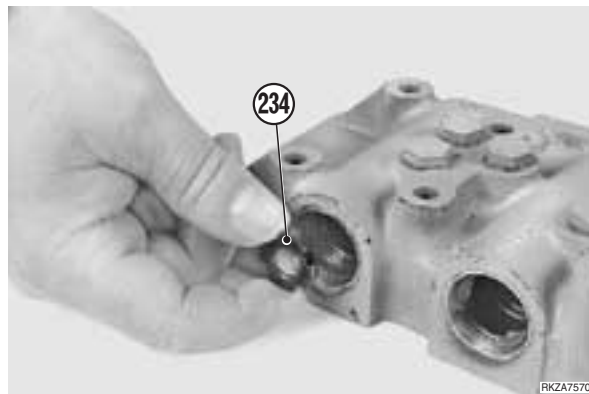


26 - Remove the cap (232) of the spool that selects the direction of movement.

27 - Remove the spring (233).



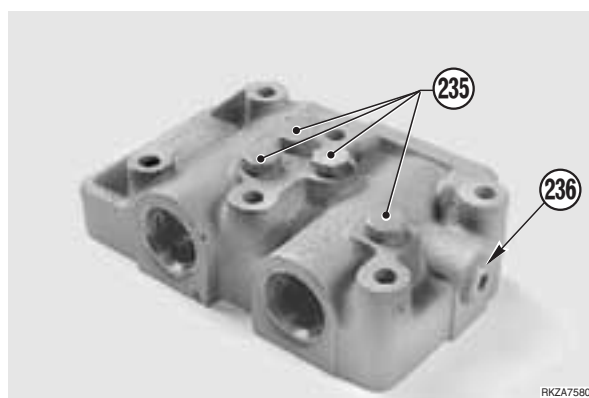
28 - Remove the spacer (234).



Only if necessary

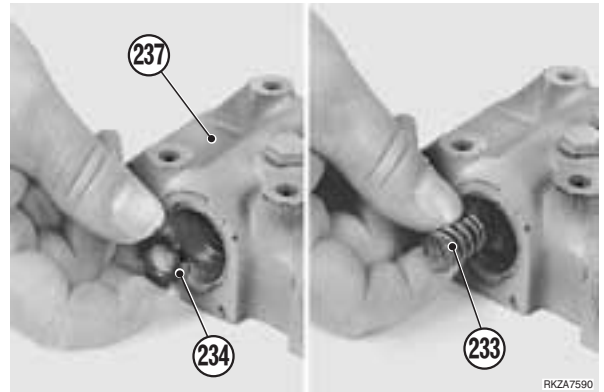
29 - Remove the four caps (235) and (236).

- ★ Beneath each cap there is a copper washer that must be substituted each time it is dismantled.

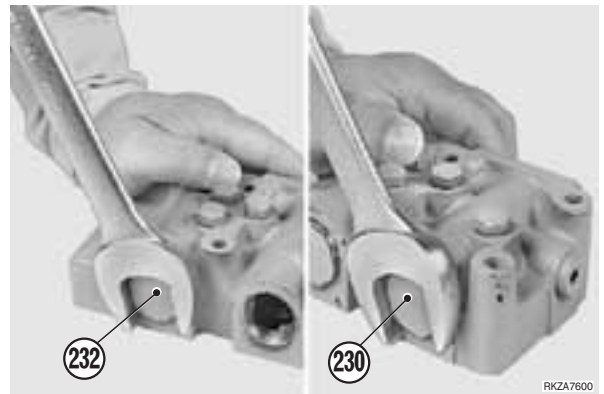


22. Re-assembly of the distributor

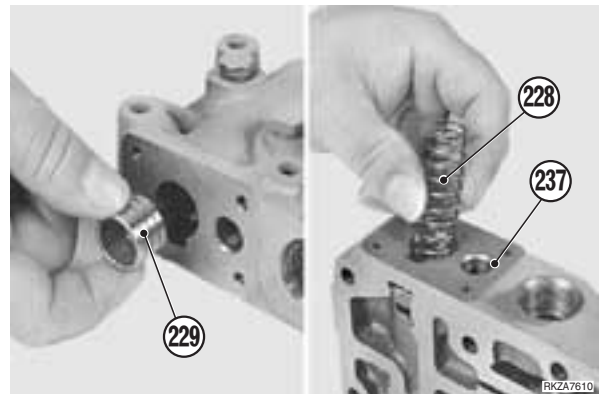
- 1 - Install the spacer (234) in the distributor body (237).
 - ★ The chamfer on the central hole must face towards the inside of the distributor.
- 2 - Mount the spring (233).



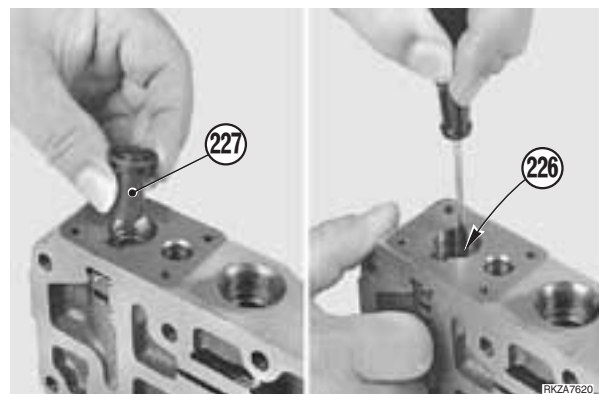
- 3 - Mount the cap (232).
 - ★ Substitute the O-ring.
- 4 - Mount the cap (230).
 - ★ Substitute the O-ring.



- 5 - Lubricate the regulating piston (229) with transmission oil and mount it in the body of the distributor (237).
 - ★ The perforated surface must face towards the inside of the distributor.
- 6 - Mount the spring (228).



- 7 - Mount the flow regulator (227).
- 8 - Mount the snap ring (226) and push it home in the seating with a plunger.
 - ★ Make sure that the snap ring is completely inserted into its seating.

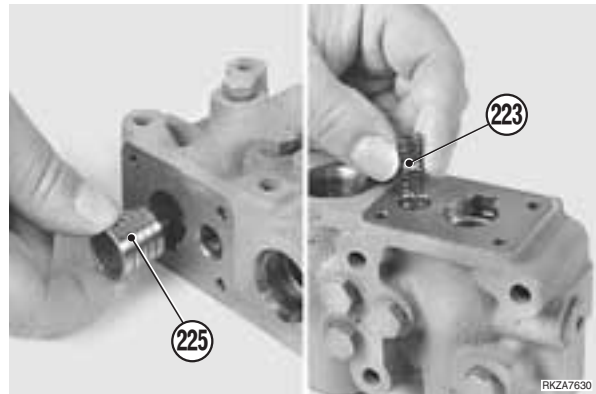


REMOVAL AND INSTALLATION

TRANSMISSION

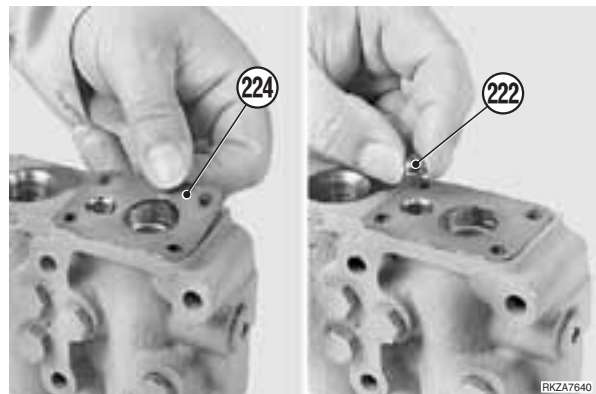
9 - Lubricate the innermodulation piston (225) with transmission oil and mount it so that the extremity with the smallest diameter hole faces towards the inside of the distributor.

10 - Mount the spring (223).



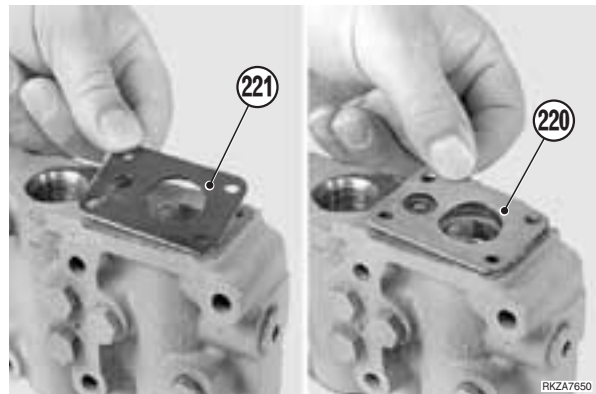
11 - Mount the first gasket (224).

12 - Mount the ball (222).



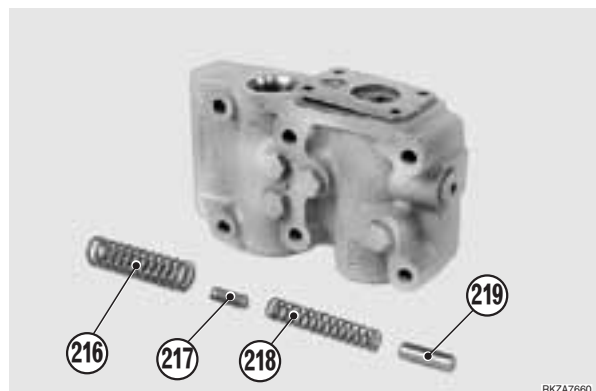
13 - Position the plate (221).

14 - Position the second gasket (220).



15 - Mount concentrically the pin (219), the small spring (218), then the medium spring (217) inserted into the spring with the largest diameter (216).

★ The springs must be new.

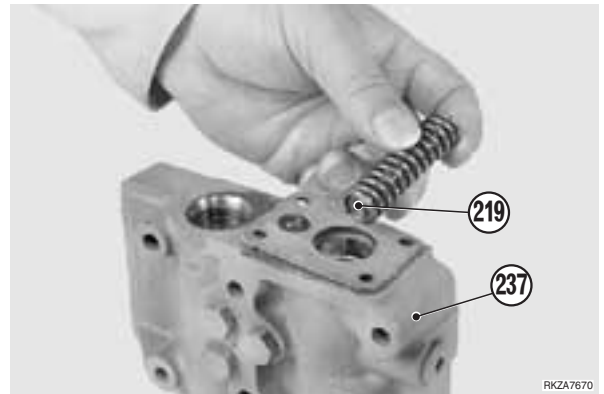


REMOVAL AND INSTALLATION

TRANSMISSION

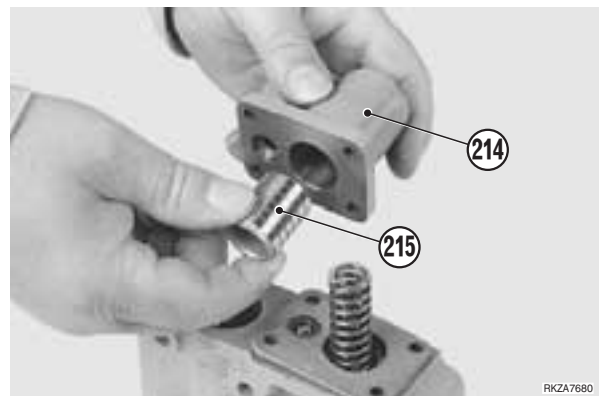
16 - Insert the pin and spring group into the distributor (237).

- ★ The pin (219) must face towards the inside of the distributor.



17 - Lubricate the outermodulation piston (215) and mount it in the cover (214).

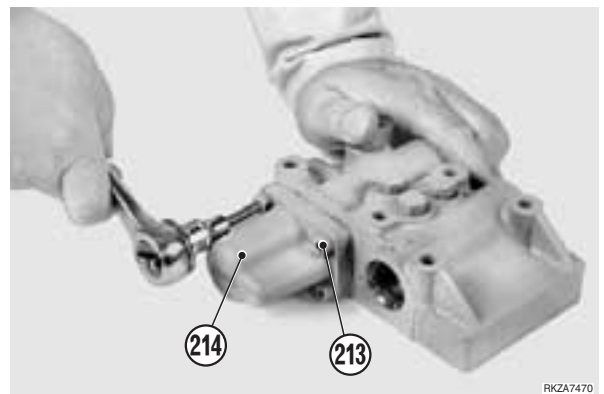
- ★ The closed extremity of the piston (215) must face towards the cover (214).



18 - Mount the cover (214) and secure it with the screws (213).

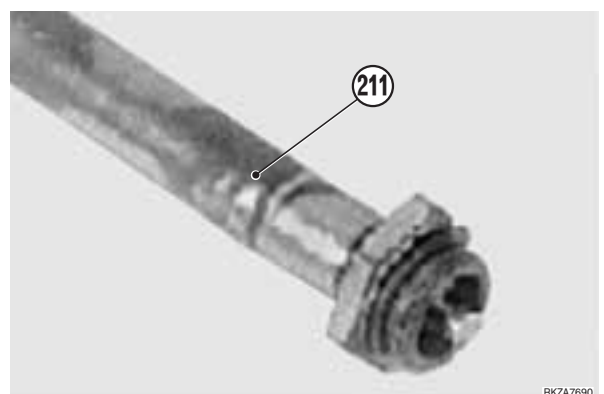
 Nm Screws: 11 Nm

- ★ Tighten using the alternating crosswise method.



19 - Mount a new O-ring on the solenoid plunger (211).

- ★ Lubricate the O-ring with transmission oil.

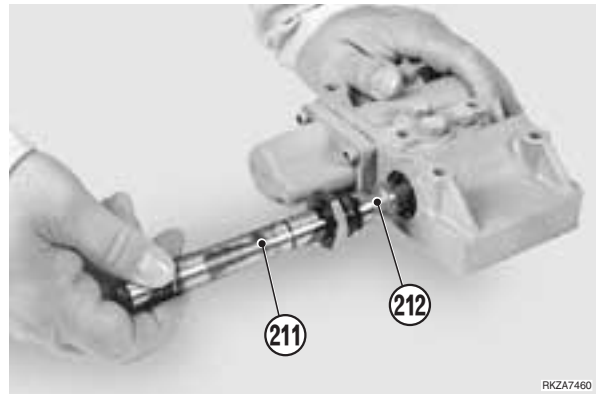


REMOVAL AND INSTALLATION

TRANSMISSION

20 - Lubricate the spool (212), insert it in the solenoid plunger (211), and mount the group.

- ★ Check carefully that the extremity of the spool is engaged in the spring mounted in phase 2.

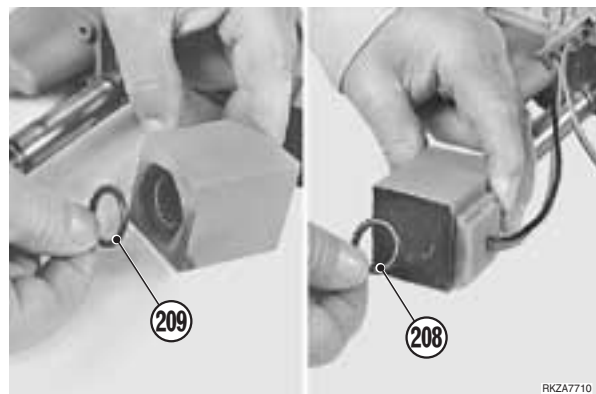


21 - Tighten the solenoid plunger (211).

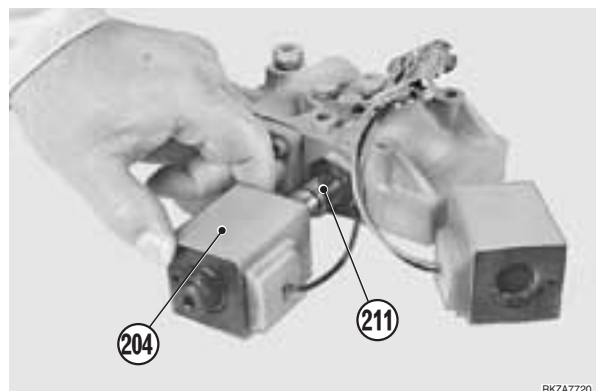
 Solenoid plunger: 23 Nm



22 - Mount the O-rings (208) and (209) on both sides of the internal coil and lubricate them with transmission oil.



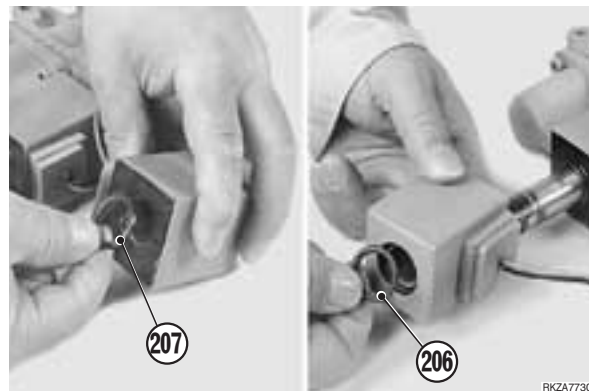
23 - Mount the complete internal coil (204) on the solenoid plunger (211).



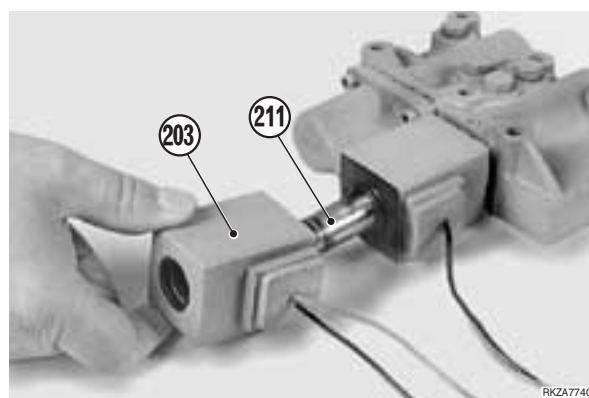
REMOVAL AND INSTALLATION

TRANSMISSION

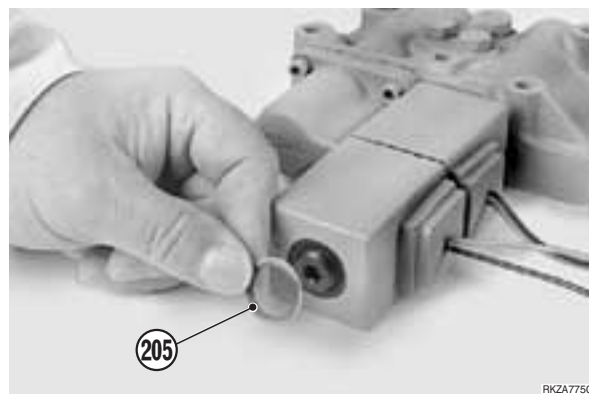
24 - Mount the O-rings (207) and (206) on both sides of the external coil and lubricate them with transmission oil.



25 - Mount the complete external coil (203) on the solenoid plunger (211).



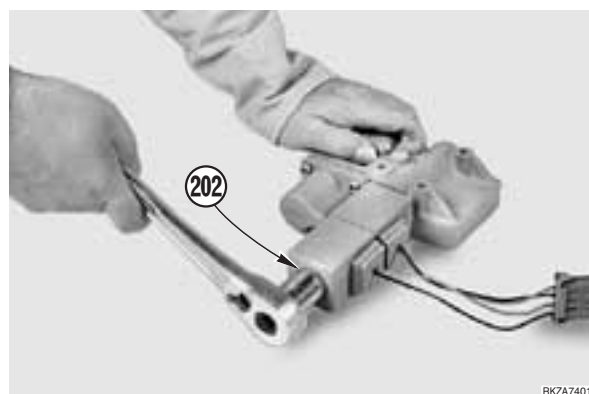
26 - Mount the copper washer (205).



27 - Mount the nut (202) and tighten it, keeping the two coils aligned.



Nut: 7–10 Nm



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REMOVAL OF THE CONVERTOR

⚠ Lower the working equipment completely until it rests on the ground and stop the engine.

⚠ Raise the engine hood and disconnect the cable from battery negative terminal (-).

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

★ Drain the hydraulic oil.



Hydraulic oil: 92 ℓ

★ Drain the oil from the gearbox.



Gearbox oil: 16 ℓ

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

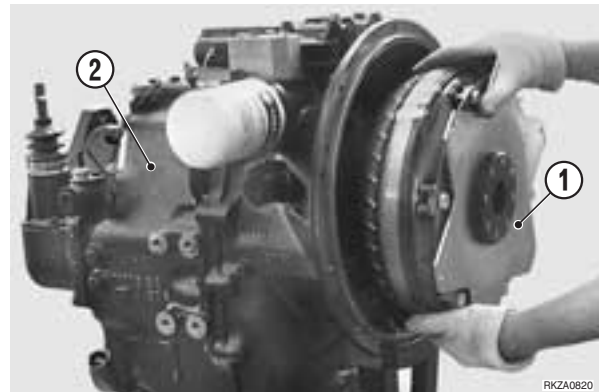


2 - Remove the gearbox.
(For details, see «REMOVAL OF THE GEARBOX»).

3 - Slide the convertor (1) away from the gearbox shafts (2), (primary and secondary).

★ If necessary, use two levers applied in opposed positions.

★ Take great care not to damage the centering hub of the gearbox.



INSTALLATION OF THE CONVERTOR

• To install, reverse the removal procedure.

★ Engage the two shafts (primary and secondary) by slowly rotating the body of the convertor.

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



Hydraulic oil: 92 ℓ



★ Fill the pump body and the pump, bringing the tank up to pressure.
For the method, see «20. TESTING AND ADJUSTMENTS».

2 - Refill the gearbox.



Gearbox oil: 16 ℓ

3 - Start the engine to circulate the oil in all circuits. Check that there are no leaks.

4 - Bleed the air from the working equipment circuits. (For details, see «20. TESTING AND ADJUSTMENTS»)

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

REMOVAL AND INSTALLATION

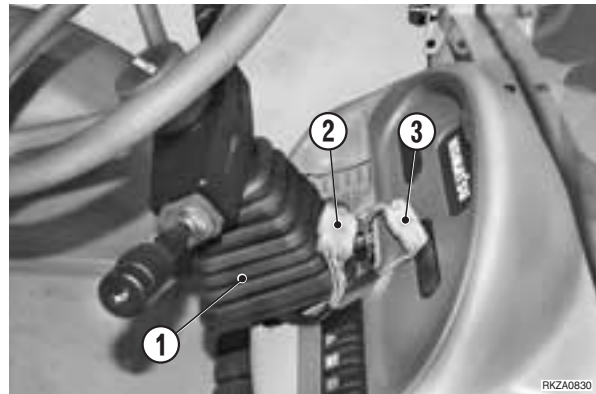
TRANSMISSION-REVERSE, DIRECTION INDICATOR AND HEADLIGHT DIPPER BEAM CONTROL GROUP

REMOVAL OF THE TRANSMISSION-REVERSE, DIRECTION INDICATOR AND HEADLIGHT DIPPER BEAM CONTROL GROUP

⚠ Lower the working equipment completely until it rests on the ground, and stop the engine.

⚠ Raise the cable from battery negative terminal (-).

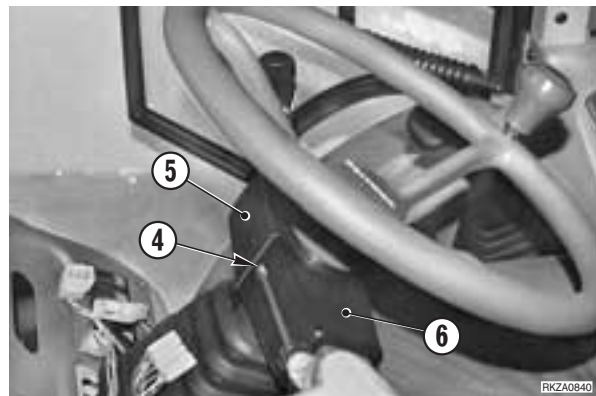
- 1 - Raise the protective sleeve (1) and disconnect the connectors (2) and (3)



- 2 - Take out the two screws (4) that hold the switching groups (5) and (6).

- 3 - Remove the right-hand half-clamp (7) (4 screws).

※ 1

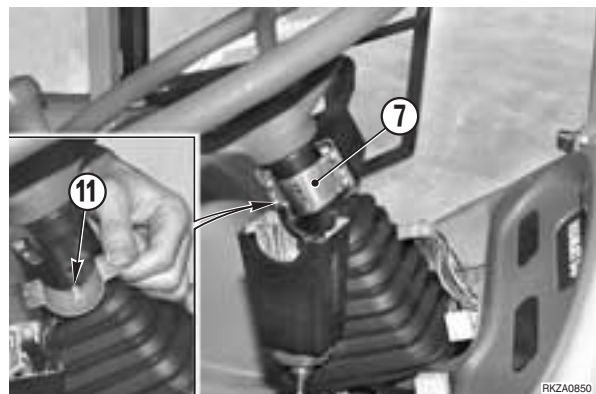


- 4 - Take off the central cap (8) of the steering wheel.

- 5 - Remove the retaining nut (9) and its washer. Remove the steering wheel (10).

※ 2

- 6 - Take out the switching groups (5) and (6) complete with their protective sleeve (1).



INSTALLATION OF THE TRANSMISSION-REVERSE, DIRECTION INDICATOR AND HEADLIGHT DIPPER BEAM CONTROL GROUP

- To install, reverse the removal procedure.

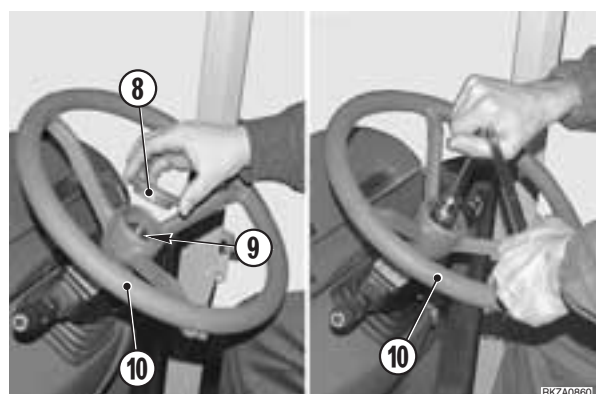
※ 1

- ★ Check that the reference pin (11) enters fully into the steering column and that the transmission-reverse gear control unit is perfectly attached to the steering column.

※ 2



Steering column retaining nut: 40 Nm



REMOVAL OF THE STEERING UNIT

⚠ Lower the working equipment completely until it rests on the ground and stop the engine and remove the ignition wrench.

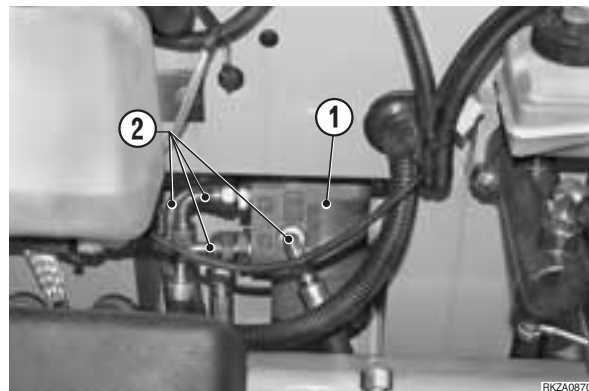
⚠ Release all residual pressure in all circuits.
↑ (For details, see «20. TESTING AND ADJUSTMENTS»).

⚠ Raise the engine hood and disconnect the cable from battery negative terminal (-).

1 - Disconnect the five pipes (2) from the steering unit (1) and plug them to prevent entry of impurities. **⚠ 1**

★ Mark the positions to prevent exchanges during reconnection.

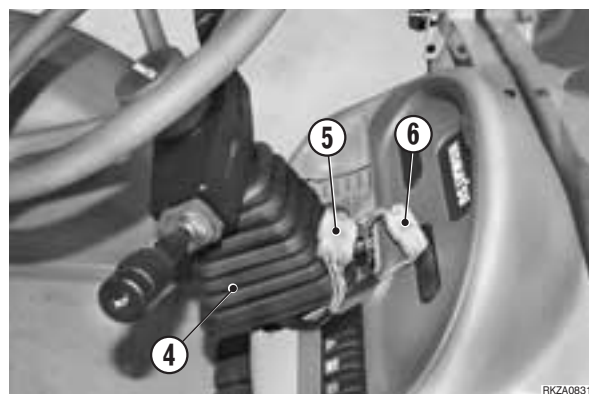
2 - Remove the central guard (3) beneath the steering wheel.



3 - Raise the protective sleeve (4) and disconnect the connectors (5) and (6).

4 - Disconnect the connector (7) and the relay (8).

5 - Loosen the steering column (10) retaining screws (9) and the steering unit (1). Remove the steering unit (1).



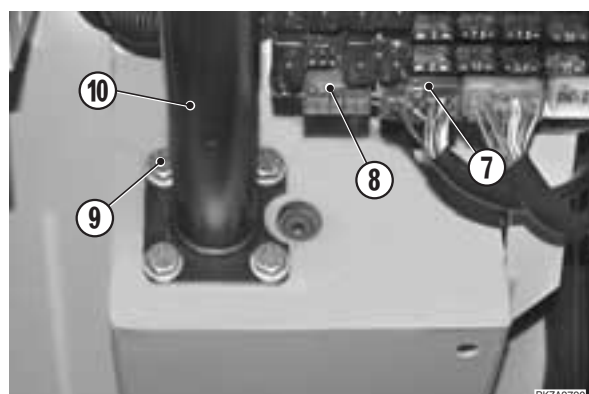
INSTALLATION OF THE STEERING UNIT

- To install, reverse the removal procedure.

⚠ 1

★ Bleed the air from the Load Sensing circuit.
(For details, see «20. TESTING AND ADJUSTMENTS»).

★ Start the engine and perform several complete steering manoeuvres in both directions, to bleed the air out of the steering system.



REMOVAL OF THE WORKING BRAKE PUMP GROUP

⚠ Lower the working equipment completely until it rests on the ground, and stop the engine.

⚠ Raise the engine hood and disconnect the cable from battery negative terminal (-).

1 - Remove the cap (1) of the oil tank (2) and draw out the oil contained inside it.

2 - Disconnect the connectors (3).

3 - Remove the oil tank (2).

4 - Remove the clip (4) that holds the delivery lines (5).

5 - Remove the delivery lines (5) from the pumps (6).

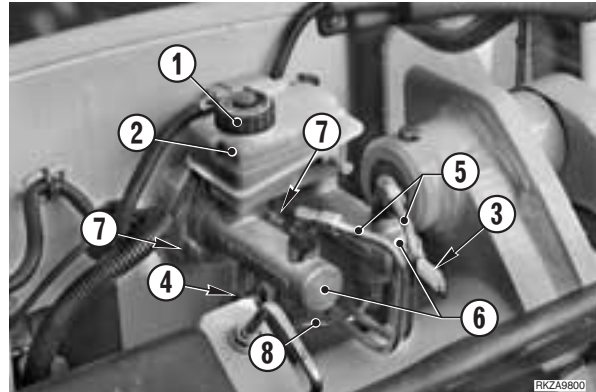
※ 1

6 - Take out the four screws (7) and remove the pump group (6).

※ 2

★ If only one pump is to be removed, also disconnect the pressure- equalizing pipe (8).

※ 3



INSTALLATION OF THE WORKING BRAKE PUMP GROUP

• To install, reverse the removal procedure.

※ 1

★ Bleed the air from the braking circuit. (For details, see «20. TESTING AND ADJUSTMENTS»).

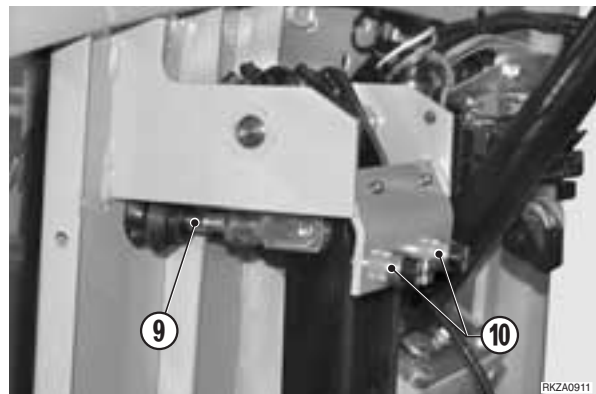
※ 2

★ Make sure that the push-rods (9) center the seating of the pistons.

★ After installation, check the idle stroke and parallelism of the brake pedals and, if necessary, adjust the coupling microswitches for 4-wheel brake control. (For details, see «20. TESTING AND ADJUSTMENTS»).

※ 3

 Nm Pipe fitting: 20 Nm



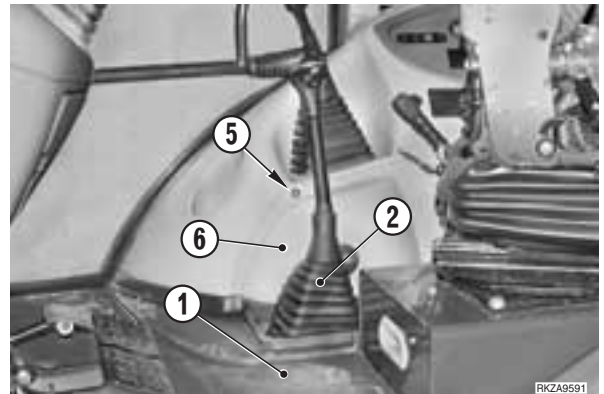
REMOVAL OF THE FRONT WORKING EQUIPMENT CONTROL VALVE

! Lower the working equipment completely until it rests on the ground and stop the engine and remove the ignition wrench.

! Raise the engine hood and disconnect the cable from battery negative terminal (-).

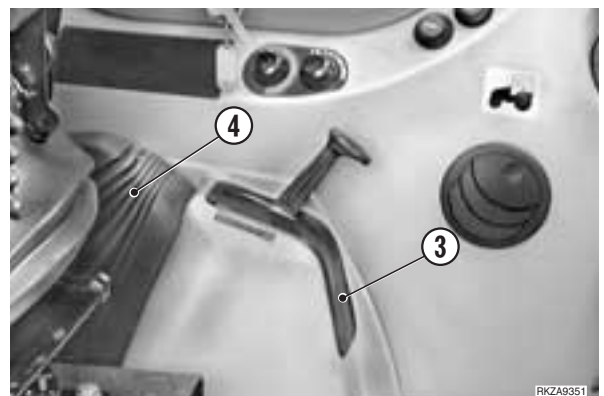
! Release all residual pressure in all circuits.
(For details, see «20. TESTING AND ADJUSTMENTS»).

1 - Remove the grip (1) of the hand accelerator and disengage the protective sleeves (2), (3) and (4).



2 - Take out the screws (5) and remove the guard (6).

3 - Disconnect the spool control tie-rods (8) from the control valve (7).

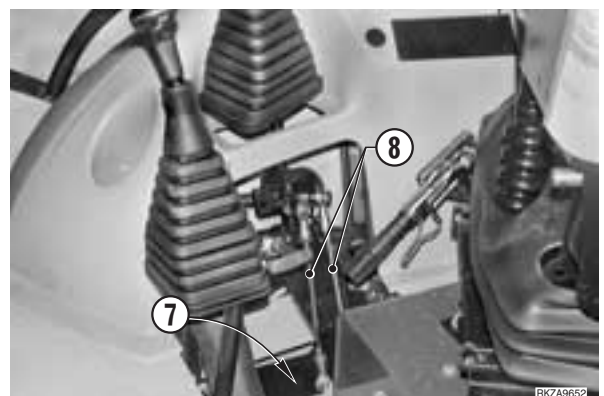


4 - Disconnect from the control valve all pipes and lines for the actuators (9), pump delivery (10), drainage (11), Load Sensing (12) and steering unit delivery (13), and plug them.

★ Mark the pipes to avoid exchanging positions during reconnection.

5 - Take out the four control valve retaining screws.

6 - Remove the control valve (7).



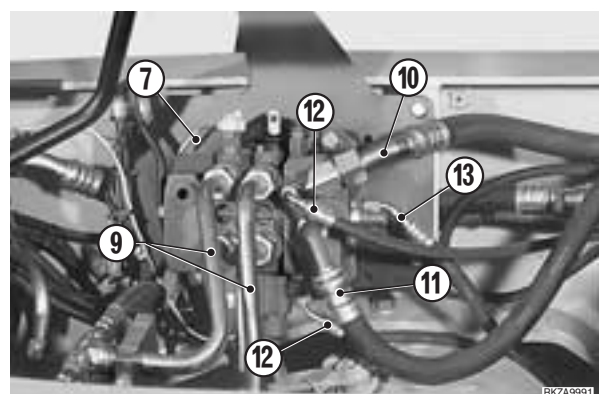
INSTALLATION OF THE FRONT WORKING EQUIPMENT CONTROL VALVE

• To install, reverse removal procedure.

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

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

3 - Stop the engine and check the oil level in the tank.



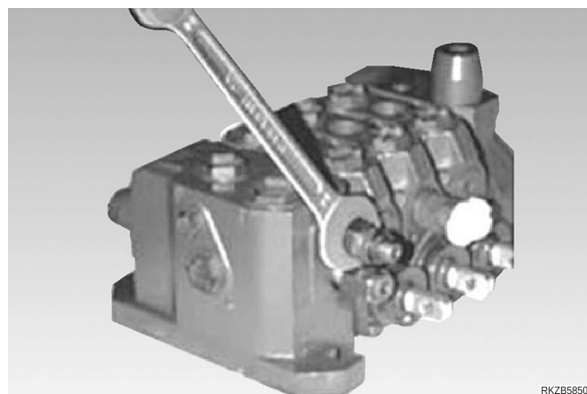
DISASSEMBLY AND ASSEMBLY FRONT AND BACKHOE CONTROL VALVE

- WB91R-2 from s/n 91F20169 -
- WB93R-2 from s/n 93F24324 -
included s/n from 93F24234 to 93F24237,
93F24299 and 93F24301

INLET AND OUTLET ELEMENTS REPAIR PROCEDURES

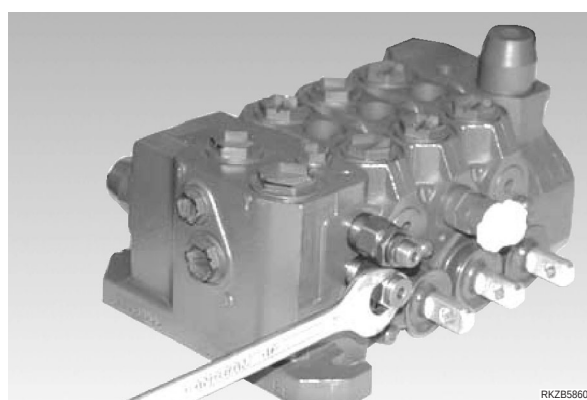
1. LS pressure relief valve replacement

- On the inlet element, unscrew the LS pressure relief valve (17 mm wrench).
- ★ Reassembly: torque: 45 ± 4 Nm



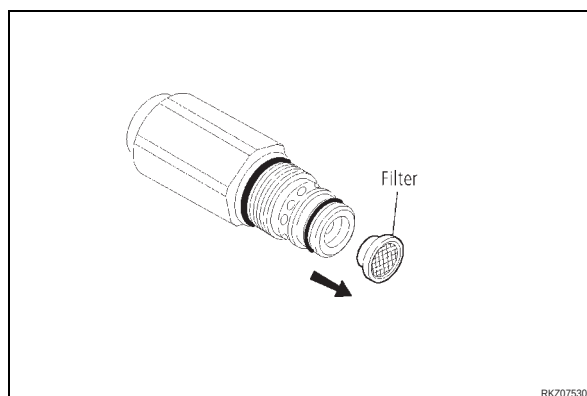
2. Flow regulator replacement

- On the inlet element, unscrew the flow regulator (22 mm wrench).
- ★ Reassembly:
install the flow regulator on the inlet element,
torque: 20 ± 2 Nm



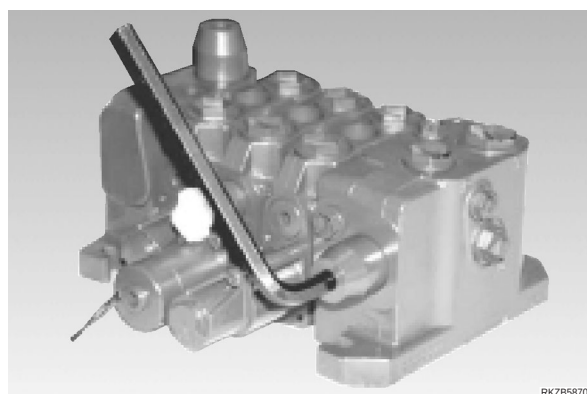
2.1 Flow regulator filter replacement

- Using pliers, extract the filter from the end of the flow regulator.
- ★ Be careful not to damage the seal and the end of the flow regulator.



3. Flow divider replacement

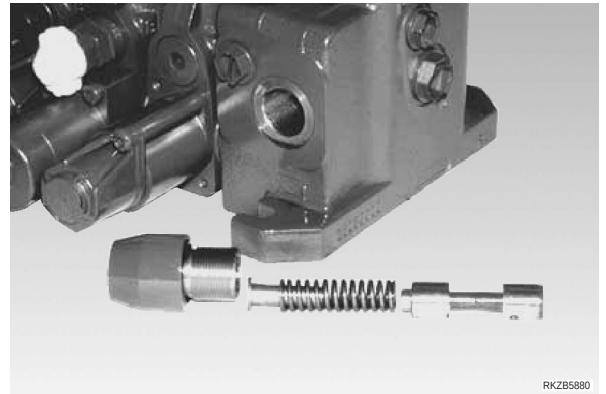
- On the inlet element, unscrew the plug (12 mm socket wrench).
- ★ Reassembly:
 - Replace the plug O-ring
 - torque: 100 ± 10 Nm



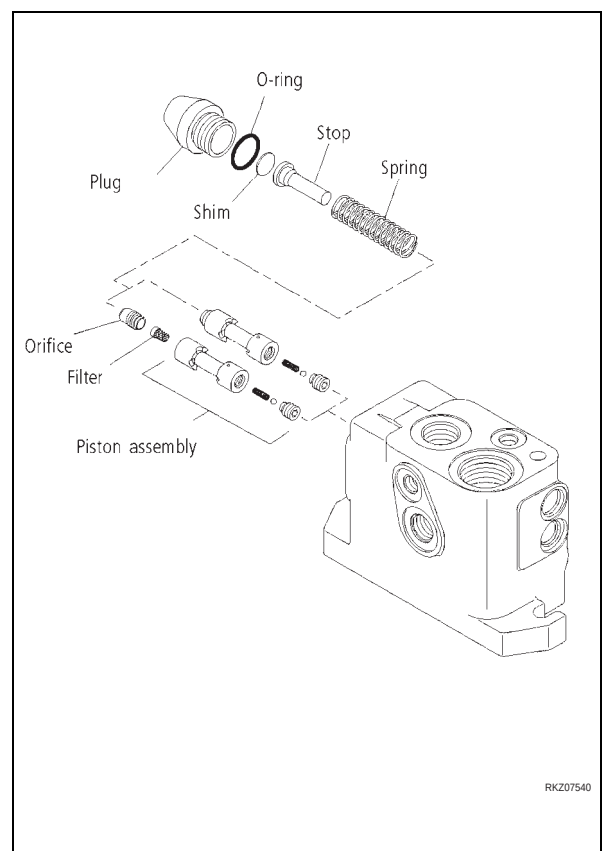
REMOVAL AND INSTALLATION

FRONT AND BACKHOE CONTROL VALVE

- Remove the shim, the stop, the spring and the piston assembly.

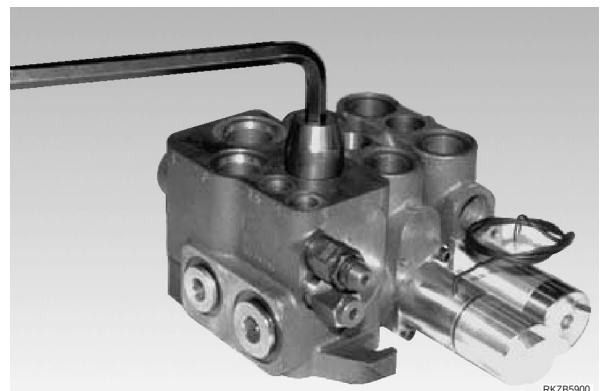


- ★ Replace defective parts.
- ★ Reassemble parts in reverse order.



4. Removal of the flushing valve for “closed center”

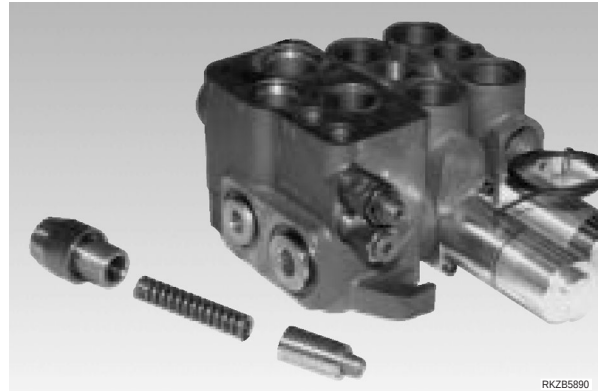
- On the inlet element, unscrew the flushing valve plug (12 mm socket wrench).
- ★ Reassembly:
 - replace the plug O-ring.
 - torque: 100 ± 10 Nm



REMOVAL AND INSTALLATION

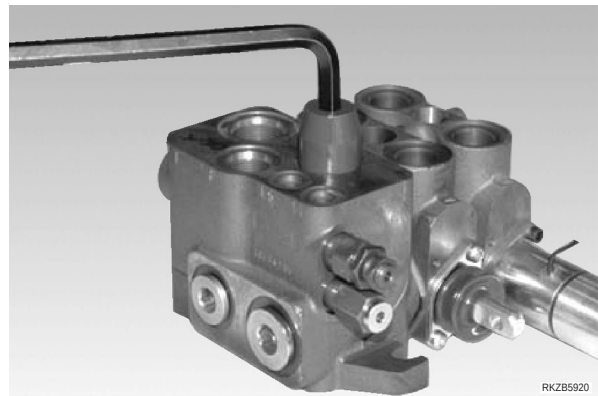
FRONT AND BACKHOE CONTROL VALVE

- Remove:
 - shim
 - spring
 - piston.
- ★ Reassemble parts in reverse order.

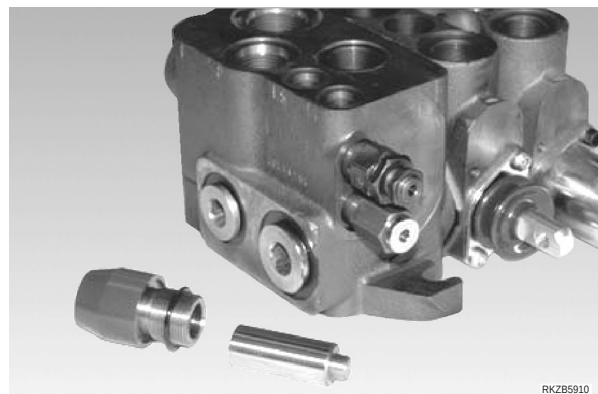


5. "Closed center" removal

- On the inlet element, unscrew the plug from the "closed center" (12 mm allen wrench).
- ★ Reassembly:
 - replace the plug O-ring
 - torque: 100 ± 10 Nm



- Remove the piston.
- ★ Reassemble parts in reverse order.



6. Solenoid valve, "clamps" and shuttle valve removal (installed on backhoe loader)

6.1 Solenoid replacement

- On the outlet element, unscrew the knurled knob from the solenoid.
Pull the solenoid off the stem of the 2-ways valve.
- ★ Reassembly: replace the 2 seals of the solenoid.

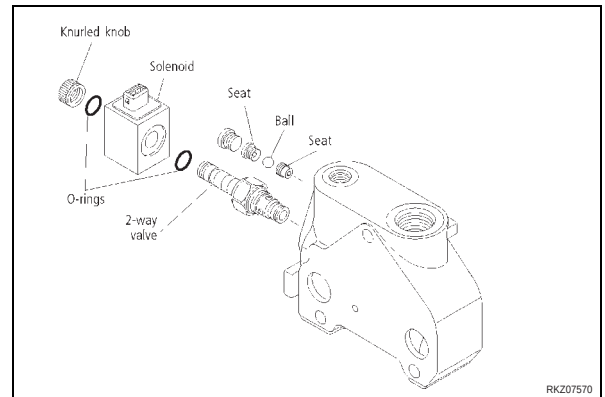


6.2 2-ways valve replacement

- Unscrew the 2-ways valve (24 mm wrench)
 - ★ Reassembly: torque: 45 ± 4 Nm

6.3 Shuttle valve or selector removal

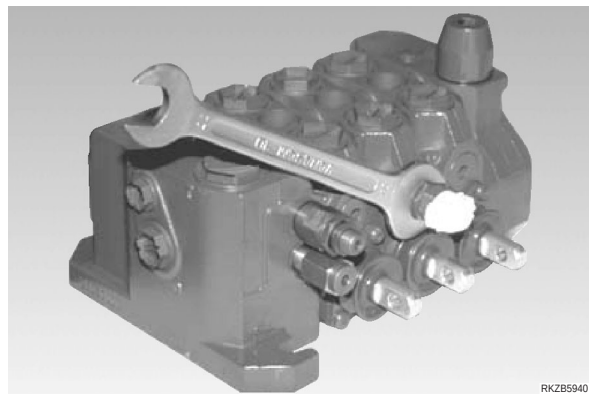
- On the outlet element, unscrew the upper seat (4 mm socket wrench).
 - ★ Reassembly: torque: 20 ± 2 N.m.
- Remove the ball.
- Unscrew the lower seat.
 - ★ Reassembly: torque: 20 ± 2 N.m.
- Replace shuttle valve parts.
 - ★ Apply Loctite 542 pneumatic/hydraulic sealant
- Reassemble parts in reverse order.



DISTRIBUTION ELEMENT REPAIR PROCEDURE

1. Secondary pressure relief valve replacement

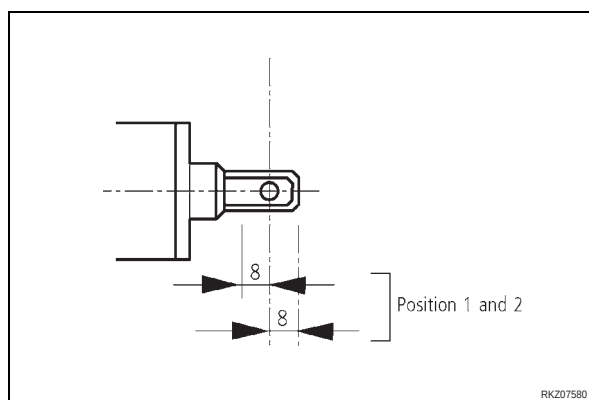
- On the distribution element in question, unscrew the secondary pressure relief valve (24 mm open end spanner).
- ★ Reassembly:
 - set the pressure relief valve to the specified value.
 - install the secondary pressure relief valve on the distribution element (torque: 70 ± 7 Nm)
 - fit a new appropriate locking cover.



RKZB5940

2. Spool stroke measurement

- Move the control lever of the element in question in all possible positions, and measure the corresponding spool stroke values at the tongue.

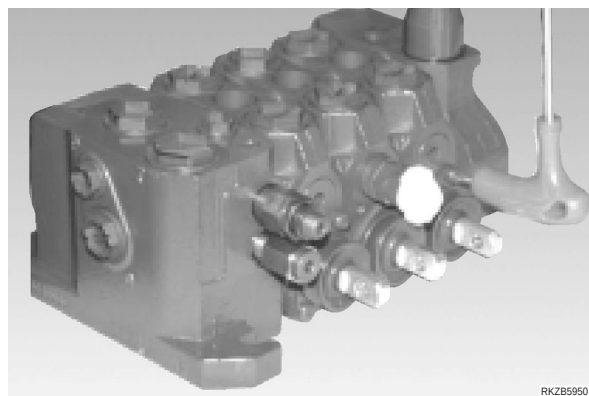


RKZ07580

3. Removal of spool with spring return and lip seal

3.1 Tongue side

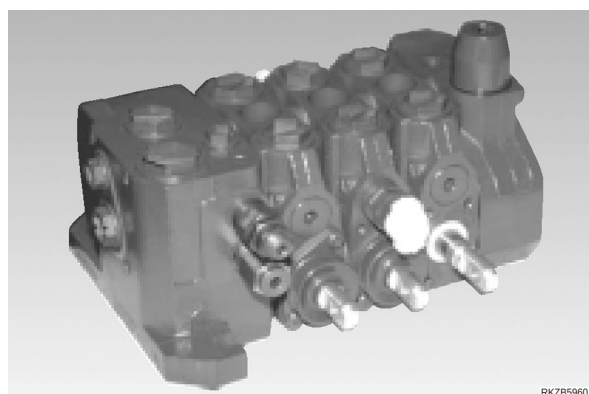
- Remove:
 - mounting screws (L=12 mm) (screwdriver Torx Tx30)
 - the boot and its plate
 - plate.
- ★ Reassembly:
 - replace the lip seal
 - torque: 10 ± 1 Nm



RKZB5950

⚠ CAUTION

- Position the metallic part of the lip seal on the outside.
- The lip seal must be fitted on the end of the spool so that it is not damaged on the spool grooves and its tightness property does not deteriorate.
Slide the lip seal perpendicularly onto the spool.
(For detail see «8. PRECAUTION WHEN REPLACING THE SPOOL LIP SEAL»).



RKZB5960

REMOVAL AND INSTALLATION

FRONT AND BACKHOE CONTROL VALVE

3.2 Cover side

- Remove the mounting screws (L=16 mm) and the cover (screwdriver Torx Tx30).
- ★ Reassembly:
 - replace the lip seal
 - torque: 10 ± 1 Nm



⚠ CAUTION

- Position the metallic part of the lip seal on the outside.
- The lip seal must be fitted on the end of the spool so that it is not damaged on the spool grooves and its tightness property does not deteriorate. Slide the lip seal perpendicularly onto the spool. (For detail see «8. PRECAUTION WHEN REPLACING THE SPOOL LIP SEAL»).
- Remove the spool from the working section.
- ★ Reassemble parts in reverse order.



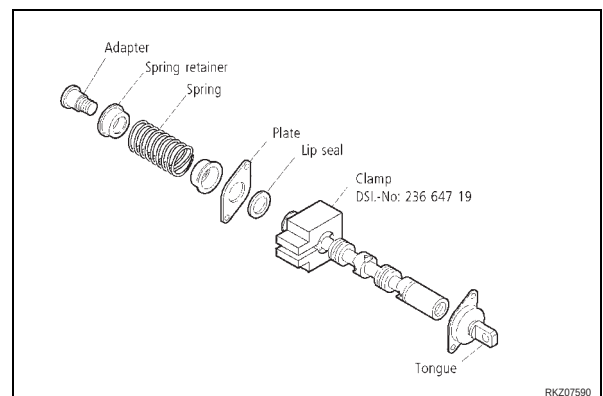
3.3 Return system removal for lip seal replacement

⚠ CAUTION

- In order to avoid breaking the clamp, place it approximately 15 mm from the end of the spool (never in the centre).
- Beforehand, heat the spool to 200° C in an oven or, failing that, with a heat gun.

⚠ Wear thick protective gloves when handling the hot spool.

- Remove the adapter (5 mm socket wrench).
- Remove 2 spring retainers, spring, plate and lip seal.
- ★ Reassembly:
 - Fit the lip seal and reassemble the return system parts in reverse order after greasing the spring
 - torque: 10 ± 1 Nm



⚠ CAUTION

- Position the metallic part of the lip seal on the outside.
- The lip seal must be fitted on the end of the spool so that it is not damaged on the spool grooves and its tightness property does not deteriorate. Slide the lip seal perpendicularly onto the spool. (For detail see «8. PRECAUTION WHEN REPLACING THE SPOOL LIP SEAL»).



REMOVAL AND INSTALLATION

FRONT AND BACKHOE CONTROL VALVE

3.4 Tongue replacement (if necessary)

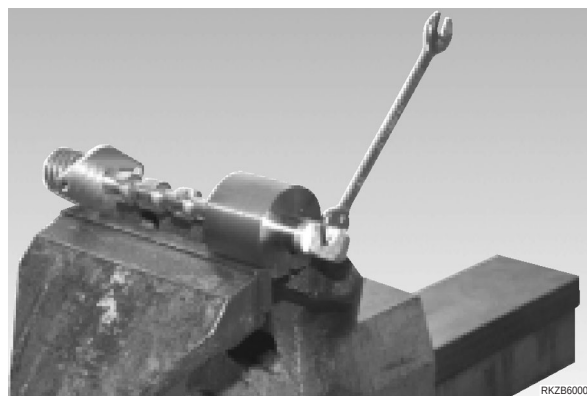
- Beforehand, heat the spool to 200° C in an oven or, failing that, with a heat gun.

⚠ Wear thick protective gloves when handling the hot spool.

⚠ Do not use a welding torch to heat the tongue as spool deformation may result.

- Loosen the tongue with an open end wrench (8 mm wrench).

★ Reassembly: torque: 10 ± 1 Nm



4. Removal of mechanical detent system (pull function only) with lip seal

4.1 Tongue side

- For detail see paragraph 3.1.

4.2 Cover side

- Remove the 2 mounting screws and the cover (screwdriver Torx Tx30).
- Remove the spool from the working section.

- ★ Reassembly:
- replace the O-ring on the spacer
 - replace the spool lip seals on the space side and tongue side.
 - torque: 10 ± 1 Nm

⚠ CAUTION

- Position the metallic part of the lip seal on the outside.
- The lip seal must be fitted on the end of the spool so that it is not damaged on the spool grooves and its tightness property does not deteriorate.

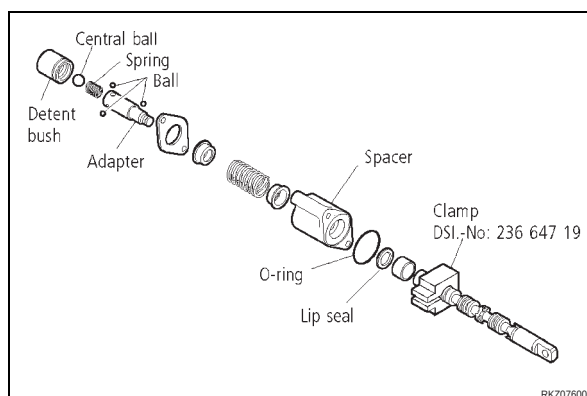
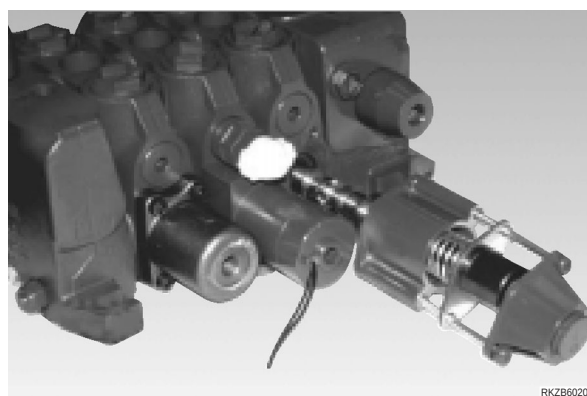
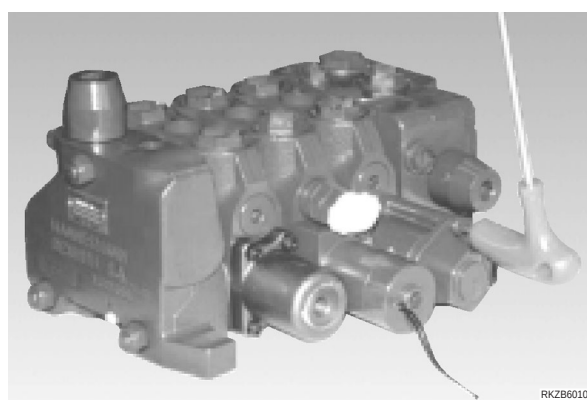
Slide the lip seal perpendicularly onto the spool.

(For detail see «8. PRECAUTION WHEN REPLACING THE SPOOL LIP SEAL»).

- Use the spool clamp (DSI.-No: 236 647 19) and a vice to secure the spool.

⚠ CAUTION

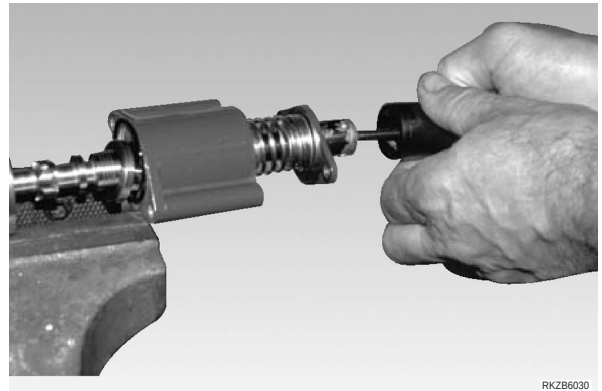
- In order to avoid breaking the clamp, place it approximately 15 mm from the end of the spool (never in the centre).



REMOVAL AND INSTALLATION

FRONT AND BACKHOE CONTROL VALVE

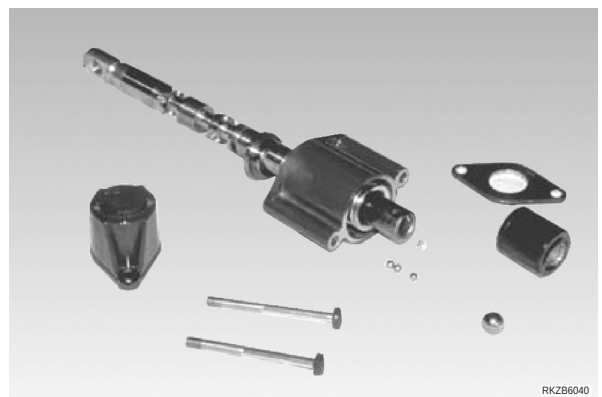
- Using a metal rod (min. length= 80 mm Ø6), push the central ball while extracting the detent bush.
 - ★ Mark the orientation of the detent bush for the re-assembly.
- Remove the balls and the spring.



- ★ Reassembly:
 - introduce the spring into the adapter
 - place the 3 balls into the radial holes of the adapter and hold them with a small amount of grease
 - position the central ball against with the spring
 - slip the detent bush onto a metal rod
 - using the rod, press the central ball into the adapter, then slide the detent bush onto the adapter, making sure that the 3 balls are still in place,

NOTE: the orientation of the detent bush must be respected.

- Remove the metal rod, assembly is complete.



5. Removal of electrical detent system (spool pushed) with lip seal on tongue side

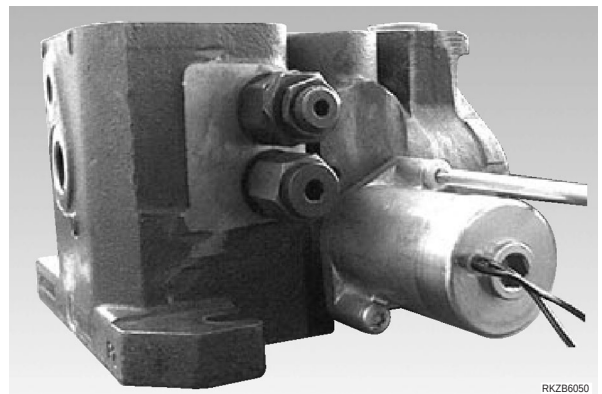
5.1 Spool removal for seal replacement

Tongue side

- For detail see paragraph 3.1.

Control side

- Remove the 2 mounting screws (screwdriver Torx Tx30)
 - ★ Reassembly
 - torque: 10 ±1 Nm



- Remove the detent system.
- Remove the spool from the distribution element.



REMOVAL AND INSTALLATION

FRONT AND BACKHOE CONTROL VALVE

- ★ Reassembly:
 - replace the detent system O-ring
 - replace the spool lip seal on tongue side.

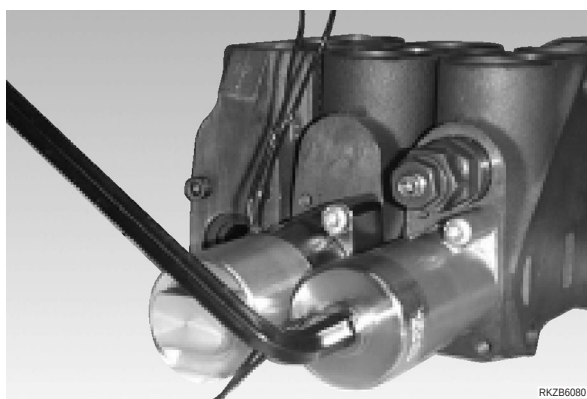
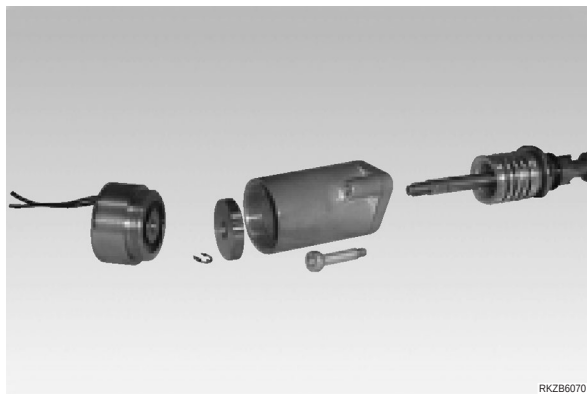
⚠ CAUTION

- Position the metallic part of the lip seal on the outside.
- The lip seal must be fitted on the end of the spool so that it is not damaged on the spool grooves and its tightness property does not deteriorate. Slide the lip seal perpendicularly onto the spool. (For detail see «8. PRECAUTION WHEN REPLACING THE SPOOL LIP SEAL»).

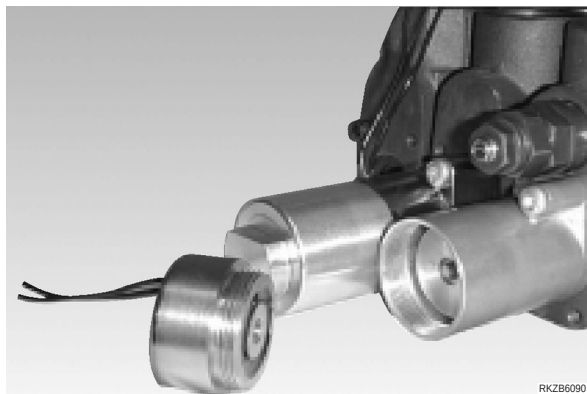
Solenoid replacement

NOTE: this operation can be performed independently of the solenoid replacement operation.

- Unscrew the solenoid from the housing (10 mm Allen wrench).



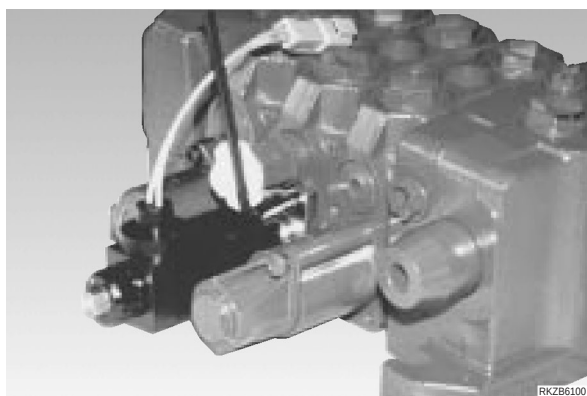
- Install a new solenoid.
 - ★ Reassembly: torque: 20 ± 2 Nm



6. Electrical controlled spool removal

6.1 Solenoid control replacement

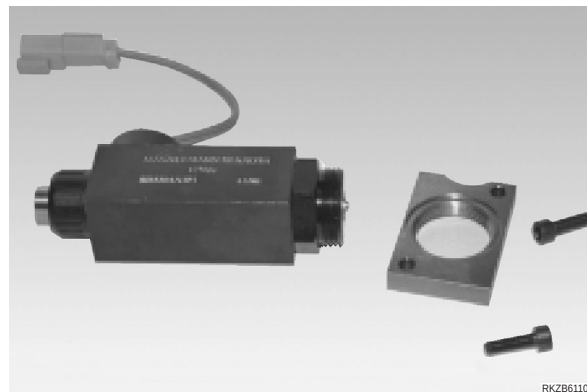
- Remove the 2 mounting screws and the solenoid control (5 mm socket wrench).
 - ★ Reassembly: torque: 10 ± 1 Nm



REMOVAL AND INSTALLATION

FRONT AND BACKHOE CONTROL VALVE

- Unscrew the mounting plate from the solenoid control.
 - ★ Reassembly
Replace the O-rings on the solenoid control and mounting plate.
- Repeat the operation on the other side of the distribution element.
- ★ Reassemble parts in reverse order.



