WEBM007500

SHOP MANUAL

WB97S-5

BACKHOE-LOADER

SERIAL NUMBER
WB97S-5 F00003 and up

KOMATSU
Utility

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REVISED PAGES

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

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

SAFETY

GENERAL PRECAUTIONS

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

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

PREPARATIONS FOR WORK

7. Before adding or making any repairs, park the machine on hard, level ground, and block the 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 in stopped, so be careful not to get burned.
    Wait for the oil water to cool before carrying out any work on the cooling water circuits.
13. Before starting work, remove the leads from the battery. Always remove the lead from the negative (–) terminal first.

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

REMOVAL AND INSTALLATION
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.

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

NOTE

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

HOW TO READ THE SHOP MANUAL

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

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

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

   10 - 3

   10: Item number (10. Structure and Function)

   3: Consecutive page number for each item

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

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   10-4-1 ⎤
   10-4-2 ⎦ Added pages
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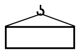
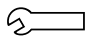
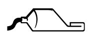
REVISED EDITION MARK
When a manual is revised, an edition mark is recorded on the bottom outside corner of the pages.

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

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

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

HOISTING INSTRUCTIONS

> ⚠ Heavy parts (25 kg or more) must be lifted with a hoist etc. In the Disassembly and Assembly section, every part weighing 25 kg or more is clearly indicated with the symbol

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

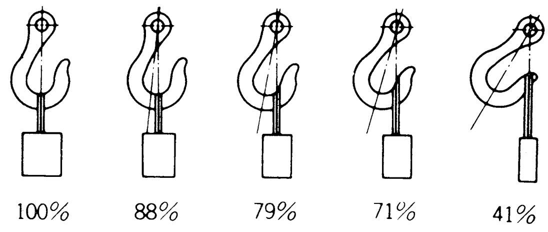
2. Wire ropes

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

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

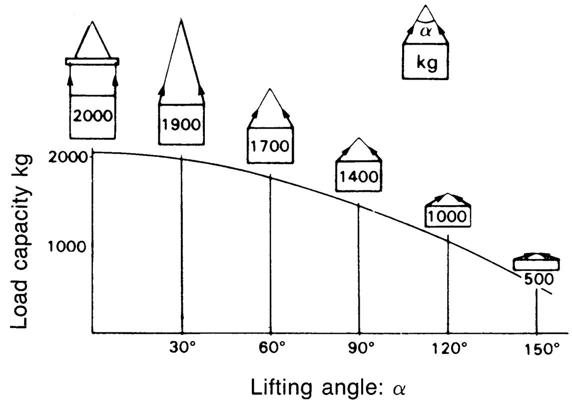
The allowable load value is estimated to be one-sixth or one-seventh of the breaking strength of the rope used.

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



3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound on to the load.
⚠ Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can cause dangerous accidents.

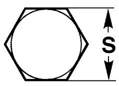
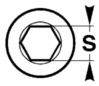
4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook.
When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles.
The table below shows the variation of allowable load (kg) when hoisting is made with two ropes, each of which is allowed to sling up to 1000 kg vertically, at various handing angles.
When two ropes sling a load vertically, up to 2000 kg of total weight can be suspended.
This weight becomes 1000 kg when two ropes make a 120° hanging angle.
On the other hand, two ropes are subjected to an excessive force as large as 4000 kg if they sling a 2000 kg load at a lifting angle of 150°.



STANDARD TIGHTENING TORQUE

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

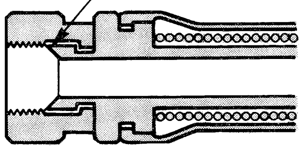
1. STANDARD TIGHTENING TORQUE OF BOLTS AND NUT

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

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

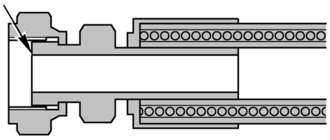
★ **Nm (newton meter): 1 Nm = 0.102 kgm**

2. TIGHTENING TORQUE FOR NUTS OF FLARED



Use these torques for nut part of flared.

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



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

COATING MATERIALS

The recommended coating materials prescribed in Komatsu 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

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–L	–	H–N	H/N	–	–	–	–	–	–
Colour	Grey	Grey–Blue		Grey–Black		–		–		–	
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	WB97S-5
Engine assembly - Muffler - Exhaust pipe	394
Radiator - exchanger	
Hydraulic oil tank (empty)	10
Fuel tank (empty)	68
Front counterweight	372
Engine hood	32
Cabin (without seat)	
Seat	
Engine-gear box-pump group	
Piston pump	36.8
Transmission	254
Front axle	525
Rear axle	545
Front wheel Rear wheel	
Work equipment • Boom • Shovel • Fulcrum lever • Tilt lever • Raise cylinder • Tilt cylinder	1100 313 436 13x4 32.5x2 46x2 35x2
Work equipment • with standard arm • with long arm • with jig arm	 850 885 1030
Boom	248
Arm	
Long arm	
Boom swing bracket	162.5
Backframe	246
Control valve (8-spool)	
Control valve (10-spool)	
Jig arm	460
Outriggers	39x2
Boom cylinder	87.5
Arm cylinder	67
Bucket cylinder	52.5
Outriggers cylinder	27.5x2
Swing cylinder	34x2
Bucket	158

TABLE OF OIL AND COOLANT QUANTITIES

TANK / RESERVOIR	FLUID	AMBIENT TEMPERATURE -30 -20 -10 0 10 20 30 40 50 °C	CAPACITY (l) 1st filling	CAPACITY (l) Change
Engine oil pan	OIL ACEA E5 - E4	SAE 5W-30	13	13
	OIL API CI-4 ACEA E7	SAE 15W-40		
Hydraulic system	OIL API CF - CF2 - CD	SAE 10W-30	98	40
Hydraulic system with biodegradable oil			98	40
Front axle: Differential	OIL UTTO FLUID		10.5	10.5
Final reduction gear (ea)			1.3	1.3
Rear axle: Differential			10.5	10.5
Final reduction gear (ea)			1.3	1.3
Hydraulic transmission	OIL GM DEXRON® II D (DEXRON® is a registered trademark of General Motors Corporation)		20	20
Braking system			0.8	0.8
Fuel tank	DIESEL OIL	★ ASTM D975 N. 2	150	–
Engine cooling system	PERMANENT COOLANT (★★)		15	–

★ **ASTM D975 N. 1**

★★ **Special red permanent antifreeze suitable for aluminium radiators. If pure, dilute with water (50%).**

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

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

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

NOTE:

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

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

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

(3) Use engine oil with CD classification; if oil with CC 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 drow a horizontal line from A.

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

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

2. Convert 550 mm into inches

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

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

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

From millimeters to inches

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 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

From liter to U.S. Gall.

1 ℓ = 0.2642 U.S. Gall.

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

From liter to U.K. Gall.

1 ℓ = 0.21997 U.K. Gall.

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

From Nm to lb.ft.

1 Nm = 0.737 lb.ft.

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

From Nm to kgm

1 Nm = 0.102 kgm

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

From kgm to lb.ft.

1 kgm = 7.233 lb.ft.

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

From bar to psi (lb/in^2)

1 bar = 14.503 psi

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

TEMPERATURE

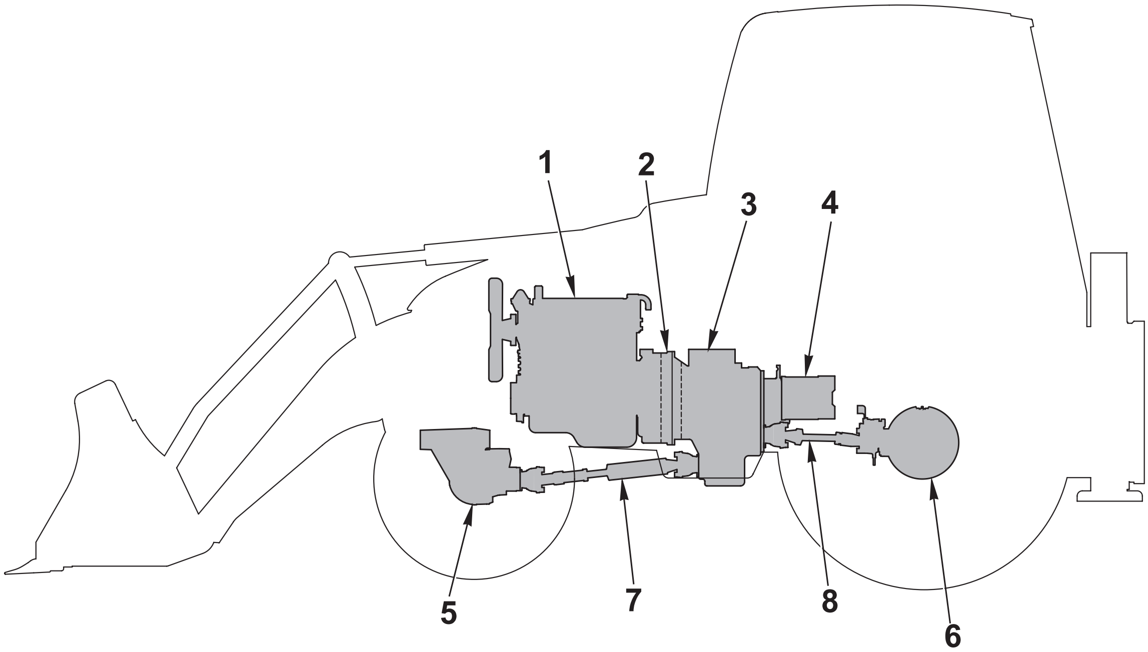
Fahrenheit-Centigrade conversion; a simple way to convert a Fahrenheit temperature reading into a Centigrade temperature reading or vice versa is to enter the accompanying table in the center or boldface column of figures.
These figures refer to the temperature in either Fahrenheit or Centigrade degrees.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

1 °C = 33.8°F

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

10 STRUCTURE AND FUNCTION

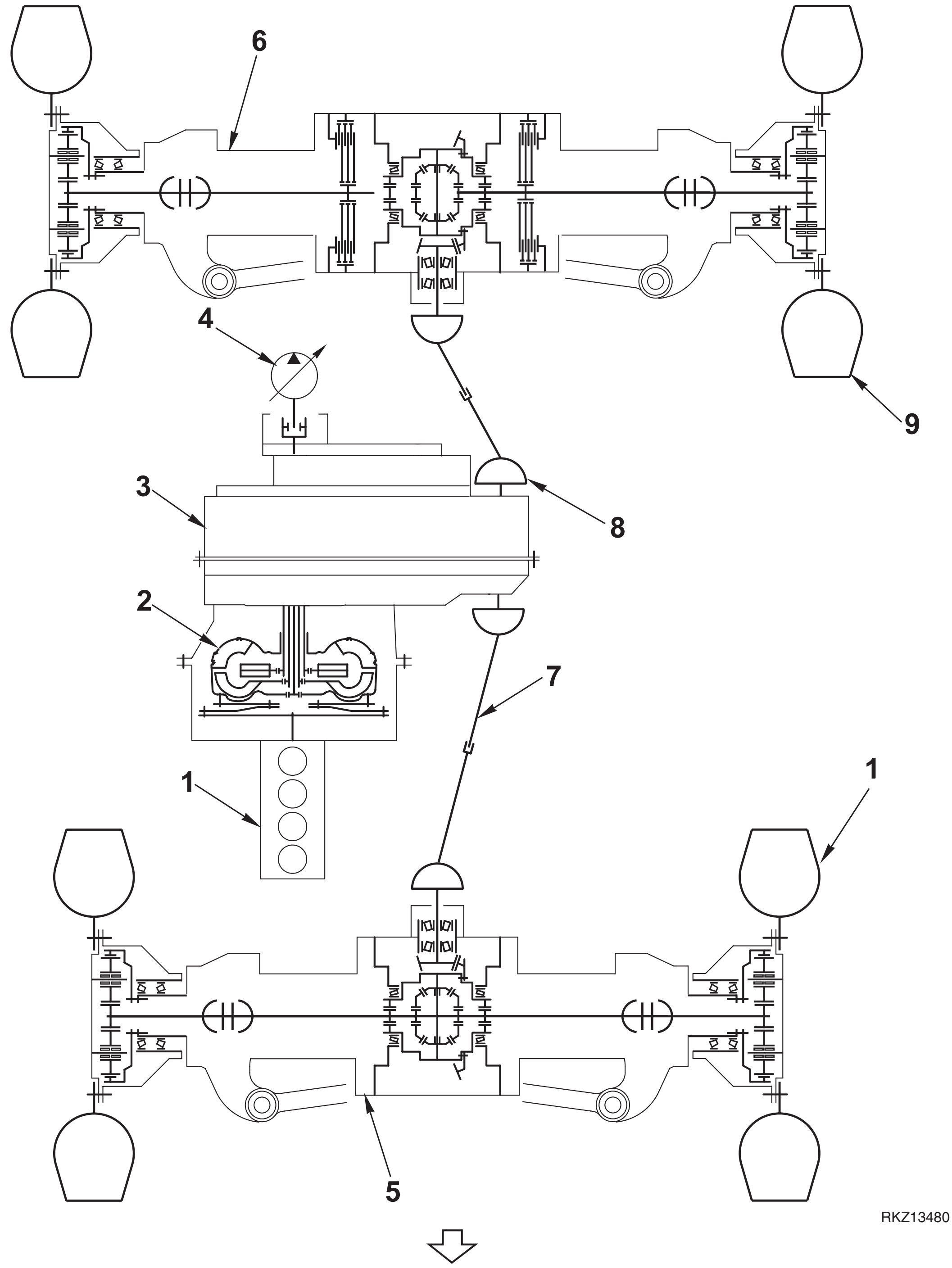
POWER TRAIN



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) is electro-hydraulic in all its functions (power shuttle); direction and speed can be selected manually from a dedicated control unit and is managed by solenoid valves.
- The driving power is transmitted from the transmission (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.

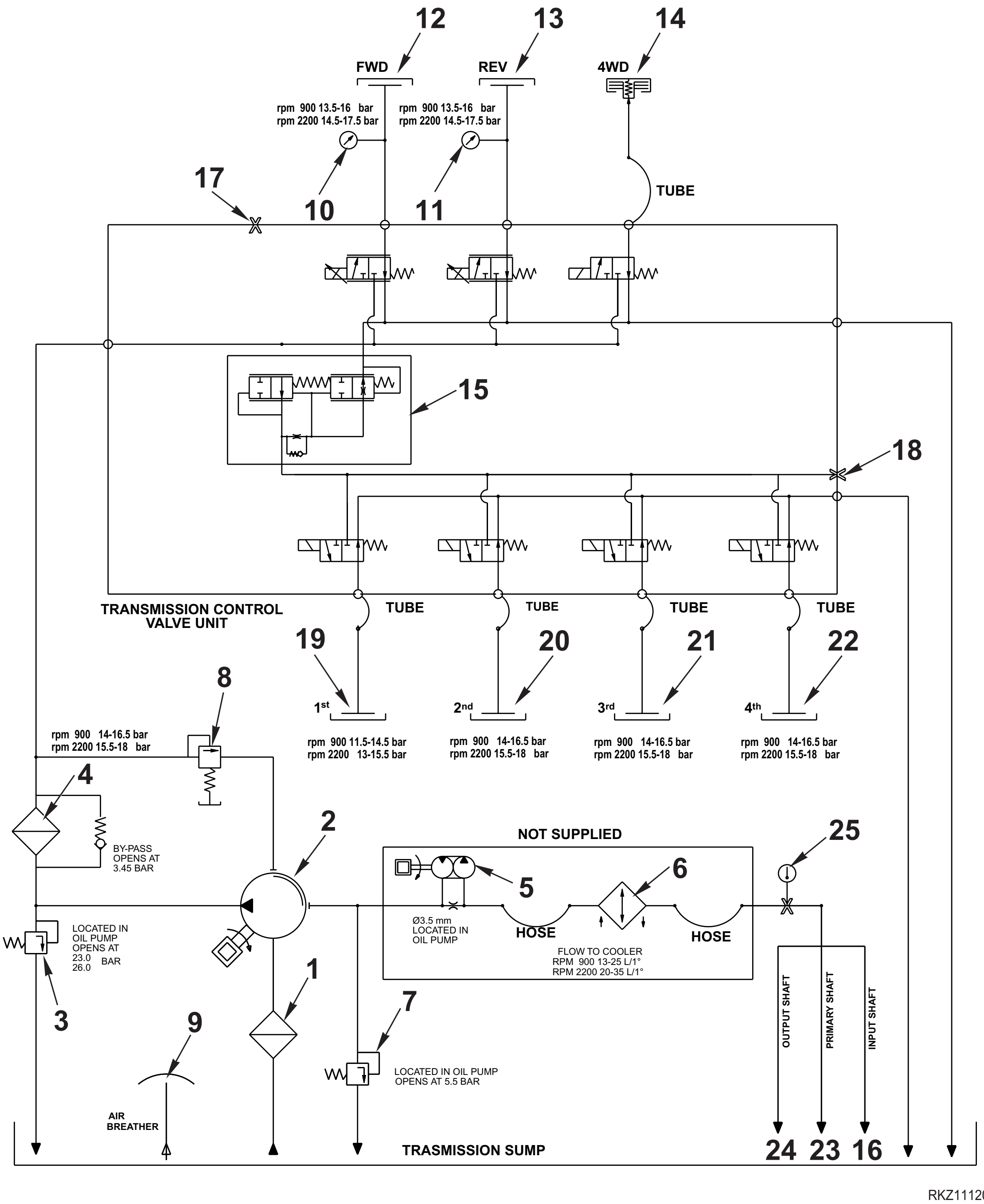
Gears	Front axle				Rear axle			
	Transmission	Differential	Planetary	Total	Transmission	Differential	Planetary	Total
1st gear	5.533	2.909	6.923	111.43	5.533	2.477	6.923	94.48
2nd gear	3.360			67.67	3.360			57.38
3rd gear	1.532			30.85	1.532			26.16
4th gear	0.810			16.31	0.810			13.83



1. Diesel engine
2. Convertor
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

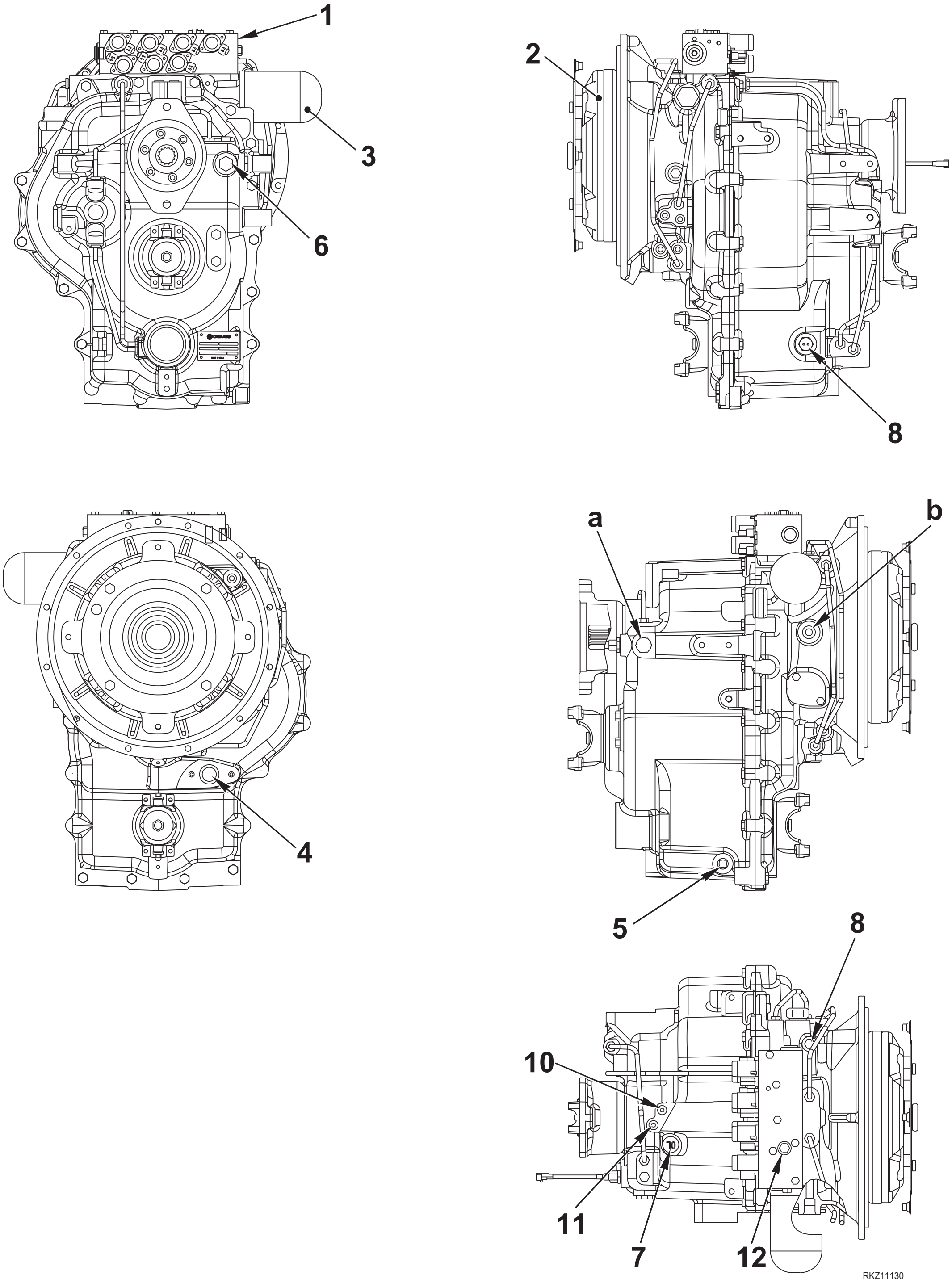
TRANSMISSION (4WD)

Hydraulic convertor-transmission circuit diagram



1. Suction filter (250 µm)
2. Pump
3. Oil screen drain valve
4. Spin-on filter (10 µm)
5. Convertor
6. Radiator
7. Torque converter pressure relief valve
8. Pressure control/flow divider valve
9. Vent
10. FORWARD engagement pressure check
11. REVERSE engagement pressure check
12. FORWARD engagement
13. REVERSE engagement
14. 4WD engagement/disengagement
15. Modulating valve
16. Input shaft lubrication (A pivot)
17. Backhoe oil feed port
18. Drive engagement pressure check
19. 1st gear engagement
20. 2nd gear engagement
21. 3rd gear engagement
22. 4th gear engagement
23. Main shaft lubrication (B shaft)
24. Output shaft lubrication (C/E shafts)
25. Oil temperature thermostat port from oil cooler

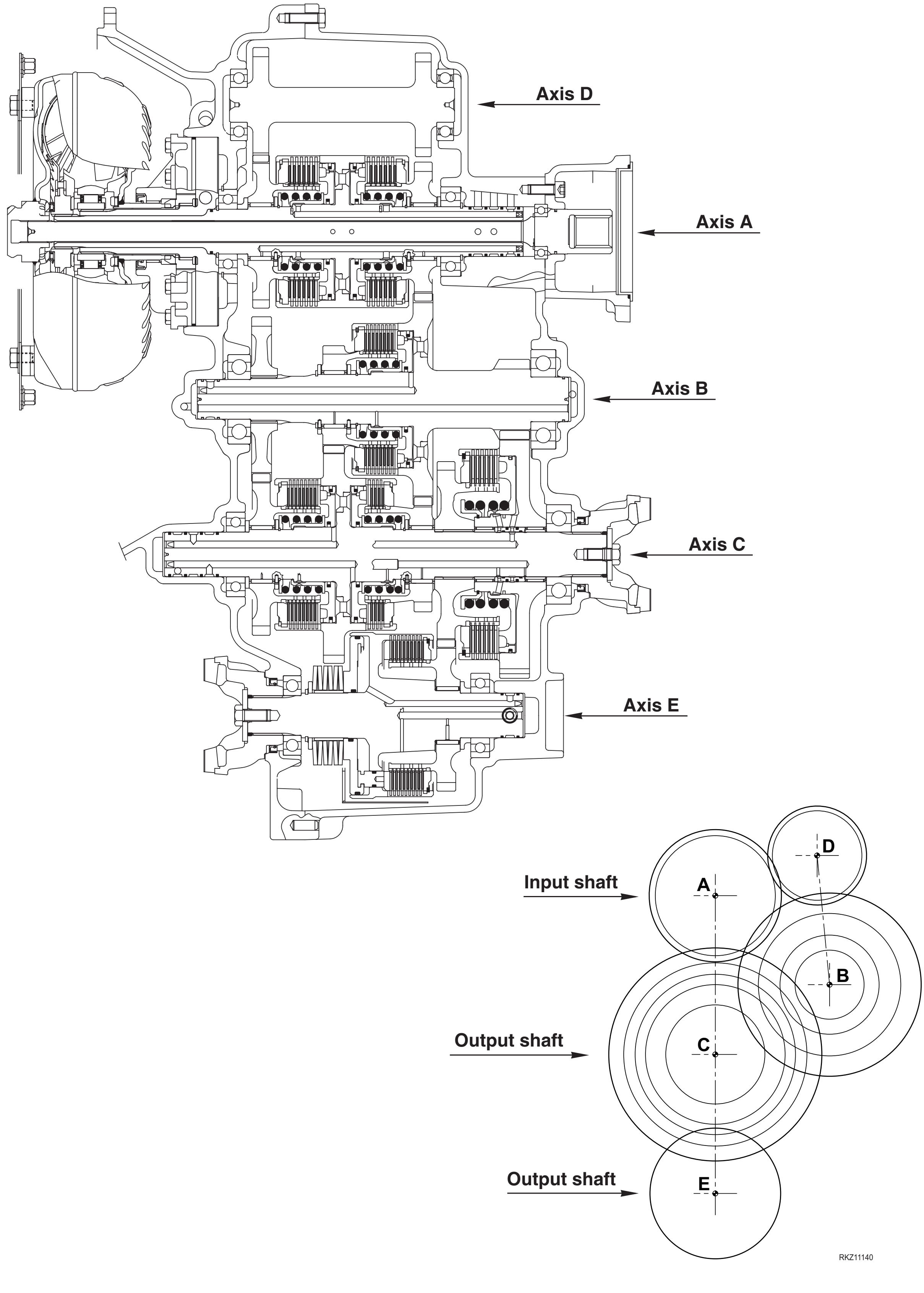
TRANSMISSION



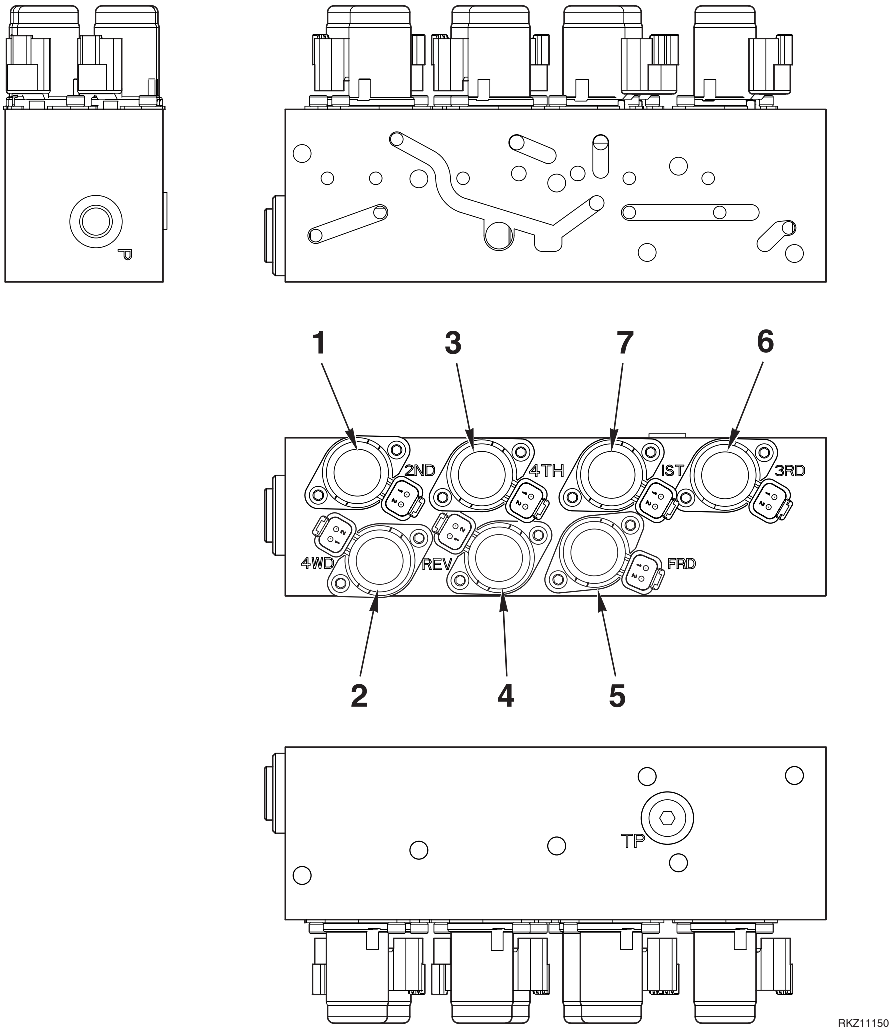
a. To the oil cooler
b. From the oil cooler

1. Control valve group
2. Convertor
3. Oil filter
4. Oil refilling port
5. Oil drain plug
6. Oil temperature sensor
7. Vent plug
8. Revolution sensor
9. Converter input pressure check port
10. Reverse engagement pressure check port
11. Forward engagement pressure check port
12. PPC valve feed pressure check port

Kinematics diagram



CONTROL VALVE BLOCK



ELECTRICAL COMPONENTS

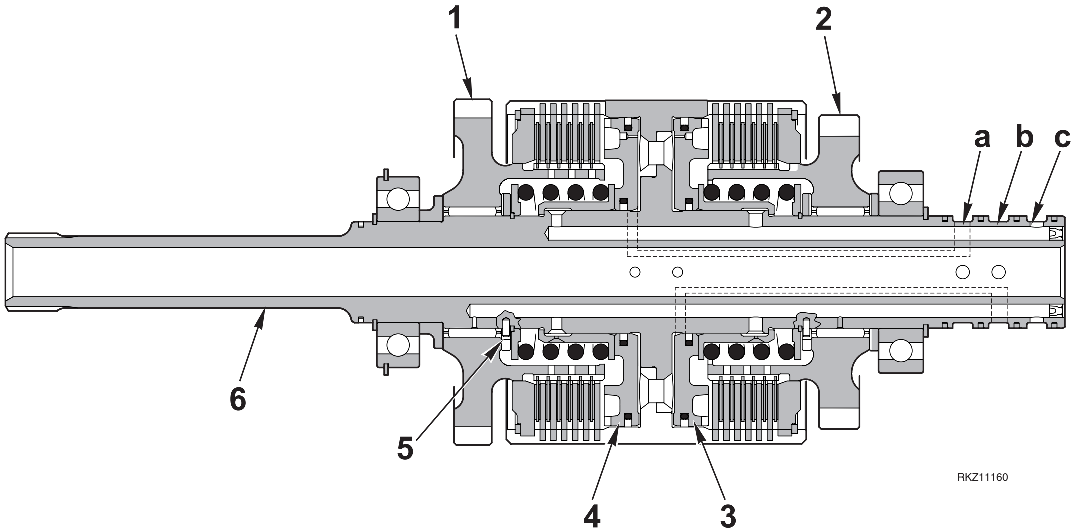
1. C24 – 2nd gear solenoid valve (ED6)
2. C27 - 4WD solenoid valve(ED5)
3. C26 – 4th gear solenoid valve (ED2)
4. C21 - Reverse gears command solenoid valve (ED4)
5. C22 – Forward gear solenoid valve (ED3)

6 - C25 – 3rd gear solenoid valve (ED7)

7. C23 – 1st gear solenoid valve (ED1)

DRIVE SHAFTS

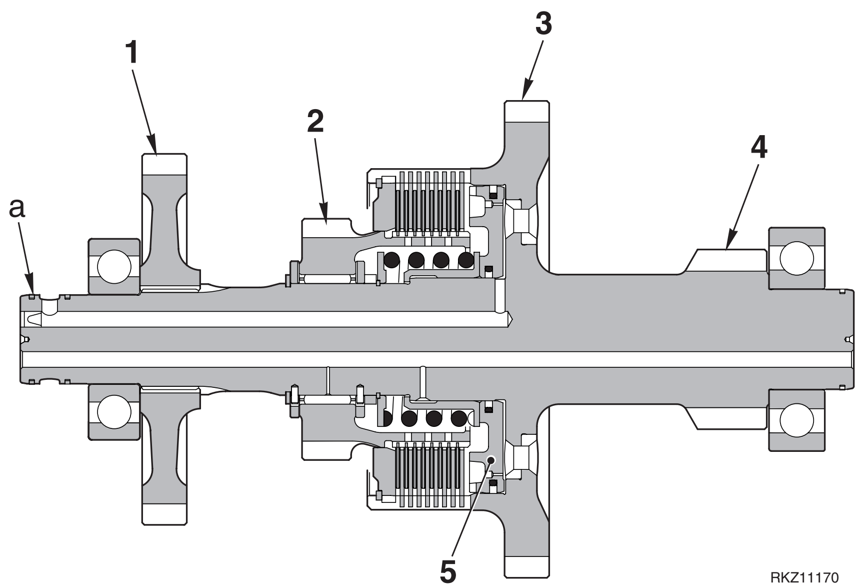
Drive shaft for forward and reverse movement



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

1. Reverse gear clutch (Z=37)
2. Forward gear (Z=37)
3. Reverse clutch piston
4. Forward clutch piston
5. Shoulder ring
6. Driven shaft

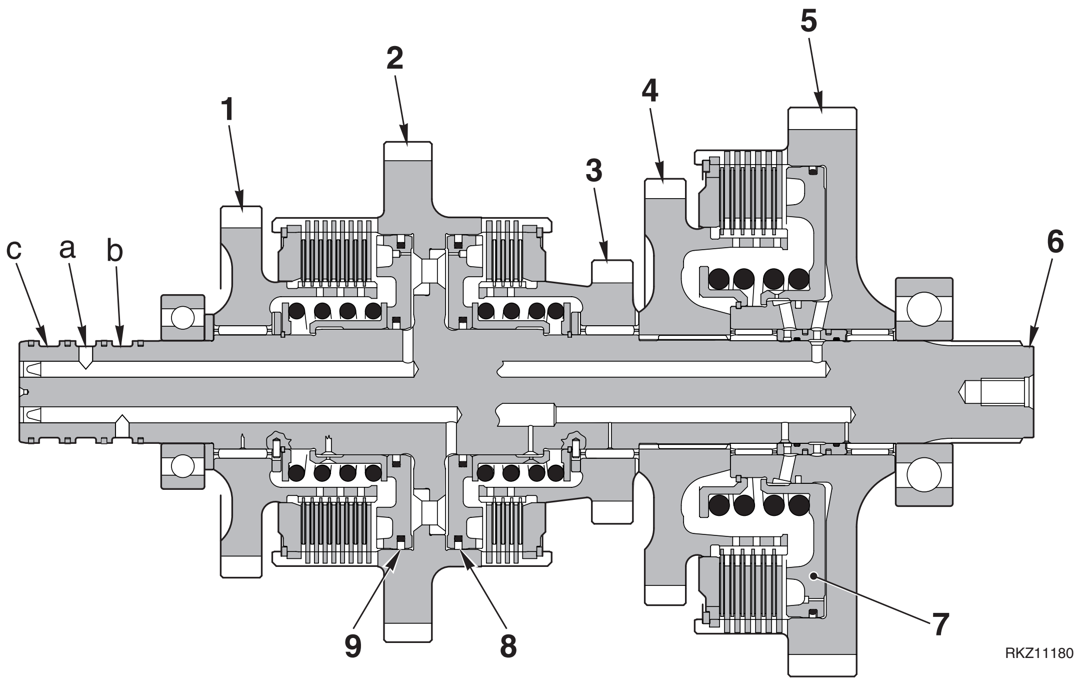
Drive shaft



a. 2nd gear port

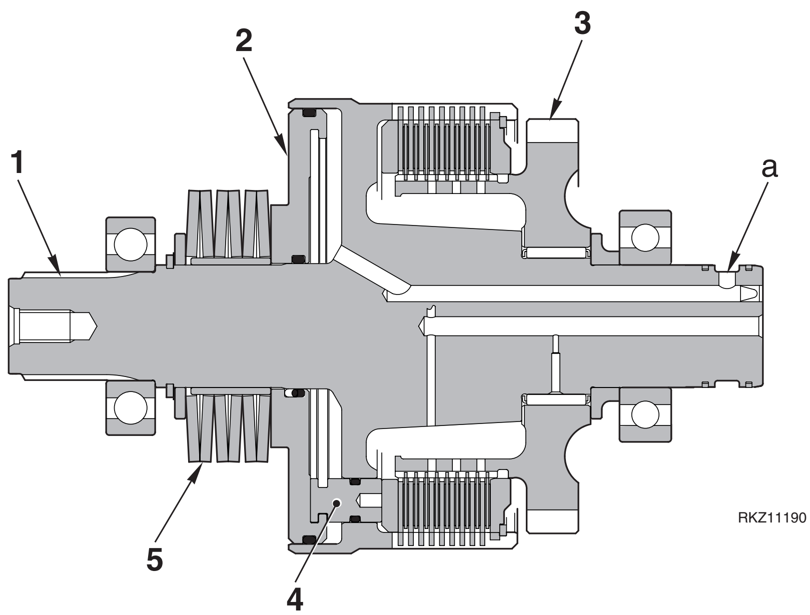
1. 3rd drive gear (Z=45)
2. 2nd drive gear (Z=28)
3. 4th drive gear (Z=58)
4. 1st drive gear (Z=17)
5. 2nd gear piston

Driven gear shaft



a. 4th gear port
a. 3rd gear port
a. 1st gear port
1. 3rd gear driven gear (Z=44)
2. 2nd gear driven gear (Z=60)
3. 4th gear driven gear (Z=30)
4. 4WD drive gear (Z=51)
5. 1st gear driven gear (Z=60)
6. Rear output shaft
7. 1st gear piston
8. 4th gear piston
9. 3rd gear piston

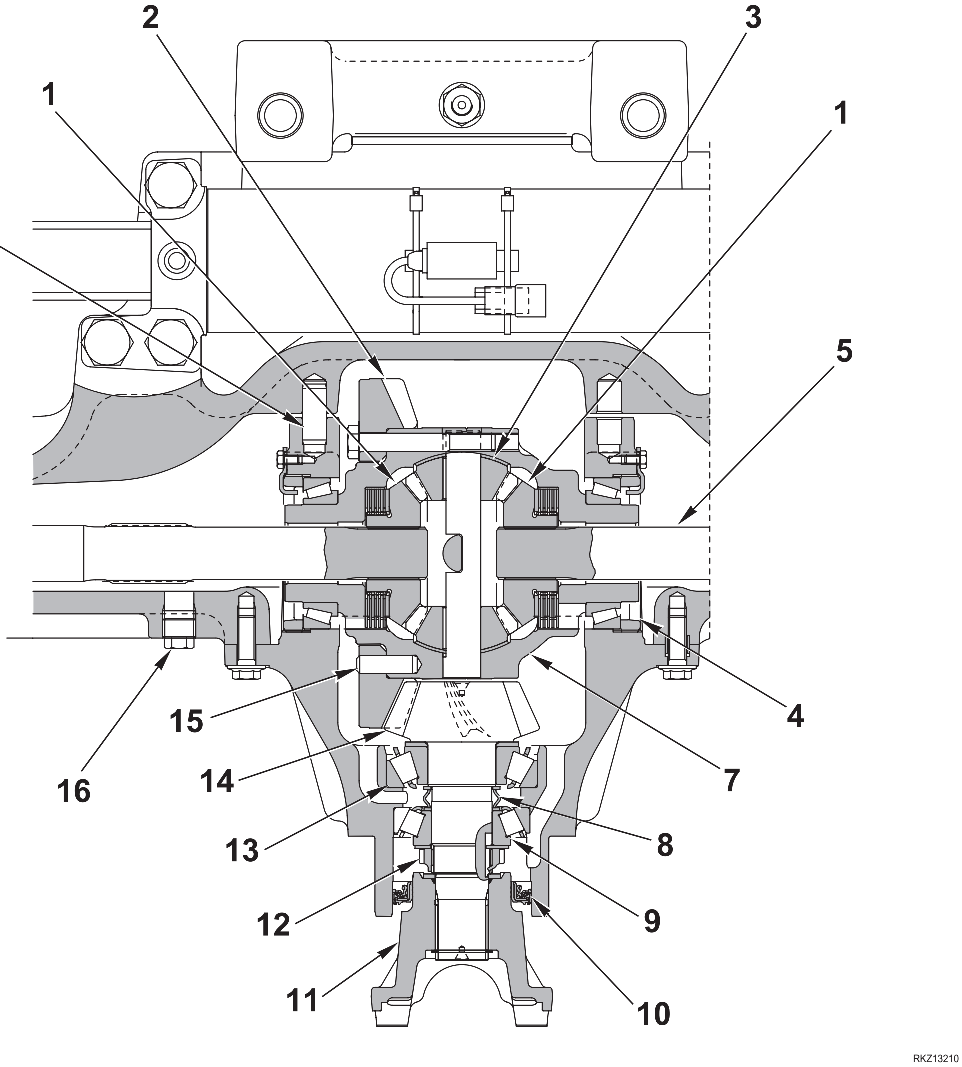
4WD driven shaft



a. 4WD disengagement command port
1. Front output shaft
2. 4WD disengagement piston
3. 4WD gear driven (Z=41)
4. Piston (n°3).
5. Spring

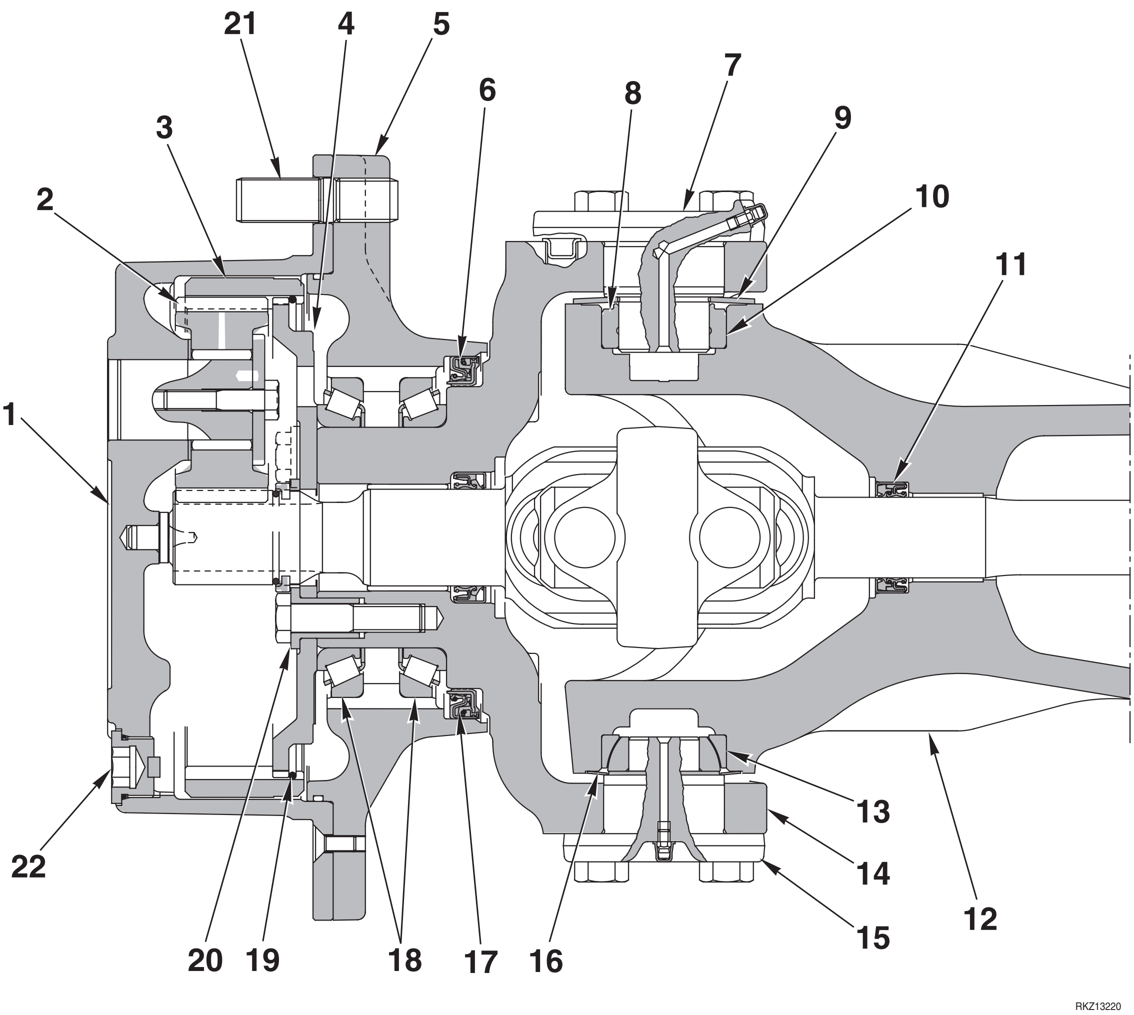
FRONT AXLE

Differential



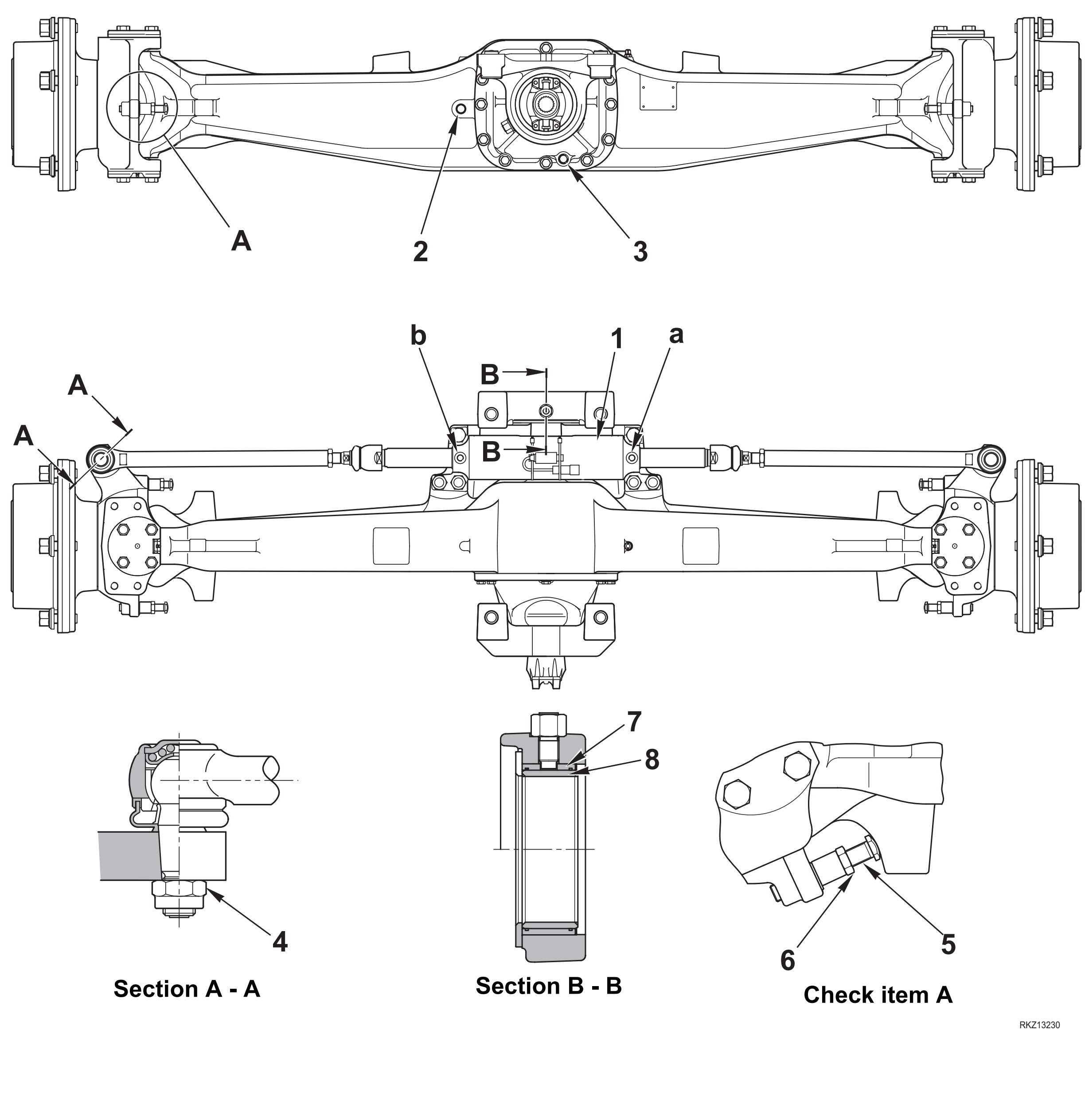
1. Planetary gear
2. Ring gear
3. Planetary gear
4. Ring nut
5. Half-axle
6. Pin
7. Differential housing
8. Spacer
9. Bearing
10. Sealing ring
11. Flange
12. Ring nut
13. Bearing
14. Bevel pinion
15. Pin
16. Oil refilling plug

Final reduction gear - Joint



1. Planetary gear
2. Planetary gear
3. Ring gear
4. Crown wheel holder
5. Wheel hub
6. Sealing ring
7. Pin
8. Shim
9. Protection
10. Bushing
11. Sealing ring
12. Axle body
13. Bearing
14. Joint
15. Pin
16. Protection
17. Sealing ring
18. Bearing
19. Snap ring
20. Centering pin
21. Stud bolt
22. Plug

Steering unit cylinder

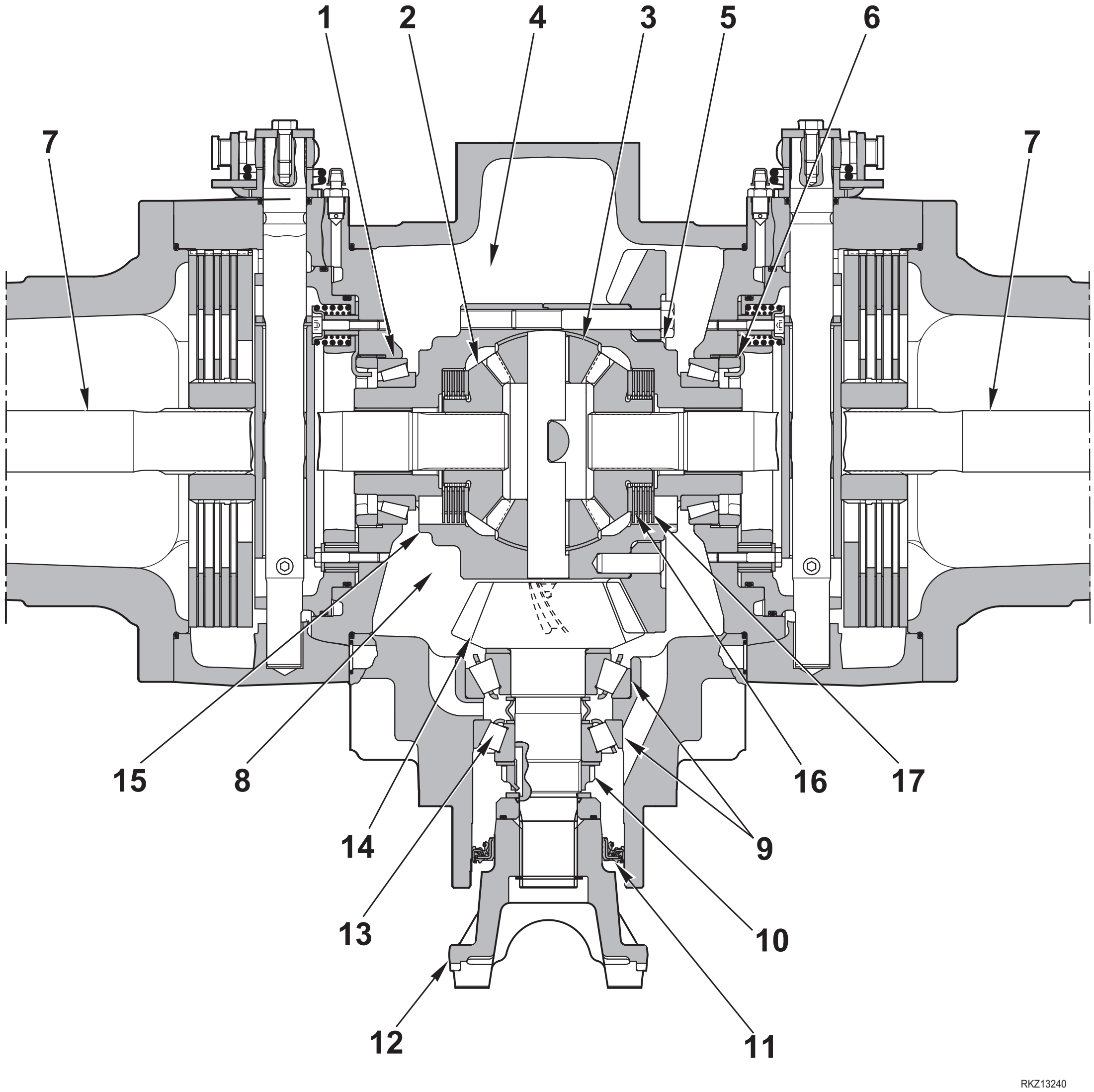


1. Steering cylinder
2. Oil refilling plug
3. Oil drain plug
4. Nut
5. Adjusting screw
6. Nut
7. Bushing
8. Bushing

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

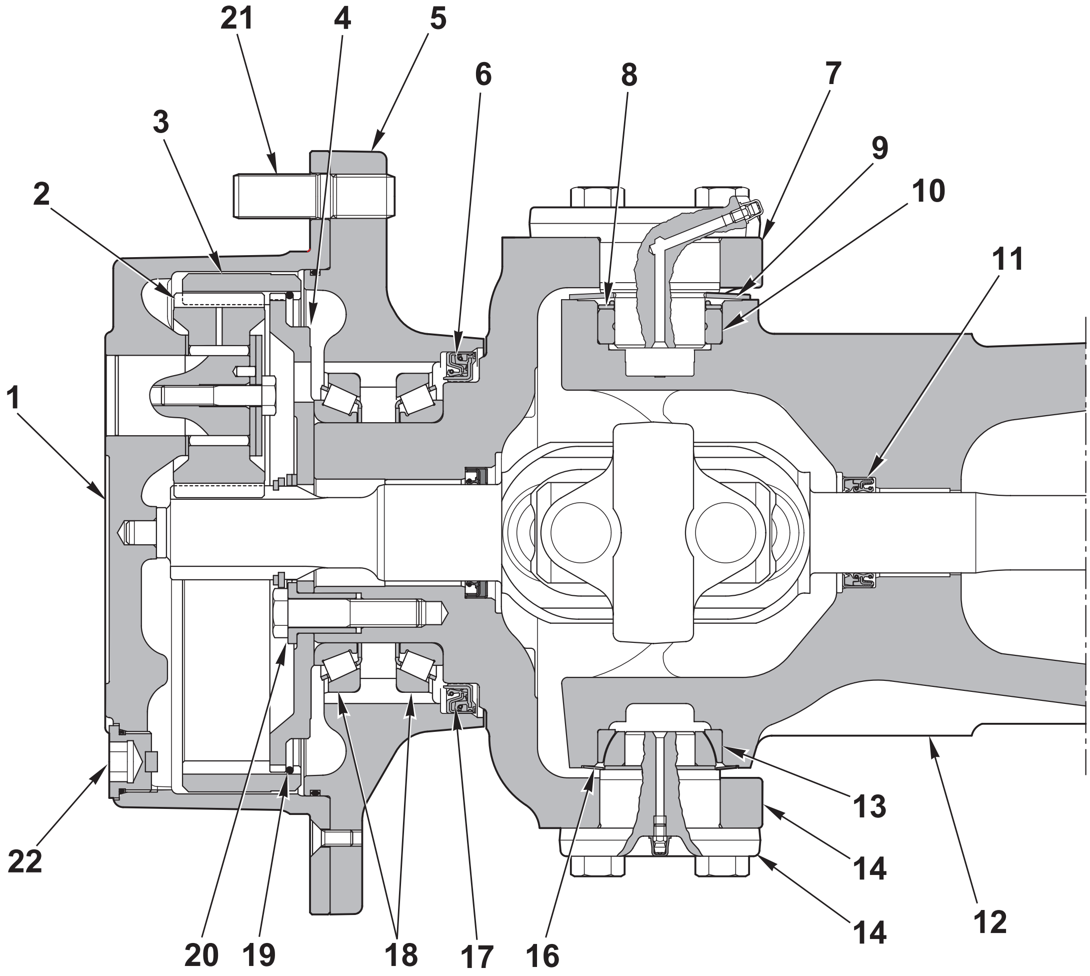
REAR AXLE

Differential



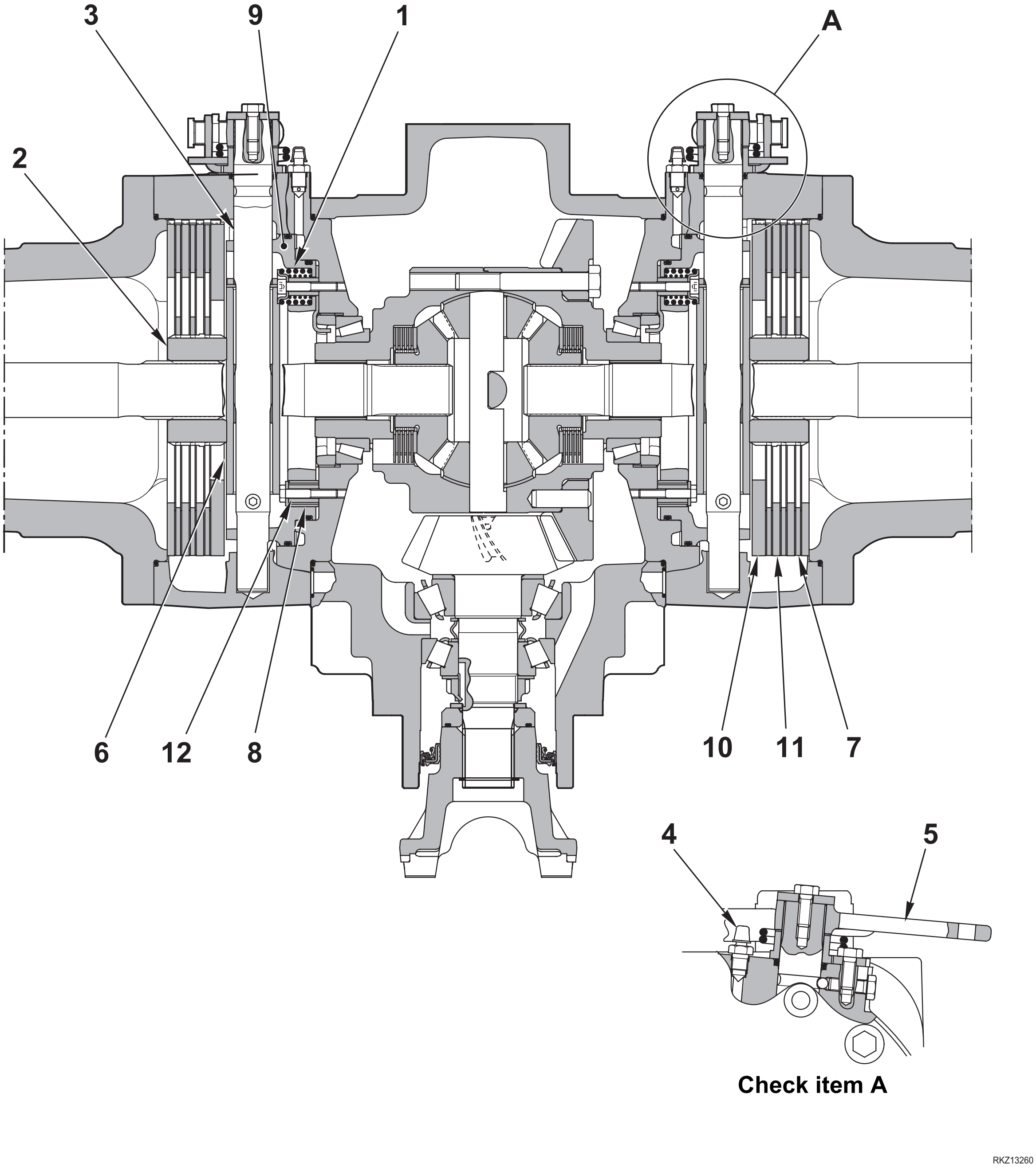
1. Bearing
2. Planetary gear
3. Planetary gear
4. Ring gear
5. Differential housing
6. Ring nut
7. Half-axle
8. Pin
9. Bearing
10. Spacer
11. Sealing ring
12. Flange
13. Spacer
14. Bevel pinion
15. Differential housing
16. Disk
17. Steel disk

Final reduction gear



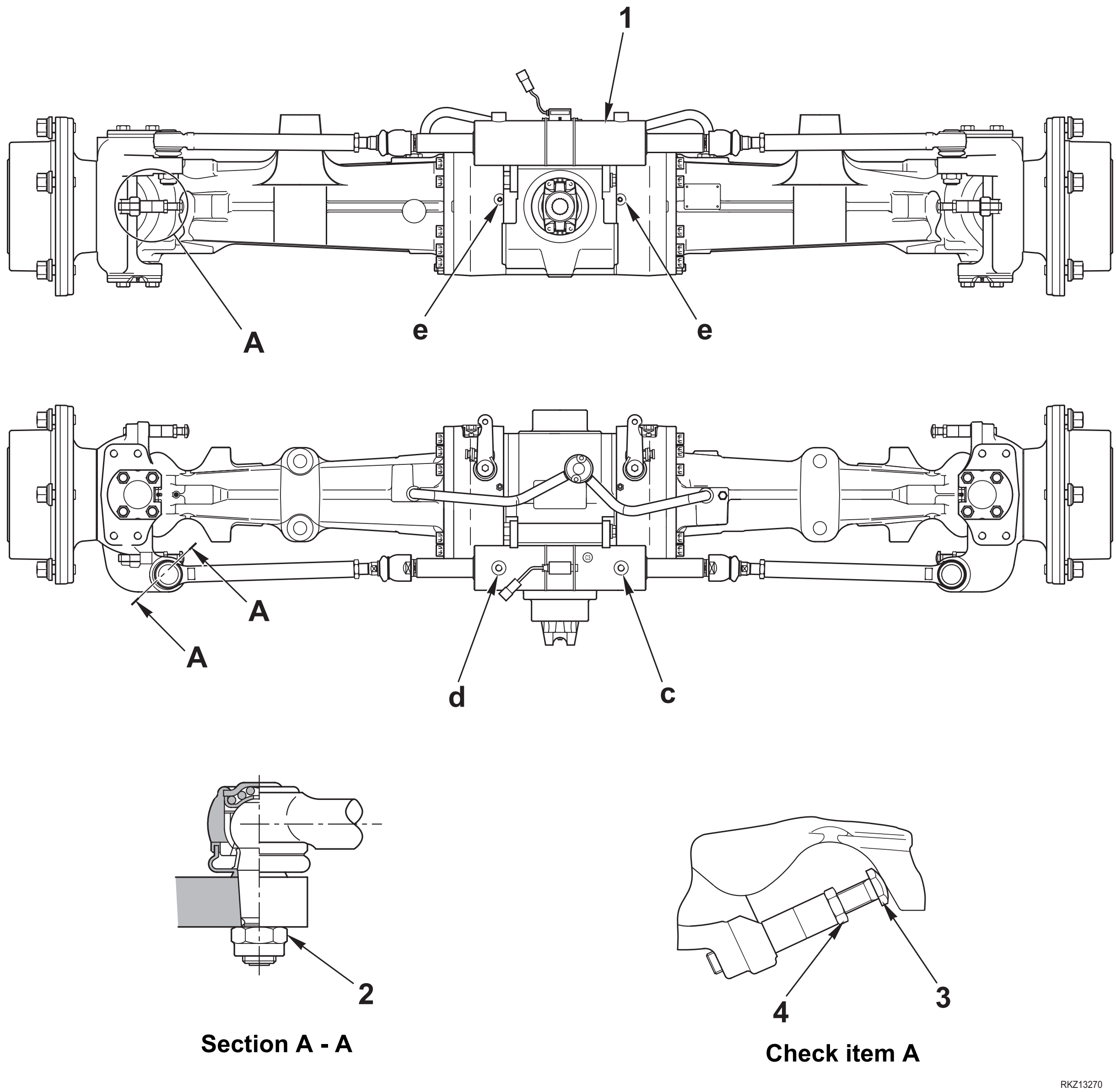
1. Planetary gear
2. Planetary gear
3. Ring gear
4. Crown wheel holder
5. Wheel hub
6. Gasket
7. Pin
8. Shim
9. Protection
10. Bushing
11. Gasket
12. Axle body
13. Bearing
14. Joint
15. Pin
16. Protection
17. Gasket
18. Bearing
19. Snap ring
20. Centering pin
21. Stud bolt
22. Plug

Brakes



1. Spring
2. Bushing
3. Parking brake control shaft
4. Bleed screw
5. Parking brake control lever
6. Parking brake control cam
7. Brake disk
8. Bushing
9. Working brake control piston
10. Pressure disk
11. Intermediate disk
12. Spacer

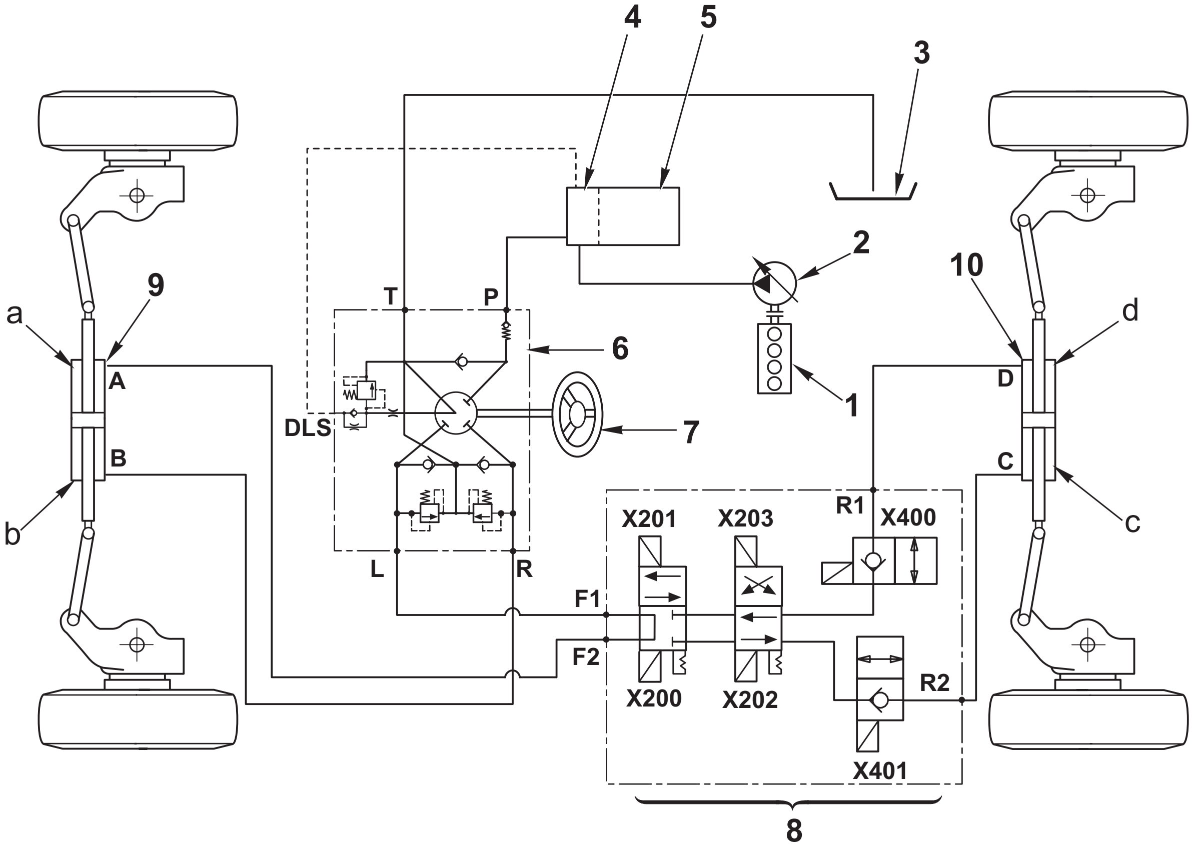
Steering unit cylinder



1. Steering cylinder
2. Nut
3. Adjusting screw
4. Nut

Port c	-	From solenoid valve group ST2 (Port A)
Port d	-	From solenoid valve group ST2 (Port B)
Port e	-	From brake pump

STEERING SYSTEM (4WS)



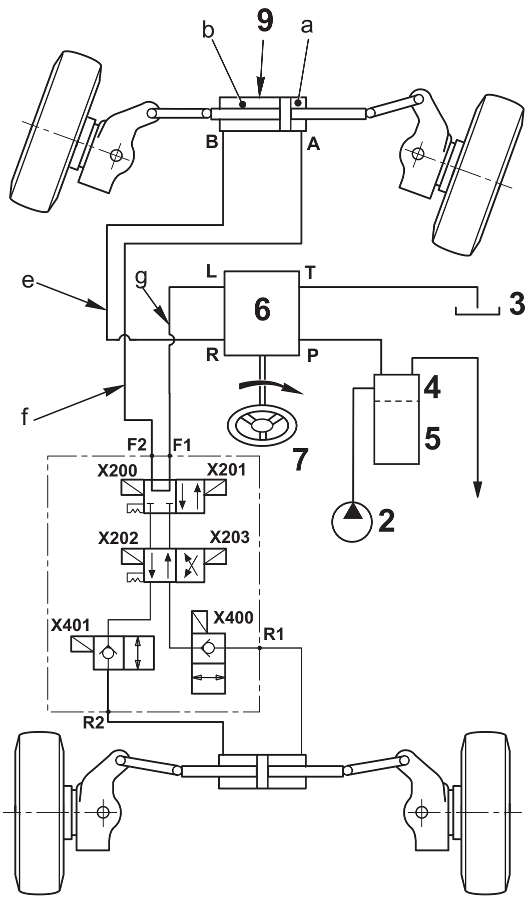
1. Diesel engine
2. Pump
3. Tank
4. Priority valve
5. Shovel control valve
6. Steering unit
7. Steering wheel
8. Solenoid valve group ST2
   – Y1: Rear steering cut out
   – Y2: Front/rear steering
   – Y3: Phase coincidence steering
   – Y4: Crab steering
9. Steering cylinder front axle
10. Steering cylinder rear axle
11. Front axle cylinder piston
12. Rear axle cylinder piston

DESCRIPTION

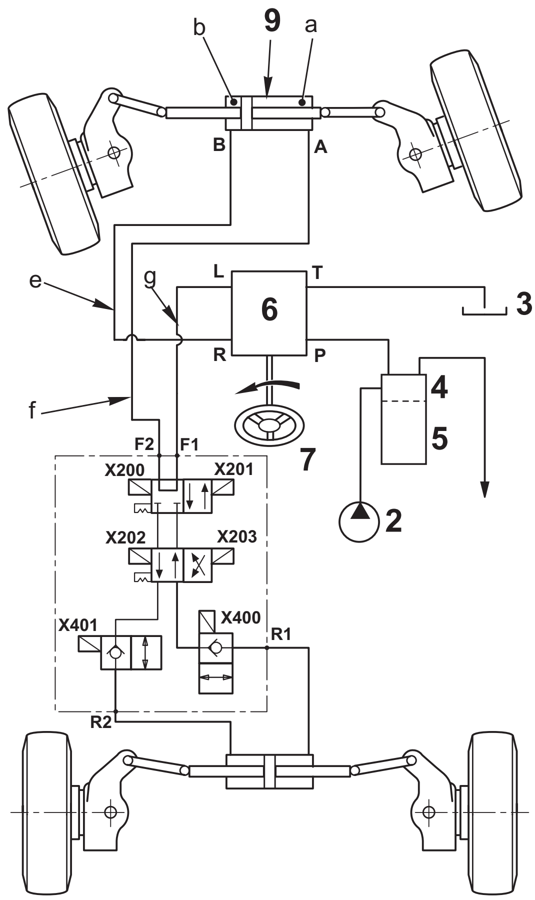
- The steering system is completely hydraulic. The oil required, supplied by the pump (2) driven by the motor (1), is sent to the priority valve (4) which functions by Load Sensing, and sends the necessary quantity of oil to the steering system (6), even when other oleodynamic components supplied by the same circuit are in operation. The oil passes from this group (6) into the steering cylinders (9) and (10). The solenoid valve group (8) can switch the oil flow to provide three types of steering:
  1 - 2-wheels steering
  Steering condition in which the rear axle is excluded.
  2 - 2-wheels steering and 2 wheels countersteering
  Steering condition in which rear steering is activated and the direction of the rear wheels is contrary to that of the front wheels.
  3 - 4-wheels steering in the same direction
  Steering condition in which rear axle steering is activated and the direction of the rear wheels agrees with that of the front wheels.
- The hydraulic power supplied by the pump (2) is transferred to cylinders (9) and (10) and transformed into mechanical steering power.

OPERATION

1 - Steering with front wheels, only.



RKZ13290



RKZ13300

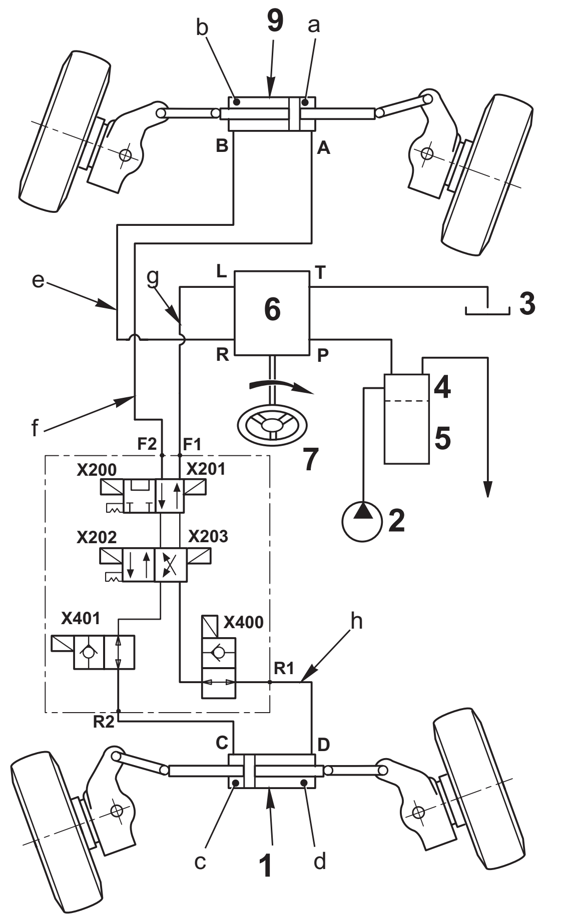
STEERING TO THE RIGHT

Turning the steering wheel (7) clockwise causes rotation of the steering metering group (6) and prepares the control valve (port **R**) to send oil through line **e** directly into chamber **b** of the cylinder (9); the pressurized oil moves the piston which then steers the wheels.
The oil in chamber **a** of cylinder (9) is impelled into line **f** to solenoid valve group and thence into line **g** which is coupled to the control valve of the steering group (6) (port **L**); from the control valve the oil passes out of Port **T** and drains into the tank (3).

STEERING TO THE LEFT

Turning the steering wheel (7) anti-clockwise causes rotation of the steering metering group (6) and prepares the control valve (port **L**) to send oil through line **g** to solenoid valve group and thence through line **f**, into chamber **a** of the cylinder (9); the pressurized oil moves the piston which then steers the wheels.
The oil in chamber **b** of cylinder (9) is impelled into line **e** which is coupled to the control valve of the steering group (5) (port **R**); from the control valve the oil passes out of Port **T** and drains into the tank (3).

2 - Steering with 2 wheels steering and 2 wheels countersteering.



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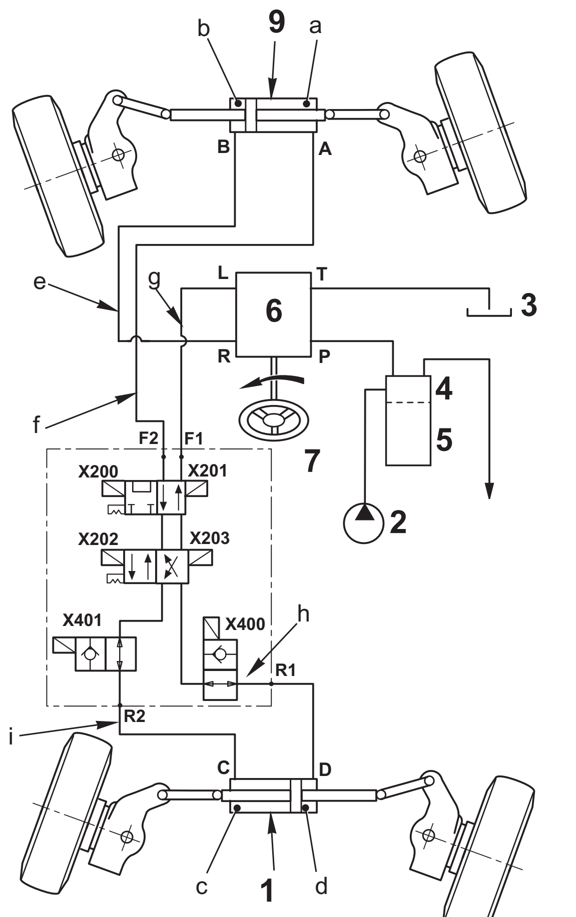

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STEERING TO THE RIGHT

Turning the steering wheel (7) clockwise causes rotation of the steering metering group (6) and prepares the control valve (port **R**) to send oil through line **e** directly to chamber **b** of cylinder (9).

The pressurized oil moves the piston of cylinder (9) which in turn steers the wheels while simultaneously impelling the oil in chamber **a** (at the same pressure as chamber **b**, through lines **f** - **h** into chamber **d** of cylinder (10).

The oil in chamber **c** of cylinder (9) is impelled through lines **i** and **g** to the control valve of the steering group (port **L**) from which it passes (port **T**) to drain into the tank (3).

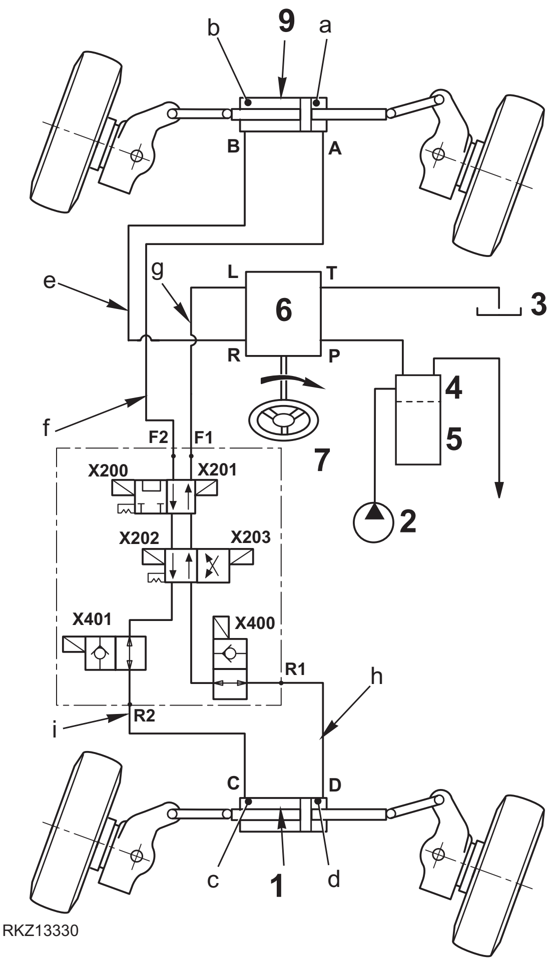
STEERING TO THE LEFT

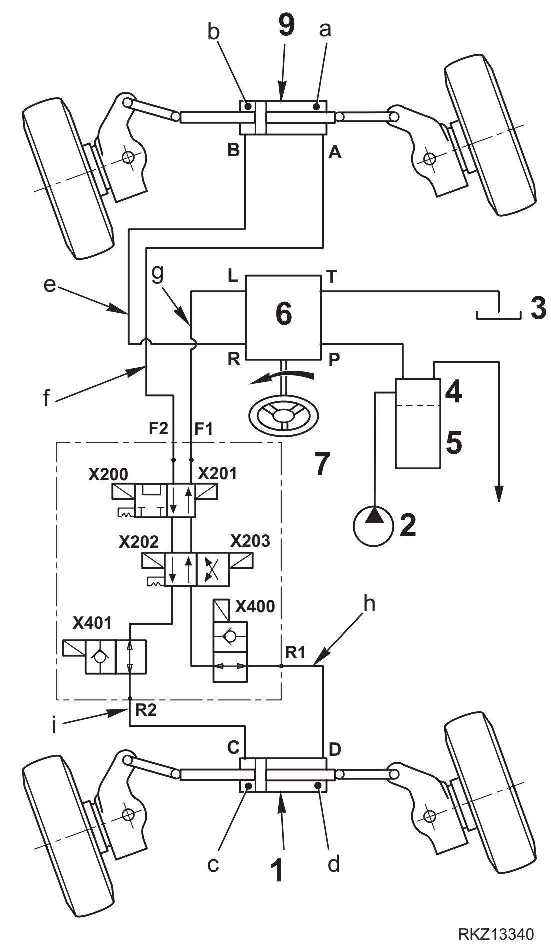
Turning the steering wheel (7) anti-clockwise causes rotation of the steering metering group (6) and prepares the control valve (port **L**) to send oil (through line **g**) to solenoid valve group and thence through line **i** into chamber **c** of cylinder (10).

The pressurized oil moves the piston of the cylinder (10) that steers the wheels and at the same time impels the oil in chamber **d** (at the same pressure as chamber **c**), through lines **h** and **f** into chamber **a** of cylinder (9).

The oil in chamber **b** of cylinder (9) is impelled through line **e** to the control valve of the steering group (port **R**), from which it passes (port **T**) to drain into the tank (3).

3 - Steering with 4 wheels steering in the same direction.





STEERING TO THE RIGHT

Turning the steering wheel (7) clockwise causes rotation of the steering metering group (6) and prepares the control valve (port **R**) to send oil through line **e** into chamber **b** of cylinder (9).

The pressurized oil moves the piston of cylinder (9) which in turn steers the wheels while simultaneously impelling the oil in chamber **a** (at the same pressure as chamber **b**) through lines **f** and **i** into chamber **c** of cylinder (10).

The oil in chamber **d** of cylinder (10) is impelled through lines **h** and **g** to the control valve of the steering group (5) (port **L**) from which it passes (port **T**) to drain into the tank (3).

STEERING TO THE LEFT

Turning the steering wheel (7) anti-clockwise causes rotation of the steering metering group (6) and prepares the control valve (port **L**) to send oil (through line **g**) to solenoid valve group and then through line **h** into chamber **d** of cylinder (10).

The pressurized oil moves the piston of the cylinder (10) that steers the wheels while simultaneously impelling the oil in chamber **c** (at the same pressure as chamber **d**) through lines **i** and **f** into chamber **a** of the cylinder (9).

The oil in chamber **b** of cylinder (9) is sent through line **e** to the control valve of the steering group (port **R**) from which the oil passes (port **T**) to drain into the tank (3).

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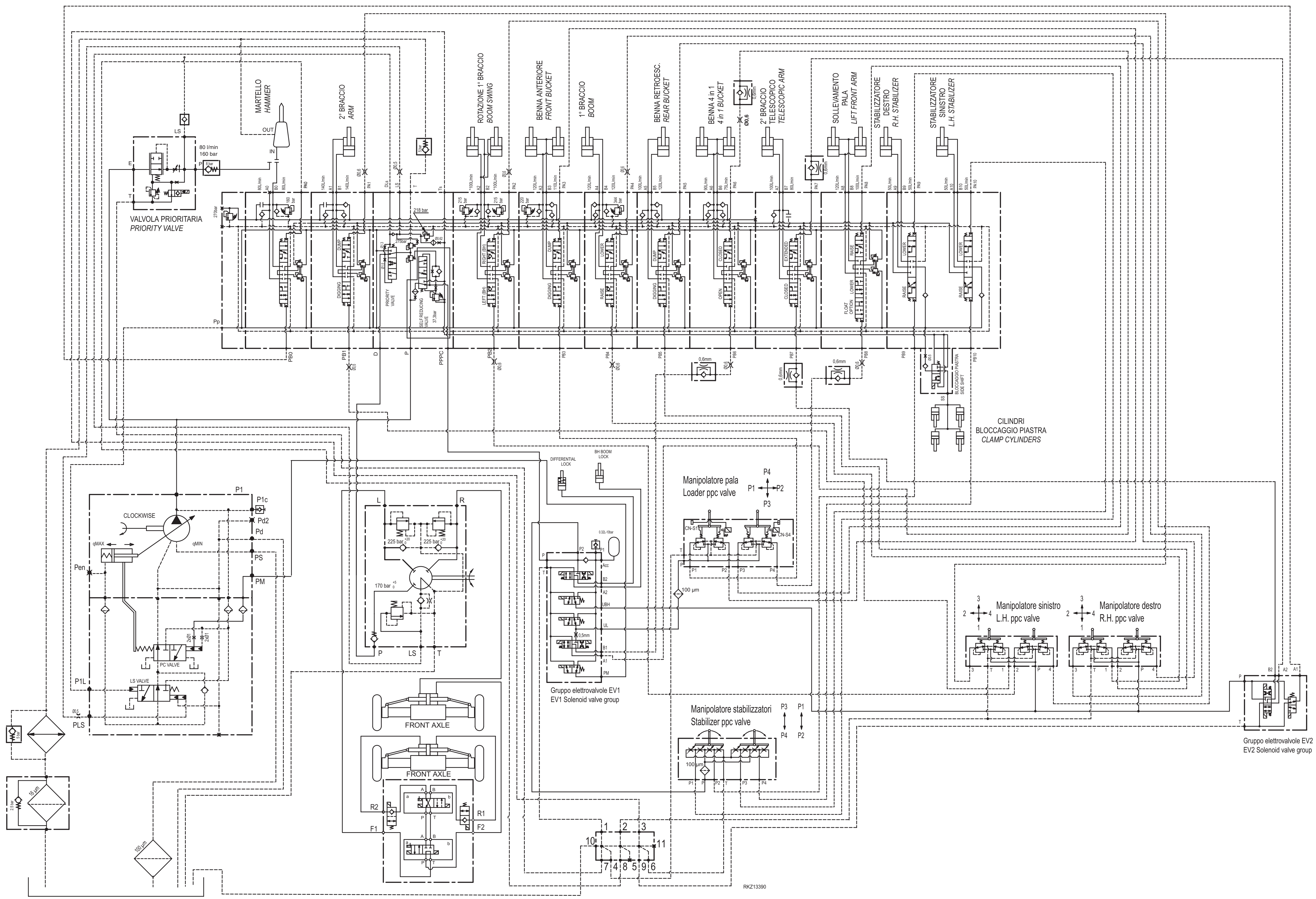
HYDRAULIC CIRCUIT



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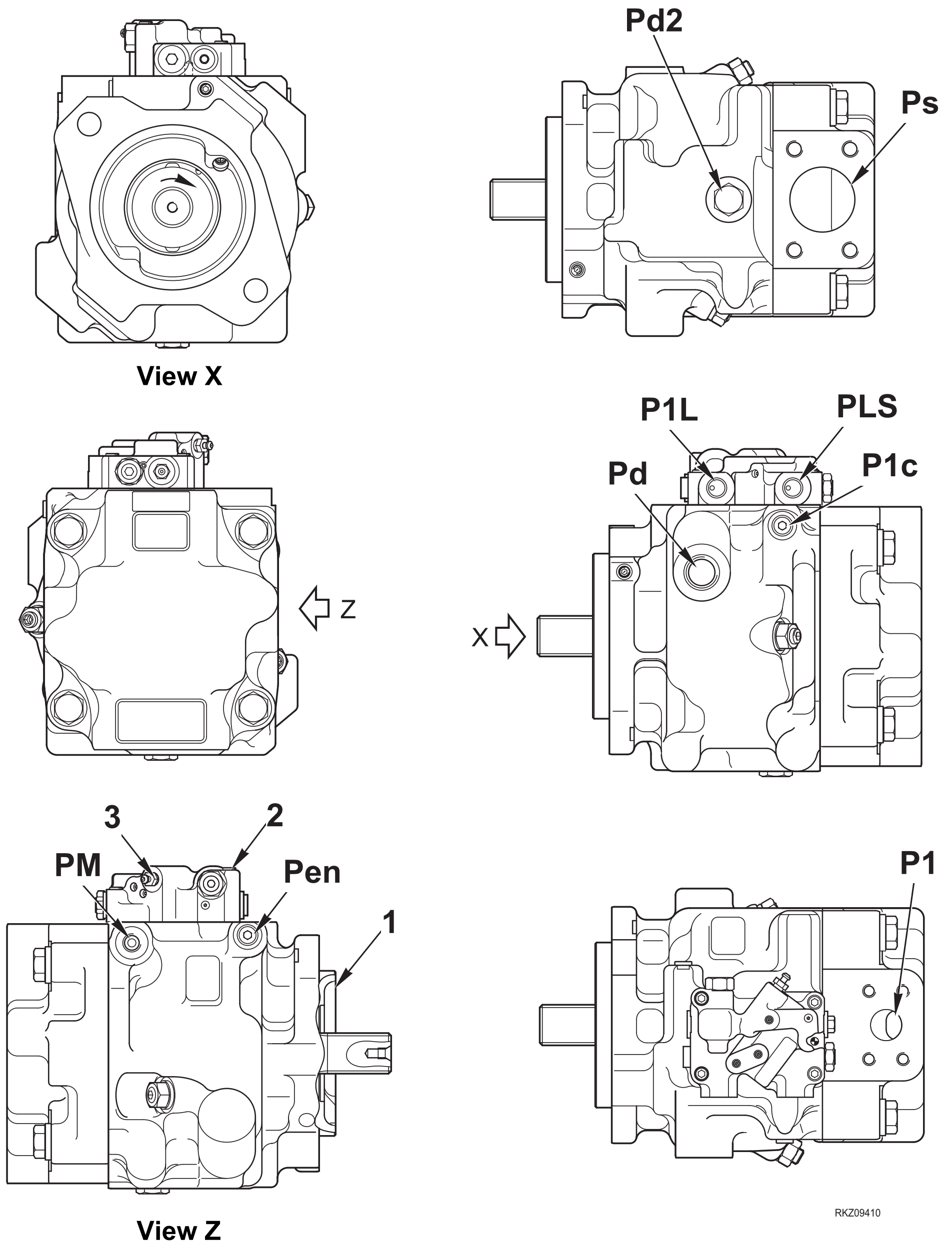
HYDRAULIC PUMP



COMPONENTS

1. Hydraulic pump
2. Delivery control valve
3. Oil refilling plug

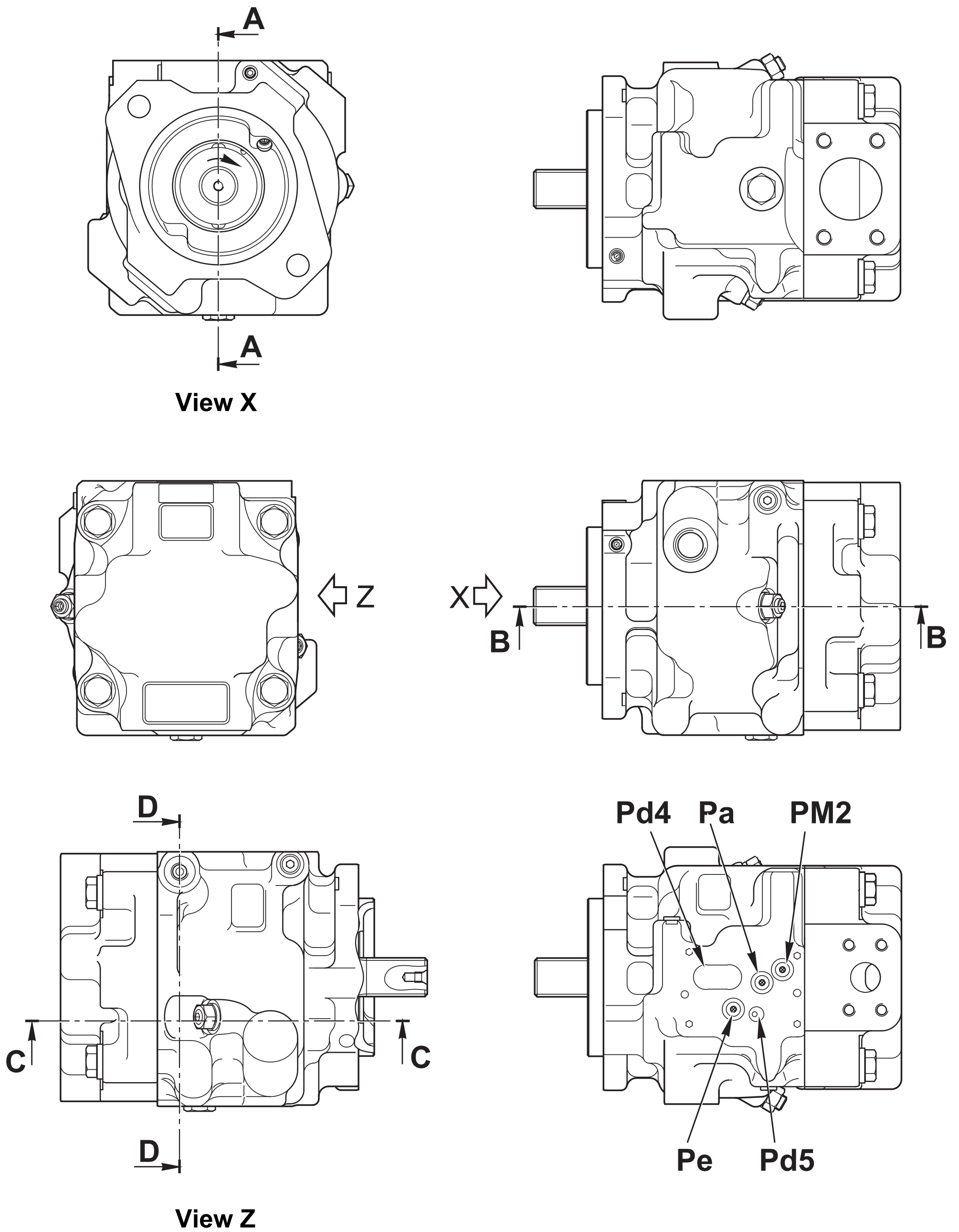
CONNECTIONS

P1 port -To control valve (P port)
Port Pd - To hydraulic tank
Port Ps - From hydraulic tank
Port P1L - From control valve (Port Pp)
Port PLS - From control valve (Port LS)
Port PM - From EV1 solenoid valve group (Port PM)

PORT FUNCTIONS

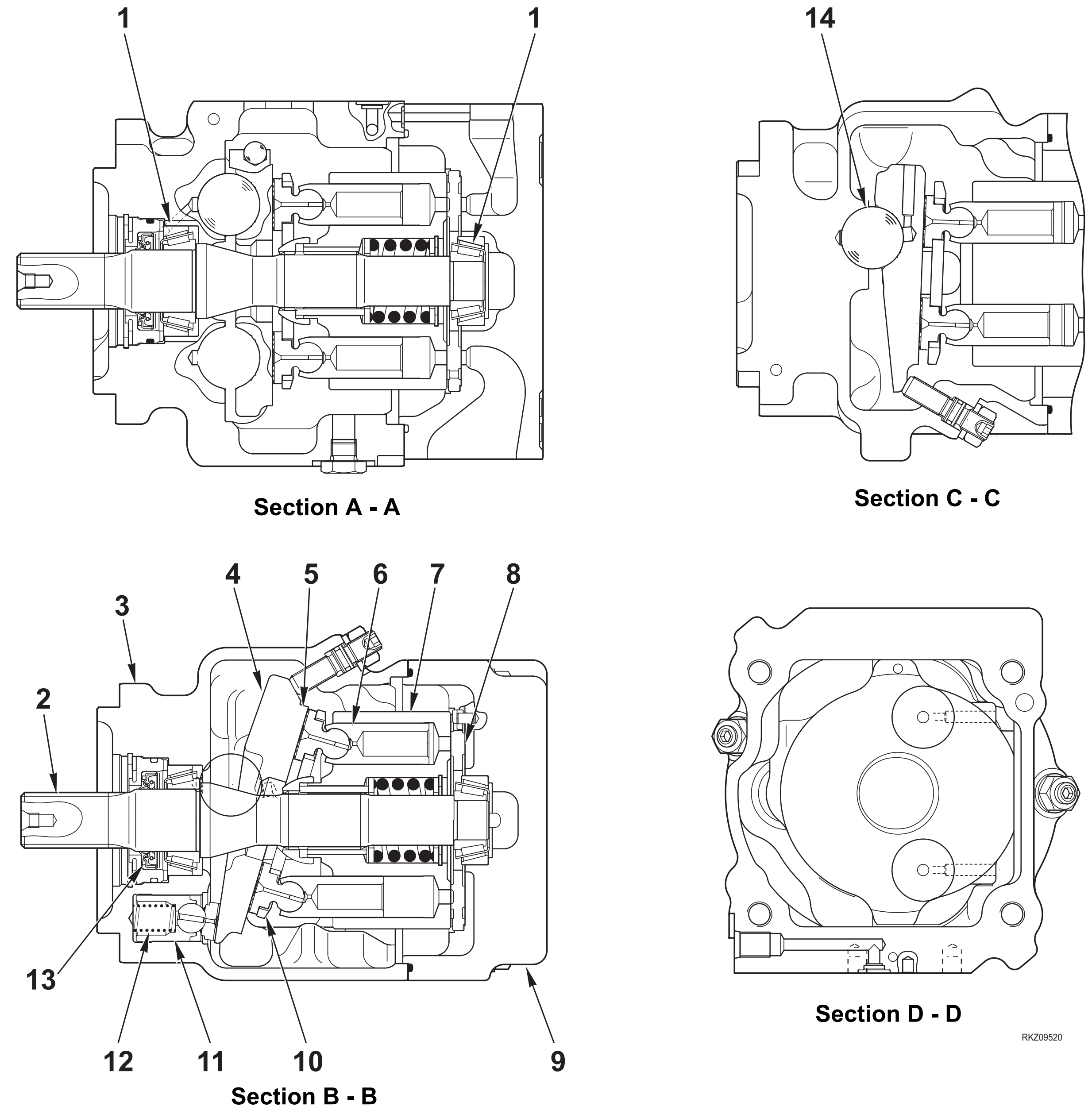
Port P1 - Pump delivery
Port Pd - Drain
Port Ps - Intake of oil
Port P1L - Pump delivery pressure input
Port P1C - Quick connect for pump delivery pressure
Port Pd2 - Drain plug
Pen port - Delivery control pressure check
Port PLS - Load Sensing signal input
Port PM - Operating mode control signal input

1. MAIN PUMP



PORT FUNCTIONS

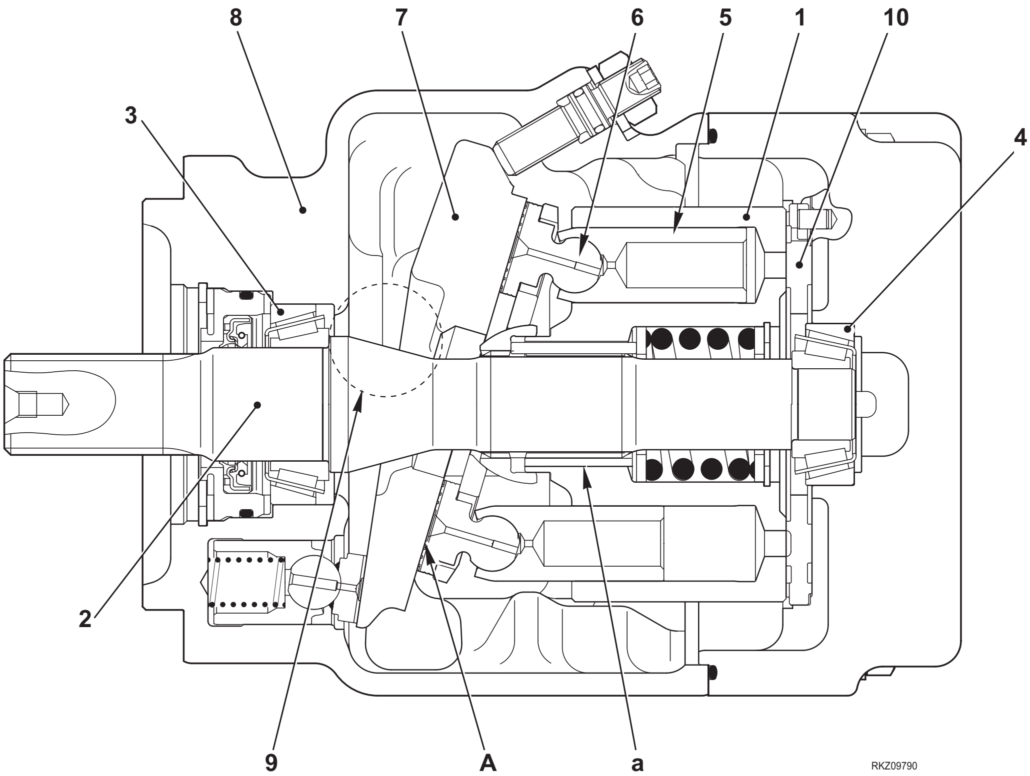
Port Pa - Delivery control group feed
Port Pe - Delivery control signal
Port Pd4 - Drain
Port Pd5 - Drain
Port PM2 - Operating mode signal



1. Bearing
2. Input shaft
3. Hydraulic pump
4. Swash plate
5. Shoe
6. Piston
7. Cylinder block
8. Swash plate
9. Cover
10. Shoe guide
11. Control piston
12. Spring
13. Sealing ring
14. Ball

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.



STRUCTURE

- Groove **a** supports and makes cylinder block (1) an integral part of shaft (2), and shaft (2) is supported by front and rear bearings (3), (4).
- The end of piston (5) is a concave ball, and shoe (6) is caulked to it to form one unit. Piston (5) and shoe (6) form a spherical bearing.
- Swash plate (7) is supported by pump body (8) and ball (9), and has a flat surface **A**.
  Shoe (6) remains in contact with swash plate (7) and slides in a circular movement.
  Pressurised oil is introduced between shoe (6) and swash plate (7) forming a static bearing that allows shoes (6) to slip.
- The pistons (5) perform their relative movements in an axial direction, inside cylindrical chambers fashioned in the cylinder block (1).
- The rotation of the cylinder block (1) pressurises the oil inside the chambers of the block; pressure is adjusted by the valve plate (10). The surface of the swash plate (10) 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 (10).

OPERATION

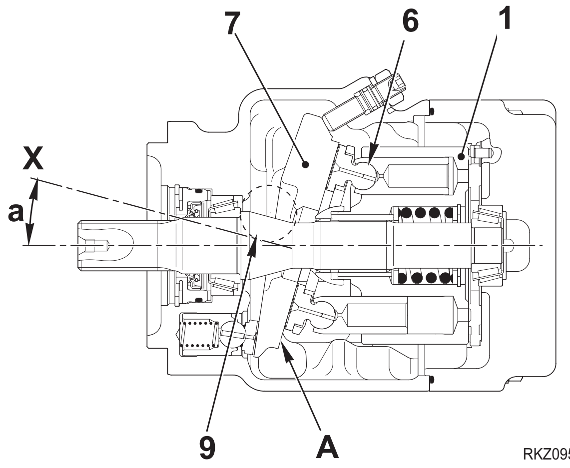
1. Pump operation

1 - The cylinder block (1) rotates with the shaft (2), and the shoe (6) slides on the flat surface **A**.
When this happens, the swash plate (7) rotates on the ball (9), and the angle **a** between the axis of the cylinder block (1) and the axis **X** of the swash plate (3) changes. The angle **a** is known as the swash plate angle.

2 - When the axis **X** of the swash plate (7) retains the angle **a** in relation to the axis of the cylinder block (1), flat surface **A** acts as a cam for the shoe (6). This is why the piston (5) slides inside the cylinder block (1), creating a difference between volumes **E** and **F** and therefore causing the suction and delivery of oil in a quantity that is equivalent to the difference between those volumes (**F**–**E** = delivery).
In other words, when cylinder block (1) rotates, chamber **F** decreases in volume causing oil to be delivered to the circuits, while chamber **E** increases in volume causing oil to be suctioned. (The illustration shows the state of the pump when suction at chamber **F** and delivery at chamber **E** are complete).

3 - When the center line **X** of the swash plate (7) and the center line of the cylinder block (1) are perfectly aligned (the swash plate angle **a** = 0), the difference between the volumes **E'** and **F'** within the cylinder block (1) becomes 0 and the pump does not take in or deliver any oil.

4 - In brief, the angle of the swash plate **a** is proportional to pump delivery.



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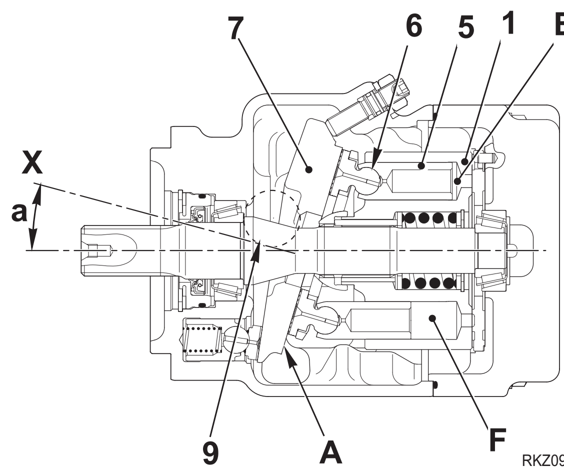

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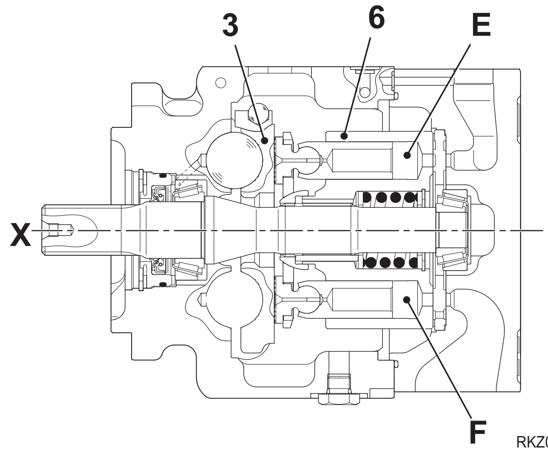

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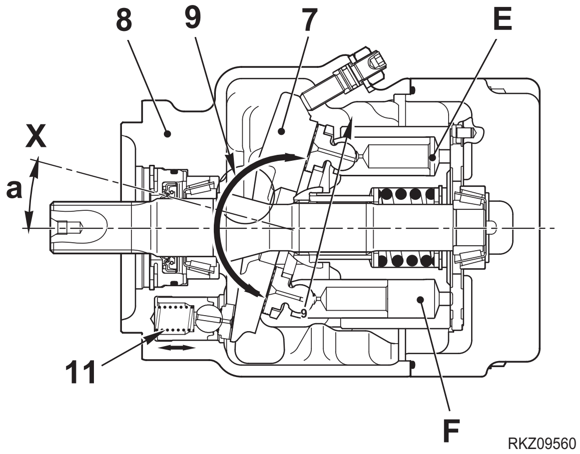
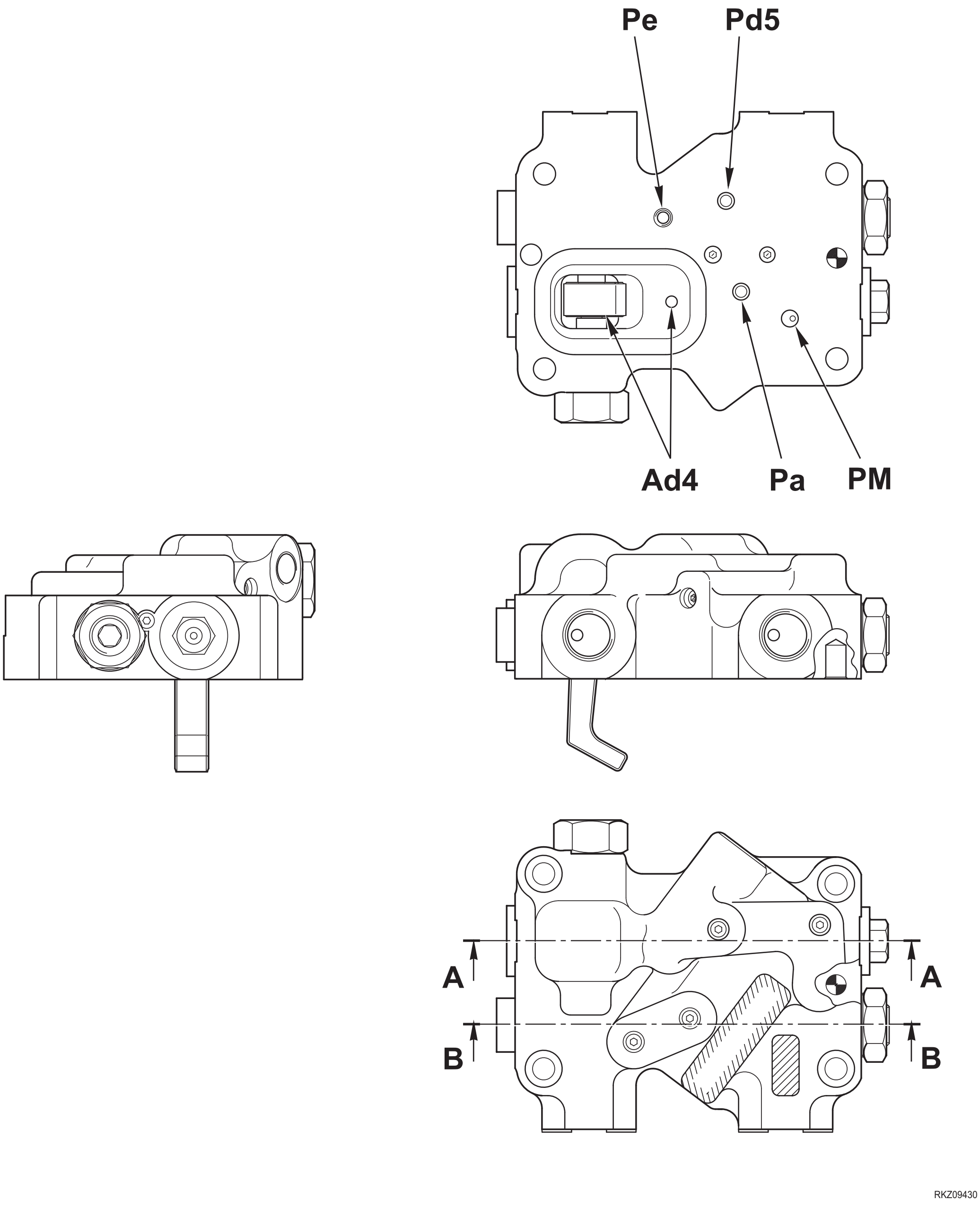
2. Control of Delivery

1 - When angle **a** of the swash plate increases, the difference between volumes **E** and **F** increases too, and this makes delivery **Q** increase accordingly. Angle a of the swash plate is varied by the servo-piston (11).

2 - The servo-piston (11) moves in a reciprocating linear motion caused by pressure signals from the PC and LS valves. The linear motion is transmitted to the swash plate (7). The swash plate is supported by the pump body (8) through the ball (9), and this is the reason why the swash plate (7) moves in a semicircular alternate motion.



2. DELIVERY CONTROL VALVE



PORT FUNCTIONS

T port - Drain

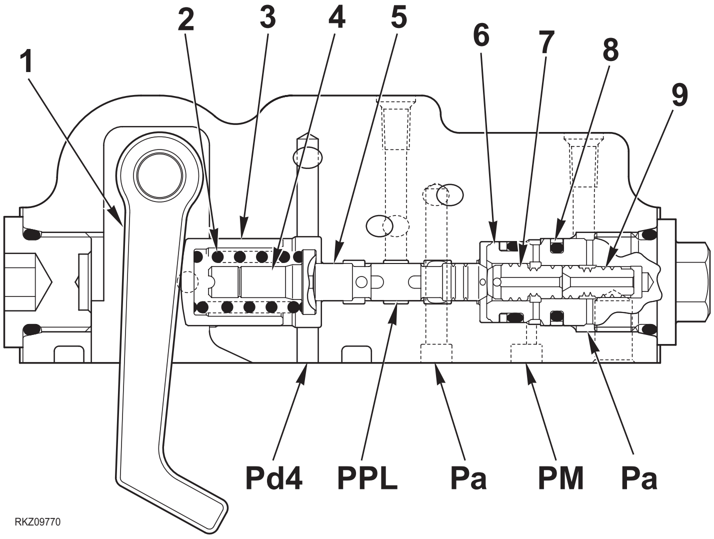
P1 port - Delivery control group feed

Pd4 port - Drain

PE port - Delivery control signal output

PM port - Operating mode signal input

2.1 PC VALVE



Section A - A

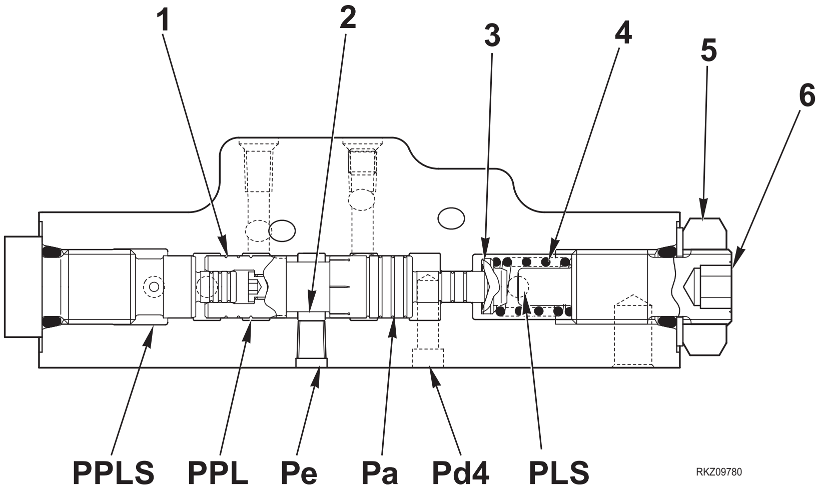
COMPONENTS

1. Lever
2. Spring
3. Retainer
4. Seat
5. Spool
6. Sleeve
7. Piston
8. Gasket
9. Piston

PORT FUNCTIONS

T port - Drain
PA Port - Pump delivery pressure
PM port - Operating mode signal input
PPL port - Delivery control signal output

2.2 LS VALVE



Section B - B

COMPONENTS

1. Spool
2. Plug
3. Seat
4. Spring
5. Nut
6. Plug

PORT FUNCTIONS

T port - Drain

PA Port - Pump delivery pressure

PE port - Delivery control signal

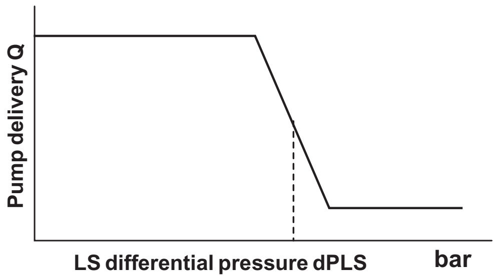
PLS port - LS signal input

PPL port - Delivery control signal input

PPLS port - LS pump signal input

LS VALVE FUNCTION

- The LS valve controls the pump delivery according to the stroke of the control valve lever, 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 DPLS existing between pressure PPLS (control valve input pressure) and pressure PLS (control valve output pressure). The sensing of this differential pressure permits control of the main pump delivery **Q**. (PPLS, PLS and DPLS 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 DPLS 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.
- Pump pressure PPLS (pump pressure at control valve input) and pressure PLS (Load Sensing pressure) are introduced into the LS valve. The relation between differential pressure DPLS and pump delivery varies as shown in the diagram on the right.



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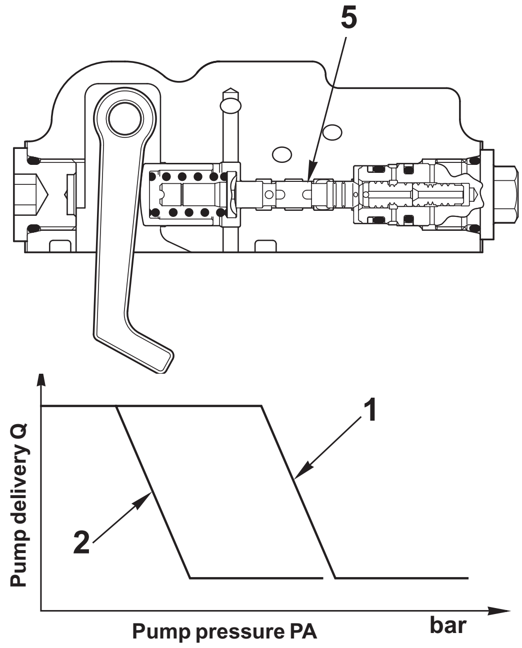
PC (Power Control) VALVE FUNCTION

- 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 PPLS, 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 PPLS also increases simultaneously, the PC valve reduces the pump delivery **Q**. When the delivery pressure PPLS decreases, the PC valve increases the pump flow.
- As pressure PC increases, the relation between pressure PA and delivery **Q** is changed in accordance with the force applied by pressure PC.
- In other words, when the force applied by pressure PC is added to the force applied by the pump's delivery pressure against the spool (5), the relation between pump delivery pressure and delivery is switched from "**1**" to "**2**" in accordance with increment "**X**".



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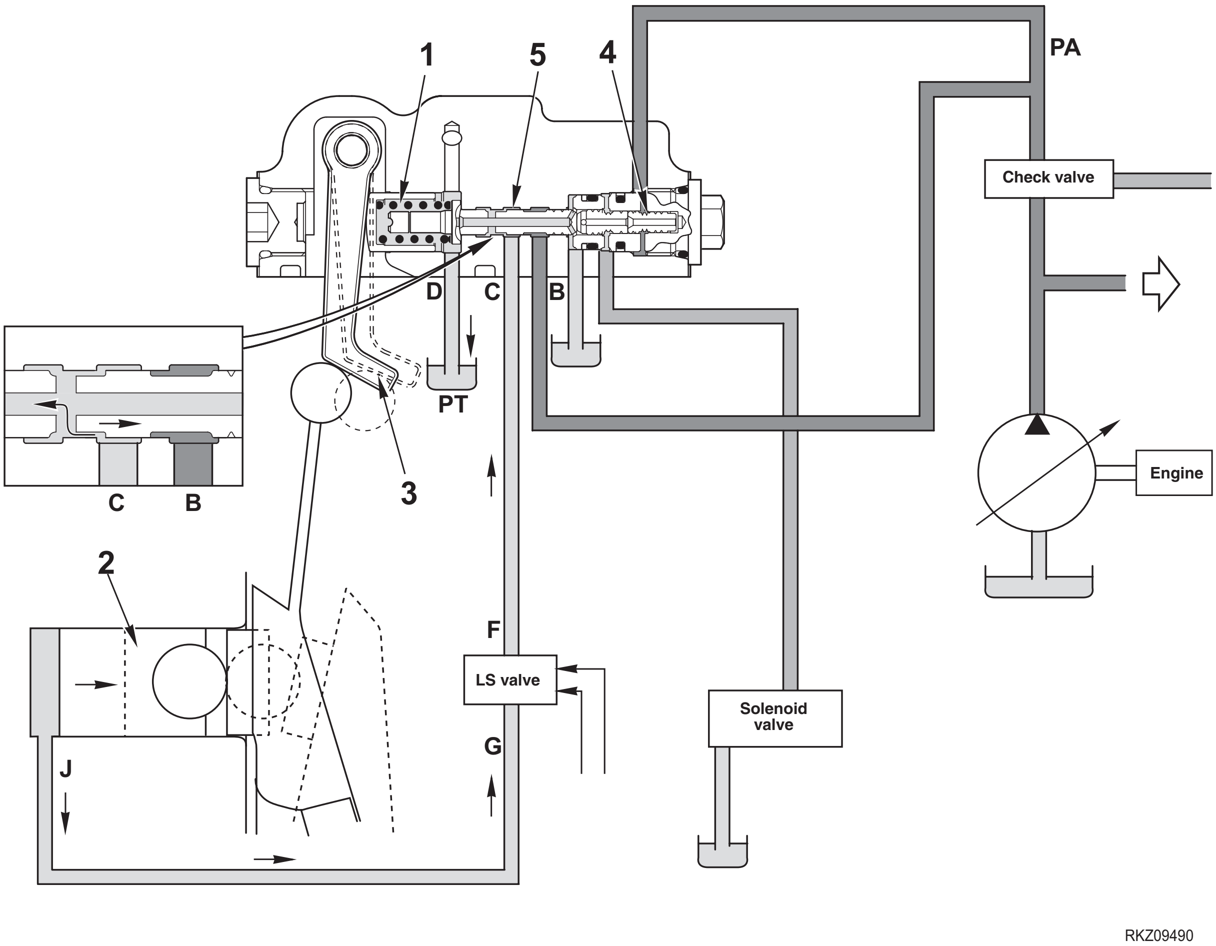
PC VALVE OPERATION

1. Spring operation

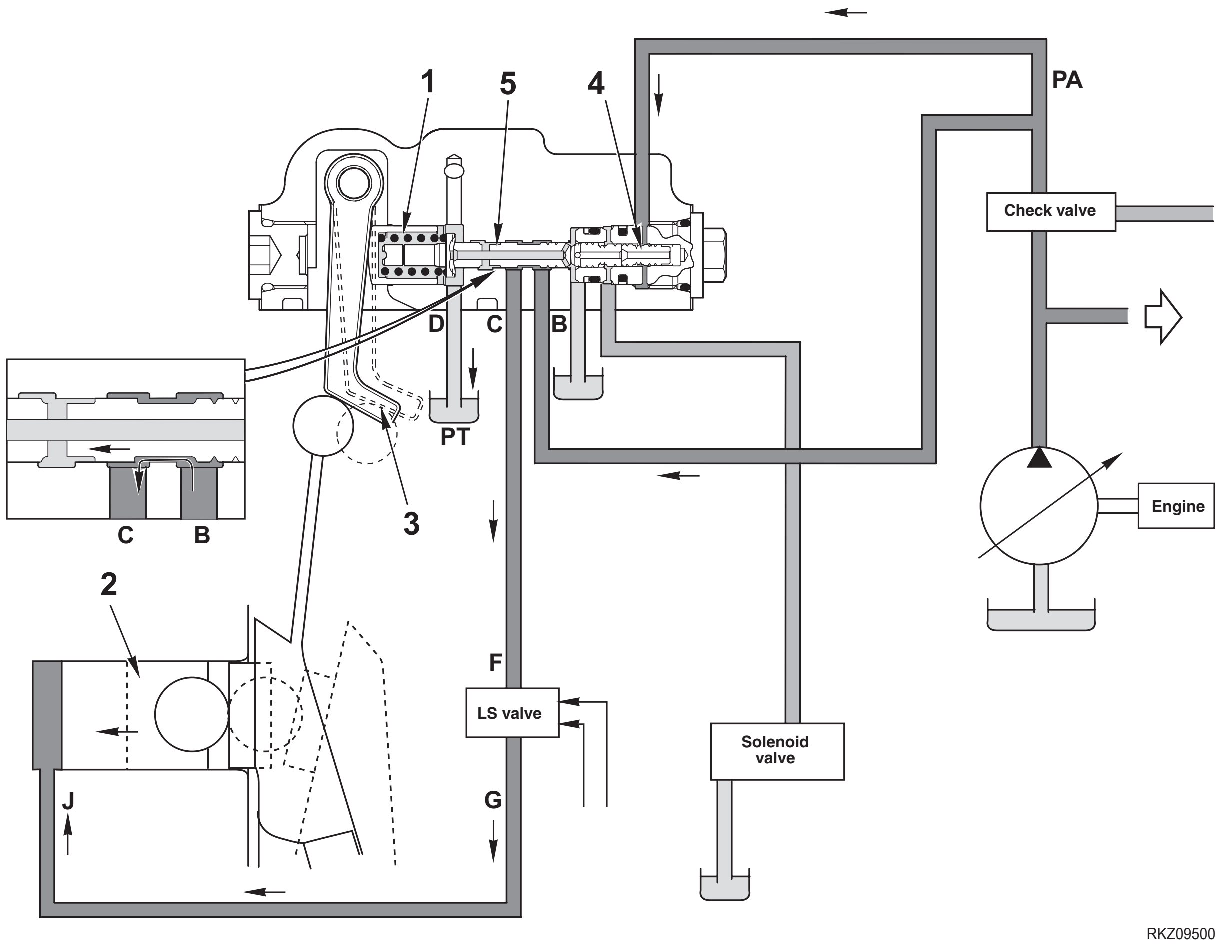
- PC valve spring loading (3) is defined by swash plate position.
- If control piston (6) moves to the right, spring (3) is compressed by lever (2) and spring loading increases.

2. When pump pressure PA is low



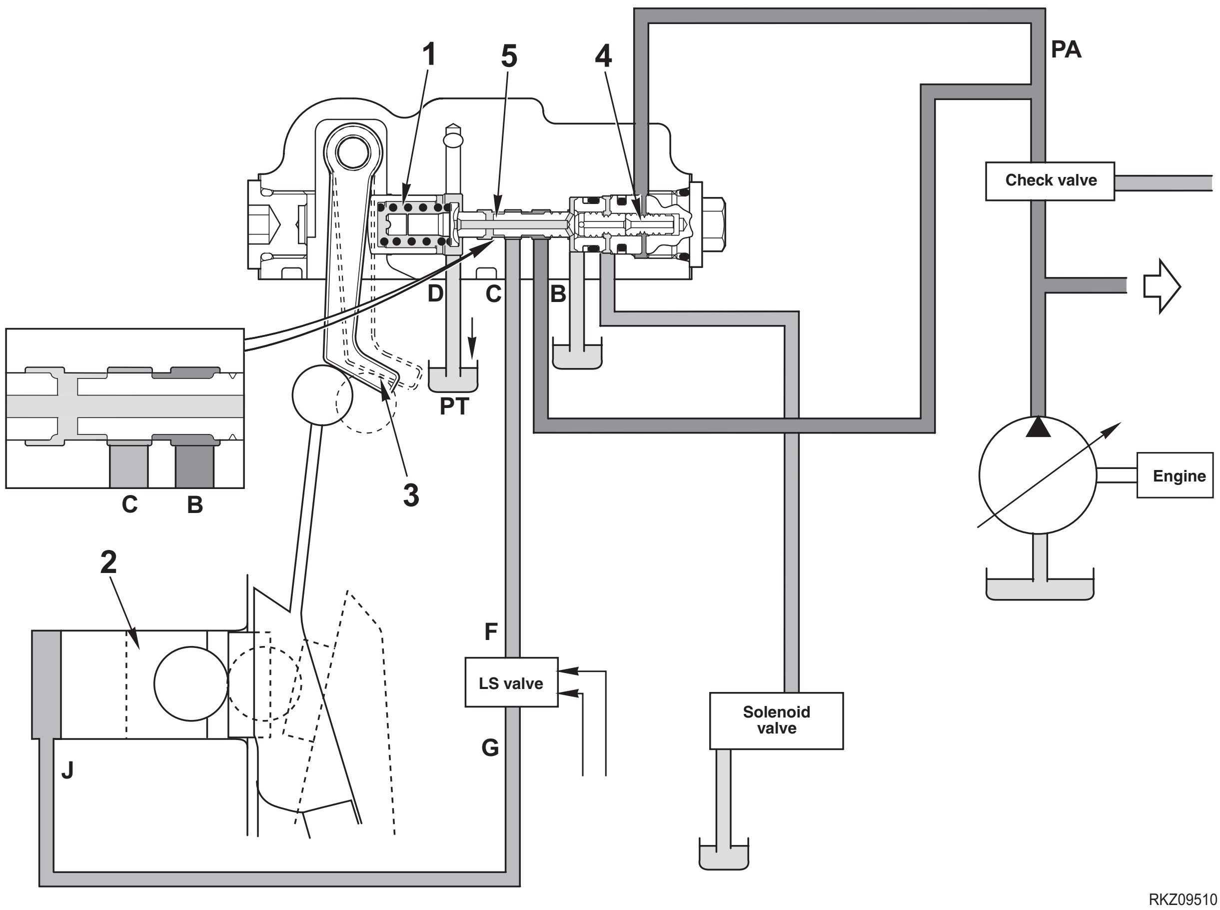
- The force applied by the pressure against the spool (4) decreases, and the spool (5) shifts slightly to the right.
  At the same time, a connection opens between passages **C** and **D**, and pressurised oil from valve LS is sent for relief (PT).
- Simultaneously, passages **F** and **G** on valve LS are interconnected: pressure at passage **J** is sent for relief (PT), and the control piston (2) shifts to the left.
- Pump delivery increases as a result.
- When the control piston (2) moves, the lever (3) moves to the left, and the spring (1) expands, thereby reducing its load on the spool (5). Consequently, the spool (5) moves to the left and stops the oil flow between **C** and **D**, and a passage opens between ports **B** and **C**.
- As a result of that, the pressure in **C** increases, and the control piston (2) stops.

3. When pump pressure PA is high



- The force applied by the pressure against the spool (4) increases, and the spool (5) shifts slightly to the left. At the same time, a connection opens **C** and **B**, and the pressure of the oil sent to valve LS becomes equivalent to the pump's delivery pressure (PA).
- Simultaneously, passages **F** and **G** in valve LS are interconnected, and pressure at port **J** becomes equivalent to the pump's delivery pressure (PA), and the control piston (2) shifts to the right.
- Pump delivery decreases as a result.
- When the control piston (2) moves, the lever (3) moves to the right, and the spring (1) compresses, thereby increasing its load on the spool (5). Consequently, the spool (5) moves to the right and stops the oil flow **C** and **B**, and a passage opens **D** and **C**.
- As a result of that, the pressure in **C** decreases, and the control piston (2) stops.

4. When equilibrium has been reached



- The equilibrium between the force applied by pressure PA against spool (4) and the force applied by spring (1) against spool (5) is what determines the position at which the control piston (2) (hence pump delivery) stops.

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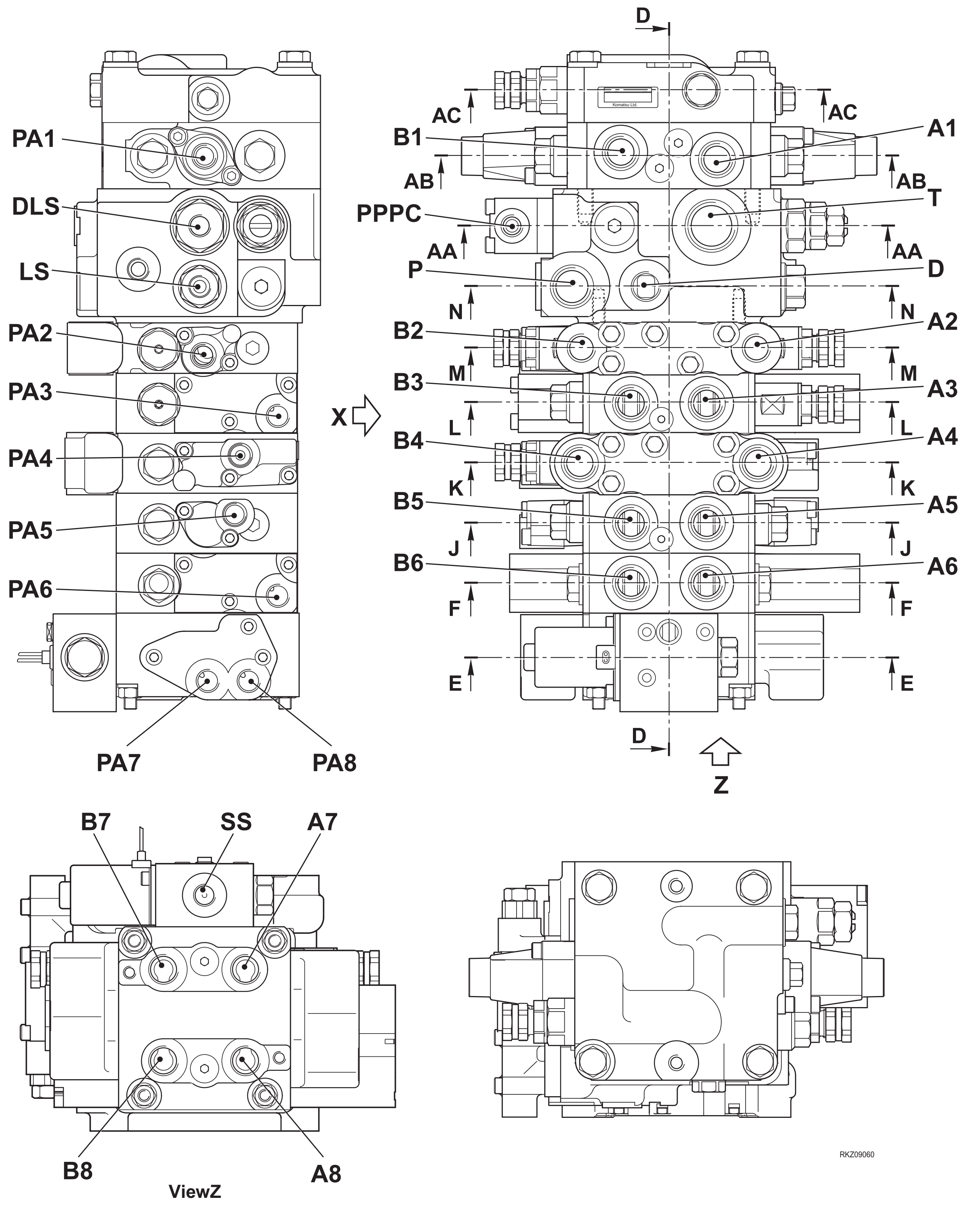
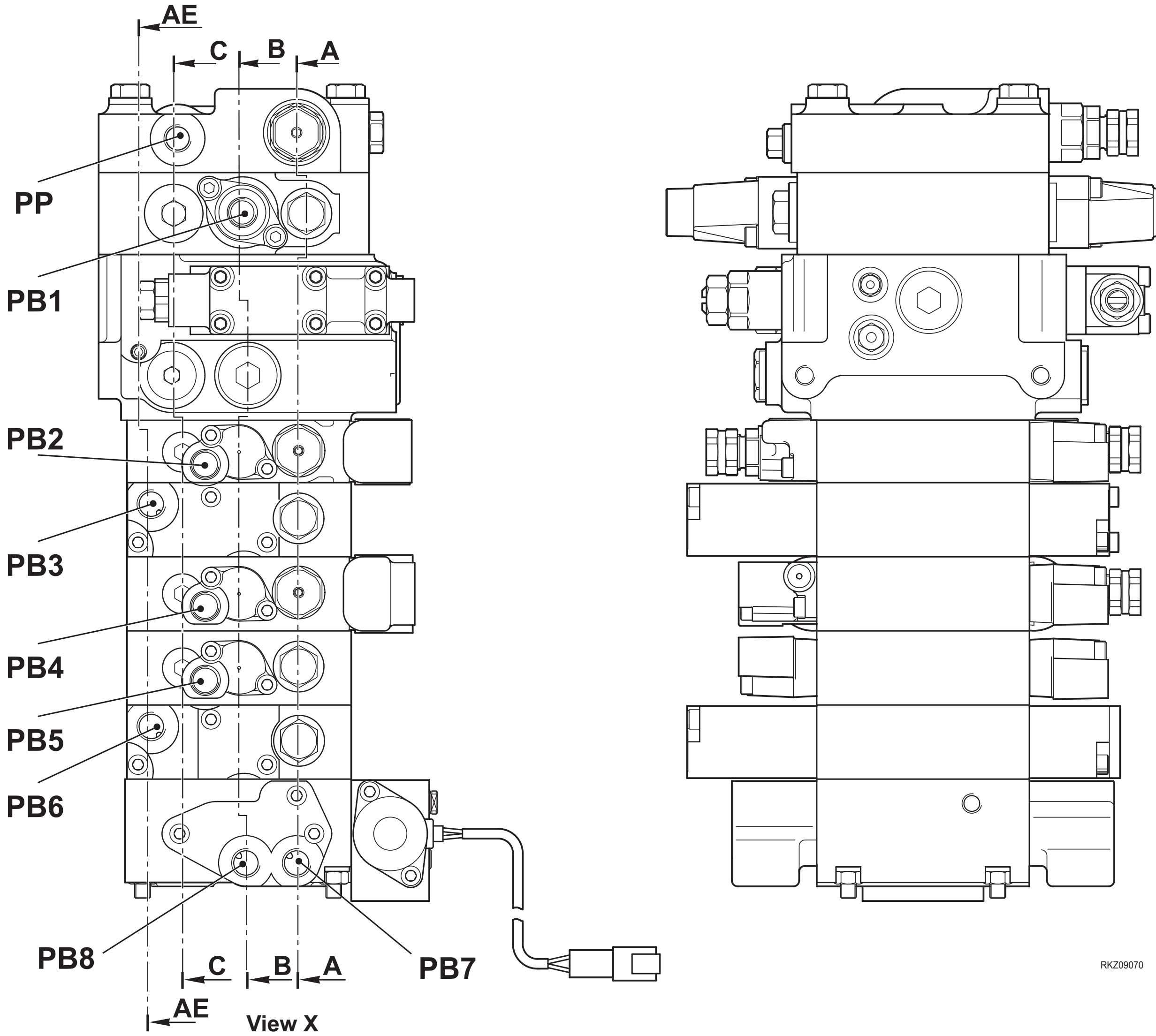
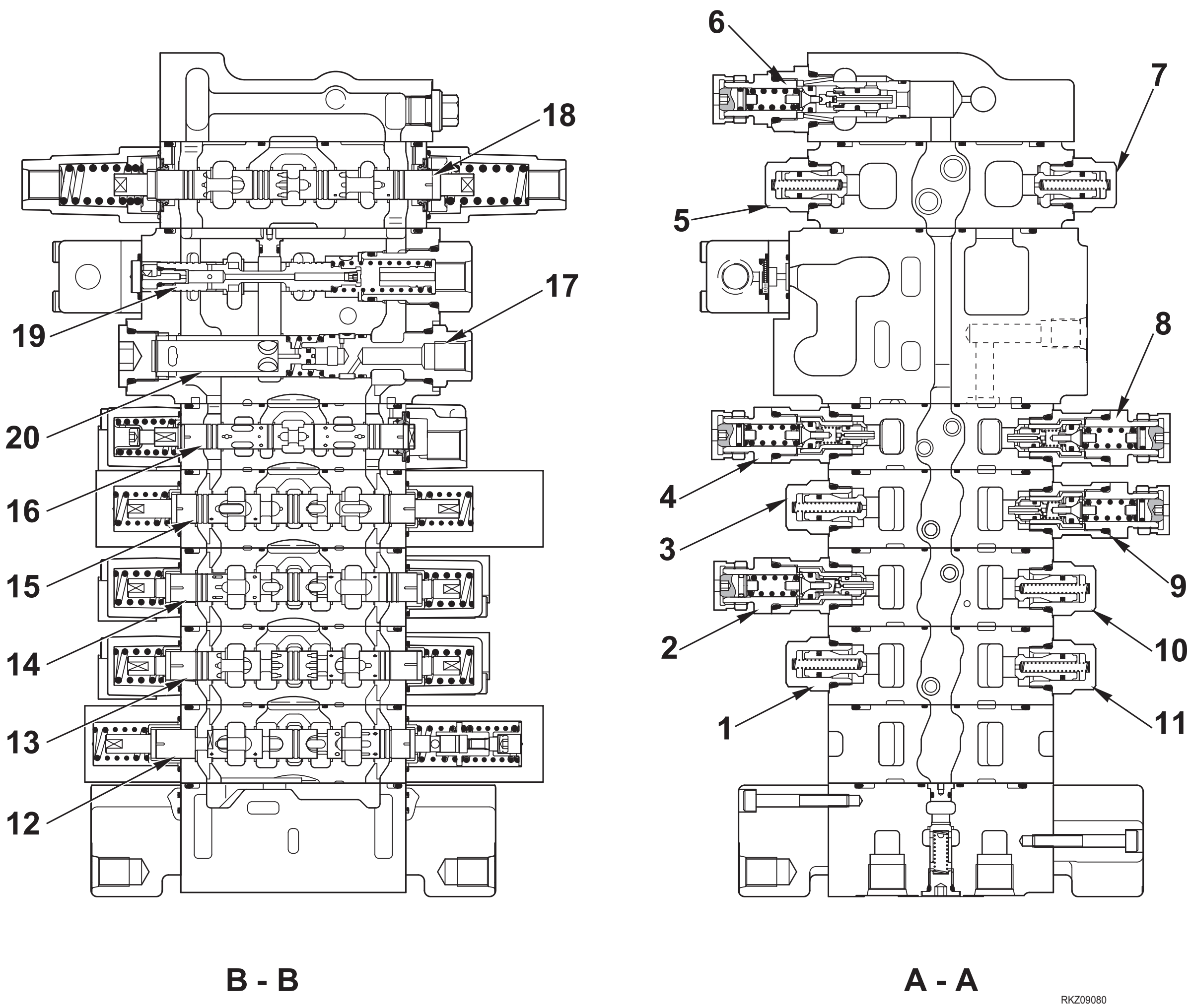
8-SPOOL CONTROL VALVE

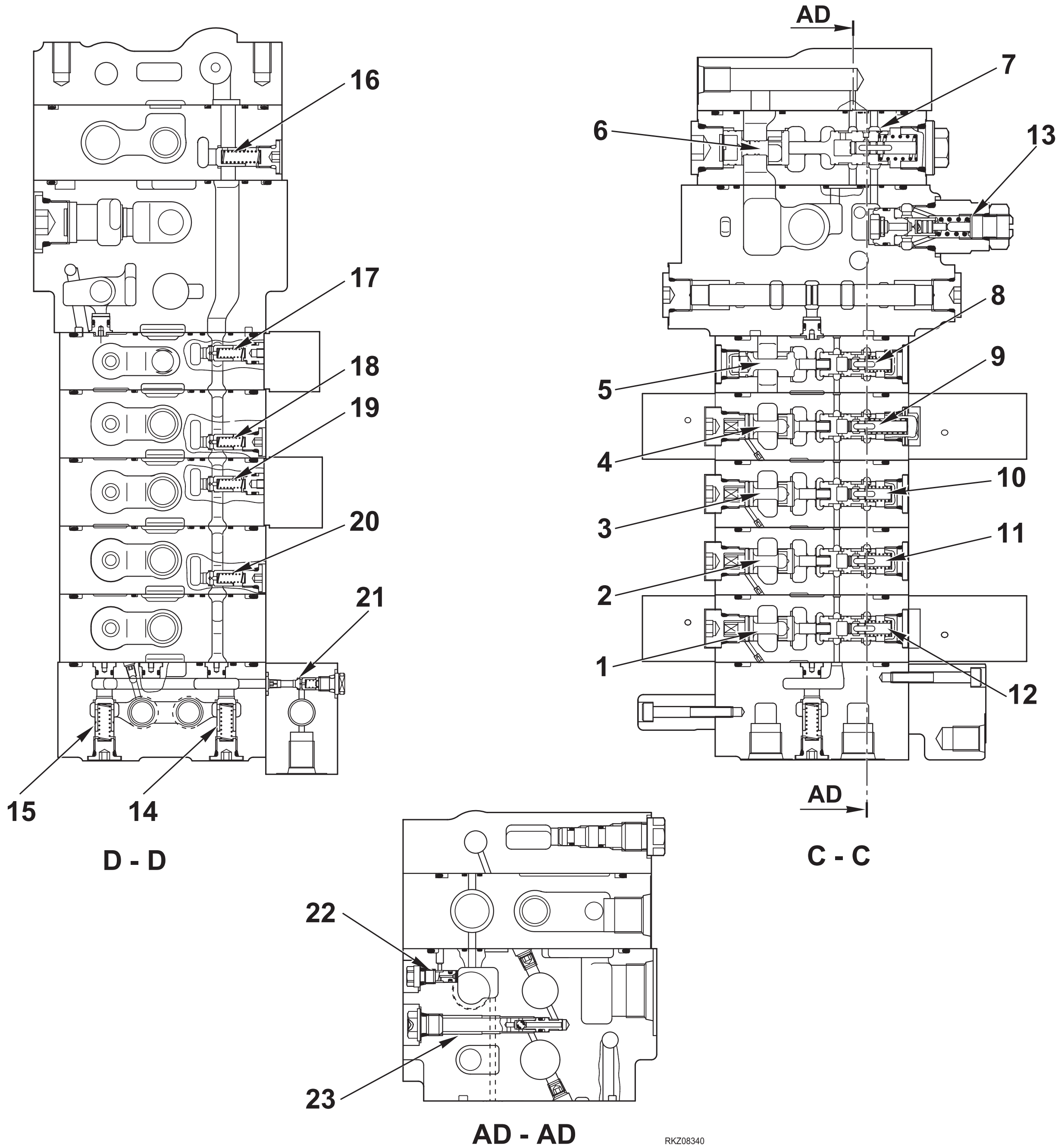




A1 - To the arm cylinder (Head side)
A2 - To the boom (LH-RH) swing cylinder (Bottom side)
A3 - To the shovel cylinders (Bottom side)
A4 - To the boom cylinder (Bottom side)
A5 - To the backhoe bucket cylinder (Head side)
A6 - To the shovel arm raise cylinder (Bottom side)
A7 - To the RH outrigger cylinder (bottom side)
A8 - To the LH outrigger cylinder (bottom side)
B1 - To the arm cylinder (Bottom side)
B2 - To the boom (LH-RH) swing cylinder (Head side)
B3 - To the shovel cylinders (Head side)
B4 - To the boom cylinder (Head side)
B5 - To the backhoe bucket cylinder (Bottom side)
B6 - To the shovel arm raise cylinder (Head side)
B7 - To the RH outrigger cylinder (Head side)
B8 - To the LH outrigger cylinder (Head side)
LS - To the hydraulic pump (PLS port)
P - From hydraulic pump (P1 port)
D - To the steering unit (P Port)
DLS - From the steering unit (LS Port)
PP - To the hydraulic pump (P1L port)
T - To hydraulic tank
TS - To hydraulic tank
PPPC - To solenoid valve group EV1 (P Port)
SS - To the backhoe plate lock cylinders
PA1 - From backhoe LH PPC valve (port 3)
PA2 - From backhoe LH PPC valve (port 4)
PA3 - From the shovel PPC valve (P2 port)
PA4 - From backhoe RH PPC valve (port 3)
PA5 - From backhoe RH PPC valve (port 4)
PA6 - From the shovel PPC valve (P3 port)
PA7 - From the outriggers PPC valve (P1 port)
PA8 - From the outriggers PPC valve (P3 port)
PB1 - From backhoe LH PPC valve (port 1)
PB2 - From backhoe LH PPC valve (port 2)
PB3 - From the shovel PPC valve (P1 port)
PB4 - From backhoe RH PPC valve (port 1)
PB5 - From backhoe RH PPC valve (port 2)
PB6 - From the shovel PPC valve (P4 port)
PB7 - From the outriggers PPC valve (P2 port)
PB8 - From the outriggers PPC valve (P4 port)



1. Anticavitation valve (backhoe bucket curl)
2. Anti-shock/anticavitation valve (boom raise)
3. Anticavitation valve (shovel dump)
4. Anti-shock/anticavitation valve (LH swing)
5. Anticavitation valve (arm out)
6. Safety valve
7. Anticavitation valve (arm in)
8. Anti-shock/anticavitation valve (RH swing)
9. Anti-shock/anticavitation valve (shovel curl)
10. Anticavitation valve (boom lower)
11. Anticavitation valve (backhoe bucket dump)
12. Spool (shovel arm control)
13. Spool (backhoe bucket control)
14. Spool (boom control)
15. Spool (front bucket control)
16. Spool (boom swing control)
17. LS by-pass plug
18. Spool (arm control)
19. Spool (priority valve)
20. Unloading valve

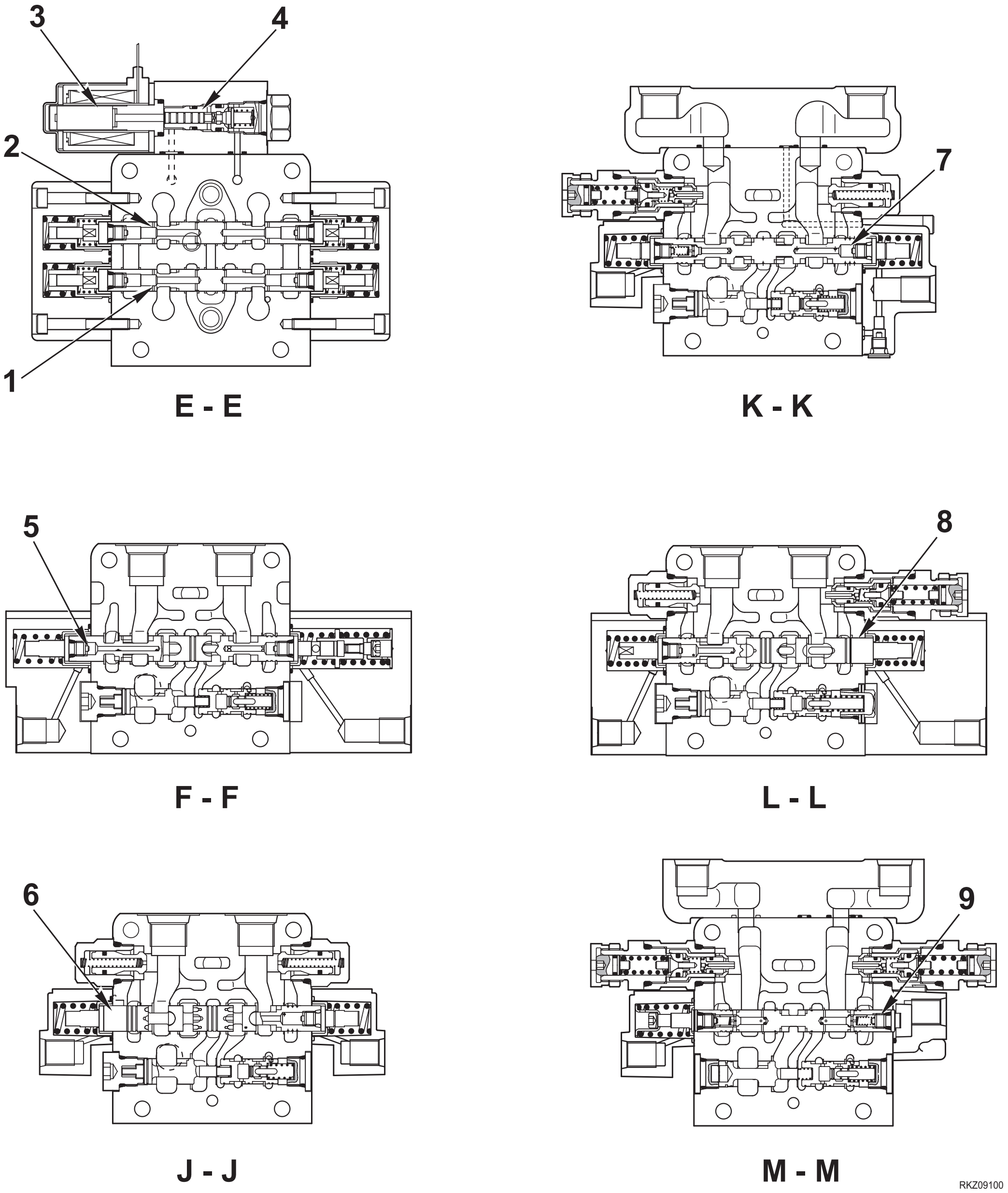


PRESSURE REDUCING VALVE

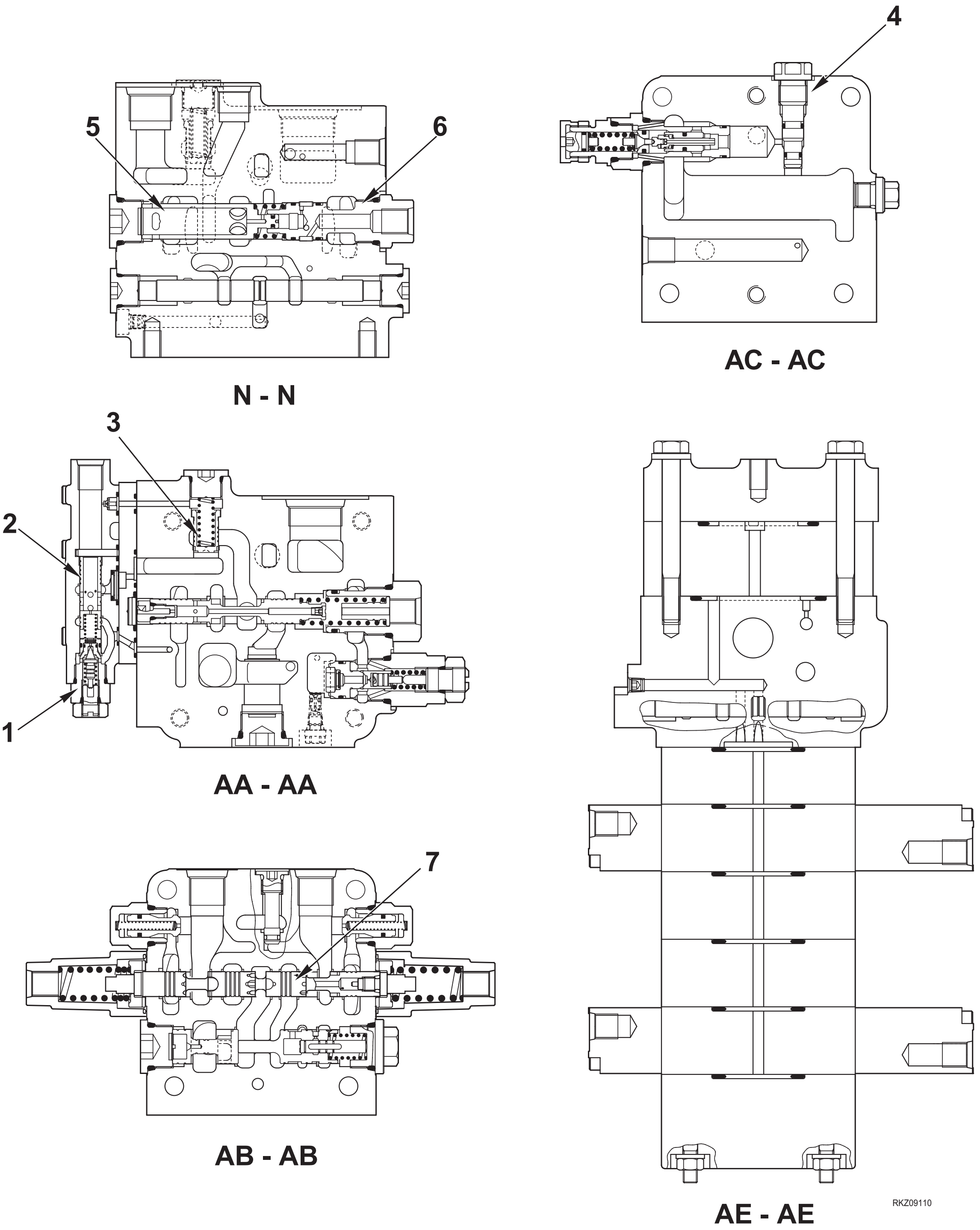
1. Shovel arm
2. Backhoe bucket
3. Boom
4. Front bucket
5. Boom swing
6. Arm

DELIVERY CONTROL VALVE

7. Arm
8. Boom swing
9. Front bucket
10. Boom
11. Backhoe bucket
12. Shovel arm
13. Max. pressure valve
14. Check valve
15. Check valve
16. Check valve
17. Check valve
18. Check valve
19. Check valve
20. Check valve
21. Check valve
22. LS, DLS pressure check valve
23. LS by-pass plug

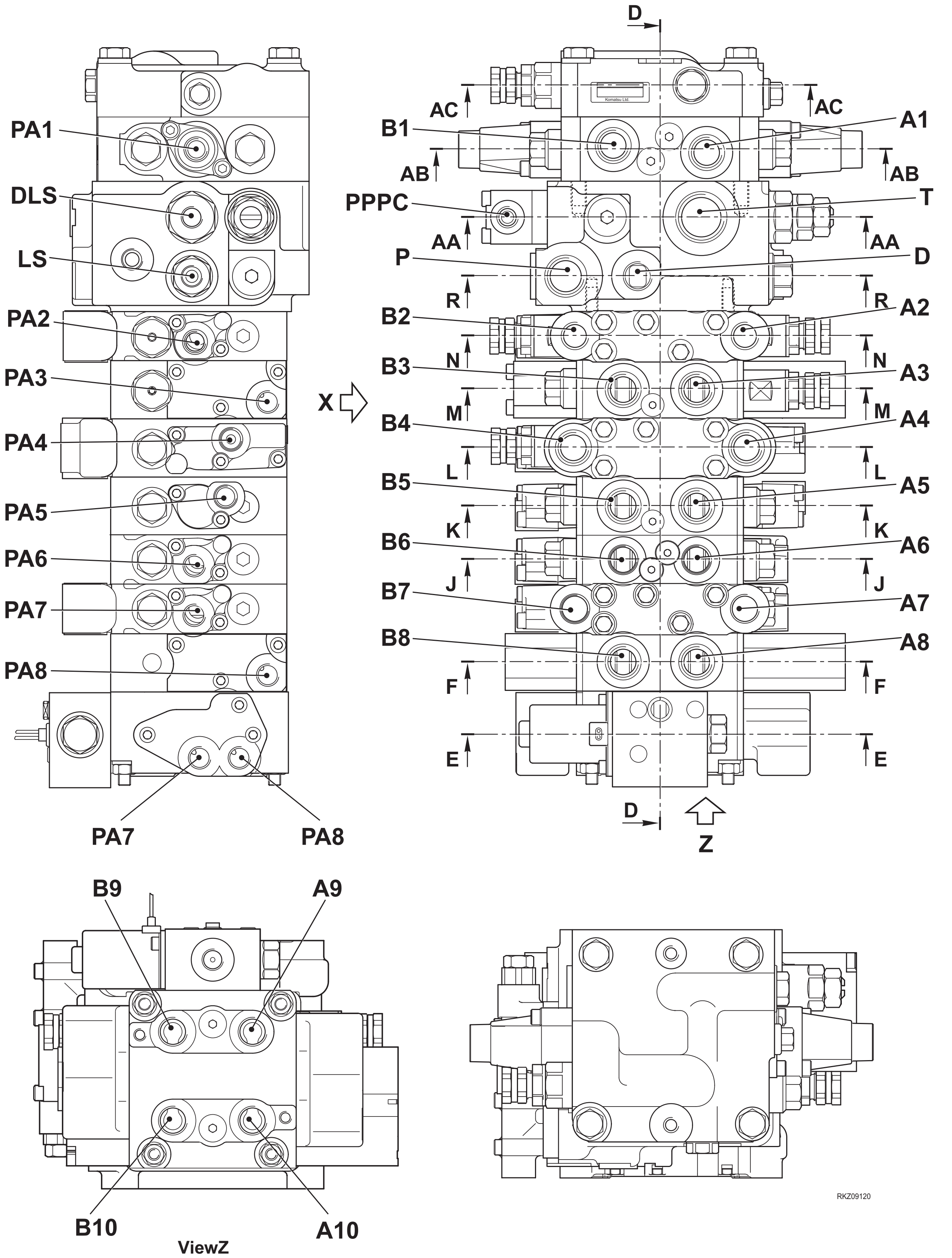


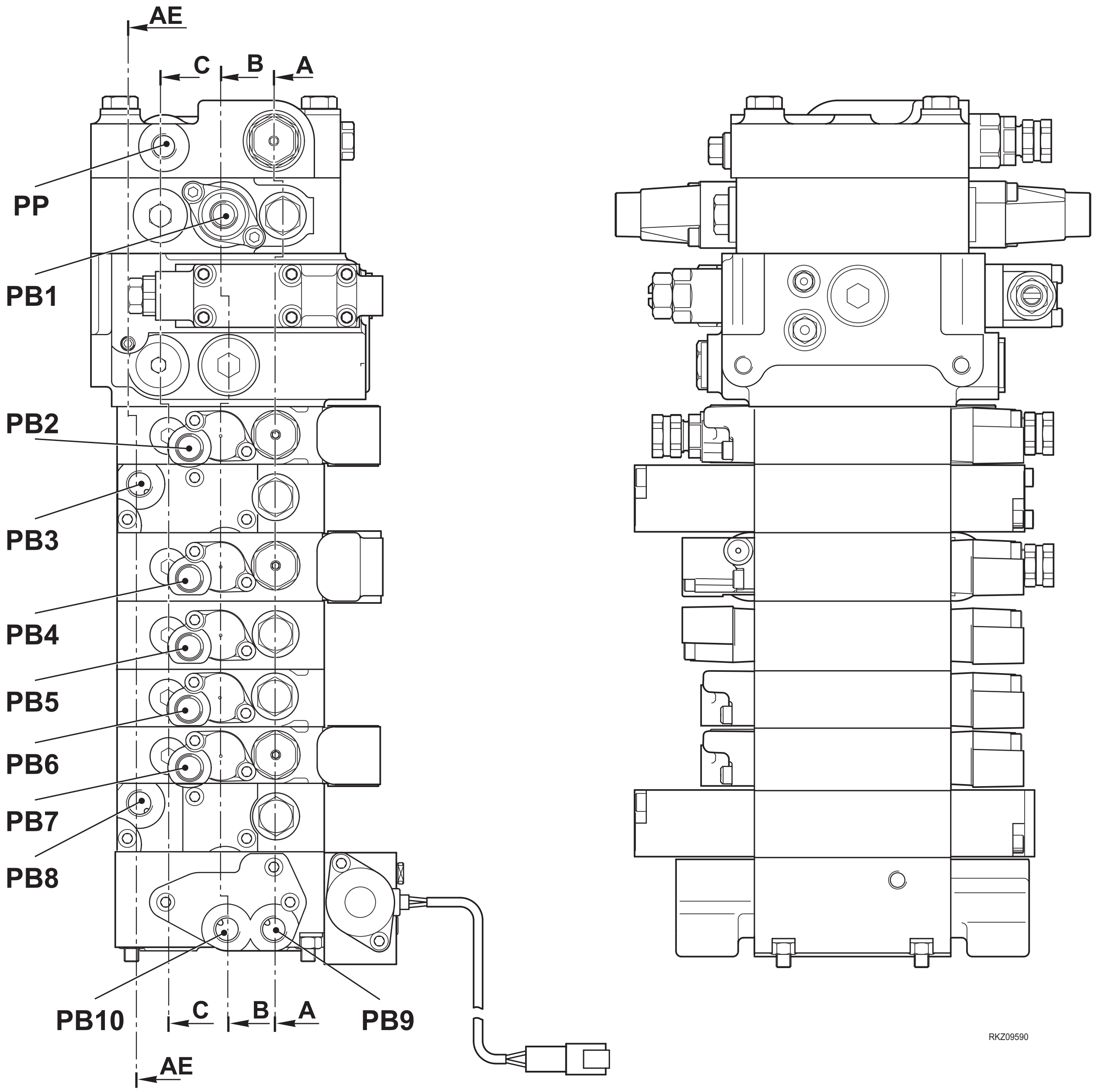
1. Spool (right outrigger control)
2. Spool (left outrigger control)
3. Backhoe plate lock solenoid valve
4. Backhoe plate lock valve
5. Spool (shovel arm control)
6. Spool (backhoe bucket control)
7. Spool (Boom control)
8. Spool (front bucket control)
9. Spool (boom swing control)



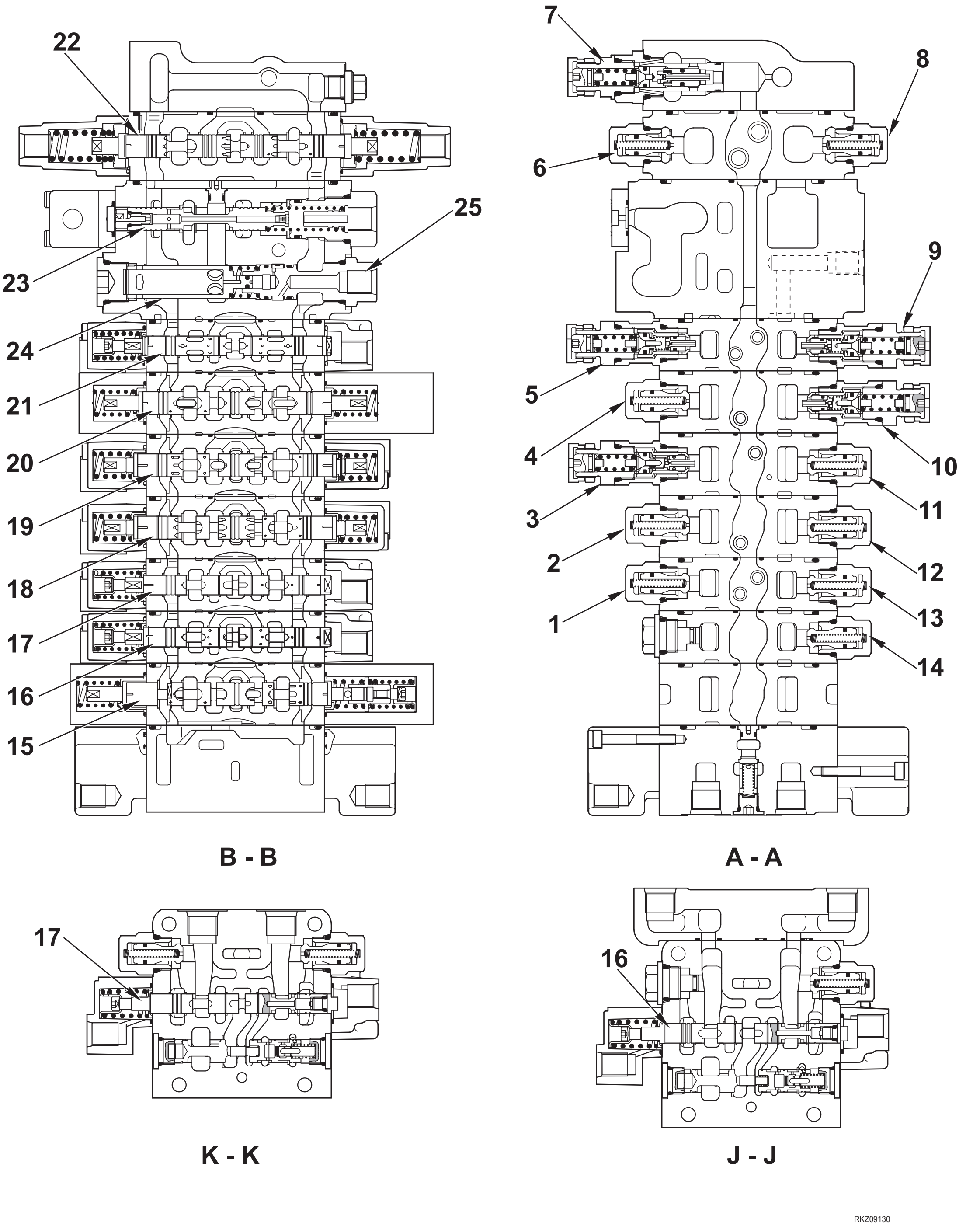
1. Servocontrol max. pressure valve
2. Max. pressure valve spool
3. Sequential reducing valve
4. Blow out plug
5. Unloading valve
6. LS by-pass plug
7. Spool (Arm control)

10-SPOOL CONTROL VALVE

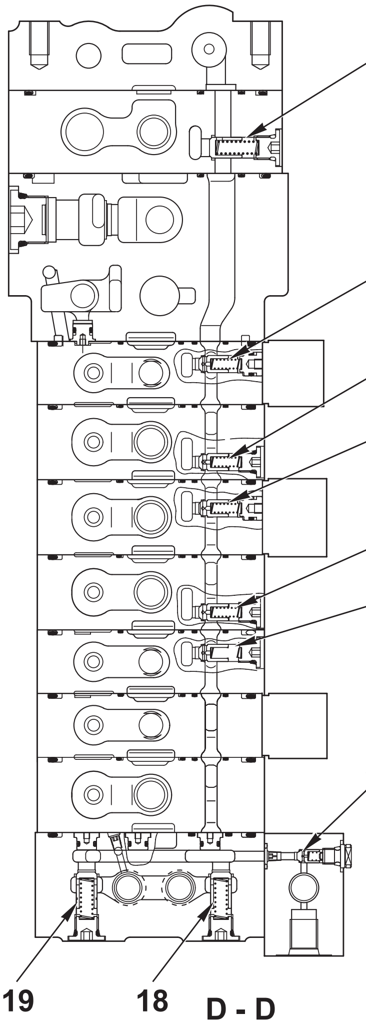



AE
C
B
A
PP
PB1
PB2
PB3
PB4
PB5
PB6
PB7
PB8
PB10
C
B
A
PB9
AE
RKZ09590

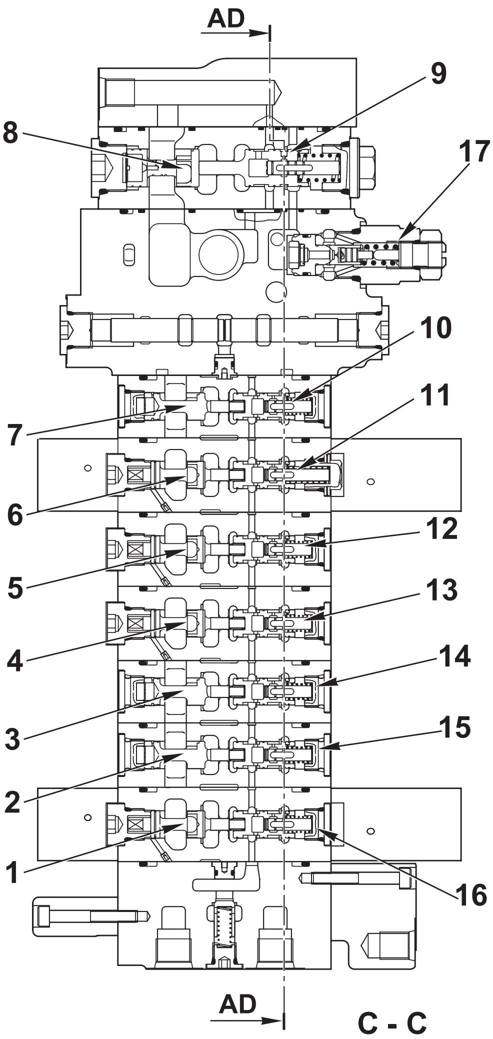
A1 - To the arm cylinder (Head side)
A2 - To the boom (LH-RH) swing cylinder (Bottom side)
A3 - To the shovel cylinders (Bottom side)
A4 - To the boom cylinder (Bottom side)
A5 - To the backhoe bucket cylinder (Head side)
A6 - To the 4 in 1 bucket cylinder (Bottom side)
A7 - To the jig arm cylinder (Bottom side)
A8 - To the shovel arm raise cylinder (Bottom side)
A9 - To the RH outrigger cylinder (Bottom side)
A10 - To the LH outrigger cylinder (Bottom side)
B1 - To the arm cylinder (Bottom side)
B2 - To the boom (LH-RH) swing cylinder (Head side)
B3 - To the shovel cylinders (Head side)
B4 - To the boom cylinder (Head side)
B5 - To the backhoe bucket cylinder (Bottom side)
B6 - To the 4 in 1 bucket cylinder (Head side)
B7 - To the jig arm cylinder (Head side)
B8 - To the shovel arm raise cylinder (Head side)
B9 - To the RH outrigger cylinder (Head side)
B10 - To the LH outrigger cylinder (Head side)
LS - To the hydraulic pump (PLS port)
P - From hydraulic pump (P1 port)
D - To the steering unit (P Port)
DLS - From the steering unit (LS Port)
PP - To the hydraulic pump (P1L port)
T - To hydraulic tank
TS - To hydraulic tank
PPPC -To solenoid valve group EV1 (P Port)
SS - To the backhoe plate lock cylinders
PA1 - From backhoe LH PPC valve (port 3)
PA2 - From backhoe LH PPC valve (port 4)
PA3 - From the shovel PPC valve (P2 port)
PA4 - From backhoe RH PPC valve (port 3)
PA5 - From backhoe RH PPC valve (port 4)
PA6 - From solenoid valve group EV1 (A1 Port)
PA7 - From solenoid valve group EV2 (A2 Port)
PA8 - From the shovel PPC valve (P3 port)
PA9 - From the outriggers PPC valve (P1 port)
PA10 - From the outriggers PPC valve (P3 port)
PB1 - From backhoe LH PPC valve (port 1)
PB2 - From backhoe LH PPC valve (port 2)
PB3 - From the shovel PPC valve (P1 port)
PB4 - From backhoe RH PPC valve (port 1)
PB5 - From backhoe RH PPC valve (port 2)
PB6 - From solenoid valve group EV1 (B1 Port)
PB7 - From solenoid valve group EV2 (B2 Port)
PB8 - From the shovel PPC valve (P4 port)
PB9 - From the outriggers PPC valve (P2 port)
PB10 -From the outriggers PPC valve (P4 port)



1. Anticavitation valve (jig arm extend)
2. Anticavitation valve (backhoe bucket curl)
3. Anti-shock/anticavitation valve (boom raise)
4. Anticavitation valve (shovel dump)
5. Anti-shock/anticavitation valve (LH swing)
6. Anticavitation valve (arm out)
7. Safety valve
8. Anticavitation valve (arm in)
9. Anti-shock/anticavitation valve (RH swing)
10. Anti-shock/anticavitation valve (shovel curl)
11. Anticavitation valve (boom lower)
12. Anticavitation valve (backhoe bucket dump)
13. Anticavitation valve (jig arm retract)
14. Anticavitation valve (4 in 1 bucket dump)
15. Spool (shovel arm control)
16. Spool (Jig arm control)
17. Spool (4 in 1 bucket control)
18. Spool (backhoe bucket control)
19. Spool (boom control)
20. Spool (front bucket control)
21. Spool (boom swing control)
22. Spool (arm control)
23. Spool (priority valve)
24. Unloading valve
25. LS by-pass plug



D - D



C - C

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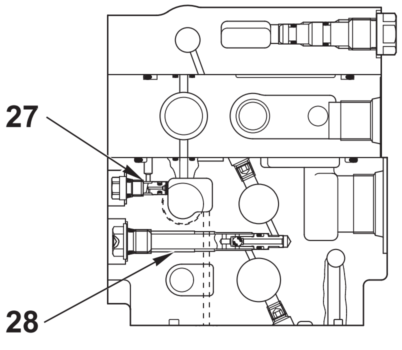


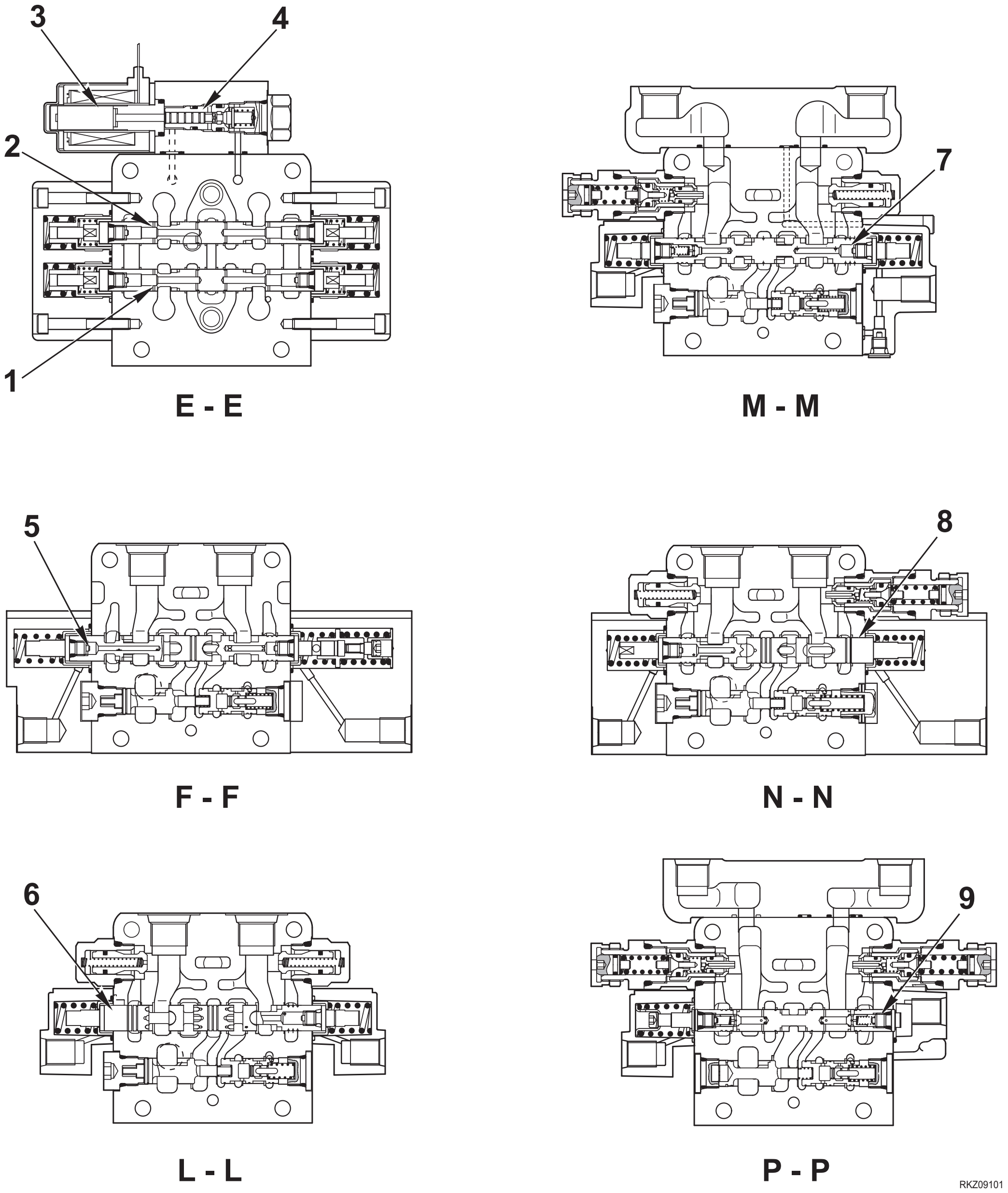
AD - AD

PRESSURE REDUCING VALVE

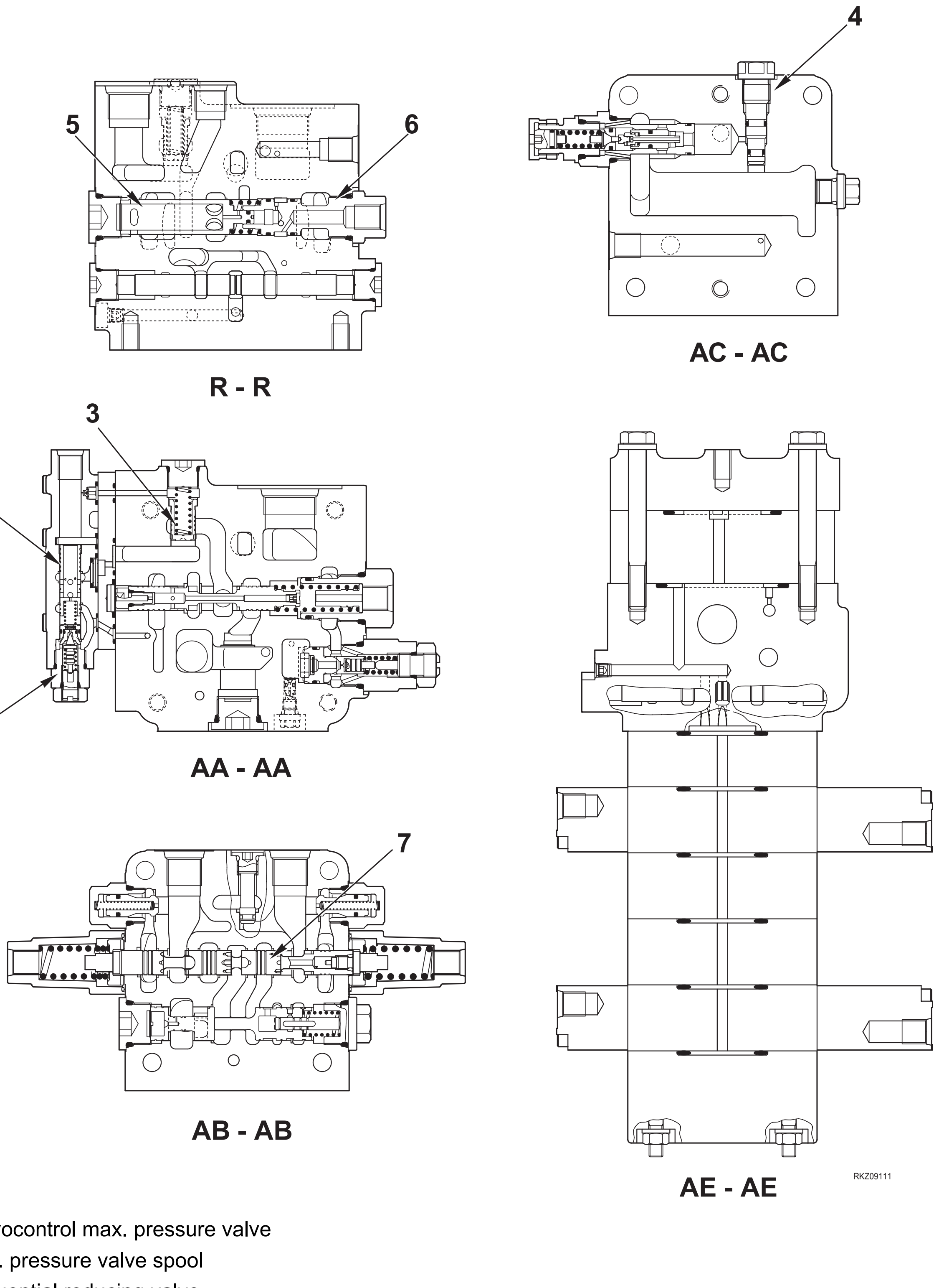
1. Shovel arm
2. Jig arm
3. 4 in 1 bucket
4. Backhoe bucket
5. Boom
6. Front bucket
7. Boom swing
8. Arm

DELIVERY CONTROL VALVE

9. Arm
10. Boom swing
11. Front bucket
12. Boom
13. Backhoe bucket
14. 4 in 1 bucket
15. Jig arm
16. Shovel arm
17. Max. pressure valve
18. Check valve
19. Check valve
20. Check valve
21. Check valve
22. Check valve
23. Check valve
24. Check valve
25. Check valve
26. Check valve
27. LS, DLS pressure check valve
28. LS by-pass plug



1. Spool (right outrigger control)
2. Spool (left outrigger control)
3. Backhoe plate lock solenoid valve
4. Backhoe plate lock valve
5. Spool (shovel arm control)
6. Spool (backhoe bucket control)
7. Spool (Boom control)
8. Spool (front bucket control)
9. Spool (boom swing control)



1. Servocontrol max. pressure valve
2. Max. pressure valve spool
3. Sequential reducing valve
4. Blow out plug
5. Unloading valve
6. LS by-pass plug
7. Spool (Arm control)

CLSS

1. DESCRIPTION

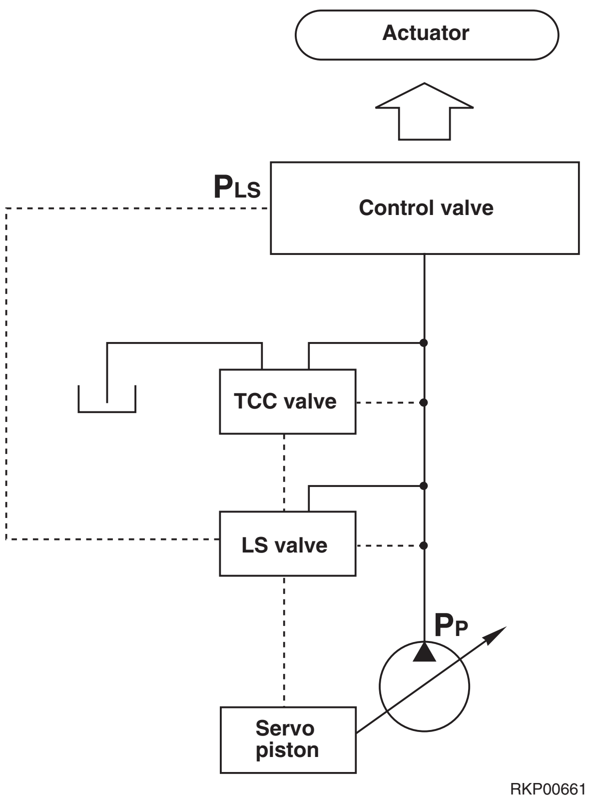
1.1 CHARACTERISTICS

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

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

1.2 STRUCTURE

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

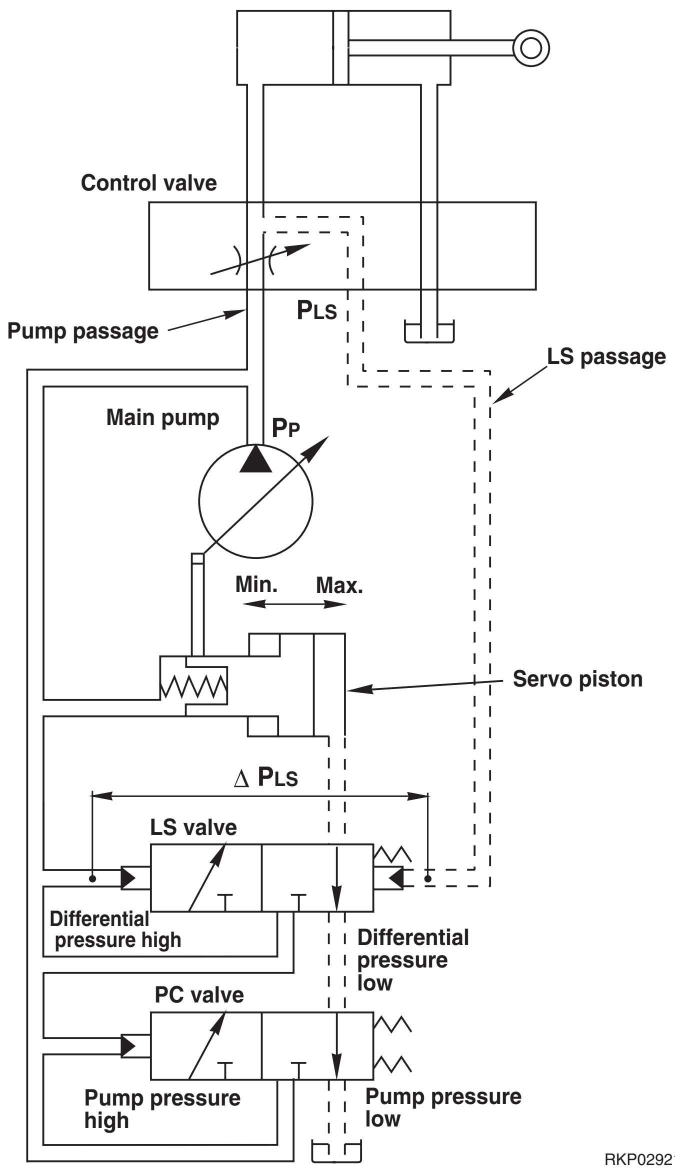


2. OPERATING PRINCIPLES

2.1 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 **DPLS** 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. (**DPLS**=Pump delivery pressure **PP** – pressure **PLS** of delivery to the actuator.
- If the differential pressure **DPLS** becomes lower than the set pressure of the LS, valve, the angle of the swash plate increases.
  If the differential pressure **DPLS** increases, the angle of the swash plate decreases.

★ For details about this movement, see the description of the "HYDRAULIC PUMP".



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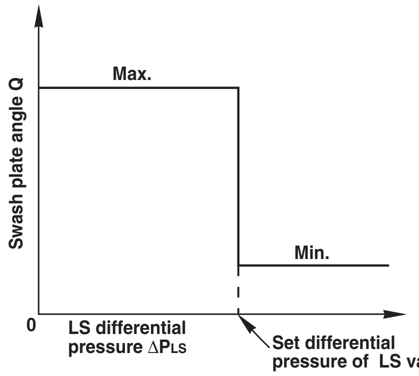

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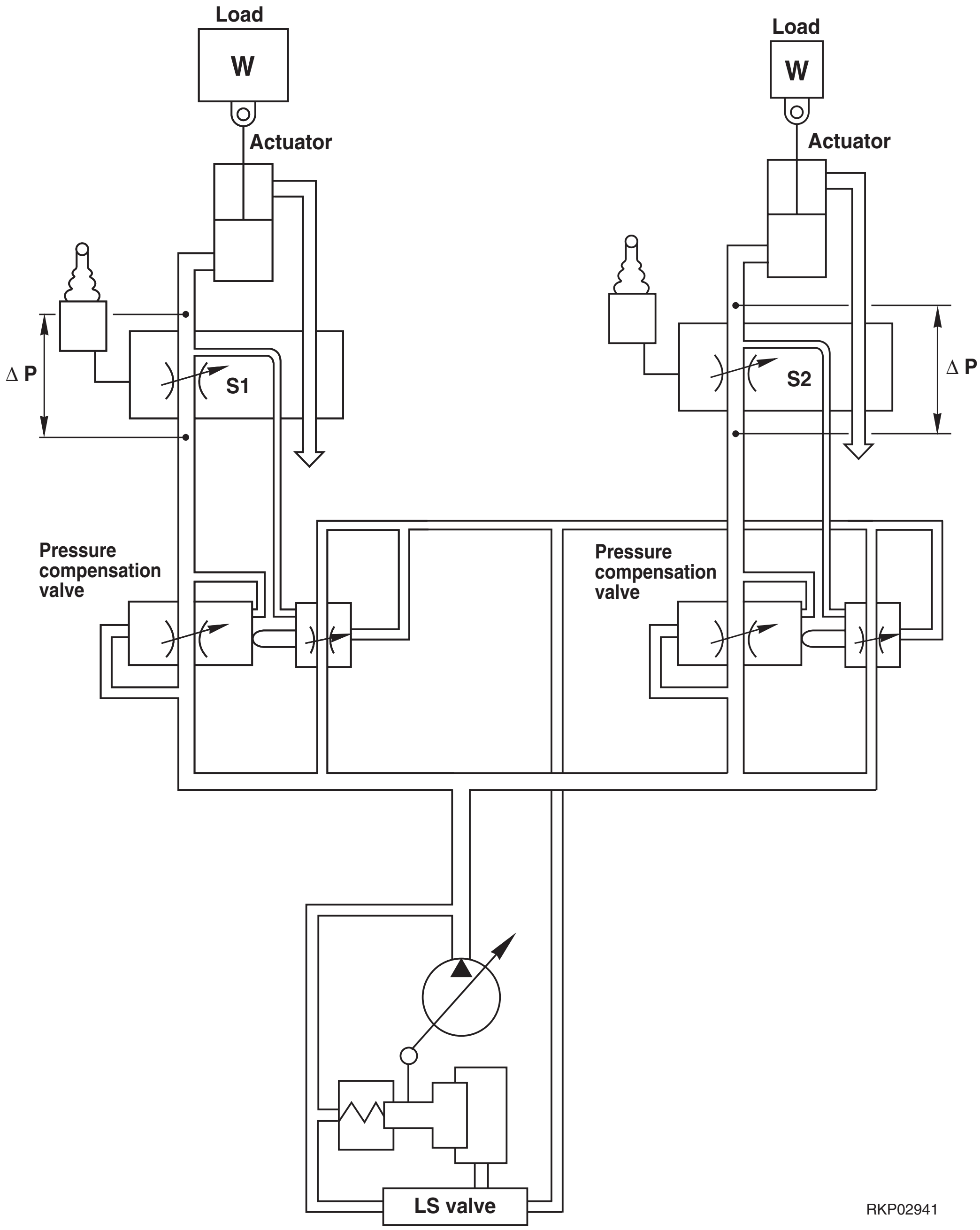
2.2 PRESSURE COMPENSATION CONTROL

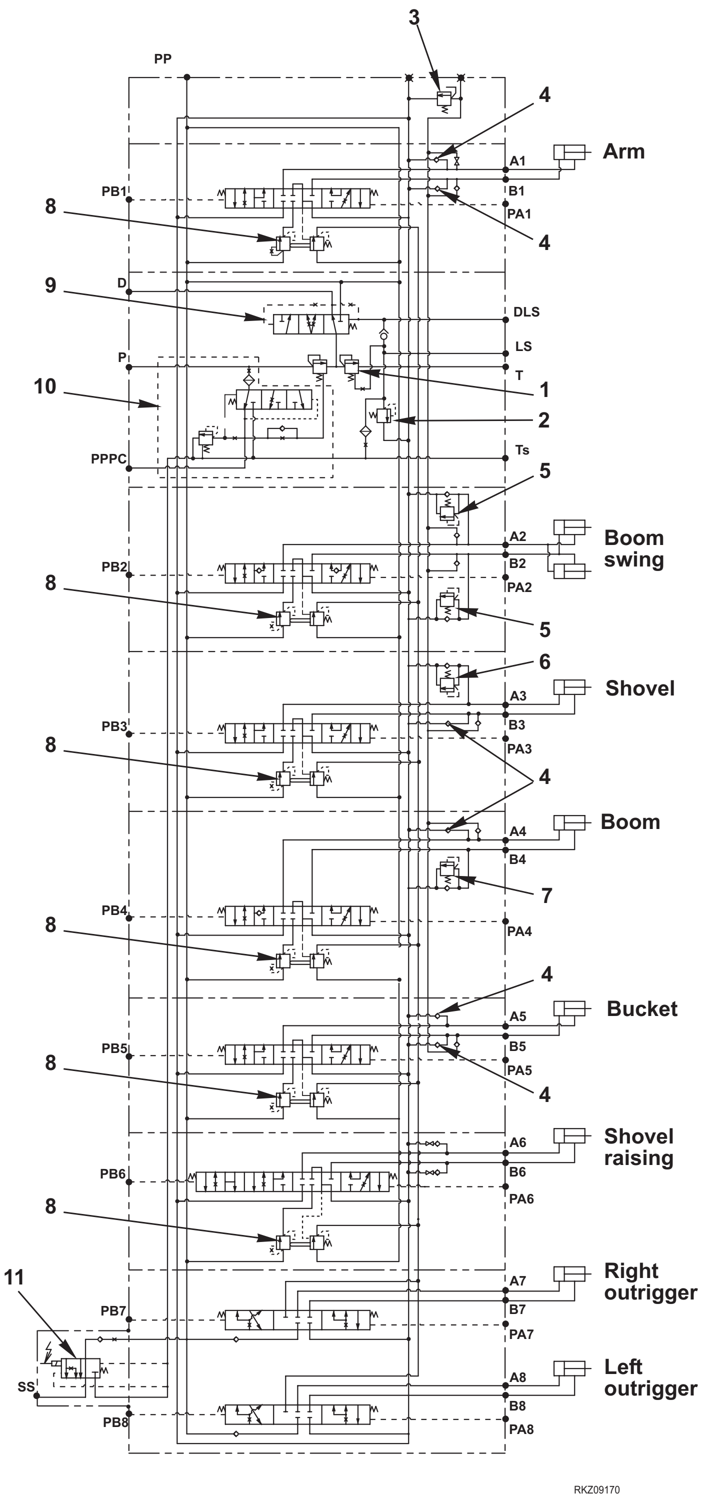
- The pressure compensation valves are installed downstream from the control valve in order to balance the differential pressure between the loads.
  When two or more movements (cylinders) are activated simultaneously, the pressure differences **DP** between the delivery at the control valve inlet and 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.



3. OPERATION FOR EACH CIRCUIT AND VALVE

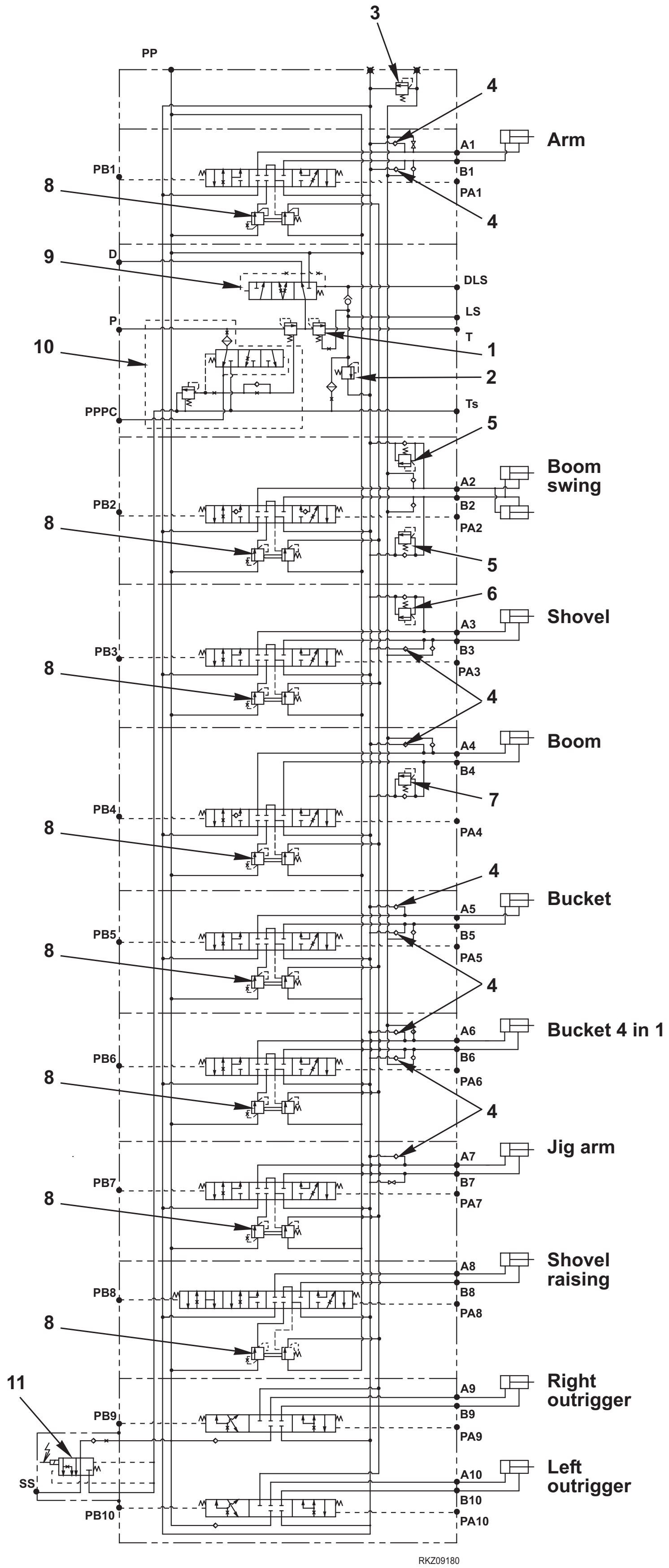
3.1 HYDRAULIC CIRCUIT DIAGRAM AND NAMES OF VALVES

3.1.1 8-spool control valve



1. Unloading valve: pressure LS + 27.5 bar
2. Max. pressure valve: 218 bar
3. Safety valve: 270 bar
4. Check valve
5. Anti-shock/anticavitation valve: 215 bar
6. Anti-shock/anticavitation valve: 220 bar
7. Anti-shock/anticavitation valve: 350 bar
8. Pressure compensation valves
9. Priority valve
10. Servocontrols reducing valve
11. Backhoe plate lock valve

3.1.1 10-spool control valve



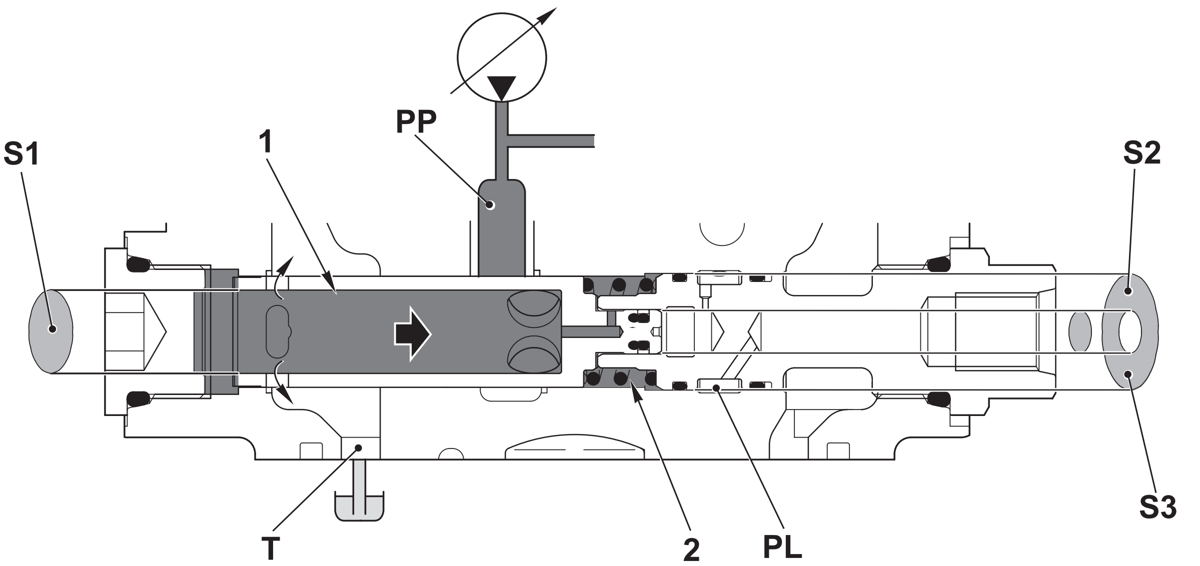
1. Unloading valve: pressure LS + 27.5 bar
2. Max. pressure valve: 218 bar
3. Safety valve: 270 bar
4. Check valve
5. Anti-shock/anticavitation valve: 215 bar
6. Anti-shock/anticavitation valve: 220 bar
7. Anti-shock/anticavitation valve: 350 bar
8. Pressure compensation valves
9. Priority valve
10. Servocontrols reducing valve
11. Backhoe plate lock valve

3.2 UNLOADING VALVE

3.2.1 When the control valve is in "NEUTRAL" position

Function

- When the control valve is in “NEUTRAL” position, pump delivery **Q** (resulting from the swash plate being at its min. angle) is sent into the tank circuit.
  When this happens, the pump's delivery pressure **PP** is regulated at 27.5 bar (28 kg/cm^2) by means of the spring (2) inside the valve.
  (**LS** signal with **PLS** pressure=0 bar (0 kg/cm^2)



Functioning

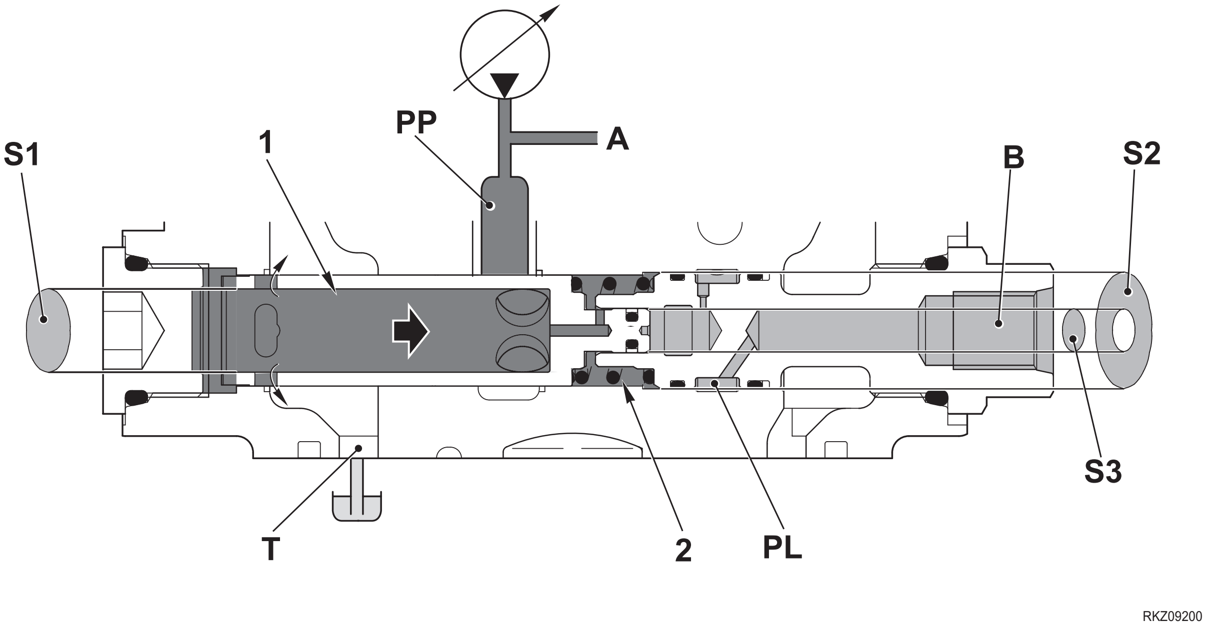
- Pump pressure **PP** acts on spool (1) – left, on surface **S1**, and right, on surface **S2** – whereas Load Sensing pressure **PLS** acts on surface **S2**.
- Since no **LS** signal with **PLS** pressure is generated when the control valve is in “NEUTRAL” position, the only pressure acting on spool (1) in this condition is the pump's delivery pressure **PP** as regulated by spring compression (2).
- As the pump's delivery pressure **PP** increases and the resulting force equals spring loading (2), the spool (1) shifts to the right. The pump's delivery circuit **PP** is then connected to the tank circuit **T** by means of the holes in spool (1).
- This ensures that the pump delivery pressure **PP** stays regulated at 27.5 bar (28 kg/cm^2).

PP = Pump circuit
PLS = Load Sensing circuit
T = Tank circuit
A = To control valve spools

3.2.2 Control valve fine control

Function

- When the actuators' delivery needs during fine control are within the delivery values related to the minimum angle of the swash plate, the pump's delivery pressure **PP** is regulated by pressure **PLS** at +27.5 bar (28 kg/cm^2). Since the unloading valve opens when the differential pressure between the pump's delivery pressure **PP** and pressure **PLS** of the **LS** equals spring loading (2) (27.5 bar (28 kg/cm^2)), the differential pressure **DPLS** becomes 27.5 bar (28 kg/cm^2).



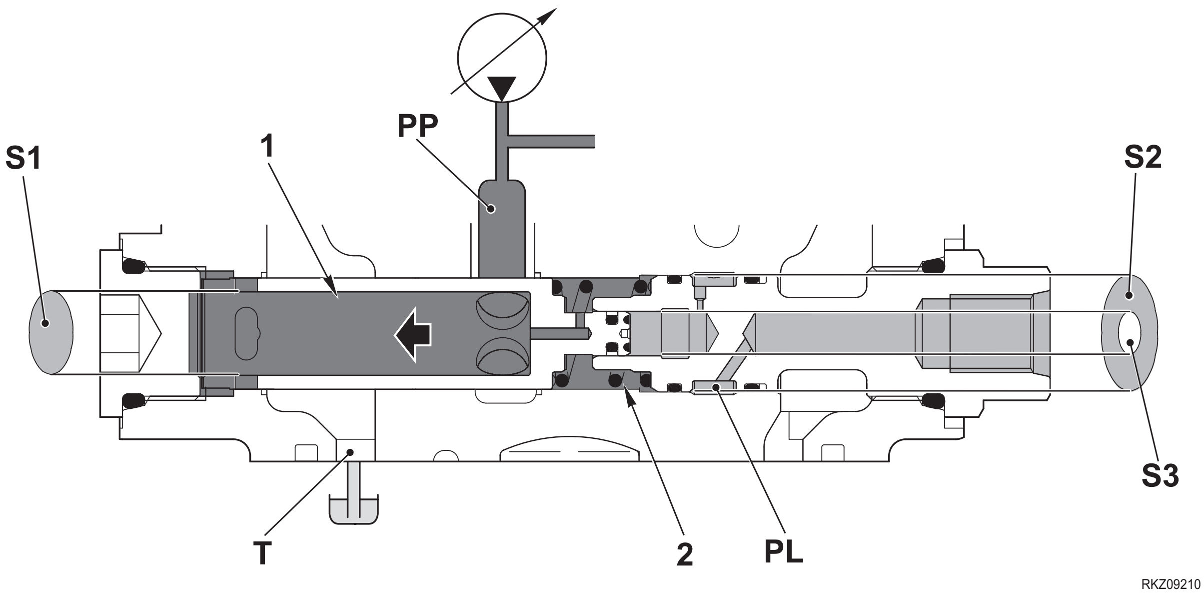
Functioning

- When fine controls are performed at the control valve, a **PLS** pressure is generated. This pressure acts on surface **S3** on the right hand side of the spool (1). Since pressure **PLS** of **LS** is low – because the control valve passage is small – the difference with the pump's delivery pressure **PP** is great.
- When the differential pressure between the pump's delivery pressure **PP** and pressure **PLS** of the **LS** equals spring loading (2) (27.5 bar (28 kg/cm^2)), the spool (1) shifts to the right and, in turn, the pump circuit **PP** connects to the tank circuit **T.**
- The pump's delivery pressure **PP** is regulated by the combination of the pressure from the spring (27.5 bar (28 kg/cm^2)) and the pressure **PLS** of the **LS**, i.e. when the differential pressure **DPLS** reaches a value of 27.5 bar (28 kg/cm^2).

3.2.3 When the control valve is in use

Function

- 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.



Functioning

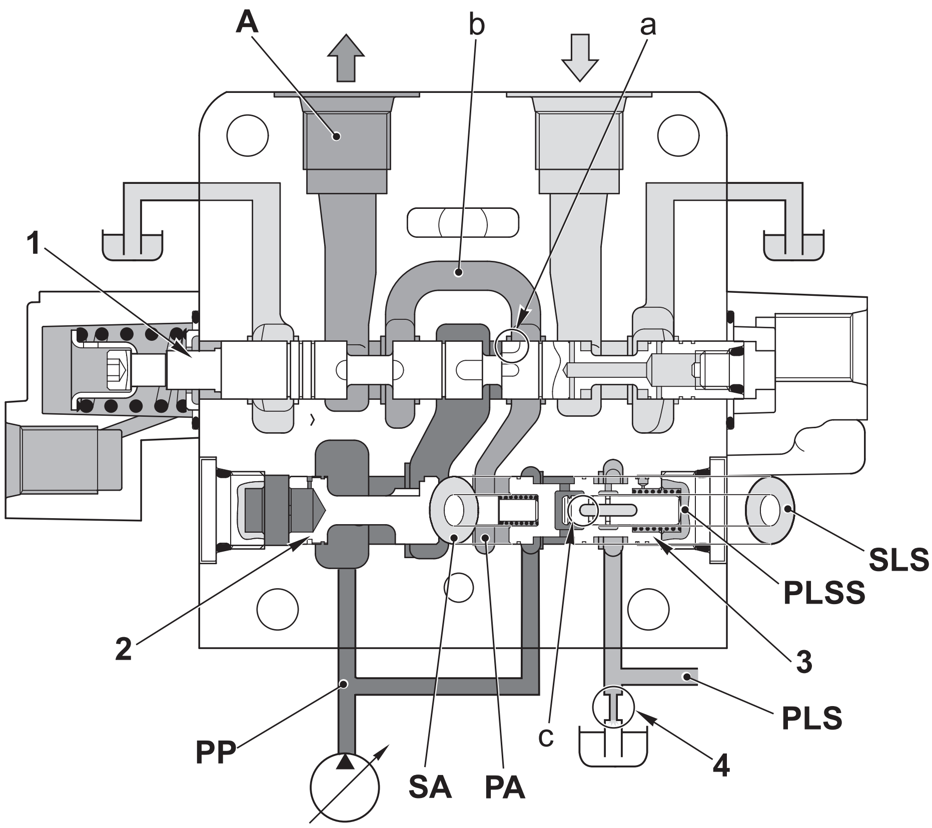
- When the control valve spool is caused to perform a longer travel, this generates a pressure **PLS** of the **LS**, which acts on the right hand side of the spool (1). Since the control valve passage is wide, the difference between the pressure **PLS** of the **LS** and the pump's delivery pressure **PP** is small.
- For this reason, since the differential pressure between the pump's delivery pressure **PP** and the pressure **PLS** of the **LS** fails to reach the spring loading pressure value of spring (2) (27.5 bar (28 kg/cm^2), the spool (1) is pushed to the left by 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.

3.3 INTRODUCTION OF THE LS PRESSURE

Function

- **LS** pressure is the actuator's pressure at control valve output.
- This pressure actually reduces the pump's **PP** pressure – via the pressure compensation group reducing valve (3) – to the same **A** pressure of the actuator circuit and then sends it into the **PLS** circuit of the **LS**.
- In the outriggers control valve, the actuator's pressure **A** is introduced directly into circuit **PLS** of the **LS**

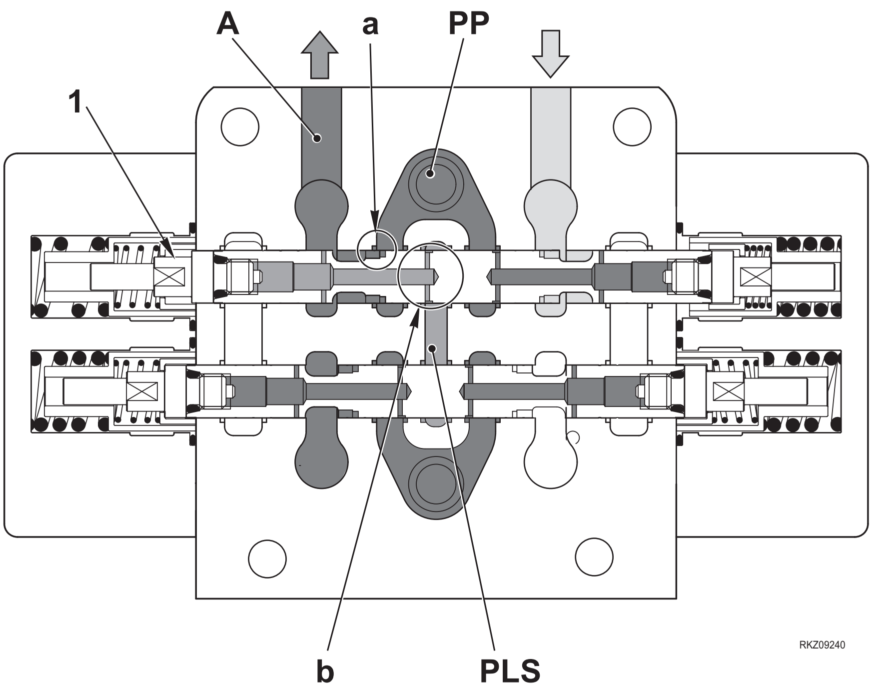
3.3.1 Control valve (working equipment not including outriggers).



Functioning

- When the spool (1) is operated, pump pressure **PP** starts flowing into the circuit of actuator **A** – from the delivery control valve (2) and from the notch **a** via the duct **b**.
- At the same time, the pressure reducing valve (3) moves to the right thereby making the pump's pressure **PP** drop as it flows through the bottleneck **c**, and causing the pressure to flow into the circuit **PLS** of the **LS** and into the chamber of spring **PLSS**.
- At this point, the **PLS** circuit of the **LS** is connected to the tank circuit **T** by means of the by-pass plug (4). (See the description of the **LS** by-pass plug).
- The pressure acting on the left side of the reducing valve (3) is pressure **PA** (= **A**) of the actuator, whereas the pressure acting on the right hand side is the reduced pressure **PP** of pump delivery.
- The reducing valve (3) therefore balances out when pressure **PA** of the actuators and pressure **PLSS** of the spring chamber are balanced. This in turn allows the pressure **PP** – now reduced by the bottleneck **c** – to be introduced into the **PLS** circuit of the **LS** at the same pressure **A** as the actuator's circuit.

3.3.2 Outriggers control valve



Functioning

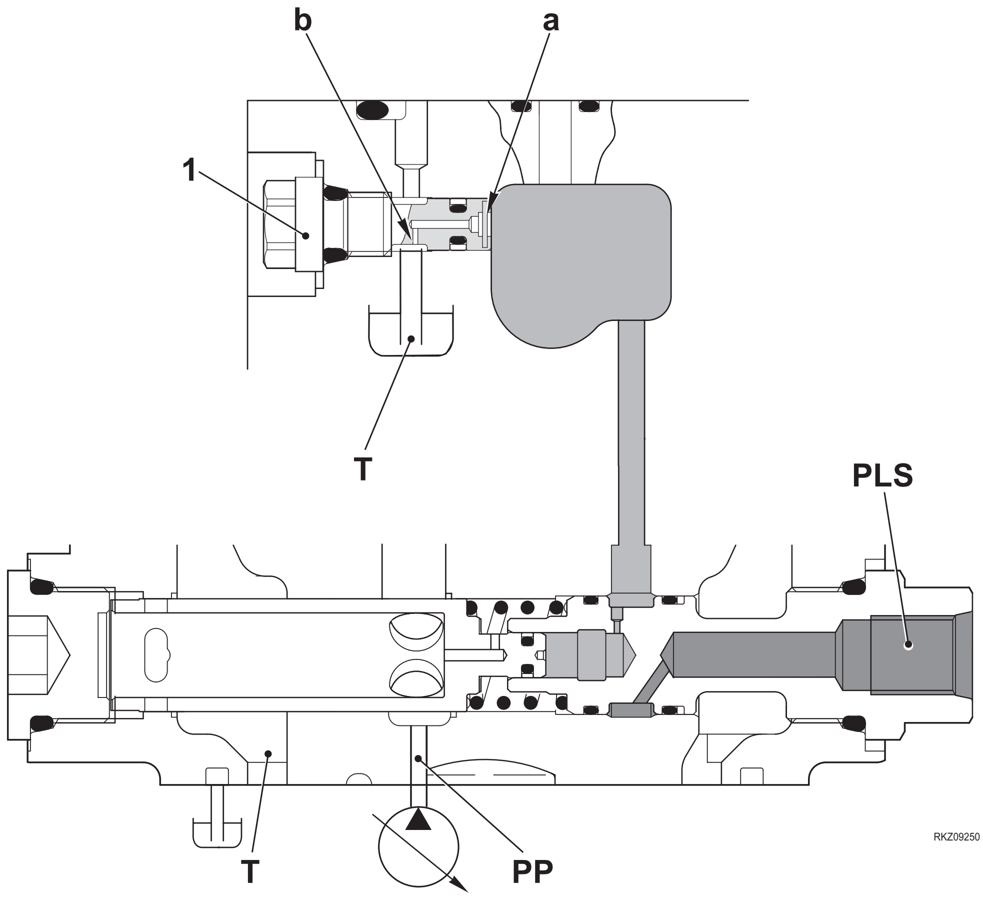
- When the spool (1) is operated, pump pressure **PP** starts flowing into the circuit of actuator **A** through the duct **a**.
- At the same time, pressurised oil is introduced into the **PLS** circuit of the **LS** through holes **b**.

★ The outriggers circuit differs from the working equipment circuit in that the operating pressure of actuator **A** is introduced directly into the **PLS** circuit of the **LS**.

3.4 LS BY-PASS PLUG

Description

- The **LS** by-pass plug unloads residual pressure from the Load Sensing's **PLS** circuit.
- This makes the increment rate of Load Sensing's **PLS** pressure smoother.
  Moreover, by eliminating oil (through the bottleneck), a loss of pressure is generated in the flow that is controlled by the spool, and stability is increased as a result, thereby reducing the actual differential pressure **LS**.



Functioning

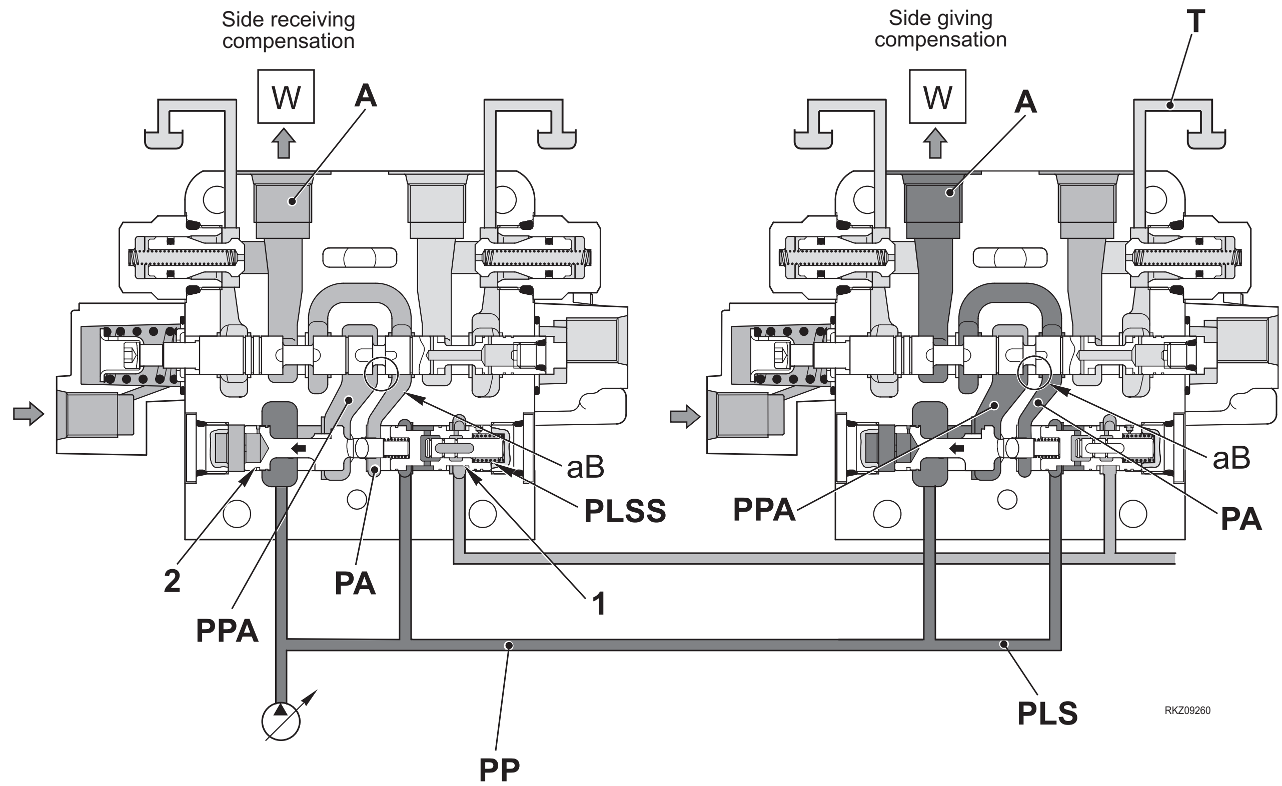
- Pressurised oil in the Load Sensing **PLS** circuit flows through filter **a**, through orifice **b** and into the tank circuit **T**.

PP = Pump circuit
PLS = Load Sensing circuit
T = Drain circuit

3.5 PRESSURE COMPENSATION VALVES

Function

- Pressure compensation occurs during simultaneous operation of several movements, specifically when the pressure of an actuator becomes lower than the pressure of the actuator on the opposite side, and pump delivery is on the verge of being increased.
  In this specific case, the RH actuator withstands a higher pressure than the LH actuator.



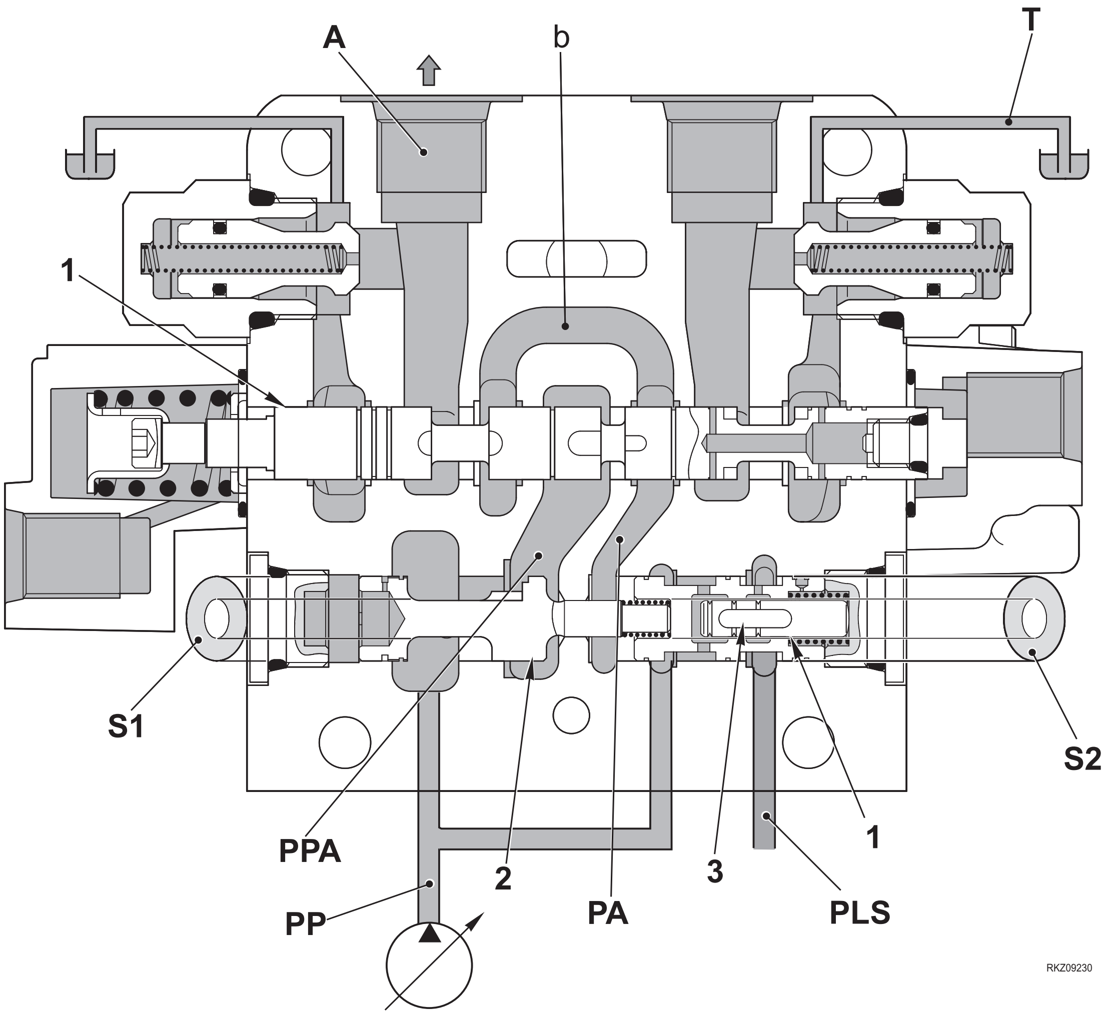
Functioning

- During simultaneous operation, when RH actuator pressure increases, delivery in circuit **A** of the LH actuator tends to increase.
- In this case, the **PLS** pressure of the **LS** for the RH actuator acts on chamber **PLS1** of the spring and pushes the pressure reducing valve (1) and the delivery control valve (2) to the left.
- The delivery control valve (2) produces a bottleneck between the pump's delivery **PP** circuit and the **PPA** circuit upstream of the control valve spool.
  This bottleneck generates a pressure loss between circuits **PP** and **PPA**.
- The delivery control valve (2) and the pressure reducing valve (1) are balanced out at a point where the differential pressure between **PA** and **PLS** (these two acting on both surfaces of the pressure reducing valve (1)), equals the loss of pressure between **PP** and **PPA** (these two acting on both surfaces of the delivery control valve (1)).
- The differential pressure between the upstream pressure **PPA** and the downstream pressure of both spools in the control valves concerned in the simultaneous movements are equalised, and pump delivery is distributed proportionally to the sections **a** that are responsible for opening the notches of each spool.

3.6 PRESSURE COMPENSATION VALVE SURFACE/SURFACE RATIO

Function

- In order to equalize the characteristics of each actuator, the pressure compensation valve will determine the compensation characteristics by performing a micrometer adjustment of the surface ratio **S1/S2**. This is the ratio of area **S1** (delivery control valve (2) end) to area **S2** (pressure reducing valve (1) end).
  S1 = surface of the delivery control valve (2) – Surface of piston (3).
  S2 = surface of pressure reducing valve (1) – Surface of piston (3).



