WEBM007500

SHOP MANUAL

WB97S-5

BACKHOE-LOADER

SERIAL NUMBER
WB97S-5 F00003 and up

KOMATSU
Utility

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

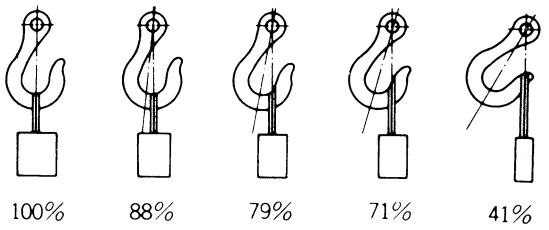
1) Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

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.

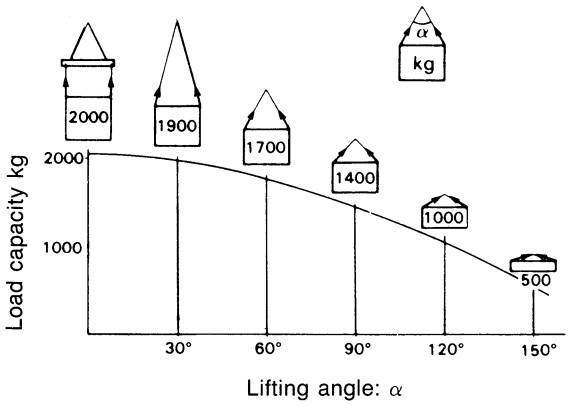
Hooks have maximum strength at the middle portion.



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°.



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

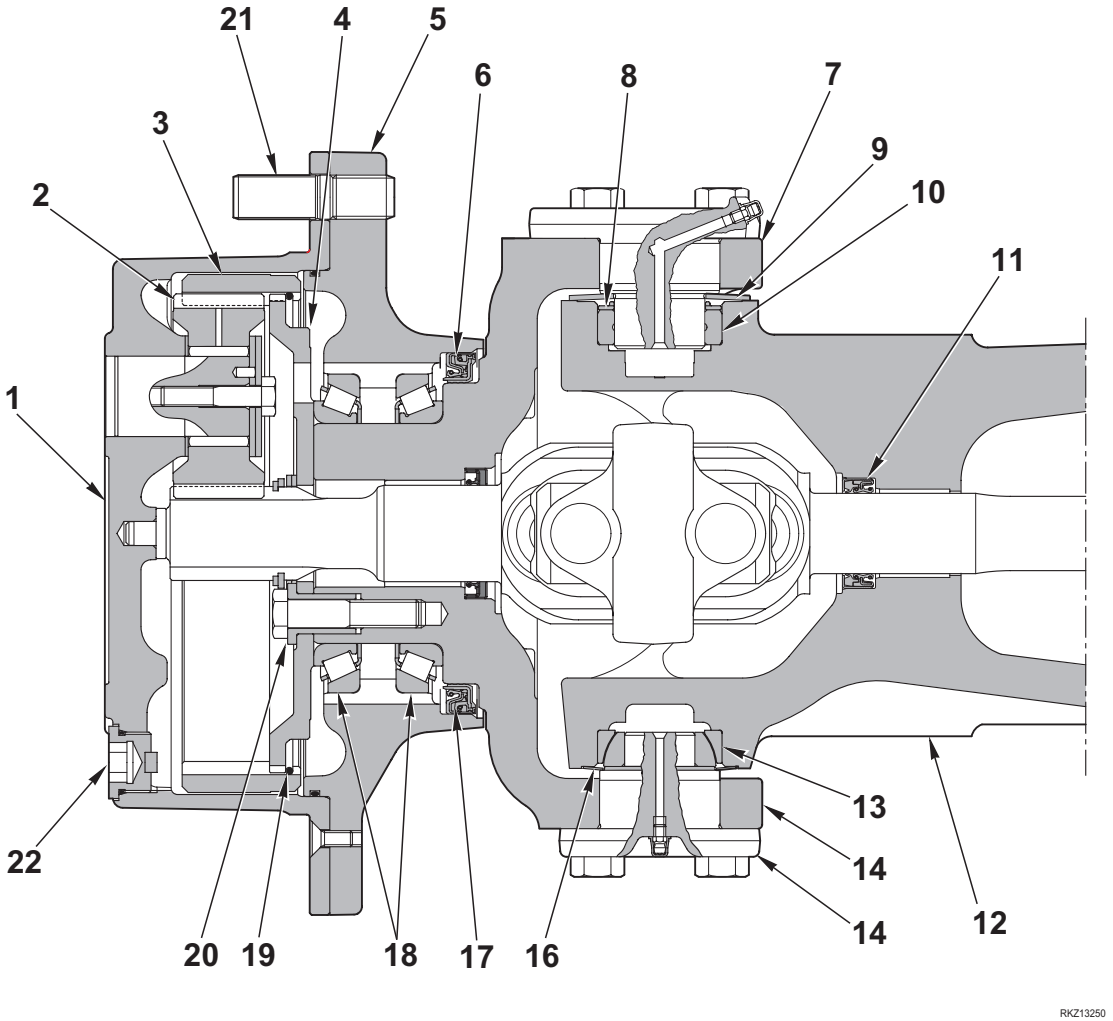
From liter to U.K. Gall.

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

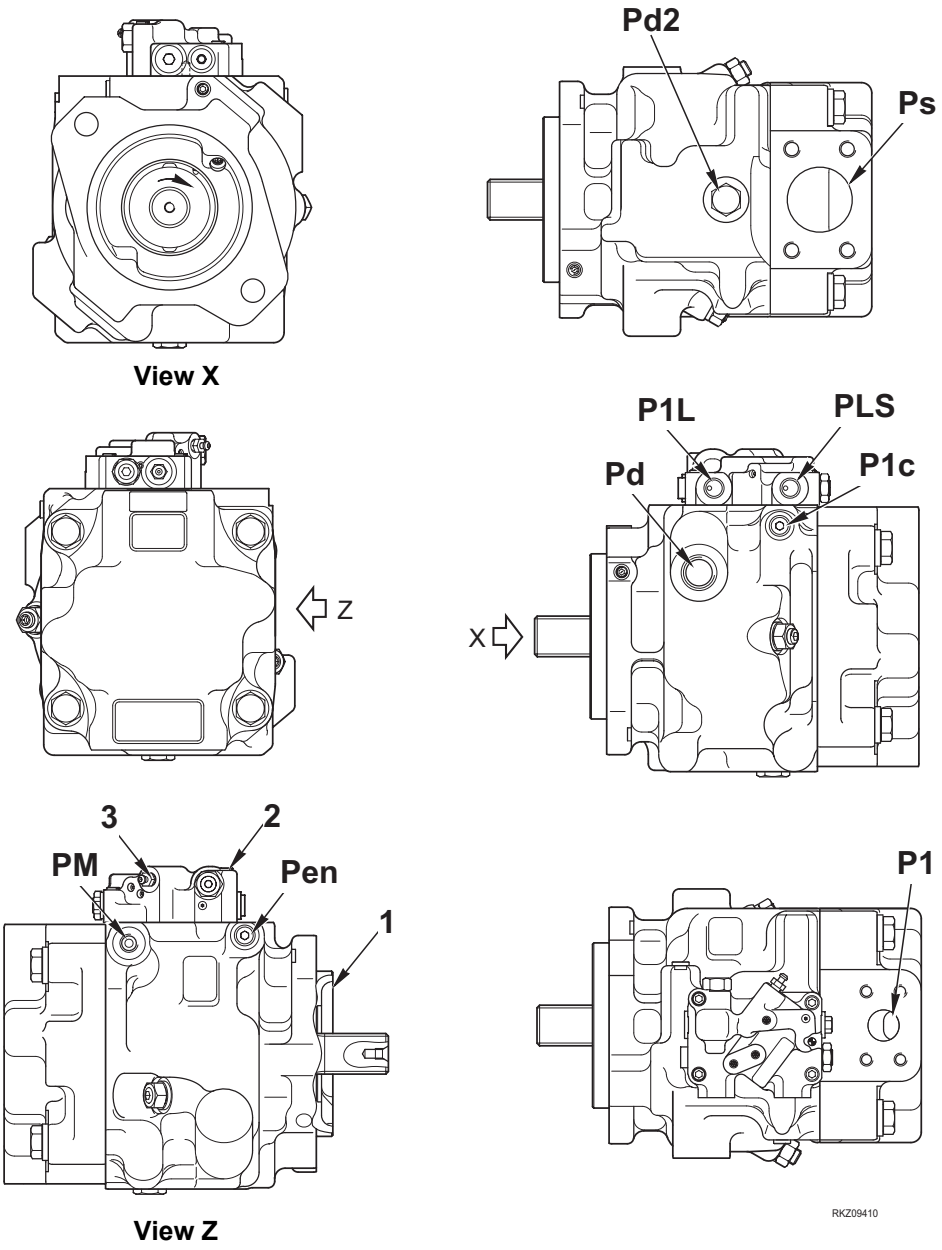
1. Suction filter (250 μm)
2. Pump
3. Oil screen drain valve
4. Spin-on filter (10 μm)
5. Convertor
6. Radiator
7. Torque converter pressure relief valve
8. Pressure control/flow divider valve
9. Vent
10. FORWARD engagement pressure check
11. REVERSE engagement pressure check
12. FORWARD engagement
13. 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

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

HYDRAULIC PUMP



COMPONENTS

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

CONNECTIONS

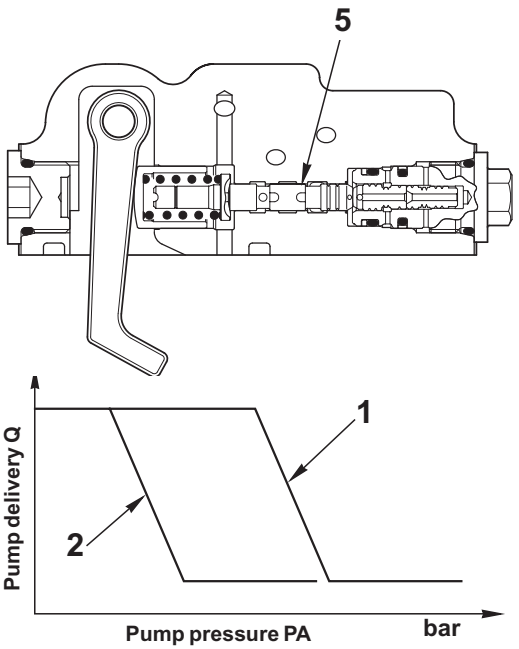
P1 port -To control valve (P port)
Port Pd - To hydraulic tank
Port Ps - From hydraulic tank
Port P1L - From control valve (Port Pp)
Port PLS - From control valve (Port LS)
Port PM - From EV1 solenoid valve group (Port PM)

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

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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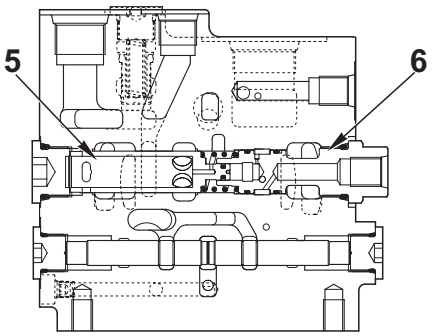
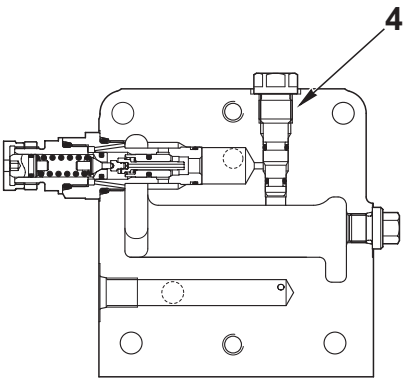
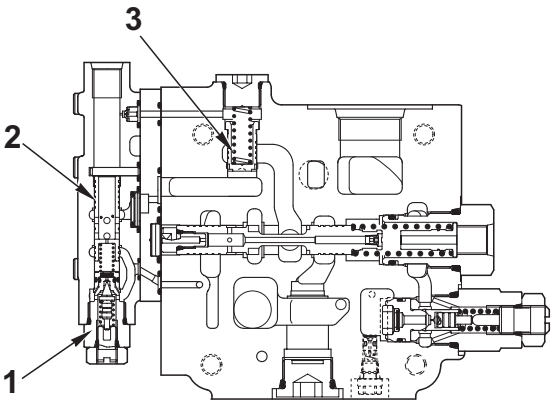


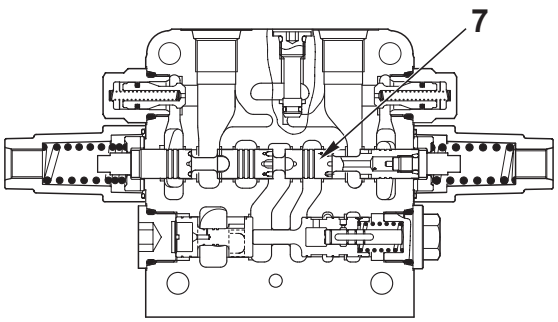
N - N



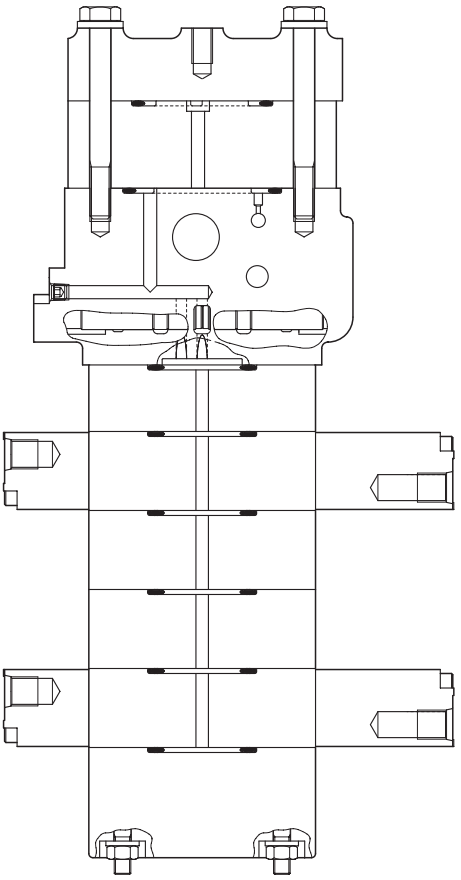
AC - AC



AA - AA



AB - AB

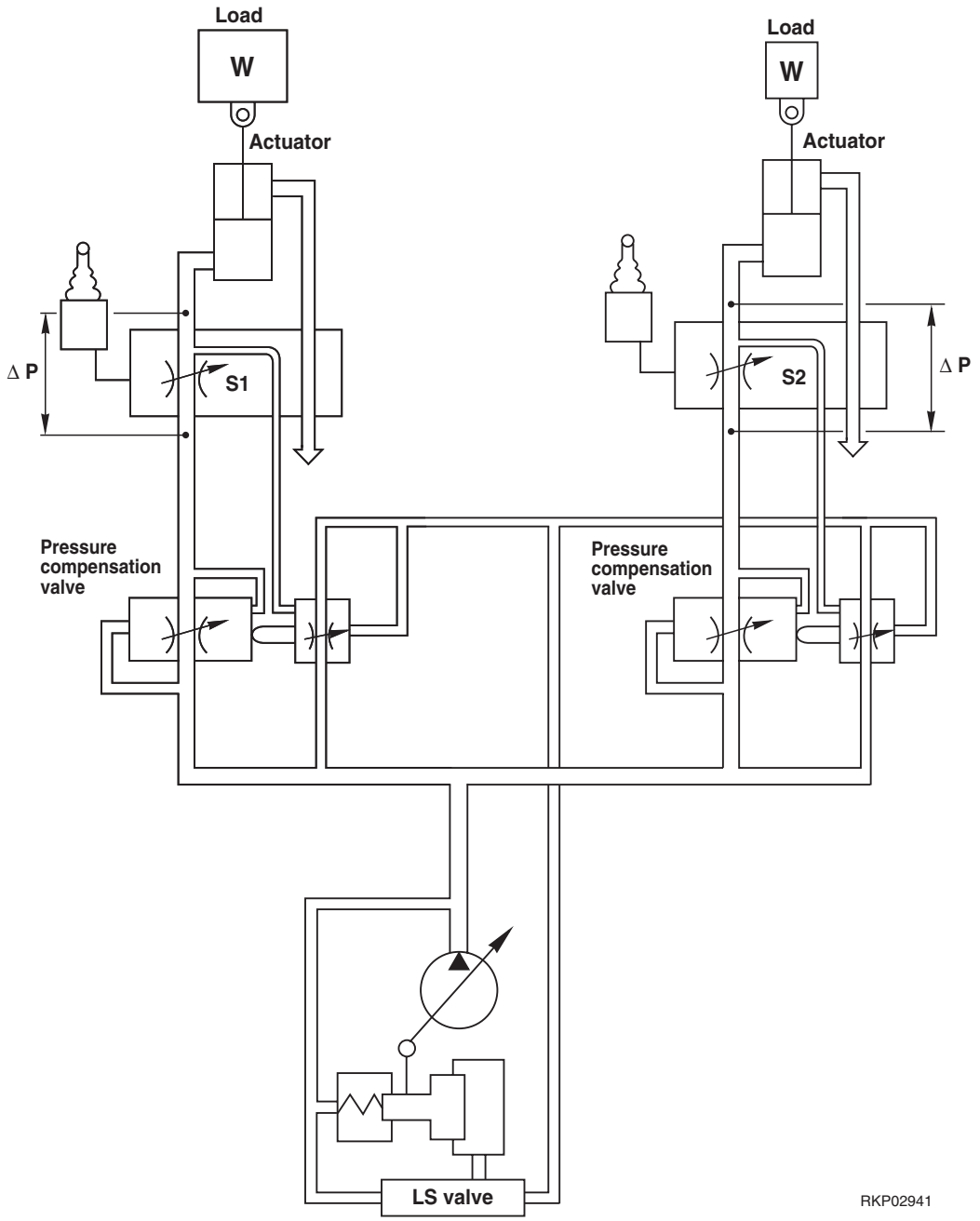


AE - AE

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)

2.2 PRESSURE COMPENSATION CONTROL

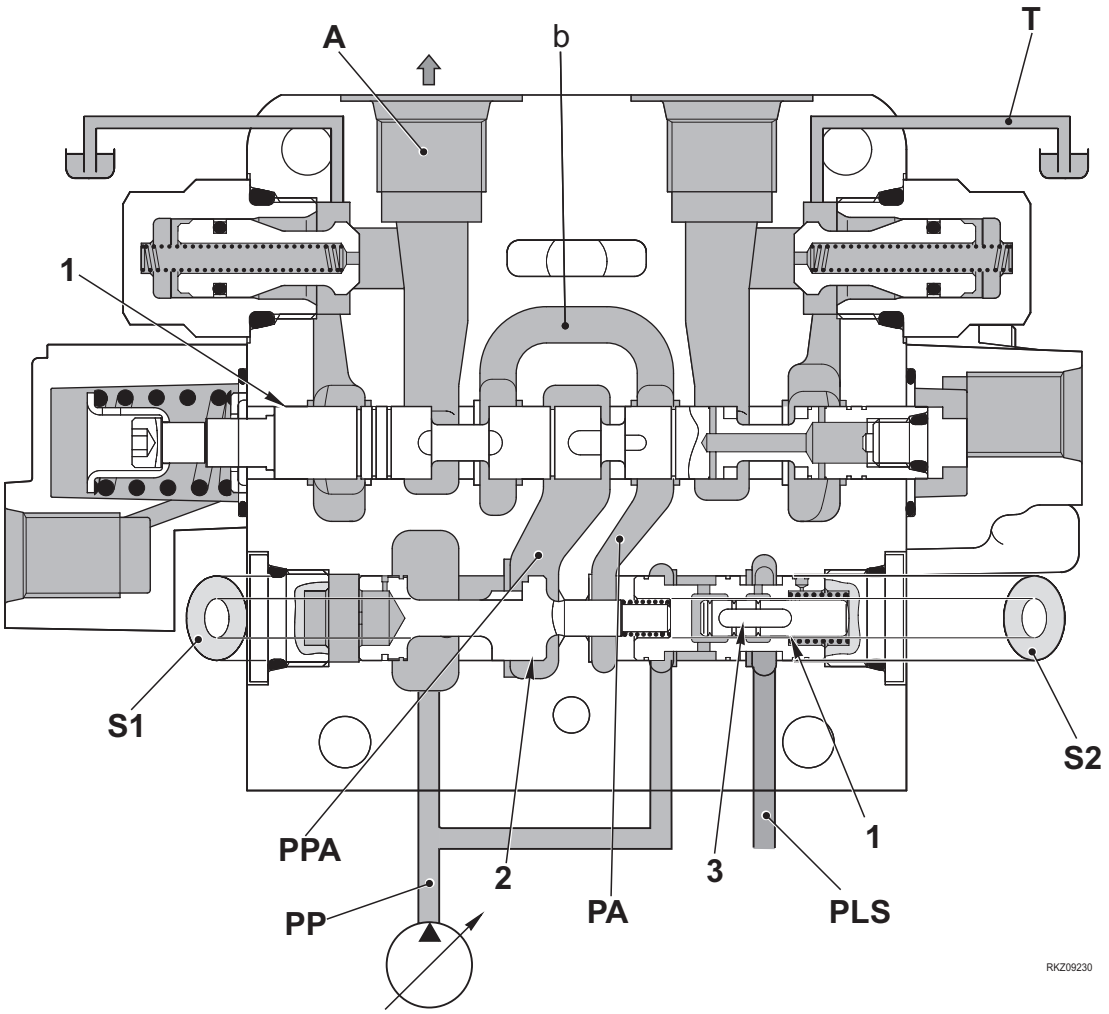
- The pressure compensation valves are installed downstream from the control valve in order to balance the differential pressure between the loads.
  When two or more movements (cylinders) are activated simultaneously, the pressure differences **DP** between the delivery at the control valve inlet and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



3.6 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).