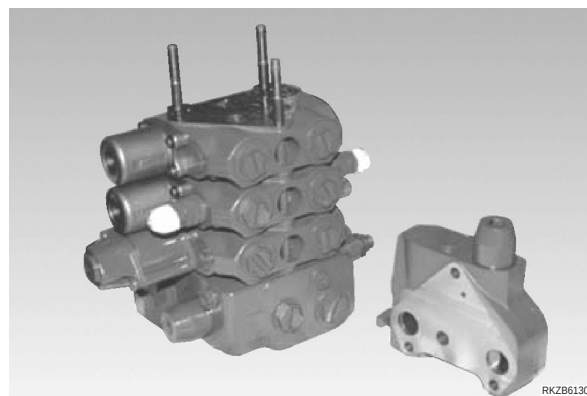
7. Control block Disassembly / Assembly

7.1 Preliminary operations

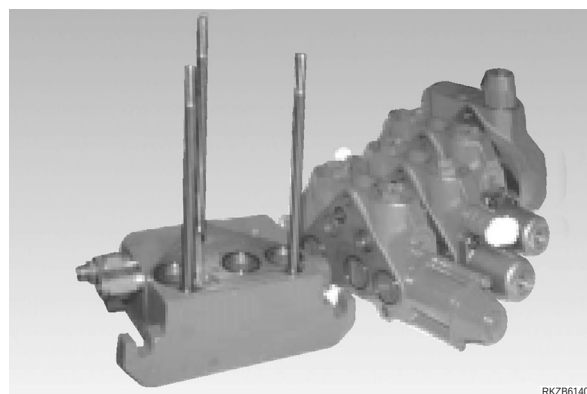
- Remove the 3 nuts (13 mm ring wrench)
 - ★ Reassembly: torque: 35 ± 3 Nm



- Remove the outlet element.



- Separate the working sections from the inlet element.
- Replace the O-rings located between the working sections, the inlet element and the outlet element.
- If the inlet element is to be replaced, remove the tie rods.
 - ★ Reassemble parts in reverse order, and make sure that the tie rods are tightened to the specified torque.
- Check the cleanliness of the element faces prior to re-assembly.



REMOVAL AND INSTALLATION

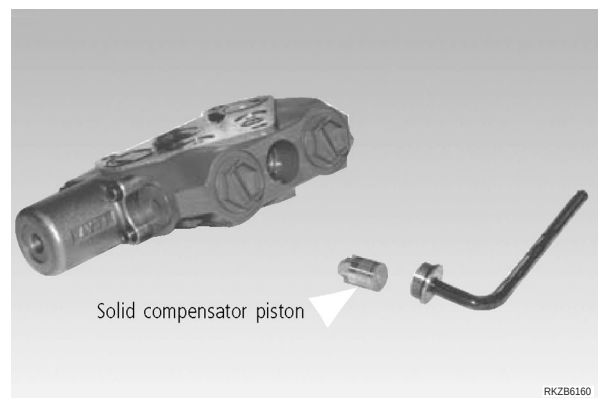
FRONT AND BACKHOE CONTROL VALVE

7.2 Individual pressure compensator removal

- Unscrew the compensator plug (8 mm socket wrench).

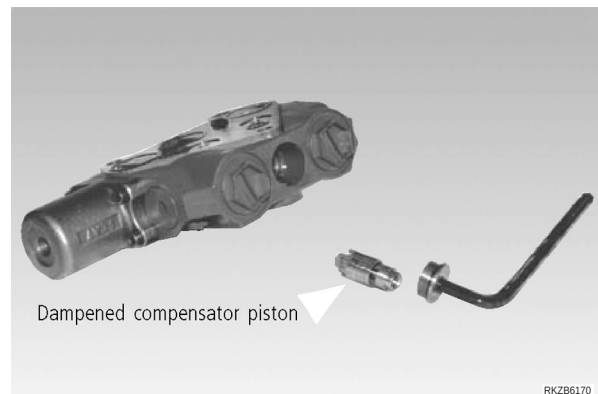


- Remove the compensator piston.
 - Clean the piston's nozzle with compressed air.
 - Check the condition of the bore in the distribution element body.
- ★ Reassembly:
- replace the plug O-ring.
 - torque: 60 ± 6 N.m.

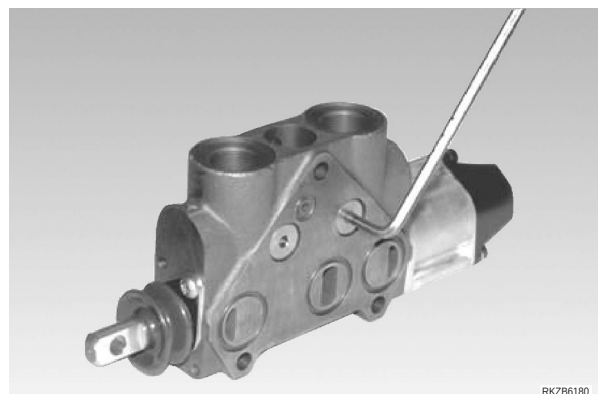


7.3 Check valve removal

- Unscrew the check valve plug (5 mm allen wrench).



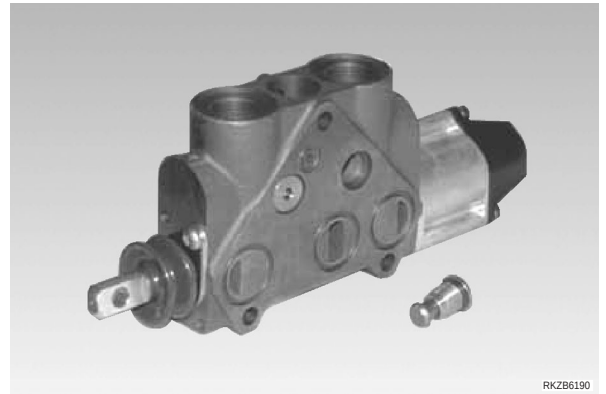
- Visually check the condition of parts and replace the assembly if necessary.



REMOVAL AND INSTALLATION

FRONT AND BACKHOE CONTROL VALVE

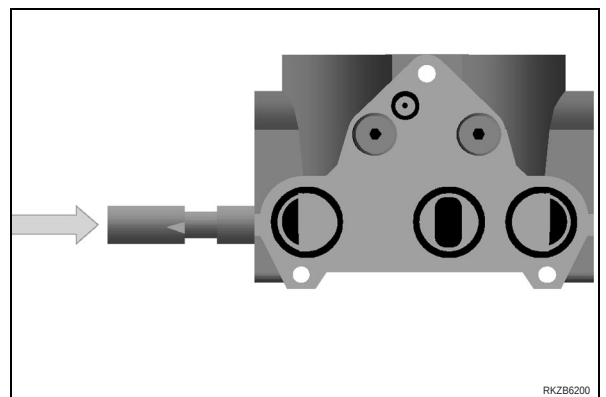
- ★ Reassembly:
 - replace the plug O-ring.
 - torque: 30 ± 3 Nm



8. Precaution when replacing the spool lip seal

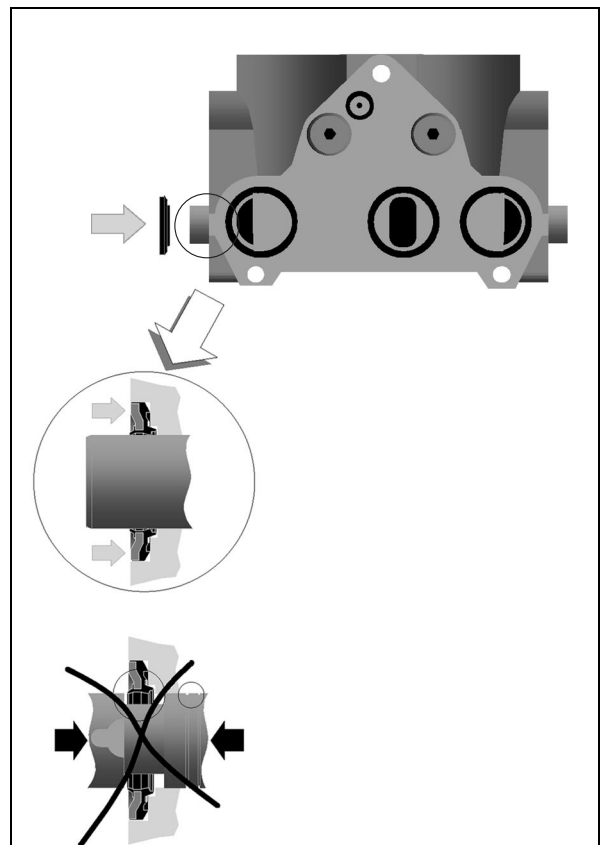
- ⚠ The lip seals are not interchangeable with the other spool seals (O-ring + wiper ring).

- Place the spool in the working section.



- Slide the lip seal perpendicularly onto the spool, positioning the metallic part of the lip seal on the outside.

NOTE: the lip seal must be fitted on the end of the spool so that it is not damaged on the spool grooves and its tightness property does not deteriorate.



REMOVAL AND INSTALLATION

FRONT AND BACKHOE CONTROL VALVE

TROUBLESHOOTING

⚠ Before starting any procedures of trouble shooting or removing the control block, inspect the global machine's hydraulic system to eliminate all possible malfunctions not related to the sx 14 control block.

Abnormal operation of the actuators connected to the control block

Malfunction	Probable cause	Additional checks	Remedy
Lack of strength at all actuators	1 - LS pressure relief valve defective	Take a pressure measurement (see block specifications)	Replace LS pressure relief valve
	2 - LS pressure relief valve out of adjustment		Make necessary adjustments
Lack of force on one actuator only	1 - Secondary pressure relief valve out of adjustment		Reset to original pressure (refer to block specifications)
	2 - Secondary pressure relief valve blocked "open" (return to tank)		Replace secondary pressure relief valve
Movement performance slow	1 - Spool stroke incorrect	Manual control: measure spool stroke Direct electrical control: - check solenoid resistance (R : 2,5 Ω at 25 °C)	If stroke is incorrect: replace housing + spool assembly If resistance is incorrect: replace solenoid
	2 - Hydraulic operator adjustable stopnut out of adjustment		Make necessary adjustments
	3 - Individual compensator pressure blocked		Replace housing + pressure compensator assembly
Lack of load hold	1 - Load hold check valve failure		Replace housing + valve assembly
	2 - Excessive clearance between the housing and the spool		Replace housing + spool assembly
Steering abnormally hard	1 - Flow divider adjustment problem	1 - Adjustment piston sliding freely	Replace control sub-system
		2 - Adjustment piston blocked	Replace housing + control system assembly
Steering response time abnormally long	Filter of the check piston's flow divider is clogged		Replace the filter
Clamp operation malfunction	1 - Solenoid on the outlet element defective	Check solenoid resistance (R : 7,6 Ω at 20 °C)	If resistance is incorrect replace the solenoid
	2 - Shuttle valve malfunction on the outlet element		Replace shuttle valve
	3 - 2-way valve defective		Replace 2-way valve
Simultaneous movement malfunction	1 - Blockage of the individual compensator orifice		Remove and clean individual compensator
	2 - Individual pressure compensator blocked		Replace the housing + pressure compensator assembly
	3 - LS line leakage		Replace LS flow regulator

REMOVAL AND INSTALLATION

FRONT AND BACKHOE CONTROL VALVE

Abnormal machine operation

Malfunction	Probable cause	Additional checks	Remedy
Engine remains under load after spools are returned to neutral	1- Flow regulator blocked		Replace flow regulator
	2- Flow regulator filter clogged		Replace the filter

Abnormal control block operation

Malfunction	Probable cause	Additional checks	Remedy
Detent malfunction	1- Mechanism defective		Replace mechanical detent
	2- Solenoid defective	Check solenoid resistance (for electrical detent) (R: 16,5 Ω at 20 °C)	If resistance is incorrect: Replace solenoid
Increase of force on controls or spool return defective	Control block assembly tie rods too tight		Loosen and tighten to 25 $\pm$ 2 Nm Remove control block fixation points
	Spool seals obsolete		Replace spool seals

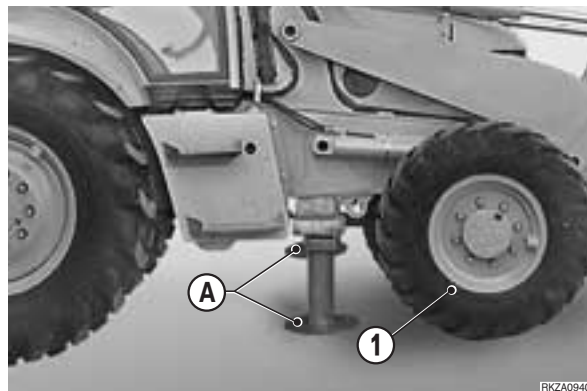
Visual defects

Malfunction	Probable cause	Additional checks	Remedy
Spool leaking oil	Spool seals defective		Replace spool seals Check the rubber boot condition
Oil leakage at pressure relief valves and plugs	Seals defective		Remove pressure relief valve or plug and replace seals
Oil leakage between elements	Seals between elements defective		Remove working sections and replace joints
Oil leaking from hydraulic operator housing	1 - Seal between housing and body defective		Replace seal
	2 - Seal of adjustable stop nut defective		Replace seal
Tongue control boot damaged			Replace boot

REMOVAL OF THE FRONT AXLE

- 1 - Start the engine and force the front bucket downwards in order to raise the machine and the front wheels.
- 2 - Place two stands "A" and some blocks beneath the chassis.
- 3 - Slowly lower the machine onto the blocks, checking that the wheels remain at least 5 cm above the ground.

! Fully raise the front working equipment and engage the safety stop.
Also make the backhoe safe.



- 4 - Engage the parking brake.
- 5 - Stop the engine and eliminate residual pressure from all circuits. (See «20. TESTING AND ADJUSTMENTS»).

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

- 6 - Take off the front wheels (1).

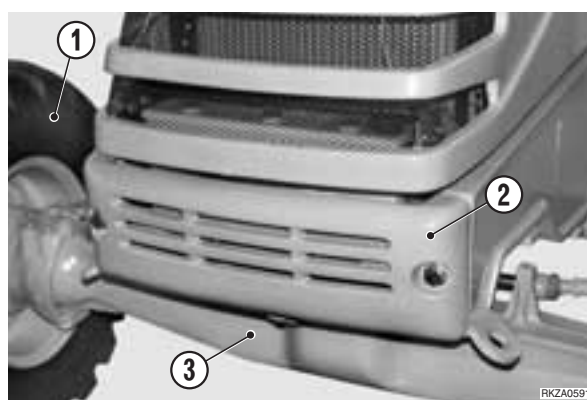


Wheel: 65 kg

✖ 1

- 7 - Remove the front guard (2).
(For details, see «REMOVAL OF FRONT GUARD»).

✖ 2



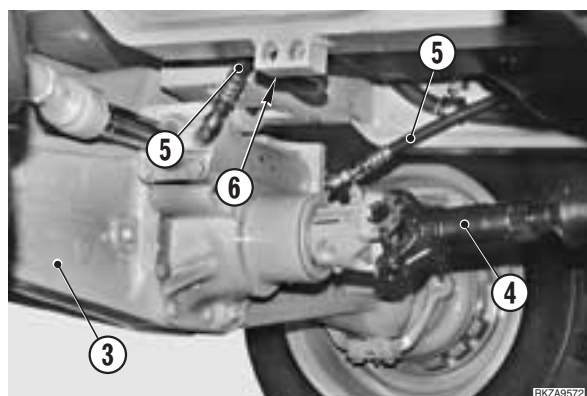
- 8 - Disconnect the cardan shaft (4) from the axle (3).

✖ 3

- 9 - Disconnect the lines (5) from the steering cylinder and plug them to prevent entry of impurities.

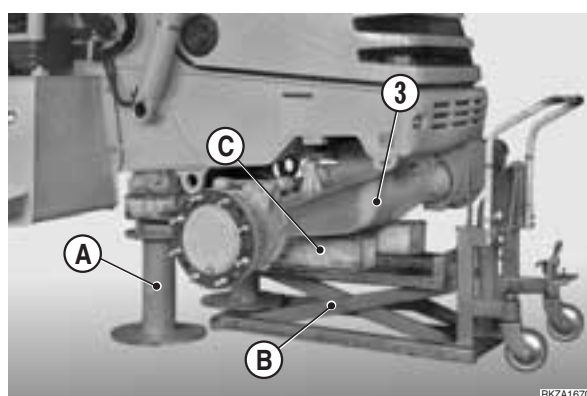
✖ 4

- 10 - Disconnect the lubrication tube (6) for the axle oscillation pin (7).



- 11 - Position a jack "B" and some blocks "C" beneath the axle. Raise the jack until the blocks can be forced under the axle arms (3).

★ It should be possible to lower the jack 10 cm in order to disengage the axle from the fulcrum supports.



12 - Take out the nut and remove the retaining screw (8) of the axle oscillation pin (7).

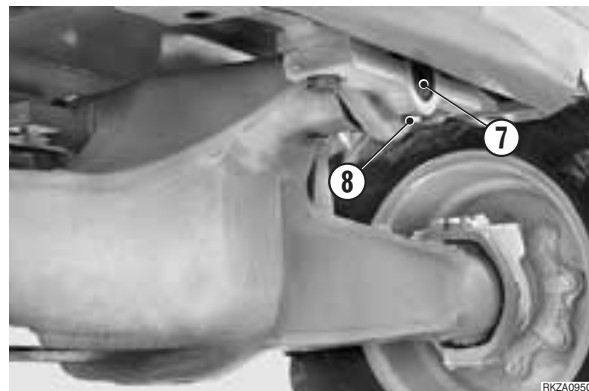
13 - Screw an eyebolt into the central hole of the axle oscillation pin (7). Extract the axle oscillation pin. 

14 - Lower the jack until the axle is disengaged.

15 - Extract the entire axle (3).



Front axle: 316 kg



INSTALLATION OF THE FRONT AXLE

- To install, reverse the removal procedure.

 1



Nuts for front wheels: $350 \pm 9,8$ Nm

 2



Front closing screws: 300 ± 30 Nm

 3



Screws on gearbox side: 70 Nm



Self-locking nuts on axle side: 70 Nm

 4

- ★ Bleed the air from the Load Sensing circuit. (For details, see «20. TESTING AND ADJUSTMENTS»).

 5



Axle oscillation pin - bushings: ASL800050

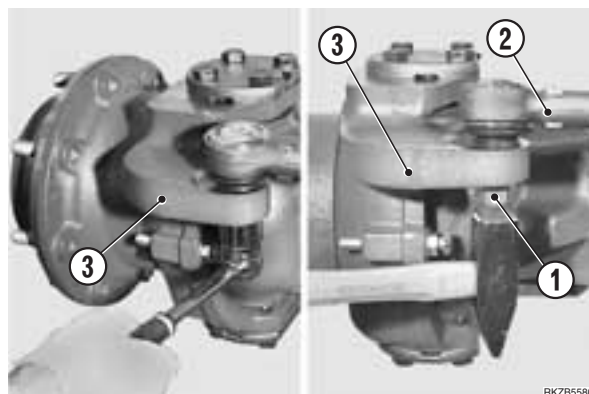
1 - Check the oil level in the tank and start the engine.

2 - Perform a few complete steering manoeuvres in both directions to bleed the air from the steering circuit.

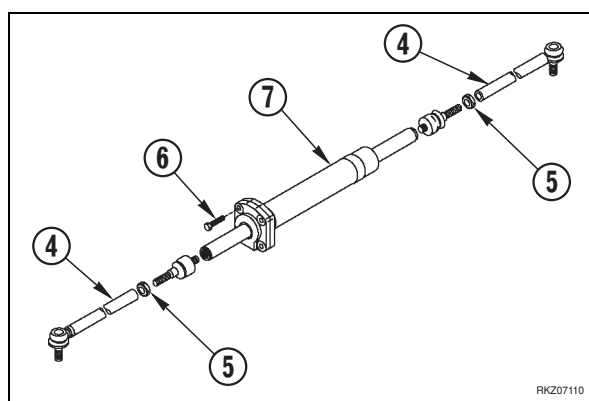
DISASSEMBLY OF FRONT AXLE

1. Steering cylinder group disassembly

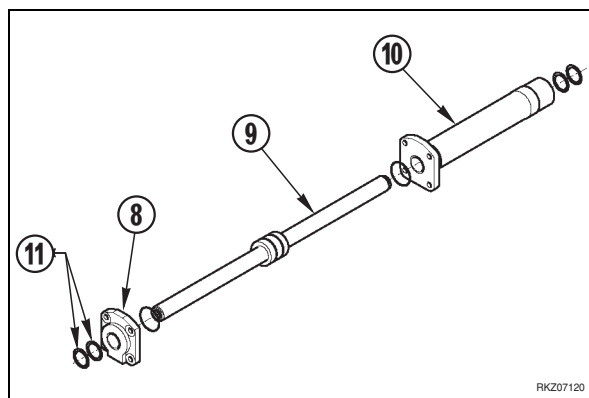
- 1 - Unloose the guide rod (2) locknut (1) of some turns till it is over the end of the threaded pin.
Beat on the nut (1) with a hammer in order to disjoin the guide rod (2) from the swivel housing (3).
★ Don't beat on the end of the threaded pin.
★ This is a destructive operation for the nut.



- 2 - Remove the guide rod link (4) by unloosing the nut (5) with a suitable wrench, then check its conditions.
- 3 - Unscrew the fastening screws (6) of the cylinder, then take the cylinder (7) out of its housing and, if necessary, use a rubber hammer.

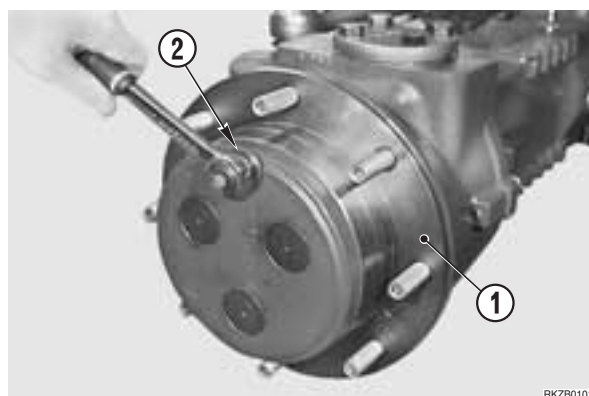


- 4 - Detach the cylinder head (8) from the cylinder case (10). Remove off the cylinder head and the rod (9) from the cylinder case.
- 5 - Remove all the sealings and O-Rings (11), both from the cylinder head and the rod.



2. Epicyclic reduction gear disassembly

- ★⚠ Before draining the oil, position the wheel hub (1) with the plug (2) on the upper part and loosen it of some turns in order to eliminate any possible inner pressure, then remove it completely. Turn the wheel hub upside-down till the hole is in the lowest point.
Drain the oil completely.



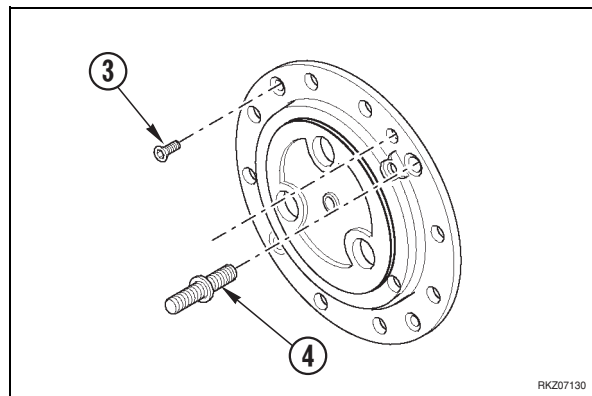
REMOVAL AND INSTALLATION

FRONT AXLE

- 1 - Unscrew and remove both fastening screws (3) and the 2 stud bolts (4) of the planetary carrier with a standard wrench.

★ Don't ruin the thread of the two stud bolts.

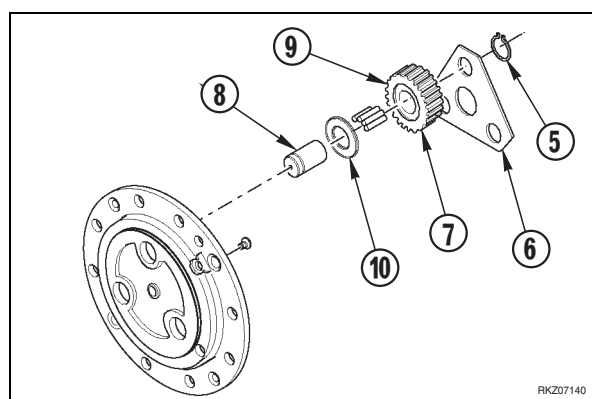
- 2 - Remove the planetary carrier from the wheel hub. Position the planetary carrier on a workbench and check its wear conditions.



2.1 Replacements of the planetary gears (if necessary)

- 1 - Remove the snap ring (5).
- 2 - Remove the thrust washer (6).
- 3 - Take the planetary gears (7) out of the pins (8).
- 4 - Collect the needle bearings (9), checking their conditions.
- 5 - Remove the thrust washers (10).

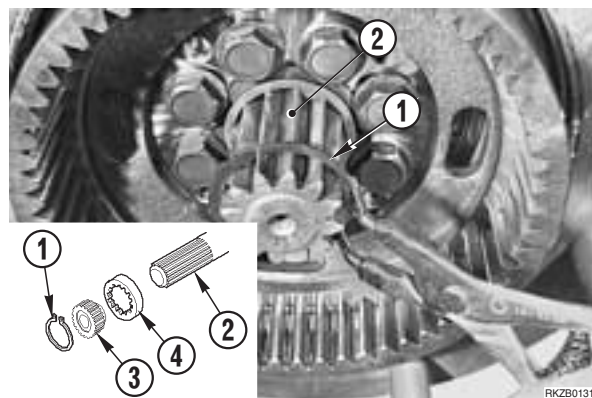
★ With new planetary gears is advisable to assembly new roller bearings.



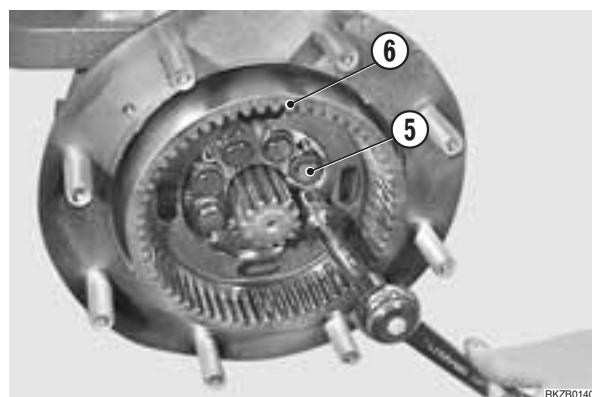
3. Wheel hub group disassembly

⚠ Before disassembling the wheel hub, it is advisable to secure it with a belt or a rope on a hoist or any other supporting device, in order to avoid its accidental fall that could damage either the operator or the wheel hub group.

- 1 - Remove the steel lock ring (1) from the axle shaft (2) by using a suitable plier.
- 2 - Remove and collect the lock ring, the sleeve (3) and the spacer (4) from the axle shaft.



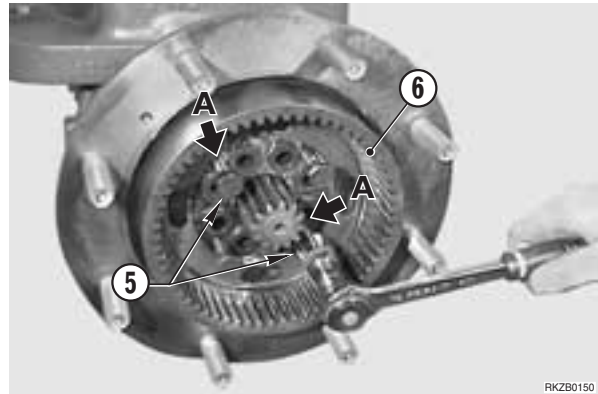
- 3 - Unscrew and remove the fastening screws (5) from the wheel carrier (6) group.



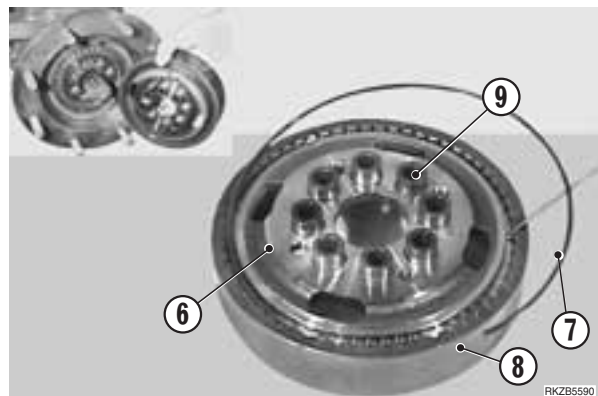
REMOVAL AND INSTALLATION

FRONT AXLE

- 4 - In order to remove the wheel carrier group (6) from its housing, screw (5) at least two of the just removed screws in the threaded extraction holes "A".



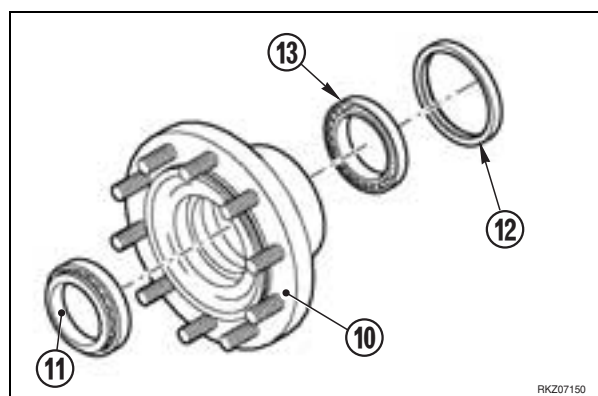
- 5 - Extract and remove the wheel carrier (6) together with the epicyclic ring gear (8).
- 6 - Remove the steel lock ring (7) and disjoin the wheel carrier (6) from the epicyclic ring gear (8).
★ Check the wear conditions of the components.
- 7 - **Only if necessary**, remove the centering bushes (9) of the hub lock ring gear with a hammer and the special tool D1.



- 8 - Remove the hub (10), using levers and a hammer to facilitate the operation.
★ Collect the bearing cone (11).



- 9 - Position on a flat surface the hub and take the seal ring out (12) with a lever.
★ This is a destructive operation for the seal ring.
- 10 - Take the bearing cups out (11) and (13), on both sides of the hub, using a hammer and a suitable tool to be beaten.
- 11 - Remove the bearing cone (13) from the swivel housing end, using a suitable extractor.



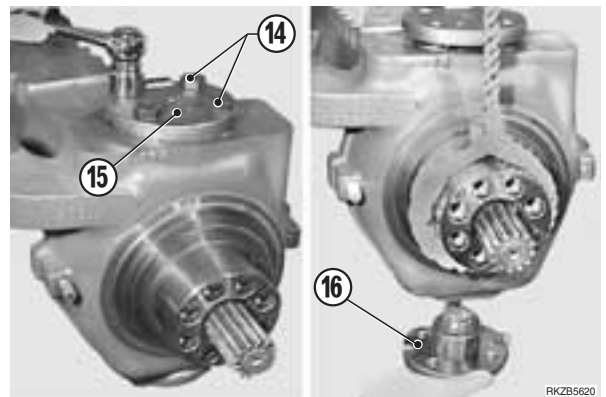
REMOVAL AND INSTALLATION

FRONT AXLE

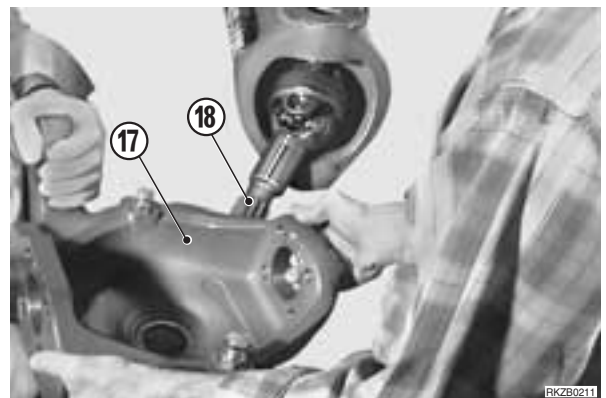
12 - Unscrew and remove the fastening screws (14) from the upper (15) and lower (16) king pin.

! Before removing the king pins, secure the swivel housing with a belt or a rope to a hoist or any other supporting device.

13 - Remove the king pins (15) and (16).



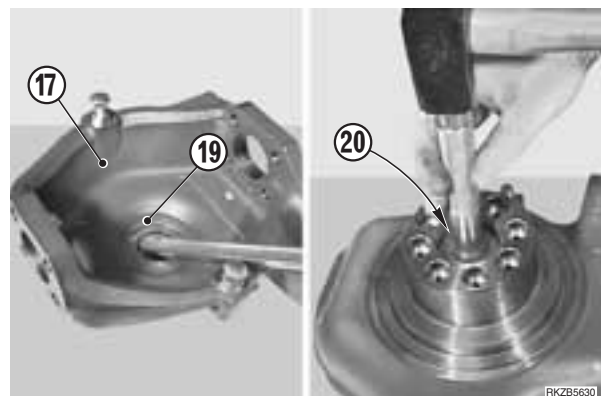
14 - Remove the swivel housing (17) from the axle beam and from the short shaft (18) of the U-Joint.



15 - Position the swivel housing (17) on a flat surface and take the seal ring (19) out with a lever.

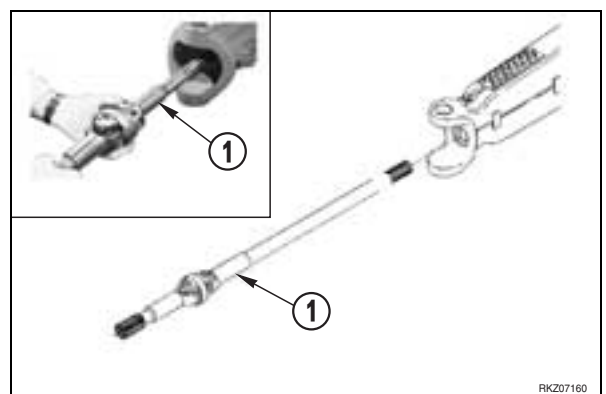
★ This is a destructive operation for the seal ring.

16 - Turn the swivel housing (17) and take the bush (20) out, using a driver and a hammer.



4. Axle beam group disassembly

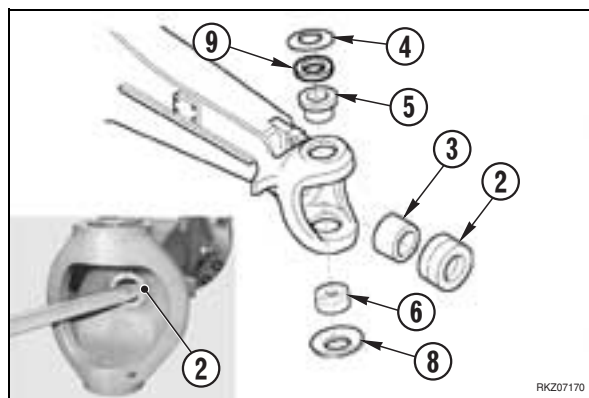
1 - Remove the U-Joint (1) from the axle beam.



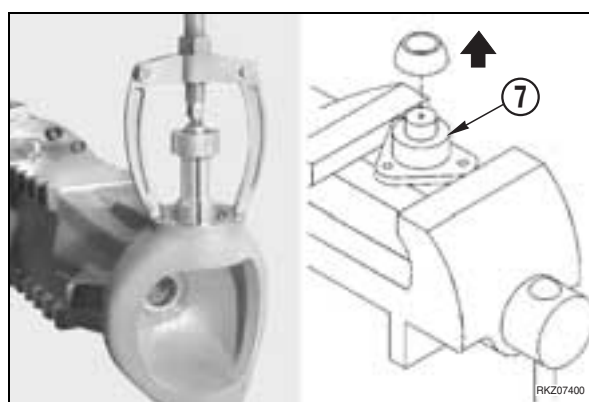
REMOVAL AND INSTALLATION

FRONT AXLE

- 2 - Take the seal ring (2) out of the axle beam with a lever.
★ This is a destructive operation for the seal ring.
- 3 - Remove the cup springs (4) and (8) from the king pin housings in the axle beam.
- 4 - Remove thickness (9) from the upper part of axle beam.
- 5 - Remove the bush (3) from the beam with a suitable extractor.
★ Examine the bush before the removal and replace it only if the wear conditions require this.



- 6 - Take the upper (5) and lower (6) bushes out of the king pin housings (7) and out of king pin with a suitable extractor.

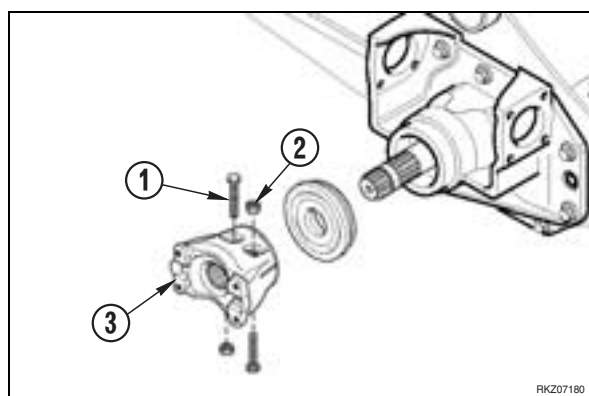


- 7 - Remove the seal rings (10) from the pivot with a suitable tool.
★ Destructive operation for the seal rings.
- If necessary, replace the bushings with a standard three-gripping point extractor or a suitable driver and a hammer.



5. Differential support group disassembly

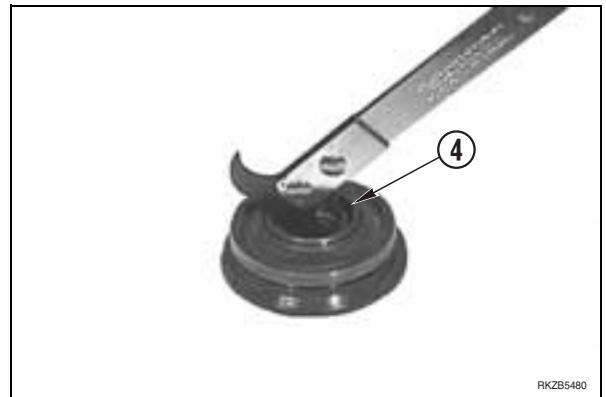
- 1 - Remove the fastening screw (1) and the nut (2) from the flange (3).
Using a small chisel, detach the oil seal cover just enough to fit a lever.
- 2 - Remove the oil seal cover from the central beam assembly, using two levers.



REMOVAL AND INSTALLATION

FRONT AXLE

- 3 - Remove the seal ring (4) from the oil seal cover, using a suitable tool.

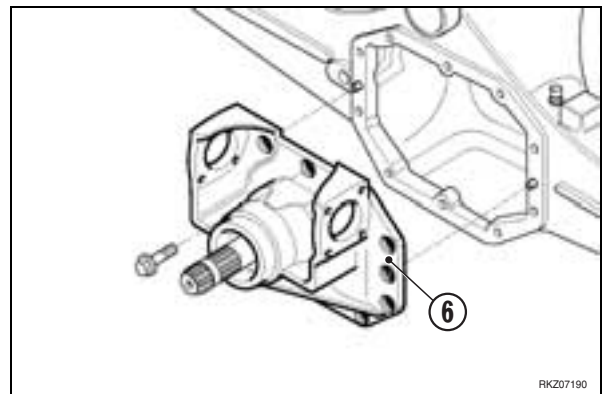


- 4 - Put the O-ring (5) from the oil seal cover in a safe place.

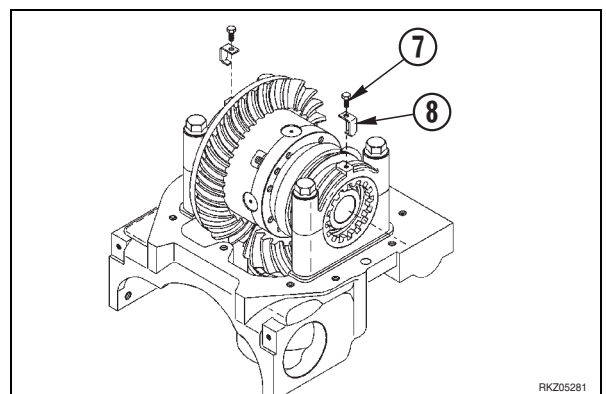


- 5 - Loosen and remove the screws on the differential support (6).
Remove the differential carrier (6).

⚠ Support the differential carrier with a rope or other appropriate means.



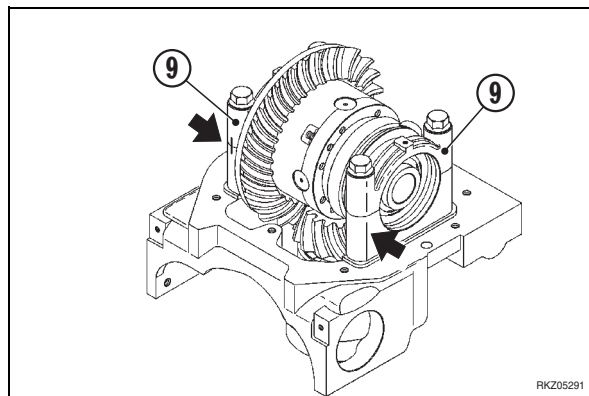
- 6 - Loosen and remove the screws (7) to remove the two ring nut retainers (8).



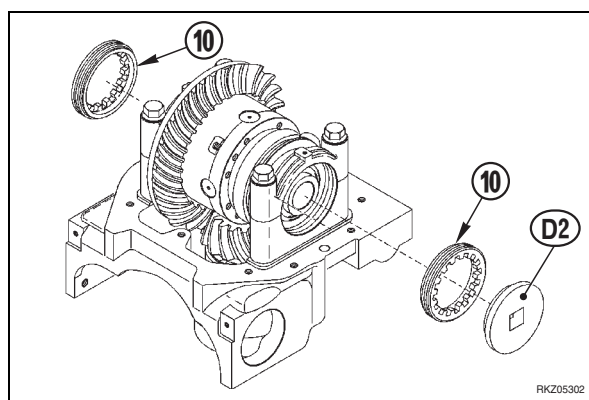
REMOVAL AND INSTALLATION

FRONT AXLE

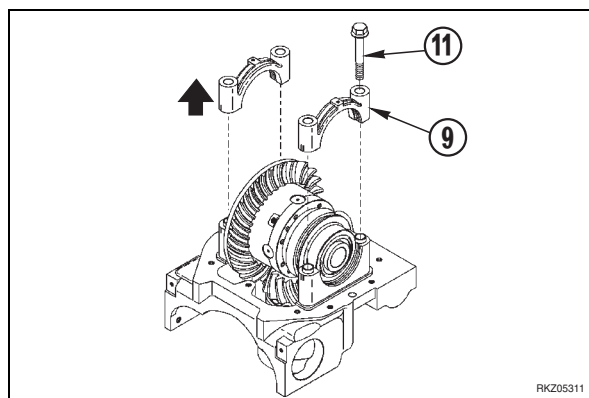
7 - Before removing bolts, mark halfbridles (9) and the differential carrier with permanent reference marks to avoid inverting them when re-assembling the unit. Mark the area between the ring butts and the differential carrier as well.



8 - Unscrew the adjuster ring nuts (10) using tool **D2** and a wrench.

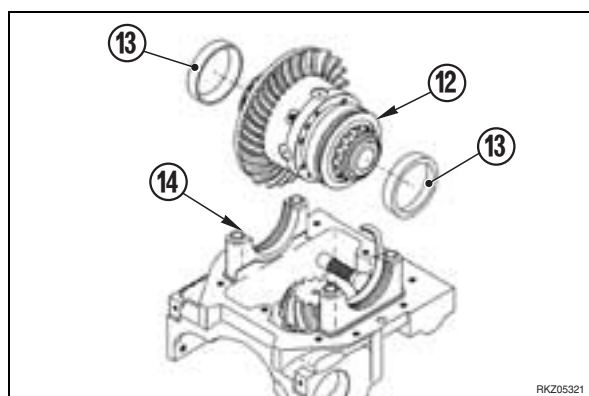


9 - Loosen and remove the 4 screws (11) and remove the 2 half-collar (9).



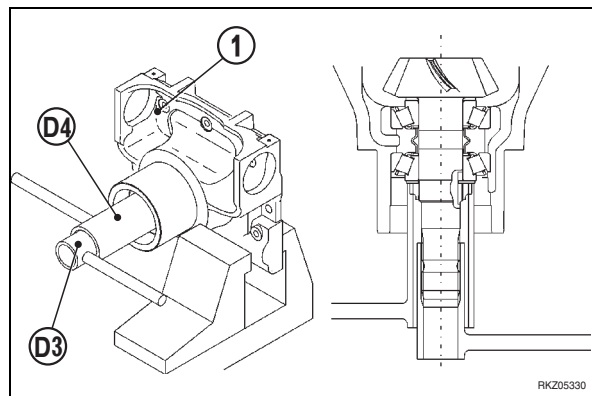
10 - Take out the differential case (12).

- ★ Take care not to loose the cups bearing (13) that are removed together with the differential case (12).
- ★ Not mismatch the cups of the bearings (13) if they are not to be replaced.
- ★ Check that the bushes (14) remains in their housings.

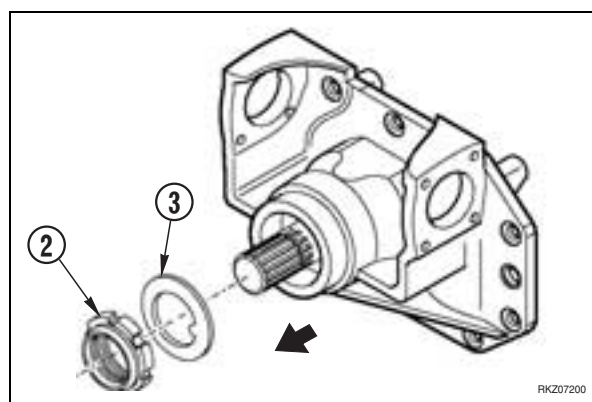


6. Pinion group disassembly

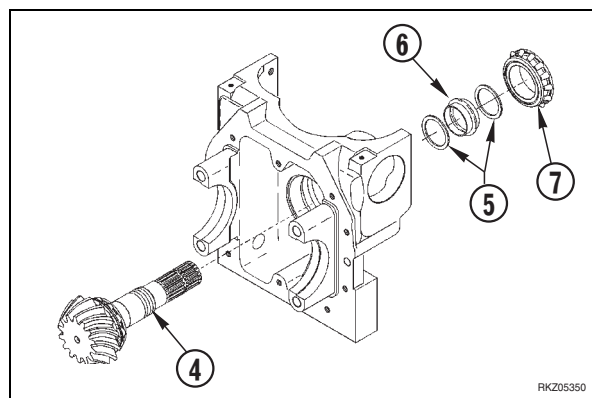
- 1 - Fit the differential carrier (1) in a vise.
- 2 - Unscrew the lock nut using special tools **D3** and **D4**.
 - ★ This operation will irretrievably damage the ring nut.



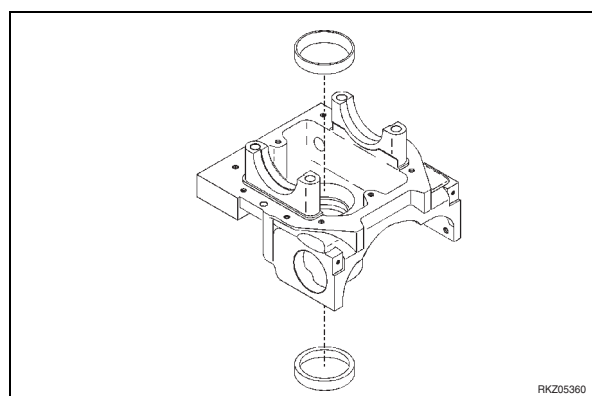
- 3 - Remove the ring nut (2) and collect its retaining washer (3).



- 4 - Tap the shaft with a soft hammer to remove the bevel pinion (4).
 - ★ Take care not to drop the pinion.
- 5 - Collect the washers (5), the collapsible spacer (6) and the inner cone of the tapered roller bearing (7).



- 6 - Place the differential carrier on a flat surface as shown in the figure and remove the outer cups of the taper roller bearing (7) using a driver and a hammer.

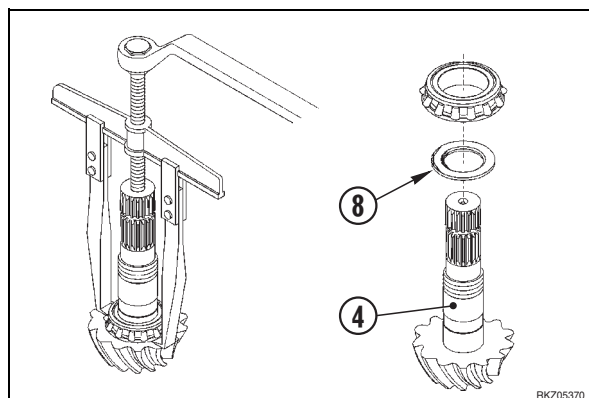


REMOVAL AND INSTALLATION

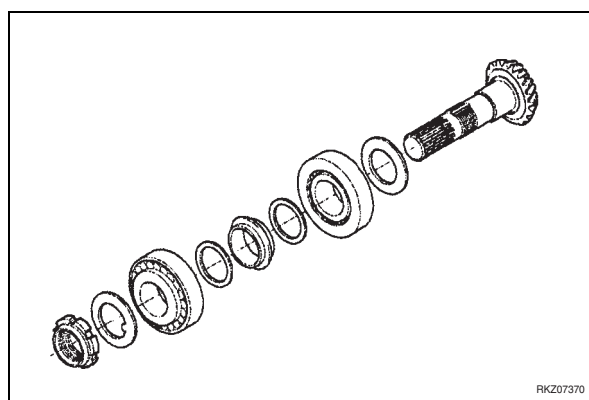
FRONT AXLE

7 - To remove the inner cone of the tapered roller bearing (7) of the pinion (4), use a standard extractor.

8 - Collect the bearing cone and the underlying shim (8).



9 - Check all pinion components for wear.
The ring nut and the snap spacer **must be replaced** when reassembling the unit.



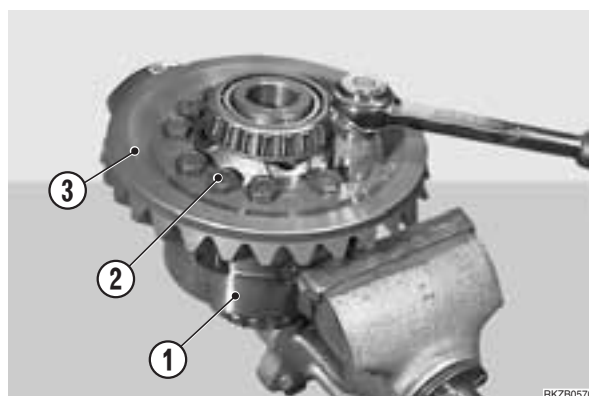
7. Differential group disassembly

1 - Collect the differential (1) and put it in a clamp.

2 - Unscrew all the fastening screws (2) of the bevel gear crown (3).

★ This will make both differential half boxes free, so take care not to drop the internal components.

3 - Remove the bevel gear crown.

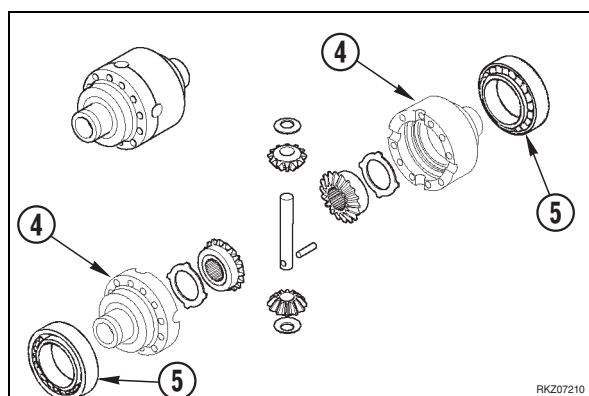


4 - Disassemble the differential box in two half boxes (3) complete with the relevant components.

5 - Recover the components from both half boxes.

6 - Check the operating and wear conditions of the components.

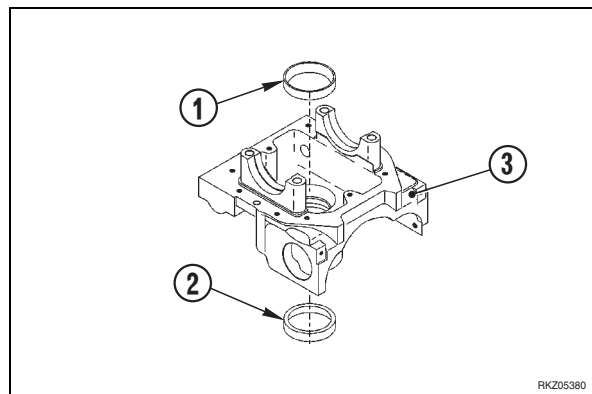
7 - Take the bearing (5) out of the differential half box (4), using two levers or a three-hold extractor.



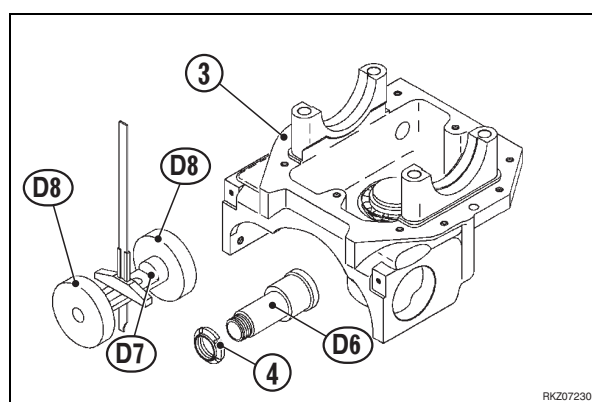
ASSEMBLY OF FRONT AXLE

1. Pinion group assembly

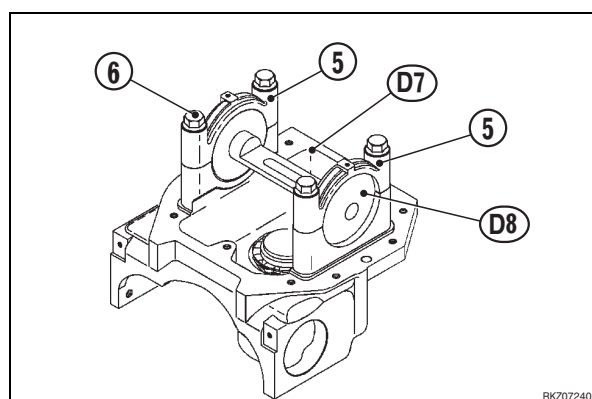
- 1 - Place the differential support (3) on a workbench.
- 2 - Fit the outer cups of the new bearings (1) and (2) using the special tool **D5** and a hammer.



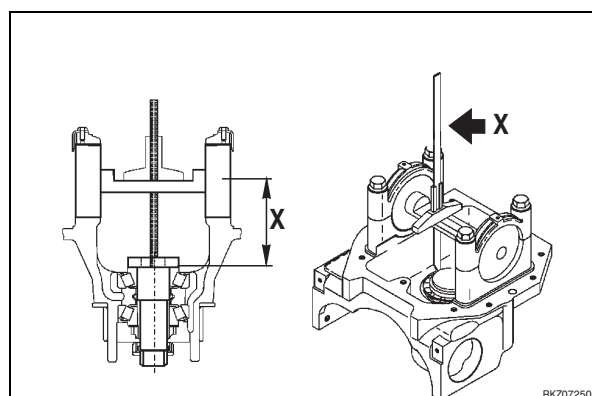
- 3 - In order to measure the distance, use the kit consisting of the special tools called "false pinion" **D6** and "false differential box" **D7** e **D8**.
 - 4 - Insert the false pinion with **D6**, together with its bearings and its ring nut (4), in the just mounted housings for the bearings.
- Tighten without exceeding, till the backlash is eliminated.



- 5 - Install special tools **D7** and **D8** to the differential group supports and screw in the half collar bolts (5) and (6).



- 6 - Use a deep gauge to take the measurement "X".
- ★ Write down the "X" measurement.



REMOVAL AND INSTALLATION

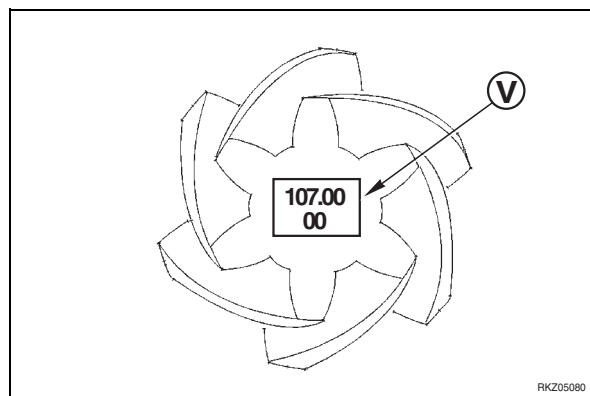
FRONT AXLE

- 7 - Make a note of the value “V” marked on the head of the pinion.

Calculate the thickness “S” to be installed beneath the pinion, using the formula:

$$S = X - V$$

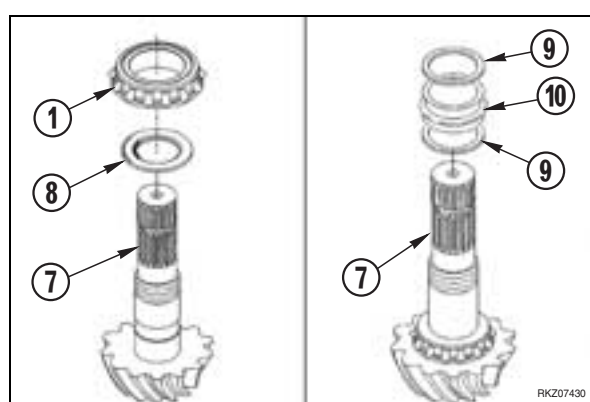
“S” is the thickness of the shim.



- 9 - Mount the shim (8) onto the pinion (7) and press the inner bearing (1) using the tool **D9**.

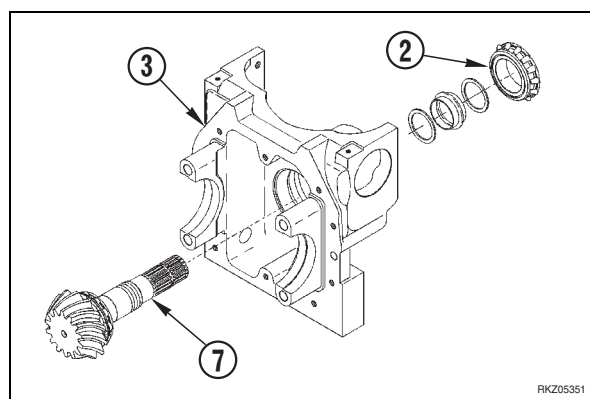
★ The chamfer on the inner diameter of the shim must face the toothings.

- 10 - Mount onto the pinion the first washer (9), the new spacer (10) and the second washer (9).

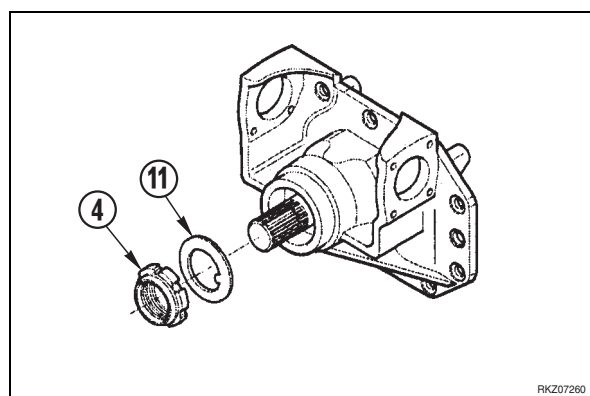


- 11 - Insert the bevel pinion unit (7) into the differential support housing (3) (from the internal axle side) and the second bearing cone (2) into the pinion end, from the opposite side.

★ In order to force the second bearing into position, use the special tool **D9** and a hammer.



- 12 - Insert a ring nut washer (11) and screw a new lock ring nut (4) on the pinion end.

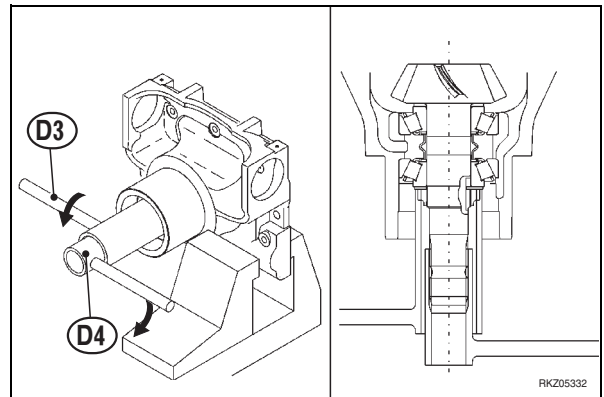


REMOVAL AND INSTALLATION

FRONT AXLE

13 - Screw the ring nut in, using the wrench for ring nut **D3** and for pinion retainer **D4**.

- ★ The torque setting is given by the preloading measurement on bearings. Tighten the ring nut gradually.
- ★ If the tightening is excessive, the elastic spacer must be replaced and the procedure repeated. When you check the preloading, it is advisable to beat slightly both pinion ends with a soft hammer, so as to help setting the bearings.



14 - Wind a wire line round the pinion, uniformly and without overlapping. Connect it to a dynamometer and check the force "P" required to rotate the shaft.

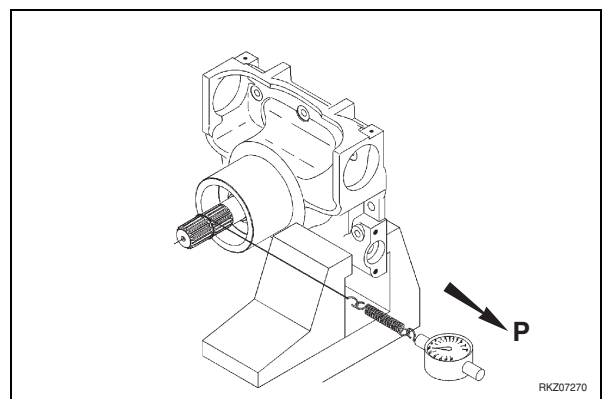
- ⚠ The force should be that needed for continual rotation.

Do not take into consideration the thrust force.

15 - Using the tools mentioned in point 13, tighten the lock nut (4) taking dynamometric measurements at intervals until the indicated force "P" has been obtained.

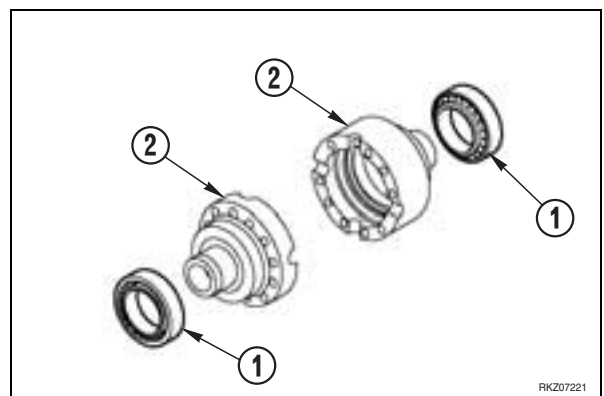
$$P = (9.2 - 13.7) \text{ daN}$$

If the maximum permissible value is exceeded, a new spacer must be fitted and all the bearing pre-loading operations must be repeated.

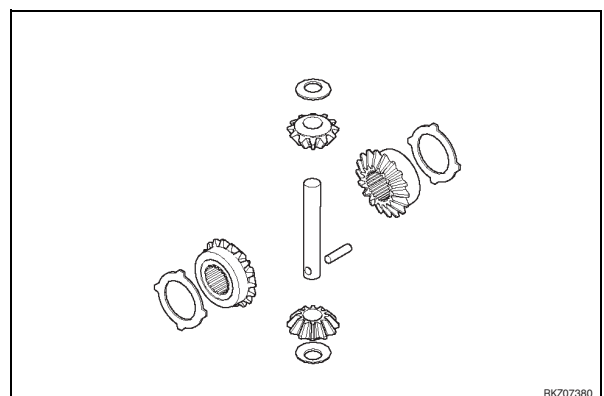


2. Differential group assembly

1 - Assemble the cones of the new taper roller bearings (1) on the half boxes (2), using the special tool **D10** and a hammer.



2 - After accurate cleaning and after checking both the operation conditions and the components wear, it is possible to assemble the differential parts.

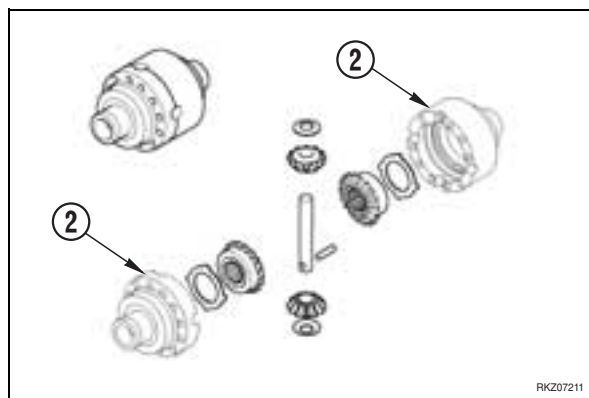


REMOVAL AND INSTALLATION

FRONT AXLE

- 3 - Position a half box on a workbench and assemble all its inner components (sun gears, planetary gears, thrust washers pin and differential lock counterdiscs) as illustrated in the figure.

Join the two half boxes (2).



- 4 - Position the ring bevel gear (3) and then fix the whole by tightening the screws (4).



Screw: 95 Nm



Screw: Loctite 270

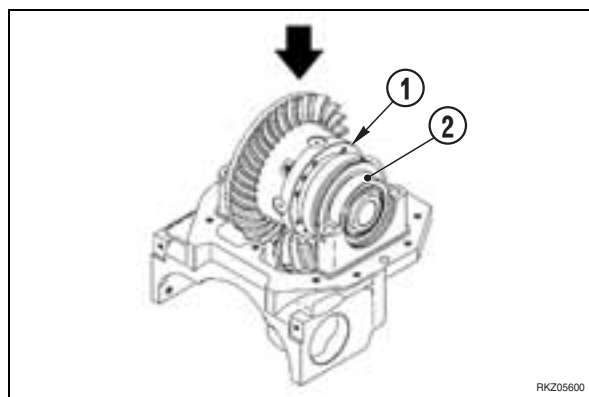


3. Differential carrier group assembly

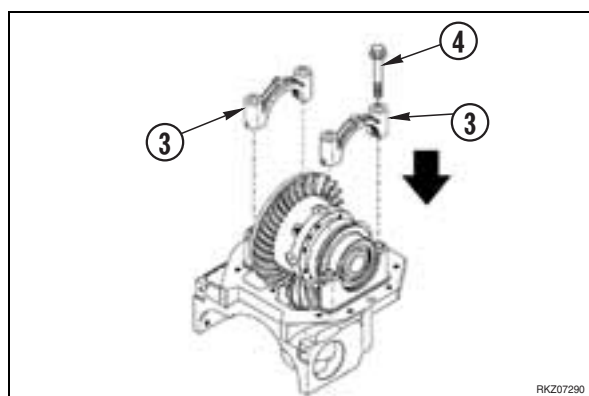
- 1 - Position the complete differential box (1), with the outer cups (2) of the tapered roller bearings already assembled, on the differential carrier.



Take care not to invert the outer races of the tapered roller bearings and check you are working on the right side of the bevel crown assembly.



- 2 - Place the differential group and the two halfbridles (3) and bolts in their seat. Check the right position of the halfbridles with the previously-traced reference marks. Position and tighten slightly the halfbridles bolts (4).