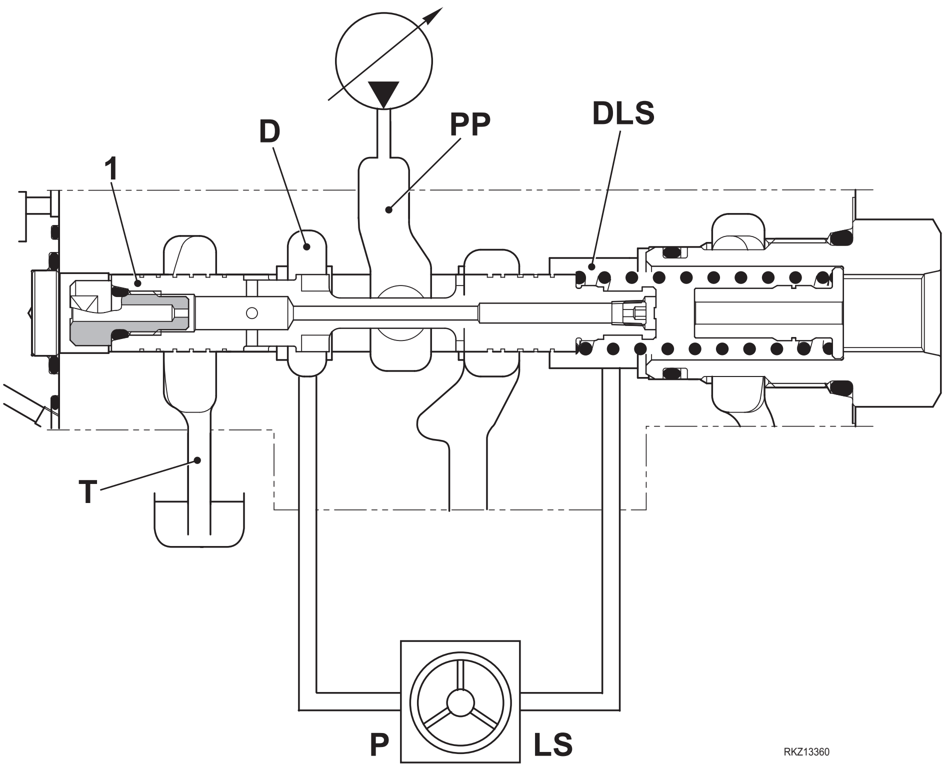
Surface ratio (S1:S2) and compensation characteristics

- When the ratio is 1.00 :
  [Pump pressure **PP** – Pressure **PPA** upstream of spool] ≒ [Load Sensing **PLS** pressure – Actuator **PA** pressure (= **A**)]
  Delivery is distributed proportionally to the opening surfaces of the spool.
- When the ratio is greater than 1.00: **PP** – **PPA** > **PLS** – **PA** (= **A**)
  Delivery distribution is lower than the proportion of the opening surfaces of the spool.
- When the ratio is lower than 1.00: **PP** – **PPA** < **PLS** – **PA** (= **A**)
  Delivery distribution is higher than the proportion of the opening surfaces of the spool.

3.7 PRIORITY VALVE

Function

- The purpose of the priority valve is to feed pressurised oil to the steering unit and to the other actuators.
- Oil distribution is determined by the position of the spool (1) of the priority valve, which is in turn determined by LS signal, pump delivery, steering circuit pressure, and hydraulic circuit pressure.
- The position of the spool (1) is determined in such a way as to ensure that the oil delivered to the steering unit matches the delivery needs at any time.



1= Priority valve spool

PP = Pump circuit

D = Steering unit feed circuit

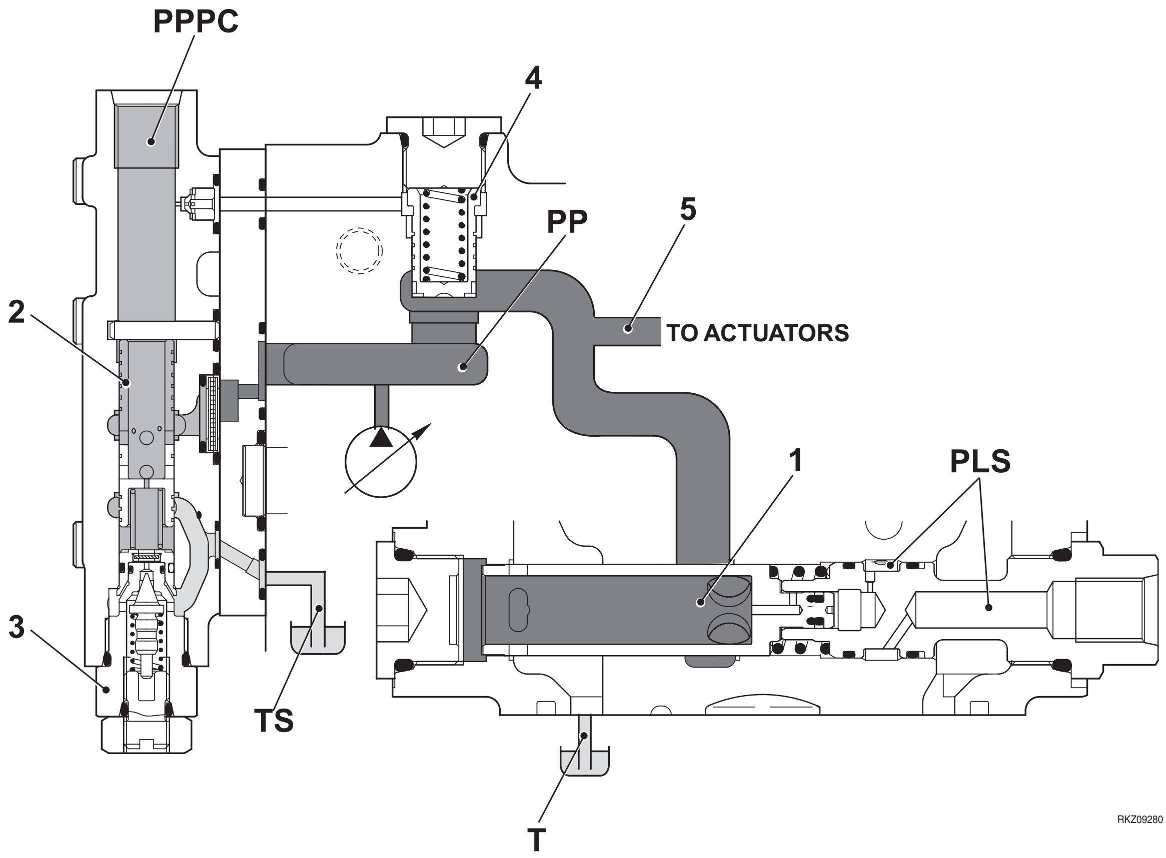
DLS = Steering unit LS signal

3.8 SERVOCONTROLS REDUCING VALVE

Function

- This valve regulates the servocontrol feed pressure at 29 bar (30 kg/cm^2).
- When actuator pressure is low, the sequential valve closes to permit an increase in the pump's delivery pressure **PP** in order to supply pressure to the servocontrols.

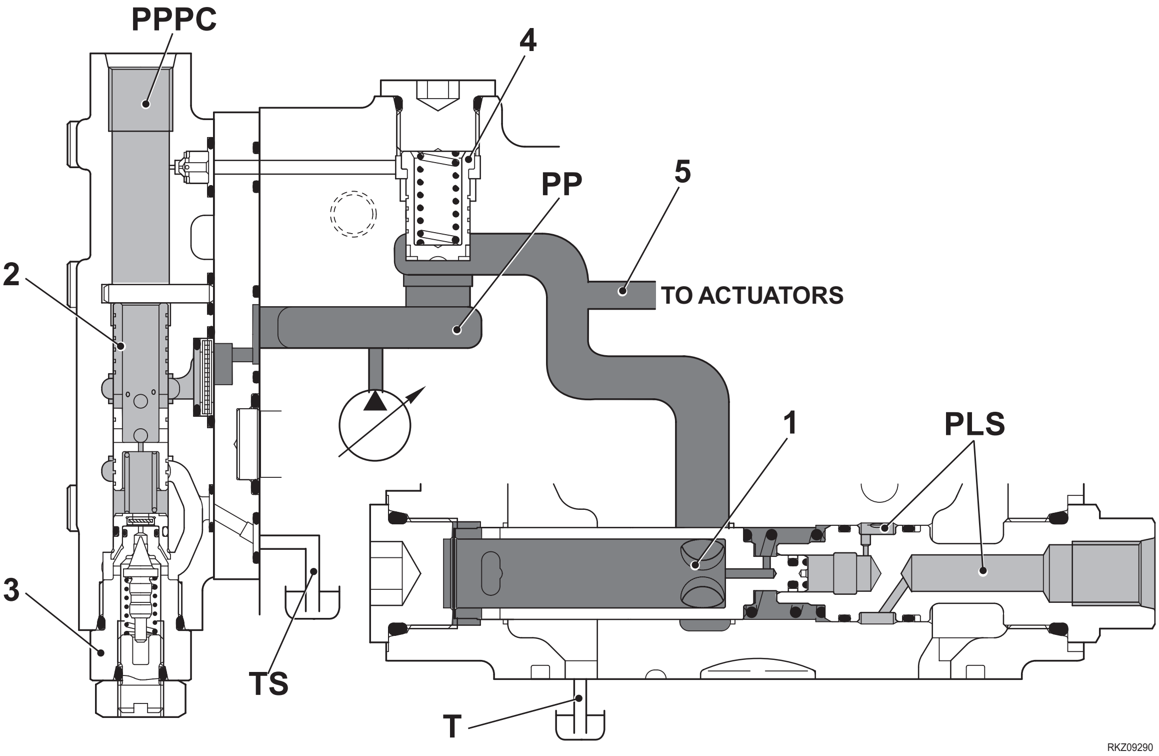
3.8.1 When all actuators are in a neutral condition



Functioning

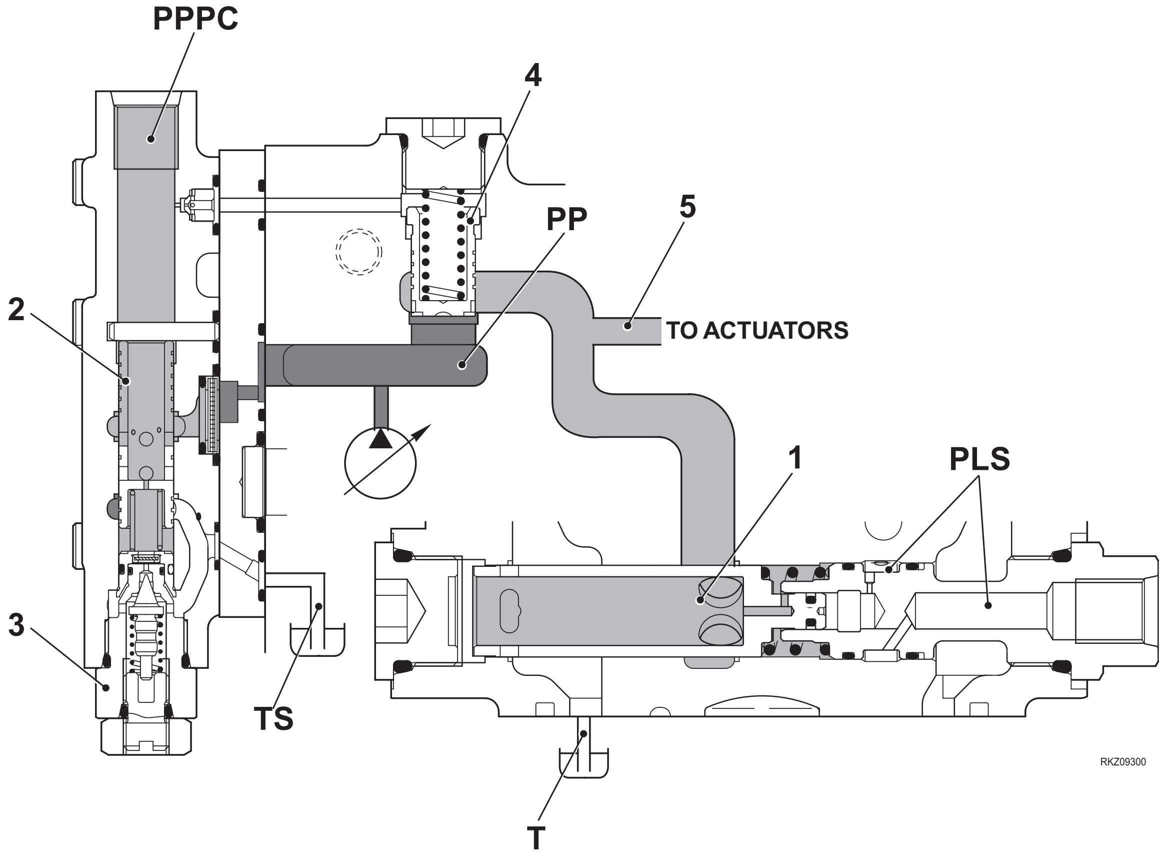
- The spool (1) of the unloading valve moves, and delivery pressure is regulated at 29 bar (30 kg/cm^2). (For details, see 3.2 UNLOADING VALVE).
- The spool (2) and valve (3) reduce the pump's delivery pressure **PP** to 29 bar (30 kg/cm^2) . Pressure is then sent to the servocontrols via port **PC.**

3.8.2 When the control valve is operated



Functioning

- The spool (1) of the unloading valve moves to the left, and the pump's delivery pressure exceeds the pressure of the actuator circuit (5) by an amount equivalent to LS differential pressure.
  (For details, see 3.2 UNLOADING VALVE).
- If the pump's delivery pressure **PP** exceeds 29 bar (30 kg/cm^2), valves (2) and (3) reduce pressure **PP** to 29 bar (30 kg/cm^2).
  The reduced pressure is then sent to the servocontrols via port **PC**.
- When this occurs, the sequential reducing valve (4) stays open.



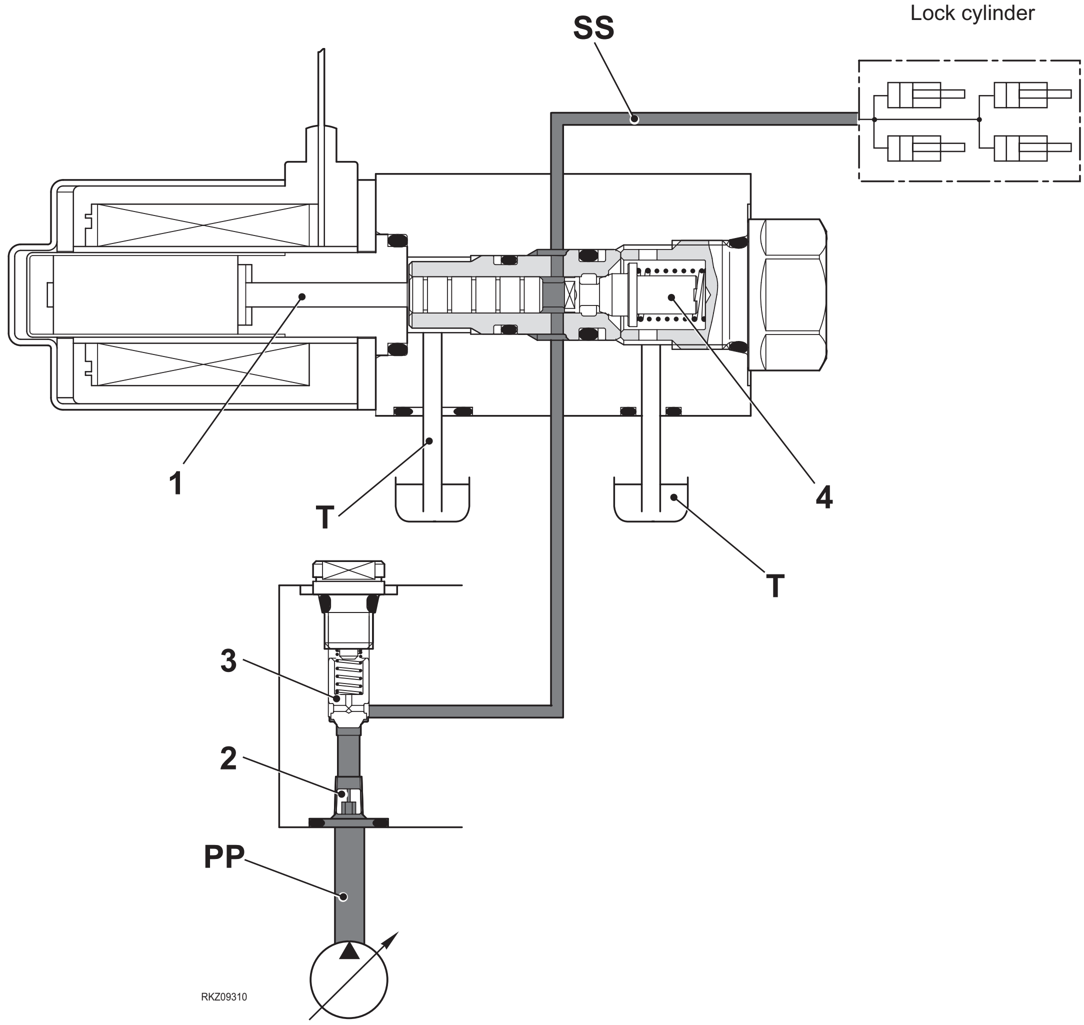
- When the pump's delivery pressure **PP** is lower than 29 bar (30 kg/cm^2), the sequential reducing valve shifts to the right, thereby reducing the flow of the **PP** pressure to the actuator circuit (5).
  This generates a pressure gap between **PP** pressure and actuator pressure.
  PP pressure is incremented in excess of 29 bar (30 kg/cm^2) and is then reduced to 29 bar (30 kg/cm^2) by valves (2) and (3) to guarantee pressure feed to the servocontrols.

3.9 BACKHOE PLATE LOCK SOLENOID VALVE

Function

- The purpose of this solenoid valve is to send pump delivery pressure PP to backhoe plate lock cylinders.

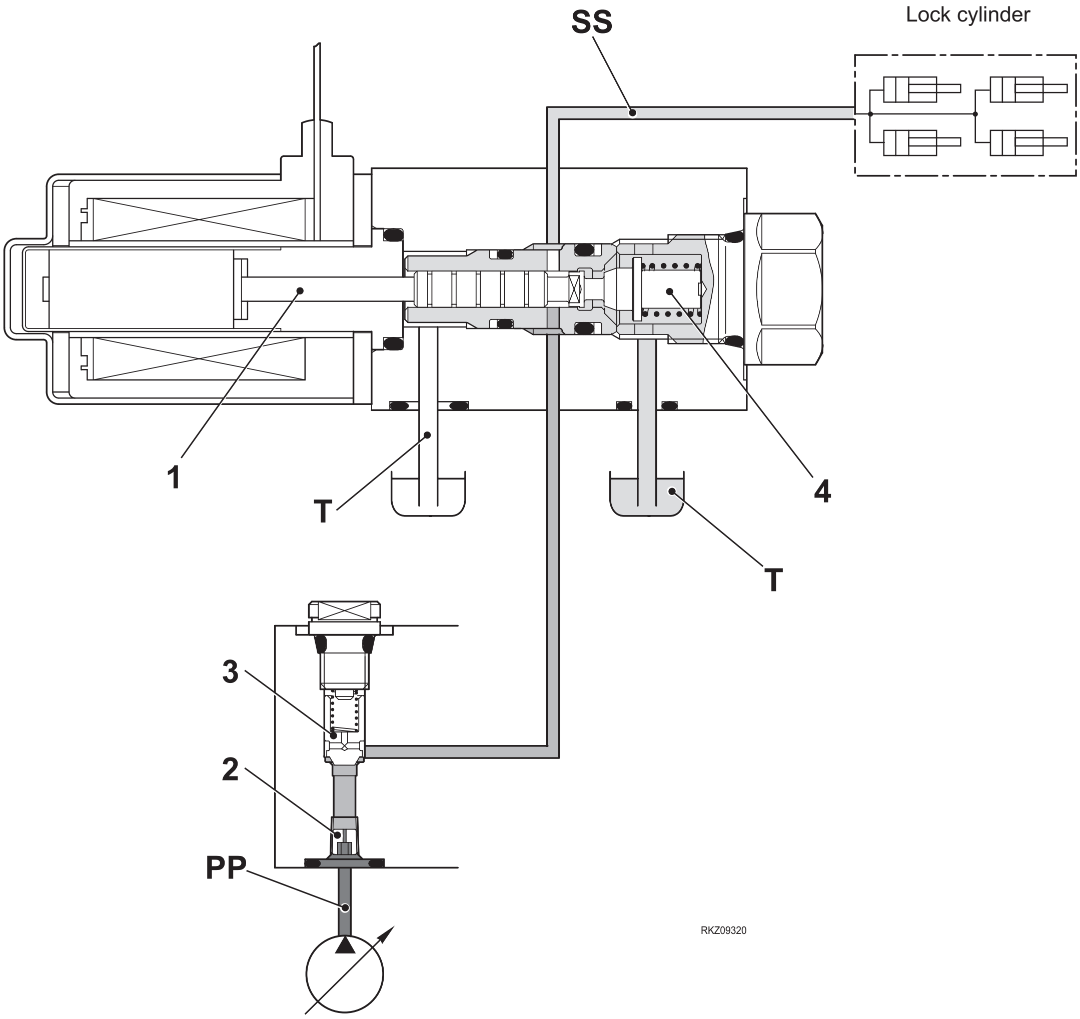
3.9.1 When the solenoid valve is deenergized



Functioning

- When the solenoid valve is deenergized, pump delivery pressure **PP** flows through orifice (2) and check valve (3) and into the **SS** circuit of the plate lock cylinders.
- When the entire circuit reaches pump delivery pressure **PP**, the check valve (3) lowers, thereby dividing the circuit, which is therefore kept at the maximum pressure reached by the delivery circuit.

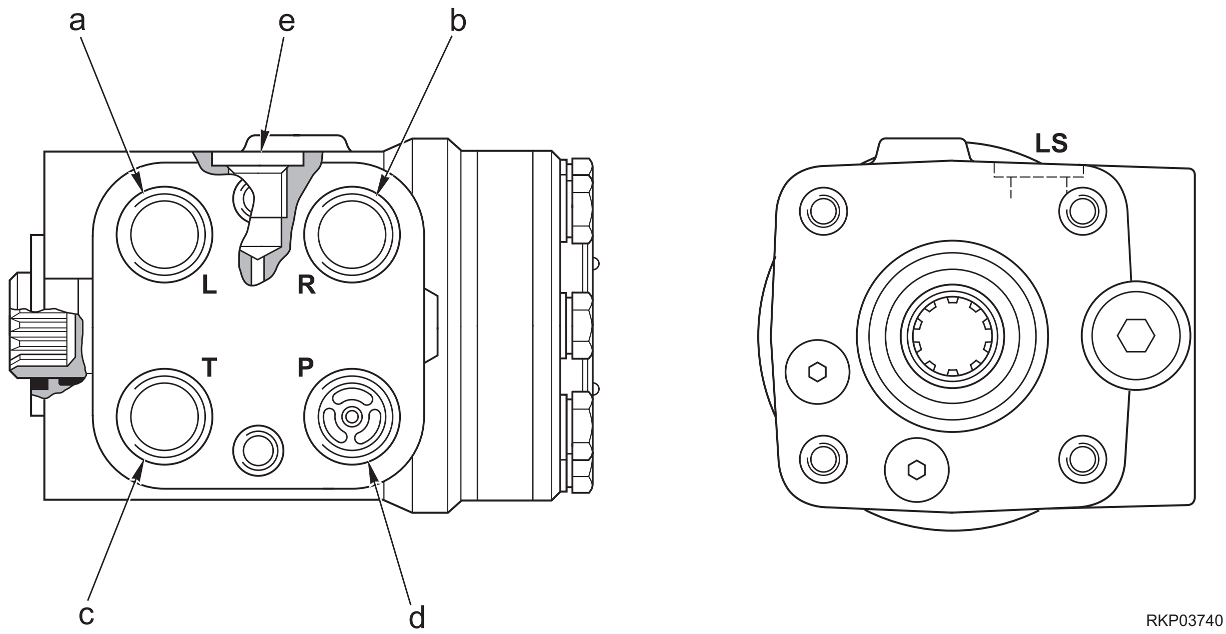
3.9.2 When the solenoid valve is energized



Functioning

- When the solenoid valve is energized, pressurised oil in the **SS** circuit is sent to the tank circuit through spool (4).
- As a result, the **SS** circuit pressure decreases, and the plate is released, so it can be shifted.

STEERING UNIT



a. L Port - To solenoid valve group EV2 (F1 Port)
b. Port R - To steering cylinder (b Port)
c. Port T - To hydraulic tank
d. Port P - From control valve (D port)
e. Port LS - To control valve (DLS port)

TECHNICAL DATA

Steering unit type: OSPC200LS

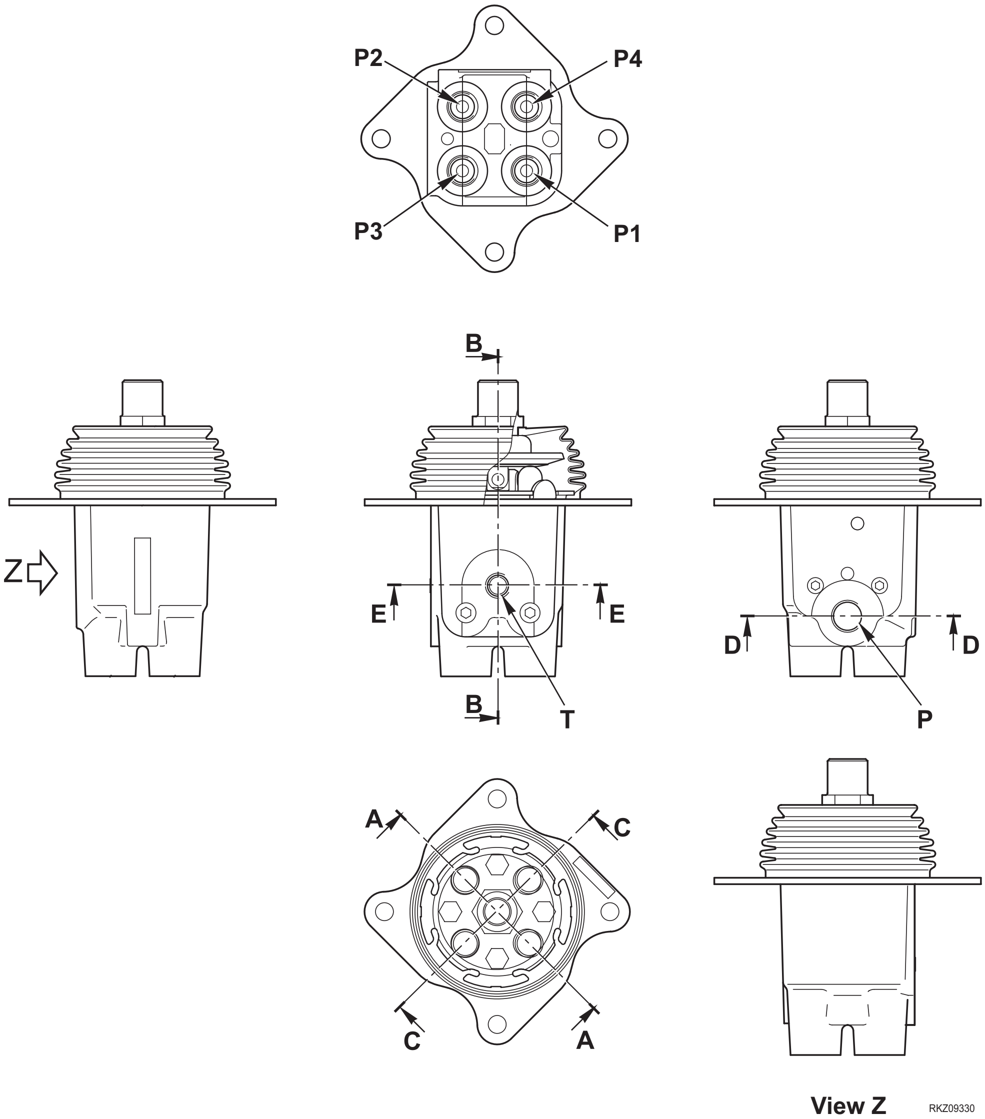
Nominal flow: 20 ℓ

OPERATION

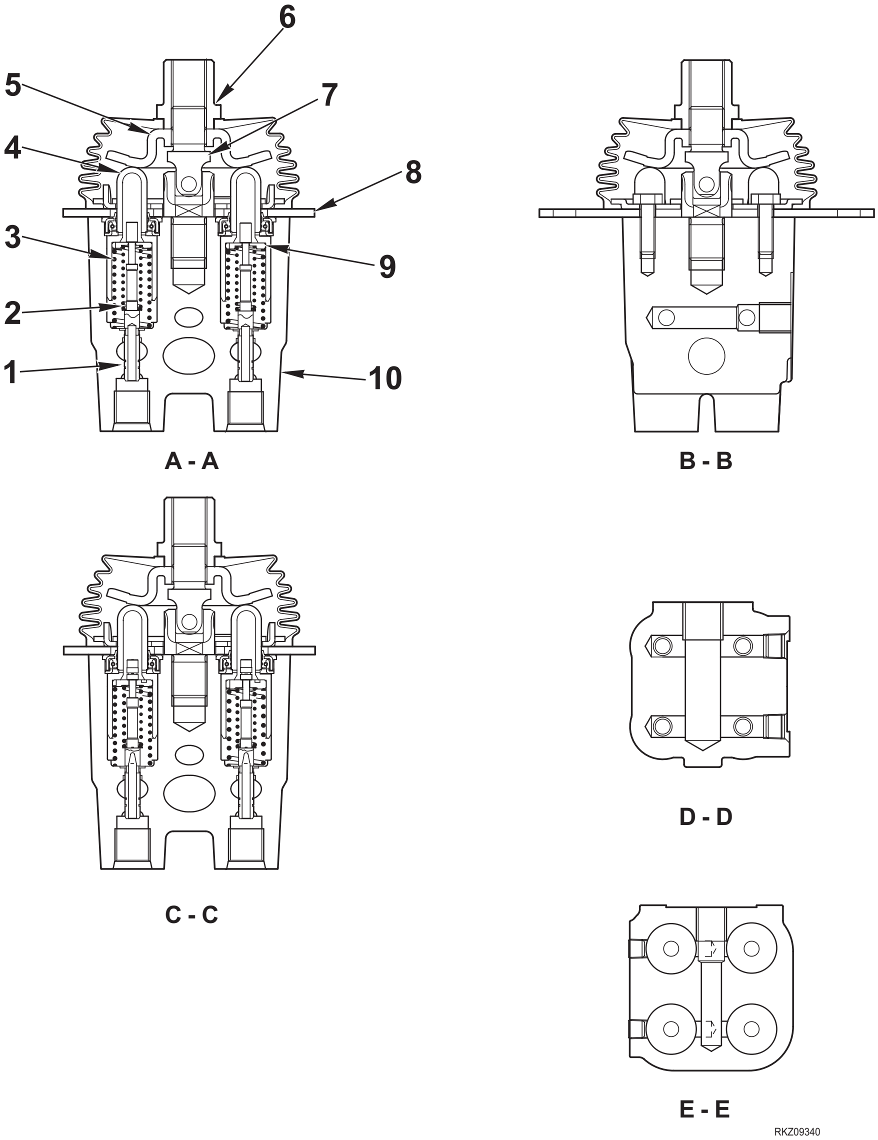
- The steering unit is composed of a control valve and a rotating oil dispenser, and is of the hydrostatic type.
- When the steering wheel is turned, the control valve sends oil from the pump (by means of the rotating oil dispenser) to one of the sides of the steering cylinder. The rotating dispenser 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.

PPC VALVES

SHOVEL PPC VALVE (STANDARD)



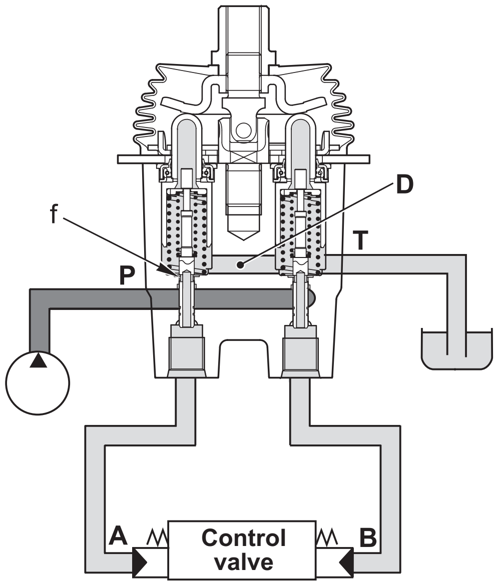
P1 port - To control valve (PB3 port)
P2 port - To control valve (PA3 port)
P3 port - To control valve (PA8 port)
P4 port - To control valve (PB8 port)
P port - From EV1 solenoid valve group (VL port)
Port T - To hydraulic tank



1. Spool
2. Adjusting screw (inner)
3. Adjusting screw (outer)
4. Piston
5. Disk
6. Nut
7. Joint
8. Cover
9. Retainer
10. Body

OPERATION

1. **Control lever in neutral position**
   Control valve ducts **A** and **B** and PPC valve ducts **P1** and **P2** are connected to discharge chamber **D** by means of the calibrated hole **f** in spool (1).



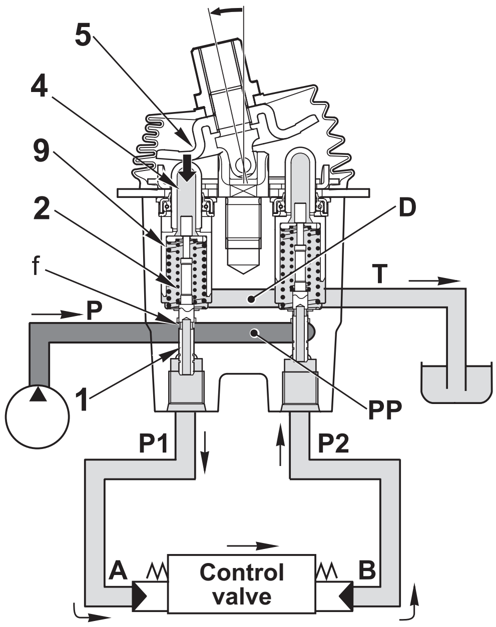
RKZ09450

2. **During fine control (NEUTRAL → Actuator)**
   When the disk (5) starts pushing down on the piston (4), the retainer (9) moves as a result. This movement will compress the spring (2) which will in turn act on the spool (1) and push it downwards.
   As a result of this action, the calibrated hole **f** will be isolated from the discharge chamber **D** and at almost at the same time it will be put in connection with the **PP** chamber, which is directly connected to the servocontrols circuit.
   Pressure in the servocontrols circuit will flow through the calibrated hole**f** and into the circuit thereby increasing the pressure in duct **P1-A**.
   When pressure **P1** increases, spool (1) is pushed upwards, and calibrated hole **f** is connected back to discharge chamber **D** thereby compressing the spring (2).
   The floating of the spool (1) will continue until calibrated hole **f** is halfway between discharge chamber **D** and pressure chamber **PP**, in other words until the pressure in duct **P1** – the pressure acting on the section of stem (1) – offsets the force applied by the spring (2).
   The spring (2) is compressed proportionally to the movement of the disk (5) and therefore, pressure at **P1** increases in proportion to the travel of the disk (5).
   The equilibrium position is then kept until the position of piston (4) is changed, i.e.:

   a) as long as pressures at ports **A** and **P1** are perfectly balanced;

   b) until pressure in section **A-P1** – i.e. the pressure acting on stem (1) – is enough to counteract the force of the spring (2).

   This ensures proportionality between control lever position, **A-P1** circuit pressure, and main control valve stem displacement.



RKZ09470

3. **During fine control (Actuator→ NEUTRAL)**

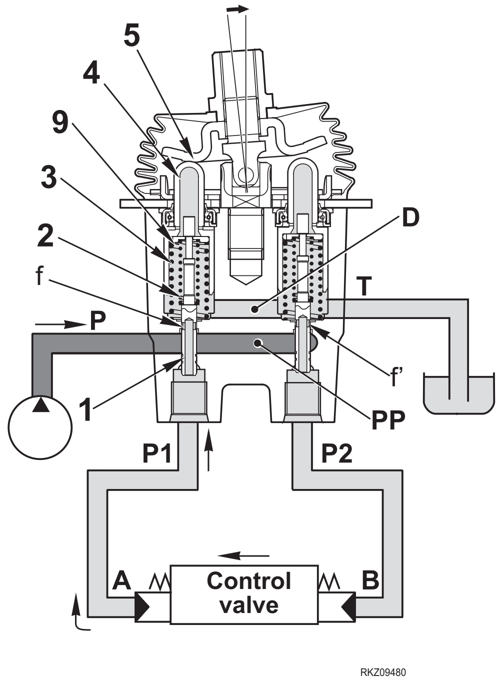
When the disk (5) is released and moved to neutral position, the piston (4) is pushed upwards by the spring (3) acting on the retainer (9), and spool (1) is thrusted upwards both by the force of spring (2) and by the force that the pressure in section **A-P1** applies against the stem.

This movement moves the calibrated hole **f** of spool (1) into the discharge chamber **D**, thereby allowing pressure in section **A-P1** to be released.

If pressure **P1** drops too quickly, spool (1) is pushed downwards by spring (2) and the calibrated hole **f** becomes cut off from the discharge chamber **D**; at almost the same time, the calibrated hole **f** is put in connection with pressure chamber **PP** and starts supplying pressure to section **P1** until the pressure corresponding to the control lever position is balanced.

When the spool of the control valve returns, oil flows back into chamber **D**, through calibrated hole **f'**, and into chamber **B** of the control valve spool opposite the operating one.

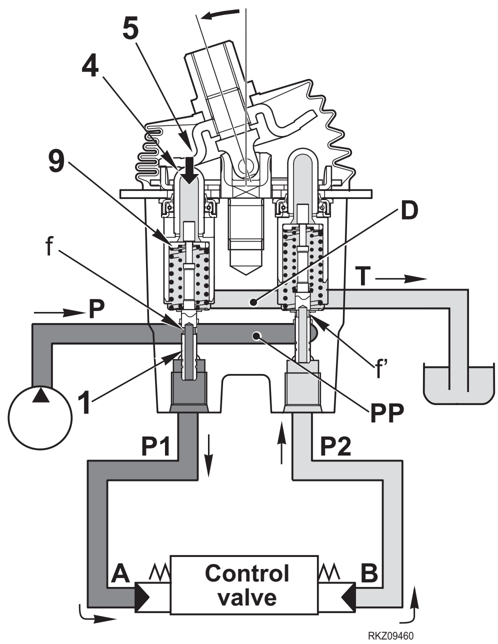
Oil flows through duct **P2** and into chamber **B** to ensure it is filled properly.



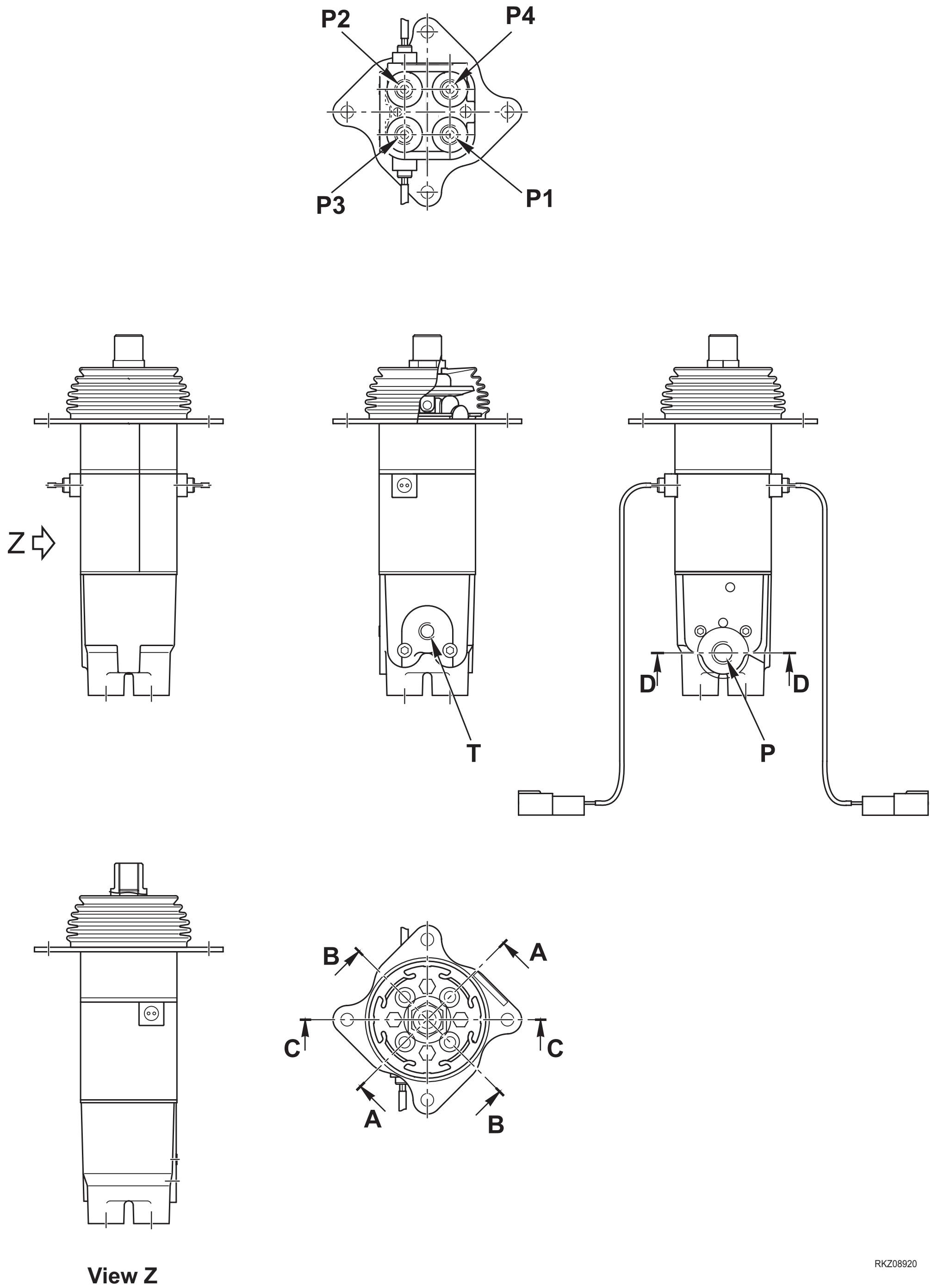
4. **During fine control (NEUTRAL → Full stroke)**

When the disk (5) pushes down on the piston (4), and the retainer (9) pushes down on the spool (1), calibrated hole **f** is put in direct connection with chamber **PP**, which is in turn connected to a constantly pressurised servocontrols circuit.

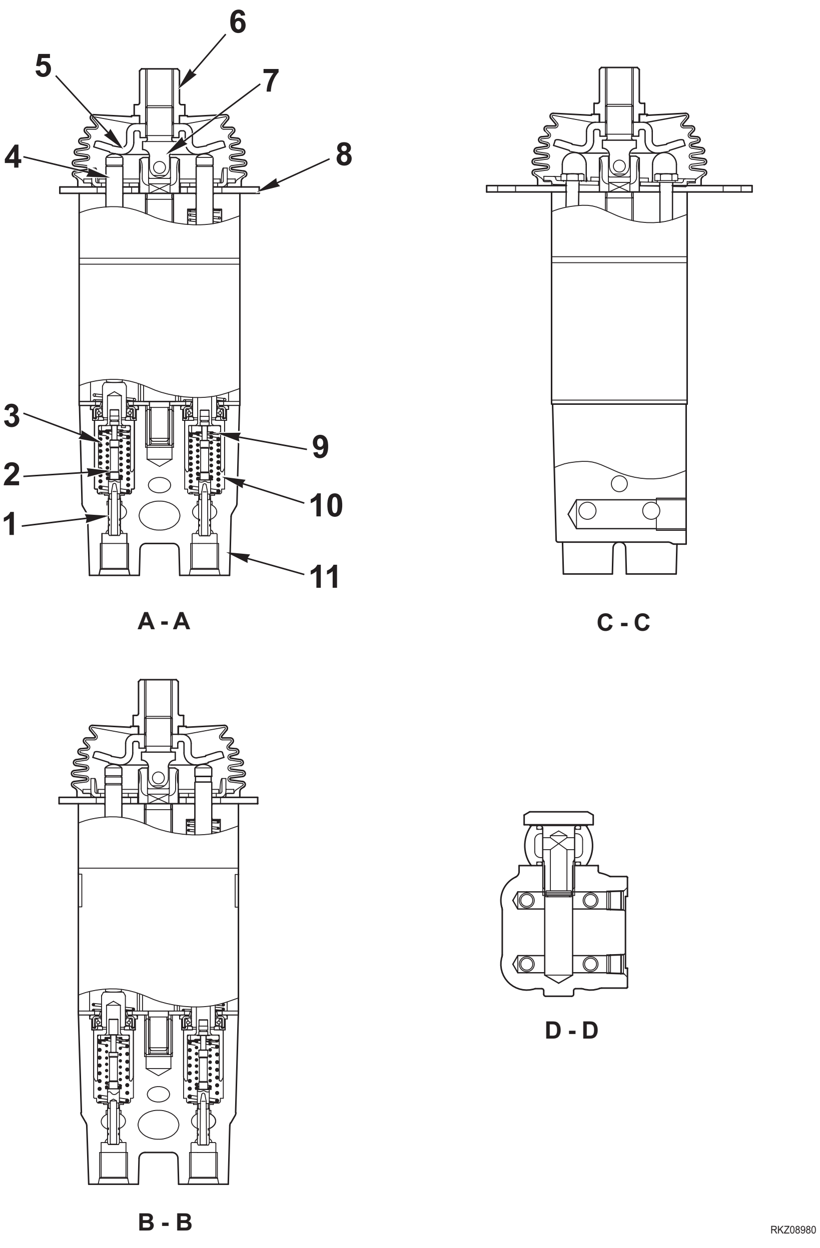
Oil is then allowed to flow directly into section **A-P1**, thereby pushing the stem of the main control valve to the end of its travel. This causes the main control valve to send the oil contained in chamber **B** towards input **P2**, through calibrated hole **f'** and into discharge chamber **D**.



SHOVEL PPC VALVE (FLOAT + RETURN TO DIG)



P1 port -	To control valve (PB3 port)
P2 port -	To control valve (PA3 port)
P3 port -	To control valve (PA8 port)
P4 port -	To control valve (PB8 port)
P port -	From EV1 solenoid valve group (VL port)
Port T -	To hydraulic tank

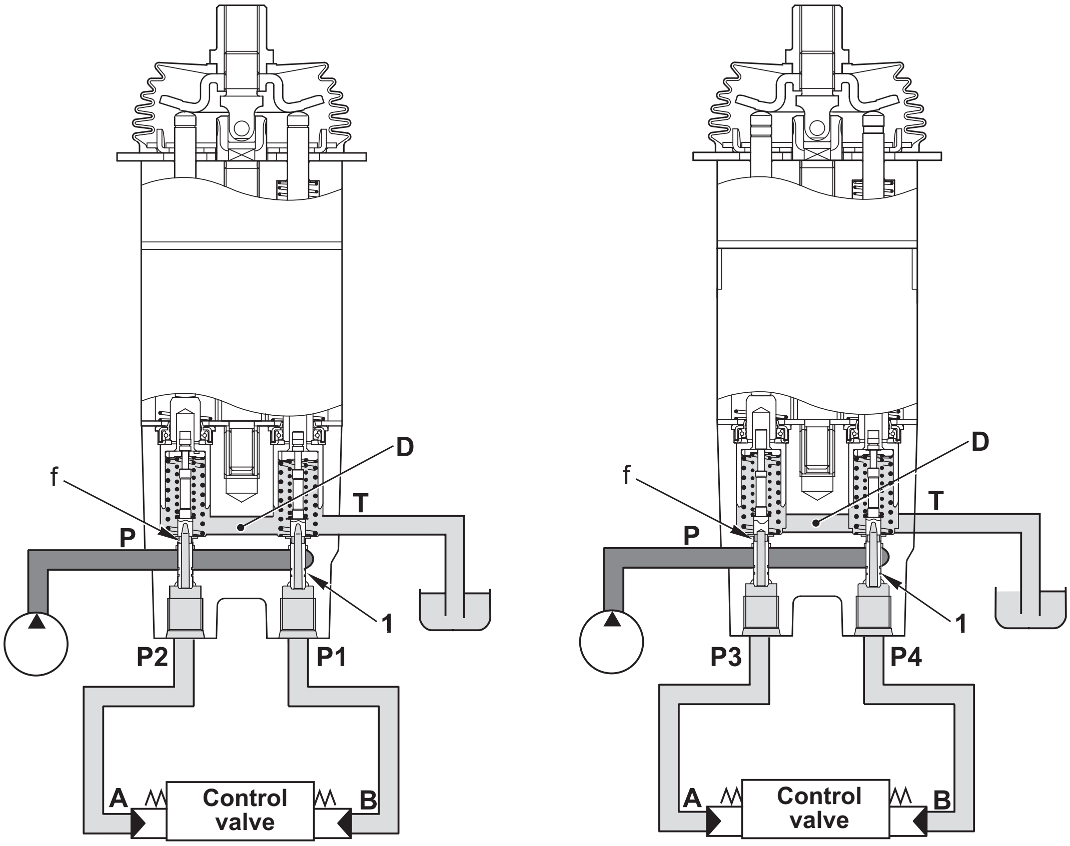


1. Spool
2. Adjusting screw (inner)
3. Adjusting screw (outer)
4. Piston
5. Disk
6. Disk
7. Joint
8. Cover
9. Retainer
10. Piston
11. Body

OPERATION

1. Control lever in neutral position

- **Shovel PPC valve**
  Control valve ducts **A** and **B** and PPC valve ducts **P1** and **P2** are connected to discharge chamber **D** by means of the calibrated hole **f** in spool (1).
- **Shovel raise PPC valve**
  Control valve ducts **A** and **B** and PPC valve ducts **P3** and **P4** are connected to discharge chamber **D** by means of the calibrated hole **f** in spool (1).



RKZ08990

2. During fine control (NEUTRAL → Actuator)

When the disk (5) starts pushing down on piston (4) and piston (10), the retainer (9) moves as a result. This movement will compress the spring (2) which will in turn act on the spool (1) and push it downwards.

As a result of this action, the calibrated hole **f** will be isolated from the drain chamber **D** and at almost at the same time it will be put in connection with the **PP** chamber, which is directly connected to the servocontrols circuit.

Pressure in the servocontrols circuit will flow through the calibrated hole**f** and into the circuit thereby increasing the pressure in duct **P1-B**.

When pressure **P1** increases, spool (1) is pushed upwards, and calibrated hole **f** is connected back to discharge chamber **D** thereby compressing the spring (2).

The floating of the spool (1) will continue until calibrated hole **f** is halfway between discharge chamber **D** and pressure chamber **PP**, in other words until the pressure in duct **P1** – the pressure acting on the section of stem (1) – offsets the force applied by the spring (2).

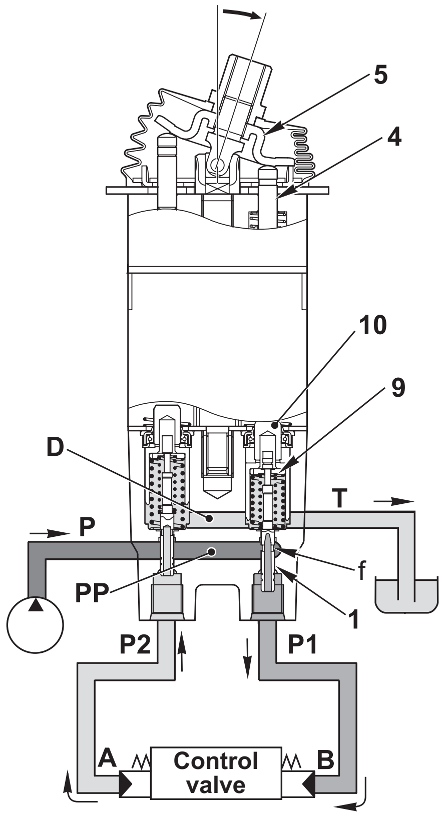
The spring (2) is compressed proportionally to the movement of the disk (5) and therefore, pressure at **P1** increases in proportion to the travel of the disk (5).

The equilibrium position is then kept until the position of piston (4) is changed, i.e.:

a) as long as pressures at ports **B** and **P1** are perfectly balanced;

b) until pressure in section **B-P1** – i.e. the pressure acting on stem (1) – is enough to counteract the force of the spring (2).

This ensures proportionality between control lever position, **B-P1** circuit pressure, and main control valve stem displacement.



RKZ09000

3. During fine control (Actuator→ NEUTRAL)

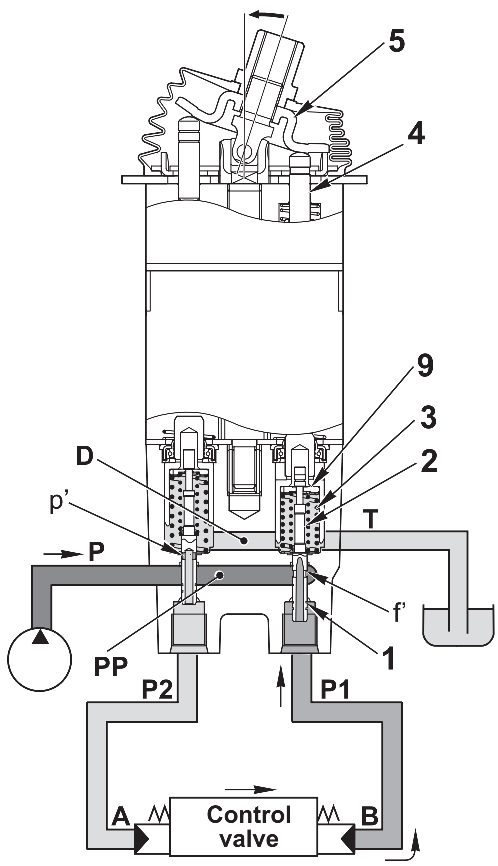
When the disk (5) is released and moved to neutral position, the piston (4) is pushed upwards by the spring (3) acting on the retainer (9), and spool (1) is thrusted upwards both by the force of spring (2) and by the force that the pressure in section **B-P1** applies against the stem.

This movement moves the calibrated hole **f** of spool (1) into the discharge chamber **D**, thereby allowing pressure in section **B-P1** to be released.

If pressure **P1** drops too quickly, spool (1) is pushed downwards by spring (2) and the calibrated hole **f** becomes cut off from the discharge chamber **D**; at almost the same time, the calibrated hole **f** is put in connection with pressure chamber **PP** and starts supplying pressure to section **P1** until the pressure corresponding to the control lever position is balanced.

When the spool of the control valve returns, oil flows back into chamber **D**, through calibrated hole **f'**, and into chamber **B** of the control valve spool opposite the operating one.

Oil flows through duct **P2** and into chamber **B** to ensure it is filled properly.

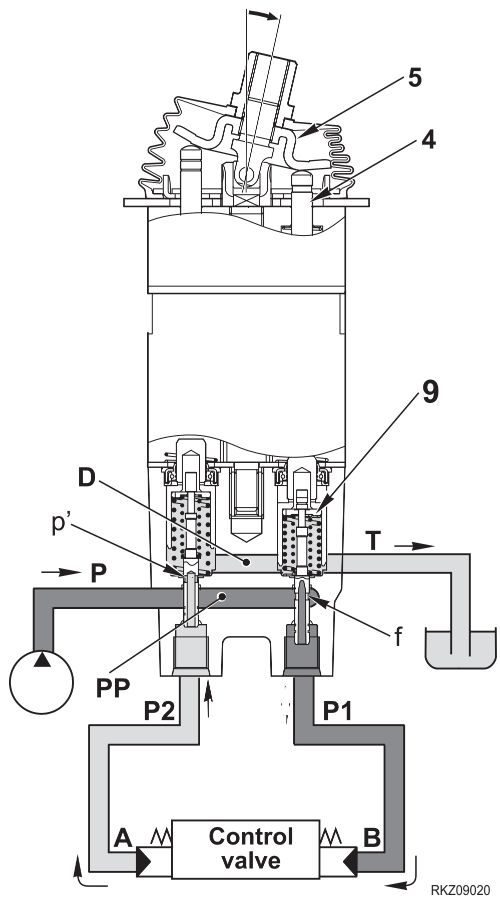


RKZ09010

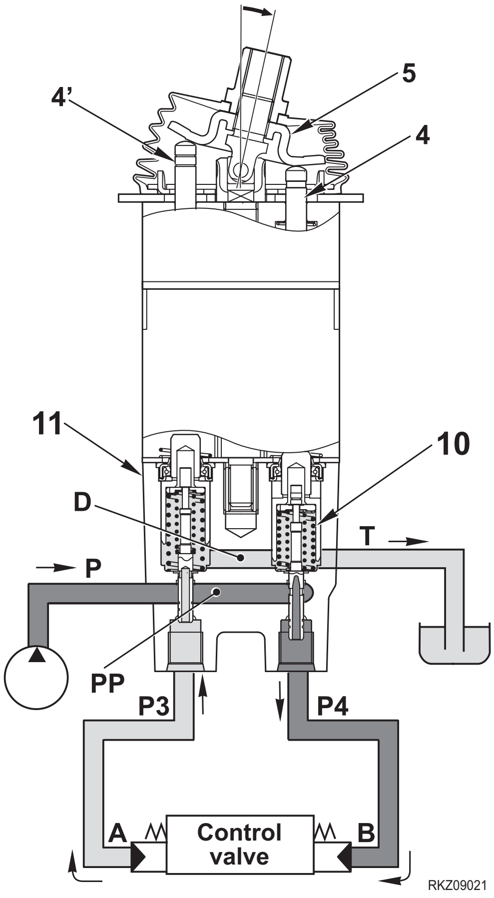
4. During fine control (NEUTRAL → Full stroke)

When the disk (5) pushes down on the piston (4), and the retainer (9) pushes down on the spool (1), calibrated hole **f** is put in direct connection with chamber **PP**, which is in turn connected to a constantly pressurised servocontrols circuit.

Oil is then allowed to flow directly into section **B-P1** thereby pushing the stem of the main control valve to the end of its travel. This causes the main control valve to send the oil contained in chamber **AB** towards input **P2**, through calibrated hole **f'** and into relief chamber **D**.



RKZ09020



5. When control lever is moved to float position

If piston (4) and piston (10) of the spool controlling the arm (port P4) are pushed downwards by disk (5), the mechanism inside the PPC valve will start locking the spool halfway along its travel.

If piston (4') is pushed upwards and the solenoid in the PPC valve is energized, the force generated by the solenoid will retain the piston (4') in place and the arm float condition will be retained – even if the lever is released.

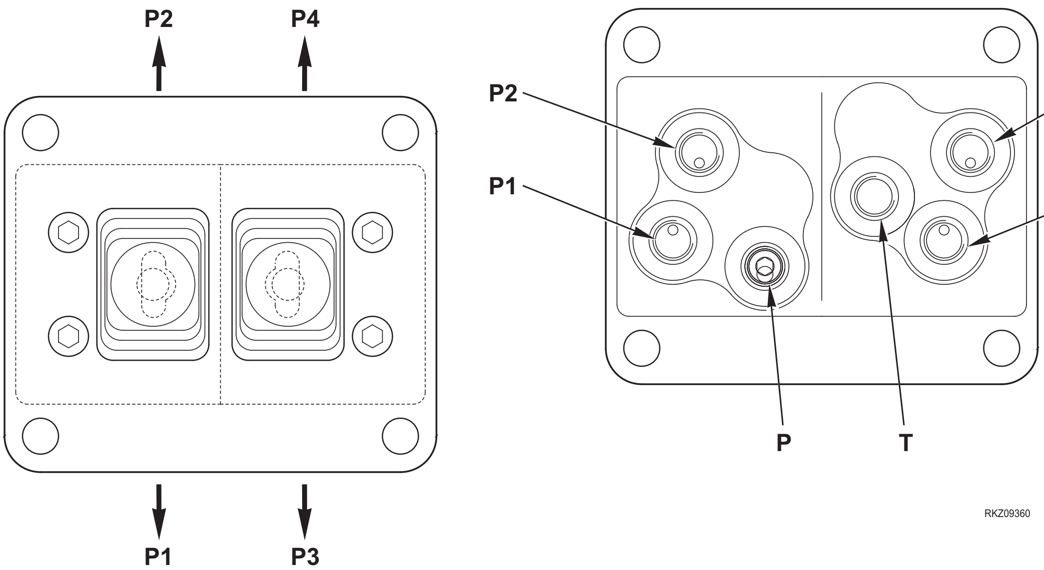
At the same time, the control valve will also be activated and retained in the arm float position.

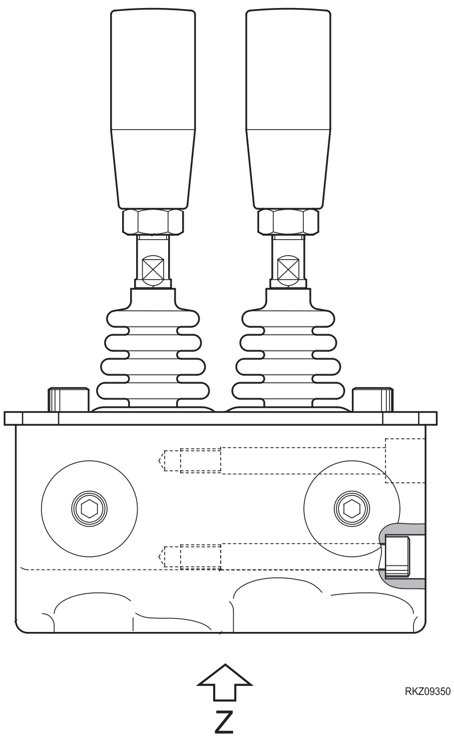
6. When control lever is moved from float back to neutral position

The disk (5) can be moved back to neutral position by applying a force that exceeds the force applied by the solenoid.

The floating state can also be cancelled, and the lever can move back to neutral position, denergizing the solenoid.

OUTRIGGERS PPC VALVE





P1 port - To control valve (8 spools) (PA7 port)
To control valve (10 spools) (PA9 port)

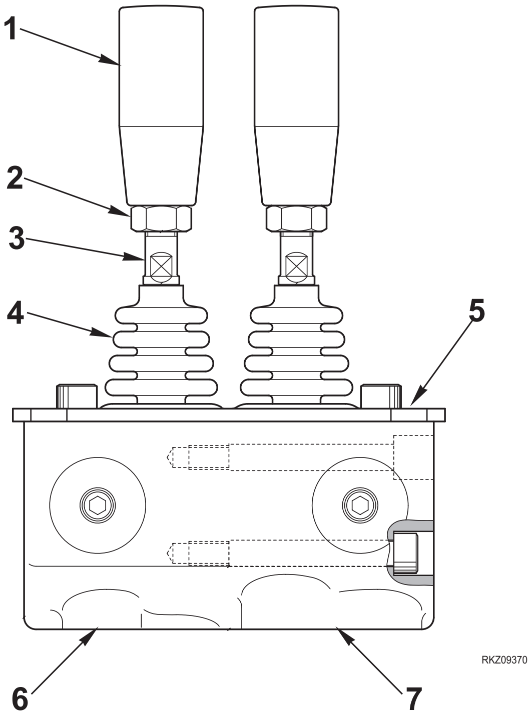
P2 port - To control valve (8 spools) (PB7 port)
To control valve (10 spools) (PB9 port)

P3 port - To control valve (8 spools) (PA8 port)
To control valve (10 spools) (PA10 port)

P4 port - To control valve (8 spools) (PB7 port)
To control valve (10 spools) (PB10 port)

P port - To EV1 solenoid valve group (P2 port)

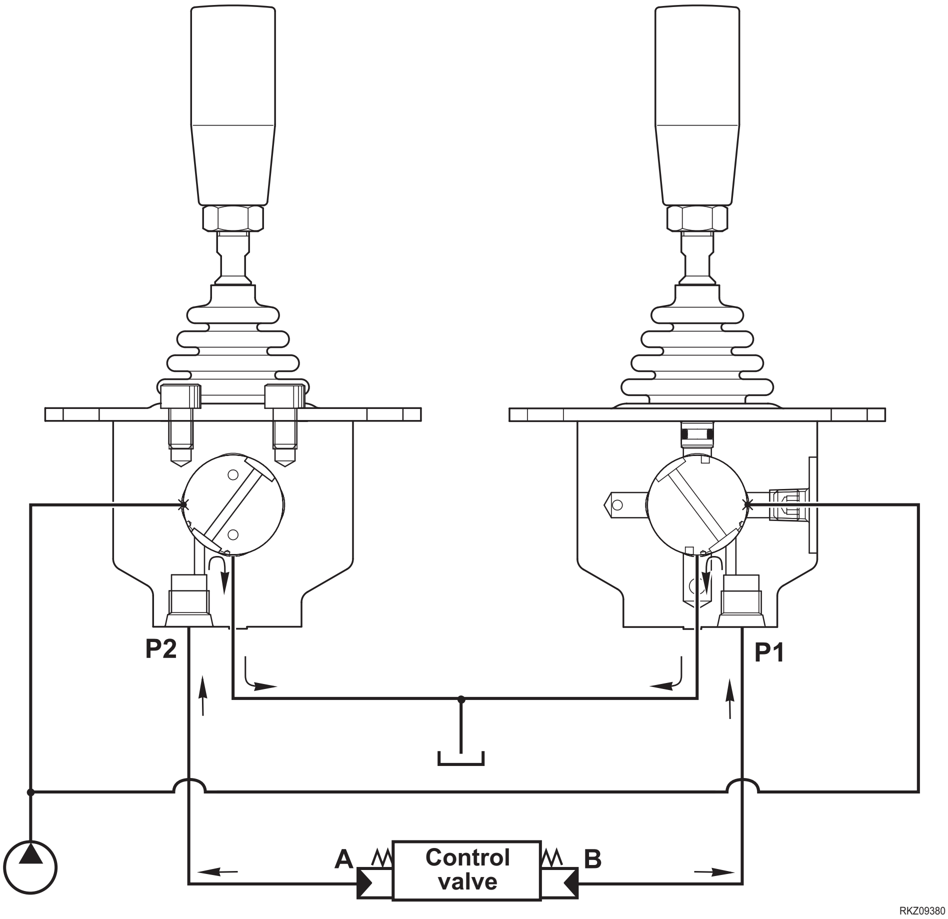
Port T - To hydraulic tank



1. knob
2. Nut
3. Lever
4. Boot
5. Plate
6. LH PPC valve body
7. RH PPC valve body

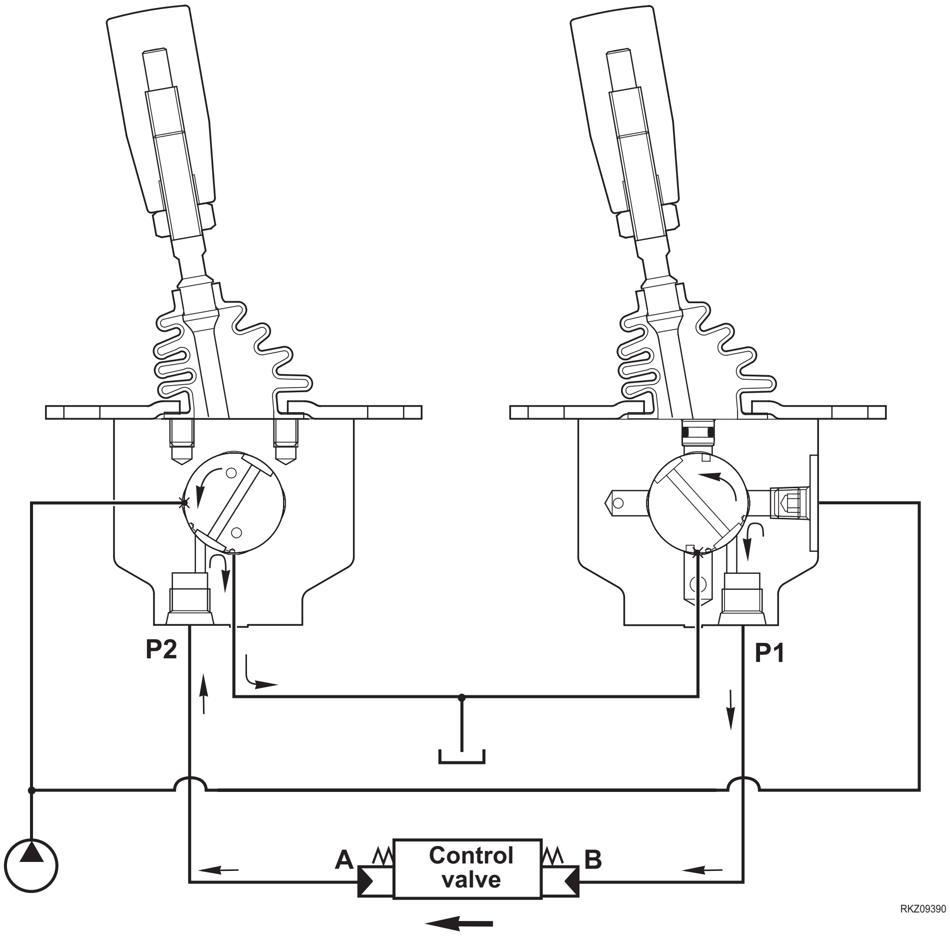
OPERATION

1. Control lever in neutral position



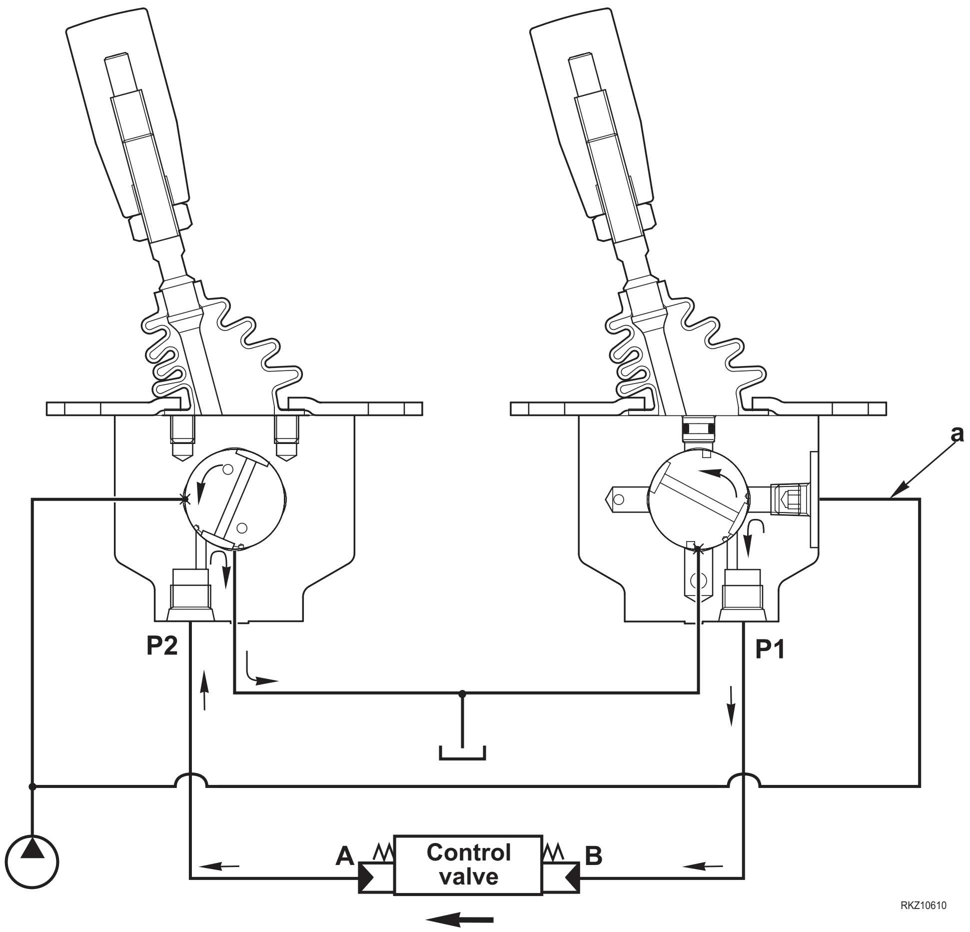
- Ports **A** and **B** of control valve and ports **P1** and **P2** of PPC valves are connected to the tank circuit.
- Hence, the spool is in neutral position.

2. During fine control (NEUTRAL → Actuator)



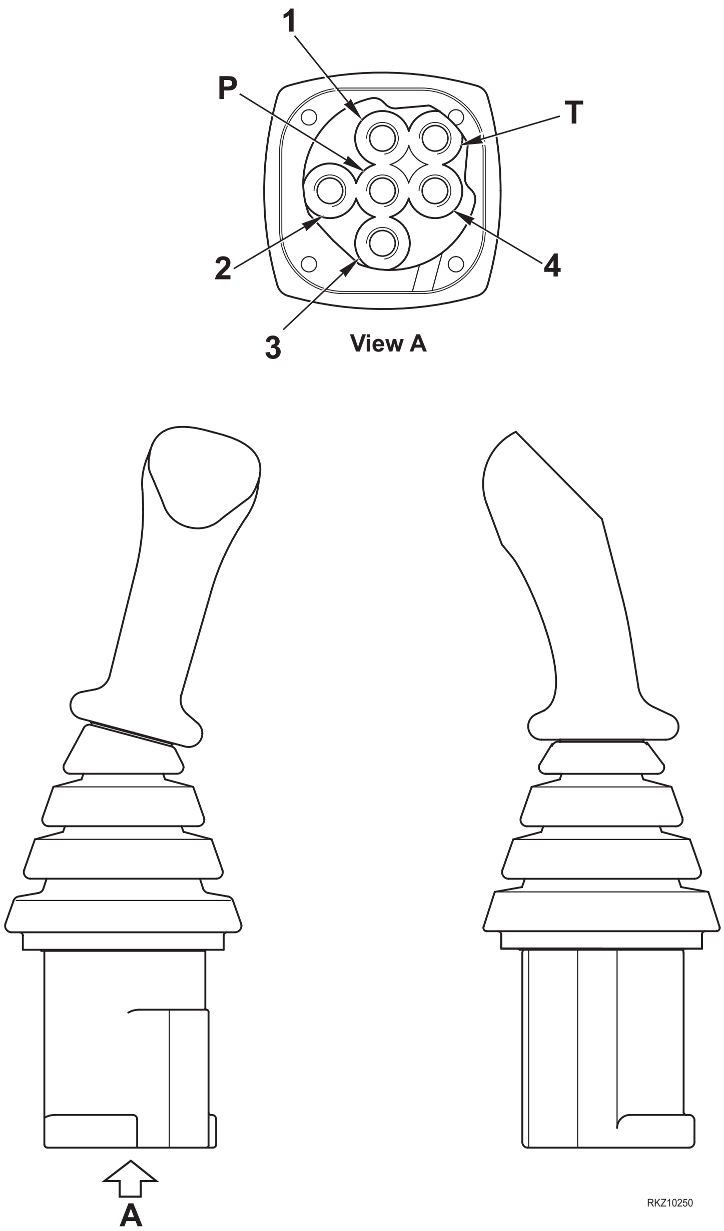
- When the lever (1) is moved in the direction shown by the arrow, the valves (2) are rotated and a passage is opened between delivery duct **a** and port **P1**, while port **P2** remains conected to the tank circuit.
- Pressure at port **P1** increases as the travel of lever (1) increases. Consequently, the spool of the control valve moves to the left by a distance that is proportional to the travel of the lever (1).

3. **Control lever at full stroke (Actuator → NEUTRAL)**



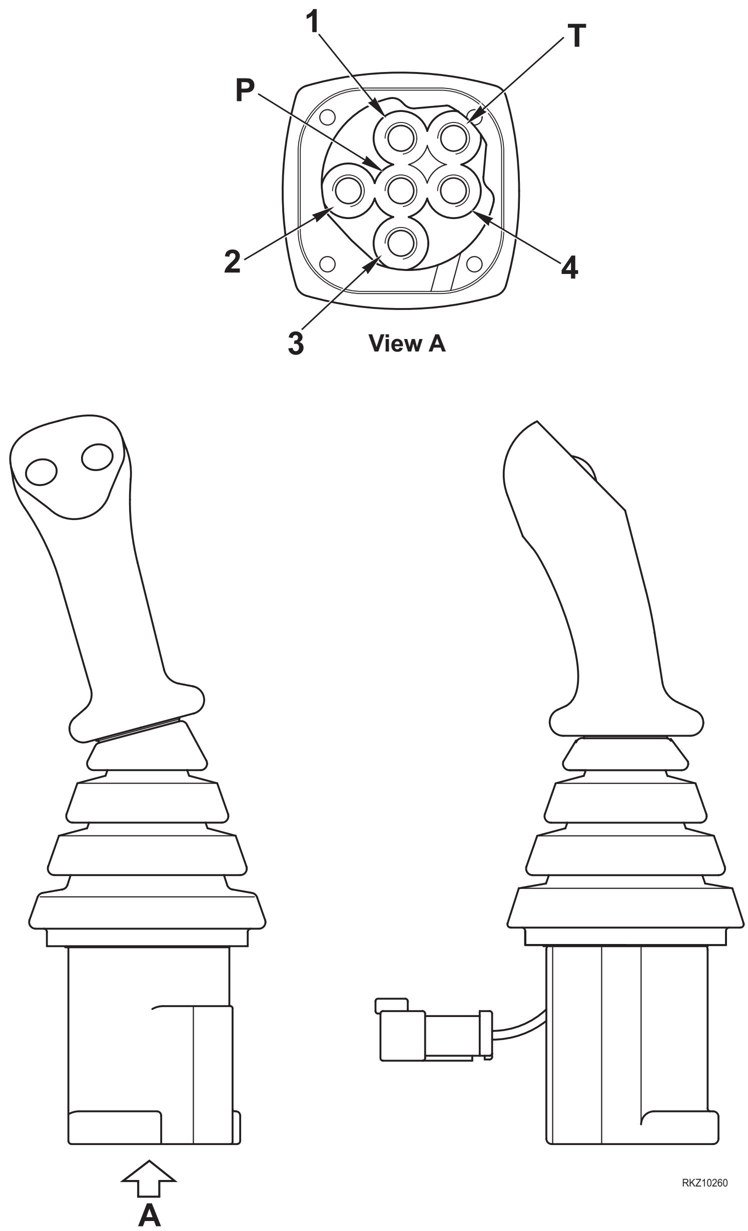
- When lever (1) is moved fully to the left, the valves (2) are fully rotated.
- Port **P1** is then connected directly to delivery duct **a** whereas port **P2** is connected to tank circuit only, and the spool of the control valve performs its full travel.

BACKHOE LH PPC VALVE



1 port -	To control valve (Port PB1) (Out arm)
Port T -	To hydraulic tank
4 port -	To backhoe control valve (Port PA2) (LH swing boom)
3 port -	To backhoe control valve (Port PA1) (In arm)
P port -	To EV1 solenoid valve group (VBH port)
2 port -	To backhoe control valve (Port PB2) (swing boom)

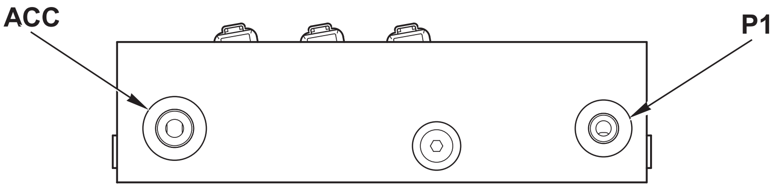
BACKHOE RH PPC VALVE

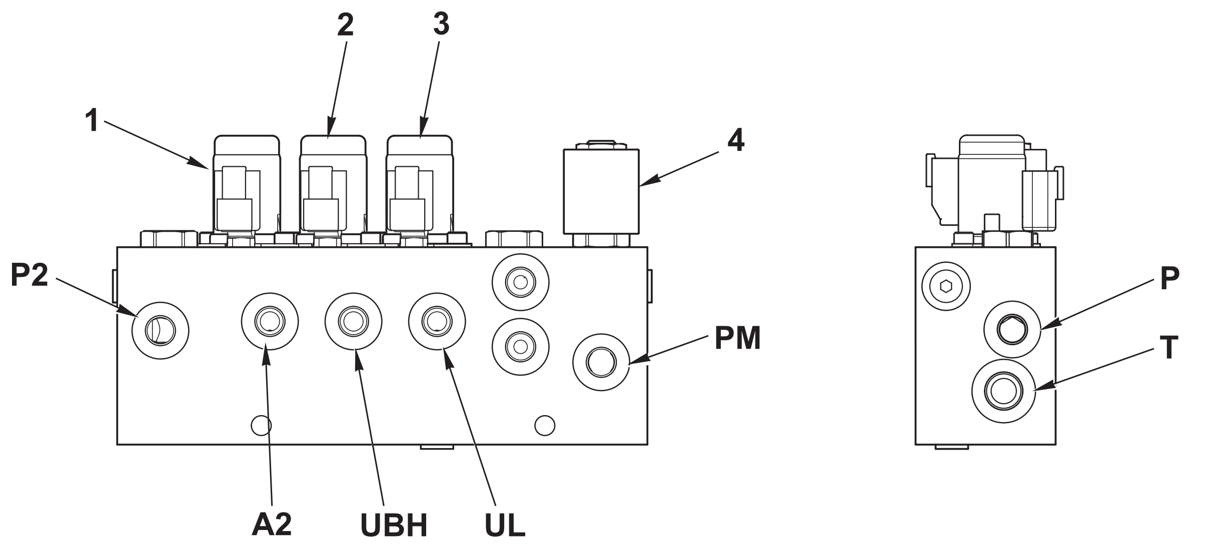


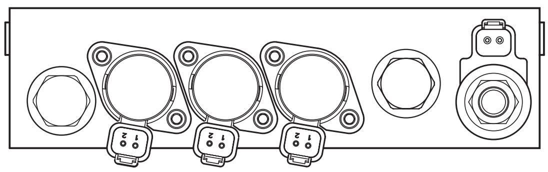
Port 1 - To control valve (Port PB4) (raise boom)
Port T - To hydraulic tank
Port 4 - To control valve (Port PA5) (dump bucket)
Port 3 - To backhoe control valve (Port PA4) (lower boom)
Port P - To solenoid valve group (VBH port)
Port 2 - To control valve (Port PB5) (curl bucket)

SOLENOID VALVE GROUP (EV1)

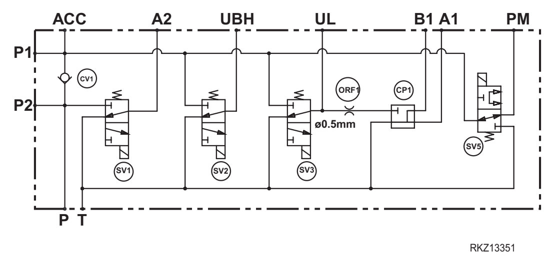
BACKHOE VERSION WITHOUT 4 IN 1 BUCKET







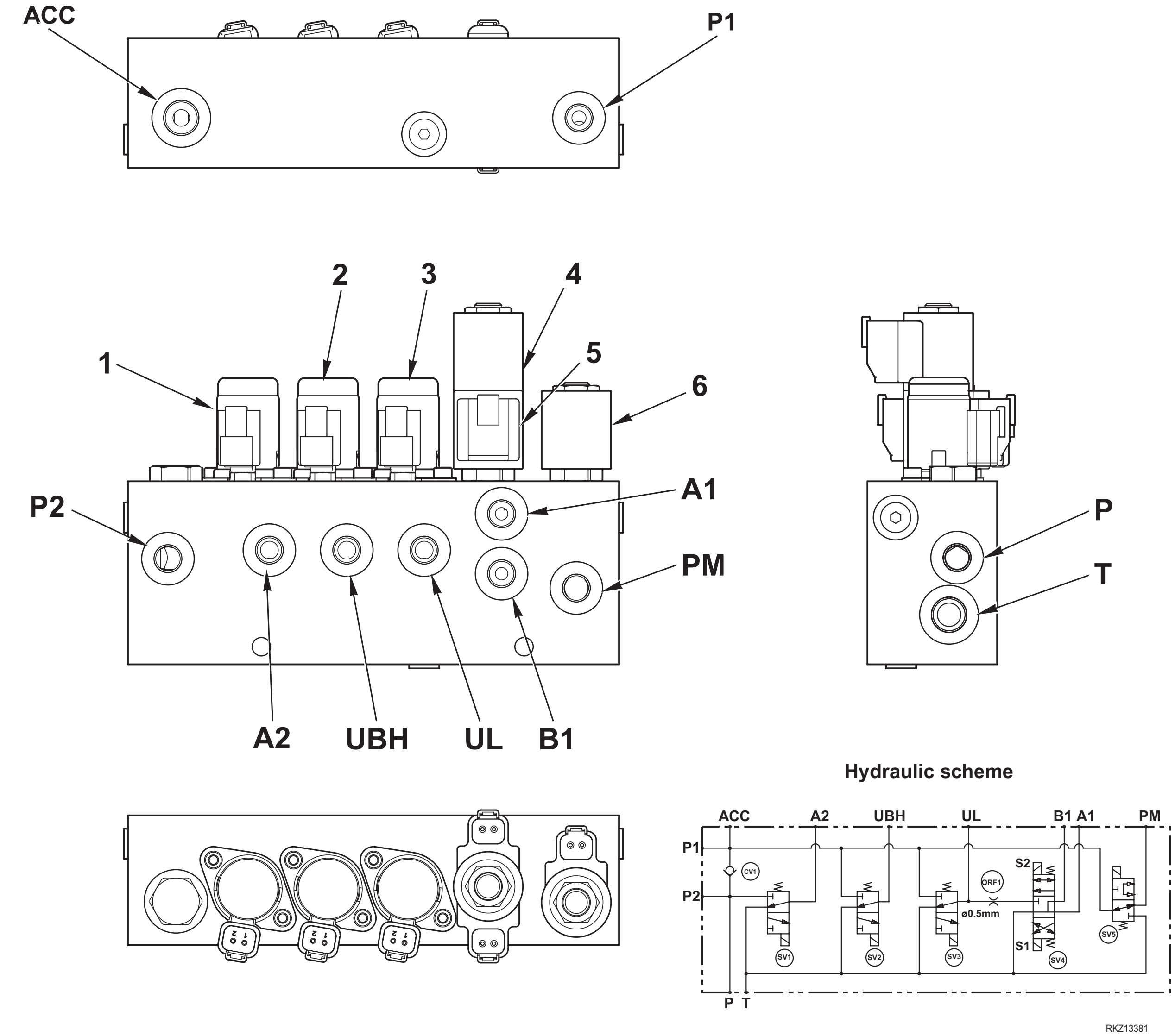
Hydraulic scheme



1. Y95 - Boom unlock solenoid valve
2. Y90 - Backhoe PPC solenoid valve
3. Y93 - PPC solenoid valve
4. Y91 - Ecopower solenoid valve

Port Acc -	Accumulator
Port P1 -	Pressure tap
Port P2 -	To outriggers PPC valve (Port P)
Port A2 -	To boom unlock cylinder
Port UBH -	To backhoe PPC valves (Port P)
Port UL -	To shovel PPC valve (Port P)
Port PM -	To hydraulic pump (Port PM)
Port P -	From control valve (Port PPPC)
Port T -	To hydraulic tank

BACKHOE VERSION WITH 4 IN 1 BUCKET

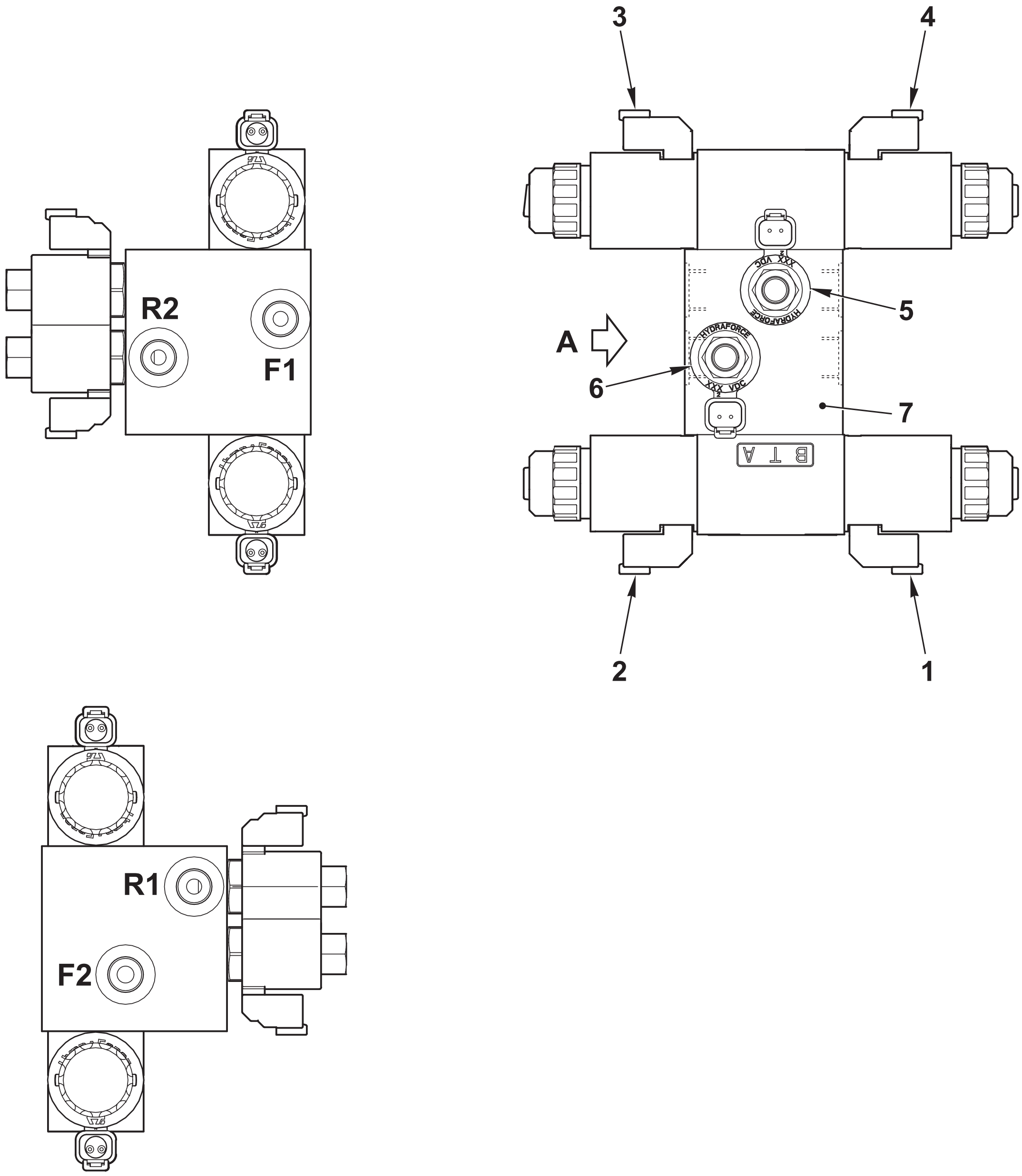


1. Y95 - Boom unlock solenoid valve
2. Y90 - Backhoe PPC solenoid valve
3. Y93 - PPC solenoid valve
4. Y98 - Bucket curl solenoid valve
5. Y99 - Bucket dump solenoid valve
6. Y91 - Ecopower solenoid valve

Port Acc -	Accumulator
Port P1 -	Pressure tap
Port P2 -	To outriggers PPC valve (Port P)
Port A2 -	To boom unlock cylinder
Port UBH -	To backhoe PPC valves (Port P)
Port UL -	To shovel PPC valve (Port P)
Port A1 -	To control valve (Port PA6)
Port B1 -	To control valve (Port PB6)
Port PM -	To hydraulic pump (Port PM)
Port P -	From control valve (Port PPPC)
Port T -	To hydraulic tank

SOLENOID VALVE GROUP (EV2)

STEERING



View A

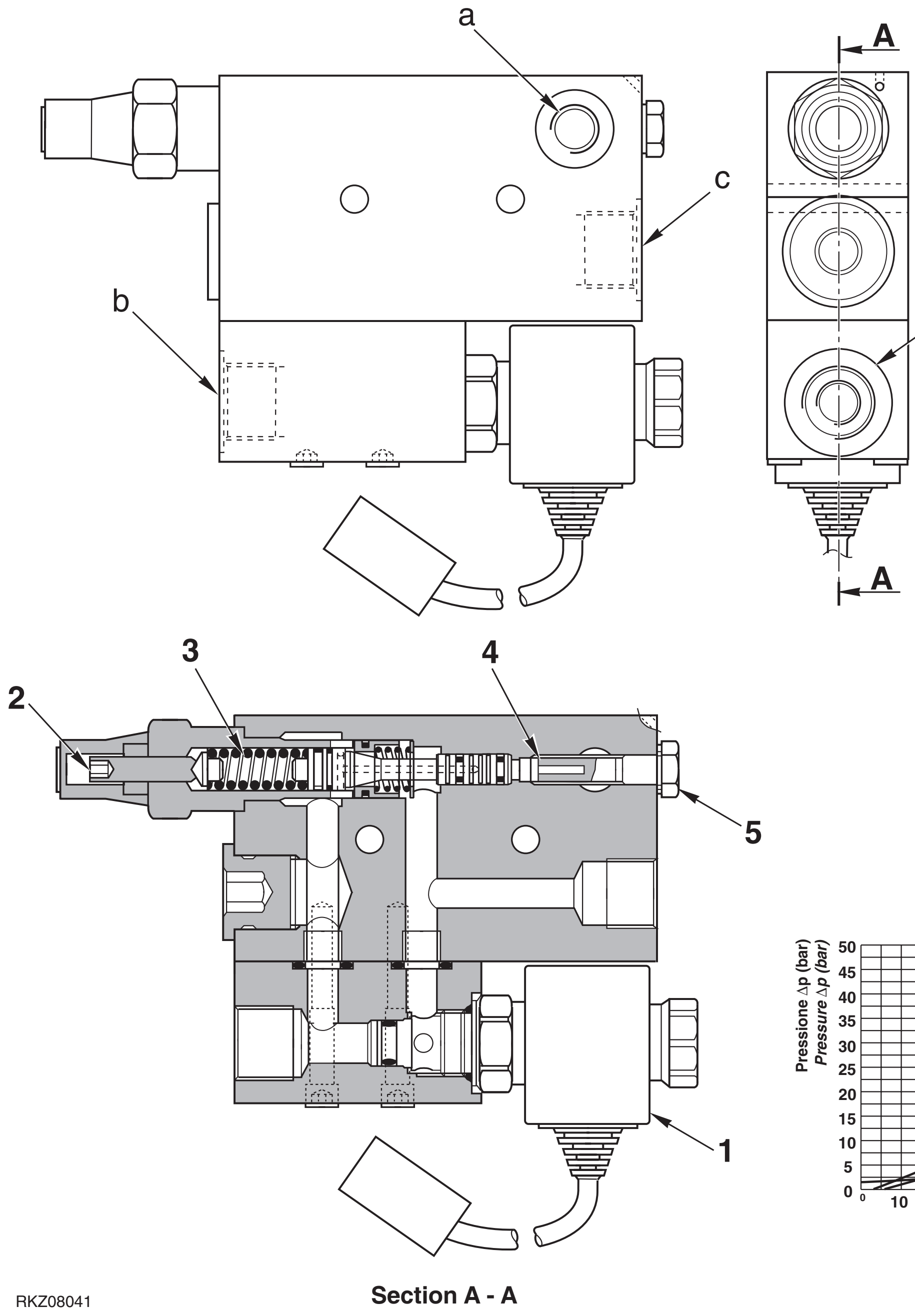
RKT13371

1. Y200 - Rear steering cut out solenoid valve
2. Y201 - Front/rear steering solenoid valve
3. Y203 - Phase coincidence steering solenoid valve
4. Y202 - Crab steering solenoid valve
5. Y400 - Safety lock solenoid valve
6. Y401 - Safety lock solenoid valve
7. Port block

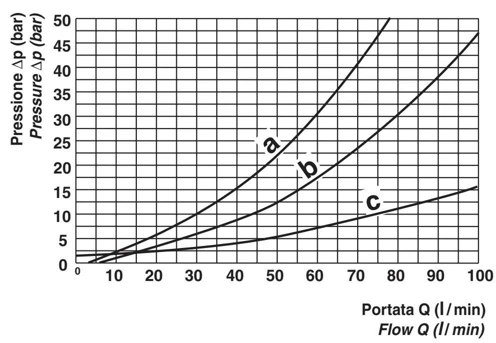
Port F2 -	Accumulator
Port R1 -	Pressure tap
Port F1 -	To outriggers PPC valve (Port P)
Port R2 -	To boom unlock cylinder

SAFETY VALVES

SHOVEL RAISE



RKZ08041 Section A - A



RKZ08050

a.	Port PiL	-	To the raise cylinders (Head side)
b.	Port V2	-	From control valve (8-spool) (Port A6) From control valve (10-spool) (Port A8)
c.	Port C2	-	To the raise cylinders (Bottom side)

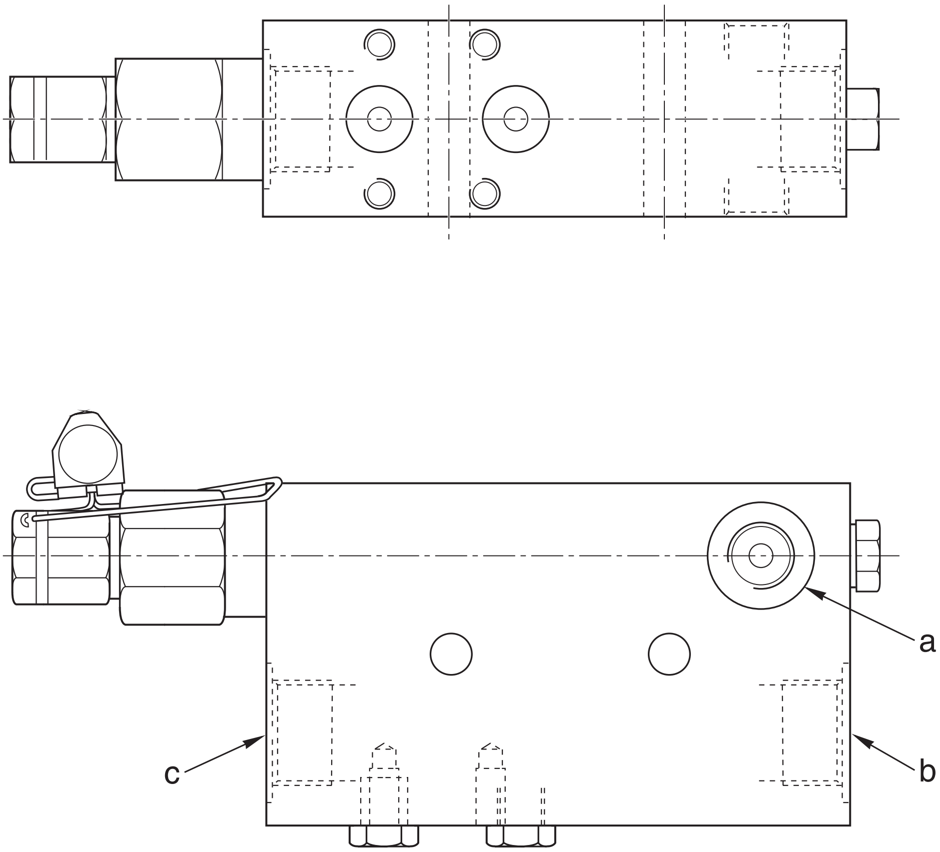
COMPONENTS

1 - Solenoid valve
2 - Adjusting screw
3 - Spring
4 - Spool
5 - Unlock screw

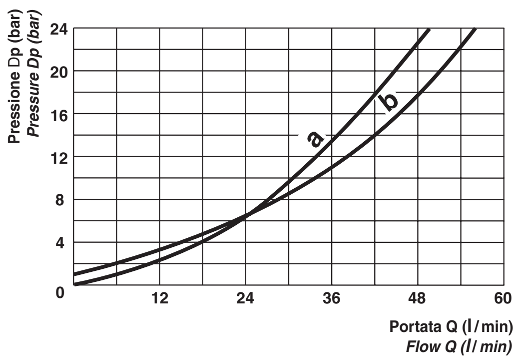
CHARACTERISTICS

Safety valve calibration: 220^{0}_{+10} bar

SHOVEL DUMP



RKZ08060



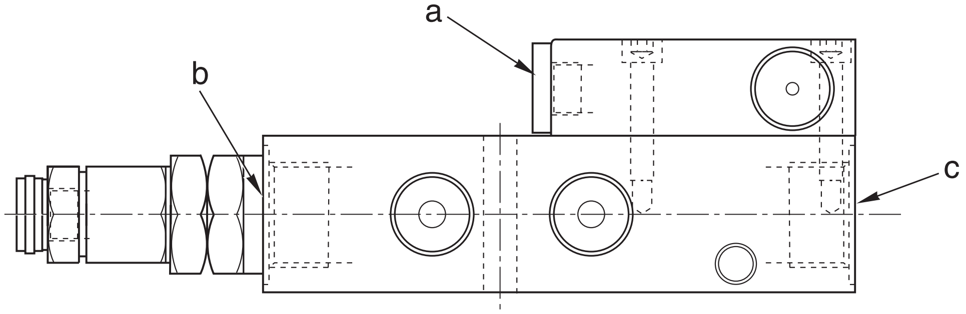
RKZ08070

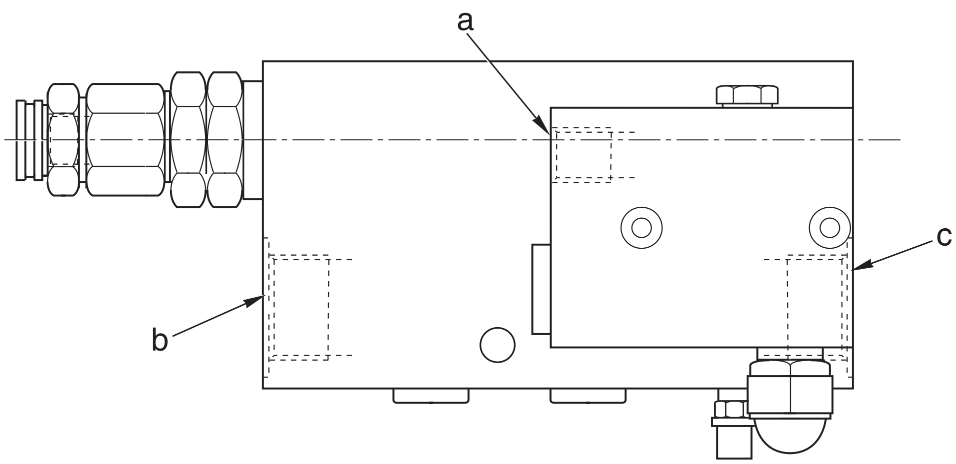
a. Port PiL - To the dump cylinder (Bottom side)
b. Port C2 - To the dump cylinder (Head side)
b. Port V2 - From control valve (8-spool) (B3 port)

CHARACTERISTICS

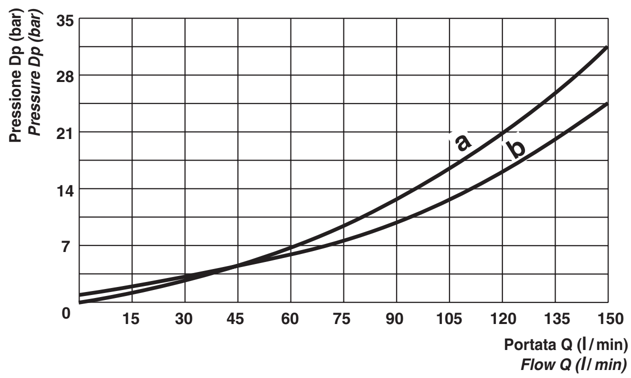
Safety valve calibration: 220±10 bar

BOOM





RKZ08080



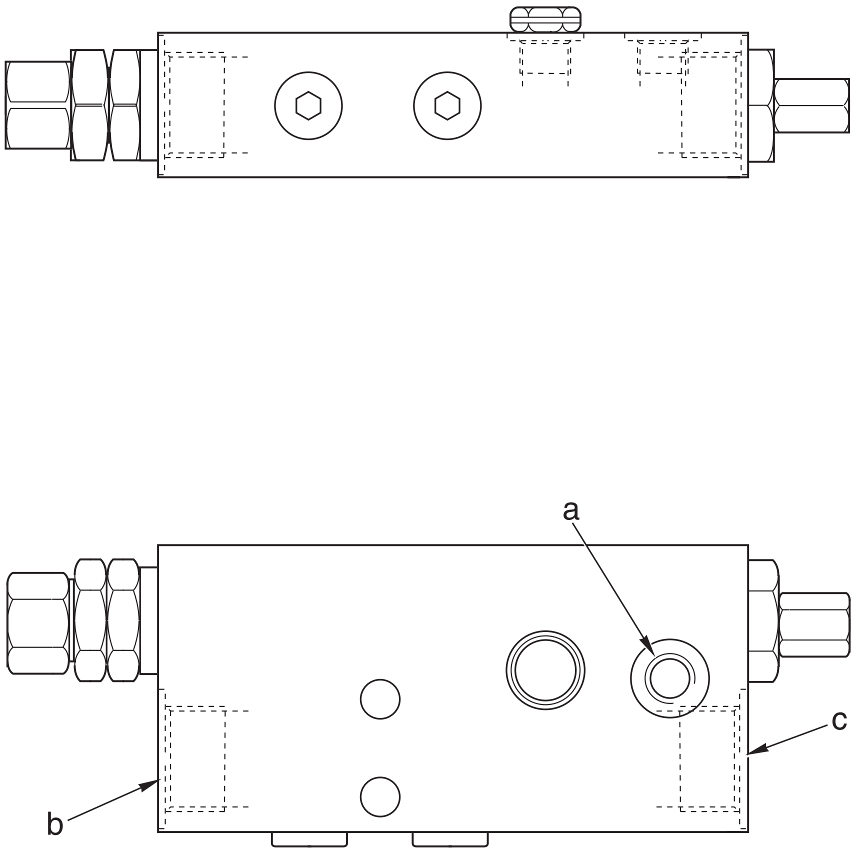
RKZ08090

a. PiL port - To the boom cylinder (bottom side)
b. V2 port - From control valve (B4 port)
c. C2 port - To the boom cylinder (Head side)

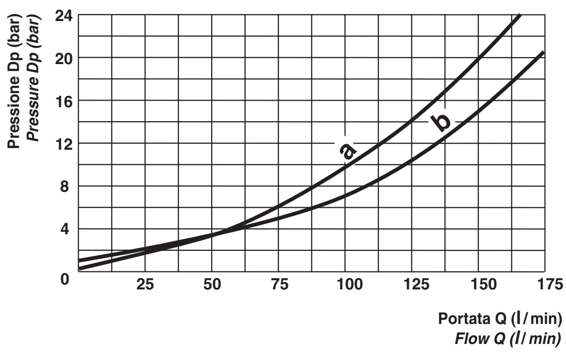
CHARACTERISTICS

Safety valve calibration 1: 250$^{0}_{+}$15 bar
Safety valve calibration 2: 200$^{0}_{+}$20 bar

ARM



RKZ08100



RKZ08110

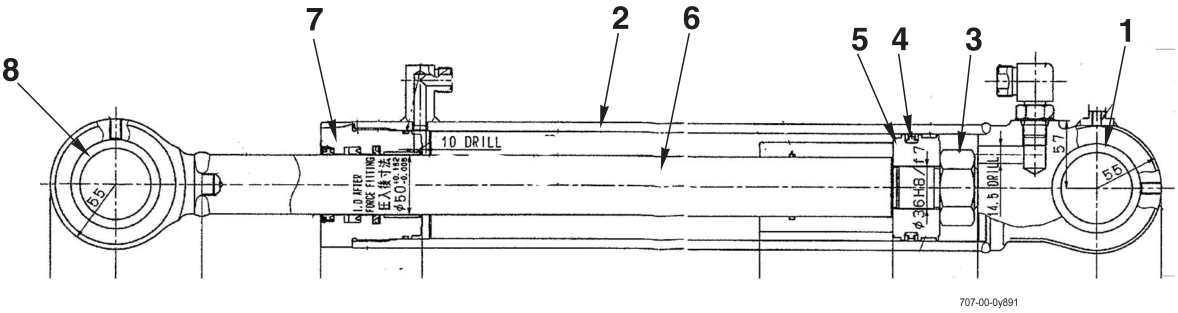
a. PiL port - To the arm cylinder (bottom side)
b. V2 port - From control valve (A1 port)
c. C2 port - To the arm cylinder (Head side)

CHARACTERISTICS

Safety valve calibration 1: $300{}^{0}_{+}10$ bar

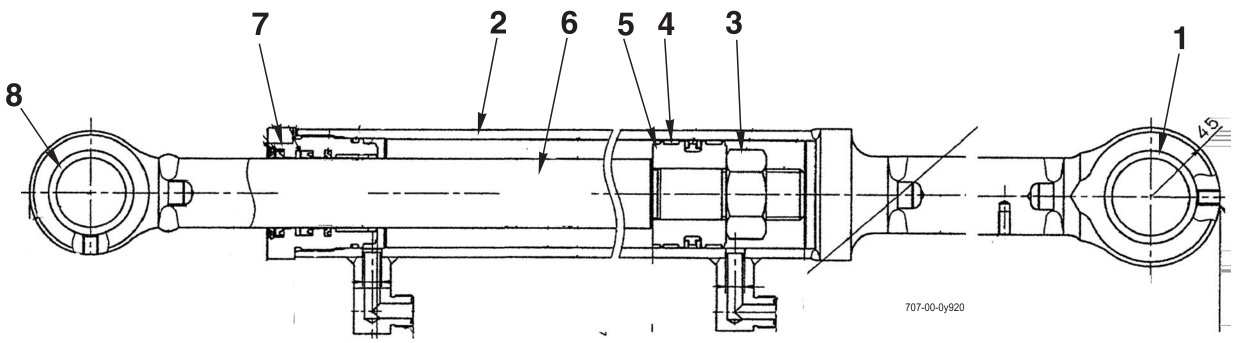
SHOVEL CYLINDERS

RAISING CYLINDER



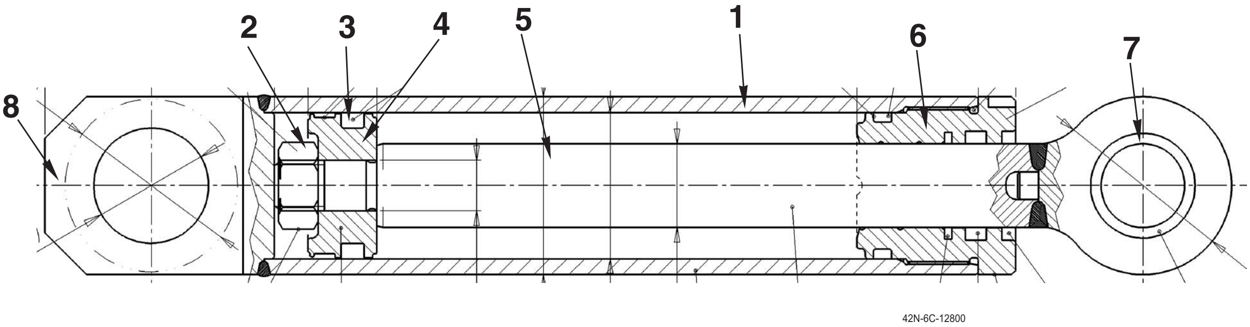
1. Bottom bushing
2. Cylinder
3. Nut
4. Gasket
5. Piston
6. Stem
7. Head
8. Head bushing

DUMPING CYLINDER



1. Bottom bushing
2. Cylinder
3. Nut
4. Gasket
5. Piston
6. Stem
7. Head
8. Head bushing

4 IN 1 BUCKET



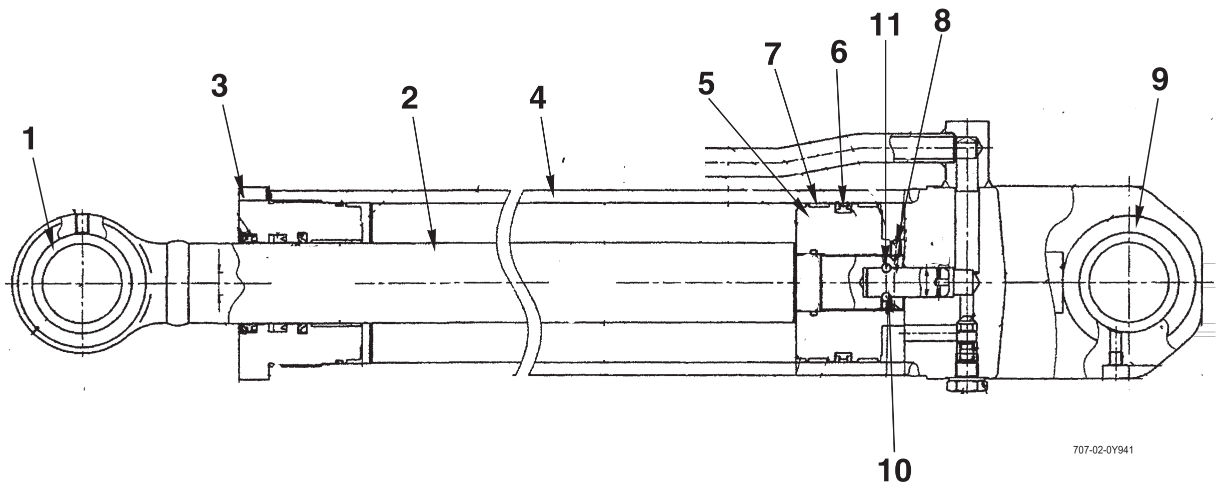
1. Cylinder
2. Nut
3. Gasket
4. Piston
5. Stem
6. Head
7. Head bushing

CHARACTERISTICS

Cylinder	Lifting	Dump	4 in 1 bucket
Piston rod diameter	50	45	40
Internal cylinder diameter	90	70	70
Piston stroke	570	745	230
Max. cylinder length	1740	2145	705
Min. cylinder length	1170	144	475
Key size for piston safety nut	55	40	36

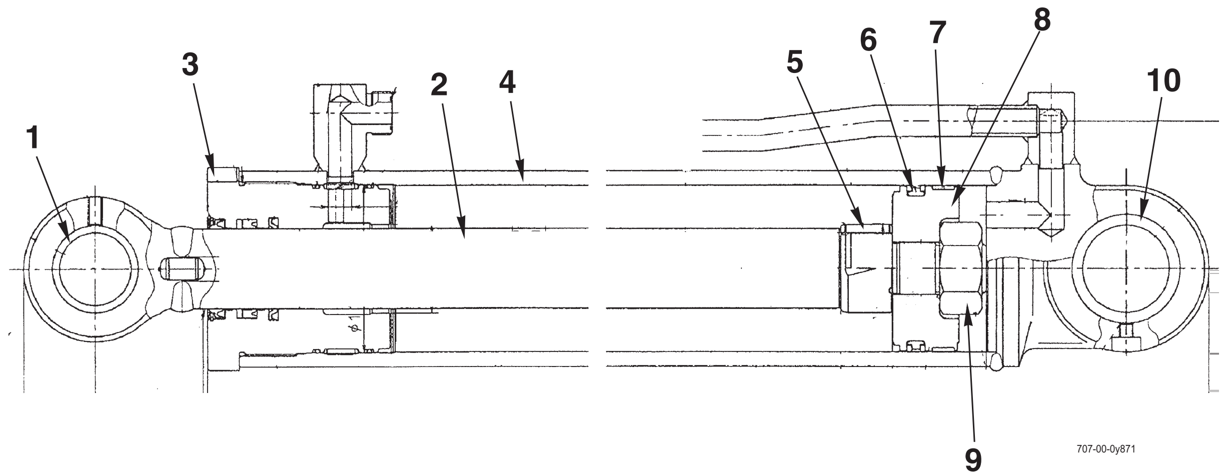
BACKHOE CYLINDERS

BOOM CYLINDER



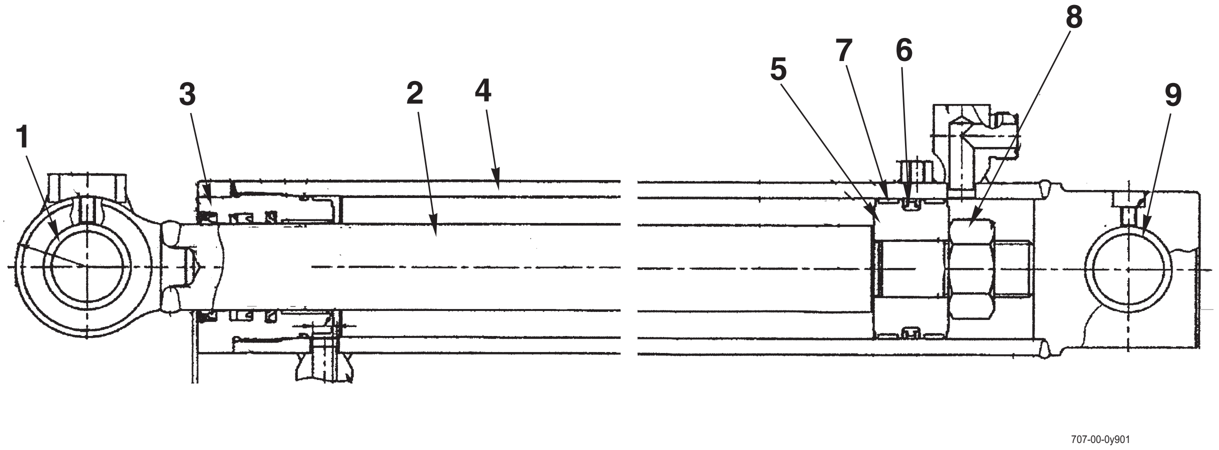
1. Bottom bushing
2. Stem
3. Head
4. Cylinder
5. Piston
6. Gasket
7. Guide ring
8. Cushion plunger
9. Bottom bushing
10. Dowel
11. Ball-bearings (no. 10)

ARM



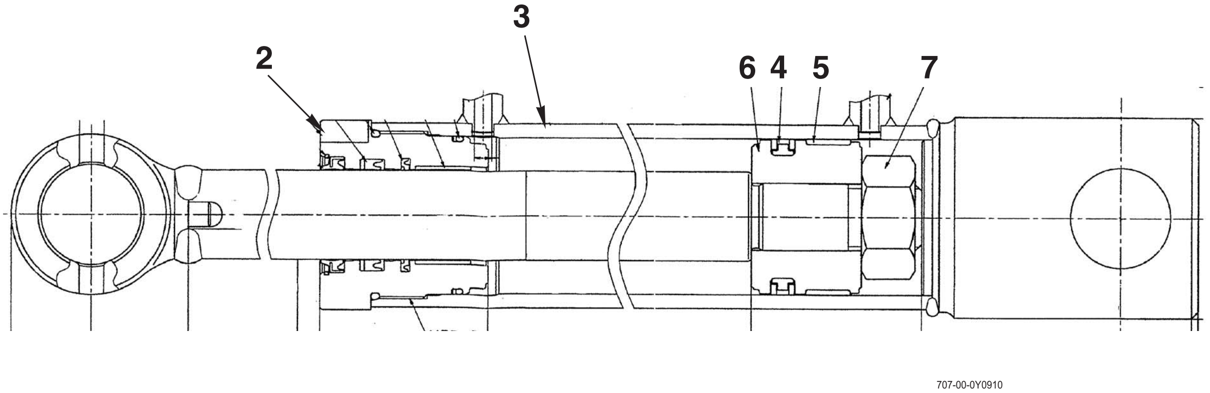
1. Bottom bushing
2. Stem
3. Head
4. Cylinder
5. Brake bushing
6. Gasket
7. Guide ring
8. Piston
9. Nut
10. Bottom bushing

BUCKET CYLINDER



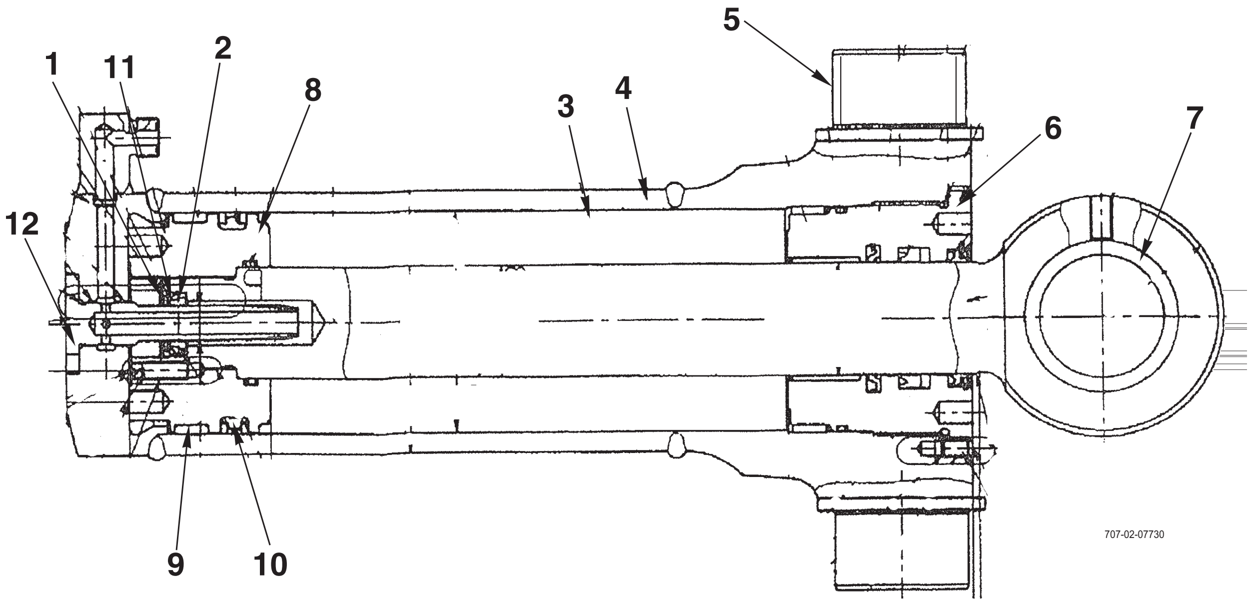
1. Bottom bushing
2. Stem
3. Head
4. Cylinder
5. Piston
6. Gasket
7. Guide ring
8. Nut
9. Bottom bushing

OUTRIGGER CYLINDER



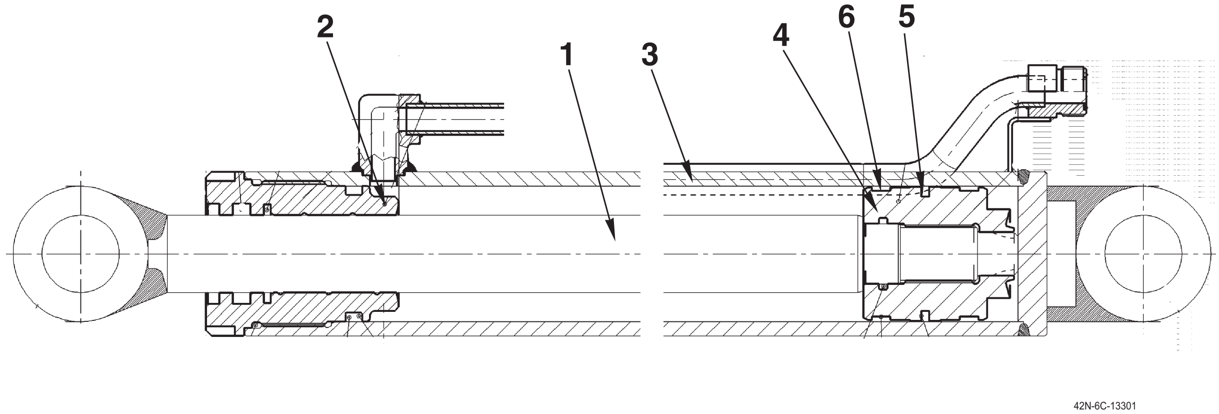
1. Stem
2. Head
3. Cylinder
4. Gasket
5. Guide ring
6. Piston
7. Nut

BOOM SWING CYLINDER



1. Retaining ring
2. Restriction ring
3. Stem
4. Cylinder
5. Bushing
6. Head
7. Bottom bushing
8. Piston
9. Guide ring
10. Piston seal
11. Spacer
12. Cushion plunger

JIG ARM CYLINDER



1. Stem
2. Head
3. Cylinder
4. Piston
5. Gasket
6. Guide ring

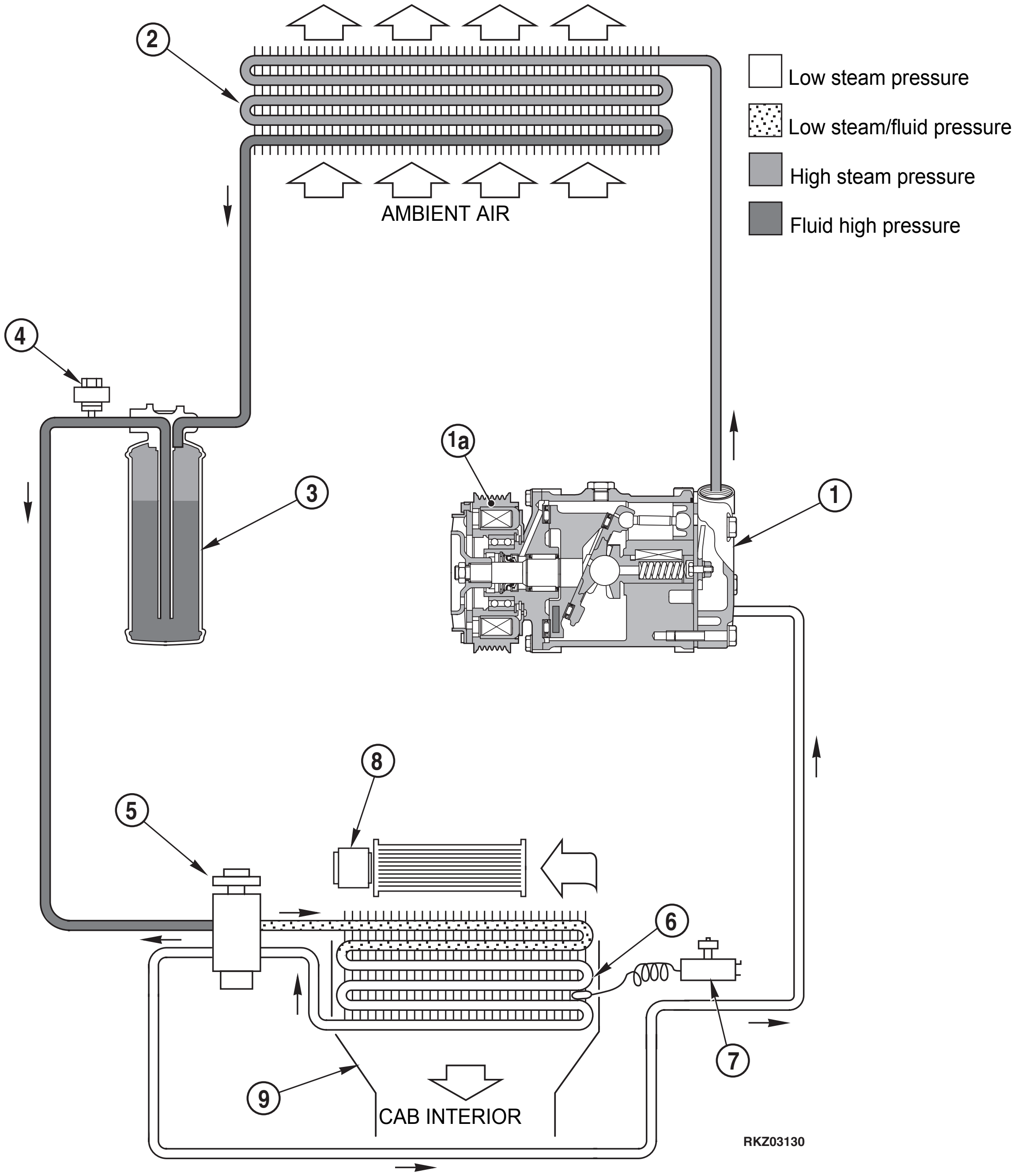
CHARACTERISTICS

Cylinder	Boom	Arm	Bucket
Piston rod diameter	60	55	55
Internal cylinder diameter	120	115	90
Piston stroke	850	700	765
Max. cylinder length	2160	1765	1850
Min. cylinder length	1310	1065	1085
Key size for piston safety nut	–	55	55

CHARACTERISTICS

Cylinder	Outriggers	Boom swing	Jig arm
Piston rod diameter	40	50	40
Internal cylinder diameter	70	100	70
Piston stroke	635	230	1140
Max. cylinder length	1690	319.5	2590
Min. cylinder length	1055	89.5	1450
Key size for piston safety nut	46	–	46

AIR-CONDITIONING UNIT



1. Compressor
2. Condenser
3. Filter – dehydrator tank
4. Safety pressure switch
5. Expansion valve
6. Evaporator
7. Clutch thermostat sensor
8. Cab air circulation fans
9. Air feeder

TECHNICAL DATA

- Circuit operating pressure with engine @ 2500 RPM at an ambient temperature of 25–30°C:
  Regular pressure: 15–17 bar
  Low pressure: 1.6–1.8 bar
- Safe pressures:
  High pressure: 26 bar
  Low pressure: 2.5 bar
- Coolant fluid: R134a
- Coolant quantity: 2250 ±150 g

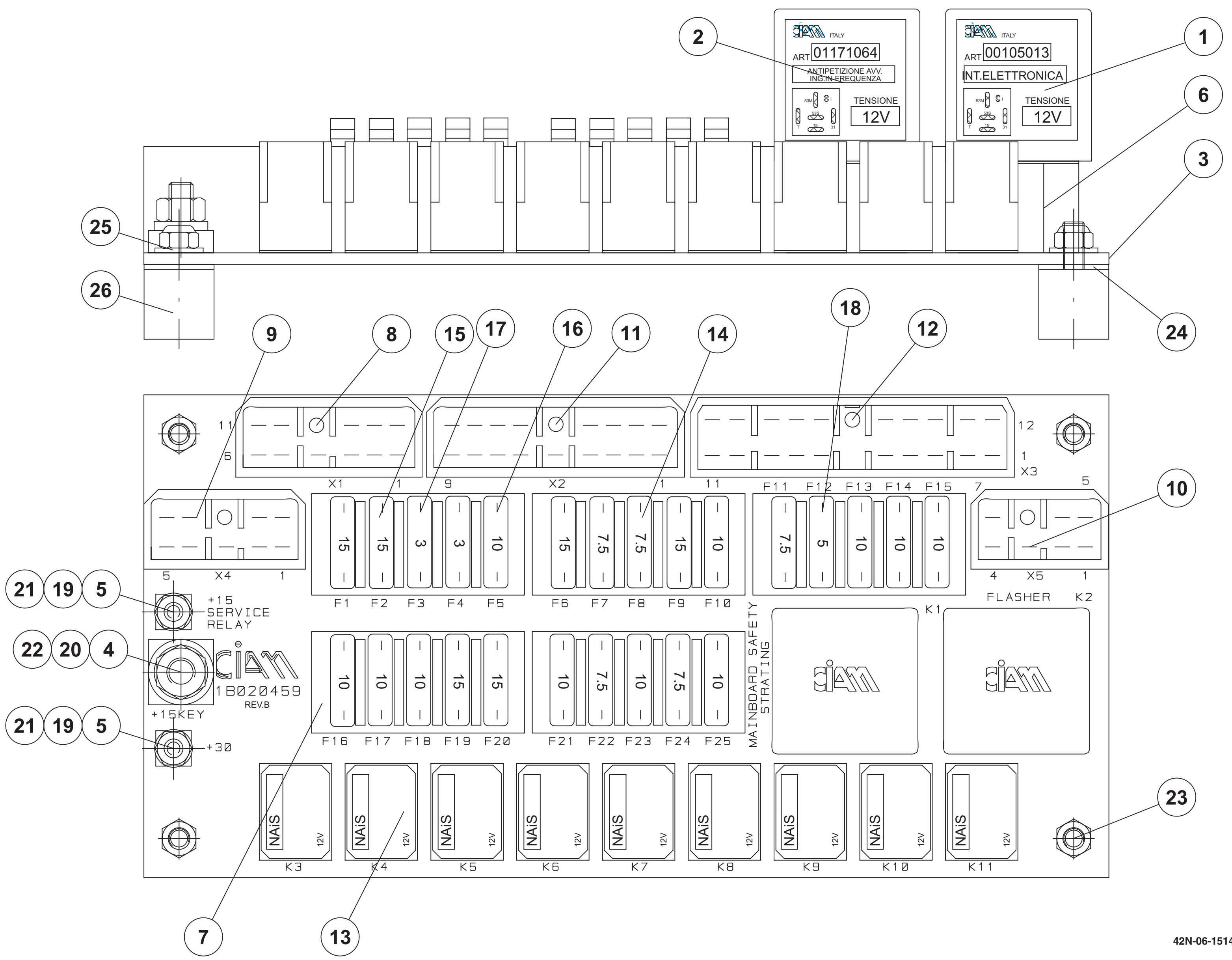
OPERATION OF THE AIR CONDITIONING UNIT

The compressor (1) receives drive directly from the driving shaft through a belt, and compressor rotation is caused by a pulley with electromagnetic clutch (1a).
Clutch engagement and disengagement are controlled by the thermostatic sensor (7). When the evaporator reaches the lower limit temperature, the thermostatic sensor comes into operation to command clutch disengagement. When the evaporator reaches the higher limit temperature, the thermostatic sensor commands clutch engagement.
The coolant fluid (in gaseous phase) is drawn into the compressor where it is subjected to compression and an intense heating process; the compressed and heated fluid is then sent into the condenser (2). Here, it reaches condensation temperature as a result of heat extraction due to the air flowing through the condenser fins, and the fluid switches to a high-pressure liquid state.
Subsequently the coolant passes into the drying-filter assembly (3) which performs three functions: it filters out impurities, absorbs any moisture from 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 starts.
The extraction of heat from the atmosphere in which the evaporator is located 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 released 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 A/C system. A percentage of this oil circulates constantly throughout the A/C system in atomised 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 A/C system in the case of a lack of coolant fluid or if the quantity of fluid becomes insufficient due to leakages. This switch will inhibit the engagement of the electromagnetic clutch and hence the functioning of the air-conditioning system.

FUSE AND RELAY CENTRE

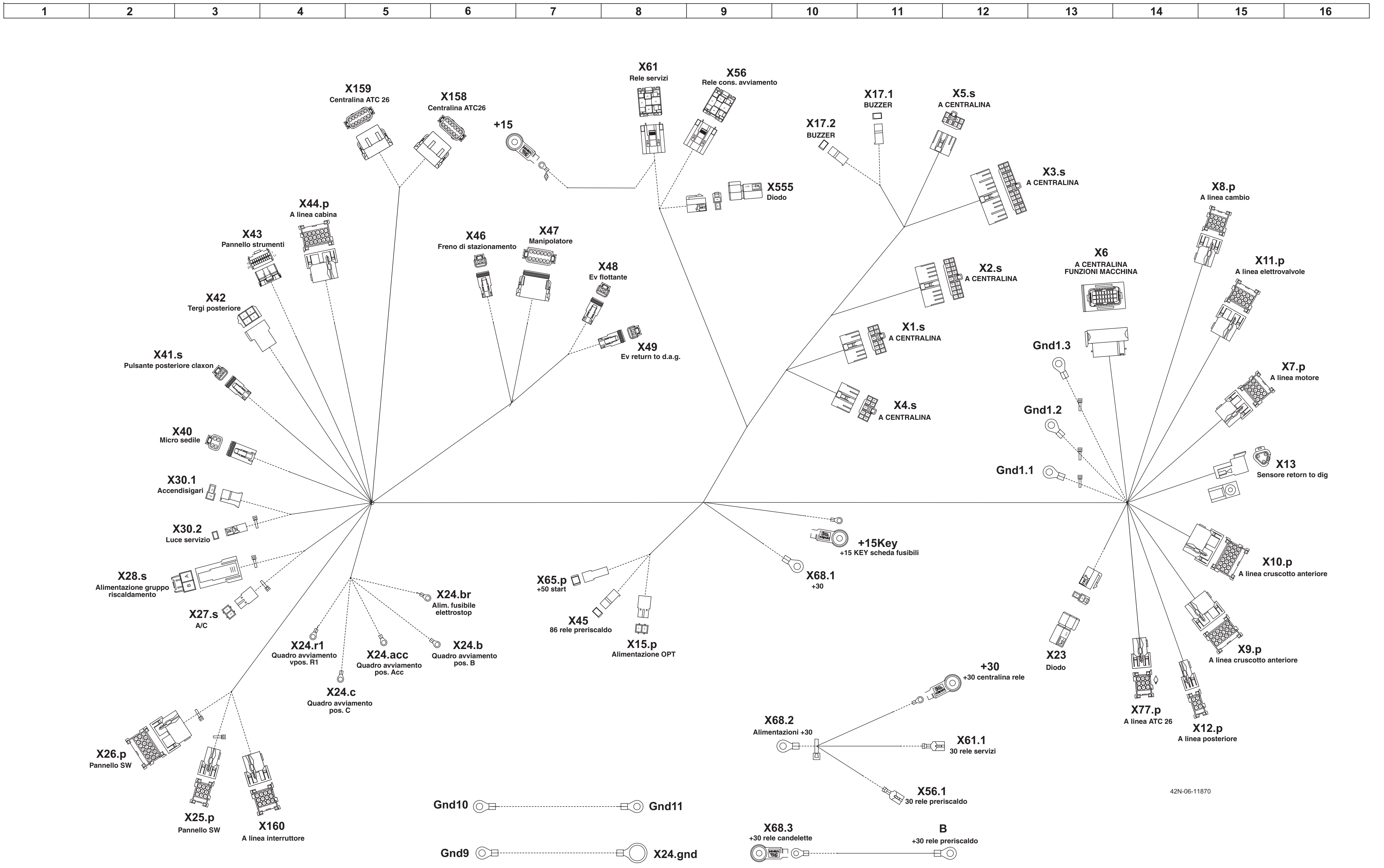
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

POS	CODICE	DESCRIZIONE	
1	00105013	INTERMITTENZA ELETTRONICA 12V	1
2	01171064	CENTRALINA ANTIRIPETIZIONE AVV. 12V	1
3	1B020459	CIRCUITO STAMPATO	1
4	120231	TERMINALE DI POTENZA M6	1
5	120232	TERMINALE DI POTENZA M5	2
6	124004	CONNETTORE PORTARELE'SCHEDE	2
7	124526	CONNETTORE PORTAFUFIBILE 5 VIE	5
8	125188	CONNETTORE MARK II 11V SCHEDE	1
9	125191	CONNETTORE MARK II 9V SCHEDE	1
10	125223	CONNETTORE MARKII 7VIE SCHEDE	1
11	125224	CONNETTORE MARKII 17VIE SCHEDE	1
12	125225	CONNETTORE MARKII 21VIE SCHEDE	1
13	157137	RELE' CM1-DP-12V	9
14	163005	FUSIBILE A LAMA 7.5 A	5
15	163006	FUSIBILE A LAMA 15 A	6
16	163007	FUSIBILE A LAMA 10 A	11
17	163010	FUSIBILE A LAMA 3 A	2
18	163031	FUSIBILE A LAMA 5 A 257005	1
19	190288	ROND.EL.SP.5,3X8,9X1,2 UNI1751 INOX	2
20	190289	ROND.EL.SP.6,4X11,3X1,6 UNI1751INOX	1
21	190468	DADO M5 UNI 5588-65 INOX	2
22	190479	DADO M6 UNI 5588 INOX A2	1
23	190534	DADO M4 BLOK UNI 7473 INOX A2	4
24	191368	RONDELLA 3,5X13,6X2 CERTENE	4
25	191369	RONDELLA 4,4X10X1,1 NYLON	4
26	191804	ANTIVIBRANTE M/F M4X10 H15 INOX	4

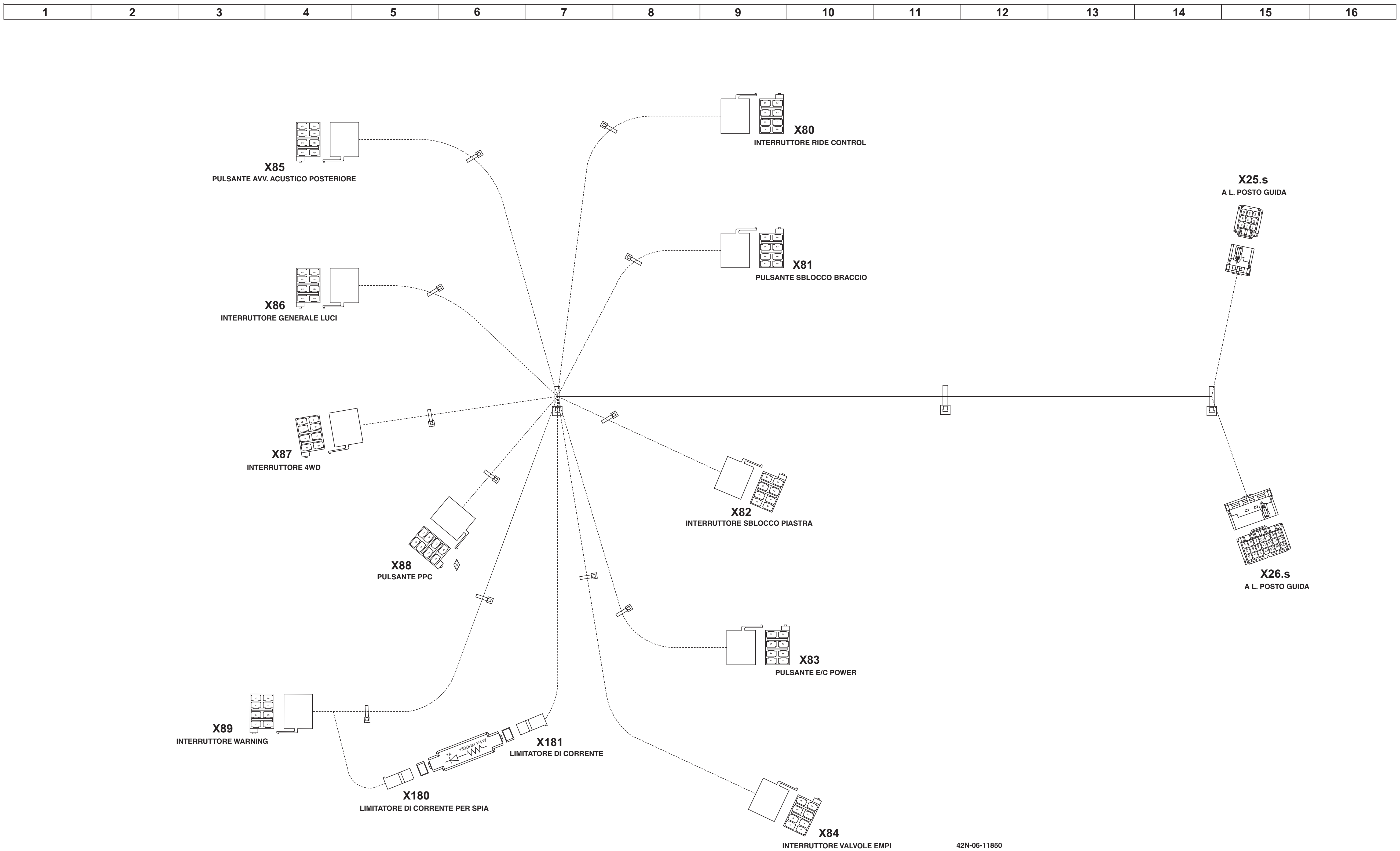


42N-06-15140

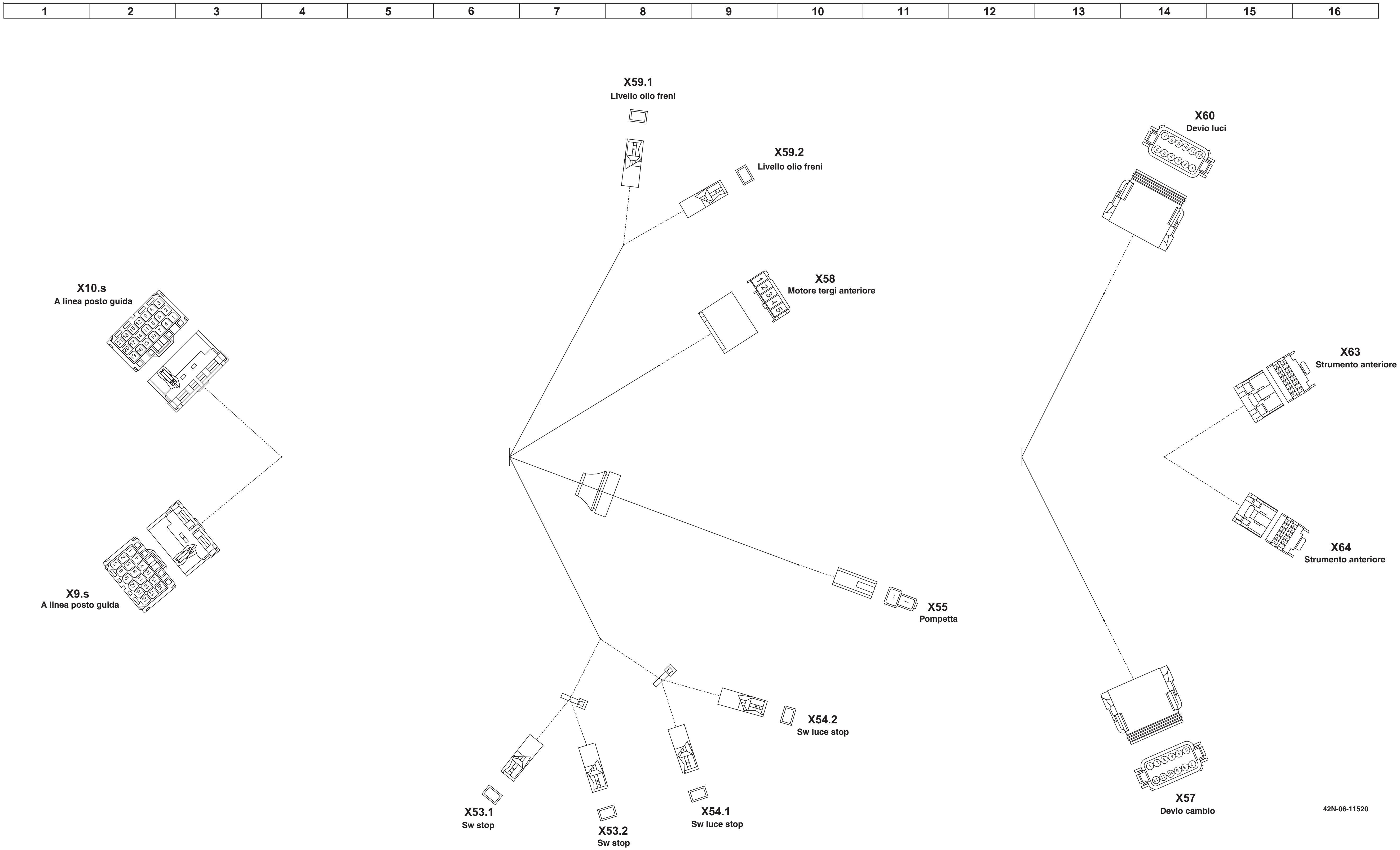
DRIVER SEAT WIRING



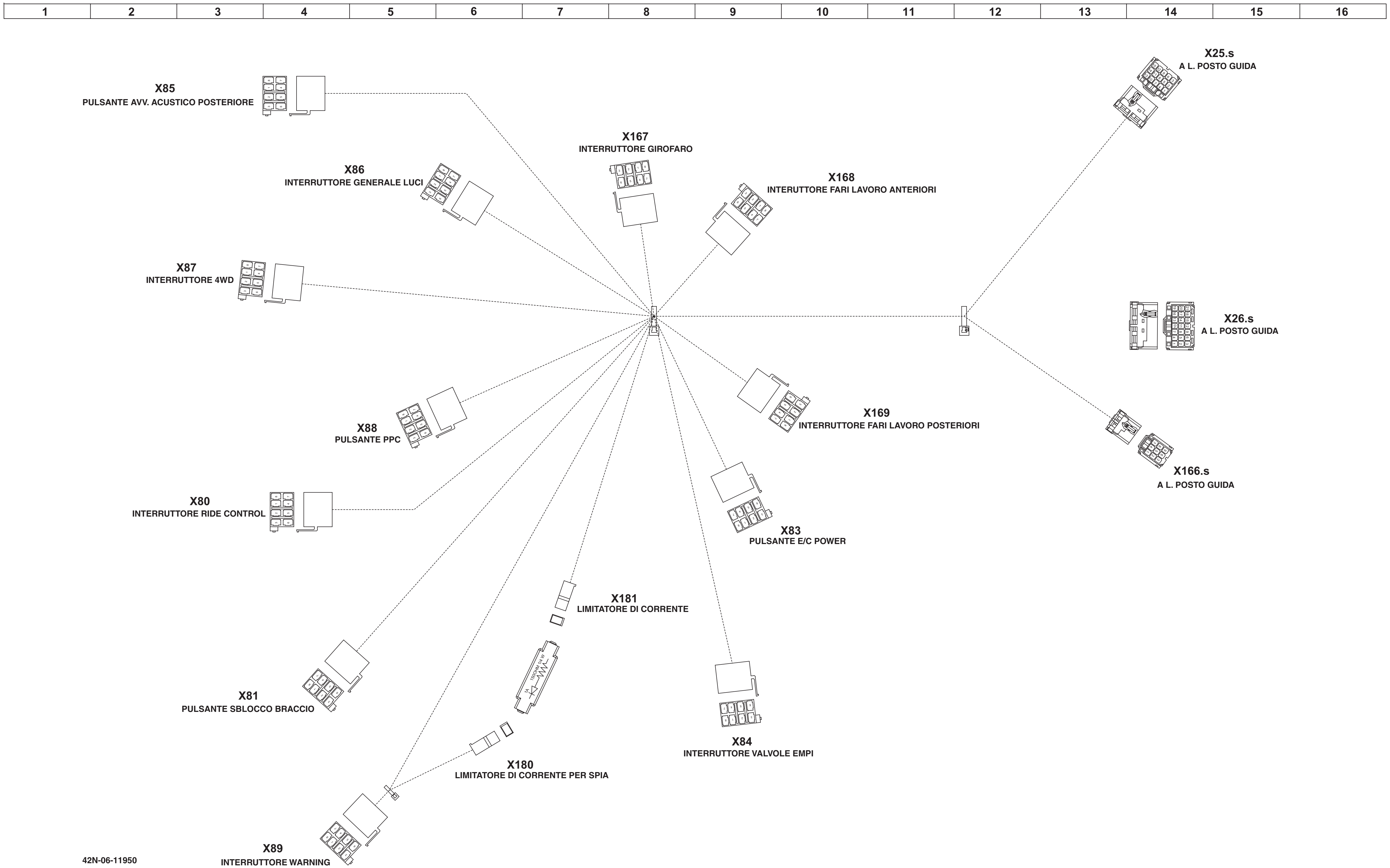
SWITCH PANEL WIRING



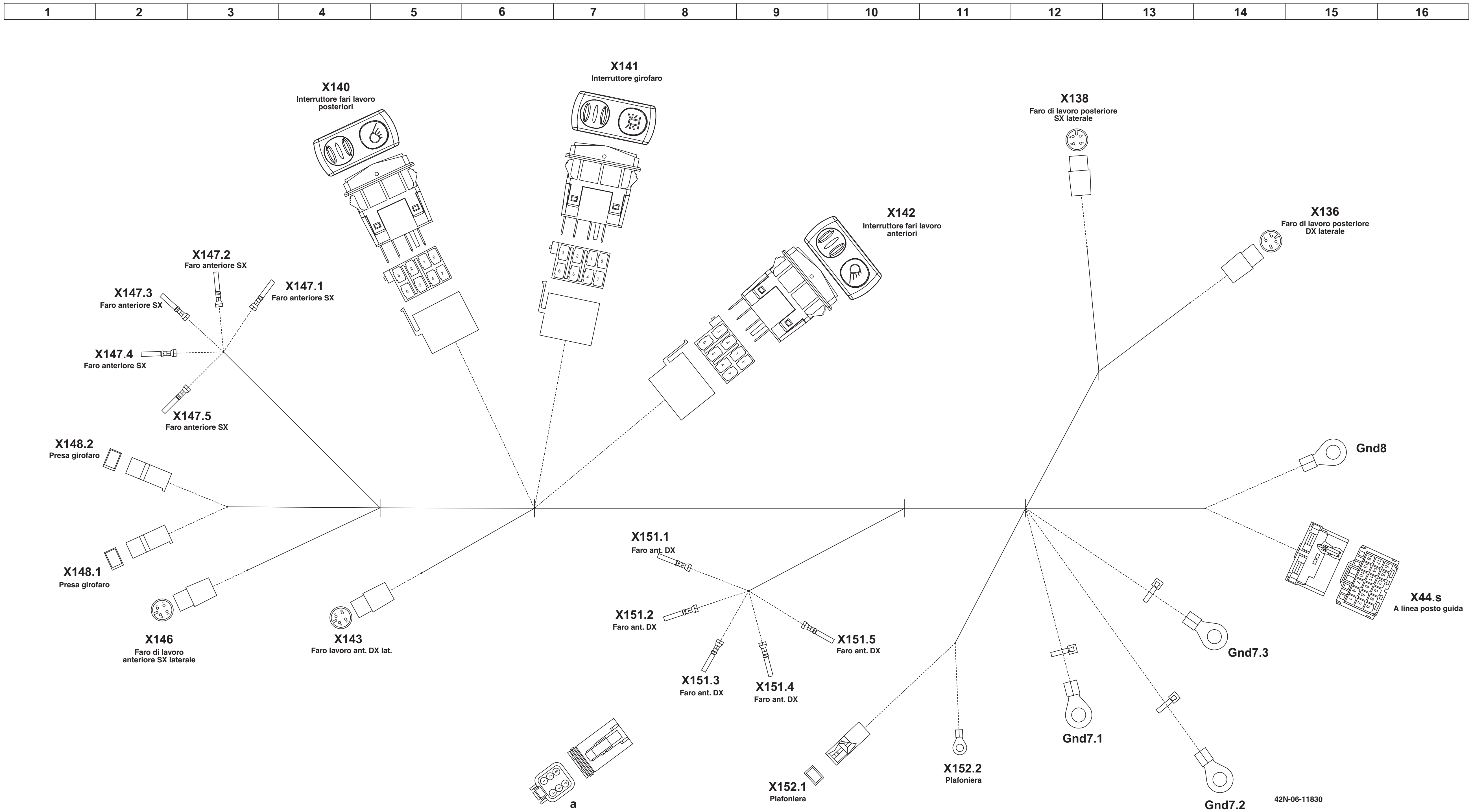
FRONT DASH WIRING



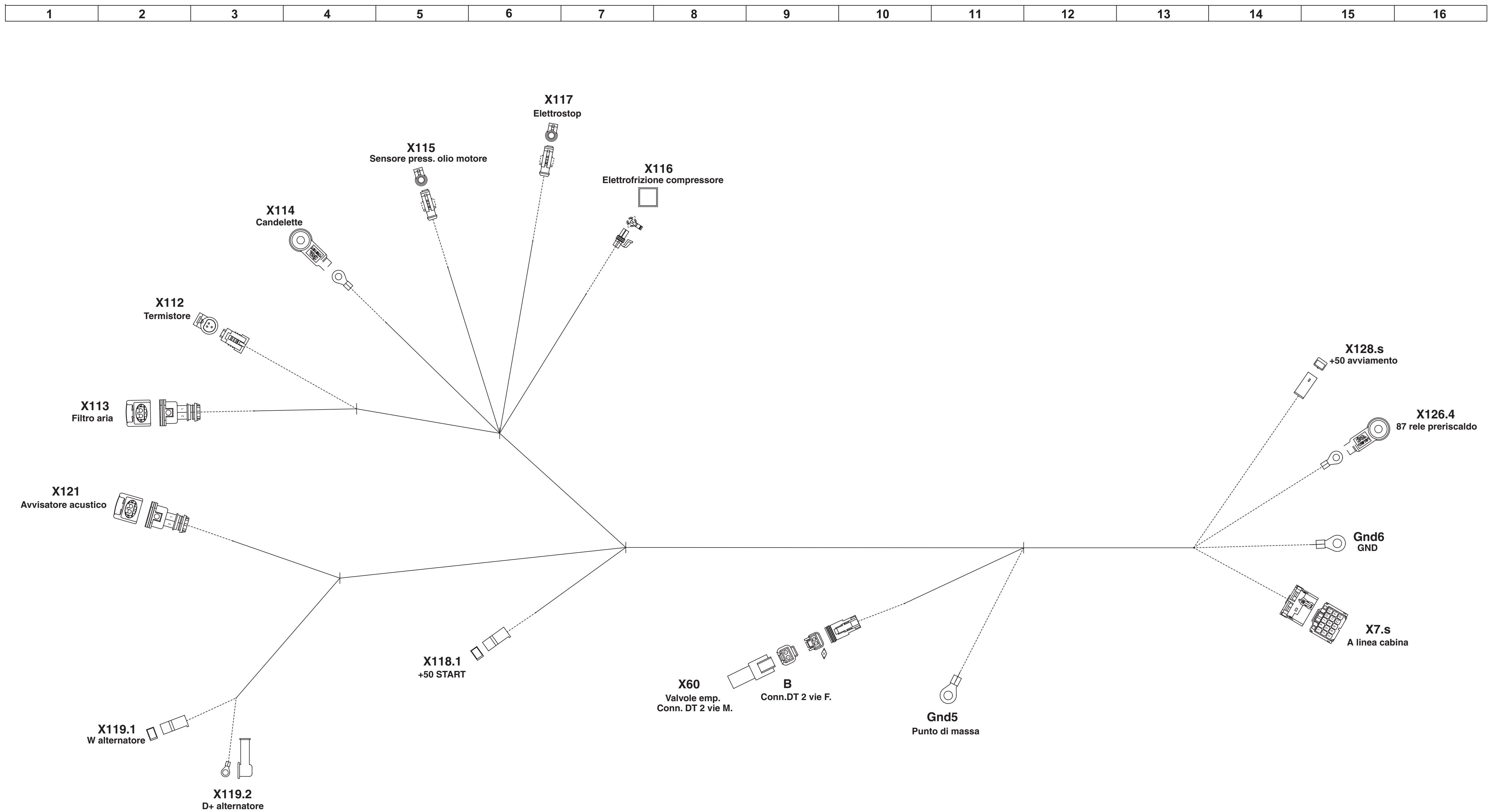
LATERAL DASH WIRING



ROOF WIRING

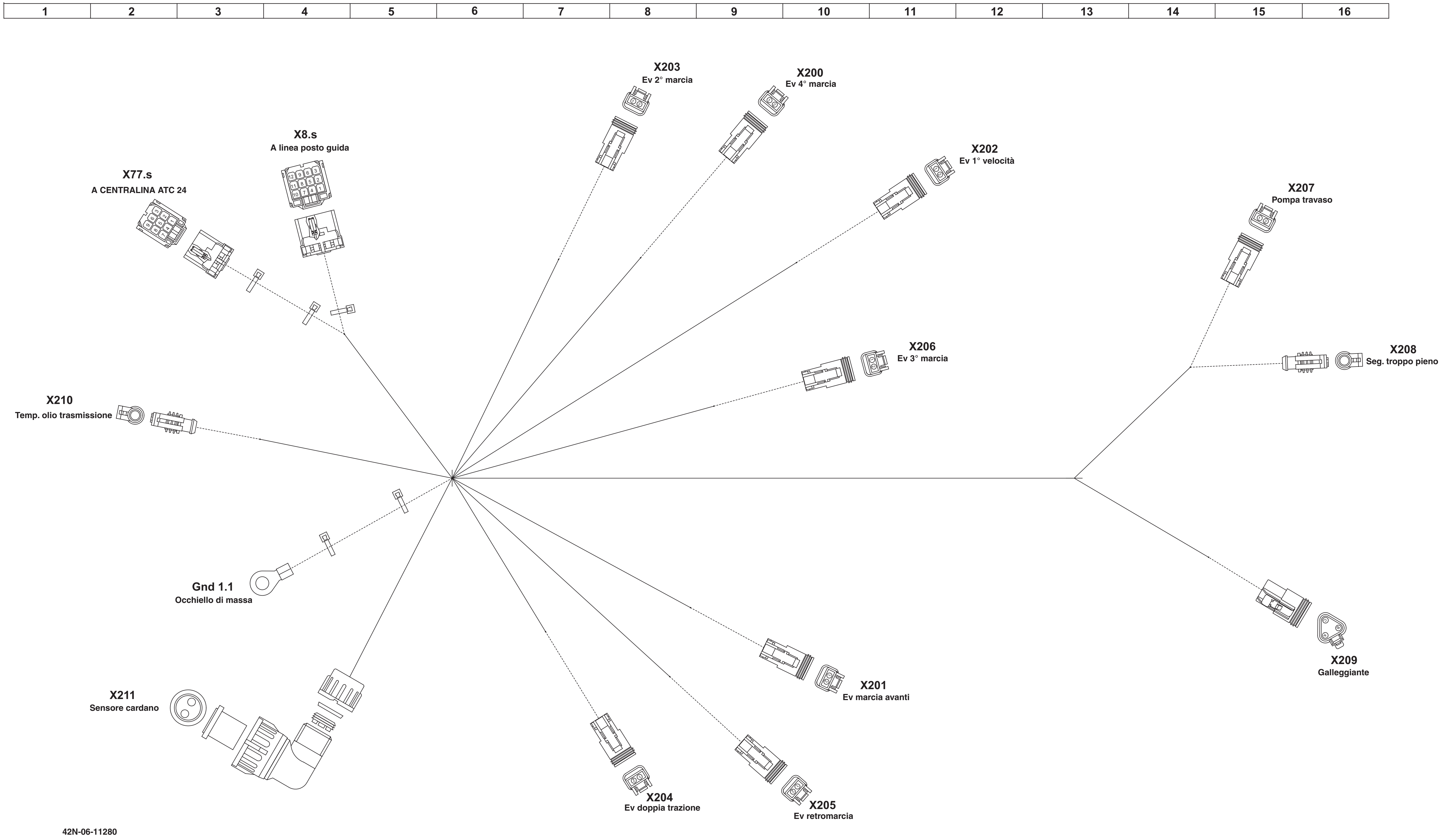

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
X140
Interruttore fari lavoro posteriori
X141
Interruttore girofaro
X138
Faro di lavoro posteriore SX laterale
X142
Interruttore fari lavoro anteriori
X136
Faro di lavoro posteriore DX laterale
X147.2
Faro anteriore SX
X147.3
Faro anteriore SX
X147.1
Faro anteriore SX
X147.4
Faro anteriore SX
X147.5
Faro anteriore SX
X148.2
Presa girofaro
Gnd8
X151.1
Faro ant. DX
X148.1
Presa girofaro
X151.2
Faro ant. DX
X44.s
A linea posto guida
X146
Faro di lavoro anteriore SX laterale
X143
Faro lavoro ant. DX lat.
X151.5
Faro ant. DX
Gnd7.3
X151.3
Faro ant. DX
X151.4
Faro ant. DX
Gnd7.1
X152.2
Plafoniera
X152.1
Plafoniera
a
Gnd7.2
42N-06-11830

ENGINE WIRING

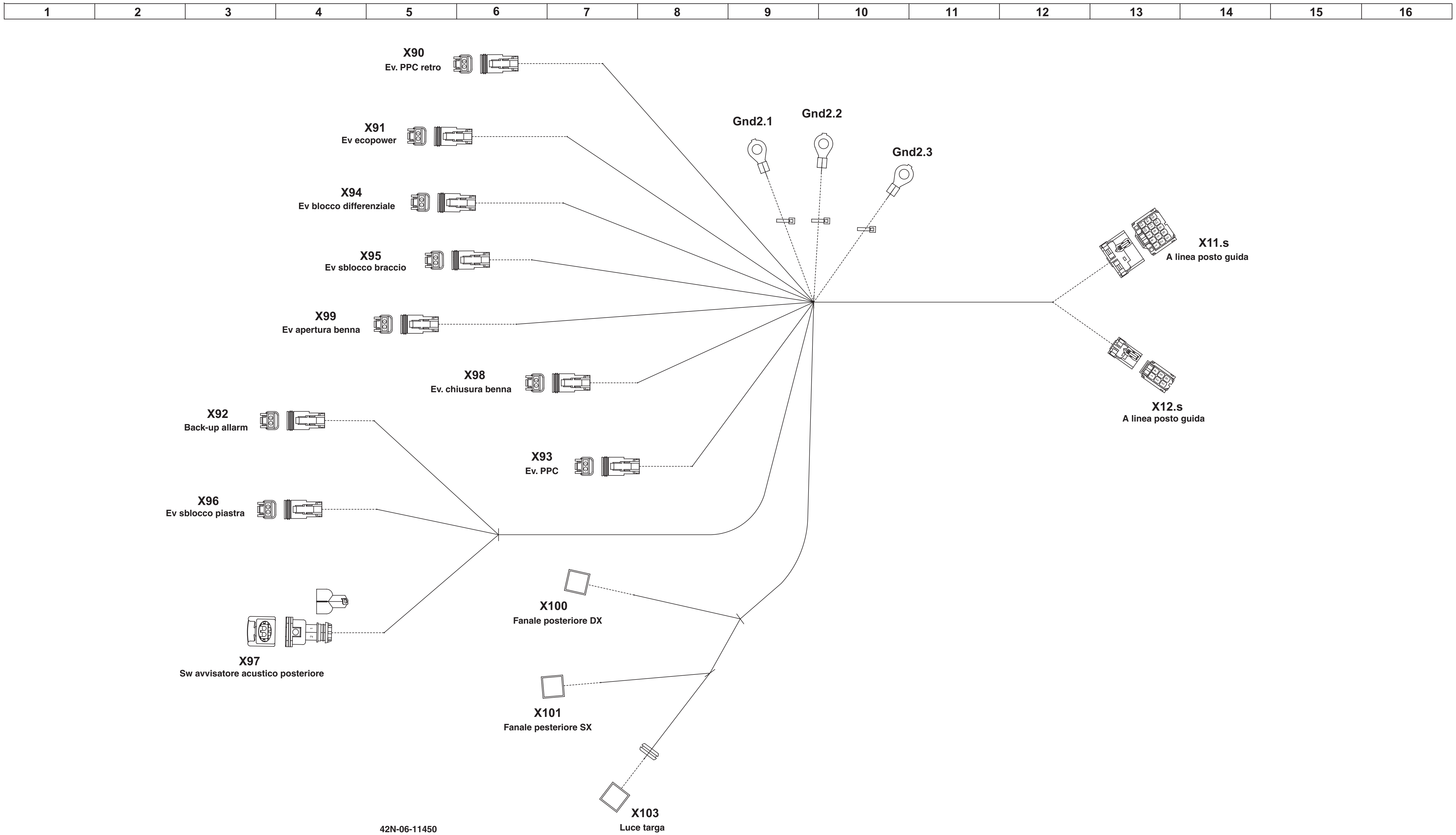


42N-06-11160

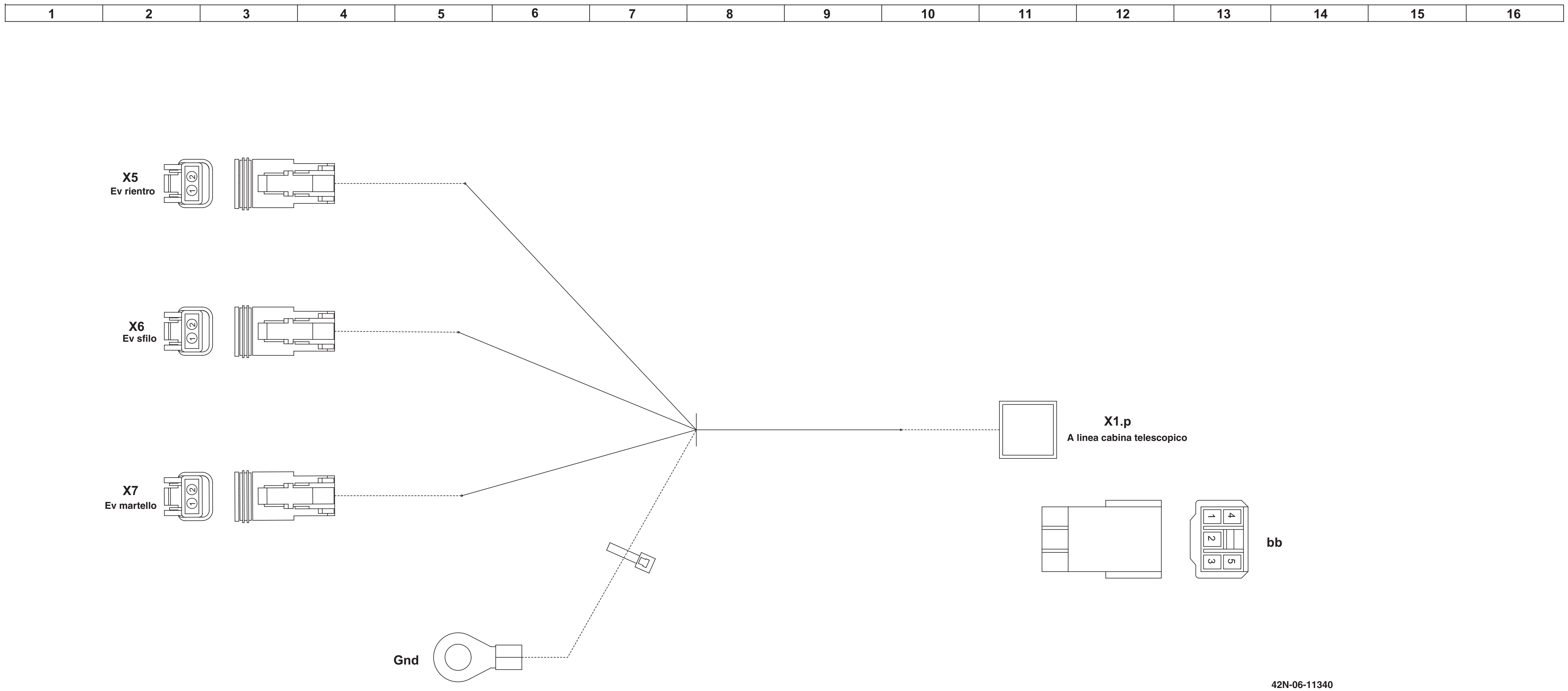
SPEED SELECTOR WIRING



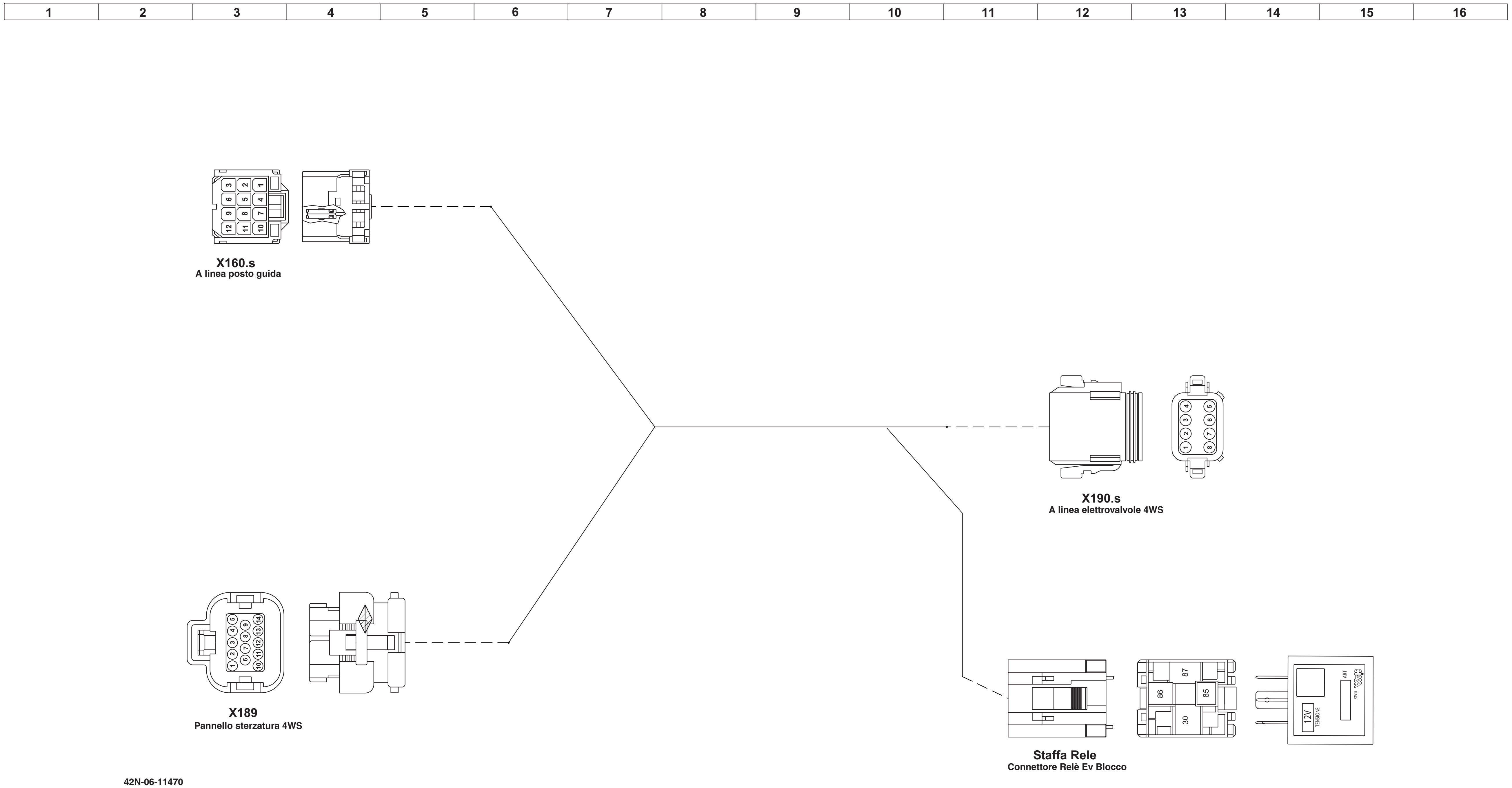
BACKHOE WIRING



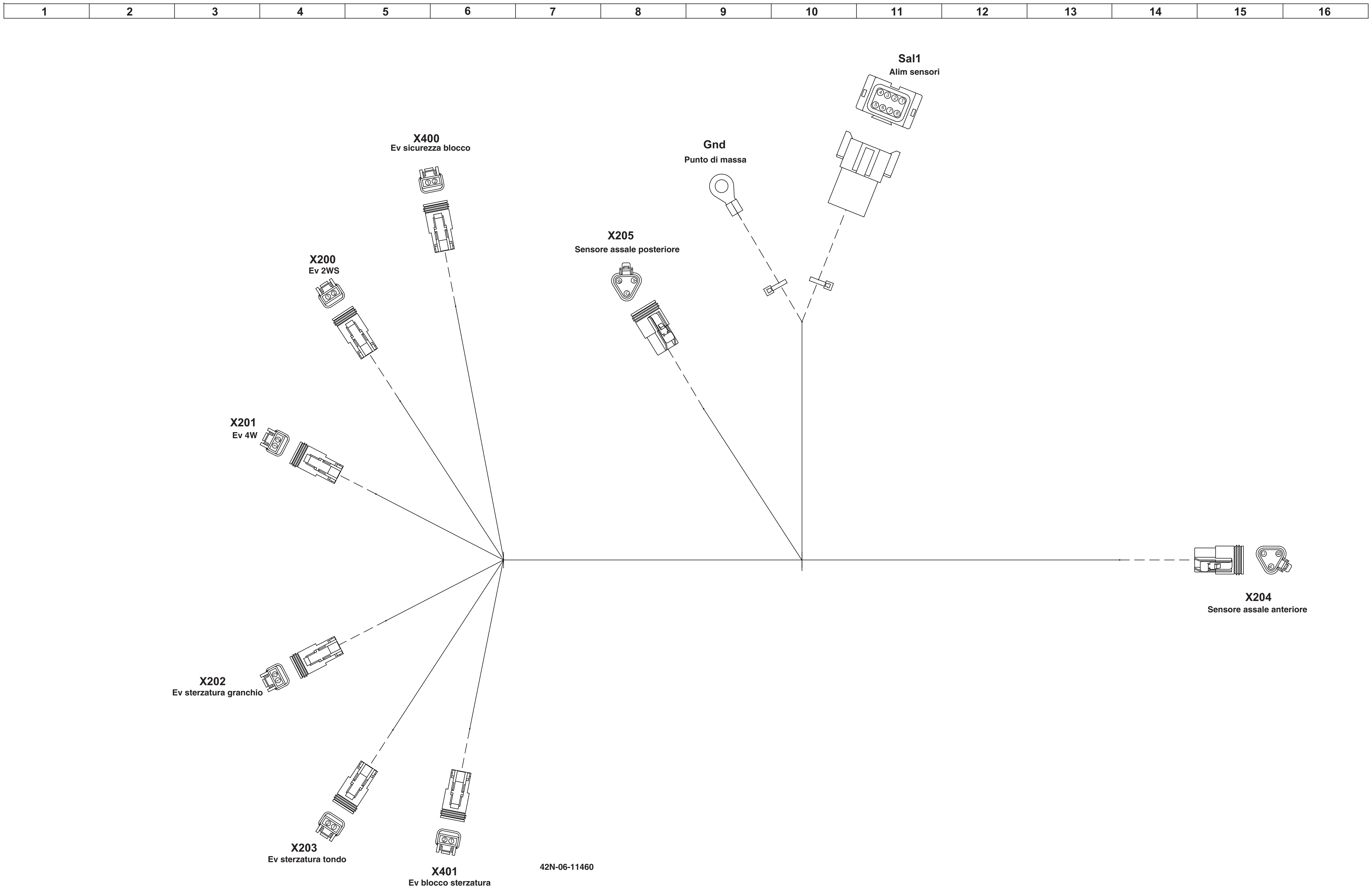
JIG ARM WIRING



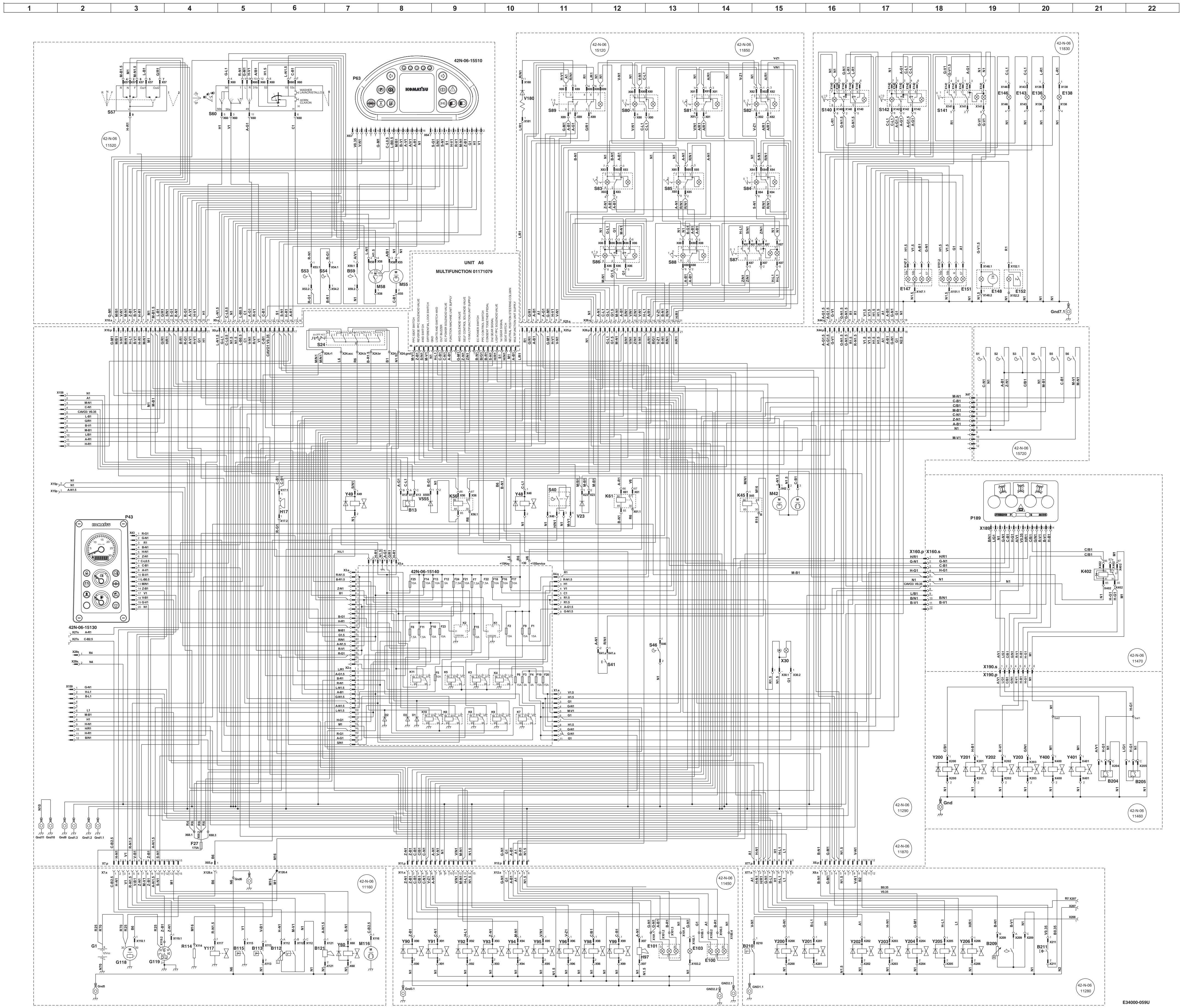
4WS PUSH-BUTTONS PANEL WIRING



4WD SOLENOID VALVES WIRING



WIRING DIAGRAM (STANDARD VERSION) (see also Group 90)



Nome/Item	Descrizione	Description	KUE P/N
A6	A CENTRALINA FUNZIONI MACCHINA	FUNCTION MACHINE UNIT	
B13	SENSORE RETURN TO DIG	RETURN TO DIG SENDER	
B59	Livello olio freni	BRAKE OIL LOW LEVEL SWITCH	
B112	Termistore	Thermistor switch	
B113	Filtro aria	Air filter blocked switch	
B115	Sensore press. olio motore	Engine oil low pressure switch	
B121	Avvisatore acustico	Horn	
B209	Galleggiante	Fuel level sender	
B210	Temp. olio trasmissione	Gearing oil temperature sensor	
B211	Sensore cardano	Cardan sensor	
E100	Fanale podteriore DX	Right rear beam	
E101	Fanale posteriore SX	Left rear beam	
E103	Luce targa	Plate light	
E136	Faro di lavoro posteriore DX laterale	Lateral right rear working light	
E138	Faro di lavoro posteriore SX laterale	Lateral left rear working light	
E143	Faro lavoro ant. DX lat.	Lateral right front working light	
E146	Faro di lavoro anteriore SX laterale	Lateral left front working light	
E147	Faro anteriore SX	Left front light	
E148	Girofaro	Beacon lamp	
E151	Faro ant. DX	Right front light	
E152	Plafoniera	Room lamp	
F1	FUSIBILE FARI LAVORO ANTERIORI CENTRALI 15A	Central front working light fuse 15A	
F2	FUSIBILE FARI LAVORO POSTERIORI CENTRALI 15A	Central rear working light fuse 15A	
F3	FUSIBILE LUCE POSIZIONE DX 3A	Right position light fuse 3A	
F4	FUSIBILE LUCE POSIZIONE SX 3A	Left position light fuse 3A	
F5	FUSIBILE AVVISATORE ACUSTICO 10A	Horn fuse 10A	
F6	FUSIBILE FARI LAVORO POSTERIORI LATERALI 15A	Lateral rear working light fuse 15A	
F7	FUSIBILE TERGI POSTERIORE + AVVISATORE ACUSTICO POSTERIORE 7,5A	Winshield wiper-washer + rear horn fuse 7,5A	
F8	FUSIBILE SWITCH LUCI STOP 7,5A	Stop light swicth fuse 7,5A	
F9	FUSIBILI FARI LAVORO ANTERIORI LATERALI 15A	Lateral front working light fuse 15A	
F10	FUSIBILE ALIM. TERGI ANTERIORE 10A	Front windhield-motor supply fuse 10A	
F11	FUSIBILE OPTIONAL 7,5A	Optional fuse 7,5A	
F12	FUSIBILE BUZZER+STR.ANTERIORE+STR.LATERALE 5A	Front + lateral instruments + buzzer fuse 5A	
F13	FUSIBILE ALIM. MANIPOLATORE10A	Supply level grip fuse 10A	
F14	FUSIBILE LAMPADE SWITCH + SWTCH OPTIONAL 10A	Light switch + swicth optional fuse 10A	
F15	Fusibile elettrostop + sicurezza avviamento 10A	ELETTROSTOP + SAFETY STARTER FUSE 10A	
F16	FUSIBILE GIROFARO 10A	Beacon light fuse 10A	
F17	FUSIBILE SWITCH EMERGENZA 10A	Warning swicth fuse 10A	
F18	FUSIBILE PLAFONIERA+ACCENDISIGARI 10A	Cabin lamp + cigarette lighter fuse 10A	
F19	FUSIBILE ANABBAGLIANTI 15A	Low beam fuse 15A	
F20	FUSIBILE ABBAGLIANTI 15A	Main beam light 15A	
F21	FUSIBILE ALIM. SENSORE RETURN + DIG 10A	Return sender supply + DIG fuse 10A	
F22	FUSIBILE EC POWER 7,5A	EC POWER FUSE 7,5A	
F23	FUSIBILE +15 CENTRALINA STERZATURA 10A	+15 STEERING UNIT FUSE 10A	
F24	FUSIBILE ALIM. INTERMITTENZA 7,5A	FLASHER FUSE 7,5A	
F25	FUSIBILE SIRENA RETRO + ALIM. DEVIO 10A	REVERSE SPEED BUZZER + STEERING COLUMN 10A	
F27	FUSIBILE GENERALE 175A	General fuse 175A	
G1	Batteria	Battery	
G118	Motorino avviamento	Starter	
G119	Alternatore	Generetor	
H17	BUZZER	BUZZER	
K1	CENTRALINA ANTIRIPETIZIONE AVVIAMENTO	Unrepeat start unit	
K2	INTERMITTENZA	Flasher	
K3	RELE' ANABBAGLIANTI	Low beam relay	
K4	RELE' ABBAGLIANTI	Main beam relay	
K5	RELE' avvisatore acustico anteriore	Front horn relay	
K6	RELE' ELETTROVALVOLA RETURN TO DIG	Return to DIG solenoid valve relay	
K7	RELE' LUCI STOP	Light stop relay	
K8	RELE' CONSENSO AVVIAMENTO	Assent start relay	
K9	RELE' MARCIA AVANTI	Forword speed relay	
K10	RELE' MARCIA INDIETRO	Reverse speed relay	
K11	RELE' STACCO TRASMISSIONE	Stop drive relay	
K45	Rele' preriscaldo	Preheating Relay	
K56	Rele' consenso avviamento	Starting relay	
K61	Rele' servizi	Service realy	
M42	Tergi posteriore	Rear Windshield-washer	
M55	Pompetta	Motor pump	
M58	Motore tergi anteriore	Front windshild-washer	
M116	Elettrofrizione compressore	Compressor Electonic cluch	
R114	Candelette	Preheating	
S1	INTERRUTTORE FUNZIONE KICK DOWN	KICK DOWN SWITCH	
S2	INTERRUTTORE ELETTROVALVOLA EC POWER	SOLENOID VALVE E.C. POWER SWITCH	
S3	INTERRUTTORE CHIUSURA BENNA	LOCK GRAB SWITCH	
S4	INTERRUTTORE STACCO TRASMISSIONE	DECLUCH SWITCH	
S5	INTERRUTTORE APERTURA BENNA	OPEN GRAB SWITCH	
S6	INTERRUTTORE BLOCCO DIFFERENZIALE	DIFFERENTIAL LOCK SWITCH	
H97	CLAXON POSTERIORE	REAR HORN	
S24	Quadro avviamento	Starting switch	
S40	Micro sedile	Seating switch	
S41	PULSANTE POSTERIORE CLAXON	Rear horn Switch	
S46	Freno di stazionamento	Parking brake switch	
S53	Interruttore luci stop	Stop light switch	
S54	Interruttore stop 4wd	Stop 4wd witch	
S57	Devio cambio	Steering column gear switch	
S60	Devio luci	Steering column light switch	
S80	INTERRUTTORE RIDE CONTROL	Ride control switch	
S81	PULSANTE SBLOCCO BRACCIO	Arm unlock switch	
S82	INTERRUTTORE SBLOCCO PIASTRA	Plate unlock switch	
S83	PULSANTE E/C POWER	E/C Power Switch	
S84	INTERRUTTORE VALVOLE EMPI	EMPI solenoid valve switch	
S85	PULSANTE AVV. ACUSTICO POSTERIORE	Rear horn switch	
S86	INTERRUTTORE GENERALE LUCI	General light switch	
S87	INTERRUTTORE 4WD	4WD Switch	
S88	PULSANTE PPC	PPC switch	
S89	INTERRUTTORE WARNING	WARNING switch	
S140	Interruttore fari lavoro posteriori	Rear working light switch	
S141	Interruttore girofaro	Beacon light switch	
S142	Interruttore fari lavoro anteriori	Front working light switch	
Y48	Ev flottante	Float solenoid valve	
Y49	Ev return to d.i.g.	Return to Dig solenoid valve	
Y60	Valvole emp.	EMP Solenoid Valve	
Y90	Ev. PPC retro	Rear PPC solenoid valve	
Y91	Ev ecopower	EC power Solenoid valve	
Y92	ELETTROVALVOLA ALLARME MARCIA INDIETRO	Back-up allarm solenoid valve	
Y93	Ev. PPC	PPC solenoid valve	
Y94	Ev blocco differenziale	Lock Differential gear solenoid valve	
Y95	Ev sblocco braccio	Arm unlock solenoid valve	
Y96	Ev sblocco piastra	Plate unlock solenoid valve	
Y98	Ev. chiusura benna	Grab close solenoid valve	
Y99	Ev apertura benna	Grab open solenoid valve	
Y117	Elettrostop	Elettrostop	
Y200	Ev 4° marcia	4th gear solenoid valve	
Y201	Ev marcia avanti	Forword solenoid valve	
Y202	Ev 1° velocita'	1st gear solenoid valve	
Y203	Ev 2° marcia	2nd gear solenoid valve	
Y204	Ev doppia trazione	Doble traction solenoid valve	
Y205	Ev retromarcia	Reverse speed solenoid valve	
Y206	Ev 3° marcia	3rd gear solenoid valve	
X12.s	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
X25.s	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
X26.s	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
X44.s	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
X77.s	CONNETTORE A CETRALINA ATC26	TO ATC 26 UNIT CONNECTOR	
X8.s	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
X10.s	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
X9.s	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
X1.s	CONNETTORE a linea posto guida	TO UNIT 01171062 CONNECTOR	
X10.p	CONNETTORE a linea cruscotto anteriore	TO FRONT DASHBOARD HARNESS CONNECTOR	
X11.p	CONNETTORE a linea telaio	TO CHASSIS HARNESS CONNECTOR	
X12.p	CONNETTORE a linea telaio	TO CHASSIS HARNESS CONNECTOR	
X15.p	CONNETTORE a linee optional	TO OPTIONAL HARNESS	
X158	CONNETTORE A LINEA CENTRALINA ATC26	TO ATC26 UNIT CONNECTOR	
X159	CONNETTORE A LINEA CENTRALINA ATC26	TO ATC26 UNIT CONNECTOR	
X160.p	CONNETTORE A LINEA PANNELLO INTERRUTTORI	TO SWITCHES PANEL HARNESS CONNECTOR	
X2.s	CONNETTORE A LINEA CENTRALINA 01171062	TO UNIT 01171062 CONNECTOR	
X25.p	CONNETTORE A LINEA PANNELLO INTERRUTTORI	TO SWITCHES PANEL HARNESS CONNECTOR	
X26.p	CONNETTORE A LINEA PANNELLO INTERRUTTORI	TO SWITCHES PANEL HARNESS CONNECTOR	
X27.s	CONNETTORE ARIA CONDIZIONATA	A/C HARNES CONNECTOR	
X28.s	CONNETTORE RISCALDAMENTO	HEATING CONNECTOR	
X3.s	CONNETTORE A LINEA CENTRALINA 01171062	TO UNIT 01171062 CONNECTOR	
X30	Accendisigari	CIGARETTE LIGHTER	
X4.s	CONNETTORE A LINEA CENTRALINA 01171062	TO UNIT 01171062 CONNECTOR	
X44.p	CONNETTORE A LINEA CABINA	TO CABIN HARNESS CONNECTOR	
X5.s	CONNETTORE A LINEA CENTRALINA 01171062	TO UNIT 01171062 CONNECTOR	
X6	CONNETTORE A LINEA CENTRALINA FUNZIONI MACCHINA	TO FUNCTION MACHINE UNIT	
X65.p	CONNETTORE A LINEA MOTORE	TO MOTOR HARNESS CONNECTOR	
X7.p	CONNETTORE A LINEA MOTORE	TO MOTOR HARNESS CONNECTOR	
X77.p	CONNETTORE A LINEA ATC26	ATC26 HARNESS CONNECTOR	
X8.p	CONNETTORE A LINEA ATC26	ATC26 HARNESS CONNECTOR	
X9.p	CONNETTORE a linea cruscotto anteriore	TO FRONT DASHBOARD HARNESS CONNECTOR	
X11.s	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
P43	PANNELLO STRUMENTI	INSTRUMENTS PANEL	
P63	PANNELLO DI CONTROLLO ANTERIORE	FRONT CONTROL PANEL	

B204	SENSORE ASSALE ANTERIORE	Front axle Sensor	
B205	SENSORE ASSALE POSTERIORE	Rear axle Sensor	
K402	RELE' SICUREZZA STERZO	LOCK SECURITY SOLENID VALVE RELAY	
Y200	EV. STERZATURE 2WS	2WS solenoid valve	
Y201	EV. STERZATURE 4WS	4WS solenoid valve	
Y202	EV. STERZATURE A GRANCHIO	Crab steering solenoid valve	
Y203	EV. STERZATURE IN TONDO	Round steering solenoid valve	
Y400	EV. SICUREZZA STERZO	LOCK SECURITY SOLENID VALVE	
Y401	EV. SICUREZZA STERZO	LOCK SECURITY SOLENID VALVE	
X190.p	CONNETTORE A LINEA POSTO GUIDA	TO DRIVER SITE HARNESS CONNECTOR	
P189	PANNELLO 4WS	4WS STEERING PANEL	
X189	CONNETTORE PANNELLO 4WS	4WS STEERING PANEL CONNECTOR	
X160.s		TO DRIVER SITE HARNESS CONNECTOR	
X190.s	A LINEA ELETTROVALVOLE 4WS	TO SOLENOID VALVE 4WS HARNESS	

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20 TESTING AND ADJUSTMENTS

NORMAL OR STANDARD TECHNICAL DATA

Machine model			WB97S-5	
Check item	Test conditions	Unit:	Standard value	Normal value
Engine speed (without load):	High idling Low idling Calibration speed	rpm rpm rpm	2400±50 1050±50 –	2350–2450 1000–1100 –
Exhaust gas colour	Sudden acceleration At high idling speed	Bosch index	– <1.5	<3.0 <3.0
Valve clearance	Intake valve (20°C) Exhaust (20°C)	mm mm	0.30±0.05 0.55±0.05	0.30±0.05 0.55±0.05
Compression pressure (SAE30 oil)	Oil temperature: 69–72°C (Engine speed)	bar rpm	34.3±1 250	27.5±1 250
Engine oil pressure (SAE30 oil)	With blow-by Free exhaust	mm H_2O	5–10 50.0	5–10 50.0
Engine oil pressure	At high idling speed At Low idling	bar (kPa) bar (kPa)	3.5 (350) 0.7 (70)	–
Engine oil temperature	Entire speed range	°C	Max. 120	Max. 120
Fuel injectiontiming	B.T.D.C.	mm	1.00	1.00±0.05

<table>
<tr><th colspan="5">Machine model</th><th colspan="8">WB97S-5</th></tr>
<tr><th>Classification</th><th>Check item</th><th colspan="2">Test conditions</th><th>Unit</th><th colspan="4">Standard value</th><th colspan="4">Normal value</th></tr>
<tr><td rowspan="4">Engine speed</td><td rowspan="2">Accelerator pedal</td><td rowspan="2">• Hydraulic oil temperature: 45–55 °C
• Converter oil temperature: 80 °C
• Engine oil temperature cooling circuit: in the limits
• Measurement taken on drive shaft pulley with stroboscopic rev counter.</td><td>Max.</td><td rowspan="4">rpm</td><td colspan="4">2400±50</td><td colspan="4">2350–2450</td></tr>
<tr><td>Min.</td><td colspan="4">1050±50</td><td colspan="4">1000–1100</td></tr>
<tr><td rowspan="2">Accelerator fuel</td><td rowspan="2">• Hydraulic oil temperature: 45–55 °C
• Converter oil temperature: 80 °C
• Engine oil temperature cooling circuit: in the limits
• Measurement taken on drive shaft pulley with stroboscopic rev counter.</td><td>Max.</td><td colspan="4">1900±50</td><td colspan="4">1850–1950</td></tr>
<tr><td>Min.</td><td colspan="4">1050±50</td><td colspan="4">1000–1100</td></tr>
<tr><td rowspan="2">Control valve</td><td></td><td colspan="2"></td><td rowspan="2">mm</td><td>ℓ</td><td>a</td><td>b</td><td>c</td><td>ℓ</td><td>a</td><td>b</td><td>c</td></tr>
<tr><td>Arm shovel, shovel, boom, boom swing, 4 in 1 bucket, arm, jig arm cylinder, outrigger, backhoe bucket</td><td colspan="2">• See Fig. A</td><td>–</td><td>6</td><td>5.5</td><td>2</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td rowspan="8">Travel of levers and pedals</td><td>Shovel arm control lever</td><td rowspan="8">• Engine stopped
• Knob lever: at the center and at 90° from the lever
• Value reading at the end of working stroke plus half measured backlash
• Attachments on the ground
• Instrument metre w/ millimetre divisions</td><td>Neutral → Raise
Lower</td><td rowspan="8">mm</td><td colspan="4">95
95</td><td colspan="4">80–110
80–110</td></tr>
<tr><td>Shovel control lever</td><td>Neutral → Dump
Curl</td><td colspan="4">95
95</td><td colspan="4">80–110
80–110</td></tr>
<tr><td>Boom backhoe controllever</td><td>Neutral → Raise
Lower</td><td colspan="4">50
50</td><td colspan="4">40–60
40–60</td></tr>
<tr><td>Arm backhoe control lever</td><td>Neutral → Opening
Closing</td><td colspan="4">50
50</td><td colspan="4">40–60
40–60</td></tr>
<tr><td>Bucket backhoe control lever</td><td>Neutral → Opening
Curl</td><td colspan="4">50
50</td><td colspan="4">40–60
40–60</td></tr>
<tr><td>Boom swing backhoe control lever</td><td>Neutral → Right
Left</td><td colspan="4">50
50</td><td colspan="4">40–60
40–60</td></tr>
<tr><td>Outriggers control lever</td><td>Neutral → Up
Down</td><td colspan="4">35
35</td><td colspan="4">25–45
25–45</td></tr>
<tr><td>Fuel control lever</td><td>Min. → Max.</td><td colspan="4">40</td><td colspan="4">30–50</td></tr>
</table>

Machine model					WB97S-5	
Classification	Check item	Test conditions		Unit	Standard value	Normal value
Travel of levers and pedals	Accelerator pedal	• Engine stopped • Knob lever: at the center and at 90° from the lever • Value reading at the end of working stroke • Attachments on the ground • Instrument:	Min. → Max.	mm	80	65–95
	Wheel swing		Right→Left Left→Right	rev.	4.3 4.3	3.8–4.8 3.8–4.8
Force for lever, pedal and steering wheel operation	Shovel arm control lever	• Engine speed: min. • Oil temperature: 45–55 °C • Tool connection at centre of knob and 80 mm away from handle base (see Fig. B) • Value reading at the 10 mm before end of working stroke. • Instrument force gauge. • Ambient temperature: 15–35 °C		kg	1.5	1.0–2.0
	Shovel control lever				1.5	1.0–2.0
	Control lever Boom				1.8	1.3–2.3
	Arm control lever				1.8	1.3–2.3
	Bucket control lever				1.3	0.8–1.8
	Boom swing control lever				1.3	0.8–1.8
	Outriggers control lever				1.5	1.0–2.0
	Fuel control lever				6.0	5.0–7.0
	Accelerator pedal				4.0	2.5–5.5
	Steering wheel	• Force measured on steering wheel knob at min. RPM for approx. half a revolution under steady motion at a speed of 2.5” per rev.			–	–

Machine model				WB97S-5	
Classification	Check item	Test conditions	Unit	Standard value	Normal value
Main valve pressure	Control valve	• Engine speed: 2200 rpm • Oil temperature: 45–55 °C • Move arm cylinder to end of stroke and measure the pressure • Instrument: 0-600 bar pressure gauge mounted on adapters at port “P1C”. • Working mode switch: POWER	bar	245	235–260
	Steering unit	• Engine speed: 1500±50 rpm		175	170–185
Pressures of secondary valves circuits	Shovel (curled)	• Engine speed: min. • Oil temperature: 45–55 °C • Check one circuit at the time • Instrument: 0-600 bar pressure gauge mounted on adapters at port “P1C”. • Working mode switch: POWER	bar	270	260–280
	Shovel (Dump)			240	230–255
	4 in 1 bucket (opens-closes)			270	260–280
	Boom (raising)			345	320–360
	Boom (lowering)			270	260–280
	Arm (Closing)			270	260–280
	Arm (Out)			270	260–280
	Boom swing			230	220–245
	Bucket (curled)			270	260–280
	Bucket (Dump)			–	–
	Jig arm (out - in)			–	–
	Hammer (delivery)			190	180–210
	Steering unit (safety)			225	225–245

Machine model				WB97S-5	
Classification	Check item	Test conditions	Unit	Standard value	Normal value
Engine speed (with load) - Converter	With converter	• Engine speed (without load): 2400±50 • Hydraulic oil temperature: 45–55 °C • Machine in 3rd gear • Working brakes: engaged. • Working mode switch: POWER	rpm	2175±50	2125–2225
	With converter and hydraulic circuit	• Engine speed (without load): 2400±50 • Hydraulic oil temperature: 45–55 °C • Machine in 3rd gear • Working brakes: engaged. • Shovel raise bottom of stroke • Steering held at the end of stroke • Working mode switch: POWER		2075±50	2025–2125
	Hydraulic circuit at Low idling	• Engine speed: 1050±50 • Hydraulic oil temperature: 45–55 °C • Vehicle in neutral • Parking brake: applied • Bucket dump bottom of stroke • Working mode switch: POWER		600	Min. 600

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

<table>
<tr><td colspan="5">Machine model</td><td colspan="2">WB97S-5</td></tr>
<tr><td>Classification</td><td colspan="2">Check item</td><td>Test conditions</td><td>Unit</td><td>Standard value</td><td>Normal value</td></tr>
<tr><td rowspan="7">Hydraulic drift working equipment</td><td rowspan="3">Shovel</td><td>Complete working equipment (Shovel teeth tip lower)</td><td rowspan="3">Measuring posture: see Fig. C
• In this position check in feedback of each cylinder and the leakage with applied load on the tip of shovel teeth.
• On level ground.
• Shovel: load 1800 Kg
4 in 1 bucket: load 1550 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.</td><td rowspan="3">mm</td><td>150</td><td>300</td></tr>
<tr><td>Raise cylinder (Cylinder in)</td><td>12</td><td>20</td></tr>
<tr><td>Shovel cylinder (Cylinder out)</td><td>35</td><td>50</td></tr>
<tr><td rowspan="4">Backhoe</td><td>Complete working equipment (Bucket teeth tip lower)</td><td rowspan="4">Measuring posture: see Fig. D
• In this position check the extension of each cylinder and the leakage with normal load on the bucket.
• On level ground.
• Bucket: load with standard arm: 340 kg
Bucket load with jig arm: 0 kg
Fully extend jig arm
• 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.</td><td rowspan="4">mm</td><td>200</td><td>350</td></tr>
<tr><td>Boom cylinders (Cylinder out)</td><td>10</td><td>20</td></tr>
<tr><td>Arm cylinders (Cylinder out)</td><td>10</td><td>20</td></tr>
<tr><td>Bucket cylinder (Cylinder in)</td><td>8</td><td>15</td></tr>
</table>

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

Machine model					WB97S-5	
Classification	Check item		Test conditions	Unit	Standard value	Normal value
Hydraulic drift working equipment	Backhoe	Boom swing	Measuring posture: see Fig. E • Oil temperature: 45–55 °C • Backhoe balanced on the guides bucket in transport condition. • Fully retract arm and bucket cylinder Lift the bucket fulcrum pin 1 m off the ground and swing boom to bottom of stroke in either direction. • Move the machine on a slope of 15° and apply the parking brake. • Stop the engine and, after 1 minute, check the inner cylinder feed back opposite to the boom every 5 min. for a total of 15 minutes. • Perform the above test on both swing directions.	mm	15	25
		Outriggers	Measuring posture: see Fig. F • 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.		7	15
Cylinder leaking	Shovel	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 arm shovel, shovel and for swing, check the two cylinders separately.	cm³/min	2.0 (each cylinder)	Max. 8.0
		Shovel			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
		Outriggers			3.3	Max. 13.5
		Side digging boom			2.0	Max. 8.0
		Jig arm			1.6	Max. 6.0

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

Machine model						WB97S-5	
Classification	Check item		Test conditions		Unit	Standard value	Normal value
Work equipment speed	Shovel	Arm shovel Cylinders fully out ↕ Shovel at the ground	Measuring posture: see Fig. G • Engine speed: max. • Oil temperature: 45–55 °C • Power mode ON	Lifting	sec.	3.6	3.1–4.1
				Lowering		2.6	2.2–3.0
		shovel Cylinders fully out ↕ Cylinders fully in	Measuring posture: see Fig. H • Engine speed: max. • Oil temperature: 45–55 °C • Power mode ON	Curl		2.3	2.0–2.6
				Dump		2.8	2.4–3.2
	Backhoe	Boom Cylinders fully in ↕ Teeth bucket on level ground	Measuring posture: see Fig. J • Engine speed: $1700^{0}_{+}50$ rpm • Oil temperature: 45–55 °C • Backhoe balanced • Power mode ON	Lifting ●		2.7	2.3–3.1
				Lowering		2.0	1.7–2.3
		Arm Cylinders fully in ↕ Cylinders fully out	Measuring posture: see Fig. K • Engine speed: $1700^{0}_{+}50$ rpm • Oil temperature: 45–55 °C • Backhoe balanced • Power mode ON	Opening		3.8	3.2–4.3
				Closing ●		4.4	3.7–5.1
		Bucket Cylinders fully in ↕ Cylinders fully out	Measuring posture: see Fig. L • Engine speed: $1700^{0}_{+}50$ rpm • Oil temperature: 45–55 °C • Backhoe balanced • Power mode ON	Dump		2.4	2.0–2.8
				Curl		3.1	2.6–3.6

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

Machine model						WB97S-5	
Classification	Check item		Test conditions		Unit	Standard value	Normal value
Work equipment speed	Backhoe	Boom swing Right end travel ↕ Left end travel	Measuring posture: see Fig. M • Engine speed: 1700^{0}_{-50} rpm • Oil temperature: 45–55 °C • arm and bucket fully in • Power mode ON	Right ●	sec.	3.2	2.7–3.7
				Left ●		3.2	2.7–3.7

● Times are referred to the cylinder stroke whitout the brake phase.

NOTE. The engine speed (1700^{0}_{-50} rpm) has to be checked with the procedure described at paragraph «MEASURING ENGINE SPEED» in this section.

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

Machine model					WB97S-5	
Classification	Check item		Test conditions	Unit	Standard value	Normal value
Work equipment	Time lags	Arm shovel	Measuring posture: see Fig. N • Engine speed: Min. • Oil temperature: 45–55 °C • Check the time necessary to lift shovel from level ground.	sec.	0	Max. 2
		Boom	Measuring posture: see Fig. P • 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
		Arm	Measuring posture: see Fig. Q • 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
		Bucket	Measuring posture: see Fig. R • Engine speed: Min. • Oil temperature: 45–55 °C • Put arm in horizontal position. Tilt back bucket cylinder an then extend it. Check the time passing between bucket stop at dead centre and the restart movement.		0	Max. 2
		Outriggers	Measuring posture: see Fig. S • 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

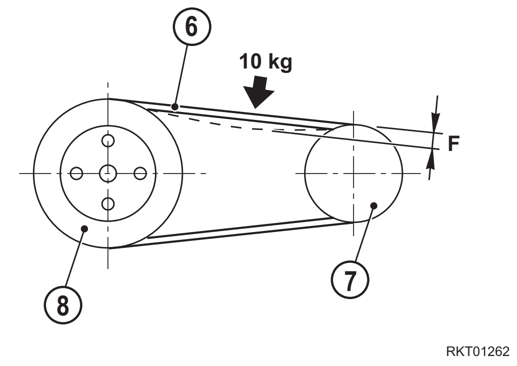
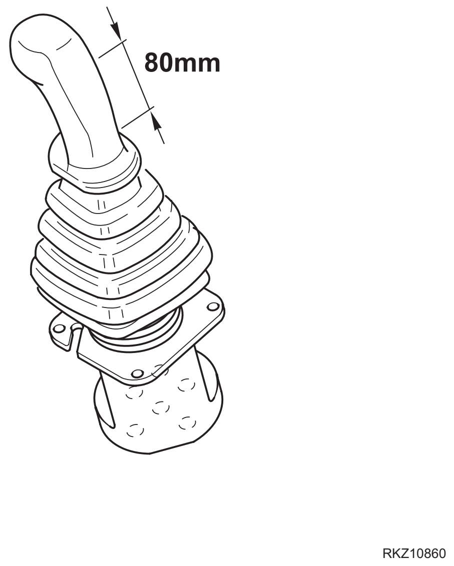
Fig. A	Fig. B
	

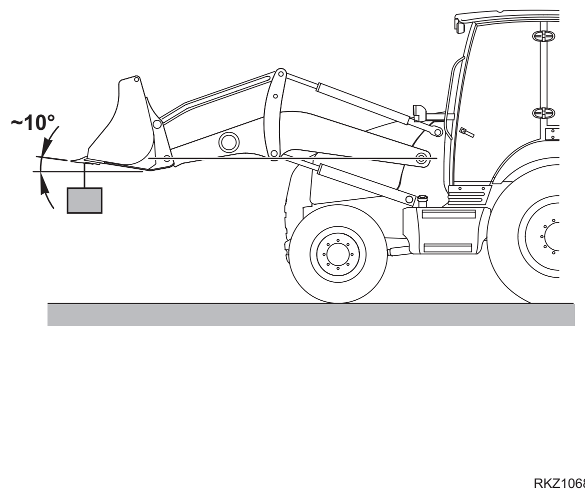
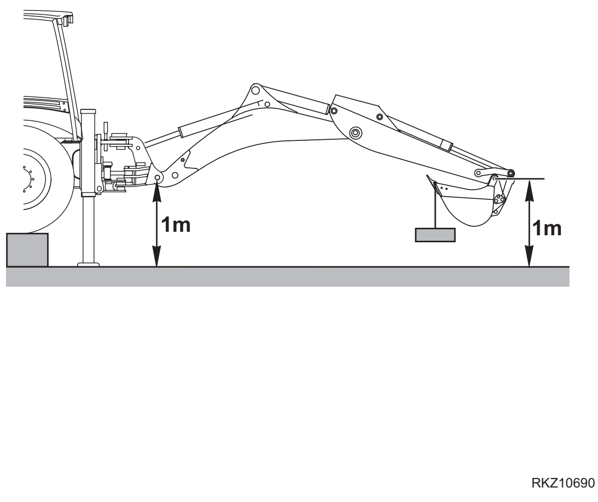
Fig. C	Fig. D
	

Fig. E

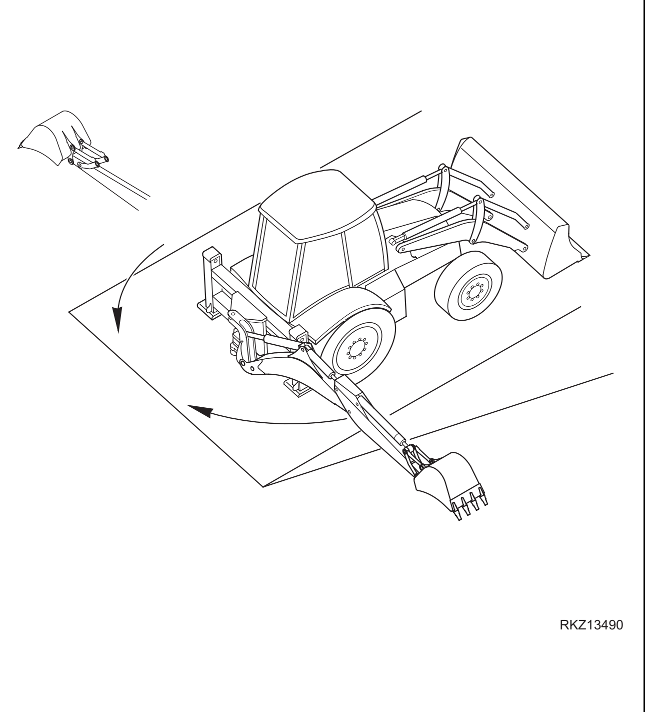


Fig. F

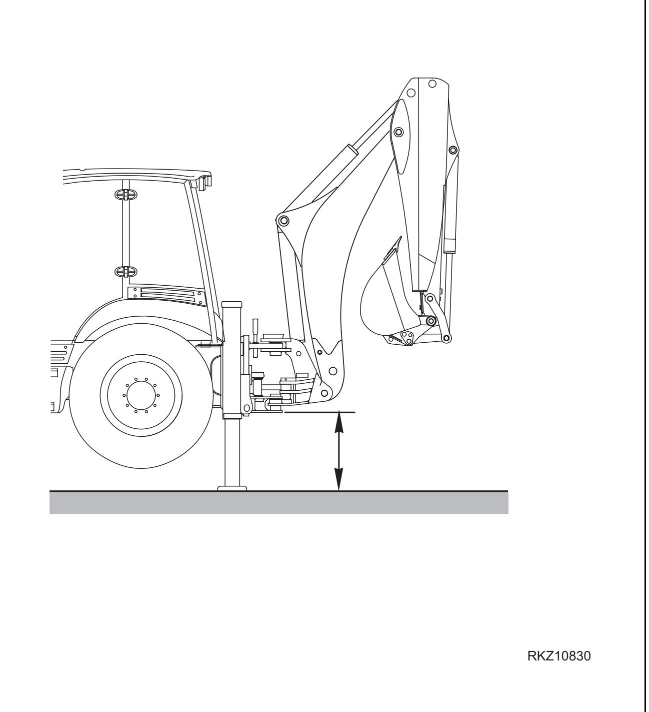


Fig. G

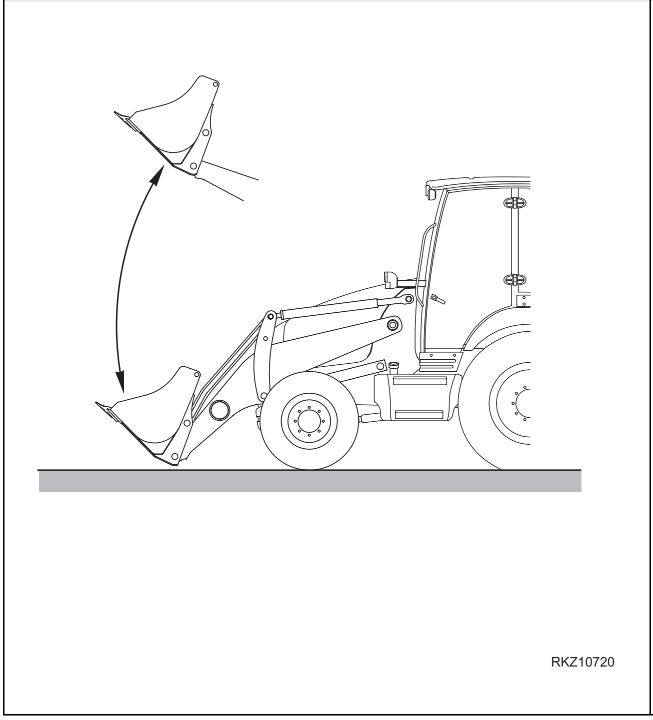


Fig. H

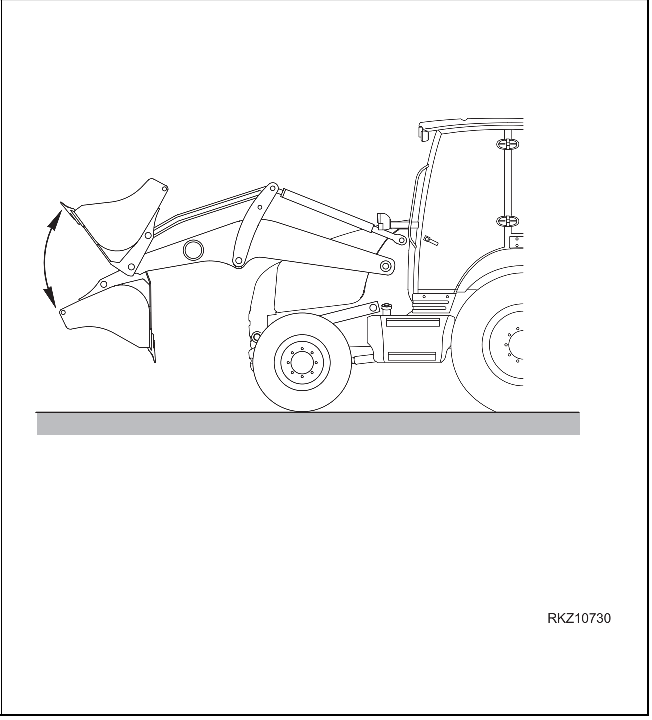
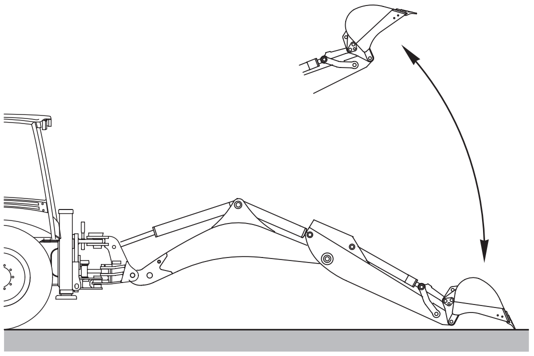
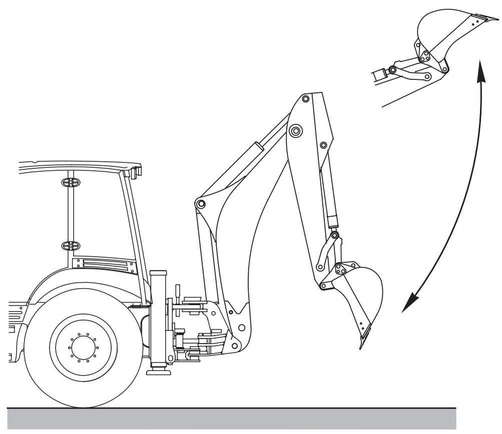


Fig. J



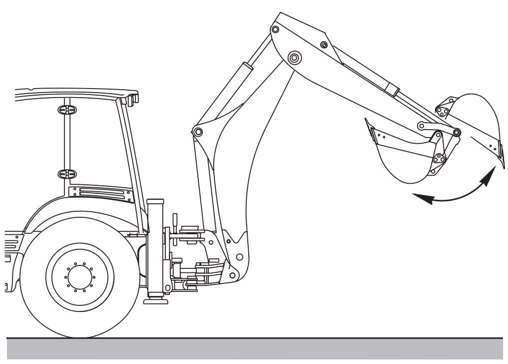
RKZ10740

Fig. K



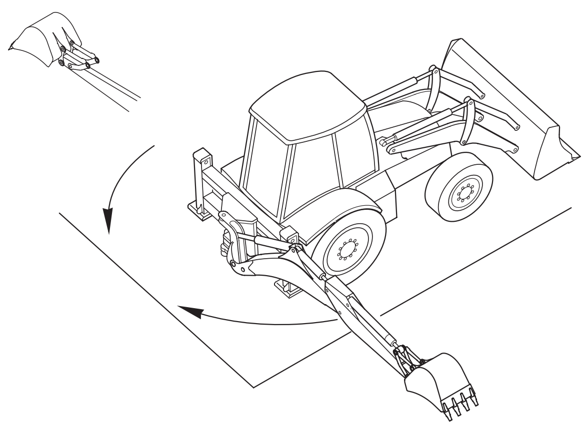
RKZ10750

Fig. L



RKZ10780

Fig. M



RKZ13500

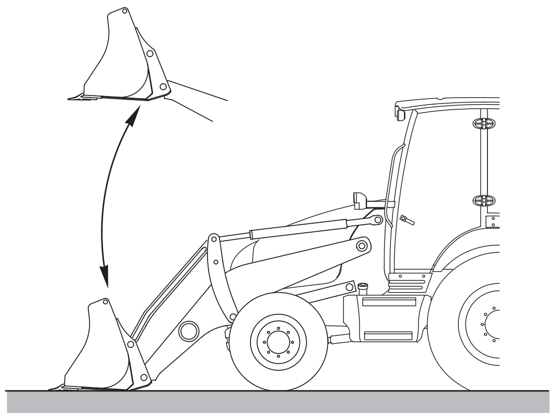
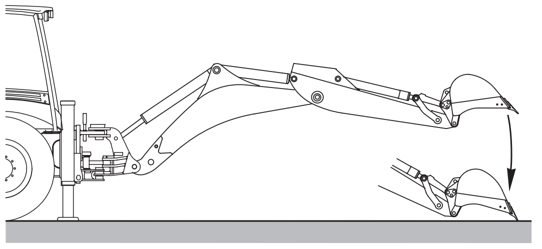
Fig. N	Fig. P
 RKZ10790	 RKZ10800

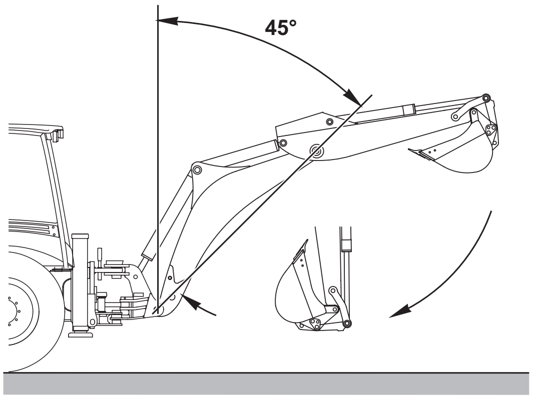
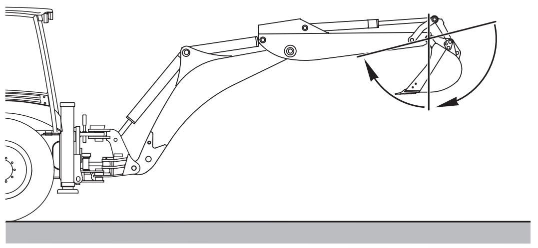
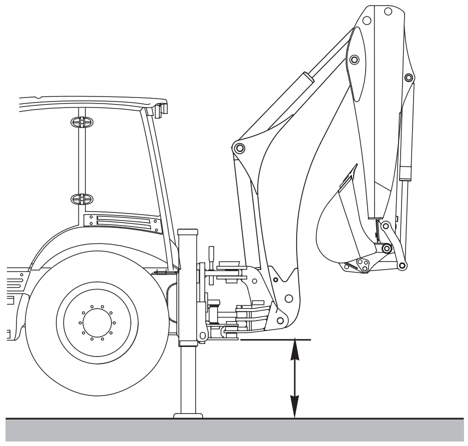
Fig. Q	Fig. R
 RKZ10810	 RKZ10820

Fig. S



SPECIAL TOOLS

Measurement check point	Symbol		Code	Name	Q.ty	Note
Engine speed	**C**	**1**		Stroboscopic tachometer	1	6 - 30000 rpm
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 Differential digital pressure gauge	1	0–1000 bar
		6				
	F	**1**		Flow-meter	1	Delivery 0–300 ℓ/min.
		2		Pipe fitting kit	1	–
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

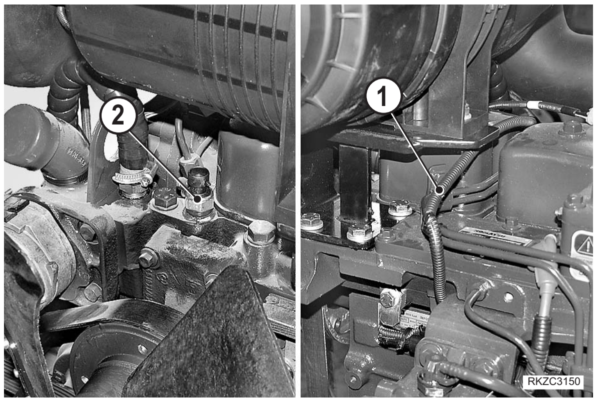
ADJUSTING VALVE CLEARANCE

1 - Park the machine on solid, level ground, apply the parking brake, and remove the ignition key.

2 - Remove the intake filter and muffler.
(For details see "30 REMOVAL AND INSTALLATION").

3 - Release from straps and disconnect the wiring harness (1) of the coolant liquid temperature sensor (2).

4 - Adjust valve clearance according to the instructions provided in the engine shop manual (code WHBMNEF000).



ENGINE SPEED TESTS

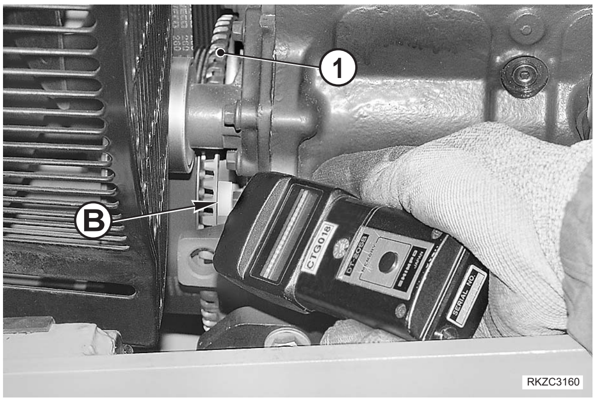
⚠ When checking engine speeds, be careful not to touch high temperature parts and not to get caught in rotating parts.

1 - Start the engine and heat the hydraulic oil by performing all normal working motions, including travel.

★ Check hydraulic oil temperature with a probe plunged in the reservoir or with a probe applied to the reservoir wall.
Temperature should be at 50±5°C.

2 - Place the machine on solid level ground with the transmission in NEUTRAL.

3 - Stop the engine and apply a reading notch "**B**" to the engine pulley (1) for the stroboscopic rev counter.



- **CHECKING ENGINE WITHOUT LOAD**

1 - Start engine and check:

Low idling speed without load (accelerator pedal released).

- Minimum speed: 1050±50 rpm

High idling speed without load (accelerator pedal at the travel end).

- Maximum speed: 2400±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 "ADJUSTING ACCELERATOR PEDAL TRAVEL AND ACCELERATOR LEVER").

• CHECKING ENGINE WITH LOAD

1. With the machine in Power mode at MIN.

1 - With the transmission in neutral, idle the engine.

2 - Dump shovel and force the movement; let the engine stabilize and then read the engine speed.

★ Normal speed: 600 rpm
Minimum speed: 600 rpm

2. With converter stalled

1 - Increase speed to high idling and brake with the working brakes.

2 - Hold the brakes while simultaneously engaging 3rd gear; let the engine stabilize, and read the rpm value.

★ Minimum speed: 2125 rpm
Maximum speed: 2225 rpm

⚠ Hold the machine stalled as long as necessary, in any case for not more than 30 sec., and carry out the tests at least 15 sec one from the other.

3. With converter stalled and hydraulic pump under load

1 - Increase speed to high idling and brake with the working brakes.

2 - While holding the brakes:

a - engage 3rd FORWARD;

b - raise shovel the full travel span and hold in this position;

c - steer the wheels fully;

3 - In the above conditions, let the engine stabilize, then red the engine rpm.

