

SECTION 8 DISASSEMBLY AND ASSEMBLY

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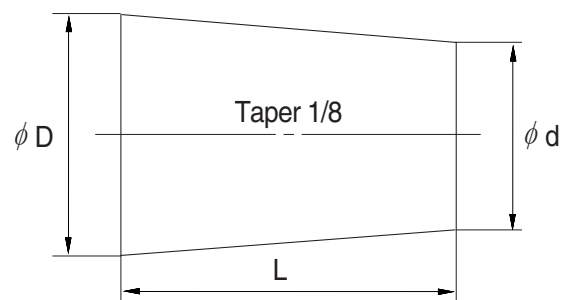
SECTION 8 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

- 1) Lower the work equipment completely to the ground.
If the coolant contains antifreeze, dispose of it correctly.
- 2) After disconnecting hoses or tubes, cover them or fit blind plugs to prevent dirt or dust from entering.
- 3) When draining oil, prepare a container of adequate size to catch the oil.
- 4) Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.
- 5) To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors.
- 6) Fit wires and hoses with tags to show their installation position to prevent any mistake when installing.
- 7) Check the number and thickness of the shims, and keep in a safe place.
- 8) When raising components, be sure to use lifting equipment of ample strength.
- 9) When using forcing screws to remove any components, tighten the forcing screws alternately.
- 10) Before removing any unit, clean the surrounding area and fit a cover to prevent any dust or dirt from entering after removal.
- 11) When removing hydraulic equipment, first release the remaining pressure inside the hydraulic tank and the hydraulic piping.
- 12) If the part is not under hydraulic pressure, the following corks can be used.

Nominal number	Dimensions		
	D	d	L
06	6	5	8
08	8	6.5	11
10	10	8.5	12
12	12	10	15
14	14	11.5	18
16	16	13.5	20
18	18	15	22
20	20	17	25
22	22	18.5	28
24	24	20	30
27	27	22.5	34



2. INSTALL WORK

- 1) Tighten all bolts and nuts (sleeve nuts) to the specified torque.
- 2) Install the hoses without twisting or interference.
- 3) Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
- 4) Bend the cotter pin or lock plate securely.
- 5) When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2-3 drops of adhesive.
- 6) When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
- 7) Clean all parts, and correct any damage, dents, burrs, or rust.
- 8) Coat rotating parts and sliding parts with engine oil.
- 9) When press fitting parts, coat the surface with antifriction compound (LM-P).
- 10) After installing snap rings, check that the snap ring is fitted securely in the ring groove (check that the snap ring moves in the direction of rotation).
- 11) When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
- 12) When using eyebolts, check that there is no deformation or deterioration, and screw them in fully.
- 13) When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.
- 14) When operating the hydraulic cylinders for the first time after repairing and reassembling the hydraulic cylinders, pumps, or other hydraulic equipment or piping, always bleed the air from the hydraulic cylinders as follows:
 - (1) Start the engine and run at low idling.
 - (2) Operate the control lever and actuate the hydraulic cylinder 4-5 times, stopping 100mm before the end of the stroke.
 - (3) Next, operate the piston rod to the end of its stroke to relieve the circuit. (The air bleed valve is actuated to bleed the air.)
 - (4) After completing this operation, raise the engine speed to the normal operating condition.
 - ※ If the hydraulic cylinder has been replaced, carry out this procedure before assembling the rod to the work equipment.
 - ※ Carry out the same operation on machines that have been in storage for a long time after completion of repairs.

3. COMPLETING WORK

- 1) If the coolant has been drained, tighten the drain valve, and add water to the specified level. Run the engine to circulate the water through the system. Then check the water level again.
- 2) If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
- 3) If the piping or hydraulic equipment, such as hydraulic cylinders, pumps, or motors, have been removed for repair, always bleed the air from the system after reassembling the parts.
- 4) Add the specified amount of grease (molybdenum disulphied grease) to the work equipment related parts.

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (bracket-frame, FR)	M20 × 2.5	52.1 ± 5.0	370 ± 36.2
2		Engine mounting bolt (bracket-frame, RR)	M20 × 2.5	52.1 ± 5.0	370 ± 36.2
3		Engine mounting bolt (engine-bracket)	M12 × 1.75	11.5 ± 1.0	83.2 ± 7.2
4		Radiator mounting bolt, nut	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
5		Coupling mounting bolt	M18 × 2.5	32.0 ± 1.0	231 ± 7.2
6	Hydraulic system	Main pump housing mounting bolt	M10 × 1.5	6.5 ± 0.7	47.0 ± 5.1
7		Main pump mounting socket bolt	M20 × 2.5	57.9 ± 8.7	418 ± 62.9
8		Main control valve mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
9		Travel motor mounting bolt	M16 × 2.0	35.6 ± 7.1	257 ± 51.4
10		Fuel tank mounting bolt	M20 × 2.5	46 ± 5.1	333 ± 36.9
11		Hydraulic oil tank mounting bolt	M20 × 2.5	46 ± 5.1	333 ± 36.9
12		Turning joint mounting bolt, nut	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
13		Swing motor mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
14	Power train system	Swing bearing upper mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
15		Swing bearing lower mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
16		Real axle mounting bolt, nut	M24 × 2.0	100 ± 10.7	723 ± 77.4
			M24 × 3.0	100 ± 10.7	723 ± 77.4
17		Transmission bracket mounting bolt	M20 × 2.5	39 ± 4.2	282 ± 30.4
18		Transmission mounting bolt	M20 × 2.5	44 ± 2.0	318 ± 14.5
19		Oscillating cylinder mounting bolt	M22 × 1.5	69.4 ± 10.4	502 ± 75.2
20		Oscillating cylinder support bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
21		Wheel nut	M22 × 1.5	60	433
22		Front drive shaft mounting bolt, nut	M10 × 1.0	5.9 ± 0.6	42.7 ± 4.3
23		Rear drive shaft mounting bolt, nut	M10 × 1.0	5.9 ± 0.6	42.7 ± 4.3
24	Others	Counterweight mounting bolt	M36 × 3.0	337 ± 33	2440 ± 72.3
25		Cab mounting bolt, nut	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
26		Operator's seat mounting bolt	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8
27		Under cover mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7

※ For tightening torque of engine and hydraulic components, see engine maintenance guide and service manual.

2. TORQUE CHART

The torques given are standard figures. Any figures specifically described in this manual has priority.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8T		10T	
	kg · m	lb · ft	kg · m	lb · ft
M 6 × 1.0	0.9 ~ 1.3	6.5 ~ 9.4	1.1 ~ 1.7	8.0 ~ 12.3
M 8 × 1.25	2.0 ~ 3.0	14.5 ~ 21.7	2.7 ~ 4.1	19.5 ~ 29.7
M10 × 1.5	4.0 ~ 6.0	28.9 ~ 43.4	5.5 ~ 8.3	39.8 ~ 60.0
M12 × 1.75	7.4 ~ 11.2	53.5 ~ 81.0	9.8 ~ 15.8	70.9 ~ 114
M14 × 2.0	12.2 ~ 16.6	88.2 ~ 120	16.7 ~ 22.5	121 ~ 163
M16 × 2.0	18.6 ~ 25.2	135 ~ 182	25.2 ~ 34.2	182 ~ 247
M18 × 2.5	25.8 ~ 35.0	187 ~ 253	35.1 ~ 47.5	254 ~ 344
M20 × 2.5	36.2 ~ 49.0	262 ~ 354	49.2 ~ 66.6	356 ~ 482
M22 × 2.5	48.3 ~ 63.3	349 ~ 458	65.8 ~ 98.0	476 ~ 709
M24 × 3.0	62.5 ~ 84.5	452 ~ 611	85.0 ~ 115	615 ~ 832
M30 × 3.0	124 ~ 168	898 ~ 1214	169 ~ 229	1223 ~ 1656
M36 × 4.0	174 ~ 236	1261 ~ 1704	250 ~ 310	1808 ~ 2242

(2) Fine thread

Bolt size	8T		10T	
	kg · m	lb · ft	kg · m	lb · ft
M 8 × 1.0	2.2 ~ 3.4	15.9 ~ 24.6	3.0 ~ 4.4	21.7 ~ 31.8
M10 × 1.2	4.5 ~ 6.7	32.5 ~ 48.5	5.9 ~ 8.9	42.7 ~ 64.4
M12 × 1.25	7.8 ~ 11.6	56.4 ~ 83.9	10.6 ~ 16.0	76.7 ~ 116
M14 × 1.5	13.3 ~ 18.1	96.2 ~ 131	17.9 ~ 24.1	130 ~ 174
M16 × 1.5	19.9 ~ 26.9	144 ~ 195	26.6 ~ 36.0	192 ~ 260
M18 × 1.5	28.6 ~ 43.6	207 ~ 315	38.4 ~ 52.0	278 ~ 376
M20 × 1.5	40.0 ~ 54.0	289 ~ 391	53.4 ~ 72.2	386 ~ 522
M22 × 1.5	52.7 ~ 71.3	381 ~ 516	70.7 ~ 95.7	511 ~ 692
M24 × 2.0	67.9 ~ 91.9	491 ~ 665	90.9 ~ 123	658 ~ 890
M30 × 2.0	137 ~ 185	990 ~ 1339	182 ~ 248	1314 ~ 1796
M36 × 3.0	192 ~ 260	1390 ~ 1880	262 ~ 354	1894 ~ 2562

2) PIPE AND HOSE (FLARE type)

Thread size (PF)	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

3) PIPE AND HOSE (ORFS type)

Thread size (UNF)	Width across flat (mm)	kgf · m	lbf · ft
9/16-18	19	4	28.9
11/16-16	22	5	36.2
13/16-16	27	9.5	68.7
1-3/16-12	36	18	130.2
1-7/16-12	41	21	151.9
1-11/16-12	50	35	253.2

4) FITTING

Thread size	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

GROUP 3 PUMP DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

- (4) Remove the wirings for the pressure sensors and so on.
- (5) Loosen the drain plug under the hydraulic tank and drain the oil from the hydraulic tank.
· Hydraulic tank quantity : 160 ℓ
- (6) Remove socket bolts (25) and disconnect pipe (7, 8).
- (7) Disconnect pilot line hoses (2, 3, 4, 5, 6, 7).

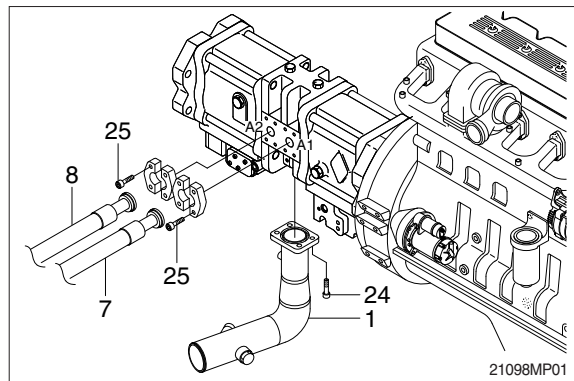
- (8) Remove socket bolts (24) and disconnect pump suction tube (1).
- ※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (9) Sling the pump assembly and remove the pump mounting bolts.
· Weight : 140 kg (310 lb)
· Tightening torque : $57.9 \pm 8.7 \text{ kgf} \cdot \text{m}$
($419 \pm 62.9 \text{ lbf} \cdot \text{ft}$)

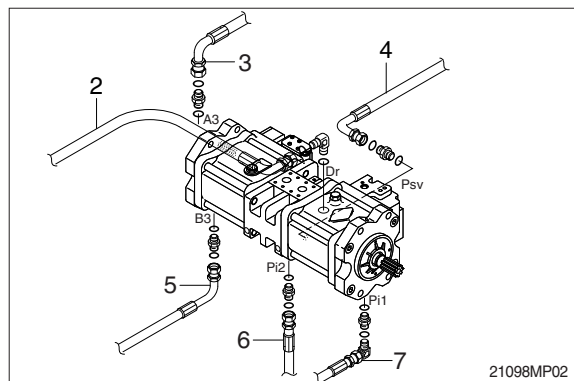
- ※ Pull out the pump assembly from housing.
When removing the pump assembly, check that all the hoses have been disconnected.



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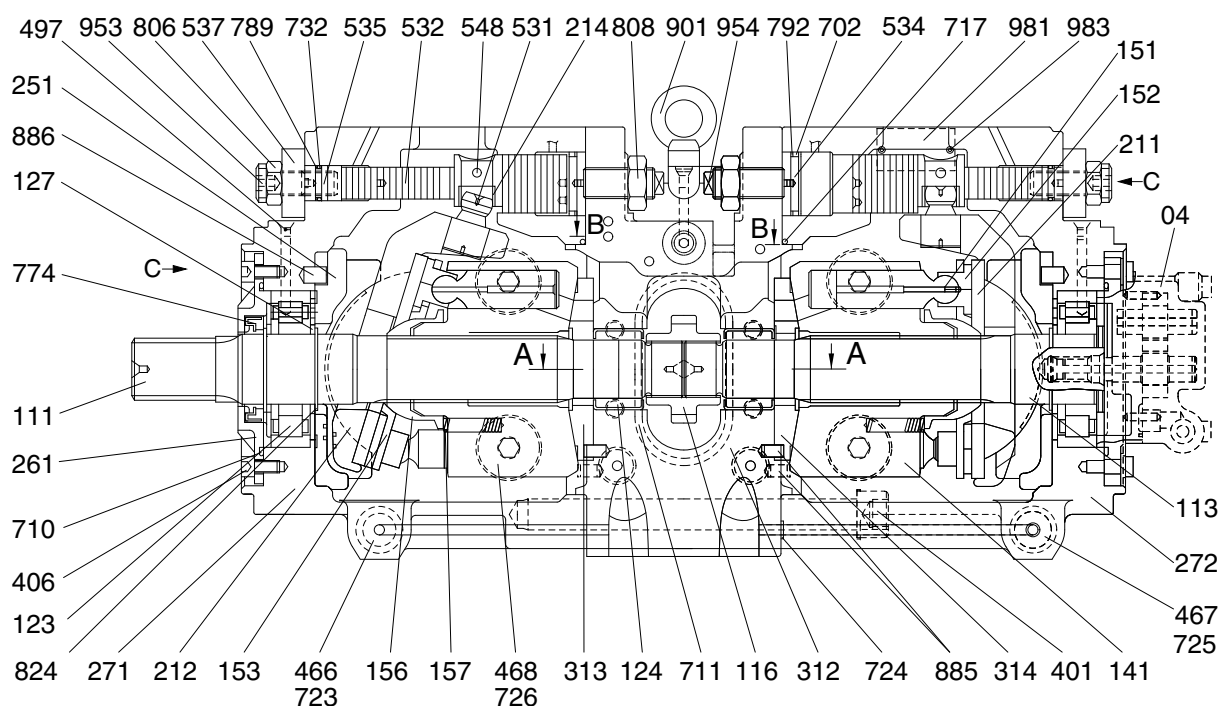
21098MP02

2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Remove the suction strainer and clean it.
- (3) Replace return filter with new one.
- (4) Remove breather and clean it.
- (5) After adding oil to the hydraulic tank to the specified level.
- (6) Bleed the air from the hydraulic pump.
 - ① Remove the air vent plug (2EA).
 - ② Tighten plug lightly.
 - ③ Start the engine, run at low idling, and check oil come out from plug.
 - ④ Tighten plug.
- (7) Start the engine, run at low idling (3~5 minutes) to circulate the oil through the system.
- (8) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. MAIN PUMP (1/2)

1) STRUCTURE

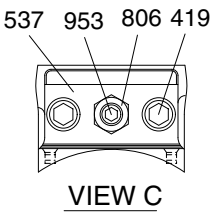
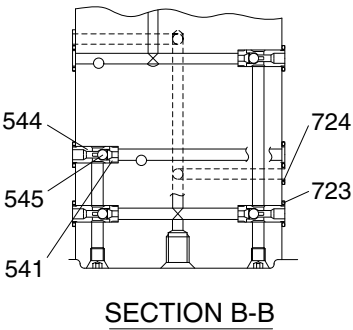
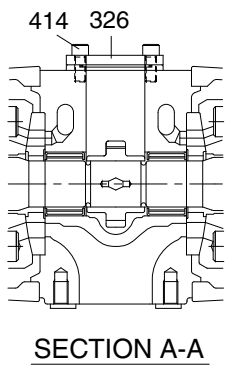


※ Section A-A, B-B, view C : see next page.

210WA2MP05

04	Gear pump	272	Pump casing (R)	723	O-ring
111	Drive shaft (F)	312	Valve block B	724	Square ring
113	Drive shaft (R)	313	Valve plate (R)	725	O-ring
116	1st gear	314	Valve plate (L)	726	O-ring
123	Roller bearing	401	Hexagon socket bolt	732	O-ring
124	Needle bearing	406	Hexagon socket bolt	774	Oil seal
127	Bearing spacer	466	Plug	789	Back up ring
141	Cylinder block	467	Plug	792	Back up ring
151	Piston	468	Plug	806	Hexagon head nut
152	Shoe	497	Plug	808	Hexagon head nut
153	Set plate	531	Tilting pin	824	Snap ring
156	Spherical bushing	532	Servo piston	885	Pin
157	Cylinder spring	534	Stopper (L)	886	Pin
211	Shoe plate	535	Stopper (S)	901	Eye bolt
212	Swash plate	537	Servo cover	953	Hexagon socket set screw
214	Tilting bushing	548	Feedback pin	954	Set screw
251	Support	702	O-ring	981	Name plate
261	Seal cover (F)	710	O-ring	983	Pin
271	Pump casing (F)	711	O-ring		
		717	O-ring		

MAIN PUMP (2/2)



210WA2MP06

- 326 Cover
- 414 Hexagon socket bolt
- 419 Hexagon socket bolt
- 537 Servo cover


- 541 Seat
- 544 Stopper 1
- 545 Steel ball
- 723 O-ring

- 724 Square ring
- 806 Hexagon head nut
- 953 Hexagon set screw

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the following list.

Tool name & size		Part name		
Name	B	Hexagon socket head bolt	ROH, VP plug (Parallel thread)	Hexagon socket head setscrew
Allen wrench 	6	M 8	PF 1/4	M12, M14
	8	M10	PF 3/8	M16, M18
	10	M12	PF 1/2	M20
	14	M16, M18	PF 3/4	-
	17	M20, M22	PF 1	-
Adjustable angle wrench		Medium size, 1 set		
Screw driver		Minus type screw driver, Medium size, 2 pieces		
Hammer		Plastic hammer, 1 pieces		
Pliers		For snap ring, TSR-160		
Torque wrench		Capable of tightening with the specified torques		

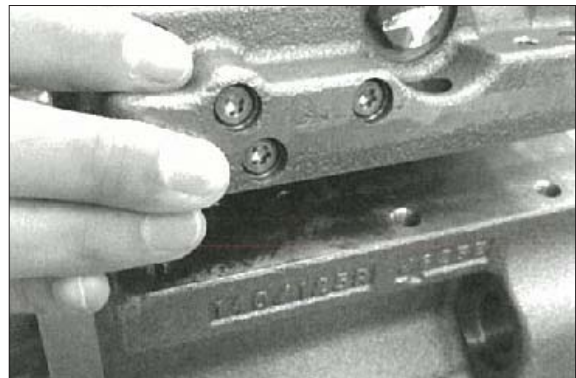
(2) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (Material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.3	118	0.47	12
	M16	23.5	170	0.55	14
	M18	33.7	244	0.55	14
	M20	43.8	317	0.67	17
ROH Plug PF 3/8 or under : S45C PF 1/2 or over : SCM435	PF 1/4	3.0	21.7	0.24	6
	PF 3/8	7.5	54.2	0.31	8
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.3	111	0.47	12

3) DISASSEMBLY

For disassembling the pump, read this section thoroughly and then disassemble it in the following sequence. The figures in parentheses after part names show the item in structure drawing.

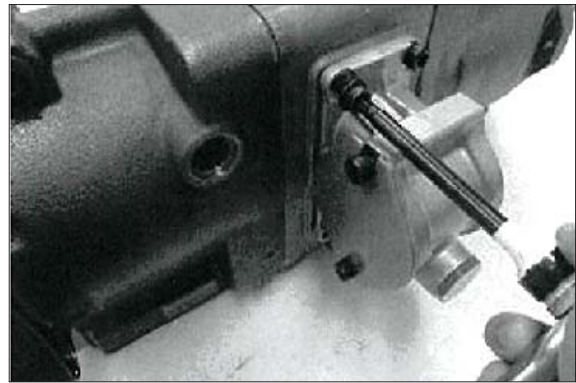
- (1) Select place suitable to disassembling.
 - ※ Select clean place.
 - ※ Spread rubber sheet, cloth or so on overhaul workbench top to prevent parts from being damaged.
- (2) Remove dust, rust, etc, from pump surfaces with cleaning oil or so on.
- (3) Remove drain port plug (468) and let the oil out from pump casing (271, 272).
 - ※ For tandem type pump, remove plugs of both front and rear pumps.
- (4) Remove hexagon socket head bolts (412) and remove regulator.
 - ※ Refer to page 8-28 for disassemble regulator.



220F8MP11

(5) Place the pump horizontally on workbench with its regulator-fitting surface down, and remove PTO unit from valve block (if equipped).

※ Before bringing regulator-fitting surface down, spread rubber sheet on workbench to avoid damaging the surface.



220S8MP13

※ In case the pump is provided without PTO unit, remove the cover (326) with the hexagon socket head cap screws.



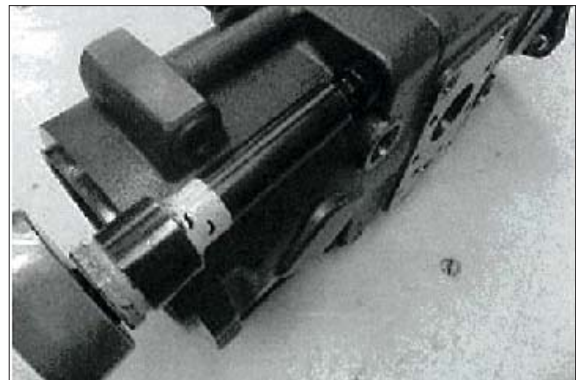
220S8MP14

(6) Remove flange sockets (435) and the gear pump (04).



220S8MP15

(7) Loosen hexagon socket head bolts (401) which tighten pump casing (F, 271) pump casing (R, 272), and valve block (312).



220S8MP16

- (8) Separate pump casing (F, 271), pump casing (272), from valve block (312)

※ Remove the 1st gear (116), when pump casings are separated from valve block.



220S8MP17

- (9) Pull out cylinder block (141), piston-shoes (011), set plate (153), spherical bushing (156), and cylinder springs (157) simultaneously from pump casing (F, 271) and (R, 272), straightly over drive shaft (111, 113)

※ Take care not to damage sliding surface of cylinder block (141), spherical bushing (156), piston-shoes (011), swash plate (212), drive shaft (111, 113), etc.



220S8MP18

- (10) Remove hexagon socket head bolts (406) and seal cover (F, 261).

※ In the case it is difficult to remove, put flat-blade screwdriver into the notch of seal cover. Then the cover can be removed easily.

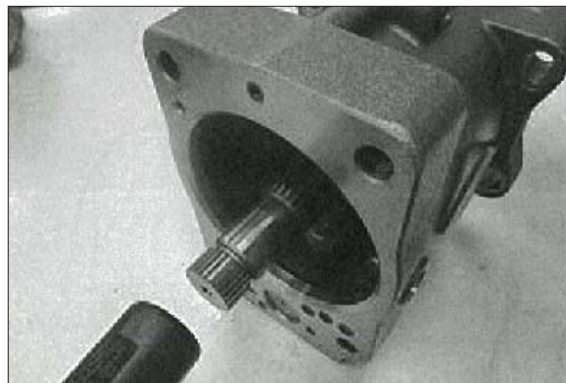
※ Since oil seal is fitted on seal cover (F, 261), take care not to damage it while removing cover.



220S8MP19

- (11) Remove the drive shafts (111, 113) from the pump casing (271, 272), lightly with plastic hammer, remove them from pump casing (271, 272)

※ In the case it is difficult to remove, tap the end of the drive shaft lightly with plastic hammer.



220F8MP20

- (12) Remove the swash plates (212) and shoe plates (211) from swash plate support (251), and pull out the swash plates with turning shown in this picture from casing.



220S8MP21



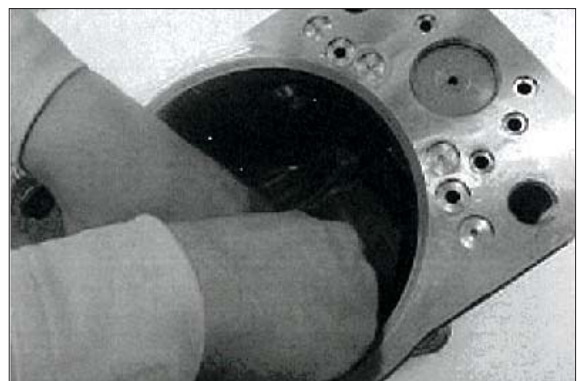
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220S8MP23

- (13) Remove swash plate supports (251) from pump casing.

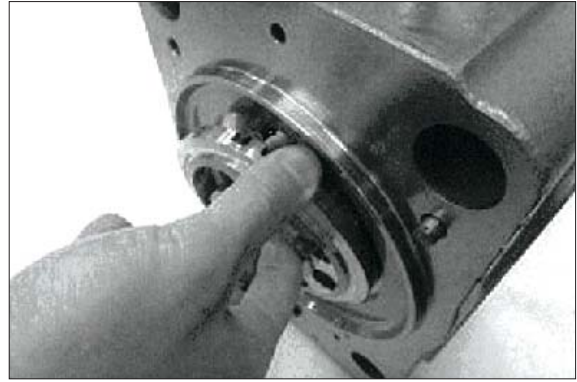
- ※ In the case it is difficult to remove, tap the opposite side of the swash plate support (251) with plastic hammer to remove it from pump casing easily.



220S8MP24

(14) Remove valve plates (313, 314) from valve block (312)

※ There may be removed in work (7).



220S8MP25

(15) If necessary, remove the servo covers (537), stopper (L, 534), stopper (S, 535), and servo piston sub (530) from pump casing (271, 272).

※ Do not remove needle bearing (124) as far as possible, except the case that the bearing is considered to be out of its life-time.

※ Do not loosen hexagon nuts of valve block (312) and servo cover (537). If loosened, flow setting will be changed.

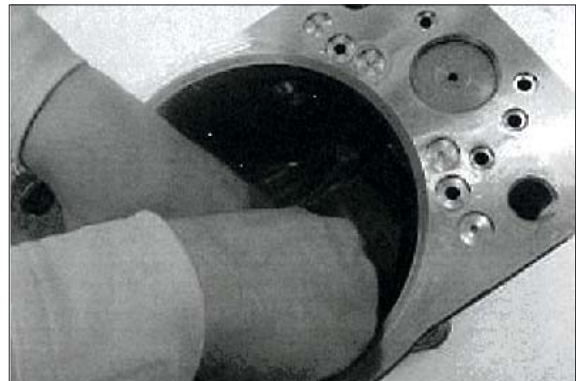
4) REASSEMBLY

(1) For reassembling reverse the disassembling procedures, paying attention to the following.

- ① Do not fail to repair the parts damaged during disassembling, and repair replacement part in advance.
- ② Clean each part fully with cleaning oil and dry it with compressed air.
- ③ Apply clean working oil to sliding sections, bearings, etc. before assembling them.
- ④ In general rule, replace the sealing parts, such as O-ring, oil seal, etc.
- ⑤ For fitting bolts, plug, etc. prepare a torque wrench or so on, and tighten them with torque shown at page 8-12.
- ⑥ For the tandem type pump, take care not to mix up parts of the front pump with those of the rear pump

(2) Insert swash plate supports (251) into the casing (F, 271) and (R, 272) with fitting.

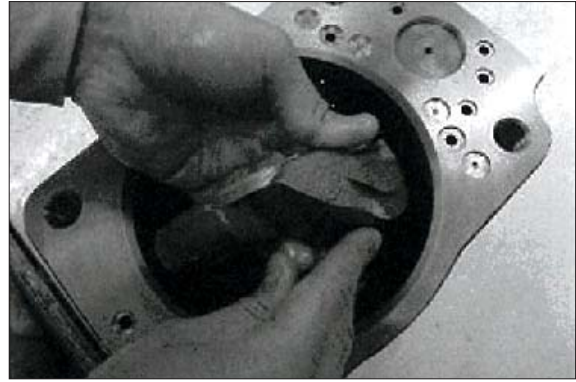
※ If the servo piston, stopper (L), stopper (S), and servo cover are removed, fit them to pump casing in advance for reassembling.



220S8MP24

(3) Attach shoe plate (211) to swash plate (212) and insert tilting pin (531) to tilting bushing (214) of servo piston (532). As shown in the right figure, attach to swash plate support (251) correctly, leaning swash plate and shoe plate.

- ※ Confirm with fingers of both hands that swash plate can moved smoothly.
- ※ Apply grease to sliding sections of swash plate and swash plate support, to assemble the drive shaft easily.
- ※ Take care not to damage the sliding surface of the shoe plate.



220S8MP23



220S8MP22



220S8MP21

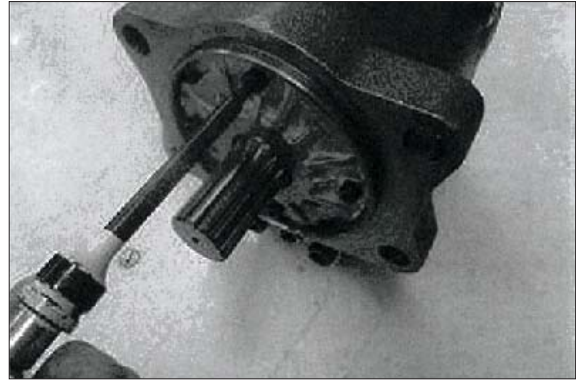
(4) Fit drive shaft (111, 113) where bearing (123), bearing spacer (127), snap ring (824) were set to pump casing (271, 272).



220S8MP20

- (5) Assemble seal cover (F, 261) to pump casing (271) and fix it with hexagon socket head bolts (406).

- ※ Apply grease lightly to oil seal in seal cover (F).
- ※ Assemble oil seal, taking full care not to damage it.



220S8MP26

- (6) Assemble piston cylinder sub assembly [cylinder (141), piston sub assembly (151, 152), set plate (153), spherical bushing (156) and cylinder spring (157)].

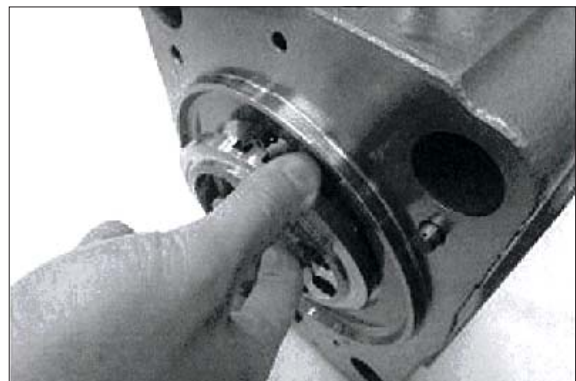
- ※ Fit spline phases of spherical bushing and cylinder.
- ※ Then, insert piston cylinder subassembly into pump casing.



220S8MP18

- (7) Fit valve plate (313) to valve block (312) according to pin (885).

- ※ Take care not to mistake suction/delivery directions of valve plate.



220S8MP27

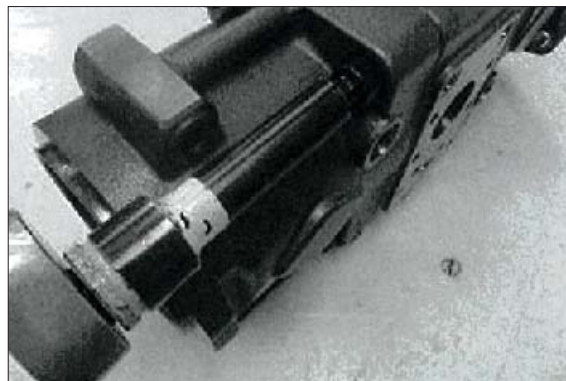
- (8) Place pump horizontally on workbench with its regulator-fitting surface down, and attach pump casing (271) to valve block (312).

- ※ Before bringing regulator-fitting surface down, spread rubber sheet on workbench and do not damage this surface.
- ※ Take care not to mistake direction of valve block. [clockwise rotation (viewed from input shaft side)]. Fit the valve block with suction flange left when regulator side below, viewed from front side.
- ※ Fit 1st gear simultaneously.



220S8MP17

- (9) Fit valve block (312) to pump casing (271, 272) with hexagon socket head bolts (401, 402).



220S8MP16

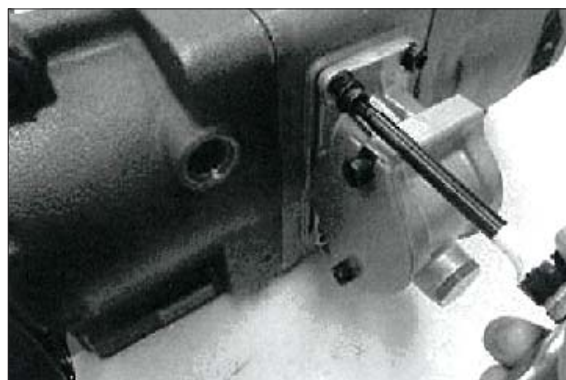
- (10) Fit gear pump (04) to pump casing (271) with hexagon socket head bolts.



220S8MP15

- (11) Attach the PTO unit (05) by fastening the flange socket to the valve block (312).

※ Be careful about the attaching direction of the PTO unit.



220S8MP13

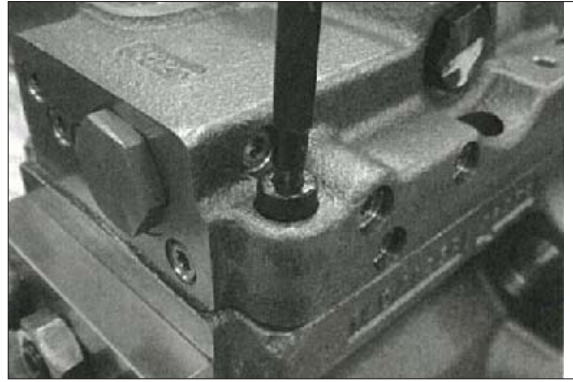
In case the pump is not provided with the PTO unit (05), attach the cover (326) with the hexagon socket head cap screws (414).



220S8MP14

(12) Putting feedback lever of regulator into feedback pin (548) of tilting pin (531), fit regulator with hexagon socket head bolts.

※ Take care not to mix up regulator of front pump with another.



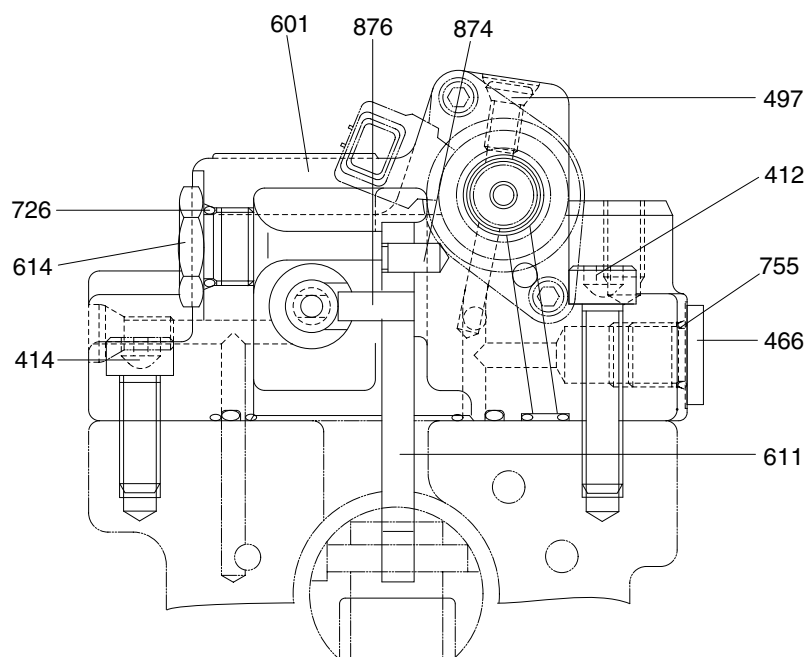
220F8MP28

(13) Fit drain port plug (467).

This is the end of reassembling procedure.

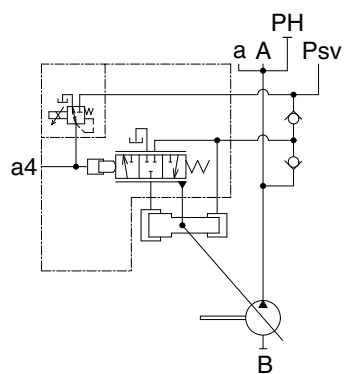
3. REGULATOR

1) STRUCTURE (1/2)



SECTION A-A

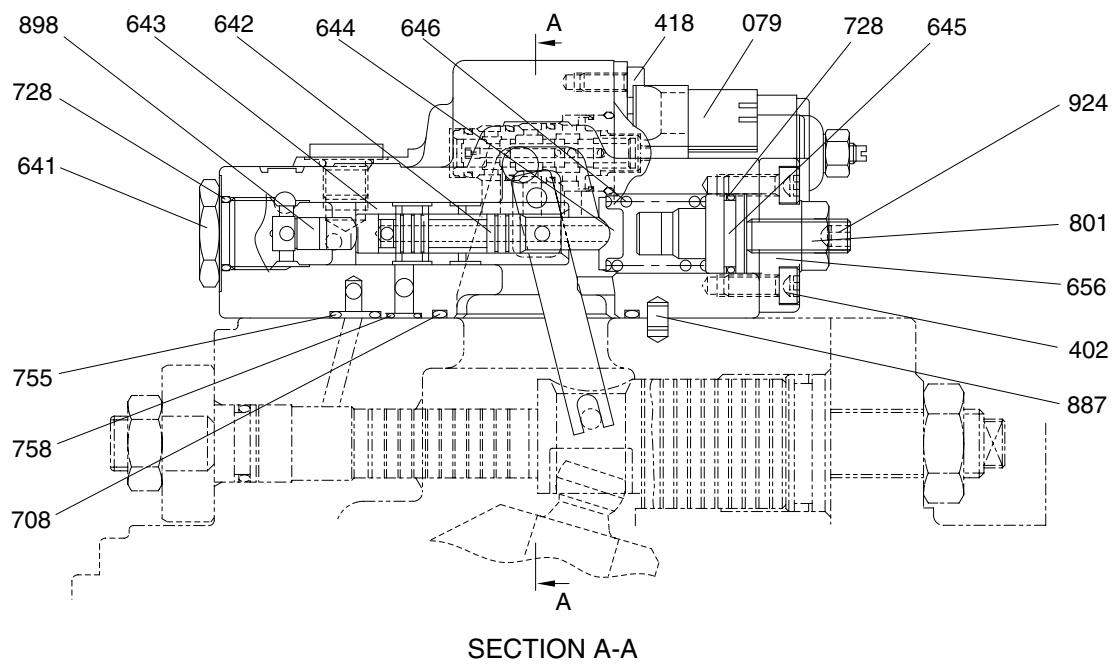
See next page



210WA2MP08

412	Hexagon socket screw	601	Regulator casing	755	O-ring
414	Hexagon socket screw	611	Feedback lever	874	Pivot pin
466	Plug	614	Adjust plug	876	Pin
497	Plug	726	O-ring		

STRUCTURE (2/2)




210WA2MP09

079	EPPR valve	644	Spring seat (Q)	755	O-ring
402	Hexagon socket screw	645	Adjust stem (Q)	758	Square ring
418	Hexagon socket screw	646	Pilot spring	801	Nut
641	Pilot plug	656	Cover	887	Pin
642	Pilot spool	708	O-ring	898	Pilot piston
632	Pilot sleeve	728	O-ring	924	Hexagon socket set screw

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the following list.

Tool name & size		Part name		
Name	B	Hexagon socket head cap screw	Pressure plug (taper thread)	Hexagon socket head set screw
Allen wrench Spanner 	4	M 5	-	M8
	5	M 6	-	M10
	6	M 8	ROH 1/4	M12, M14
	22	-	VP 3/8	-
	27	M18	VP 1/2	-
Adjustable angle wrench		Medium size, 1 set		
Torque wrench		Capable of tightening with the specified torques		
Hexagon socket head cap screw		M4, Length : 50 mm		

(2) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (Material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 7	3.0	21.7	0.24	6
	M 8	5.8	42	0.31	8
	M 9	10.0	72.3	0.39	10
	M14	16.3	118	0.47	12
	M16	23.5	170	0.55	14
	M18	33.7	244	0.55	14
	M20	43.8	317	0.67	17
	M22	64.2	464	0.67	17
PT Plug (Material : S45C) ※ Wind a seal tape 1 1/2 to 2 turns round the plug	PT 1/8	1.2	8.7	0.20	5
	PT 1/4	2.2	15.9	0.24	6
	PT 3/8	4.5	32.5	0.31	8
	PT 1/2	6.6	47.7	0.39	10
ROH Plug PF 3/8 or under : S45C PF 1/2 or over : SCM435	PF 1/4	3.5	25.3	0.24	6
	PF 3/8	7.5	54.2	0.31	8
	PF 1/2	11.2	81.0	0.39	10
	PF 3/4	17.3	125	0.55	14

3) DISASSEMBLY

(1) Preparation for disassembling

- ① Since the regulator consists of small, precision, and well-finished parts, disassembling and assembling are rather complicated. For this reason, replacement of a regulator assembly is recommended, unless there is a special reason. If in case disassembling is necessary for an unavoidable special reason, read through this manual to the end before starting disassembling.
- ② Since the regulators on the front pump and the rear pump are set at different pressure and flow values, mark each of them so as not to mix up one of front pump with another.
- ③ For reason that regulator contain two parts which are tightened with large torque, prepare a vise to hold the regulator stable.
- ④ The numbers in parentheses after part names represent those in the cross-sectional drawings (on page 8-23, 24)

(2) Select a place for disassembling.

- ※ Select clean place.
- ※ Spread rubber sheet or cloth to cover the workbench to prevent parts from being damaged.

(3) Remove dust, rust, etc. from surfaces of regulator with clean oil.

(4) Remove hexagon socket head cap screws (412, 414) and remove regulator from the pump.

- ※ If the pump is disassembled, check the page 7-21 for this axial piston pump.
- ※ Take care not to lose O-ring while removing regulator.

- (5) Remove hexagon socket head cap screws (418) and remove the proportion reducing valve.

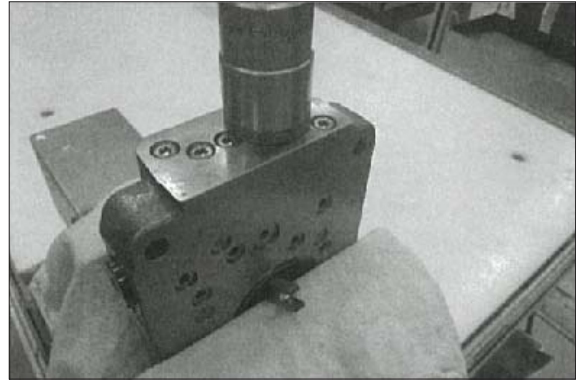
※ Do not damage to the proportional reducing valve's connector.

- (6) Loosen the pilot plug (641).

※ Do not remove the pilot plug (641). If it is removed, the pilot spring (646) and the spring stem (Q, 644) will fall from casing.

※ Be careful not to damage regulator casing (601) while loosening the pilot plug (641).

※ Do not damage to the regulator casing while using a vise.



220F8MP30

- (7) Remove hexagon socket head cap screws (402) and remove cover (656)

※ Cover (656) is fixed with adjusting screw (924), hexagon nut (801). Do not loosen screw and nut. If they are loosened, adjusted pressure-flow setting will be changed.

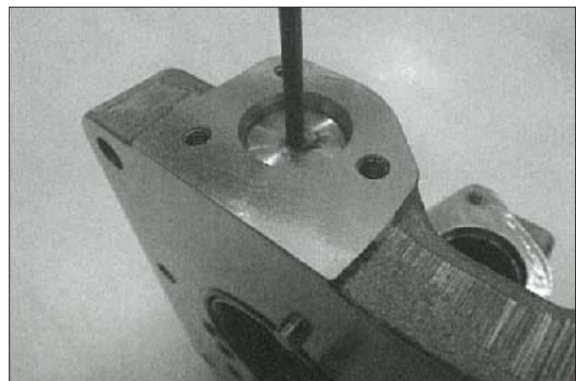


220F8MP31

- (8) Remove the adjusting stem (Q, 645), the pilot spring (646), and the spring seat (Q, 644) from regulator.

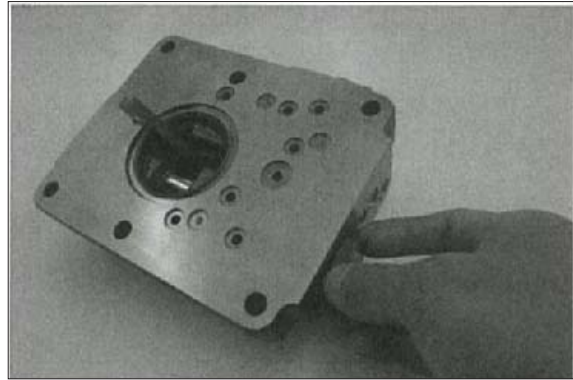
※ Adjusting stem (Q, 645) can easily be drawn out with M4 screw.

※ Take care not to lose the pilot spring (646) and the spring stem (Q, 644) which they fall from casing when the adjusting stem (Q, 645) is removed.



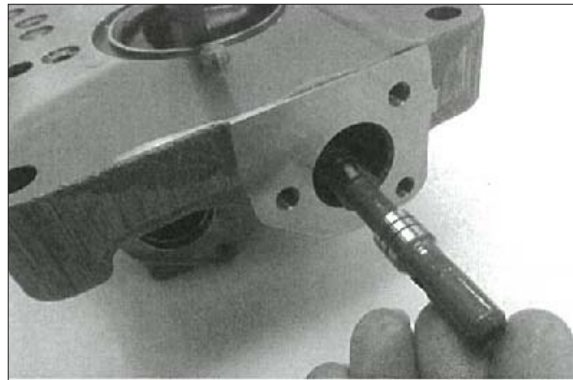
220F8MP32

- (9) Remove the pilot plug (641) and the pilot piston (898).
- ※ Take care not to lose the pilot piston (898) because of its smallness.



220F8MP33

- (10) Remove the pilot spool (642) from pilot section.



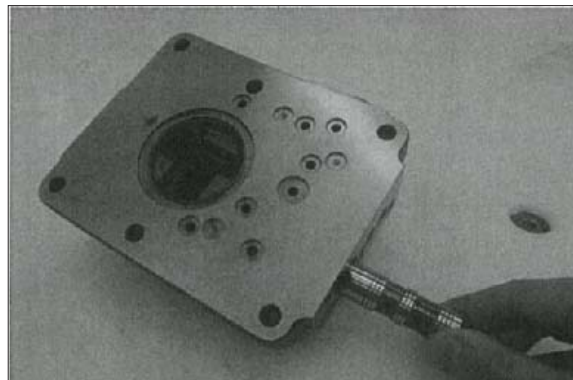
220F8MP34

- (11) Remove the adjusting plug (614) and feedback lever (611) from the casing.
- ※ Be careful not to damage regulator casing (601) while loosening the adjusting plug (614).
 - ※ Do not remove the pin (876) from the feedback lever (611).



220F8MP35

- (12) Remove the pilot sleeve (643).
- ※ This completes operation.



220F8MP36

※ Since component part are small, take care not to them.

4) REASSEMBLY

(1) For assembling, reverse disassembling procedures. But pay attention to the following.

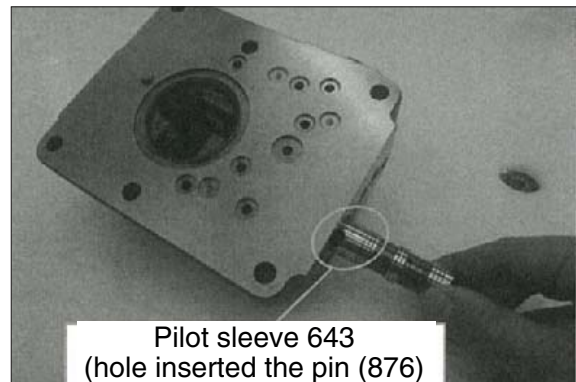
- ① Repair parts that were damaged at disassembling.
Prepare replacement parts beforehand.
- ② Contamination will cause malfunction.
Therefore, wash parts well with cleaning oil, let them dry with jet air and handle them in clean place.
- ③ Tighten screws, plugs, etc. with their specified torques.
- ④ Replace seals such as O-ring with new ones as a general rule.

(2) Select a place for assembling.

- ※ Select clean place.
- ※ Spread rubber sheet or cloth to cover the workbench to prevent parts from being damaged.

(3) Fit the pilot sleeve (643) into pilot section of the casing (601).

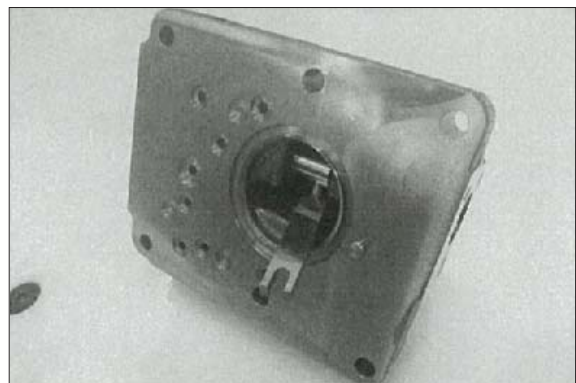
- ※ Be careful not to fit the pilot sleeve (643) with the wrong way.
- ※ Confirm the the sleeve slides smoothly in casing without sticking.



220F8MP37

(4) Insert the pin (876) fixed on feedback lever (611) to the oval shaped hole of the sleeve (643) and fit the hole of the feedback lever to the pin (874) fixed inside the casing (601).

- ※ If the pilot spool (642) is in the pilot sleeve (643), the pin (876) can not be inserted to the pilot sleeve.



220F8MP38

(5) Tighten the adjusting plug (614) to the casing (601).

※ Be careful not to damage regulator casing (601) while tightening the adjusting plug (614).

※ Confirm that the sleeve slides smoothly in casing without sticking or excess play among parts.



220F8MP39

(6) Fit the pilot spool (642) into the pilot sleeve (643).

※ Be careful not to fit the pilot spool (642) with the wrong way.

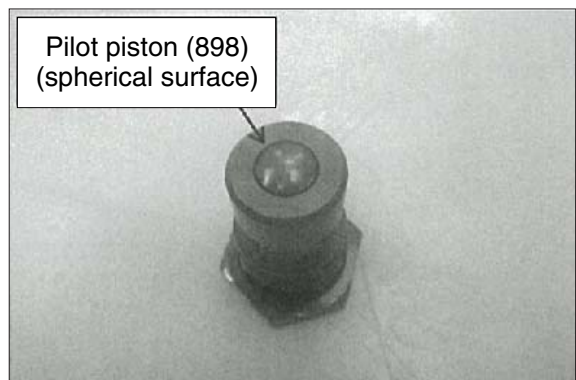


220F8MP40

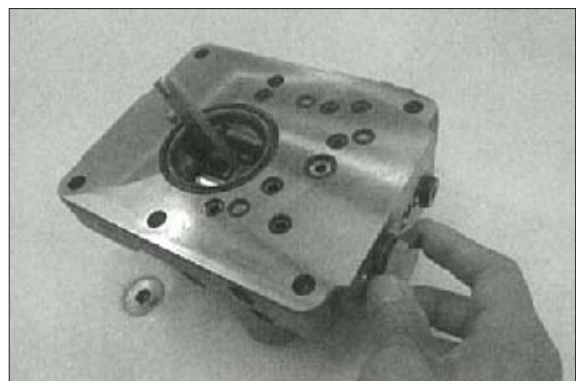
(7) After the pilot piston (898) is fitted into the pilot plug (641), put the plug to the casing (601).

※ Be careful not to fit the pilot piston (898) with the wrong way.

※ At the present stage, it is no need to tighten the pilot plug (641) with recommended torque.



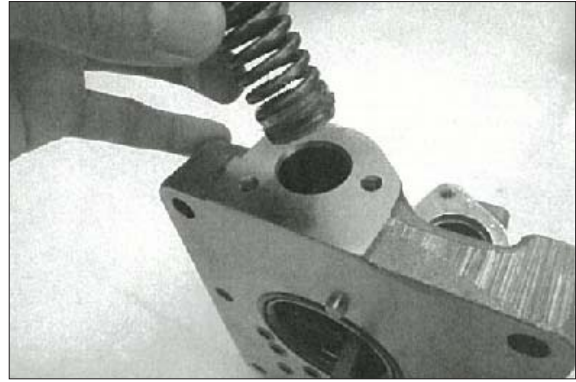
220F8MP41



220F8MP42

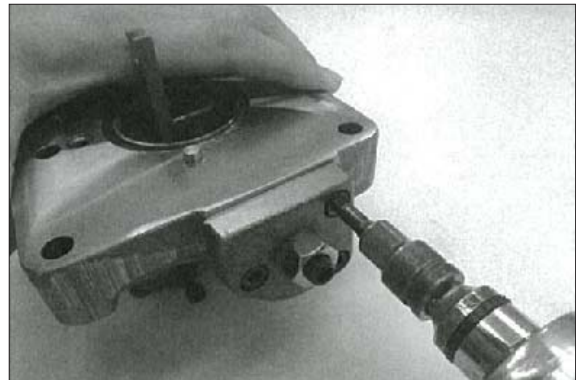
- (8) Put the spring seat (Q, 644) and the pilot spring (646) into the pilot section of the casing (601).

※ Be careful not to fall the spring seat (Q).
Recommended to apply grease to the spring seat to prevent falling.



220F8MP43

- (9) Put the adjusting stem (Q, 645), and tighten the cover (656) with the adjusting screw (924) and the hexagon nut (801) with hexagon socket head cap screws (402).



220F8MP44

- (10) Tight the pilot plug (641) to the casing (601).

※ Be careful not to damage regulator casing (601) while tightening the pilot plug (641).
※ Do not damage to the regulator casing while using a vise.



220F8MP45

- (11) Tighten the proportional reducing valve with hexagon socket head cap screw (418).

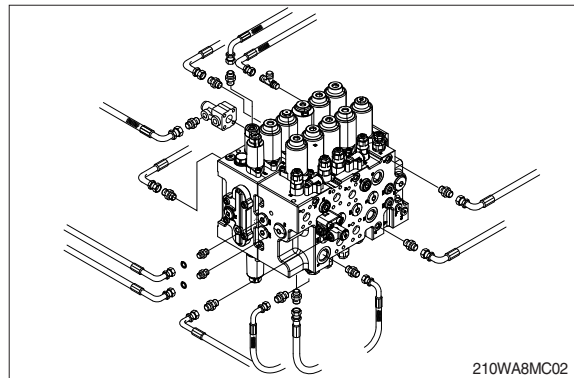
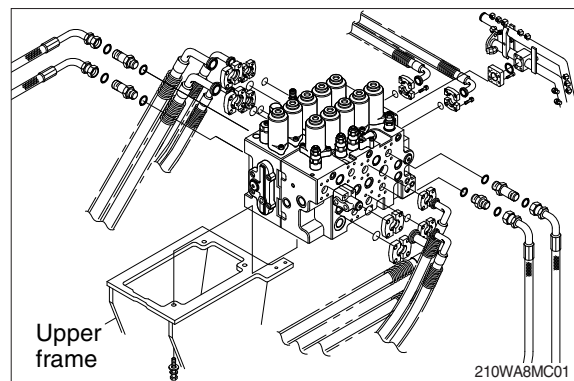
※ This completes assembling.

GROUP 4 MAIN CONTROL VALVE

1. REMOVAL AND INSTALL OF MOTOR

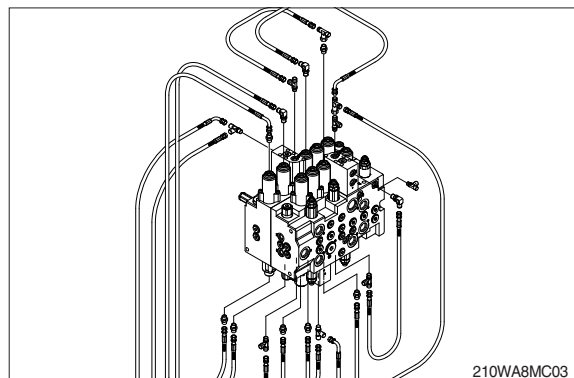
1) REMOVAL

- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ **Escaping fluid under pressure can penetrate the skin causing serious injury.**
 - ※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (4) Remove the wirings for the pressure sensor and so on.
- (5) Remove bolts and disconnect pipe.
- (6) Disconnect pilot line hoses.
- (7) Disconnect pilot piping.
- (8) Sling the control valve assembly and remove the control valve mounting bolt and bracket.
 - Weight : 220 kg (485 lb)
 - Tightening torque : $12.8 \pm 3.0 \text{ kgf} \cdot \text{m}$
($92.6 \pm 21.7 \text{ lbf} \cdot \text{ft}$)
- (9) Remove the control valve assembly.
When removing the control valve assembly, check that all the piping have been disconnected.



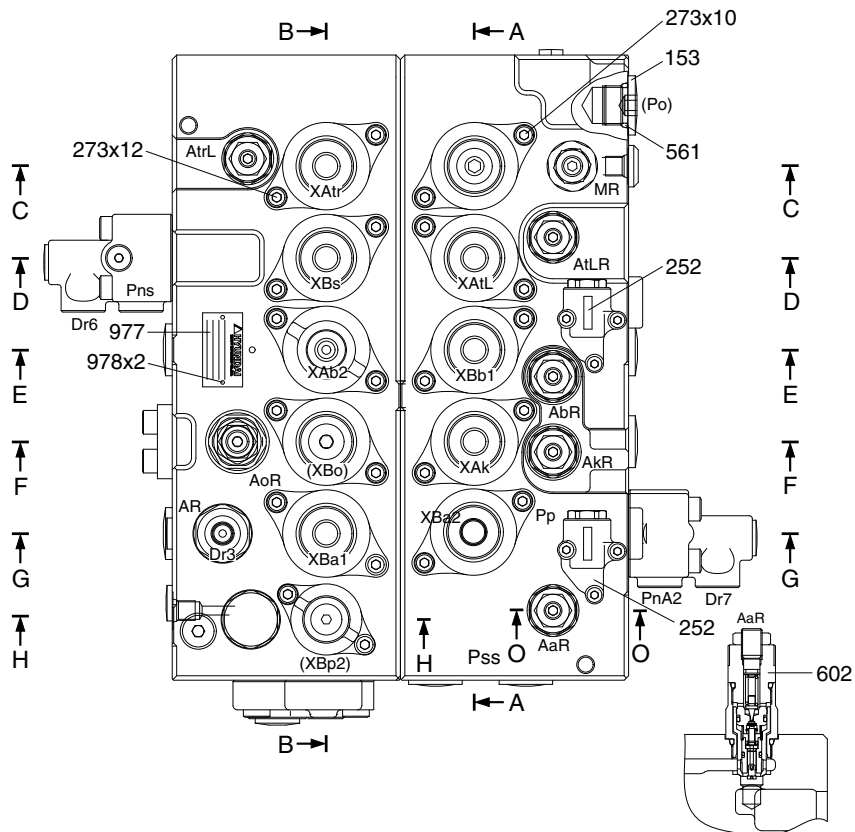
2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from below items.
 - ① Cylinder (boom, arm, bucket)
 - ② Swing motor
 - ③ Travel motor
 - ※ See each item removal and install.
- (3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.



2. STRUCTURE

1) RELIEF VALVE SIDE VIEW

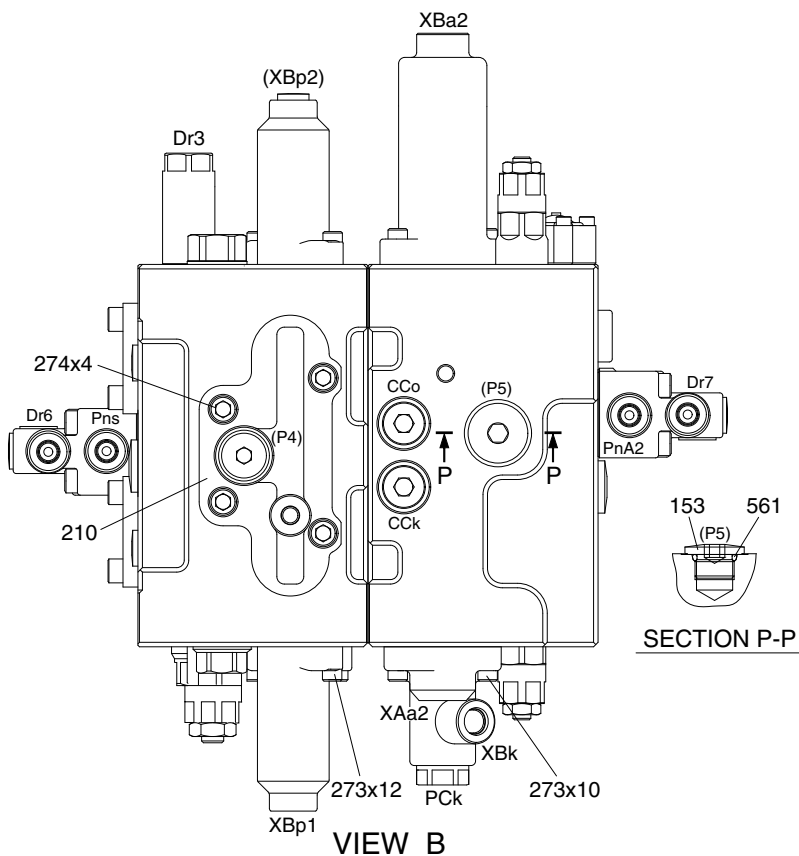


- 153 Plug
- 252 Lock valve selector sub assy
- 273 Socket screw
- 561 O-ring
- 602 Port relief valve assy
- 977 Name plate
- 978 Pin

SECTION O-O

210WA2MC02

2) BYPAS CUT SPOOL SIDE VIEW



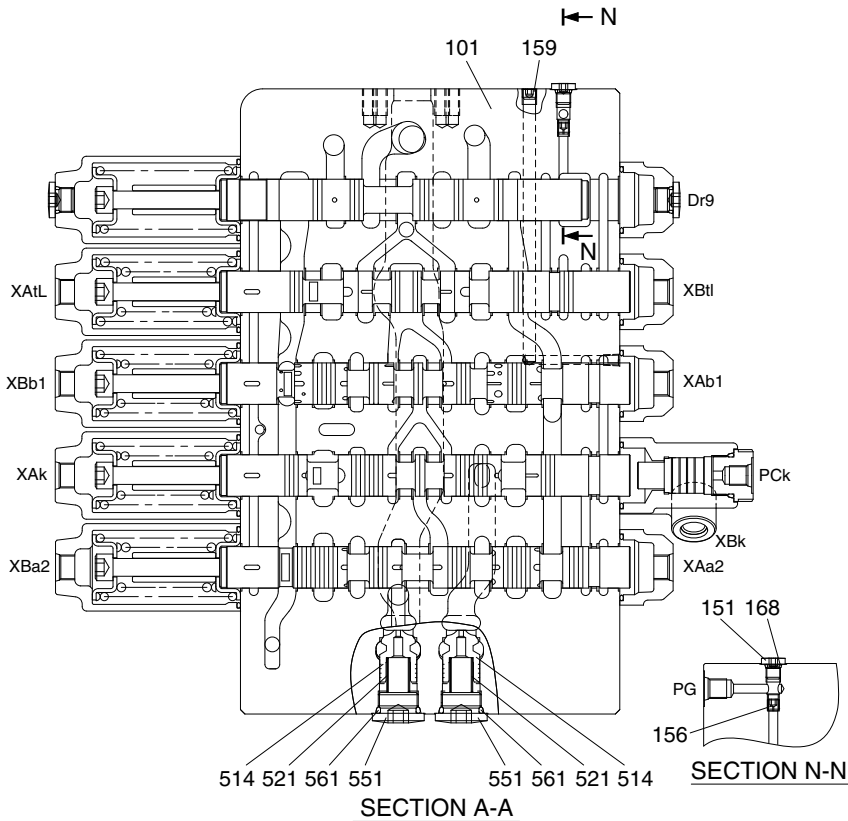
- 153 Plug
- 210 Plate
- 273 Socket screw
- 274 Socket screw
- 561 O-ring

SECTION P-P

VIEW B

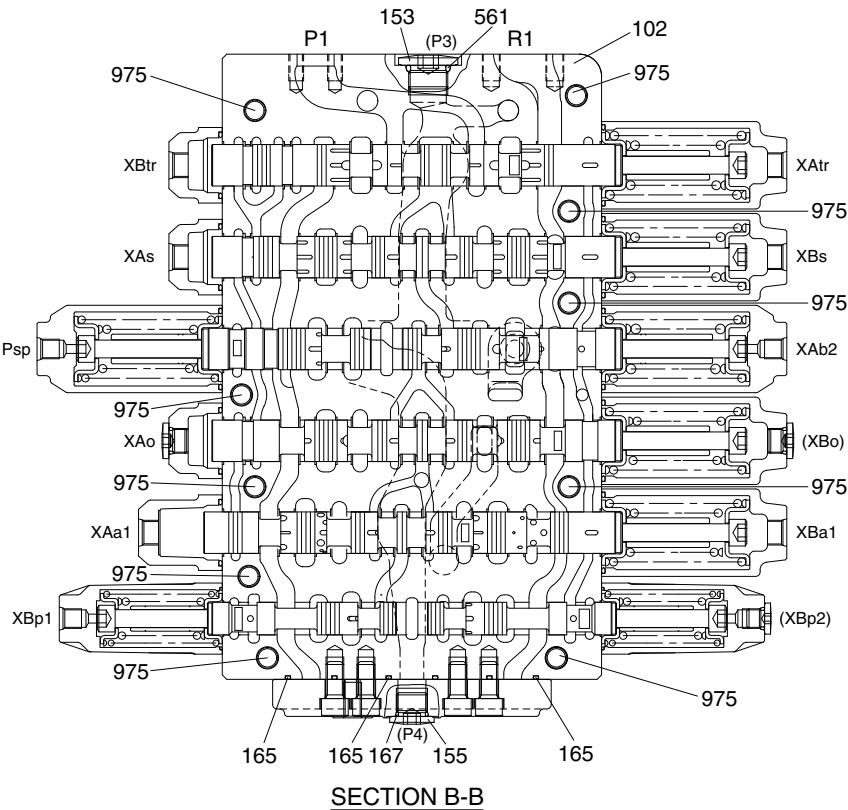
210WA2MC03

3) CASING A SPOOL SECTION



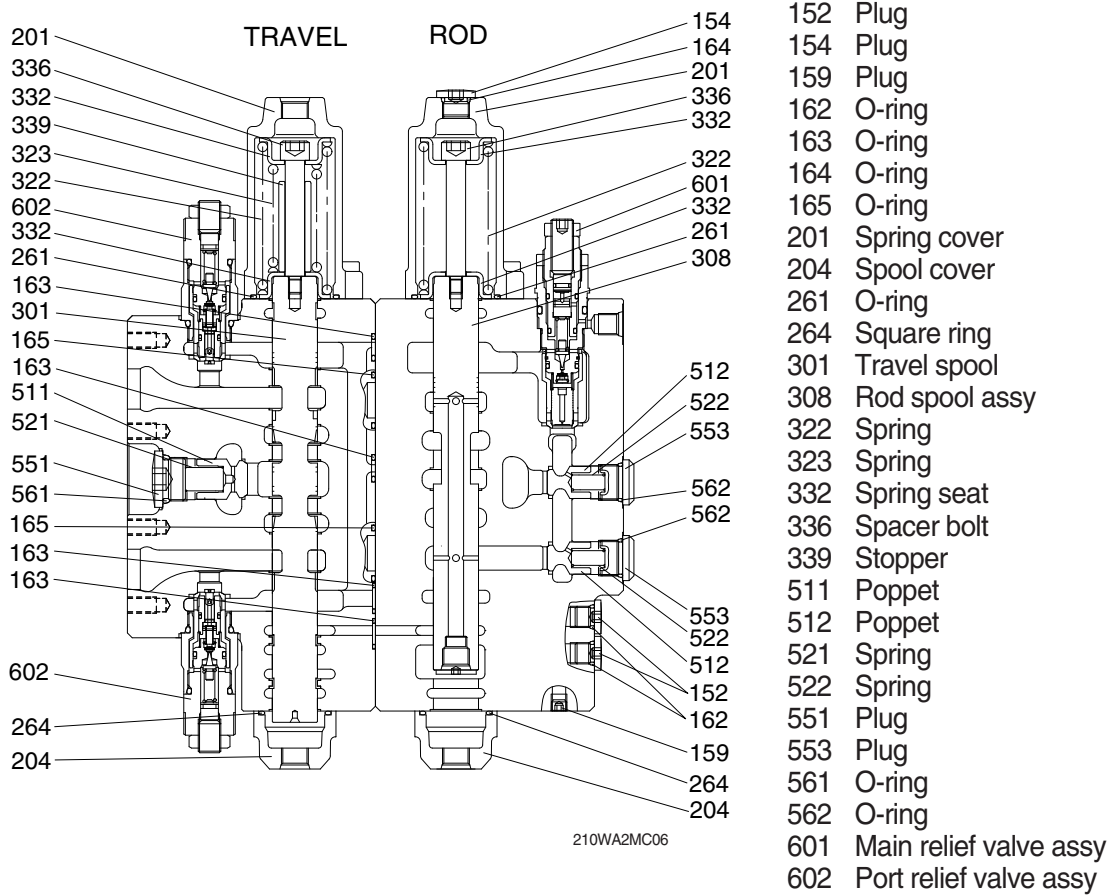
210WA2MC04

4) CASING B SPOOL SECTION

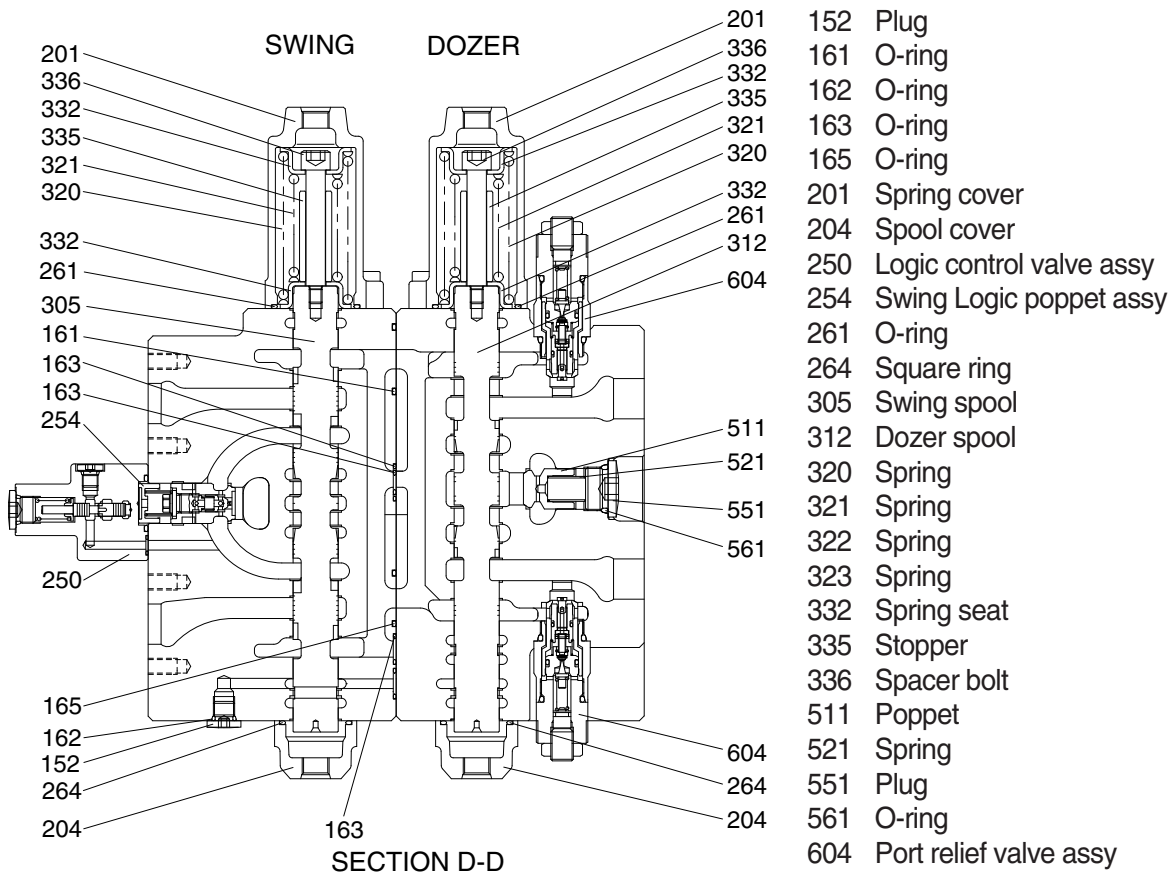


210WA2MC05

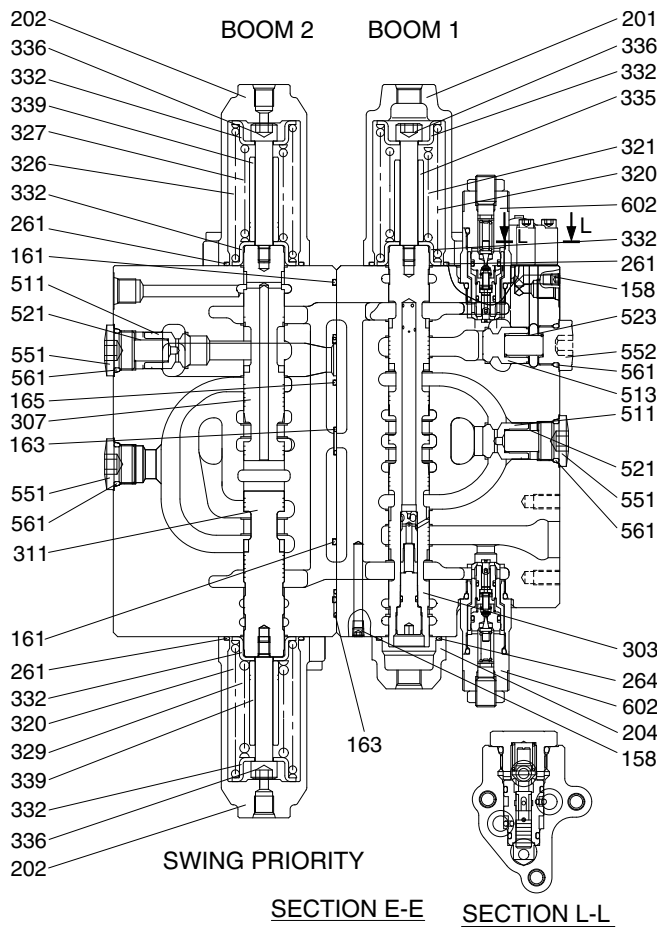
5) TRAVEL AND ROD SECTION



6) SWING AND DOZER SECTION

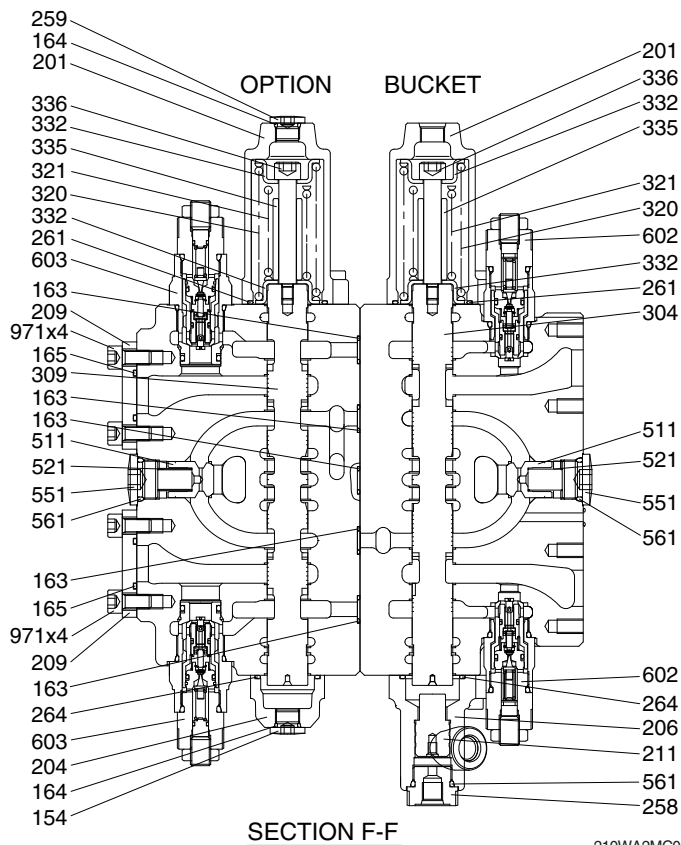


7) BOOM 1 AND BOOM 2 SECTION



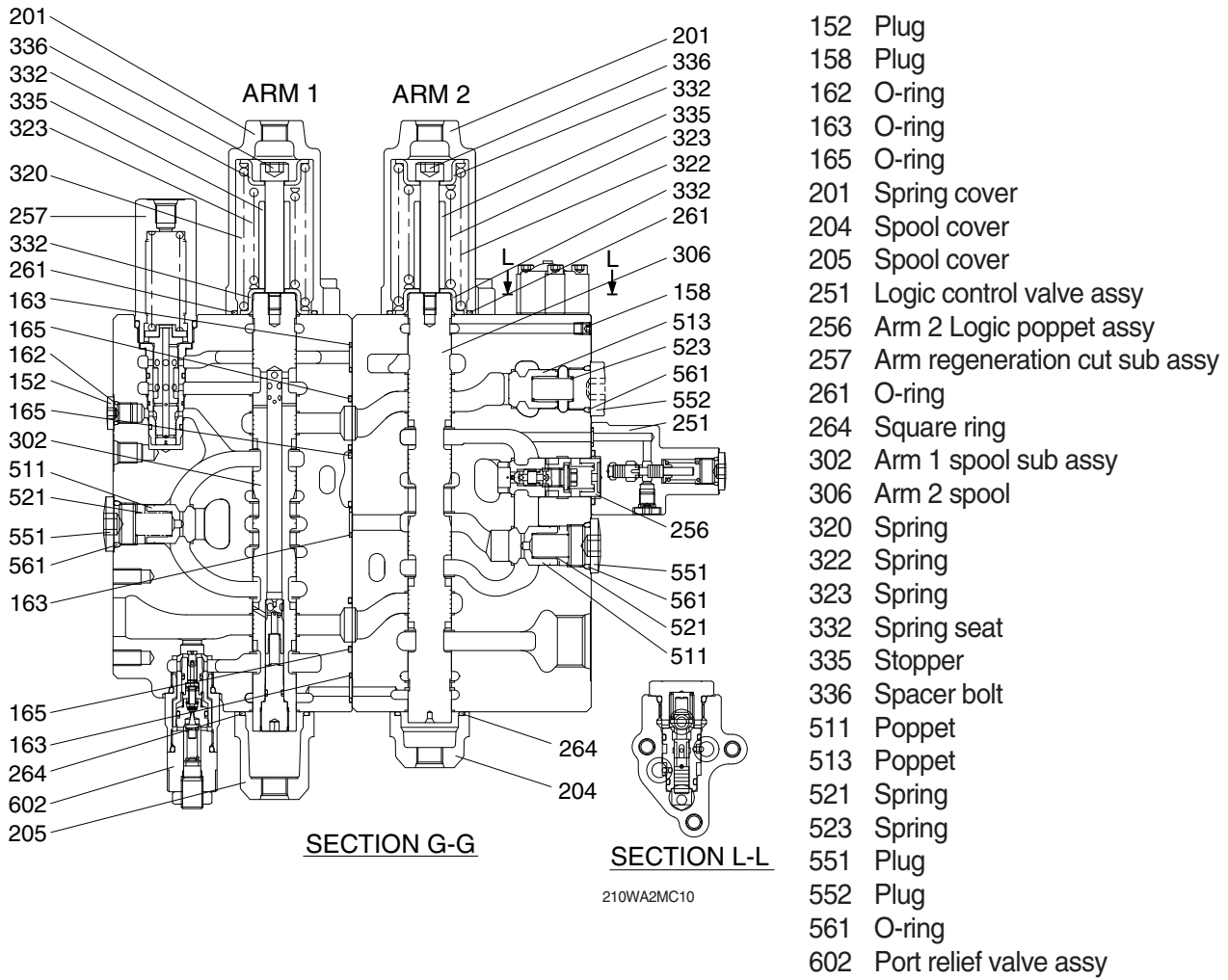
- 158 Plug
- 161 O-ring
- 163 O-ring
- 165 O-ring
- 201 Spring cover
- 202 Spring cover
- 204 Spool cover
- 261 O-ring
- 264 Square ring
- 303 Boom 1 spool sub assy
- 307 Boom 2 spool
- 311 Swing priority spool
- 320 Spring
- 321 Spring
- 326 Spring
- 327 Spring
- 329 Spring
- 332 Spring seat
- 335 Stopper
- 336 Spacer bolt
- 339 Stopper
- 511 Poppet
- 513 Poppet
- 521 Spring
- 523 Spring
- 551 Plug
- 552 Plug
- 561 O-ring
- 602 Port relief valve assy

8) BUCKET AND OPTION SECTION

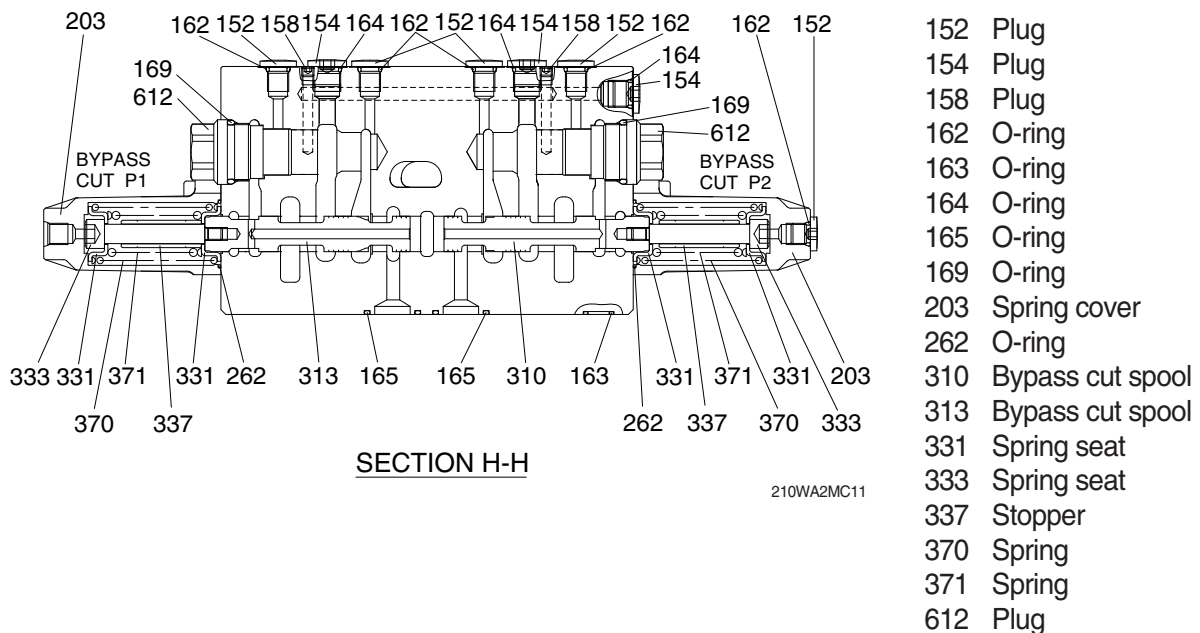


- 154 Plug
- 163 O-ring
- 164 O-ring
- 165 O-ring
- 201 Spring cover
- 204 Spool cover
- 206 Spool cover
- 209 Flange
- 211 Piston
- 258 Plug
- 259 Plug
- 261 O-ring
- 264 Square ring
- 304 Bucket spool
- 309 Option spool
- 320 Spring
- 321 Spring
- 332 Spring seat
- 335 Stopper
- 336 Spacer bolt
- 511 Poppet
- 521 Spring
- 551 Plug
- 561 O-ring
- 602 Port relief valve assy
- 603 Port relief valve assy
- 971 Socket screw

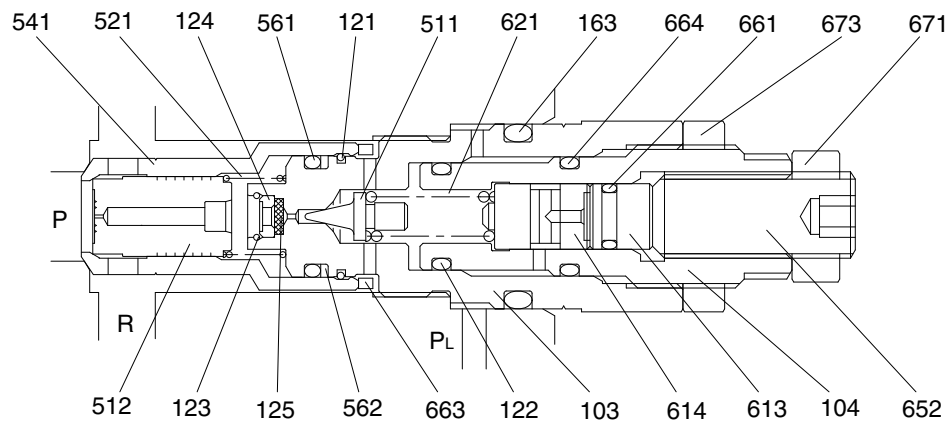
9) ARM 1 AND ARM 2 SECTION



10) BYPASS CUT SECTION



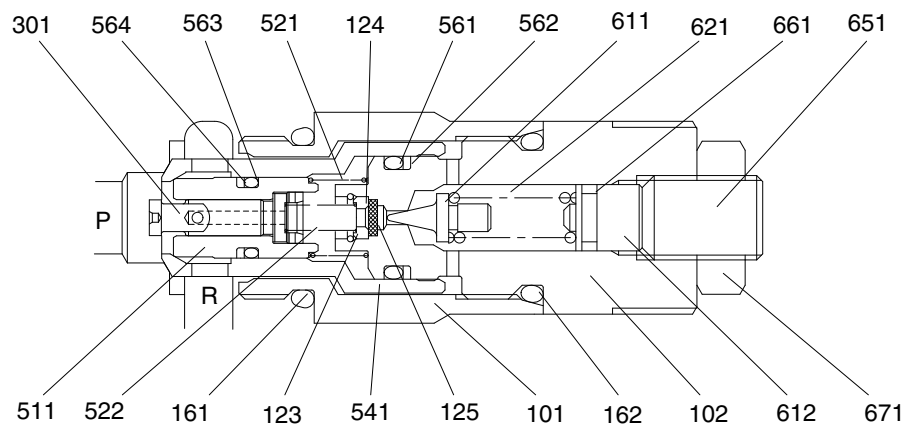
11) MAIN RELIEF VALVE (601)



220F2MC70

103 Plug	512 Plunger	621 Spring
104 Adjust plug	521 Spring	652 Adjust screw
121 C-ring	541 Seat	661 O-ring
122 Spacer	561 O-ring	663 O-ring
123 C-ring	562 Back-up ring	664 O-ring
124 Filler stopper	611 Poppet	671 Lock nut
125 Filler	613 Stopper	673 Lock nut
163 O-ring	614 Piston	

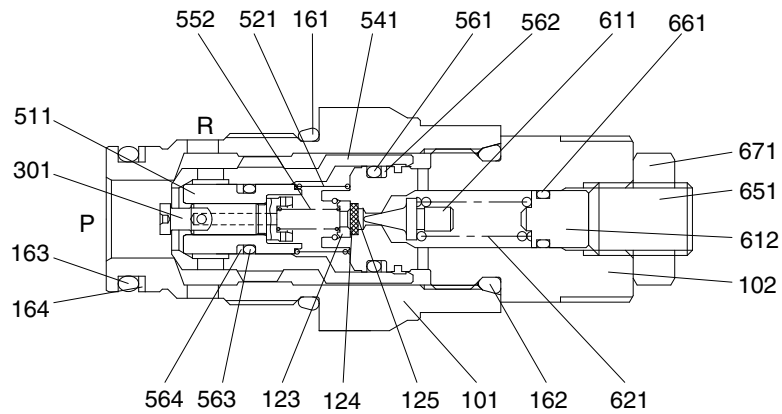
12) PORT RELIEF VALVE (602)



220F2MC71

101 Body	511 Plunger	564 Back-up ring
102 Plug	521 Spring	611 Poppet
161 O-ring	522 Spring	612 Spring seat
162 O-ring	541 Seat	621 Spring
123 O-ring	561 O-ring	651 Adjust screw
124 Filler stopper	562 Back-up ring	661 O-ring
125 Filler	563 O-ring	671 Lock nut

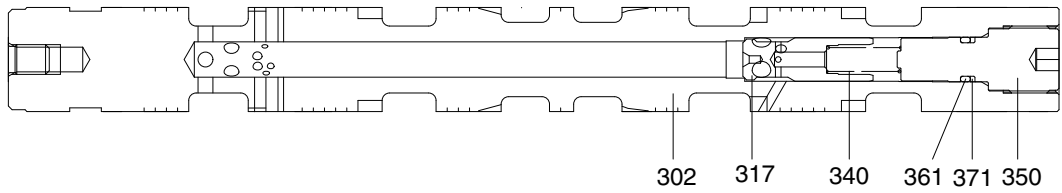
13) PORT RELIEF VALVE (603)



220F2MC72

101	Body	301	Piston	564	Back-up ring
102	Plug	511	Plunger	611	Poppet
123	C-ring	521	Spring	612	Spring seat
124	Filler stopper	522	Spring	621	Spring
125	Filler	541	Seat	651	Adjust screw
161	O-ring	561	O-ring	661	O-ring
162	O-ring	562	Back-up ring	671	Lock nut
163	O-ring	563	O-ring		

14) ARM 1 SPOOL ASSY (302)



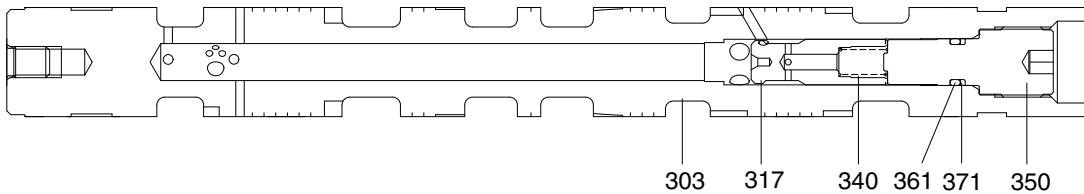
210WA2MC12

302 Spool
317 Plunger

340 Spring
350 Plug

361 O-ring
371 Back-up ring

15) BOOM 1 SPOOL ASSY (303)



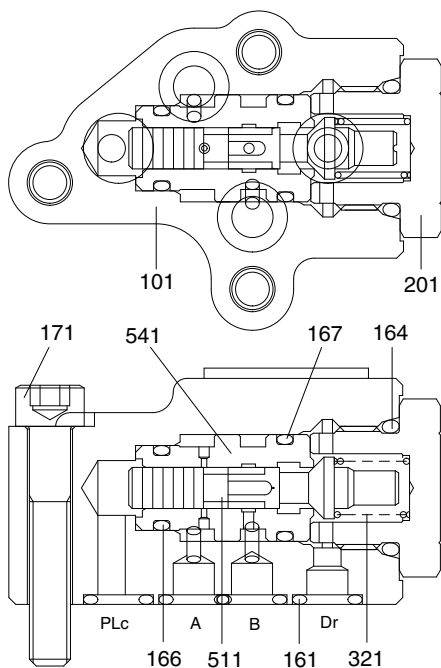
210WA2MC13

303 Spool
317 Plunger

340 Spring
350 Plug

361 O-ring
371 Back-up ring

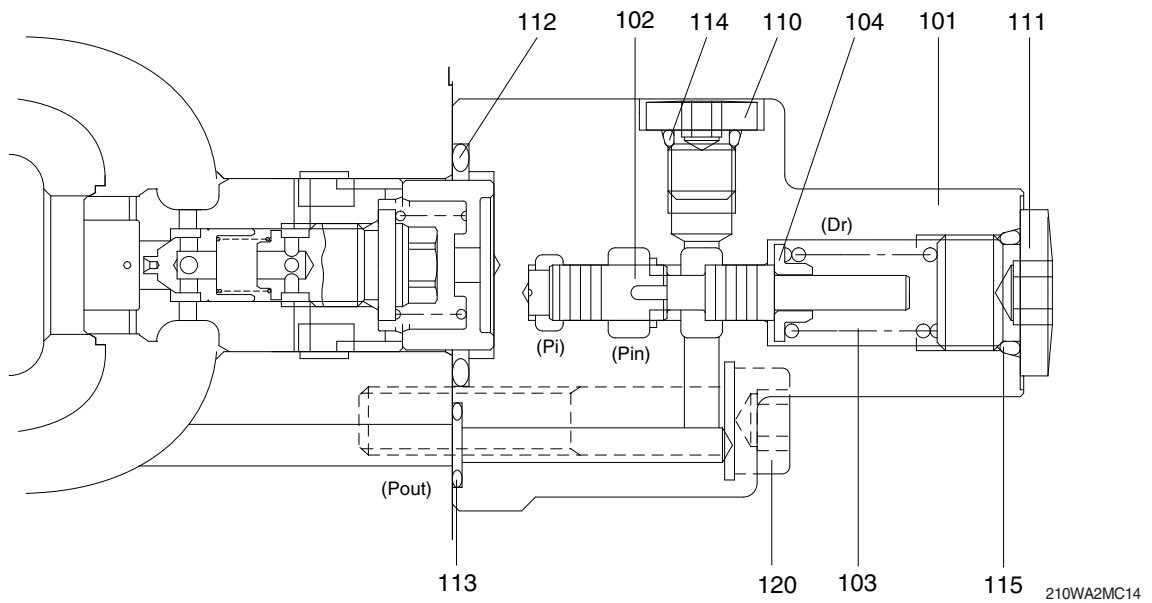
16) LOCK VALVE SELECTOR SUB ASSY (252)



220F2MC76

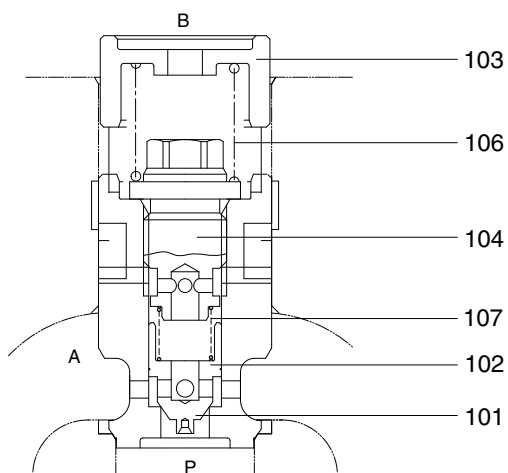
101 Casing
161 O-ring
164 O-ring
166 O-ring
167 O-ring
171 Hex socket head cap screw
201 Plug
321 Spring
511 Spool
541 Sleeve

17) LOGIC CONTROL VALVE ASSY (250, 251)



- | | | |
|-----------------|------------|-------------------------------|
| 101 Casing | 110 Plug | 114 O-ring |
| 102 Spool | 111 Plug | 115 O-ring |
| 103 Spring | 112 O-ring | 120 Hex socket head cap screw |
| 104 Spring seat | 113 O-ring | |

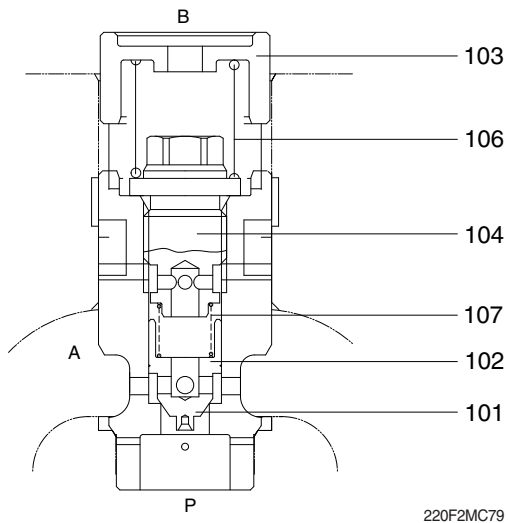
18) SWING LOGIC POPPET ASSY (254)



- | |
|------------------|
| 101 Logic poppet |
| 102 Poppet |
| 103 Spring seat |
| 104 Plug |
| 106 Spring |
| 107 Spring |

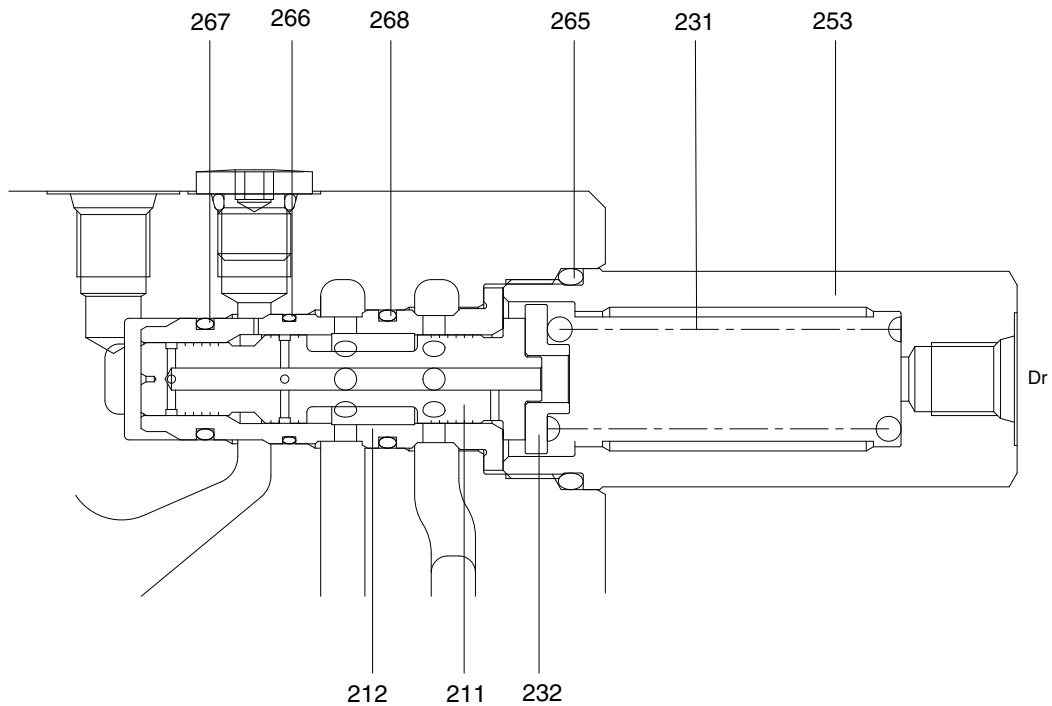
220F2MC78

19) ARM 2 LOGIC POPPET ASSY (256)



- 101 Logic poppet
- 102 Poppet
- 103 Spring seat
- 104 Plug
- 106 Spring
- 107 Spring

20) ARM REGENERATION CUT SUB ASSY (257)



- | | | |
|------------|-----------------|------------|
| 211 Spool | 232 Spring seat | 266 O-ring |
| 212 Sleeve | 253 Plug | 267 O-ring |
| 231 Spring | 265 O-ring | 268 O-ring |

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

- (1) All hydraulic components must be worked with precision working. Then, before disassembling and assembling them, it is essential to select an especially clean place.
- (2) In handling a control valve, pay full attention to prevent dust, sand, etc. from entering into it.
- (3) When a control valve is to be removed from the machine, apply caps and masking seals to all ports. Before disassembling the valve, recheck that these caps and masking seals are fitted completely, and then clean the outside of the assembly. Use a proper bench for working. Spread a paper or rubber mat on the bench, and disassemble the valve on it.
- (4) Support the body section carefully when carrying or transferring the control valve. Be sure not to hold it by the lever, exposed spool, end cover section etc.
- (5) After disassembling and assembling of the component it is desired to carry out various tests (for the relief characteristics, leakage, flow resistance, etc.), but the hydraulic test equipment is necessary for these tests. Therefore, even when its disassembling can be carried out technically, do not disassemble such components that cannot be tested, adjusted, and so on. Additionally one should always prepare clean cleaning oil, hydraulic oil, grease, etc. beforehand.

2) TOOLS

Before disassembling the control valve, prepare the following tools beforehand.

Name of tool	Quantity	Size (mm)
Vice mounted on bench (soft jaws)	1 unit	
Box wrench	Each 1 piece	24, 32, 36
Hexagon key wrench	Each 1 piece	4, 5, 6, 8, 10 and 12
Loctite #262	1 piece	-
Spanner	Each 1 piece	32 (main relief valve, 601) 32 (port relief valve, 602, 604) 36 (port relief valve, 603)

3) DISASSEMBLY

The figure in () shown after the part name in the explanation sentence shows its number in the structure figures (8-34~43).

(1) Place control valve on a working bench.

※ Disassemble it in a clean place and take care not to damage flange faces and plate faces.



21098MC37

(2) Disassembling of main spools

· Travel (301), dozer (312), bucket (304), swing (305), option (309), arm 2 (306), boom 2 (307), swing priority (311).

① Loosen the hexagon the socket head bolts (273) and remove the spring cover (201, 202) and the O-ring (261).

· Hexagon key wrench : 6 mm



21098MC38

② Pull out the spool, spring, spring seats (322), stopper (335 or 339) and spacer bolt (336) in the spool assembly condition from the casing.

※ When pulling out the spool assembly from housing, take care not to damage the housing.



21078MC11

- ③ Hold the spool in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Remove the spacer bolt (336) and disassemble the stopper (335 or 339) and spring seats (332).
- Hexagon key wrench : 10 mm



21098MC40

(3) Disassembling of boom 1 spool (303):

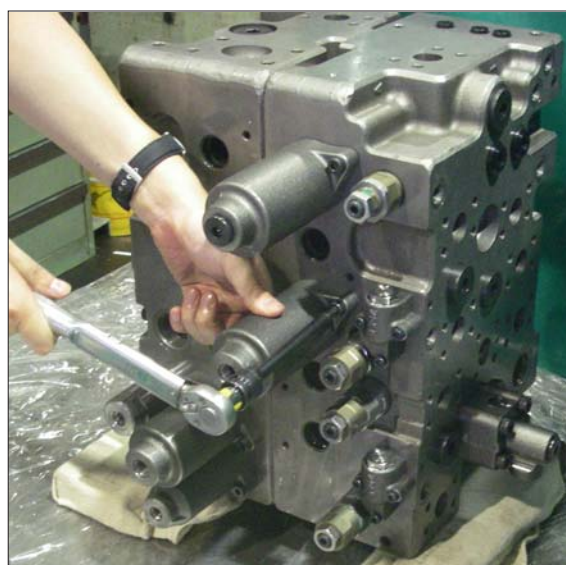
- ① Loosen the hexagon socket head bolts (273), and remove the spring cover (201) and the O-ring (261).
- Hexagon key wrench : 6 mm

- ② Pull out the boom 1 spool (303), spring (320, 321), spring seats (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the P2 housing (101).

※ When pulling out the spool assembly from P2 housing (101), take care not to damage housing.

- ③ Hold the boom1 spool (303) in a mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Remove the spacer bolt (336), and disassemble the spring (320, 321), spring seats (332) and stopper (335).
- Hexagon key wrench : 10 mm

- ④ In addition to ③ above, do not disassemble the boom 1 spool (303) any further.



21098MC41

(4) Disassembling of arm 1 spool (302):

- ① Loosen the hexagon socket head bolts (273), and remove the spring cover (201) and the O-ring (261).

· Hexagon key wrench : 6 mm

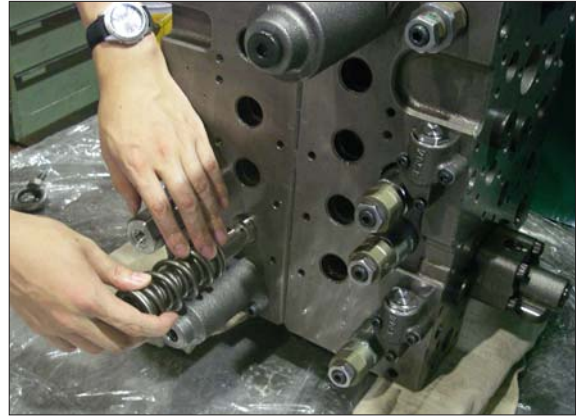
- ② Pull out the arm 1 spool (302), spring (320, 321), spring seats (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the P1 housing (102).

※ When pulling out the spool assembly from P1 housing(102), take care not to damage housing.

- ③ Hold the arm 1 spool (302) in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Remove the spacer bolt (336), and disassemble the spring (320, 321), spring seats (332) and stopper (335).

· Hexagon key wrench : 10 mm

- ④ In addition to ③ above, do not disassemble the arm 1 spool (302) any further.



21098MC42

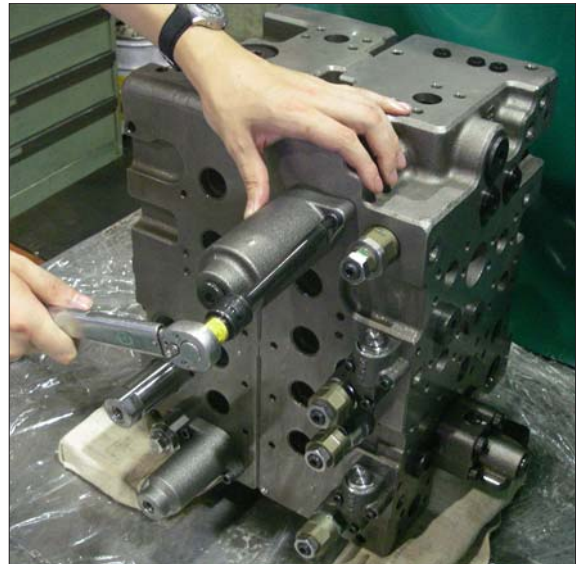
(5) Disassembling of rod spool (308):

- ① Loosen the hexagon socket head bolts (273), and remove the spring cover (201) and the O-ring (261).

· Hexagon key wrench : 6 mm

- ② Pull out the rod spool (308), spring (322, 323), spring seat (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the P2 housing (101).

※ When pulling out the spool assembly from P2 housing (101), take care not to damage housing.



21098MC43

- ③ Hold the rod spool (308) in the mouth-piece attached vise applying a protection plate (aluminum plate etc.) in between. Remove the spacer bolt (336) and disassemble the spring(322, 323), spring seats(332) and stopper (335).

· Hexagon key wrench : 10 mm

(6) Disassembling of bypass cut spool (310, 313):

- ① Loosen the hexagon socket head bolts (273), and remove the spring cover (203) and the O-ring (262).

· Hexagon key wrench : 6 mm

- ② Pull out the bypass cut spool (310, 313), spring (370, 371), spring seats (331), stopper (337) and spacer bolt (333) in the spool assembly condition from the P1 housing.

※ When pulling out the spool assembly from P1 housing (102), take care not to damage housing.



21098MC44

- ③ Hold the bypass cut spool (310,313) in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Remove the spacer bolt (333) and disassemble the spring (370, 371), spring seats (331) and stopper (337).

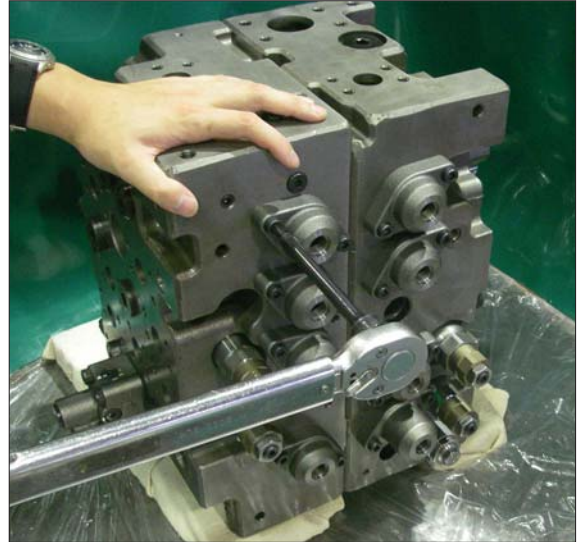
· Hexagon key wrench : 10 mm



21098MC45

(7) Disassembling of spool covers (204, 205, 206):

- ① Remove the hexagon socket head bolts (273), and remove the spool cover (204, 205, 206) and the O-ring (264).
 - Hexagon key wrench : 6 mm
- ② In case of removing the bucket spool cover (206), at first loosen the plug (258) before it is removed from the P1 housing (102). After removing the bucket spring cover (206) remove the plug (551), and take out the piston (211).
 - Box wrench : 32 mm



21098MC46

(8) Removal of main relief valve (601) port relief valves (602, 603, 604) :

- ① Remove the main relief valve (601) and the port relief valves (602, 603, 604) from the housing.
 - Main relief valve (601) : spanner 32 mm
 - Port relief valve (602, 604) : spanner or box wrench 32 mm
 - Port relief valve (603) : spanner 36 mm



21098MC47

- ② In addition to the above, do not disassemble the relief valves any further.



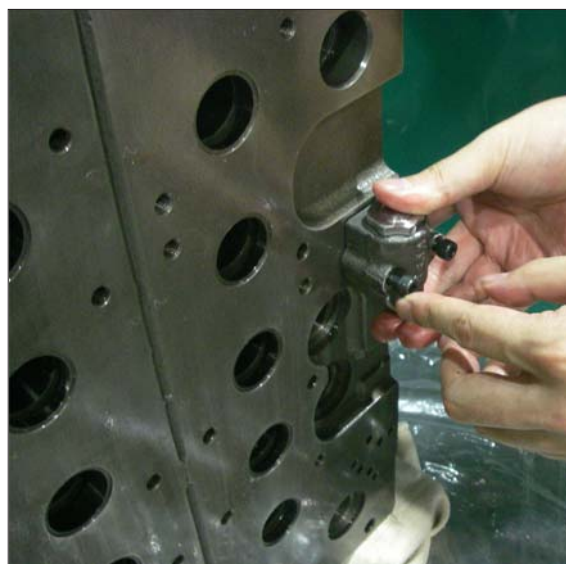
21098MC48



21098MC49

(9) Removal of lock valve selector (252):

- ① Loosen the hexagon socket head cap screws (252-171) and remove the lock valve selector (252) and the O-rings (252-161).
 - Hexagon key wrench : 5 mm
- ② In addition to the above, do not disassemble the lock valve selector (252) any further.



21098MC50

(10) Removal of arm regeneration cut valve (257):

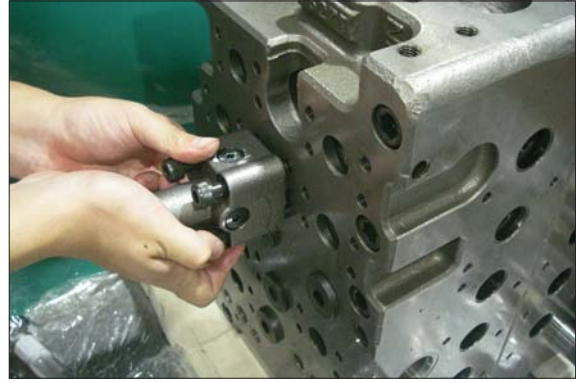
- ① Remove the plug (257-353), spring (257-331), spool (257-211), and sleeve (257-392) from the P1 housing (102).
 - Box wrench : 36 mm
- ② In addition to the above, do not disassemble the arm regeneration cut valve (257) any further.



21098MC52

(11) Disassembly of logic control valve (250, 251) and logic poppet (254, 256):

- ① Loosen the hexagon socket head bolts (250-120, 251-120) and remove the logic control valve (250, 251) and the O-rings (250-112 and 113, 251-112 and 113).
 - Hexagon key wrench : 8 mm
- ② Pull out the logic poppet (254, 256), spring (254-106, 256-106) and spring seat (254-103, 256-103) from the housing.
- ③ In addition to the above, do not disassemble the logic control valve and the logic poppet any further.



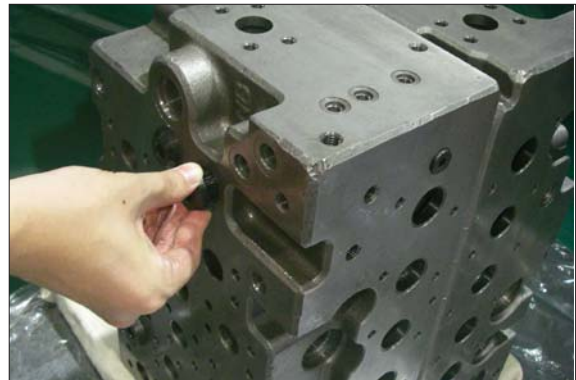
21098MC53



21098MC54

(12) Disassembly of check valve :

- ① CP1, C2, CCb, LCb, LCo, LCk, LCa, LCAT2
Remove the plug (551) and take out the poppet (511) and the spring (521).
 - Hexagon key wrench : 12 mm
- ② CMR1, CMR2
Remove the plug (553) and take out the poppet (512) and the spring (522).
 - Hexagon key wrench : 10 mm



21098MC55

③ CRa, CRb

Remove the plug (552) and take out the poppet (513) and the spring (523).

- Hexagon key wrench : 12 mm



21098MC56

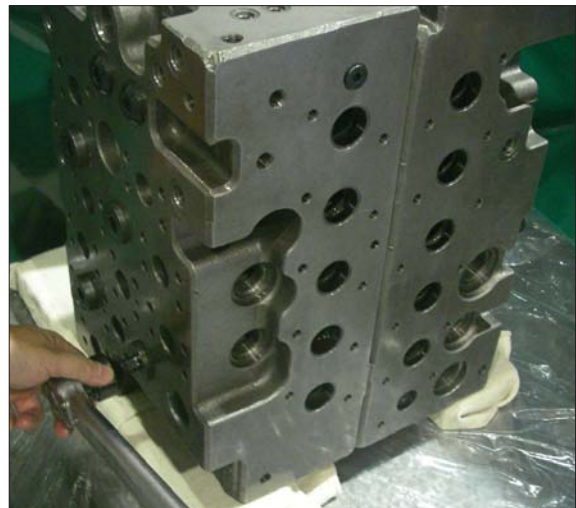
④ CCK, CCo

Remove the plug (551) and take out poppet (514) and the spring (521).

- Hexagon key wrench : 12 mm

⑤ Remove the plug (550) and take out the ball (541), spring (543) and spring seat (542).

- Hexagon key wrench : 6 mm



21098MC57

(13) Disassembly of flanges (209) :

Loosen the hexagon socket head bolts (971) and remove the flange (209) and the O-ring (165).

- Hexagon key wrench : 8 mm

(14) Disassembly of plate (210) :

Loosen the hexagon socket head bolts (274) and remove the plate (210) and the O-rings (165).

- Hexagon key wrench : 10 mm

(15) Disassembly of orifices for signal line :

Do not disassemble the plug (151) and orifice (156), except in special cases.

(16) Disassembly of casing :

- ① Except in special cases, do not disassemble the tie bolts (975) of the P1 housing.
- ② Regarding the plugs not described in above disassembling procedures, the blind plugs for sacrifice holes and for the housing sanitation, do not disassemble them, except in special cases.



21098MC58

(17) Inspection after disassembling

Thoroughly clean all the disassembled parts with clean mineral oil, and dry them with compressed air.

Then, place them on clean paper or cloth for inspection.