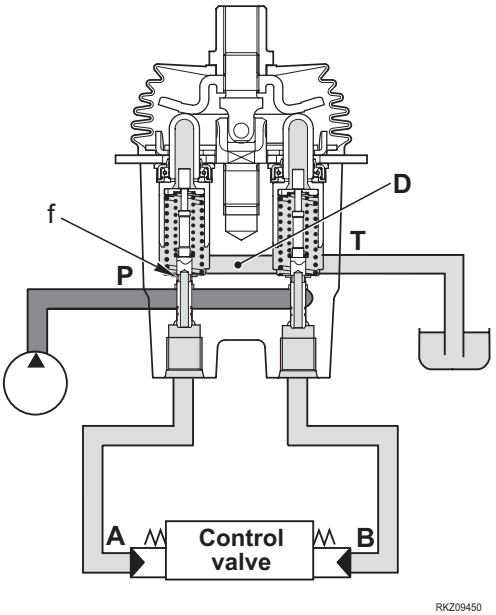
Surface ratio (S1:S2) and compensation characteristics

- 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.

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).



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).

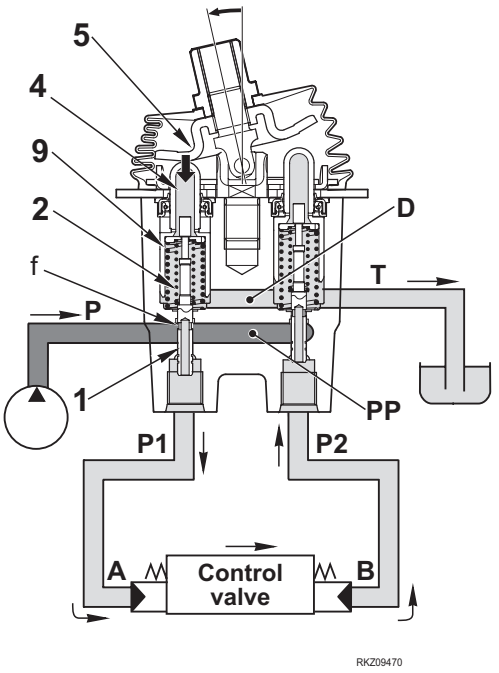
The spring (2) is compressed proportionally to the movement of the disk (5) and therefore, pressure at **P1** increases in proportion to the travel of the disk (5).

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;

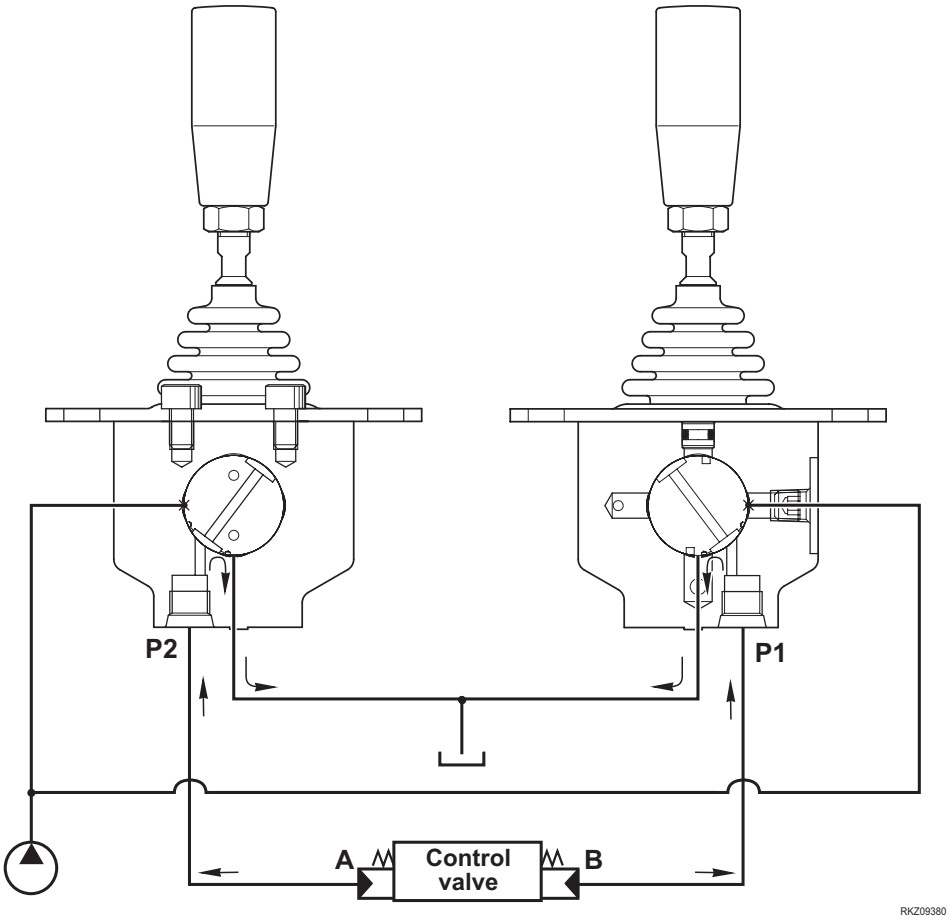
b) until pressure in section **A-P1** – i.e. the pressure acting on stem (1) – is enough to counteract the force of the spring (2).

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



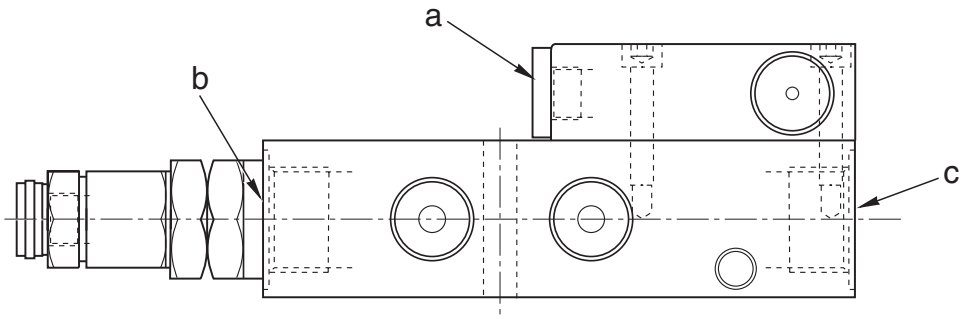
OPERATION

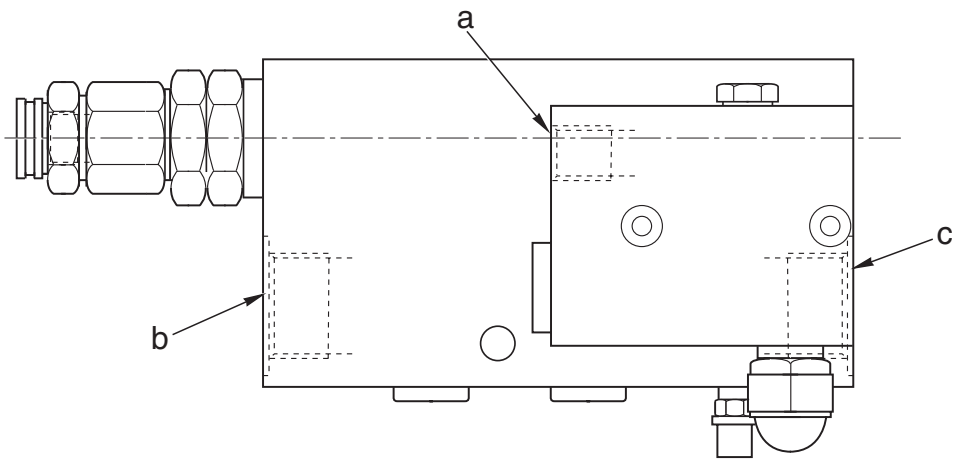
1. Control lever in neutral position



- 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.

BOOM





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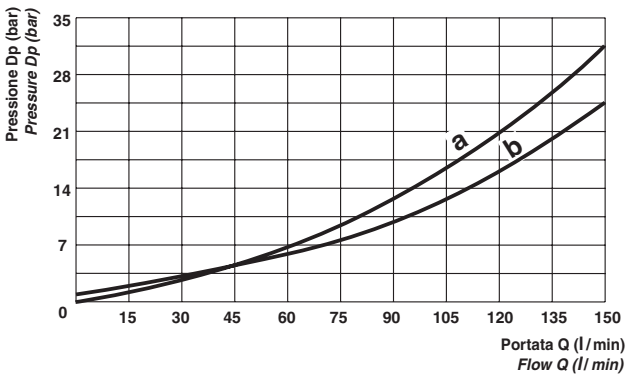

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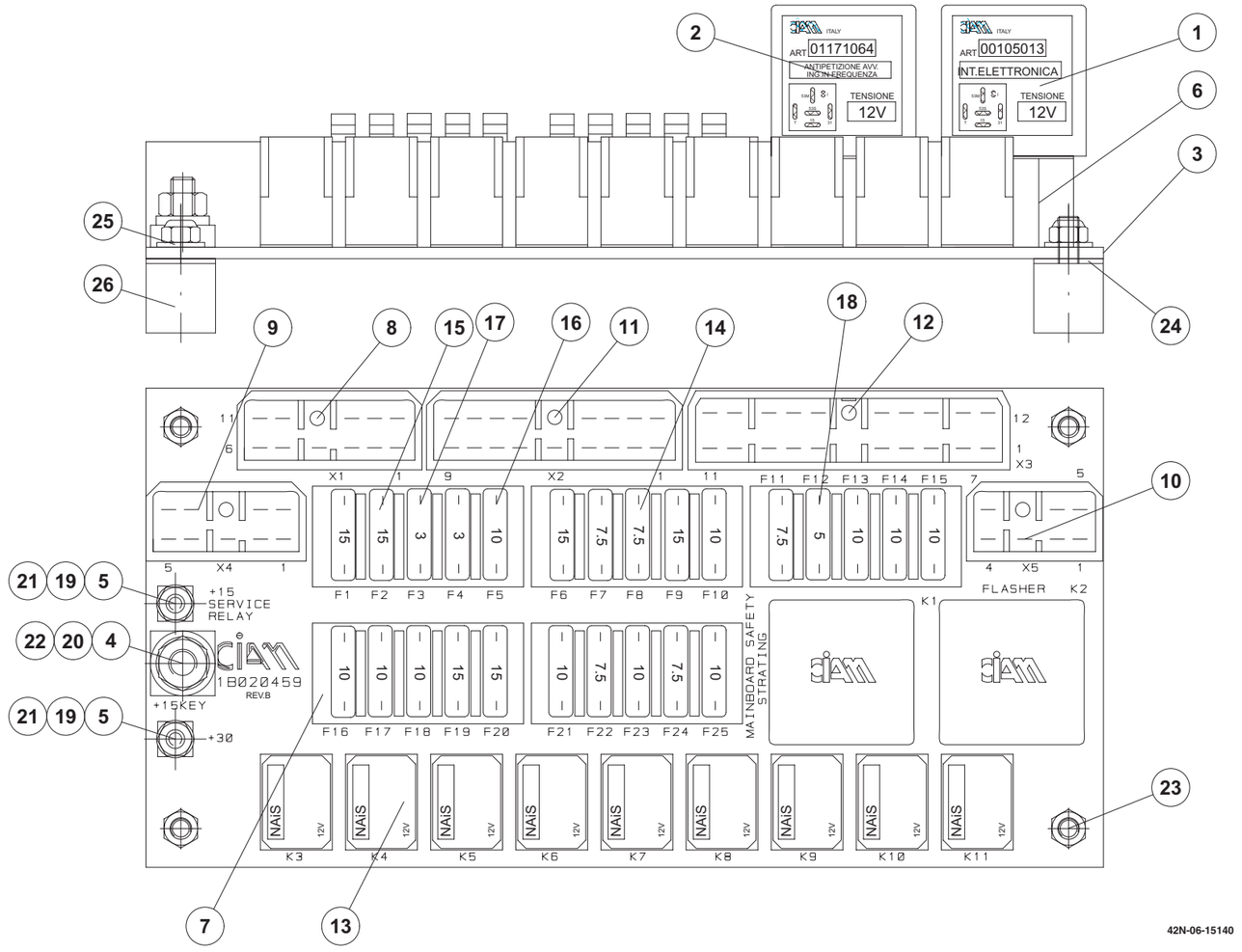
a. PiL port - To the boom cylinder (bottom side)
b. V2 port - From control valve (B4 port)
c. C2 port - To the boom cylinder (Head side)

CHARACTERISTICS
Safety valve calibration 1: 250 ± 15 bar
Safety valve calibration 2: 200 ± 20 bar

FUSE AND RELAY CENTRE

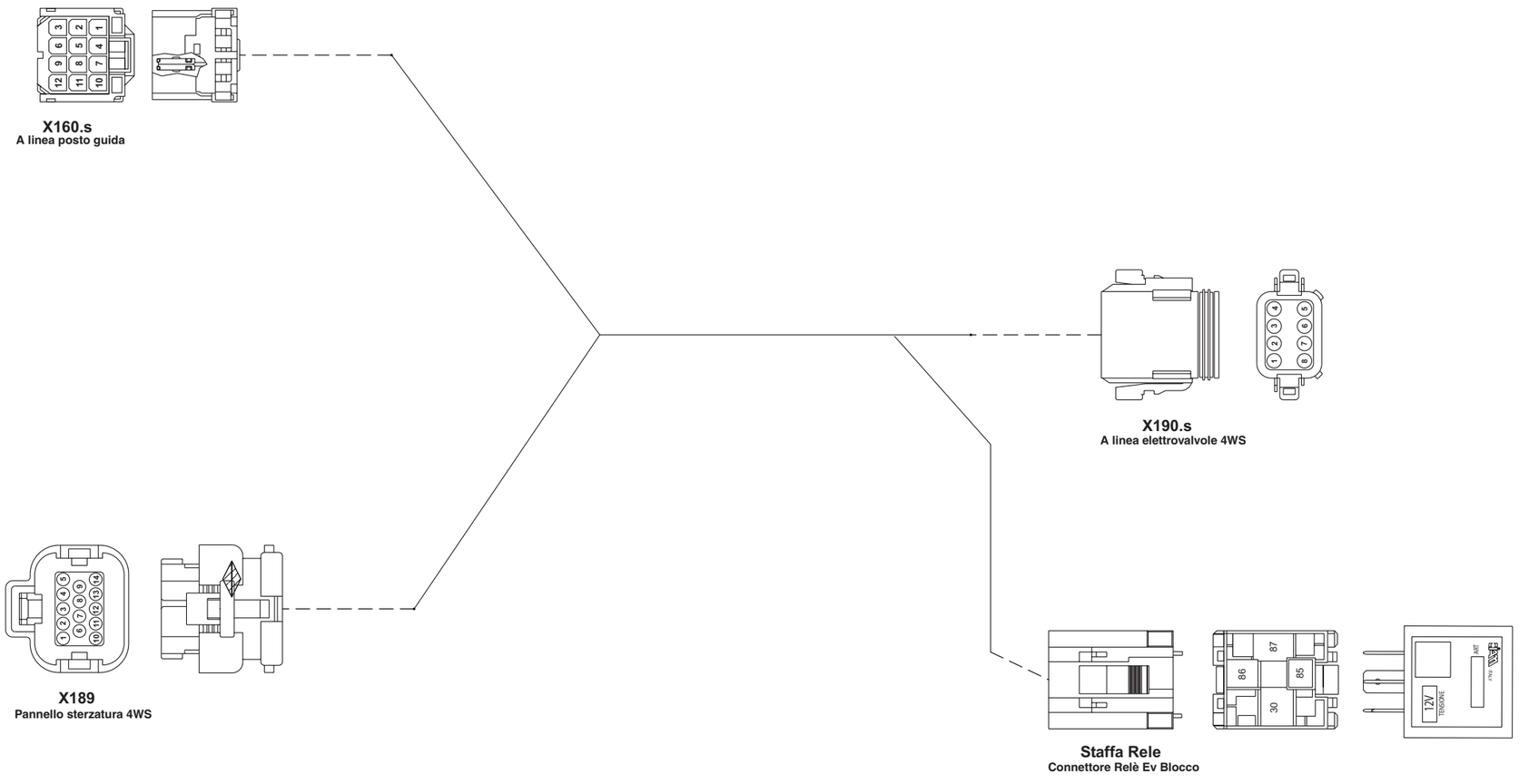
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

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



4WS PUSH-BUTTONS PANEL WIRING

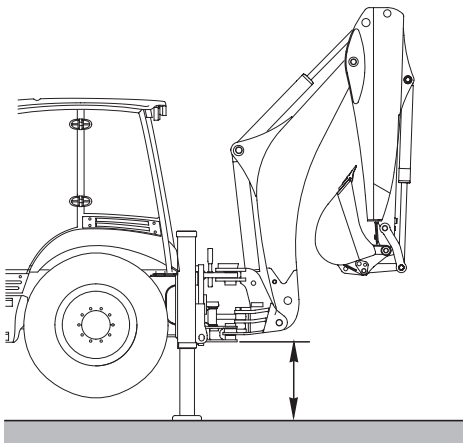
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16



42N-06-11470

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

Fig. S



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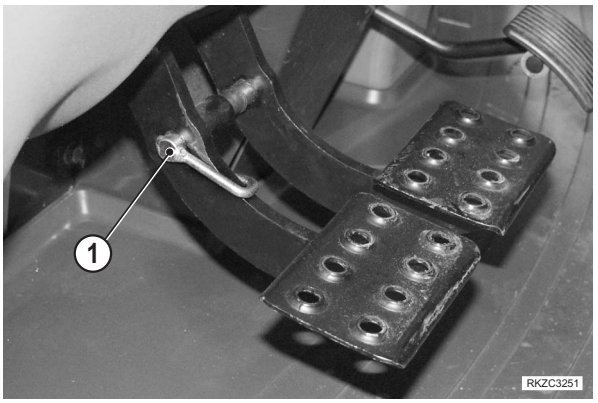
ADJUSTING BRAKE PEDAL SLACK/ALIGNMENT

★ 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.



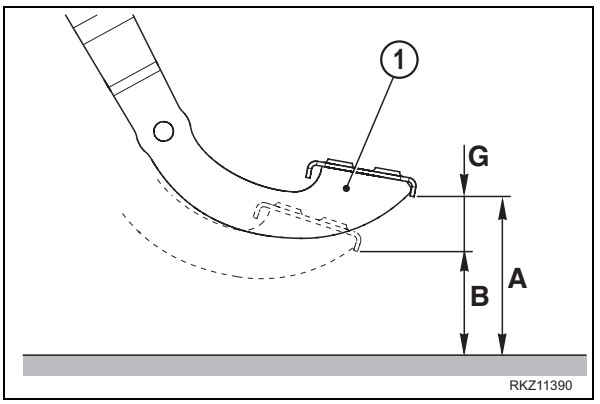
• Control

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



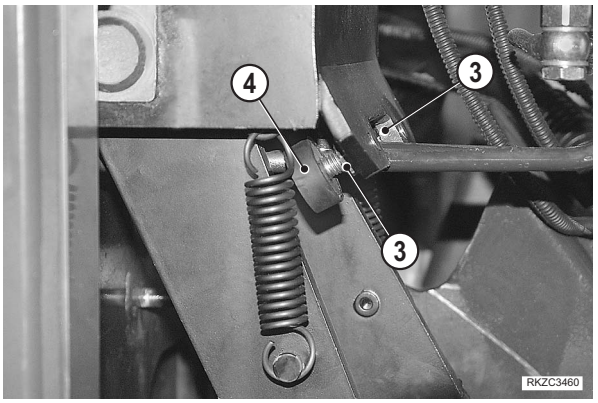
• Adjustment

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.