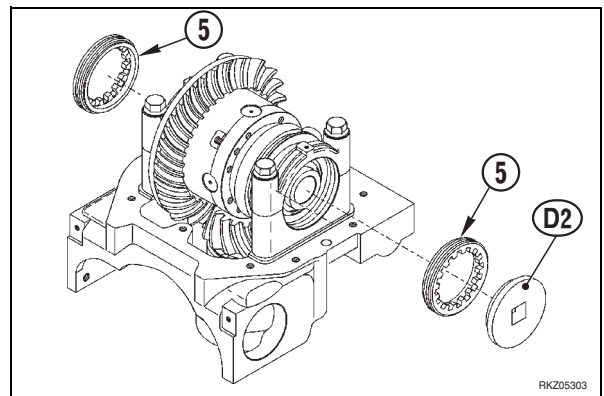


REMOVAL AND INSTALLATION

FRONT AXLE

- 3 - Assemble and tighten the two adjustment ring nuts (5) in the differential support with tool **D2**, so as to pre-load the differential bearings slightly. Knock lightly with a soft hammer in order to properly set the bearings in position.

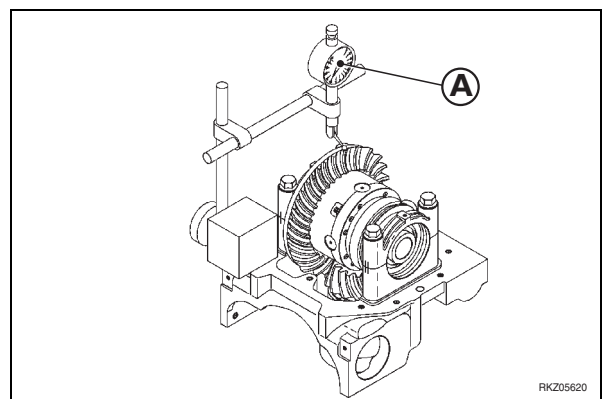
★ Take care not to reverse the ring nuts; align the previously-traced reference marks.



- 4 - Position a magnetic-base dial gauge "A" on the differential carrier, so that the feeler stylus touches the surface of one tooth of the crown gear with a 90° angle. Lock the pinion and move the crown gear alternatively and note the pinion-ring gear backlash, measured with the comparator.

Repeat the operation on 2 or more points (teeth), rotating the crown gear, so that to obtain an average value.

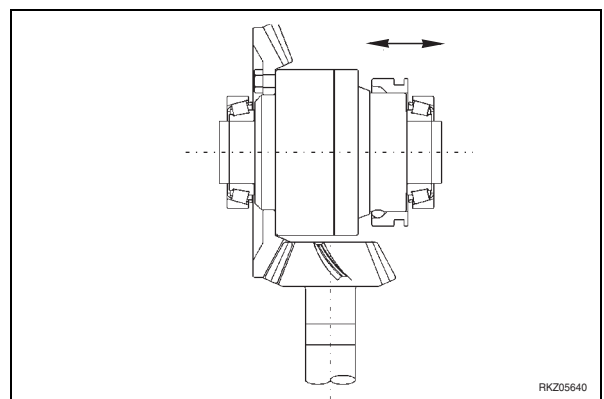
Permissible backlash: 0.18 – 0.25 mm



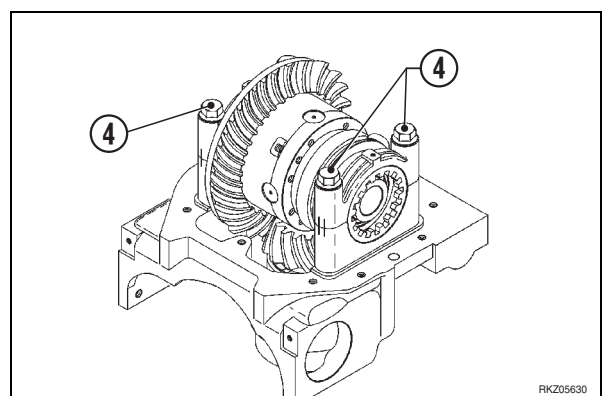
- 5 - If **the measured backlash is lesser** than the given tolerance range, screw the ring nut from the side opposite to the ring gear and unscrew the opposite one of the same measure.

If **the measured backlash is higher** than the given tolerance range, screw the ring nut from the side of the ring gear and unscrew the opposite one of the same measure.

★ Before measuring the clearance, knock lightly on the bearing covers with a mallet to ensure that they are securely positioned.



- 6 - Tighten screw (4).



REMOVAL AND INSTALLATION

FRONT AXLE

7 - Using the same method employed to check the pinion rotation torque, check the force "T" required to rotate the entire group.

★ Force required:

$$(P+3.9) < T < (P+5.9) \text{ daN}$$

P= the force found for the pinion

★ The force should be that of continual rotation. Do not take the thrust force into consideration.

8 - If the force is not within permissible limits:

a - Tighten both the lock nuts to the same extent to increase the force "T".

b - Loosen both the lock nuts to the same extent to decrease the force "T".

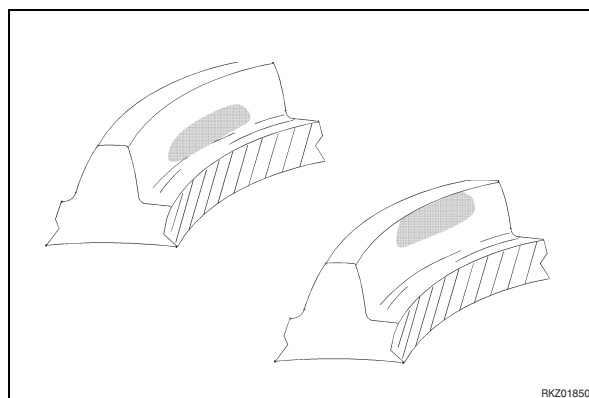
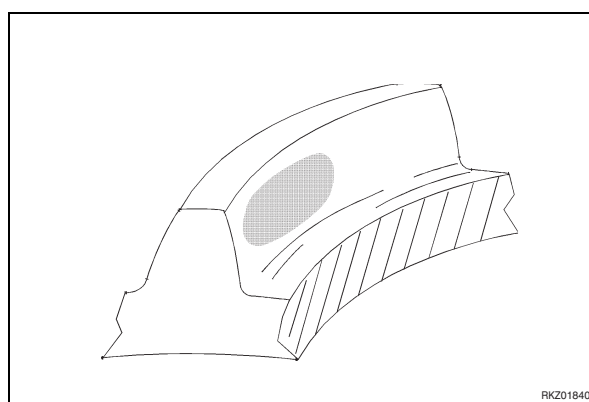
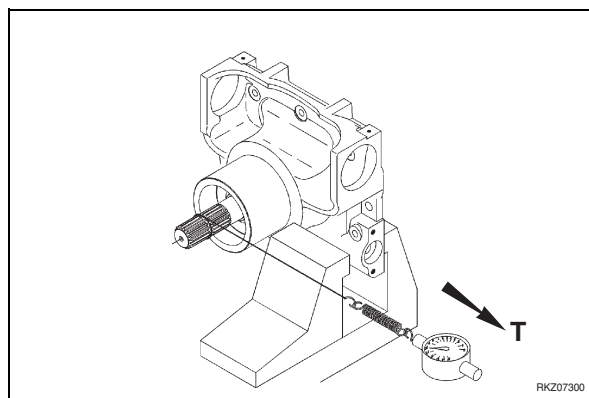
⚠ The clearance between the ring bevel gear and the pinion must remain within permissible limits.

9 - Check the centering of the contact area using the following procedure:

a - Coat both surfaces of the teeth of the ring bevel gear with a marking substance.

b - Rotate the pinion.

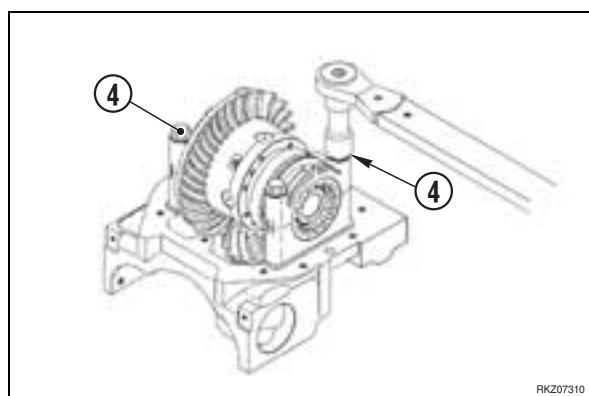
If the contact area is excessive near to the edge of the teeth, the ring bevel gear must be brought closer to the pinion. If the contact area is excessive on the side of the teeth, the ring bevel gear must be moved away from the pinion.



10 - Tighten the bolts (4).



Screw: 266 Nm

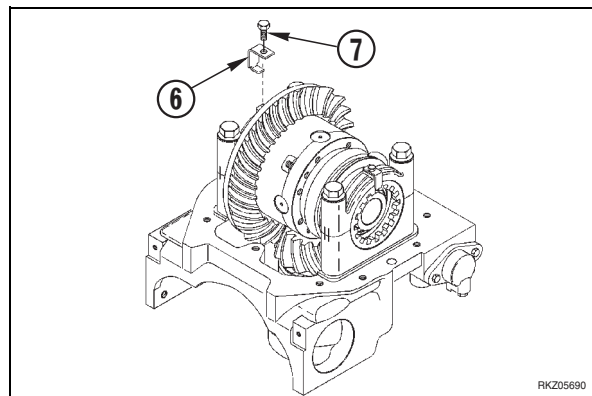


REMOVAL AND INSTALLATION

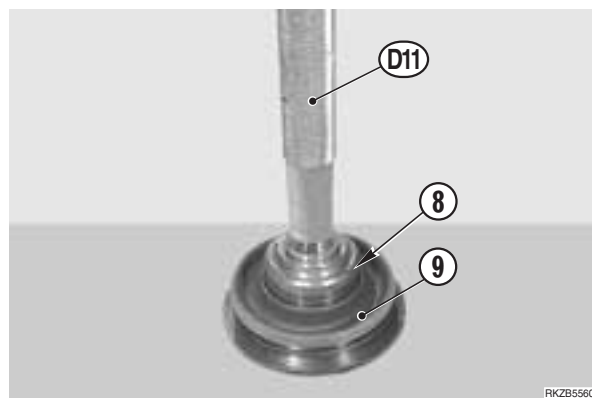
FRONT AXLE

11 - Once you have completed adjustment operations, fit the adjuster nut (6) retainers screws (7).

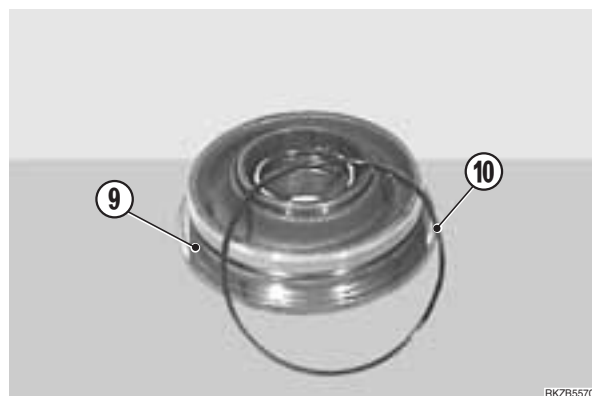
 Screw: 13 Nm



12 - Fit the seal ring (8) in the bevel pinion cover (9) with special tool **D11**.

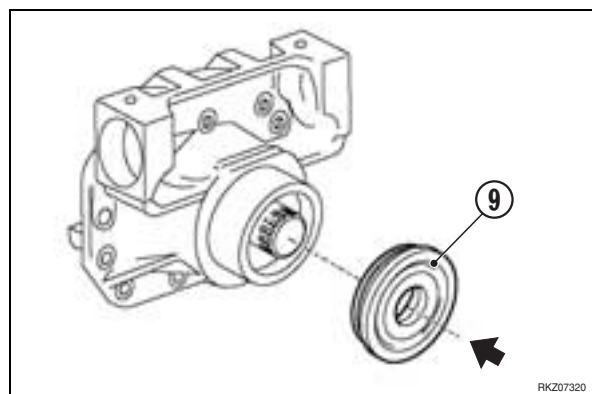


13 - Fit new O-ring (10) onto the bevel pinion cover (9).



14 - Assemble the bevel pinion cover (9) with a suitable beater.

★ Do not damage the O-ring (10).

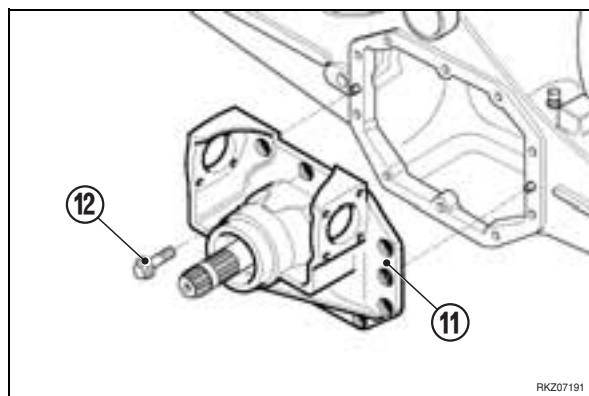


REMOVAL AND INSTALLATION

FRONT AXLE

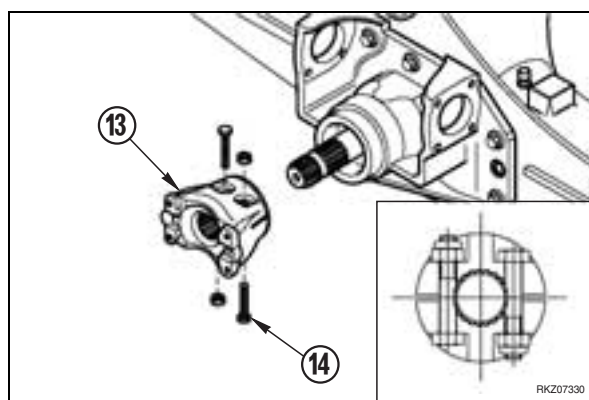
- 15 - Before matching two surfaces make sure they are perfectly clean. Degrease and clean with the appropriate cleaner. Spread a film of Loctite 510 on the contact surface between the axle beam and the differential carrier. Position the differential carrier (11) on the axle housing. Re-place and tighten retaining screws (12) to the prescribed torque with a torque wrench.

 Nm Screw: 169 Nm



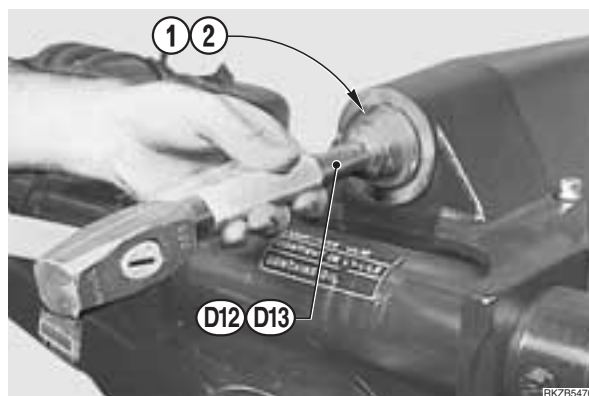
- 16 - Insert the flange (13) on the pinion end. Fit the flange fastening screws (14) with the relative nuts on the flange (13). Tighten screws and nuts with dynamometric wrench to the requested torque.

 Nm Screw: 56 Nm



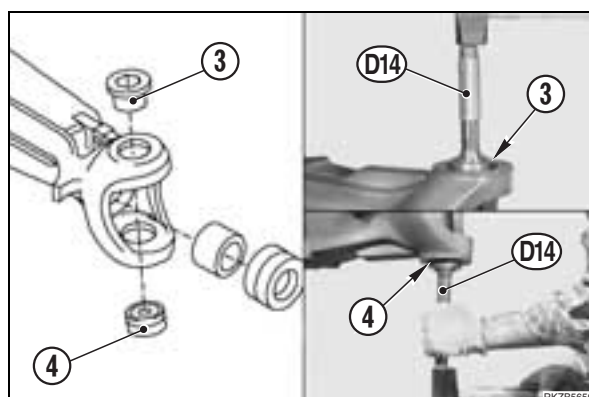
4. Axle beam group assembly

- 1 - Assemble two new bushings (1) respectively (assemble the longer bushing from the bevel pinion side) and two new seal rings (2) in the central unit pivot by using special tools **D12** and **D13**.



- 2 - Assemble the upper king pin bush (3) and (4) on the axle beam with the special tool **D14** and a hammer.

★ To make the assembly easier, it is suggest to cool the cup of the ball bearing at a temperature less than -100°C .

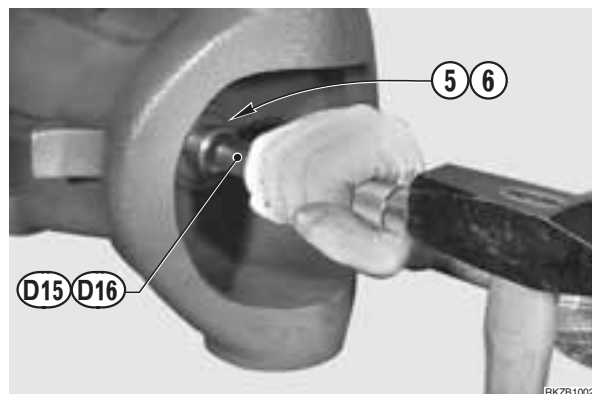


REMOVAL AND INSTALLATION

FRONT AXLE

3 - Assemble the bush (5) on the axle beam with the special tool **D15** and a hammer.

4 - Assemble the seal ring (6) on the beam with the special tool **D16** and a hammer.
Fill $\frac{3}{4}$ of the seal ring cavity with grease.



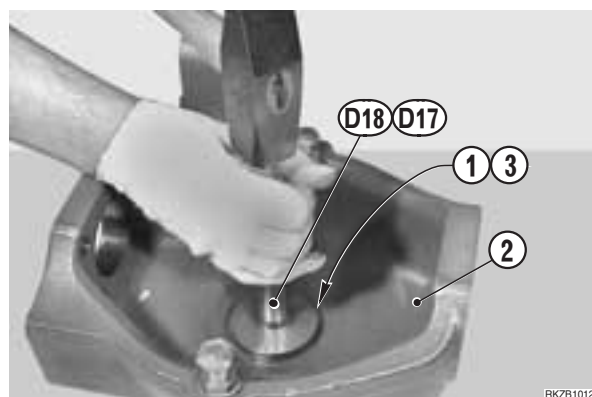
5 - Lubricate the bush (5) and the seal ring lip (6).
Insert the U-Joint (7) inside the axle beam.
★ Be careful not to damage the seal.



5. Wheel hub group assembly

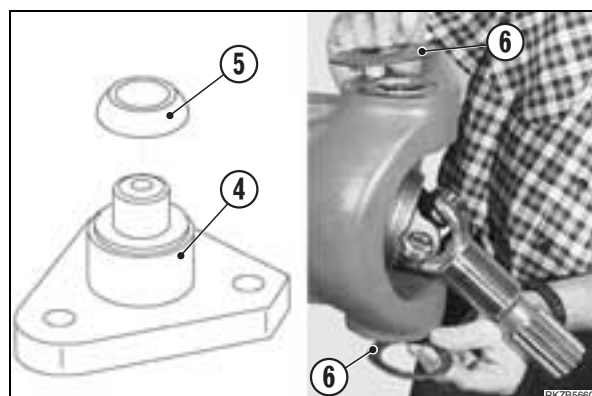
1 - Force the bush (1) into the swivel housing (2) with the special tool **D17** and a hammer or a press.

2 - Assemble the seal ring (3) on the swivel housing (2) with the special tool **D18** and a hammer.
Fill $\frac{3}{4}$ of the seal ring cavity with grease.



3 - Position the lower king pin (4) on a workbench and assemble the cone of the spherical joint (5) with the special tool **D19** under a press. Put the shim under the Belleville washer on the upper part.
Grease well the king pin housings with specific grease.

4 - Position the Belleville washers (6) on the king pin housings.



REMOVAL AND INSTALLATION

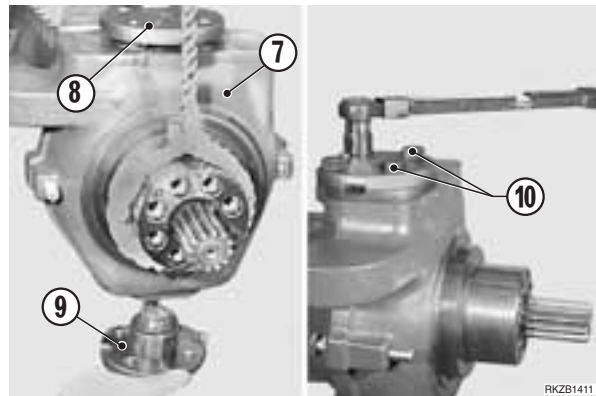
FRONT AXLE

- 5 - Secure the swivel housing (7) group with a rope.
Lubricate the seal ring lip and protect the splined end of the axle shaft by winding it with thin adhesive tape to avoid damage to the seal ring. After assembly, remove completely the adhesive tape. Assemble the swivel housing on the axle beam.

- 6 - Assemble the two king pins, the upper (9) and the lower (8), and tighten the retaining screws (10).

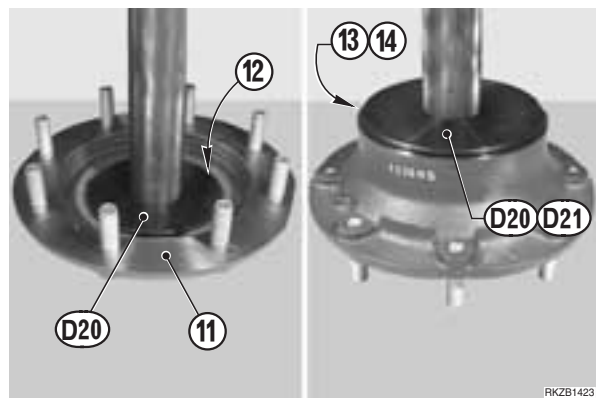
 Nm Screw: 190 Nm

- ★ Make sure that the Belleville washers remain in their position.



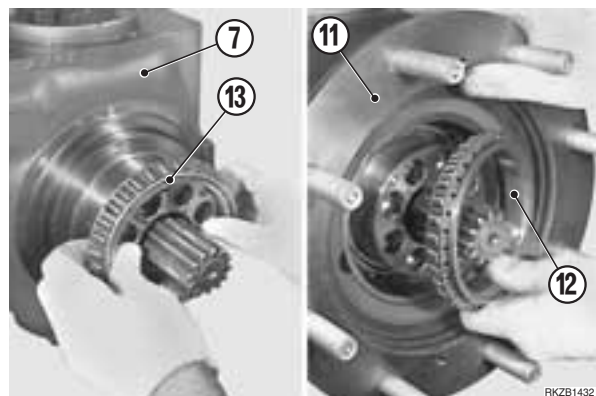
- 7 - Position the wheel hub (11) on a workbench and force both cups of the taper roller bearings (12) e (13) in position with the special tool **D20** under a press or with a hammer.

- 8 - Insert the seal ring (14) into the wheel hub (11) with the special tool **D21** and a hammer.



- 9 - Assemble the cone of the taper roller bearing (13) on the swivel housing end (7).

- 10 - Assemble the wheel hub (11) on the swivel housing (7) and fit the other cone of the taper roller bearing (12) in position.



- 11 - Position the wheel carrier (15) on a workbench and force the bushes (16) to the carrier surface level with the special tool **D1**.

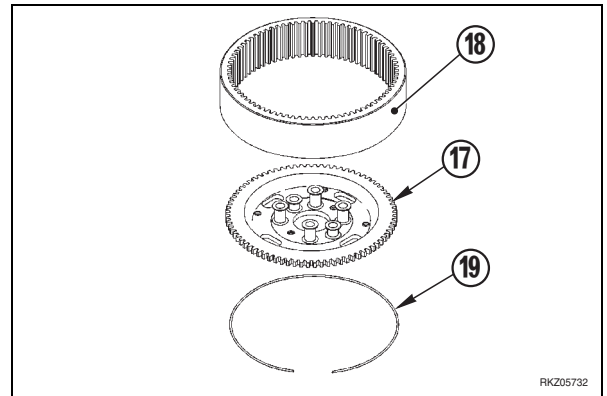
At least two bushes (diametrically-opposed) should be set slightly higher than the carrier surface level to be used as dowel pins.



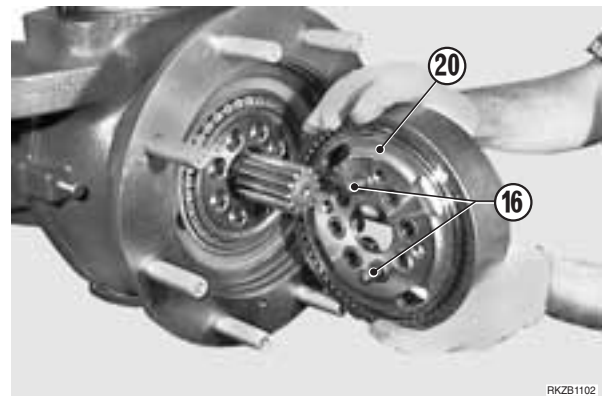
REMOVAL AND INSTALLATION

FRONT AXLE

- 12 - Preassemble the wheel carrier-epicyclic ring gear group (17) and (18) with the special locking ring (19) shown in figure.

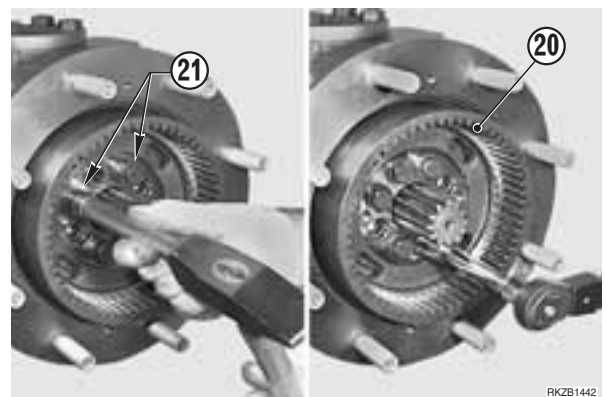


- 13 - Assemble the wheel carrier group (20) on the wheel hub using the two projecting bushes (16) as dowel pins and screw the relative screws in order to put in contact the ring bevel gear with the wheel hub.



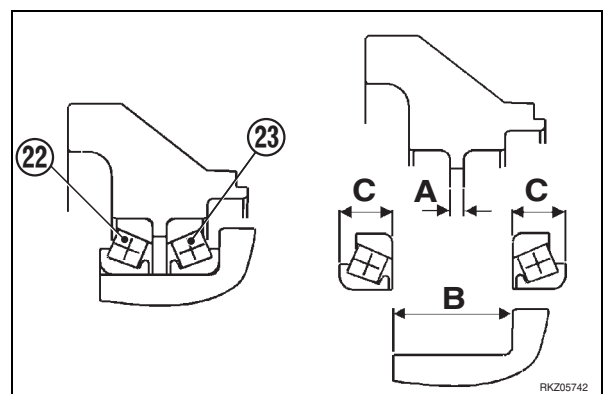
- 14 - Force all the hub dowel bushes completely with the special tool **D1** and a hammer. Assemble the wheel carrier (20) fastening screws (21) and tighten.

 Nm Screw: 230 Nm



- 15 - In the case the bearings (22) and (23) are substituted, verify that the measure "A", "B" and "C" are in the limits.

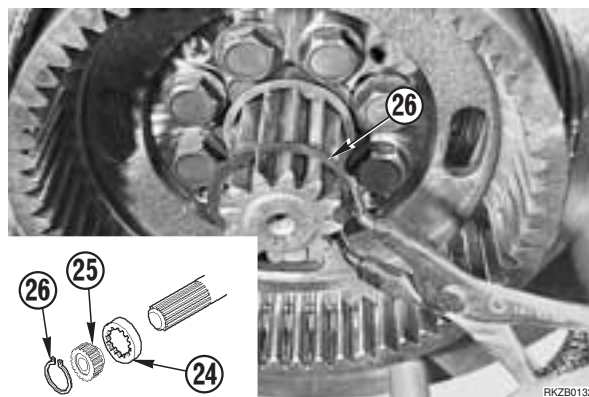
A = 17.950 – 18.000
B = 64.275 – 64.325
C = 23.070 – 23.172



REMOVAL AND INSTALLATION

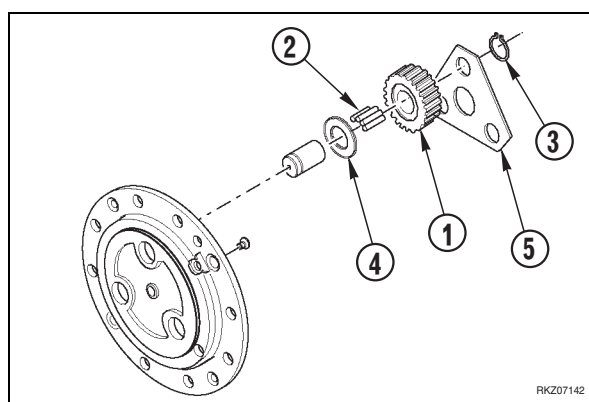
FRONT AXLE

- 16 - Slide the spacer (24) onto the axle shaft of the double joint, fit the sleeve (25) and assemble the lock ring (26) by inserting it at the end of the splined hub and pushing it into its housing.



6. Epicyclic reduction gear assembly

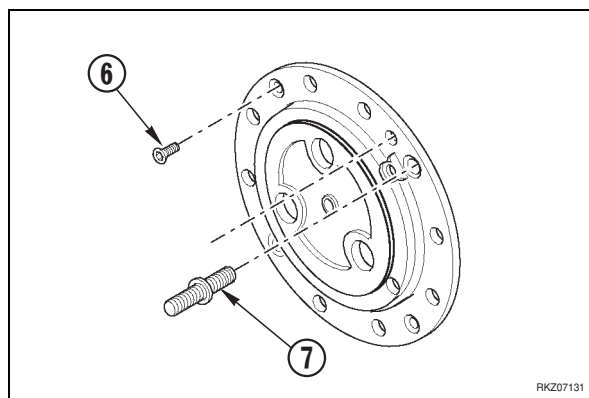
- 1 - Position the planetary carrier on a workbench.
- 2 - Insert the planetary gear (1) the rolls (2), the upper trust washers (3), the snap rings (4) and the plate (5) in the planetary carrier pins.



- 3 - Assemble the epicyclic reduction gear on the wheel hub.
Apply Loctite 542 on hub side thread of the 2 special stud bolts.
- 4 - Screw in the fastening screws (6) and the 2 stud bolts (7) and tighten with dynamometric wrench.

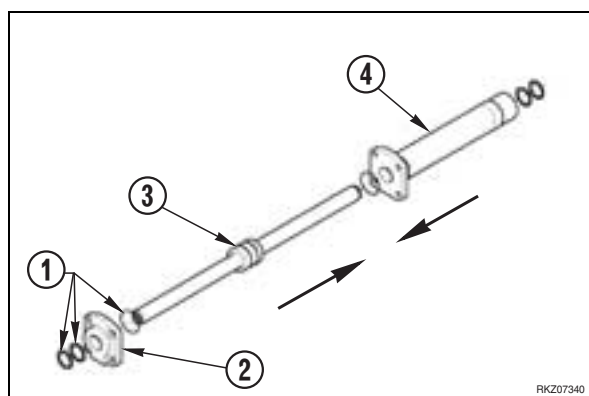
 Nm Screw: 80 Nm

 Nm Stud: 70 Nm



7. Steering cylinders group assembly

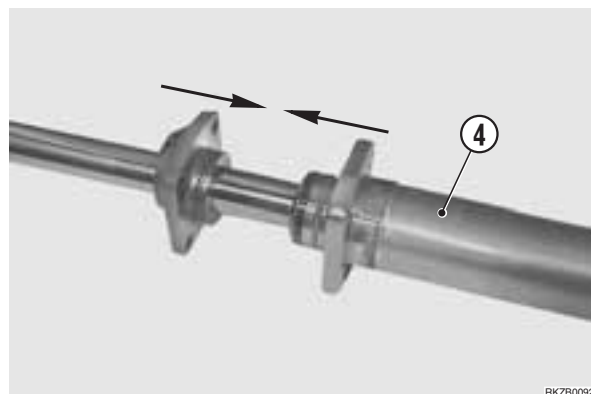
- 1 - Assemble new seal rings (1) on the cylinder head (2), on the piston (3) and on the cylinder body (4).



REMOVAL AND INSTALLATION

FRONT AXLE

- 2 - Slide pre-assembled rod into the cylinder body (4).



- 3 - Fit the guide rods (5) to the ends of the cylinder rod and tighten with dynamometric wrench.

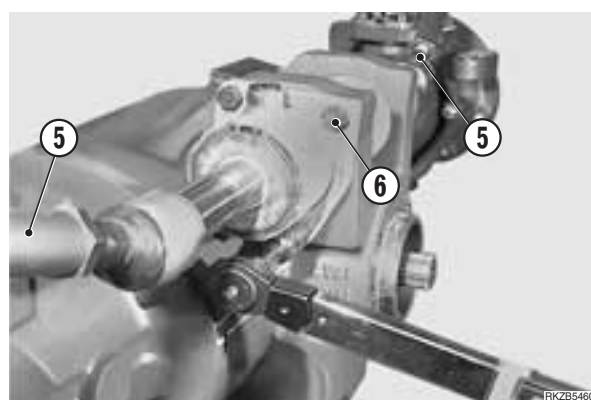
 Guide rod: 300 Nm

- 4 - Install the steering cylinder on the central body, with guide rods (5) already assembled on the stem.

- 5 - Install the spacer flange.

- 6 - Assemble and tighten the steering cylinder fastening screws (6) with dynamometric wrench.

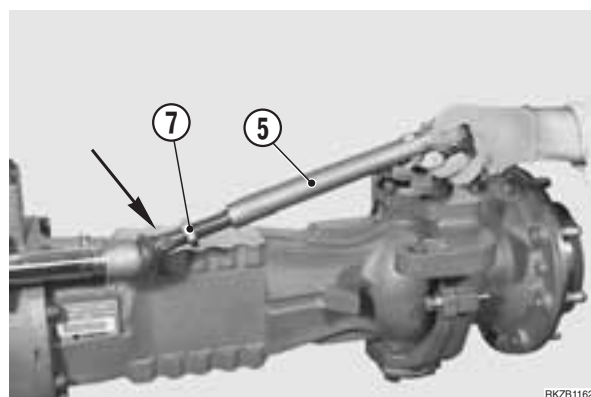
 Guide rod: 120 Nm



- 7 - Align the swivel housings with the axle (parallel wheel hub).

Screw the guide rod (5) so that the ball joint can be inserted into the swivel housing arm.

- ★ It is important to unscrew the locking nut (7) to carry out this operation.

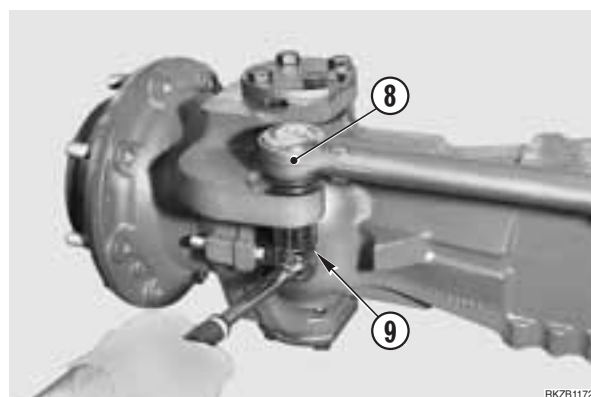


- 8 - Insert the ball joint (8) (into its own housing on the swivel housing).

Assemble and tighten the lock nut (9) with dynamometric wrench.

 Lock nut: 220 Nm

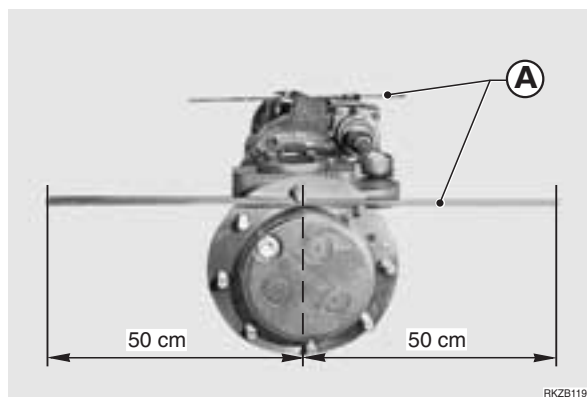
- 9 - Screw in the lock nut (7) of the guide rod (5) only when the toe-in adjustment has been carried out.



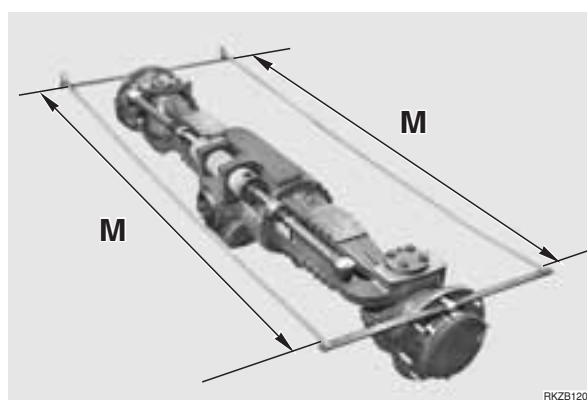
8. Toe-in adjustment

- 1 - Put two equal one-meter-long linear bars "**A**" on the wheel sides and lock them with two nuts on the wheel hub stud bolt.

★ The two bars should be fixed on their middle so that they are perpendicular to the supporting surface and parallel to the pinion shaft axis.
Align the two bars.



- 2 - Measure the distance in mm "**M**" between the bar ends with a tapeline. Keep the minimum value, swinging the measurement point.

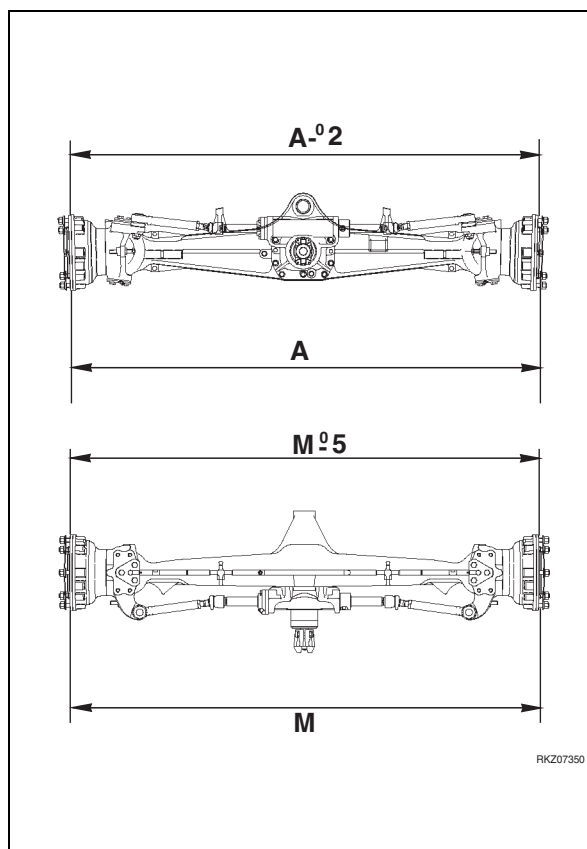


- 3 - Check that the difference of the measurements between the wheel hubs diameters ends is within the requested tolerance range.

The nominal toe-in (**A**) value is referred to the external diameter of the wheel hubs flange, therefore the measured toe-in value (**M**) at the bars ends must be related to the ratio between length of the bar and flange diameter.

$$\text{nominal toe-in} = A \div 2$$

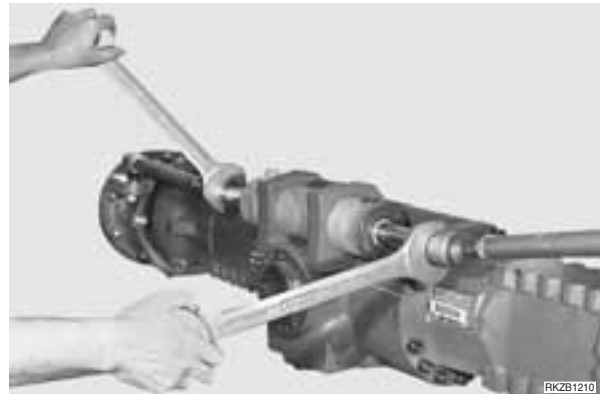
$$\text{measured toe-in} = M \div 5$$



REMOVAL AND INSTALLATION

FRONT AXLE

- 4 - If toe-in is incorrect, operate with two wrenches on the guide rods screwing in and out the two joint tie rods equally till the toe-in is within the requested tolerance.



- 5 - After adjusting, screw in the lock nuts of the guide rods.

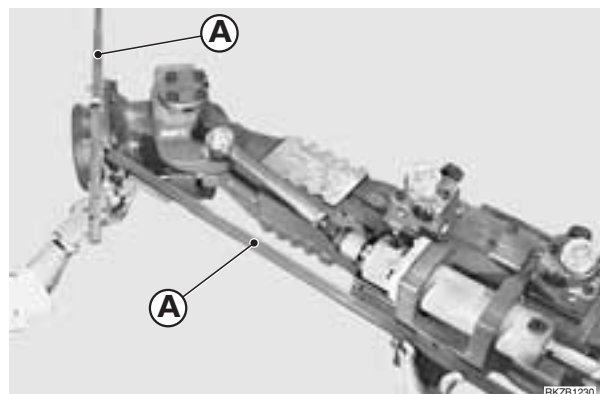


Lock nut: 250 Nm



9. Steering angle adjustment

- 1 - Use the same bars "A" assembled for the toe-in adjustment and a long bar perfectly leant over the machined part of the central body (pinion side), so that the two bars form an acute angle at the maximum steering.



- 2 - Adjust a goniometer to the angle of 50° and position it on the long bar.
Move a wheel side till it forms, with the two bars, the angle fixed by the goniometer.



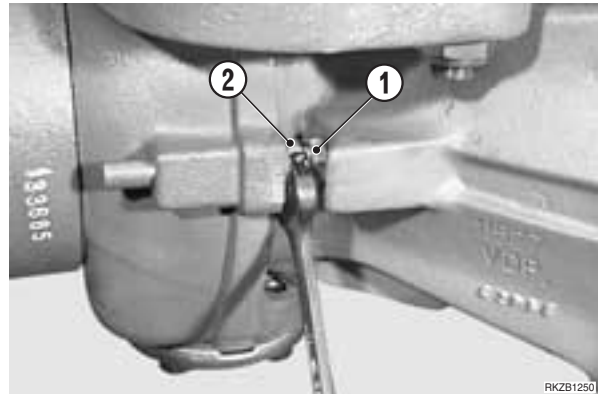
REMOVAL AND INSTALLATION

FRONT AXLE

- 3 - Adjust the steering mechanical retainer, screwing in or out the special screws (1) on the bar body, locking them with a locknut (2).

 Lock nut: 150 Nm

Steer completely towards the other side and repeat the same operations.

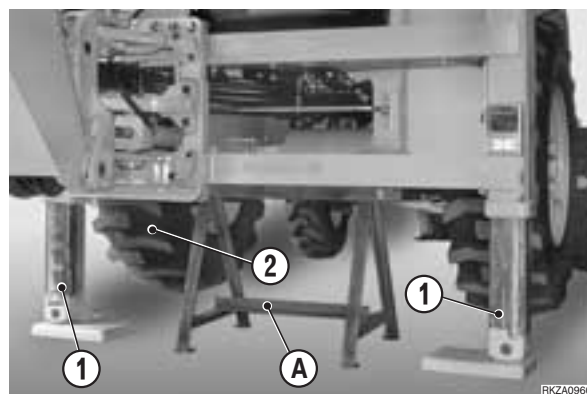


REMOVAL OF THE REAR AXLE

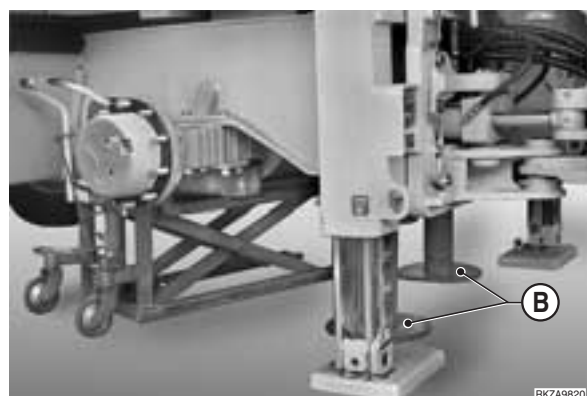
- 1 - Lower the backhoe outriggers (1) and force them downwards in order to raise the rear wheels (2) by approx. 5 cm.
- 2 - Prepare a safety stand "A", approx. 65 cm high, beneath the backhoe chassis. Pull up the outriggers until the machine is resting on the stand "A".
- 3 - Stop the engine and take off the rear wheels (2).



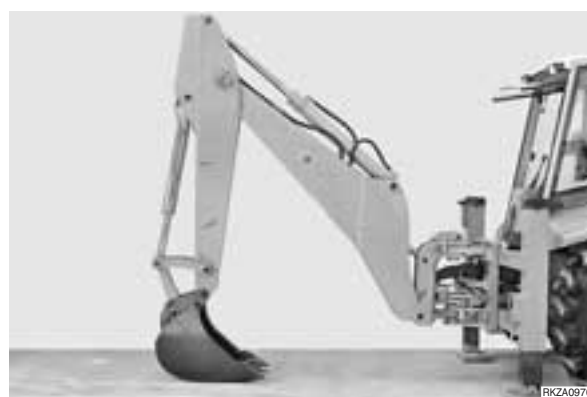
Wheel: 163 kg



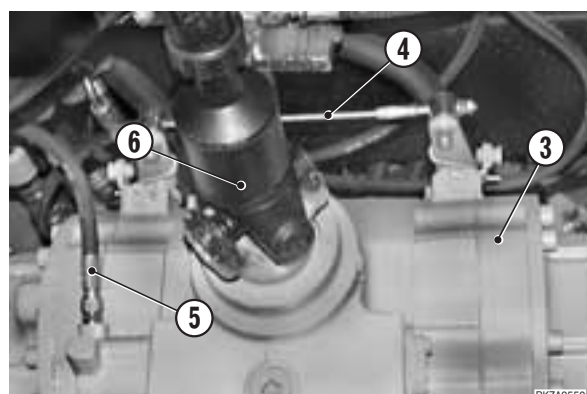
- 4 - Start engine, remove the stand "A" and set two stands "B" 50 cm high under the frame. Pull up the outriggers until the machine is resting on the stands "B" and return back the frame in horizontal position.



- 5 - For safety's sake, rest the backhoe bucket with its back on the ground, keeping the arm vertical. Also rest the front bucket on the ground.
- 6 - Stop the engine and completely release residual pressures from all the circuits. (For details, see «20.TESTING AND ADJUSTMENTS»).



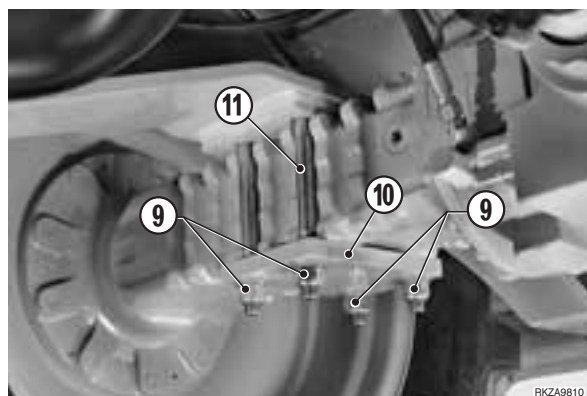
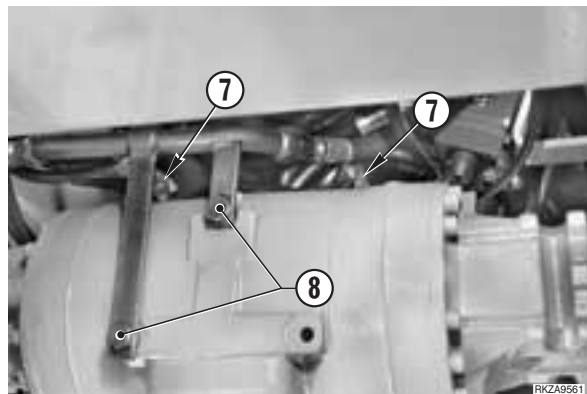
- 7 - Disconnect the working brake hoses (4) and the differential lock tube (5) from the rear axle (3).
- ★ Plug the pipes to prevent entry of impurities.
- 8 - Disconnect the cardan shaft (6) from the rear axle.



REMOVAL AND INSTALLATION

REAR AXLE

- 9 - Disconnect hoses (7) from axle and loose screw (8). ✖ 3
- 10 - Partially loosen the self-locking nuts (9) in order to eliminate the tightening torque and thus facilitate subsequent dismantling. ✖ 4
- ★ Loosen the nuts in criss-cross sequence.
- 11 - Place a jack "C" and some blocks beneath the axle (3). Raise the jack until the blocks can be forced under the arms of the axle.
- ★ Leave free the nuts (9) and plates (10) that secure the axle.
- ★ It should be possible to lower the jack by approx. 20 cm.
- 12 - Remove the self-locking nuts (9), the plates (10) and the screws (11).
- 13 - Lower the jack until the axle (3) is disengaged from the chassis.
- 14 - Extract the entire axle (3).



INSTALLATION OF THE REAR AXLE

- To install, reverse the removal procedure.

✖ 1



Wheel nuts: 500 ± 9.8 Nm

✖ 2

- ★ Adjust the stroke of the parking brake lever. (See «20. TESTING AND ADJUSTMENTS»).

✖ 3

- ★ Bleed the air from the braking circuits. (See «20. TESTING AND ADJUSTMENTS»).

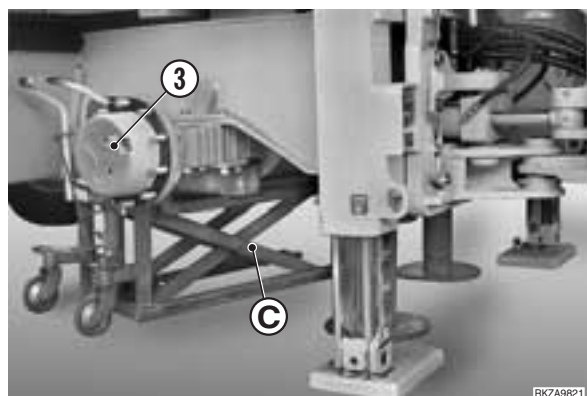
✖ 4



Self-locking nuts for securing axle: 570 Nm

- ★ Tighten in two stages, using the criss-cross method.

- 1 - Check the level in the tank and start the engine.



DISASSEMBLY OF REAR AXLE

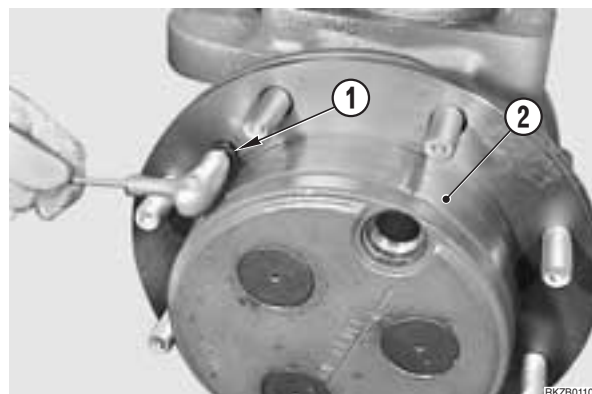
1. Epicyclic reduction gear disassembly

! Before draining the oil, position the hub with the plug on the upper part and loosen it of some turns in order to eliminate any possible inner pressure, and then remove it completely.

Turn the hub upside-down till the hole is in the lowest point.

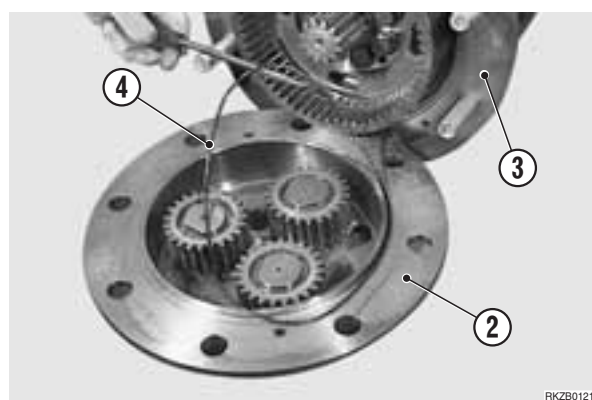
Drain the oil completely.

- 1 - Unscrew and remove the two fastening screws (1) of the planetary carrier (2) with a wrench.



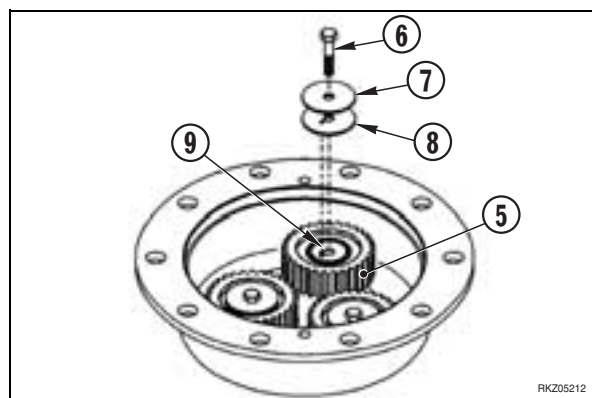
- 2 - Remove the planetary carrier (2) from the wheel hub (3). Position the planetary carrier on a table and check its wear conditions.

- 3 - Remove the O-ring (4) and check its conditions.



- 4 - To replace the epicyclic gears (5), if necessary, remove the screw (6) and relevant washers (7) and (8).

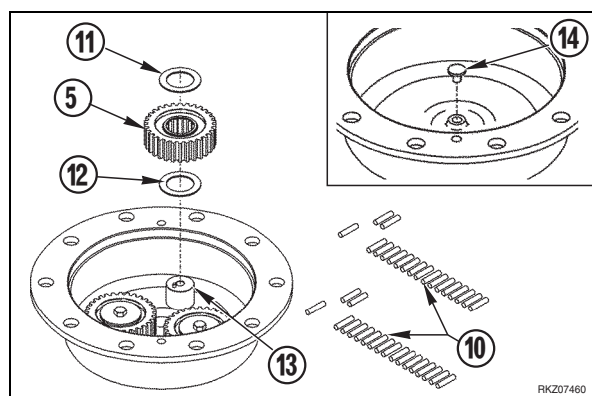
★ Treat the pin (9) with care.



- 5 - Remove the epicyclic gear (5) from its seat, taking care not to lose the two units of rollers (10) and thrust washer (11) and (12) inside it.

★ If the pins (13) of the pinion gears are in poor condition, replace the entire planetary train with pre-fitted pins.

★ If the halfshaft stop (14) is worn, replace the entire planetary carrier.



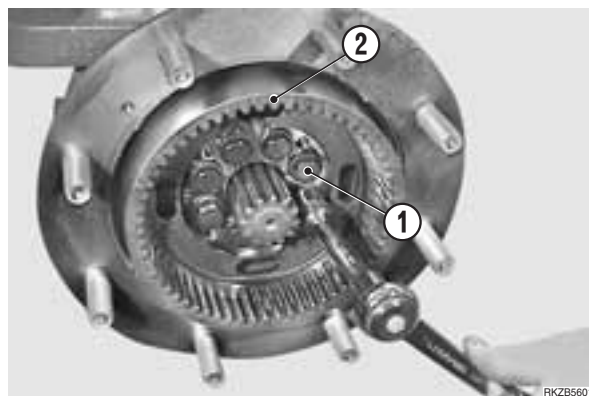
REMOVAL AND INSTALLATION

REAR AXLE

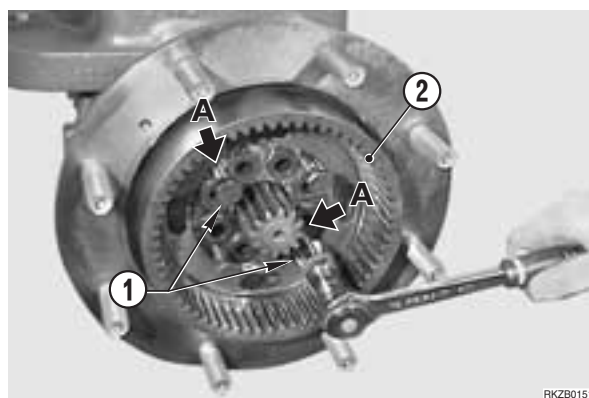
2. Wheel hub group disassembly

! Before disassembling the wheel hub, it is advisable to secure it with a belt or a rope on a hoist or any other supporting device, in order to avoid its accidental fall that could damage either the operator or the wheel hub group.

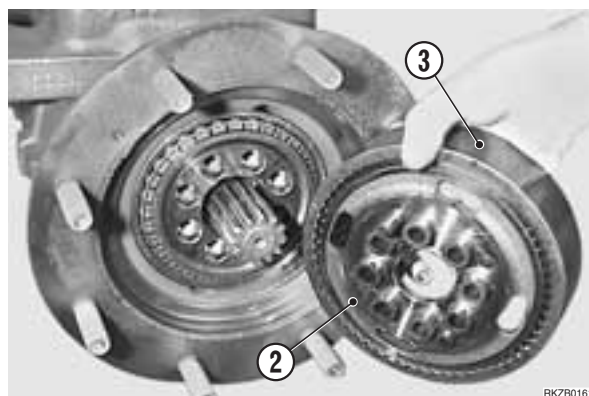
- 1 - Remove the short half-shaft.
Unscrew and remove the fastening screws (1) from the wheel the hub-lock ring gear (2).



- 2 - To remove the hub-lock ring gear (2) from its housing, screw at least two of the just removed screws (1) in the threaded extraction holes "A".

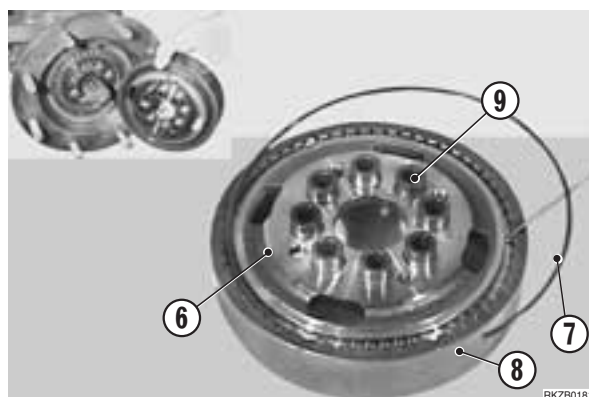


- 3 - Extract and remove the hub-lock ring gear (2) together with the epicyclic ring gear (3).



- 4 - Remove the steel stop ring (4) and disjoin the hub-lock ring gear (2) from the epicyclic ring gear (3).

- 5 - **Only if necessary**, remove the centering bushes (5) of the hub lock ring gear with a hammer and the special tool E1.

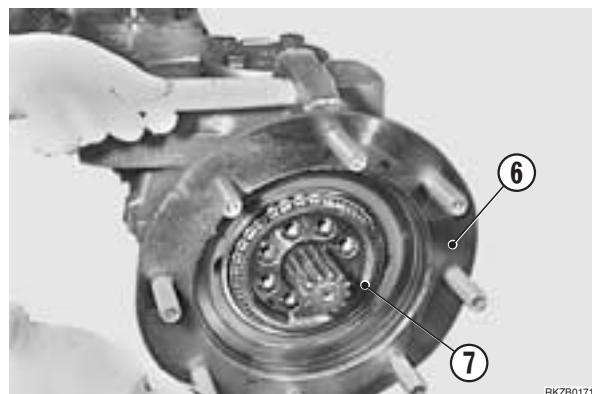


REMOVAL AND INSTALLATION

REAR AXLE

- 6 - Remove the hub (6), using levers and a hammer to facilitate the operation.

★ Collect the bearing (7) cone.

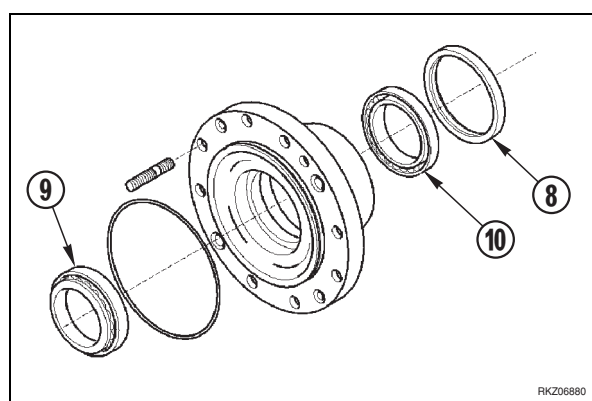


- 7 - Position on a flat surface the hub and take the seal ring out (8) with a lever.

★ This is a destructive operation for the seal ring.

- 8 - Take the bearing cups out (9) and (10), on both sides of the hub, using a hammer and a suitable tool to be beaten.

Remove the bearing (10) cone from the swivel housing end, using a suitable extractor.



3. Axle beam trumpets and brake groups disassembly

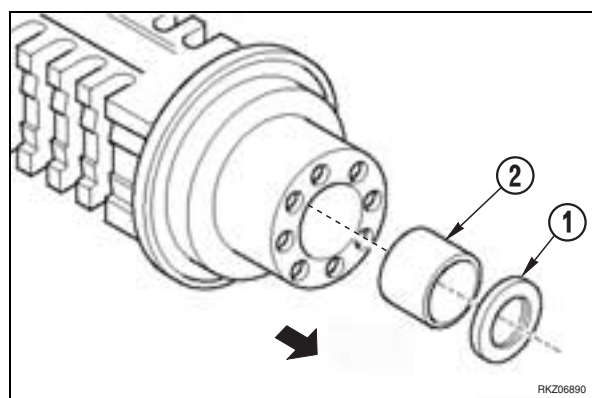
⚠ Drain oil from the axle, removing the breathers first, for to release the axle inner pression, then loosen the plug very carefully.

- 1 - Extract from the axle beam trumpet the seal ring (1) out with a lever.

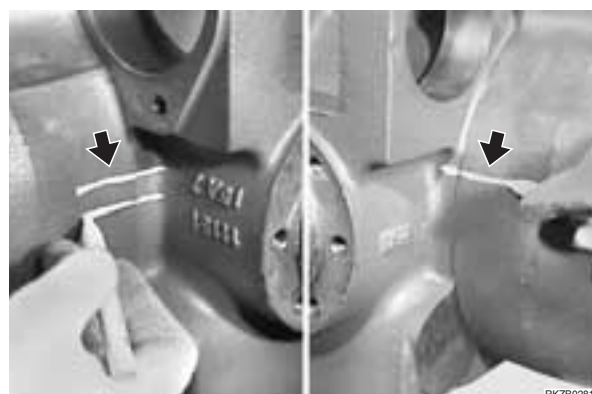
★ This is a destructive operation for the seal ring.

- 2 - In order to replace it inside the axle beam trumpet, the bushing (2) to be cut and destroyed with a chisel.

★ Do not ruin the bushing seat



- 3 - Put alignment marks on the axle beam body and on the differential supporting flanges, in order to identify the right side and the left side with certainty.



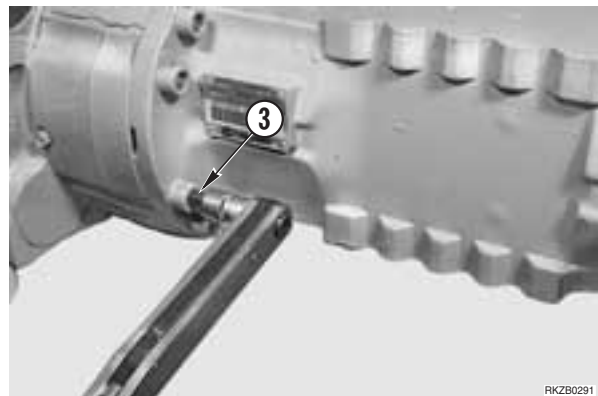
REMOVAL AND INSTALLATION

REAR AXLE

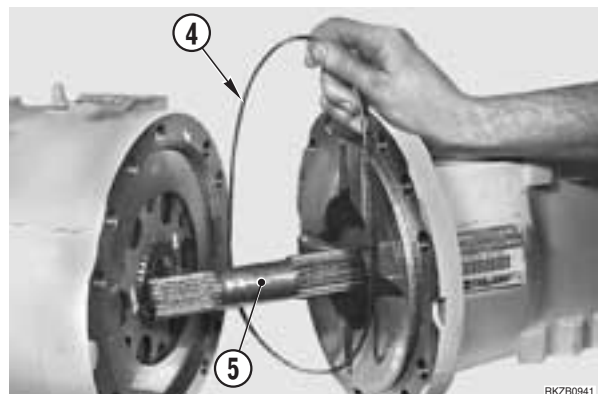
- 4 - Position the axle on supports fitted to hold either the central body or the two beam trumpets, even after their disjunction, or secure the three disjointed groups to a lifting device with ropes or belts.



- 3 - Unscrew the fastening screws (3) to disassemble the axle beam trumpet.



- 4 - Spread apart the axle beam trumpet.
★ Once the axle beam trumpet has been removed, the brake disks are free.
- 5 - Remove the O-ring (4) from its seat and the oil passage hole and check the conditions. Remove the long axle shaft (5) and the sleeve. Remove the snap ring from the sleeve.



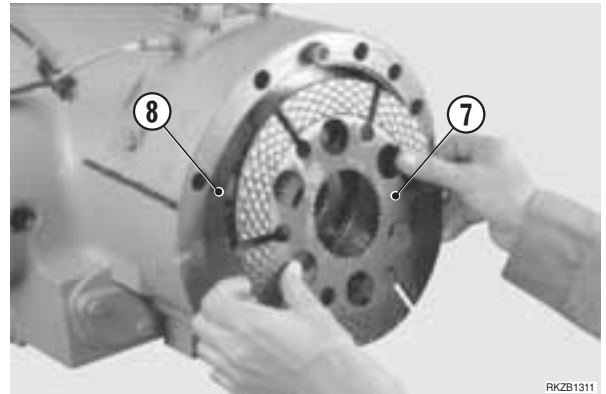
- 6 - Remove the first brake counter disk (6).



REMOVAL AND INSTALLATION

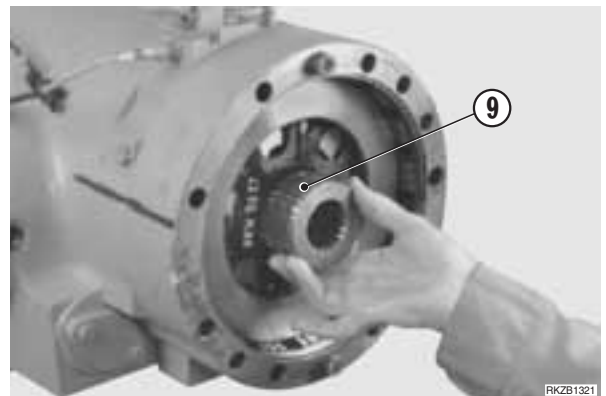
REAR AXLE

- 7 - Remove the other disks (7) and counter disks (8) as far as the brake splined sleeve, being careful how the different parts are positioned.

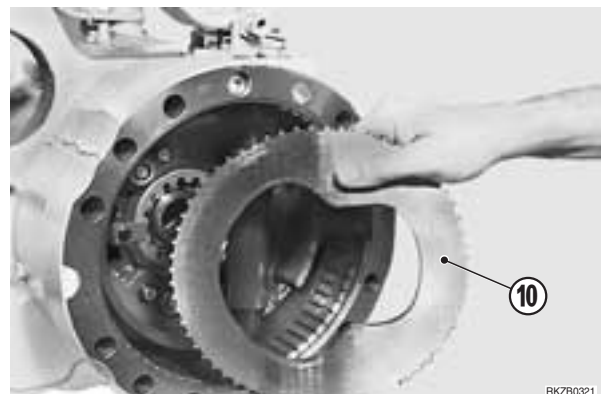


- 8 - Remove the brake splined sleeve (9), recording the indent position compared to the brake group.

- ★ The brake splined sleeve should be reassembled in the same position as the one before disassembling.



- 9 - Remove the last counter disk (10).