① Control valve

- a. Check surfaces of all parts for burrs, scratches, notches and other defects.
- b. Confirm that the seal groove faces of the housing and the covers are smooth and free of dust, dent, rust etc.
- c. Correct dents and damages on check seat faces of housing, if any, by lapping.
 - ※ Pay attention not to leave lapping agent in the housing.
- d. Confirm that all sliding and fitting parts can be moved manually and that all grooves and paths are free from foreign matter.
- e. If any spring is broken or deformed, replace it with new one.
- f. When a relief valve does not function properly, repair it, as per the disassembly and assembly instructions.
- g. Replace all the O-rings with new ones.

② Relief valve

- a. Confirm that all seat faces at ends of all poppets and seats are free of defects and have uniform contact faces.
- b. Confirm manually that main poppet and seat can slide lightly and smoothly.
- c. Confirm that outside face of main poppet and inside face of seat are free from scratches etc.
- d. Confirm that the orifices of the main poppet and seat section are not clogged with foreign matter.
- e. Replace all O-rings with new ones.
- f. When any light damage is found in inspections, correct it by lapping.
- g. When any abnormal part is found, replace it with a relief valve assembly.

4) ASSEMBLY

- ① Figure in () shown after part name in explanation sentence shows number in structure figure.
- ② Cautions in assembling O-rings
 - a. Take care avoid defects when forming O-rings and damage to the rings when handling them.
 - b. Apply grease, hydraulic oil on to O-rings and seal-fitting sections for full lubrication.
 - c. Do not stretch O-rings so much to deform them permanently.
 - d. In fitting O-ring, take care not to roll it into its position. In addition, twisted O-ring cannot have the twist removed naturally with ease after being fitted, and causes oil leakage.
 - e. Tighten the bolts in each section with a torque wrench to their respective tightening torques.

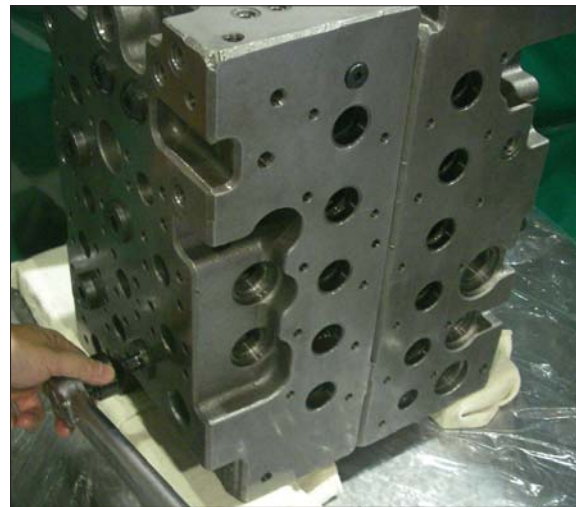
(1) Assembly of the check valve :

- ① Assemble the poppets (511, 512, 513, 514) and the springs (521, 522, 523) : Put the O-rings (561) onto the plugs (551, 552). Put the O-rings (562) onto the plugs (553). Tighten the plugs (551, 552, 553) with their specified torques.

※ Use the poppets, springs and plugs in the following groups.

Poppet	Spring	Plug	Mounting positions
511	521	551	511 in 8 positions
512	522	553	512 in 2 positions
513	523	552	513 in 2 positions
514	521	551	514 in 2 positions

Plug	Hexagon key wrench (mm)	Tightening torque (kgf·m)
551	12	23.5 ~ 26.5
552	12	23.5 ~ 26.5
553	10	13.3 ~ 15.3



21098MC57



21098MC56

(2) Assembly of the plate (210) :

Fit the O-rings (165) to the P1 housing (102), and tighten the hexagon socket head bolts (274) with specified torque.

- Hexagon key wrench : 10 mm
- Tightening torque : 10.0 ~ 12.2 kgf·m
(72.3~88.2 lbf·ft)

If this plate face looks downward, turn the control valve.

(3) Assembly of the flange (209) :

Fit the O-rings (165) to the flange (209), and tighten the hexagon socket head bolts (971) with specified torque.

- Hexagon key wrench : 8 mm
- Tightening torque : 5.0 ~ 6.6 kgf·m
(36.2~47.7 lbf·ft)

(4) Assembly the of logic control valve :

- ① Put the O-ring (250-115, 251-115) onto the plug (250-111, 251-111).



21098MC53

- ② Assemble the spool (250-102, 251-102), spring seat (250-104, 251-104) and spring (251-105, 251-105) into the casing (250-101, 251-101) of the logic control valve, and tighten the plug (250-111, 251-111) with specified torque.

- Hexagon key wrench : 8 mm
- Tightening torque : 7.0 ~ 8.1 kgf·m
(50.6~58.6 lbf·ft)

- ③ Assemble the logic poppet (254; poppet, spring, spring seat) into the housing of the control valve.

- ④ Fit the O-rings (250-112 and 113, 251-112 and 113) to the casing (250-101, 251-101) of the logic control valve, and tighten the hexagon socket head bolts (250-120, 251-120) with specified torque.

- Hexagon key wrench : 8 mm
- Tightening torque : 5.0 ~ 6.6 kgf·m
(36.2~47.7 lbf·ft)



21098MC54

(5) Assembly of the arm regeneration cut valve (257) :

Assemble the sleeve (257-212), spool (257-211), and spring (257-231) into the P1 housing (102). Put the O-ring (265) onto the plug (257-253), and tighten with specified torque.

- Box wrench : 36 mm
- Tightening torque : 7.0 ~ 8.0 kgf·m
(50.6~57.9 lbf·ft)

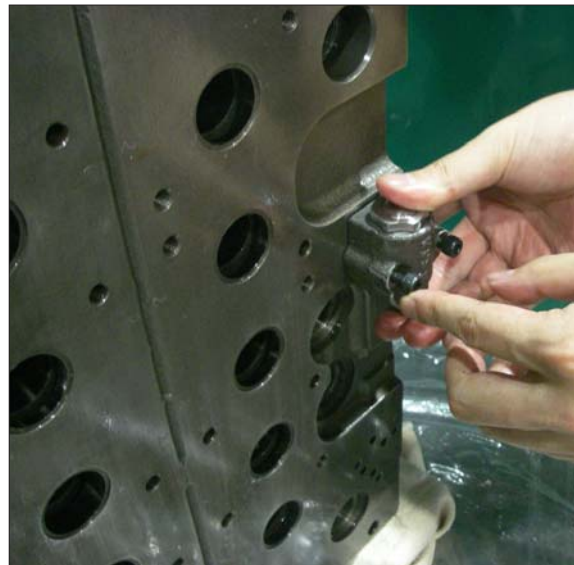


21098MC52

(6) Assembly of the lock valve selector (252) :

Fit the O-rings (252-161) to the lock valve selector (252) and tighten the hexagon socket head bolts (252-171) with specified torque.

- Hexagon key wrench : 5 mm
- Tightening torque : 1.0 ~ 1.4 kgf·m
(7.2~10.1 lbf·ft)



21098MC50

(7) Assembly of the main relief valve (601) and the port relief valve (602, 603, 604) :

Assemble the main relief valve (601) and the port relief valves (602, 603, 604) to the housing, and tighten them with specified torque.

Item	Tool	Tightening torque (kgf·m)
Main relief valve (601)	Spanner 32	7.0 ~ 8.1
Port relief valve (602, 604)	Spanner 32 or box wrench 32	7.0 ~ 8.1
Port relief valve (603)	Spanner 36	12.2 ~14.3



21098MC49



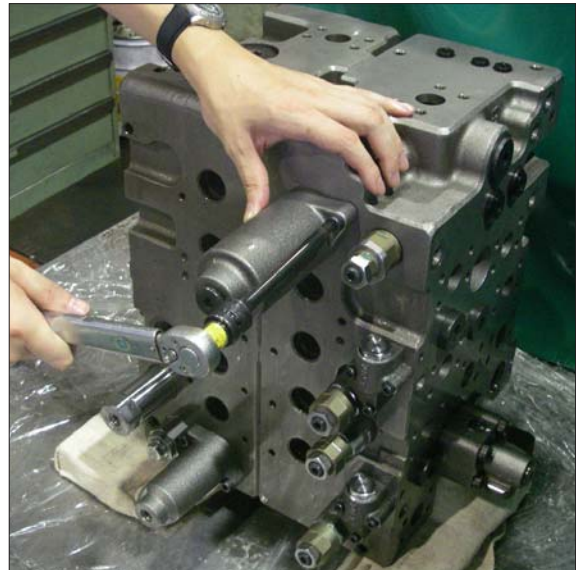
21098MC48



21098MC47

(8) Assembly of the rod spool (308) :

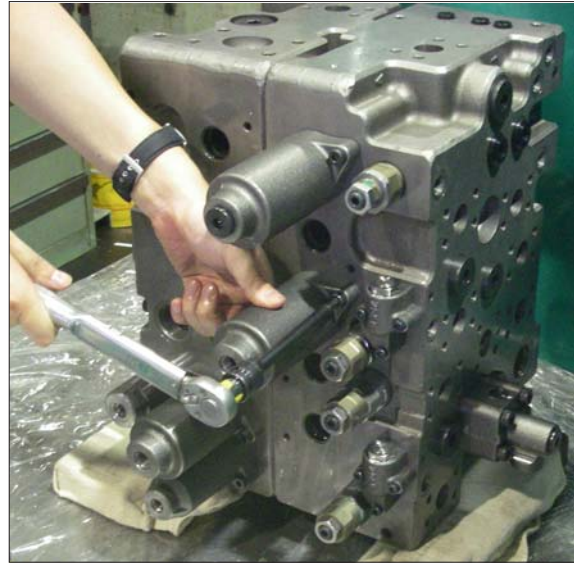
- ① Hold the middle of the travel straight spool (308) in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Attach the spring seats (332), springs (320) and stopper (335), and tighten the spacer bolt (336) with specified torque.
 - ※ Before tightening the spacer bolt (336), apply loctite #262 to it.
 - Hexagon key wrench : 10 mm
 - Tightening torque : 1.6 ~ 1.8 kgf·m
(11.6~13.0 lbf·ft)
 - ※ Take care not to fasten the vise excessively to the shape of the rod spool (308) is deformed.
- ② Insert the spool assemblies of items ① above into the P2 housing (101).
 - ※ Assemble the spool assembly into P2 housing (101) carefully and slowly.
 - ※ Do not push them forcibly.



21098MC43

(9) Assembly of the boom 1 spool (303) :

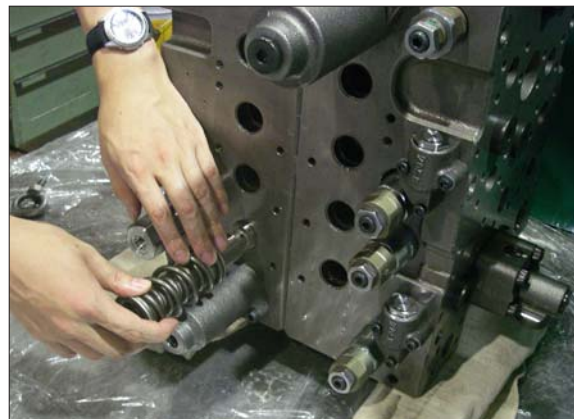
- ① Hold the middle of the boom1 spool (303) in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Attach the spring seats (332), springs (320, 321) and stopper (335), and tighten the spacer bolt (336) with specified torque.
 - ※ Before tightening the spacer bolt (336), apply loctite #262 to it.
 - Hexagon key wrench : 10 mm
 - Tightening torque : 1.6 ~ 1.8 kgf·m
(11.6~13.0 lbf·ft)
 - ※ Take care not to fasten the vise so much that the shape of the boom 1 spool (303) is deformed.
- ② Insert the spool assembly of items ① above into the P2 housing (101).
 - ※ Assemble the spool assembly into the P2 housing (101) carefully and slowly.
 - ※ Do not push them forcibly.



21098MC41

(10) Assembly of the arm 1 spool (302) :

- ① Hold the middle of the arm 1 spool (302) in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Attach the spring seats (332), springs (320, 323) and stopper (335) and tighten the spacer bolt (336) with specified torque.
 - ※ Before tightening the spacer bolt (336), apply loctite #262 to it.
 - Hexagon key wrench : 10 mm
 - Tightening torque : 1.6 ~ 1.8 kgf·m
(11.6~13.0 lbf·ft)
 - ※ Take care not to fasten the vise so much that the shape of the arm 1 spool (302) is deformed.
- ② Insert the spool assemblies of items ① above into the P1 housing (102).
 - ※ Assemble the spool assembly into the P1 housing (102) carefully and slowly.
 - ※ Do not push them forcibly.



21098MC42

(11) Assembly of the main spool (travel (301), dozer (312), bucket (304), swing (305), option (309), arm 2 (306), boom 2 (307), swing priority (311)):

① Hold the middle of each spool in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Attach the spring seats (332), springs and stopper (335 or 339) and tighten the spacer bolt (336) with specified torque.

※ Before tightening the spacer bolt (336), apply loctite #262 to it.

· Hexagon key wrench : 10 mm

· Tightening torque : 1.6 ~ 1.8 kgf·m
(11.6~13.0 lbf·ft)

※ Take care not to fasten the vise so much that the shape of the spool is deformed.

② Insert the spool assemblies of Items ① above into the P2 housing (101) or P1 housing (102).

※ Assemble the spool assemblies into P2 housing (101) or P1 housing (102) carefully and slowly.

※ Do not push them forcibly.



21098MC39



21098MC38

(12) Assembly of the bypass cut spool (310, 313) :

- ① Hold the middle of each spool in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Attach the spring seats (331), springs (370, 371) and stopper (337) and tighten the spacer bolt (333) with specified torque.
 - ※ Before tightening the spacer bolt (333), apply loctite #262 to it.
 - Hexagon key wrench : 10 mm
 - Tightening torque : 1.6 ~ 1.8 kgf·m
(11.6~13.0 lbf·ft)
 - ※ Take care not to fasten the vise so much that the shape of the bypass cut spool (310, 313) is deformed.
- ② Insert the spool assemblies of Items ① above into the P1 housing (102).
- ※ Assemble the spool assemblies into the P1 housing (102) carefully and slowly.
- ※ Do not push them forcibly.



21098MC44

(13) Assembly of the covers :

- ① Fit the square rings (264) to the spool covers (204, 205, 206) in reverse sides to the spring sides of spools, and tighten the hexagon socket head bolts (273) with specified torque.
 - ※ Confirm that square rings (264) have been fitted to the spool covers (204, 205, 206).
 - Hexagon key wrench : 6 mm
 - Tightening torque : 2.5 ~ 3.5 kgf·m
(18.1~25.3 lbf·ft)
- ② Bucket spool cover (206) : Assemble piston (211) into bucket spool cover (206). Put O-ring (561) onto plug (258) and tighten it with specified torque.
 - Box wrench : 32 mm
 - Tightening torque : 15.3 ~ 18.4 kgf·m
(111~133 lbf·ft)
- ③ Fit the O-rings (261, 262) to spring covers (201, 202, 203) on the spring sides of spools, and tighten the hexagon socket head bolts (273) with specified torque.
 - ※ Confirm that O-rings (261,262) have been fitted to spring covers (204, 205, 206).
 - Hexagon key wrench : 6 mm
 - Tightening torque : 2.5 ~ 3.5 kgf·m
(18.1~25.3 lbf·ft)



21098MC46

GROUP 5 SWING DEVICE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

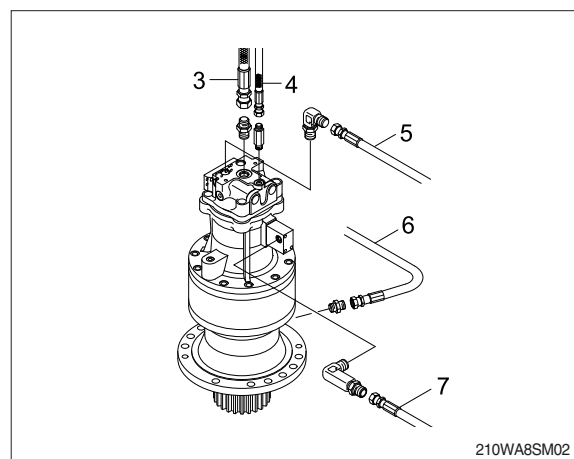
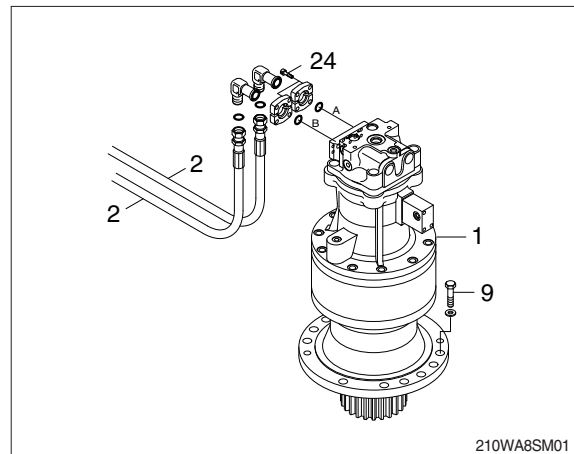
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (4) Disconnect hose assembly (2).
- (5) Disconnect pilot line hoses (3, 4, 5, 6, 7, 8).
- (6) Sling the swing motor assembly (1) and remove the swing motor mounting socket bolts (9).
 - Weight : 254 kg (560 lb)
 - Tightening torque : $12.8 \pm 3.0 \text{ kgf} \cdot \text{m}$
($92.6 \pm 21.7 \text{ lbf} \cdot \text{ft}$)

- (7) Remove the swing motor assembly.
 - ※ When removing the swing motor assembly, check that all the piping have been disconnected.

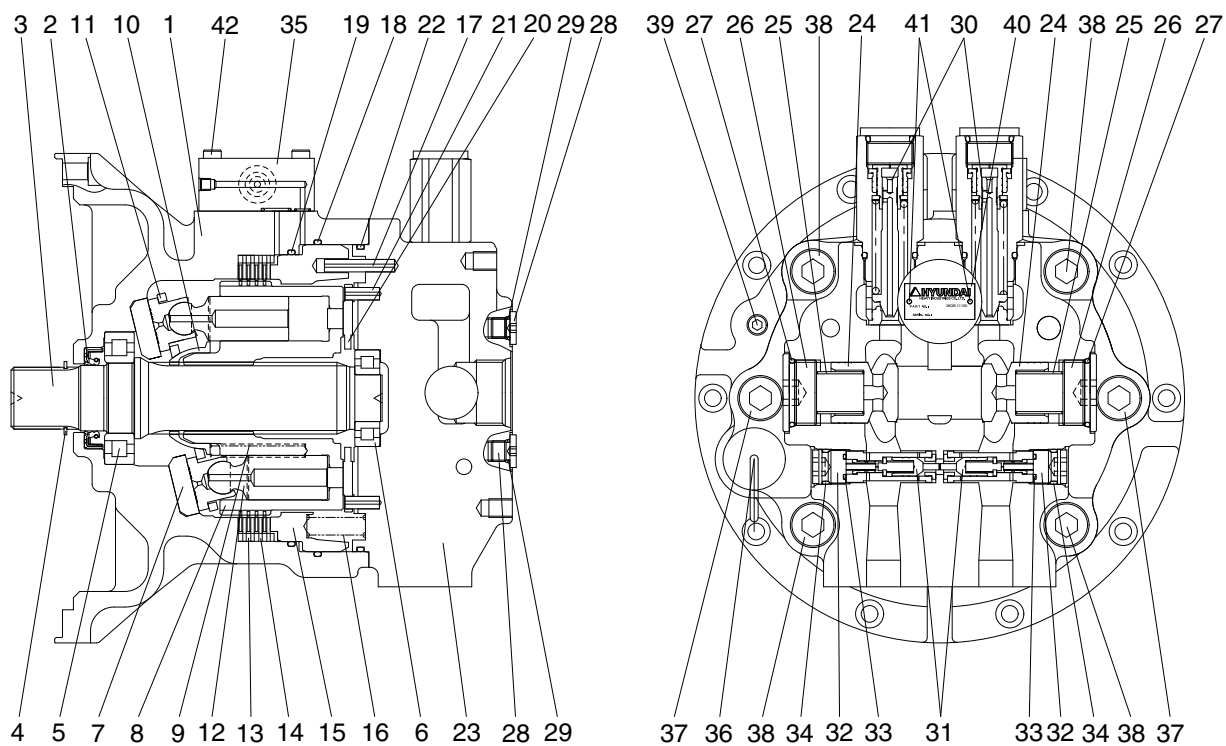
2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from the swing motor.
 - ① Remove the air vent plug.
 - ② Pour in hydraulic oil until it overflows from the port.
 - ③ Tighten plug lightly.
 - ④ Start the engine, run at low idling and check oil come out from plug.
 - ⑤ Tighten plug fully.
- (3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.



2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



210WA2SM02

1	Casing	15	Parking piston	29	O-ring
2	Oil seal	16	Brake spring	30	Relief valve assy
3	Shaft	17	Spring pin	31	Anti-rotating valve assy
4	Retainer ring	18	O-ring	32	Plug
5	Roller bearing	19	O-ring	33	O-ring
6	Roller bearing	20	Valve plate	34	O-ring
7	Swash plate	21	Spring pin	35	Port block assy
8	Rotary block	22	O-ring	36	Level gauge assy
9	Spring	23	Valve casing	37	Socket bolt
10	Ball guide	24	Check valve	38	Socket bolt
11	Retainer plate	25	Spring	39	Plug
12	Piston assy	26	Plug	40	Name plate
13	Friction plate	27	O-ring	41	Rivet
14	Separate plate	28	Plug	42	Socket bolt

2) DISASSEMBLY

(1) Disassemble drive shaft

- ① Unloosing socket bolt (port block assy, 42) and disassemble port block assy (35) from casing (1).



2209A8SM51

- ② Disassemble level gauge assy (36) from casing (1).



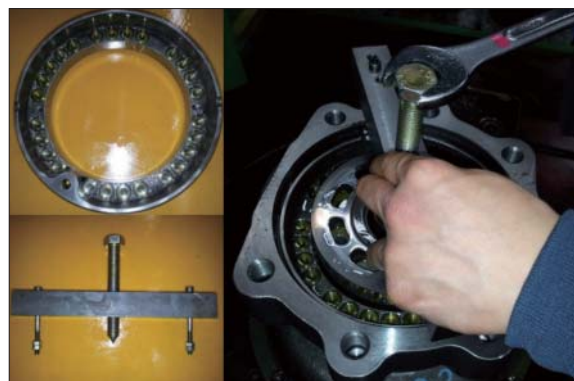
2209A8SM52

- ③ Hang valve casing (23) on hoist, unloose socket bolt (37, 38) and disassemble from casing (1).



2209A8SM53

- ④ Disassemble brake spring (16) and using a jig, disassemble parking piston (15) from casing (1).



2209A8SM54

- ⑤ Disassemble respectively rotary block sub (8), friction plate (13), separate plate (14) from casing (1).



2209A8SM55

- ⑥ Disassemble swash plate (7) from casing (1).



2209A8SM56

- ⑦ Using a plier jig, disassemble retainer ring (4) from casing (1).



2209A8SM57

- ⑧ Disassemble shaft (3), oil seal (2) and O-ring (18, 22) from casing (1).



2209A8SM58

(2) Disassemble rotary block sub

- ① Disassemble piston assy (12) from rotary block (8).



2209A8SM59

- ② Disassemble ball guide (10) and spring (rotary block, 9) from rotary block (8).
 - Ball guide × 1EA
 - Spring × 9EA



2209A8SM60

(3) Disassemble valve casing sub

- ① Disassemble spring pin (17, 21), valve plate (20), O-ring (22) from valve casing (23).



2209A8SM61

- ② Using a torque wrench, disassemble relief valve assy (30) from valve casing (23).



2209A8SM62

- ③ Using a torque wrench, disassemble plug (32) from valve casing (23) and disassemble O-ring (33, 34) and anti-rotating valve assy (31).



- ④ Using a torque wrench, disassemble check valve (24) from valve casing (23).



- ⑤ Disassemble plug (28), O-ring (29) from valve casing (23).



3) ASSEMBLING

(1) Assemble shaft sub

- ① Put roller bearing (5) on preheater and provide heat to inner race.
(Temperature in conveyor : 120°C for 3~5 minutes)



2209A8SM66

- ② Using a robot machine, assemble and press preheated roller bearing (5) into shaft (3).



2209A8SM67

(2) Assemble rotary block sub

- ① Assemble 9 springs (rotary block, 9) into rotary block (8).
 - Spring × 9EA



2209A8SM68

- ② Assemble ball guide (10) into rotary block (8).
 - Ball guide × 1EA



2209A8SM69

③ Assemble 9 piston assy (12) into retainer plate (11).

- Piston assy × 9EA
- Retainer plate × 1EA



2209A8SM70

④ Assemble parts of procedure ② and ③.



2209A8SM71

(3) Assemble valve casing sub

① Assemble make up check valve sub

Assemble check valve (24), O-ring (27), plug (26) in that order and then screw it with torque wrench.

- Make up check valve × 2EA
- Spring × 2EA
- Plug × 2EA
- O-ring × 2EA



2209A8SM72

② Assemble anti-rotating valve assy

Assemble anti-rotating valve assy (31), plug (32), O-ring (33, 34) in that order and then screw it with a torque wrench.

- Anti-rotating valve assy (31) × 2EA
- Plug (32) × 2EA
- O-ring (33, 34) × 2EA



2209A8SM73

- ③ Using a torque wrench, assemble relief valve assy (30) 2 sets into valve casing (23).

- Relief valve assy (30) × 2EA



2209A8SM74

- ④ Assemble plug (28) and O-ring (27) into valve casing (23).

- Plug (28) × 3EA
- O-ring (27) × 3EA



2209A8SM75

- ⑤ Assemble roller bearing (6) into valve casing (23) and assemble spring pin (17, 21) into valve casing (23).

- Roller bearing (6) × 1EA
- Spring pin (17, 21) × 1EA



2209A8SM76

- ⑥ Apply some grease valve plate (20) and assemble it into valve casing (23).



2209A8SM77

(4) Assemble drive shaft sub

- ① Using a jig, assemble oil seal (2) into casing (1).



2209A8SM78

- ② Fit shaft sub (shaft+roller bearing) into casing (1).



2209A8SM79

- ③ Using a plier jig, assemble retainer ring (4) to shaft (3).
· Retainer ring × 1EA



2209A8SM80

- ④ Apply some grease swash plate (7) and assemble it into casing (1).
· Swash plate × 1EA



2209A8SM81

⑤ Insert O-ring (18, 19) into casing (1).

- O-ring (18) × 1EA
- O-ring (19) × 1EA



2209A8SM82

⑥ Assemble rotating block (8) into casing (1).



2209A8SM83

⑦ Assemble separate plate (14) and friction plate (13) 4 sets into casing (1) and fit parking piston (15) into casing (1) by a jig or a press.

- Separate plate × 4EA
- Friction plate × 4EA
- Parking piston × 1EA



2209A8SM84

⑧ Assemble spring (parking piston, 16) into parking piston (15).

- Spring × 26EA



2209A8SM85

- ⑨ Lift up valve casing (23) on casing (1) by a crane and assemble it with socket bolts (37, 38).



- ⑩ Assemble level gauge assy (36) and plug (39) into casing (1).



- ⑪ Assemble port block assy (35) into valve casing (23) with socket bolt (42).
- Port block assy × 1EA
 - Socket bolt × 3EA



- ⑫ **Air pressing test**
Be sure of leakage, after press air into assembled motor and put it in water for 1 minute (pressure : 2 kgf/cm²).



⑬ **Leakage check**

Place motor on a bench tester and after cleaning motor by color check No.1, paint No.3 and be sure of leakage.



2209A8SM90

⑭ **Mount test bench**

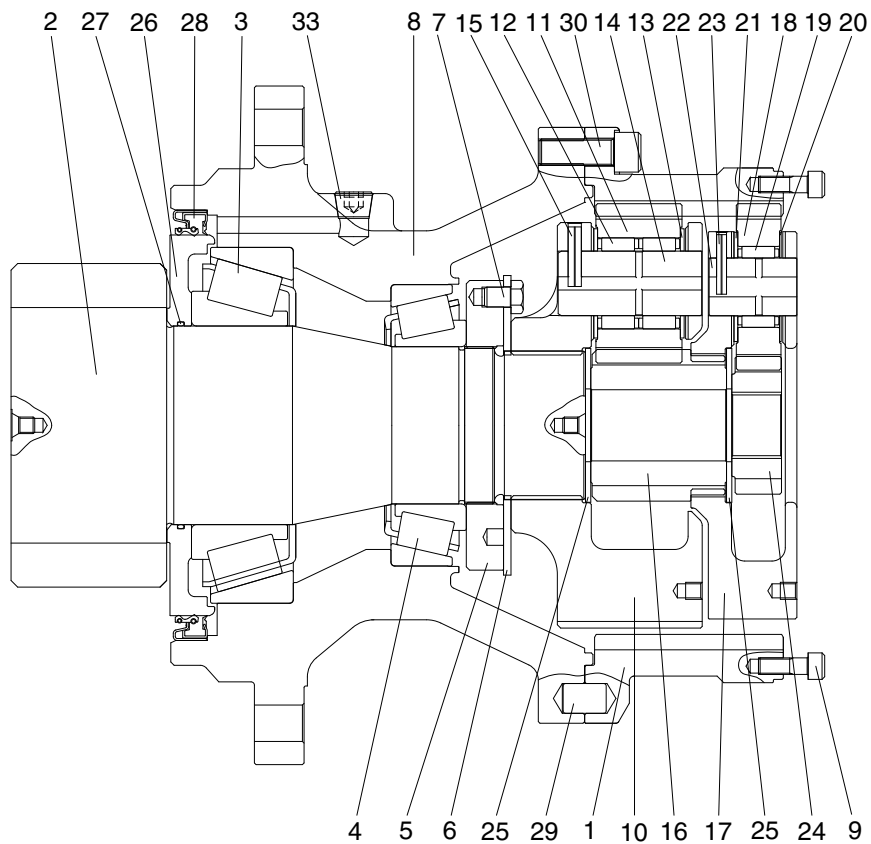
Mounting motor a test bench, test the availability of each part.



2209A8SM91

3. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE



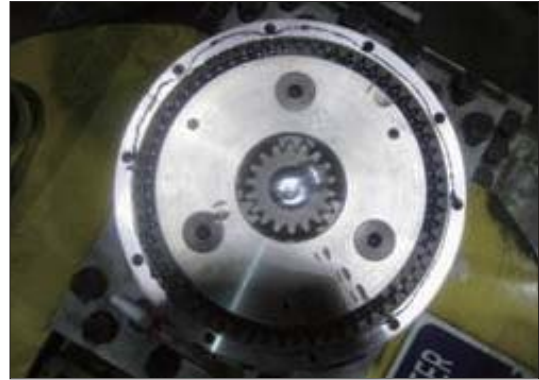
220L2SM03

1	Ring gear	11	Planetary gear 2	21	Thrust washer
2	Drive shaft	12	Needle bearing	22	Carrier pin 1
3	Taper bearing	13	Thrust washer	23	Spring pin
4	Taper bearing	14	Carrier pin 2	24	Sun gear 1
5	Ring nut	15	Spring pin	25	Thrust plate
6	Lock plate	16	Sun gear 2	26	Sleeve
7	Hexagon bolt	17	Carrier 1	27	O-ring
8	Casing	18	Planetary gear 1	29	Parallel pin
9	Socket bolt	19	Needle bearing	30	Socket bolt
10	Carrier 2	20	Thrust washer	33	Plug

2) DISASSEMBLY

(1) Preparation

- ① The reduction gear removed from machine is usually covered with mud.
Wash out side of reduction gear and dry it.
 - ② Setting reduction gear on work stand for disassembling.
 - ③ Mark for mating
Put marks on each mating parts when disassembling so as to reassemble correctly as before.
- ▲ Take great care not to pinch your hand between parts while disassembling not let fall parts on your foot while lifting them.



2209A8SM01

(2) Disassembly

- ① Remove every "Socket bolt (M10)" that secure swing motor and reduction gear.
- ② Removing carrier sub assy & sun gear
 - a. Removing No.1 sun gear from No.1 carrier sub assy.
 - ※ Be sure maintaining it vertical with ground when disassembling No.1 sun gear.
 - b. Removing No.1 carrier sub assy screwing I-bolt to tab hole (M10) in No.1 carrier.
Lifting it gradually maintaining it vertical with ground.
 - ※ It's impossible to disassemble No.1 spring pin. If No.1 spring pin has problem, change whole No.1 carrier sub assy.



2209A8SM02



2209A8SM03

c. Removing No.2 sun gear from No.2 carrier sub assy.

※ Be sure maintaining it vertical with ground when disassembling No.2 sun gear.



2209A8SM04

d. Removing No.2 carrier sub assy screwing I-bolt to tab hole (M10) in No.2 carrier. Lifting it gradually maintaining it vertical with ground.

※ It's impossible to disassemble No.2 spring pin. If No.2 spring pin has problem, change whole No.2 carrier sub assy.



2209A8SM05

③ Removing ring gear

After unscrewing every socket bolt (M16), remove ring gear from casing.

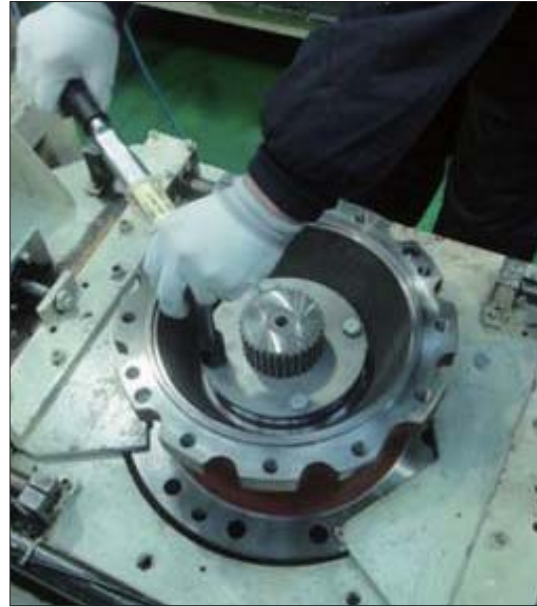
※ Because of liquid gaskets between ring gear and casing, put sharp punch between ring gear and casing and tapping it to remove them.



2209A8SM06

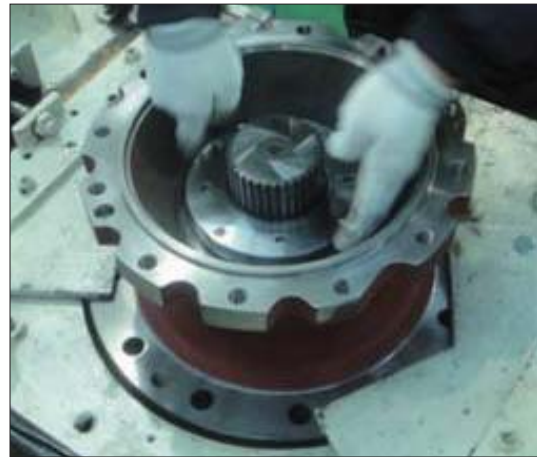
④ **Removing drive shaft sub assy**

- a. Unscrew every hex head bolt (M12) to remove lock plate.



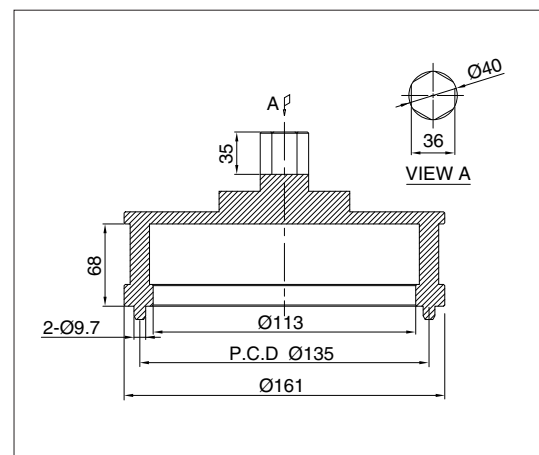
2209A8SM07

- b. Rolling ring nut for removing them from drive shaft sub assy.



2209A8SM08

- ※ Use special tool to roll ring nut to counter clockwise.



220L8SM01

- c. Remove drive shaft sub assy from casing.
- ※ Set a rack for flange of casing, and remove drive shaft sub assy from casing by using press.



2209A8SM09

- d. Remove oil seal & taper bearing (small) from casing.
- ※ Do not re-use oil seal. It is impossible to disassemble drive shaft sub assy.



2209A8SM10



2209A8SM11

4. ASSEMBLY REDUCTION UNIT

1) GENERAL NOTES

- (1) Clean every part by kerosene and dry them in a cool and dry place.
- (2) Loctite on surface must be removed by solvent.
- (3) Check every part for any abnormal.
- (4) Each hexagon socket head bolt should be used with loctite #242 applied on its threads.
- (5) Apply gear oil slightly on each part before assembling.

▲ Take great care not to pinch your hand between parts or tools while assembling nor let fall parts on your foot while lifting them.

Inspection before assembling.

Thrust washer

- Check the seizure, abnormal wear or uneven wear.
- Check the unallowable wear.

Gear

- Check the pitting or seizure on tooth surface.
- Check the cracks on the root of tooth.

Bearing

- Rotate it by hands to check such noise or uneven rotation.

2) ASSEMBLING NO.1 CARRIER SUB ASSY

- (1) Put thrust plate firmly in No.1 carrier.
- (2) After assembling No.1 needle bearing to No.1 planetary gear, put a pair of No.1 thrust washer on both sides of bearing and install them to No.1 carrier.



2209A8SM12



2209A8SM13

- (3) Make of spring pin hole No.1 pin and No.1 carrier of spring pin hole in line, press No.1 spring pin into the holes.
Make No.1 spring pin hole head for No.1 planetary gear.



2209A8SM14

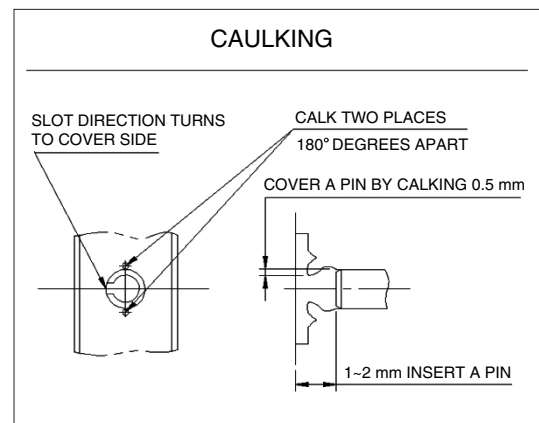
- (4) Caulk carrier holes to make No.1 spring pin settle down stably.



2209A8SM15

※ Refer to “Caulking details”

Use paint marker for marking after caulking.



220SA8TM147

3) ASSEMBLING NO.2 CARRIER SUB ASSY

(1) Put thrust plate in firmly No.2 carrier.



2209A8SM17

(2) After assembling No.2 needle bearing to No.2 planetary gear, put 2 pieces of No.2 thrust washer on both sides of bearing and install them to No.2 carrier.



2209A8SM18

(3) Align No.2 spring pin hole and No.2 carrier spring pin hole, put No.2 spring pin into the holes.
Make No.2 spring pin cutting line face to No.2 planetary gear.

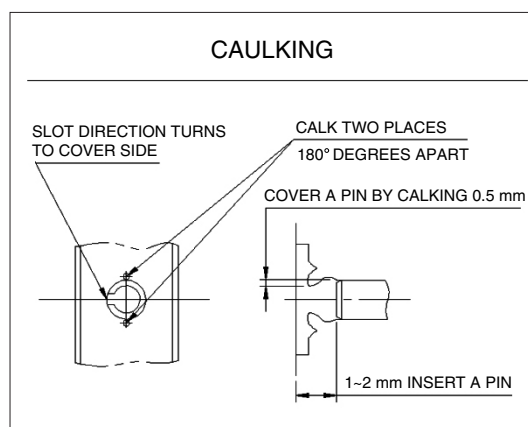


2209A8SM19

(4) Caulk carrier holes to make No.2 spring pin settle down stably.

※ Refer to “Caulking details”

Use paint marker for marking after caulking.



220SA8TM147

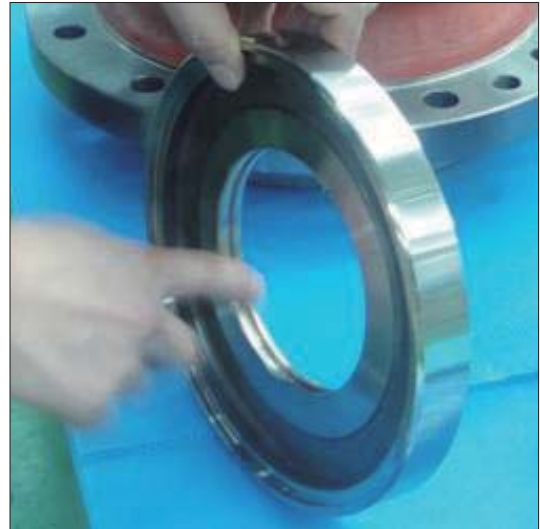
4) ASSEMBLING PINION GEAR SUB ASSY

- (1) Prepare drive shaft pinion gear vertical with ground.



2209A8SM21

- (2) Fully apply grease (albania EP02) to O-ring groove of sleeve.
※ Be sure to maintain it vertical with ground when assembling it.
- (3) Put O-ring into O-ring groove of sleeve.
Fully apply grease on O-ring.



2209A8SM22

- (4) Assemble taper bearing and sleeve into drive shaft using press jig.
Use special jig for pressing. Leave no space between sleeve and taper bearing.



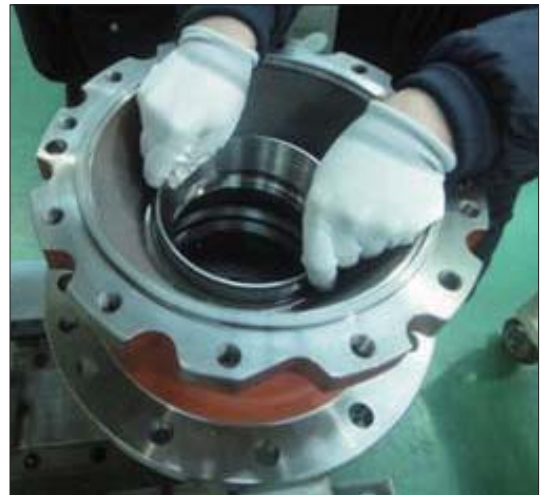
2209A8SM23



2209A8SM24

5) ASSEMBLING BEARING CUP & OIL SEAL (PRESSING)

- (1) Put top, bottom bearing cup into casing.
Use special jig for pressing. Pay attention to foreign materials while assembling bearing cup.
- ※ Flip over casing to assemble oil seal.



2209A8SM25



2209A8SM26

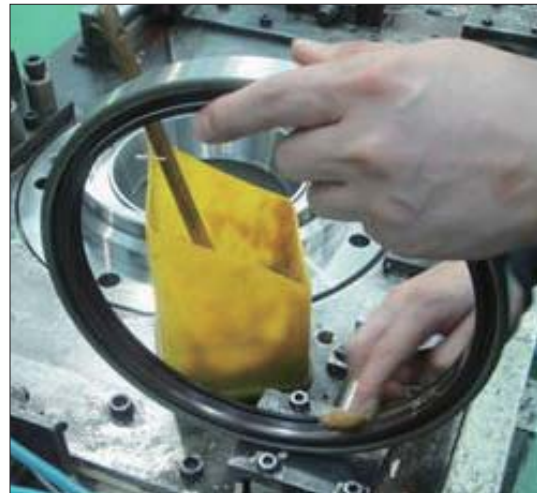
- (2) Assemble oil seal to casing.
Use special jig for pressing. Pay attention to direction of dust seal and dent.



2209A8SM27

※ WHILE ASSEMBLING OIL SEAL

1. Be sure to set dust seal to gear oil.
2. Before assembling, charge enough grease in oil seal.
3. Before assembling, apply enough grease inside and outside of oil seal.



2209A8SM28

6) ASSEMBLING SHAFT SUB ASSY & RING NUT

- (1) After assembling casing & drive shaft sub
assy, flip it over.



2209A8SM29

- (2) Put drive shaft sub assy into casing.
※ Be sure to maintain it vertical with ground when assembling it.



2209A8SM30

- (3) Put taper bearing into it.
Rotate bearing by hands for checking after assembly.



2209A8SM31

- (4) Put ring nut into drive shaft sub assy by using special jig.
The tightening torque (M95) = 3.5 ± 0.4 kgf·m
(25.3 ± 2.9 lbf·ft)



2209A8SM32

- ※ Apply enough loctite #242 before screwing bolts.



2209A8SM33

- (5) Align bolt screw of ring nut with lock plate's hole.

In case of misalign between bolt screw ring nut and lock plate's hole, put lock plate as near as possible to hole of bolt screw of ring nut and make it in line by increasing tightening torque.



2209A8SM34



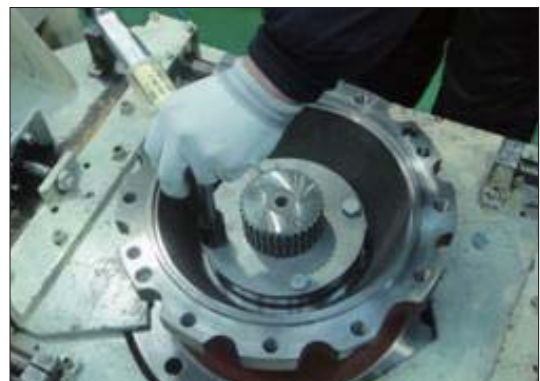
2209A8SM35

- (6) Screw 4 bolts (M12×16) to connect ring nut and lock plate by using torque wrench.

Bolt (M12, 4EA) = 10.9T

The tightening torque = 8.8 ± 0.9 kgf·m
(63.7 ± 6.5 lbf·ft)

- ※ Apply enough loctite #242 before screwing bolts.



2209A8SM36

- (7) Use paint marker for checking surplus parts after assembling.



2209A8SM37

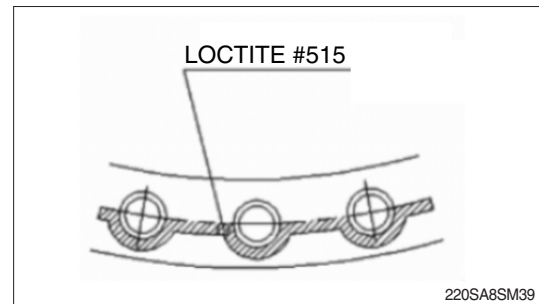
7) ASSEMBLING RING GEAR

- (1) Apply loctite #515 bottom of casing sub assy contacting with ring gear without disconnection.



2209A8SM38

Refer to loctite detail.



220SA8SM39

- (2) Put parallel pin into hole of casing sub assy.
Mark parallel pin position using paint marker.



2209A8SM40

- (3) Align ring gear with parallel pin to put them into casing sub assy.
※ Be sure to maintain them vertical with ground while using press.



2209A8SM41

- (4) Screw 12 bolts (M16×45) to connect casing sub assy and ring gear (01) by using torque wrench.

Bolt (M16, 12EA) = 12.9T

The tightening torque = 27 ± 2.7 kgf·m
(195 ± 19.5 lbf·ft)

- ※ Apply enough loctite #242 before screwing bolts.



2209A8SM42

- (5) Use paint marker for checking surplus parts after assembling.



2209A8SM43



2209A8SM44

8) ASSEMBLING CARRIER SUB ASSY & SUN GEAR

- (1) Put No.2 carrier sub assy along spline of drive shaft spline.
- Screw M10 I-bolt to No.2 carrier sub assy.
 - Lifting up No.2 carrier sub assy and align planetary gear and tooth of ring gear by rotating planetary gear by hands.
 - Rotate No.2 carrier sub assy by hands to fit No.2 carrier sub assy into drive shaft spline.



2209A8SM45

- (2) Put No.2 sun gear into No.2 carrier sub assy.



2209A8SM46

- (3) Put No.1 carrier sub assy into No.2 sun gear along spline.
- Screw M10 I-bolt to No.1 carrier sub assy.
 - Lifting up No.1 carrier sub assy and align planetary gear and tooth of ring gear by rotating planetary gear by hands.
 - Rotate No.1 carrier sub assy by hands to fit No.1 carrier into No.2 sun gear spline.



2209A8SM47

- (4) Put No.1 sun gear into No.1 carrier sub assy. Be sure to maintain it vertical with ground. And align with No.1 planetary gear spline.
- (5) Rotate No.1 carrier sub assy by hands to check noise.



2209A8SM48

9) MEASURING CLEARANCE & ASSEMBLING NAME PLATE

- (1) Check the clearance between ring gear and No.1 sun gear using a tool with dial gauge.

Check the clearance

Dial gauge = -0.3 ~ +2.95



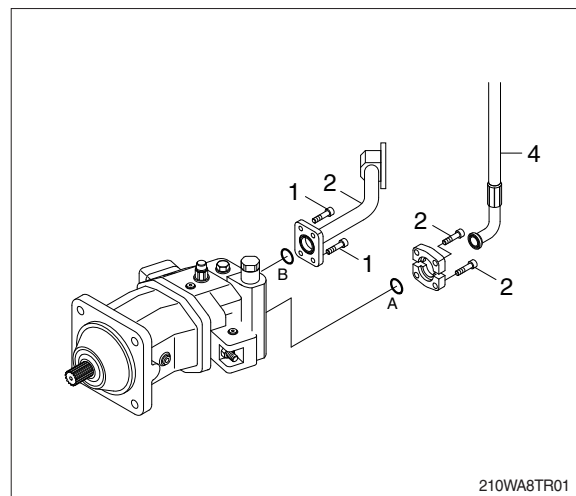
2209A8SM49

GROUP 6 TRAVEL MOTOR

1. REMOVAL AND INSTALL

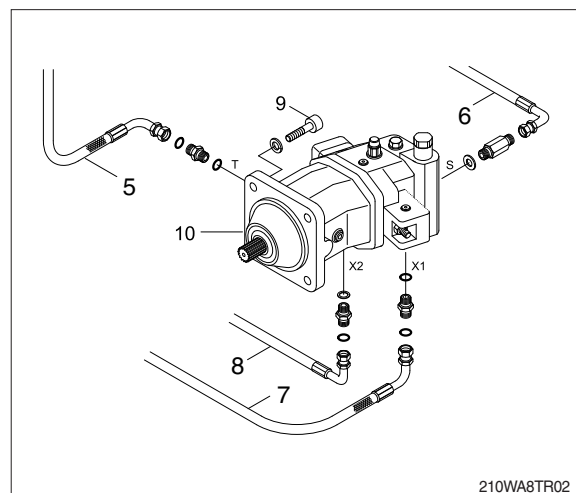
1) REMOVAL

- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ Escaping fluid under pressure can penetrate the skin causing serious injury.
- (4) Loosen the socket bolt (1) and remove the pipes (2).
- (5) Disconnect hoses (3, 4, 5, 6, 7, 8).
- (6) Loosen the socket bolt (9) and remove travel motor (10).
 - Weight : 77 kg (170 lb)
 - Tightening torque : $35.6 \pm 7.1 \text{ kgf} \cdot \text{m}$
($257 \pm 51.4 \text{ lbf} \cdot \text{ft}$)
- ※ When removing the travel motor assembly, check that all the hoses have been disconnected.



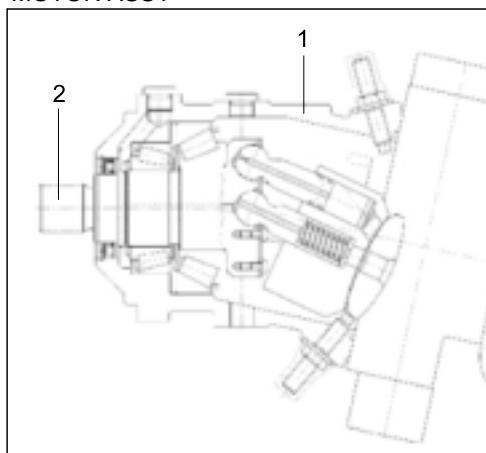
2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Confirm the hydraulic oil level and check the hydraulic oil leak or not.



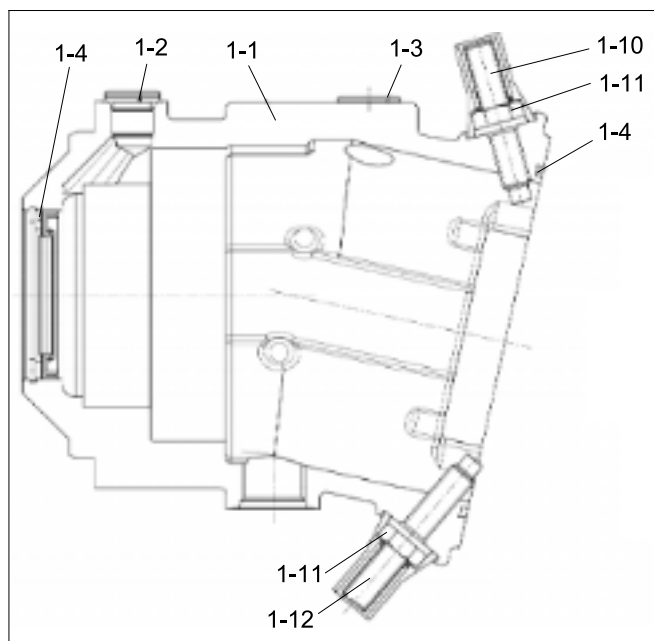
2. PARTS LIST (1/3)

MOTOR ASSY

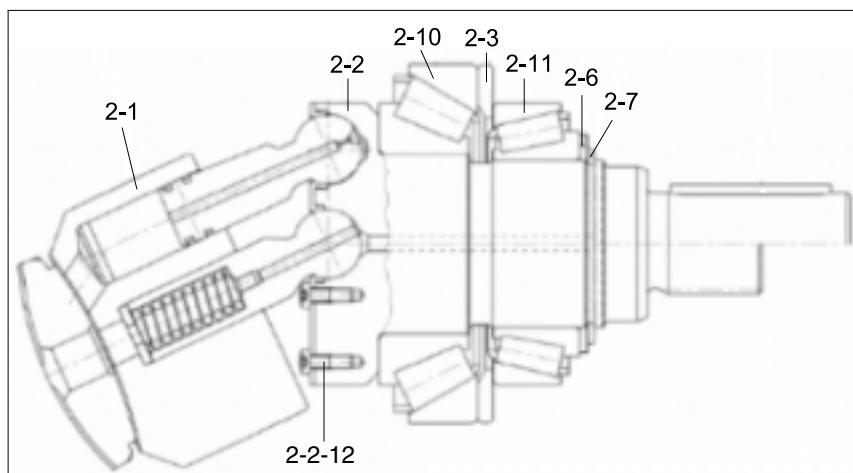


- 1 Motor housing assy
- 2 Rotary kit

ITEM 1



ITEM 2



140WA2TR10

- | | | |
|--------------------|------------------------------|---------------------|
| 1-1 Housing | 1-11 Sealing nut | 2-3 Shim |
| 1-2 Lock screw | 1-12 Threaded pin | 2-6 Backup plate |
| 1-3 Lock screw | 2-1 Hydraulic rotary section | 2-7 Retainer ring |
| 1-4 Motor seal kit | 2-2 Drive shaft | 2-10 Roller bearing |
| 1-10 Threaded pin | 2-2-12 Screw | 2-11 Roller bearing |

PARTS LIST (2/3)

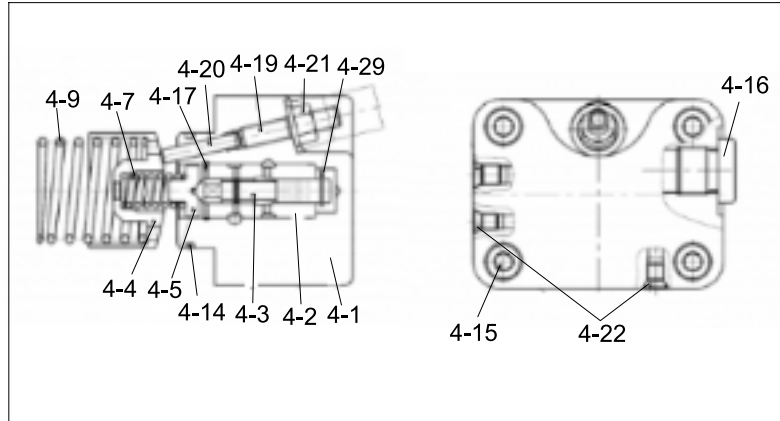
MOTOR ASSY



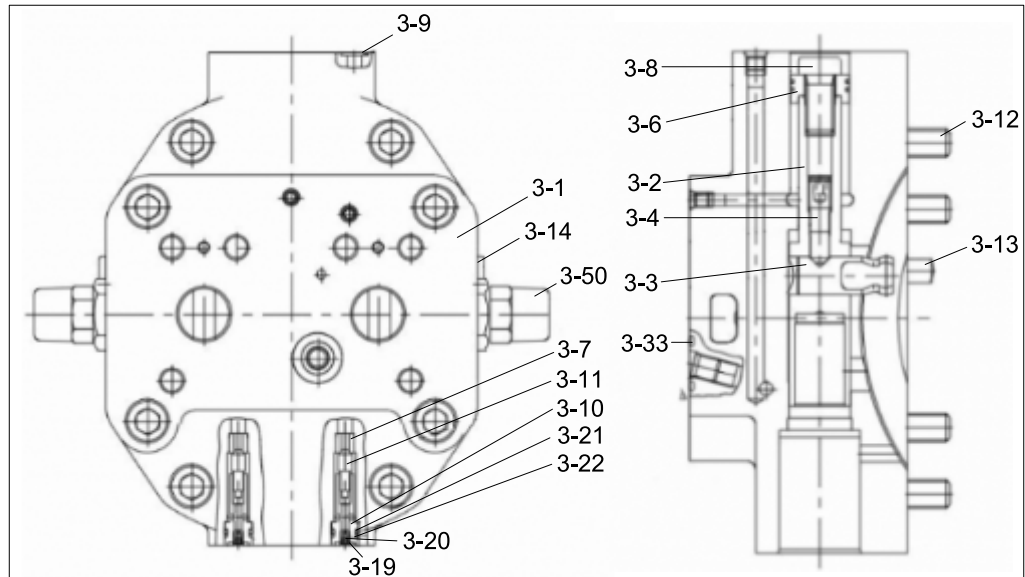
3 Port plate assy

4 Control unit

ITEM 4



ITEM 3



3-1 Port plate
3-2 Positioning piston
3-3 Positioning trunnion
3-4 Threaded pin
3-6 Piston ring
3-7 Bushing
3-8 Socket screw
3-9 O-ring
3-10 Valve guide
3-11 Socket bolt
3-12 Socket screw
3-13 Cylinder pin

3-14 Locking screw
3-19 O-ring
3-20 Throttle screw
3-21 O-ring
3-22 Back up ring
3-33 O-ring
3-50 Relief valve
4-1 Control housing
4-2 Control bushing
4-3 Control piston
4-4 Adjust bushing
4-5 Spring collar

4-7 Pressure spring
4-9 Pressure spring
4-14 O-ring
4-15 Socket screw
4-16 Locking screw
4-17 Retainer ring
4-19 Thread pin
4-20 Cylinder pin
4-21 Seal lock nut
4-22 Break pin
4-29 Retainer disc

210WA2TR12

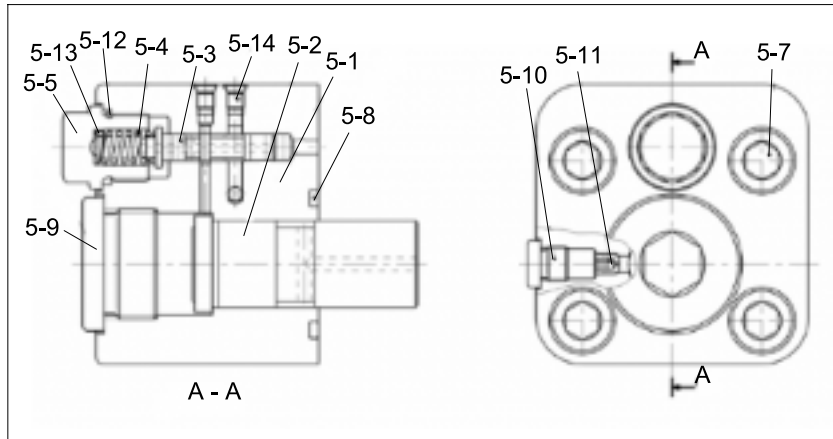
PARTS LIST (3/3)

MOTOR ASSY

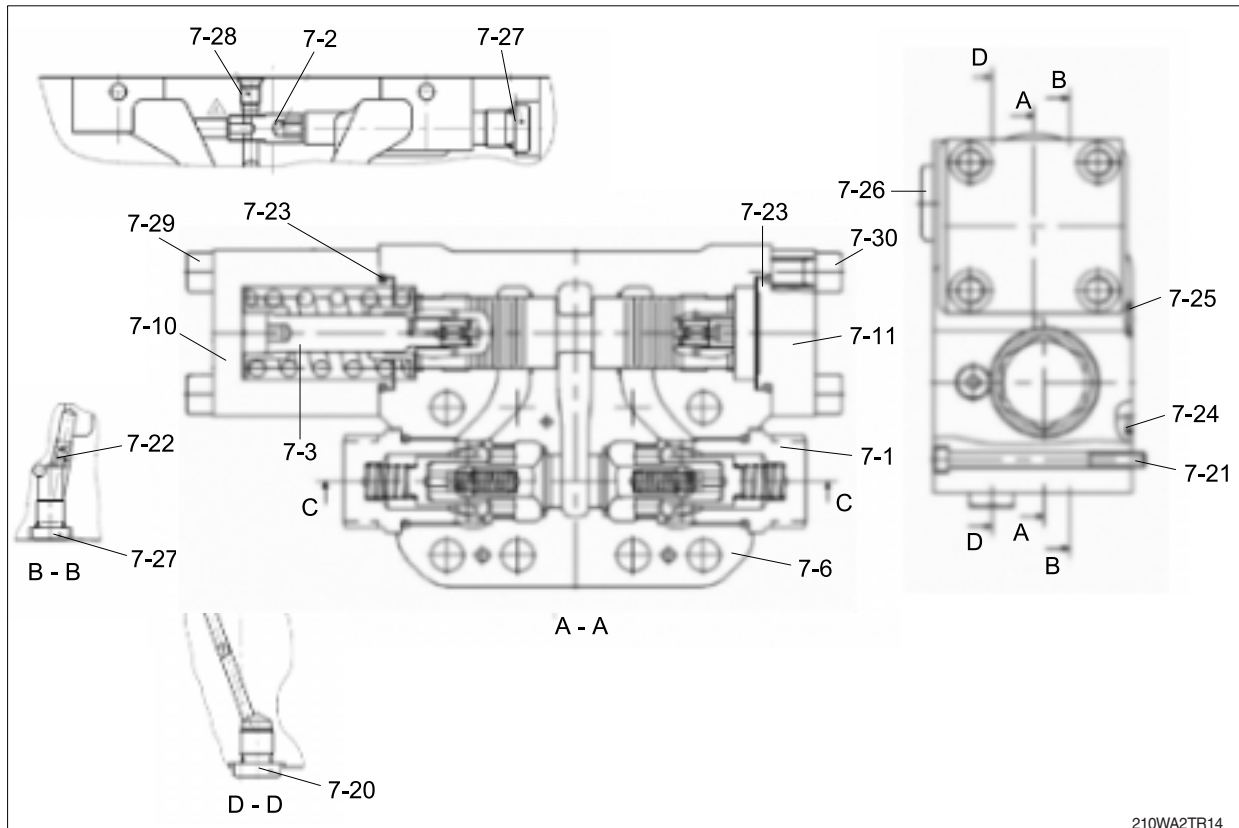


- 5 Hydraulic stroke limiter
7 Motion control valve assy

ITEM 5



ITEM 7



210WA2TR14

- | | | |
|---------------------|------------------------|--------------------|
| 5-1 Limiter housing | 5-12 O-ring | 7-21 Socket screw |
| 5-2 Piston | 5-13 Shim | 7-22 Plug |
| 5-3 Control piston | 5-14 Break pin | 7-23 O-ring |
| 5-4 Pressure spring | 7-1 Control valve assy | 7-24 O-ring |
| 5-5 Lock screw | 7-2 Shuttle valve | 7-25 O-ring |
| 5-7 Cap screw | 7-3 Brake piston assy | 7-26 Locking serew |
| 5-8 O-ring | 7-6 Housing | 7-27 Locking screw |
| 5-9 Lock screw | 7-10 Cover | 7-28 Break pin |
| 5-10 Lock screw | 7-11 Cover | 7-29 Socket serew |
| 5-11 Orifice | 7-20 Locking screw | |

3. TIGHTENING TORQUE

The torques given are standard figures. Any figures specifically described in the procedure has priority.

Page	Item	Size	kgf · m	lbf · ft
8-94	1-2	M22 × 1.5	6.1	44
	1-3	M26 × 1.5	7.1	51
	1-11	M12	7.0	50.9
	2-2-12	M 6 × 20	1.4	10.3

4. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

(1) Disassembly

- ① Before disassembling the motor, check the items to be inspected and, for remedy against trouble, closely examine the nature of the trouble, so that the motor can be disassembled effectively.
- ② To disassemble the motor, use the disassembling procedures described in section 2) and select a clean place.
- ③ Place a rubber or vinyl sheet or other such protective materials on your working bench to protect the surface of the motor to be serviced.
- ④ During disassembly, give a match mark to the mating surfaces of each part.
- ⑤ Arrange removed parts in order so that they will not become damaged or missing during disassembly.
- ⑥ Once seals have been disassembled, they should be replaced even if damage is not observed. Have replacement seals ready on hand before starting your disassembling job.

(2) Assembly

- ① Reassemble in a work area that is clean and free from dust and grit.
- ② Handle parts with bare hands to keep them free of linty contaminants.
- ③ Repair or replace the damaged parts.
Each parts must be free of burrs its corners.
- ④ Do not reuse O-ring oil seal and floating seal that were removed in disassembly.
Provide the new parts.
- ⑤ Wash all parts thoroughly in a suitable solvent.
Dry thoroughly with compressed air.
Do not use the cloths.
- ⑥ When reassembling oil motor components of motor, be sure to coat the sliding parts of the motor and valve with fresh hydraulic oil. (NAS class 9 or above)
- ⑦ Use a torque wrench to tighten bolts and plugs, to the torque specified as follows.

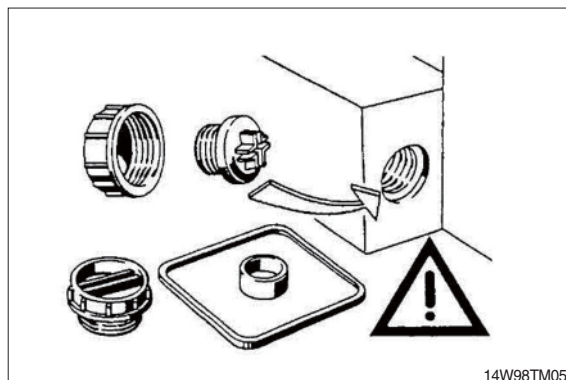
2) SEAL KITS AND COMPONENT GROUPS

Observe the following notices when carrying out repair work at hydraulic aggregates.



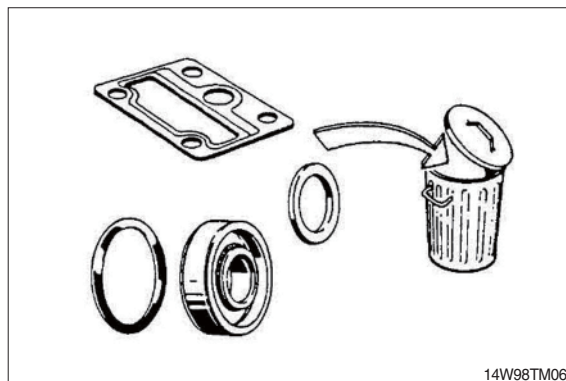
14W7TM004

- (1) Close all ports of the hydraulic aggregates.



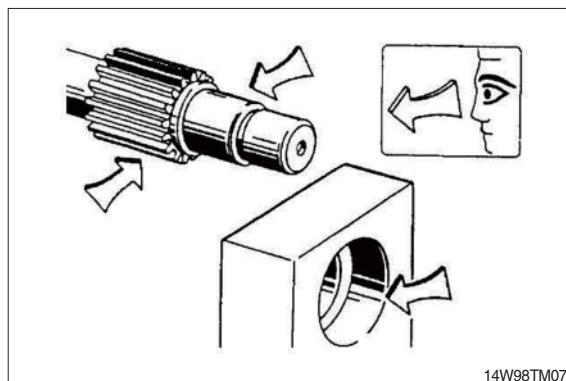
14W98TM05

- (2) Replace all seals.
Use only original spare parts.



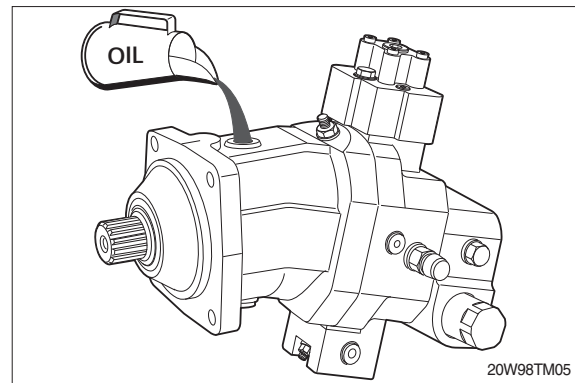
14W98TM06

- (3) Check all seal and sliding surfaces for wear.
※ Rework of sealing area f.ex. with abrasive paper can damage surface.

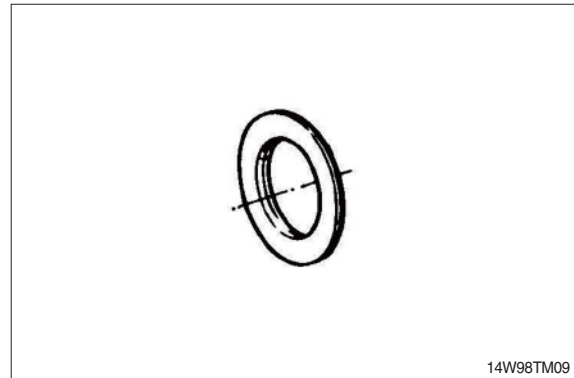


14W98TM07

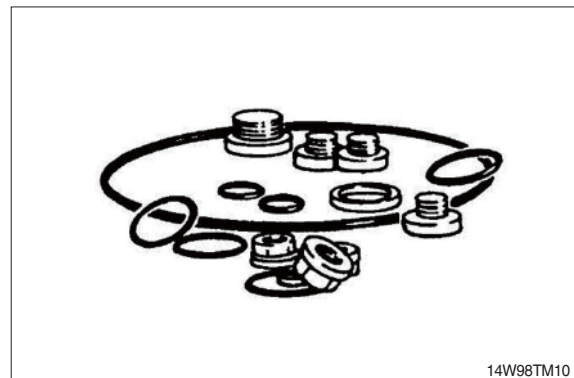
- (4) Fill up hydraulic aggregates with hydraulic oil before start up.
※ Without fill up bearing damage happens!



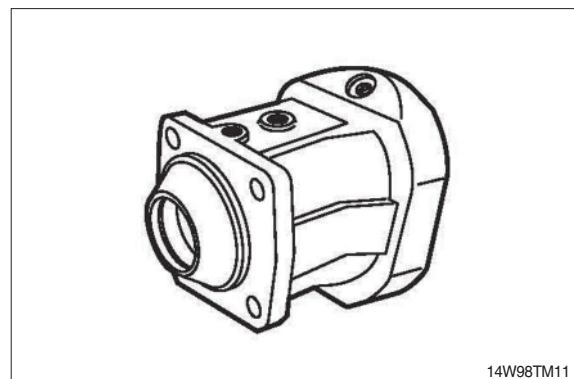
- (5) Seal kit for drive shaft



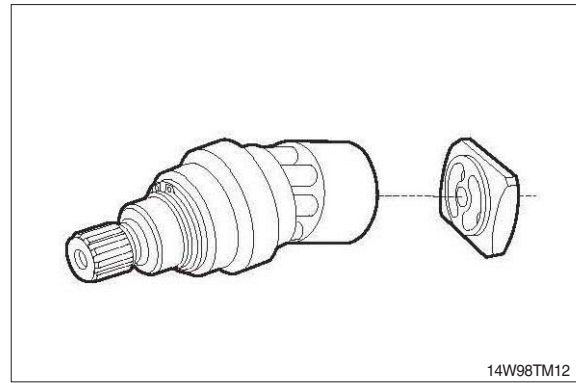
- (6) External seal kit.



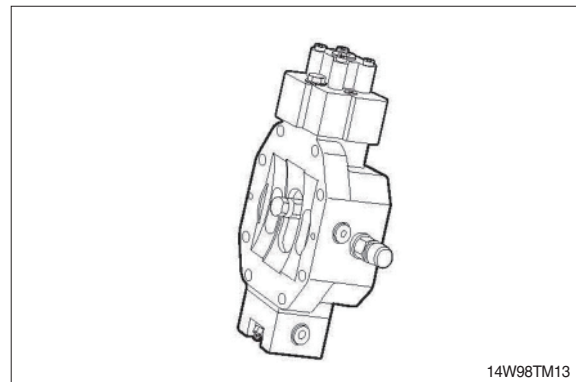
- (7) Housing.



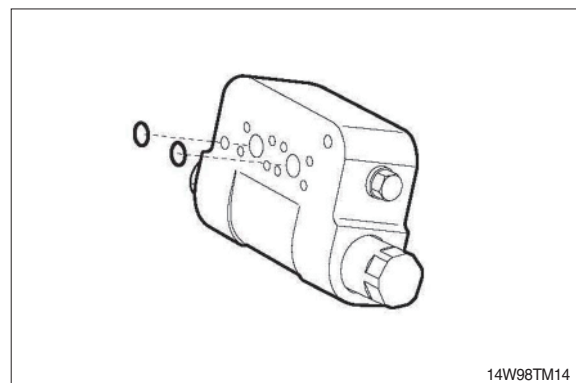
(8) Complete rotary group.



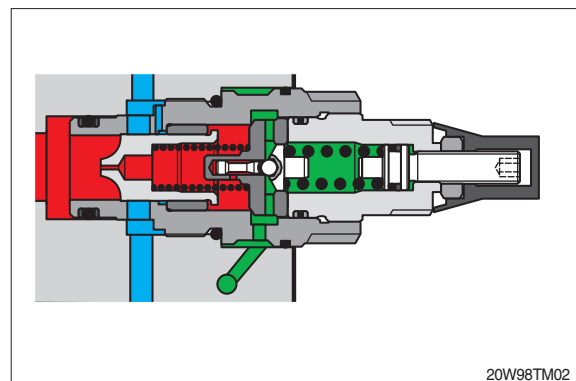
(9) Port plate with control piston.



(10) Counter balance valve.

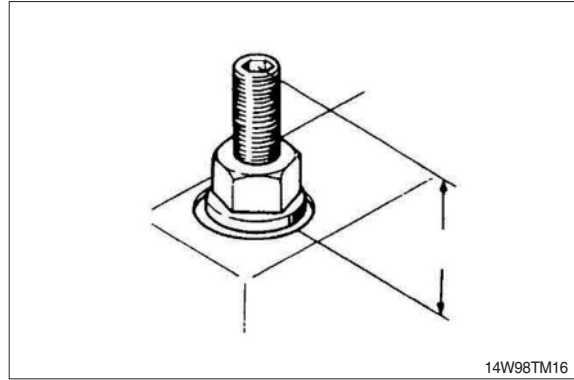


(11) Relief valve.

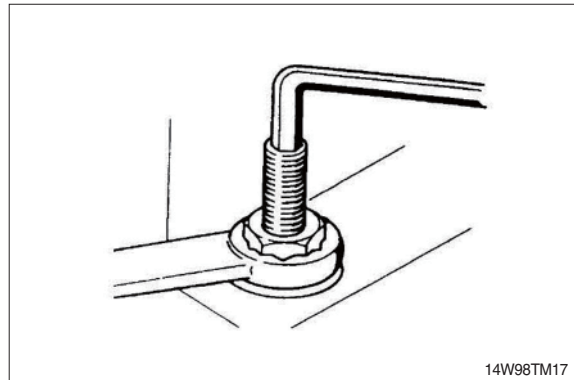


3) SEAL NUT

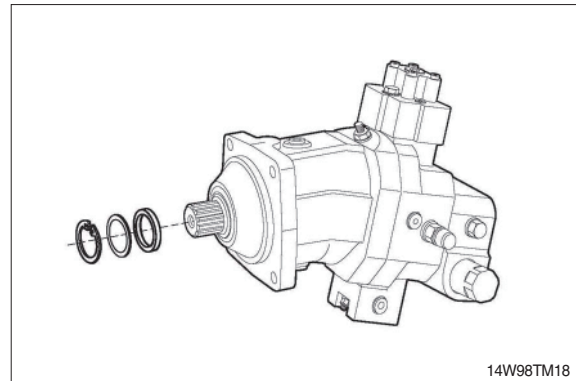
- (1) Replace seal nut.
First measure and record setting height.



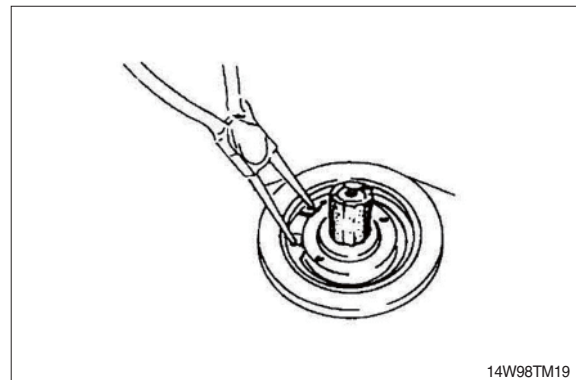
- (2) When tightening, counterhold setting screw, then check setting height.



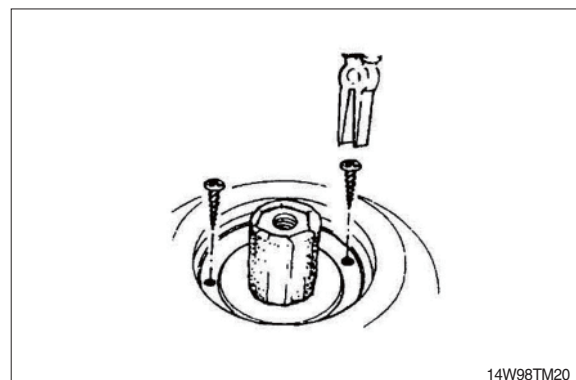
4) SEALING THE DRIVE SHAFT



- (1) Protecting the drive shaft.
Remove retaining ring and shim.



- (2) Screw in sheet metal screw into the holes
fitted with rubber.
Pull out seal with pliers.

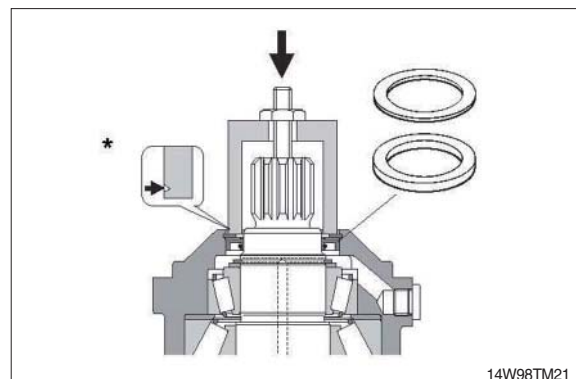


- (3) Press in shaft seal and shim with bush to
stop.

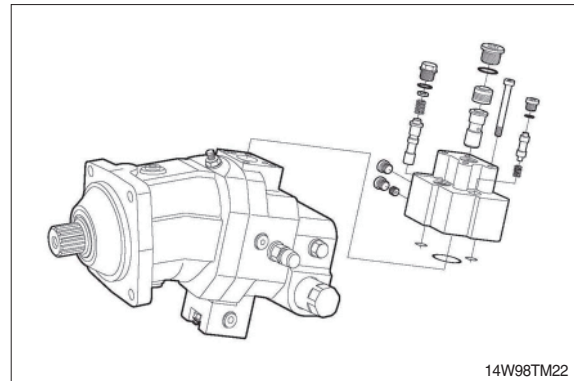
▲ Pay attention to pressing depth.

* Mark for pressing depth.

Assemble retaining ring.

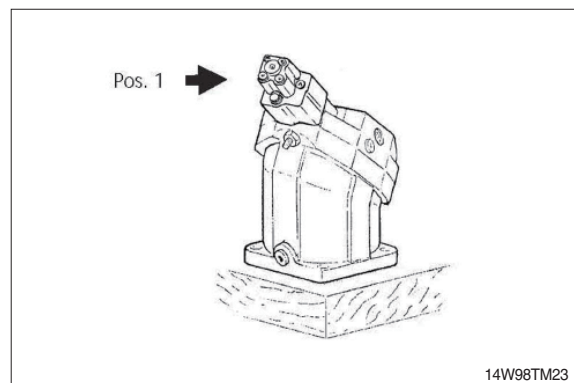


5) SEALING OF THE CONTROL PARTS



(1) Disassembly position

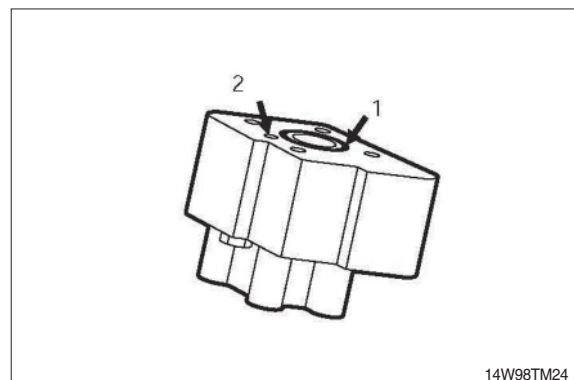
Remove cover pos. 1.



1 O-ring

2 Input flow of oil control

※ Installation position differs according to the control components.



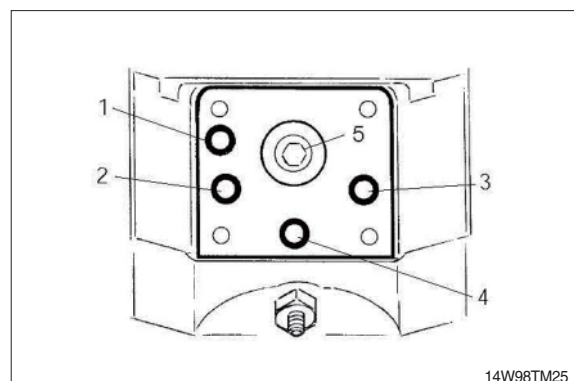
1 Input flow of oil control

2 High pressure / Low pressure

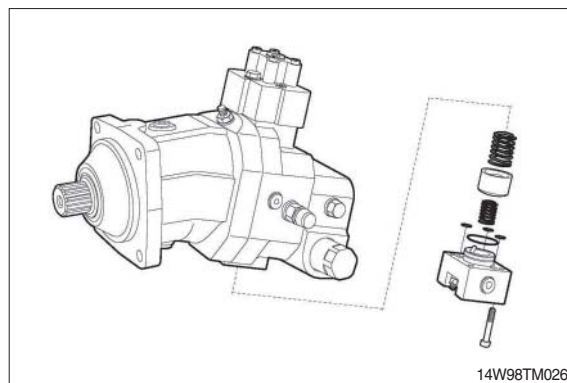
3 High pressure / Low pressure

4 Leakage oil

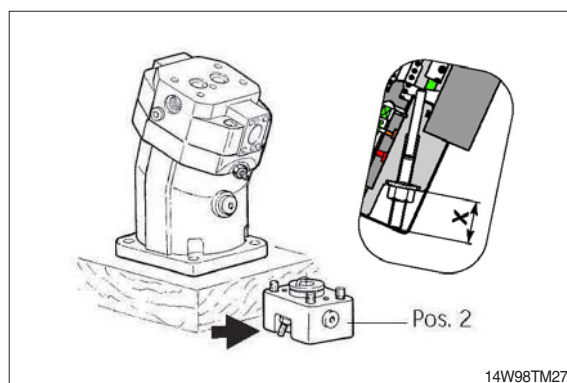
5 Control piston



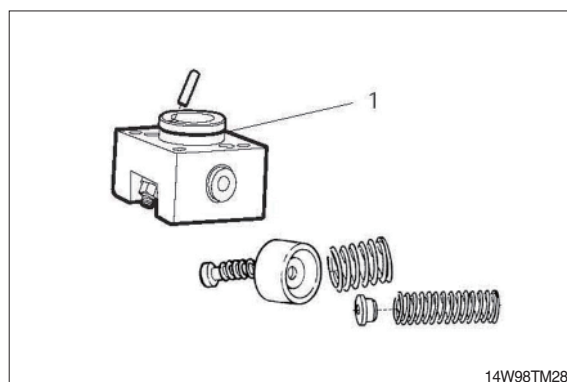
- (2) Disassembly position : Remove cover 2.
 ※ Attention spring load.



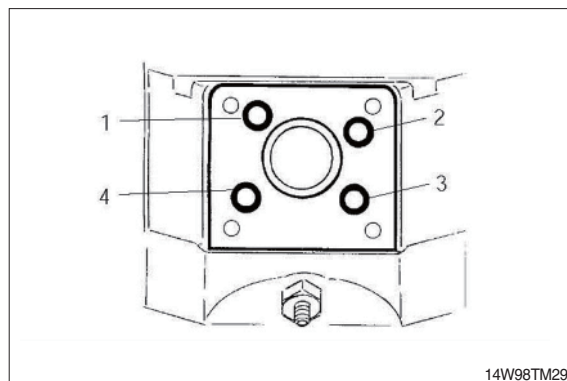
- ※ Dimension X : Note dimension (begin of regulation)



- 1 Check of O-ring

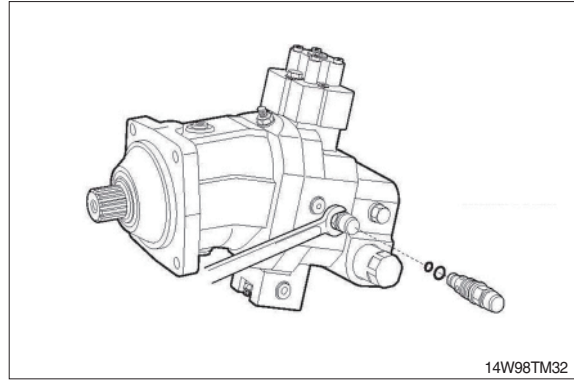


- 1 O-ring / High pressure-small control position side
 2 O-ring / Control pressure
 3 O-ring / High pressure-check valve
 4 O-ring / High pressure-check valve

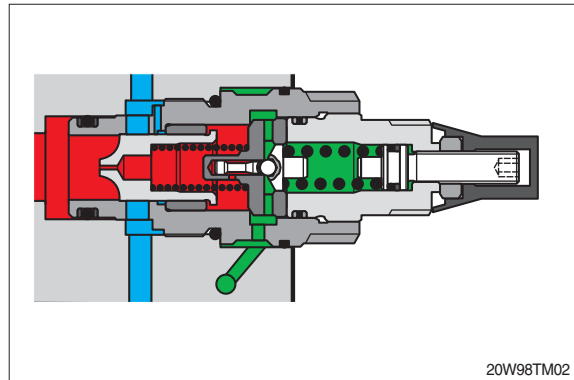


6) SEALING OF THE RELIEF VALVE / COUNTER BALANCE VALVE

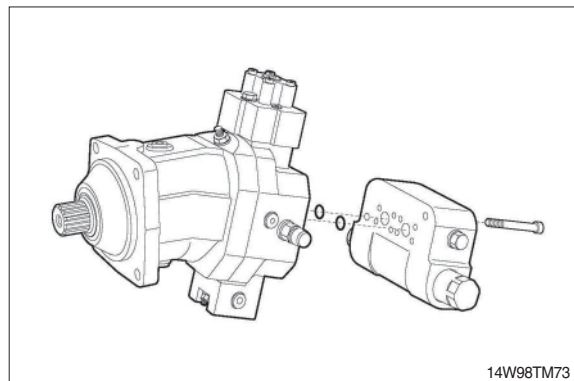
(1) Remove relief valve.



(2) Inspect
O-ring



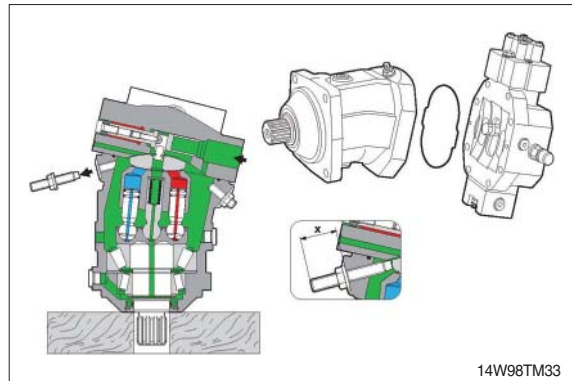
(3) Remove counter-balance valve.
Inspect
O-ring



7) DISASSEMBLY OF THE PORT PLATE

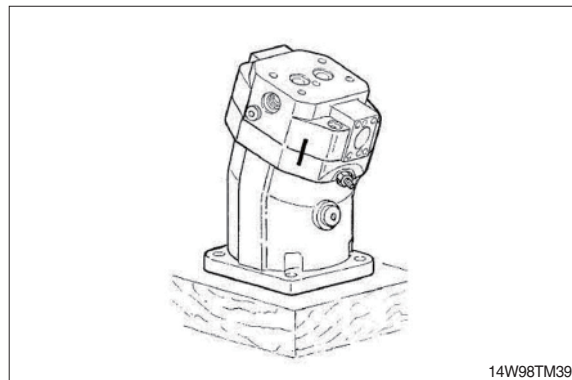
- Note dimension X
- Remove Q_{min} screw
- Swivel rotary group to zero P

※ For disassembly of the port plate, swivel always rotary group to zero position. Piston rings to hang out of the cylinder boring.



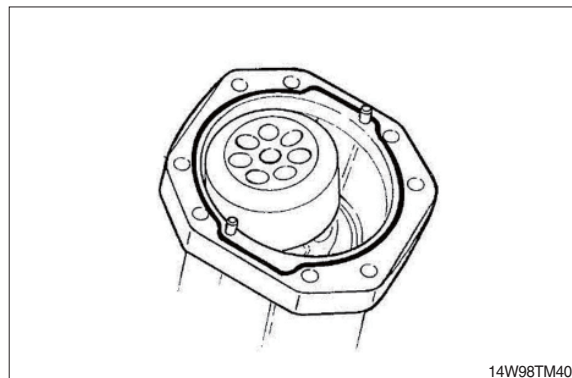
(1) Port plate.

Mark position. Loosen screws.
Removal.

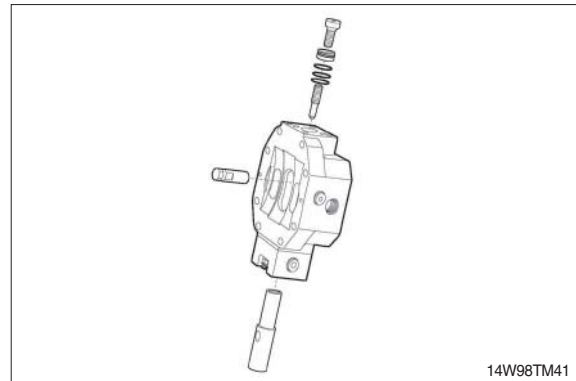


(2) Check O-ring.

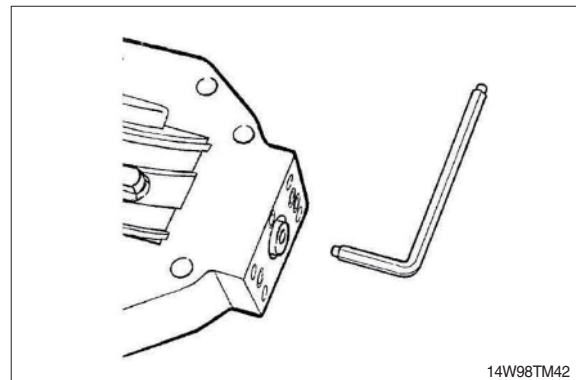
- ※ Stick new O-ring with some grease.
- Do not swivel rotary group.
- Piston rings to hang out from the cylinder boring.



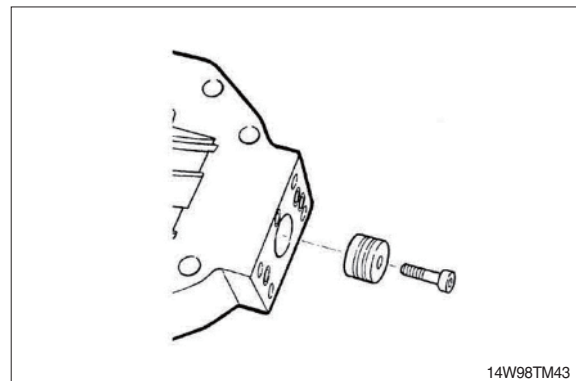
8) REMOVE OF THE POSITIONING PISTON



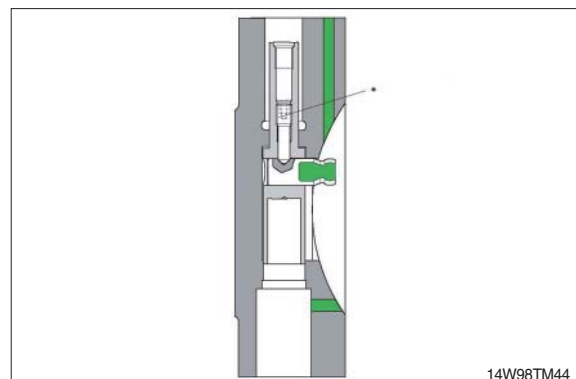
- (1) Loosen fixing screw.
Use only socket wrench.



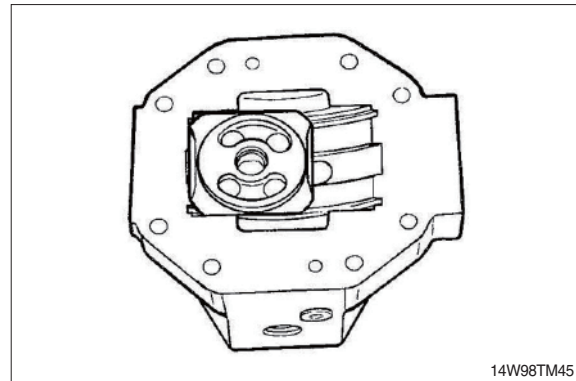
- (2) Remove piston with piston ring.



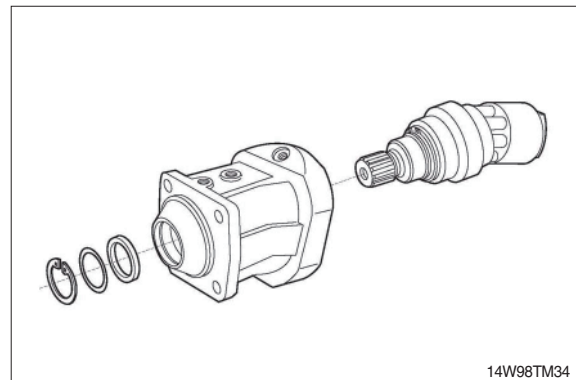
- (3) Warm up fixation screw * for positioning plug via boring (screw glued-to turn out).
※ Use new screw.
Precote coating.
Note tightening torque.



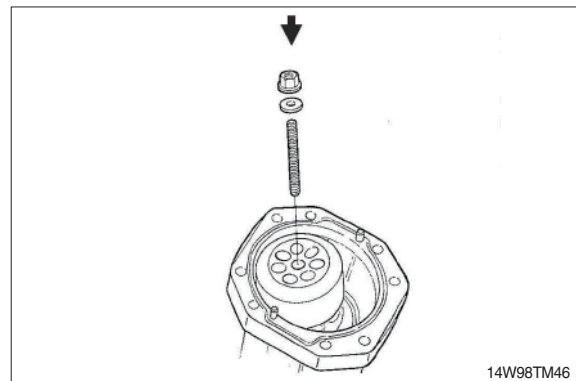
- ※ Stick control lens in sliding surface with grease. Assembly in reversal order. Mount port plate.
- ※ Rotary group vertical.



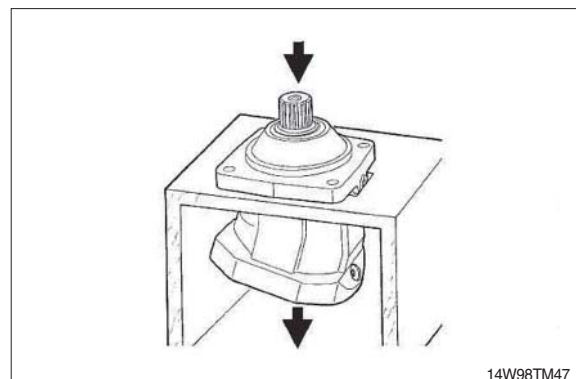
9) REMOVE ROTARY GROUP



- (1) Screw in threaded pin into center pin.
Fix the cylinder with disc and locknut.
M8×105 ℓ

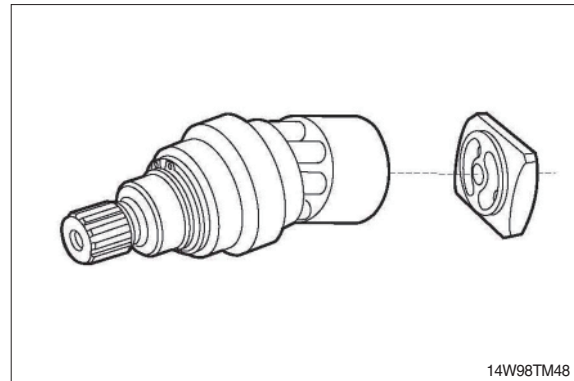


- (2) Press out rotary group.
- ※ If the bearings are used again do not hit on the drive shaft.



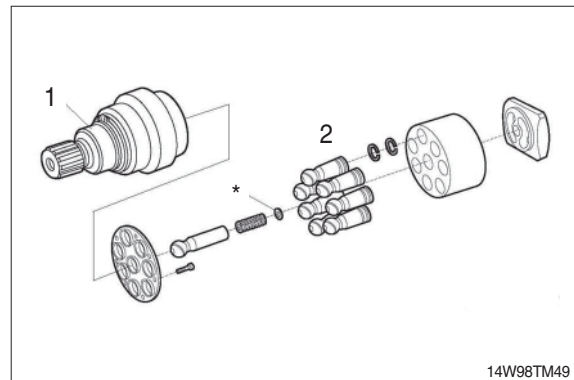
10) EXCHANGING OF THE ROTARY GROUP

- ※ Complete rotary group
Setting of hydraulic part necessary.

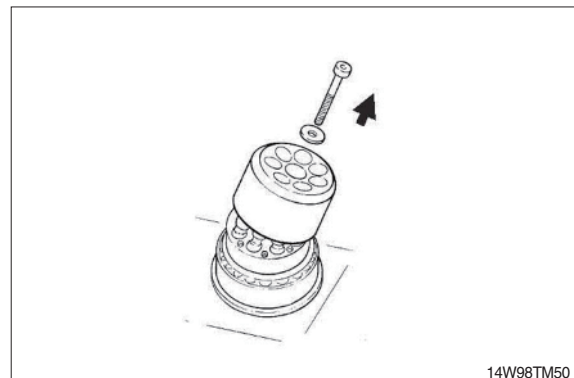


Rotary group

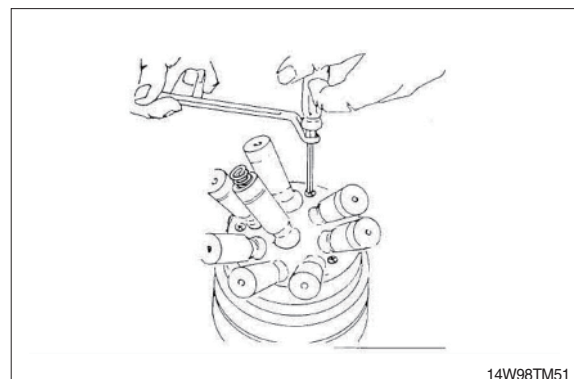
- 1 Mechanical part : Adjust drive shaft with bearing
- 2 Hydraulic part : Adjustment necessary



- (1) Remove fixing screw (cylinder).
Remove cylinder.

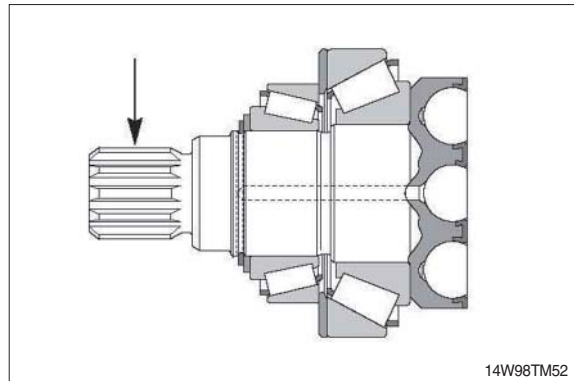


- (2) Disassemble retaining plate.
※ Screws are glued.
Use Torx tools.



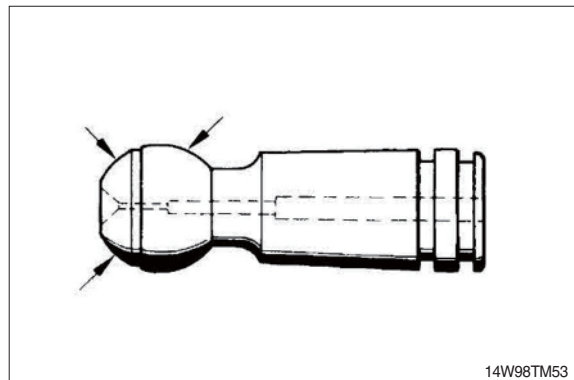
11) INSPECTION INSTRUCTIONS

- (1) Free of corrosion, erosion or fretting; No damage to splines or keyways.



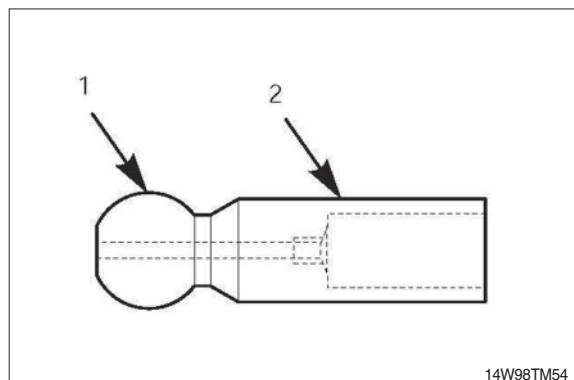
(2) Pistons

No scoring and no pittings.



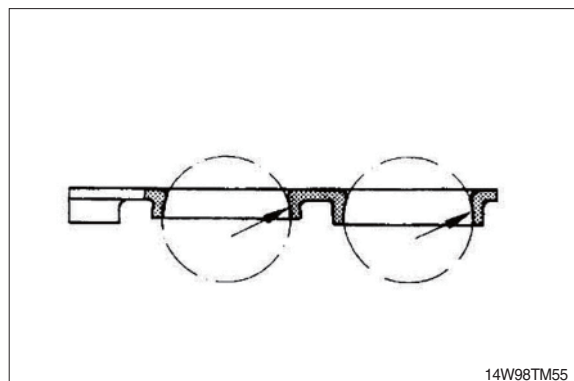
(3) Center pin

No scoring and no pittings.



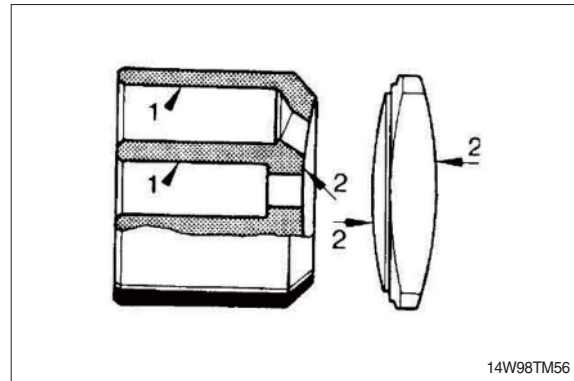
(4) Retaining plate

No scoring and no evidence of wear.



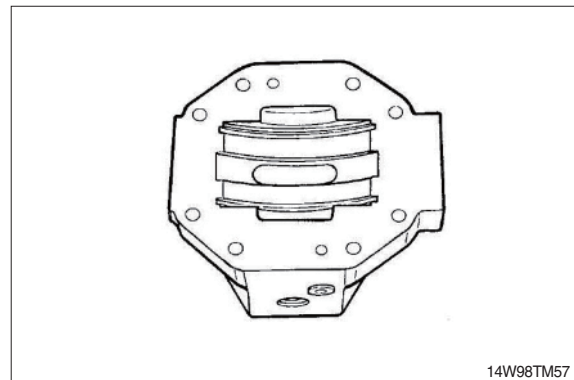
(5) Cylinder block / Control lens

- 1 Bores free of scoring, no evidence of wear
- 2 Faces smooth and even, free of cracks and scoring



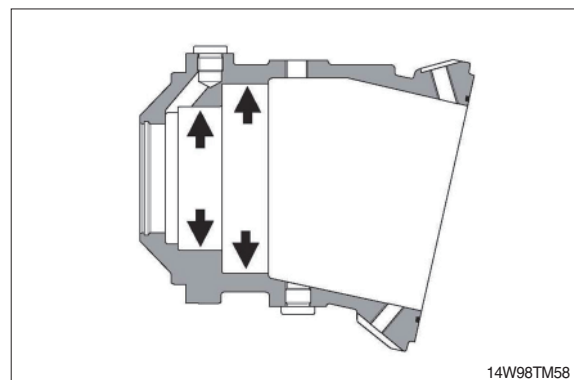
(6) Control housing

Sliding surface and side guides free of scoring and no wear.



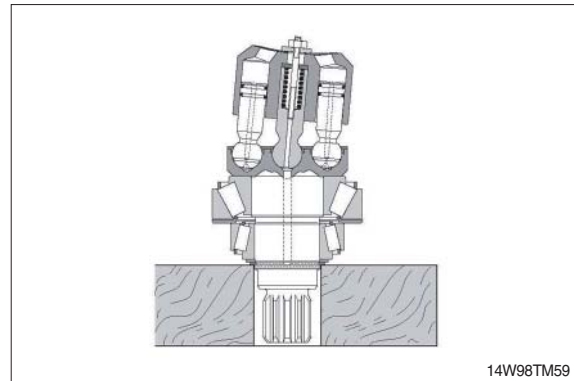
(7) Visual check

Bearing areas free of scoring and no evidence of wear.

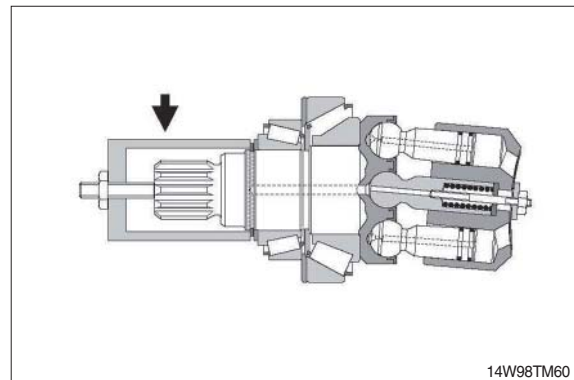


12) ROTARY GROUP ASSEMBLY

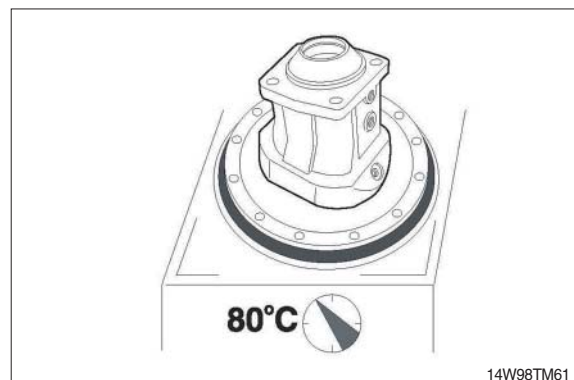
- (1) Rotary group completely assembled ready for assembly.



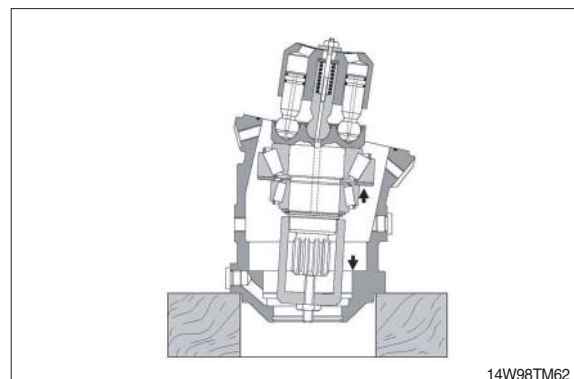
- (2) Place assembly sleeve.



- (3) Warm up housing to 80°C.

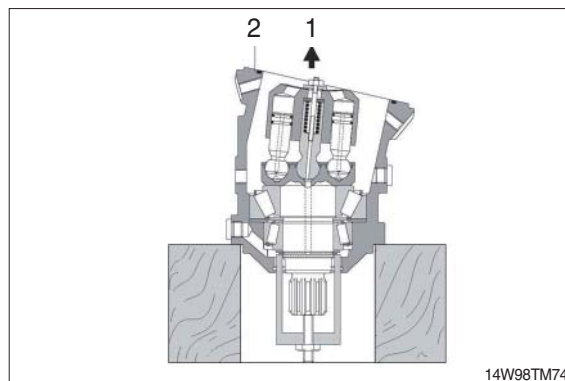


- (4) Insert rotary group into housing to seat position.



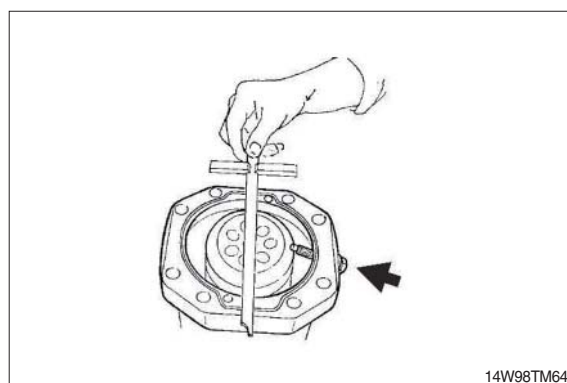
(5) Fix zero position of cylinder with Q_{max} screw.

- 1 Disassemble cylinder fixing screw
- 2 Insert O-ring

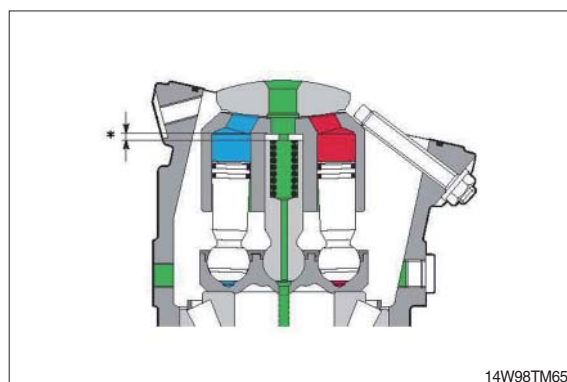


13) ROTARY GROUP ADJUSTMENT

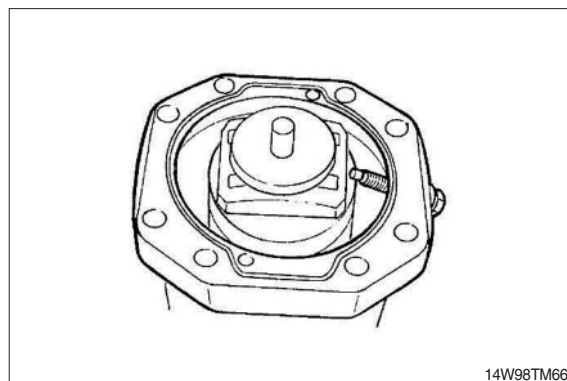
(1) Determine cylinder swivel range to max angle with screw.



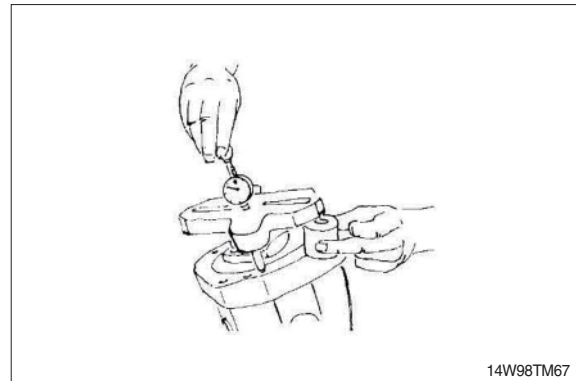
(2) * Disc



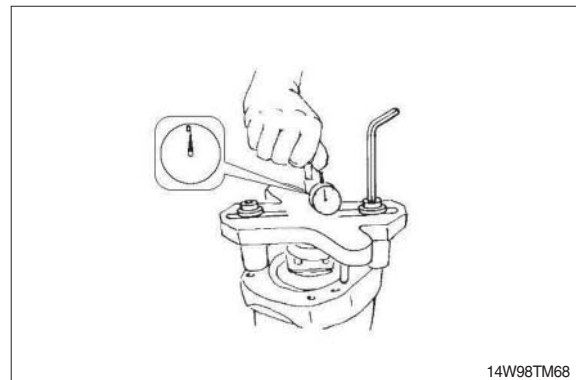
(3) Place centering disc.



(4) Mount measuring device.

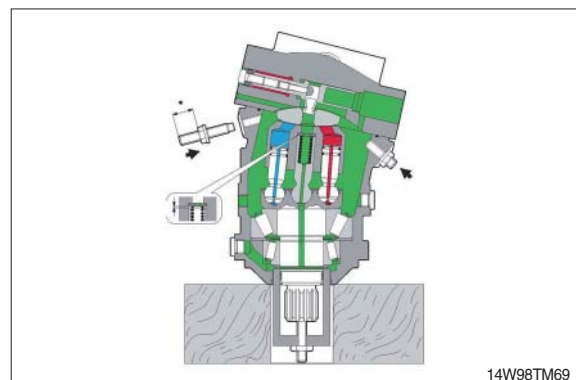


(5) Check dimension X.

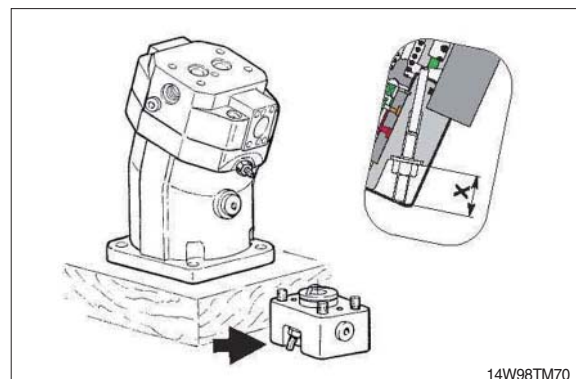


14) ASSEMBLY OF THE PORT PLATE

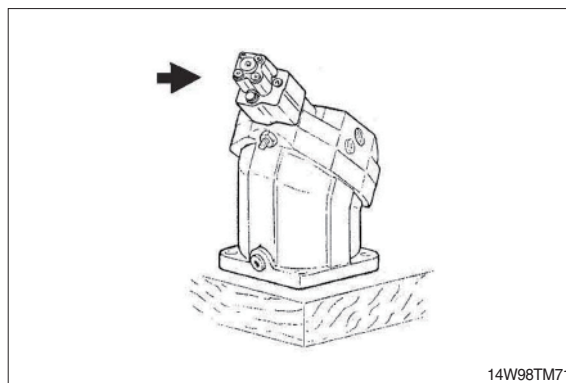
- (1) Assemble port plate.
 - ※ Take care of assembly design.
 - Tighten fixing screws with torque.
- (2) Set Q_{min} screw to dimension(*).
- (3) Assemble plug.
- (4) Remove assembly sleeve.