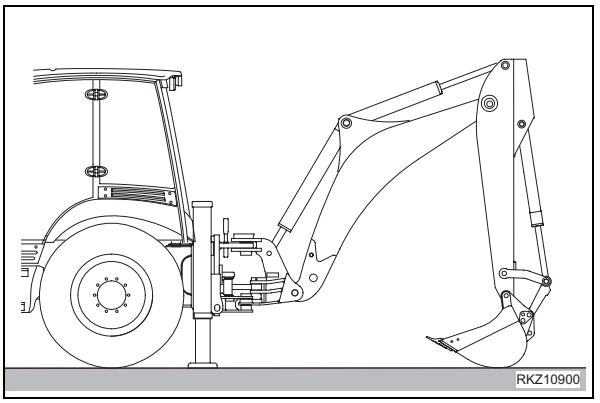


- **Checking secondary valve setting (for boom raise movement)**

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

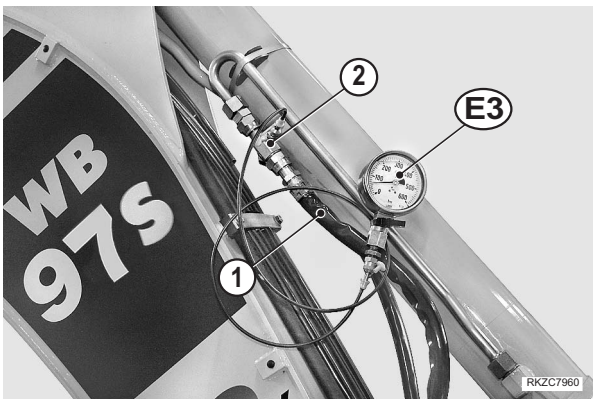
1 - Set the machine with arm in vertical position and with bucket on level ground leaned on the side.

2 - Stop the engine and release residual hydraulic pressures.

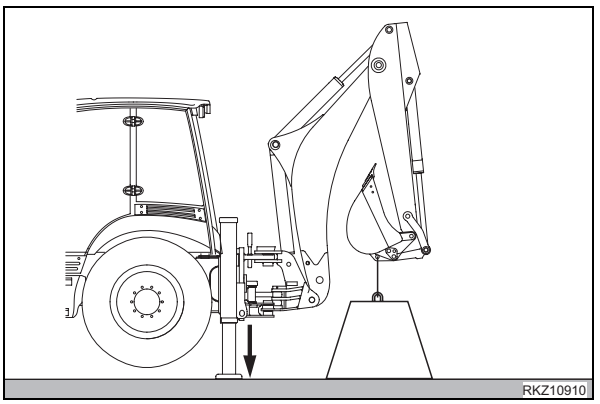


3 - Disconnect the hose (1) and connect a tee fitting (2) with adapter.

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

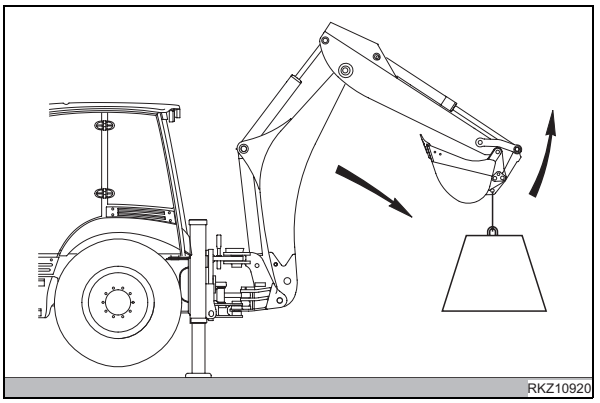


5 - Start the engine, connect a weight of approx. 1500 kg to the bucket, and fully lower the outriggers.



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

★ Normal pressure: 320–360 bar



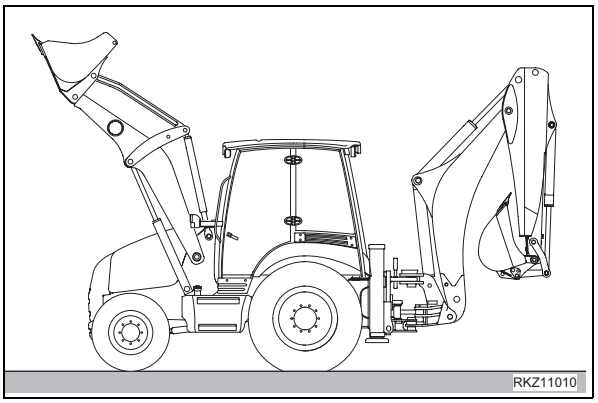
TESTING PRESSURES IN THE POWER TRAIN GROUP

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.



• 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**.

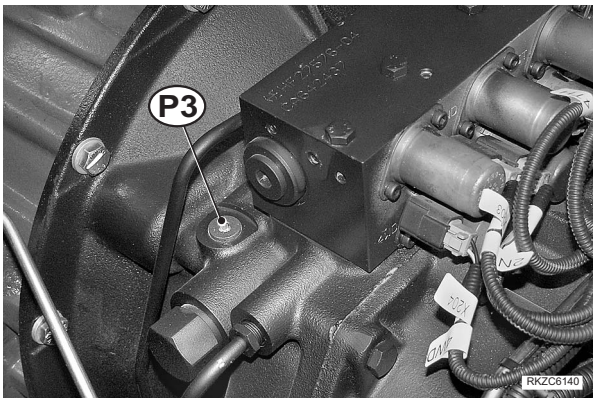
★ Normal pressure: 3–9 bar

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

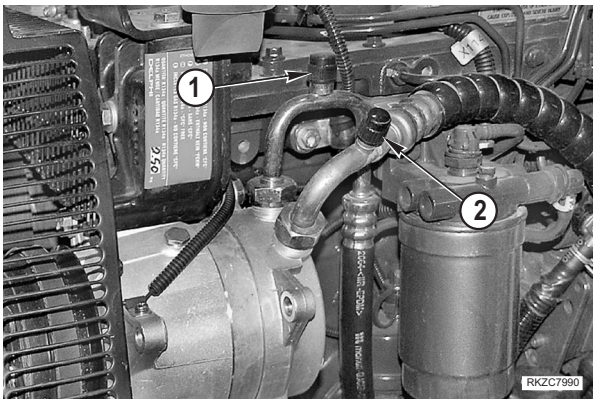


EMPTYING THE AIR-CONDITIONING UNIT

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.



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	

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

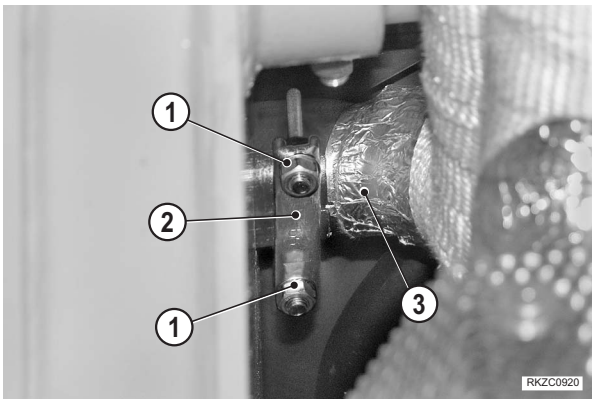
MUFFLER

Removal

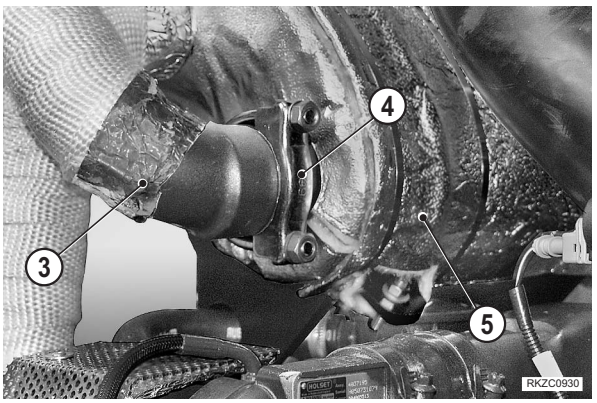
Fully raise the front working equipment and engage the safety stop.
Also place the backhoe in its secure position.

Remove the ignition key and fully raise the engine hood.

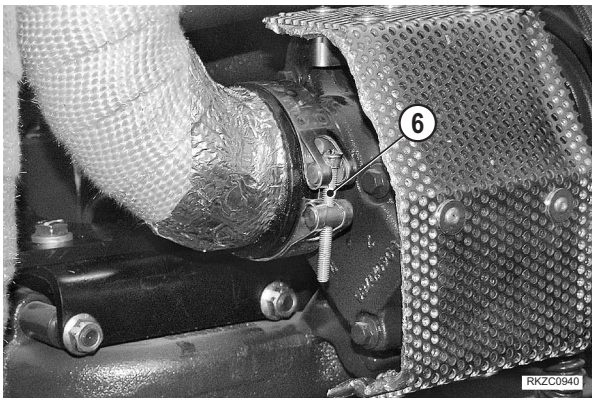
1 -Loosen the nuts (1) on the jumper pin (2) retaining the muffler pipe (3) to the exhaust pipe.



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

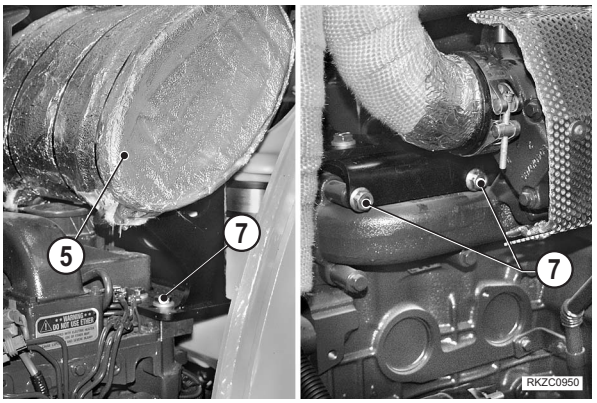


3 -Loosen the tie strap (6) retaining the muffler pipe to the turbocharger.



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

5 -Remove the muffler (5).



Installation

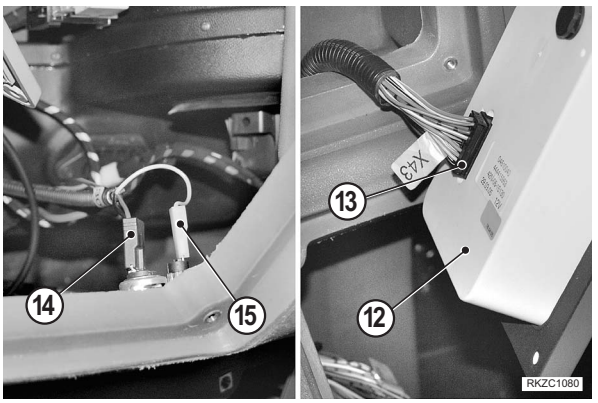
- To install, reverse removal procedure.

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

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

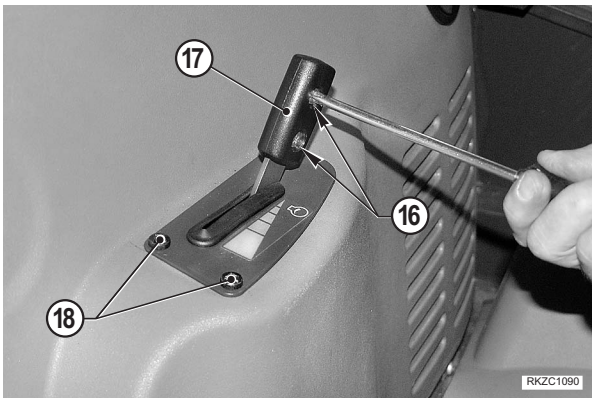
8 - Disconnect the connector (13) from the instrument board (12).

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

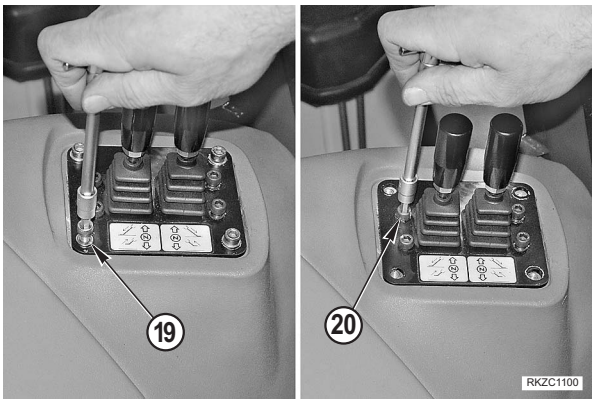


10 - Extract screws (16) and remove the hand accelerator handle (17).

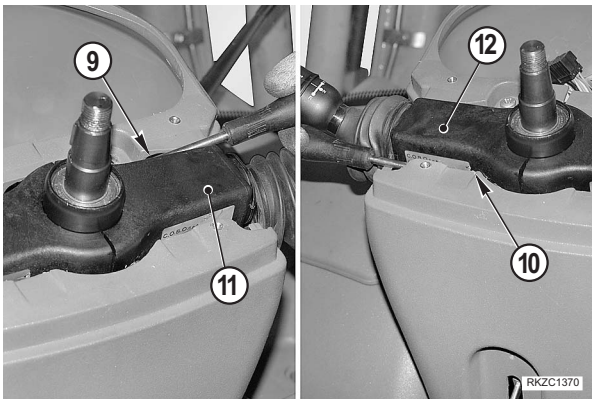
11 - Remove screws (18) from the accelerator lever assembly.



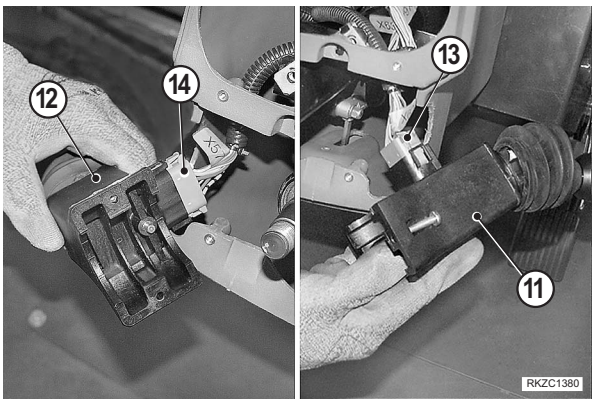
12 - Loosen and remove the screws (19) and (20).



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]

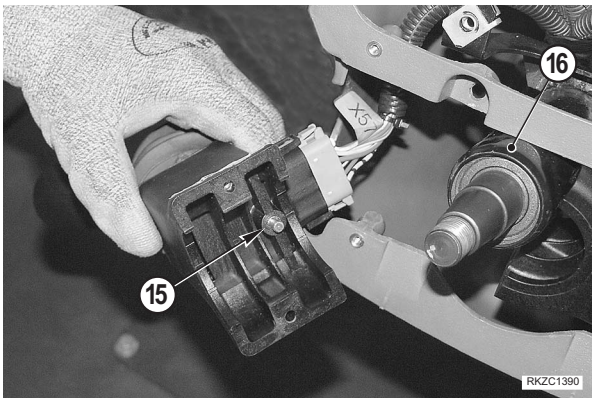


Installation

- 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).

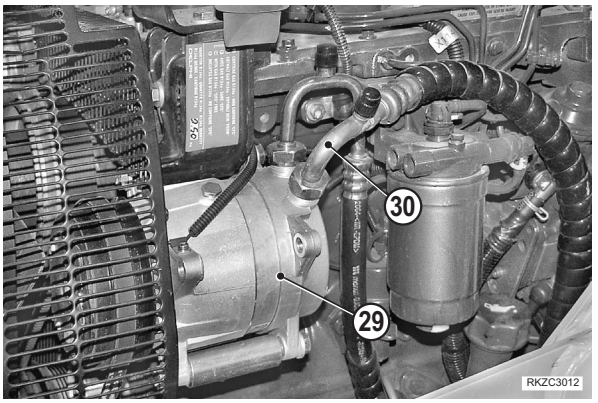


- **Version with air-conditioning unit**

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.

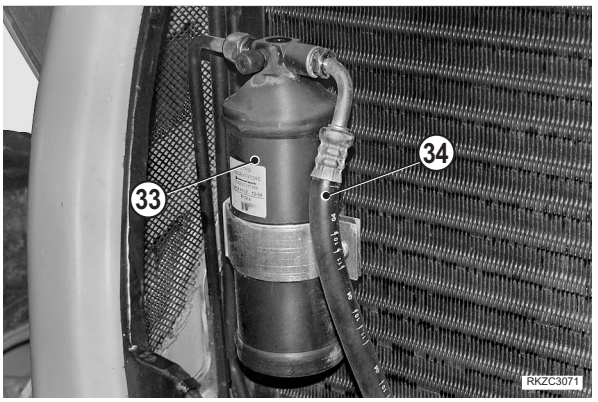


19 - Take out the screws (31) and remove the protection (32).

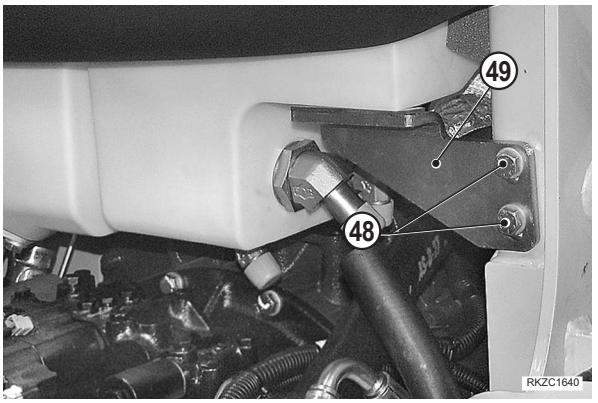
20 - Disconnect hose (34) from condenser (33). [*8]

★ Cap the hose and hole to ward off humidity.

★ Release the hose and route it under the cab.



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.

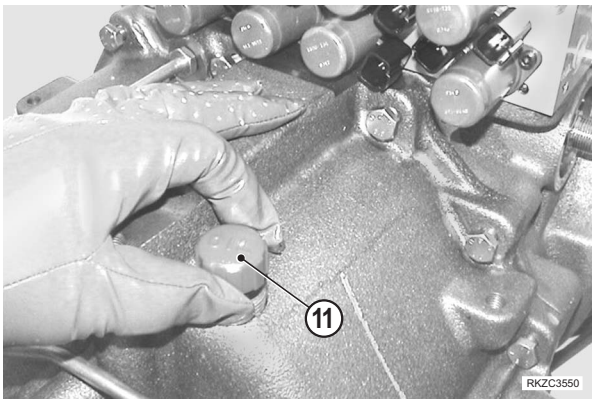
Hydraulic oil: approx. 40 ℓ

2 - Start the engine and check for leaks.

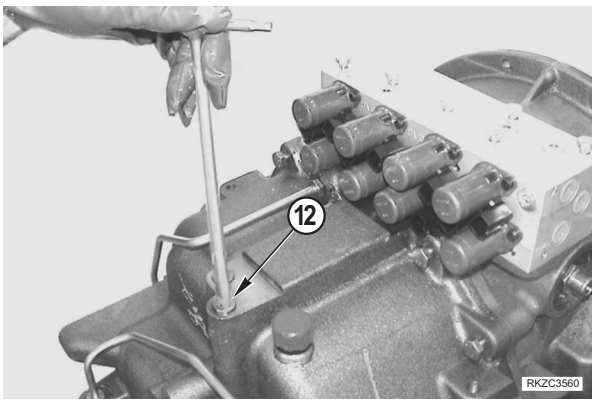
3 - Bleed the air from the cylinders. (For details, see "20 TESTING AND ADJUSTMENTS").

4 - Stop the engine, check the oil level in the tank and, if necessary, top it up.

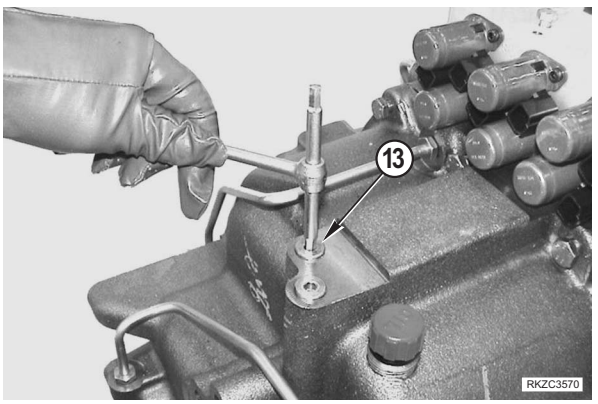
7 - Remove the breather (11) from the transmission housing only if this part is leaking or damaged.