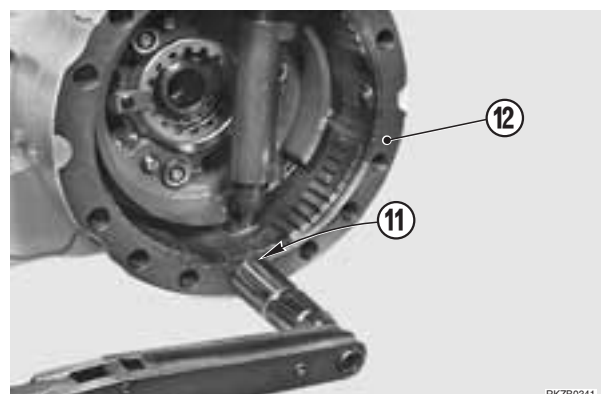


- 10 - Secure the brake flange to a hoist with ropes or safety belts.

Unscrew the lower screw (11).

Remove the differential supporting flange (12) from the central body, together with the bevel gear backlash-adjusting ring nut and the brake control unit.

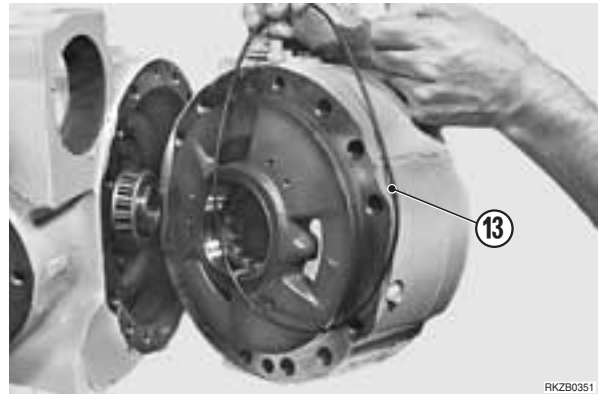
- ★ This operation frees the differential box, that must be kept to avoid its fall.



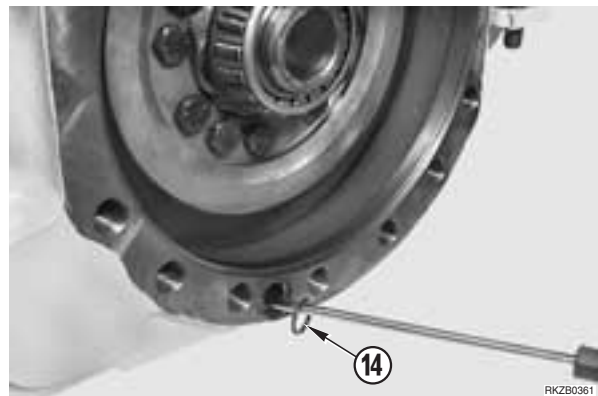
REMOVAL AND INSTALLATION

REAR AXLE

- 11 - Remove the O-ring (13) from its housing and check its conditions.

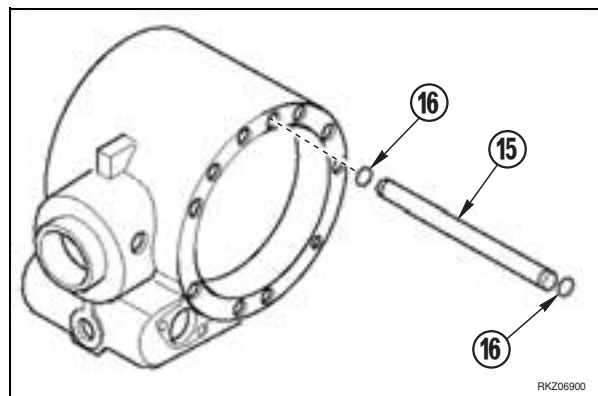


- 12 - Remove the O-Ring (14) from the two oil pipe holes and check its conditions.



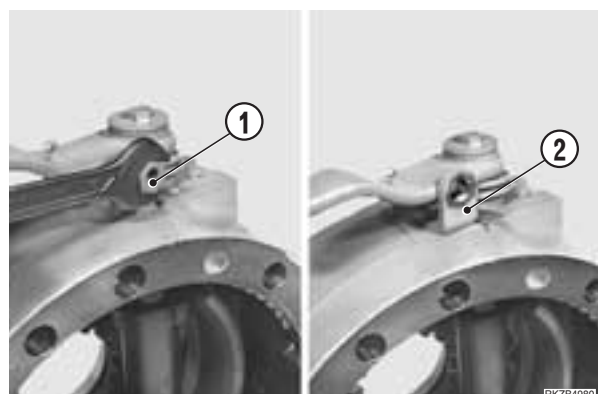
- 13 - Remove the oil blow-by tube (15) from the central body.

- 14 - Remove the O-Rings (16) and check their conditions



4. Brake control group disassembly

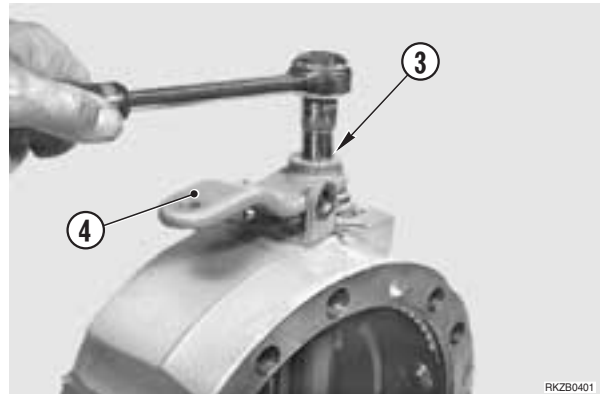
- 1 - Remove the brake group and position it on a workbench or fix it in a clamp.
- 2 - Unloose the locknut (1) and unscrew the adjusting screw on the supporting bracket (2). Remove the adjusting screw.



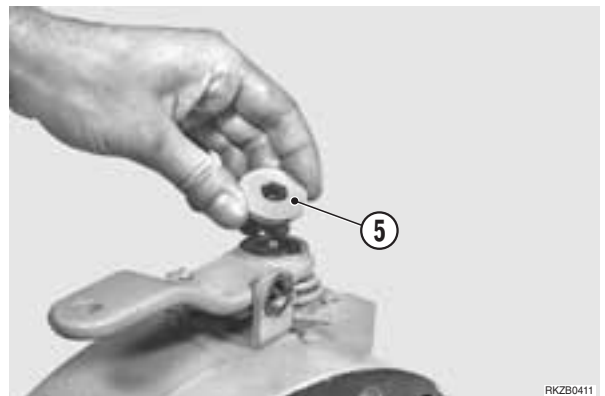
REMOVAL AND INSTALLATION

REAR AXLE

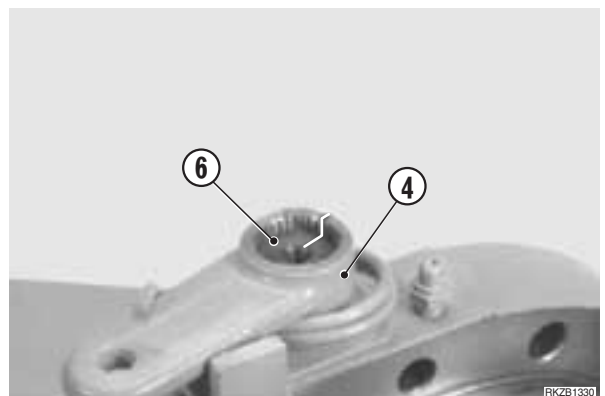
- 3 - Unscrew and remove the lever fastening screw (3) at the shaft end (4).



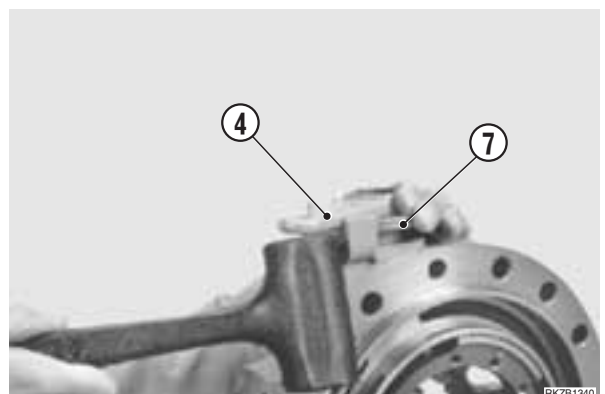
- 4 - Remove the washer (5).



- 5 - Put an alignment mark on the lever (4) and shaft (6) splines for use during installation and to distinguish between right and left control (for example: you can put two marks on the right and only one on the left).



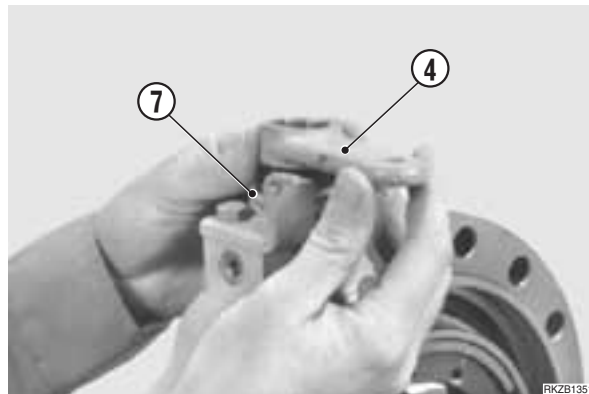
- 6 - Loosen the lever (4) to release the tension on the spring (7).



REMOVAL AND INSTALLATION

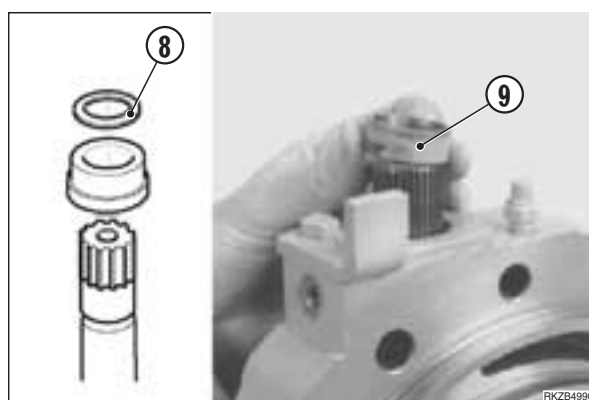
REAR AXLE

7 - Remove the lever (4).

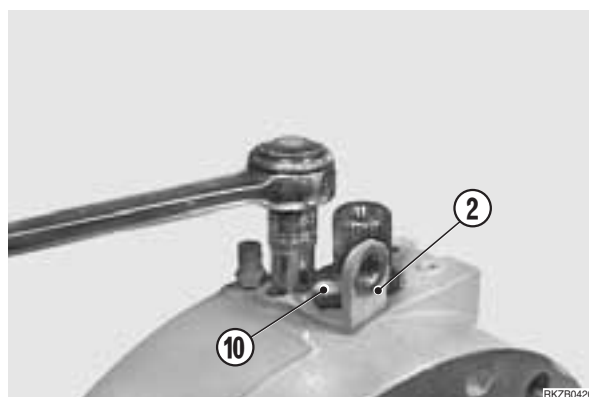


8 - Remove the spring (7).

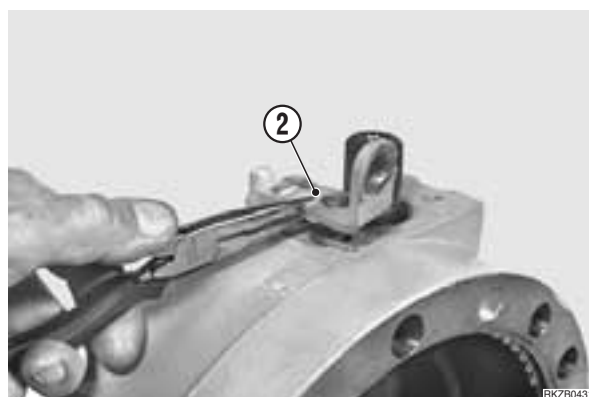
9 - Remove the washer (8) and the spacer (9).



10 - Remove the two bracket (2) fastening screws (10).



11 - Remove the bracket (2).

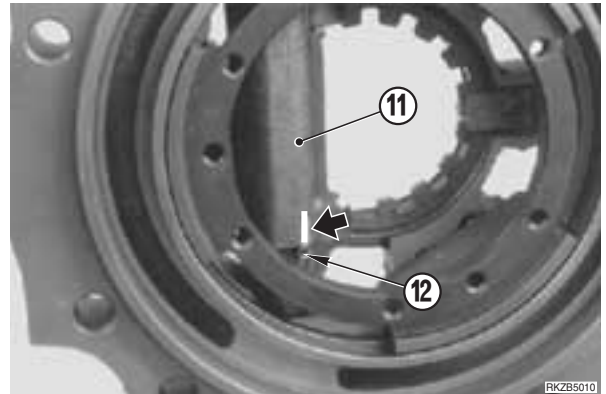


REMOVAL AND INSTALLATION

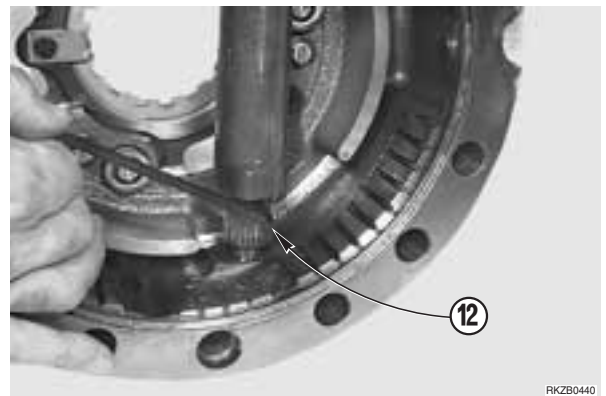
REAR AXLE

12 - Make an alignment mark on the cam (11) near the set-screw (12) align with the top of the roll pin, for use during assembly.

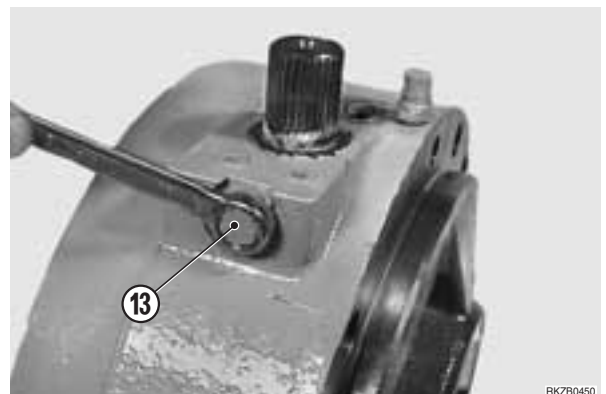
- ★ Distinguish between right operation side and left one.



13 - Free the cam unscrewing the setscrew (12).



14 - Unscrew the shaft setscrew (13), being careful the steel ball (14) does not get lost.



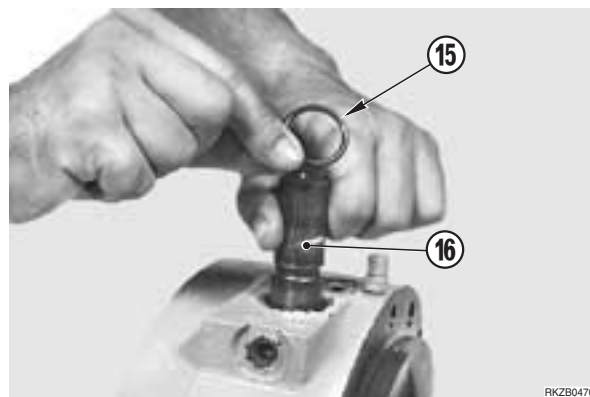
15 - Collect the steel ball (14).



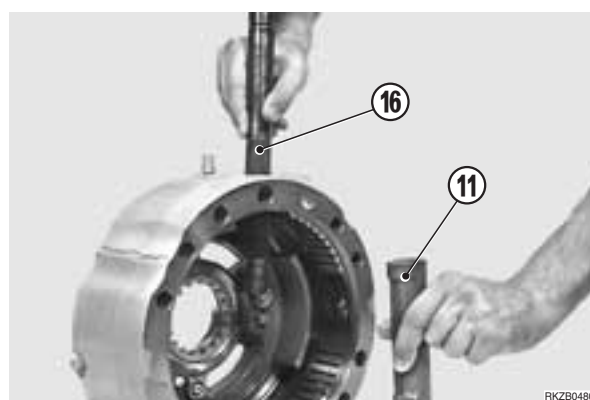
REMOVAL AND INSTALLATION

REAR AXLE

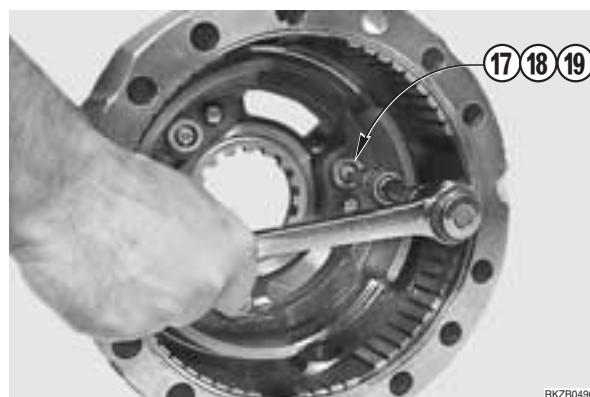
16 - Remove the O-Ring (15), taking the shaft (16) out.



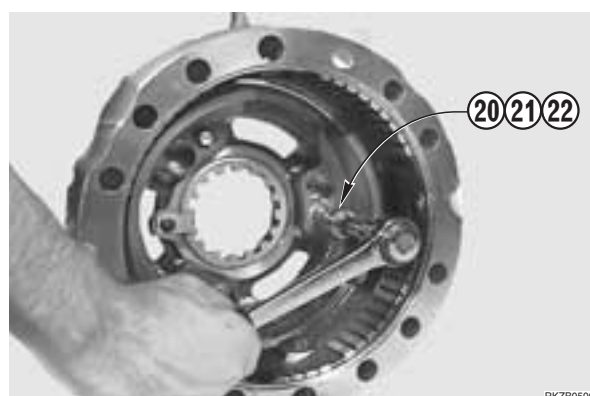
17 - Remove the shaft (16) and collect the cam (11).



18 - Unscrew the upper screws (17) of kit brake mechanism return and take the springs (18) and the bushes out (19).



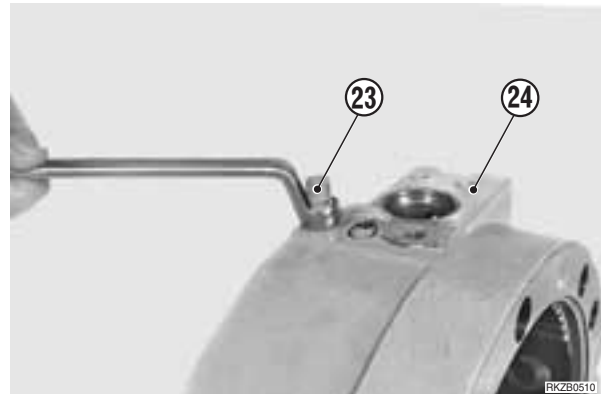
19 - Unscrew the lower self-adjust kit screws (20) and take the bushes (21) and the spacers (22) out.



REMOVAL AND INSTALLATION

REAR AXLE

20 - Unloose the brake flange (24) bleed (23).



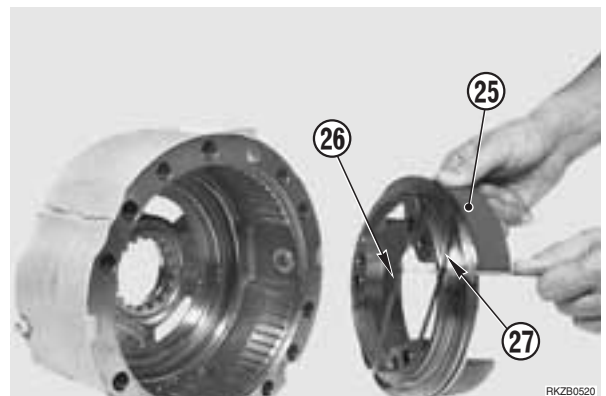
21 - Take the piston out (25).

If necessary, blow in air through the brake bleeder vent to eject the piston, using the minimum pressure.

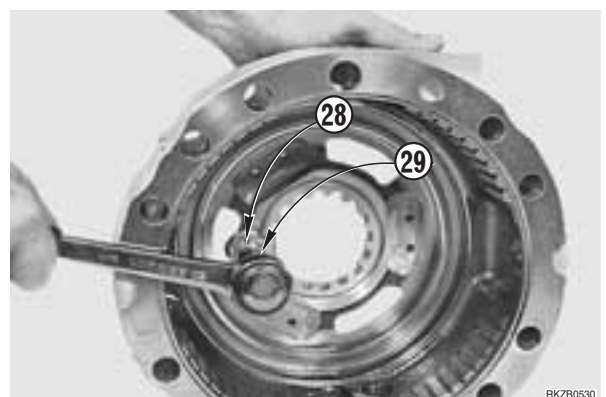
★ Possible swift ejection of the piston.



22 - Remove the O-Rings (26) and (27) from the piston (25) and check their conditions.



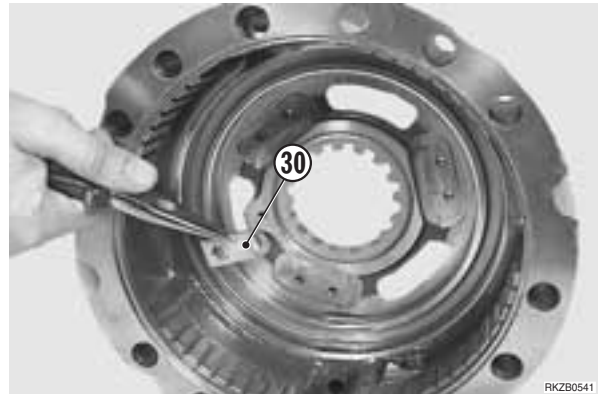
23 - Unscrew the fastening screw (28) of the ring nut retainer (29).



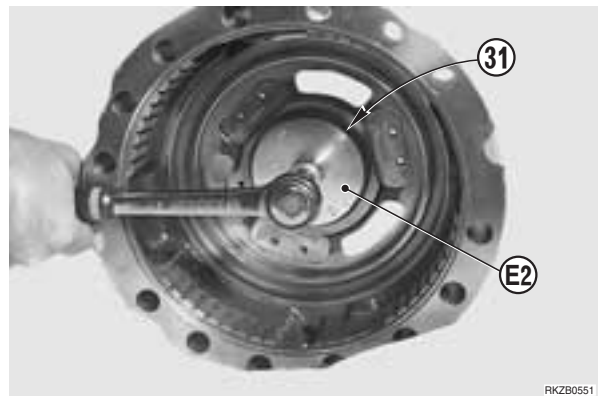
REMOVAL AND INSTALLATION

REAR AXLE

24 - Remove the ring nut retainer (30).



25 - Unscrew the ring nut (32) with suitable **E2** special tool. Remove the ring nut.

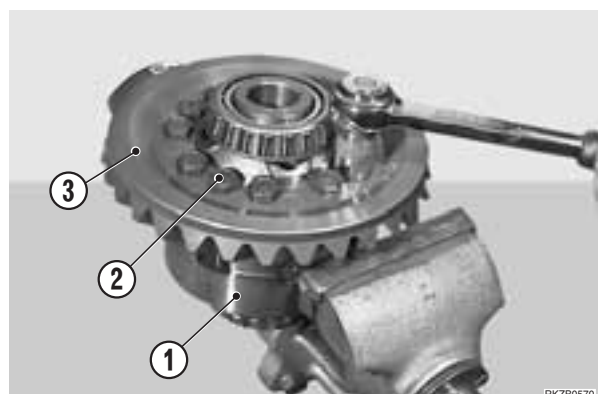


26 - Remove the bearing cup (31) with a hammer and a suitable tool.



5. Differential group disassembly

- 1 - Collect the differential and put it in a clamp. Unscrew all the fastening screws (1) of the bevel gear crown (2).
- ★ This will make both differential half boxes free, so take care not to drop the internal components.



REMOVAL AND INSTALLATION

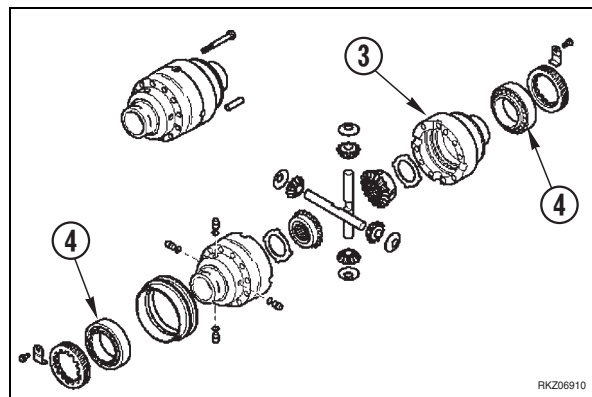
REAR AXLE

2 - Disassemble the differential box in two half boxes (3) complete with the relative components.

- ★ Mark the two half boxes (3) before disjoining them, in order to reassemble them in the same position as the one before disassembling.

3 - Disassemble all the components and check the operating and wear conditions of the components.

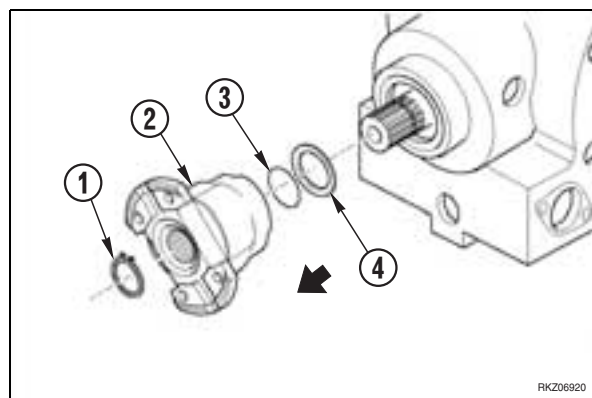
- ★ Take the bearing (4) out of the differential half box, using two levers or a three-hold extractor.



6. Pinion group disassembly

1 - Remove the snap ring (1) and slide the input flange (2).

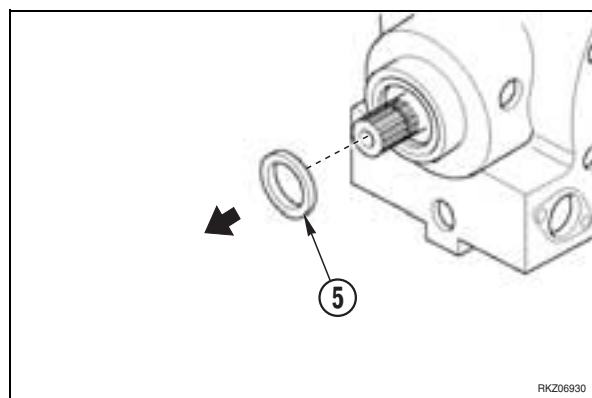
- ★ Collect the O-ring (3) and the shim (4).



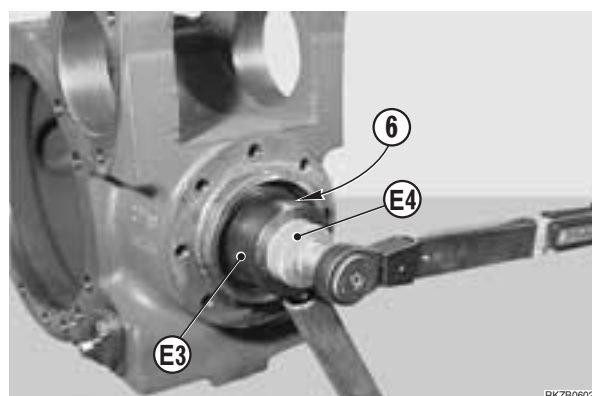
2 - Remove the seal ring (5) from the central housing with a puller.

- ★ This is a destructive operation for the seal ring.

3 - Position the central body on a steady plane, before disassembling it.



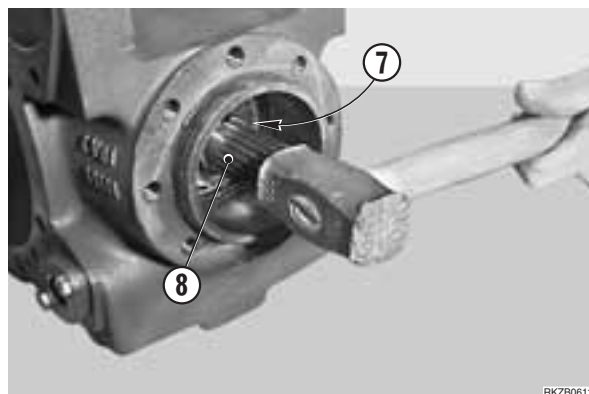
4 - Unscrew the ring nut (6) with the special tools **E3** and **E4**.



REMOVAL AND INSTALLATION

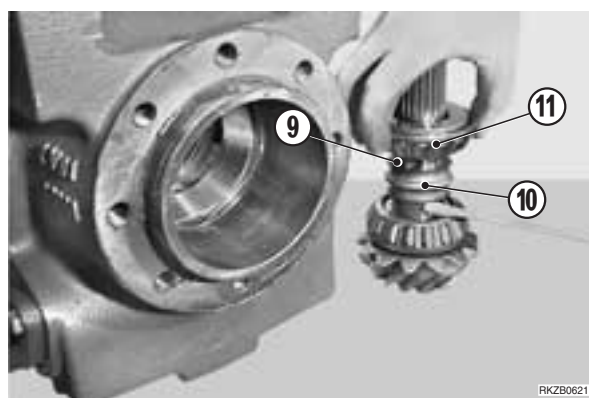
REAR AXLE

- 5 - Once the ring nut washer (7) has been removed, take the pinion (8) out of its housing, by beating with a hammer made of soft material on the splined end.



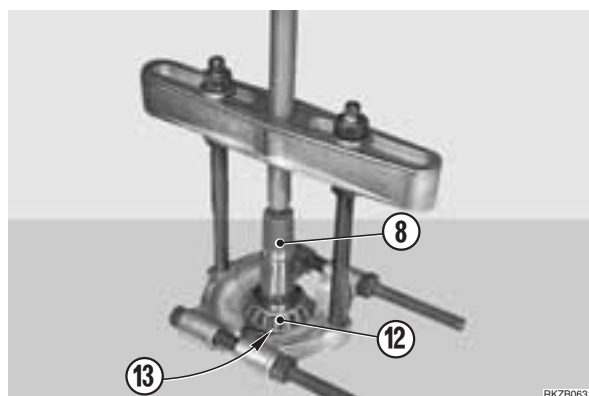
- 6 - Collect the washers (9), the elastic spacer (10) and the cones of the taper roller bearing (11).

★ When the elastic spacer is removed, it should be replaced by a new one.

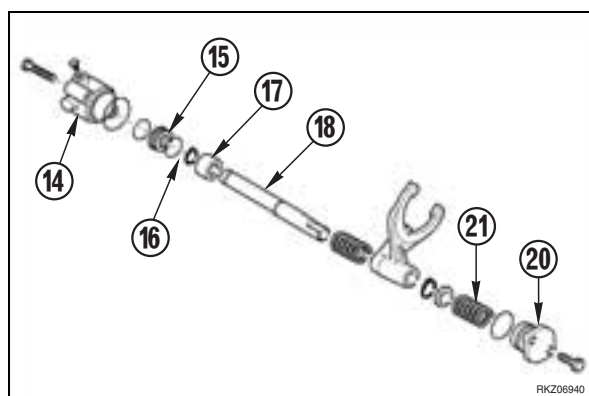


- 8 - Take the bearing (12) cone out of the bevel pinion (8) end, using a suitable extractor.

- 9 - Remove the adjusting shim (13) placed under the bearing and check its wear conditions.



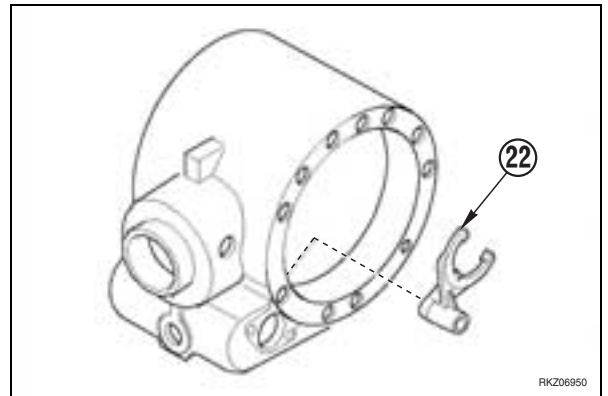
- 10 - In order to remove the differential lock device unscrew the cylinder support screws (14), then remove off it collecting the O-Rings and the piston (15). Remove the Seeger ring (16), holding the bush (17) that is pushed outside by the spring (19), remove off the bush and the spring from the shaft (18). Remove the cover (20) paying attention to the spring (21) that could still be under load. Remove off the shaft (18) by collecting the O-Ring, the spring, the spacer and the snap ring.



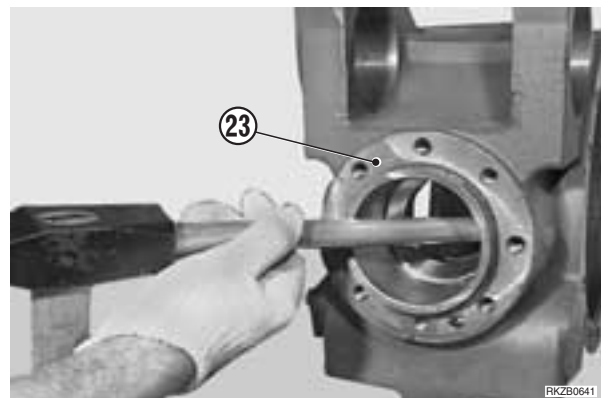
REMOVAL AND INSTALLATION

REAR AXLE

- 11 - Extract differential lock fork (22) from the central body.
★ Check the integrity of all components disassembled.



- 12 - Take the cups of the taper roller bearing out of the central body (23), using a chisel and a hammer.



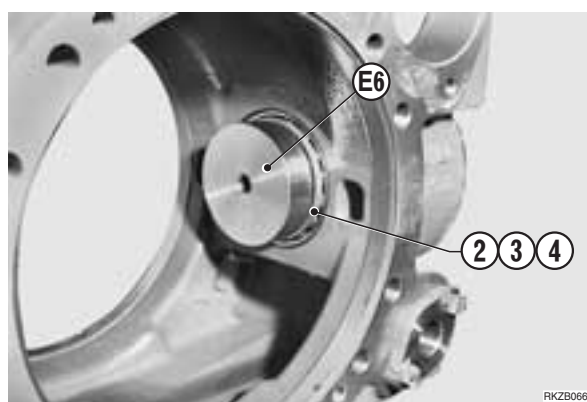
ASSEMBLY OF REAR AXLE

1. Pinion group assembly

- 1 - Position the central body (1) on a workbench.
- 2 - Insert the cups of the taper roller bearings on their housings using the special tools included on the kit **E5**



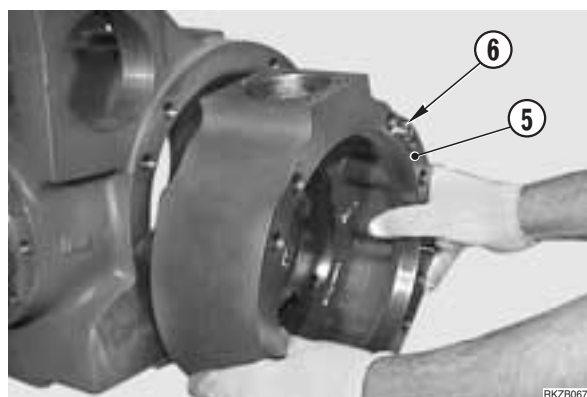
- 3 - In order to measure the distance, the kit composed of the special tools **E5** and **E6**, respectively called "false pinion" and "false differential box", is used.
- 4 - Insert the false pinion with **E5**, together with its bearings (2) and (3) and its ring nut (4), in the just mounted housings for the bearings. Tighten without exceeding, till the backlash is eliminated.



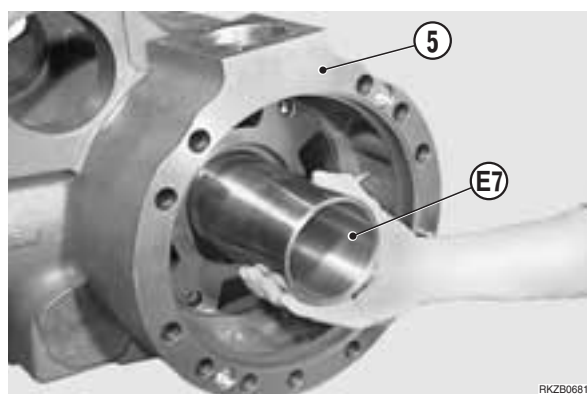
- 5 - Check the correct positioning of the right and left flanges, using the reference marks on them and on the central body. Assemble the two brake flanges (5) and fix them with their screws (6) M14X120.

 Screw: 79 Nm

- ★ Screw in at least two ones diametrically-opposed for each flange).



- 6 - Insert the false differential box with **E6** into the central body to measure the distance. Check that the false box is inserted in both brake flanges' housings (5).



REMOVAL AND INSTALLATION

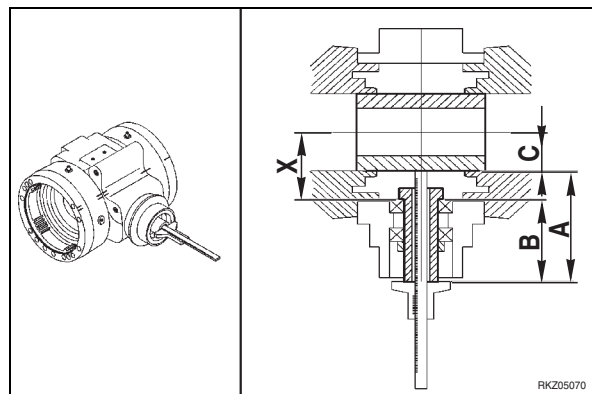
REAR AXLE

- 7 - Carry out the measurement "A" with a depth gauge through the suitable false pinion hole and calculate the measure "X".

B = 100 mm

C = 50 mm

$$(A+C) - B = X$$

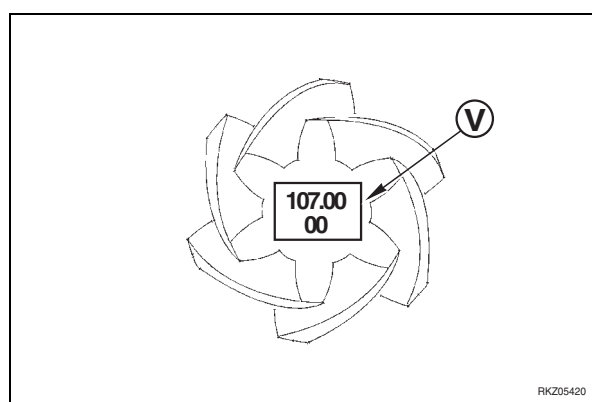


- 8 - Make a note of the value "V" marked on the head of the pinion.

Calculate the thickness "S" to be installed beneath the pinion, using the formula:

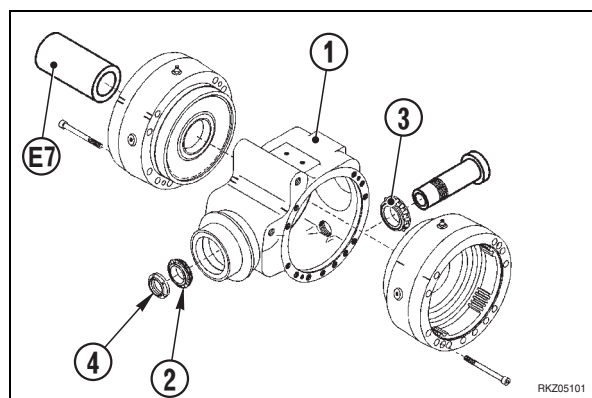
$$S = X - V$$

- ★ "S" is the thickness of the shim.



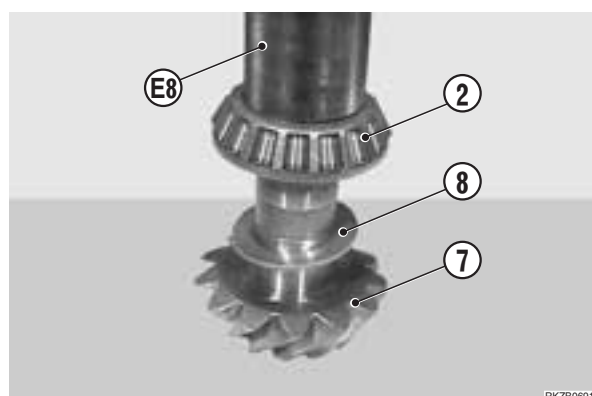
- 9 - Remove the false pinion, the bearings (2) and (3) and the ring nut (4) from the central body (1).

Disassemble the false differential box from the flanges (5) and then unscrew the screws to remove the flanges.



- 10 - Mount the shim (8) onto the pinion (7) and press the inner bearing (2) using the tool **E8**.

- ★ Use always a new elastic spacer.

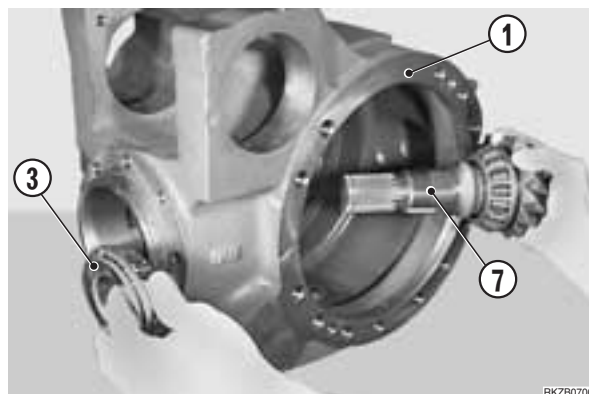


REMOVAL AND INSTALLATION

REAR AXLE

- 11 - Insert the bevel pinion unit (7) into the central body housing (1) and the second bearing (3) cone into the pinion end.

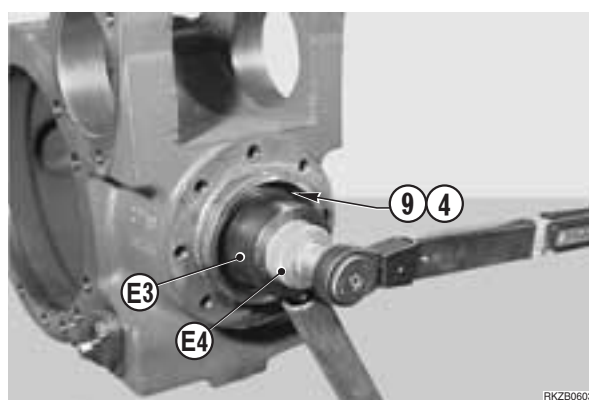
In order to force the bearing into position use the special tool **E8** and a hammer.



- 12 - Insert into the pinion shaft (7) a new ring nut washer (9) and the ring nut (4) retainer.

- 13 - Screw the ring nut in, using the wrench for ring nut **E3** and for pinion retainer **E4**.

- ★ The torque setting is given by the preloading measurement on bearings.
- ★ Tighten the ring nut step by step.
- ★ If it is tightened too much, the elastic spacer should be replaced and the procedure repeated.



- 14 - Carry out the preloading measurement **P** of the pinion taper roller bearings, using a dynamometer whose cord is wound on the 34.87 mm diameter of the pinion spline.

- ★ The adjustment is carried out by increasing the ring nut torque setting gradually, being careful not to exceed.
- ★ All preloadings should be measured without the seal ring.

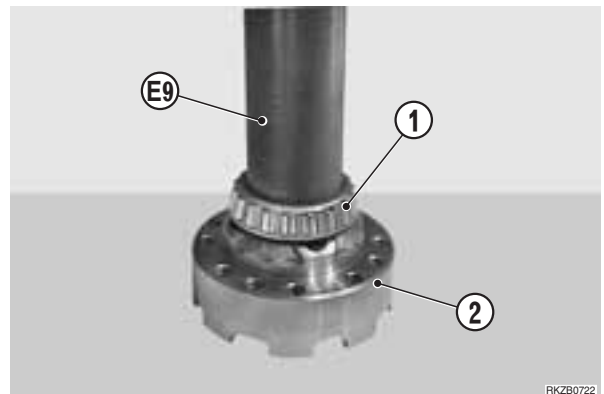
- 15 - Once you got the requested preloading value, caulk the ring nut, using a hammer and a chisel.

P=9.2–13.8 daN

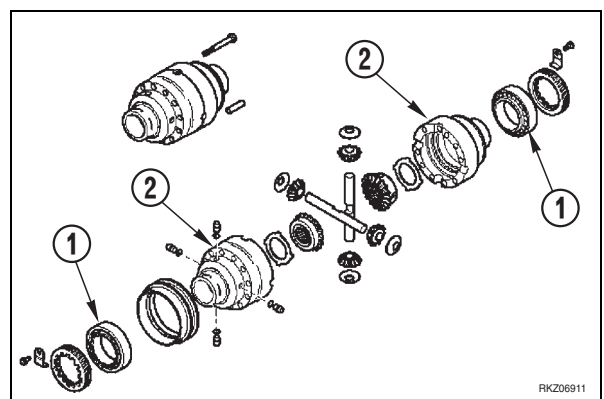


2. Differential group assembly

- 1 - Assemble the cones of the new taper roller bearings (1) on the half boxes (2), using the special tool **E9** and a hammer.



- 2 - Position a half box (2) on a workbench and assemble all its inner components (sun gears, planetary gears, thrust washers, pins, discs and counterdiscs) as per figure. Join the two half boxes (2), aligning the reference marks made upon them.



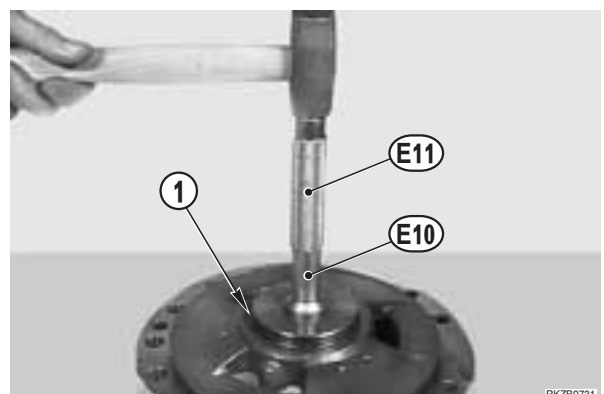
- 3 - Position the ring bevel gear (3), apply Loctite 270 on the thread and then fix the whole by tightening the screws (4).

 Screw: 155 Nm



3. Brake flange and differential housing assembly

- 1 - Position the flange on a flat surface and force the cup of the taper roller bearing (1) in position, using the special tool **E10**, interchangeable handle **E11** and a hammer



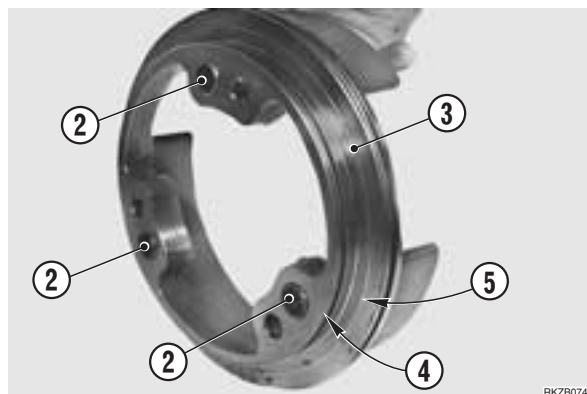
REMOVAL AND INSTALLATION

REAR AXLE

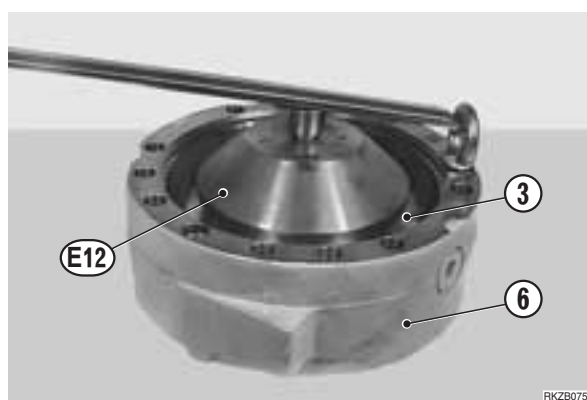
2 - Collect the brake piston (3).

Push the elastic pin (2) into the self-adjust kit housing till they are leveled with the piston supporting inner surface.

Assemble the O-rings (4) and (5) on the piston and lubricate the faying surface piston flange with a light layer of grease.

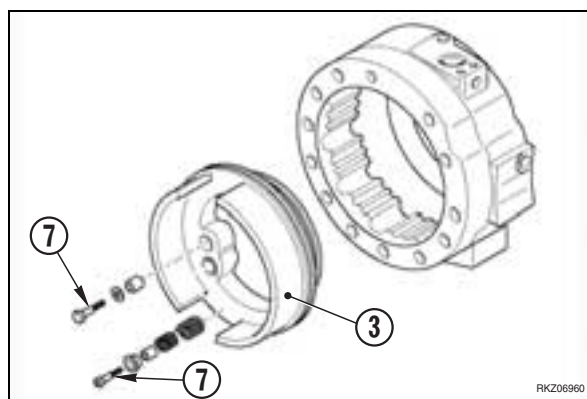


3 - Apply a slight coat of grease on the piston surfaces and especially on the O-rings already inserted, insert the piston (3) into the brake flange (6) and position the special tool E12 or a disk on the piston and with a lever anchored to an eyebolt, exert a pressure just enough to insert the piston into the brake flange.



4 - Take the components of the self-adjust kit and fit them on the piston (3) as shown in the figure. Screw the securing screws (7) of the two kits and tighten them.

 Screw: 10 Nm

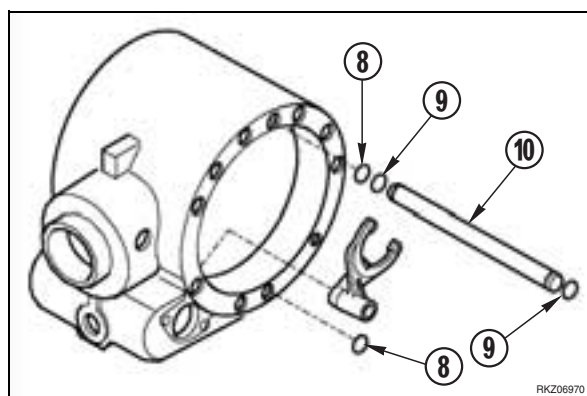


5 - Insert the new O-rings in their relative housings (oil pipe hole) on the central body. Before assembling, lubricate the O-rings (8). Insert two new O-rings (9) in the oil pipe hole housings (10). Grease the O-rings.

6 - Insert the oil blow-by tube.

Insert the differential locking fork (10) in the central body, respecting the showed position.

★ Do not invert the fork assembly position.



REMOVAL AND INSTALLATION

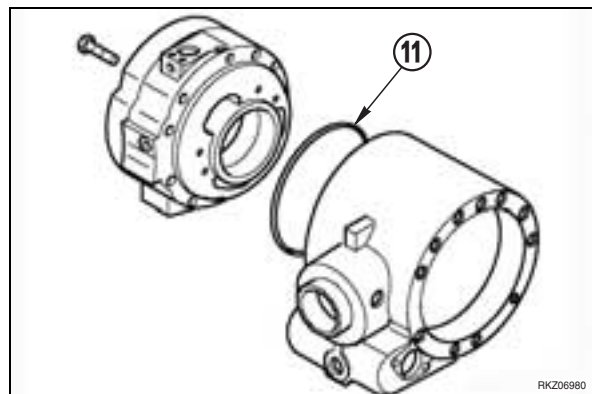
REAR AXLE

7 - Insert a new O-ring (11) on the flange. Lubricate the O-ring. Assemble the left flange on the central body.

8 - Tighten the securing screw of the brake cylinder with a torque-wrench.

 Nm Screw: 79 Nm

- ★ Check that the reference marks made in the disassembly between flange and central body coincide.



9 - Before the adjustment of the ring bevel gear bearings preloading, prefasten the brake cylinders with two additive screws M14X120.

Tighten at 79 Nm.

Once adjustment is made, remove them.

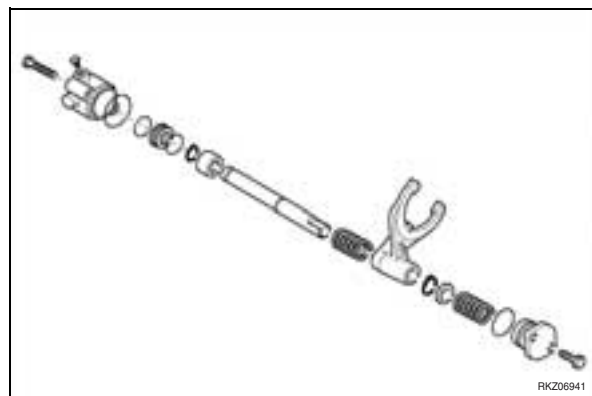
- ★ Respect the correct assemble side of the differential box with its relative components.

10 - Overturn and position the flange central body on a flat surface.

Insert the differential box.

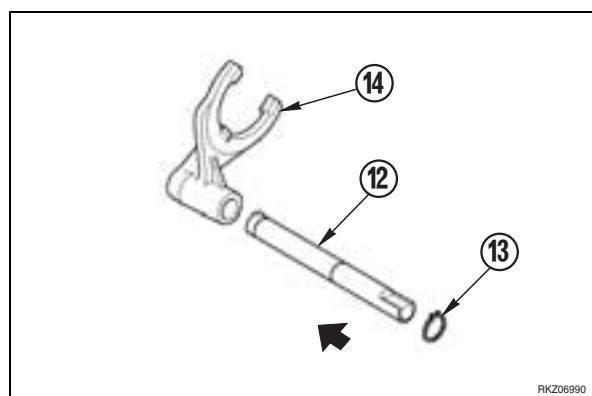


- ★ The differential locking device elements have to be assembled by respecting the relative position pointed out in the figure.



11 - Once the snap ring (13) has been introduced into the shaft (12) till about 20 mm from the flattened end, introduce the shaft into its housing in the central body, on the gear side, slipping it into the fork (14).

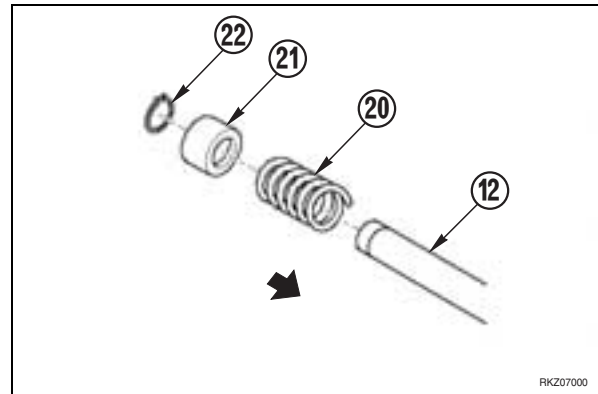
- ★ Do not put the snap ring in the housing.



REMOVAL AND INSTALLATION

REAR AXLE

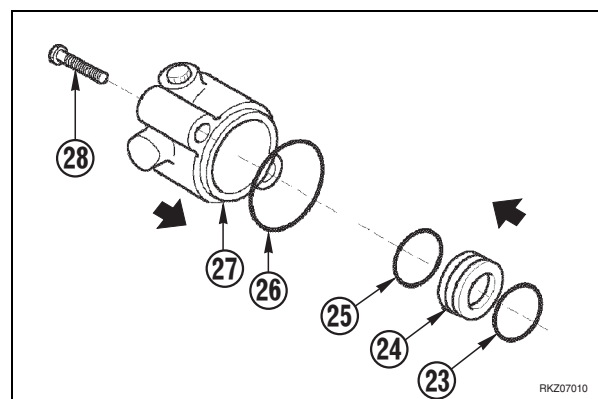
- 12 - Insert the spring (20) and the bush (21) into the shaft (12), operating into the central body on the opposite side of the gear, then assemble the snap ring (22) in its housing.



- 13 - Insert the piston (24) in the cylinder (27), with new O-Ring (23) and (25). Assemble a new O-Ring (26) in the cylinder support (27), and then insert the support, with the piston, in the central body, fastening it with relative screws (28), tightened with dynamometric wrench.

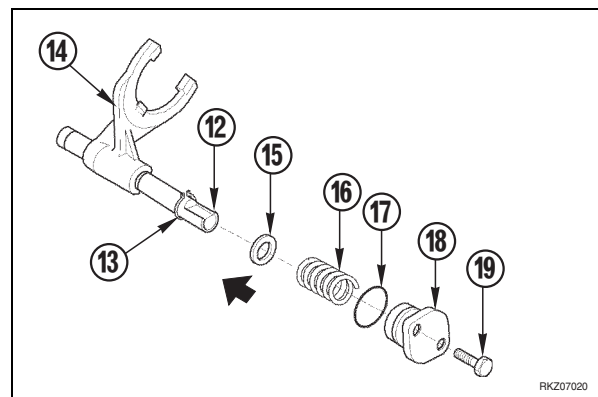
Screw: 27.6 Nm

- ★ Before the assembly lubricate properly the seal rings and the faying surfaces.



- 14 - Push the seeger lock ring (13) in its housing in the differential locking device of the shaft (12), by operating in the central body on the bevel gear side. Then let the seeger ring sliding along the shaft with a pipe or a suitable tool. Insert the spacer (15) and the spring (16) into the shaft. Assemble a new lubricate O-Ring (17) upon the cap (18). Assemble the cap (18) upon the central body at the flatted end of the shaft, tightening the relative screws (19).

Screw: 27.6 Nm



- 15 - Assemble the right brake flange. Tighten the securing screw of the brake flange with a torque-wrench.

Screw: 79 Nm

Once the correct assembly side of the differential box it has been checked, assemble the second brake flange on the opposite bevel gear side. Insert and screw the adjusting ring nuts of the pinion-ring, using the wrench with **E2** till the bearing backlash is eliminated. Then measure the pinion-ring gear backlash.



REMOVAL AND INSTALLATION

REAR AXLE

16 - Assemble the special tool **E13** on the pinion end.

Move the pinion end alternatively and note the pinion gear backlash, measured with a comparator "**A**", so that the feeler is in contact and at 90° with the bracket surface on the special tool in correspondence with the reference mark.

Check if the measured backlash value is within the request range.

★ Backlash: **0.18 – 0.23 mm**

Carry out the adjustment by operating on the two ring nuts with the tool **E2**.

Adjust the ring nuts remembering that:

- If **the measured backlash is less** than the given tolerance range, screw the ring nut from the side opposite to the ring gear and unscrew the opposite one of the same measure;
- If **the measured backlash is higher** than the given tolerance range, screw the ring nut from the side of the ring gear and unscrew the opposite one of the same measure.

17 - Once you have carried out the adjusting of the pinion-ring gear backlash, check also that there is a minimum preloading on the differential box bearings.

Repeat the whole sequence of the above mentioned operations till the indicated conditions are reached.

18 - Once the pinion gear backlash has been established, measure the total preloading "**T**" of the bearings (pinion-ring gear system), using a dynamometer whose cord "**B**" is wound on the diameter 34.87 mm of the pinion spline shaft.

★ Force required:

$$(P+3.73) < T < (P+5.55) \text{ daN}$$

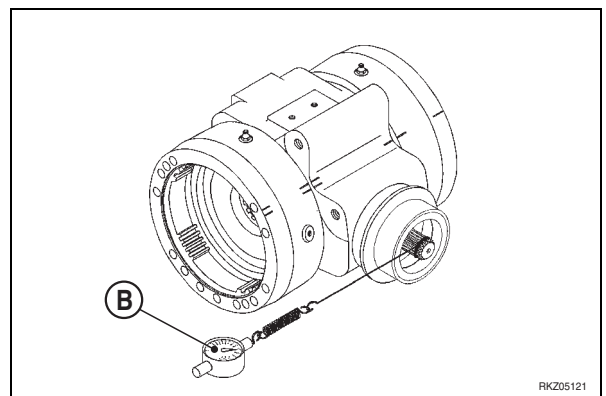
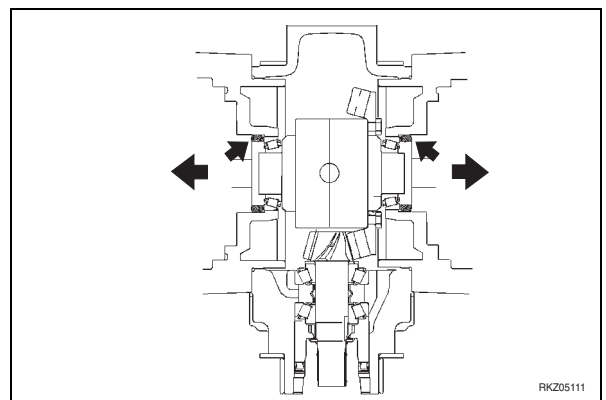
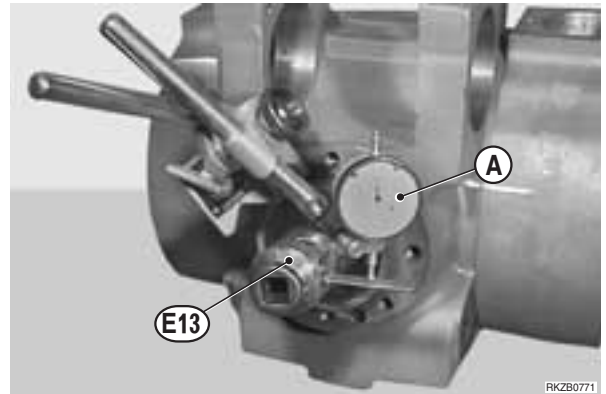
P = the force found for the pinion

★ The force should be that of continual rotation. Do not take the thrust force into consideration.

19 - If the force is not within permissible limits:

- a - Tighten both the lock nuts to the same extent to increase the force "**T**".
- b - Loosen both the lock nuts to the same extent to decrease the force "**T**".

⚠ The clearance between the ring bevel gear and the pinion must remain within permissible limits.



REMOVAL AND INSTALLATION

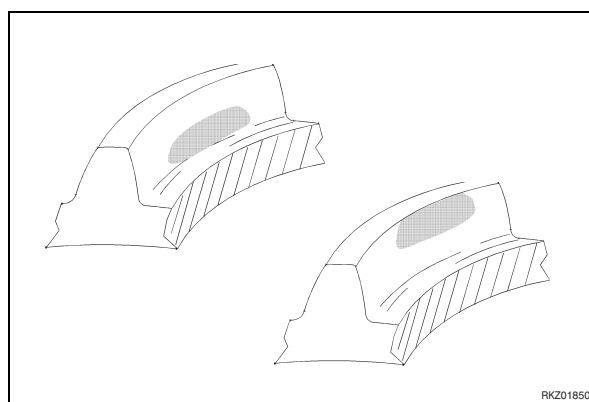
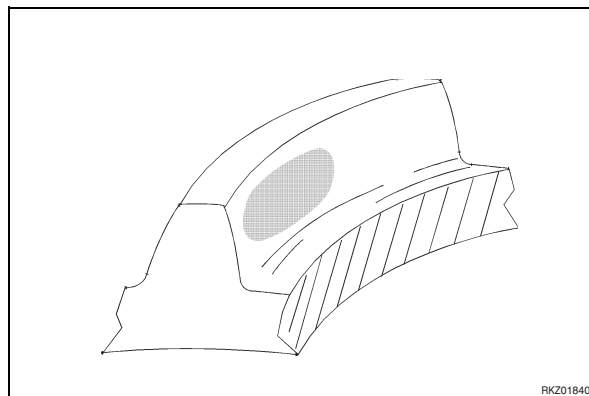
REAR AXLE

20 - Check the centering of the contact area using the following procedure:

a - Coat both surfaces of the teeth of the ring bevel gear with a marking substance.

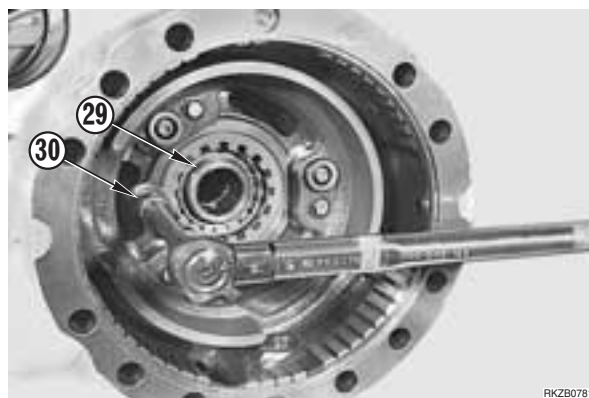
b - Rotate the pinion.

If the contact area is excessive near to the edge of the teeth, the ring bevel gear must be brought closer to the pinion. If the contact area is excessive on the side of the teeth, the ring bevel gear must be moved away from the pinion.

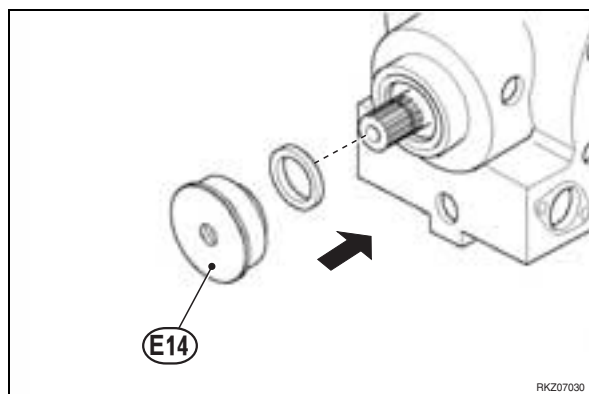


21 - Insert the ring nut retainer (29) turning the ring nut slightly in order to align it to the retainer. Screw in and tighten the screw (30) of the ring nut retainer with a dynamometric wrench.

 Nm Screw: 13 Nm



22 - The seal ring into the central housing using seal driver **E14**.

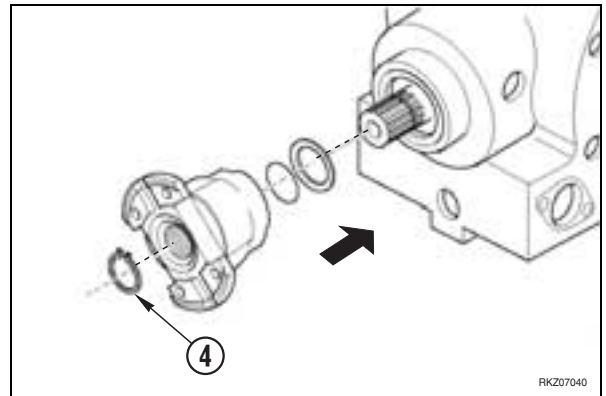


REMOVAL AND INSTALLATION

REAR AXLE

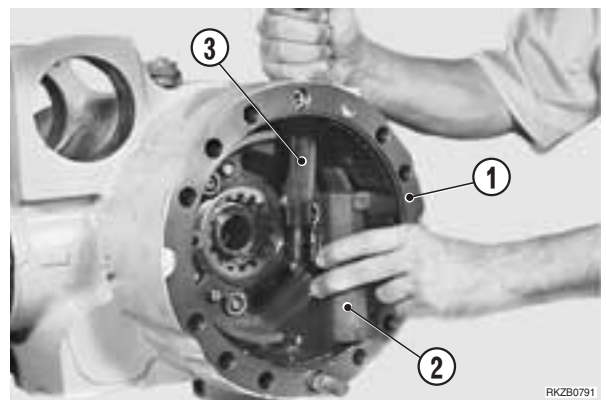
23 - Coat the seal lip and O-ring with oil and insert on the pinion shaft the shim together with a new O-ring and input flange.

Secure the assembled parts with snap ring (4).