(5) Assemble control components.



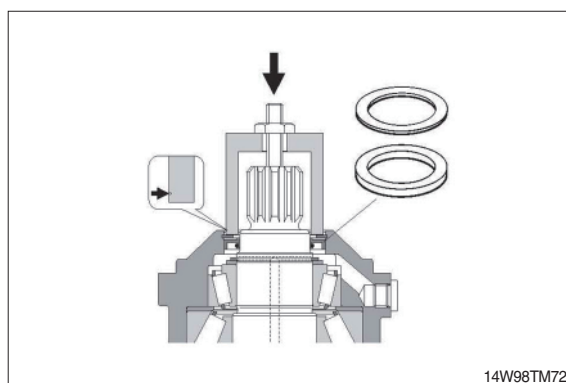
(6) Assemble cover.



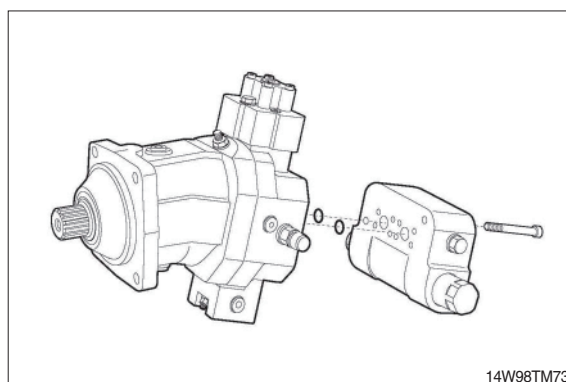
(7) Assemble shaft seal, disc and safety ring.

Press in with assembly sleeve.

※ Take care of press in depth.



(8) Assemble counter balance valve.



GROUP 7 TRANSMISSION

1. REMOVAL AND INSTALL

1) REMOVAL

- (1) Swing the work equipment 90° and lower it completely to the ground.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (4) Loosen the mounting bolt (5) and remove the transmission guard.

· Tightening torque : $29.7 \pm 4.5 \text{ kgf} \cdot \text{m}$
($215 \pm 32.5 \text{ lbf} \cdot \text{ft}$)

- (5) Remove the propeller shaft mounting nuts (1).

· Tightening torque : $5.9 \pm 0.6 \text{ kgf} \cdot \text{m}$
($42.7 \pm 4.3 \text{ lbf} \cdot \text{ft}$)

- (6) Remove the travel motor mounting bolt (2).

· Tightening torque : $35.6 \pm 7.1 \text{ kgf} \cdot \text{m}$
($257 \pm 51.4 \text{ lbf} \cdot \text{ft}$)

- (7) Remove the hoses (3).

Fit blind plugs to the disconnected hoses.

- (8) Remove the mounting bolts (4), then remove the transmission device assembly.

· Weight : 135 kg (298 lb)
· Tightening torque : $44 \pm 2.0 \text{ kgf} \cdot \text{m}$
($318 \pm 14.5 \text{ lbf} \cdot \text{ft}$)

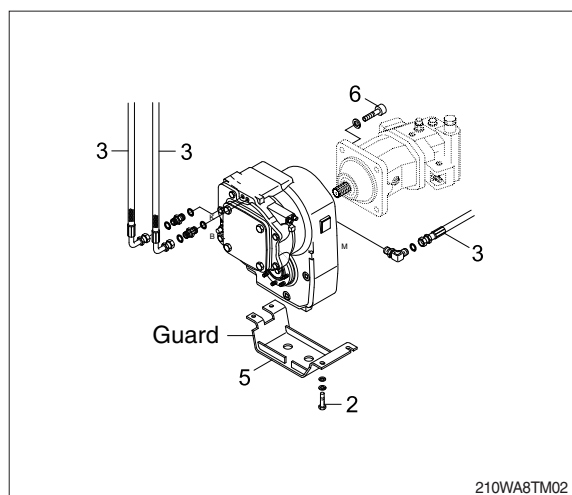
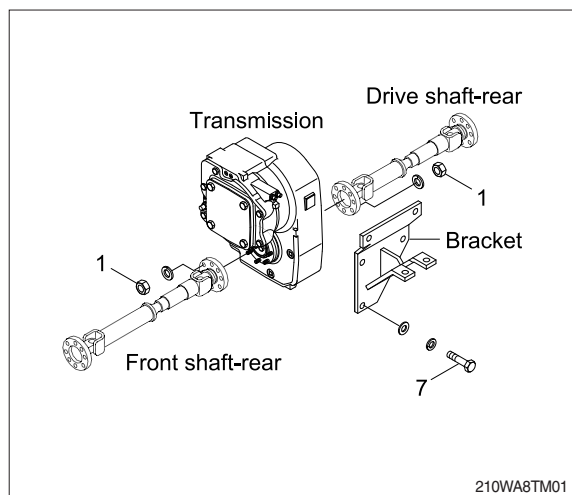
2) INSTALL

- (1) Carry out installation in the reverse order to removal.

- (2) Bleed the air from the transmission.

- ① Remove the air vent plug.
- ② Pour in hydraulic oil until it overflows from the port.
- ③ Tighten plug lightly.
- ④ Start the engine, run at low idling, and check oil come out from plug.
- ⑤ Tighten plug fully.

- (3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.



2. GENERAL INSTRUCTIONS

1) GENERAL WORKING INSTRUCTIONS

- (1) This manual has been developed for the skilled serviceman, trained by manufacturer.
- (2) During all operations, pay attention to cleanliness and skilled working.
Therefore, transmission removed from the machine must be cleaned prior to open them.
- (3) We assume that the special tools, specified by manufacturer, will be used.
The special tools are available from manufacturer.
- (4) After the disassembly, all components must be cleaned, especially corners, cavities and recesses of housing and covers.
- (5) The old sealing compound must be carefully removed.
- (6) Check lubricating holes, grooves and pipes for free passage. They must be free of residues, foreign material or protective compounds.
- (7) The latter refers especially to new parts.
- (8) Parts which have been inevitably damaged in a disassembly operation, must be generally replaced by new ones, e.g. rotary seal rings, O-rings, U-section rings, cap boots, protective caps etc..
- (9) Components such as roller bearings, thrust washers, synchronizing parts etc. which are subject to normal wear in automotive operation, must be checked by the skilled Serviceman.
He will decide if the parts can be reused.
- (10) For the heating of bearings etc., hot plates, rod heaters or heating furnaces must be used.
- (11) Never heat parts directly with the flame. An auxiliary solution would be to immerse the bearing in a vessel filled with oil, which is then heated with the flame.
In this way, damage to the bearings could be avoided.
- (12) Ball bearings, covers, flanges and parts like that must be heated to about 90 to 100°C.
- (13) Hot-mounted parts must be reset after cooling in order to assure a proper contact.
- (14) Before pressing shafts, bearings etc. in position, both parts must be lubricated.
- (15) During to reassembly, all specified adjustment values, testing specifications and tightening torque must be respected.
- (16) After the repair, units are filled up with oil.
- (17) After the oil filling, the oil level plugs and oil drain plugs must be tightened to the specified tightening torque.

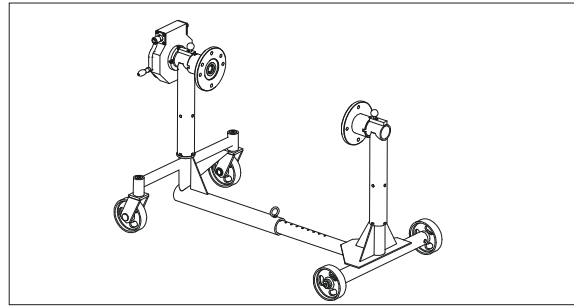
2) IMPORTANT INSTRUCTIONS CONCERNING THE LABOUR SAFETY

- (1) In principle, repairers are themselves responsible for the labour safety.
- (2) The observance of all valid safety regulations and legal rules is a precondition to prevent damage to individuals and products during the maintenance and repair operations.
- (3) Before starting the work, the repairers have to make themselves familiar with these regulations.
- (4) The proper repair of these products requires especially trained personnel.
- (5) The repairer himself is obliged to provide for the training.

3. SPECIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

- 1) Assembly truck assy with tilting device

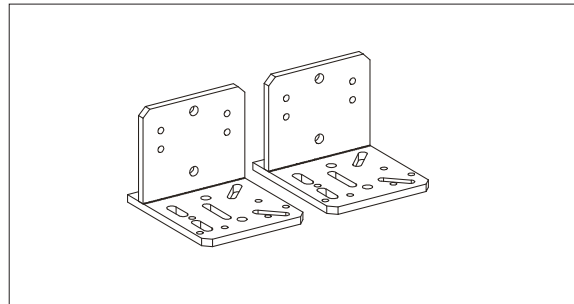
5870 350 000



14WF8TM01

- 2) Supporting bracket

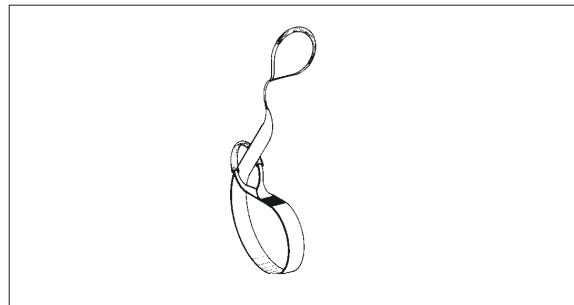
5870 350 106



14WF8TM02

- 3) Lifting strap

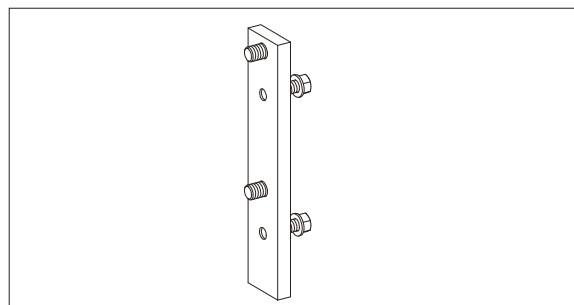
5870 281 026



14WF8TM03

- 4) Fixture

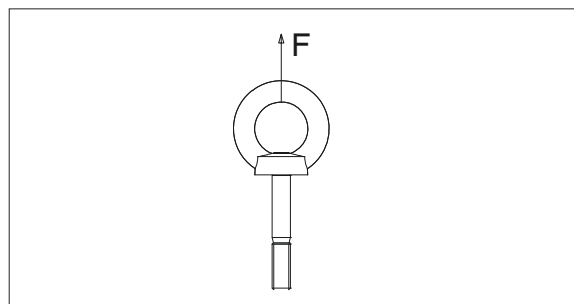
5870 350 079



14WF8TM04

- 5) Eye bolt assortment

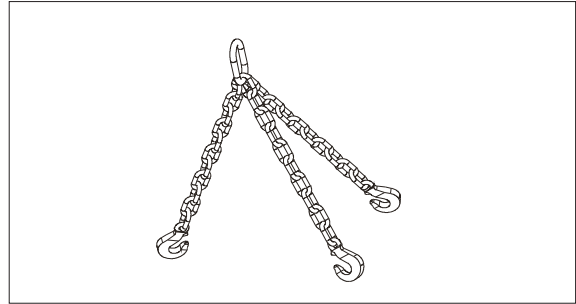
5870 204 002



14WF8TM05

6) Lifting chain

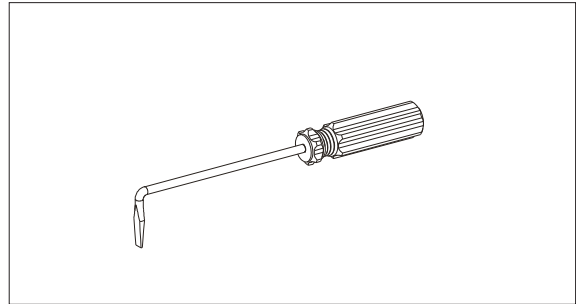
5870 221 047



14WF8TM06

7) Resetting device

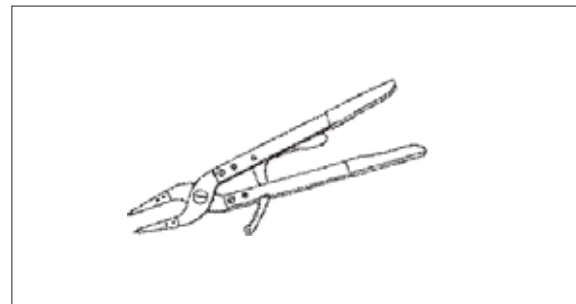
5870 400 001



14WF8TM07

8) Clamping pliers

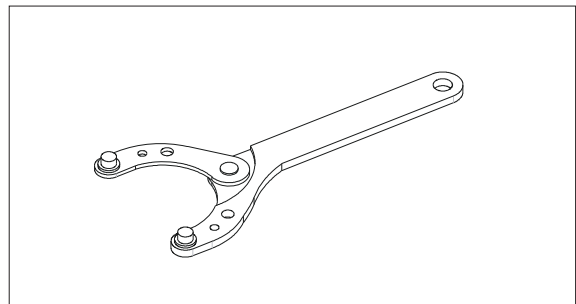
5870 900 021



14WF8TM08

9) Clamping fork

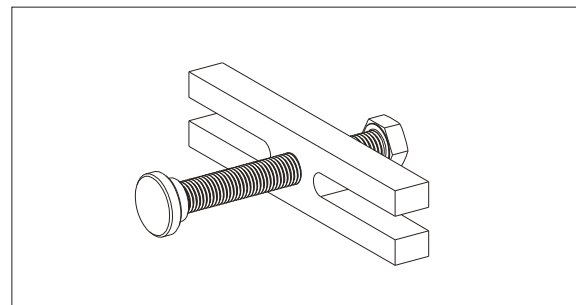
5870 240 025



14WF8TM09

10) Extractor

5870 000 017



14WF8TM10

11) Rapid grip

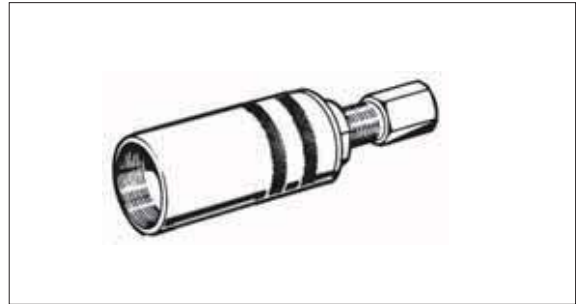
5873 012 021



14WF8TM11

12) Basic tool

5873 002 001



14WF8TM12

13) Cut-off device

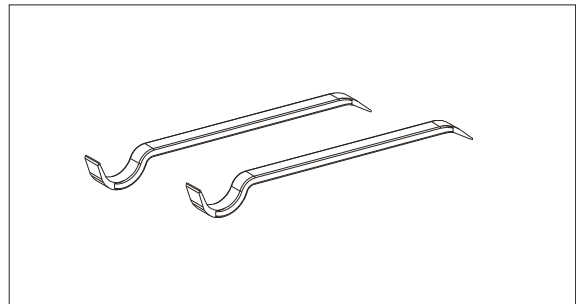
5870 300 028



14WF8TM13

14) Assembly lever

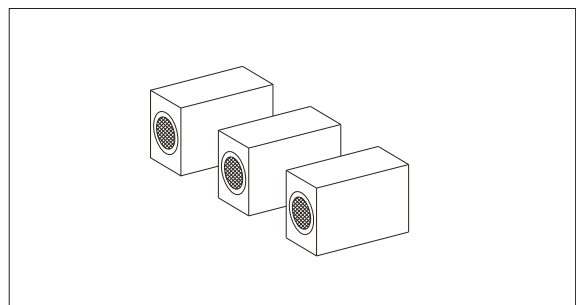
5870 345 036



14WF8TM14

15) Solenoid block

5870 450 003



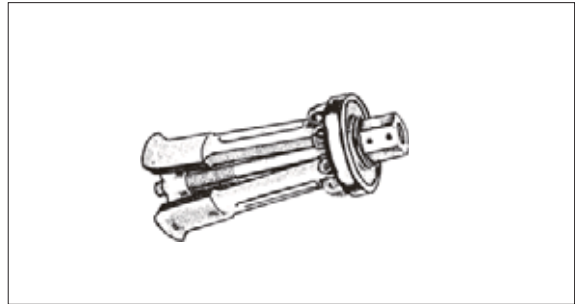
14WF8TM15

- 16) Grab sleeve
5873 001 037



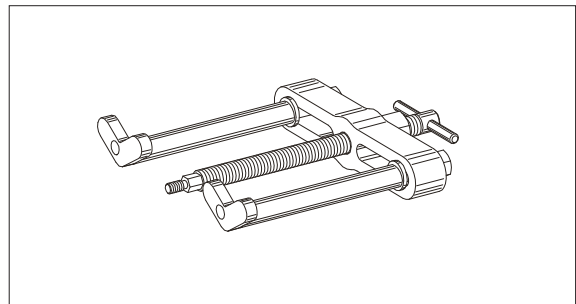
14WF8TM16

- 17) Inner extractor
5870 300 019



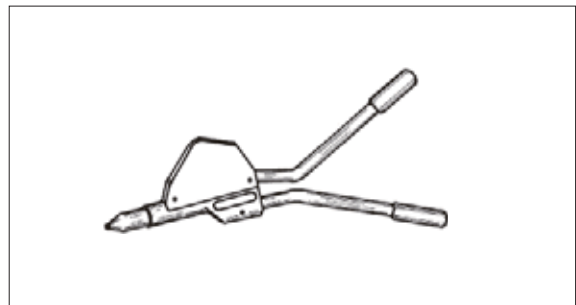
14WF8TM17

- 18) Counter support
5870 300 020



14WF8TM18

- 19) Lever riveting tongs
5870 320 016



14WF8TM19

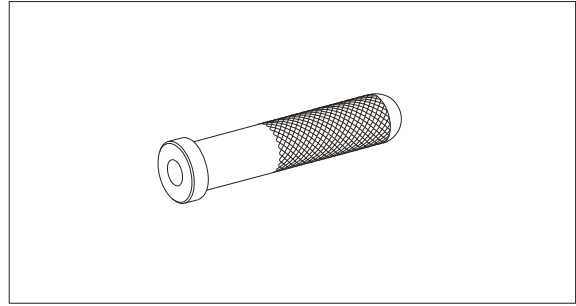
- 20) Driver tool
5870 058 073



14WF8TM20

21) Handle

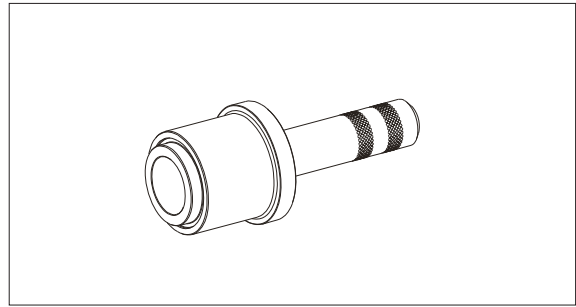
5870 260 002



14WF8TM21

22) Driver tool

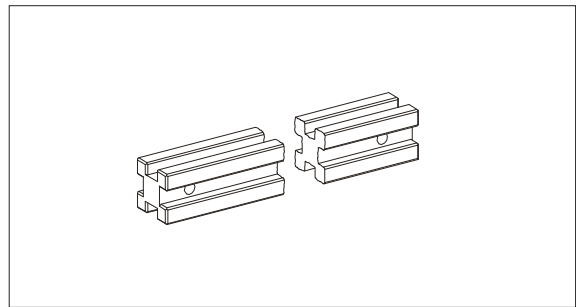
5870 048 281



14WF8TM22

23) Straightedge

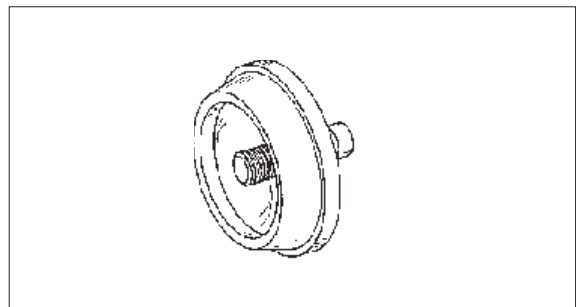
5870 200 108



14WF8TM23

24) Driver tool

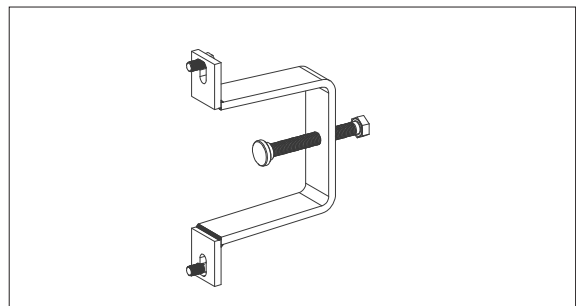
5870 058 078



14WF8TM24

25) Clamping bar

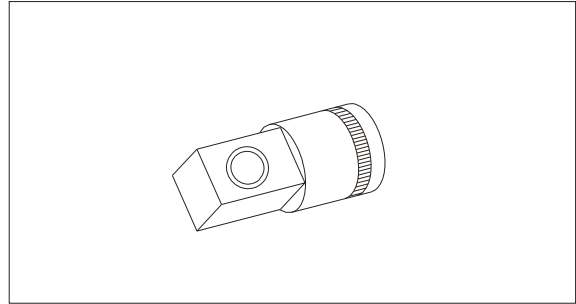
5870 654 049



14WF8TM25

26) Reduction

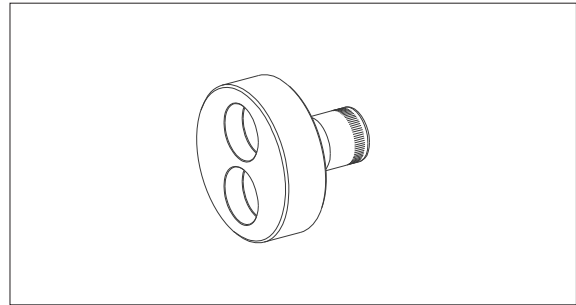
5870 656 056



14WF8TM26

27) Plug insert

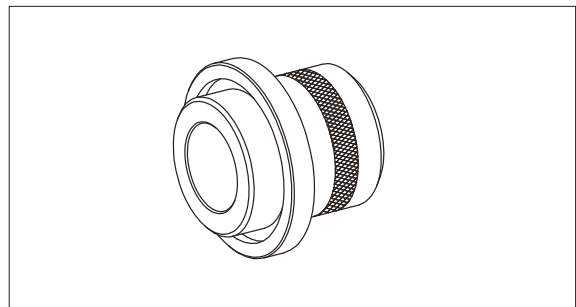
AA00 392 461



14WF8TM27

28) Driver tool

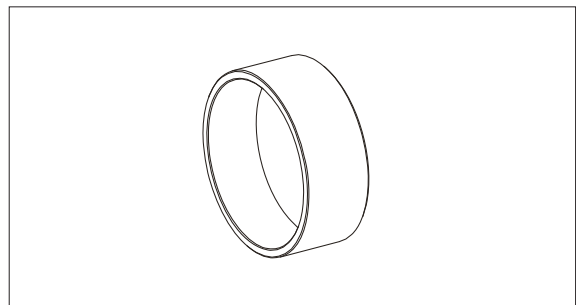
5870 048 279



14WF8TM28

29) Pressure piece

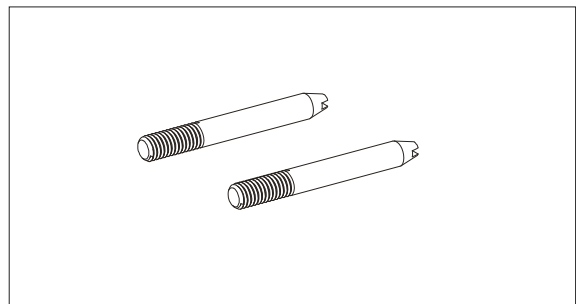
5870 506 150



14WF8TM29

30) Adjusting screws (M12)

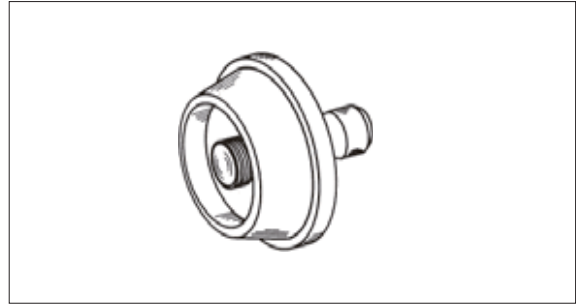
5870 204 021



14WF8TM30

31) Driver tool

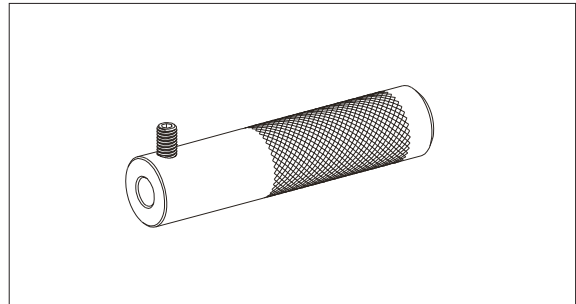
5870 058 051



14WF8TM31

32) Press-fit mandrel

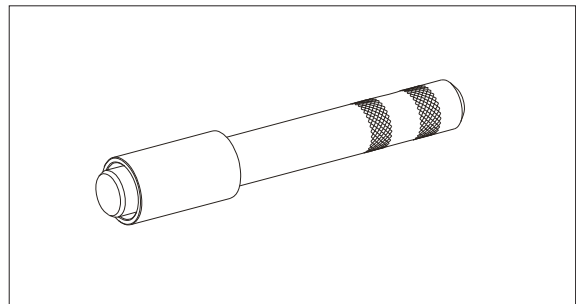
AA00 392 151



14WF8TM32

33) Driver tool

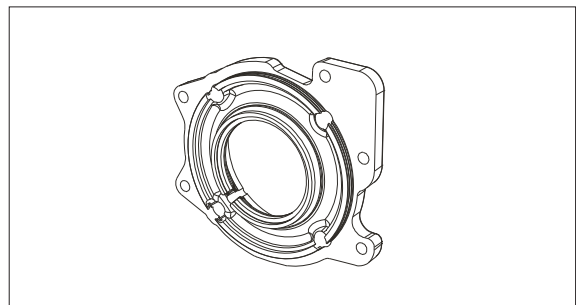
5870 048 283



14WF8TM33

34) Measuring device

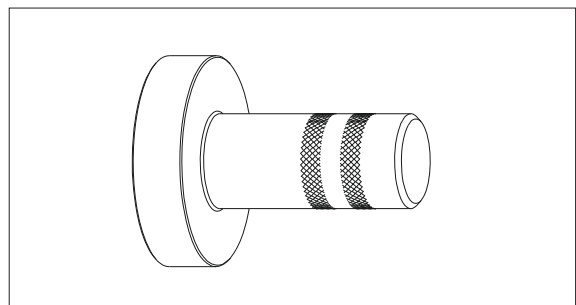
5870 200 131



14WF8TM34

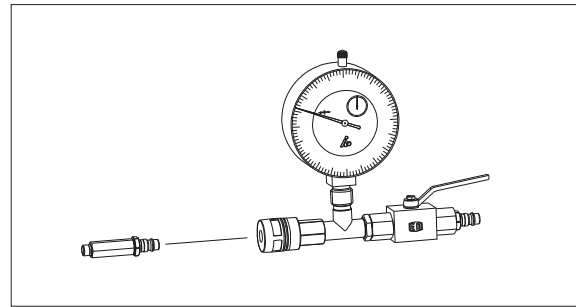
35) Driver tool

5870 506 161



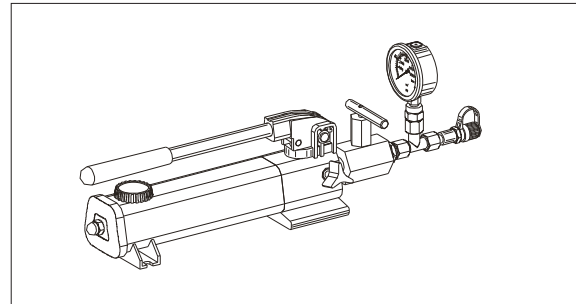
14WF8TM35

- 36) Air connection
5870 505 012



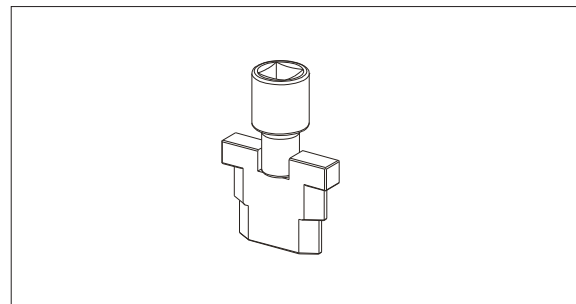
14WF8TM36

- 37) HP pump
5870 287 007



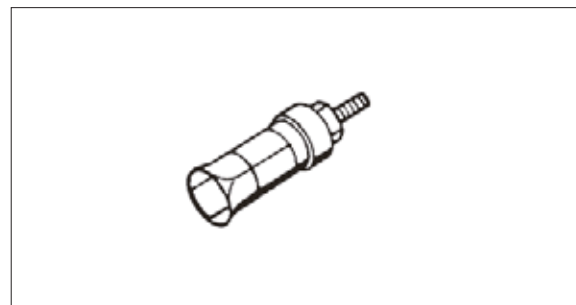
14WF8TM37

- 38) Spline mandrel
5870 510 039



14WF8TM38

- 39) Inner extractor
5870 300 012



14WF8TM39

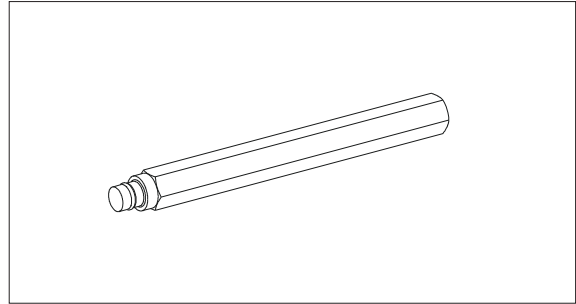
- 40) Counter support
5870 300 011



14WF8TM40

41) Driver tool

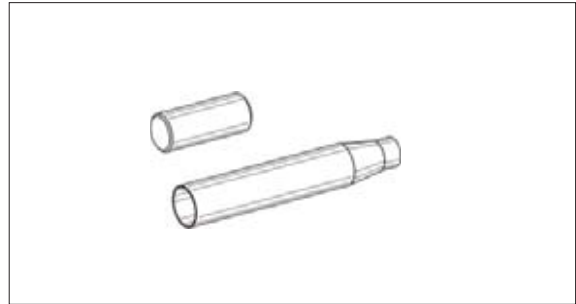
5870 705 003



14WF8TM41

42) Inner installer

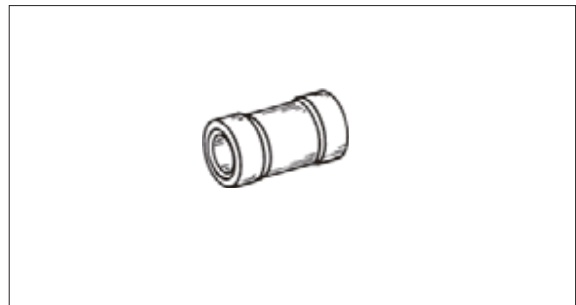
5870 651 055



14WF8TM42

43) Calibrating mandrel

5870 651 056



14WF8TM43

4. COMMERCIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

1) Magnetic stand

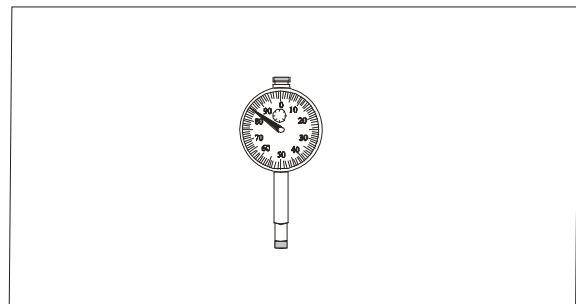
5870 200 055



14WF8TM44

2) Dial indicator

5870 200 057



14WF8TM45

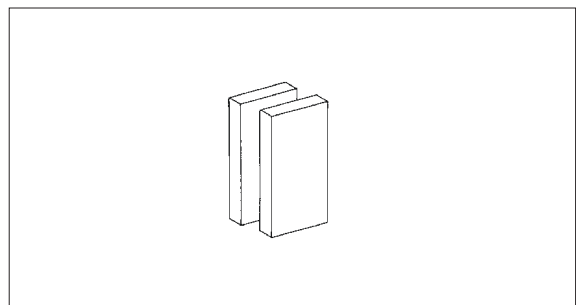
3) Gauge blocks

5870 200 066

5870 200 067

70 mm

100 mm



14WF8TM46

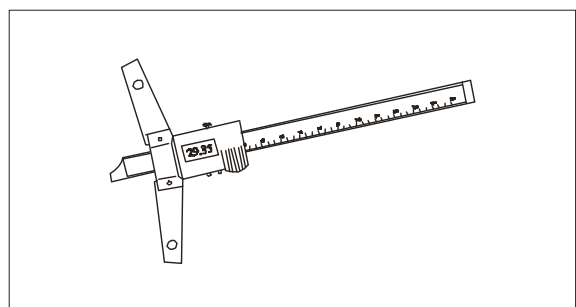
4) Digital depth gauge

5870 200 072

5870 200 114

200 mm

300 mm



14WF8TM47

5) Digital caliper gauge

5870 200 109

150 mm



14WF8TM48

6) Torque wrench

5870 203 030	0.6 -6.0 Nm
5870 203 031	1.0 – 12 Nm
5870 203 032	3.0 – 23 Nm
5870 203 033	5.0 – 45 Nm
5870 203 034	10 – 90 Nm
5870 203 039	80 – 400 Nm
5870 203 016	140 – 750 Nm
5870 203 011	750 - 2000 Nm



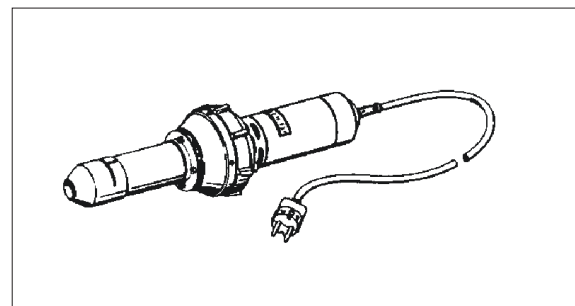
14WF8TM49



14WF8TM50

7) Hot air blower

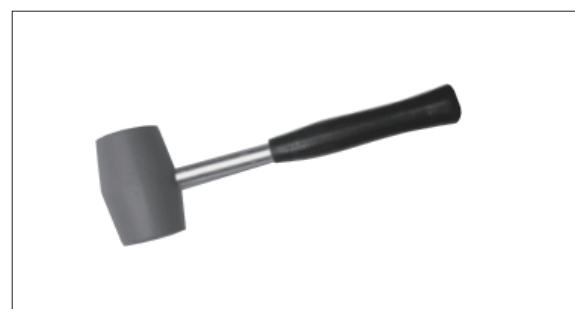
5870 221 500	230 V
5870 221 501	115 V



14WF8TM51

8) Plastic hammer

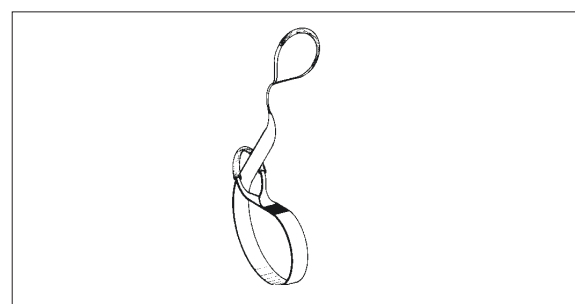
5870 280 004	Ø 60 mm
Substitute nylon insert	
5870 280 006	



14WF8TM52

9) Lifting strap

5870 281 026



14WF8TM53

- 10) Lifting chain
5870 281 047



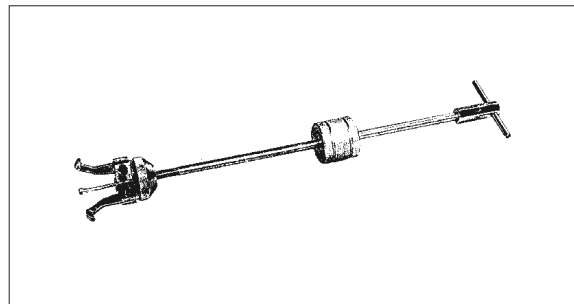
14WF8TM54

- 11) Pry bar
5870 345 071



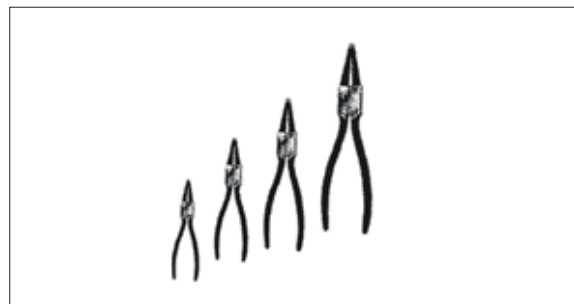
14WF8TM55

- 12) Striker
5870 650 004



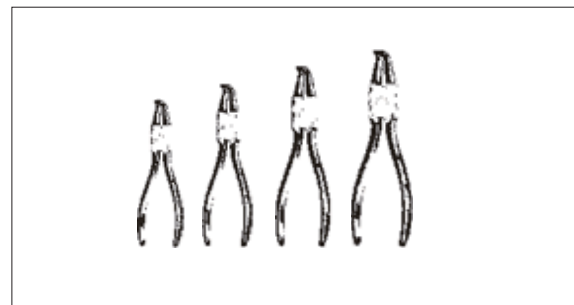
14WF8TM56

- 13) Set of internal pliers
I1-I2-I3-I4
5870 900 013



14WF8TM57

- 14) Set of internal pliers
I11-I21-I31-I41 90°
5870 900 014



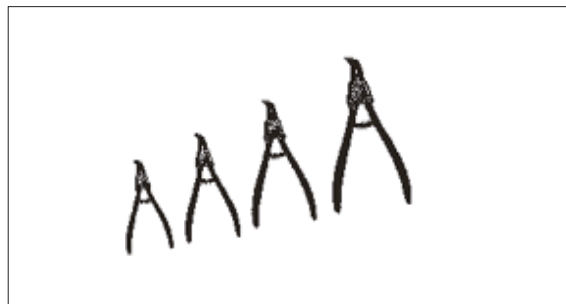
14WF8TM58

- 15) Set of external pliers
A1-A2-A3-A4
5870 900 015



14WF8TM59

- 16) Set of external pliers
A01-A02-A03-A04 90°
5870 900 016



14WF8TM60

- 17) Two-armed puller

5870 970 001

Jaw width 80 mm

Throat depth 100 mm

5870 970 002

Jaw width 120 mm

Throat depth 125 mm

5870 970 003

Jaw width 170 mm

Throat depth 125 mm

5870 970 004

Jaw width 200 mm

Throat depth 175 mm

5870 970 006

Jaw width 350 mm

Throat depth 250 mm

5870 970 007

Jaw width 520 mm

Throat depth 300 - 500 mm

5870 970 026

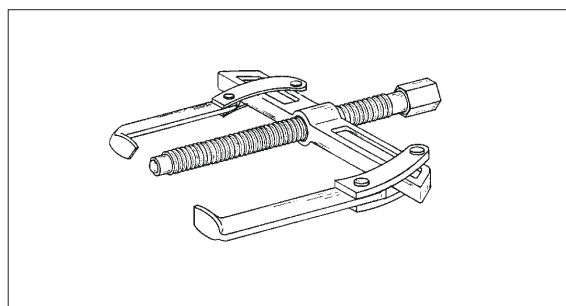
Jaw width 250 mm

Throat depth 200 mm

5870 970 028

Jaw width 380 mm

Throat depth 200 mm



14WF8TM61

18) Three armed puller

5870 971 001

Jaw width 85 mm

Throat depth 65 mm

5870 971 002

Jaw width 130 mm

Throat depth 105 mm

5870 971 003

Jaw width 230 mm

Throat depth 150 mm

5870 971 004

Jaw width 295 mm

Throat depth 235 mm

5870 971 005

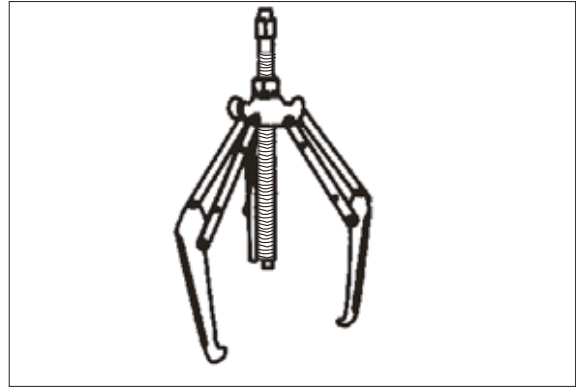
Jaw width 390 mm

Throat depth 230 mm

5870 971 006

Jaw width 640 mm

Throat depth 290 mm



14WF8TM62

5. SEPARATE TRANSMISSION FROM AXLE HOUSING

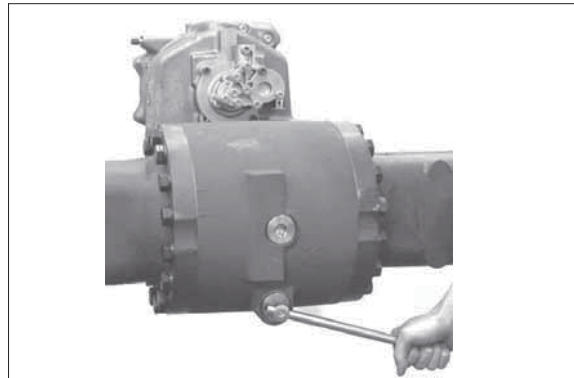
(only for version Axle attachment)

- 1) Drain oil from axle housing – use a suitable oil reservoir.

(S) Assembly truck 5870 350 000

(S) Clamping fork 5870 350 106

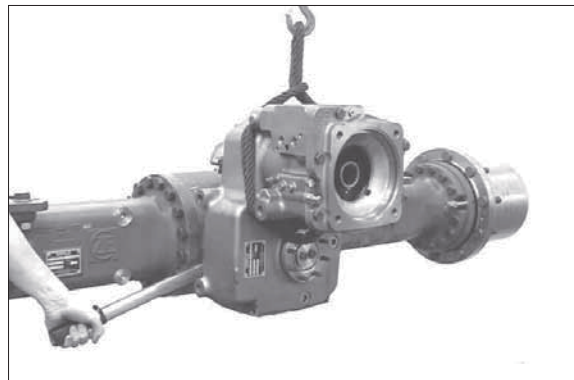
▲ Waste oil to be disposed of ecologically.



14WF8TM63

- 2) Pick-up Transmission by means of lifting tackle, loosen threaded joint and separate complete Transmission from axle housing.

(S) Lifting strap 5870 281 026



14WF8TM64

6. DISASSEMBLY – BRAKE / CLUTCH / PLANETARY CARRIER

- 1) Mount transmission to assembly truck.

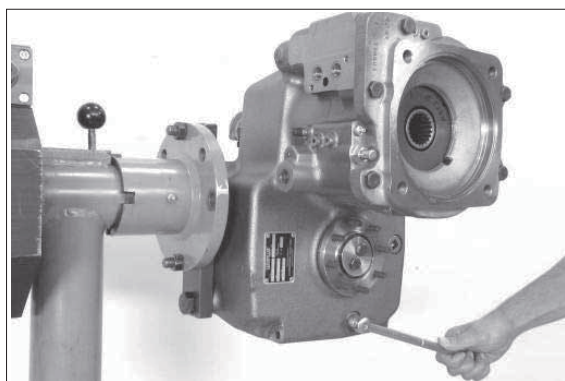
(S) Assembly truck assy. 5870 350 000 (S)
Fixture 5870 350 079



14WF8TM65

- 2) Loosen screw plug and drain oil – use a suitable oil reservoir.

⚠ Waste oil to be disposed of ecologically.

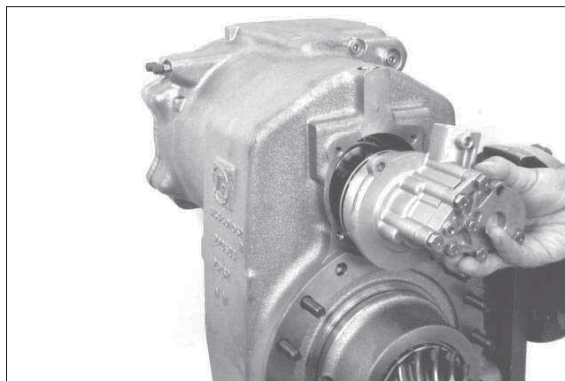


14WF8TM66

Lubrication pump

- 3) Remove lubrication pump or shift interlock (depending on version, Illustration shows version with Lubrication pump).

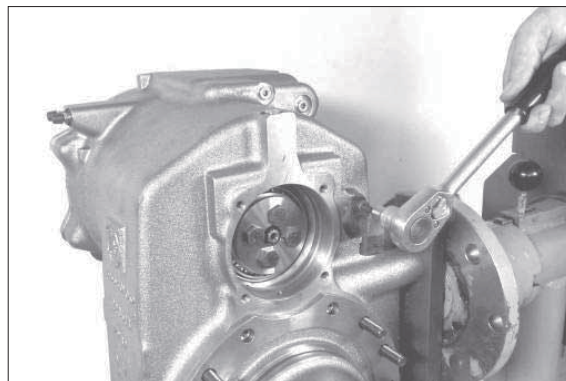
※ Complete disassembly of lubrication pump / shift interlock – see page 8-164.



14WF8TM67

Speed sensor

- 4) Loosen screw and pull off speed sensor.



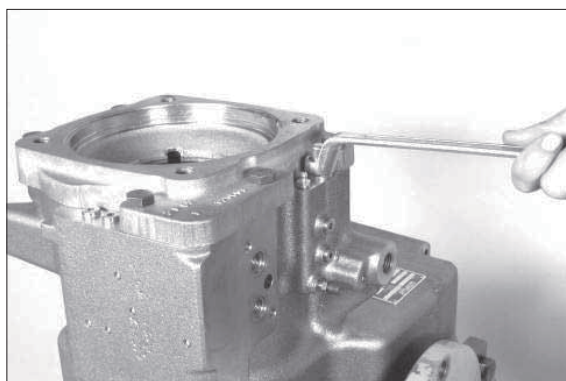
14WF8TM68

Emergency release (Parking brake)

- 5) Remove breather.

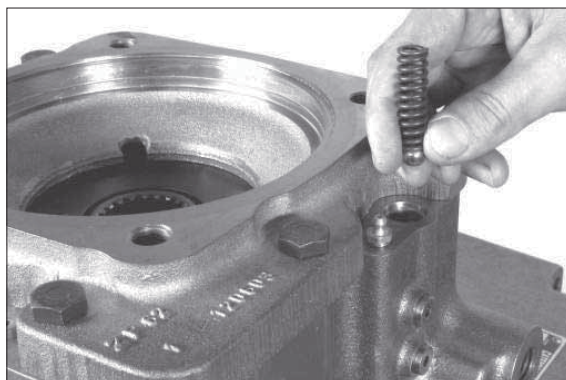
(Illustration 14WF8TM69~14WF8TM72 shows version transmission installation position "Vertical")

- ※ Position of single connections or breather valves /lubrication nipples etc. as to version transmission installation position Horizontal - see 14WF8TM265.



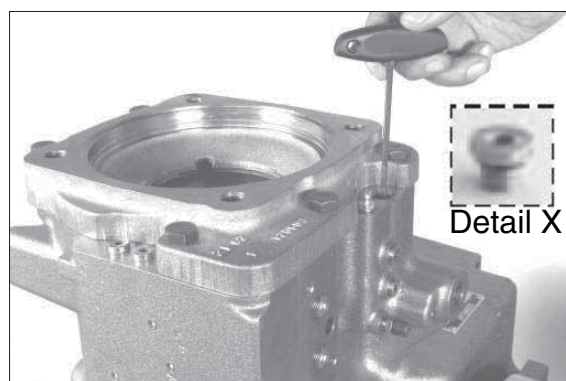
14WF8TM69

- 6) Remove compression spring and ball.



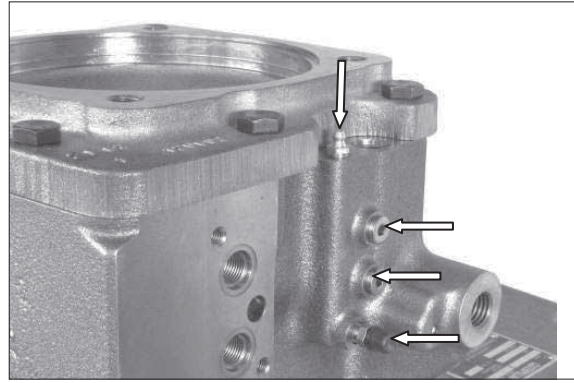
14WF8TM70

- 7) Remove threaded element (see Detail X) with O-ring from hole.



14WF8TM71

- 8) Remove lubrication nipple, both screw plugs and breather valve – see arrow.



14WF8TM72

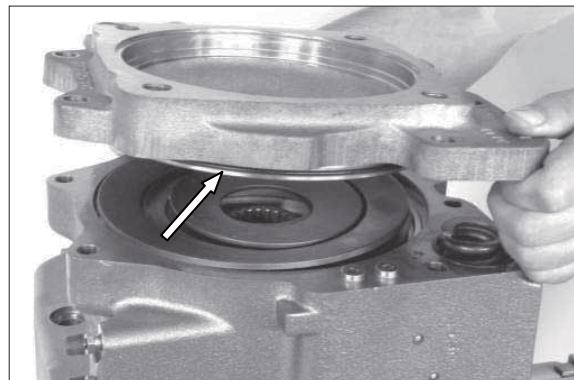
Input housing and modulation valve

- 9) Loosen threaded joint of input housing evenly.
- ※ Input housing is subject to cup spring and compression spring preload.



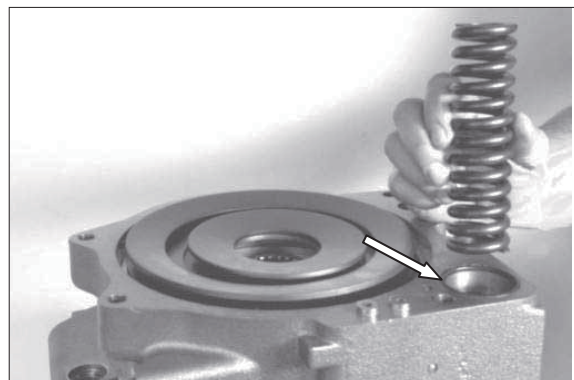
14WF8TM73

- 10) Take off input housing and remove O-ring (arrow).



14WF8TM74

- 11) Remove compression spring and O-ring (arrow).



14WF8TM75

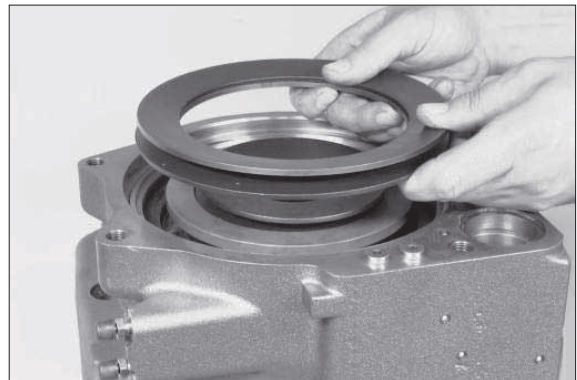
12) Pull complete piston out of hole.



14WF8TM76

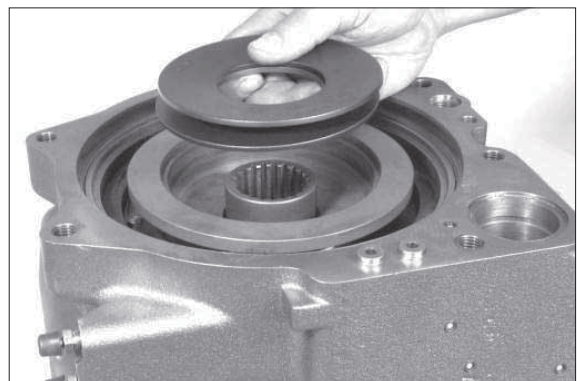
Brake and clutch

13) Remove cup springs from brake.



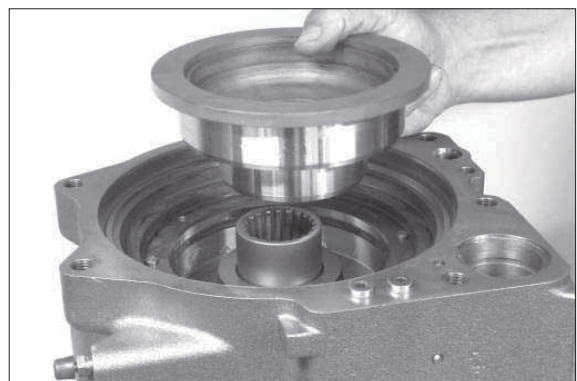
14WF8TM77

14) Remove cup springs from clutch.



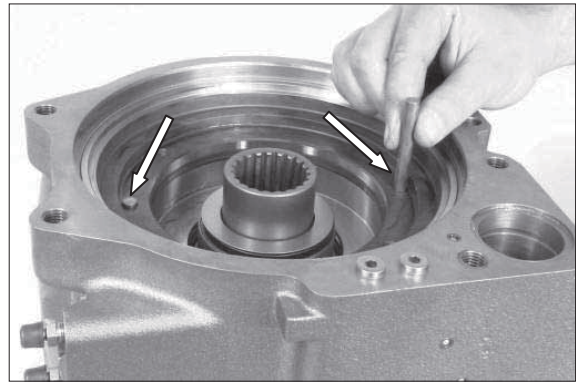
14WF8TM78

15) Remove piston.



14WF8TM79

16) Pull off both cyl. pins (arrows).

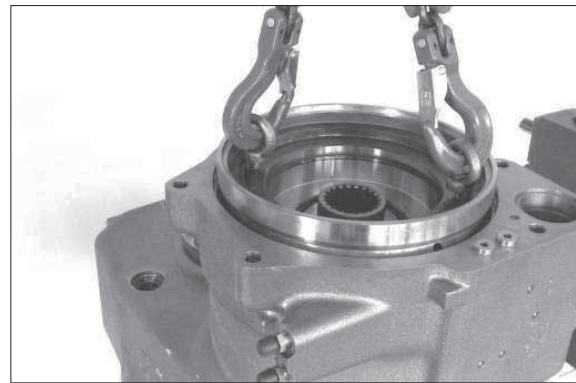


14WF8TM80

17) Attach 2 (two) eyebolts and pull piston cautiously out of housing – risk of damage.

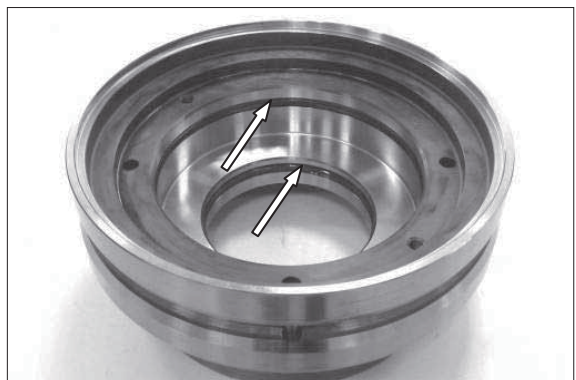
(S) Eyebolt assortment 5870 204 002

(S) Lifting chain 5870 281 047



14WF8TM81

18) Remove both seals (arrows) from piston.



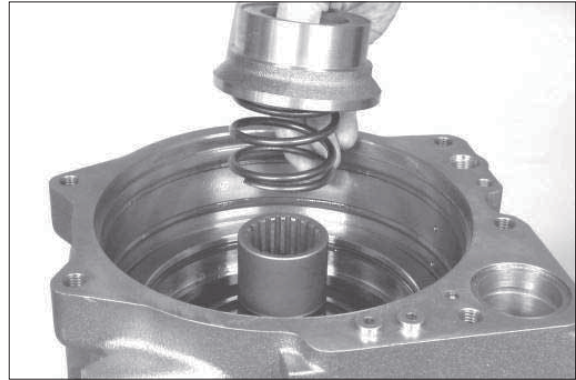
14WF8TM82

19) Remove axial roller cage with both thrust washers.



14WF8TM83

- 20) Remove pressure piece and compression spring.

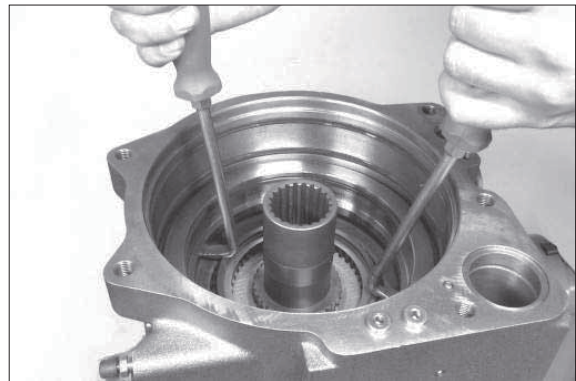


14WF8TM84

- 21) Remove pressure ring with ring – also see 14WF8TM86 – cautiously with lever – risk of damaging sealing surfaces.

(S) Resetting device 5870 400 001

- ※ Ring may also remain in housing during disassembly – disassemble ring separately.



14WF8TM85

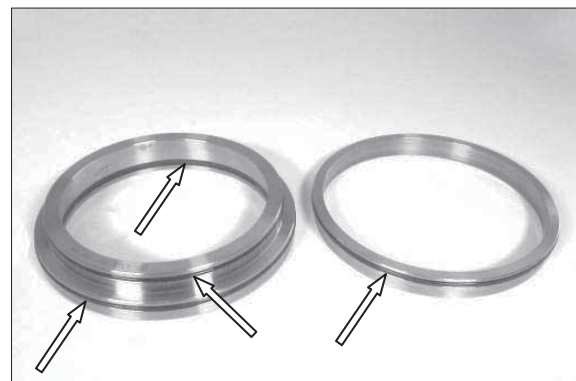
- 22) Remove pressure ring from ring cautiously with lever – risk of damaging sealing surfaces .

(S) Resetting device 5870 400 001



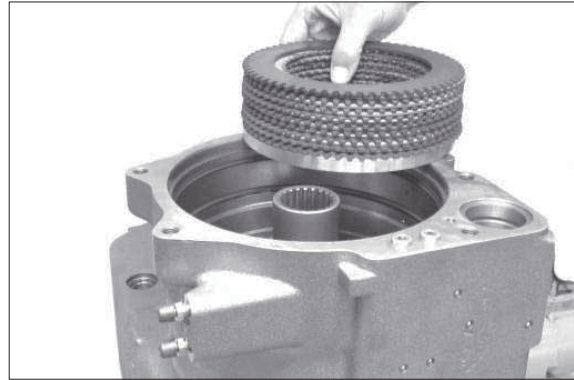
14WF8TM86

- 23) Remove seal and O-rings (see arrows) from pressure ring and ring.



14WF8TM87

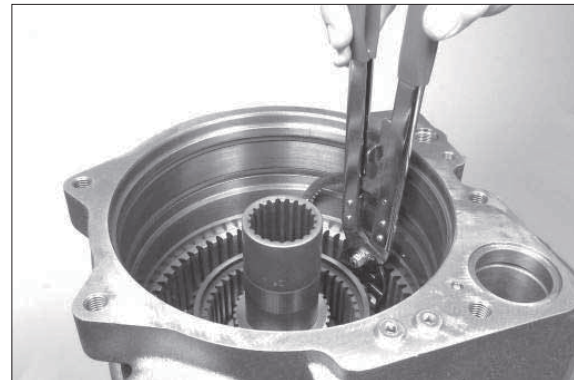
24) Take disk package of brake with end plate(s) out of housing.



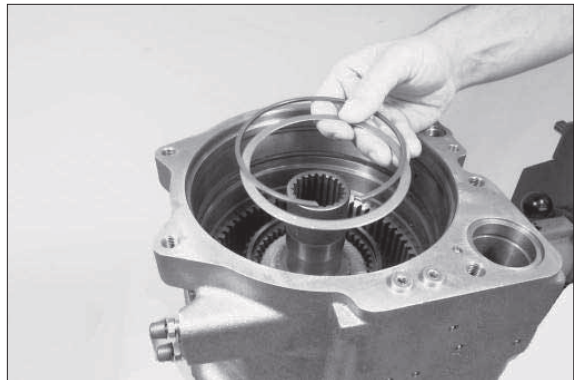
25) Disengage retaining ring.

(S) Clamping pliers

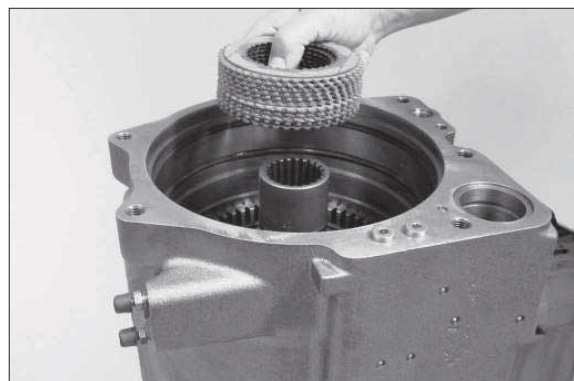
5870 900 021



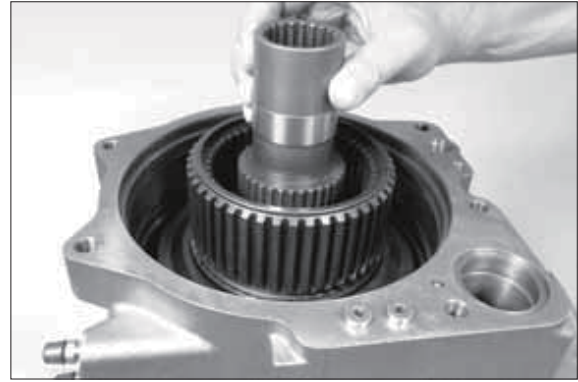
26) Remove snap ring and shim.



27) Take disk package of clutch with end plate(s) out of ring gear.



28) Remove cpl. input shaft with ring gear from housing.



14WF8TM92

29) Unsnap retaining ring.



14WF8TM93

30) Press input shaft out of ball bearing/ring gear.



14WF8TM94

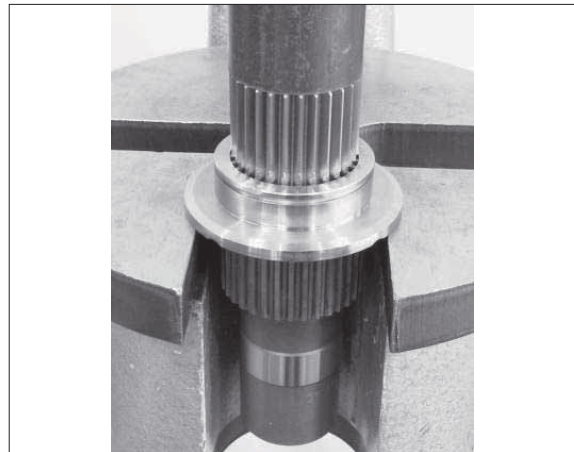
31) Unsnap retaining ring.



14WF8TM95

32) Press centering disk from input shaft.

※ In case of extreme press fit – heat centering disk.



14WF8TM96

33) Unsnap retaining ring and remove ball bearing.

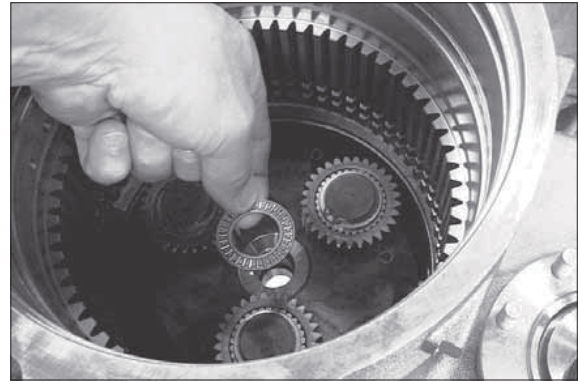
(S) Clamping pliers 5870 900 021



14WF8TM97

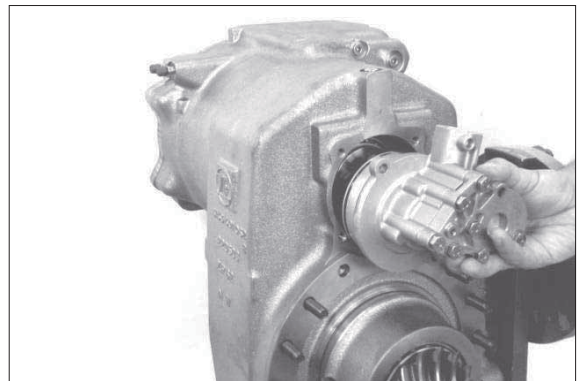
Planetary carrier

34) Remove axial needle cage.



14WF8TM98

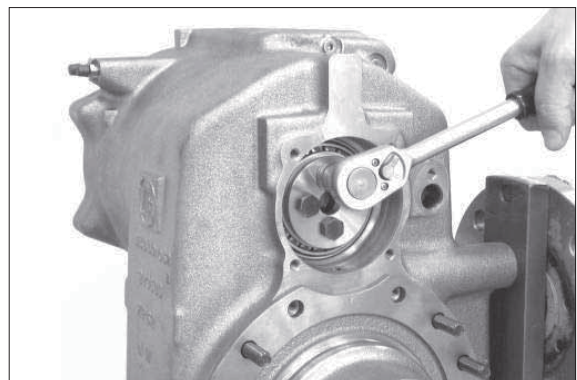
35) If not yet disassembled previously – remove lubrication pump or shift interlock (depending on version).
(Illustration shows version - Lubrication pump).



14WF8TM99

36) Loosen threaded joint and remove disk – fasten output flange by means of clamping fork.

(S) Clamping fork 5870 240 025

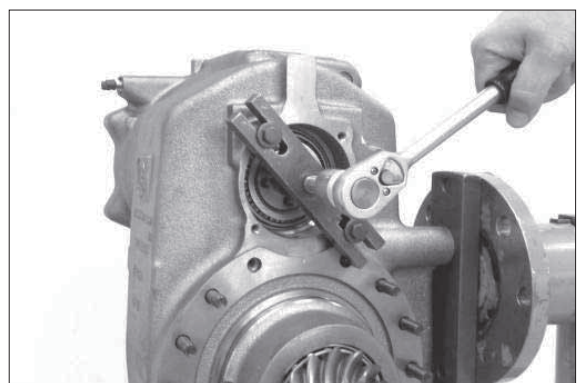


14WF8TM100

37) Press cpl. planetary carrier out of roller bearing.

(S) Extractor 5870 000 017

※ Pay attention to releasing planetary carrier and bearing inner ring.



14WF8TM101

38) Pull second bearing inner ring from planetary carrier.

(S) Rapid grip 5873 012 021

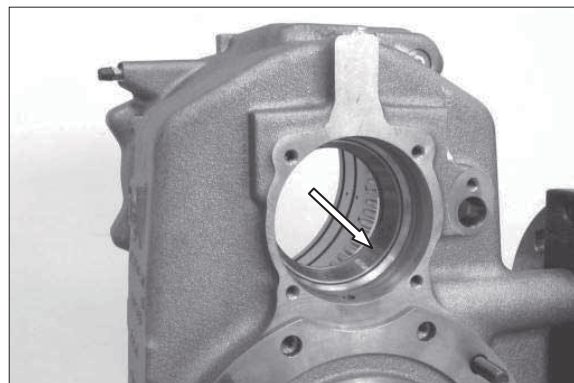
(S) Basic tool 5873 002 001



14WF8TM102

39) If required – force both bearing outer rings (arrow) out of bearing hole.

※ When reusing tapered roller bearings – pay attention to bearing allocation, i.e. respective bearing inner ring to bearing outer ring.



14WF8TM103

40) Unsnap retaining ring.



14WF8TM104

41) Lift planetary gear with resetting device – then disassemble with two armed puller .

(S) Resetting device 5870 400 001

※ If necessary, force out slotted pins (6x).

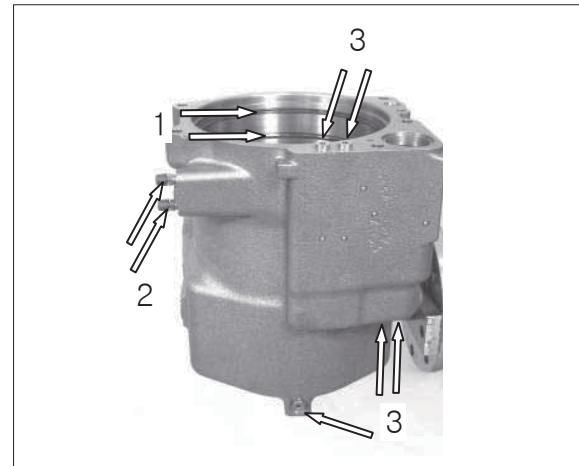


14WF8TM105

42) Remove both seals (1).

Remove breather valves (2) and all screw plugs (3) with seal and O-ring.

※ Illustration shows positions for transmission version Installation position "Vertical".



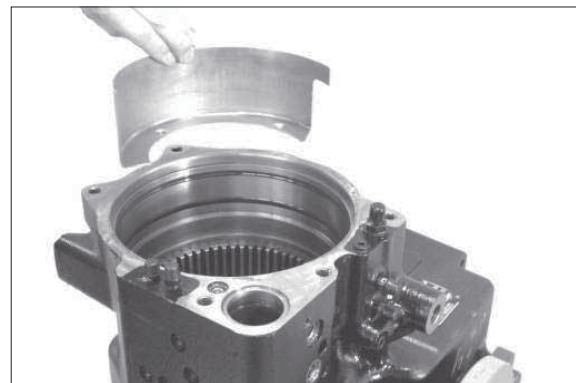
14WF8TM106

43) Only for version

Transmission installation position "Horizontal" :

Loosen countersunk screws and remove screen sheet.

※ Countersunk screws are installed with locking compound (loctite). If necessary, heat for disassembly .



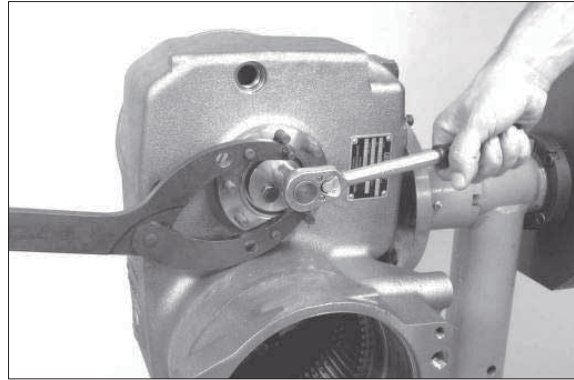
14WF8TM107

7. DISASSEMBLY - OUTPUT

Version "Axle attachment"

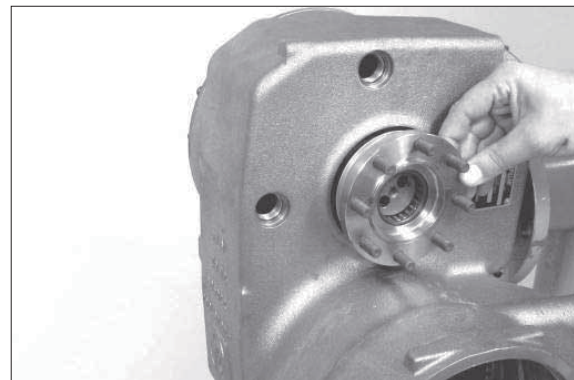
- 1) Loosen threaded joint, remove cover and O-ring.

※ (S) Clamping fork 5870 240 025



14WF8TM108

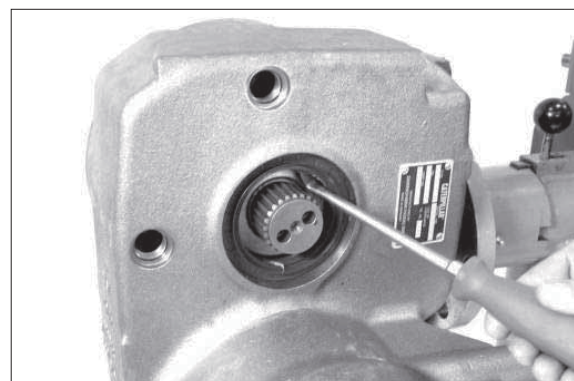
- 2) Pull off flange.



14WF8TM109

- 3) Remove shaft seal with a lever.

※ (S) Resetting device 5870 400 001



14WF8TM110

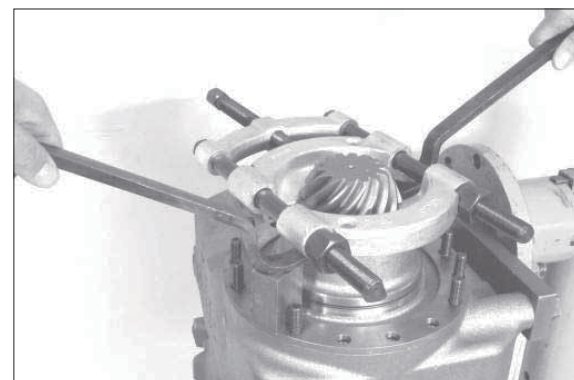
- 4) Fix pinion with fixture and press off.

(S) Cut-off device 5870 300 028

(S) Assembly lever 5870 345 036

(S) Solenoid block 5870 450 003

- ※ Pay attention to releasing bearing inner ring and adjusting ring (rolling torque/pinion bearing) behind.



14WF8TM111

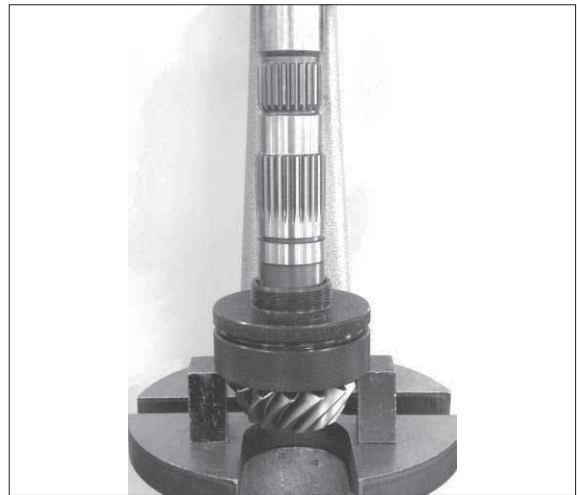
- 5) Remove O-ring (see arrow) and bush from pinion.



14WF8TM112

- 6) Press-off bearing inner ring from pinion shaft.

(S) Grab sleeve	5873 001 037
(S) Solenoid block	5870 450 003



14WF8TM113

- 7) Pull bearing outer ring out of bearing cover.

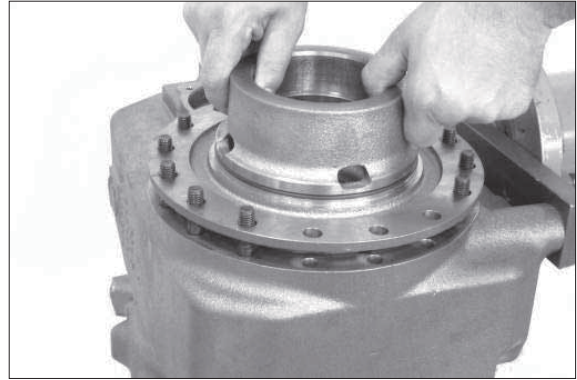
(S) Inner extractor	5870 300 019
(S) Counter support	5870 300 020

- ※ Pay attention to shim behind (pinion gap setting).



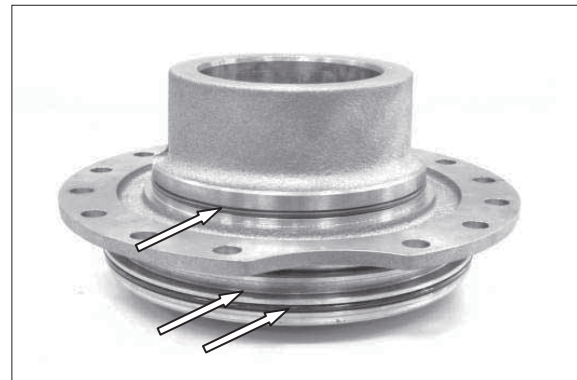
14WF8TM114

8) Pull off bearing cover.



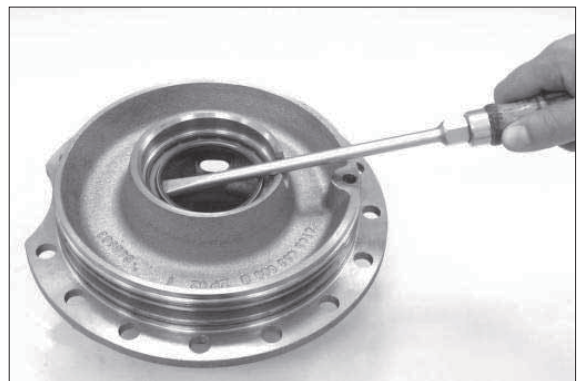
14WF8TM115

9) Remove O-rings (arrows).



14WF8TM116

10) Remove shaft seal.



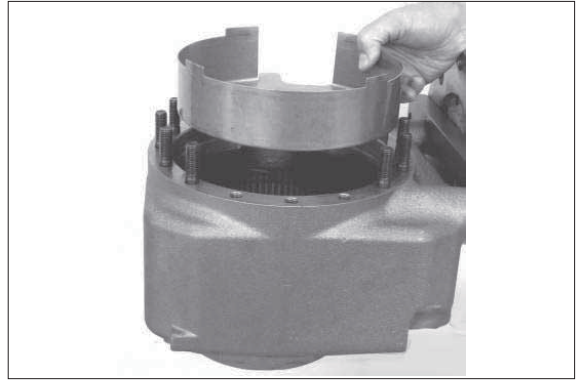
14WF8TM117

11) Lift output gear with oil screen sheet out of housing. Remove oil screen sheet from output gear.



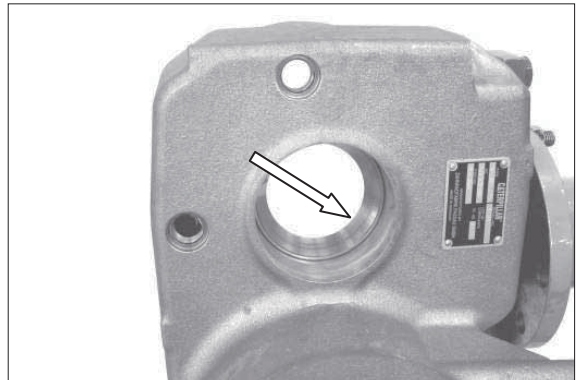
14WF8TM118

12) Remove screen sheet.



14WF8TM119

13) Disassemble bearing outer ring from housing hole (see arrow).



14WF8TM120

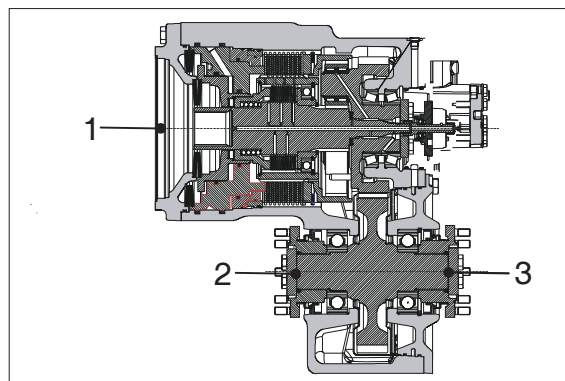
14) If necessary, remove stud bolts.



14WF8TM121

Version "Separate installation"

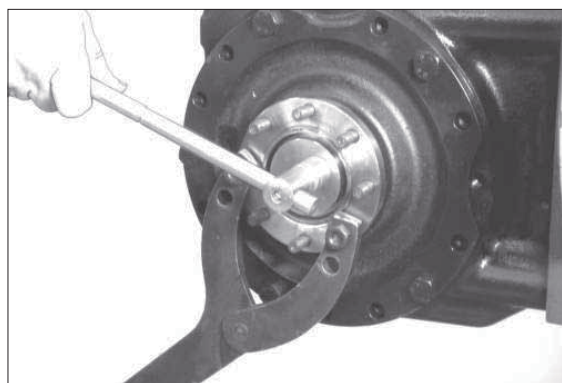
- 15) 1 = Input
2 = Output – front axle
3 = Output – rear axle



14WF8TM122

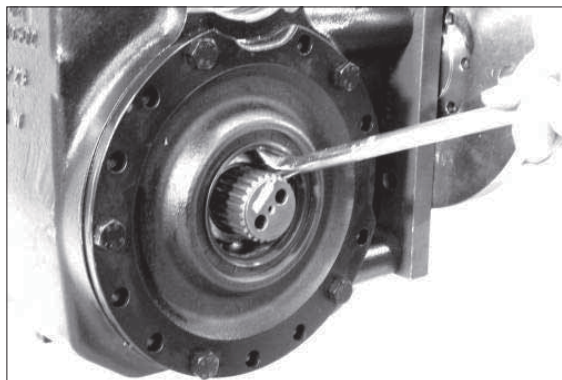
- 16) Use clamping fork to fix output flange.
Loosen threaded joint, pull off disk, O-ring
and flange.

(S) Clamping fork 5870 240 025



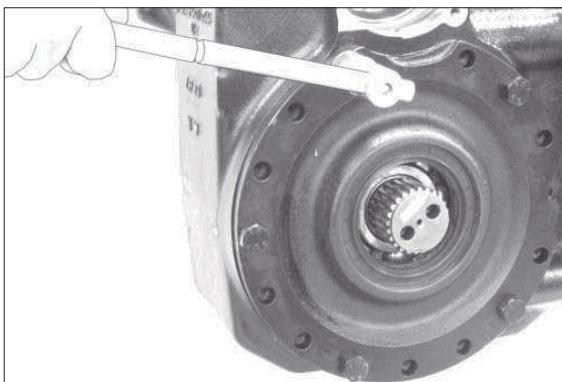
14WF8TM123

- 17) Remove shaft seal with a lever.
※ Disassemble second output flange and
shaft seal analogously.



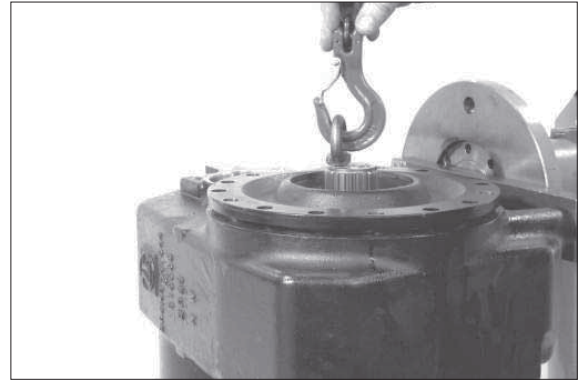
14WF8TM124

- 18) Loosen threaded joint.



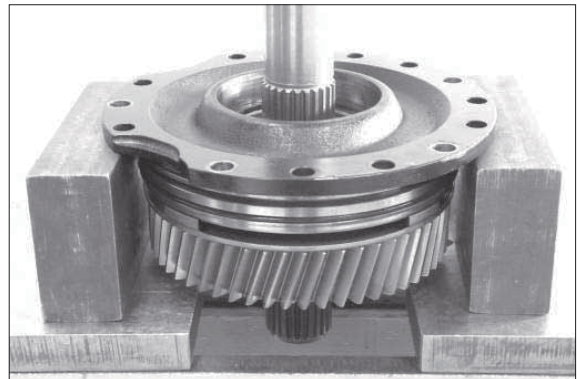
14WF8TM125

- 19) Use lifting tackle to separate output gear with cover from transmission housing.



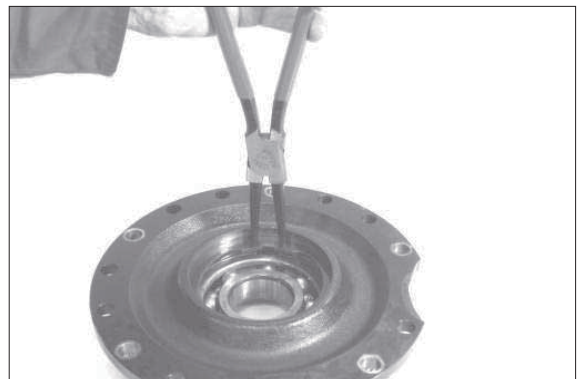
14WF8TM126

- 20) Press output gear out of ball bearing/cover – remove releasing oil screen sheet.



14WF8TM127

- 21) Unsnap retaining ring and disassemble ball bearing from cover.



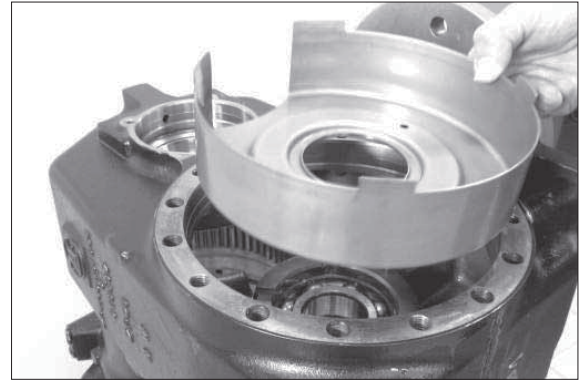
14WF8TM128

- 22) Remove O-rings (see arrows) from cover.



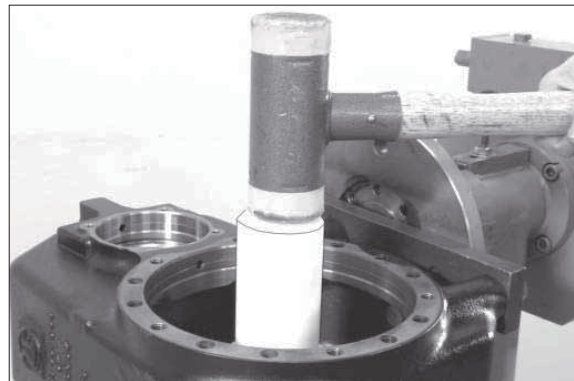
14WF8TM129

23) Remove screen sheet from transmission housing.



14WF8TM130

24) Disassemble ball bearing from housing hole.

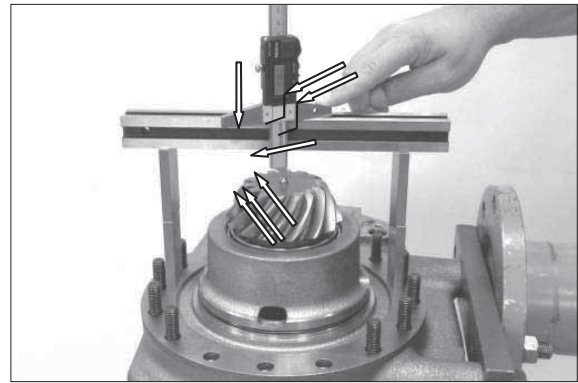


14WF8TM131

8. REASSEMBLY - OUTPUT

- 1) Seal finished holes (8x) of oil supply holes with screw plugs.

(S) Lever riveting tongs 5870 320 016



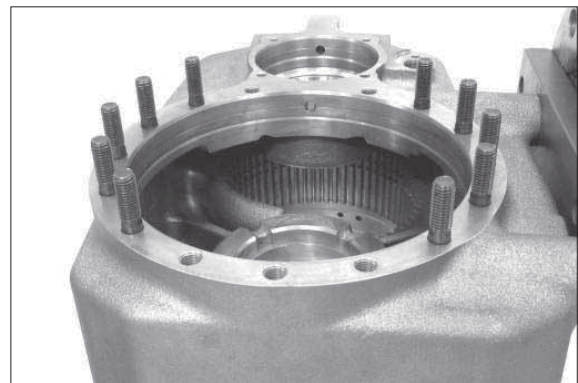
14WF8TM132

Version "Axle attachment"

- 2) Install stud bolts.

Tightening torque $M_A = 27 \text{ Nm}$

※ Pay attention to installation position.

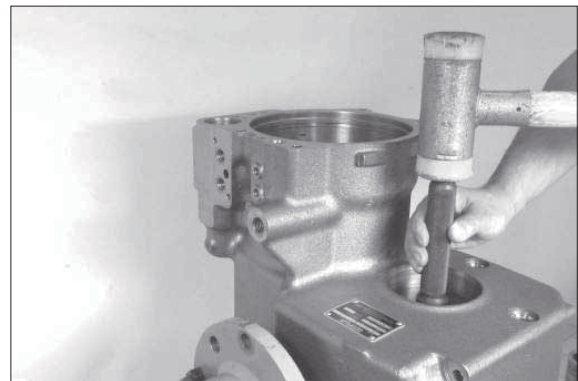


14WF8TM133

- 3) Install bearing outer ring until contact.

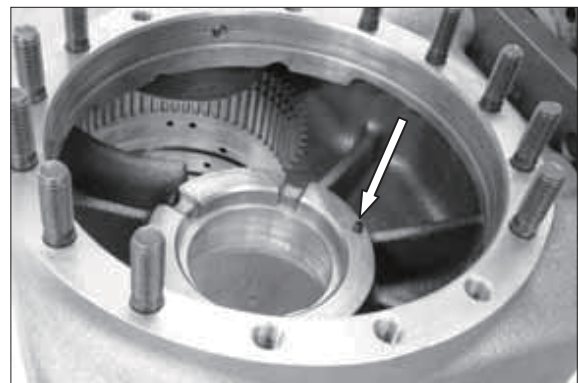
(S) Driver tool 5870 058 073

(S) Handle 5870 260 002



14WF8TM134

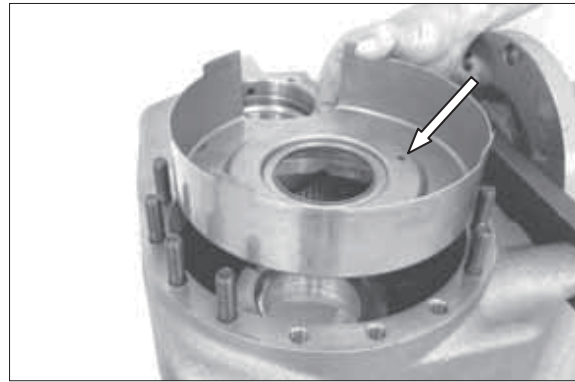
- 4) Insert slotted pin (see arrow) to the bottom.



14WF8TM135

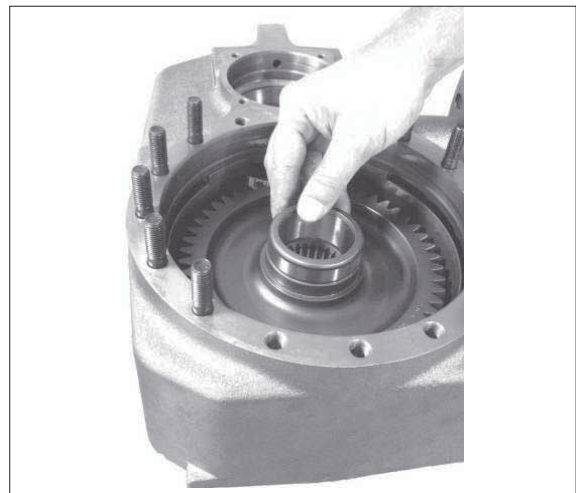
5) Position screen sheet – with slotted pin (see 14WF8TM135) into fixing hole (arrow).

※ Pay attention to installation position, slotted pin = radial fixing of screen sheet.



14WF8TM136

6) Insert output gear with the short collar showing downwards.



14WF8TM137

7) Press shaft seal into bearing cover.

(S) Driver tool 5870 048 281

※ For installation wet shaft seal on outer diameter with spirit.

※ Installation position of shaft seal, pay attention that seal lip is showing to oil sump (see 14WF8TM139).

※ Use of specified driver ensures exact installation position of shaft seal.

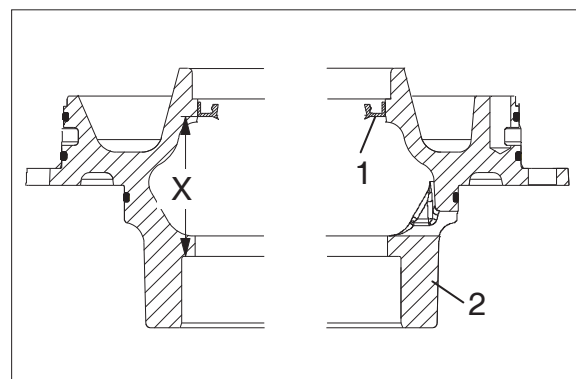


14WF8TM138

8) 1 = Shaft seal

2 = Bearing cover

X = Installation dimension



14WF8TM139

Determine shim for pinion gap

9) 1 = Pinion

2 = Roller bearing

3 = Bearing cover

4 = Ball ($\varnothing = 7$ mm)

A = Auxiliary dimension

B = Bearing width

C = Reference dimension

D = Contact surface/bearing cover to contact/bearing hole

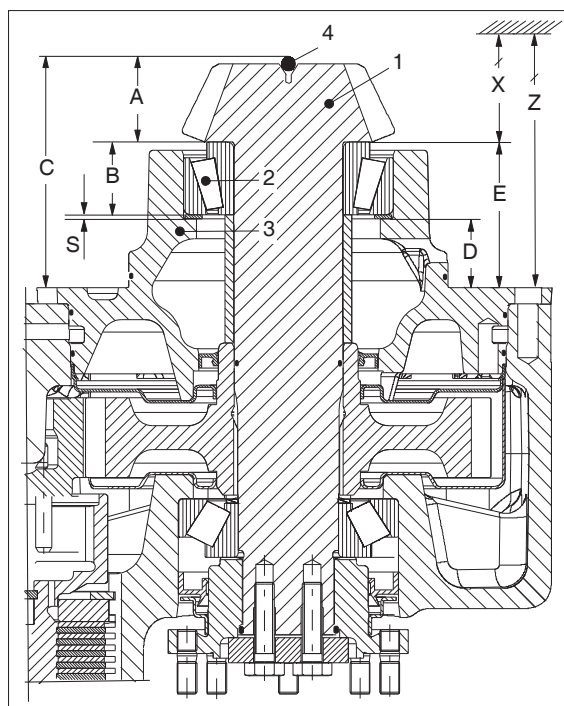
E = 73.0 mm (constant value)

X = Pinion dimension (stamped into pinion)

Z = 189.0 mm

(contact surface/bearing cover to center/axle housing)

※ For correct installation and positioning of pinion, following steps must be carried out as precisely as possible .



14WF8TM140

10) Determine auxiliary dimension A.

Position ball ($\varnothing = 7$ mm) into centering hole of pinion and determine dim. A, from contact surface/pinion shoulder to ball.

Auxiliary dimension A = e.g. 42.56 mm

※ Auxiliary dimension A is obligatory to determine reference dimension C – on installed pinion (Fig. 14WF8TM168).

(S) Straightedge

5870 200 108



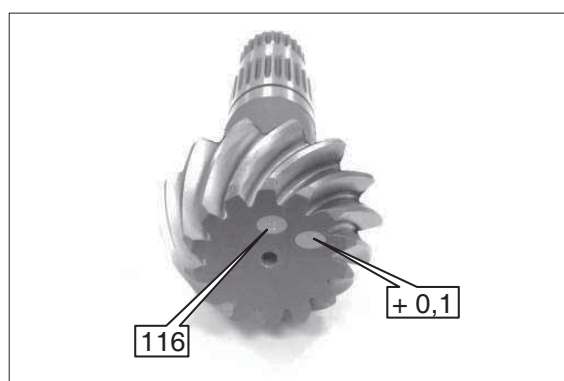
14WF8TM141

11) Read pinion dim. X on pinion (see arrow) or measure it in case of manufacturing-specific + or – deviation from pinion dim. (relating value is marked by hand on pinion e.g. + 0.1).

Pinion dim. X (without + or – deviation) = 116.0 mm

Pinion dim. X with an indicated deviation + 0.1 = 116.1 mm

Pinion dim. X with an indicated deviation - 0.1 = 115.9 mm

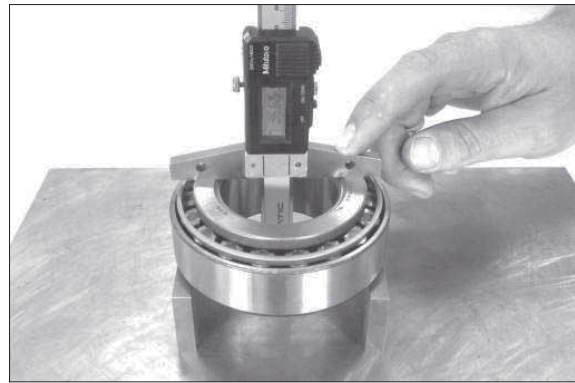


14WF8TM142

12) Determine dim. B bearing width, paying attention that rollers are seated without clearance (roller setting – rotate bearing inner ring in both directions several times).

※ Since installed roller bearing is subject to preload in installation position, deduction of empirical value of – 0.1 mm must be considered.

Dim. B = e.g. 36.65 mm - 0.1 mm → 36.55 mm

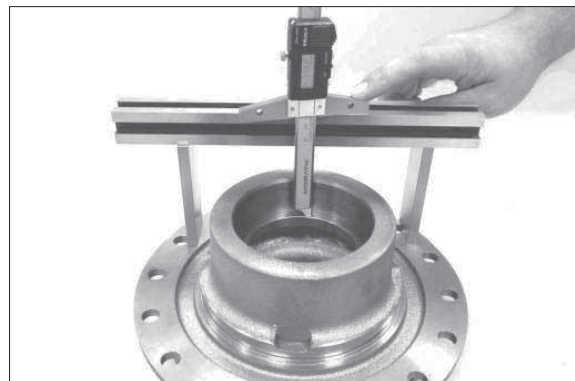


14WF8TM143

13) Determine dim. D (contact surface/bearing cover to contact/bearing hole).

Dim. D = e.g. 35.10 mm

(S) Straightedge (2 sets) 5870 200 066

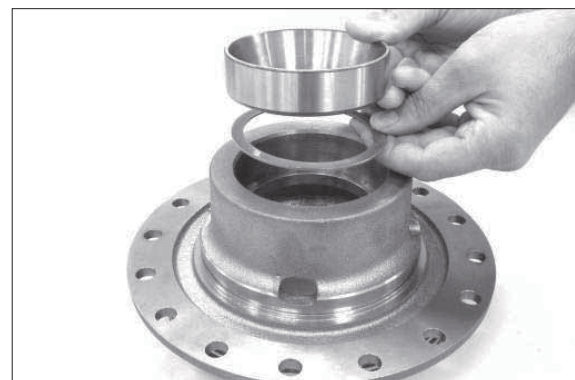


14WF8TM144

14) Insert determined shim(s) S = e.g. 1.35 mm and install bearing outer ring until contact.

(S) Driver tool 5870 058 078

(S) Handle 5870 260 002



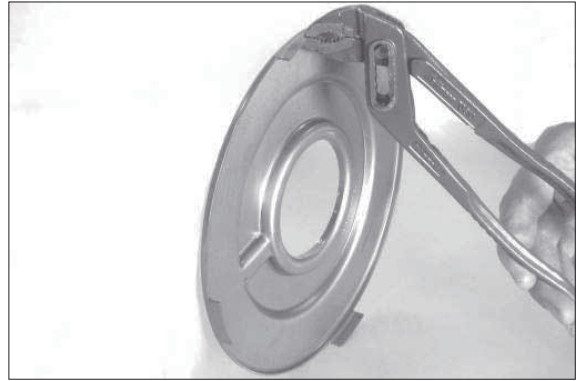
14WF8TM145

15) Oil O-rings (arrows) and insert them into annular grooves of bearing cover.



14WF8TM146

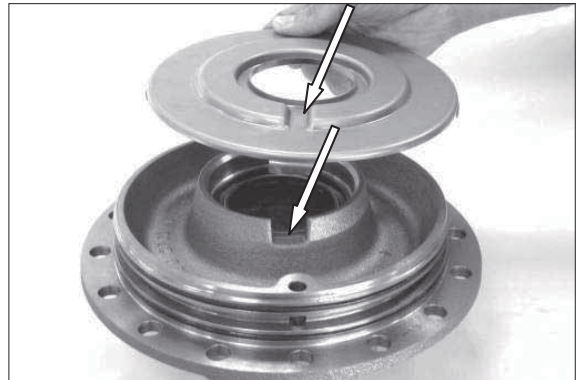
- 16) Bend edges of fixing straps of oil screen sheet slightly – assembly aid (sheet is fixed to bearing cover – see 14WF8TM148).



14WF8TM147

- 17) Mount oil screen sheet on bearing cover.

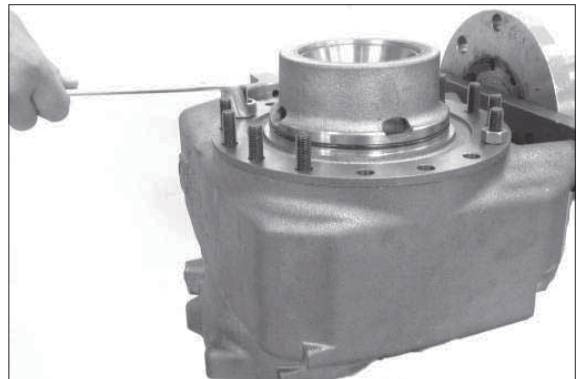
- ※ Pay attention to installation position – place locating tab of oil screen sheet into recess of bearing cover (see arrow).



14WF8TM148

- 18) Mount preassembled bearing cover and locate equally with hexagon nuts until contact. Then remove hexagon nuts again.

- ※ Oil contact face/oil screen sheet/housing (assembly aid).



14WF8TM149

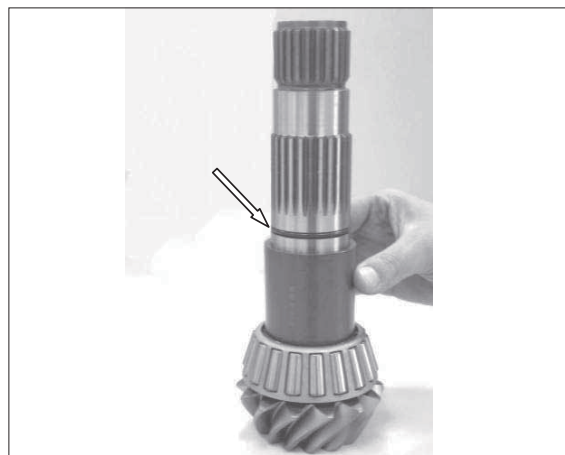
- 19) Install heated bearing inner ring until contact.

- ※ Adjust bearing inner ring after cooling down.



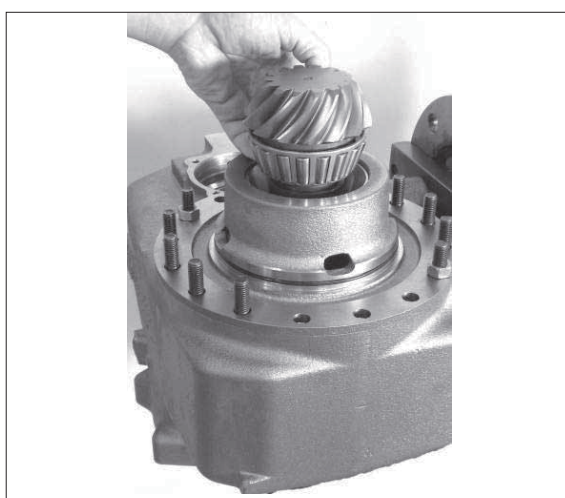
14WF8TM150

20) Mount bush, oil O-ring (arrow) and put it into annular groove.



14WF8TM151

21) Mount preassembled pinion.

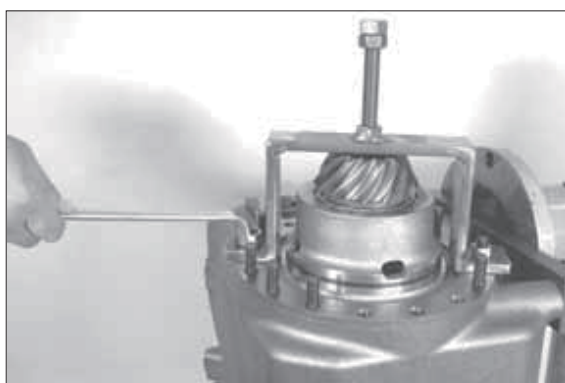


14WF8TM152

22) Fix pinion with clamping bar.

(S) Clamping bar

5870 654 049



14WF8TM153

Determine adjusting ring for rolling torque/pinion bearing :

23) Rotate transmission by 180°.

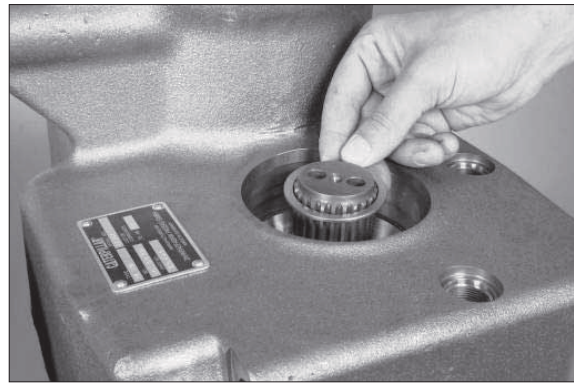
Mount adjusting ring (s = optional).

※ It is recommended to reinstall the adjusting ring (e.g. $s = 1.35 \text{ mm}$) removed during disassembly, if however the required rolling torque of 1.5~4.0 Nm (without shaft seal) is not obtained – see bearing rolling torque check Fig. 14WF8TM159 – bearing rolling torque is to be corrected with an adequate adjusting ring.

※ When shaft seal is installed, try to achieve upper rolling torque value.

24) Insert heated bearing inner ring until contact.

※ Adjust bearing inner ring after cooling down.



14WF8TM154



14WF8TM155

25) Mount flange.

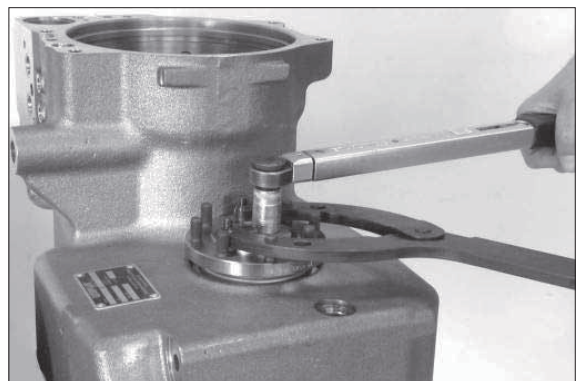


14WF8TM156

26) Place shim and fix flange with hexagon screws.

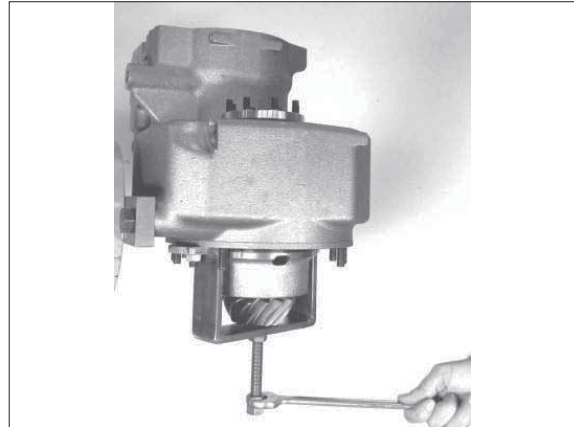
Tightening torque (M 10/10.9) $M_A = 68 \text{ Nm}$
(S) Clamping fork 5870 240 025

※ Rotate pinion – when tightening – in both directions (roller setting) several times .



14WF8TM157

27) Turn back pinion fastening / remove clamping bar.



14WF8TM158

Check rolling torque of pinion bearing

28) Bearing rolling torque (without shaft seal)
1.5~4.0 Nm

- ※ When using new roller bearings /for mounted shaft seal, try to achieve the upper value.
- ※ If the required rolling torque deviates, it must be corrected with an adequate adjusting ring (see 14WF8TM154).

(S) Reduction $\frac{1}{2}$ - $\frac{1}{4}$	5870 656 056
(S) Plug insert	AA00 392 461



14WF8TM159

29) Disassemble flange again.



14WF8TM160

Shaft seal output flange

30) Install new shaft seal.

(S) Driver tool 5870 048 279

- ※ For reassembly wet shaft seal on outer diameter with spirit.
- ※ Pay attention to installation position of shaft seal, seal lip showing to oil sump (see 14WF8TM162).
- ※ Use of specified driver tool ensures exact installation position of shaft seal.



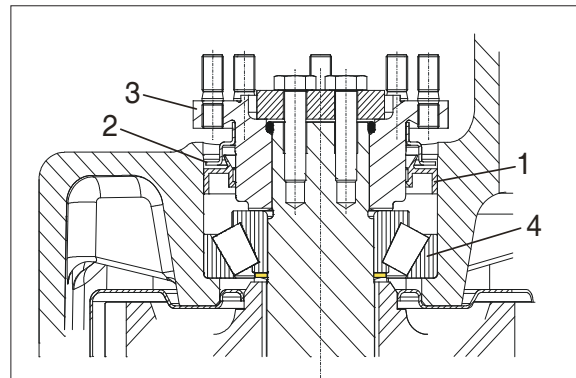
14WF8TM161

31) 1 = Shaft seal

2 = Metal sheet

3 = Output flange

4 = Roller bearing



14WF8TM162

32) Install stud bolts.

Tightening torque ($M10 \times 1$) $M_A = 20 \text{ Nm}$

- ※ Pay attention to installation position.
Install stud bolts with short thread length into flange.

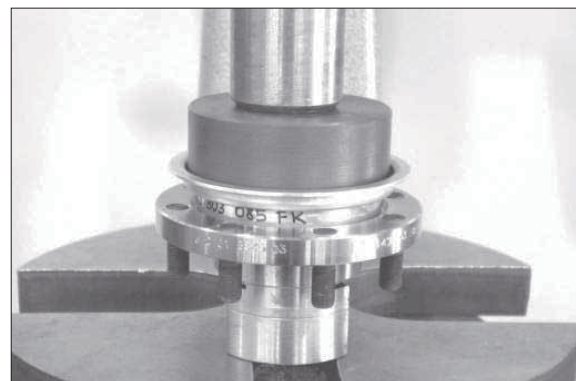


14WF8TM163

33) Install screen sheet (see 14WF8TM162).

(S) Pressure piece 5870 506 150

- ※ Use of specified driver tool ensures exact installation position of screen sheet.



14WF8TM164

- 34) Mount preassembled flange and put O-ring into recess.



14WF8TM165

- 35) Place disk and fix it with hexagon screws.

Tightening torque (M 10/10.9) $M_A = 68 \text{ Nm}$

(S) Clamping fork 5870 240 025



14WF8TM166

Check pinion gap

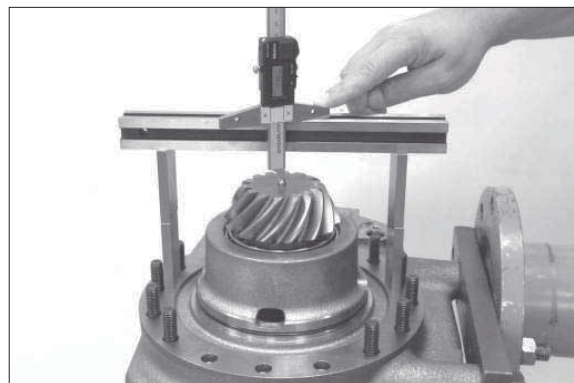
- 36) Position ball [use $\varnothing = 7 \text{ mm}$ → ball \varnothing like for determination of auxiliary dimension A into centering hole of the pinion and determine dim. C (see 14WF8TM140), from contact surface/bearing cover to ball.

(S) Straightedge 5870 200 108

▲ If the constant value of dimension E = $73.00 \pm 0.05 \text{ mm}$

If the constant value of Dim. E = $73.00 \pm 0.05 \text{ mm}$ is not achieved, correct with an adequate shim/pinion gap (see 14WF8TM145).

For a correction of the shim/pinion gap, a counter correction of adjusting ring of rolling moment/ pinion gap – Fig. 14WF8TM154 must also be considered.



14WF8TM167

37) 1 = Transmission housing

2 = Ball bearing

3 = Screen sheet

4 = Bearing cover

5 = Ball bearing

6 = Retaining ring

7 = O-ring

8 = Oil screen sheet

9 = Output gear

10 = Shaft seal

11 = Output flange

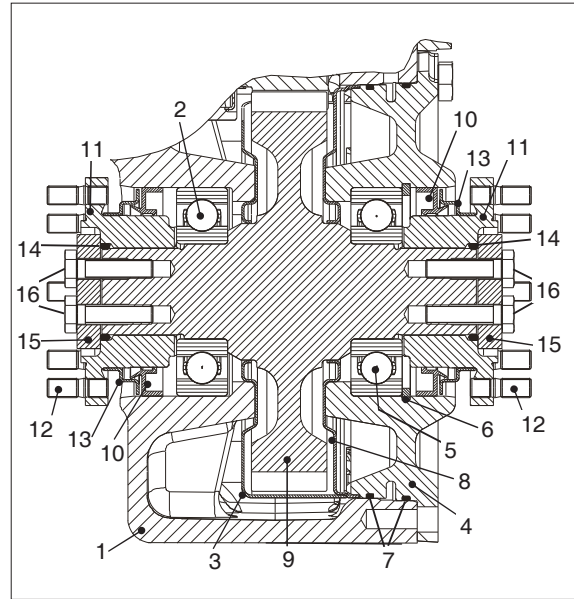
12 = Stud bolt

13 = Metal sheet

14 = O-ring

15 = Disk

16 = Hexagon screw

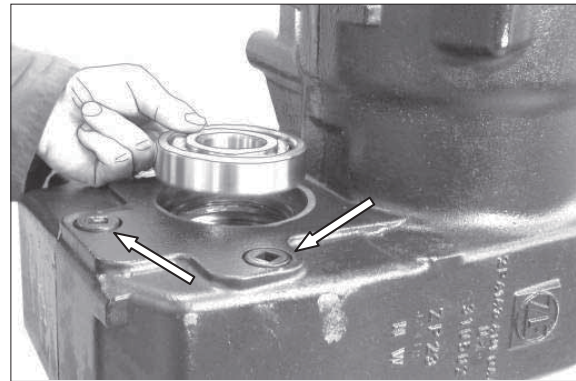


14WF8TM168

38) Provide screw plugs (see arrows) with new O-ring and install it.