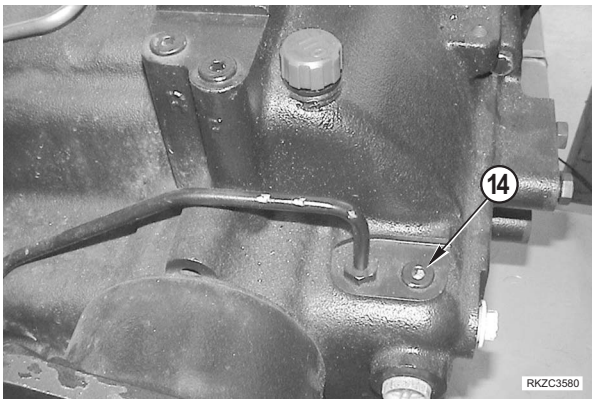
8 - To check the FORWARD clutch pressure, remove the plug (12).



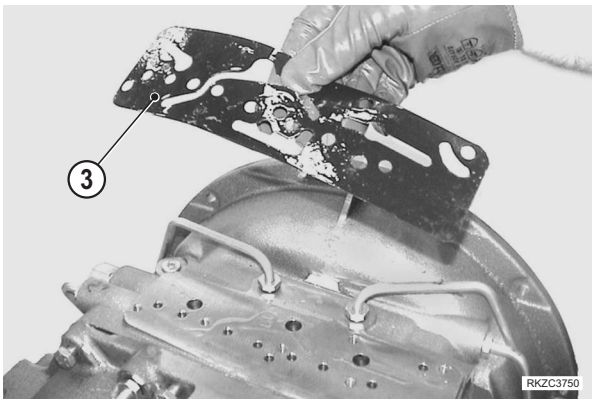
9 - To check the REVERSE clutch pressure, remove the plug (13).



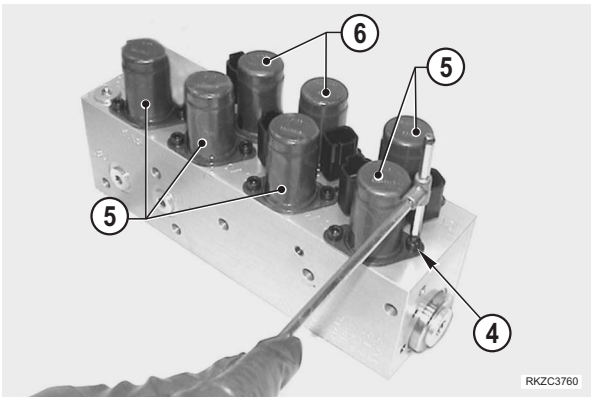
10 - To check the lubrication pressure, remove the plug (14).



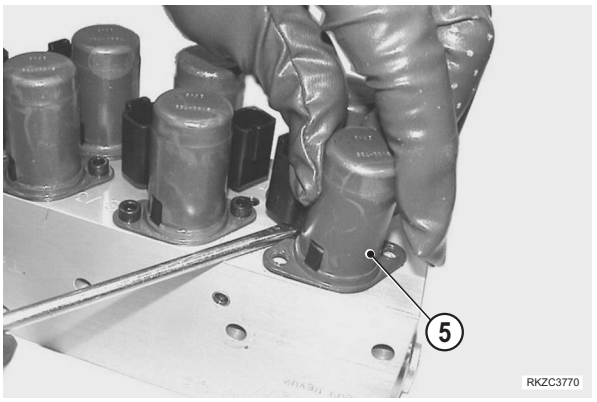
3 - Remove the gasket (3).



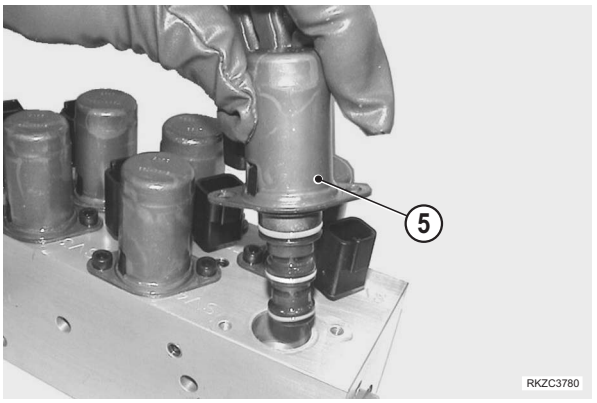
4 - Place the control valve unit on a clean workbench. Remove fastening screws (4) from the valves (5) and (6).



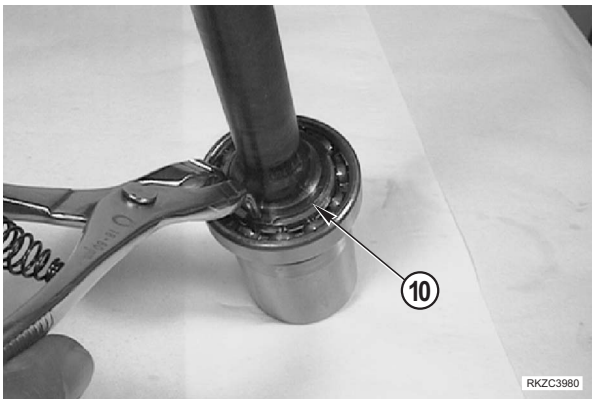
5 - Extract with care the valves (5) and (6) with a screwdriver.



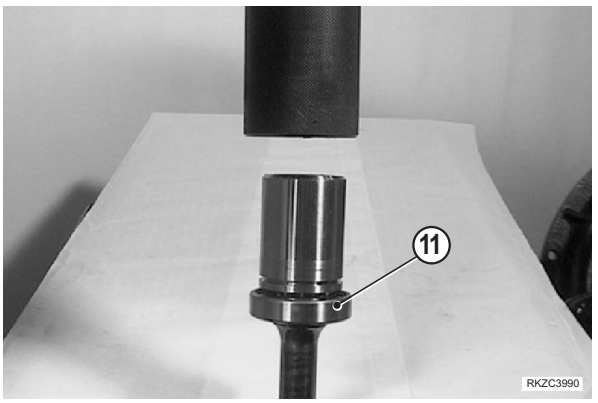
6 - Remove the valves (5) and (6).



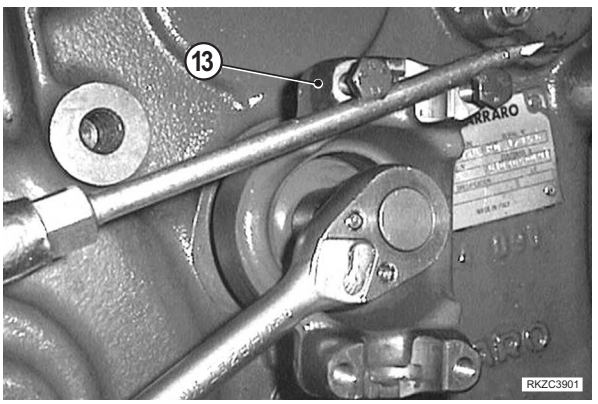
10 -Remove snap ring (10).



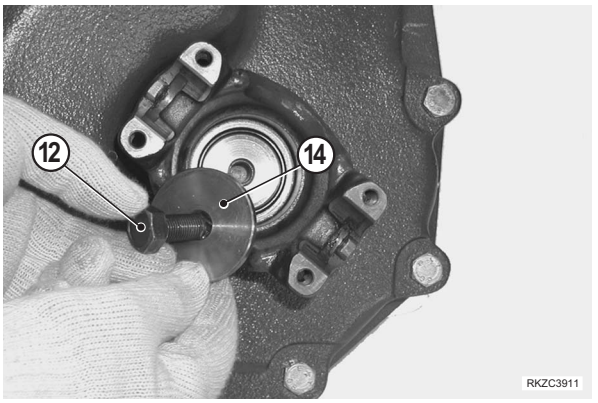
11 -Extract bearing (11) with tool **F2**.



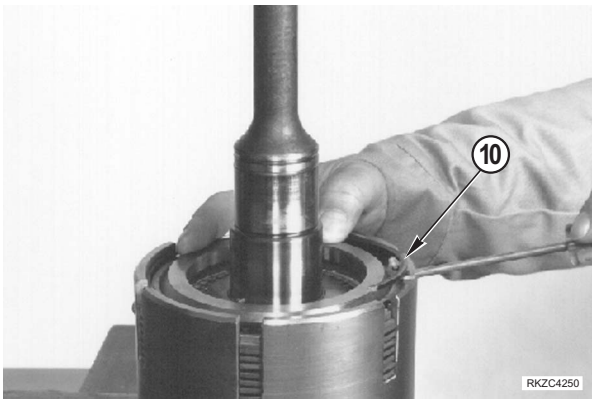
12 -Unscrew flange (13) fastening bolt (12).
Use a screwdriver and two screws to stop flange rotation.



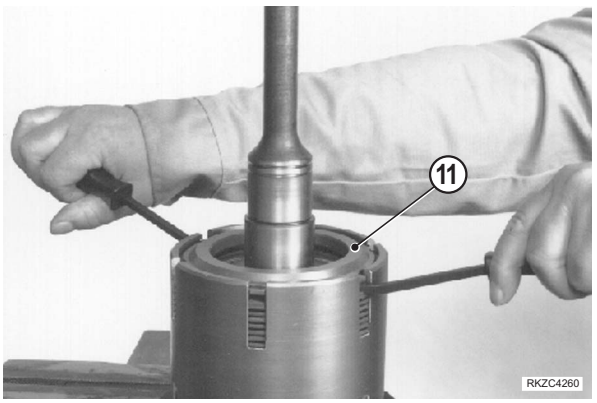
13 -Remove the bolt (12) and washer (14).



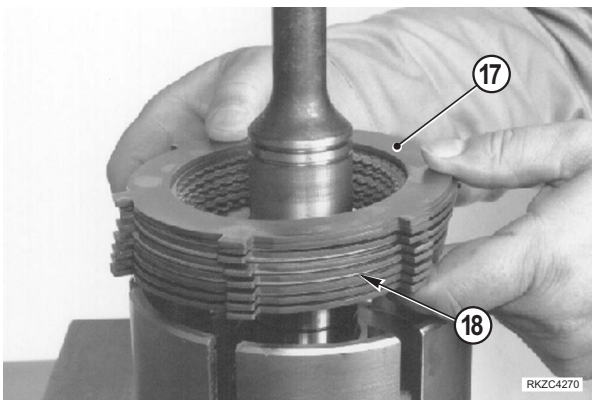
11 -Remove the snap ring (10).



12 -Use prybars to lift and to remove the thrust plate lock ring (11) evenly.



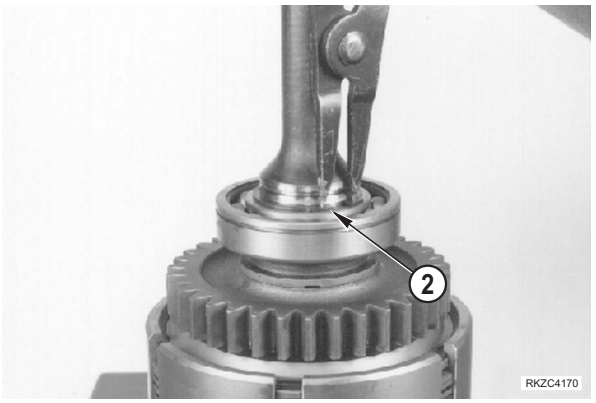
13 -Remove the clutch plates (18) and the clutch drive plates (17).



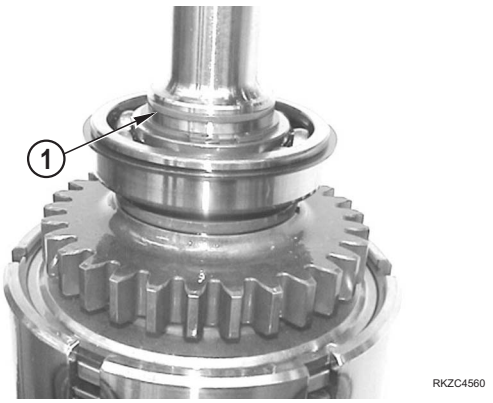
14 -Place a mark below the groove on the friction bell.

18 - Install the snap ring (2).

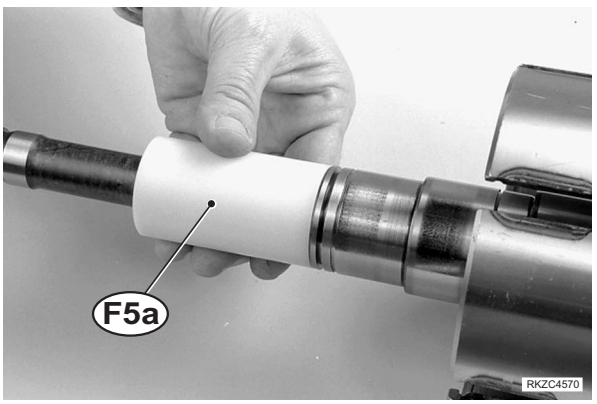
NOTA .
For clarity of the Teflon sealing ring installation procedure the following photos do not show the clutch pack, gear, spacer, bearing, and snap ring installed on the input shaft.



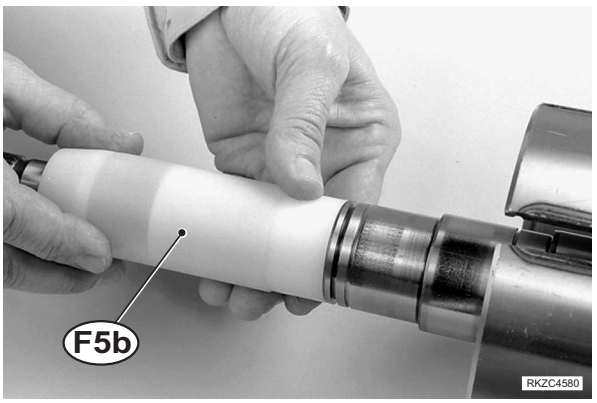
19 - Insert the teflon seal ring (1) as follows.



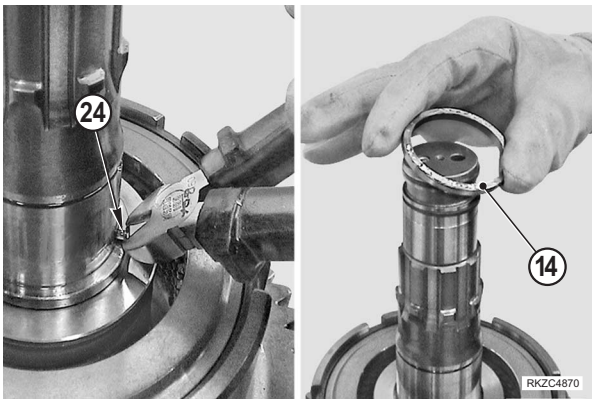
20 - Install the **F5a** spacer onto the input shaft with the chamfered end facing in.



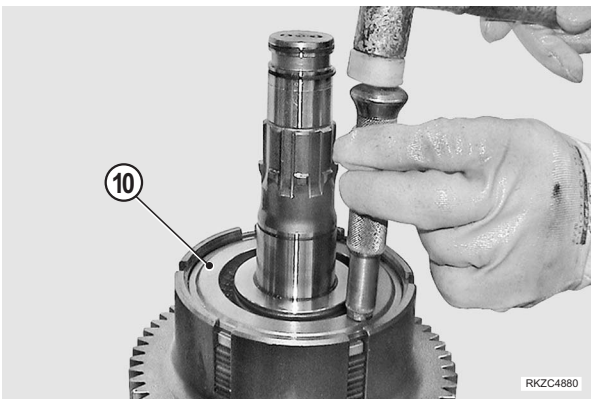
21 - Slide the **F5b** expander/protector onto the input shaft and on the spacer.
The expander/protector will stop in the correct position to install the seal ring in the groove.



11 -Remove spring pin (24) and spacer (14).

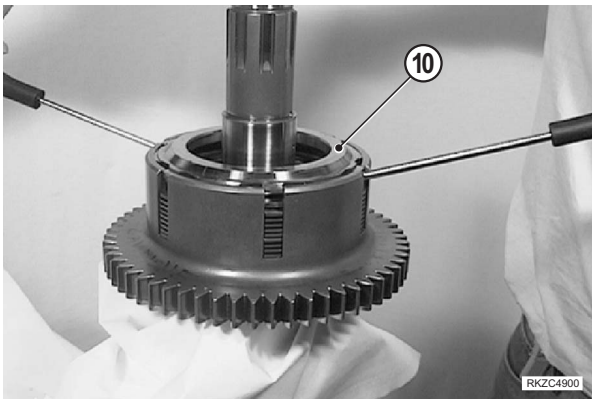


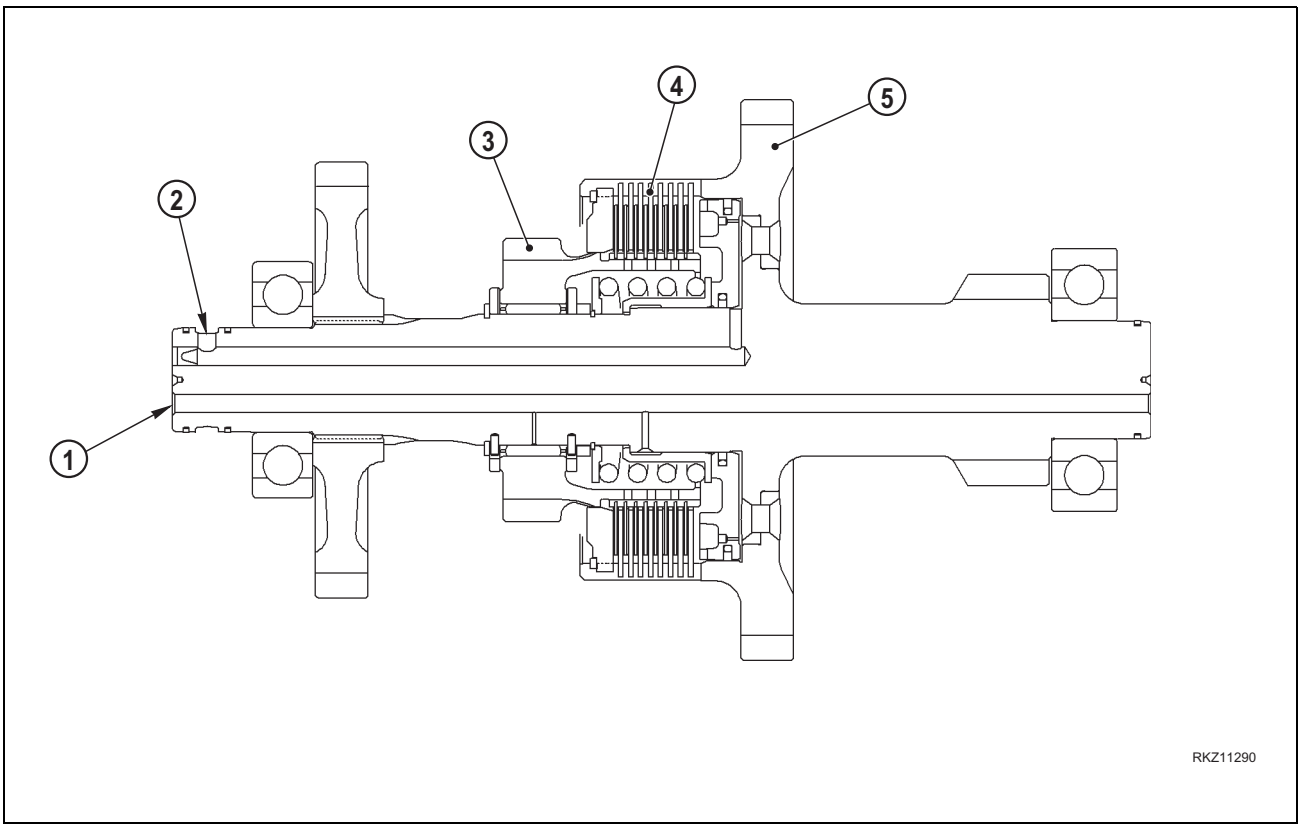
12 -Slightly press thrust plate (10).



13 -Remove snap ring (9).

14 -Remove thrust plate (10) by means of two screwdrivers.

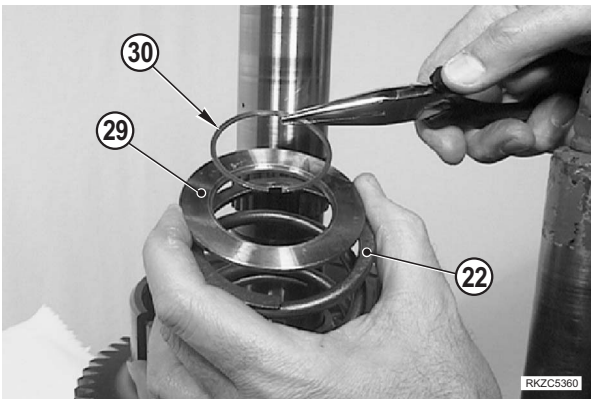




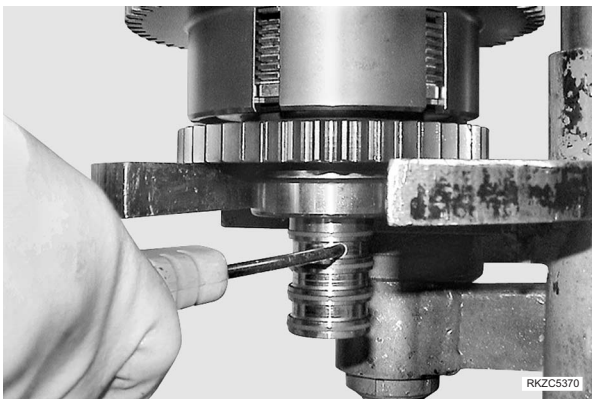
1. Lubrication oil passage
2. 2nd speed clutch oil passage
3. 2nd speed gear
4. 2nd speed clutch pack
5. Input shaft

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.