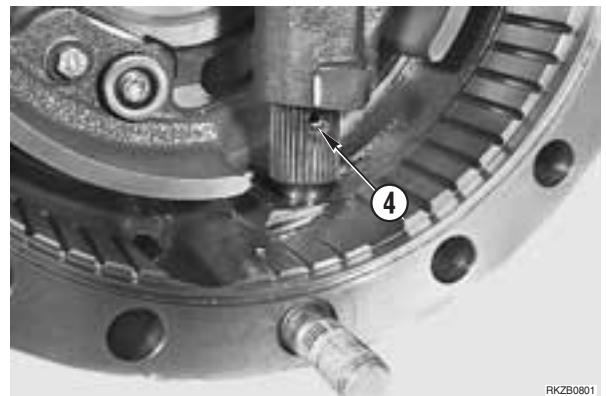


4. Brake control group assembly

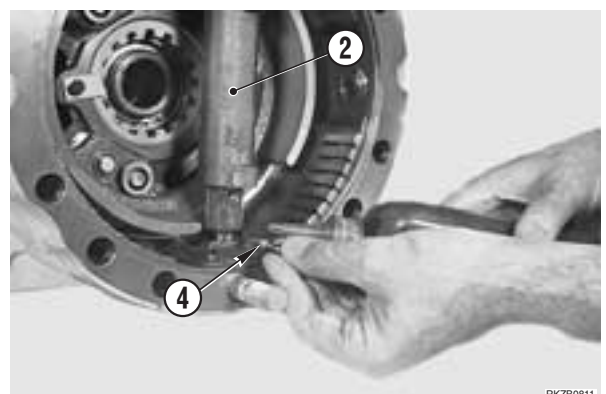
1 - Insert the cam (2) and the shaft (3), on the side you are operating, on the brake flange (1). They can be recognized by the reference marks previously put.



2 - When the shaft is inserted into the cam, align the reference mark with the cam setscrew (4) hole.



3 - Insert the cam setscrew (4).

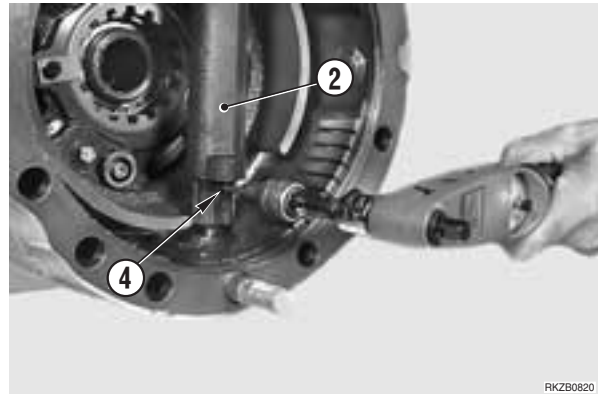


REMOVAL AND INSTALLATION

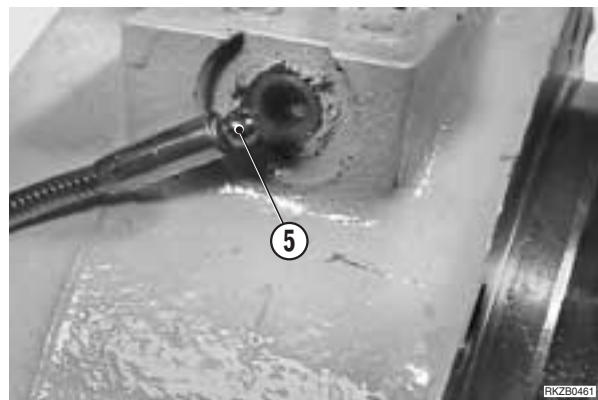
REAR AXLE

- 4 - Screw in the cam setscrew (4) with dynamometric wrench.

 Screw: 10 Nm



- 5 - Insert the steel ball (5) that sets the shaft and the relative screw (4).

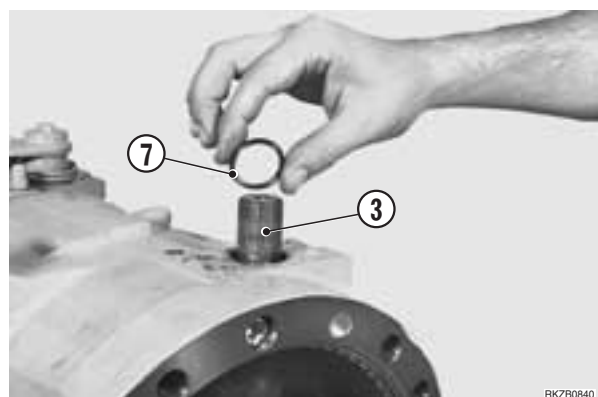


- 6 - Put on the shaft setscrew (6) thread a slight layer of SI-LASTIC.
Screw in and tighten the shaft setscrew (6) with dynamometric wrench.

 Screw: 25 Nm



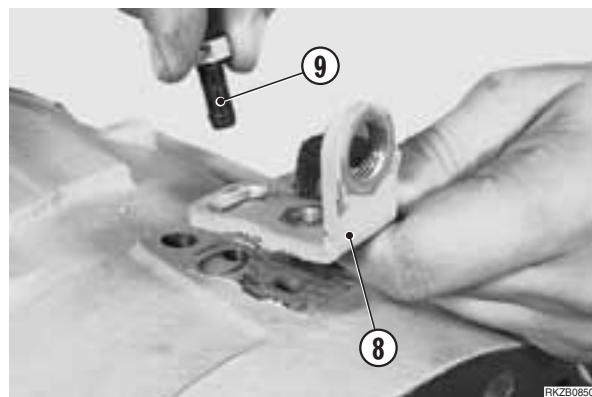
- 7 - Insert a new O-Ring (7) on the shaft (3).



REMOVAL AND INSTALLATION

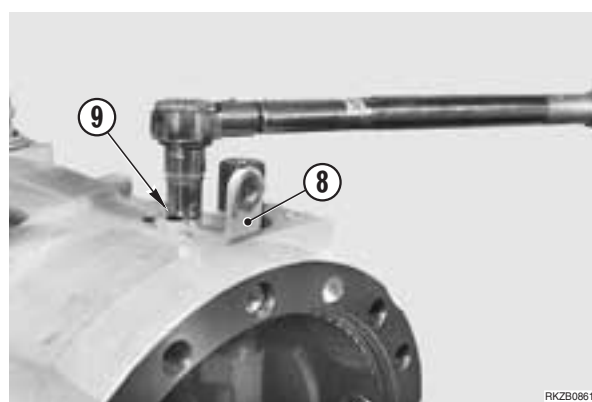
REAR AXLE

- 8 - Position the supporting bracket (8).
Insert the fastening screws (9).

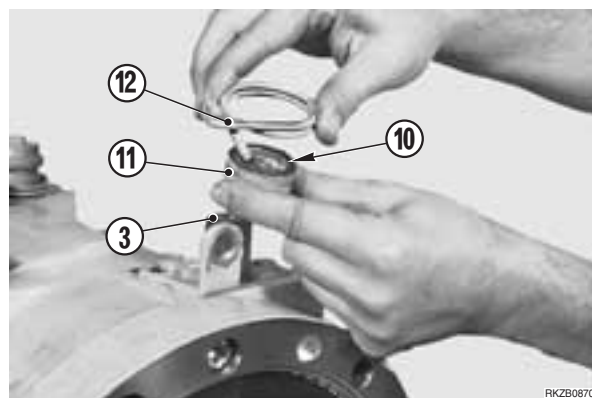


- 9 - Screw in and tighten the bracket fastening screws (9) with dynamometric wrench.

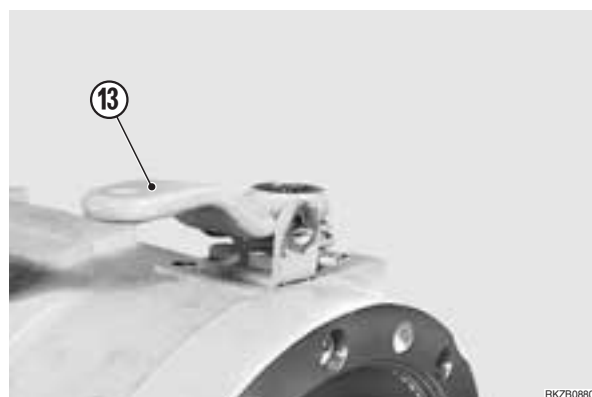
 Screw: 35 Nm



- 10 - Insert the spacer (11) the washer (10) and the spring (12) on the shaft end.

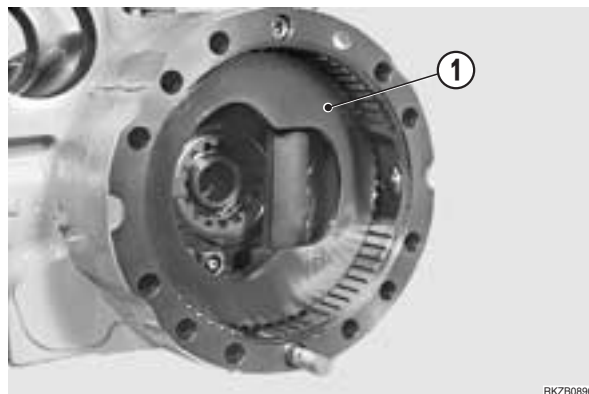


- 11 - Insert the brake control lever (13), respecting the reference marks put during disassembly.



5. Brake and axle beam groups assembly

- 1 - Insert the first shaped brake counterdisc (1), respecting the indicated position compared to the cam position.



- 2 - Check that the friction discs and the counterdiscs do not present any sign of burning; if yes, replace them. Furthermore check friction disc wear and if necessary replace them.

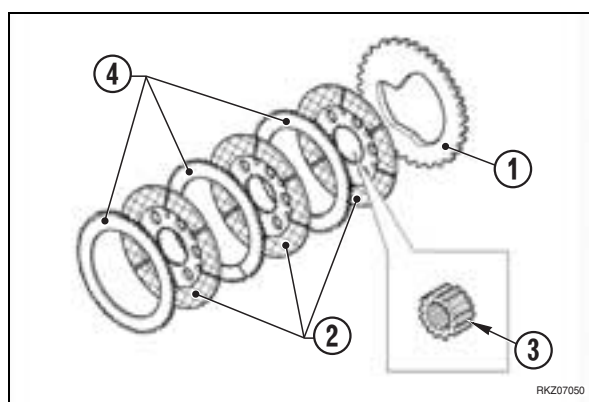
★ Friction disc thickness: min. 4.03 mm

- 3 - Reassemble all the components of the brake group (discs (2), counterdiscs (4) and coupling (3)) inside the flange as per the sequence in the figure.

★ The coupling should be inserted after the first disc and positioned with the shortest spline against the differential.

★ If new brake discs are installed, before assembling, they should be dipped in the suitable oil.

★ The discs and counterdisc unit are free.

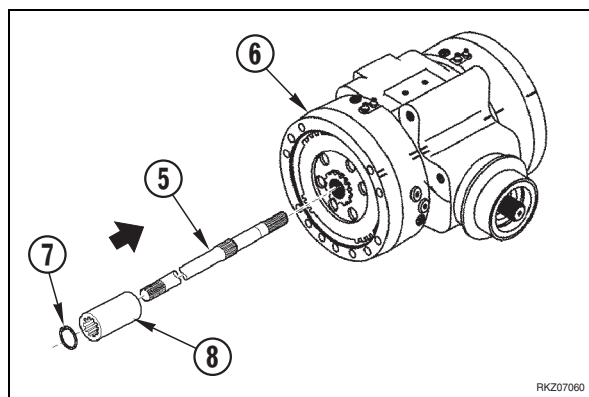


- 4 - Insert the long half-shaft (5) into the axle central body (6).

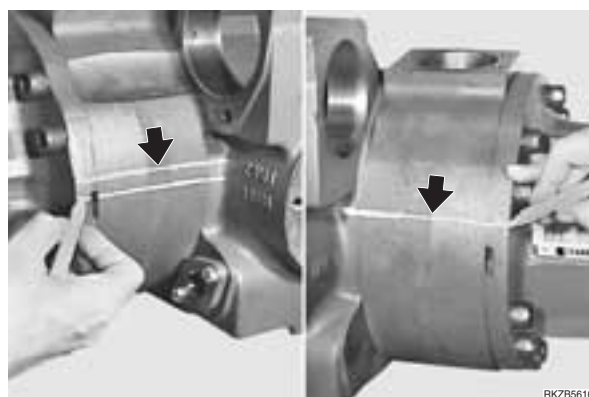
Position the seeger ring (7) on the inner seat of sleeve (8).

Insert the sleeve on the long half-shaft.

★ The sleeve must be inserted with the inner seeger ring resting against on the long half-shaft



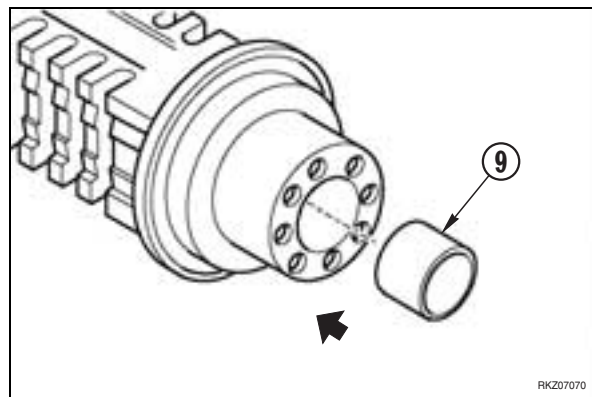
- 5 - Before assembly, check the reference marks carried out during disassembly for the correct positioning of the axle beam trumpets.



REMOVAL AND INSTALLATION

REAR AXLE

- 6 - Drive the bushing (9) in the seat on the axle beam trumpet by means of the special tool **E15**.



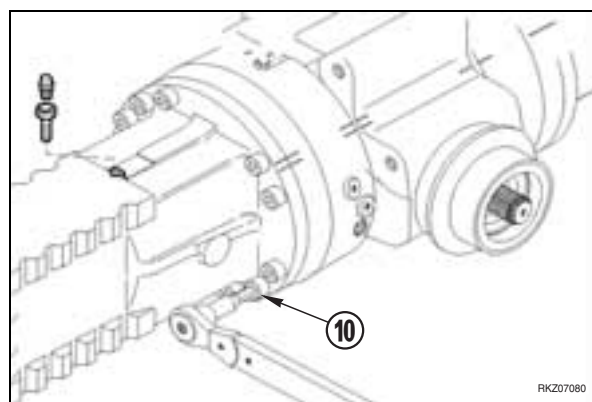
- 7 - Assemble a new O-ring into the axle beam trumpet and into the two oil blow-by holes. Lubricate the O-rings. Assemble the axle beam trumpet on the flange, being careful to the fastening holes' alignment.

★ Support the groups properly as already pointed out for disassembly phase.

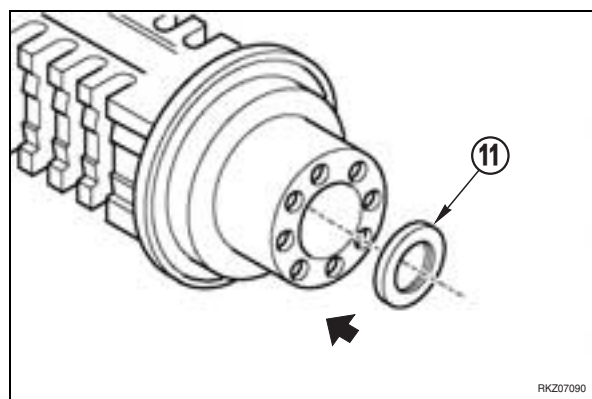
- 8 - Screw in and tighten the fastening screws (10) of the axle beam trumpet with a dynamometric wrench.

 Nm Screw: 176 Nm

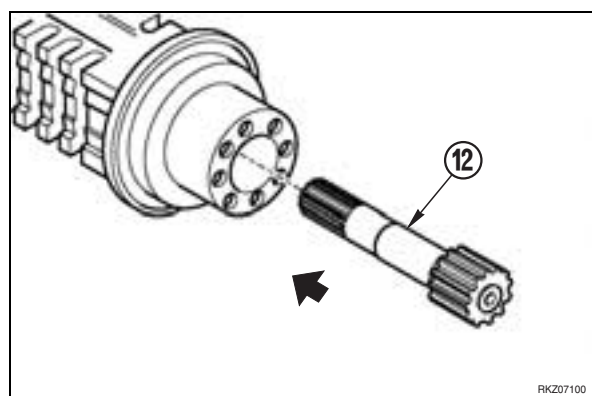
★ Assemble the breather adapter with the nocht aligned to half-shaft.



- 9 - Lubricate with care the lip of the new seal ring. Insert the new seal ring (11) in the seat on the axle beam trumpet by means of the special tool **E16**.



- 10 - Insert the short half-shaft (12) on the axle beam trumpet.



REMOVAL AND INSTALLATION

REAR AXLE

11 - Set the brake group, putting the system under pressure. It is advisable to use compressed air at high pressure blown through the breather.

- ★ The braking system (piston, discs, self-adjust kit and kit brake mechanism return) should be set, before moving the brake control levers.

12 - Operate the control levers, setting them on braking position (locked levers).

- ★ The lever return springs should not be inserted.

13 - Measure the distance between the middle of the connection holes at the ends of the control levers and check that it is within the foreseen range:

301–310.5 mm

- If the value is not within the foreseen range, correct the lever position: take them out of the shaft and reinsert them shifted of one spline so that the error can be compensated.

Repeat the checking operation and the further adjustment till the requested conditions are reached.

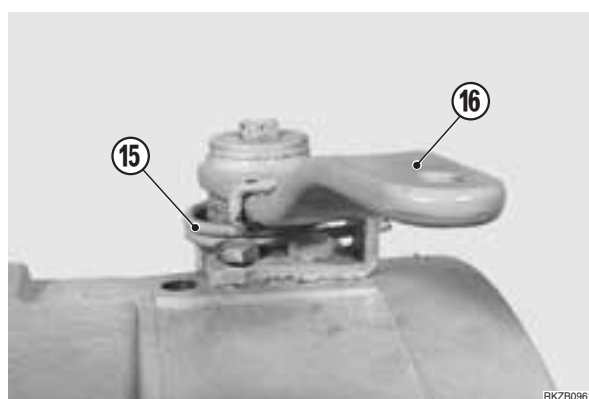
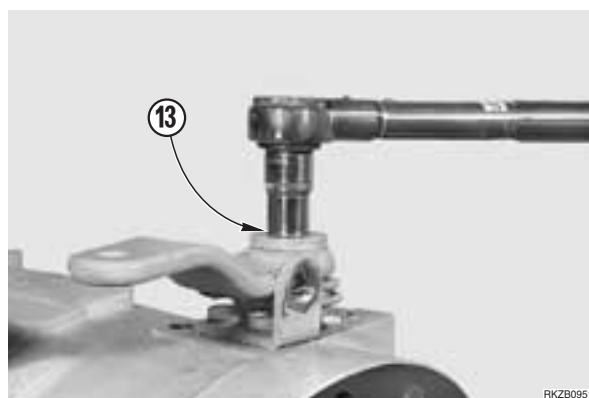
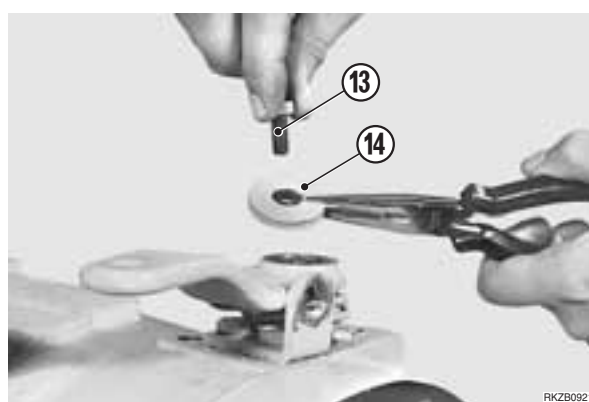
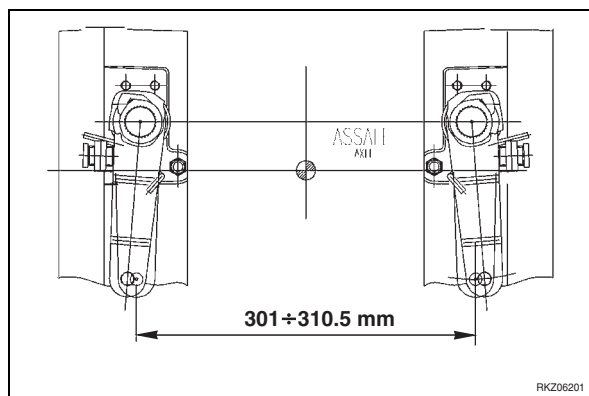
14 - Release the brake control levers, screw in the fastening screws (13) and the relative washers (14).

15 - Tighten the fastening screw (13) of the control lever with dynamometric wrench.

 Nm Screw: 35 Nm

16 - Hitch the return spring (15) to the brake control lever (16).

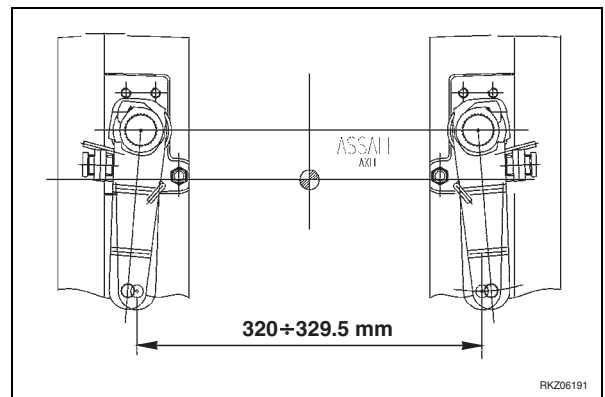
Repeat all the described operations also for the other brake group.



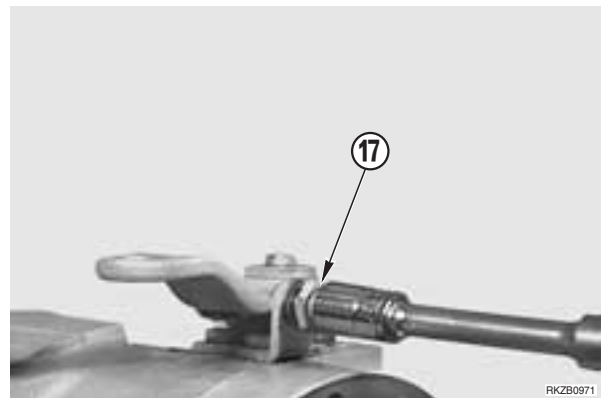
REMOVAL AND INSTALLATION

REAR AXLE

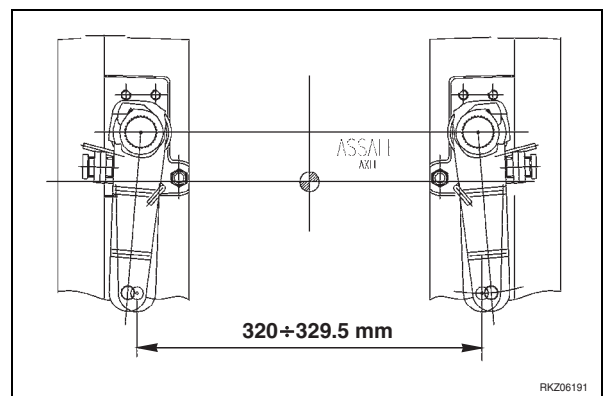
- 17 - Check that, in rest position, the measure between the middle of the connection holes at the lever ends is higher than the minimum value 320 mm.



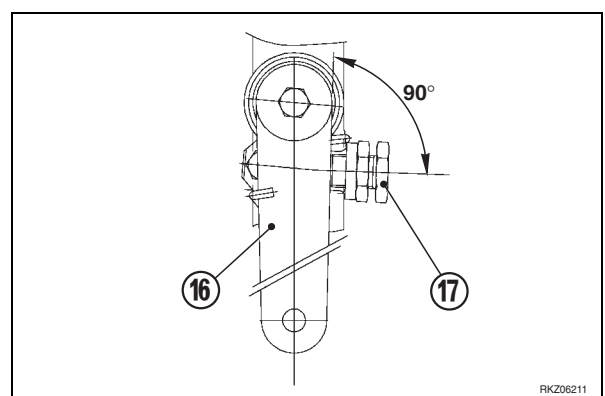
- 18 - Assemble the adjusting screws (17) on the brackets and screw in them, till they are in contact with the levers.



- 19 - Screw in the two screws of the same measure to be within the foreseen range for the levers in rest position: 320–329.5 mm (about 3 mm between lever and bracket will remain).



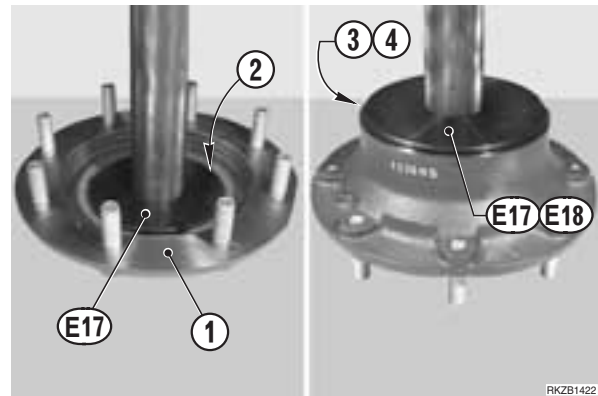
- 20 - If the screw (17) is not perpendicular to the side surface of the lever (16), adjust its position by moving the supporting bracket.



6. Wheel hub group assembly

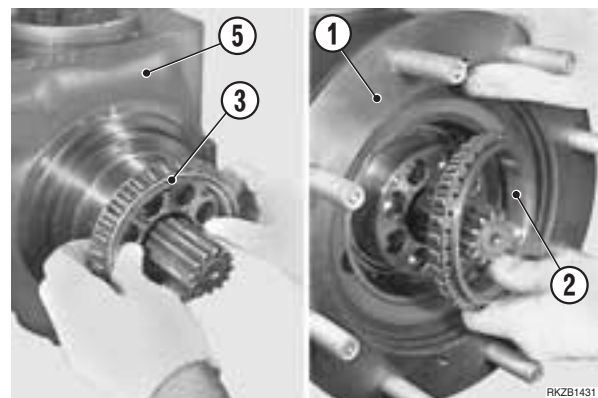
1 - Position the wheel hub (1) on a workbench and force the two cups of the taper roller bearings (2) and (3) in position with the special tool **E17** under a press or with a hammer.

2 - Insert the seal ring (4) into the wheel hub with the special tool **E18** and a hammer.



3 - Assemble the cone of the taper roller bearing (3) on the beam trumpet (5) end.

4 - Assemble the wheel hub (1) on the beam trumpet (5) and force the other cone of the taper roller bearing (2) in position.

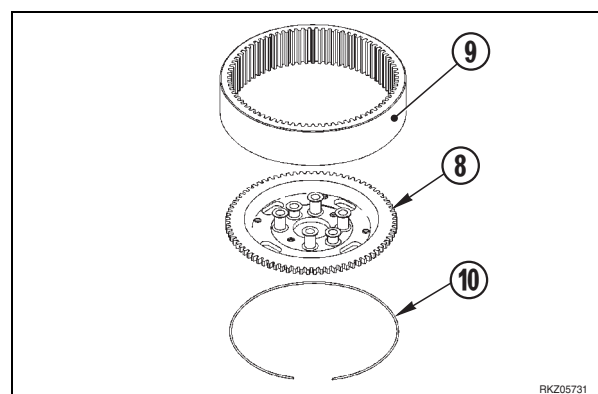


5 - Position the wheel carrier (6) on a workbench and force the bushes (7) to the carrier surface level with the special tool **E1**.

At least two bushes (diametrically-opposed) should be set slightly higher than the carrier surface level to be used as dowel pins.



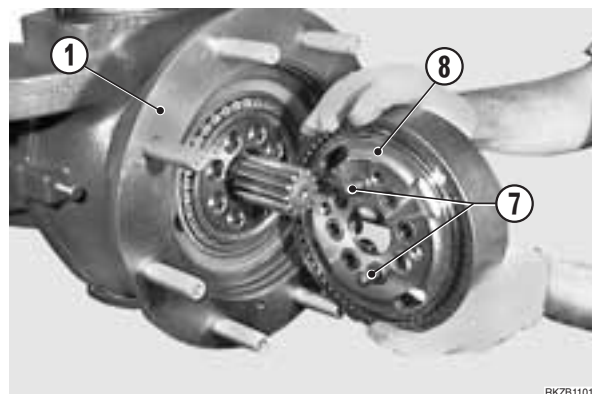
6 - Preassemble the wheel carrier group (8), epicyclic ring gear (9), with the special snap ring (10) shown in the figure.



REMOVAL AND INSTALLATION

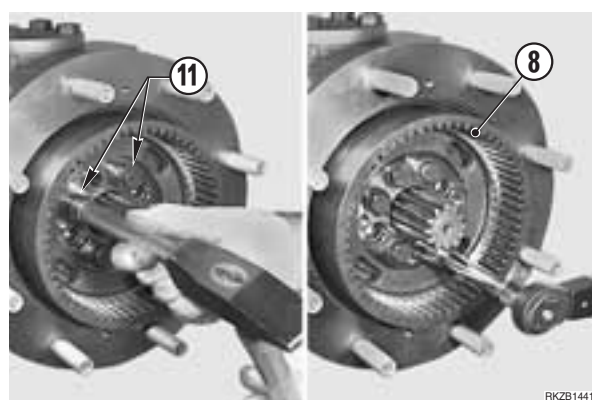
REAR AXLE

- 7 - Assemble the wheel carrier group (8) on the wheel hub (1) using the two projecting bushes (7) as dowel pins.



- 8 - Force all the hub dowel bushes completely with the special tool **E1** and a hammer.
Assemble the wheel carrier fastening screws (11) and tighten.

 Nm Screw: 230 Nm

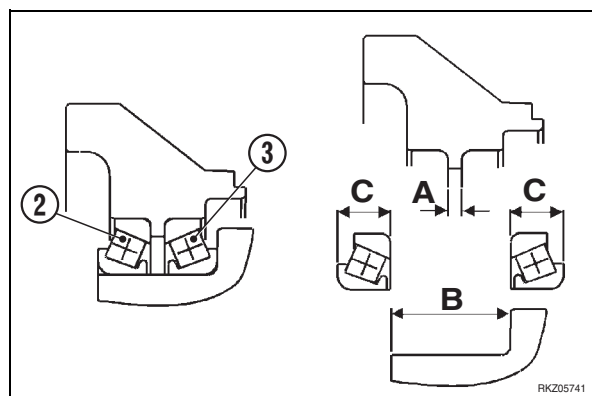


- 9 - In the case the bearings (2) and (3) are substituted, verify that the measure "A", "B" and "C" are in the limits.

A = 17.950 – 18.000

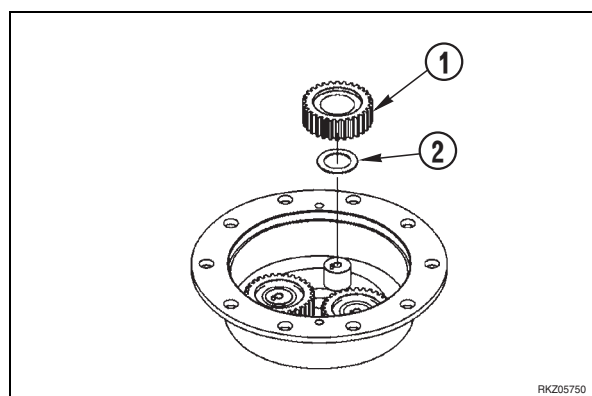
B = 64.275 – 64.325

C = 23.070 – 23.172



7. Epicyclic reduction gear assembly

- 1 - Place the planetary carrier on a work bench and fit the epicyclic gears (1) and respective washers (2) on the dowels already fitted.

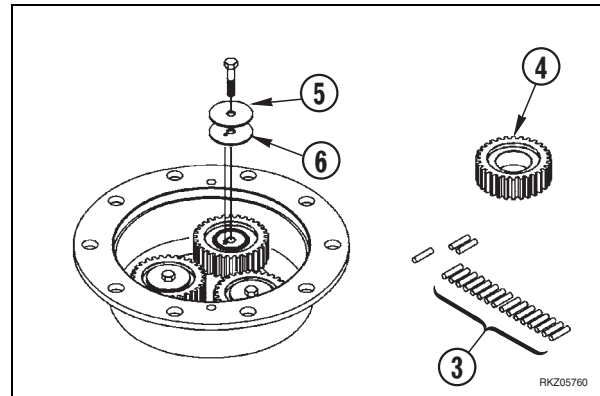


REMOVAL AND INSTALLATION

REAR AXLE

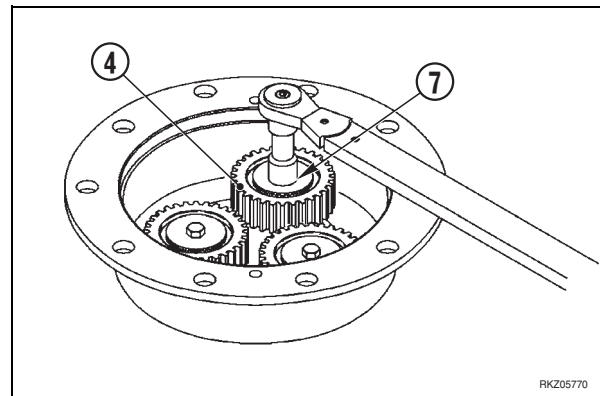
- 2 - Insert all the rollers (3) into the epicyclic gears (4), then place the two thrust washers (5) and (6).

★ The first washer must be aligned with the dowel pin.



- 3 - Fit and tighten the epicyclic gears (4) fixing bolts (7), tightening.

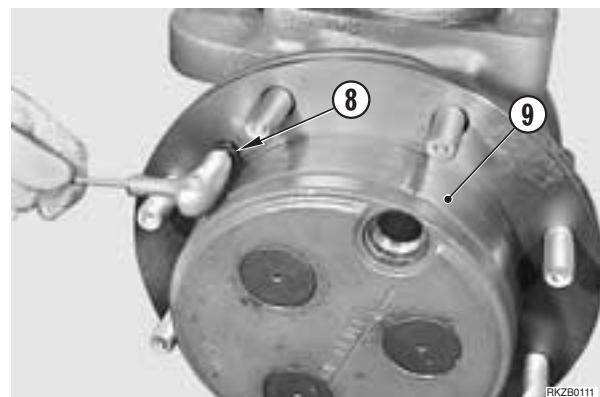
 Nm Screw: 79 Nm



- 4 - Insert a new O-ring on the centering diameter of wheel hub.

- 5 - Fit the planetary carrier to the wheel hub (8). Insert and tighten the fixing bolts (9) to the prescribed torque.

 Nm Screw: 25 Nm



REMOVAL OF THE FRONT BUCKET BOOM-RAISING CYLINDER

! Lower completely the working equipment until it rests on the ground and stop the engine.

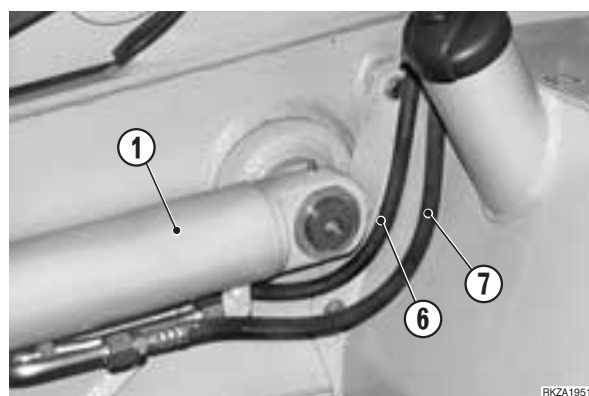
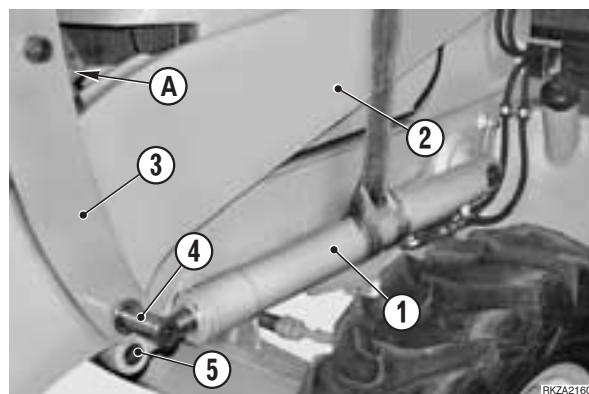
- 1 - Put a sling round the cylinder (1) and insert some blocks "A" between the boom (2) and the fulcrum lever spacer (3).
- 2 - Take off the snap-ring and the internal retaining spacer for the piston attachment pin (4).
- 3 - Take out the pin (4) in order to free the piston head (5), but leave the fulcrum lever engaged (3).
- 4 - Start the engine to retract the piston (1).
 - ★ Bind the piston head with wire to secure the fully retracted position and stop the engine.

※ 1 ※ 2

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

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

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

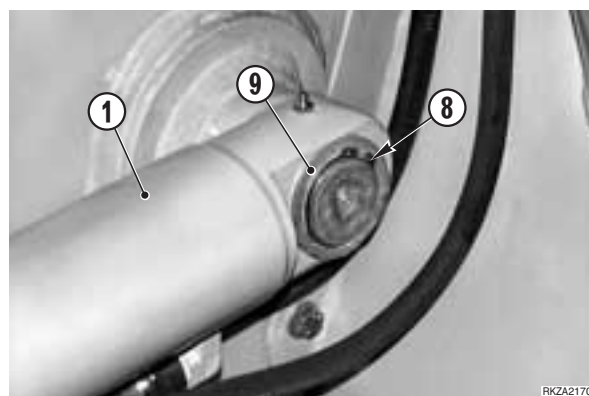


- 6 - Remove the snap-ring (8) and the spacer (9).

- 7 - Remove the cylinder (1).



Cylinder: 40 kg



INSTALLATION OF FRONT BUCKET BOOM-RAISING CYLINDER

- To install, reverse the removal procedure.

※ 1

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

※ 2



Internal bushing: ASL800050

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

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

REMOVAL OF THE FRONT BUCKET TILT CYLINDERS

! Lower the working equipment completely until it rests on the ground and stop the engine.

1 - Loosen the clips (1) and remove the tube protection (2).

★ **For the right-hand cylinder only**

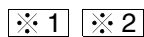
Disconnect the sensor (3) and remove the bucket position indicator (4).

2 - Place a sling round the cylinder (5) and insert a block "A" between the spacer (6) of the piston fulcrum lever (7) and the link (8).

3 - Take off the snap-ring and the internal retaining spacer for the piston attachment pin (9).

4 - Take out the pin (9).

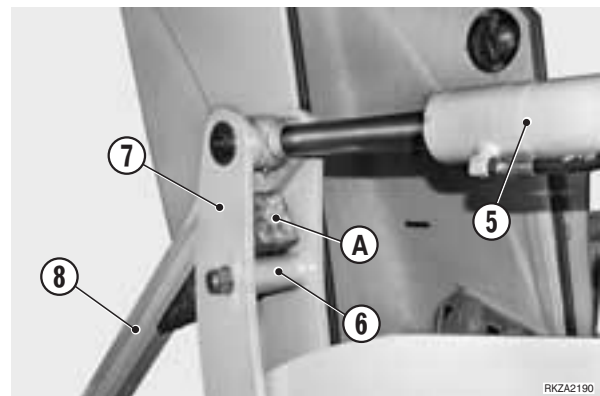
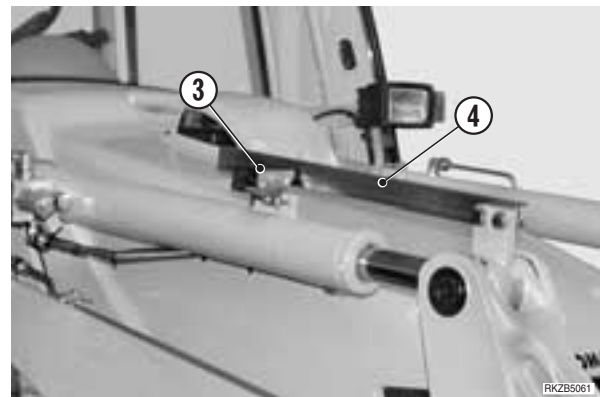
5 - Start the engine to retract the piston (10).



★ Bind the piston head with wire to secure the fully retracted position and stop the engine.

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

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



6 - Take out the screw (11) and remove the clamp (12).

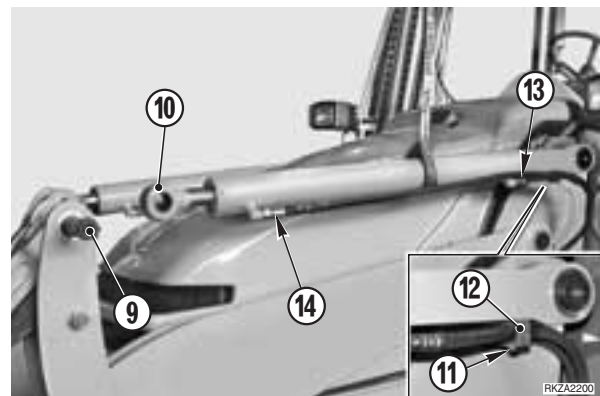
7 - Disconnect the tubes (13) and (14) and plug them to prevent entry of impurities.

8 - Remove the snap-ring (15) and the spacer (16).

9 - Remove the cylinder (5).



Cylinder: 45 kg



INSTALLATION OF THE FRONT BUCKET TILT CYLINDERS

• To install, reverse the removal procedure.



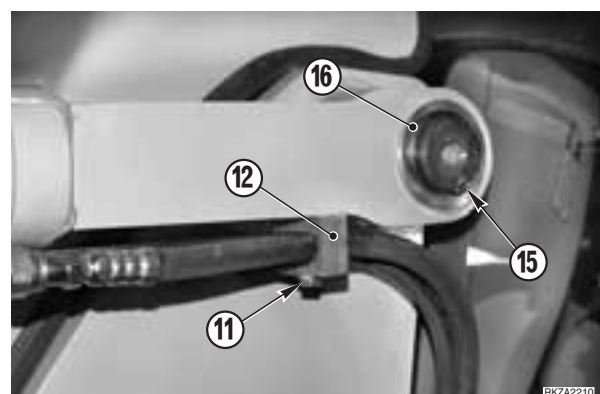
! When aligning the positions between the hole and the pin, turn the engine over at low idling speed.
 Do not insert fingers into the holes to check alignment.



Internal bushing: ASL800050

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

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



REMOVAL OF THE FRONT BUCKET

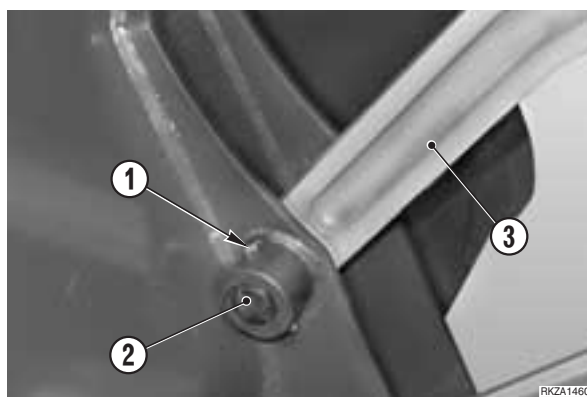
⚠ Lower the bucket to the ground, resting on its back, but without forcing it downwards.

1 - Stop the engine and release residual pressures.



2 - Take out the screws (1) and remove the pins (2) of the lever (3).

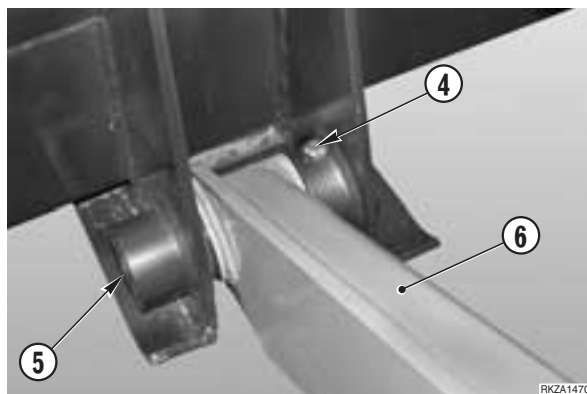
Rest the lever (3) on the boom.



3 - Take out the screws (4) and remove the pins (5) of the bucket fulcrum.



4 - Start the engine and put the machine into reverse gear in order to disengage the boom (6).



INSTALLATION OF THE FRONT BUCKET

- To install, reverse the removal procedure.



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



Internal bushing: ASL800050

REMOVAL OF THE FRONT WORKING EQUIPMENT

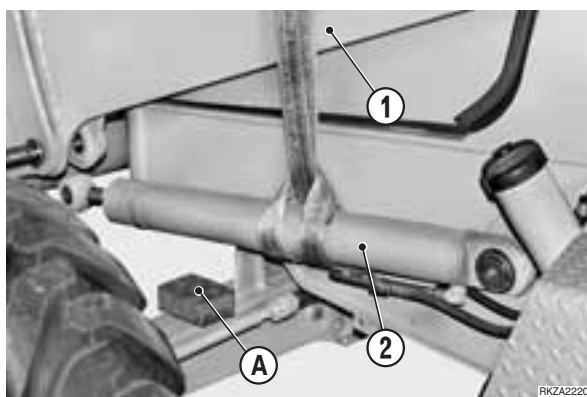
⚠ Lower the working equipment completely until it rests on the ground stop the engine and remove the ignition wrench.

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

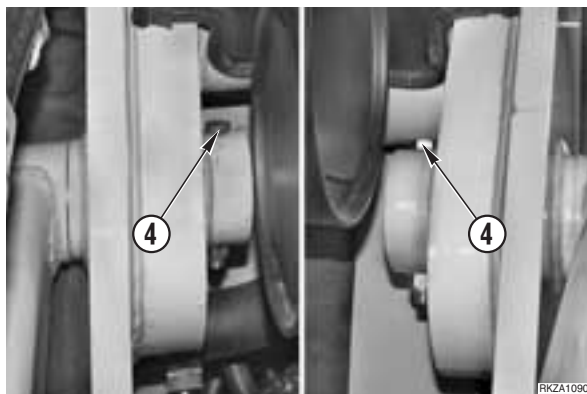
1 - Remove the tilt cylinders. (See «REMOVAL OF FRONT BUCKET TILT CYLINDERS»).



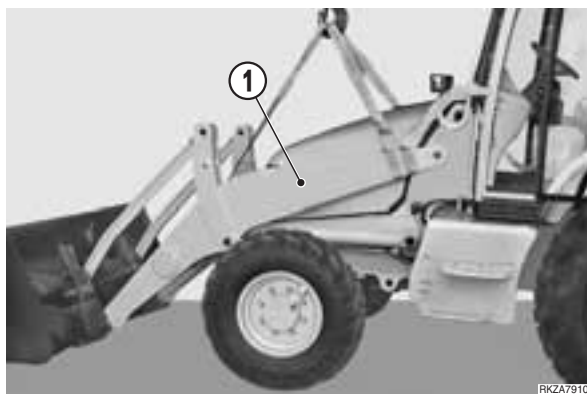
2 - Disconnect the cylinders (2) from the boom (1) and rest them on wooden blocks «A» placed on the front axle.



3 - Open the front hood (3) and take out the screws (4) that lock the axle oscillation pins of the boom (1). Close the front hood.



4 - Put a sling round the boom (1) as shown in the figure, and attach it to the hoisting tackle. Apply a slight tension to the cables.



5 - Using a puller, take out the axle oscillation pins (5) of the boom (1).



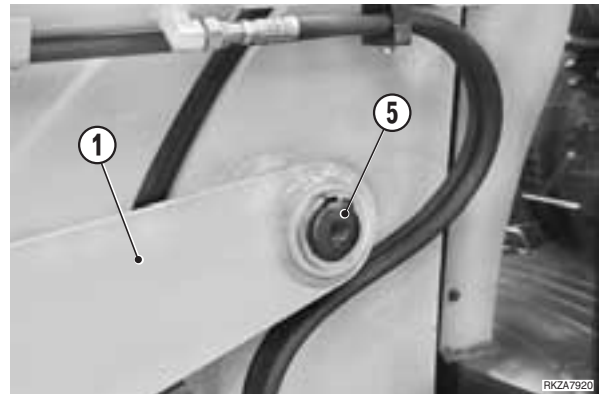
6 - Start the engine and put the machine into reverse gear travel until the boom is disengaged.

- ★ If the working equipment is to be detached to aid the removal of the engine-gearbox-pump group, and the machine cannot travel automatically, it can be towed using the towing hooks of the backhoe.

7 - Place two stands in position and lower the boom until it is resting on them.



Work equipment: 960 kg



INSTALLATION OF THE FRONT WORKING EQUIPMENT

- To install, reverse the removal procedure, if necessary using the front towing hook.



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



Internal bushing: ASL800050

- Start the engine and bleed the air from the cylinders. (For details, see «20. TESTING AND ADJUSTMENTS»).
- ★ After bleeding the air, check the oil level in the tank.

REMOVAL OF THE BACKHOE CONTROL VALVE

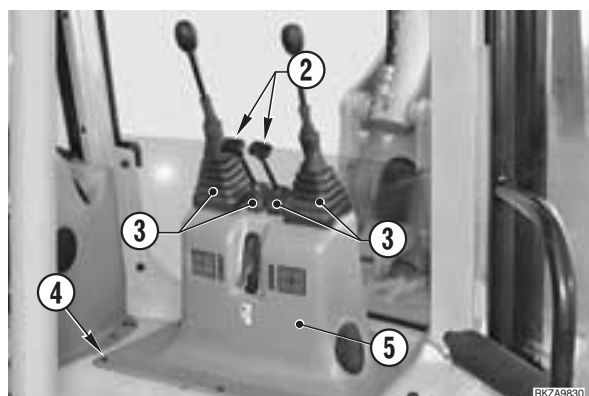
- 1 - Swing the backhoe completely to the right of the machine, and rotate the boom to approx. 45° to the right.
- 2 - Lower the outriggers to the ground, open the bucket and rest the arm on a block "A" keeping it perpendicular to the ground.
- 3 - Rest the bucket teeth on the ground, release the backhoe plate and stop the engine.
- ⚠ Release all residual pressure in all circuits.
↑ (For details, see «20. TESTING AND ADJUSTMENTS»).



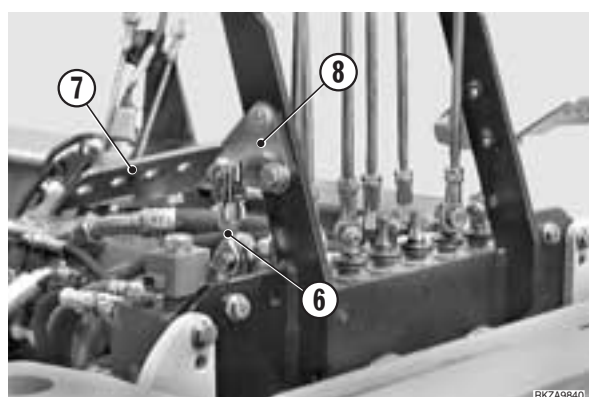
- 4 - Take out the lower window (1) of the cab and completely raise the upper window.



- 5 - Remove the grips (2) of the control levers of the outriggers.
- 6 - Raise the protective sleeves (3) of the control levers, take out the screws (4) and remove the cover (5).



- ★ If any optional devices have been fitted, unhook the spool command tie-rods (6) and remove the pedals (7) and the supports (8).



REMOVAL AND INSTALLATION

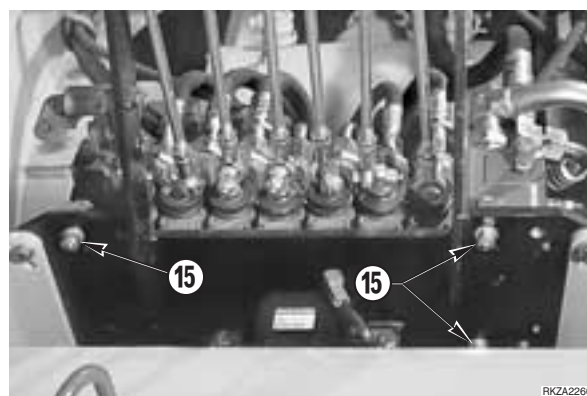
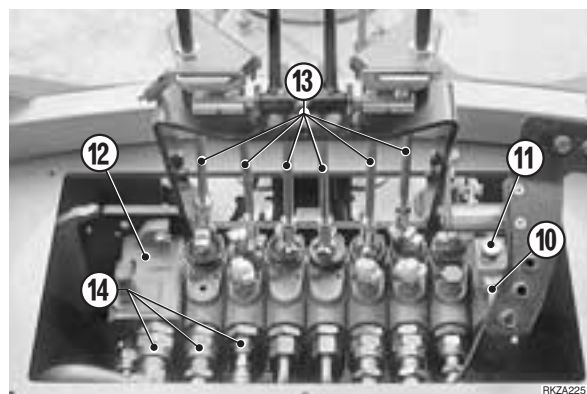
BACKHOE CONTROL VALVE

- 7 - Disconnect the connector (10) of the solenoid (11) of the control valve (12).
- 8 - Disconnect the lever command tie-rods (13) from the control valve.
- 9 - Disconnect from the control valve the pipes (14) (delivery, return, Load Sensing and actuators). Plug them to prevent entry of impurities.
 - ★ Mark the pipes to prevent exchanging positions during re-connection.
- 10 - Attach the control valve (12) to some hoisting tackle and apply a slight tension to the cables.

- 11 - Remove the four screws (15) and then the entire control valve.



Control valve: 6-spool 47 kg
7-spool 53 kg
8-spool 59 kg



INSTALLATION OF THE BACKHOE CONTROL VALVE

- To install, reverse the removal procedure.
- ★ Bleed the air from Load Sensing circuits and from the hydraulic circuits of all the actuators.
(For details, see «20. TESTING AND ADJUSTMENTS).

REMOVAL OF BACKHOE BOOM CYLINDER

1 - Remove the lubrication nipple and the extension.

! Extend the arm (2) completely and fully open the bucket (3).

Manoeuvre the front equipment until the bucket teeth are resting on the ground, the arm on a block "A" about 10 cm high, and the joint between the arm and the boom on a stand "B", about 70 cm high.

2 - Stop the engine and release residual pressures.

3 - Place a sling around the cylinder (4).

4 - Take out the screws (5) and remove the pin (6).

※ 1 ※ 2

5 - Start the engine and retract the piston.

★ Secure the position of total retraction by binding the piston head rod with wire.

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

7 - Disconnect the pipes (7) and (8) and plug them to prevent entry of impurities.

8 - Take out the screw (9) and remove the pin (10).

※ 1 ※ 2

9 - Remove the cylinder (4).



Cylinder: WB91R-2: 65 kg
WB93R-2: 78 kg

INSTALLATION OF THE BACKHOE BOOM CYLINDER

• To install, reverse the removal procedure.

※ 1

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

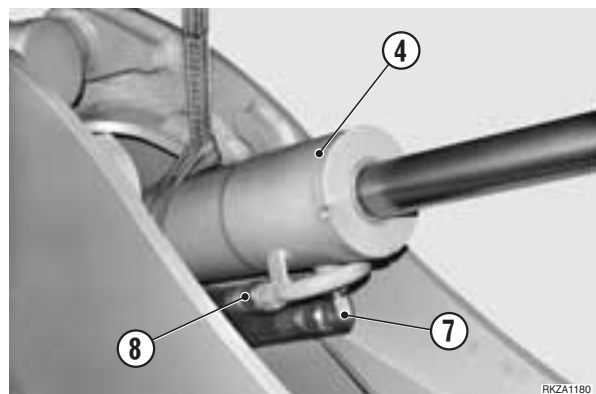
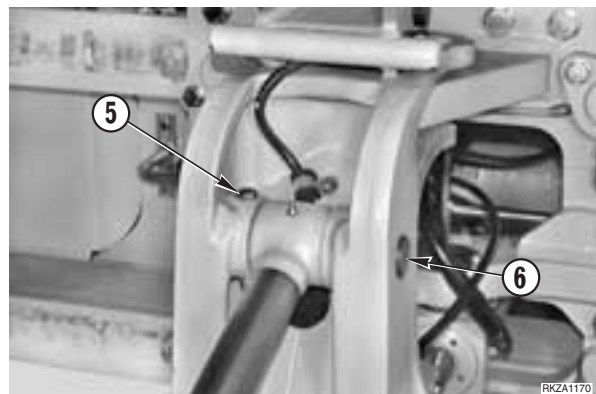
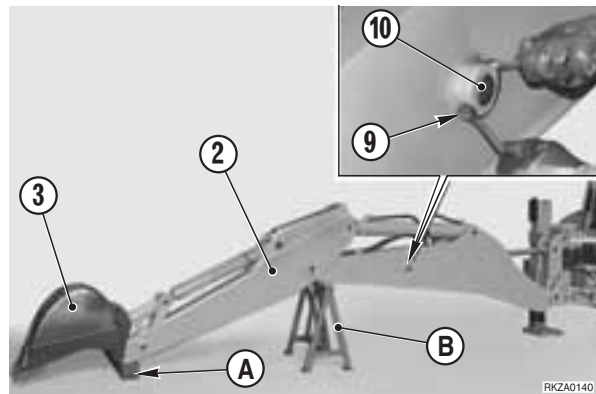
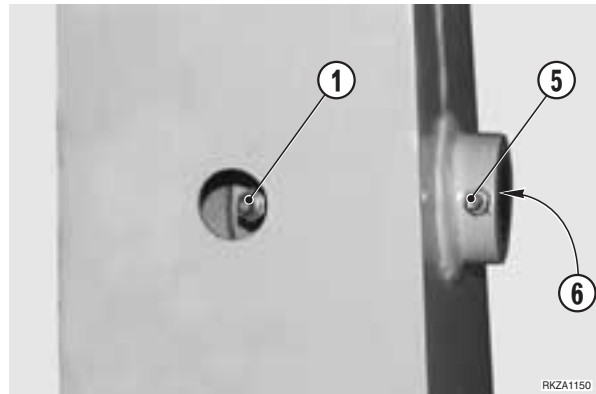
※ 2



Internal bushing: ASL800050

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

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



REMOVAL OF THE BACKHOE ARM CYLINDER

! Extend the arm (1) completely and fully open the bucket (2). Lower the arm (3) until the joint between the arm and the boom is resting on a stand "A" about 90 cm high, and tip of the arm on a block "B" about 10 cm high. Rest the bucket teeth on the ground.

1 - Stop the engine and release the pressures in the cylinder by moving the control lever several times.

2 - Place a sling around the cylinder (4).

3 - Take out the screws (5) and remove the pin (6).



4 - Start the engine and retract the piston (7).

★ Secure the position of total retraction of the piston (7) by binding the piston head rod with wire.

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

6 - Disconnect the pipes (8) and (9) and plug them to prevent entry of impurities.

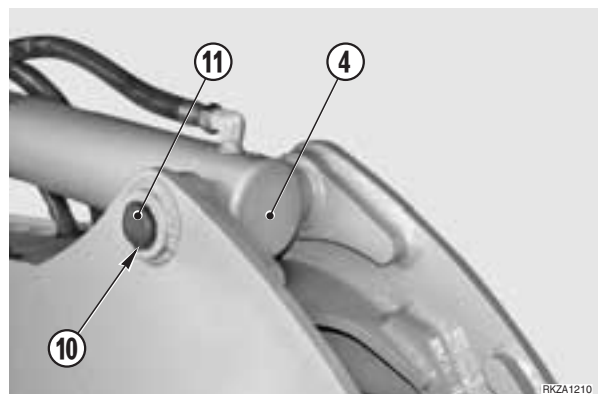
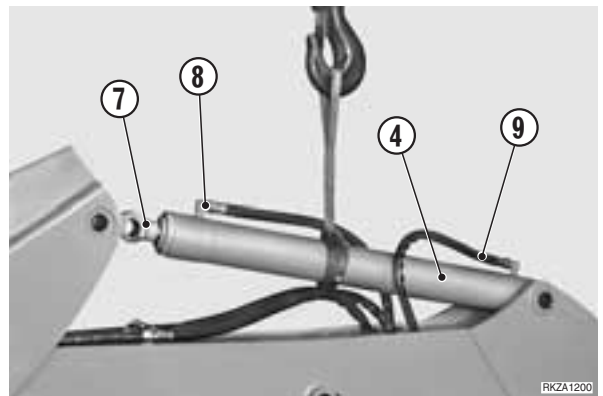
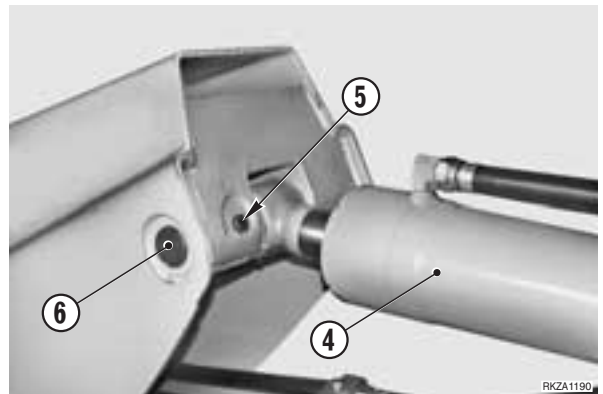
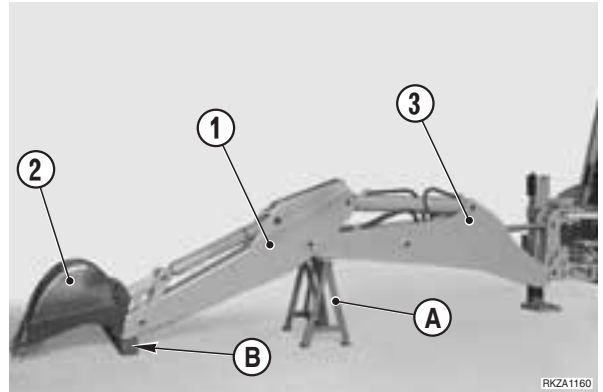
7 - Take out the snap-ring (10) and remove the pin (11).



8 - Remove the cylinder (4).



Cylinder: 69 kg



INSTALLATION OF THE BACKHOE ARM CYLINDER

- To install, reverse the removal procedure.



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



Internal bushing: ASL800050

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

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

REMOVAL OF THE JIG ARM CYLINDER

⚠ Open the arm (1) completely and lower it until it rests on a trestle "A" that is roughly 40 cm high. Extend the jig arm (2) until it rests on a block "B", and let the bucket teeth rest on the ground.

1 - Stop the engine and release the cylinder (3) pressures, by moving the command pedal several times.

2 - Put a sling around the cylinder (3).

3 - Take off the snap ring and remove the pin (4).



4 - Start the engine to retract the piston.

★ Secure the fully retracted position of the piston by binding it with wire.

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

(For details see «20. TESTS AND ADJUSTMENTS»).

6 - Take out the safety pin (5).

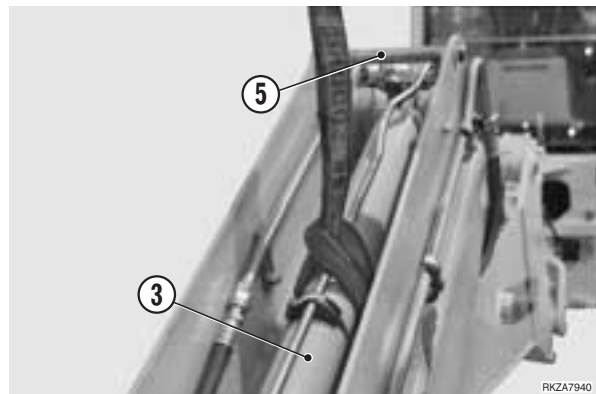
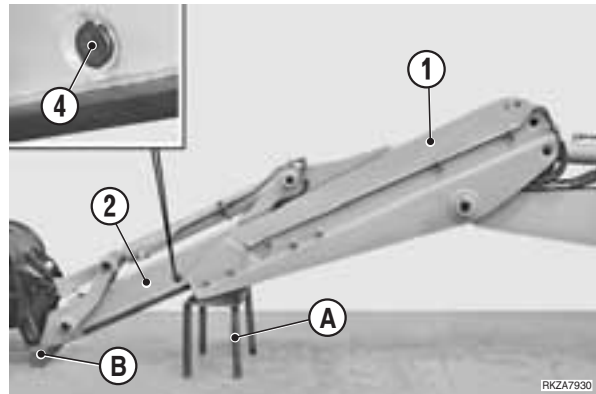
7 - Disconnect the hoses (6), (7), (8) and (9), and plug them to prevent entry of impurities.

8 - Remove the clamp (10).

9 - Remove the screws (11) and the pin (12).



10 - Remove the cylinder (3).



INSTALLATION OF THE JIG ARM CYLINDER

• To install, reverse the removal procedure.



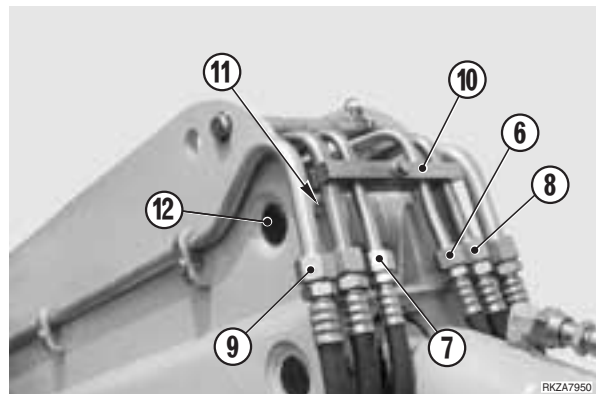
⚠ When aligning positions between hole and pin, let the engine turn over at low idling. Do not insert fingers into the holes to check on alignment.



Internal bushings: ASL800050

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

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



REMOVAL OF THE BACKHOE BUCKET CYLINDER

! Extend the arm (1) completely and fully open the bucket (2). Lower the boom (3) until the arm is resting on a stand "A" about 90 cm high, and tip of the arm on a block "B" about 10 cm high.

Rest the bucket teeth on the ground.

- 1 - Stop the engine and release the pressures in the cylinder (4) by moving the control lever several times.
- 2 - Place a sling around the cylinder (4).
- 3 - Take out the lock-nut (5) and the washer and remove the pin (6).

※ 1 ※ 2 ※ 3

- 4 - Start the engine and retract the piston (7).

★ Secure the position of total retraction of the piston by binding the piston head rod with wire

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

- 6 - Disconnect the pipes (8) and (9), and plug them to prevent entry of impurities.

- 7 - Take out the snap-ring (10) and remove the pin (11).

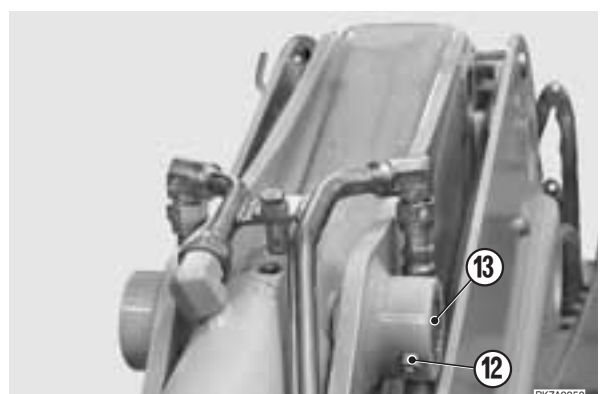
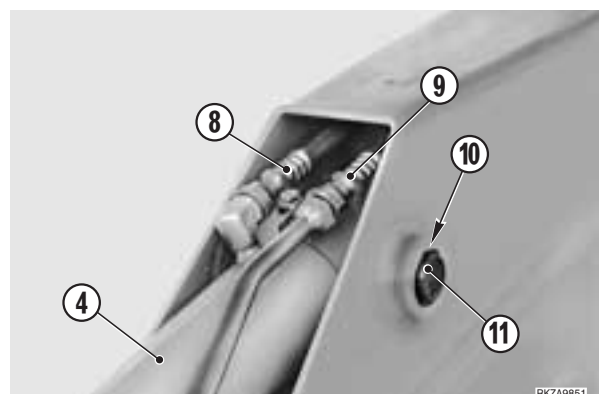
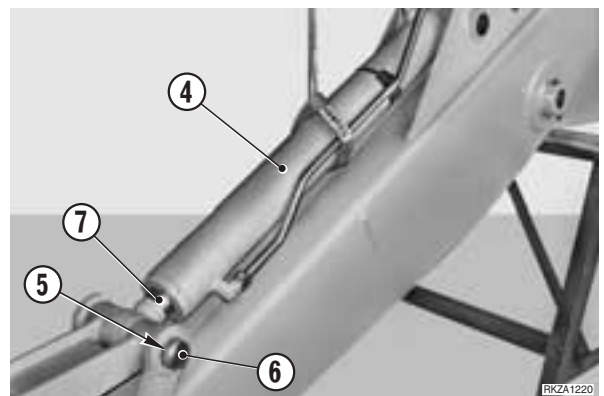
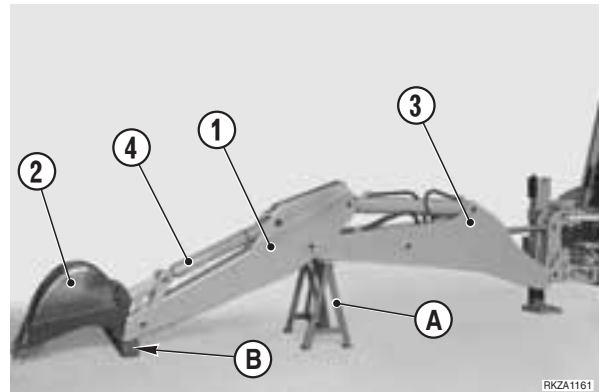
※ 1 ※ 2

★ For jig arm: loosen nut (12) and remove pin (13).