★ Minimum speed: 2025 rpm
Maximum speed: 2125 rpm

⚠ Hold the machine stalled as little as necessary, in any case for not more than 30 sec., and carry out the tests at least 15 sec one from the other.

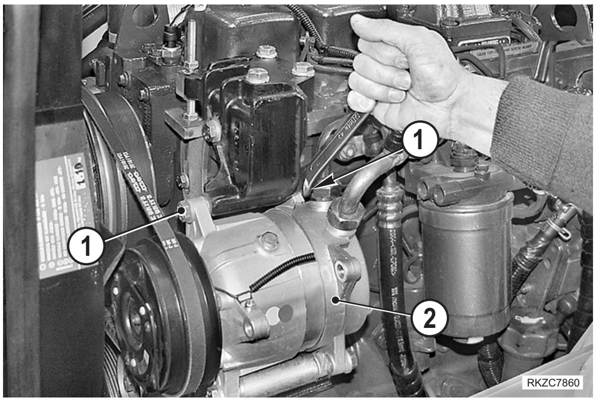
• ANALYSIS

1 - If readings are not within the required interval, check the engine according to the instructions provided in manual code WHBMNEF000.

2 - If the engine has no conditions, adjust the pump's power absorption (PC valve).

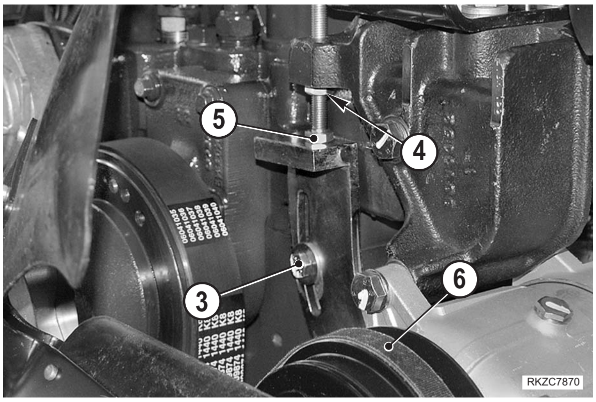
TENSIONING THE AIR-CONDITIONING COMPRESSOR BELT

1 - Loosen the screws (1) retaining the compressor (2).



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

3 - Turn the screw (5) clockwise to tension the belt (6).

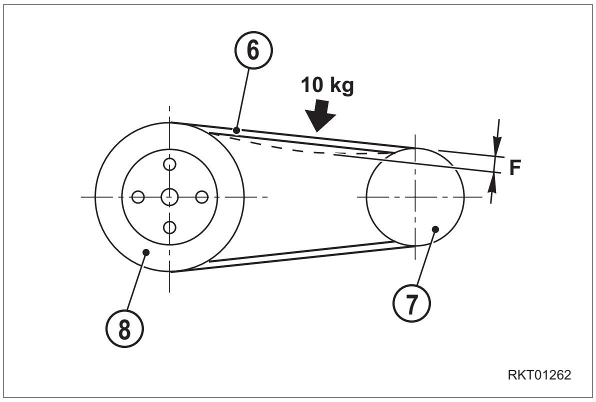


4 - Apply a 10 kg force halfway between compressor pulley (7) and engine pulley (8).

5 - Check the resulting arrow "**F**".

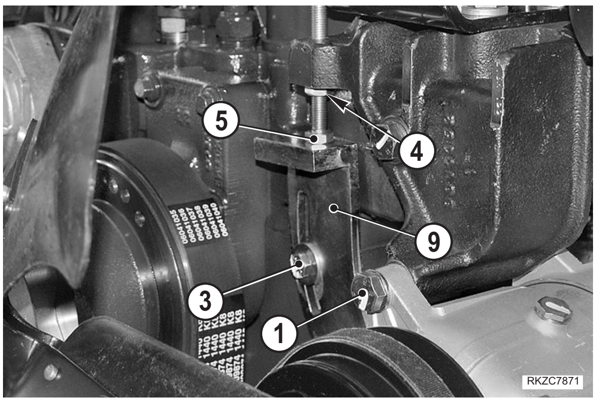
★ **F** = 4-6 mm normal tensioning
F = 3 mm new belt

⚠ Check belt tension again after 15 minutes of operation.



6 - Once proper tension is reached, retain the position of the adjustment bolt (5) with the nut (4).

7 - Retain the adjustment bracket (9) with the screw (3)and the compressor with the screws (1).



BLEEDING AIR FROM CIRCUITS - ELIMINATING RESIDUAL PRESSURE

• Bleeding air from cylinders

★ When hydraulic cylinders or associated pipes have been removed, it is necessary to bleed air before using the machine again.

★ Perform bleeding on one movement at a time starting from the main cylinders (boom out and boom raise).

1 - Start the engine and run the engine at high speed for about 5 minutes to heat the oil.

2 - Reduce speed to low idling and extend and retract the 1st piston to be bled several times.

  ★ Extend, lower and retract pistons until about 100 mm from their end of stroke.

3 - Stop the engine, check and top up the oil in the tank.

4 - 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.

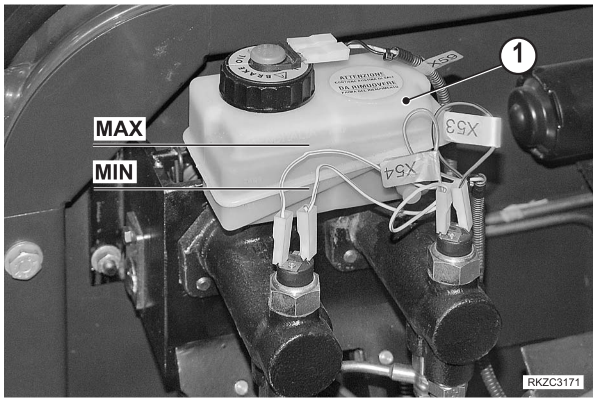
5 - Repeat steps (from Step 2) for all cylinders, frequently checking the oil level in the tank.

• 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.

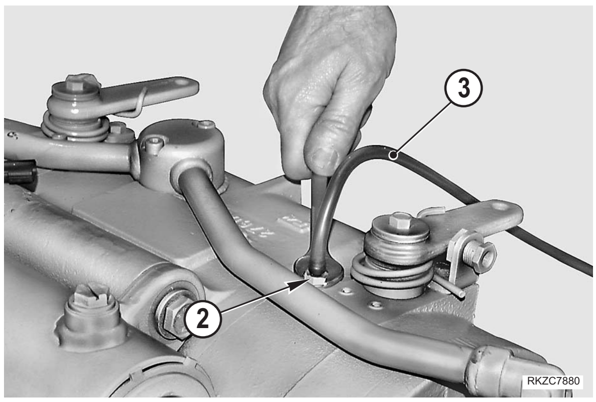
1 - Make sure that oil in brake system tank (1) is at maximum level.



2 - Remove safety plugs and applied to bleeding screws (2) a vinyl hose (3) to catch oil.

3- Push brake pedal to bottom and, while keeping it pushed, loosen the bleeding screw (2) of the braking unit that is being bled until the pedal reaches the end of its stroke.

4 - Keeping pedal at the end stroke, tighten bleeding screw (2).



5 - Release brake pedal, wait for few seconds and repeat above operations two or three times until from bleeding screw, oil flows out without air bubbles.

6 - Repeat the same steps for the opposite 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.

- **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 fully release cylinder and servocontrol circuit residual pressure.

ADJUSTING ACCELERATOR PEDAL TRAVEL AND ACCELERATOR LEVER

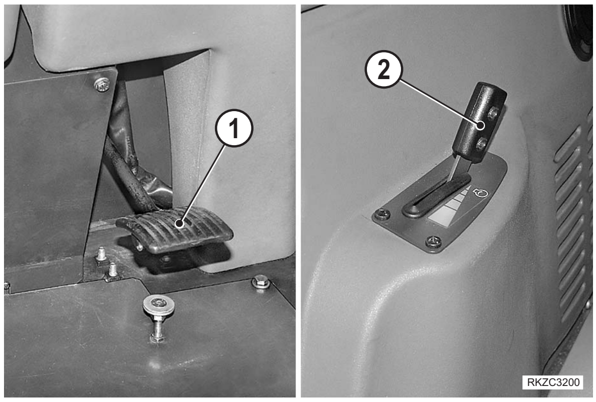
★ Working condition:

- Machine in safety conditions.
- Engine stopped but at operating temperature.
- Low and high idling speed: within permissible values.

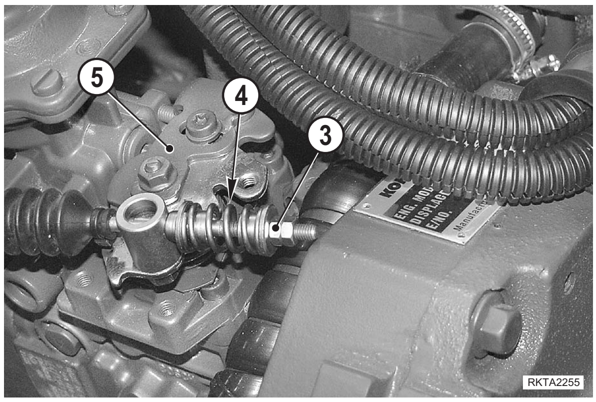
★ In order to check high speed engine idling, push the accelerator pedal (1) manually.

• Accelerator pedal travel adjusting

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



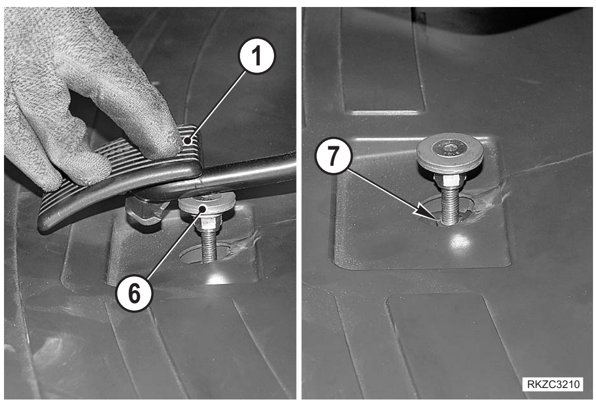
2 -Tighten the nut (3) until spring slack is eliminated (4) and spring is preloaded to about 1 mm.



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

4 -Adjust the end travel stopper (6) of accelerator pedal (1) in this position and lock it with nut (7).

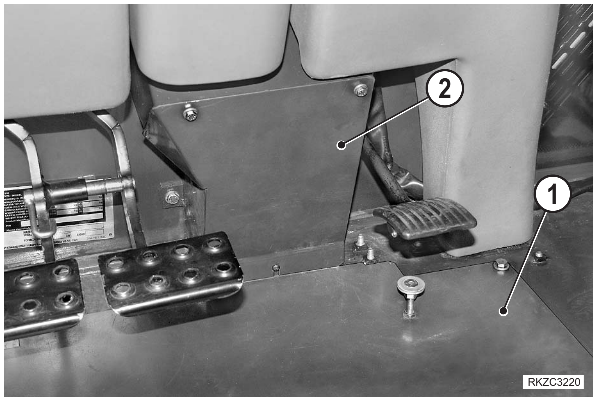
5 -Release the accelerator pedal (1).



- **Accelerator lever travel adjusting**

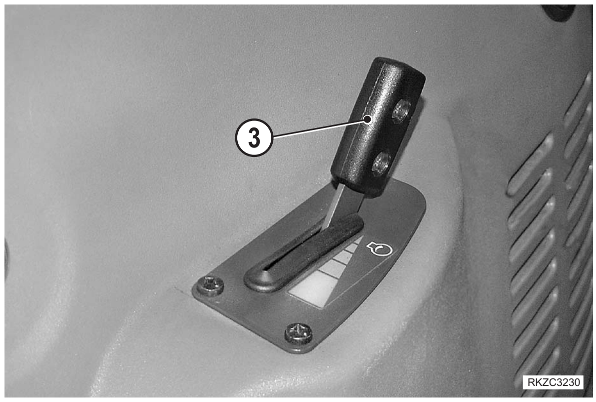
1 - Remove the front mat.

2 - Remove the metal sheet (1) closing the bottom of the cab and the upright guard (2).



3 - Check that the hand accelerator (3) is at end of travel at MIN.

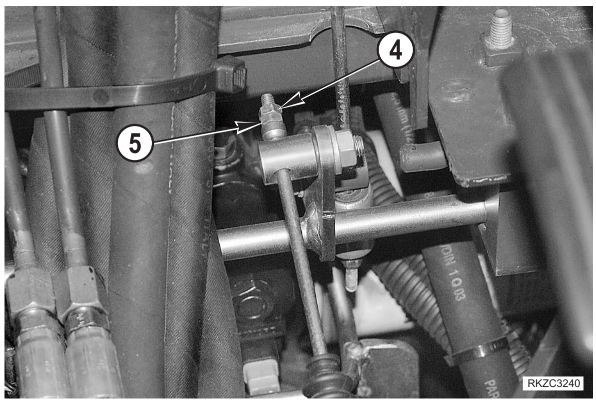
4 - Loosen and unscrew the locking nut (4).



5 - Start the engine and move the hand accelerator (3) to MAX.

6 - Tighten the nut (5) to the required speed for hand accelerator.

★ Engine idling speed: 1900±50 rpm

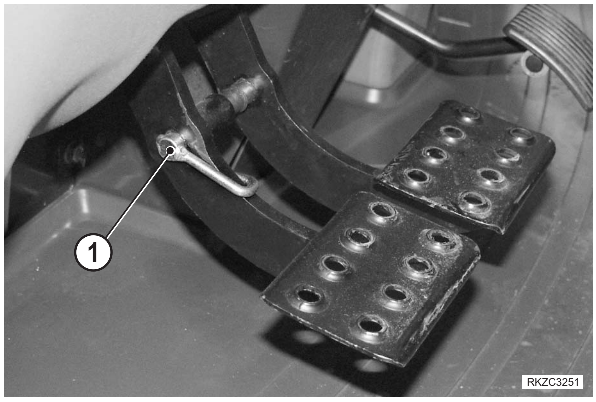


7 - Return to engine low idling speed and retain the position of the nut (5) with the locking nut (4).

8 - Check MAX speed once more by pushing the hand accelerator to end of travel.

ADJUSTING BRAKE PEDAL SLACK/ALIGNMENT

★ Working condition:
- Set the machine on level surface with attachments on ground level
- Apply the parking brake and remove the ignition key
- Pedal connection pin (1) inserted.



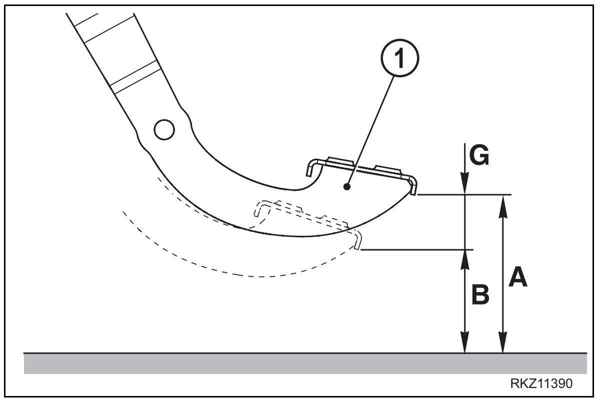
• Control

1 -Remove mat.

2 -Check height "**A**" between floor and pedal lower edge.

3 -Depress pedals by hand and check height "**B**" to determine slack "**G**".

★ Standard clearance: 3–8 mm



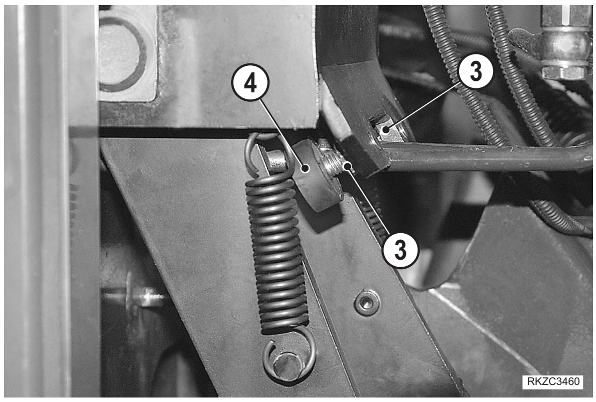
• Adjustment

4 -Remove the front cover (2).
(For details see "30 REMOVAL AND INSTALLATION").

5 -Loosen nuts (3) and adjust slack using stoppers (4).

6 -When adjustment is complete, secure the stoppers (4).

★ When stoppers are secured, double check to ensure that slack "**G**" is within range and that the pedals touch the stoppers simultaneously.



BRAKING SYSTEM CHECKS

★ Working condition:
- Engine stopped
- Place the vehicle on firm level ground with the equipment raised and the safety devices activated.
- Independent brake pedals and oil pan at maximum level.

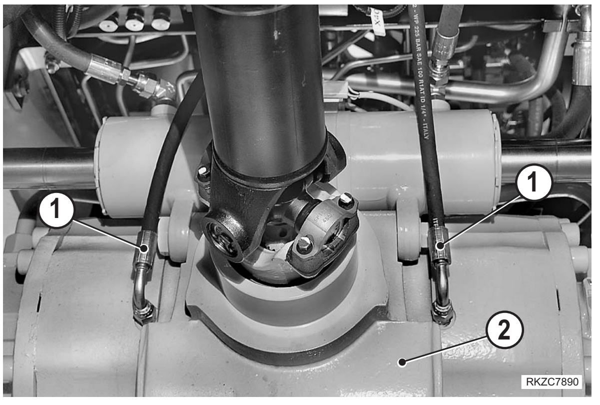
★ The brake system checking procedure consists of two steps:
- checking the brake pumps;
- checking the braking groups for leaks.

• Checking brake pumps and brake system for leaks

1 - Disconnect hoses (1) connecting to the axle braking groups (2).

2 - Seal either hose (1).

★ Plug the axle (2) to prevent contamination.



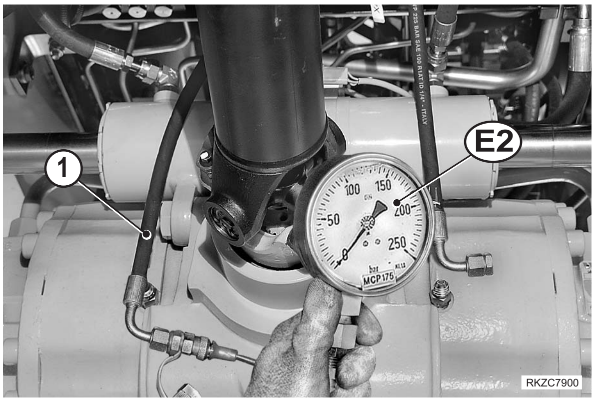
3 - Connect a pressure gauge **E2** (250 bar) to the other hose (1).

4 - Apply either brake pedal until a pressure of approx. 120 bar is reached.

★ Do not exceed maximum permitted pressure (150±5 bar).

5 - Hold the pressure on the pedal for at least 2 minutes and verify that pressure and pedal position remain unchanged.

★ If the position of the pedal needs to be changed in order to hold the pressure, then the loss of pressure is to be blamed on leaks inside either pump.
To confirm whether this is the case, check the oil. If a leak condition exists, the oil will be stirred.

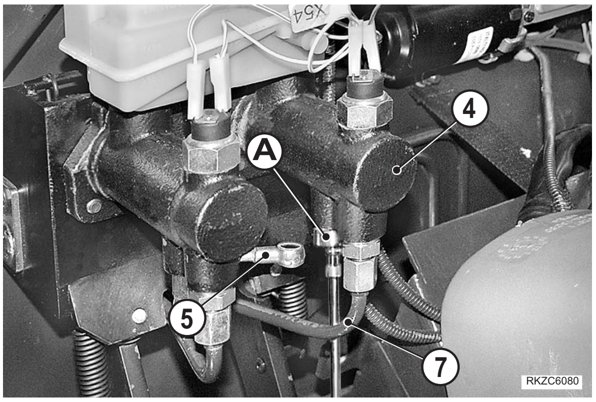


• Checking individual pumps

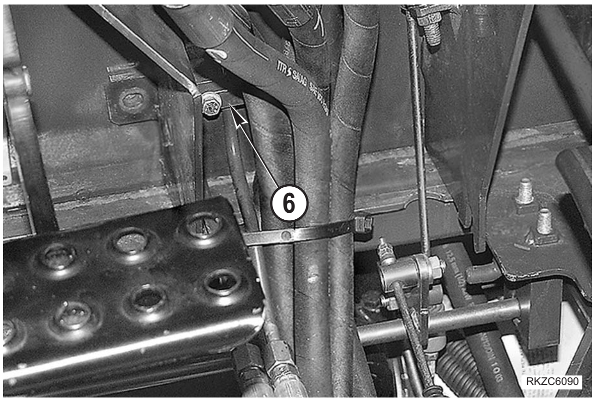
1 -Remove the front lining (3).

2 -Disconnect the pressure equalizer hose (5) from the brake circuit pump (4) that is being inspected.

3 -Seal the hole of the equalizer (plug "**A**").



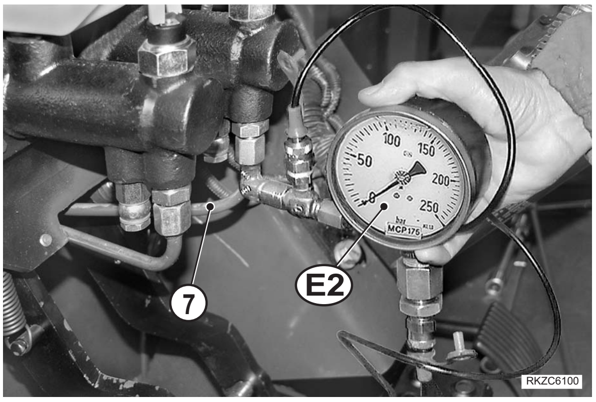
4 -Remove the clamp (6).



5 -Disconnect the delivery hoses (7) from the pump that is being tested. Connect a pressure gauge **E2** (250 bar) to the pump during the inspection.

6 -Apply the brake pedal corresponding to the pump and pressurize the circuit to approx. 120 bar.

★ Do not exceed maximum permitted pressure (150±5 bar).

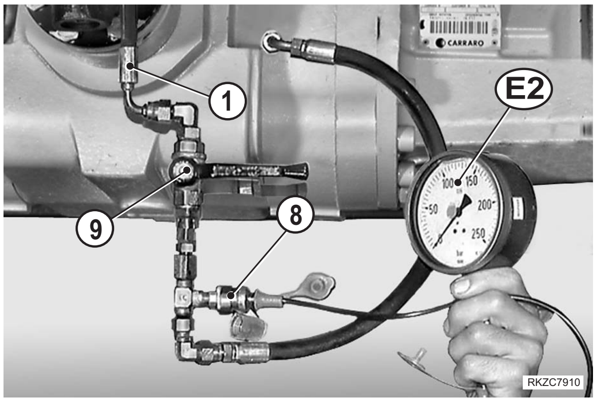


7 - Hold the pressure on the pedal for at least 2 minutes and verify that pressure and pedal position remain unchanged.

★ If the position of the pedal needs to be changed in order to hold the pressure, then the loss of pressure is to be blamed on leaks inside the pump, and in this case the pump needs to be changed. To confirm whether this is the case, check the oil. If a leak condition exists, the oil will be stirred.

8 - Repeat for the other pump.

• Checking the braking groups for leaks.



1 - Disconnect the delivery hose (1) from the braking group that is being inspected.

2 - Connect a suitable tool between the delivery hose (1) and the braking group.

★ Check to ensure that the pressure tap (8) is installed between the braking group and the cut out valve (9).

3 - Connect a pressure gauge **E2** (250 bar) to the tool pressure tap and open the cut out valve (9).

4 - Operate the brake pump and pressurize the circuit to 150±55 bar maximum.

5 - Hold the pressure while simultaneously closing the valve (9) to keep the braking circuit that is being inspected under pressure.

6 - Release the brake pedal and monitor pressure gauge **E2** for two minutes.

★ If the pressure reading changes in the negative, then there is a brake piston seal failure.

⚠ Further evidence of leak is an increase in the level of oil in the axle, and the fact that the oil is stirred as a result. Replace all sealing rings in the various axle sections and completely change the lubricant.

7 - Repeat the test for the other braking group using the same procedure as above.

8 - Restore the braking circuit to operating condition.

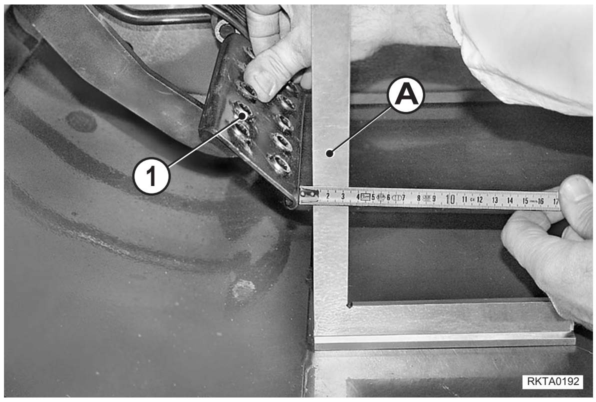
⚠ When checks and repair (if any) are complete, bleed the air from the braking groups (See "BLEEDING AIR FROM CIRCUITS - ELIMINATING RESIDUAL PRESSURE").

PARKING BRAKE ADJUSTMENT

⚠ Those adjustings have to be carried out with the axle brake levers adjusted wioht the prescribed play. (For details, see "30 REMOVAL AND INSTALLATION").

1 -Set the machine on level surface with attachments and outriggers on ground level.

2 -Stop the engine and remove the ignition key.

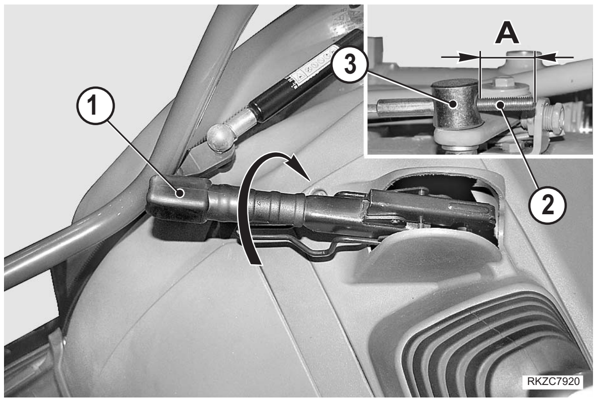


- **Cable lenght adjusting**

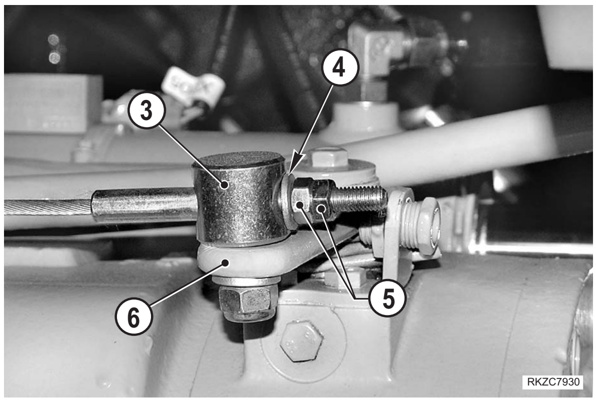
1 -With the lever fully down, turn the handbrake handle (1) clockwise until reaching the cable (2) projection “**A**” referred to the brake lever pin (3).

★ **A** = 40±1 mm

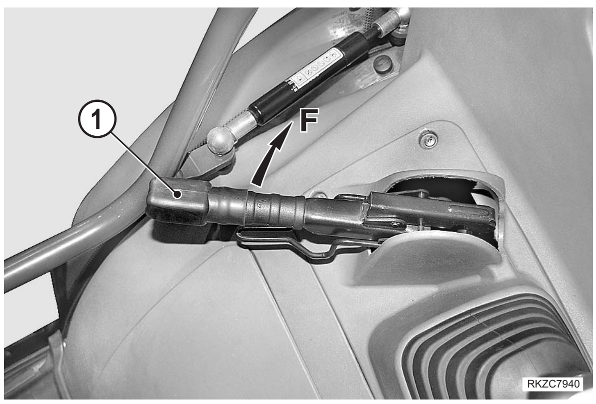
NOTE
Direction of rotation is from the operator’ point of view when the operator is sitting on the driver’s seat.



2 -Mount washer (4) and two nuts (5); screw in nuts (5) up to washer (4) get in contact with pin (3) of lever (6). Lock nuts (5) position.



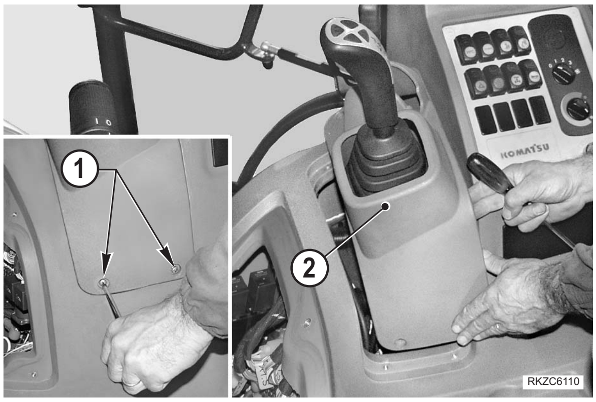
3 -Apply a dynamometer in the middle of the handle (1) and verify that the handle lock the position happens when a pull force “**F**” of 40± 2 kg.



• Functional check

★ Test conditions:
- Tire pressure within the prescribed range.
- Machine in operating conditions without load and on level ground.
- Working brake pedals: connected by a cotter pin.

1 - Remove the screws (1) and remove PPC valve and parking brake casing (2).

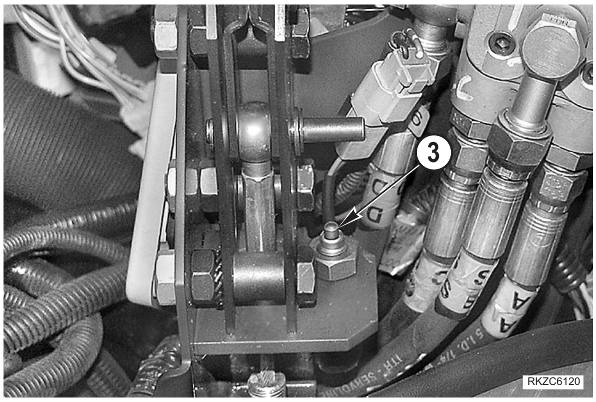


2 - Engage the parking brake.

3 - Press and hold the microswitch (3) while engaging 2nd gear and selecting a direction of movement.

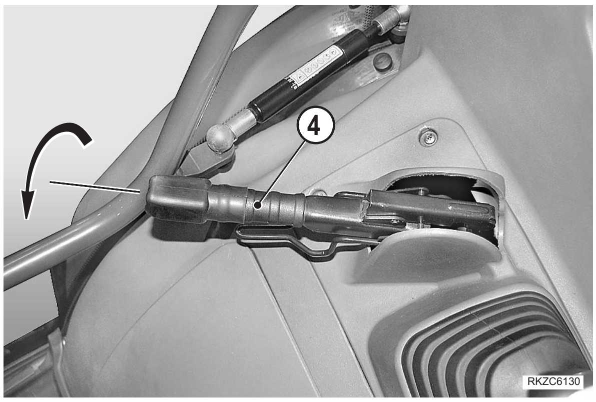
4 - Accelerate engine revs gradually up to 1530±50 RPM.

⚠ If machine attempts to move, release the microswitch to return to N (Neutral).



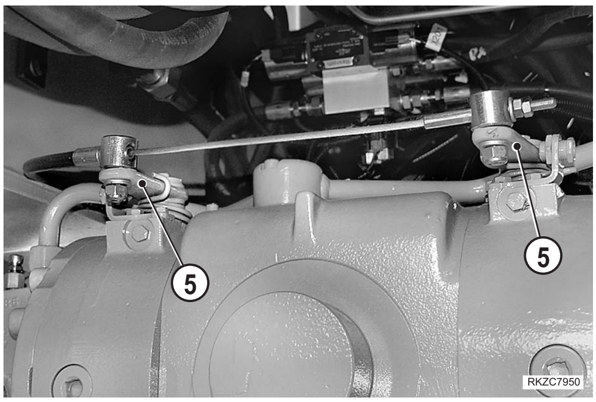
5 - Rotate the end of the lever (4) by 2 or 3 turns counterclockwise.

★ Direction of rotation is from the operator' point of view when the operator is sitting on the driver's seat.

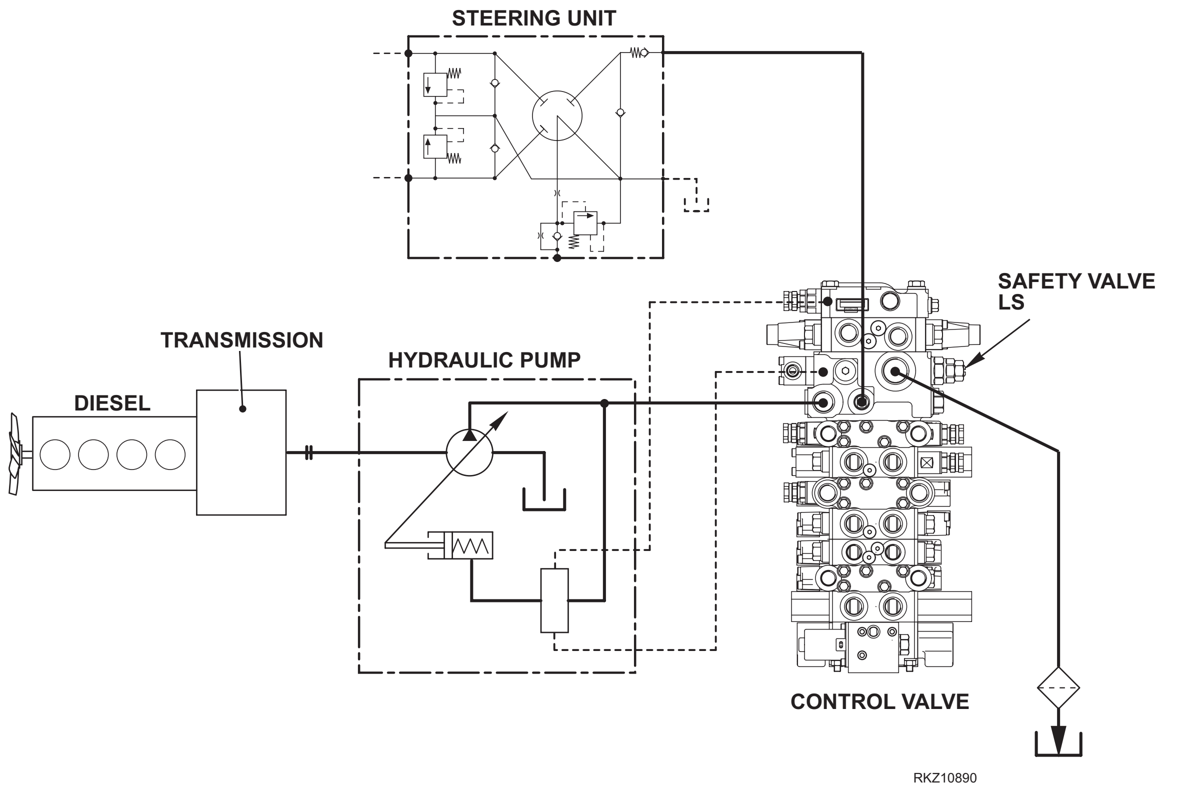


6 - Re-apply the parking brake and repeat the test.

★ If a normal braking condition is not achieved after two attempts to adjust the lever, check control cable for slackness and braking discs for wear and replace components as necessary.
(See "30 REMOVAL AND INSTALLATION" for details).



CHECKING AND SETTING PRESSURE IN THE ATTACHMENTS HYDRAULIC CIRCUIT



NOTE
Shown in this section is the servocontrolled version of the control valve.

- **Introduction**

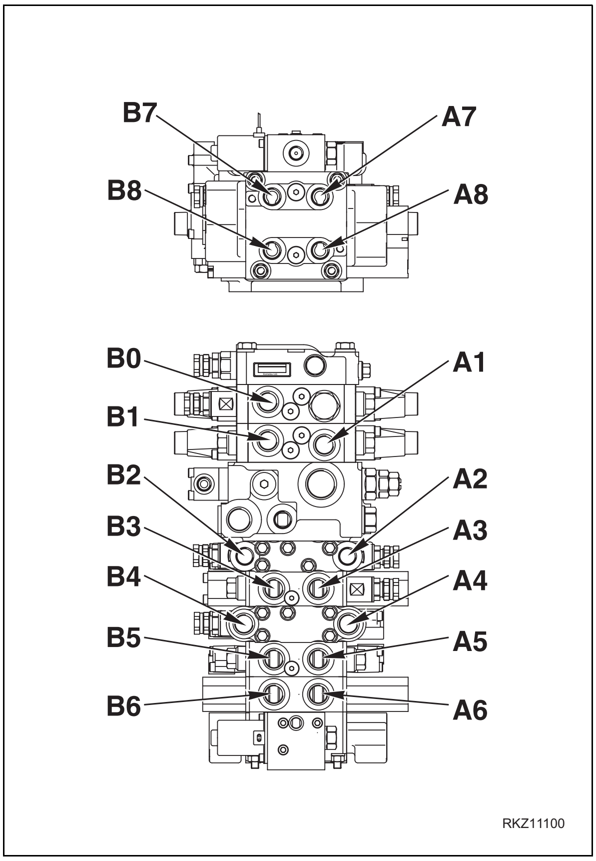
1 - The machine is equipped with a single control valve with hydraulically controlled spools. The control valve is protected against overpressure by a single upper valve (or main valve, referred to as "LS safety valve") with adjustable pressure setting.

2 - The full pump delivery supplies the control valve.

3 - Pump delivery is shut by the priority valve (inside the control valve) when the steering unit is used for a steering manoeuvre.

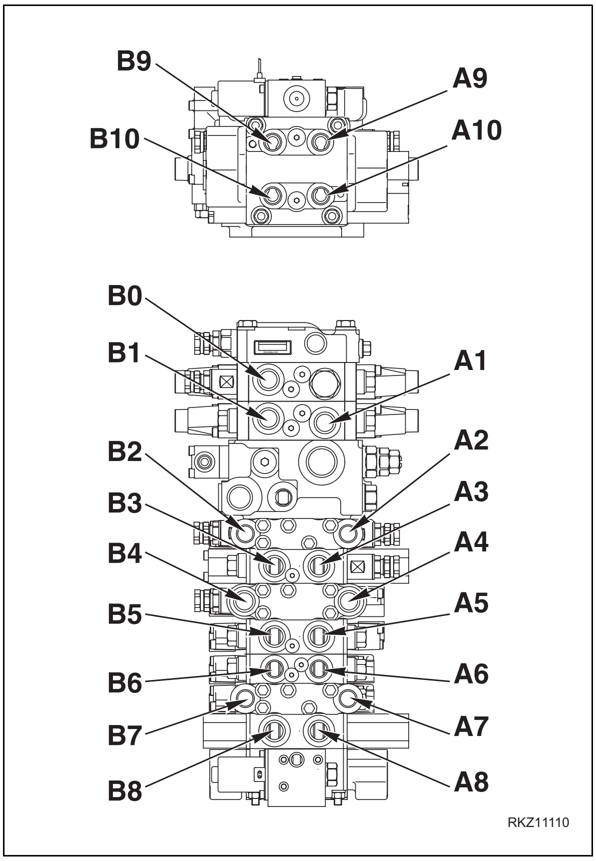
• 8-spool control valve + Hammer

Cylinder and movement		Port	Set (bar)
Hammer		B0	190
Arm	Opens	A1	270
	Closes	B1	270
Boom swing	Right	A2	230
	Left	B2	230
Shovel	Dump	A3	240
	Curl	B3	270
Boom	Lowering	A4	270
	Lifting	B4	345
Backhoe bucket	Dump	A5	–
	Curl	B5	270
Shovel arm	Lifting	A6	–
	Lowering	B6	–
Right outrigger	Down	A7	–
	Up	B7	–
Left outrigger	Down	A8	–
	Up	B8	–



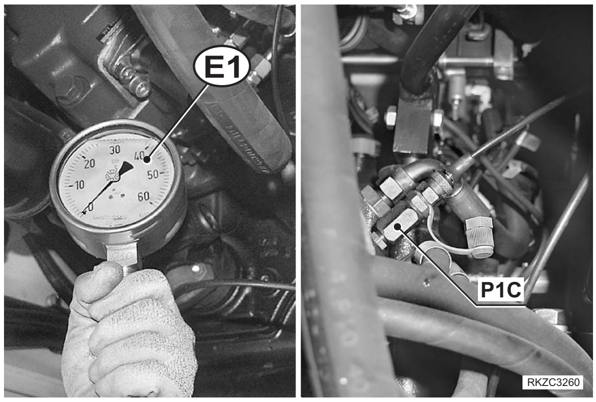
• 10-spool control valve + Hammer

Cylinder and movement		Port	Set (bar)
Hammer		B0	190
Arm	Opens	A1	270
	Closes	B1	270
Boom swing	Right	A2	230
	Left	B2	230
Shovel	Dump	A3	240
	Curl	B3	270
Boom	Lowering	A4	270
	Lifting	B4	345
Backhoe bucket	Dump	A5	–
	Curl	B5	270
4 in 1 bucket	Closes	A6	270
	Opens	B6	270
Jig arm	Out	A7	–
	In	B7	–
Shovel arm	Lifting	A8	–
	Lowering	B8	–
Right outrigger	Down	A9	–
	Up	B9	–
Left outrigger	Down	A10	–
	Up	B10	–



CHECKING THE SETTING OF MAIN RELIEF AND SECONDARY VALVES

• Checking the operating pressure of the unloading valve



1 - Connect a pressure gauge **E1** (60 bar) to the pressure tap **P1C** on the pump.

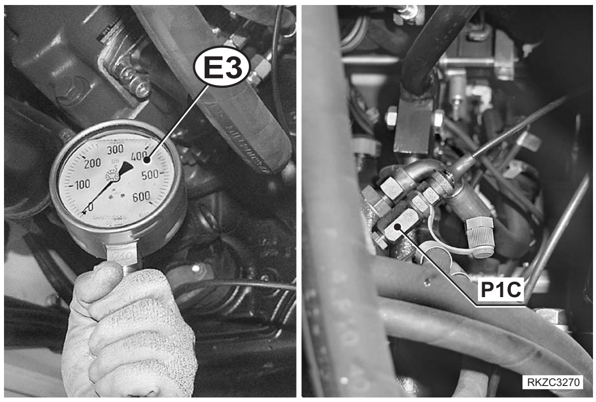
2 - Start the engine and run the engine at low idling with all levers in neutral position.

3 - In this condition, check the pressure in the hydraulic circuit.

★ Normal pressure: 41±4 bar

★ The unloading valve cannot be pressure set; if pressure changes from its normal value, replace the valve.

• Checking main relief valve setting



★ Test conditions:

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

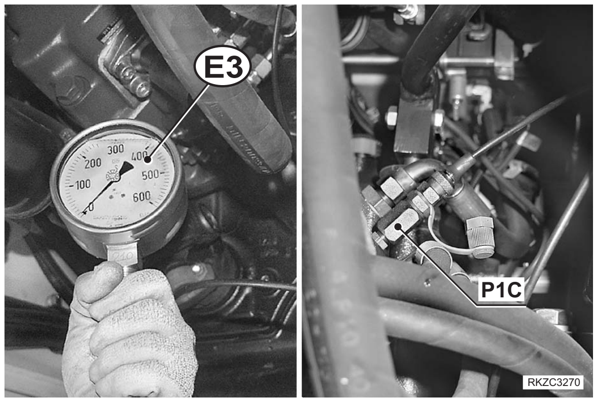
1 - Connect a pressure gauge **E3** (600 bar) to pressure tap **P1C** of the pump.

2 - Start the engine, move the hand accelerator lever to full throttle and check setting pressure for main relief valve by forcing the shovel arm raise movement the full travel span.

★ Nominal pressure: 235–260 bar

★ If the main relief valve pressure does not correspond to the nominal pressure value, it must be re-set (For details, see "SETTING THE MAIN RELIEF VALVES AND THE REDUCING VALVES").

• Checking secondary valves setting (for boom swing, shovel dump, and hammer movements)



★ Test conditions:
- Engine: at operating temperature.
- Hydraulic oil: 45-55 °C
- Working brakes applied

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

1 - Connect a pressure gauge **E3** (600 bar) to pressure tap **P1C** of the pump.

2 - Start the engine and bring the hand accelerator lever up to 2200 rpm.

3 - Check pressure for each movement, with the control lever at the end of its travel and at stabilized pressure.

★ Move piston to the end of stroke to check the pressure.

★ Normal pressure values:

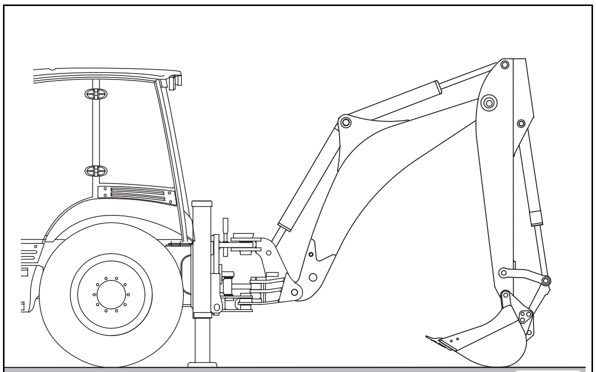
Cylinder and movement		**Set (bar)**
Hammer		180–210
Boom swing	Right	225–250
	Left	225–250
Shovel	Dump	235–260

- **Checking secondary valve setting (for boom raise movement)**

★ Test conditions:
- Engine: at operating temperature.
- Hydraulic oil: 45-55 °C
- Working brakes applied

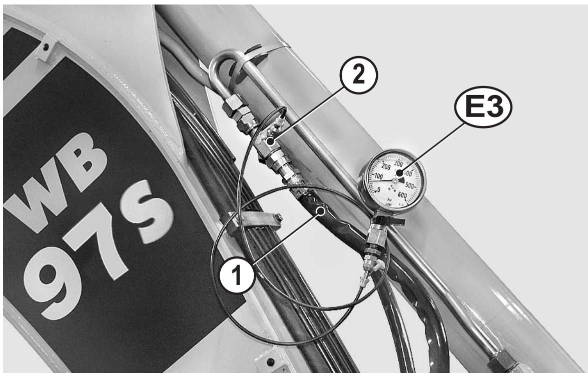
1 - Set the machine with arm in vertical position and with bucket on level ground leaned on the side.

2 - Stop the engine and release residual hydraulic pressures.


RKZ10900

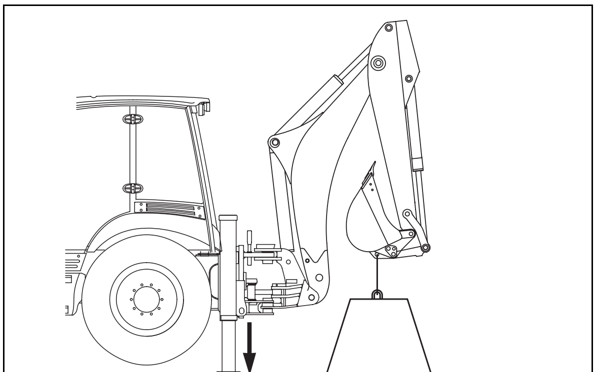
3 - Disconnect the hose (1) and connect a tee fitting (2) with adapter.

4 - Connect a pressure gauge **E3** (600 bar) to the adapter.



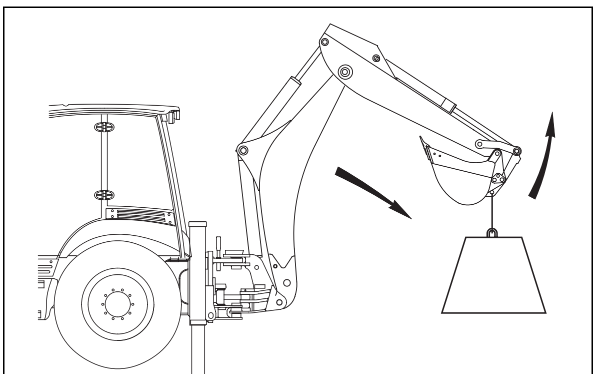
RKZC7960

5 - Start the engine, connect a weight of approx. 1500 kg to the bucket, and fully lower the outriggers.


RKZ10910

6 - Slowly extend the arm and boom and take the pressure when the boom lowers.

★ Normal pressure: 320–360 bar


RKZ10920

- **Checking secondary valve setting (for arm in, shovel loading, backhoe bucket loading, boom raise, and 4-in-1 bucket movements)**

★ Test conditions:
- Engine: at operating temperature.
- Hydraulic oil: 45-55 °C
- Working brakes applied

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

1 - Connect a pressure gauge **E3** (600 bar) to pressure tap **P1C** of the pump.

2 - Start the engine and bring the hand accelerator lever up to 2200 rpm.

3 - Set the main relief valve to a value 30 bar higher than the maximum pressure to be tested.
(For details, see "Setting the main relief valve").

4 - Check pressure for each movement, with the control lever at the end of its travel and at stabilized pressure.

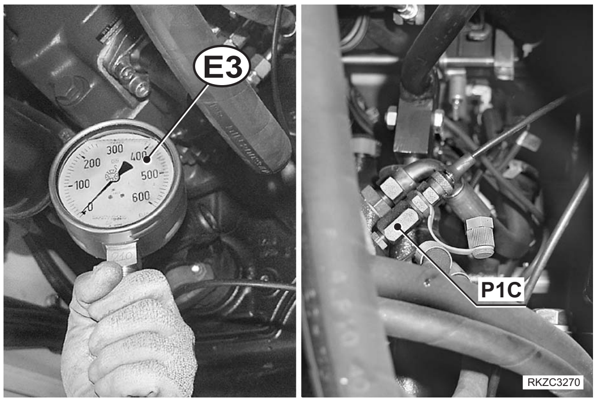
★ Move piston to the end of stroke to check the pressure of the working equipment.

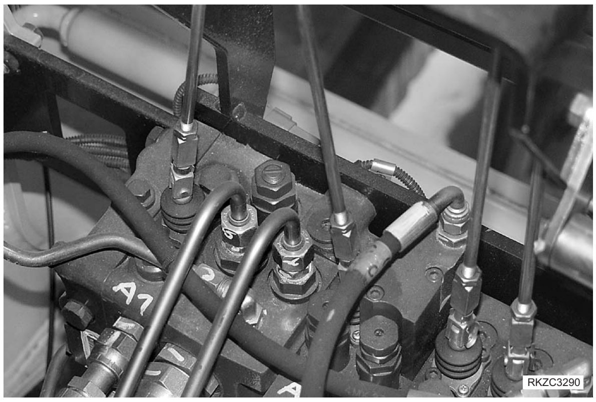
★ Normal pressure values:

Cylinder and movement		Set (bar)
Arm	Closing	260–280
Shovel	Curl	260–280
Boom	Lowering	260–280
Backhoe bucket	Curl	260–280
4 in 1 bucket	Closes	260–280
	Opens	260–280

★ If one movement fails to reach the setting pressure, then the malfunction is in the tested element.

★ If all movements fail to reach the setting pressure, then you need to pressure set or replace the secondary valve.

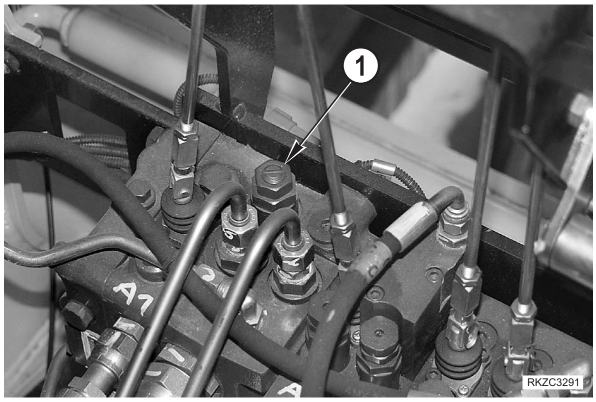




SETTING THE MAIN RELIEF VALVES AND THE REDUCING VALVES

- **Setting the main relief valve**

1 - Loosen lock nut (1).

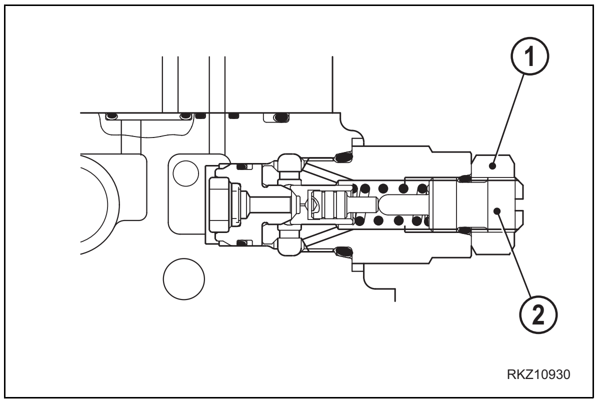


2 - Adjust the pressure using the screw (2).
- To INCREASE pressure turn in CLOCKWISE direction.
- To DECREASE pressure turn in COUNTERCLOCKWISE direction.

3 - Lock the nut (1).

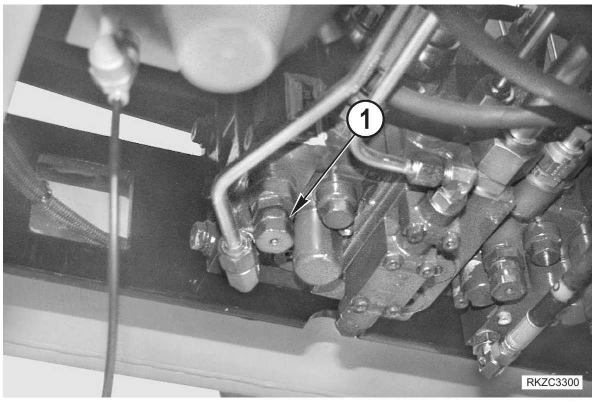
Nut: 29.4– 39.2 Nm

★ When adjustment is complete, check the setting of the main relief valve using the procedures used for measurements.



- **Adjusting secondary valves (for boom swing, shovel dump, hammer, and boom raise movements)**

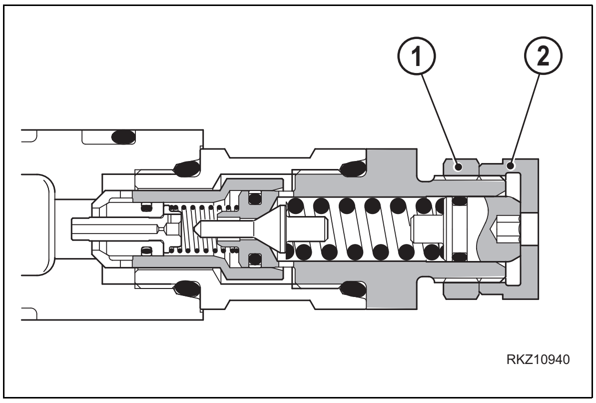
1 - Loosen nut (1)



2 - Adjust the pressure using the nut (2).
  - To INCREASE pressure turn in CLOCKWISE direction.
  - To DECREASE pressure turn in COUNTERCLOCKWISE direction.

3 - Tighten nut (1) while holding nut (2).

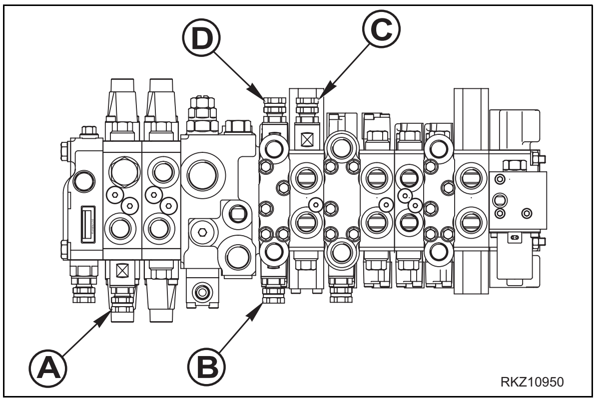
Nut (1): 39 – 49 Nm



- **Adjusting the secondary valve (for arm in, shovel curl, backhoe bucket curl, boom raise, and 4-in-1 bucket movements)**

1 - Loosen nut (1).

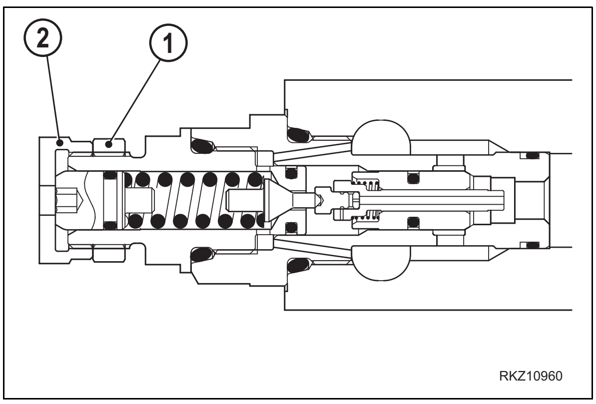
A = hammer secondary valve
B = LH swing secondary valve
C = shovel dump secondary valve
D = RH swing secondary valve



2 - Adjust the pressure using the nut (2).
  - To INCREASE pressure turn in CLOCKWISE direction.
  - To DECREASE pressure turn in COUNTERCLOCKWISE direction.

3 - Tighten nut (1) while holding nut (2).

Nut (1): 39 – 49 Nm

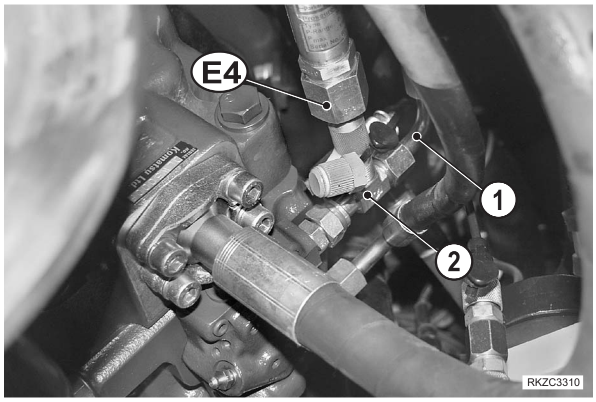


CHECKING AND ADJUSTING THE LS DIFFERENTIAL PRESSURE. ADJUSTING THE LS VALVE

- **Control**

★ Test 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 a tee with pressure tap (2) and reconnect hose (1).



RKZC3310

2 -Connect a differential pressure gauge **E4** to adaptor (2) and to pressure tap **P1C** of the pump.

3- Start the engine and run it at low idling (1050±50 rpm) and, without any movement (lever in neutral position), read the DP pressure.

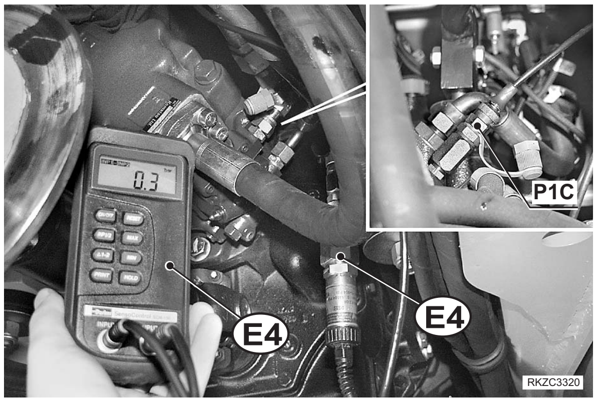
★ Normal value: 41±4 bar

★ If **DPLS** pressure is not within the permissible range, replace the control valve unloading valve.

4 -Simultaneously perform a boom raise and a backhoe bucket curl movement to end of travel and then read the DP pressure.

★ Normal value: 27.5±1.5 bar

★ If the **DPLS** value is not within the permissible range, set the unloading valve.



RKZC3320

- **Adjusting the LS valve**

★ If the **DPLS** value is not within the specified range, adjust the LS valve as follows:

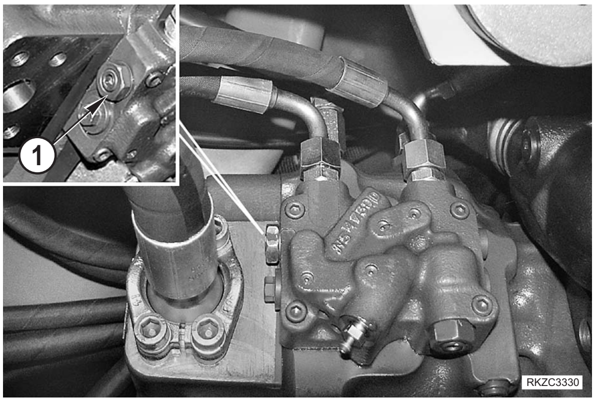
1 - Loosen the retaining nut (1) and turn the adjustment screw (2).
   - To INCREASE pressure turn in CLOCKWISE direction.
   - To DECREASE pressure turn in COUNTERCLOCKWISE direction.

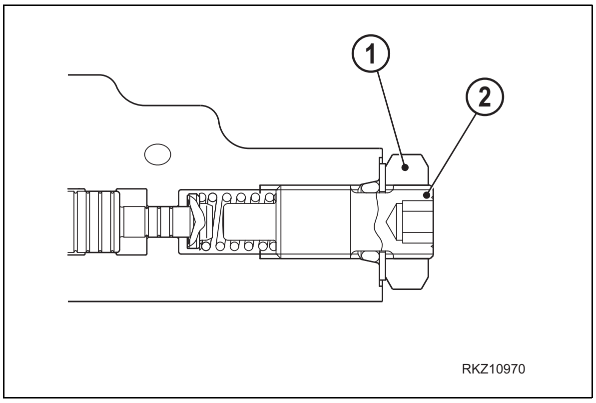
   ★ Each turn of the adjustment screw (2) will change the pressure by approx. 13 bar.

2 - Lock the nut (3).

Nut: 27.4- 34.3 Nm

3 - When adjustment is complete, check the setting of the LS valve (1) using the procedures used for checking.





CHECKING AND ADJUSTING SERVOCONTROLS SUPPLY PRESSURE

• Checking servocontrols supply pressure

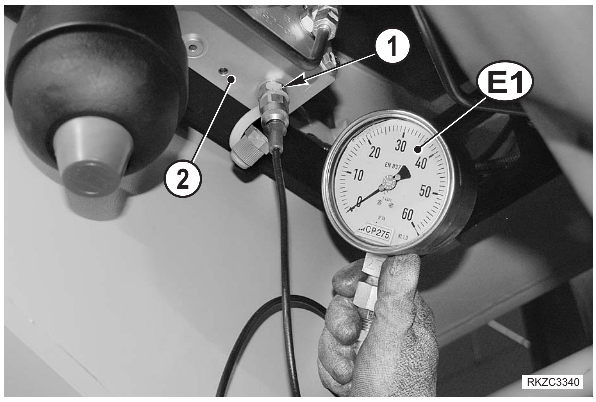
★ Test conditions:
- Engine: at operating temperature.
- Hydraulic oil temperature: 45–55 °C

1 - Connect a pressure gauge **E1** (60 bar) to the pressure tap (1) of the solenoid valve group (2).

2 - Start the engine and run the engine at low idling with all levers in neutral position.

3 - Check the pressure.

★ Normal pressure: 37.3±3 bar



• Adjusting the servocontrol valve

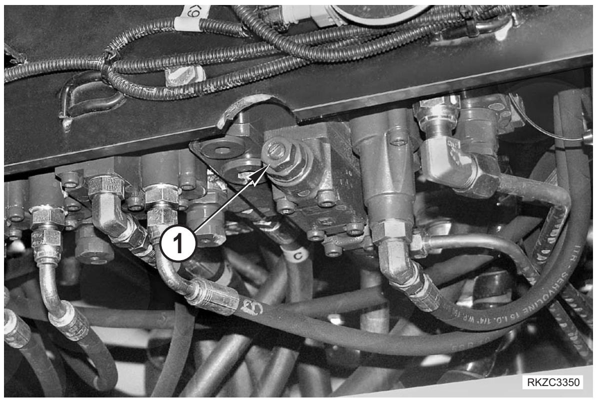
★ If the pressure value is not within the tolerance range, adjust the valve (1) as follows:

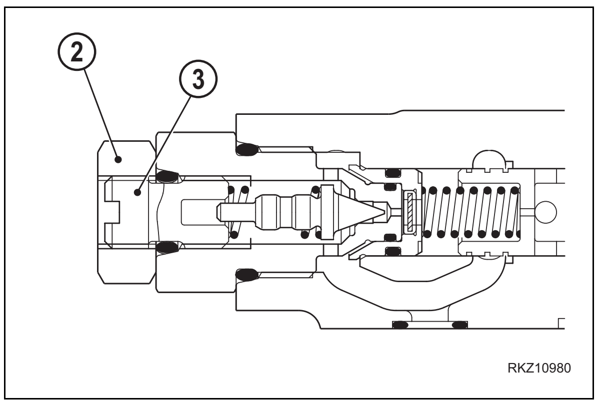
1 - Loosen the retaining nut (2) and turn the adjustment screw (3).
- To INCREASE pressure rotate in CLOCKWISE direction.
- To DECREASE pressure rotate in COUNTERCLOCKWISE direction.

★ Each turn of the screw (3) will change the pressure by _____ bar.

2 - Lock the nut (2).

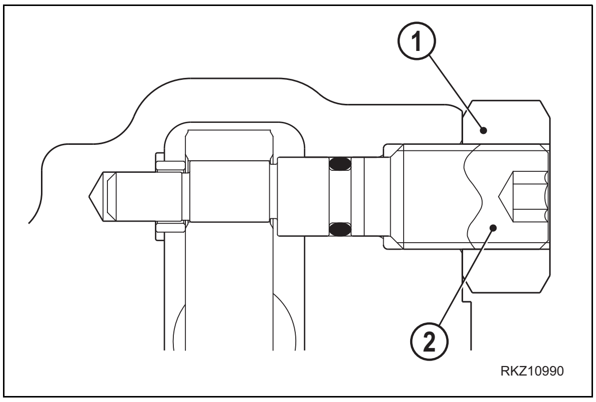
Nut: 22 ± 2.5 Nm





ADJUSTING THE PC VALVE

★ If pump delivery and LS differential pressure are within permissible values, but you notice that the engine rpm drops as a result of a change in the load, or that working equipment is very slow, it is time to adjust the PC valve.



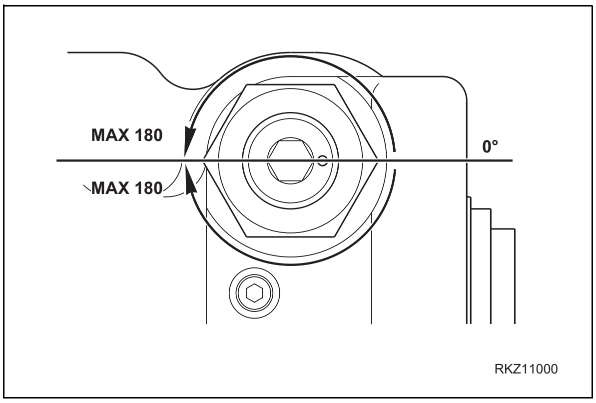
1 - Loosen the nut (1) and turn the adjustment screw (2).

★ To decrease the pump's torque absorption, turn the adjustment screw (2) counterclockwise

★ To increase the pump's torque absorption (i.e. to increase the speed of working equipment) turn the adjustment screw (2) clockwise.

★ Turn the adjustment screw by not more than 180° in relation to the 0° line, in both directions

★ Adjustment screw position on first installation shown



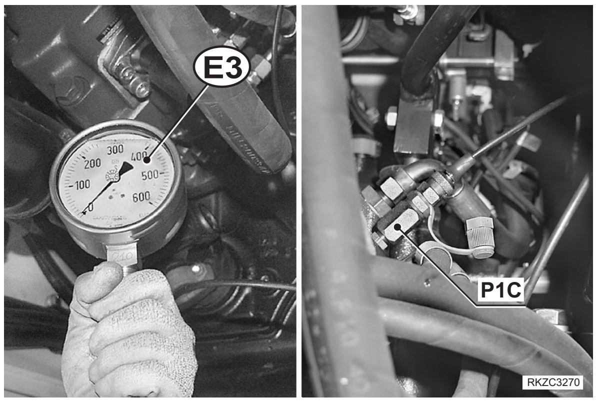
2 - Lock the nut (1).

Nut: 27.4–34.4 Nm

TESTING AND SETTING STEERING CONTROL SYSTEM PRESSURE

★ Test conditions:
- Engine: operating temperature
- Hydraulic oil: 45–55 °C

• Control



1 - Connect a pressure gauge **E3** (600 bar) to the pressure tap **P1C** on the backhoe control valve.

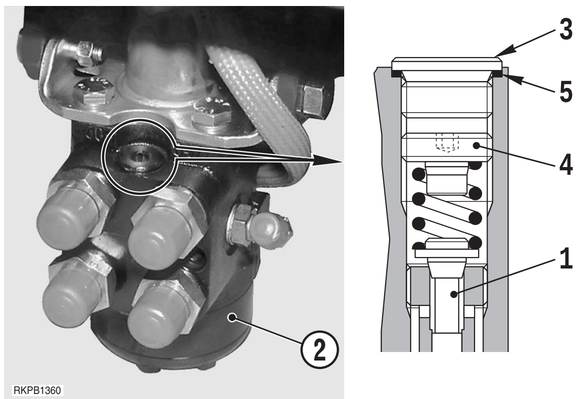
2 - Start the engine and bring it to idle speed 1500±50 rpm and carry out a total steering.

3 - Forcing the steering wheel at the end of stroke, check pressure.

★ Normal pressure: 175–185 bar

4 - Check for the other steering direction too.

• Setting



★ If pressure is not within permissible value, carry out setting acting on upper valve (1) of the steering unit (2).

1 - Remove the plug (3).

2 - Insert a wrench of 4 mm and loosen screw (4).
- To INCREASE pressure rotate in CLOCKWISE direction.
- To DECREASE pressure rotate in COUNTERCLOCKWISE direction.

3 - Stop the engine and replace the plug (3); ensure that the seal (5) is in its proper position.

Plug: 50±10 Nm

CHECKING FOR LEAKS IN THE STEERING CYLINDERS

★ Test conditions:
- Engine: at operating temperature.
- Hydraulic oil: 45–55°C.
- Working brakes: engaged.
- Maximum steering pressure: within permissible limits.

★ Check first the front axle cylinder and second, with the same procedure, the rear axle cylinder.

1 - Start the engine and fully steer the wheels in either direction.

2 - Stop the engine.

3 - Disconnect the supply hose (2) from the cylinder (1) on the side where the rod is fully out (3); plug the hose tightly.

4 - Connect a provisional hose to the cylinder (1) to collect any leaking fluid.

5 - Start the engine and operate the engine at high idling speed.

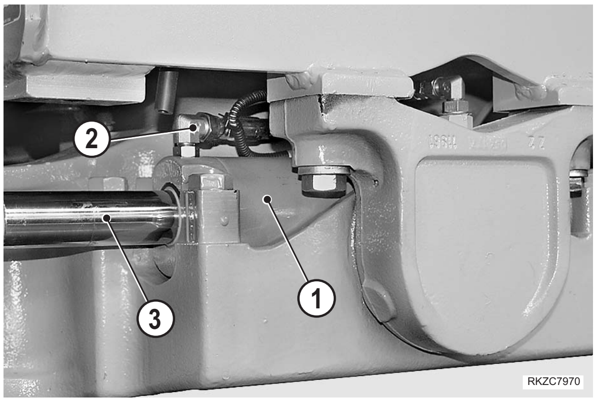
6 - Force the steering wheel to the end of its travel and retain the position for 30 seconds; measure any leak during the following minute.

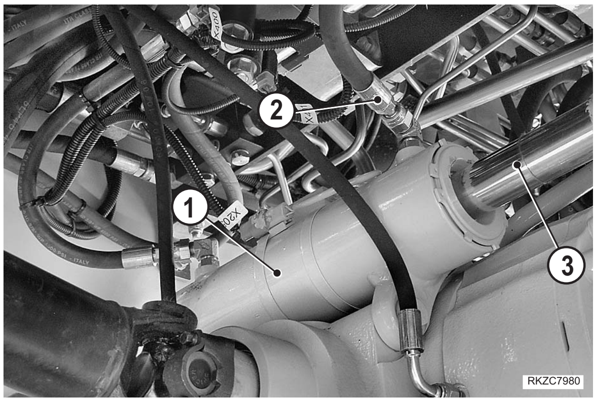
7 - Release the steering wheel, run the engine at low idling, and then stop the engine.

8 - Check if leakage is normal (see «NORMAL OR STANDARD TECHNICAL DATA).

★ Test cylinder on one side only, as there is only one gasket separating the two chambers.

9 - Restore the hydraulic connection, steer the wheel several times in both directions to remove any air from the circuit.





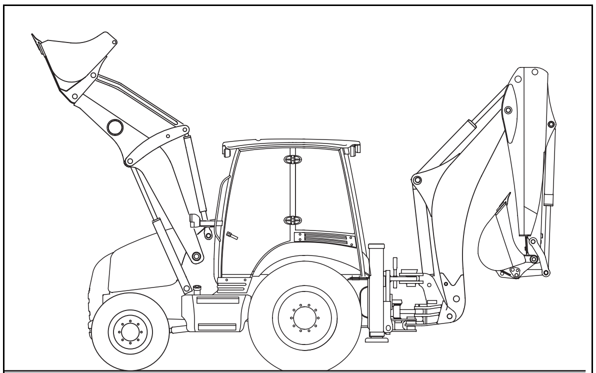
TESTING PRESSURES IN THE POWER TRAIN GROUP

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


RKZ11010

• Converter oil pressure

1 - Remove the plug (P3) 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**.

★ Idle pressure: 3 bar

4 - Gradually increase engine speed to 2200 rpm; take a new reading on pressure gauge **E6**.

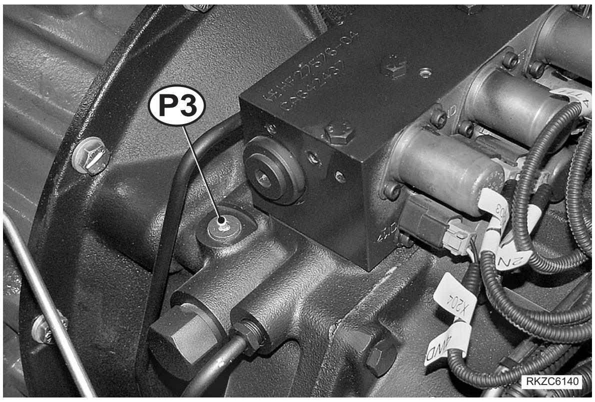
★ Normal pressure: 3–9 bar

5 - Bring the engine back to MIN and compare the pressure with the normal value.

★ Min. pressure: 3 bar

★ If the pressure value drops to below the permissible lower limit, the power train pump needs an replacement.

Plug: 30 Nm



RKZC6140

- **Clutch engagement pressure**

1 - Remove the plug (P18) 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 - Bring the engine up to MIN (idling) and check the pressure on the pressure gauge **E6**.

★ Normal pressure: Max. 0.3 bar

4 - With the working brakes applied, select reverse gear and gradually increase rev speed up to MAX, then take a new reading from the pressure gauge **E6**.

★ Normal pressure: 13.5–16.5 bar

5 - Bring the engine back to MIN and the transmission in neutral position; compare the pressure with the normal value.

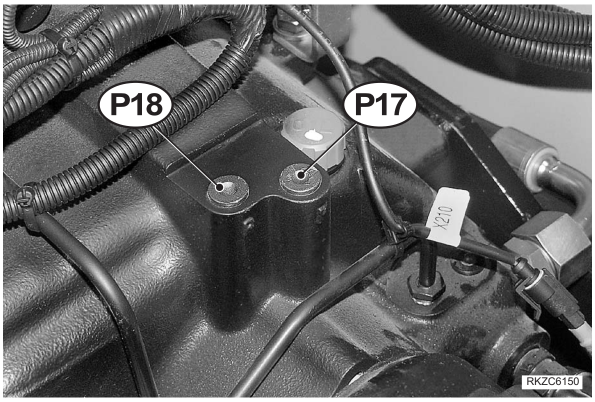
★ Normal pressure: Max. 0.3 bar

6 - Remove the pressure adapter and replace the plug (P19).

Plug: 30 Nm

7 - Repeat the same test for the FORWARD gear, reading the pressure from the orifice protected by the plug (P17).

- If the pressures are different for the two travel directions, there is a loss of pressure on the clutch piston with lower pressure.



- **Supply pressure**

1 - Remove the plug (P21) 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 - Bring the engine up to MIN (idling) and check the pressure on the pressure gauge E6.

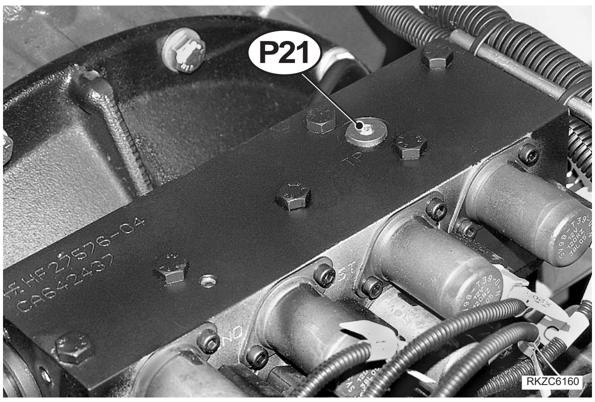
★ Normal pressure: 14-17 bar

4 - Gradually increase engine speed to 2.200 rpm; take a new reading on pressure gauge E6.

★ Min. pressure: 14 bar

★ If reading drops below minimum, the transmission pump needs replacing.

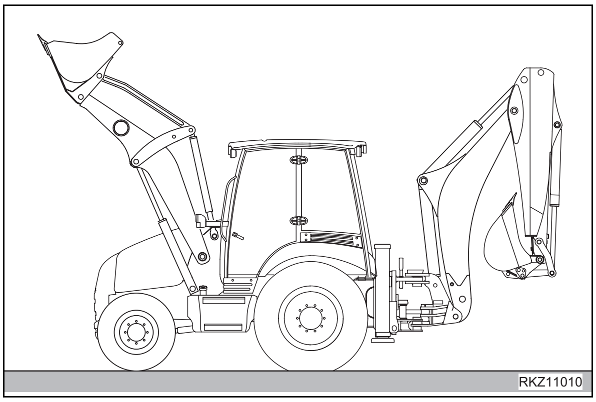
Plug: 30 Nm



TESTING THE CORRECT FUNCTIONING OF THE POWER TRAINCLUTCHES

★ 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.



• Preparation of the machine

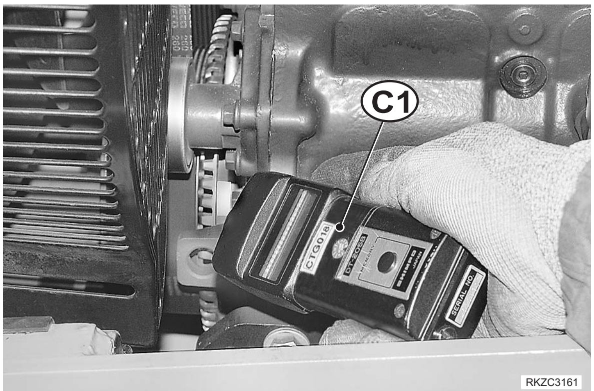
1 -Prepare a rev. counter **C1** to measure the engine rpm.

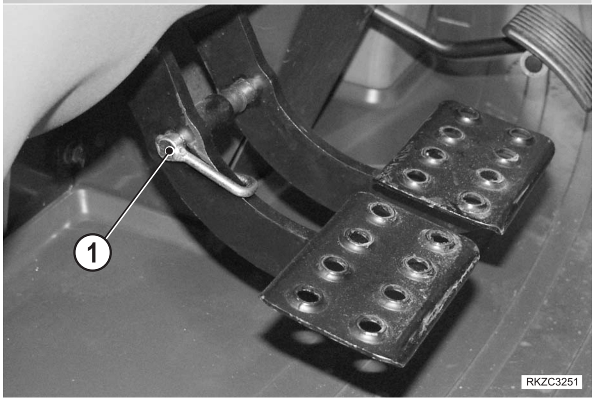
⚠ Make sure that the brake pedals are fastened together by the cotter pin (1).

⚠ 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. (For details, see "30 REMOVAL AND INSTALLATION").





• Control

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 "ENGINE SPEED TESTS").

3 -Brake hard and bring the engine up to MAX.

4 -Engage the 3rd gear while braking and accelerating as above; confirm that engine speed decreases to the permissible range (See "CHECKING ENGINE WITH LOAD").

5 -Repeat this test in REVERSE gear.

★ If the revs are high than the permissible limits, the clutches are worn, and must be replaced.

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.

FRONT EQUIPMENT

• Shovel raise check

1 - Put the machine with the shovel teeth on blocks "**A**" of about 10 cm and in vertical position in relation to the ground.

2 - Stop the engine and release residual hydraulic pressures.

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 curl shovel until the teeth are in tilt position by about 10°.

6 - Stop the engine and check shovel link position for 5 minutes.
- If bucket link has no lowering movement, drift is due to control valve.

To test the individual cylinders, proceed as follows:

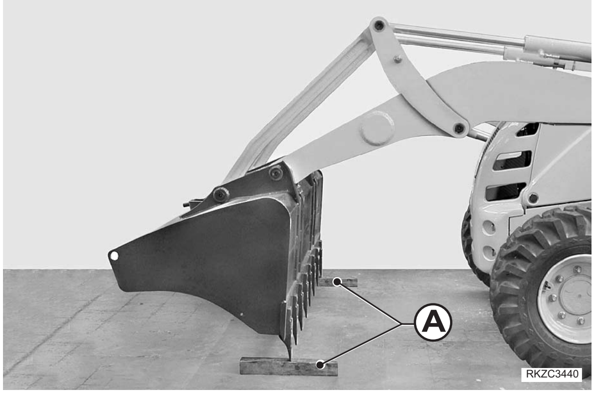
7 - Carry out with shovel a dump movement to let teeth lean on ground in vertical position.

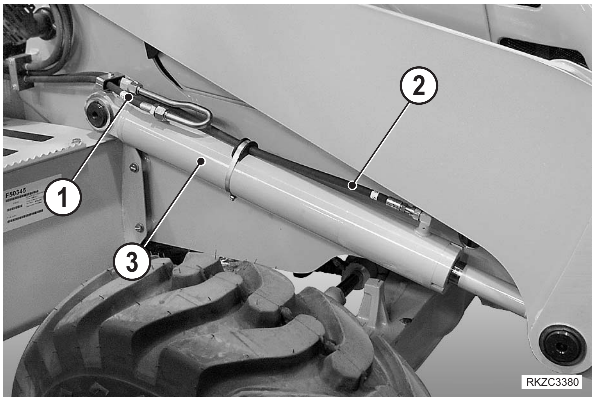
8 - Remove from one of the cylinders the plug fitted on the cylinder bottom side in Phase 4.

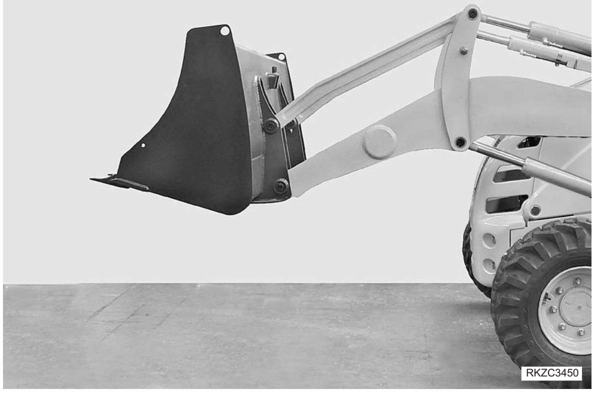
9 - Start the engine and retract the shovel until to bring the teeth in tilt position of about 10° towards upper.

10 - Stop the engine and check the shovel position for 5 minutes.
- If shovel 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.

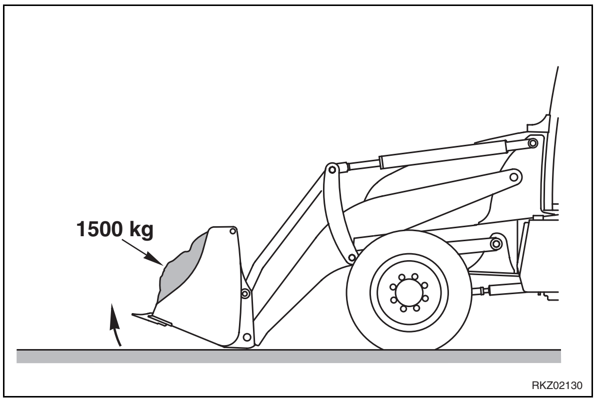






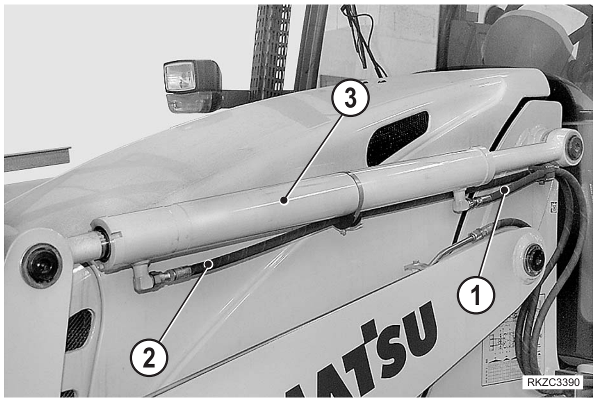
• Shovel dump check

1 - Put the machine with shovel on level ground and teeth tilted of about 10°.
Put in the bucket a weight of 1500 kg.



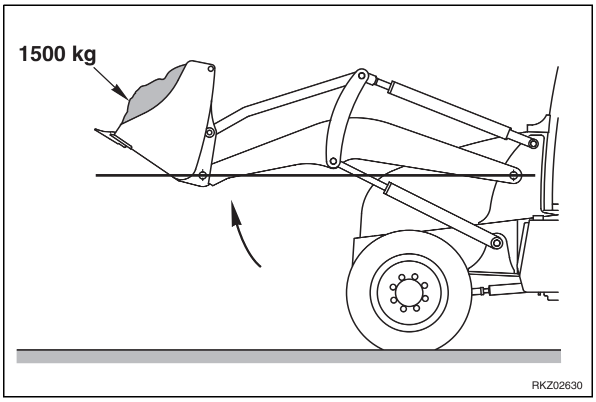
2 - Disconnect pipes (1) and (2) from both dump cylinders (3) and plug them to prevent contamination of the ducts.

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 shovel until shovel hinge pin is aligned with shovel arm hinge pin.

5 - Stop the engine and check the position of the shovel teeth for 5 minutes.
   - If shovel has no swing movement, drift is due to control valve.



To test the individual cylinders, proceed as follows:

6 - Lower the shovel to the ground.

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

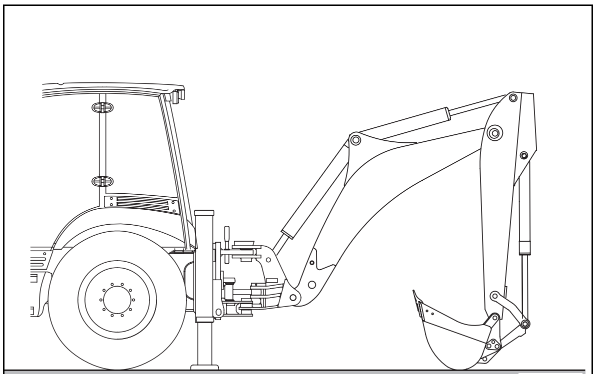
8 - Start the engine and raise the shovel as indicated in phase 4.

9 - Stop the engine and check the position of the shovel teeth for 5 minutes.
   - If the shovel teeth turn, the drift is due to the gasket seals of the plugged cylinder.

10 - Repeat operation from stage 6 to stage 9 to check the other cylinder.

BACKHOE

★ Test condition:
- Backhoe aligned
- Lifted outriggers


RKZ11020

• Boom testing

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

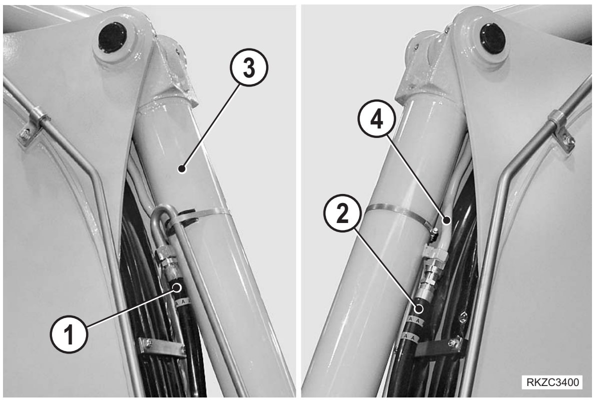
2 - Stop the engine and release residual hydraulic pressures.

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.

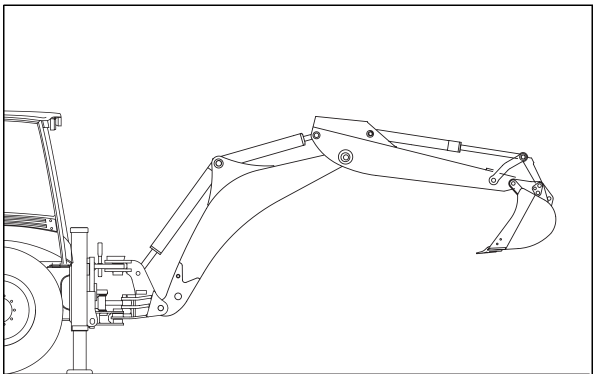
6 - Apply a temporary pipe on pipe (3) base side to catch possible oil leakage.



RKZC3400

7 - Start the engine and extend completely the arm.

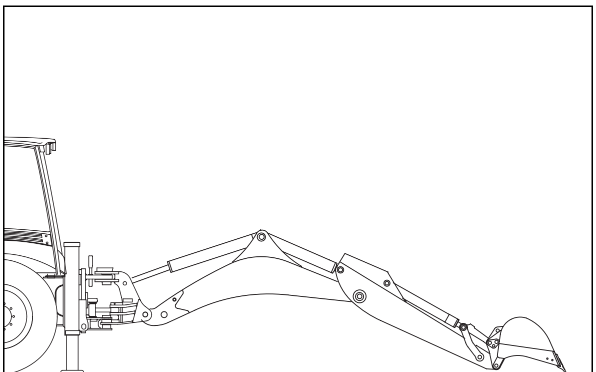
8 - Stop the engine and check the boom position for 5 minutes.
- If boom has a lowering movement, drift is due to cylinder gaskets.
- If boom has no lowering movement, drift is due to control valve.


RKZ11030

• Arm testing

1 - Set the machine with arm fully extended and with bucket teeth on ground.

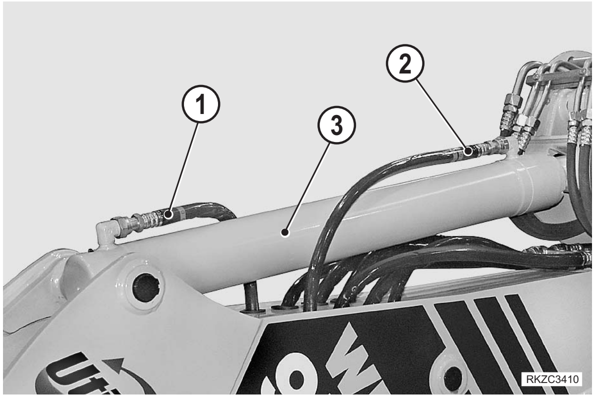
2 - Stop the engine and release residual hydraulic pressures.


RKZ11040

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.

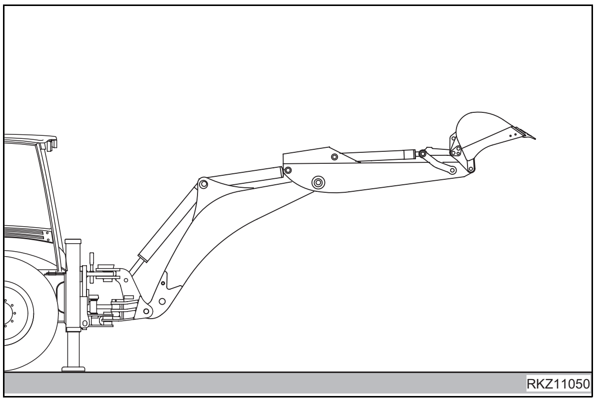
4 - Plug arm cylinder hole on head side and fit a temporary pipe on base side to catch possible oil leakage.



5 - Start the engine and raise the boom.

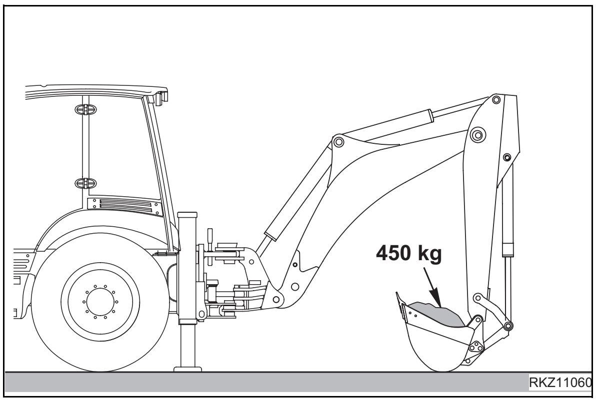
6 - Stop the engine and check the arm position for 5 minutes.

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



- **Bucket testing**

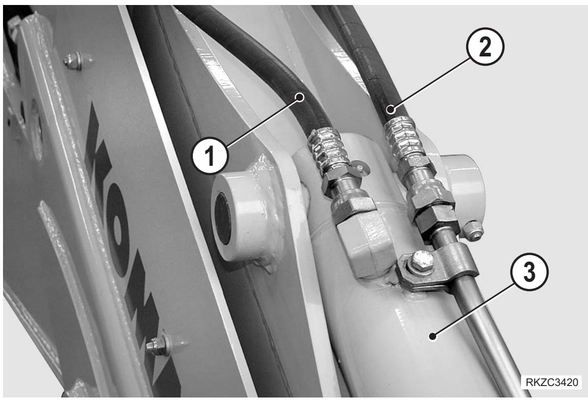
1 - Set the machine with vertical arm and horizontal bucket leaned at level ground on the side.
Put in the bucket a weight of 450 kg or fill it with earth.



2 - Stop the engine and release residual hydraulic pressures.

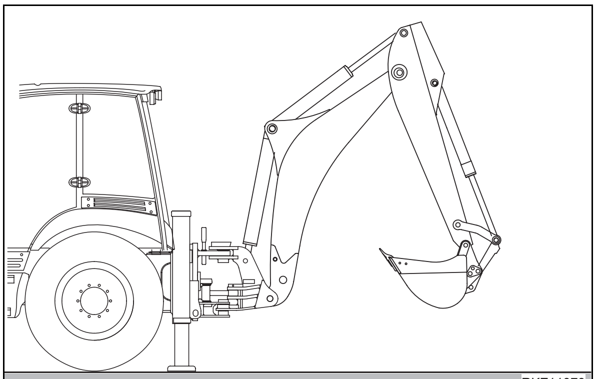
3 - Disconnect bucket cylinders (3) pipes (1) and (2) and plug them to avoid impurity inlet.

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



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.

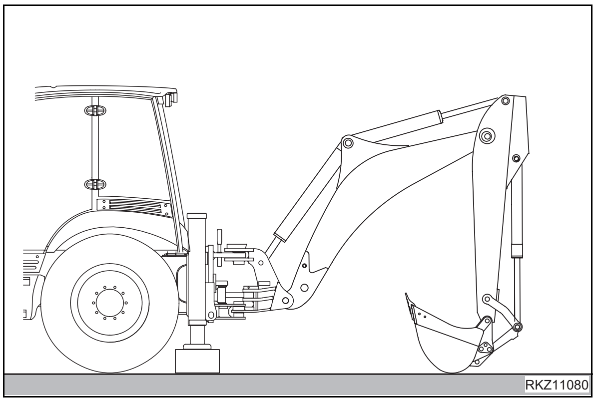

RKZ11070

• Outriggers testing

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

2 - Put blocks of about 20 cm under the outriggers.

3 - Without forcing them, lower the outriggers onto the trestles.

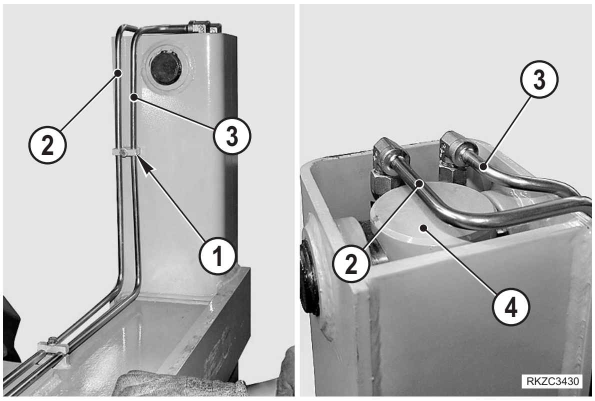

RKZ11080

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.

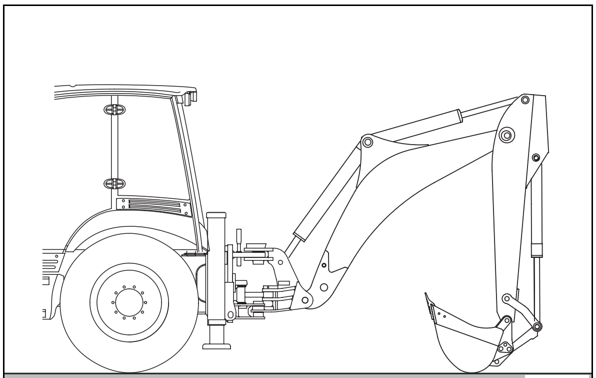
7 - Start the engine, use force on the boom to raise the machine, and remove the trestles supporting the outriggers.



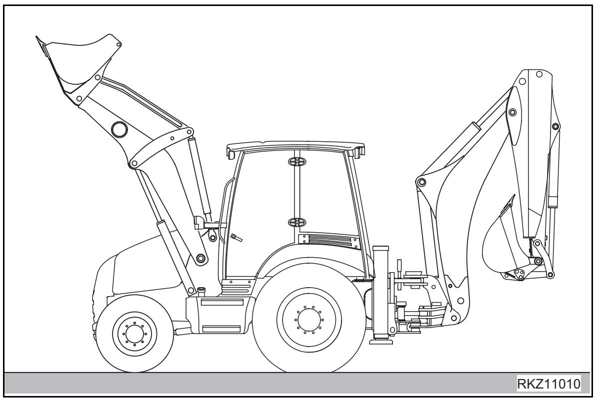
RKZC3430

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.


RKZ11090

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 widows and wait until the cab temperature stabilizes at the outside value.

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

7 -Use the thermometer **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 -f the average value of the temperature measured does not fall within the values given in the table, it will be necessary to thoroughly check the unit.

2. Checking the unit

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

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

The following conditions may be found:

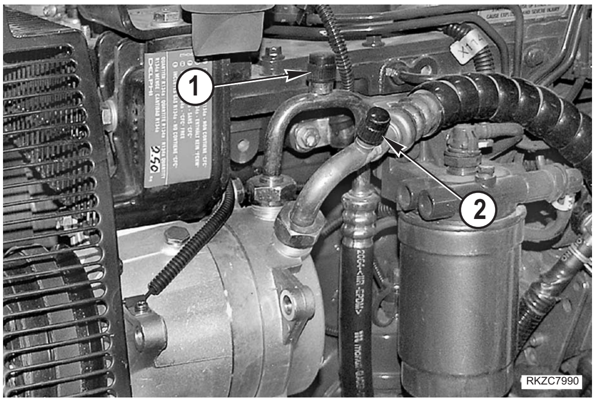
Conditions	Causes - Faults
L.P. high - H.P. normal or low	• Electromagnetic pulley that slips or does not engage correctly • Expansion valve blocked in open position • Compressor damaged
L.P. low - A.P. high or normal	• Expansion valve blocked in closed position or obstructed • Filter saturated with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

EMPTYING THE AIR-CONDITIONING UNIT

1 - Connect the maintenance station **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

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
Bent halfshaft	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	Remove excessive weight and redistribute load, following instructions related to the vehicle

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
Bent halfshaft	Remove excessive weight and redistribute load, following linstructions 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	Remove excessive weight and redistribute load, following instructions related to the vehicle

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
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle

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
Bent halfshaft	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
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
Incorrect wheel adjustment	Verify group integrity and wheel side bearings.
Contamination in the axle box or incorrect assemblyof parts	Look for foreign particles. Check assembly of the various parts of the 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
Bent halfshaft	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
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
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.	Blocked halfshaft: • 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
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
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 assemblyof 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
Bent halfshaft	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

Noise while driving	
CAUSES	**REMEDY**
Excessive backlash between pinion and ring gear	Replace
Worn out pinion and gear ring	Replace
Worn out pinion bearings	Replace
Pinion bearings loosened	Replace
Excessive pinion axial backlash	Replace
Worn out differential bearings	Replace
Differential bearings loosened	Replace
Ring gear out of roundness	Replace
Low lubricant level	Top up
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	Replace

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

FRONT AXLE CHECKING AND TROUBLESHOOTING

Ring gear tooth broken at the outer side	
CAUSES	**REMEDY**
Excessive gear load compared to the one foreseen	Replace bevel gear set Adjust bevel gear set freebacklash
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. Use correct lubrication, fill up to the right level and substitute at recommended intervals
Worn out pinion bearings	Use correct lubricants, fill up to the right levels and replace according to the recommended program.

Overheated ring and pinion teeth	
CAUSES	**REMEDY**
Prolong ed functioning at high temperatures	Replace bevel gear set. Use correct lubrication, fill up to the right level and substitute at recommended intervals
Insufficient lubrication; contaminated oil; incorrect lubrication	

Pinion teeth pitting	
CAUSES	**REMEDY**
Excessive use axial pinion	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 substitute at recommended intervals
Excessive use axial pinion	
Normal wear out	
Pinion nut loosened	

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, fill up to the right level and substitute at recommended intervals
Oil gasket assembled incorrectly	
Seal lip damaged	
Contaminated oil	

Excessive wearing out of input flange spline	
CAUSES	**REMEDY**
Excessive use axial pinion	Replace the flange. Check that the pinion spline is not excessively worn out. Replace bevel gear set if required.
Pinion nut loosened	
Pinion axle backlash	

Fatigue failure of pinion teeth	
CAUSES	**REMEDY**
Excessive use axial pinion	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 axial pinion	Replace differential gear group. Replace halfshaft if required

Thrust washer surface worn out or scratched	
CAUSES	**REMEDY**
Insufficient lubrication; contaminated oil; incorrect lubrication	Replace all scratched washers and those with 0.1mm thickness lower than the new ones. Use correct lubrication, fill up to the right level and substitute at recommended intervals

Inner diameter of tapered roller bearing worn out	
CAUSES	**REMEDY**
Excessive use axial pinion	Replace bearing. Check pinion axial backlash. Use correct lubrication, fill up to the right level and substitute at recommended intervals
Excessive pinion axial backlash	
Insufficient lubrication; contaminated oil	

Bent or broken halfshaft or halfshaft broken at wheel side	
CAUSES	**REMEDY**
Vehicle intensively operated or overloaded	Replace the axle shaft Check beam body distortion. Check wheel bearing and replace if necessary.
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
Bent halfshaft	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	Remove excessive weight and redistribute load, following instructions related to the vehicle

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
Bent halfshaft	Remove excessive weight and redistribute load, following linstructions 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	Remove excessive weight and redistribute load, following instructions related to the vehicle

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
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle

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
Bent halfshaft	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
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
Incorrect wheel adjustment	Verify group integrity and wheel side bearings.
Contamination in the axle box or incorrect assemblyof parts	Look for foreign particles. Check assembly of the various parts of the 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
Bent halfshaft	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
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
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
Overloading/ incorrect weight distribution	Remove excessive weight and redistribute load, following instructions related to the vehicle
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 assemblyof 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	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

Noise while driving	
CAUSES	**REMEDY**
Excessive backlash between pinion and ring gear	Replace
Worn out pinion and gear ring	Replace
Worn out pinion bearings	Replace
Pinion bearings loosened	Replace
Excessive pinion axial backlash	Replace
Worn out differential bearings	Replace
Differential bearings loosened	Replace
Ring gear out of roundness	Replace
Low lubricant level	Top up
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	Replace

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

REAR AXLE CHECKING AND TROUBLESHOOTING

Ring gear tooth broken at the outer side	
CAUSES	**REMEDY**
Excessive gear load compared to the one foreseen	Replace bevel gear set Adjust bevel gear set freebacklash
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. Use correct lubrication, fill up to the right level and substitute at recommended intervals
Worn out pinion bearings	Use correct lubricants, fill up to the right levels and replace according to the recommended program.

Overheated ring and pinion teeth	
CAUSES	**REMEDY**
Prolong ed functioning at high temperatures	Replace bevel gear set. Use correct lubrication, fill up to the right level and substitute at recommended intervals
Insufficient lubrication; contaminated oil; incorrect lubrication	

Pinion teeth pitting	
CAUSES	**REMEDY**
Excessive use axial pinion	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 substitute at recommended intervals
Excessive use axial pinion	
Normal wear out	
Pinion nut loosened	

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, fill up to the right level and substitute at recommended intervals
Oil gasket assembled incorrectly	
Seal lip damaged	
Contaminated oil	

Excessive wearing out of input flange spline	
CAUSES	**REMEDY**
Excessive use axial pinion	Replace the flange. Check that the pinion spline is not excessively worn out. Replace bevel gear set if required.
Pinion nut loosened	
Pinion axle backlash	

Fatigue failure of pinion teeth	
CAUSES	**REMEDY**
Excessive use axial pinion	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 axial pinion	Replace differential gear group. Replace halfshaft if required

Thrust washer surface worn out or scratched	
CAUSES	**REMEDY**
Insufficient lubrication; contaminated oil; incorrect lubrication	Replace all scratched washers and those with 0.1mm thickness lower than the new ones. Use correct lubrication, fill up to the right level and substitute at recommended intervals

Inner diameter of tapered roller bearing worn out	
CAUSES	**REMEDY**
Excessive use axial pinion	Replace bearing. Check pinion axial backlash. Use correct lubrication, fill up to the right level and substitute at recommended intervals
Excessive pinion axial backlash	
Insufficient lubrication; contaminated oil	

Bent or broken halfshaft or halfshaft broken at wheel side	
CAUSES	**REMEDY**
Vehicle intensively operated or overloaded	Replace the axle shaft Check beam body distortion. Check wheel bearing and replace if necessary.
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
Gear selector and direction of movement selector malfunction	Replace selector
Shift electronic control malfunction	Replace
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 0ûC	Wait for oil to reach working temperature (stall test)
Damaged rotary seals	Replace
Reverser locking	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
Overheated solenoids/solenoid valves	Replace
Damaged wiring connections between transmission and vehicle	Repair/Replace
Damage to shift electronic control logic	Replace
Damaged sensors	Replace

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"
Gear selector or direction of movement selector malfunction	Replace
Control module malfunction	Replace
Shift electronic control malfunction	Replace
Damaged hydraulic system	Repair/Replace

Gear remains engaged	
CAUSES	**REMEDY**
Damaged/jammed shuttleshaft lever	Repair/Replace
Electrical system fault	Repair/Replace
Damaged control valve	Replace
Damaged hydraulic system	Repair/Replace
Damaged clutch unit	Repair/Replace
Selector malfunction	Replace
Control module malfunction	Replace
Shift electronic control malfunction	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
Selector malfunction	Replace
Control module malfunction	Replace
Shift electronic control malfunction	Replace

Gear shift won’t engage	
CAUSES	**REMEDY**
Damage to clutch engagement assembly	Repair/Replace
Damaged hydraulic system	Repair/Replace
Damaged control valve	Replace
Damage to pressure sensors	Check/Replace
Electrical system fault	Repair/Replace
Selector malfunction	Replace
Control module malfunction	Replace
Shift electronic control malfunction	Replace

30 REMOVAL AND INSTALLATION

HOW TO READ THE MANUAL

1. Removal and Installation of the groups

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

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

(Example)

REMOVAL OF THE GROUP ●●●: .... Title of operation

: .... Safety precautions to be followed when carryingout the operation.

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

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

2 - ▲▲▲ (2): .... [*1] This sign means that information is given\line for the installation procedure

3 - Remove ■■■ (3):

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

INSTALLATION OF THE GROUP ●●●: .... Title of operation

- To install, reverse removal procedure.

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

★: .... Technique or important point to remember when installing ▲▲▲ (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 WHILE WORKING".
Always make sure that these precautions are taken.

3. List of special tools

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

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

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

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

PRECAUTIONS TO BE TAKEN 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.
- Always use the safety devices when working with the working equipment raised.
- 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.
- Use a receptacle of adequate capacity 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.
- Replace the O-rings, cotter pins and stop rings with new ones.
- 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.
- Fill with lubricant when installing mechanical assemblies.
- If hoses or hydraulic equipment, such as hydraulic cylinders, pumps, motors, solenoid valves and valves, are removed for repairs or substitution, bleed air from the hydraulic circuits after having re-assembled the machine.

★ For details, see «20. TESTING AND ADJUSTMENTS».

- After having re-assembled cylinder joints or cylinders, or work equipment articulations, lubricate thoroughly.

SPECIAL TOOLS

Nature of work	Symbol		Code	Name	Q.ty
Removal of piston pump	**B**	**1**		Pump support tool	1
Removal of transmission		**2**		Transmission support tool	1
Disassembly - assembly front axle	**D**	**1**	CA119099	Closed end wrench	1
		2	CA119143	Plunger	1
		3	CA119200	False differential box	1
		4	CA119202	False pinion	1
		5	CA119225	Plunger	1
		6	CA119226	Plunger	1
		7	CA119228	False differential box	1
		8	CA715004	Plunger	1
		9	CA715022	Key	1
		10	CA715026	Plunger	1
		11	CA715027	Plunger	1
		12	CA715039	Plunger	1
		13	CA715042	Plunger	1
		14	CA715064	Plunger	1
		15	CA715108	Plunger	1
		16	CA715265	Key	1
		17	CA715505	Plunger	1
		18	CA715506	Plunger	1
		19	CA715543	Plunger	1
		20	CA715742	Plunger	1
		21	CA722521	Sensor test system	1

Nature of work	Symbol		Code	Name	Q.ty
Disassembly - assembly rear axle	E	1	CA119099	Key	1
		2	CA119143	Plunger	1
		3	CA119226	Plunger	1
		4	CA715004	Plunger	1
		5	CA715022	Key	1
		6	CA715026	Plunger	1
		7	CA715027	Plunger	1
		8	CA715033	Plunger	1
		9	CA715039	Plunger	1
		10	CA715042	Plunger	1
		11	CA715056	Plunger	1
		12	CA715108	Plunger	1
		13	CA715128	False pinion	1
		14	CA715172	Plunger	1
		15	CA715265	Key	1
		16	CA715380	Bearing assembly kit	1
		17	CA715388	False differential box	1
		18	CA715391	Plunger	1
		19	CA715456	Backlash meas. tool	1
		20	CA715505	Plunger	1
		21	CA715506	Plunger	1
		22	CA715541	Plunger	1
		23	CA715706	Preloading meas. tool	1
		24	CA715742	Plunger	
		25	CA715521	Sensor test system	1

Nature of work	Symbol		Code	Name	Q.ty
Disassembly - assembly transmission	F	**1**	CA715409	Plunger	1
		2	CA715004	Plunger	1
		3	CA715623	Plunger	1
		4	CA715494	Control	1
		5	CA715495	Protection + shims	1
		6	CA715497	Plunger	1
		7	CA715356	Calibrator	1
		8	CA715501	Plunger	1
		9	CA715358	Installation/assembly tool clutches	1
		10	CA715499	Protection	1
		11	CA715046	Plunger	1
		12	CA715743	Protection + shims	1
		13	CA715746	Plunger	1
		14	CA715745	Calibrator	1
		15	CA715732	Lifting of B, C, and E shafts	1
		16	CA715149	Plunger	1
		17	CA715744	Protection + shims	1
		18	CA715747	Calibrator	1
		19	CA715748	Plunger	1
		20	CA716009	Calibrator	1
		21	CA716010	Protection	1
		22	CA716018	Protection + shims	1
		23	CA716019	Plunger	1
		24	CA716020	Calibrator	1
		25	CA716021	Extractor	1

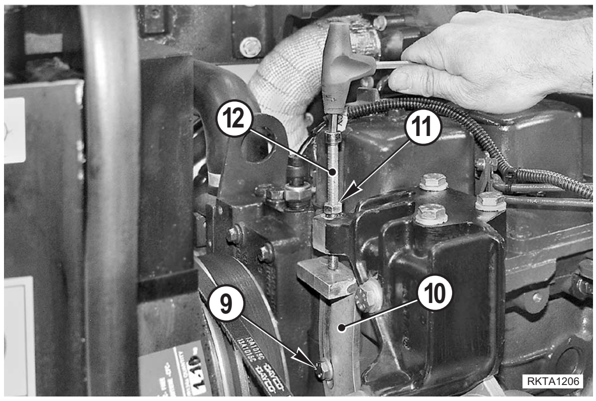
Nature of work	Symbol		Code	Name	Q.ty
Disassembly - assembly cylinder	U	1	790-502-1003	Equipment	1
			790-101-1102	Pump	1
		2	790-102-3802	Key	1
		3	790-302-1310	Key 65 mm	1
			790-302-1280	Key 55 mm	1
			790-302-1270	Key 50 mm	1
			790-302-1390	Key 46 mm	1
		4	790-102-4300	Expander	1
		5	796-720-1670 07281-01279	Calibrator for boom cylinder	1
			796-720-1660 07281-01159	Calibrator for arm and swing cylinders	1
			796-720-1650 07281-01029	Calibrator for bucket and shovel arm cylinders	1
			796-720-1640 07281-00909	Calibrator for outriggers and shovel cylinders	1
		6	790-201-1702	Driver kit	1
			790-101-5021	. Handle	1
			01010-50816	. Screw	1
			790-201-1781	. Driver for boom cylinder	1
			790-201-1771	. Driver for bucket cylinder	1
			790-201-1761	. Driver for swing and shovel arm cylinder	1
			790-201-1751	. Driver for shovel cylinder	1
			790-201-1741	. Driver for outrigger cylinder	1
		7	790-201-1500	Driver kit	1
			790-101-5021	. Handle	1
			01010-50816	. Screw	1
			790-201-1590	. Driver for boom cylinder	1
			790-201-1580	. Driver for bucket cylinder	1
			790-201-1570	. Driver for swing and shovel arm cylinder	1
			790-201-1560	. Driver for shovel cylinder	1
			790-201-1550	. Driver for outrigger cylinder	1
		8	790-102-4300	Key	1
			790-102-4310	Pin	2

ENGINE HOOD

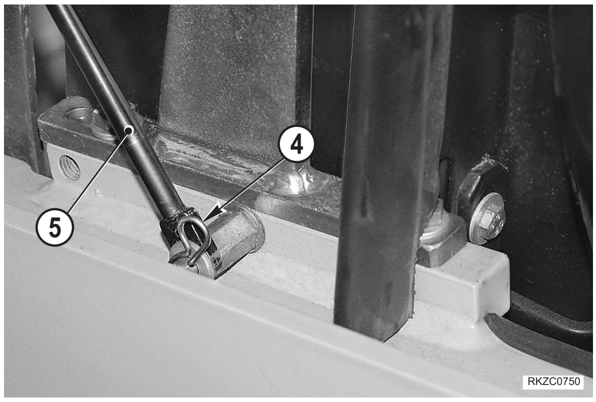
Removal

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

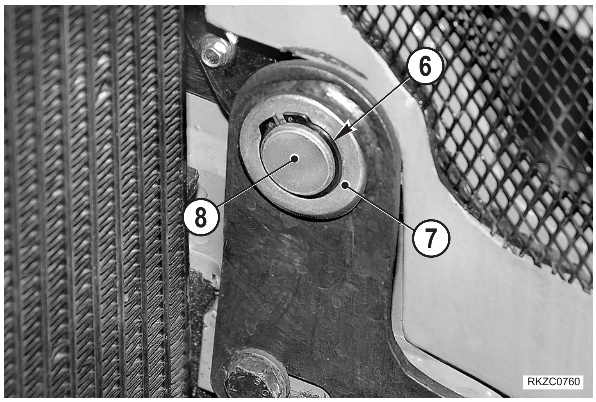
1 - Loosen and remove the screws (1) and washers and remove the front grille (2).



2 - Fully raise the engine hood (3), remove the safety pins (4) and disconnect the gas springs (5) from the chassis.

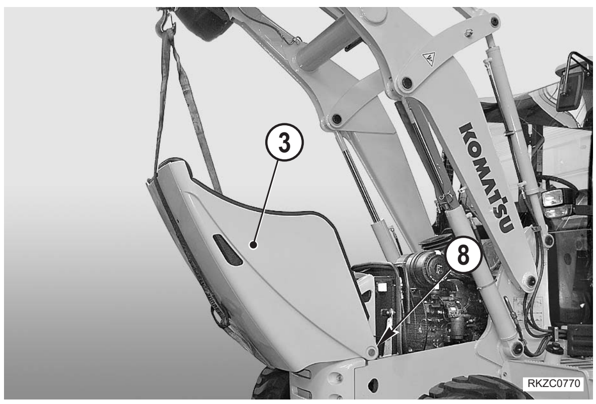


3 - Remove the snap rings (6) and washers (7).



4 - Attach lifting equipment to engine hood (3); pull out fulcrum pins (8) and remove hood (3).

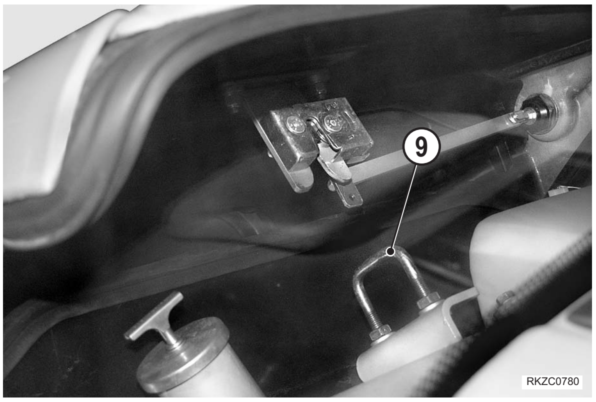
Engine hood: 32 kg



Installation

- To install, reverse removal procedure.

★ Check catch (9) for proper centring.



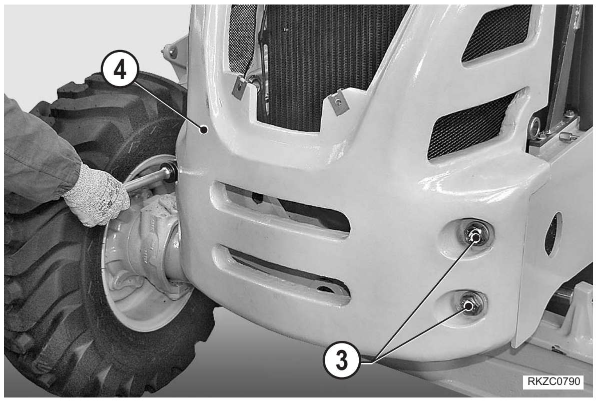
FRONT GUARD

Removal

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

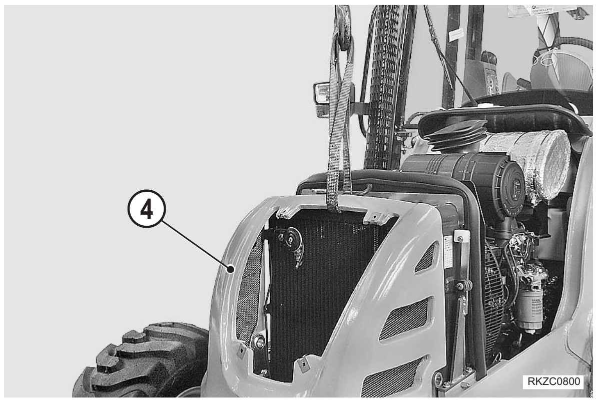
1 - Loosen and remove the screws (1) and washers and remove the front grille (2).

2 - Loosen the screws (3) retaining the guard (4) to eliminate torque. [*1]



3 - Connect the guard (4) to the lifting equipment and slightly tension the rope.

4 - Take out the screws (1) and remove the protection (4).



Installation

- To install, reverse removal procedure.

[*1]

Screw: Loctite 242

Screw: 300 Nm

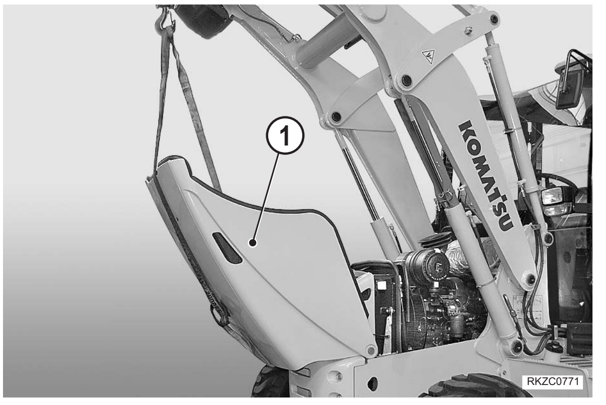
RADIATOR GROUP

Removal

⚠ Fully raise the front working equipment and engage the safety stop.
Also place the backhoe in its secure position.

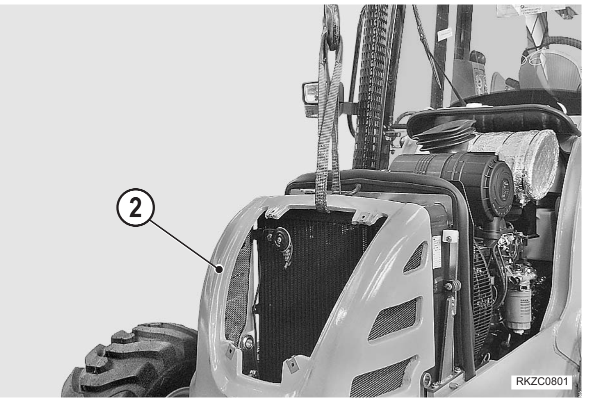
⚠ Remove the ignition key.

1 - Remove the engine hood (1).
(For details see "ENGINE HOOD").



2 - Remove the front guard (2).
(For details see "FRONT GUARD").

⚠ Release all residual pressure in all circuits.



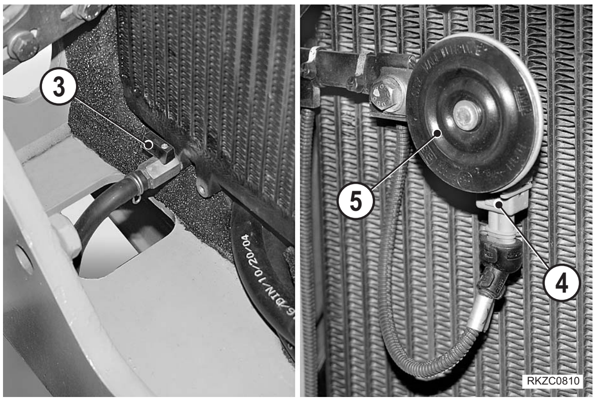
3 - Open the cock (3) and drain the coolant liquid. [*1]

Coolant liquid: approx. 15 ℓ

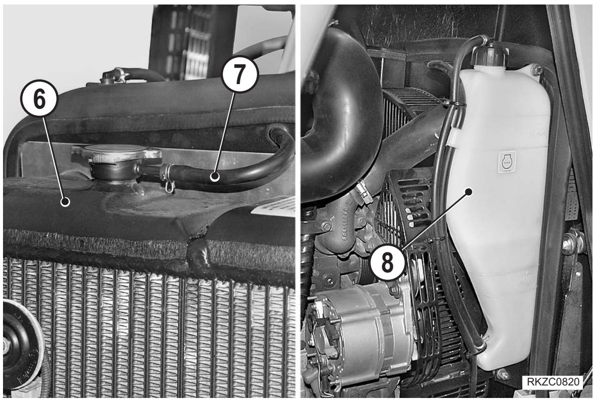
For machines equipped with an air-conditioning unit.

4- Drain the air conditioning unit.
(For details see "20 TESTING AND ADJUSTMENTS").
[*2]

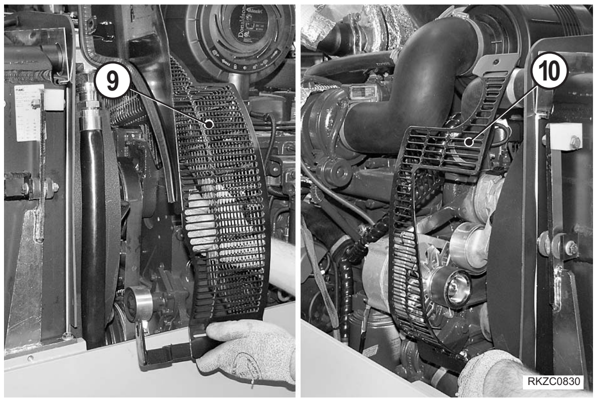
5 - Disconnect the connector (4) and remove the horn (5).



6 - Disconnect hose (7) from radiator (6) and remove surge tank (8).

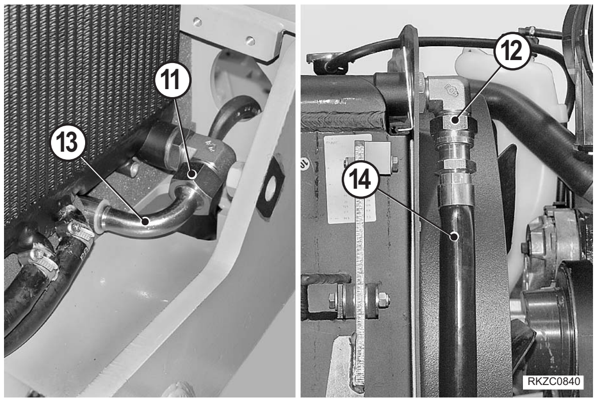


7 - Loosen and remove four screws and fan guards (9) and (10).



8 - Partly loosen fittings (11) and (12) to drain the hydraulic oil from the oil cooler; once the oil is drained, fully disconnect hoses (13), (14) and plug them to prevent contamination. [*3]

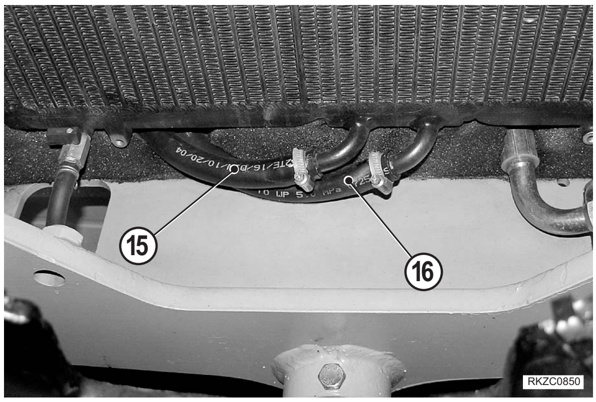
Hydraulic oil: 40 ℓ



9 - Disconnect gearbox oil hoses (15) and (16) from the oil cooler and plug them to prevent contamination.

Mark the hoses and their respective positions for connection.

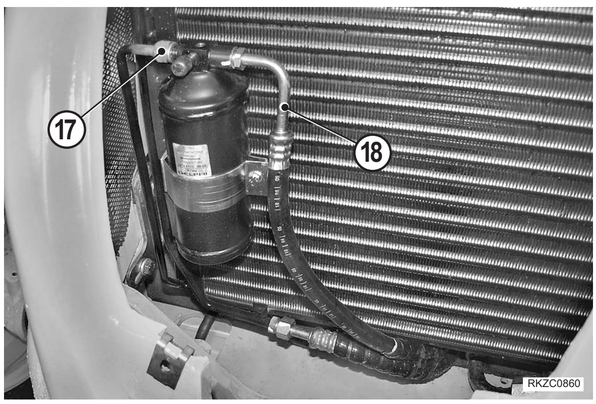
[*4]



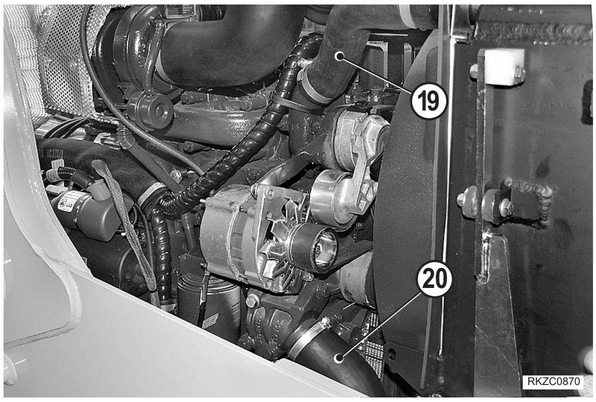
For machines equipped with an air-conditioning unit.

10 - Disconnect the tubes (17) and (18).

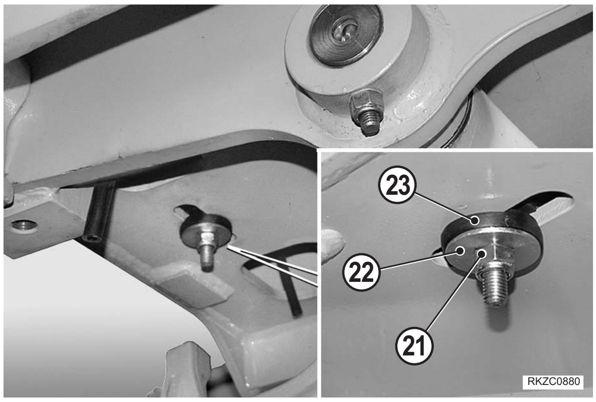
★ Immediately plug the tubes and the orifices to prevent to prevent moisture from entering into the circuit.



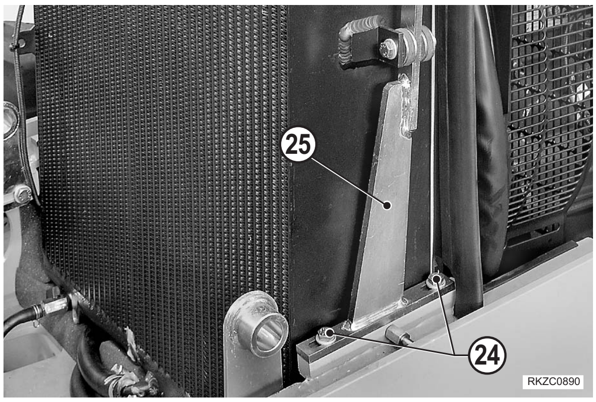
11 - Disconnect the tubes (19) and (20).



12 - Loosen and remove the self-locking nuts (21) (n°2), washers (22) and anti-vibration dampers (23).



13 - Loosen and remove the screws (24) retaining the holders (25).

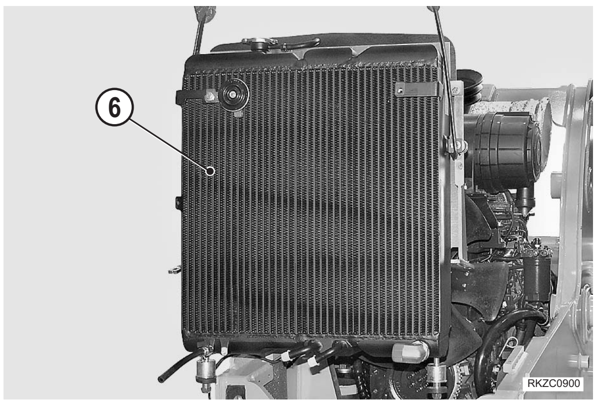


14 - Move the radiator group (6) to the front of the machine so as to disengage it from the cooling fan.

[*5]

15 - Attach lifting equipment to the group (6) and remove the group.

Radiator group: 37 kg



Installation

- To install, reverse removal procedure.

[*1]

★ Refill the coolant liquid circuit.

Coolant liquid: 15 ℓ

[*2]

★ Refill the air-conditioning unit.

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

[*3]

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

Hydraulic oil: 40 ℓ

[*4]

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

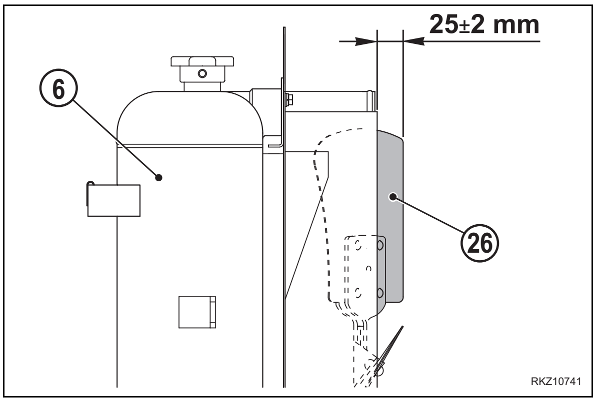
1 - Start the engine at low idling to circulate all the fluids and to fill up the systems.

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

★ After about one minute, stop the engine and top up all levels.

[*5]

★ Align radiator (6) with fan (26), making sure the fan protrudes from fan shroud by 25±2 mm.



CONDENSER
(For machines equipped with an air-conditioning unit)
Removal

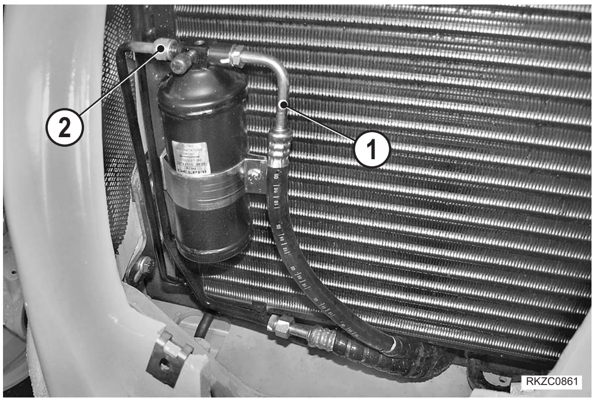
⚠ Fully raise the front working equipment and engage the safety stop.
Also place the backhoe in its secure position.

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

2 - Remove the front grille and the front guard
(For details see "FRONT GUARD").

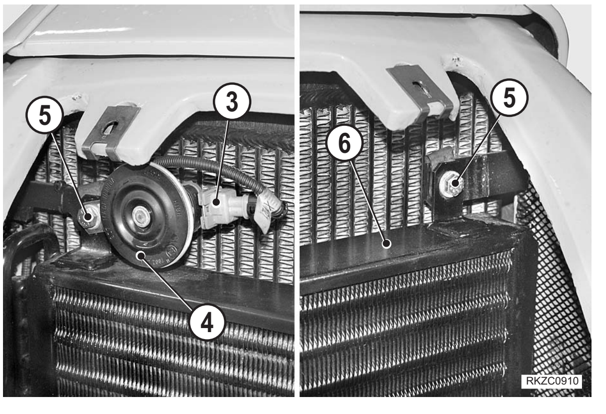
3 - Disconnect the tubes (1) and (2).

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



4 - Disconnect the connector (3) and remove the horn (4).

5 - Loosen and remove four screws (5) and washers, and remove condenser (6) together with dehydrating filter.



Installation

- To install, reverse removal procedure.

1 - Refill the air-conditioning unit. (For details, see "20 TESTING AND ADJUSTMENTS").

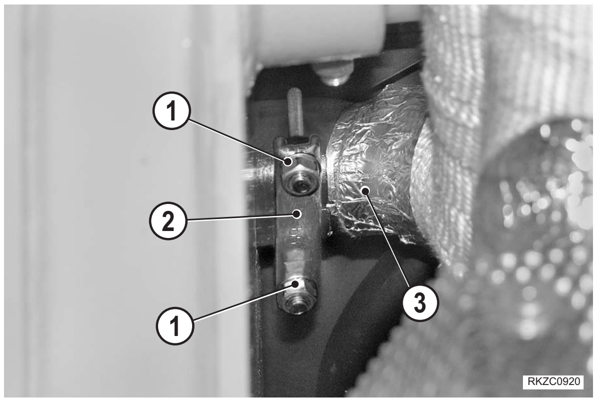
MUFFLER

Removal

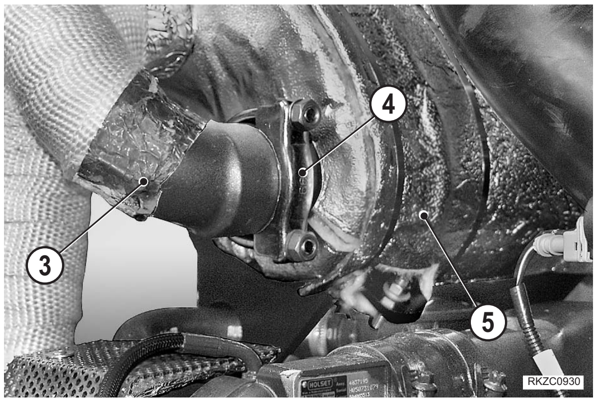
⚠ Fully raise the front working equipment and engage the safety stop.
Also place the backhoe in its secure position.

⚠ Remove the ignition key and fully raise the engine hood.

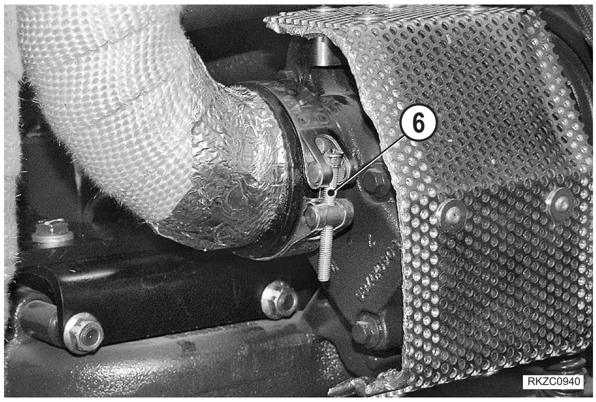
1 - Loosen the nuts (1) on the jumper pin (2) retaining the muffler pipe (3) to the exhaust pipe.



2 - Loosen the jumper pin (4), disconnect the pipe (3) from the muffler (5) and remove pipe.

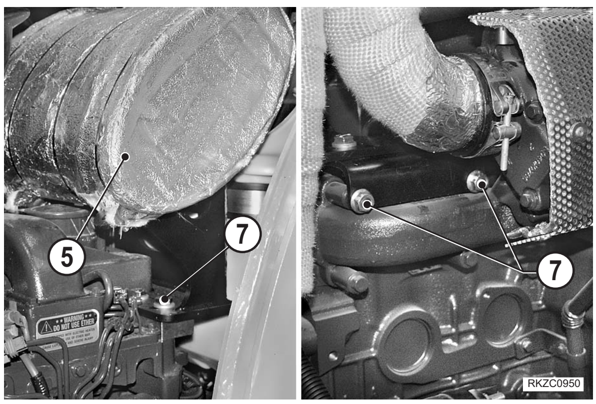


3 - Loosen the tie strap (6) retaining the muffler pipe to the turbocharger.



4 - Loosen and remove the four screws (7) and washers.

5 - Remove the muffler (5).



Installation

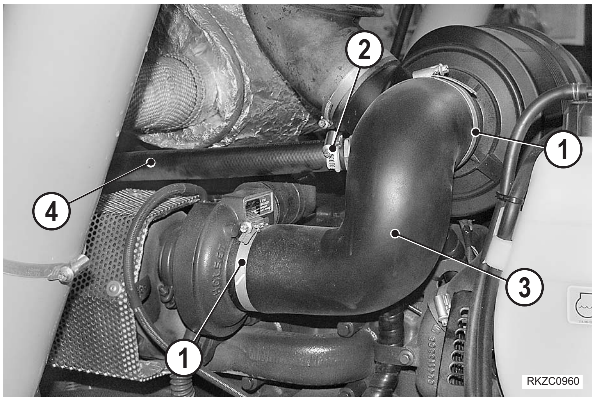
- To install, reverse removal procedure.

AIR FILTER

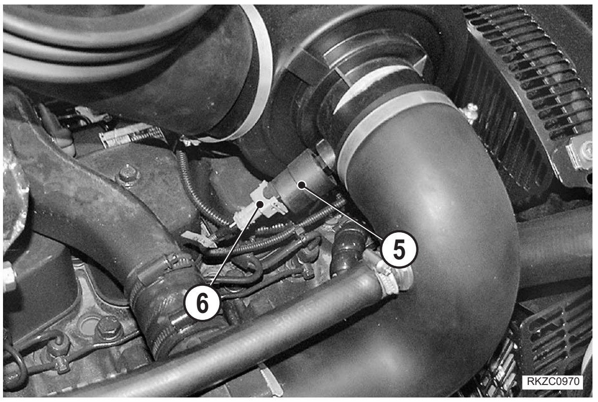
Removal

1 - Park the machine on hard, level ground, apply the parking brake, stop the engine and remove the ignition key.

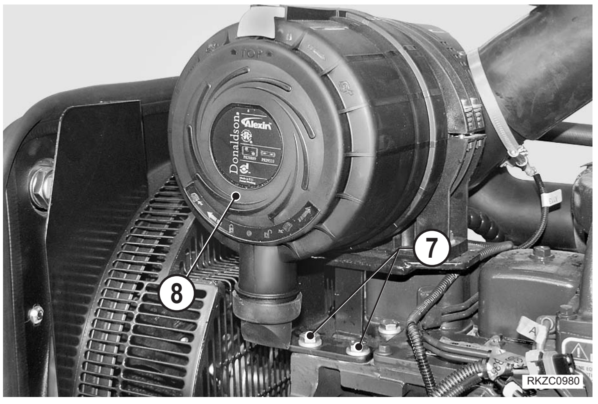
2 - Fully open engine hood, loosen straps (1) and (2), and disconnect pipes (3) and (4).



3 - Disconnect connector (6) from filter clogging sensor (5).



4 - Loosen and remove the screws (7) and remove the filter (8) together with the filter holder.



Installation

- To install, reverse removal procedure.

TURBOCHARGER

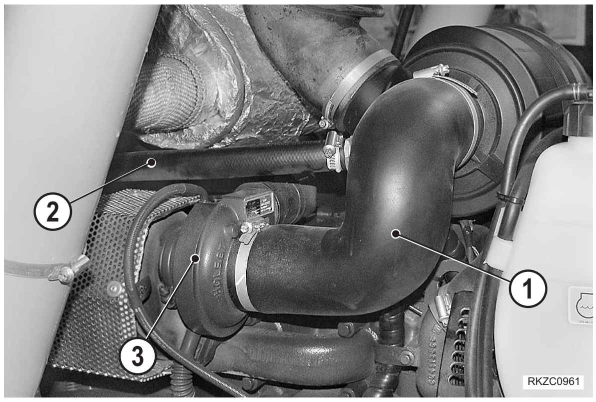
Removal

⚠ Fully raise the front working equipment and engage the safety stop.
Also place the backhoe in its secure position.

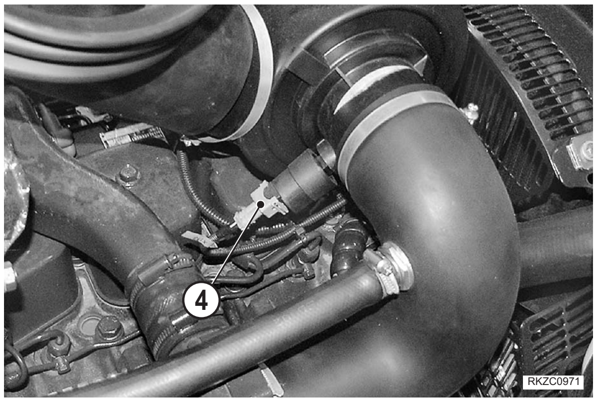
⚠ Remove the ignition key.

1 -Disconnect the vapour recovery pipe (2) from the suction pipe (1).

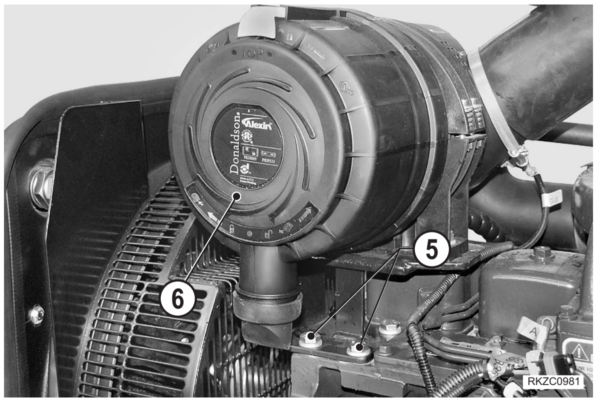
2 -Disconnect the suction pipe (1) from the turbocharger (3).



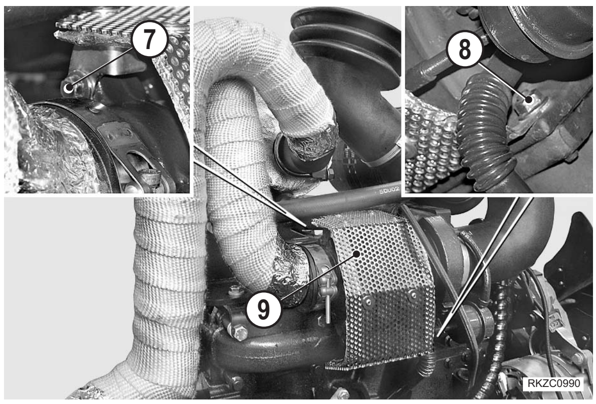
3 -Disconnect the connector (4) from the filter clogging lamp.



4 -Loosen and remove the screws (5) and the air filter (6).

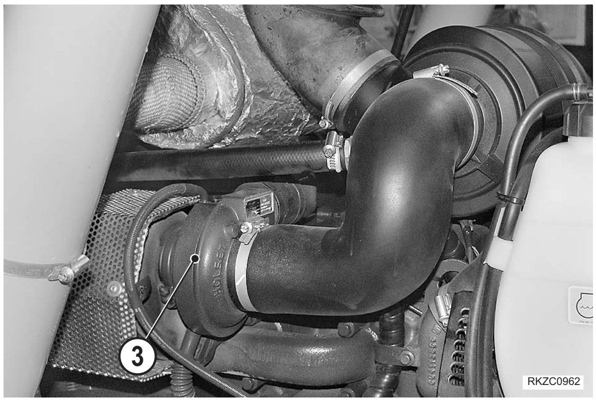


5 -Loosen and remove screw (7) and nut (8), and remove heat guard (9).



6 - Remove the muffler (10)
(For details see "MUFFLER").

7 - Remove the turbocharger (3) according to the instructions provided in the engine manual (manual code WHBMNEF000).



Installation

- To install, reverse removal procedure.

AIR-CONDITIONING UNIT COMPRESSOR

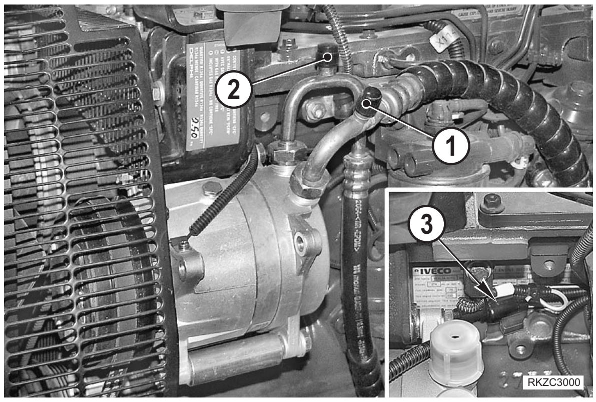
Removal

⚠ Fully raise the front working equipment and engage the safety stop.
Also place the backhoe in its secure position.

⚠ Remove the ignition key.

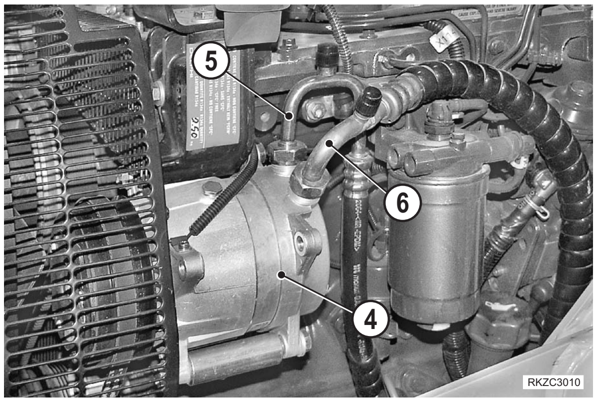
1 - Connect the outlets (1) and (2) to the maintenance station for air-conditioning units and drain the cooling fluid.
(For details see "20 TESTING AND ADJUSTMENTS").

2 - Release the tie strap and disconnect the connector (3).

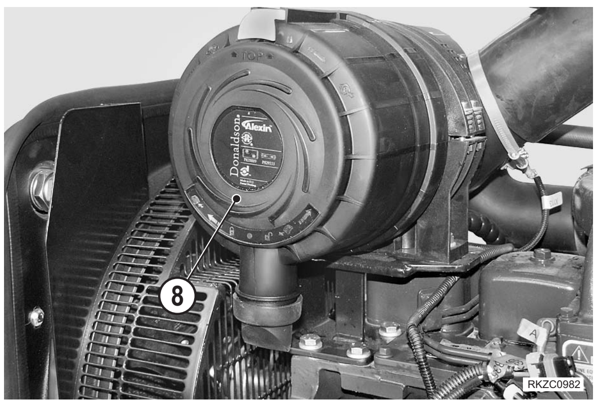


3 - Disconnect fluid delivery and return pipes (5), (6) from compressor (4). [*1]

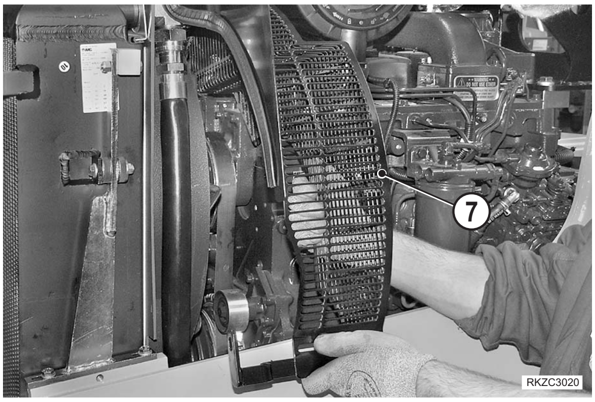
★ Collect the O-rings.



4 - Remove the air filter (8).

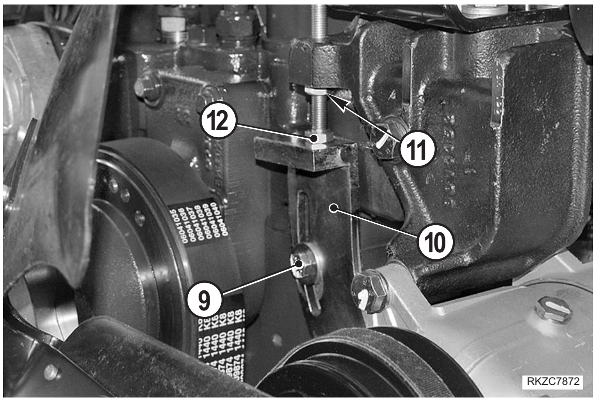


5 - Remove the left fan guard (7).



6 - Loosen the screw (9) retaining the tensioner (10).

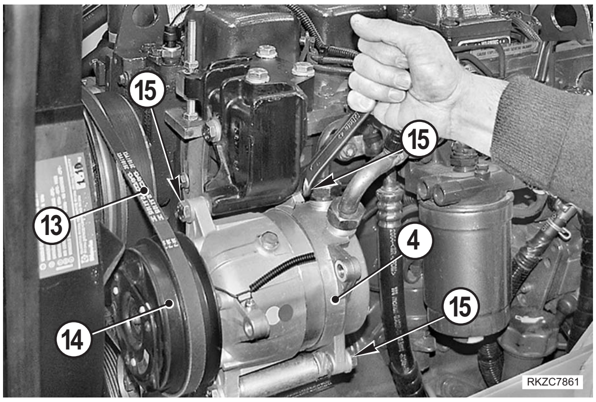
7 - Loosen the nut (11) and turn the screw (12) to loosen the belt.



8 - Disengage belt (13) from pulley (14).

9 - Loosen the screws (15) retaining the compressor (4).

10 - Take out the screws (15) and remove the compressor (4).



Installation

- To install, reverse removal procedure.

[*1]

★ Check O-rings for damage.

O-rings and fittings: coolant oil

1 - Tension the compressor belt.
(For details see "AIR-CONDITIONING UNIT COMPRESSOR BELT").

2 - Connect the unit to the maintenance station and refill it.
(For details see "20 TESTING AND ADJUSTMENTS").

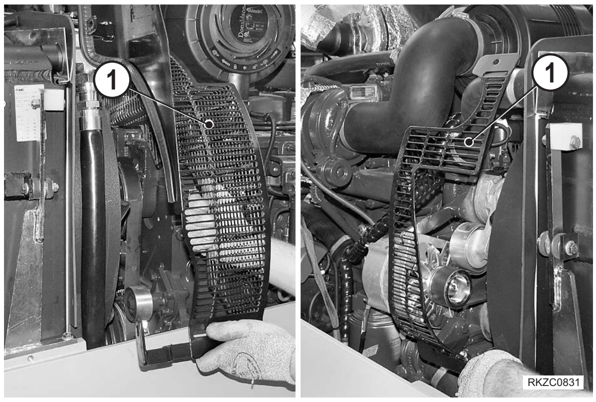
AIR-CONDITIONING UNIT COMPRESSOR BELT

Removal

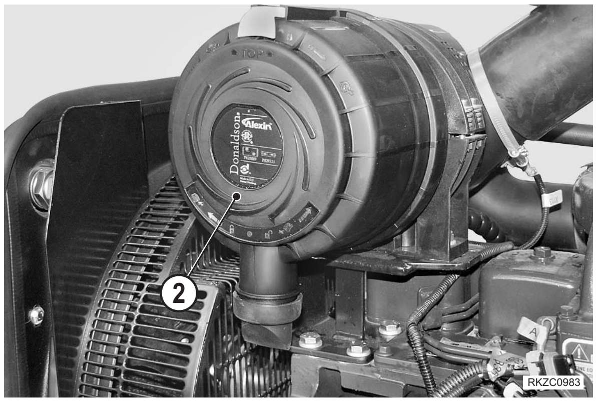
⚠ Fully raise the front working equipment and engage the safety stop.
Also place the backhoe in its secure position.

⚠ Remove the ignition key.

1 -Take out the screws and remove the fan guards (1).

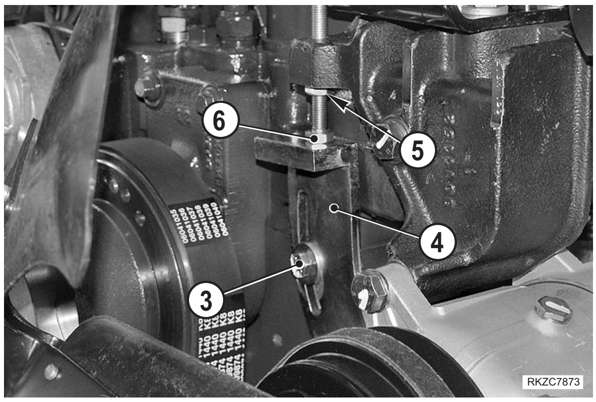


2 -Remove the air filter (2).

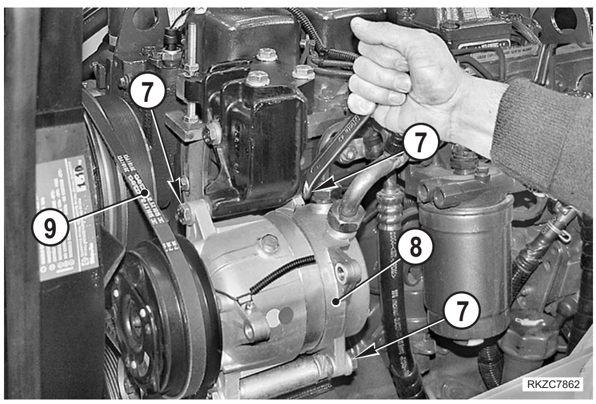


3 -Loosen the screw (3) retaining the tensioner bracket (4).

4 -Loosen nut (5) and screw (6) for belt tension.



5 -Loosen the screws (7) retaining the compressor (8) and remove the belt (9).



Installation

- To install, reverse removal procedure.

[*1]

Bracket lock nut: 117.6 Nm

[*2]

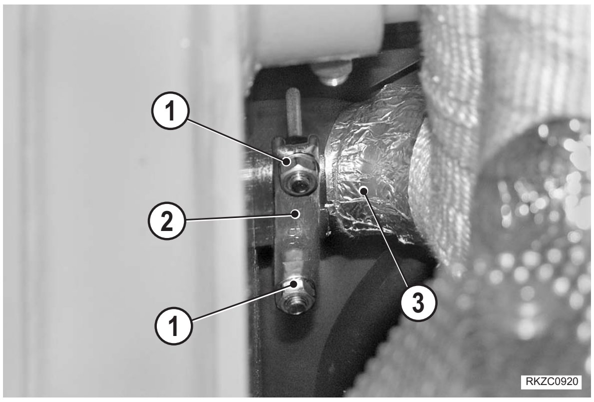
Fan fastening nuts: 42 Nm

1 - Carry out the belt tensioning procedure.
(For details see "20 TESTING AND ADJUSTMENTS").

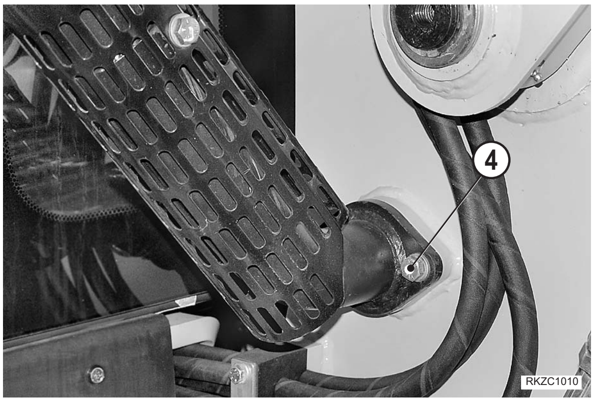
EXHAUST PIPE

Removal

1 - Loosen the nuts (1) on the jumper pin (2) retaining the muffler pipe (3) to the exhaust pipe.

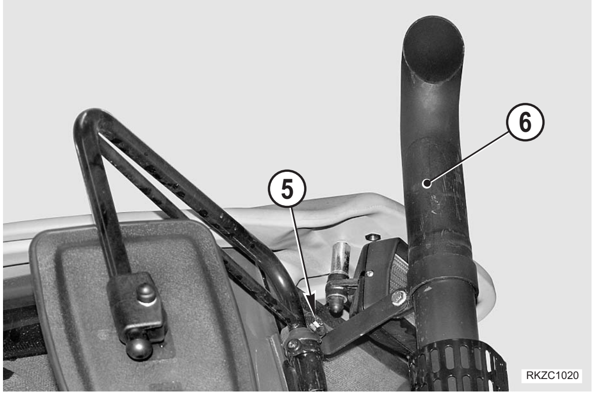


2 - Loosen the screws (4) on the attachment flange; remove one screw but leave the second screw in place for added safety.



3 - Remove the screw (5) and washer from the upper vibration damper.

4 - Remove the second screw (4) and remove the exhaust pipe (6).



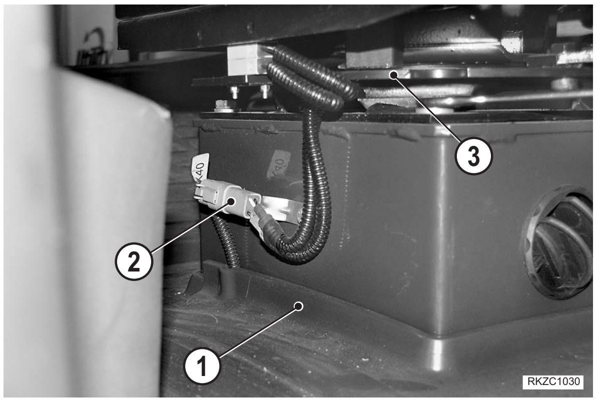
Installation

- To install, reverse removal procedure.

FAN AND HEATING GROUP

Removal

NOTEIf 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 (–).
(For details see "BATTERY").

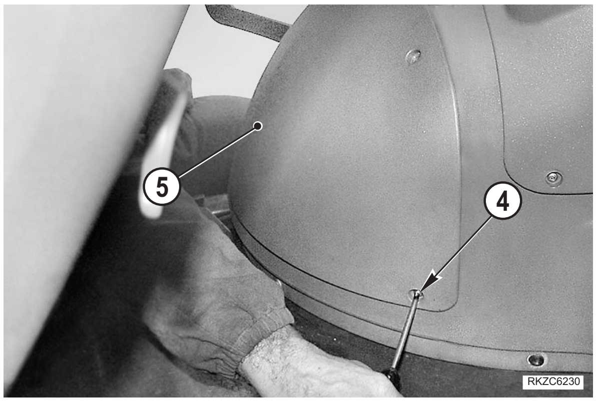
★ Drain the engine cooling liquid.

Coolant liquid: 15 ℓ

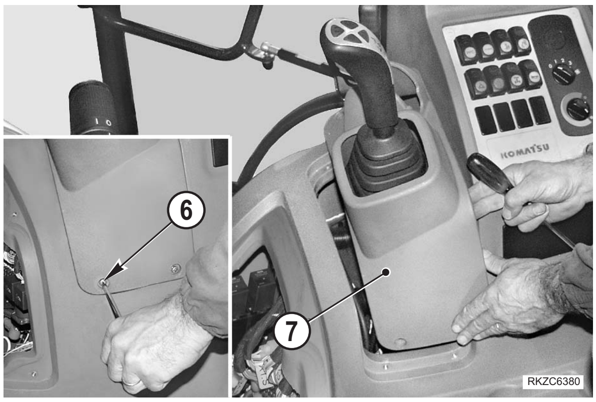
★ Drain the air conditioning unit.
(For details see "20 TESTING AND ADJUSTMENTS").

1 - Remove the floor-mat (1); disconnect the connector (2) and remove the seat (3).

2 - Take out the screws (4) and remove the control unit protection (5).



3 - Remove four screws (6) and remove PPC valve and parking brake casing (7).

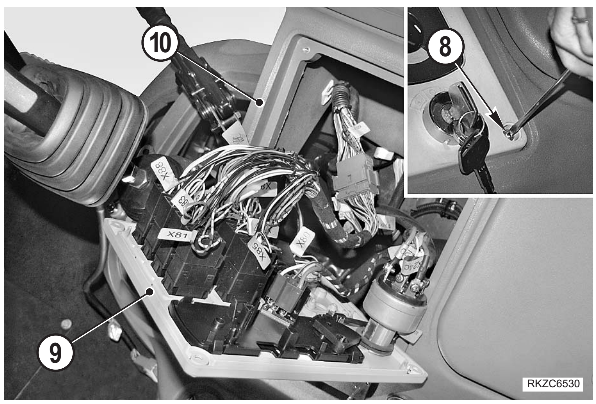


4 - Remove four screw covers and screws (8).

5 - Remove the lower side instrument board (9).

★ Cut the wiring harness strap and position the instrument board (9) inside the RH case (10).

- To install, reverse removal procedure.

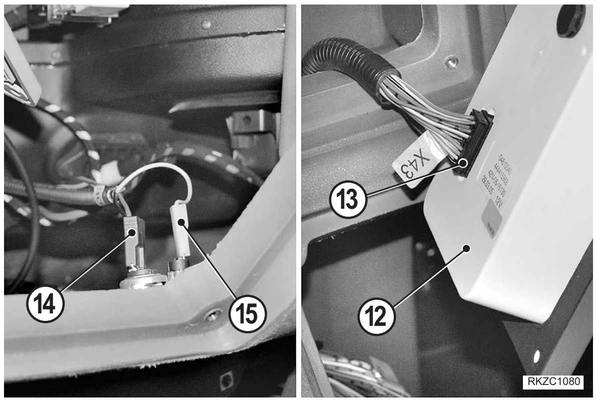


6 - Remove four screw covers and screws (11).

7 - Remove the upper side instrument board (12).

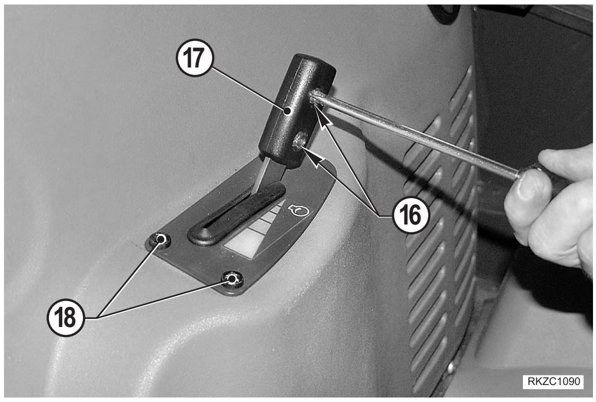
8 - Disconnect the connector (13) from the instrument board (12).

9 - Disconnect connectors (14) and (15) from the lighter.

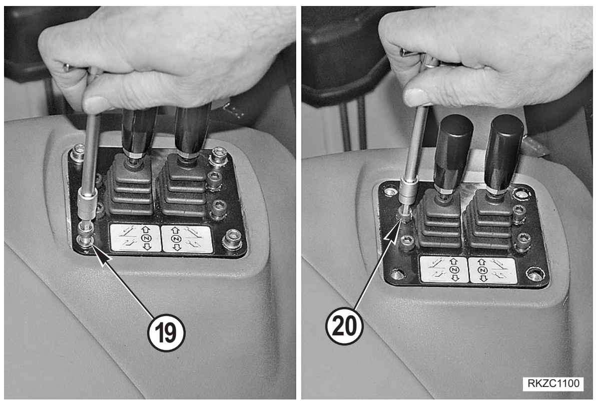


10 - Extract screws (16) and remove the hand accelerator handle (17).

11 - Remove screws (18) from the accelerator lever assembly.

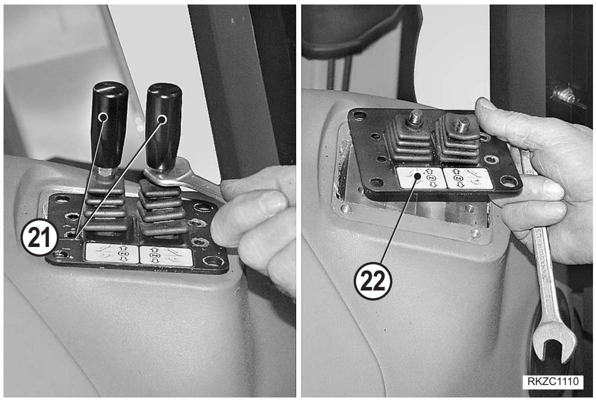


12 - Loosen and remove the screws (19) and (20).

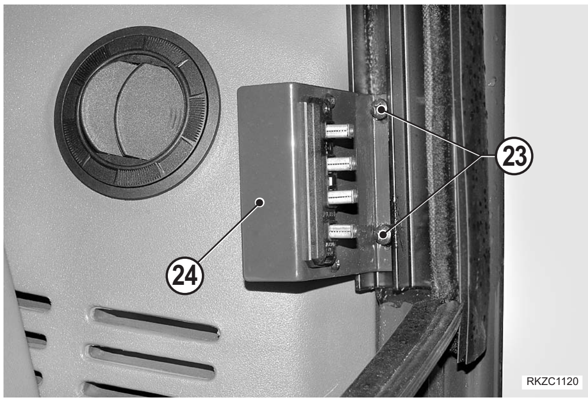


13 - Loosen nuts and remove knobs (21) from outrigger PPC valves.

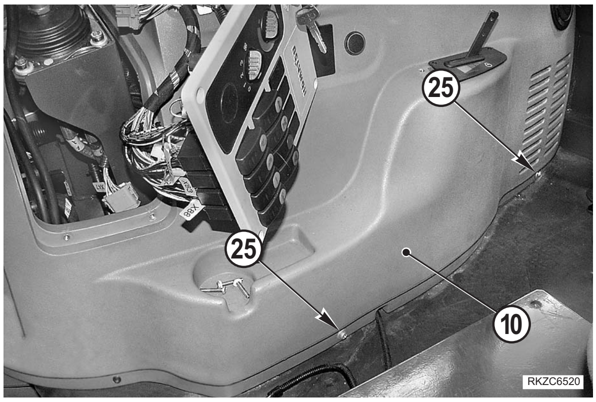
14 - Remove PPC valve mounting plate (22).



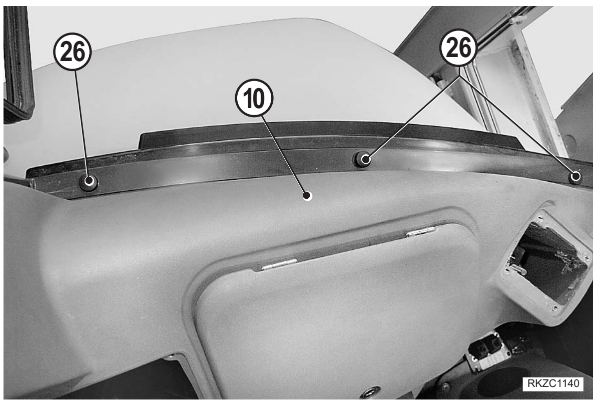
15 - Extract screws (23) and remove contact carrier plate (24) for rear wiper.



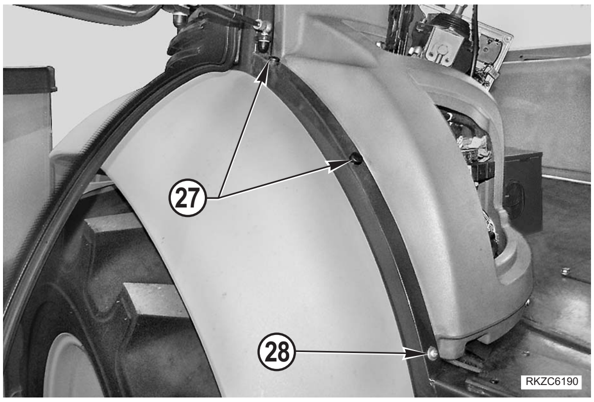
16 - Extract the lower screws (25) retaining the right hand case (10).



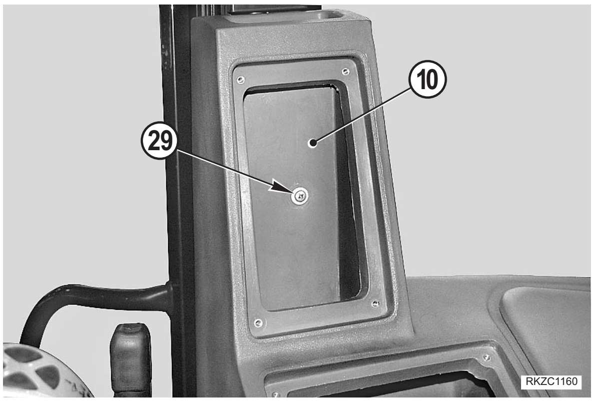
17 - Extract three screw covers (26) and screws retaining the right hand case (10) at the rear.



18 - Extract two screw covers (27) and screws; extract the lower screw (28) and washer.

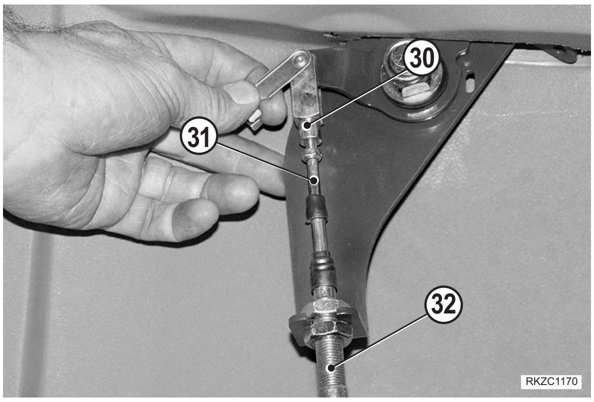


19 - Extract the upper screw (29) retaining the right hand case (10) and its washer.

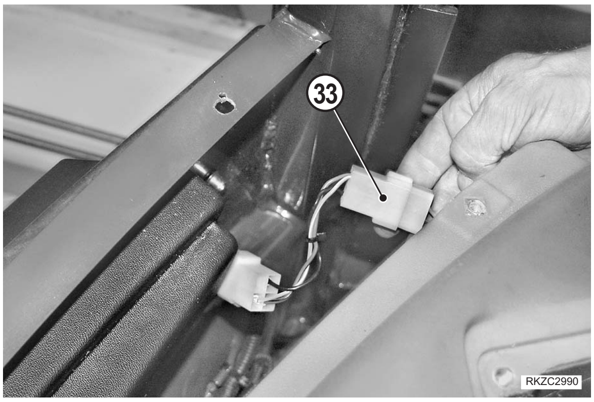


20 - Move the rear of the right hand case (10) towards the middle of the cab, remove pin (30), and disconnect hand accelerator cable (31).

21 - Loosen nut and disconnect sheath (32).

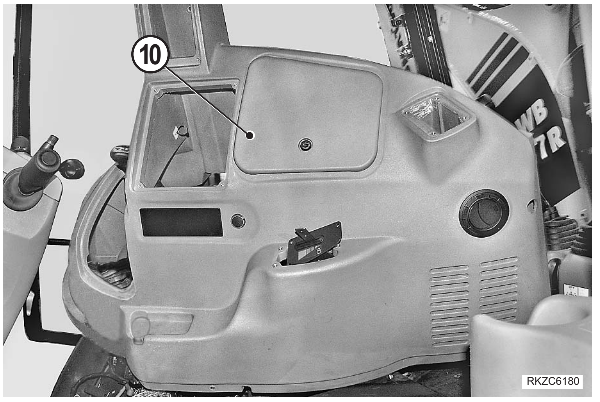


22 - Disconnect the contact carrier plate connector (33).



24 - Engage the parking brake.

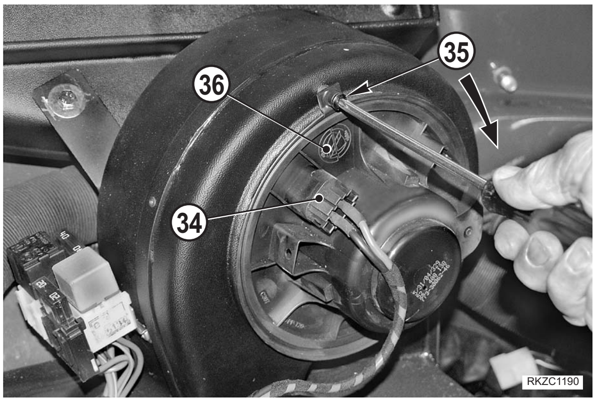
25 - Raise right hand case (10) until PPC valve control and parking brake lever are disengaged; fully remove the case.



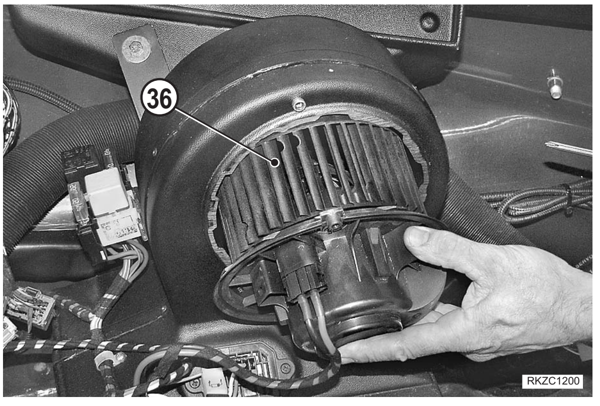
FAN

26 - Disconnect the connector (34).

27 - Remove screw (35), then rotate fan group (36) counterclockwise.

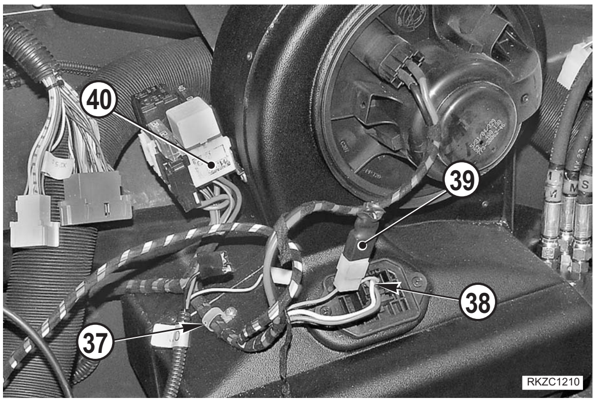


28 - Extract the fan group (36).

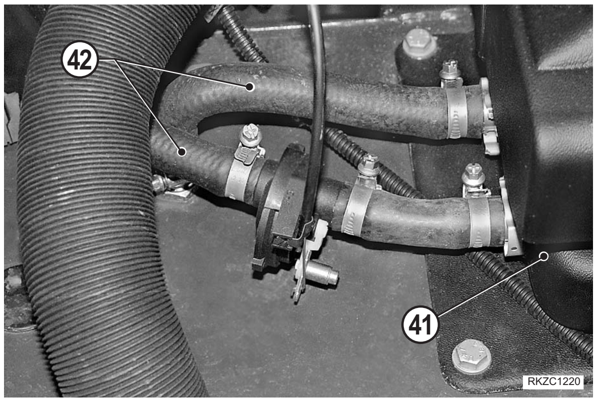


29 - Remove the clamp (37).

30 - Disconnect connectors (38) and (39); slide off and move to one side the fuse and relay group (40).

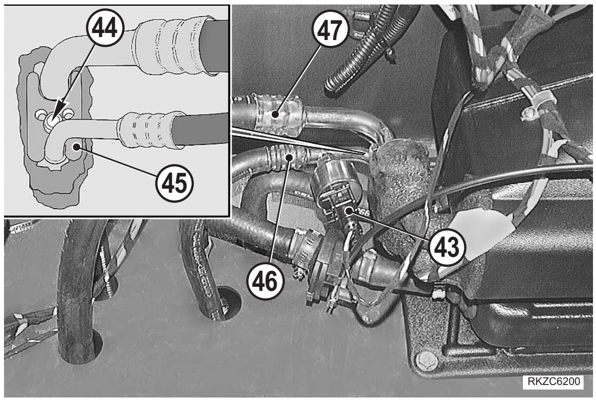


31 - Disconnect the heating system liquid inlet and outlet pipes (42) from the oil cooler (41).



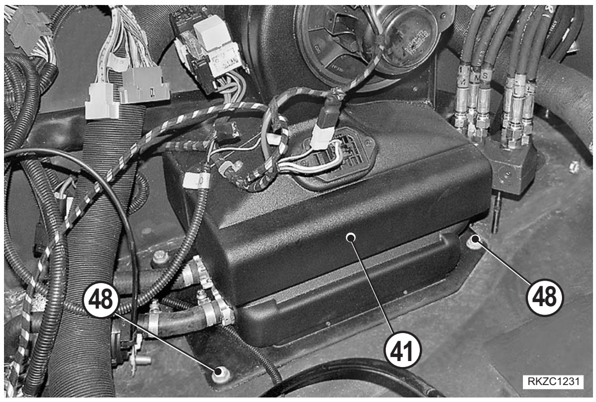
32 - Only for machines with air-conditioning.
Disconnect the pressure switch connector (43).
Remove the screw (44), the washer and the plate (45); disconnect delivery and return hoses (46), (47).
[*1]

★ Collect the O-rings.



OIL COOLER GROUP

33 - Loosen and remove the four screws (48) and remove the group (41).



Installation

[*1]

Screw: 6 Nm

1 - Refill the coolant liquid.

Coolant liquid: approx. 15 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.

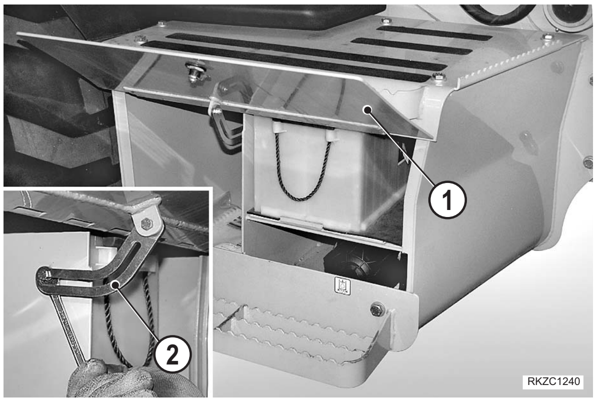
4 - Complete installation by reversing the removal procedure.

BATTERY

Removal

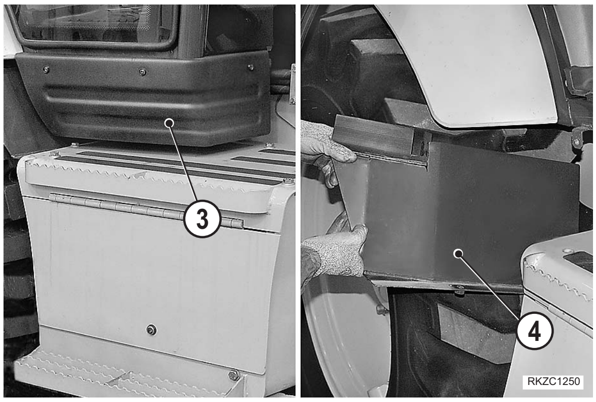
⚠ Lower the working equipment completely until it is resting on the ground.
Engage the parking brake, stop the engine and remove the ignition key.

1 -Lift the door (1) and disconnect the catch (2).

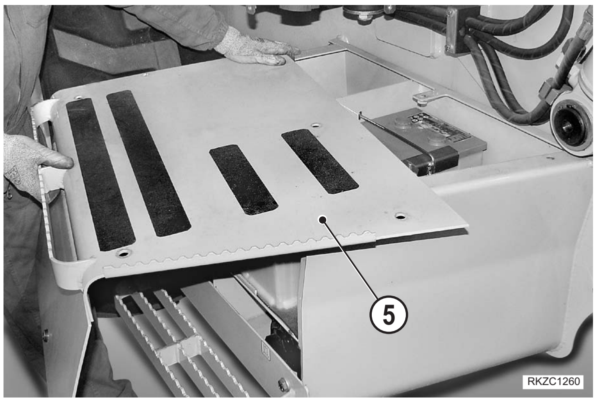


2 -Remove the lower right-hand guard (3) of the cab.

3 -Remove the protection (4).

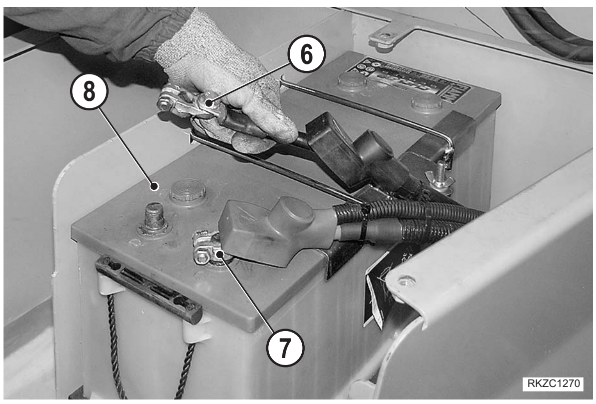


4 -Take out the screws and remove the platform (5) and door.



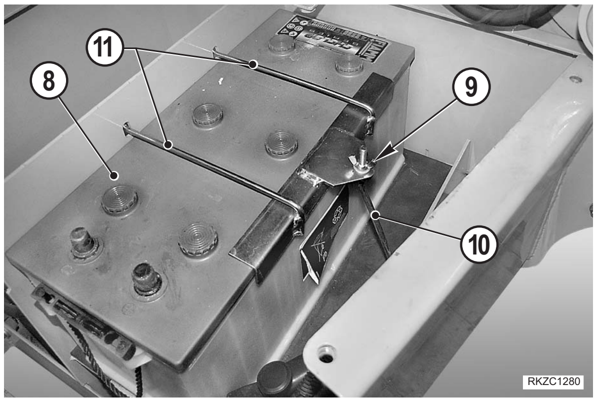
5 -Disengage battery negative (–) terminal (6) from shield and disconnect from battery (7).

6 -Use the same procedure as above to disconnect the battery positive terminal (8). [*1]



7 - Loosen wing nut (9) and remove tie rod (10) and bracket (11).

8 - Remove the battery (8).



Installation

- To install, reverse removal procedure.

[*1]

Connect the battery positive (+) cable first, and then the battery negative (–) cable.

FUEL TANK

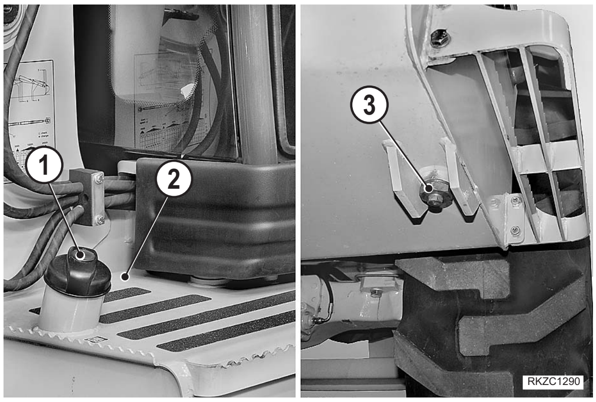
Removal

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

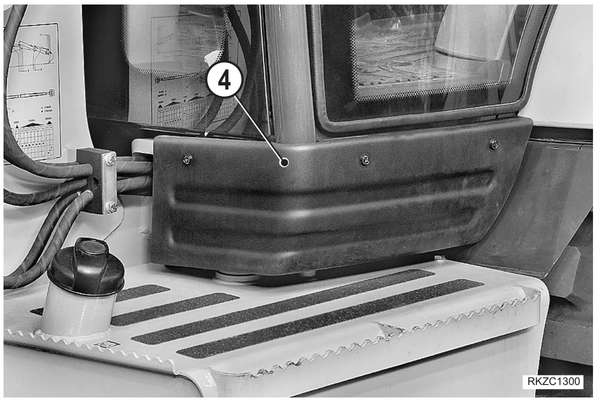
1 - Take the cap (2) off the filling inlet of the fuel tank (3) and remove also the bottom plug in order to drain the fuel.

Fuel: max. 150 ℓ

2 - Reinstall the fill plug (1) and the drain plug (3).



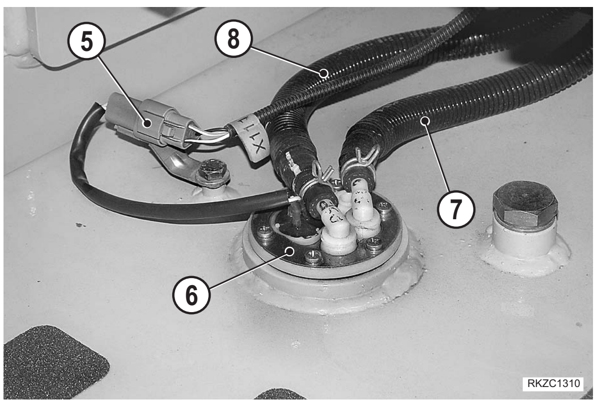
3 - Remove the lower left-hand guard (4) of the cab.



4 - Disconnect the connector (5) from the level gauge (6).

5 - Mark and disconnect the fuel inlet and return hoses (7), (8).

★ Plug all pipes/hoses to prevent contamination.



6 -Place a hoist under the fuel tank (2); remove four retaining screws (9) and washers, and remove the tank. [*1]

Fuel tank: 68 kg

Installation

- To install, reverse removal procedure.

[*1]

Tank retaining screws: 120 Nm

1 -Refill the fuel tank.

Fuel: max. 150 ℓ

2 -Bleed the air from the fuel circuit.

3 -Start the engine.

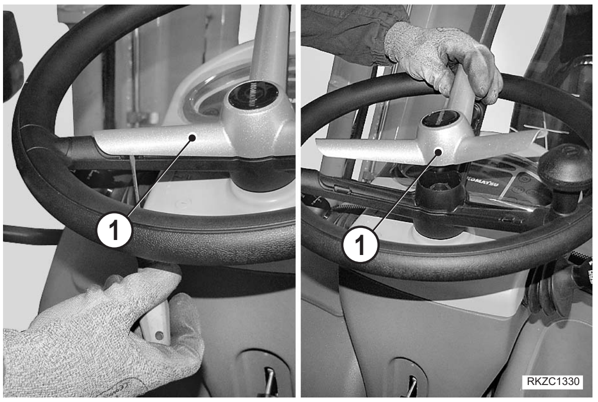
STEERING WHEEL AND TRANSMISSION-REVERSE, DIRECTION INDICATOR AND HEADLIGHT DIPPER BEAM CONTROL GROUP

Removal

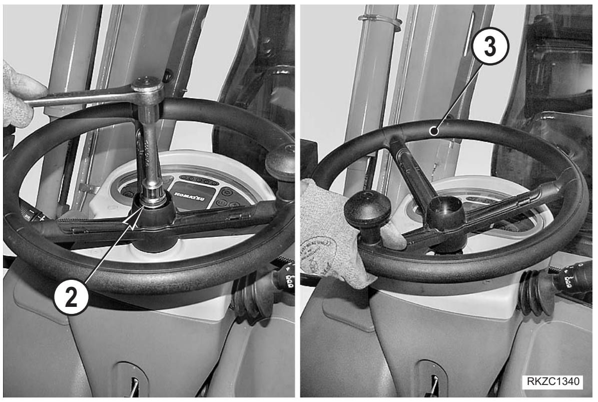
⚠ Lower the working equipment completely until it rests on the ground.
Engage the parking brake and stop the engine.

⚠ Disconnect the cable from battery negative terminal (–).
(For details see "BATTERY").

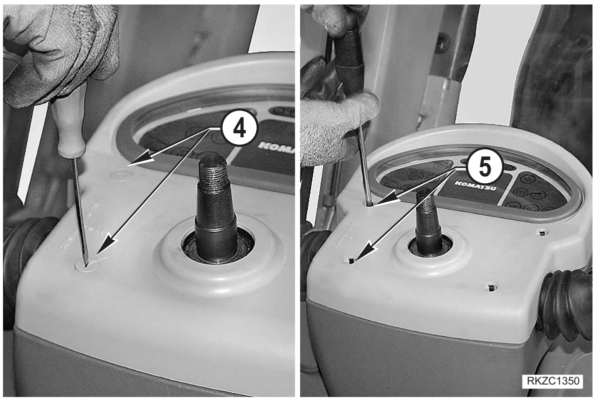
1 - Use a thin bladed screwdriver placed under each spoke of the steering wheel to pry away the cover (1).



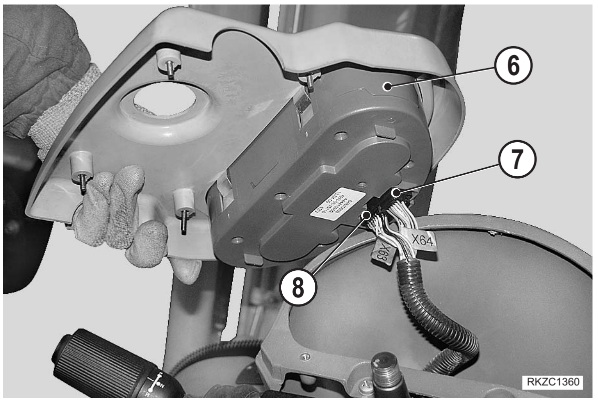
2 - Loosen and remove the retaining nut (2) and remove the steering wheel (3).



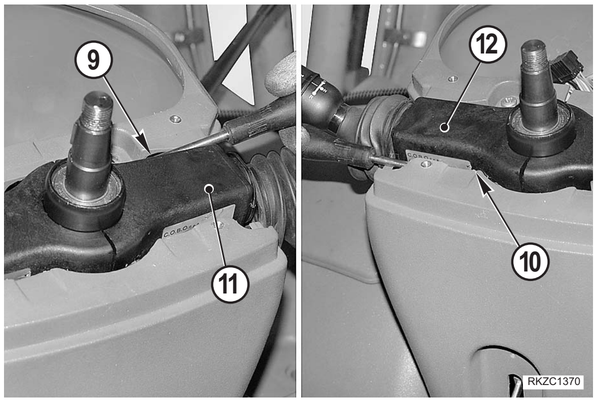
3 - Remove four screw covers (4) and loosen four screws (5) retaining the instrument panel.



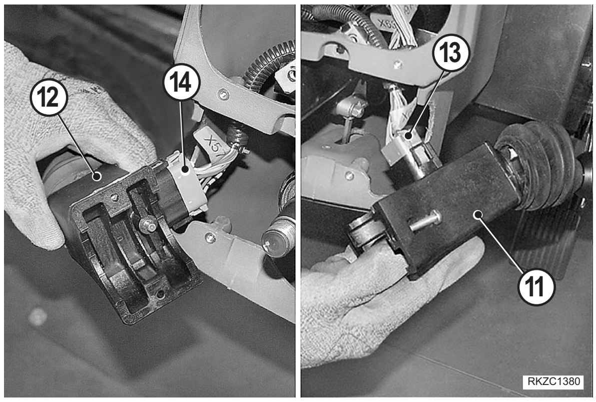
4 - Slide off instrument panel (6) from steering column; disconnect connectors (7) and (8), and remove instrument panel.



5 - Loosen and remove screws (9) and (10) and release direction indicator group (11)and transmission reverse control group (12).



6 - Disconnect connectors (13) and (14) and remove groups (11) and (12). [*1]

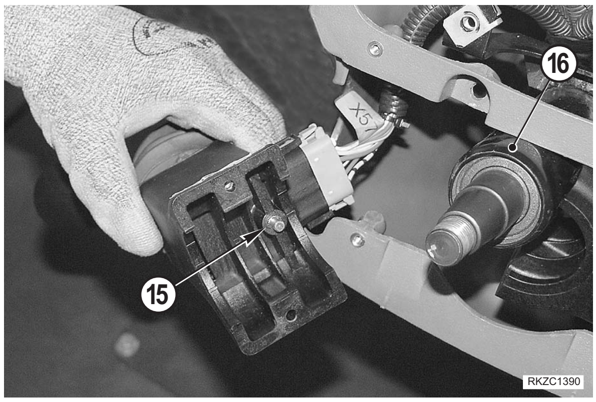


Installation

- To install, reverse removal procedure.

[*1]

★ Before attempting to tighten the screws, check the antirotation stake (15) for proper engagement into the steering column (16).



WORKING BRAKE PUMP GROUP

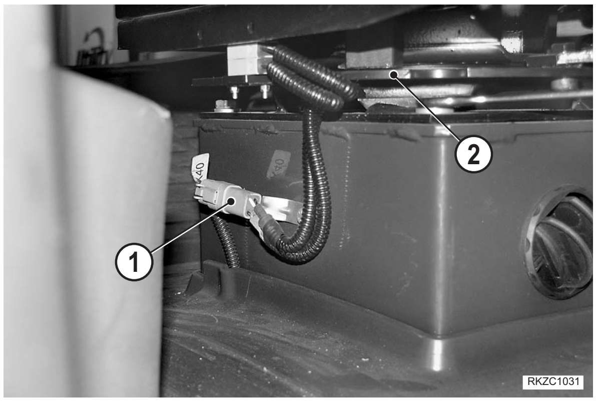
Removal

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

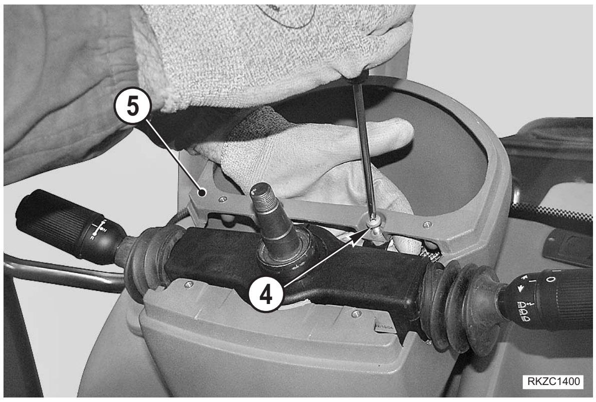
1 - Remove the steering wheel and the direction indicator and transmission reverse control groups
(For details, see "STEERING WHEEL AND TRANSMISSION-REVERSE, DIRECTION INDICATOR AND HEADLIGHT DIPPER BEAM CONTROL GROUP").

2 - Disconnect the connector (1) and remove the seat (2).

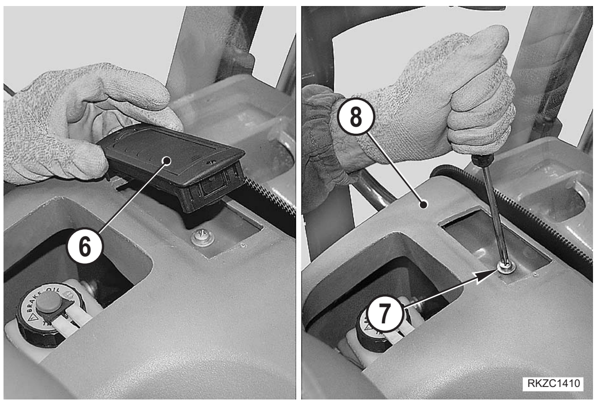
3 - Remove the front mat (3).



4 - Loosen and remove the upper screws (4) retaining the instrument panel holder (5).

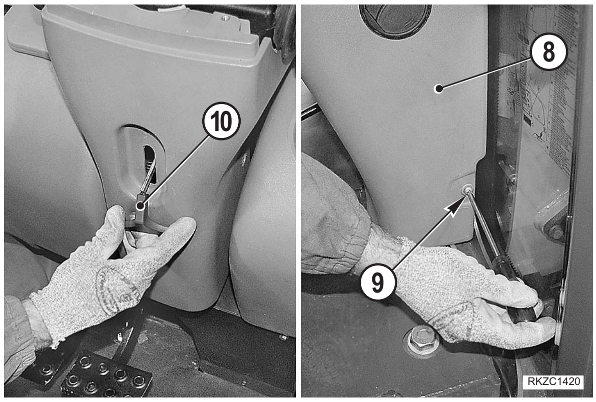


5 - Remove the guards (6) and extract the upper screws (7) retaining the front trim cover (8).

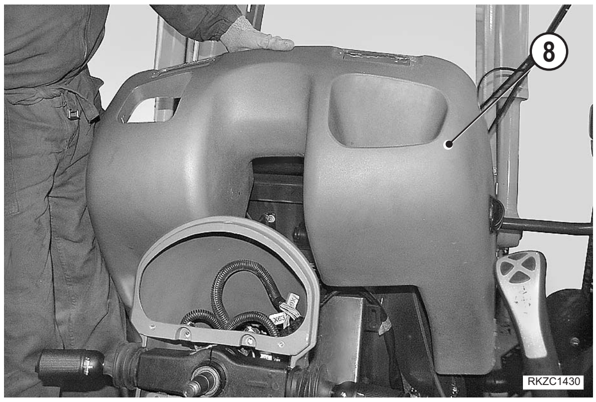


6 - Loosen and remove the lower screws (9) retaining the front trim cover (8).

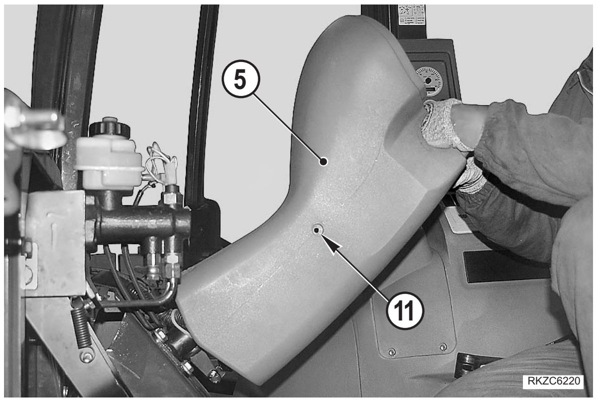
7 - Fully lower the steering column; extract the knob (10).



8 - Slide the front trim cover (8) up to remove it.



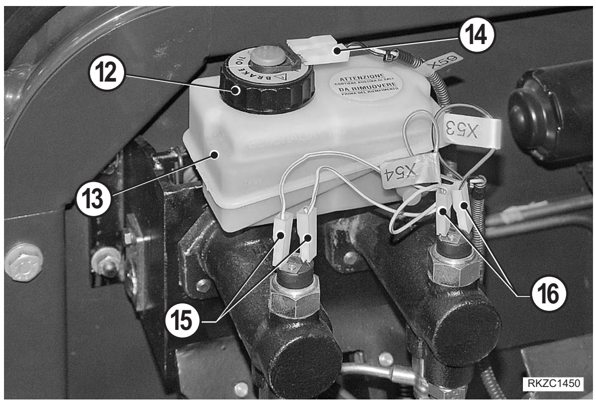
9 - Take out the lower screws (11) and remove the instrument panel holder (5).



10 - Remove the plug and (12) and draw oil from the tank (13).

11 - Reinstall the plug and disconnect connectors (14) and pressure switch connectors (15) and (16).

12 - Remove the tank (13).

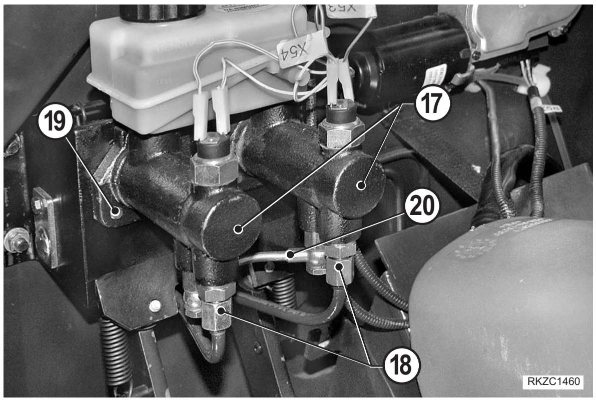


13 - Disconnect the delivery pipes (18) from the pumps (17). [*1]

★ Plug all pipes/hoses to prevent contamination.

14 - Take out four screws (19) and remove the pump group. [*2]

★ If only one pump is to be removed, also disconnect the pressure equalizing pipe (20). [*3]



Installation

- To install, reverse removal procedure.

[*1]

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

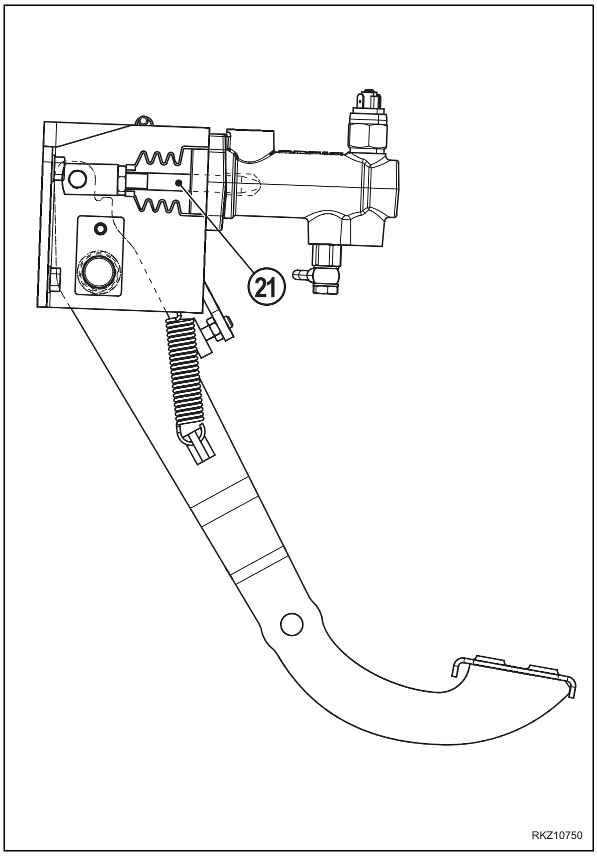
[*2]

★ Make sure that the push-rods (21) center the seating of the pistons.

★ When installation is complete, inspect for proper brake pedal pre-travel and alignment.
(For details, see "20 TESTING AND ADJUSTMENTS").

[*3]

Union: 20 Nm



STEERING UNIT

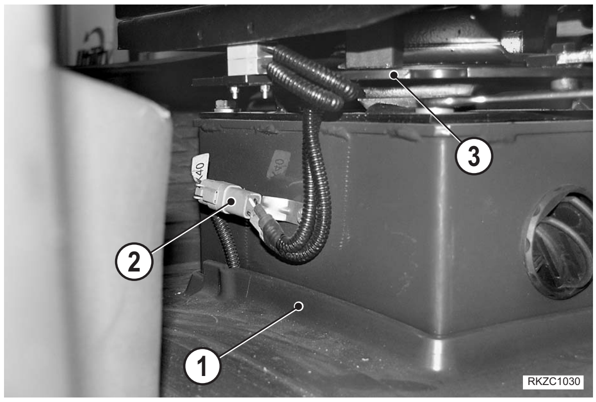
Removal

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

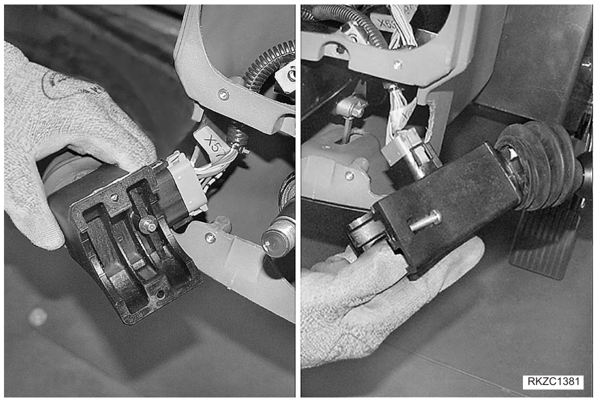
⚠ Eliminate residual pressure from all circuits by moving all control levers in all directions.

1 -Remove the front mat (1).

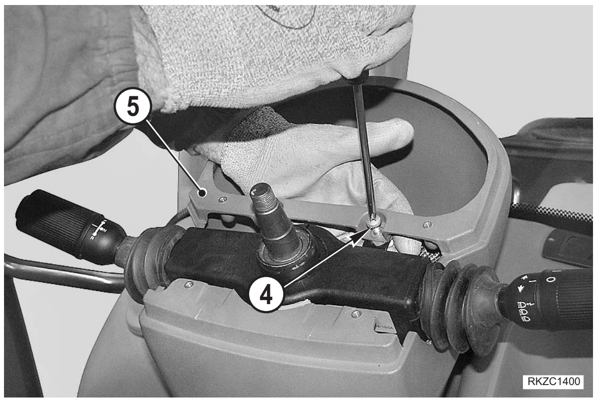
2 -Disconnect the connector (2) and remove the seat (3).



3 -Remove the steering wheel and the direction indicator, transmission reverse and headlight dipper beam control groups
(For details, see "STEERING WHEEL AND TRANSMISSION-REVERSE, DIRECTION INDICATOR AND HEADLIGHT DIPPER BEAM CONTROL GROUP").

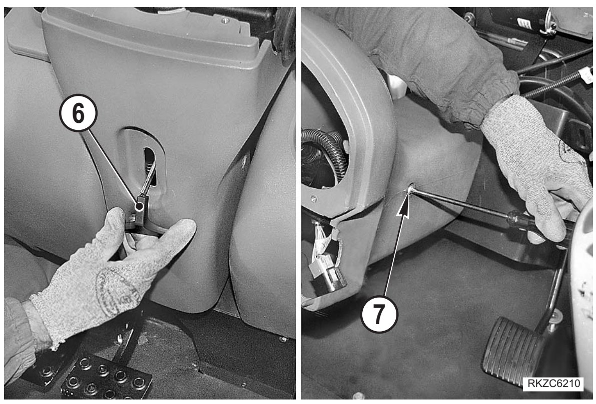


4 -Loosen and remove the upper screws (4) retaining the instrument panel holder (5).

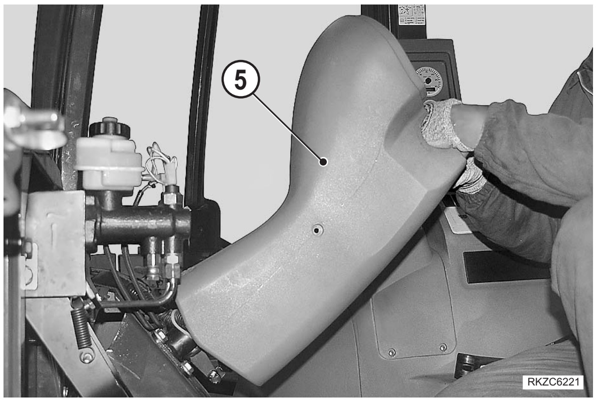


5 -Remove the steering column lock knob (6).

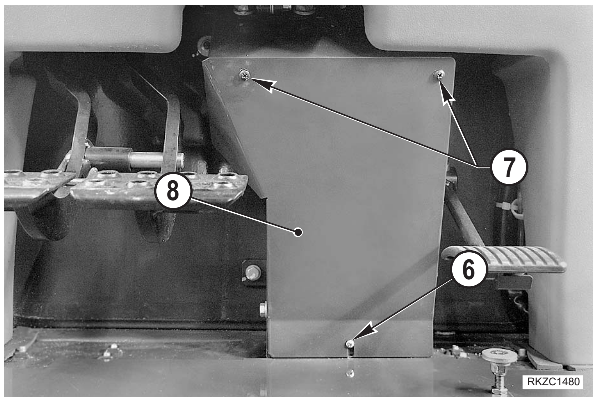
6 -Remove the screws (7) retaining the side of the instrument panel holder.



7 - Slide the instrument panel holder (5) up to remove it.



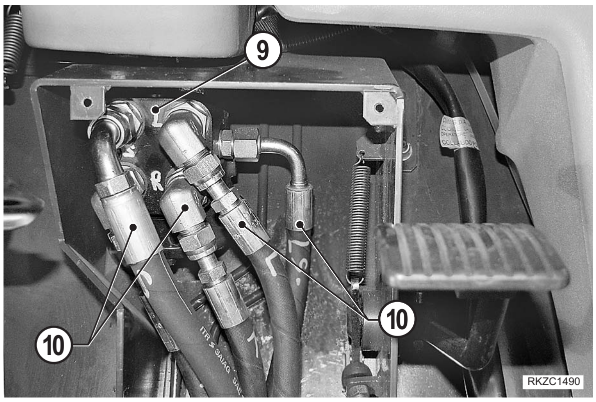
8 - Loosen screw (6) and remove two screws (7); remove the front guard (8).



9 - Mark the respective positions of and disconnect five pipes (10) from steering unit.

★ Plug all pipes to prevent contamination.

[*1]



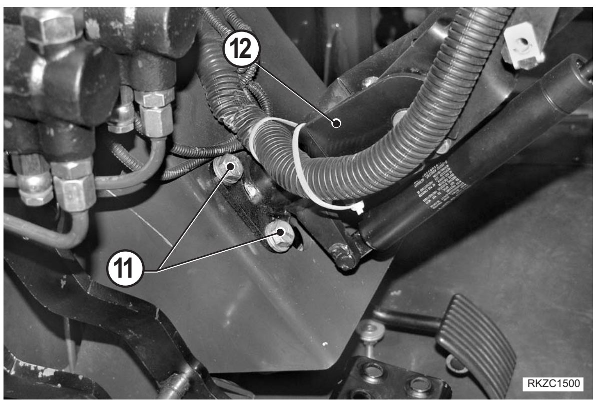
10 - Loosen the screws (11) fastening the column (12) and steering unit (9); remove the steering unit.

Installation

- To install, reverse removal procedure.

[*1]

★ Start the engine and perform several complete steering manoeuvres in both directions, to bleed the air out of the steering system.



CAB

Removal

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

⚠ Disconnect the cable from battery negative terminal (–).
(For details see "BATTERY").

⚠ Release all residual pressure in all circuits.

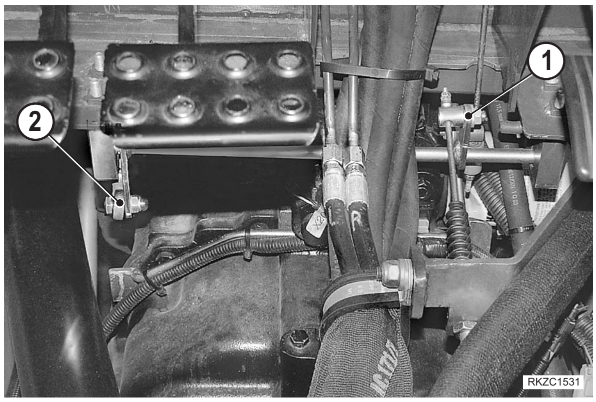
★ Drain the engine cooling liquid.

Coolant liquid: 15 ℓ

★ **Only for machines equipped with an air-conditioning unit.**
Drain the air conditioning unit.
(For details see "20 TESTING AND ADJUSTMENTS").
[*1]

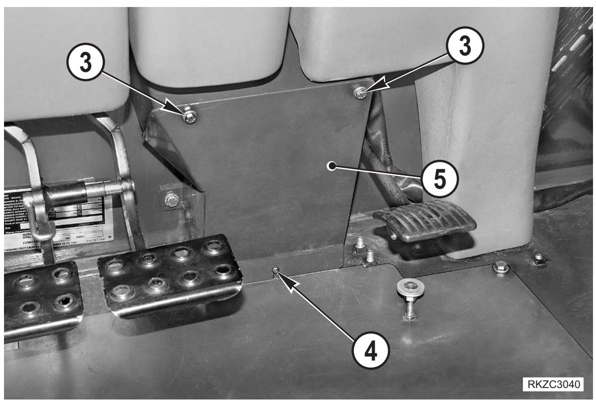
1 - Remove the exhaust pipe.
(For details see "EXHAUST PIPE").

2 - Disconnect the injection pump control rod (2) from the pitman arm (1).



3 - Remove the front mat, remove screws (3) and loosen screw (4).

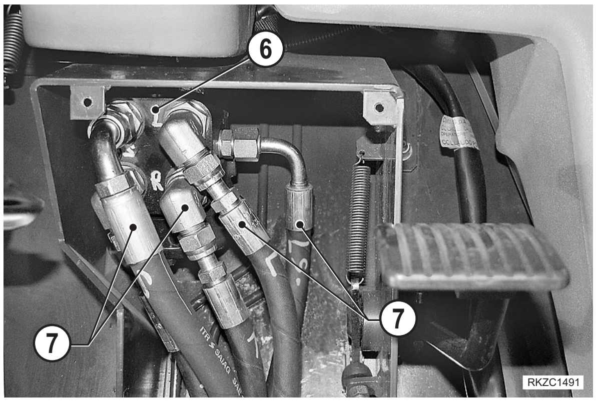
4 - Remove the steering unit guard (5).



5 - Disconnect pipes (7) from steering unit. [*2]

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

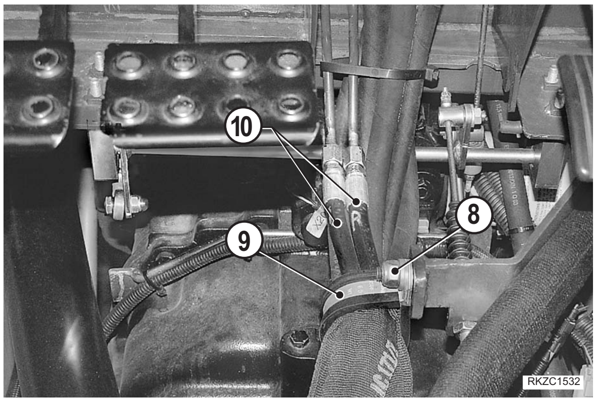
★ Plug the pipes and pipe-fittings to prevent entry of impurities.



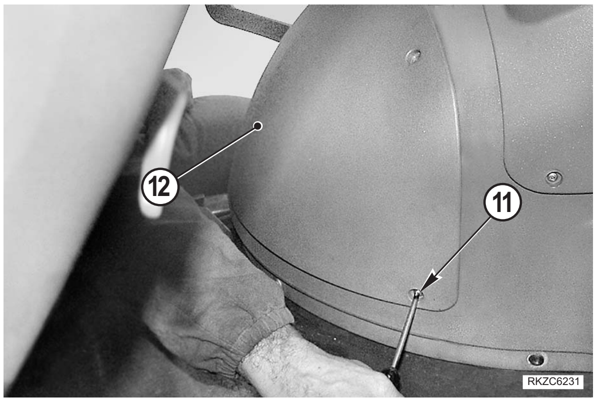
6 - Remove nut (8) and disconnect strap (9) from frame.

7 - Disconnect the tubes (10) and (3). [*3]

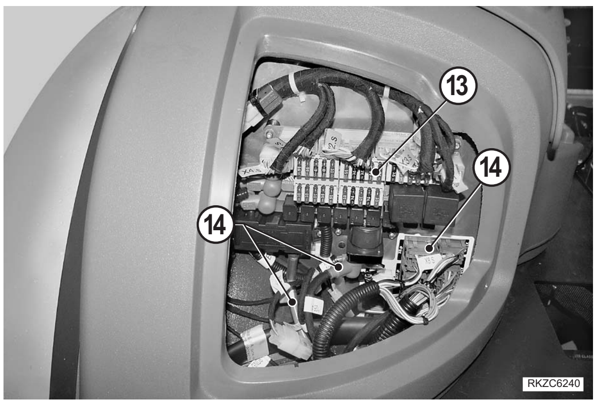
★ Plug the pipes and pipe-fittings to prevent entry of impurities.



8 - Take out the screws (11) and remove the hood (12).

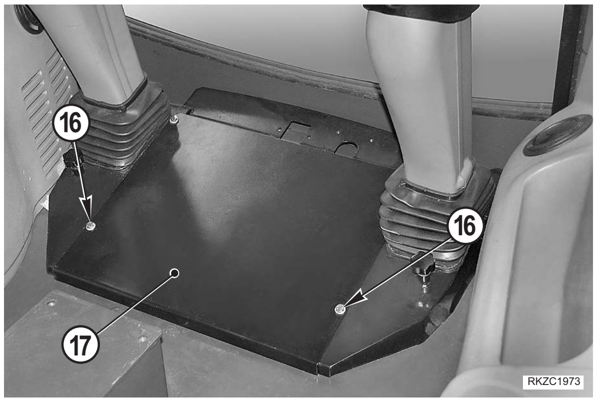


9 - Disconnect lower frame harness connectors (14) from fuse block (13).



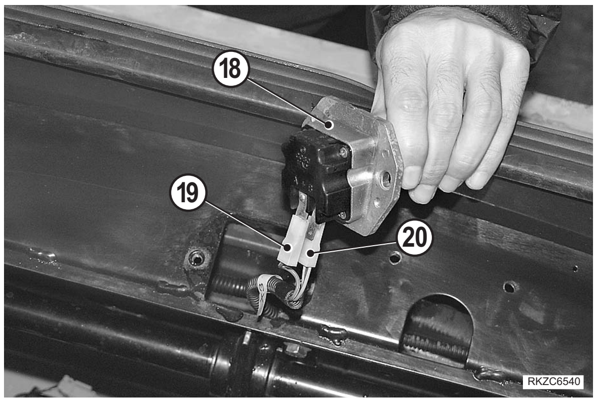
10 - Lift rear window (15) to the top and remove the rear mat.

11 - Take out the screws (16) and remove the platform (17).



12 - S**nly if equipped.**
Disconnect connectors (19) and (20) from foot button (18).

★ Mark the position of connectors to avoid mixing them during installation.

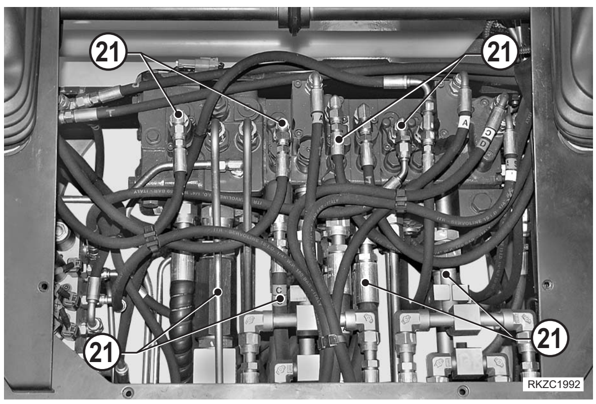


13 - Disconnect the servocontrols upper and lower pipes (21) from the control valve. [*4]

★ Check that all the hoses are marked and note down the bends and routing patterns.

★ Cap pipes, hoses and holes to prevent contamination.

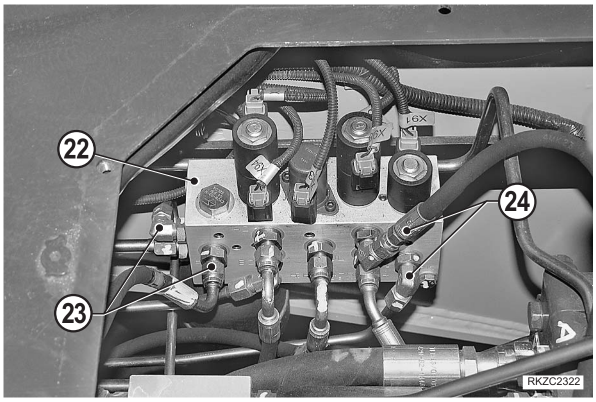
★ Lay the hoses inside the cab to gain access to the feed and exhaust hoses.



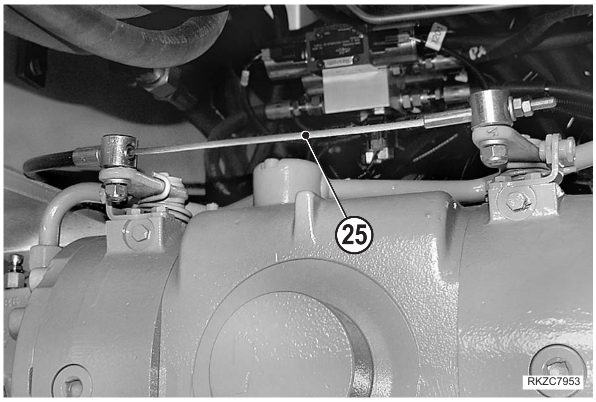
14 - Disconnect servocontrol supply hoses (23) and (24) from solenoid valve group (22).

★ Mark the pipes to avoid exchanging them during installation.

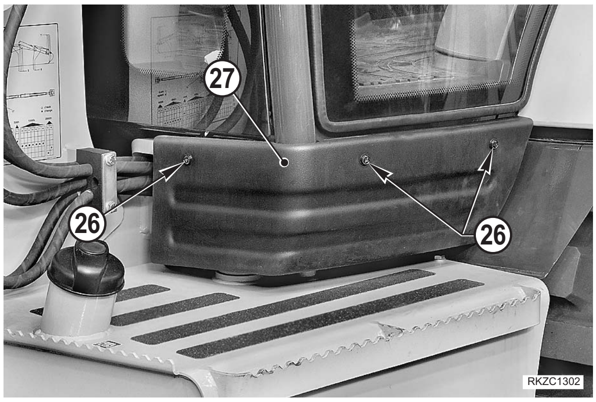
★ Cap pipes, hoses and holes to prevent contamination.



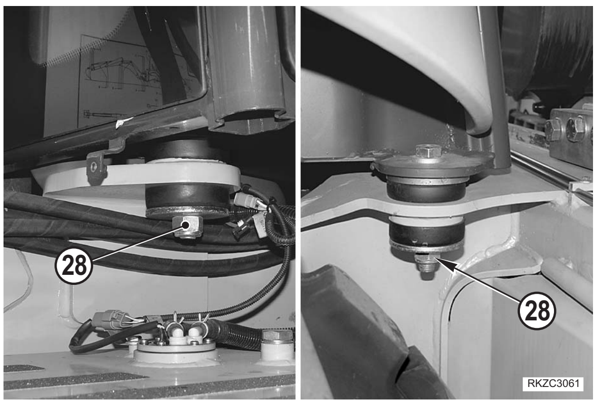
15 - Disconnect parking brake cable (25) from brake caliper. [*5]



16 - Take out the screws (26) and remove the protection (27).



17 - Remove nuts (28) as well as front and rear screws. [*6]

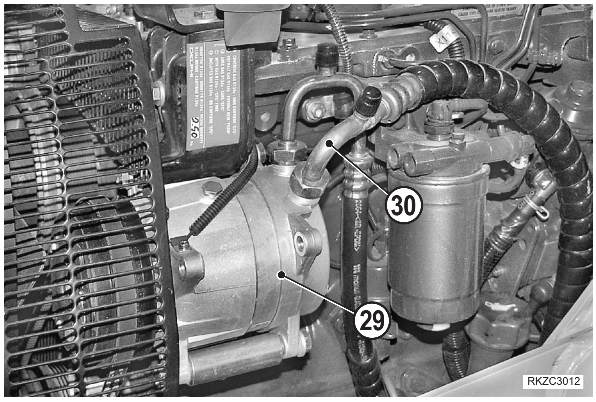


• Version with air-conditioning unit

18 - Disconnect the suction pipe (30) from the compressor (29). [*7]

★ Cap the hose and hole to ward off humidity.

★ Release the hose and route it under the cab.

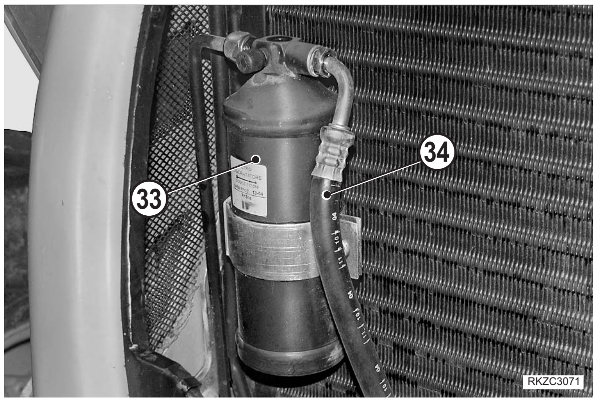


19 - Take out the screws (31) and remove the protection (32).

20 - Disconnect hose (34) from condenser (33). [*8]

★ Cap the hose and hole to ward off humidity.

★ Release the hose and route it under the cab.

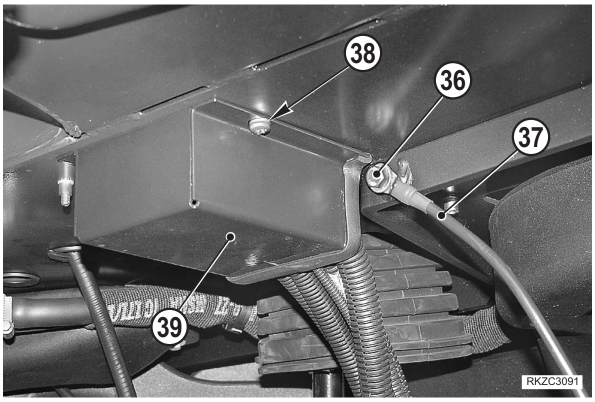


21 - Remove the hole plugs and tighten two lifting eyes into the lifting holes provided.
Connect the cab (35) to the lifting equipment and apply light tension.

22 - Lift the cab by about 30 cm and place some safety blocks “**A**” under it.

23 - Remove the screw (36) and disconnect the ground wire (37).

24 - Pull out screws (38) and remove cable guard (39).

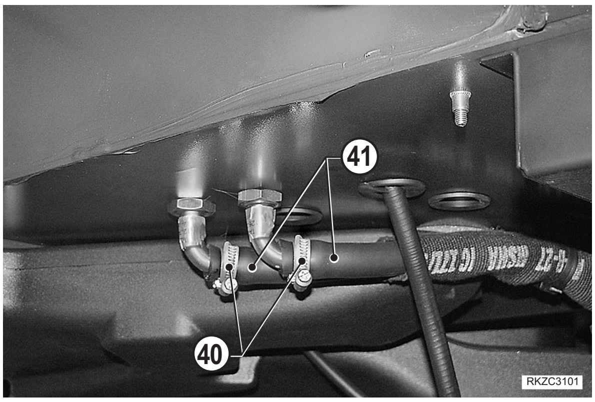


25 - Loosen straps (40) and disconnect heating hoses (41).

★ Mark the pipes to avoid exchanging them during installation.

★ Cap pipes, hoses and holes to prevent contamination.

26 - Ensure that all hoses, harnesses and wires are free, and remove the cab.



Installation

- To install, reverse 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]

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

[*3]

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

[*4]

★ Perform all possible backhoe movements to bleed the servocontrol system.

[*5]

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

[*6]

Cab retaining screws: 200 Nm

[*7]

Suction pipe union: __________ Nm

[*8]

Union (34): 16 Nm

1 - Refill the coolant liquid.