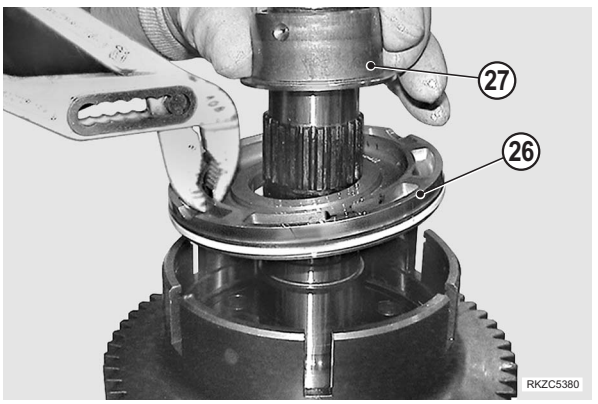
31 -Remove the lock ring (30), the thrust washer (29) and spring (28).



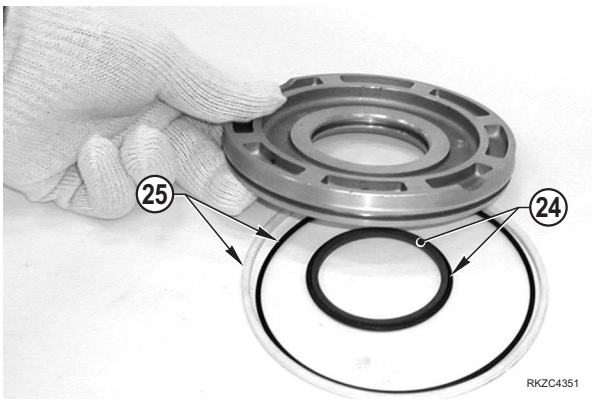
32 -Extract clutch piston (26) from its seat by blowing in compressed air through the delivery hole.



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.

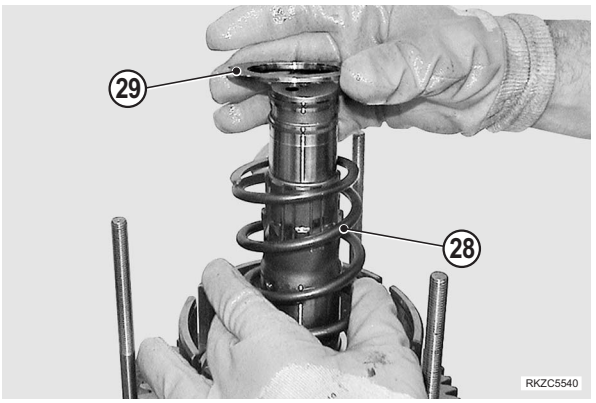


13 - Apply a thin film of grease on the sealing rings just inserted.

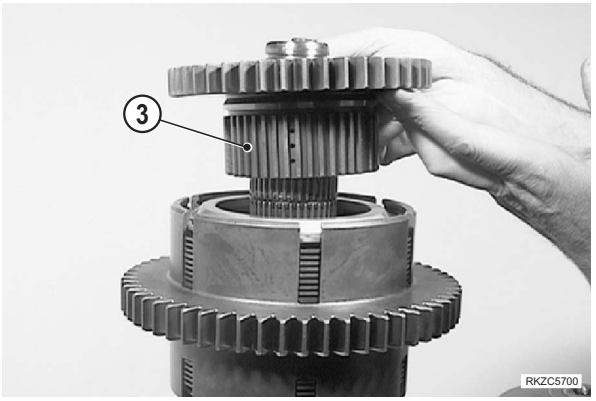
14 - Insert clutch piston (26) with special tool **F10** as protection of seal rings (24).

15 - Assemble sleeve (27).

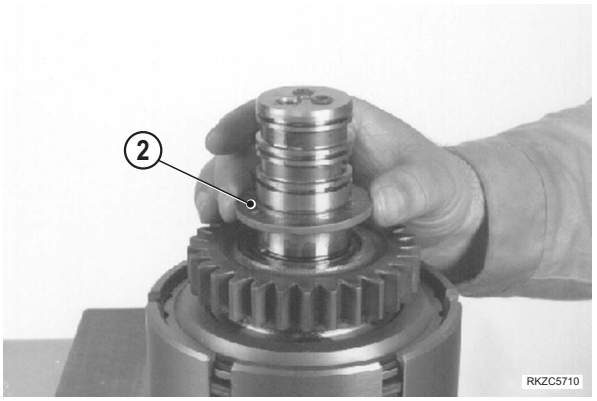
16 - Assemble spring (28) and retainer washer (29).



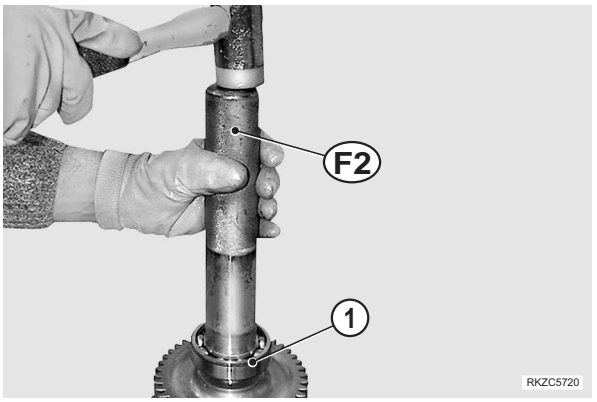
53 -Assemble the gear (3).



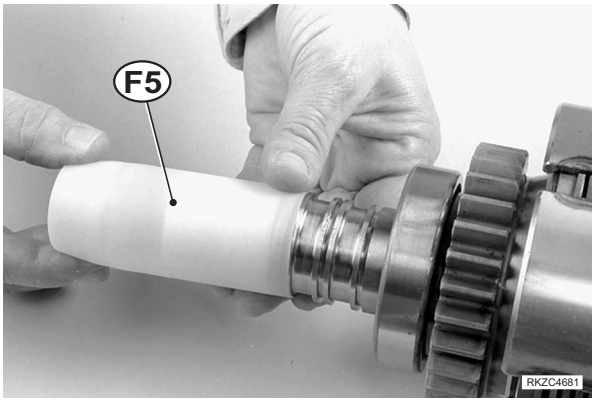
54 -Assemble the thrust washer (2).



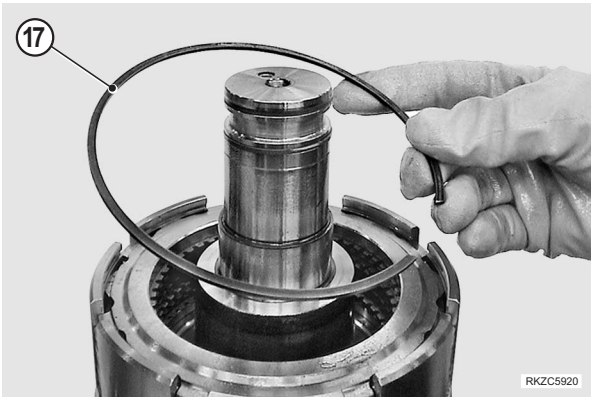
55 -Assemble bearing (1) with the special tool **F2**.



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.

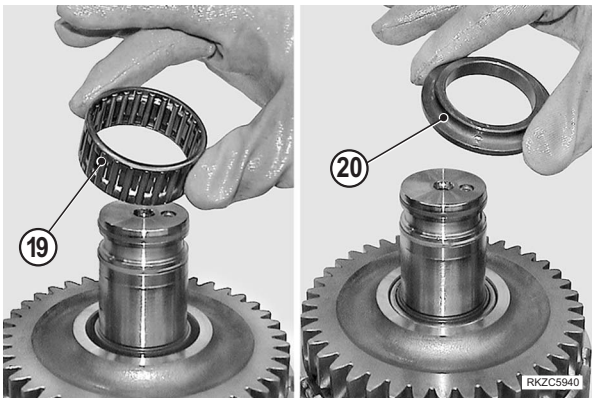


9 -Assemble retaining ring (17).

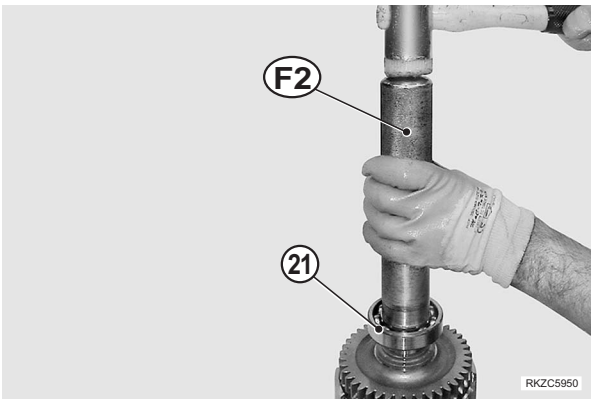


10 -Assemble gear (18).

11 -Assemble roller bearing (19) and spacer (20).

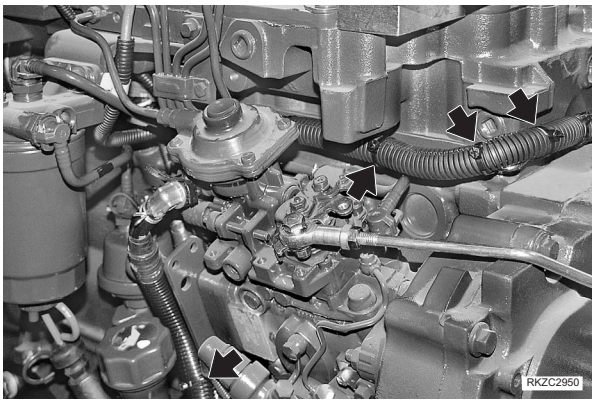


12 -Assemble bearing (21) using special tool **F2**.

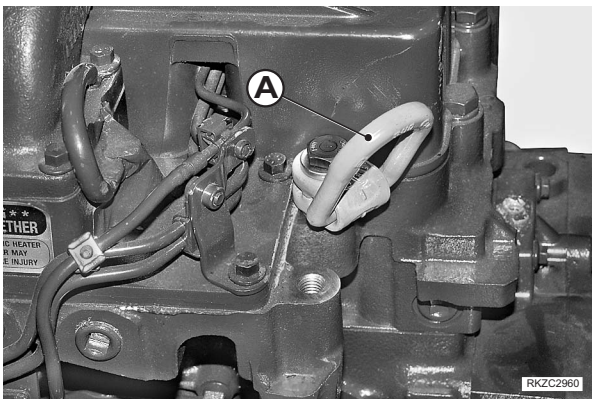


13 - Release the entire engine harness from the tie straps and route the harness down, and use some straps on the inner sides of the frame to let the wiring hang termporarily.

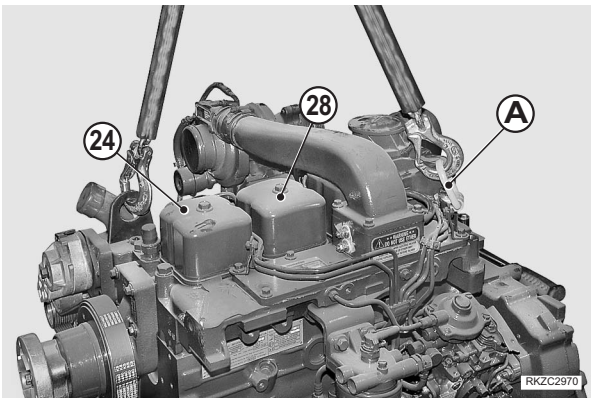
14 - Check to ensure that all hoses to the engine are released from straps or ties.



15 - Tighten a revolving lifting eye "**A**" to the muffler inner mounting hole.



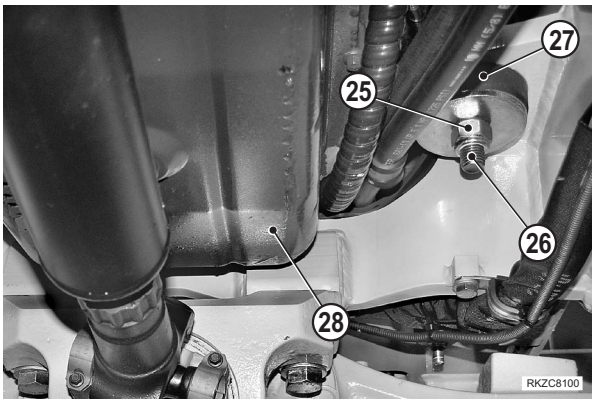
16 - Attach a lifting device to lifting eye "**A**" and to engine front bracket (24), and apply a slight tension to the chains or cables.



17 - Loosen and remove nuts (25), screws (26) and vibration dampers (27) from front engine mounts. [*1]

18 - Remove the engine (28).

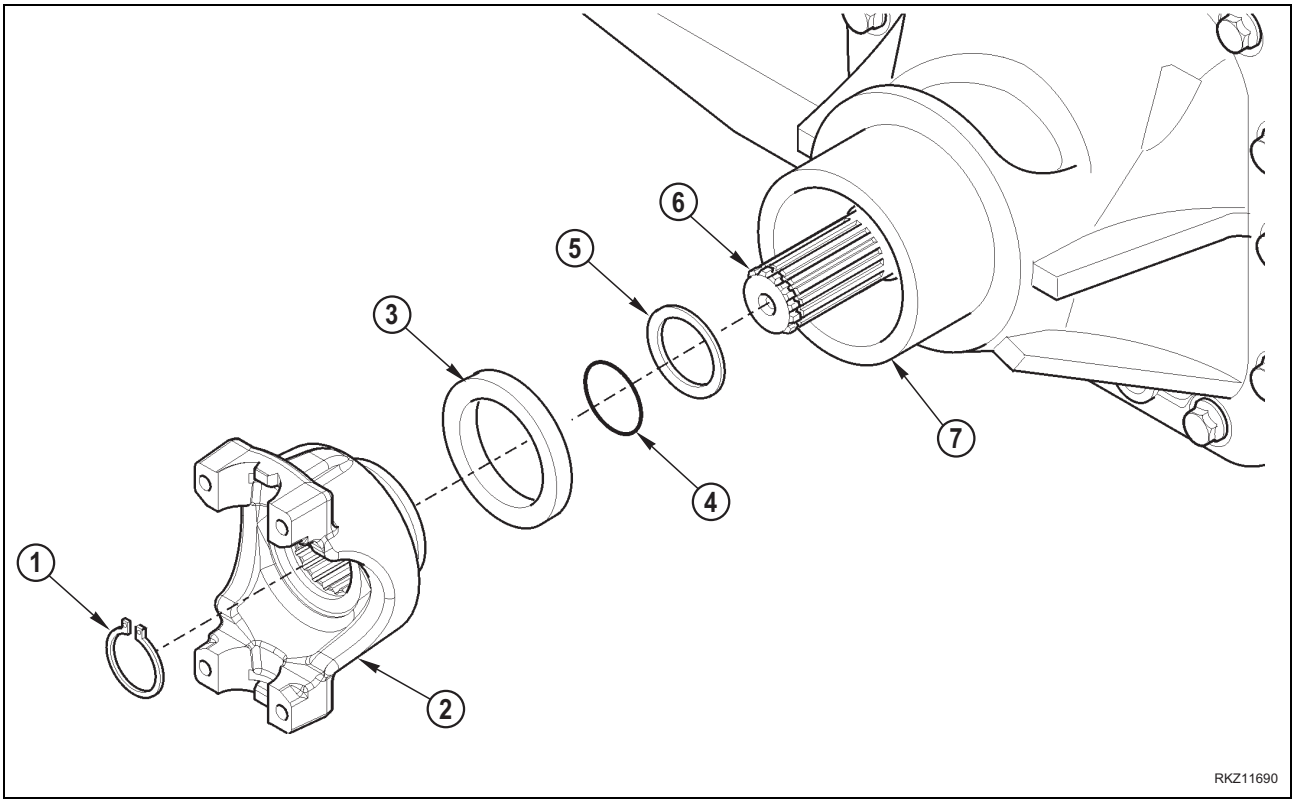
Engine: approx. 370 kg



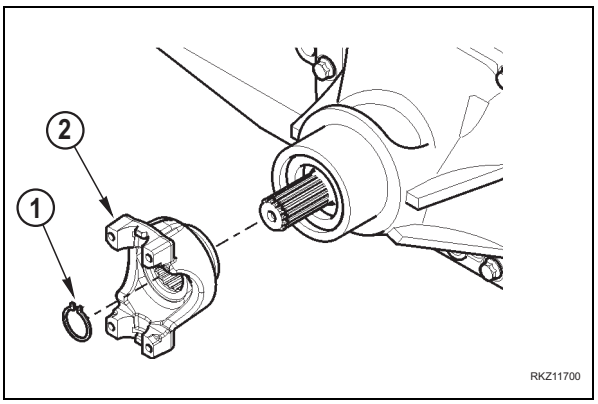
Disassembly and assembly

1. Flange group

1.1 Disassembly

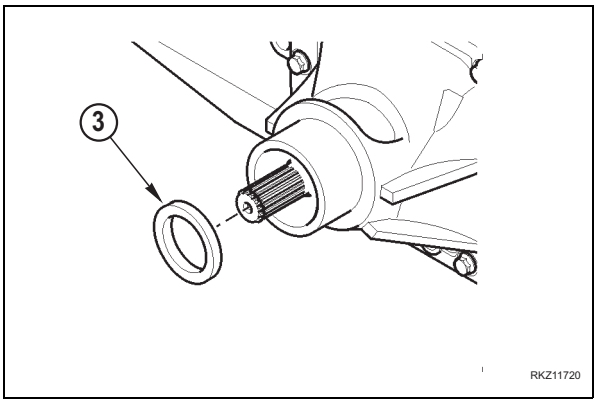


1 -Remove the lock ring (1) and flange (2).



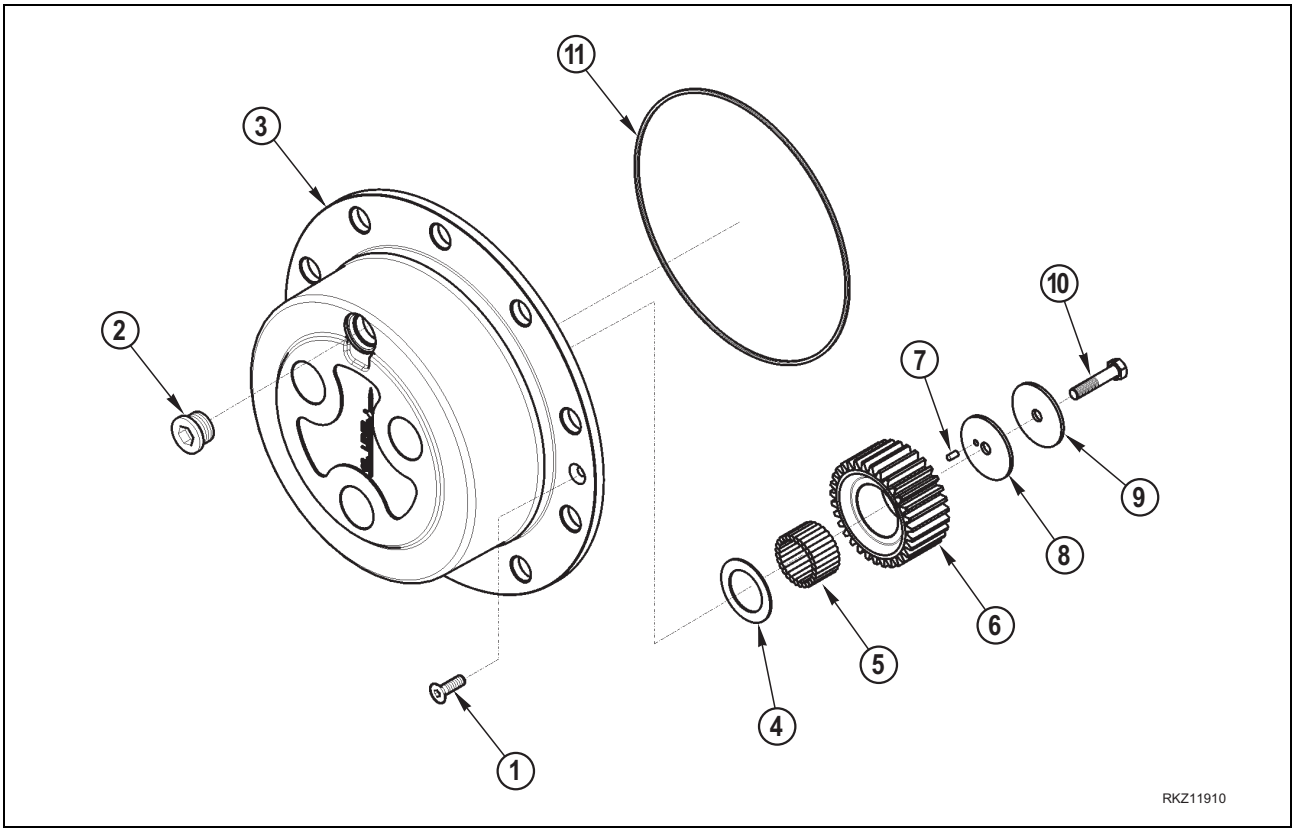
2 -Remove seal ring (3).