Tightening torque $M_A = 80 \text{ Nm}$

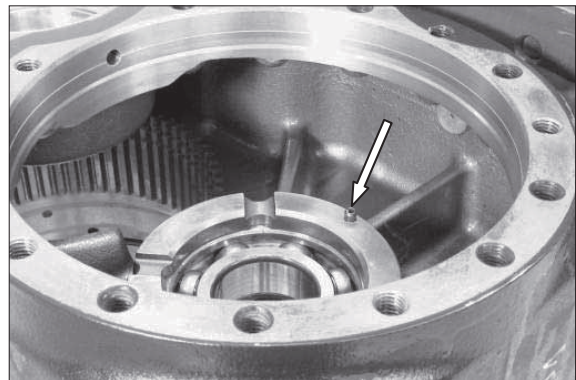
※ Then insert ball bearing (2) until contact.



14WF8TM169

39) Rotate transmission by 180°.

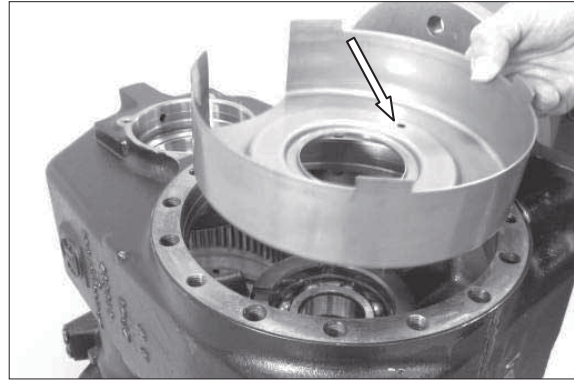
Insert slotted pin (see arrow) to the bottom.



14WF8TM170

40) Position screen sheet – with slotted pin into fixing hole (arrow).

※ Observe installation position –slotted pin = radial fixing of screen sheet.



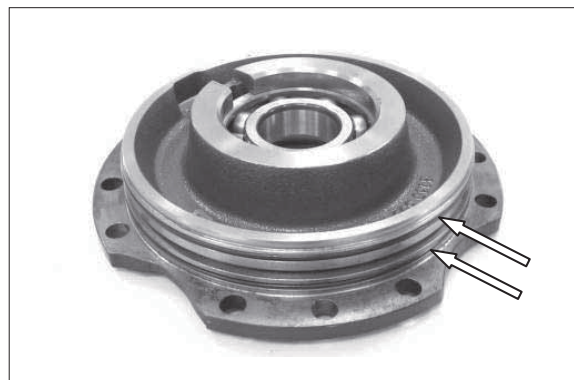
14WF8TM171

41) Insert ball bearing into cover and fix with retaining ring.



14WF8TM172

42) Oil both O-rings (arrows) and insert them into annular grooves of planetary carrier.



14WF8TM173

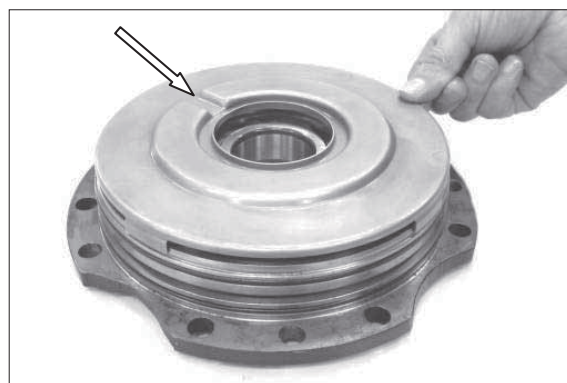
43) Bend edges of fixing straps of oil screen sheet slightly. Assembly aid screen sheet is fixed to bearing cover – see 14WF8TM176).



14WF8TM174

44) Insert oil screen sheet onto bearing cover

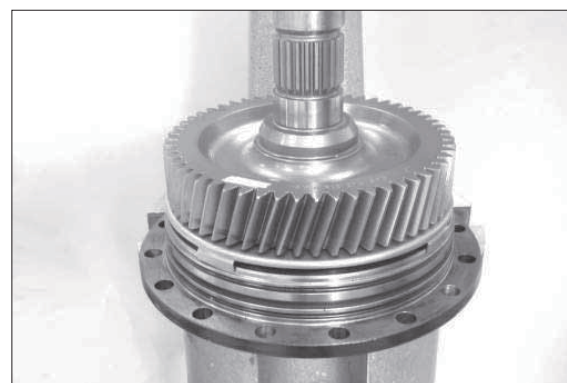
- ※ Observe installation position - place locating tab (see arrow) into recess of bearing cover (radial fixing).



14WF8TM175

45) Press output gear into ball bearing/bearing cover.

- ※ Support ball bearing onto bearing inner ring.



14WF8TM176

46) Heat bearing inner ring of ball bearing.



14WF8TM177

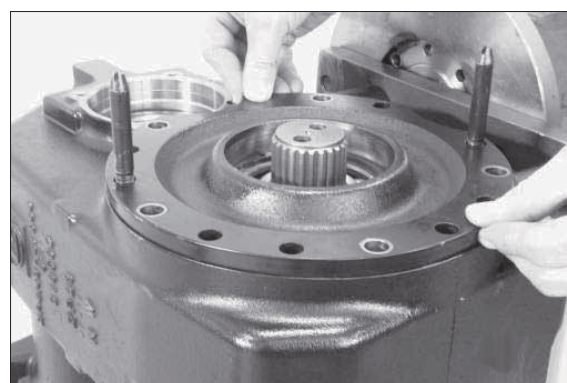
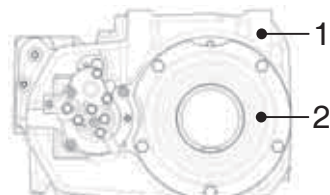
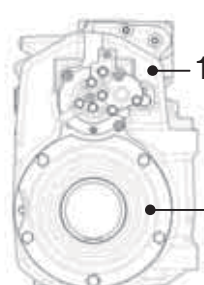
47) Attach two adjusting screws and mount preassembled bearing cover/output gear until contact.

(S) Adjusting screws (M12) 5870 204 021

- ※ Observe installation position of bearing cover (2) in transmission (1) – transmission installation VERTICAL or HORIZONTAL - see detailed sketches below:

<VERTICAL>

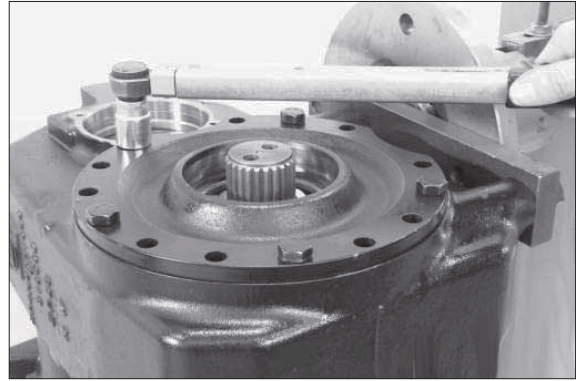
<HORIZONTAL>



14WF8TM178

- 48) Fix bearing cover by means of hexagon screws.

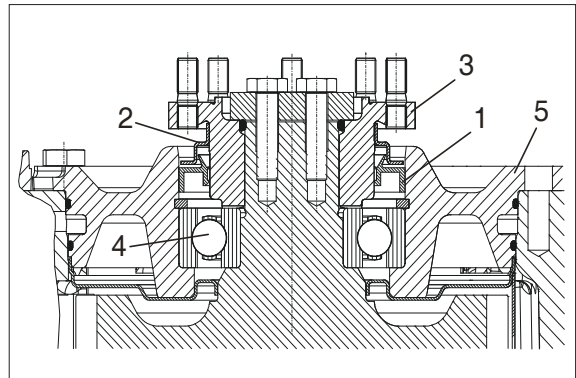
Tightening torque (M 12/8.8) $M_A = 80 \text{ Nm}$



14WF8TM181

Shaft seal output flange

- 49) 1 = Shaft seal
2 = Metal sheet
3 = Output flange
4 = Ball bearing
5 = Bearing cover

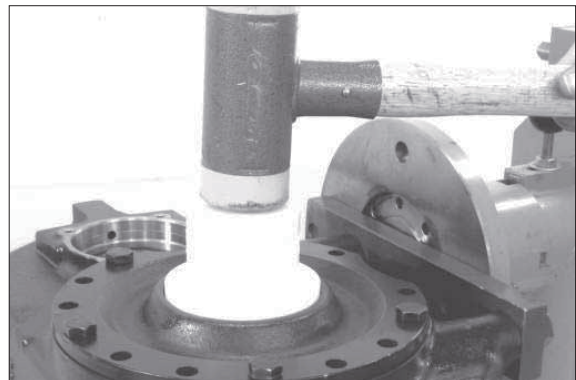


14WF8TM182

- 50) Install new shaft seal.

(S) Driver tool 5870 048 279

- ※ For reassembly wet shaft seal on outer diameter with spirit.
- ※ Pay attention to installation position of shaft seal, seal lip showing to oil sump.
- ※ Use of specified driver tool ensures exact installation position of shaft seal.



14WF8TM183

- 51) Install stud bolts.

Tightening torque (M10 × 1) $M_A = 20 \text{ Nm}$

- ※ Pay attention to installation position.
- Install stud bolts with short thread length into flange.

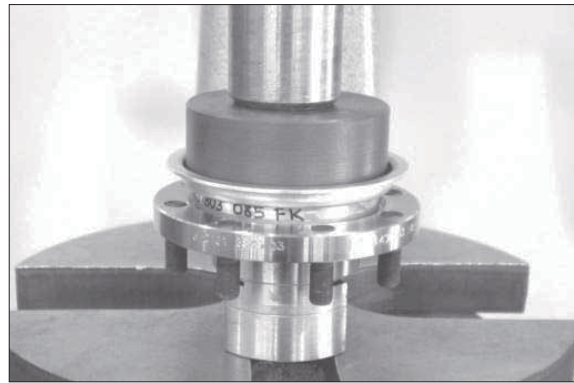


14WF8TM184

52) Install screen sheet (see 14WF8TM183).

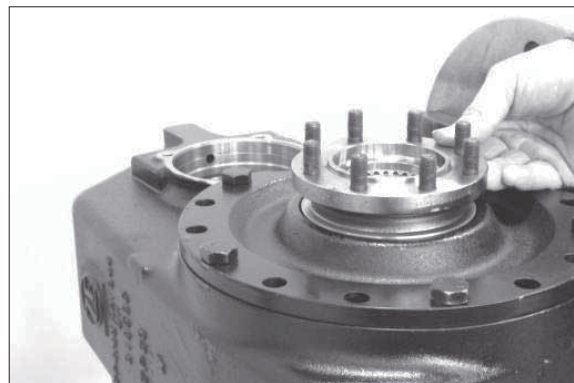
(S) Pressure piece 5870 506 150

※ Use of specified driver tool ensures exact installation position of screen sheet.



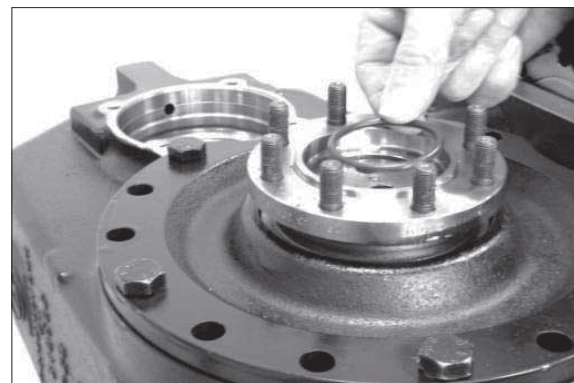
14WF8TM185

53) Install preassembled output flange.



14WF8TM186

54) Insert O-ring.

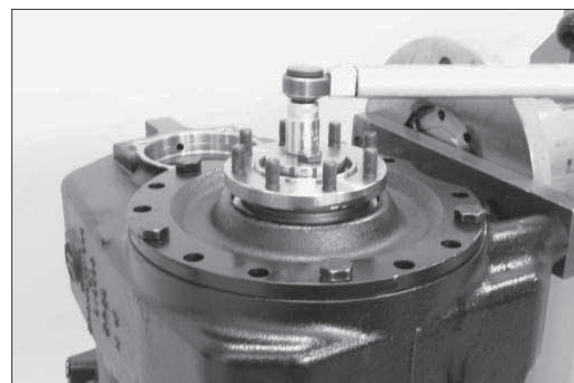


14WF8TM187

55) Position disk and fix output flange by means of hexagon screws.

Tightening torque (M10/10.9) $M_A = 68 \text{ Nm}$

※ Install second shaft seal/output flange (front axle output) analogously.



14WF8TM188

9. REASSEMBLY - BRAKE / CLUTCH / PLANETARY CARRIER

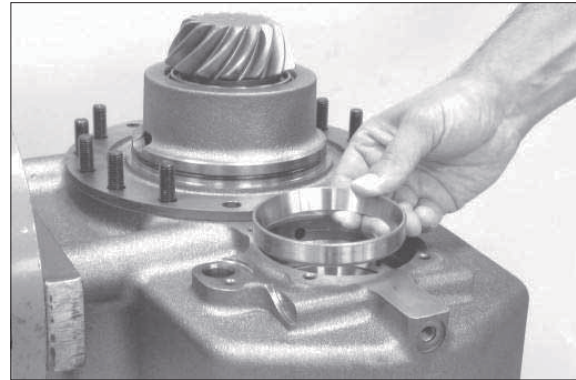
Planetary carrier

- 1) Install bearing outer ring until contact.

(S) Driver tool 5870 058 051

(S) Handle 5870 260 002

- ※ Observe bearing allocation – bearing inner ring to bearing outer ring – also see instructions for disassembly, 14WF8TM103.



14WF8TM189

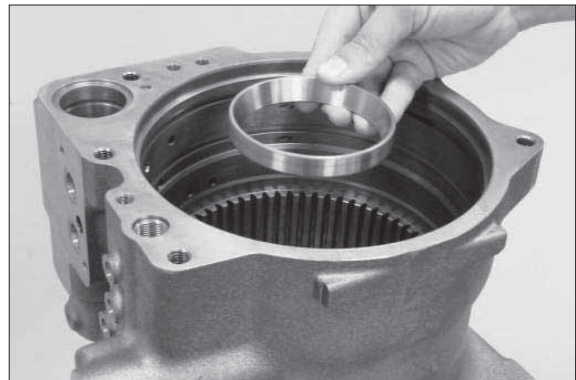
- 2) Rotate transmission by 180°.

Install second bearing outer ring until contact.

(S) Driver tool 5870 058 051

(S) Handle 5870 260 002

- ※ Observe bearing allocation – bearing inner ring to bearing outer ring – also see instructions for disassembly 14WF8TM103.



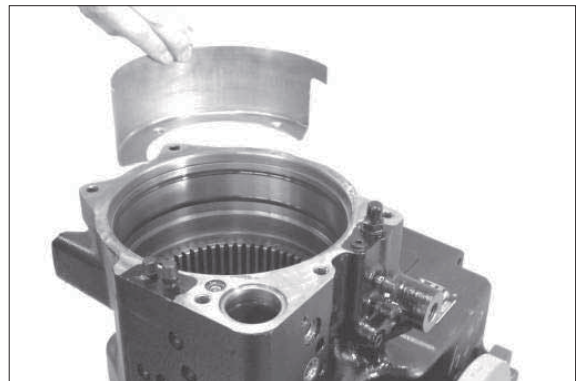
14WF8TM190

- 3) **Only for version transmission installation position**

- ※ Insert screen sheet and fasten with countersunk screws.

Tightening torque (M 6/8.8) $M_A = 7.4 \text{ Nm}$

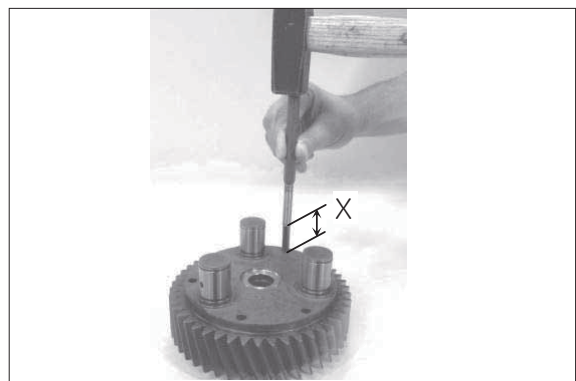
Wet countersunk screws with Loctite type no.243.



14WF8TM191

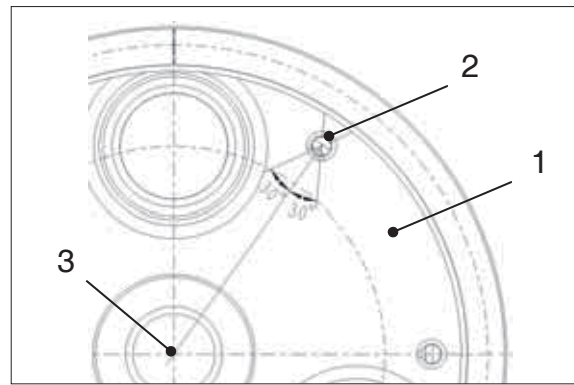
- 4) Install slotted pins (2) considering installation dimension X and installation position, see 14WF8TM193 (groove showing to center).

(S) Press-fit mandrel AA00 392 151



14WF8TM192

- 5) 1 = Planetary carrier
 2 = Slotted pin (6x)
 3 = Center (planetary carrier)

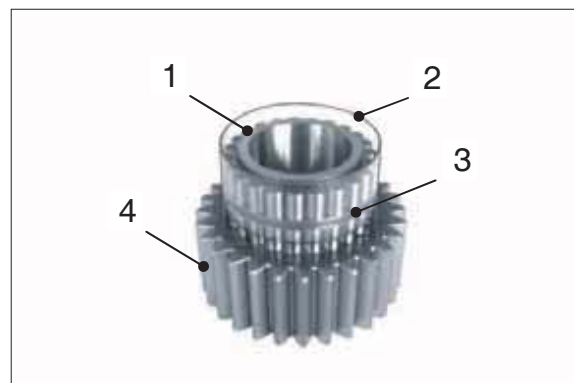


14WF8TM193

- 6) Insert cylindrical roller bearing into planetary gear. Press cylindrical roller bearing through packaging sleeve until snap ring engages into annular groove of planetary gear.

※ Use packaging sleeve to facilitate assembly.

- 1 = Cylindrical roller bearing
 2 = Packaging sleeve
 3 = Snap ring
 4 = Planetary gear

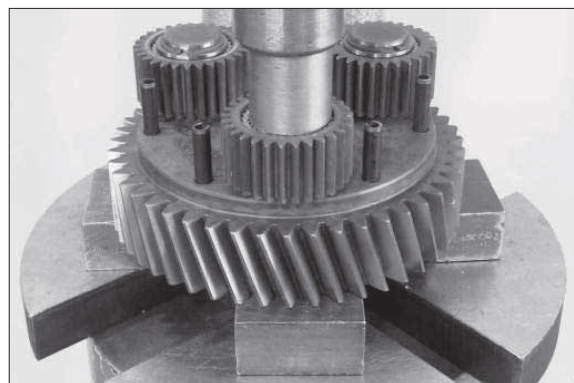


14WF8TM194

- 7) Press on planetary gear over bearing inner ring until contact.

(S) Driver tool 5870 048 283

※ Install planetary gears with large radius on cylindrical roller bearing (downwards) towards planetary carrier.



14WF8TM195

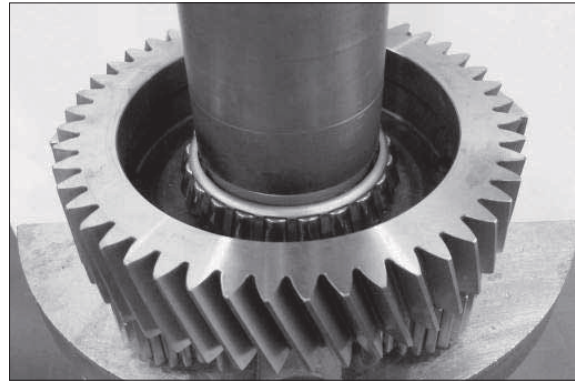
- 8) Engage retaining ring.

※ Adjust retaining ring until contact with groove base.



14WF8TM196

- 9) Press bearing inner ring onto planetary carrier until contact.



14WF8TM197

- 10) Insert preassembled planetary carrier.



14WF8TM198

- 11) Fix planetary carrier with pressure plate and clamping bar.

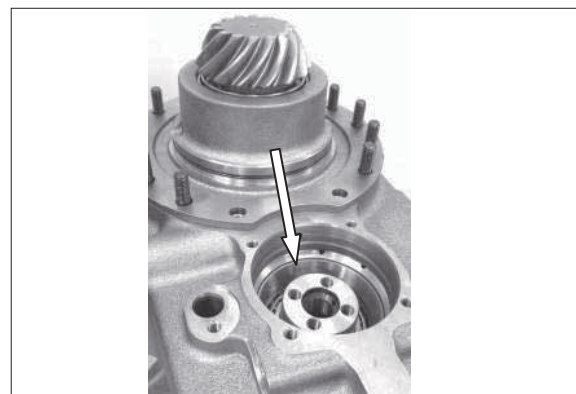
(S) Clamping bar

5870 654 049



14WF8TM199

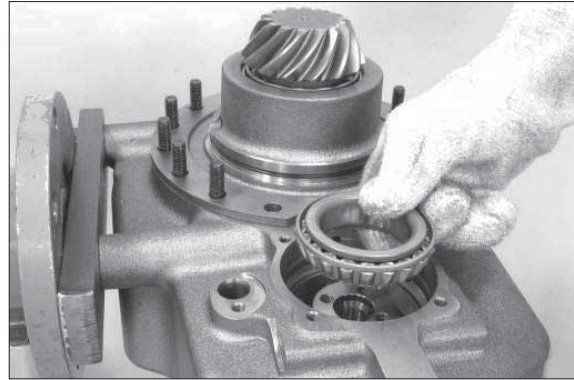
- 12) Rotate transmission by 180°.
Check contact of bearing outer ring (see arrow). Reassembly of bearing outer ring, see 14WF8TM189.



14WF8TM200

13) Install heated bearing inner ring until contact.

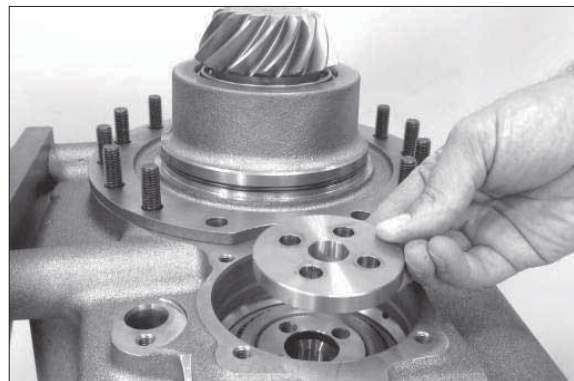
※ Adjust bearing inner ring after cooling down.



14WF8TM201

14) Position disk and manually turn in hexagon screws (fix planetary carrier).

Then remove clamping bar, see 14WF8TM199.



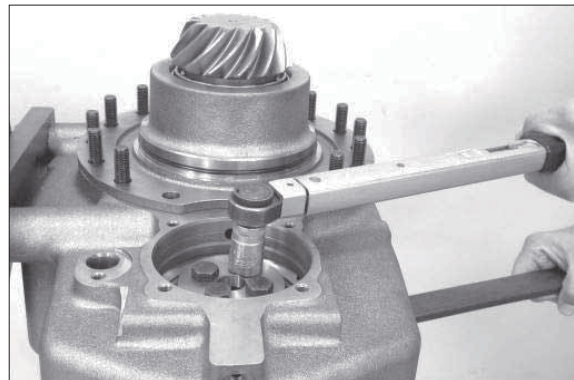
14WF8TM202

15) Fix clamping fork to output flange.

Tighten hexagon screws evenly – risk of strain.

Tightening torque (M 10/10.9) $M_A = 46 \text{ Nm}$
(S) Clamping fork 5870 240 025

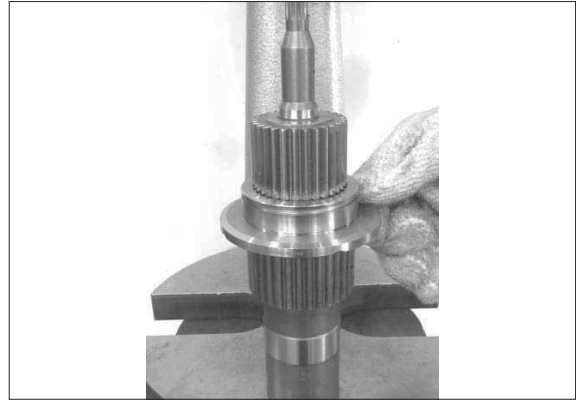
※ While tightening hexagon screws, rotate planetary carrier several times in both directions (roller setting).



14WF8TM203

Brake and clutch

- 16) Mount heated centering disk and press it until contact.



14WF8TM204

- 17) Fix centering disk by engaging retaining ring into annular groove of input shaft.



14WF8TM205

- 18) Insert ball bearing into ring gear and fasten it by engaging retaining ring into annular groove of ring gear.

(S) Clamping pliers 5870 900 021



14WF8TM206

- 19) Heat bearing inner ring of ball bearing.



14WF8TM207

20) Mount preassembled ring gear to input shaft until contact.



14WF8TM208

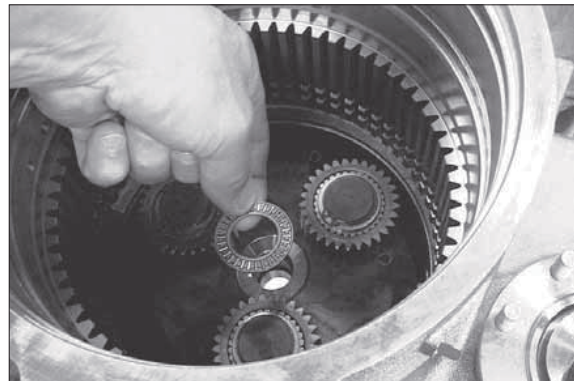
21) Engage retaining ring into annular groove of input shaft.



14WF8TM209

22) Rotate transmission by 180°.
Insert axial needle cage into recess of planetary carrier.

※ Oil axial needle cage for reassembly.



14WF8TM210

23) Insert preassembled input shaft (with ring gear).

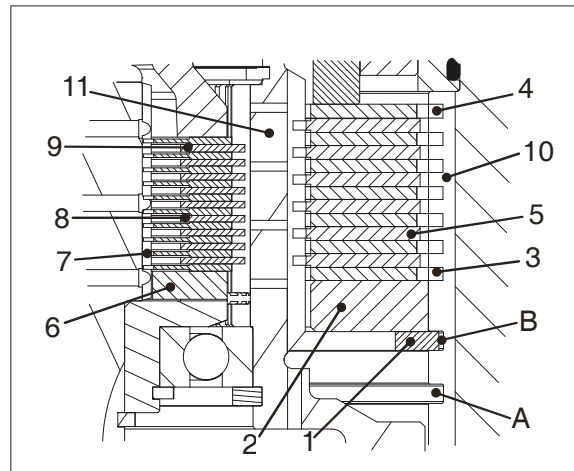


14WF8TM211

Disk components brake and clutch

- 24) A = Lower annular groove (Item retaining ring-1)
B = Upper annular groove (Item retaining ring-1)

- 1 = Retaining ring
- 2 = End plate/Brake (1 pc)
- 3 = Outer disk/Brake (6 pcs.)
- 4 = Outer disk/Brake optional (1 pc)
- 5 = Inner disk/Brake (6 pcs.)
- 6 = End plate/Clutch (1 pc)
- 7 = Lining disk/Clutch (10 pcs.)
- 8 = Outer disk/Clutch (8 pcs.)
- 9 = Outer disk/Clutch optional (1 pc)
- 10 = Transmission housing
- 11 = Disk carrier / Ring gear



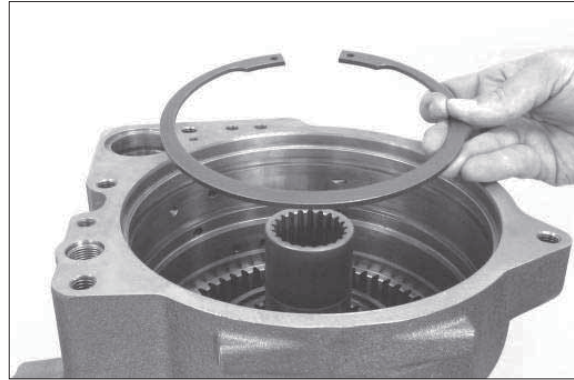
14WF8TM213

Reassembly brake :

25) Engage retaining ring (1) into annular groove (A).

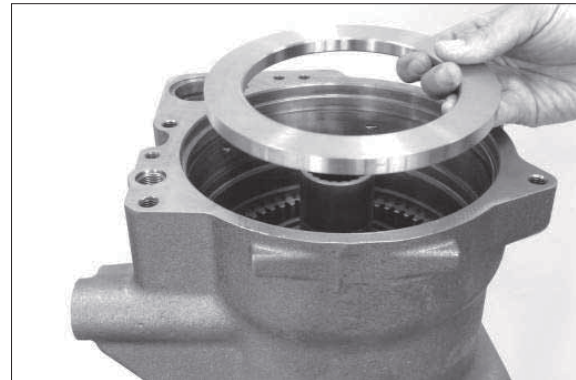
(S) Clamping pliers 5870 900 021

※ Observe installation position of retaining ring (1).



14WF8TM215

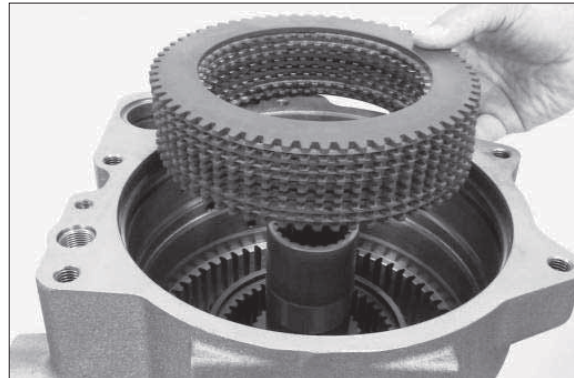
26) Insert end plate (2).



14WF8TM216

27) Insert disk package alternately, beginning with an outer disk.

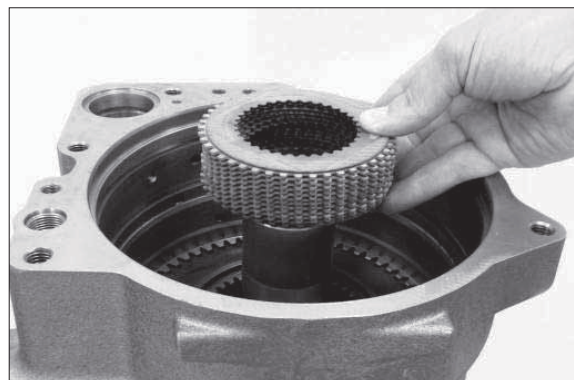
※ Position outer disk (1 pc) s = variable 2.8 ~ 3.7 mm to top of disk package (piston side).
With outer disk s = variable, disk clearance / piston stroke is adjusted - see 14WF8TM229.



14WF8TM217

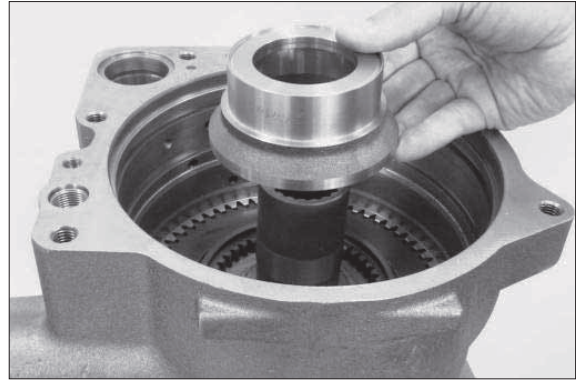
28) Insert disk package alternately, beginning with a lining disk.

※ Position outer disk (1 pc) s = variable 1.2 ~ 1.6 mm to top of disk package (pressure piece side).
With outer disk s = variable, disk clearance / piston stroke is adjusted - see 14WF8TM228.



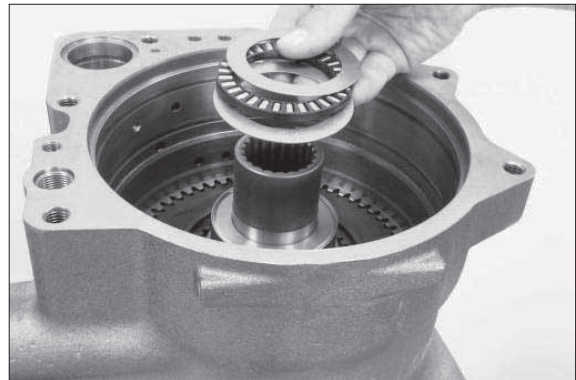
14WF8TM218

29) Mount pressure piece (without compression spring).



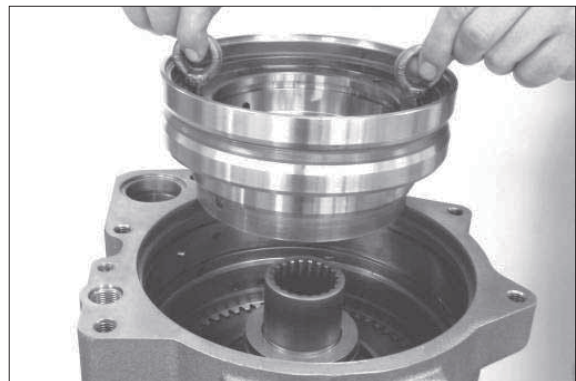
14WF8TM219

30) Oil axial roller cage and mount it with both axial washers (1x each, positioned underneath and onto axial needle cage).



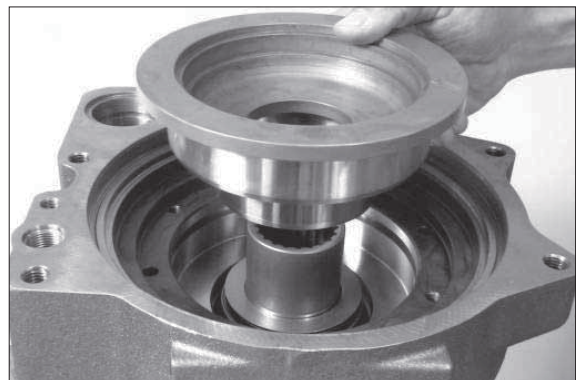
14WF8TM220

31) Insert piston (brake) – without mounted sealing elements.



14WF8TM221

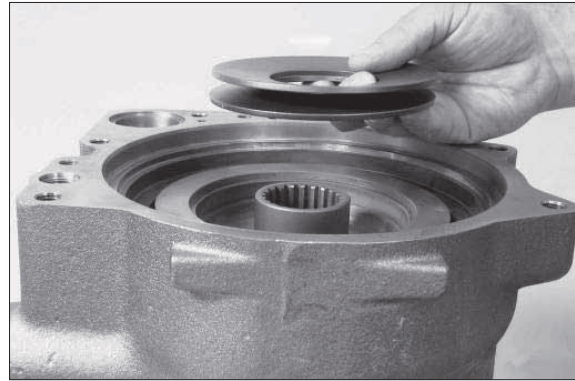
32) Insert piston (clutch) – without mounted sealing elements.



14WF8TM222

33) Insert both cup springs/clutch.

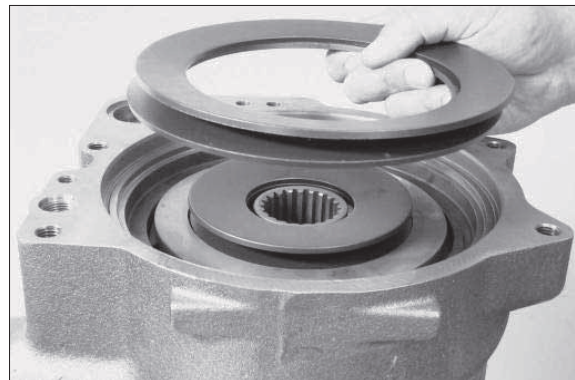
- ※ Fix cup springs with grease and position them centrally.
- ※ Observe installation position, see 14WF8TM225.



14WF8TM223

34) Insert both cup springs/brake.

- ※ Fix cup springs with grease and position them centrally.
- ※ Observe installation position, see 14WF8TM225.



14WF8TM224

35) 1 = Measuring device

2 = Piston/clutch

3 = Cup springs/Clutch

4 = Piston/Brake

5 = Cup springs/Brake

6 = Transmission housing

I = Measuring hole (disk clearance / clutch)

II = Measuring hole (disk clearance / brake)

A = Mounting face/Housing – Front face/Piston

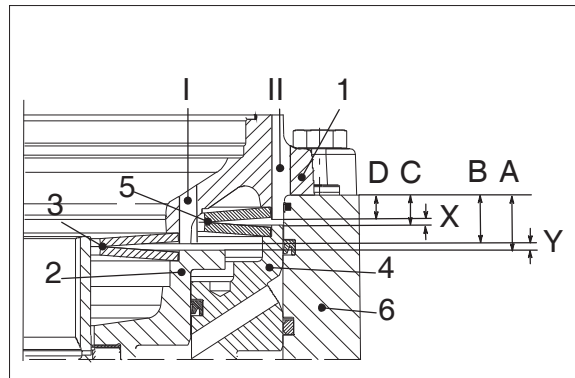
B = Mounting face/Housing – Piston contact/Housing

C = Mounting face/Housing – Front face/Piston

D = Mounting face/Housing – Piston contact/Housing

Y = Disk clearance/Clutch → $2.4 + 0.3$ mm (piston stroke)

X = Disk clearance/Brake → $1.8 + 0.3$ mm (piston stroke)

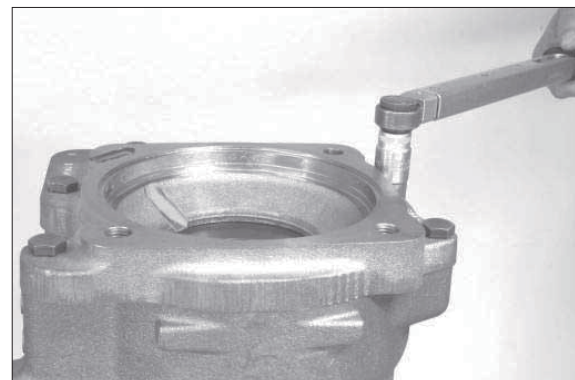


14WF8TM225

36) Locate measuring device evenly with hexagon screws (risk of breakage) until contact.

Tightening torque (M 12/8.8) $M_A = 80$ Nm

(S) Measuring device 5870 200 131

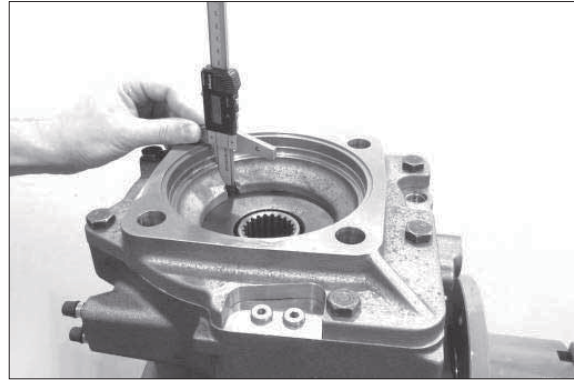


14WF8TM226

- 37) Determine dim. A (Measuring hole I) from mounting face/housing to front face/piston (clutch).

Dim. A e.g. = 22.45 mm

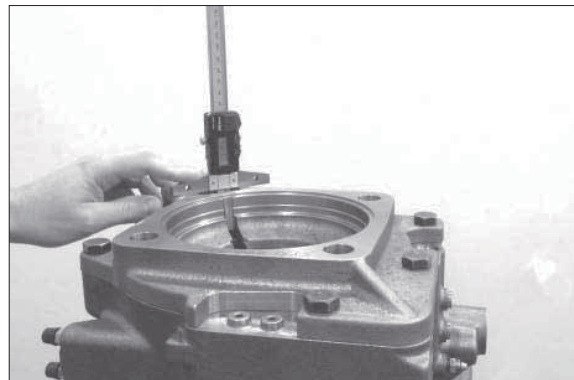
(S) Straightedge 5870 200 108



14WF8TM227

- 38) Determine Dim. C (Measuring hole II) from mounting face/housing to front face/piston (brake).

Dim. C e.g. = 11.85 mm



14WF8TM228

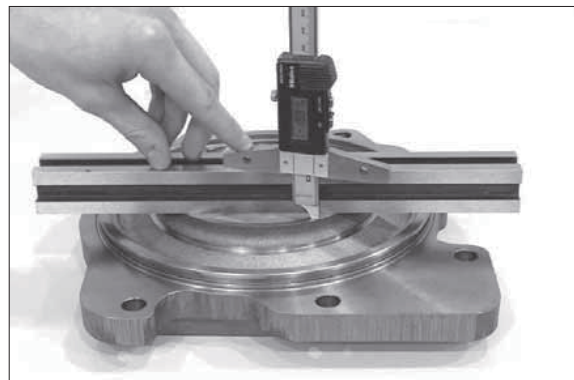
- 39) Determine Dim. B from mounting face/housing to clutch piston contact/housing.

Dim. B e.g. = 19.95 mm

A-B = 2.50 mm (disk clearance)

Clutch disk clearance (piston stroke) = $2.4^{+0.3}$ mm

▲ If the required disk clearance (piston stroke) is not obtained, correct with a suitable outer disk – see 14WF8TM218.



14WF8TM229

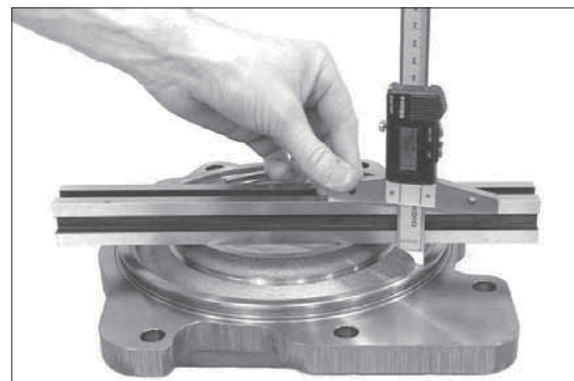
- 40) Determine Dim. D from mounting face/housing to brake piston contact/housing.

Dim. D e.g. = 9.95 mm

C-D = 1.90 mm (disk clearance)

Disk clearance (piston stroke) Brake = $1.8^{+0.3}$ mm

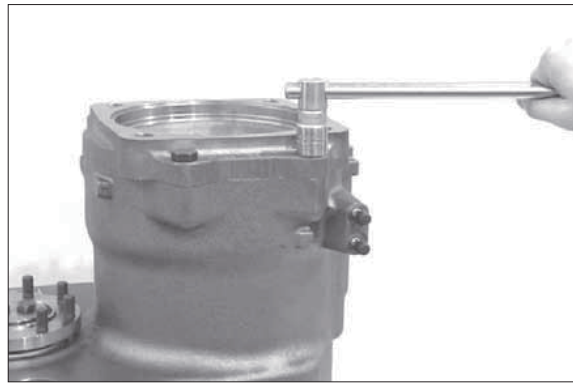
▲ If the required disk clearance (piston stroke) is not obtained, correct with a suitable outer disk – see 14WF8TM217.



14WF8TM230

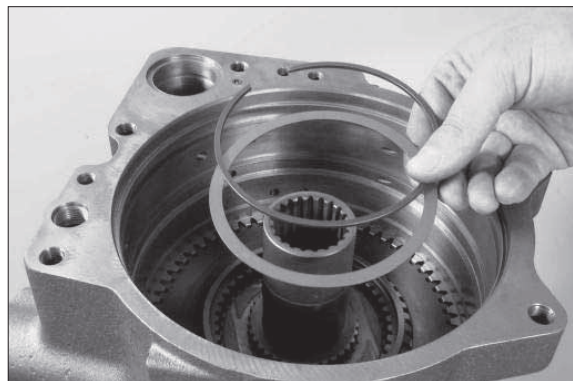
41) Remove measuring device again – loosen screws evenly.

Remove all cup springs, both pistons, axial roller cage with axial washers and pressure piece.



14WF8TM231

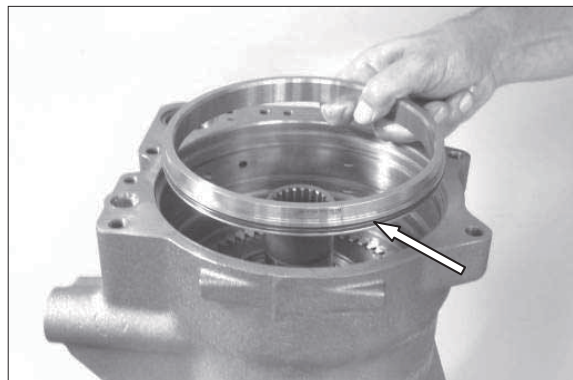
42) Insert shim into ring gear and fix by engaging snap ring into annular groove of ring gear.



14WF8TM232

43) Place O-ring (see arrow) into groove and insert ring.

- ※ Oil sealing surfaces in housing and O-ring for reassembly.
- ※ Observe installation position



14WF8TM233

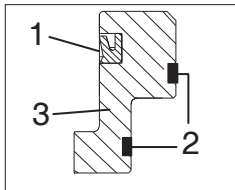
44) Mount ring with driver tool until contact.

(S) Driver tool 5870 506 161

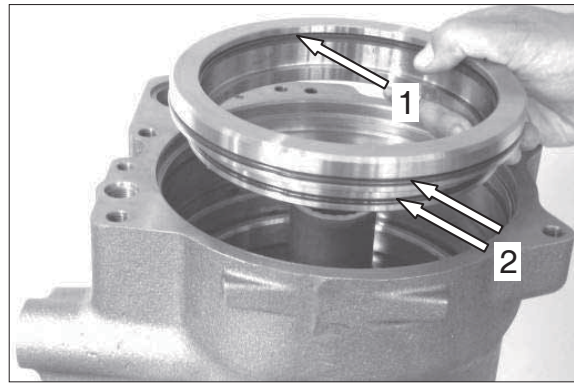


14WF8TM234

- 45) Oil sealing surfaces in housing and sealing elements. Insert seal (1) with sealing lip showing to oil sump – also see detail sketch.



Put both O-rings (2) into annular grooves of pressure ring (3) and insert preassembled pressure ring into housing.



14WF8TM235

- 46) Bring pressure ring with driver tool into contact position.

(S) Driver tool 5870 506 161



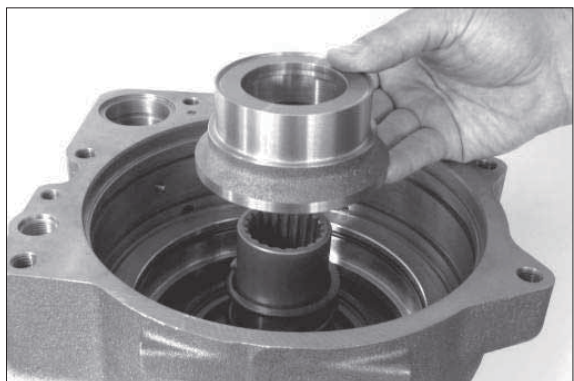
14WF8TM237

- 47) Insert compression spring until contact.



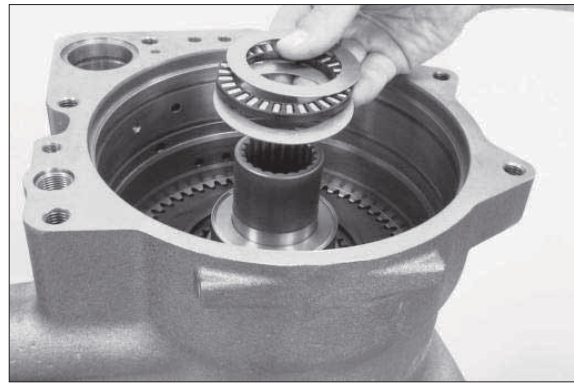
14WF8TM238

- 48) Insert pressure piece over compression spring until contact.



14WF8TM239

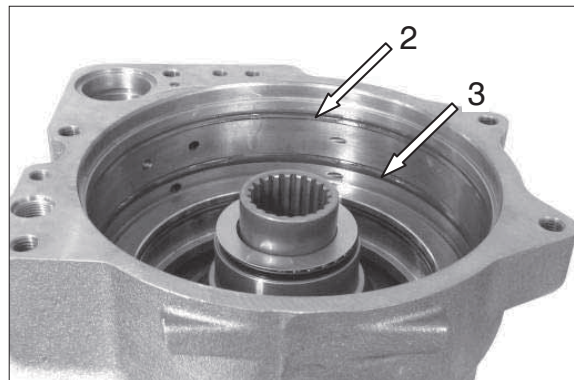
- 49) Oil axial roller cage and mount it with both axial washers (1x each to be positioned underneath and onto axial needle cage).



14WF8TM240

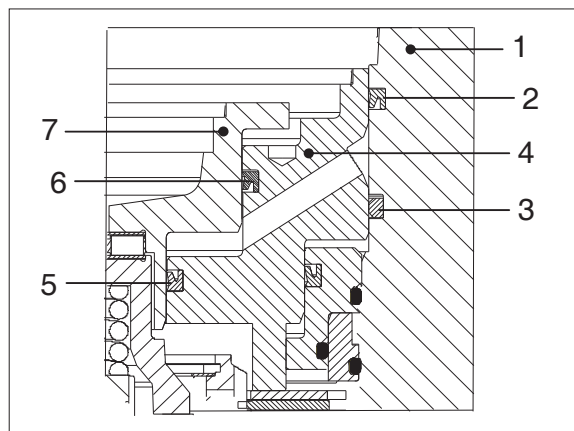
- 50) Insert seal (2, with sealing lip showing to oil sump) and seal (3) – see 14WF8TM242 into housing (1).

※ Oil sealing elements and sealing surfaces on piston for reassembly.



14WF8TM241

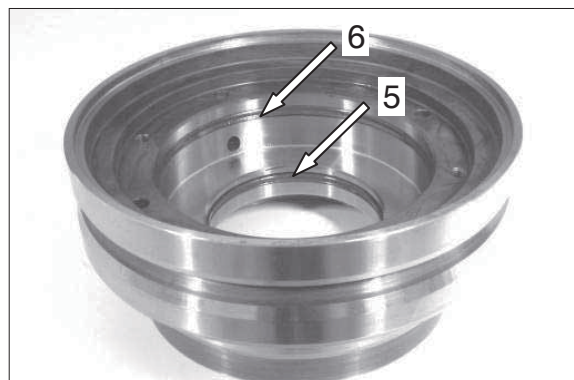
- 51) 1 = Housing
2 = Seal (with sealing lip)
3 = Seal
4 = Piston / Brake
5 = Seal (with sealing lip)
6 = Seal (with sealing lip)
7 = Piston / Clutch



14WF8TM242

- 52) Insert seals (5 and 6, see 14WF8TM247), with sealing lips showing to oil sump into piston / brake (4).

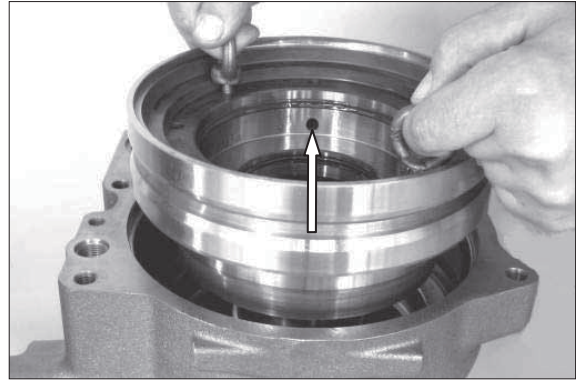
※ Oil sealing surfaces on piston and sealing elements for reassembly.



14WF8TM243

53) Insert preassembled piston/brake until contact.

※ Position piston in such a way that oil supply hole (see arrow) is at 12.00 o'clock position. Observe version as to transmission installation position HORIZONTAL – VERTICAL.

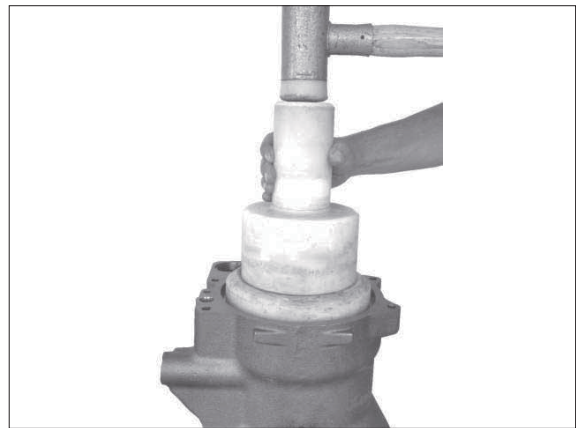


14WF8TM244

54) Use driver tool to bring piston into contact position.

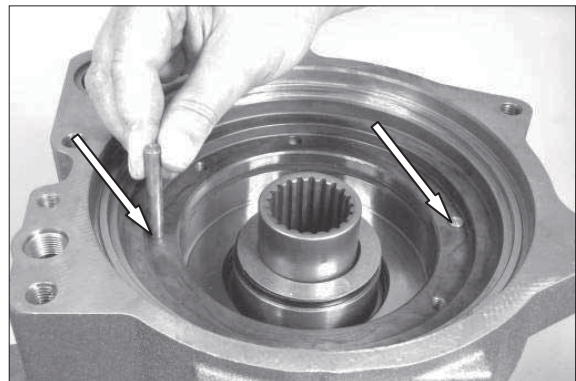
(S) Driver tool

5870 506 161



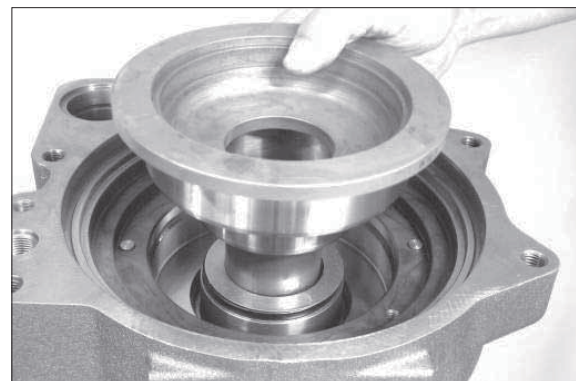
14WF8TM245

55) Insert both cyl. pins (arrow).



14WF8TM246

56) Insert piston/clutch until contact.



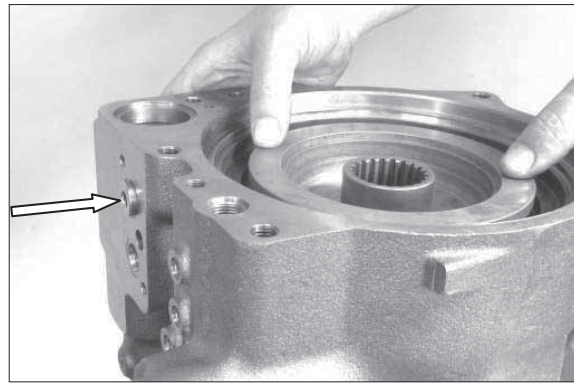
14WF8TM247

57) Press piston axially, against compression spring preload.

Provide screw plug with new O-ring and seal pressure oil supply hole (see arrow).

Tightening torque $M_A = 40 \text{ Nm}$

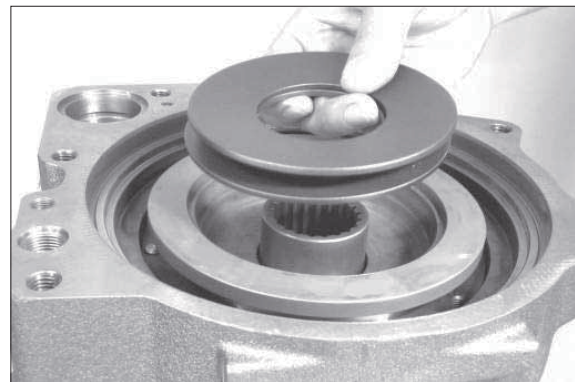
※ Axial position of piston is maintained (Facilitate assembly for installation of input housing, see 14WF8TM254~ 14WF8TM255).



14WF8TM248

58) Insert both cup springs/clutch.

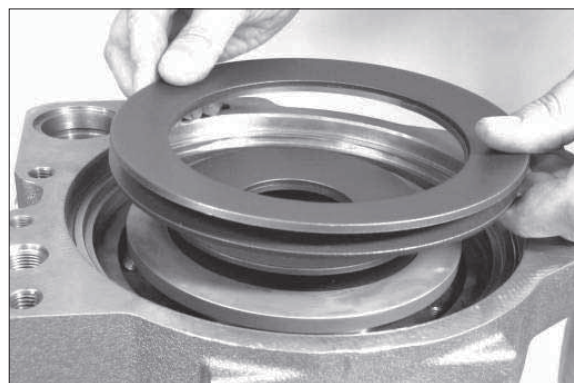
※ Observe installation position, see also 14WF8TM225.



14WF8TM249

59) Insert both cup springs/brake.

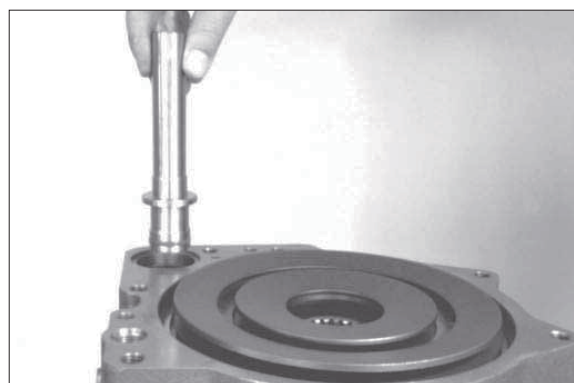
※ Observe installation position – see also 14WF8TM225.



14WF8TM250

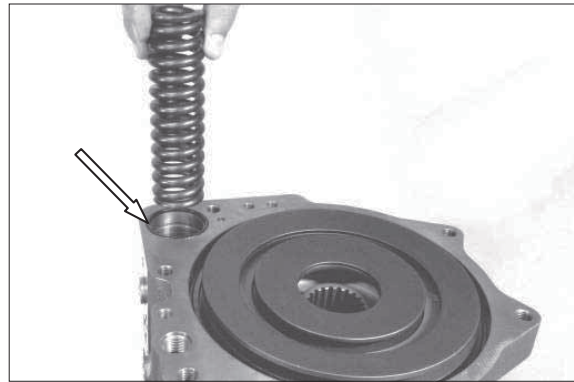
Install modulation valve and input housing

60) Insert piston (modulation valve cpl. – can only be replaced as unit).



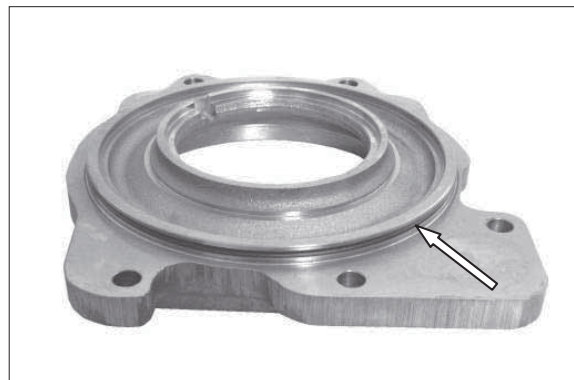
14WF8TM251

- 61) Place O-ring (see arrow) into annular groove of housing and insert compression spring.



14WF8TM252

- 62) Oil O-ring and insert it into annular groove of input housing.

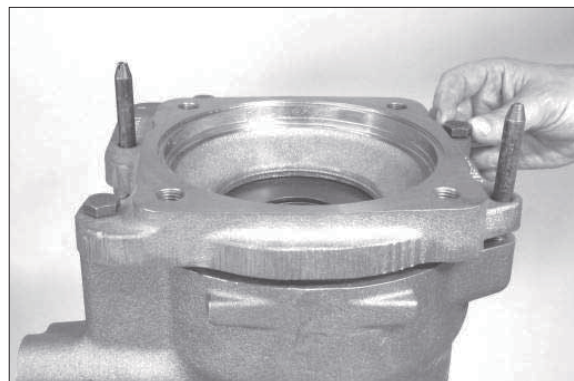


14WF8TM253

- 63) Insert two adjusting screws (M 12), mount input housing and fix it with hexagon screws.

(S) Adjusting screws (M12) 5870 204 021

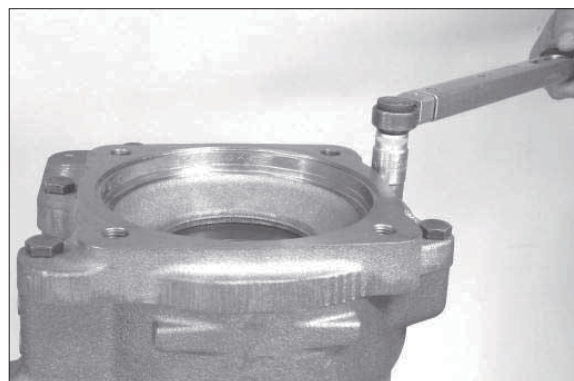
- ※ For installation of input housing align cup springs centrally.



14WF8TM254

- 64) Locate input housing evenly with hexagon screws (risk of breakage) until contact.

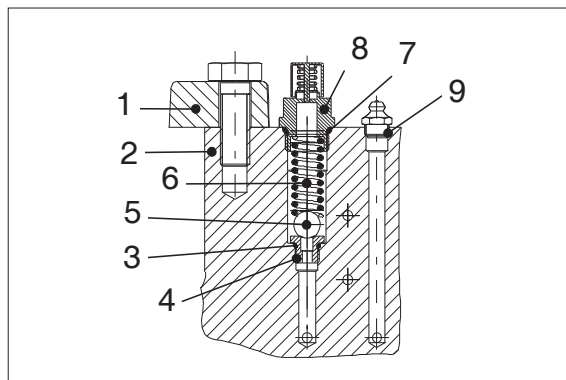
Tightening torque (M 12/8.8) $M_A = 80 \text{ Nm}$



14WF8TM255

Emergency release (parking brake)

- 65) 1 = Input housing
 2 = Housing
 3 = O-ring
 4 = Threaded element (orifice)
 5 = Ball
 6 = Compression spring
 7 = O-ring
 8 = Breather
 9 = Position of lubrication nipple for version
 Transmission installation position Vertical

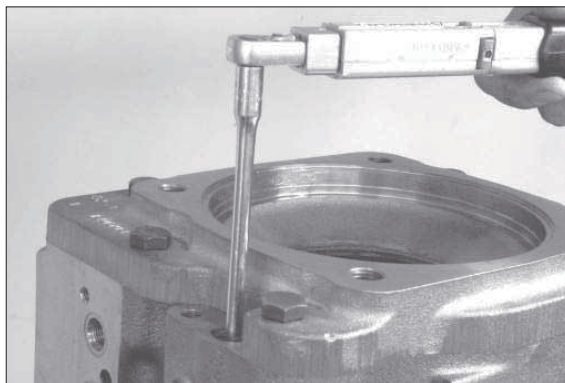


14WF8TM256

- ※ Position of lubrication nipple for version
 transmission installation position Horizontal,
 see 14WF8TM261.
- ※ Remove protective cap of lubrication nipple
 only if emergency release is required.

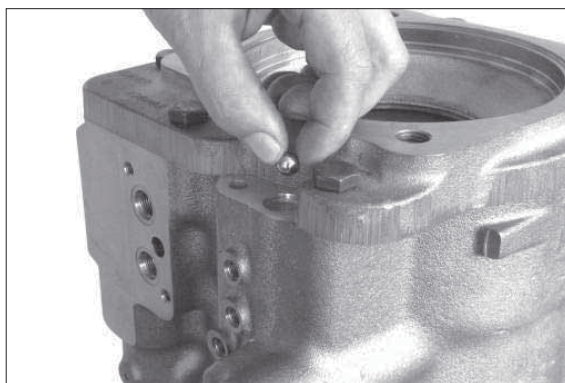
- 66) Install threaded element (4) with new O-ring
 (3).

Tightening torque (M 10 × 1) $M_A = 15 \text{ Nm}$



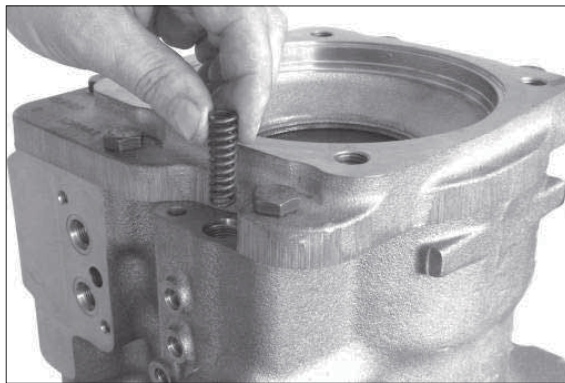
14WF8TM257

- 67) Insert ball (5).



14WF8TM258

- 68) Insert compression spring (6).



14WF8TM259

Check emergency release for leak tightness

69) Illustration shows version transmission installation position Vertical.

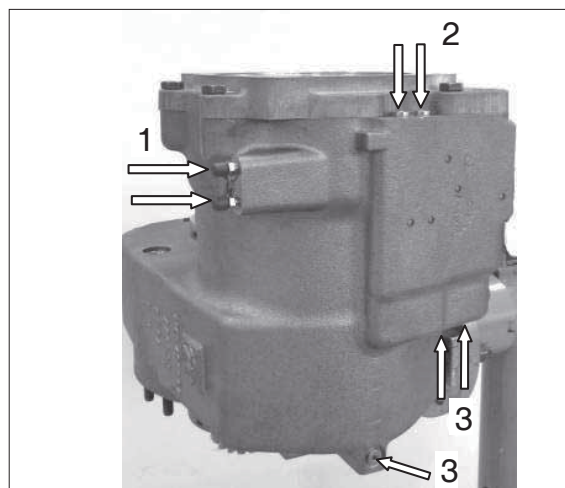
※ For version transmission installation position Horizontal connections and positions of breather valves/lubrication nipple etc. must be considered as shown on illustration of 14WF8TM261.

Install both breather valves (1), screw plugs (2) with new seal rings and screw plugs (3) with new O-rings.

Breather valve (M 10×1) $MA = 15 \text{ Nm}$

Screw plug (M 10×1 with seal ring) $MA = 20 \text{ Nm}$

Screw plug (M 10×1 with O-ring) $MA = 20 \text{ Nm}$



14WF8TM260

70) 1 = Breather/Pressure relief-valve

(emergency release – parking brake)

2 = Screw plug

3 = Breather valve

(emergency release – parking brake)

4 = Lubrication nipple

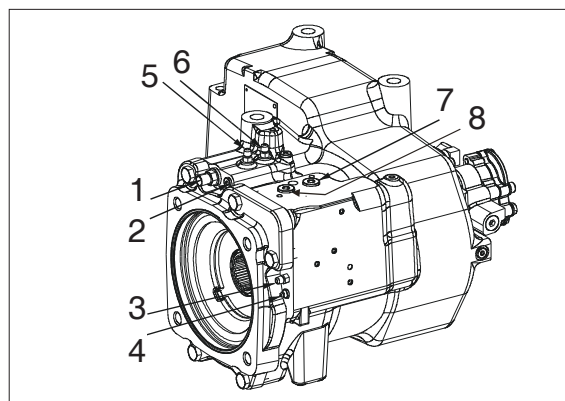
(emergency release – parking brake)

5 = Breather valve (multi-disk clutch)

6 = Breather valve (multi-disk brake)

7 = Pressure oil connection – multi-disk brake

8 = Pressure oil connection – multi-disk clutch



14WF8TM261

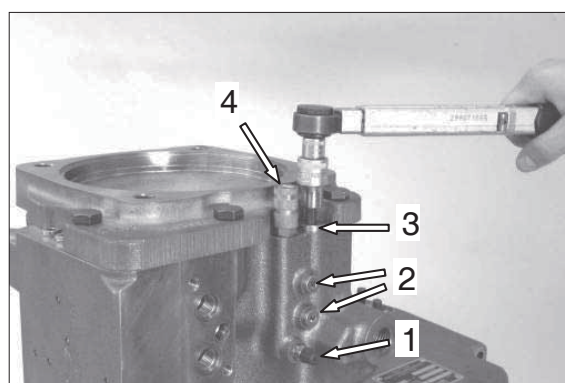
71) Install breather valve (1), screw plugs (2), screw plug (3) with new O-ring and compressed air connection piece (4).

Breather valve (M 10×1) $MA = 15 \text{ Nm}$

Screw plug (M 10×1 with O-ring) $MA = 20 \text{ Nm}$

Screw plug (M 18×1.5 with O-ring) $MA = 35 \text{ Nm}$

Compressed air connect. piece (M 10×1) with seal ring $MA = 20 \text{ Nm}$

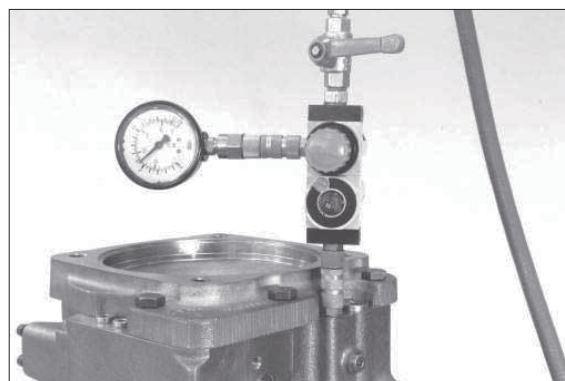


14WF8TM262

72) Pressurize emergency release with compressed air $p = 5 + 1 \text{ bar}$ and close shut-off valve. During a test duration of 3 minutes no pressure drop is allowed.

(S) Air connection

5870 505 012



14WF8TM263

- 73) Remove screw plug and compressed air connection piece (see 14WF8TM262).
Install breather (3) with new O-ring and lubrication nipple (4).

Lubrication nipple (M 10×1) $M_A = 15 \text{ Nm}$
Breather (M 18×1.5) $M_A = 22 \text{ Nm}$

Check multi-disk brake and clutch for leak tightness as well as closing pressure

- 74) 1 = Transmission housing
2 = Input housing

AB = Pressure oil connection – multi-disk brake

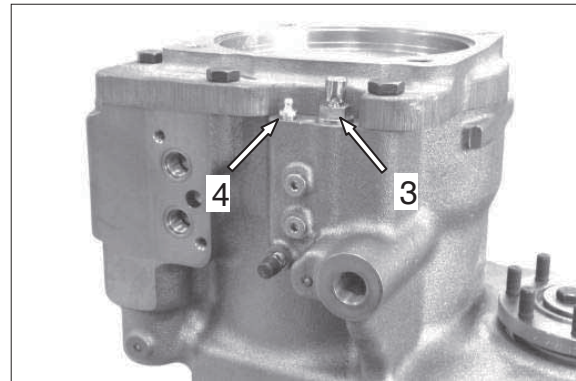
AK = Pressure oil connection – multi-disk clutch

EB = Breather valve – multi-disk brake

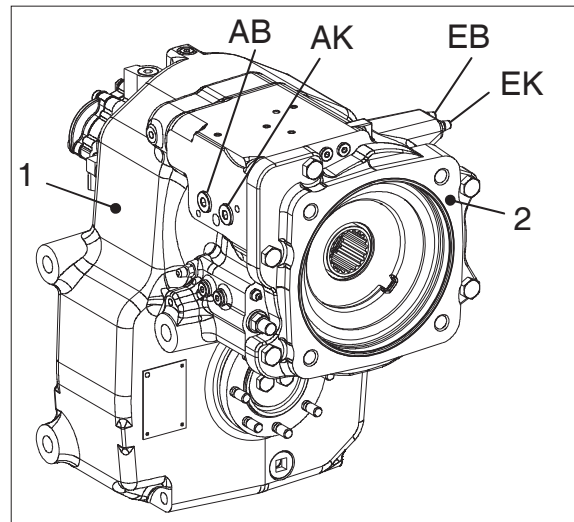
EK = Breather valve – multi-disk clutch

※ Illustration shows version transmission installation position Vertical.

※ For version Transmission installation position Horizontal, connections and positions of breather valves/lubrication nipple etc. according to illustration in 14WF8TM261 must be considered.



14WF8TM264



14WF8TM265

Multi-disk brake

- 75) Connect HP pump (AB – see 14WF8TM265 and 14WF8TM261) and build up pressure of $p = 30$ (max. 35 bar).
- Bleed pressure chamber several times.
Close shut-off valve.
During a test duration of 3 minutes no measurable pressure drop is allowed.

(S) HP pump 5870 287 007



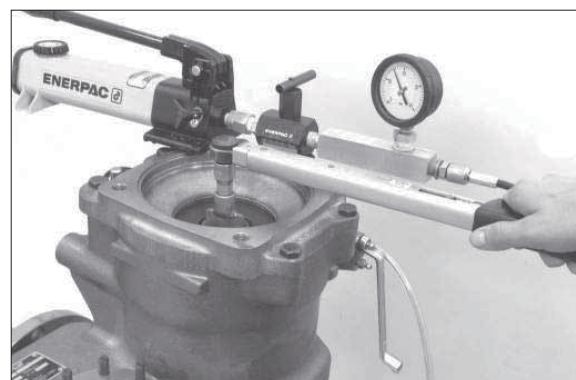
14WF8TM266

Closing pressure test (Cup spring preloading force)

- 76) When measuring closing pressure, valve block may not be attached to transmission due to by-pass function between brake and clutch.
Connection AK (see 14WF8TM265 and 14WF8TM261) open (not closed and tank connection).

Reduce pressure slowly, when pressure range 12~9 bar (closing pressure) is reached, input shaft must be locked at a tightening torque of 35 Nm.

(S) Spline mandrel 5870 510 039



14WF8TM267

Multi-disk clutch

- 77) Connect HP-pump (AK see 14WF8TM265 and 14WF8TM261), build up pressure of $p = 30 \sim \text{max. } 35 \text{ bar}$.

- Relieve pressure chamber several times.
Close shut-off valve.

During a test duration of 3 minutes no measurable pressure drop is allowed.

(S) HP-pump 5870 287 007



14WF8TM268

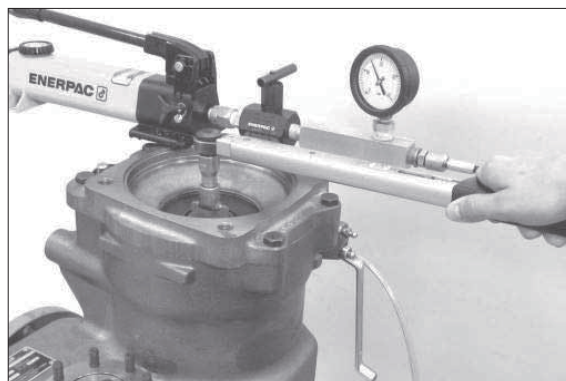
Closing pressure test (Cup spring preloading force)

- 78) When measuring closing pressure, valve block (only for version with mounted valve block) may not be attached to transmission due to by-pass function between brake and clutch.

Connection AB (see 14WF8TM265 and 14WF8TM261) open (not closed and tank connection).

Reduce pressure slowly, when pressure range $17 \sim 13 \text{ bar}$ (closing pressure) is reached, input shaft must be locked at a tightening torque of 35 Nm .

(S) Spline mandrel 5870 510 039

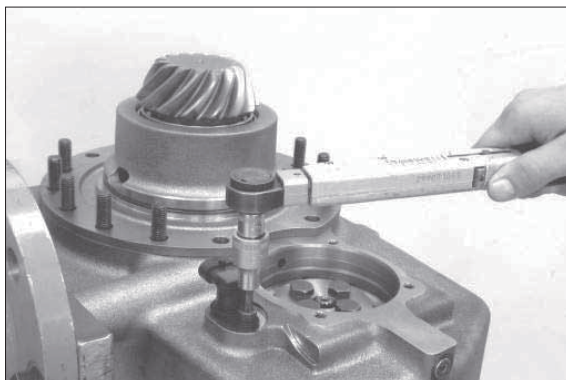


14WF8TM269

Speed sensor

- 79) Install speed sensor with new O-ring.

Tightening torque (M 8/8.8) $M_A = 23 \text{ Nm}$

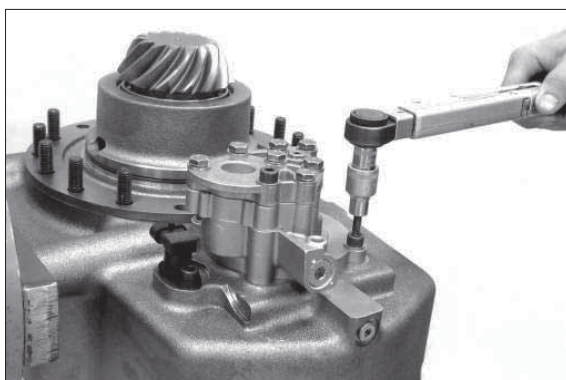


14WF8TM270

Lubrication pump/shift interlock

- 80) Install lubrication pump (with O-rings) or shift interlock – depending on version – (Illustration shows – Lubrication Pump).

Tightening torque (M 8/10.9) $M_A = 23 \text{ Nm}$

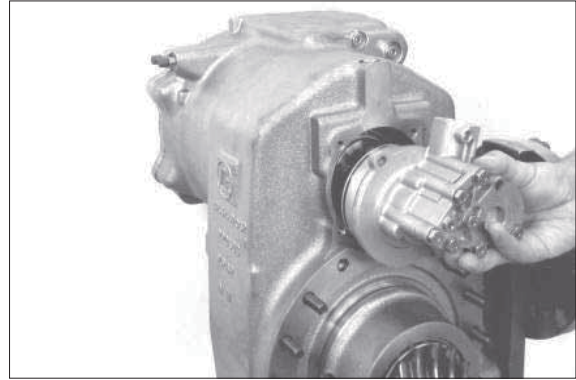


14WF8TM271

10.DISASSEMBLY - LUBRICATION PUMP/ SHIFT INTERLOCK and VALVE BLOCK

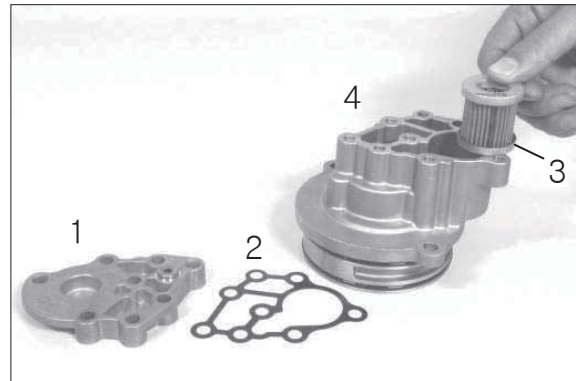
Lubrication pump version

- 1) Loosen threaded joint and pull off cpl. lubrication pump.



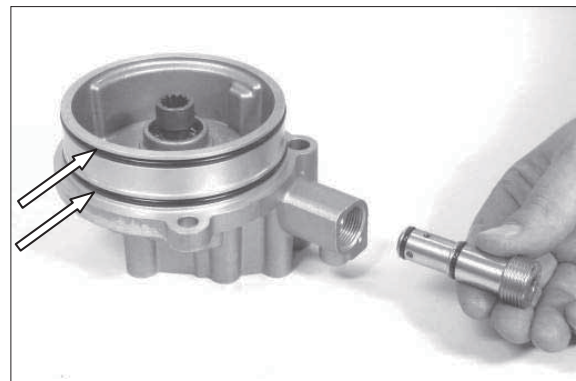
14WF8TM272

- 2) Loosen cover screws, remove cover (1) with seal (2) and filter (3) from housing (4).



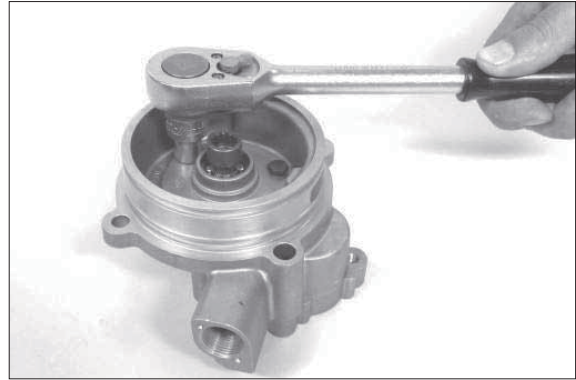
14WF8TM273

- 3) Remove cpl. pressure limiting valve and both O-rings (arrows).



14WF8TM274

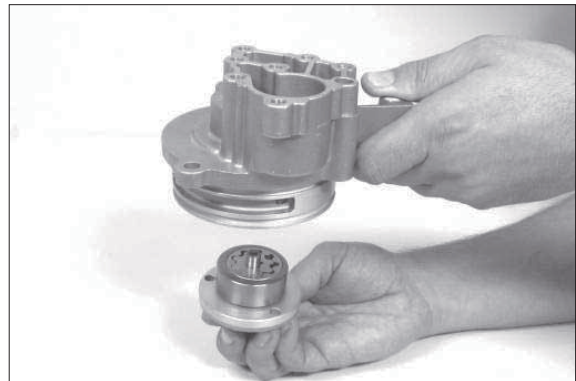
- 4) Keep housing in vertical position, while loosening pump cover screws.



14WF8TM275

- ※ Maintain contact position of pump and rotate by 180° - disassembly aid.

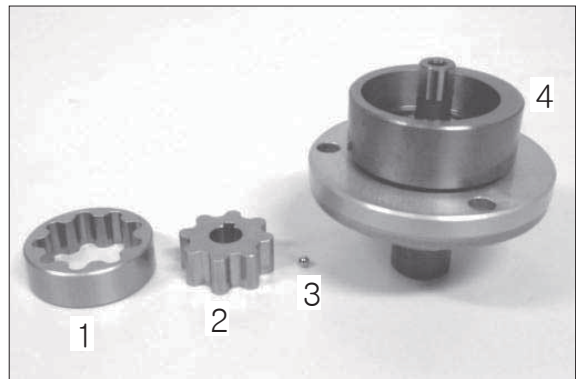
- 5) Then pull pump in vertical position out of housing – pay attention to possibly releasing balls and compression springs.



14WF8TM276

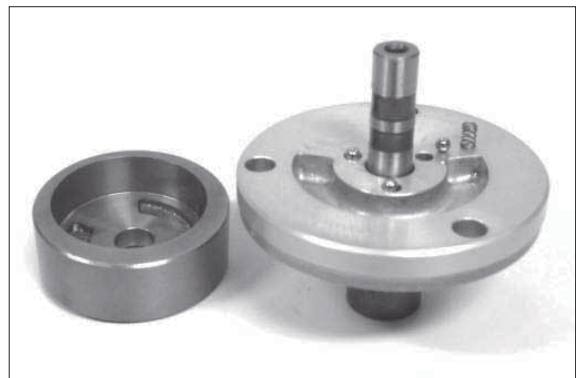
- 6) Remove outer (1) and inner rotor (2) and take releasing ball [(3) driver] out of control housing (4).

- ※ Outer, inner rotor and control housing = rotor set



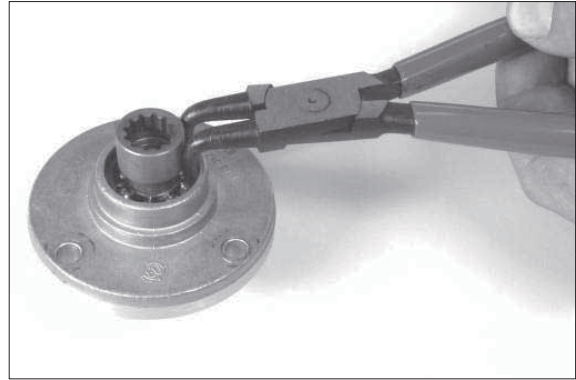
14WF8TM277

- 7) Remove control housing and releasing balls and compression springs (3 pcs. each).



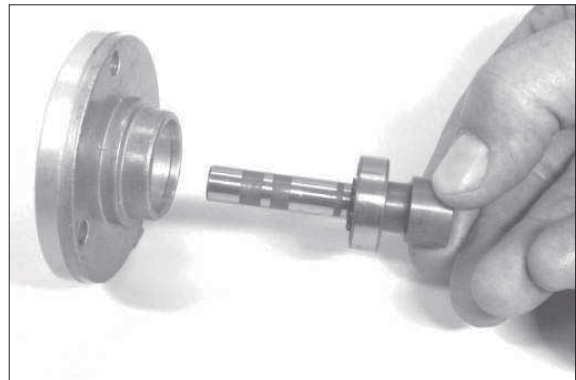
14WF8TM278

8) Unsnap retaining ring.



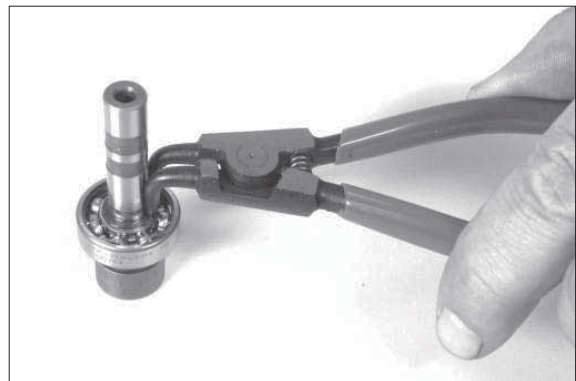
14WF8TM279

9) Pull cpl. pump shaft out of pump cover.



14WF8TM280

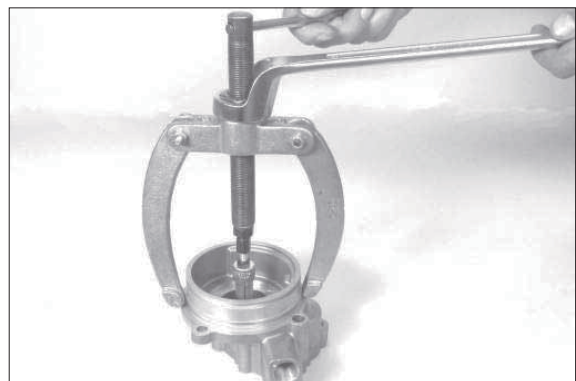
10) Unsnap retaining ring and press ball bearing from shaft.



14WF8TM281

11) Pull needle sleeve out of housing hole.

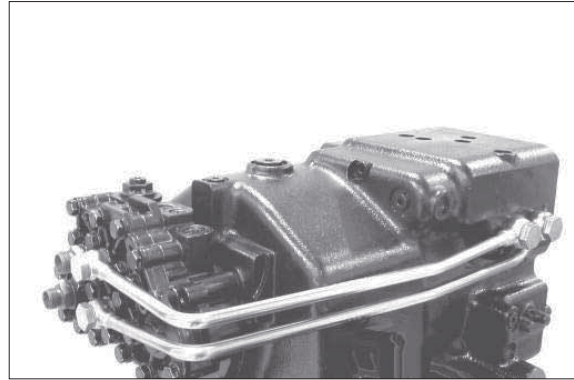
(S) Inner extractor	5870 300 012
(S) Counter support	5870 300 011



14WF8TM282

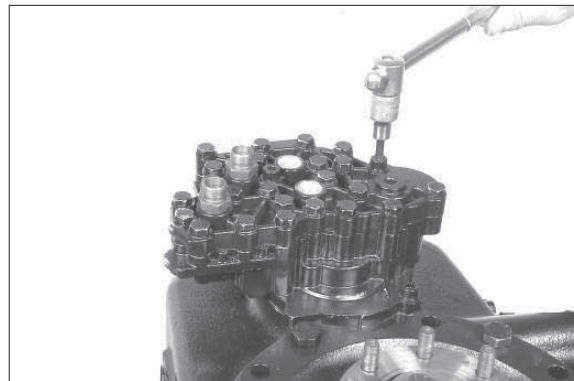
Shift interlock version

12) Disassemble both oil tubes.



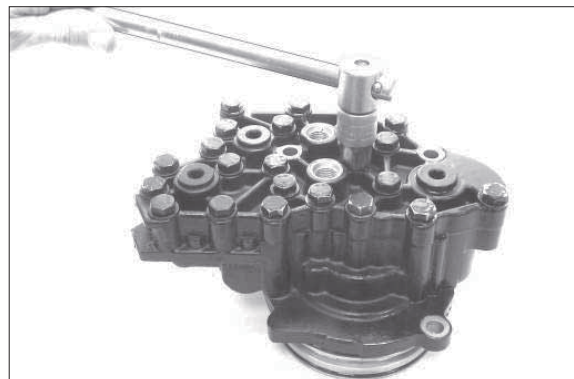
14WF8TM283

13) Loosen threaded joint of shift interlock (3 x cylindrical screws) and remove cpl. shift interlock.



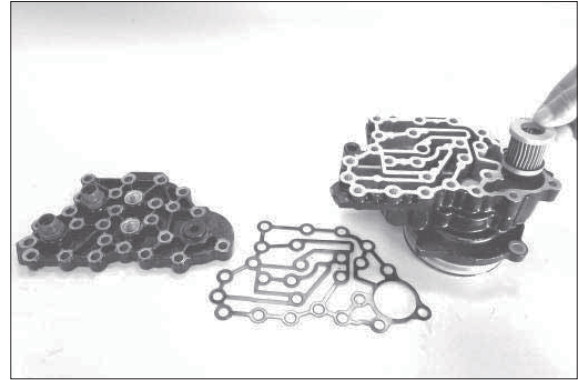
14WF8TM284

14) Loosen cover screws, remove cover and gasket (see also 14WF8TM286).



14WF8TM285

15) Take filter out of housing.



14WF8TM286

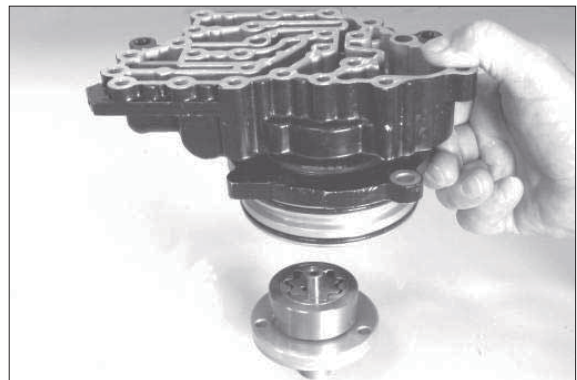
16) Loosen cover screws of pump.



14WF8TM287

※ Maintain contact position of pump and rotate it by 180° – disassembly aid.

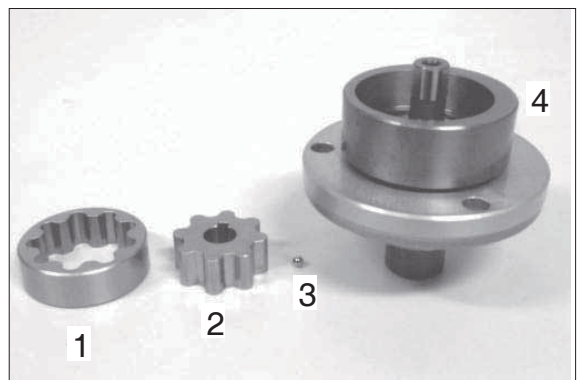
17) Then pull pump in vertical position out of housing – pay attention to possibly releasing balls and compression springs (see 14WF8TM289 and 14WF8TM290).



14WF8TM288

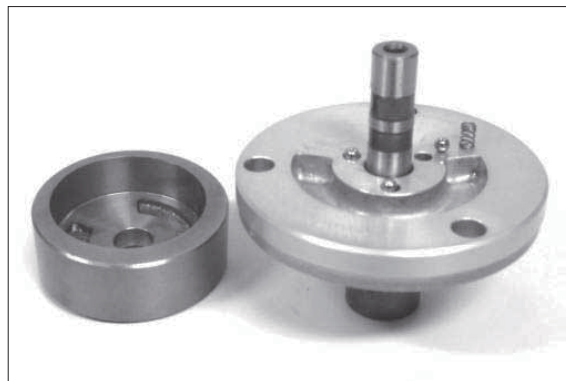
18) Remove outer (1) and inner rotor (2) and take releasing ball [(3) driver] out of control housing (4).

※ Outer, inner rotor and control housing = rotor set



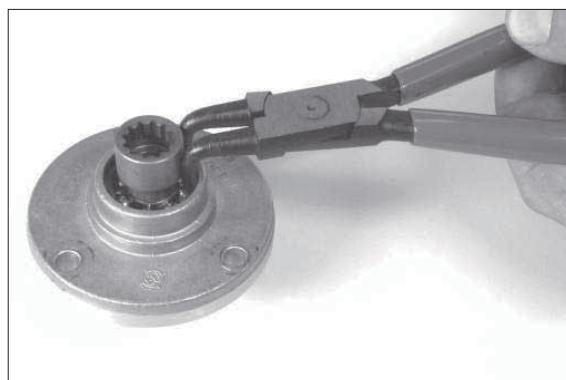
14WF8TM289

- 19) Remove control housing and releasing balls and compression springs (3 pcs. each).



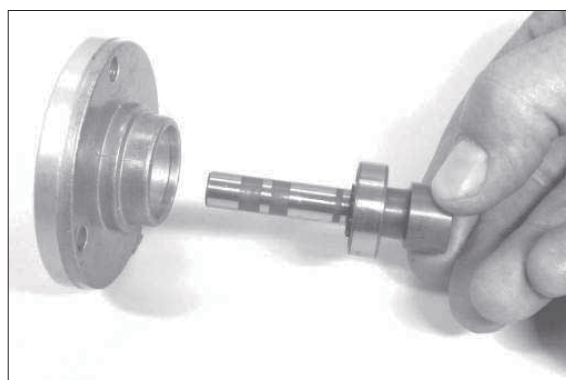
14WF8TM290

- 20) Unsnap retaining ring.



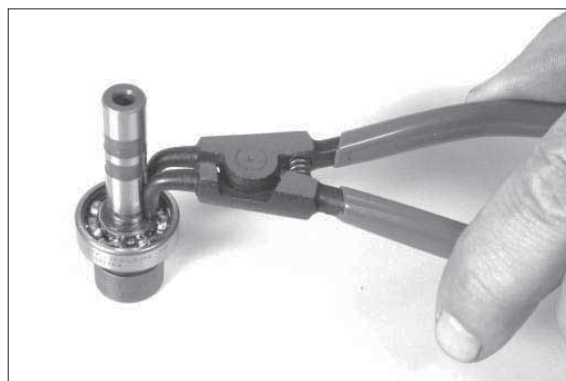
14WF8TM291

- 21) Pull cpl. pump shaft out of pump cover.



14WF8TM292

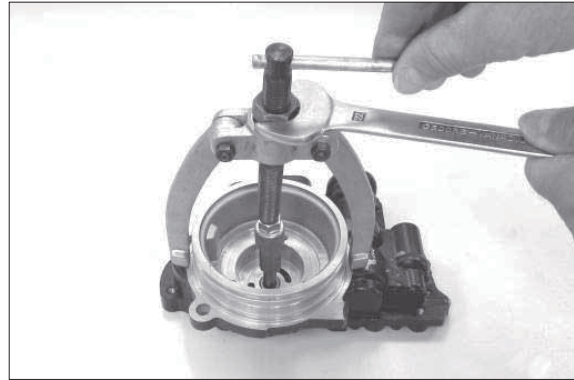
- 22) Unsnap retaining ring and press ball bearing from shaft.



14WF8TM293

23) Pull needle sleeve out of housing hole.

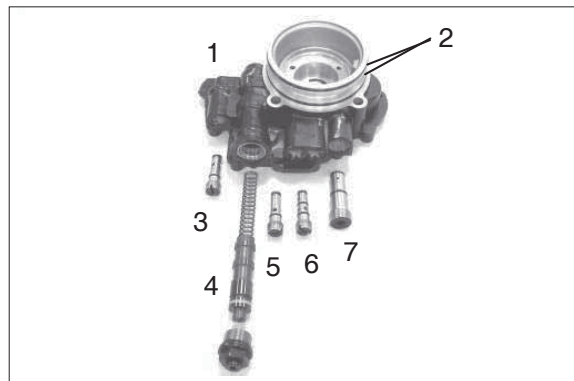
(S) Inner extractor 5870 300 012
(S) Counter support 5870 300 011



14WF8TM294

24) Remove O-rings and all single parts, remove valves.

1 = Housing
2 = O-rings
3 = Check valve (010)
4 = Shift piston
5 = Check valve (009)
6 = Check valve (008)
7 = Pressure relief valve

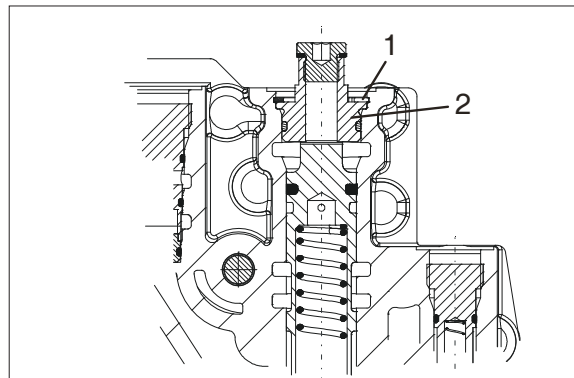


14WF8TM295

Position 4 (shift piston) shows version with screw plug.

25) In sketch 14WF8TM296 version II is shown with plug (2) and retaining ring (1).

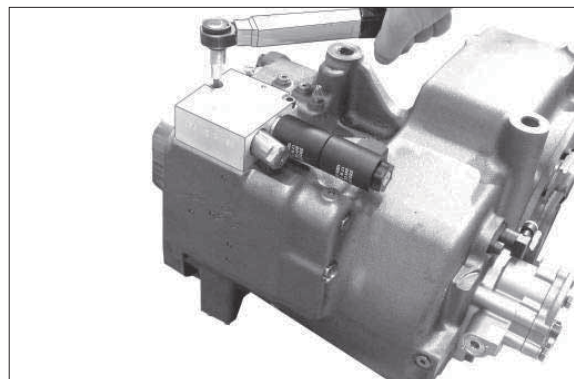
⚠ When disengaging retaining ring – Pay attention to spring preload. Protect against movement.



14WF8TM296

Disassemble valve block

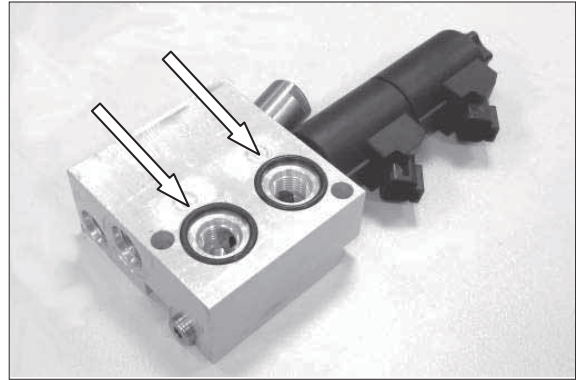
26) Loosen fixing screws and remove cpl. valve block.



14WF8TM297

27) Remove both O-rings (see arrows).

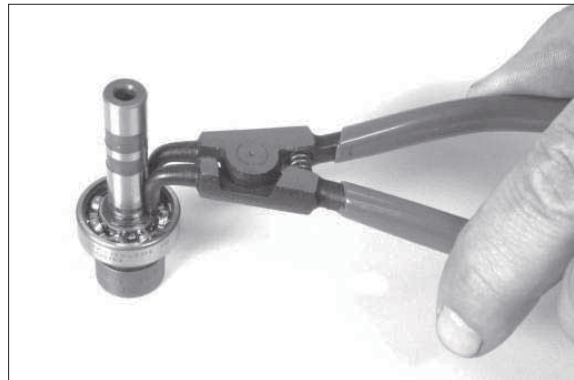
※ Do not further disassemble. Valve block may only be replaced as component.



14WF8TM298

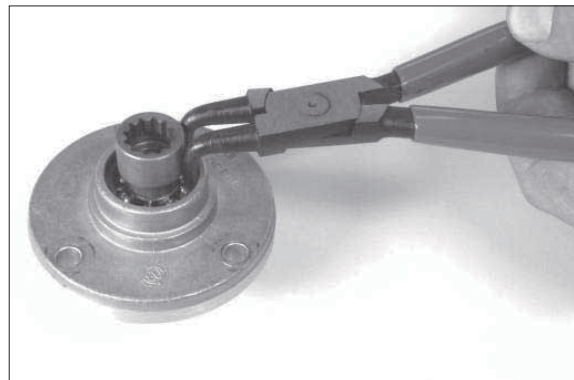
11. REASSEMBLY LUBRICATION PUMP

- 1) Mount ball bearing onto pump shaft and fix it by engaging retaining ring into annular groove of pump shaft.



14WF8TM299

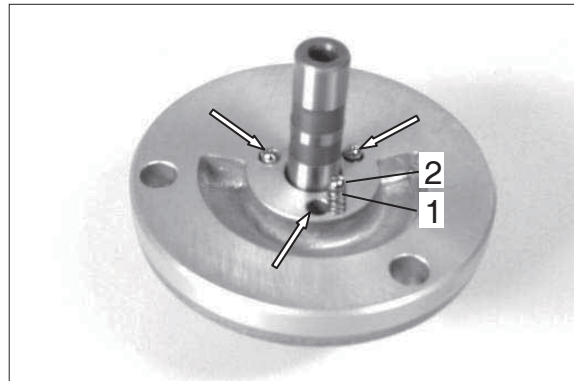
- 2) Press preassembled pump shaft into pump cover and fix it by engaging retaining ring into annular groove of pump cover.



14WF8TM300

- 3) Insert compression springs (1) and ball (2) into holes (see arrows - 3x).

※ Keep preassembled single parts in vertical position—pay attention to position of inserted balls and compression springs (see work steps 14WF8TM301~14WF8TM307).



14WF8TM301

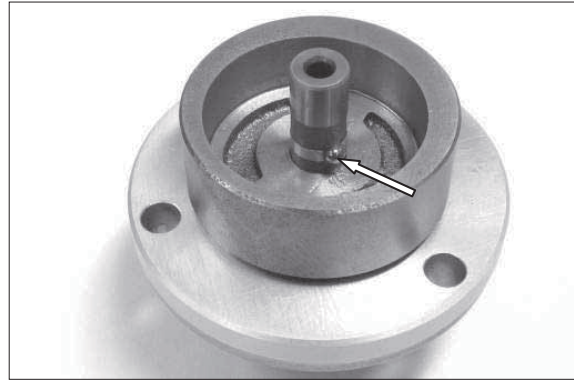
- 4) Mount control housing.

※ Control housing, inner and outer rotor = rotor set



14WF8TM302

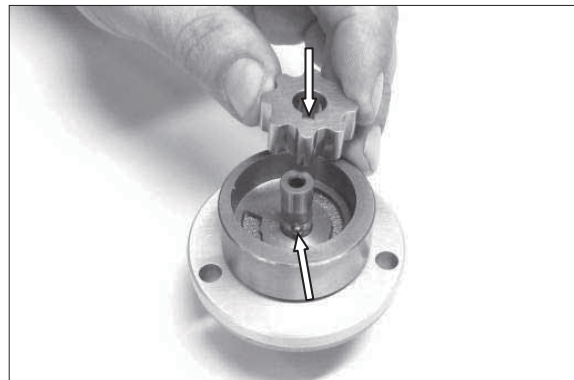
- 5) Position ball – (see arrow, engagement for inner rotor) with grease into countersink of pump shaft.



14WF8TM303

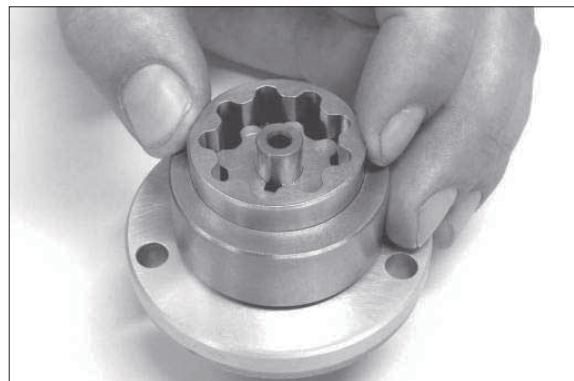
- 6) Mount inner rotor.

※ Place groove of inner rotor over ball (see arrows).



14WF8TM304

- 7) Mount outer rotor



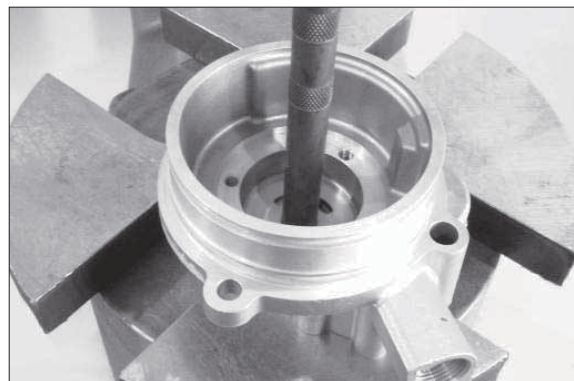
14WF8TM305

- 8) Insert needle sleeve to installation dimension X into housing.

X = 0.2~0.7 mm below plane face / housing

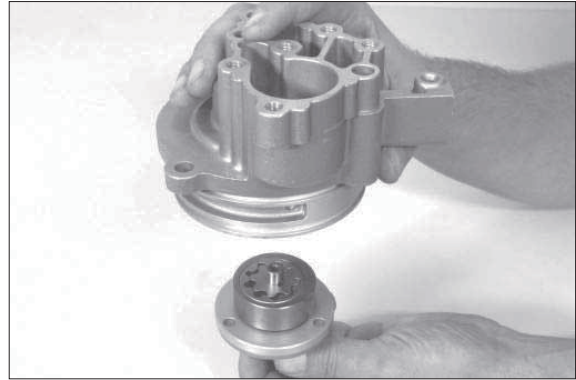
(S) Driver tool 5870 705 003

- ※ Use of specified driver tool ensures exact installation position.
- ※ Insert needle sleeve with marked front face showing upwards.
- ※ Check opening of orifice / oil hole in housing bottom.



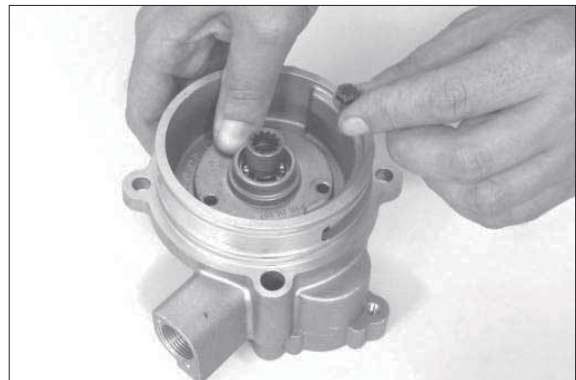
14WF8TM306

- 9) Maintain pump in vertical position while inserting housing with mounted needle sleeve onto preassembled pump.



14WF8TM307

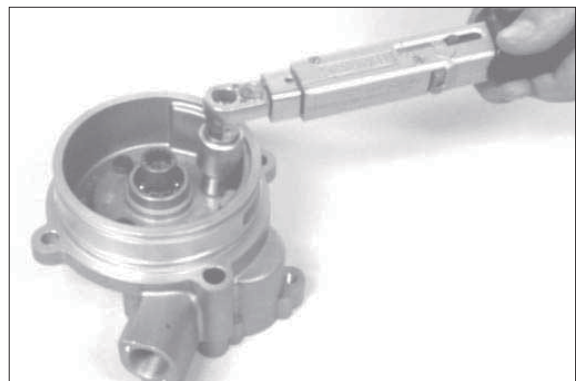
- 10) Rotate housing by 180° and fix pump with hexagon screws.
- ※ Maintain contact position of inserted pump.



14WF8TM308

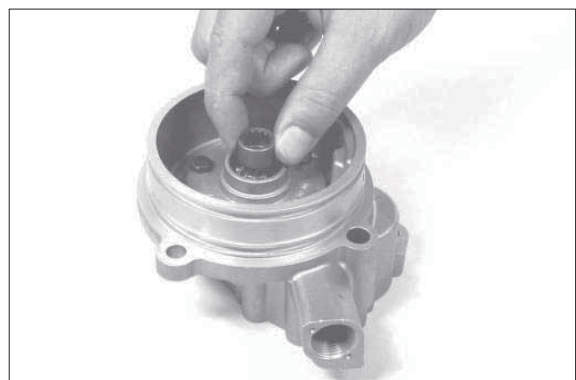
- 11) Fix pump.

Tightening torque (M6/8.8) $M_A = 9.5 \text{ Nm}$



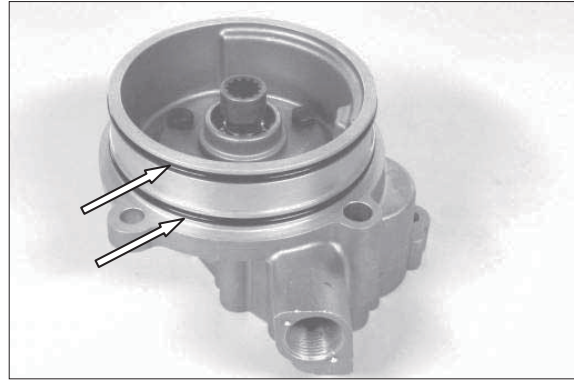
14WF8TM309

- 12) With counter-turning motions on pump shaft, swiveling of control housing (stop LH/RH in pump cover) is audible.



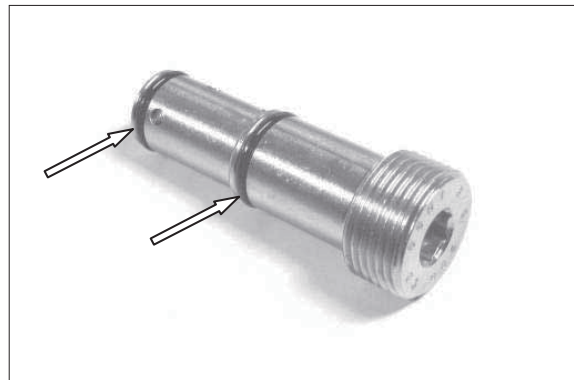
14WF8TM310

- 13) Oil both O-rings (arrows) and put them into annular groove of housing.



14WF8TM311

- 14) Insert O-rings (see arrows) into annular grooves of pressure relief valve.

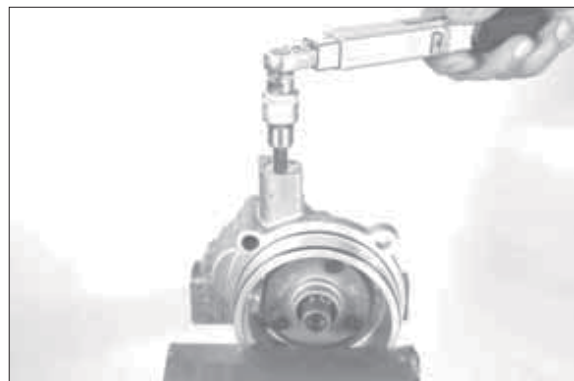


14WF8TM312

- 15) Mount pressure relief valve.

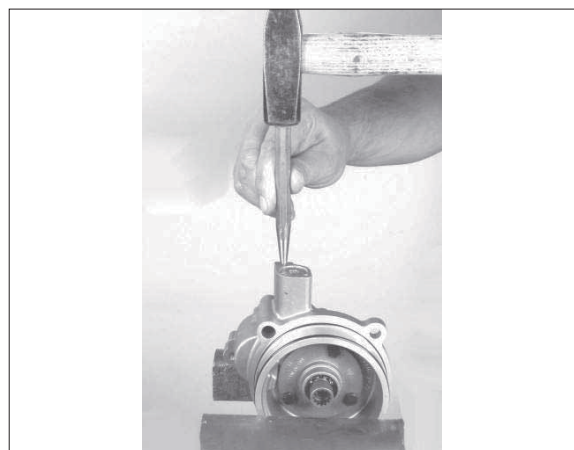
Tightening torque

$M_A = 10 \text{ Nm}$



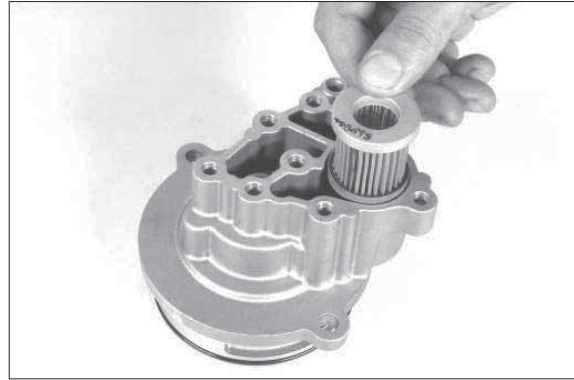
14WF8TM313

- 16) Secure pressure relief valve by center punch marks (2x).



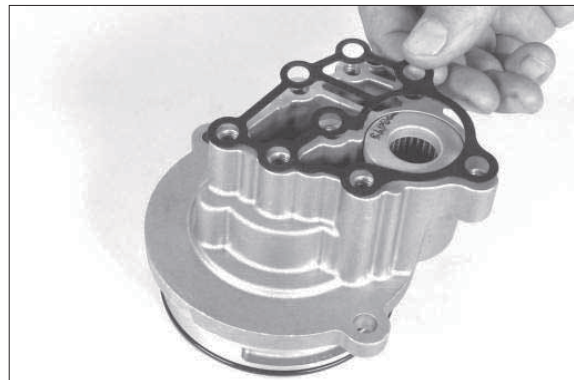
14WF8TM314

17) Insert filter.



14WF8TM315

18) Place gasket.



14WF8TM316

19) Place cover and fix it with hexagon screws and disks.

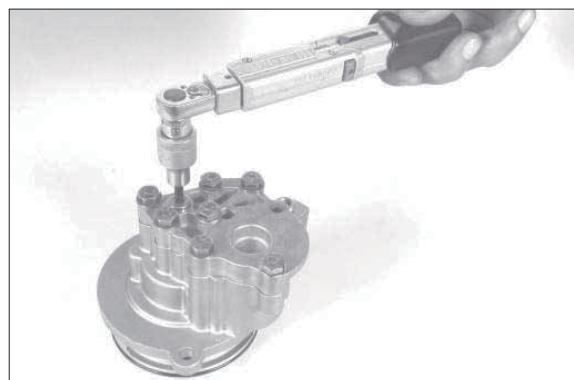
Tightening torque (M8/8.8) $M_A = 23 \text{ Nm}$



14WF8TM317

20) Insert screw plug with new O-ring.

Tightening torque (M10 \times 1) $M_A = 15 \text{ Nm}$

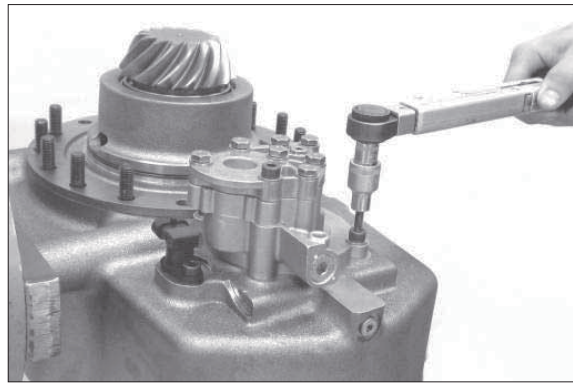


14WF8TM318

21) Mount cpl. lubrication pump and fasten it with cylindrical screws and disks.

Tightening torque (M8/10.9) $M_A = 23 \text{ Nm}$

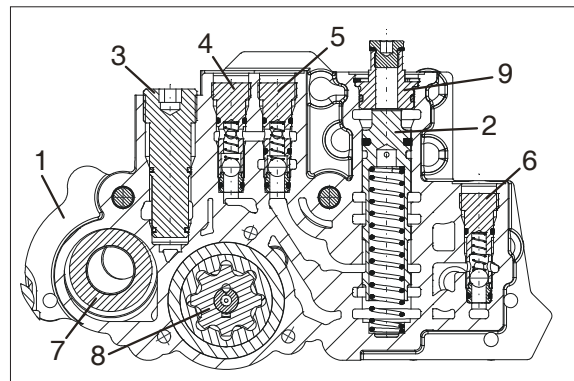
※ Prior to putting the unit into operation, observe the specifications and regulations.