Coolant liquid: approx. 15 ℓ

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HYDRAULIC OIL TANK

Removal

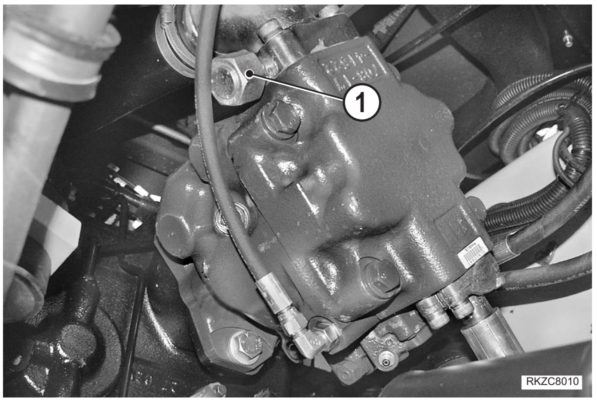
⚠ Lower the working equipment completely until it rests on the ground.
Engage the parking brake, stop the engine and remove the ignition key.

⚠ Eliminate residual pressure from all circuits by moving all control levers in all directions.

⚠ Disconnect the cable from battery negative terminal (–). (For details, see "BATTERY").

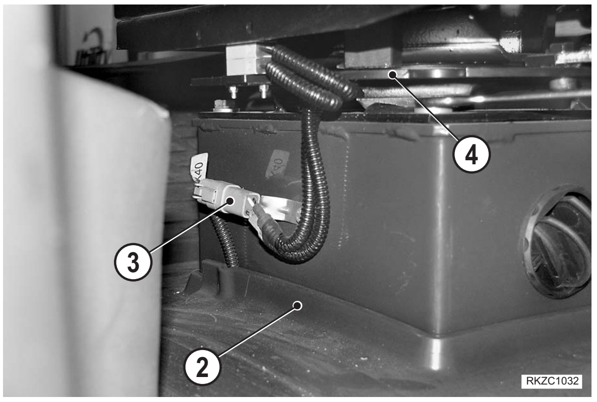
1 - Remove the plug (1) and drain the hydraulic oil.

Hydraulic oil: approx. 40 ℓ

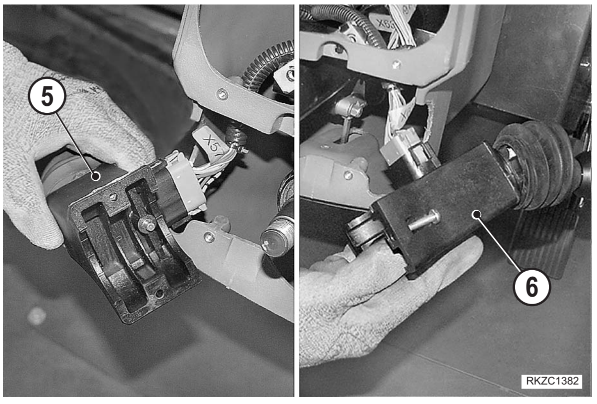


2 - Remove the front mat (2).

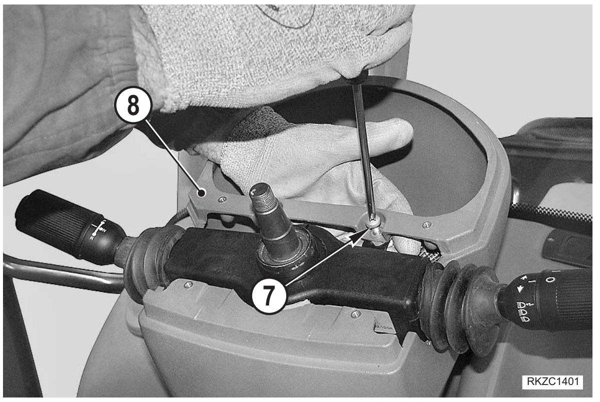
3 - Disconnect the connector (3) and remove the seat (4).



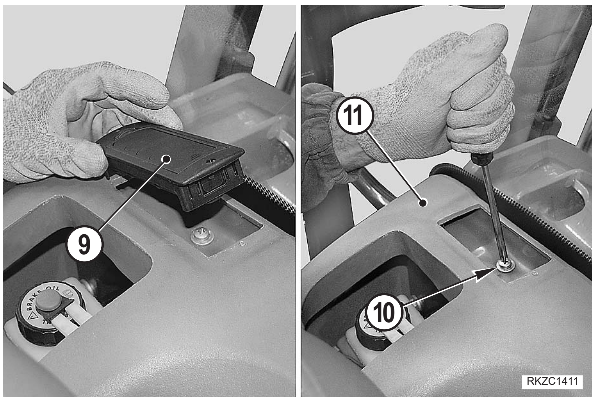
4 - Remove the steering wheel and remove the transmission reverse control group (5) and the direction indicator and headlight dipper beam control group (6) (For details, see "STEERING WHEEL AND TRANSMISSION-REVERSE, DIRECTION INDICATOR AND HEADLIGHT DIPPER BEAM CONTROL GROUP").



5 - Loosen and remove the upper screws (7) retaining the instrument panel holder (8).

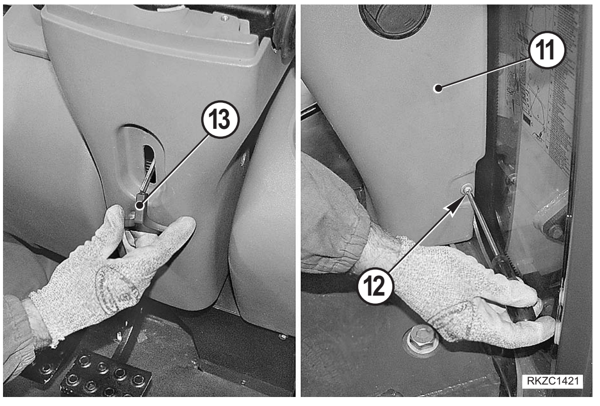


6 - Remove the guards (9) and extract the upper screws (10) retaining the front trim cover (11).

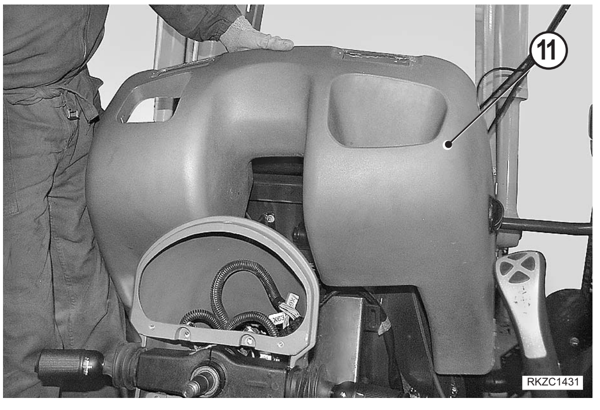


7 - Loosen and remove the lower screws (12) retaining the front trim cover (11).

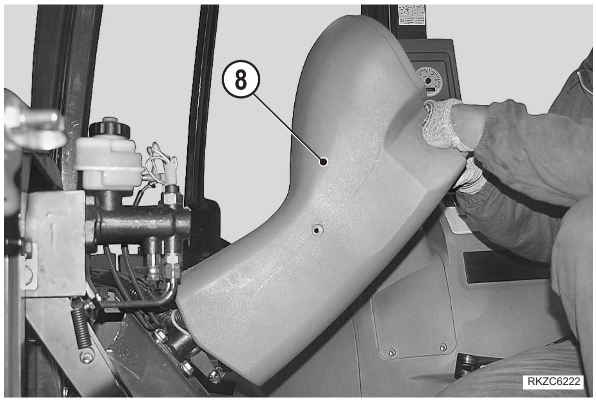
8 - Fully lower the steering column; extract the knob (13).



9 - Slide the front trim cover (11) up to remove it.



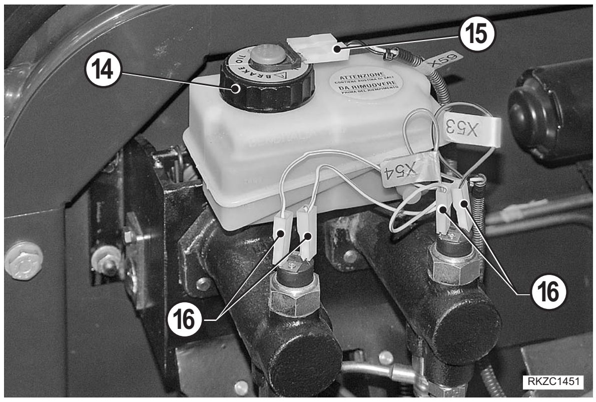
10 - Take out the lower screws and remove the instrument panel holder (8).



11 - Remove the fill plug (14) and draw the brake fluid.

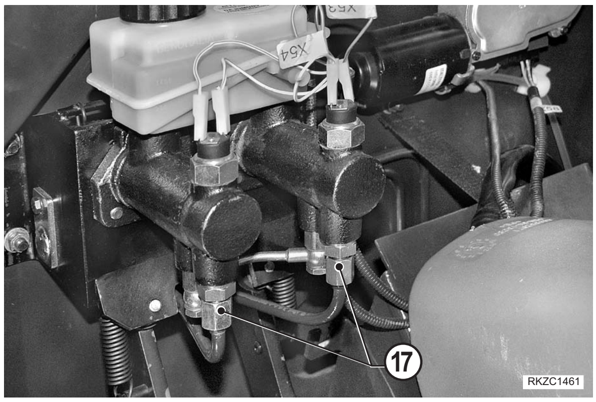
★ Replace plug to prevent contamination.

12 - Disconnect oil level and pressure switch connectors (15) and (16).



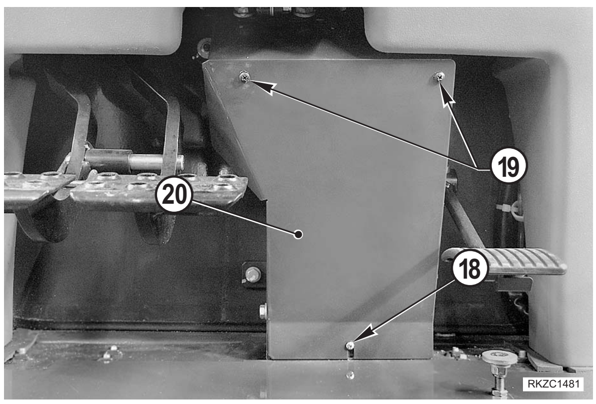
13 - Disconnect the brake fluid delivery tubes (17). [*1]

★ Plug all pipes/hoses to prevent contamination.

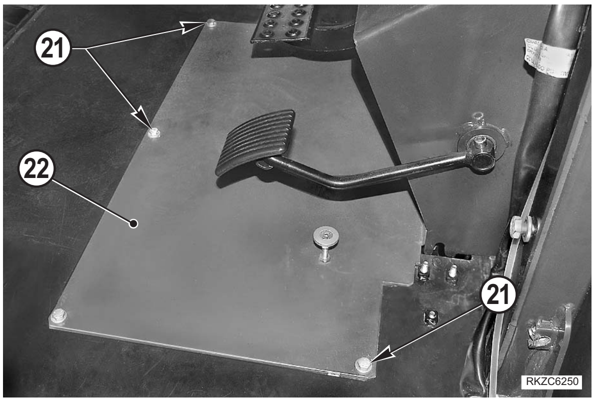


14 - Loosen mounting bolt (18).

15 - Pull out the screws (19) and remove the protection (20).



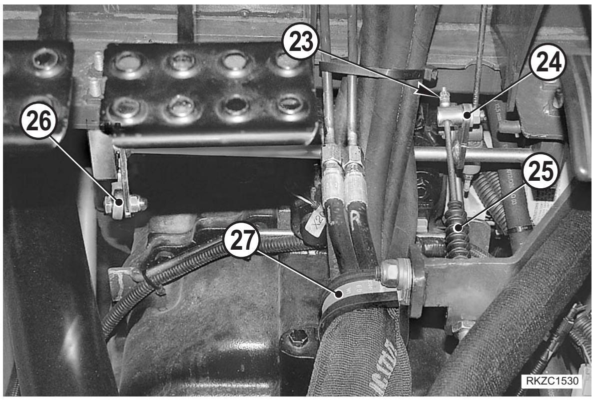
16 - Loosen and remove five screws (21) and remove the metal sheet (22) closing off the cab floor.



17 - Loosen and remove nuts (23) and disconnect the hand accelerator cable (25) from the relay rod (24). [*2]

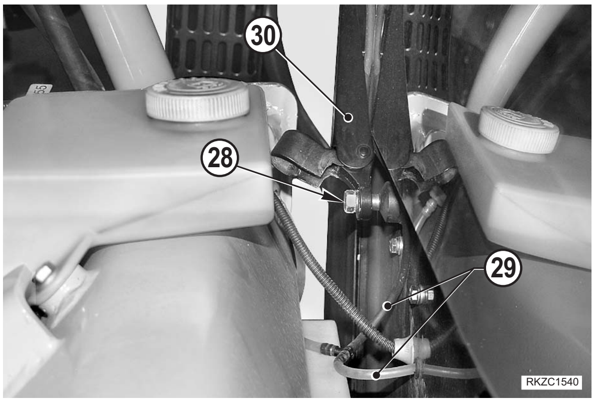
18 - Disconnect the injection pump rod (26) from the relay rod (24).

19 - Disconnect the strap (27) holding the steering unit and working brake hoses.

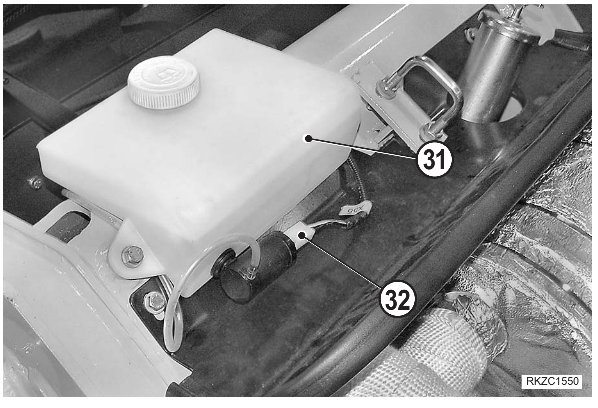


20 - Loosen and remove nut (28) and washer.

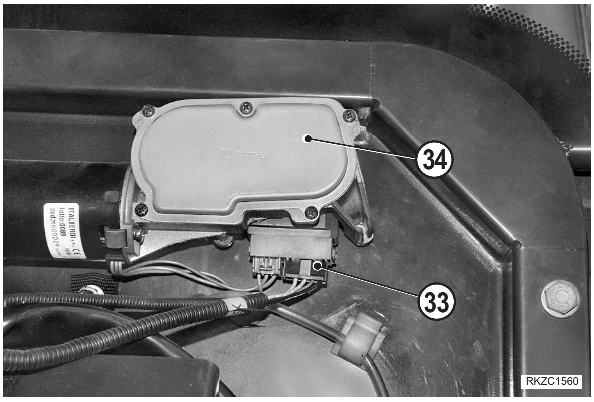
21 - Disconnect the washer hoses (29) and remove the complete wiper arm (30).



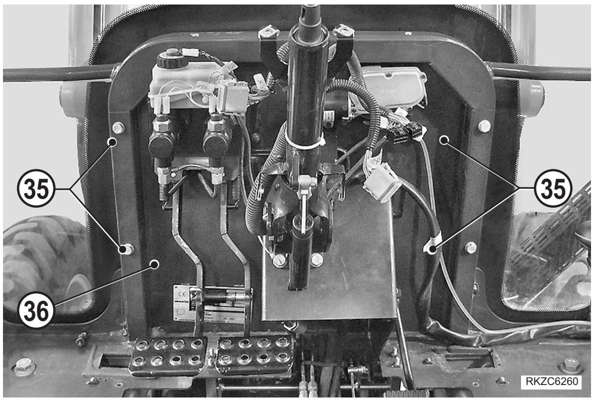
22 - Disconnect connector (32) from washer pump (31).



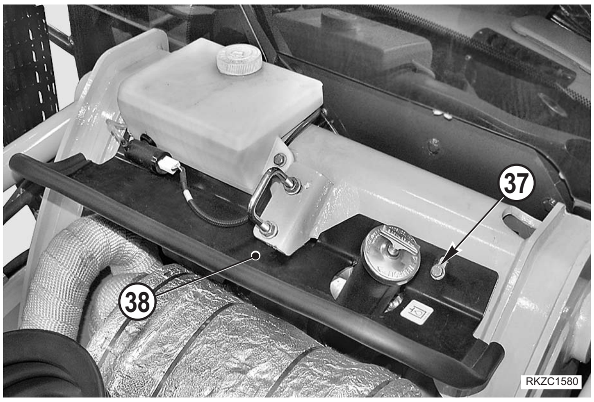
23 - Disconnect connector (33) from wiper (34).



24 - Loosen and remove screws (35) and washers.
Remove the complete bulkhead (36) and move it to the rear of the machine.

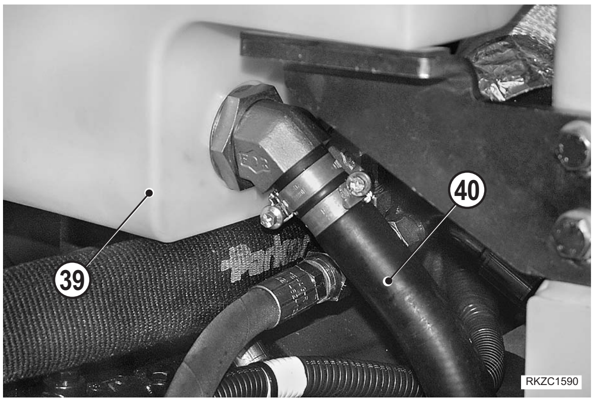


25 - Take out the screws (37) and remove the conveyor (38).



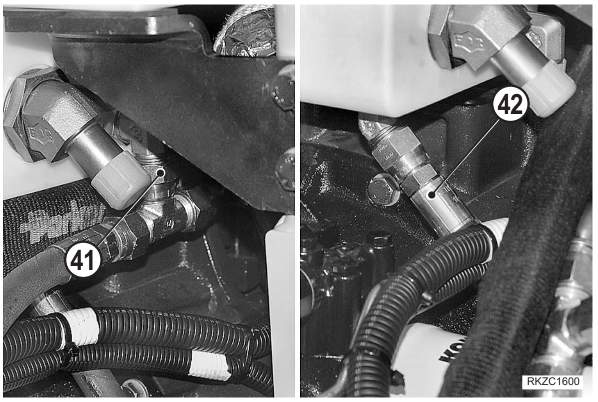
26 - Lift the rubber bulkhead and disconnect the discharge hose (40) from the tank (39).

★ Plug the pipe to prevent contamination.



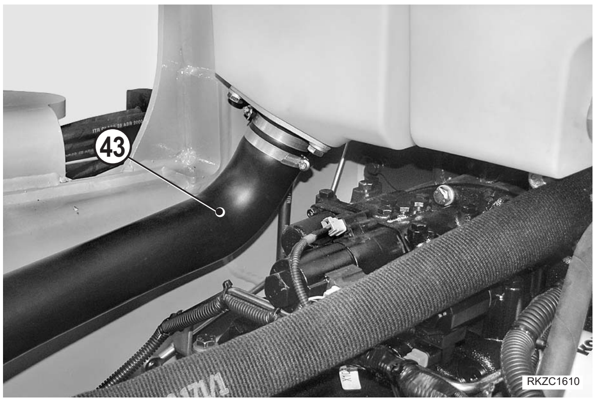
27 - Disconnect the draining union (41) and pipe (42).

★ Plug the union to prevent contamination.



28 - Disconnect the pump suction pipe (43).

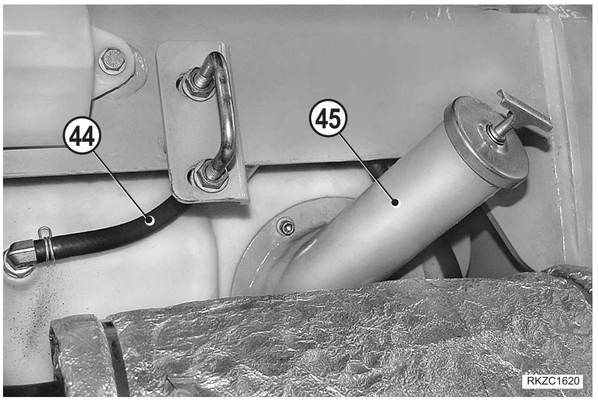
★ Plug the pipe to prevent contamination.



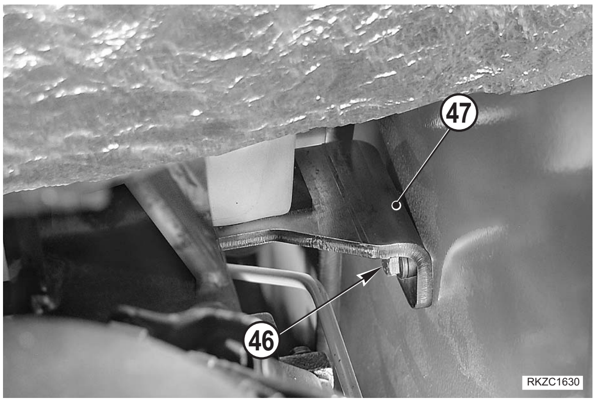
29 - Disconnect the vent hose (44) and filter and remove.

30 - Remove the screws and remove the fill sleeve (45).

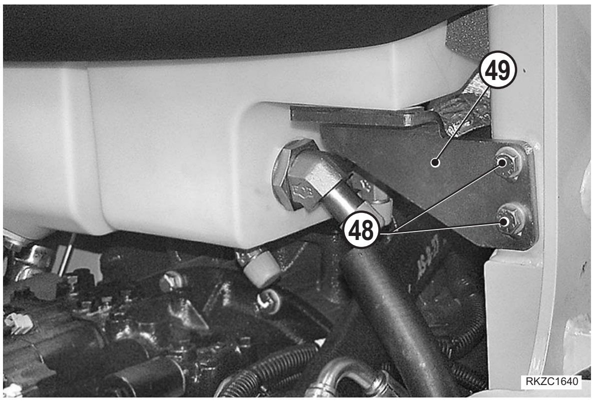
★ Collect the O-ring.



31 - Remove screws (46) and washers and remove the tank's front holder (47).



32 -Remove screws (48) and washers and remove the tank's rear holder (49).



33 -Remove two screws (50) and washers to release the complete tank (39).

34 -Extract the tank (39).

Installation

- To install, reverse removal procedure.

[*1]

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

[*2]

★ Check and adjust the stroke of the hand accelerator.

1 -Refill the hydraulic oil.

Hydraulic oil: approx. 40 ℓ

2 -Start the engine and check for leaks.

3 -Bleed the air from the cylinders. (For details, see "20 TESTING AND ADJUSTMENTS").

4 -Stop the engine, check the oil level in the tank and, if necessary, top it up.

PISTON PUMP

Removal

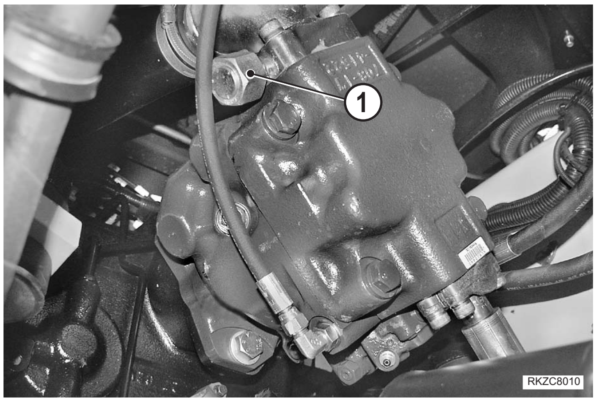
⚠ Lower the working equipment completely until it rests on the ground.
Stop the engine and remove the ignition key.

⚠ Eliminate all residual pressure from all circuits by moving all hydraulic controls in all directions.

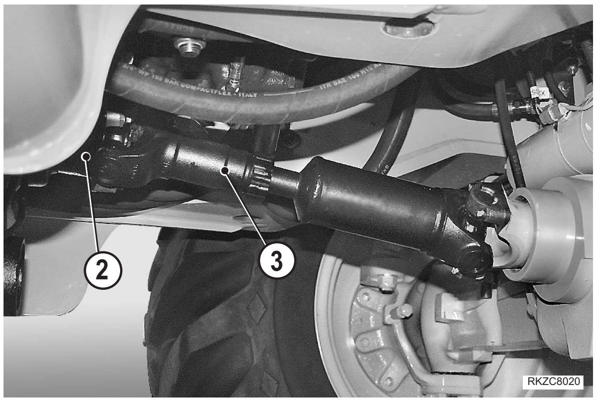
1 - Remove the plug (1) and drain the hydraulic oil.

Hydraulic oil: approx. 40 ℓ

★ Replace plug to prevent contamination.

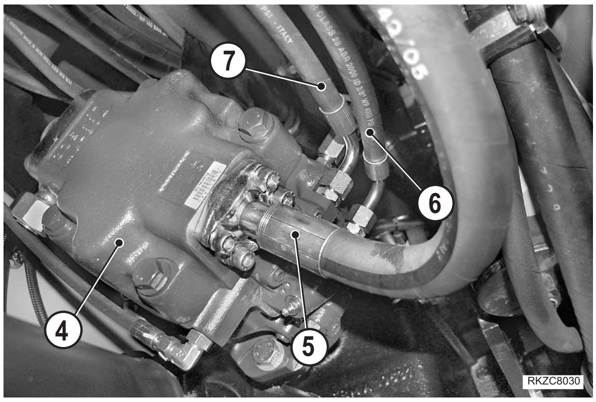


2 - Disconnect rear cardan shaft (3) from transmission (2). [*1]



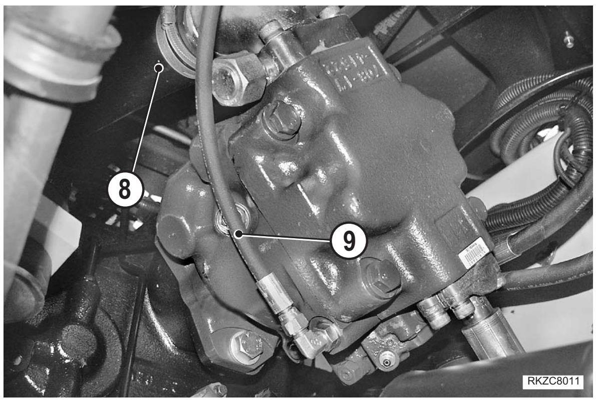
3 - Disconnect the delivery hose (5) and the LS and pump delivery pressure control hoses (6) and (7) from the pump (4).

★ Cap pipes, hoses and holes to prevent contamination.



4 - Disconnect the suction pipe (8) and the draining hose (9) from the pump.

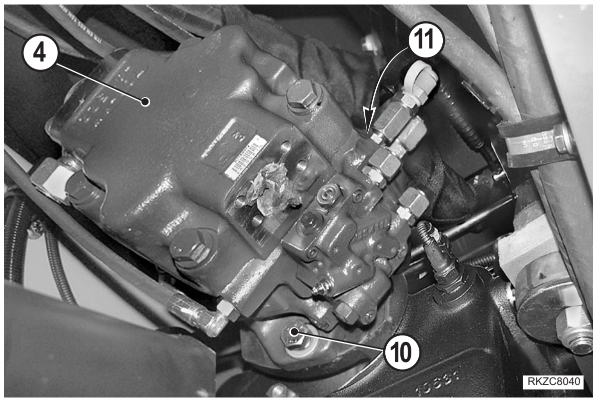
★ Cap pipes, hoses and holes to prevent contamination.



5 -Loosen and remove the lower screw (10) retaining the pump (4) and its washer.

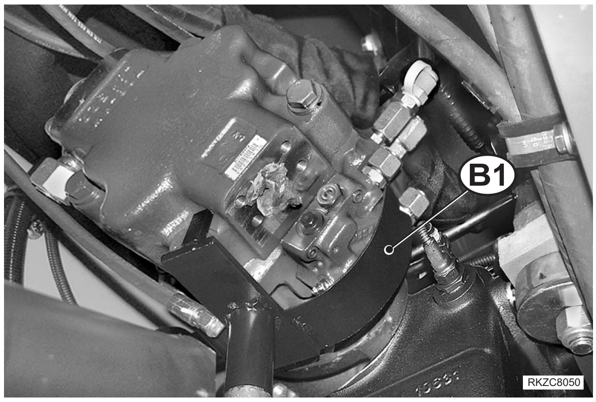
6 -Loosen upper screw (11) but leave it in place.

★ Do not remove the screw at this stage. [*2]



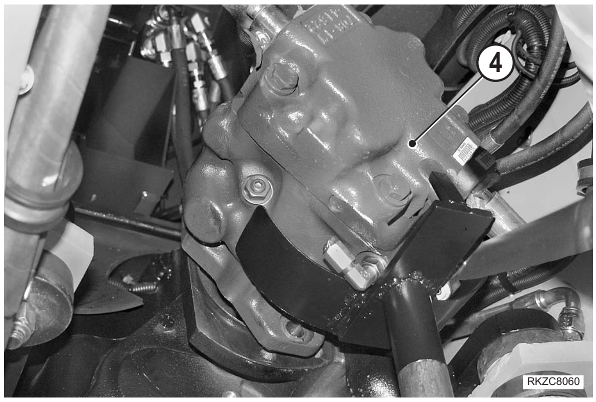
7 -Install pump holding tool "**B1**" to a hydraulic jack.

8 -Place tool "**B1**" under the pump until the pump fully supported.



9 -Take out the upper screw (11) and remove the pump (4).

Piston pump: 36.8 kg



Installation

- To install, reverse removal procedure.

[*1]

Screw: 38±1 Nm

[*2]

Pump screws: 220 Nm

1 -Refill the hydraulic oil.

Hydraulic oil: approx. 40 ℓ

2 -Start the engine and run it at MIN. to bleed any air.

3 -Stop the engine and check the oil level in the tank.

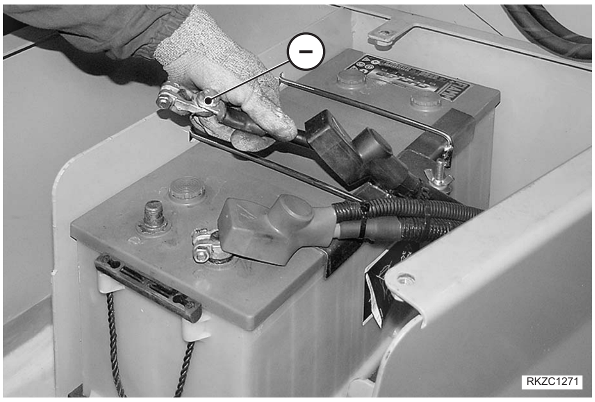
TRANSMISSION

Removal

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

⚠ Eliminate all residual pressure from all circuits by moving all hydraulic controls in all directions.

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



★ Drain the hydraulic oil.

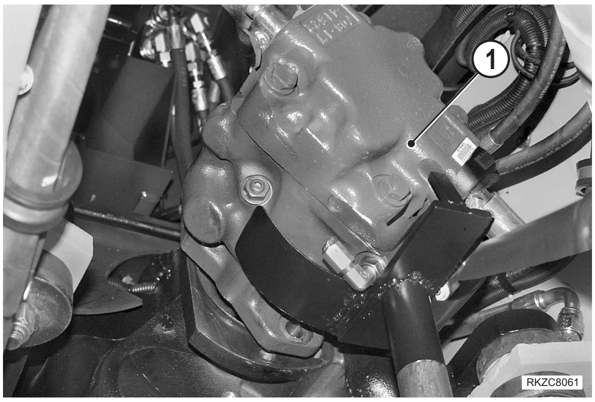
Hydraulic oil: approx. 40 ℓ

★ Drain the oil from the gearbox.

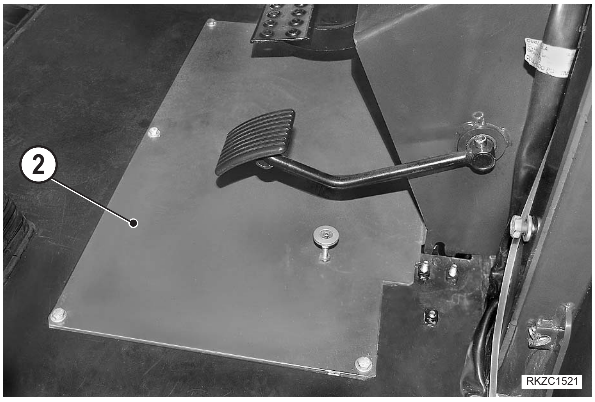
Hydraulic oil: approx. 20 ℓ

[*1]

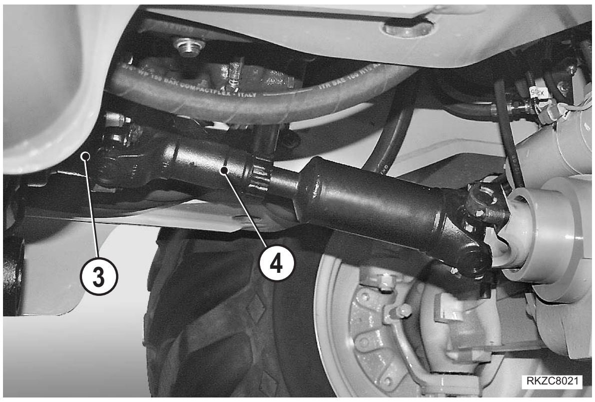
1 - Remove the piston pump (1).
(For details see "PISTON PUMP"). [*2]



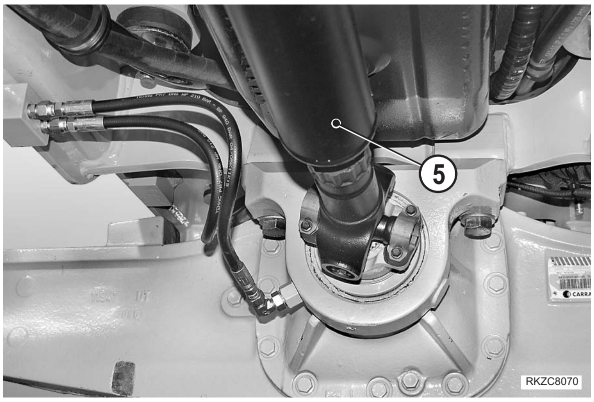
2 - Remove the front mat and remove the metal sheet (2) closing off the cab floor.



3 - Disconnect rear cardan shaft (4) from transmission (3). [*4]

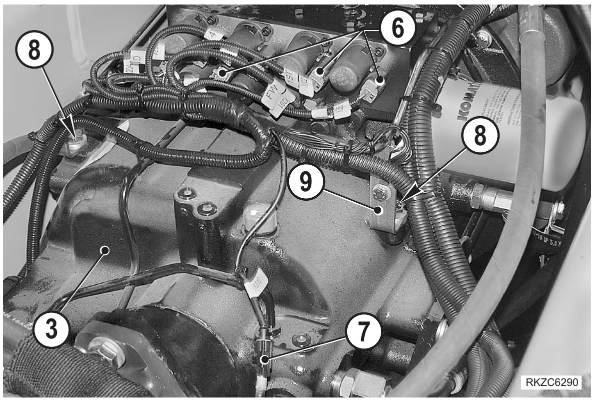


4 - Remove front cardan shaft (5). [*4]

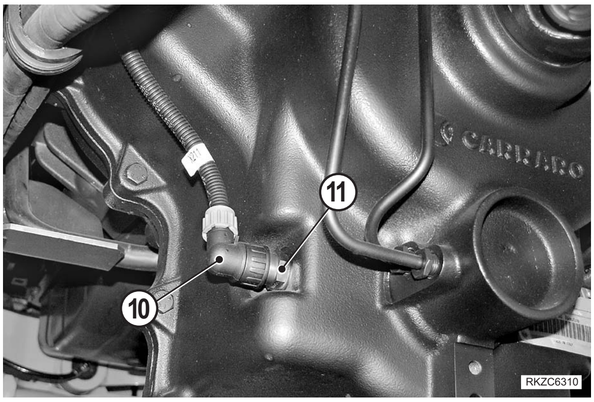


5 - Disconnect seven solenoid valve connectors (6) and shift oil temperature sensor connector (7) from gearshift (3).

6 - Take out the screws (8) and remove the harness holder (9).

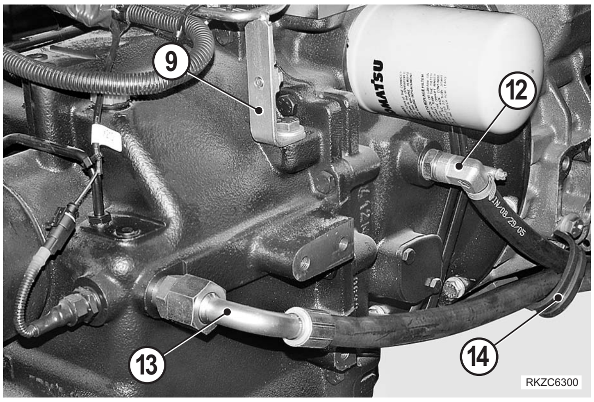


7 - Disconnect the connector (10) from the rev sensor (11).



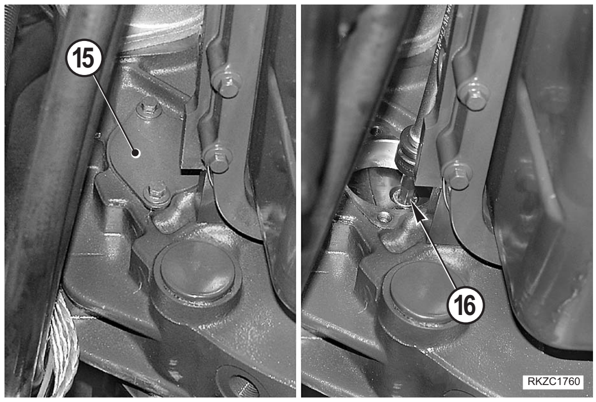
8 - Disconnect delivery hose (12) to oil cooler and return hose (13) from gearbox (3).

9 - Remove the clamp (14).

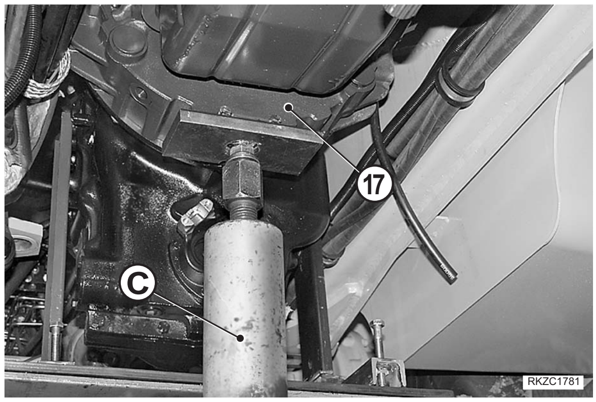


10 - Remove the screws and remove the cover (15) giving access to the converter coupling flange.

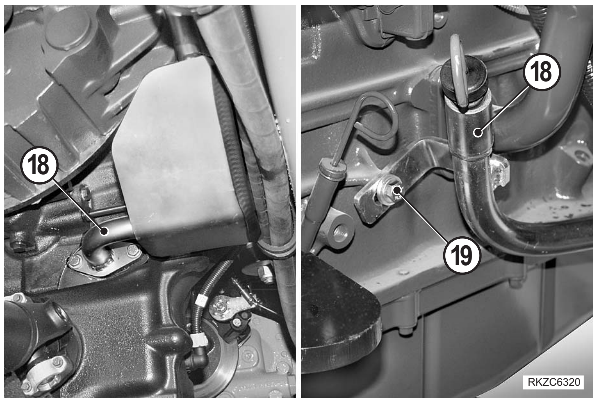
11 - Slowly rotate the engine flywheel until the converter retaining screws (16) are centred in the hole; remove the four screws. [*5]



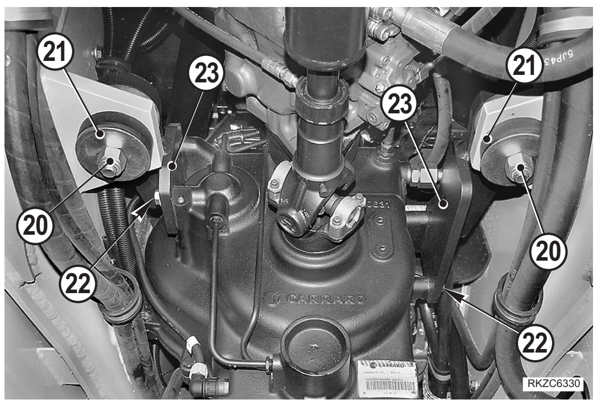
12 - Procure to support the engine (17) with a stand "**C**" placed under the flywheel bell.



13 - Disconnect the gearbox oil load and oil level control pipe (18), remove the screw (19) and remove the complete pipe (18).

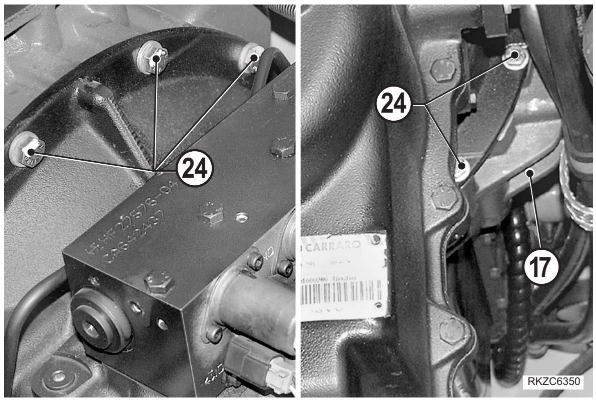


14 - Remove the nuts (20) on the vibration dampers (21), the screws (22) and remove the gearbox supports (23). [*6] [*7]



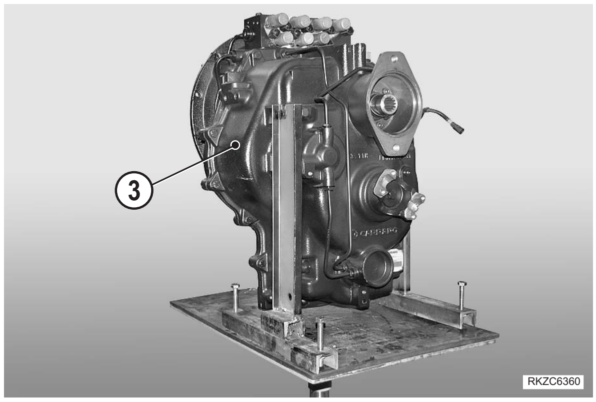
15 - Install the gearbox holding tool "**B2**" to a stand that is capable of descending by about 60 cm.
Using the holes on the supports, secure the tool "**B2**" to the gearbox.

16 - Loosen and remove the two screws (24) retaining the gearbox (3) to the engine (17). [*8]



17 - Move the gearbox group (3) towards the rear of the machine and extract the group.

Transmission: 254 kg



Installation

- To install, reverse removal procedure.

[*1]

Hydraulic oil: approx. 20 ℓ

[*2]

Hydraulic oil: approx. 40 ℓ

[*3]

Screw: 120 Nm

[*4]

Cardan shaft screws: 38 Nm

[*5]

Screw: Loctite 242

Screw: 64 Nm

[*6]

Anti-vibration nuts: 195±20 Nm

[*7]

Support screws: Loctite 262

Support screws: 90±5 Nm

[*8]

Engine-gearbox screws: Loctite 262

Engine-gearbox screws: 50±5 Nm

★ Tighten the screws using the alternating crosswise method.

1 - Start the engine to circulate the oil. Check that there are no leaks.

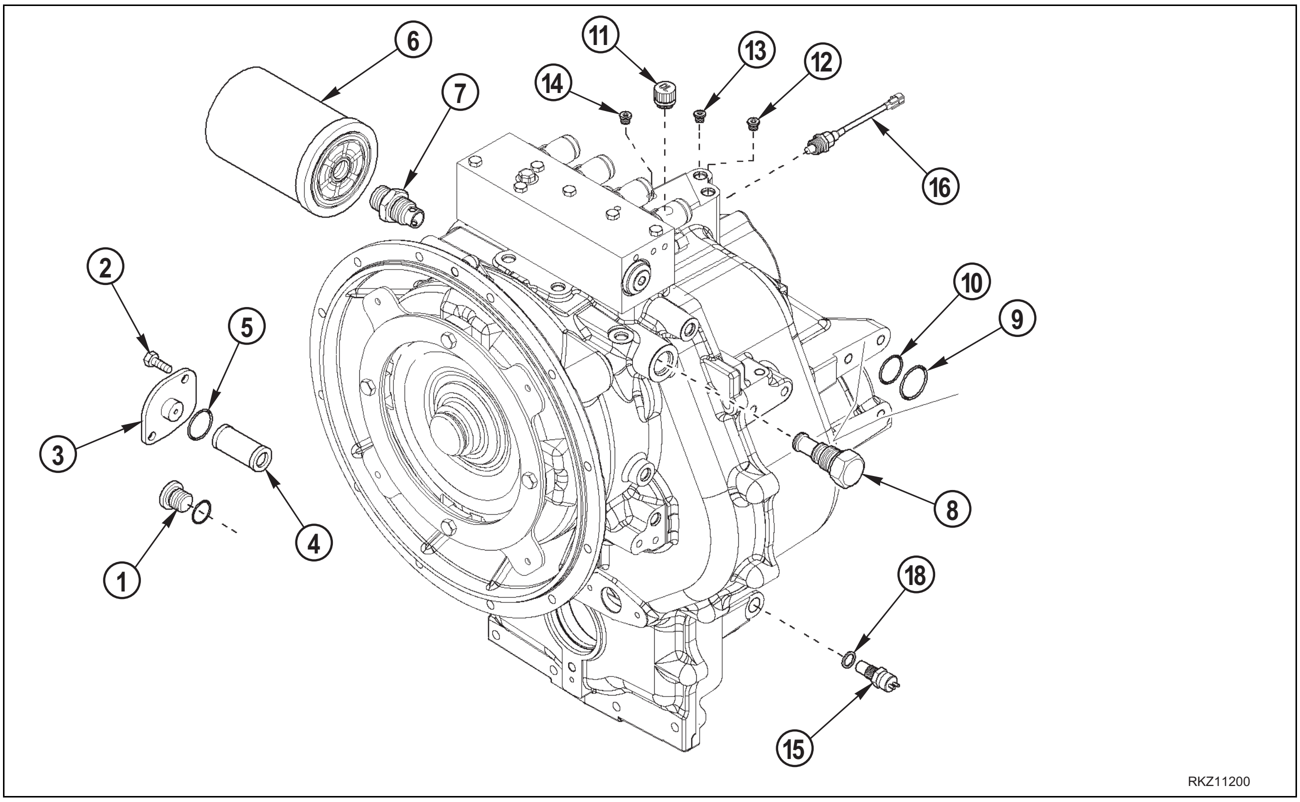
2 - Bleed the air from the working equipment circuits. (For details see "20 TESTING AND ADJUSTMENTS").

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

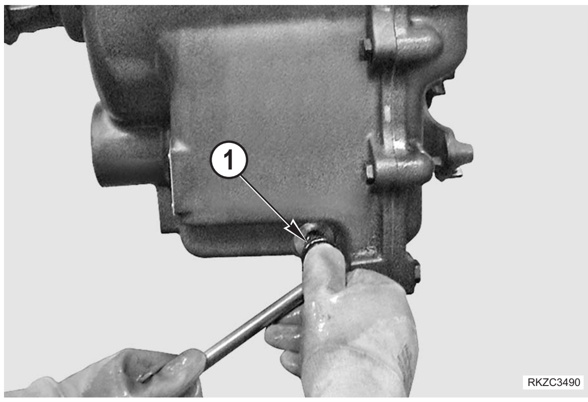
Disassembly and assembly

1. Plugs and filters

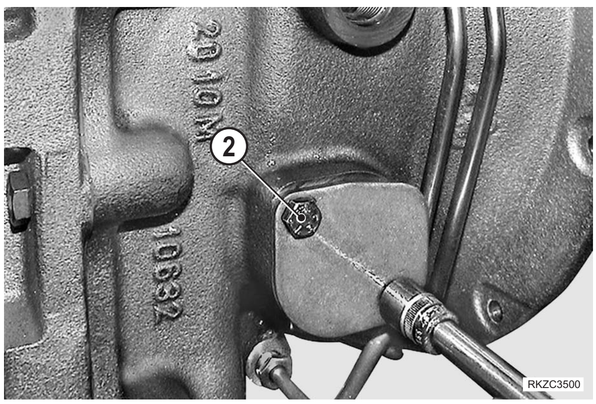
1.1 Disassembly



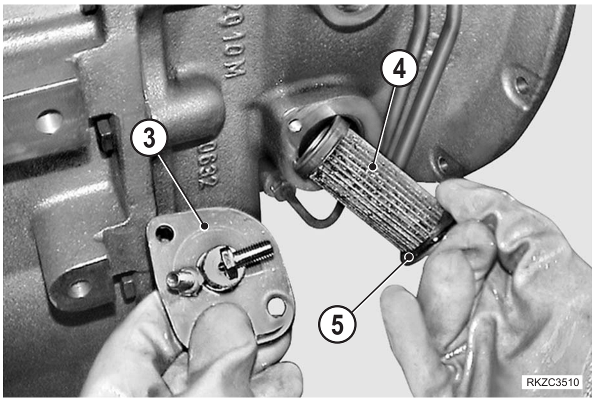
1 -Remove the drain plug (1) and drain the oil from the transmission.



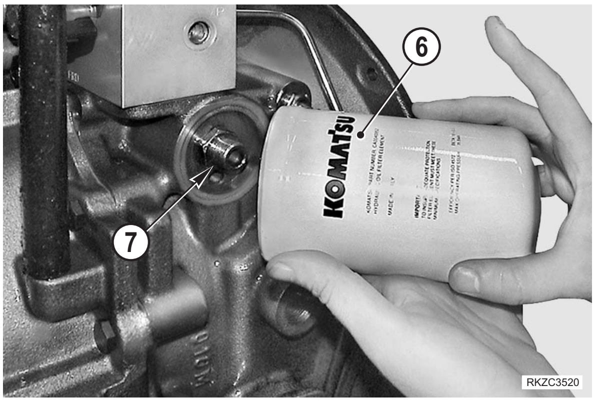
2 -Remove the two cap screws (2) which fasten the cover for the oil screen.



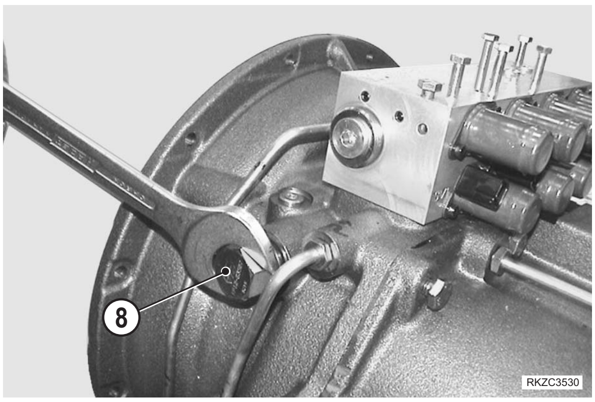
3 - Remove the cover (3), the oil screen (4) and the ring (5).



4 - Unscrew the oil filter (6).
If necessary, remove the connector (7) for the oil filter (6).

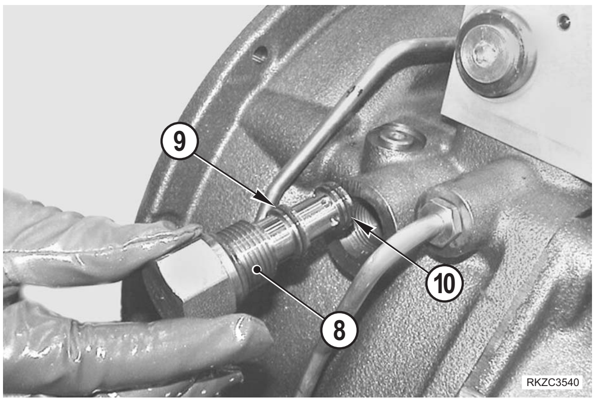


5 - Unscrew and remove the oil filter protection valve (8).

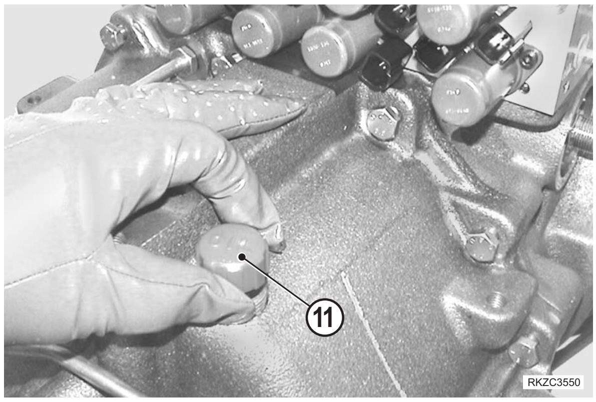


6 - Check the valve (8) condition.

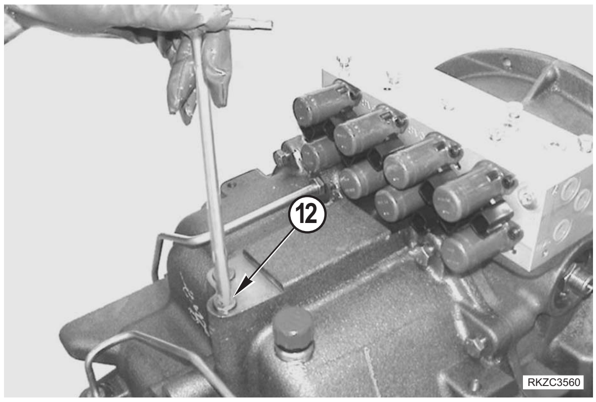
★ Clean with care the valve and replace the O-ring (9) and (10) if necessary.



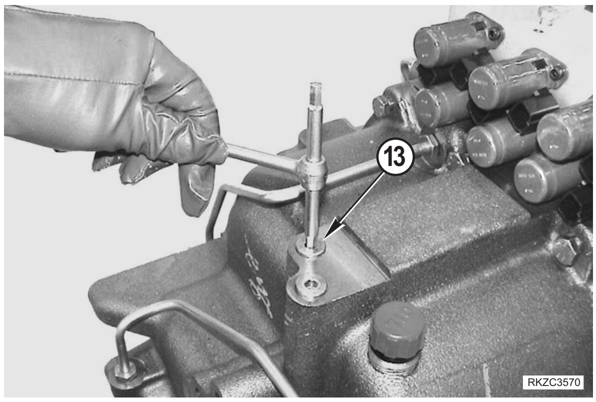
7 - Remove the breather (11) from the transmission housing only if this part is leaking or damaged.



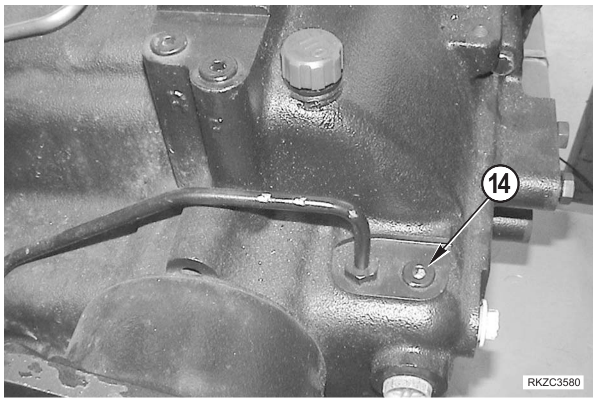
8 - To check the FORWARD clutch pressure, remove the plug (12).



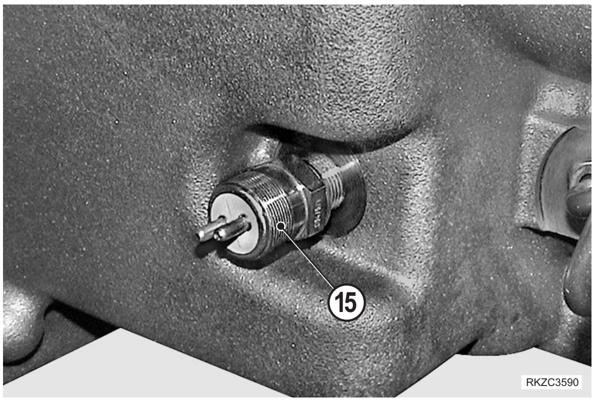
9 - To check the REVERSE clutch pressure, remove the plug (13).



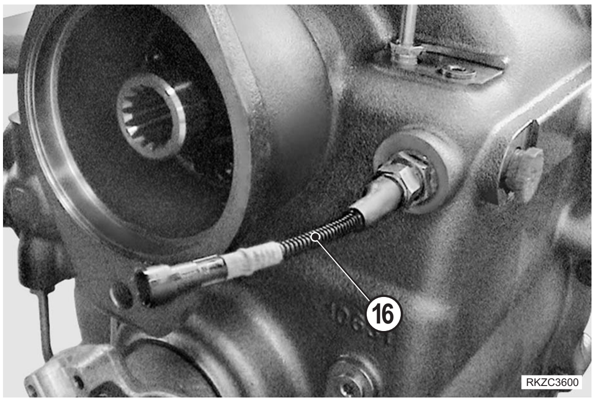
10 - To check the lubrication pressure, remove the plug (14).



11 - Remove the speed sensor (15).



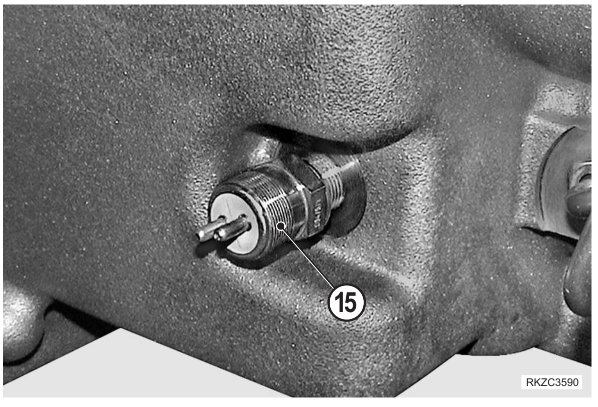
12 - Rimuovere il termostato olio (16).



1.2 Assembly

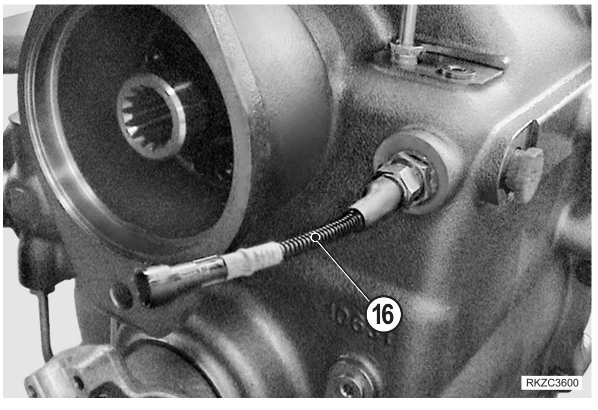
1 - Assemble the speed sensor (15) to the prescribed torque

Sensor: 50 Nm



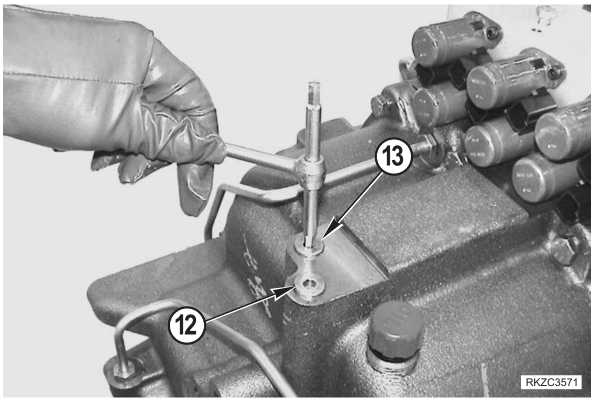
2 - Assemble the thermostat (16) to the prescribed torque.

Thermostat: 30 Nm

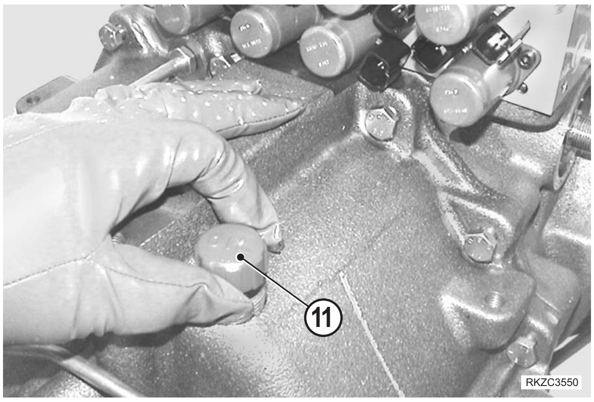


3 - Assemble the plugs (12), (13) and (14) to the prescribed torque after the pressure check.

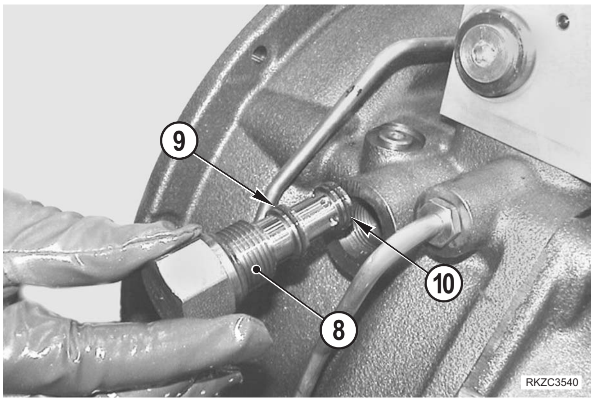
Caps: 30 Nm



4 - Assemble by hand the breather (11) to the transmission housing and tighten it strongly.

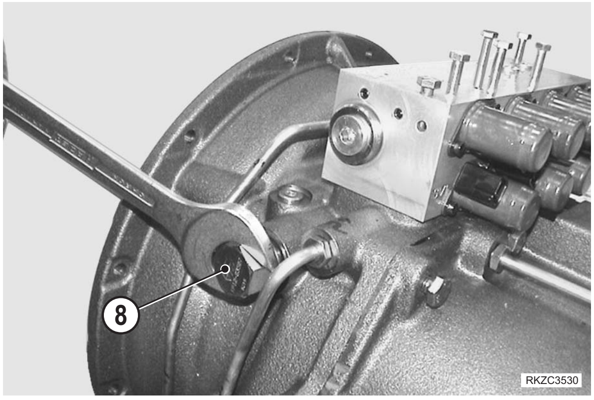


5 - Clean with care the oil filter protection valve (8). Assemble the new O-ring (9) and (10).



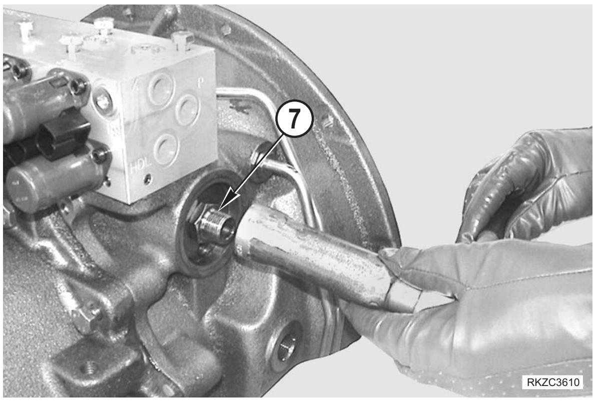
6 - Assemble the oil filter protection valves (8).
Tighten the valve (8) to the prescribed torque

Valve: 23 Nm



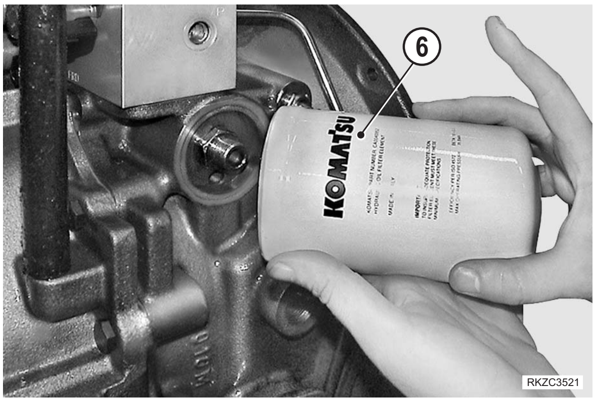
7 - Assemble the connector (7) for the oil filter (6) then tighten it to the prescribed torque.

Union: 50 Nm

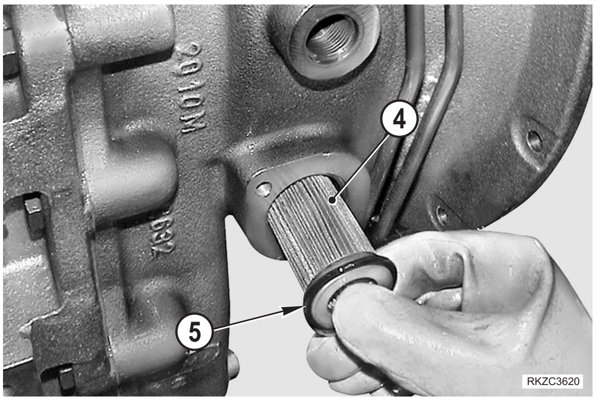


8 - Assemble new oil filter (6).

★ Put a thin coat of oil or grease on the filter gasket, turn clockwise until the gasket makes contact with the base, continue to turn the filter 2/3 turn.

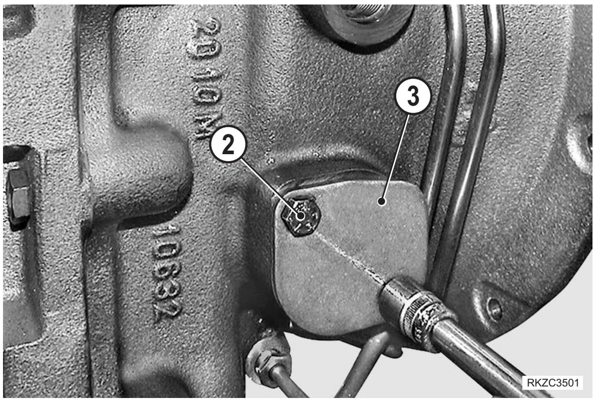


9 - Assemble new O-ring (5) to the filter (4).
Insert the filter (4) with O-ring (5) and assemble the cover (3).



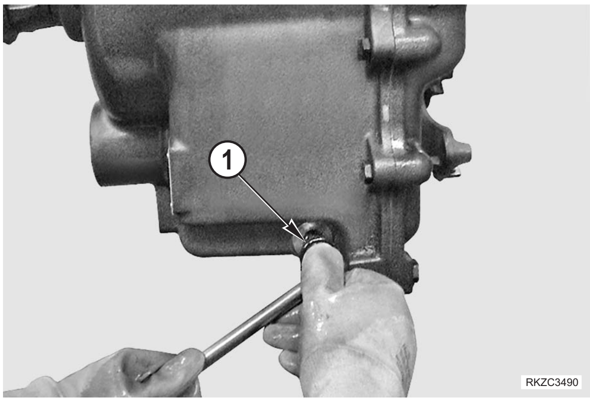
10 - Assemble the two cap screws (2) at prescribed torque to fasten the cover (3).

Screw: 23 Nm



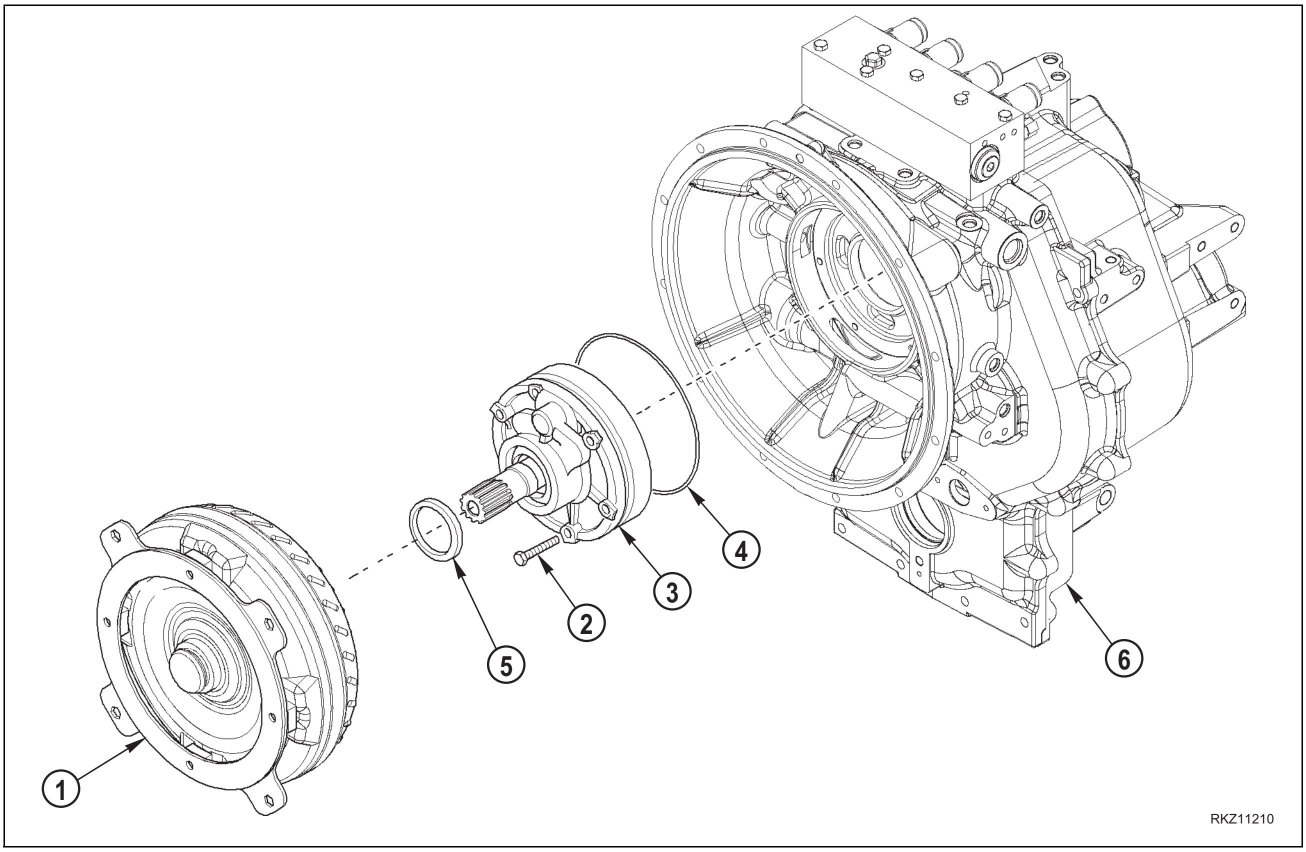
11 -Assemble the drain plug (1) to the prescribed torque.

Plug: 80 Nm

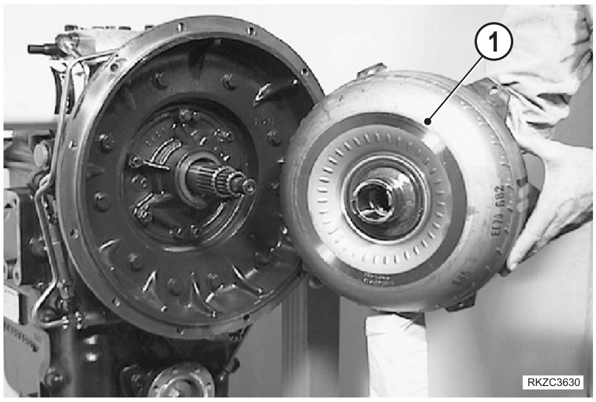


2. Torque converter and oil pump

2.1 Disassembly

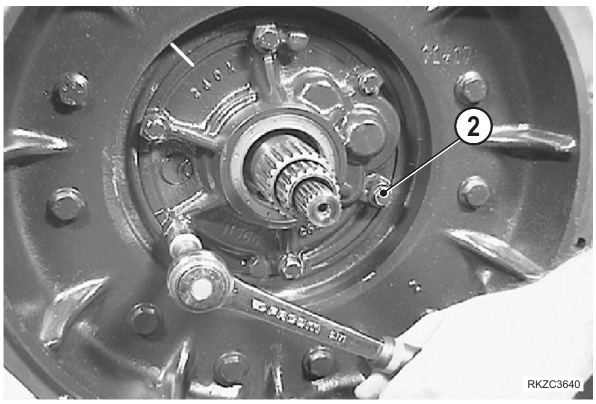


1 -Remove torque converter (1).
(For details see "CONVERTOR").

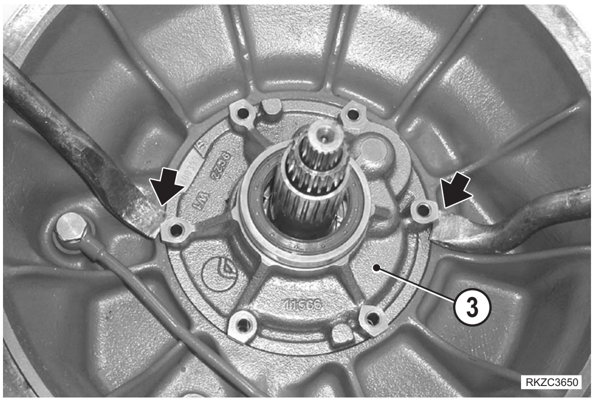


2 -Remove screws (2).

★ Make reference mark on the pump and bell housing before untightening the screws.

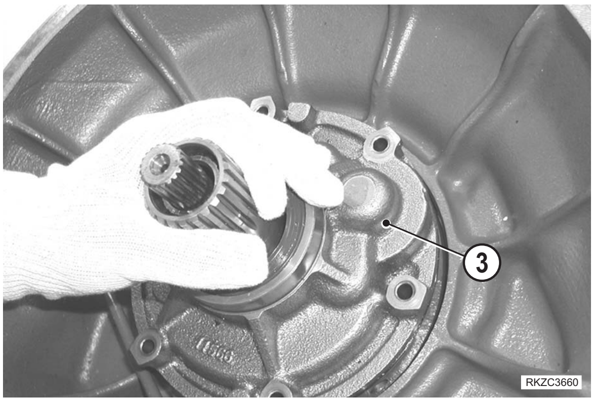


3 -Extract the pump (3) by means of two levers.



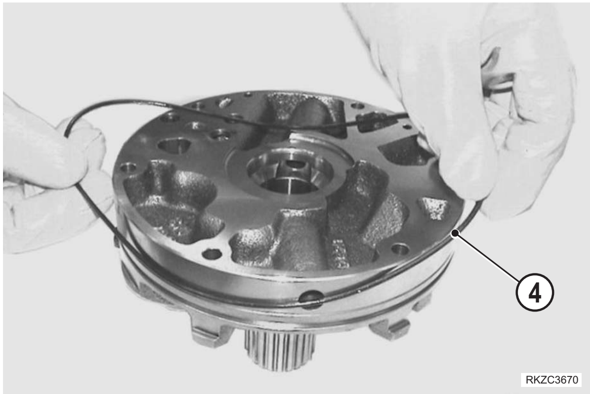
4 -Remove the oil pump (3).

⚠ Do not disassemble the oil pump (3)



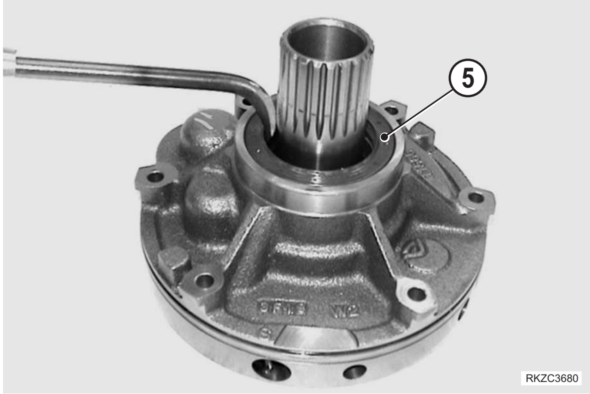
5 -Remove O-ring (4).

★ Replace the O-ring at each disassembly.



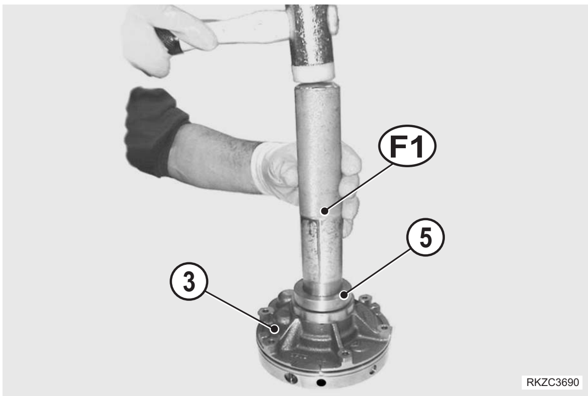
6 -If replacement is necessary, remove the seal ring (5).

★ This is a destructive operation for the seal ring.

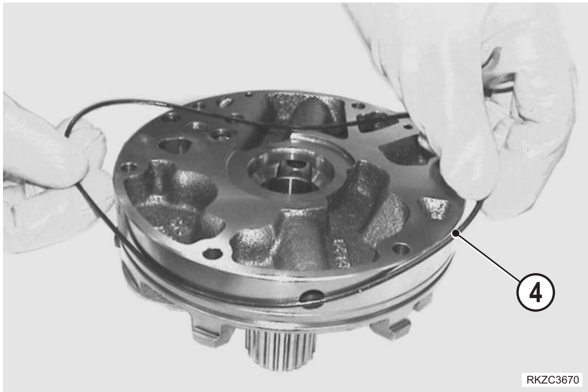


2.2 Assembly

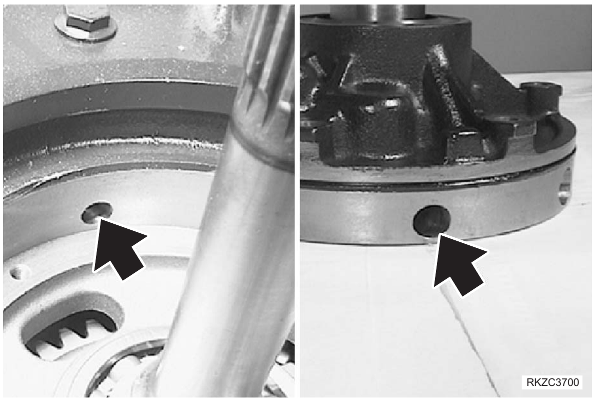
1 - Assemble new seal ring (5) on the oil pump (3).
Use tool **F1**.



2 - Assemble new O-ring (4).

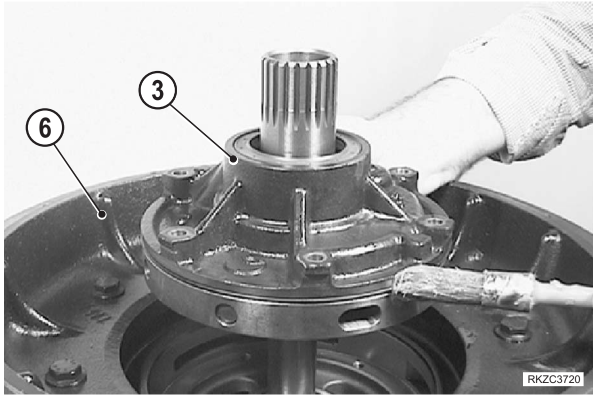


★ If the oil pump is being replaced, verify that the oil passage holes between the pump and the half housing, and the marks on the side in view match.



3 - Grease the ring (5) to keep it centred/coaxial with respect to the shaft slot centre line and to make the introduction onto the pump easier.

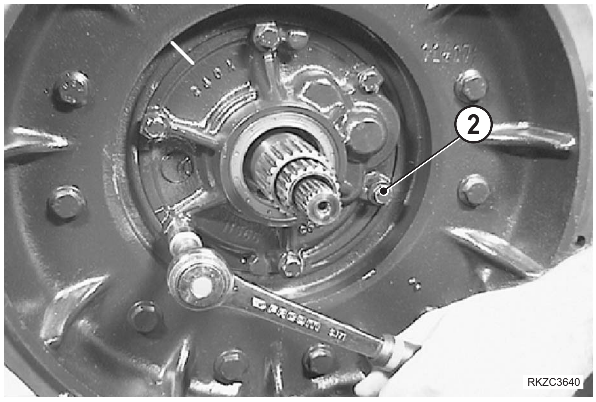
4 - Apply a thin film of grease on the coupling seat with the transmission housing (6). Assemble the oil pump (3).



5 - Assemble the screws (2) to prescribed torque.

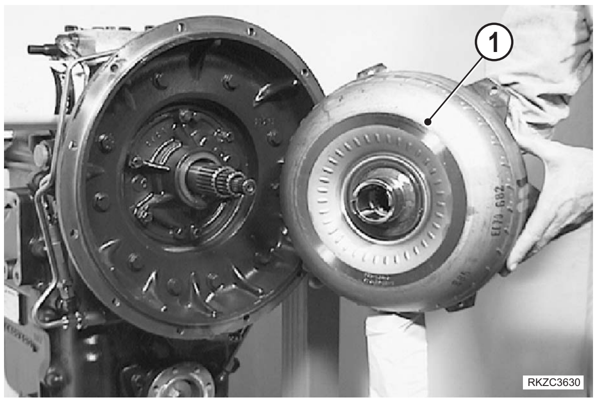
Screw: 23 Nm

★ Check that reference marks made on the oil pump and on the bell housing coincide.



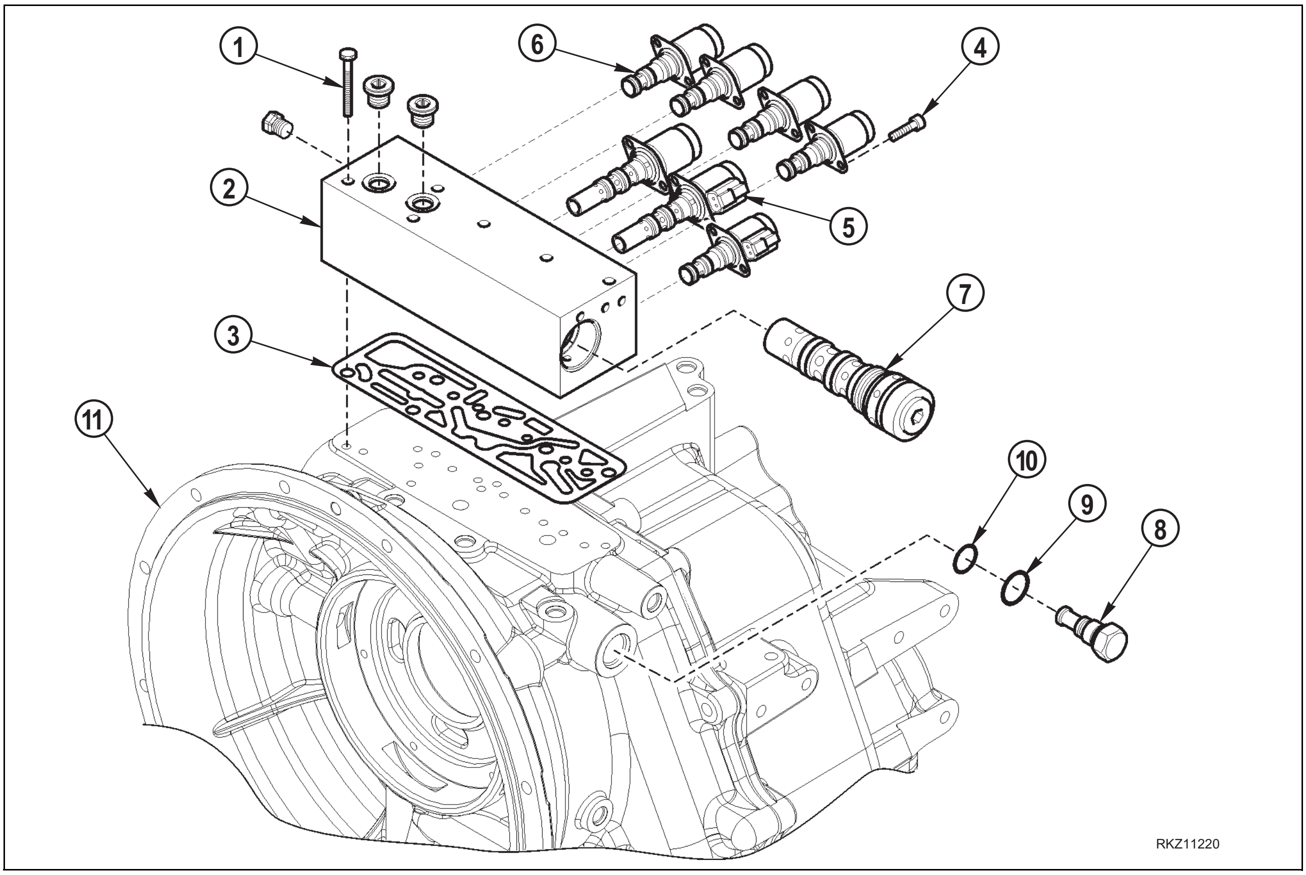
6 - To prevent damage to the pump sealing ring, install the converter to the transmission by hand. The two teeth on the converter that are responsible for driving the pump can cut the lip of the sealing ring.

7 - Couple transmission and converter to the engine flywheel with the screws of the bell converter drive plate.

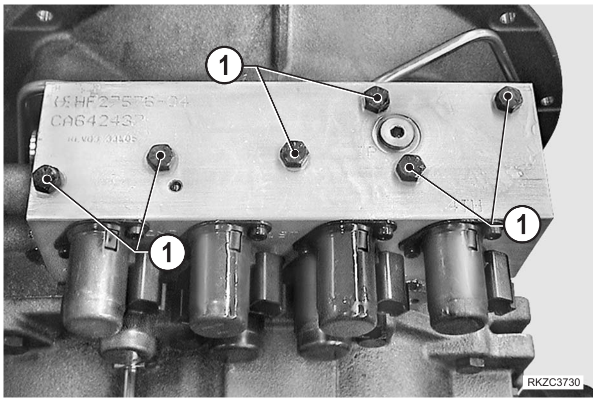


3. Hydraulic control valve

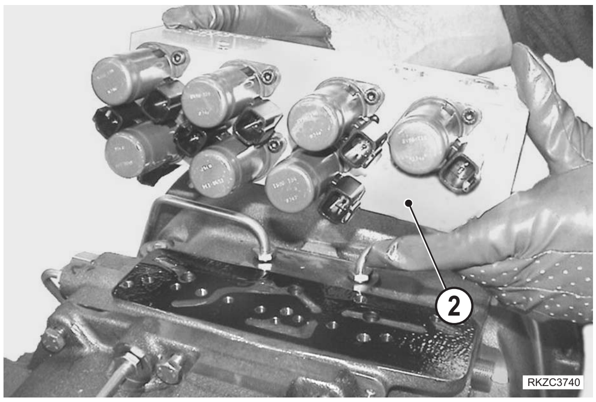
3.1 Disassembly



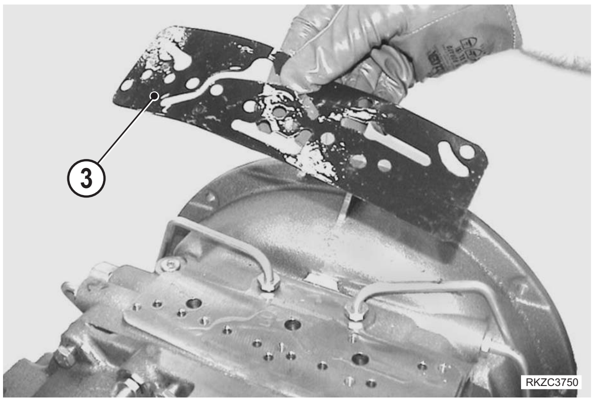
1 - Drain oil from transmission hydraulic circuit, disconnect all electrical connections.
Remove screws (1).



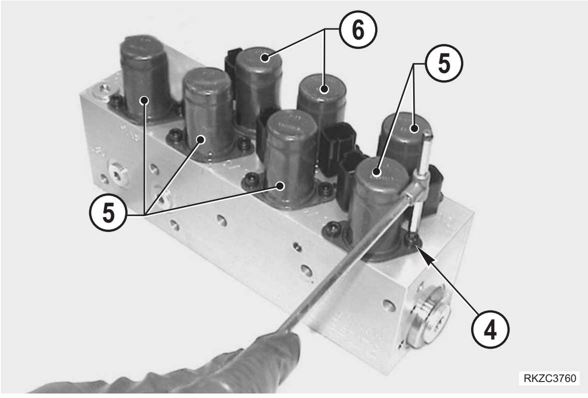
2 - Lift control valve (2).



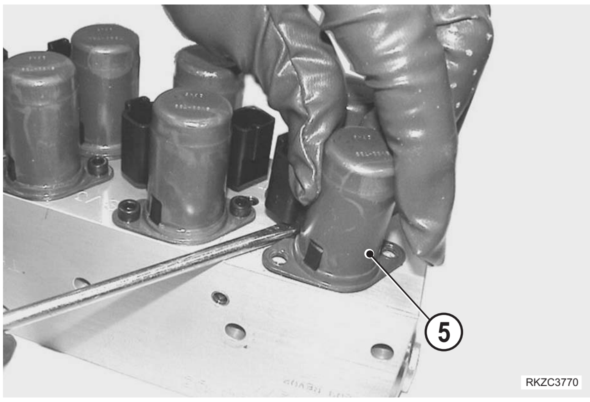
3 - Remove the gasket (3).



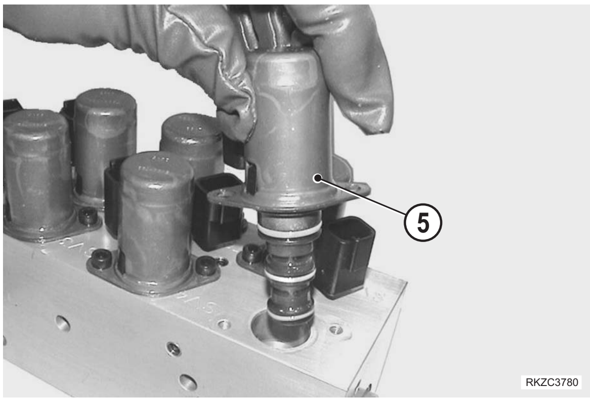
4 - Place the control valve unit on a clean workbench. Remove fastening screws (4) from the valves (5) and (6).



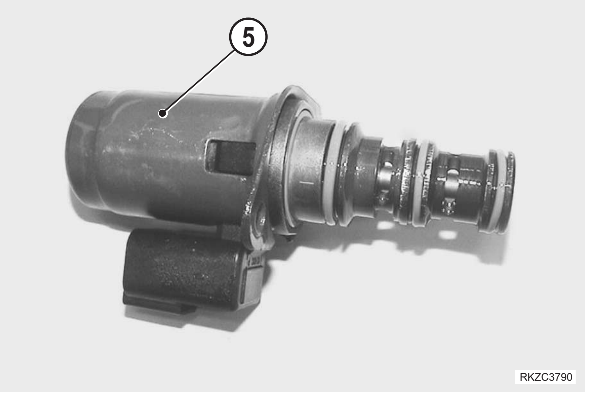
5 - Extract with care the valves (5) and (6) with a screwdriver.



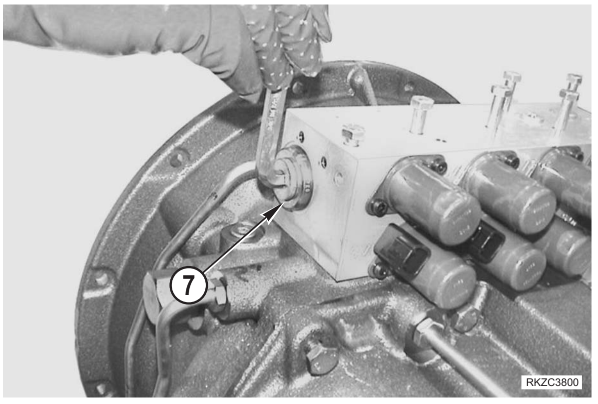
6 - Remove the valves (5) and (6).



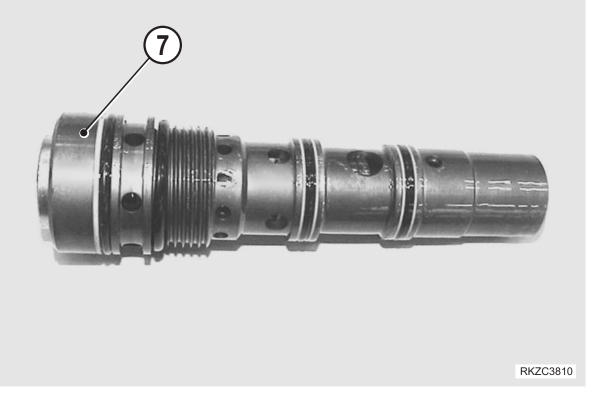
7 - Check the valves (5) and (6) condition.



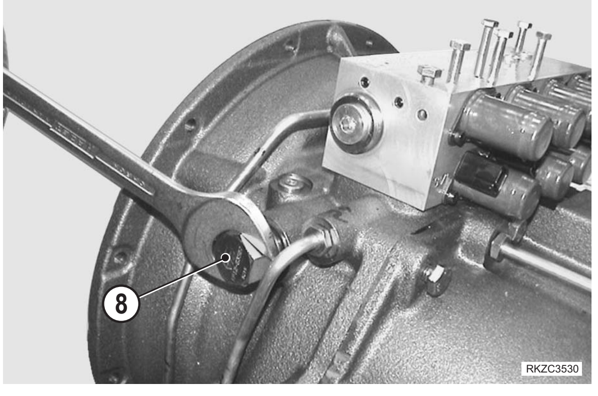
8 - Unscrew and remove the valve (7).



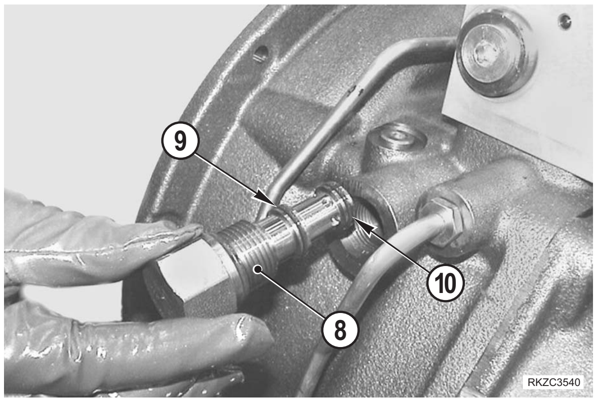
9 - Check the valve (7) condition.



10 - Unscrew and remove the oil filter protection valve (8).

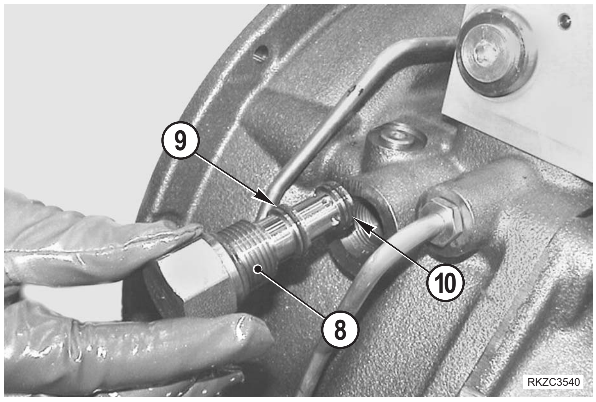


11 - Check the valve (8) condition.
Clean with care the valve and replace the O-ring (9) and (10) if necessary.



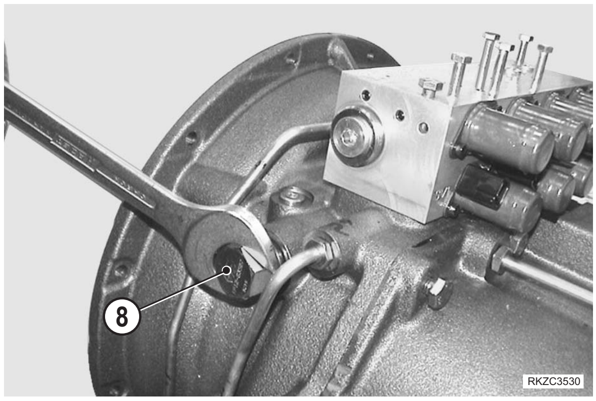
3.2 Assembly

1 - Clean with care the oil filter protection valve (8) and assemble the new O-ring (9) and (10).

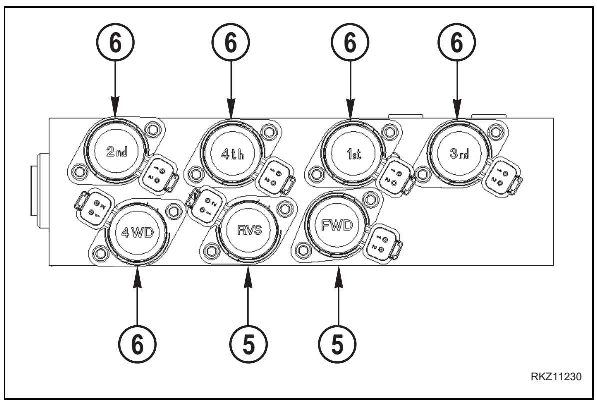


2 - Assemble the oil filter protection valves (8).
Tighten the valve (8) to the prescribed torque

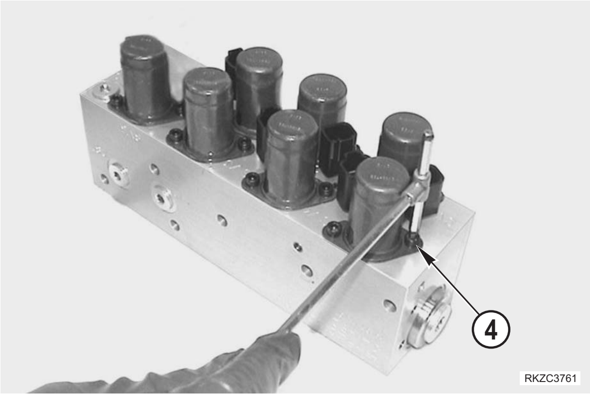
Valve: 23 Nm



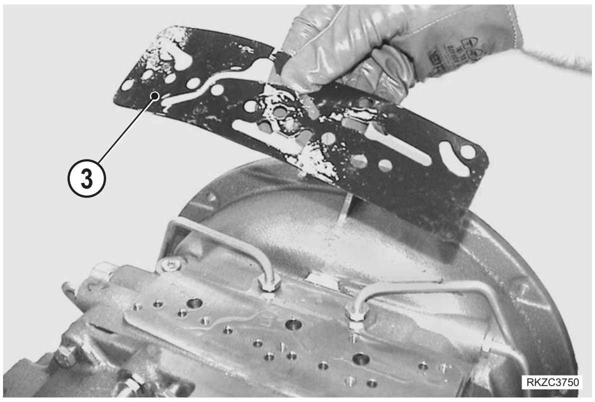
3 - Assemble the ON/OFF (6) and proportional (5) valves using the locations shown on the side.



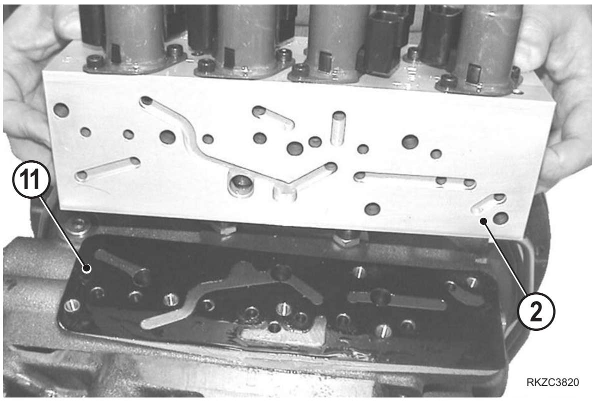
4 - Assemble the valve mounting screws (4).



6 - Assemble the new gasket (3).

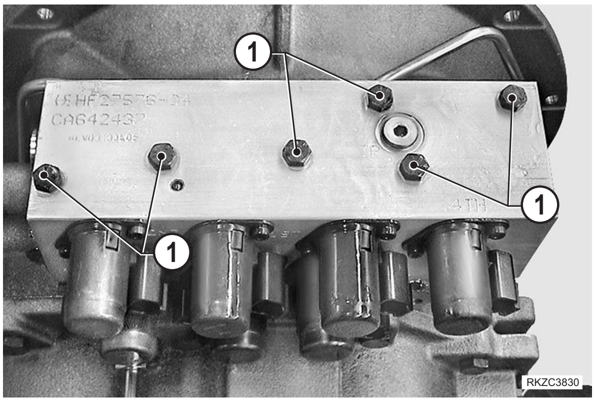


7 - Assemble the control valve unit (2) to the transmission (11).



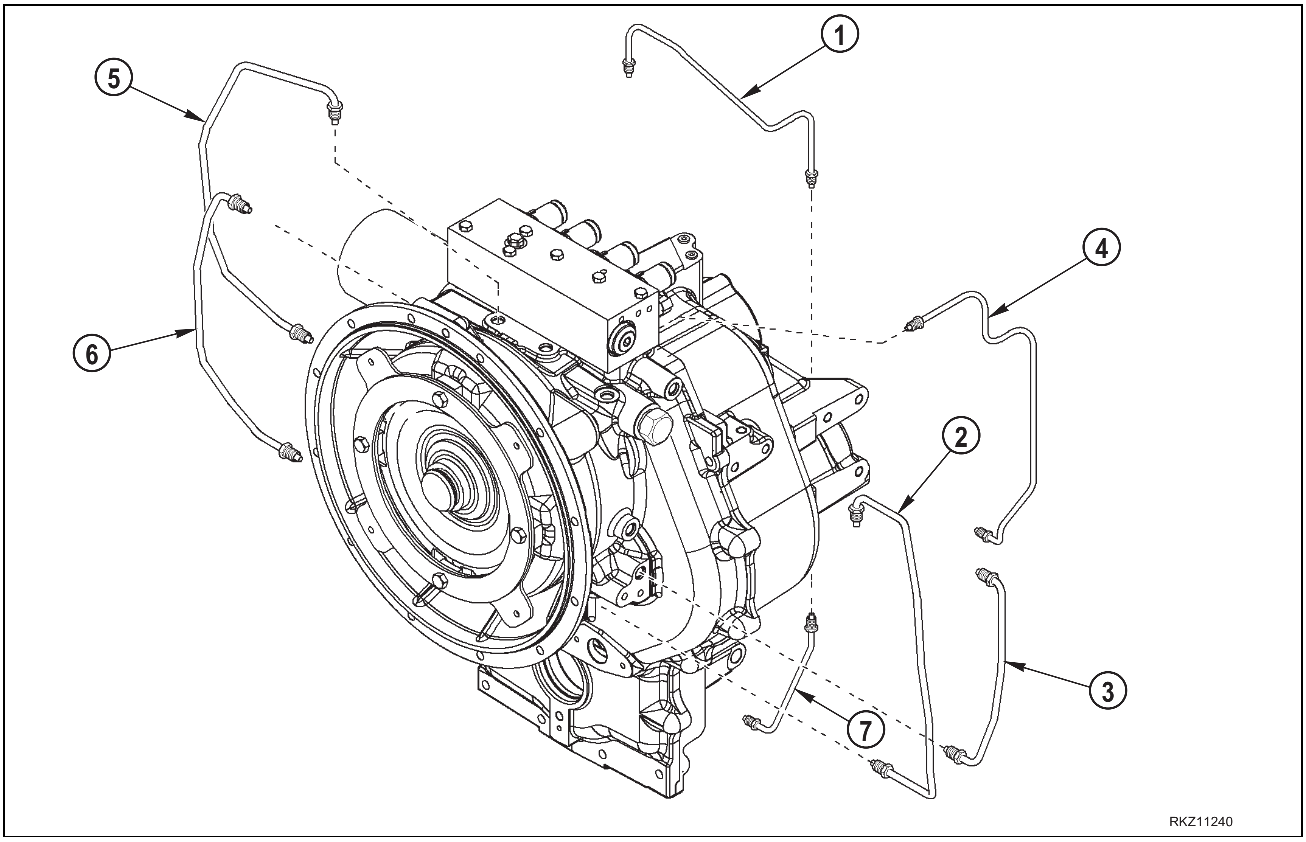
8 - Tighten the bolts (1) to the prescribed torque.

Screws: 23 Nm

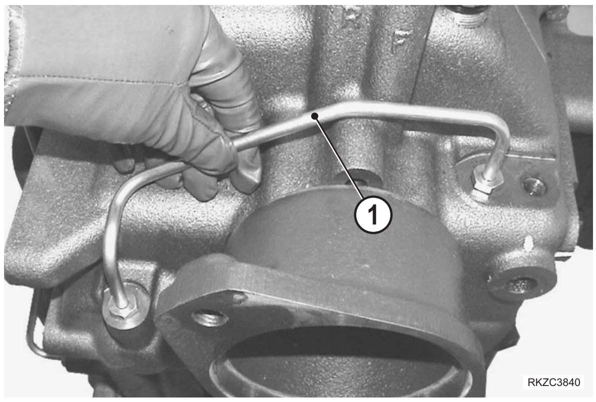


4. Hydraulic system lines

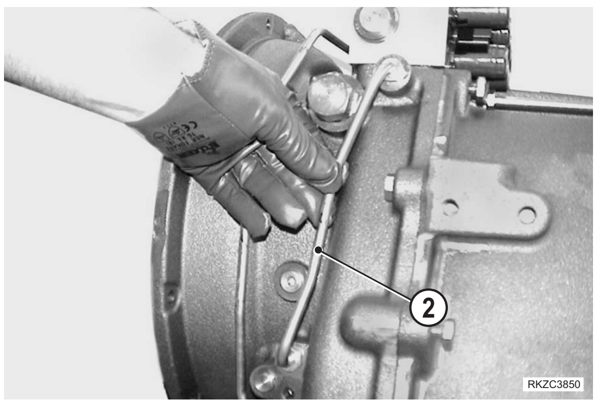
4.1 Disassembly



1 - Drain oil from transmission hydraulic circuit.
Unscrew the connections of pipe (1) (shaft lubrication) and remove the pipe (1).

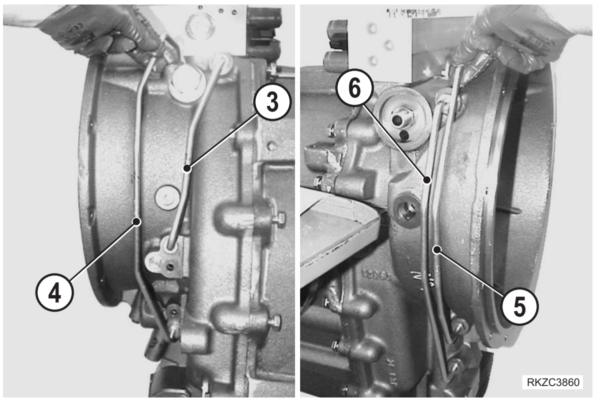


2 - Remove the pipe (2) (2nd speed) unscrewing related connections.

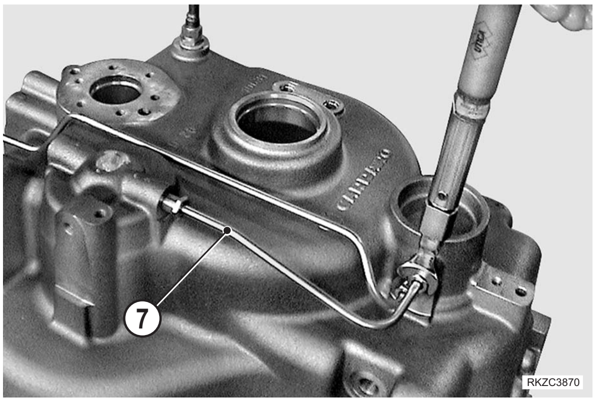


3 - Remove the pipes (3) (4th speed), (4) (4WD), (5) (1st speed) and (6) (3rd speed) unscrewing related connections.

★ Collect connection gaskets.



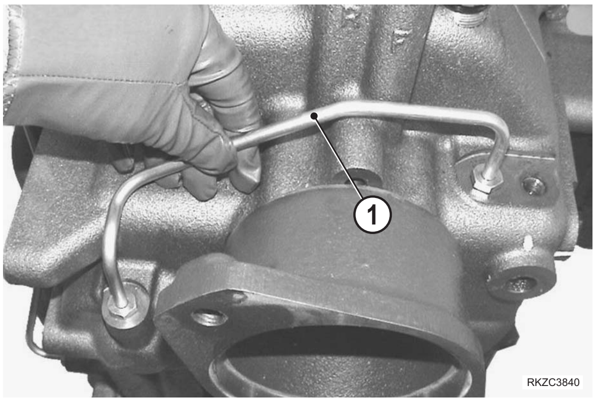
4 - Remove the pipe (7) (shaft lubrication) unscrewing related connections.



4.1 Assembly

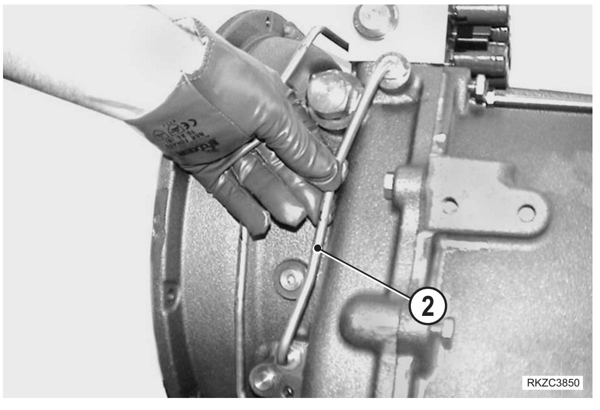
1 - Assemble the pipe (1) tightening the connections to the prescribed torque.

Unions: 30 Nm



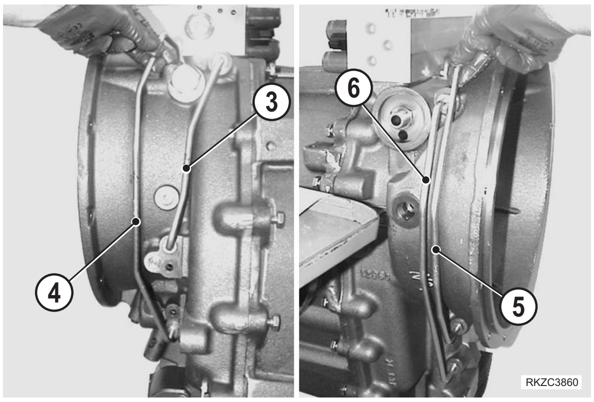
2 - Assemble the pipe (2) tightening torques the connections to the prescribed torque.

Unions: 30 Nm



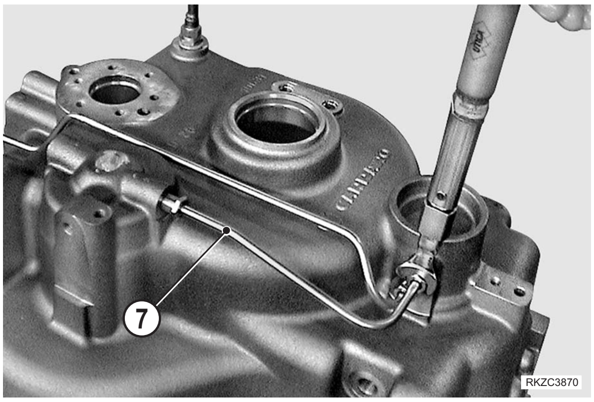
3 - Assemble the pipes (3), (4), (5) and (6) then tighten related connections to the prescribed torque.

Unions: 30 Nm



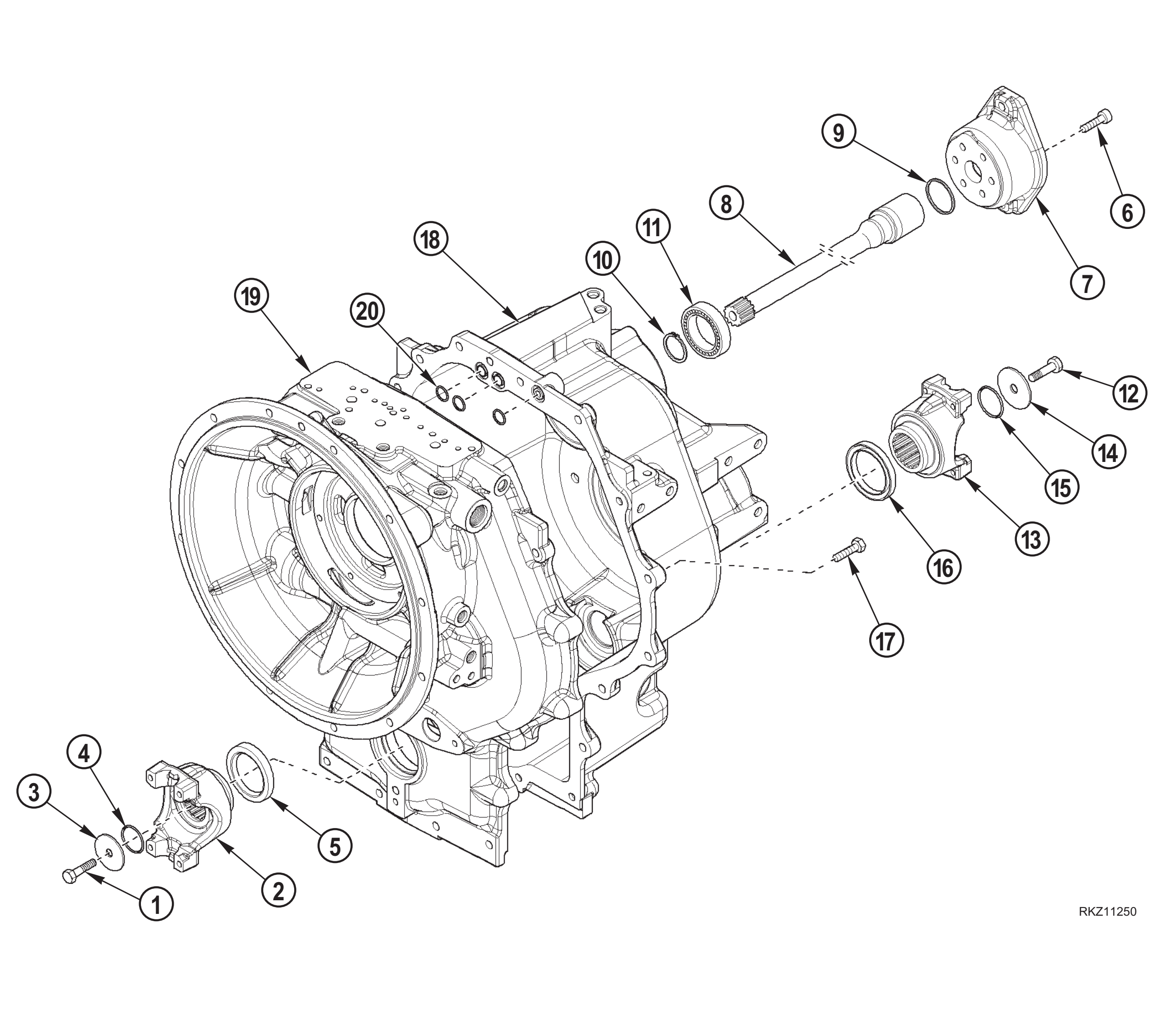
4 - Assemble the pipe (7) tightening torques the connections to the prescribed torque.

Unions: 30 Nm

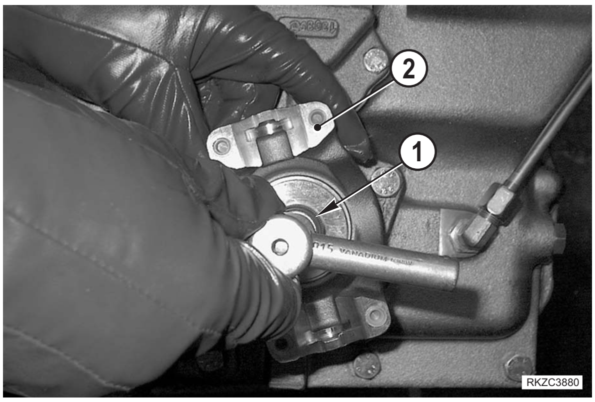


5. Transmission housing

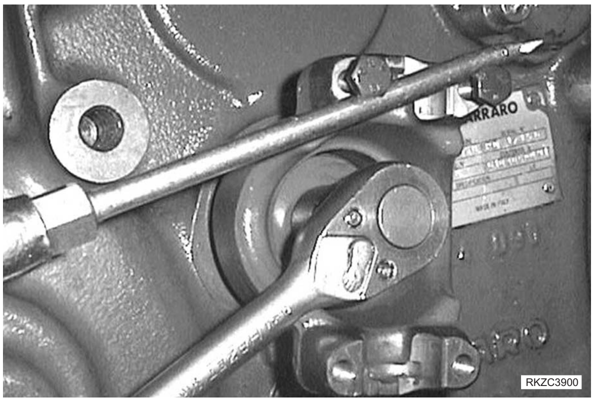
5.1 Disassembly



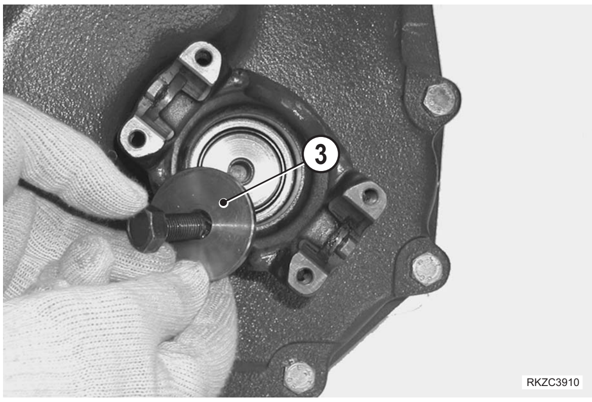
1 - Drain oil from transmission.
Unscrew flange (2) fastening bolt (1).



2 - If necessary use a screwdriver and two screws to stop flange rotation.

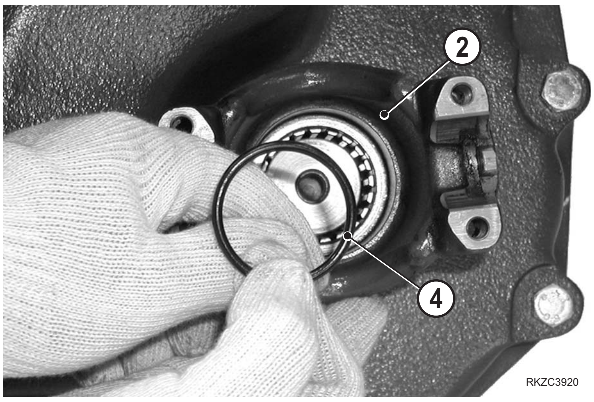


3 - Collect the washer (3).



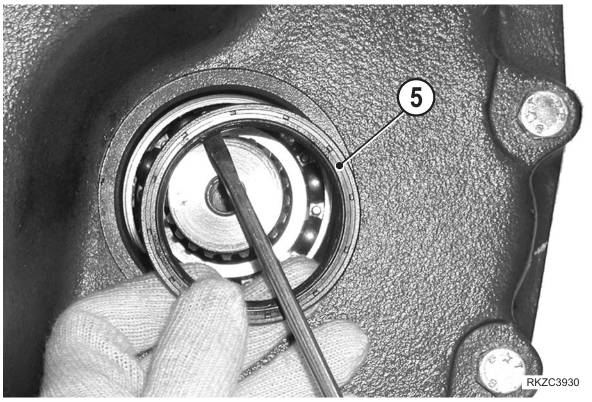
4 - Remove flange (2) and O-ring (4).

★ Replace the O-ring at each disassembly.

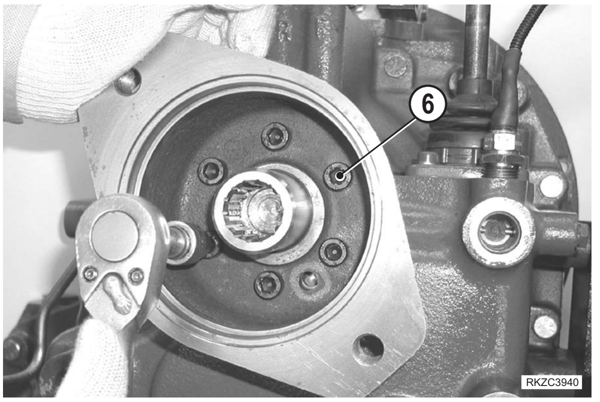


5 - Remove seal ring (5).

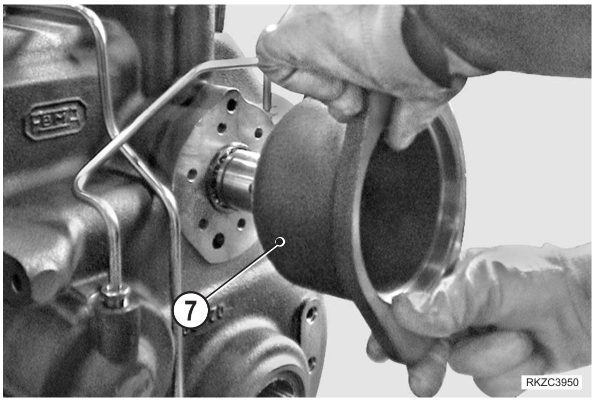
★ This is a destructive operation for the seal ring.



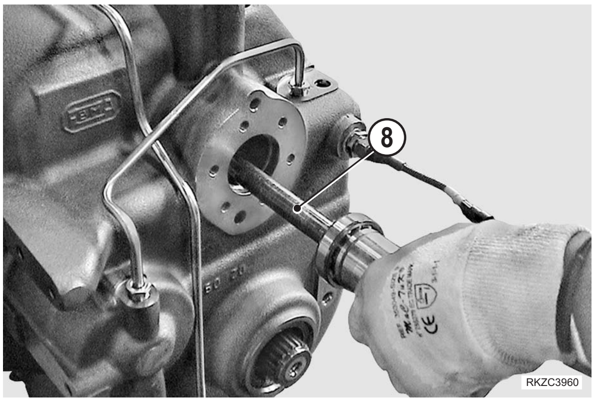
6 - Remove the fastening screws (6) from the flange (7).



7 - Remove flange (7).

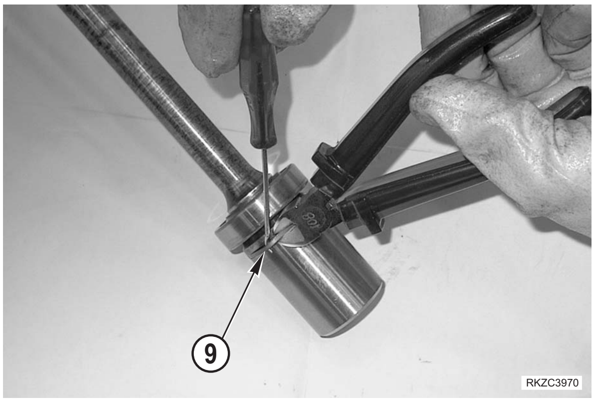


8 - Extract transmission shaft PTO (8).

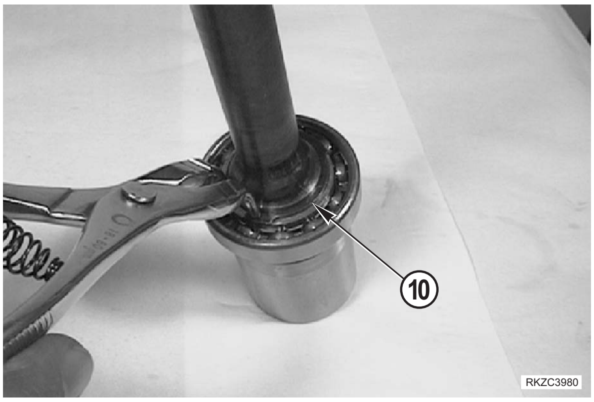


9 - If to be replaced, remove teflon seal ring (9) by cutting it.

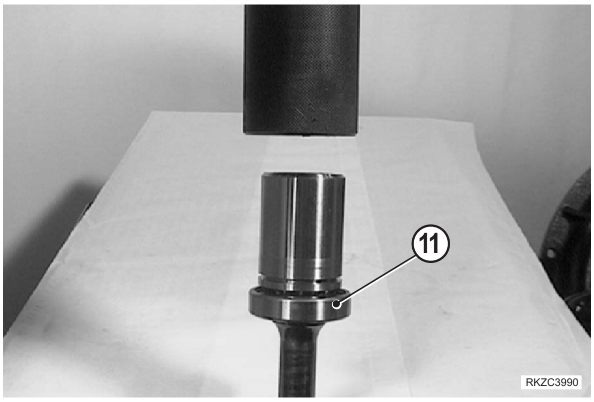
★ This is a destructive operation for the seal ring.



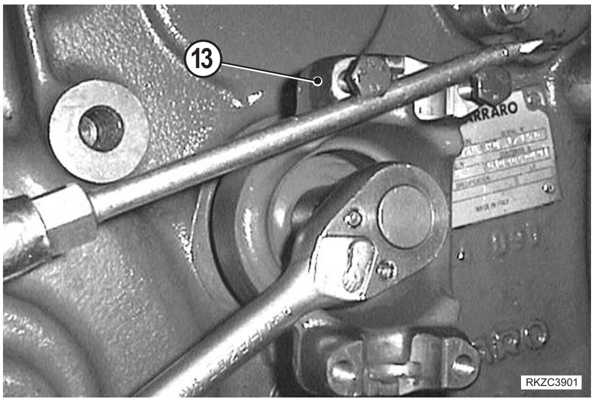
10 - Remove snap ring (10).



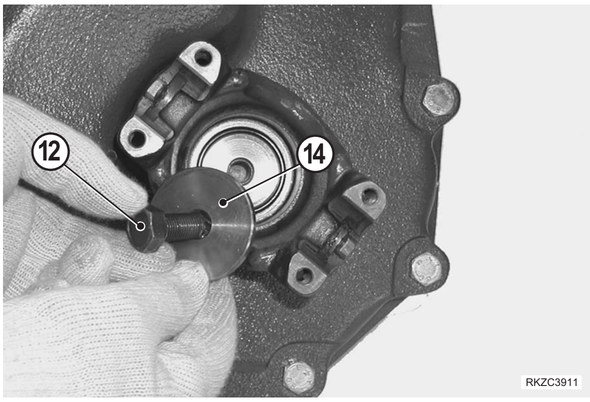
11 - Extract bearing (11) with tool **F2**.



12 - Unscrew flange (13) fastening bolt (12).
Use a screwdriver and two screws to stop flange rotation.

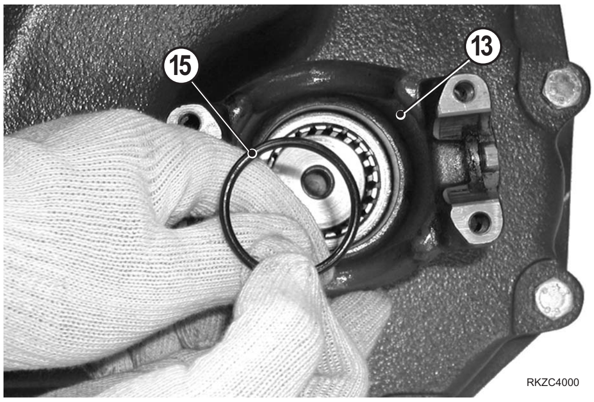


13 - Remove the bolt (12) and washer (14).



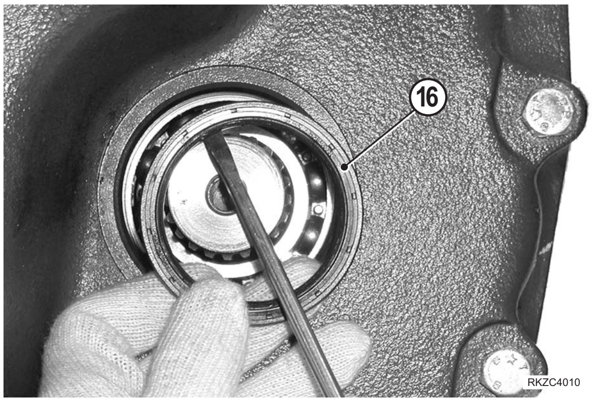
14 - Remove flange (13) and O-ring (15).

★ Replace the O-ring at each disassembly.

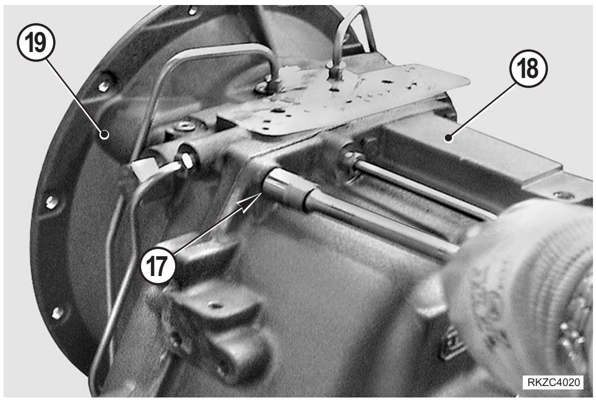


15 - Remove seal ring (16).

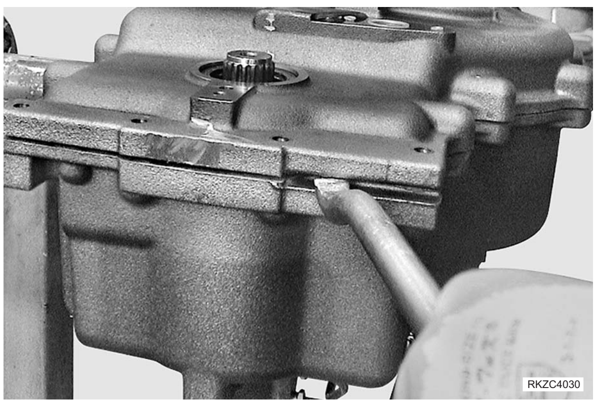
★ This is a destructive operation for the seal ring.



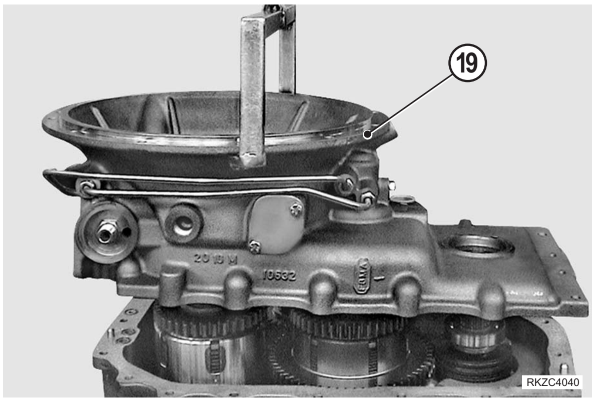
16 - Remove fastening bolts (17) from the rear (18) and front (19) half housings.



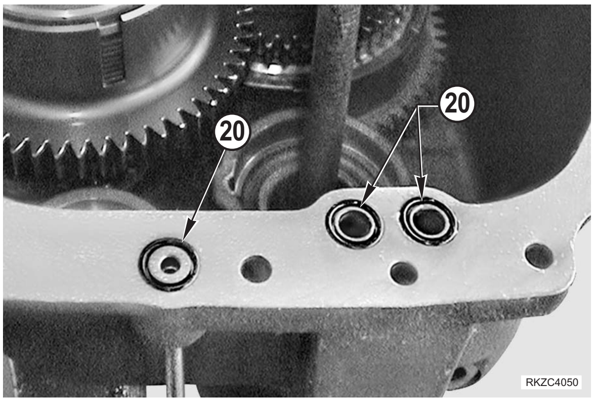
17 - Insert a lever in the special slot to detach the cover.



18 -Lift the front half housing (19) by means of two hooks.



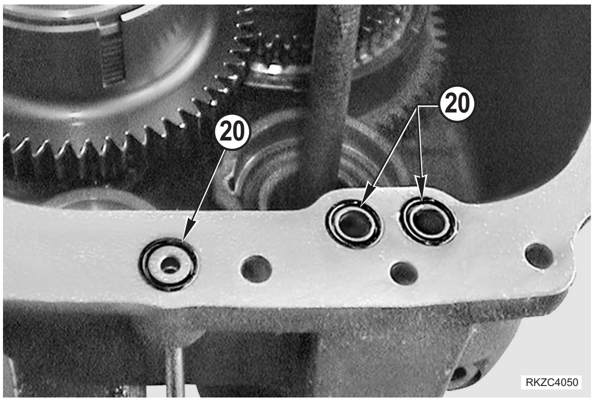
19 -Remove the three O-rings (20).



5.2 Assembly

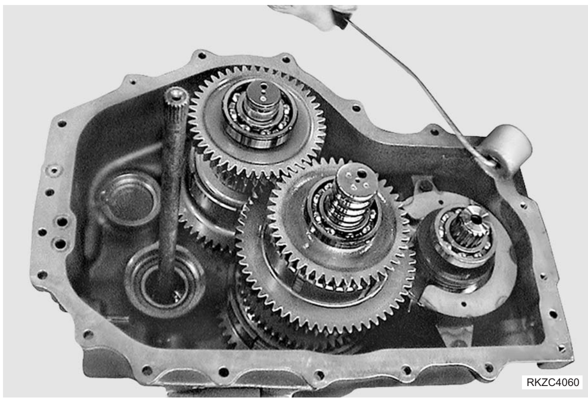
1 -Assemble three new O-rings (20) to the rear half housings (18).

★ Accurately remove from mating surfaces any residual of sealant and clean them with a detergent.

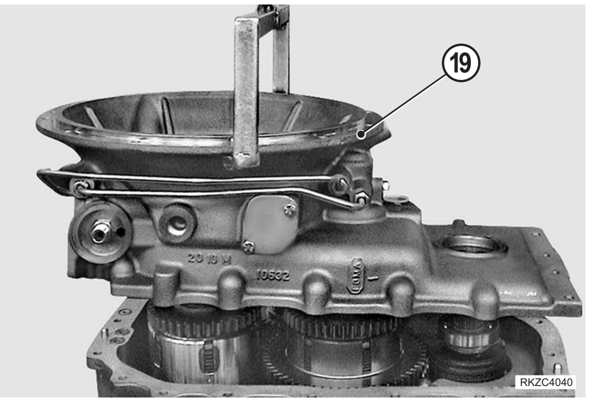


2 -Assemble all the transmission internal parts.
Apply a thin film of prescribed sealant on the edge of the rear half-housing.

Loctite 510

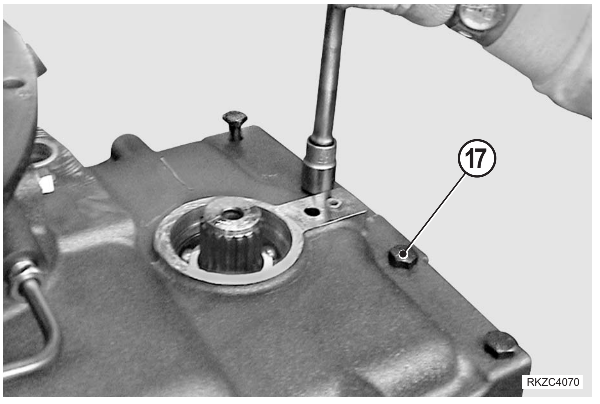


3 - Install front half housing (19) to rear half housing. Make sure that the bearings on the shafts go straight into the bores in the front half housing. Push the front half housing all the way down on the rear half housing.

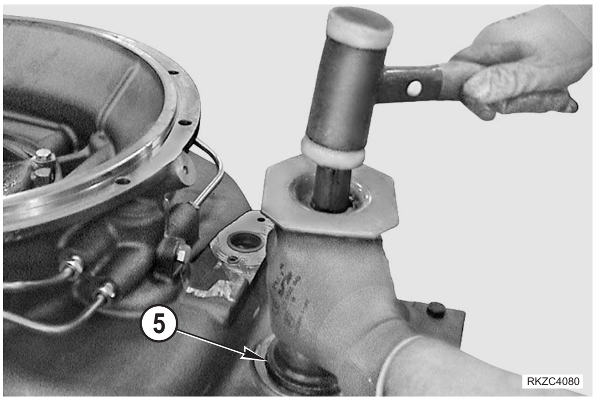


4 - Assemblare fastening bolts (17) to the rear (18) and front (19) half housings.
Tighten the bolts to the prescribed torque.

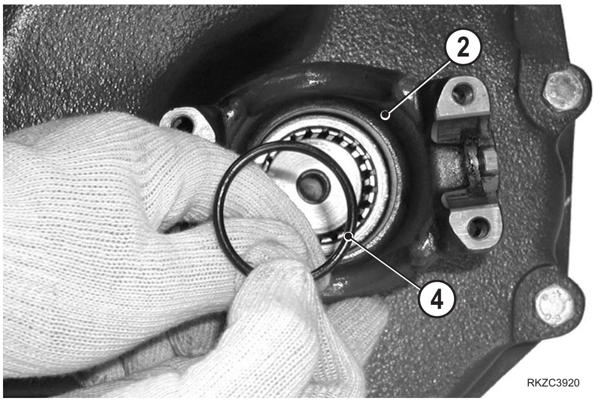
Screws: 50 Nm



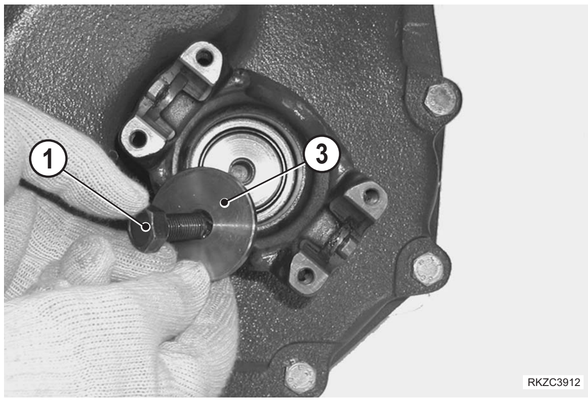
5 - Assemble seal ring (5) on front shaft output.
Use tool **F8**.



6 - Assemble flange (2) and a new O-ring (4).

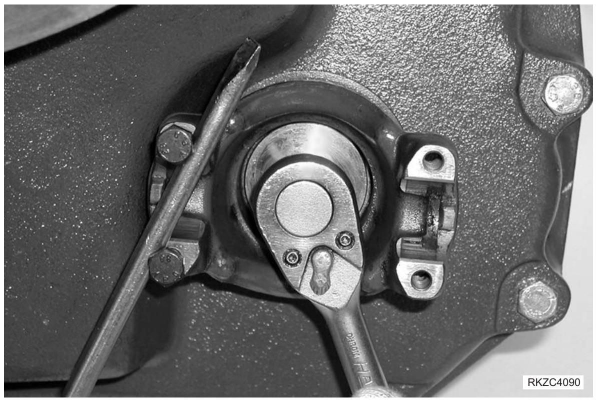


7 -Assemble the washer (3) and bolt (1).



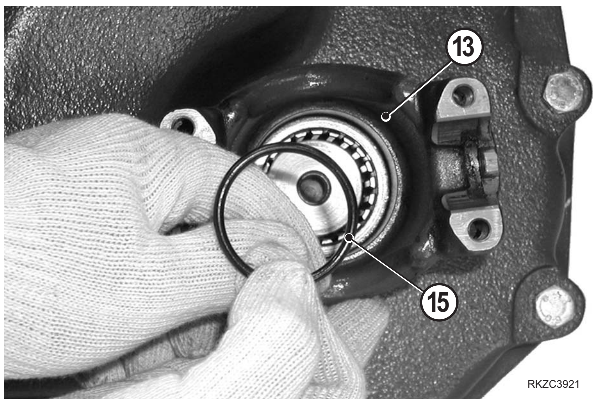
8 -Tighten the bolt (1) to the prescribed torque.
Use screwdriver and two screws to stop flange rotation.

Screws: 139 Nm

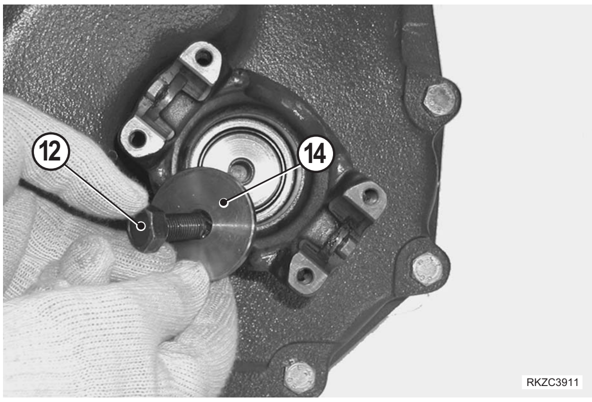


9 -Assemble seal ring (16) on rear shaft output.
Use tool **F8**.

10 -Assemble flange (13) and a new O-ring (15).

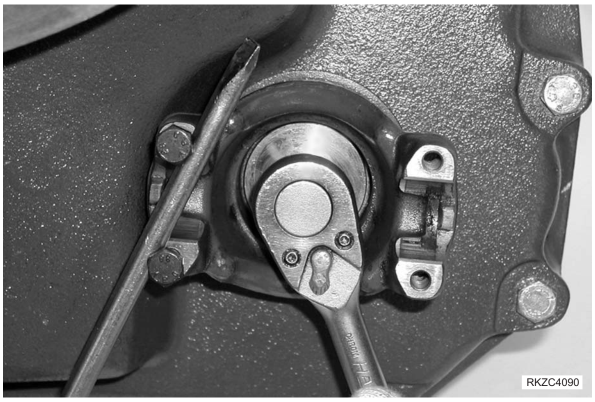


11 - Assemble the washer (14) and bolt (12).

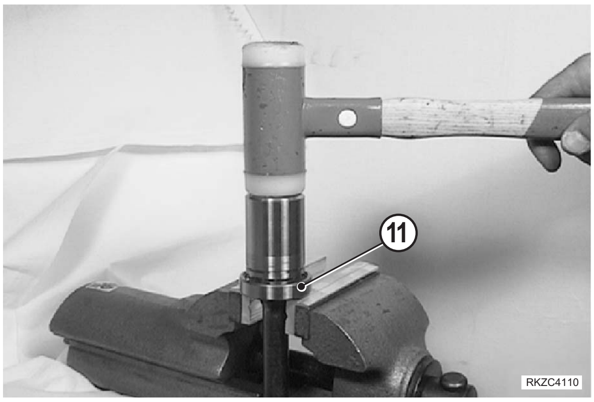


12 - Tighten the bolt (12) to the prescribed torque.
Use screwdriver and two screws to stop flange rotation.

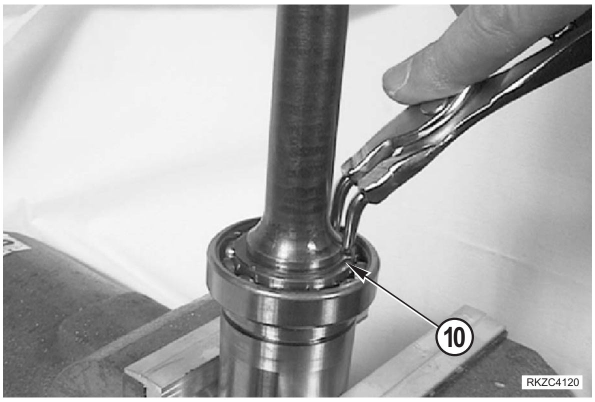
Screws: 139 Nm



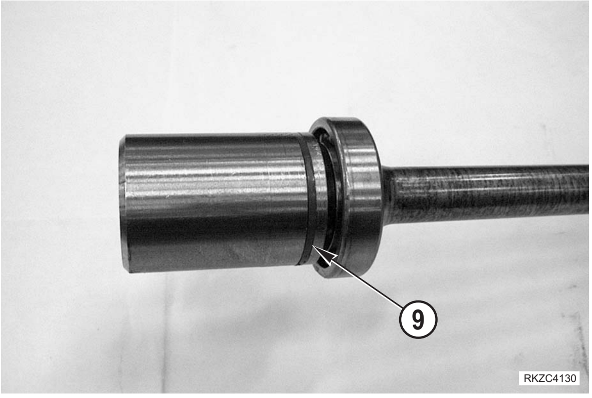
13 - Assemble bearing (11) on transmission shaft PTO (8).



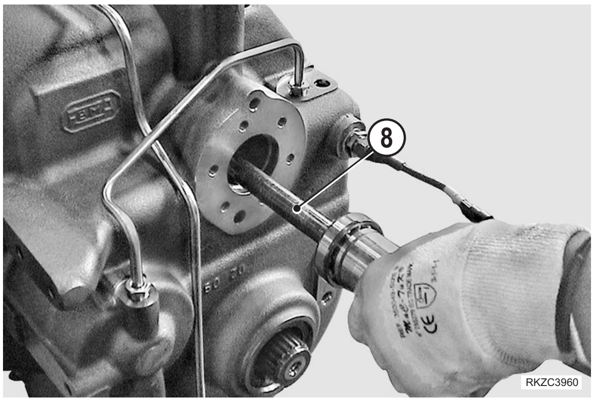
14 - Assemble snap ring (10).



15 - Install the Teflon sealing ring (9) according to steps 21 to 25 of the procedure described in paragraph "6.2 Assembly", using tools **F5 - F6 - F7.**



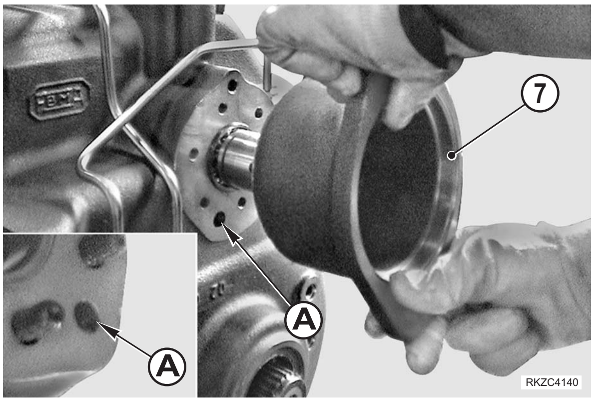
16 - Insert transmission shaft PTO (8) to the stroke.



17 - Apply a thin film of sealant to the flange (7).

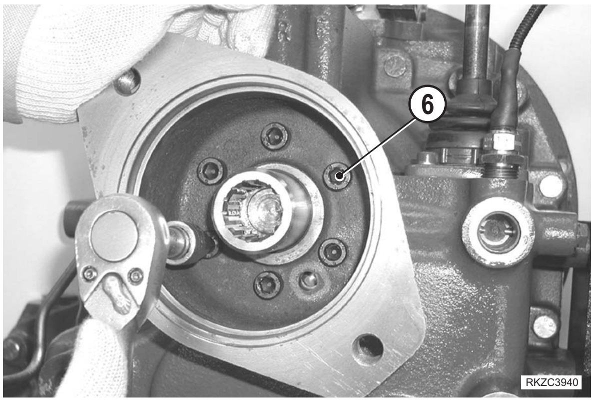
Loctite 510

★ Verify that the two holes for oil passage (A) match.



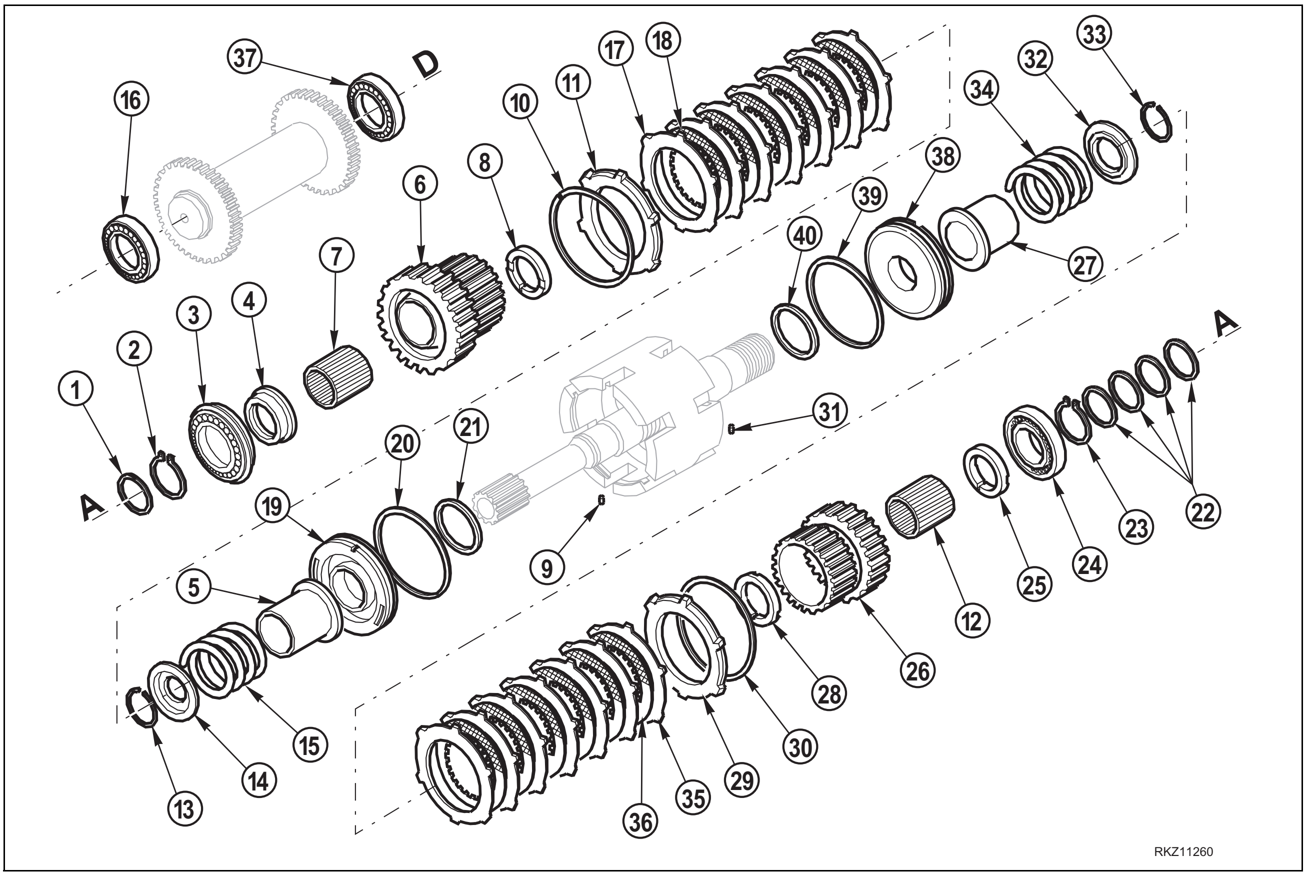
18 - Assemble the screws (6) to prescribed torque.

Screw: 50 Nm

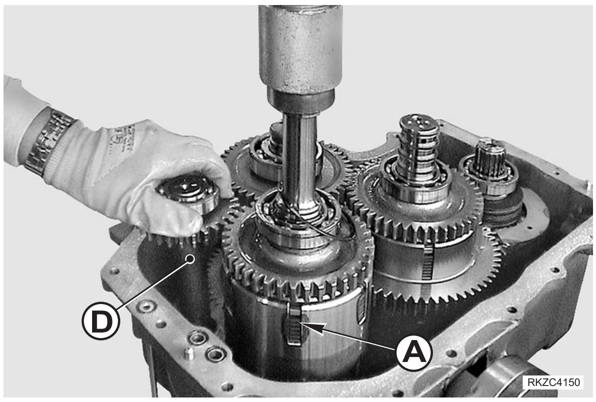


6. Shafts A - D

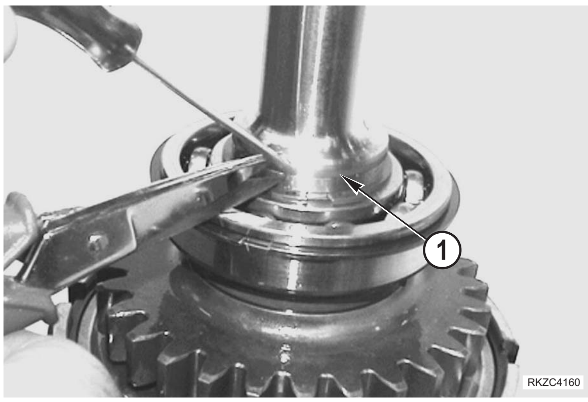
6.1 Disassembly



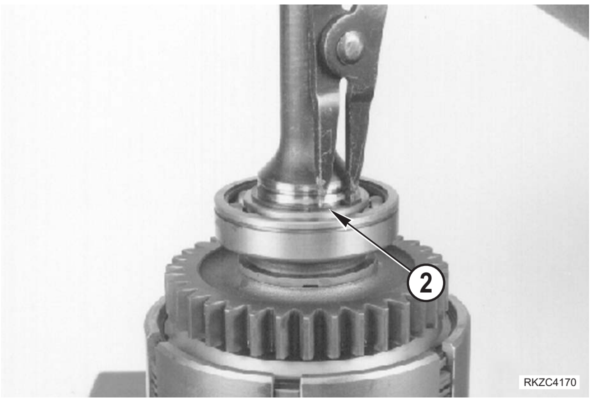
1 - Grasp with pliers the input shaft assembly **A** . Remove with shaft assembly **D** and lift.



2 - If to be replaced, remove the teflon seal ring (1).

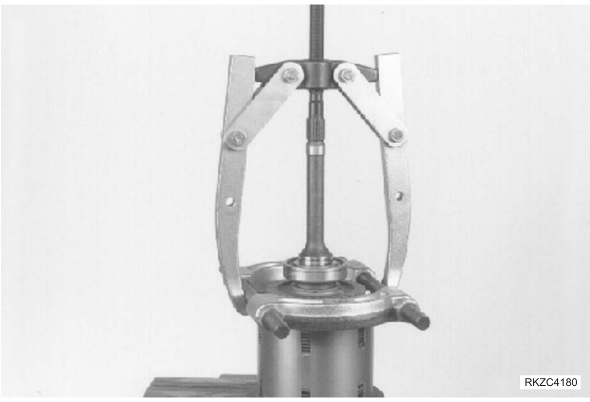


3 - Remove the snap ring (2).

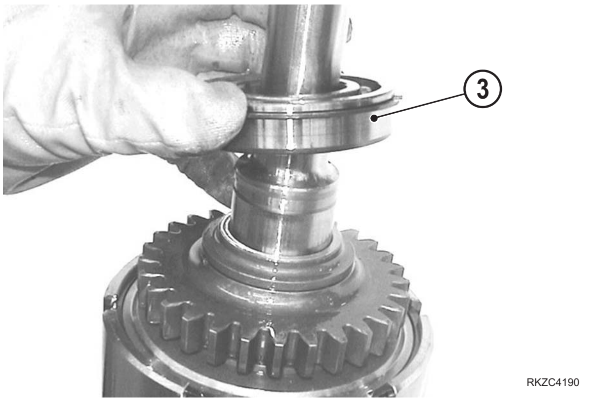


4 - Install a bearing separator under the gear.
Use a puller on the bearing separator and insert a shaft protector between the puller and the end of the input shaft.
Operate with the puller between bearing separator and shaft protector and pull only until the bearing is free.
Pulling any farther can damage the parts.

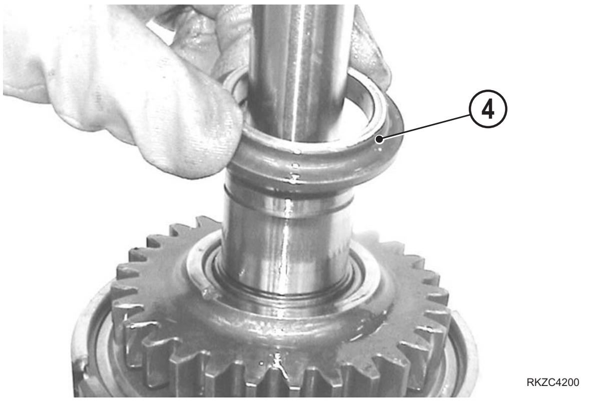
⚠ Do not install the separator between gear and bearing.



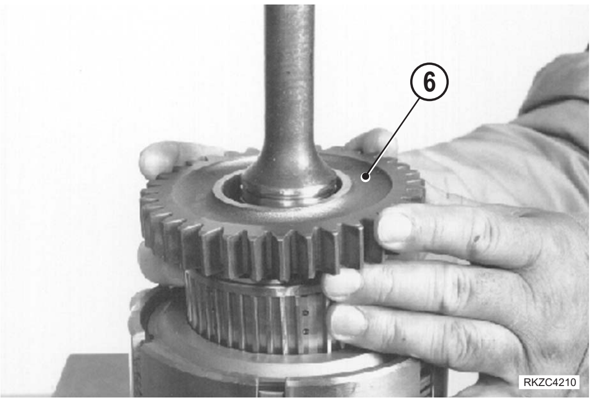
5 - Remove bearing (3).



6 - Remove spacer (4).

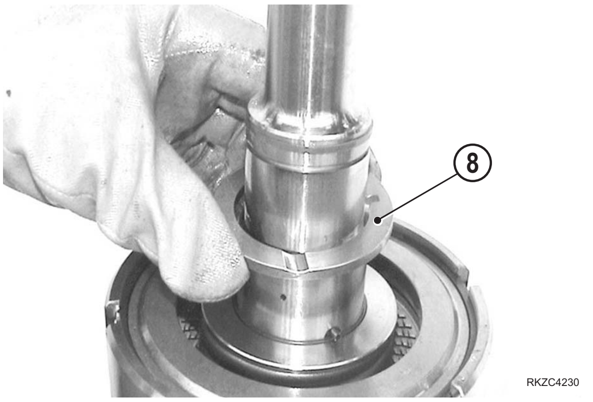


7 - Remove gear (6).

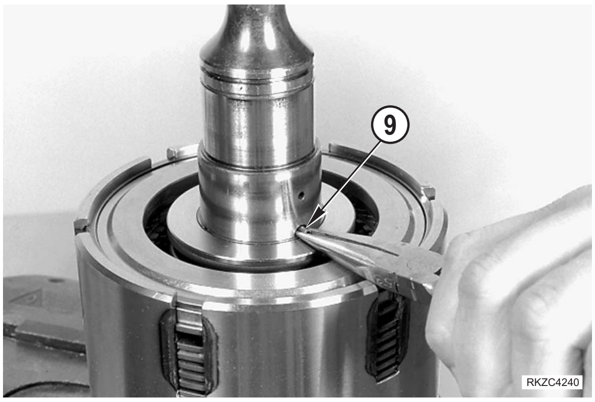


8 - Remove needle cage (7).

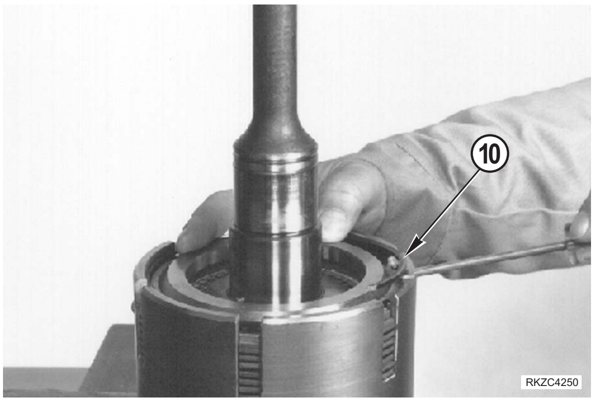
9 - Remove spacer (8).



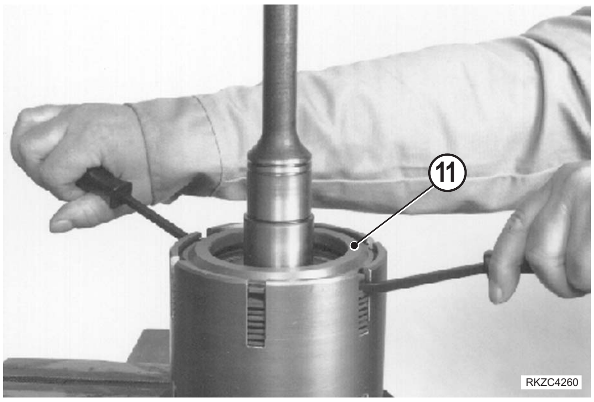
10 - Remove split pin (9).



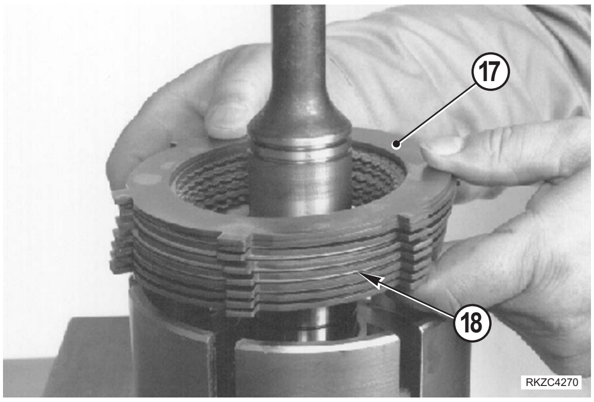
11 - Remove the snap ring (10).



12 - Use prybars to lift and to remove the thrust plate lock ring (11) evenly.

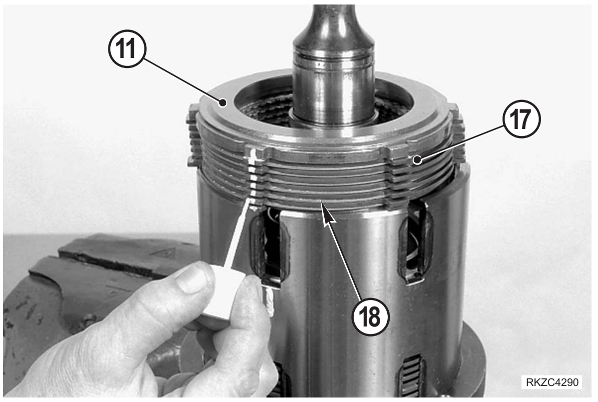


13 - Remove the clutch plates (18) and the clutch drive plates (17).

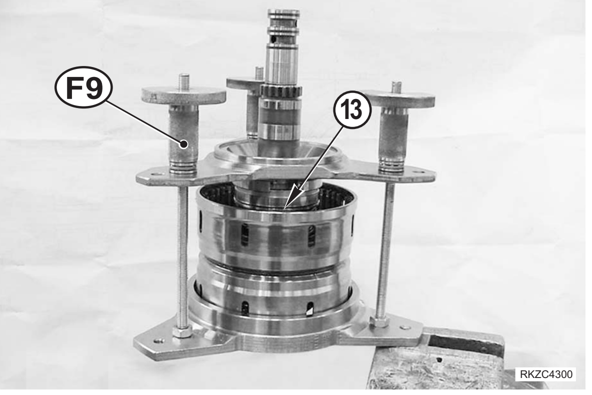


14 - Place a mark below the groove on the friction bell.

15 -Place a marks on each thrust plate lock ring (11), clutch plate (18) and clutch drive plate (17).
These marks will be used for reference during the reassembly procedure.



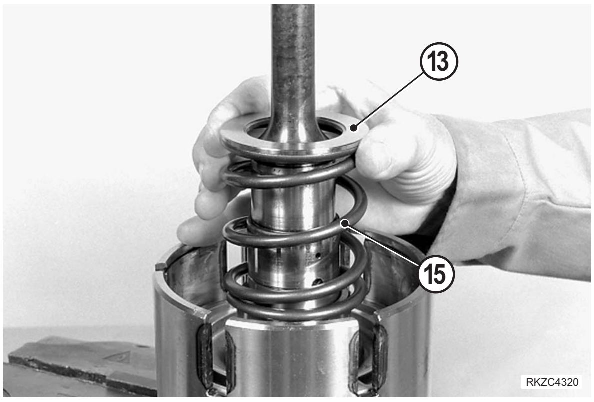
Lower the spring (15) lock washer (13).
Use tool **F9**.



17 -Remove snap ring (14).

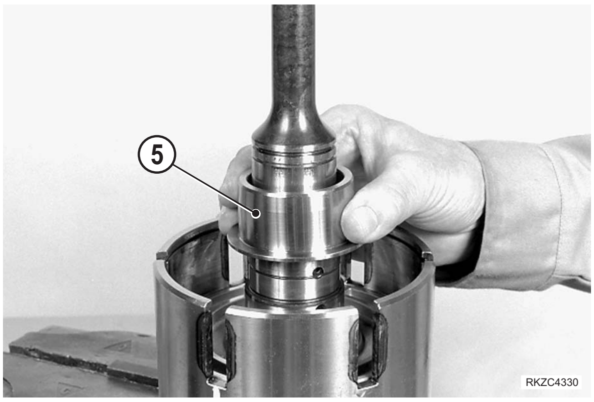
18 -Loosen the handles of the threaded rods to release the tension from the spring.
Remove the top piece of the **F9** special tool.

19 - Remove lock spring cover (13) and spring (15).



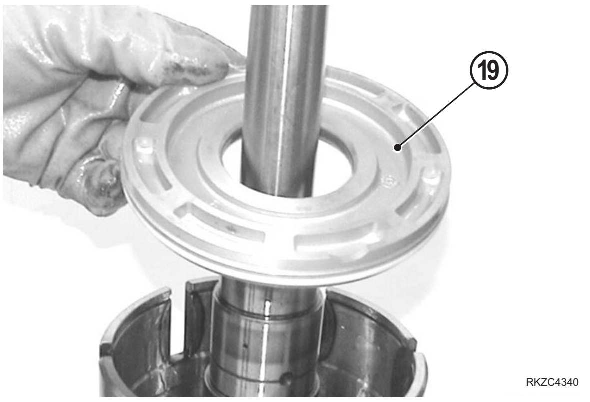
RKZC4320

20 - Remove sleeve (5).



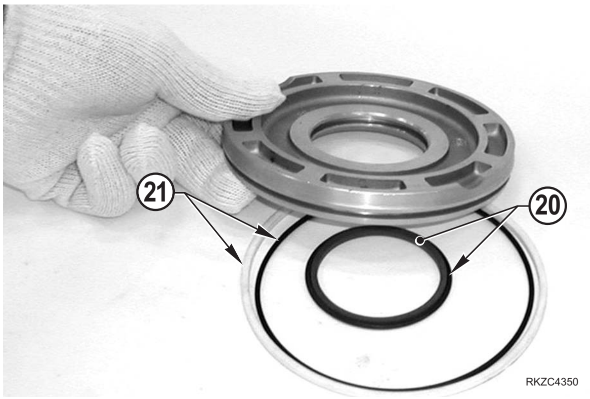
RKZC4330

21 - Remove clutch piston (19) by blowing in compressed air through the delivery hole.



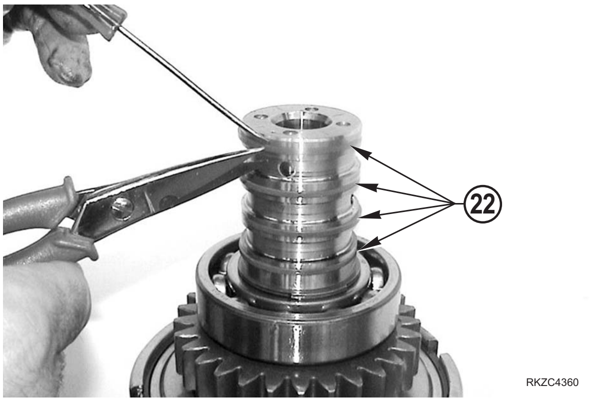
RKZC4340

22 - If to be replaced, remove teflon seal ring (20) and relevant inner O-ring (20) from outer seat of piston and teflon seal rings (21) and relevant inner O-ring (21) from inner of piston. To remove the rings it is necessary to cut them.

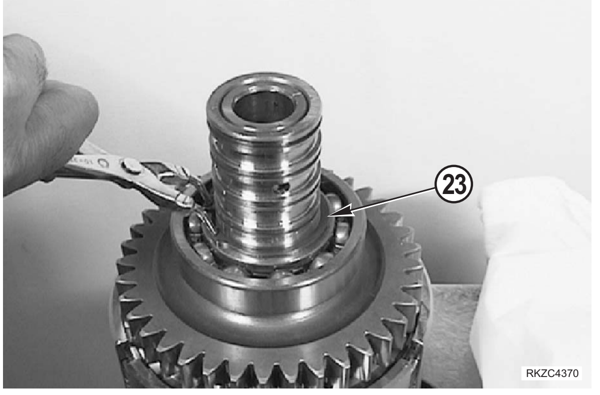


RKZC4350

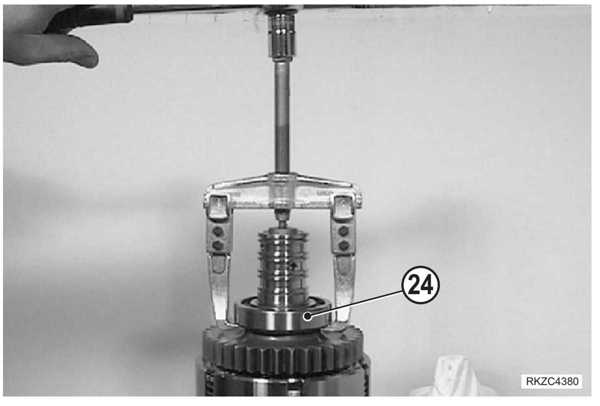
23 - Turn the shaft.
If Teflon seal rings (22) are to be replaced, remove the rings by cutting them.



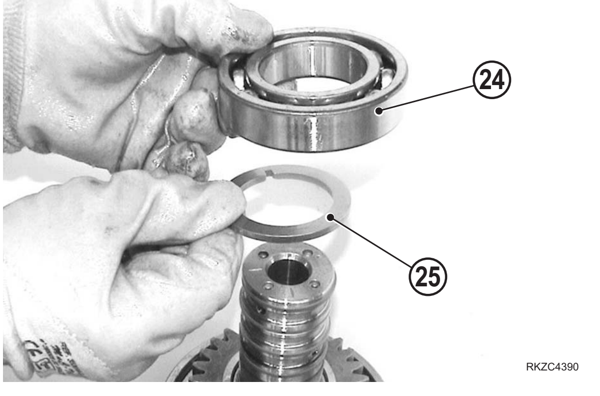
24 - Remove snap ring (23).



25 - Remove bearing (24) by means of an extractor.



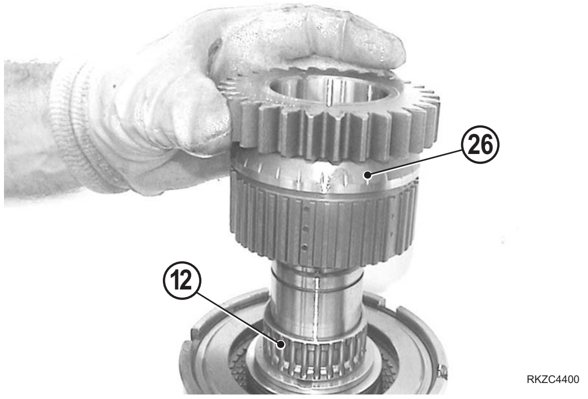
26 - Remove bearing (24) and thrust washer (25).



27 -Remove gear (26) and needle cage (12).

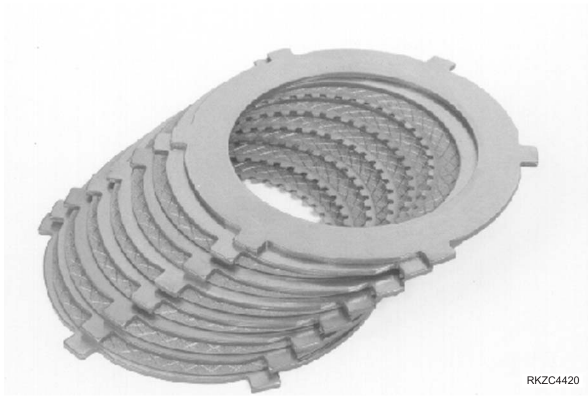
28 -Repeat steps 9 to 22 in this section to disinstall the other components.

29 -Check:
- the sealing ring grooves (large and small) for wear and damage if necessary.
- on the output shaft for wear and damage.
- oil passages in the output shaft to be sure that the passages are open and free of foreign material.
- ball bearings and roller bearings for smooth areas, pits or other damage.
Use new parts as required.



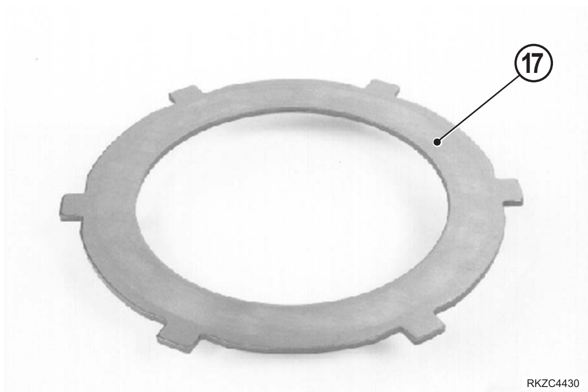
30 -If the clutch discs are to be used again, keep the clutch packs in the same previous assembly order separate and record which clutch pack goes with each clutch.

31 -At each disassembly, use a gauge bar to check that total thickness of clutch unit is within the permissible wear limit. If it is not, replace the clutch unit (18) with a new one.
Check all clutch plates for burns and inspect the friction material for damage. Inspect the grooves in the friction material for being well traced.
Verify also that all the clutch drive plates (17) are perfectly plane and inspect for pitting or scoring.
In the case that at least one of the above problems occurs, replace the complete clutch kit with a new one. If using a new clutch kit soak the clutch plates in clean transmission oil for at least an hour before assembly.
Lubricate the contact surfaces of clutch drive plates with clean transmission oil before assembly.

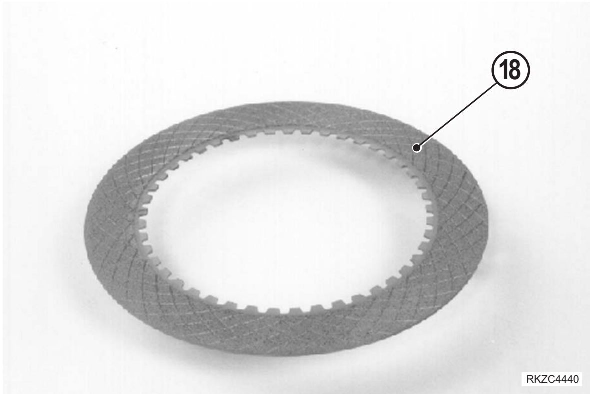


Number of clutch plates (each side)	6
Number clutch steel plate (each side)	6
Nominal clutch plate thickness	2.40±0.05 mm
Nominal clutch kit thickness	* 29.0–29.2 mm
Maximum clutch plate wear (each side)	0.25 mm
Maximum clutch kit wear	1.5 mm

* Under load of 163 kg

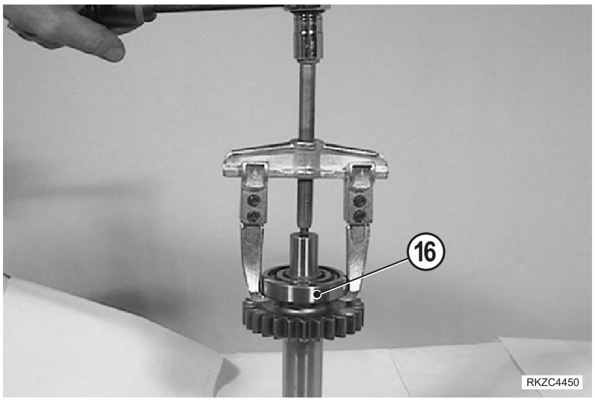


32 - Inspect the bore of the shaft in the input shaft housing for damage that will cause leakage when the clucth is assembled.
Check the slots in the side of the input shaft housing for damage from the tangs on the steel discs.
Use new parts as required during assembly.

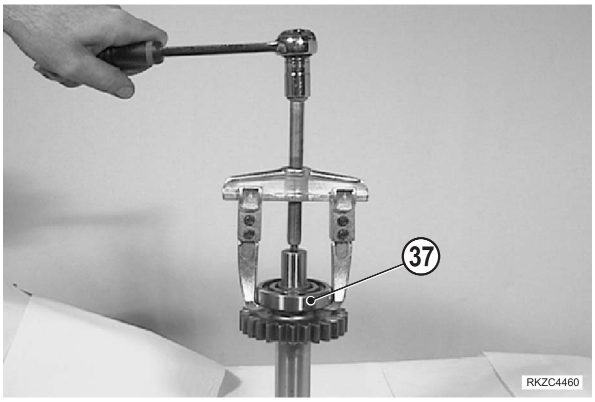


SHAFT D

1 - Remove bearing (16) of shaft **D** by means of an extractor.



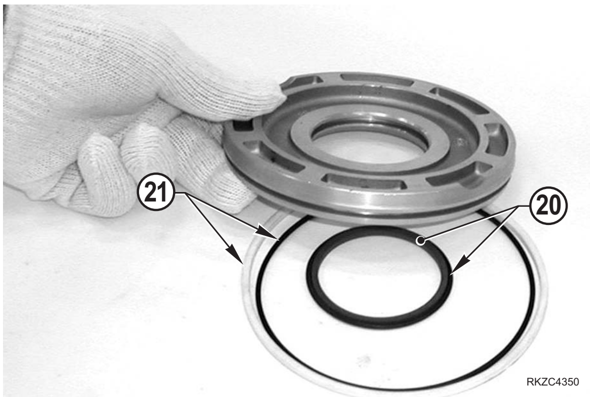
2 - Remove bearing (37) of shaft **D** by means of an extractor.



6.2 Assembly

SHAFT A

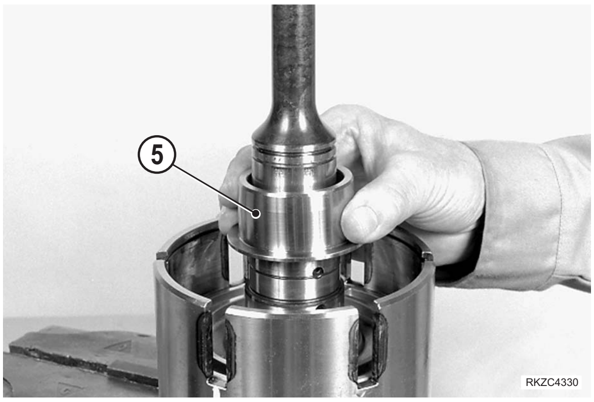
1 - Assemble new teflon ring (20) and relevant inner O-rings (20),new teflon ring (21) and relevant inner O-rings (21) respectively into the piston outer and inner seats.



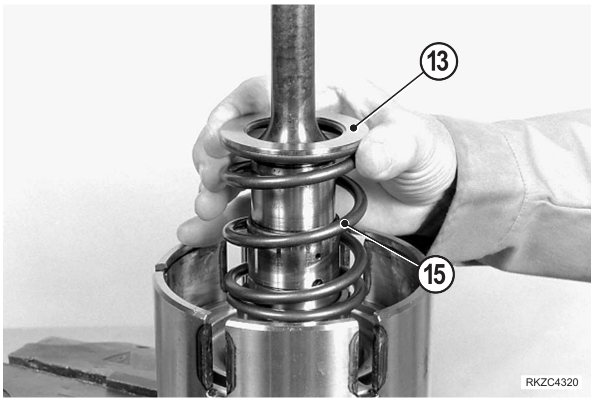
2 - Apply a thin film of grease on the sealing rings just inserted.

3 - Insert clutch piston (19) with special tool **F10** as protection of seal rings (21).

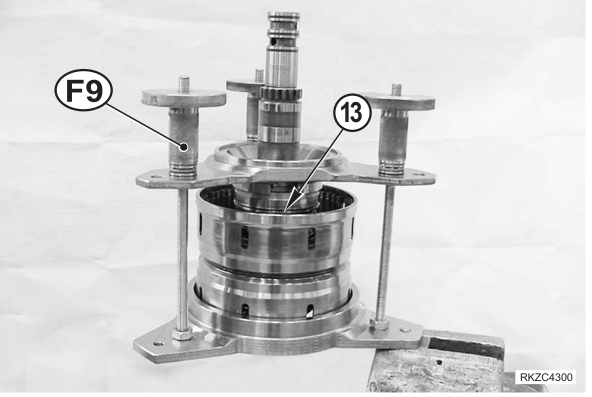
4 - Assemble sleeve (5).



5 - Assemble spring (15) and washer (13).



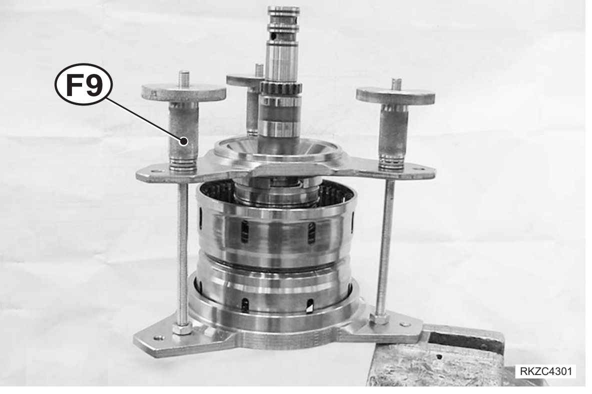
6 - Lower the spring (15) lock washer (13).
Use tool **F9**.



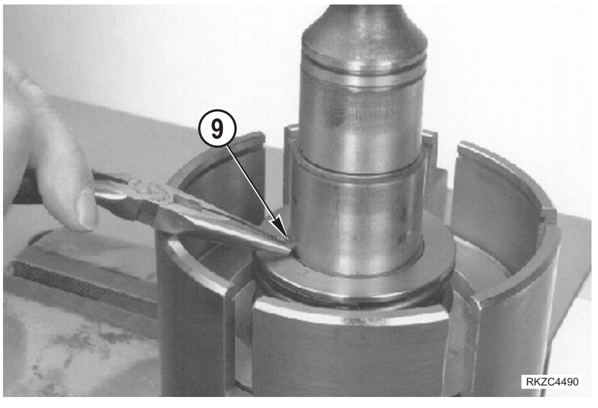
7 - Insert snap ring (14).

★ Ensure that the snap ring (14) is well fitted.

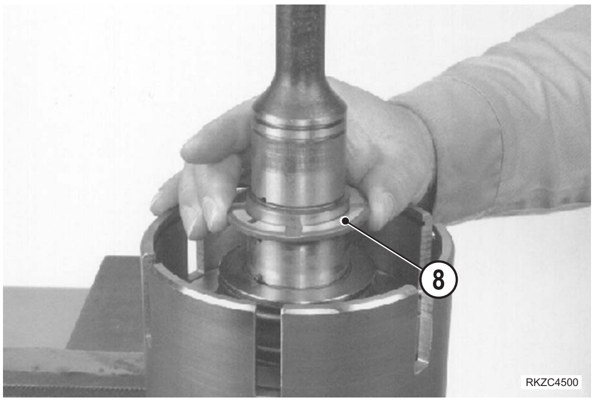
8 - Loosen the handles of the threaded rods to release the tension from the spring.
Remove the top piece of the **F9** special tool.



9 - Remove tool **F9** and assemble split pin (9).

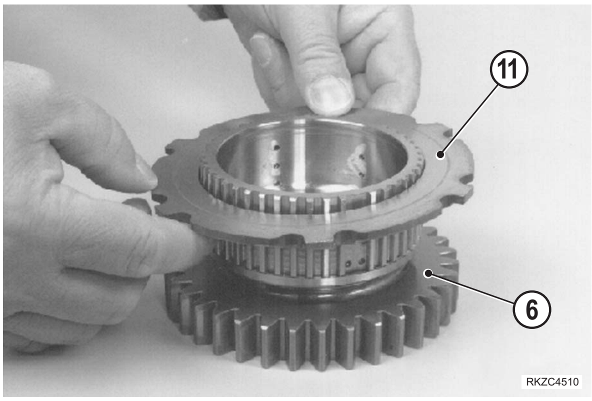


10 - Insert thrust washer (8)

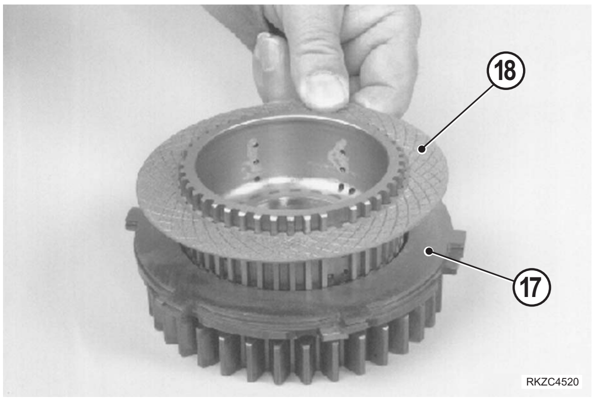


11 - Insert needle cage (7).

12 - To assemble the clutch pack start with the gear (6) on the bench.
Install the thrust plate (11) so that the reference mark on top of the plate made during disassembly is facing towards the gear.

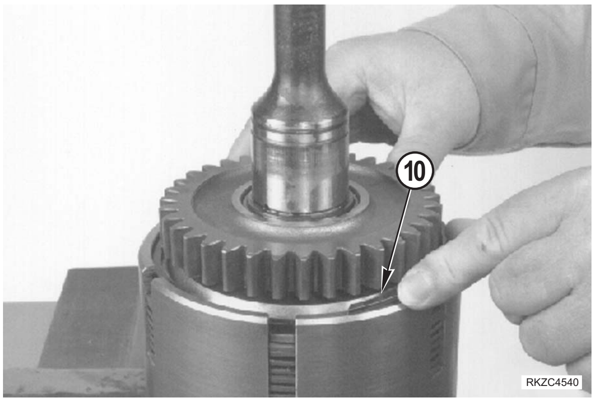


13 - Assemble clutch plates (18) and clutch drive plates (17) on the gear (6).
The assembled clutch pack must contain seven clutch drive plates and six clutch plates.

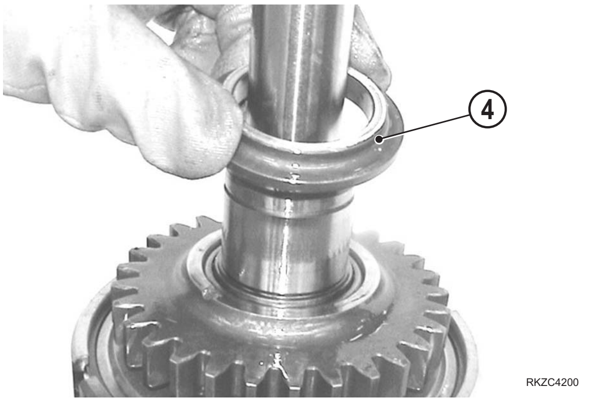


14 - Locate the pack assembly by means of two screwdrivers.

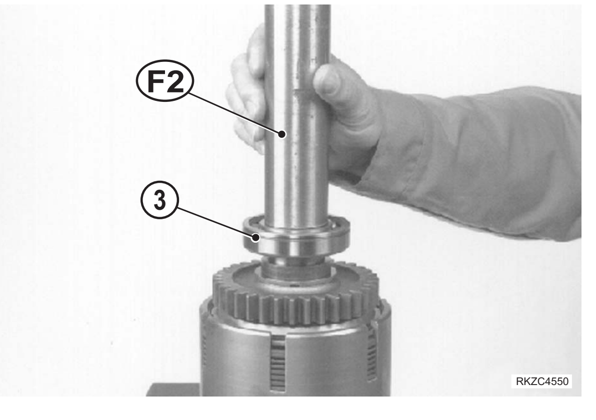
15 - Assemble snap ring (10).



16 - Assemble washer (4).

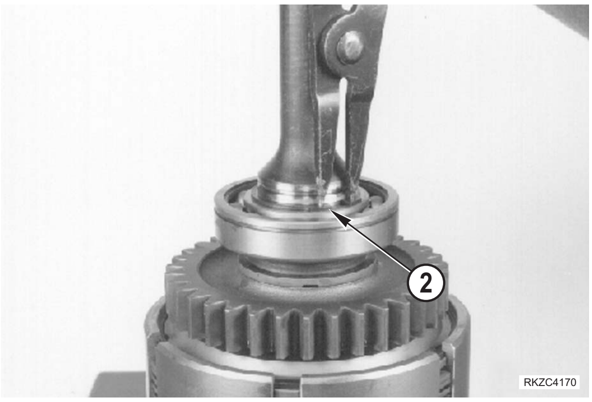


17 - Heat the bearing (3) to 80÷100 °C (176° to 212 °F).
Assemble bearing (3).
Use tool **F2**.

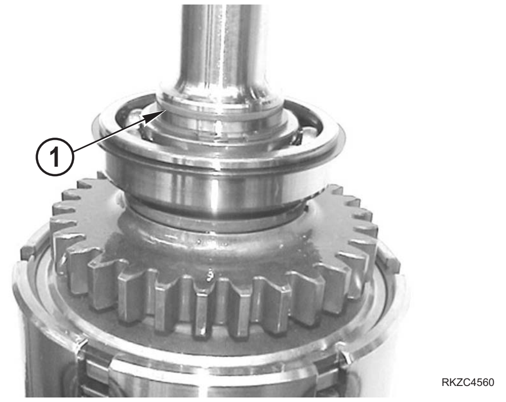


18 - Install the snap ring (2).

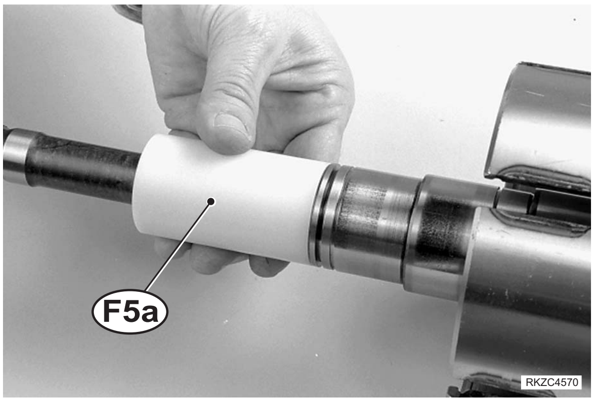
NOTA .
For clarity of the Teflon sealing ring installation procedure the following photos do not show the clutch pack, gear, spacer, bearing, and snap ring installed on the input shaft.



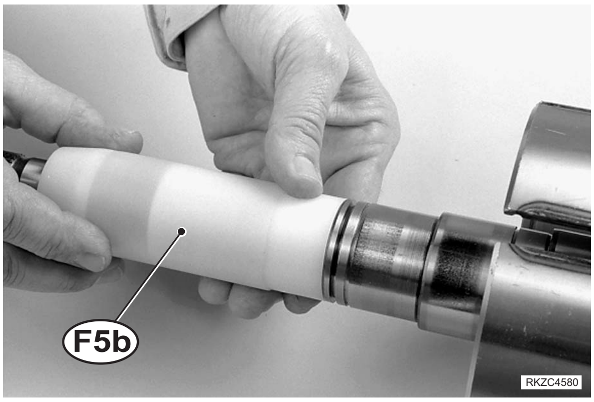
19 - Insert the teflon seal ring (1) as follows.



20 - Install the **F5a** spacer onto the input shaft with the chamfered end facing in.



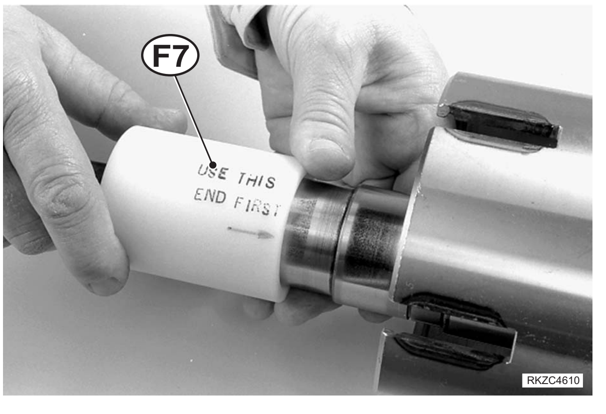
21 - Slide the **F5b** expander/protector onto the input shaft and on the spacer.
The expander/protector will stop in the correct position to install the seal ring in the groove.



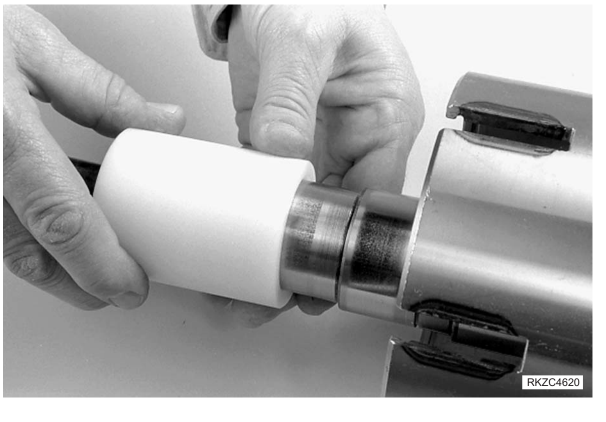
22 - Heat the Teflon seal ring to 60°-80°C (140°-176° F) for 5 minutes.
Install the teflon seal ring onto the expander/protector.

23 - Install the **F6** pusher over the expander/protector and slide the seal ring until it reaches the groove in the shaft. Remove the pusher, expander/protector, and spacer from the shaft.

24 - Install the end of the **F7** seal compressor with the deep chamfer onto the shaft and over the sealing ring.
Use a back and forth twisting motion to allow the seal compressor to slip over the top of the sealing ring and seat the sealing ring into the groove. Be careful not to damage the seal ring. After the sealing ring is seated in the groove, remove the seal compressor from the shaft.



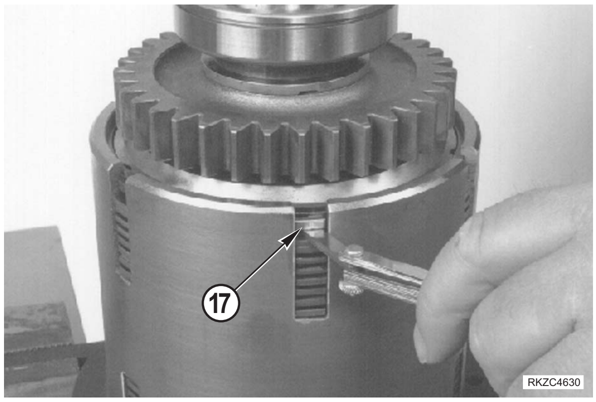
25 - Turn the seal compressor around and slide the end with the narrow chamfer over the shaft and over the seal ring. Leave the seal compressor in place for 15 minutes until the sealing ring has cooled and is properly sized and seated in the groove. After the seal ring has cooled, remove the seal compressor from the shaft.



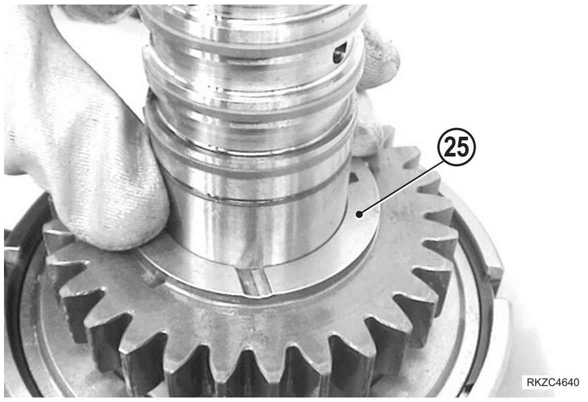
26 - Measure the clutch discs clearance for each clutch assembly.
The thrust plate lock ring must be all the way up against the lock ring.
Use a feeler gauge to measure the distance between the thrust plate lock ring and the first clutch drive plate (17).

★ Distance: 1.60–2.45 mm.

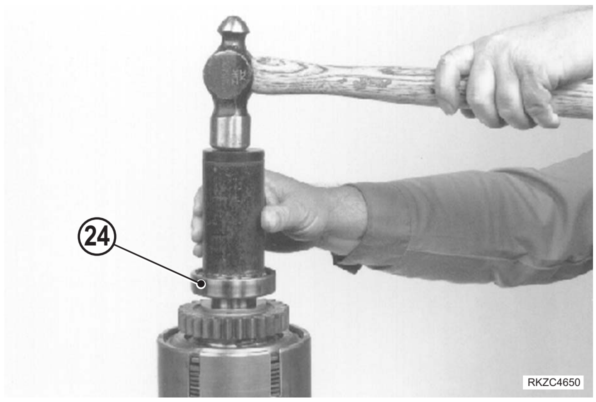
★ If the distance is not within specification, the clutch is probably assembled wrong.



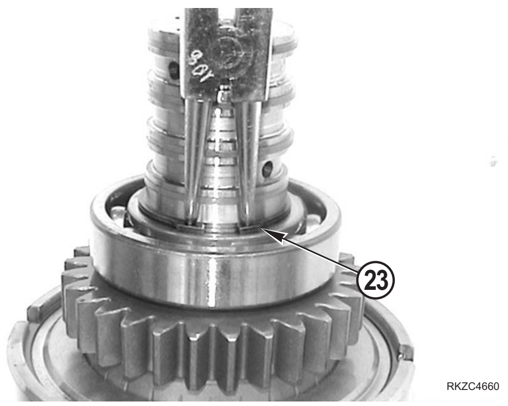
27 - Turn shaft upside down and carry out steps from 1 to 15 in this section .
Lubricate the washer (25) with transmission oil.
Install the thrust washer ensuring that the notch on the inner edge goes onto the pin.
Make sure that the side with the holes in it for oil passage is at the bottom.



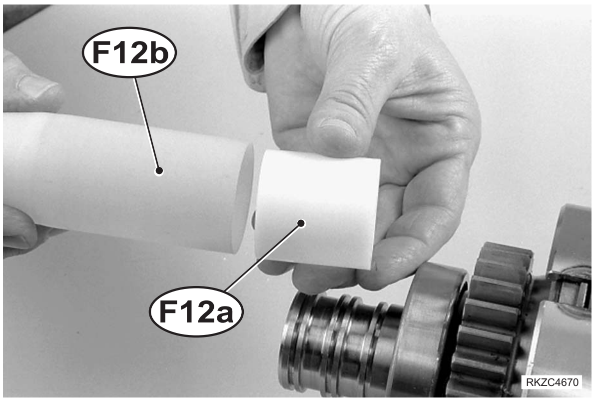
27 - Heat the bearing (24) to 80÷100 °C (176° to 212 °F)
Use driver **F11** to drive the bearing (24) onto the input shaft until the bearing makes contact with the thrust washer.



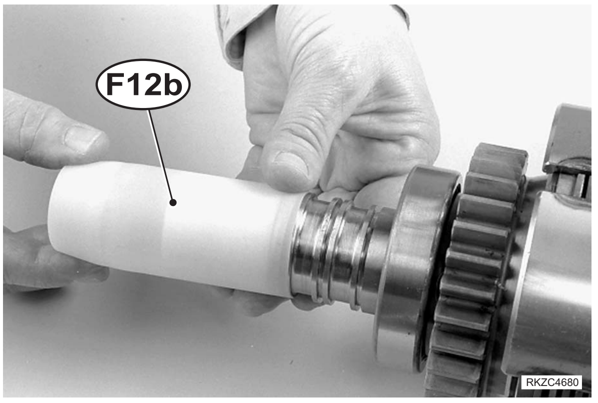
28 - Assemble snap ring (23).



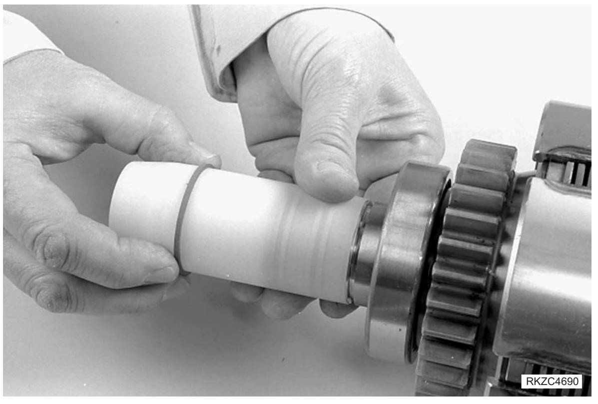
29 - Assemble the teflon seal rings (22) as follows: place the **F12a** spacer into the **F12b** expander/protector.



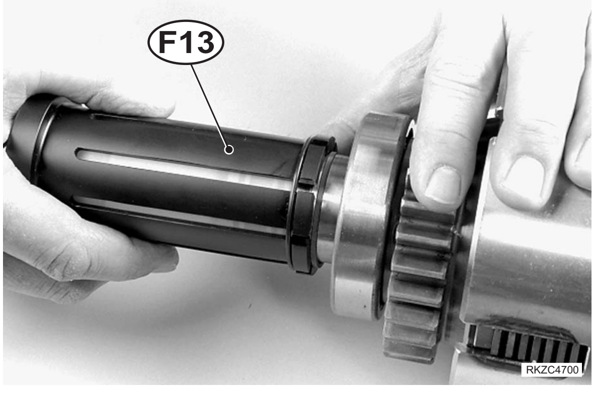
30 - Slide the **F12** expander/protector and the spacer onto the shaft.
The expander/protector will stop in the correct position to install the seal ring in the groove.



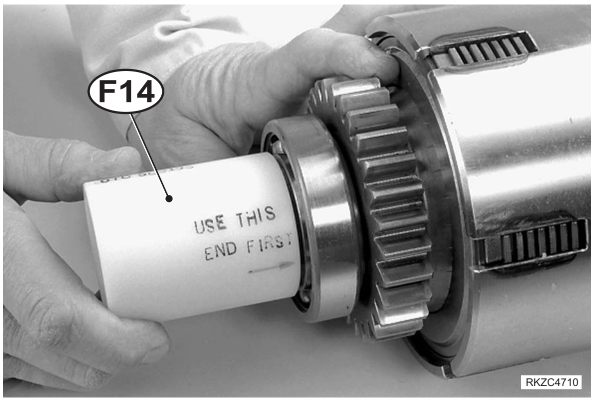
31 - Heat the Teflon seal ring to 60°-80°C (140°-176° F) for 5 minutes.
Install the teflon seal ring onto the expander/protector.



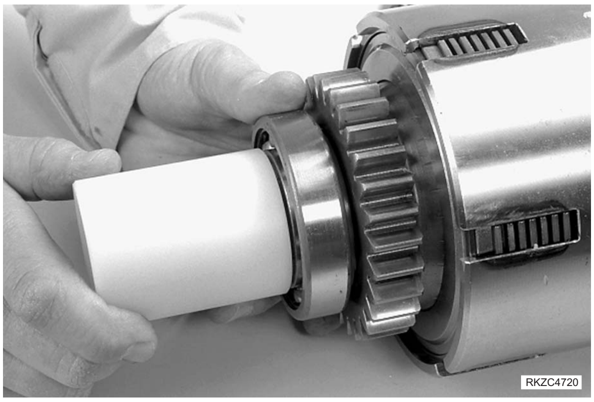
32 - Install the **F13** pusher over the expander/protector and slide the seal ring until it reaches the groove in the shaft.
Remove the pusher, expander/protector, and spacer from the shaft.

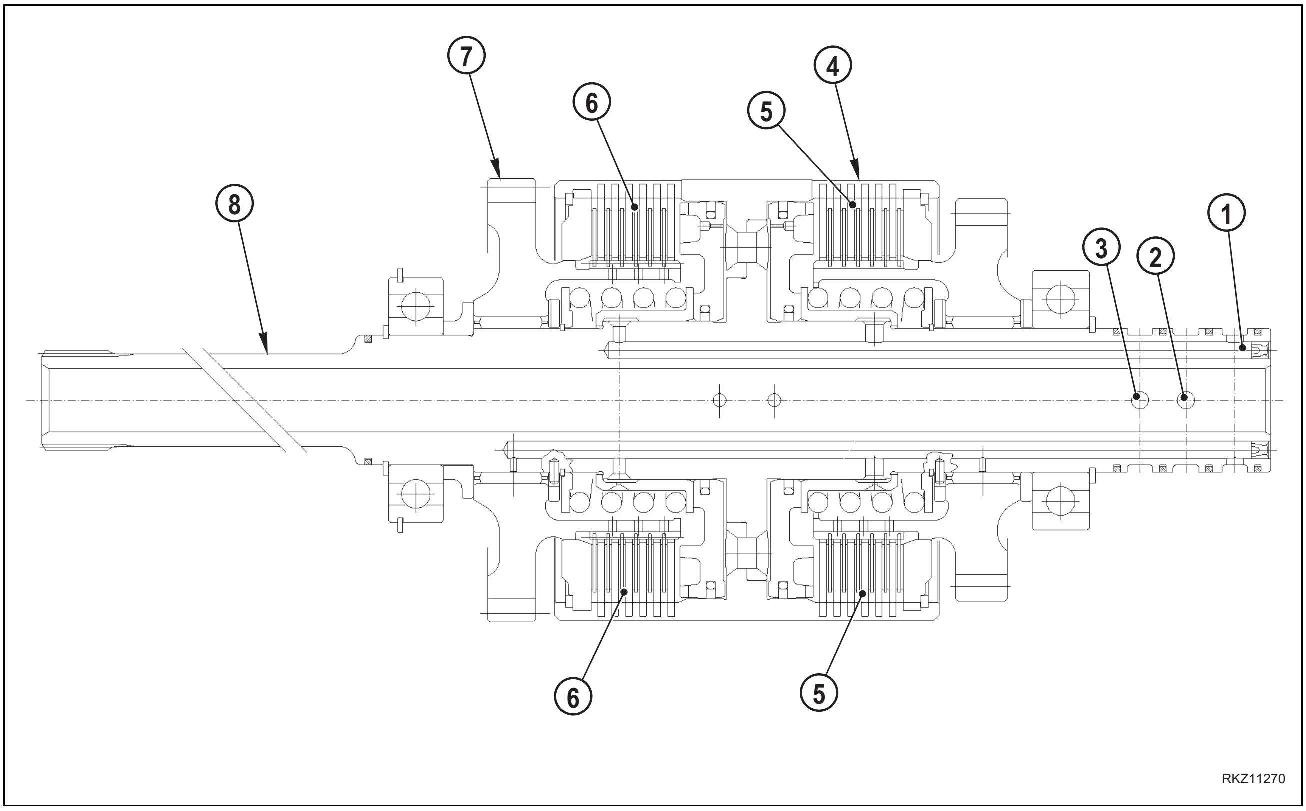


33 - Install the end of the **F14** seal compressor with the deep chamfer onto the shaft and over the sealing ring.
Use a back and forth twisting motion to allow the seal compressor to slip over the top of the sealing ring and seat the sealing ring into the groove. Be careful not to damage the seal ring. After the sealing ring is seated in the groove, remove the seal compressor from the shaft.



34 - Turn the seal compressor around and slide the end with the narrow chamfer over the shaft and over the seal ring.
Leave the seal compressor in place for 15 minutes until the sealing ring has cooled and is properly sized and seated in the groove. Once the sealing ring has cooled, remove the seal compressor from the shaft.
To install the three Teflon rings remaining, carry out steps 29 to 33 in this section using the other spacers of tool **F12**.





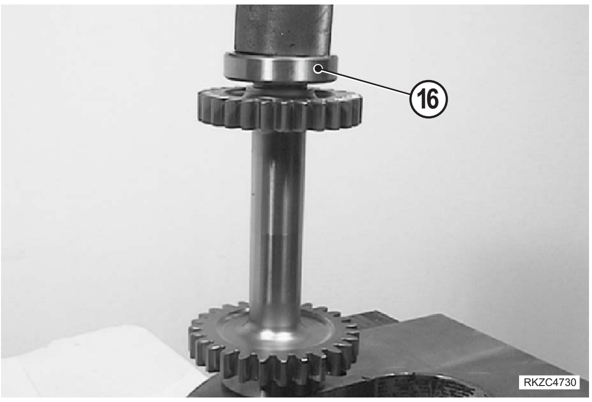
1. Lubrication oil passage
2. Forward clutch oil passage
3. Reverse clutch oil passage
4. Forward gear
5. Forward clutch pack
6. Reverse clutch pack
7. Reverse gear
8. Input shaft

36 - Apply compressed air at about 6 bar for forward gear clutch passage.
Feel the forward gear piston move to lock its respective clutch pack. Try to move the forward gear. The forward gear must not turn on the input shaft. Try to move the reverse gear. The reverse gear must turn freely on the input shaft. If the clutches do not work correctly, disassemble the clutches to find the problem.

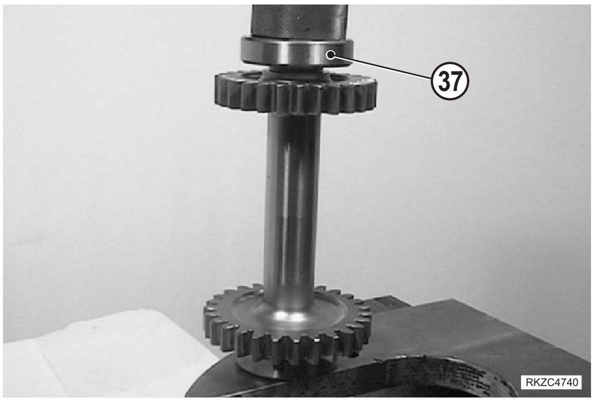
37 - Apply compressed air at about 6 bar for reverse gear clutch passage.
Feel the reverse gear piston move to lock its respective clutch pack. Try to move the reverse gear. The forward gear must not turn on the input shaft. Try to move the forward gear. The reverse gear must turn freely on the input shaft. If the clutches do not work correctly, disassemble the clutches to find the problem.

SHAFT D

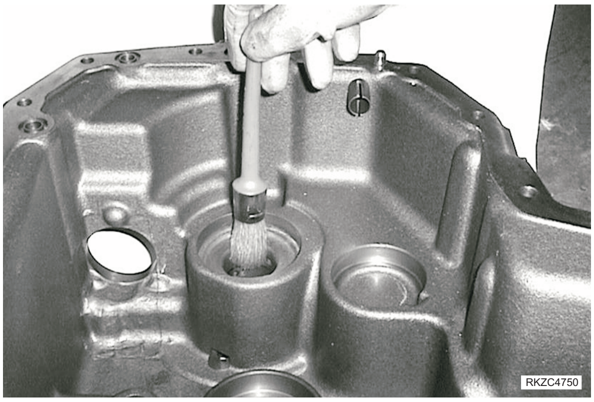
38 -Assemble **D** shaft bearing (16).
Use tool **F3**.



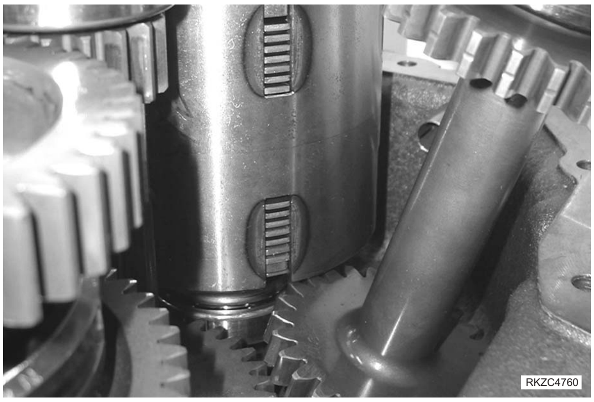
39 -Assemble **D** shaft bearing (37).
Use tool **F3**.



40 -Lubricate with oil the shaft seat A.**A**.

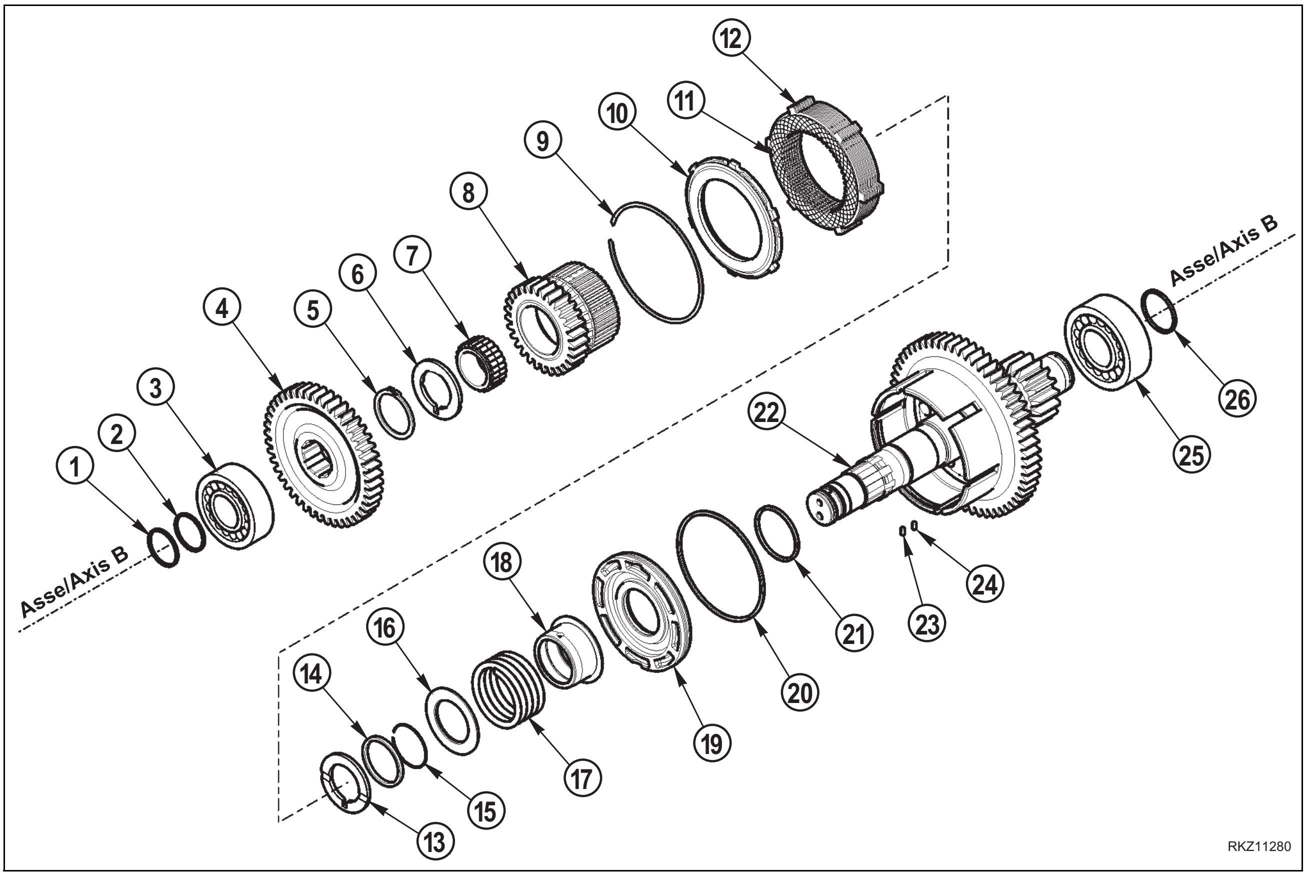


41 -Fit shaft assembly **D** and shaft assembly **A**.
The operation is correct only if the two shafts are fitted at the same time.

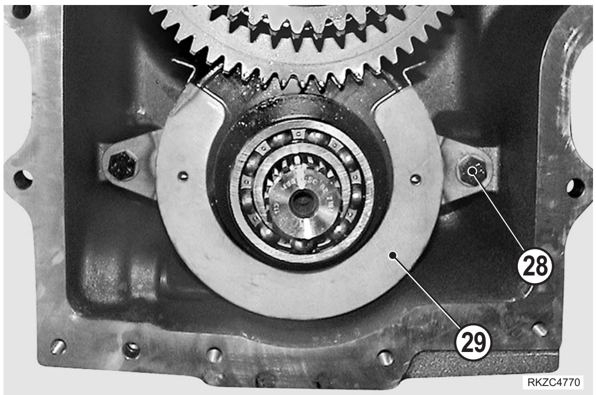


7. AXIS B

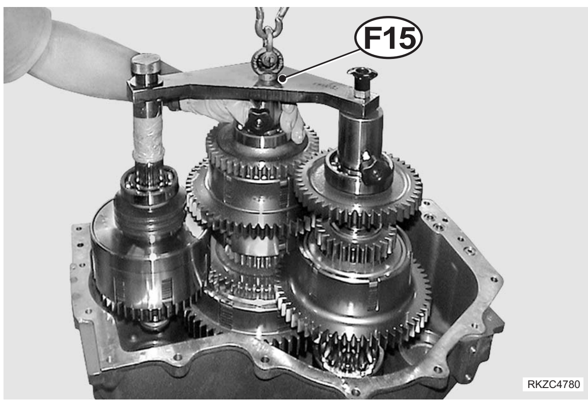
7.1 Disassembly



1 -Remove screws (28) and protection (29).

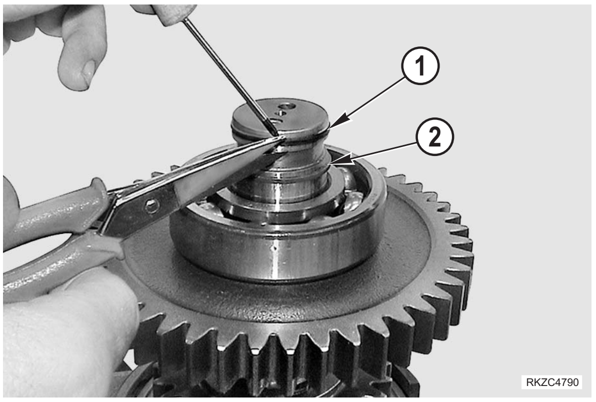


2 -Lift the three shafts B-C-E, at the same time **B-C-E**.
Use tool **F15**.

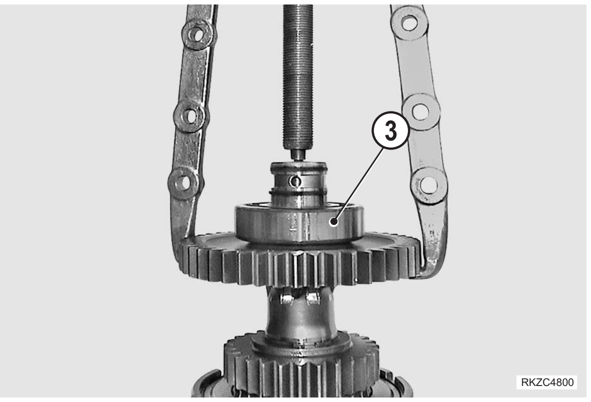


3 -Remove seals (1) and (2).

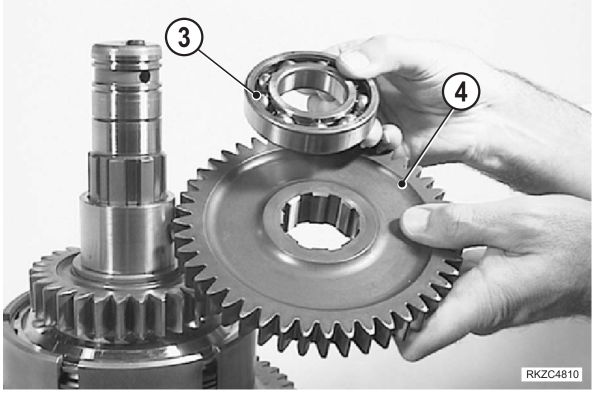
★ This is a destructive operation for the seal rings.



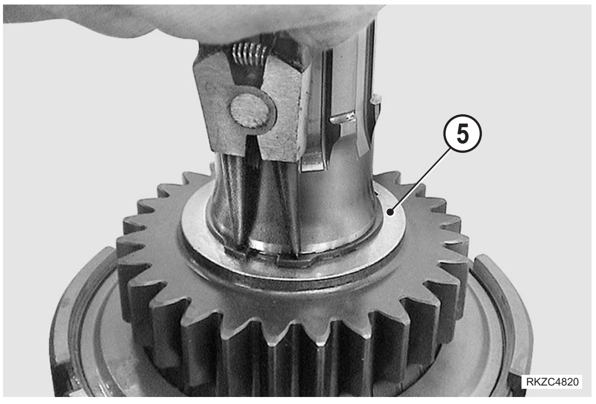
4 -By means of an extractor remove bearing (3) and gear (4).



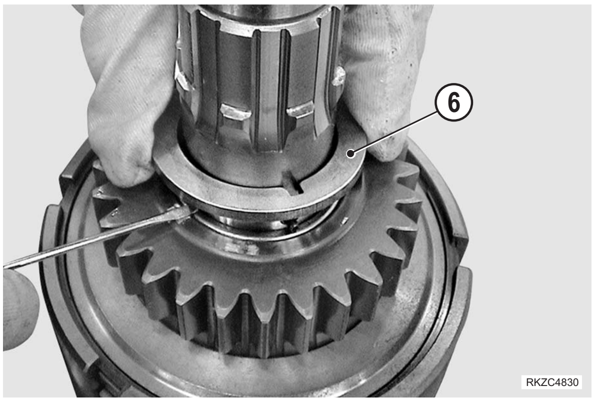
5 -Remove The bearing (3) and the gear (4).



6 -Remove snap ring (5).

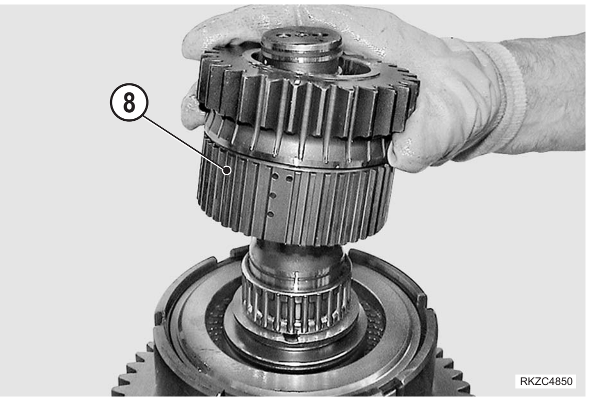


7 - Remove spacer (6).

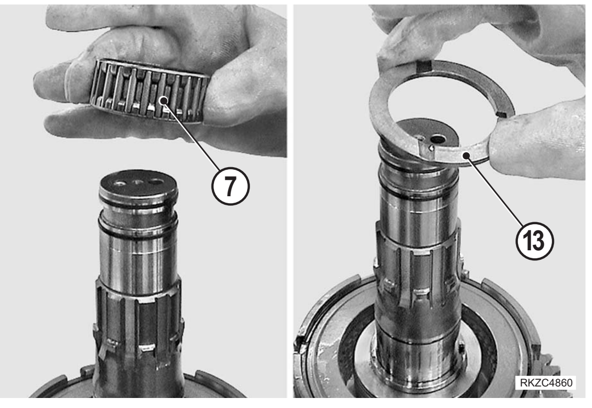


8 - Remove the spring pin (23).

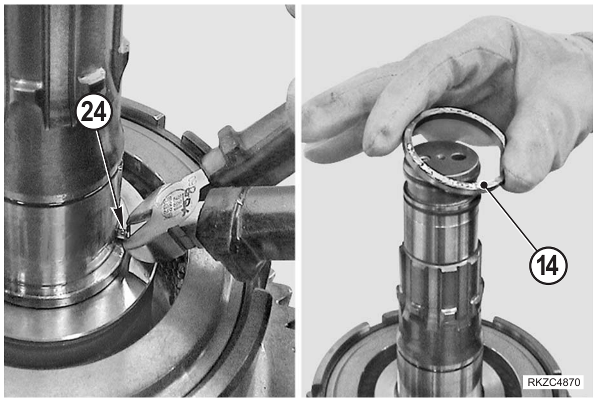
9 - Remove gear (8).



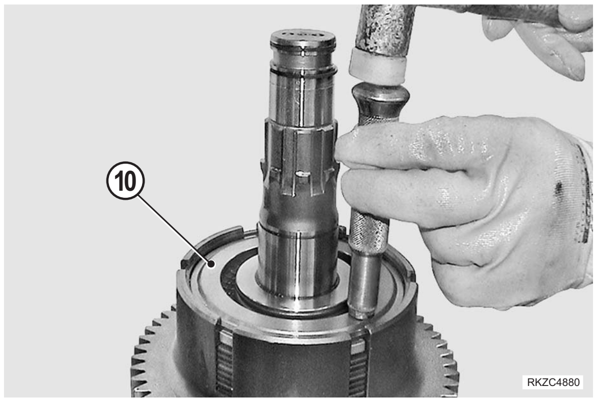
10 - Remove roller retainers (7) and washer (13).



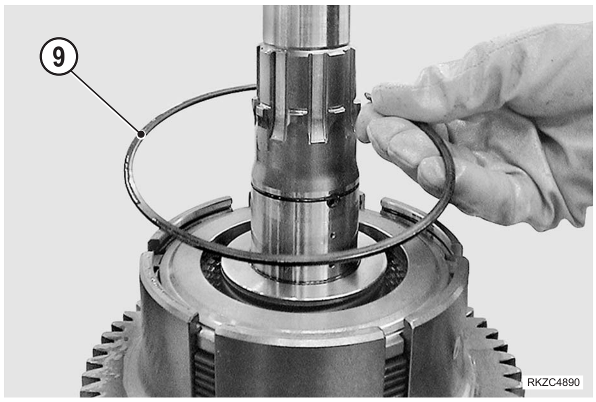
11 - Remove spring pin (24) and spacer (14).



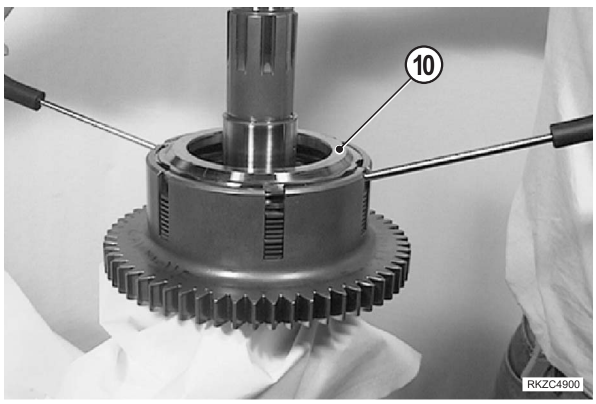
12 - Slightly press thrust plate (10).



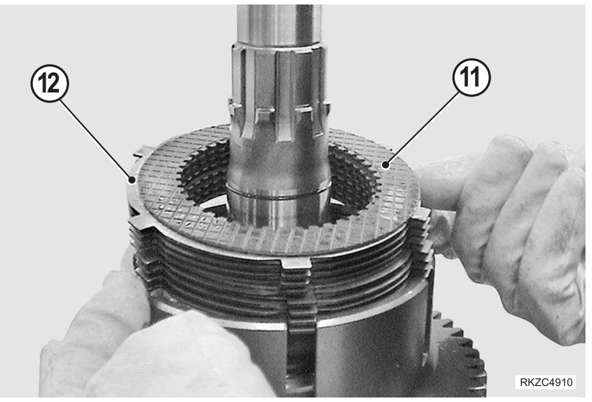
13 - Remove snap ring (9).



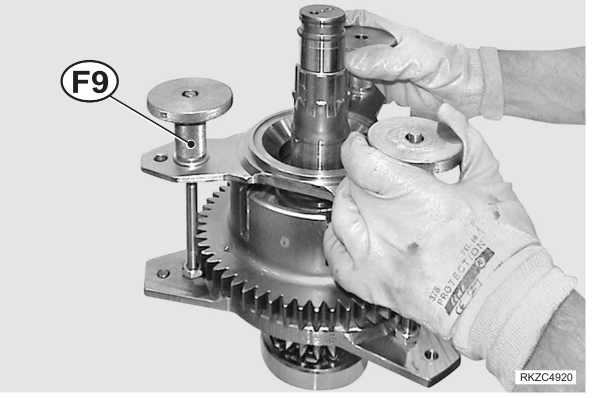
14 - Remove thrust plate (10) by means of two screwdrivers.



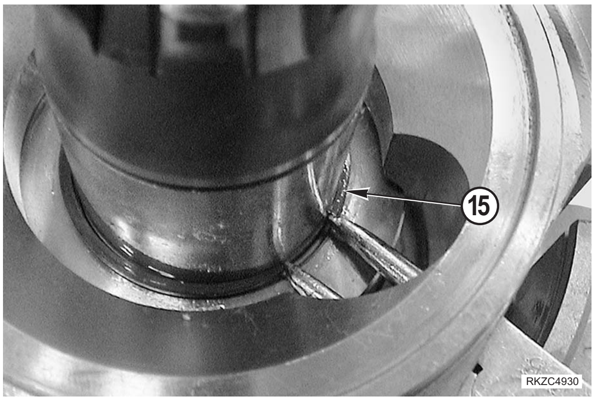
15 - Remove disc (11) and counterdiscs (12) pack.



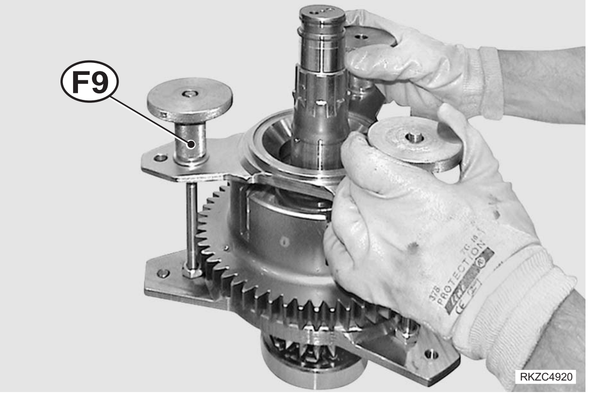
16 - Lower the spring (17) retaining washer (16).
Use tool **F9**.