★ This is a destructive operation for the seal ring.

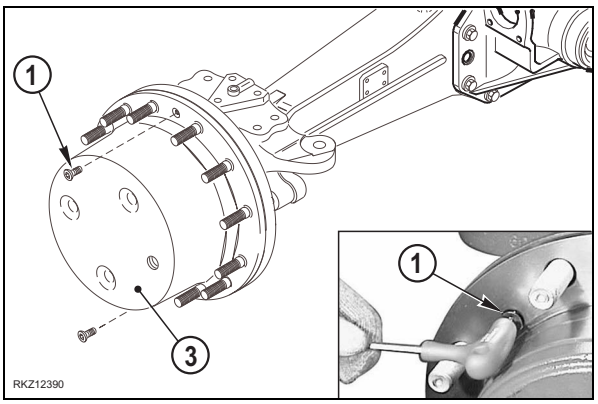


4. Epicyclic reduction gear group

4.1 Disassembly

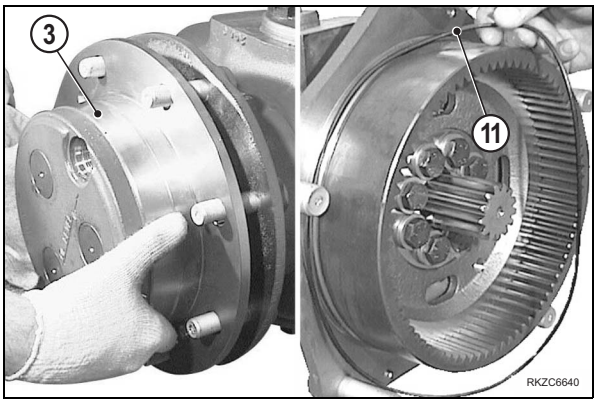


1 - Unscrew and remove both fastening screws (1) of the planetary carrier (3) with a wrench.



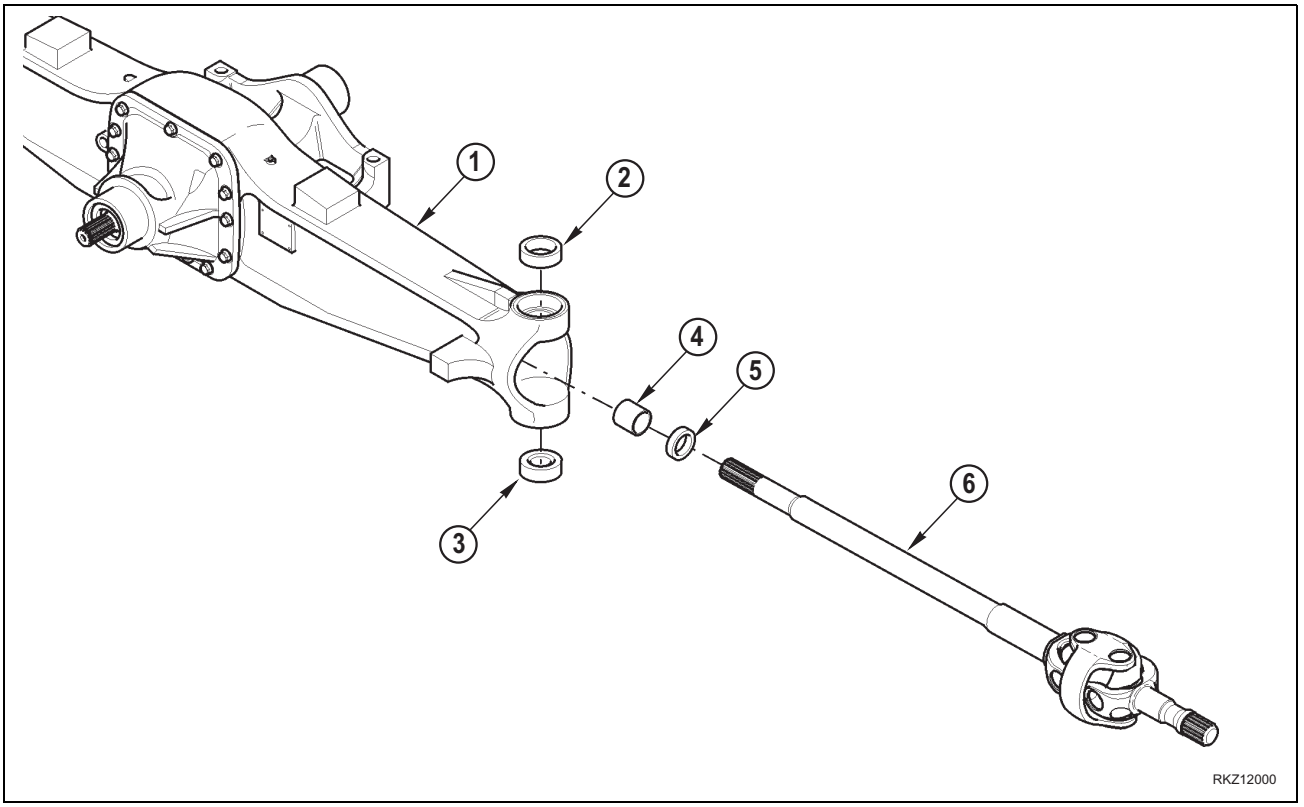
2 - Remove the planetary carrier (3) from the wheel hub and collect the relative O-Ring (11).

3 - Position the planetary carrier (3) on a workbench and check its wear conditions.

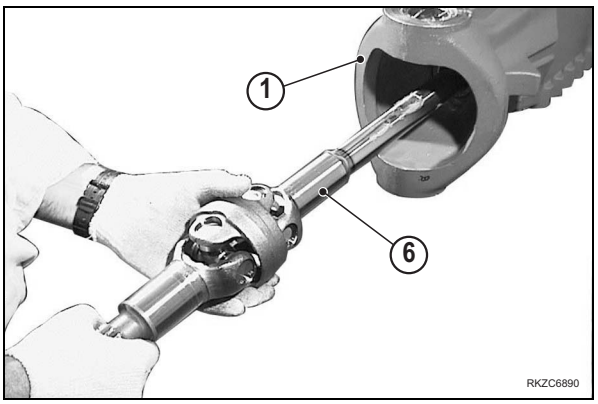


6. Axle beam group

6.1 Disassembly



1 - Remove the two double U-Joints (6) from the axle beam (1).

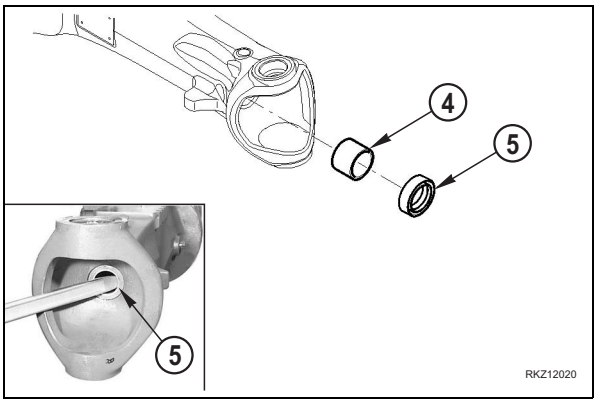


2 - Remove the seal rings (5) from the axle beam (1).

★ Replace the seal rings at each disassembly.

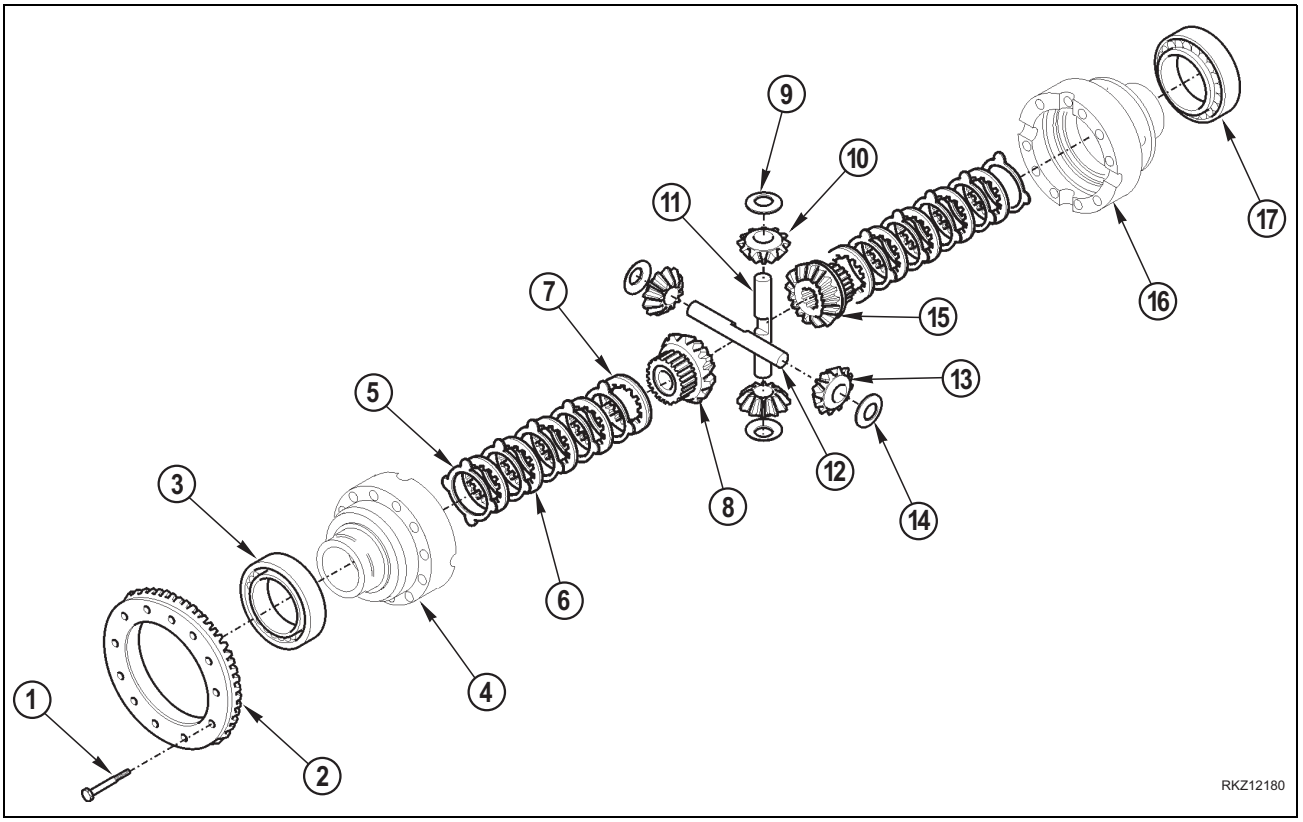
3 - Remove the bush (4) from the axle beam (1) only if the wear conditions require this.

★ Be careful not to damage the bush seat.



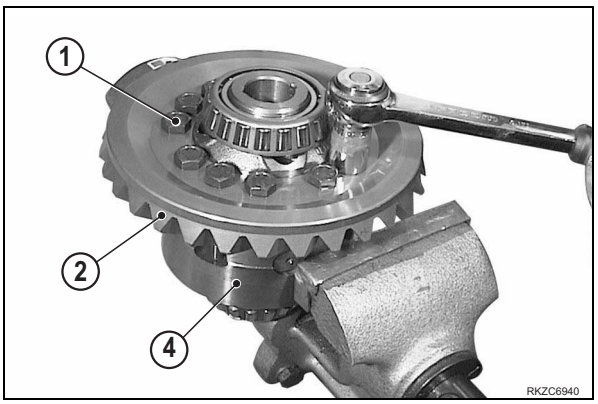
8. Differential group (LS)

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.

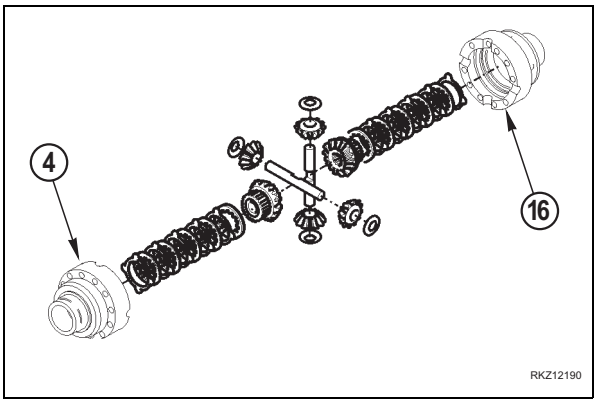


2 - Disassemble the differential box in two half boxes (4), (16) complete with the relevant components.

★ Make alignement marks on the half boxes before separating them.

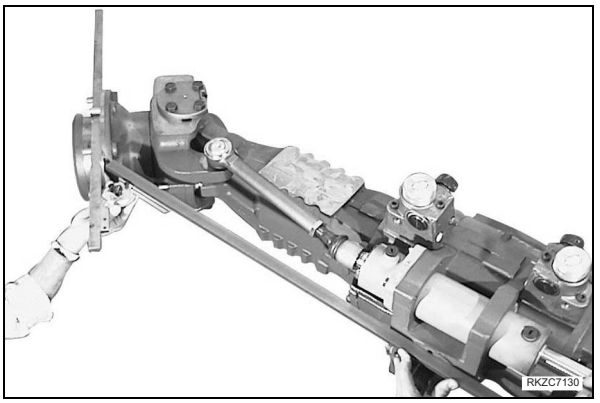
3 - Disassemble all the components.

★ Check the operating and wear conditions of the components.

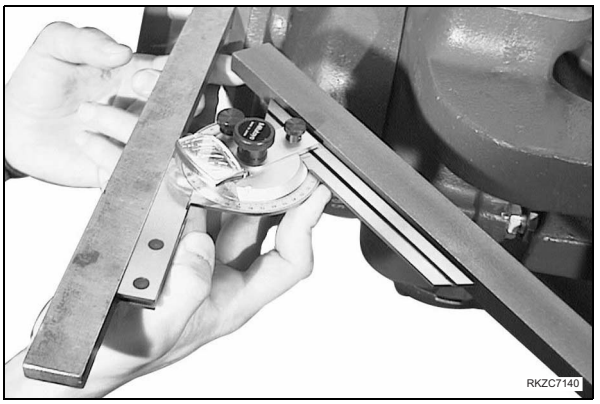


10.2 Steering angle adjustment

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.

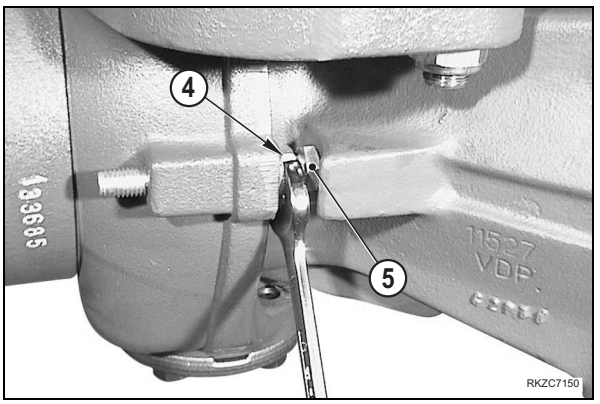


2 - Adjust a protractor to the requested angle and position it on the long bar.
Move a wheel side till it forms, with the two bars, the angle fixed by the protractor.

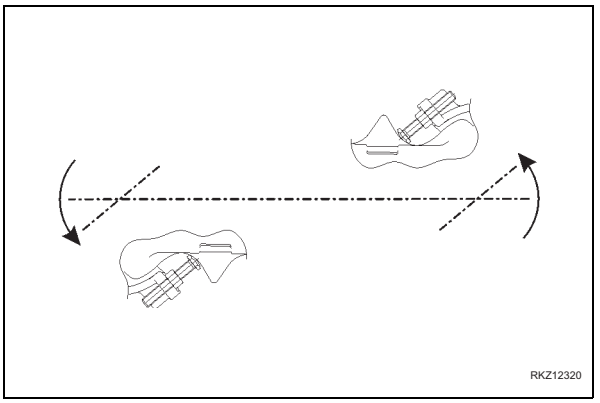


3 - Adjust the mechanical steering stop, screwing in or out the stop bolt (5), locking them with the locknut (4).

Lock nut: 150 Nm



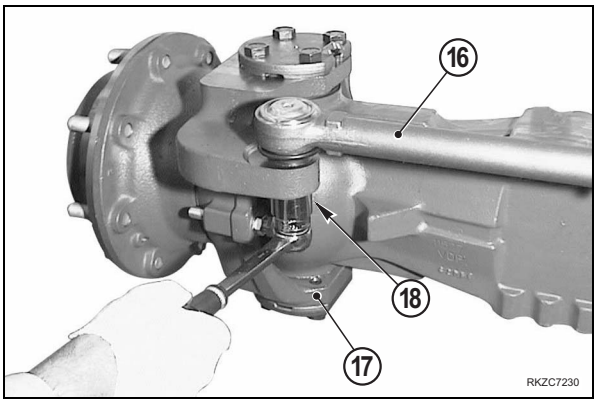
4 - Check the position of the stops on the opposite side, both screws must touch the steering stop pads at the same time.



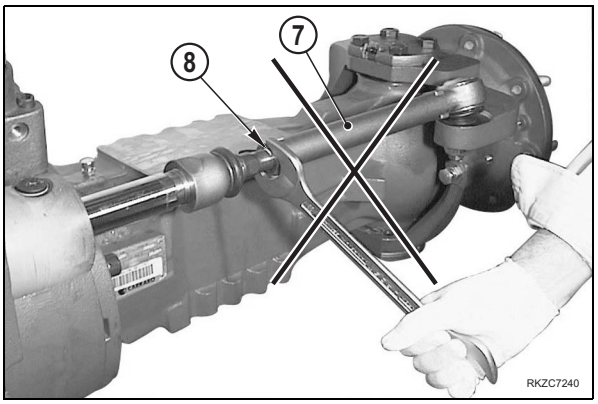
9 - Insert the ball joint of the tie rod (16) into its housing on the swivel housing (17).
Assemble and tighten the lock nut (18).

Nuts: 280 Nm

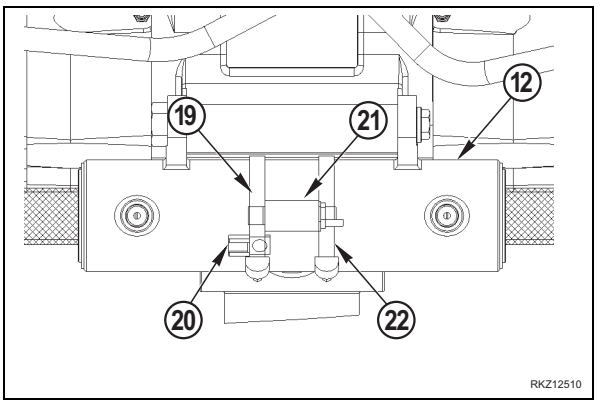
10 - Repeat the operation for the opposite side.



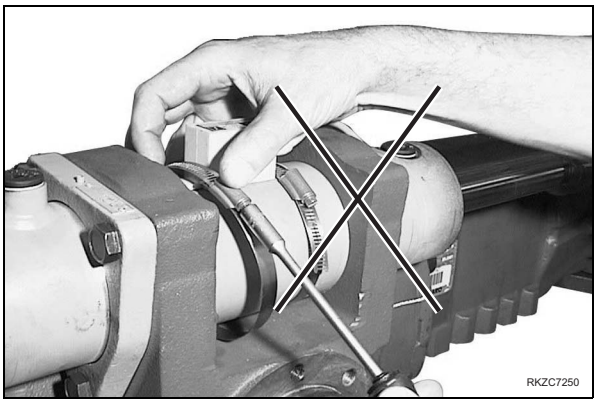
11 - Screw in the lock nuts (8) and (15) of the tie rods (7) and (16) only when the toe-in adjustment has been carried out.
(For details, see "10.1 Toe-in adjustment").