14WF8TM319

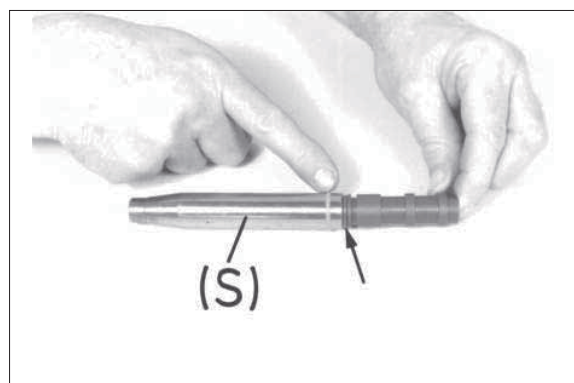
12. REASSEMBLY SHIFT INTERLOCK

- 1) 1 = Housing
- 2 = Shift piston
- 3 = Pressure relief valve
- 4 = Check valve (008)
- 5 = Check valve (009)
- 6 = Check valve (010)
- 7 = Filter
- 8 = Lubrication pump
- 9 = Plug



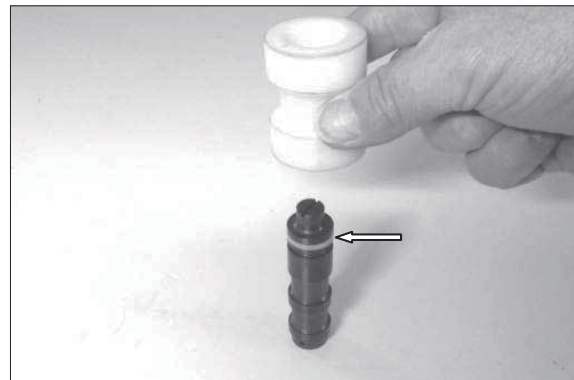
14WF8TM320

- 2) Put O-ring (see arrow) into annular groove of piston.
Lead plastic ring by means of inner installer (S) over piston and position it at O-ring.
- (S) Inner installer 5870 651 055
- ※ Seal consists of plastic ring and O-ring (see 14WF8TM321~14WF8TM322).



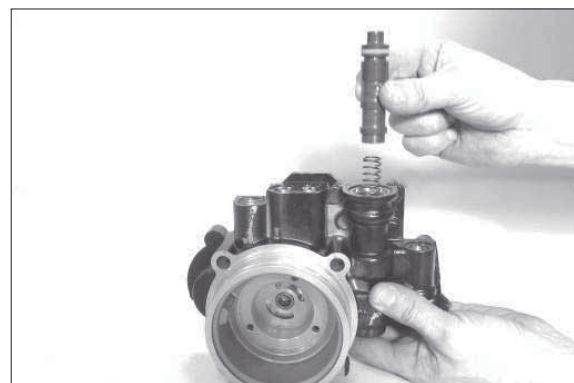
14WF8TM321

- 3) Center plastic ring (see arrow) with calibrating mandrel.
- (S) Calibrating mandrel 5870 651 056



14WF8TM322

- 4) Insert compression spring, oil preassembled piston and install.



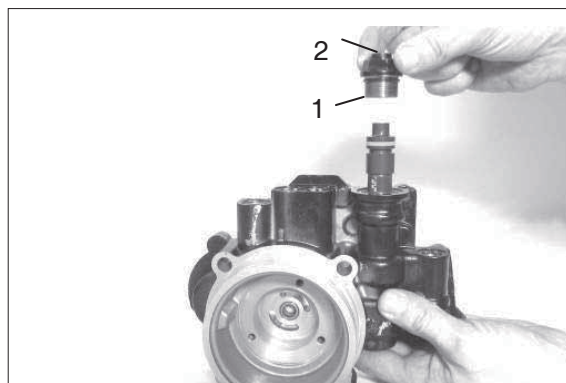
14WF8TM323

Version I :

- 5) Fix piston with screw plug (1- with O-ring).
Install screw plug (2 – with seal ring).

Screw plug (M24 × 1.5) $M_A = 50 \text{ Nm}$

Screw plug (M10 × 1) $M_A = 15 \text{ Nm}$



14WF8TM324

Version II (14WF8TM325 ~ 14WF8TM327) :

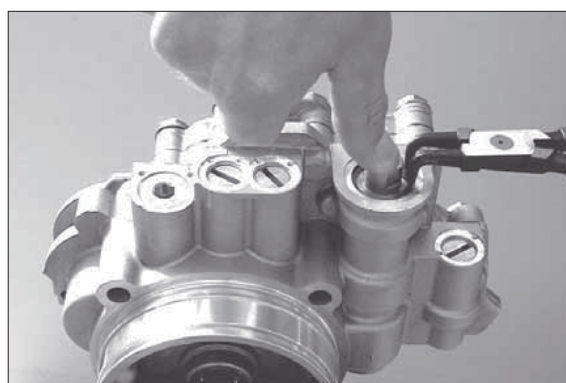
- 6) Oil O-ring and insert it into annular groove of plug.



14WF8TM325

- 7) Fix plug by engaging retaining ring into annular groove of housing.

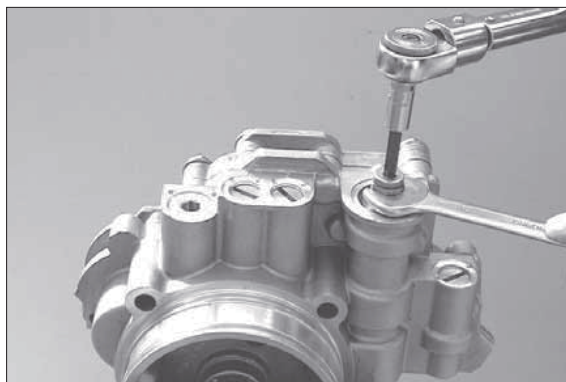
※ Pay attention to spring preload – protect against movement.



14WF8TM326

- 8) Mount screw plug with seal.

Tightening torque (M10 × 1) $M_A = 15 \text{ Nm}$



14WF8TM327

9) Install single parts according to adjacent illustration.

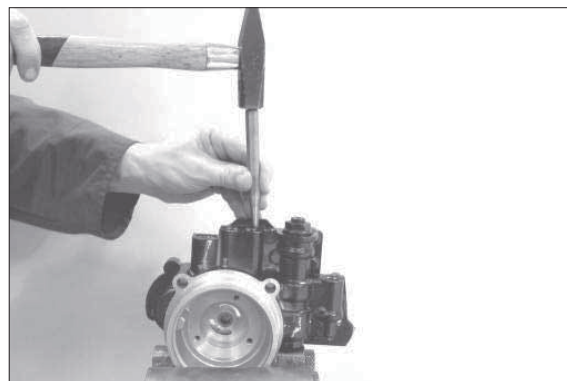
- 1 = Pressure relief valve cpl. $M_A = 10 \text{ Nm}$
- 2 = Check valve cpl. $M_A = 10 \text{ Nm}$
- 3 = Check valve cpl. $M_A = 10 \text{ Nm}$
- 4 = Check valve cpl. $M_A = 10 \text{ Nm}$

※ Observe installation position of the different check valves (see also 14WF8TM320).



14WF8TM328

10) Secure check valves and pressure relief valves with two center punch marks each.



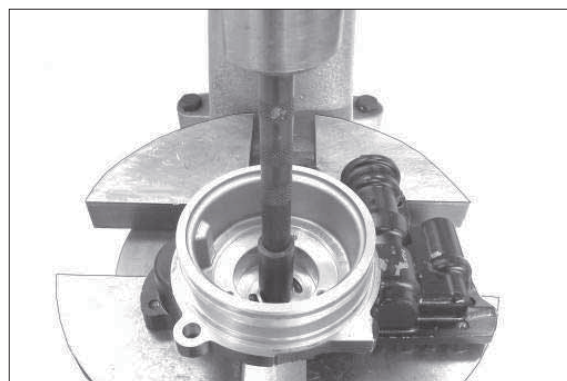
14WF8TM329

11) Insert needle sleeve to installation dimension X into housing.

$X = 0.2 \sim 0.7 \text{ mm}$ below plane face/housing

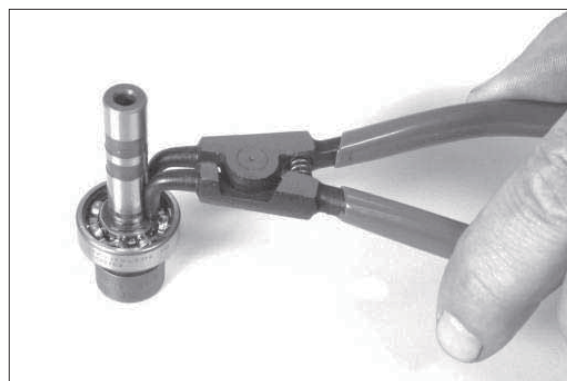
(S) Driver tool 5870 705 003

- ※ Use of specified driver ensures exact installation position.
- ※ Insert needle sleeve with marked front face showing upwards.
- ※ Check opening of orifice / oil hole in housing bottom.



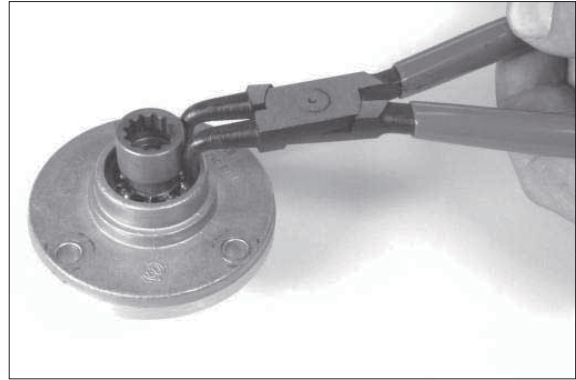
14WF8TM330

12) Insert ball bearing onto pump shaft and fix it by engaging retaining ring into annular groove of pump shaft.



14WF8TM331

- 13) Press preassembled pump shaft into pump cover and fix it by engaging retaining ring into annular groove of pump cover.

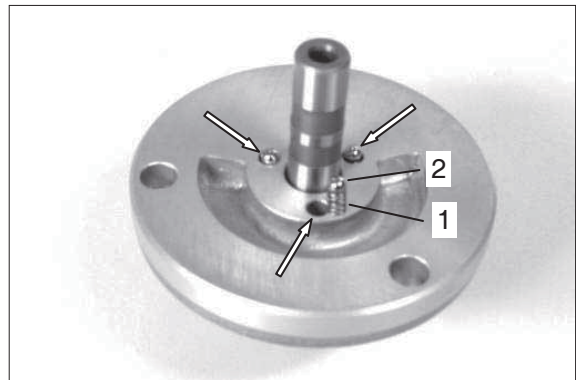


14WF8TM332

- 14) Insert compression springs (1) and ball (2) into holes (see arrows - 3x).

▲ Prior to installation, oil single parts of pump/rotor set (control housing, inner and outer rotor) – use oil (lubrication)

- ※ Keep preassembled single parts in vertical position – pay attention to position of inserted balls and compression springs (see work steps 14WF8TM333 ~14WF8TM338).



14WF8TM333

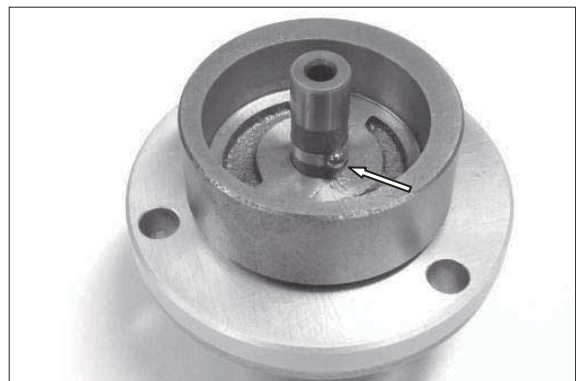
- 15) Mount control housing.

- ※ Control housing, inner and outer rotor = rotor set



14WF8TM334

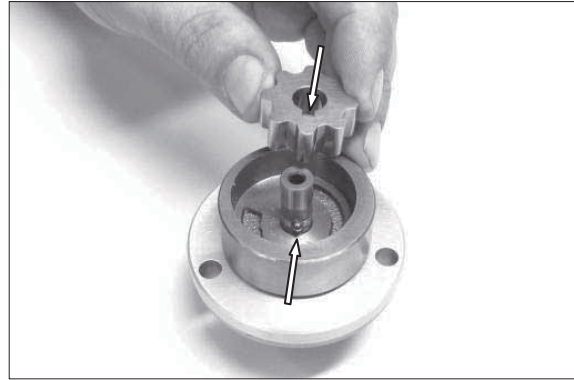
- 16) Position ball – (see arrow –engagement for inner rotor) with grease into countersink of pump shaft



14WF8TM335

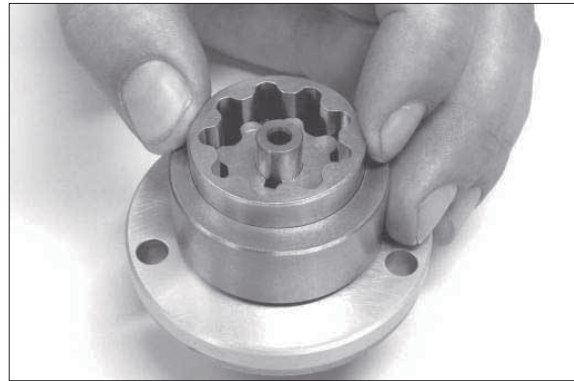
17) Mount inner rotor.

- ※ Place groove of inner rotor over ball (see arrows).



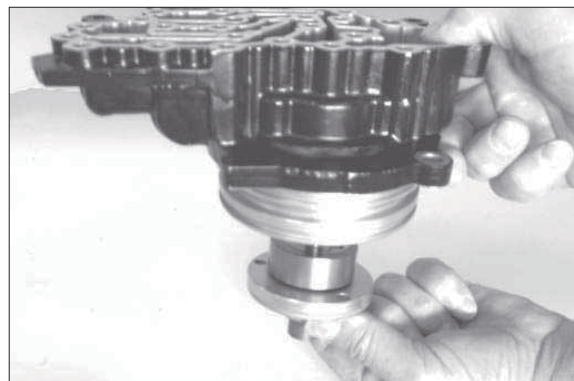
14WF8TM336

18) Mount outer rotor.



14WF8TM337

19) Maintain pump in vertical position while inserting housing with mounted needle sleeve onto preassembled pump.



14WF8TM338

20) Rotate housing by 180° and fix pump with hexagon screws.

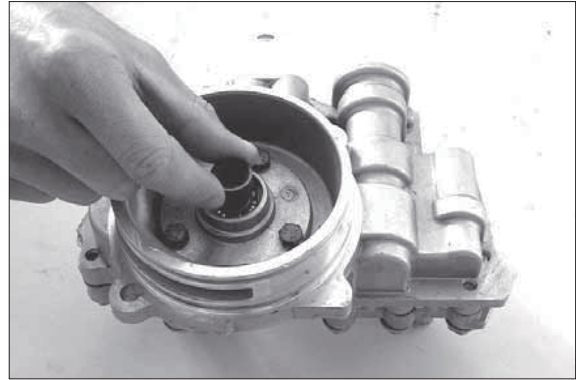
Tightening torque (M6/8.8) $M_A = 9.5 \text{ Nm}$

- ※ Maintain contact position of inserted pump.



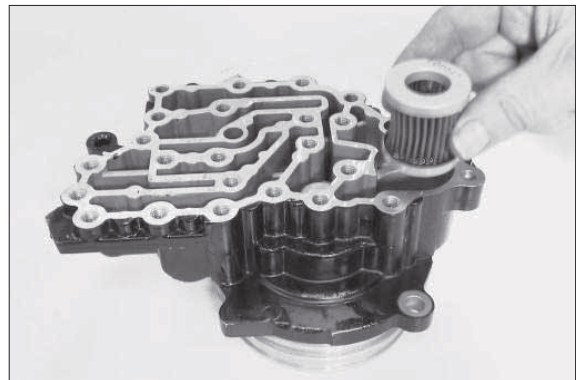
14WF8TM339

- 21) With counter-turning motions on pump shaft, swiveling of control housing (stop LH/ RH in pump cover) is audible.



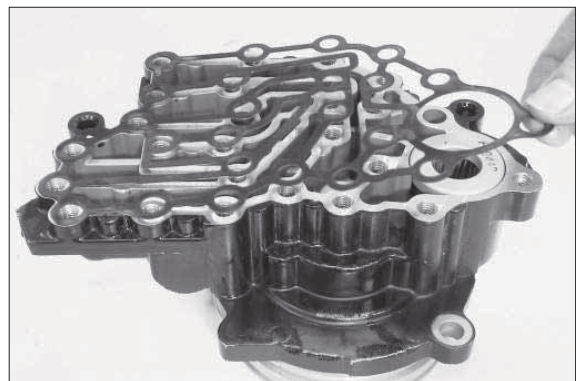
14WF8TM340

- 22) Insert screen filter.



14WF8TM341

- 23) Place gasket.

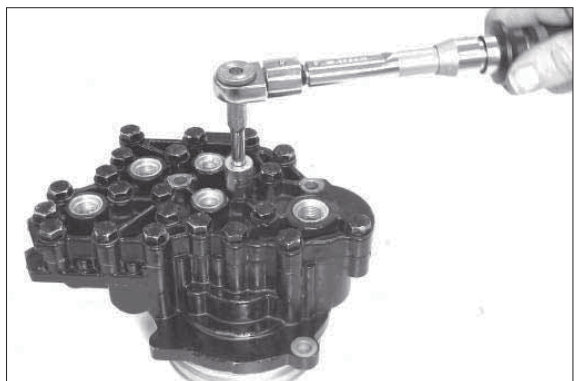


14WF8TM342

- 24) Place cover and fix with hexagon screws and disks.

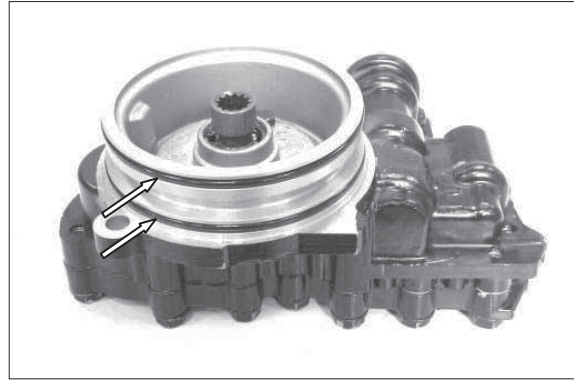
Tightening torque (M8/8.8) $M_A = 23 \text{ Nm}$

※ Pay attention to different screw length.



14WF8TM343

- 25) Oil both O-rings (arrows) and put them into annular groove of housing.

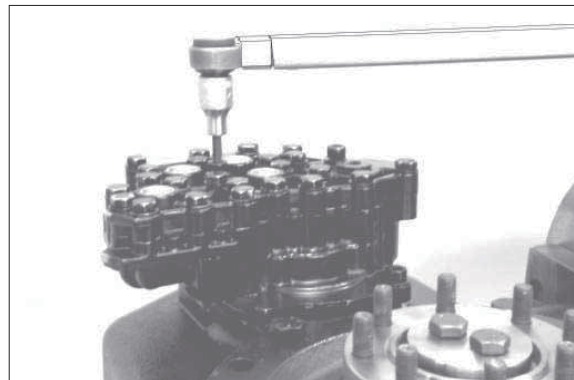


14WF8TM344

- 26) Insert cpl. shift interlock and fix with cylindrical screws with disks.

Tightening torque (M8/10.9) $M_A = 23 \text{ Nm}$

※ Pay attention to different screw length.

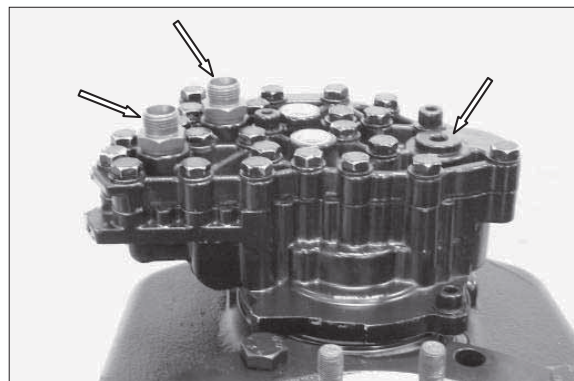


14WF8TM345

- 27) Install both screw-in sleeves and screw plug (see arrow) with O-rings.

Screw-in sleeve (M 16 \times 1.5) $M_A = 30 \text{ Nm}$

Screw plug (M 18 \times 1.5) $M_A = 35 \text{ Nm}$



14WF8TM346

- 28) 1 = Oil tube
2 = Hollow screw (M16 \times 1.5)
3 = Seal ring
4 = Hollow screw (M14 \times 1.5)
5 = Seal ring



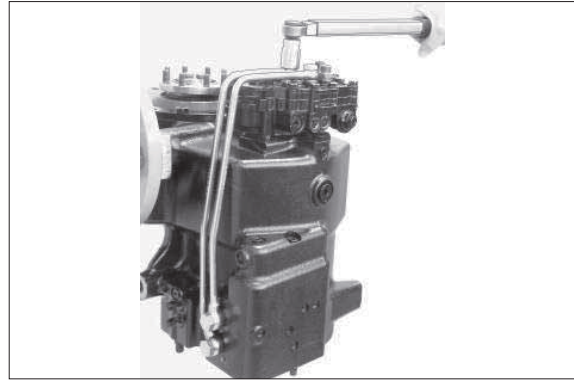
14WF8TM347

29) Mount oil tubes.

Hollow screw (M14×1.5) $M_A = 40 \text{ Nm}$

Hollow screw (M16×1.5) $M_A = 40 \text{ Nm}$

※ Prior to putting the unit into operation,
observe the specifications and regulations.

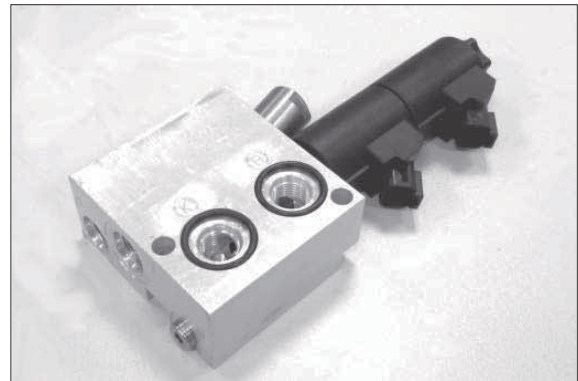


14WF8TM3428

13. VALVE BLOCK (shifting low gear – high gear)

1) Insert O-rings (see arrows) into countersinks of valve block.

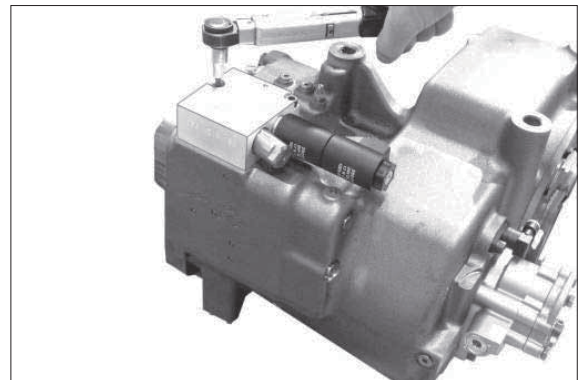
※ Use grease as assembly aid.



14WF8TM349

2) Fix cpl. valve block with cylindrical screws.

Tightening torque (M8/10.9) $M_A = 23 \text{ Nm}$

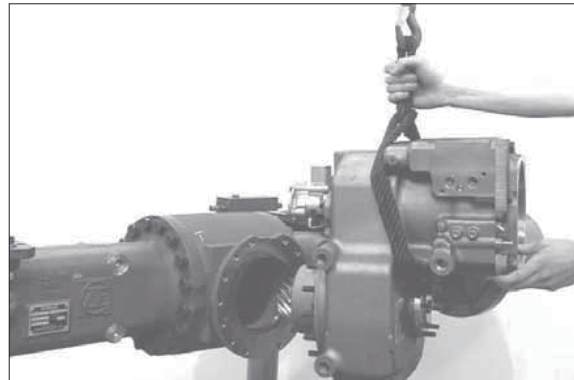


14WF8TM350

14. Mount TRANSMISSION to AXLE (only for version axle attachment)

1) Position complete transmission to axle.

(S) Lifting strap 5870 281 026

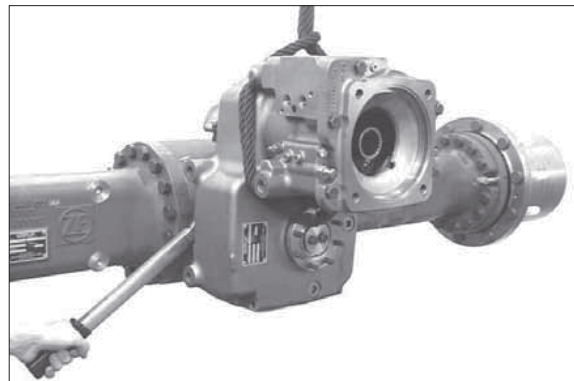


14WF8TM351

2) Fix transmission to axle with hexagon screws and nuts.

Tightening torque (M12/8.8) $M_A = 79 \text{ Nm}$

※ Prior to putting the unit into operation, observe the specifications and regulations.



14WF8TM352

GROUP 8 STEERING VALVE

1. REMOVAL AND INSTALL

1) REMOVAL

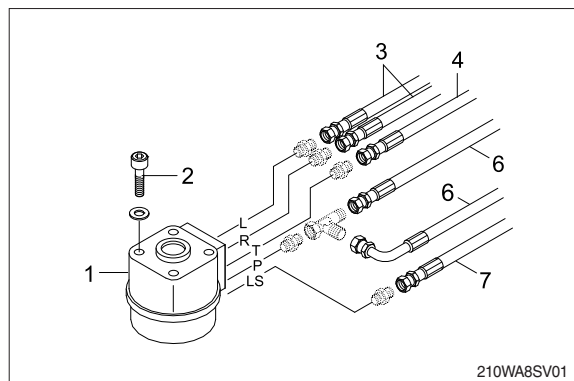
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

- (4) Disconnect steering line hoses (3, 4, 5, 6).
- (5) Loosen the socket bolt (2) and remove the steering valve assembly (1).
 - Tightening torque : $8.27 \pm 1.7 \text{ kgf} \cdot \text{m}$
($59.8 \pm 12.3 \text{ lbf} \cdot \text{ft}$)

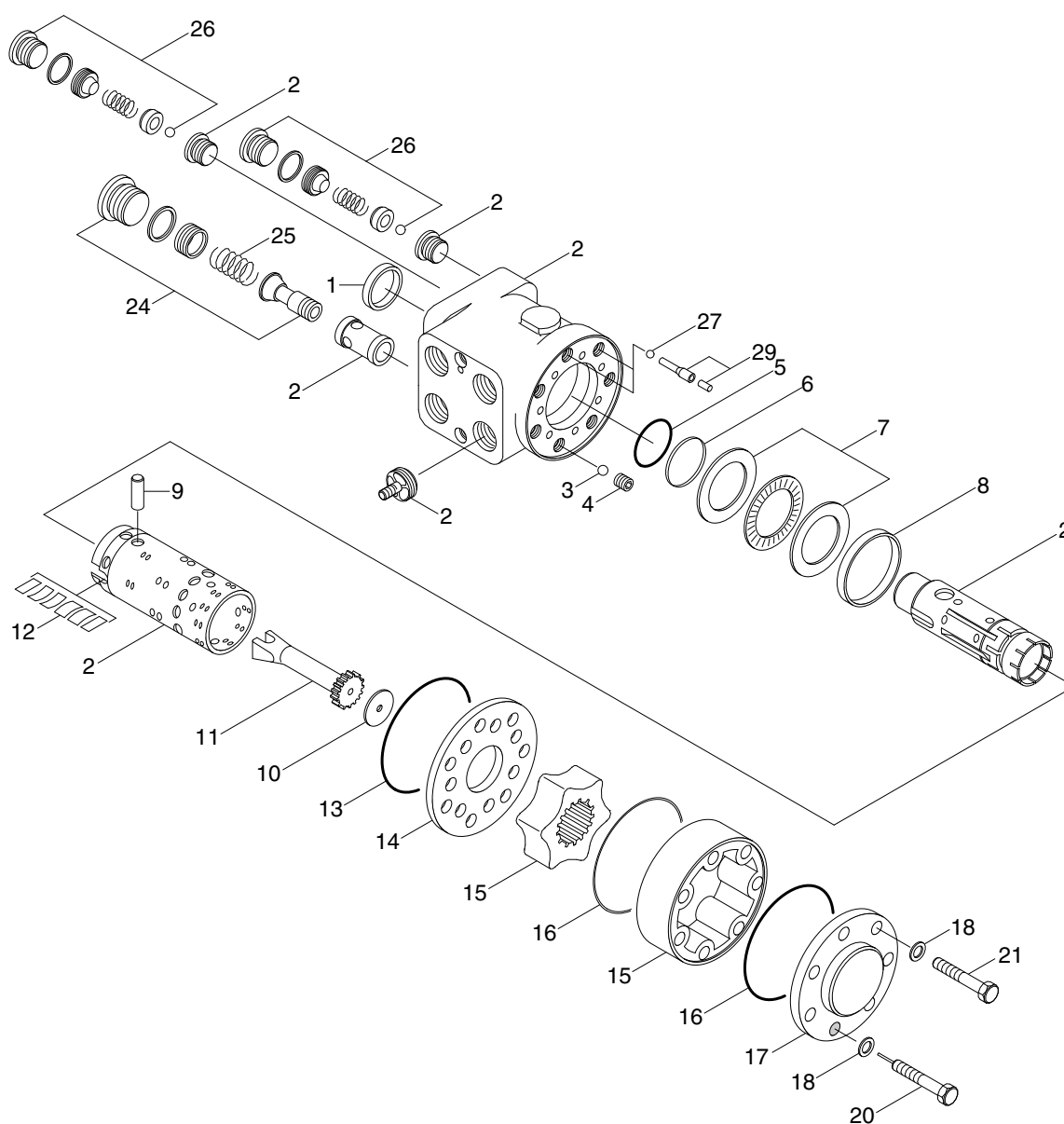
2) INSTALL

- (1) Carry out installation in the reverse order to removal.
 - (2) Confirm the hydraulic oil level and check the hydraulic oil leak or not.
- ※ When removing the steering valve assembly, check that all the hoses have been disconnected.



2. STEERING VALVE

1) STRUCTURE

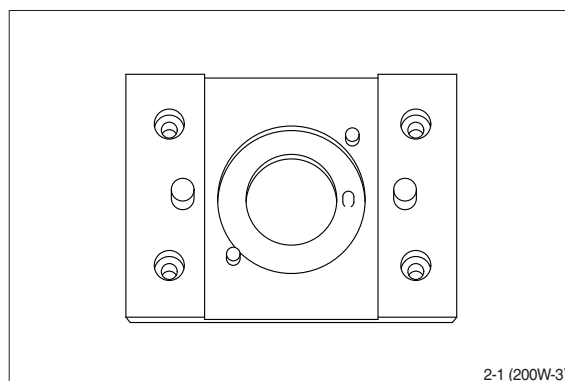


20W72STV01

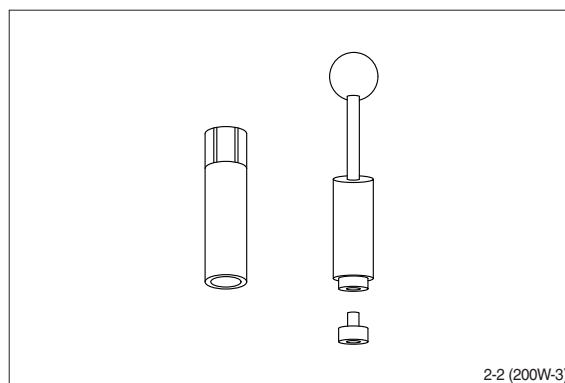
1	Dust seal	10	Spacer	18	Washer
2	Housing, spool, sleeve	11	Shaft	20	Pin screw
3	Ball	12	Spring set	21	Screw
4	Bushing	13	O-ring	24	Pressure relief valve
5	O-ring	14	Distributor plate	25	Wire spring
7	Bearing assy	15	Gear wheel set	26	Shock valve
8	Ring	16	O-ring	27	Ball
9	Cross pin	17	End cover	29	Bushing

2) TOOLS

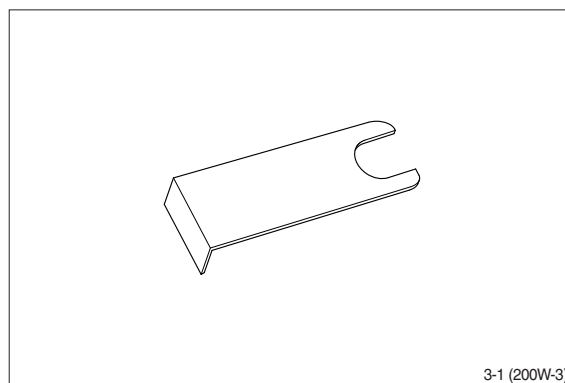
(1) Holding tool.



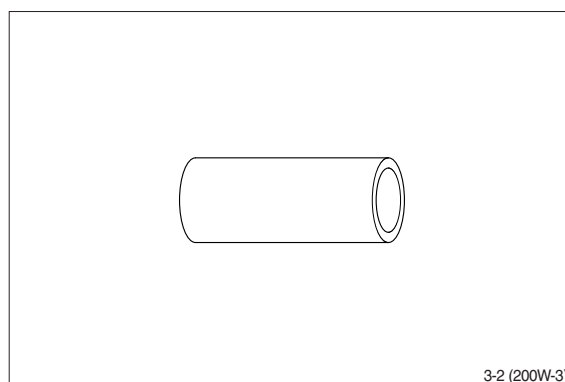
(2) Assembly tool for O-ring (5,13,16) and kin-ring (6).



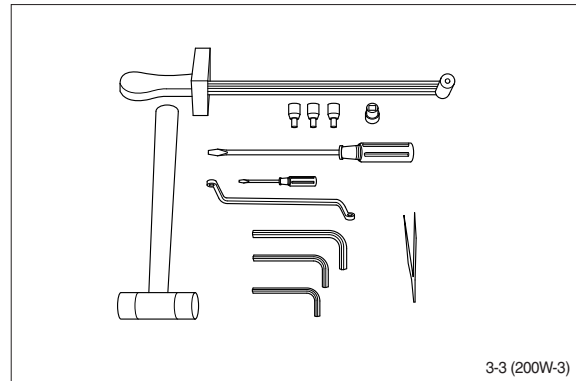
(3) Assembly tool for cardan shaft (11).



(4) Assembly tool for dust seal (1).

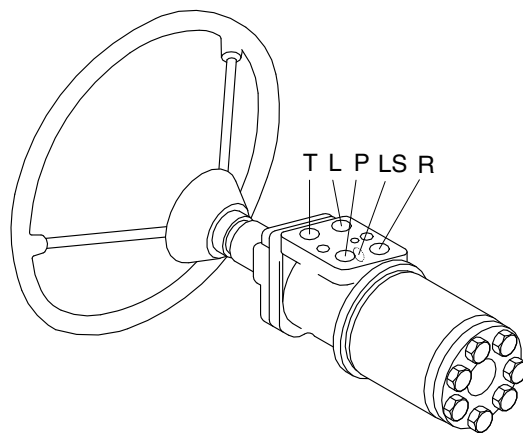


- (5) Torque wrench : 0~7.1 kgf · m
(0~54.4 lbf · ft)
- 13 mm socket spanner.
 - 6, 8 mm and 12 mm hexagon sockets.
 - 12 mm screwdriver.
 - 2 mm screwdriver.
 - 13 mm ring spanner.
 - 6,8 mm and 12 mm hexagon socket spanners.
 - Plastic hammer.
 - Tweezers.



3) TIGHTENING TORQUE AND HYDRAULIC CONNECTIONS

(1) Hydraulic connections



L : Left port
R : Right port
T : Tank
P : Pump

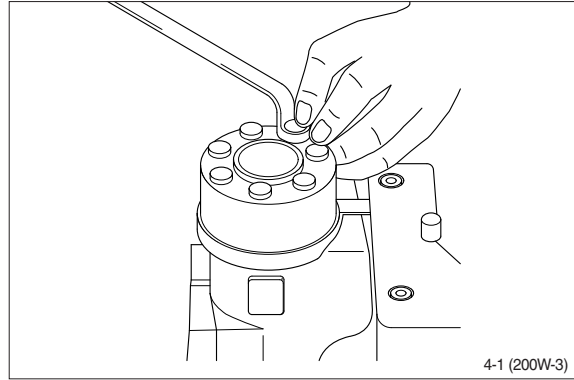
140WA8SV03

(2) Tightening torque

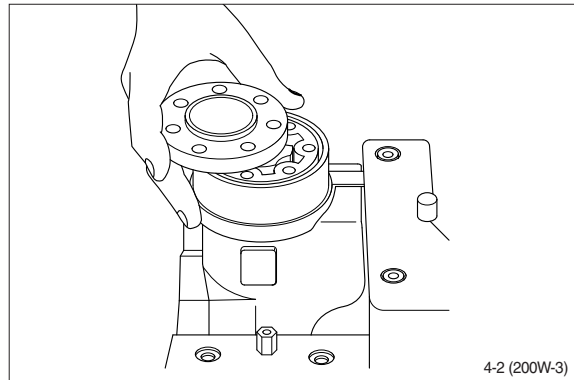
Screwed connection	Max. tightening torque kgf · m (lbf · ft)			
	With cutting edge	With copper washer	With aluminum washer	With O-ring
1.4 BSP.F	4.1 (29.7)	2.0 (14.5)	3.1 (22.4)	-
3/8 BSP.F	6.1 (44.1)	2.0 (14.5)	5.1 (36.9)	-
1/2 BSP.F	10.2 (73.8)	3.1 (22.4)	8.2 (59.3)	-
7/16-20 UNF	-	-	-	2.0 (14.5)
3/4-16 UNF	-	-	-	6.1 (44.1)
M12 × 1.5	4.1 (29.7)	2.0 (14.5)	3.1 (22.4)	2.0 (14.5)
M18 × 1.5	7.1 (51.4)	2.0 (14.5)	5.1 (36.9)	5.1 (36.9)
M22 × 1.5	10.2 (73.8)	3.1 (22.4)	8.2 (59.3)	7.1 (51.4)

4) DISASSEMBLY

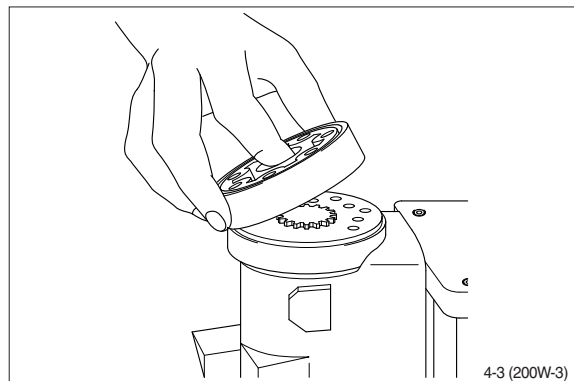
- (1) Disassemble steering column from steering valve and place the steering valve in the holding tool.
Screw out the screws in the end cover (6-off plus one special screw).



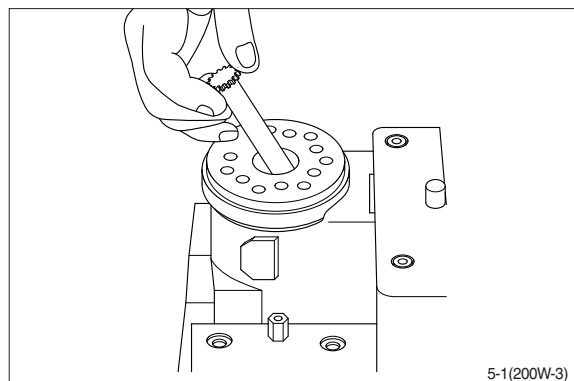
- (2) Remove the end cover, sideways.



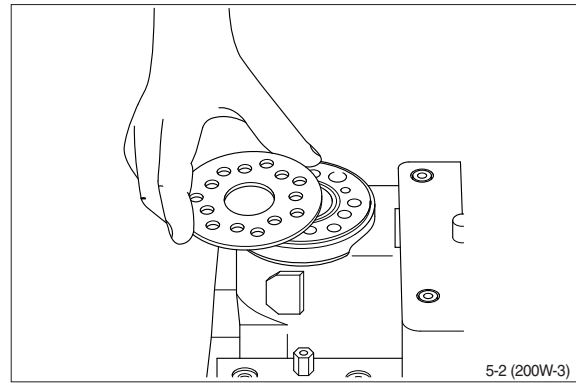
- (3) Lift the gearwheel set (with spacer if fitted) off the unit.
Take out the two O-rings.



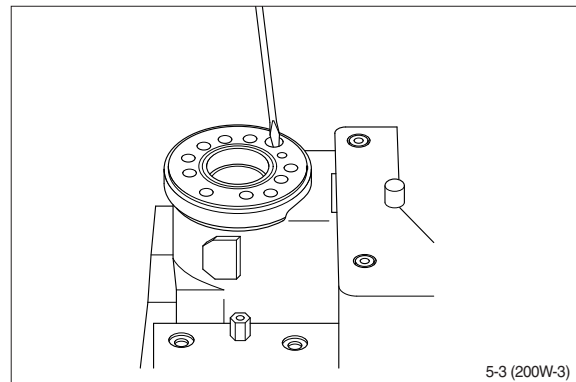
- (4) Remove cardan shaft.



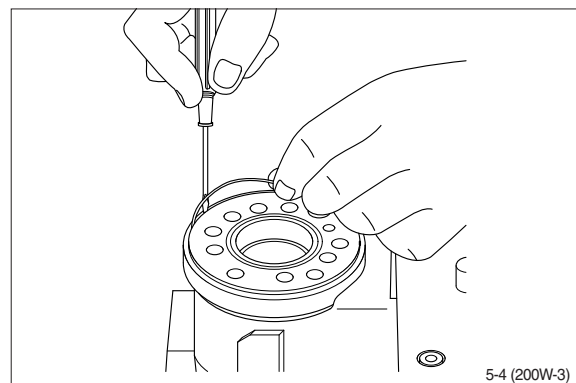
(5) Remove distributor plate.



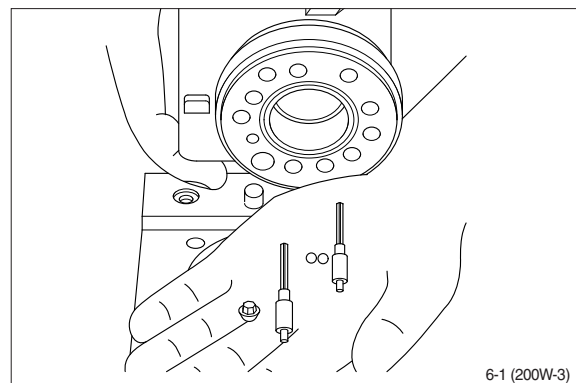
(6) Screw out the threaded bushing over the check valve.



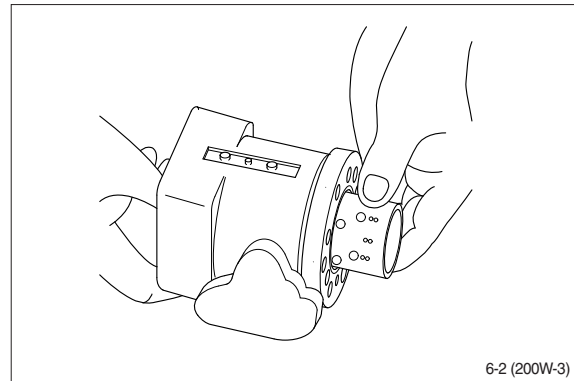
(7) Remove O-ring.



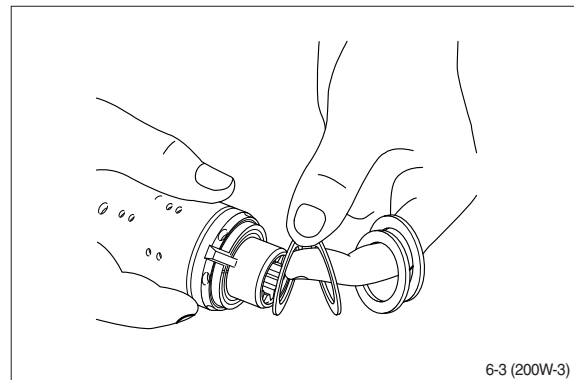
(8) Shake out the check valve ball and suction valve pins and balls.



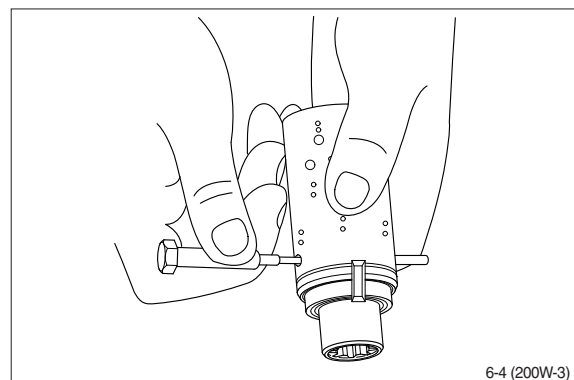
- (9) Take care to keep the cross pin in the sleeve and spool horizontal. The pin can be seen through the open end of the spool. Press the spool inwards and the sleeve, ring, bearing races and needle bearing will be pushed out of the housing together.



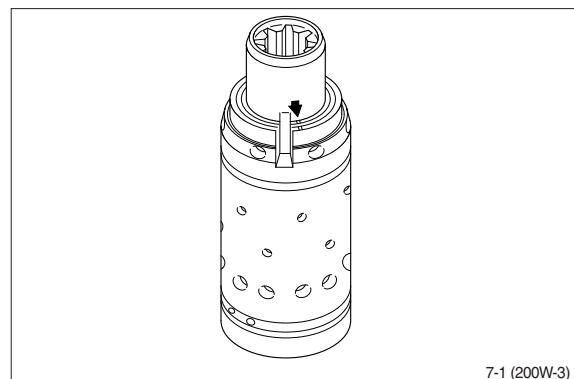
- (10) Take ring, bearing races and needle bearing from sleeve and spool. The outer(thin) bearing race can sometimes "stick" in the housing, therefore check that it has come out.



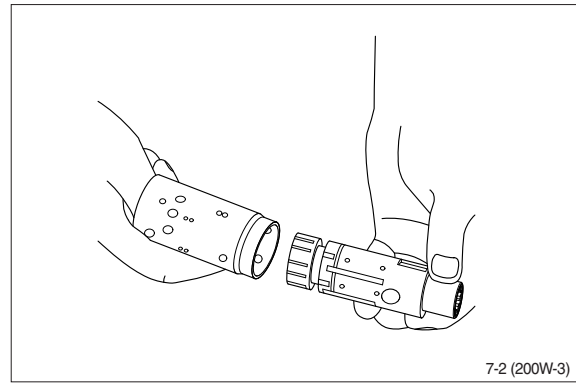
- (11) Press out the cross pin. Use the special screw from the end cover.



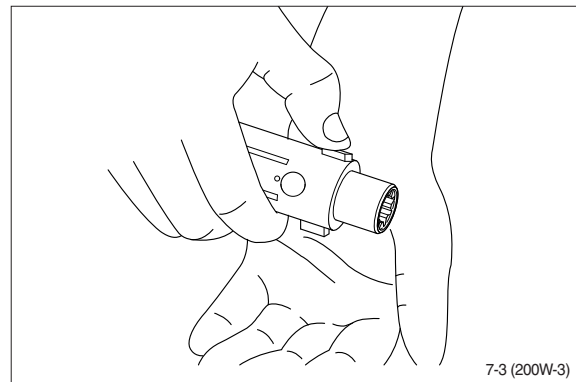
- ※ A small mark has been made with a pumice stone on both spool and sleeve close to one of the slots for the neutral position spring as figure. If the mark is not visible, remember to leave a mark of your own on sleeve and spool before the neutral position springs are disassembled.



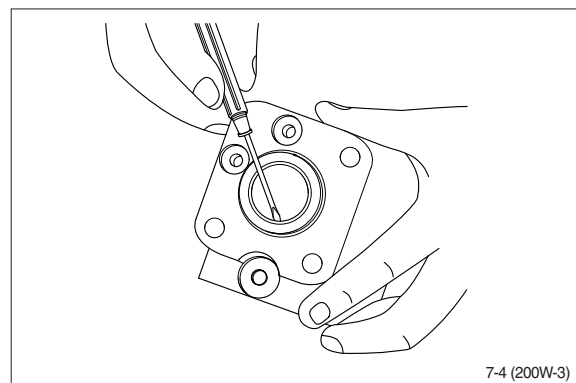
(12) Carefully press the spool out of the sleeve.



(13) Press the neutral position springs out of their slots in the spool.

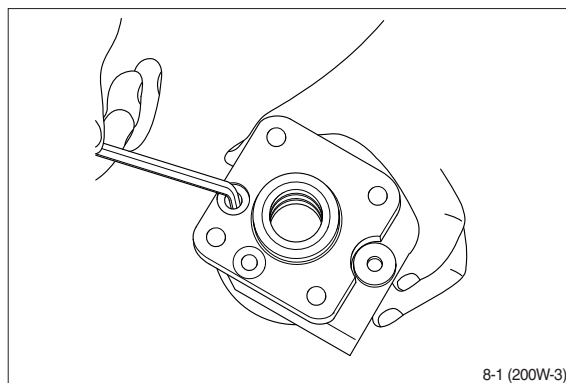


(14) Remove dust seal and O-ring.

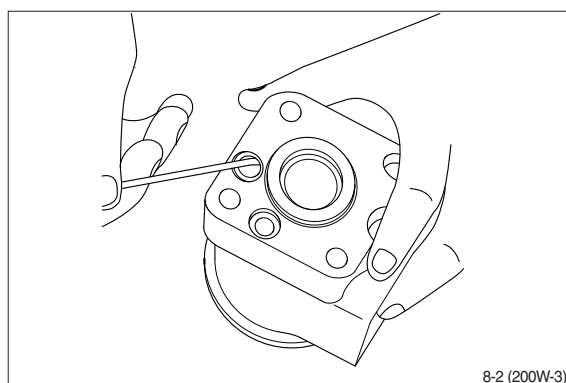


(15) Disassemble the dual shock valve

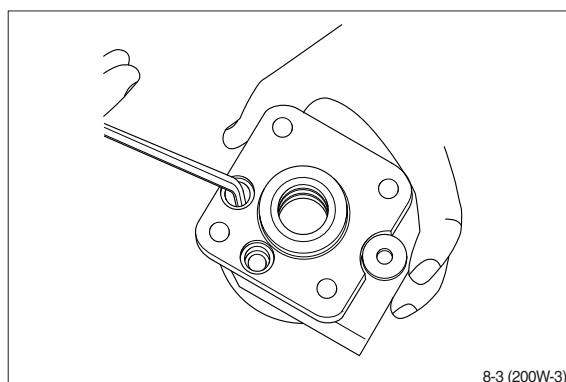
- ① Remove plugs from shock valves using a 6mm hexagon socket spanner.



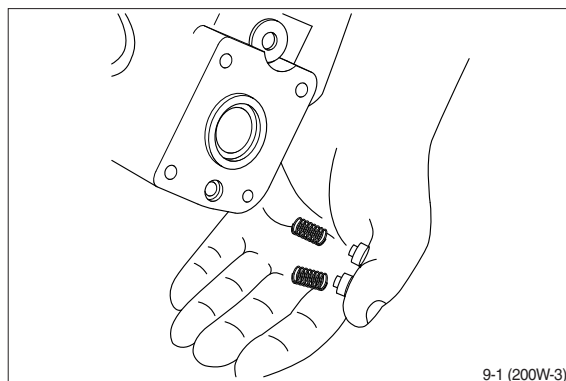
- ② Remove seal washers (2-off).



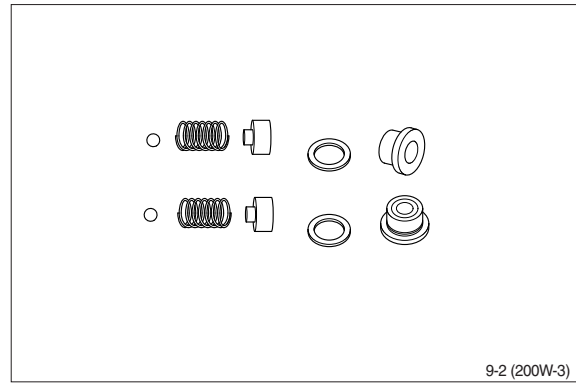
- ③ Unscrew the setting screws using a 6 mm hexagon socket spanner.



- ④ Shake out the two springs and two valve balls into your hand. The valve seats are bonded into the housing and cannot be removed.

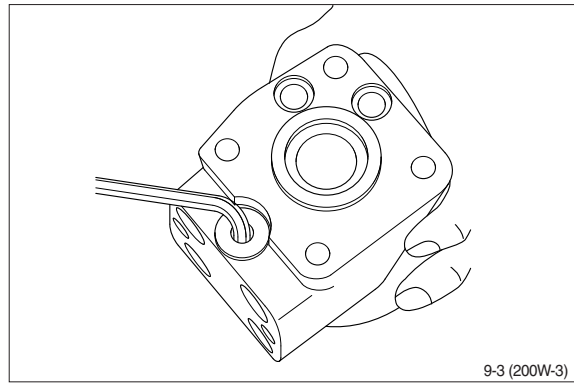


- ⑤ The dual shock valves are now disassembled.

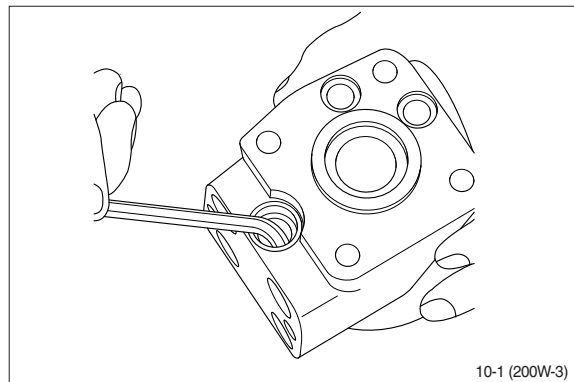


(16) Disassemble the pressure relief valve (cartridge)

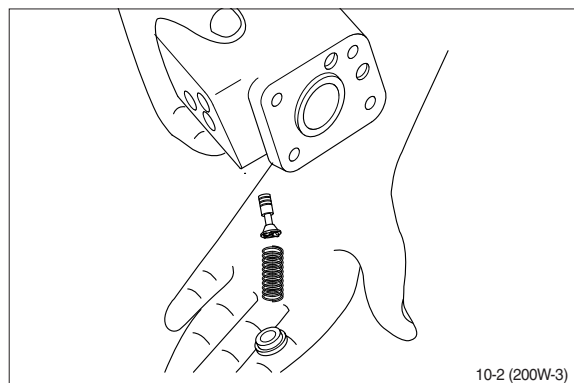
- ① Screw out the plug using an 8 mm hexagon socket spanner. Remove seal washers.



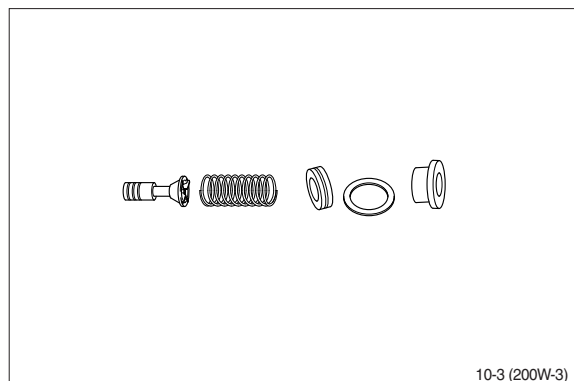
- ② Unscrew the setting screw using an 8mm hexagon socket spanner.



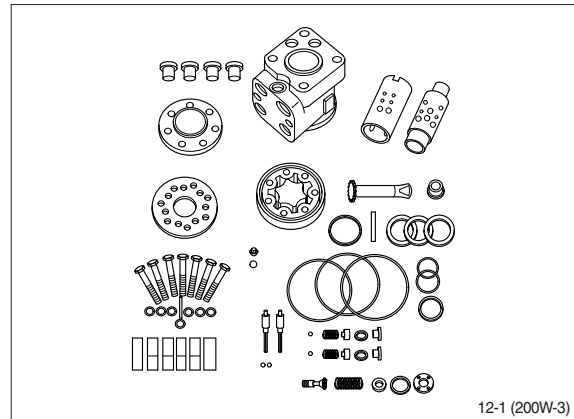
- ③ Shake out spring and piston. The valve seat is bonded into the housing and cannot be removed.



- ④ The pressure relief valve is now disassembled.



- ⑤ The steering valve is now completely disassembled.



※ **Cleaning**

Clean all parts carefully in shellsol K or the like.

※ **Inspection and replacement**

Replace all seals and washers. Check all parts carefully and make any replacements necessary.

※ **Lubrication**

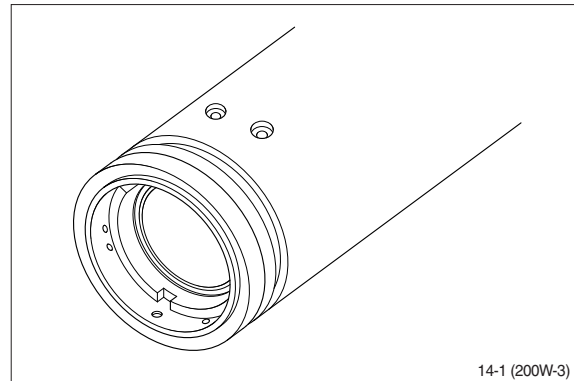
Before assembly, lubricate all parts with hydraulic oil.

5) ASSEMBLY

(1) Assemble spool and sleeve.

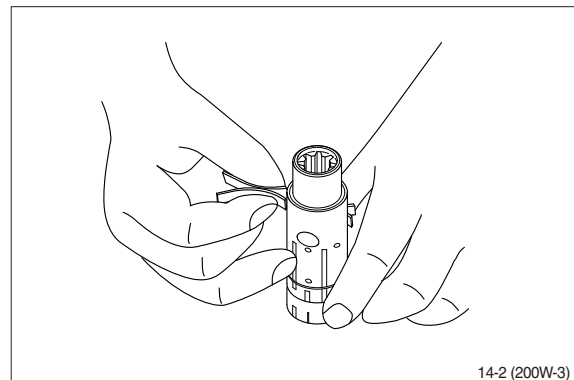
When assembling spool and sleeve only one of two possible ways of positioning the spring slots is correct. There are three slots in the spool and three holes in the sleeve in the end of the spool / sleeve opposite to the end with spring slots.

Place the slots and holes opposite each other so that parts of the holes in the sleeve are visible through the slots in the spool.



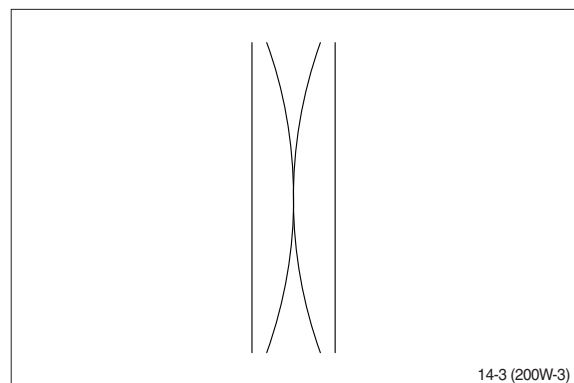
(2) Place the two flat neutral position springs in the slot.

Place the curved springs between the flat ones and press them into place (see assembly pattern).

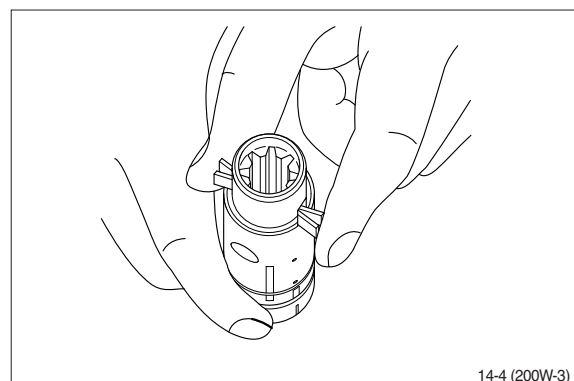


※ Assembly pattern.

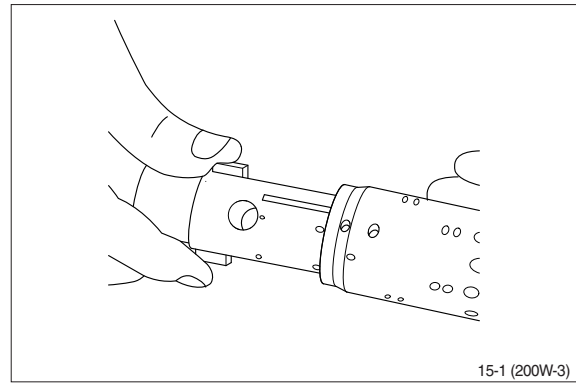
· Part no : 150N4035



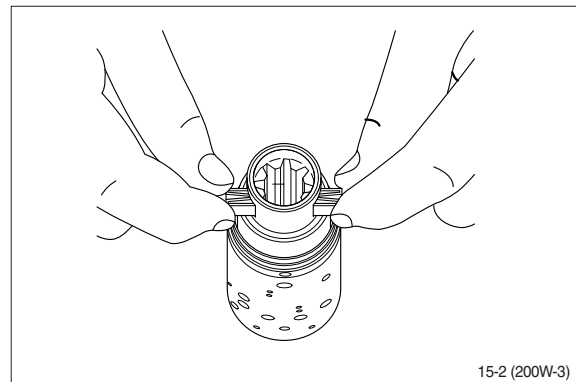
(3) Line up the spring set.



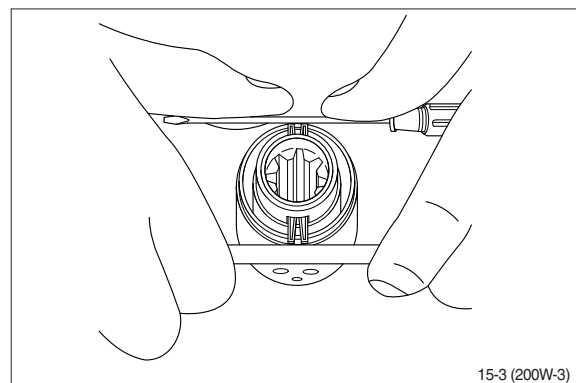
- (4) Guide the spool into the sleeve. Make sure that spool and sleeve are placed correctly in relation to each other.



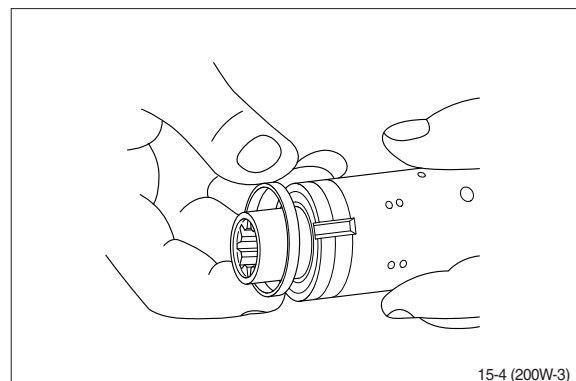
- (5) Press the springs together and push the neutral position springs into place in the sleeve.



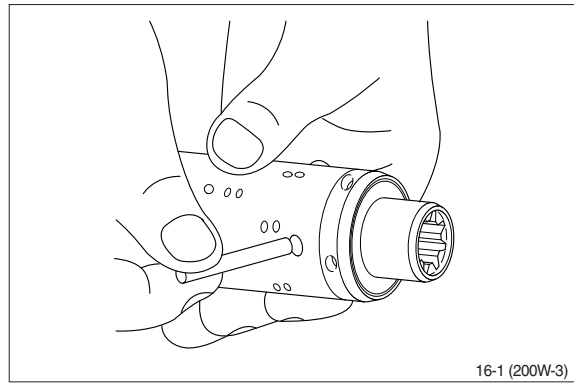
- (6) Line up the springs and center them.



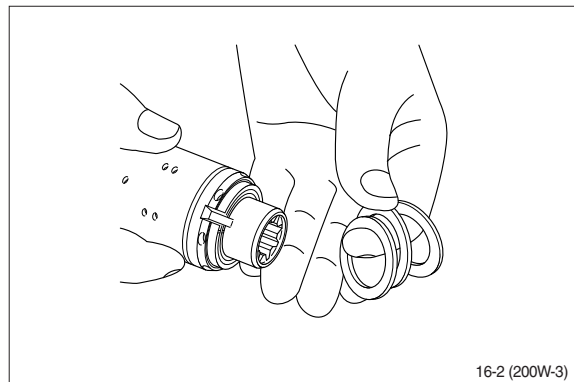
- (7) Guide the ring down over the sleeve.
※ The ring should be able to rotate free of the springs.



(8) Fit the cross pin into the spool / sleeve.

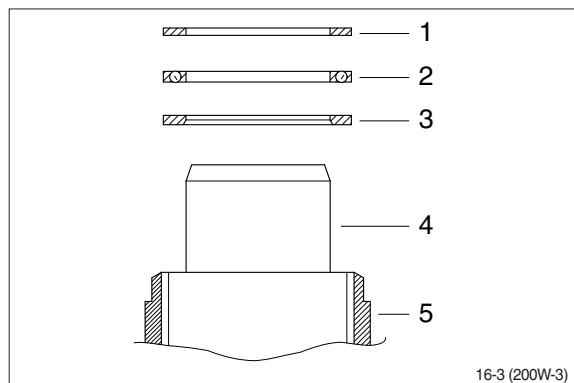


(9) Fit bearing races and needle bearing as shown on below drawing.



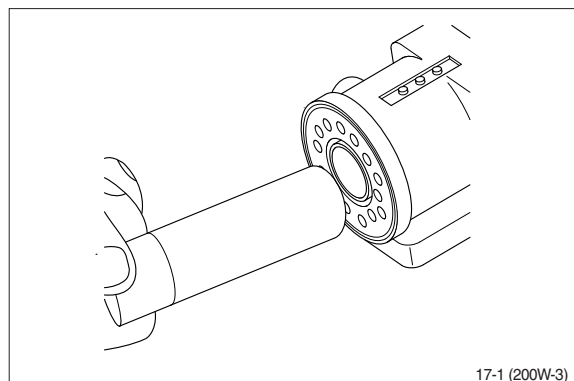
※ Assembly patted for standard bearings

- 1 Outer bearing race
- 2 Needle bearing
- 3 Inner bearing race
- 4 Spool
- 5 Sleeve

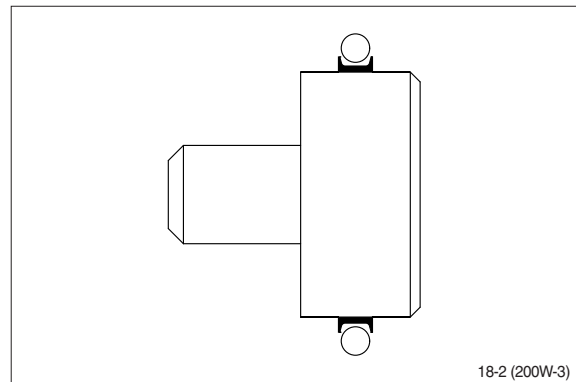
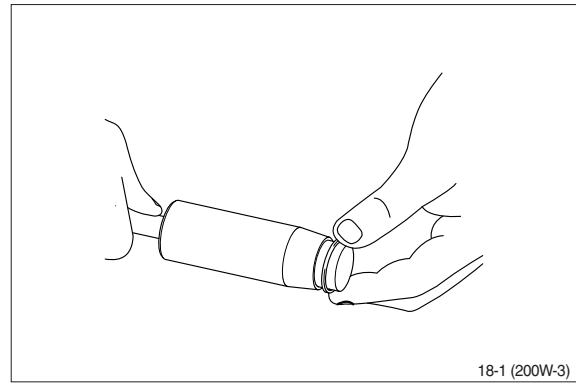


Installation instruction for O-ring

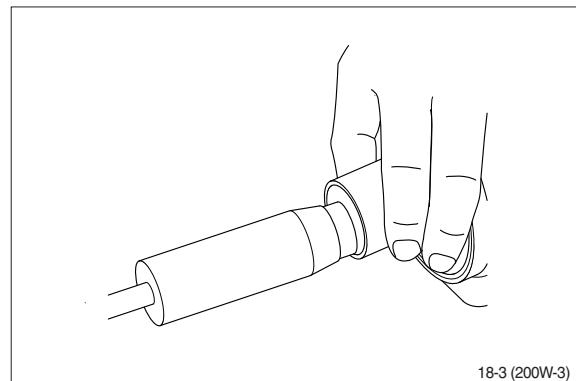
(10) Turn the steering unit until the bore is horizontal. Guide the outer part of the assembly tool into the bore for the spool / sleeve.



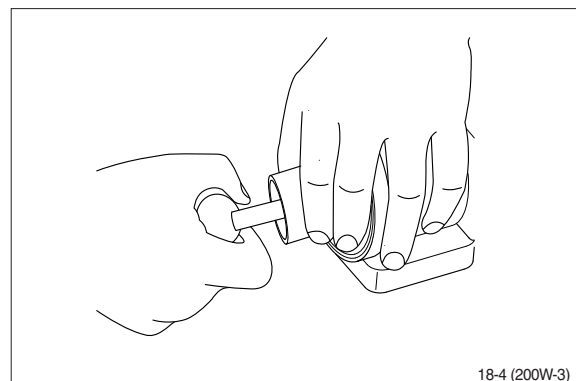
- (11) Grease O-ring with hydraulic oil and place them on the tool.



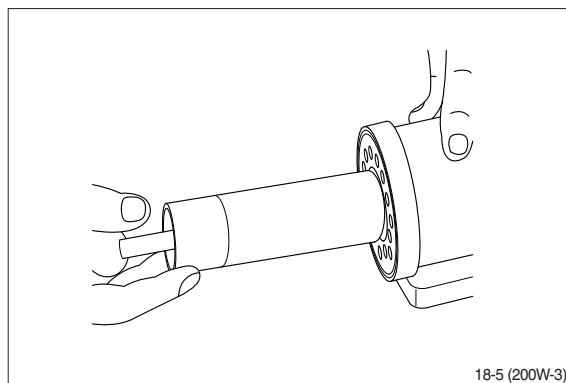
- (12) Hole the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.



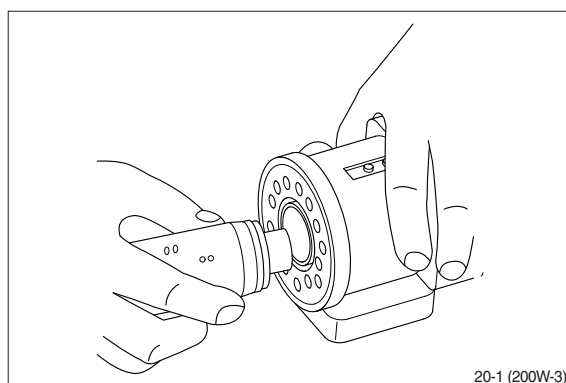
- (13) Press and turn the O-ring into position in the housing.



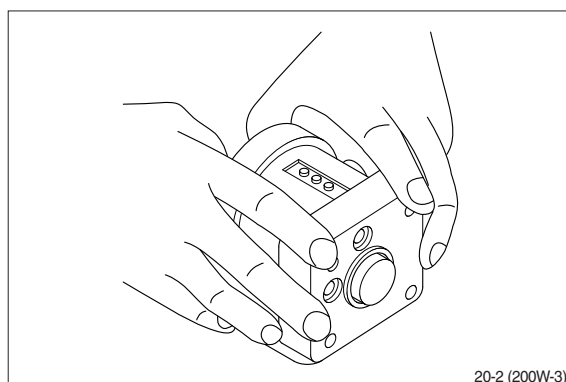
- (14) Draw the inner and outer parts of the assembly tool out of the steering unit bore, leaving the guide from the inner part in the bore.



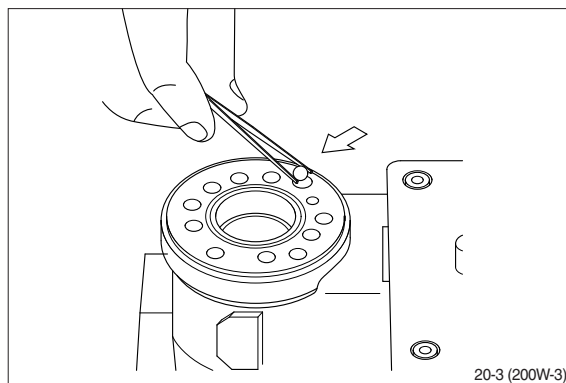
- (15) With a light turning movement, guide the spool and sleeve into the bore.
※ Fit the spool set holding the cross pin horizontal.



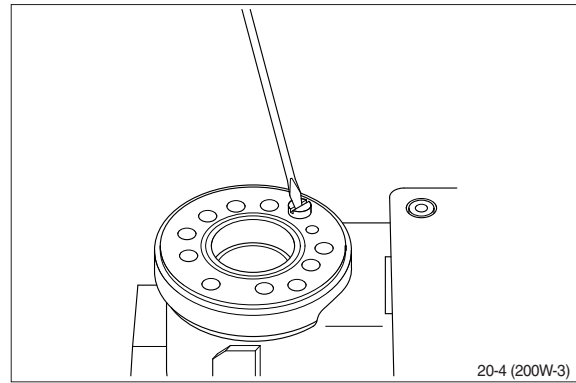
- (16) The spool set will push out the assembly tool guide. The O-ring is now in position.



- (17) Turn the steering unit until the bore is vertical again. Put the check valve ball into the hole indicated by the arrow.

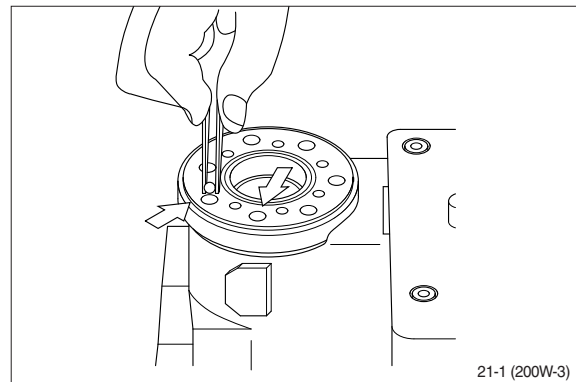


- (18) Screw the threaded bush lightly into the check valve bore. The top of the bushing must lie just below the surface of the housing.

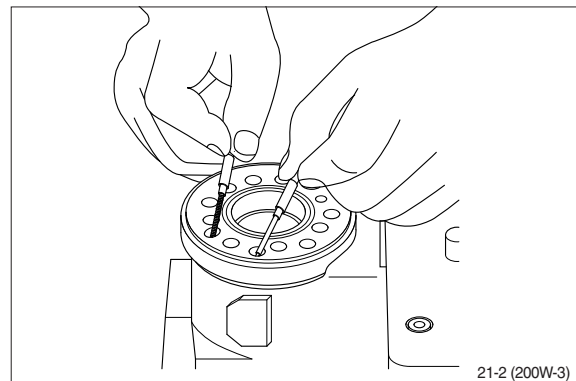


Assembly of the two suction valve

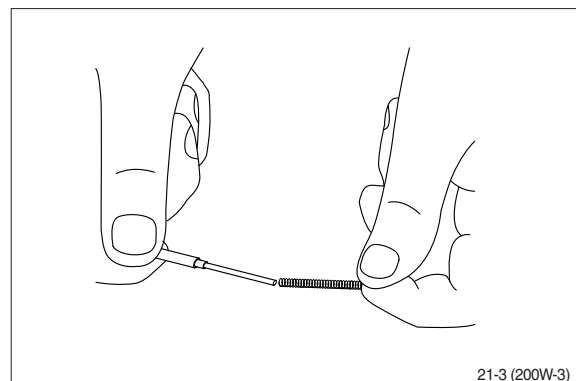
- (19) Place a ball in the two holes indicated by the arrows.



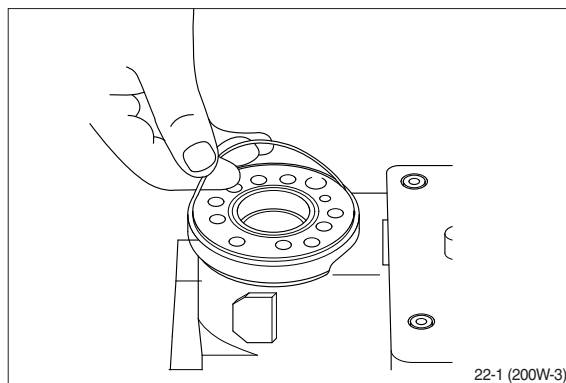
- (20) Place a pin in the same two holes.



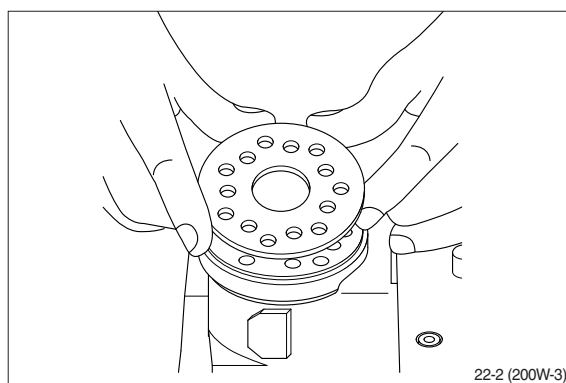
- (21) In some cases a spring has to be fitted on the pin before it is placed in the housing.



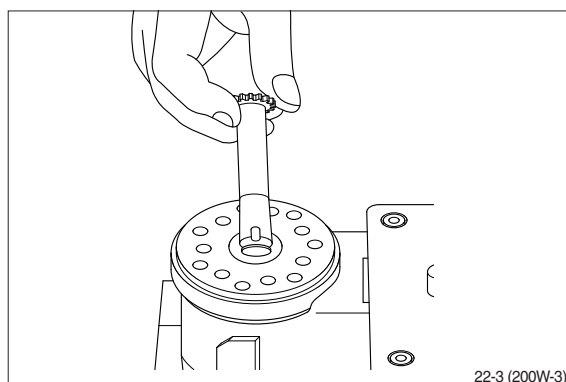
- (22) Grease the O-ring with mineral oil approx viscosity 500 cST at 20°C.



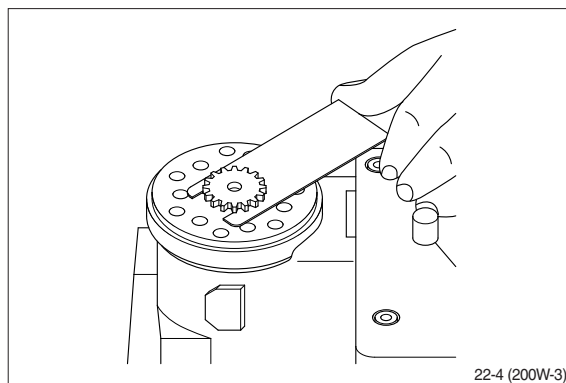
- (23) Place the distributor plate so that the channel holes match the holes in the housing.



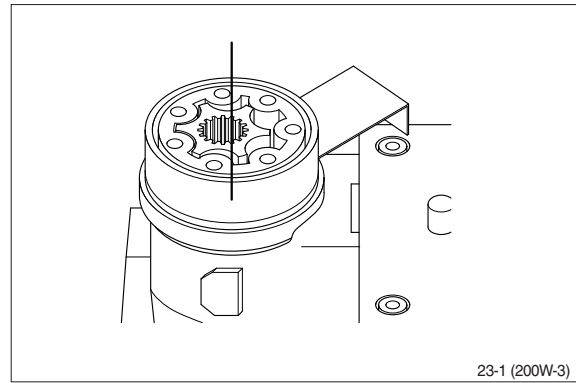
- (24) Guide the cardan shaft down into the bore so that the slot is parallel with the connection flange.



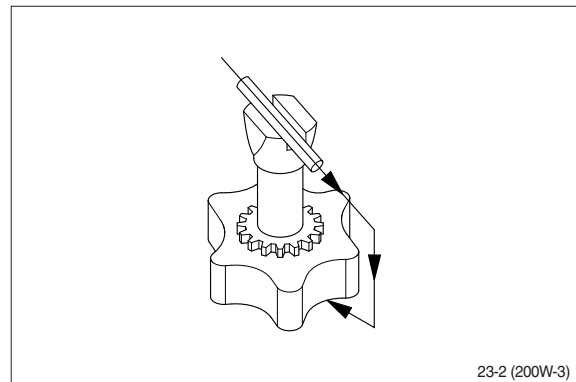
- (25) Place the cardan shaft as shown so that it is held in position by the mounting fork.



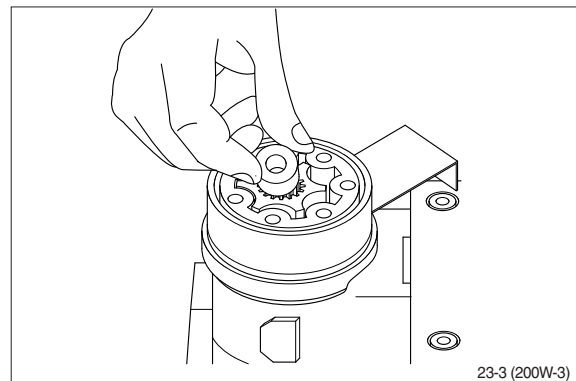
- (26) Grease the two O-rings with mineral oil approx. viscosity 500 cST at 20°C and place them in the two grooves in the gear rim. Fit the gearwheel and rim on the cardan shaft.



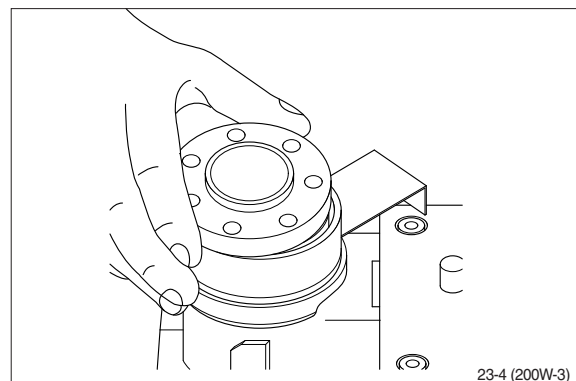
- (27) Fit the gearwheel (rotor) and cardan shaft so that a tooth base in the rotor is positioned in relation to the shaft slot as shown. Turn the gear rim so that the seven through holes match the holes in the housing.



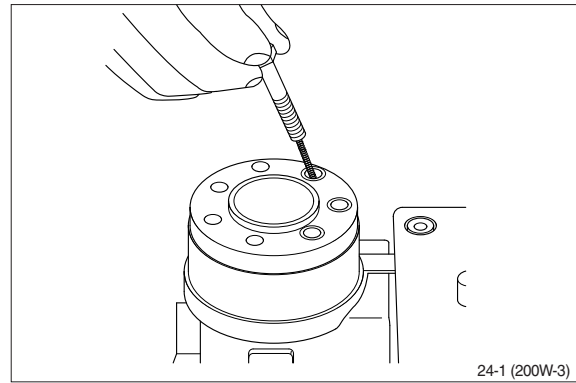
- (28) Fit the spacer, if any.



- (29) Place the end cover in position.

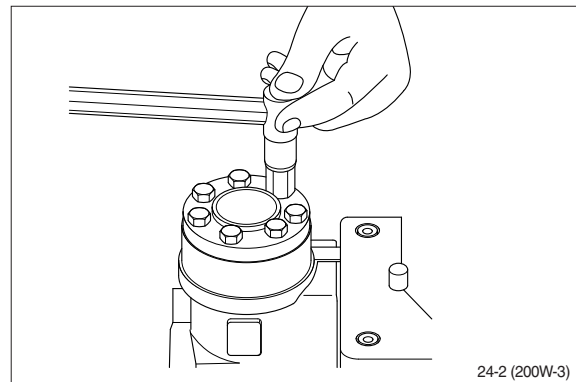


- (30) Fit the special screw with washer and place it in the hole shown.

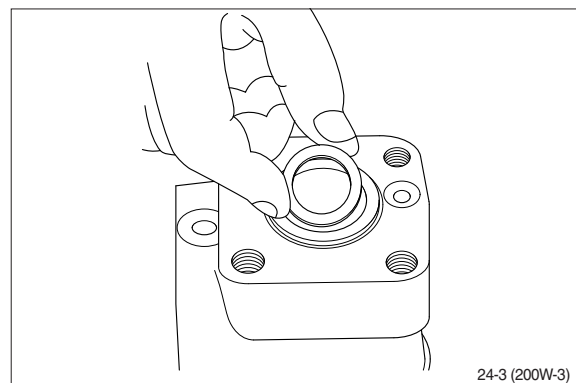


- (31) Fit the six screws with washers and insert them. Cross-tighten all the screws and the rolled pin.

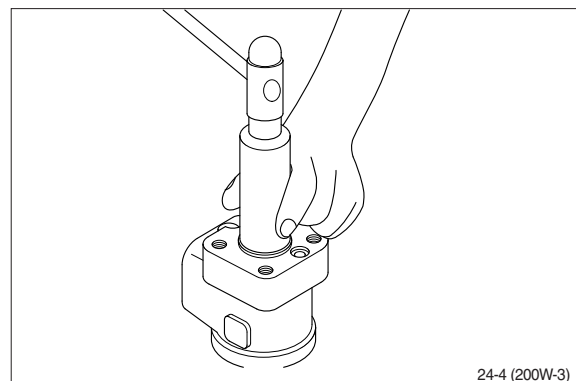
· Tightening torque : $3.0 \pm 0.6 \text{ kgf} \cdot \text{m}$
($22.4 \pm 4.3 \text{ lbf} \cdot \text{ft}$)



- (32) Place the dust seal ring in the housing.
The dust seal ring must be placed only after the pressure relief valve and shock valves have been fitted.

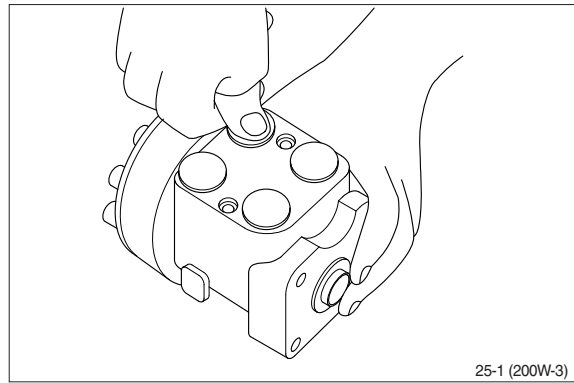


- (33) Fit the dust seal ring in the housing.



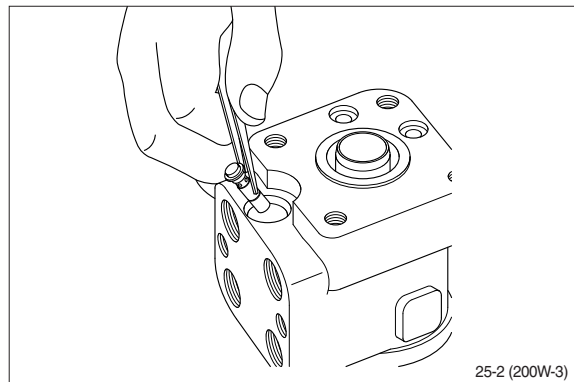
(34) Press the plastic plugs into the connection ports.

※ Do not use a hammer!

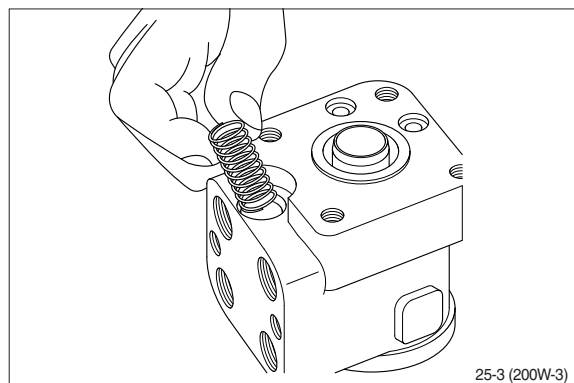


Assembly of the pressure relief valve

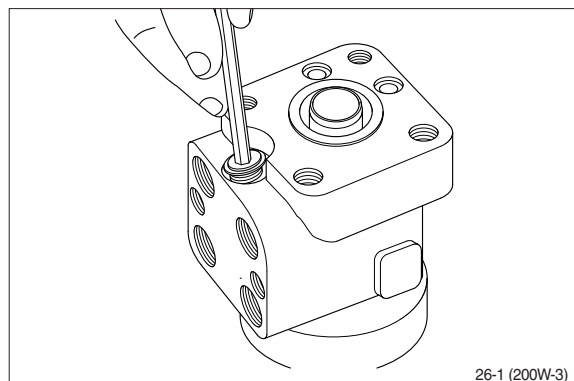
(35) Fit the piston.



(36) Fit the spring.

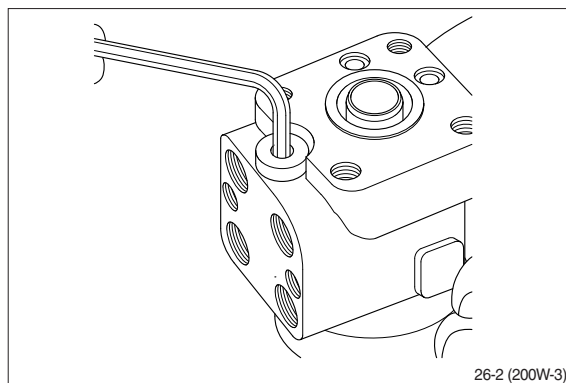


(37) Screw in the setting screw with an 8mm hexagon socket spanner. Make the pressure setting on a panel or the machine.



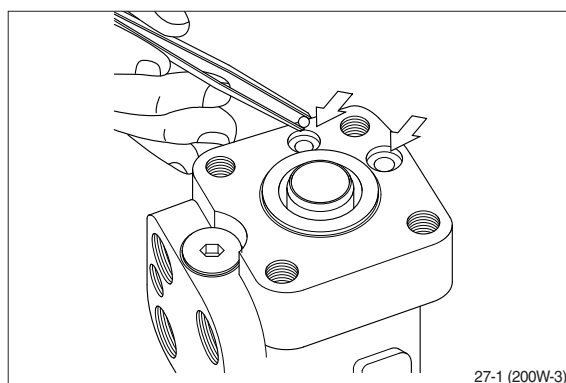
(38) Screw plug with dust seal into the housing using an 8mm hexagon socket spanner.

- Tightening torque : $5.1 \pm 1.0 \text{ kgf} \cdot \text{m}$
($36.9 \pm 7.2 \text{ lbf} \cdot \text{ft}$)

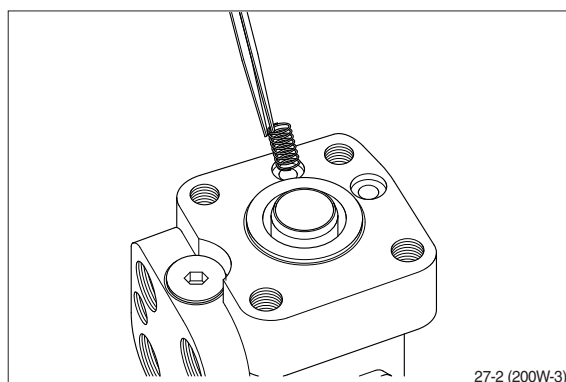


Assembly of the dual shock valve

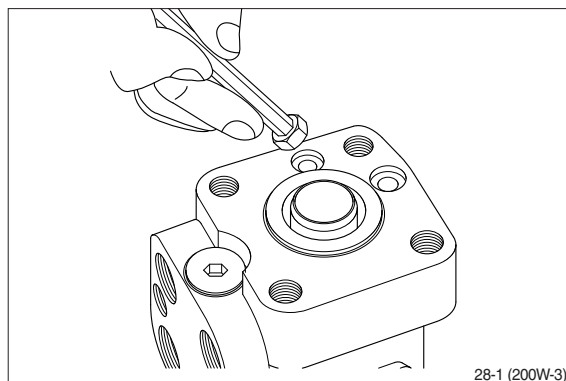
(39) Put a ball in the two holes indicated by the arrows.



(40) Place springs and valve cones over the two balls.

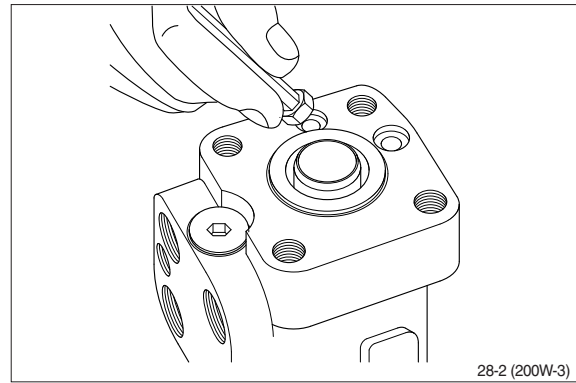


(41) Screw in the two setting screws using a 6mm hexagon socket spanner. Make the pressure setting on a panel or the machine.



(42) Screw plug with seal ring into the two shock valves using a 6mm hexagon socket spanner.

- Tightening torque : 3.1 kgf · m
(22.4 lbf · ft)

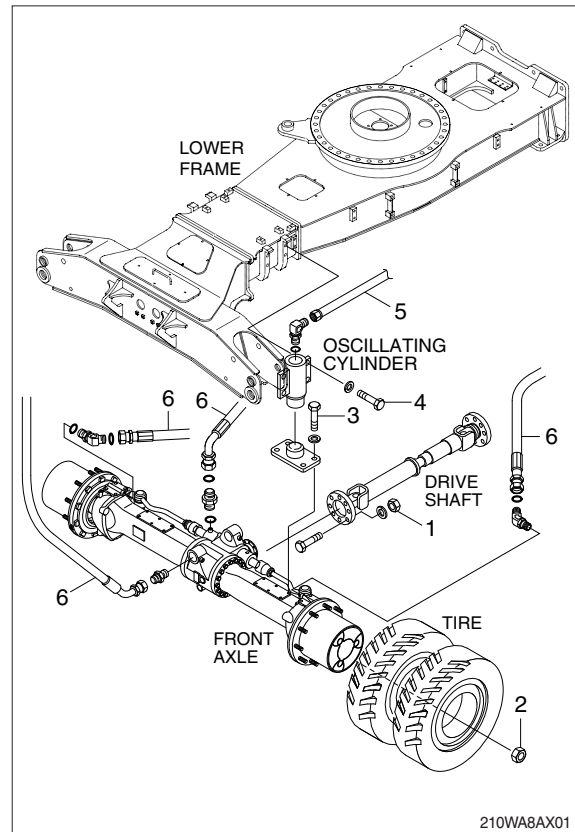


Steering valve is now assembled.

GROUP 9 FRONT AXLE

1. REMOVAL FRONT AXLE

- 1) Propeller shaft mounting bolt (1, M10)
 - Tightening torque : 5.9 ± 0.6 kgf · m
(42.7 ± 4.3 lbf · ft)
- 2) Wheel nut (2, M22)
 - Tightening torque : 60 kgf · m
(433 lbf · ft)
- 3) Oscillating cylinder supporting mounting bolt (3, M16)
 - Tightening torque : 29.7 ± 4.5 kgf · m
(215 ± 32.5 lbf · ft)
- 4) Oscillating cylinder mounting bolt (4, M22)
 - Tightening torque : 69.4 ± 10.4 kgf · m
(502 ± 75.2 lbf · ft)
- 5) Pipe assy (5)
- 6) Hose assy (6)
- 7) Front axle weight : 749 kg (1651 lb)



3. GENERAL INSTRUCTIONS

1) GENERAL WORKING INSTRUCTIONS

- (1) This manual has been developed for the skilled serviceman, trained by the ZF-Passau.
- (2) During all operations, pay attention to cleanliness and skilled working.
Therefore, axle removed from the machine, must be cleaned prior to open them.
- (3) We assume that the special tools, specified by ZF, will be used.
The special tools are available from ZF-Passau.
- (4) After the disassembly, all components must be cleansed, especially corners, cavities and recesses of housing and covers.
- (5) The old sealing compound must be carefully removed.
- (6) Check lubricating holes, grooves and pipes for free passage. They must be free of residues, foreign material or protective compounds.
- (7) The latter refers especially to new parts.
- (8) Parts which have been inevitably damaged in a disassembly operation, must be generally replaced by new ones, e.g. rotary seal rings, O-rings, U-section rings, cap boots, protective caps etc..
- (9) Components such as roller bearings, thrust washers, synchronizing parts etc. which are subject to normal wear in automotive operation, must be checked by the skilled Serviceman.
He will decide if the parts can be reused.
- (10) For the heating of bearings etc., hot plates, rod heaters or heating furnaces must be used.
- (11) Never heat parts directly with the flame. An auxiliary solution would be to immerse the bearing in a vessel filled with oil, which is then heated with the flame.
In this way, damage to the bearings could be avoided.
- (12) Ball bearings, covers, flanges and parts like that must be heated to about 90 to 100°C.
- (13) Hot-mounted parts must be reset after cooling in order to assure a proper contact.
- (14) Before pressing shafts, bearings etc. in position, both parts must be lubricated.
- (15) During to reassembly, all specified adjustment values, testing specifications and tightening torque must be respected.
- (16) After the repair, units are filled up with oil.
- (17) After the oil filling, the oil level plugs and oil drain plugs must be tightened to the specified tightening torque.

2) IMPORTANT INSTRUCTIONS CONCERNING THE LABOUR SAFETY

- (1) In principle, repairers are themselves responsible for the labour safety.
- (2) The observance of all valid safety regulations and legal rules is a precondition to prevent damage to individuals and products during the maintenance and repair operations.
- (3) Before starting the work, the repairers have to make themselves familiar with these regulations.
- (4) The proper repair of these products requires especially trained personnel.
- (5) The repairer himself is obliged to provide for the training.

3) LUBRICANT SPECIFICATIONS

- (1) Gear oils with limited - slip additives.
- (2) API GL-5
- (3) MIL-L-2105D (SAE 85W-90, 85W-140 with LS-Additive)

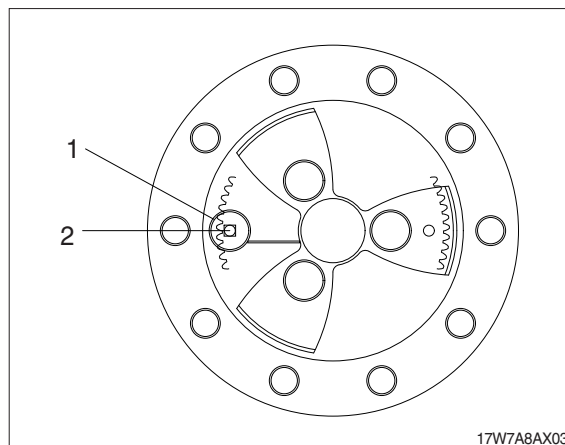
4) BRAKE LINING WEARING TEST

(1) The measurement of wear on the multi-disc brake only gives limited information on the total state of the plate pack without disassembling the output.

Make measurement of lining wear at least once per year, in particular, however, in case of a different braking behaviour, like :

- Braking noises
- Reduced braking power
- Different deceleration
- Different brake oil level
- Different braking pressure

※ To avoid injury when opening the oil drain/ oil filler plug (1), due to a possible pressure build-up in the planetary carrier bring drain hole to topmost position (12 o'clock) and carefully unscrew oil drain and filler plug (1).



17W7A8AX03

(2) Then turn output until oil filler / oil drain hole (2) is on 9 o'clock position.

1 = Oil filler-/oil drain hole

2 = Gauge hole ($\varnothing=10$ mm) in ring gear
9 o'clock position

3 = Dial indicator with solenoid support

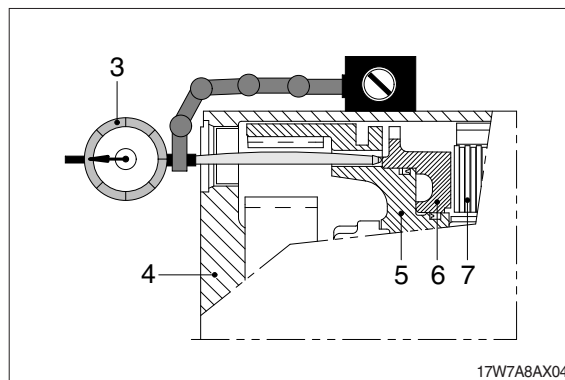
4 = Planetary carrier

5 = Ring gear

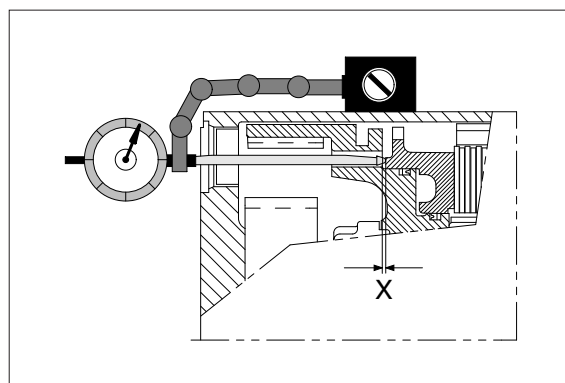
6 = Piston

7 = Plate pack

X = Piston stroke



17W7A8AX04



17W7A8AX05

3. DISASSEMBLY

1) STEERING

(1) Fix the axle to the assembly truck.

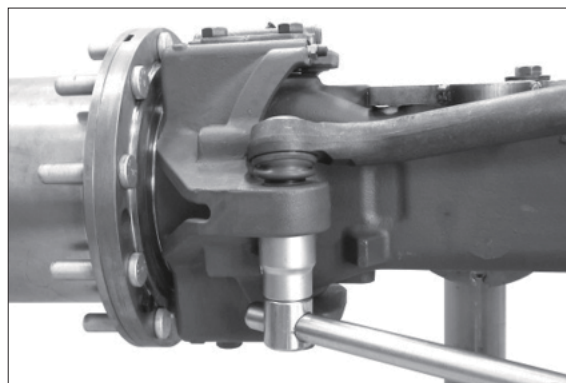
(S) Assembly truck 5870 350 000

(S) Support 5870 350 106



17W98FA001

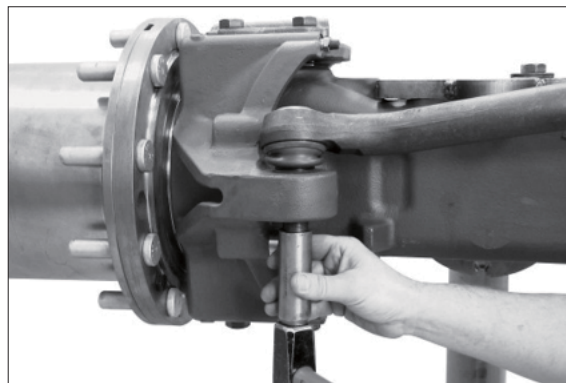
(2) Loosen locknut.



17W98FA002

(3) Force out tie rod from bevel seat.

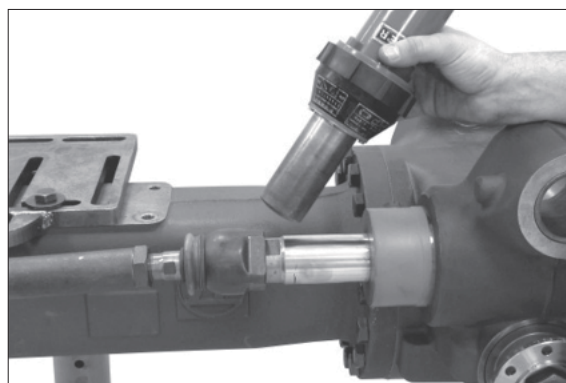
※ Use suitable mandrel (brass or aluminum).



17W98FA003

(4) Warm up piston rod by means of hot air blower.

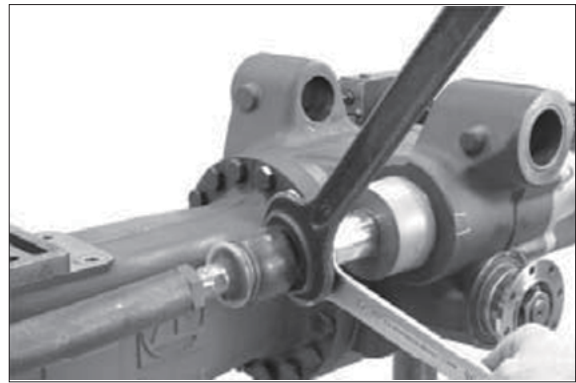
※ Axial joint is installed with Loctite no. 243.



17W98FA004

(5) Separate both tie rods from piston rod.

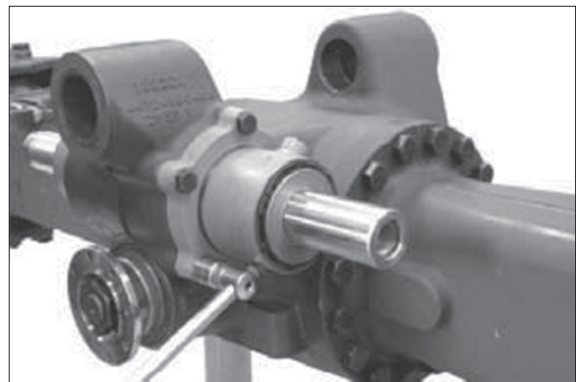
- ※ If work is just to be done on piston rod, guide or sealing elements, no disassembly of the steering cylinder assy is required.



17W98FA005

(6) Loosen hexagon screws.

- ※ Mark radial installation position of steering cylinder to axle housing – assembly aid.



17W98FA006

(7) Drive out steering cylinder assy from axle housing hole.

- ※ Use a plastic hammer.



17W98FA007

(8) Unsnap the retaining ring and remove the releasing flange.



17W98FA008

(9) Unsnap retaining ring.



17W98FA009

(10) Push/force the brake head into the cylinder tube, until the retaining ring (see figure FA011) can be removed.



17W98FA010

(11) Unsnap retaining ring.

Then drive out piston rod together with brake head from cylinder tube.



17W98FA011

(12) Pull off brake head from the piston rod.

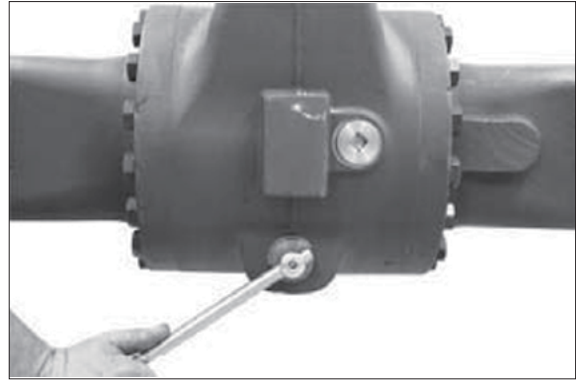
Then remove all sealing elements from piston rod, brake head and cylinder tube.



17W98FA012

2) OUTPUT

- (1) Loosen screw plug and drain oil from the axle.



17W98FA013

- (2) Loosen screw plug and drain oil from the planetary carrier.

※ To avoid injury due to a possible pressure build-up in the oil system of the planetary carrier, bring oil filler and control plug to 12 o'clock position and carefully unscrew. Then bring drain hole to 6 o'clock position and drain oil.

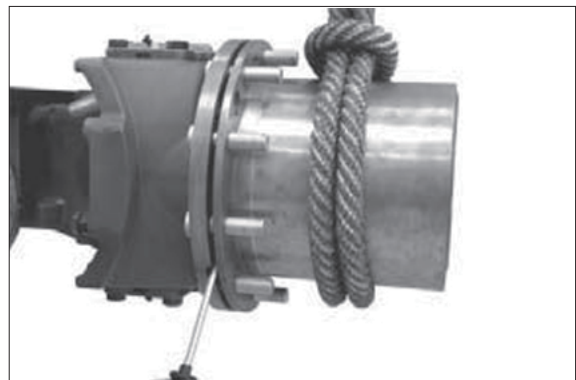
※ Use suitable collecting basin environmental protection.



17W98FA014

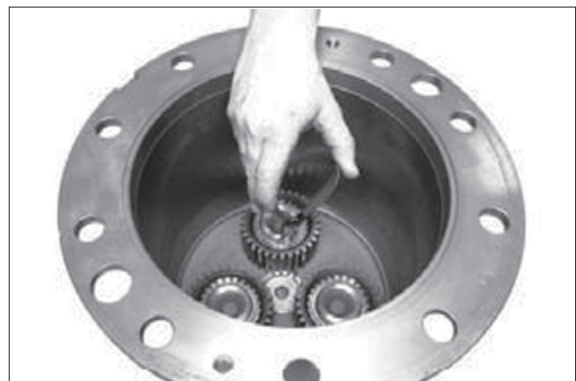
(3) Planetary carrier

Loosen both hexagon screws and separate planetary carrier from hub.



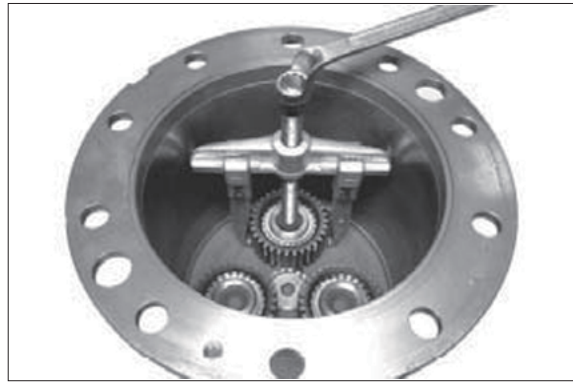
17W98FA015

- (4) Unsnap retaining ring.



17W98FA016

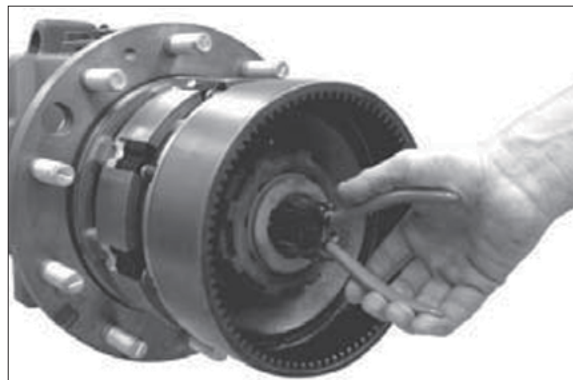
- (5) Pull off planetary gear together with cylindrical roller bearing.



17W98FA017

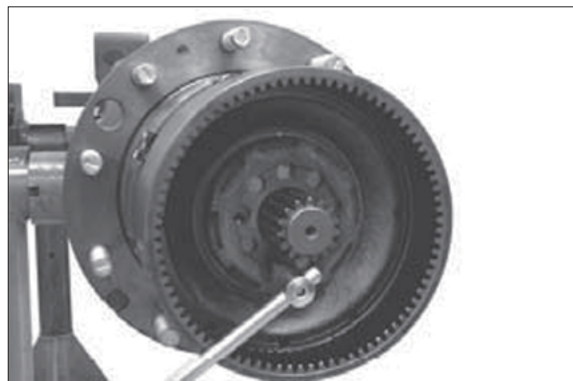
(6) Brake

Unsnap retaining ring and remove both thrust washers.



17W98FA018

- (7) Loosen cylindrical screw (slotted nut fixing).



17W98FA019

- (8) Loosen slotted nut.

(S) Socket wrench

5870 656 097

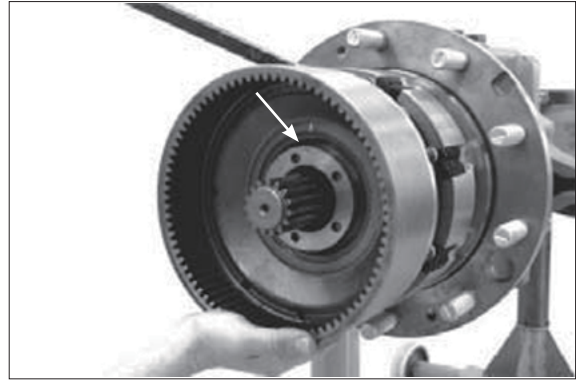


17W98FA020

(9) Press off ring gear together with piston from joint housing.

(S) Assembly lever 5870 345 036

※ Pay attention to releasing O-ring (arrow).



17W98FA021

(10) Loosen hexagon screws and remove releasing spring sleeves and compression springs.



17W98FA022

(11) Press off piston from ring gear.



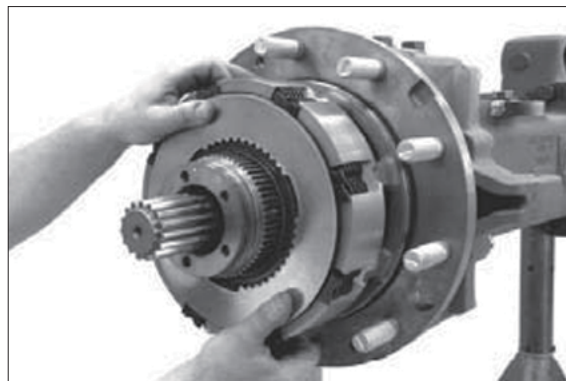
17W98FA023

(12) Remove sealing elements from the annular grooves (see arrows) of the ring gear.



17W98FA024

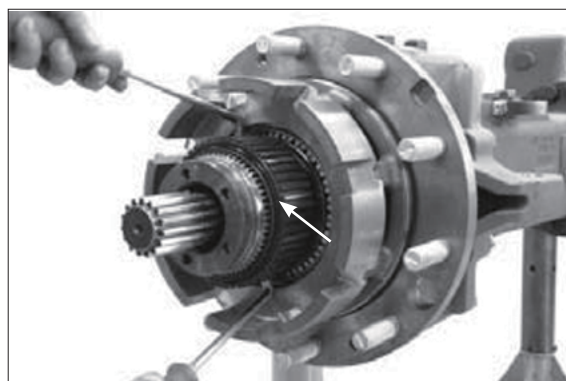
(13) Remove disk package.



17W98FA025

(14) Remove O-ring (see arrow) and lift off disk carrier from the joint housing.

(S) Adjusting device 5870 400 001



17W98FA026

(15) Hub

Remove O-ring (see arrow).

Secure hub with lifting bracket (S) and pull from joint housing by means of a two armed puller.

(S) Lifting bracket 5870 281 043

(S) Pressure piece 5870 100 067

※ Pay attention to releasing bearing inner ring.



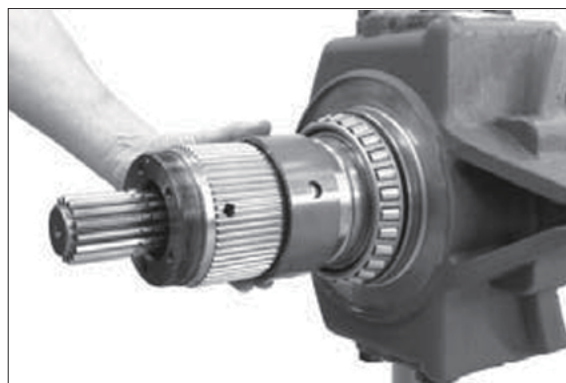
17W98FA027

(16) Use a lever to lift-off shaft seal ring (see arrow) from hub hole and force both bearing outer rings out of the hub.



17W98FA028

(17) Remove spacer bushing.



17W98FA029

(18) Pull tapered roller bearing from joint housing.