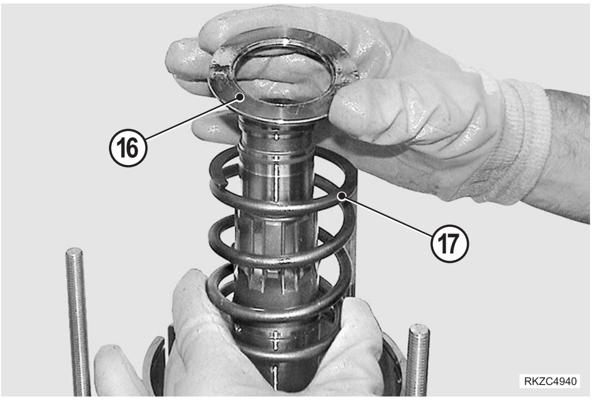
17 - Remove snap ring (15).



18 - Loosen the handles of the threaded rods to release the tension from the spring.
Remove the top piece of the **F9** special tool.

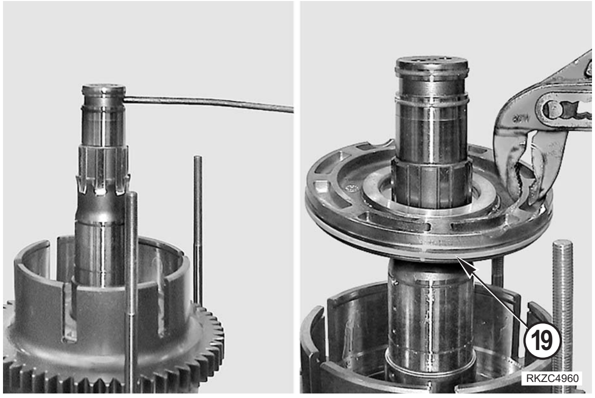


19 - Remove the washer (16) and spring (17).

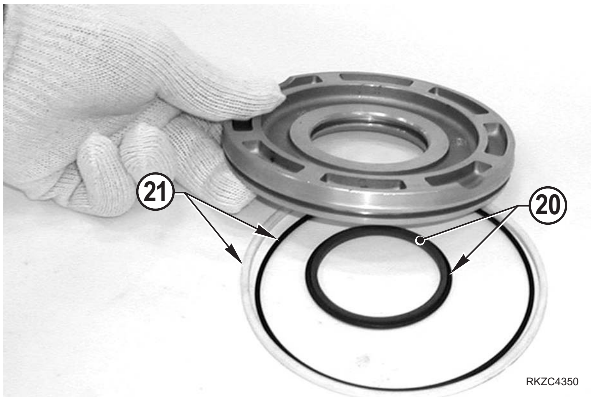


20 - Remove sleeve (18).

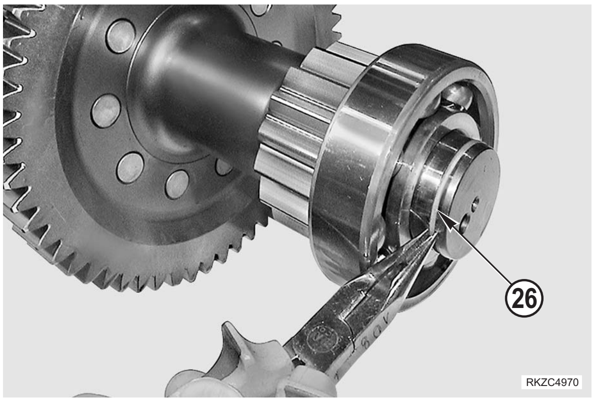
21 - Remove clutch piston (19) by blowing in compressed air through the delivery hole.



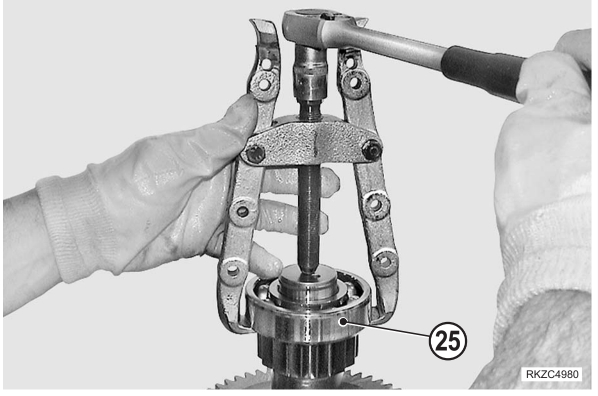
22 - If to be replaced, remove teflon seal ring (20) and relevant inner O-ring from outer seat of piston and teflon seal rings (21) and relevant inner O-ring from inner of piston. To remove the rings it is necessary to cut them.



23 - Remove the teflon seal ring (26).



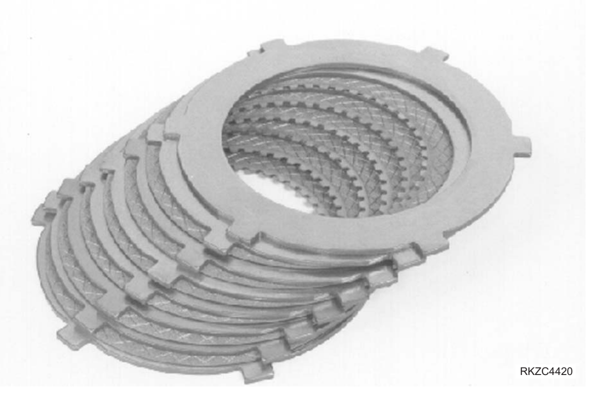
24 - Remove bearing (25) by means of an extractor.



25 - Check:
- the sealing ring grooves (large and small) for wear and damage if necessary.
- on the output shaft for wear and damage.
- the oil passages in the output shaft to be sure that the passages are open and free of foreign material.
- the ball bearings and the needle bearings for flat areas, pitting, and other damage.

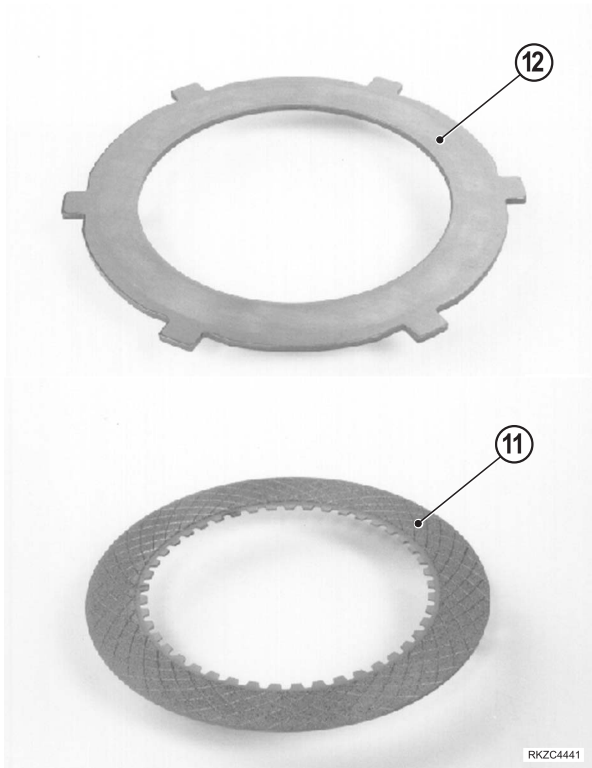
Use new parts as required.

26 - If the clutch discs are to be used again, keep the clutch packs in the same previous assembly order separate and record which clutch pack goes with each clutch.



27 -At each disassembly:
- verify with a caliper that the total thickness of the clutch kit is within the wear limit.
- Verify that all the clutch plates do not appear burned or that the friction material it is not damaged and that splines are well traced.
- Verify also that all the clutch drive plates (12) are perfectly plane and inspect for pitting or scoring.

In the case that at least one of the above problems occurs, replace the complete clutch kit with a new one. If using a new clutch kit soak the clutch plates in clean transmission oil for at least an hour before assembly. In any case lubricate the contact surfaces of clutch drive plates with clean transmission oil before assembly.



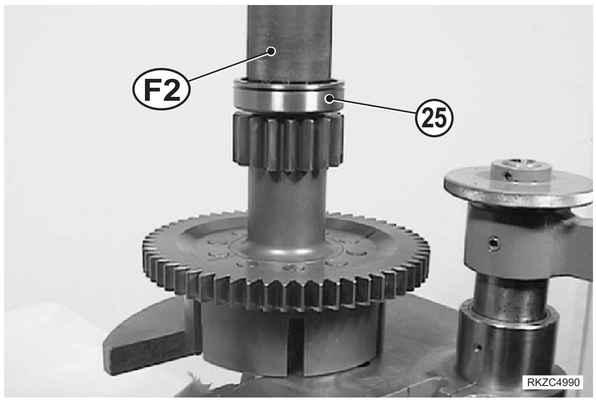
Number of clutch plate	8
Number clutch steel plate	8
Nominal clutch plate thickness	2.00±0.05 mm
Nominal clutch kit thickness	* 30.5–30.7 mm
Maximum clutch plate wear (each side)	0.20 mm
Maximum clutch kit wear	1.6 mm

* Under load of 163 kg

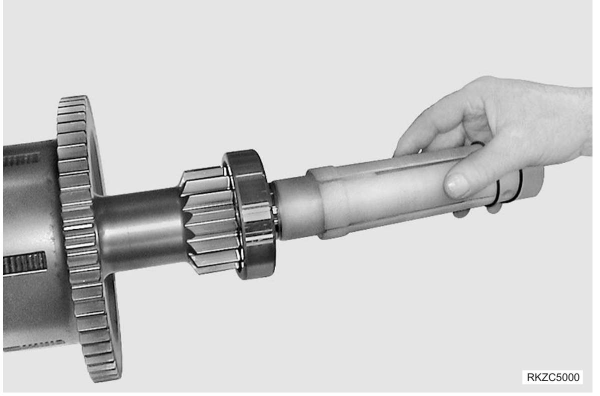
28 -Inspect the bore of the shaft in the input shaft housing for damage that will cause leakage when the clucth is assembled.
Check the slots in the side of the input shaft housing for damage from the tangs on the steel discs.
Use new parts as required during assembly.

7.2 Assembly

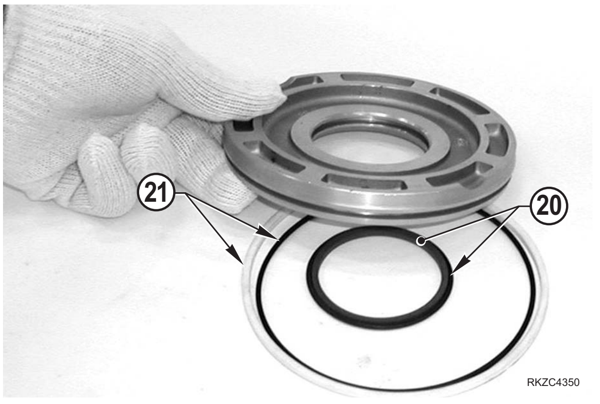
1 -Assemble bearing (25).
Use tool **F2**.



2 - Assemble a new Teflon sealing ring (**26**).
To install the ring (**26**), repeat steps 29 to 34 in section"6.2 Assembly" using tool **F5**.



3 - Assemble new teflon ring (20) and relevant inner O-ring, new teflon ring (21) and relevant inner O-rings respectively into the piston outer and inner seats.

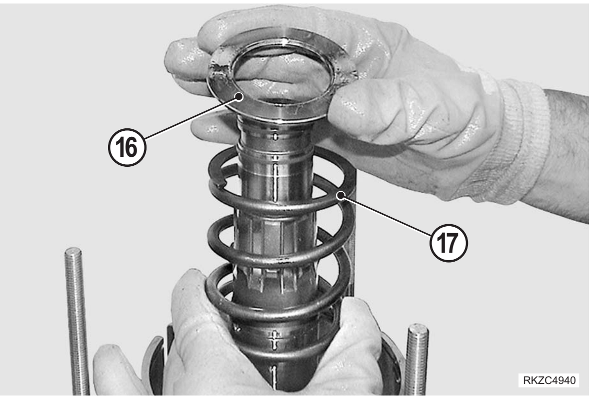


4 - Apply a thin film of grease on the sealing rings just inserted.

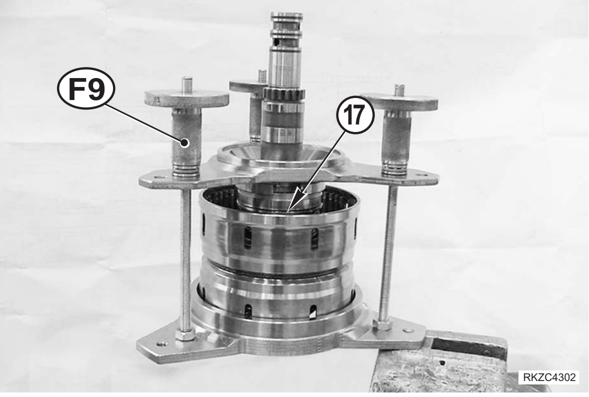
5 - Insert clutch piston (19) with special tool **F10** as protection of seal rings (21).

6 - Assemble sleeve (18).

7 - Assemble spring (17) and washer (16).

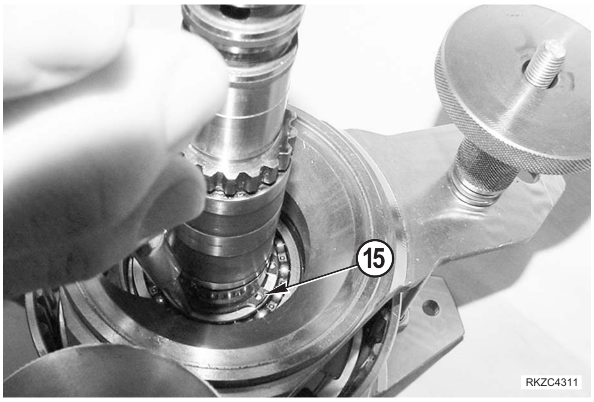


8 - Lower the spring (16) lock washer (17).
Use tool **F9**.



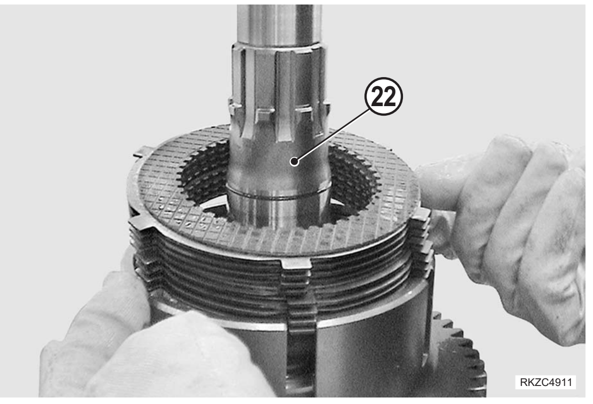
9 - Insert snap ring (15).

★ Ensure that the snap ring (15) is well fitted.

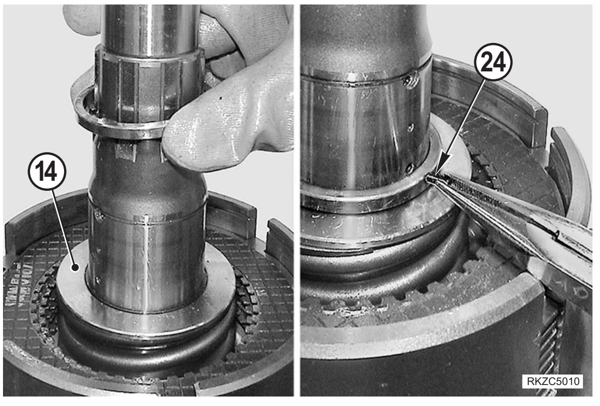


10 - Loosen the handles of the threaded rods to release the tension from the spring.
Remove the top piece of the **F9** special tool.

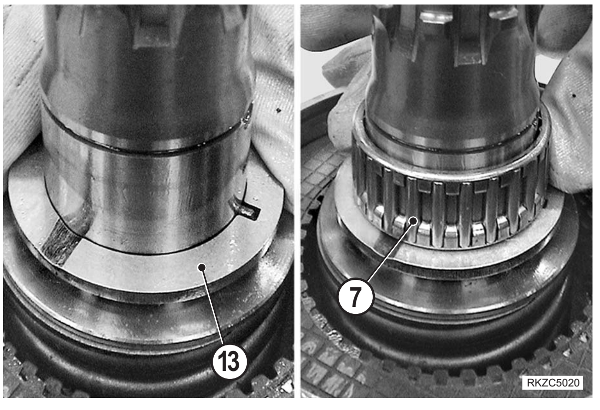
11 - Assemble clutch pack to shaft (22).



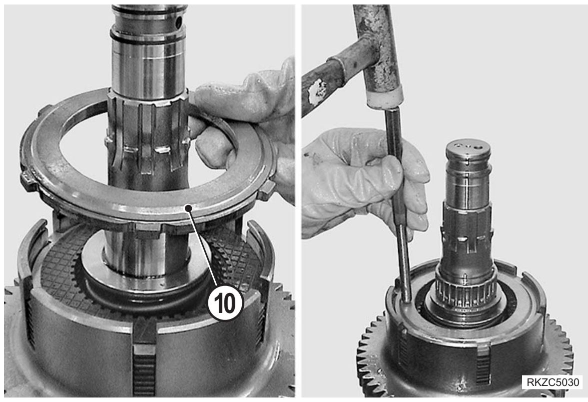
12 - Assemble spacer (14) and spring pin (24).



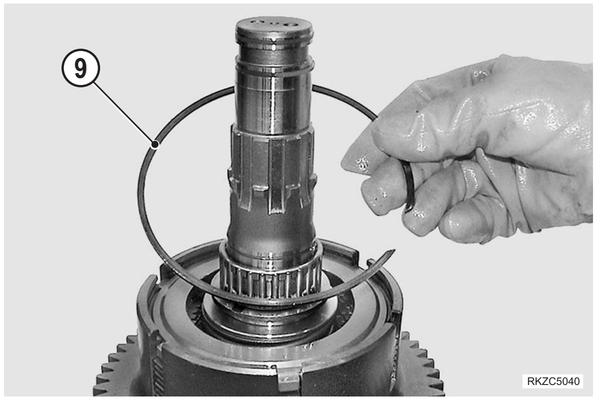
13 - Insert washer (13) and roller bearing (7).



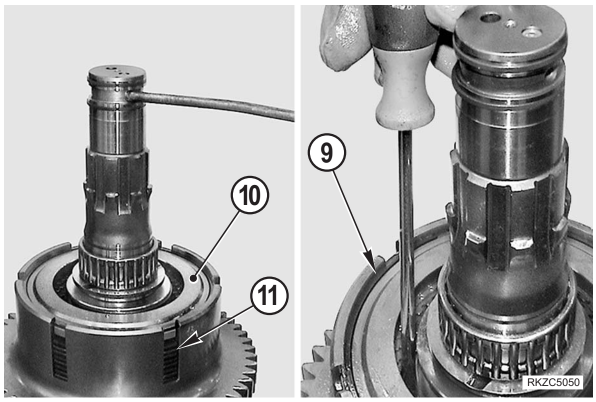
14 - Assemble thrust plate (10) and press it against the clutch pack.



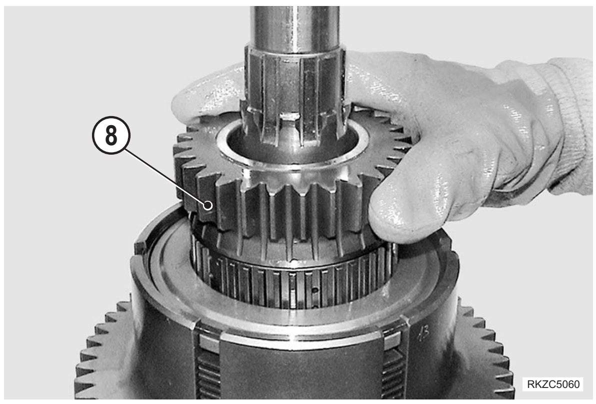
15 - Assemble snap ring (9).



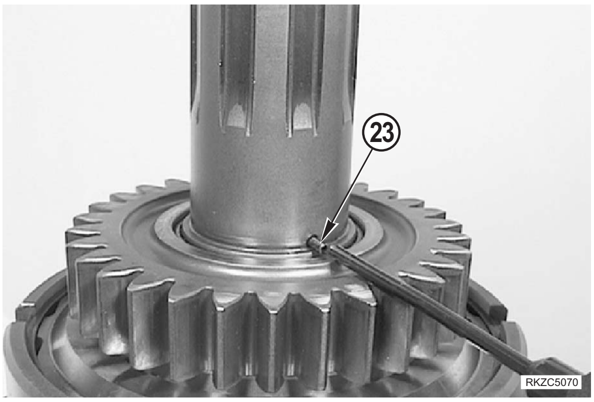
16 - Apply compressed air at low pressure in hole in order to push the thrust plate (10) against the retaining ring (9), then align the clutch plate (11) spline.



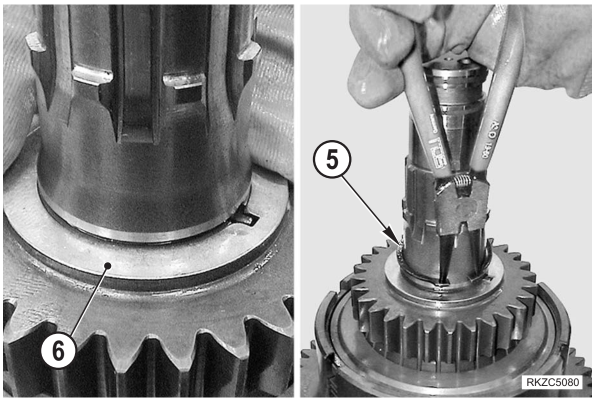
17 - Assemble gear (8) paying attention it completely fit in its seat.



18 - Assemble spring pin (23).



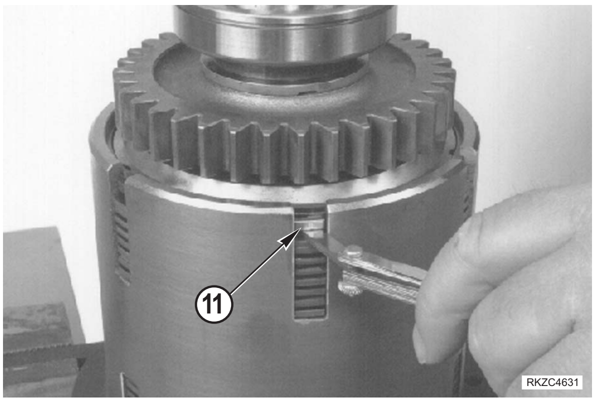
19 - Assemble the washer (6) and lock ring (5).



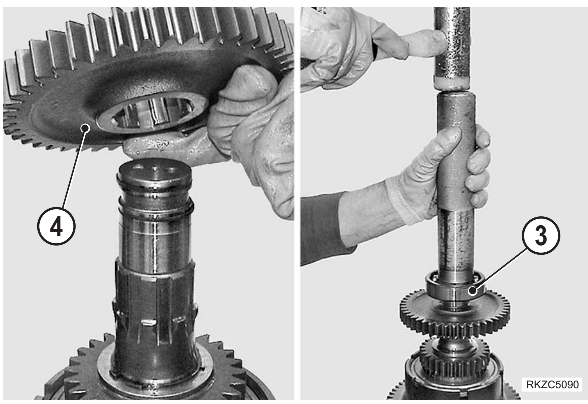
20 - Measure the clutch discs clearance for each clutch assembly.
The clutch plate lock ring must be all the way up against the lock ring.
Use a feeler gauge to measure the distance between the clutch plate lock ring and the first clutch plate (11).

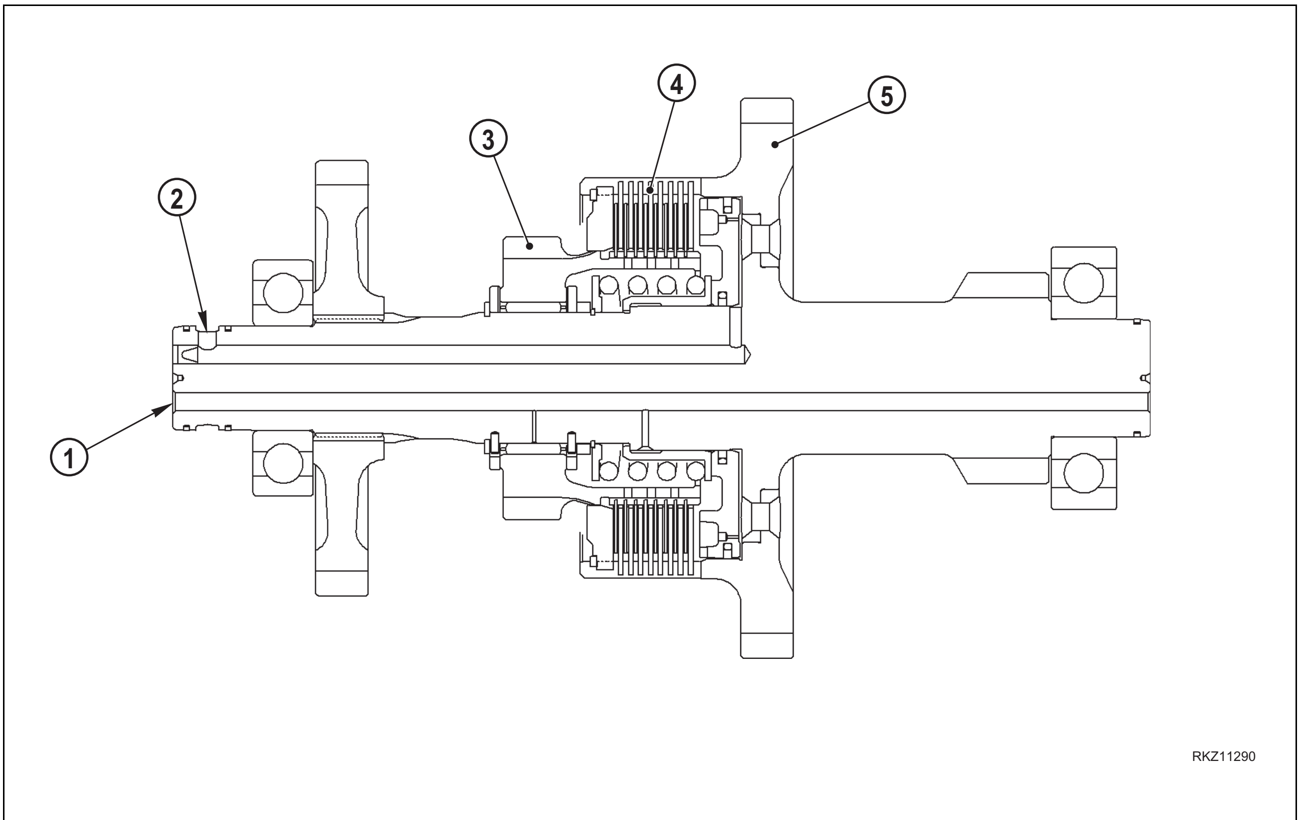
★ Distance: 2.20–3.05 mm.

★ If the distance is not within specification, the clutch is probably assembled wrong.



21 - Assemble gear (4) taking care to orientate the shelf facing the clutch and bearing (3).
Use tool **F16**.

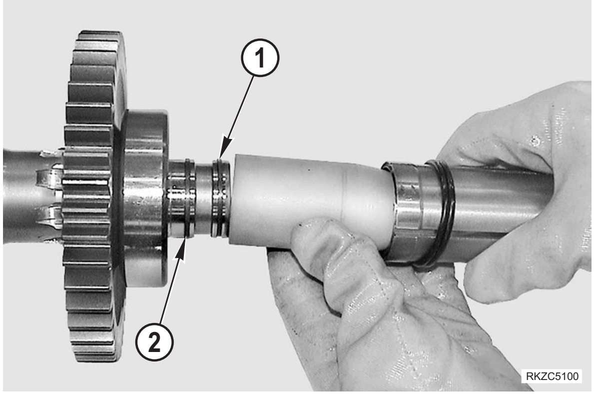




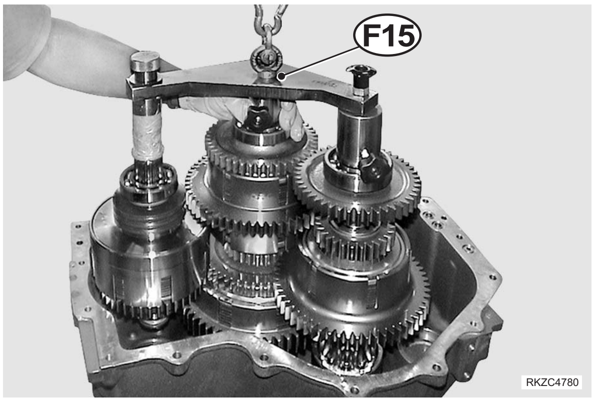
1. Lubrication oil passage
2. 2nd speed clutch oil passage
3. 2nd speed gear
4. 2nd speed clutch pack
5. Input shaft

22 - Try to rotate the 2nd speed gear. The 2nd speed gear must turn freely on the input shaft.
Apply compressed air of approximately 6 bar to the 2nd speed gear clutch passage.
Hear the 2nd speed gear piston moving to lock the 2nd speed gear clutch pack. Try to move the 2nd speed gear. The 2nd speed gear must not turn on the input shaft.
If the clutch does not work correctly, disassemble the clutch to find the problem.

23 - Assemble Teflon sealing rings (**1**) and (**2**).
To install the sealing rings, repeat steps 29 to 34 in section "6.2 Assembly" using the spacer rings of tool **F17**.

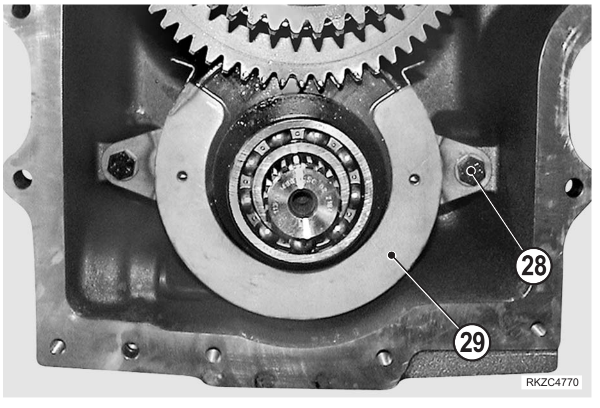


24 - Lift the three shafts **B-C-E** at the same time and insert into the half-housing.
Use tool **F15**.



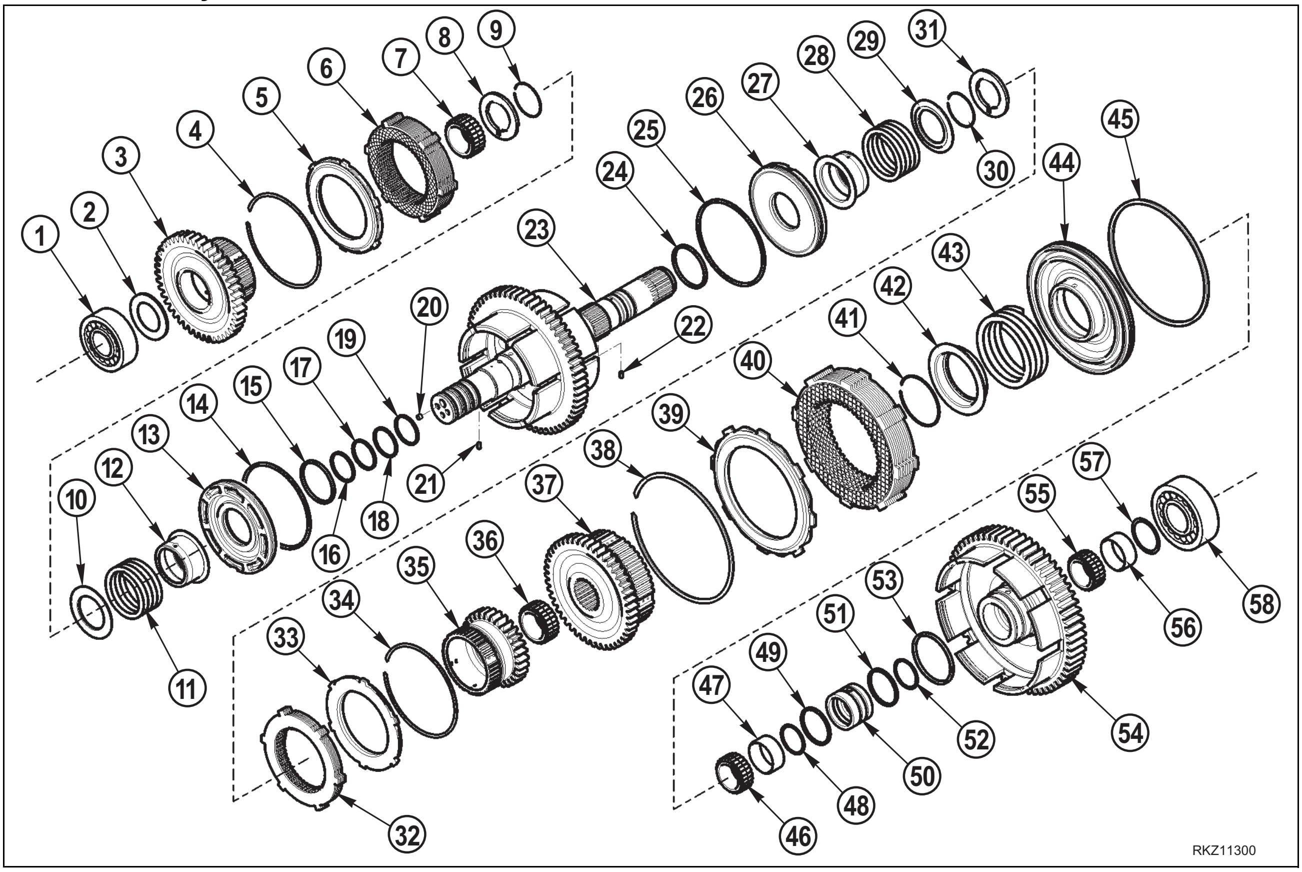
25 - Assemble protection (29) and tighten screws (28) to the prescribed torque.

Screw: 50 Nm

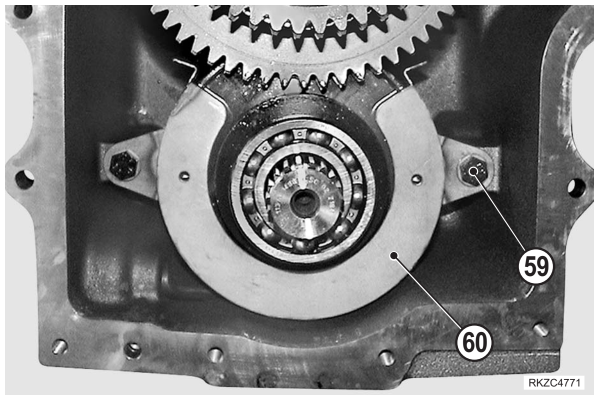


8. AXIS C

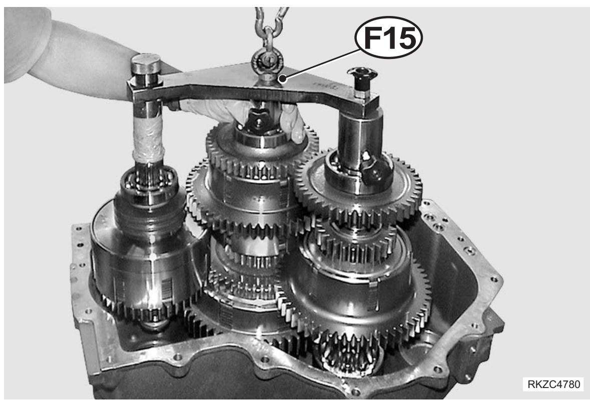
8.1 Disassembly



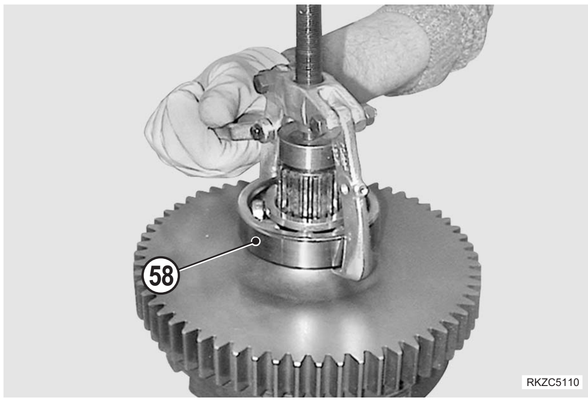
1 -Remove screws (59) and protection (60).



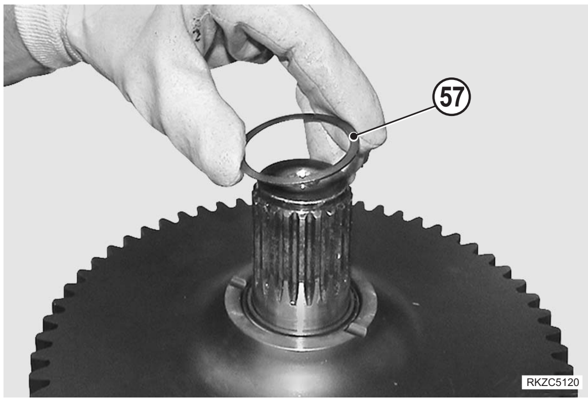
2 -Lift the three shafts B-C-E, at the same time **B-C-E**. Use tool **F15**.



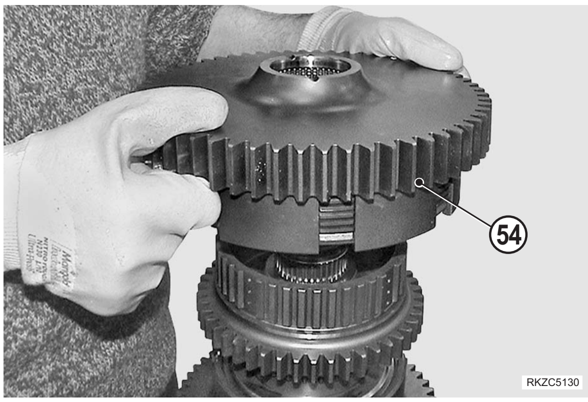
3 - By means of an extractor remove bearing (58).



4 - Remove the spacer (57).



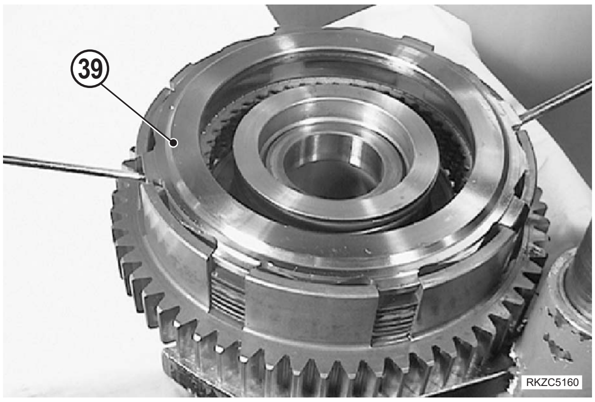
5 - Remove the gear (54) with its inner parts.



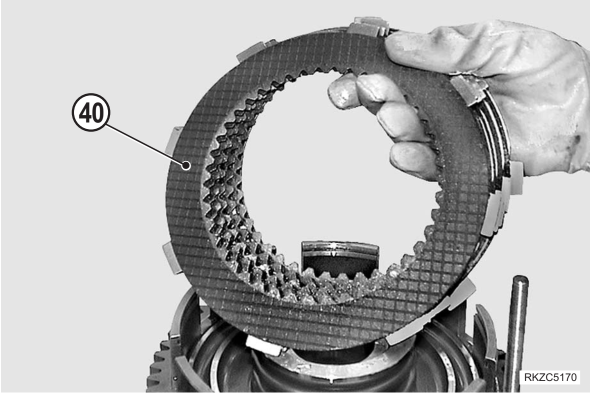
6 - Overturn the group.
Push down the thrust plate (39).

7 - Remove snap ring (38).

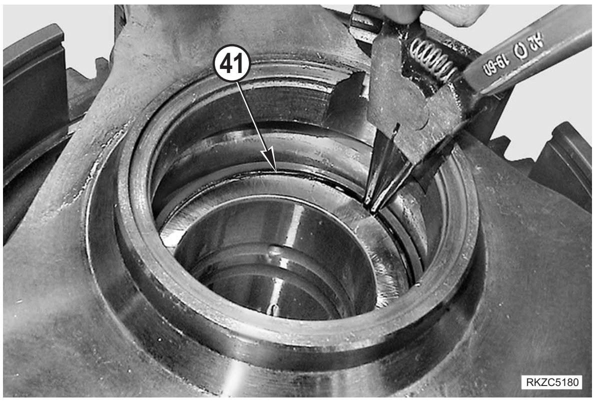
8 - Remove the thrust plate (39) by means of two screwdrivers.



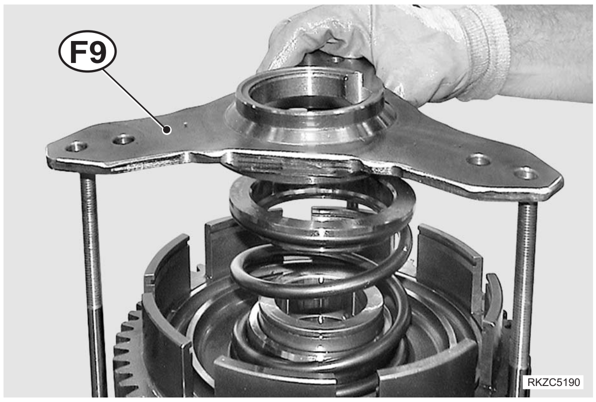
9 - Remove clutch kit (40).



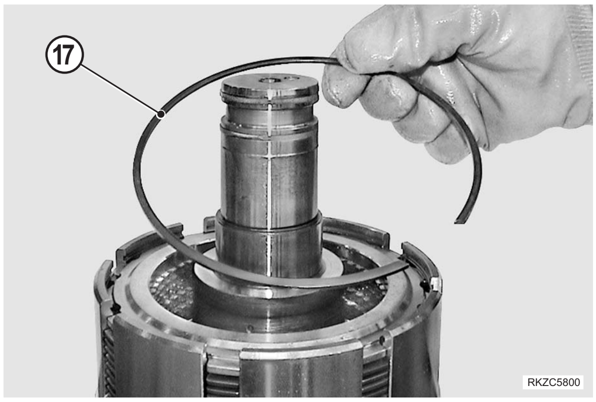
10 - Push down the thrust washer (42) to allow lock ring removal (41).
Use the special tool **F9**.



11 - Loosen the handles of the threaded rods to release the tension from the spring.
Remove the top piece of the **F9** special tool.

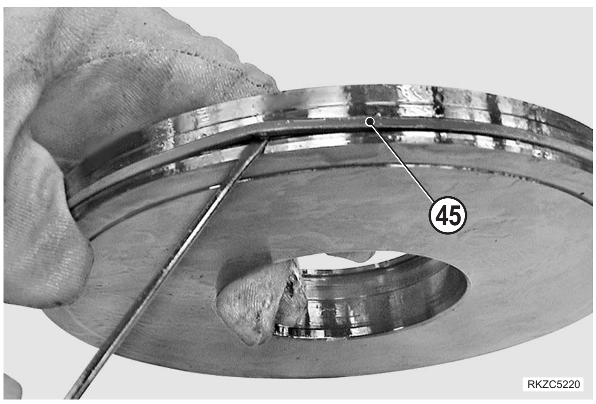


12 - Remove the lock ring (41), the thrust washer (42) and spring (43).

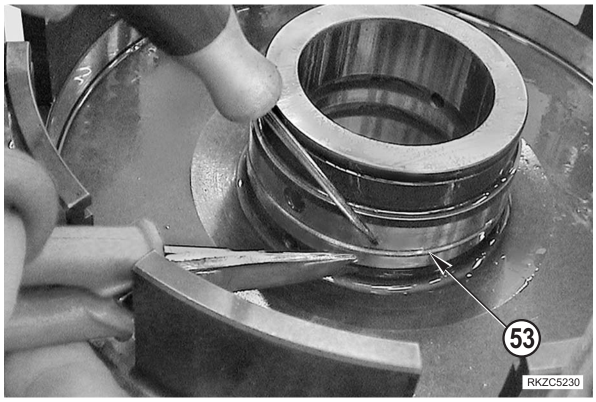


13 - Remove clutch piston (44) by blowing in compressed air through the delivery hole.

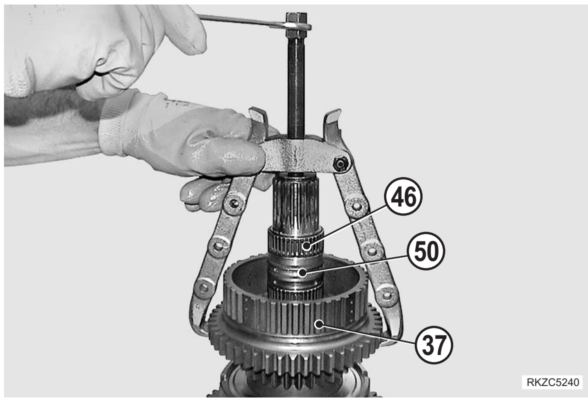
14 - If to be replaced, remove teflon seal ring (45) and relevantimer O-ring from outer seat of piston (44).



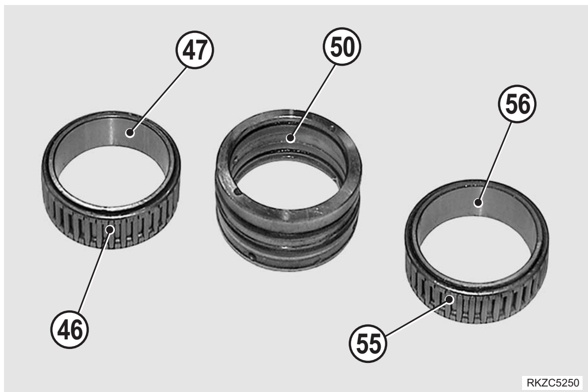
15 - If to be replaced, remove the teflon sealving (53) and relevant inner O-ring from seat of gear (54).



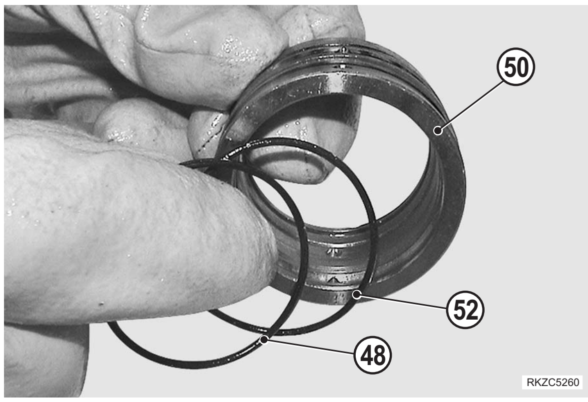
16 - Remove gear (37) with an extractor.
Remove bushing (47) and (56), roller bearing (46) and (55) and spacer (50).



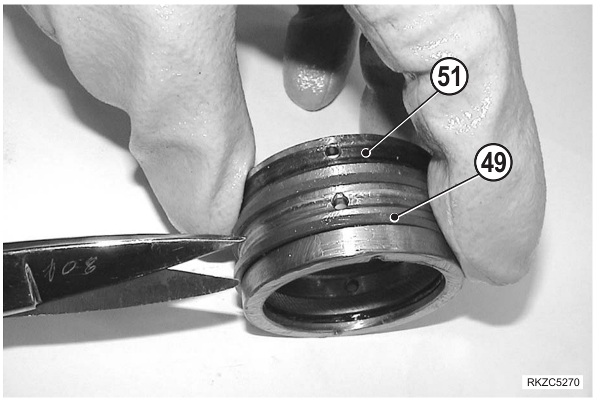
17 - Chech the condition of removed parts (46), (47), (50), (55) and (56).



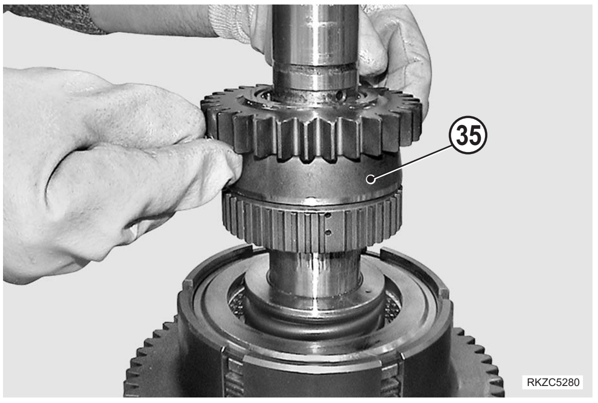
18 - Remove the O-rings (48) and (52) from the bush (50).
destructive operation for the seal rings



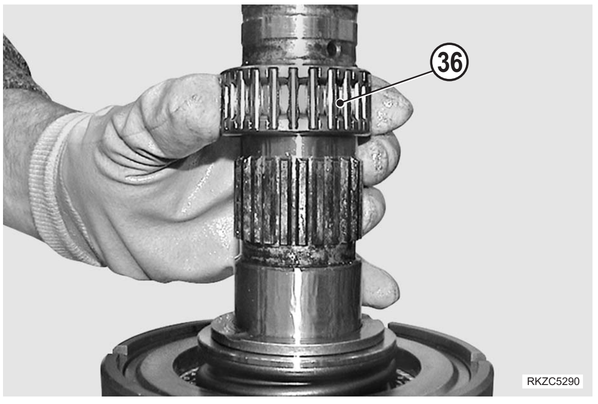
19 - Check the wear condition of the teflon seal rings (49) and (51).
If replacement is necessary, cut the teflon seal rings (49) and (51) to remove they from the bush (50).
destructive operation for the seal rings



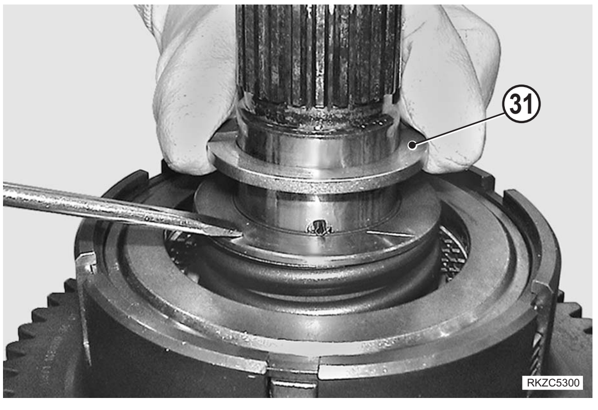
20 - Remove gear (35).



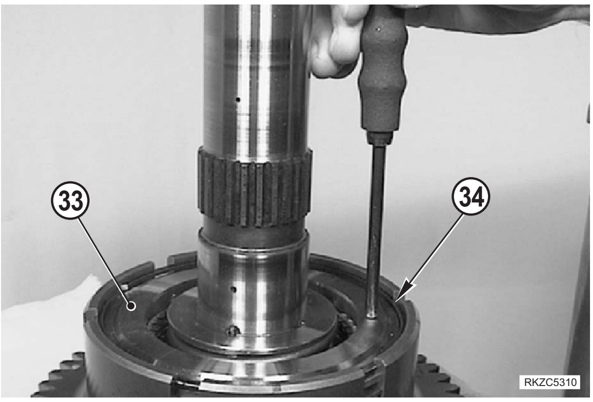
21 - Remove roller retainer (36).



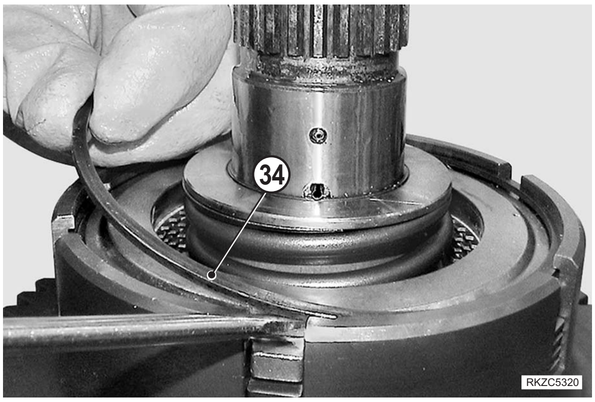
22 - Remove spacer (31).



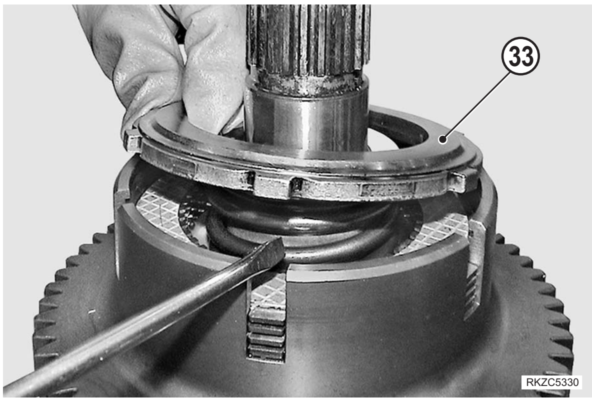
23 - Push down the counterdisk (33) to set free the lock ring (34).



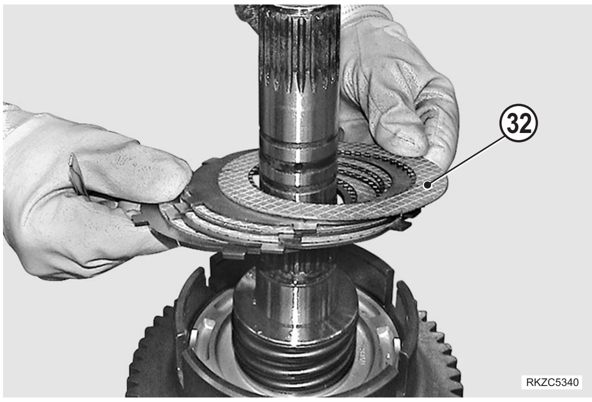
24 - Remove snap ring (34).



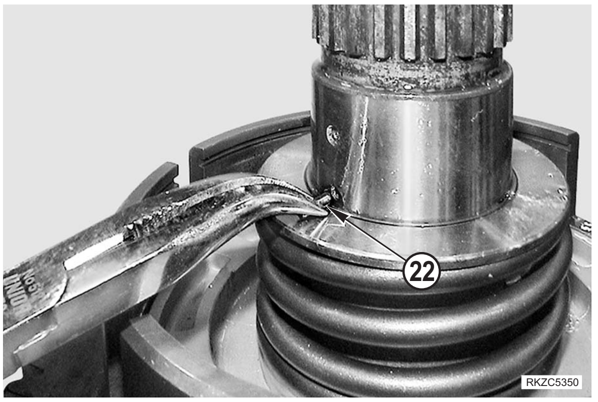
25 - Remove the thrust plate (33) by means of two screwdrivers.



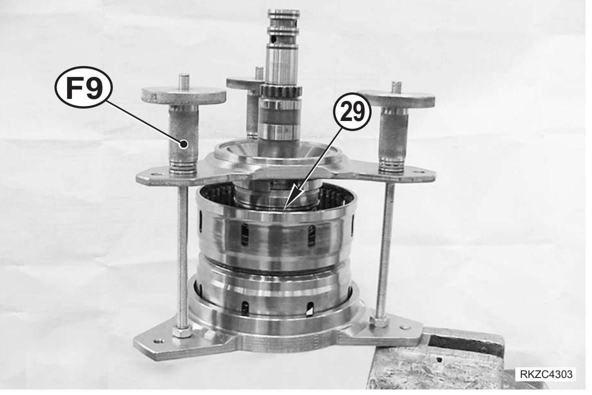
26 - Remove clutch kit (32).



27 - Remove the spring pin (22).



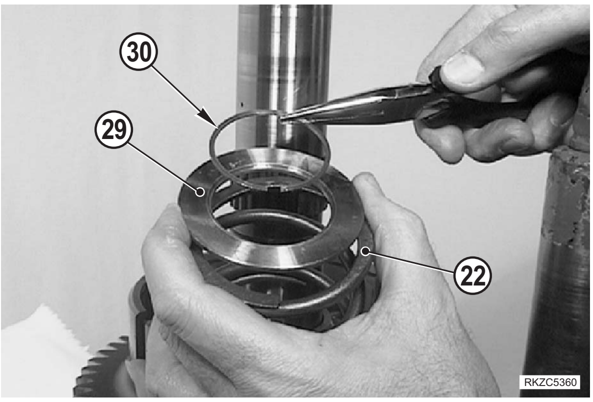
28 - Lower the spring (28) lock washer (29).
Use tool **F9**.



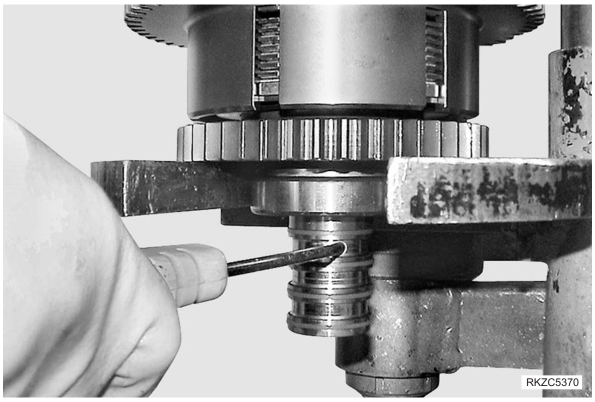
29 - Remove snap ring (30).

30 - Loosen the handles of the threaded rods to release the tension from the spring.
Remove the top piece of the **F9** special tool.

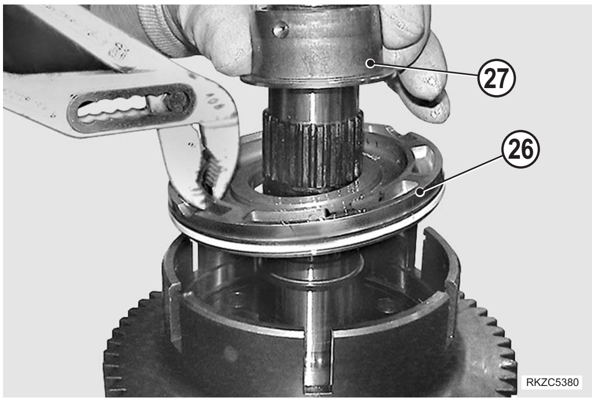
31 - Remove the lock ring (30), the thrust washer (29) and spring (28).



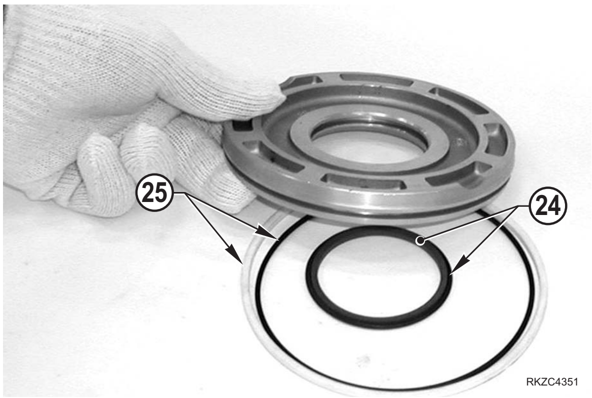
32 - Extract clutch piston (26) from its seat by blowing in compressed air through the delivery hole.



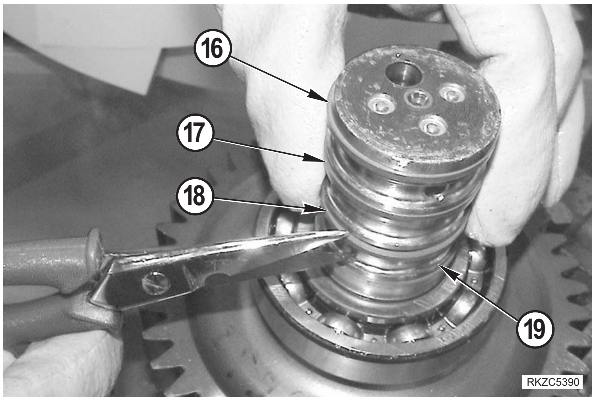
33 - Remove the bush (27) and clutch piston (26).



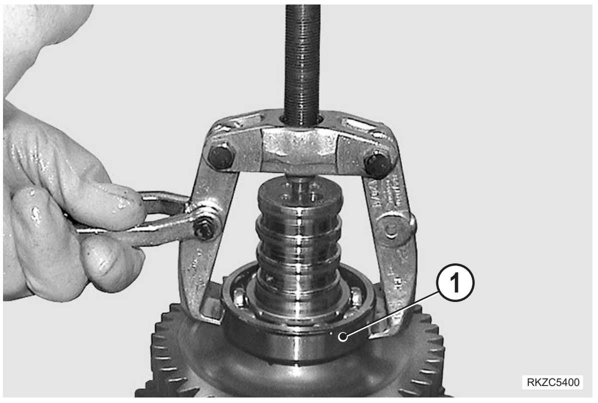
34 - If to be replaced, remove teflon seal ring (25) and relevant inner O-ring from outer seat of piston and teflon seal rings (24) and relevant inner O-ring from inner of piston.
To remove the rings it is necessary to cut them.



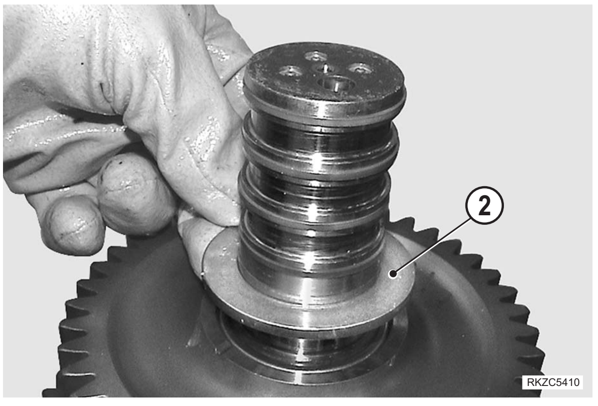
35 - Overturn the shaft (23).
Cut and remove the seal rings (16), (17), (18) and (19).



36 - By means of an extractor remove bearing (1).

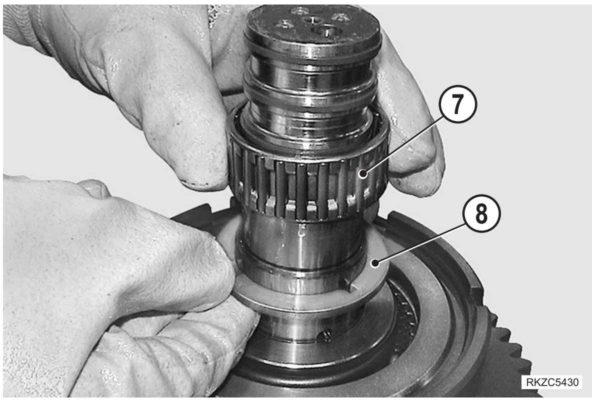


37 - Remove spacer (2).

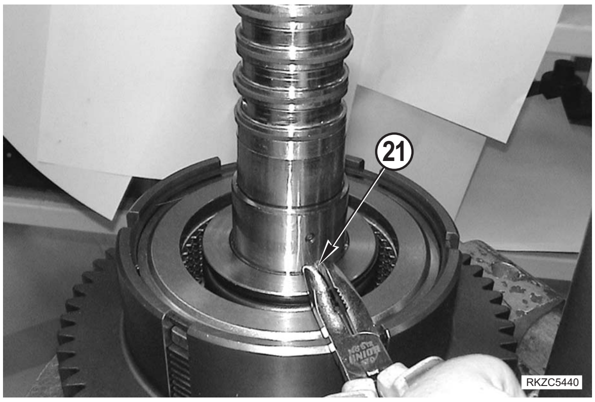


38 - Remove gear (3).

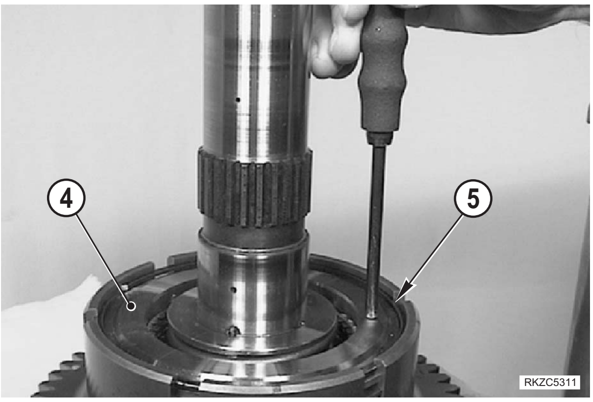
39 -Remove roller retainers (7) and washer (8).



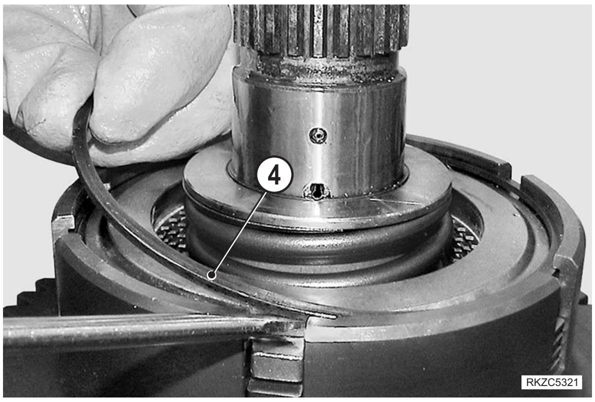
40 -Remove the spring pin (21).



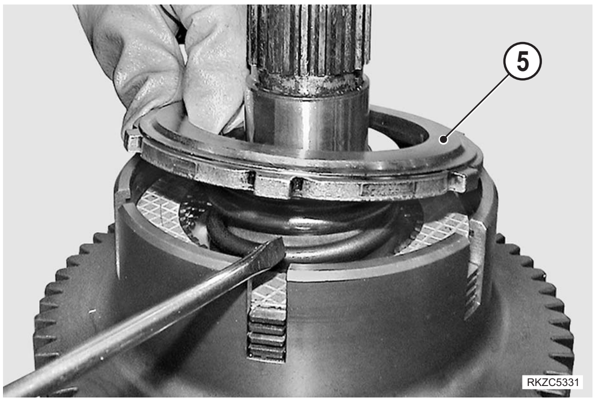
41 -Push down the thrust plate (5) to set free the lock ring (4).



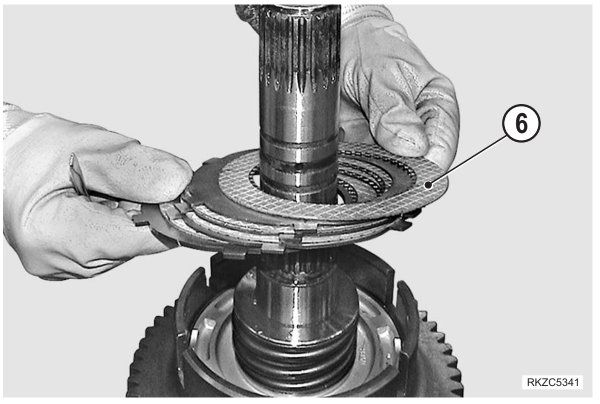
42 -Remove snap ring (4).



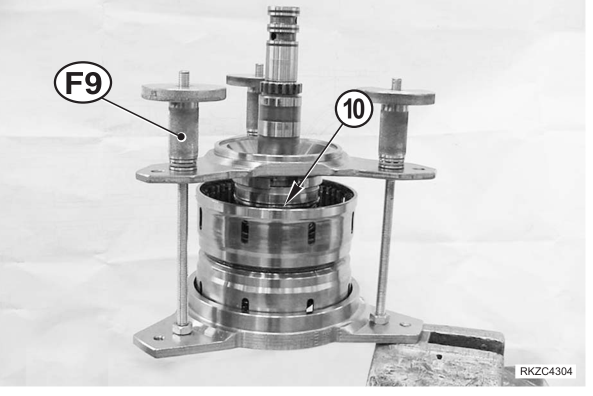
43 - Remove the thrust plate (5) by means of two screwdrivers.



44 - Remove clutch kit (6).

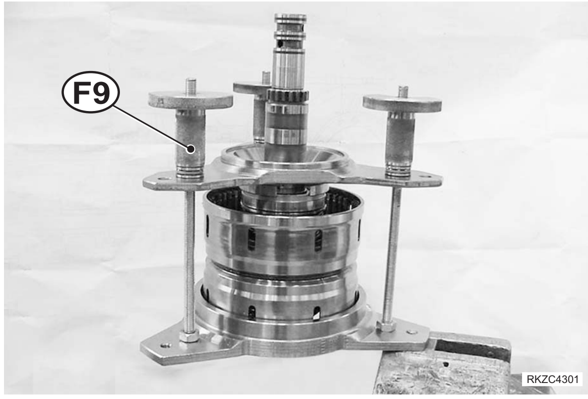


45 - Lower the spring (11) lock washer (10).
Use tool **F9**.

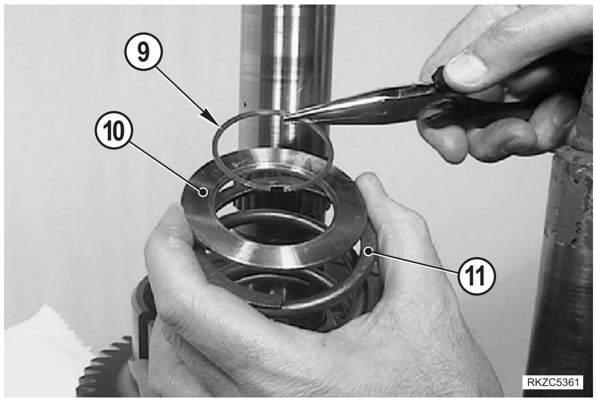


46 - Remove snap ring (9).

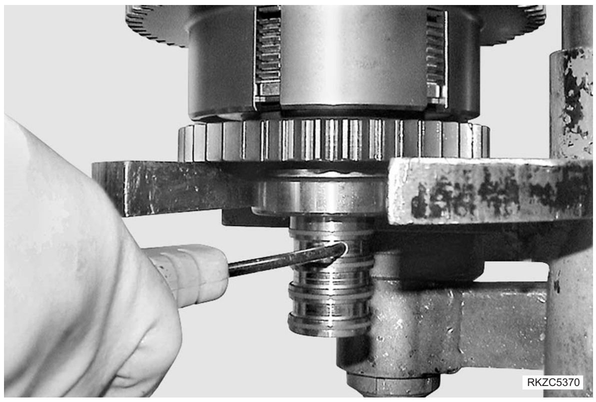
47 - Loosen the handles of the threaded rods to release the tension from the spring.
Remove the top piece of the **F9** special tool.



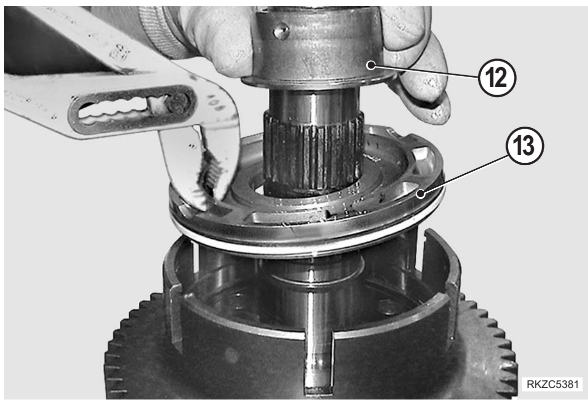
48 - Remove the lock ring (9), the thrust washer (10) and spring (11).



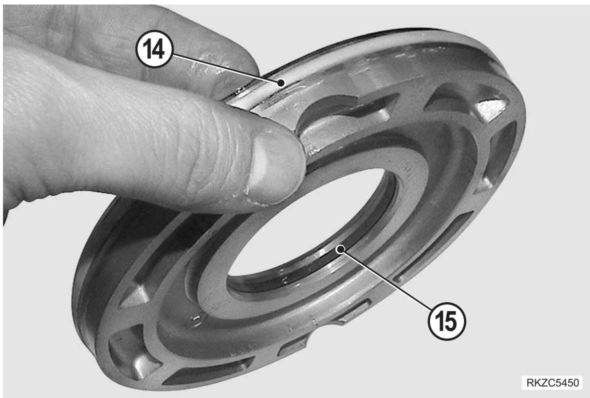
49 - Extract clutch piston (13) from its seat by blowing in compressed air through the delivery hole.



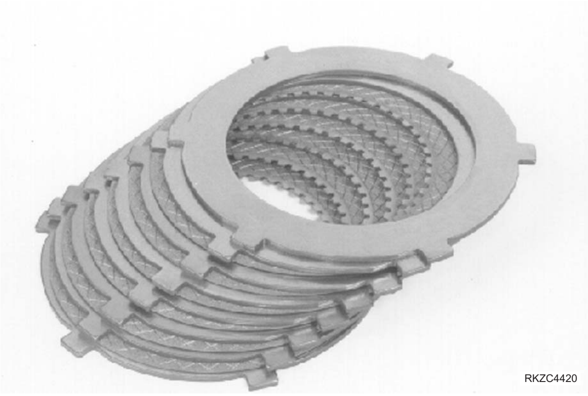
50 - Remove the bush (12) and clutch piston (13).



51 - If to be replaced, remove teflon seal ring (15) and relevant inner O-ring from outer seat of piston and teflon seal rings (14) and relevant inner O-ring from inner of piston.
To remove the rings it is necessary to cut them.

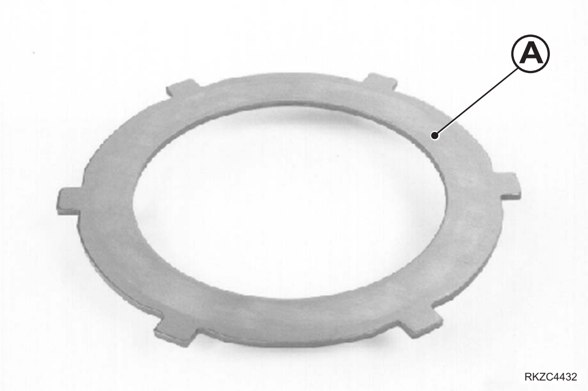


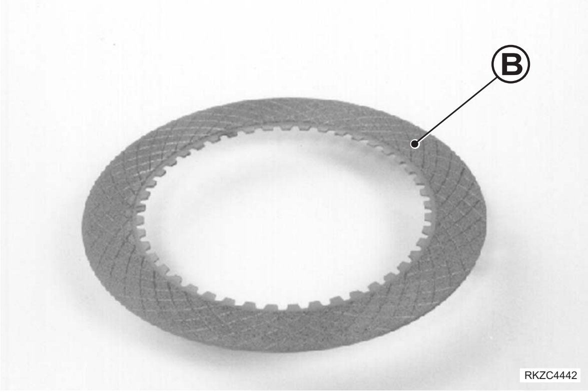
52 - Check:
- the sealing ring grooves (large and small) for wear and damage if necessary.
- on the output shaft for wear and damage.
- the oil passages in the output shaft for restrictions or foreing matter.
- the ball bearings and the needle bearings for flat areas, pitting, and other damage.
Use new parts as required.



53 - If the clutch discs are to be used again, keep the clutch packs in the same previous assembly order separate and record which clutch pack goes with each clutch.

54 - At each disassembly:
- verify with a caliper that the total thickness of the clutch kit is within the wear limit.
- Verify that all the clutch plates do not appear burned or that the friction material it is not damaged and that splines are well traced.
- Verify also that all the clutch drive plates (**A**) are perfectly plane and inspect for pitting or scoring.
In the case that at least one of the above problems occurs, replace the complete clutch kit with a new one.
If using a new clutch kit soak the clutch plates (**B**) in clean transmission oil for at least an hour before assembly. In any case lubricate the contact surfaces of clutch drive plates with clean transmission oil before assembly.





1st GEAR CLUTCH

Number of clutch plate	6
Number clutch steel plate	6
Nominal clutch plate thickness	2.20±0.05 mm
Nominal clutch kit thickness	* 27.5–27.7 mm
Maximum clutch plate wear (each side)	0.15 mm
Maximum clutch kit wear	0.9 mm

* Under load of 163 kg

3rd GEAR CLUTCH

Number of clutch plate	6
Number clutch steel plate	6
Nominal clutch plate thickness	2.00±0.05 mm
Nominal clutch kit thickness	* 30.5–30.7 mm
Maximum clutch plate wear (each side)	0.20 mm
Maximum clutch kit wear	1.6 mm

* Under load of 163 kg

4th GEAR CLUTCH

Number of clutch plate	6
Number clutch steel plate	6
Nominal clutch plate thickness	2.00±0.05 mm
Nominal clutch kit thickness	* 15.9–16.1 mm
Maximum clutch plate wear (each side)	0.2 mm
Maximum clutch kit wear	0.8 mm

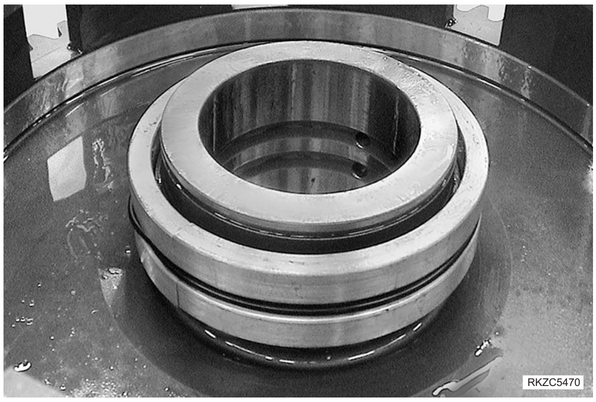
* Under load of 163 kg

55 - Inspect the bore of the shaft in the input shaft housing for damage that will cause leakage when the clucth is assembled.
Check the slots in the side of the input shaft housing for damage from the tangs on the steel discs.
Use new parts as required during assembly.

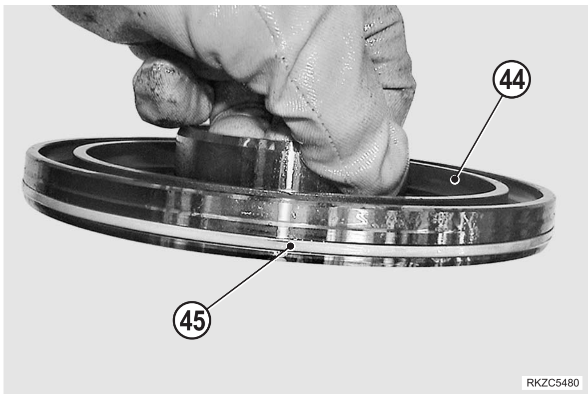
8.2 Assembly

1 - Assemble new teflon ring (53) and relevant inner O-Ring on gear (54) using special tool **F21**.
. Assemble the O-Ring (52).

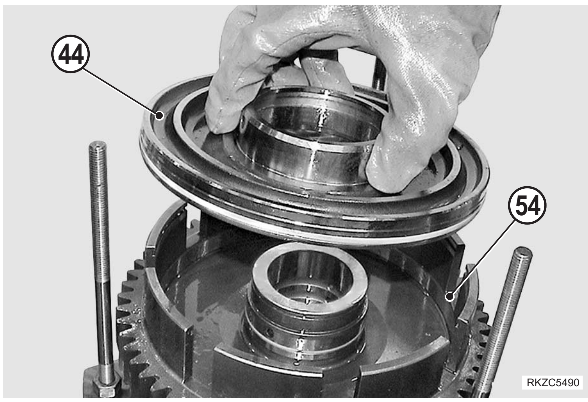
2 - Calibrate the teflon ring (53) using special tool **F20**.



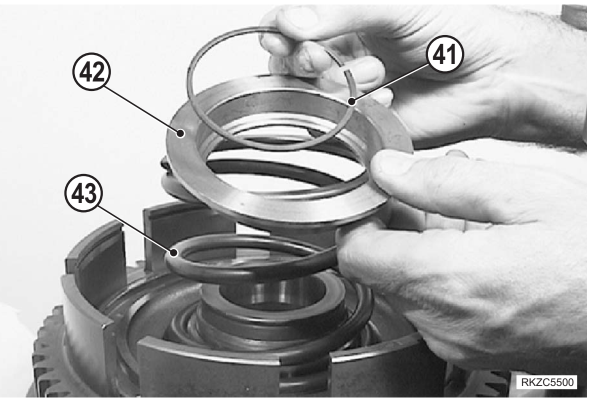
3 - Assemble new teflon ring (45) with relative O-ring on clutch piston (44).



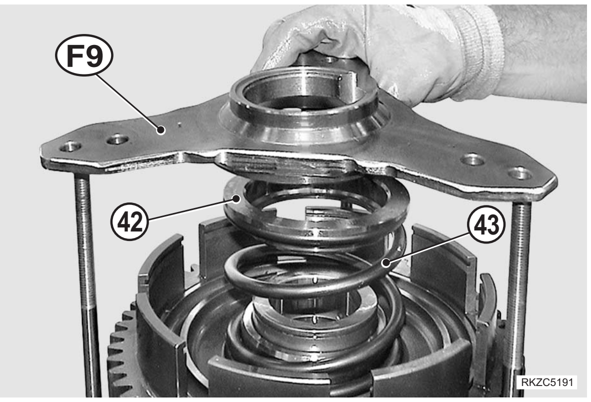
4 - Apply a thin film of grease on the outer edge and in the inner part of clutch piston (44) and assemble in gear (54).



5 - Insert spring (43), thrust washer (42) and snap ring (41).

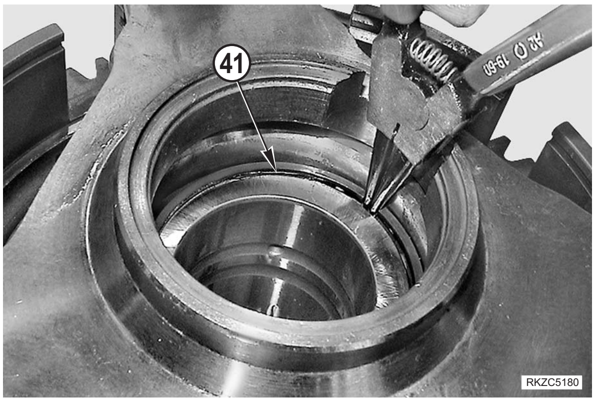


6 - Lower the spring (43) lock washer (42).
Use tool **F9**.

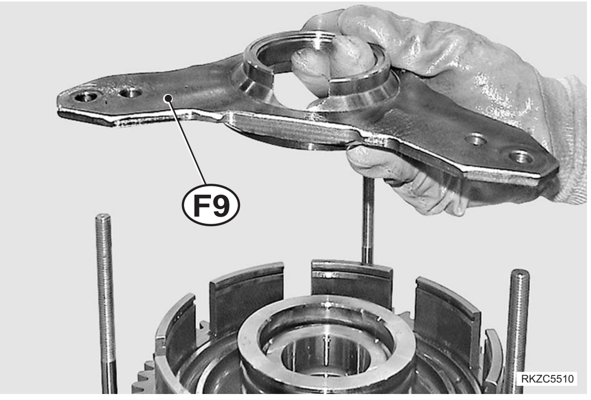


7 - Insert snap ring (41).

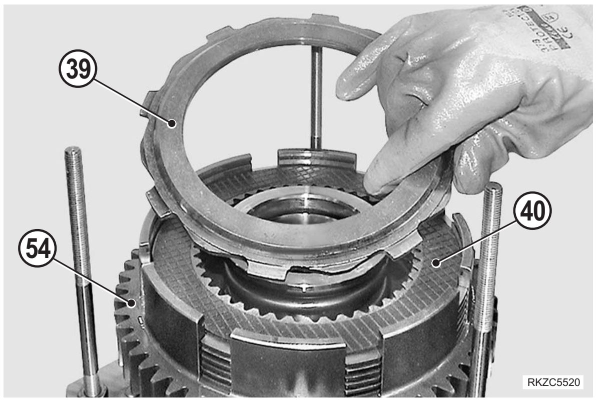
★ Ensure that the snap ring (41) is well fitted.



8 - Loosen the handles of the threaded rods to release the tension from the spring. Remove the top piece of the **F9** special tool.



9 - Insert clutch kit (40) and thrust plate (39) into the gear (54).



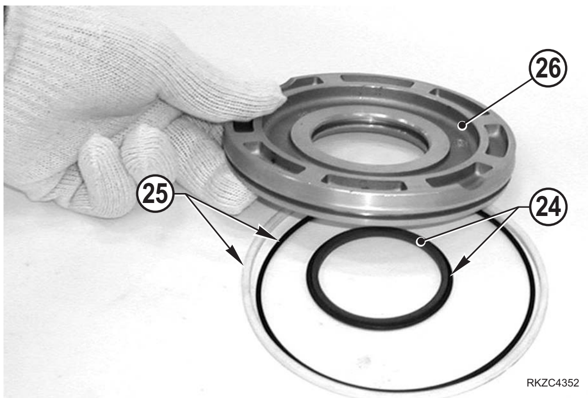
10 - Assemble retaining ring (38) making sure it is correctly seated.

11 - Measure the clutch discs clearance for each clutch assembly.
The clutch plate lock ring must be all the way up against the lock ring.
Use a feeler gauge to measure the distance between the clutch plate lock ring and the first clutch plate (40).

★ Distance: 1.725–2.375 mm.

★ If the distance is not within specification, the clutch is probably assembled wrong.

12 - Assemble new teflon ring (25) and relevant inner O-ring, new teflon ring (24) and relevant inner O-rings respectively into the piston (26) outer and inner seats.

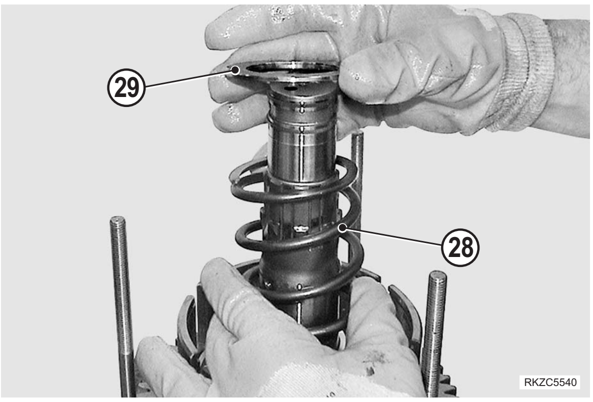


13 - Apply a thin film of grease on the sealing rings just inserted.

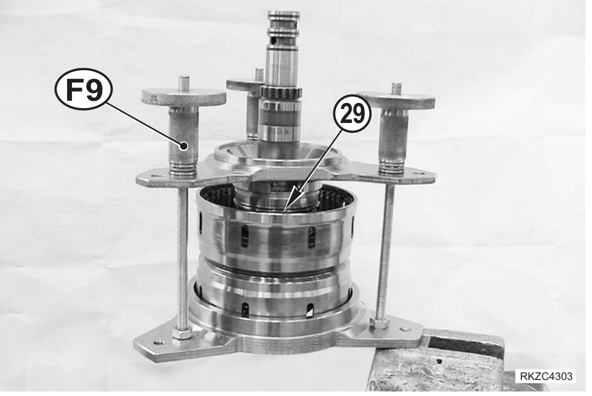
14 - Insert clutch piston (26) with special tool **F10** as protection of seal rings (24).

15 - Assemble sleeve (27).

16 - Assemble spring (28) and retainer washer (29).

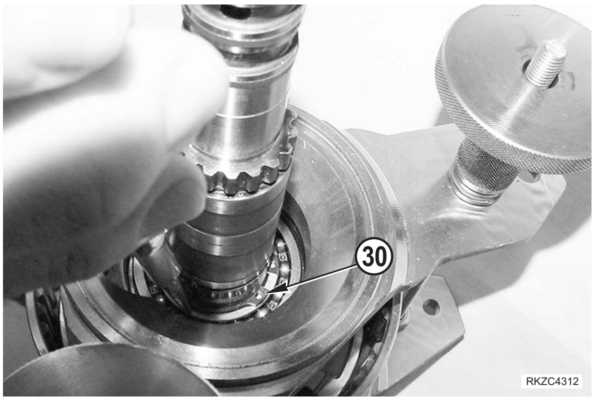


17 - Lower the spring (28) lock washer (29).
Use tool **F9**.

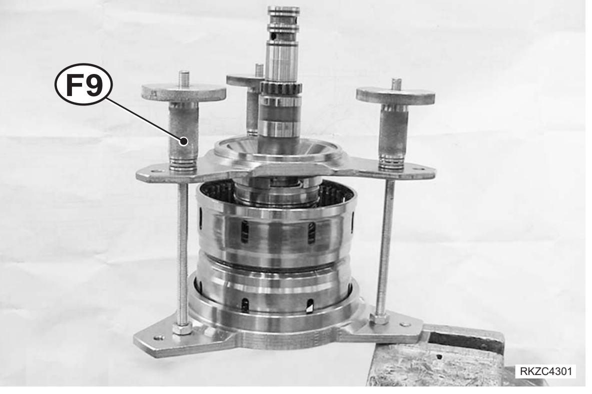


18 - Insert snap ring (30).

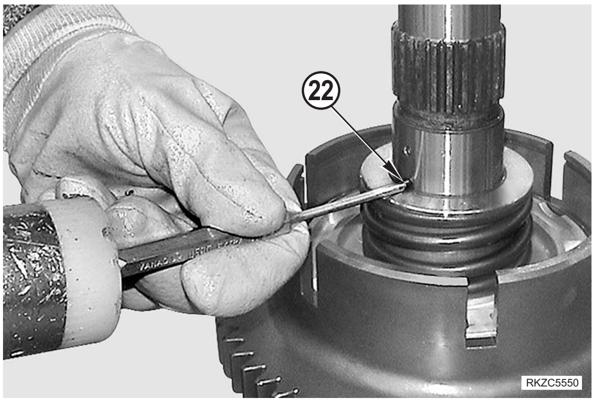
★ Ensure that the snap ring (30) is well fitted.



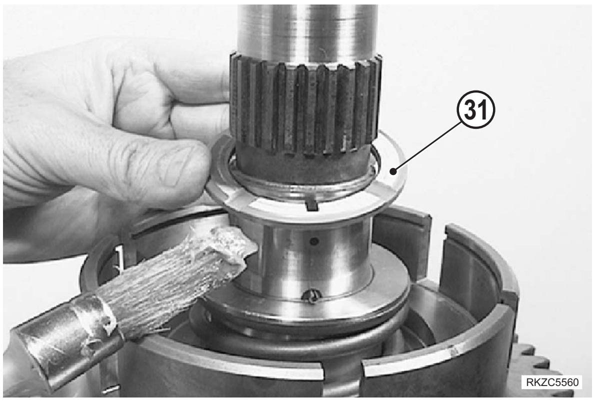
19 - Loosen the handles of the threaded rods to release the tension from the spring.
Remove the top piece of the **F9** special tool.



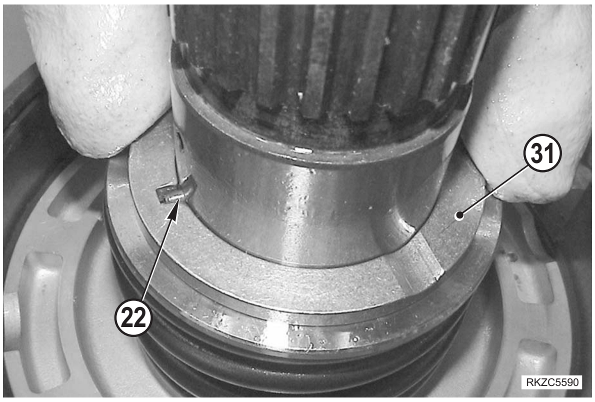
20 - Remove tool **F9** and assemble spring pin (22).



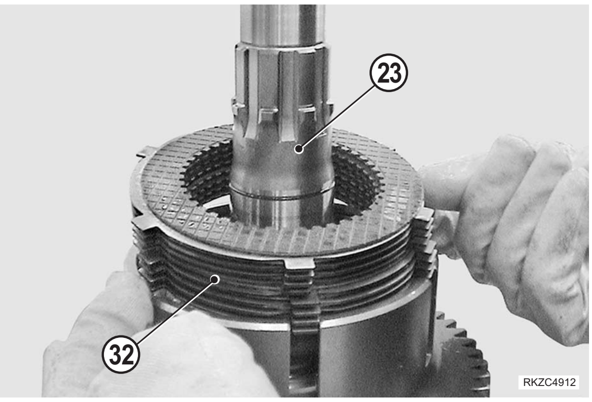
21 - Insert the thrust washer (31) into the shaft (23).
Apply a thin film of grease under washer (31) to avoid its falling when overturning the shaft.



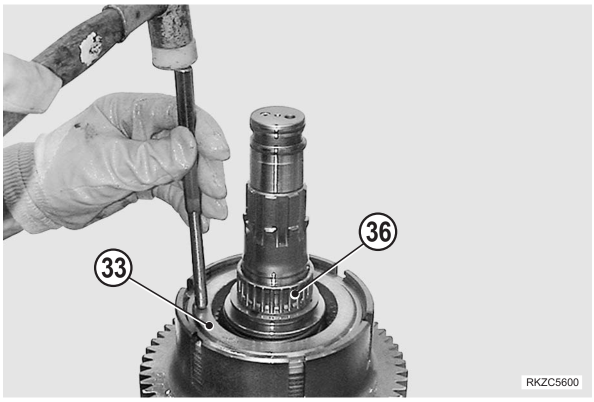
22 - Assemble the washer (31) on the pin (22).



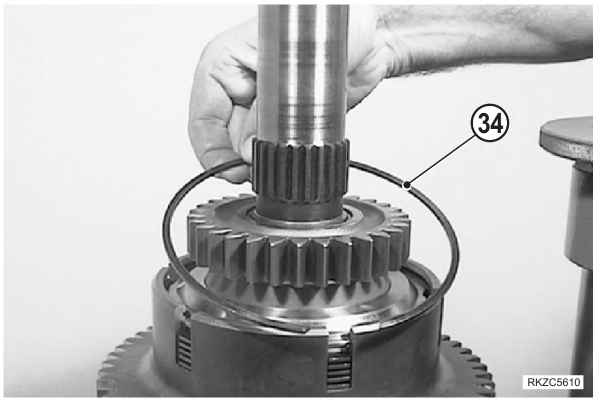
23 - Insert clutch kit (32) on main shaft (23).



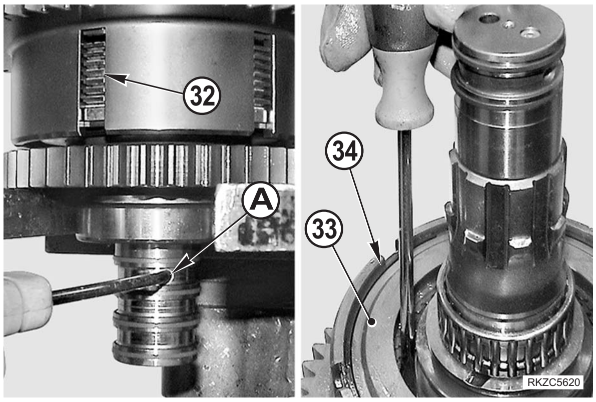
24 - Insert the roller bearing (36) and thrust plate (33).



25 - Assemble snap ring (34).



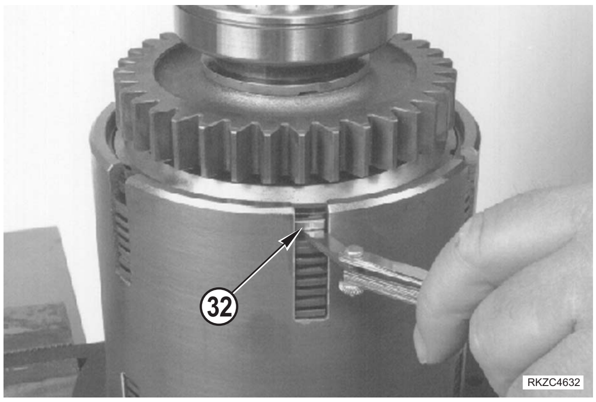
26 - Apply compressed air at low pressure in hole (**a**) in order to push the thrust plate (33) against retaining ring (34), then align the clutch plate (32) spline.



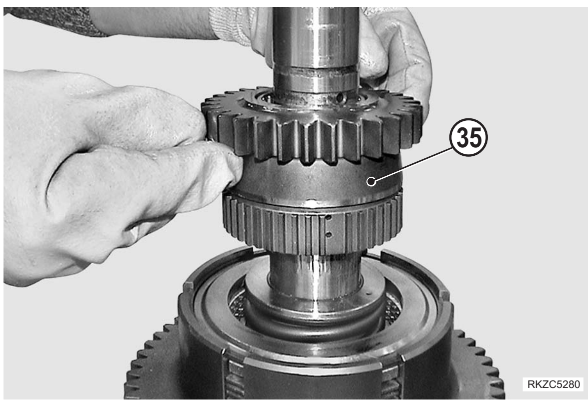
27 - Measure the clutch discs clearance for each clutch assembly.
The clutch plate lock ring must be all the way up against the lock ring.
Use a feeler gauge to measure the distance between the clutch plate lock ring and the first clutch plate (32).

★ Distance: 1.50–1.95 mm.

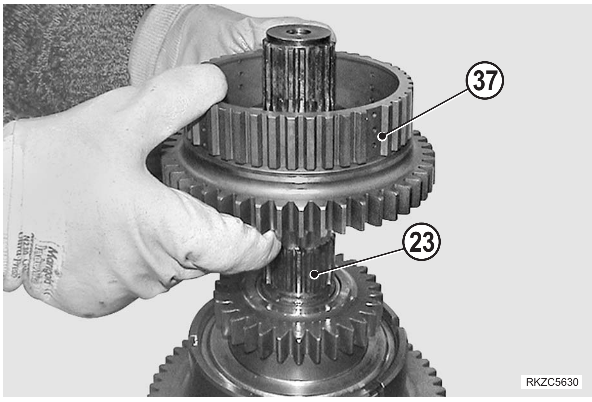
★ If the distance is not within specification, the clutch is probably assembled wrong.



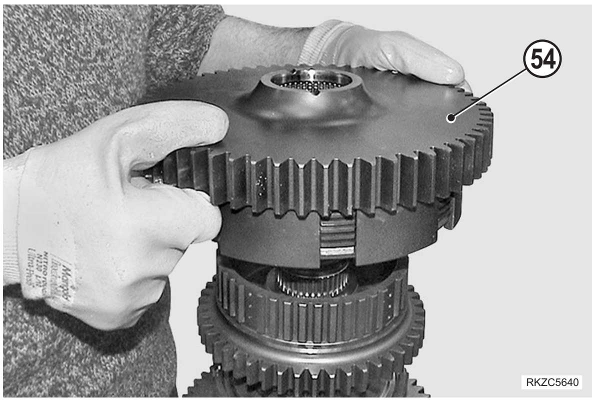
28 - Insert gear (35) paying attention it completely fit in its seat.



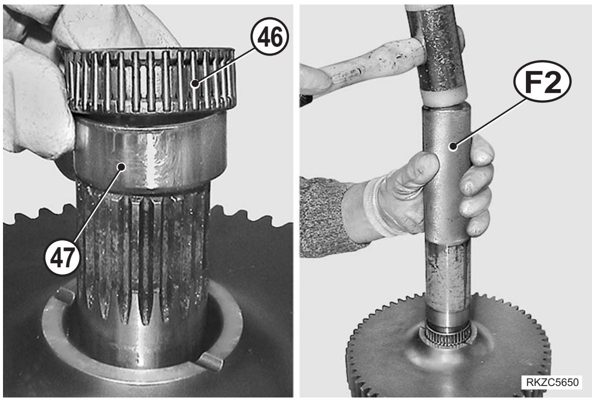
29 - Insert gear (37) on the shaft (23) by side shown in figure.



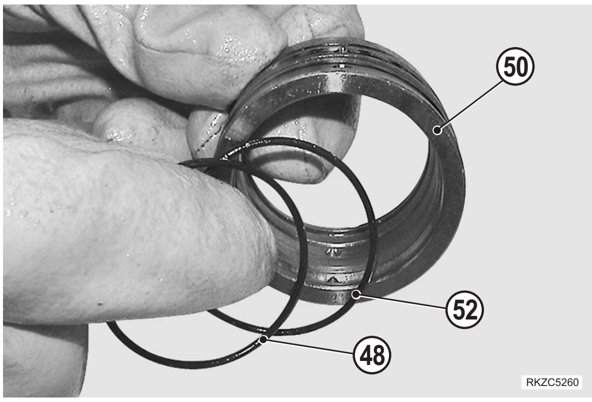
30 - Assemble the gear assembly (54) on main shaft (23).



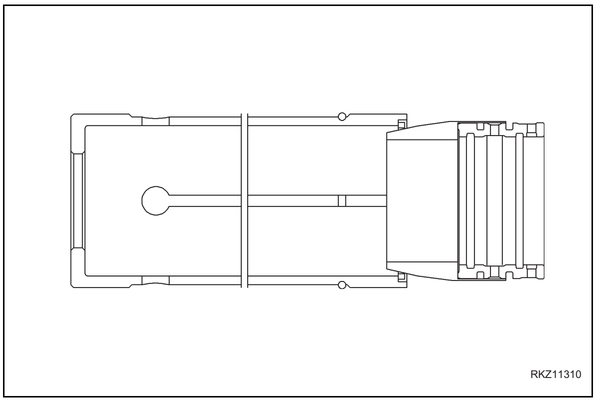
31 - Assemble the bush (47) and needle bearing (46) with special tool **F2**.



32 - Assemble the new O-rings (48) and (52) to the bush (50).

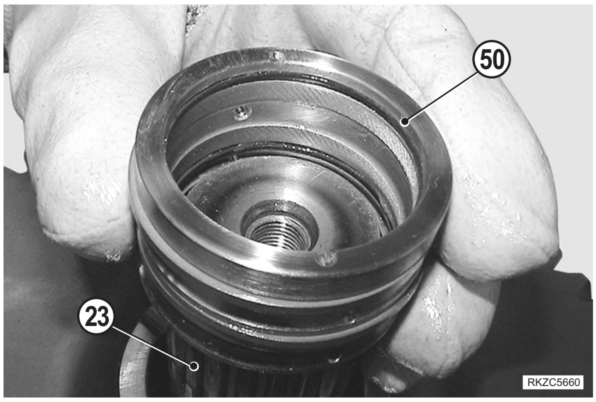


33 - Install new sealing rings (49) and (51) to bushing (50) using tools **F22**, **F23** and **F24.** Carry out steps 29 to 34 in section "6.2 Assembly" to install.

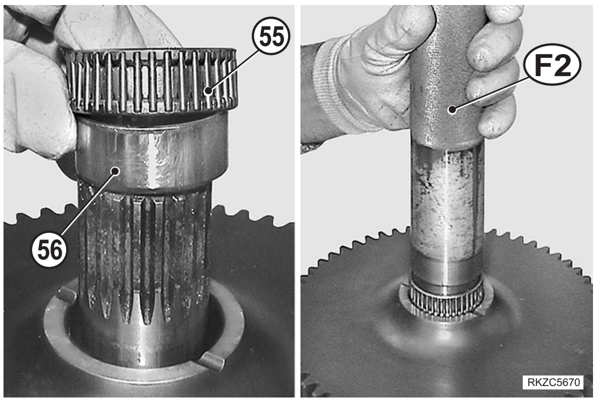


35 - Assemble the bush (50) on main shaft (23) with special tool **F2**.

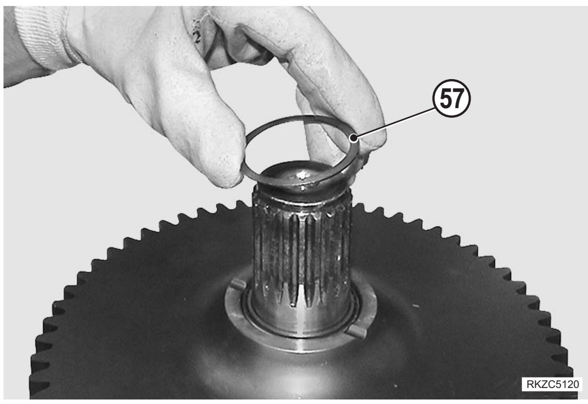
⚠ The reference mark must be on the top surface



36 - Assemble the bush (56) and needle bearing (55) with special tool **F2**.

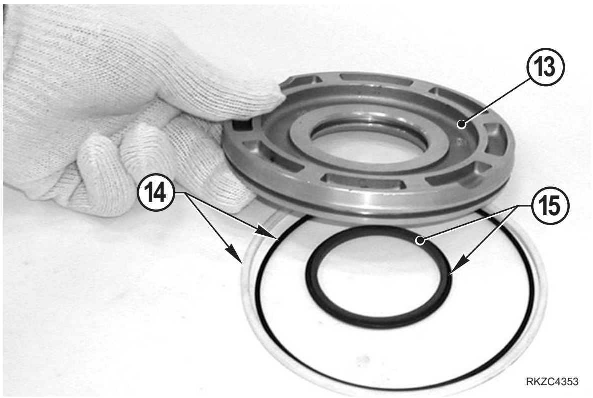


36 - Assemble the spacer (57).



37 - Assemble bearing (58).
Use tool **F2**.

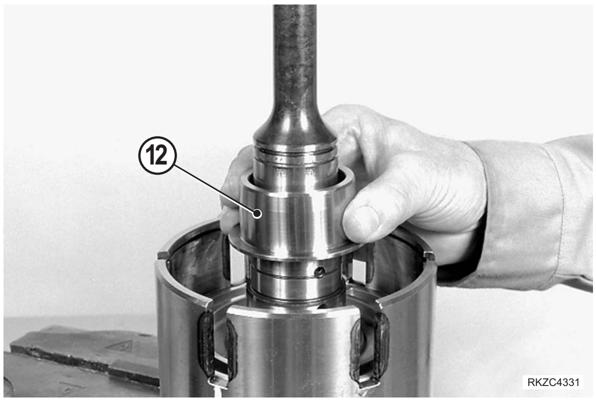
38 - Turn the shaft.
Assemble new O-ring with relative teflon ring (14) into the piston (13) outer seat.
Assemble new O-ring with relative teflon ring (15) into the piston (13) inner seat.



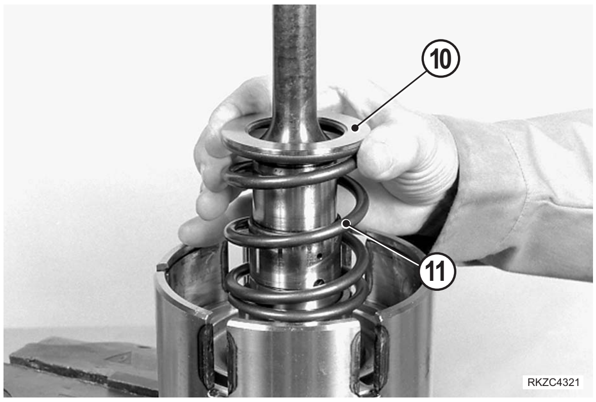
39 - Apply a thin film of grease on the sealing rings just inserted.

40 - Inseryt the clutch piston (13) with the special tool **F10** as protection of seal rings (15).

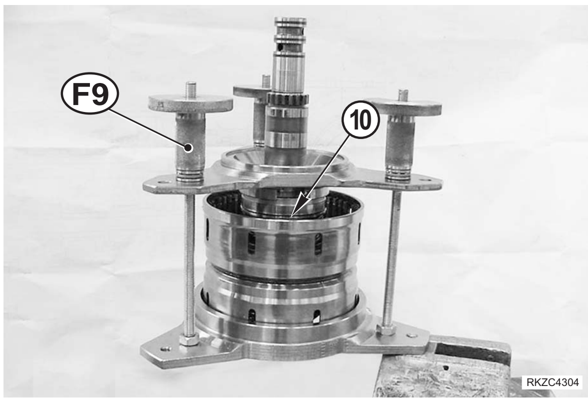
41 - Assemble sleeve (12).



42 - Assemble spring (11) and washer (10).

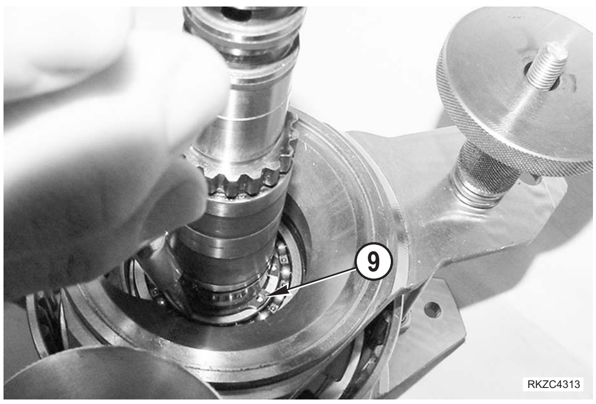


43 - Lower the spring (11) lock washer (10).
Use tool **F9**.

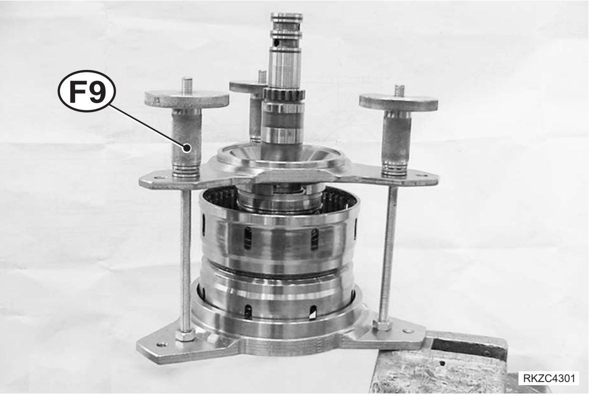


44 - Insert snap ring (9).

★ Ensure that the snap ring (9) is well fitted.

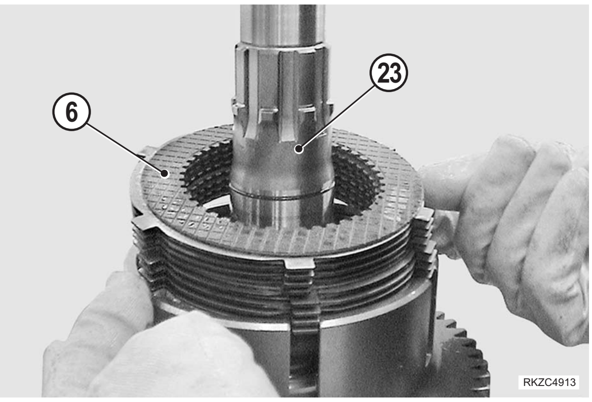


45 - Loosen the handles of the threaded rods to release the tension from the spring.
Remove the top piece of the **F9** special tool.

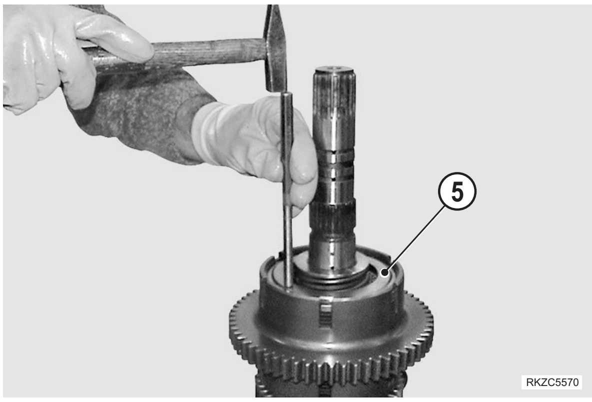


46 - Assemble spring pin (21).

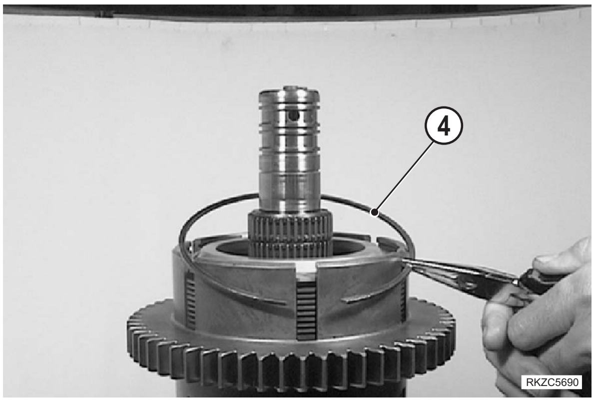
47 - Insert clutch kit (6) on main shaft (23).



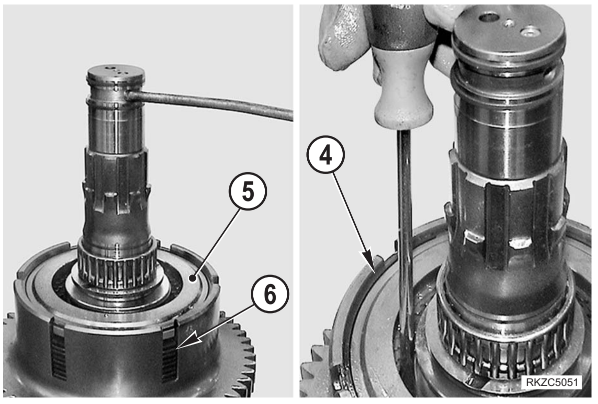
48 - Assemble thrust plate (5).



49 - Assemble snap ring (4).



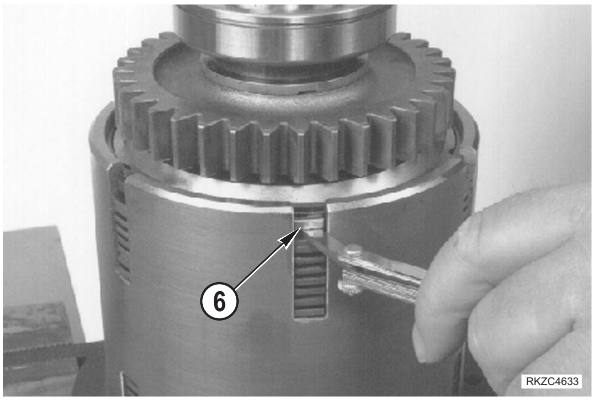
50 - Apply compressed air at low pressure in hole in order to push the thrust plate (5) against the retaining ring (4), then align the clutch plate (6) spline.



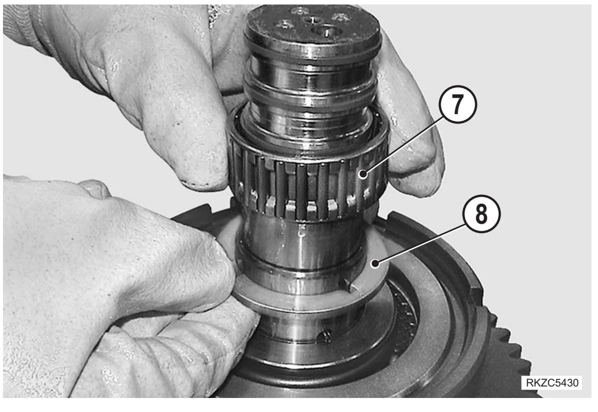
51 - Measure the clutch discs clearance for each clutch assembly.
The clutch plate lock ring must be all the way up against the lock ring.
Use a feeler gauge to measure the distance between the clutch plate lock ring and the first clutch plate (6).

★ Distance: 2.20–3.05 mm.

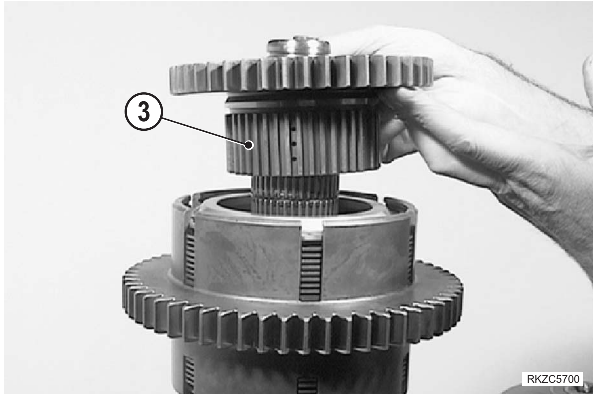
★ If the distance is not within specification, the clutch is probably assembled wrong.



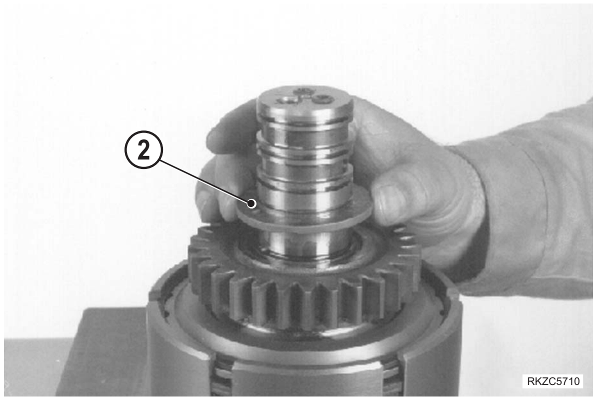
52 - Assemble the thrust washer (8) and roller bearing (7).



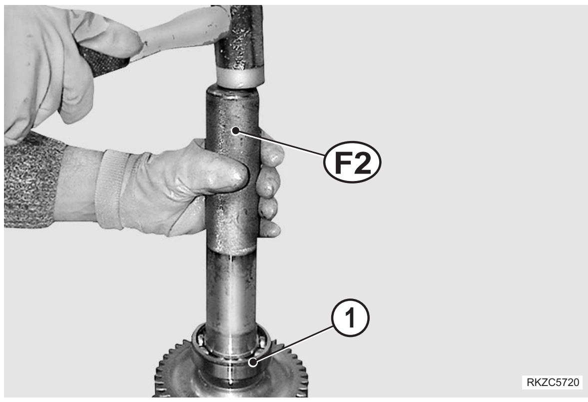
53 - Assemble the gear (3).



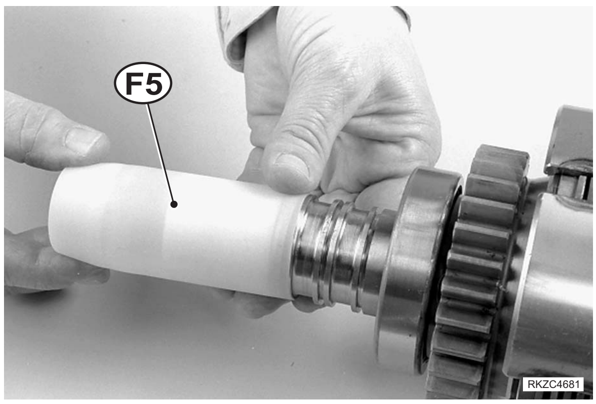
54 - Assemble the thrust washer (2).

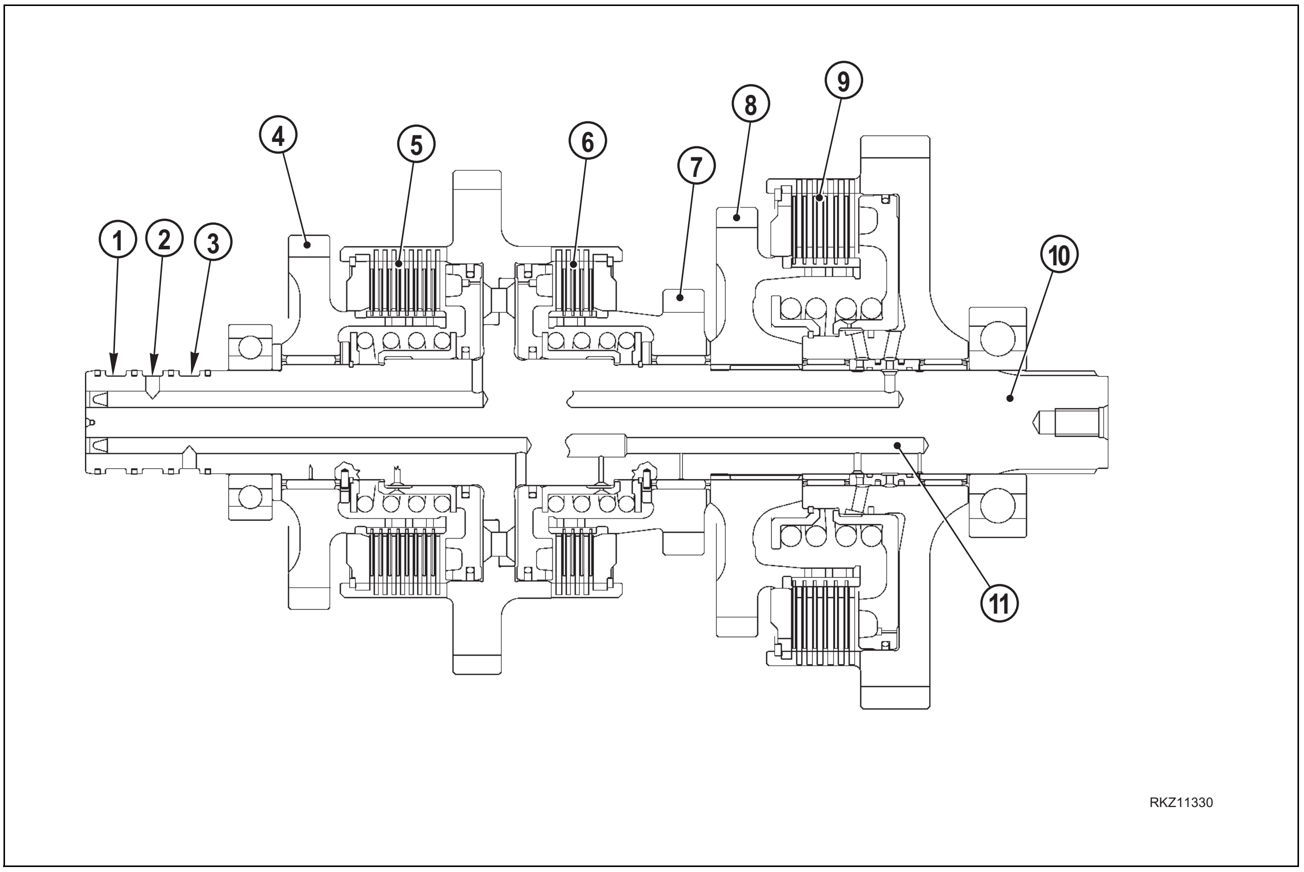


55 - Assemble bearing (1) with the special tool **F2**.



56 - Install Teflon sealing rings (16), (17), (18) and (19). Use special tool **F5** and carry out steps 29 to 34 in section "6.2 Assembly" to install.

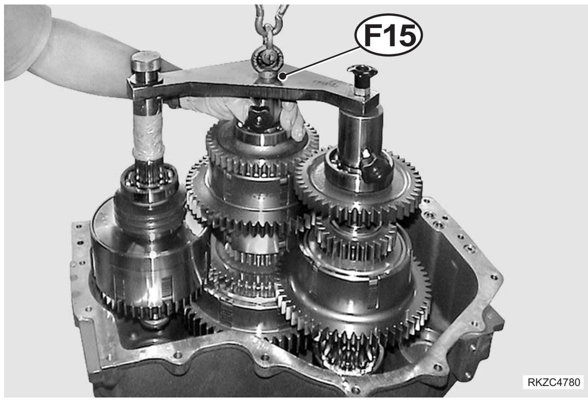




1. 1st clutch oil passage
2. 3rd clutch oil passage
3. 4th clutch oil passage
4. 3rd gear
5. 3rd gear clutch pack
6. 4th gear clutch pack
7. 4th gear
8. 1st gear
9. 1st gear clutch pack
10. Main shaft
11. Lubrication oil passage

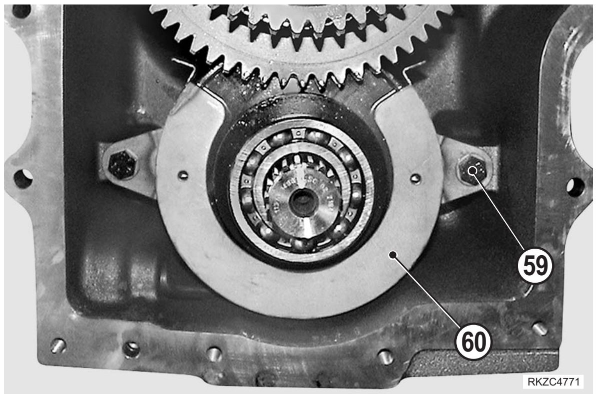
57 - Verify that all the gears can freely rotate on the main shaft.
Apply compressed air of approximately 6 bar to the 1st speed gear clutch passage.
Hear the 1st speed gear piston moving to lock the 1st speed gear clutch pack. Try to move the 1st speed gear. The 1st speed gear must not turn on the input shaft.
If the clutch does not work correctly, disassemble the clutch to find the problem.
Apply compressed air of approximately 6 bar to the 3rd speed gear clutch passage.
Hear the 3rd speed gear piston moving to lock the 3rd speed gear clutch pack. Try to move the 3rd speed gear. The 3rd speed gear must not turn on the input shaft.
If the clutch does not work correctly, disassemble the clutch to find the problem.
Apply compressed air of approximately 6 bar to the 4th speed gear clutch passage.
Hear the 4th speed gear piston moving to lock the 4th speed gear clutch pack. Try to move the 4th speed gear. The 4th speed gear must not turn on the input shaft.
If the clutch does not work correctly, disassemble the clutch to find the problem.

58 - Hook the three shafts **B**-**C**-**E** using the special tool **F15**.
Lift the shafts **B**-**C**-**E** at the same time and insert the unit into the half-housing.
Use tool **F15**.



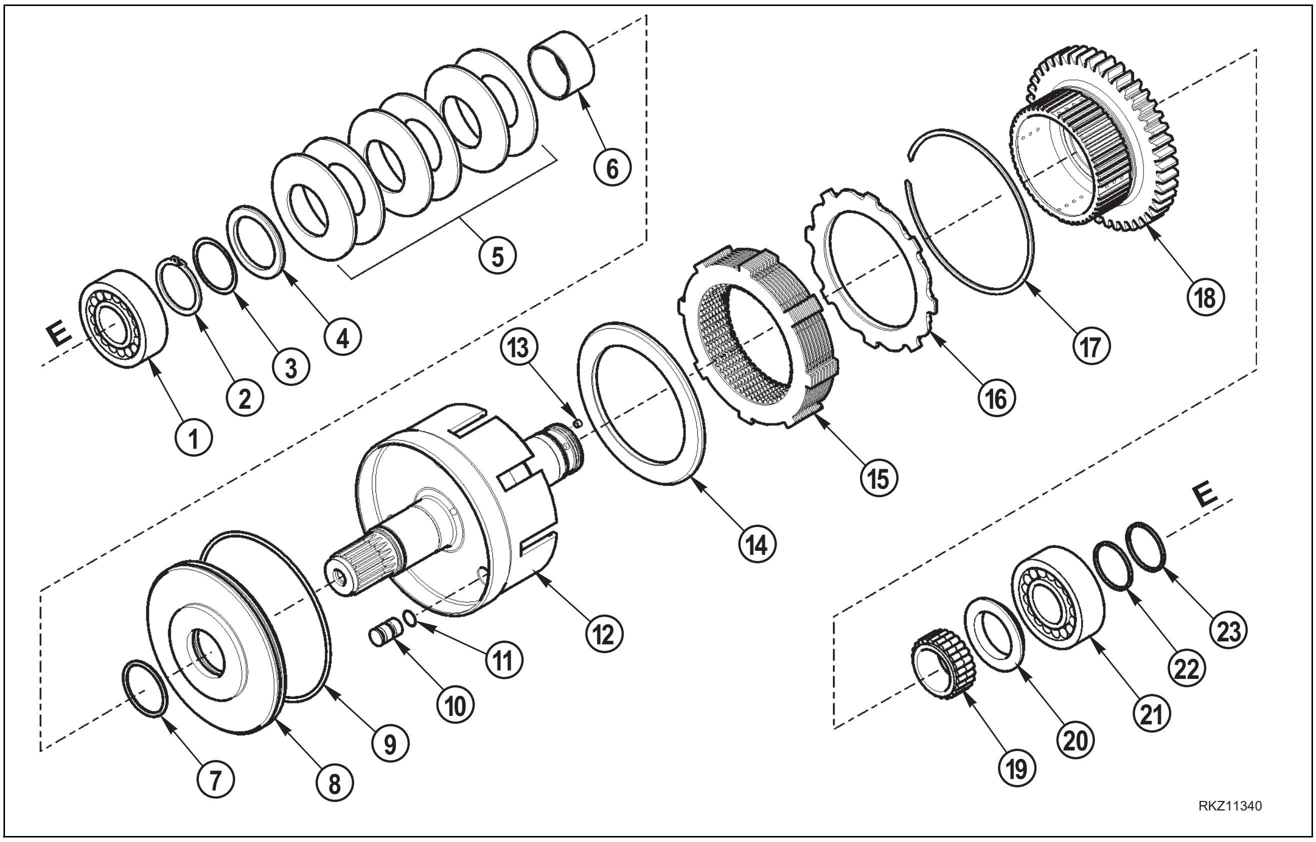
59 - Assemble protection (60) and tighten screws (59) to the prescribed torque.

Screw: 50 Nm

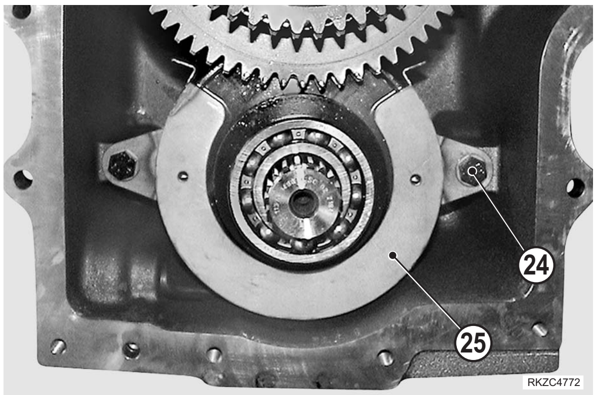


9. AXIS E

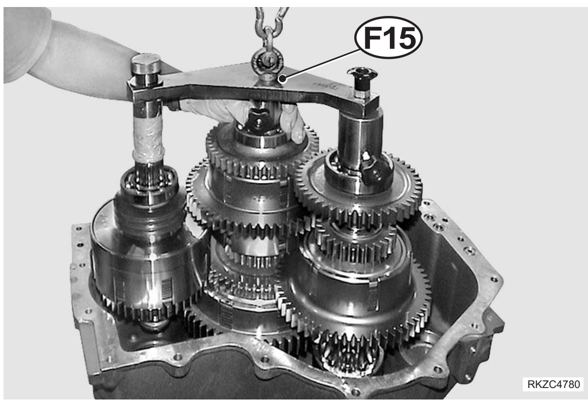
9.1 Disassembly



1 - Remove screws (24) and protection (25).

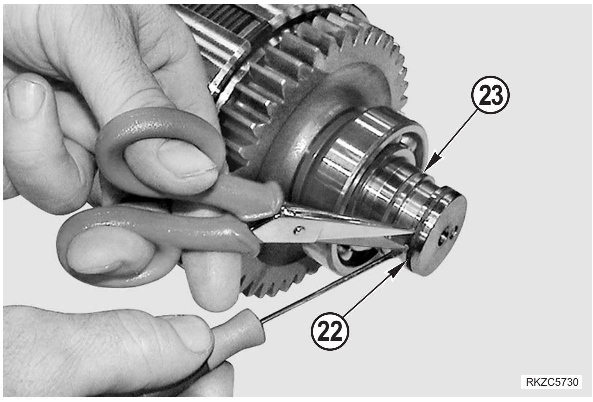


2 - Lift the three shafts **B**-**C**-**E** at the same time.
Use tool **F15**.

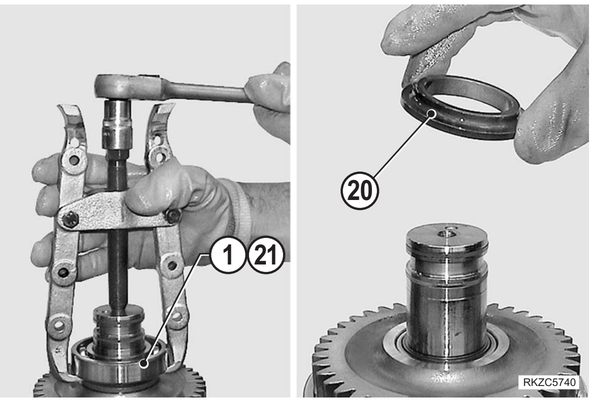


3 -Remove seals (22) and (23).

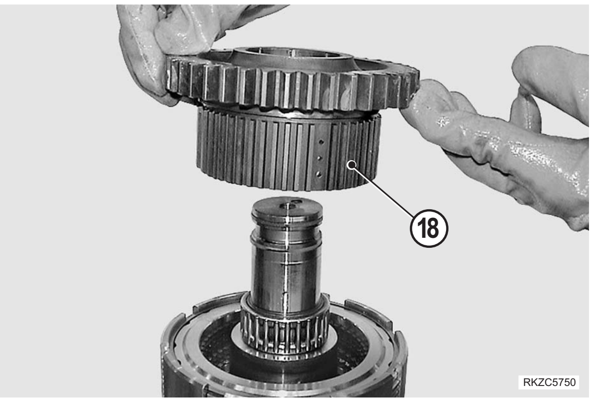
★ This is a destructive operation for the seal rings.



4 -By neans of an extractor, remove bearings (21) and (1).
Remove spacer (20).

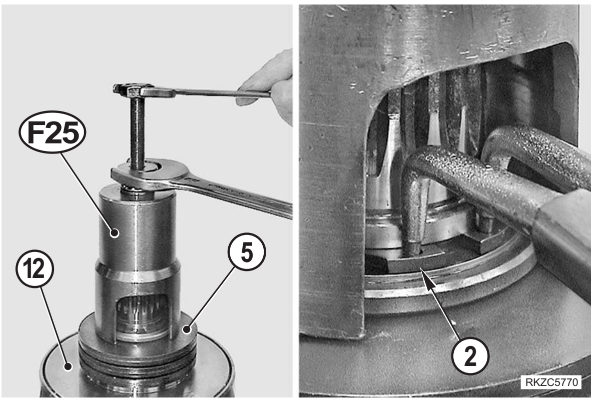


5 -Assemble the gear (18).

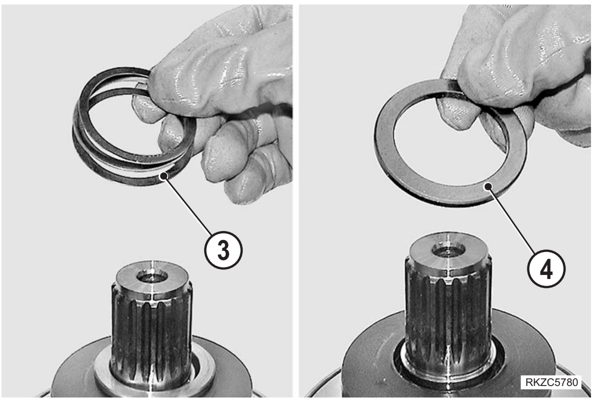


6 -Remove roller bearing (19).

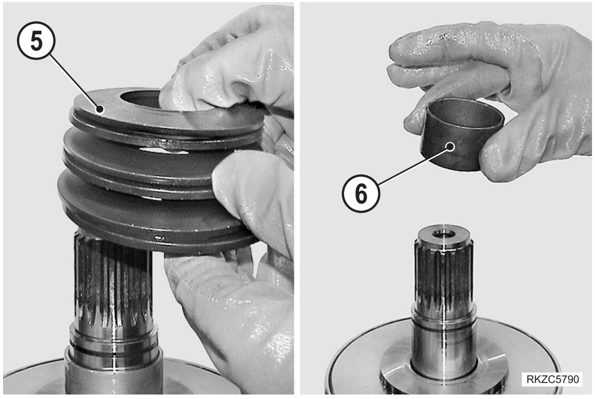
7 - Overturn the shaft (12).
Press the Belleville washers (5) and remove retaining ring (2).
Use tool **F25**.



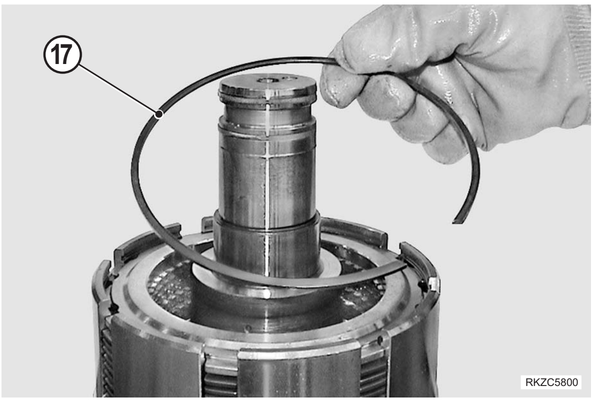
8 - Remove the shim (3) and washers (4).



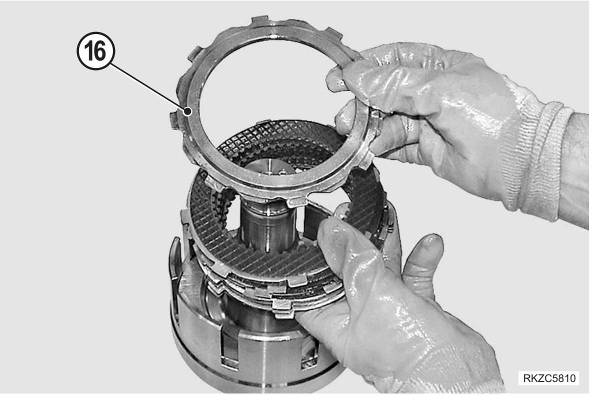
9 - Remove the Belleville washers (5) and spacer (6).



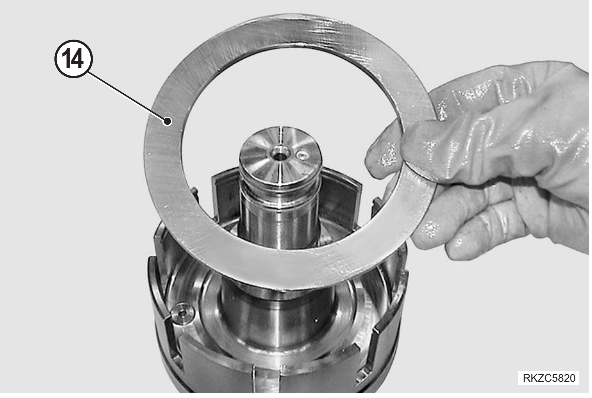
10 - Remove snap ring (17).



11 -Remove the thrust plate (16) and clutch kit (15).



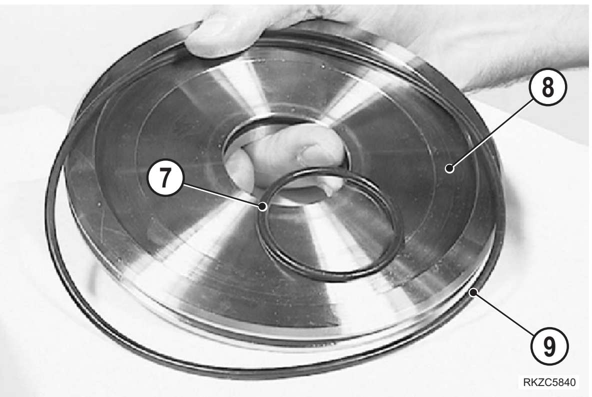
12 -Remove brake counter disk (14).



13 -Estract piston (8) using pins (10) as pusher.

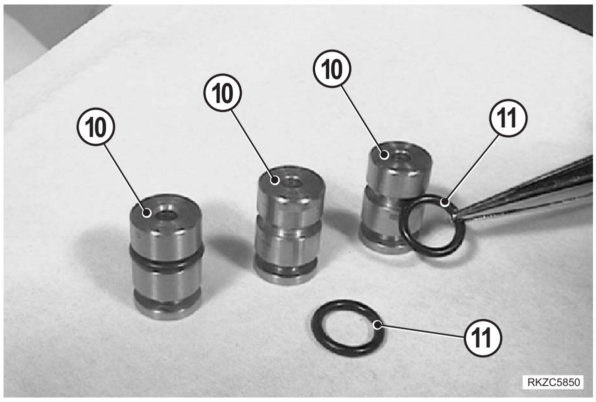
14 -Remove the O-rings, inner (7) and outer (9).

★ Replace the O-rings at each disassembly.

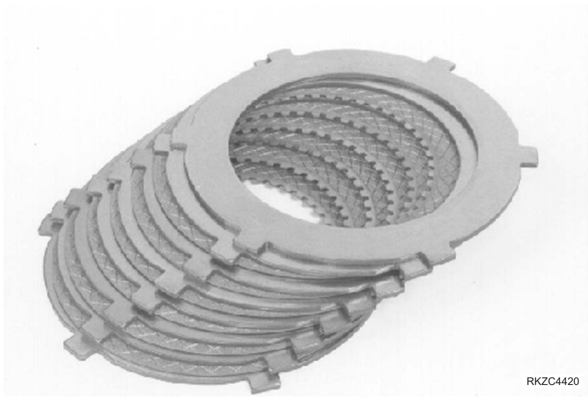


15 - Remove the O-rings (11) from pins (10).

★ Replace the O-rings at each disassembly.



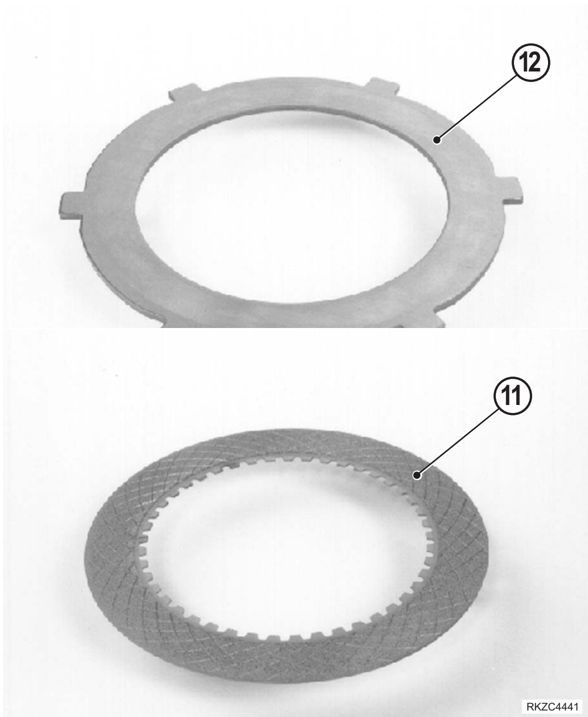
16 - If the clutch discs are to be used again, keep the clutch packs in the same previous assembly order separate and record which clutch pack goes with each clutch.



17 - At each disassembly:
- verify with a caliper that the total thickness of the clutch kit is within the wear limit.
- verify that all the clutch plates do not appear burned or that the friction material it is not damaged and that splines are well traced.
- verify also that all the clutch drive plates (12) are perfectly plane and inspect for pitting or scoring.

In the case that at least one of the above problems occurs, replace the complete clutch kit with a new one. If using a new clutch kit soak the clutch plates in clean transmission oil for at least an hour before assembly. In any case lubricate the contact surfaces of clutch drive plates with clean transmission oil before assembly.

18 - Inspect the bore of the shaft in the input shaft housing for damage that will cause leakage when the clucth is assembled.
Check the slots in the side of the input shaft housing for damage from the tangs on the steel discs.
Use new parts as required during assembly.

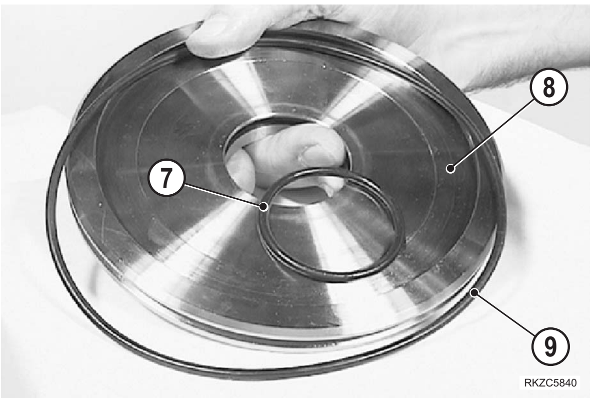


Number of clutch plate	9
Number clutch steel plate	9
Nominal clutch plate thickness	2.00±0.05 mm
Nominal clutch kit thickness	* 33.8–34.0 mm
Maximum clutch plate wear (each side)	0.15 mm
Maximum clutch kit wear	1.35 mm

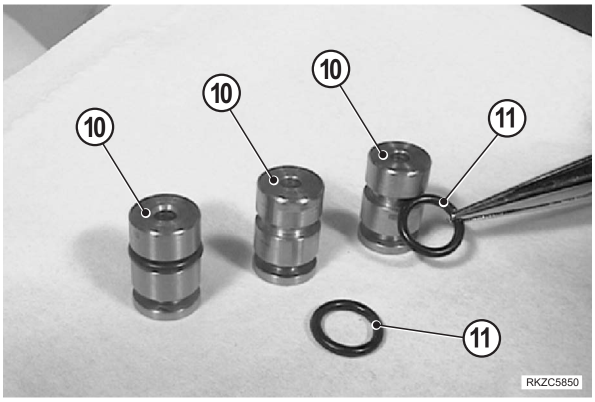
* Under load of 163 kg

9.2 Assembly

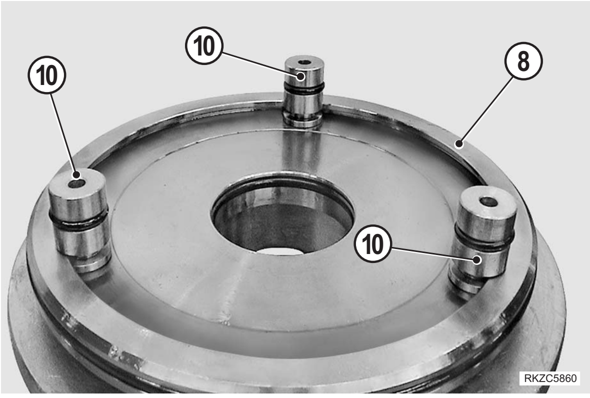
1 - Insert inner (7) and outer (9) O-rings on clutch piston (8).



2 - Insert O-rings (11) on the relative pins (10).

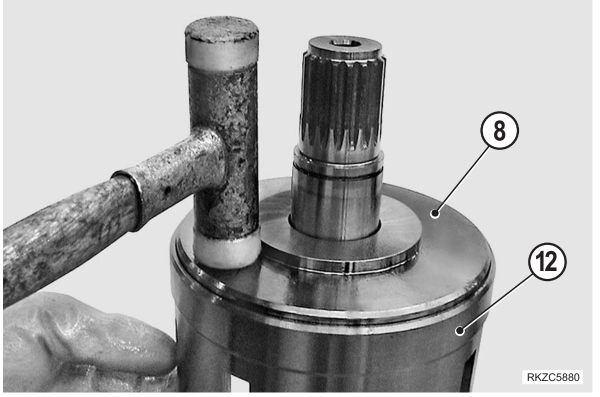


3 - Insert pins (10) on clutch piston (8).

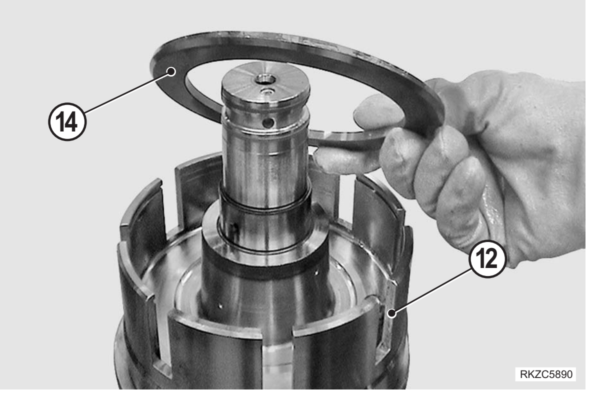


4 - Apply a thin film of grease on O-Rings and position the pins on clutch piston (8) in correspondence with the holes on output shaft.

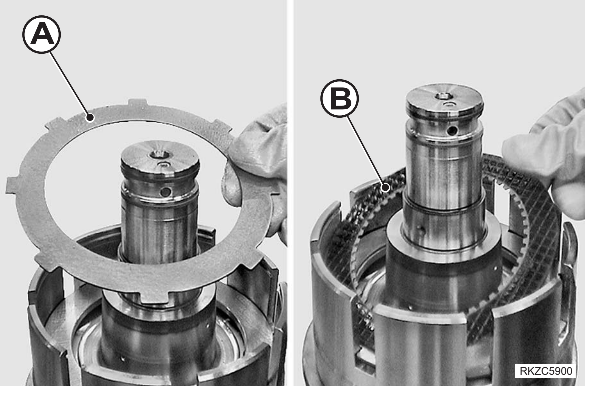
5 - Overturn the shaft (12) and fully insert the clutch piston (8).



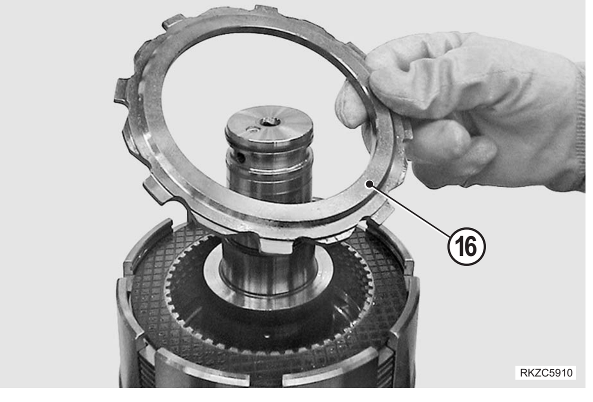
6 - Insert brake counter disk (14) on shaft (12) with with tapered edge facing down.



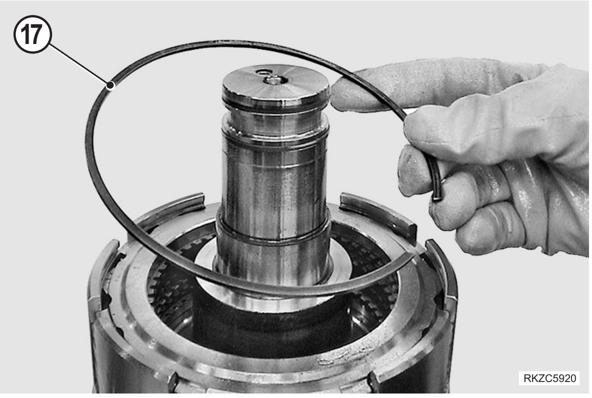
7 - Mount the clutch kit (15) starting with a drive plate (A) followed by a clutch plate (B).



8 - Mount thrust plate (16) on shaft (12).

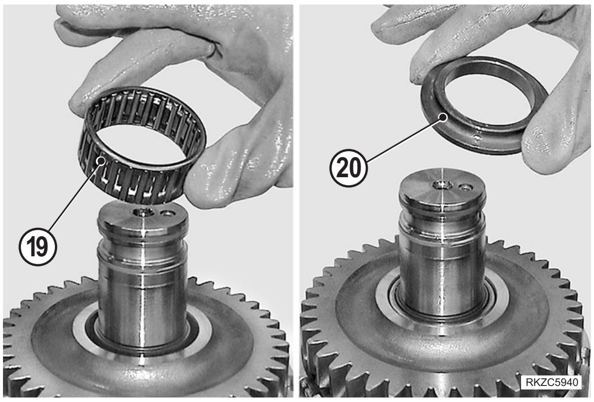


9 -Assemble retaining ring (17).

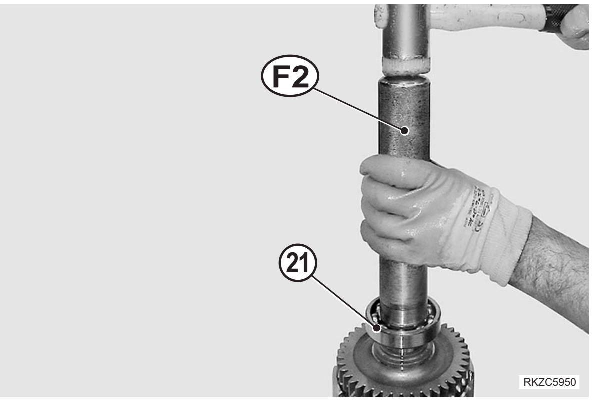


10 -Assemble gear (18).

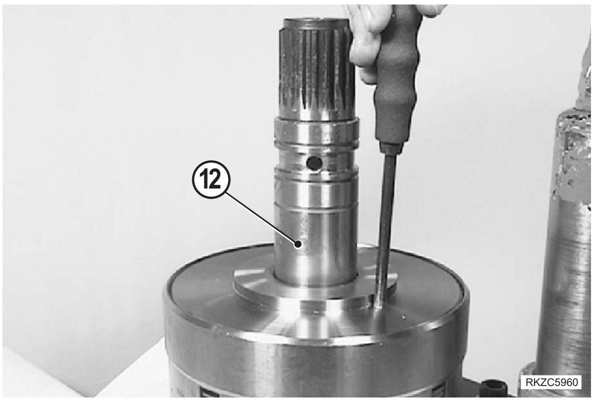
11 -Assemble roller bearing (19) and spacer (20).



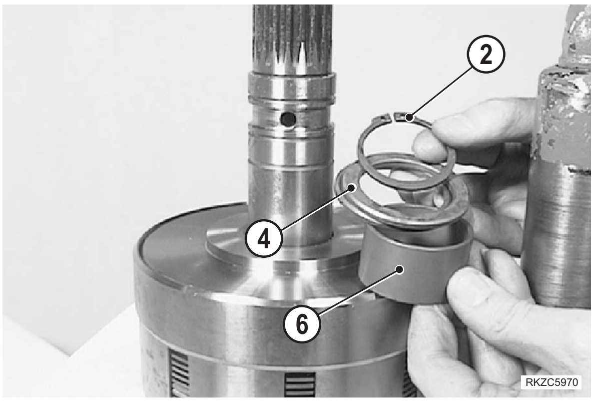
12 -Assemble bearing (21) using special tool **F2**.



13 - Turn shaft (12). Make sure that the disk/counterdisk pack and the piston are correctly seated.

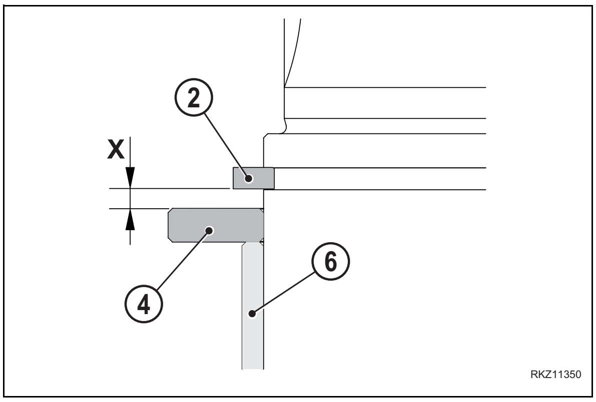


14 - Preassemble spacer (6), washer (4) and lock ring (2).



15 - Using a thickness gauge measure quote **X** between washer (4) and lock ring (2).
Subtract from quote **X** fixed quote **S1** (S1=1.80mm).
The result S is the thickness of shims (3) which has to be inser to between washer (4) and locking (2).

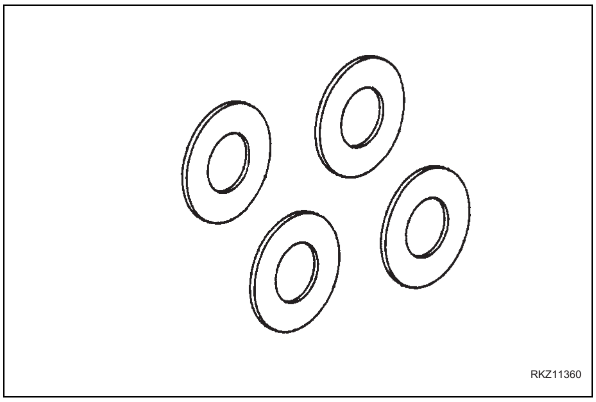
S=X-S1=X-1.80mm



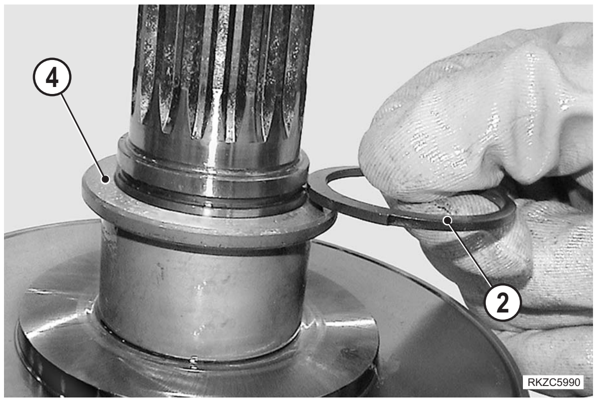
16 - Pick the (**S**) shim (3) from the range of shims available.

★ Choose a shim that will provide a piston travel of 1.70-1.90 mm.

SHIM RANGE			
Shim (mm)	0.1	0.3	0.5

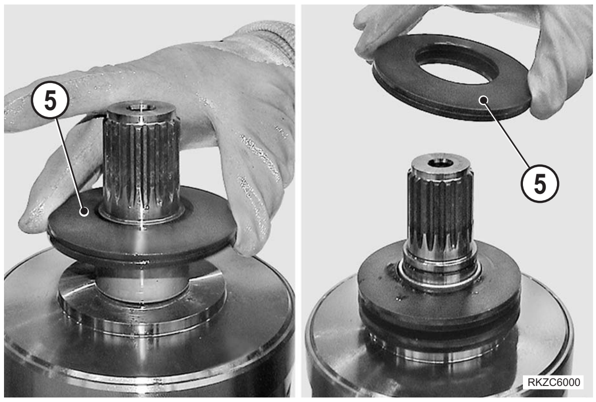


17 - Disassemble the washer (4) and lock ring (2).

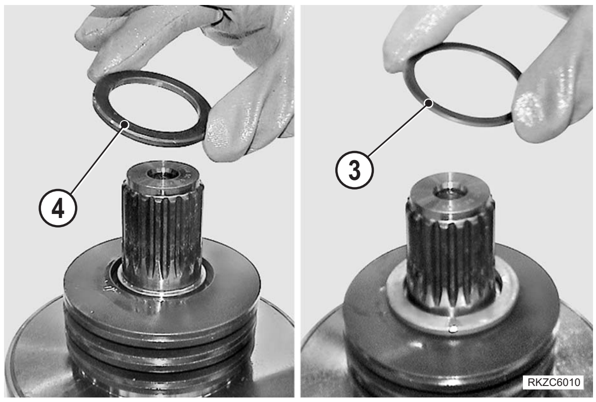


18 - Insert Belleville washer (5).

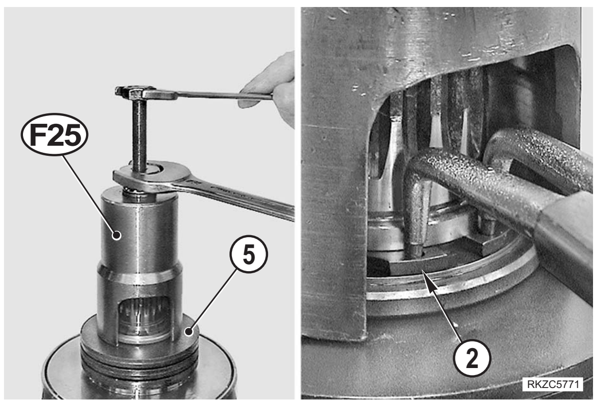
★ Check the Belleville washer (5) orientation.



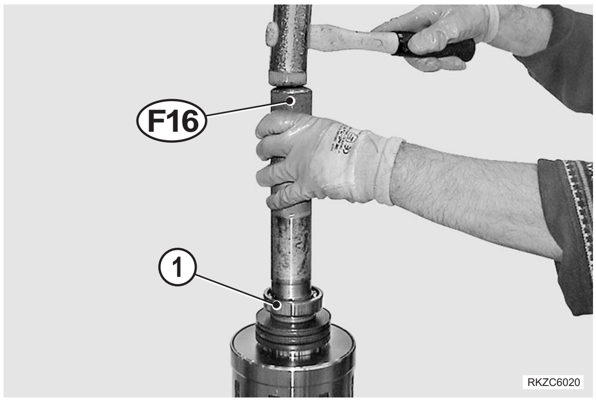
19 - Mount washer (4) and shims (3) with thickness **S** defined at sequence 14.



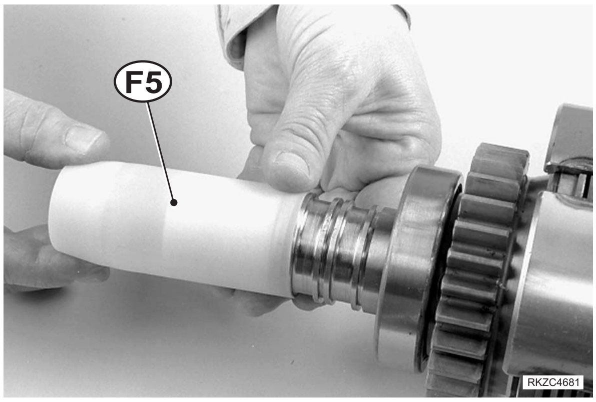
20 - Lower Belleville washers (5) and assemble retaining ring (2). Use tool **F25**.



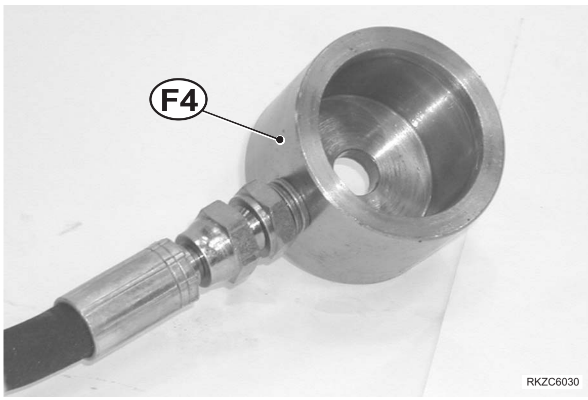
21 - Assemble bearing (1) using tool **F16**.



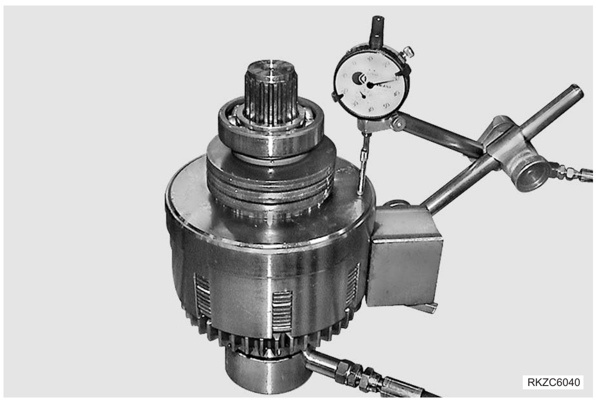
22 - Install Teflon sealing rings (**22**) and (**23**).
Use special tool **F5** and carry out steps 29 to 34 in section "6.2 Assembly" to install.

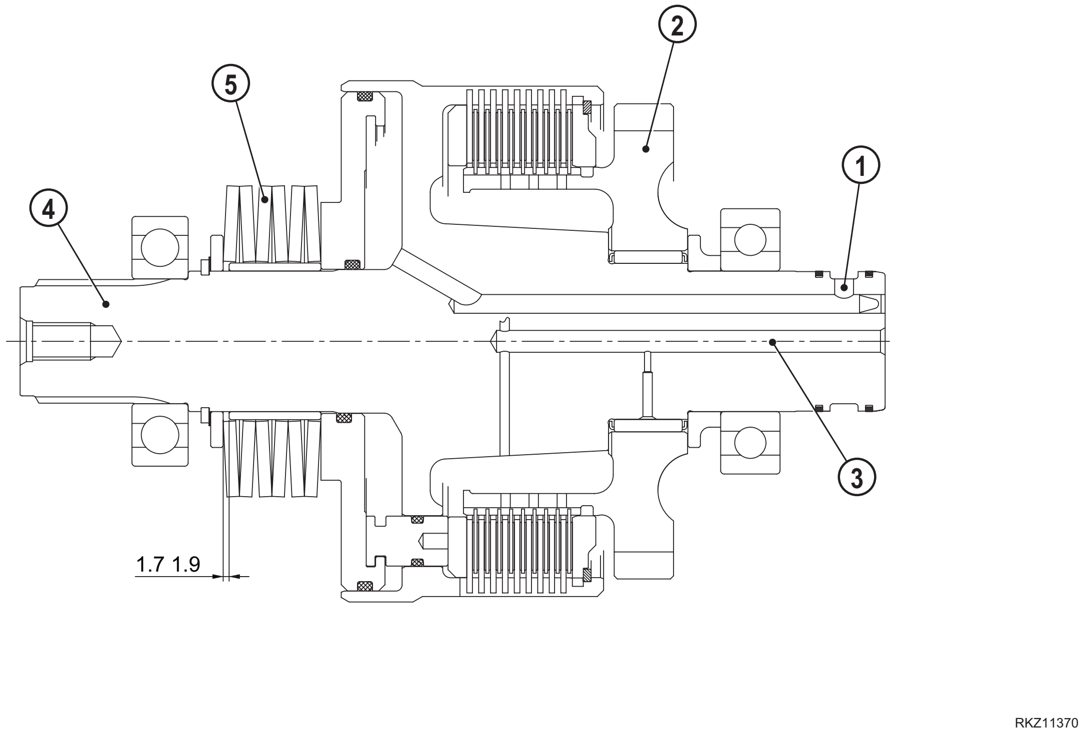


23 - Use tool **F4** for piston operation check and correct adjustment check.



24 - In order to verify the seal of rings (7) and (9) feed the piston chamber with oil at 10 bar and check with a dial gauge located as shown in the photo if the real stroke is included between 1.7 and 1.9 mm.

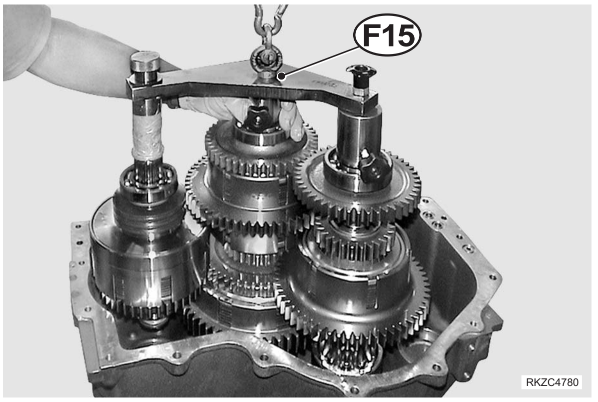




1. 4WD oil passage.
2. 4WD drive gear.
3. 4WD lubricant oil passage.
4. Shaft
5. Belleville washers.

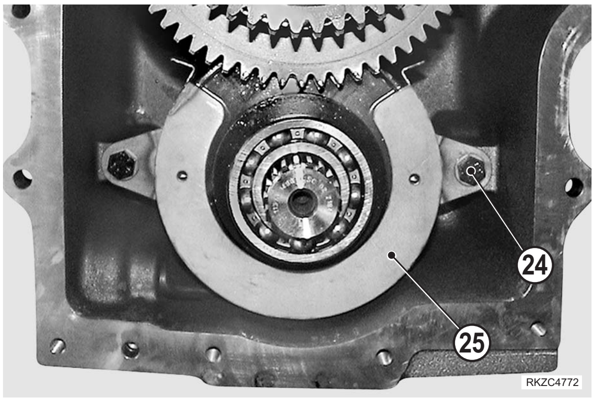
25 - Apply compressed oil pressure of approximately 10 bar to the 4WD clutch passage.
Listen to hear the piston moving to unlock the clutch pack. The belleville washers compressing.
Try to move the 4WD gear.
The 4WD gear must turn freely on the 4WD shaft.
If the clutches do not work correctly, disassemble the clutches to find the problem.

26 - Lift the three shafts **B-C-E** at the same time and insert into the half-housing.
Use tool **F15**.



26 - Assemble protection (**25**) and tighten screws (**24**) to the prescribed torque.

Screw: 50 Nm



CONVERTOR

Removal

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

⚠ Eliminate all residual pressure from all circuits by moving the hydraulic controls in all directions.

★ Drain the hydraulic oil.

Hydraulic oil: approx. 40 ℓ

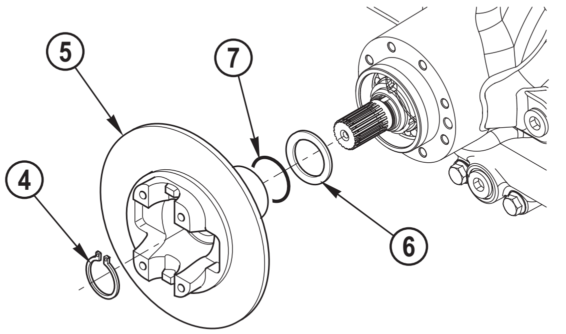
★ Drain the oil from the gearbox.

Gearbox oil: approx. 20 ℓ

1 -Remove the piston pump.
(For details see "PISTON PUMP").

2 -Remove the engine hood.
(For details see "TRANSMISSION").

3 -Remove the converter (1). [*1]



RKZ08470

Installation

- To install, reverse removal procedure.

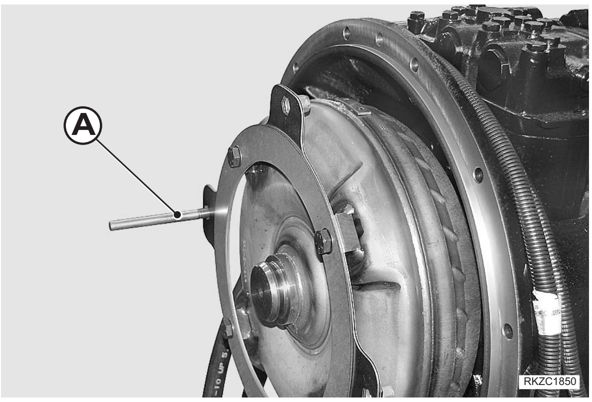
★ Ensure that the mating surfaces are clean and free of dents.

[*1]

★ To aid in mating flywheel and joint, before mating engine and transmission, tighten a threaded shank "**A**" as guide to the joint:

Screw: Loctite 262

Screw: 39 Nm



ENGINE

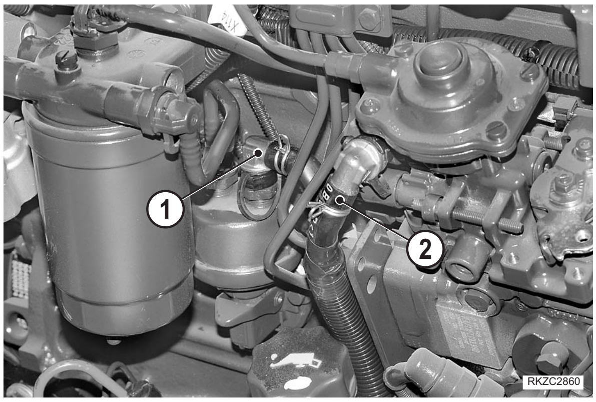
Removal

1 - Remove:
- ENGINE HOOD
- FRONT GUARD
- FRONT COUNTERWEIGHT
- RADIATOR GROUP
- CONDENSER
- MUFFLER
- AIR FILTER
- PISTON PUMP
- TRANSMISSION

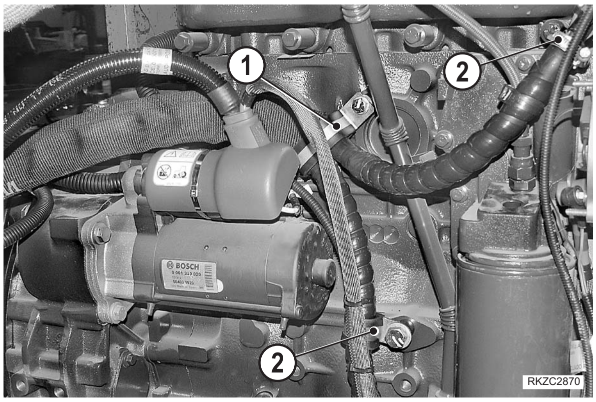
For details, see the individual removal procedures.

2 - Disconnect the fuel inlet and return pipes (1) and (2), release them from the tie straps and position them aside.

★ Cap pipes, hoses and holes to prevent contamination.

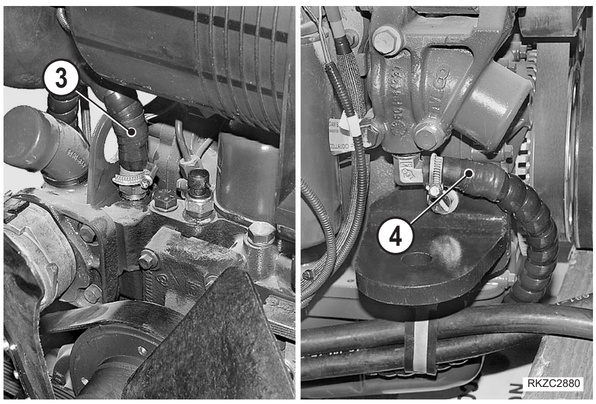


3 - Remove the screws and release the straps (1) and (2) retaining the heating system hoses.

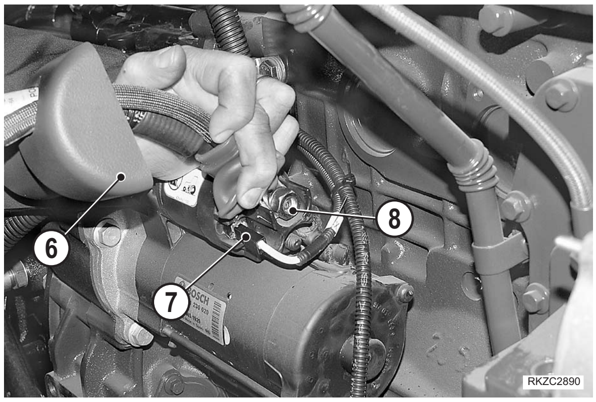


4 - Disconnect the heating system hoses (3) and (4) and remove the tie strap (5) retaining the gearbox oil hoses.

★ Cap pipes, hoses and holes to prevent contamination.



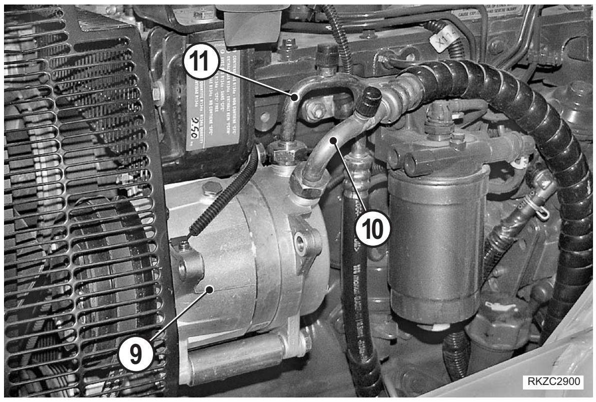
5 - Lift the cover (6) and disconnect wiring harnesses (7) and (8) from starter.



Only if equipped

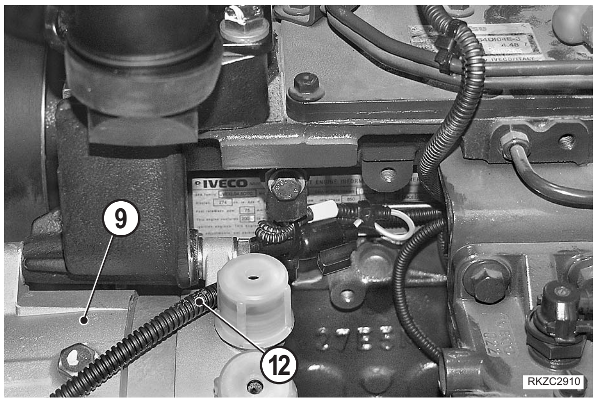
6 - Disconnect suction and delivery hoses (10) and (11) from air-conditioning group compressor (9).

★ Cap the hoses and holes to prevent contamination.

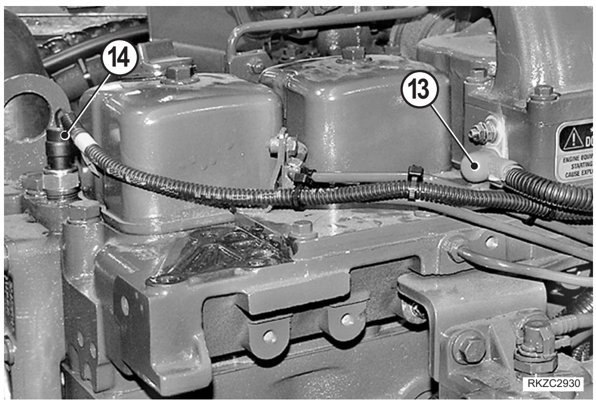


Only if equipped

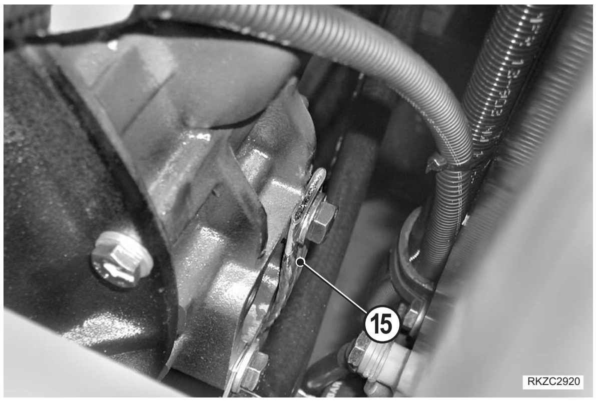
7 - Release the wiring harness (12) to the compressor (9) from the tie straps and disconnect.



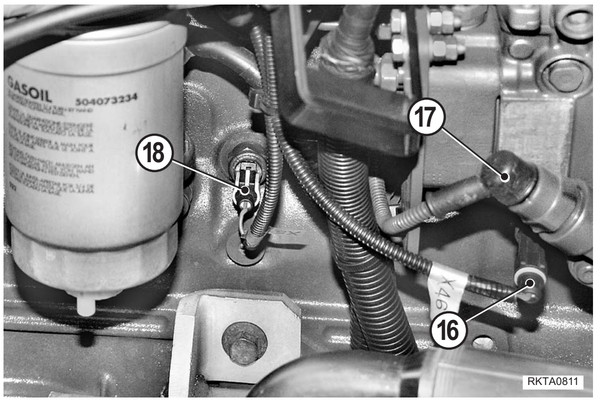
8 - Disconnect wiring harness (13) from thermal starter and disconnect connector (14) from the coolant liquid temperature sensor.



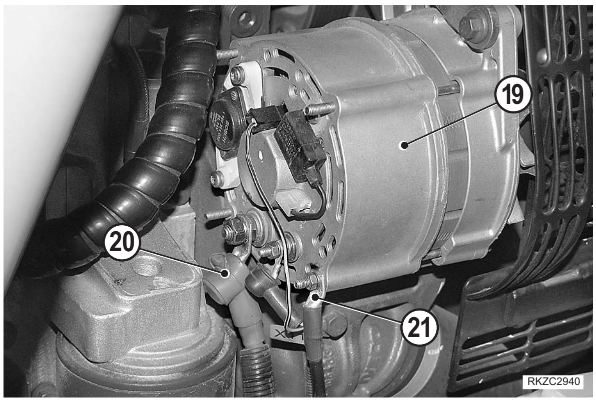
9 - Disconnect the ground plait (15) from the engine.



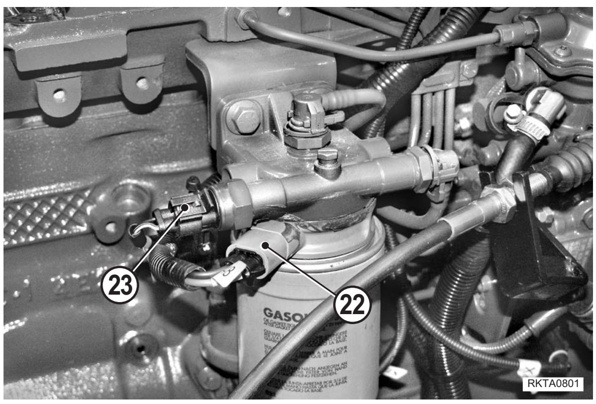
10 - Disconnect connector (16) from the engine stop solenoid valve, disconnect connector (17) from the engine oil temperature sensor (17), and disconnect connector (18) from the oil pressure sensor.



11 - Disconnect wiring harness (20) and ground wire (21) from generator (19).

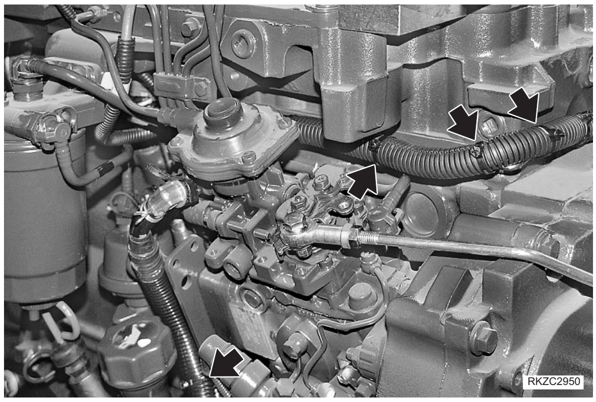


12 - Disconnect heating system connector and fuel temperature sensor connector (22) and (23) from the filter holder.

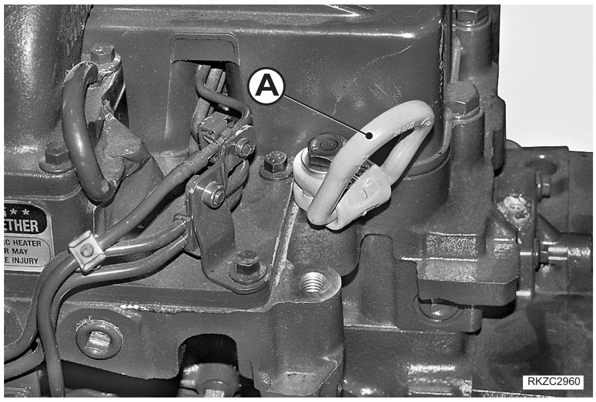


13 - Release the entire engine harness from the tie straps and route the harness down, and use some straps on the inner sides of the frame to let the wiring hang termporarily.

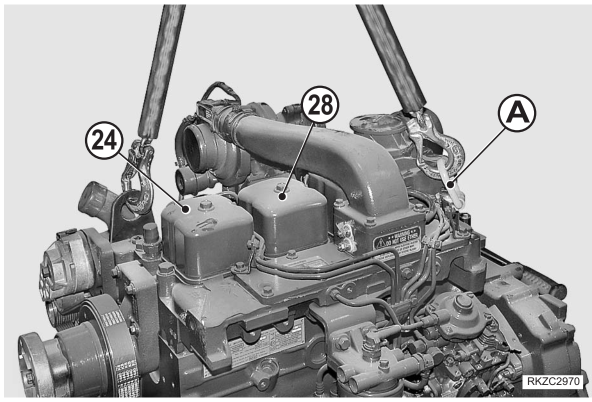
14 - Check to ensure that all hoses to the engine are released from straps or ties.



15 - Tighten a revolving lifting eye "**A**" to the muffler inner mounting hole.



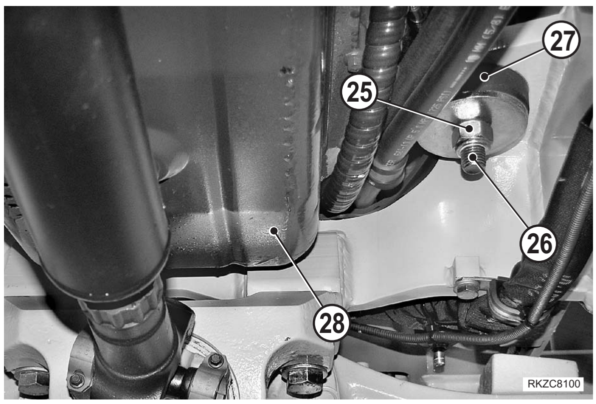
16 - Attach a lifting device to lifting eye "**A**" and to engine front bracket (24), and apply a slight tension to the chains or cables.



17 - Loosen and remove nuts (25), screws (26) and vibration dampers (27) from front engine mounts. [*1]

18 - Remove the engine (28).

Engine: approx. 370 kg



Installation

- To install, reverse removal procedure.

[*1]

Nuts: 200 Nm

★ Check transmission oil level before starting the engine.

★ Thoroughly check the connectors to ensure that they are properly connected.

1 - Start the engine and let it idle for a couple of minutes.

2 - Stop the engine and check all levels.

CONTROL VALVE

Removal

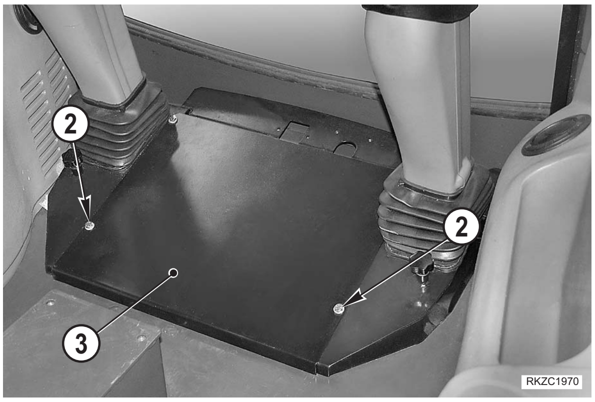
1 -Move backhoe fully to the right and swing the boom by about 45° to the right leaving the backhoe plate unlocked.

2 -Lower the outriggers to the ground, curl the bucket and allow it to rest on the ground on its back.
Apply the parking brakes, stop the engine.

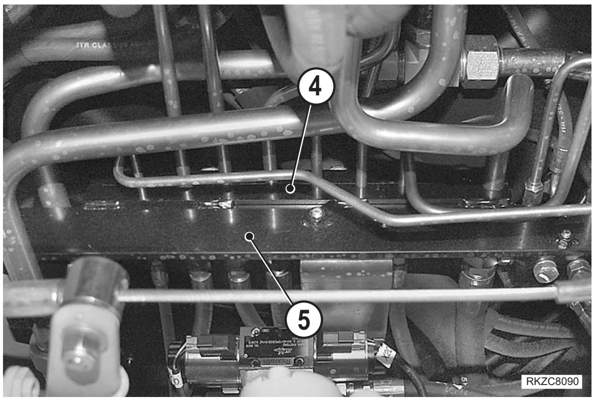
3 -Release all residual pressure.
(For details see "20 TESTING AND ADJUSTMENTS").

4 -Lift rear window (1) to the top and remove the rear mat.

5 -Take out the screws (2) and remove the platform (3).



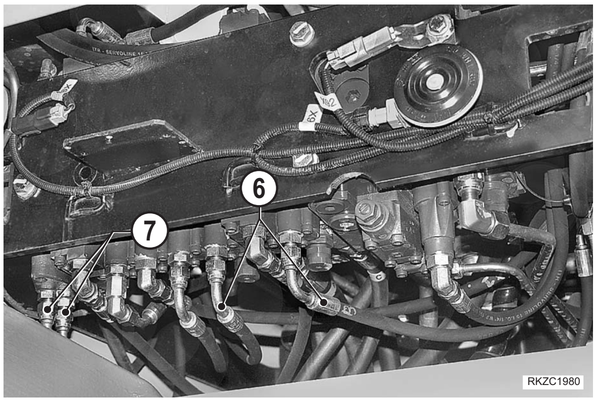
6 -Loosen the clamp (4) on the control valve support frame (5) (4 screws).



7 - Disconnect lower servocontrol and actuator hoses (6) together will all accessible side hoses (7) from control valve.

★ Check that all the hoses are marked and note down the bends and routing patterns.

★ Cap pipes, hoses and holes to prevent contamination.

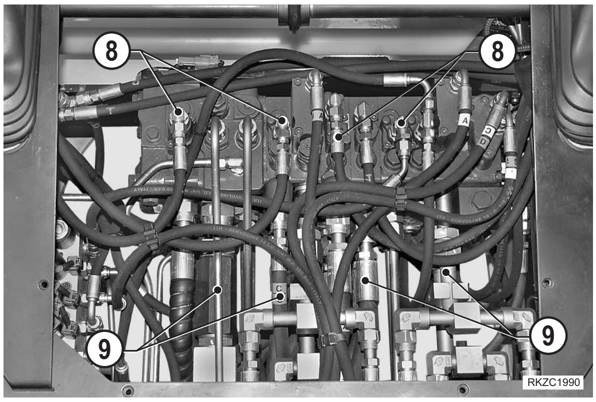


8 - Disconnect upper servocontrol hoses (8) and actuator hoses (9) from control valve.

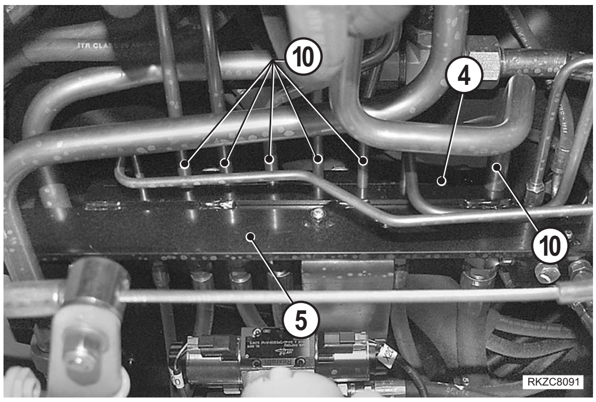
★ Check that all the hoses are marked and note down the bends and routing patterns.

★ Cap pipes, hoses and holes to prevent contamination.

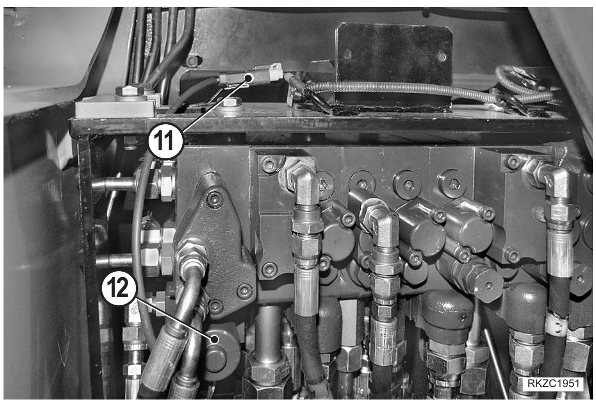
★ Lay the servocontrol hoses inside the cab to gain access to the delivery, exhaust, and actuator hoses.



9 - Turn the tubes (10) that provide direct connection away from control valve and retain their position by temporarily tightening clamp (4) on frame (5).



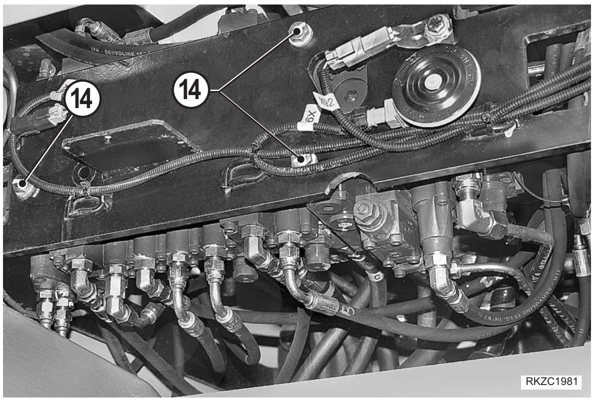
10 - Disconnect connector (11) from backhoe plate lockout solenoid valve (12).



11 - Support control valve (13) by means of two ropes connected to a lift arm to be introduced through the cab opening.
Apply a slight tension to the ropes.

★ Pay special attention to rope routing to prevent damaging the unions.

12 - Loosen and remove the four screws (14) (n° 3) and the relative washers.



13 - Lower the control valve (13) onto a lift. [*1]

8-spool control valve: _______ kg

10-spool control valve: _______ kg

Installation

- To install, reverse removal procedure.

[*1]

★ Install control valve from top.

1 - Start the machine to circulate the oil; check to ensure 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 hydraulic oil level and top up as necessary.

STEERING SOLENOID VALVE GROUP

Removal

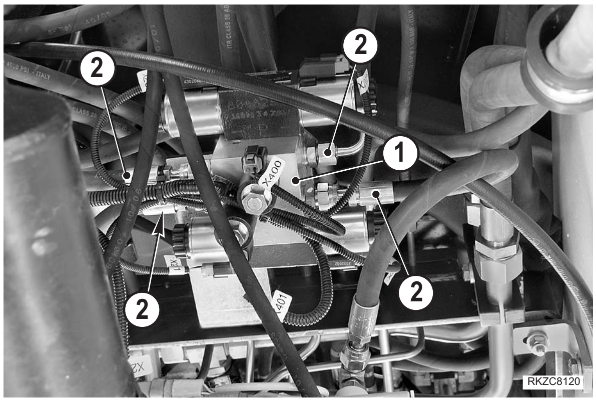
⚠ Lower the working equipment completely until it rests on the ground; engage the parking brake, stop the engine and remove the ignition key.

⚠ Release all residual pressure.
(For details see "20 TESTING AND ADJUSTMENTS").

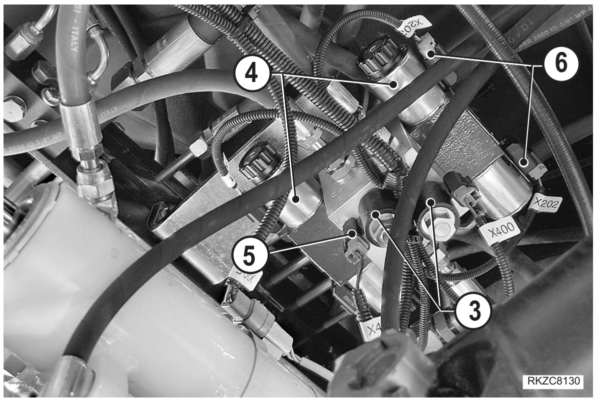
1 - Mark and disconnect all hoses (2) from selonoid valve group (1).

★ Plug all pipes/hoses to prevent contamination.

2 - Mark and disconnect all connectors (5) (No. 2) and (6) (No. 2) from selonoid valve (3) and (4) (No. 4).



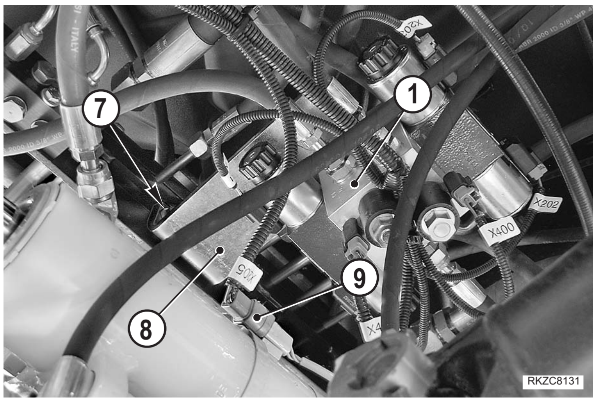
3 - Loose and remove bracket (8) fixing screws (7) (No. 2), disconnect connectors (9) and remove steering solenoid valve group (1).



Installation

- To install, reverse removal procedure.

1 - Run the engine and and steer few times in both direction, using alternatively the 2 wheel steering mode and one of the 4 wheel steering mode.



FRONT AXLE

Removal

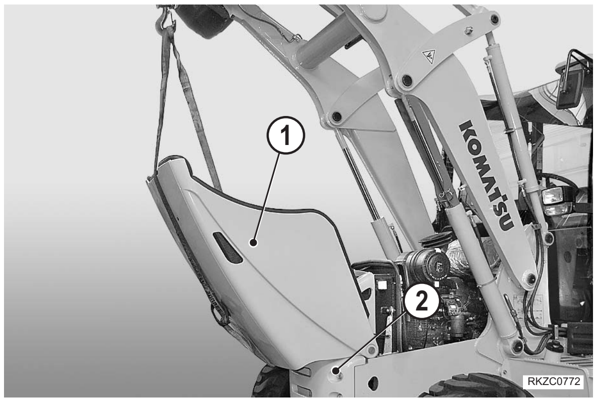
1- Start the engine and force the shovel downwards in order to raise the machine and the front wheels.

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 place the backhoe in its secure position.

4 -Engage the parking brake.



5 -Stop the engine and eliminate residual pressure from all circuits. (For details see "20 TESTING AND ADJUSTMENTS").
Remove the ignition key.

6 -Remove the engine hood (1) and the front guard (2). (For details, see "ENGINE HOOD" and "FRONT GUARD").

7 -If equipped, remove the front counterweight. [*1]

Counterweight: 372 kg

8 -Remove the front wheels. [*2]

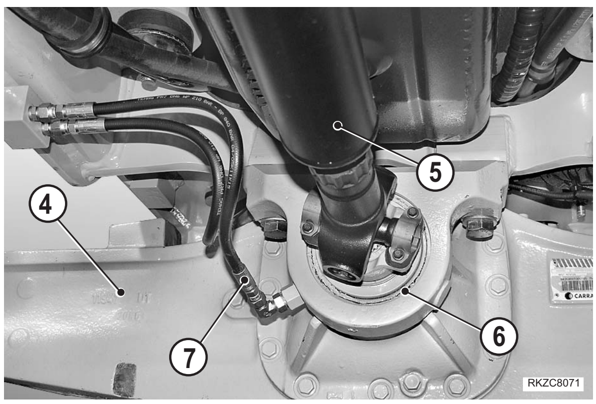
Wheel: _________ kg

9 -Remove the mud guard (3). [*3]

10 -Disconnect the cardan shaft (5) from the axle (4). [*4]

11 -Disconnect from rear axle support (6) the lubrication hose (7).

★ Plug the pipe to prevent contamination.

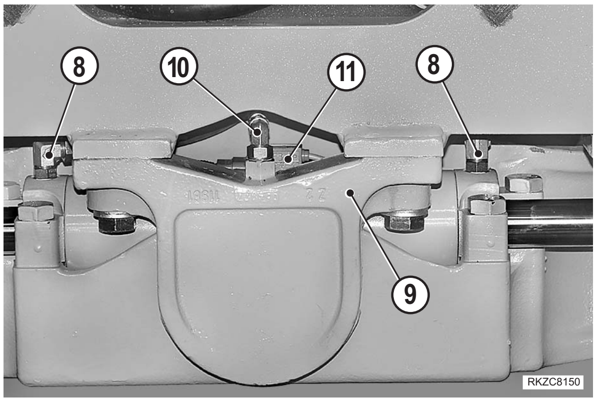


12 - Disconnect hoses (8) from cylinder. [*5]

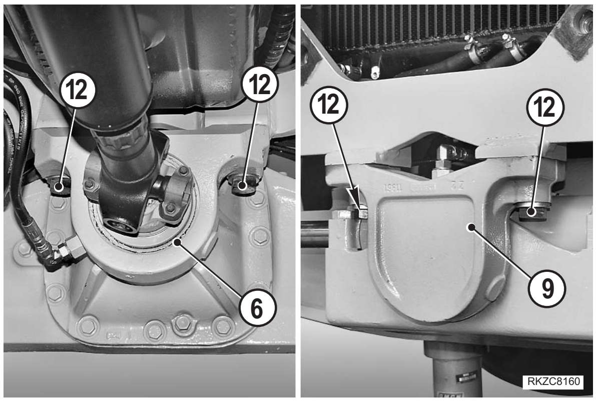
13 - Disconnect from front axle support (9) the lubrication hose (10).

14 - Disconnect the connector (10) from the steering sensor (11).

★ Cap the hoses and cover the connector to prevent contamination.



15 - Loosen the screws (12) retaining the supports (6), (9) to eliminate torque. [*6]



16 - Position a jack "**B**" and some blocks "**C**" beneath the axle. Raise the jack until the blocks can be forced under the axle arms (4).

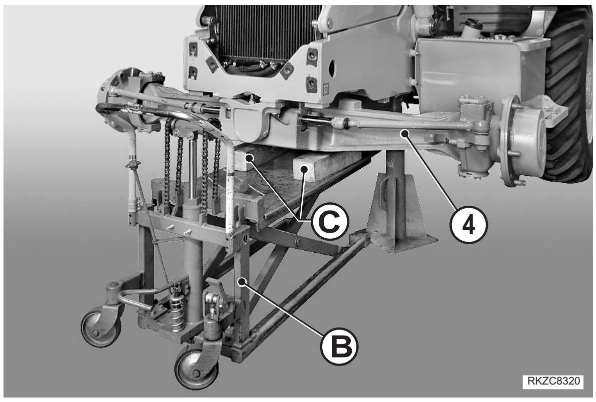
★ It should be possible to lower the jack 10 cm in order to disengage the axle from the fulcrum supports.

17 - Remove the screws (6), (9) with washers.

18 - Lower the jack until the axle is disengaged.

19 - Extract the entire axle (4).

Front axle: 525 kg



Installation

- To install, reverse removal procedure.

[*1]

Nuts for front wheels: 370 Nm

[*2]

Front closing screws: 300 Nm

[*3]

Screws: _________ Nm

[*4]

Screws on gearbox side: 38 Nm

[*5]

★ Bleed the air from the Load Sensing circuit.
(For details, see "20 TESTING AND ADJUSTMENTS").

[*6]

Support screws: 550±55 Nm

Screw: Loctite 242

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.

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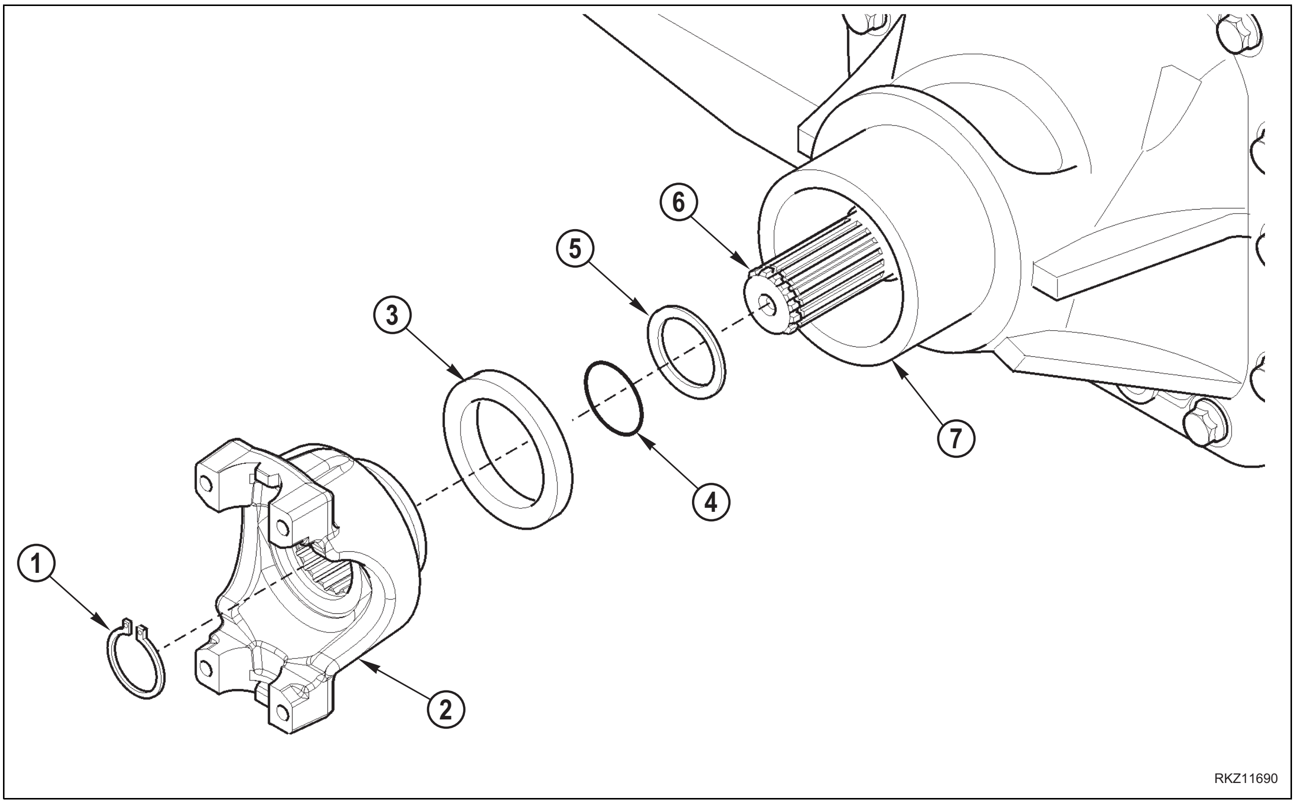
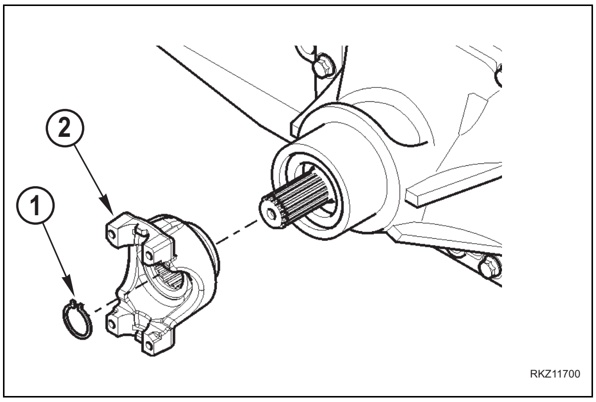
Disassembly and assembly

1. Flange group

1.1 Disassembly

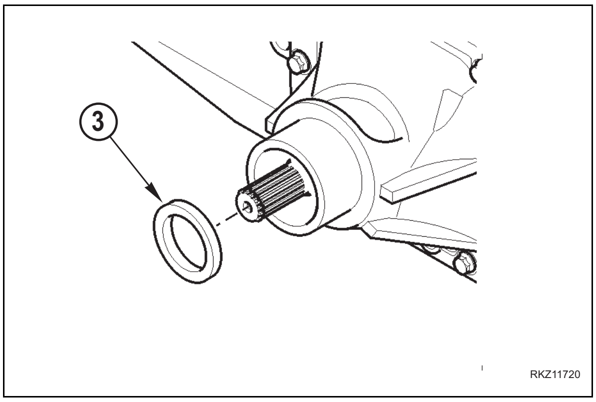


1 -Remove the lock ring (1) and flange (2).

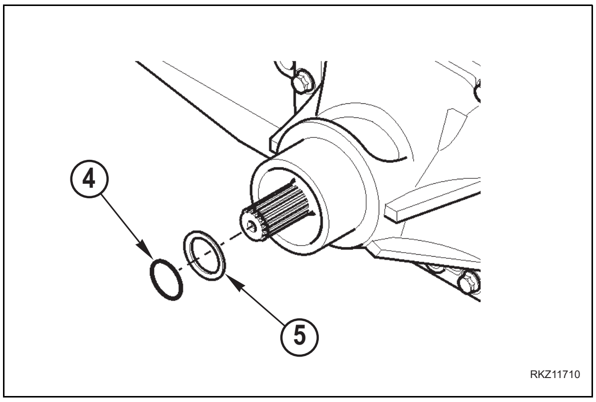


2 -Remove seal ring (3).

★ This is a destructive operation for the seal ring.



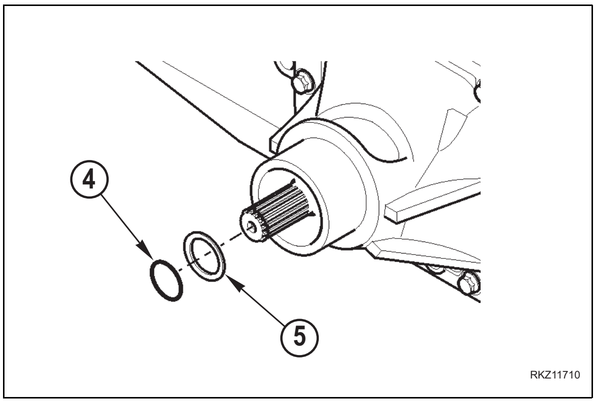
4 - Remove the O-ring (4) and the washer (5).



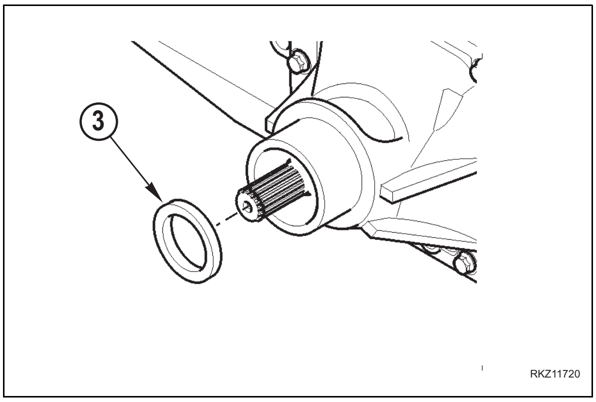
1.2 Assembly

1 - Insert the washer (5) on the pinion end.
Lubricate and assemble a new O-Ring (4).

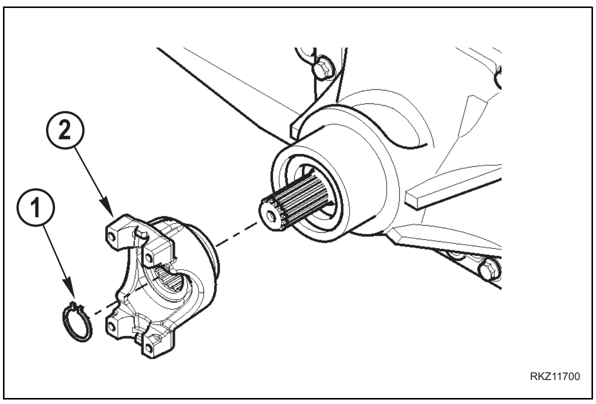
O-ring: oil



2 - Assemble the seal ring (3) into the central body with the special tool **D19** and a hammer.

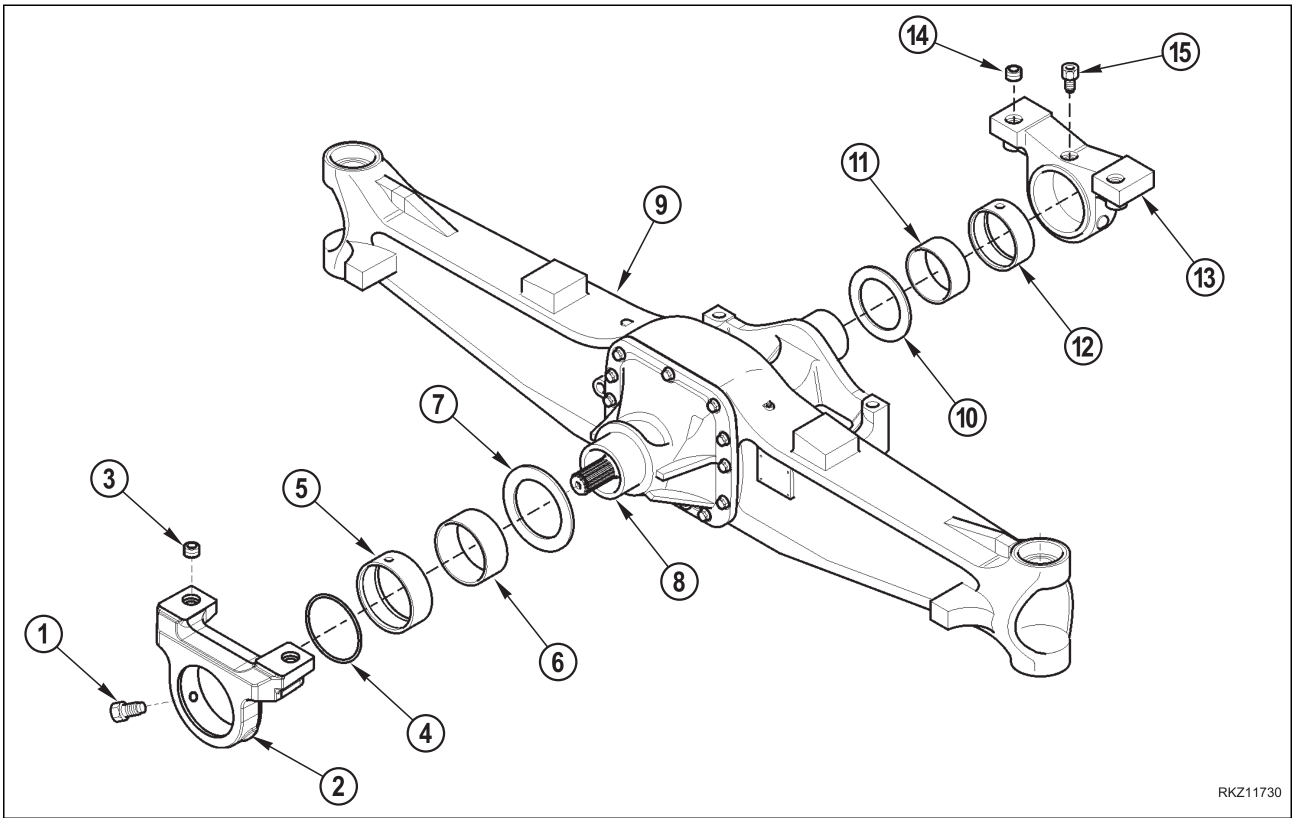


3 - Install the flange (2) on the pinion end.
Assemble the lock ring (1).

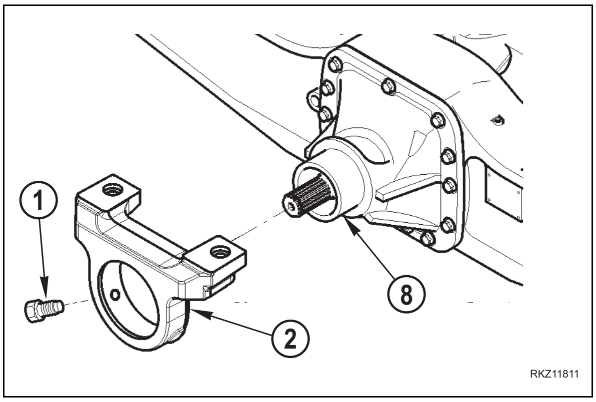


2. Trunnions group

2.1 Disassembly

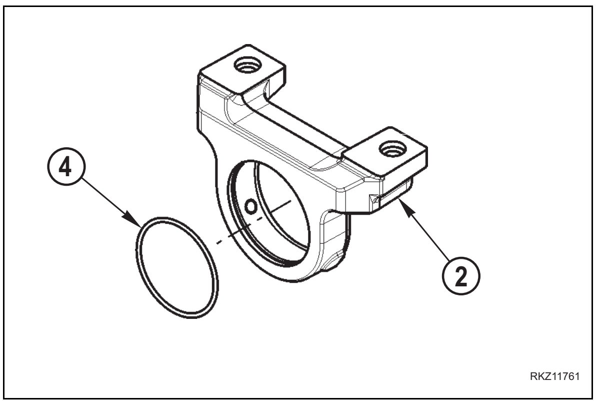


1 -Loosen the special screw (1).
Remove the rear support (2) from the differential support (8).

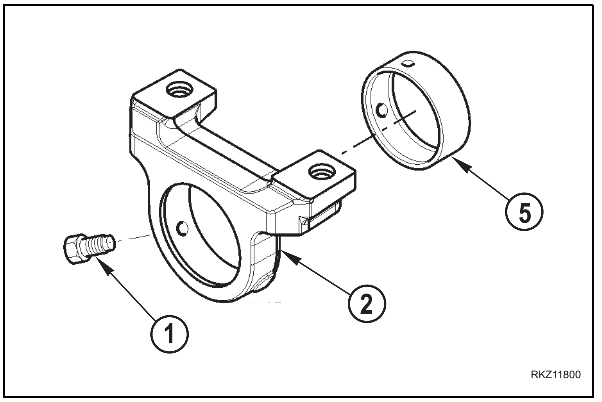


2 -Remove the O-Ring (4) from the rear support (2).

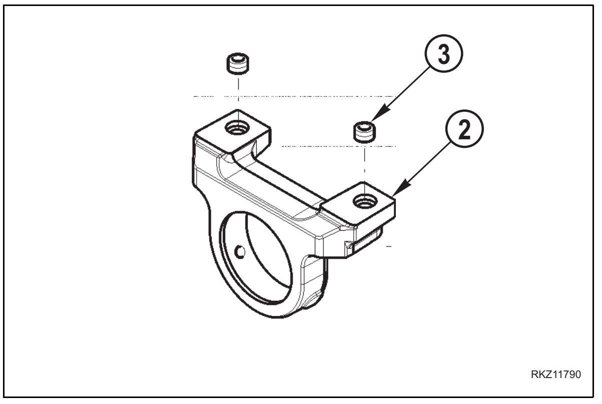
★ Replace the O-ring at each disassembly.



3 - Remove the special screw (1).
Remove the bush (5) from the rear support (2).



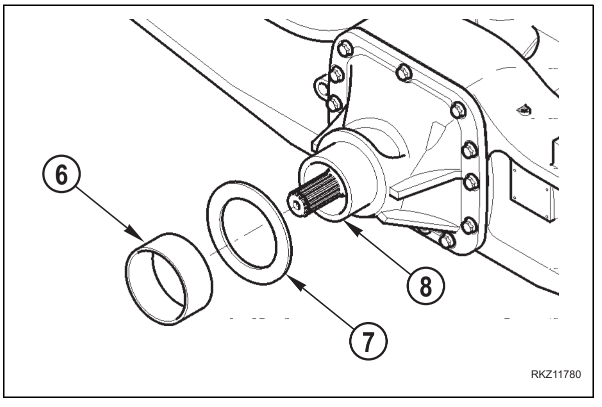
4 - Remove the bushes (3) from rear support (2).



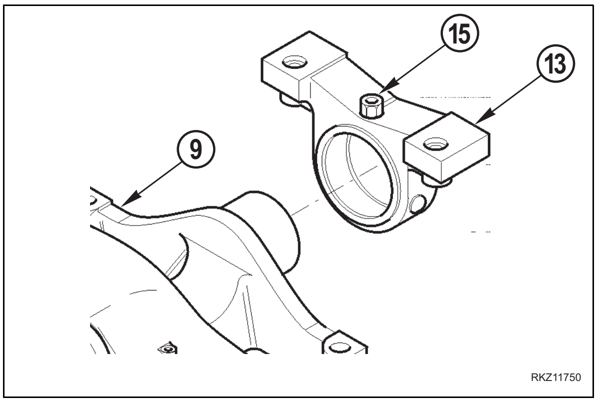
5 - Remove the bush (6) and washer (7) from differential support (8) **only if necessary**.

★ Cut the bush (6) with a chisel.

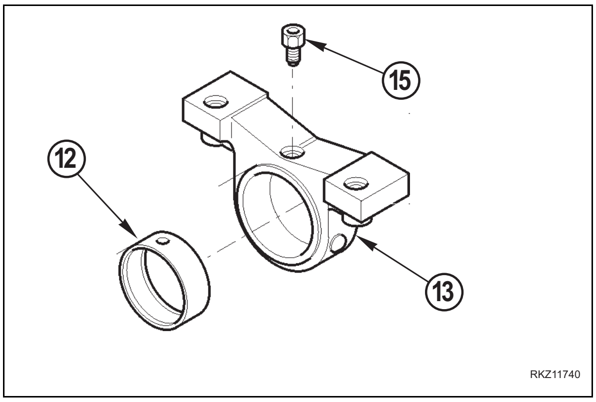
★ Replace the bush at each disassembly.



6 - Loosen the special screw (15).
Remove the front support (13) from the axle housing (9).



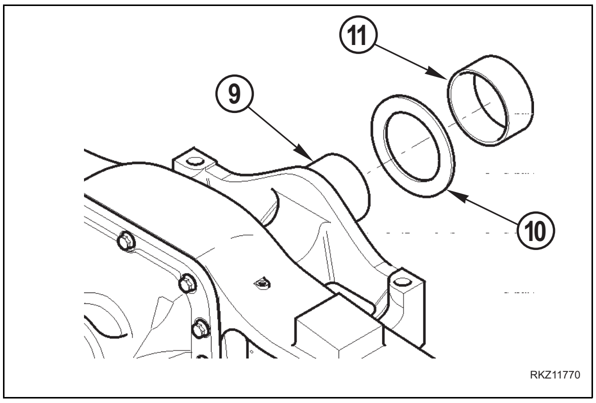
7 - Unscrew the bolt (15).
Remove the bush (12) from the front support (13).



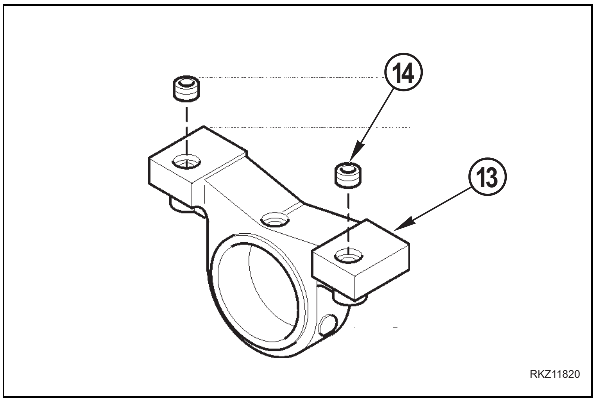
8 - Remove the bush (11) and washer (10) from axle housing (9) **only if necessary**.

★ Cut the bush (11) with a chisel.

★ Replace the bush at each disassembly.



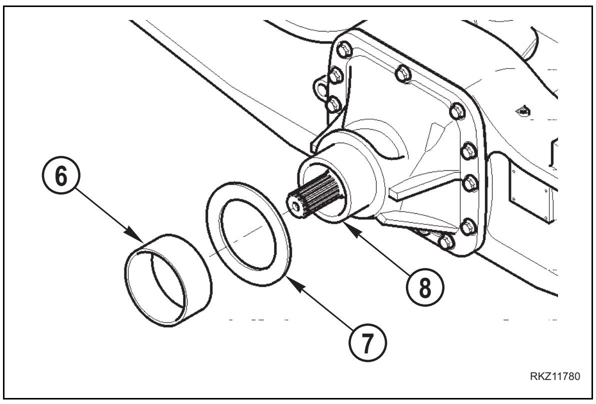
9 - Remove the bushes (14) from rear support (13).



2.2 Assembly

1 - Insert the washer (7) onto the differential support.
Heat the bush (6) at 110–120 °C than assemble it to the differential support.

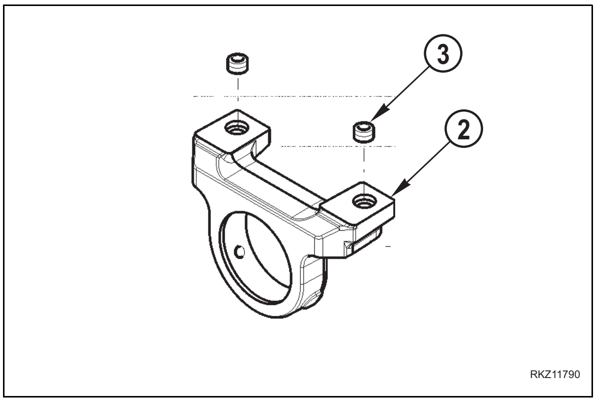
★ If necessary use a pad and a hammer to assemble the bush (6).



2 - Apply sealant on bushes (3) contact surface.

Bushings: Loctite 542

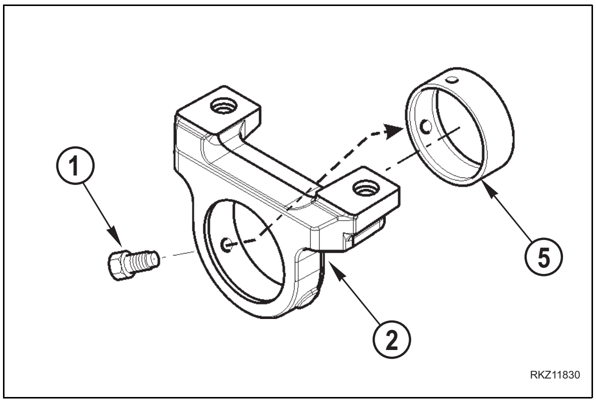
3 - Assemble the bushes (3) to the rear support (2) with a pad and a hammer.



4 - Assemble the bush (5) in the rear support (2).

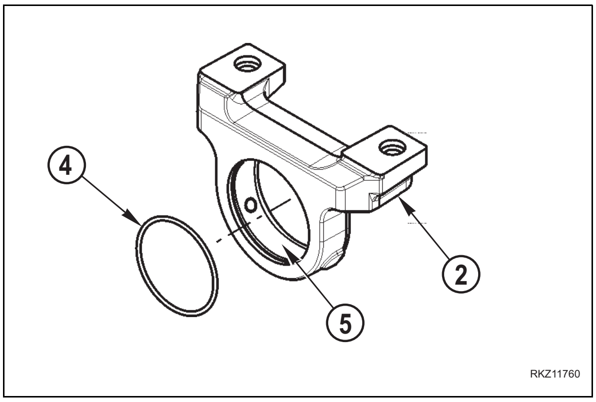
★ Set the bush (5) with the screw hole aligned with the screw hole in the support (2).

5 - Mount the special screw (1).



6 - Lubricate and insert the new O-ring (4) in the bush (5) in the rear support (2).

★ Insert the O-ring into the seat on the shown side.

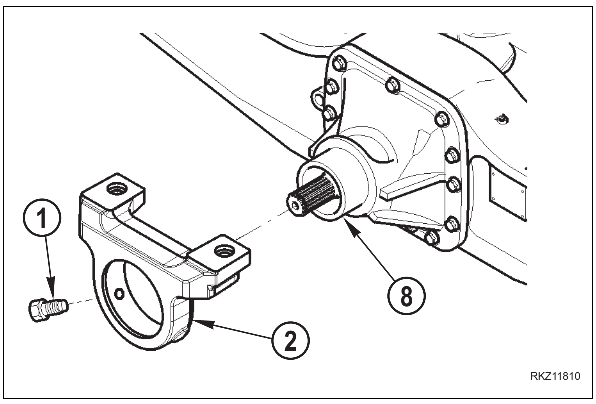


7 - Insert the rear support (2) on the differential support (8).

★ Be careful to avoid damaging the O-ring (4).

8 - Tighten the screw (1).

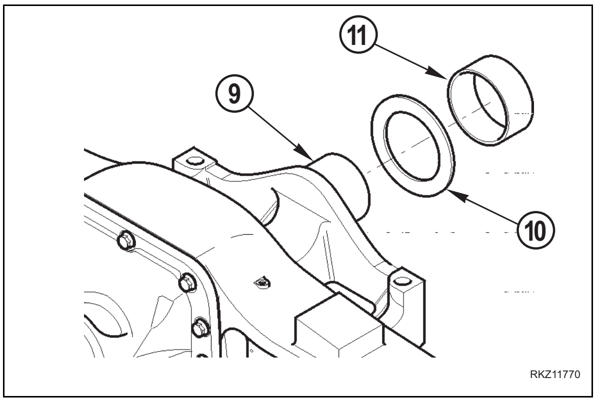
Screw: 200 Nm



9 - Insert the washer (10) on the front support seat.

10 - Heat the bush (11) at 110–120 °C than assemble it to the axle housing (9).

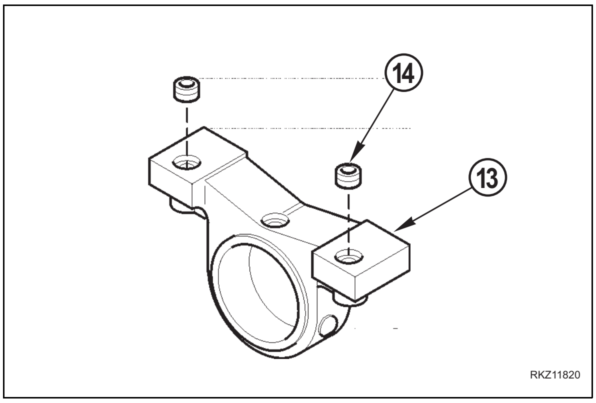
★ If necessary use a pad and a hammer to assemble the bush (11).



11 - Apply sealant on bushes (14) contact surface.

Bushings: Loctite 542

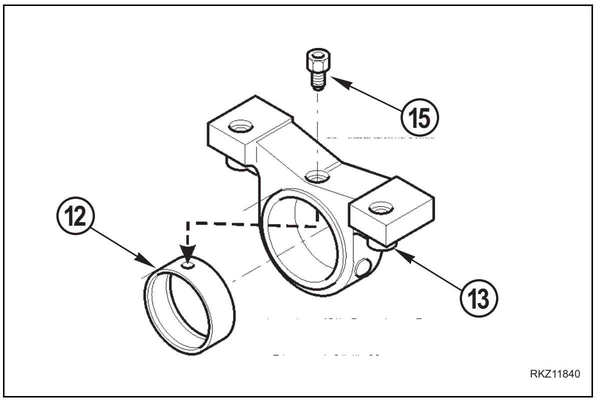
12 - Assemble the bushes (14) to the front support (13) with a pad and a hammer.