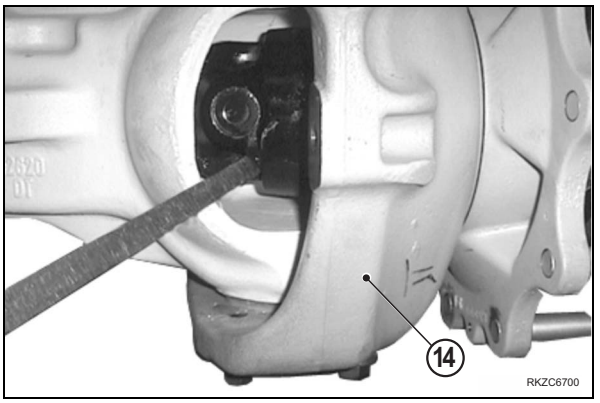
12 - Assemble the sensor (21) and receptacle bracket (20) with the clamps (19) and (22) to the steering cylinder (12).



★ The clamps can be completely tightened only when the toe-in adjustment has been carried out.
(For details, see "10.1 Toe-in adjustment").



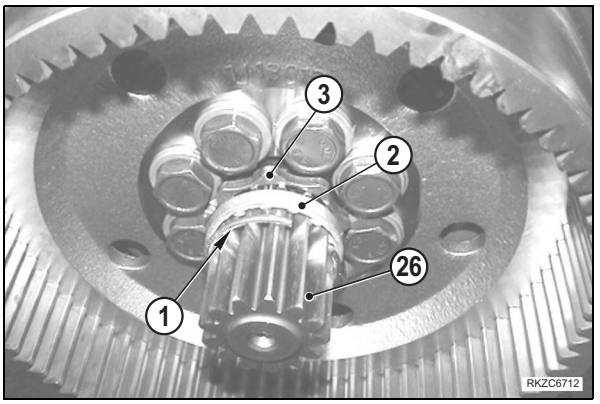
13 - Insert a lever between the swivel housing (14) and the axle beam and fit it into the double U-Joint.
With the lever push the double U-Joint in the direction of the wheel hub to make easier the lock ring (1) insertion.



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.

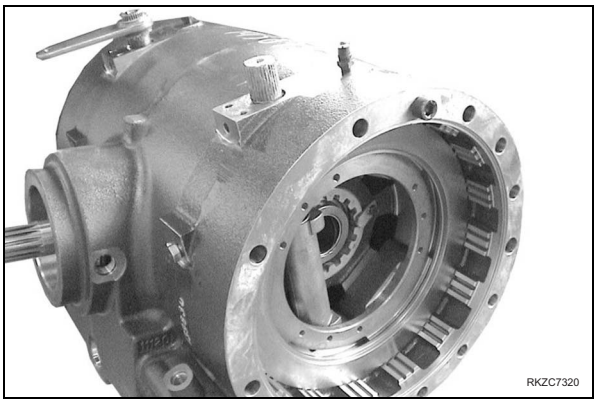
★ Check that the lock ring (1) is correctly fitted in its seat.

15 - Push the double U-Joint thoroughly.



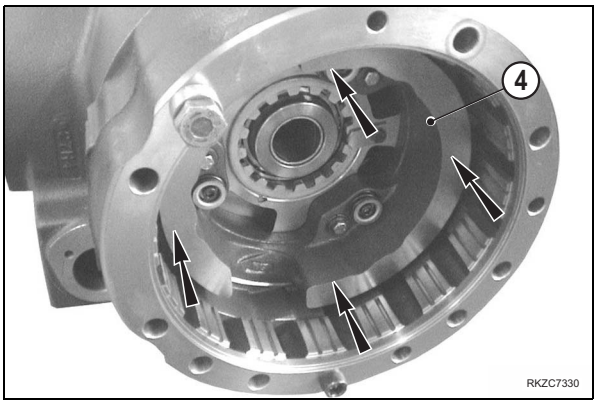
9 - The brake piston must be pushed in the original position if worn brake disks are replaced by new disks.
Remove straight threads, bleeds or plugs from the service brake oil port.

⚠ Risk of oil ejection from the axle.

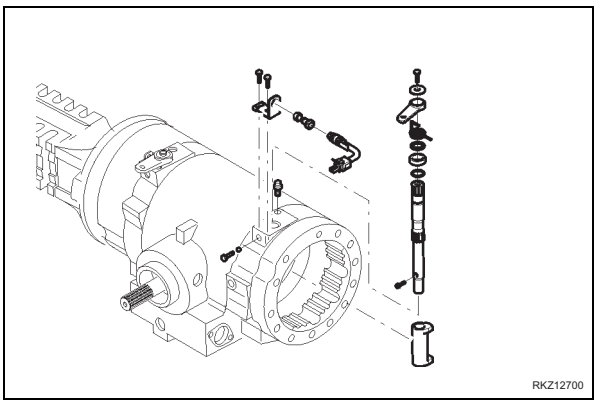


10 - Push the brake piston (4) at the end of stroke using the special pad **E11** and the handle **E8** with a hammer.

★ Position the pad with accuracy to do not damage the brake piston.



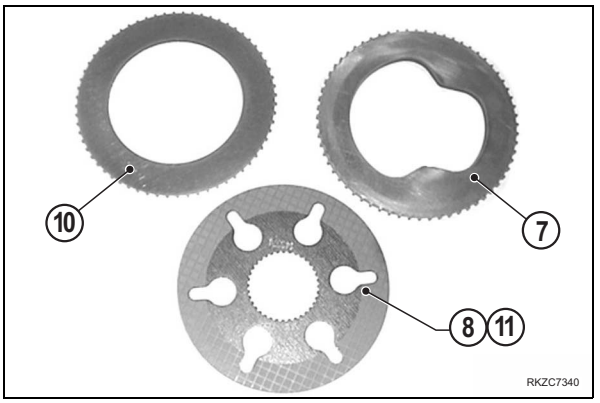
11 - Assemble the brake control group.
(For detail see "6. Brake control group").



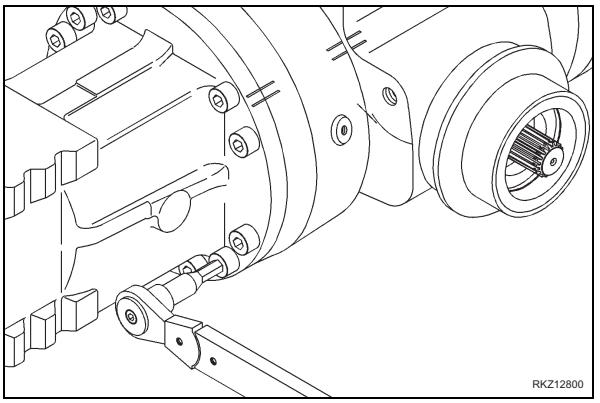
12 - Check that the brake plate (8 and 11) and the brake drive plate (7 and 10) do not present any sign of burning; on the contrary, replace them.
Furthermore check brake plate wear and if necessary replace it.

★ If new brake plate are installed, before assembling they should be dipped in the prescribed oil

Plate: Axle oil



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.

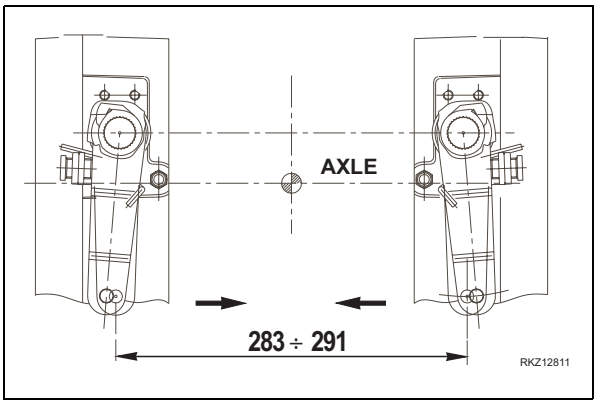
- Operate the control levers, setting them on braking position (locked levers).

  ★ The lever return springs should not be inserted.

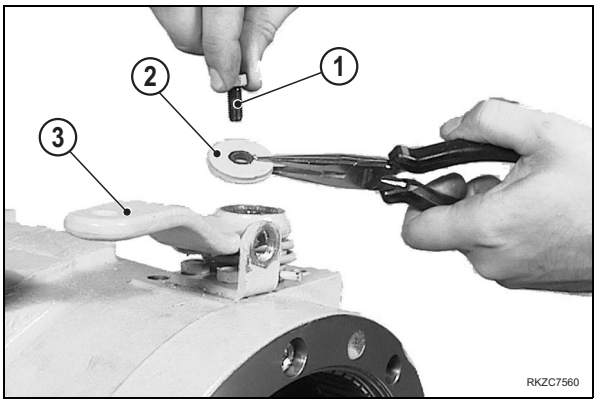
- Measure the distance between the middle of the connection holes at the ends of the control levers and check that it is within the foreseen range: 283– 291 mm

- 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.

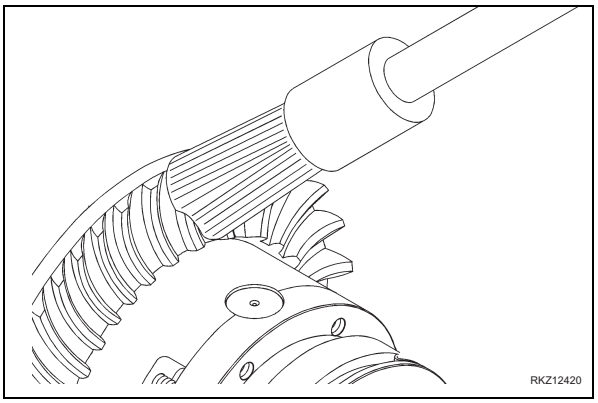


16 - Release the brake control levers (3), assemble the fastening screws (1) and the relative washers (2).



7.3 Bevel gear marking test

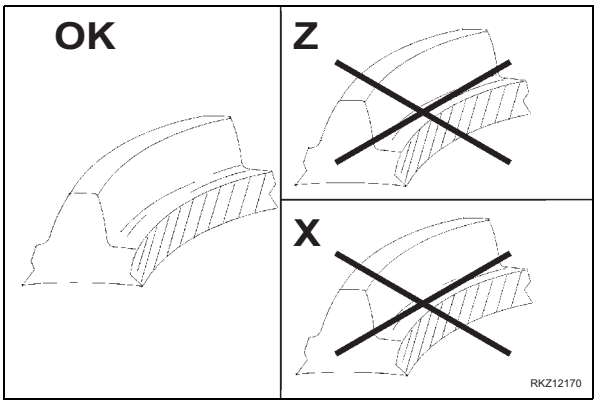
★ To test the marks of the bevel gear teeth, paint the ring gear with red lead paint.
The marking test should be always carried out on the ring bevel gear teeth and on both sides.



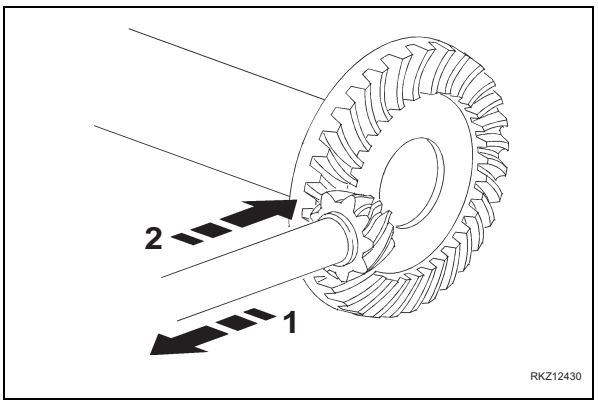
OK ->Correct contact:
If the bevel gear is well adjusted, the mark on the teeth surfaces will be regular.

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.

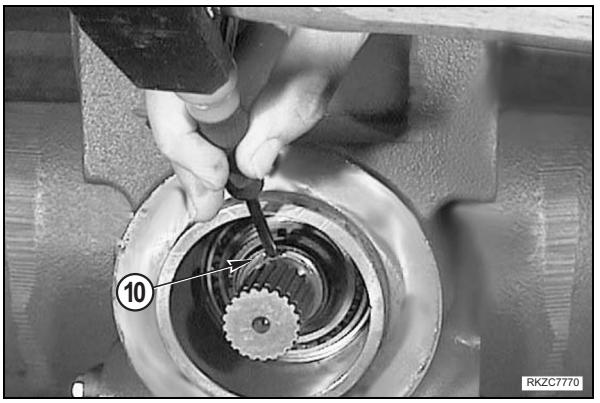
X ->Excessive contact at the tooth base:
Move the pinion away from the ring bevel gear and then approach the ring bevel gear to the pinion in order to adjust the backlash.



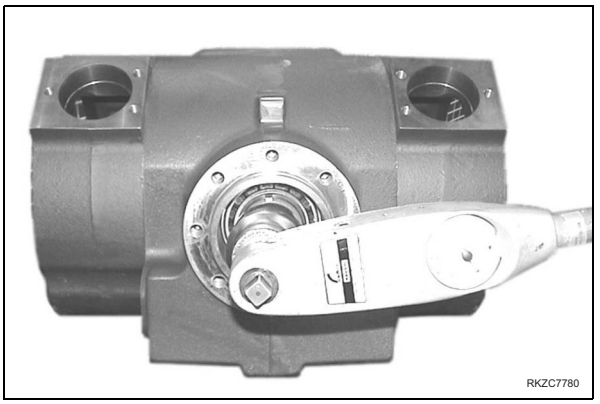
Movements to correct:
1 -> move the pinion for type X contact adjustment
2 -> move the pinion for type Z contact adjustment.



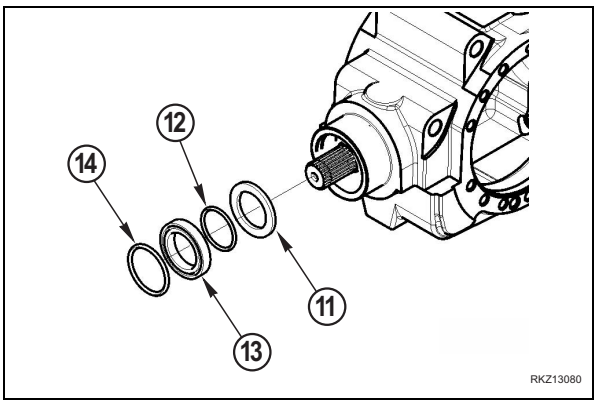
18 - The preloading/rolling torque adjustment is carried out by increasing the ring nut torque gradually, being careful not to exceed.
Once the requested preloading value is achieved, stake the ring nut (10), using a hammer and a chisel.



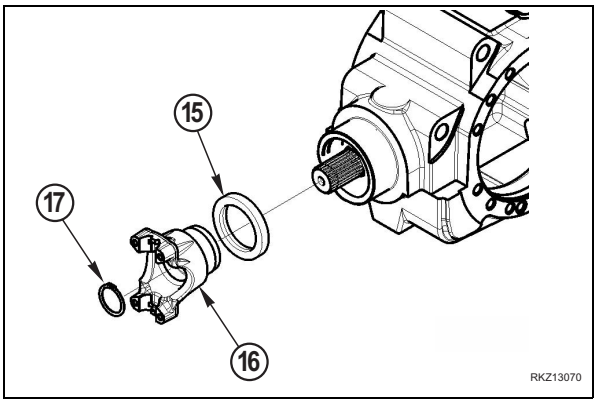
★ Before mounting the next parts assemble the differential support group (see "7. Differential support group"); the total preloading of the bearings in the pinion-crown bevel gear system must be measured without the seal rings (see "7. Differential support group" at points 15, 16 and 17).



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).

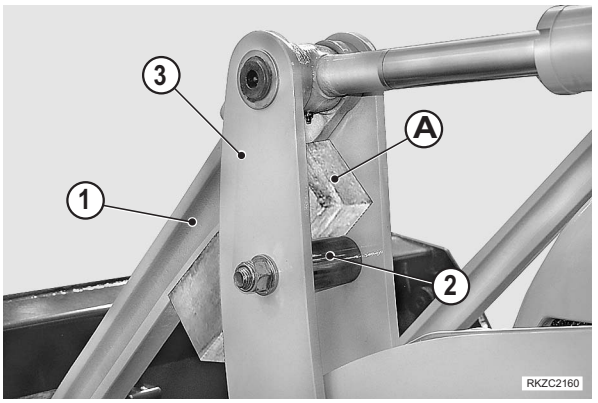


SHOVEL LIFT CYLINDERS

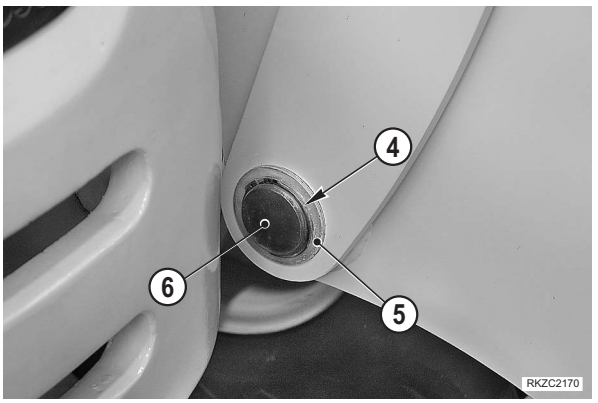
Removal

⚠ 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).



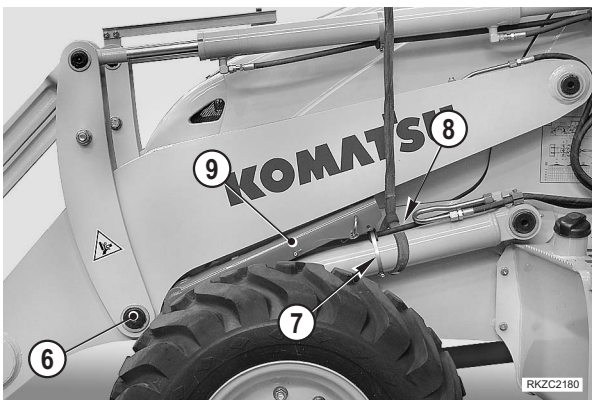
3 - Remove the tie strap (7) retaining the piston return hose (8).

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.

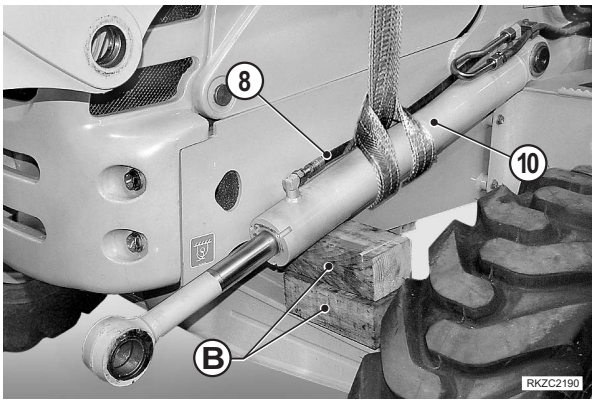


7 - Lower cylinder (10) until it rests on blocks "**B**".

8 - Start the engine to retract the piston.

[*1] [*2]

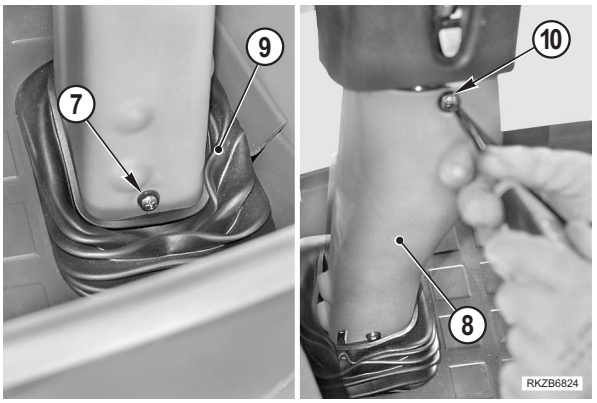
⚠ Stop the engine and eliminate residual pressure.



6 -Raise the armrest from the rear side and remove the screw (7) retaining the rear guard (8).

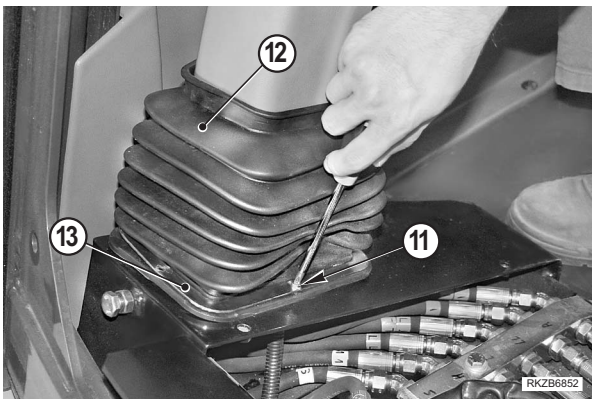
7 -Cut the retaining clamp and release the lower boot (9).

8 -Loosen and remove the screws (10) and remove the rear guard (8).