(S) Grab sleeve 5873 004 022

(S) Pressure piece 5870 100 067



17W98FA030

(19) Knuckle housing

Loosen threaded joint and remove upper bearing pin.

※ Pay attention to releasing O-ring.

※ Remove lower bearing pin only after securing the knuckle housing (see figure FA032).

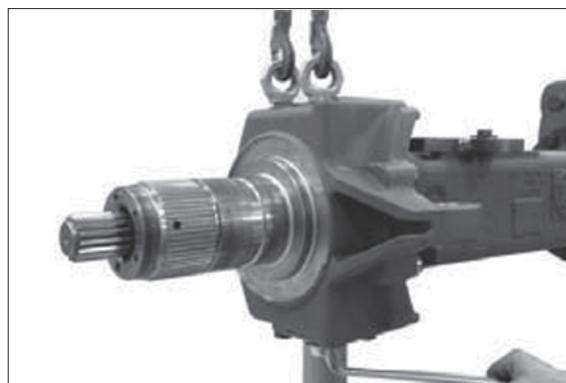


17W98FA031

(20) Secure knuckle housing by means of lifting tackle.

Then loosen threaded joint and remove lower bearing pin.

(S) Eyebolts (M 20) 0636 804 003



17W98FA032

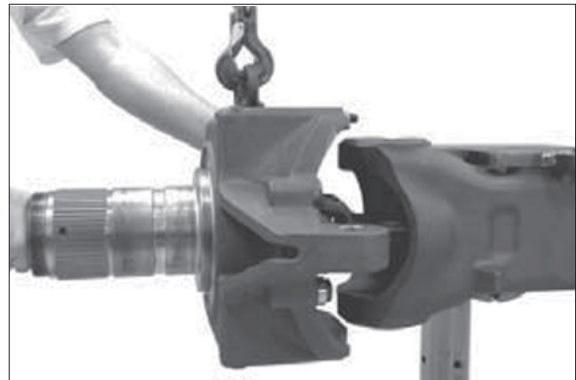
- (21) Use lever to remove tapered roller bearing (1) from bearing pin, remove releasing sealing cap (2) and the O-ring lying behind.



17W98FA033

- (22) Separate knuckle housing with double u-joint shaft from the axle housing.

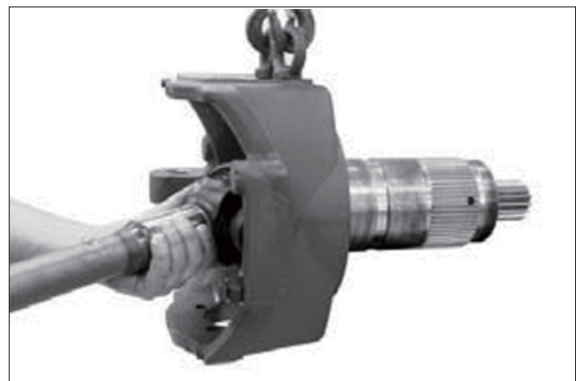
※ Pay attention to shaft seal ring in the axle housing risk of damage.



17W98FA034

- (23) Pull out double u-joint shaft from knuckle housing.

※ Pay attention to shaft seal ring in the knuckle housing risk of damage.



17W98FA035

- (24) Pull out shaft seal ring and afterwards the bushing behind from the axle housing.

(S) Internal extractor 5870 300 017
(S) Counter support 5870 300 020

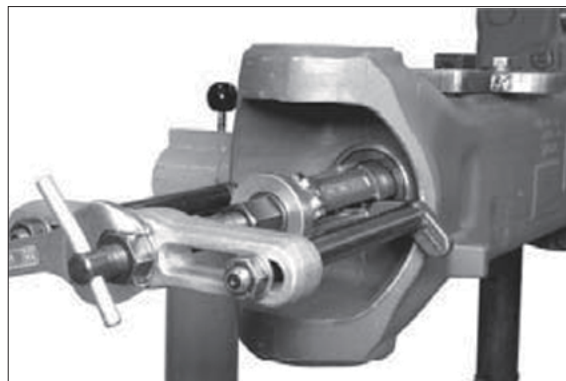


17W98FA036

(25) Pull out shaft seal ring and afterwards the bushing behind from the axle housing.

(S) Internal extractor 5870 300 017

(S) Counter support 5870 300 020



17W98FA037

(26) Pull out both bearing outer rings from the pivot bearing holes.

(S) Internal extractor 5870 300 019

(S) Counter support 5870 300 020



17W98FA038

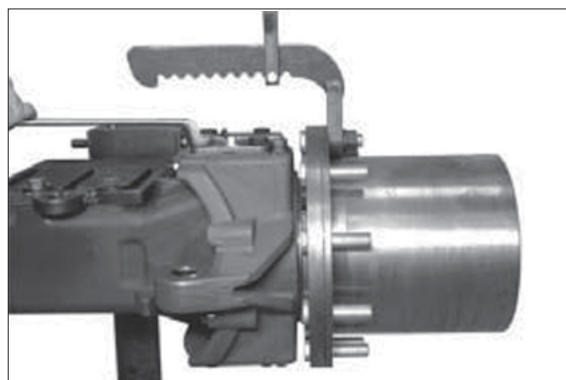
(27) Output assy

※ If work is required on the differential or pinion, you may disassembly the output as complete unit (operation FA039 and FA040).

Secure output assy by means of lifting tackle (S).

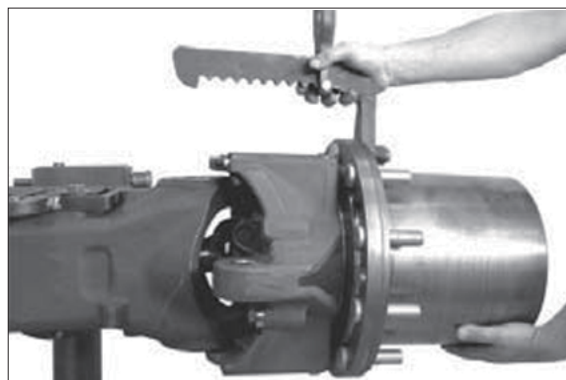
(S) Lifting bracket 5870 281 043

Then loosen threaded joints of both bearing pins.



17W98FA039

(28) Remove both bearing pins and separate the output assy from the axle housing.



17W98FA040

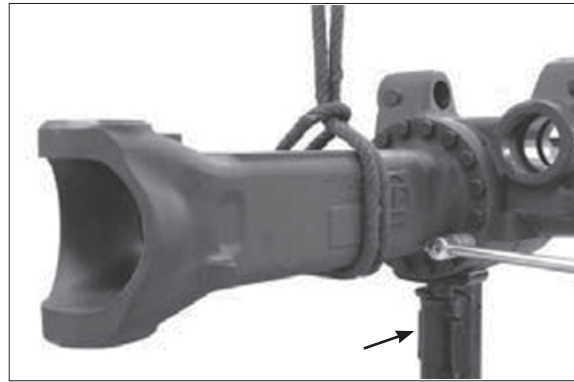
3) INPUT

- (1) Support axle to axle drive housing (see arrow).

Then secure axle housing (crown wheel side) by means of lifting tackle and loosen threaded joint.

Then separate axle housing from axle drive housing.

※ Pay attention to possibly releasing differential.

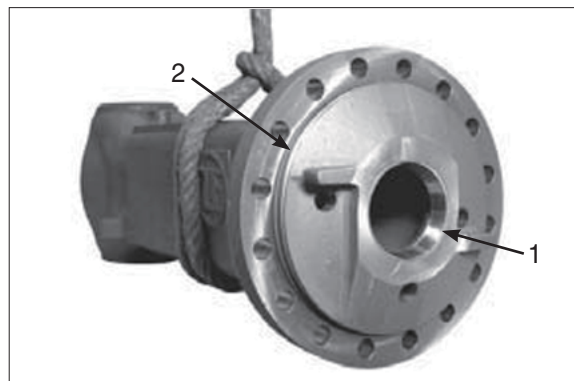


17W98FA041

- (2) Pull bearing outer ring (arrow 1) from the bearing hole and remove releasing shim. Then remove O-ring (arrow 2).

(S) Striker

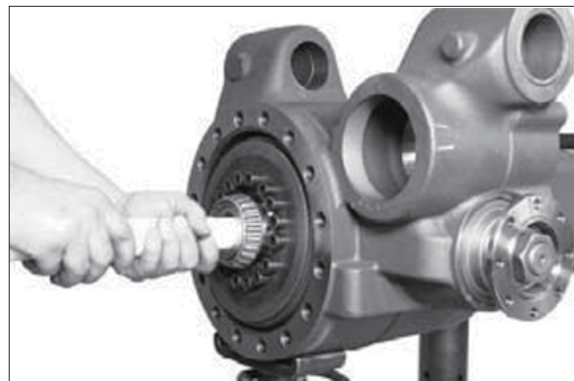
5870 650 004



17W98FA042

- (3) Lift differential out of the axle drive housing.

※ Disassembly of the differential is described as of page 8-259.

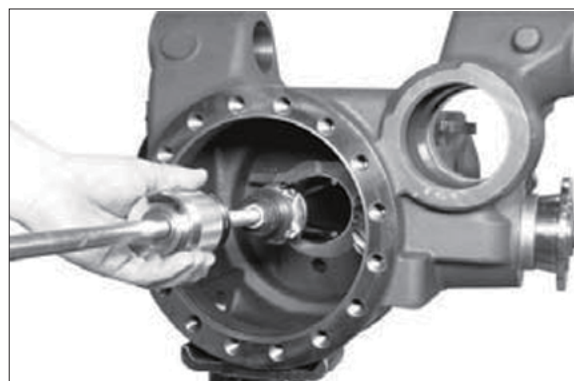


17W98FA043

- (4) Use striker (S) to pull bearing outer ring out of the bearing hole (axle housing) and remove releasing shim.

(S) Striker

5870 650 004

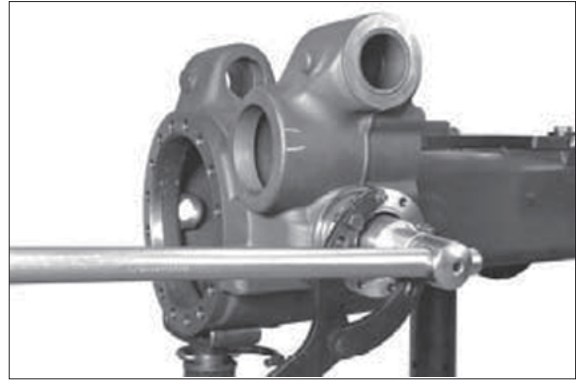


17W98FA044

- (5) Warm up hexagon nut by means of hot air blower.
Then loosen hexagon nut and remove the releasing shim.

(S) Clamping fork 5870 240 025

- ※ Hexagon nut is installed with Loctite no. 262.



17W98FA045

- (6) Pull input flange from pinion.
If necessary, remove screen sheet from flange.



17W98FA046

- (7) Use a lever to remove the shaft seal ring from the housing hole.



17W98FA047

- (8) Force out input pinion and remove releasing roller bearing.

- ※ Use plastic hammer.
※ If tapered roller bearings should not be replaced, pay attention that the outer bearing inner ring with all its rolls is in contact with bearing outer ring when forcing out the input pinion.



17W98FA048

(9) Remove spacer ring.



17W98FA049

(10) Press roller bearing from input pinion.

(S) Grab sleeve 5873 001 037



17W98FA050

(11) Pull off outer bearing outer ring from bearing hole.

(S) Internal extractor 5870 300 019

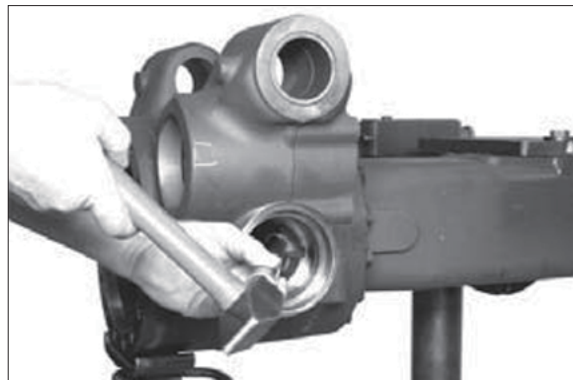
(S) Counter support 5870 300 020



17W98FA051

(12) Force out bearing outer ring from the inner bearing hole pay attention to the shim behind.

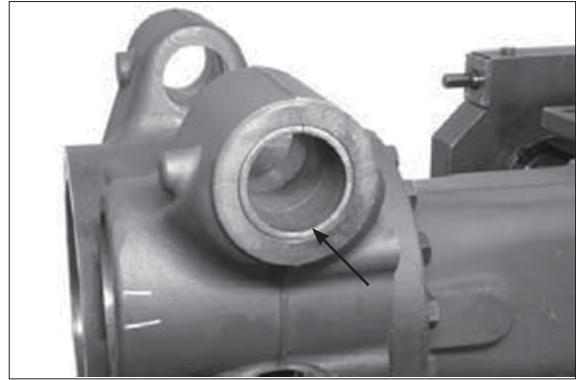
※ Mark shim (with regard to position/bearing allocation) assembly aid.



17W98FA052

(13) If necessary, provide bushings with a separating slot (see arrow) and remove from holes.

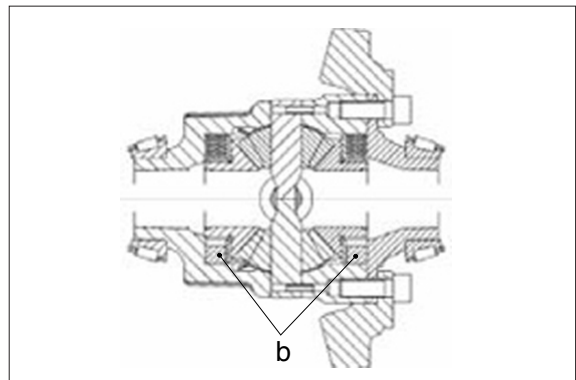
※ Bushings are destroyed by this.



17W98FA053

4) DIFFERENTIAL

(1) Differential - versions:
b = Constant spacers



17W98FA054

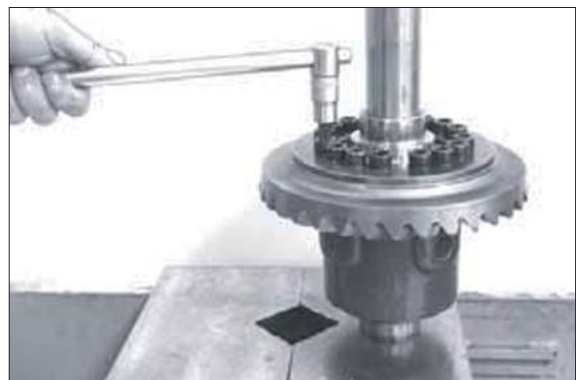
(2) Pull both tapered roller bearings from differential carrier.

(S) Grab sleeve	5873 011 019
(S) Basic tool	5873 001 000
(S) Pressure piece	5870 100 009



17W98FA055

(3) Use press to fix differential and loosen threaded joint crown wheel / differential carrier.



17W98FA056

(4) Press crown wheel from differential.



17W98FA057

(5) Remove single parts.

Remove axle bevel gear together with thrust washer and constant spacer from the differential carrier.



17W98FA058

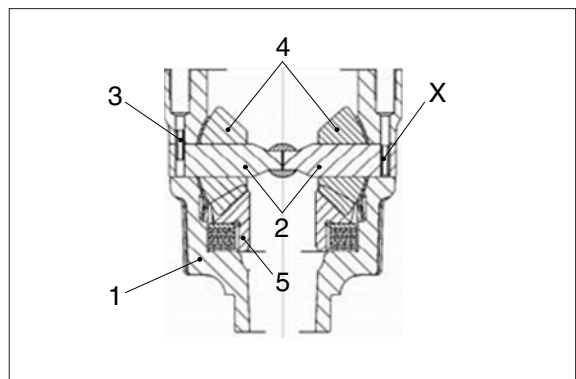
(6) Force slotted pins (considering position "X", see subsequent sketch FA060) into the spider shafts.



17W98FA059

(7) Comment on sketch:

- 1 = Differential carrier
- 2 = Spider shafts (short)
- 3 = Slotted pins
- 4 = Differential bevel gears
- 5 = Axle bevel gear
- X = Position of the slotted pin to force out the spider shafts



17W98FA060

(8) Force out both spider shafts (short).



17W98FA061

(9) Remove all single parts.

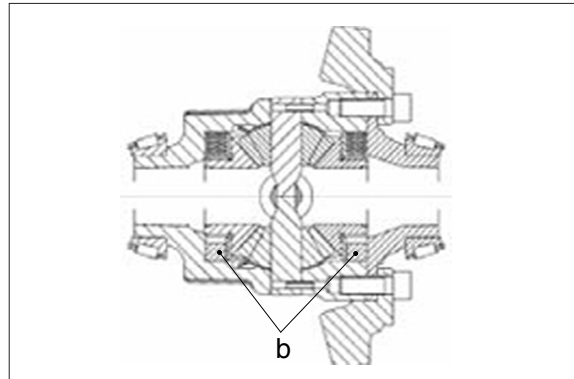


17W98FA062

4. REASSEMBLY

1) DIFFERENTIAL

(1) b = Constant spacers



17W98FA054

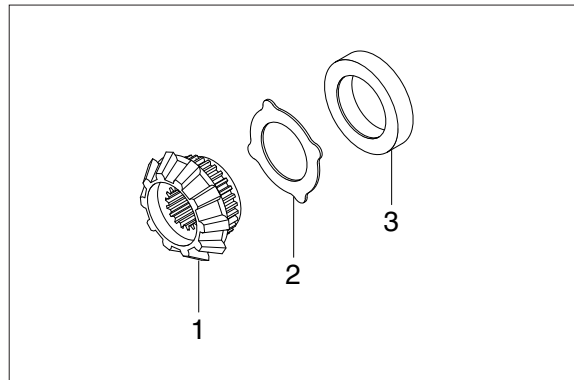
(2) All outer and inner disks are replaced by a constant spacer (see figure FA066).

1 = Axle bevel gear

2 = Pressure disk

3 = Constant ring

※ No measuring / setting of the axial play of the two axle bevel gears is required, therefore single parts can be immediately oiled.



17W98FA065

(3) Insert premounted axle bevel gear into the differential carrier.



17W98FA066

(4) Insert differential bevel gears (1) with thrust washers (2) and fix with spider shafts (3 and 4).

※ Pay attention to radial installation position of the thrust washers.



17W98FA067

- (5) Check axial play of the axle bevel gear $0.0 \sim 0.15$ mm.

※ If the axial play is not within the specified tolerance, correct with the corresponding outer disks.

After the setting procedure separate the single parts again.

Then oil and reassemble all single parts again.

※ Make sure that thickness and arrangement of the second disk package are identical (figure FA071).

- (6) Fix both spider shafts (short) by means of slotted pins (considering installation dimension, see sketch FA070).



17W98FA068



17W98FA069

- (7) Comment on sketch:

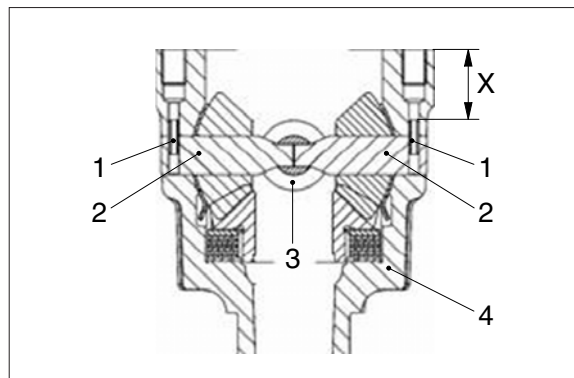
1 = Slotted pin

2 = Spider shaft (short)

3 = Spider shaft

4 = Differential carrier

X = Installation dimension 34 ± 0.5 mm



17W98FA070

- (8) Mount second axle bevel gear with thrust washer and constant spacer (see also figure FA065).

※ Mount the pressure disk with the coated surface showing to the outer disk.

※ Thickness and arrangement of the disk package must be identical on both sides of the differential gear.



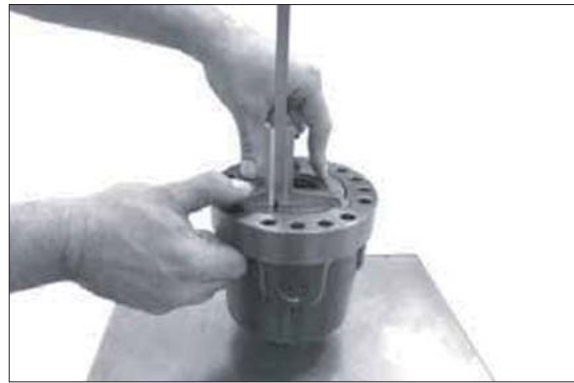
17W98FA071

(9) Check axial play of the second axle bevel gear 0.0~0.15 mm.

※ If the axial play is not within the specified tolerance, correct with the corresponding outer disks.

After the resetting procedure remove the second axle bevel gear together with the disk package from the differential carrier.

Then oil and reassemble all single parts.



17W98FA072

(10) Mount two adjusting screws (S) and insert cover.

(S) Adjusting screws (M12×1.5)

5870 204 027



17W98FA073

(11) Press crown wheel onto the cover / differential carrier until contact position is obtained.



17W98FA074

(12) Fix differential with press and tighten crown wheel with cylindrical screws.

Tightening torque (M12×1,5/12.9)

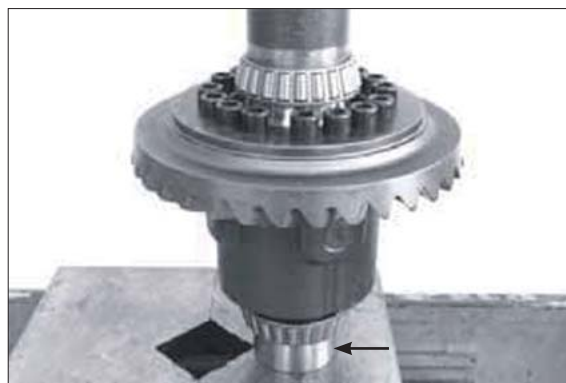
..... MA = 145 Nm



17W98FA075

(13) Press on both bearing inner rings until contact is obtained.

- ※ Use an appropriate support (arrow) differential may not be supported on the bearing cage.



17W98FA076

2) INPUT

(1) Input pinion

- ※ The following measuring procedures must be carried out with utmost accuracy. Inaccurate measurements lead to an incorrect contact pattern and another disassembly and reassembly of the input pinion is required.

(2) Determine thickness of the shim to obtain a correct contact pattern

Read dimension I from the axle drive housing.

Dimension I e.g. 154.05 mm



17W98FA077

(3) Read dimension II (pinion dimension).

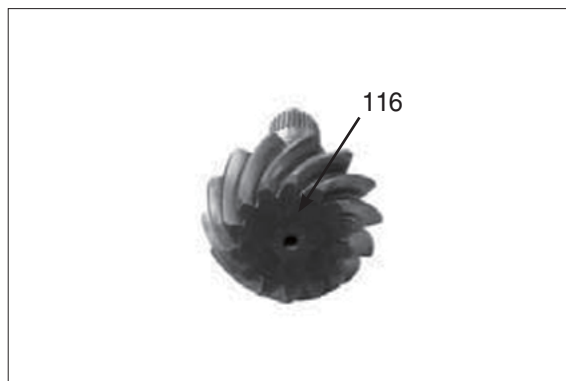
Dimension II e.g. 116.00 mm

In case of a + or – deviation of the pinion dimension for production reasons the relevant value is marked by hand on the pinion.

Pinion dimension (without + or – deviation) = 116.0 mm

Pinion dimension with an indicated + 0.1 deviation = 116.1 mm

Pinion dimension with an indicated – 0.1 deviation = 115.9 mm



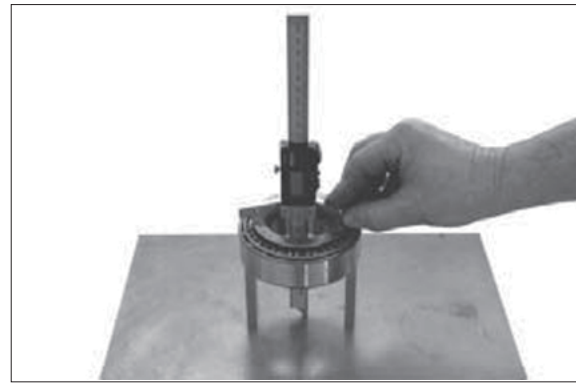
17W98FA078

(4) Determine dimension III (bearing width).

- ※ Make sure that the rollers are located without any play (rotate bearing g inner ring several times in both directions roller setting).

Since the installed roller bearing is subject to a pre-load in installation position, consider an experience deduction of 0.1 mm.

Dimension III, e.g. 36.60 mm – 0.1 mm
 = 36.50 mm

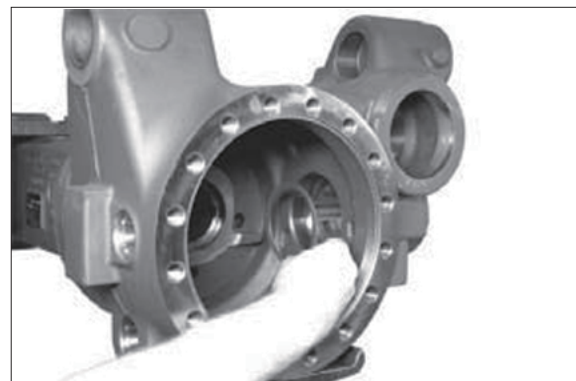


17W98FA079

(5) Calculation example "B" :

Dimension I 154.05 mm
 Dimension X - 152.50 mm
 Difference = shim s = 1.55 mm

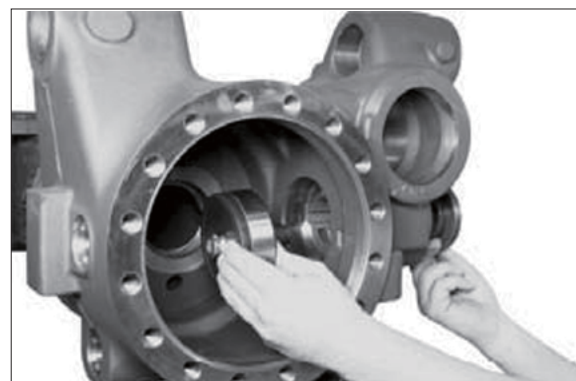
Insert the determined shim (e.g. s = 1.55 mm) into the inner bearing hole.



17W98FA080

(6) Undercool bearing outer ring (see arrow) and bring into contact position in the bearing hole by using the assembly fixture (S).

(S) Assembly fixture 5870 345 049
 (S) Pressure ring 5870 345 056



17W98FA081

(7) Undercool outer bearing outer ring and insert into bearing hole until contact is obtained.

(S) Assembly fixture 5870 345 049
 (S) Pressure ring 5870 345 056



17W98FA082

(8) Setting of rolling torque of the input pinion bearing 1.0 ... 3.0 Nm (without shaft seal ring)

Warm up roller bearing and insert until contact is obtained.

※ Adjust bearing after cooling down.



17W98FA083

(9) Insert spacer ring (e.g. $s = 16.96$ mm).

※ According to our experience, the necessary rolling torque is obtained when reusing the spacer ring which has been removed during disassembly (e.g. $s = 16.96$ mm).

A later check of the rolling torque, however, is absolutely necessary.



17W98FA084

(10) Insert the preassembled input pinion into the axle housing and mount the heated roller bearing until contact is obtained.



17W98FA085

(11) Press screen sheet (see arrow) onto the input flange until contact is obtained.

※ The shaft seal ring is mounted only after contact pattern check.



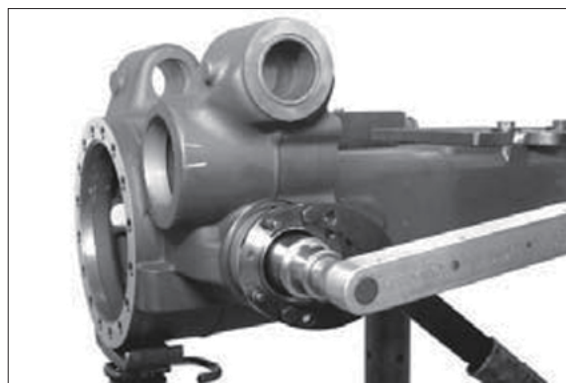
17W98FA086

- (12) Mount input flange, fix with disk and hexagon nut.

Tightening torque (M30 x 1,5)
..... MA = 600 Nm

(S) Clamping fork 5870 240 025

- ※ During the tightening process rotate the input pinion several times in both directions.



17W98FA087

- (13) Check rolling torque (1.0 ... 3.0 Nm without shaft seal ring).

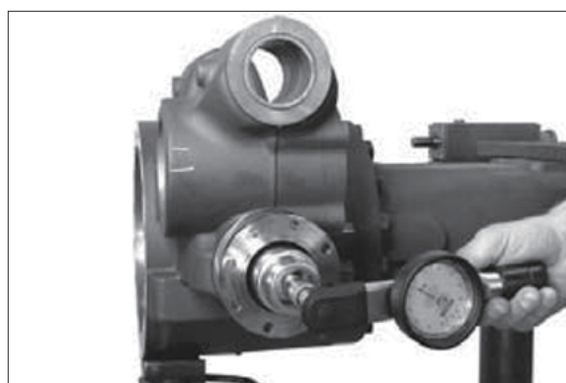
- ※ When installing new bearings try to achieve the upper value of the rolling torque.
- ※ In case of deviations from the necessary rolling torque correct with a corresponding spacer ring (figure FA084) as specified below.

Insufficient rolling torque

install thinner spacer ring

Excessive rolling torque

install thicker spacer ring.



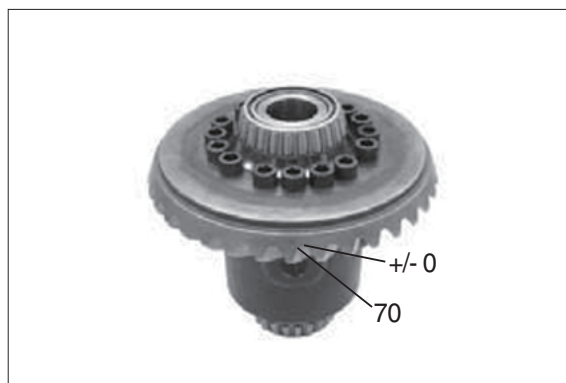
17W98FA088

- (14) Determine shim for setting the bearing rolling torque (differential bearing) and backlash (bevel gear set).

- ※ The required shims must be determined on the basis of the read value (test dimension / crown wheel) and the corresponding specifications of the table next page : (KRS – SET – RIGHT) :
Read test dimension from crown wheel rear.

- ※ Test dimension "70" is stamped into the crown wheel rear. Without + or deviation specification, this corresponds to test dimension / Actual value "70" in the table below.

According to this value the necessary shims are allocated in the table next page.



17W98FA089

※ In case of + or – deviation of the test dimension for production reasons, it is additionally signed on the crown wheel rear (e.g. - 20 or - 10 . 10 or 20) .

※ In accordance with this deviation the necessary shims are allocated in the below table.

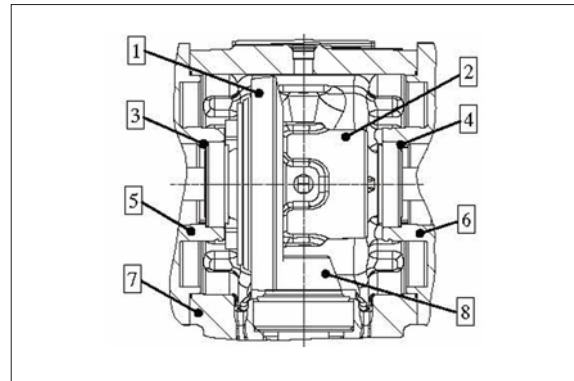
(15) Comment on sketch:

1 = Crown wheel 2 = Differential carrier

3 = Shim 4 = Shim
(crown wheel side) (diff. carrier side)

5 = Axle housing 6 = Axle housing

7 = Axle drive housing 8 = Input pinion



17W98FA090

Setting disks for differential					
Test dimension/Marking of crown wheel 70 and deviation	-20	-10	0	10	20
Result → Test dimension / Act. value	69.80	69.90	70.0	70.10	70.20
Shim/Diff. carrier side Required disk thickness	0.95	1.05	1.15	1.25	1.35
Shim no.	0730 006 518	0730 006 519	0730 006 521	0730 006 522	0730 006 524
Shim/Crown wheel side Required disk thickness	1.35	1.25	1.15	1.05	0.95
Shim no.	0730 006 524	0730 006 522	0730 006 521	0730 006 519	0730 006 518

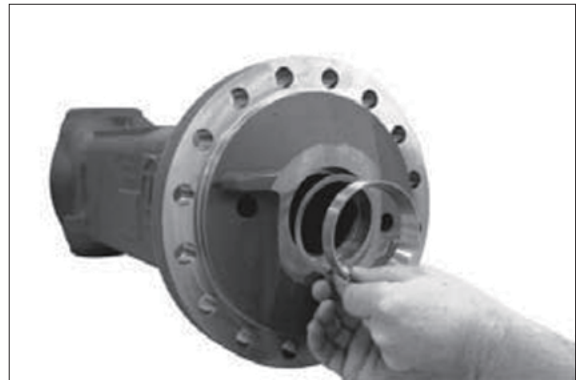
- (16) Insert the determined shim (e.g. $s = 1.15$ mm) and the bearing outer ring into the hole of the axle housing on the differential carrier side.

※ Pivot axle housing 90° .



17W98FA091

- (17) Insert the determined shim (e.g. $s = 1.15$ mm) and the bearing outer ring into the hole of the axle housing on the crown wheel side.



17W98FA092

- (18) Check the contact pattern of the bevel gear set

Wet some drive and coast flanks of the crown wheel with marking ink.



17W98FA093

- (19) Insert the preassembled differential into the axle drive housing.

(S) Internal extractor 5870 300 005



17W98FA094

- (20) Use lifting tackle to mount the axle housing (crown wheel side) and preliminarily fix with hexagon screws.

Tightening torque (M18/10.9)
..... MA = 390 Nm

- ※ Preliminarily fix axle housing without O-ring.

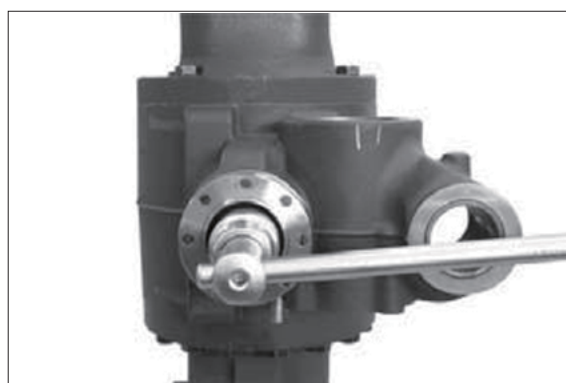


17W98FA095

- (21) Roll the crown wheel by rotation on the input flange several times in both directions over the input pinion.

Then remove axle housing again and lift differential out of the axle drive housing. Compare the obtained contact pattern with contact pattern example page 0/4 and 0/5.

- ※ In case of a contact pattern deviation a measuring mistake was made when determining the shim (figure FA080), which must be absolutely corrected.



17W98FA096

- (22) Grease O-ring (see arrow) and mount to axle housing.



17W98FA097

- (23) Use lifting tackle to mount the axle housing (part II), finally tighten with hexagon screws.

Tightening torque (M18/12.9)
..... MA = 440 Nm

Then bring axle into horizontal position and reassemble the second clamping angle (S) (see also figure FA001).



17W98FA098

(24) Mount shaft seal ring (input flange)

Loosen hexagon nut and pull the input flange from the input pinion.

(S) Clamping fork 5870 240 025



17W98FA099

(25) Comment on sketch:

1 = Input pinion

2 = Axle drive housing

3 = Tapered roller bearing

4 = Shaft seal ring

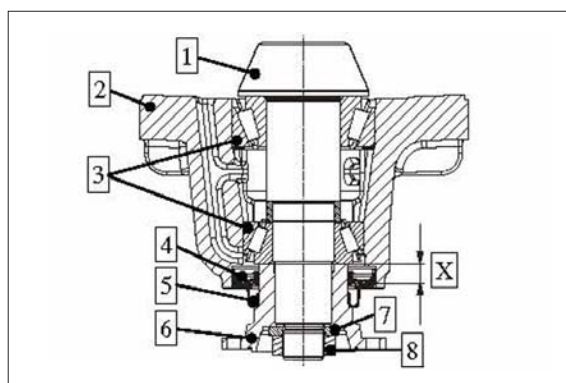
5 = Screen sheet

6 = Input flange

7 = Disk

8 = Hexagon nut

X = Installation dimension $\rightarrow 13.5 +0, 2 \text{ mm}$



17W98FA100

(26) Mount shaft seal ring with the seal lip showing to the oil chamber.

(S) Driver tool 5870 048 286

※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.

※ Just before fitting, wet contact face shaft seal ring/axle drive housing with lubricant. Apply grease on seal and dust lip of the shaft seal ring.



17W98FA101

(27) Mount input flange, finally tighten with disk and hexagon nut.

Tightening torque (M30x1.5)
..... MA = 600 Nm

(S) Clamping fork 5870 240 025

※ Wet thread of the hexagon nut with Loctite no. 262.



17W98FA102

3) OUTPUT

(1) Preassembly axle housing

Insert bushing into hole of axle housing considering installation dimension "B" and installation position "Y" (see also sketch FA104 and FA106).

(S) Driver tool 5870 055 090

(S) Handle 5870 260 002



17W98FA103

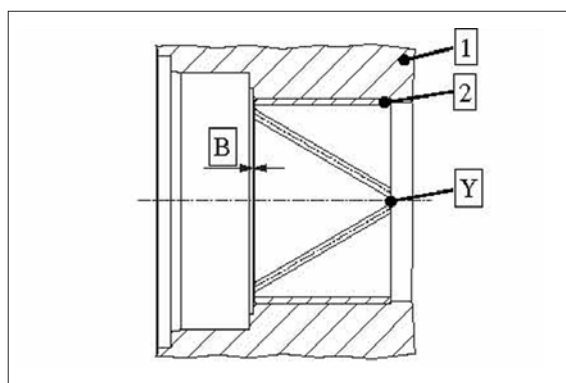
(2) Comment on sketch:

1 = Axle housing

2 = Bushing

B = Installation dimension 1.0 ± 0.3 mm

Y = Installation position / lubrication groove outlet of bushing (top view)



17W98FA104

※ Lubrication groove outlet (V-point) must be mounted in 6 o'clock position (bottom) and showing to the oil chamber side.

※ Use of the specified driver tool (S) ensures the exact installation depth of the bushing.

(3) Flush-mount seal ring with the seal lip showing to the oil chamber (see sketch FA106) into the axle housing hole.

(S) Driver tool 5870 055 090

(S) Handle 5870 260 002



17W98FA105

※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.

※ Just before fitting wet the contact face shaft seal ring/axle drive housing with lubricant.

Apply grease on seal and dust lip of the shaft seal ring.

(4) Comment on sketch:

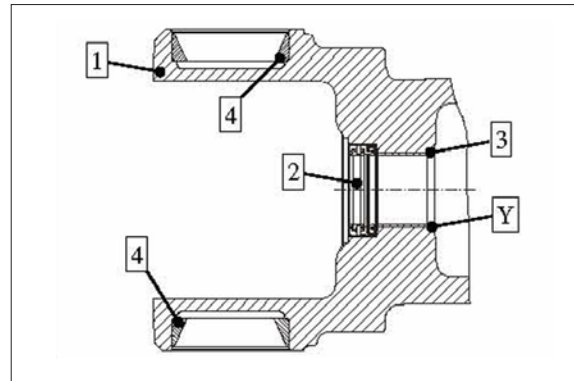
1 = Axle housing

2 = Shaft seal ring

3 = Bushing

4 = Bearing outer rings (pivot bearing)

Y = Lubrication groove outlet (V-point – in 6 o'clock position and on oil chamber side)

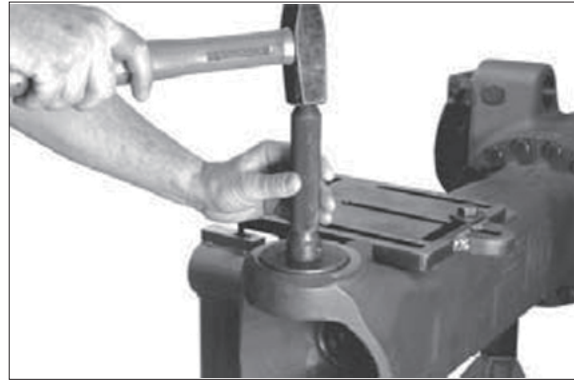


17W98FA106

(5) Insert both bearing outer rings into the pivot bearing holes of the axle housing.

(S) Driver tool 5870 058 078

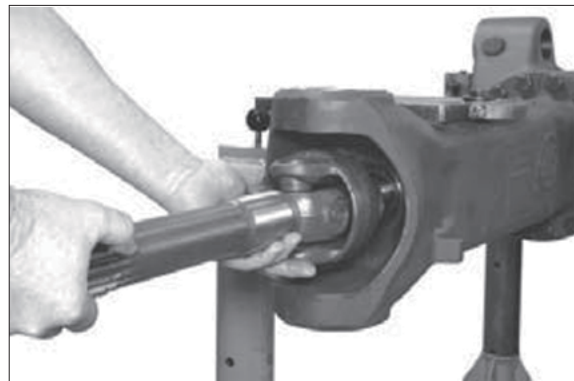
(S) Handle 5870 260 002



17W98FA107

(6) Install the u-joint shaft by inserting the u-joint shaft into the axle bevel gear teeth.

※ Pay attention to shaft seal ring in the axle housing risk of damage.



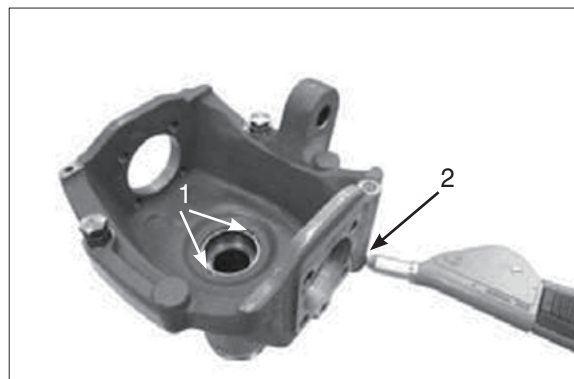
17W98FA108

(7) Knuckle housing (pivot bearing-SET-RIGHT)

Seal machining openings of oil supply holes – position 1 and 2 with plugs.

(S) Lever riveting tongs 5870 320 016

※ Operation is only required when using a new knuckle housing.



17W98FA109

- (8) Insert bushing into the hole of the knuckle housing considering the installation dimension "B" and installation position "Y" (see also sketch FA111 and FA113).

(S) Driver tool 5870 055 090
(S) Handle 5870 260 002



17W98FA110

- (9) Comment on sketch:

1 = Knuckle housing

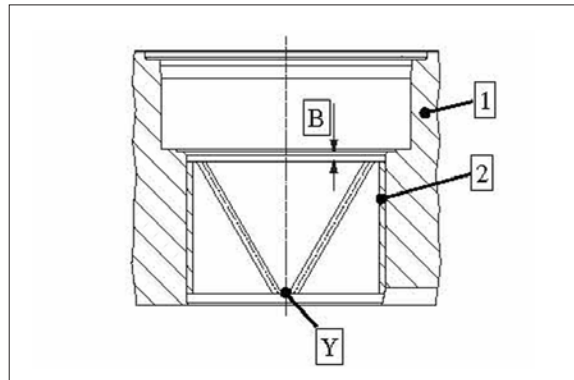
2 = Bushing

B = Installation dimension . . . 2.0 ± 0.2 mm

Y = Installation position / lubrication
groove outlet of the bushing

- ※ Lubrication groove outlet (V-point) must be mounted in 6 o'clock position (bottom) and showing to the oil chamber side (referred to the axle fitted into the vehicle).

- ※ Use of the specified driver tool (S) ensures the exact installation depth of the bushing.



17W98FA111

- (10) Insert shaft seal ring into the hole of the knuckle housing with the seal lip showing to the oil chamber – considering the installation dimension "W" (see also sketch below).

(S) Driver tool 5870 055 090
(S) Handle 5870 260 002

- ※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.



17W98FA112

(11) Comment on sketch:

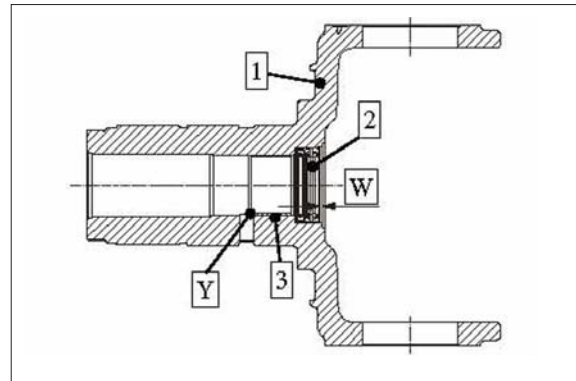
1 = Knuckle housing

2 = Shaft seal ring

3 = Bushing

W = Installation dimension – shaft seal ring
ring 3.5 ± 0.2 mm

Y = Lubrication groove outlet (V-point)
must be mounted in 6 o'clock
position and showing to the oil
chamber side (referred to the axle
fitted into the vehicle)



17W98FA113

※ Just before fitting wet contact face shaft
seal ring/knuckle housing with sealing
agent.

Apply grease on seal and dust lip of the
seal ring.

(12) Grease O-ring (see arrow) and insert it
into the groove of the bearing pin.



17W98FA114

(13) Place sealing cap (see arrow) and mount
the tapered roller bearing until contact
position is obtained.

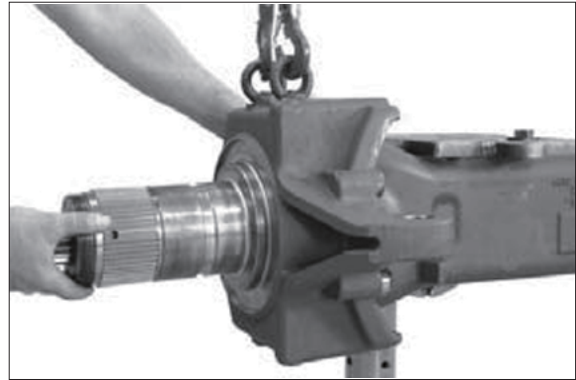


17W98FA115

- (14) Locate pre-assembled knuckle housing on axle housing and carefully mount u-joint shaft.

(S) Eyebolts (M 20) 0636 804 003

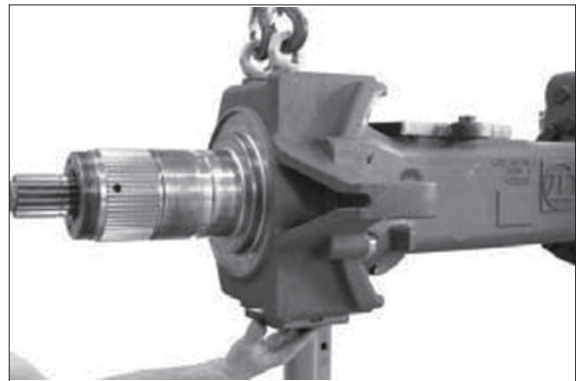
- ※ Pay attention to shaft seal ring in the knuckle housing risk of danger.



17W98FA116

- (15) Insert the pre-assembled lower bearing pin and preliminarily fix with hexagon screws.

- ※ Pay attention to installation position mount bearing pin with lubrication nipple showing to axle centre.

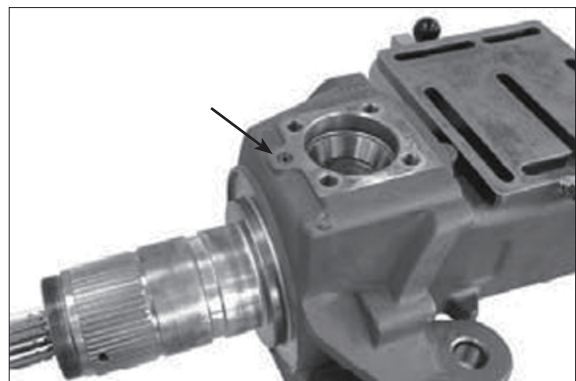


17W98FA117

- (16) Insert O-ring (see arrow) or O-rings into countersink of the knuckle housing.

1 ps for version with breather valve in the knuckle housing

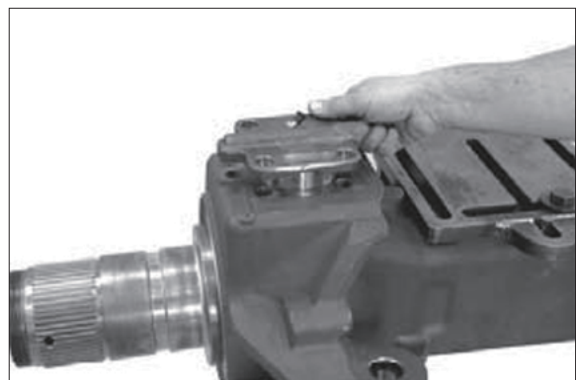
2 pcs for version with breather valve in the bearing pin



17W98FA118

- (17) Insert pre-assembled upper bearing pin.

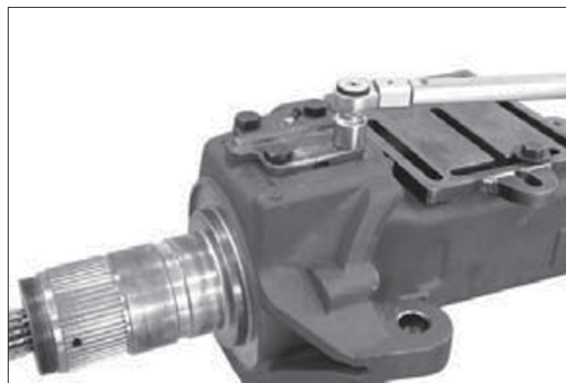
- ※ Observe installation position mount bearing pin with oil supply holes showing to axle centre.



17W98FA119

(18) Fix both bearing pins definitely.

※ Tightening torque (M 20/10.9)
..... MA = 560 Nm



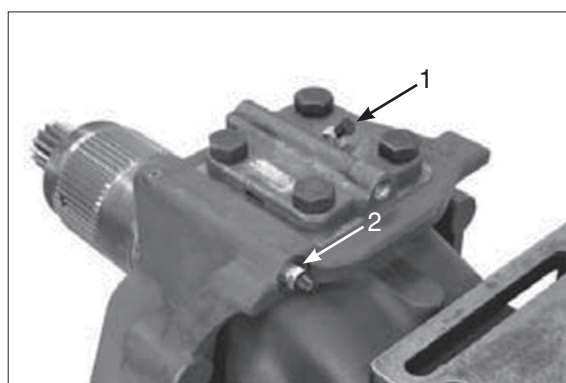
17W98FA120

(19) Mount lubrication nipple in both bearing pins (arrow 1 showing to the axle centre) and apply grease to the pivot bearing.

Tightening torque (M 10×1)
..... MA = 3 Nm

Mount breather valve (arrow 2, position depending on version : integrated in the knuckle housing or in the bearing lid) and provide with dust cap.

Tightening torque (M 14×1,5)
..... MA = 20 Nm



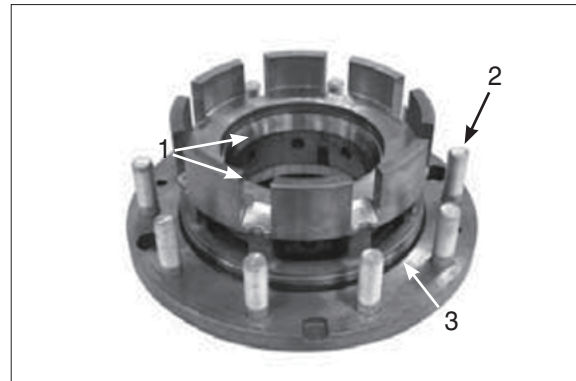
17W98FA121

4) HUB (Hub bearing-SET-RIGHT)

- (1) Insert both bearing outer rings (1) of the hub bearing until contact position is obtained.

Press wheel bolts (2) into the hub until contact position is obtained.

Oil O-ring (3) and locate in annular groove of hub.



17W98FA122

- (2) Press shaft seal ring with the marking "OUT SIDE" showing outside (upwards) into the hub.

(S) Driver tool 5870 051 068

- ※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.
- ※ Wet the outer diameter of the shaft seal ring with Loctite no. 574.



17W98FA123

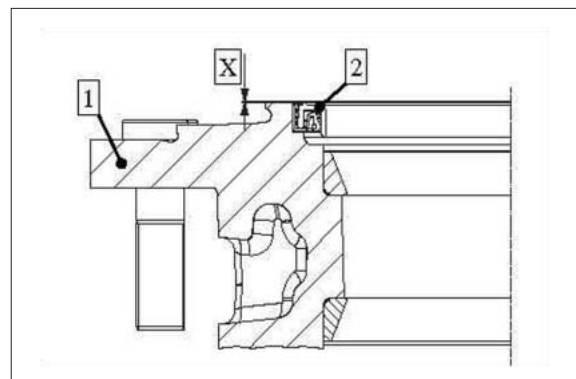
- (3) Comment on sketch:

1 = Hub

2 = Shaft seal ring

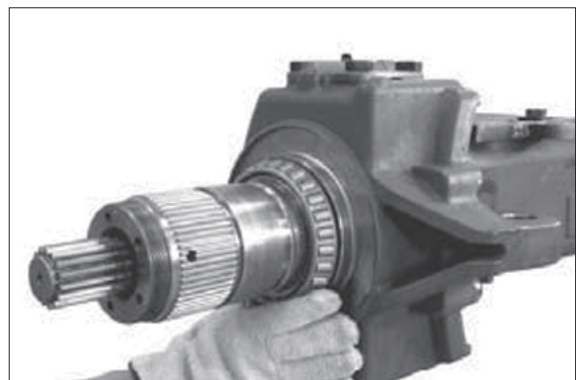
X = Installation dimension – Shaft seal ring

..... 2.5 + 0.5 mm



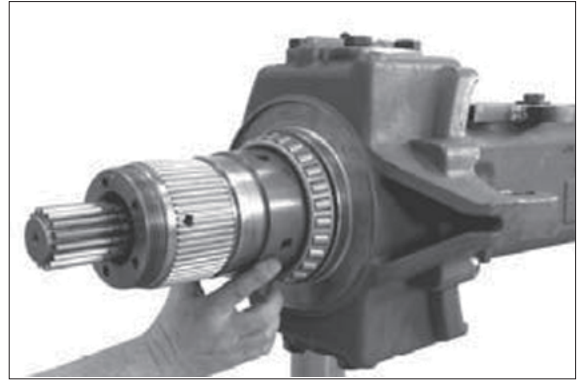
17W98FA124

- (4) Heat the tapered roller bearing and mount until contact position with the knuckle housing is obtained.



17W98FA125

(5) Insert spacer bushing.



17W98FA126

(6) Install preassembled hub until contact is obtained and fix with heated tapered roller bearing.

(S) Lifting bracket 5870 281 043

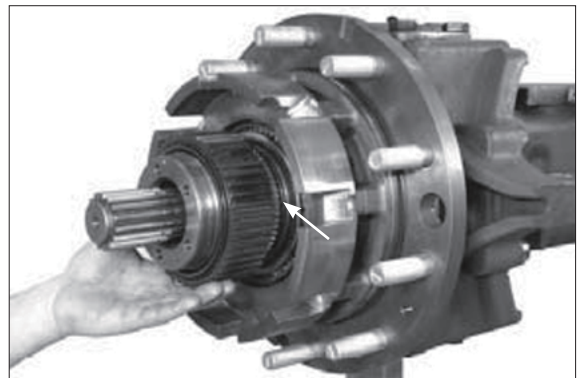
※ Just before fitting wet the seal lips of the shaft seal ring with lubricant.



17W98FA127

(7) Oil O-ring and insert it into the annular groove (see arrow) of the knuckle housing.

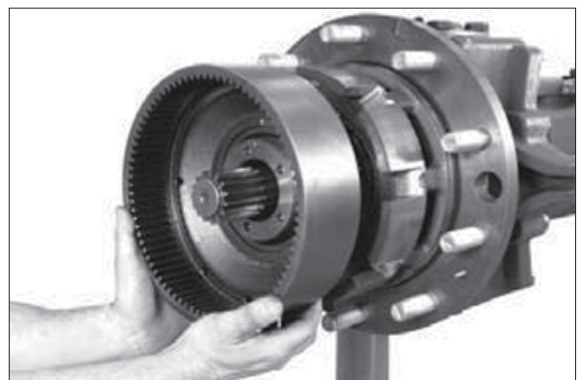
Then install disk carrier.



17W98FA128

(8) Bring disk carrier and hub bearing into contact position (figure FA129 and FA130)

Install ring gear (without sealing elements).



17W98FA129

- (9) Bring hub bearing into contact position for this purpose tighten slotted nut with a tightening torque of max. 1400 Nm.

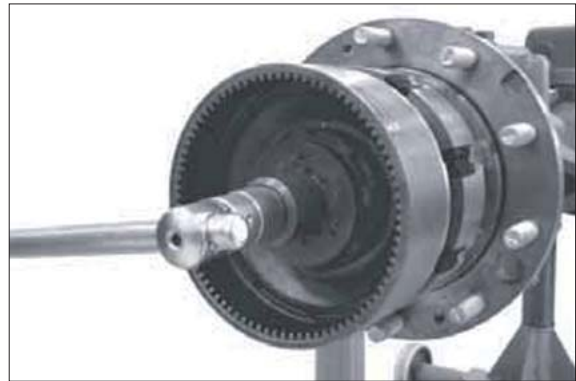
(S) Socket wrench 5870 656 097

- ※ While tightening the slotted nut rotate hub in both directions several times roller setting.
- ※ Apply lubricant to thread knuckle housing / slotted nut.



17W98FA130

- (10) Loosen slotted nut again and remove ring gear.



17W98FA131

5) DISK BRAKE

- (1) Install disk package alternately starting with an outer disk.

- ※ Take the actually required disk fitting / arrangement from the corresponding spare parts list.
- ※ Bring inner clutch disks in a position where one of the tooth recesses (see arrow) is in 6 o'clock position with axle being installed in the vehicle.



17W98FA132

- (2) Oil O-ring and locate in annular groove of disk carrier.



17W98FA133

(3) Oil U- and support rings and insert them into the annular grooves of the ring gear.

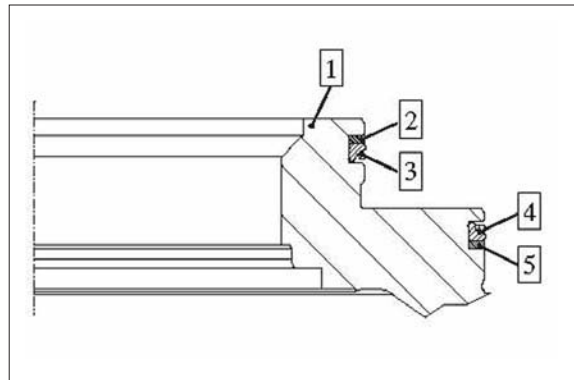
※ Observe installation position, see sketch below.



17W98FA134

(4) Comment on sketch:

- 1 = Ring gear
- 2 = Support ring
- 3 = U-ring
- 4 = U-ring
- 5 = Support ring



17W98FA135

(5) Mount cylindrical pins into piston, considering installation dimension "X".

X = Installation dimension 16.00 mm



17W98FA136

(6) Install piston on ring gear.



17W98FA137

- (7) Fix piston with "new" hexagon screws (1), spring sleeves (2) and compression springs (3 and 4).

Tightening torque (M 6/8.8)
 MA = 8 Nm

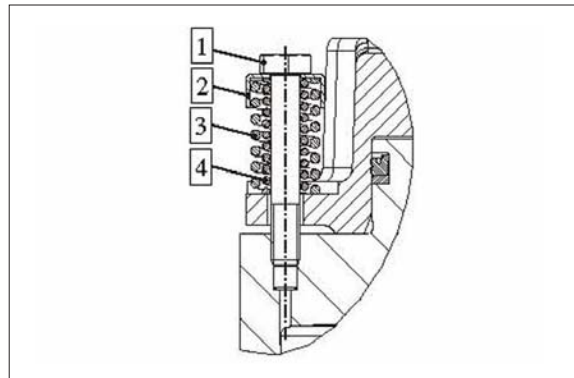
※ Use hexagon screws just once.



17W98FA138

- (8) Comment on sketch:

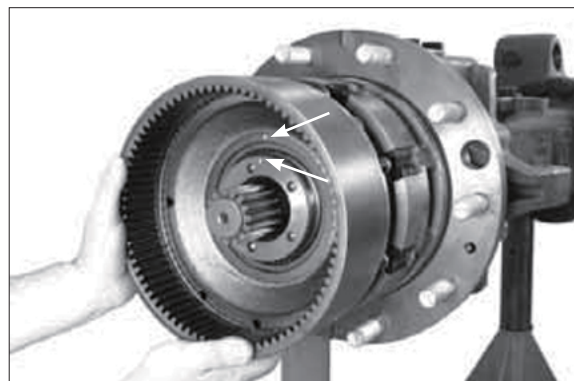
1 = Hexagon screw (special version)
 2 = Spring sleeve
 3 = Compression spring
 4 = Compression spring



17W98FA139

- (9) Mount preassembled ring gear considering the installation position (markings O in 12 o'clock position - see arrows).

※ Ensure exact toothing position of oil supply holes knuckle housing / ring gear (pressure oil supply to brake piston).



17W98FA140

- (10) Oil O-ring and insert in recess (see arrow).



17W98FA141

(11) Fix ring gear with slotted nut.

Tightening torque:

(M 110 x 1.5) MA = 1400 + 600 Nm

(S) Socket wrench 5870 656 097

- ※ First tighten slotted nut with 1400 Nm, then retighten slotted nut until a fixing hole overlaps a threaded hole in the knuckle housing.

While tightening the slotted nut rotate hub in both directions several times roller setting.

- ※ Wet thread knuckle housing / slotted nut with lubricant.



17W98FA142

(12) **Make leakage test of multi-disk brake**

Mount threaded coupling (S) and connect HP pump.

(S) HP pump 5870 287 007

(S) Threaded coupling (M14x1.5) 5870 950 102

(S) Breather bottle 5870 286 072

- ※ Breathe brake completely before starting the test.

Test media :

Motor oils SAE-10W

High-pressure test:

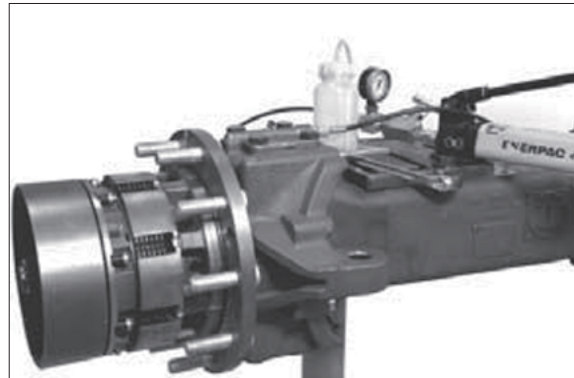
Build up test pressure $p = 100$ bar and close locking valve of HP pump.

A pressure drop by max. 3 bar is permissible during a 5-minute test duration.

Low pressure test:

Reduce test pressure $p = 5$ bar and close locking valve.

No pressure drop is allowed during a 5-minute testing duration.



17W98FA143

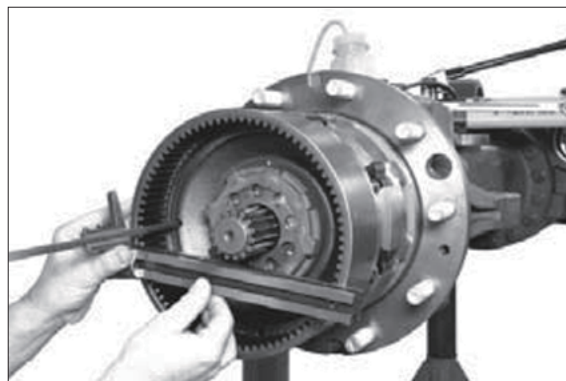
(13) Adjust and check piston stroke

Piston stroke / disk clearance = 0.7 1.3 mm
Build up braking pressure (100 bar) and close locking valve of the HP pump.

Determine dimension "A", from face of the ring gear (1) through measuring hole (see also sketch FA145) to the face of the piston (3).

Dimension "A" e.g. 83.10 mm

- ※ Breathe brake completely before starting the measuring operation.

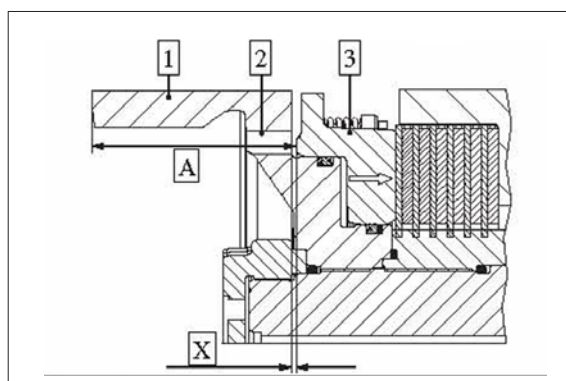


17W98FA144

- (14) Then open locking valve of the HP pump and release pressure from brake (reset piston through compression springs).

Determine dimension "B", from the face of the ring gear (1) through the measuring hole (see also sketch FA146) to the face of the piston (3).

Dimension "B" e.g. 82.10 mm



17W98FA145

(15) CALCULATION EXAMPLE:

Dimension "A" e.g. 83.10 mm

Dimension "B" e.g. - 82.10 mm

Difference = Piston stroke = 1.00 mm

- ※ If the required piston stroke (0.7 ... 1.3 mm) is not achieved, correct it with the corresponding inner clutch disk (s) – refer to corresponding spare parts list.

Then remove HP pump (S), breather bottle (S) and threaded coupling (S).

Comment on sketch 43 and 44:

1 = Ring gear

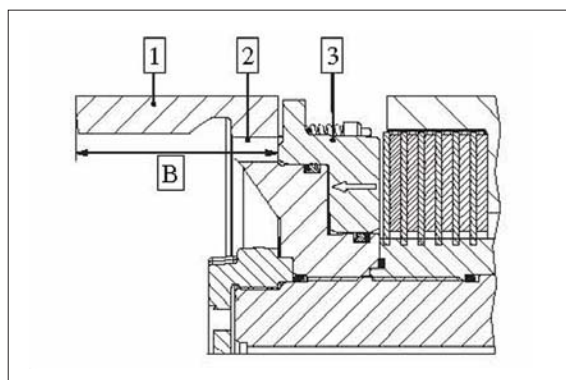
2 = Measuring hole

3 = Piston

X = Piston stroke / disk clearance

(S) Straightedge

5870 200 022



17W98FA146

- (16) Secure slotted nut with cylindrical screw
(please also refer to figure FA142)

Tightening torque (M 10/8.8)
..... MA = 32 Nm



17W98FA147

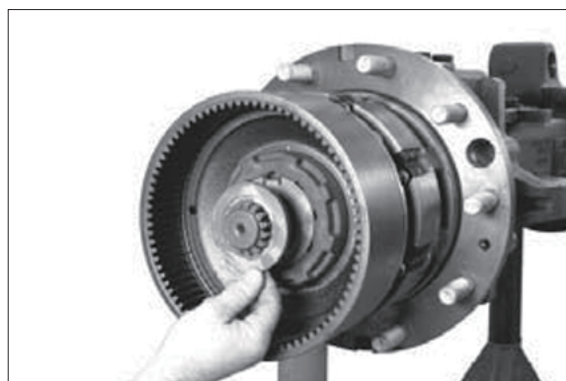
- (17) Insert thrust washer.

- ※ Observe installation position ensure that both lugs of the thrust washer are engaged each in a spare fixing hole of the slotted nut.



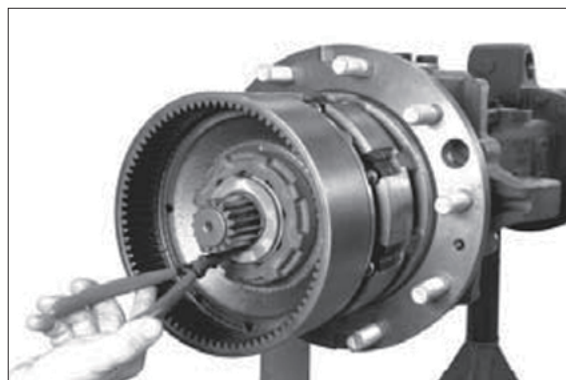
17W98FA148

- (18) Mount thrust washer with shoulder showing to the retaining ring (outwards).



17W98FA149

- (19) Fix thrust washers by using a retaining ring.



17W98FA150

6) PLANETARY CARRIER

- (1) Press thrust washer into the planetary carrier until contact position is obtained.

(S) Driver tool 5870 048 263



17W98FA151

- (2) Insert the cylindrical roller bearing into the planetary gear for this purpose press the cylindrical roller bearing through the packaging sleeve until the snap ring engages into the annular groove of the planetary gear.

※ Use packaging sleeve to facilitate assembly.

1 = Cylindrical roller bearing

2 = Packaging sleeve

3 = Snap ring

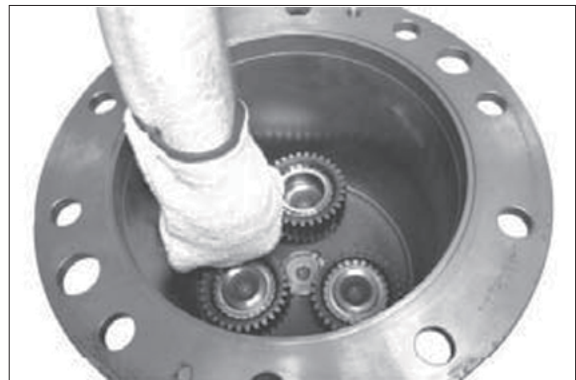
4 = Planetary gear



17W98FA152

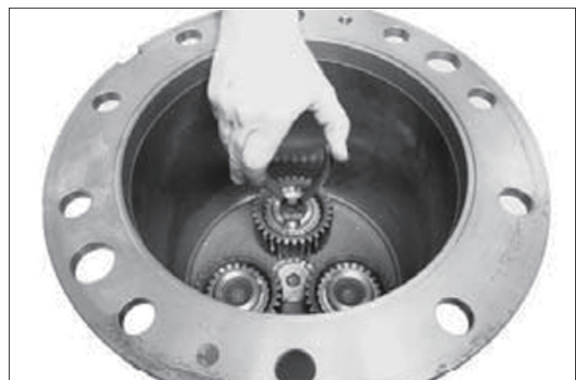
- (3) Warm up bearing inner ring and install pre-assembled planetary gear until contact is obtained.

※ Mount bearing inner ring with large radius, showing to the planetary carrier (downwards).



17W98FA153

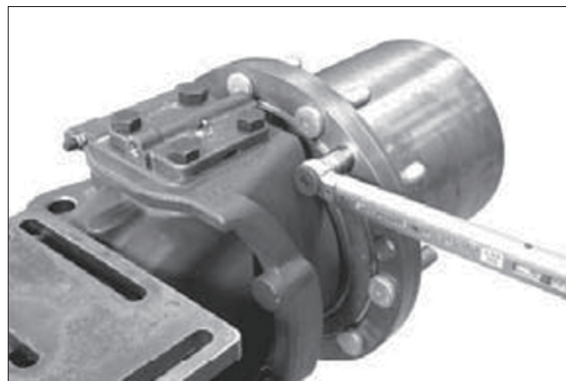
- (4) Fix planetary gear by means of retaining ring.



17W98FA154

- (5) Install preassembled planetary carrier and fix with hexagon screws.

Tightening torque (M12/8.8)
 MA = 55 Nm



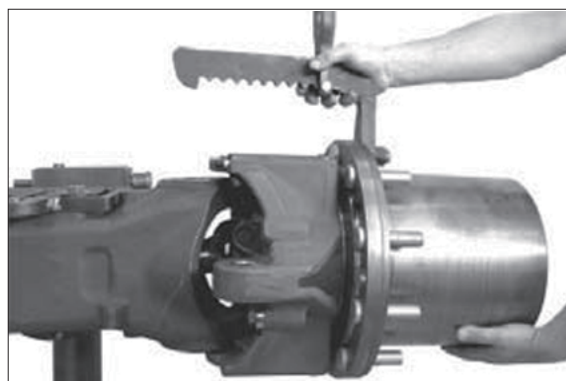
17W98FA155

(6) Output assy

Locate output assy on the axle by means of the lifting bracket (S) by installing the u-joint shaft in the axle bevel gear toothing.

(S) Lifting bracket 5870 281 043

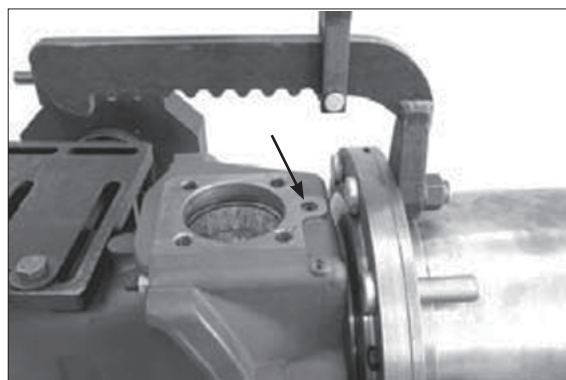
- ※ Pay attention to shaft seal ring in the axle housing risk of damage.



17W98FA156

- (7) Insert O-ring (see arrow) or O-rings into the countersink (s) of the knuckle housing.

- 1 pc for version with breather valve in knuckle housing.
- 2 pcs. for version with breather valve in bearing housing.

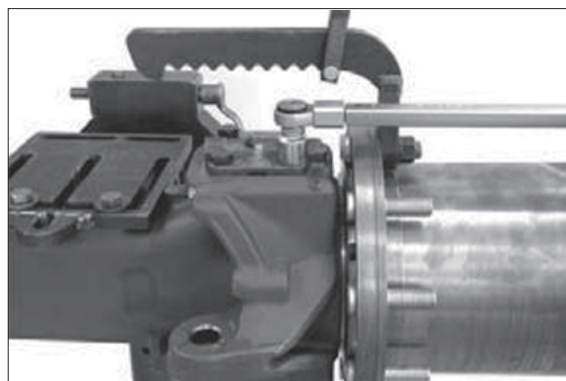


17W98FA157

- (8) Mount both bearing pins and fix with hexagon screws or locking screws.

Tightening torque (M 20/10.9)
 MA = 560 Nm

- ※ Observe installation position, mount upper bearing pin with oil supply holes showing to axle centre.

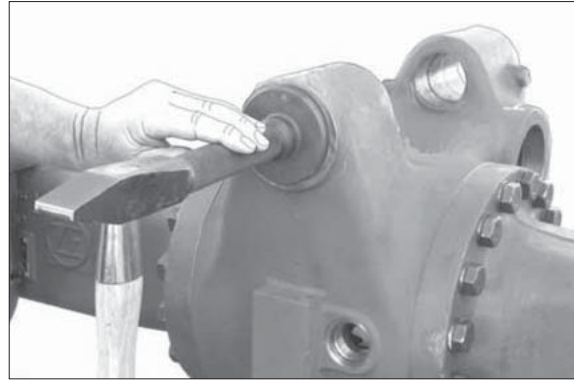


17W98FA158

(9) Pivot bearing

Super-cool bushings and insert into the heated pivot bearing hole until contact is obtained.

- ※ Observe installation position for bushing version with slot, insert bushings with slot in 12 o'clock position.
- ※ Prior to putting the axle into operation, fill in oil.



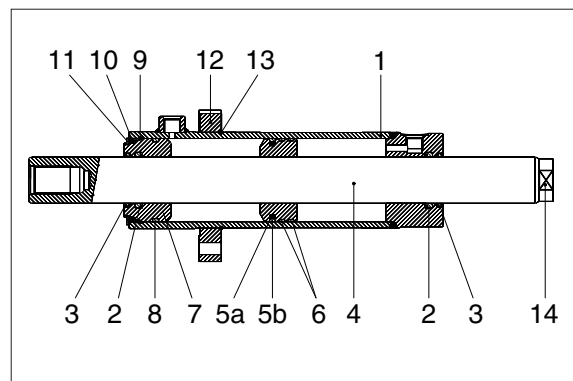
17W98FA159

7) STEERING

(1) Comment on sketch:

- 1 = Steering cylinder
- 2 = Grooved ring
- 3 = Scraper
- 4 = Piston rod
- 5a = O-ring
- 5b = Form seal ring
- 6 = Guide ring
- 7 = Brake head
- 8 = Dual ring
- 9 = Retaining ring
- 10 = O-Ring (only for version "with" O-ring)
- 11 = Retaining ring
- 12 = Flange
- 13 = Retaining ring
- 14 = Wrench point of attack (piston rod)

› Piston sealing



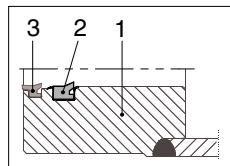
17W98FA160

(2) Preassembly steering

Mount U-ring (2) and scraper (3) in the steering cylinder (1).

- ※ Observe installation position – see detailed sketch.

Detailed sketch:



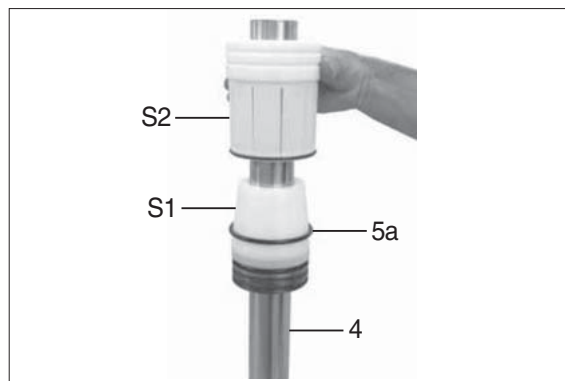
17W98FA161

- (3) Position inner installer (S1) on piston rod (4).

Mount O-ring (5a) and press with inner installer (S2) into annular groove (arrow) of the piston (4).

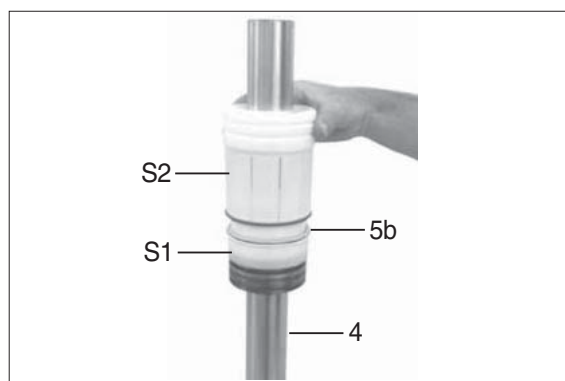
(S) Inner installer (S1) 5870 651 088

(S) Inner installer (S2) 5870 651 089



17W98FA162

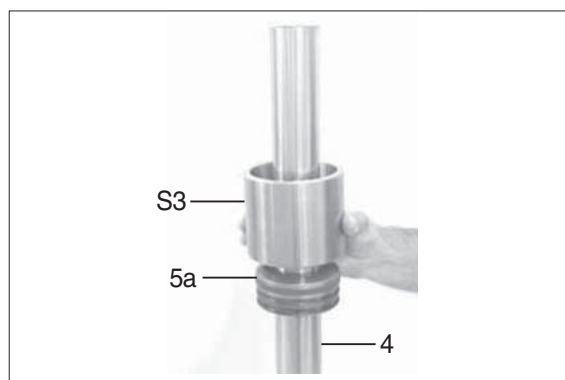
- (4) Install form seal ring (5b) and press with inner installer (S2) into the annular groove of the piston (4).



17W98FA163

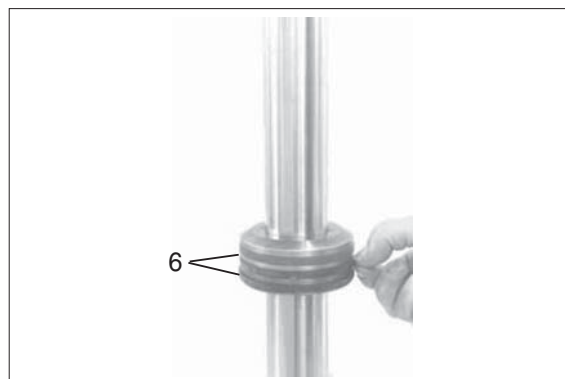
- (5) Calibrate form seal ring (5b) with calibration bushing (S3).

(S) Calibration bushing (S3) 5870 651 091



17W98FA164

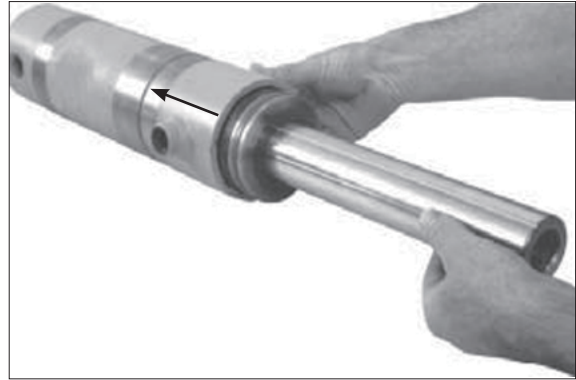
- (6) Place both guide rings (6) into the annular grooves of the piston rod.



17W98FA165

(7) Insert preassembled piston rod into the steering cylinder.

- ※ Slightly oil all sealing elements before installing the piston rod.
- ※ Observe installation position, insert piston rod with wrench point of attack (14, see also sketch FA160) showing in direction of arrow.

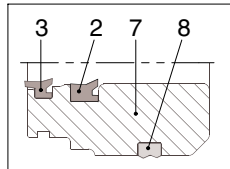


17W98FA166

(8) Insert U-ring (2), scraper (3) and dual ring (8) into the grooves of the brake head (7).

- ※ Observe installation position in this connection refer to detailed sketch.

Detailed sketch:



17W98FA167

(9) Push preassembled brake head into the steering cylinder so that the retaining ring (see figure FA169) can be mounted.

- ※ Slightly oil all sealing elements before inserting the brake head.



17W98FA168

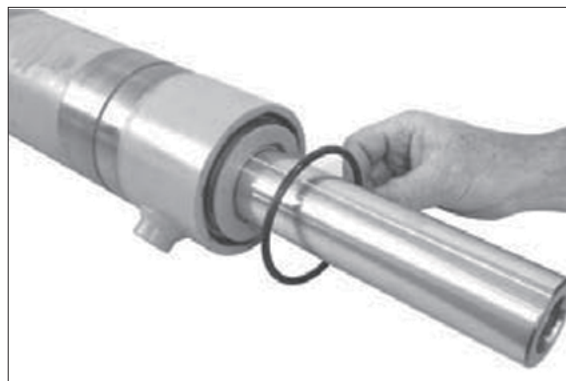
(10) Engage retaining ring (9) into the groove of the cylinder tube.



17W98FA169

- (11) Position the inserted brake head (7) on the snap ring (9) until contact is obtained (arrow).

Only for version with O-ring (see corresponding spare parts list) : Oil O-ring (10) and place into the recess.



17W98FA170

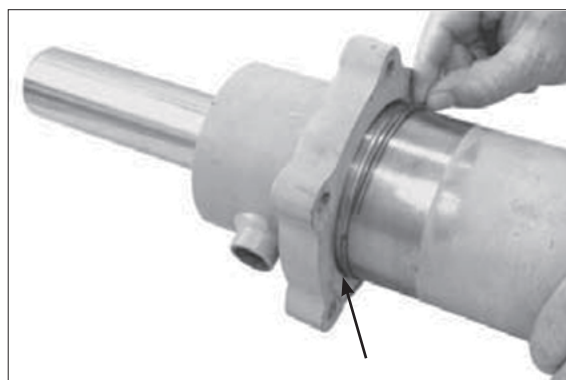
- (12) Fix brake head (7) with retaining ring (11).



17W98FA171

- (13) Install flange (12) and engage retaining ring (13).

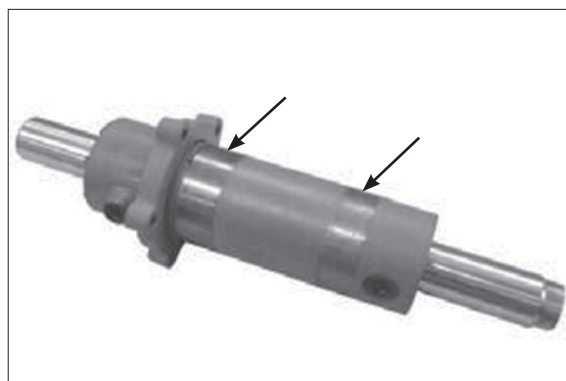
※ Observe installation position of flange mount flange with chamfer (see arrow) showing to the snap ring.



17W98FA172

(14) Mount steering

Apply anti-corrosive agent (Weicon Anti-Seize) on contact faces (cylinder tube / axle housing, see arrow).



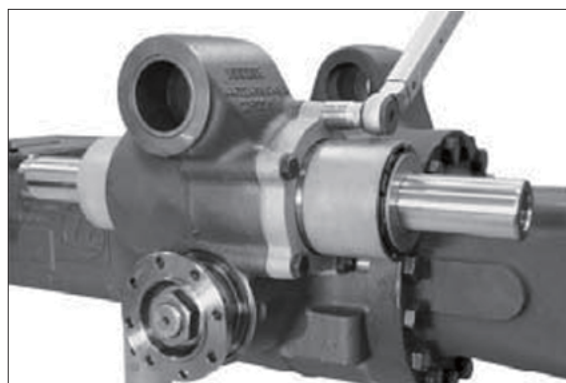
17W98FA173

- (15) Insert preassembled steering cylinder into axle housing and fix with hexagon screws.

Tightening torque (M 12/8.8)
..... MA = 79 Nm

- ※ The radial installation position of the steering cylinder (position of the hydr. connections) is customer specific see also disassembly instructions figure FA018.

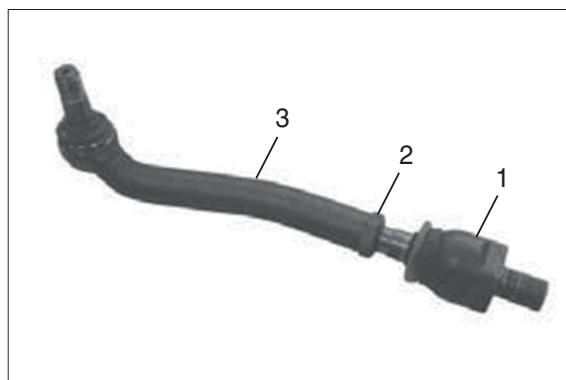
- ※ Wet the thread of the hexagon screws with Loctite no. 243.



17W98FA174

- (16) Bolt hexagon nut (2) and ball joint (3) to axial joint (1).

- ※ Do not tighten hexagon nut before setting the track.



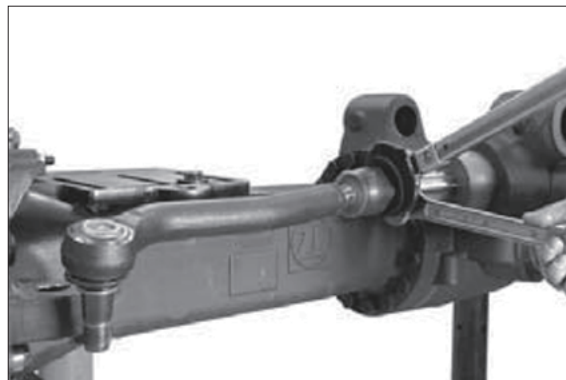
17W98FA175

- (17) Fix both tie rods to piston rod (with offset showing to the axle housing).

Tightening torque (M30 × 1.5)
..... MA = 600 Nm

(S) Socket wrench (SW 55) 5870 656 099

- ※ Wet thread of the axial joint with Loctite no. 243.

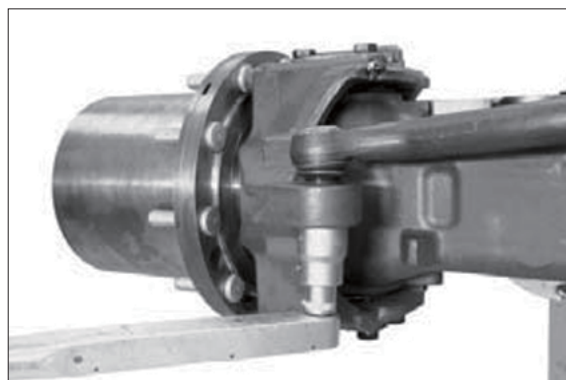


17W98FA176

- (18) Install tie rod into knuckle housing and fix with "new" locking nut.

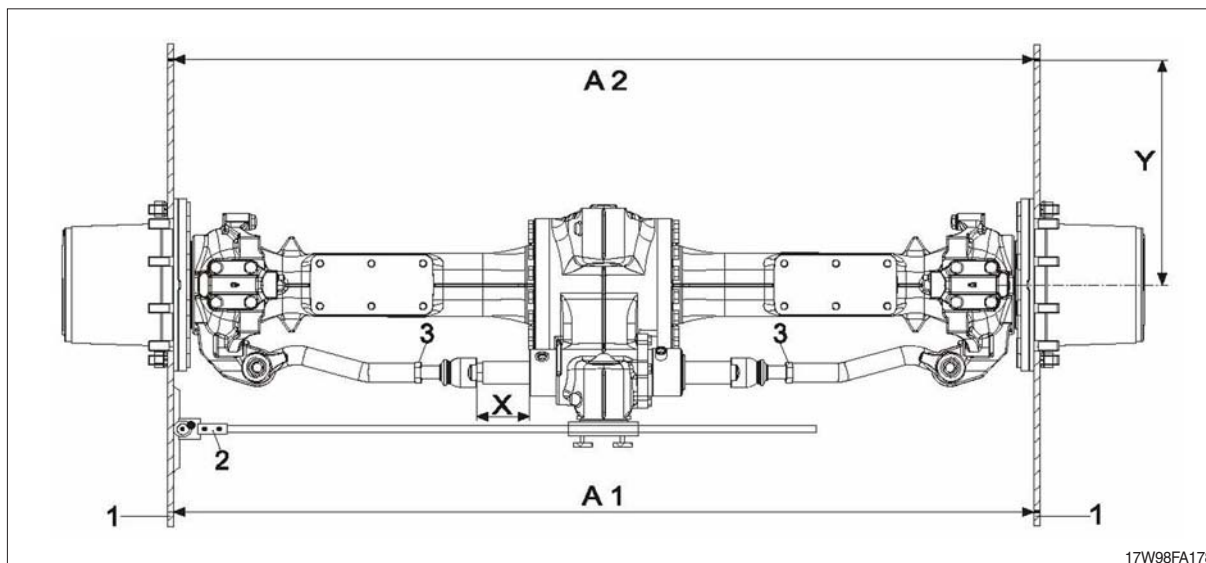
Tightening torque (M 30 × 1.5)
..... MA = 800 Nm

- ※ Use locking screws just once.



17W98FA177

(19) Steering setting and checking



1 = (S) Straightedge 5870 200 029

2 = (S) Measuring device 5870 200 033

3 = Hexagon nut

X = Installation dimension (central position – piston rod)

Y = Distance – wheel center to rim flange

(20) Basic track setting

Bring piston rod in central position.

Dimension X = 124 mm (measured from front face/steering cylinder to front face/axial joint).

※ Do not change axial position of piston rod any more during track setting.

Mount straightedge (1) in horizontal and central axis position.

Fix measuring device (2) to yoke.

Loosen hexagon nut (3) and set length of tie rod (axial joint) until the measuring device (2) indicates 0° (corresponds to a track setting of zero mm).

※ For a toe-in and toe-out setting, which might be required, stick to the vehicle manufacturer's specification.

※ Make setting on both output sides.

Check track setting (0°):

Determine dimension A1.

Rotate both outputs by 180° – dimension A2 must equal dimension A1.

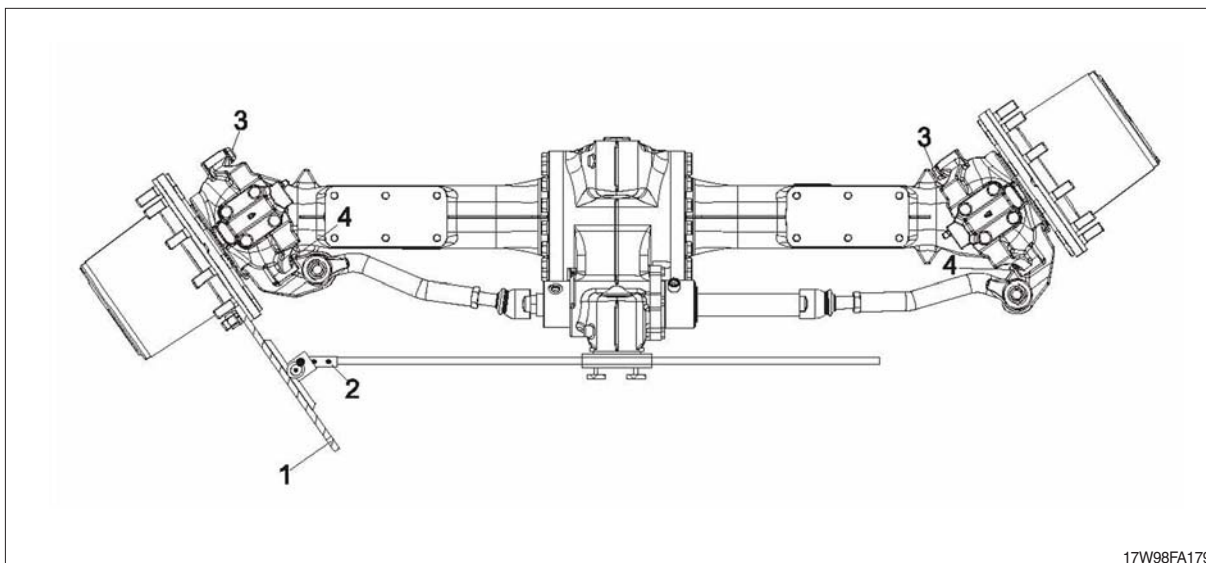
Dimension "Y" = distance between rim center and rim flange.

Then fix both tie rods (axial joint) by means of hexagon nut (3).

Tightening torque MA = 400 - 450 Nm

(21) Steering angle setting

- ※ When track setting is required, steering angle setting may only be carried out after track setting has been completed.



17W98FA179

- 1 = (S) Straightedge 5870 200 029
- 2 = (S) Measuring device 5870 200 033
- 3 = Stop screw with stop washer (optional)
- 4 = Stop screw with hexagon nut

Mount straightedge (1) in horizontal and central axis position.

Fix measuring device (2) to yoke.

Pivot output until the required steering angle (e.g. 35°) is indicated on the measuring device (2).

- ※ Take the value of the steering angle to be set from the vehicle manufacturer's specifications.

Bring the stop screw (4) on the axle housing in contact position and lock with hexagon nut.

Tightening torque (M18/10.9) MA = 300 Nm

Then set inner stop by means of stop screw (3) and stop washer (s = optional).

Tightening torque (M18/10) MA = 390 Nm

- ※ Make setting on both output sides.

(22) Check leakage of steering

Make leakage test of steering in both steering directions by means of HP pump.

Test pressure: 200 bar

Test medium: Engine oils SAE 10W

Test pressure p = Build up 200 bar (bleed pressure chamber).

Then close connection to HP pump by means of locking valve.

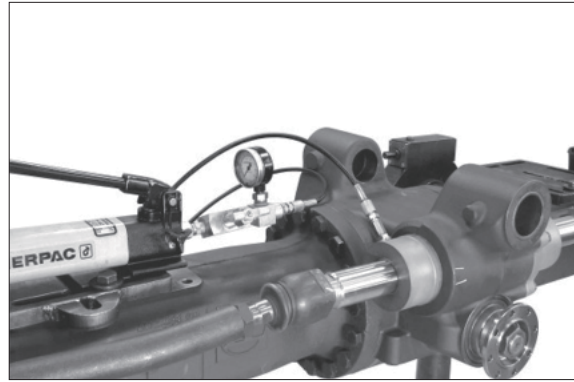
A 5 bar pressure drop is permissible during a test duration of 20 sec.

(S) HP pump 5870 287 007

(S) Reduction 5870 950 161

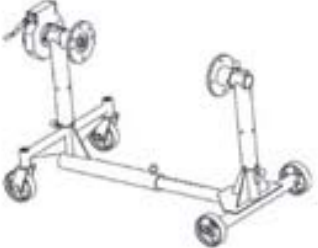
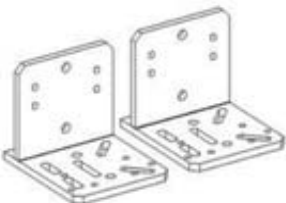
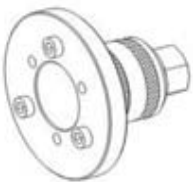
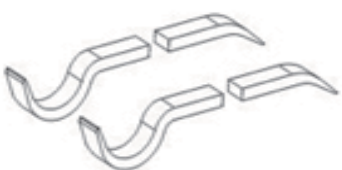

(S) Clutch 0501 207 939

※ Prior to putting the axle into operation fill it with oil.




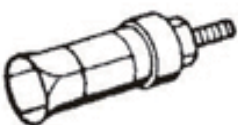
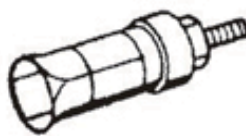


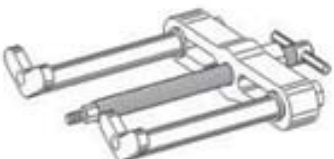
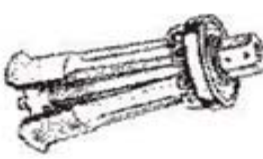
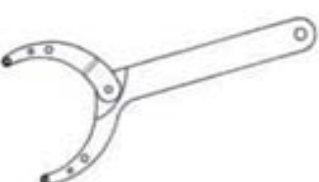

17W98FA180





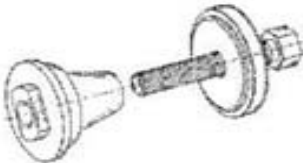
5. SPECIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY


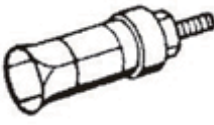
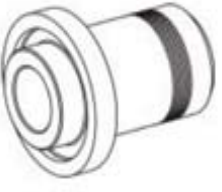

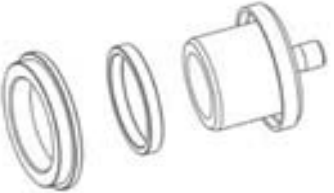
No.	Figure	Designation order no.	Qty	Page
1	 <p>180W9A8FA501</p>	<p>Assembly truck assy with tilting device 5870 350 000</p>	1	<p>8-243 8-314</p>
2	 <p>180W9A8FA502</p>	<p>Supporting bracket 5870 350 106</p>	1	<p>8-243 8-314</p>
3	 <p>180W9A8FA503</p>	<p>Socket wrench 5870 656 097</p>	1	<p>8-247 8-315</p>
4	 <p>180W9A8FA504</p>	<p>Assembly lever 5870 345 036</p>	1	<p>8-248 8-316</p>
5	 <p>180W9A8FA505</p>	<p>Adjusting device 5870 400 001</p>	2	<p>8-249 8-317</p>






No.	Figure		Designation order no.	Qty	Page
6	 180W9A8FA506		Lifting bracket 5870 281 043	1	8-249, 252, 277, 285 8-317, 319, 343, 351
7	 180W9A8FA507		Pressure piece 5870 100 067 (FR axle) 5870 100 063 (RR axle)	1 1	8-249, 250 8-317, 318
8	FR axle  180W9A8FA508-1	RR axle  180W9A8FA508-2	Grab sleeve 5873 003 022 (Not used) 5873 013 015 (Not used)	1	-
9	 180W9A8FA509		Grab sleeve 5873 004 026	1	8-318
10	 180W9A8FA510		Grab sleeve 5873 004 022	1	8-250



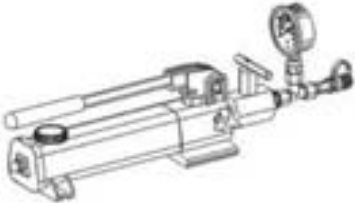


No.	Figure	Designation order no.	Qty	Page
11	 180W9A8FA511	Eyebolts (FR axle) 0636 804 001 (M16) (Not used)	2	-
12	 180W9A8FA512	Eyebolts (FR axle) 5870 204 085 (M18) (Not used)	2	-
13	 180W9A8FA513	Eyebolts (FR axle) 0636 804 003 (M20)	2	8-250, 274
14	 180W9A8FA514	Inner installer (FR axle) 5870 300 007 (Ø 46 ~ 56 mm) (Not used)	1	-
15	 180W9A8FA515	Inner installer (FR axle) 5870 300 017 (Ø 56 ~ 70 mm)	1	8-251, 252




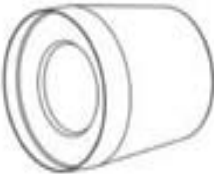
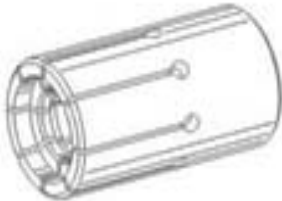
No.	Figure	Designation order no.	Qty	Page
16	 180W9A8FA516	Counter support 5870 300 020	1	8-251, 252, 255 8-323
17	 180W9A8FA517	Inner installer 5870 300 019 (Ø 56 - 110 mm)	1	8-252, 255 8-323
18	 180W9A8FA518	Striker 5870 650 004	1	8-253 8-320, 321, 322
19	 180W9A8FA519	Clamping fork 5870 240 025	1	8-254, 265, 269 8-322, 337, 341
20	 180W9A8FA520	Grab sleeve 5873 001 037	1	8-255 8-323

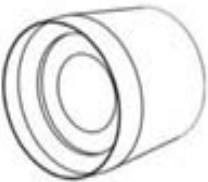




No.	Figure	Designation order no.	Qty	Page
21	 180W9A8FA521	Grab sleeve 5873 011 019	1	8-256 8-324
22	 180W9A8FA522	Basic tool 5873 001 000	1	8-256 8-324
23	 180W9A8FA523	Pressure piece 5870 100 009	1	8-256 8-324
24	 180W9A8FA524	Adjusting screws 5870 204 027 (M12 × 1.5)	1	8-261 8-329
25	 180W9A8FA525	Assembly fixture 5870 345 049	1	8-263 8-336






No.	Figure	Designation order no.	Qty	Page
26	 180W9A8FA526	Pressure ring 5870 345 056	1	8-263 8-336
27	 180W9A8FA527	Internal extractor 5870 300 005 (Ø 36 ~ 46 mm)	1	8-267 8-332
28	 180W9A8FA528	Driver tool (FR axle) 5870 048 286	1	8-269
29	 180W9A8FA529	Driver tool (FR axle) 5870 055 081 (Not used)	1	-
30	 180W9A8FA530	Driver tool (FR axle) 5870 055 090	1	8-270, 272

No.	Figure	Designation order no.	Qty	Page
31	 180W9A8FA531	Handle (FR axle) 5870 260 002	1	8-270, 271, 272
32	 180W9A8FA532	Driver tool 5870 058 058 (Not used)	1	-
33	 180W9A8FA533	Driver tool 5870 058 022 (Not used)	1	-
34	 180W9A8FA534	Driver tool (FR axle) 5870 058 078	1	8-271
35	 180W9A8FA535	Lever riveting tongs (RR axle) 5870 320 016	1	8-271 8-342



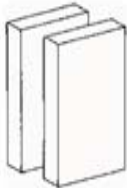


No.	Figure	Designation order no.	Qty	Page
36	 180W9A8FA536	Driver tool 5870 051 035 (Not used)	1	-
37	 180W9A8FA537	Driver tool 5870 051 068	1	8-276 8-343
38	 180W9A8FA538	HP pump 5870 287 007	1	8-281, 293 8-348
39	 180W9A8FA539	Threaded coupling 5870 950 102 (M14×1.5)	1	8-281 8-348
40	 180W9A8FA540	Breather bottle 5870 286 072	1	8-281 8-348


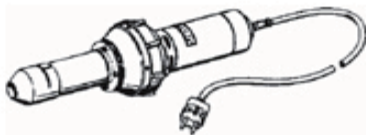


No.	Figure	Designation order no.	Qty	Page
41	 180W9A8FA541	Straightedge 5870 200 022	1	8-282 8-349
42	 180W9A8FA542	Driver tool 5870 048 245 (Not used)	1	-
43	 180W9A8FA543	Driver tool 5870 048 263	1	8-284 8-350
44	 180W9A8FA544	Inner installer (FR axle) 5870 651 086 (Not used)	1	-
45	 180W9A8FA545	Inner installer (FR axle) 5870 651 087 (Not used)	1	-





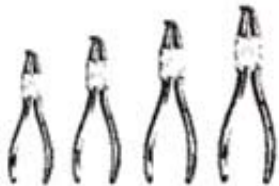
No.	Figure	Designation order no.	Qty	Page
46	 180W9A8FA546	Inner installer (FR axle) 5870 651 088	1	8-287
47	 180W9A8FA547	Inner installer 5870 651 089	1	8-287
48	 180W9A8FA548	Calibration bushing 5870 651 090 (Not used)	1	8-264
49	 180W9A8FA549	Calibration bushing 5870 651 091	1	8-287
50	 180W9A8FA550	Socket wrench (FR axle) 5870 656 097	1	8-247, 278, 281 8-315, 344, 348



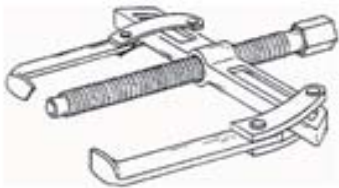
No.	Figure	Designation order no.	Qty	Page
51	 180W9A8FA551	Socket wrench (FR axle) 5870 656 099 (SW 75)	1	8-290
52	 180W9A8FA552	Straightedges (FR axle) 5870 200 029	1	8-291, 292
53	 180W9A8FA553	Measuring device (FR axle) 5870 200 033	1	8-291, 292
54	 180W9A8FA554	Reduction (FR axle) 5870 950 161	1	8-293
55	 180W9A8FA555	Clutch (FR axle) 0501 207 939	1	8-293


6. COMMERCIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

No.	Figure	Designation order no.	Qty	Remark
1	 180W9A8FA556	Magnetic stand 5870 200 055	1	Universal
2	 180W9A8FA557	Dial indicator 5870 200 057	1	Universal
3	 180W9A8FA558	Gauge blocks 5870 200 066 (70 mm) 5870 200 067 (100 mm)	1	Universal 8-268
4	 180W9A8FA559	Digital depth gauge 5870 200 072 (200 mm) 5870 200 114 (300 mm)	1	Universal
5	 180W9A8FA560	Digital caliper gauge 5870 200 109 (150 mm)	1	Universal

No.	Figure	Designation order no.	Qty	Remark
6	 180W9A8FA561	Torque wrench 5870 203 030 0.6 ~ 6.0 Nm 5870 203 031 1.0 ~ 12 Nm 5870 203 032 3.0 ~ 23 Nm 5870 203 033 5.0 ~ 45 Nm 5870 203 034 10 ~ 90 Nm 5870 203 039 80 ~ 400 Nm 5870 203 016 140 ~ 750 Nm 5870 203 011 750 ~ 2000 Nm	1	Universal
7	 180W9A8FA562	Hot air blower 5870 221 500 230 V 5870 221 501 115 V	1	Universal
8	 180W9A8FA563	Plastic hammer 5870 280 004 Ø 60 mm Substitute nylon insert 5870 280 006	1	Universal
9	 180W9A8FA564	Lifting strap 5870 281 026	1	Universal

No.	Figure	Designation order no.	Qty	Remark
10	 180W9A8FA565	Lifting chain 5870 281 047	1	Universal
11	 180W9A8FA566	Pry bar 5870 345 071	1	Universal
12	 180W9A8FA567	Striker 5870 650 004	1	Universal
13	 180W9A8FA568	Set of internal pliers I1-I2-I3-I4 5870 900 013	1	Universal
14	 180W9A8FA569	Set of internal pliers I11-I21-I31-I41 90° 5870 900 014	1	Universal

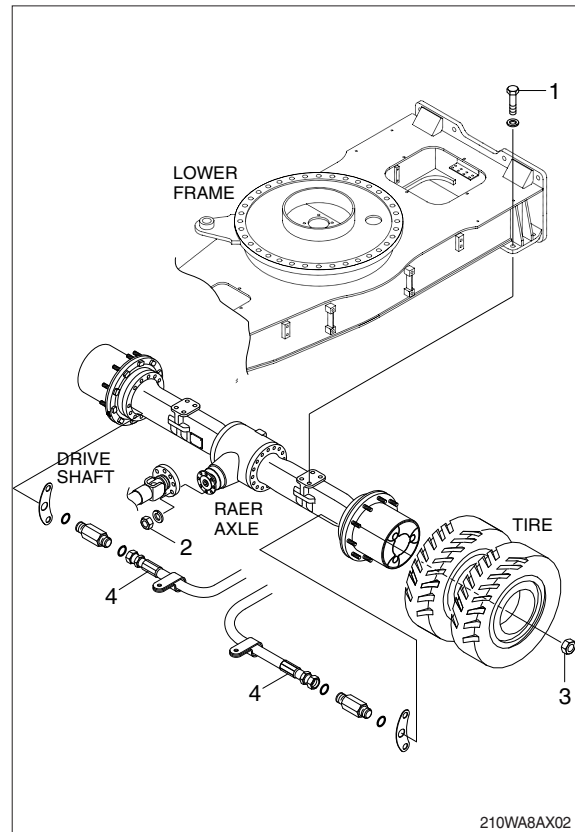
No.	Figure	Designation order no.	Qty	Remark
15	 180W9A8FA570	Set of external pliers A1-A2-A3-A4 5870 900 015	1	Universal
16	 180W9A8FA571	Set of external pliers A01-A02-A03-A04 90° 5870 900 016	1	Universal
17	 180W9A8FA572	Two-armed puller 5870 970 001 Jaw width 80 mm Throat depth 100 mm 5870 970 002 Jaw width 120 mm Throat depth 125 mm 5870 970 003 Jaw width 170 mm Throat depth 125 mm 5870 970 004 Jaw width 200 mm Throat depth 175 mm 5870 970 006 Jaw width 350 mm Throat depth 250 mm 5870 970 007 Jaw width 520 mm Throat depth 300 ~ 500 mm 5870 970 026 Jaw width 250 mm Throat depth 200 mm 5870 970 028 Jaw width 380 mm Throat depth 200 mm	1	Universal

No.	Figure	Designation order no.	Qty	Remark
18	 <p>180W9A8FA573</p>	<p>Two-armed puller</p> <p>5870 971 001</p> <p>Jaw width 85 mm</p> <p>Throat depth 65 mm</p> <p>5870 971 002</p> <p>Jaw width 130 mm</p> <p>Throat depth 105 mm</p> <p>5870 971 003</p> <p>Jaw width 230 mm</p> <p>Throat depth 150 mm</p> <p>5870 971 004</p> <p>Jaw width 295 mm</p> <p>Throat depth 235 mm</p> <p>5870 971 005</p> <p>Jaw width 390 mm</p> <p>Throat depth 270 mm</p> <p>5870 971 006</p> <p>Jaw width 640 mm</p> <p>Throat depth 300 mm</p>	1	Universal

GROUP 10 REAR AXLE

1. REMOVAL FRONT AXLE

- 1) Rear axle mounting nut (1, M24)
 - Tightening torque : 100 ± 10 kgf · m
(723 ± 72.3 lbf · ft)
- 2) Propeller shaft mounting bolt (2, M10)
 - Tightening torque : 5.9 ± 0.6 kgf · m
(42.7 ± 4.3 lbf · ft)
- 3) Wheel nut (3, M22)
 - Tightening torque : 60 kgf · m
(434 lbf · ft)
- 4) Hose assy (4)
- 5) Axle weight : 592 kg (1305 lb)



2. GENERAL INSTRUCTIONS

1) GENERAL WORKING INSTRUCTIONS

- (1) This manual has been developed for the skilled serviceman, trained by the ZF-Passau.
- (2) During all operations, pay attention to cleanliness and skilled working.
Therefore, axle removed from the machine, must be cleaned prior to open them.
- (3) We assume that the special tools, specified by ZF, will be used.
The special tools are available from ZF-Passau.
- (4) After the disassembly, all components must be cleansed, especially corners, cavities and recesses of housing and covers.
- (5) The old sealing compound must be carefully removed.
- (6) Check lubricating holes, grooves and pipes for free passage. They must be free of residues, foreign material or protective compounds.
- (7) The latter refers especially to new parts.
- (8) Parts which have been inevitably damaged in a disassembly operation, must be generally replaced by new ones, e.g. rotary seal rings, O-rings, U-section rings, cap boots, protective caps etc..
- (9) Components such as roller bearings, thrust washers, synchronizing parts etc. which are subject to normal wear in automotive operation, must be checked by the skilled Serviceman.
He will decide if the parts can be reused.
- (10) For the heating of bearings etc., hot plates, rod heaters or heating furnaces must be used.
- (11) Never heat parts directly with the flame. An auxiliary solution would be to immerse the bearing in a vessel filled with oil, which is then heated with the flame.
In this way, damage to the bearings could be avoided.
- (12) Ball bearings, covers, flanges and parts like that must be heated to about 90 to 100°C.
- (13) Hot-mounted parts must be reset after cooling in order to assure a proper contact.
- (14) Before pressing shafts, bearings etc. in position, both parts must be lubricated.
- (15) During to reassembly, all specified adjustment values, testing specifications and tightening torque must be respected.
- (16) After the repair, units are filled up with oil.
- (17) After the oil filling, the oil level plugs and oil drain plugs must be tightened to the specified tightening torque.

2) IMPORTANT INSTRUCTIONS CONCERNING THE LABOUR SAFETY

- (1) In principle, repairers are themselves responsible for the labour safety.
- (2) The observance of all valid safety regulations and legal rules is a precondition to prevent damage to individuals and products during the maintenance and repair operations.
- (3) Before starting the work, the repairers have to make themselves familiar with these regulations.
- (4) The proper repair of these products requires especially trained personnel.
- (5) The repairer himself is obliged to provide for the training.

3) LUBRICANT SPECIFICATIONS

- (1) Gear oils with limited - slip additives.
- (2) API GL-5
- (3) MIL-L-2105D (SAE 85W-90, 85W-140 with LS-Additive)

4) BRAKE LINING WEARING TEST

(1) The measurement of wear on the multi-disc brake only gives limited information on the total state of the plate pack without disassembling the output.

Make measurement of lining wear at least once per year, in particular, however, in case of a different braking behaviour, like :

- Braking noises
- Reduced braking power
- Different deceleration
- Different brake oil level
- Different braking pressure

※ To avoid injury when opening the oil drain/ oil filler plug (1), due to a possible pressure build-up in the planetary carrier bring drain hole to topmost position (12 o'clock) and carefully unscrew oil drain and filler plug (1).

(2) Then turn output until oil filler / oil drain hole (2) is on 9 o'clock position.