13 - Assemble the bush (12) into the front support (13) with a suitable driver and a hammer.

★ Set the bush (12) with the screw hole aligned with the screw hole in the support (13).

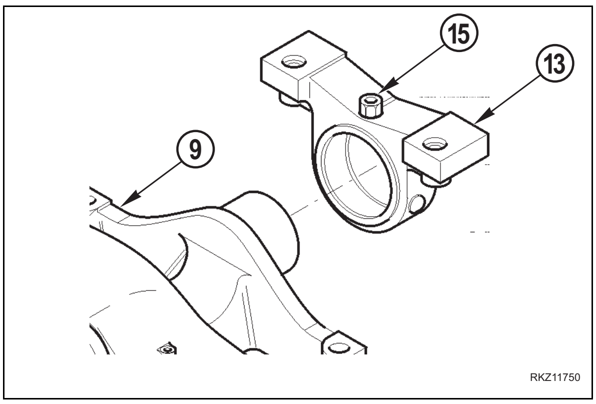
14 - Assemble the screw (15).



15 - Insert the front support (13) on the axle beam.

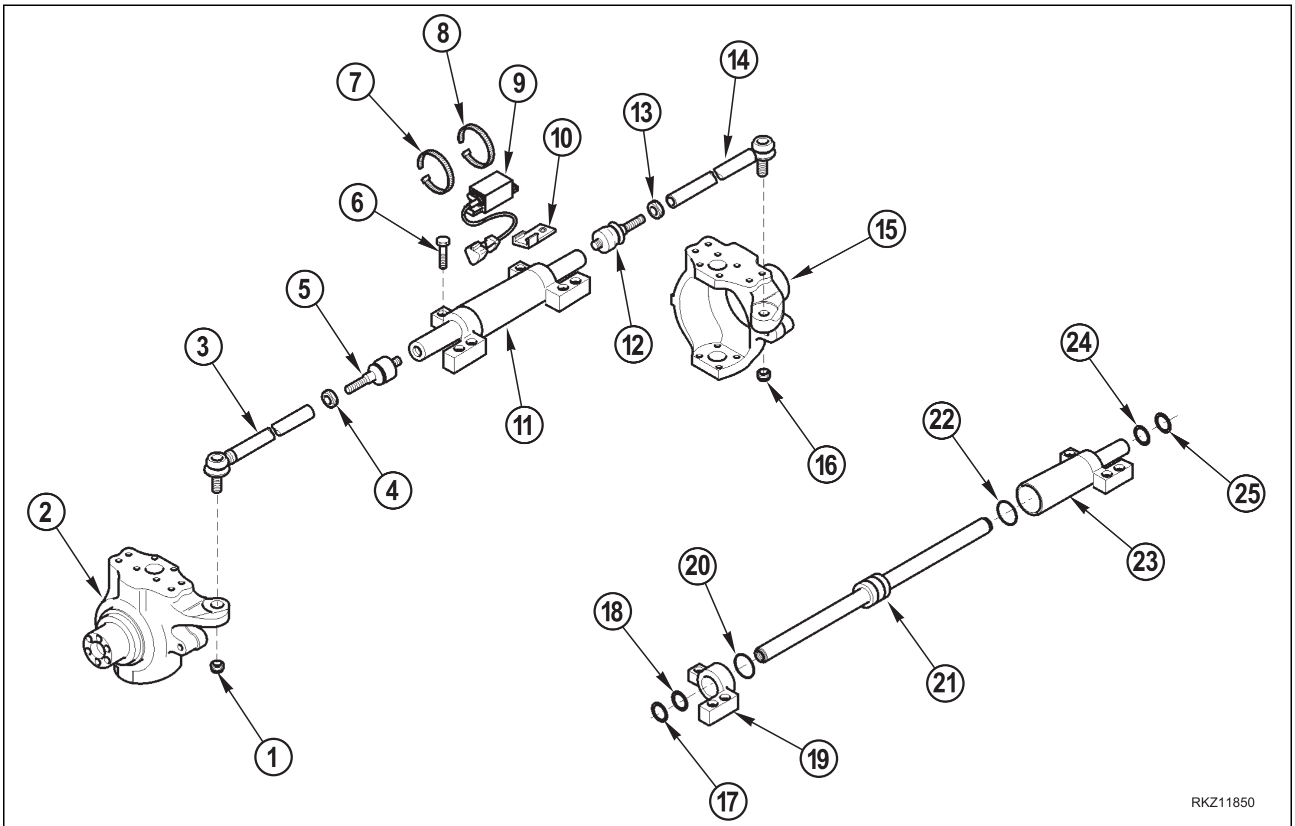
16 - Tighten the screw (15).

Screw: 200 Nm



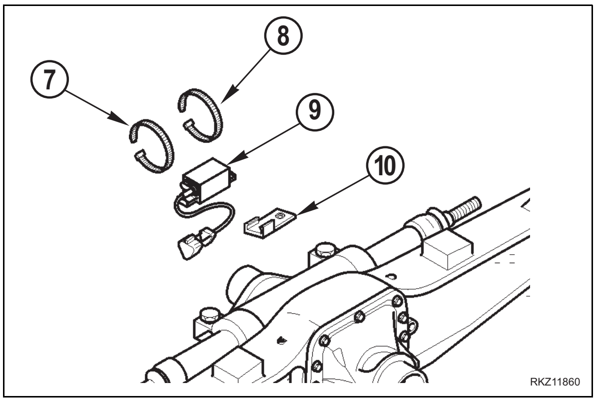
3. Steering cylinder group

3.1 Disassembly



RKZ11850

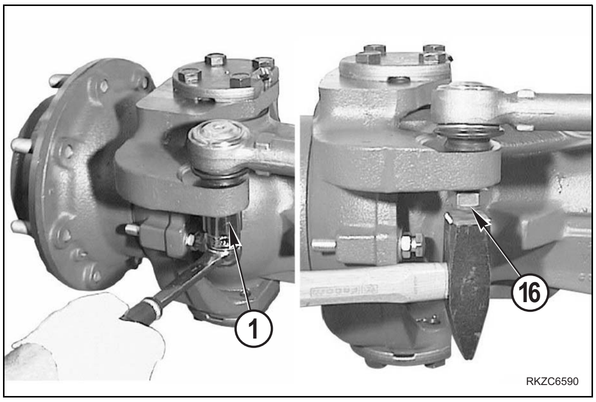
1 - Remove the inductive magnetic steering sensor, by unloosing the locking clamps' screws (7) and (8).
Remove the sensor (9).
Collect the receptacle braket (10).



RKZ11860

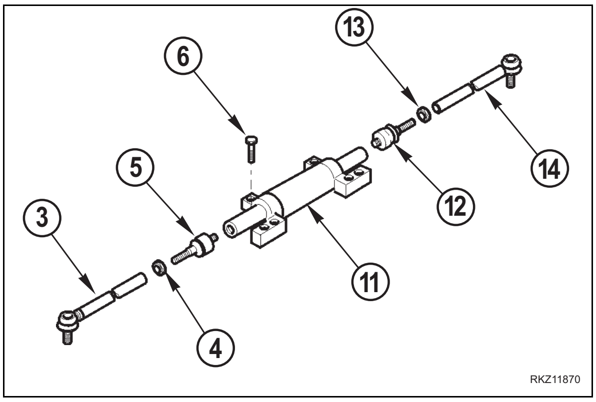
2 - Loosen the tie rod locknut (1) and (16) of some turns till it is over the end of the threaded pin.
Beat the nut with a hammer to remove the steering arm from the swivel housing.

★ Replace the nut at each disassembly.

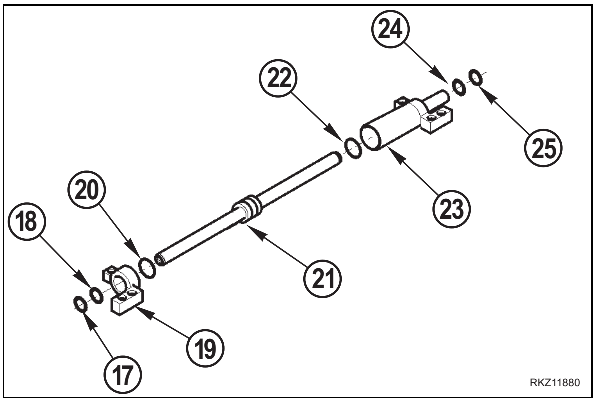


RKZC6590

3 - Loosen the nuts (3) and (14), remove and inspect the tie rods (4) and (13).
Unscrew the fastening screws (6) and remove the steering cylinder (11), using a soft hammer.
Remove the ball joint (5) and (12).
Remove only parts that need overhauling or replacement

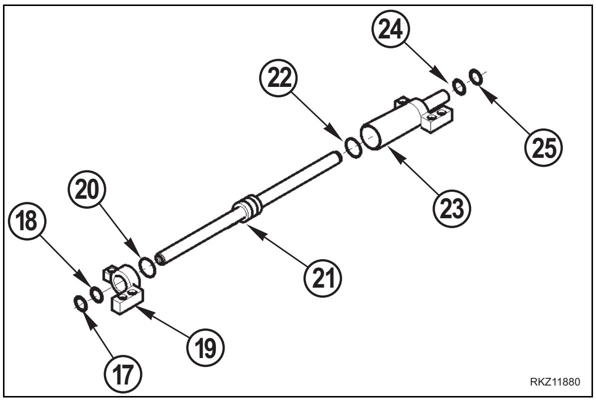


4 - Remove the cylinder heads (19) and (23) and the rod (21) from cylinder body (23).
Collect all the seal rings (17, 18, 20, 22, 24 e 25) from the rod and the cylinder heads.



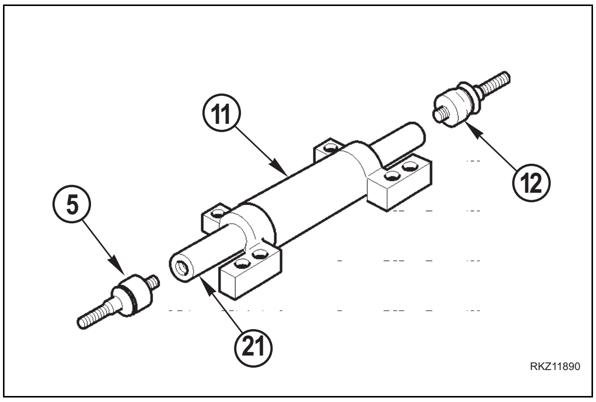
3.2 Assembly

1 - Assemble new seal rings (17, 18, 20, 22, 24 e 25) on the rod (21) and on the cylinder heads (19) and (23).
Insert the rod (21) into the cylinder body (23) and assemble the cylinder heads (19) and (23).



2 - Assemble the ball joints (5) and (12) to the ends of the cylinder rod (21).

Ball joints: 300 Nm

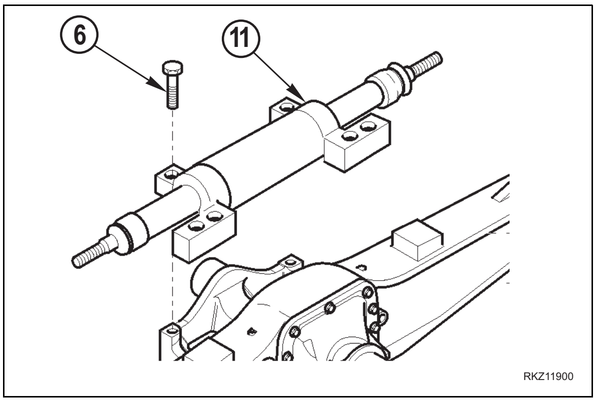


3 - Before matching surfaces, make sure that they are perfectly clean, degrease and clean them with appropriate detergents.
Spread a film of adhesive on the contact surface between the axle beam and the supports of steering cylinder (11).

Sealant: Loctite 638

4 - Assemble and tighten the fastening screws (6) of the steering cylinder heads (19) and (23).

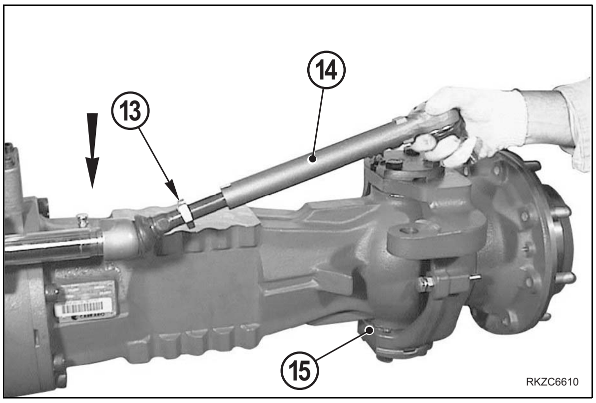
Screw: 460 Nm



5 - Align the swivel housing (15) with the axle.
Screw the tie rod (14) so that its ball joint can be inserted into the swivel housing (15) arm.

★ If necessary unscrew the lock nut (13).

6 - Repeat the whole sequence of the mentioned operations on the opposite side.

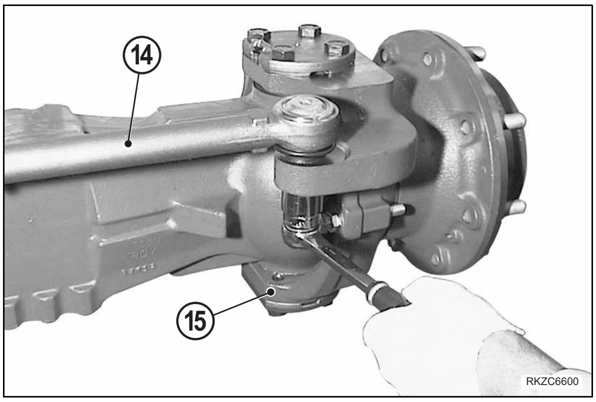


7 - Insert the ball joint of the tie rod (14) into its housing on the swivel housing (15).
Assemble and tighten the lock nut (16).

Nut: 280 Nm

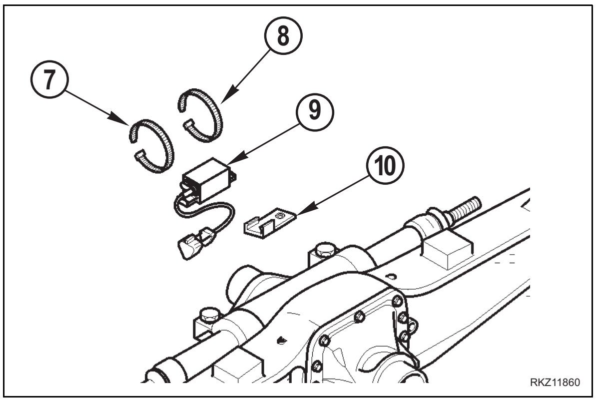
8 - Repeat the whole sequence of the mentioned operations on the opposite side.

★ Before screw the lock nuts (4) and (13) of the tie rods (3) and (14) adjust the toe-in.
(For details see "10. Toe-in/steering angle").



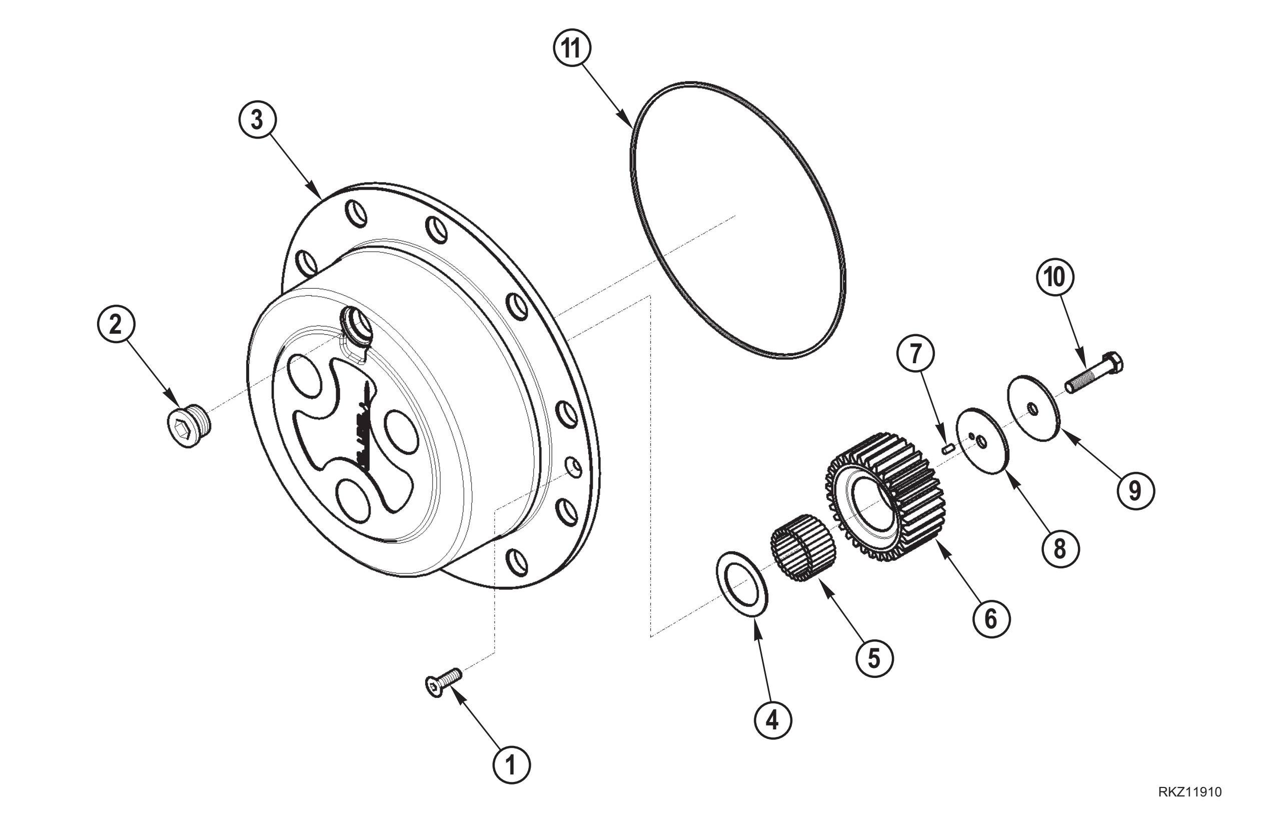
10 - Assemble the sensor (9) with the bracket (10).
Install the sensor (9) in the middle of the cylinder by means of properly tightened clamps (7) and (8).

★ The clamps (10) can be completely tightened only when the toe-in adjustment has been carried out.
(For details see "10. Toe-in/steering angle").

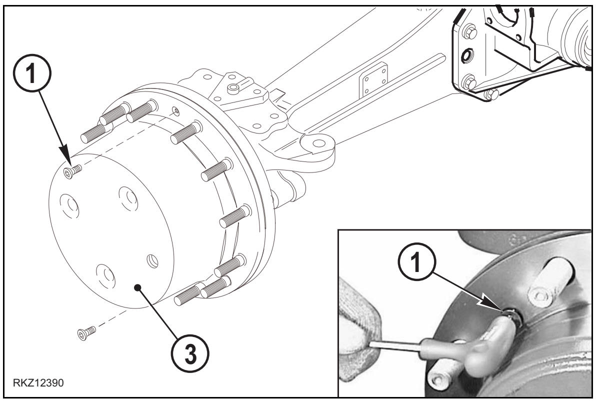


4. Epicyclic reduction gear group

4.1 Disassembly

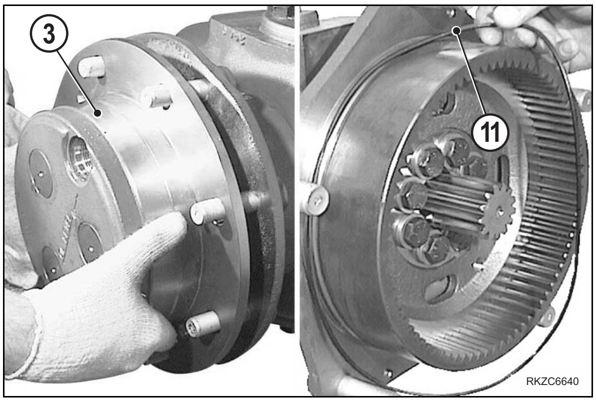


1 - Unscrew and remove both fastening screws (1) of the planetary carrier (3) with a wrench.

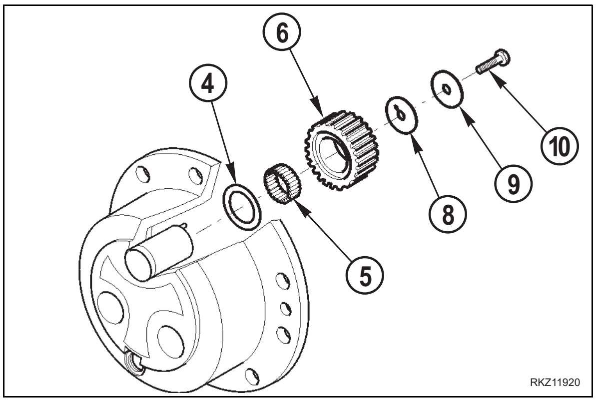


2 - Remove the planetary carrier (3) from the wheel hub and collect the relative O-Ring (11).

3 - Position the planetary carrier (3) on a workbench and check its wear conditions.

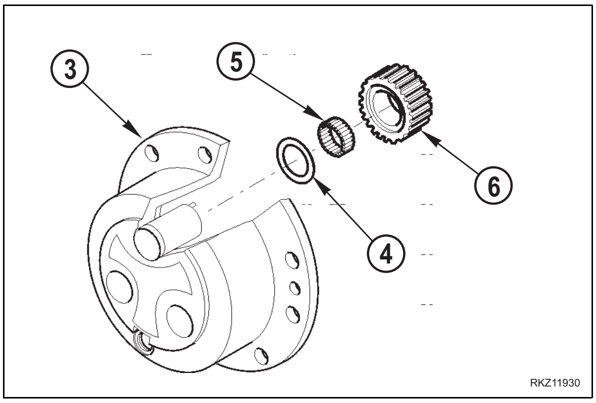


4 - To replace the planetary gears (6):
- remove the fastening screws (10) of every planetary gear (6);
- remove the washers (8) and (9);
- take the planetary gears (6) out of the pins;
- collect the needles bearing (5) and check their conditions;
- collect the thrust washer (4).



4.2 Assembly

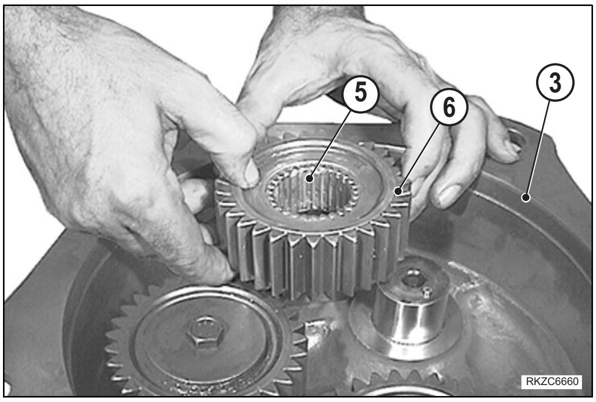
1 - Position the planetary carrier (3) on a workbench. Insert the thrust washer (4) on every pin.



2 - Position the planetary carrier (3) on a workbench. Insert the needles (5), the thrust washer (4) and the needles (5) in the epicyclic gears (6).

★ Grease well the needles (5).

3 - Insert the thrust washer (4) and the assembled epicyclic gears (6) in the planetary carrier (3) pins.

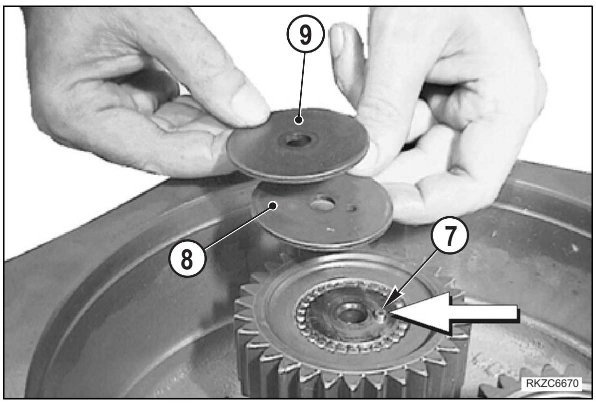


4 - Fit the thrust washers (8) and (9) to the planetary carrier (3) pins.

★ The intermediate thrust washers (8) has a hole for centering with the dowel pin (7) fitted on the planetary carrier (3) pins.

5 - Assemble the fastening bolt (10).

Screw: 79 Nm

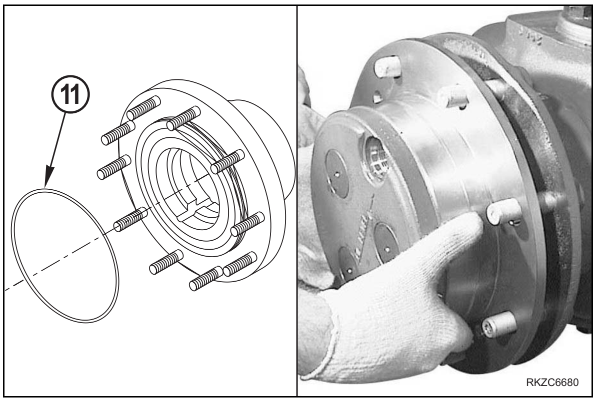


6 -Assemble a new O-Ring (11) on the wheel hub.

7 -Fit the epicyclic reduction gear assembly to the wheel hub.

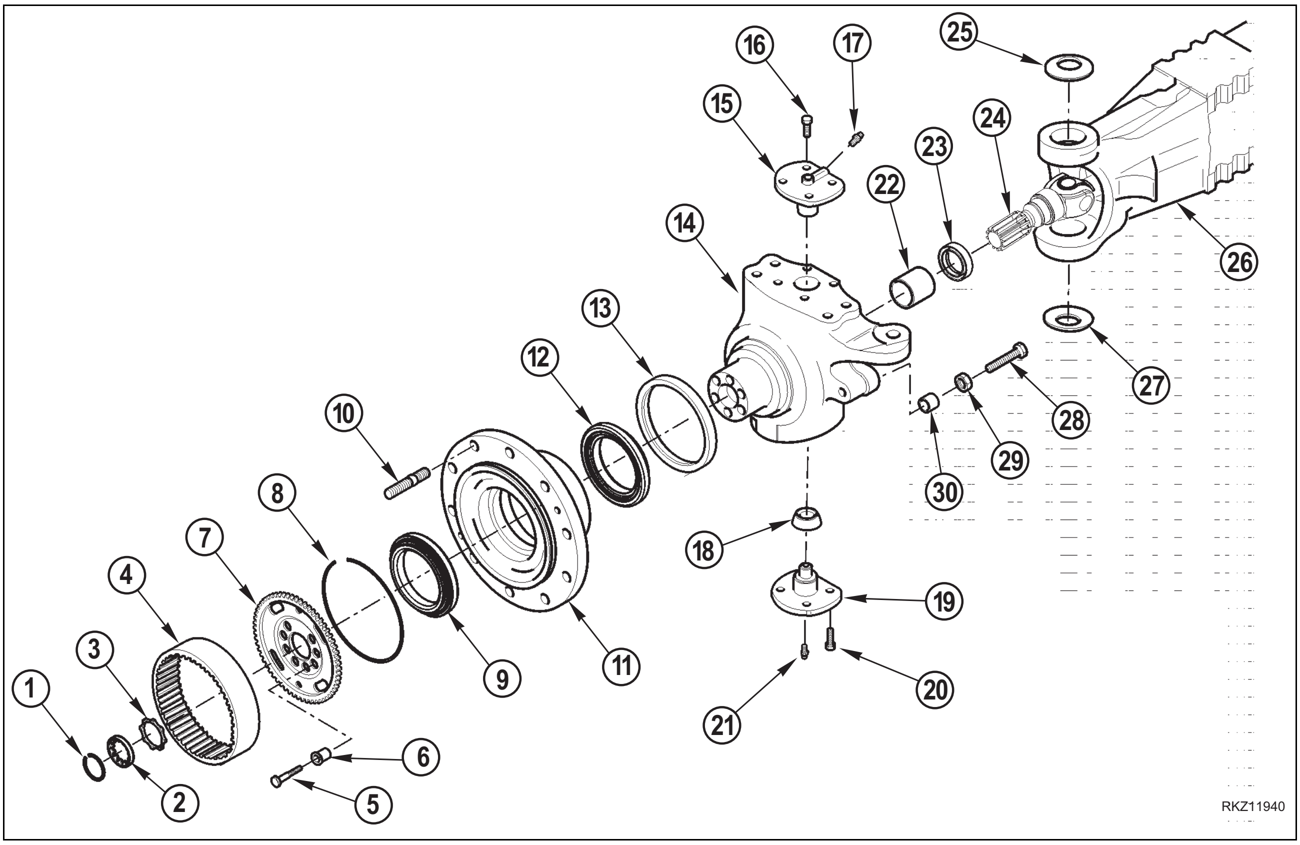
8 -Screw the fastening screws (1).

Screw: 25 Nm



5. Wheel hub group

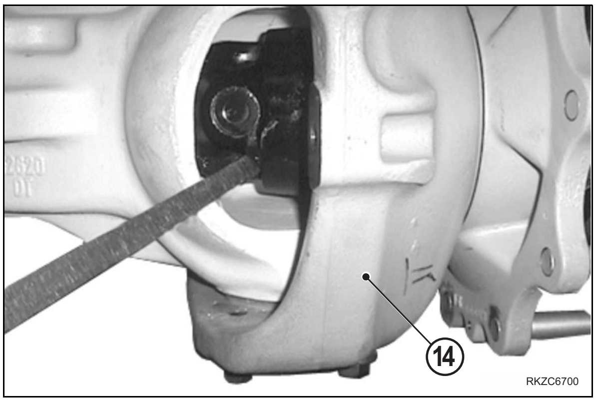
5.1 Disassembly



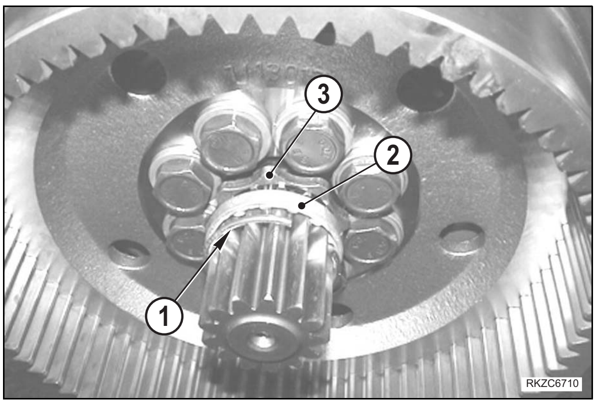
★ Remove the epicyclic reduction gear group before disassembling wheel hub group.
(For details see "4. Epicyclic reduction gear group").

1 - Insert a lever between the swivel housing (14) and the axle beam and fit it into the double U-Joint.
With the lever push the double U-Joint in the direction of the wheel hub to allow the lock ring (1) removal.

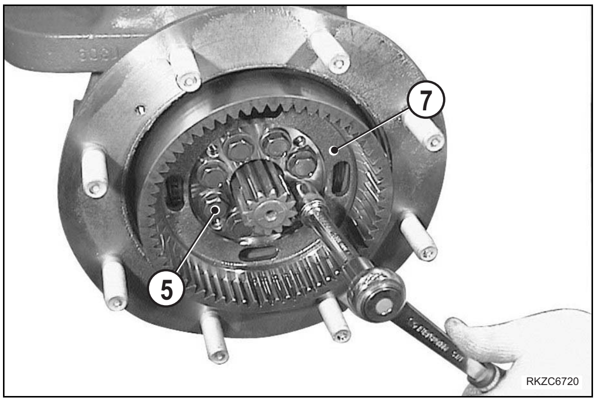
★ Be careful to avoid damaging the double U-Joint.



2 - Remove the lock ring (1) from the double U-Joint shaft.
Collect the double U-Joint shaft washers (2, 3).

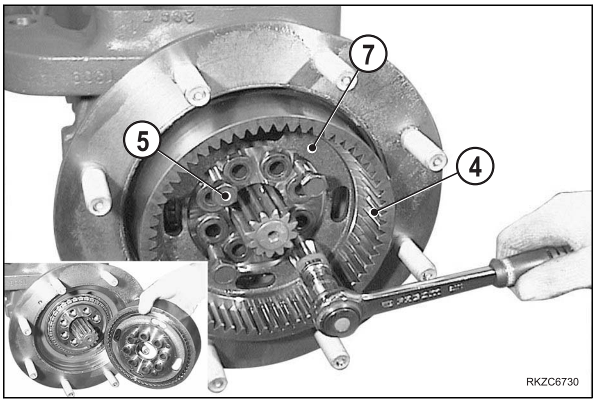


3 - Unscrew and remove the fastening bolts (5) from the wheel carrier (7).



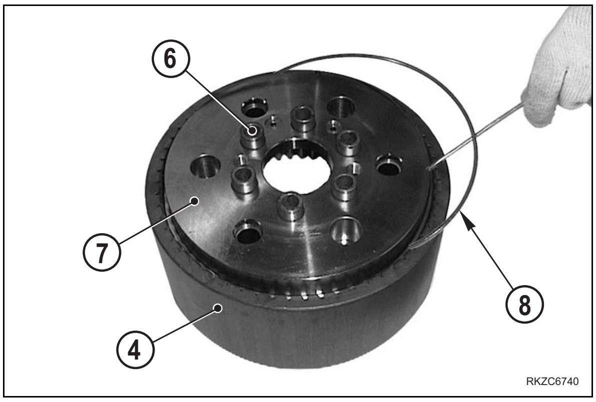
4 - To extract the wheel carrier, screw two of the just removed bolts (5) in the threaded holes.

5 - Remove the wheel carrier (7) with the epicyclic ring gear (4).



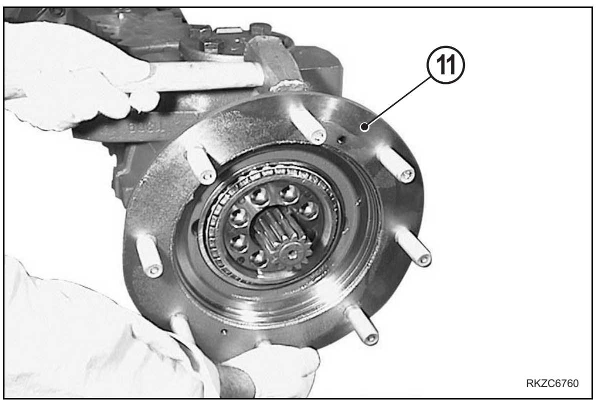
6 - Remove the steel lock ring (8) and disjoin the wheel carrier (7) from the epicyclic ring gear (4).

7 - **Only if necessary**, remove the centering bushes (6) from the wheel carrier with a hammer and the special tool **D11**.



8 - Remove the wheel hub (11) using levers and a hammer to facilitate the operation.

★ Collect the bearing cone (9).

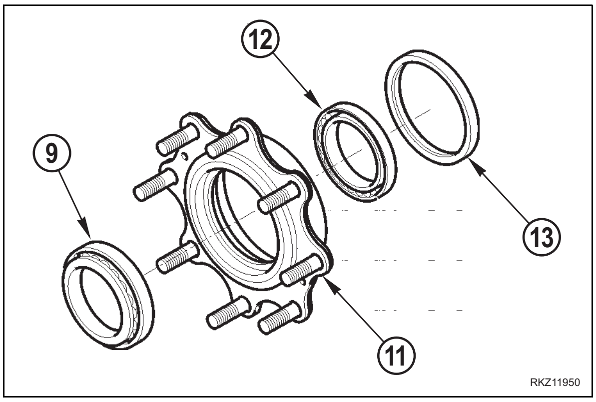


9 - Position the wheel hub (11) on a flat surface and remove the seal ring (13) with a lever.

★ Replace the seal ring (13) at each disassembly.

10 - Remove the bearing cups (9) and (12) using a hammer and a suitable drift.

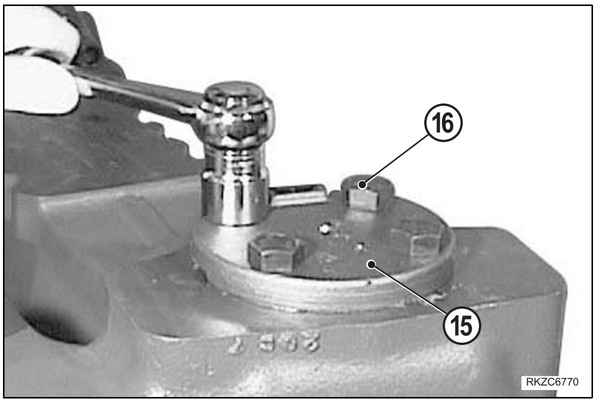
11 - Remove the bearing cone (12) from the swivel housing end (14), using a suitable extractor.



12 - Unscrew and remove the fastening screws (16) and (20) from the upper (15) and lower (19) king pin.

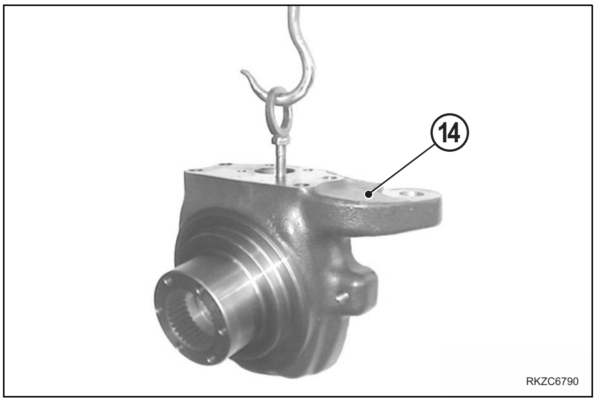
⚠ Before removing the king pins (15) and (19), secure the swivel housing (14) with a belt or a rope to a hoist or any other supporting device; observe all current safety regulations to guarantee operator's safety.

13 - Remove the king pins (15) and (19).



13 - Remove the swivel housing (14) from the axle beam and from the short shaft of the double U-Joint.

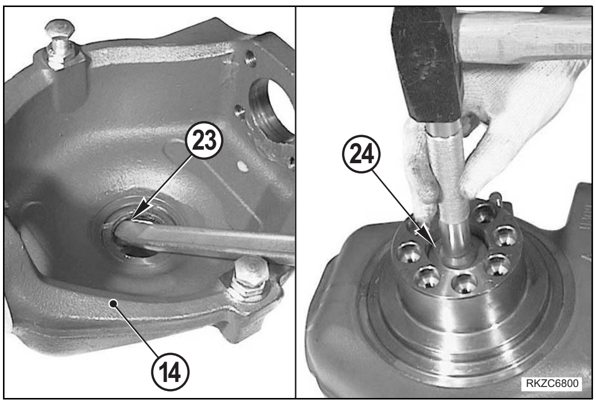
14 - Collect the belleville washers (25) and (27).



15 - Position the swivel housing (14) on a flat surface and take the seal ring (23) out with a lever.

★ Replace the seal ring (23) at each disassembly.

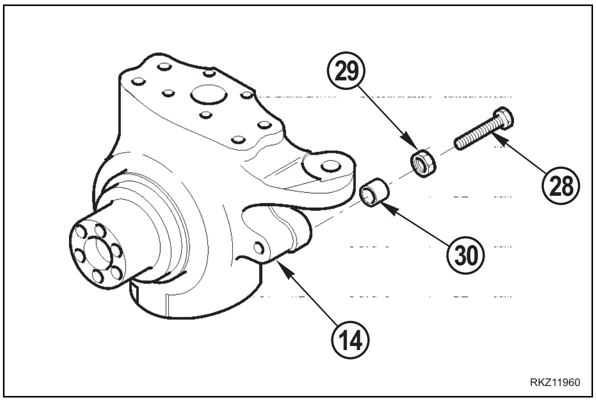
16 - Turn the swivel housing and take the bush (24) out, using a suitable drift and a hammer.



5.2 Assembly

1 - If it has been previously removed, reassemble the steering stop composed by the screw (28), the nut (29) and bush (30).

★ Do not tighten the nut (29) until the steering angle adjustment has been done.
(For details see "10.2 Steering angle adjustment").

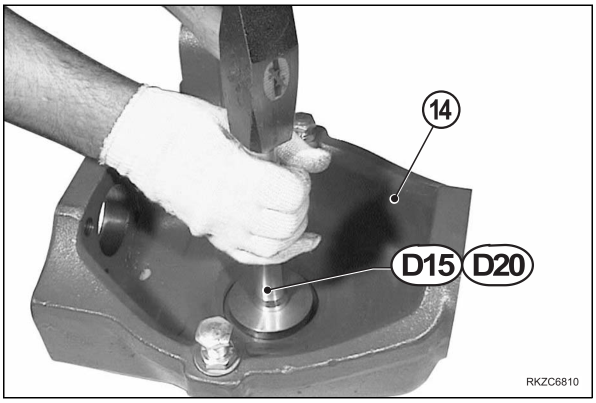


2 - Force the bush (22) into the swivel housing (14) with the special tool **D15** and a hammer or a press.

3 - Assemble the seal ring (23) on the swivel housing (14) with the special tool **D20** and a hammer.

4 - Grease carefully the seal ring (23).

Sealing ring POLYMER 400 Tecnolube

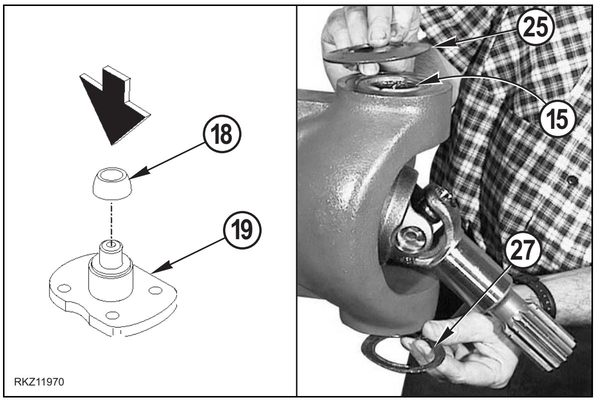


5 - If the cone (18) of the spherical joint has been previously removed, reassemble it to the lower king pin (19) using the special tool **D13** under a press.

6 - Grease carefully the king pin (15) and (19) housings with specific grease.

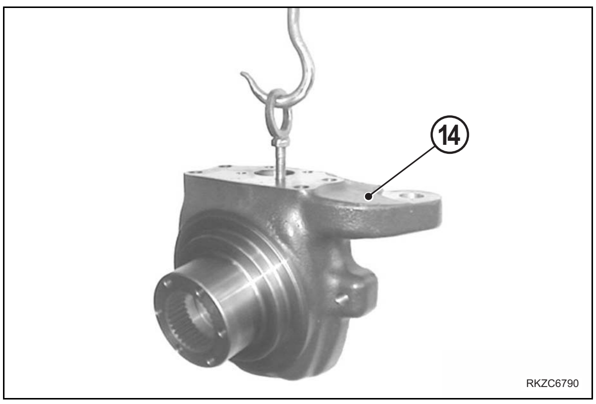
King pin: ASL800050

7 - Position the belleville washers (25) and (27) on the king pin (15) and (19) housings.



8 - Secure the swivel housing (14) with a belt or a rope to a hoist or any other supporting device.

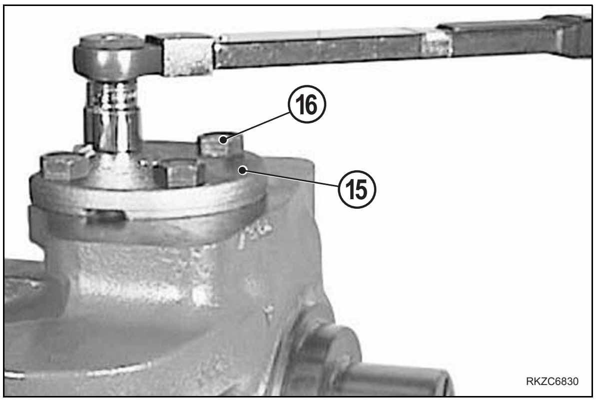
9 - Protect the splined end of the axle shaft by winding it with an adhesive tape to avoid damage to the seal ring (23). Assemble the swivel housing (14) on the axle beam and after assembly, remove completely the adhesive tape.



10 - Assemble the king pins, the lower (19) and the upper (15), and tighten the retaining screws (20) and (16).

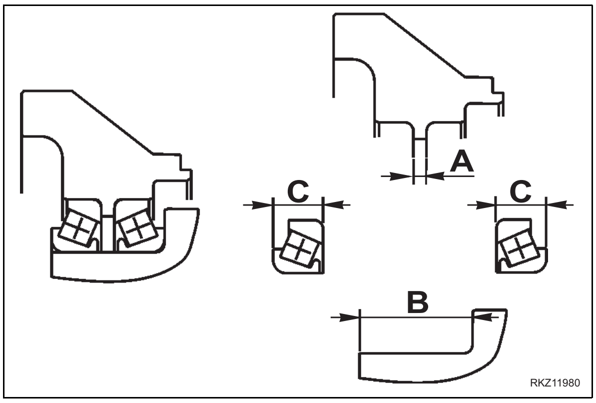
Screw: 300 Nm

★ Make sure that the belleville washers (27) and (25) are in the correct position.



11 - The special operation "Set Right" of the bearings (9) and (12) does not require preload or backlash adjustment. Anyway, before assembling new components check the indicated dimensions.

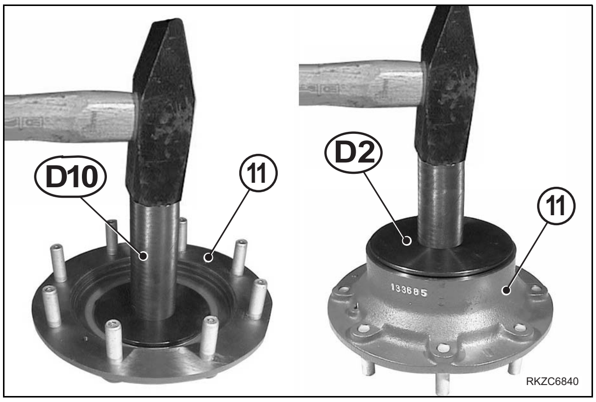
A= 17.950 – 18.000 mm
B= 64.275 – 64.325 mm
C= 23.072 – 23.173 mm



12 - Force both bearing cups (9) and (12) to their wheel hub (11) housings using the special tool **D10** under a press or with a hammer.

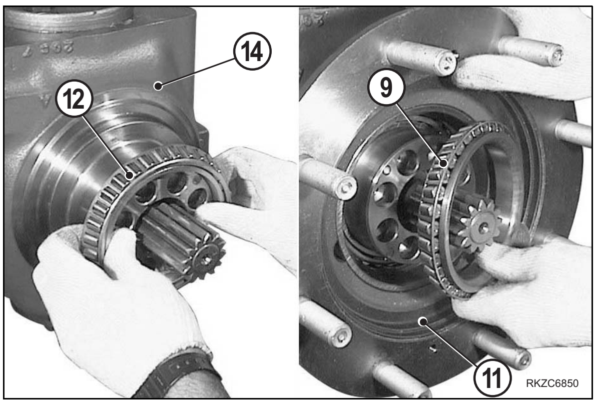
13 - Insert the seal ring (13) into the wheel hub (11) with the special tool **D2** and a hammer.

★ Do not lubricate the seal ring (13).

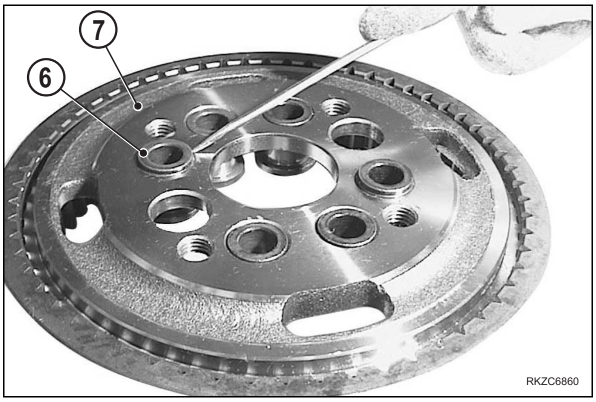


14 - Assemble the bearing cone (12) on the swivel housing (14) end.

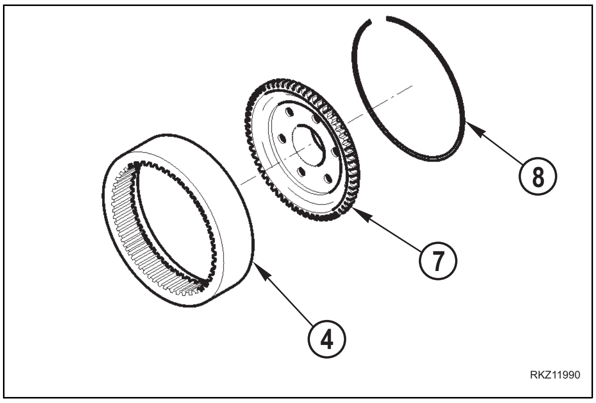
15 - Assemble the wheel hub (11) on the swivel housing (14) and fit the bearing cone (9).



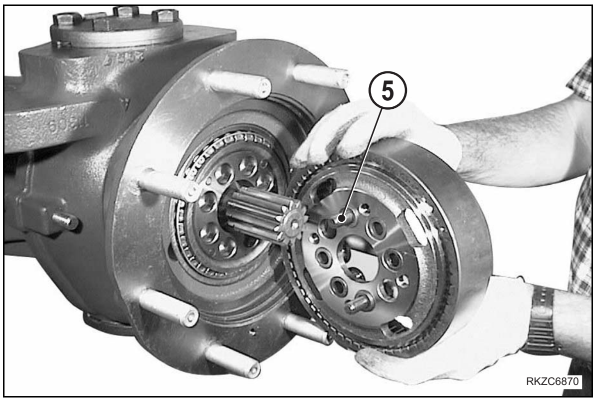
16 - Position the wheel carrier (7) on a workbench and force the bushes (6) to the carrier surface level with the special tool **D11**.
At least two bushes (diametrically-opposed) should be set slightly higher than the carrier surface level to be used as dowel pins.



17 - Preassemble the wheel carrier (7) and the epicyclic ring gear (4) with the special locking ring (8) shown in figure.

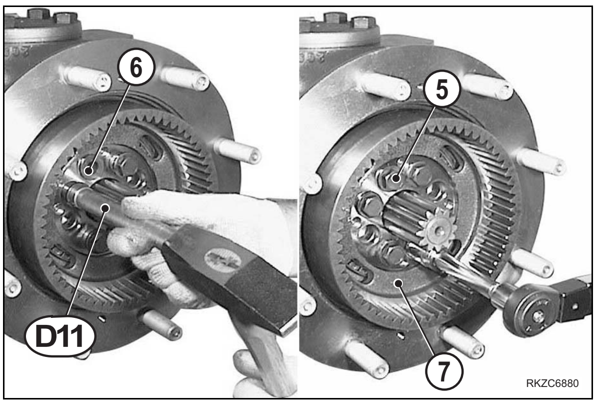


18 - Assemble the wheel carrier group on the wheel hub using the two projecting bushes as dowel pins and screw the relative screws (5) in order to put in contact the ring bevel gear with the wheel hub.

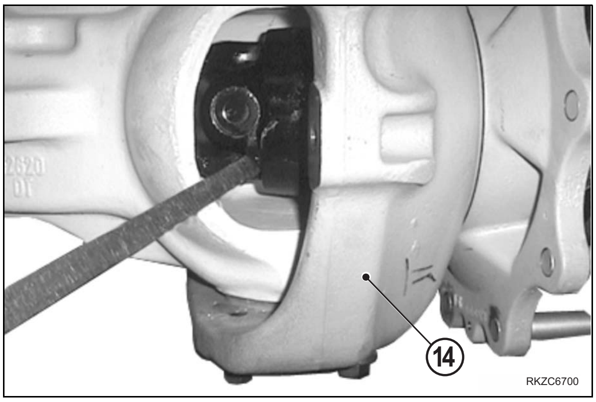


19 - Force all the hub dowel bushes (6) completely with the special tool **D11** and a hammer.
Assemble the wheel carrier (7) fastening bolts (5).

Screw: 220 Nm



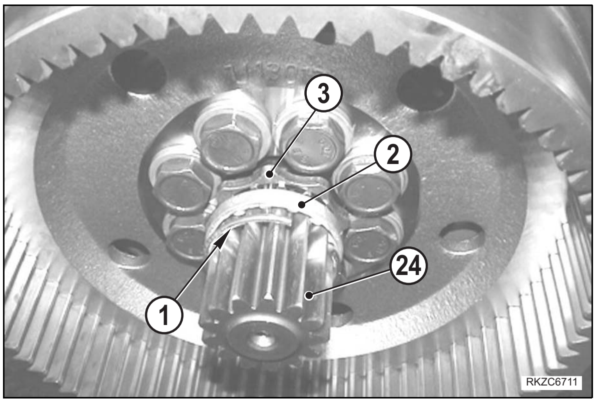
20 - Insert a lever between the swivel housing (14) and the axle beam and fit it into the double U-Joint.
With the lever push the double U-Joint in the direction of the wheel hub to make easier the lock ring (1) insertion.



21 - Slide the thrust washers (3) and (2) onto the double U-Joint shaft end (24).
Insert the lock ring (1) at the end of the splined hub and push it into its housing.

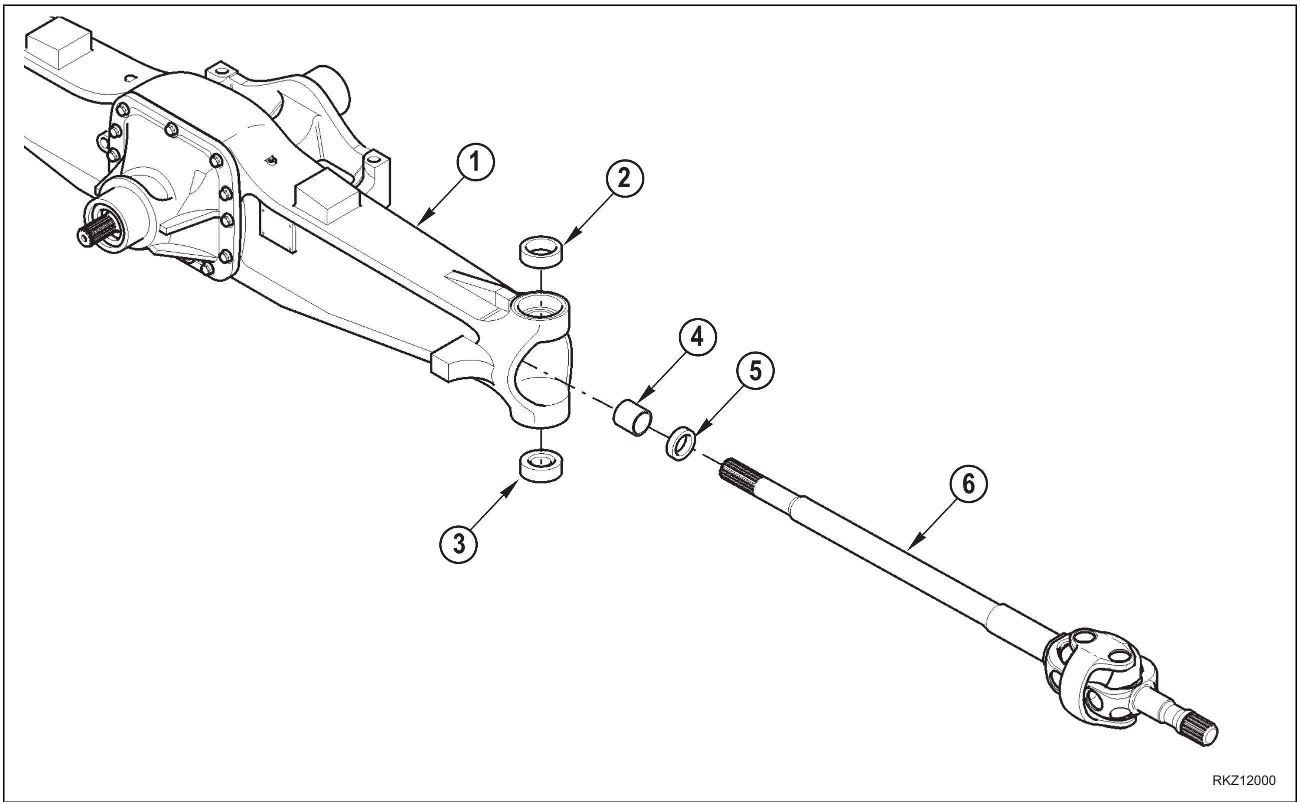
★ Check that the lock ring (1) is correctly fitted in its seat.

22 - Push the double U-Joint thoroughly.

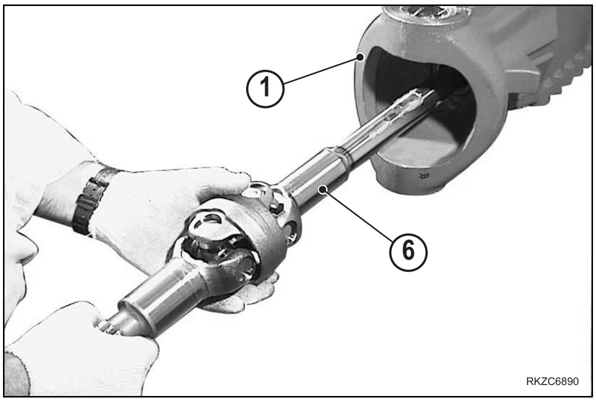


6. Axle beam group

6.1 Disassembly



1 -Remove the two double U-Joints (6) from the axle beam (1).

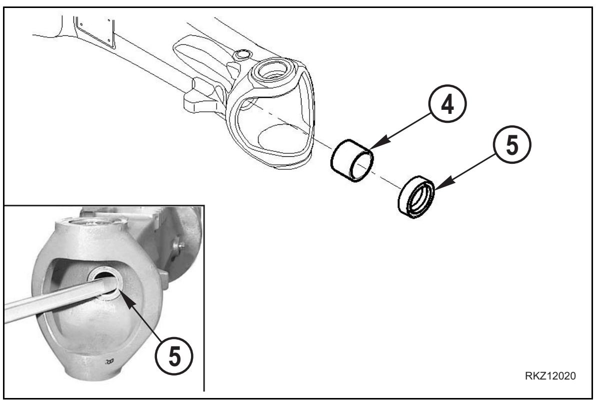


2 -Remove the seal rings (5) from the axle beam (1).

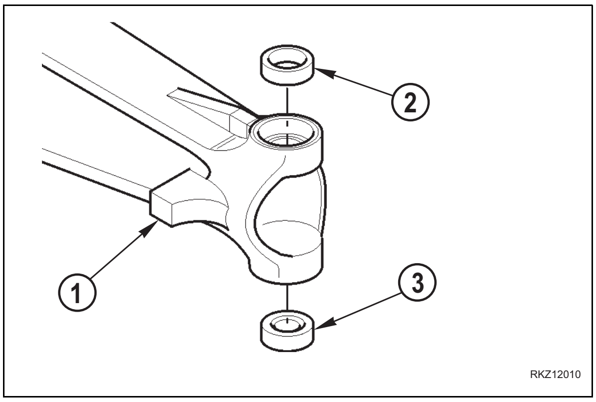
★ Replace the seal rings at each disassembly.

3 -Remove the bush (4) from the axle beam (1) only if the wear conditions require this.

★ Be careful not to damage the bush seat.



4 - Remove the upper king pin bush (2) and the ball bearing cup (3) from the king pin seats using a suitable extractor only if the wear conditions require this.



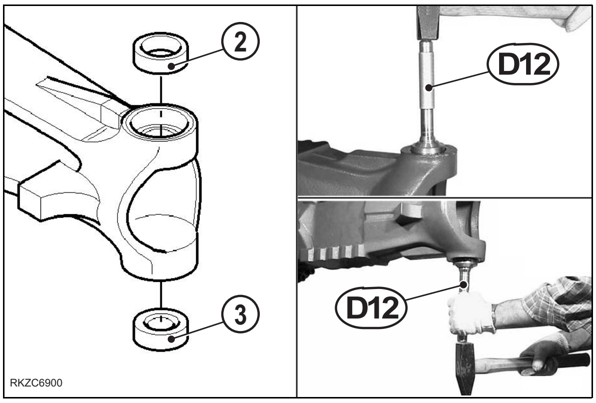
6.2 Assembly

1 - Cool the upper king pin bush (2) and the ball bearing cup (3) at a temperature lower than -100 °C with liquid nitrogen.

Wear safety gloves.

2 - Assemble the upper bush (2) on the upper king pin seat with the special tool **D12** and a hammer.

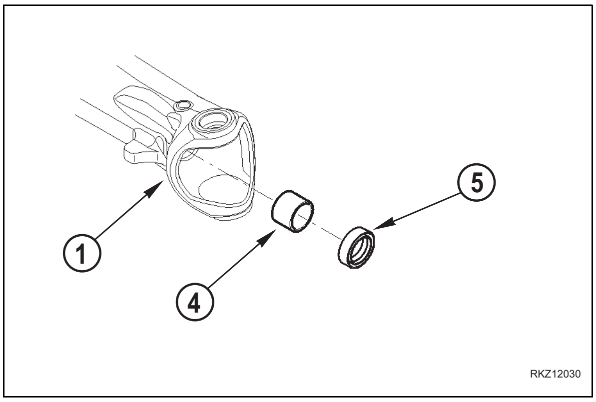
3 - Assemble the ball bearing cup (3) on the lower king pin seat with the special tool **D12** and a hammer.



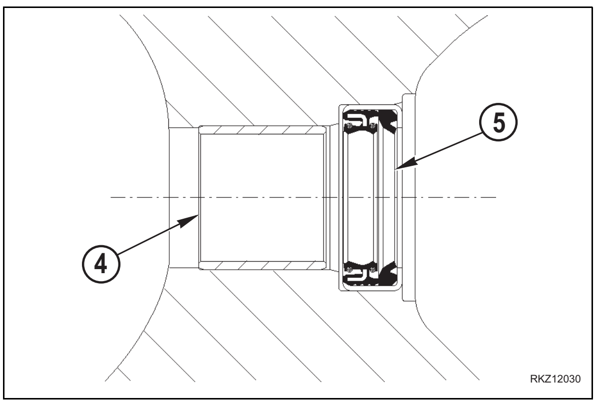
4 - Assemble the bush (4) on the axle beam (1) with the special tool **D17** and a hammer.

5 - Assemble the seal ring (5) on the axle beam with the special tool **D18** and a hammer.

Sealing rings: POLYMER 400 Tecnolube

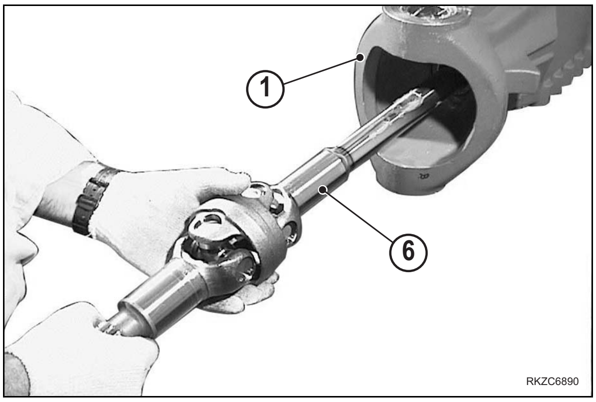


6 - Assemble the seal ring (5) as in figure.



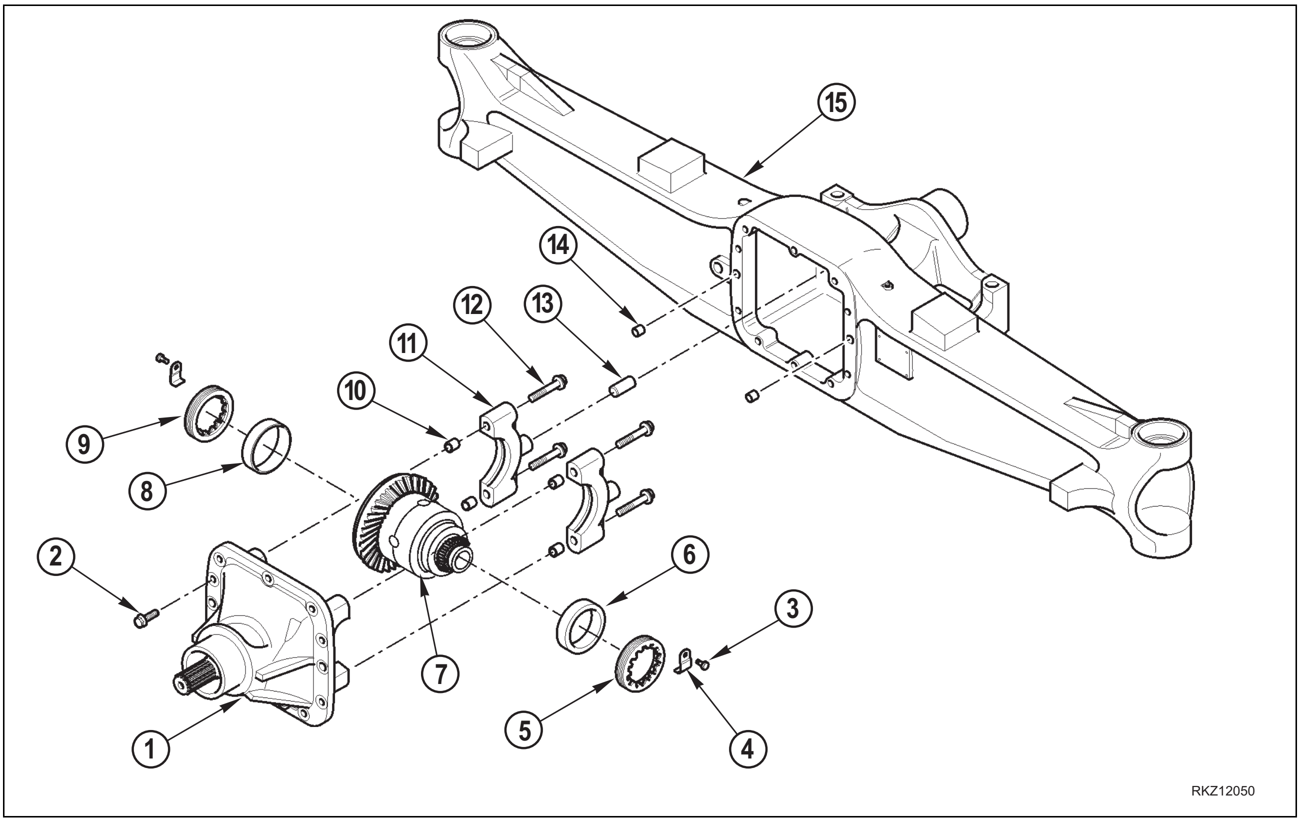
7 -Insert the double U-Joint (6) inside the axle beam (1).

★ Be careful not to damage the seal ring (5).



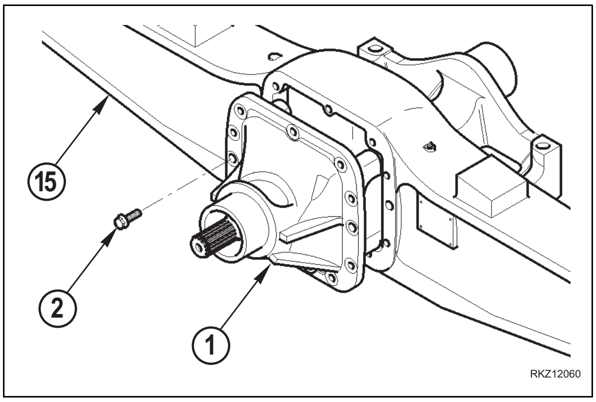
7. Differential support group

7.1 Disassembly

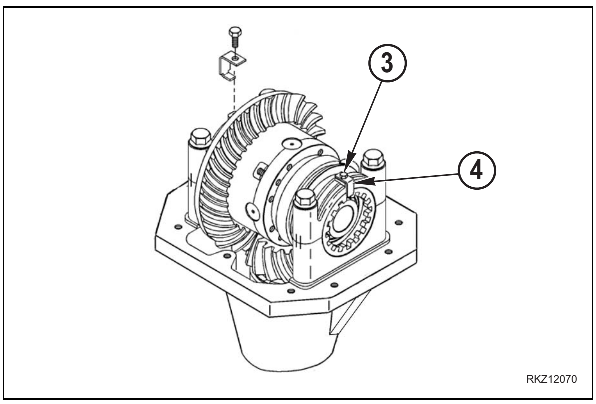


1 - Loosen and remove the 12 screws (2) on the differential support (1). Remove the differential support (1) from the axle housing (15).

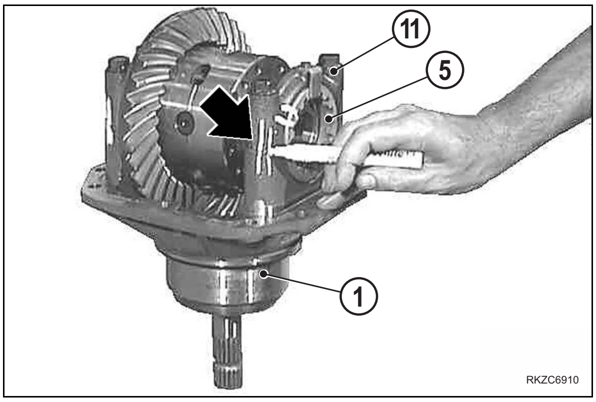
2 - support the differential support with a rope or other appropriate means.



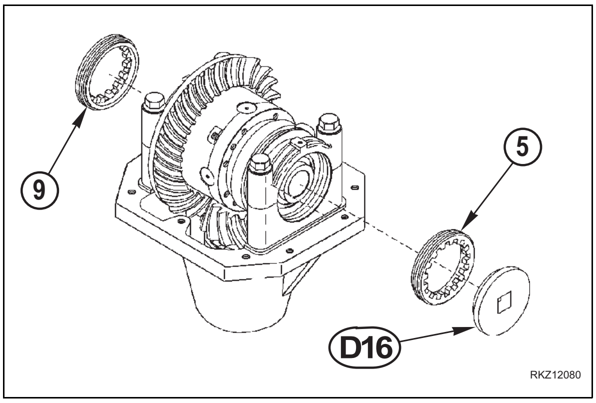
3 - Loosen and remove the screws (3) to remove the two ring nut retainers (4).



4 - Before removing the bolts, mark both half-collars (11) and the differential support with permanent reference marks to avoid inverting them during re-assembly. Mark the area between the ring nuts (5) and (9) and the differential support (1) as well.

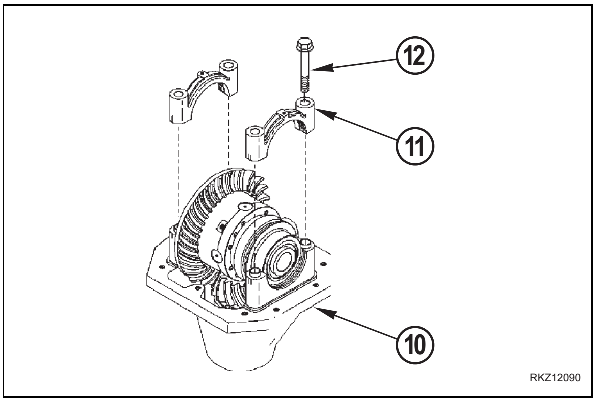


5 - Unscrew the adjuster ring nuts (5) and (9) using tools **D16** and a wrench.



6 - Remove the 4 screws (12) and remove both half-collars (11).

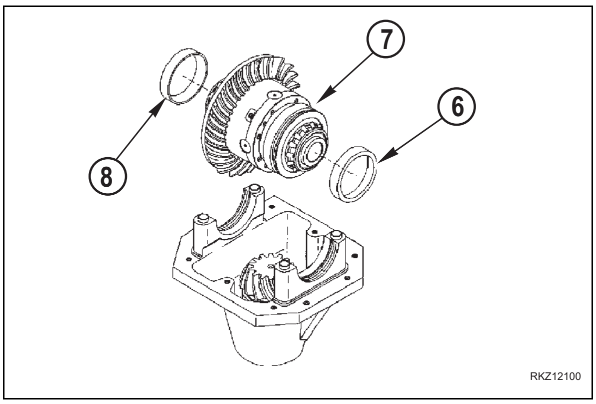
★ Check that the bushes (10) remains in their housings.



7 - Remove out the differential case (7).

★ The bearing cones (6) and (8) are removed together with the differential housing.

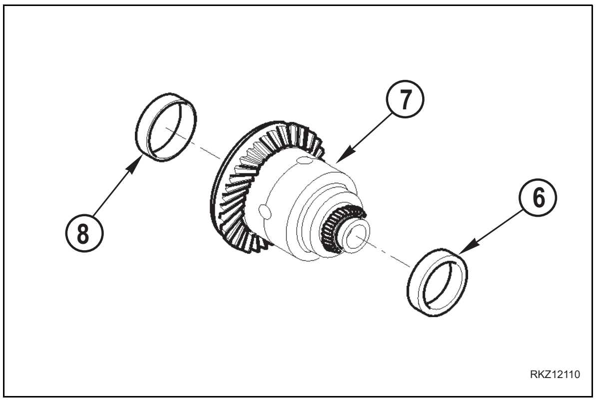
★ Do not invert the bearing cone if the bearings are not replaced.



7.2 Assembly

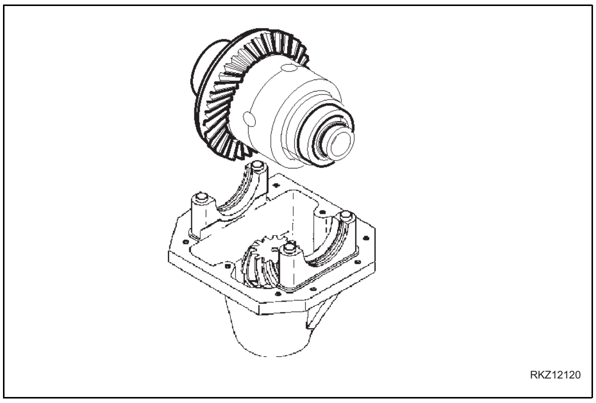
1 - Assemble the bearings cups (6) and (8) on the assembled differential housing (7).

★ Do not invert the bearing cone if the bearings are not replaced.



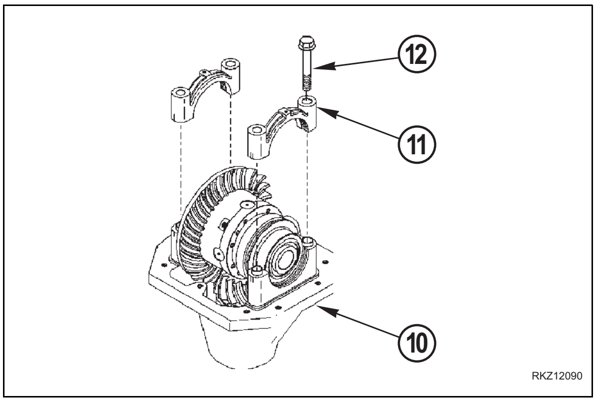
2 - Position the complete differential box with bearings on the differential carrier (1).

★ Check the right side of the bevel gear assembly.



3 - Move the differential group so to place the bevel crown gear on the pinion.

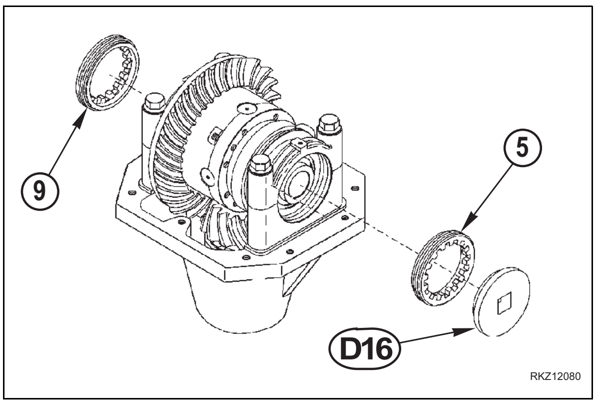
4 - Check that all bushes (10) are in their housings and position both half collars (11) on their seats using the previously traced reference marks.
Lock both collars with their fastening bolts (12).



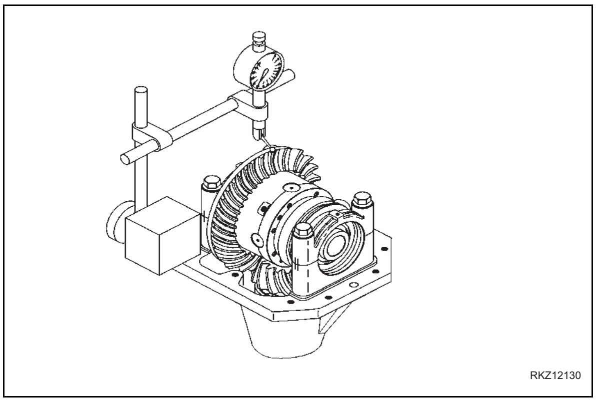
5 - Assemble the adjusting ring nuts (5) and (9) to the differential support.

6 - Tighten both ring nuts (5) and (9) with special tools **D16**, till the backlash is eliminated and the differential bearings are slightly preloaded.

★ Knock lightly with a soft hammer in order to properly set the bearings in position.



7 - Position a magnetic-base dial gauge on the differential support, so that the feeler stylus touches the surface of one tooth of the crown gear with a 90° angle.

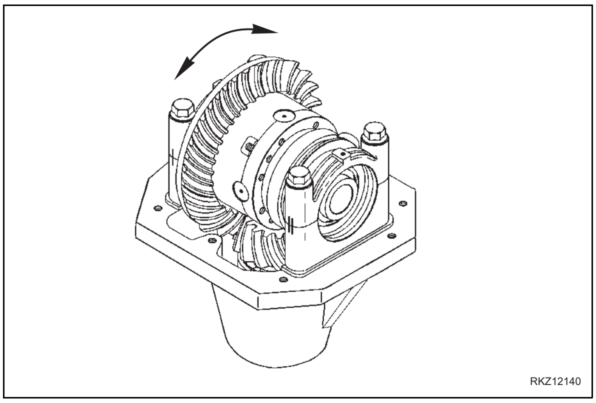


8 - Lock the pinion and move the crown gear alternatively and note the pinion-ring gear backlash, measured with the comparator.

9 - Repeat the operation on 2 or more points (teeth), rotating the crown gear, so that to obtain an average value.

★ Check if the measured backlash value is within the requested range: 0.20–0.30 mm

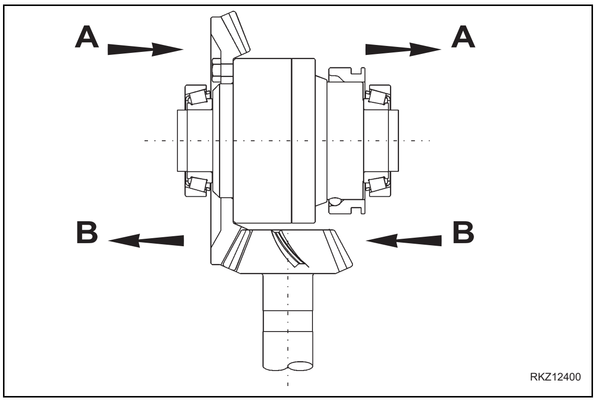
10 - Set the bevel gear backlash by turning adjusting rings (5) and (9) with the appropriate tool **D16.**



11 - Adjust the ring nuts (5) and (9) remembering that:

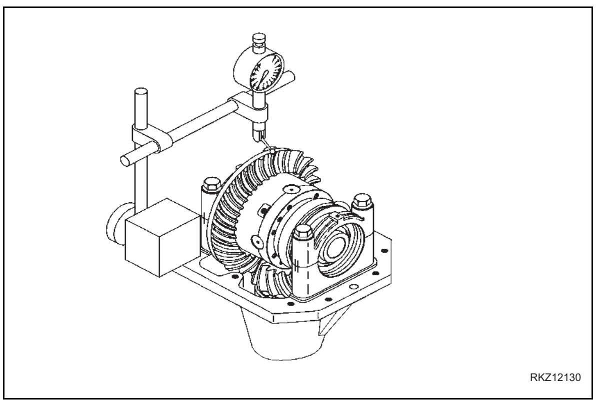
A - if the measured backlash **is greater** than the given tolerance range, unscrew the adjuster ring nut (5) and screw in the adjuster ring nut (9) by the same measure;

B - if the measured backlash **is less** than the given tolerance range, unscrew the adjuster ring nut (9) and screw in the adjuster ring nut (5) by the same measure.



12 - Once the adjustment of the pinion-ring gear backlash has been carried out, check also that there is a minimum preloading on the differential box bearings.

13 - Repeat the whole sequence of the above mentioned operations till the indicated conditions are reached.

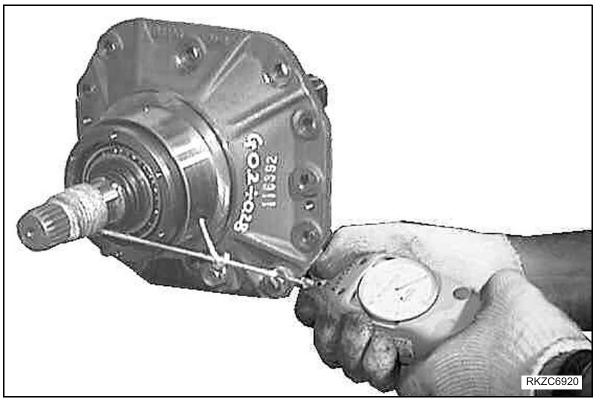


14 - Once the pinion-ring gear backlash has been established, measure the total preloading (T) of the bearings (pinion-crown bevel gear system), using a dynamometer whose cord is wound on the pinion splined end. The measured value should be within the following range:

T= (P+3.2)–(P+4.7) daN

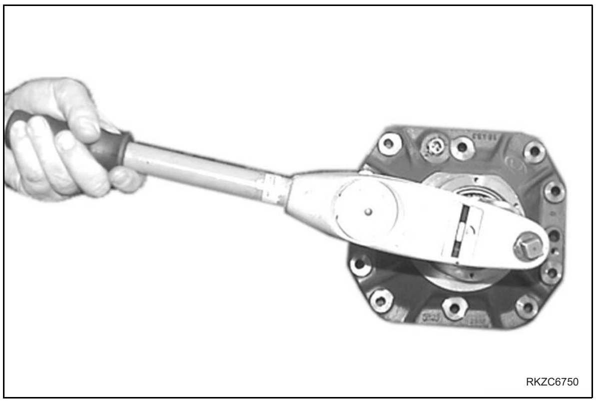
where **P** is the effectively measured pinion preloading (For details, see "9.2 Assembly" at point 13).

★ **Warning:**All preloadings must be measured without seal ring.



15 - Once the pinion-ring gear backlash has been established, instead proceding with a dynamometer, measure the total rolling torque (TT) of the bearings (pinion-crown bevel gear system) with a torquemeter.

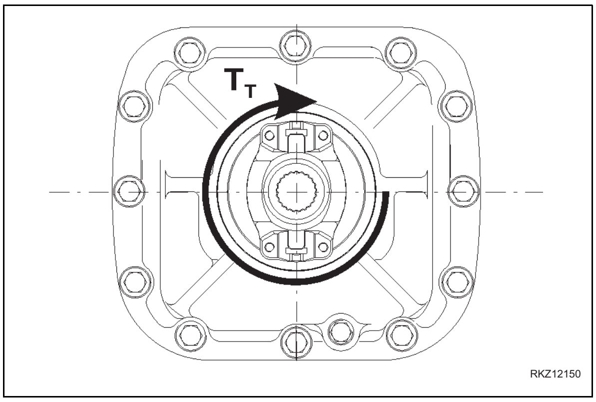
★ **Warning:**All preloadings must be measured without seal ring.



16 - The total rolling torque TT must be within the following range:

TT= (TP+0.55)–(TP+0.82) Nm

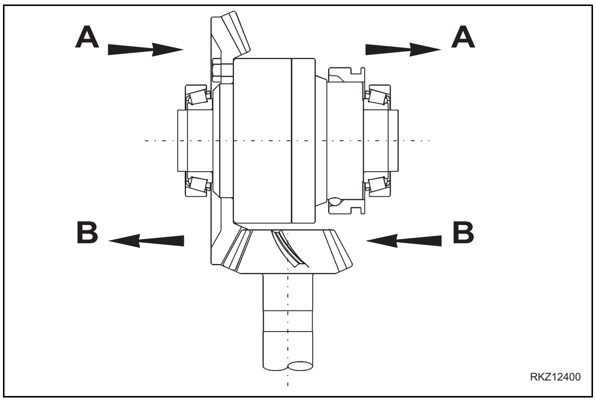
where **TP** is the pinion bearings preloading.
(For details see "9.2 Assembly" at point 14).



17 - If the measurement is not within the requested range, check well the assembly of each component and operate on the adjuster ring nuts (5) and (9) of the differential support:

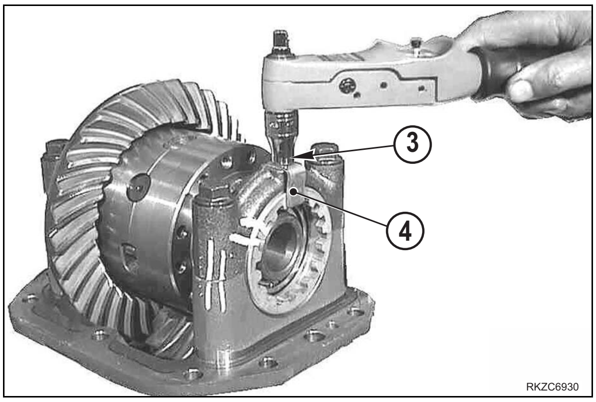
A - if the total preloading **is less** than the given range, screw in both adjuster ring nuts (5) and (9) by the same measure, keeping the pinion-ring gear backlash value unchanged;

B - if the total preloading **is greater** than the given range, unscrew both adjuster ring nuts (5) and (9) by the same measure, keeping the pinion-ring gear backlash value unchanged.



18 - Once all the adjustment operations have been completed, fit the ring nut retainers (4) and their screws (3).

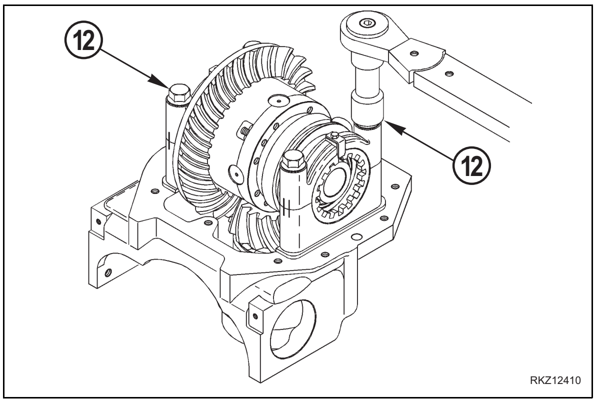
Screw: 20 Nm



19 - Tighten the bolts (12) of both half collars (10).

Screw: 413 Nm

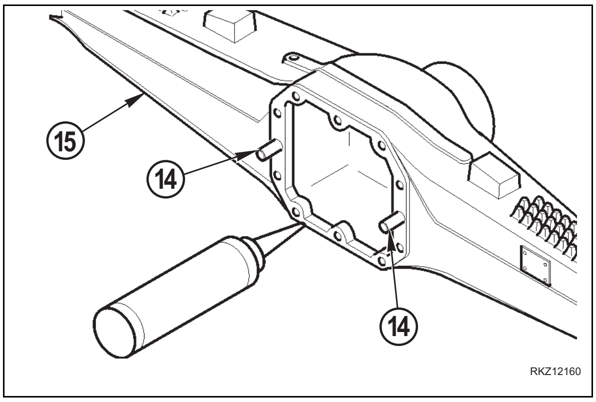
20 - Check again the total preloading or the total rolling torque as indicated in step 14, 15 and 16.



21 - Before matching surfaces, make sure that they are perfectly clean, degrease and clean them with appropriate detergents.
Spread a film of adhesive on the contact surface between the axle beam (15) and the differential carrier (1).

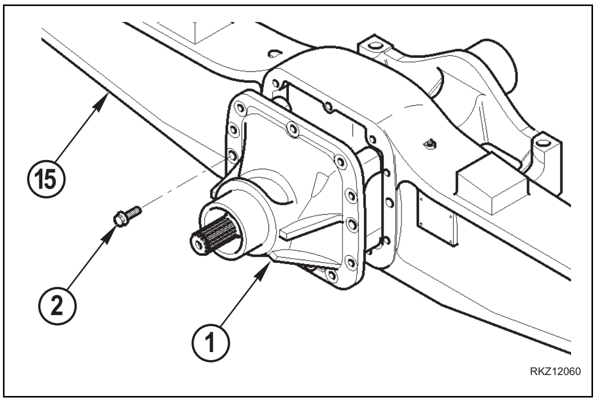
Sealant: Loctite 510

★ Check that two dowel bushes (14) are in their seats; the dowel pin (13) must be in their seat on the half collar (11).



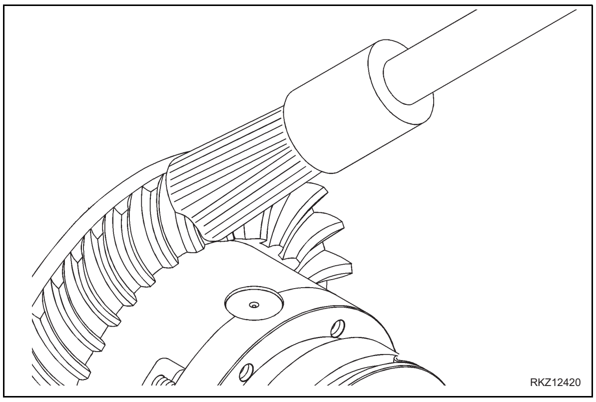
22 - Assemble the differential support (1) to the axle housing (15), and tighten the retaining bolts (2).

Screw: 169 Nm



7.3 Bevel gear marking test

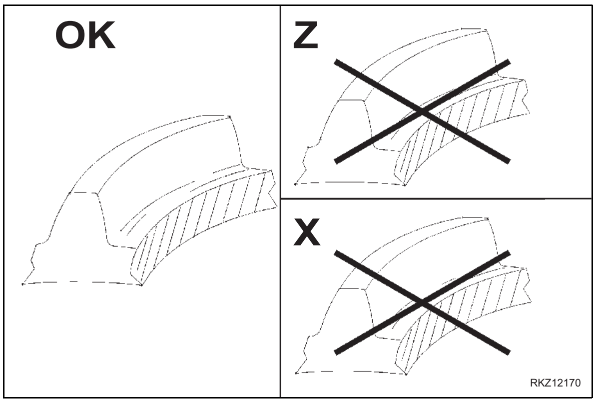
1 - To test the marks of the bevel gear teeth, paint the ring gear with red lead paint.
The marking test should be always carried out on the ring bevel gear teeth and on both sides.



OK ->Correct contact:
If the bevel gear is well adjusted, the mark on the teeth surfaces will be regular.

Z ->Excessive contact on the tooth tip:
Approach the pinion to the ring bevel gear and then move the ring bevel gear away from the pinion in order to adjust the backlash.

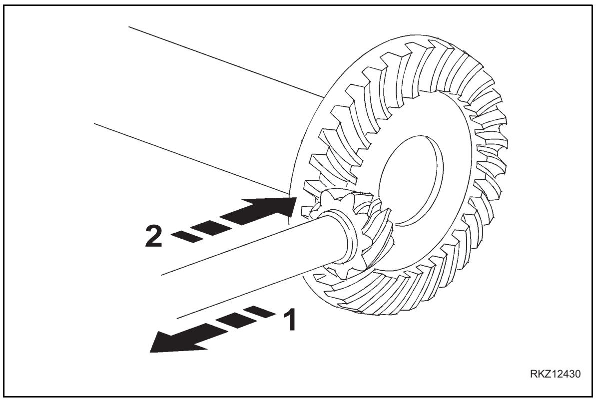
X ->Excessive contact at the tooth base:
Move the pinion away from the ring bevel gear and then approach the ring bevel gear to the pinion in order to adjust the backlash.



Movements to correct:

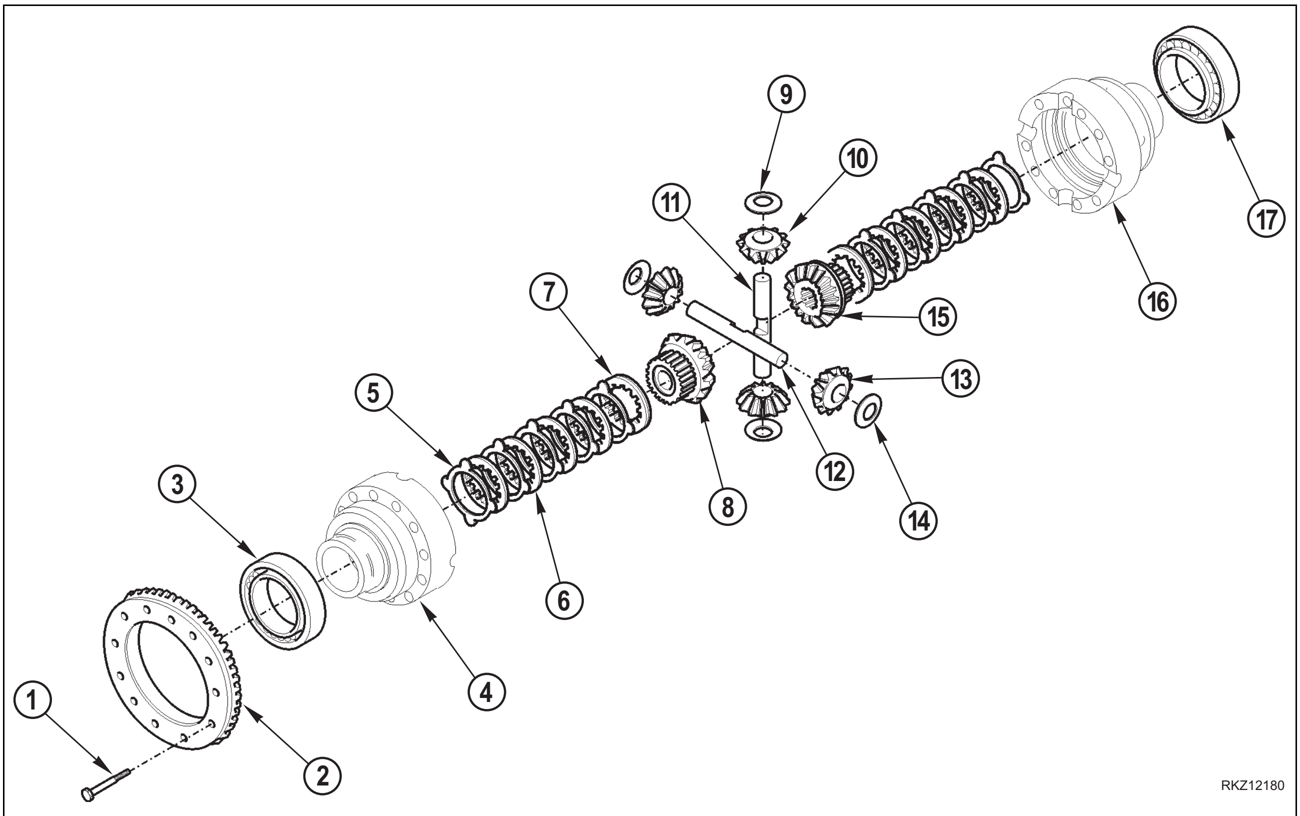
1 -> move the pinion for type X contact adjustment X.

2 -> move the pinion for type X contact adjustment Z.



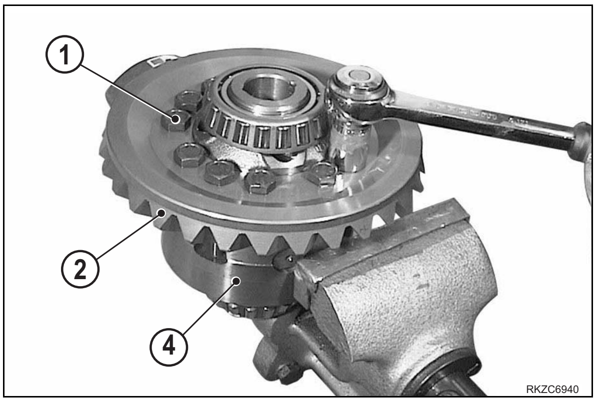
8. Differential group (LS)

8.1 Disassembly



1 -Lock the differential with a clamp.
Unscrew the fastening bolts (1) and remove the bevel gear crown (2).

★ **Warning:** This will make both differential half boxes (4), (16) free, so take care not to drop the internal components.

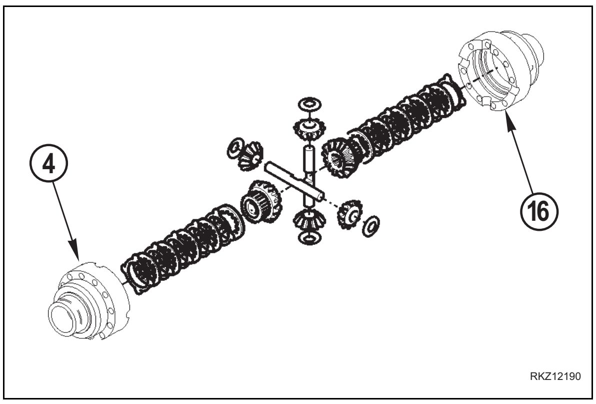


2 -Disassemble the differential box in two half boxes (4), (16) complete with the relevant components.

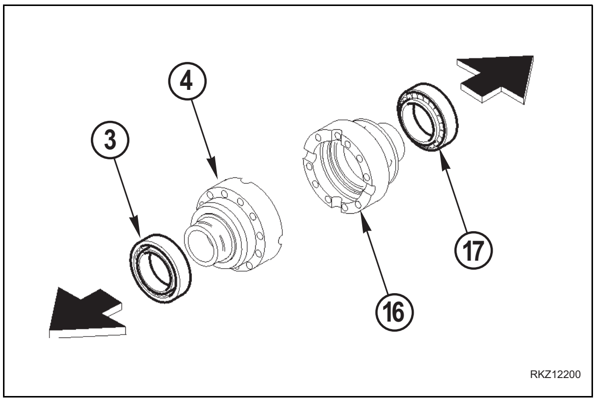
★ Make alignement marks on the half boxes before separating them.

3 -Disassemble all the components.

★ Check the operating and wear conditions of the components.

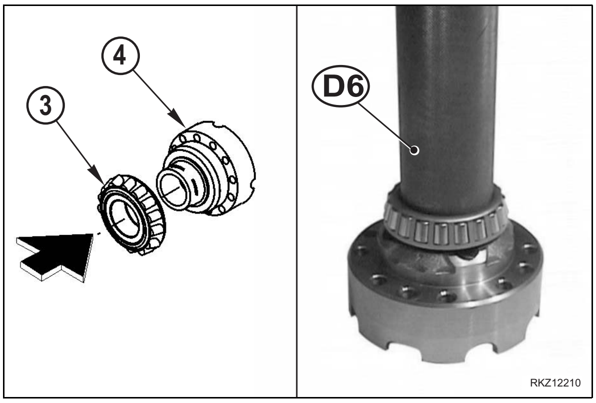


4 - Take the bearings (3) and (17) out of the differential half box (4) and (16), using two levers or a three-hold extractor.



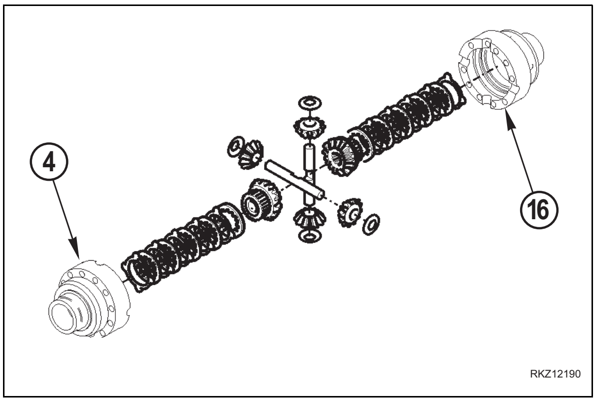
8.2 Assembly

1 - Assemble the bearing cones (3) and (17) on the half boxes (4) and (16), using the special tool **D6** and a hammer.



2 - Position a half housing on a workbench and assemble all inner components: locking differential counterplate (5), locking differential disks (6) and (7), sun gears (8) and (15), spider (11) and (12), planetary gears (10) and (13), thrust washers (9) and (14), as shown in figure.

★ The first disk (7) must be assembled with friction material on the disks side and the flat surface on the sun gear (8) side.
Join the two half boxes (4) and (16), aligning the reference marks made during disassembly.



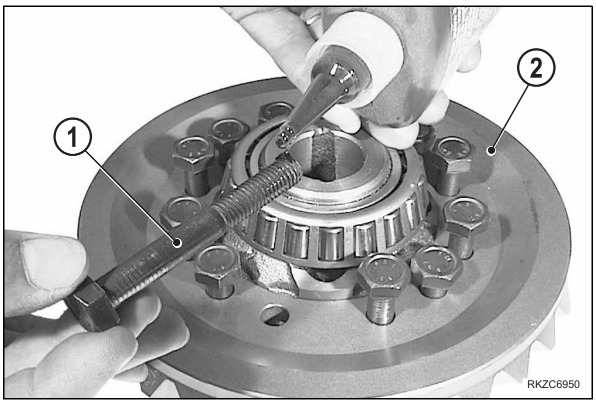
3 - Position the bevel crown gear (2) on the half box (4).

★ Clean with care the matching surfaces.

4 - Apply the specified sealant on the thread and tighten the bolts (1).

Screw: Loctite 510

Screw: 155 Nm

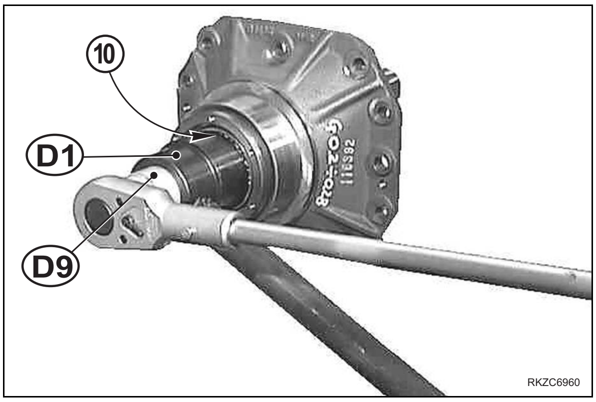


9. Pinion group

9.1 Disassembly

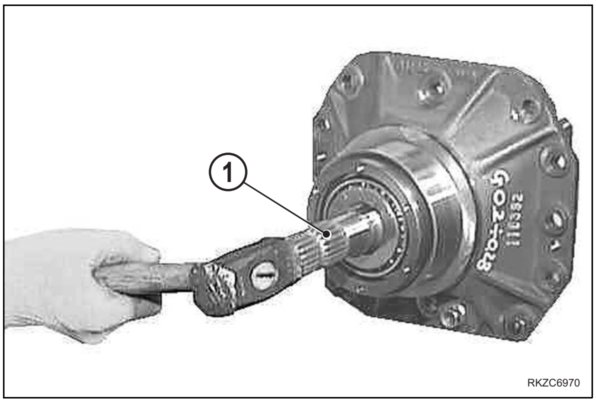
1 -Lock the differential carrier in a vice.
Unscrew the lock nut (10) using special tools **D1** and **D9**.

★ Replace the lock nut at each disassembly.

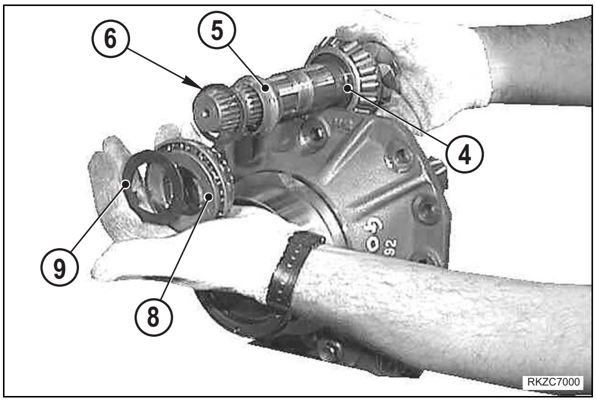


2 -Tap the shaft with a soft hammer to remove the bevel pinion (1).

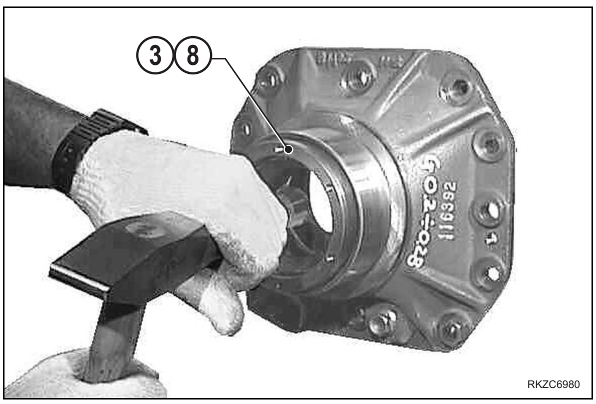
★ Take care not to drop the pinion.



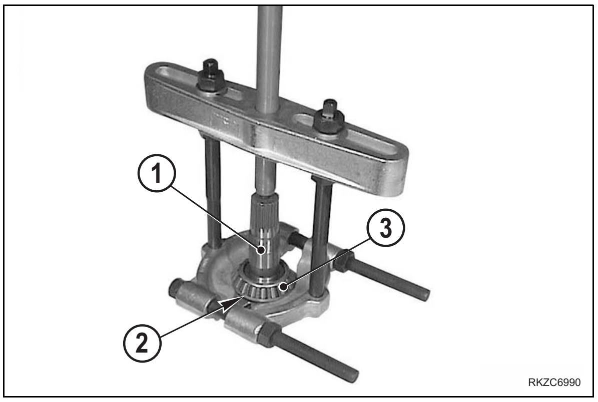
3 -Collect the washer (4) and (6), the collapsible spacer (5), the bearing cone (8) and the retaining washer (9).



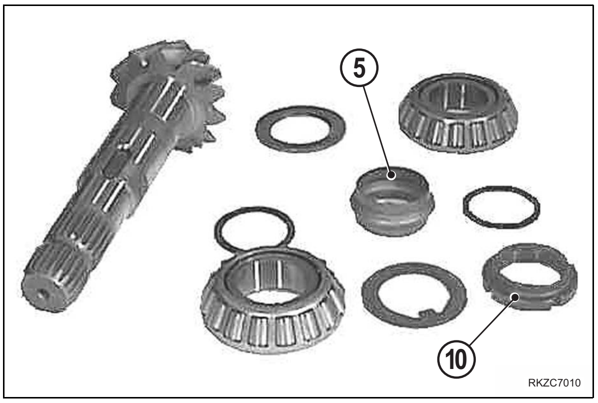
4 -Remove the bearing cups (3) and (8) using a driver and a hammer.



5 - To remove the bearing cone (3) of the pinion (1), use a standard extractor.
Collect the bearing cone (3) and the underlying shim (2).

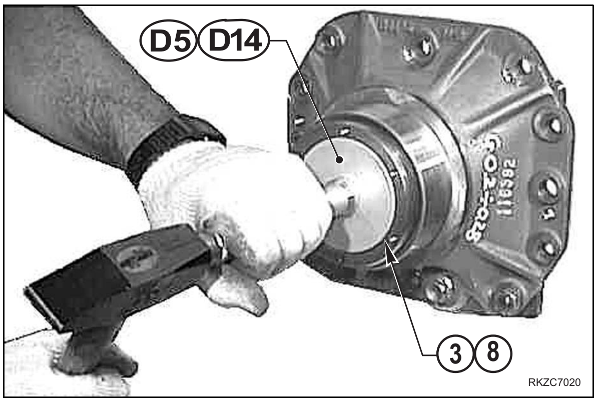


6 - Check all pinion components for wear.
The ring nut (10) and the collapsible spacer (5) must be replaced when reassembling the unit.

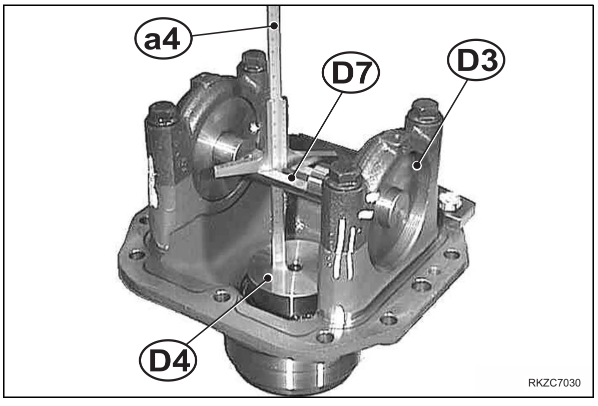


9.2 Assembly

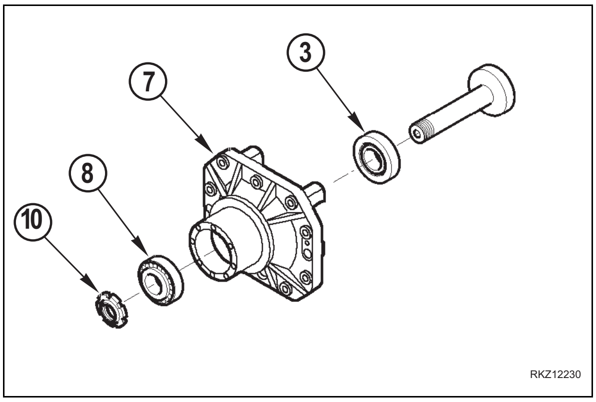
1 - Fit the bearings cups (3) and (8) using the special tools **D14**, **D5** and a hammer.



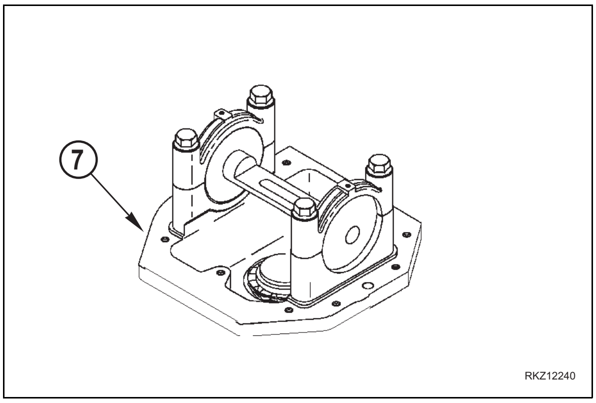
2 - Prepare ithe kit consisting of the special tools called "false pinion" **D4** and "false differential box" **D3** and **D7** and a depth gauge (**a4**).



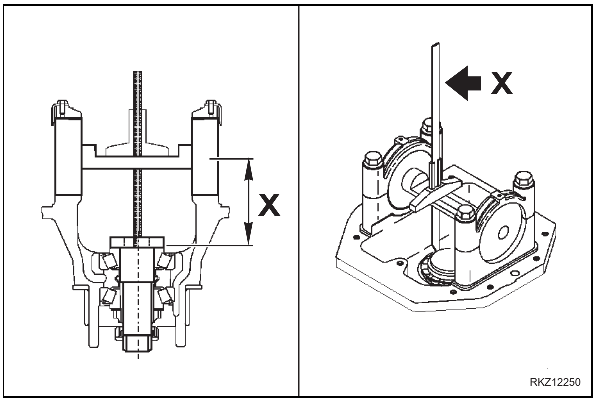
3 - Insert the bearing cones (3) and (8) in their seats. Assemble the "false pinion" and its ring nut (10). Tighten without exceeding the ring nut, till the backlash is eliminated.



4 - Install "false differential box" special tools into the differential group support (7) and lock it with the half collars.

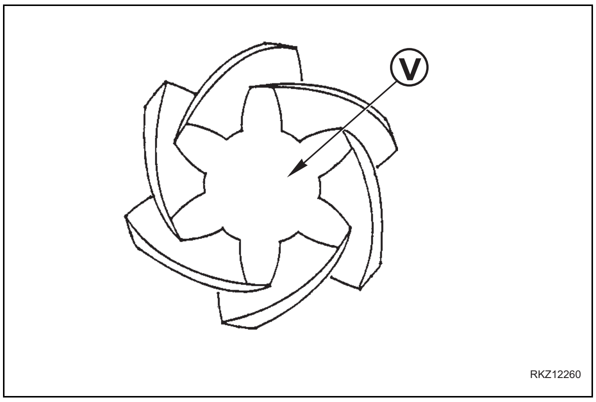


5 - **Assembly diagram of the "false differential box" (on the left).**
Use a depth gauge to measure distance (X) (distance between the axis of the differential bearings and the point at which the pinion head is supported, or base of the bearing)



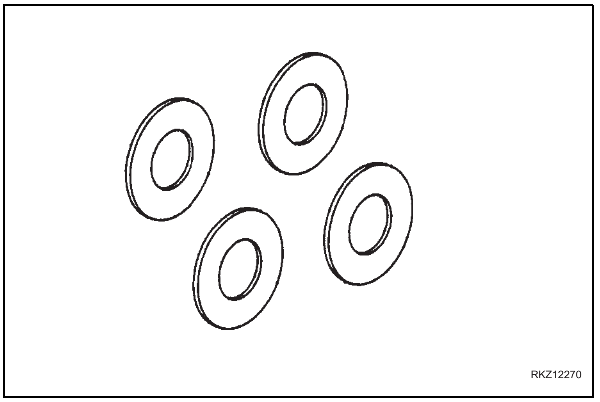
6 - In order to determine the necessary thickness value (**S**) between pinion and bearing, subtract the value (**S**) stamped on pinion head (**V** = requested distance) from the measured value (X).

S= X - V mm

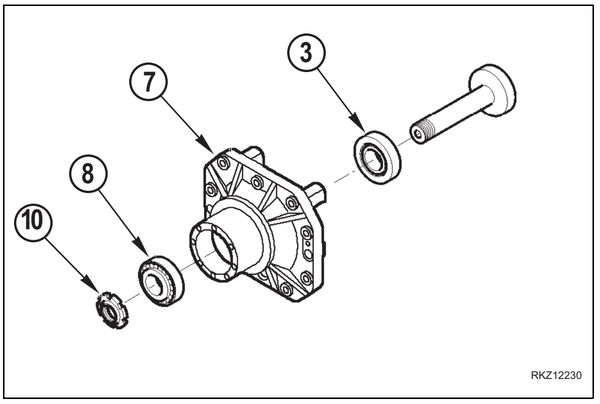


7 - Select the shim (2) of thickness value (S) among the range of available shims.

SHIMS RANGE
2.5 - 2.6 - 2.7 - 2.8 - 2.9 - 3.0 - 3.1 - 3.2 - 3.3 - 3.4 mm

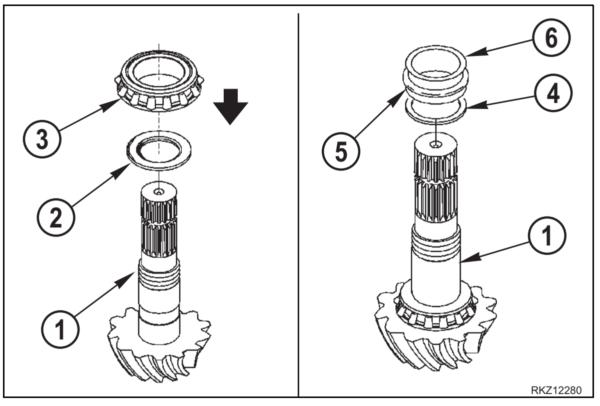


8 - Remove the "false differential box" special tool from the differential support (7).
Remove the ring nut (10), the "false pinion" and the bearing cones (3) and (8).

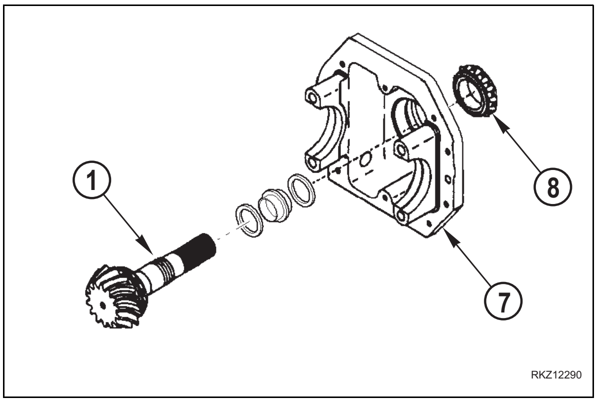


9 - Insert the chosen shim (2) **with the chamfer against the gear** into the pinion shaft (1).
Force the bearing (3) into the pinion shaft (1) with the special tool **D8** under a press, making sure that it is well set.
Insert the shims (4) and (6) and the new collapsible spacer (5).

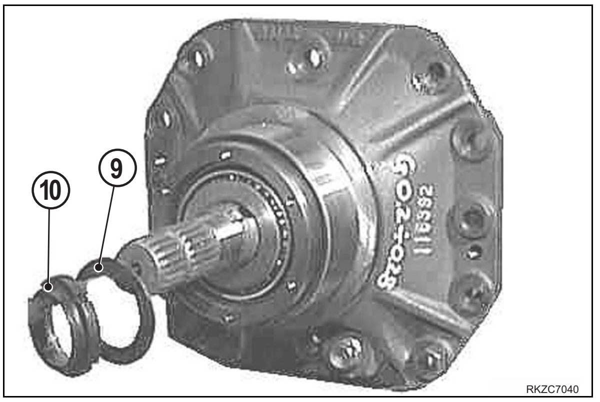
★ Use always a new collapsible spacer.



10 - Insert the bevel pinion (1) unit into the differential support housing (7) and the bearing cone (8) into the pinion end, as shown in figure.
Use the special tool **D8** and a hammer to drive the bearing (8).



11 - Insert a ring nut washer (9) and screw a new lock ring nut (10) on the pinion end.

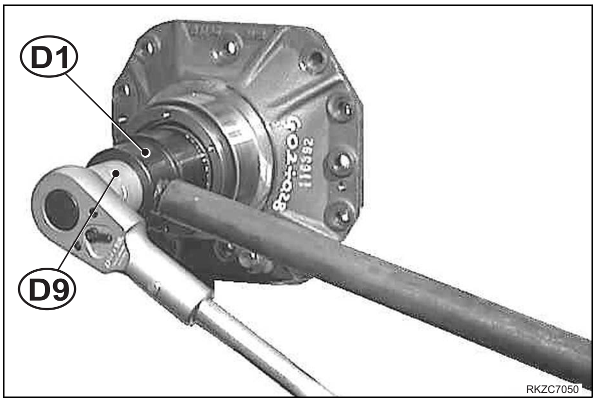


12 - Screw the ring nut (10) in, using the wrench for ring nut **D1** and for pinion retainer **D9**.

★ The torque setting is given by the preloading measurement on bearings (3) and (8). Tighten the ring nut (10) gradually.

★ If it is tightened too much, the elastic spacer (5) should 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 (3) and (8).

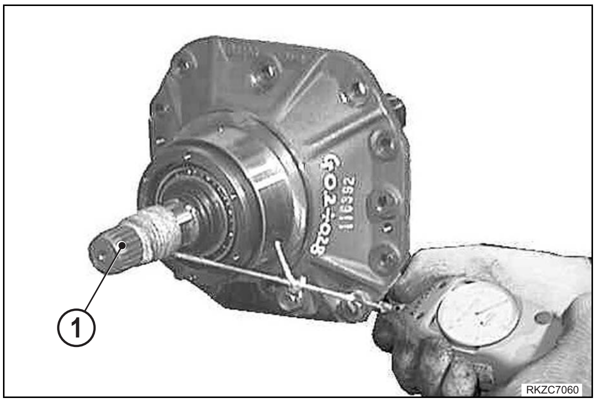


13 - Carry out the preloading measurement **P** of the pinion taper roller bearings (3) and (8), using a dynamometer whose cord is wound on the end of pinion spline (1). The measured value should be within the following range:

P= 9.2–13.7 daN

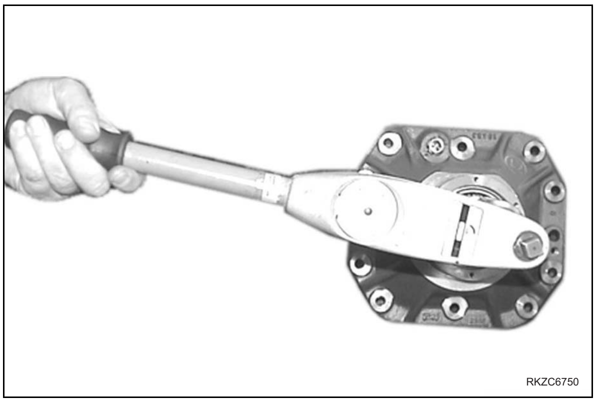
The adjustment is carried out by increasing the ring nut (10) torque gradually, being careful not to exceed.

★ **Warning:** All preloadings must be measured without seal ring.



14 - Instead proceding with a dynamometer measure the pinion shaft bearings rolling torque **TP** with a torquemeter.

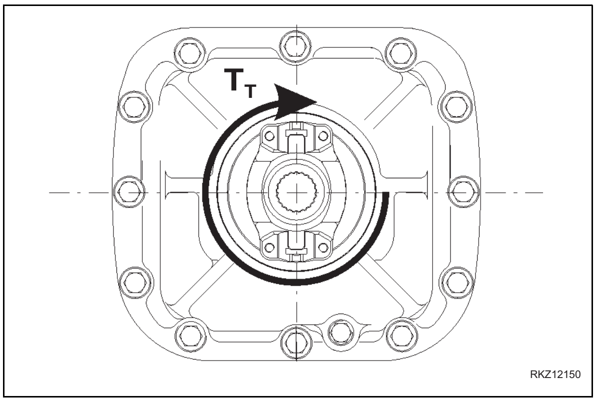
★ **Warning:** All preloadings must be measured without seal ring.



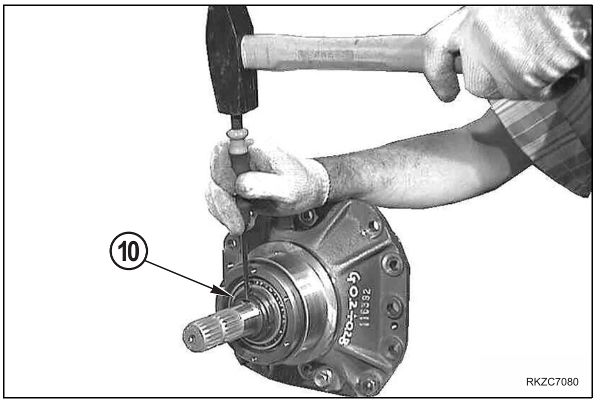
15 - he measured value **TP** must be within the following range:

TP= 1.6–2.4 Nm

The adjustment is carried out by increasing the ring nut (10) torque gradually, being careful not to exceed.

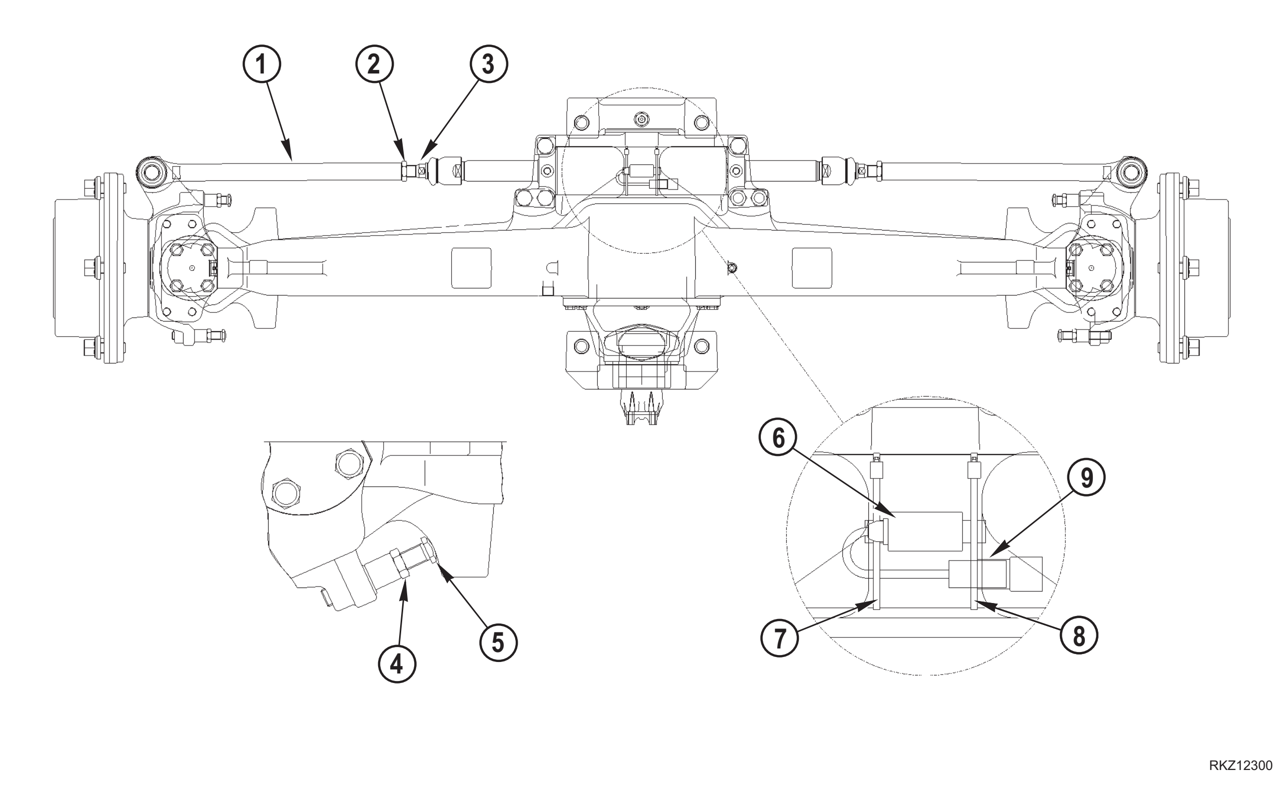


16 - Once the requested preloading value is achieved, caulk the ring nut (10), using a hammer and a chisel.



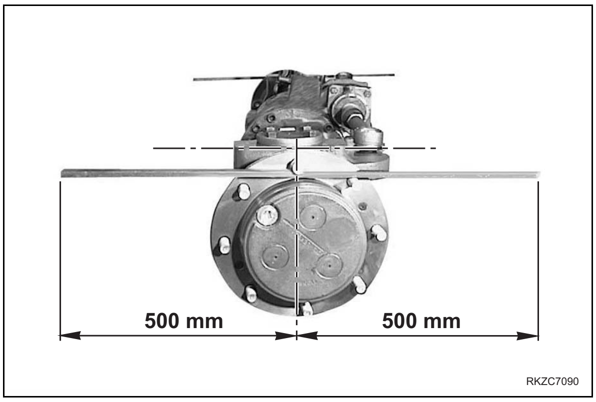
10. Toe-in/steering angle

10.1 Toe-in adjustment



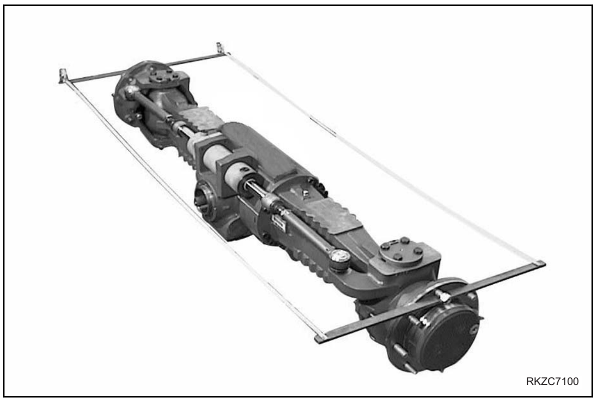
1 -Put two equal one-meter-long linear bars on the wheel sides and lock them with two nuts on the wheel hub stud bolt.

★ 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.

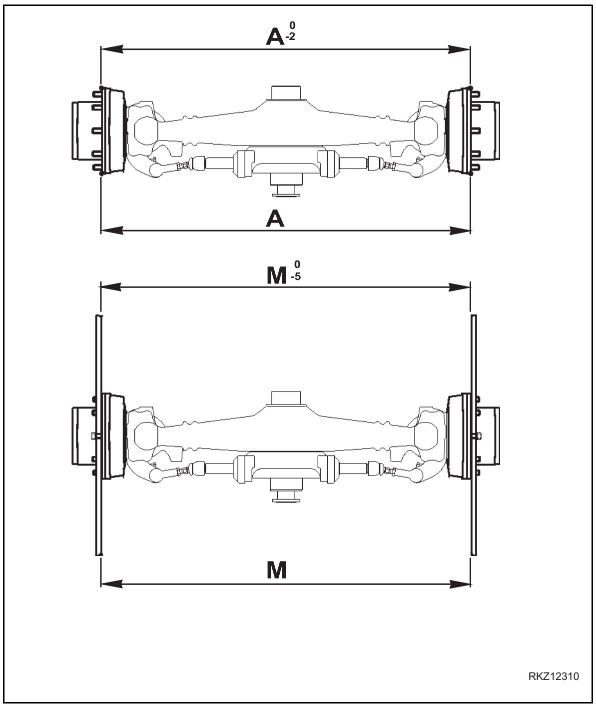


2 -Measure the distance in mm **M** between the bars ends with a tapeline.

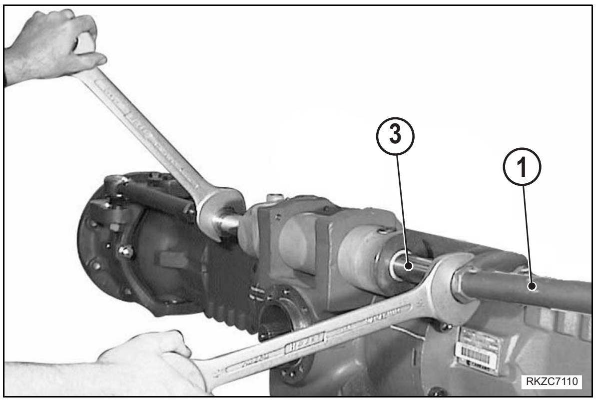
★ Keep the minimum value, swinging the measurement point.



3 - Check that the difference of the measurements between the wheel hubs diameters ends is within the requested tolerance range
The nominal toe-in value (**A**) is referred to the external diameter of the wheel hubs flange, therefore the measured value (**M**) at the bars ends must be related to the ratio between length of the bar and flange diameter
nominal toe-in = A^{0}_{-} –> measured toe-in = M

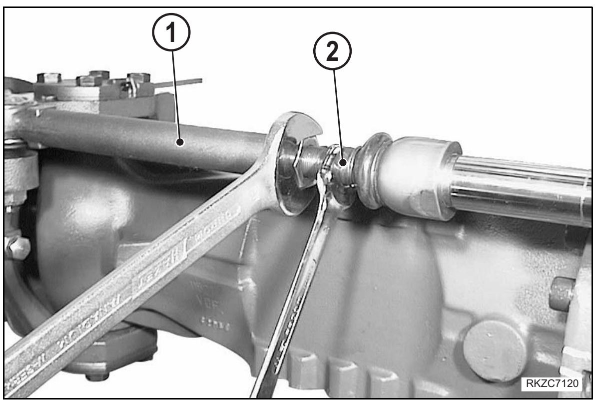


4- If toe-in is incorrect, operate with two wrenches on the steering arms (1) screwing in and out the two joint tie rods (3) equally till the toe-in is within the requested tolerance.



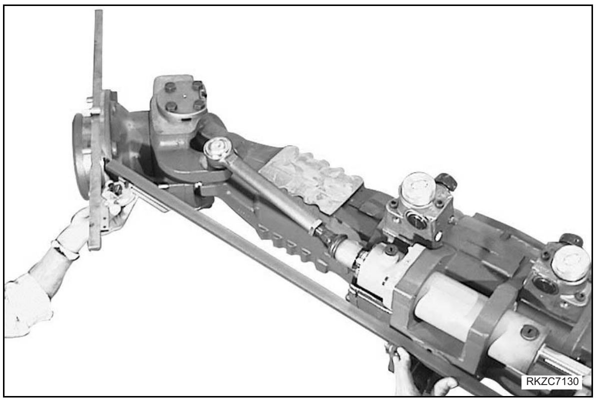
5 - After adjusting, screw in the lock nuts (2) of the steering arms (1).

Nuts: 250 Nm

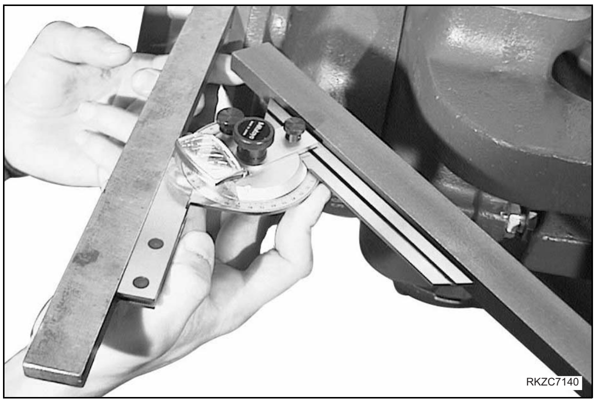


10.2 Steering angle adjustment

1 - Use the same bars assembled for the toe-in adjustment and a long bar perfectly leaned over the machined part of the central body (pinion side), so that the two bars form an acute angle at the maximum steering.

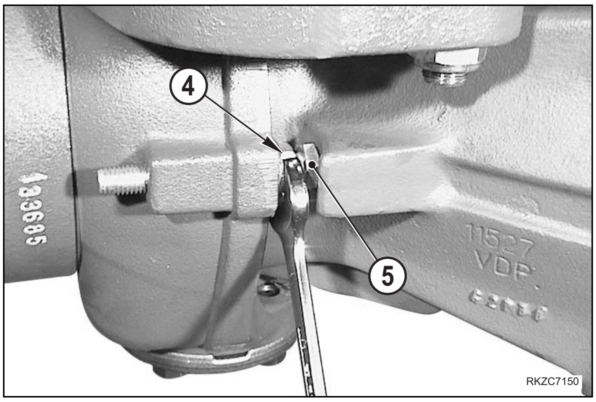

RKZC7130

2 - Adjust a protractor to the requested angle and position it on the long bar.
Move a wheel side till it forms, with the two bars, the angle fixed by the protractor.


RKZC7140

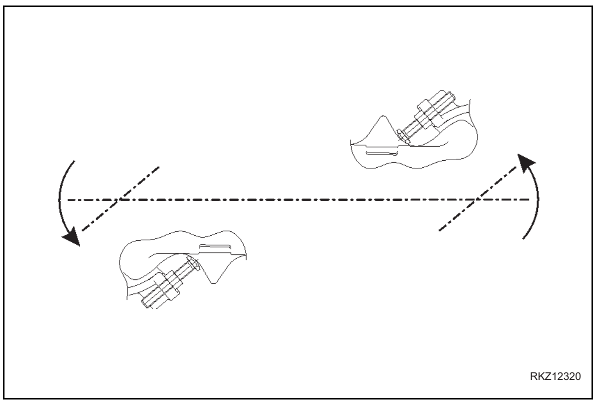
3 - Adjust the mechanical steering stop, screwing in or out the stop bolt (5), locking them with the locknut (4).

Lock nut: 150 Nm

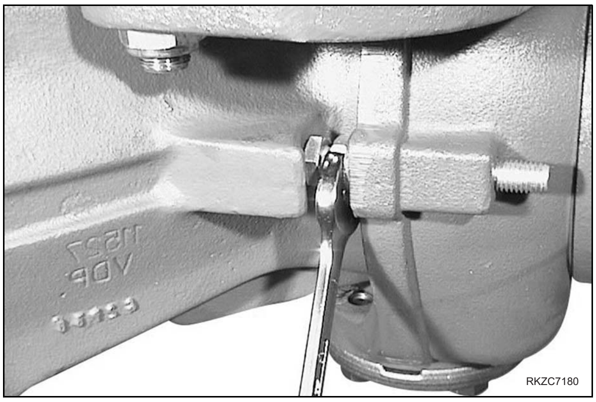


RKZC7150

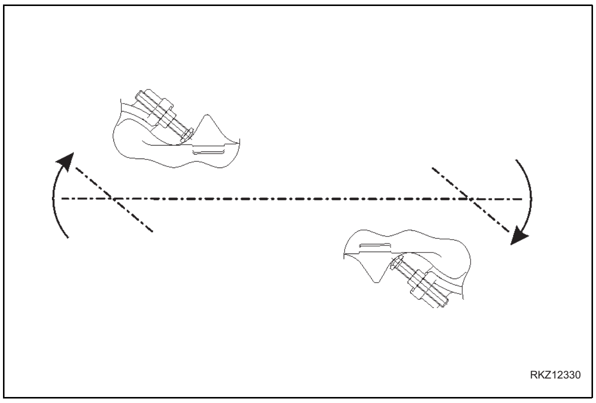
4 - Check the position of the stops on the opposite side, both screws must touch the steering stop pads at the same time.


RKZ12320

5 - Steer completely towards the other side and repeat the same operations.



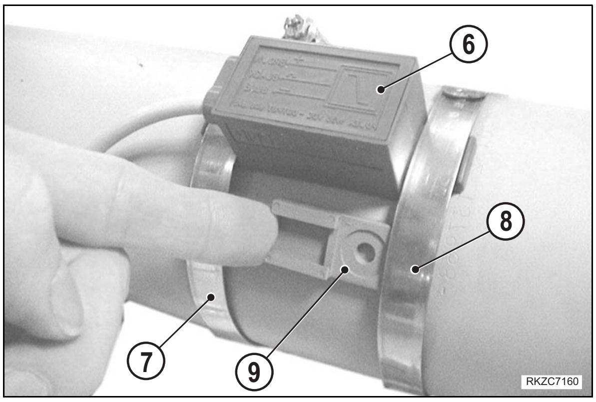
6 - Check the position of the stops on the opposite side, both screws must touch the steering stop pads at the same time.



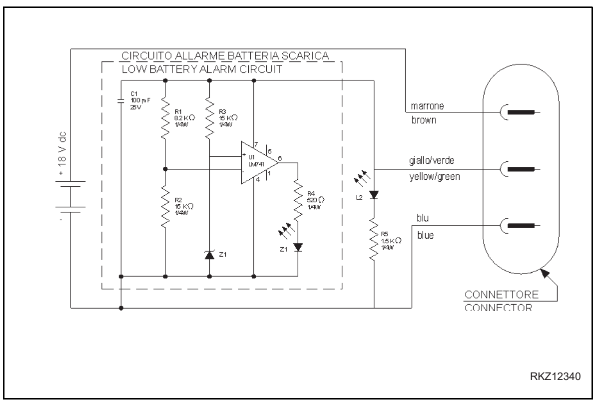
7 - Assemble the steering sensor (6) on the cylinder with relative clamps (7) and (8).

★ Do not lock the clamps.

8 - Insert into the clamp (8) the plastic support (9) as shown.



9 - Connect the steering sensor (6) with the special testing system **D22**.
Supply 18 V dc with a battery to the testing system.

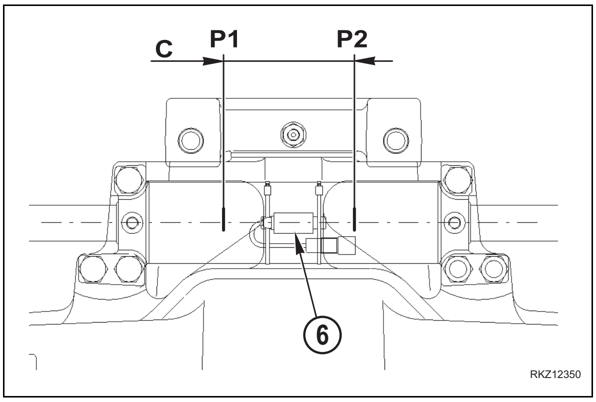


10 - Adjust the steering sensor (6) on the cylinder carrying out the following operations:

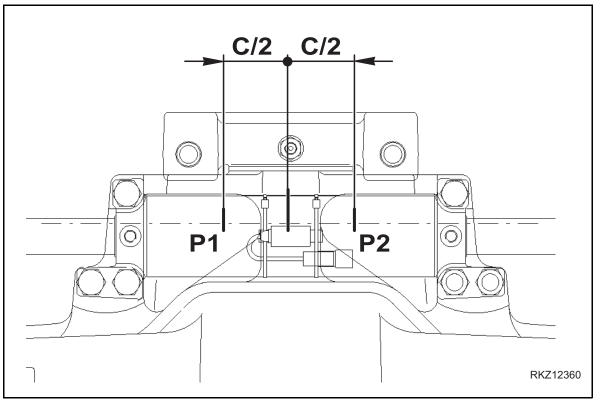
a - slide horizzontally the steering sensor on the cylinder surface till led is on (position "P1");

b - slowly, slide again the sensor till led is off in the same direction (position "P2").

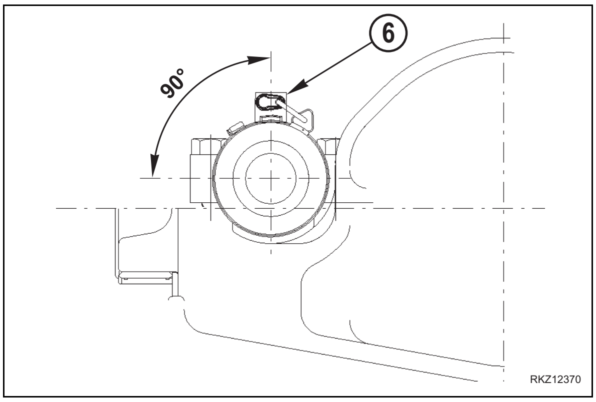
c - measure the stroke (C) between position "P1" and "P2";



d - set sensor right in the middle between position "P1" and "P2" with tolerance ±1mm.

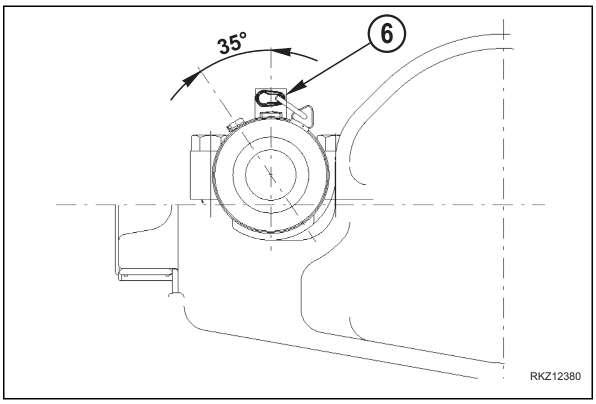


e - turn the sensor (6) in the shown position;

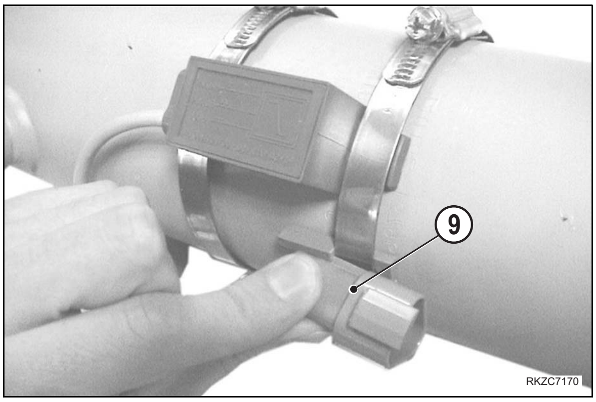


f - lock the sensor with the clamps (7) and (8).

★ The clamps must be tightened with the screw head in the shown position.



11 - Assemble the electrical connector to the plastic support (9) as shown.



11. Testing after assembly

1 - With engine off, lift the axle so that the tyres get away from the ground.

2 - Engage the gear so that the pinion gets locked.

3 - With the help of another person standing on the opposite side, begin the assembly testing by rotating as much as possible both the wheels forward. (Both the wheels should get blocked after a while.)

4 - Keeping the pinion blocked, free the right wheel and rotate the left one in the line of march.
Rotate the right wheels in the opposite direction. The wheel will move freely without difficulty and the right wheel will move in the opposite direction if the assembly has been carried out correctly.
Repeat the same operation in the opposite direction (reverse gear).

5 - IF ONE WHEEL DOES NOT ROTATE FREELY IN BOTH DIRECTIONS, then check step by step all assembly operations.
Check and see that the brakes are regulated correctly and functioning properly.

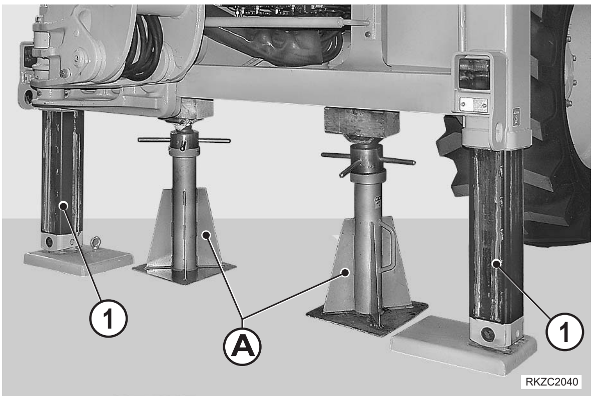
REAR AXLE

Removal

1 - Lower the backhoe outriggers (1) and force them downwards in order to raise the rear wheels.

2 - Place jacks or stands "**A**" under backhoe frame with non slip blocks that are 50–52 cm high.

3 - Start the engine and slowly retract the outriggers until the machine rests on jacks "**A**", then move frame back to its horizontal position.

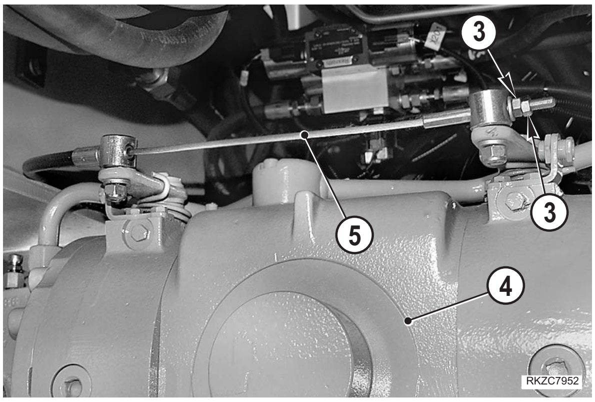


4 - For added safety, place the backhoe bucket with its back on the ground while holding the arm in its upright position.
Lower shovel to the ground as well.

5 - Remove the rear wheels (2). [*1]

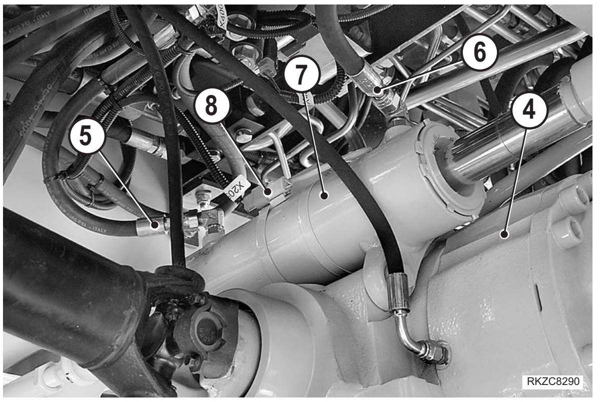
6 - Stop the engine and completely release residual pressures from all the circuits.
(For details, see "20 TESTING AND ADJUSTMENTS").

7 - Loosen and remove nuts (3) and disconnect the parking brake cable (5) from the axle (4). [*2]



8 - Disconnect from axle (4) steering cylinder (7) hoses (6) and steering sensor (8) connector.

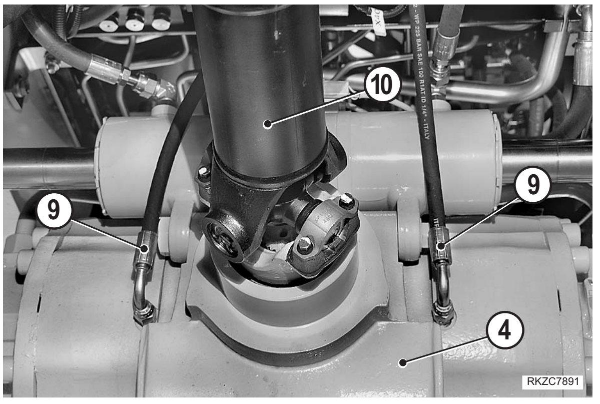
★ Cap the hoses and cover the connector to prevent contamination.



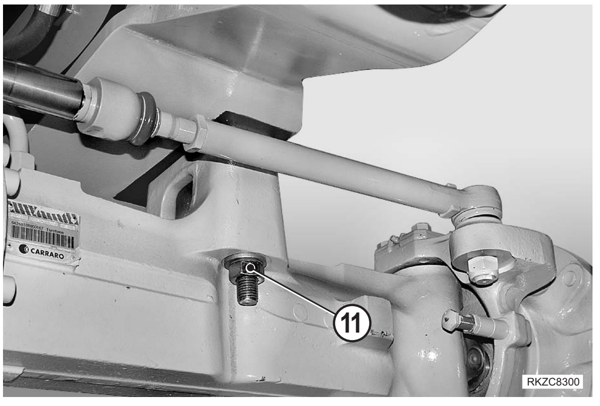
9 - Disconnect the tubes (9) . [*3]

★ Plug all pipes/hoses to prevent contamination.

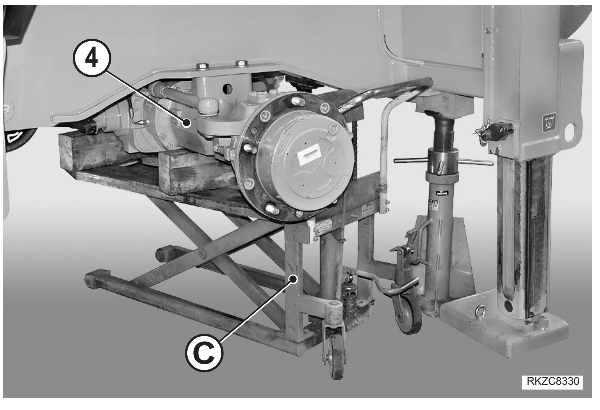
10 - Disconnect from axle (4) rear cardan shaft (10) and put aside. [*4]



11 - Loose nuts (11) (No. 4) until release tightening torque. [*5]



12 - Position a jack "**C**" and some blocks beneath the axle (4). Raise the jack until the blocks can be forced under the axle arms.

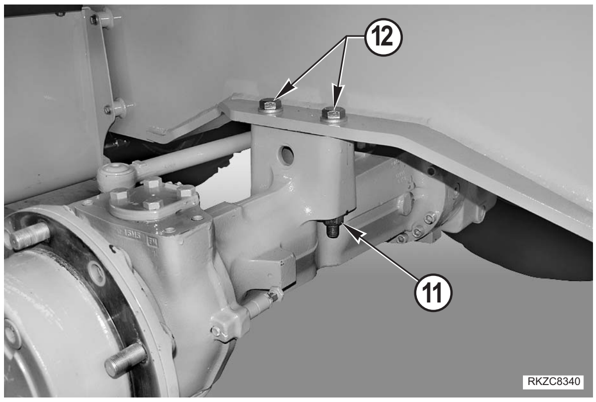


13 - remove nuts (11) (No. 4) losen during step 11.

14 - Lower the jack until the axle is disengaged from the chassis.

15 - Remove screw (12) and lower the jack up to allow axle removal.

Rear axle: 545 kg



Installation

- To install, reverse removal procedure.

[*1]

Wheel nuts: 500±9.8 Nm

[*2]

★ Bleed the air from the braking circuits. (For details, see "20 TESTING AND ADJUSTMENTS").

[*3]

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

[*4]

Cardan shaft screws: 38 Nm

[*5]

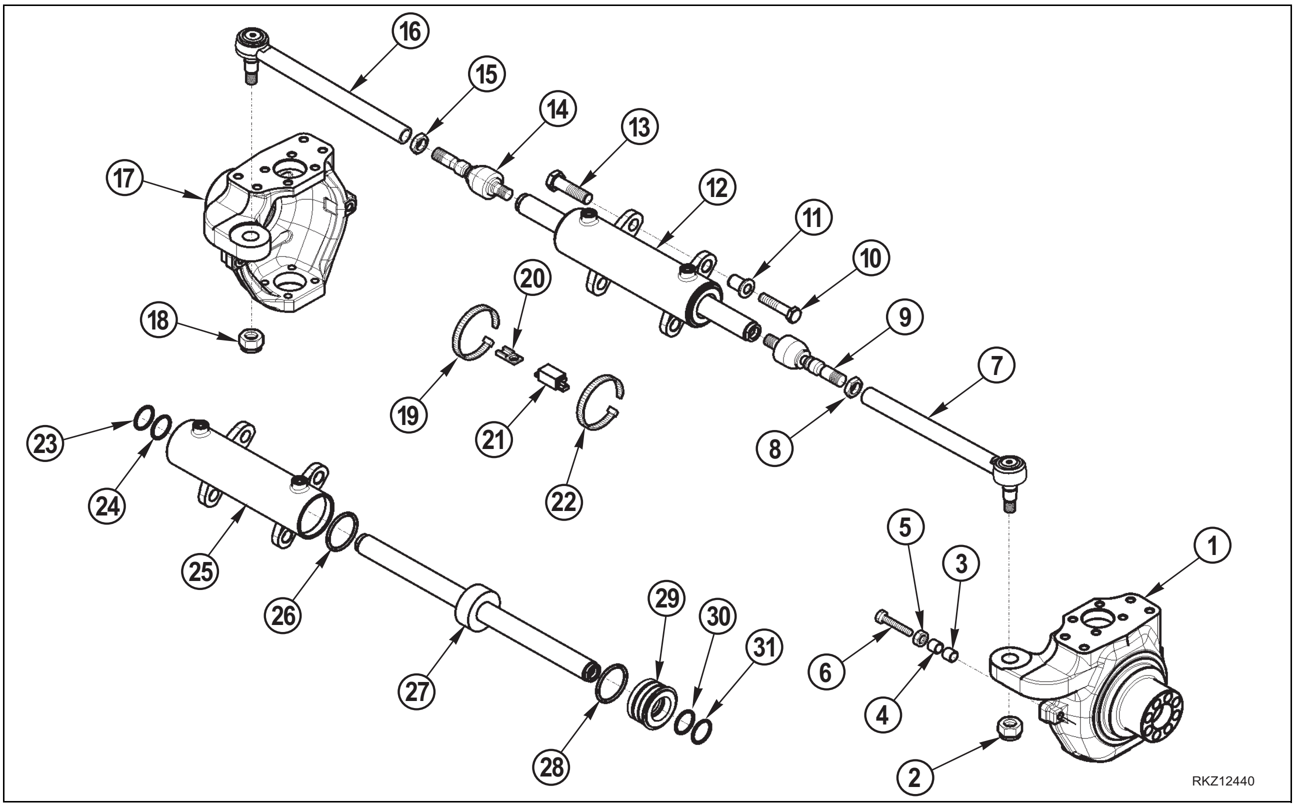
Nuts: Loctite 242

Nuts: _________ Nm

Disassembly and assembly

1. Steering cylinder group

1.1 Disassembly

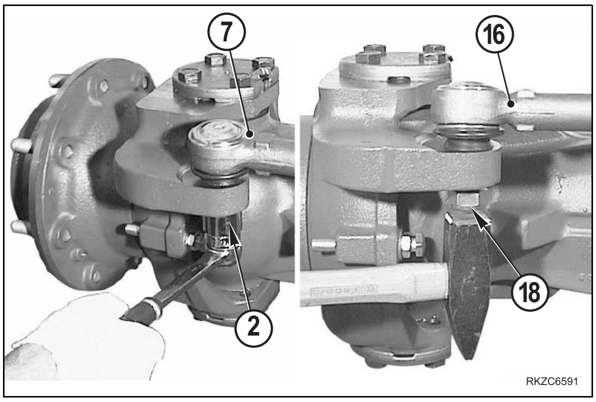


1 - Remove nuts (2, 18) and remove tie-rods (7, 16) from swivel housing (1), (17).

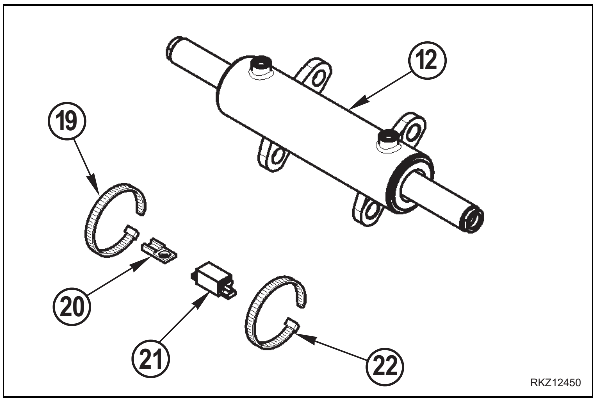
★ If necessary, use a hammer.

★ Don’t damage the threaded pin ends.

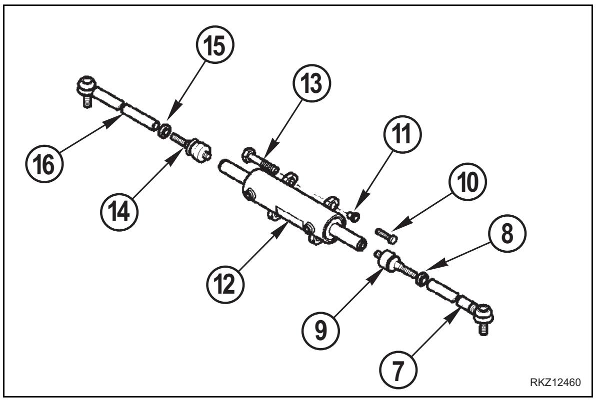
★ Replace the nuts (2), (18) at each disassembly.



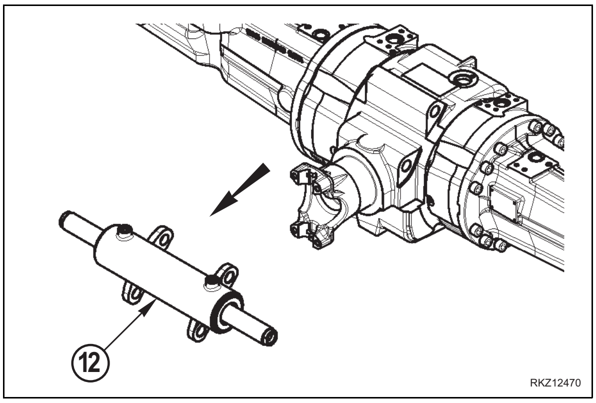
2 - Remove the clamps (19) and (22), sensor (21) and receptacle bracket (20) from the cylinder (12).



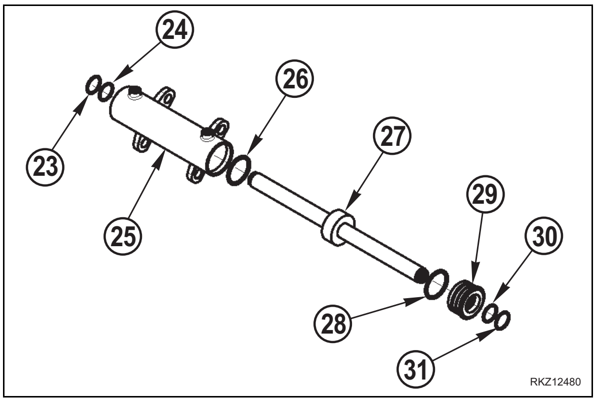
3 - Remove the tie rods (7) and (16) from the cylinder rods by loosing the nuts (8) and (15), then check their conditions.
Unscrew the ball joints (9) and (14).
Remove the fastening bolts (10) and (13).
Extract the bushes (11) using an extractor with screw M18.



4 - Remove the cylinder (12) from the axle.

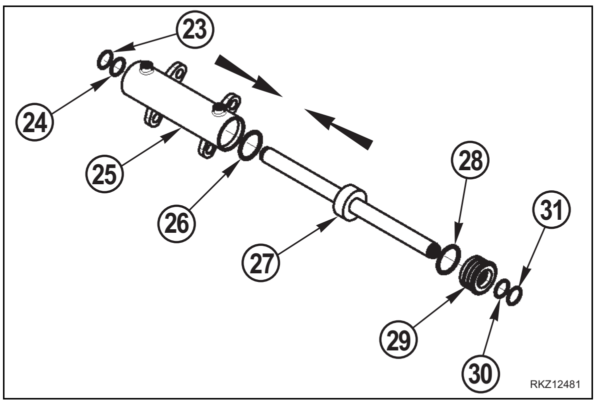


5 - Detach the cylinder head (29) from the cylinder case (25) and remove it from the rod (27).
Remove the rod (27) from the cylinder case (25).
Remove all the seals and O-Rings (23, 24, 26, 28, 30 and 31) from the cylinder head (29) and piston (27).



1.2 Assembly

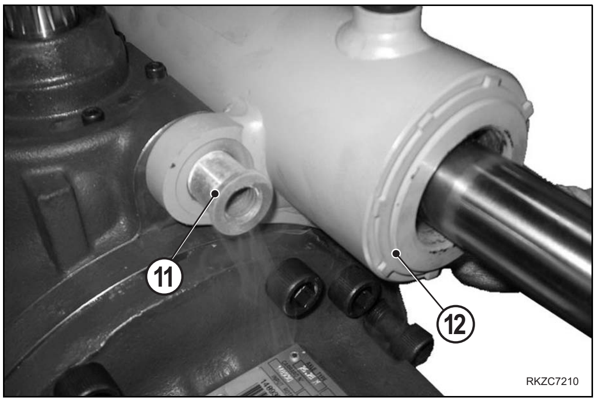
1 - Assemble new seals and O-Rings (23, 24, 26, 28, 30 and 31) on the cylinder heads (29), on the piston (27) and on the cylinder body (25).
Insert the rod (27) into the cylinder (25) then assemble the cylinder head (29).



2 - Assemble the steering cylinder (12) to the axle.
Cool the bushes (11) at a temperature lower than -100°C with liquid nitrogen.

Wear safety gloves.

3 - Assemble the bushes (11) with a punch and a hammer.



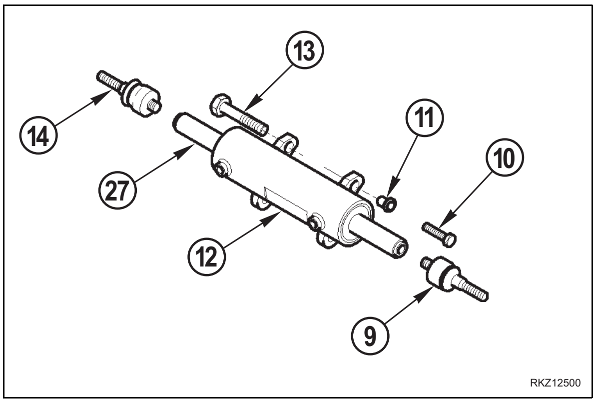
4 - Assemble the fastening screws (10) and (13).

Screws (10): 220 Nm
Screws (13): 660 Nm

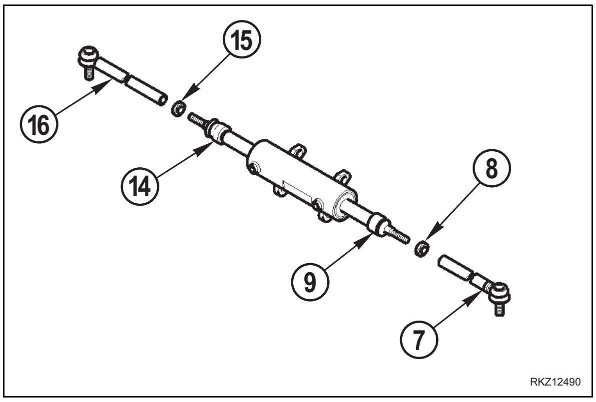
Screw: Loctite 270

5 - Screw the ball joints (9) and (14) to the ends of the rod (27).

Ball joints: 300 Nm



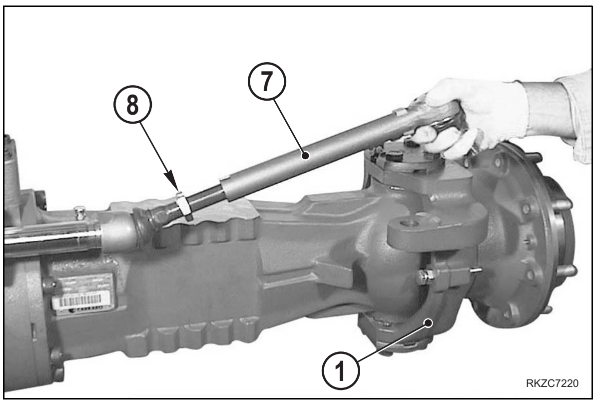
6 - Assemble the nuts (8) and (15) then the tie rods (7) and (16) to the ball joints (9) and (14).



7 - Align the swivel housing (1) with the axle.
Screw the tie rod (7) so that its ball joint can be inserted into the swivel housing (1) arm.

★ It's important to unscrew the lock nut (8) to carry out this operation.

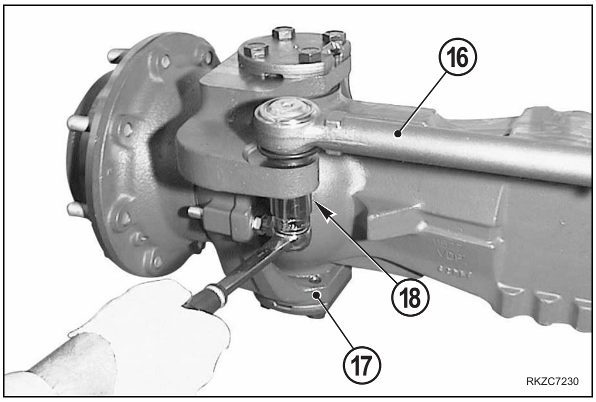
8 - Repeat the operation for the opposite side.



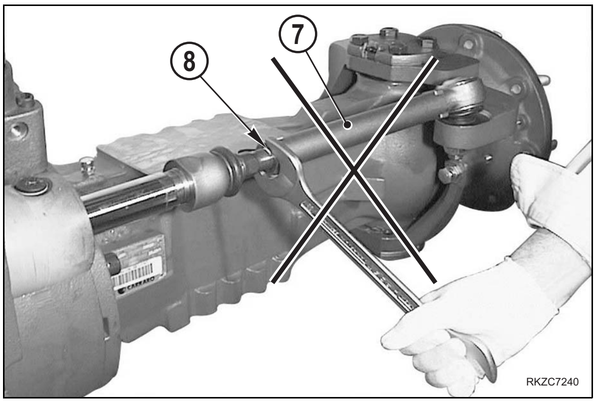
9 - Insert the ball joint of the tie rod (16) into its housing on the swivel housing (17).
Assemble and tighten the lock nut (18).

Nuts: 280 Nm

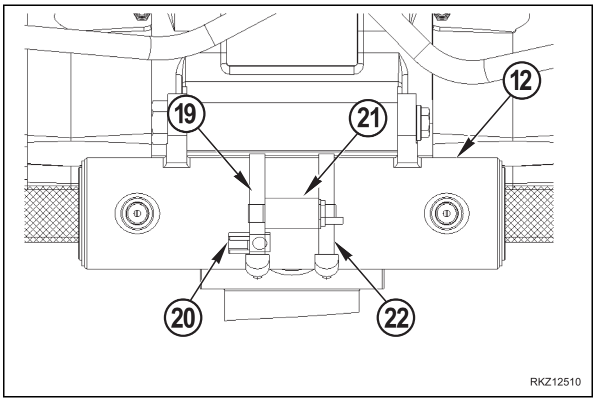
10 - Repeat the operation for the opposite side.



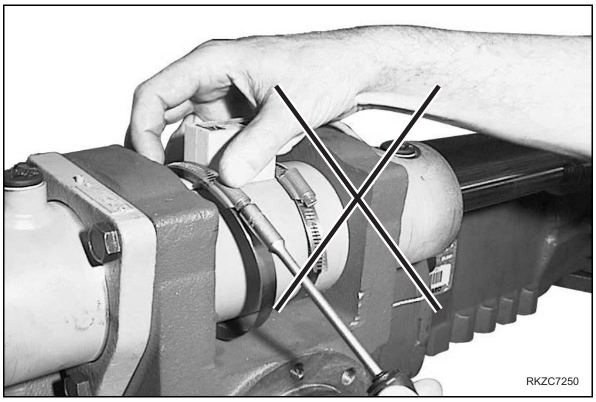
11 - Screw in the lock nuts (8) and (15) of the tie rods (7) and (16) only when the toe-in adjustment has been carried out.
(For details, see "10.1 Toe-in adjustment").



12 - Assemble the sensor (21) and receptacle bracket (20) with the clamps (19) and (22) to the steering cylinder (12).

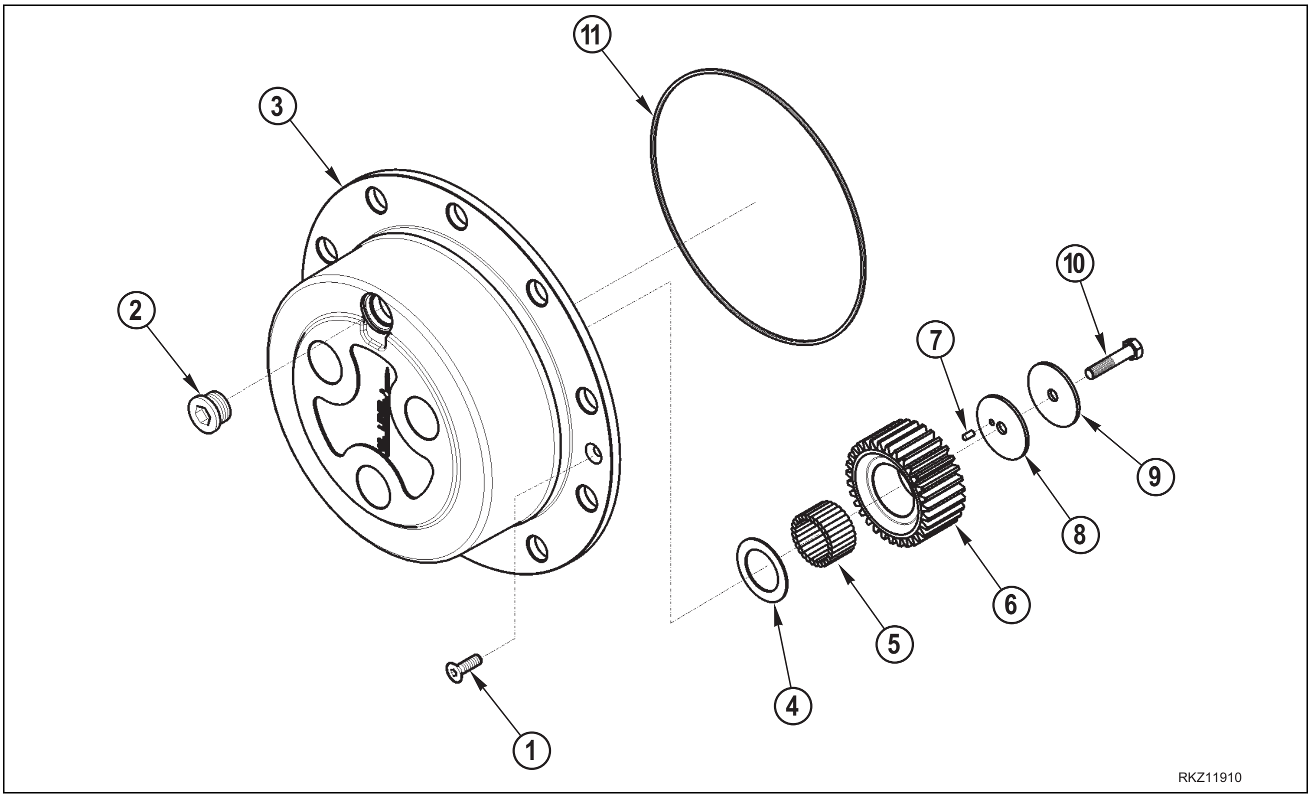


★ The clamps can be completely tightened only when the toe-in adjustment has been carried out.
(For details, see "10.1 Toe-in adjustment").

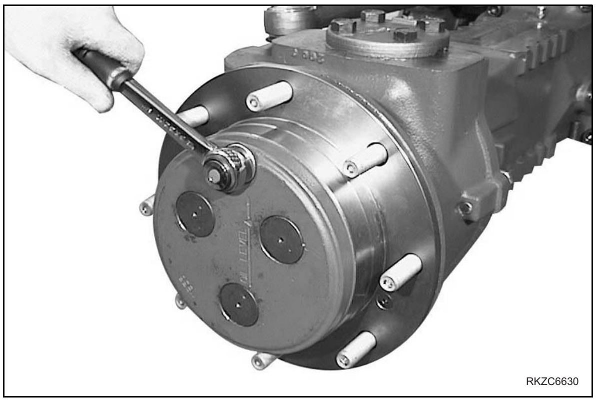


2. Epicyclic reduction gear group

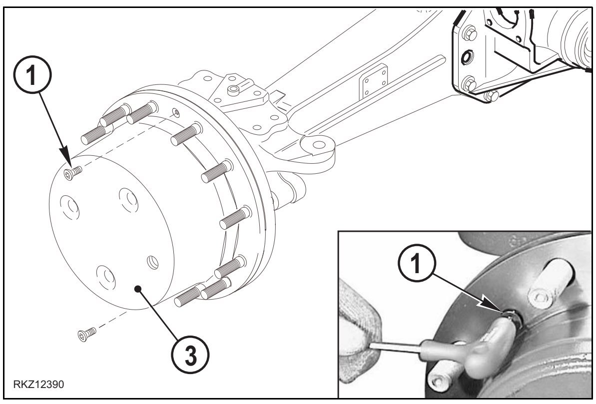
2.1 Disassembly



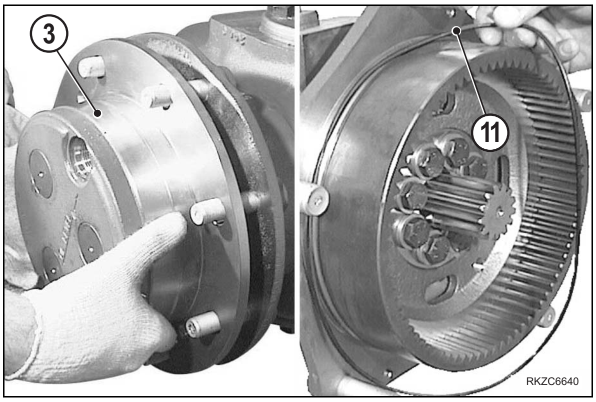
1 - Drain the oil completely from the epicyclic reduction gear.



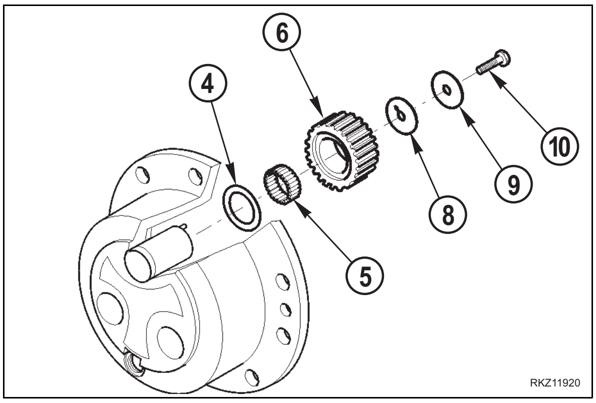
2 - Unscrew and remove both fastening screws (1) of the planetary carrier (3) with a wrench.



3 - Remove the planetary carrier (3) from the wheel hub and collect the relative O-Ring (11).
Position the planetary carrier (3) on a workbench and check its wear conditions.

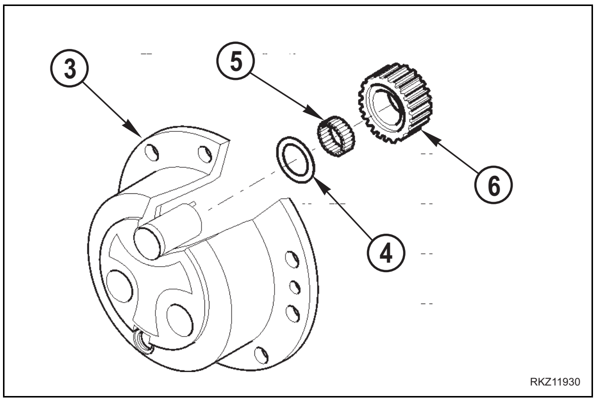


1 - To replace the planetary gears (6):
- remove the fastening screws (10) of every planetary gear (6);
- remove the washers (8) and (9);
- take the planetary gears (6) out of the pins;
- collect the needles bearing (5) and check their conditions;
- collect the thrust washer (4).



2.2 Assembly

1 - Position the planetary carrier (3) on a workbench. Insert the thrust washer (4) on every pin.

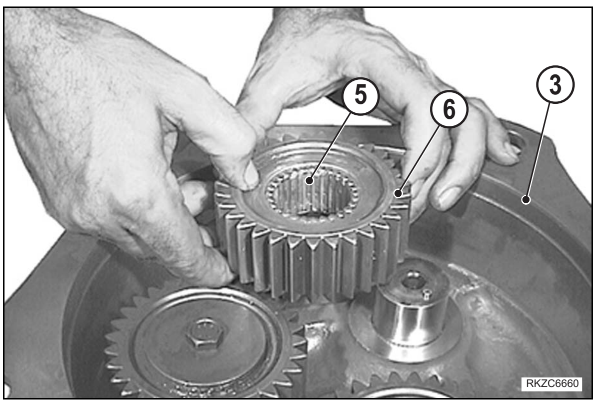


2 - Position the planetary carrier (3) on a workbench.

3 - Insert the needles (5), the thrust washer (4) and the needles (5) in the epicyclic gears (6).

★ Grease well the needles (5).

4 - Insert the thrust washer (4) and the assembled epicyclic gears (6) in the planetary carrier (3) pins.

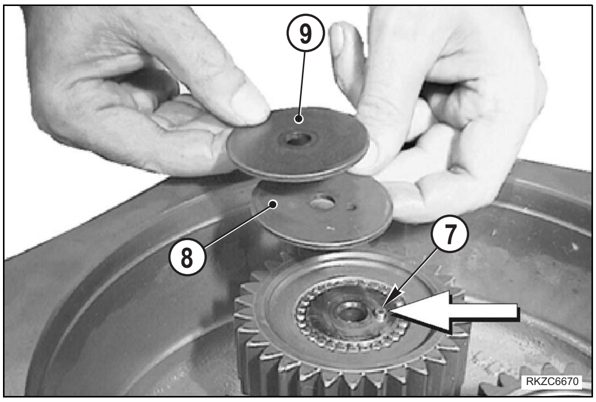


5 - Fit the thrust washers (8) and (9) to the planetary carrier (3) pins.

★ The intermediate thrust washers (8) has a hole for centering with the dowel pin (7) fitted on the planetary carrier (3) pins.

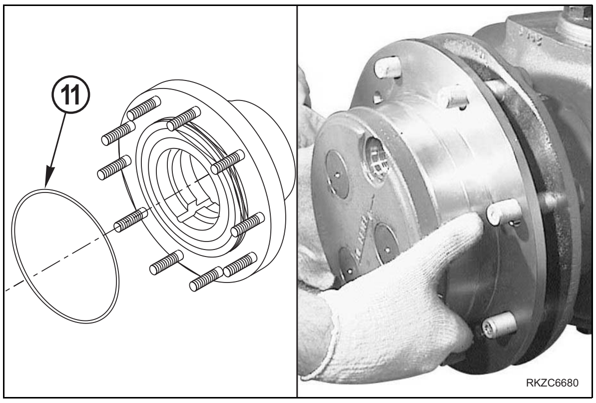
6 - Assemble the fastening bolt (10).

Screw: 79 Nm



7 - Assemble a new O-Ring (11) on the wheel hub.
Fit the epicyclic reduction gear assembly to the wheel hub.
Screw the fastening screws (1).

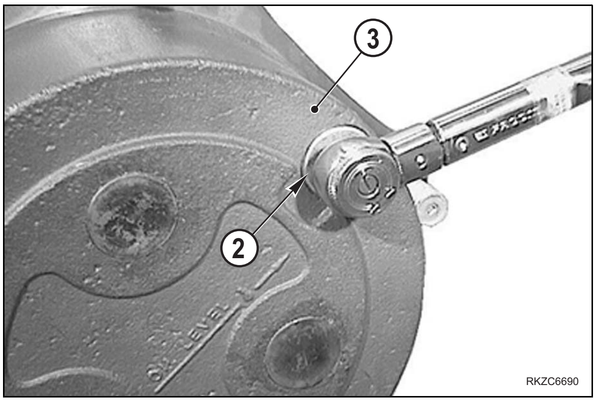
Screw: 25 Nm



8 - Top up the oil on the wheel hub.
(For details, see _______).

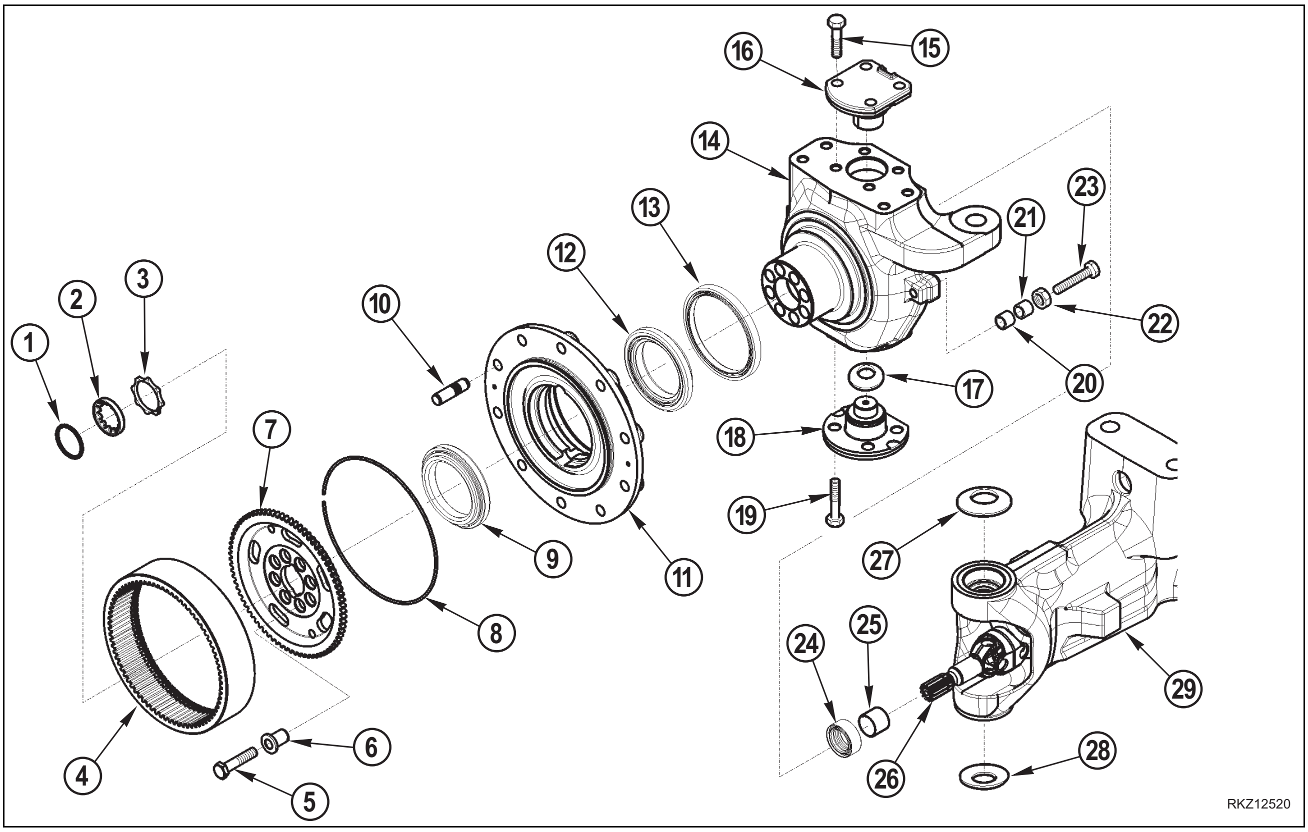
9 - Fit the plug (2) on the epicyclic reduction gear (3).

Plug: 60 Nm



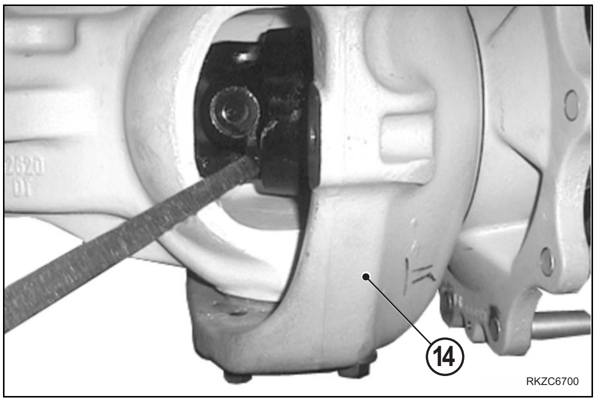
3. Wheel hub group

3.1 Disassembly

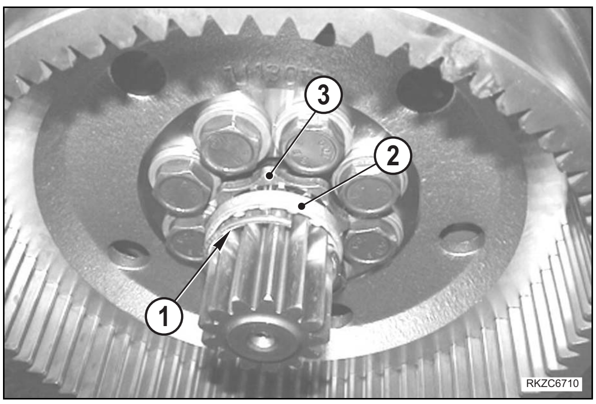


1 - Insert a lever between the swivel housing (14) and the axle beam and fit it into the double U-Joint.
With the lever push the double U-Joint in the direction of the wheel hub to allow the lock ring (1) removal.

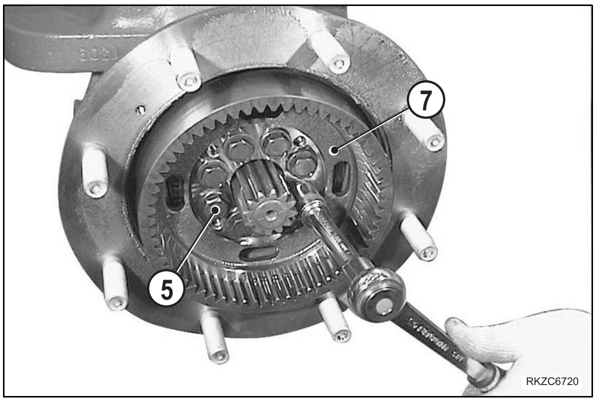
★ Do not damage the double U-Joint.



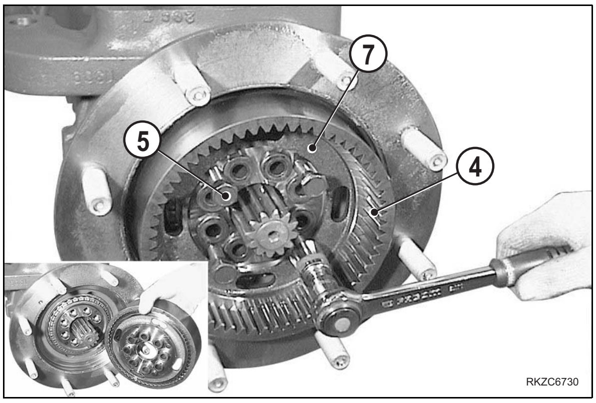
2 - Remove the lock ring (1) from the double U-Joint shaft.
Collect the double U-Joint shaft washers (2, 3).



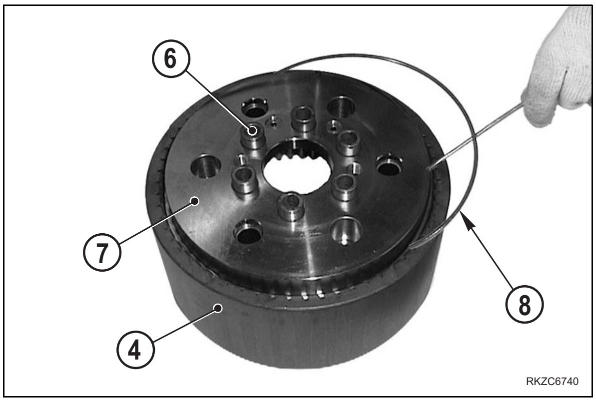
3 - Unscrew and remove the fastening bolts (5) from the wheel carrier (7).



4 - To extract the wheel carrier, screw two of the just removed bolts (5) in the threaded holes.
Remove the wheel carrier (7) with the epicyclic ring gear (4).

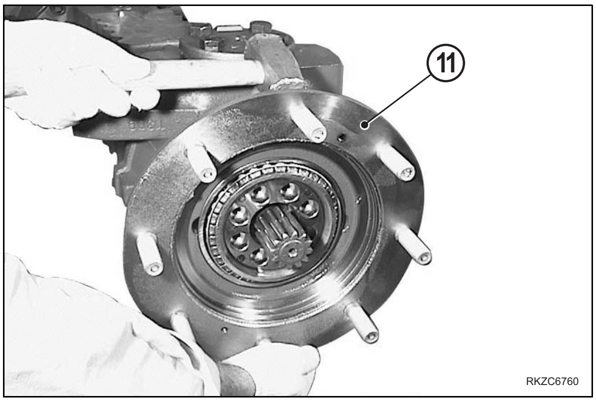


5 - Remove the steel lock ring (8) and disjoin the wheel carrier (7) from the epicyclic ring gear (4).
Only if necessary, remove the centering bushes (6) from the wheel carrier with a hammer and the special tool **E7**.



6 - Remove the wheel hub (11) using levers and a hammer to facilitate the operation.

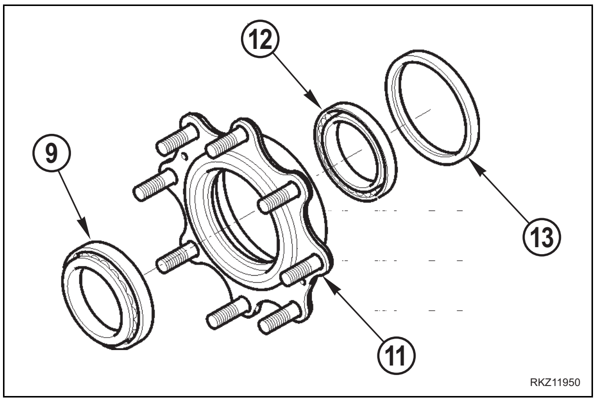
★ Collect the bearing cone (9).



7 - Position the wheel hub (11) on a flat surface and remove the seal ring (13) with a lever.

★ Replace the seal ring (13) at each disassembly.

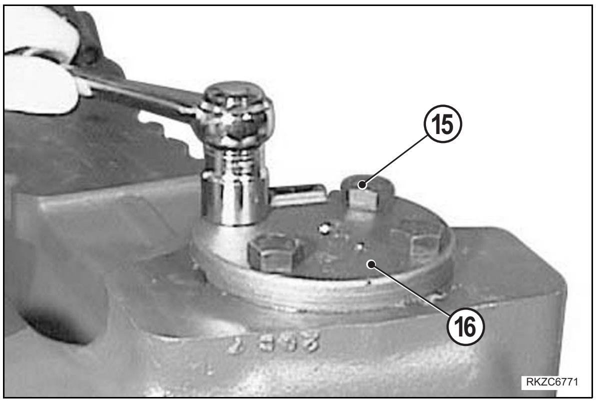
8 - Remove the bearing cups (9) and (12) using a hammer and a suitable drift.
Remove the bearing cone (12) from the swivel housing end (14), using a suitable extractor.



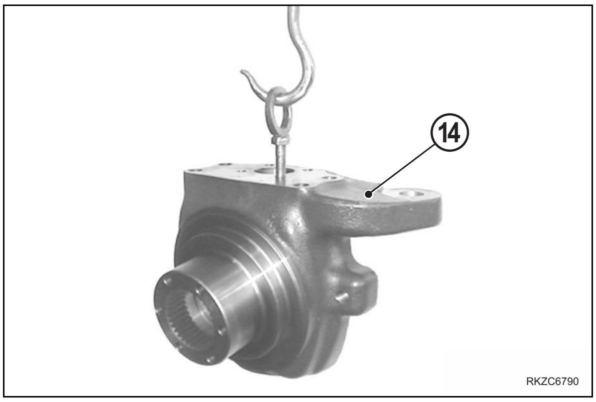
9 - Unscrew and remove the fastening screws (15) and (19) from the upper (16) and lower (18) king pin.

★ Before removing the king pins (16) and (18), secure the swivel housing (14) with a belt or a rope to a hoist or any other supporting device; observe all current safety regulations to guarantee operator's safety.

10 - Remove the king pins (16) and (18).



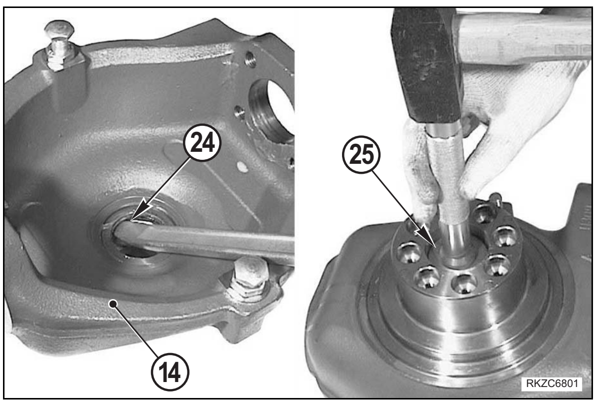
11 - Remove the swivel housing (14) from the axle beam and from the short shaft of the double U-Joint.
Collect the belleville washers (27) and (28).



12 - Position the swivel housing (14) on a flat surface and take the seal ring (24) out with a lever.

★ Replace the seal ring at each disassembly.

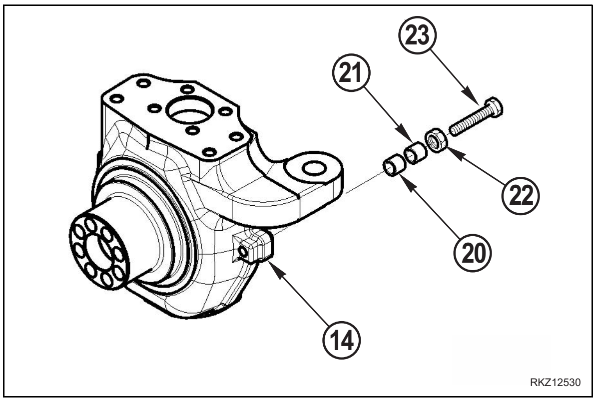
13 - Turn the swivel housing and take the bush (25) out, using a suitable drift and a hammer.



3.2 Assembly

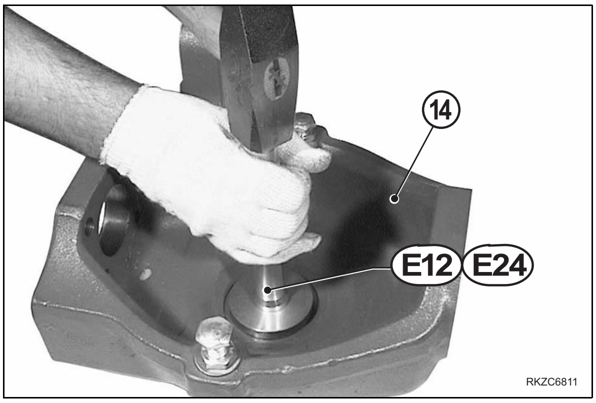
1 - If it has been previously removed, reassemble the steering stop composed by the screw (23), the nut (22) and bushes (20) and (21).

★ Do not tighten the nut (22) until the steering angle adjustment has been done.
(For details see "10.1 Toe-in adjustment").



2 - Force the bush (25) into the swivel housing (14) with the special tool **E12** and a hammer or a press.
Assemble the seal ring (24) on the swivel housing (14) with the special tool **E24** and a hammer.
Grease carefully the seal ring (24).

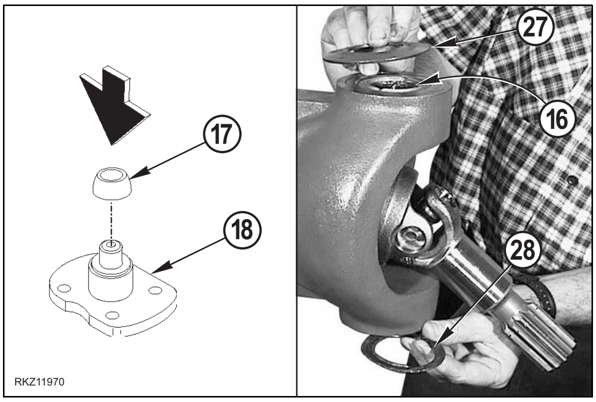
Sealing ring POLYMER 400 Tecnolube



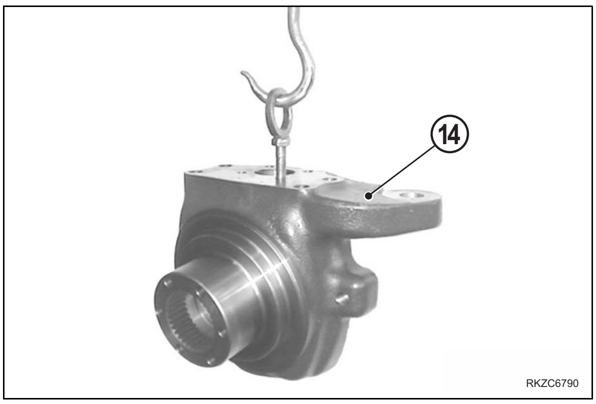
3 - If the cone (17) of the spherical joint has been previously removed, reassemble it to the lower king pin (18) using the special tool **E10** under a press.
Grease carefully the king pin (16) and (18) housings with specific grease.

King pin: ASL800050

4 - Position the belleville washers (25) and (27) on the king pin (16) and (18) housings.



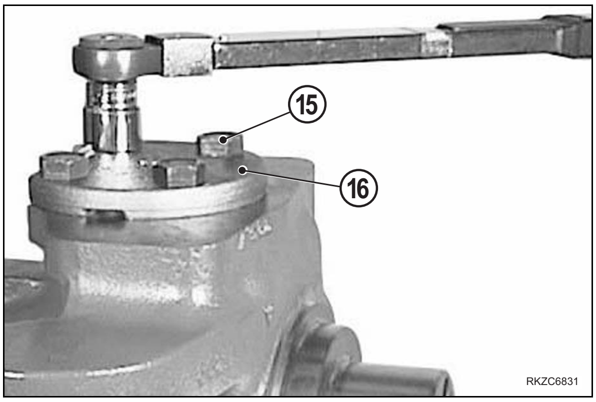
★ Secure the swivel housing (14) with a belt or a rope to a hoist or any other supporting device.
Protect the splined end of the axle shaft by winding it with an adhesive tape to avoid damage to the seal ring (24).
Assemble the swivel housing (14) on the axle beam and after assembly, remove completely the adhesive tape.



5 - Assemble the king pins, the lower (18) and the upper (16), and tighten the retaining screws (19) and (15).

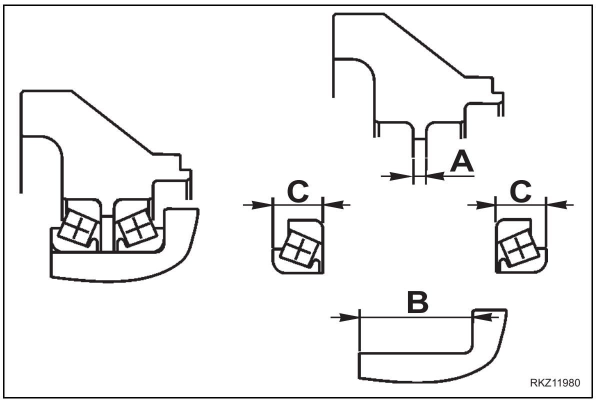
Screw: 300 Nm

★ Make sure that the Belleville washers (28) and (27) remain in their position.



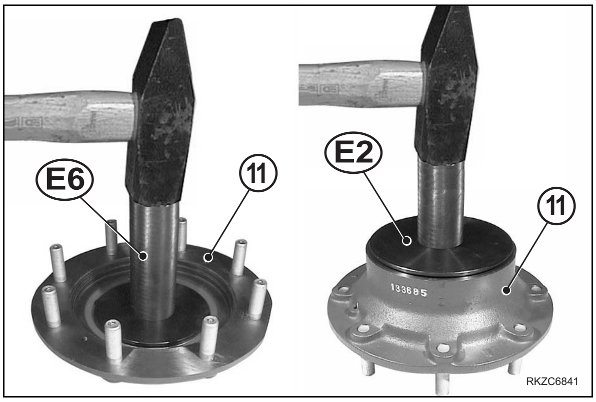
6 - The special operation “Set Right” of the bearings (9) and (12) does not require preload or backlash adjustment. Anyway, before assembling new components check the indicated dimensions.

A= 17.950 – 18.000 mm
B= 64.275 – 64.325 mm
C= 23.072 – 23.173 mm

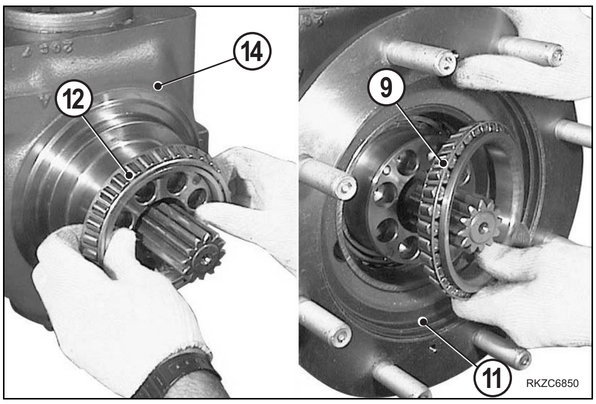


7 - Force both bearing cups (9) and (12) to their wheel hub (11) housings using the special tool **E6** under a press or with a hammer.
Insert the seal ring (13) into the wheel hub (11) with the special tool **E2** and a hammer.

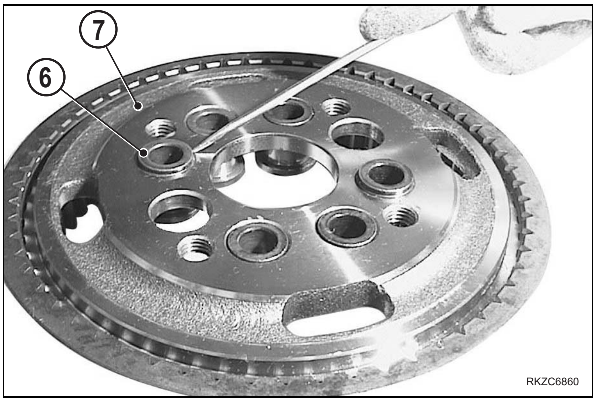
★ Do not lubricate the seal ring (13).



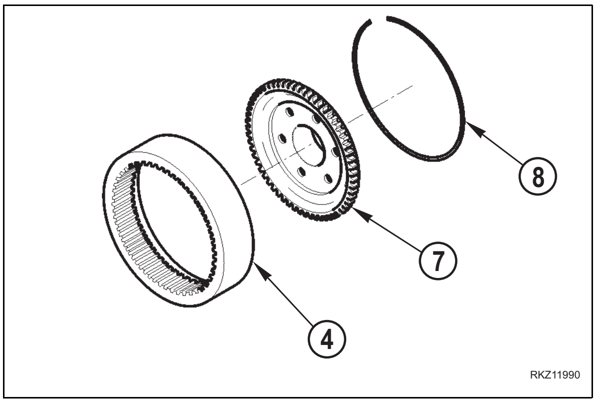
8 - Assemble the bearing cone (12) on the swivel housing (14) end.
Assemble the wheel hub (11) on the swivel housing (14) and fit the bearing cone (9).



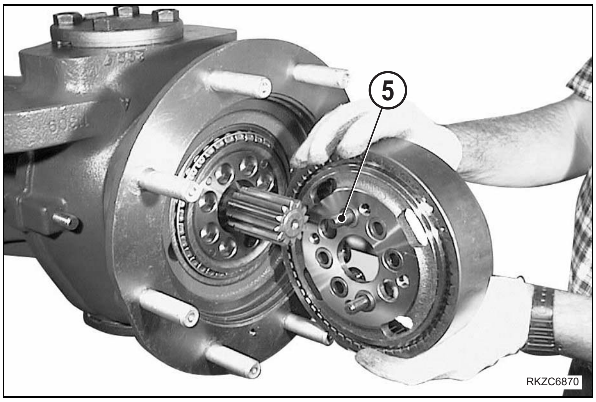
9 - Position the wheel carrier (7) on a workbench and force the bushes (6) to the carrier surface level with the special tool **E7**.
At least two bushes (diametrically-opposed) should be set slightly higher than the carrier surface level to be used as dowel pins.



10 - Preassemble the wheel carrier (7) and the epicyclic ring gear (4) with the special locking ring (8) shown in figure.

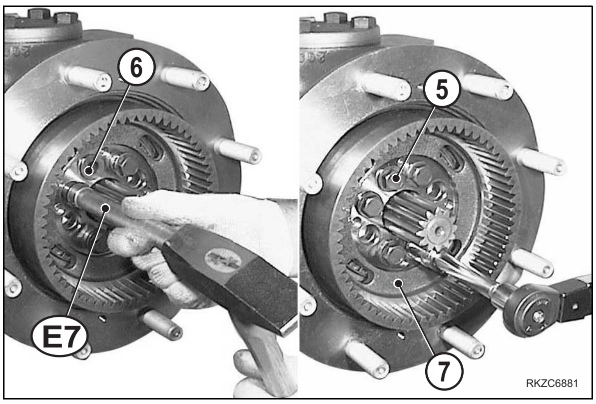


11 - Assemble the wheel carrier group on the wheel hub using the two projecting bushes as dowel pins and screw the relative screws (5) in order to put in contact the ring bevel gear with the wheel hub.

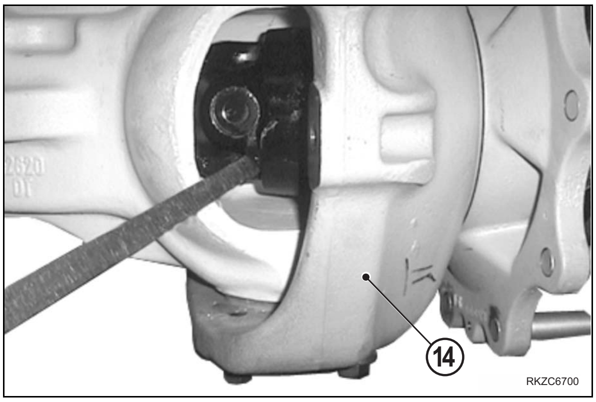


12 - Force all the hub dowel bushes (6) completely with the special tool **E7** and a hammer.
Assemble the wheel carrier (7) fastening bolts (5).

Screw: 230 Nm



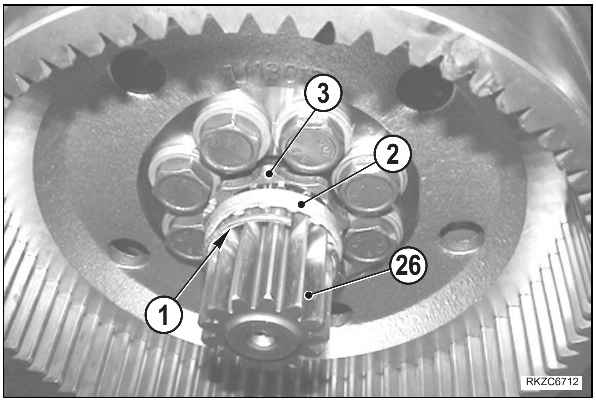
13 -Insert a lever between the swivel housing (14) and the axle beam and fit it into the double U-Joint.
With the lever push the double U-Joint in the direction of the wheel hub to make easier the lock ring (1) insertion.



14 -Slide the thrust washers (3) and (2) onto the double U-Joint shaft end (26).
Insert the lock ring (1) at the end of the splined hub and push it into its housing.

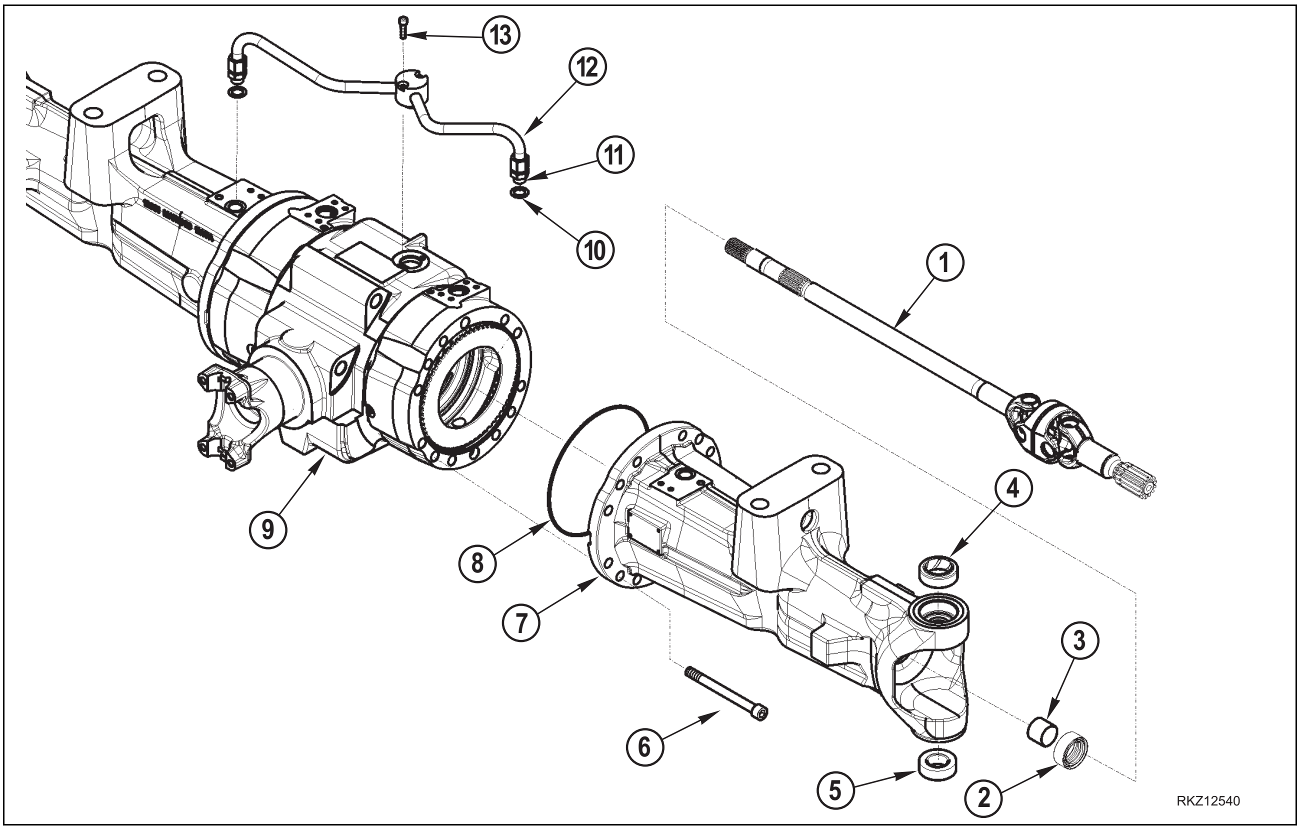
★ Check that the lock ring (1) is correctly fitted in its seat.

15 -Push the double U-Joint thoroughly.



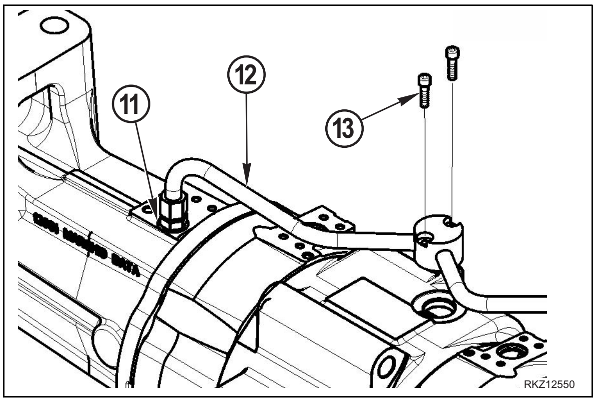
4. Axle beam group

4.1 Disassembly

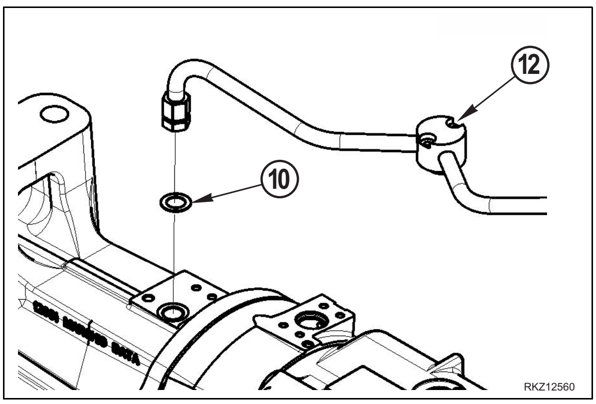


1 - Drain the oil completely from the axle.

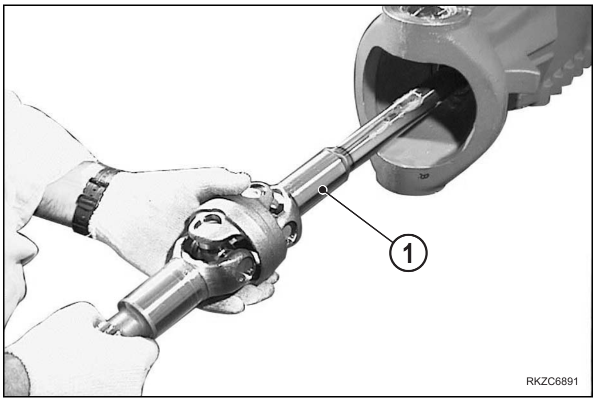
2 - Remove the screws (13).
Unscrew the oil pipe nuts (11).



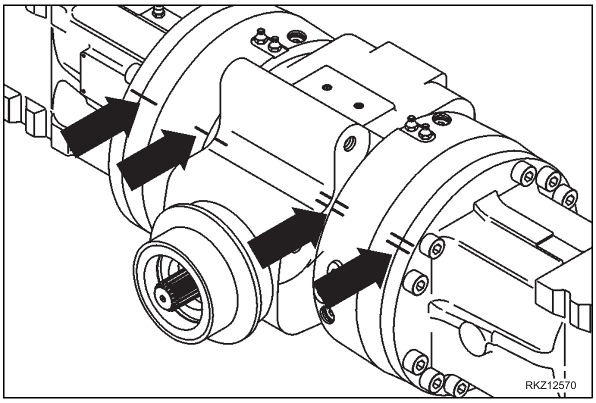
3 - Remove the oil pipe (12).
Collect the washer (10).



4 -Remove the two double U-Joints (1) from the axle beam.

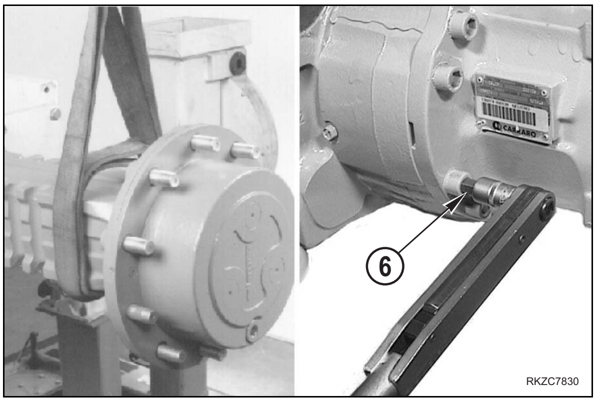


5 -Put alignment marks on the beam trumpets, on the brake cylinders and on the central body, in order to be absolutely sure to identify the coupled parts.



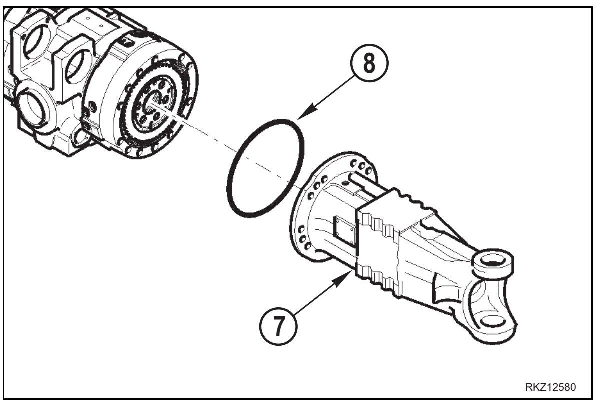
★ Position the axle on supports fitted to hold either the central body and the two beam trumpets, even after their disjunction, or secure the disjointed groups to a lifting device with ropes or belts.

6 -Remove the fastening screws (6).



7 -Remove the beam trumpet (7) and collect the O-Ring (8).

★ Once the beam trumpet has been removed, the brake group is free.

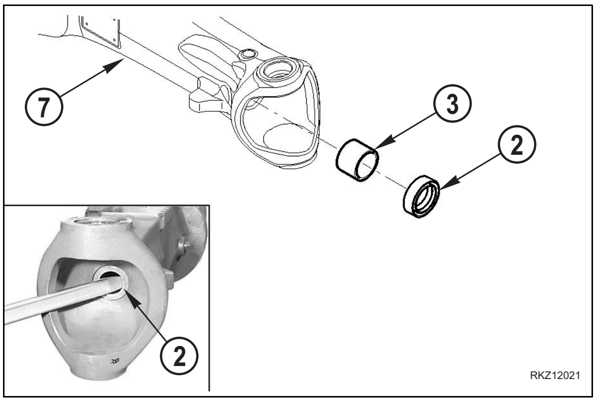


8 - Remove the seal rings (2) from the axle beam (7).

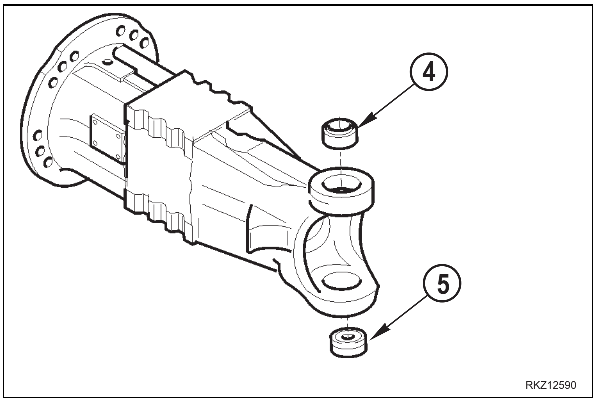
★ Replace the seal rings (13) at each disassembly.

9 - Remove the bush (3) from the axle beam trumpet (7) only if the wear conditions require this.

★ Be careful not to damage the bush seat.



10 - Remove the upper king pin bush (4) and the ball bearing cup (5) from the king pin seats using a suitable extractor only if the wear conditions require this.

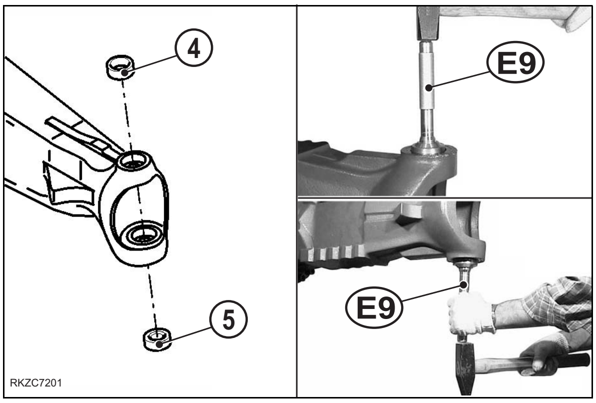


4.2 Assembly

11 - Cool the upper king pin bush (4) and the ball bearing cup (5) at a temperature lower than -100 °C with liquid nitrogen.

⚠ Wear safety gloves.

12 - Assemble the bush (4) on the upper king pin seat with the special tool **E9** and a hammer.
Assemble the ball bearing cup (5) on the lower king pin seat with the special tool **E9** and a hammer.

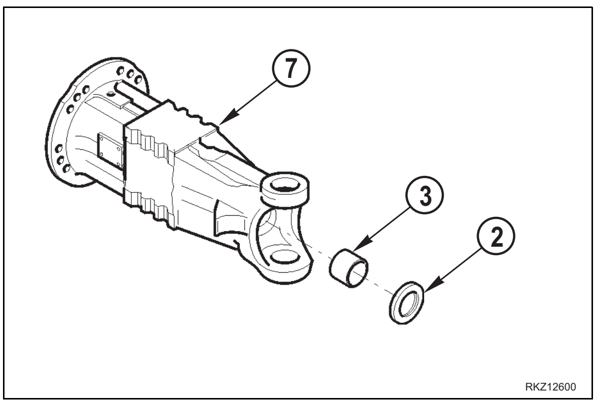


13 - Assemble the bush (7) on the axle beam (3) with the special tool **E20** and a hammer. Assemble the seal ring (2) on the axle beam (7) with the special tool **E21** and a hammer.

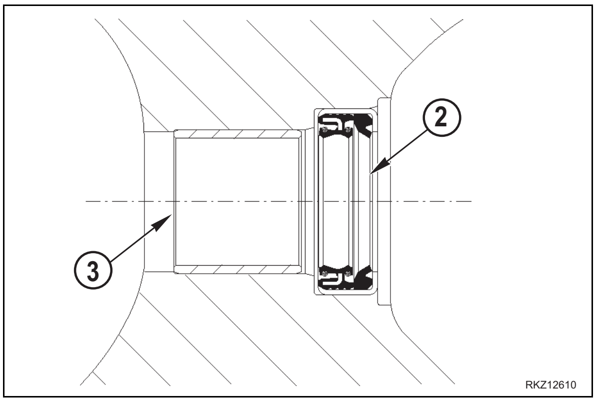
See: next step.

★ Grease carefully the seal rings

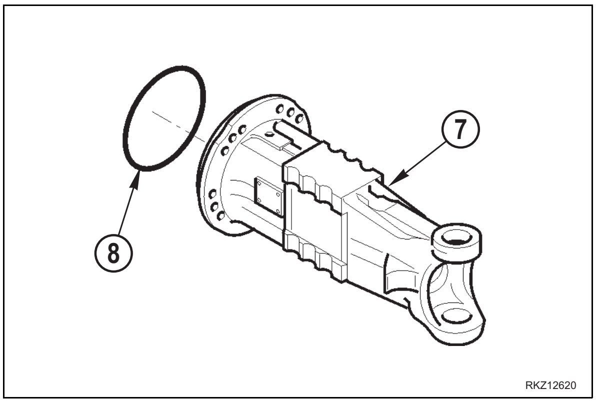
Seal rings: POLYMER 400 Tecnolube



★ Assemble the seal ring (2) as in figure.



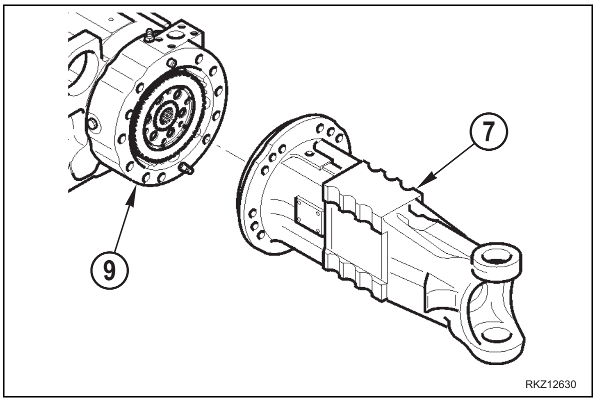
14 -Assemble a new O-Ring (8) to the beam trumpet (7).



★ Support the groups properly as already pointed out for disassembly phase.

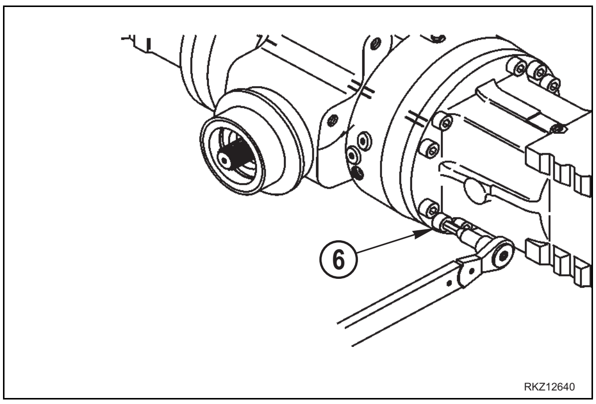
15 -Assemble the beam trumpet (7) on the central body (9) using the reference marks carried out during disassembly.

★ Be careful not to damage the O-ring (8).



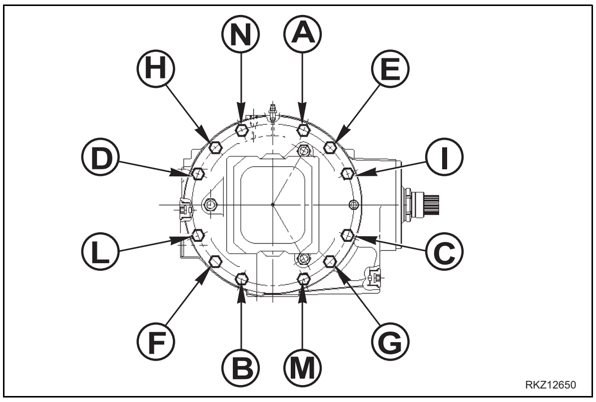
16 -Assemble the fastening screws (6).
Tighten the fastening screws (6) to the requested torque according to the shown sequence.

Screw: see next step



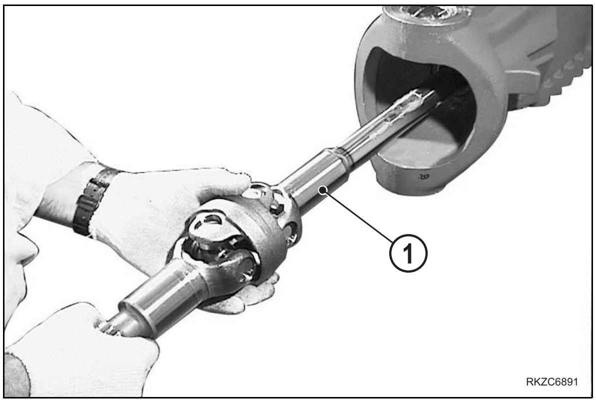
17 - Tighten the fastening screws (6) according to the sequence shown in figure.

Screw: 320 Nm

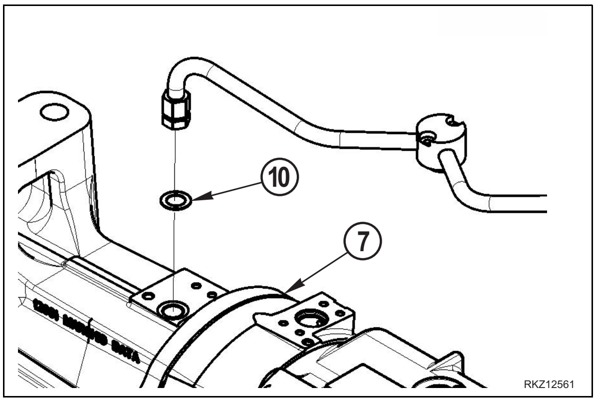


18 - Insert the double U-Joint (1) inside the axle beam.

★ Be careful not to damage the seal rings.



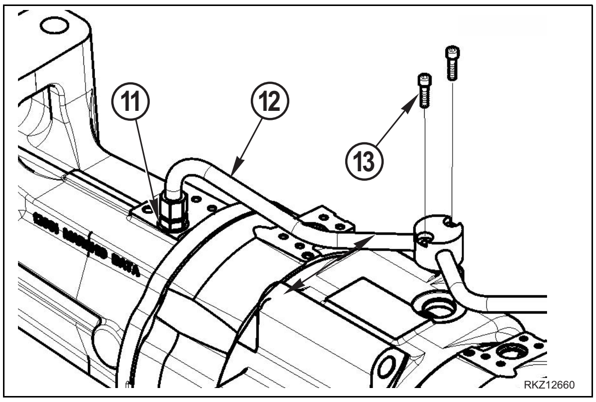
19 - Position the washer (10) on the beam trumpet (7).