- 8 - Remove the cylinder (4).



Cylinder: 49 kg



INSTALLATION OF THE BACKHOE BUCKET CYLINDER

- To install, reverse the removal procedure.

※ 1

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

※ 2



Internal bushing: ASL800050

※ 3

★ Tighten the locknut completely, then release it half a turn.

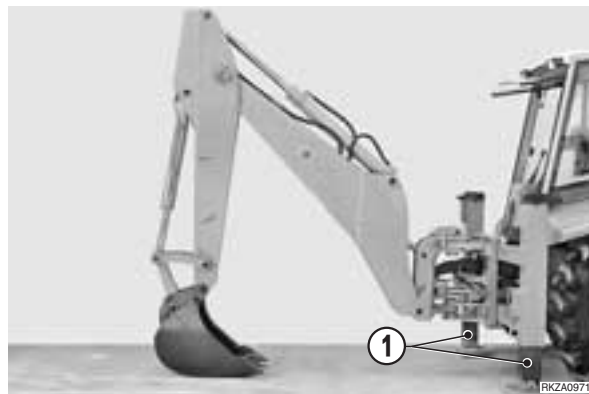
- 1 - Start the engine and bleed the air from the cylinders. (For details, see «20. TESTING AND ADJUSTMENTS»).

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

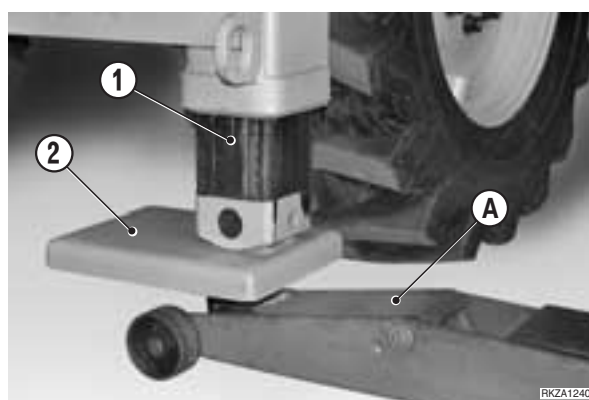
REMOVAL OF THE OUTRIGGER CYLINDERS

! Position the backhoe with the equipment centered, the arm vertical and the back of the bucket resting on the ground.

1 - Extend the outriggers (1) of about 15 cm, stop the engine and release the cylinders pressures.



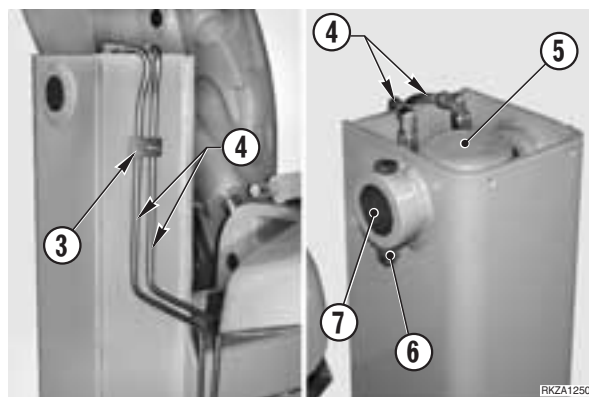
2 - Place a lifting platform "A" beneath outrigger (2) of cylinder to be remove.
Raise this until it is forced up against the outrigger.



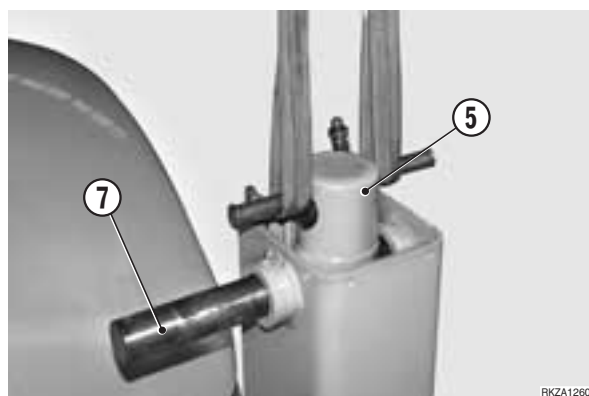
3 - Remove the retainer pipes clamp (3).

4 - Disconnect from cylinder (5) the pipes (4) and plug them to avoid impurity entry.
Plug also the union to avoid the movement of piston.

5 - Remove screw (6) and extract the pin (7) until the cylinder (5) is free.



6 - Raise the lifting platform "A" to disengage the cylinder head (5) from frame
Place a sling round the cylinder (5) and apply slight tension to the cables.



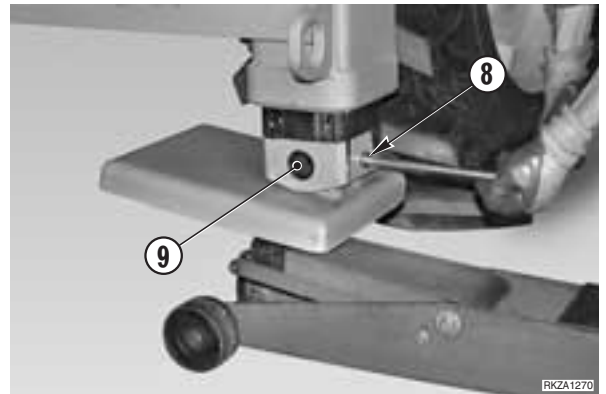
7 - Take out the screw (8) and remove the pin (9).



8 - Remove the cylinder (5).



Cylinder: 42 kg



INSTALLATION OF THE OUTRIGGER CYLINDERS

- To install, reverse the removal procedure.



 Do not insert fingers into the holes to check alignment.



Internal bushing: ASL800050

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

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

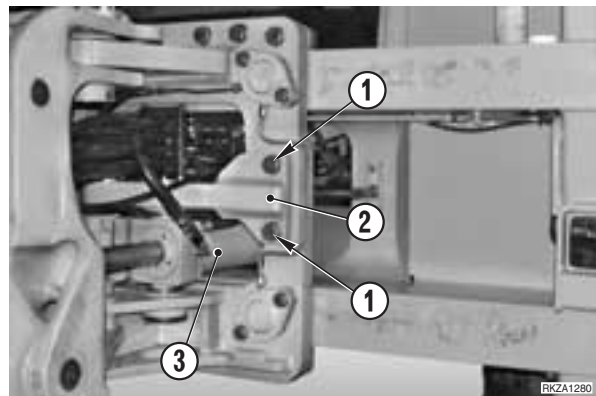
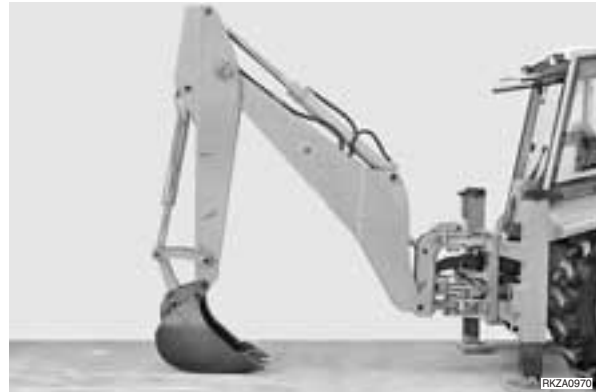
REMOVAL OF THE BACKHOE SWING CYLINDERS

! Position the backhoe with the equipment centered, the arm vertical and the back of the bucket resting on the ground.

- 1 - Stop the engine and release cylinder pressures by moving the control levers several times.
- 2 - Take out the screws (1) and remove vertically the upper support (2) of the cylinder fulcrum.  1  3
- 3 - Disconnect the four tubes (4) from the cylinders (3) and plug them to prevent entry of impurities.
- 4 - Take out the screws (5) and remove the pins (6).  2  3
- 5 - Rotate the cylinders to disengage the piston heads from the swing bracket (7) and remove the cylinders (3).



Cylinder: 30 kg



INSTALLATION OF THE BACKHOE SWING CYLINDERS

- 1 - Mount the cylinders (3) and the upper cylinder fulcrum support (2). Secure the support with the four screws (1).



Support screws: Loctite 262



Support screws: 981±98 Nm

- 2 - Connect the four tubes (4) to the cylinders.
- 3 - Start the engine and swing the boom in order to center one of two pins (6). Secure the 1st pin with the screw. Perform the same operation for the other pin.



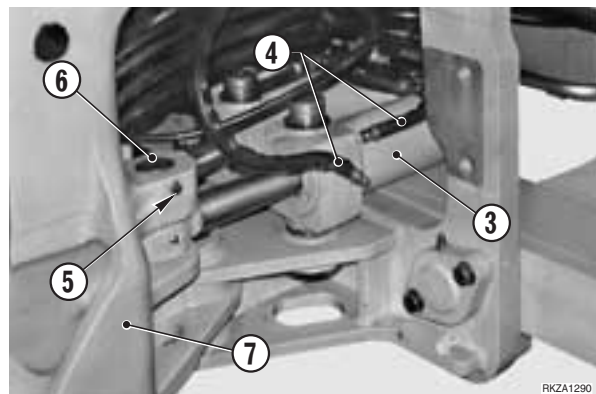
! When aligning the positions between the hole and the pin, turn the engine over at low idling speed. Do not insert fingers into the holes to check alignment.



Internal bushing: ASL800050

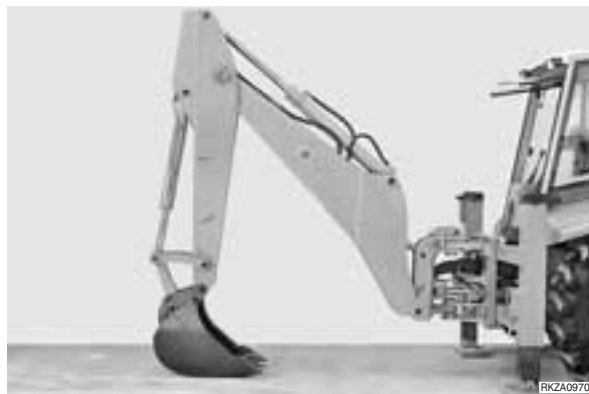
- 4 - Bleed the air from the cylinders. (For details, see «20. TESTING AND ADJUSTMENTS»).

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

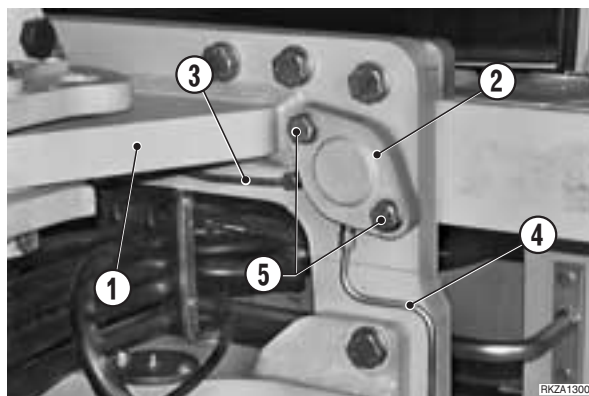


REMOVAL OF BACKHOE BACKFRAME LOCK CYLINDER

- ★ Set the backhoe with the centered attachments with the arm in vertical position and the bucket leaned on the back at level ground.



- 1 - Unlock the backframe (1).
- 2 - Stop the engine and release the residual hydraulic pressures. (For details, see «20. TESTING AND ADJUSTMENT»).
- 3 - Disconnect from cylinder (2) the pipes (3) and (4) and plug them to avoid impurity entry.
- 4 - Remove screws (5) and cylinders (2).



INSTALLATION OF BACKHOE BACKFRAME LOCK CYLINDER

- To install, reverse the removal procedure.



Locking screw: Loctite 262



Locking screw: 420±40 Nm



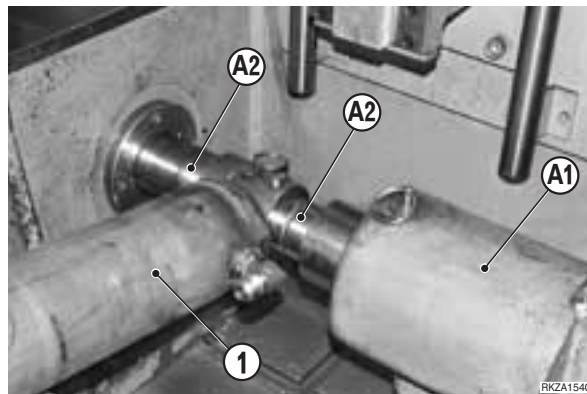
Cylinder seat: ASL800050

- 1 - Start the engine, lock and unlock the backframe several times to make the circuit feeling.

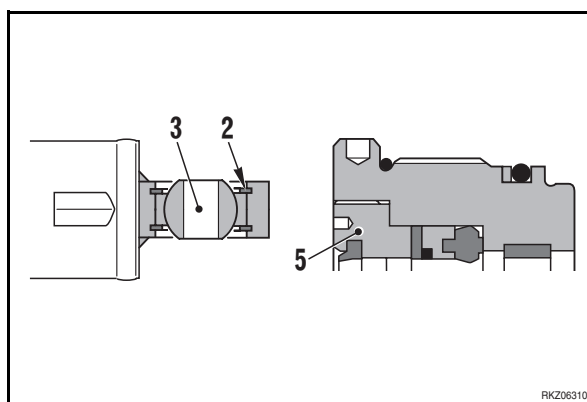
DISASSEMBLY OF CYLINDERS

(Front bucket raise and tilt, boom, arm, bucket, outriggers and telescopic arm)

1 - Place the cylinder (1) on the tool **A1**.



! For the arm cylinder with side-digging boom first extract the snap-rings (2) and the ball-and-socket joint (3).

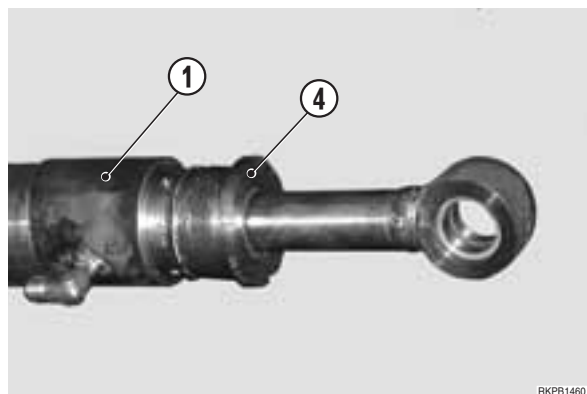


2 - Using the specially-made wrench **A4**, **A5**, **A6** unscrew the cylinder head (4) and extract it from the cylinder (1).

! For the side-digging boom cylinder, first remove the lock-nut (5) that secures the piston-rod seal.

3 - Extract the piston-rod group (6) from the cylinder (1)

4 - Remove the cylinder (1) and the piston-rod group (6).



REMOVAL AND INSTALLATION

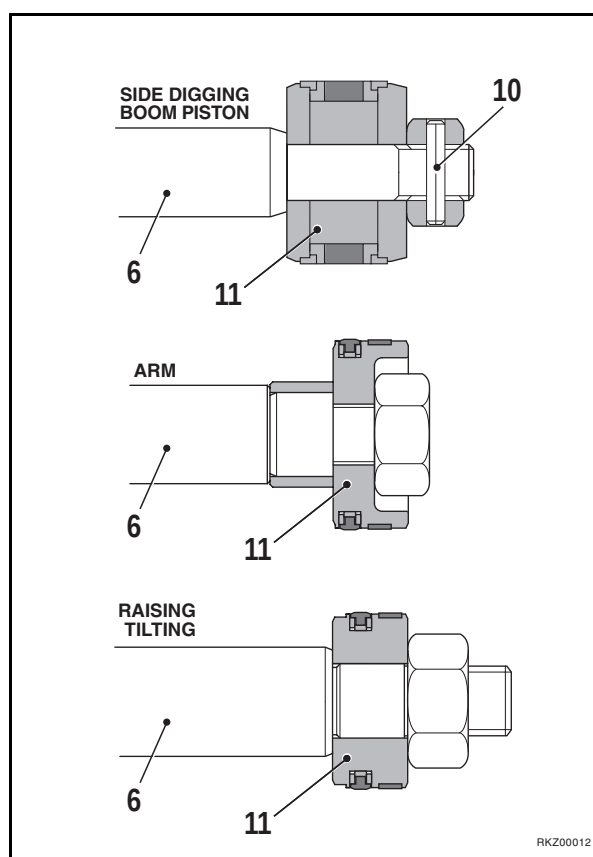
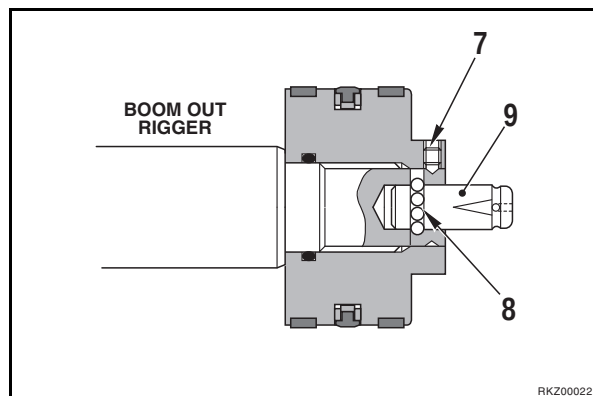
CYLINDERS

- 5 - Secure the piston-rod group (6) on the tool **A1**.
- 6 - **For the side digging boom cylinder:** remove the snap-spin (10).
- 7 - **For the piston rod of the boom cylinder:** remove the screw (7).
- 8 - Use the appropriate socket wrench **A7** on the piston hexagon (11) and unscrew the piston.
 - ★ Measurement of the socket wrench:

For raising the front bucket.:	55 mm
For tilting the front bucket.:	55 mm
Boom:	65 mm
Arm:	55 mm
Bucket:	55 mm
Outriggers:	46 mm
Telescopic arm:	46 mm
Side digging boom:	46 mm
- 9 - **For the piston rod of the boom cylinder:** Take out the ball bearings (8) and the cushion plunger (9).
- 10 - Dismantle all the groups by removing all the seals, the dust-seals, the guide rings, and the fulcrum bushings.

⚠ The seals, the dust seals and the guide rings cannot be used again.

⚠ Carefully check the pistons (11). If both safety-caulked areas show wear, the pistons must be replaced.



ASSEMBLY OF CYLINDERS

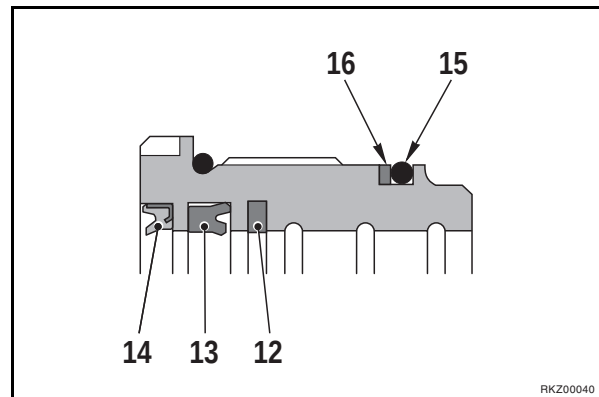
(Front bucket raise and tilt, boom, arm, bucket, outriggers and jig arm)

- ★ Take great care not to damage the seals and the sliding surfaces.
- ★ Prepare each individual component before the final assembly.

1. Assembly of the cylinder head

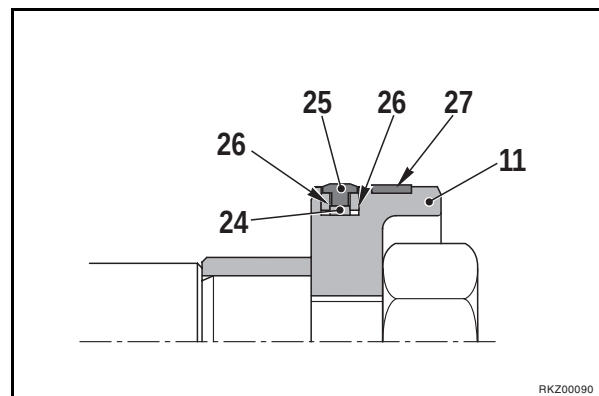
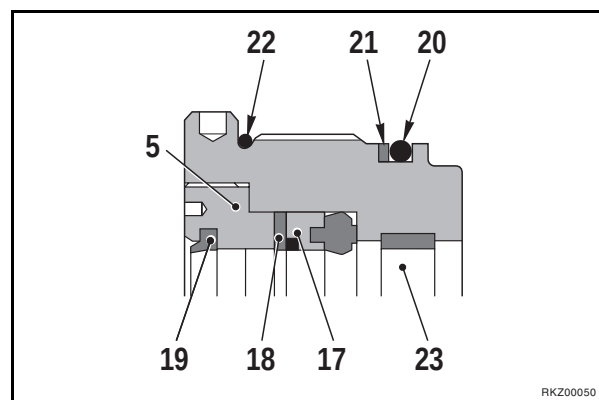
1.1 Only for the cylinders for front bucket raise and tilt, boom, arm, bucket, outriggers, jig arm

- 1 - Mount the gasket (12) in the cylinder head.
- 2 - Mount the gasket (13) in the cylinder head.
 - ★ Make sure that the lips are turned towards the inside of the cylinder.
- 3 - Mount the guard ring (14) using the tool **A8**.
- 4 - Mount the O-ring (15) and the anti-extrusion ring (16) on the outside of the cylinder head.



1.2 Cylinder for side digging boom

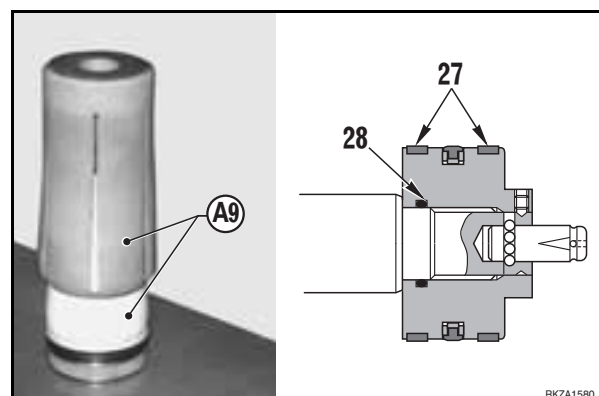
- 1 - Insert the gasket (17) in the cylinder head, and let it beat on seat bottom, then insert the anti-extrusion ring (18).
 - ★ Check carefully the assembly orientation.
- 2 - Mount the guard ring (19) in the lock-nut (5).
- 3 - Tighten the lock nut (5) until leaning lightly on anti-extrusion ring (18).
- 4 - Assemble on head the O-ring (20), the anti-extrusion ring (21), the O-ring (22) and the ring (23).



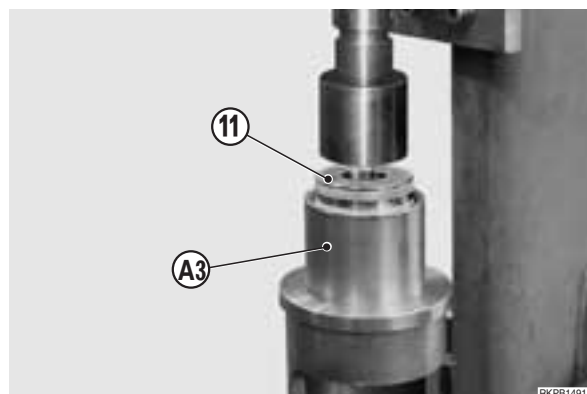
2. Re-assembling the piston

2.1 Only for the cylinders for front bucket raise and tilt, boom, arm, bucket, outriggers, jig arm

- 1 - Use the tool **A9** with the appropriate diameter, mount the ring (24) the external seal (25) and the anti-extrusion rings (26) onto the piston (11).
- 2 - Prepare the guide ring (27).
 - ★ There are two guide rings (27) for the boom piston.
- 3 - For the boom piston only: insert the O-ring (28) into the internal seating.



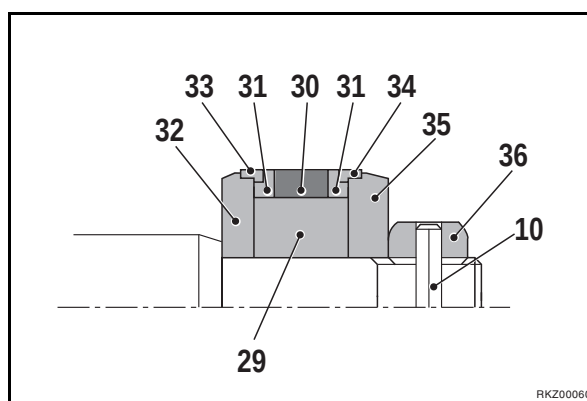
- 4 - Gauge the diameter of the seal (25) of the piston (11) mounting the group under a press and use the tools **A3** for the piston diameter.



2.1 Side digging boom cylinder

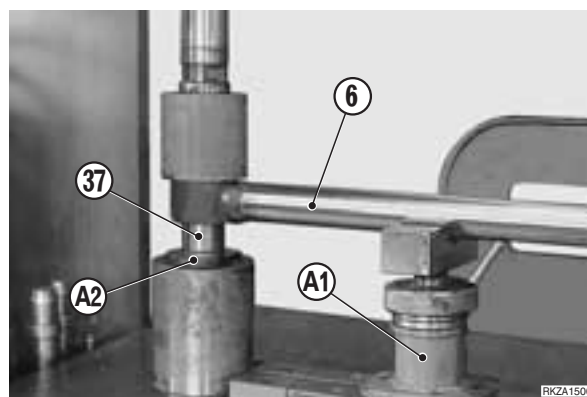
- ★ This mounting should be performed directly on piston.

- 1 - Mount central ring (29), rubber ring (30) and anti-extrusion ring (31).
- 2 - Mount on piston first washer (32), guide ring (33), central ring assembly (29), second guide ring (34) and second washer (35).
- 3 - Tighten nut (36) and lock the piston group after locking rod head under the press. (See «3. RE-ASSEMBLING THE PISTON-ROD GROUP»).
- 4 - Insert the snap ring (10).



3. Re-assembling the piston-rod group

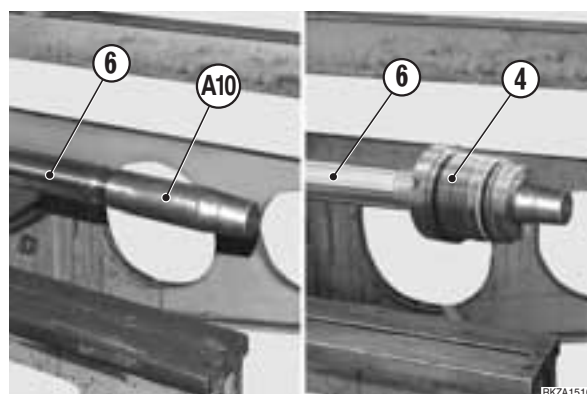
- 1 - **Only for the cylinders for front bucket raise and tilt, boom, arm, bucket and side digging boom:** using a press and tools **A2** with the appropriate diameter, insert the bushing (37) into the piston head (6).



- 2 - Mount the bushing **A10** of the correct diameter onto the tip of the piston rod (6).
- 3 - Slightly lubricate the cylinder head seals (4) and slide the group onto the piston rod (6).



Seals: ASL800050



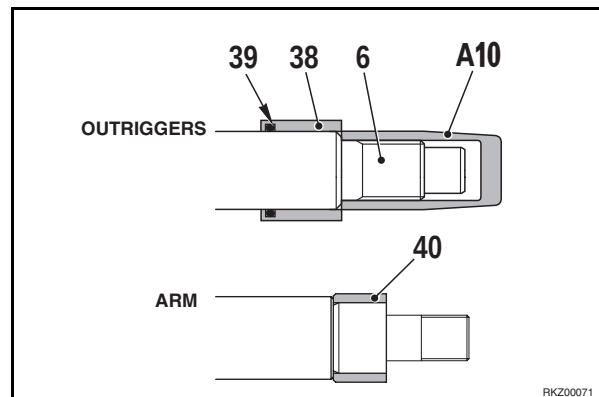
REMOVAL AND INSTALLATION

CYLINDERS

4 - **For the cylinders of the outriggers only:** mount the spacer (38) with the O-ring (39).

★ Check carefully the assembly orientation.

For the arm cylinder only: insert the spacer (40).

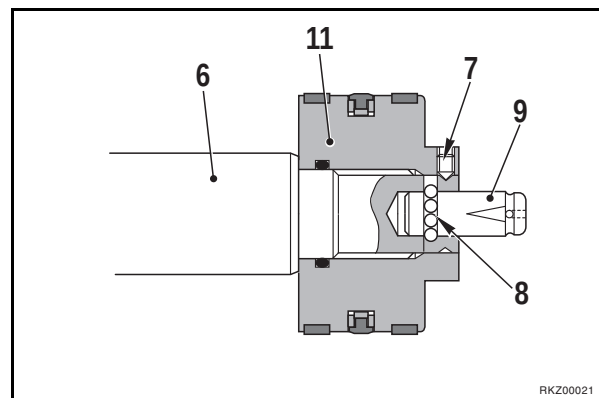


5 - Remove from the tip of the piston rod (6) the bushing **A10** and mount the piston (11) and the nut (36).

★ Grease the piston threading.

Piston locking nut: Loctite 262

Piston locking nut:
 Front bucket raise: 2845±284 Nm
 Front bucket tilt: 2845±284 Nm
 Arm: 2845±284 Nm
 Bucket: 2845±284 Nm
 Outriggers: 1520±152 Nm
 Telescopic arm: 1520±152 Nm



6 - **For the boom cylinder:** mount the cushion plunger (9), slide the eleven ball-bearings (8) into the hole, and mount the dowel bolt (7).

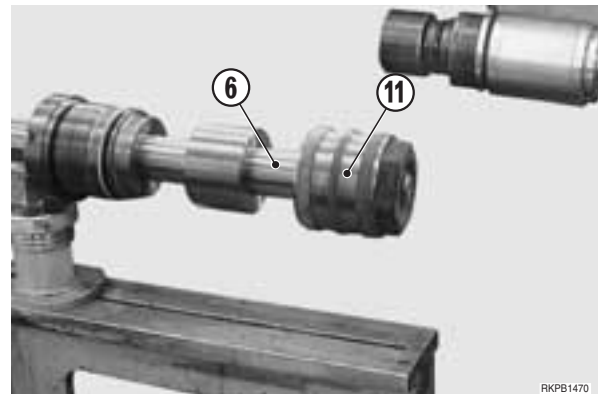
Dowel bolt: Loctite 262

Dowel bolt: 23±2 Nm

7 - Screw the complete piston (11) onto the piston rod (6), and secure it with the dynamometric wrench.

Piston: 2697–3924 Nm

8 - Caulk the piston (11) to correspond to the slot in the piston rod (6) not previously used.



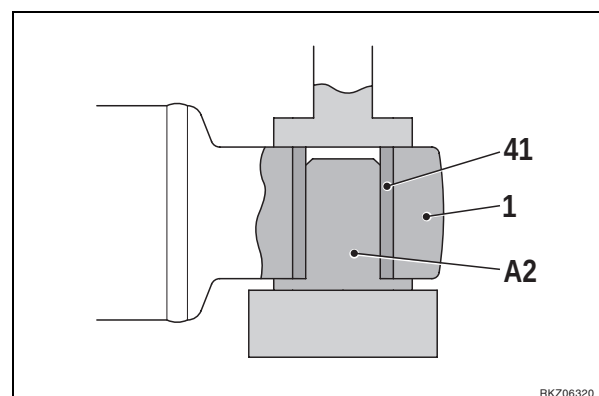
4. Re-assembling the cylinders

1 - **For the boom, arm, bucket and side digging boom cylinders only:**

Position the bushing (41) and mount it in the cylinder head (1) using tool **A2** of the correct diameter.

★ There are two bushings for the arm cylinder, with a spacer between them.

★ Leave the cylinder in position for subsequent assembly.



REMOVAL AND INSTALLATION

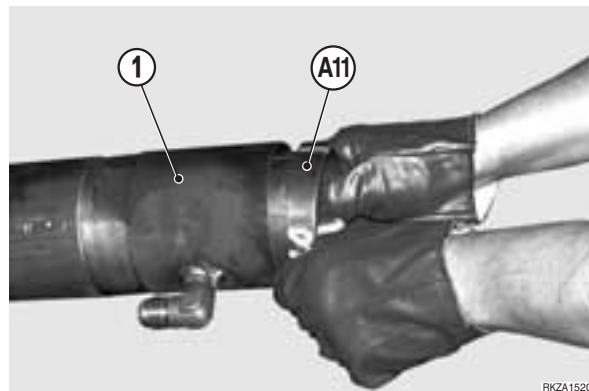
CYLINDERS

- 2 - Lubricate the threading and the first part of the cylinder (1).



Cylinder: ASL800050

- 3 - Mount the two halves of the tool **A11** with the appropriate diameter at the mouth of the cylinder (1).



- 4 - Mount the piston rod group (6) and the cylinder (1) on the apparatus **A1**.

- 5 - Guide the piston and center it in the tool **A11**.

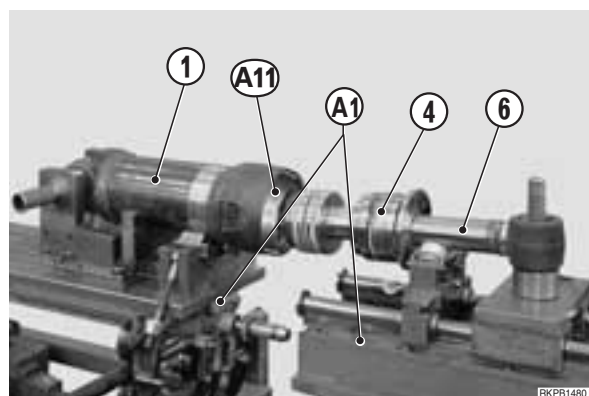
- 6 - Mount the first guide ring (27) onto the piston and insert part of the piston into the tool **A11**.

For the boom cylinder only: mount the second guide ring (27) and fully insert the piston.



Insert the piston slowly in order to calibrate the guide rings (27) without overheating them.

- 7 - Take the cylinder out of the tool **A11** and bring the cylinder head (4) and the piston rod head closer to the cylinder.



- 8 - Bring the cylinder (1) into position for screwing in the cylinder head (4).

- 9 - Insert the cylinder head into the cylinder and screw it in by hand for several turns.

- 10 - Use the right special wrench **A4**, **A5**, **A6** to screw the cylinder head (4) home.

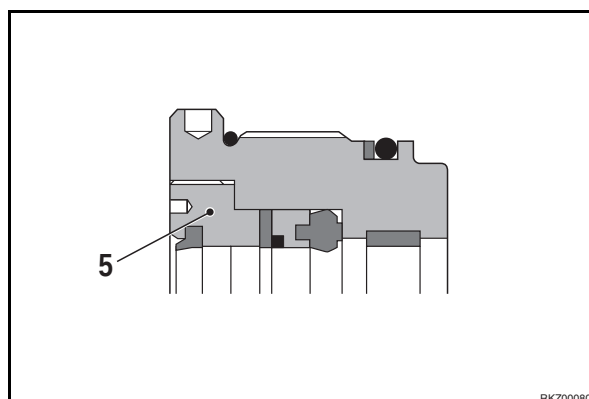


Cylinder head: 932–980 Nm

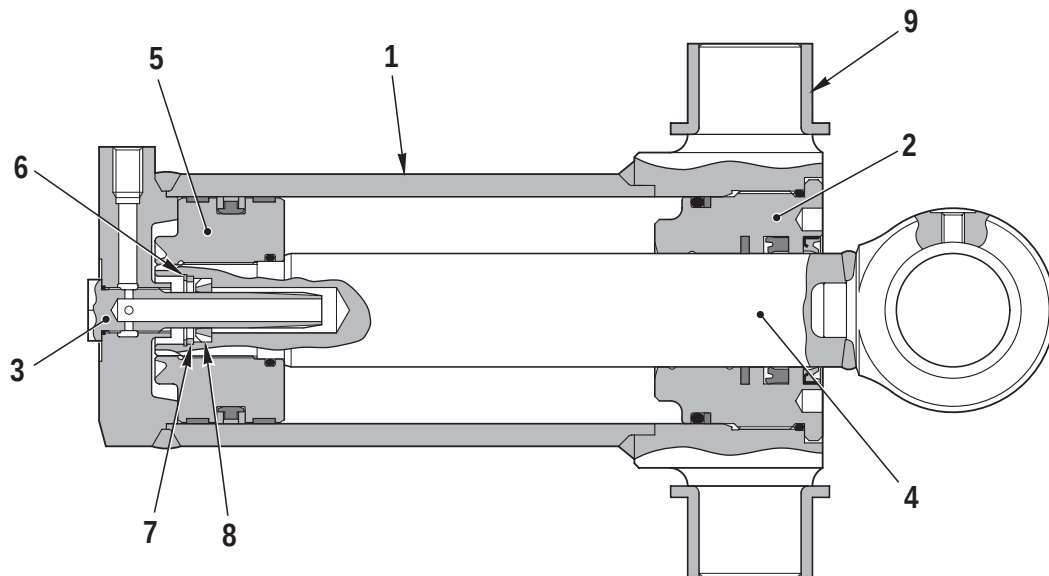
- 11 - **For the side digging boom cylinders only:** tighten the lock-nut (5).



Lock-nut: 490 Nm



DISASSEMBLY OF BOOM SWING CYLINDER



RKZ00100

- 1 - Place the cylinder (1) on the apparatus **A1**. Engage the fulcrum pins in the suitable support.
- 2 - Using the specially-designed wrench **A6**, unscrew the cylinder head (2) and extract it completely from the cylinder (1).
- 3 - Remove brake cylinder (3).
- 4 - Attach the piston head to the mobile group of the apparatus **A1**.
- 5 - Extract the piston rod group (4) from the cylinder.
- 6 - Remove the cylinder and the piston rod group.
- 7 - Secure the complete piston rod (4) to the apparatus **A1**.
- 8 - Raise the part caulked for safety purposes and unscrew the piston using the tool **A7**.
- 9 - Remove the snap-ring (6) from the piston and extract the ring (7) and the spacer ring (8).
 - ★ Make a note of the order of assembly of the ring (7).
- 10 - Using a puller remove the swing bushings (9) from the cylinder axle oscillation pins.
- 11 - Dismantle the groups by removing all the seals, the guard rings, the guide rings and the piston fulcrum bushing.

! Check the piston (5) carefully. If both safety-caulked areas have been used, the piston must be replaced.

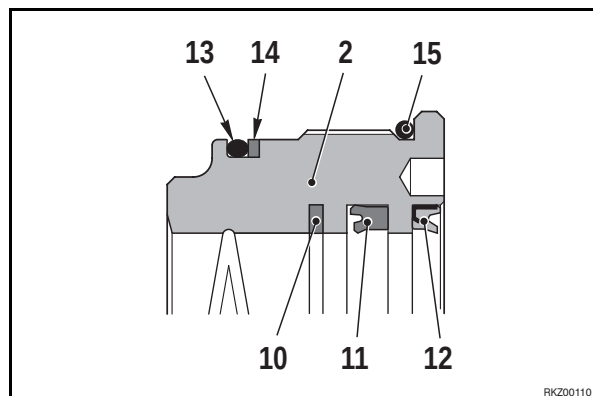
! The seals, guard rings and guide rings must not be used again.

ASSEMBLY OF BOOM SWING CYLINDER

- ★ Take great care not to damage the seals and the sliding surfaces.
- ★ Prepare each individual component before the final assembly.

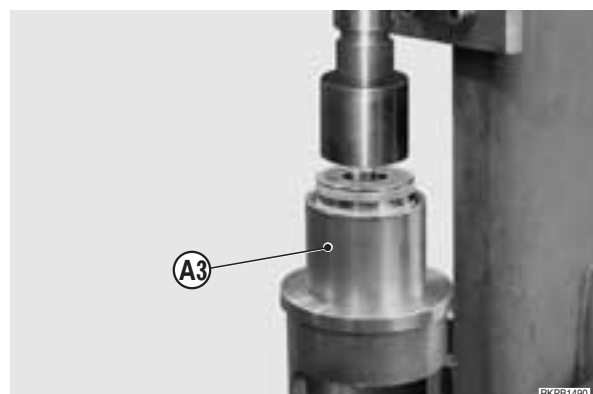
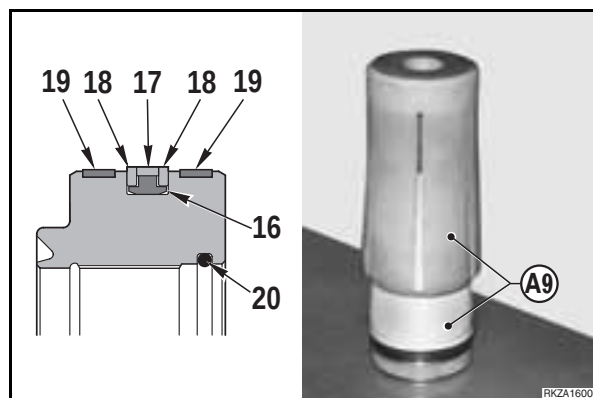
1. Assembly of the cylinder head

- 1 - Mount the gasket (10) and the gasket (11) in the cylinder head (2).
 - ★ Make sure that the gasket lips (11) are turned towards the inside of the cylinder.
- 2 - Mount the scraper ring (12).
- 3 - Mount the O-ring (13), the anti-extrusion ring (14) and lastly the O-ring (15) of the front seal.



2. Re-assembling the piston

- 1 - Use the tool **A9** with the appropriate diameter, mount the rubber ring (16) and the seal ring (17) onto the piston. Remove the tool **A9** and mount the anti-extrusion rings (18).
- 2 - Prepare the guide rings (19).
- 3 - Mount the O-ring (20) in the internal seating of the piston.
- 4 - Gauge the diameter of the seal (16) of the piston mounting the group under a press and use the tools **A3** for the piston diameter.



REMOVAL AND INSTALLATION

BOOM SWING CYLINDER

3. Re-assembling the piston rod group

- 1 - Using a press and tools **A2** with the appropriate diameter, insert the bushing (21) into the piston head (4).
- 2 - Insert the ring (8) into the piston rod (4).
 - ★ Check carefully the direction of assembly of the ring (8).
- 3 - Insert the spacer ring (7) and secure the group with the snap-ring (6).
- 4 - Mount the bushing **A10** of appropriate diameter on the tip of the piston rod (4).
- 5 - Lightly lubricate the cylinder head gaskets (2) and slide the group onto the piston rod (4).

 Gaskets: ASL800050

- 6 - Lubricate the O-ring seals (22) and screw the piston (5) onto the piston rod (4) by hand for several turns.

 O-ring seal: ASL800050

- 7 - Position the group on the tool **A1** and tighten the piston with the round prong wrench **A7**.

 Piston: 932–980 Nm

4. Re-assembling cylinders

- 1 - Place the cylinder (1) on the apparatus **A1**. Engage the fulcrum pins in the suitable support.
- 2 - Lubricate the threading and the first part of the cylinder (1).

 Cylinder: ASL800050

- 3 - Mount the two halves of the tool **A11** with the appropriate diameter at the mouth of the cylinder (1).
- 4 - Mount the piston rod group on the apparatus **A1**.
- 5 - Center the piston (5) in the tool **A11**.
- 6 - Wind the first guide ring (19) round the piston and insert part of the piston into the tool **A11**. Wind the second guide ring (19) and fully insert the piston.

 Insert the piston slowly in order to calibrate the guide rings (19) without overheating them.

- 7 - Insert the cylinder head (2) and screw it in by hand for several turns.

- 8 - Use the special wrench **A6** to screw the cylinder head home.

 Cylinder head: 932–980 Nm

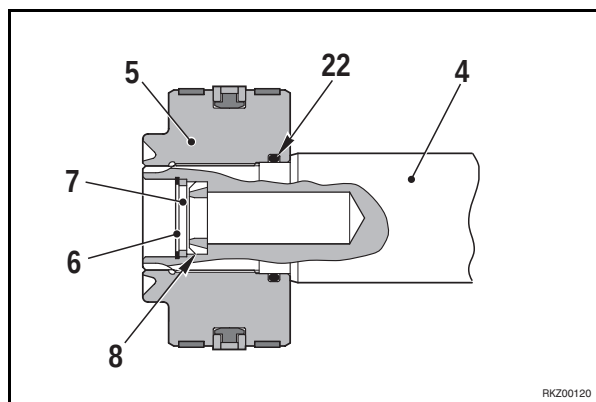
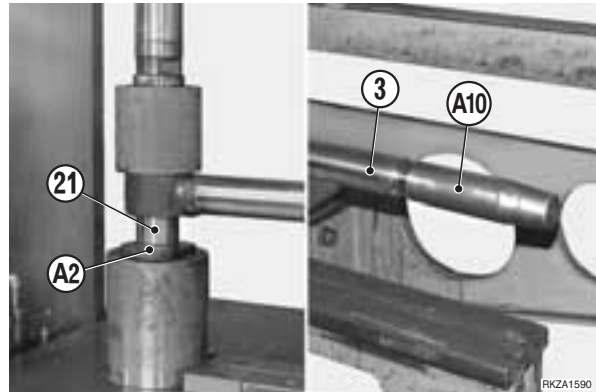
- 9 - Screw the brake cylinder (3) into the cylinder (1).

 Brake cylinder: Loctite 270

 Brake cylinder: 804 Nm

- 10 - Remove the cylinder from the equipment **A1**.

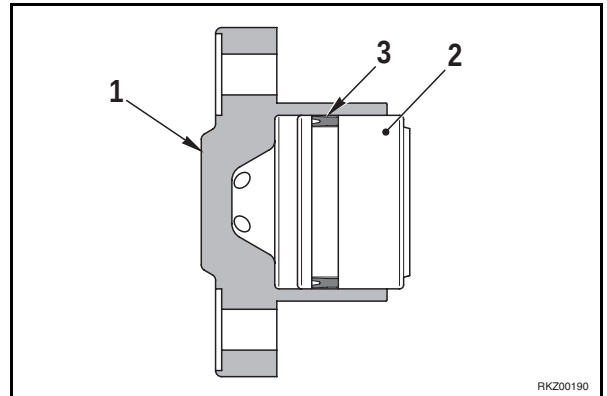
- 11 - Using a press and the appropriate tool **A2**, mount the swing bushings (9).



DISASSEMBLY OF BACKHOE BACKFRAME LOCK CYLINDER

- 1 - Plug one of the two cylinder (1) ports.
- 2 - Connect to the other port compressed air (max. 3 bar).
- 3 - Slowly insert pressure up to piston (2) comes out.
 - ★ Retain piston and protect from oil using gloves and a protection.
- 4 - Remove gasket (3).

 The gasket has be replaced.

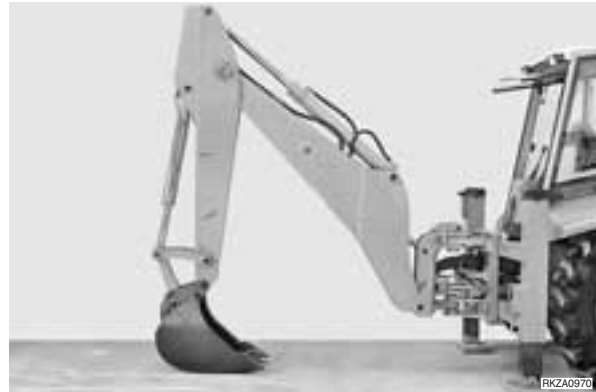


ASSEMBLY OF BACKHOE BACKFRAME LOCK CYLINDER

- 1 - Use the tool with the appropriate diameter, mount the seal ring (3) onto the piston (2).
 - ★ Make sure that the lips are turned towards the inside of the cylinder.
- 2 - Put the piston (2) onto cylinder (1).
 -  Internal Cylinder: ASL800050
- 3 - Apply an elastic band, tighten gasket (3) and using a press insert the piston at the end of stroke.

REMOVAL OF THE BOOM SAFETY CYLINDER

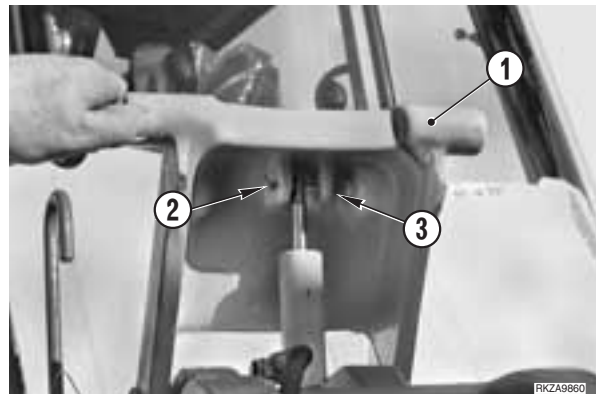
⚠ Center the backhoe with the arm vertical and the back of the bucket on the ground.



1 - Make sure that the safety stop (1) is raised.

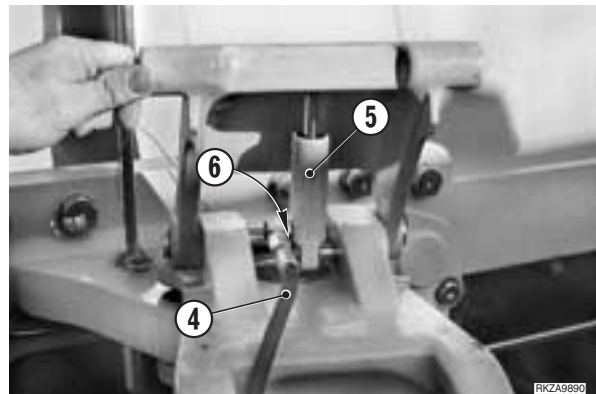
2 - Stop the engine and release the residual hydraulic pressures.

3 - Take out the cotter pins (2) and remove the pin (3).



4 - Disconnect the tube (4) that feeds the cylinder (5). Plug the tube to prevent entry of impurities.

5 - Take out the snap ring (6) and remove the cylinder (5).



INSTALLATION OF THE BOOM SAFETY CYLINDER

• To install, reverse the removal procedure.



 Pin seatings: ASL800050



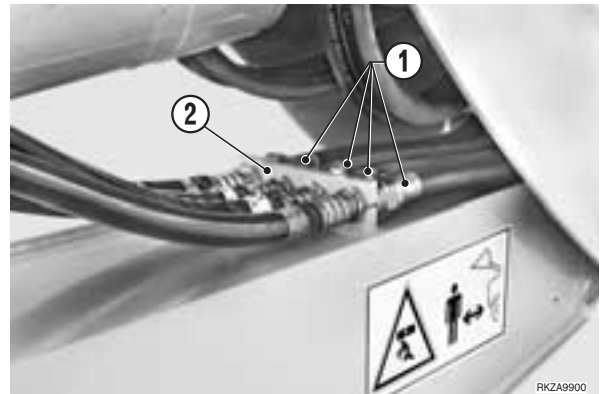
★ Install new cotter pins.

1 - Start the engine and perform several lock and release manoeuvres to fill up and bleed air from the unit.

REMOVAL OF THE BACKHOE WORKING EQUIPMENT

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

- 1 - Stop the engine and release the residual hydraulic pressures. (For details, see «20. TESTING AND ADJUSTMENTS»).
- 2 - Remove the boom cylinder. (For details, see «REMOVAL OF BOOM CYLINDER»).
- 3 - Take out the bracket (2) mounted inside the boom. Disconnect the tubes (1) from the arm cylinders.
 - ★ Plug all tubes to prevent entry of impurities.
 - ★ Mark the tubes to prevent exchanging positions during re-connection.



- 4 - Remove bracket (3).
 - ★ Mark the tubes to prevent exchanging positions during re-connection.
- 5 - Put a sling round the equipment (4) and apply slight tension to the cables.
- 6 - Take out the snap-rings and remove the pin (5).

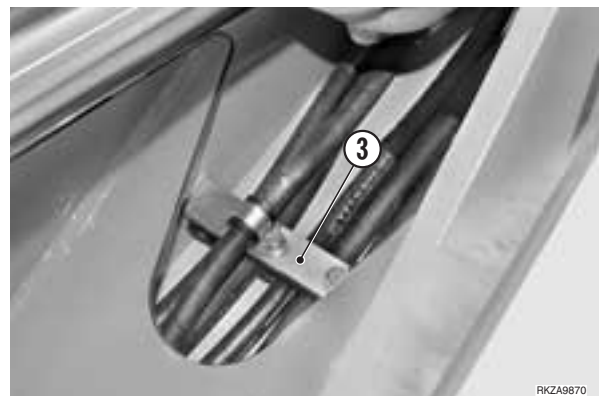


- 7 - Remove the working equipment (4).



Standard work equipment: 850 kg

- ★ While remove the equipment, extract the control hoses and take care to not stress them.



INSTALLATION OF THE BACKHOE WORKING EQUIPMENT

- To install, reverse the removal procedure.



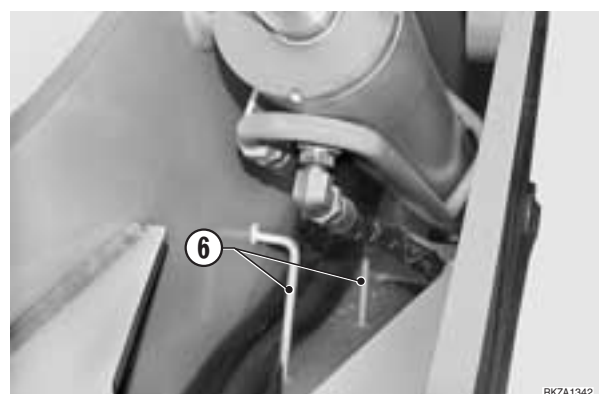
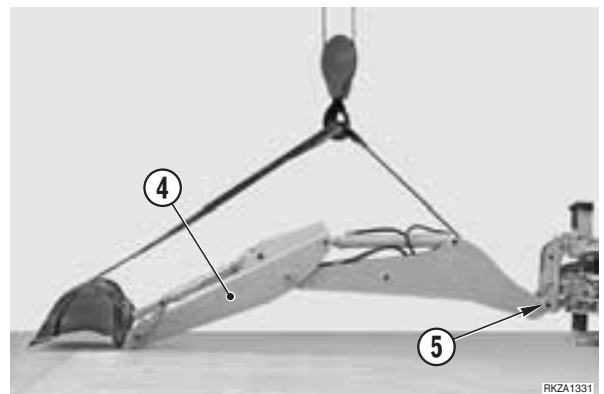
! When aligning the positions between the hole and the pin, turn the engine over at low idling speed. Do not insert fingers into the holes to check alignment.



Internal bushing: ASL800050



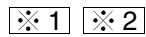
- ★ Pass the tubes of the cylinders inside the brackets (6).
- 1 - Start the engine and bleed the air from the cylinders. (For details, see «20. TESTING AND ADJUSTMENTS»).
- ★ After bleeding the air, check the oil level in the tank.



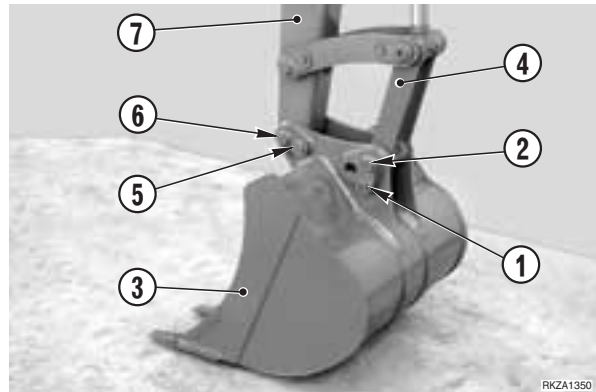
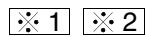
REMOVAL OF THE BACKHOE BUCKET

⚠ Place the bucket on a level surface, resting on its back.

- 1 - Take out the safety pin (1) and remove the connecting pin (2) between bucket (3) and tie-rods (4).



- 2 - Take out the safety pin (5) and remove the pin (6) that attaches the bucket to the arm (7).



INSTALLATION OF THE BACKHOE BUCKET

- To install, reverse the removal procedure.



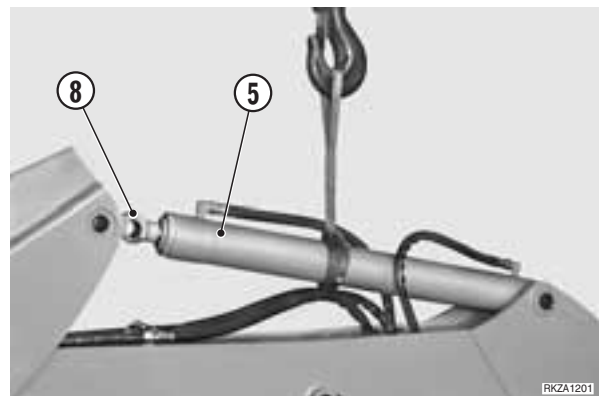
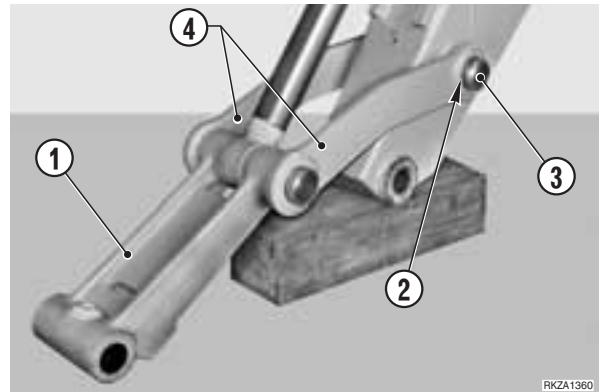
⚠ When aligning the positions between the hole and the pin, turn the engine over at low idling speed.
Do not insert fingers into the holes to check alignment.



Internal bushing: ASL800050

REMOVAL OF THE ARM

- 1 - Remove the bucket.
(For details, see «REMOVAL OF BUCKET»).
- 2 - Remove the bucket cylinder and the lever (1).
(For details, see «REMOVAL OF THE BUCKET CYLINDER»).
- 3 - Take off the lock-nut (2), and the washer, and remove the pin (3) and the levers (4).  1  2
- 4 - Start the engine, bring the arm into a vertical position and lower it to the ground.
- 5 - Stop the engine and release residual pressures from the cylinder.
- 6 - Put a sling around the arm cylinder (5), remove the screws (6) and remove the pin (7).  2  3
- 7 - Start the engine and retract the piston completely (8).
★ Secure the fully retracted position by binding the piston head with wire.
- 8 - Rest the cylinder (5) on a block “A”.
- 9 - Stop the engine.
- 10 - Attach the arm (9) to the hoisting tackle and apply a slight tension to the cable.



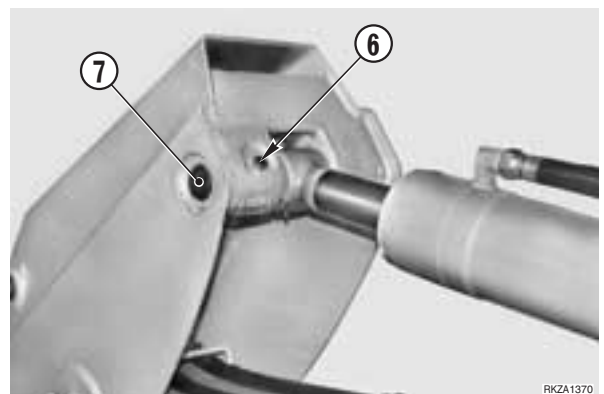
- 11 - Take out the screws and remove the pin (10).

 1  2

- 12 - Remove the arm (9).



Arm: 213 kg



INSTALLATION OF THE ARM

- To install, reverse the removal procedure.

 1

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

 2

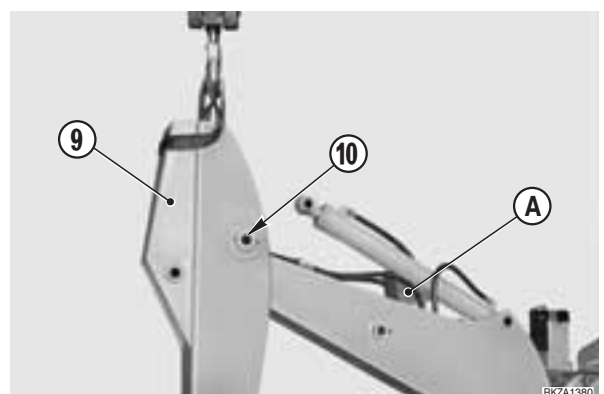


Internal bushing: ASL800050

★ Tighten the locknut completely, then release it half a turn.

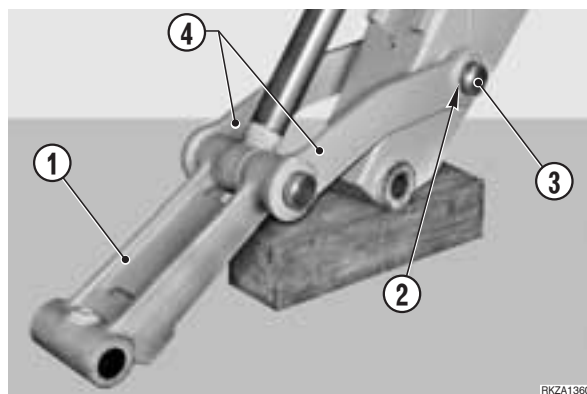
 3

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



REMOVAL OF COMPLETE JIG ARM

- 1 - Remove the bucket.
(For details, see «REMOVAL OF BUCKET»).
- 2 - Remove the bucket cylinder and the link (1).
(For details, see REMOVAL OF BUCKET CYLINDER»).
- 3 - Take out the lock nut (2) and the washer, and remove the pin (3) and the cylinder link (4).  



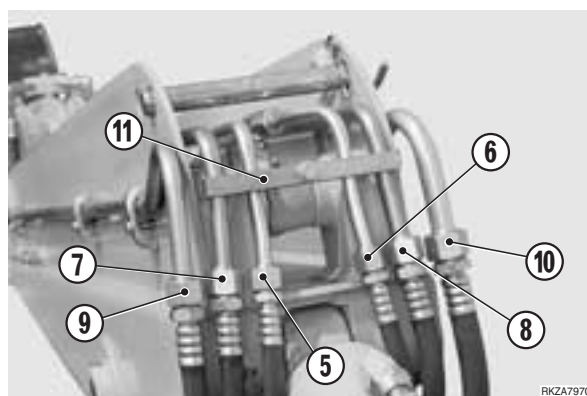
- 4 - Disconnect the jig arm hoses (5) and (6), the bucket cylinder hoses (7) and (8), and the hoses of the auxiliary equipment (9) and (10).
★ Mark the hoses to avoid exchanging them during INSTALLATION.

- 5 - Remove the clamp (11).

- 6 - Proceed with the removal as for the arm.
(See «REMOVAL OF THE ARM»).



Jig arm cylinder: 392 kg



INSTALLATION OF THE COMPLETE JIG ARM

- To install reverse the removal procedure.



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

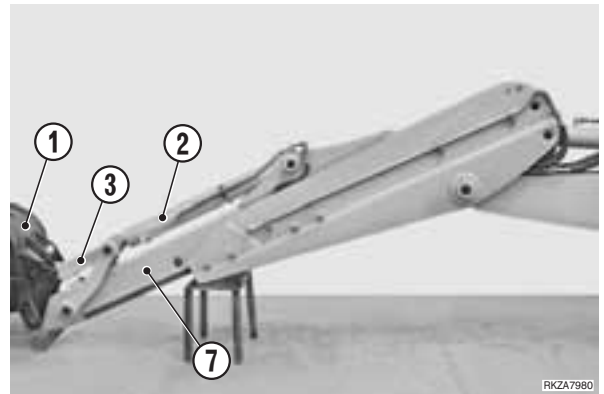


Internal bushings: ASL800050

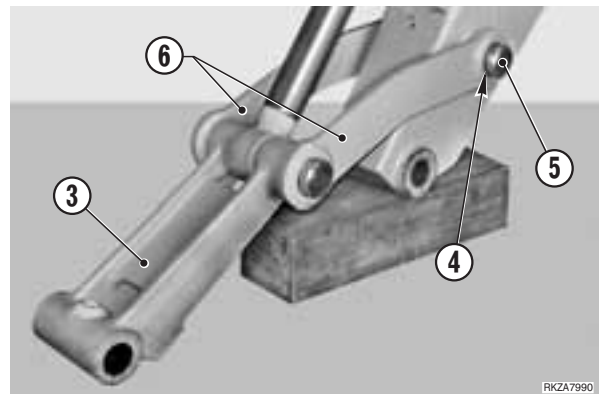
- ★ Tighten the locknut completely, then release it half a turn.

REMOVAL OF 2nd ARM

- 1 - Remove the bucket (1).
(For details, see «REMOVAL OF BUCKET»).
 - 2 - Remove the bucket cylinder (2) and the link (3).
(For details, see «REMOVAL OF THE BUCKET CYLINDER»).
 - 3 - Remove the 2nd arm cylinder.
(For details, see «REMOVAL OF THE 2nd ARM CYLINDER»).
- ★ For safety, tightly plug all the disconnected hoses.



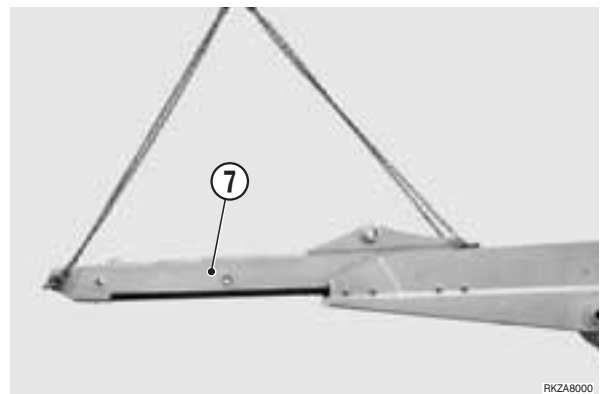
- 4 - Take out the lock nut (4), and the washer and remove the pin (5) and the links (6).   
- 5 - Connect the 2nd arm (7) to some hoisting tackle.
★ Use the bucket pin hole and the safety pin holes.
- 6 - Start the engine and, maintaining constant tension on the section of cable or chain connected to the bucket coupling, slowly raise the boom until both sections of cable or chain are under slight tension.
- 7 - Stop the engine and loosen by several turns the gib adjustment screws.
★ Loosen the screws on both sides.



- 8 - Slide out the 2nd arm (7).



2nd arm: 160 kg



INSTALLATION OF 2nd ARM

- To install, reverse the removal procedure.



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



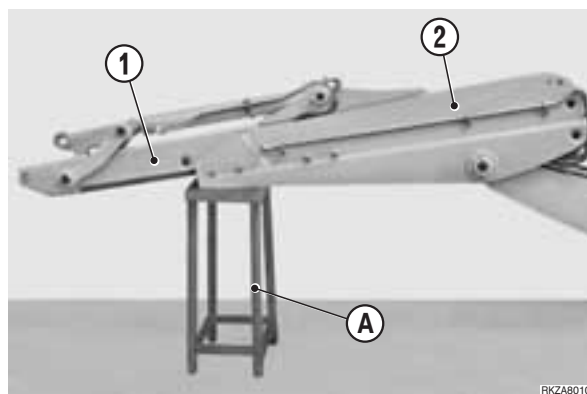
Internal bushings: ASL800050



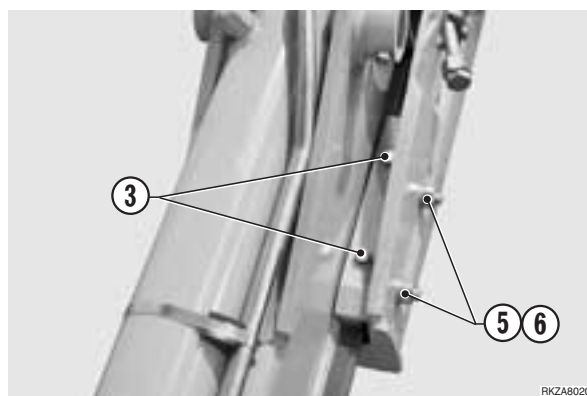
- ★ Tighten the locknut completely, then release it half a turn.