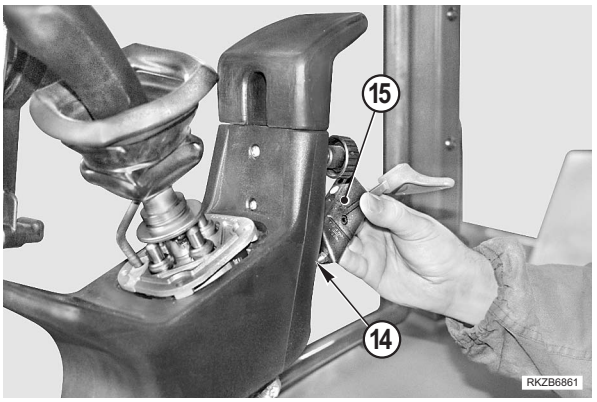
9 -Loosen and remove the screws (11) and raise the boot (12) and the retaining edge (13).

★ Raise until the lower fulcrum and locking assembly become fully disengaged.



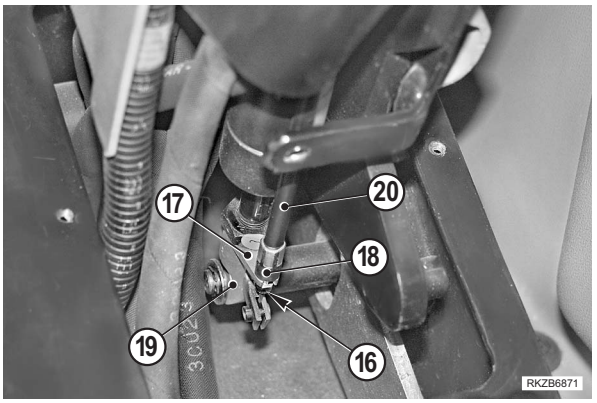
10 -Remove the retaining screws (14) from the lock-actuating lever assembly (15).

11 -Remove the entire lever assembly (15).

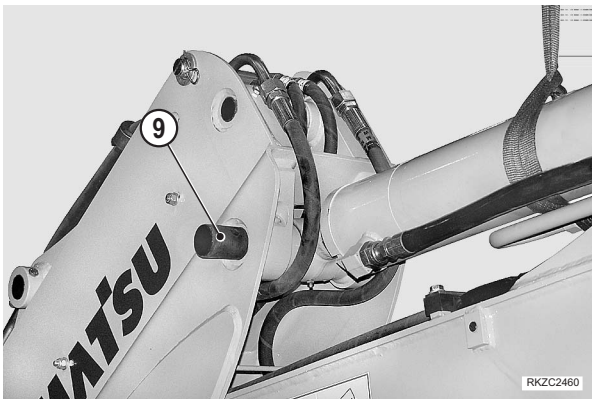


12 -Loosen the nut (16) and disengage the sheath (18) from the support (17).

13 -Disconnect the cable (20) from the lower locking lever (19).



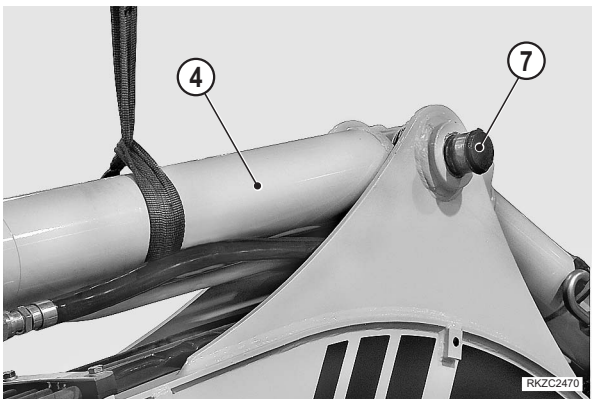
10 - Pull out the piston attachment pin (9). [*1] [*2]



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.

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.

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.

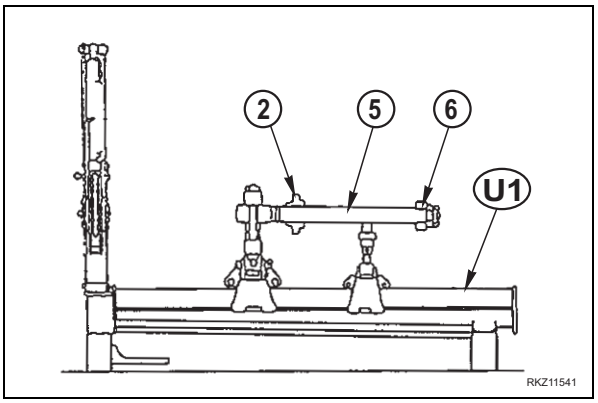
★ Hole Ø 6.8 – depth 31 mm
Thread: M8x1.25 - depth 25 mm

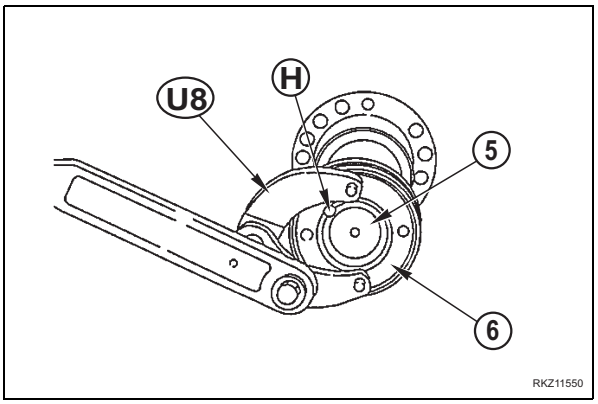
4 - Remove any dirt or shaving and install the safety screw (4).

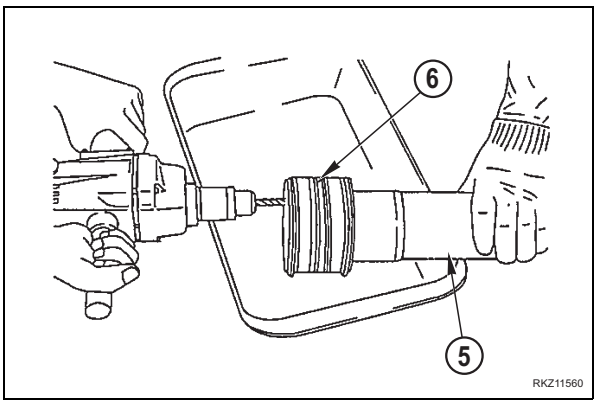
Screw: Loctite 262

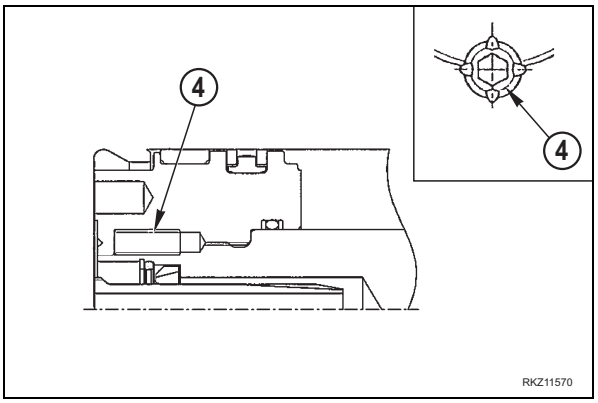
Screw: 13.25±1.45 Nm

5 - Calk screw (4) in four locations.









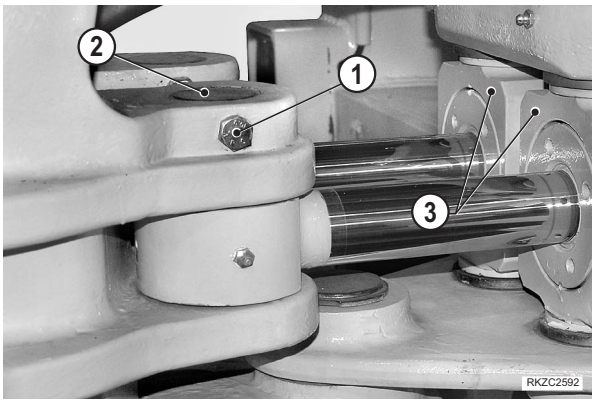
BACKHOE SWING BRACKET

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").

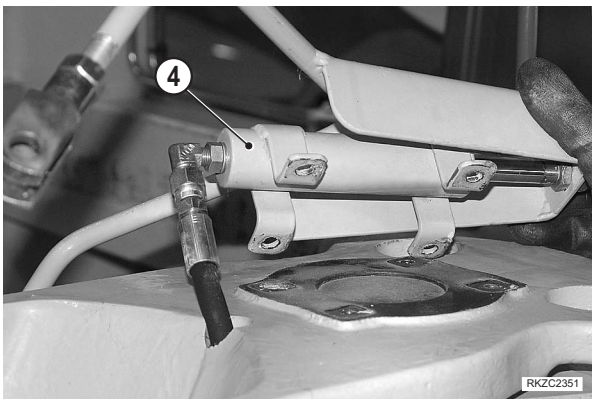


4 -Sling the swing bracket (5)

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]

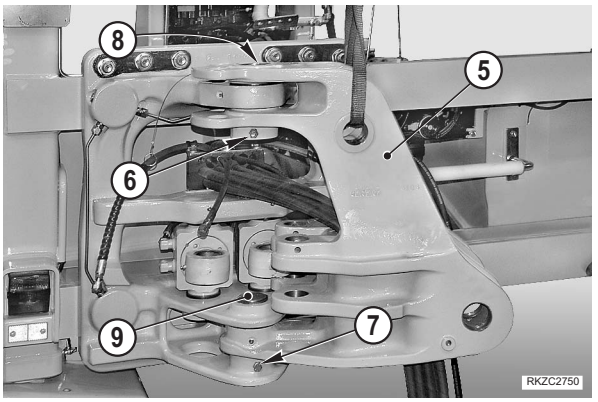
Internal bushing: ASL800050

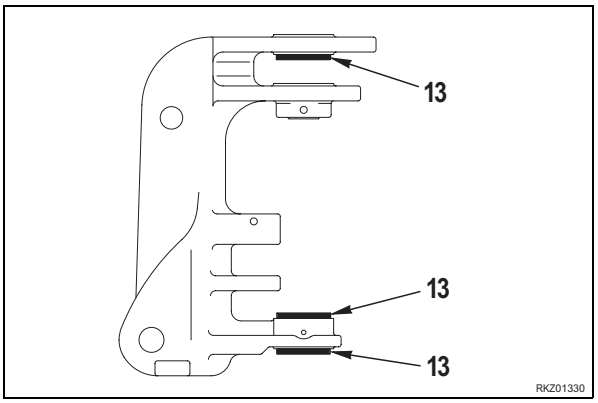
[*3]

★ Insert the shims.

1 -Start the engine and bleed the air from the cylinders.
(For details, see "20 TESTING AND ADJUSTMENTS").

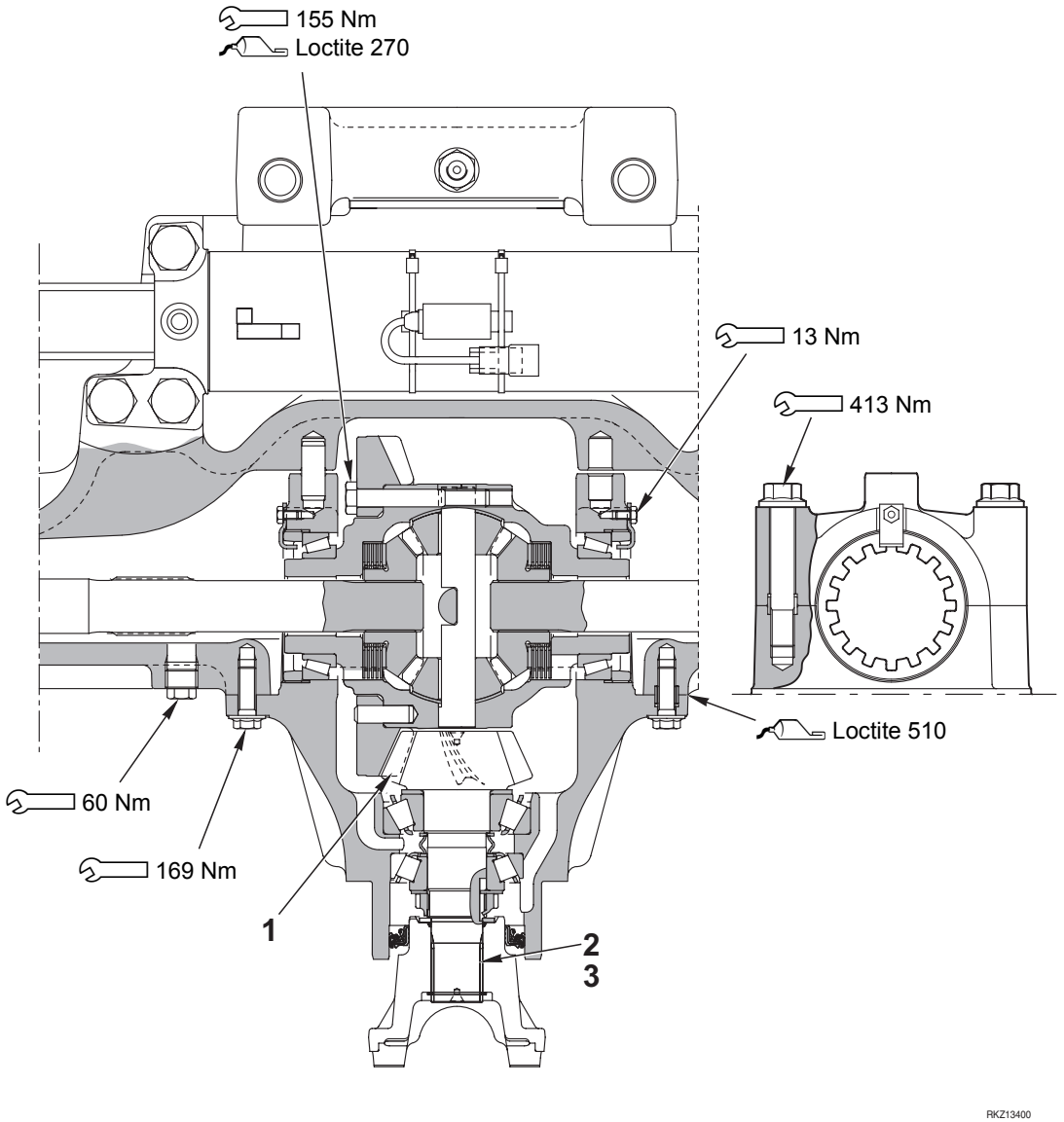
★ After bleeding the air, check the oil level in the tank.





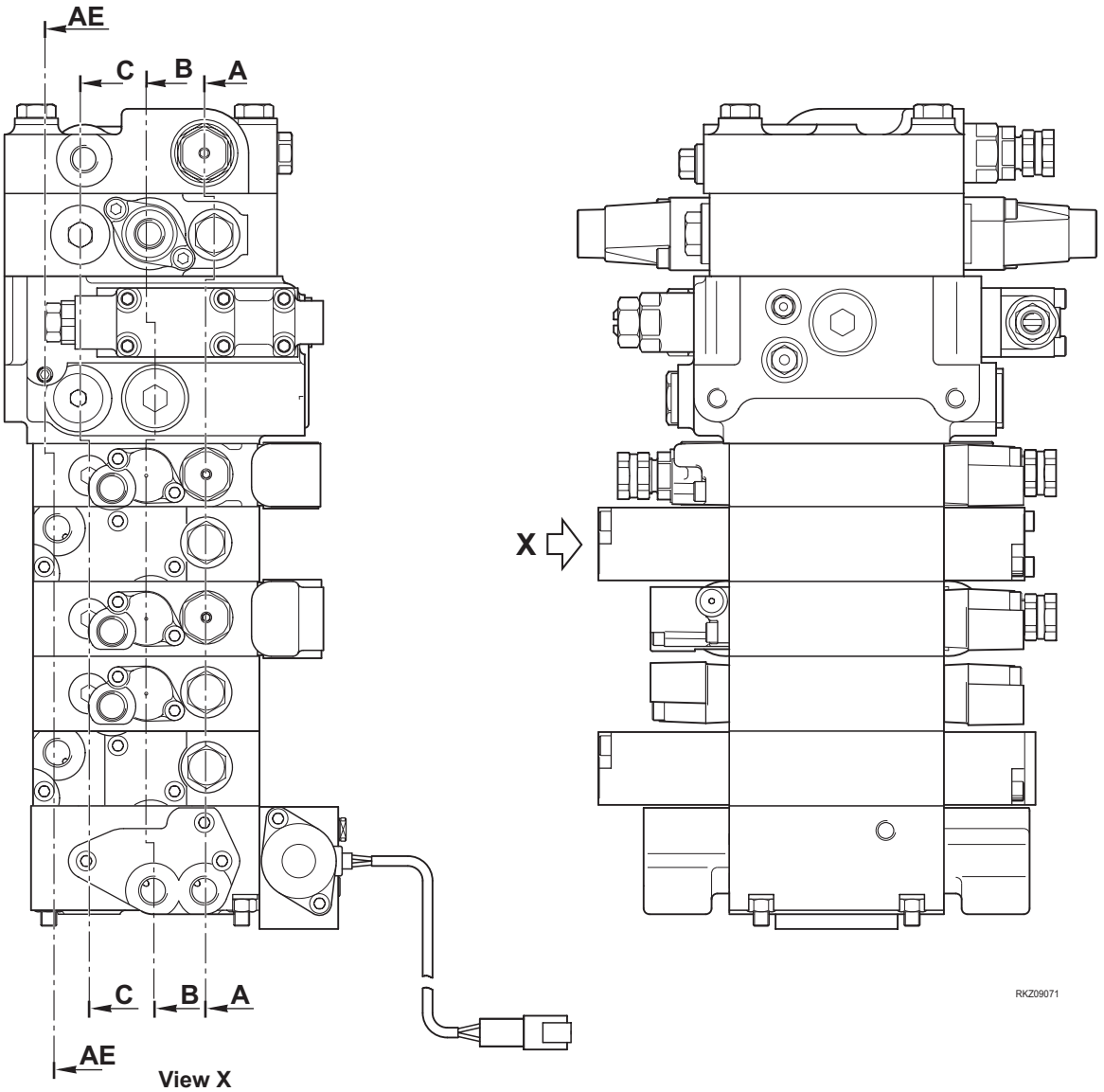
FRONT AXLE

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		

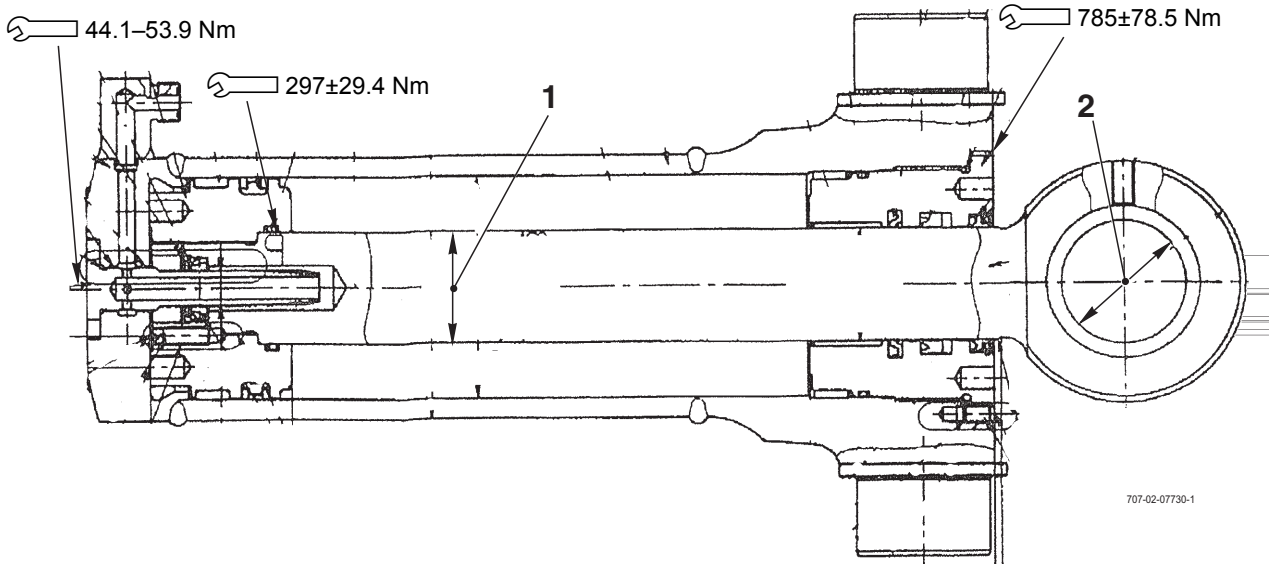


View X

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	
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	Replace spring
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	

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	