1 = Oil filler-/oil drain hole

2 = Gauge hole ($\varnothing=10$ mm) in ring gear
9 o'clock position

3 = Dial indicator with solenoid support

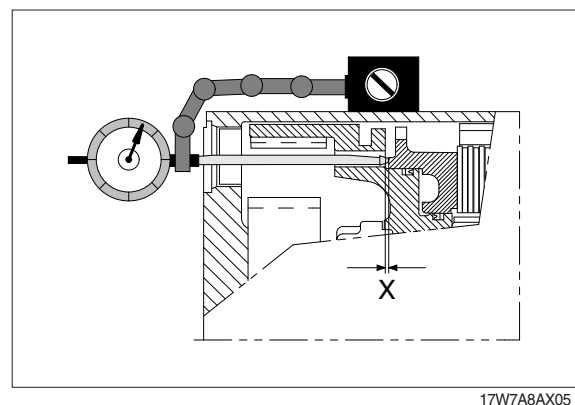
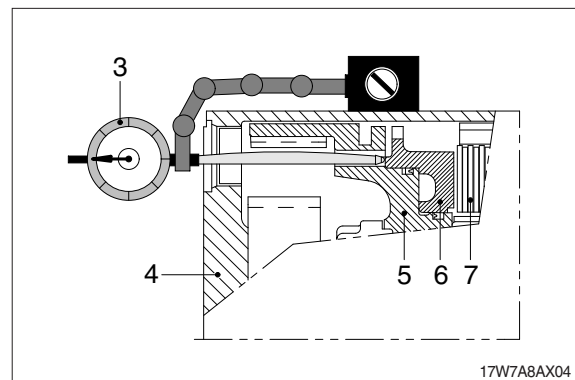
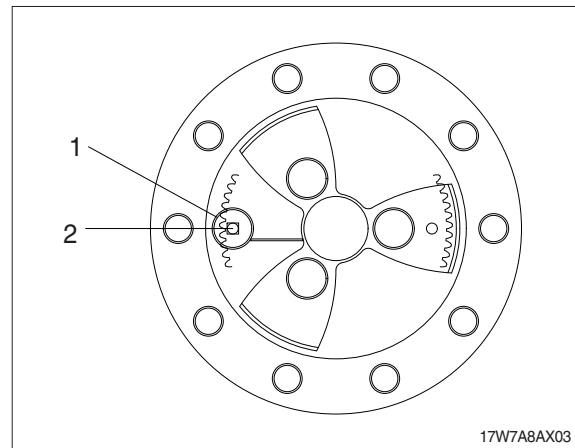
4 = Planetary carrier

5 = Ring gear

6 = Piston

7 = Plate pack

X = Piston stroke



3. DISASSEMBLY

1) OUTPUT

(1) Attach axle to the assembly truck.

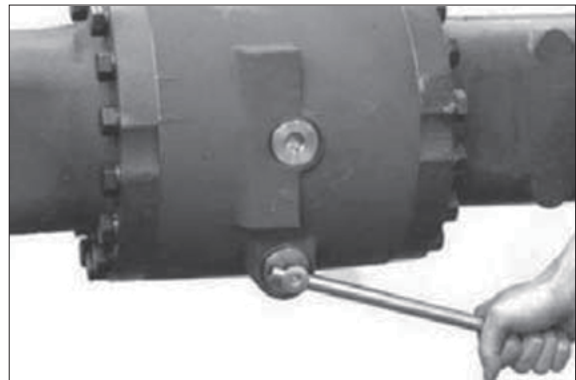
(S) Assembly truck 5870 350 000

(S) Supporting bracket 5870 350 106



17W98RA001

(2) Loosen screw plug and drain oil from the axle.



17W98RA002

(3) Loosen screw plug and drain oil from the planetary carrier.

※ To avoid any risk of injury due to a possible pressure buildup in the oil system of the planetary carrier, bring oil filler / level check plug to the uppermost position (12 o'clock) and turn it out carefully. Then bring drain hole to 6 o'clock position and drain oil.

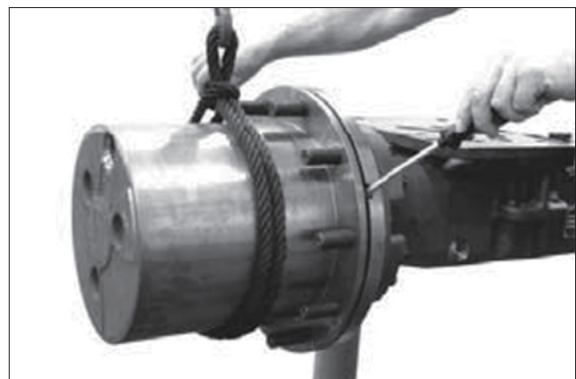
※ Use suitable oil reservoir environmental protection.



17W98RA003

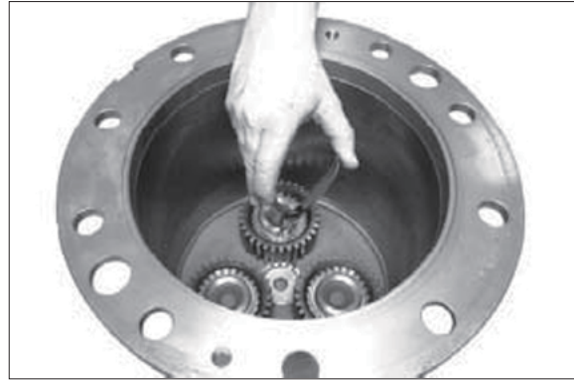
(4) Planetary carrier

Loosen both hexagon screws and separate planetary carrier from the hub.



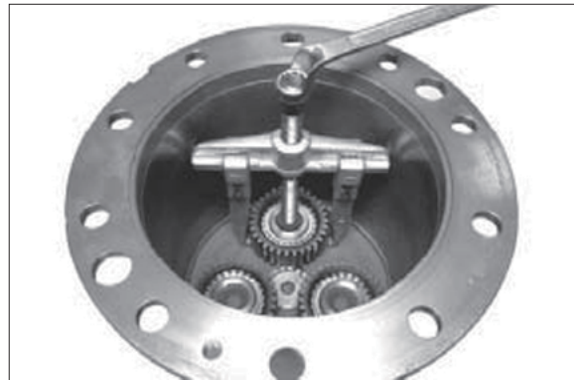
17W98RA004

(5) Snap out retaining ring.



17W98RA005

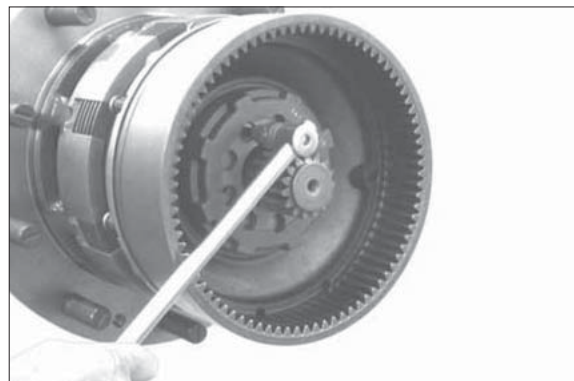
(6) Pull off planetary gear together with cylindrical roller bearing.



17W98RA006

(7) Brake

Loosen cylindrical screw (slotted nut fixing).

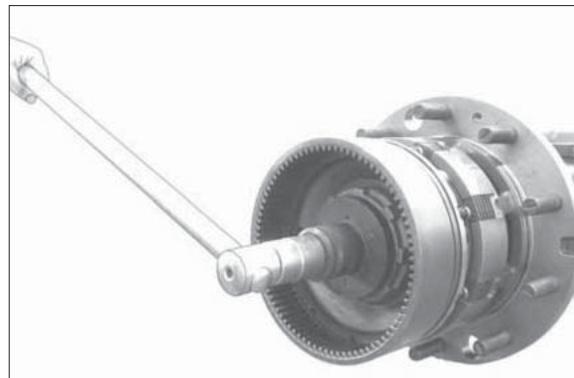


17W98RA007

(8) Loosen slotted nut.

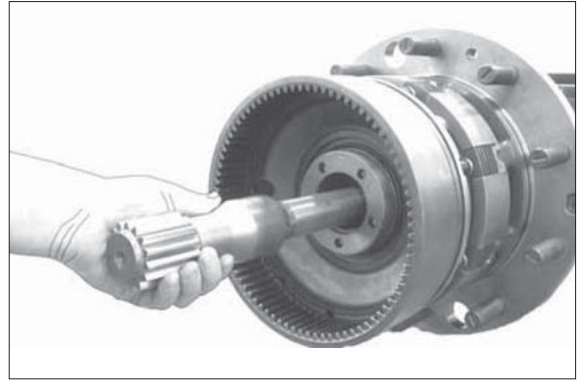
(S) Socket wrench

5870 656 097



17W98RA008

- (9) Pull sun gear together with stub shaft out of the axle housing.

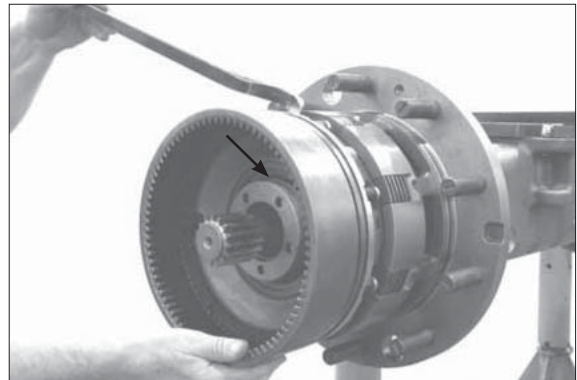


17W98RA009

- (10) Press ring gear together with piston off the hub carrier.

(S) Assembly lever 5870 345 036

- ※ Pay attention so that the O-ring (arrow) does not drop.



17W98RA010

- (11) Loosen hexagon screws and remove releasing spring sleeves and compression springs.



17W98RA011

- (12) Press piston off the ring gear.



17W98RA012

- (13) Remove sealing elements from the annular grooves (see arrows) of the ring gear.



17W98RA013

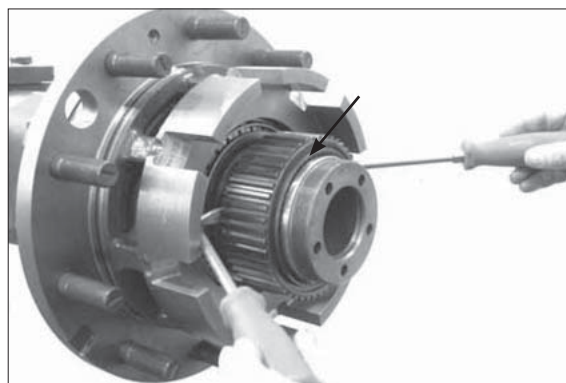
- (14) Remove disk package.



17W98RA014

- (15) Remove O-ring (see arrow) and use a lever to remove disk carrier from hub carrier.

(S) Resetting device 5870 400 001



17W98RA015

(15) Hub

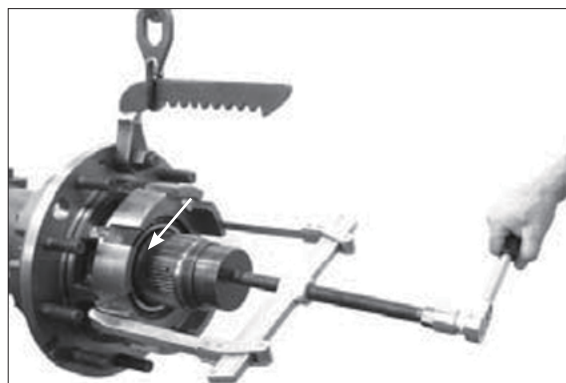
Remove O-ring (see arrow).

Secure hub with lifting bracket (S) and pull it off the hub carrier by means of a two armed puller.

(S) Lifting bracket 5870 281 043

(S) Pressure piece 5870 100 063

- ※ Pay attention that the releasing bearing inner ring does not drop.



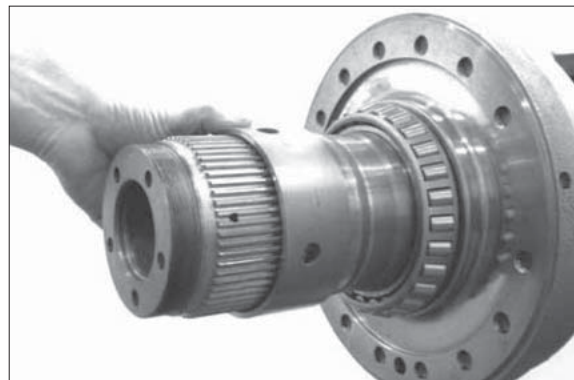
17W98RA016

- (17) Use a lever to remove the shaft seal ring (see arrow) from the hub hole and force both bearing outer rings out of the hub.



17W98RA017

- (18) Remove spacer bush.



17W98RA018

- (19) Pull tapered roller bearing off the hub.

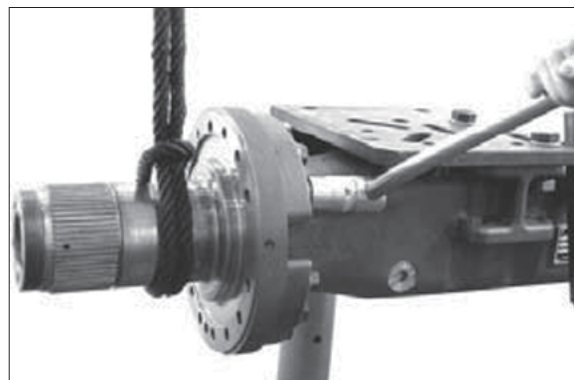
- | | |
|--------------------|--------------|
| (S) Grab sleeve | 5873 004 026 |
| (S) Pressure piece | 5870 100 063 |



17W98RA019

- (20) Secure hub carrier with lifting tackle, loosen threaded joint and separate hub carrier from the axle housing.

Then remove single parts such as screw neck, breather valve and O-ring from the hub carrier.



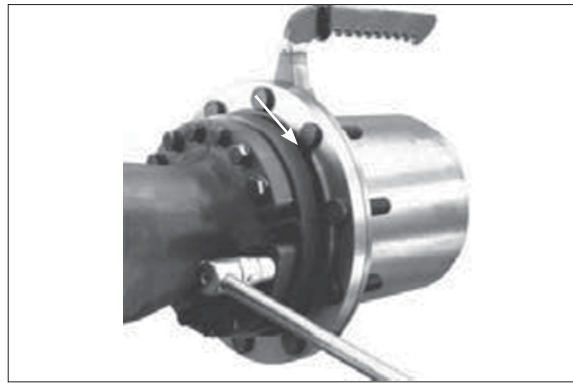
17W98RA020

(21) Output assy

- ※ If work is to be done on the differential or pinion, you may remove the output as a complete unit (operations figure RA021 and RA022).

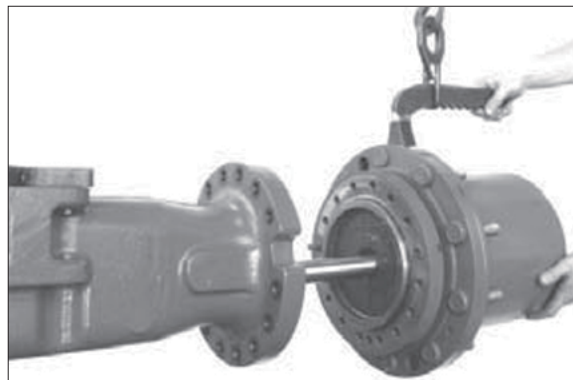
Secure output by means of lifting tackle (S) and loosen threaded joint.

(S) Lifting bracket 5870 281 043



17W98RA021

- (22) Separate output assy from the axle housing and pull out stub shaft.



17W98RA022

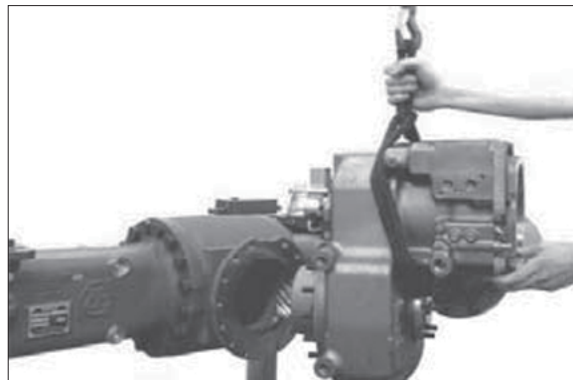
2) INPUT

- (1) Secure transmission with lifting tackle and loosen threaded joint (transmission/axle drive housing).



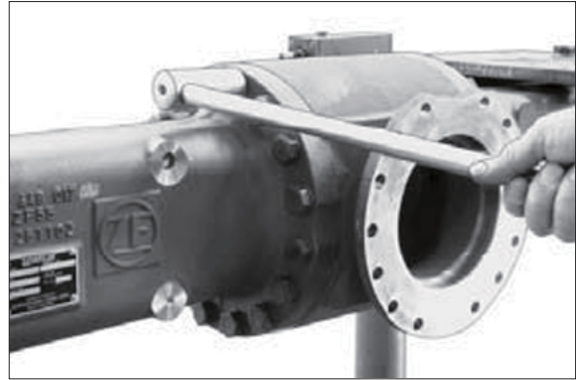
17W98RA023

- (2) Separate transmission from the axle.



17W98RA024

- (3) Secure axle housing (on crown wheel side) by means of lifting tackle and loosen threaded joint.

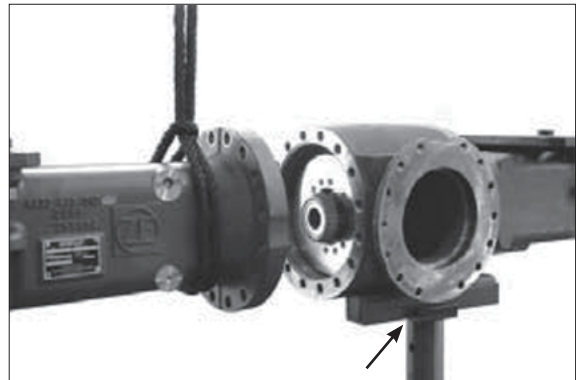


17W98RA025

- (4) Support axle at the axle drive housing (see arrow).

Then separate axle housing from the axle drive housing.

- ※ Pay attention that the differential does not drop.

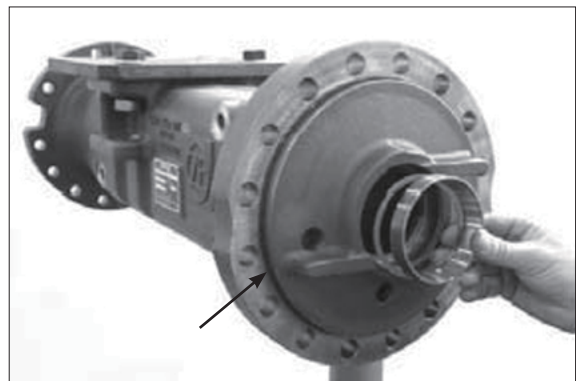


17W98RA026

- (5) Pull bearing outer ring out of the bearing hole and remove the releasing shim.

Then remove O-ring (see arrow).

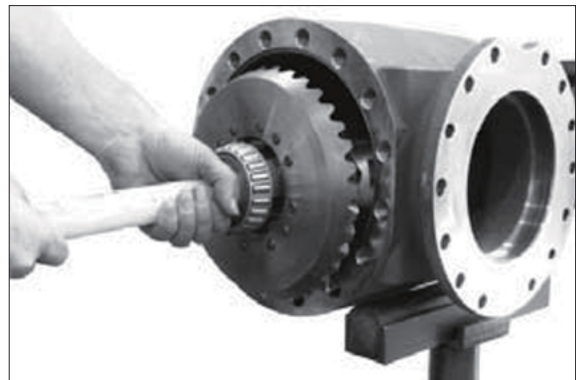
(S) Striker 5870 650 004



17W98RA027

- (6) Lift differential out of the axle drive housing.

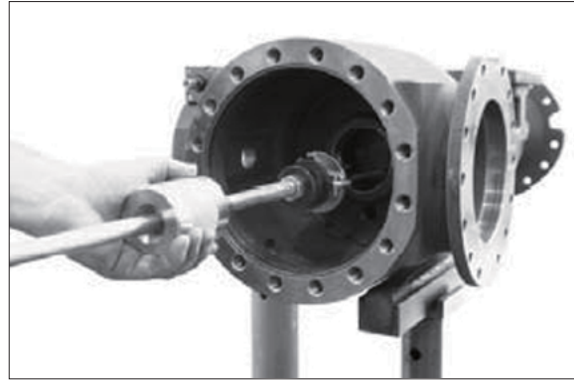
- ※ Disassembly of the differential see description on page 8-324 and following.



17W98RA028

- (7) Use striker (S) to pull bearing outer ring out of the bearing hole (axle housing) and remove the releasing shim.

(S) Striker 5870 650 004

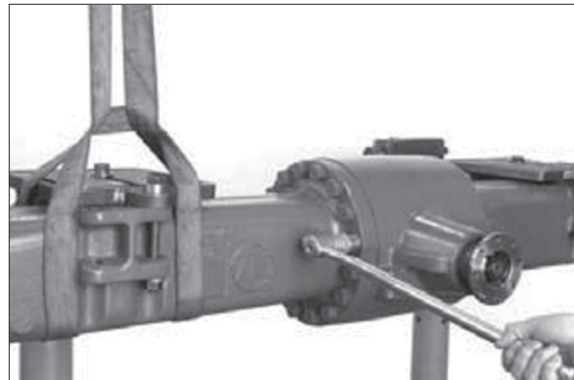


17W98RA029

- (8) Secure axle housing (on crown wheel side, part II) by means of lifting tackle and loosen threaded joint.

Then separate axle housing (part II) from the axle drive housing.

- ※ Pay attention that the differential does not drop.

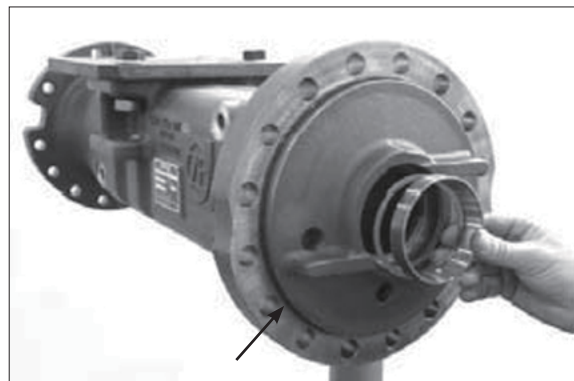


17W98RA030

- (9) Pull bearing outer ring out of the bearing hole and remove the releasing shim.

Then remove O-ring (see arrow).

(S) Striker 5870 650 004

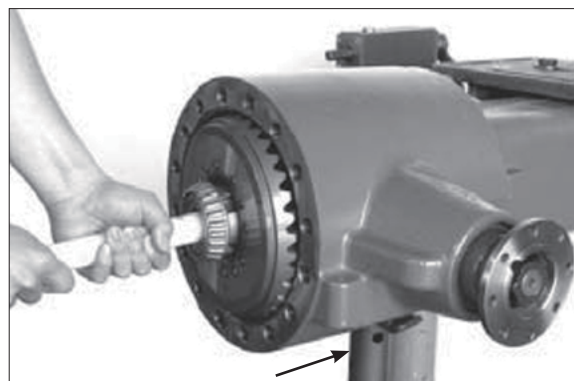


17W98RA031

- (10) Support axle at the axle drive housing (see arrow).

Then lift differential out of the axle drive housing.

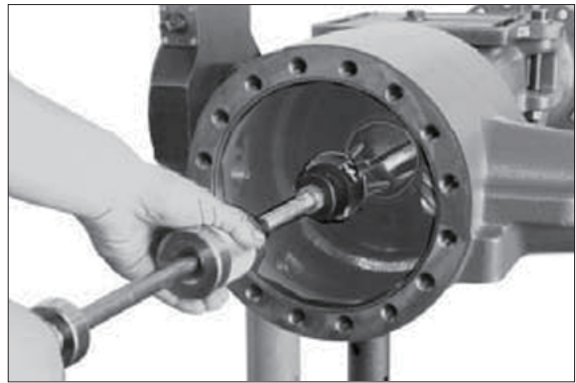
- ※ Disassembly of the differential see description on page 8-324 and following.



17W98RA032

- (11) Use striker (S) to pull bearing outer ring out of the bearing hole (axle housing) and remove the releasing shim.

(S) Striker 5870 650 004



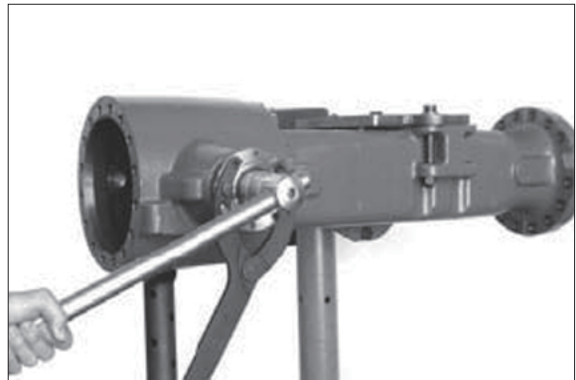
17W98RA033

- (12) Heat up hexagon nut with hot-air blower.

Then loosen hexagon nut and remove the releasing washer.

(S) Clamping fork 5870 240 025

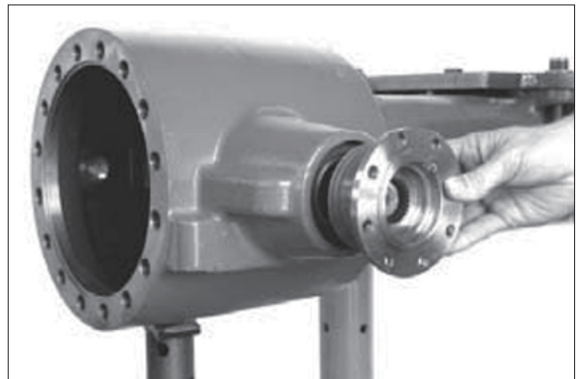
※ Hexagon nut is secured with Loctite no. 262.



17W98RA034

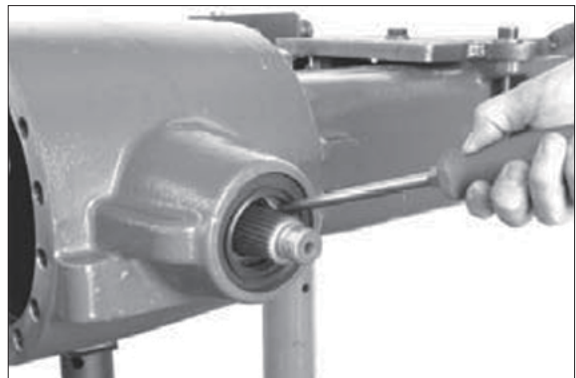
- (13) Pull input flange off the pinion.

If required, remove screen sheet from the flange.



17W98RA035

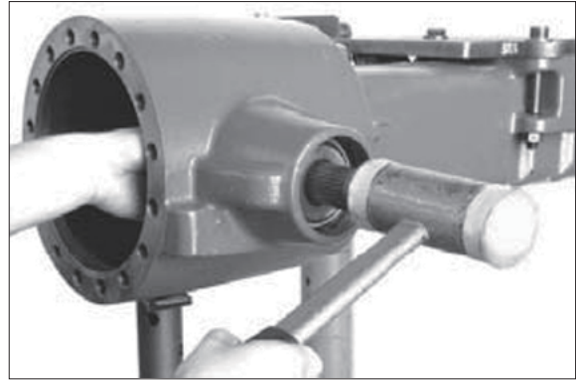
- (14) Use a lever to remove the shaft seal ring out of the housing hole.



17W98RA036

(15) Force out input pinon and remove the releasing roller bearing.

- ※ Use a plastic hammer.
- ※ If the tapered roller bearings are not replaced, pay attention that all the rollers of the outer bearing inner ring are always in contact with the bearing outer ring when forcing out the input pinon.



17W98RA037

(16) Remove spacer ring.



17W98RA038

(17) Press roller bearing off the input pinion.

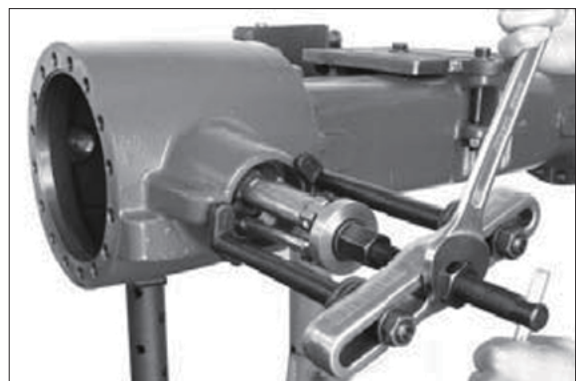
(S) Grab sleeve 5873 001 037



17W98RA039

(18) Pull external bearing outer ring out of the bearing hole.

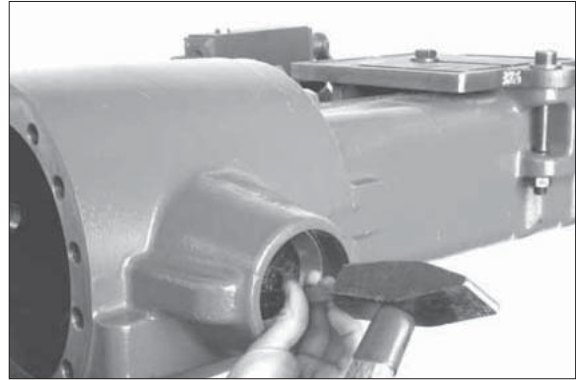
(S) Internal extractor 5870 300 019
(S) Counter support 5870 300 020



17W98RA040

(19) Force bearing outer ring off the inner bearing hole pay attention to the shim behind.

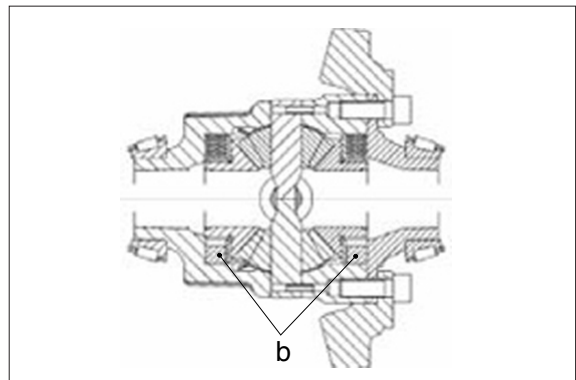
※ Mark shim regarding position/bearing allocation reassembly aid.



17W98RA041

3) DIFFERENTIAL

(1) b = Constant spacers



17W98RA042

(2) Pull both tapered roller bearings from differential carrier.

(S) Grab sleeve	5873 011 019
(S) Basic tool	5873 001 000
(S) Pressure piece	5870 100 009



17W98RA043

(3) Use press to fix differential and loosen threaded joint crown wheel / differential carrier.



17W98RA044

(4) Press crown wheel from differential.



17W98RA045

(5) Remove single parts.

Remove axle bevel gear together with thrust washer and constant spacer from the differential carrier.



17W98RA046

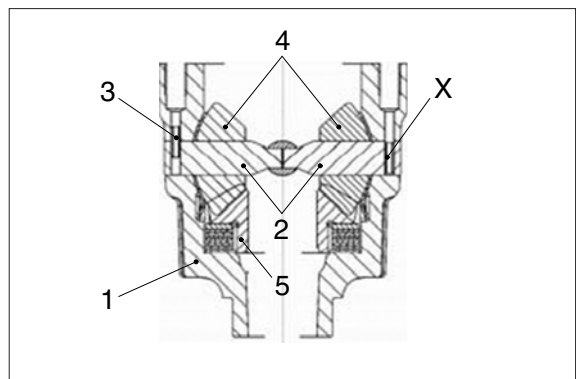
(6) Force slotted pins (considering position "X", see subsequent sketch) into the spider shafts.



17W98RA047

(7) Comment on sketch:

- 1 = Differential carrier
- 2 = Spider shafts (short)
- 3 = Slotted pins
- 4 = Differential bevel gears
- 5 = Axle bevel gear
- X = Position of the slotted pin to force out the spider shafts



17W98RA048

(8) Force out both spider shafts (short).



17W98RA049

(9) Remove all single parts.

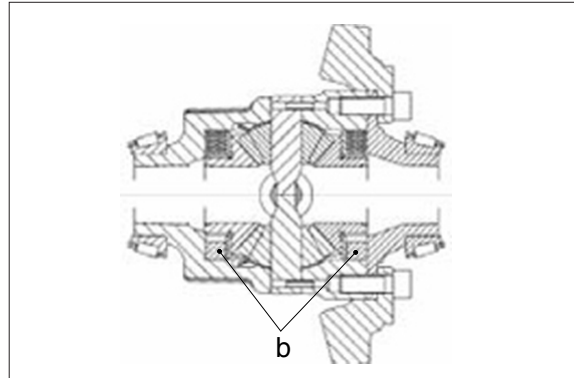


17W98RA050

4. REASSEMBLY

1) DIFFERENTIAL

(1) b = Constant spacers



17W98RA042

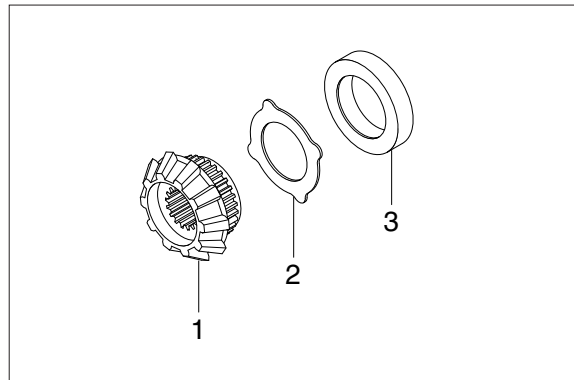
(2) All outer and inner disks are replaced by a constant spacer (see figure FA054).

1 = Axle bevel gear

2 = Pressure disk

3 = Constant ring

※ No measuring / setting of the axial play of the two axle bevel gears is required, therefore single parts can be immediately oiled.



17W98RA053

(3) Insert premounted axle bevel gear into the differential carrier.



17W98RA054

(4) Insert differential bevel gears (1) with thrust washers (2) and fix with spider shafts (3 and 4).

※ Pay attention to radial installation position of the thrust washers.



17W98RA055

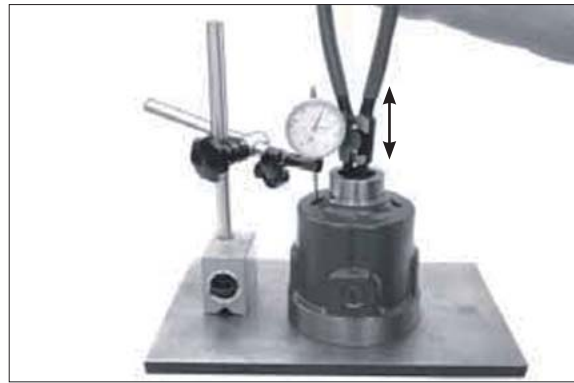
- (5) Check axial play of the axle bevel gear 0.0 ... 0.15 mm.

※ If the axial play is not within the specified tolerance, correct with the corresponding outer disks.

After the setting procedure separate the single parts again.

Then oil and reassemble all single parts again.

※ Make sure that thickness and arrangement of the second disk package are identical (figure RA059).



17W98RA056

- (6) Fix both spider shafts (short) by means of slotted pins (considering installation dimension, see sketch RA058).



17W98RA057

- (7) Comment on sketch:

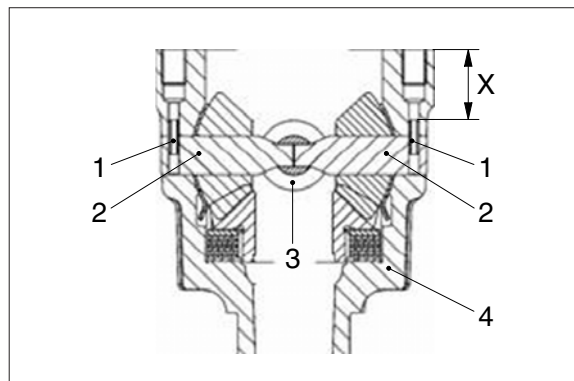
1 = Slotted pin

2 = Spider shaft (short)

3 = Spider shaft

4 = Differential carrier

X = Installation dimension 34 ± 0.5 mm



17W98RA058

(8) Mount second axle bevel gear with thrust washer and constant spacer (see also figure RA053).

※ Mount the pressure disk with the coated surface showing to the outer disk.

※ Thickness and arrangement of the disk package must be identical on both sides of the differential gear.



17W98RA059

(9) Check axial play of the second axle bevel gear 0.0 ... 0.15 mm.

※ If the axial play is not within the specified tolerance, correct with the corresponding outer disks.

After the resetting procedure remove the second axle bevel gear together with the disk package from the differential carrier.

Then oil and reassemble all single parts.



17W98RA060

(10) Mount two adjusting screws (S) and insert cover.

(S) Adjusting screws (M12×1.5)

5870 204 027



17W98RA061

(11) Press crown wheel onto the cover / differential carrier until contact position is obtained.



17W98RA062

- (12) Fix differential with press and tighten crown wheel with cylindrical screws.

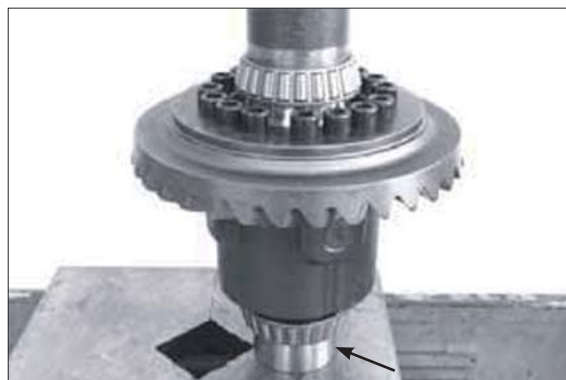
Tightening torque (M12×1.5/12.9)
 MA = 145 Nm



17W98RA063

- (13) Press on both bearing inner rings until contact is obtained.

※ Use an appropriate support (arrow) differential may not be supported on the bearing cage.

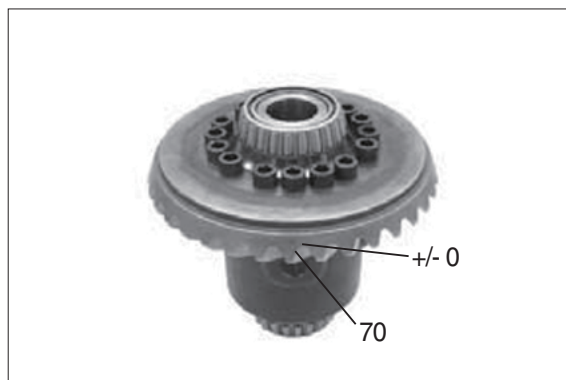


17W98RA064

2) INPUT

- (1) Determination of shims for setting the bearing rolling torque (differential bearing) and the backlash (bevel gear set).

※ Determine the required shims on basis of the read value (test dimension/ crown wheel) and the corresponding specifications of the table next page :
 (KRS – SET – RIGHT) (KRS = bevel gear set)

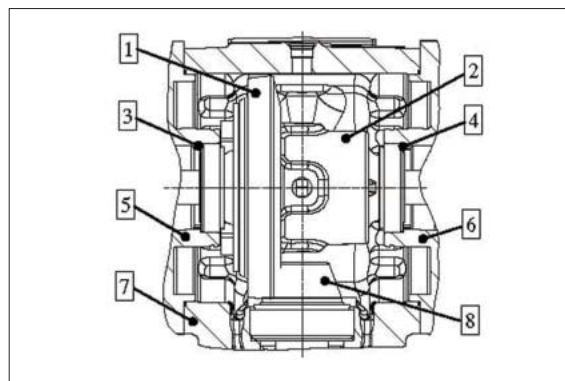


17W98RA065

(2) Test dimension see crown wheel rear side.

※ The test dimension "70" is stamped into the crown wheel rear side. If no + or deviation is indicated, this value corresponds with the test dimension/ actual value "70" in the table below. According to this value, the required shims are allocated in the table below.

Any + or - deviation of the test dimension caused by production is also marked on the crown wheel rear side (e.g. 20 or – 10 / 10 or 20) . In accordance with this deviation, the required shims are allocated in the table below.



17W98RA066

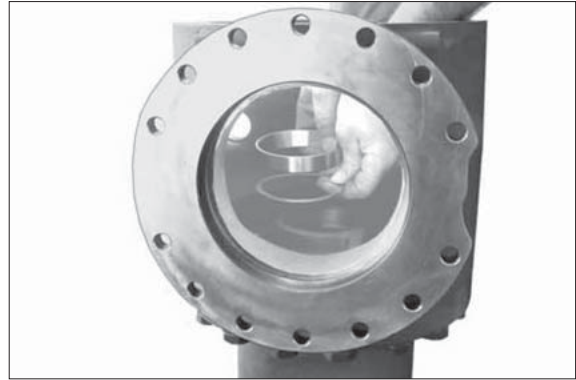
· Legend to sketch:

- 1 = Crown wheel
- 2 = Differential carrier
- 3 = Shim (crown wheel side)
- 4 = Shim (diff. carrier side)
- 5 = Axle housing
- 6 = Axle housing
- 7 = Axle drive housing
- 8 = Input pinion

Setting disks for differential					
Test dimension/crown wheel marking 70 and deviation	-20	-10	0	10	20
results in → test dim. / actual value	69.80	69.90	70.0	70.10	70.20
Shim/ diff. carrier side Required shim thickness	0.95	1.05	1.15	1.25	1.35
Shim No.	0730 006 518	0730 006 519	0730 006 521	0730 006 522	0730 006 524
Shim/crown wheel side Required shim thickness	1.35	1.25	1.15	1.05	0.95
Shim No.	0730 006 524	0730 006 522	0730 006 521	0730 006 519	0730 006 518

- (3) Place determined shim (e.g. thickness = 1.15 mm) and bearing outer ring into the hole of the axle housing on differential carrier side.

※ Rotate axle housing by 90°.



17W98RA067

- (4) Place determined shim (e.g. thickness = 1.15 mm) and bearing outer ring into the hole of the axle housing on crown wheel side.



17W98RA068

- (5) **Contact pattern check of bevel gear set**
Cover some drive and coast flanks of the crown wheel with marking ink.



17W98RA069

- (6) Place preassembled differential into the axle drive housing.

(S) Internal extractor 5870 300 005



17W98RA070

- (7) Use lifting tackle to mount the axle housing (crown wheel side) and preliminarily fix it with hexagon screws.

Tightening torque (M18/12.9)
..... MA = 440 Nm

- ※ Preliminarily fix axle housing without O-ring.

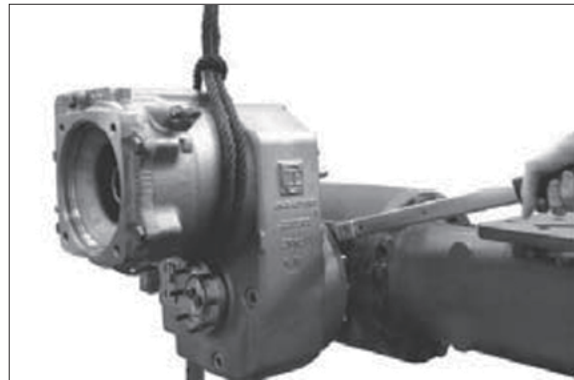


17W98RA071

- (8) Rotate axle by 90° and support it.

Use lifting tackle to bring HL transmission into contact position with the axle housing and fix it.

Tightening torque MA = 79 Nm



17W98RA072

- (9) By rotating the input flange, roll crown wheel over the input pinion in both directions several times.

Then remove transmission and axle housing and lift differential out of the axle drive housing.

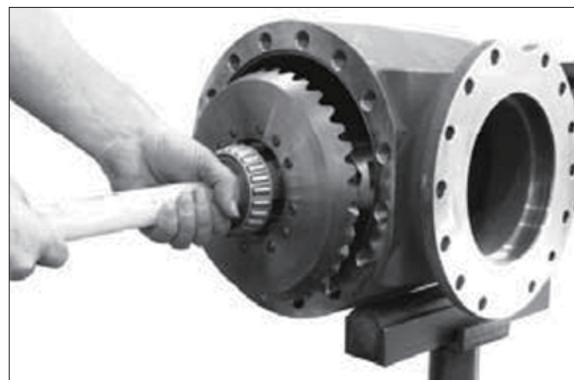
Compare the obtained contact pattern.

- ※ In case of a contact pattern deviation, check the pinion shimming of the transmission.



17W98RA073

- (10) After contact pattern check, place differential into the axle drive housing.



17W98RA074

- (11) Grease O-ring (see arrow) and mount it to axle housing.



17W98RA075

- (12) Use lifting tackle to mount the axle housing and finally tighten it with hexagon screws.

Tightening torque (M18/12.9)
 MA = 440 Nm



17W98RA076

3) INPUT PINION

The following measuring operations must be carried out with utmost accuracy. Inaccurate measurements lead to an incorrect contact pattern and require an additional disassembly and reassembly of the input pinion.

- (1) **Determination of shim thickness to obtain a correct contact pattern**

Read dimension I from the axle drive housing.

Dim. I e.g. 154.05 mm



17W98RA077

(2) Read dimension II (pinion dimension).

Dim. II e.g. 116.00 mm

In case of a + or - deviation of the pinion dimension for production reasons, the respective value is marked by hand on the pinion.

Pinion dim. (without + or - deviation) =
116.0 mm

Pinion dim. with + 0.1 deviation value =
116.1 mm

Pinion dim. with - 0.1 deviation value =
115.9 mm



17W98RA078

(3) Determine dimension III (bearing width).

- ※ Make sure that the rollers are located without any play (rotate bearing inner ring several times in both directions roller setting).

Since the installed roller bearing is subject to a preload in installation position, deduct an experience value of 0.1 mm.

Dimension III, e.g. 36.60 mm - 0.1 mm =
36.50 mm

(S) Gage blocks 5870 200 066



17W98RA079

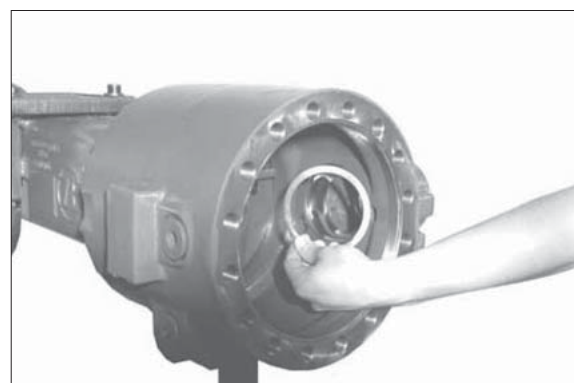
(4) Calculation example :

Dimension I 154.05 mm

Dimension X - 152.50 mm

Difference = shim s = 1.55 mm

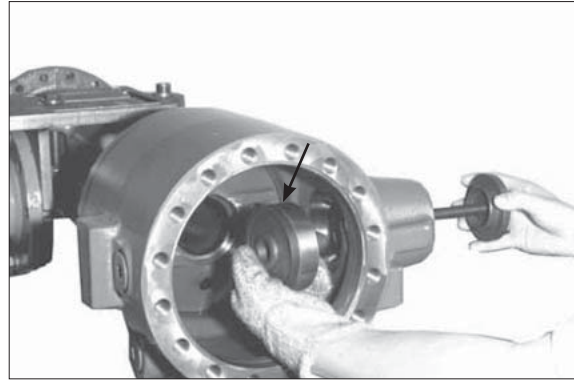
Place the determined shim (e.g. thickness = 1.55 mm) into the inner bearing hole.



17W98RA080

- (5) Undercool bearing outer ring (see arrow) and bring it into contact position in the bearing hole by using the assembly fixture (S).

(S) Assembly fixture 5870 345 049
(S) Pressure ring 5870 345 056



17W98RA081

- (6) Undercool external bearing outer ring and insert it into the bearing hole until contact is obtained.

(S) Assembly fixture 5870 345 049
(S) Pressure ring 5870 345 056



17W98RA082

- (7) **Adjustment of the rolling torque of input pinion bearing 1.0 ... 3.0 Nm (without shaft seal ring)**

Heat up roller bearing and install it until contact is obtained.

※ Adjust bearing after cooling-down.



17W98RA083

- (8) Mount spacer ring (e.g. thickness = 16.96 mm).

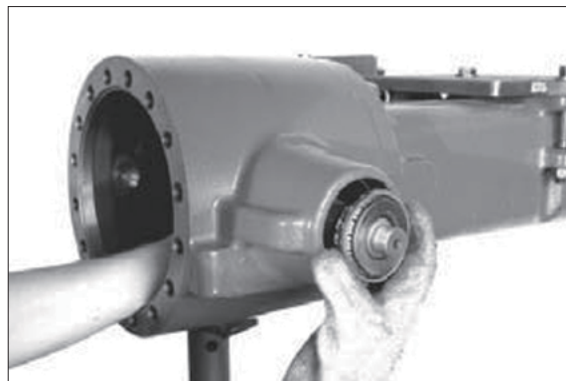
※ According to our experience, the necessary rolling torque is obtained when reusing the spacer ring which has been removed during disassembly (e.g. thickness = 16.96 mm).

A later check of the rolling torque, however, is absolutely necessary.



17W98RA084

- (9) Place the preassembled input pinion into the axle housing and mount the heated roller bearing until contact is obtained.



17W98RA085

- (10) Press screen sheet (see arrow) onto the input flange until contact is obtained.

- ※ Do not fit the shaft seal ring until the contact pattern has been checked.



17W98RA086

- (11) Mount input flange and fix it with washer and hexagon nut.

Tightening torque (M30 x 1.5)

MA = 600 Nm

(S) Clamping fork 5870 240 025

- ※ While tightening, rotate the input pinion in both directions several times.



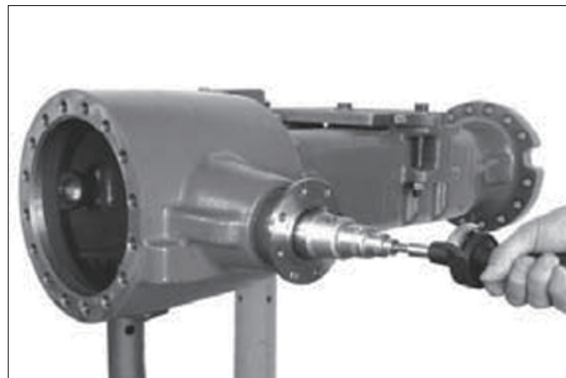
17W98RA087

- (12) Check rolling torque (1.0 ... 3.0 Nm without shaft seal ring).

- ※ When installing new bearings, try to achieve the upper value of the rolling torque.
- ※ Any deviation from the required rolling torque must be corrected with an appropriate spacer ring (figure RA110) as specified below.

Insufficient rolling torque - install thinner spacer ring.

Excessive rolling torque - install thicker spacer ring.



17W98RA088

(13) Determination of shims for setting the bearing rolling torque (differential bearing) and the backlash (bevel gear set)

※ Determine the required shims on basis of the read value (test dimension/crown wheel) and the corresponding specifications of the table below:
(KRS – SET – RIGHT) (KRS = bevel gear set) : Test dimension see crown wheel rear side.

※ The test dimension "70" is stamped into the crown wheel rear side. If no + or deviation is indicated, this value corresponds with the test dimension/ actual value "70" in the table below. According to this value, the required shims are allocated in the table below.

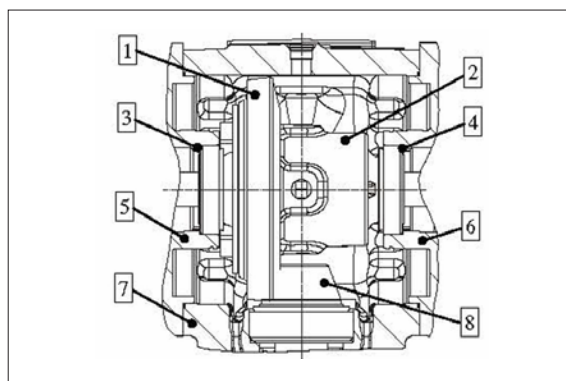
※ Any + or – deviation of the test dimension caused by production is also marked on the crown wheel rear side (e.g. – 20 or – 10 / 10 or 20) . In accordance with this deviation, the required shims are allocated in the table below.



17W98RA089

(14) Legend to sketch:

- 1 = Crown wheel
- 2 = Differential carrier
- 3 = Shim (crown wheel side)
- 4 = Shim (diff. carrier side)
- 5 = Axle housing
- 6 = Axle housing
- 7 = Axle drive housing
- 8 = Input pinion

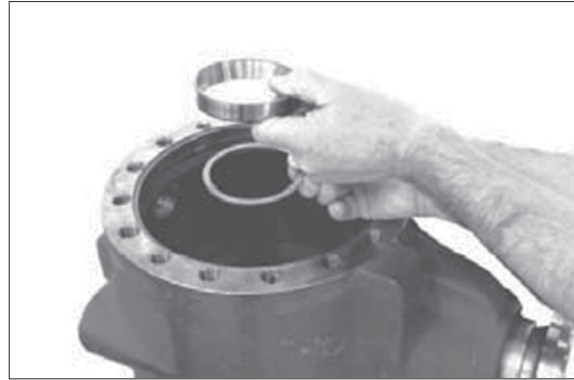


17W98RA090

Shims for differential					
Test dimension/crown wheel marking 70 and deviation	-20	-10	0	10	20
results in → test dim. / actual value	69.80	69.90	70.0	70.10	70.20
Shim/ diff. carrier side Required shim thickness	0.95	1.05	1.15	1.25	1.35
Shim No.	0730 006 518	0730 006 519	0730 006 521	0730 006 522	0730 006 524
Shim/crown wheel side Required shim thickness	1.35	1.25	1.15	1.05	0.95
Shim No.	0730 006 524	0730 006 522	0730 006 521	0730 006 519	0730 006 518

- (15) Place determined shim (e.g. thickness = 1.15 mm) and bearing outer ring into the hole of the axle housing on differential carrier side (part I).

※ Rotate axle housing by 90°.



17W98RA091

- (16) Place determined shim (e.g. thickness = 1.15 mm) and bearing outer ring into the hole of the axle housing on crown wheel side (part II).



17W98RA092

- (17) Contact pattern check of bevel gear set**

Cover some drive and coast flanks of the crown wheel with marking ink.



17W98RA093

- (18) Place preassembled differential into the axle drive housing.



17W98RA094

- (19) Use lifting tackle to mount the axle housing (crown wheel side, part II) and preliminarily fix it with hexagon screws.

Tightening torque (M18/12.9)
..... MA = 440 Nm

- ※ Preliminarily fix axle housing without O-ring.



17W98RA095

- (20) By rotating the input flange, roll crown wheel over the input pinion in both directions several times.

Then remove axle housing and lift differential out of the axle drive housing. Compare the obtained contact pattern with contact pattern.

- ※ In case of a contact pattern deviation it is imperative to correct the measuring error which was made when determining the shim (figure RA080).



17W98RA096

- (21) After contact pattern check, place differential into the axle drive housing.

Grease O-ring (see arrow) and mount it to the axle housing.



17W98RA097

- (22) Use lifting tackle to mount the axle housing and finally fix it with hexagon screws.

Tightening torque (M18/12.9)
..... MA = 440 Nm

Then bring axle into horizontal position and reassemble the second supporting bracket (S) (see also figure RA001).

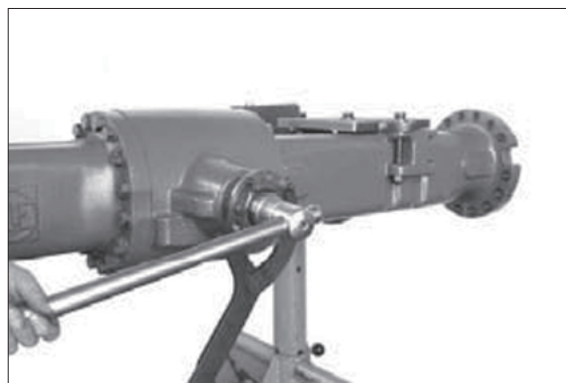


17W98RA098

(23) Fitting of shaft seal ring (input flange)

Loosen hexagon nut and pull input flange off the input pinion.

(S) Clamping fork 5870 240 025



17W98RA099

(24) Legend to sketch:

1 = Input pinion

2 = Axle drive housing

3 = Tapered roller bearing

4 = Shaft seal ring

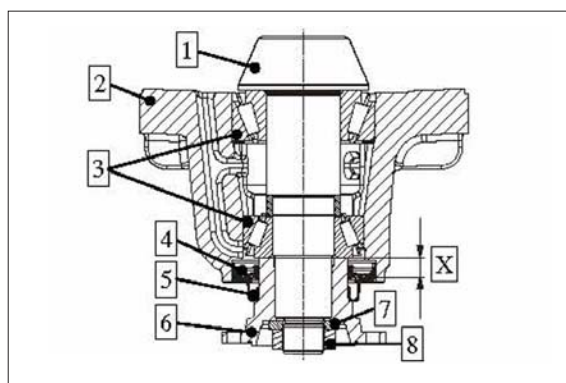
5 = Screen sheet

6 = Input flange

7 = Washer

8 = Hexagon nut

X = Installation dimension → 13.5 +0.2 mm



17W98RA100

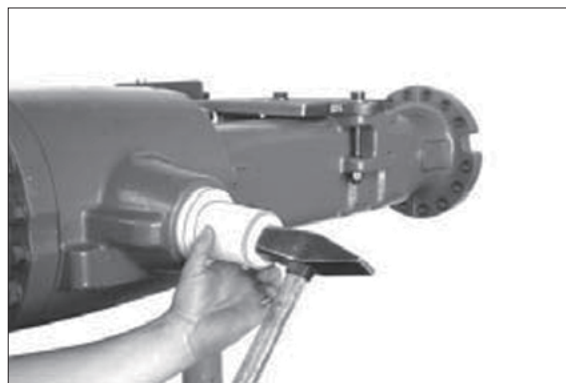
(25) Mount shaft seal ring with the sealing lip facing the oil chamber.

(S) Driver tool 5870 048 286

※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.

※ Just before fitting, apply lubricant to the contact face of shaft seal ring/axle drive housing.

Apply grease to seal and dust lip of the shaft seal ring.



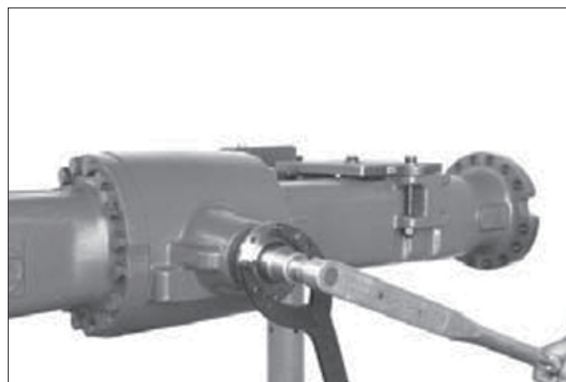
17W98RA101

(26) Mount input flange and finally fix it with washer and hexagon nut.

Tightening torque (M30 x 1.5)
..... MA = 600 Nm

(S) Clamping fork 5870 240 025

※ Wet thread of hexagon nut with Loctite no. 262.



17W98RA102

4) OUTPUT

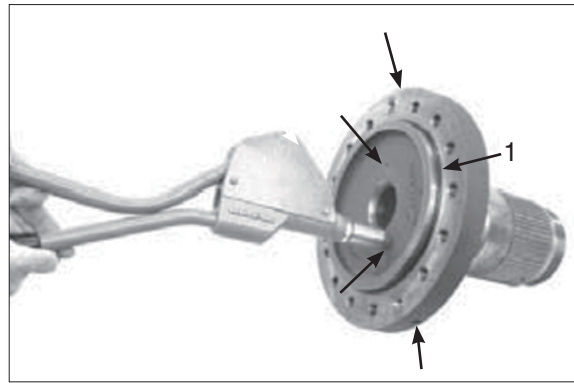
(1) Hub carrier

Grease O-ring (1) and mount it to hub carrier.

The following operation is only required when fitting a new hub carrier :

Seal machining openings (arrows) of oil supply holes with plugs.

(S) Lever riveting tongs 5870 320 016

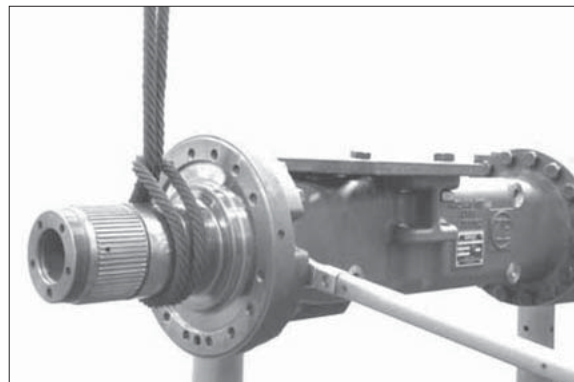


17W98RA103

- (2) Mount preassembled hub carrier to the axle housing, considering the installation position, and fix it with hexagon screws.

Tightening torque (M 16/10.9)
..... MA = 280 Nm

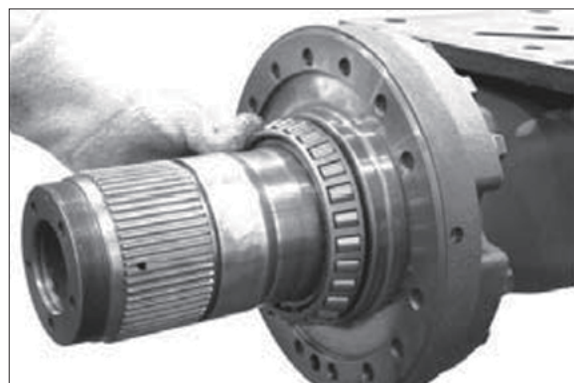
- ※ Ensure radial installation position.
Stamped circle (see arrow) must be in uppermost (12 o'clock) position.



17W98RA104

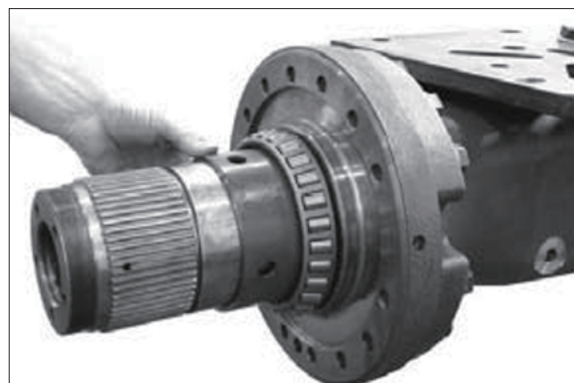
(3) Hub (Hub bearing SET-RIGHT)

Heat up tapered roller bearing and mount it to hub carrier until contact is obtained.



17W98RA105

- (4) Mount spacer bushing.

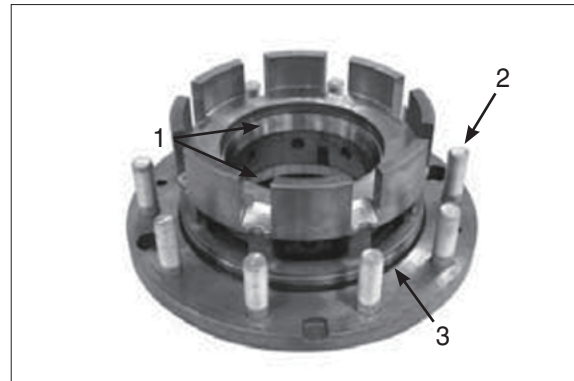


17W98RA106

- (5) Insert both bearing outer rings (1) of the hub bearing until contact position is obtained.

Press wheel bolts (2) into the hub until contact position is obtained.

Grease O-ring (3) and place it into the annular groove of the hub.

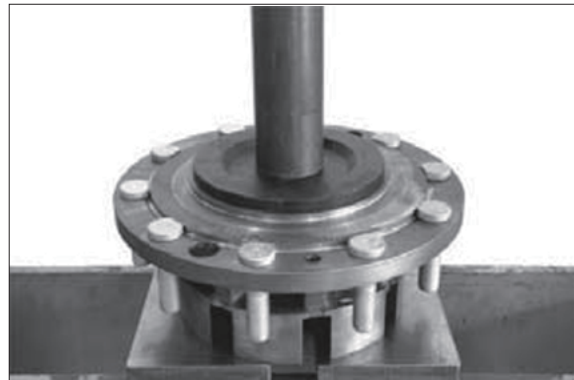


17W98RA107

- (6) Press shaft seal ring into the hub, with the marking "OUT SIDE" showing outwards (facing up):

(S) Driver tool 5870 051 068

- ※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.
- ※ Wet outer diameter of the shaft seal ring with Loctite no. 574.



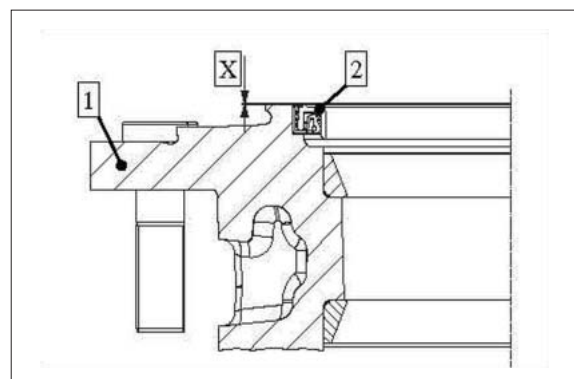
17W98RA108

- (7) Legend to sketch:

1 = Hub

2 = Shaft seal ring

X = Installation dimension – shaft seal ring
 $2.5 + 0.5$ mm

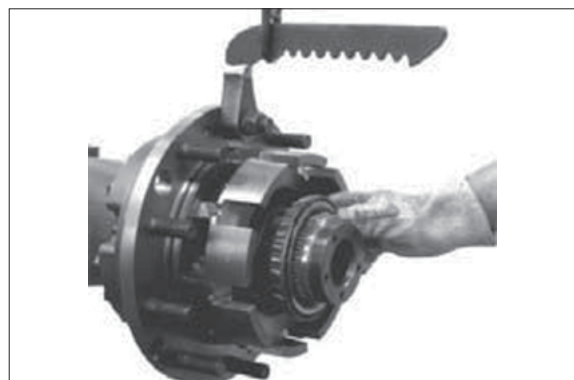


17W98RA109

- (8) Mount preassembled hub until contact is obtained and fix it with heated tapered roller bearing.

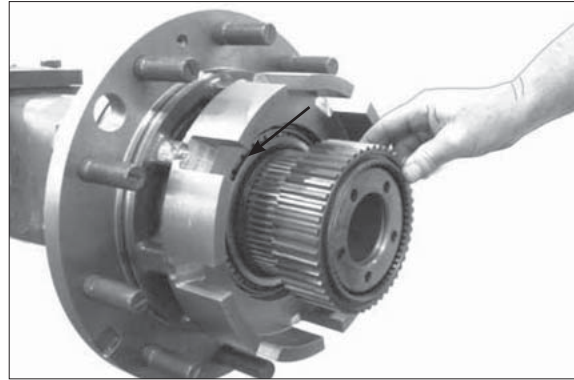
(S) Lifting bracket 5870 281 043

- ※ Just before fitting, wet sealing lips of shaft seal ring with lubricant.



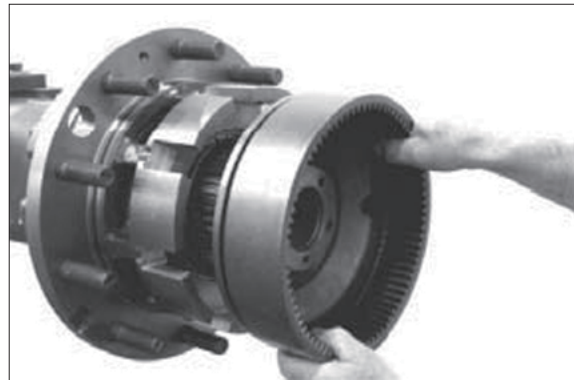
17W98RA110

- (9) Oil O-ring and insert it into the annular groove (see arrow) of the hub carrier.
Then mount disk carrier.



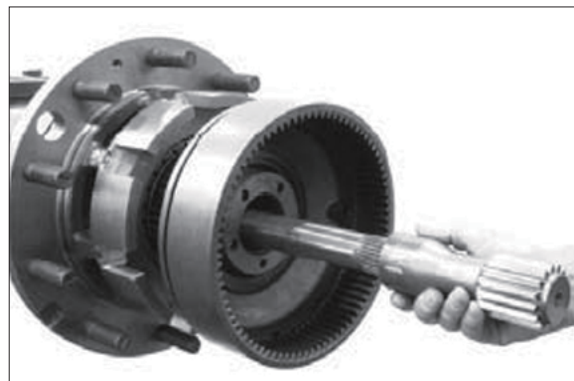
17W98RA111

- (10) Bring disk carrier and hub bearing into contact position (figure no. RA112 ... RA115):
Mount ring gear (without sealing elements).



17W98RA112

- (11) Insert stub shaft and sun gear shaft for supporting the socket wrench (see following figure).



17W98RA113

- (12) Bring hub bearing into contact position for this purpose tighten slotted nut with a tightening torque of 1400 Nm max.

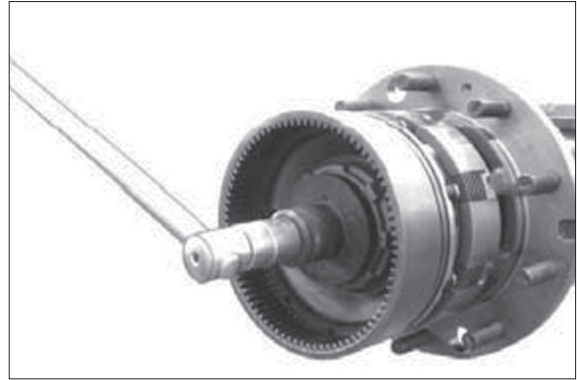
(S) Socket wrench 5870 656 097

- ※ While tightening the slotted nut rotate hub in both directions several times roller setting.
- ※ Apply lubricant to thread of knuckle housing/slotted nut.



17W98RA114

(13) Loosen slotted nut and remove ring gear.



17W98RA115

(14) Multi-disk brake

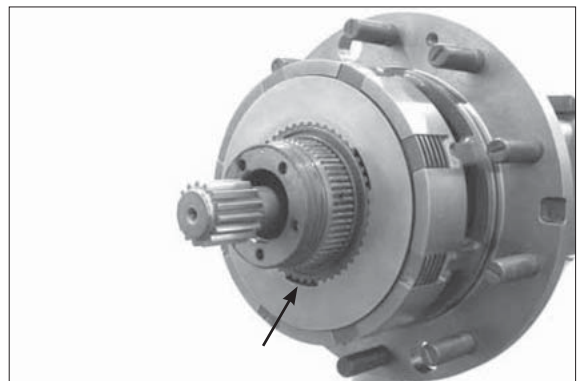
Mount outer and inner disks of the disk package alternately, starting with an outer disk.

※ For the actually required disk fitting/ arrangement please refer to the corresponding spare parts list.



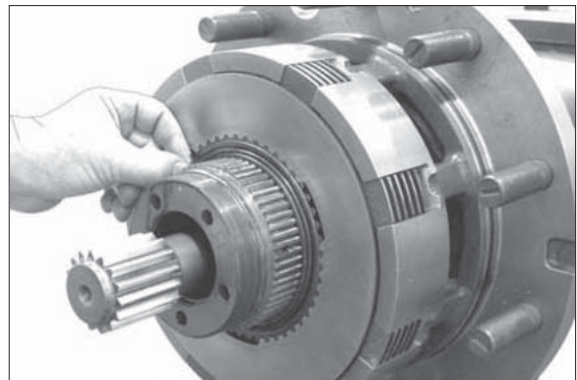
17W98RA116

(15) Bring inner clutch disks into a position where one of the tooth recesses is in 6 o'clock position after installation of the axle into the vehicle.



17W98RA117

(16) Oil O-ring and place it into the annular groove of the disk carrier.



17W98RA118

(17) Oil grooved and back-up rings and insert them into the annular grooves of the ring gear.

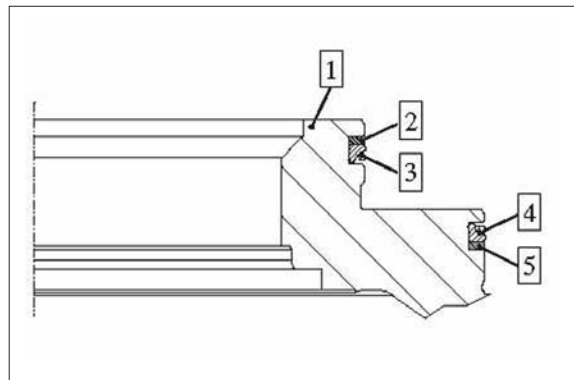
※ Observe installation position, see sketch below.



17W98RA119

(18) Legend to sketch:

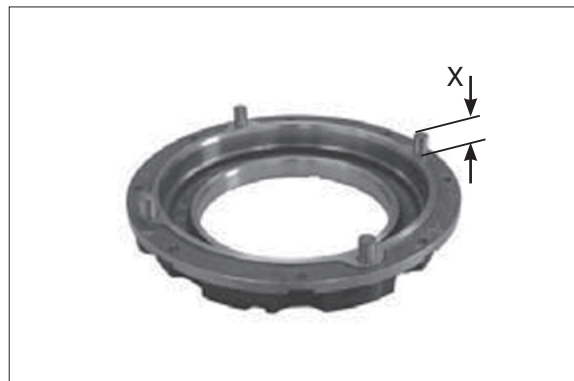
- 1 = Ring gear
- 2 = Back-up ring
- 3 = Grooved ring
- 4 = Grooved ring
- 5 = Back-up ring



17W98RA120

(19) Fit cylindrical pins into the piston, considering the installation dimension "X".

X = Installation dimension16.00 mm



17W98RA121

(20) Mount piston onto ring gear.



17W98RA122

- (21) Fix piston with "new" hexagon screws (1), spring sleeves (2) and compression springs (3 and 4).

Tightening torque (M 6/8.8)
 MA = 8 Nm

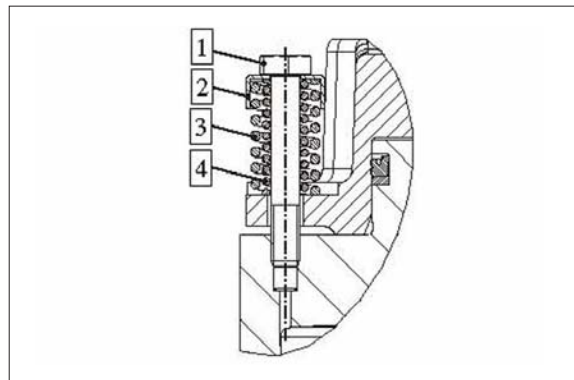
※ Use hexagon screws just once.



17W98RA123

- (22) Legend to sketch:

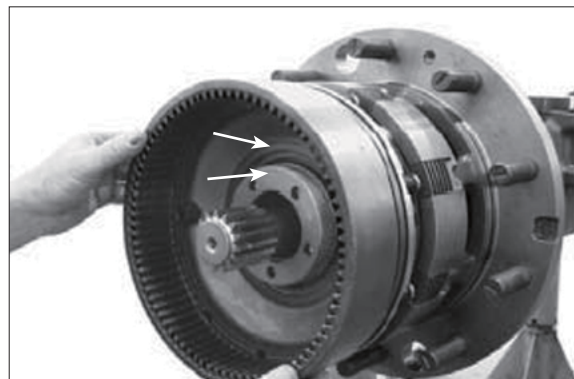
- 1 = Hexagon screw (special version)
- 2 = Spring sleeve
- 3 = Compression spring
- 4 = Compression spring



17W98RA124

- (23) Mount preassembled ring gear, considering the installation position (markings O in 12 o'clock position – see arrows).

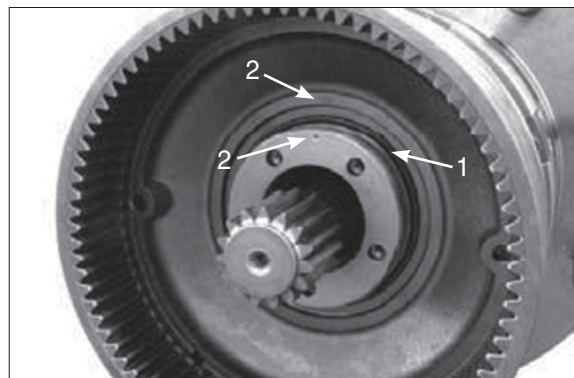
※ Ensure exact toothing position of oil supply holes – hub carrier/ring gear (pressure oil supply to brake piston).



17W98RA125

- (24) Oil O-ring and insert it into the recess (see arrow 1).

※ Arrows (2) show once more the markings O and the installation position of hub carrier and ring gear.



17W98RA126

(25) Fix ring gear with slotted nut.

Tightening torque (M110 × 1.5)

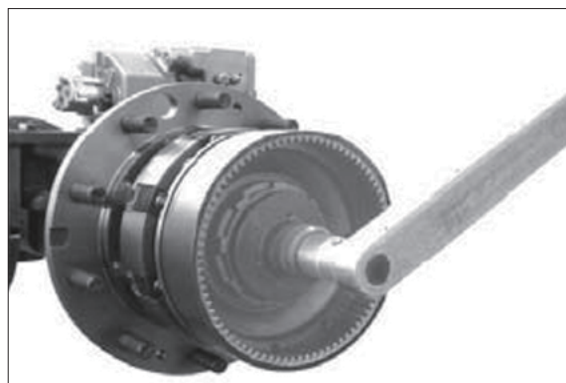
. MA = 1400 + 600 Nm

(S) Socket wrench 5870 656 097

- ※ Pretighten slotted nut with 1400 Nm, then continue tightening the slotted nut until a fixing hole overlaps a threaded hole in the knuckle housing.

While tightening the slotted nut rotate hub in both directions several times – roller setting.

- ※ Apply lubricant to thread of knuckle housing/slotted nut.



17W98RA127

(26) Leakage test of multi-disk brake

Fit breather (arrow) and threaded coupling (S), then connect HP pump.

(S) HP pump 5870 287 007

(S) Threaded coupling (M14 × 1.5) 5870 950 102

(S) Breather bottle 5870 286 072

- ※ Breathe brake completely before starting the test.

Test media :

Motor oils SAE-10W

High-pressure test:

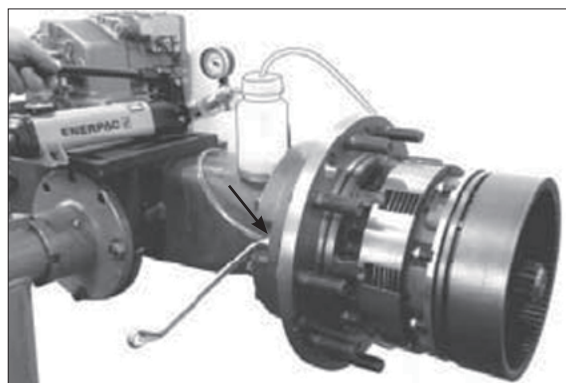
Build up test pressure $p = 100$ bar and close shut-off valve of HP pump.

A maximum pressure drop of 3 bar is permissible during a 5-minute test.

Low-pressure test:

Reduce test pressure to $p = 5$ bar and close shut-off valve.

No pressure drop is allowed during a 5-minute test.



17W98RA128

(27) Adjustment and check of piston stroke

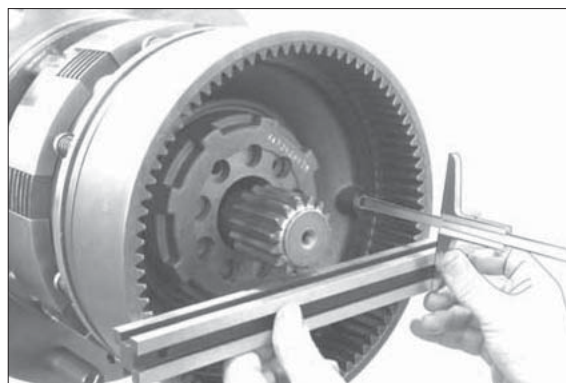
Piston stroke / disk clearance =
0.7 ... 1.3 mm

Build up brake pressure (100 bar) and close shut-off valve of HP pump.

Determine dimension "A", from face of the ring gear (1) through the measuring hole (see also sketch 43) to the face of the piston (3).

Dim. "A" e.g. 83.10 mm

※ Breathe brake completely before starting the measuring operation.

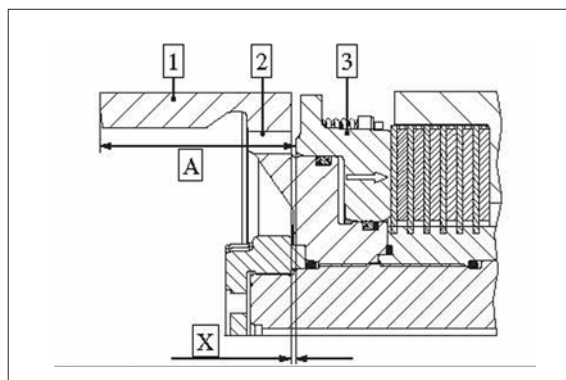


17W98RA129

(28) Then open shut-off valve of HP pump and release pressure from brake (piston return via compression springs).

Determine dimension "B", from the face of the ring gear (1) through the measuring hole (see also sketch RA131) to the face of the piston (3).

Dimension "B" e.g. 82.10 mm



17W98RA130

(29) Calculation example :

Dimension „A“ e.g. 83.10 mm

Dimension „B“ e.g. - 82.10 mm

Difference = piston stroke = 1.00 mm

※ If the required piston stroke (0.7 ... 1.3 mm) is not achieved, correct it with (a) corresponding inner clutch disk(s) – see respective spare parts list.

Then remove HP pump (S), breather bottle (S) and threaded coupling (S).

Legend to sketches RA130 and RA131:

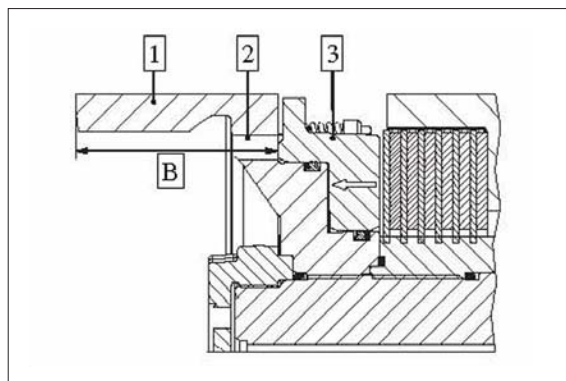
1 = Ring gear

2 = Measuring hole

3 = Piston

X = Piston stroke/disk clearance

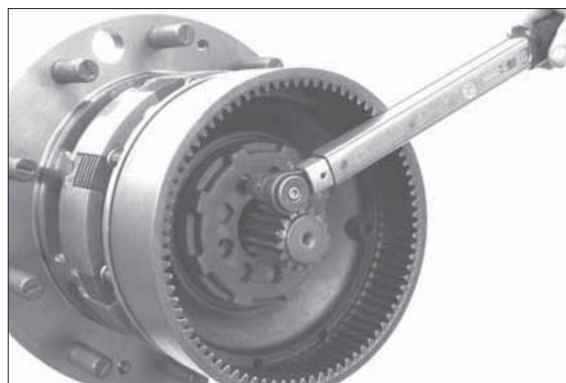
(S) Straightedge 5870 200 022



17W98RA131

- (30) Secure slotted nut with cylindrical screw
(see also figure RA127).

Tightening torque (M 10/8.8)
..... MA = 32 Nm



17W98RA132

(31) Planetary carrier

Press thrust washer into the planetary carrier until contact is obtained.

(S) Driver tool 5870 048 263



17W98RA133

- (32) Insert the cylindrical roller bearing into the planetary gear – for this purpose press the cylindrical roller bearing through the packaging sleeve until the snap ring engages into the annular groove of the planetary gear.

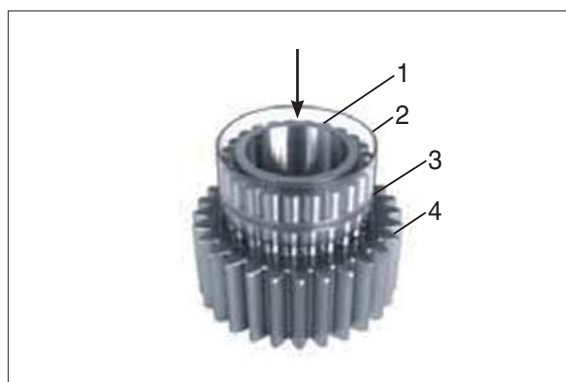
※ Use packaging sleeve to facilitate assembly.

1 = Cylindrical roller bearing

2 = Packaging sleeve

3 = Snap ring

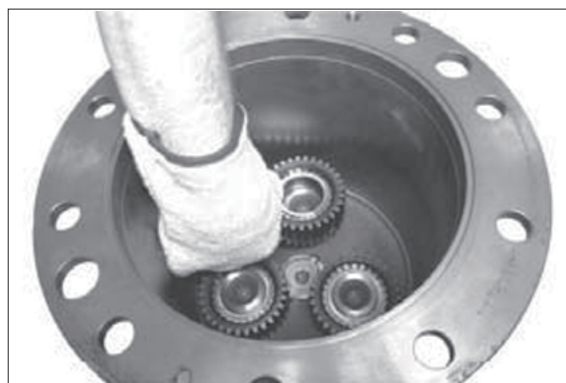
4 = Planetary gear



17W98RA134

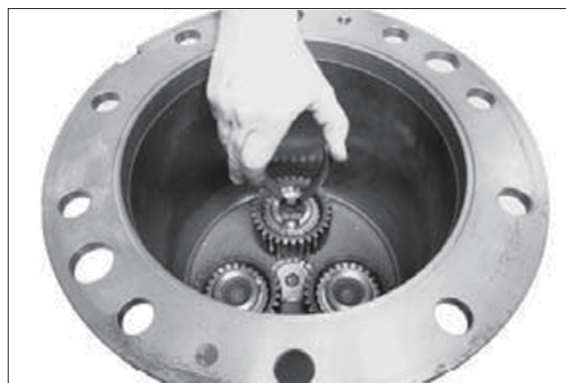
- (33) Heat up bearing inner ring and mount preassembled planetary gear until contact is obtained.

※ Mount bearing inner ring with the large radius facing the planetary carrier (downwards).



17W98RA135

- (34) Fix planetary gear by means of retaining ring.



17W98RA136

- (35) Mount preassembled planetary carrier and fix it with hexagon screws.

Tightening torque (M12/8.8)
..... MA = 55 Nm



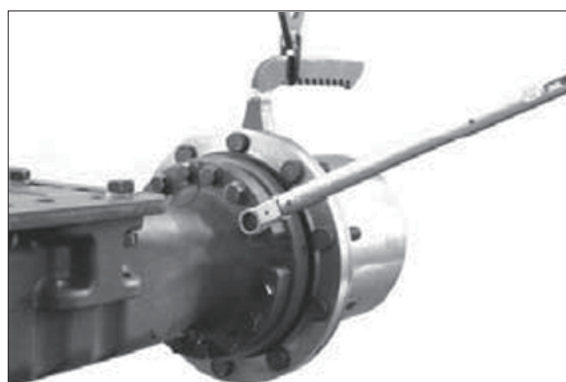
17W98RA137

(36) Output assy

Use lifting tackle (S) to locate the output assy at the axle, mount stub shaft into the teeth of the axle bevel gear and fix output assy with hexagon screws.

Tightening torque (M16/10.9)
..... MA = 280 Nm

(S) Lifting bracket 5870 281 043



17W98RA138

- ※ Prior to putting the axle into operation, fill in oil.
Observe the vehicle manufacturer's instructions and specifications for the installation and commissioning of the unit.

GROUP 11 RCV LEVER

1. REMOVAL AND INSTALL

1) REMOVAL

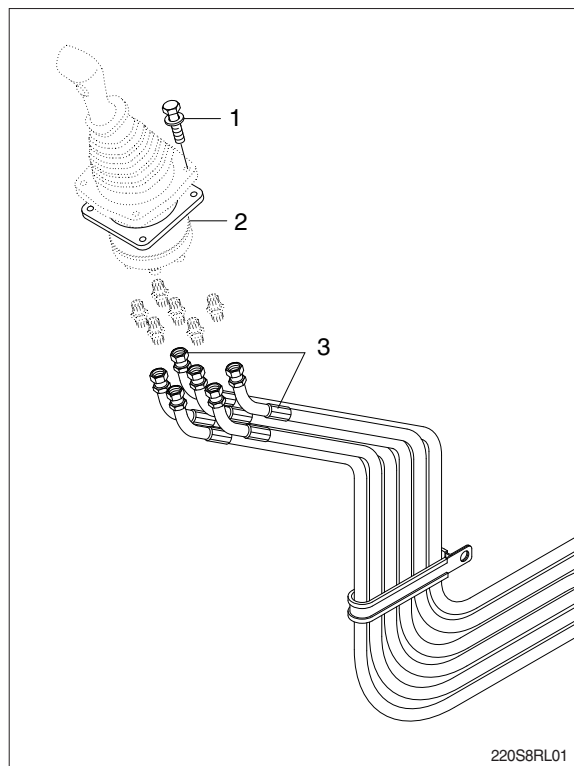
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

- (4) Loosen the socket bolt (1).
Tightening torque : $1.05 \pm 0.2 \text{ kgf} \cdot \text{m}$
($7.6 \pm 1.45 \text{ lbf} \cdot \text{ft}$)
 - (5) Remove the cover of the console box.
 - (6) Disconnect pilot line hoses (3).
 - (7) Remove the pilot valve assembly (2).
- ※ When removing the pilot valve assembly, check that all the hoses have been disconnected.

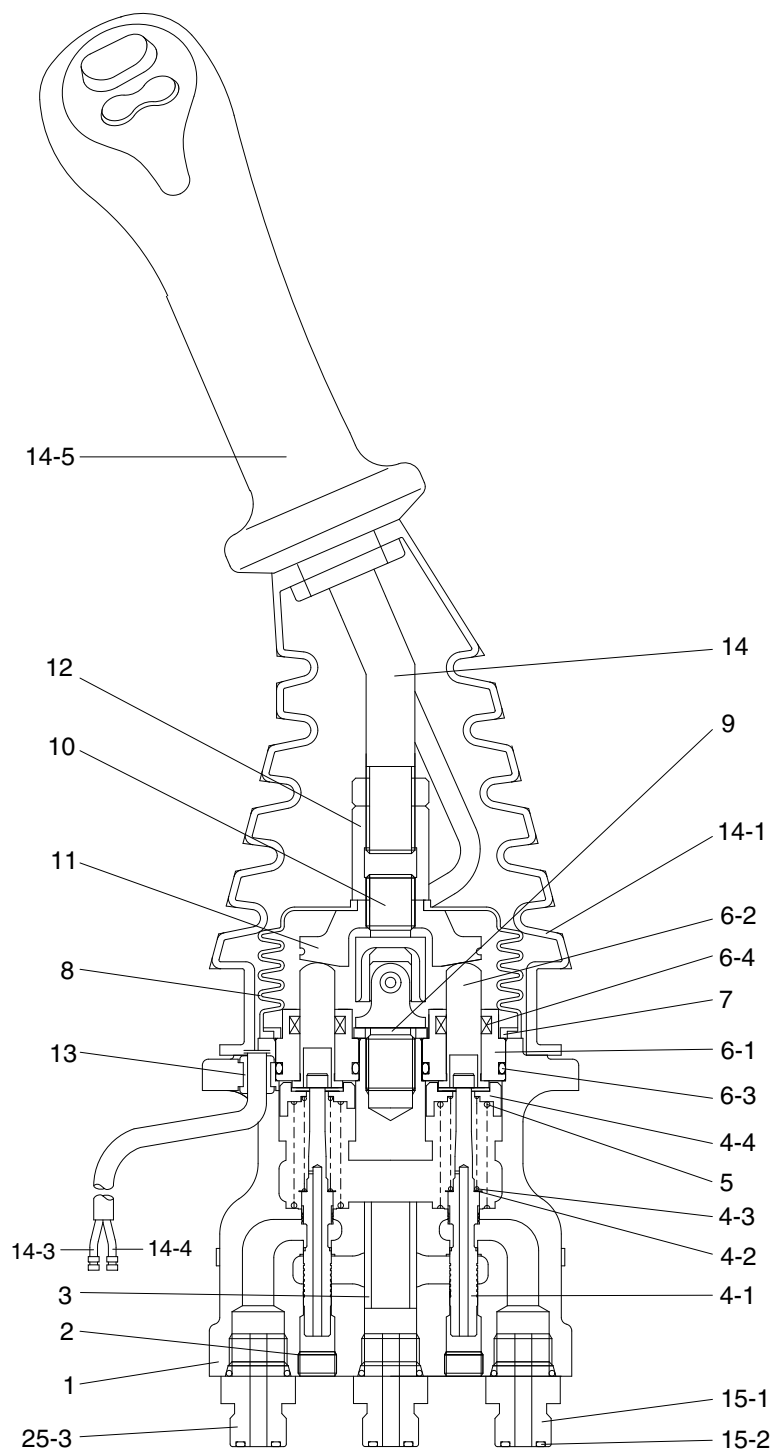
2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Confirm the hydraulic oil level and check the hydraulic oil leak or not.



2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

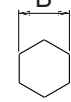


140WA2RL06

1	Case	5	Spring	9	Spacer	14-3	Housing
2	Plug	6-1	Plug	10	Joint Assy	14-4	Housing
3	Bushing	6-2	Push rod	11	Swash plate	14-5	Handle
4-1	Spool	6-3	O-ring	12	Adjusting nut	14-6	Lock nut
4-2	Shim	6-4	Rod seal	13	Bushing	15-1	Filter
4-3	Spring	7	Spacer	14-1	Boot	15-2	Connector
4-4	Spring seat	8	Boot	14-2	Spring pin	15-3	Connector

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	6	
Spanne	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

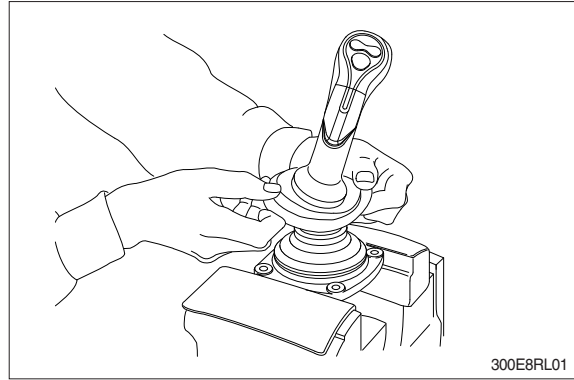
(2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Joint	10	M14	3.5	25.3
Swash plate	11	M14	5.0 ± 0.35	36.2 ± 2.5
Adjusting nut	12	M14	5.0 ± 0.35	36.2 ± 2.5
Lock nut	14-6	M14	5.0 ± 0.35	36.2 ± 2.5

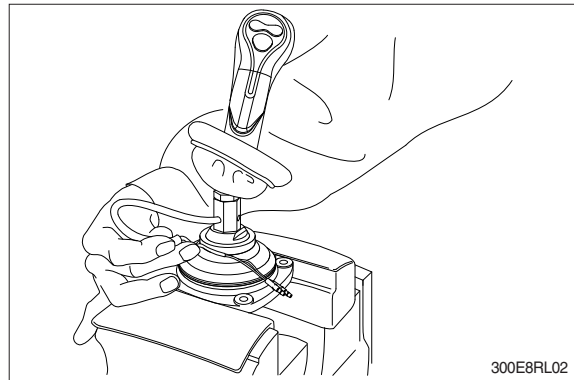
3) DISASSEMBLY

※ Procedures are based on the type M25.

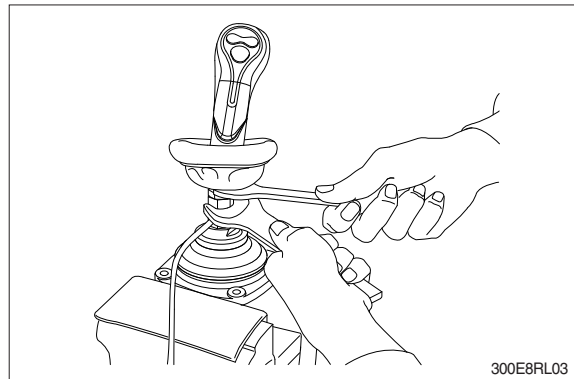
- (1) Clean pilot valve with kerosene.
- ※ Put blind plugs into all ports
- (2) Fix pilot valve in a vise with copper (or lead) sheets.
- (3) Remove end of boot (14-1) from case (1) and take it out upwards.



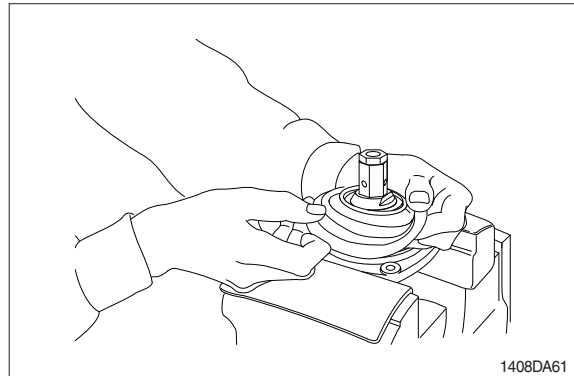
※ For valve with switch, remove cord also through hole of casing.



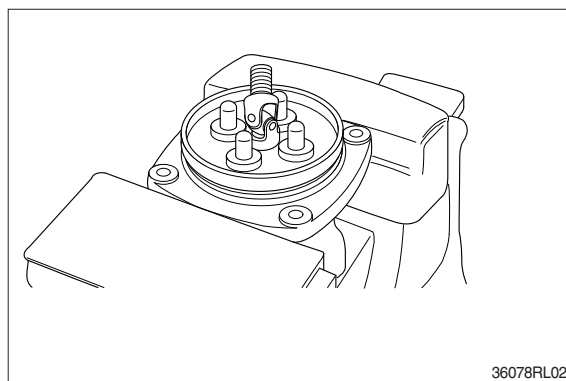
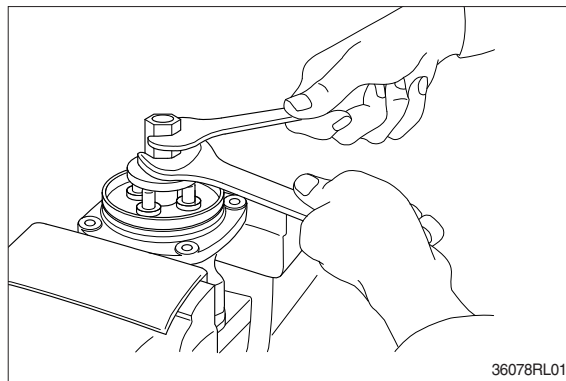
- (4) Loosen lock nut (14-6) and adjusting nut (12) with spanners on them respectively, and take out handle section as one body.



- (5) Remove the boot (8).

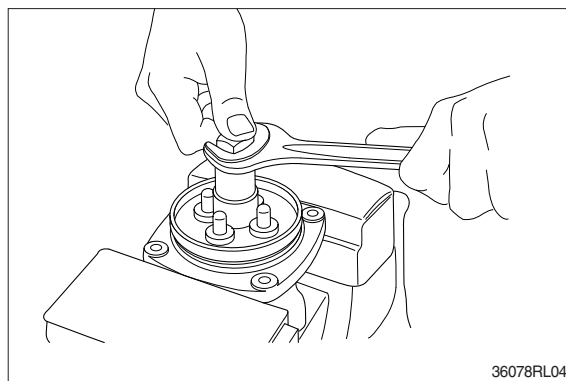
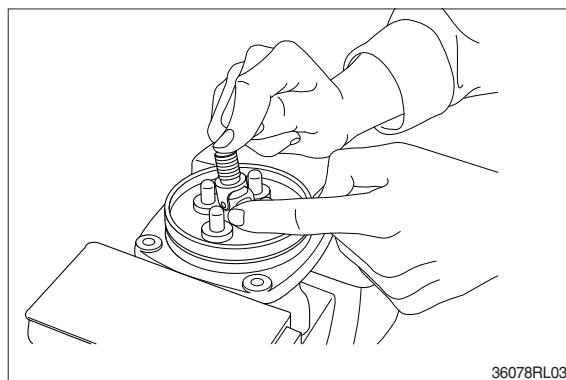


- (6) Loosen adjusting nut (12) and swash plate (11) with spanners on them respectively, and remove them.

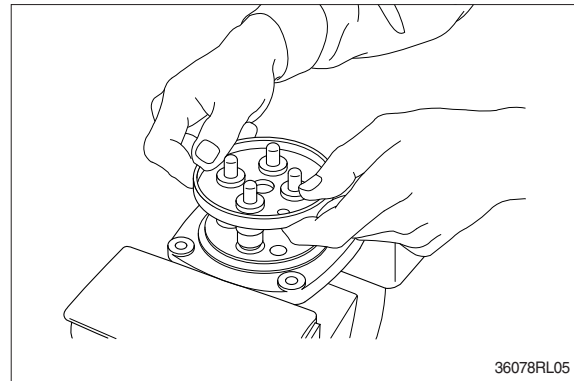


- (7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

- ※ When return spring (5) is strong in force, plate (7), plug (6-1) and push rod (6-2) will come up on loosening joint. Pay attention to this.



(8) Remove plate (7-1).



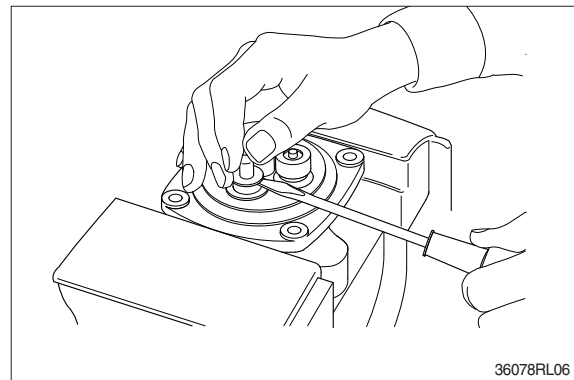
(9) When return spring (5) is weak in force, plug (6-1) stays in casing because of sliding resistance of O-ring.

※ Take it out with minus screwdriver.

Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

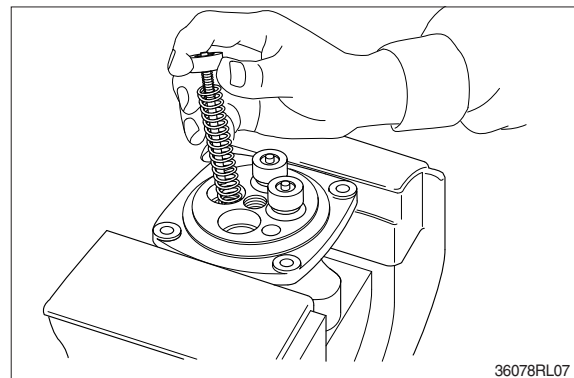
※ During taking out, plug may jump up due to return spring (5) force.

Pay attention to this.



(10) Remove reducing valve subassembly and return spring (5) out of casing.

※ Record relative position of reducing valve subassembly and return springs.

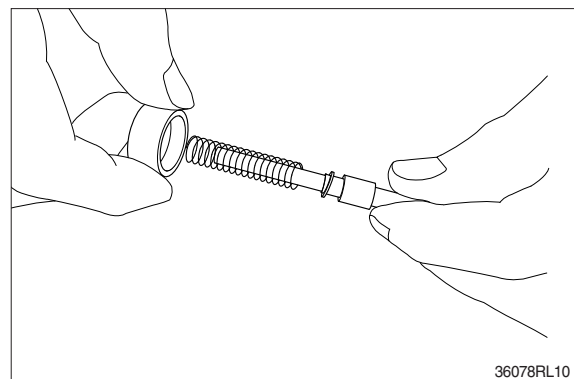


(11) Separate spool (4-1), spring seat (4-4), spring (4-3) and shim (4-2) individually.

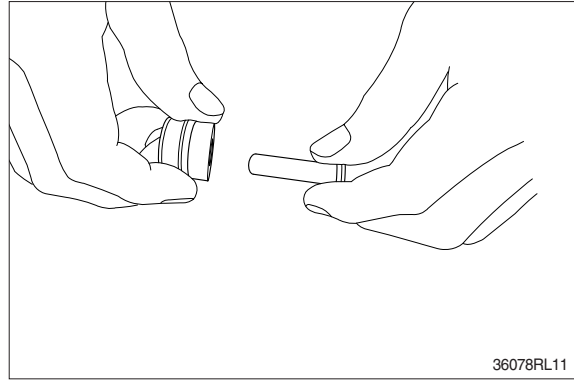
※ Pay attention not to damage spool surface.

※ Record original position of spring seat (4-4).

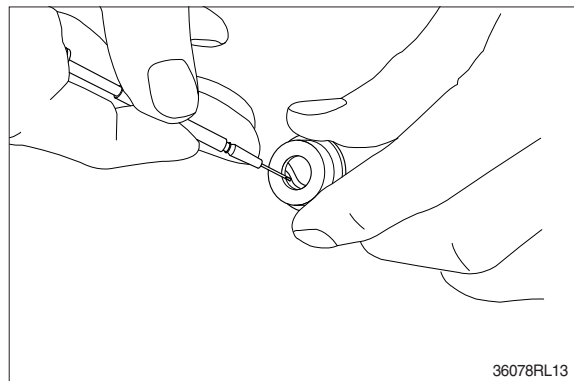
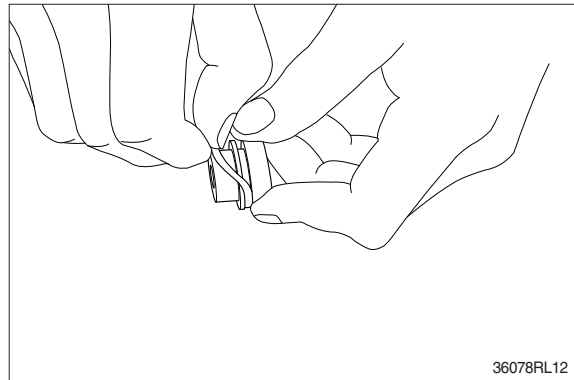
※ Until being assembled, they should be handled as one subassembly group.



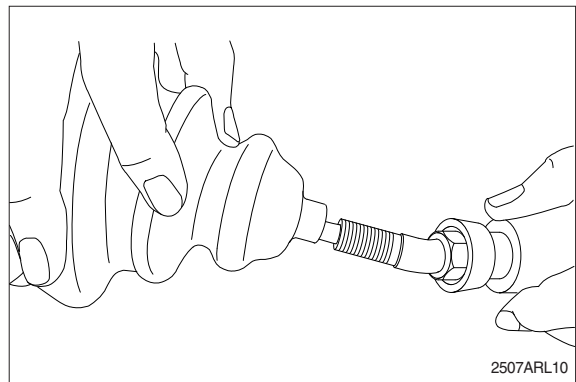
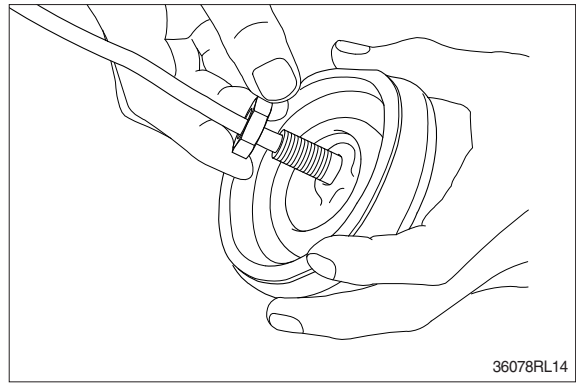
(12) Take push rod (6-2) out of plug (6-1).



(13) Remove O-ring (8-3) and seal (6-4) from plug (6-1).
Use small minus screwdriver or so on to remove this seal.



(14) Remove lock nut (14-6) and then boot (14-1).



(15) Cleaning of parts

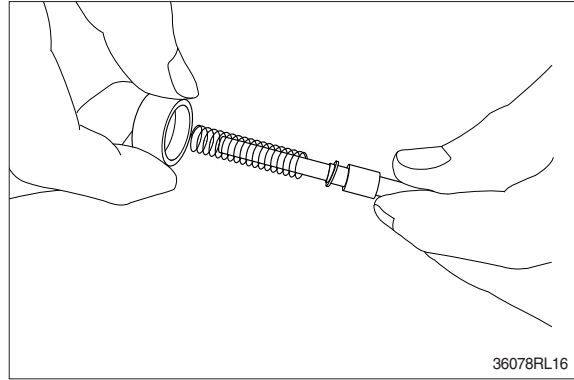
- ① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).
 - ※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.
 - ※ If this kerosene is polluted, parts will be damaged and functions of reassembled valve will be degraded.
Therefore, control cleanliness of kerosene fully.
- ② Put parts in final cleaning vessel filled with kerosene, turning it slowly to clean them even to their insides (finish cleaning).
 - ※ Do not dry parts with compressed air, since they will be damaged and/or rusted by dust and moisture in air.

(16) Rust prevention of parts

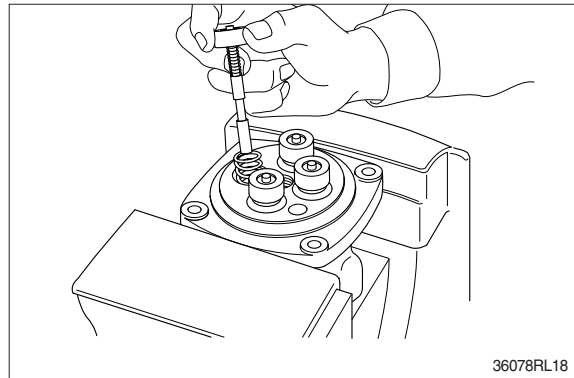
- Apply rust-preventives to all parts.
- ※ If left as they are after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

4) ASSEMBLY

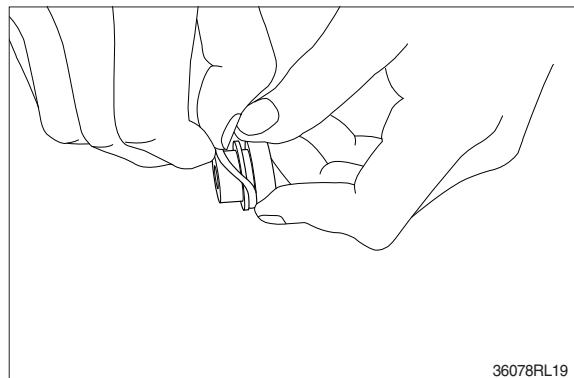
- (1) Put shim (4-2), springs (4-3) and spring seat (4-4) onto spool (3) in this order.



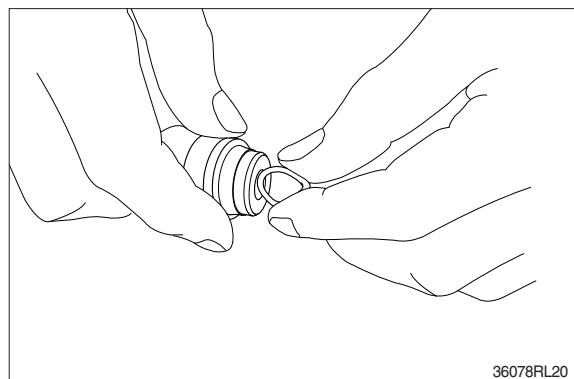
- (2) Assemble spring (5) into casing (1).
Assemble reducing valve subassembly into casing.
※ Assemble them to their original positions.



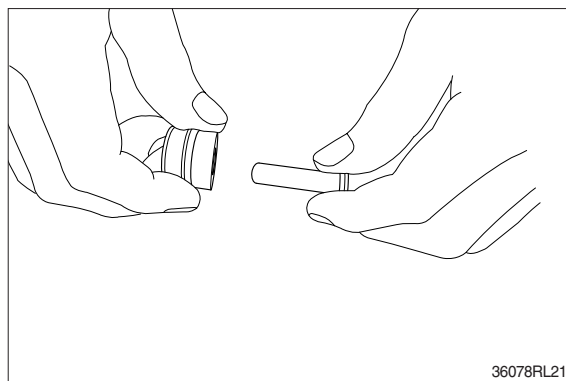
- (3) Assemble O-ring (8-3) onto plug (6-1).



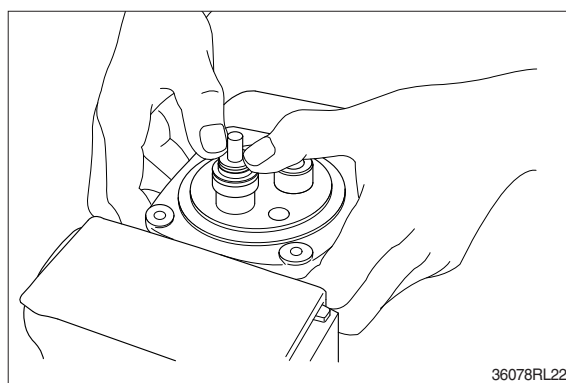
- (4) Assemble seal (6-4) to plug (6-1).
※ Assemble seal in such lip direction as shown below.



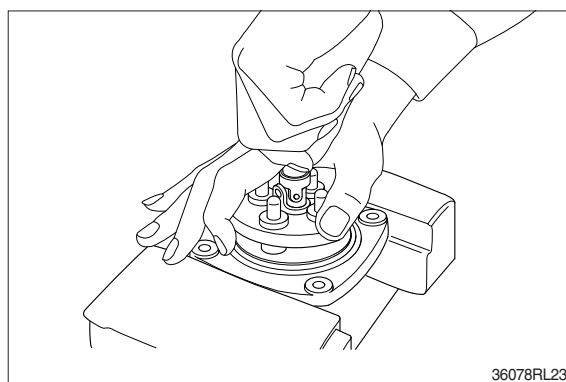
- (5) Assemble push rod (6-2) to plug (6-1).
※ Apply working oil on push-rod surface.



- (6) Assemble plug subassembly to casing.
※ When return spring is weak in force, subassembly stops due to resistance of O-ring.

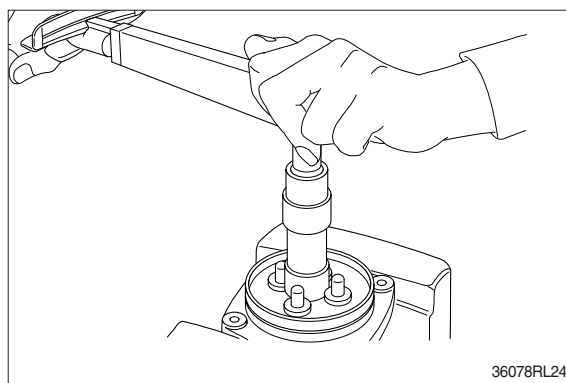


- (7) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (7), and tighten joint (10) temporarily.



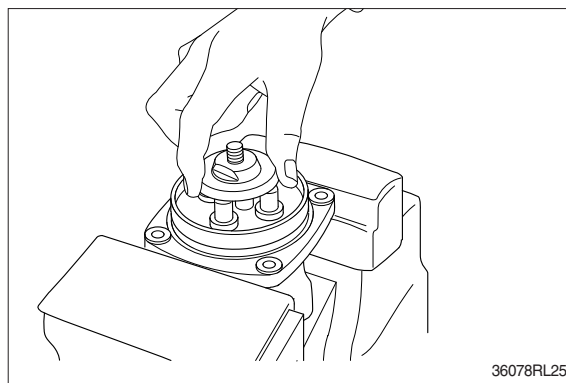
- (8) Fit plate (7).

- (9) Tighten joint (10) with the specified torque to casing, utilizing jig.



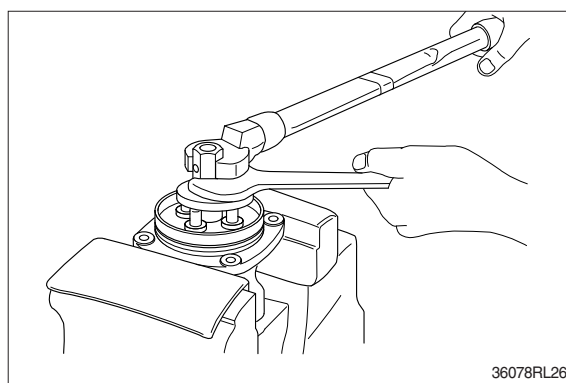
(10) Assemble swash plate (11) to joint (10).