REMOVAL OF 2nd ARM GUIDES

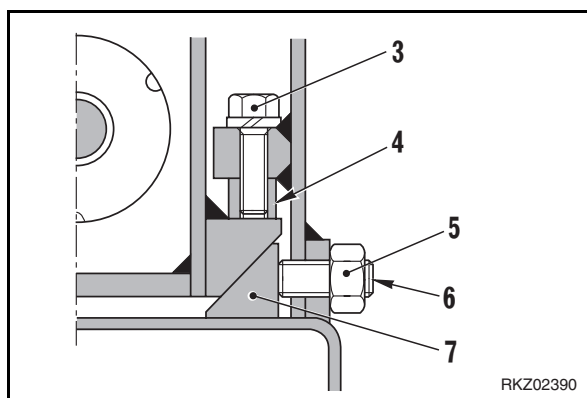
- 1 - Remove the bucket (1).
(For details, see «REMOVAL OF BUCKET»).
- 2 - Partially extend the 2nd arm (1).
- 3 - Rest the arm (2) on a trestle "A" about 80 cm (3.5 ft.) high.



- 4 - Loosen and remove the screws (3), the spring washers and remove the upper guides (4).  1
- 5 - Connect the 2nd arm (1) to some hoisting tackle.
★ Use the bucket pin hole and the safety pin holes.
- 6 - Slowly raise the 2nd arm (1) until it rests on the supporting surfaces of the upper guides.



- 7 - Loosen the nuts (5) and remove the adjustment dowel bolts (6).
- 8 - Raise the lower guides (7) and slide them out.  1



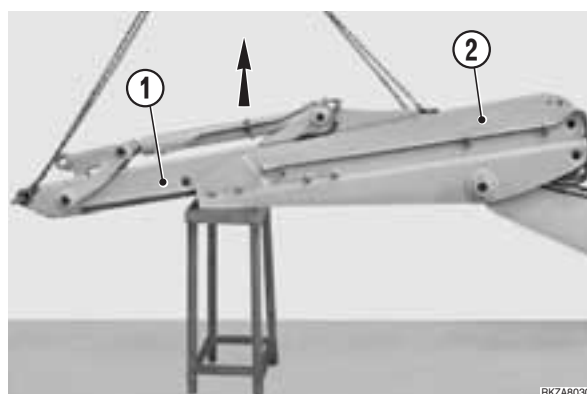
INSTALLATION OF 2nd ARM GUIDE

- To install, reverse the removal procedure.



 Guides and 2nd arm guides: ASL800040

- 1 - Adjust the clearances, keeping the jig arm (1) aligned with respect to the 2nd arm (2). (For details, see «20. TESTS AND ADJUSTMENTS»).



REMOVAL OF THE BACKHOE BOOM

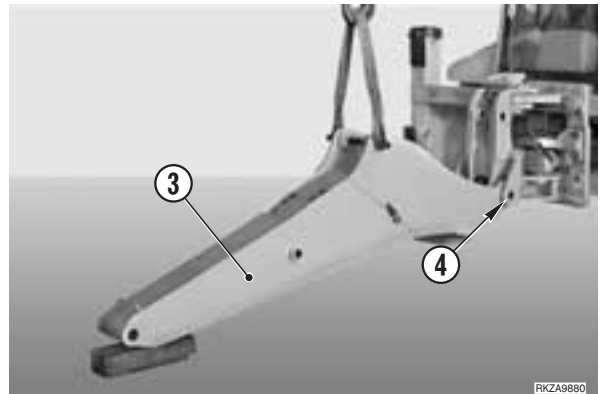
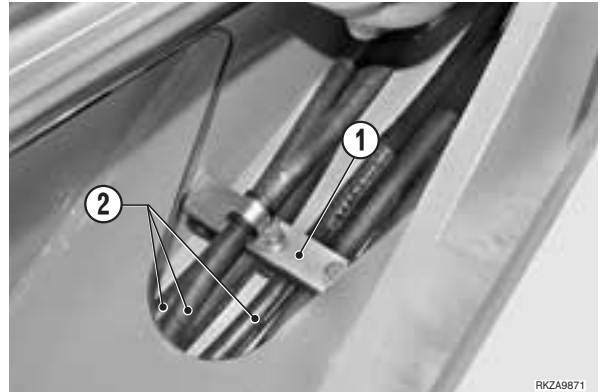
- 1 - Remove the arm.
(For details, see «REMOVAL OF THE ARM»).
- 2 - Remove the arm cylinder.
(For details, see «REMOVAL OF THE ARM CYLINDER»).
- 3 - Start the engine and rest the boom on the ground.
- 4 - Remove the boom cylinder.
(For details, see «REMOVAL OF THE BOOM CYLINDER»).
- 5 - Take out the bracket (1) and disconnect the tubes (2) from the arm cylinders and the bucket. Plug all tubes to prevent entry of impurities.
★ Mark the tubes to prevent exchanging positions during re-connection.
- 6 - Put a sling round the boom (3).
- 7 - Take out the snap-rings and remove the pin (4).



- 8 - Remove the boom (3).



Boom: 323 kg



INSTALLATION OF THE BACKHOE BOOM

- To install, reverse the removal procedure.



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



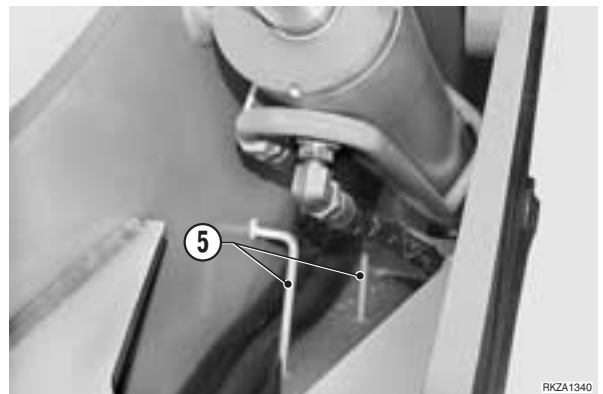
Internal bushing: ASL800050



- ★ Pass the cylinder tubes inside the brackets (5).

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

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

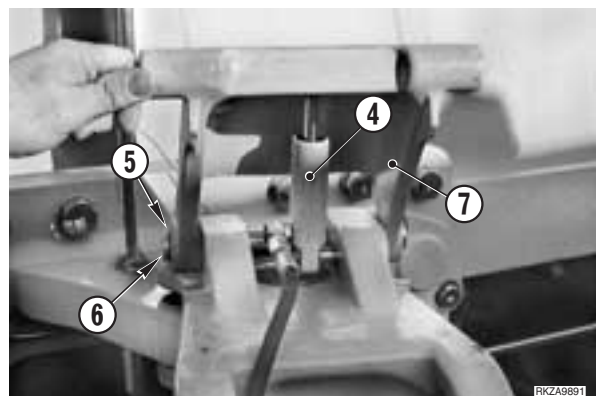
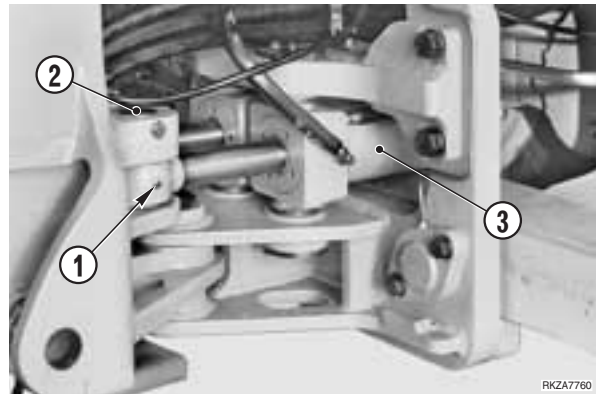


REMOVAL OF THE BACKHOE SWING BRACKET

- 1 - Remove the working equipment.
(For details, see «REMOVAL OF THE WORKING EQUIPMENT»).
- 2 - Take out the screws (1) and remove the pins (2) that connect the swing cylinders (3).
✖ 1 ✖ 2
- 3 - Remove boom safety cylinder (4).
(For details, see «REMOVAL OF BOOM SAFETY CYLINDER»).
- 4 - Remove snap ring (5), pin (6) and link (7).
✖ 3
- 5 - Put a sling round the swing bracket (8).
- 6 - Take out the screws (9) and (10) and remove the swing bracket axle oscillation pins (11) and (12).
✖ 1 ✖ 2
- 7 - Remove the swing bracket (8) and the relative shim adjustments to given clearance.
✖ 4



Bracket: 133 kg



INSTALLATION OF THE BACKHOE SWING BRACKET

- To install, reverse the removal procedure.

✖ 1

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

✖ 2



Internal bushing: ASL800050

✖ 3



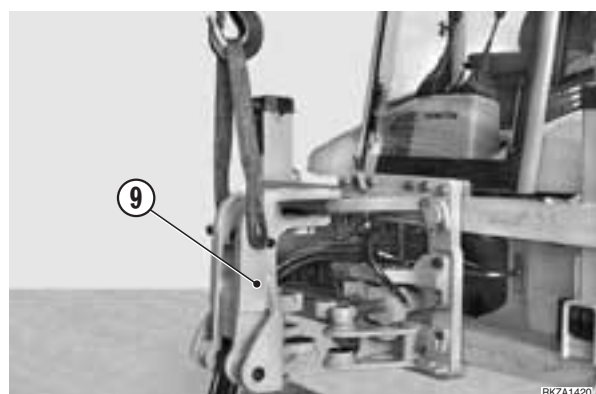
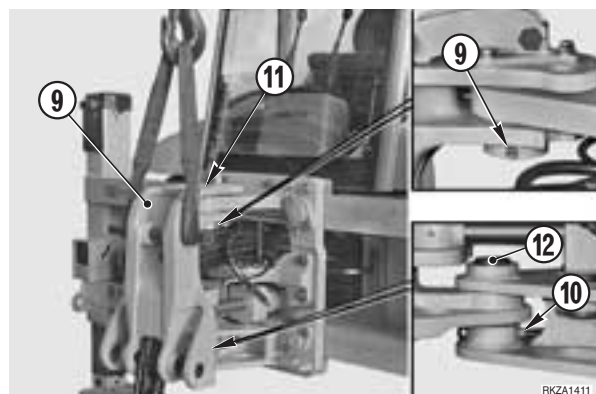
Pin: ASL800050

✖ 4

- ★ Insert the shims.

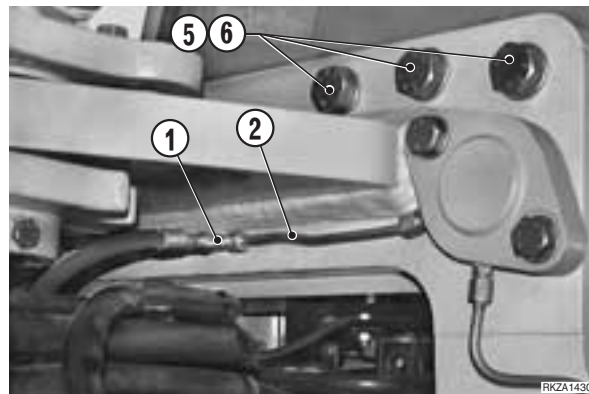
- 1 - Start the engine and bleed the air from the cylinders.
(For details, see «20. TESTING AND ADJUSTMENTS»).

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

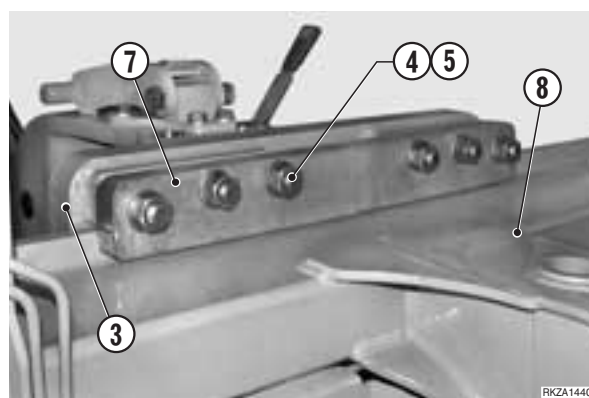


REMOVAL OF BACKHOE BACKFRAME

- 1 - Remove the equipment.
(For details, see «REMOVAL OF BACKHOE WORKING EQUIPMENT»).
- 2 - Remove the swing cylinders.
(For detail see «REMOVAL OF SWING CYLINDER»).
- 3 - Remove the swing bracket.
(For detail see «REMOVAL OF SWING BRACKET»).
- 4 - Disconnect from union (1) the feeding pipes (2) of backhoe backframe and plug them to avoid impurity entry.



- 5 - Loose nuts (4) and remove washers (5) and four screw (6).
Loose partially lateral nuts (4) to remove backframe (3) from frame (8). 
- 6 - Put a sling round the backframe (3) and apply slight tension to the cables.
- 7 - Remove external nuts (4), washers (5) and screws (6). 



- 8 - Remove the sliding piece (7) and then lower the back frame (3) and remove it.



Backframe: 237 kg

INSTALLATION OF BACKHOE BACKFRAME

- To install, reverse the removal procedure.



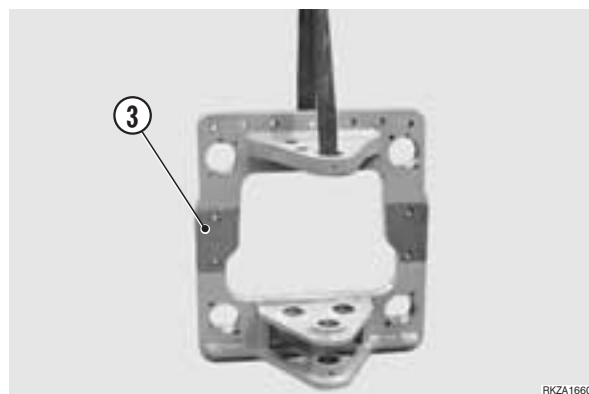
Nuts: Loctite 262



Nuts: 980±98 Nm

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

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

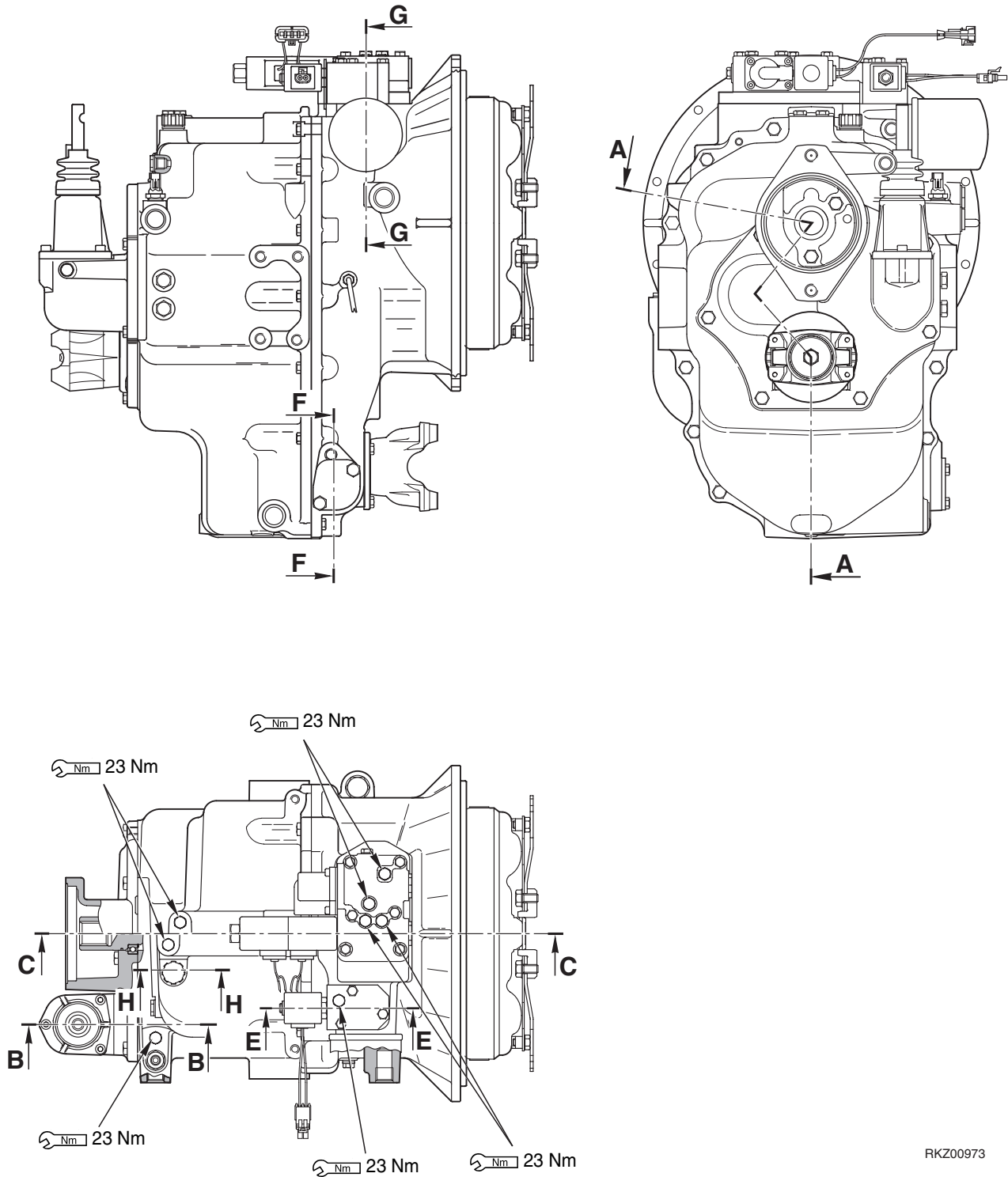


GROUP 40

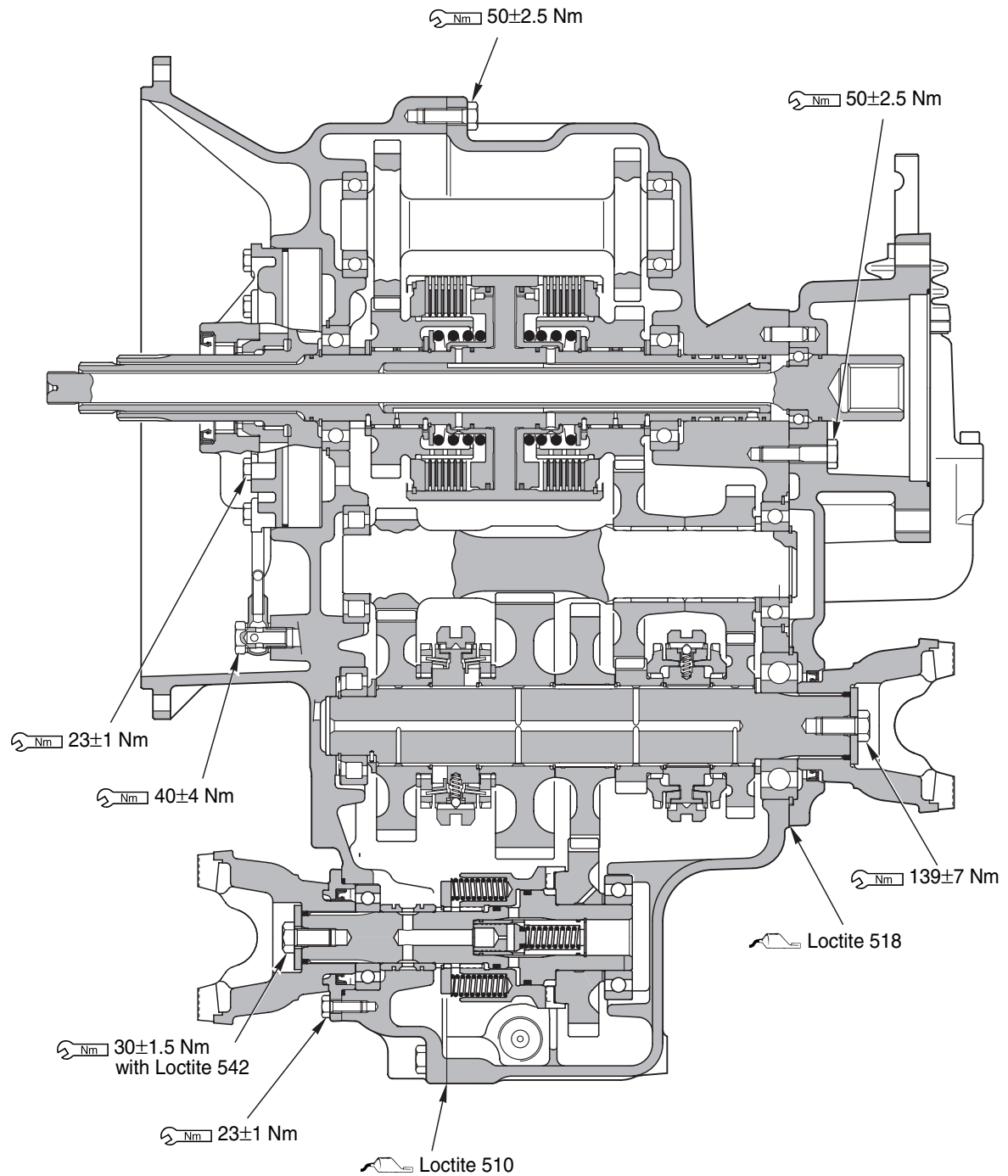
40 STANDARD MAINTENANCE

Transmission	2	7-Spool control valve	25
Front axle.....	7	8-Spool control valve.....	27
Rear axle	10	Brake pump	29
Hydraulic pump.....	14	Shovel cylinders	31
2-Spool control valve	16	Backhoe cylinders	32
3-Spool control valve	18	Front working equipment.....	36
3-Spool control valve (With Return to Dig)	20	Swing bracket.....	38
6-Spool control valve	22	Backhoe working equipment	40

TRANSMISSION

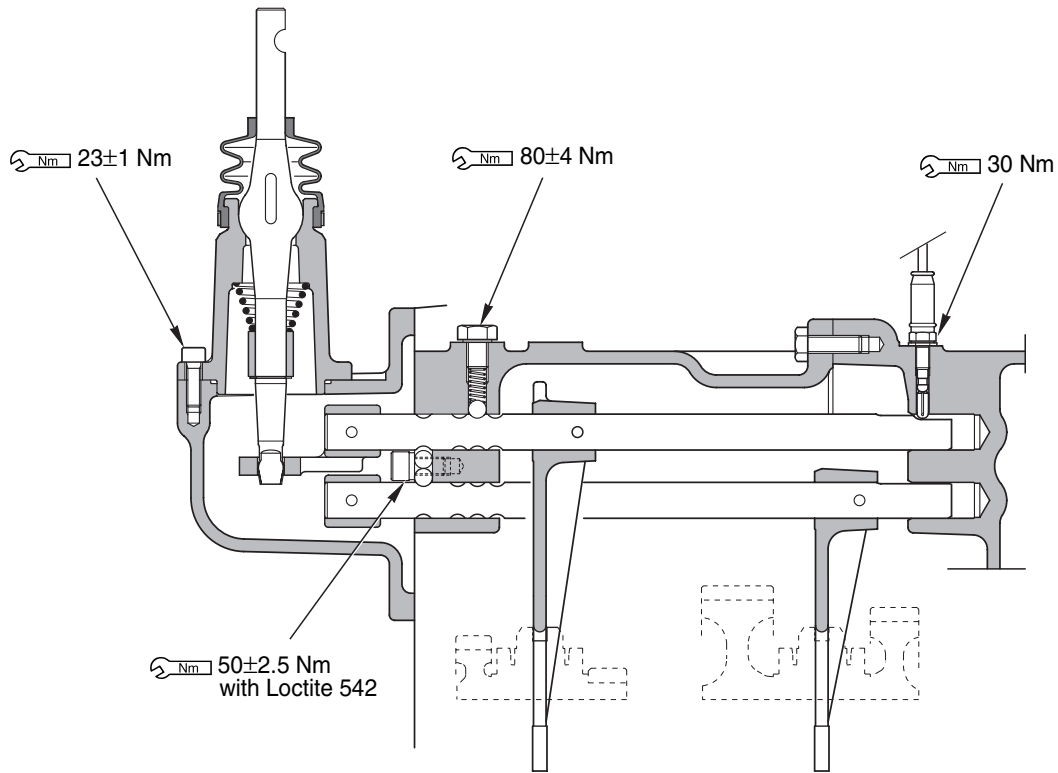


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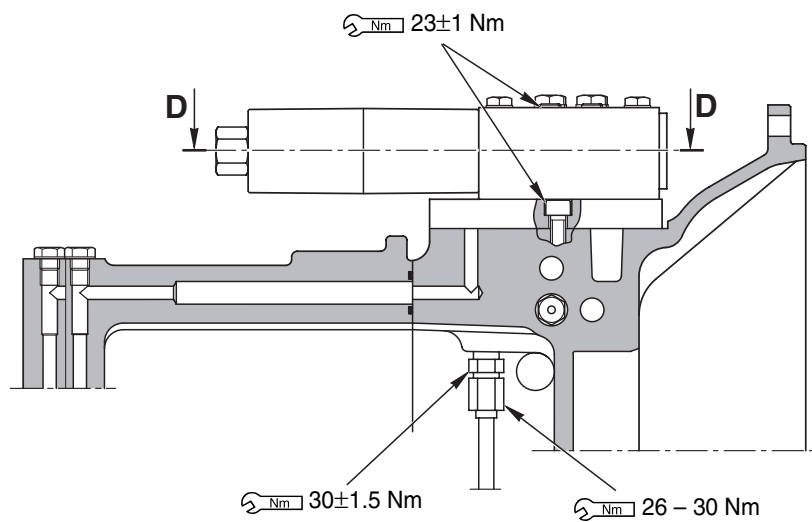


Section A - A

RKZ00982

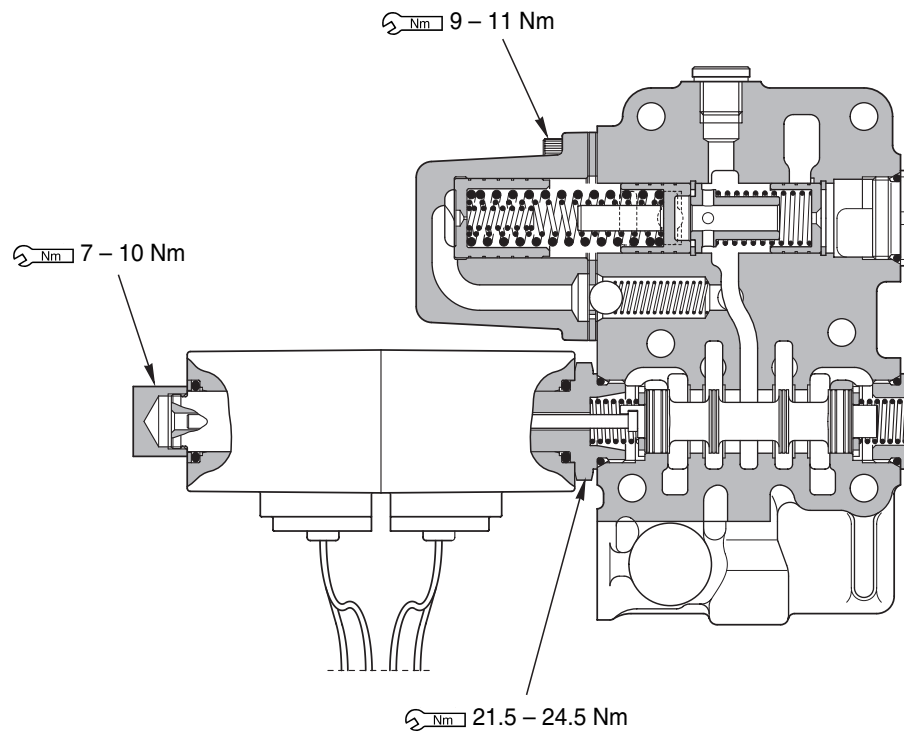


Section B - B

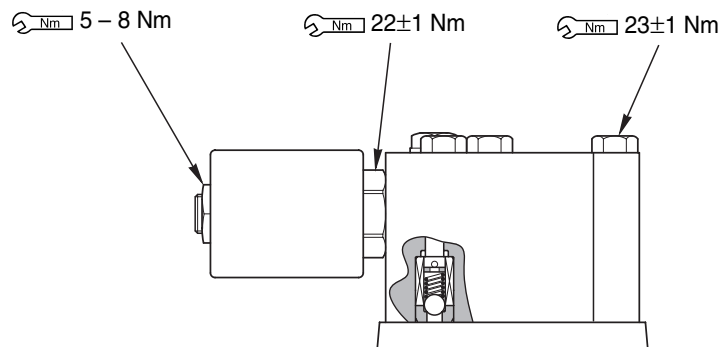


Section C - C

RKZ01261

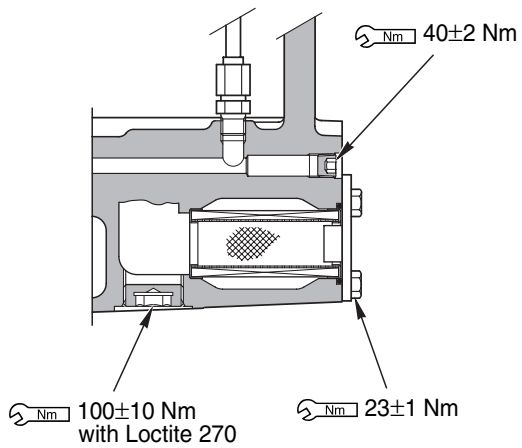


Section D - D

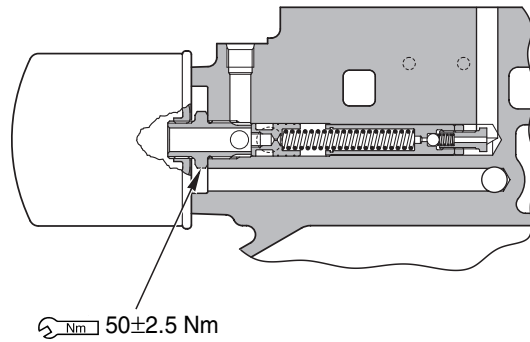


Section E - E

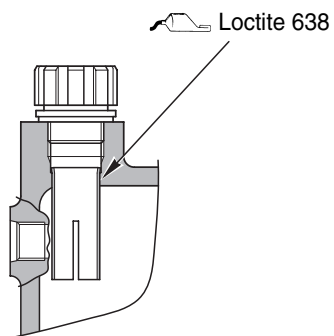
RKZ01270



Section F - F



Section G - G

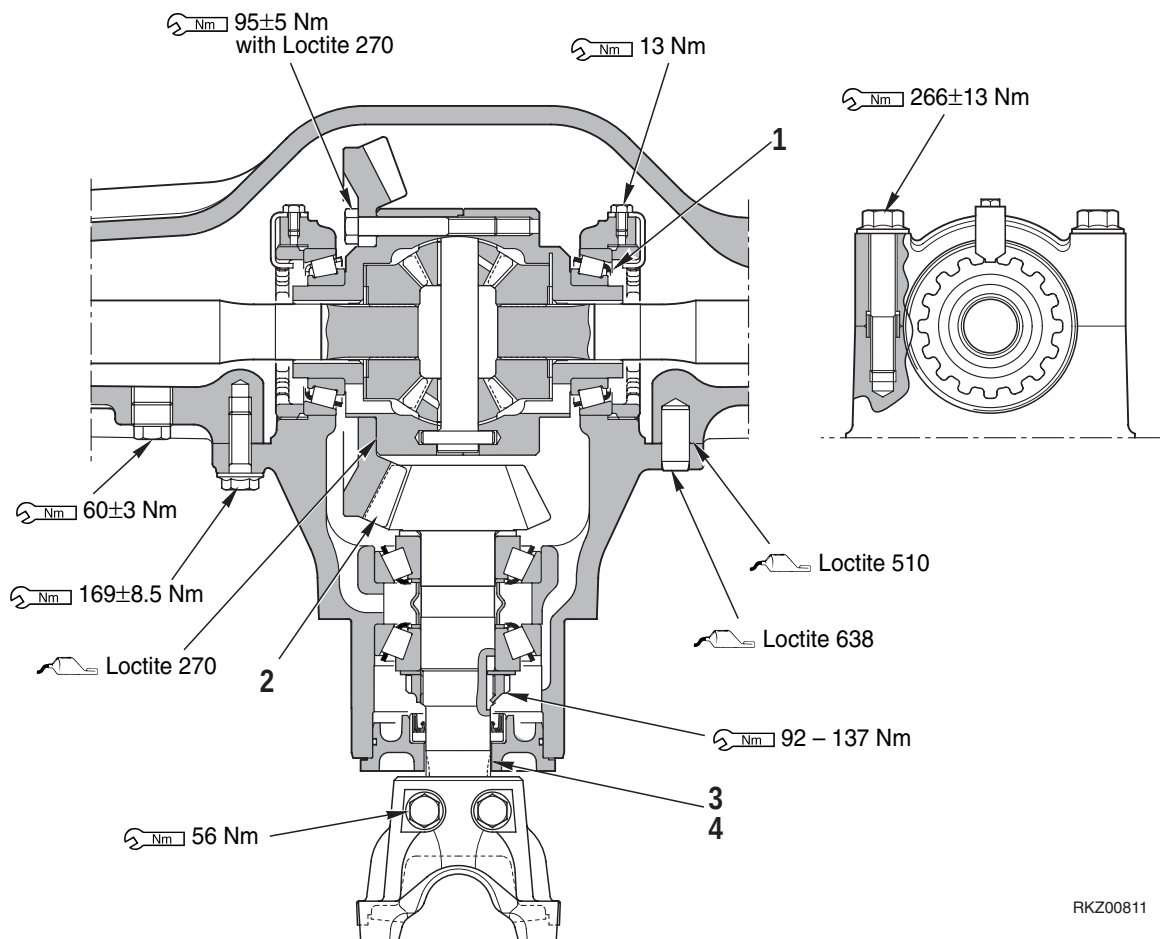


Section H - H

RKZ01280

FRONT AXLE

Differential

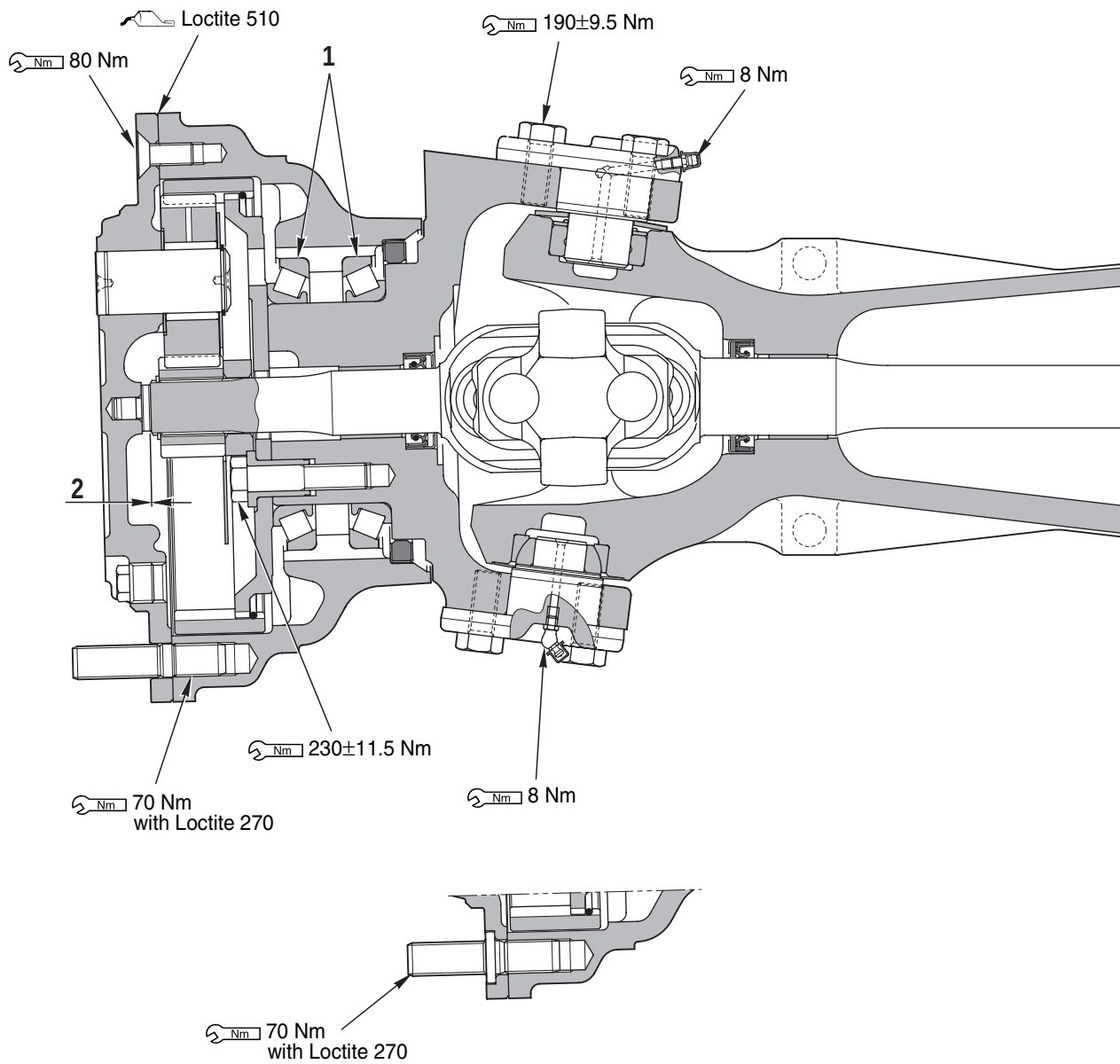


RKZ00811

Unit: mm

N°	Check item	Criteria		Remedy
1	Axle clearance	Standard clearance	Clearance limit	Adjust
		—	—	
2	Backlash of crown wheel and pinion	0.17 – 0.23	0.23	
3	Pinion preload (without seal ring)	92 – 137 Nm		
4	Pinion-crown wheel preload (without seal ring)	95.9 – 142.9		

Planetary - Joint

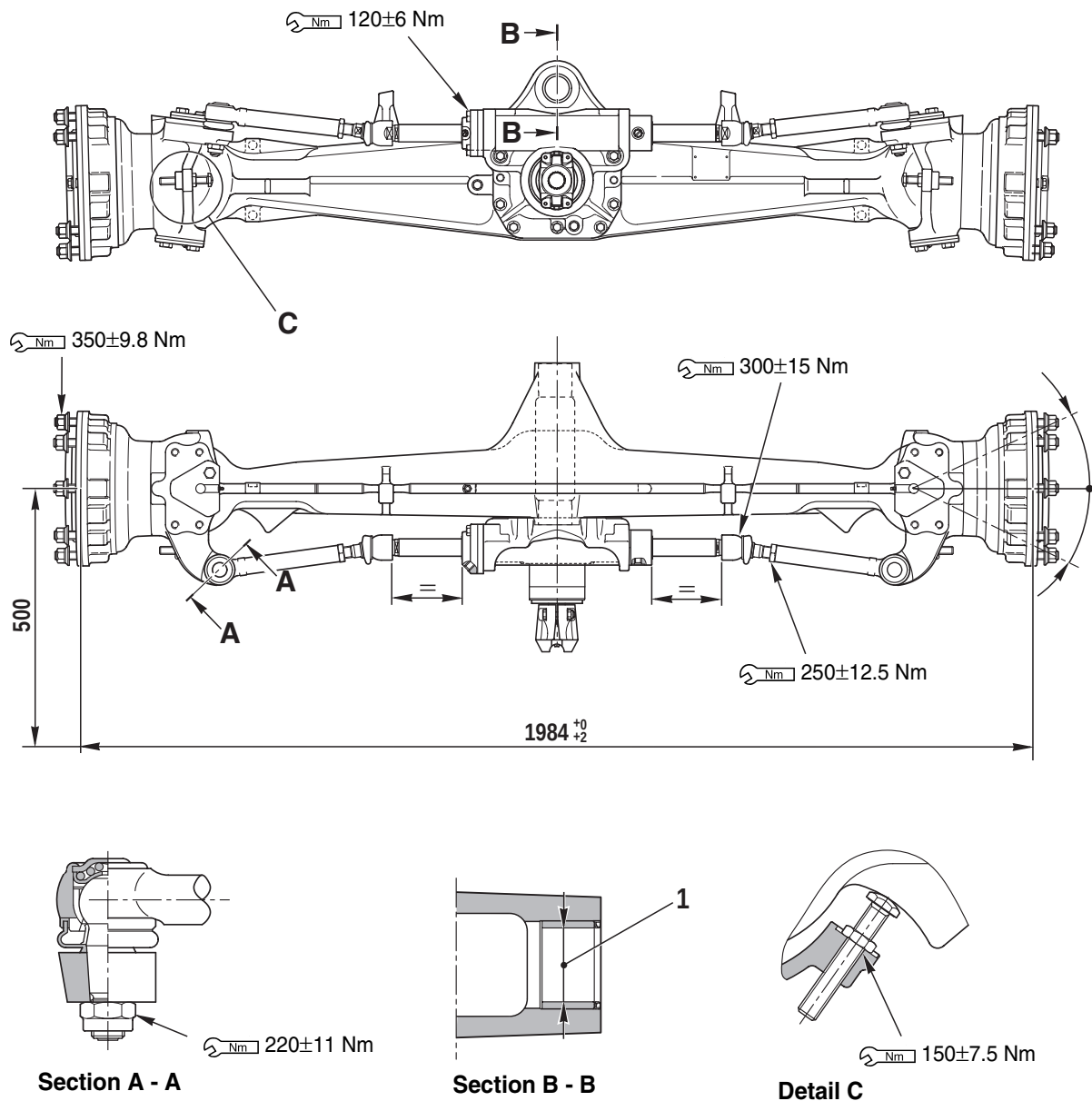


RKZ00821

Unit: mm

N°	Check item	Criteria	Remedy
1	Hub rotation torque	—	Adjust
2	Drive shaft axle clearance	—	Replace

Steering unit cylinder



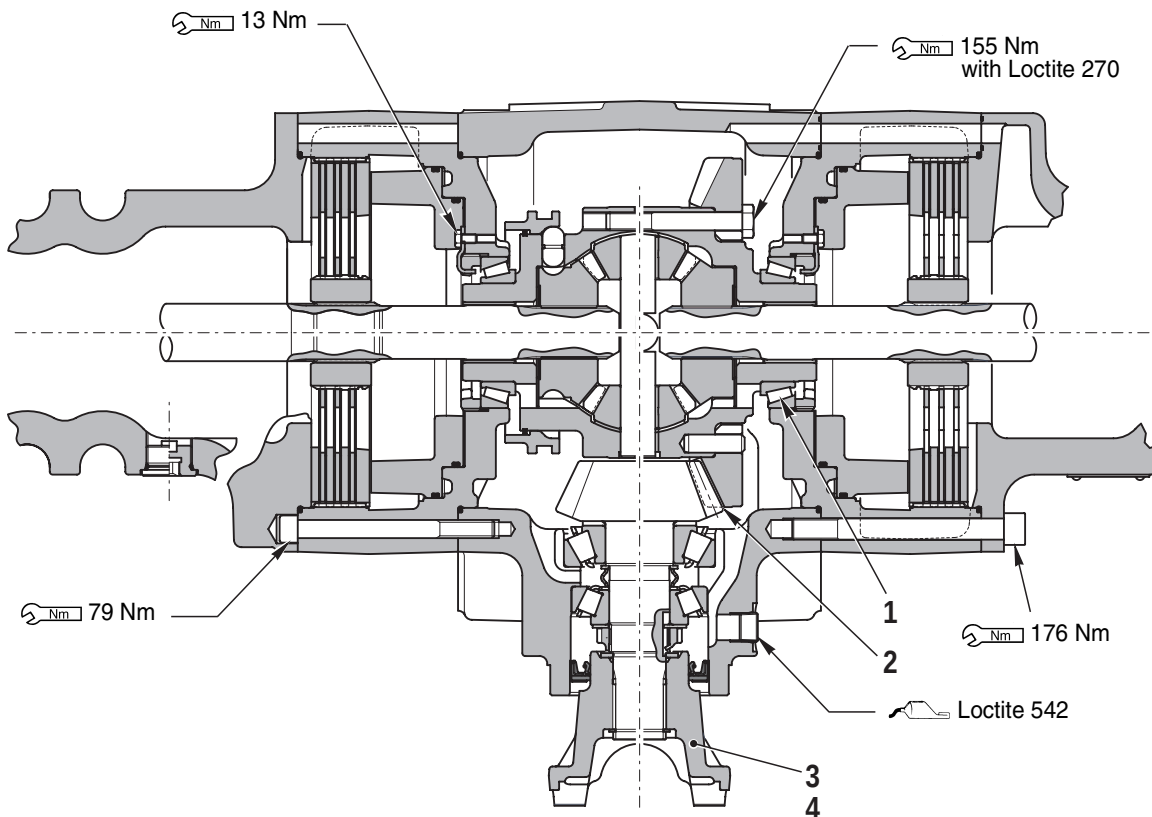
RKZ00842

Unit: mm

N°	Check item	Criteria					Remedy
1	Clearance between bushing and pin	Standard size	Tolerance		Standard clearance	Clearance limit	Replace bushing and pin
			Shaft	Hole			
		50	—	50.19 ^{+ 0.04} ₀	—	—	

REAR AXLE

Differential

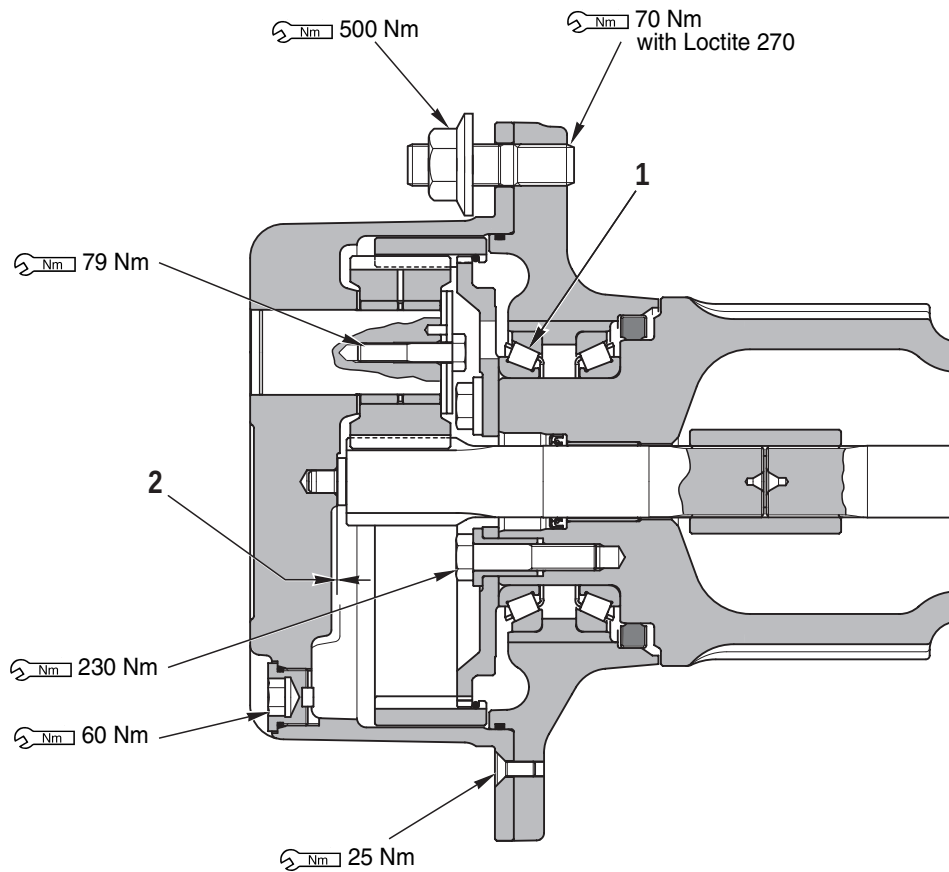


RKZ04971

Unit: mm

N°	Check item	Criteria		Remedy
1	Axle clearance	Standard clearance	Clearance limit	Adjust
		—	—	
2	Backlash of crown wheel and pinion	0.17 – 0.23	0.23	
3	Pinion preload (without seal ring)	92 – 138 Nm		
4	Pinion-crown wheel preload (without seal ring)	95.23 – 141.84 Nm		

Planetary

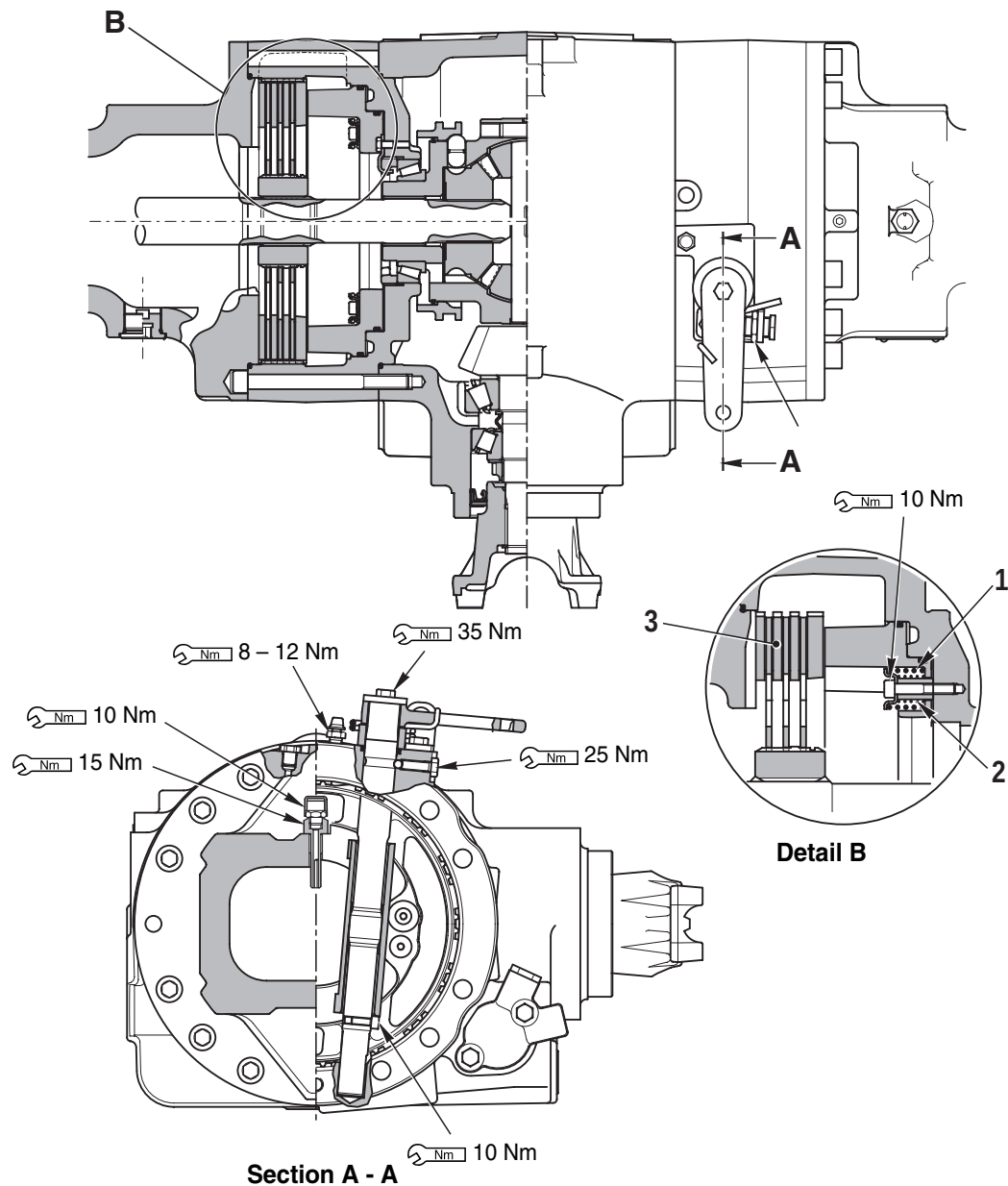


RKZ04981

Unit: mm

N°	Check item	Criteria	Remedy
1	Hub rotation torque	—	Adjust
2	Drive shaft axle clearance	—	Replace

Brakes

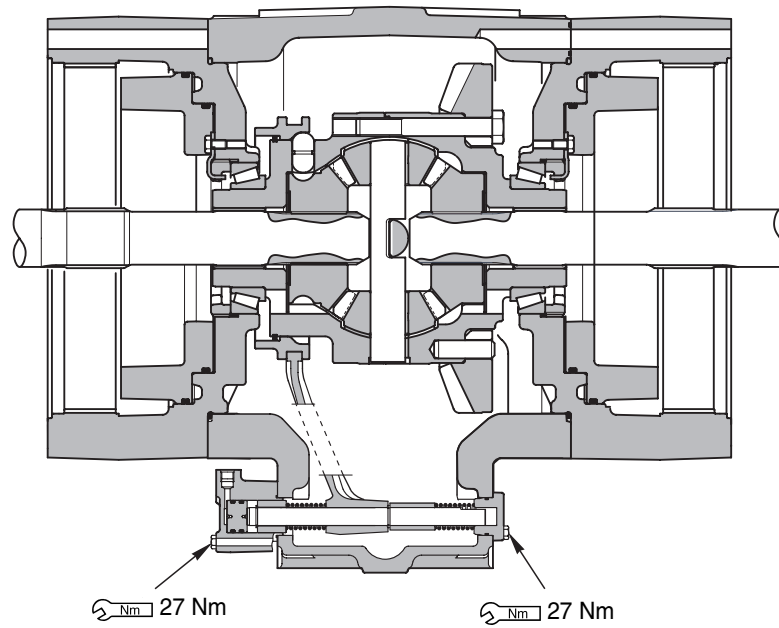


RKZ04991

Unit: mm

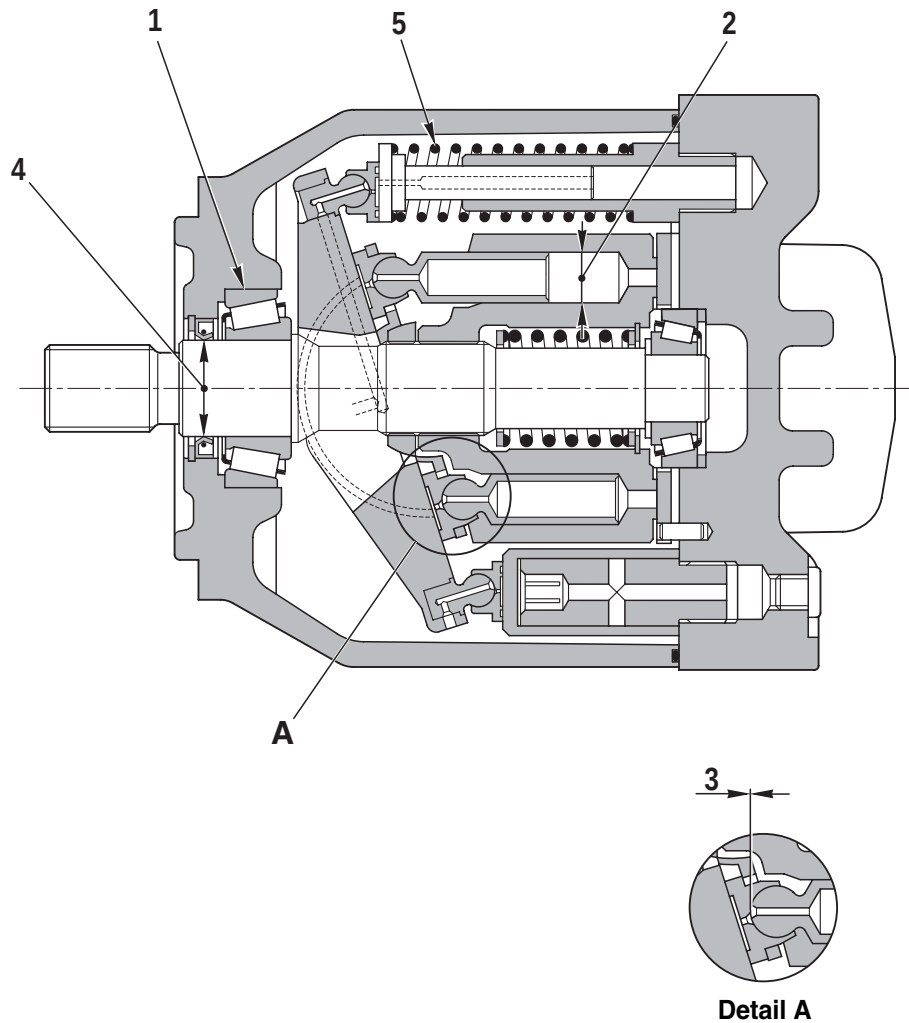
N°	Check item	Criteria					Remedy
1	Brake disc return spring	Standard size			Repair limit		Replace if damaged or deformed
		Free installed	Installed length	Installed load	Free installed	Installed load on screw	
		27	13	127 Nm	21	10 Nm	
2	Disc return spring	35	19	369 Nm	21	10 Nm	
3	Disc thickness	Standard thickness			Min. thickness		Replace
		5 ⁰ _{0.15}			3.3		

Differential lock



RKZ05001

HYDRAULIC PUMP

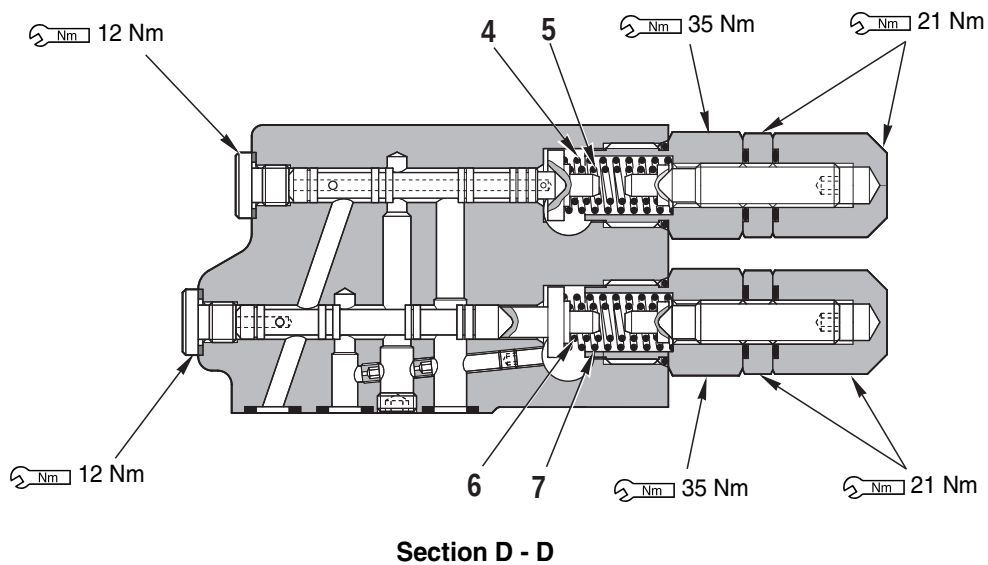
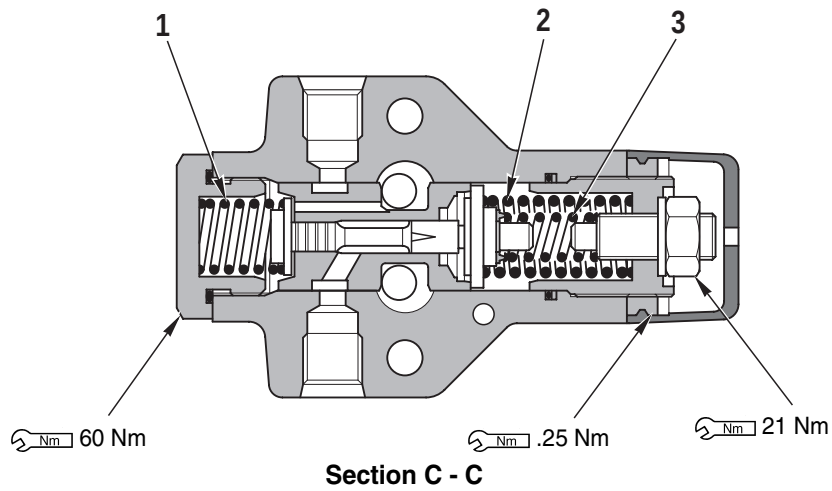


Detail A

RKZ01290

Unit: mm

N°	Check item	Criteria					Remedy
1	Ball-bearing loading	0 – 0.05					Adjust
2	Backlash between piston and cylinder	Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
		20		—		0.065	
3	Backlash between piston and shoe					0.15	
4	Drive shaft diameter	Standard value		Max. value			
		34.91					
5	Spring	Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
		—	88.7	276±12 N			

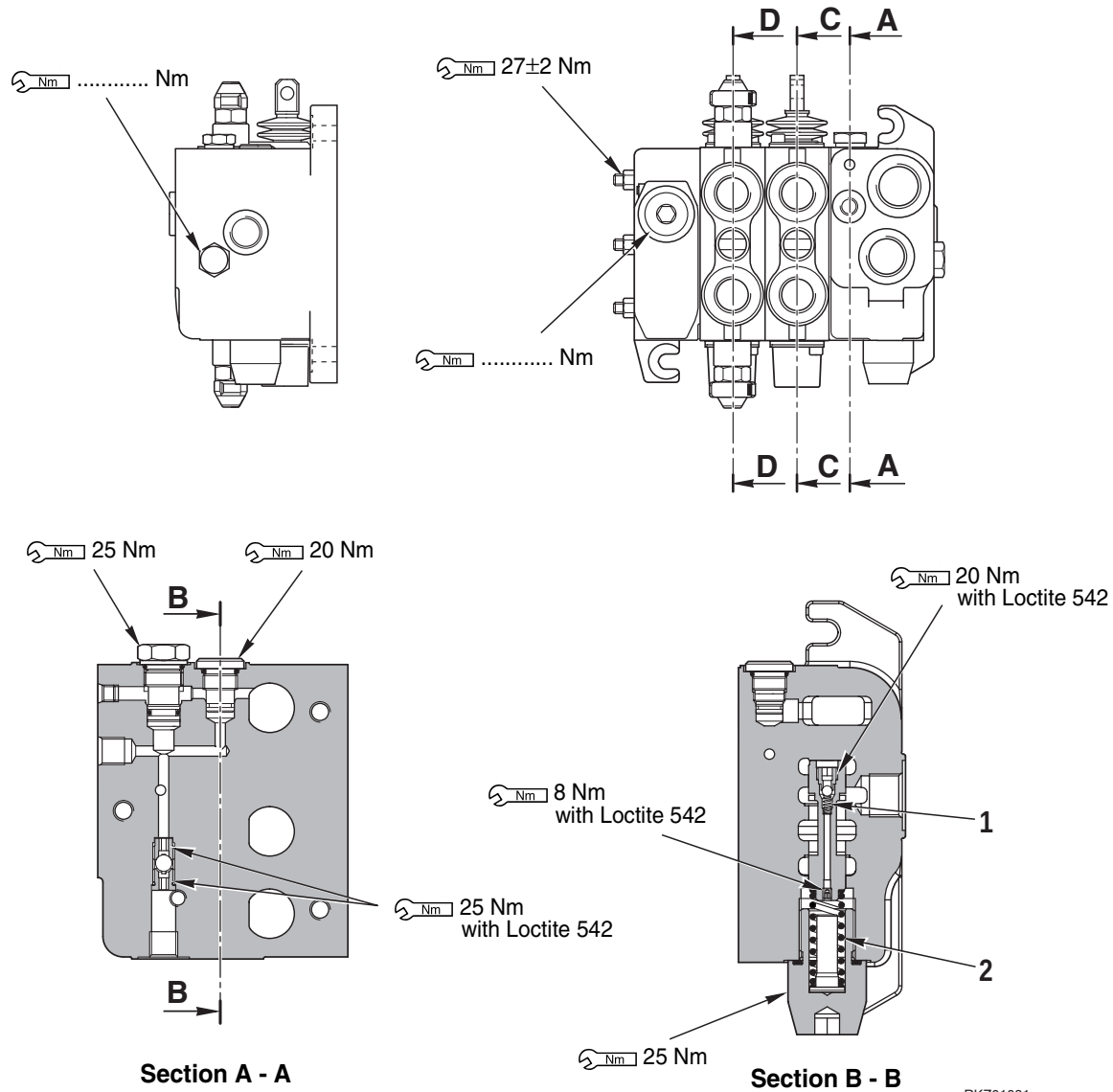


RKZ00643

Unit: mm

N°	Check item	Criteria					Remedy
1	Spring	Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
		—	—	—	—	—	
2	Power regulation spring (external)			125.4±10 N			
3	Power regulation spring (internal)			180.2±12.5			
4	PC valve spring (external)			40.2±2.8			
5	PC valve spring (internal)			81.7±14.5			
6	LS valve spring (external)			81.7±14.5			
7	LS valve spring (internal)			40.2±2.8			

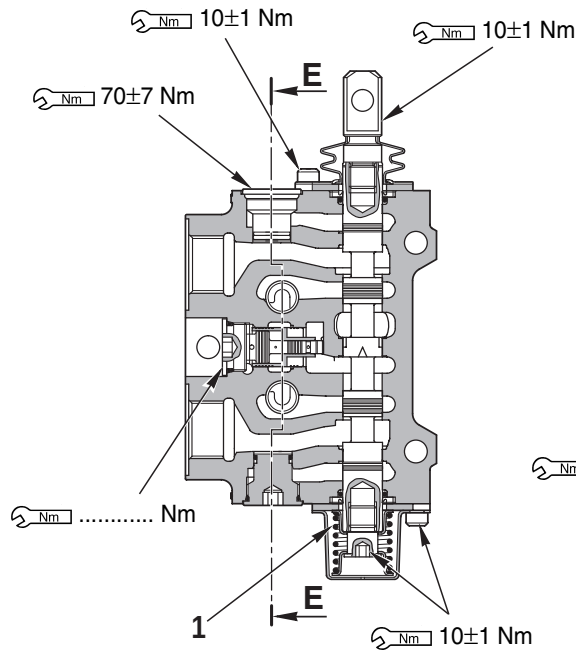
2-SPOOL CONTROL VALVE



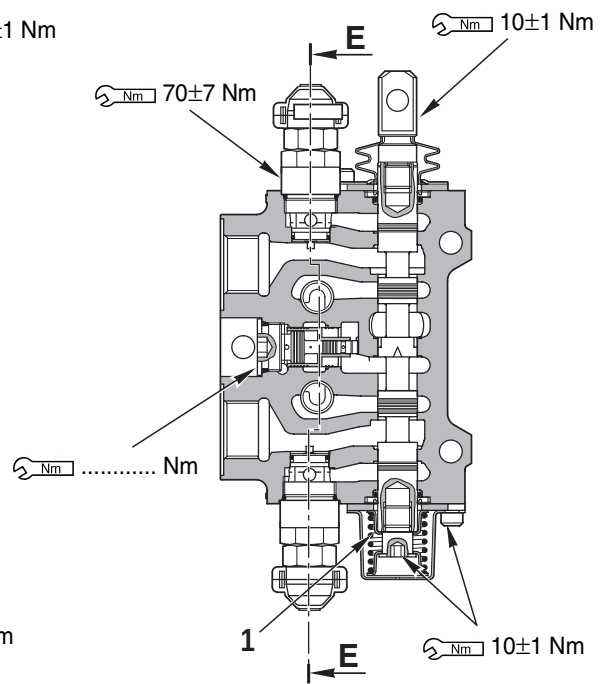
RKZ01081

Unit: mm

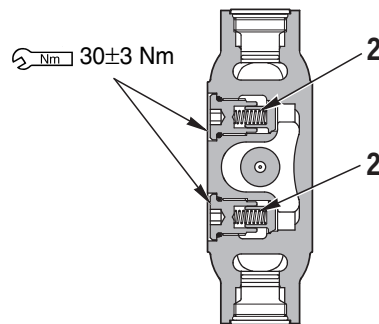
N°	Check item	Criteria					Remedy
1	Check valve spring	Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
2	Priority valve spring						