20 - Tighten the screws (13). Tighten the oil pipe nuts (11).

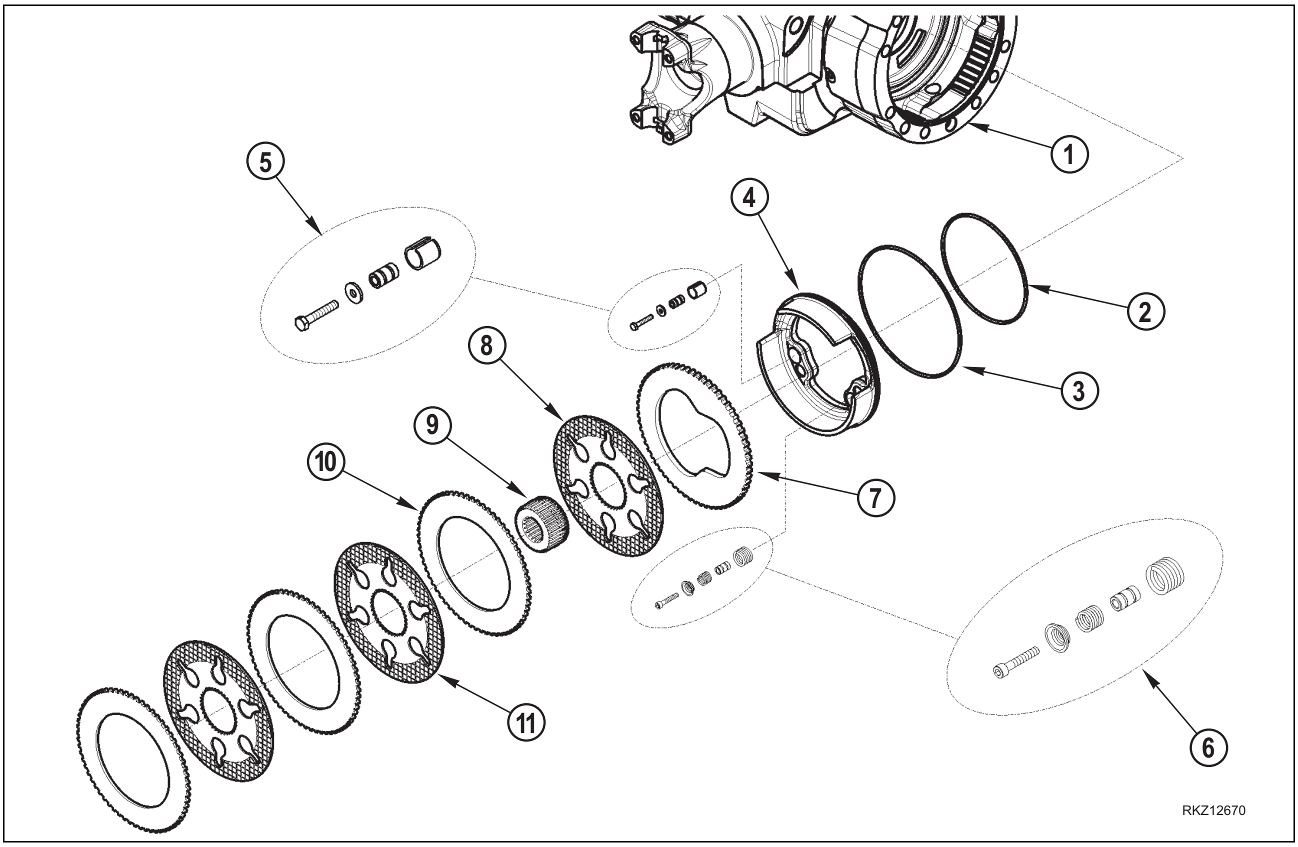
Nuts: 60 Nm

21 - Fill the axle with specified oil.

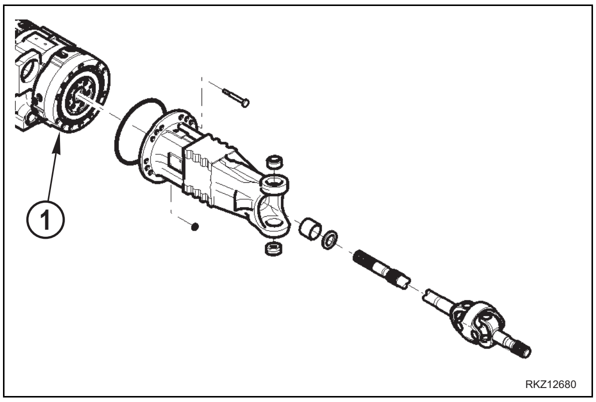


5. Brake group

5.1 Disassembly

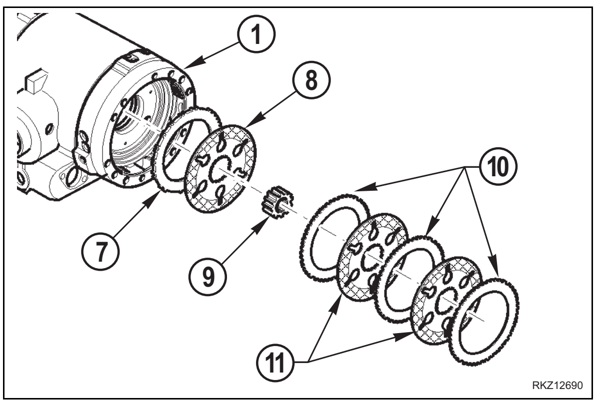


1 - Remove the beam trumpet and half-shaft.
(For details, see "4. Axle beam group").

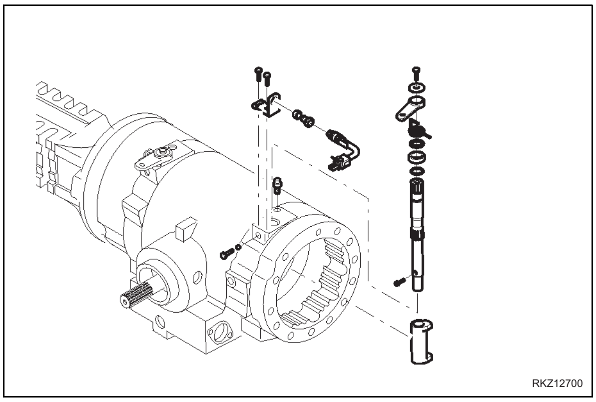


2 - Remove the components from the brake flange (1): brake counterplate (7) and brake plates (8), brake disk carrier gear (9), brake counterplates (10) and plates (11).

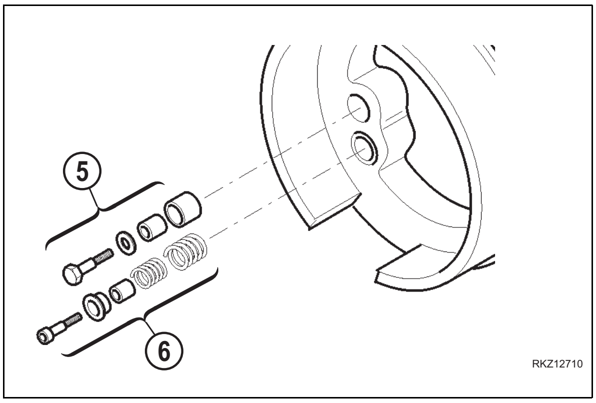
★ Remember the position of the the brake disk carrier, it must be reassembled in the same position.



3 - Remove the brake control group.



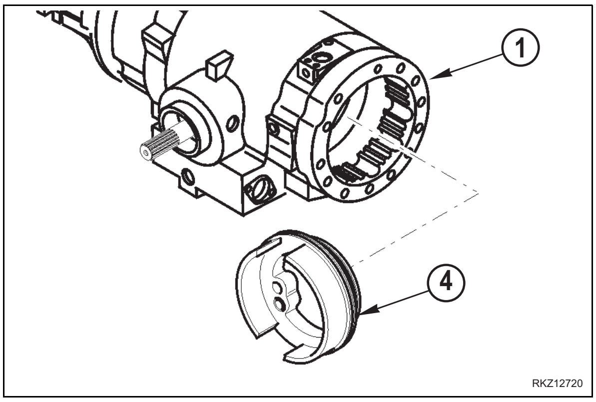
4 - Unscrew the fastening screws and remove all the parts of the self-adjust kit (5) and brake mechanism return kit (6).



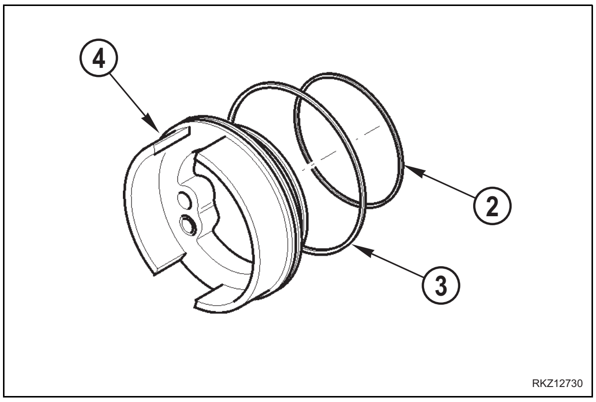
5 - Remove the brake piston (4).

★ If necessary, blow in air through the brake oil input hole to eject the piston, using the minimum pressure.

⚠ Possible swift ejection of the piston.

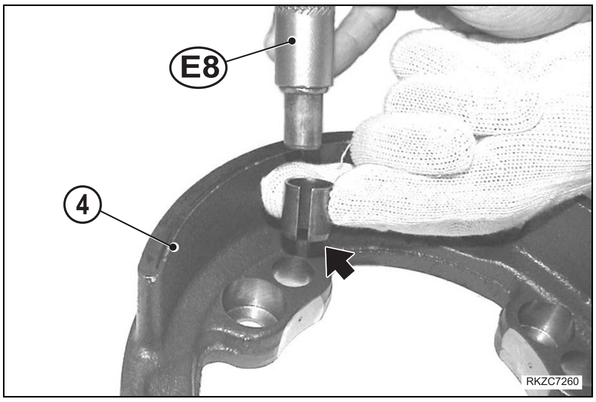


6 - Remove the O-Rings (2) and (3) from the brake piston (4).



5.2 Assembly

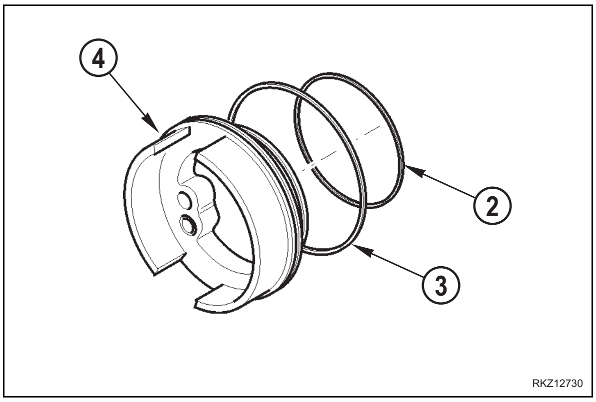
1 - Collect the brake piston (4). With special tool **E8** and a hammer, push the bushes into the self-adjust housings till they are aligned with the piston supporting inner surface.



★ The bushes must be aligned with the piston supporting inner surface.

2 - Assemble a new O-Rings (2) and (3) to the brake piston (4).

O-ring: brake oil

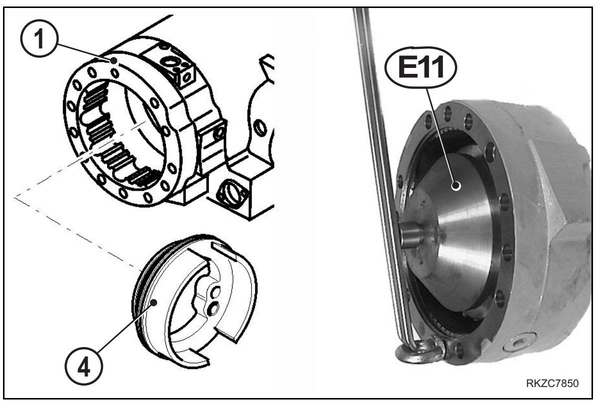


3 - Insert the piston (4) into the brake cylinder (1) and position the special tool **E11** on the piston.

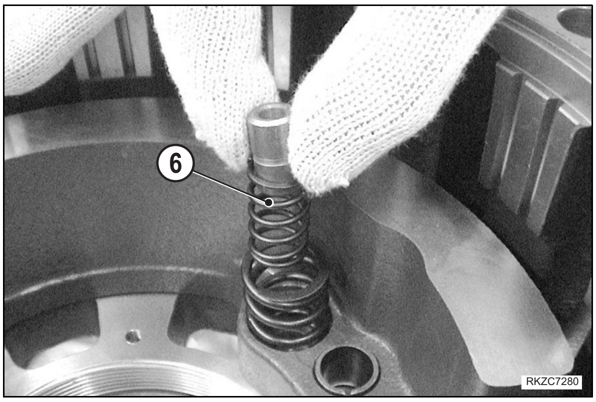
★ Position the brake piston (4) with a slot aligned with the hydraulic connection or with the inspection hole on the brake cylinder (5).

★ Do not damage the O-rings.

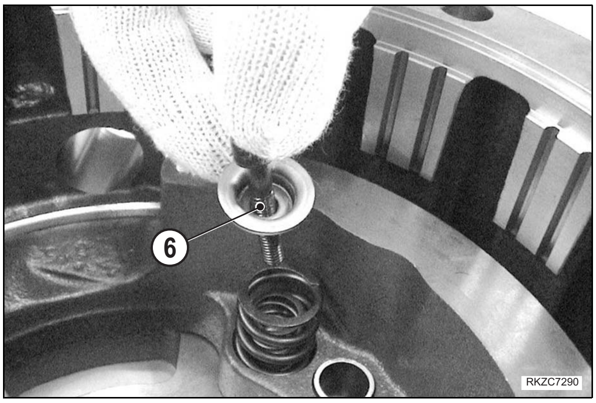
4 - With a lever anchored to an eyebolt, exert a pressure just enough to insert the piston into the brake flange.



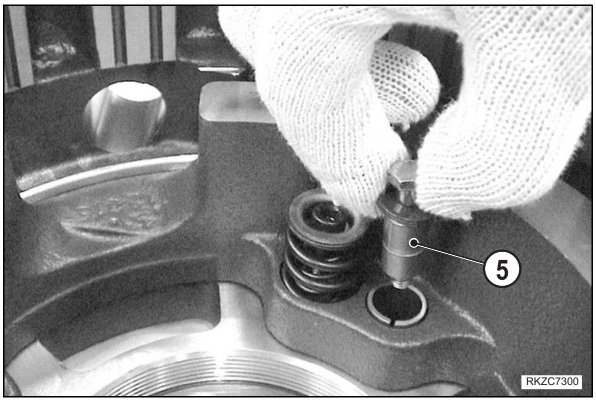
5 - Insert the large spring, the small spring and the bush of the brake mechanism return kit (6) in the largest hole of the brake piston.



6 - Assemble the spring cover and the screw of the brake mechanism return kit (6).



7 - Assemble the bush, the washer and the screw of the self-adjust kit (5).

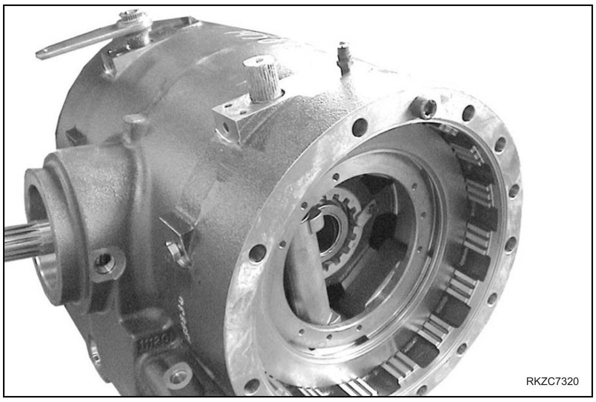


8 - Screw the fastening screws of both kits and tighten them to the prescribed torque

Screw: 10 Nm

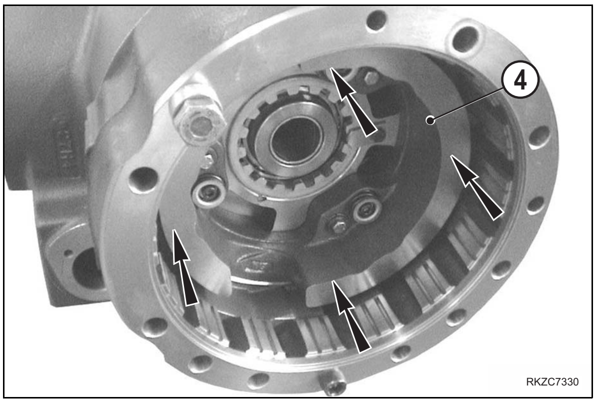
9 - The brake piston must be pushed in the original position if worn brake disks are replaced by new disks.
Remove straight threads, bleeds or plugs from the service brake oil port.

⚠ Risk of oil ejection from the axle.

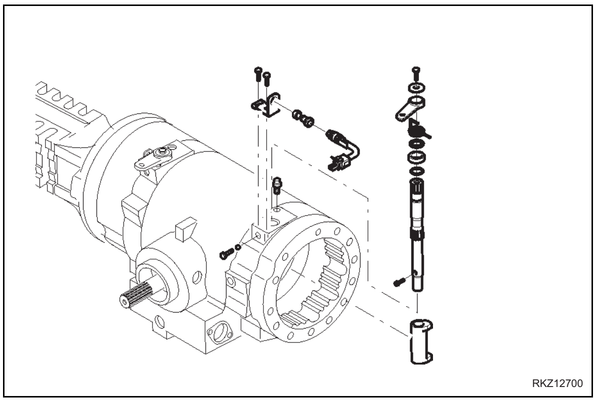


10 - Push the brake piston (4) at the end of stroke using the special pad **E11** and the handle **E8** with a hammer.

★ Position the pad with accuracy to do not damage the brake piston.



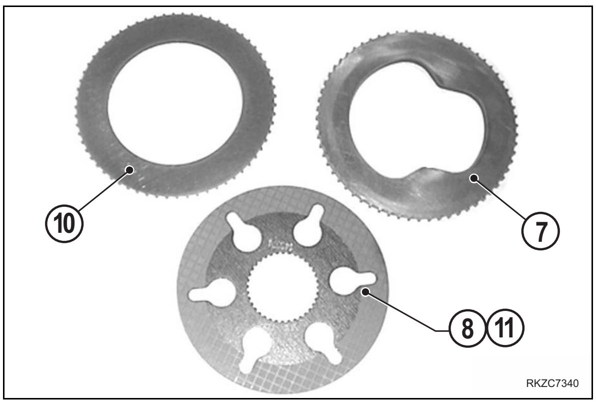
11 - Assemble the brake control group.
(For detail see "6. Brake control group").



12 - Check that the brake plate (8 and 11) and the brake drive plate (7 and 10) do not present any sign of burning; on the contrary, replace them.
Furthermore check brake plate wear and if necessary replace it.

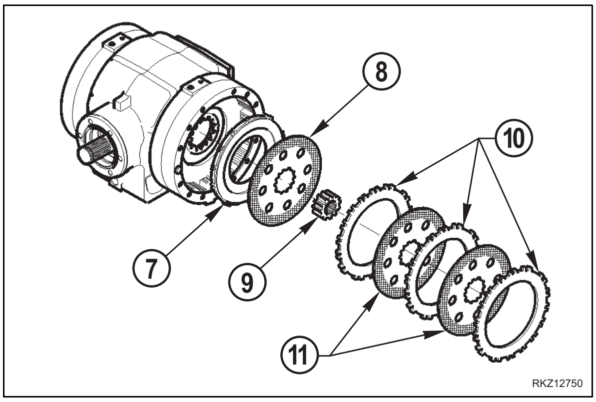
★ If new brake plate are installed, before assembling they should be dipped in the prescribed oil

Plate: Axle oil

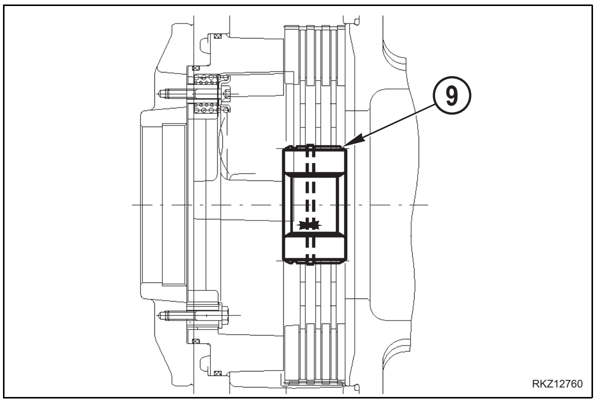


13 - Reassemble all the components of the brake group as is shown in figure: brake counterplate (7) and brake plates (8), brake disk carrier gear (9), brake counterplates (10) and plates (11).

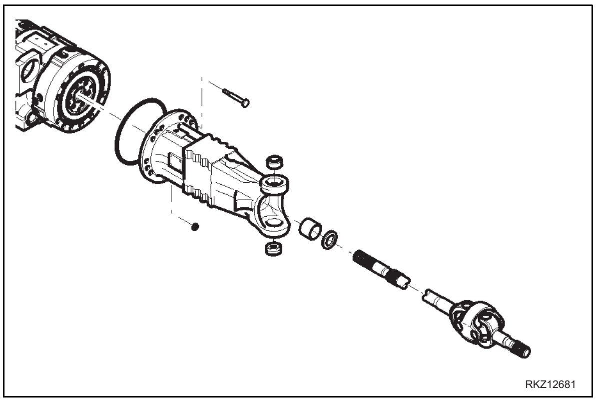
★ Place the brake disk carrier (26) as shown in the next figure; assemble brake disks with holes aligned.



★ This is the correct position of the teeth on the external surfaces of the brake disk carrier (9).

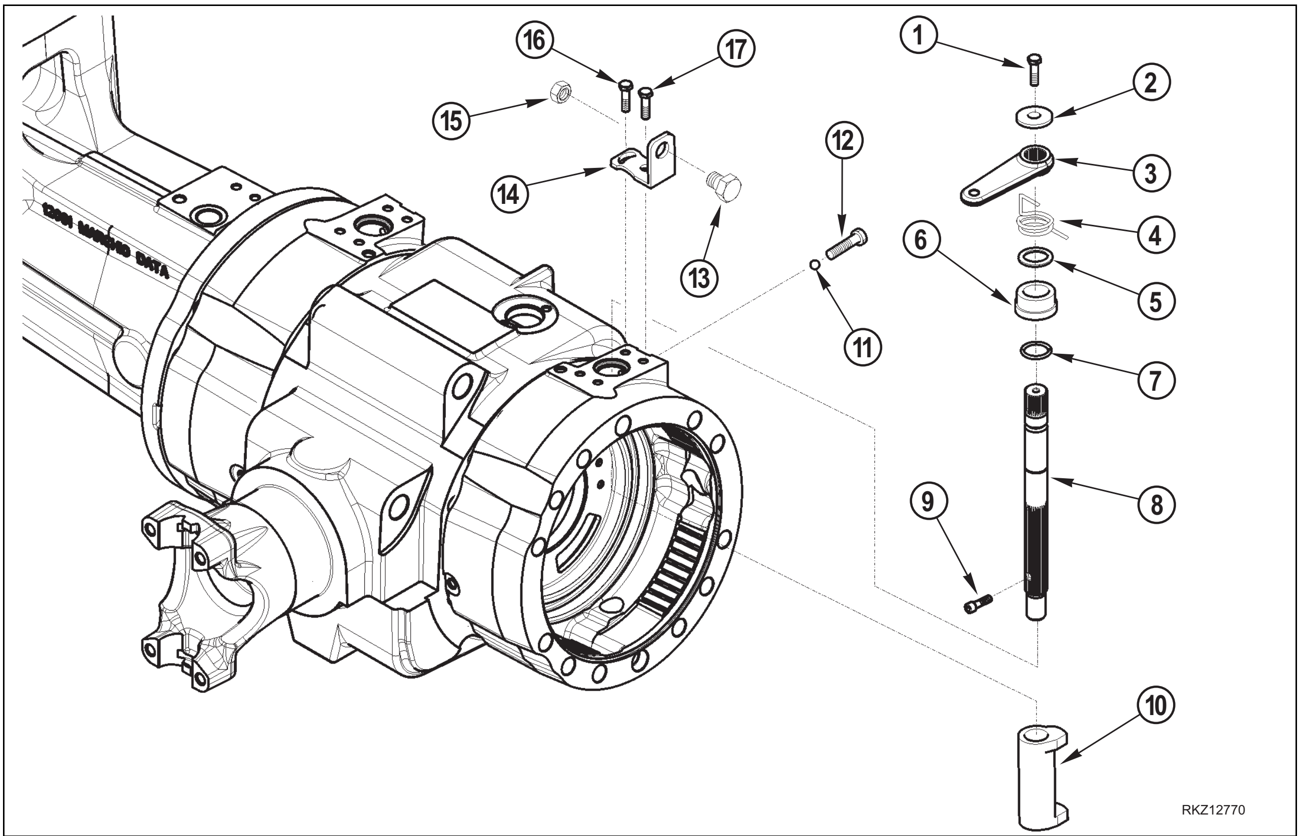


14 - Reassemble the beam trumpet and half-shaft. (For details, see "4. Axle beam group").

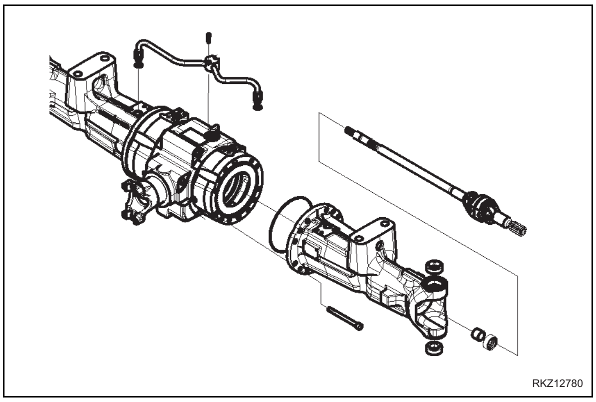


6. Brake control group

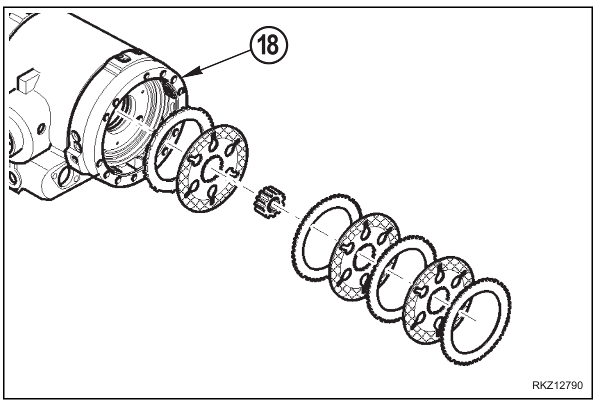
6.1 Disassembly



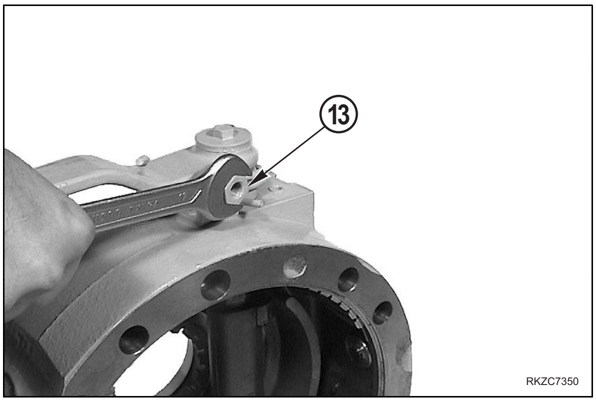
1 - Remove the beam trumpet group.
(For details see "4. Axle beam group").



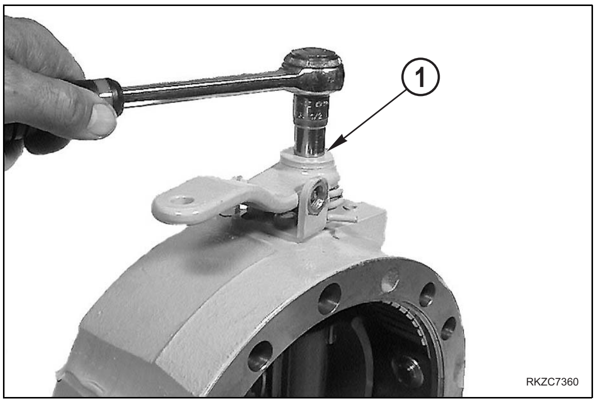
2 - Remove from the brake flange (18): brake counter plates and brake plates and brake disk carrier.
For details see "5. Brake group").



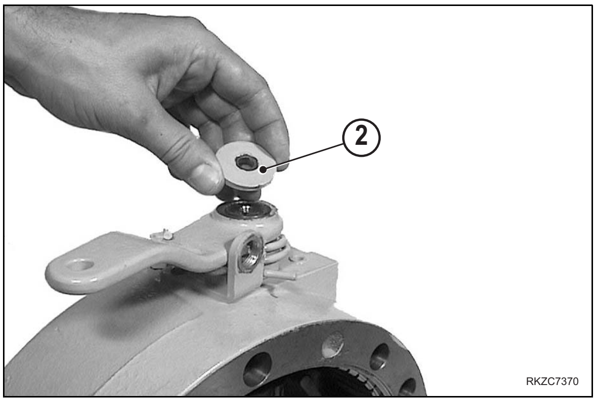
3 - Unloose the locknut (15) and remove the adjusting screw (13).



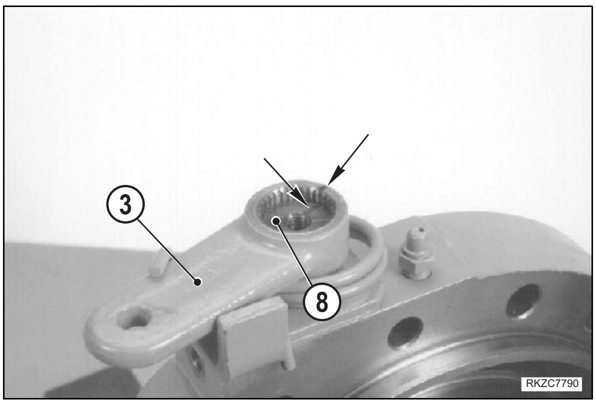
4 - Unscrew and remove the fastening screw (1).



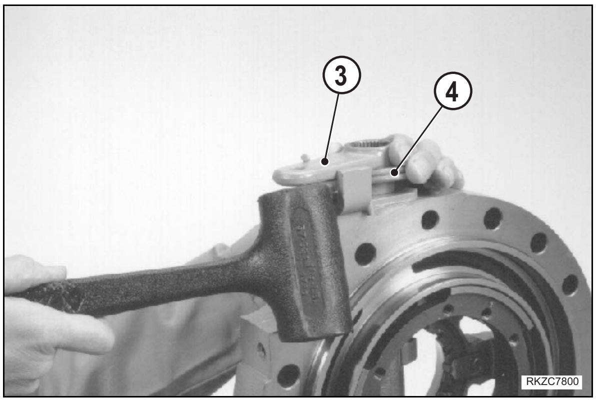
5 - Remove the washer (2).



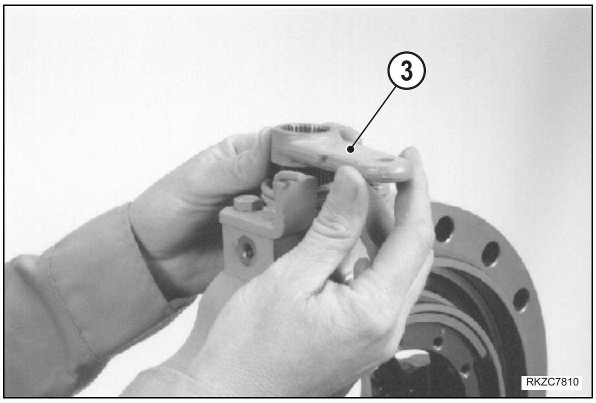
6 - Put an alignment mark on the lever (3) and shaft (8) for use during installation and to distinguish between right and left control (for example: you can put two marks on the right and only one on the left).



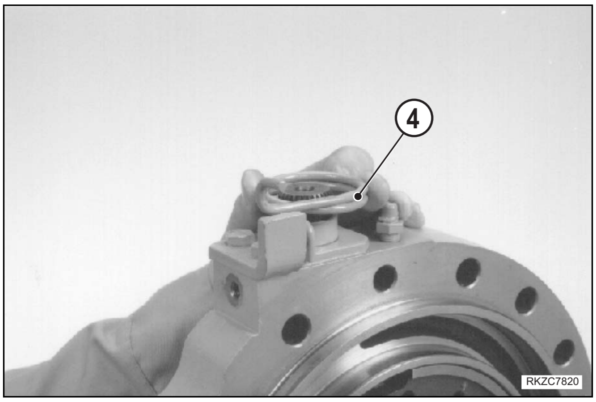
7 -Loosen the lever (3) to release the tension on the spring (4).



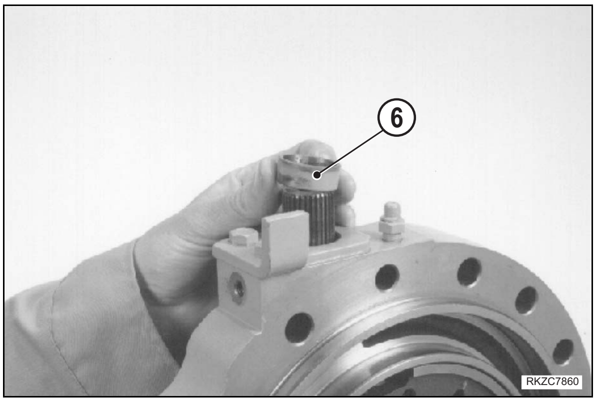
8 -Remove the lever (3).



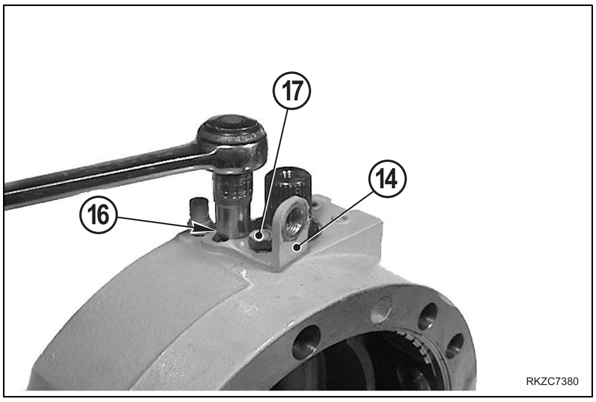
9 -Remove the spring (4).



10 -Remove the washer (5) and the spacer (6).

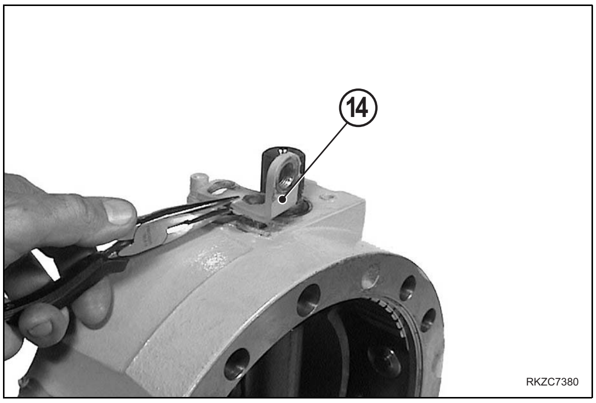


11 - Remove the bracket (14) fastening screws (16) and (17).



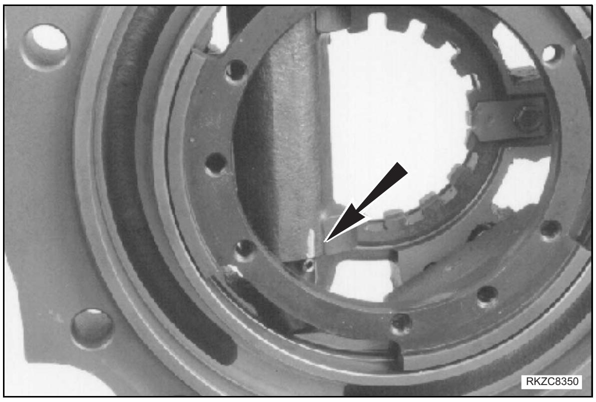
RKZC7380

12 - Remove the bracket (14).



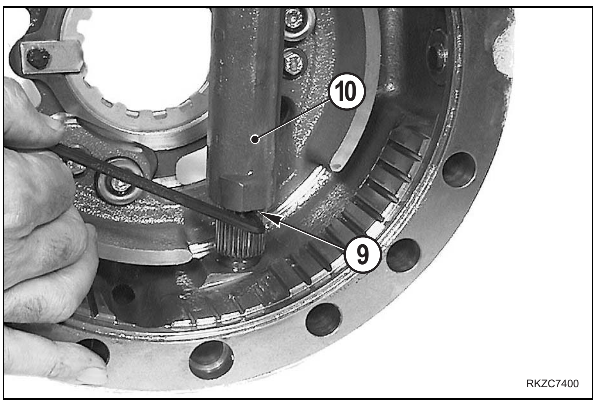
RKZC7380

13 - Make an alignment mark on the cam (10) near the screw (9) align with the top of the roll pin, for use during assembly.
As already done for the control lever, distinguish between right operation side and left one.



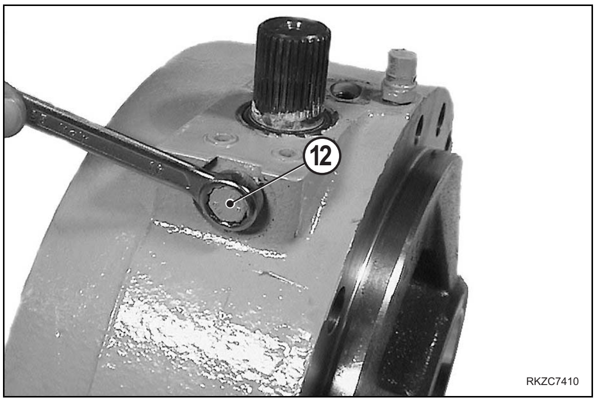
RKZC8350

14 - Free the cam (10) unscrewing the screw (9).

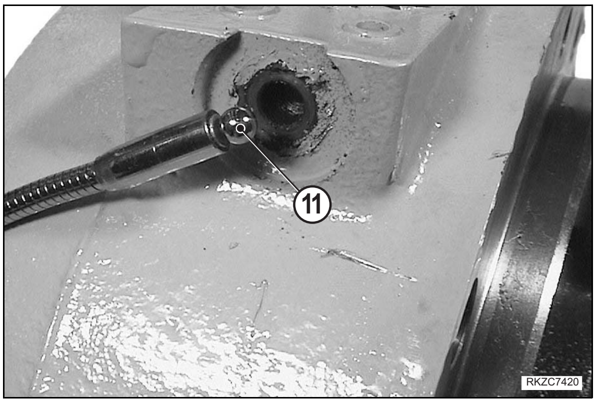


RKZC7400

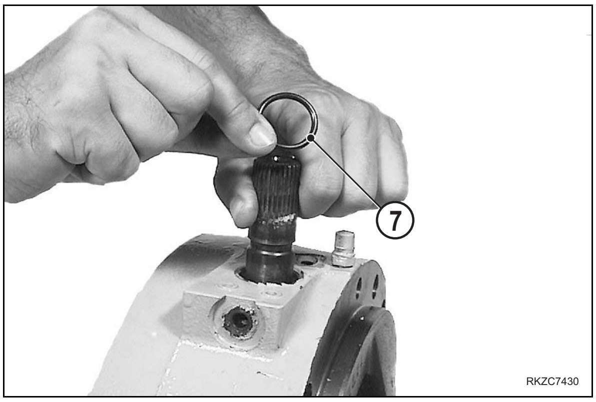
15 - Unscrew the shaft screw (12), being careful the steel ball (11) does not get lost



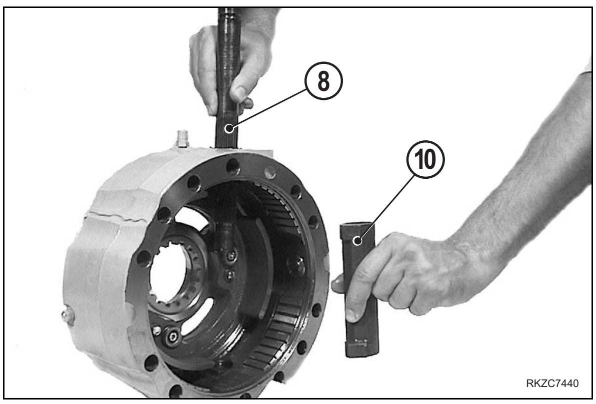
16 - Collect the steel ball (11).



17 - Remove the O-Ring (7).



18 - Remove the shaft (8) and collect the cam (10).

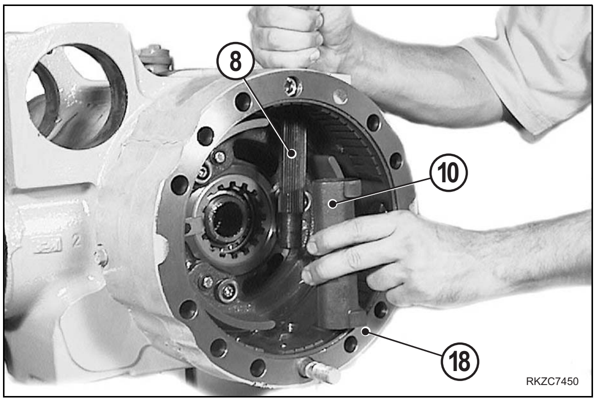


6.2 Assembly

1 - Assemble the brake piston.
(For detail see "5. Brake group").

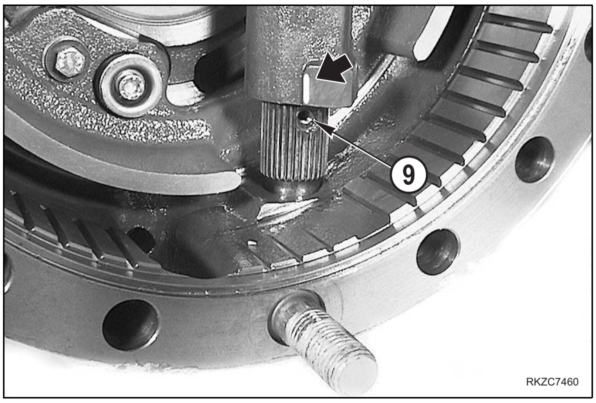
2 - Assemble the cam (10) and shaft (8), relative to the side you are operating, to the brake flange (18).

★ Refering to the marks previously done to identify the parts on the right side and on the left side.



RKZC7450

3 - Align the reference mark previously done with the screw (9) hole.

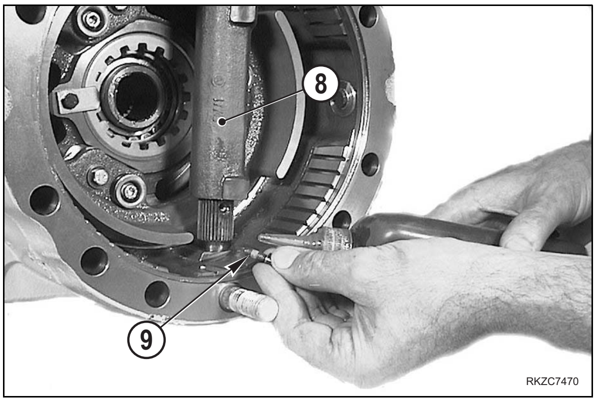


RKZC7460

4 - Assemble a new screw (9) to the shaft (8).

★ If you remove the screw (9) apply the sealant on the thread before reassemble it.

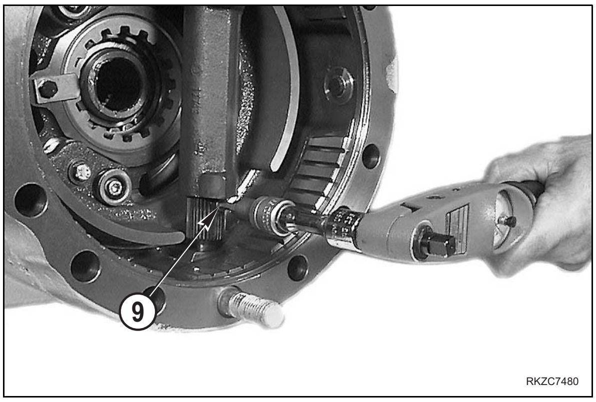
Screw: Loctite 542



RKZC7470

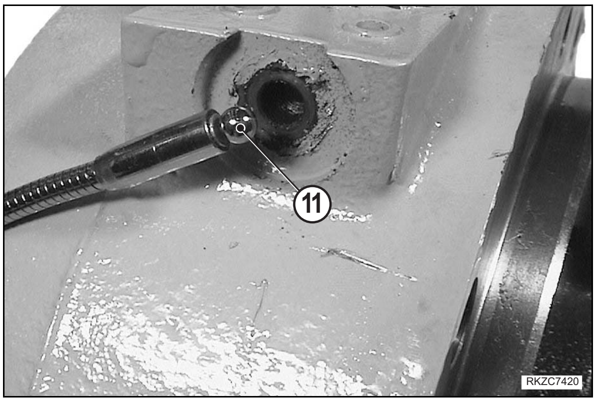
5 - Tighten the screw (9).

Screw: 10 Nm



RKZC7480

6 - Insert the steel ball (11) and the relative screw (12).

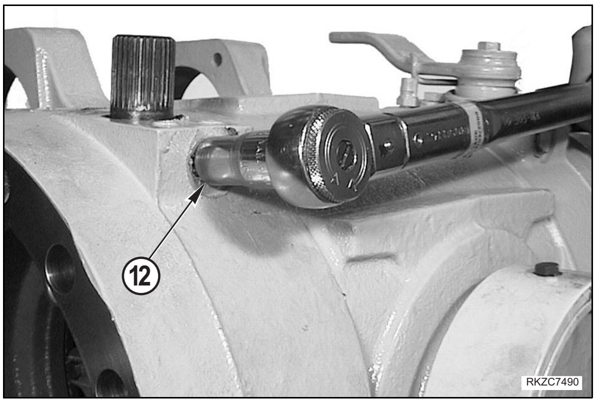


7 - Put on thread of the screw (12) a slight layer of prescribed sealant.

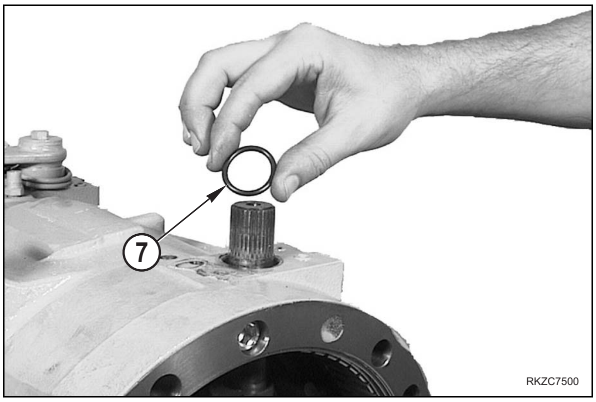
8 - Tighten the screw (12).

Screw: 25 Nm

Screw: Loctite 270

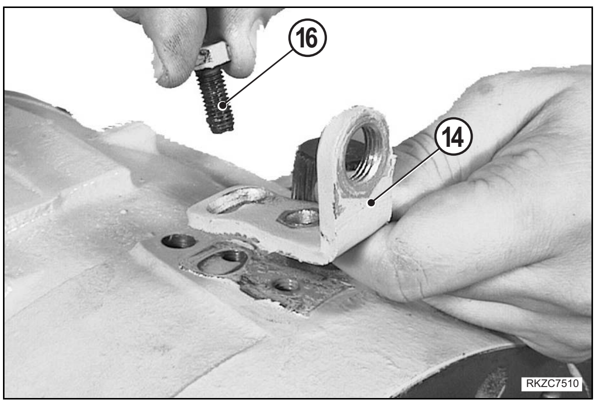


9 - Insert a new O-ring (7) on the shaft.



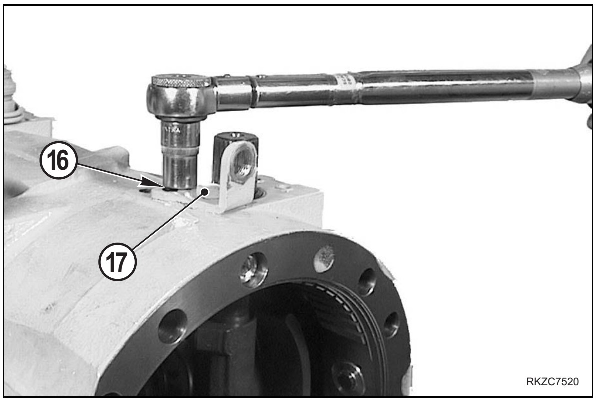
10 - Position the supporting bracket (14).

11 - Assemble the fastening screws (16) and (17).

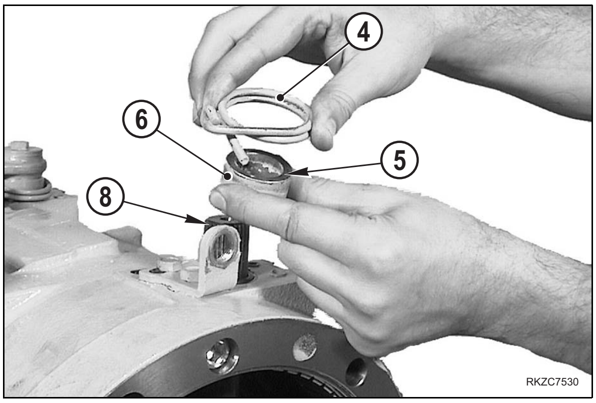


12 - Tighten the bracket fastening screws (16) and (17).

Screw: 190 Nm

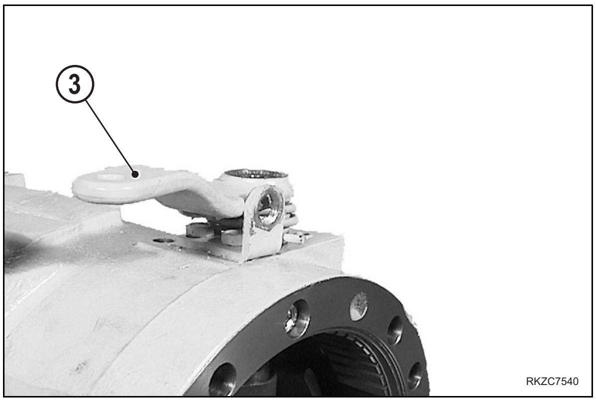


13 - Insert the spacer (6), washer (5) and spring (4) on the shaft (8) end.



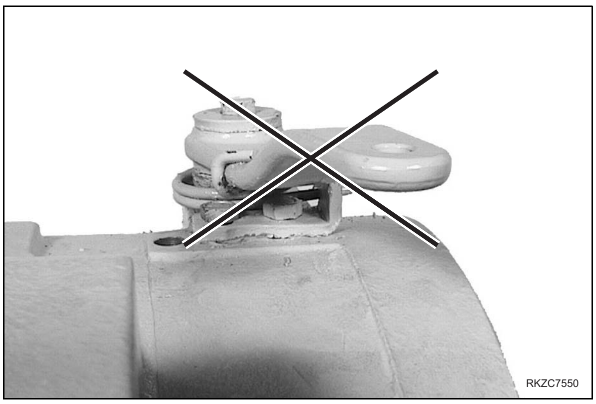
14 - Insert the brake control lever (3), respecting the reference marks put during disassembly.

★ It is very important to respect the reference marks. Control brake assembly could be completed only after the assembly of brake group and of axle.

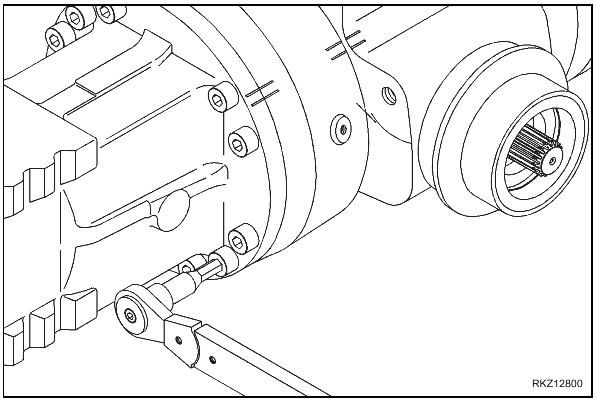


WARNING: during group handling and assembling phases, be careful not to move the brake control lever. This could cause the uncorrect positioning of the discs and of the self-adjust groups with the consequent reduction of brake efficiency.

★ Align the holes on the friction discs; such alignment is necessary to grant the correct oil flow inside the brake group.



15 - Assemble the brake disks and counterdisks, the double U-joint and beam trumpet.
(For details see "4. Axle beam group").



- Set the brake group, putting the system for 3 times under pressure of 35 bar for 2 seconds. It is advisable to use compressed air at high pressure blown through the breather.

  ★ The braking system (piston, discs and self-adjust) should be set, before moving the brake control levers.

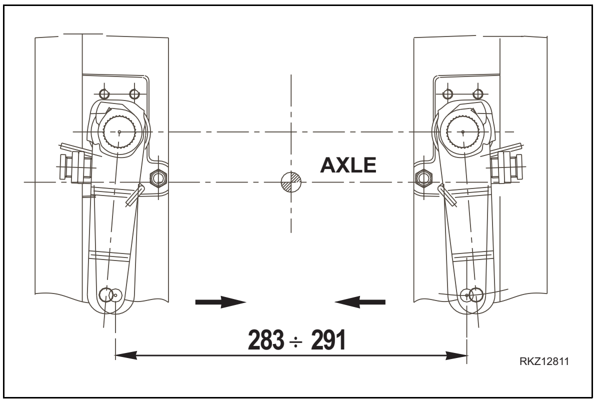
- Operate the control levers, setting them on braking position (locked levers).

  ★ The lever return springs should not be inserted.

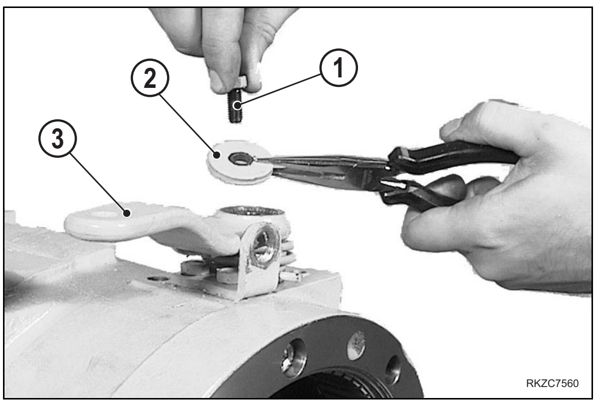
- Measure the distance between the middle of the connection holes at the ends of the control levers and check that it is within the foreseen range: 283– 291 mm

- 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.

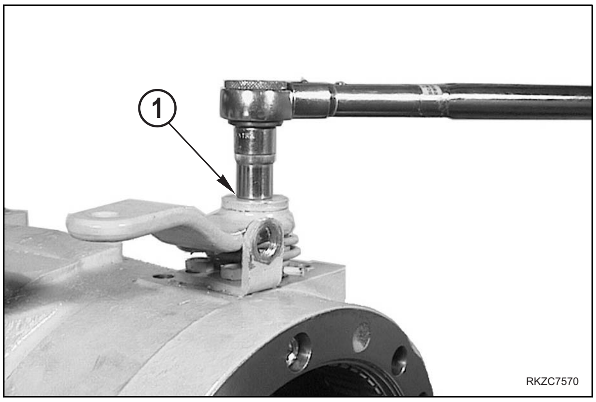


16 - Release the brake control levers (3), assemble the fastening screws (1) and the relative washers (2).

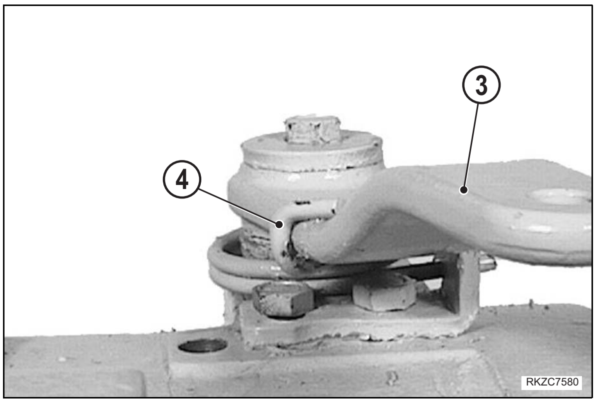


17 - Screw the fastening screws (1).

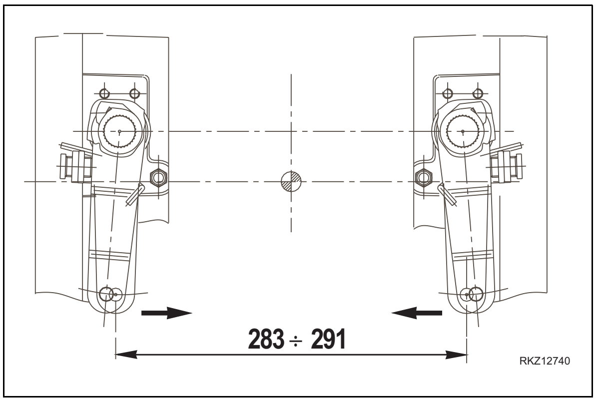
Screw: 35 Nm



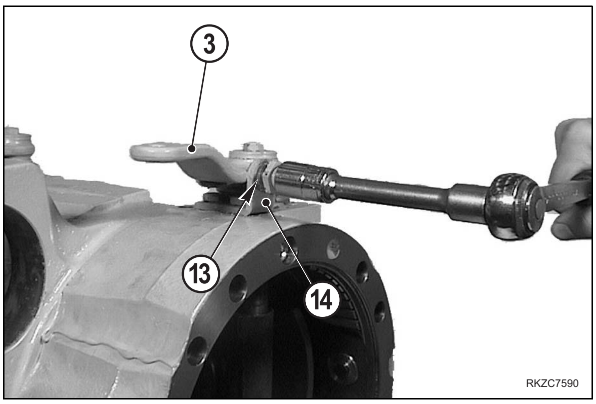
18 - Hitch the return spring (1) to the brake control lever (3). Repeat all the described operations also for the other brake group.



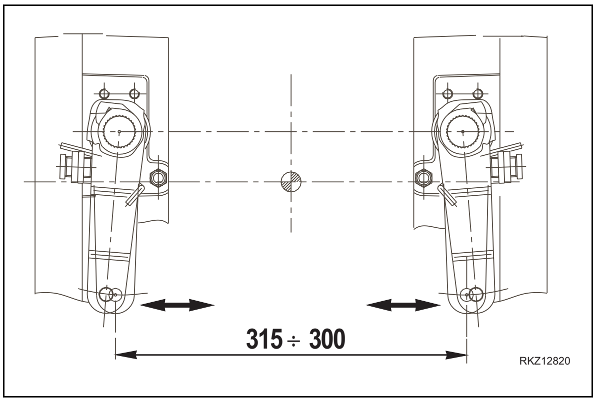
19 - Check that, in rest position (load of 5 daN), the measure between the middle of the connection holes at the lever ends is higher than the minimum value 283 mm of the requested range.
(For detail see the point 15).



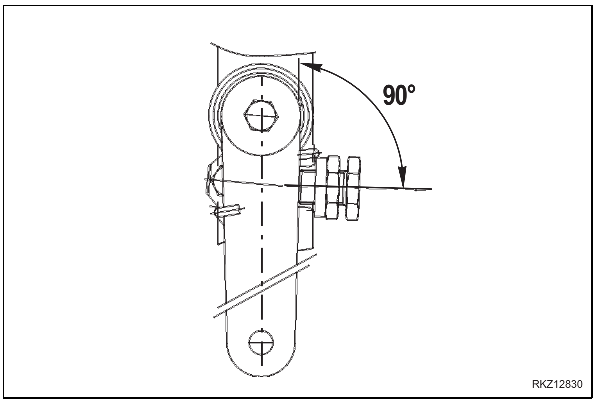
20 - Assemble the nuts (16) on the adjusting screws (13). Assemble the adjusting screws (13) on the brackets (14) and screw in them, till they are in contact with the levers (3).



21 - Screw in the two screws of the same measure to be within the foreseen range for the levers in rest position: 315 – 300 mm (about 3 mm between lever and bracket will remain).

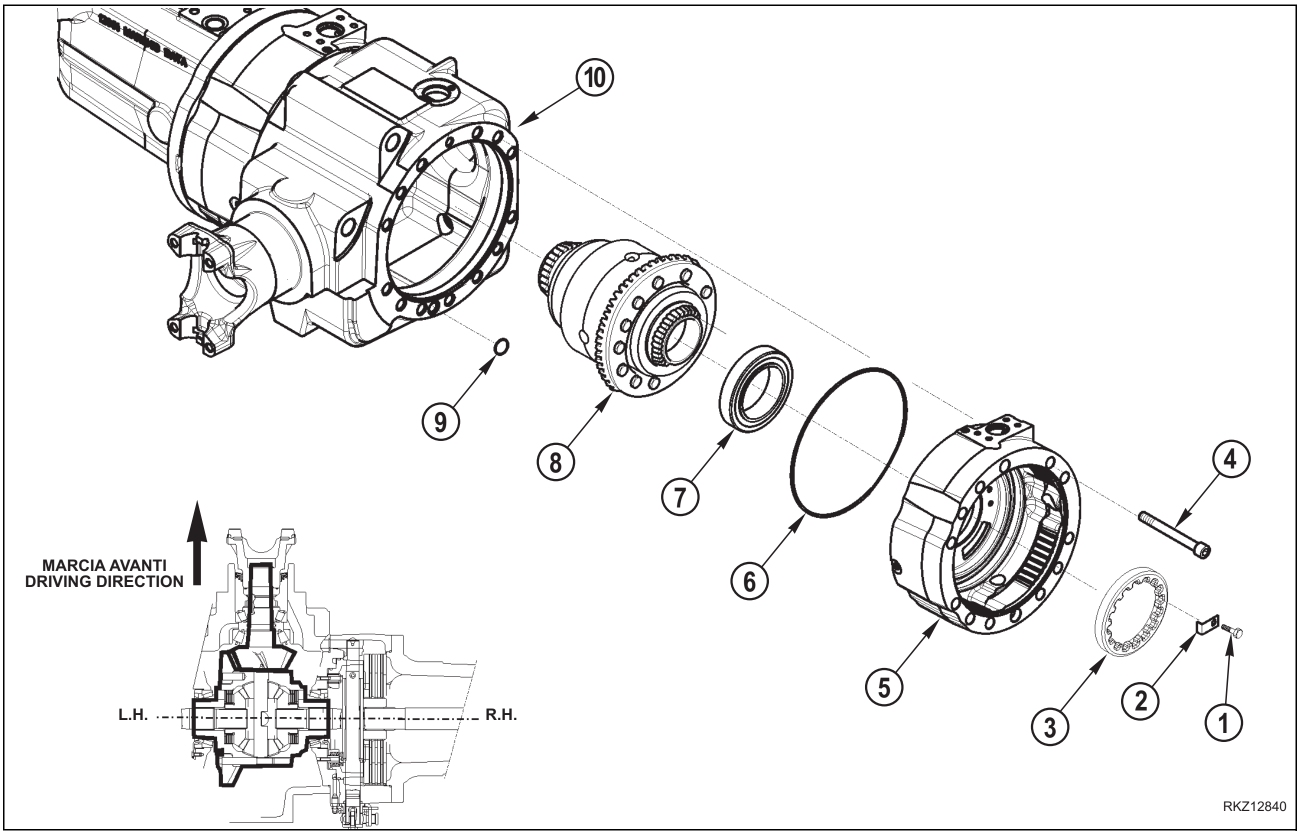


22 - If the screw is not perpendicular to the side surface of the lever, adjust its position by moving the supporting bracket (14).

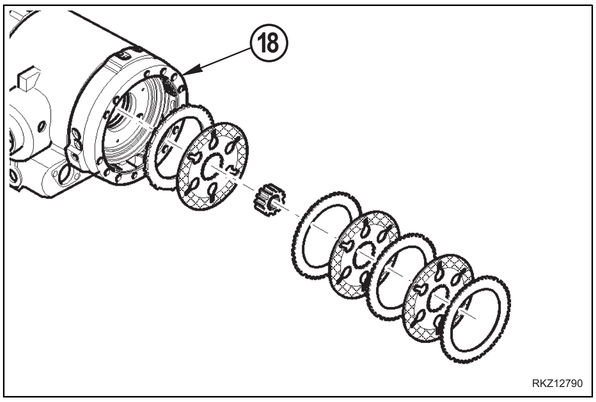


7. Differential support group

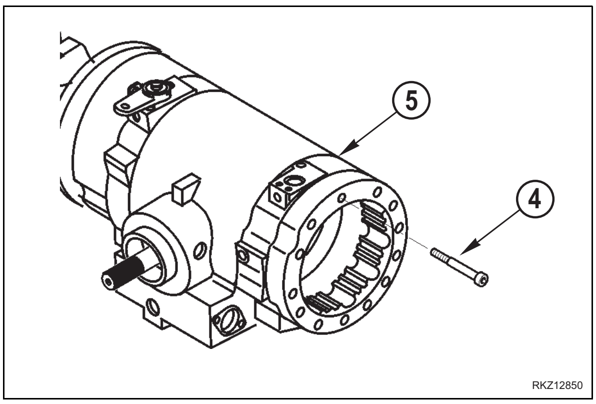
7.1 Disassembly



1 - Remove the brake disks and counterdisks.
(For details see "5. Brake group").



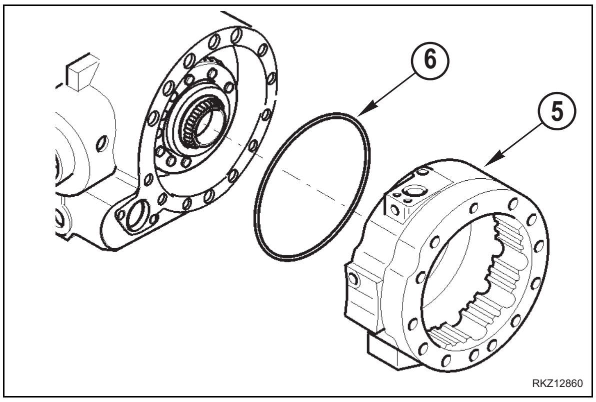
2 - Secure the brake cylinder (5) to a hoist with ropes or safety belts.
Remove the fastening screw (4).



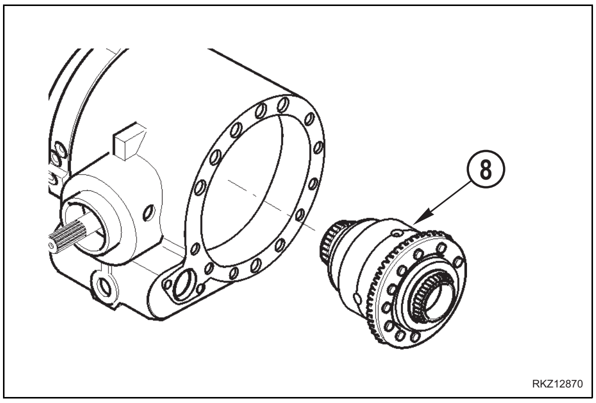
3 - Remove the brake cylinder (5).

★ The differential box is free.

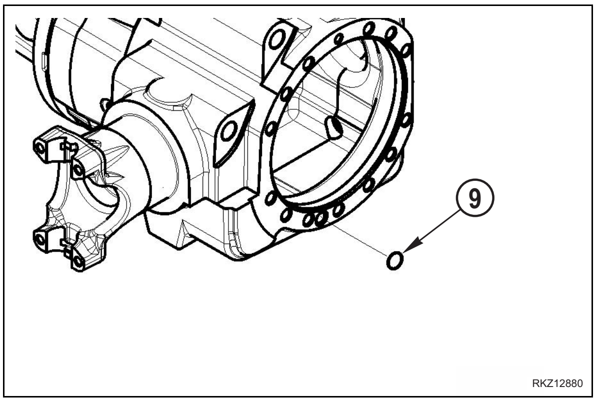
4 - Remove the O-Ring (6) from the brake cylinder (5).



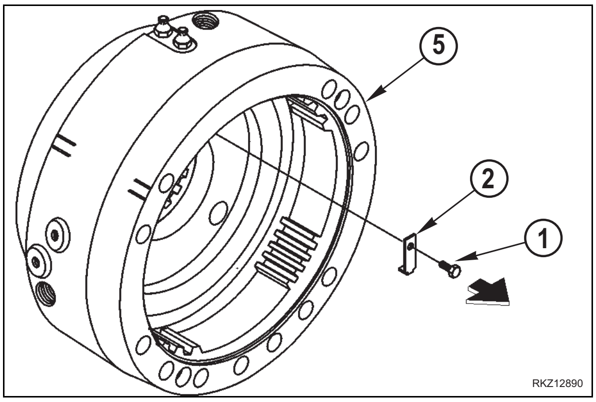
5 - Remove out the differential case (8).



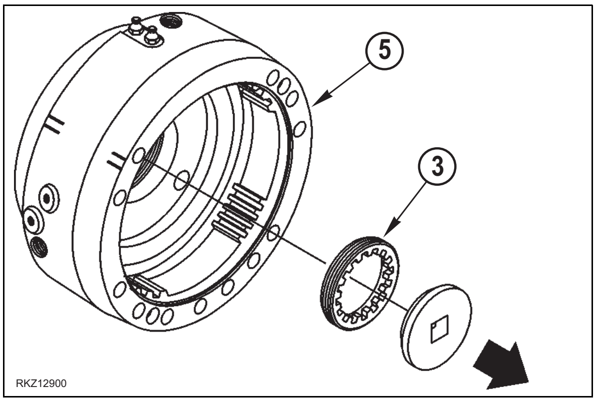
6 - Remove the O-Ring (9) from the central body (10).



7 - Unscrew and remove the screw (2) and the ring nut retainer (1) from the brake cylinder (5).

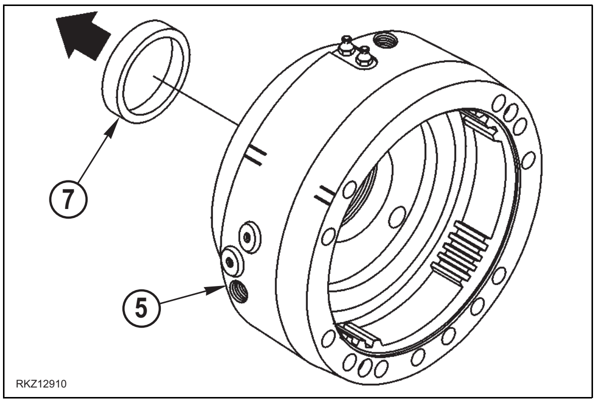


8 - Unscrew and remove the adjuster ring nut (3) from the brake cylinder (5) with the tool **E15**.



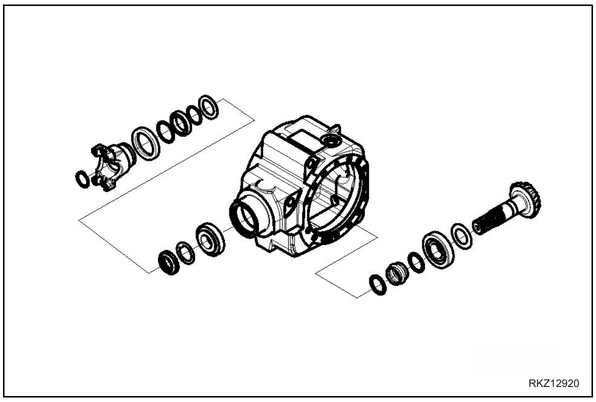
9 - Use a driver to remove the bearing cup (7) from the brake cylinder (5).

★ Do not invert the bearing cups if the bearings are not replaced.

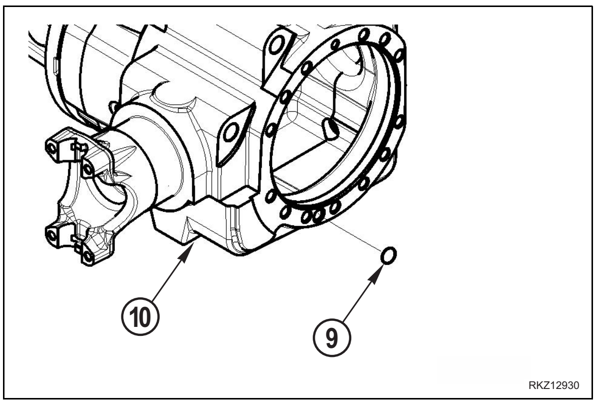


7.2 Assembly

Assemble the pinion group before assemble the differential support group.
(For details see "9. Pinion group").

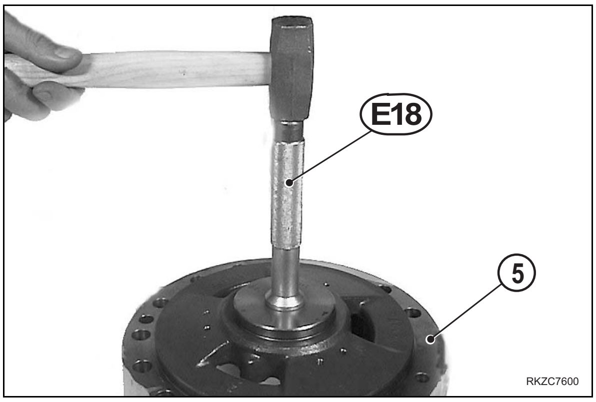


1 - Lubricate and assemble new O-Ring (9) on every side of the central body (10).



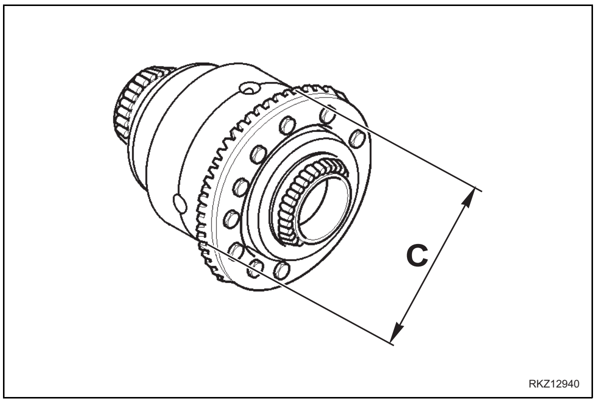
2 - Position the brake cylinder (5) on a flat surface and force the bearing cup (7) using the special tool **E18**.

★ Do not invert the bearing cups if the bearings are not replaced.



3 - Measure the external diameter C of the bevel crown gear assembled to differential housing.
Calculate the value: **R=C/2 mm**

★ This value is necessary to measure the backlash between pinion and crown.

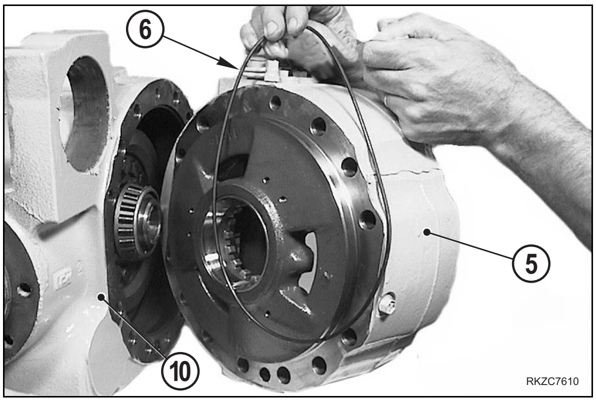


4 - Assemble a new well lubricated O-Ring (6) on the brake cylinder (5) housing.
First assemble the right brake cylinder (Rh) to the central body (1).
Insert the differential group into the central body (10).
See: part (10) in section [Differential group].

★ The bevel gear must be placed on the left side (Lh).

5 - Assemble the left brake cylinder (Lh).

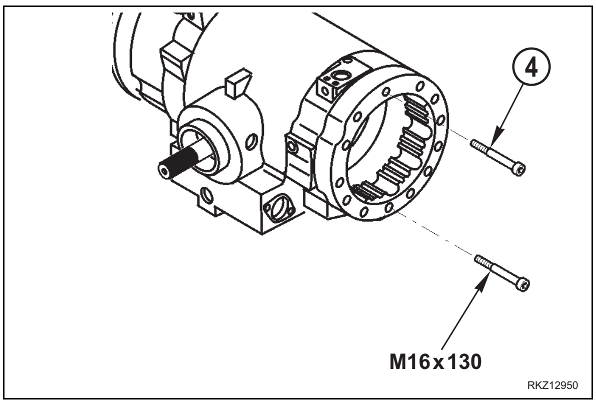
★ Check that the reference marks made during the disassembly between the brake cylinders and the central body coincide.



6 - Assemble the fastening screws (4).
Tighten the fastening screws.

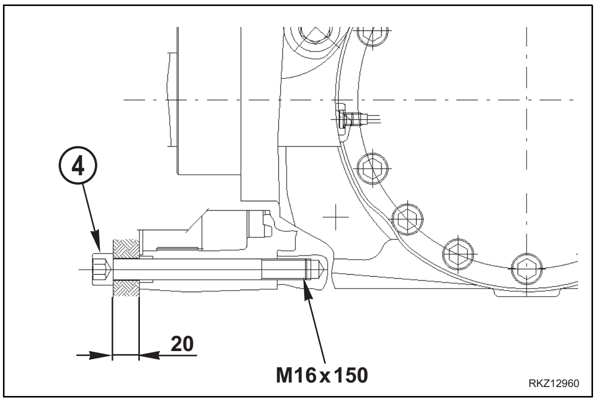
Screw: 80 Nm

7 - Assemble in the shown position a fastening screws M16 x 130 mm to torque of 80 Nm on both sides.

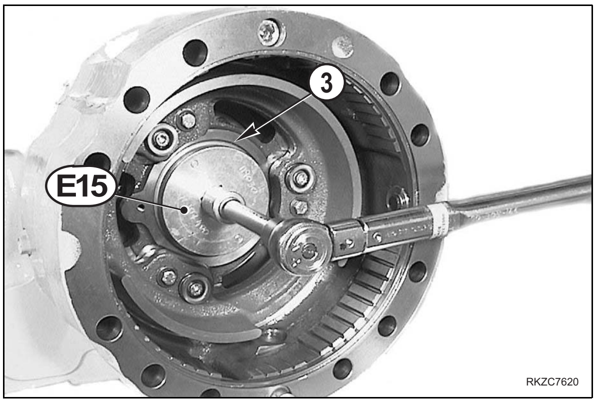


8 - Instead of the fastening screws M16 x 130 mm it's possible assemble two fastening screws (4) with a shim of 20 mm under every screw head.
ighten the fastening screws (4).

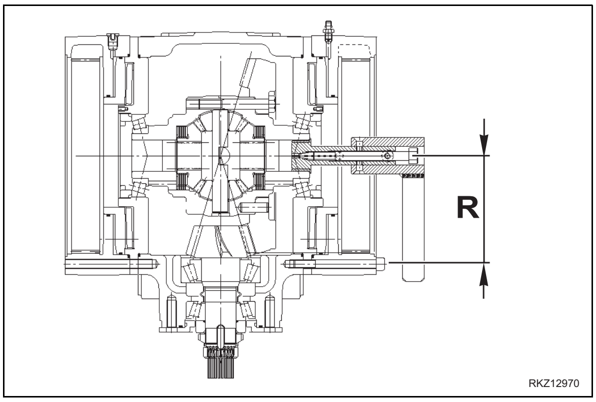
Screw: 80 Nm



9 - Screw both adjuster ring nuts (3) using the tool **E15** till the backlash is eliminated and the differential bearings are slightly preloaded.

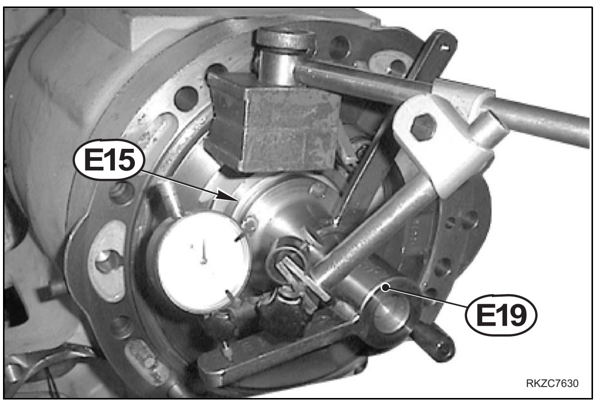


10 - Assemble the special tool **E19** on the differential housing hole. Position a comparator with the feeler in contact with and at 90° respect to the surface of the special tool bracket, in correspondence with the reference R value.

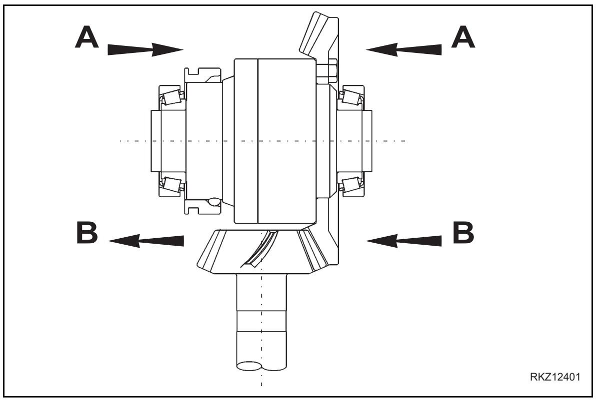


11 - Move the bracket of the tool **E19** installed on the differential housing hole alternately by hand.
Measure the backlash between pinion and crown.
Check if the measured backlash value is within the prescribed range: 0.18 –0.23 mm

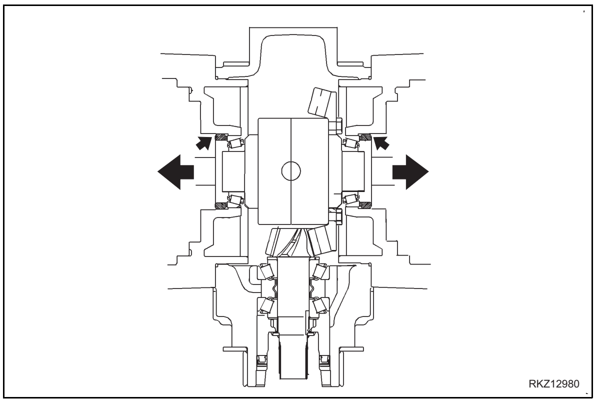
12 - Set the backlash by turning the adjusting ring nuts (10) using the wrench **E15**.



13 - Adjust the ring nuts (3), remembering that:
   - a - 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 (A);
   - b - if the measured backlash is greater 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 (B).



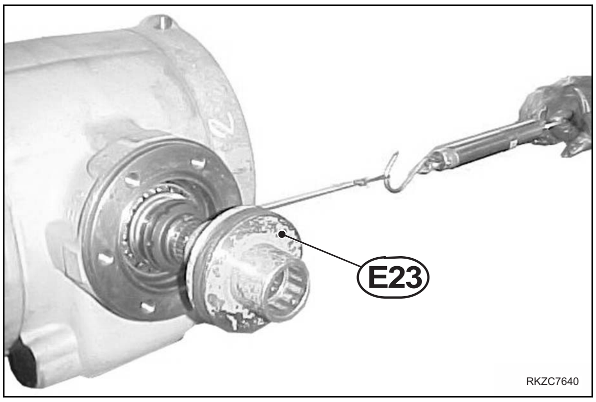
14 - Once the adjustment of the pinion-bevel gear backlash has been carried out, check also that there is a minimum preloading on the differential housing bearings.
Repeat the whole sequence of the above mentioned operations till the indicated conditions are reached.



15 - Once the pinion-ring gear backlash has been established, measure the total preloading T of the bearings (pinion-crown bevel gear system).

16 - Use a dynamometer whose cord is wound on the special tool **E23** inserted on the end of pinion shaft.

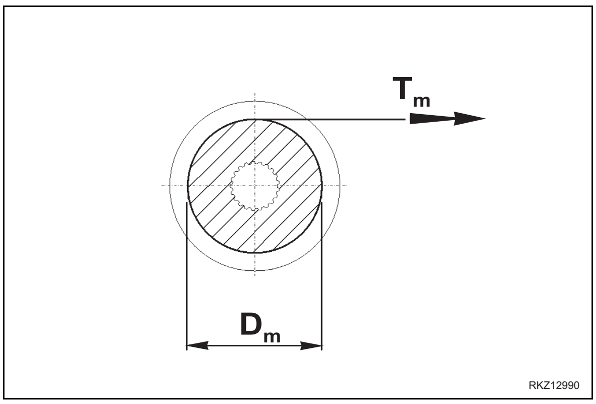
★ All the preloadings should be measured without the seal rings.



The total preloading **Tm** is measured on the special tool **E23** (gauge diameter Dm= 104.4 mm).
The measured value should be within the following range:

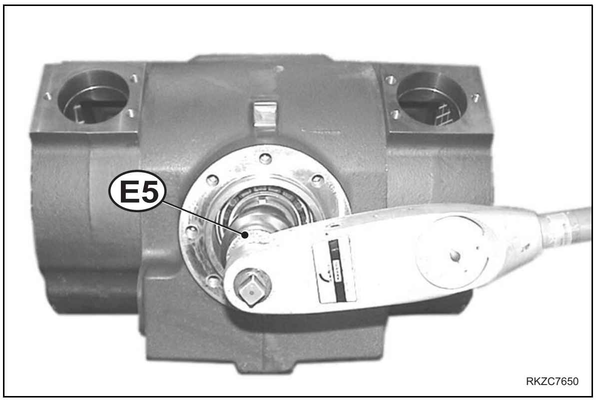
Tm= (Pm+12.4) – (Pm+18.6) N

where **Pm** is the effectively preloading measured on the special tool **E23** (gauge diameter **Dm**= 104.4 mm).
(For details see "9. Pinion group" - "9.2 Assembly" at point 14).



17 - Once the pinion-ring gear backlash has been established, instead proceding with step [13] and [14] measure the total rolling torque (**TT**) of the bearings (pinion-crown bevel gear system) with a torquemeter and the special wrench **E5**.

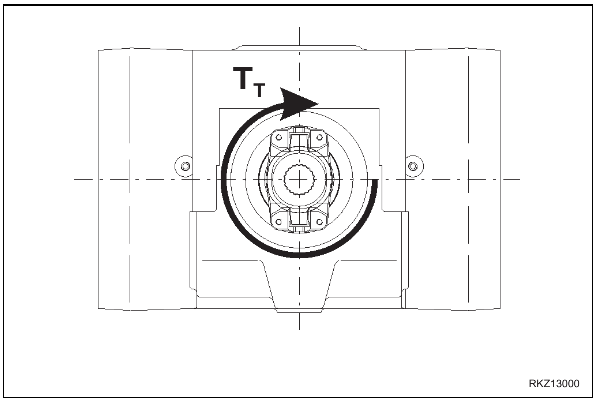
★ All preloadings should be measured without the seal ring.



RKZC7650

The total rolling torque **TT** must be within the following range:
TT= (TP+0.65)÷(TP+0.97) Nm
where **TP** is the pinion bearings preloading.

(For details, see "9. Pinion group" - "9.2 Assembly" at point 17).

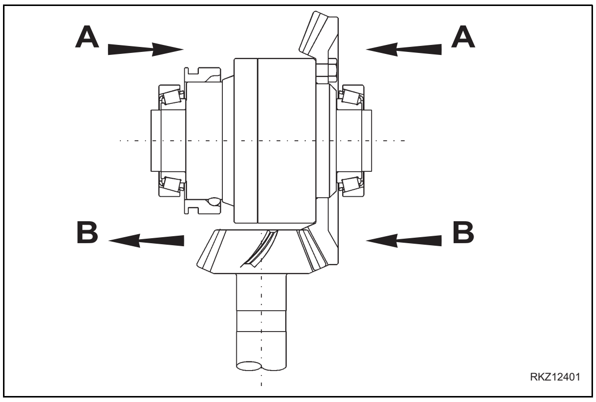


RKZ13000

18 - If the measurement is not within the requested range, check well the assembly of each component and operate on the adjuster ring nuts (3) of the differential support:

a - if the total preloading is less than the given range, screw in both adjuster ring nuts by the same measure, keeping the pinion-ring gear backlash value unchanged (A);

b - if the total preloading is greater than the given range, unscrew both adjuster ring nuts by the same measure, keeping the pinion-ring gear backlash value unchanged (B).



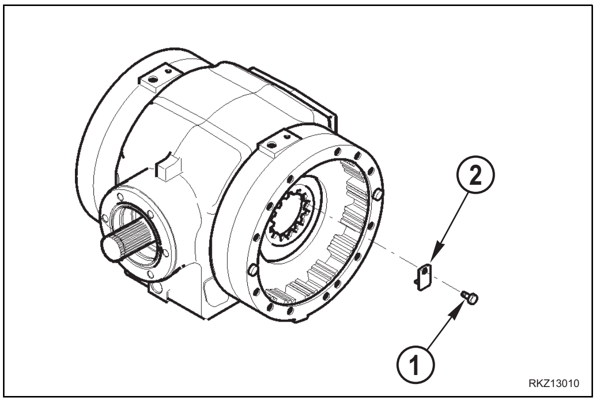
RKZ12401

19 - Once all the adjustment operations have been completed, fit the adjuster ring nut retainers (2) and their respective screws (1)

Screw: 13 Nm

★ Turn the adjuster ring nuts (3) slightly in order to allow the assembly.

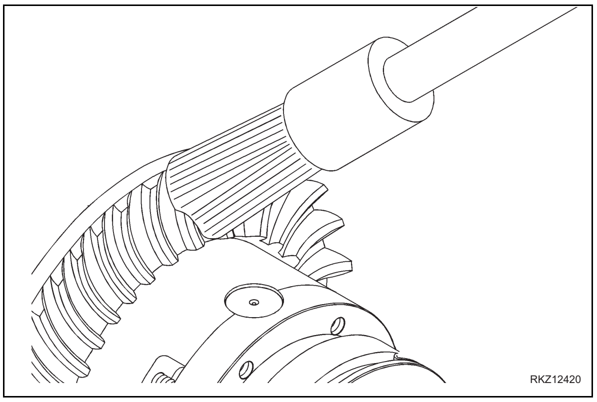
20 - Remove the fastening screws M16 x 130 mm on both sides



RKZ13010

7.3 Bevel gear marking test

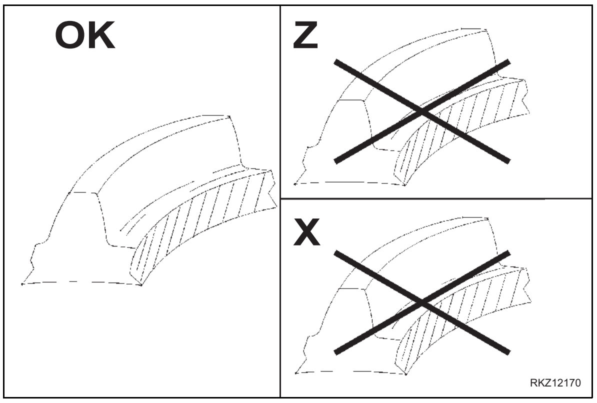
★ To test the marks of the bevel gear teeth, paint the ring gear with red lead paint.
The marking test should be always carried out on the ring bevel gear teeth and on both sides.



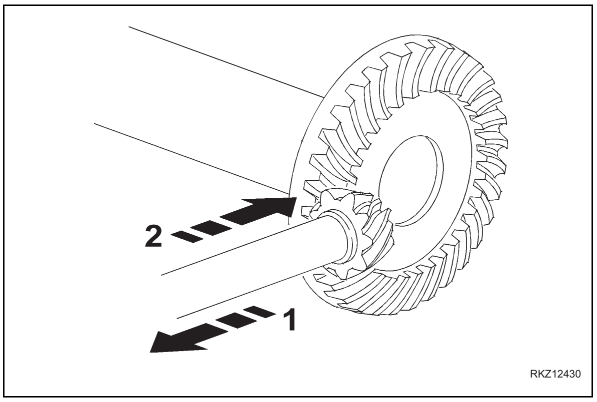
OK ->Correct contact:
If the bevel gear is well adjusted, the mark on the teeth surfaces will be regular.

Z ->Excessive contact on the tooth tip:
Approach the pinion to the ring bevel gear and then move the ring bevel gear away from the pinion in order to adjust the backlash.

X ->Excessive contact at the tooth base:
Move the pinion away from the ring bevel gear and then approach the ring bevel gear to the pinion in order to adjust the backlash.

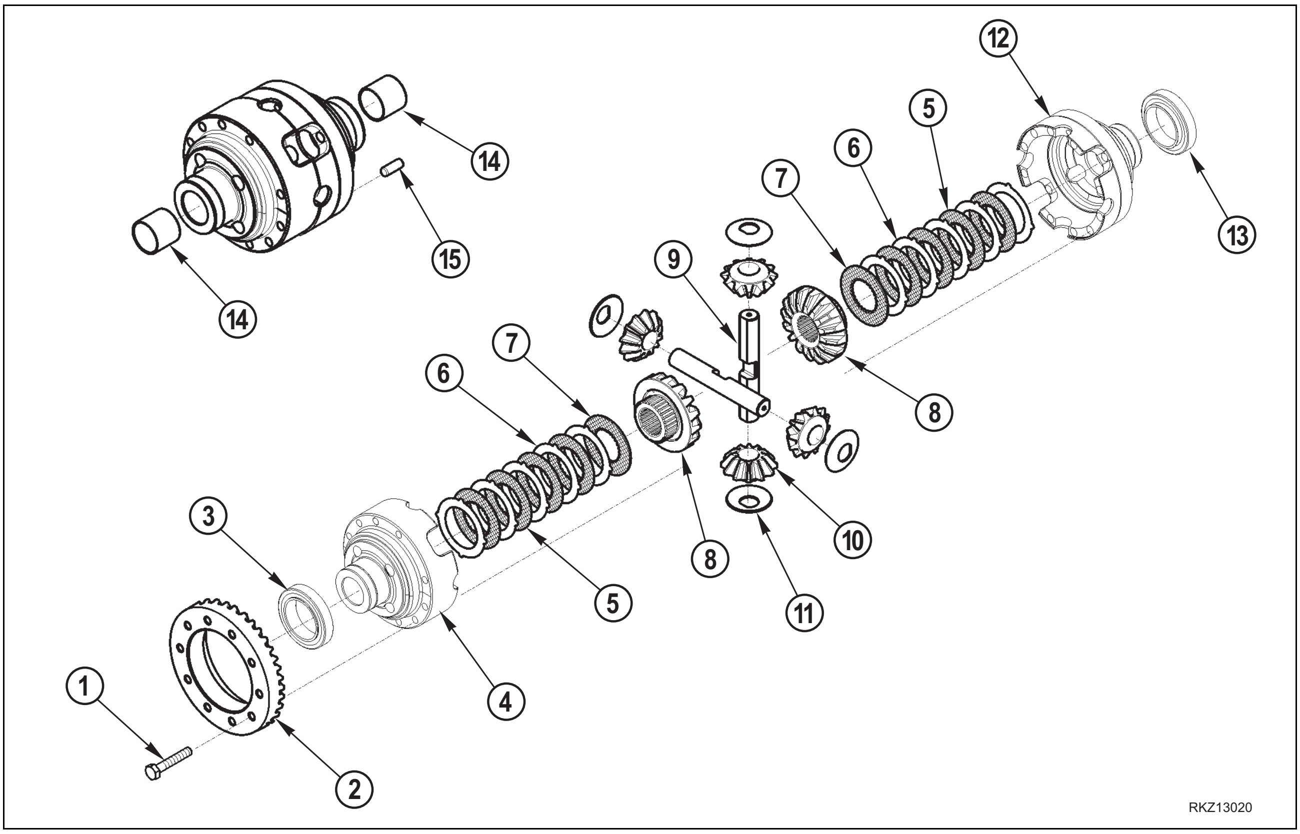


Movements to correct:
1 -> move the pinion for type X contact adjustment
2 -> move the pinion for type Z contact adjustment.



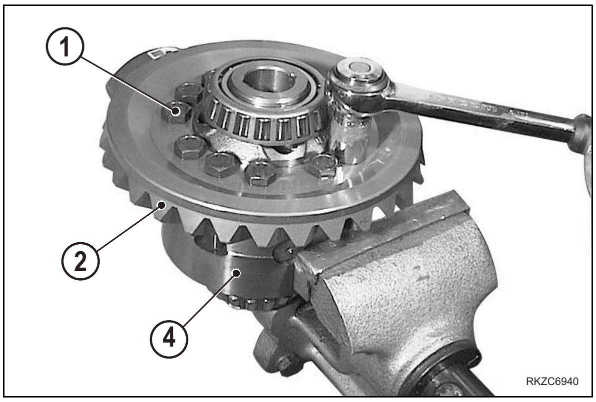
8. Differential group

8.1 Disassembly



1 - Lock the differential with a clamp.
Unscrew the fastening bolts (1) and remove the bevel gear crown (2).

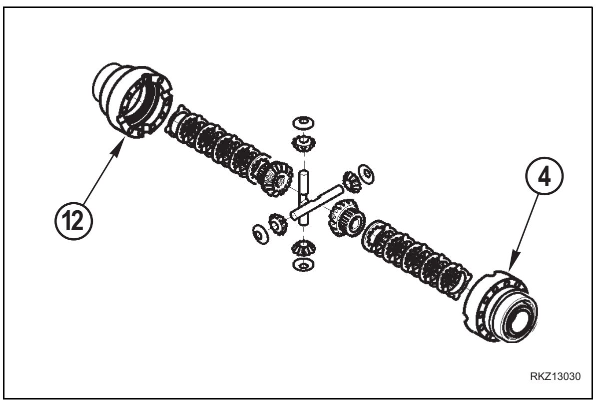
★ This will make both differential half boxes (4) and (12) free, so take care not to drop the internal components.



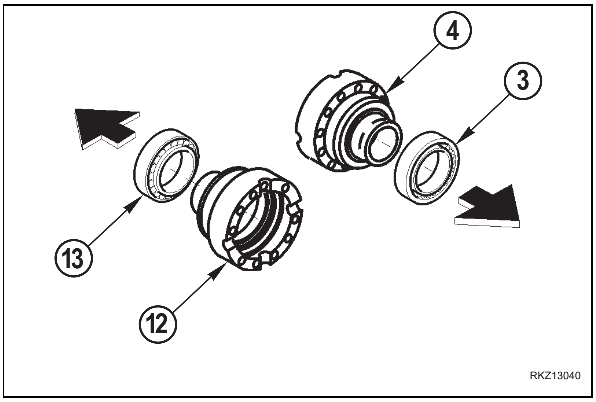
2 - Disassemble the differential box in two half boxes (4), (12) complete with the relevant components.

★ Mark the two half boxes before disjoining them, in order to reassemble them in the same position as the one before disassembling.

3 - Disassemble all the components.
Check the operating and wear conditions of the components.



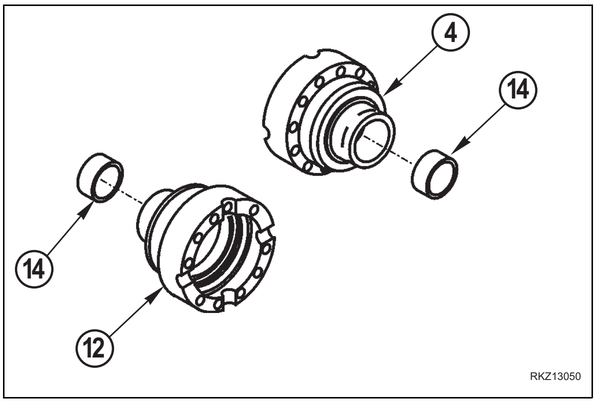
3 - Take the bearings (3) and (13) out of the differential half box (4) and (12), using two levers or a three-hold extractor.



4 - Remove the bush (14) from the half boxes (4) and (12) only if the wear conditions require this.

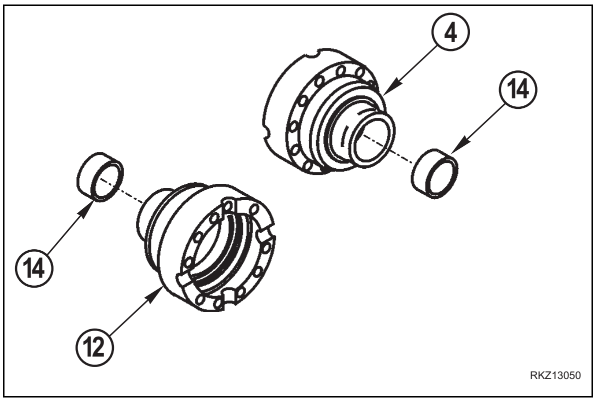
★ Replace the bush at each disassembly.

★ Be careful not to damage the bush seat.

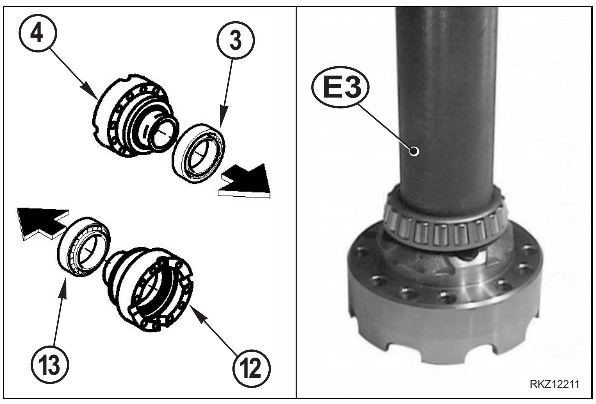


8.2 Assembly

1 - Assemble the bushes (14) to the half housings (4) and (12) with the special tool **E14** and a hammer.



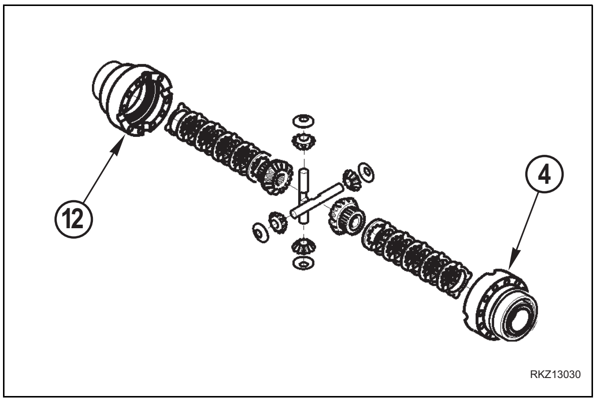
2 - Assemble the bearing cones (3) and (13) on the half housings (4) and (12), using the special tool **E3** and a hammer.



3 - Position a half housing (4) or (12) on a workbench and assemble all inner components (locking differential counterdisks (6), locking differential discs (5) and (7), sun gears (8), spiders (9), spider gears (10), thrust washers (11)), as shown in figure.

★ The first disk (7) must be assembled with friction material on the disks side and the flat surface on the sun gear (8) side.

4 - Join the two half boxes, aligning the reference marks made upon them.



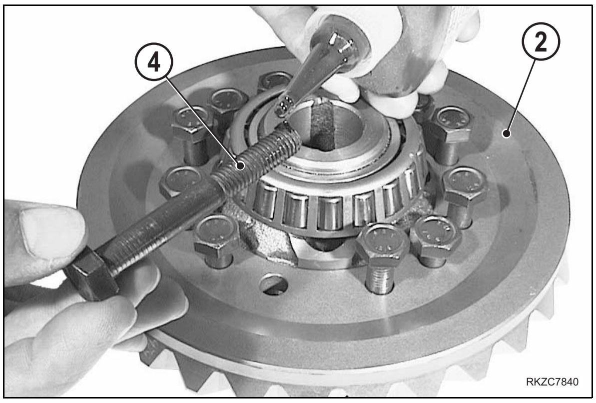
5 - Position the bevel crown gear (2) on the half box (4).

★ Check dowel pins (15) position.

6 - Apply the specified sealant on the thread and tighten the bolts (1).

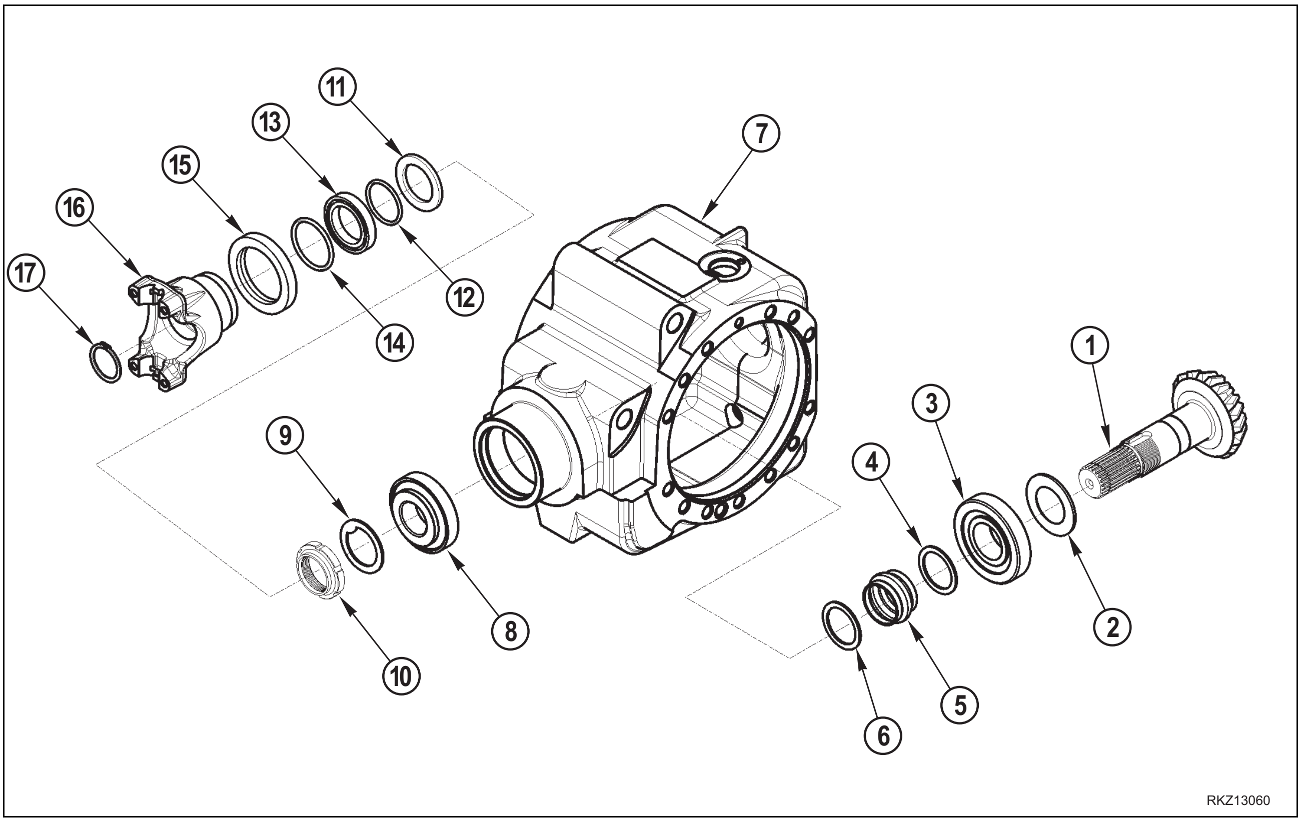
Screw: 155 Nm

Screw: Loctite 270



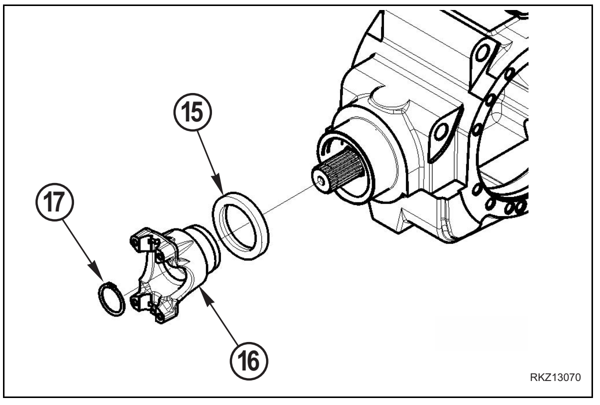
9. Pinion group

9.1 Disassembly

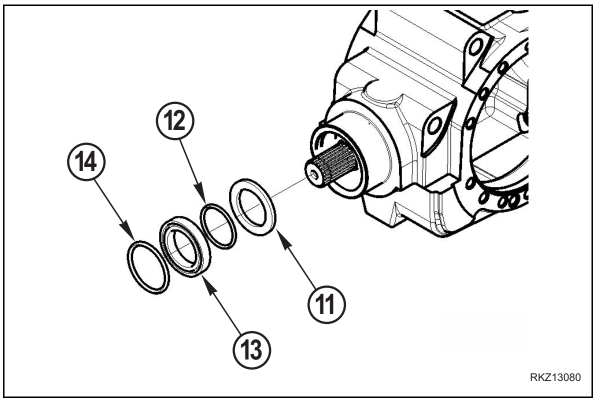


1 -Remove the lock ring (17).
Remove the flange (16) and the seal ring (15).

★ Replace the seal ring at each disassembly.

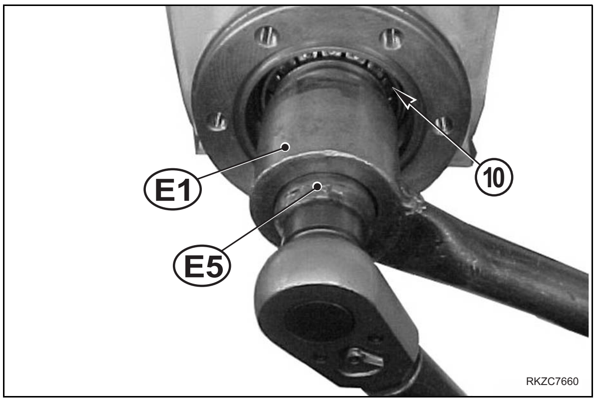


2 -Remove the O-ring (14), the spacer (13), the O-ring (12) and the washer (11).

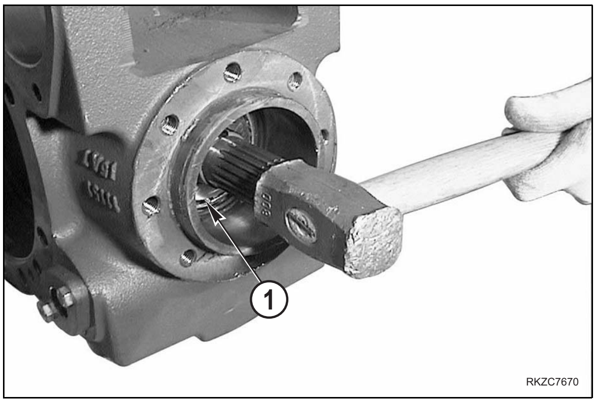


3 - Unscrew the lock nut (10) using special tools **E1** and **E5**.

★ This operation damage the ring nut; the ring nut (10) **must be replaced** when assembling the group.

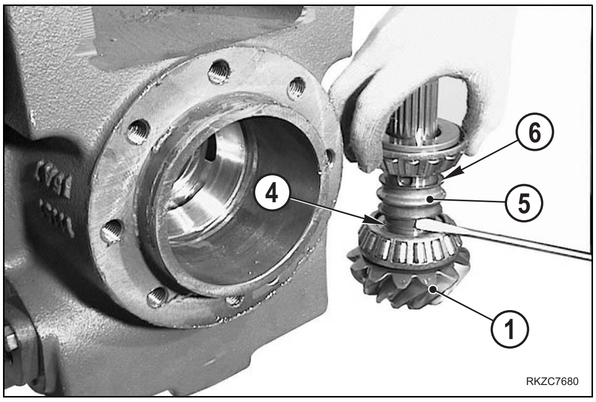


4 - Tap the end shaft with a soft hammer to remove the bevel pinion (1).
Collect the washer (9) and the bearing cone (8).

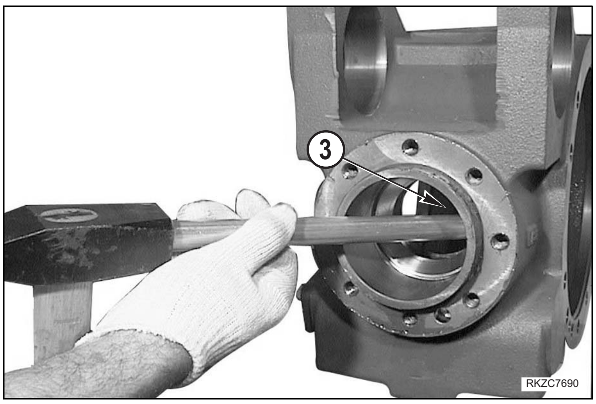


5 - Once the bevel pinion (1) has been removed, collect the washer (6), the collapsible spacer (5) and the washer (4).

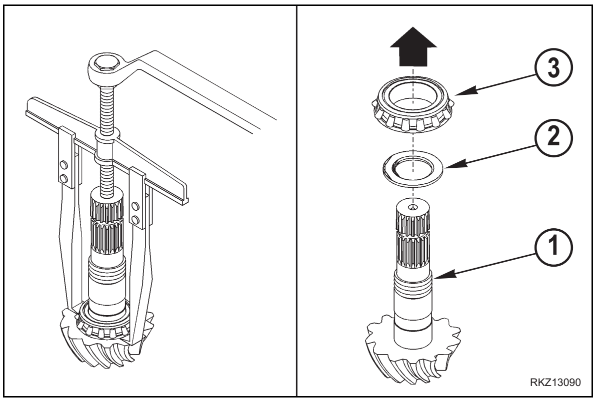
★ The collapsible spacer (5) **must be replaced** when assembling the group.



6 - Check the bearing cups wear condition.
If bearings replacement is necessary, remove bearing cups (3) and (8) from central body with a drift and a hammer.

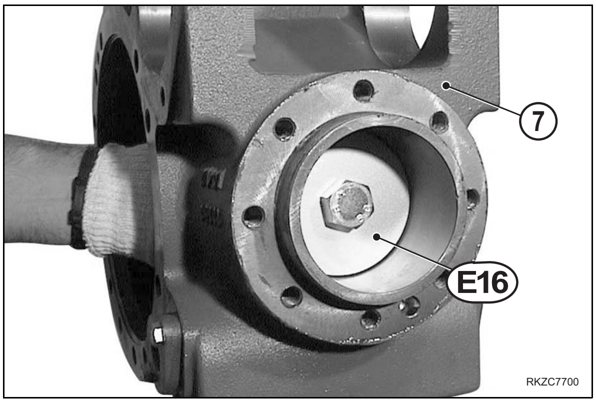


7 -Remove the bearing cone (3) of the bevel pinion (1) with a standard extractor.
Collect the shim (2).

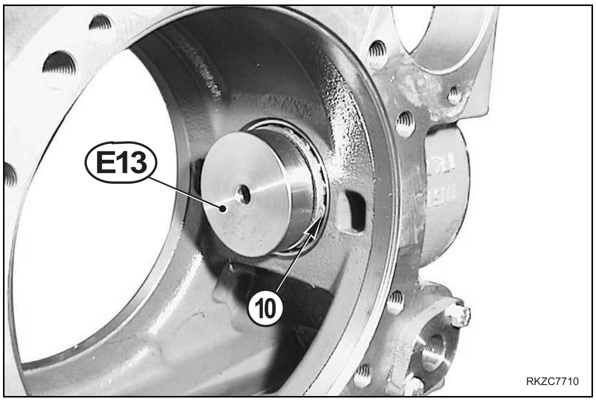


9.2 Assembly

1 -Position the central body (7) on a workbench.
Fit the bearing cups (3) and (8) into their seats using the special tools kit **E16**.

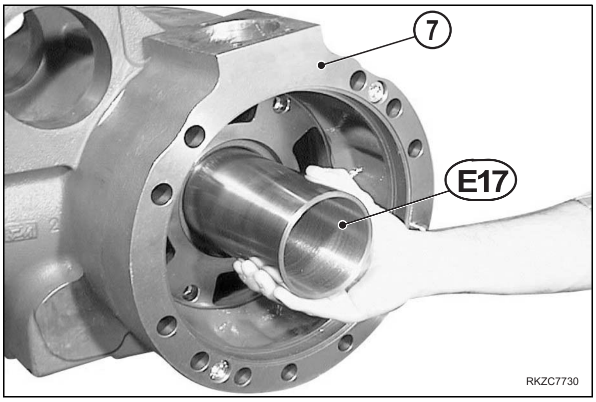


2 -Use the special tools false pinion **E13** and false differential box **E17** to measure the conic distance.
Insert into the seats the bearing cups (3) and (8) and the false pinion.
Tighten the ring nut (10) to eliminate the backlash.



3 -Check the correct positioning of the right and left brake cylinder and differential housing supports, using the reference marks on them and on the central body (7).
Assemble the differential housing supports.

4 - Insert the false differential box **E17** into the central body (7).
Check that the false differential box is inserted in both differential support housings.

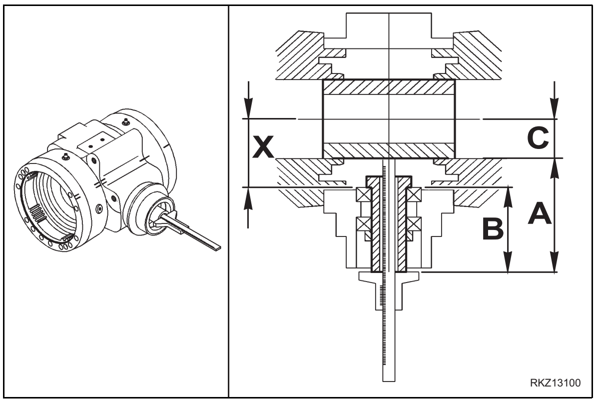


RKZC7730

5 - To adjust bevel gear/pinion measure the distance "A" with a depth gauge.
Calculate the value "X" as follows:

X = (A + C) - B mm

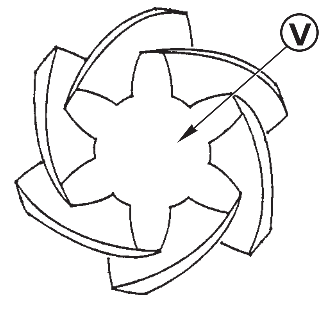
where "**B**" and "**C**" are known.



RKZ13100

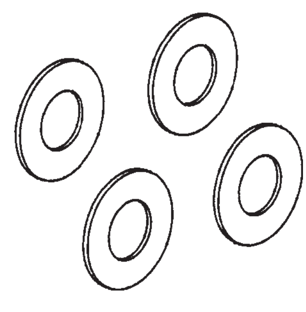
6 - From the value "**X**" deduct the value "**V**" (stamped on the pinion head) to get the value "**S**".

S= X - V mm

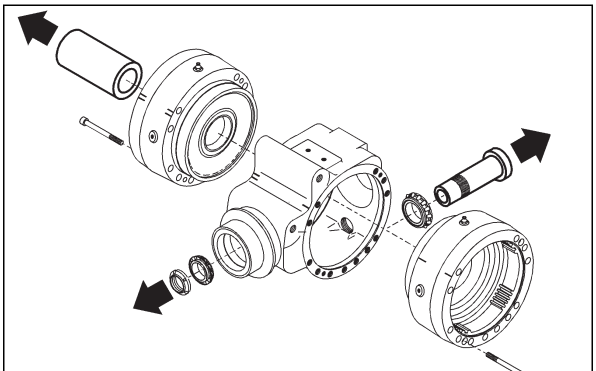


RKZ12260

7 - Select the shim (2) of thickness value (S) among the range of available shims.


RKZ12270

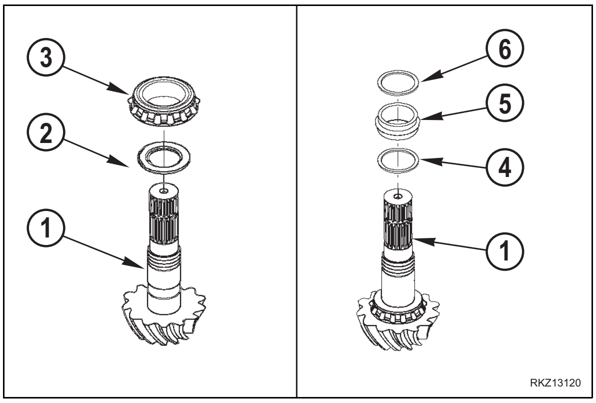
8 - Loosen and remove the ring nut (10).
Remove the false pinion **E13** and the bearing cones (3) and (8) from the central body (7).
Disassemble the false differential box **E17** from the brake cylinders and then unscrew the screws to remove the brake cylinders.



RKZ13110

9 - Insert the chosen shim (2) with the chamfer against the gear on the pinion shaft (1).
Force the bearing (3) on the pinion shaft (1) with the special tool **E4** under a press, making sure that it is well set.
Assemble the shim (4), a new collapsible spacer (5) and the shim (6) to the pinion shaft.

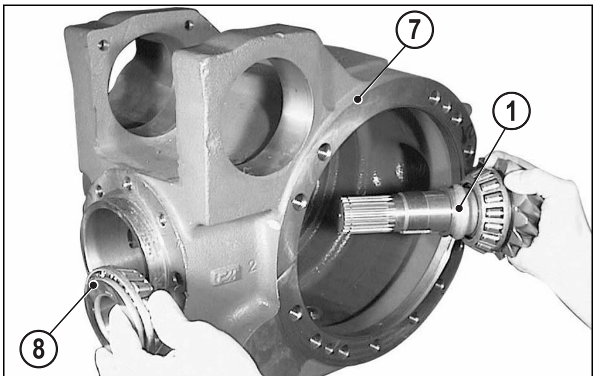
★ Use always a new collapsible spacer (5).



RKZ13120

10 - Insert the bevel pinion (1) unit into the central body (7) and the bearing (8) into the pinion shaft, as shown in figure.
Force the bearing (8) in position with the special tool **E4** and a hammer.

★ Push the pinion against the central body to perform this operation.



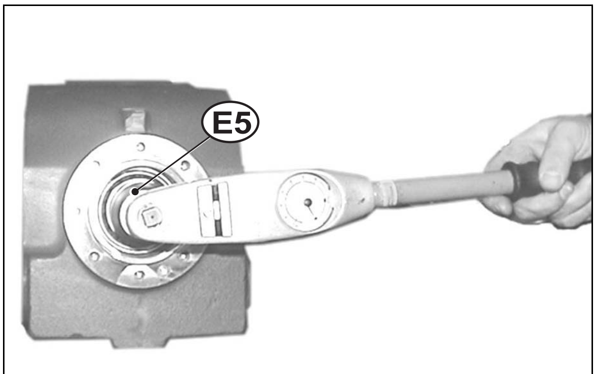
RKZC7740

11 - Insert the ring nut washer (9) and screw a new lock ring nut (10) on the pinion end. Screw the ring nut (10) in, using the wrench for ring nut **E1** and for pinion retainer **E5**.

★ The torque setting is given by the preloading measurement on bearings (3) and (8); Tighten the ring nut (10) step by step.

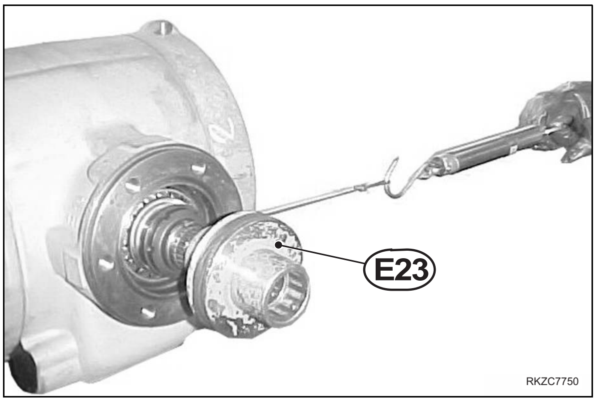
★ If it is tightened too much, the elastic spacer (5) should be replaced and the procedure repeated.

12 - When you check the preloading, it is advisable to beat slightly both pinion (1) ends with a soft hammer, so as to help setting the bearings (3) and (8).



RKZC7760

13 - To measure the preloading P of the pinion taper roller bearings, use a dynamometer whose cord is wound on the special tool **E23** inserted on the end of pinion shaft.

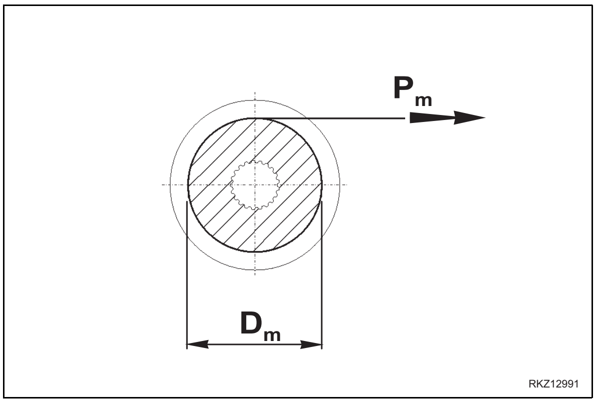


14 - The effectively preloading Pm is measured on the special tool **E23** (gauge diameter Dm= 104.4 mm)

★ All preloadings should be measured without the seal ring.

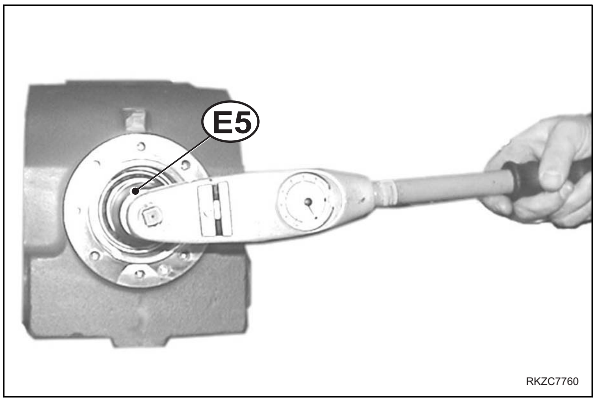
15 - The measured value should be within the following range:

Pm = 31–46 N



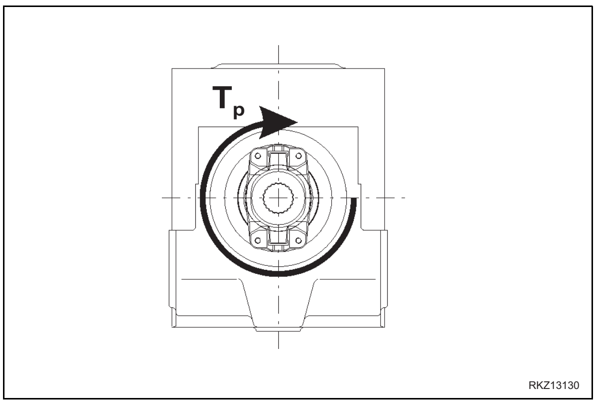
16 - Instead proceding with step [12] and [13] measure the pinion shaft bearings rolling torque **TP** with a torquemeter and the special wrench **E5**.

★ All preloadings should be measured without the seal ring.

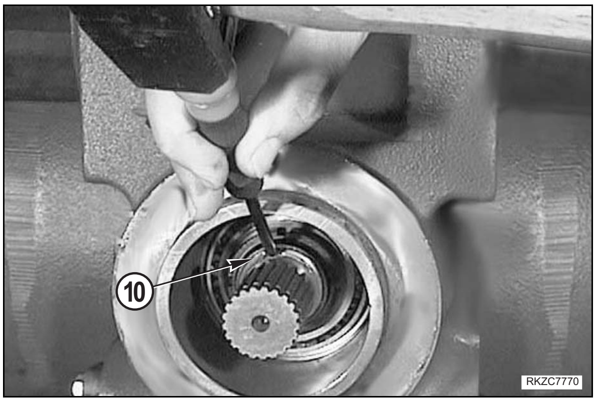


17 - The measured value **TP** must be within the following range:

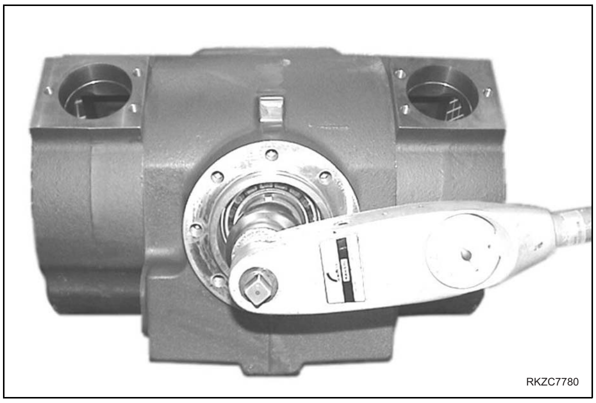
TP= 1.6–2.4 Nm



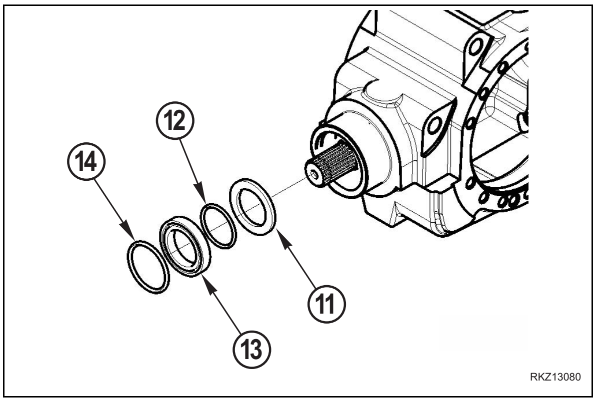
18 - The preloading/rolling torque adjustment is carried out by increasing the ring nut torque gradually, being careful not to exceed.
Once the requested preloading value is achieved, stake the ring nut (10), using a hammer and a chisel.



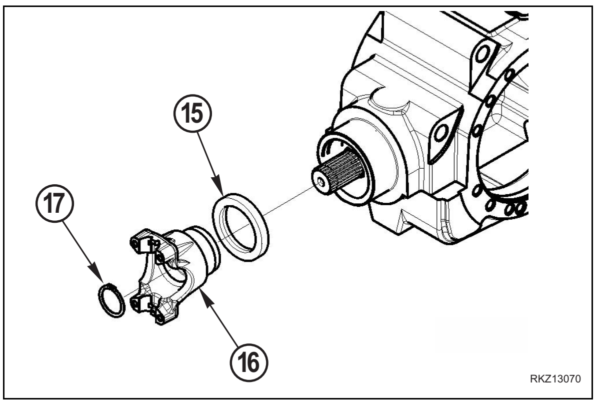
★ Before mounting the next parts assemble the differential support group (see "7. Differential support group"); the total preloading of the bearings in the pinion-crown bevel gear system must be measured without the seal rings (see "7. Differential support group" at points 15, 16 and 17).



19 - Assemble the washer (11), the O-ring (12), the spacer (13), the O-ring (14).

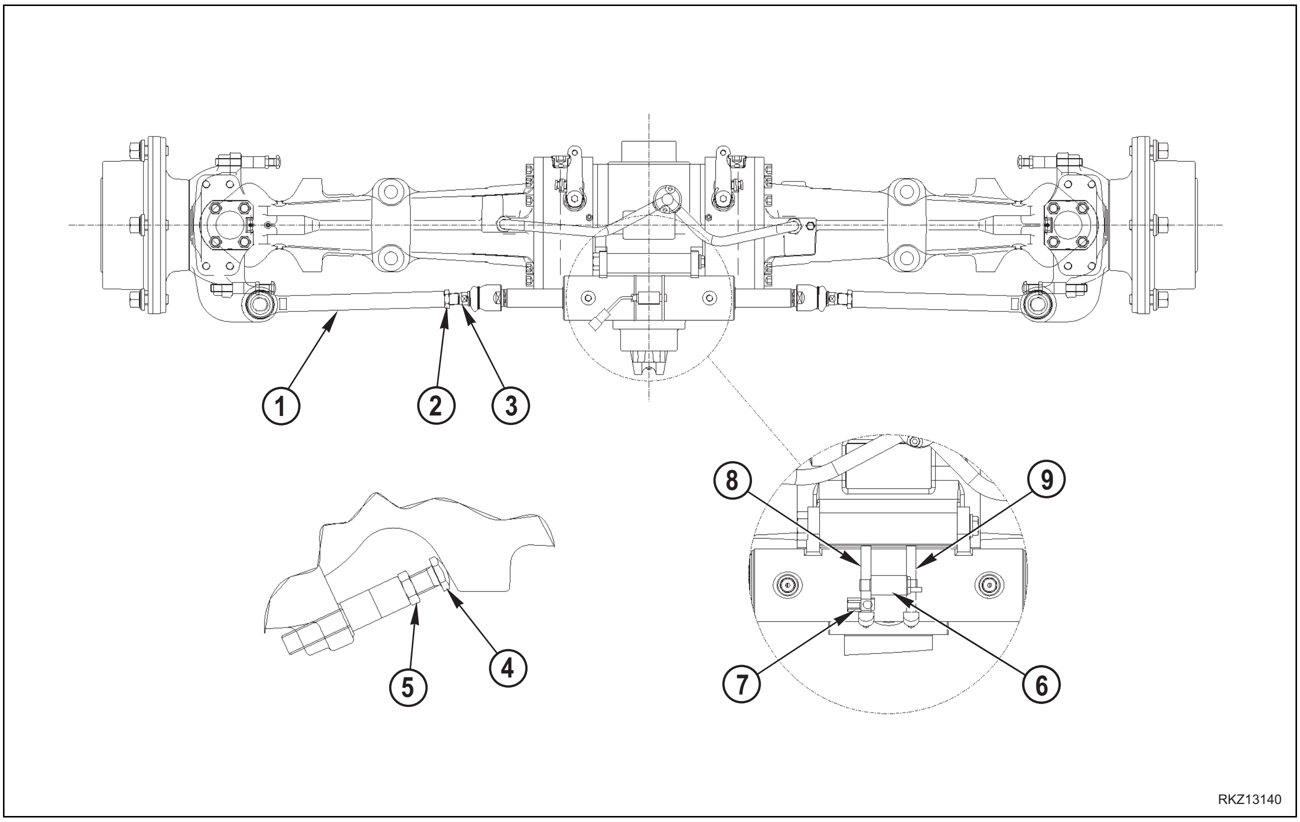


20 - Assemble the new seal ring (15) using the special tool **E22** and a hammer.
Assemble the flange (16).
Lock the whole with the snap ring (17).



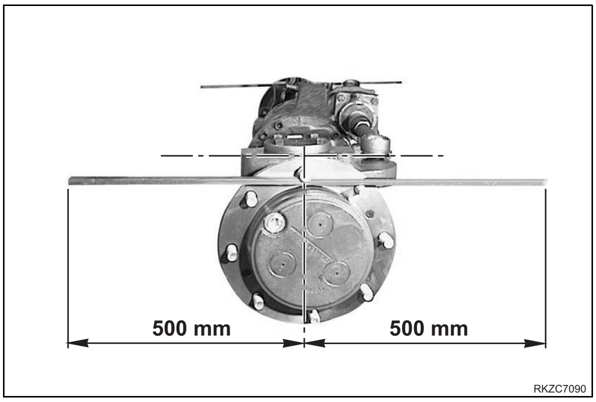
10. Toe-in/steering angle

10.1 Toe-in adjustment



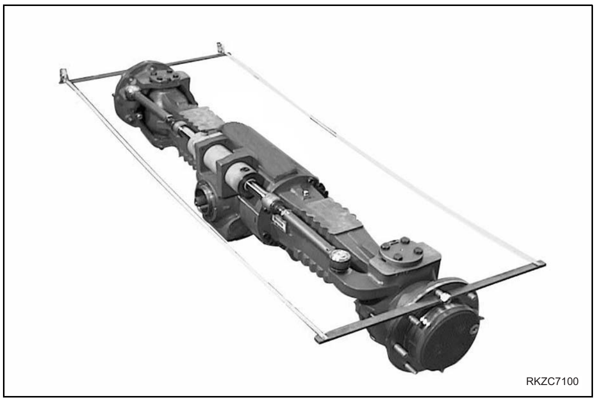
1 - Put two equal one-meter-long linear bars on the wheel sides and lock them with two nuts on the wheel hub stud bolt.

⚠ 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.



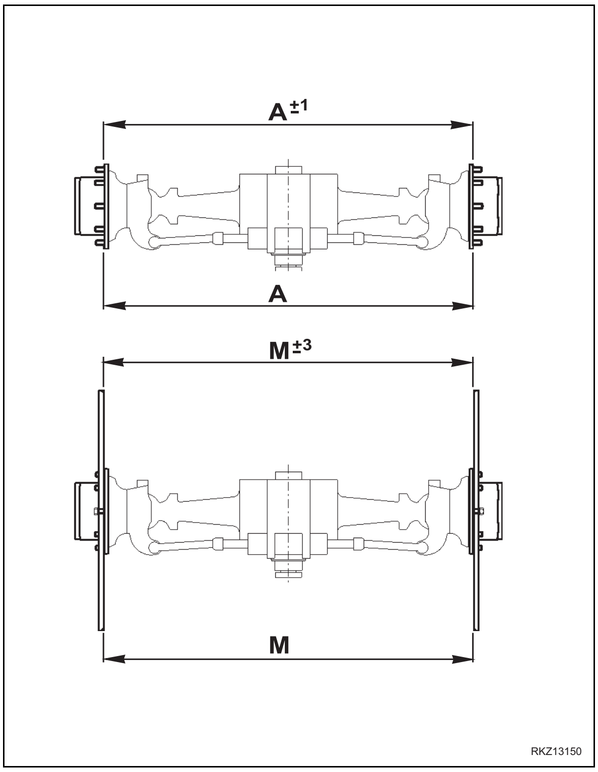
2 - Measure the distance in mm M between the bars ends with a tapeline.

★ Keep the minimum value, swinging the measurement point.

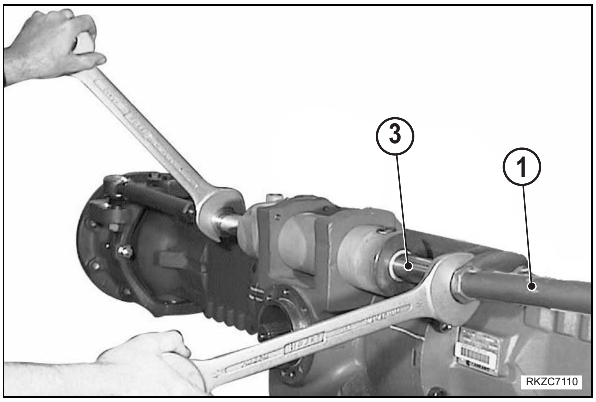


3 -Check that the difference of the measurements between the wheel hubs diameters ends is within the requested tolerance range.

4 -The nominal toe-in value (A) is referred to the external diameter of the wheel hubs flange, therefore the measured value (M) at the bars ends must be related to the ratio between length of the bar and flange diameter nominal toe-in
= A ±1 measured toe-in = M ±3

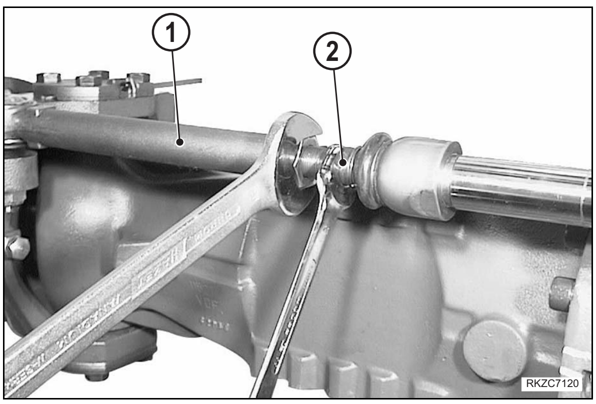


5- If toe-in is incorrect, operate with two wrenches on the steering arms (1) screwing in and out the two joint tie rods (3) equally till the toe-in is within the requested tolerance.



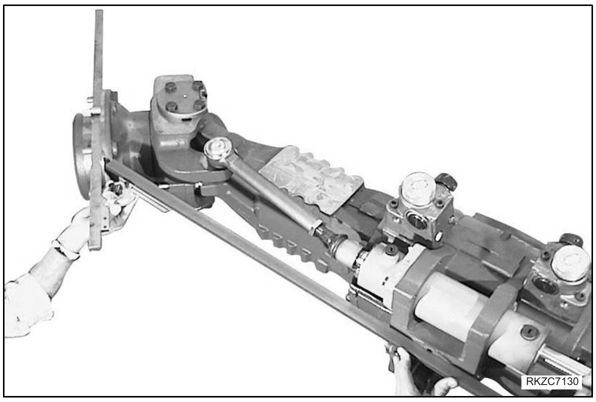
6 -After adjusting, screw in the lock nuts (2) of the steering arms (1).

Nuts: 250 Nm

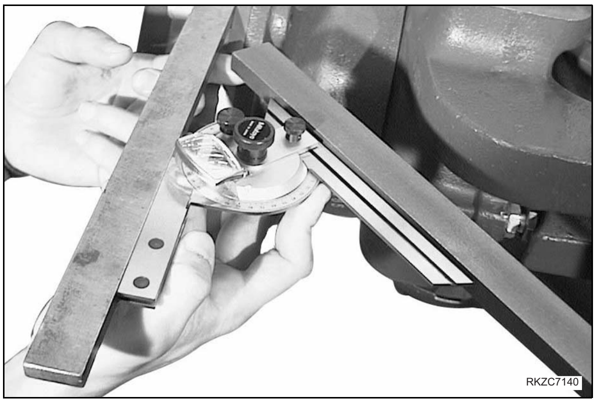


10.2 Steering angle adjustment

Use the same bars assembled for the toe-in adjustment and a long bar perfectly leaned over the machined part of the central body (pinion side), so that the two bars form an acute angle at the maximum steering.


RKZC7130

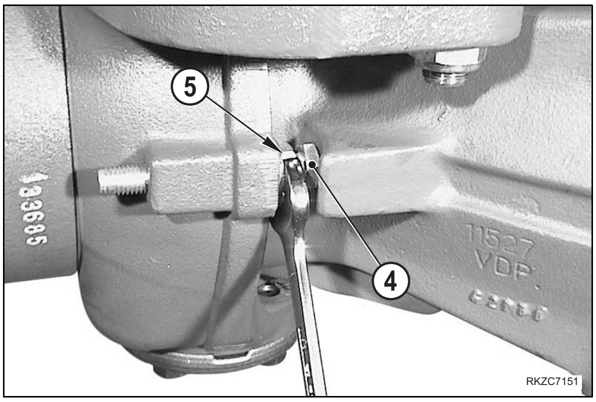
1 - Adjust a protractor to the requested angle and position it on the long bar.
Move a wheel side till it forms, with the two bars, the angle fixed by the protractor.


RKZC7140

2 - Adjust the mechanical steering stop, screwing in or out the stop bolt (4), locking them with the locknut (5).

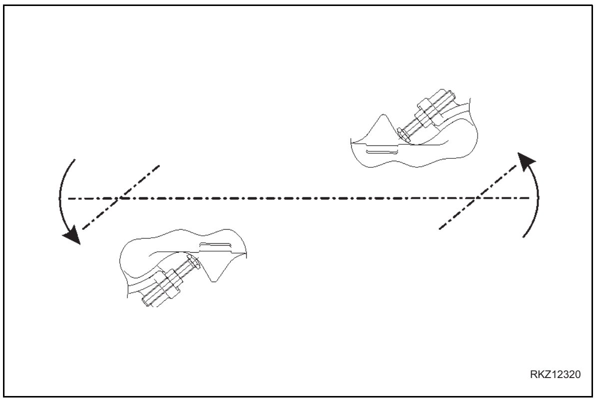
Nuts: 150 Nm

★ Apply the prescribed sealant on the thread of the screws.

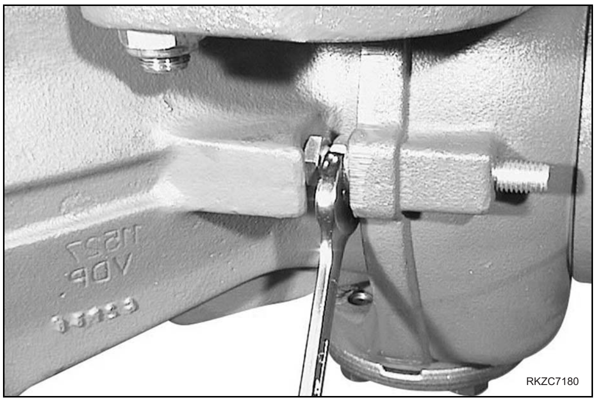


RKZC7151

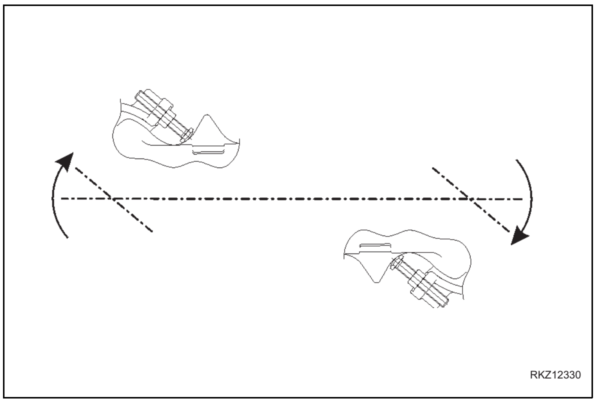
⚠ Check the position of the stops on the opposite side, both screws must touch the steering stop pads at the same time.


RKZ12320

3 - Steer completely towards the other side and repeat the same operations.



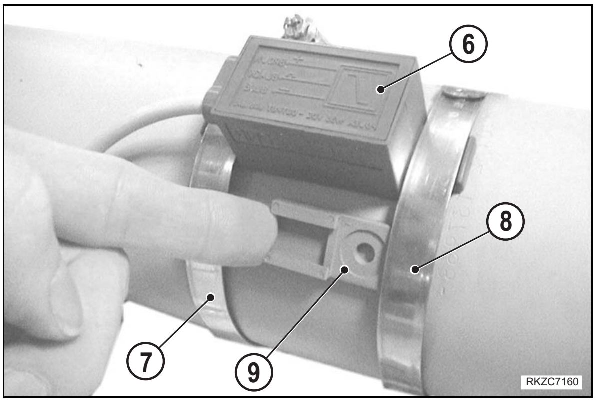
⚠ Check the position of the stops on the opposite side, both screws must touch the steering stop pads at the same time.



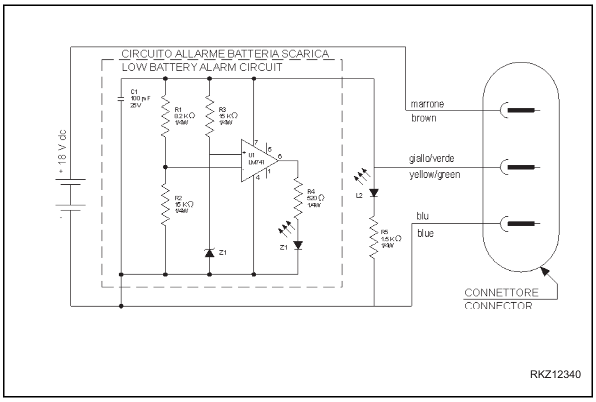
4 - Assemble the steering sensor (6) on the cylinder with relative clamps (8) and (9).

★ Do not lock the clamps.

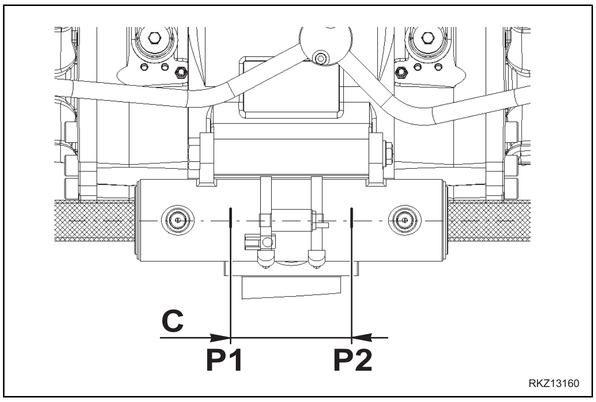
5 - Insert into the clamp (8) the plastic support (7) as shown.



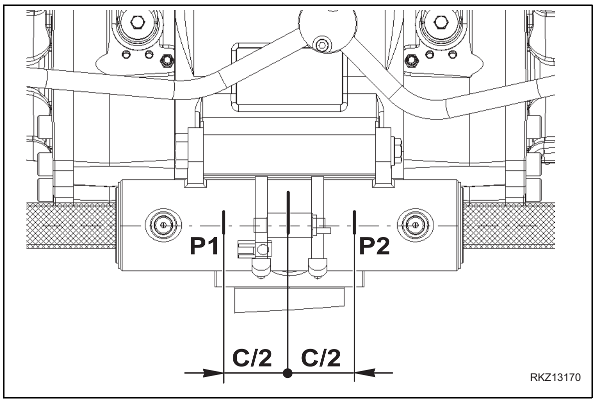
6 - Connect the steering sensor (6) with the special testing system **E25**.
Supply 18 V dc with a battery to the testing system.



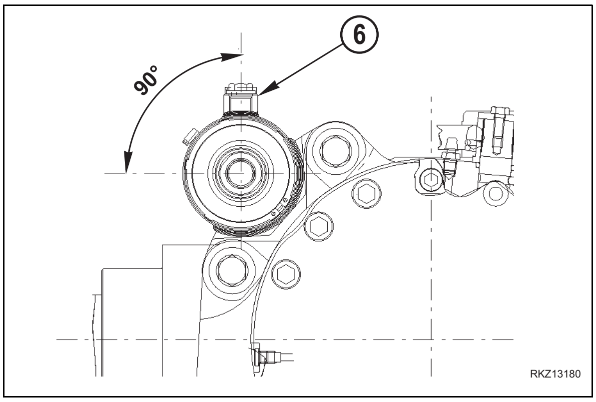
7 - Adjust the steering sensor (6) on the cylinder carrying out the following operations:
   1 - slide horizzontally the steering sensor on the cylinder surface till led is on (position "P1");
   2 - slowly, slide again the sensor till led is off in the same direction (position "P2").
   3 - measure the stroke (C) between position "P1" and "P2";



   4 - set sensor right in the middle between position "P1" and "P2" with tolerance ±1mm.

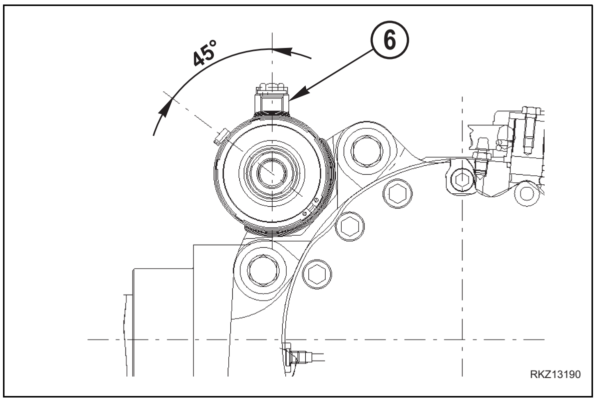


   5 - turn the sensor (6) in the shown position;

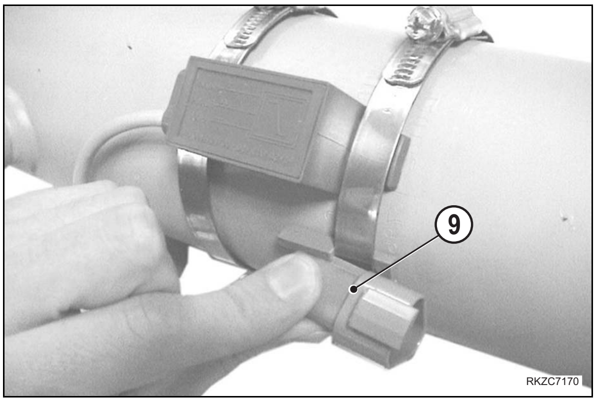


6 - lock the sensor with the clamps (8) and (9).

★ The clamps must be tightened with the screw head in the shown position.



7 - Assemble the electrical connector to the plastic support (7) as shown.



11 Testing methods

1 - With engine off, lift the axle so that the tyres get away from the ground.

2 - Engage the gear so that the pinion gets locked.

3 - With the help of another person standing on the opposite side, begin the assembly testing by rotating as much as possible both the wheels forward.
(Both the wheels should get blocked after a while.)

4 - Keeping the pinion locked, free the right wheel and rotate the left one in the line of march. Rotate the right wheels in the opposite direction. The wheel will move freely without difficulty and the right wheel will move in the opposite direction if the assembly has been carried out correctly.
Repeat the same operation in the opposite direction (reverse gear).

5 - IF ONE WHEEL DOES NOT ROTATE FREELY IN BOTH DIRECTIONS, then check step by step all assembly operations.
Check and see that the brakes are regulated correctly and functioning properly.

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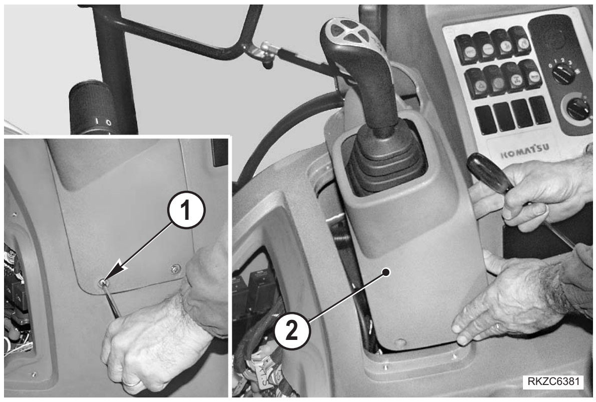
SHOVEL PPC VALVE

Removal

⚠ Lower the working equipment completely until it rests on the ground; engage the parking brake, stop the engine and remove the ignition key.

⚠ Release all residual pressure from all circuits. (For details, see "20 TESTING AND ADJUSTMENTS").

1 - Remove four screws (1) and remove PPC valve and parking brake casing (2).

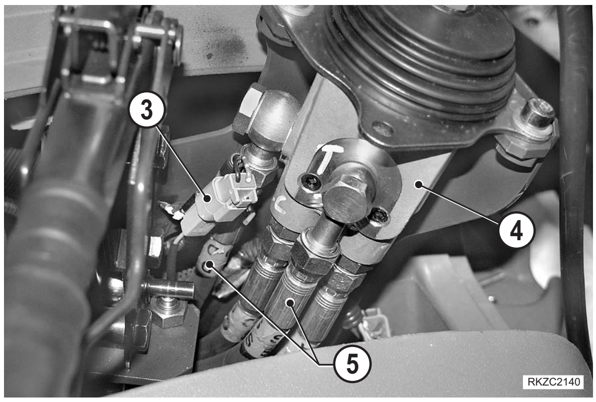


2 - Disconnect the connector (3).

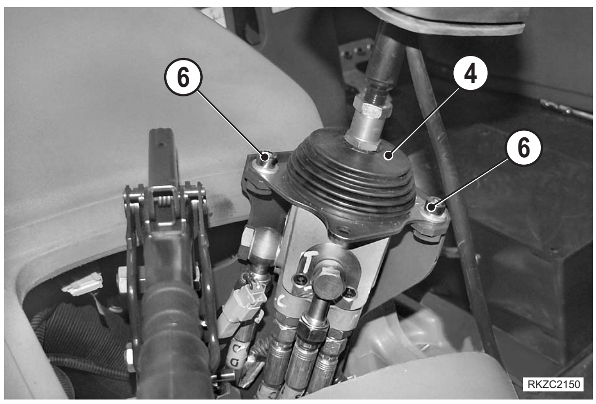
3 - Disconnect five hoses (5) from PPC valve (4).

★ Check to ensure that hoses are marked; scribble match marks if necessary. [*1]

★ Cap the hoses and holes to prevent contamination.



4 - Loosen and remove screws (6) and remove the complete PPC valve (4).

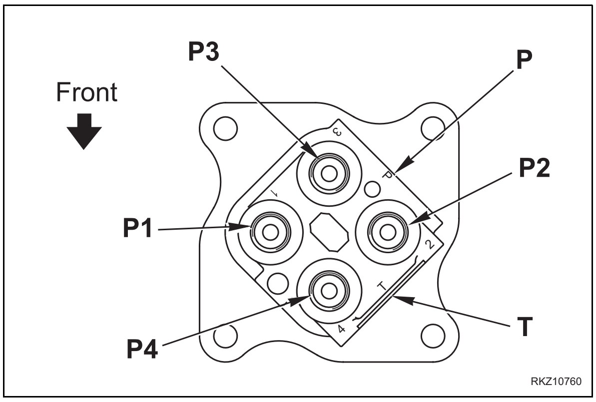


Installation

- To install, reverse removal procedure.

[*1]

★ Carefully inspect the hoses for the proper position when connecting them.
(For details, see "10 STRUCTURE AND FUNCTION").

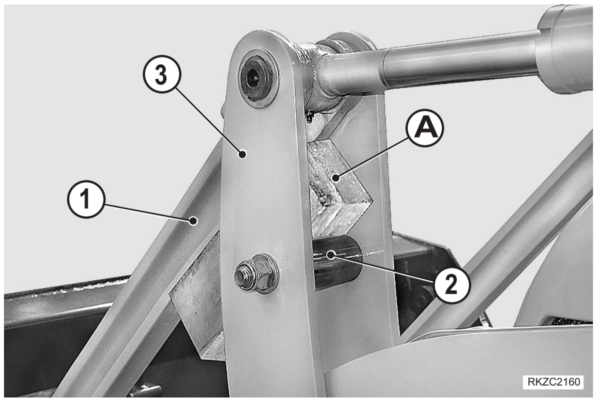


SHOVEL LIFT CYLINDERS

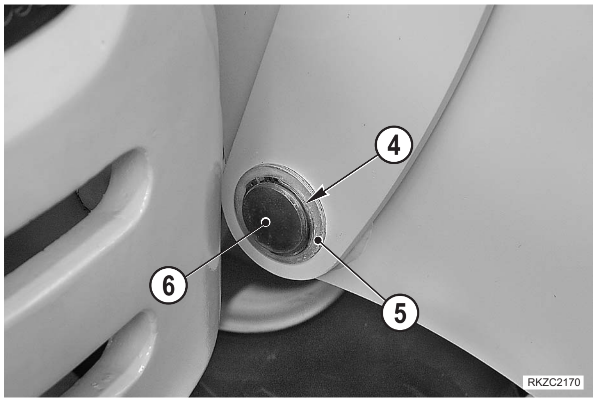
Removal

⚠ Fully lower the front working equipment until it rests on the ground; apply the parking brake, and stop the engine.

1 - Introduce non-slip blocks "**A**" between the shovel dump tie bar (1) and the spacer (2) of the fulcrum lever (3) on removal side.



2 - Take off the snap-ring (4) and the internal retaining spacer (5) for the piston attachment pin (6).



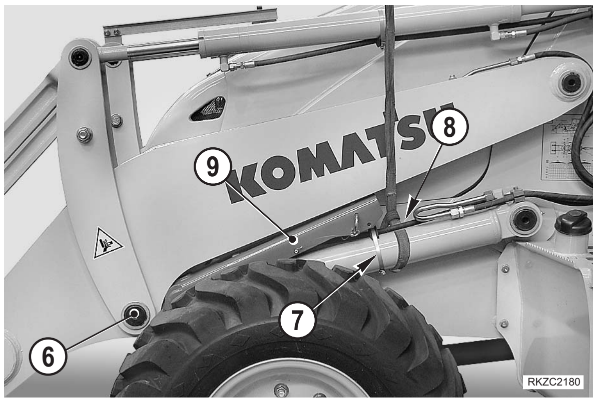
3 - Remove the tie strap (7) retaining the piston return hose (8).

4 - Place a sling around the cylinder and connect it to a hoisting device.

★ Do not engage the piston return hose with the sling.

5 - Extract pin (6) to expose piston eye and safety rod (9).

6 - Remove rod.

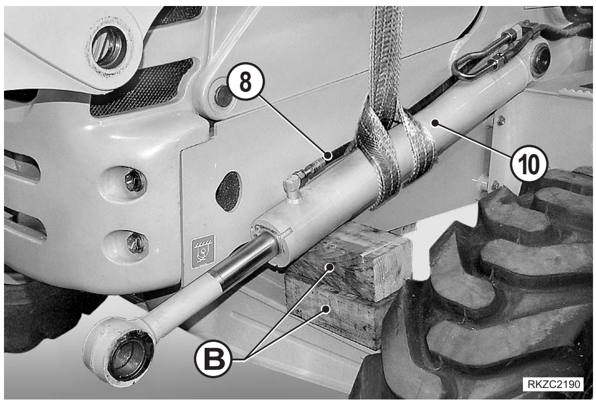


7 - Lower cylinder (10) until it rests on blocks "**B**".

8 - Start the engine to retract the piston.

[*1] [*2]

⚠ Stop the engine and eliminate residual pressure.



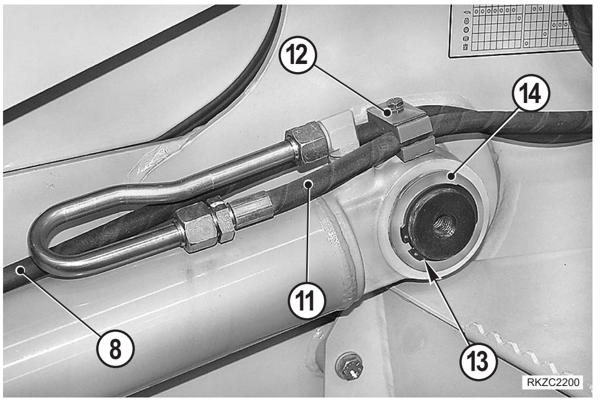
8 - Remove hoses (8) and (11), and remove hose clamp (12).

★ Cap pipes, hoses and holes to prevent contamination.

9 - Remove the snap-ring (13) and the spacer (14).

10 - Remove cylinder (10).

Cylinder: approx. 46 kg



Installation

- To install, reverse 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.

SHOVEL DUMP CYLINDERS

Removal

⚠ Fully lower the working equipment to the ground; apply the parking brake, and stop the engine.

1 -Remove the strap retaining the piston return hose (1).

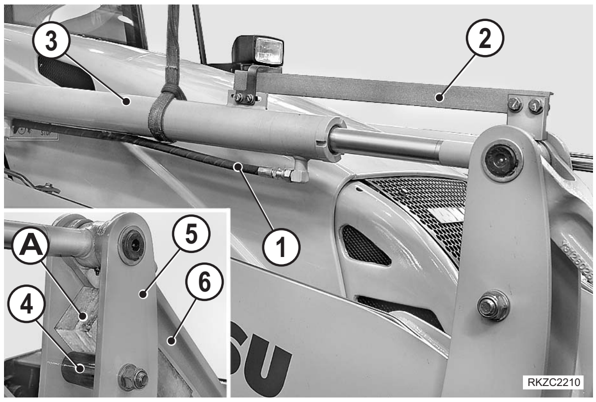
For the right-hand cylinder only

★ If installed, disconnect the return-to-dig sensor, mark its location, and then remove the lift bracket.

2 -Remove shovel position rod (2).

3 -Place a sling round the cylinder (3) and insert a block "**A**" between the spacer (4) of the piston fulcrum lever (5) and the link (6).

★ Do not engage the piston return hose with the sling.



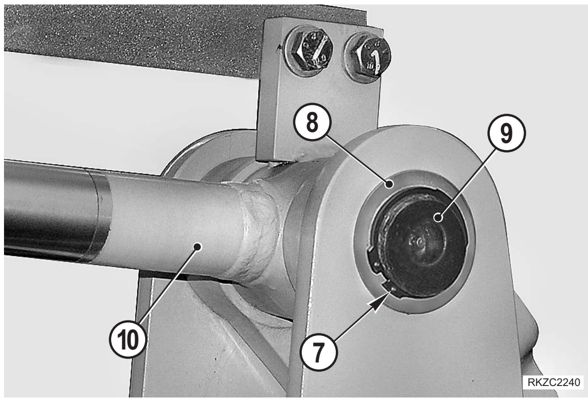
4 -Take off the snap-ring (7) and the internal retaining spacer (8) for the piston attachment pin (9).

5 -Extract pin (9) to expose piston eye.

6 -Start the engine to retract the piston(10).

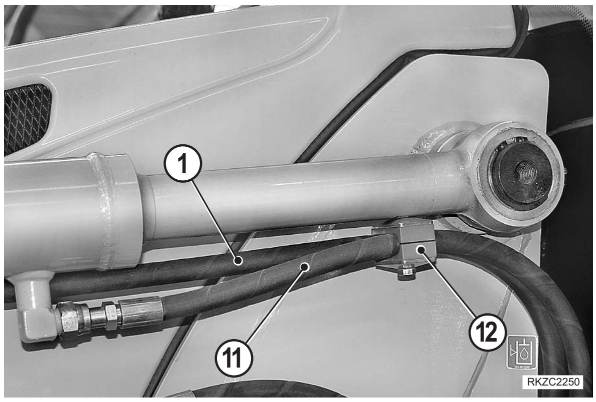
[*1] [*2]

⚠ Stop the engine and eliminate completely residual pressure from all circuits.



7 -Remove hoses (1) and (11), and remove hose clamp (12).

★ Cap the hoses and holes to prevent contamination.

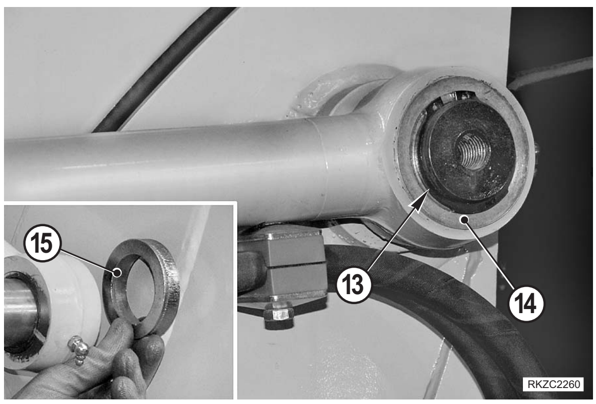


8 -Remove the snap-ring (13) and the spacer (14).

9 -Remove cylinder (3).

Tilt cylinder; approx 35 kg

★ Recover spacer (15) between frame and cylinder.



Installation

- To install, reverse 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.

Machines equipped with return-to-dig only

2 - Check sensor position and adjust as necessary.
(For details, see "20 TESTING AND ADJUSTMENTS").

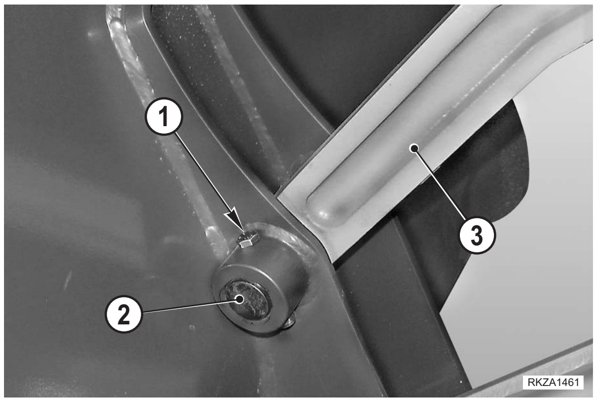
SHOVEL

Removal

⚠ Lower the shovel to the ground, resting on its back, but without forcing it downwards.

1 -Stop the engine and release residual pressures.

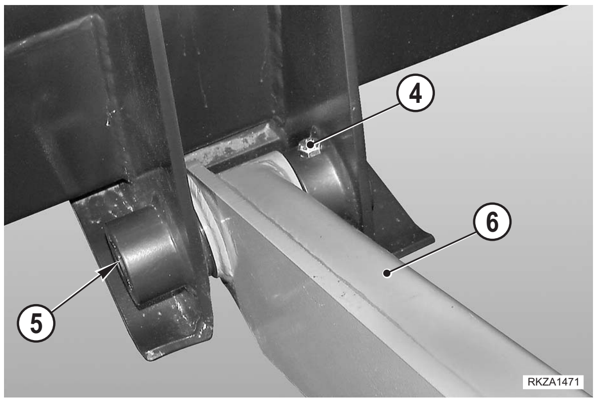
2 -Take out the screws (1) and remove the pins (2) of the lever (3).
Rest the lever (3) on the boom. [*1] [*2]



3 -Take out the screws (4) and remove the pins (5) of the shovel fulcrum. [*1] [*2]

4 -Start the engine and put the machine into reverse gear in order to disengage the boom (6).

Shovel: 436 kg



Installation

- To install, reverse 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

FRONT WORKING EQUIPMENT

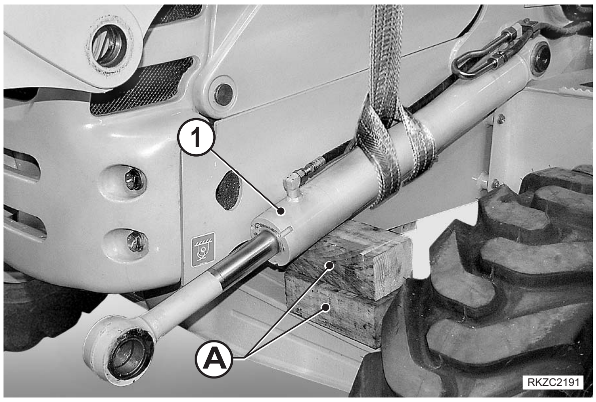
Removal

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

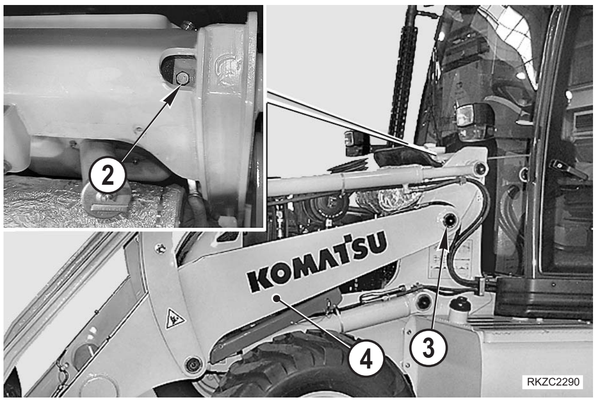
⚠ Release all residual pressure in all circuits. (For details, see "20 TESTING AND ADJUSTMENTS").

1 - Remove the tilt cylinders. (See "SHOVEL DUMP CYLINDERS").

2 - Disconnect the cylinders from the boom (1) and rest them on wooden blocks «**A**» placed on the front axle. (See "SHOVEL LIFT CYLINDERS").



3 - Open the front hood and take out the screws (2) that lock the axle oscillation pins (3) of the boom (4).
Close the front hood.



4 - Put a sling round the boom (4) as shown in the figure, and attach it to the hoisting tackle. Apply a slight tension to the cables.

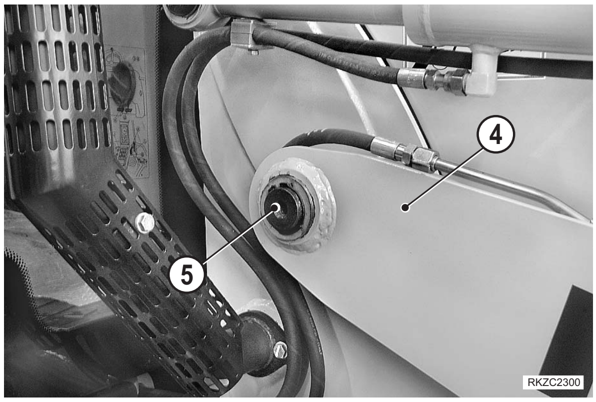
5 - Using a puller, remove the oscillation pins (5) of the arm (4) together with snap ring and spacer.
[*1] [*2]

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 while the engine or gearshift is out of order 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.

Front equipment: approx. 1100 kg



Installation

- To install, reverse the removal procedure, if necessary using the front towing hook.

[*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

- 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.

BACKHOE PPC VALVES

Removal

⚠ The following removal procedure applies to both PPC valves.

1 - Lower the outriggers to the ground: fold the bucket and rest the arm on an “**A**” block, keeping it at right angles with the ground.

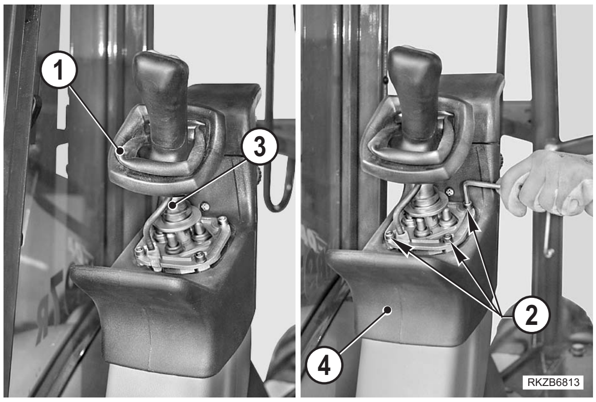
2 - Release the backhoe plate and stop the engine.

⚠ Release all residual pressure in all circuits. (For details, see "20 TESTING AND ADJUSTMENTS").

3 - Lift cab rear window up to the top.

4 - Fully raise the boot (1).

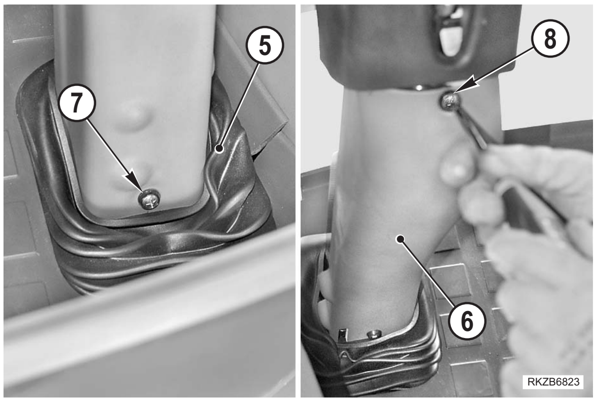
5 - Loosen and remove the screws (2) retaining the PPC valve (3) and armrest (4).



6 - Raise the armrest from the rear side and remove the screw (5) retaining the rear guard (6).

7 - Cut the retaining clamp and lower the lower boot (7).

8 - Loosen and remove screw (8), and remove rear guard (6).

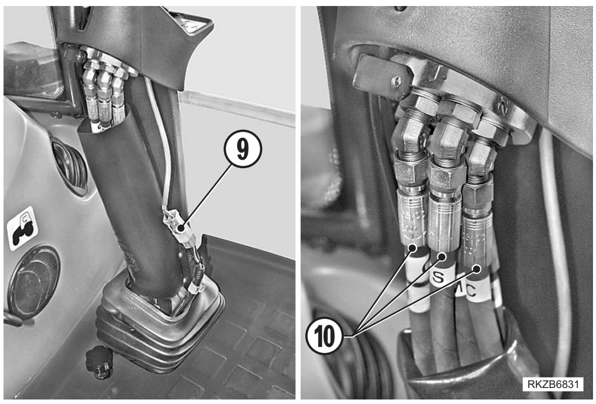


9 - Disconnect the connector (9).

10 - Ensure that the hoses are marked (10), then disconnect the hoses from the PPC valve. [*1]

★ Mark the hoses, if necessary.

★ Plug all pipes/hoses to prevent contamination.



11 -Remove the PPC valve (11).

Installation

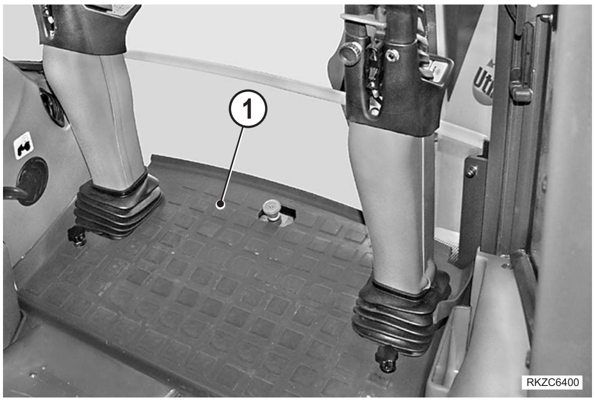
- To install, reverse removal procedure.
  ★ Carefully inspect the hoses for the proper position when connecting them.
  (For details, see "10 STRUCTURE AND FUNCTION").

PPC VALVE SUPPORT RELEASE CABLES

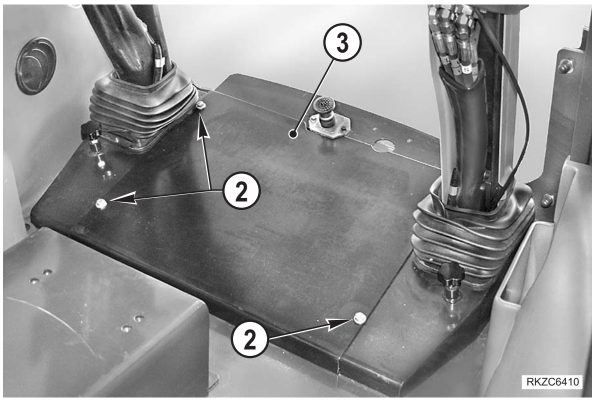
Removal

1 - Lower the outriggers and the equipment to the ground; stop the engine.

2 - Remove the rear mat (1).

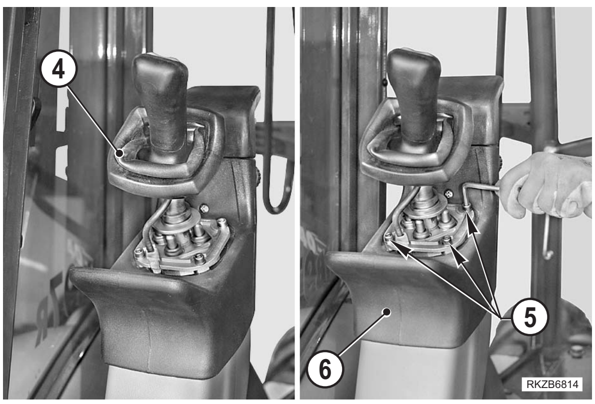


3 - Take out the screws (2) and remove the platform (3).



4 - Fully raise the boot (4).

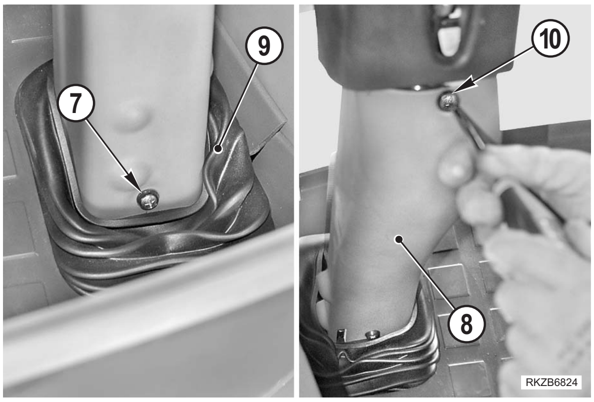
5 - Loosen and remove the screws (5) that retain the PPC valve and armrest (6).



6 - Raise the armrest from the rear side and remove the screw (7) retaining the rear guard (8).

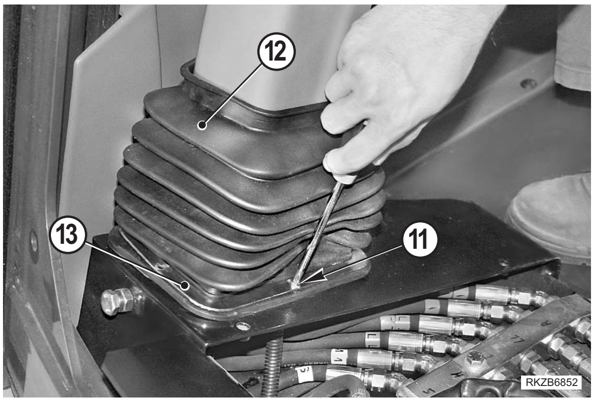
7 - Cut the retaining clamp and release the lower boot (9).

8 - Loosen and remove the screws (10) and remove the rear guard (8).



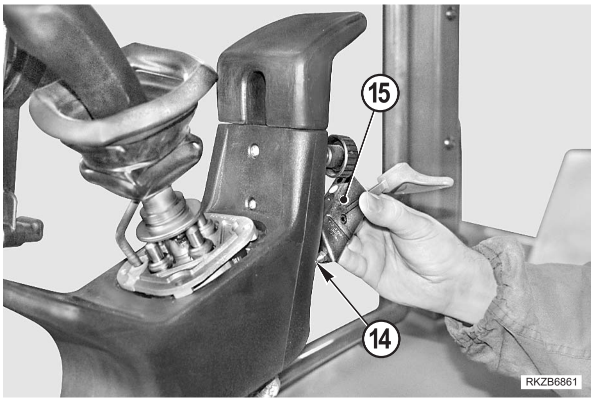
9 - Loosen and remove the screws (11) and raise the boot (12) and the retaining edge (13).

★ Raise until the lower fulcrum and locking assembly become fully disengaged.



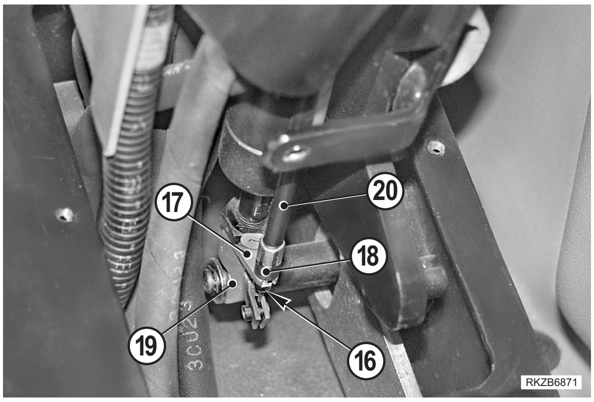
10 - Remove the retaining screws (14) from the lock-actuating lever assembly (15).

11 - Remove the entire lever assembly (15).

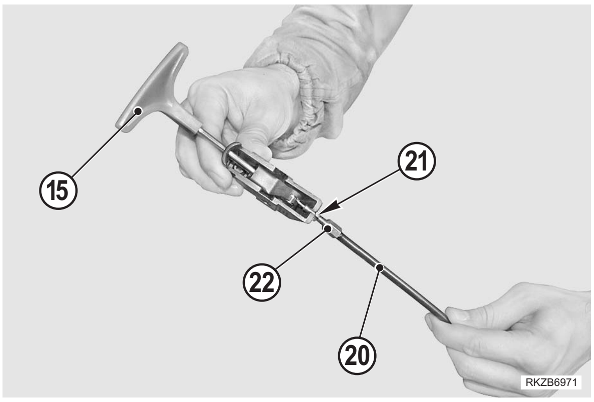


12 - Loosen the nut (16) and disengage the sheath (18) from the support (17).

13 - Disconnect the cable (20) from the lower locking lever (19).



14 - Loosen the nut (21) and unscrew the tensioner (22); disengage the control cable (20) from the release control lever (15).

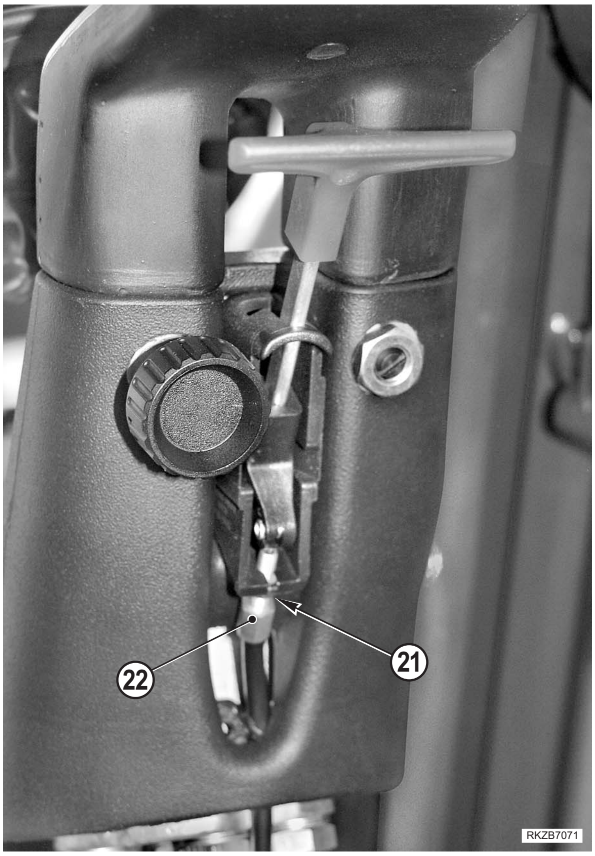


Installation and adjusting

- To install, reverse removal procedure.

1 - Using the tensioner (22), adjust cable tension to obtain safe locking and friction-free unlocking of the column.

2 - Lock the nut while holding the tensioner into position (21).

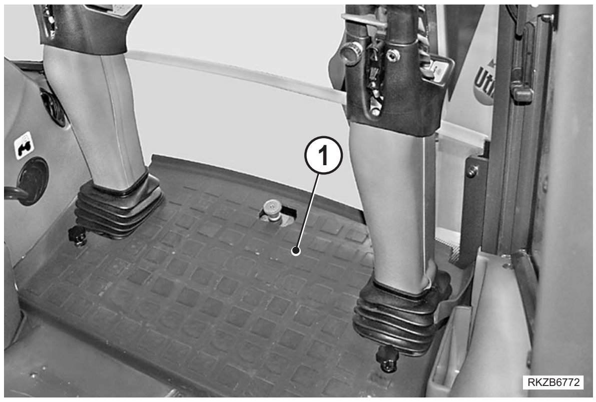


PPC VALVE SUPPORT RETURN GAS SPRING

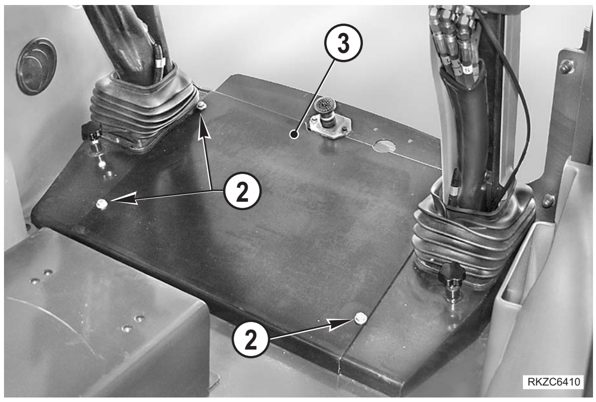
Removal

1 - Lower the outriggers and the equipment to the ground; stop the engine.

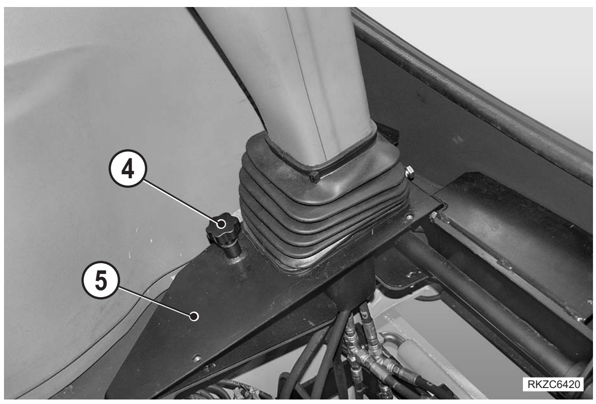
2 -Remove the rear mat (1).



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

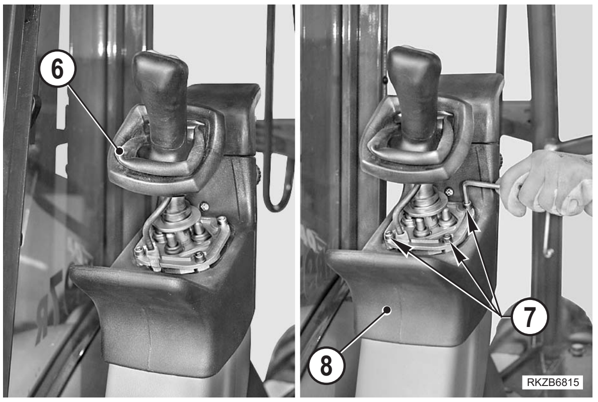


4 -Fully loosen the stop knob (4) of the PPC valve support (5) you are working on.



5 - Fully raise the boot (6).

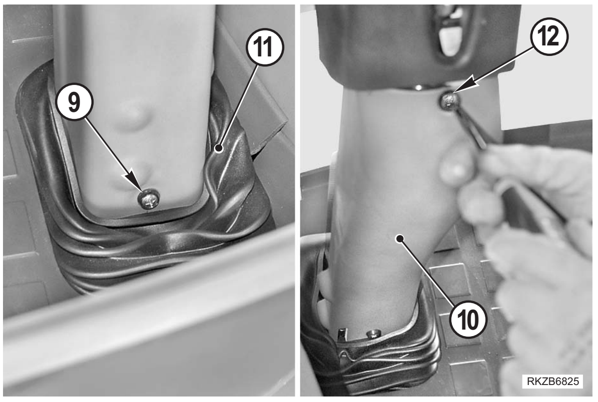
6 - Loosen and remove the screws (7) that retain the PPC valve and armrest (8).



7 - Raise the armrest from the rear side and remove the screw (9) retaining the rear guard (10).

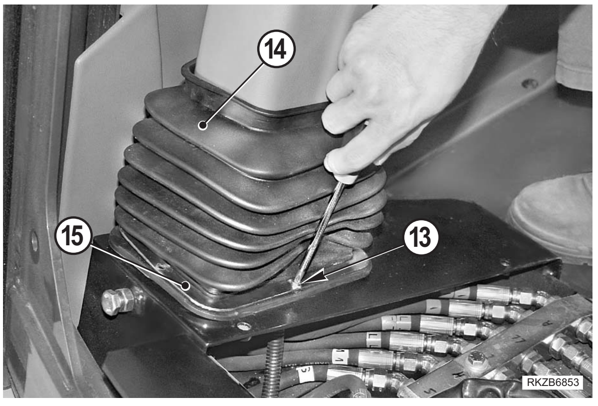
8 - Cut the retaining clamp and release the lower boot (11).

9 - Loosen and remove screw (12), and remove rear guard (10).



10 - Loosen and remove the screws (13) and raise the boot (14) and the retaining edge (15).

★ Raise until the gas spring (16) becomes fully disengaged.

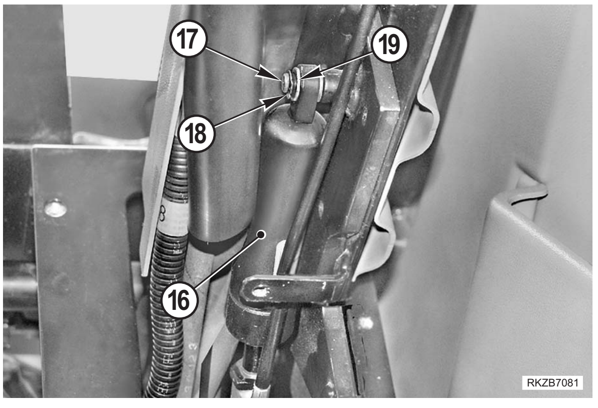


11- Loosen the nut (17) and remove the snap ring (18) and washer (19).

12- Disconnect the gas spring (16) and remove it.

Installation

- To install, reverse removal procedure.



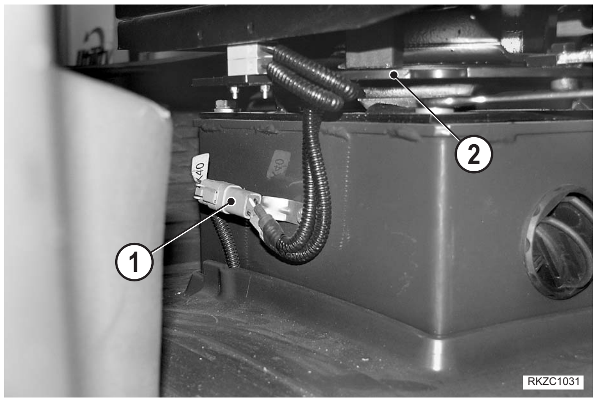
SOLENOID VALVE GROUP (servocontrol and optional attachment)

Removal

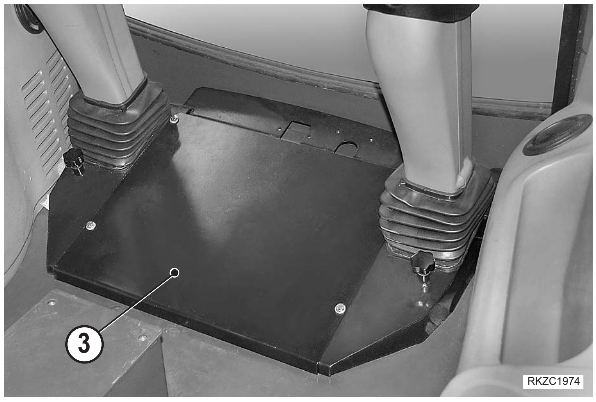
1 - Lower the outriggers and the equipment to the ground; engage the parking brake, stop the engine and extract the ignition key.

⚠ Release residual pressure from all circuits by moving all control levers in all directions.

2 - Disconnect the connector (1) and remove the seat (2).



3 - Remove the rear mat and remove the metal sheet (3) closing off the floor.



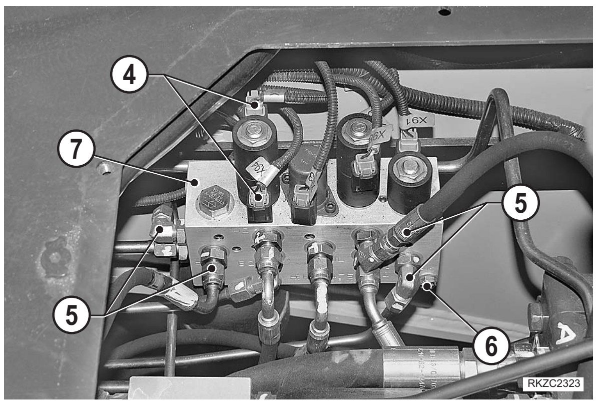
4 - Disconnect all connectors (4) from the solenoid valves .

★ Check to ensure that all connectors have marks scribbled on, and note down their plugging positions.

5 - Mark and disconnnect all hoses (5).

★ Cap pipes, hoses and holes to prevent contamination.

6 - Loosen and remove two screws (6) and washers; remove the solenoid valve group (7) together with the accumulator.



Installation

- To install, reverse removal procedure.

1 - Start the engine and perform all possible manoeuvres to eliminate the air from all circuits.

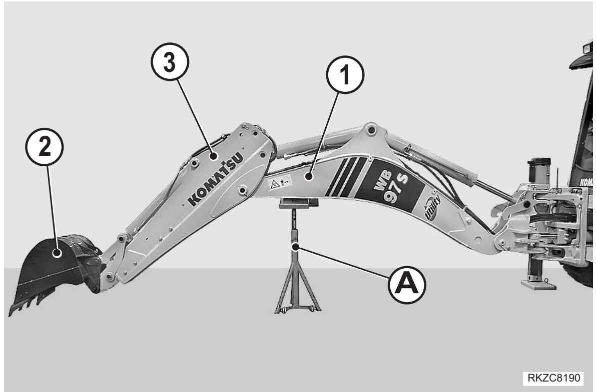
BACKHOE BOOM CYLINDER

Removal

1 - Fully extend the arm (1) and fully open the bucket (2). Manoeuvre the boom until the outer end of the boom is in a level position.

2 - Place and force a jack stand "**A**" and a non-slip block under the boom.

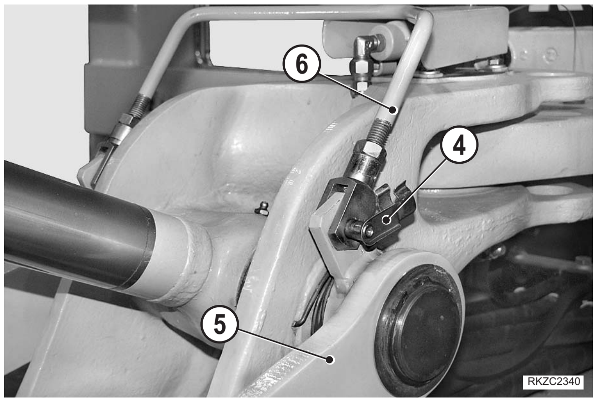
3 - Lower the arm until the bucket teeth touch the ground.



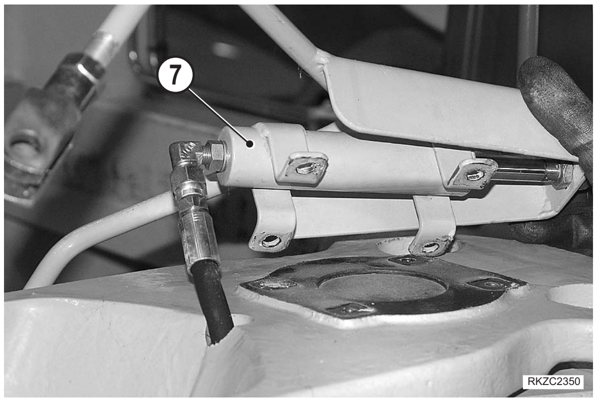
4 - Lower the outriggers to the ground, apply the parking brake, and stop the engine.

⚠ Release residual pressure from all circuits by operating the control levers in all directions.

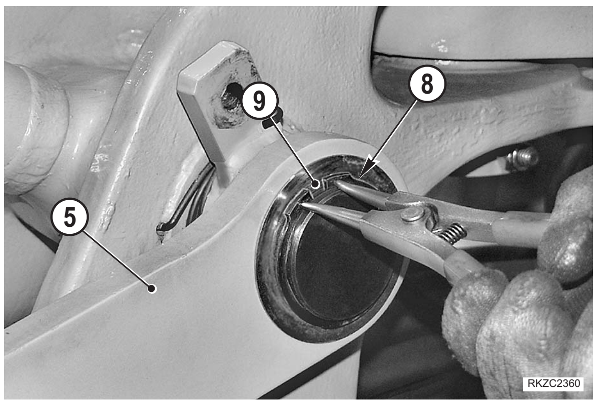
5 - Remove pins (4) and disconnect tie rod (6) from boom retaining lever (5).



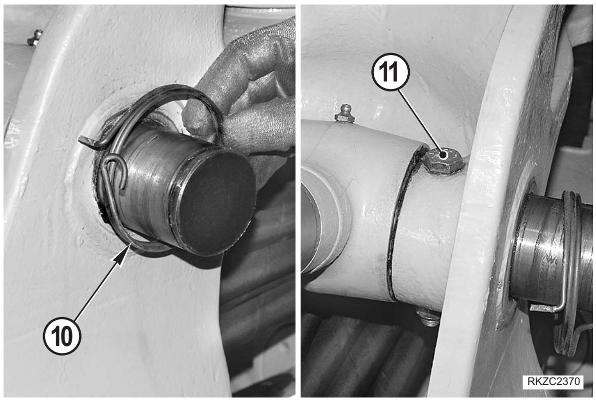
6 - Loosen and remove the screws, remove the group (7) controlling the levers (5) and position it aside.



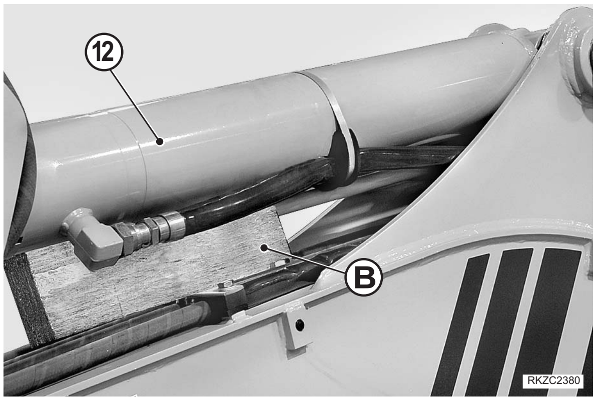
7 - Remove snap rings (8), shims (9), and levers (5).



8 - Remove springs (10), and remove the nut and screw (11) retaining the piston attachment pin.



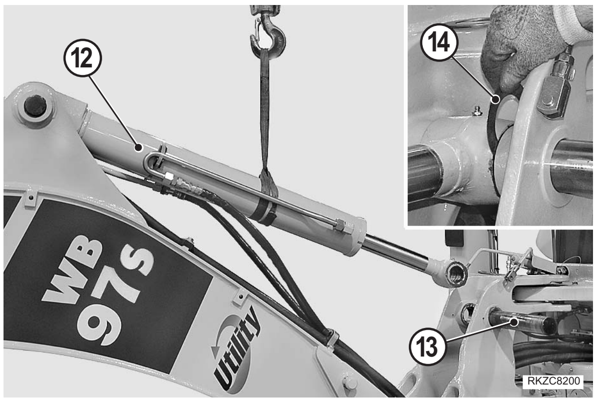
9 - Place a safety block "**B**" under the cylinder (12) controlling the arm.



10 - Sling the cylinder (12) in a band and connect it to a hoisting device; apply a slight tension.

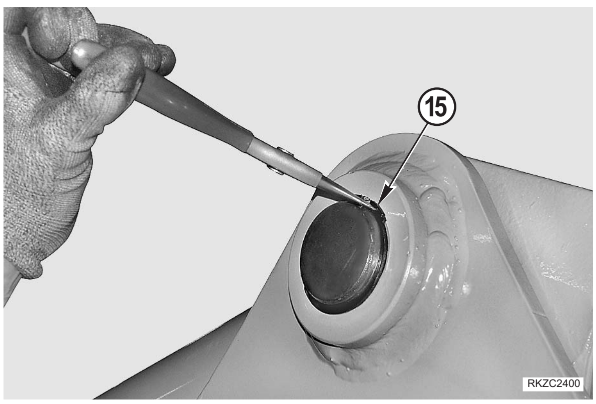
★ Do not engage the hoses with the band.

11 - Pull out pin (13) and recover spacers (14).
[*1] [*2]



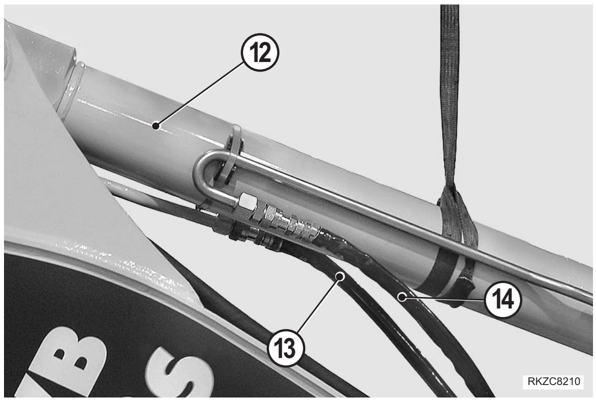
12 - Start the engine and retract the piston.
Stop the engine and release residual pressures.

13 - Remove snap ring (15).



14 - Disconnect hoses (13) and (14) from cylinder (12).

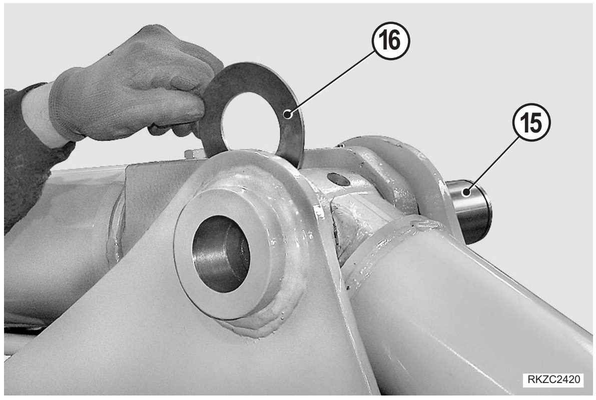
★ Cap pipes, hoses and holes to prevent contamination.



15 - Pull out pin (15) and remove cylinder (12).

★ Recover shims (16) and note down their position of installation between boom and cylinder and between boom and arm. [*1] [*2]

Cylinder: 87.5 kg



Installation

- To install, reverse 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.

ARM CYLINDER

Removal

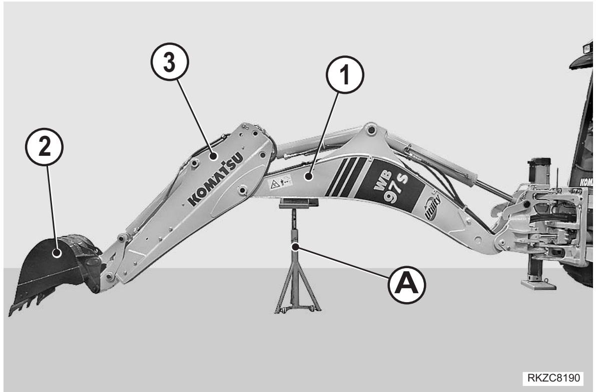
1 - Fully extend the arm (1) and fully open the bucket (2). Manoeuvre the boom until the outer end of the boom is in a level position.

2 - Place and force a jack stand "**A**" and a non-slip block under the boom.

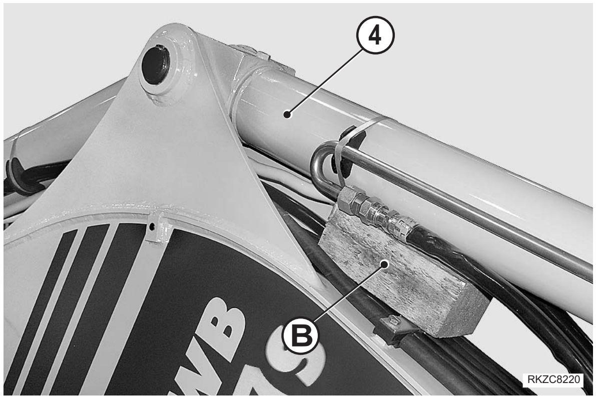
3 - Lower arm (3) until bucket teeth touch the ground.

4 - Lower the outriggers to the ground, apply the parking brake, and stop the engine.

⚠ Release residual pressure from all circuits by operating all hydraulic controls in all directions.



5 - Force a block "**B**" under the boom cylinder (4).

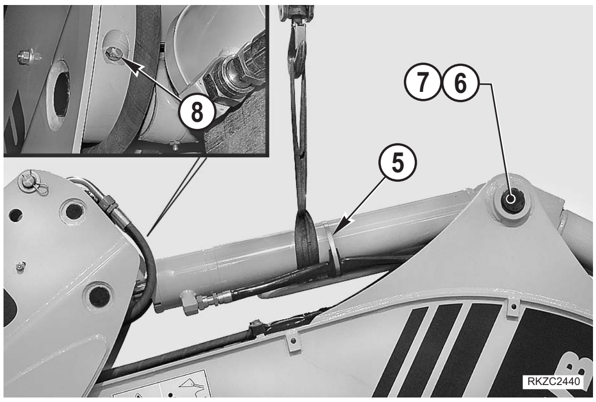


6 - Remove the strap (5) retaining the hoses.

7 - Sling the cylinder (4) in a band and connect it to a hoisting device; apply a slight tension.

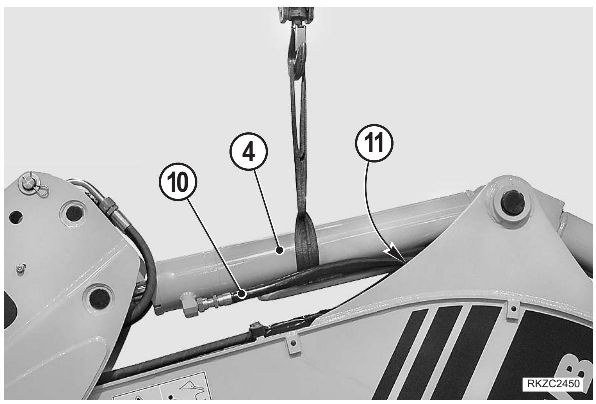
★ Do not engage the hoses with the band.

8 - Remove the snap ring (6) retaining the cylinder fulcrum pin (7) and the screw (8) retaining the piston pin (9).

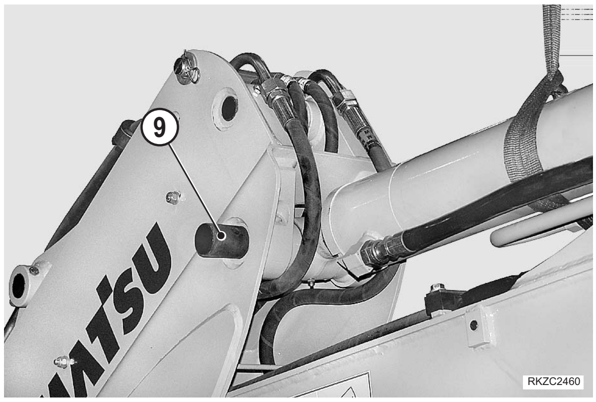


9 - Disconnect hoses (10) and (11) from cylinder (4).

★ Cap pipes, hoses and holes to prevent contamination.



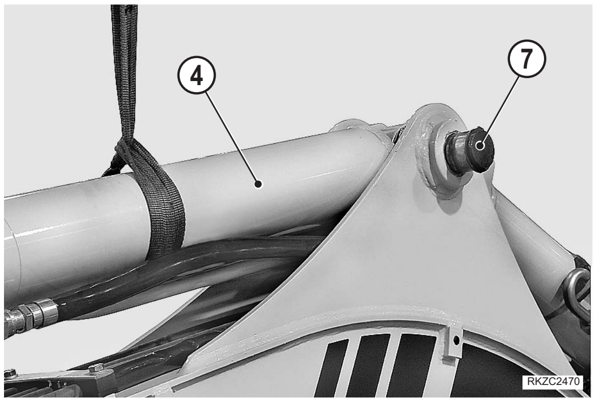
10 -Pull out the piston attachment pin (9).
[*1] [*2]



11 -Pull out the cylinder attachment pin (7) until the eye of cylinder (4) is exposed. [*1] [*2]

12 -Remove cylinder (4) and recover shims (if any).

Arm cylinders: 67 kg



Installation

- To install, reverse 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]

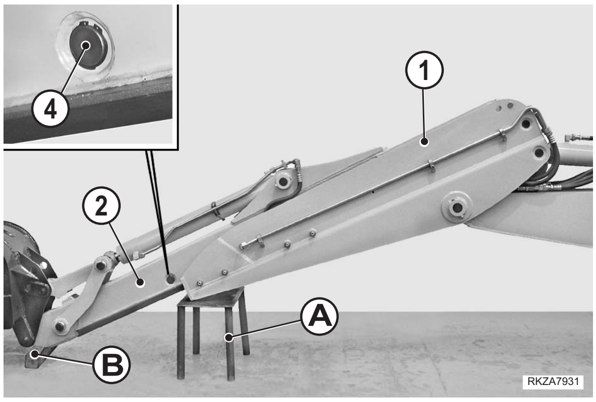
Internal bushing: ASL800050

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.

JIG ARM CYLINDER

Removal

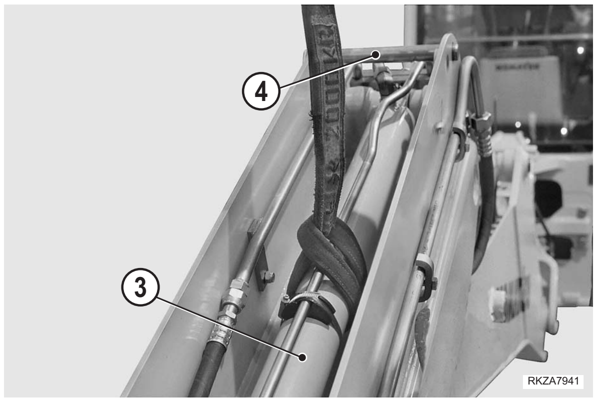


⚠ Open the arm (1) completely and lower it until it rests on a trestle "**A**" that is roughly 40 cm high. Extend the jig arm (2) until it rests on a block "**B**", and let the bucket teeth rest on the ground.

1 - Stop the engine and release the cylinder (3) pressures, by moving the command pedal several times.

2 - Place a sling around the cylinder (3).

3 - Take off the snap ring and remove the pin (4). [*1] [*2]



4 - Start the engine to retract the piston.

5 - Stop the engine and release residual hydraulic pressure from all circuits by operating the control levers in all directions.

6 - Take out the safety pin (5).

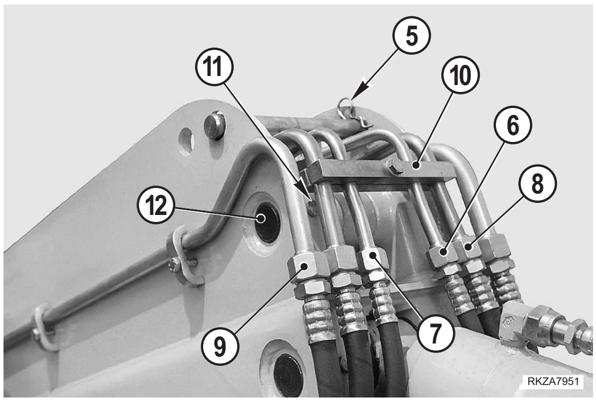
7 - Disconnect the tubes (6), (7), (8) and (9).

★ Cap pipes, hoses and holes to prevent contamination.

8 - Remove the clamp (10).

9 - Remove the screws (11) and the pin (12). [*1] [*2]

10 - Remove cylinder (3).



Installation

- To install, reverse 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.

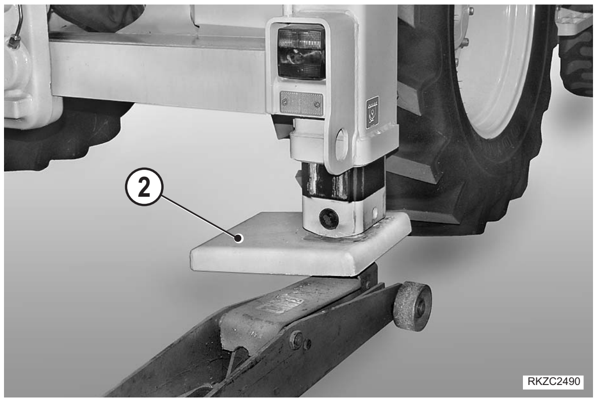
OUTRIGGER CYLINDER

Removal

⚠ Set the backhoe with the centered attachments with the arm in vertical position and the bucket leaned on the back at level ground.

1 - Extend the outriggers (1) of about 15 cm, stop the engine and release the cylinders pressures.

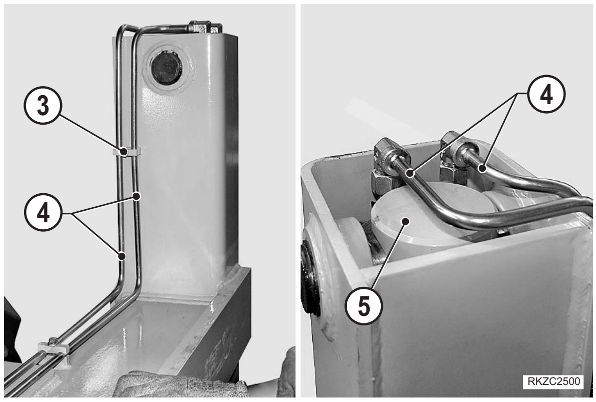
2 - Place a lifting platform "**A**" beneath outrigger (2) of cylinder to be remove.
Raise this until it is forced up against the outrigger.



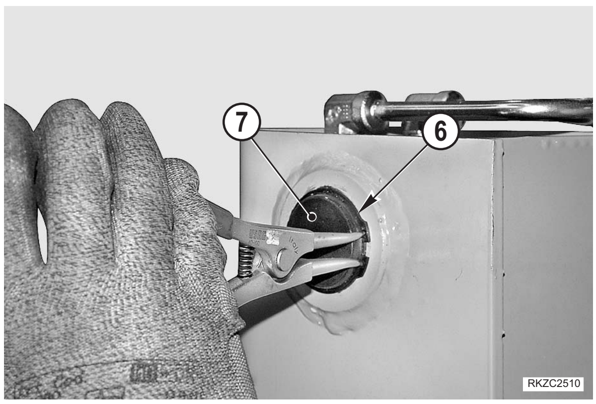
3 - Remove the clamps (3) retaining the pipes (4).

4 - Disconnect from cylinder (5) the pipes (4) and plug them to avoid impurity entry.

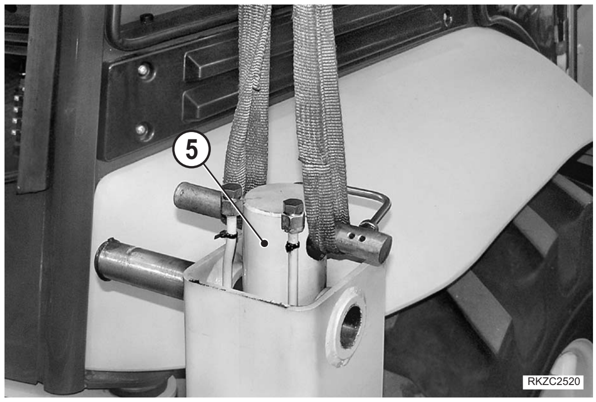
★ Plug also the union to avoid the movement of piston.



5 - Take off snap ring (6) and slide pin (7) out until cylinder (5) is disengaged. [*1] [*2]



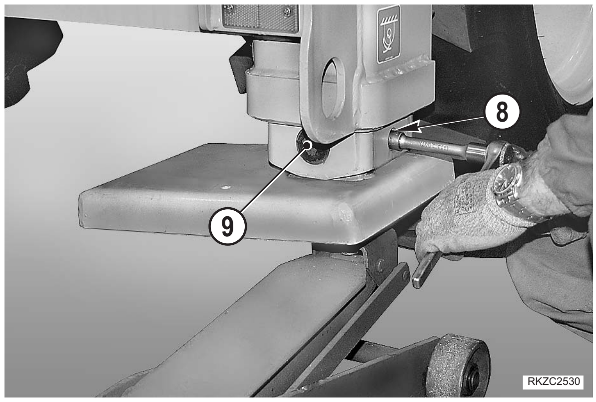
6 - Raise the lifting platform “**A**” to disengage the cylinder head (5) from frame.
Place a sling round the cylinder (5) and apply slight tension to the cables.



7 - Take out the screws and remove the pin (10).
[*1] [*2]

8 - Remove the cylinder(5).

Cylinder: approx. 27.5 kg



Installation

- To install, reverse removal procedure.

[*1]

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").

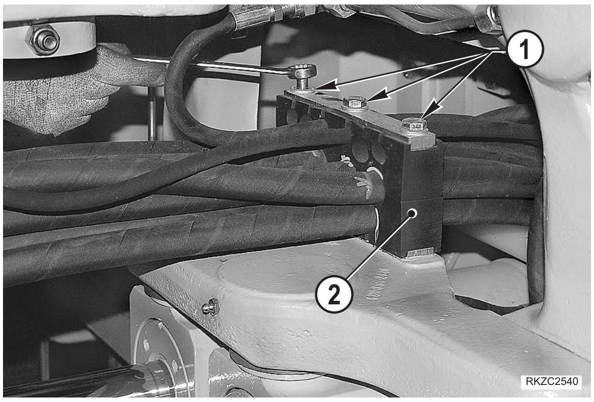
★ After bleeding the air, check the oil level in the tank.

BACKHOE SWING CYLINDERS

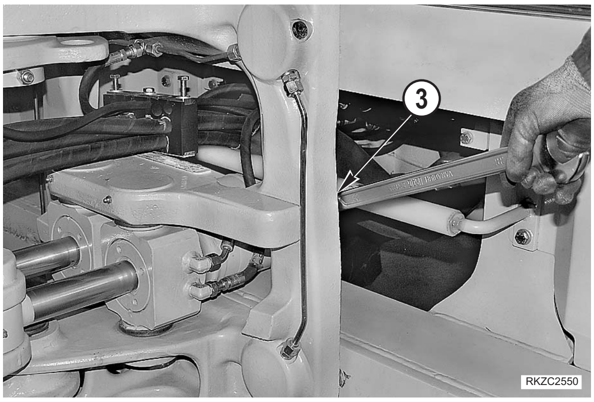
Removal

⚠ Set the backhoe with the centered attachments with the arm in vertical position and the bucket leaned on the back at level ground.

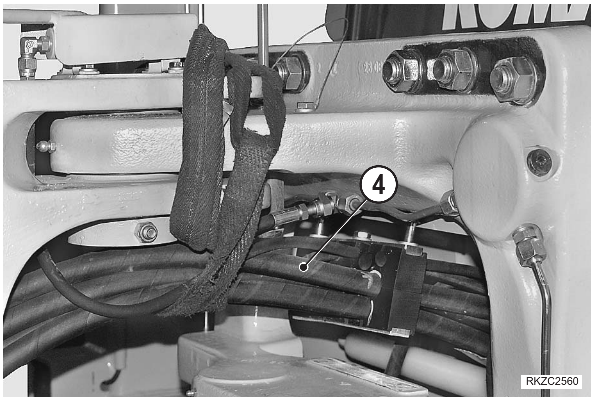
1 -Stop the engine and release all cylinder pressure by moving the lockout control several times.



2 -Loosen and remove screws (1) and release hose clamp (2).

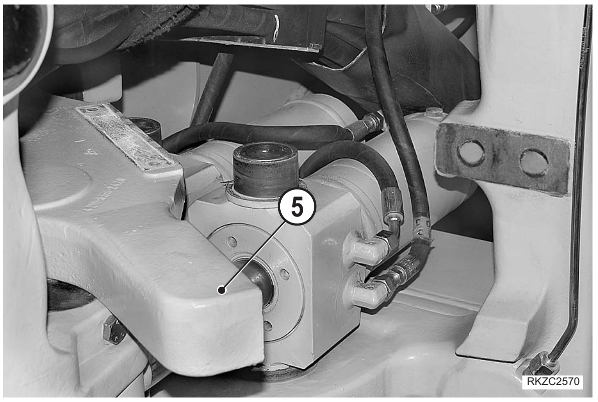


3 -Loosen and remove the four screws (3) and washers. [*1]



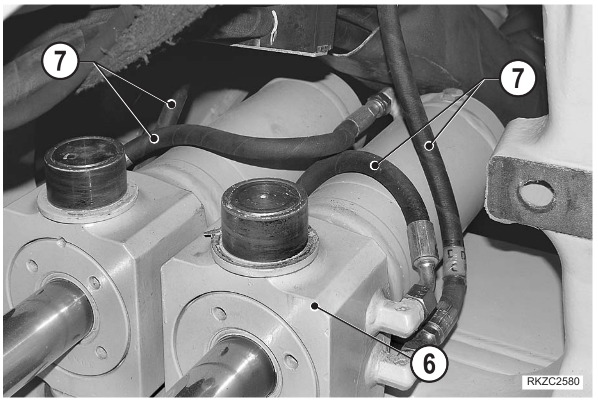
4 -Lift the hoses (4) to the backhoe cylinders and retain them in position with a band.

5 - Remove the upper support (5) with a vertical movement. [*3]



6 - Disconnect four tubes (6) from cylinders (7).

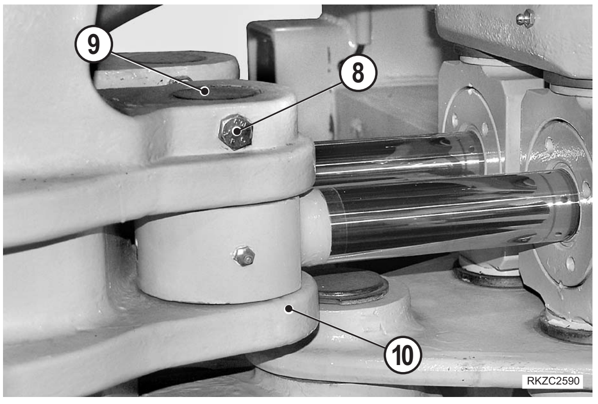
★ Cap pipes, hoses and holes to prevent contamination.



7 - Take out the screws (8) and remove the pins (9).

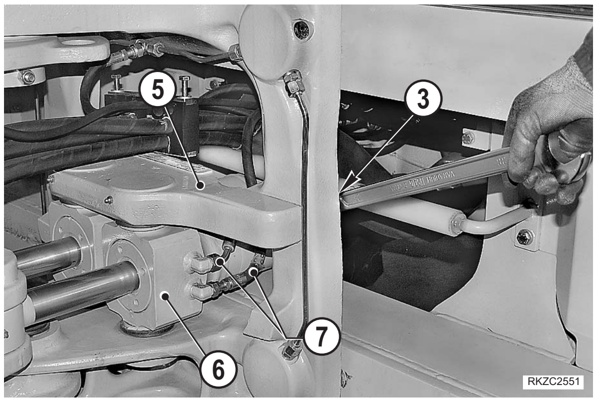
8 - Rotate the cylinders to disengage the piston heads from the swing bracket (10) and remove the cylinders (6).

Cylinder: approx. 34 kg



Installation

1 - Mount the cylinders (6) and the upper cylinder fulcrum support (2). Secure the support with the four screws (3).



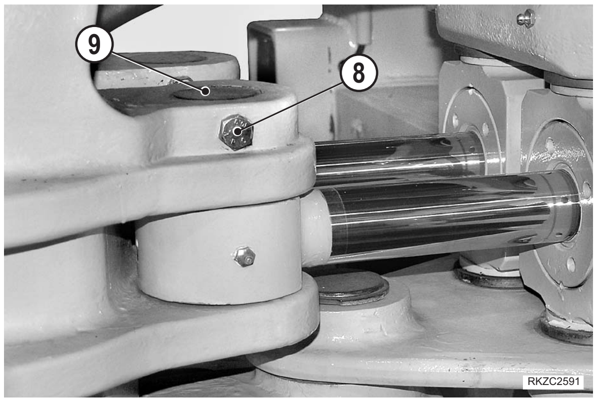
[*1]

Support screws: Loctite 262

Support screws: 981±98 Nm

2 - Connect the four tubes (7) 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.



[*2]

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.

[*3]

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.

BACKHOE BUCKET CYLINDER

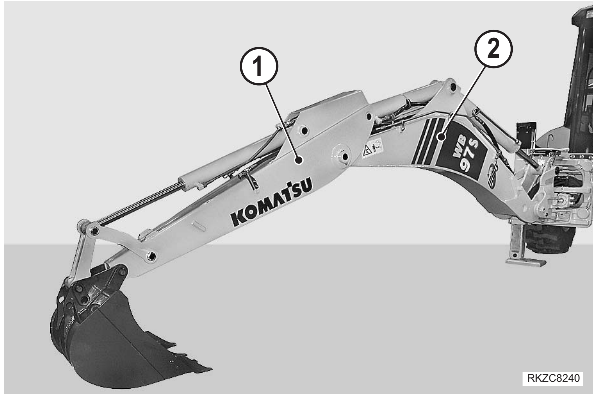
Removal

1 -Extend the arm (1).

2 -Operate the boom (2) and bucket (3) until bottom of bucket sits level.

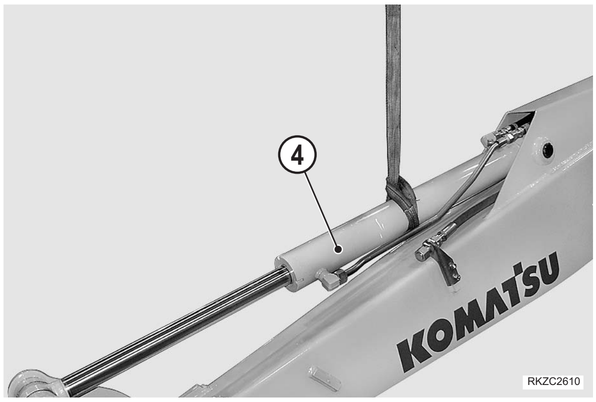
3 -Lower the outriggers to the ground, apply the parking brake, and stop the engine.

⚠ Release residual pressure from all circuits by operating the control levers in all directions.



4 -Sling the cylinder (4) in a band and connect it to a hoisting device; apply a slight tension.

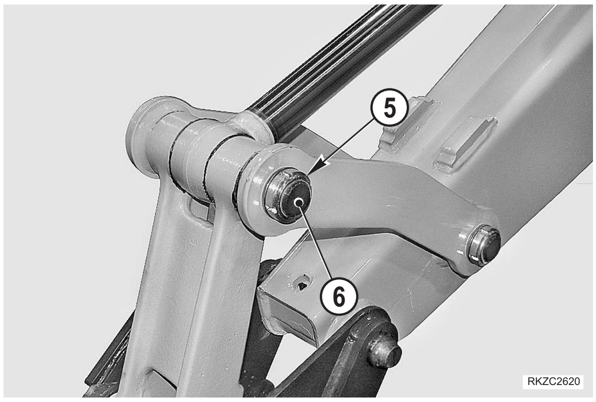
★ Do not engage the hoses with the band.



5 -Take out the lock-nut (5) and the washer and remove the pin (6). [*1] [*2] [*3]

6 -Start the engine and retract the piston.

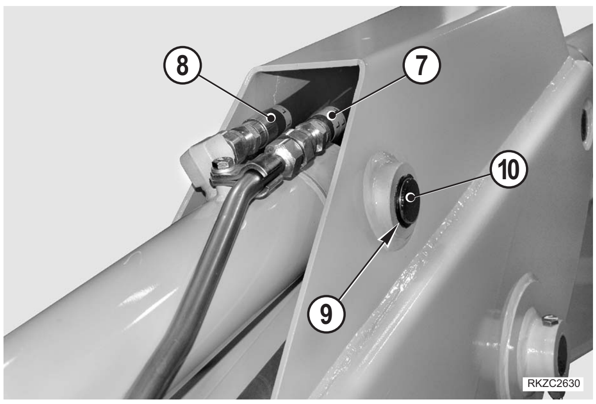
⚠ Stop the engine and release residual pressures.



7 -Disconnect the tubes (7) and (8).

★ Cap pipes, hoses and holes to prevent contamination.

8 -Take off the snap ring (9) and remove the pin (10). [*1] [*2]



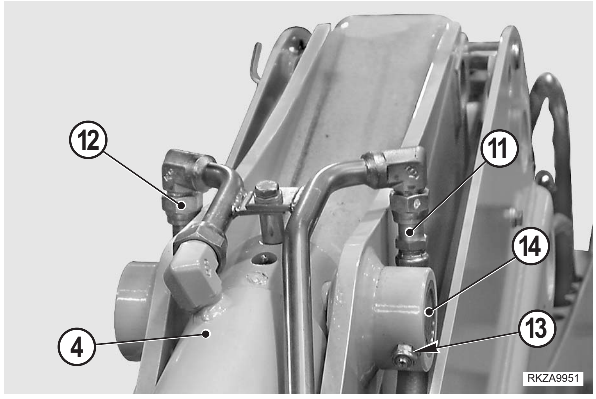
Versions with jig arm only

9 - Disconnect the tubes (11) and (12).

10 - Take out screw (13) and remove pin (14).
[*1] [*2]

11 - Remove cylinder (4).

Standard cylinder: approx. 52.5 kg



Installation

- To install, reverse 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.

BACKHOE BOOM SAFETY CYLINDER

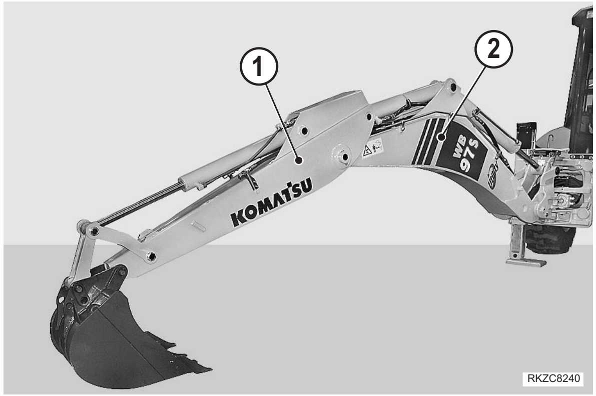
Removal

1 -Extend the arm (1).

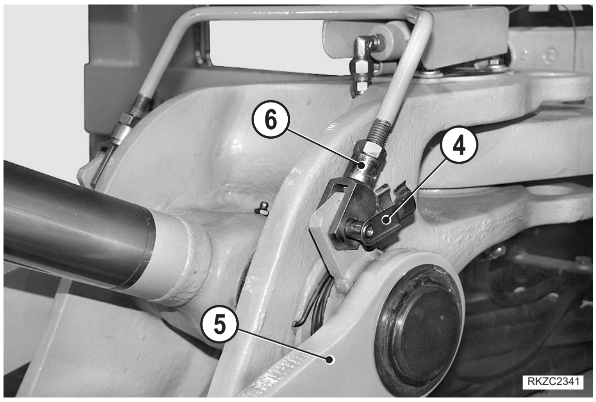
2 -Operate the boom (2) and bucket (3) until bottom of bucket sits level.

3 -Lower the outriggers to the ground, apply the parking brake, and stop the engine.

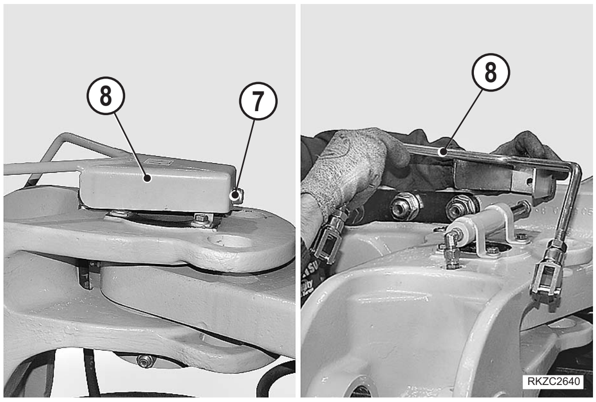
⚠ Release residual pressure from all circuits by operating the control levers in all directions.



4 -Remove pins (4) and disconnect yokes (6) from boom retaining levers (5).



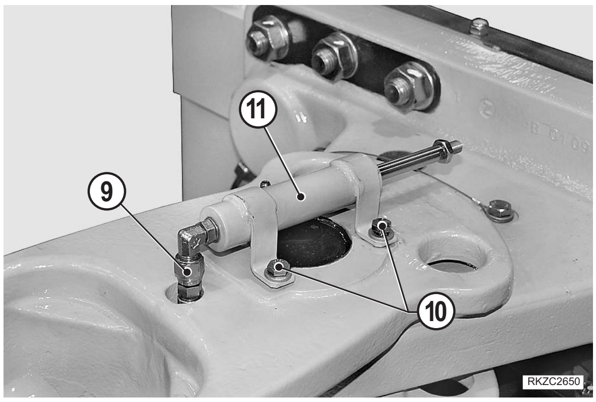
5 -Loosen and remove nut (7) and remove tie rod (8).



6 -Disconnect feed hose (9).

★ Cap the hose and hole to prevent contamination.

7 -Loosen and remove the screws (10) and the cylinder (11).



Installation

- To install, reverse removal procedure.

1 - Start the engine and operate the cylinder several times to eliminate the air from the circuit.

2 - Lift the boom and check to ensure that the safety connection is correct.

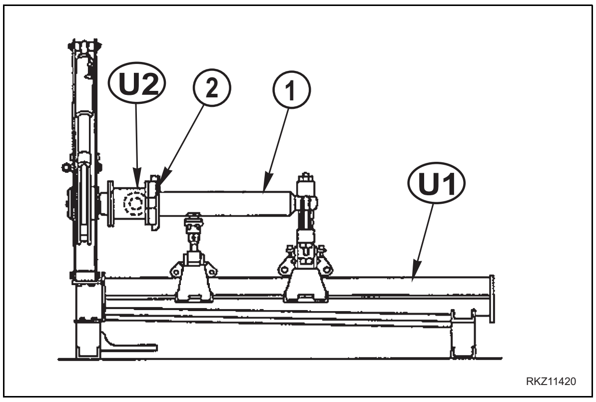
CYLINDER

SHOVEL ARM, SHOVEL, BOOM, ARM, BUCKET, OUTRIGGERS

Disassembly

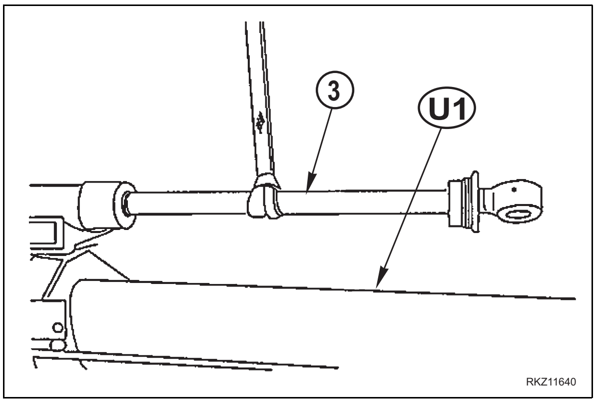
1 - Position cylinder to be disassembled (1) to equipment **U1**.

2 - Using wrench **U2** with torque amplifier, fully unscrew the head (2).



3 - Extract the complete piston (3).

★ Place a receptacle to collect the oil.

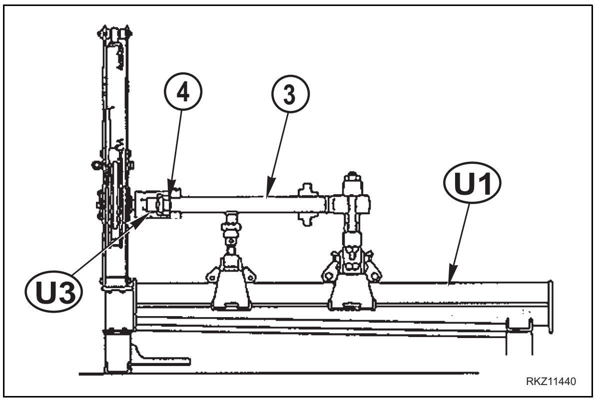


4 - Position the complete piston (3) to equipment **U1**.

5 - Using a wrench **U3** with torque amplifier, remove the nut (4) retaining the piston (5) from the following cylinders:
- Shovel raise: Key 55 mm
-Shovel dump: Key 55 mm
- Boom: Key 65 mm●
- Arm: Key 65 mm
- Bucket: Key 55 mm
-Outriggers: Key 46 mm
- Jig arm: Key 46 mm ○

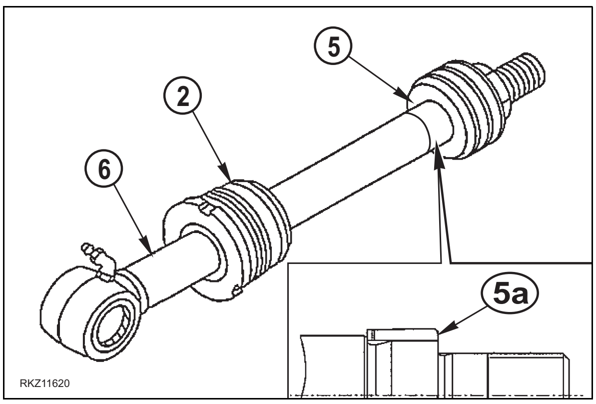
● Remove safety dowel first

○ Lift calking first



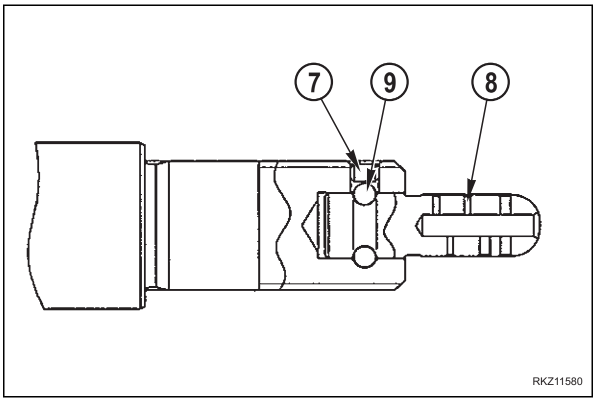
6 - Slide piston (6) and head (2) off rod (5).

★ **Arm only**:
Note down direction of installation of brake bushing (5a).

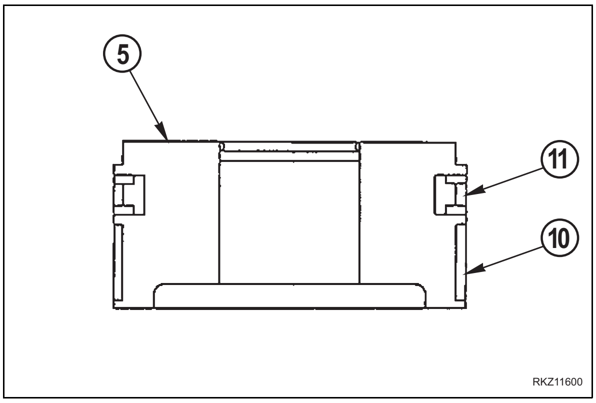


7 -**Boom cylinder rod only**.
Remove plug (7) and rotate end (8) to let the balls (9) out.

8 -Remove end (8).



9 -**All cylinders**.
Remove guide ring (10) and seal (11) from piston (5).

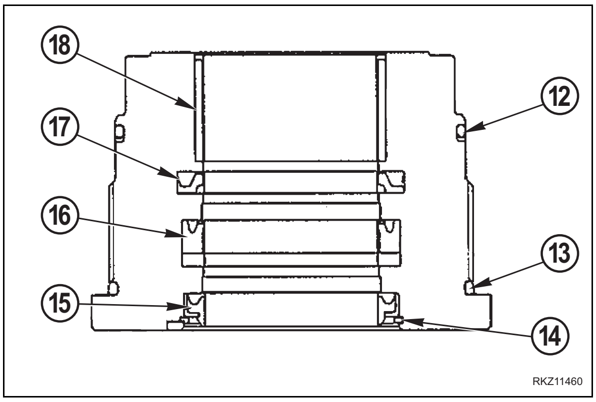


10 -Remove O-ring (12) with anti-extrusion ring, O-ring (13), snap ring (14) and scraper ring (15) from head.

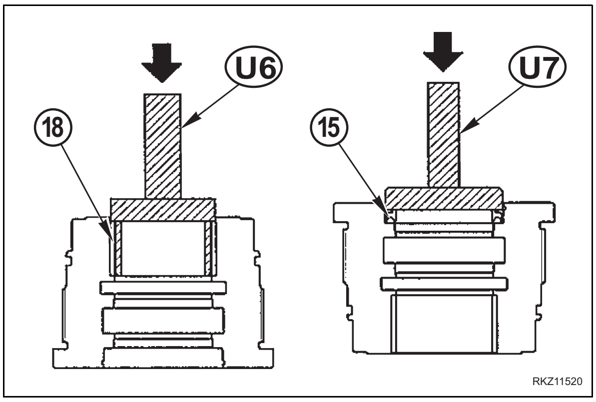
11 -Remove gaskets (16) and (17).

★ Note down direction fo installation of anti-extrusion ring and position of ring (12).

12 -**Boom head**
Remove bushing (18).



Assembly



★ Lubricate surfaces to prevent damage to the gaskets, seals, O-rings, scraper, etc.

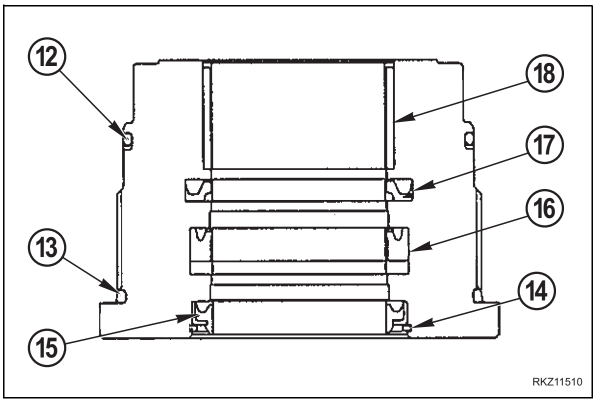
Surface: engine oil

★ Do not force sealing rings into place; heat them instead in hot water at 50-60°C before installing.

Boom head only

1 - Using tool **U6**, install bushing (18).

All cylinders

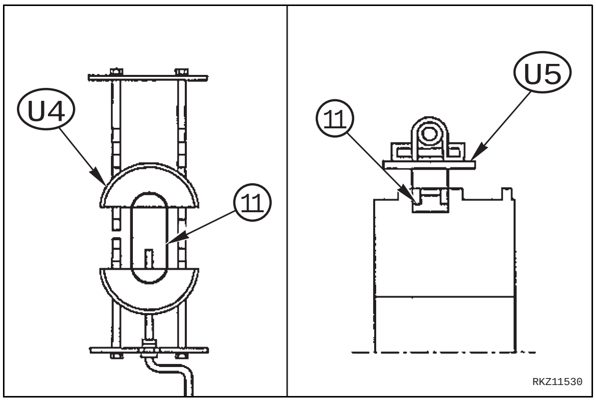


2 - Using tool **U7**, install scraper ring (15) and snap ring (14).

3 - Assemble seals (16) and (17).

★ Check direction of installation.

Assembly piston

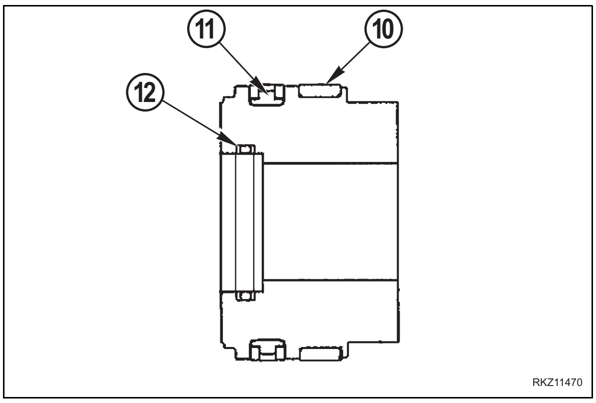


1 – Using tool **U4** expand seal (11) and fit it on the piston.

2 - Calibrate seal (11) using calibrator **U5.**

3 - **Boom cylinder only.**
Install anti-extrusion rings and O-ring (12).

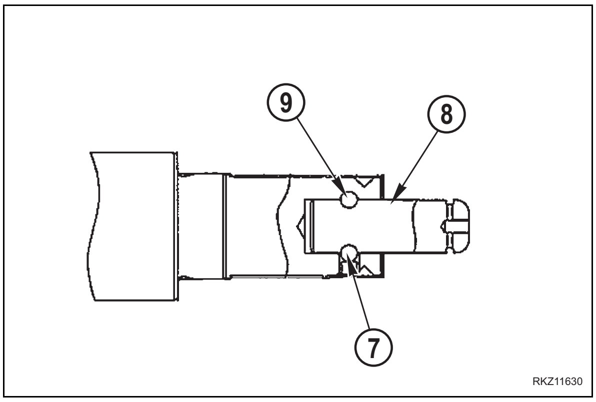
4 - Assemble the guide ring (10).



5 -**Boom cylinder only.**
Introduce rod (6), end (8), and ten balls (9); install plug (7).

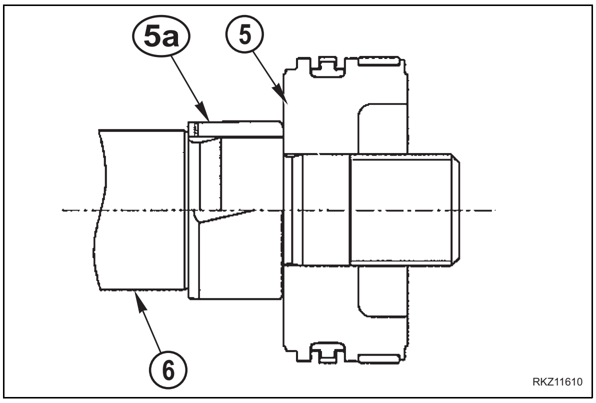
Plug: Loctite 262

Plug: 23±2 Nm



6 -Install piston (5) to rod (6).

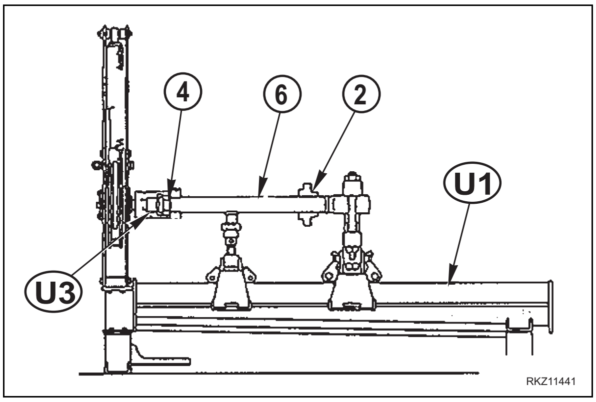
★ **Arm cylinder only.**
Check orientation of brake bushing (5a).



Assembly complete piston

1 -Install rod (6) to equipment **U1**.

2 -Remove any existing dirt from the rod and install the head (2).

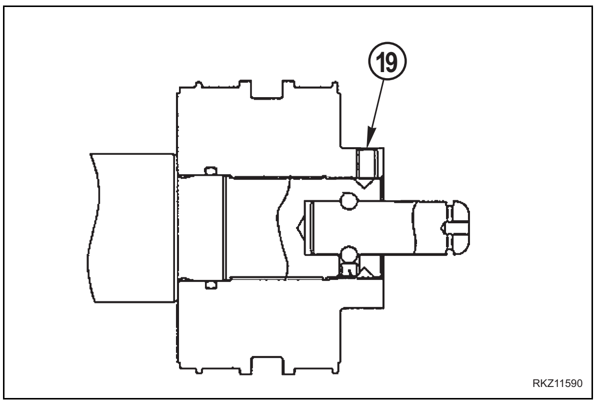


3 -**Boom cylinder only**.
Thread piston (5) onto rod (6) and lock into position with a wrench **U3** with torque amplifier.

Piston: 280–290 kgm

4 -Install safety dowel (19) and tighten until snug.

Dowel: Loctite 542



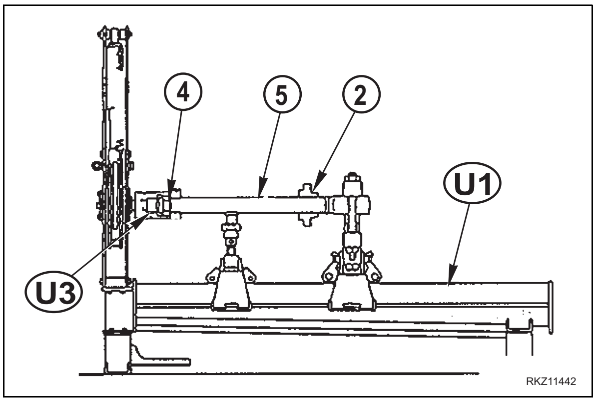
5 - **All cylinders**: install head (2) and piston (5); coat piston thread with sealant.

Piston: Loctite 262

6 - Install nut (4) and, using wrench **U3** with torque amplifier, lock piston in place using the following torques:

Shovel raise: 170±17 kgm
Shovel dump: 127±12.7 kgm
Arm backhoe 250±25 kgm
Bucket: 170±17 mm
Outriggers: 93±9.3 kgm
Jig arm: 110±11 kgm ○

○ Calk after tightening.



Final assembly

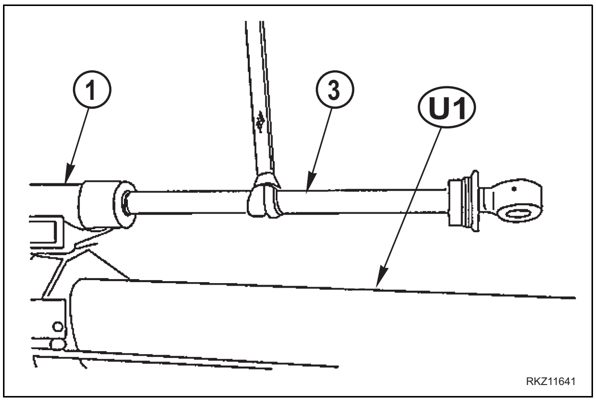
1 - Lubricate piston seals (5) and head gaskets (2) and introduce piston into cylinder (1).

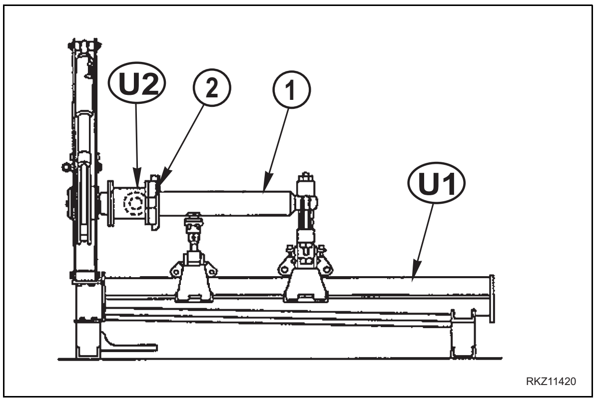
2 - Position cylinder (1) to equipment **U1** and tighten head (2) using tool **U2**; tighten to the following torque:

Shovel raise: 69±6.9 kgm
Shovel dump: 55±5.5 kgm
arm: 98±9 kgm
Bucket: 120±140 kgm △
Outriggers: 55±6.5 kgmm
Jig arm: 55±5.5 kgm
Boom: 100±10 kgm

△ Loosen down to 0 kg, tighten up to 40 kgm, and then tighten angle-wise for 3.5–4.5 mm

3 - When assembly is complete, plug union fitting holes to prevent contamination.



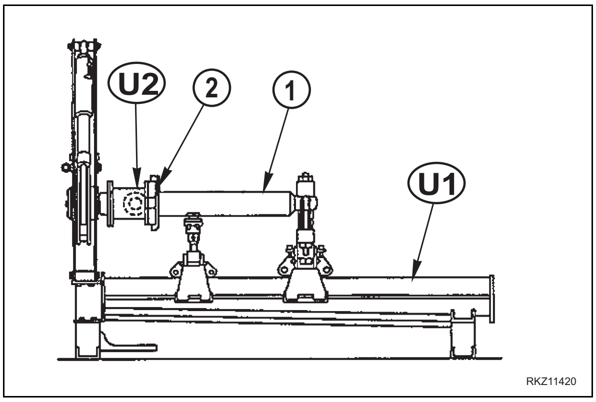


BACKHOE SWING CYLINDERS

Disassembly

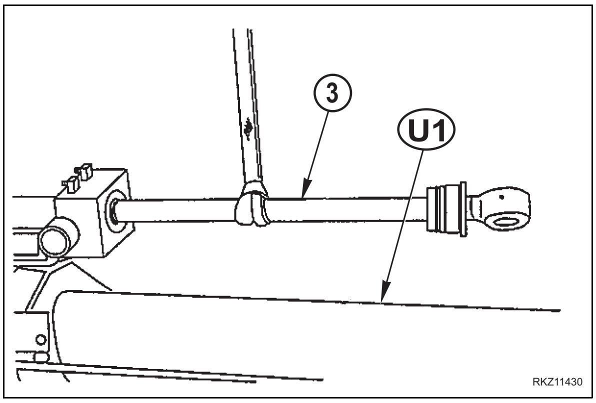
1 -Position cylinder (1) to equipment **U1**.

2 -Using wrench **U2** with torque amplifier, fully unscrew the head (2).

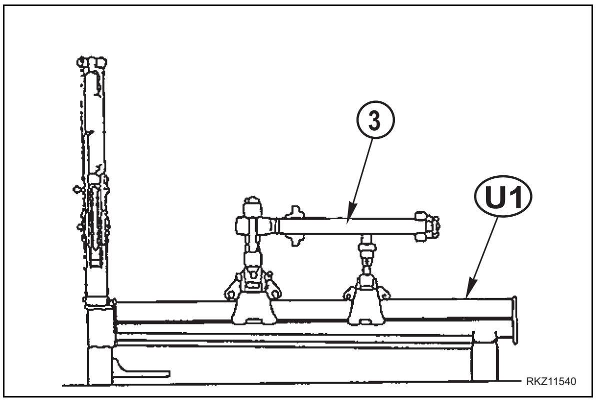


3 -Extract the complete piston (3).

★ Place a receptacle to collect the oil.

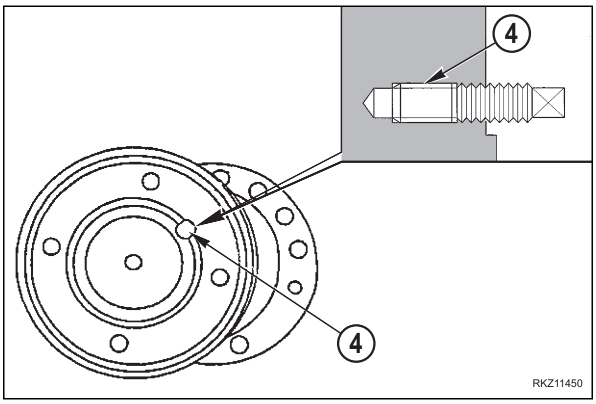


4 -Position the complete piston (3) to equipment **U1**.



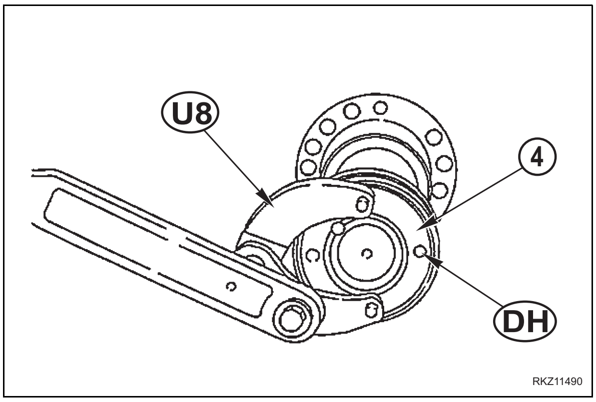
5 -Remove safety screw (4) (M8x1.25).

★ If removal is awkward, tighten screw until snug and work thread with a tap.

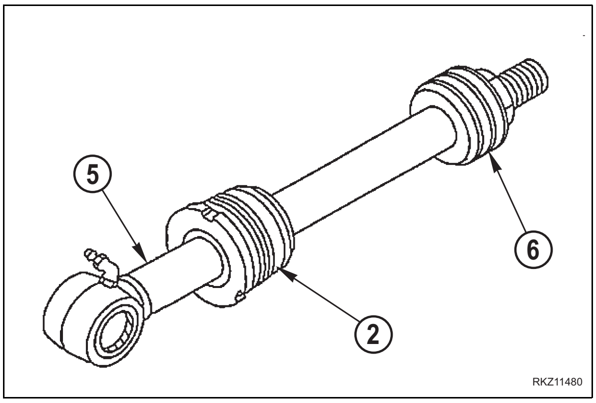


6 - Using a wrench **U8**, remove the complete piston (6).

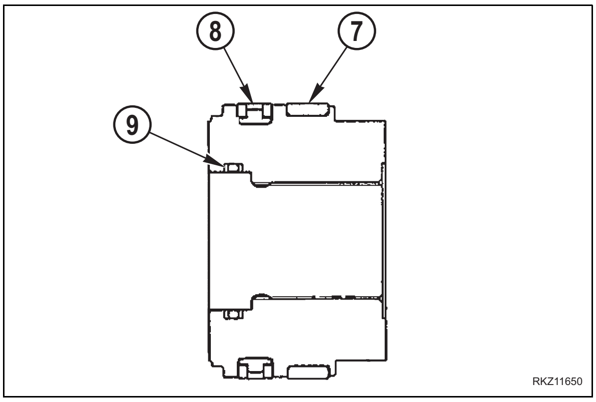
★ If no **U8** tool is used, drill 4 holes (Ø 10) and loosen the complete piston.



7 - Slide piston (6) and head (2) off rod (5).

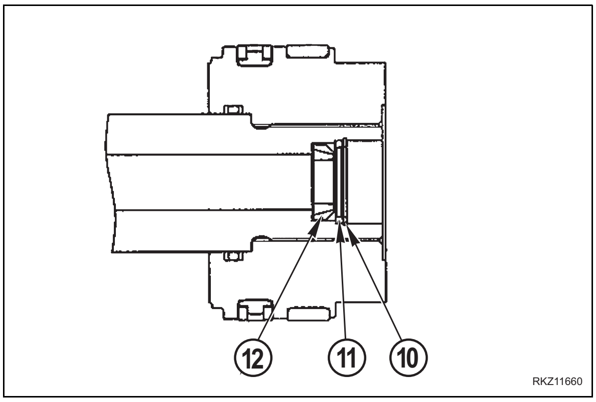


8 - Remove guide ring (7), seal (8), O-ring (9) and their respective anti-extrusion rings from piston.



9 - Remove the snap-ring (10), the spacer (11) and the ring (12).

★ Note down orientation of ring (12) and position of spacer (11).

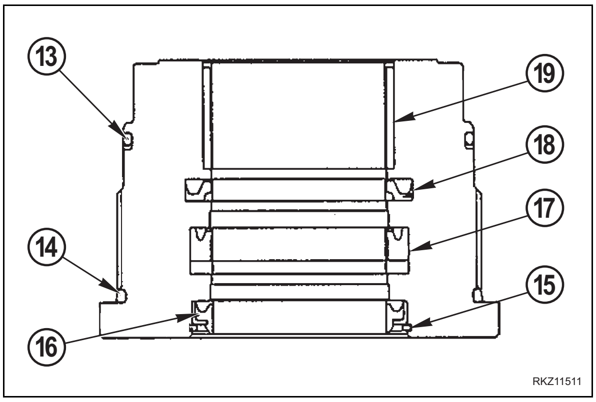


10 - Remove O-ring (13) with anti-extrusion ring, O-ring (14), snap ring (15) and scraper ring (16) from head.

11 - Remove gaskets (17) and (18).

★ Note down direction fo installation of anti-extrusion ring and position of ring (13).

12 - Remove the bushing (19).

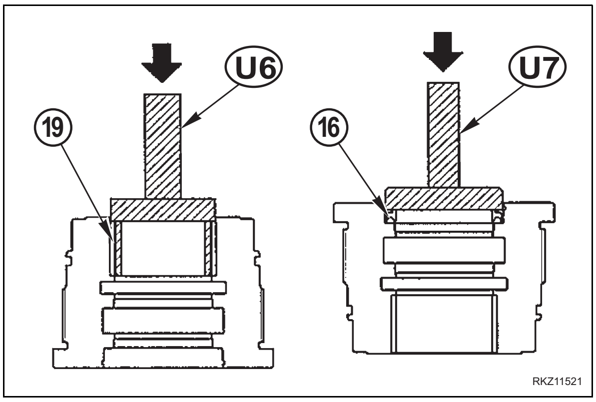


Assembly

★ Lubricate surfaces to prevent damage to the gaskets, seals, O-rings, scraper, etc.

Surface: engine oil

★ Do not force sealing rings into place; heat them in hot water at 50-60°C before installing.



Assembling the head

1 - Using tool **U6**, install bushing (19).

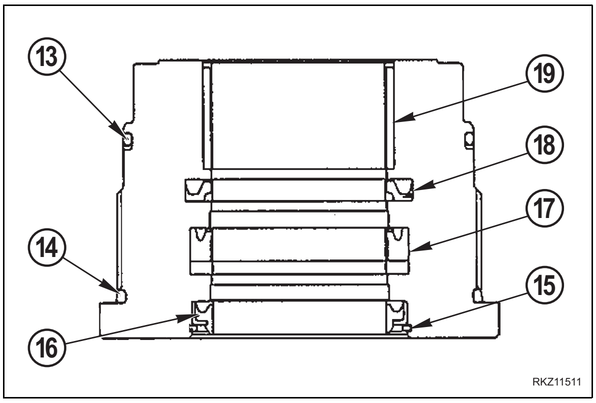
2 - Assemble seals (17) and (18).

★ Check direction of installation.

3 - Using tool **U7**, install scraper ring (16) and snap ring (15).

4 - Assemble O-ring (14).

5 - Install anti-extrusion ring and O-ring (13).



Assembly piston

1 - Using tool **U4** expand seal (8) and fit it on the piston.

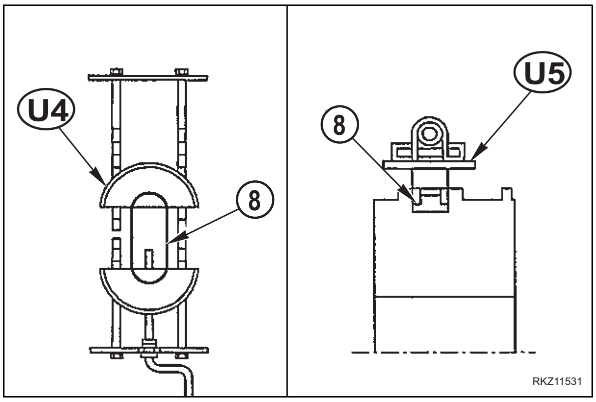
2 - Calibrate seal (8) using calibrator **U5**.

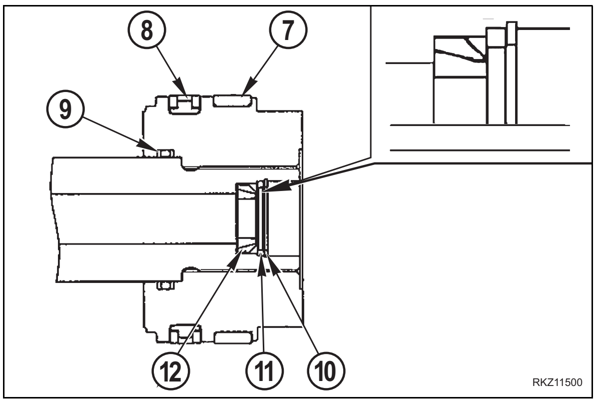
3 - Install anti-extrusion rings and O-ring (9).

4 - Assemble the guide ring (7).

5 - Install ring (12), spacer (11) and snap ring (10) to rod (5).

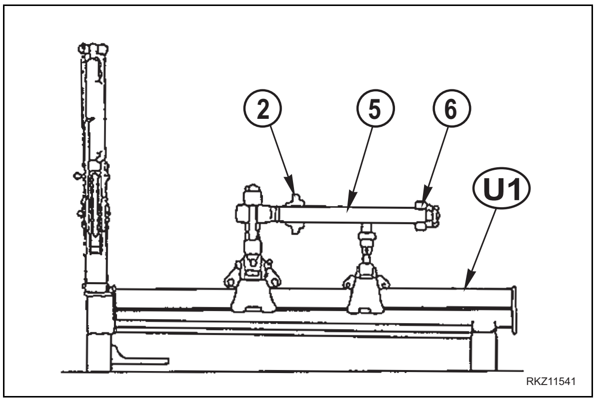
★ Pay attention to the orientation of ring (12).





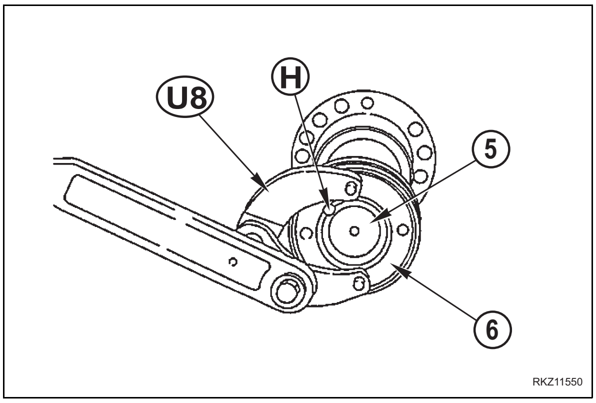
Assembly complete piston

1 -Install rod (5) to equipment **U1**.



2 -Remove any existing dirt from the rod and install the head (2).

3a - **With original parts only:**
Thread piston (6), and tighten with wrench **U8** until threaded hole **H** of safety screw (4) is perfectly aligned.



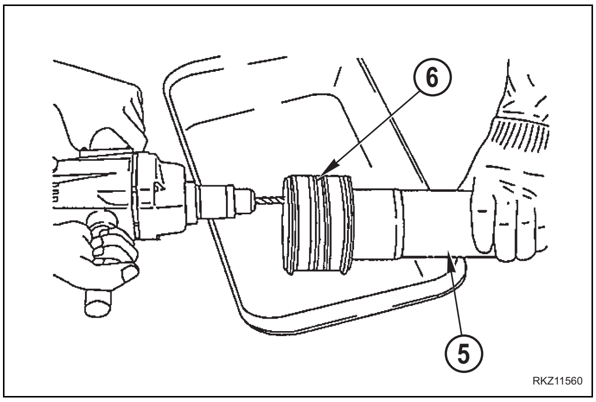
3b -**With new parts:**

a - Thread the piston (6) in, ensure it contacts the rod (5), and then tighten.

Piston: 734±49 Nm

b - Drill hole **H** for safety screw (4) on the seam of thread between rod and piston.

★ Hole Ø 6.8 – depth 31 mm
Thread: M8x1.25 - depth 25 mm

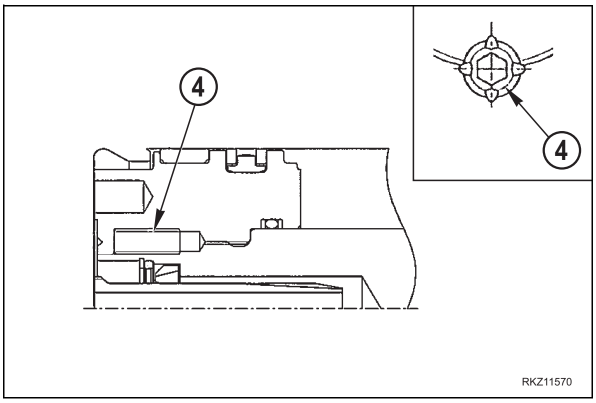


4 -Remove any dirt or shaving and install the safety screw (4).

Screw: Loctite 262

Screw: 13.25±1.45 Nm

5 -Calk screw (4) in four locations.



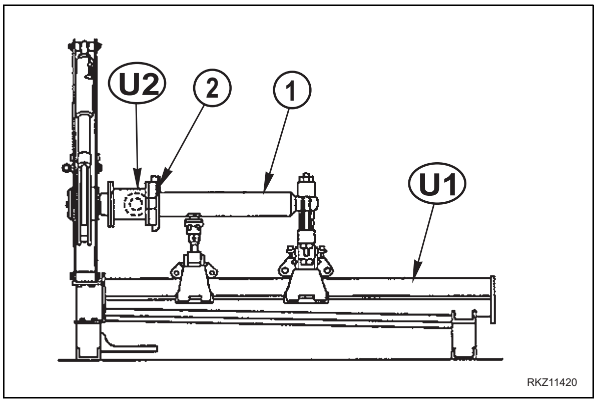
Final assembly

1 - Lubricate piston seal (6) and head gasket (2) and introduce piston into cylinder (1).

2 - Position cylinder (1) to equipment **U1** and tighten head (2) using tool **U2**; tighten to torque.

Head: 785±78.5 Nm

★ When assembly is complete, plug cylinder union fittings to prevent contamination.



BACKHOE WORKING EQUIPMENT

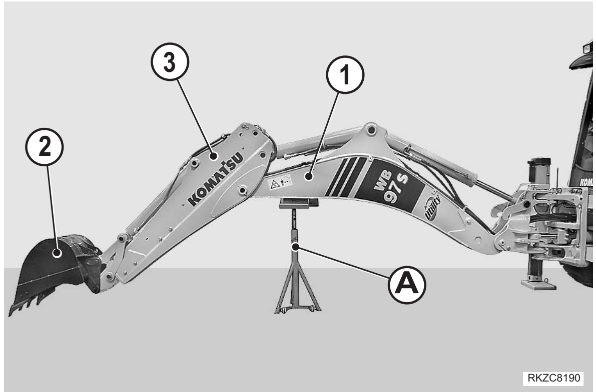
Removal

1 -Fully extend the arm (1) and fully open the bucket (2); operate the boom (3) until the outer end of the boom is in a horizontal position.

2 -Place and force a jack stand "**A**" and a non-slip block under the boom (3).

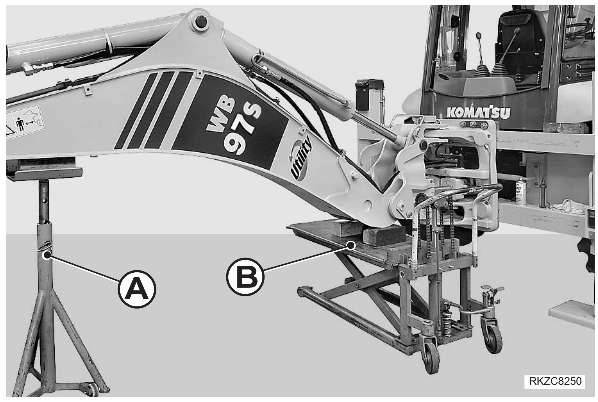
3 -Lower the arm until the bucket teeth touch the ground.

4 -Lower the outriggers to the ground, apply the parking brake, and stop the engine.

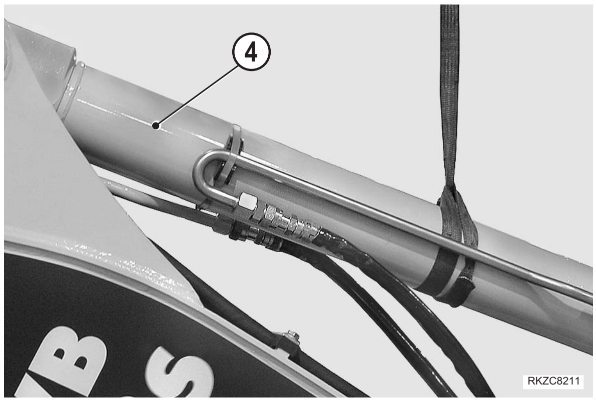


⚠ Release residual pressure from all circuits by operating all hydraulic controls in all directions.

5 -Position a lift "**B**" and some non-slip blocks under boom fulcrum.



6 -Place a sling around the boom lift cylinder (4), connect it to a hoisting device and apply a slight tension to the cable.



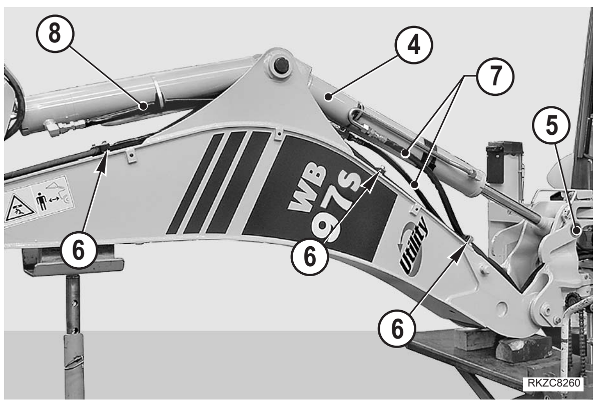
7 -Pull out the piston attachment pin (5).

8 -Release boom and arm cylinder hoses and bucket cylinder hoses from the three hose clamps (6).

9 -Disconnect hoses (7) and (8) from boom and arm cylinder.

★ Mark the pipes to avoid exchanging them during installation.

★ Plug all pipes/hoses to prevent contamination.



9 - Disconnect hoses (9) from bucket cylinder.

★ Cap pipes, hoses and holes to prevent contamination.

★ Mark the pipes to avoid exchanging them during installation.

10 - Slide all hoses off and place them aside.

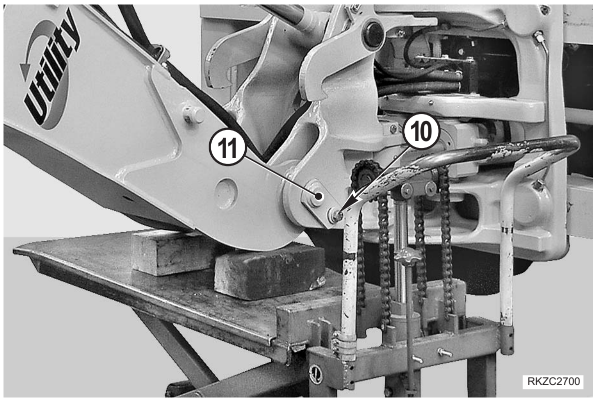
11 - Position a non-slip block "**C**" under the boom lift cylinder and disconnect the hoisting device

12 - Remove the screw (10) and the pin (11).

13 - Start the engine, draw in the outriggers and move the machine rearward.

★ Recover the shims between boom and swing bracket.

Backhoe working equipment
with standard arm: 850 kg



Installation

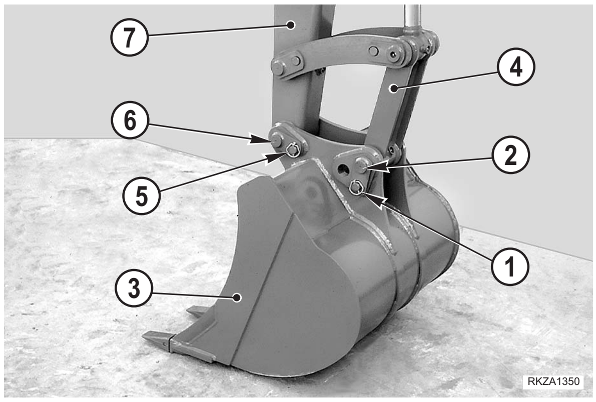
- To install, reverse removal procedure.

1 - Start the engine and bleed the air from all circuits. (For details, see "20 TESTING AND ADJUSTMENTS").

2 - Stop the engine, check the level in the tank and, if necessary, top it up.

BACKHOE BUCKET

Removal



⚠ 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). [*1] [*2]

2 - Take out the safety pin (5) and remove the pin (6) that attaches the bucket to the arm (7). [*1] [*2]

Bucket: 158 kg

Installation

- To install, reverse removal procedure.

[*1]

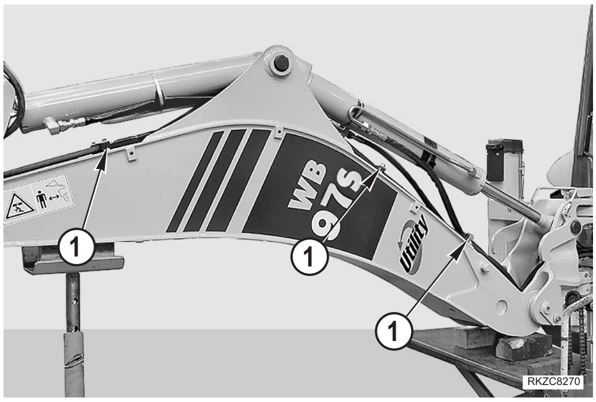
⚠ When aligning the positions between the hole and the pin, turn the engine over at low idling speed.
Do not insert fingers into the holes to check alignment.

[*2]

Internal bushing: ASL800050

BACKHOE BOOM CYLINDER

Removal



1 -Remove the arm cylinder.
(For details see "ARM CYLINDER").

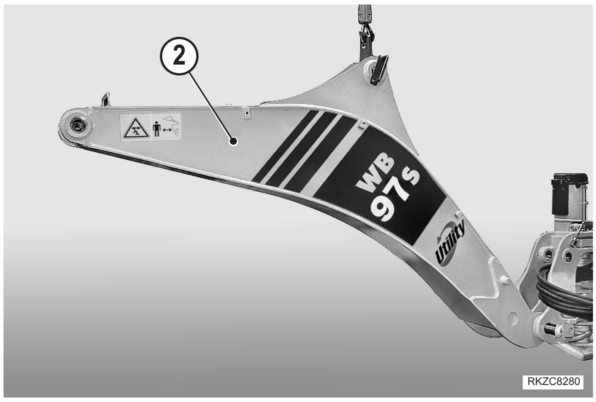
2 -Remove the arm.
(For details see "ARM").

3 -Start the engine and rest the boom on the ground.

4 -Remove the boom cylinder.
(For details see "BACKHOE BOOM CYLINDER").

5 -Remove the hose clamps (1) retaining the boom, arm and bucket hoses.

★ Mark the tubes to prevent exchanging positions during re-connection.



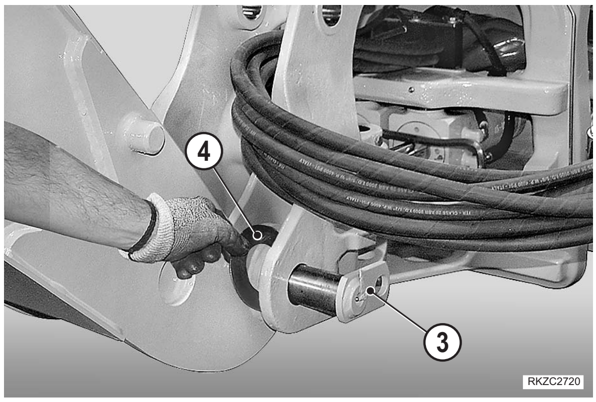
6 -Hook the boom (2).

7 -Take out the retaining screw and remove the pin (3). [*1] [*2]

★ Recover the shims (4) between boom and swing bracket.

8 -Remove the boom (2).

Boom: 248 kg



Installation

- To install, reverse 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]

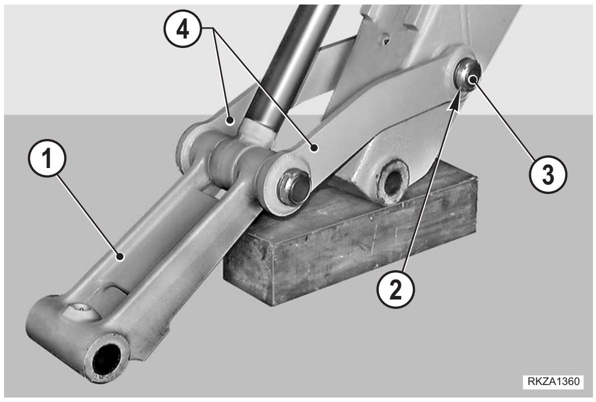
Internal bushing: ASL800050

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.

ARM

Removal



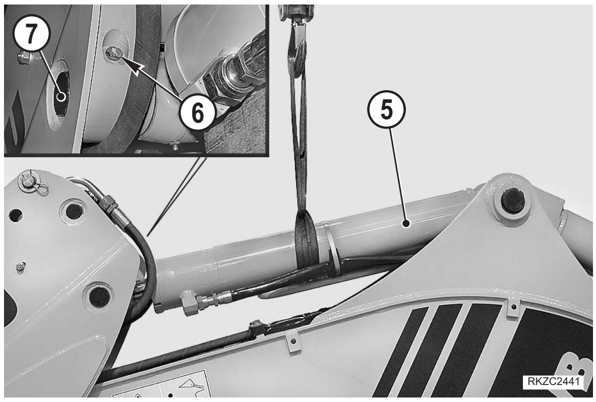
1 -Remove the bucket.
(For details see "BACKHOE BUCKET").

2 -Remove the bucket cylinder and the link (1).
(For details, see "BACKHOE BUCKET CYLINDER").

3 -Take out the lock nut (2), and the washer and remove the pin (3) and the links (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.

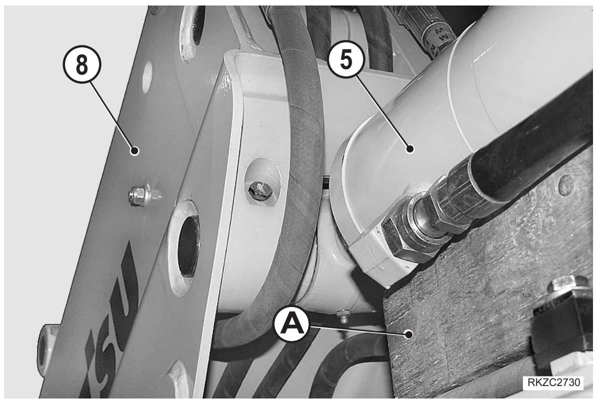
8 -Rest cylinder (5) on a block “**A**” and disconnect from the hoisting device.

9 -Stop the engine.

10 -Connect the arm (8) to the hoisting device and apply a slight tension to the cable.

11 -Take out the screws (9) and remove the pin (10). [*1] [*2]

★ Recover the shims.



12 -Remove the arm (8).

Arm: ______ kg

• To install, reverse removal procedure.

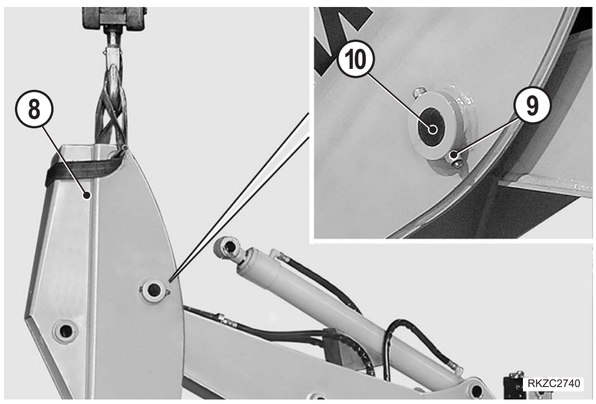
[*1]

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

[*2]

Internal bushing: ASL800050

Installation



★ 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.

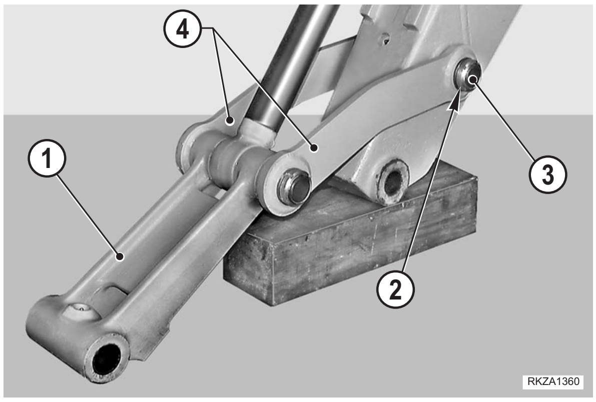
JIG ARM

Removal

1 - Remove the bucket.
(For details see "BACKHOE BUCKET").

2 - Remove the bucket cylinder and the link (1).
(For details, see "BACKHOE BUCKET CYLINDER").

3 - Take out the lock nut (2), and the washer and remove the pin (3) and the links (4). [*1] [*2]



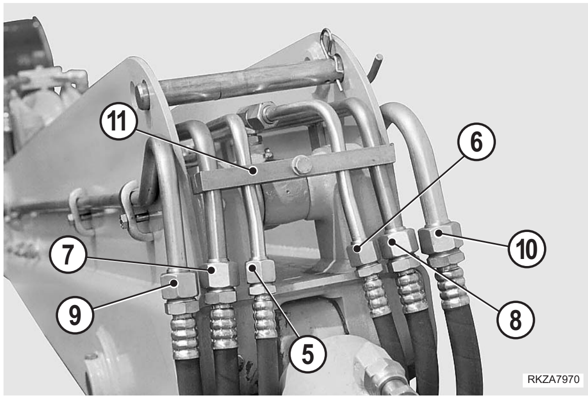
4 - Disconnect the jig arm hoses (5) and (6), the bucket cylinder hoses (7) and (8), and the hoses of the auxiliary equipment (9) and (10).

★ Mark the hoses to avoid exchanging them during INSTALLATION.

5 - Remove the clamp (11).

6 - Proceed with the removal as for the arm . (See "ARM").

Jig arm cylinder: 460 kg



Installation

- To install, reverse removal procedure.

[*1]

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

[*2]

Internal bushing: ASL800050

★ Tighten the locknut completely, then release it half a turn.

2nd ARM

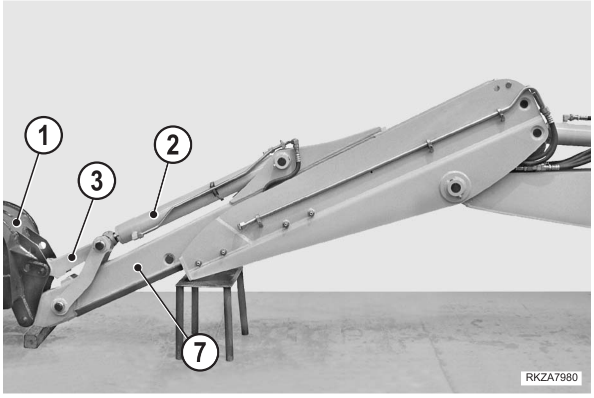
Removal

1 -Remove the bucket (1).
(For details see "BACKHOE BUCKET").

2 -Remove the bucket cylinder (2) and the link (3).
(For details, see "BACKHOE BUCKET CYLINDER").

3 -Remove the 2nd arm cylinder.
(For details see "JIG ARM CYLINDER").

★ For safety, tightly plug all the disconnected hoses.

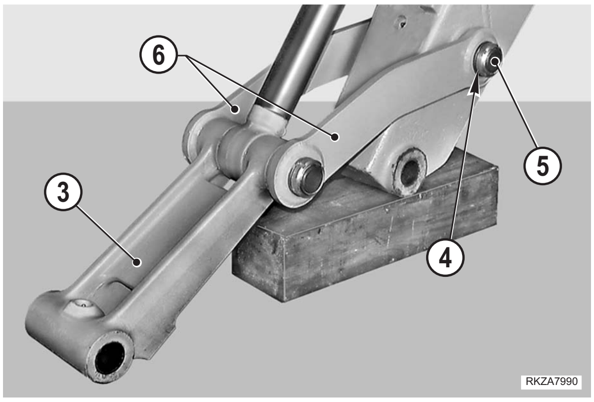


4 -Take out the lock nut (4), and the washer and remove the pin (5) and the links (6). [*1] [*2] [*3]

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.

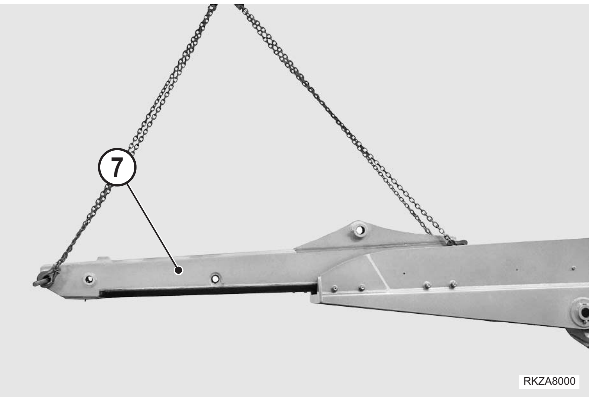


7 -Stop the engine and loosen by several turns the gib adjustment screws.

★ Loosen the screws on both sides.

8 -Slide out the 2nd arm (7).

2nd arm: _______ kg



Installation

- To install, reverse removal procedure.

[*1]

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

[*2]

Internal bushing: ASL800050

[*3]

★ Tighten the locknut completely, then release it half a turn.

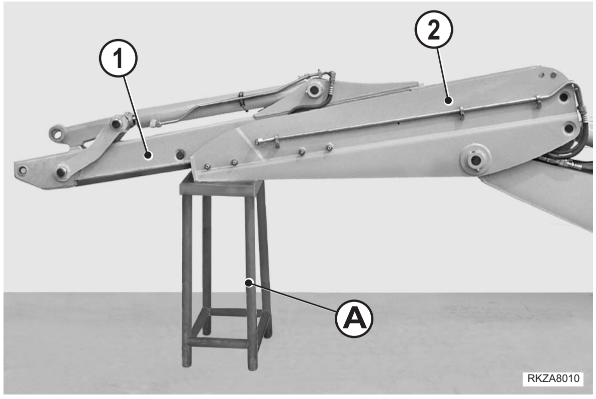
2nd ARM GUIDES

Removal

1 -Remove the bucket.
(For details see "BACKHOE BUCKET").

2 -Partially extend the 2nd arm (1).

3 -Rest the arm (2) on a trestle "**A**" about 80 cm (3.5 ft.) high.

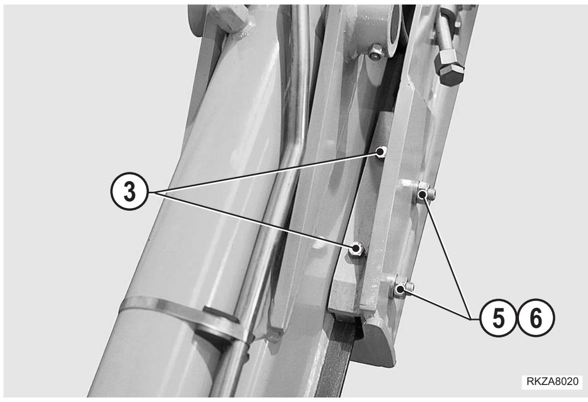


4 -Loosen and remove the screws (3), the spring washers and remove the upper guides (4). [*1]

5 -Connect the 2nd arm (1) to some hoisting tackle.

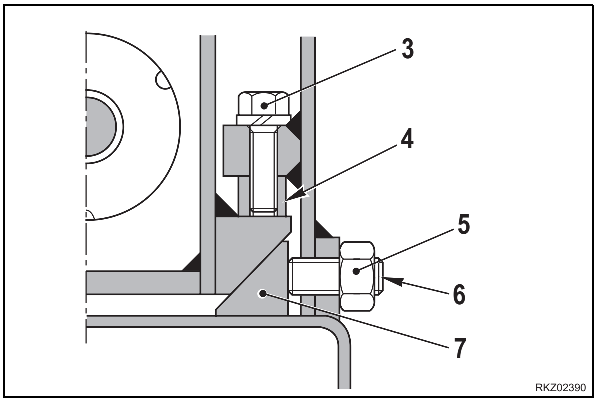
★ Use the bucket pin hole and the safety pin holes.

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]



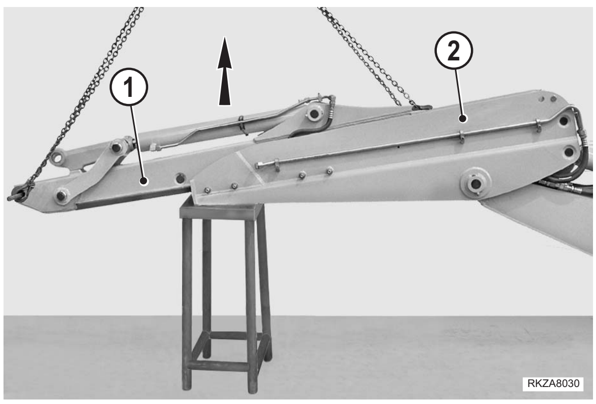
Installation

• To install, reverse removal procedure.

[*1]

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 TESTING AND ADJUSTMENTS").



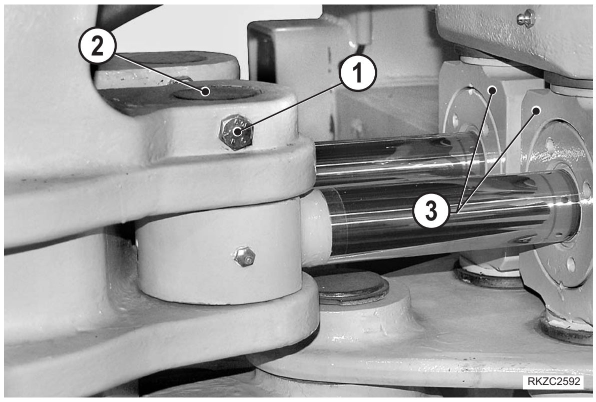
BACKHOE SWING BRACKET

Removal

1 -Remove the equipment.
(For details see "BACKHOE 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 "BACKHOE BOOM SAFETY CYLINDER").

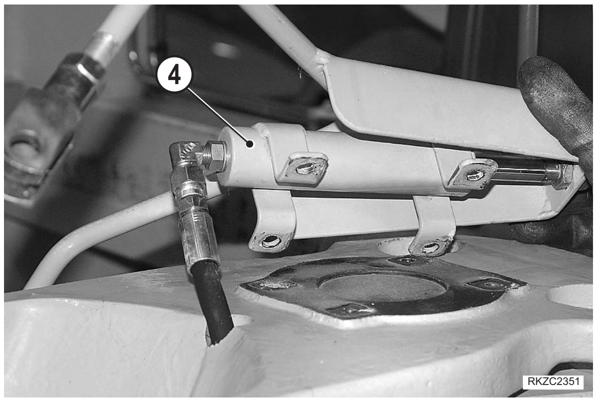


4 -Sling the swing bracket (5)

5 -Take out screws (6) and (7) and remove pins (8) and (9) from swing bracket. [*1] [*2]

6 -Remove swing bracket (5) and shims (10) and slide the hoses off. [*3]

Bracket: 162.5 kg



Installation

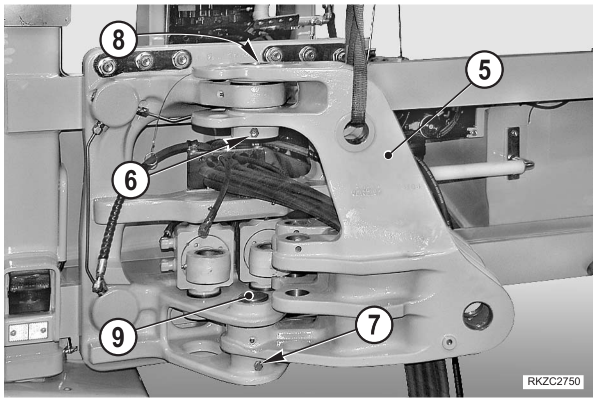
- To install, reverse removal procedure.

[*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

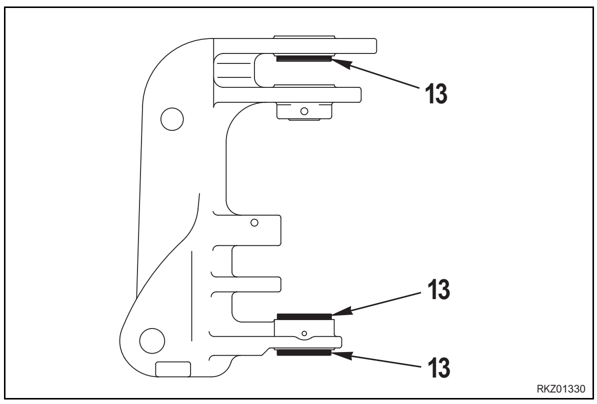


[*3]

★ 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.



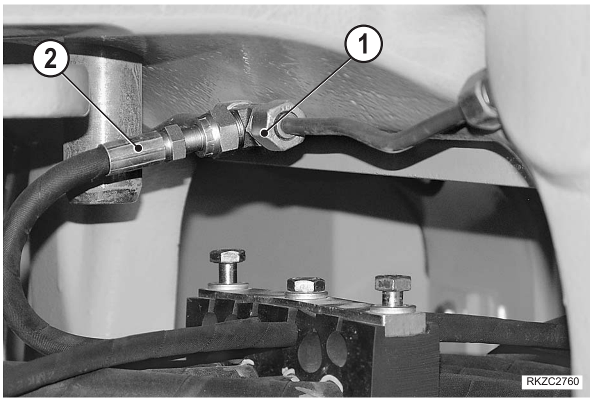
COMPLETE BACKHOE BACKFRAME

Removal

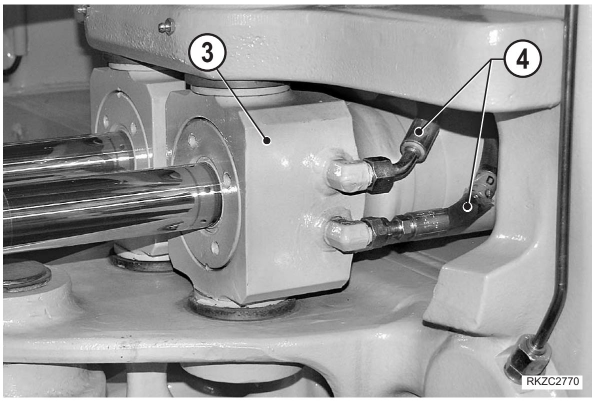
1 - Remove the equipment.
(For details see "BACKHOE WORKING EQUIPMENT").

2 - Remove the swing bracket.
(For details see "BACKHOE SWING BRACKET").

3 - Disconnect the backhoe backframe lock piston feeding hose (2) from union (1); plug hose and union to prevent contamination.

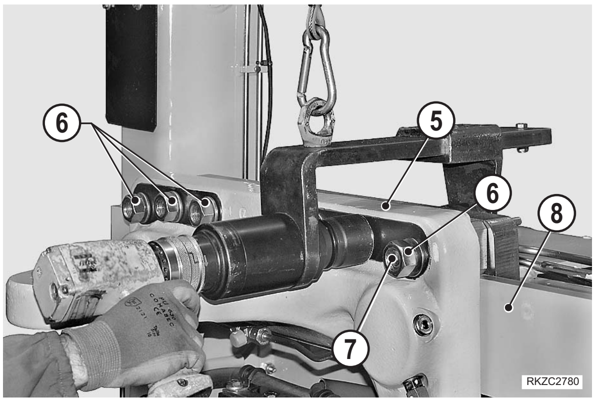


4 - Disconnect feed hoses (4) from swing cylinders (3).



5 - Connect the backframe (5) to a hoisting device.

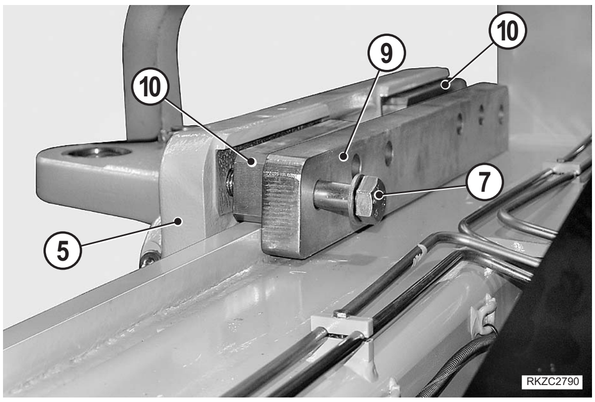
6 - Loosen nuts (6) and remove washers and four screws (7).
Loose partially lateral nuts (4) to remove backframe (3) from frame (8). [*1]



7 - Put a sling round the backframe (5) and apply slight tension to the cables.

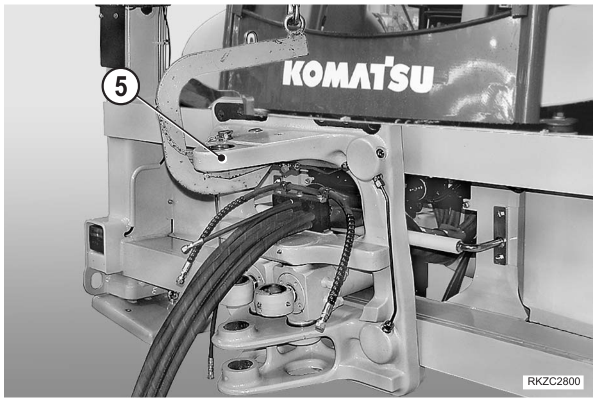
8 - Remove external nuts (6), washers and screws (7). [*1]

9 - Remove slide block (9) and spacers (10).



10 -Lower backframe (5) and remove backframe together with swing cylinders.

Complete backframe: approx. 246 kg



Installation

- To install, reverse removal procedure.

[*1]

Nuts: Loctite 262

Nuts: 980±98 Nm

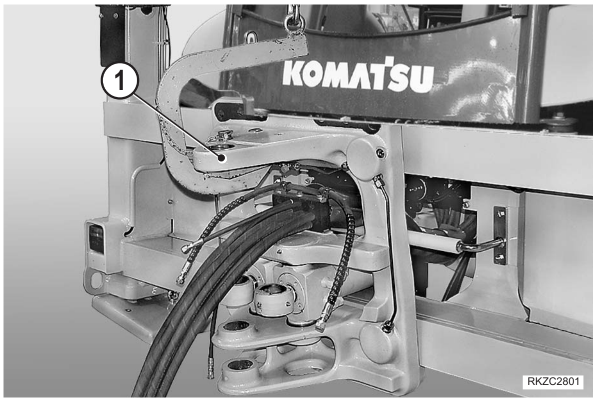
1 -Start the engine and bleed the air from the cylinders. (For details, see "20 TESTING AND ADJUSTMENTS").

★ After bleeding the air, check the oil level in the tank.

BACKFRAME LOCK PISTONS

Removal

1 -Remove the complete backframe (1).
(For details see "COMPLETE BACKHOE BACKFRAME").



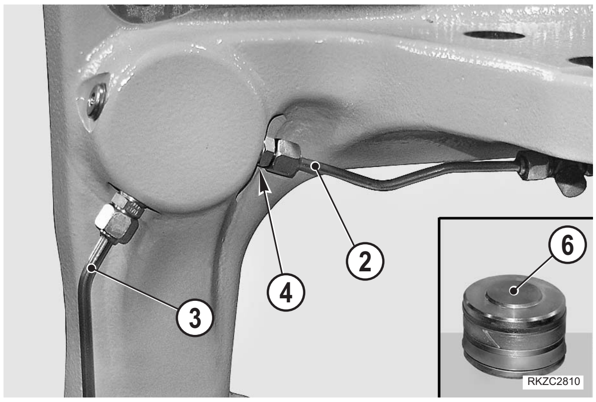
UPPER PISTON

1 -Remove two pipes (2) and (3).

2 -Plug the horizontal union (4).

3 -Introduce compressed air at low pressure (max. 2 bar) through lower union (5) and recover piston (6).

⚠ Be aware that the piston may be ejected rapidly. Use a rag or non-slip gloves to accompany the piston as it is being ejected.

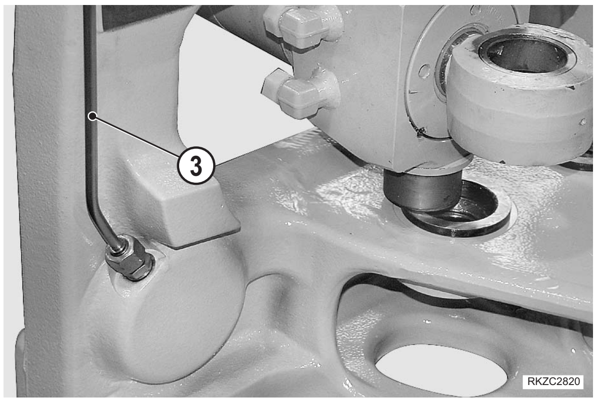


LOWER PISTON

1 -Remove pipe (3).

2 -Introduce compressed air at low pressure (max. 2 bar) through union (7) and recover piston (6).

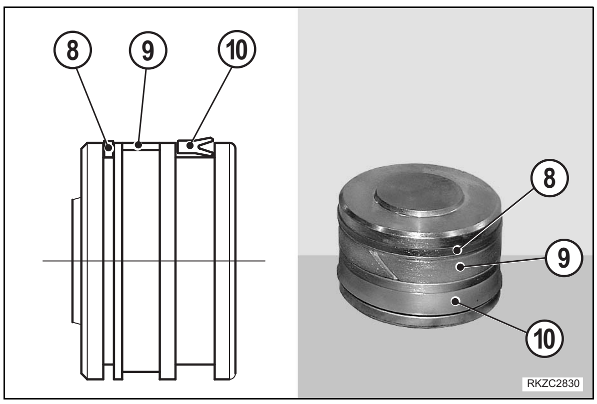
⚠ Be aware that the piston may be ejected rapidly. Use a rag or non-slip gloves to accompany the piston as it is being ejected.



REPLACING SEALS

1 -Remove seal (8), guide ring (9), and seal (10).

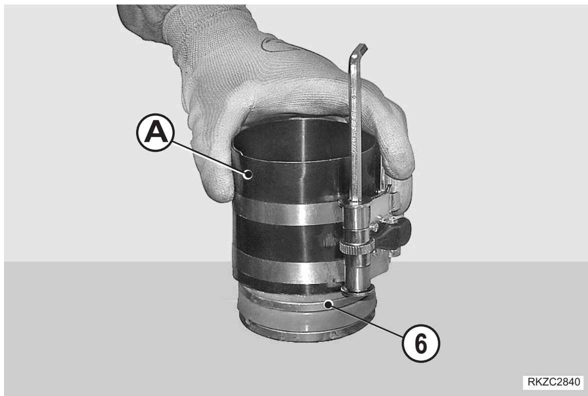
★ Note down direction of installation of seal (10).



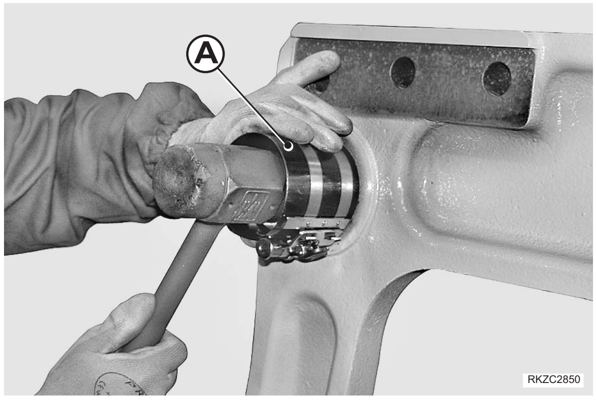
2 - Thoroughly clean the seats and install new seals and the guide ring.

3 - Lubricate the seals, guide ring, and piston seat.

Seal and seat: Hydraulic oil:



4 - Apply a band “**A**” for seal compression and install piston (6).

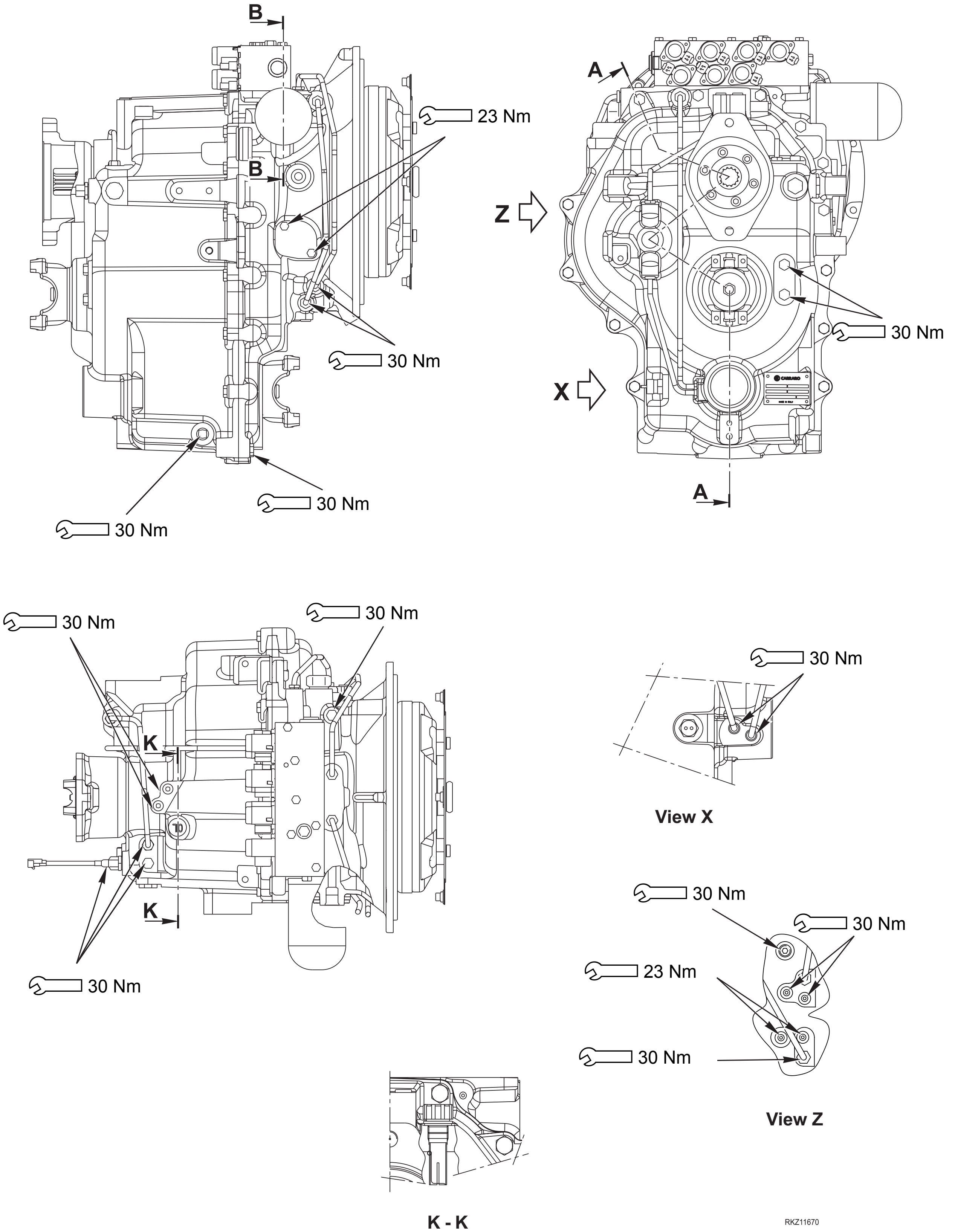


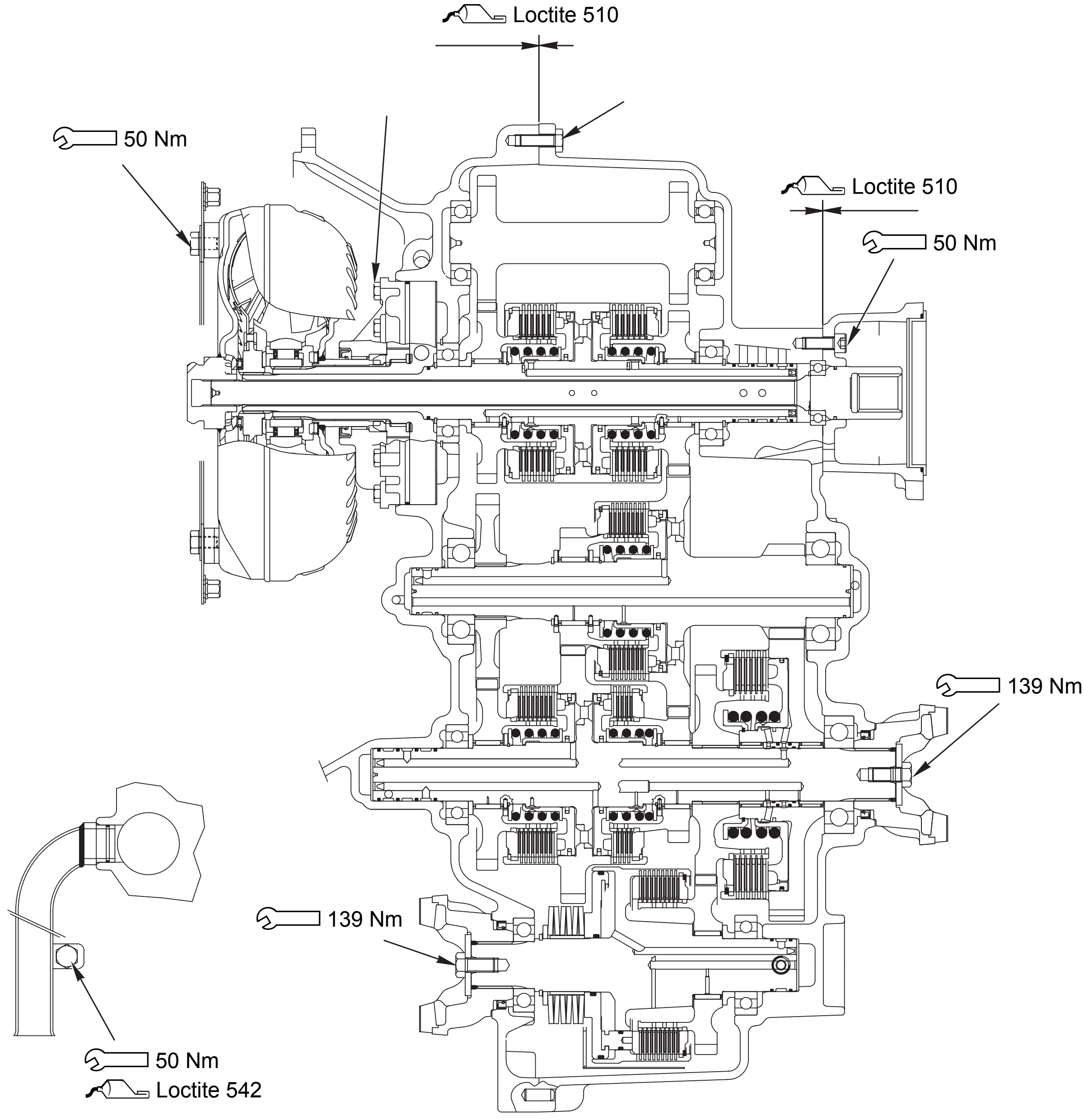
Installation

- To install, reverse removal procedure.

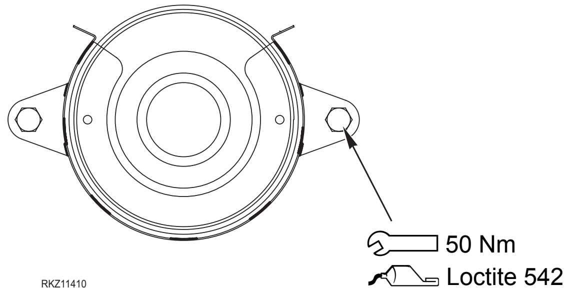
40 STANDARD MAINTENANCE

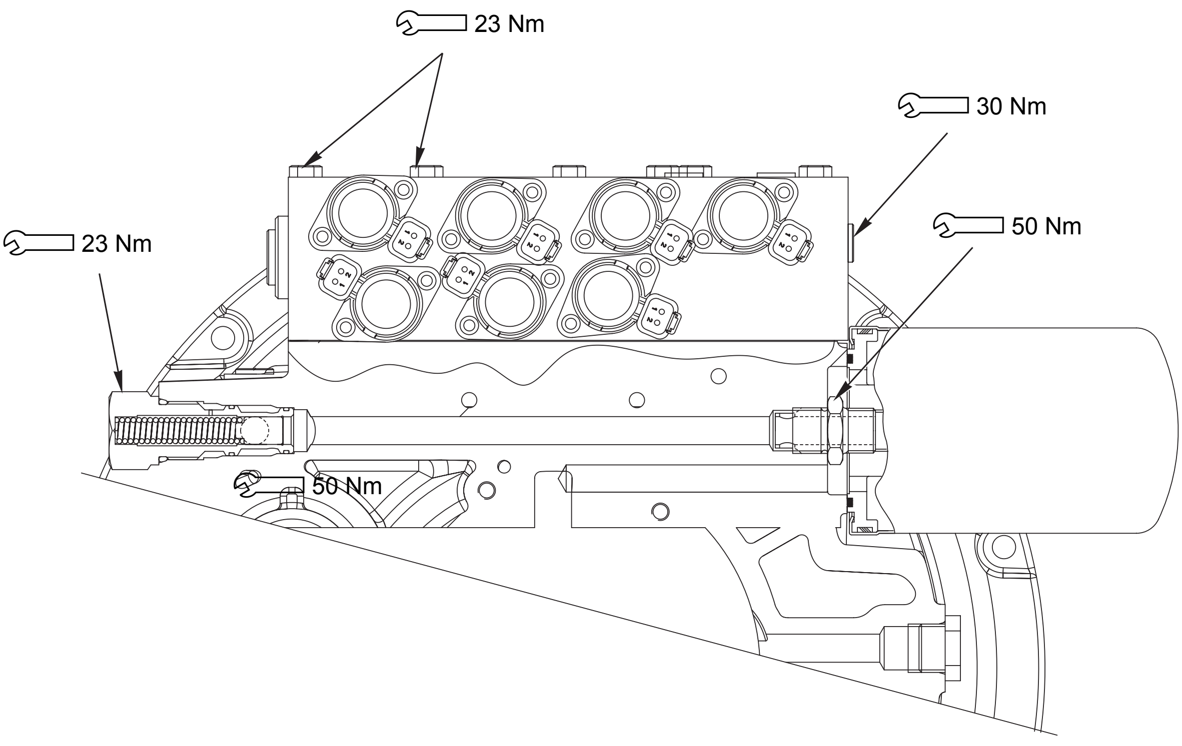
TRANSMISSION




Loctite 510
50 Nm
Loctite 510
50 Nm
139 Nm
139 Nm
50 Nm
Loctite 542

A - A

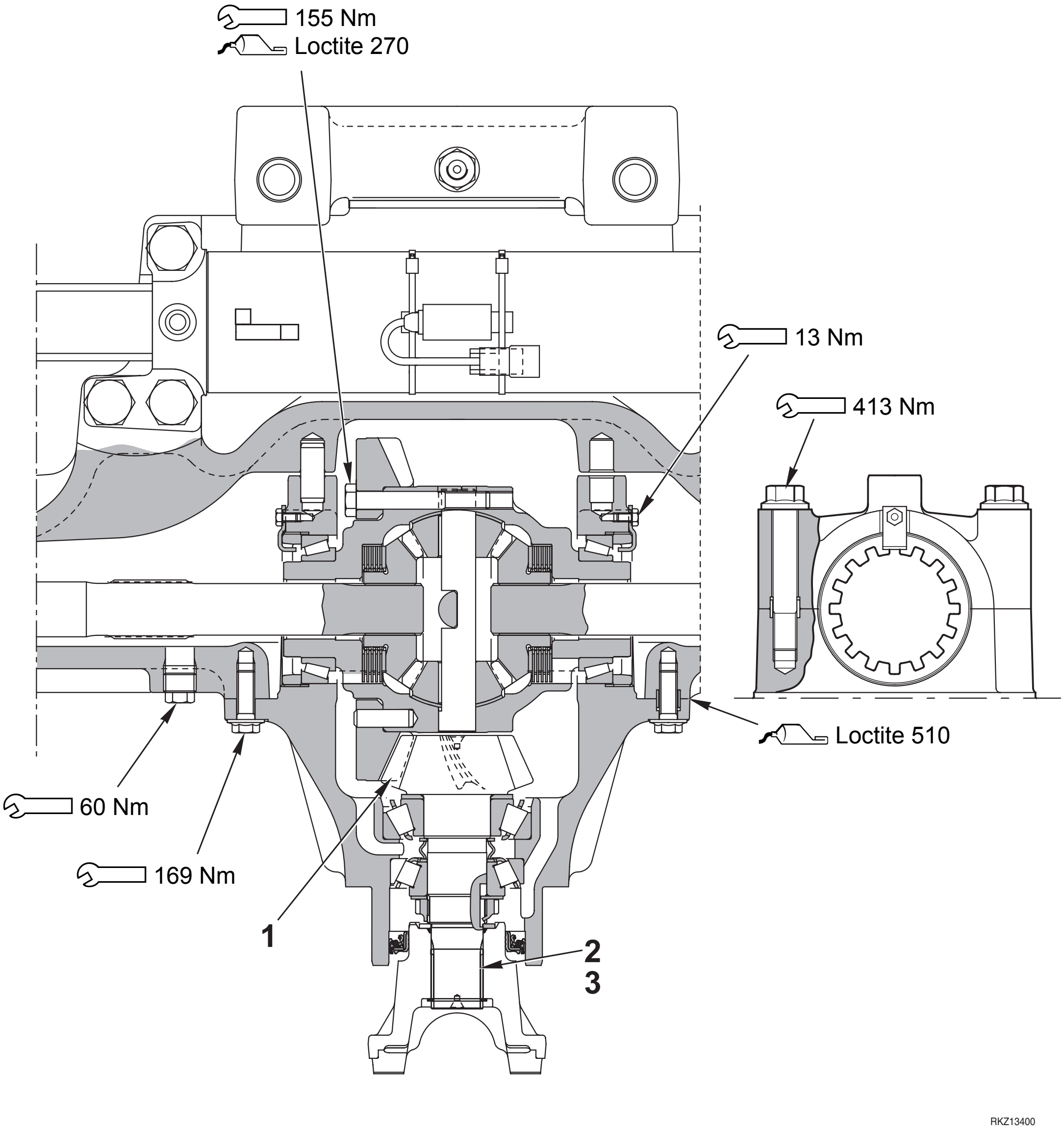

50 Nm
Loctite 542
RKZ11410



B - B

FRONT AXLE

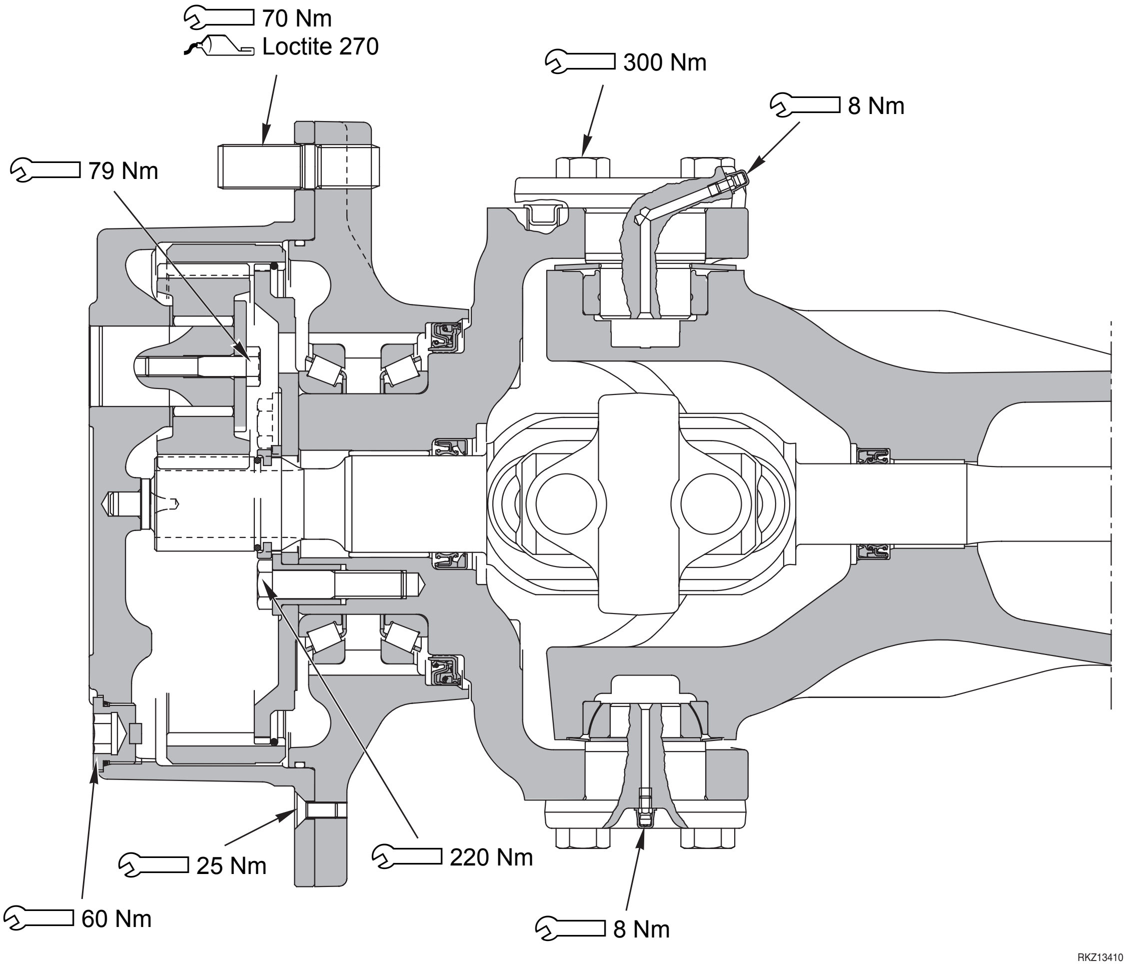
Differential



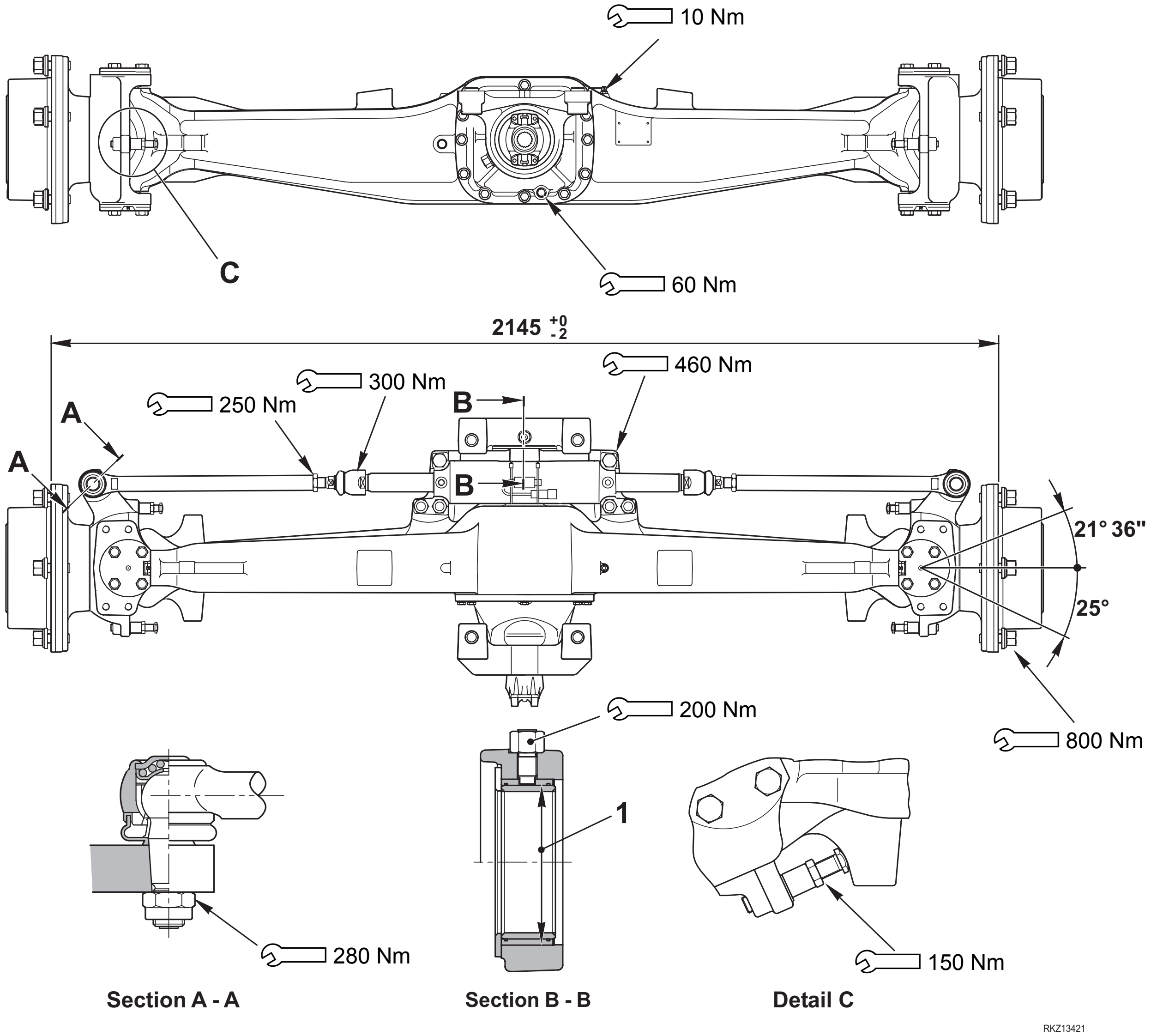
Unit: mm

No.	Check item	Criteria		Remedy
1	Backlash of crown wheel and pinion	Standard clearance	Clearance limit	Adjust
		0.20–0.30	–	
2	Pinion rotation force (without sealing ring) As measured on Ø 34.8	92–137 Nm		
3	Pinion-crown rotation force (without sealing ring) As measured on Ø 34.8	(P+32)–(P+47)N		

Planetary - Joint



Steering unit cylinder

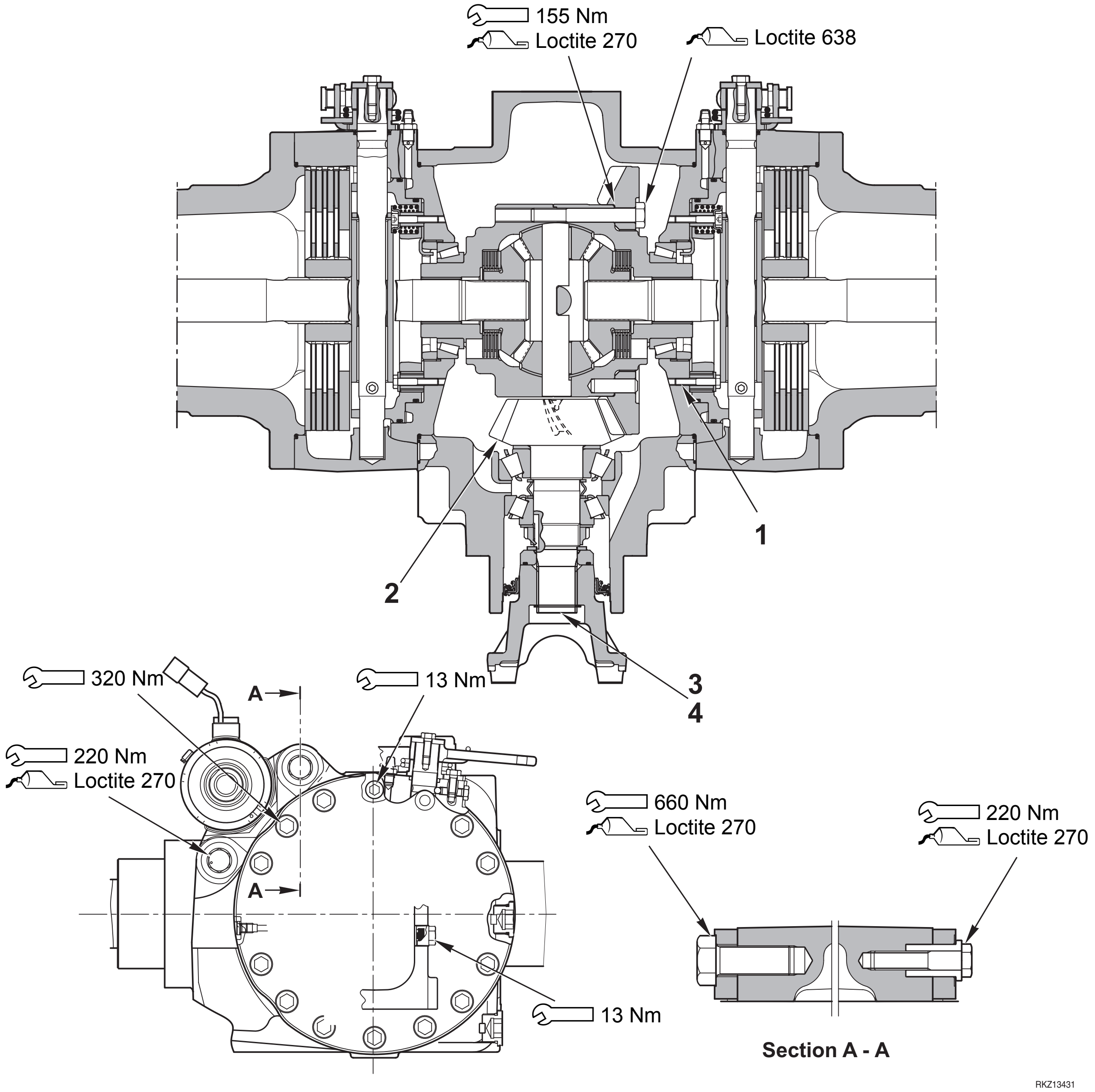


Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="5">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Clearance between bushing and pin</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="3">Replace bushing and pin</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
</table>

REAR AXLE

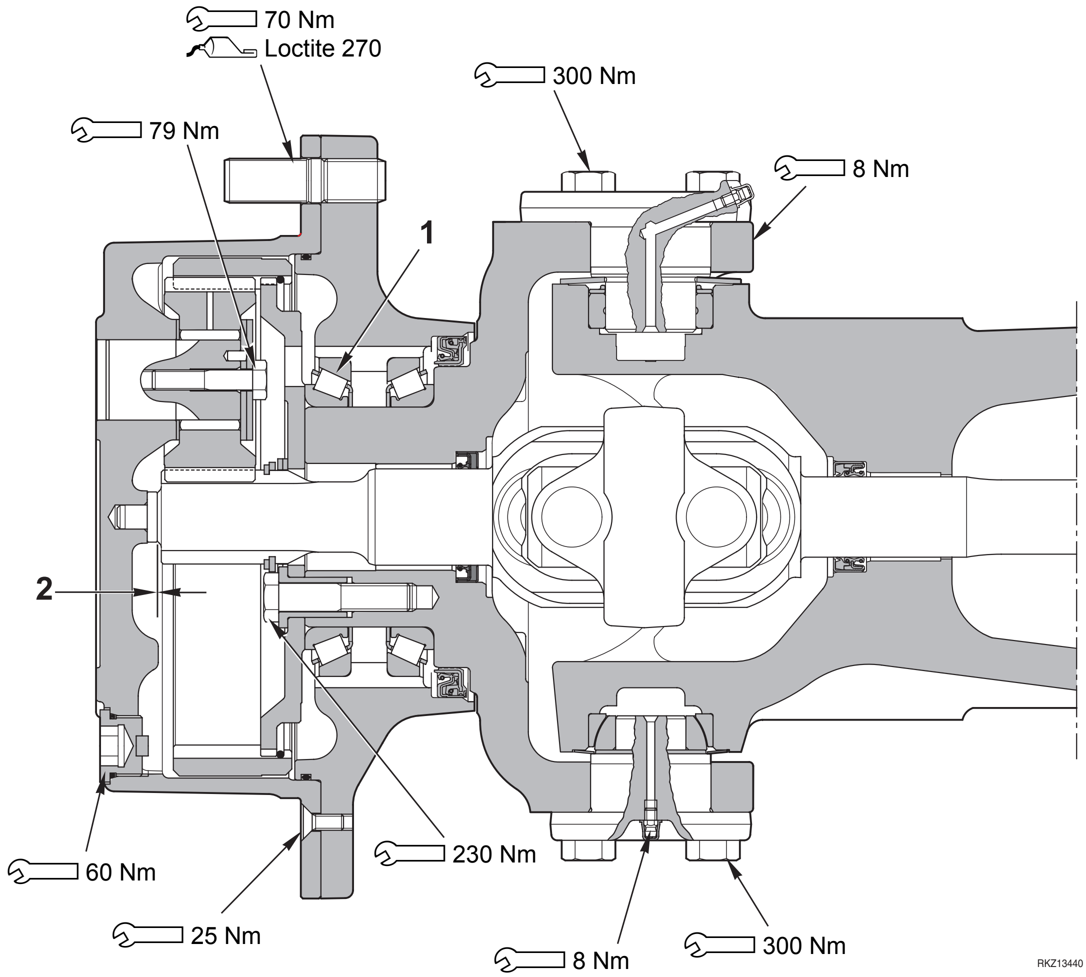
Differential



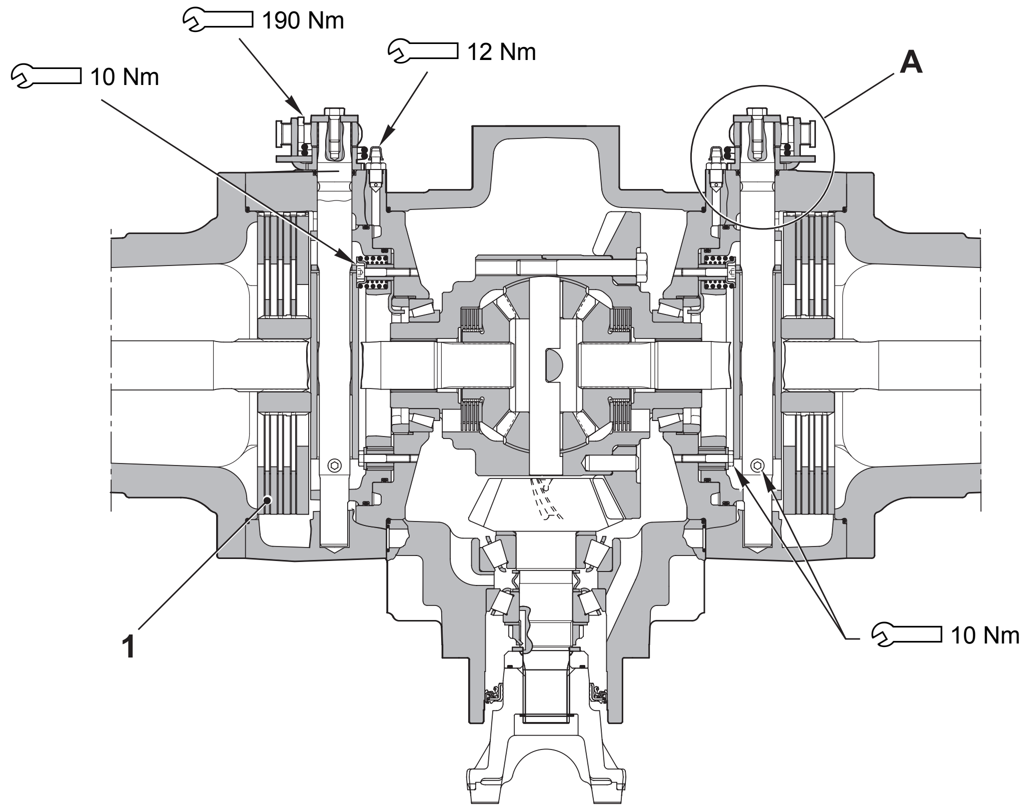
Unit: mm

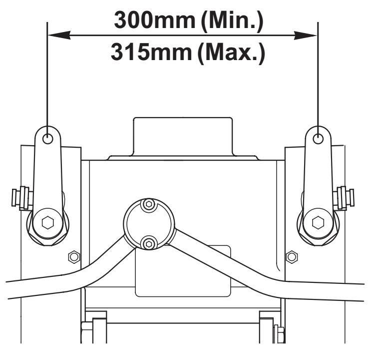
No.	Check item	Criteria		Remedy
1	Backlash of crown wheel and pinion	Standard clearance	Clearance limit	Adjust
		0.18–0.23	–	
2	Pinion rotation force (without sealing ring) As measured on Ø 34.8	92–137 Nm		
3	Pinion-crown rotation force (without sealing ring) As measured on Ø 34.8	(P+37.2)–(P+55.9)N		

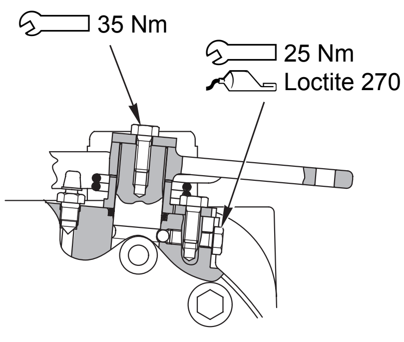
Planetary


70 Nm
Loctite 270
300 Nm
79 Nm
8 Nm
1
2
60 Nm
230 Nm
25 Nm
8 Nm
300 Nm
RKZ13440

Brakes







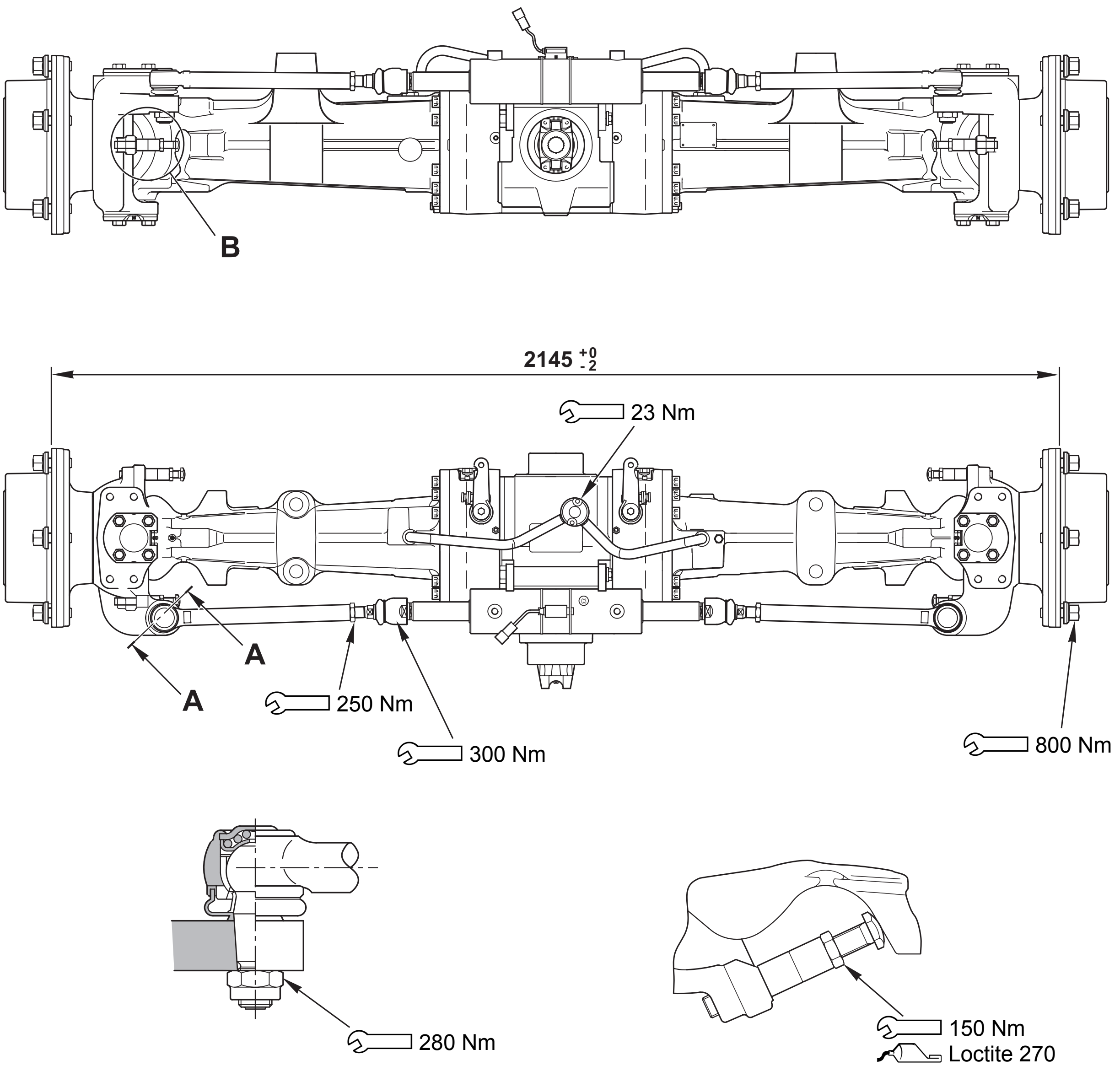
Detail A

RKZ13451

Unit: mm

No.	Check item	Criteria		Remedy
1	Disc thickness	Standard thickness	Min. thickness	Replace
		4.83	4.53	

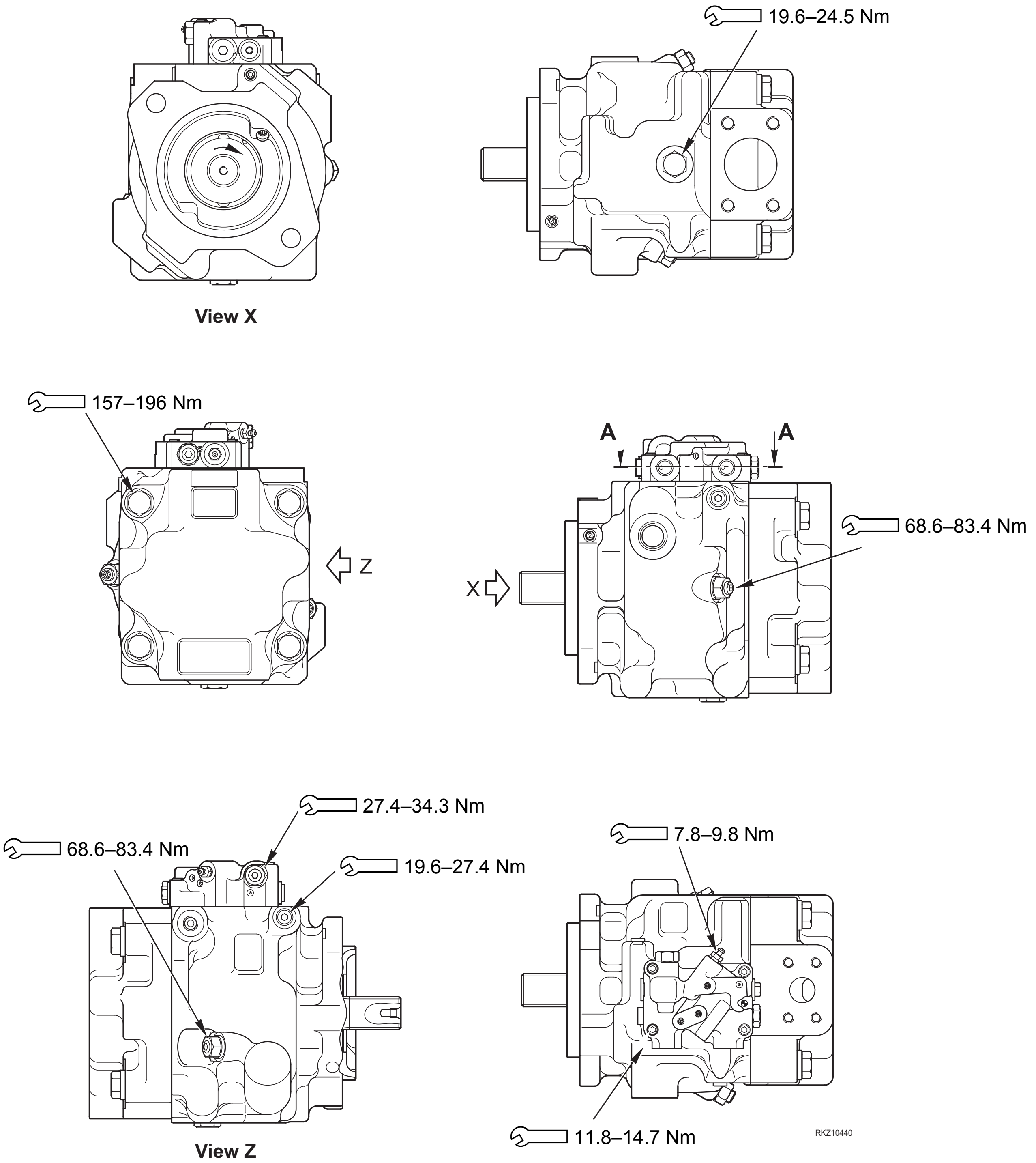
Steering unit cylinder

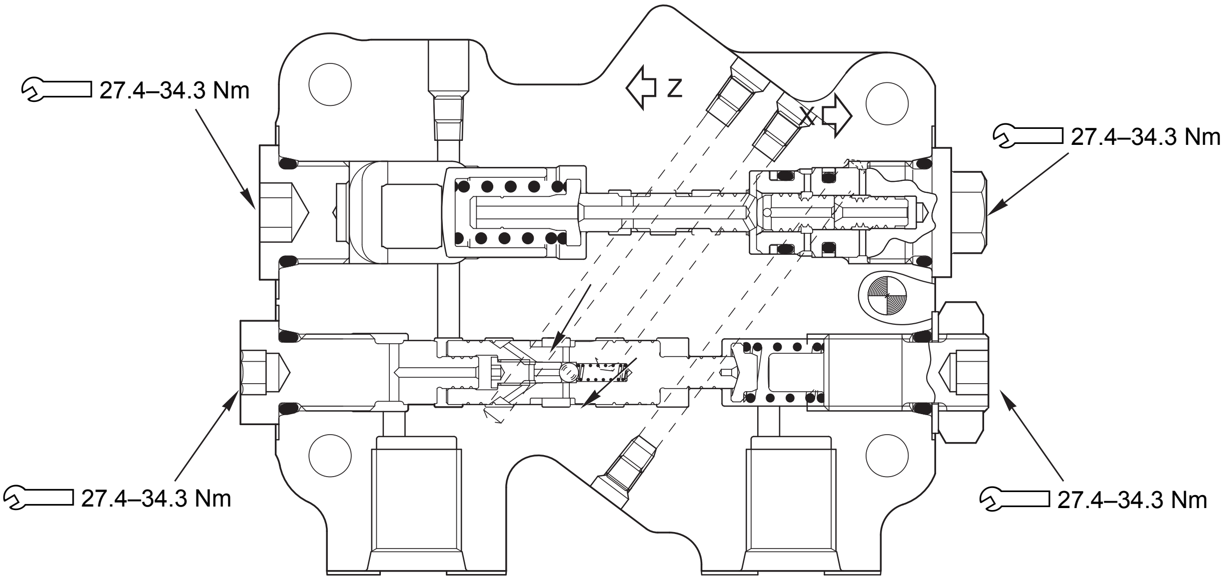


Section A - A

Detail B

HYDRAULIC PUMP

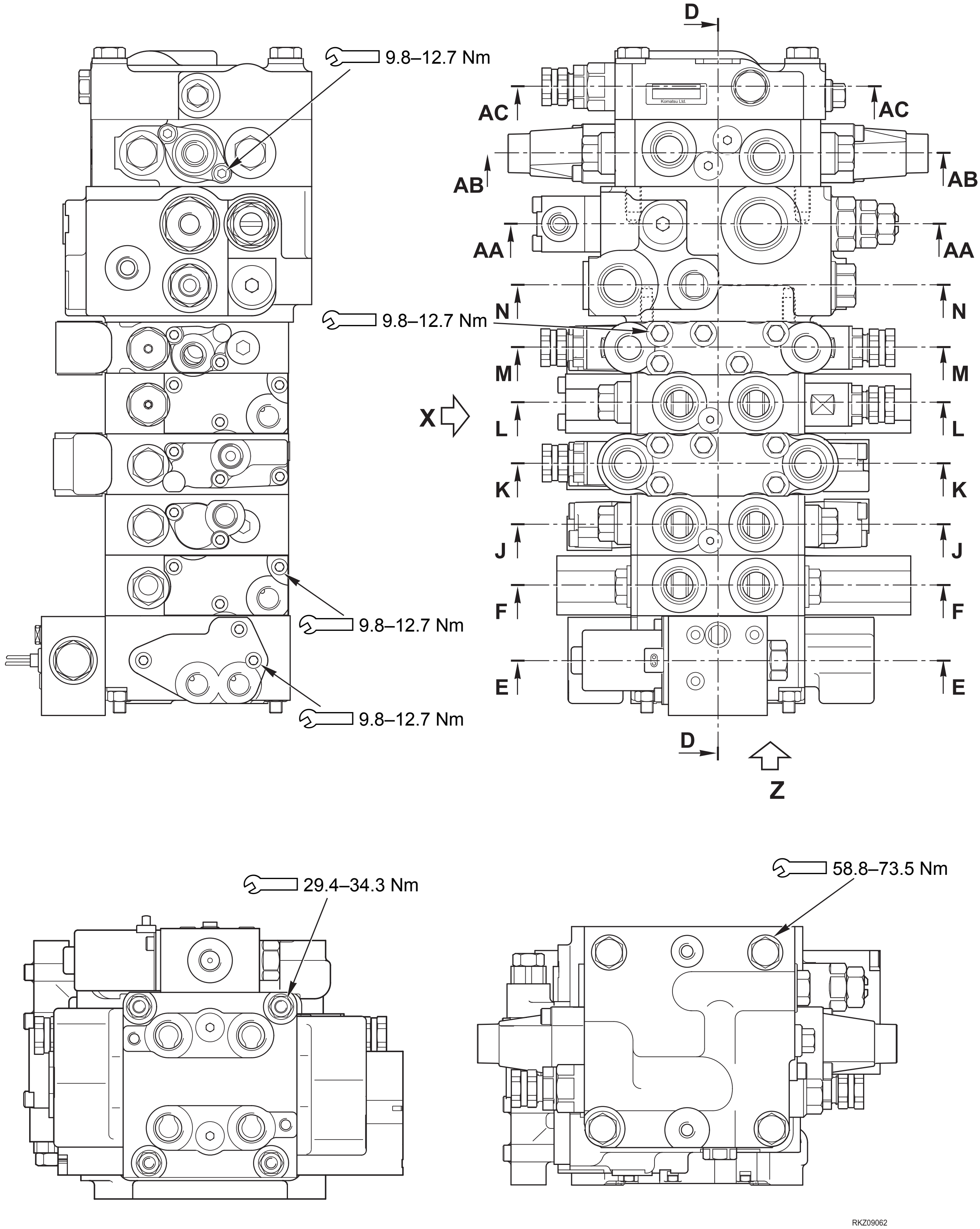


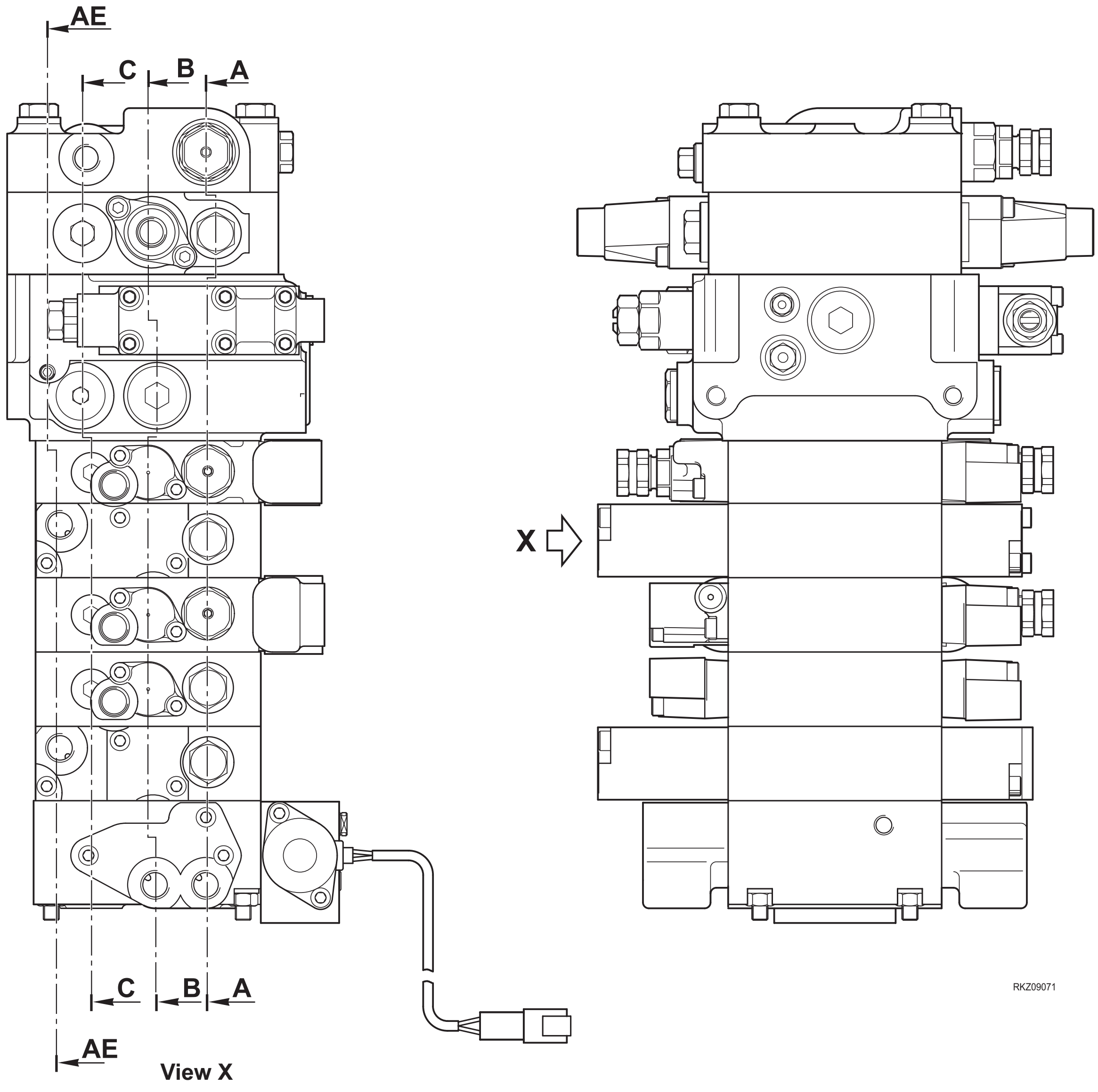


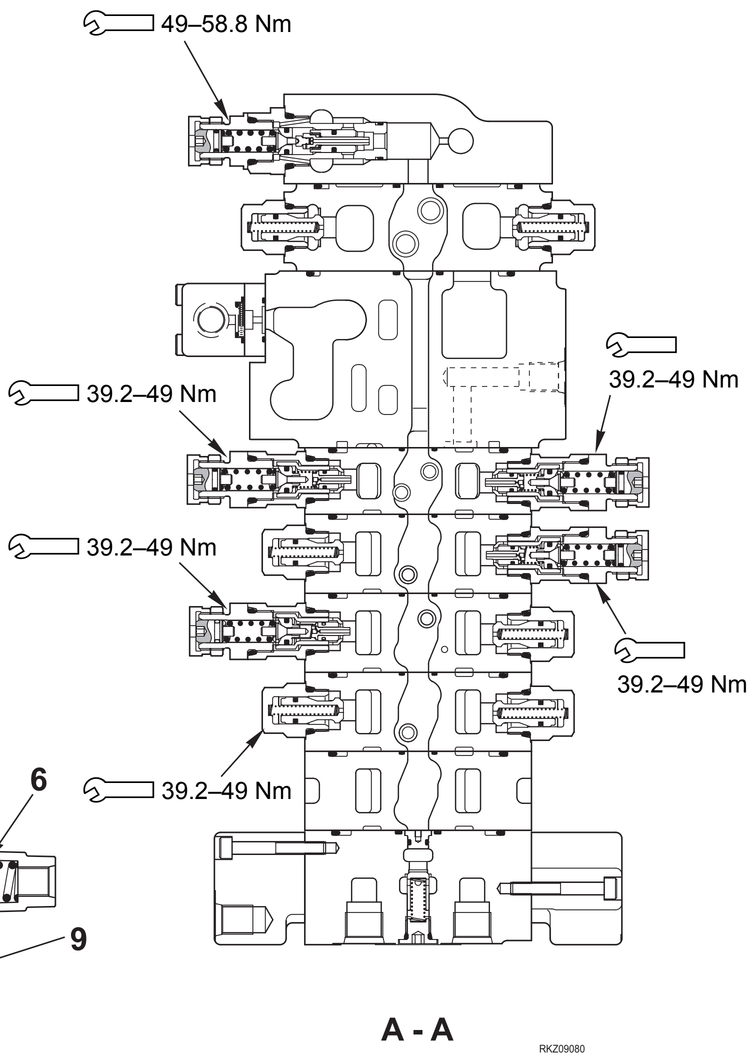
A - A

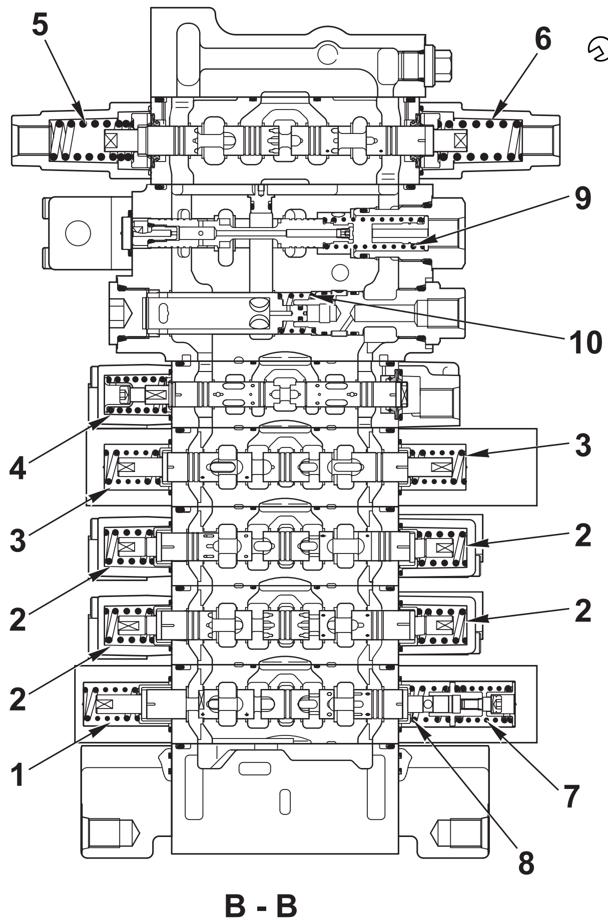
CONTROL VALVE

8-SPOOL VERSION



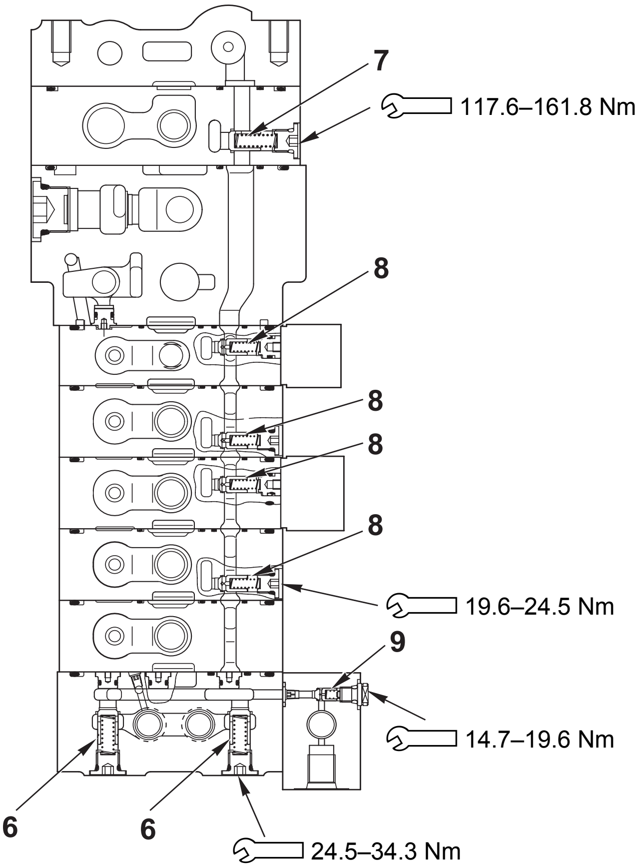

AE
C
B
A
C
B
A
AE
View X
X
RKZ09071


49–58.8 Nm
39.2–49 Nm
39.2–49 Nm
39.2–49 Nm
39.2–49 Nm
39.2–49 Nm
A - A
RKZ09080

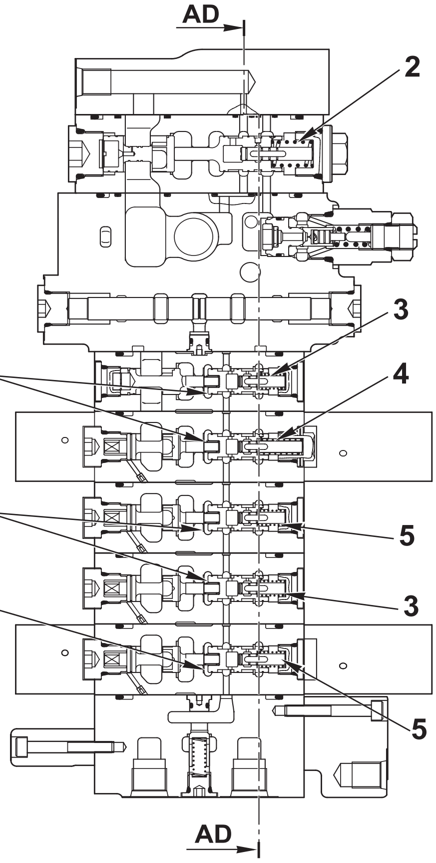

5
6
9
10
4
3
3
3
2
2
2
2
1
7
8
B - B

Unit: mm

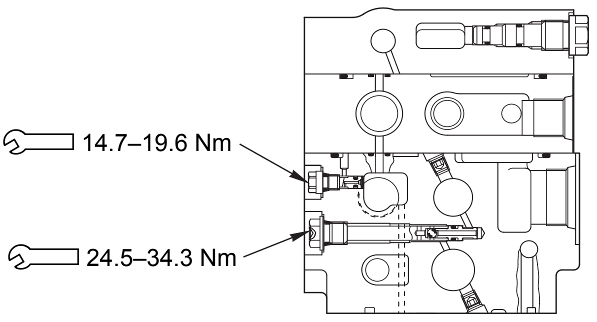
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
1	Spool return spring (shovel arm raise control)	27.1x16.2	26.7	14.7N	–	11.8N	Replace spring
2	Spool return spring (in arm control)	41.1x19.3	40.5	34.3N	–	27.4N	
3	Spool return spring (out arm control)	42.3x19.2	40.5	54.9N	–	43.9N	
4	Spool return spring (boom swing control)	29x17.5	28.5	22.5N	–	18N	
5	Spool return spring (shovel control)	27.2x16.6	26.7	30.38N	–	24.3N	
6	Spool return spring (backhoe bucket boom control)	24.2x16.7	23.7	30.4N	–	24.3N	
7	Spool return spring (shovel arm float control)	19.4x17.6	19	14.7N	–	11.8N	
8	Spool return spring (shovel arm lower control)	38.7x18	27.6	355.7N	–	284.6N	
9	Priority valve spring	56.8x15.2	48.5	29.6N	–	23.7N	
10	Unloading valve spring	25.5x19.3	18	121.5N	–	97.2N	



D - D



C - C

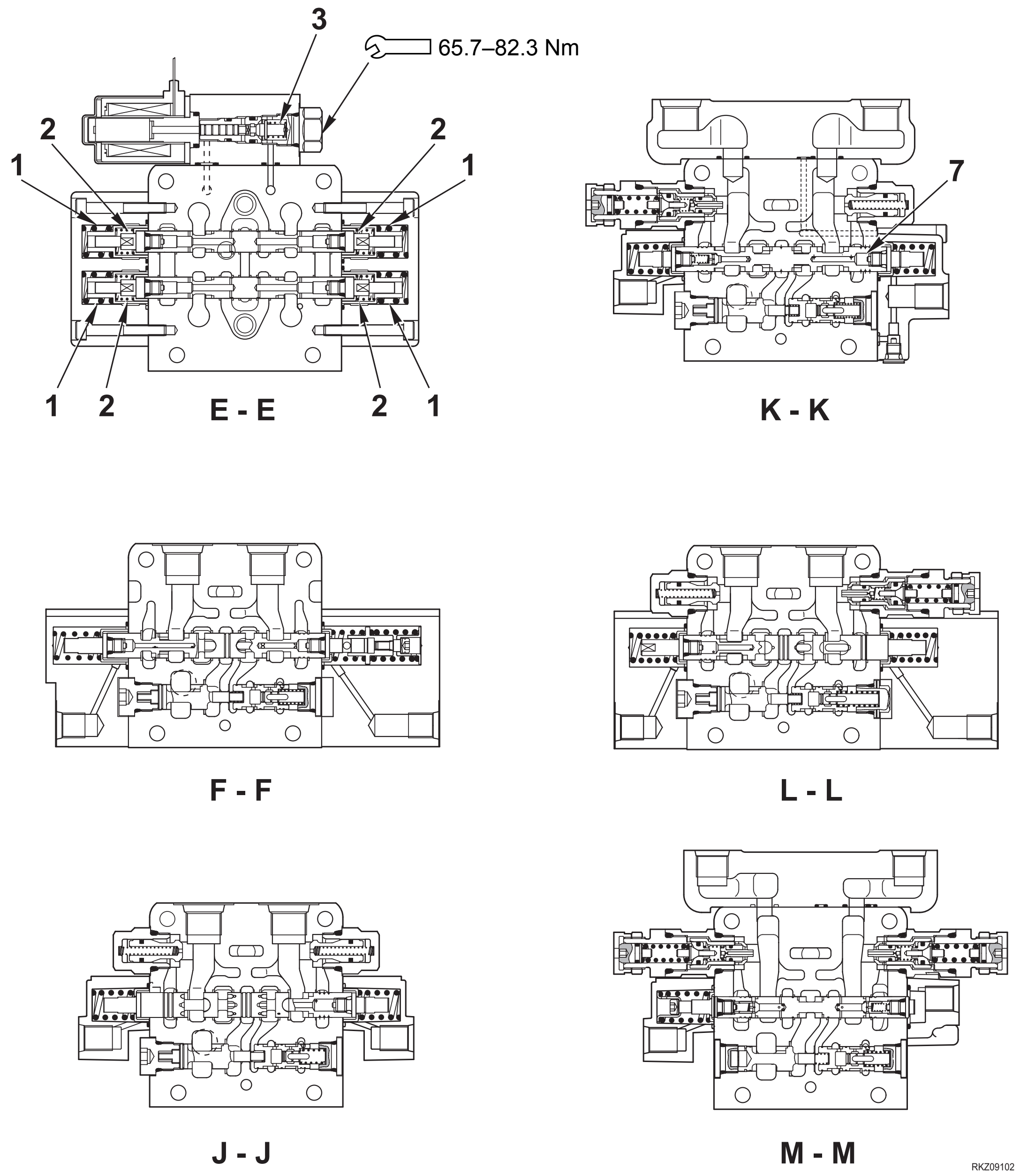


AD - AD

RKZ08341

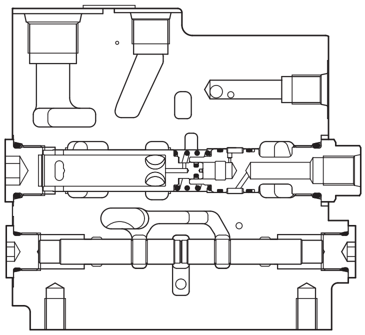
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
1	Pressure compensation valve spring (Shovel arm, backhoe bucket, boom, shovel, boom swing)	15.4x6	8	7.44N	–	5.96N	Replace spring
2	Pressure compensation valve spring (arm)	31.4x14.4	21.8	63.7N	–	51.0N	
3	Pressure compensation valve spring. (Boom swing, backhoe bucket)	18.9x8.4	15	15.7N	–	12.5N	
4	Pressure compensation valve spring. (Front bucket)	37.1x8.6	24	34.3N	–	27.4N	
5	Pressure compensation valve spring. (boom, shovel arm)	20x8.4	15	4.32N	–	3.45N	
6	Check valve spring	27.2x6.9	21	4.70N	–	3.76N	
7	Check valve spring	27.2x6.9	22	3.92N	–	3.14N	
8	Check valve spring	21.9x5	15.8	1.96N	–	1.57N	
9	Check valve spring	11.3x4.3	7.5	1.72N	–	1.38N	

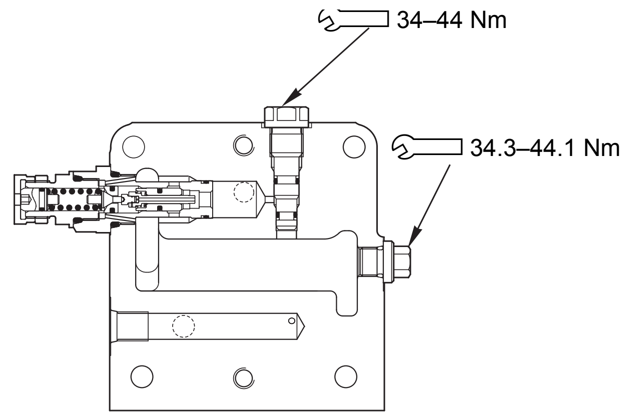


Unit: mm

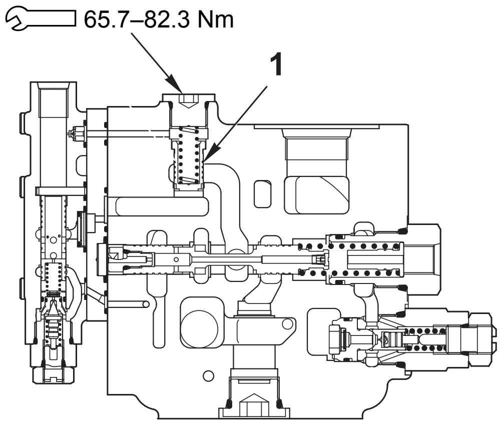
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
1	Spool return spring (Outrigger control)	18.0x18	17.5	39.2N	–	31.4N	Replace spring
2	Spool return spring (Outrigger control	20.2x14.2	10.4	30.4N	–	24.3N	
3	Control valve spring plate lock	13.0x8.8	11	3.92N	–	3.1N	



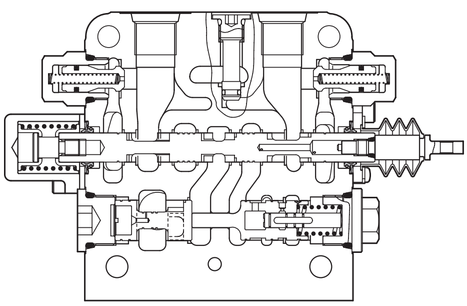
N - N



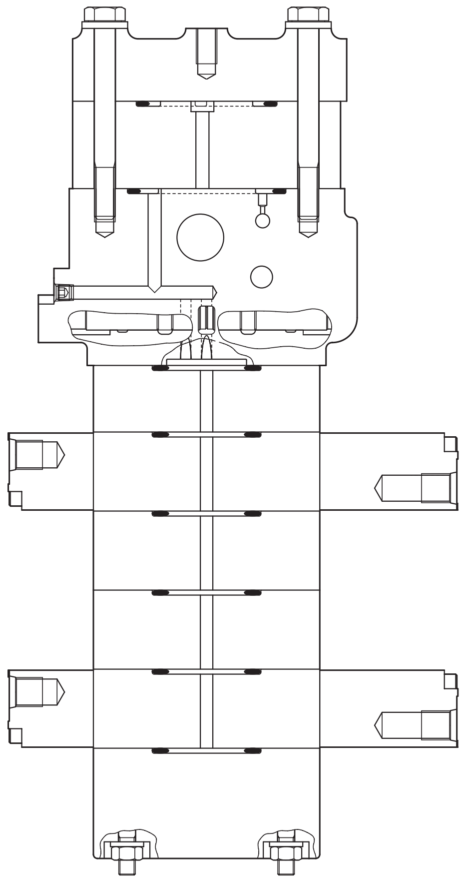
AC - AC



AA - AA



AB - AB



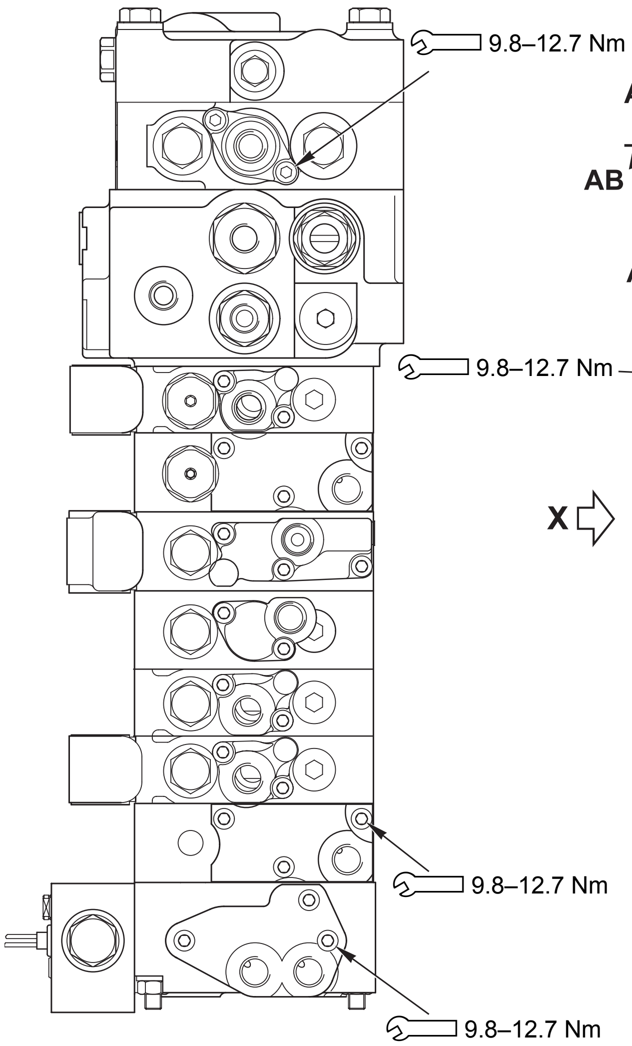
AE - AE

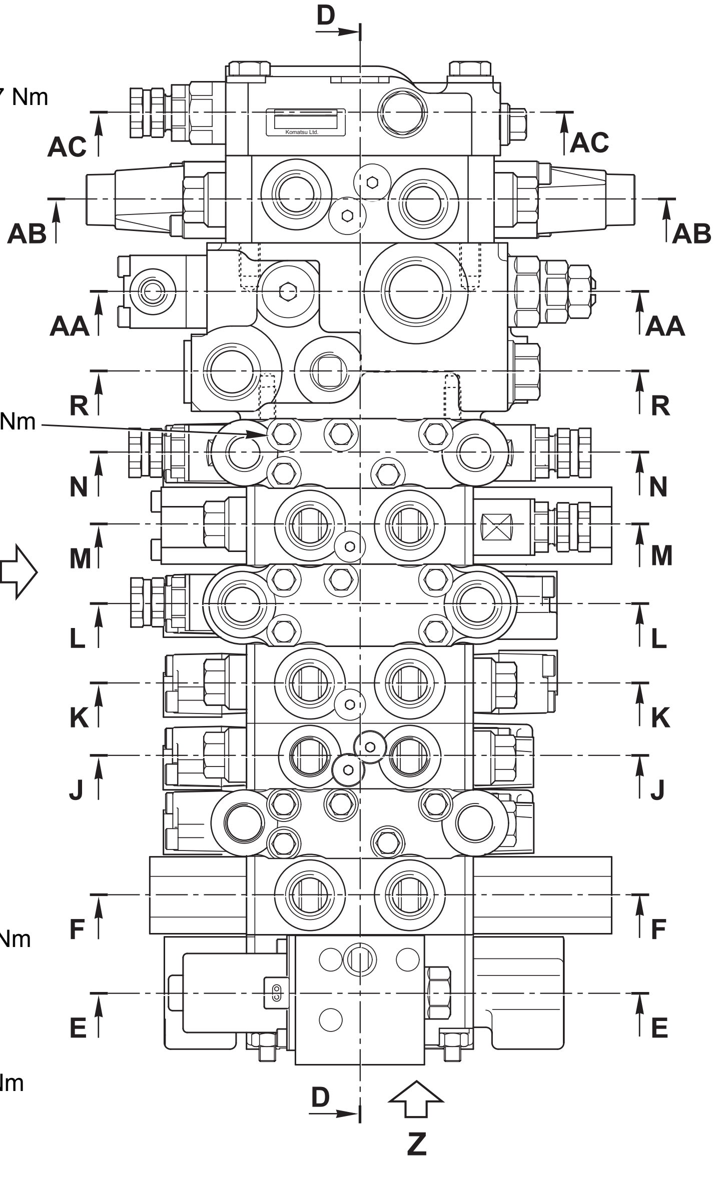
RKZ08892

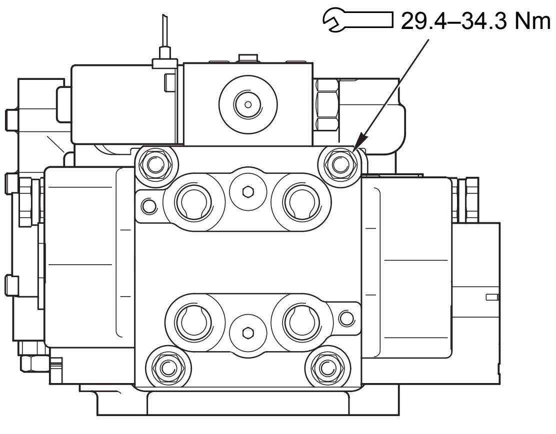
Unit: mm

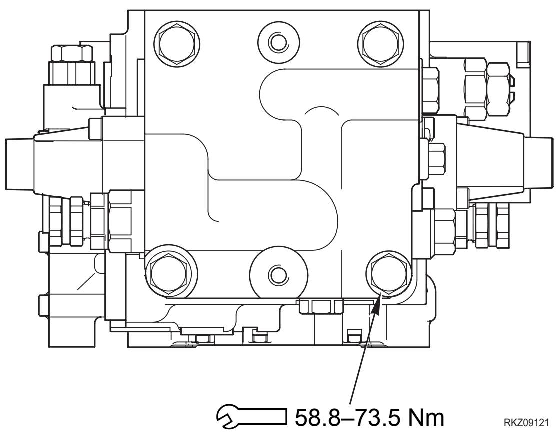
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		Replace spring
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
1	Pressure compensation valve spring.	31.7x9.2	27.5	43.1N	–	34.5N	

10-SPOOL VERSION

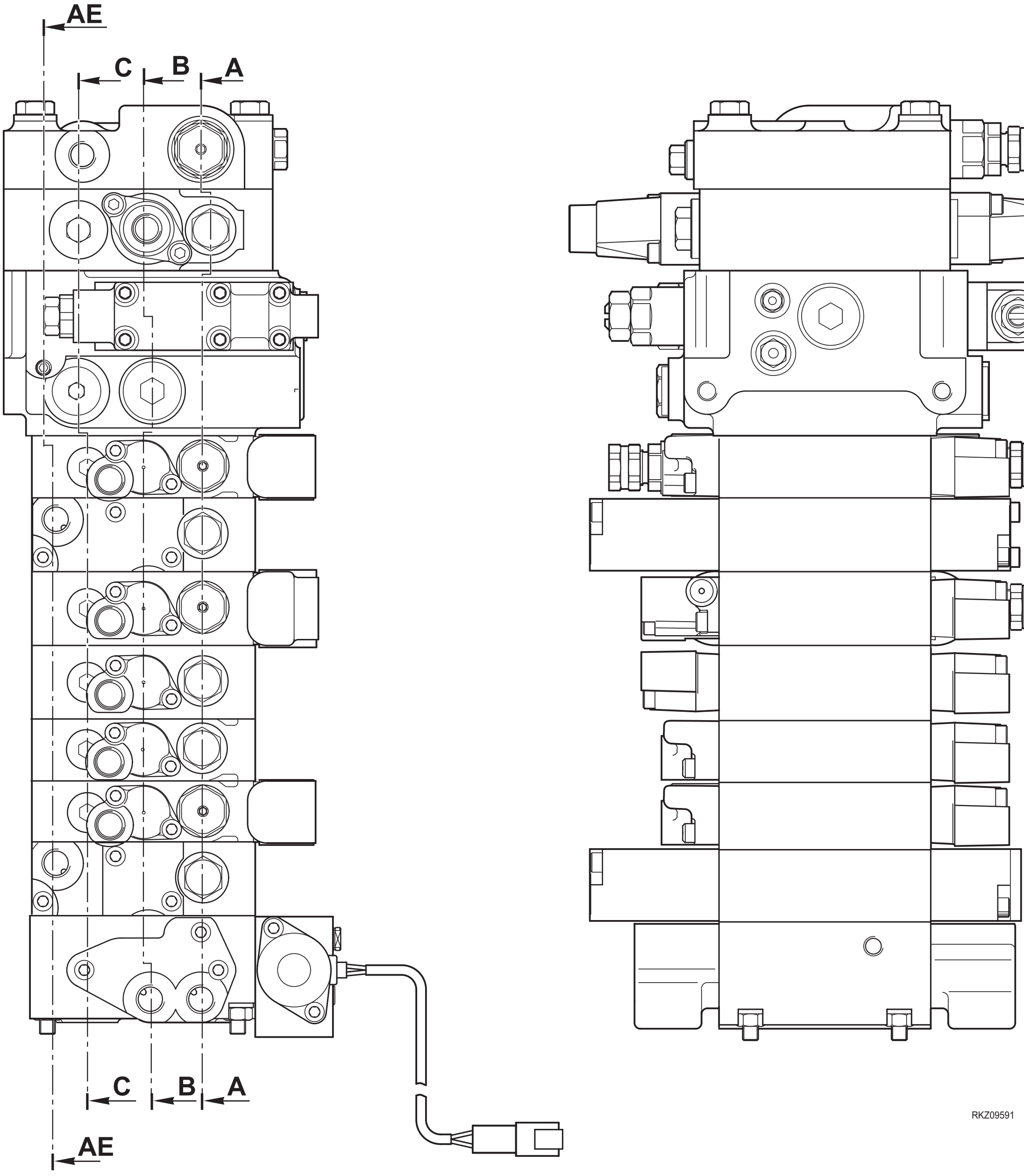




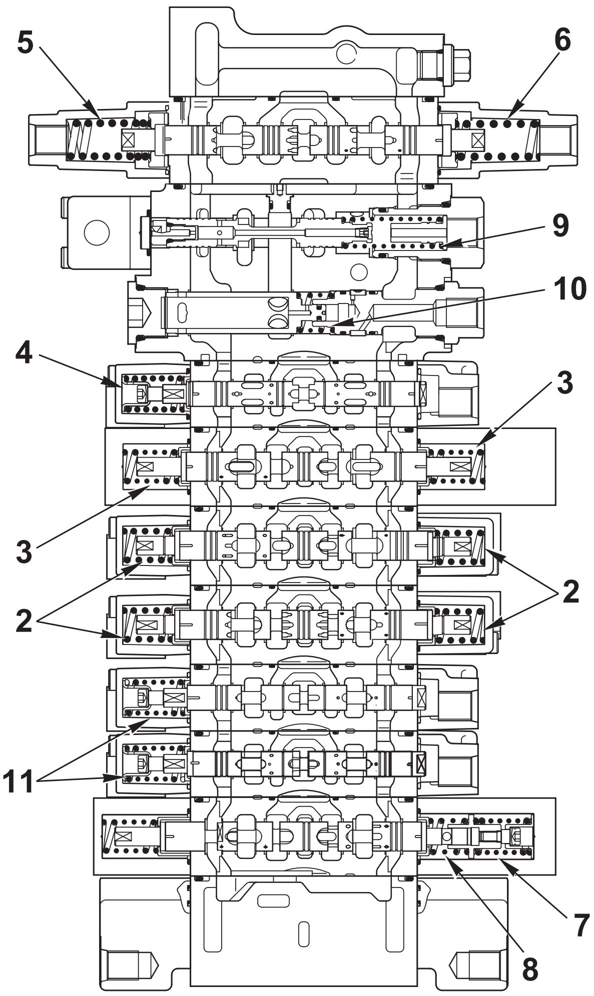




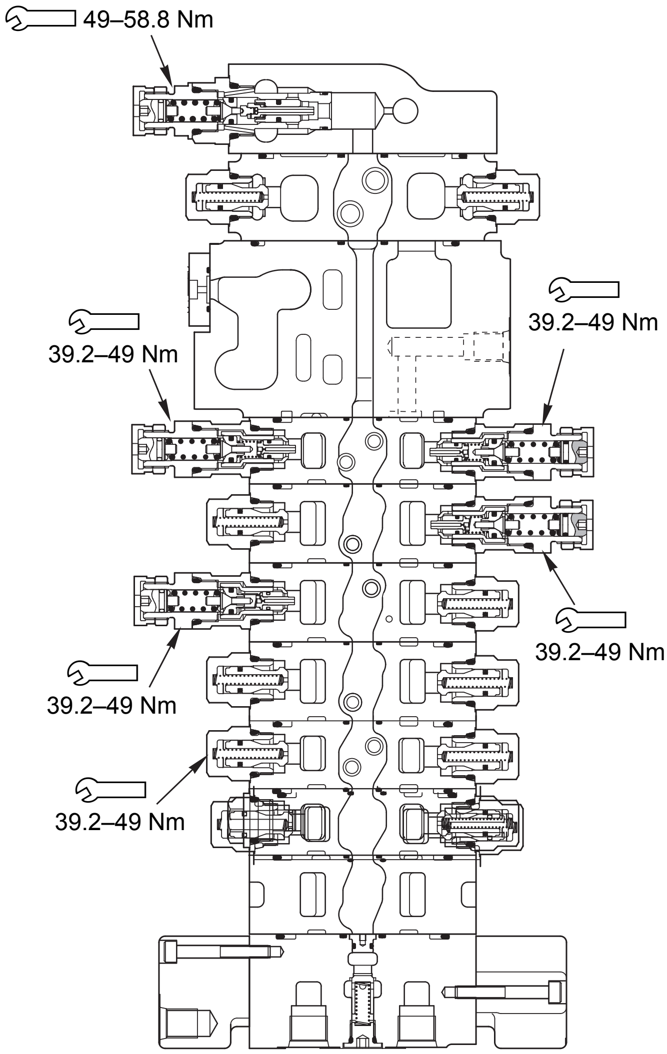
ViewZ



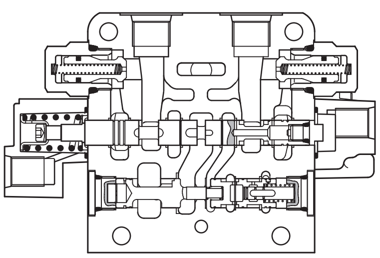
ViewX



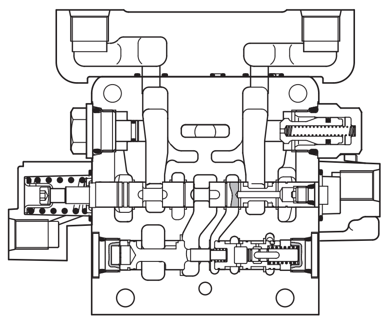
B - B



A - A



K - K

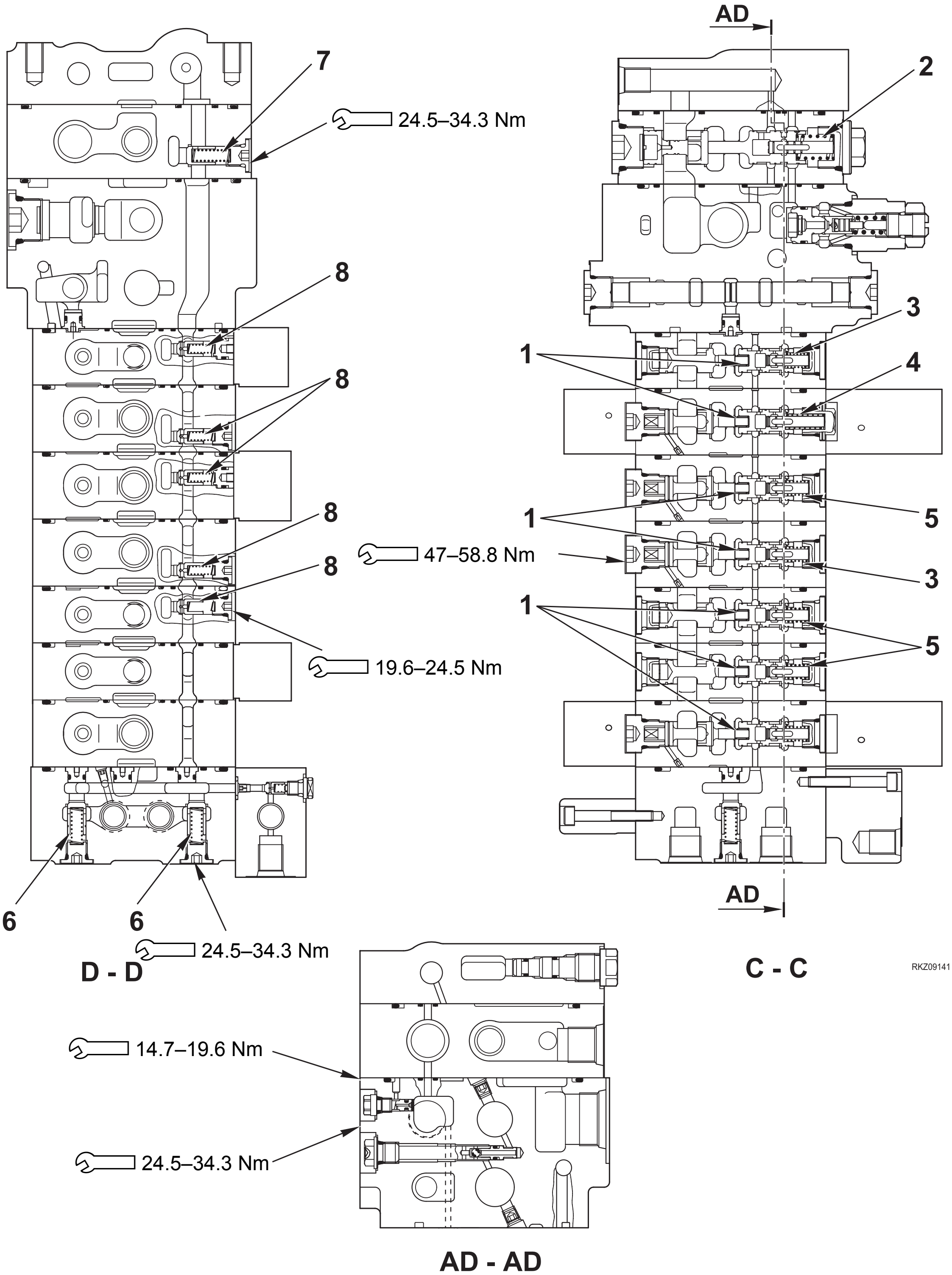


J - J

RKZ09131

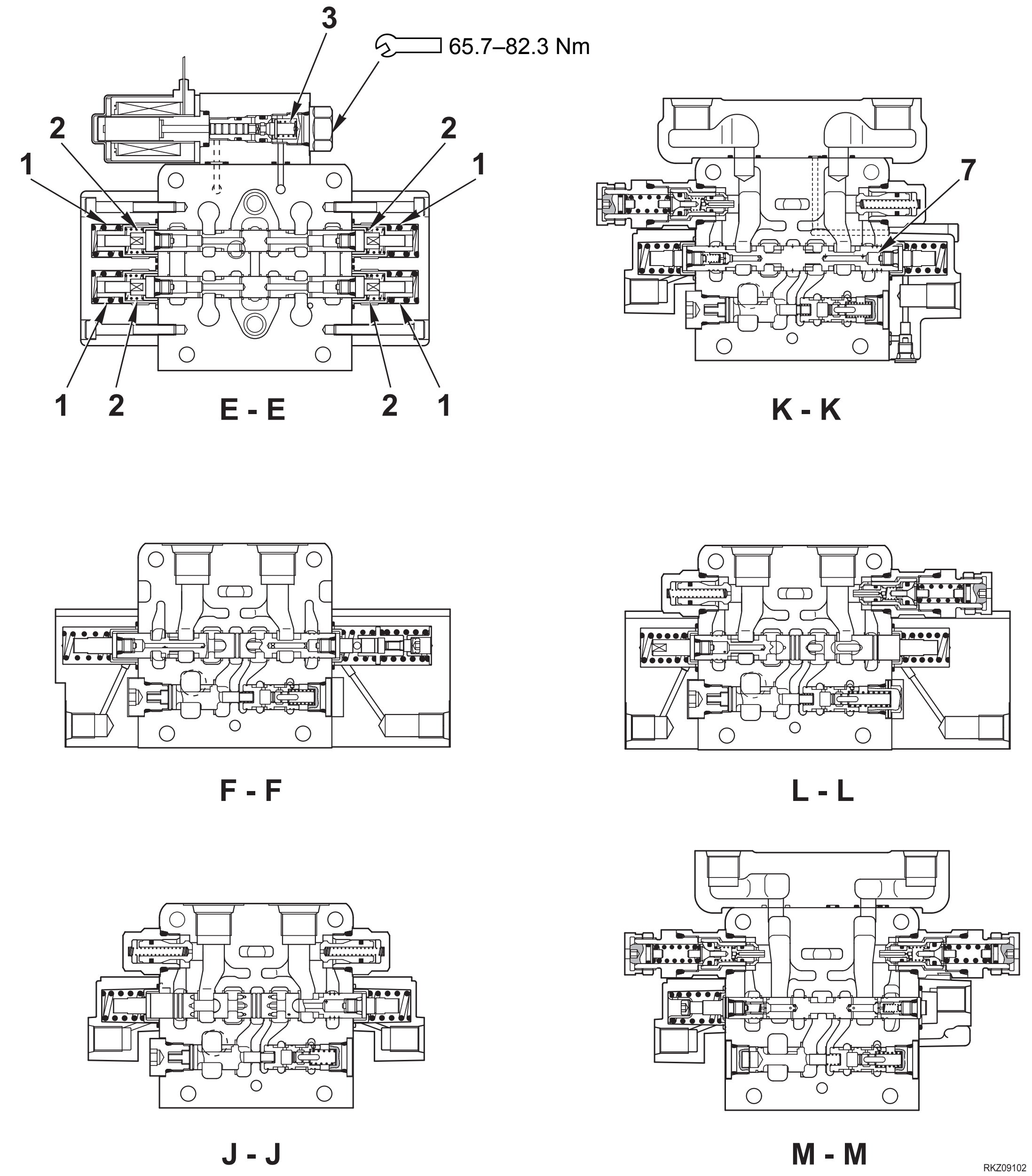
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
1	Spool return spring (shovel arm raise control)	27.1x16.2	26.7	14.7N	–	11.8N	Replace spring
2	Spool return spring (in arm control)	41.1x19.3	40.5	34.3N	–	27.4N	
3	Spool return spring (out arm control)	42.3x19.2	40.5	54.9N	–	43.9N	
4	Spool return spring (boom swing control)	29x17.5	28.5	22.5N	–	18N	
5	Spool return spring (shovel control)	27.2x16.6	26.7	30.38N	–	24.3N	
6	Spool return spring (backhoe bucket boom control)	24.2x16.7	23.7	30.4N	–	24.3N	
7	Spool return spring (shovel arm float control)	19.4x17.6	19	14.7N	–	11.8N	
8	Spool return spring (shovel arm lower control)	38.7x18	27.6	355.7N	–	284.6N	
9	Priority valve spring	56.8x15.2	48.5	29.6N	–	23.7N	
10	Unloading valve spring	25.5x19.3	18	121.5N	–	97.2N	
11	Spool return spring (jig arm control, 4 in 1 bucket control)	29x17.5	28.5	22.5N		18.0N	


7
24.5–34.3 Nm
8
8
8
8
19.6–24.5 Nm
6
6
24.5–34.3 Nm
D - D
AD
2
3
1
4
1
5
47–58.8 Nm
3
1
5
AD
C - C
RKZ09141
14.7–19.6 Nm
24.5–34.3 Nm
AD - AD

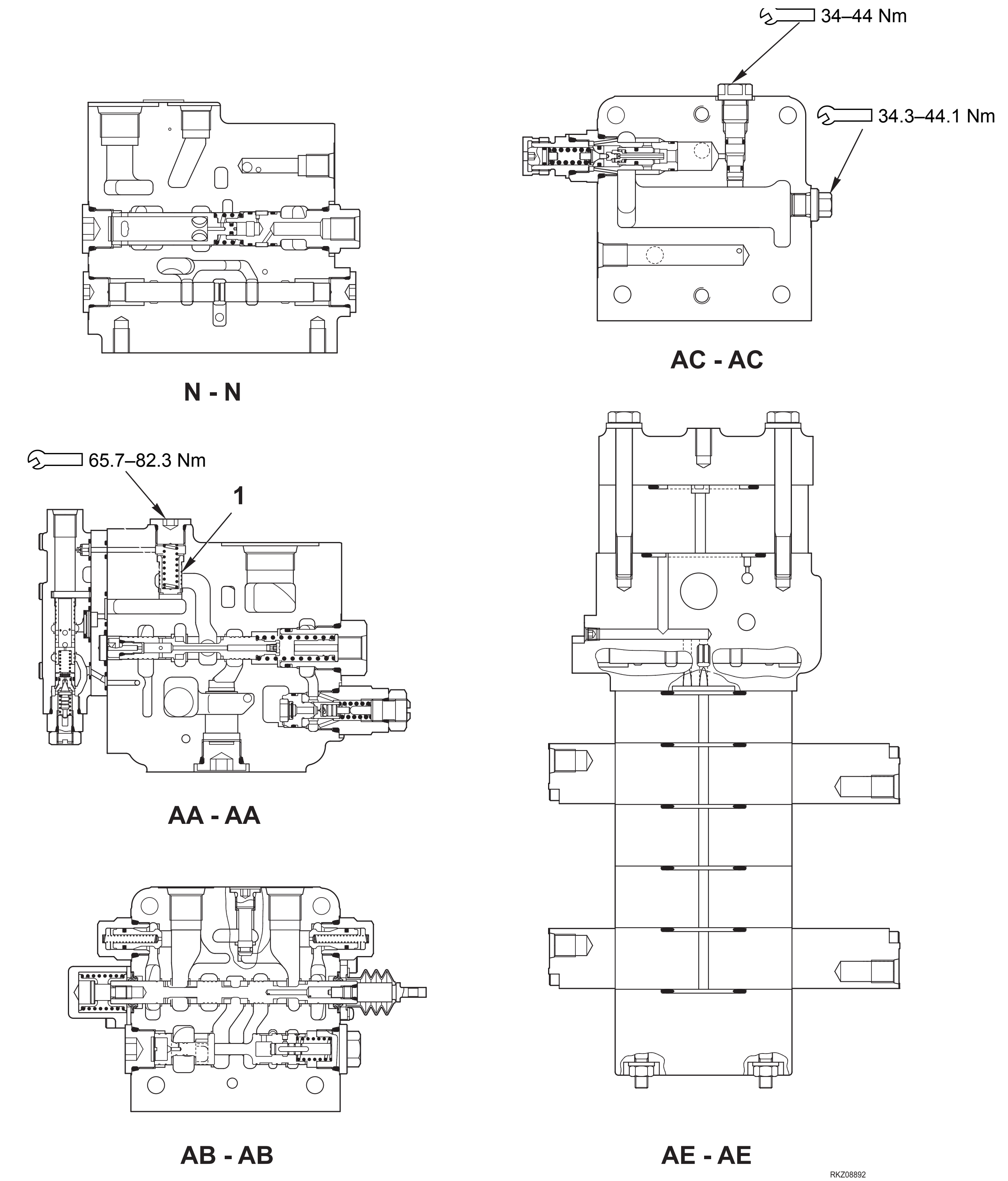
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
1	Pressure compensation valve spring (Shovel arm, backhoe bucket, boom, shovel, boom swing, jig arm, 4 in 1 bucket)	15.4x6	8	7.44N	–	5.96N	Replace spring
2	Pressure compensation valve spring (arm)	31.4x14.4	21.8	63.7N	–	51.0N	
3	Pressure compensation valve spring. (Boom swing, backhoe bucket)	18.9x8.4	15	15.7N	–	12.5N	
4	Pressure compensation valve spring. (Front bucket)	37.1x8.6	24	34.3N	–	27.4N	
5	Pressure compensation valve spring. (boom, shovel arm jig arm, 4 in 1 bucket)	20x8.4	15	4.32N	–	3.45N	
6	Check valve spring	27.2x6.9	21	4.70N	–	3.76N	
7	Check valve spring	27.2x6.9	22	3.92N	–	3.14N	
8	Check valve spring	21.9x5	15.8	1.96N	–	1.57N	
9	Check valve spring	11.3x4.3	7.5	1.72N	–	1.38N	



Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
1	Spool return spring (Outrigger control)	18.0x18	17.5	39.2N	–	31.4N	Replace spring
2	Spool return spring (Outrigger control	20.2x14.2	10.4	30.4N	–	24.3N	
3	Control valve spring plate lock	13.0x8.8	11	3.92N	–	3.1N	

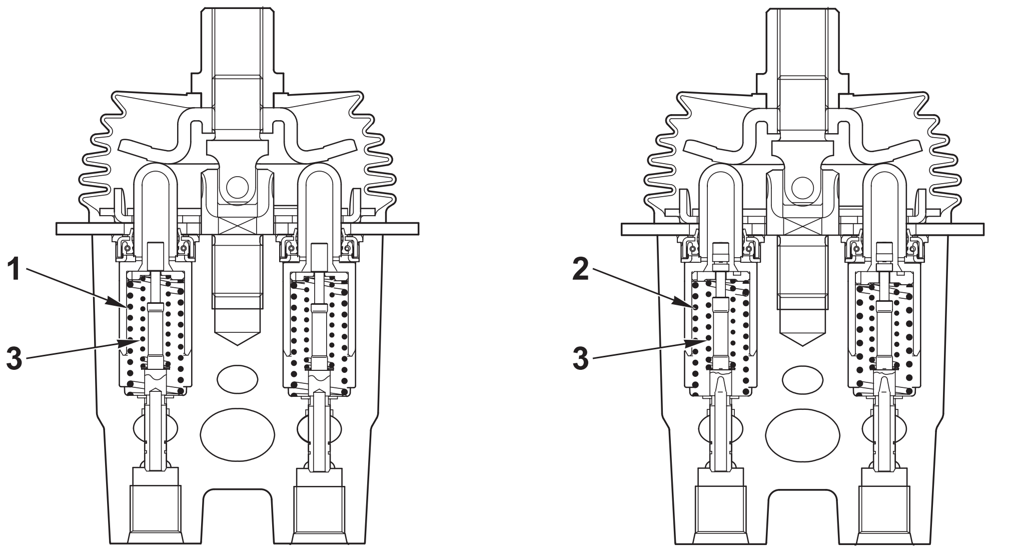


Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		Replace spring
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
1	Pressure compensation valve spring.	31.7x9.2	27.5	43.1N	–	34.5N	

PPC VALVES

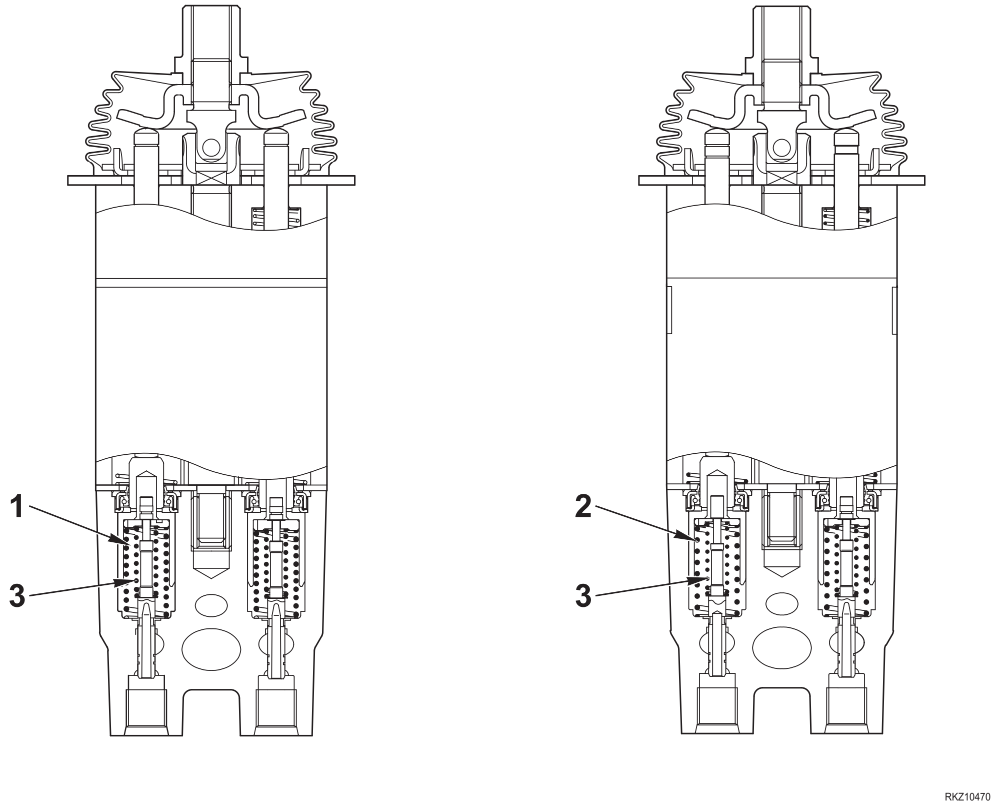
SHOVEL CONTROL



RKZ10460

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
1	Return spring (outer) (for ports P1 and P2)						Replace
2	Return spring (outer) (for ports P3 and P4)						
3	Adjusting screw (inner)						

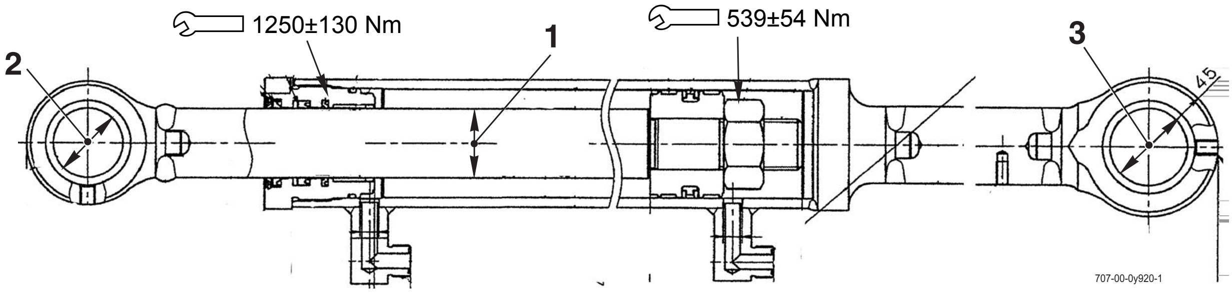


Unit: mm

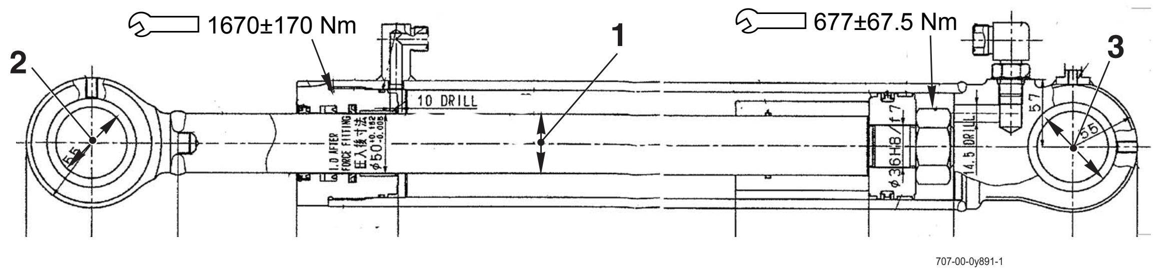
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		Replace
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
1	Return spring (outer) (for ports P1 and P2)						
2	Return spring (outer) (for ports P3 and P4)						
3	Adjusting screw (inner)						

SHOVEL CYLINDERS

DUMP CYLINDER



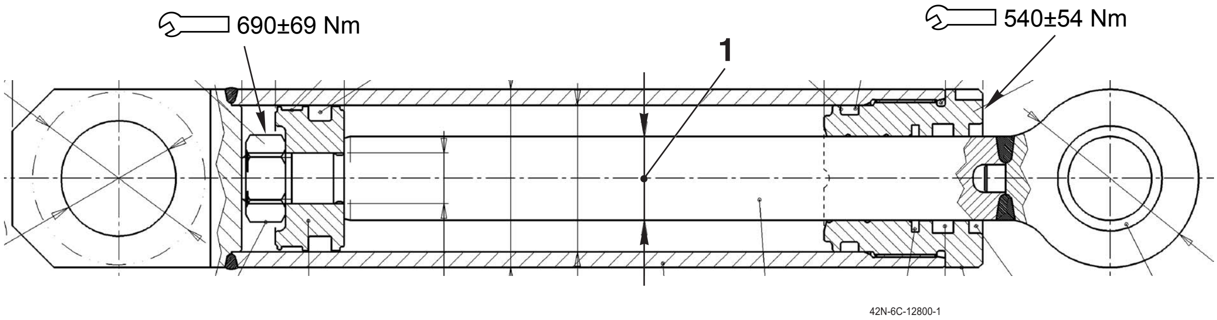
RAISE CYLINDER



Unit: mm

No.	Check item	Cylinder	Criteria					Remedy
			Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Tolerance between piston rod and head	Lifting	50	−0.030 −0.076	+ 0.162 + 0.005	0.035	0.238	Replace
		Dump	45	−0.025 −0.064	+ 0.141 + 0.004	0.029	0.205	
2	Tolerance between bushing and piston head mounting pin	Lifting	60	−0.060 −0.106	+ 0.174 + 0.100	0.160	0.280	Replace pin and bushing
		Dump	45	−0.050 −0.089	+ 0.142 + 0.080	0.130	0.231	
3	Tolerance between bushing and cylinder mounting pin	Lifting	60	−0.060 −0.106	+ 0.174 + 0.100	0.160	0.280	
		Dump	50	−0.050 −0.089	+ 0.142 + 0.080	0.130	0.231	

4 IN 1 BUCKET

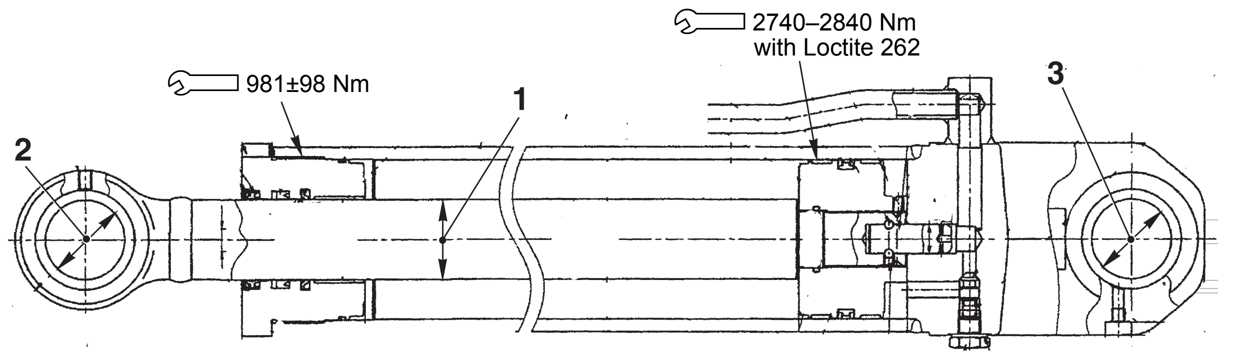


Unit: mm

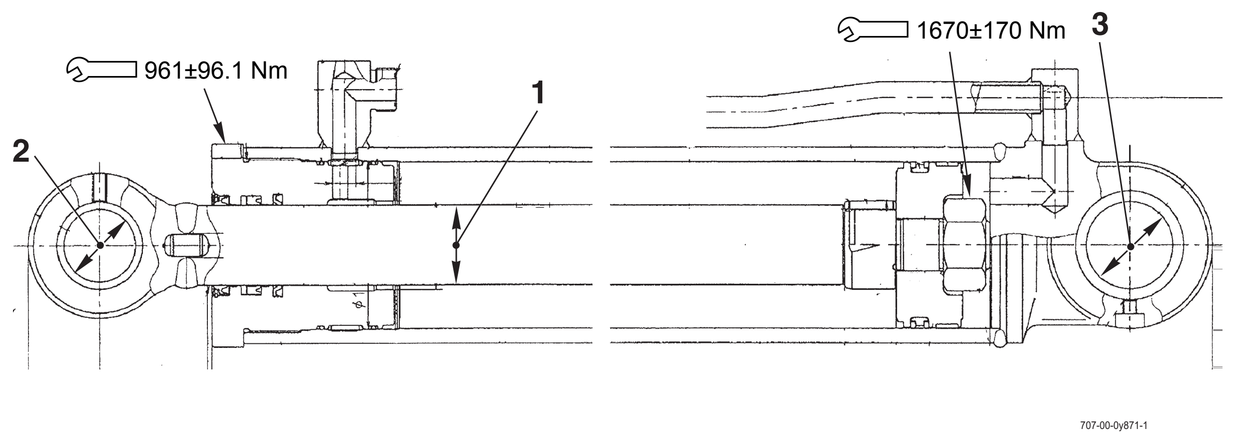
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free installed x Øe	Installed length	Installed load	Free installed	Installed load	
1	Tolerance between piston rod and head	40	−0.025 −0.050	+ 0.064 + 0.025	0.05	0.114	Replace
2	Tolerance between bushing and piston head mounting pin	40	$^{0}_{-}$0.150				

BACKHOE CYLINDERS

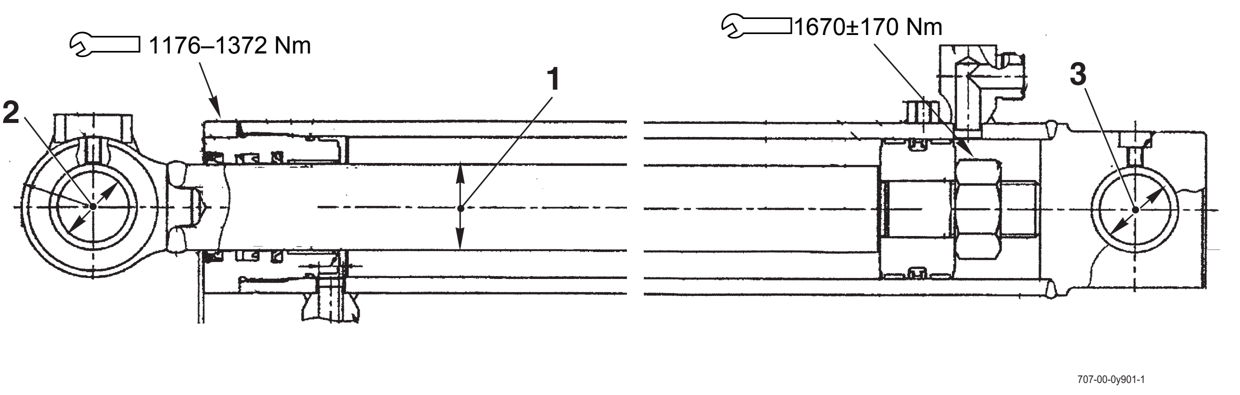
BOOM



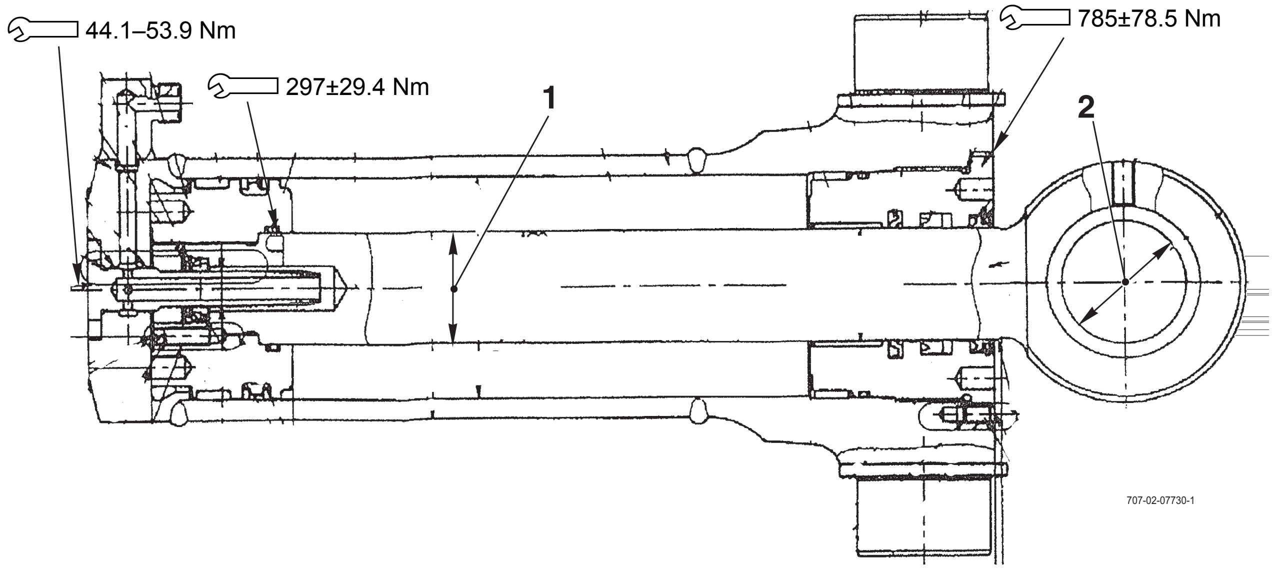
ARM



BUCKET



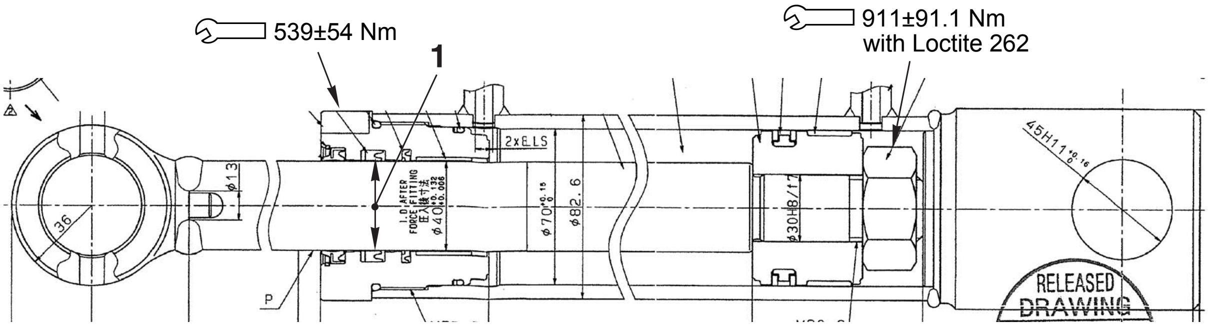
BOOM SWING



Unit: mm

No.	Check item	Cylinder	Criteria					Remedy
			Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between piston rod and head	Boom	60	−0.030 −0.076	+ 0.051 + 0.005	0.035	0.227	Replace
		Arm	55	−0.030 −0.076	+ 0.046 0	0.030	0.132	
		Bucket	55	−0.030 −0.076	+ 0.051 + 0.005	0.035	0.227	
		Boom swing	50	-0.030 −0.076	+ 0.164 + 0.007	0.037	0.240	
2	Tolerance between bushing and piston head mounting pin	Boom	60	−0.060 −0.106	+ 0.174 + 0.100	0.160	0.280	
		Arm	50	−0.050 −0.089	+ 0.142 + 0.080	0.130	0.231	Replace pin and bushing
		Bucket	45	−0.050 −0.089	+ 0.142 + 0.080	0.130	0.231	
		Boom swing	55	−0.060 −0.106	+ 0.174 + 0.100	0.160	0.280	
3	Tolerance between bushing and cylinder mounting pin	Boom	60	−0.060 −0.106	+ 0.174 + 0.100	0.160	0.280	
		Arm	60	−0.060 −0.106	+ 0.174 + 0.100	0.160	0.280	
		Bucket	45	−0.050 −0.089	+ 0.142 + 0.080	0.130	0.231	

OUTRIGGERS



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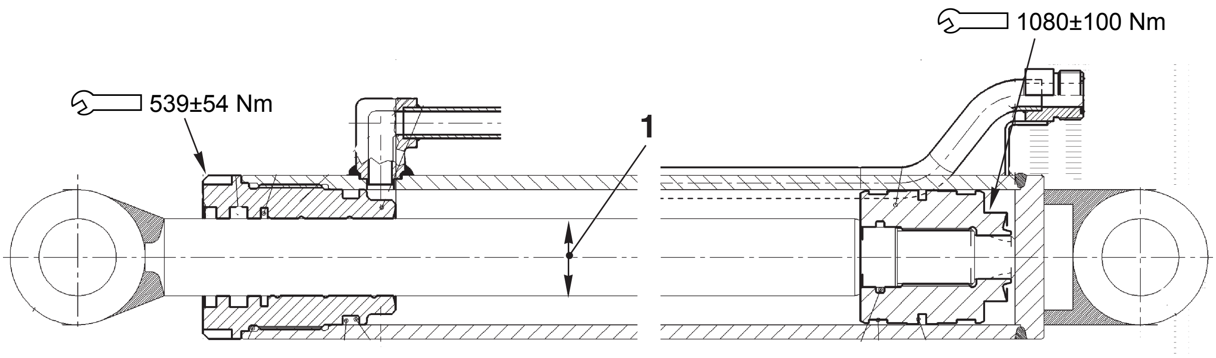
JIG ARM



42N-6C-13301-1

Unit: mm

No.	Check item	Cylinder	Criteria					Remedy
			Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between piston rod and head	Outriggers	40	−0.025 −0.064	+ 0.132 + 0.006	0.031	0.196	Replace
		Jig arm	40	−0.025 −0.050	+ 0.064 + 0.025	0.050	0.114	

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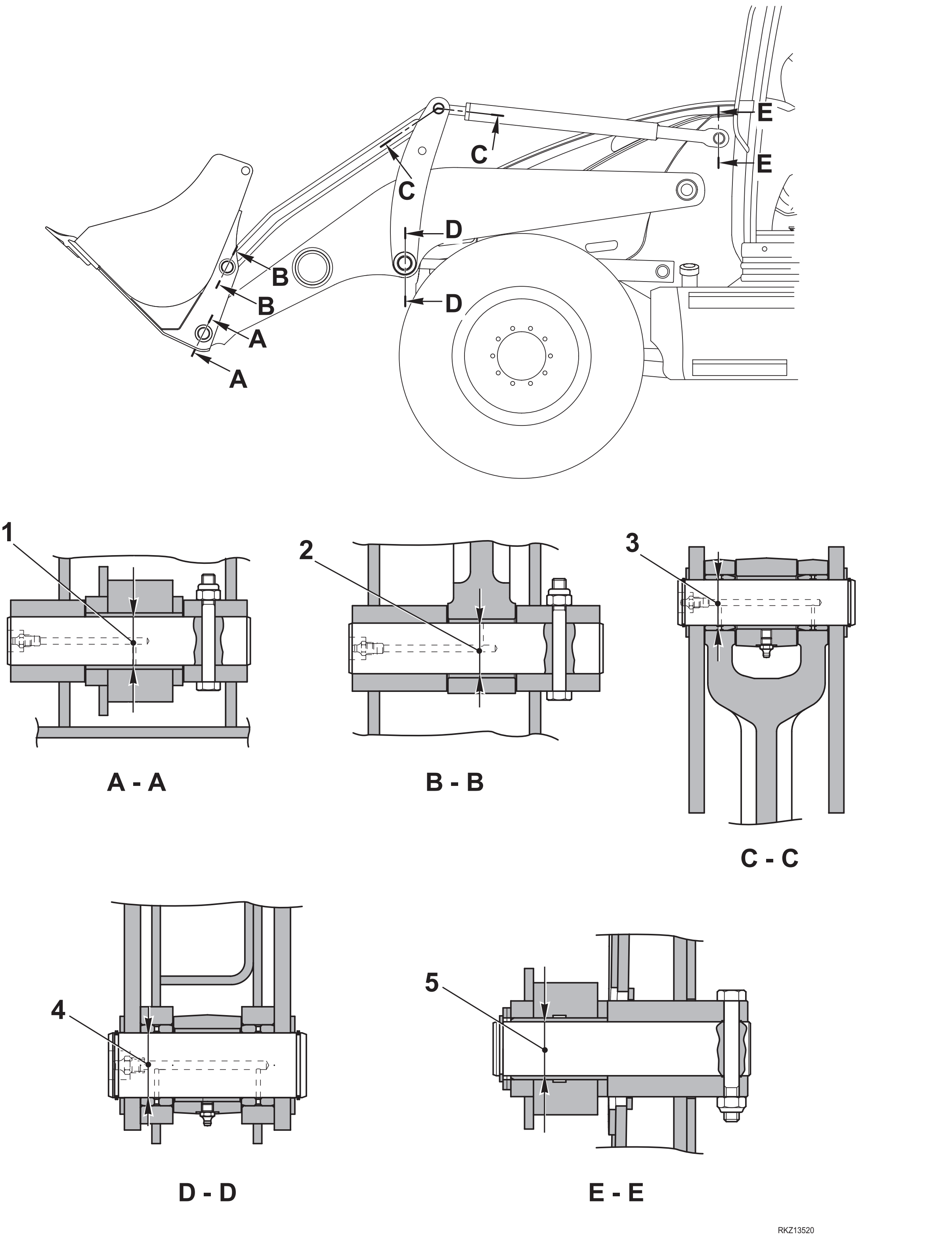
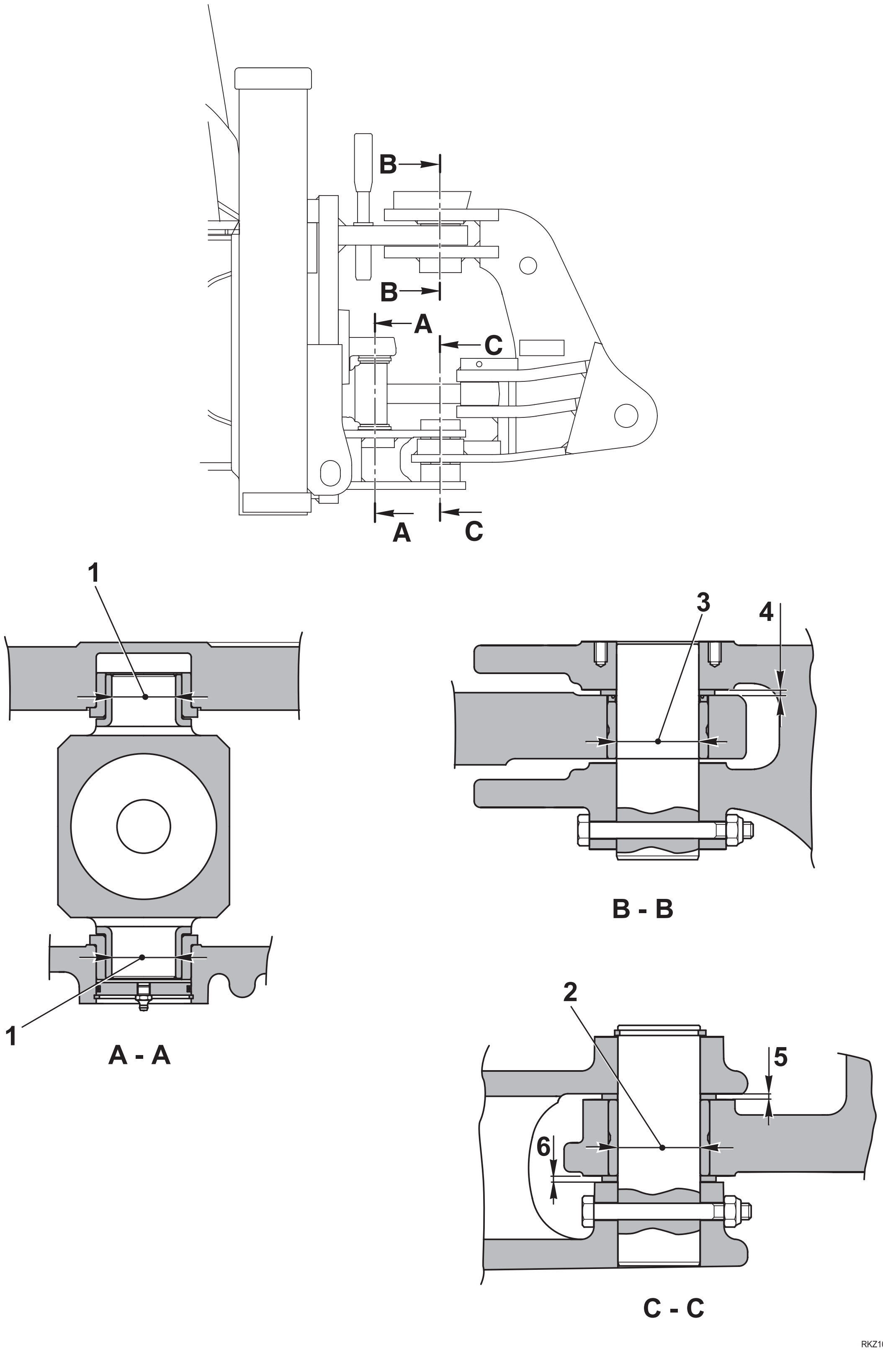
FRONT WORKING EQUIPMENT



Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between bushings 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 fulcrum link mounting pin	45	−0.050 −0.089	+ 0.080 + 0.119	0.130–0.208		
4	Clearance between bushing and link mounting pin	60	−0.060 −0.106	+ 0.137 + 0.197	0.143–0.303		
5	Clearance between bushing and boom mounting pin	50	−0.050 −0.089				

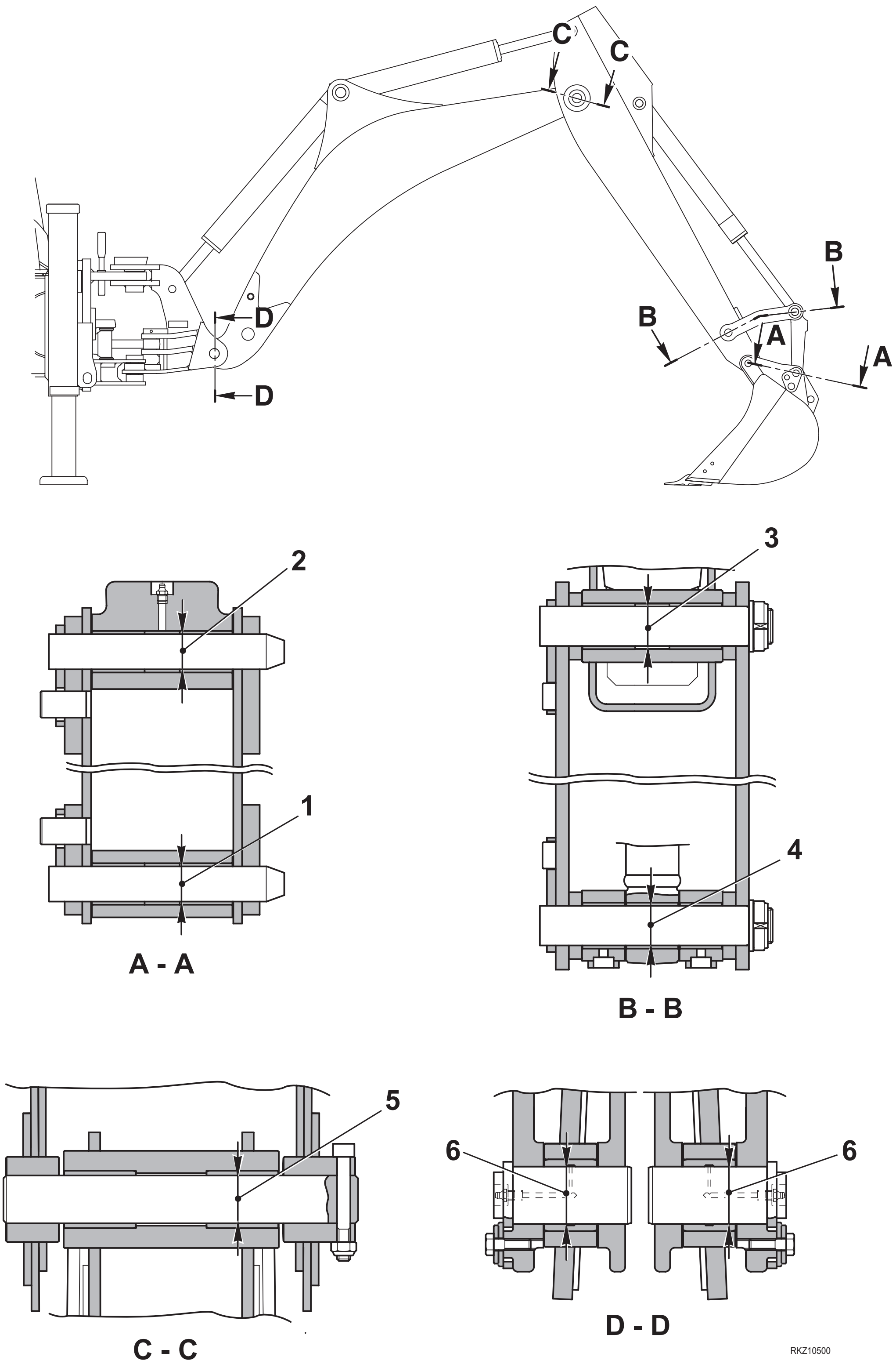
SWING BRACKET



Unit: mm

No.	Check item	Criteria: Standard size	Criteria: Tolerance — Shaft	Criteria: Tolerance — Hole	Criteria: Standard clearance	Criteria: Clearance limit	Remedy
1	Clearance between rotating bushing and boom swing cylinder bushing	60	−0.010 −0.085	+ 0.090 + 0.060	0.070–0.175		Replace bushing and pin
2	Clearance between bushing and (lower) swing bracketrotating pin	65	−0.060 −0.106	+ 0.190 + 0.264	0.250–0.370		
3	Clearance between bushing and (upper) swing bracketrotating pin	65	−0.060 −0.106	+ 0.190 + 0.264	0.250–0.370		
		Standard size			Limit size		
4	Upper shim thickness	$2.50^{0}_{-0.1}$					
5	Central shim thickness	$4.75^{0}_{-0.1}$					
6	Lower shim thickness	$4.75^{0}_{-0.1}$					

BACKHOE WORKING EQUIPMENT

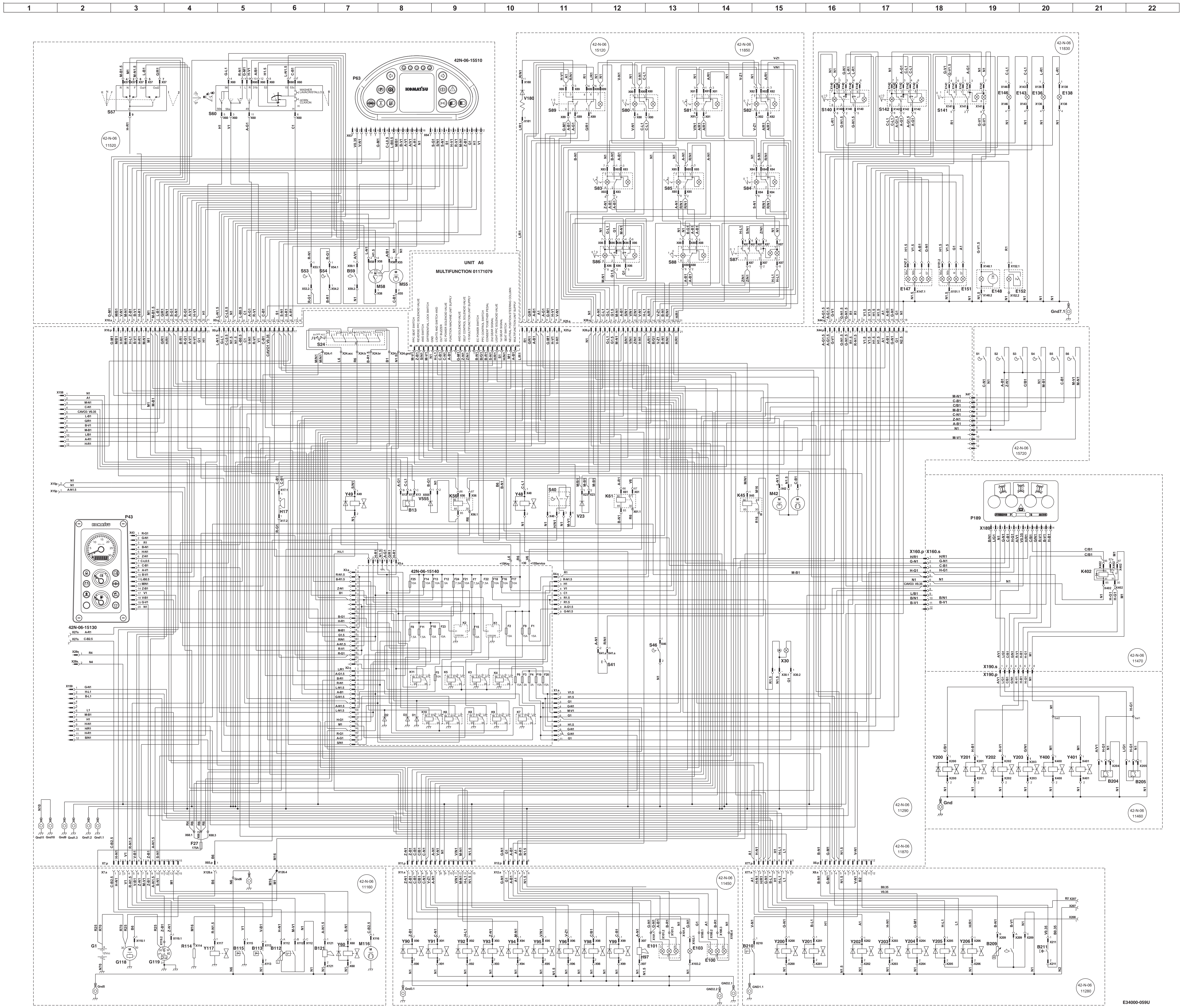


Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Minimum clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between link bushings and bucket mounting pin	45	–0.050 –0.089	— 0.080 — 0.240	0.130–0.329		Replace
2	Clearance between arm bushings and bucket mounting pin	45	–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	60	–0.060 –0.106	— 0.137 — 0.197	0.197–0.303		

90 OTHER

ELECTRICAL DIAGRAM (STANDARD VERSION)



Nome/Item	Descrizione	Description	KUE P/N
A6	A CENTRALINA FUNZIONI MACCHINA	FUNCTION MACHINE UNIT	
B13	SENSORE RETURN TO DIG	RETURN TO DIG SENDER	
B59	Livello olio freni	BRAKE OIL LOW LEVEL SWITCH	
B112	Termistore	Thermistor switch	
B113	Filtro aria	Air filter blocked switch	
B115	Sensore press. olio motore	Engine oil low pressure switch	
B121	Avvisatore acustico	Horn	
B209	Galleggiante	Fuel level sender	
B210	Temp. olio trasmissione	Gearing oil temperature sensor	
B211	Sensore cardano	Cardan sensor	
E100	Fanale podteriore DX	Right rear beam	
E101	Fanale posteriore SX	Left rear beam	
E103	Luce targa	Plate light	
E136	Faro di lavoro posteriore DX laterale	Lateral right rear working light	
E138	Faro di lavoro posteriore SX laterale	Lateral left rear working light	
E143	Faro lavoro ant. DX lat.	Lateral right front working light	
E146	Faro di lavoro anteriore SX laterale	Lateral left front working light	
E147	Faro anteriore SX	Left front light	
E148	Girofaro	Beacon lamp	
E151	Faro ant. DX	Right front light	
E152	Plafoniera	Room lamp	
F1	FUSIBILE FARI LAVORO ANTERIORI CENTRALI 15A	Central front working light fuse 15A	
F2	FUSIBILE FARI LAVORO POSTERIORI CENTRALI 15A	Central rear working light fuse 15A	
F3	FUSIBILE LUCE POSIZIONE DX 3A	Right position light fuse 3A	
F4	FUSIBILE LUCE POSIZIONE SX 3A	Left position light fuse 3A	
F5	FUSIBILE AVVISATORE ACUSTICO 10A	Horn fuse 10A	
F6	FUSIBILE FARI LAVORO POSTERIORI LATERALI 15A	Lateral rear working light fuse 15A	
F7	FUSIBILE TERGI POSTERIORE + AVVISATORE ACUSTICO POSTERIORE 7,5A	Winshield wiper-washer + rear horn fuse 7,5A	
F8	FUSIBILE SWITCH LUCI STOP 7,5A	Stop light swicth fuse 7,5A	
F9	FUSIBILI FARI LAVORO ANTERIORI LATERALI 15A	Lateral front working light fuse 15A	
F10	FUSIBILE ALIM. TERGI ANTERIORE 10A	Front windhield-motor supply fuse 10A	
F11	FUSIBILE OPTIONAL 7,5A	Optional fuse 7,5A	
F12	FUSIBILE BUZZER+STR.ANTERIORE+STR.LATERALE 5A	Front + lateral instruments + buzzer fuse 5A	
F13	FUSIBILE ALIM. MANIPOLATORE10A	Supply level grip fuse 10A	
F14	FUSIBILE LAMPADE SWITCH + SWTCH OPTIONAL 10A	Light switch + swicth optional fuse 10A	
F15	Fusibile elettrostop + sicurezza avviamento 10A	ELETTROSTOP + SAFETY STARTER FUSE 10A	
F16	FUSIBILE GIROFARO 10A	Beacon light fuse 10A	
F17	FUSIBILE SWITCH EMERGENZA 10A	Warning swicth fuse 10A	
F18	FUSIBILE PLAFONIERA+ACCENDISIGARI 10A	Cabin lamp + cigarette lighter fuse 10A	
F19	FUSIBILE ANABBAGLIANTI 15A	Low beam fuse 15A	
F20	FUSIBILE ABBAGLIANTI 15A	Main beam light 15A	
F21	FUSIBILE ALIM. SENSORE RETURN + DIG 10A	Return sender supply + DIG fuse 10A	
F22	FUSIBILE EC POWER 7,5A	EC POWER FUSE 7,5A	
F23	FUSIBILE +15 CENTRALINA STERZATURA 10A	+15 STEERING UNIT FUSE 10A	
F24	FUSIBILE ALIM. INTERMITTENZA 7,5A	FLASHER FUSE 7,5A	
F25	FUSIBILE SIRENA RETRO + ALIM. DEVIO 10A	REVERSE SPEED BUZZER + STEERING COLUMN 10A	
F27	FUSIBILE GENERALE 175A	General fuse 175A	
G1	Batteria	Battery	
G118	Motorino avviamento	Starter	
G119	Alternatore	Generetor	
H17	BUZZER	BUZZER	
K1	CENTRALINA ANTIRIPETIZIONE AVVIAMENTO	Unrepeat start unit	
K2	INTERMITTENZA	Flasher	
K3	RELE' ANABBAGLIANTI	Low beam relay	
K4	RELE' ABBAGLIANTI	Main beam relay	
K5	RELE' avvisatore acustico anteriore	Front horn relay	
K6	RELE' ELETTROVALVOLA RETURN TO DIG	Return to DIG solenoid valve relay	
K7	RELE' LUCI STOP	Light stop relay	
K8	RELE' CONSENSO AVVIAMENTO	Assent start relay	
K9	RELE' MARCIA AVANTI	Forword speed relay	
K10	RELE' MARCIA INDIETRO	Reverse speed relay	
K11	RELE' STACCO TRASMISSIONE	Stop drive relay	
K45	Rele' preriscaldo	Preheating Relay	
K56	Rele' consenso avviamento	Starting relay	
K61	Rele' servizi	Service realy	
M42	Tergi posteriore	Rear Windshield-washer	
M55	Pompetta	Motor pump	
M58	Motore tergi anteriore	Front windshild-washer	
M116	Elettrofrizione compressore	Compressor Electonic cluch	
R114	Candelette	Preheating	
S1	INTERRUTTORE FUNZIONE KICK DOWN	KICK DOWN SWITCH	
S2	INTERRUTTORE ELETTROVALVOLA EC POWER	SOLENOID VALVE E.C. POWER SWITCH	
S3	INTERRUTTORE CHIUSURA BENNA	LOCK GRAB SWITCH	
S4	INTERRUTTORE STACCO TRASMISSIONE	DECLUCH SWITCH	
S5	INTERRUTTORE APERTURA BENNA	OPEN GRAB SWITCH	
S6	INTERRUTTORE BLOCCO DIFFERENZIALE	DIFFERENTIAL LOCK SWITCH	
H97	CLAXON POSTERIORE	REAR HORN	
S24	Quadro avviamento	Starting switch	
S40	Micro sedile	Seating switch	
S41	PULSANTE POSTERIORE CLAXON	Rear horn Switch	
S46	Freno di stazionamento	Parking brake switch	
S53	Interruttore luci stop	Stop light switch	
S54	Interruttore stop 4wd	Stop 4wd witch	
S57	Devio cambio	Steering column gear switch	
S60	Devio luci	Steering column light switch	
S80	INTERRUTTORE RIDE CONTROL	Ride control switch	
S81	PULSANTE SBLOCCO BRACCIO	Arm unlock switch	
S82	INTERRUTTORE SBLOCCO PIASTRA	Plate unlock switch	
S83	PULSANTE E/C POWER	E/C Power Switch	
S84	INTERRUTTORE VALVOLE EMPI	EMPI solenoid valve switch	
S85	PULSANTE AVV. ACUSTICO POSTERIORE	Rear horn switch	
S86	INTERRUTTORE GENERALE LUCI	General light switch	
S87	INTERRUTTORE 4WD	4WD Switch	
S88	PULSANTE PPC	PPC switch	
S89	INTERRUTTORE WARNING	WARNING switch	
S140	Interruttore fari lavoro posteriori	Rear working light switch	
S141	Interruttore girofaro	Beacon light switch	
S142	Interruttore fari lavoro anteriori	Front working light switch	
Y48	Ev flottante	Float solenoid valve	
Y49	Ev return to d.i.g.	Return to Dig solenoid valve	
Y60	Valvole emp.	EMP Solenoid Valve	
Y90	Ev. PPC retro	Rear PPC solenoid valve	
Y91	Ev ecopower	EC power Solenoid valve	
Y92	ELETTROVALVOLA ALLARME MARCIA INDIETRO	Back-up allarm solenoid valve	
Y93	Ev. PPC	PPC solenoid valve	
Y94	Ev blocco differenziale	Lock Differential gear solenoid valve	
Y95	Ev sblocco braccio	Arm unlock solenoid valve	
Y96	Ev sblocco piastra	Plate unlock solenoid valve	
Y98	Ev. chiusura benna	Grab close solenoid valve	
Y99	Ev apertura benna	Grab open solenoid valve	
Y117	Elettrostop	Elettrostop	
Y200	Ev 4° marcia	4th gear solenoid valve	
Y201	Ev marcia avanti	Forword solenoid valve	
Y202	Ev 1° velocita'	1st gear solenoid valve	
Y203	Ev 2° marcia	2nd gear solenoid valve	
Y204	Ev doppia trazione	Doble traction solenoid valve	
Y205	Ev retromarcia	Reverse speed solenoid valve	
Y206	Ev 3° marcia	3rd gear solenoid valve	
X12.a	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
X25.a	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
X26.a	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
X44.a	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
X77.a	CONNETTORE A CETRALINA ATC26	TO ATC 26 UNIT CONNECTOR	
X6.a	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
X10.a	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
X8.a	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
X1.a	CONNETTORE a linea posto guida	TO UNIT 01171082 CONNECTOR	
X16.p	CONNETTORE a linea cruscotto anteriore	TO FRONT DASHBOARD HARNESS CONNECTOR	
X11.p	CONNETTORE a linea telaio	TO CHASSIS HARNESS CONNECTOR	
X12.p	CONNETTORE a linea telaio	TO CHASSIS HARNESS CONNECTOR	
X7.a	CONNETTORE a linea optional	TO OPTIONAL HARNESS	
X158	CONNETTORE A LINEA CENTRALINA ATC26	TO ATC26 UNIT CONNECTOR	
X159	CONNETTORE A LINEA CENTRALINA ATC26	TO ATC26 UNIT CONNECTOR	
X160.p	CONNETTORE A LINEA PANNELLO INTERRUTTORI	TO SWITCHES PANEL HARNESS CONNECTOR	
X2.s	CONNETTORE A LINEA CENTRALINA 01171062	TO UNIT 01171062 CONNECTOR	
X25.p	CONNETTORE A LINEA PANNELLO INTERRUTTORI	TO SWITCHES PANEL HARNESS CONNECTOR	
X26.p	CONNETTORE A LINEA PANNELLO INTERRUTTORI	TO SWITCHES PANEL HARNESS CONNECTOR	
X27.a	CONNETTORE ARIA CONDIZIONATA	A/C HARNESS CONNECTOR	
X28.a	CONNETTORE RISCALDAMENTO	HEATING CONNECTOR	
X3.a	CONNETTORE A LINEA CENTRALINA 01171062	TO UNIT 01171062 CONNECTOR	
X36	Accendisigari	CIGARETTE LIGHTER	
X44.p	CONNETTORE A LINEA CENTRALINA 01171062	TO UNIT 01171062 CONNECTOR	
X4.a	CONNETTORE A LINEA CABINA	TO CABIN HARNESS CONNECTOR	
X4.p	CONNETTORE A LINEA CENTRALINA 01171062	TO UNIT 01171062 CONNECTOR	
X6	CONNETTORE A LINEA CENTRALINA FUNZIONI MACCHINA	TO FUNCTION MACHINE UNIT	
X65.p	CONNETTORE A LINEA MOTORE	TO MOTOR HARNESS CONNECTOR	
X7.p	CONNETTORE A LINEA MOTORE	TO MOTOR HARNESS CONNECTOR	
X77.p	CONNETTORE A LINEA ATC26	ATC26 HARNESS CONNECTOR	
X8.p	CONNETTORE A LINEA ATC26	ATC26 HARNESS CONNECTOR	
X9.p	CONNETTORE a linea cruscotto anteriore	TO FRONT DASHBOARD HARNESS CONNECTOR	
X11.a	CONNETTORE a linea posto guida	TO DRIVER SITE HARNESS CONNECTOR	
P42	PANNELLO STRUMENTI	INSTRUMENTS PANEL	
P43	PANNELLO DI CONTROLLO ANTERIORE	FRONT CONTROL PANEL	

B204	SENSORE ASSALE ANTERIORE	Front axle Sensor
B205	SENSORE ASSALE POSTERIORE	Rear axle Sensor
K402	RELE' SICUREZZA STERZO	LOCK SECURITY SOLEOID VALVE RELAY
Y200	EV. STERZATURA 2WS	2WS solenoid valve
Y201	EV. STERZATURA 4WS	4WS solenoid valve
Y202	EV. STERZATURA A GRANCHIO	Crab steering solenoid valve
Y203	EV. STERZATURA IN TONDO	Round steering solenoid valve
Y400	EV. SICUREZZA STERZO	LOCK SECURITY SOLENID VALVE
Y401	EV. SICUREZZA STERZO	LOCK SECURITY SOLENOID VALVE
X160.p	CONNETTORE A LINEA POSTO GUIDA	TO DRIVER SITE HARNESS CONNECTOR
P189	PANNELLO 4WS	4WS STEERING PANEL
X189	CONNETTORE PANNELLO 4WS	4WS STEERING PANEL CONNECTOR
X160.s	CONNETTORE A LINEA POSTO GUIDA	TO DRIVER SITE HARNESS CONNECTOR
X190.s	A LINEA ELETTROVALVOLE 4WS	TO SOLENOID VALVE 4WS HARNESS

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