Section C - C



Section D - D



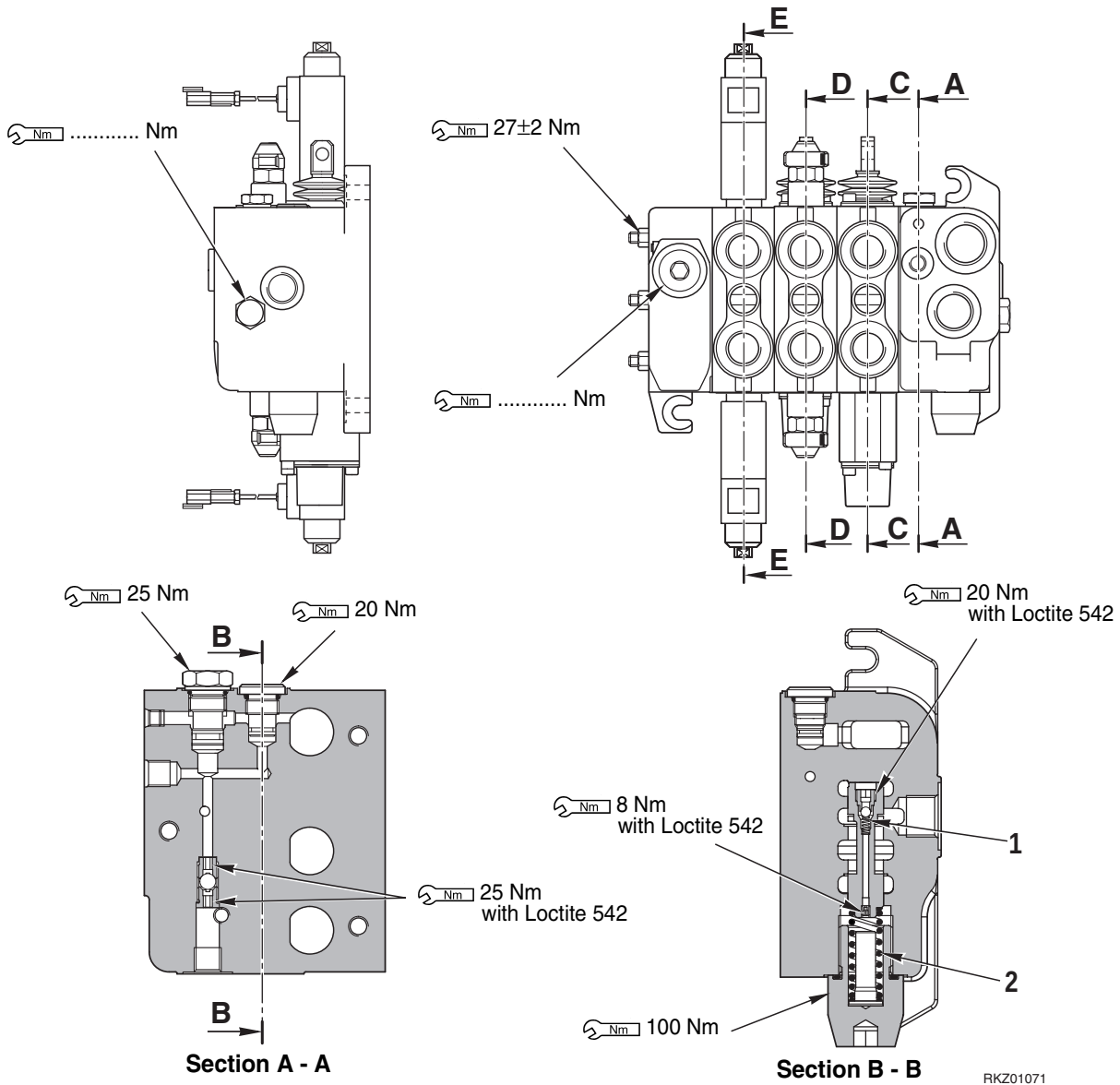
Section E - E

RKZ00661

Unit: mm

N°	Check item	Criteria					Remedy
1	Spool return spring	Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
2	Check valve spring						

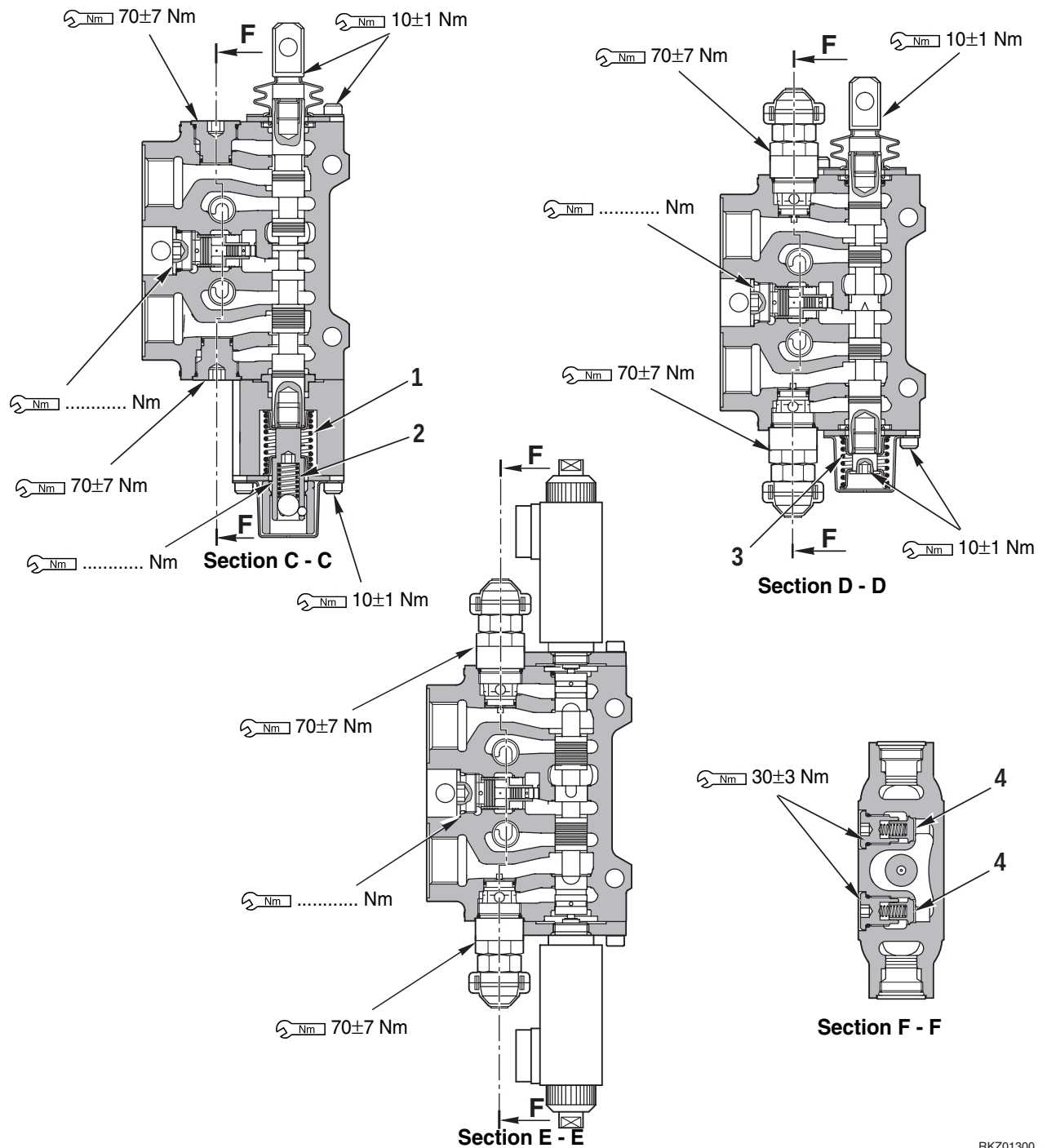
3-SPOOL CONTROL VALVE



RKZ01071

Unit: mm

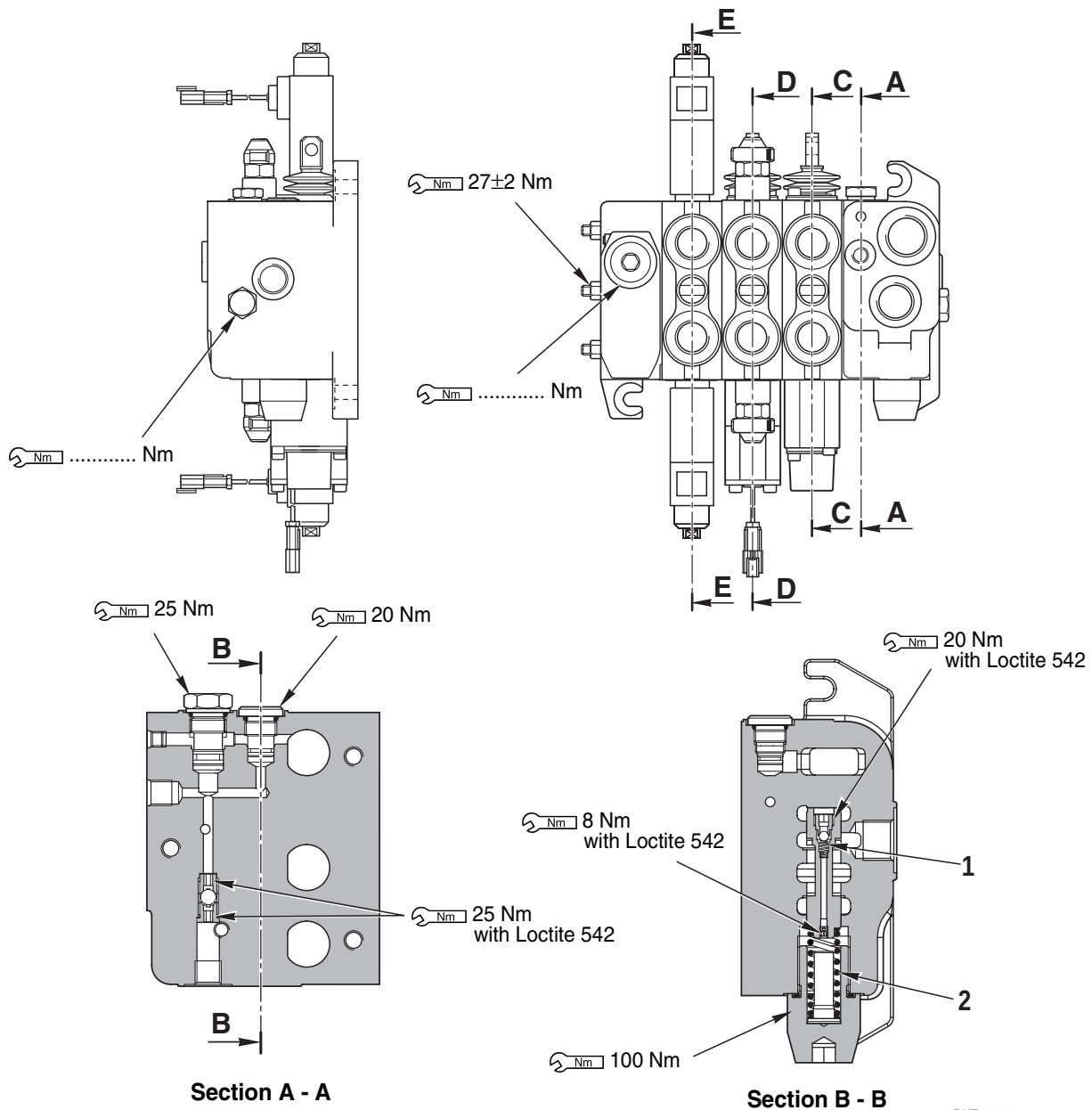
N°	Check item	Criteria					Remedy
1	Spool return spring	Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free Installed	Installed load	
2	Check valve spring						



RKZ01300
Unit: mm

N°	Check item	Criteria					Remedy
1	Spool return spring	Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
2	Spool locking spring						
3	Spool return spring						
4	Check valve spring						

3-SPOOL CONTROL VALVE (With Return to Dig)



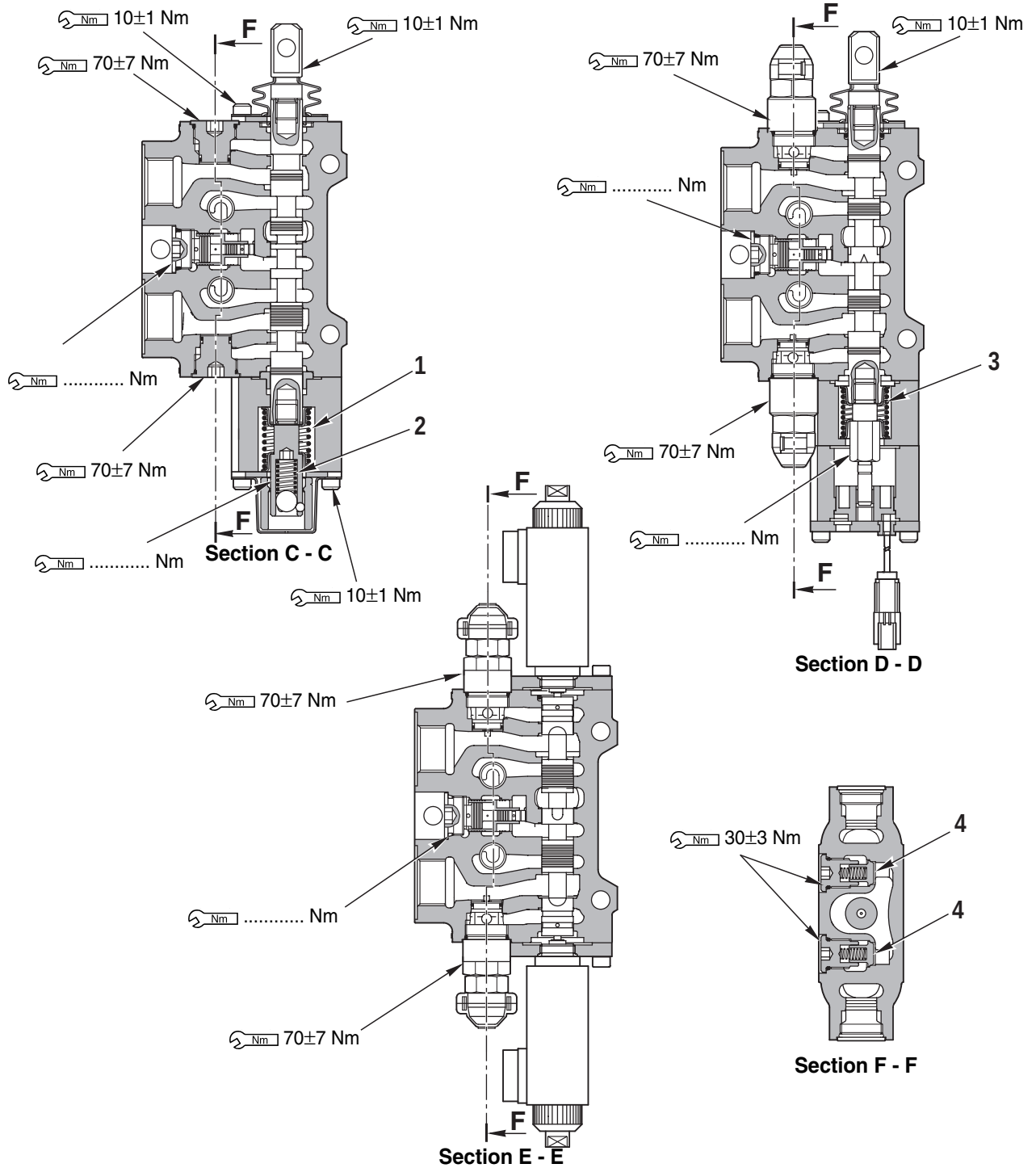
RKZ01091

Unit: mm

N°	Check item	Criteria					Remedy
1	Check valve spring	Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
2	Spool return spring						

STANDARD MAINTENANCE

3-SPOOL CONTROL VALVE (With Return to Dig)

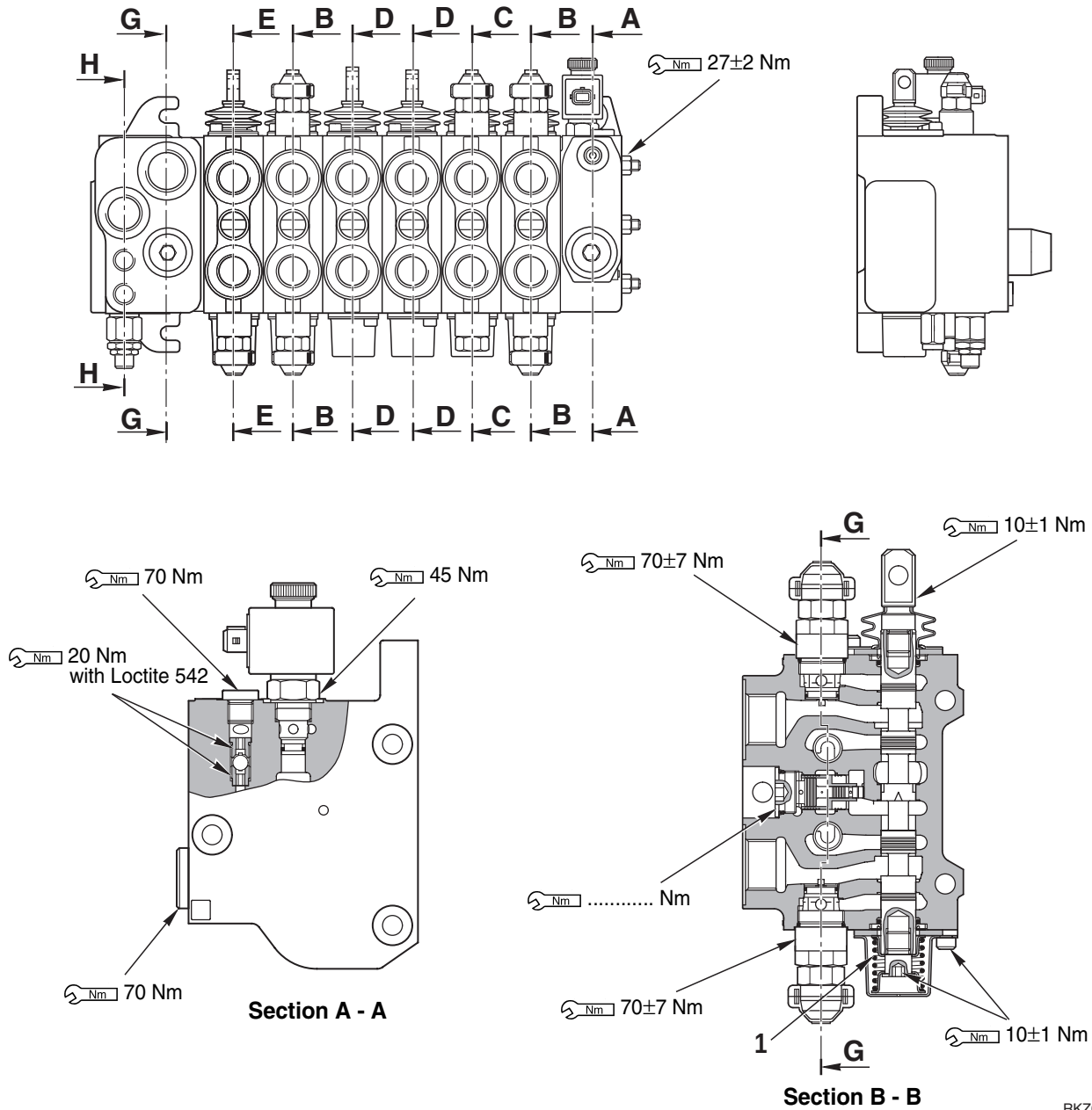


RKZ00941

Unit: mm

N°	Check item	Criteria					Remedy
1	Spool return spring	Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
2	Spool locking spring						
3	Spool return spring						
4	Check valve spring						

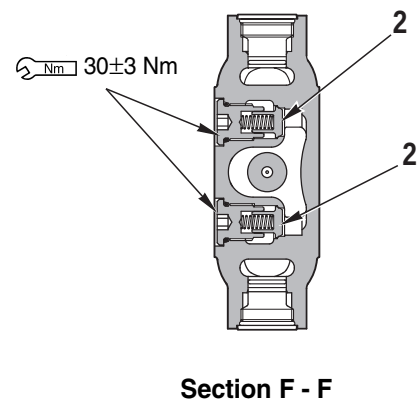
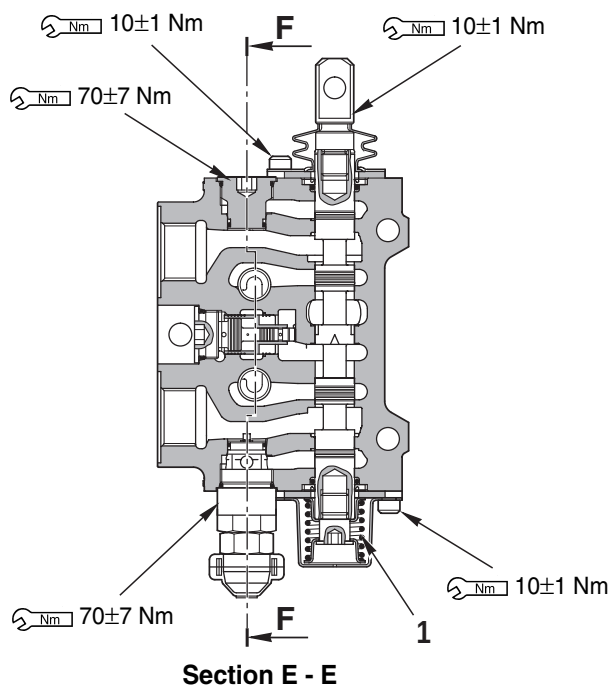
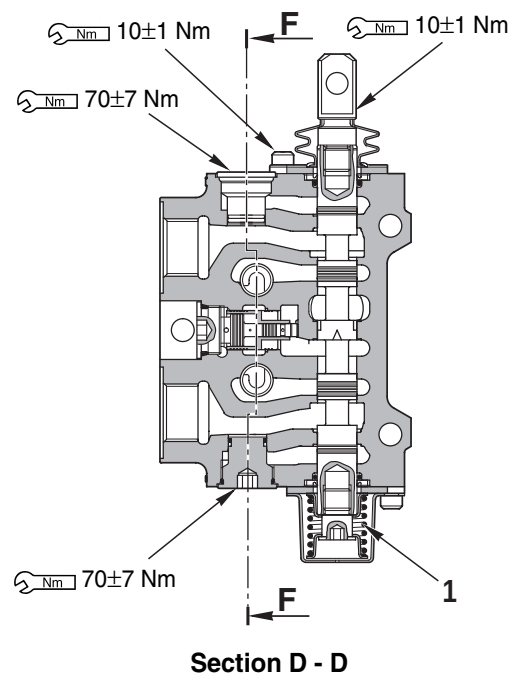
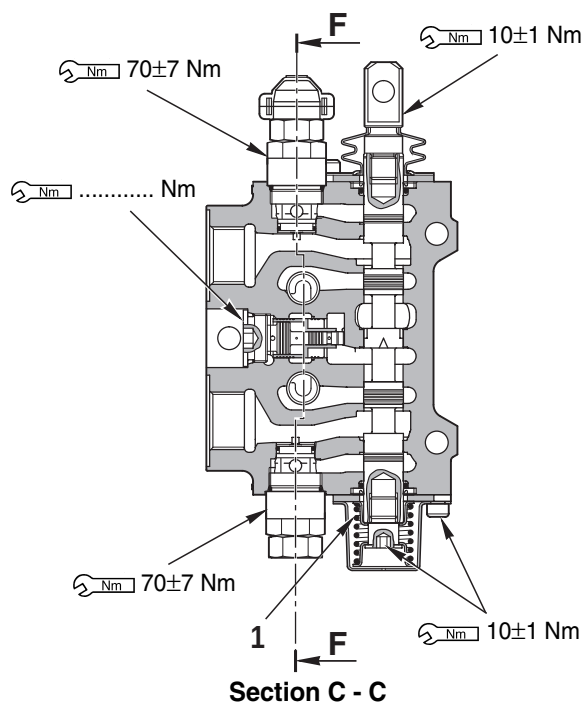
6-SPOOL CONTROL VALVE



RKZ00231

Unit: mm

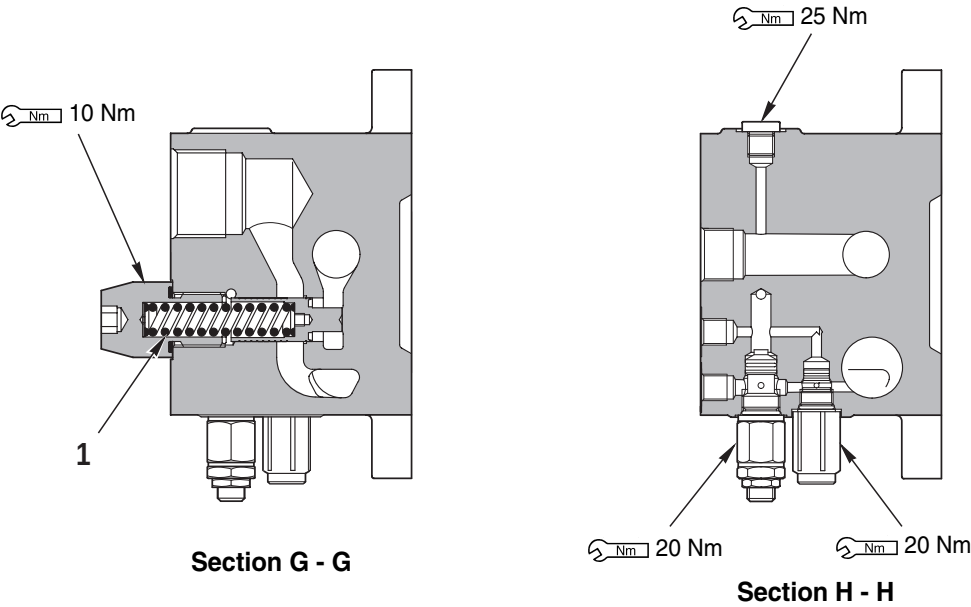
N°	Check item	Criteria					Remedy
1	Spool return spring	Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	



RKZ01310

Unit: mm

N°	Check item	Criteria					Remedy
1	Spool return spring	Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
2	Check valve spring						



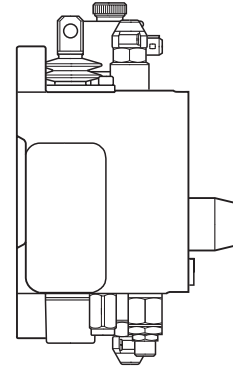
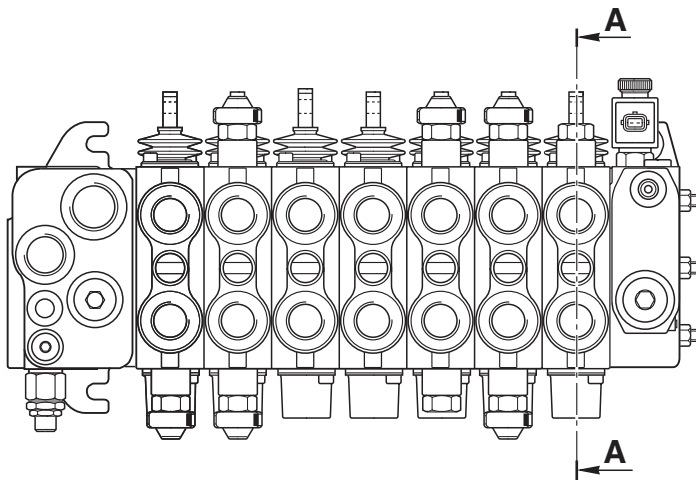
RKZ00791

Unit: mm

N°	Check item	Criteria					Remedy
1	Unloading valve spring	Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	

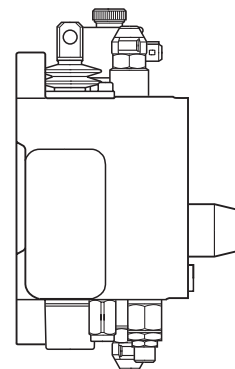
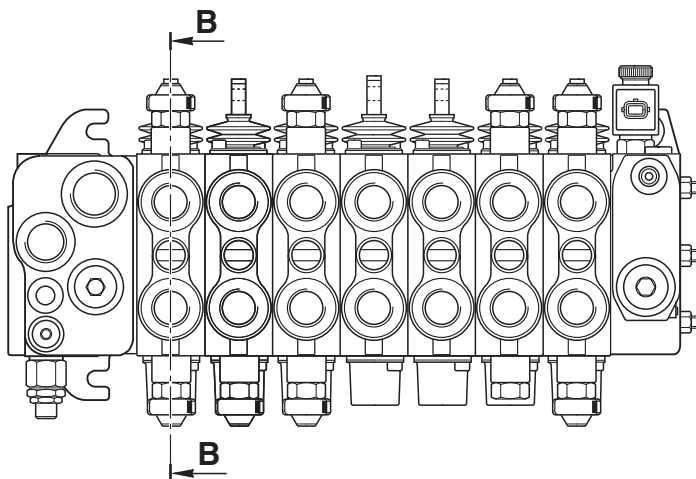
7-SPOOL CONTROL VALVE

For jig arm



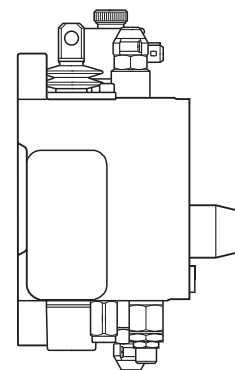
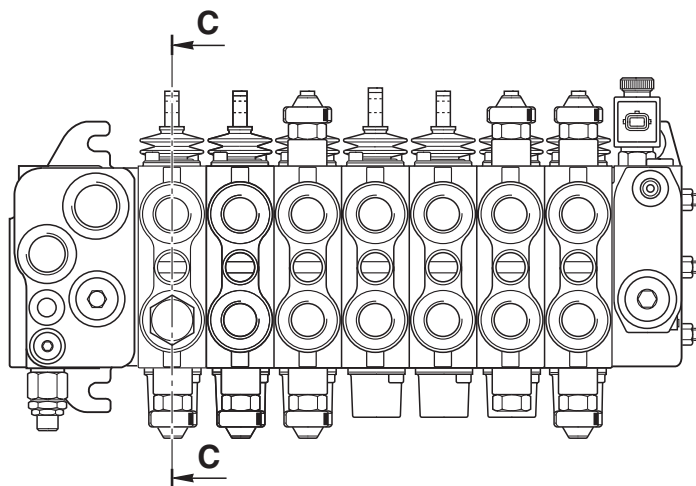
RKZ00241

For side digging boom

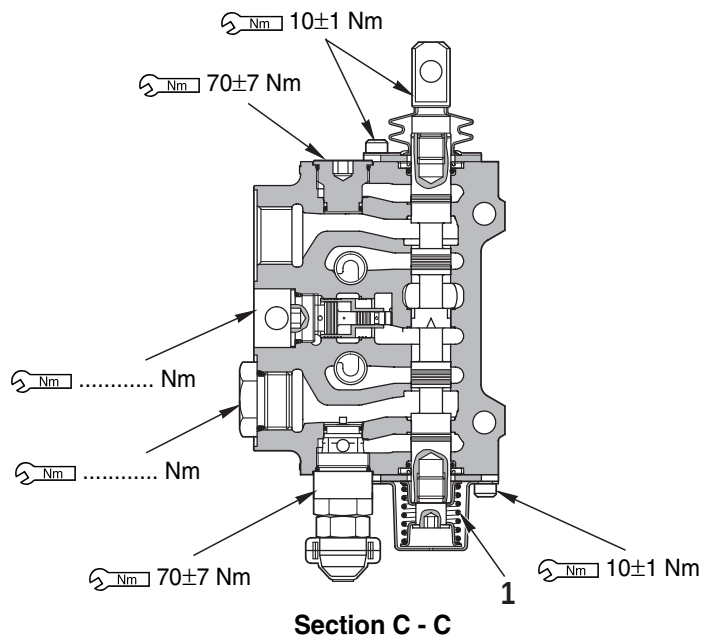
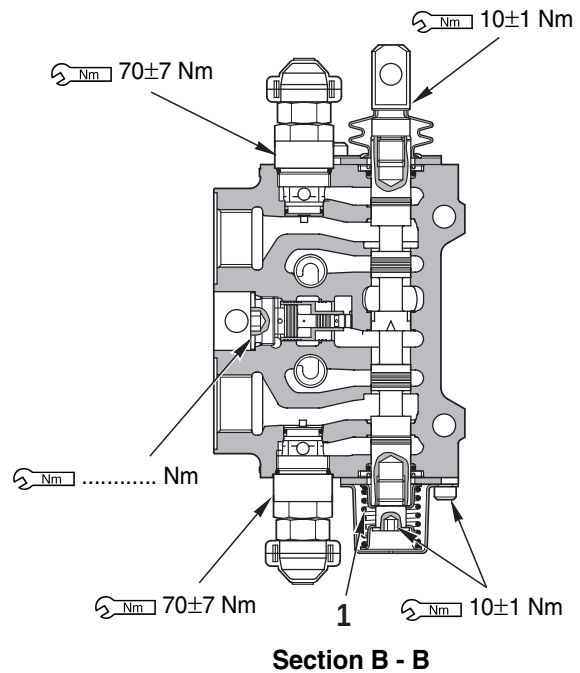


RKZ00251

For hammer



RKZ00261

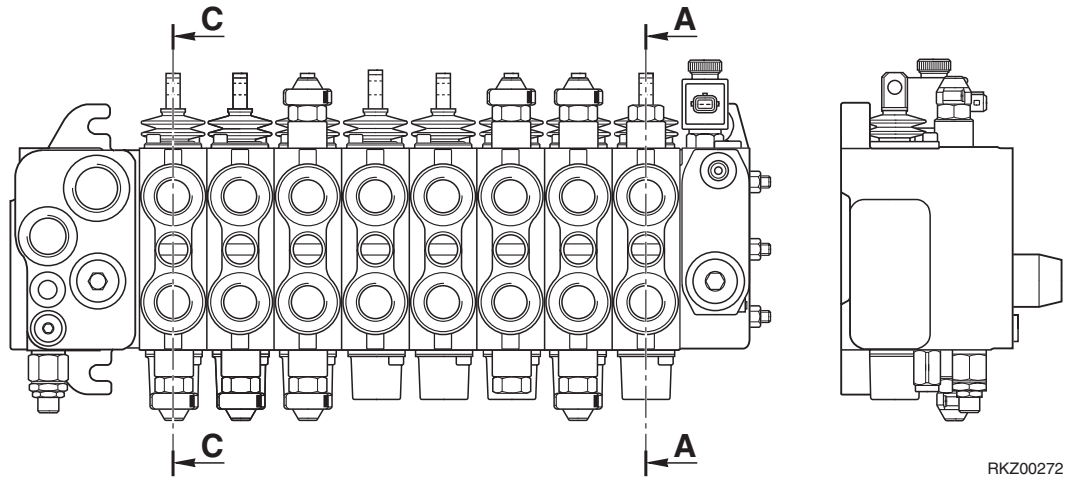


Unit: mm

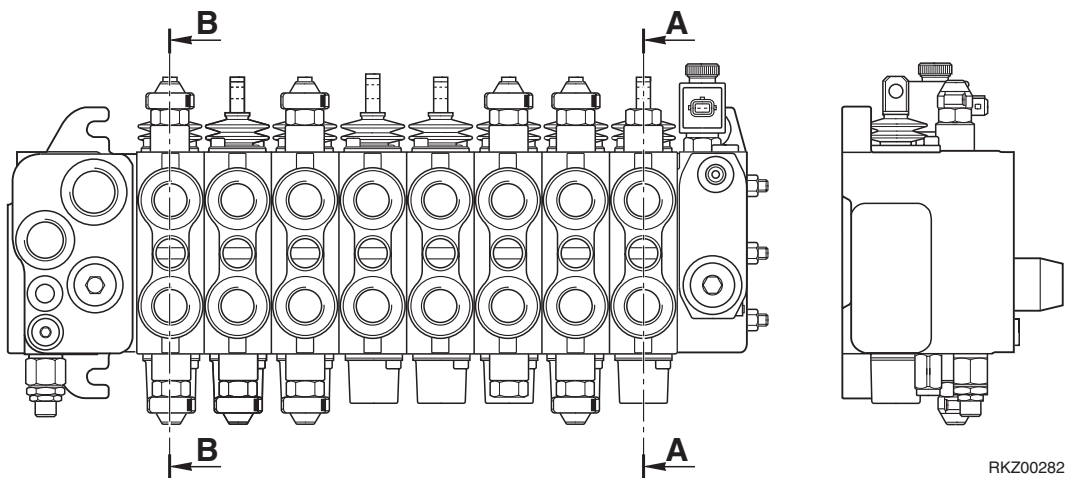
N°	Check item	Criteria					Remedy
1	Spool return spring	Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	

8-SPOOL CONTROL VALVE

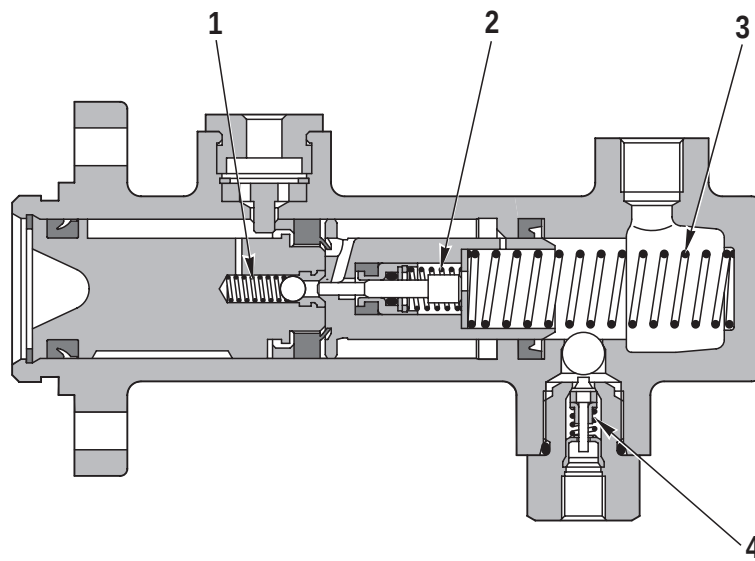
For hammer and jig arm



For side digging boom and jig arm



BRAKE PUMP



RKZ00931

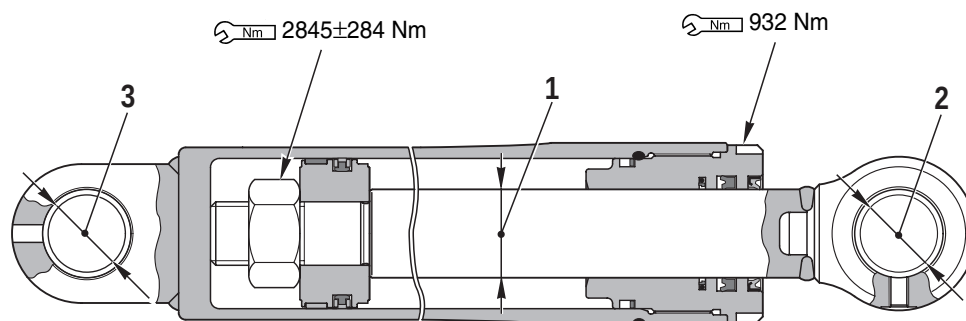
Unit: mm

N°	Check item	Criteria					Remedy
1	Ball valve spring	Standard size			Repair limit		Replace if damaged or deformed
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
		25	13	20 N		18–22 N	
2	Spring	21	13	7.3 N		7.3–7.8 N	
3	Pump spring	91	60	72 N		65–79 N	
4	Spring	14	7.3	4 N		36–44 N	

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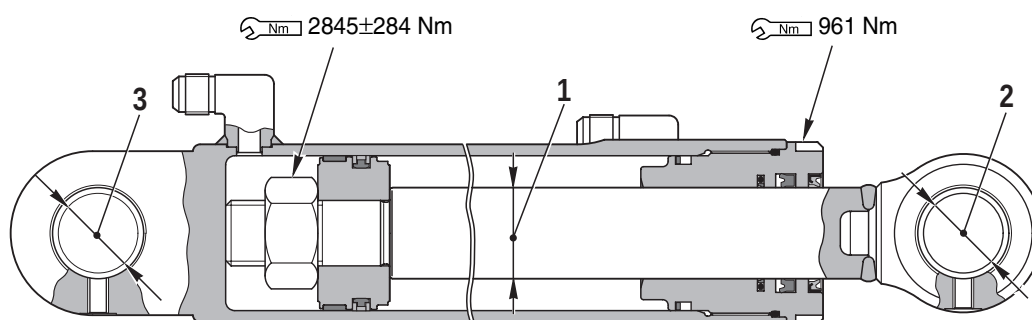
SHOVEL CYLINDERS

DUMP CYLINDER



RKZ00780

RAISE CYLINDER



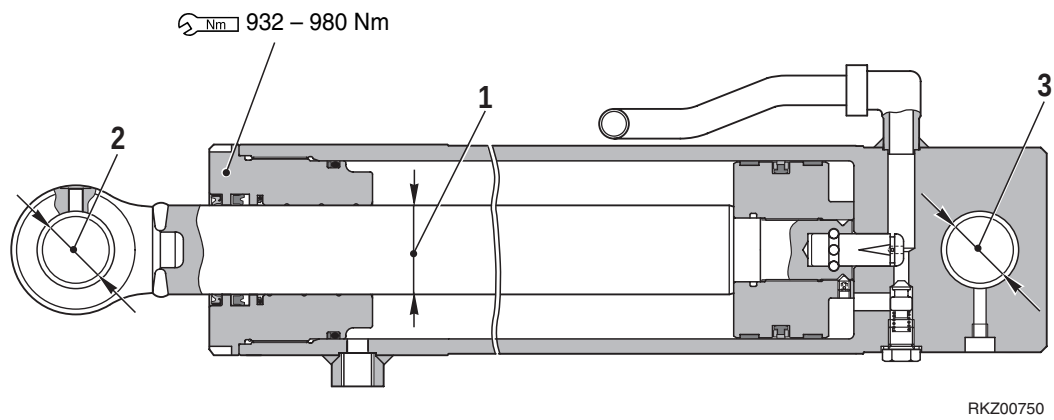
RKZ00770

Unit: mm

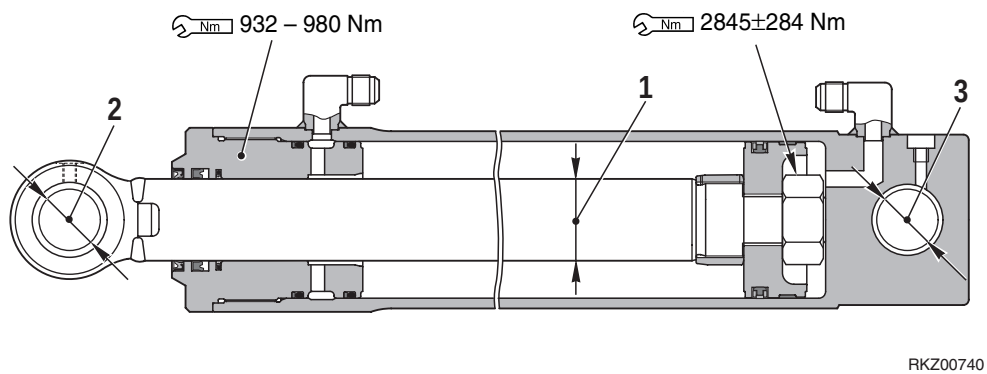
N°	Check item	Cylinder	Criteria					Remedy
			Standard size	Tolerance		Minimum clearance	Clearance limit	
				Shaft	Hole			
1	Tolerance between piston rod and cylinder head	Raise	50	-0.025 -0.050	+ 0.064 + 0.025	0.05	0.114	Replace
		Dump	50	-0.025 -0.050	+ 0.064 + 0.025	0.05	0.114	
2	Tolerance between bushing and piston rod mounting pin	Raise	45	-0.050 -0.089	+ 0.24 + 0.08	0.13	0.329	Replace pin and bushing
		Dump	45	-0.050 -0.089	+ 0.24 + 0.08	0.13	0.329	
3	Tolerance between bushing and cylinder mounting pin	Raise	50	-0.038 -0.083	+ 0.24 + 0.08	0.118	0.323	
		Dump	50	-0.038 -0.083	+ 0.24 + 0.08	0.118	0.323	

BACKHOE CYLINDERS

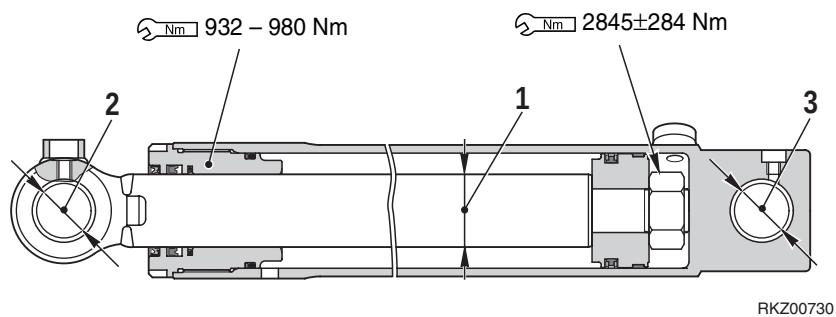
BOOM

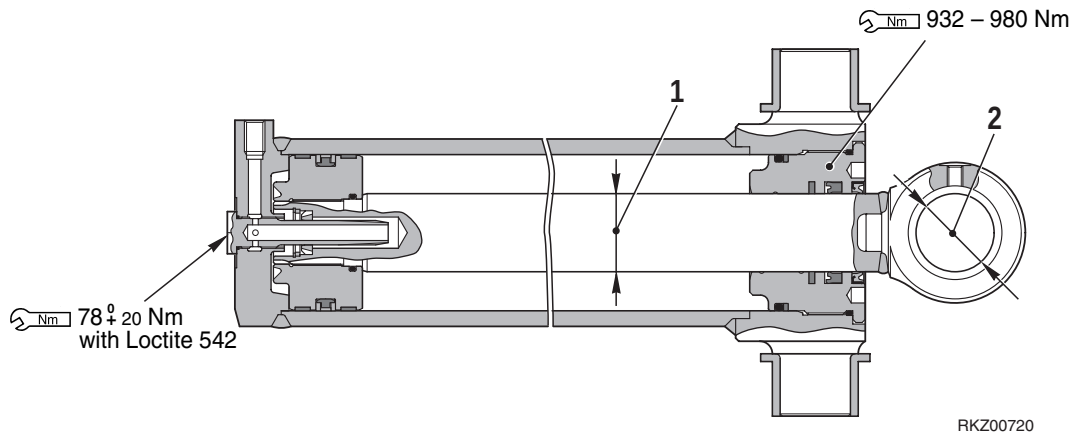


ARM



BUCKET

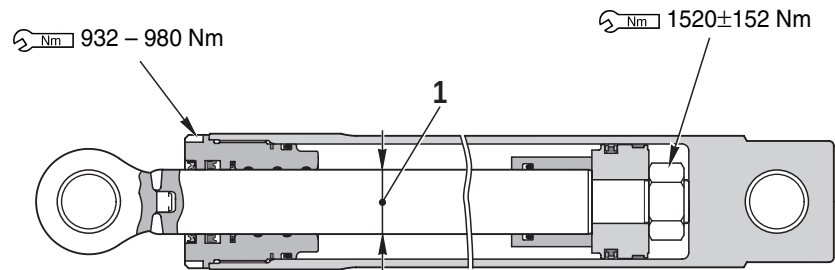


BOO M SWING


Unit: mm

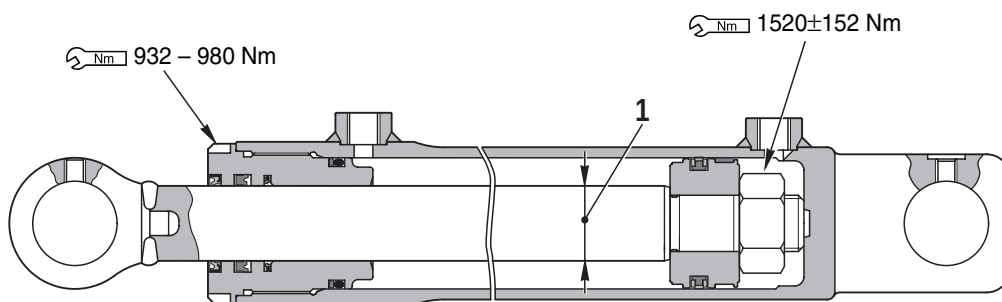
N°	Check item	Cylinder	Criteria					Remedy
			Standard size	Tolerance		Minimum clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between piston head and cylinder head	Boom	60	-0.030 -0.060	+ 0.076 + 0.030	0.06	0.136	Replace
		Arm	60	-0.030 -0.060	+ 0.076 + 0.030	0.06	0.136	
		Bucket	60	-0.030 -0.060	+ 0.076 + 0.030	0.06	0.136	
		Boom swing	50	+ 0.025 + 0.050	+ 0.064 + 0.025	0.05	0.114	
2	Tolerance between bushing and piston head mounting pin	Boom	50	-0.050 -0.089	+ 0.24 + 0.08	0.13	0.329	Replace pin and bushing
		Arm	45	-0.050 -0.089	+ 0.24 + 0.08	0.13	0.329	
		Bucket	50	-0.050 -0.089	+ 0.24 + 0.08	0.13	0.329	
		Boom swing	50	-0.050 -0.089	+ 0.119 + 0.080	0.13	0.208	
3	Tolerance between bushing and cylinder mounting pin	Boom	50	-0.050 -0.089	+ 0.24 + 0.08	0.13	0.329	
		Arm	45	-0.050 -0.089	+ 0.24 + 0.08	0.13	0.329	
		Bucket	45	-0.050 -0.089	+ 0.24 + 0.08	0.13	0.329	

OUTRIGGER



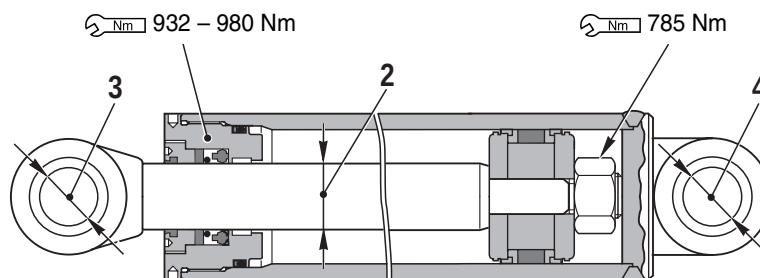
RKZ00710

JIG ARM



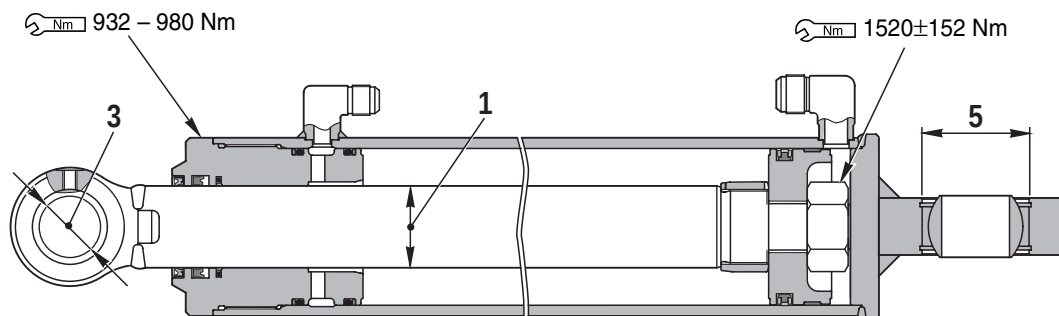
RKZ00700

SIDE DIGGING BOOM



RKZ00680

ARM (FOR SIDE DIGGING BOOM)

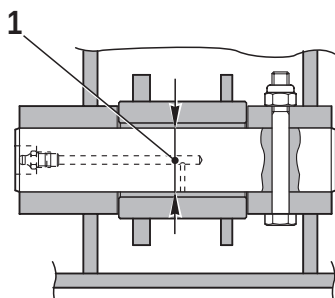
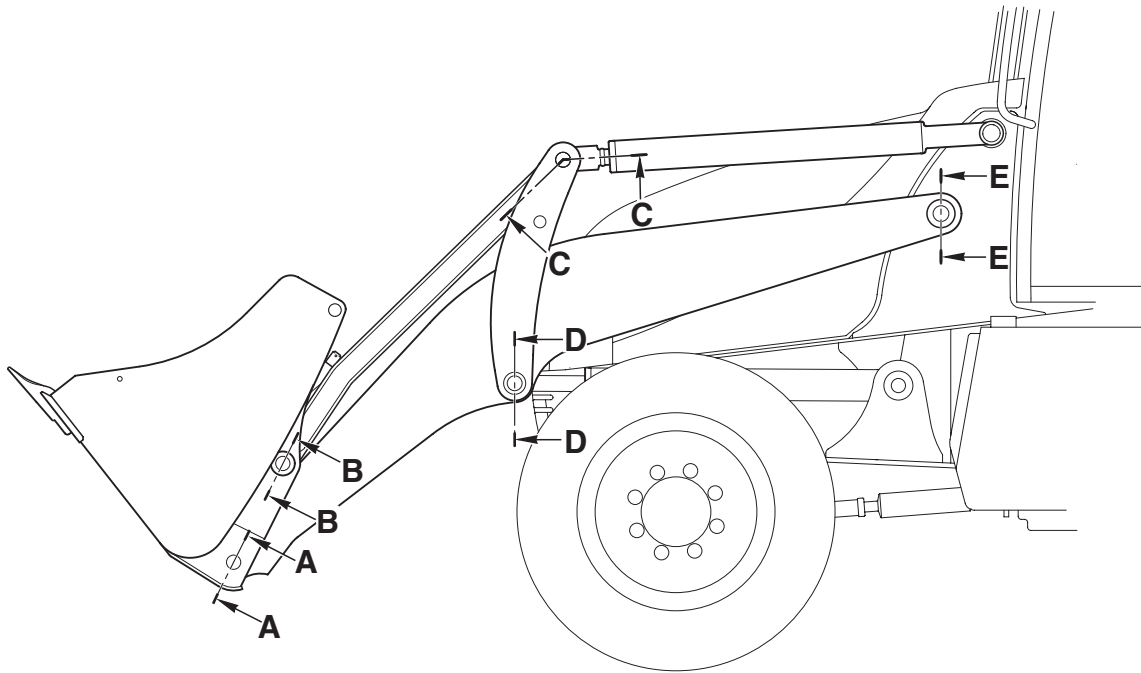


RKZ00671

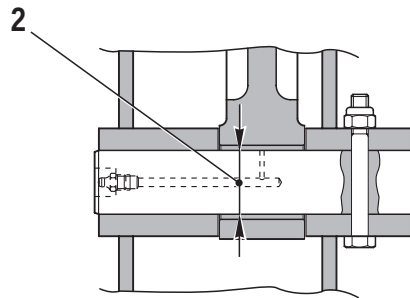
Unit: mm

N°	Check item	Cylinder	Criteria					Remedy
			Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between piston rod and cylinder head	Outrigger	40	-0.025 -0.050	+ 0.064 + 0.025	0.050	0.114	Replace
		Arm for side digging boom	60	-0.030 -0.060	+ 0.076 + 0.030	0.060	0.136	
		Jig arm	40	-0.025 -0.050	+ 0.064 + 0.025	0.114	0.050	
2	Clearance between piston rod and bushing	Side digging boom	45	-0.009 -0.025	+ 0.380 + 0.040	0.049	0.405	
3	Tolerance between bushing and piston rod mounting pin	Side digging boom	40	-0.050 -0.089	+ 0.119 + 0.080	0.130	0.208	
		Arm for side digging boom	45	-0.050 -0.089	+ 0.119 + 0.080	0.130	0.208	
4	Tolerance between bushing and cylinder mounting pin	Side digging boom	40	-0.050 -0.089	+ 0.119 + 0.080	0.130	0.208	
5	Clearance between bearing and bearing seat	Arm for side digging boom	75	0 -0.013	0 -0.035	—	0.013	

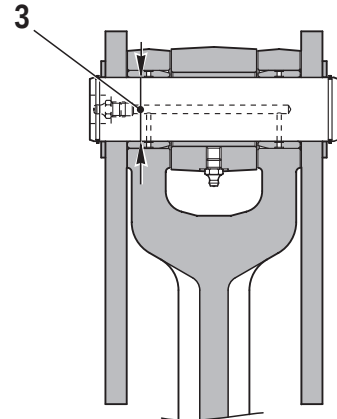
FRONT WORKING EQUIPMENT



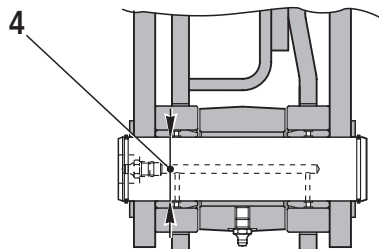
Section A - A



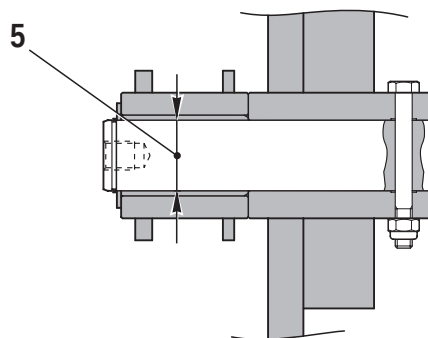
Section B - B



Section C - C



Section D - D



Section E - E

RKZ02270

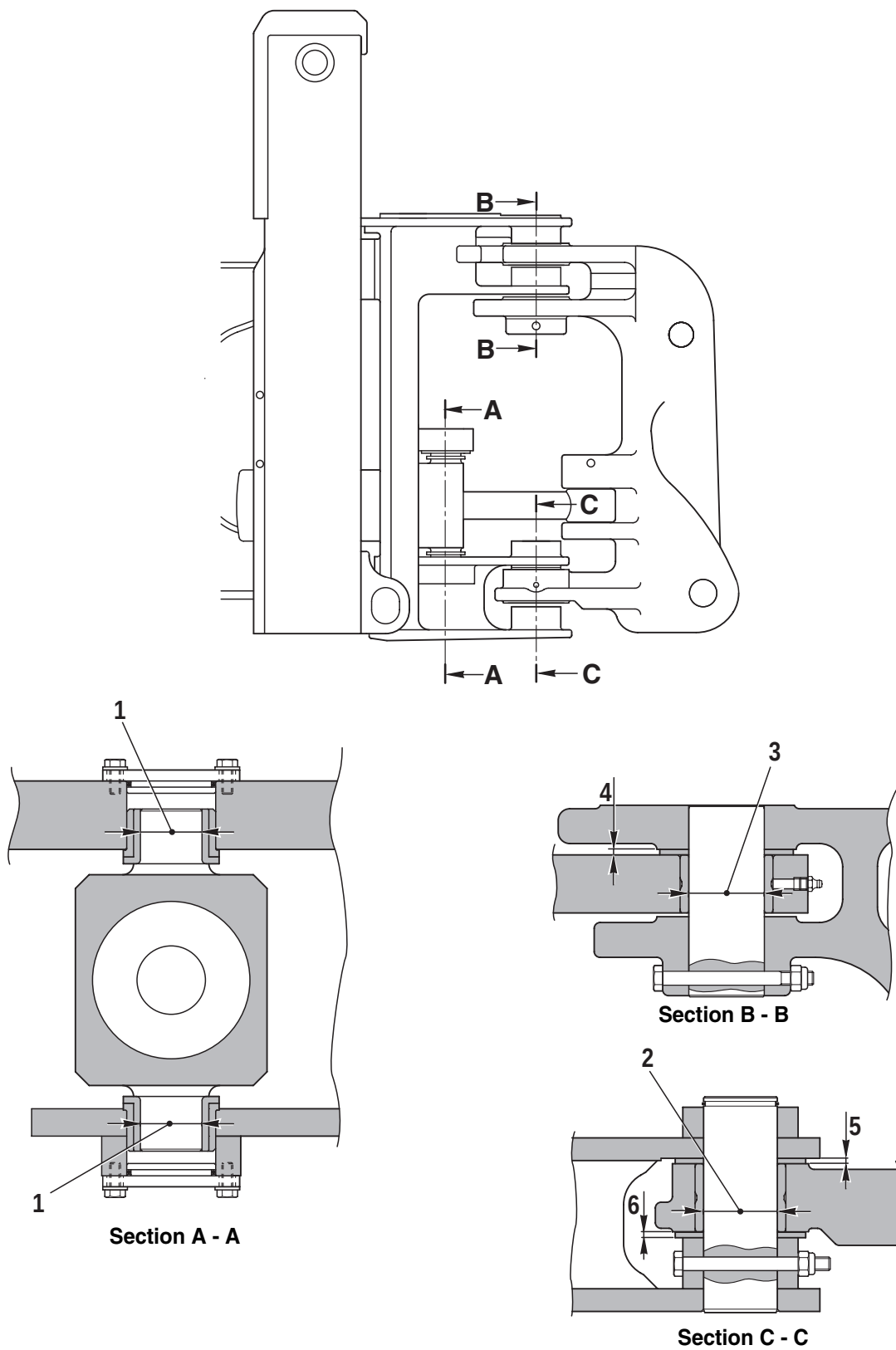
STANDARD MAINTENANCE

FRONT WORKING EQUIPMENT

Unit: mm

N°	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between bushing and bucket mounting pin	45	−0.050 −0.089	+ 0.080 + 0.240	0.130–0.329		Replace
2	Clearance between bushing and link mounting pin	45	−0.050 −0.089	+ 0.080 + 0.240	0.130–0.329		
3	Clearance between bushing and tilt lever mounting pin	45	−0.050 −0.089	+ 0.080 + 0.119	0.130–0.208		
4	Clearance between bushing and link mounting pin	45	−0.050 −0.089	+ 0.119 + 0.080	0.130–0.208		
5	Clearance between bushing and boom mounting pin	50	−0.038 −0.093	+ 0.080 + 0.240	0.118–0.323		

SWING BRACKET

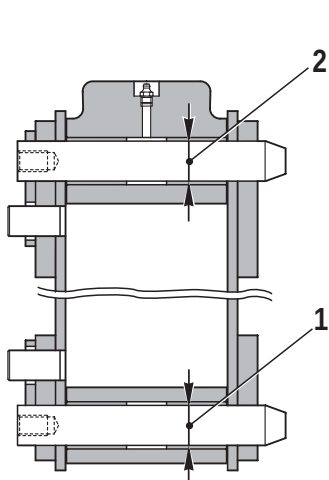
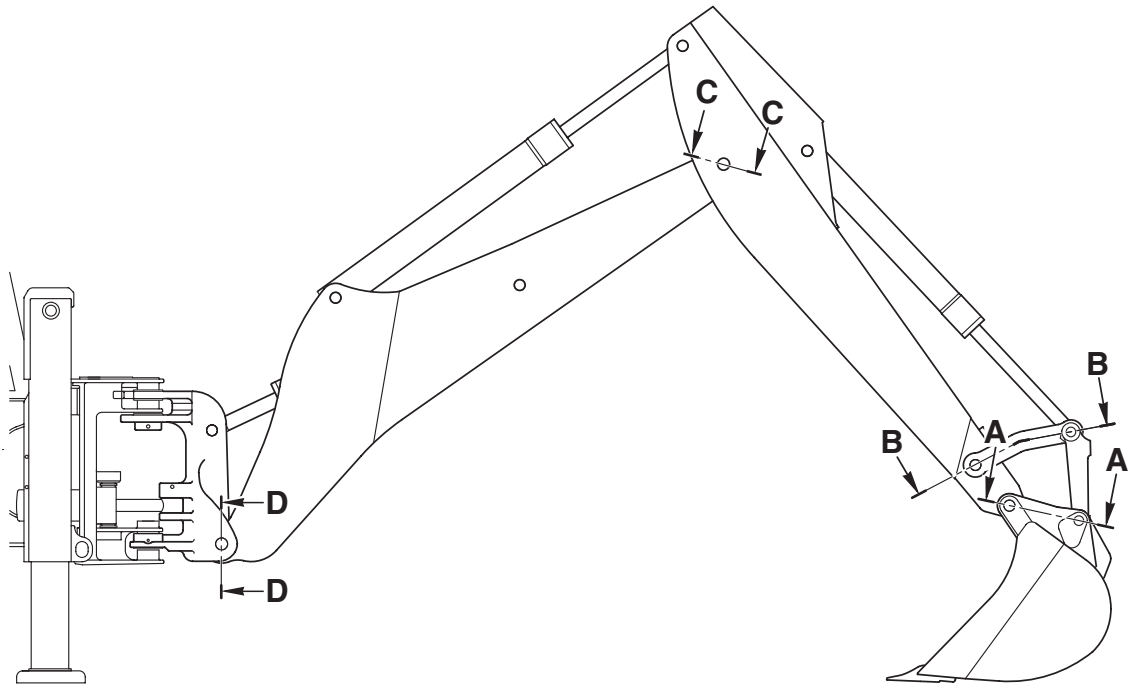


RKZ02720

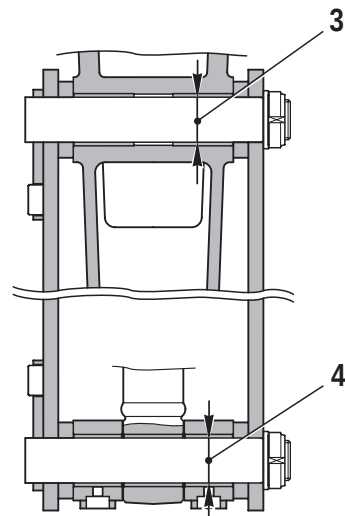
Unit: mm

N°	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between rotating bushing and boom swing cylinder bushing	55	−0.060 −0.106	+ 0.090 + 0.060	0.120–0.196		Replace bushing and pin
2	Clearance between bushing and (lower) swing bracket rotating pin	65	−0.060 −0.106	+ 0.190 + 0.264	0.250–0.370		
3	Clearance between bushing and (upper) swing bracket rotating pin	65	−0.060 −0.106	+ 0.190 + 0.264	0.250–0.370		
4	Upper shim thickness	Standard size			Limit size		
		4.75 ^{±0.1}					
5	Central shim thickness	4.75 ^{±0.1}					
6	Lower shim thickness	4.75 ^{±0.1}					

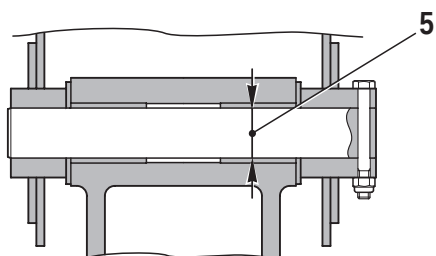
BACKHOE WORKING EQUIPMENT



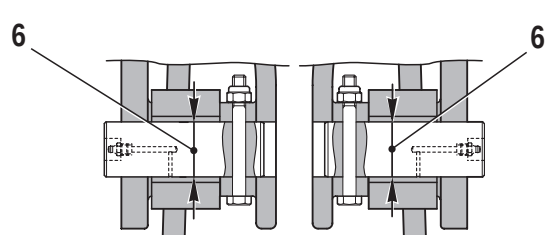
Section A - A



Section B - B



Section C - C



Section D - D

RKZ02900

STANDARD MAINTENANCE

BACKHOE WORKING EQUIPMENT

Unit: mm

N°	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between link bushings and bucket mounting pin	40	−0.050 −0.089	−0.080 −0.240	0.130–0.329		Replace
2	Clearance between arm bushings and bucket mounting pin	40	−0.050 −0.089	−0.080 −0.240	0.130–0.329		
3	Clearance between arm bushings and lever mounting pin	45	−0.050 −0.089	−0.080 −0.240	0.130–0.329		
4	Clearance between bushings and tilt lever mounting pin	45	−0.050 −0.089	−0.080 −0.240	0.130–0.329		
5	Clearance between bushings and arm mounting pin	50	−0.050 −0.089	−0.080 −0.119	0.130–0.208		
6	Clearance between bushings and boom mounting pin	50	−0.038 −0.083	−0.080 −0.119	0.118–0.202		

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