- ※ Screw it to position that it contacts with 4 push rods evenly.
- ※ Do not screw it over.

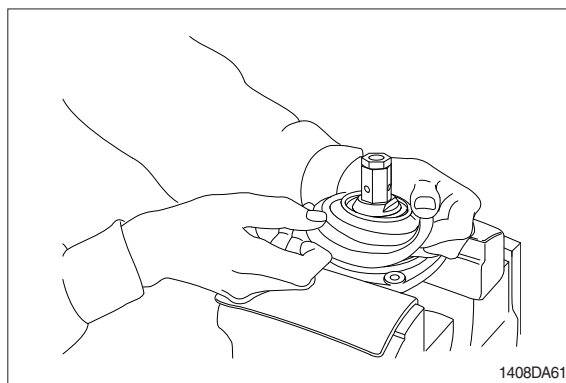


(11) Assemble adjusting nut (12), apply spanner to width across flat of plate (11) to fix it, and tighten adjusting nut to the specified torque.

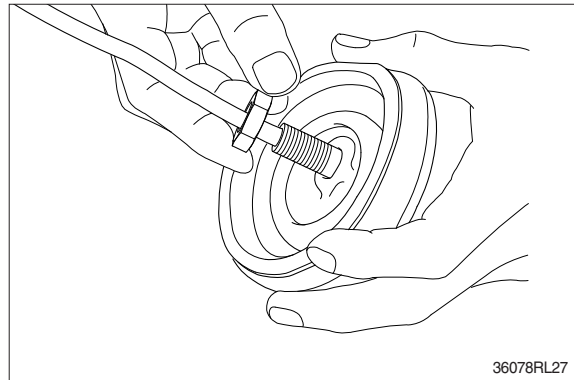
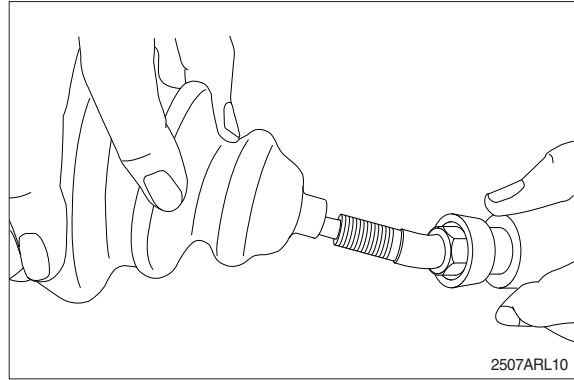
- ※ During tightening, do not change position of disk.



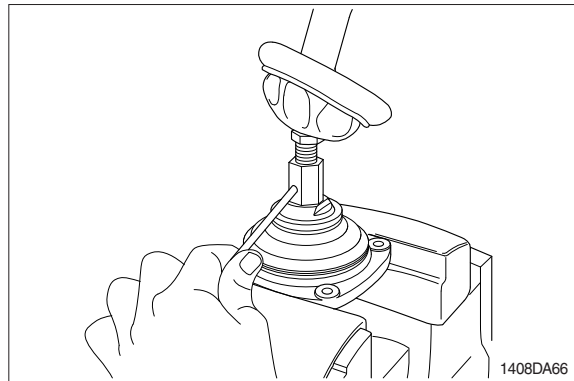
(12) Fit boot (8) to plate.



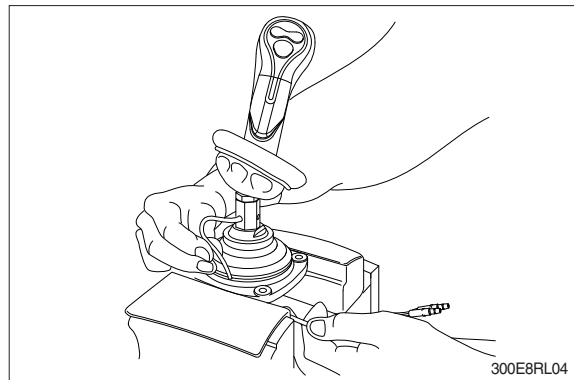
- (13) Fit boot (14-1) and lock nut (14-6), and handle subassembly is assembled completely.



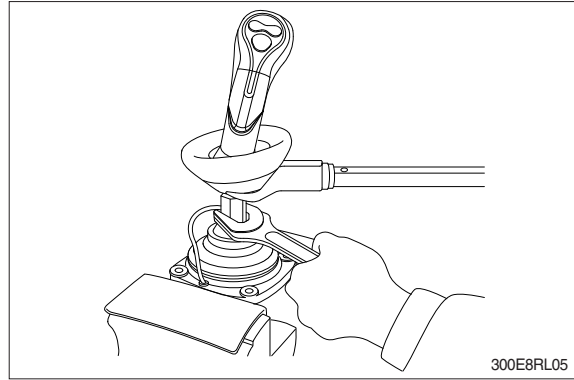
- (14) Pull out cord and tube through adjusting nut hole provided in direction 60 ° to 120 ° from casing hole.



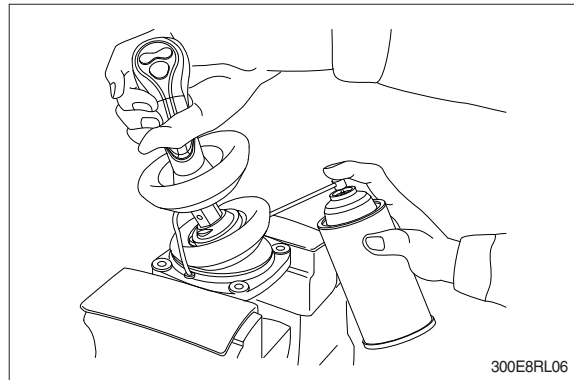
- (15) Assemble bushing (13) to plate and pass cord and tube through it.
※ Provide margin necessary to operation.



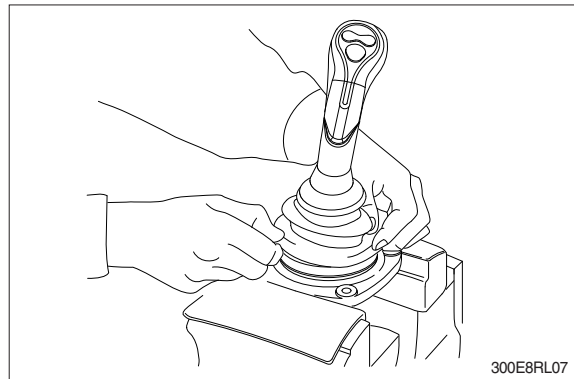
- (16) Determine handle direction, tighten lock nut (14-6) to specified torque to fix handle.



- (17) Apply grease to rotating section of joint and contacting faces of disk and push rod.



- (18) Assemble lower end of bellows to casing.
(19) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



GROUP 12 TURNING JOINT

1. REMOVAL AND INSTALL

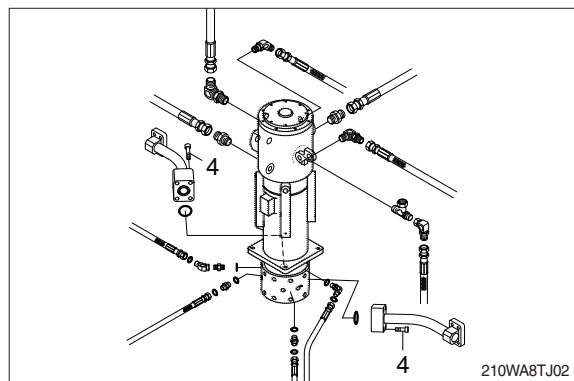
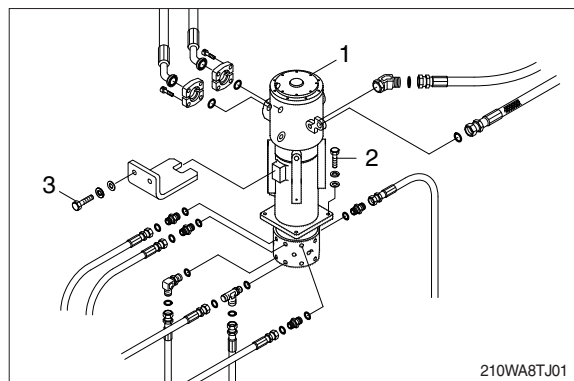
1) REMOVAL

- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

▲ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

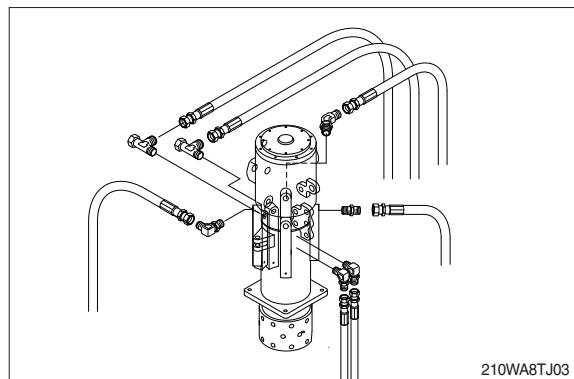
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (4) Disconnect all hoses.
- (5) Sling the turning joint assembly (1) and remove the mounting bolt (2, 3).
 - Weight : 118 kg (260 lb)
 - Tightening torque : $12.8 \pm 3.0 \text{ kgf} \cdot \text{m}$
($92.6 \pm 21.7 \text{ lbf} \cdot \text{ft}$)
- (6) Loosen the socket bolts (4) and remove the pipes.
- (7) Remove the turning joint (1) assembly.
 - ※ When removing the turning joint, check that all the hoses have been disconnected.



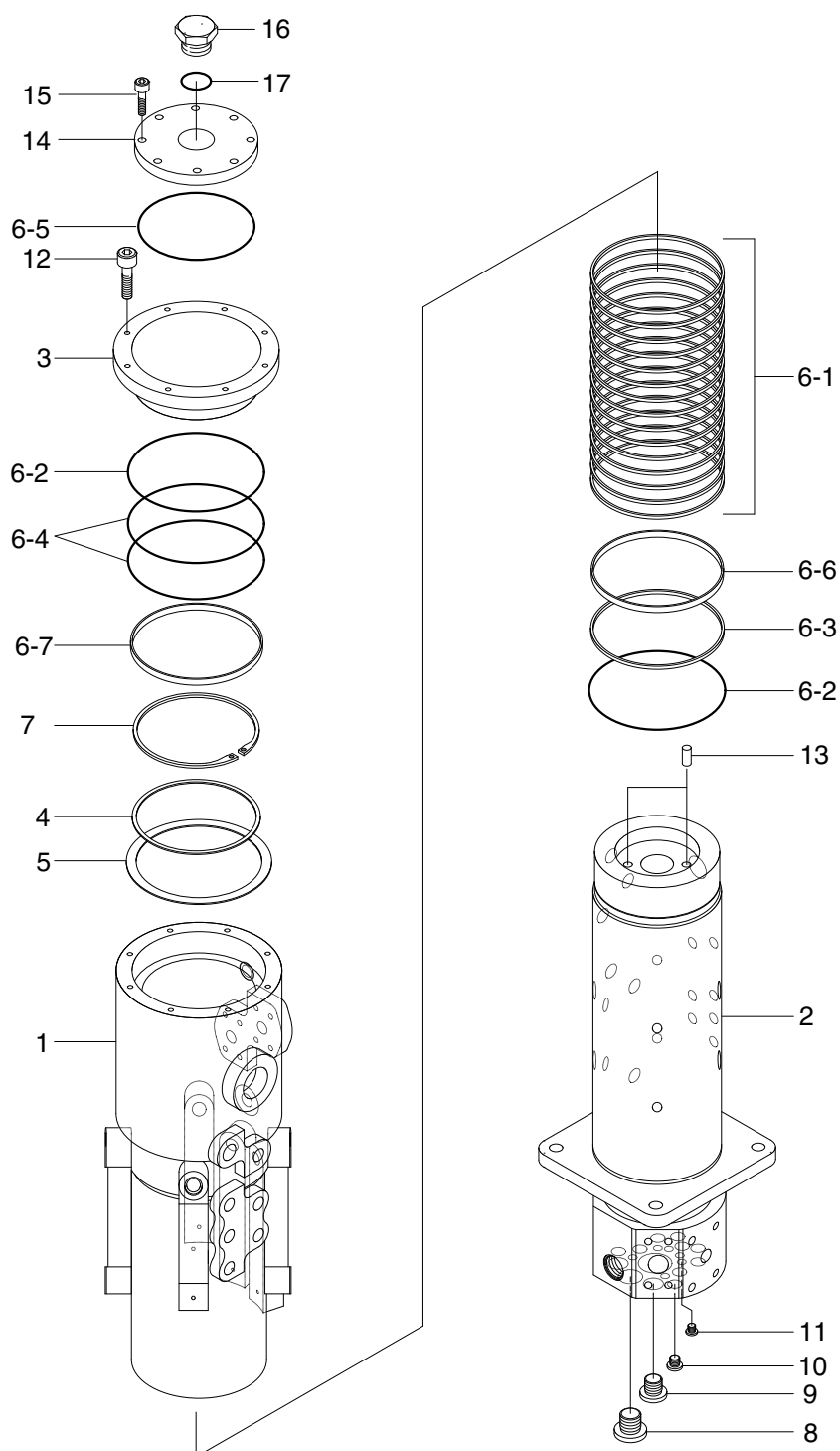
2) INSTALL

- (1) Carry out installation in the reverse order to removal.
 - ※ Take care of turning joint direction.
 - ※ Assemble hoses to their original positions.
 - ※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.



2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

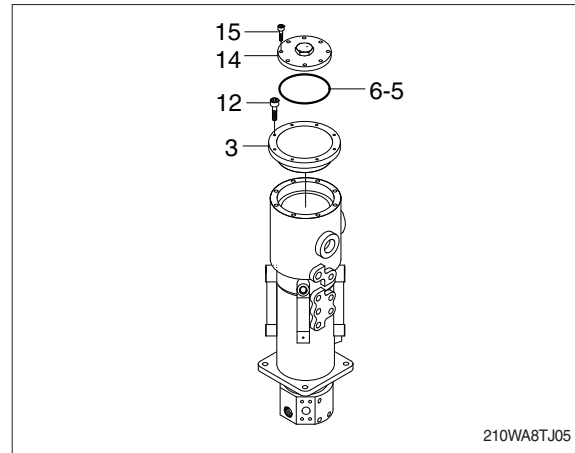


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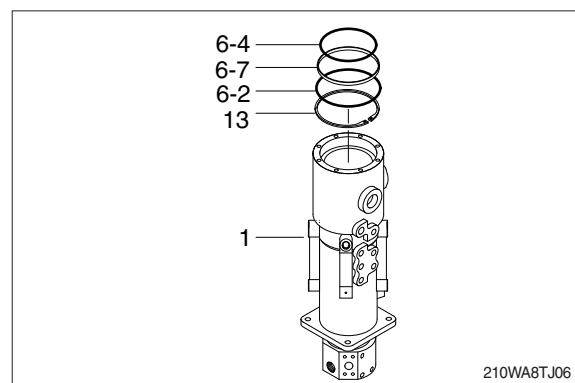
2) DISASSEMBLY

※ Before the disassembly, clean the turning joint.

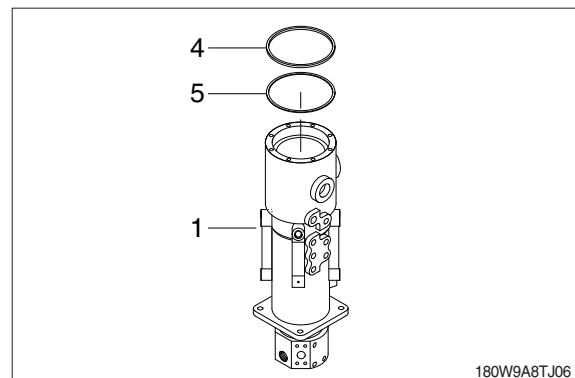
- (1) Loosen the hexagon bolt (15) and remove cover (14) and O-ring (6-5).
- (2) Loosen the socket bolt (12) and remove cover (3).



- (3) Remove O-ring (6-4), wear ring (6-7), O-ring (6-2) and retainer ring (7) from hub (1).



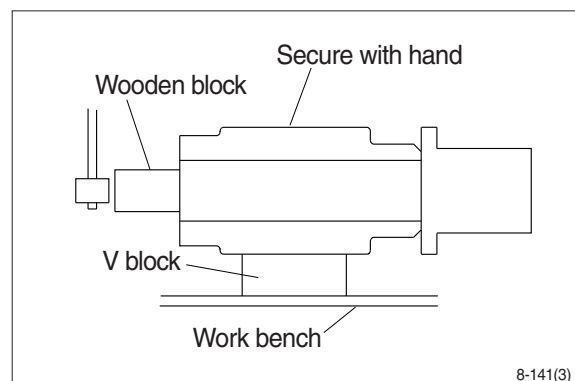
- (4) Remove spacer (4) and shim (5) from hub (1).



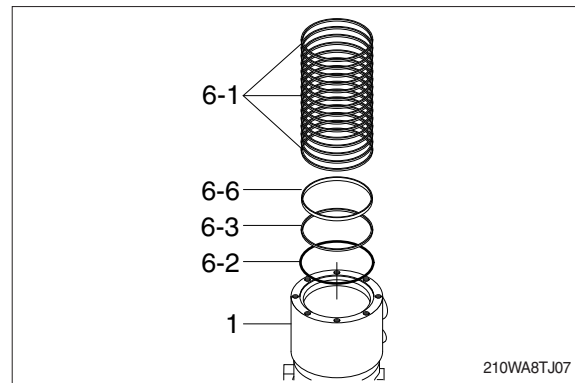
- (5) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the hub with a hammer.

※ Take care not to damage the shaft (2) when remove hub (1) or rest it sideways.

※ Put a fitting mark on hub (1) and shaft (2).



- (6) Remove seventeen slipper seal (6-1), O-ring (6-2, 6-3) and wear ring (6-6) from hub (1).

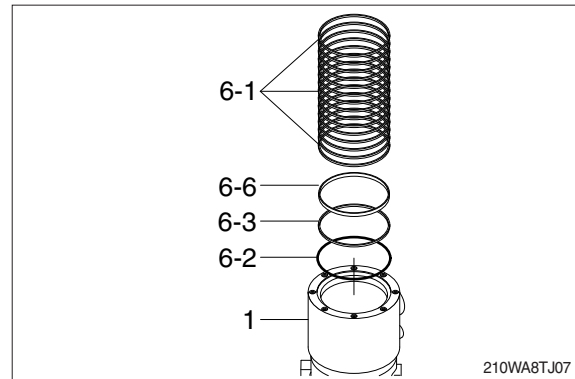


3) ASSEMBLY

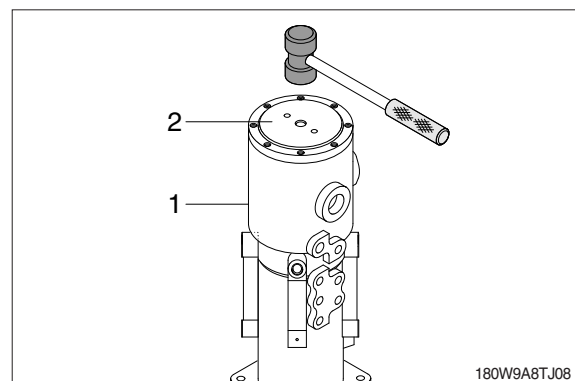
- ※ Clean all parts.
- ※ As a general rule, replace oil seals and O-ring.
- ※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fit O-ring (6-3), seventeen slipper seal (6-1), and wear ring (6-6).

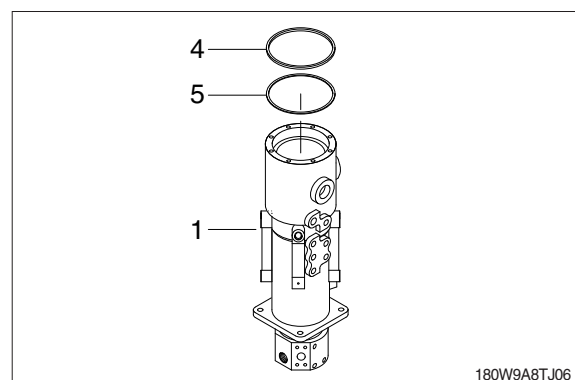
(2) Fit O-ring (6-2) to hub (1).



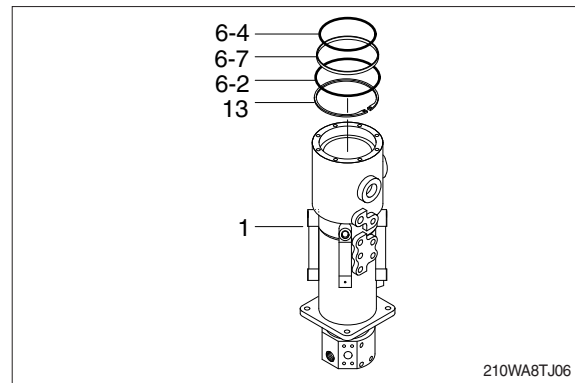
(3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.



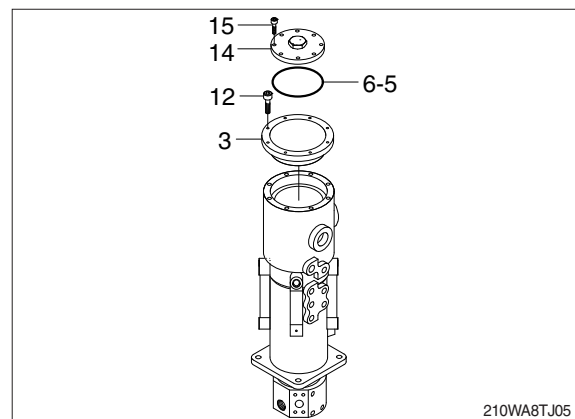
(4) Fit shim (5), and spacer (4) to hub (1) of turning joint upside.



- (5) Fit retainer ring (7), O-ring (6-2) and wear ring (6-7) to hub (1).
- (6) Fit O-ring (6-4) to hub (1).



- (7) Install cover (3) to hub and tighten bolts (12).
- Torque : 2.5~3.55 kgf · m
(18.1~25.3 lbf · ft)
- (8) Attach O-ring (6-5) to the cover (14) and tighten the bolts (15).
- Torque : 0.7~1.1 kgf · m
(5.1~8.0 lbf · ft)



GROUP 9 BOOM, ARM, BUCKET, DOZER AND OUTRIGGER CYLINDER

1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

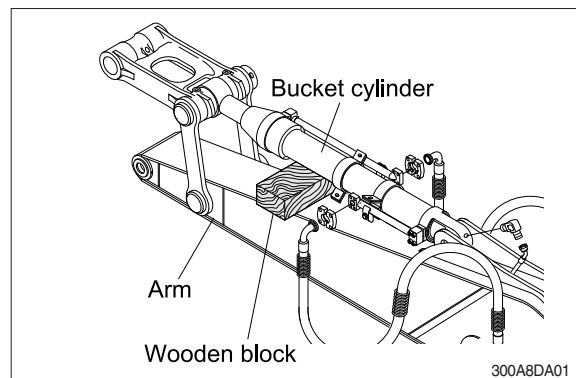
(1) Removal

- ※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
- ※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- ※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

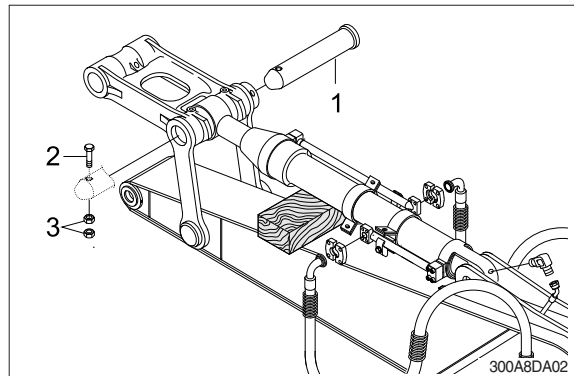
- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

- ① Set block between bucket cylinder and arm.

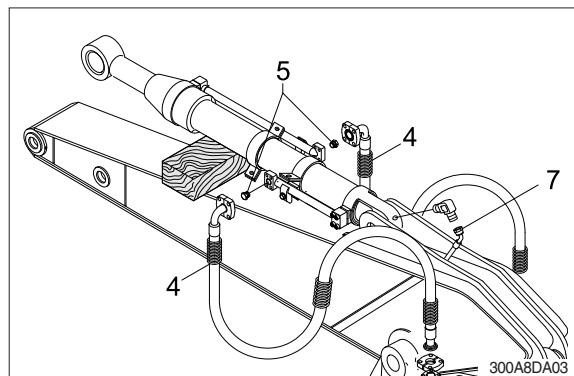


- ② Remove bolt (2), nut (3) and pull out pin (1).

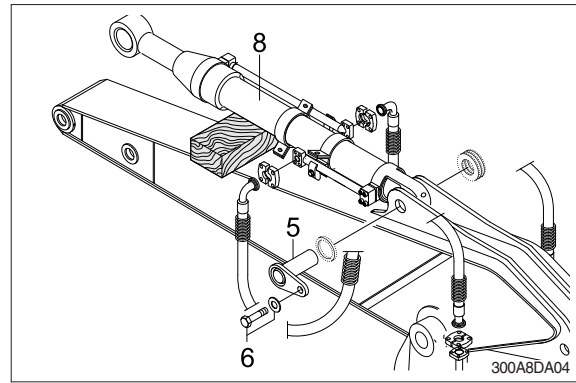
- ※ Tie the rod with wire to prevent it from coming out.
 - Tightening torque (2) : $57.9 \pm 8.7 \text{ kgf} \cdot \text{m}$
($419 \pm 62.9 \text{ lbf} \cdot \text{ft}$)



- ③ Disconnect bucket cylinder hoses (4), grease line hose (7) and put plugs (5) on cylinder pipe.



- ④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).
 - Tightening torque (6) : $29.7 \pm 4.5 \text{ kgf} \cdot \text{m}$
($215 \pm 32.5 \text{ lbf} \cdot \text{ft}$)
- ⑤ Remove bucket cylinder assembly (8).
 - Weight : 171 kg (380 lb)



(2) Install

- ① Carry out installation in the reverse order to removal.
- ▲ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**
- ※ Bleed the air from the bucket cylinder.
 - ※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

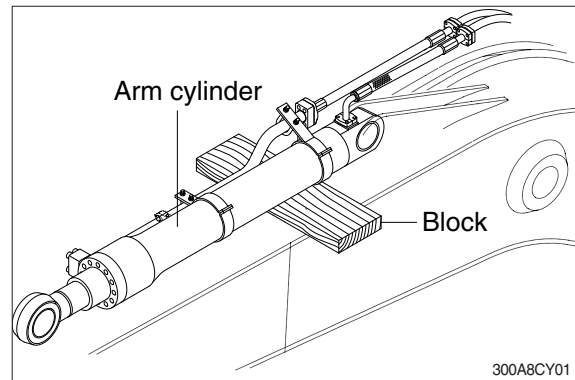
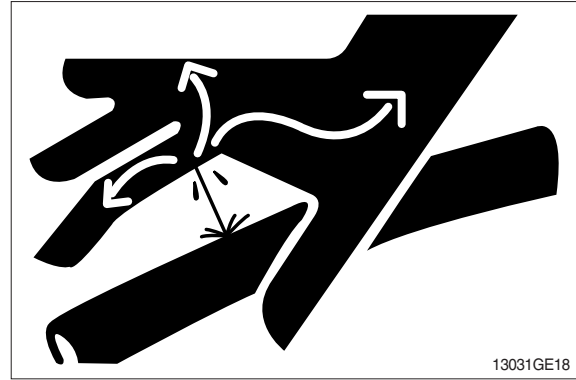
2) ARM CYLINDER

(1) Removal

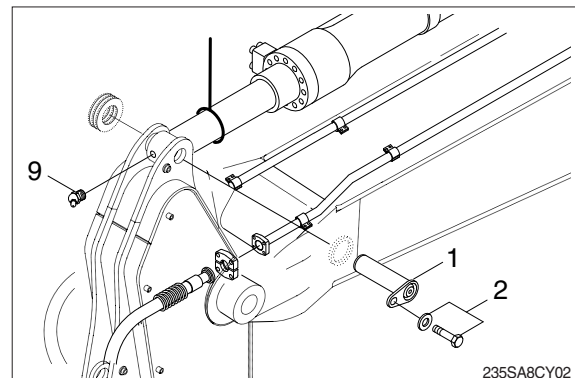
- ※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
- ※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- ※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

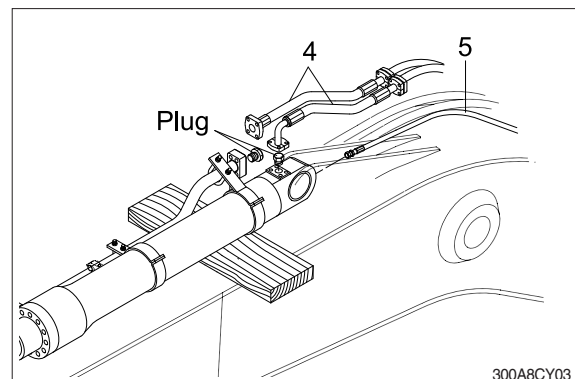
- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.
- ① Set block between arm cylinder and boom.



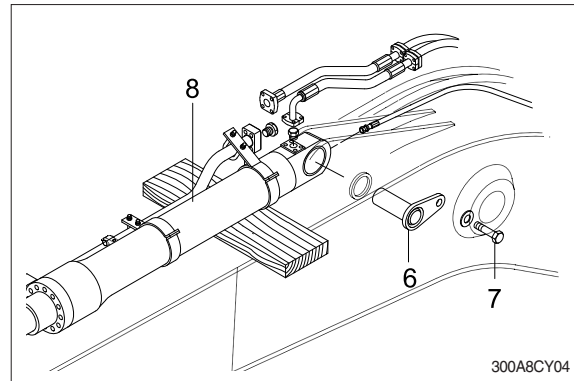
- ② Loosen grease nipple (9).
 - ③ Remove bolt (2) and pull out pin (1).
- ※ Tie the rod with wire to prevent it from coming out.
 - Tightening torque (2) : $29.7 \pm 4.5 \text{ kgf} \cdot \text{m}$
($215 \pm 32.5 \text{ lbf} \cdot \text{ft}$)



- ④ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.
- ⑤ Disconnect greasing pipings (5).



- ⑥ Sling arm cylinder assembly(8) and remove bolt (7) then pull out pin (6).
- Tightening torque (7) : $29.7 \pm 4.5 \text{ kgf} \cdot \text{m}$
($215 \pm 32.5 \text{ lbf} \cdot \text{ft}$)
- ⑦ Remove arm cylinder assembly (8).
- Weight : 278 kg (613 lb)



(2) Install

- ① Carry out installation in the reverse order to removal.
- ▲ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**
- ※ Bleed the air from the arm cylinder.
 - ※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

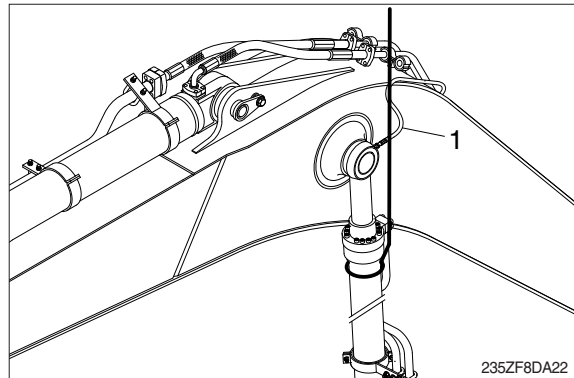
3) BOOM CYLINDER

(1) Removal

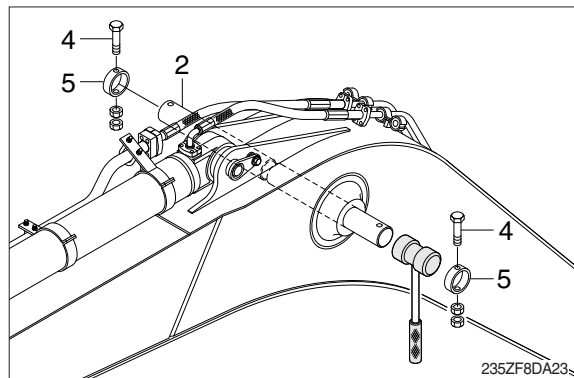
- ※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
- ※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- ※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

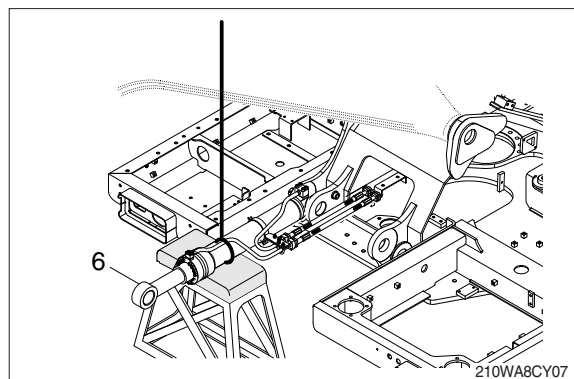
- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.
- ① Disconnect greasing hoses (1).
- ② Sling boom cylinder assembly.



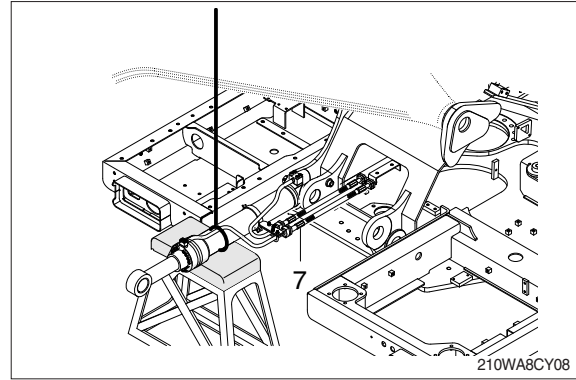
- ③ Remove bolt (4), stopper (5) and pull out pin (2).
- ※ Tie the rod with wire to prevent it from coming out.
- Tightening torque (4) : $29.7 \pm 4.5 \text{ kgf} \cdot \text{m}$
($215 \pm 32.5 \text{ lbf} \cdot \text{ft}$)



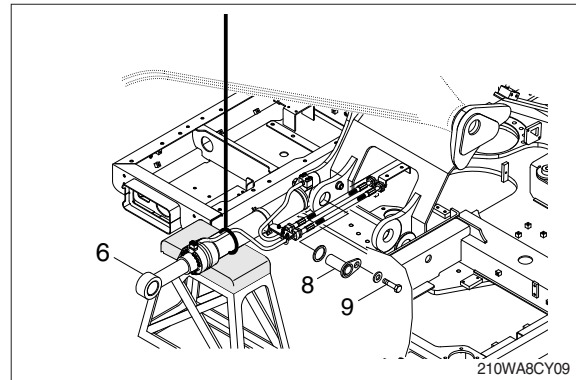
- ④ Lower the boom cylinder assembly (6) on a stand.



- ⑤ Disconnect boom cylinder hoses (7) and put plugs on cylinder pipe.



- ⑥ Remove bolt (9) and pull out pin (8).
· Tightening torque (9) : $29.7 \pm 4.5 \text{ kgf} \cdot \text{m}$
($215 \pm 32.5 \text{ lbf} \cdot \text{ft}$)
- ⑦ Remove boom cylinder assembly (6).
· Weight : 180 kg (397 lb)



(2) Install

- ① Carry out installation in the reverse order to removal.

▲ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

- ※ Bleed the air from the boom cylinder.
- ※ Confirmed the hydraulic oil level and check the hydraulic oil leak or not.

4) DOZER CYLINDER

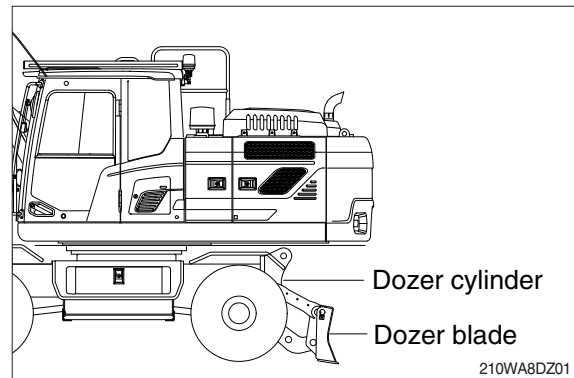
(1) Removal

- ※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
- ※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- ※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

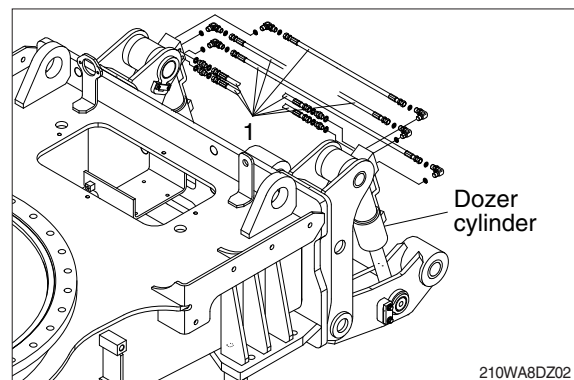
▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Lower the dozer blade to the ground.



② Disconnect dozer cylinder hoses (1), and put plugs on cylinder pipe.

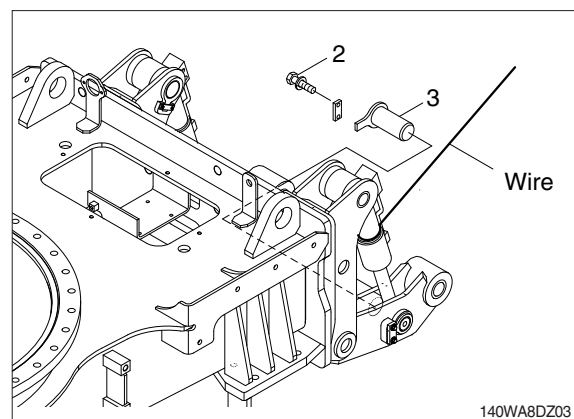


③ Sling dozer cylinder assembly.

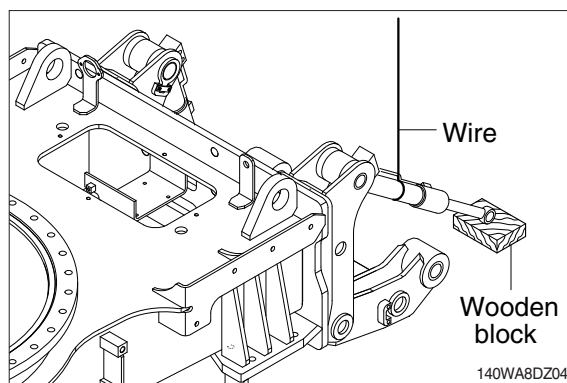
④ Remove bolt (2) and pull out pin (3).

- Tightening torque (2) : $12.8 \pm 3.0 \text{ kgf} \cdot \text{m}$
($92.6 \pm 21.7 \text{ lbf} \cdot \text{ft}$)

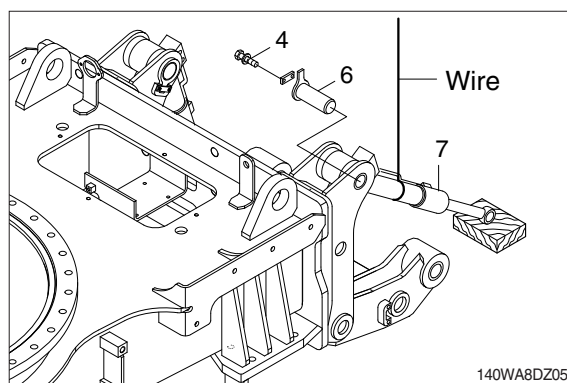
- ※ Tie the rod with wire to prevent it from coming out.



- ⑤ Lower the dozer cylinder rod side on a wooden block.



- ⑥ Loosen the bolt (4) and nut (5), and pull out pin (6).
· Tightening torque (4) : $12.8 \pm 3.0 \text{ kgf} \cdot \text{m}$
($92.6 \pm 21.7 \text{ lbf} \cdot \text{ft}$)
- ⑦ Remove the dozer cylinder assy (7).



(2) Install

- ① Carry out installation in the reverse order to removal.

▲ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

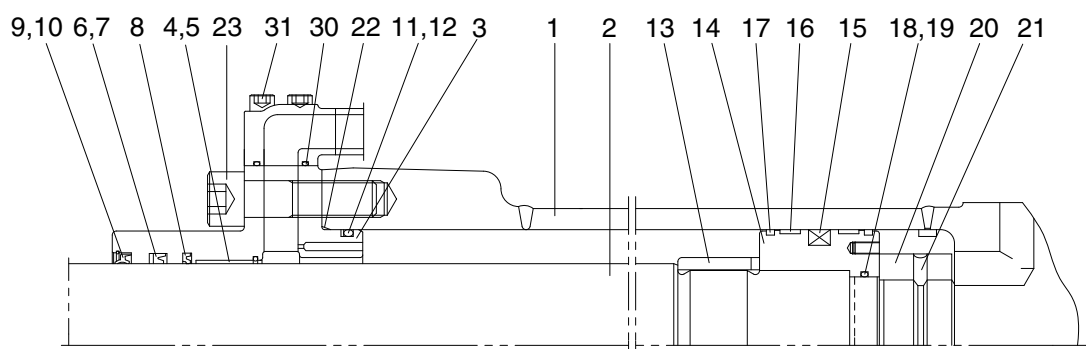
- ※ Bleed the air from the dozer cylinder.
- ※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

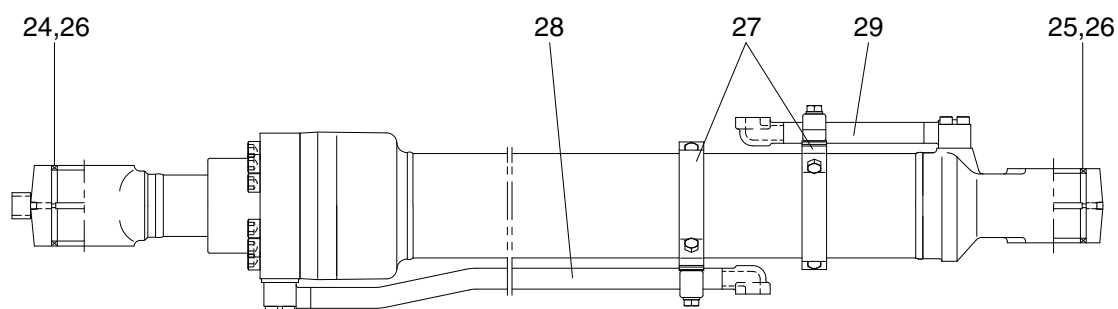
1) STRUCTURE

(1) Bucket cylinder

① Standard (CHANGZHOU)



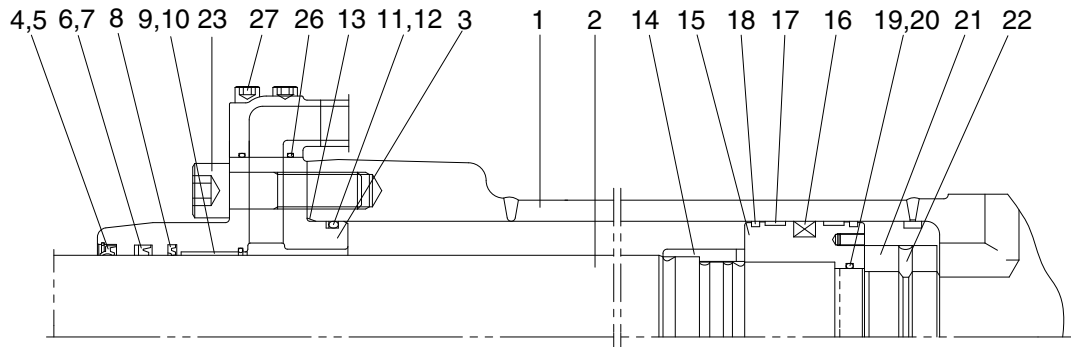
Internal detail



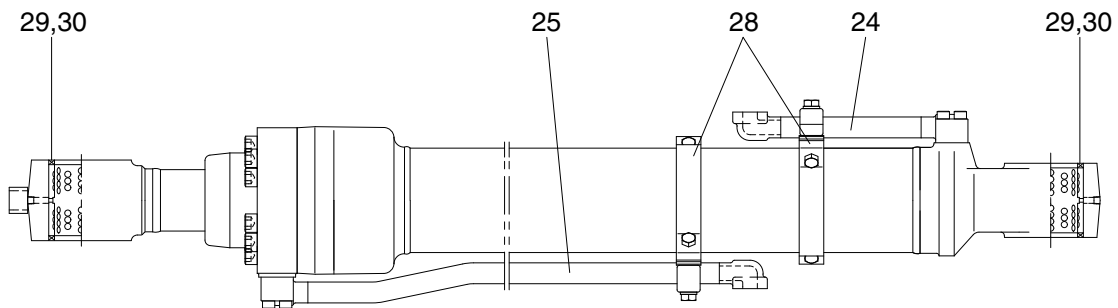
31Q6-60111CGG

1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Dimple bushing
3	Gland	14	Piston	25	Dimple bushing
4	DD2 bushing	15	Piston seal	26	Dust seal
5	Snap ring	16	Wear ring	27	Band assembly
6	Rod seal	17	Dust ring	28	Pipe assembly-R
7	Back up ring	18	O-ring	29	Pipe assembly-B
8	Buffer ring	19	Back up ring	30	O-ring
9	Dust wiper	20	Lock nut	31	Hexagon socket head bolt
10	Snap ring	21	Hex socket headless set screw		
11	O-ring	22	O-ring		

Standard (SHPAC)



Internal detail

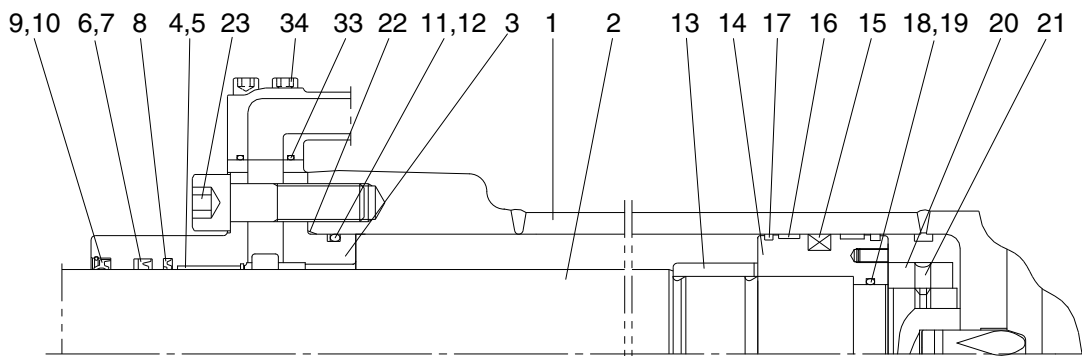


31Q6-60111EGG

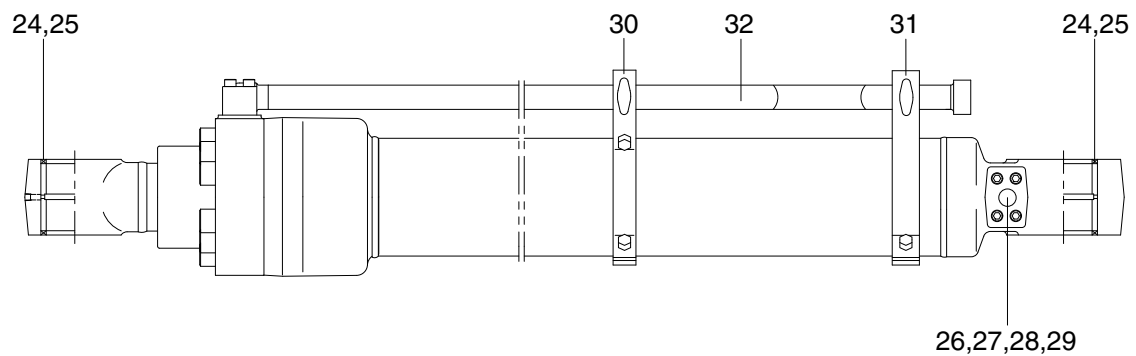
- | | | |
|-------------------|-----------------|----------------------------------|
| 1 Tube assembly | 11 O-ring | 21 Lock nut |
| 2 Rod assembly | 12 Back up ring | 22 Hex socket headless set screw |
| 3 Gland | 13 O-ring | 23 Hexagon socket head bolt |
| 4 Dust wiper | 14 Cushion ring | 24 Pipe assembly-B |
| 5 Retaining ring | 15 Piston | 25 Pipe assembly-R |
| 6 Rod seal | 16 Piston seal | 26 O-ring |
| 7 Back up ring | 17 Wear ring | 27 Hexagon socket head bolt |
| 8 Buffer ring | 18 Dust ring | 28 Band assembly |
| 9 Dry bearing | 19 O-ring | 29 Dimple bushing |
| 10 Retaining ring | 20 Back up ring | 30 Dust seal |

(2) Arm cylinder

① Standard (CHANGZHOU)



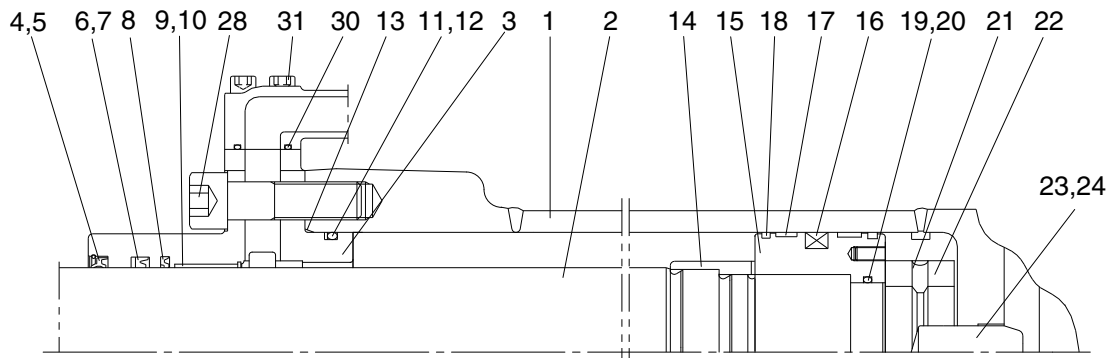
Internal detail



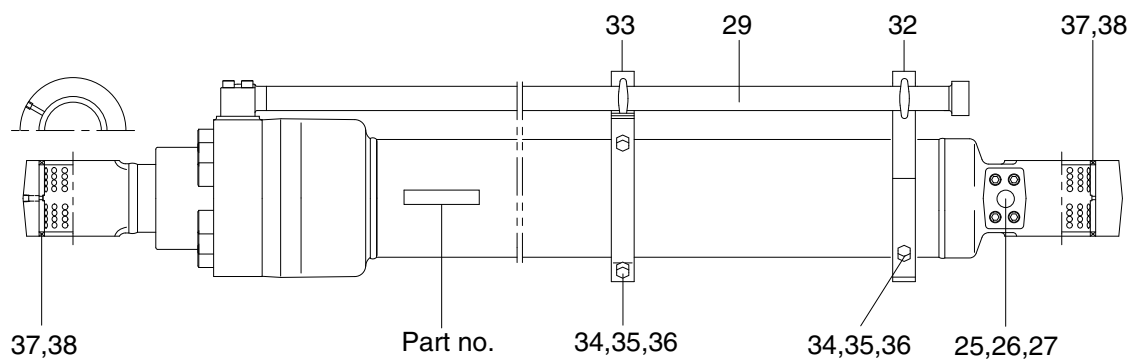
31Q6-50132CGG

1 Tube assembly	13 Cushion ring	25 Dust seal
2 Rod assembly	14 Piston	26 Check valve
3 Gland	15 Piston seal	27 Coil spring
4 DD2 bushing	16 Wear ring	28 O-ring
5 Snap ring	17 Dust ring	29 Plug
6 Rod seal	18 O-ring	30 Band assembly-R
7 Back up ring	19 Back up ring	31 Band assembly-B
8 Buffer ring	20 Lock nut	32 Pipe assembly-R
9 Dust wiper	21 Hex socket headless set screw	33 O-ring
10 Snap ring	22 O-ring	34 Hexagon socket head bolt
11 O-ring	23 Hexagon socket head bolt	
12 Back up ring	24 Dimple bushing	

Standard (SHPAC)



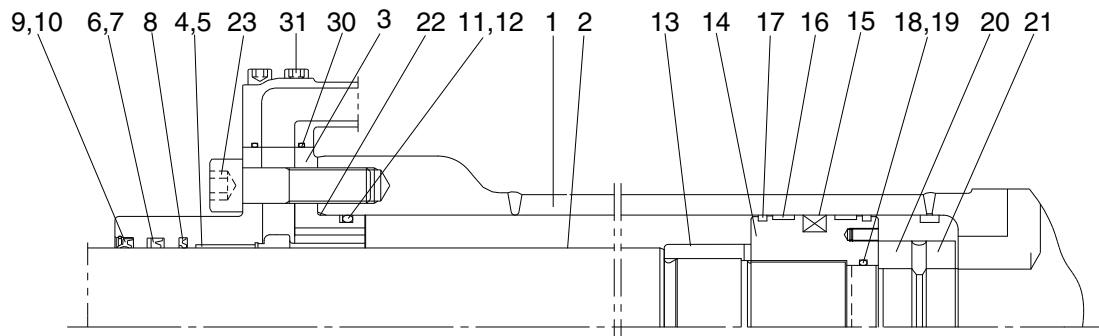
Internal detail



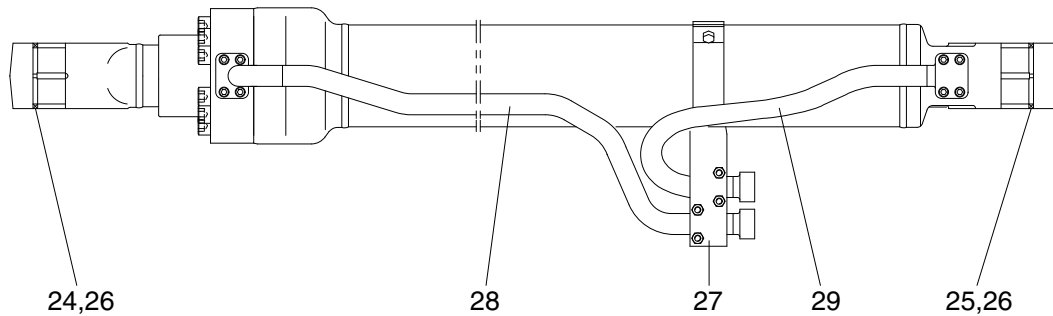
31Q6-50132EGG

1	Tube assembly	14	Cushion ring	27	Plug
2	Rod assembly	15	Piston	28	Hexagon socket head bolt
3	Gland	16	Piston seal	29	Pipe assembly-R
4	Dust wiper	17	Wear ring	30	O-ring
5	Retaining ring	18	Dust ring	31	Hexagon socket head bolt
6	Rod seal	19	O-ring	32	Band assembly-B
7	Back up ring	20	Back up ring	33	Band assembly-R
8	Buffer ring	21	Lock nut	34	U-bolt
9	Dry bearing	22	Hex socket headless set screw	35	Hexagon nut
10	Retaining ring	23	Cushion plunger	36	Spring washer
11	O-ring	24	Stop ring	37	Dimple bushing
12	Back up ring	25	Check valve	38	Dust seal
13	O-ring	26	Coil spring		

(3) Boom cylinder (CHANGZHOU, type 1)



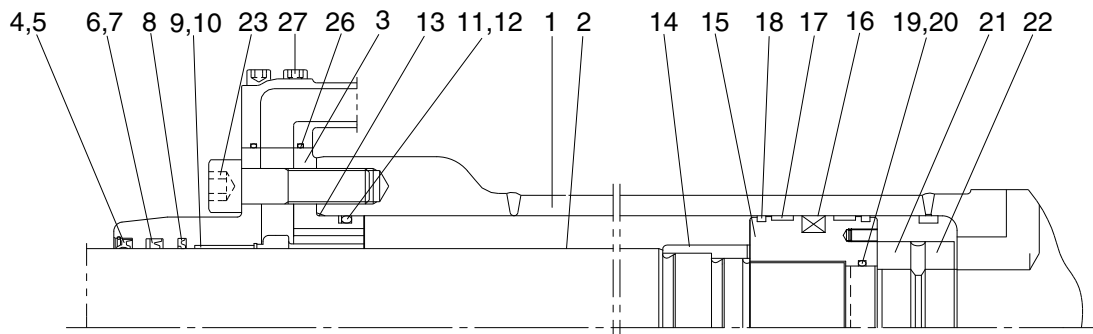
Internal detail



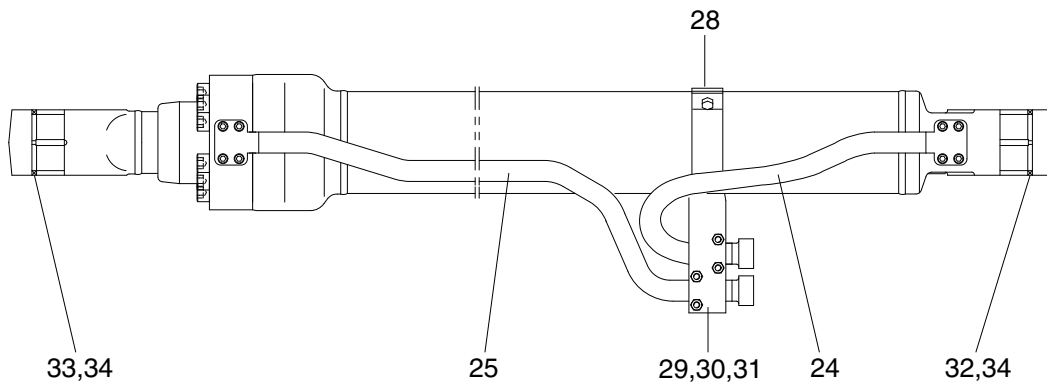
3CK6-53110GG

1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Pin bushing
3	Gland	14	Piston	25	Pin bushing
4	DD2 bushing	15	Piston seal	26	Dust seal
5	Snap ring	16	Wear ring	27	Band assembly
6	Rod seal	17	Dust ring	28	Pipe assembly-R
7	Back up ring	18	O-ring	29	Pipe assembly-B
8	Buffer ring	19	Back up ring	30	O-ring
9	Dust wiper	20	Lock nut	31	Hexagon socket head bolt
10	Snap ring	21	Hex socket headless set screw		
11	O-ring	22	O-ring		

Boom cylinder (SHPAC)



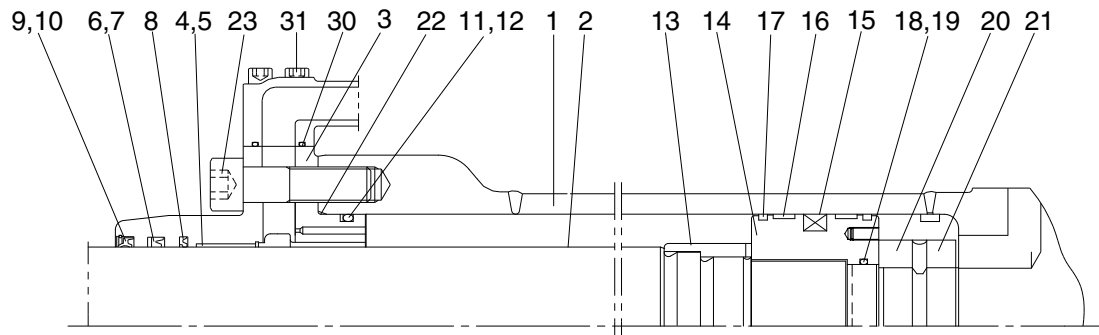
Internal detail



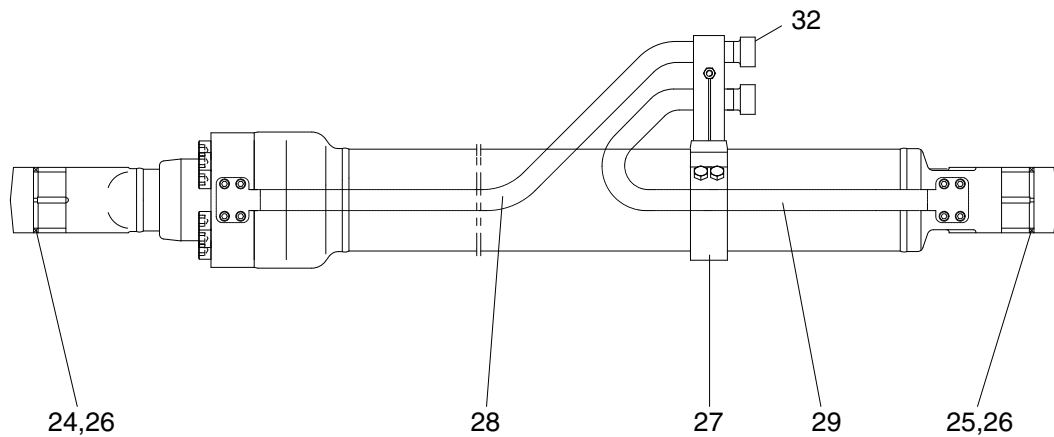
32K6-53110GG

1	Tube assembly	13	O-ring	25	Pipe assembly-R
2	Rod assembly	14	Cushion ring	26	O-ring
3	Gland	15	Piston	27	Hexagon socket head bolt
4	Dust wiper	16	Piston seal	28	Band assembly
5	Retaining ring	17	Wear ring	29	U-bolt
6	Rod seal	18	Dust ring	30	Hexagon nut
7	Back up ring	19	O-ring	31	Spring washer
8	Buffer ring	20	Back up ring	32	Dimple bushing
9	Dry bearing	21	Lock nut	33	Dimple bushing
10	Retaining ring	22	Hex socket headless set screw	34	Dust seal
11	O-ring	23	Hexagon socket head bolt		
12	Back up ring	24	Pipe assembly-B		

Boom cylinder (CHANGZHOU, type 2)



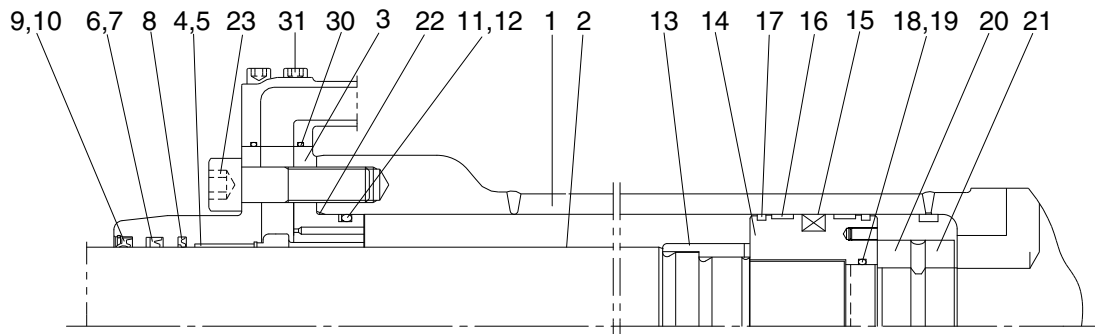
Internal detail



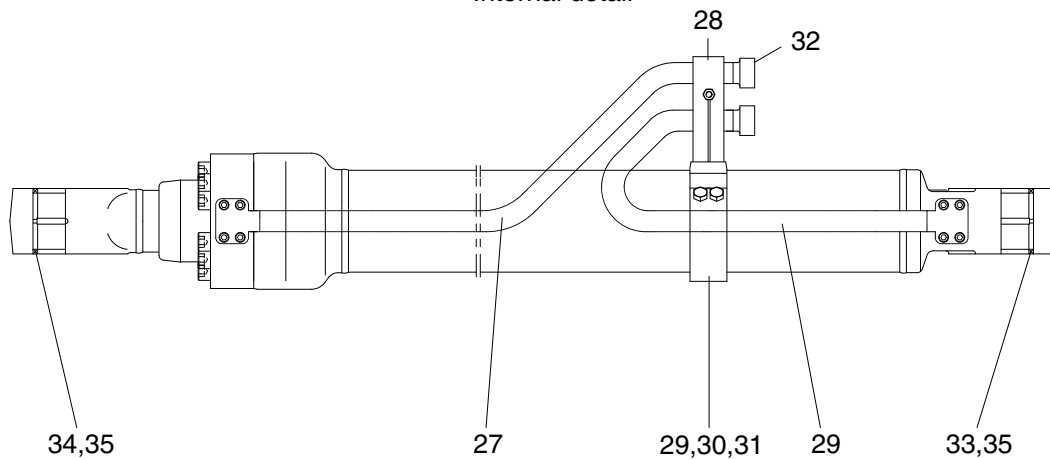
HCK6-53430GG

- | | | |
|-----------------|----------------------------------|-----------------------------|
| 1 Tube assembly | 12 Back up ring | 23 Hexagon socket head bolt |
| 2 Rod assembly | 13 Cushion ring | 24 Dimple bushing |
| 3 Gland | 14 Piston | 25 Dimple bushing |
| 4 DU bushing | 15 Piston seal | 26 Dust seal |
| 5 Snap ring | 16 Wear ring | 27 Band assembly |
| 6 Rod seal | 17 Dust ring | 28 Pipe assembly-R |
| 7 Back up ring | 18 O-ring | 29 Pipe assembly-B |
| 8 Buffer ring | 19 Back up ring | 30 O-ring |
| 9 Dust wiper | 20 Lock nut | 31 Hexagon socket head bolt |
| 10 Snap ring | 21 Hex socket headless set screw | 32 O-ring |
| 11 O-ring | 22 O-ring | |

Boom cylinder (SHPAC, 2-piece)



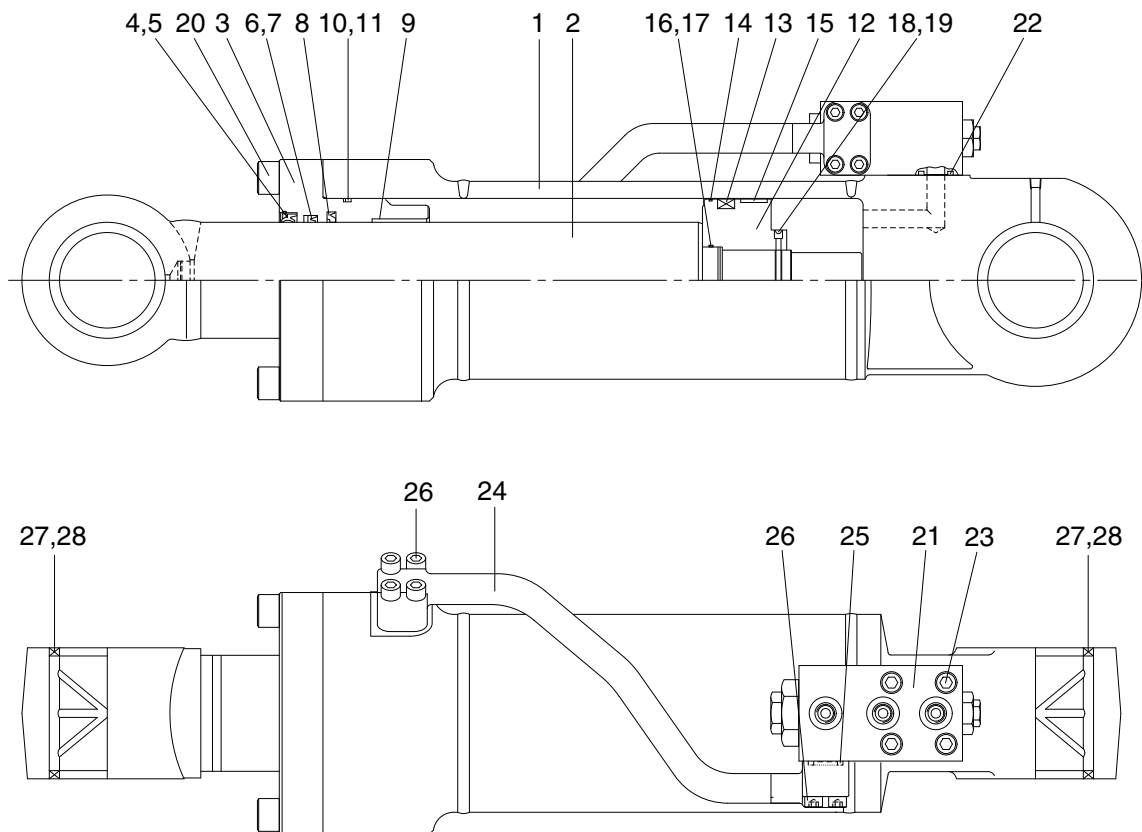
Internal detail



31K6-53430GG

1	Tube assembly	13	O-ring	25	Pipe assembly-R
2	Rod assembly	14	Cushion ring	26	O-ring
3	Gland	15	Piston	27	Hexagon socket head bolt
4	Dust wiper	16	Piston seal	28	Band assembly
5	Retaining ring	17	Wear ring	29	U-bolt
6	Rod seal	18	Dust ring	30	Hexagon nut
7	Back up ring	19	O-ring	31	Spring washer
8	Buffer ring	20	Back up ring	32	O-ring
9	Dry bearing	21	Lock nut	33	Dimple bushing
10	Retaining ring	22	Hex socket headless set screw	34	Dimple bushing
11	O-ring	23	Hexagon socket head bolt	35	Dust seal
12	Back up ring	24	Pipe assembly-B		

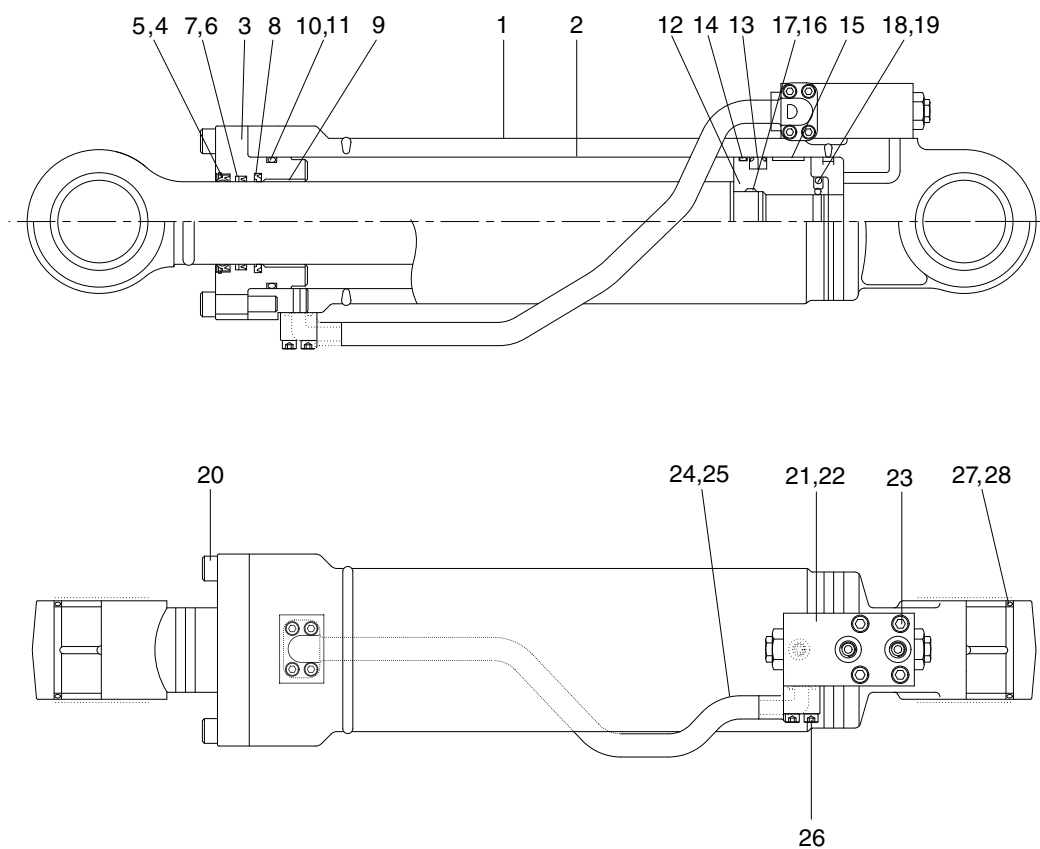
(4) Dozer cylinder



31Q6-70013

1	Tube assembly	11	Back up ring	21	Pilot check valve
2	Rod assembly	12	Piston	22	O-ring
3	Gland	13	Piston seal	23	Hexagon socket bolt
4	Dust wiper	14	Dust ring	24	Pipe assembly
5	Retainer ring	15	Wear ring	25	O-ring
6	Rod seal	16	O-ring	26	Hexagon socket bolt
7	Back up ring	17	Back up ring	27	Pin bushing
8	Buffer ring	18	Steel ball	28	Dust seal
9	Dry bushing	19	Set screw		
10	O-ring	20	Hexagon socket bolt		

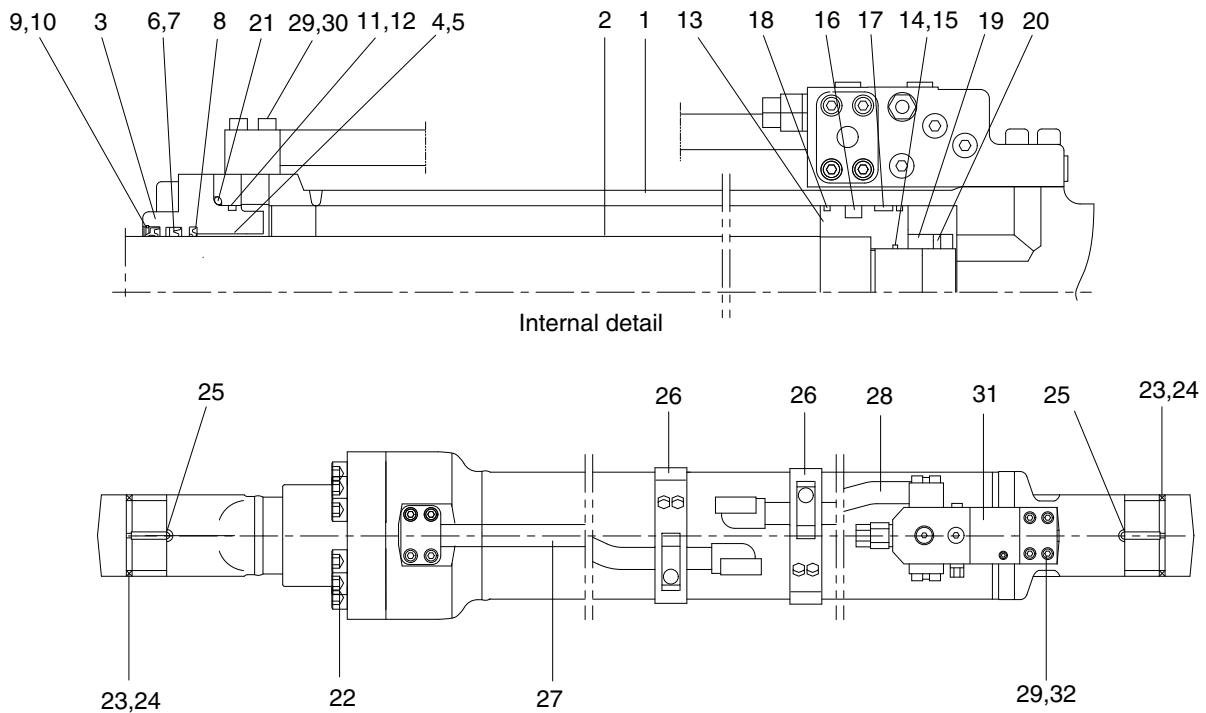
(5) Outrigger cylinder



31Q6-70032

1	Tube assembly	11	Back up ring	21	Pilot check valve
2	Rod assembly	12	Piston	22	O-ring
3	Gland	13	Piston seal	23	Hexagon socket bolt
4	Dust wiper	14	Dust ring	24	Pipe assembly
5	Retainer ring	15	Wear ring	25	O-ring
6	Rod seal	16	O-ring	26	Hexagon socket bolt
7	Back up ring	17	Back up ring	27	Pin bushing
8	Buffer ring	18	Steel ball	28	Dust seal
9	Dry bushing	19	Set screw		
10	O-ring	20	Hexagon socket bolt		

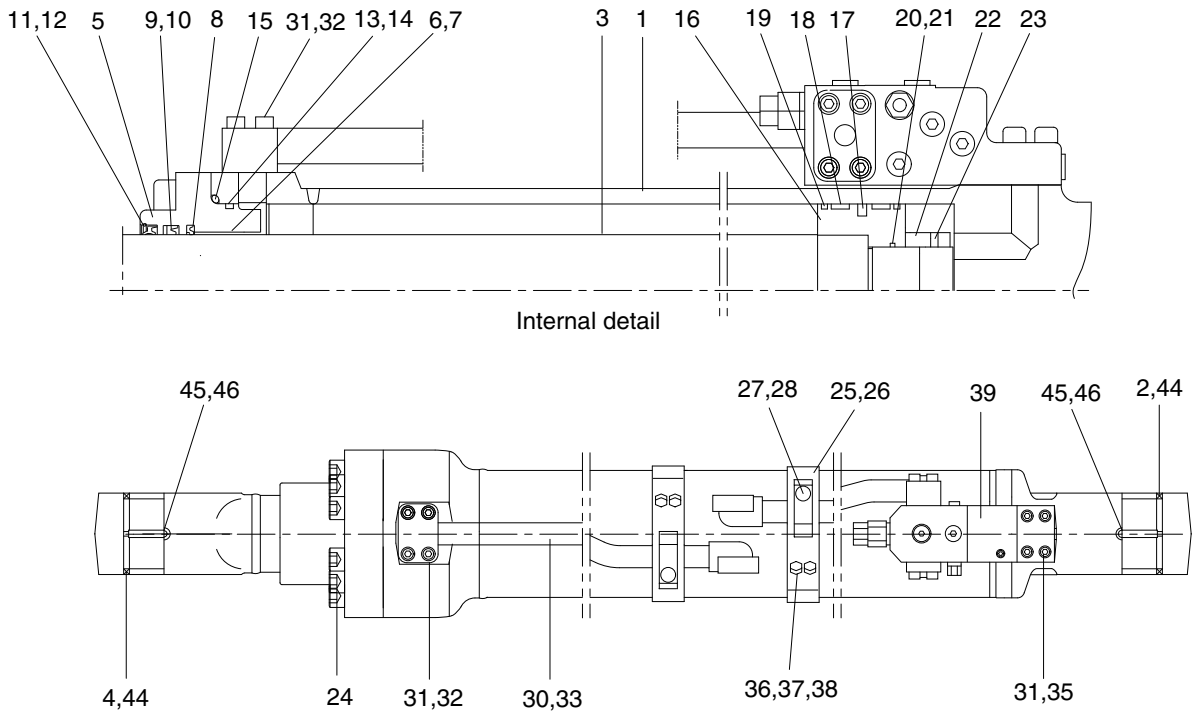
(6) Adjust cylinder (CHANGZHOU)



HCK6-54460GG

1	Tube assembly	12	Retaining ring	23	Dimple bushing
2	Rod assembly	13	Piston	24	Dust seal
3	Gland	14	O-ring	25	Grease nipple
4	DU bushing	15	Back up ring	26	Band assy
5	Snap ring	16	Piston seal	27	Pipe assy-R
6	Rod seal	17	Wear ring	28	Pipe assy-B
7	Back up ring	18	Dust ring	29	O-ring
8	Buffer ring	19	Lock nut	30	Hexagon socket head bolt
9	Dust wiper	20	Hex socket headless set screw	31	Safety lock valve
10	Snap ring	21	O-ring	32	Hexagon socket head bolt
11	O-ring	22	Hexagon socket head bolt		

Adjust cylinder (SHPAC)

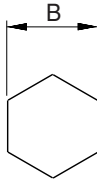


31K6-54460GG

1	Tube assembly	16	Piston	31	Spring washer
2	Dimple bushing	17	Piston seal	32	Hexagon socket head bolt
3	Rod assembly	18	Wear ring	33	Pipe assembly
4	Dimple bushing	19	Dust ring	34	Spacer
5	Rod cover	20	O-ring	35	Hexagon socket head bolt
6	Rod bushing	21	Back up ring	36	Clamp
7	Retaining ring	22	Piston nut	37	Spring washer
8	Buffer seal	23	Hex socket headless set screw	38	Hexagon bolt
9	U-packing	24	Hexagon socket head bolt	39	Lock valve
10	Back up ring	25	Band assembly	40	Hexagon socket head bolt
11	Dust wiper	26	Pipe band	42	Dust cover
12	Retaining ring	27	Spring washer	43	Hexagon bolt
13	O-ring	28	Hexagon bolt	44	Pin wiper
14	Back up ring	29	Pipe assembly	45	Grease nipple
15	O-ring	30	O-ring	46	Cap

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tools	Remark	
Allen wrench	6	
	8	
	10	
	12	
	14	
	17	
Spanner	7	
	8	
(-) Driver	Small and large sizes	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Socket head bolt	Bucket cylinder	23★1★3	M16	23.0±2.0	166±14.5
		23★1★4	M16	26.7±2.7	193±19.5
		23★1★6	M16	23.0±2.0	166±14.5
		23★1★4★5	M16	26.7±2.7	193±19.5
		31★3	M10	5.4±0.5	39.1±3.6
		27★4	M10	6.5±0.7	47.0±5.1
		31★6	M10	5.4±0.5	39.1±3.6
		23★4★5	M10	6.5±0.7	47.0±5.1
	Boom cylinder	23★1★3	M16	23.0±2.0	166±14.5
		23★1★4	M16	26.7±2.7	193±19.5
		31★3	M10	5.4±0.5	39.1±3.6
		27★4	M10	6.5±0.7	47.0±5.1
	Arm cylinder	23★1★3	M18	32.0±3.0	232±21.7
		28★1★4	M18	38.0±3.8	275±27.5
		34★3	M12	9.4±1.0	68.0±7.2
		31★4	M12	11.3±1.1	81.7±8.0
	Dozer cylinder	20★1★4	M16	26.7±2.7	193±19.5
		23★4	M10	6.5±0.7	47.0±5.1
		26★4	M8	3.3±0.3	23.9±2.2
	Outtrigger cylinder	20★1★4	M16	26.7±2.7	193±19.5
		23★4	M10	6.5±0.7	47.0±5.1
		26★4	M8	3.3±0.5	23.9±2.2

★1 : Apply loctite #243 on the thread of bolt.

★3 : CHANGZHOU, type 1

★4 : SHPAC

★5 : 2-piece boom

★6 : CHANGZHOU, type 2

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Socket head bolt	Adjust cylinder	22★1★3	M20	150±15.0	1085±108
		24★1★7	M20	58.0±4.0	420±28.9
		30★3	M10	5.4±0.5	39.1±3.6
		32★3	M10	5.4±0.5	39.1±3.6
		32★7	M10	5.5~6.0	39.8~43.4
		35★7	M10	5.5~6.0	39.8~43.4
Lock nut	Bucket cylinder	20★3	-	100±10.0	723±72.3
		21★4	M62	100±10.0	723±72.3
		20★6	M56	100±10.0	723±72.3
		21★4★5	M56	100±10.0	723±72.3
	Boom cylinder	20★3	-	100±10.0	723±72.3
		21★4	M56	100±10.0	723±72.3
	Arm cylinder	20★3	-	150±15.0	1085±108
		21★4	M70	150±15.0	1085±108
	Adjust cylinder	13★3	M85	100±10.0	723±72.3
		22★7	M82	190±19.0	1374±137
Piston	Bucket cylinder	14★3	-	150±15.0	1085±108
		15★4	M75	150±15.0	1085±108
	Boom cylinder	14★3	-	150±15.0	1085±108
		15★4	M75	150±15.0	1085±108
		14★6	M75	150±15.0	1085±108
		15★4★5	M56	150±15.0	1085±108
	Arm cylinder	14★3	-	200±20.0	1447±145
		15★4	M90	200±20.0	1447±145
	Dozer cylinder	12★4	M56	140±14.0	1013±101
	Outtrigger cylinder	12★4	M56	140±14.0	1013±101
	Adjust cylinder	13★3	M100	150±15.0	1085±108
		16★7	M95	100±10.0	723±72.3
Set screw	Bucket cylinder	21★3	M8	2.7±0.3	19.5±2.2
		22★4	M8	1.7±0.2	12.3±1.4
	Boom cylinder	21★3	M8	2.7±0.3	19.5±2.2
		22★4	M8	1.7±0.2	12.3±1.4
		21★6	M8	2.7±0.3	19.5±2.2
		22★4★5	M8	1.7±0.2	12.3±1.4
	Arm cylinder	21★3	M10	5.4±0.5	39.1±3.6
		22★4	M10	2.5±0.3	18.1±2.2
	Dozer cylinder	19★4	M8	1.7±0.2	12.3±1.4
	Outtrigger cylinder	19★4	M8	1.7±0.2	12.3±1.4
	Adjust cylinder	23★7	M8	5.0	36.2

★1 : Apply loctite #243 on the thread of bolt.

★3 : CHANGZHOU, type 1

★4 : SHPAC

★5 : 2-piece boom

★6 : CHANGZHOU, type 2

★7 : DY POWER

3) DISASSEMBLY

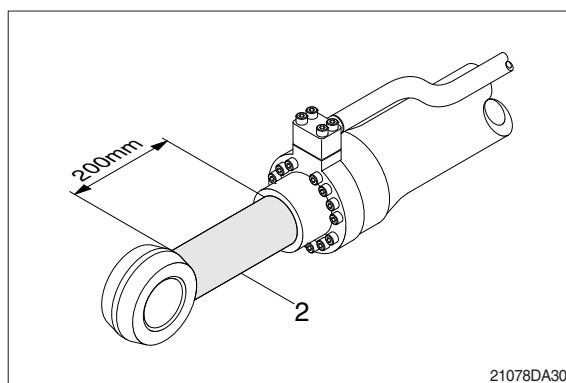
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder. (CHANGZHOU type)

① Hold the clevis section of the tube in a vise.

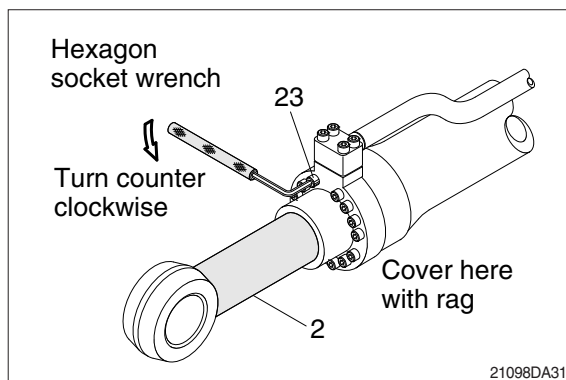
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

② Pull out rod assembly (2) about 200 mm (7.1 in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



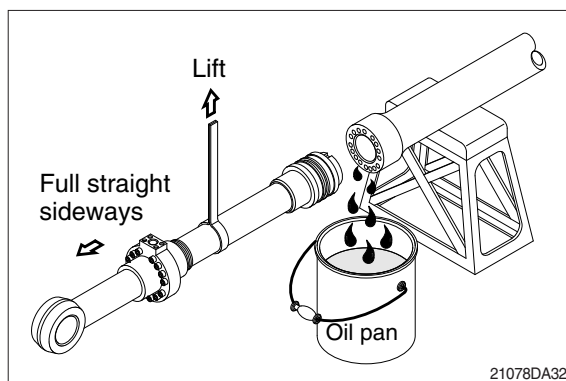
③ Loosen and remove socket bolts (23) of the gland in sequence.

※ Cover the extracted rod assembly (2) with rag to prevent it from being accidentally damaged during operation.



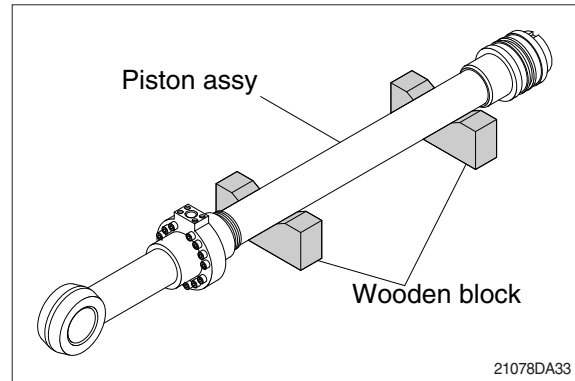
④ Draw out cylinder head and rod assembly together from tube assembly (1).

※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



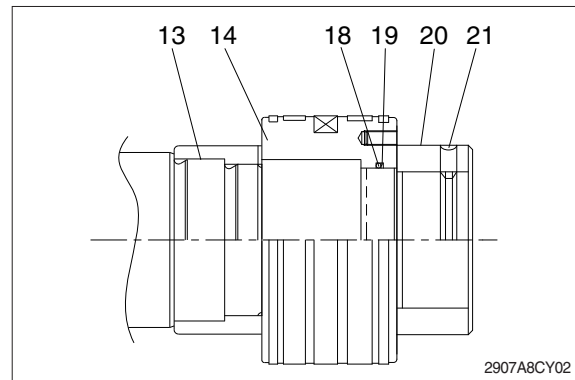
Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

- ⑤ Place the removed rod assembly on a wooden V-block that is set level.
- ※ Cover a V-block with soft rag.

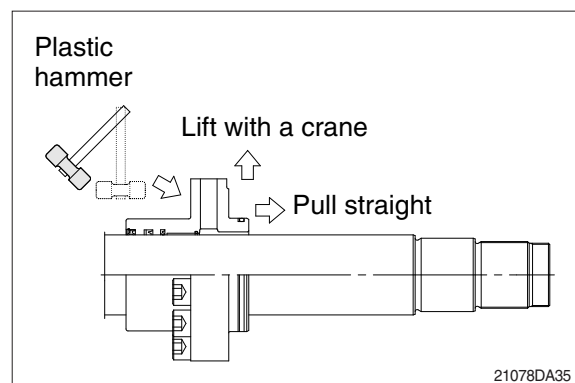


(2) Remove piston and cylinder head

- ① Remove set screw (21).
- ② Remove lock nut (20).
- ※ Since piston (14) and lock nut (20) are tightened to a high torque, use a hydraulic and power wrench that utilizes a hydraulic cylinder, to remove the piston (14) and lock nut (20).
- ③ Remove piston assembly (14), back up ring (19), and O-ring (18).
- ④ Remove cushion ring (13).

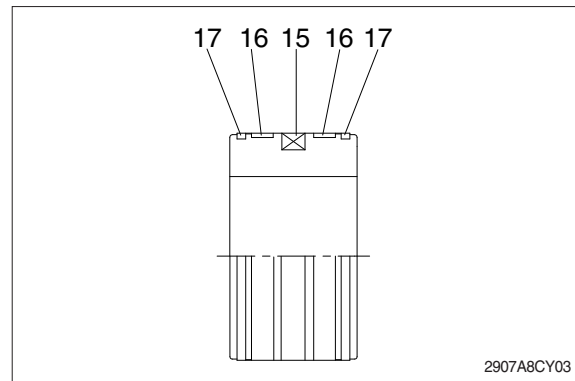


- ⑤ Remove the cylinder head assembly from rod assembly (2).
 - ※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.
 - ※ Pull it straight with cylinder head assembly lifted with a crane.
- Exercise care so as not to damage the lip of rod bushing (4) and packing (5,6,7,8,9,10) by the threads of rod assembly (2).



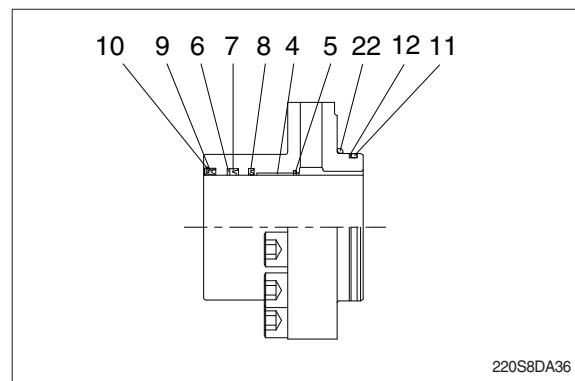
(3) Disassemble the piston assembly

- ① Remove wear ring (16).
 - ② Remove dust ring (17) and piston seal (15).
- ※ Exercise care in this operation not to damage the grooves.



(4) Disassemble cylinder head assembly

- ① Remove back up ring (12), O-ring (11) and O-ring (22).
 - ② Remove snap ring (10), dust wiper (9).
 - ③ Remove back up ring (7), rod seal (6) and buffer ring (8).
- ※ Exercise care in this operation not to damage the grooves.
- ※ Do not remove seal and ring, if does not damaged.
- ※ Do not remove bushing (4).

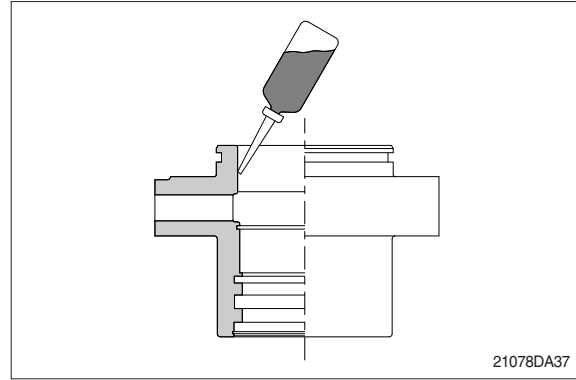


4) ASSEMBLY

(1) Assemble cylinder head assembly

- ※ Check for scratches or rough surfaces if found smooth with an oil stone.

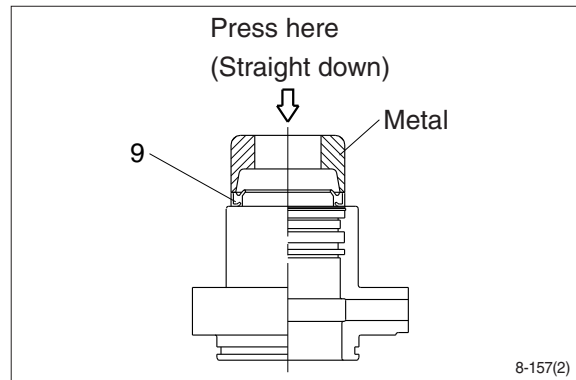
- ① Coat the inner face of gland (3) with hydraulic oil.



- ② Coat dust wiper (9) with grease and fit dust wiper (9) to the bottom of the hole of dust seal.

At this time, press a pad metal to the metal ring of dust seal.

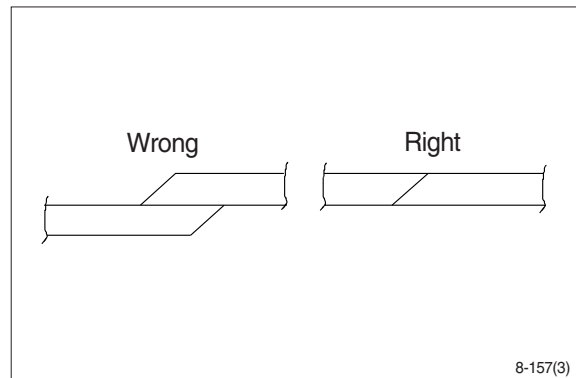
- ③ Fit snap ring (10) to the stop face.



- ④ Fit back up ring (7), rod seal (6) and buffer ring (8) to corresponding grooves, in that order.

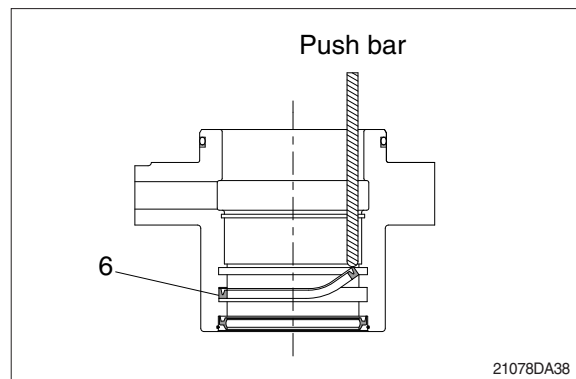
- ※ Coat each packing with hydraulic oil before fitting it.

- ※ Insert the backup ring until one side of it is inserted into groove.

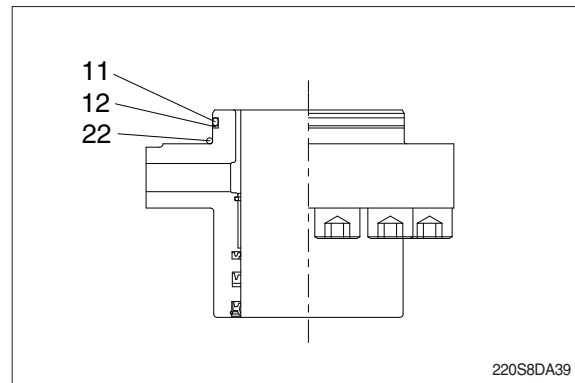


- ※ Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.

- ※ Fitting rod seal (6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.

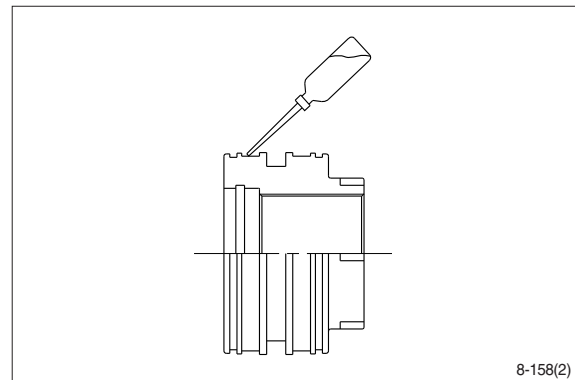


- ⑤ Fit back up ring (12) to gland (3).
- ※ Put the backup ring in the warm water of 30~50°C.
- ⑥ Fit O-ring (11) and O-ring (22) to gland (3).

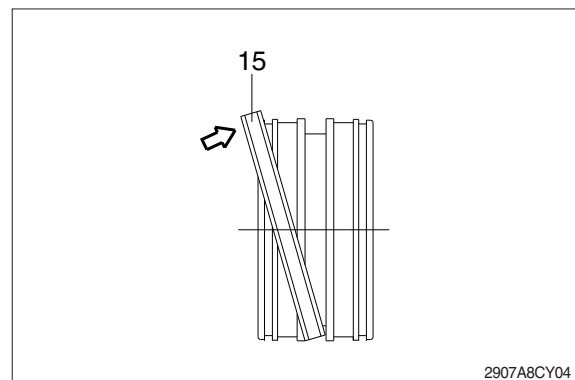


(2) Assemble piston assembly

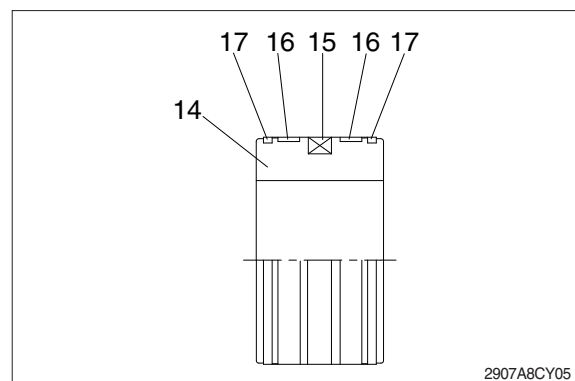
- ※ Check for scratches or rough surfaces.
If found smooth with an oil stone.
- ① Coat the outer face of piston (14) with hydraulic oil.



- ② Fit piston seal (15) to piston.
- ※ Put the piston seal in the warm water of 60~100°C for more than 5 minutes.
- ※ After assembling the piston seal, press its outer diameter to fit in.

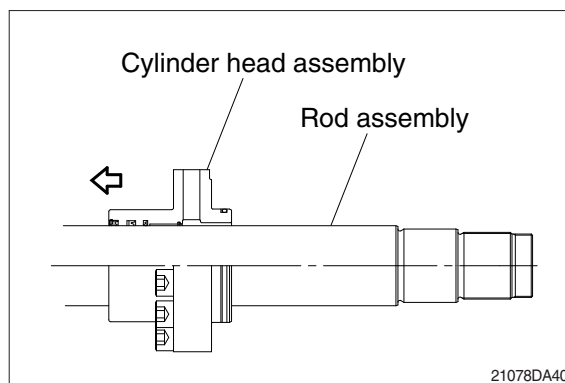


- ③ Fit wear ring (16) and dust ring (17) to piston (14).

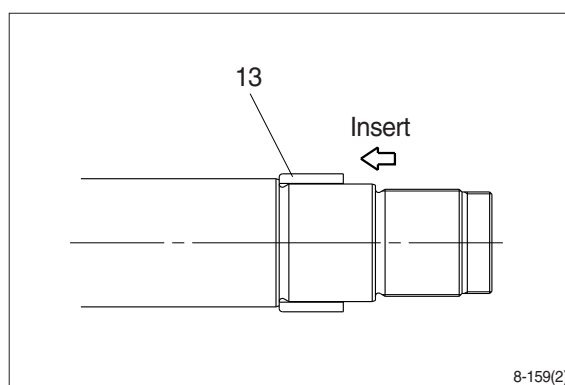


(3) Install piston and cylinder head

- ① Fix the rod assembly to the work bench.
- ② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.
- ③ Insert cylinder head assembly to rod assembly.

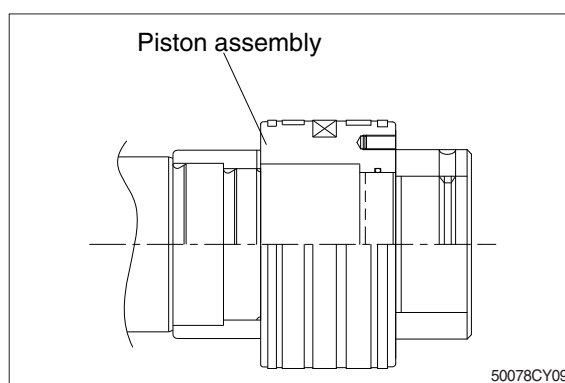


- ④ Insert cushion ring (13) to rod assembly.
- ※ Note that cushion ring (13) has a direction in which it should be fitted.



- ⑤ Fit piston assembly to rod assembly.
- Tightening torque : $150 \pm 15.0 \text{ kgf} \cdot \text{m}$
($1085 \pm 108 \text{ lbf} \cdot \text{ft}$)

※ Refer to page 8-392.



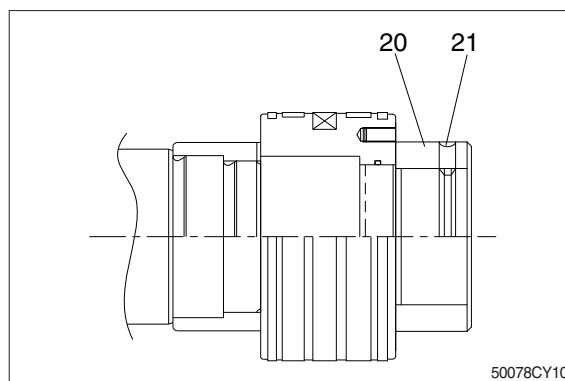
- ⑥ Fit lock nut (20) and tighten the screw (21).

· Tightening torque :

Item 20 : $100 \pm 10.0 \text{ kgf} \cdot \text{m}$ ($723 \pm 72.3 \text{ lbf} \cdot \text{ft}$)

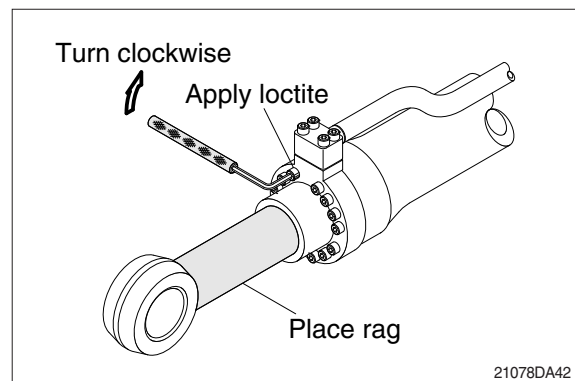
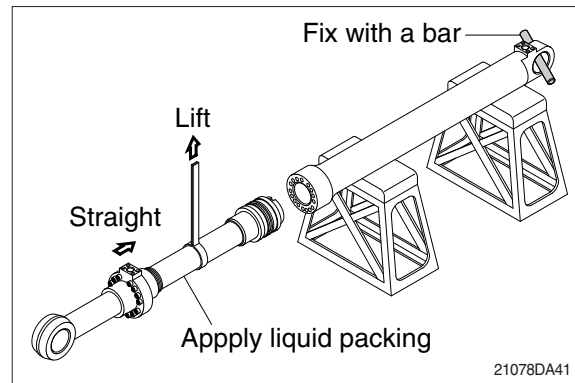
Item 21 : $2.7 \pm 0.3 \text{ kgf} \cdot \text{m}$ ($19.5 \pm 2.2 \text{ lbf} \cdot \text{ft}$)

※ Refer to page 8-392.



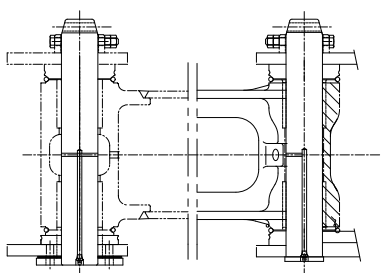
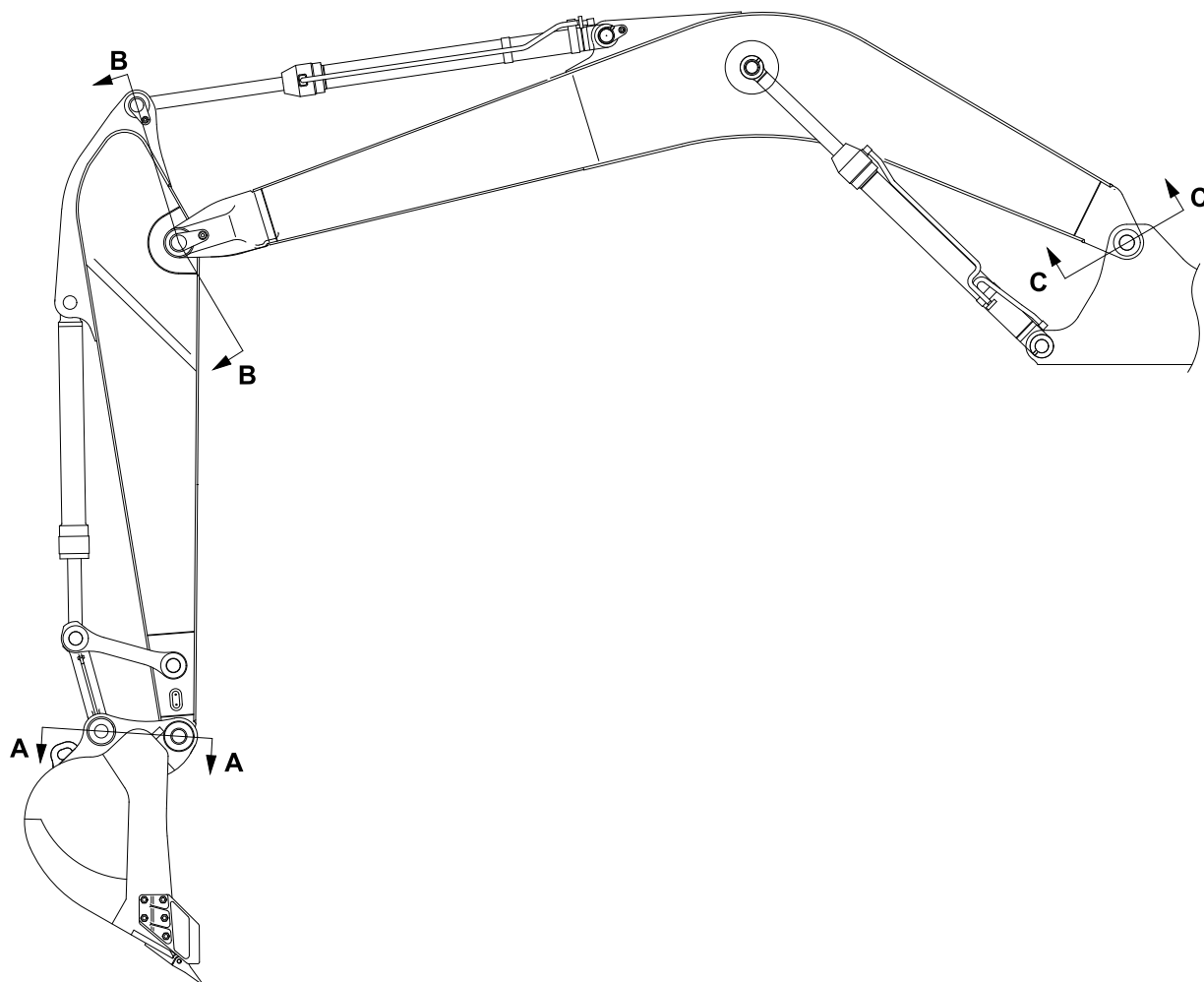
(3) Overall assemble

- ① Place a V-block on a rigid work bench.
Mount the tube assembly (1) on it and
fix the assembly by passing a bar
through the clevis pin hole to lock the
assembly.
- ② Insert the rod assembly in to the tube
assembly, while lifting and moving the
rod assembly with a crane.
- ※ Be careful not to damage piston seal by
thread of tube assembly.
- ③ Match the bolt holes in the cylinder head
flange to the tapped holes in the tube
assembly and tighten socket bolts to a
specified torque.
- ※ Refer to the table of tightening torque.

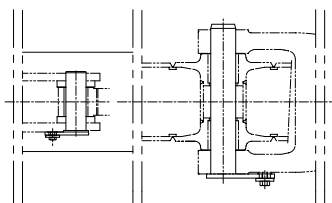


GROUP 14 WORK EQUIPMENT

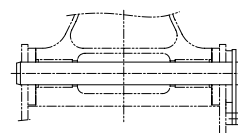
1. STRUCTURE



SECTION A



SECTION B



SECTION C

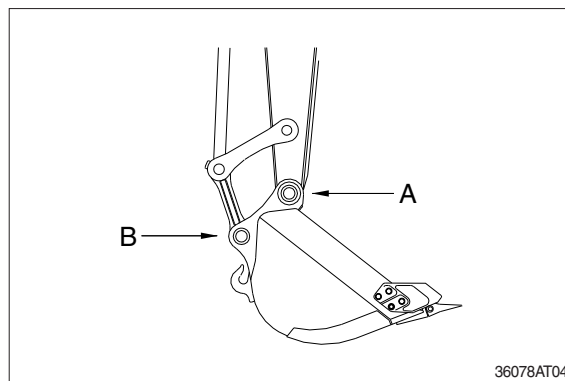
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2. REMOVAL AND INSTALL

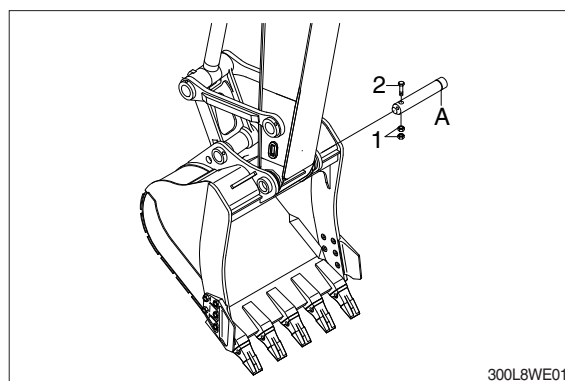
1) BUCKET ASSEMBLY

(1) Removal

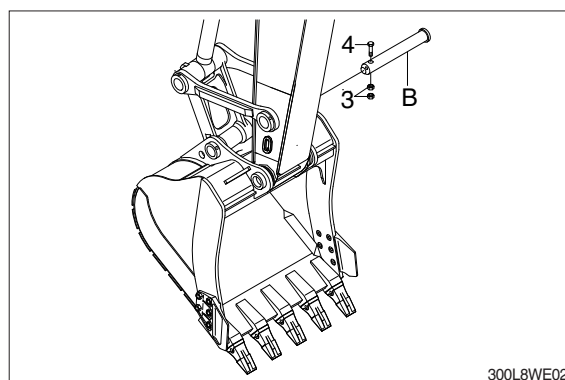
- ① Lower the work equipment completely to ground with back of bucket facing down.



- ② Remove nut (1), bolt (2) and draw out the pin (A).
 - Tightening torque (1) : $57.9 \pm 8.7 \text{ kgf} \cdot \text{m}$
($419 \pm 62.9 \text{ lbf} \cdot \text{ft}$)



- ③ Remove nut (3), bolt (4) and draw out the pin (B).
 - Tightening torque (3) : $57.9 \pm 8.7 \text{ kgf} \cdot \text{m}$
($419 \pm 62.9 \text{ lbf} \cdot \text{ft}$)
 - Weight : 817 kg (1801 lb)

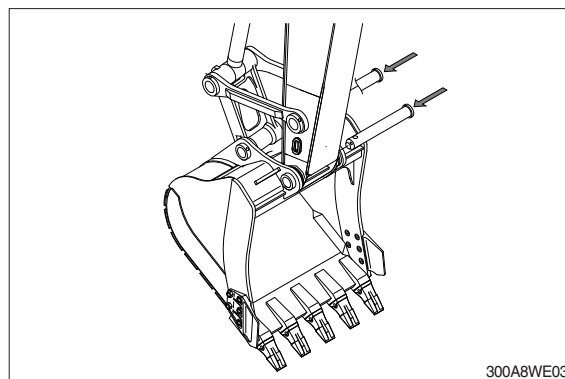


(2) Install

- ① Carry out installation in the reverse order to removal.

▲ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

※ Adjust the bucket clearance.
For detail, see operation manual.



2) ARM ASSEMBLY

(1) Removal

- ※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

① Remove bucket assembly.

For details, see removal of bucket assembly.

② Disconnect bucket cylinder hose (1).

▲ Fit blind plugs (5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.

③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

- ※ Tie the rod with wire to prevent it from coming out.

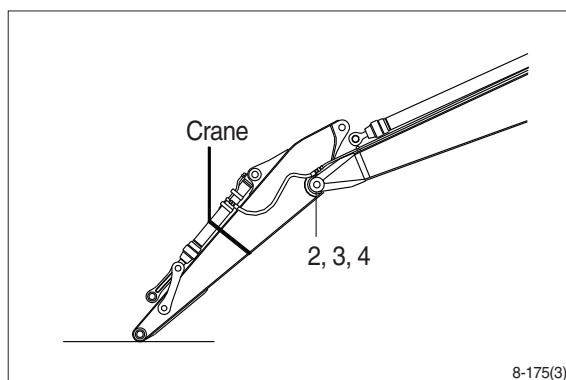
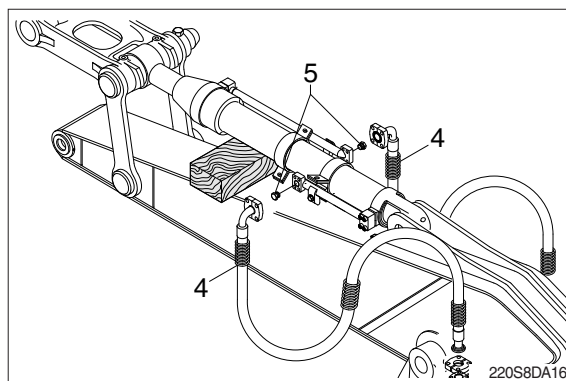
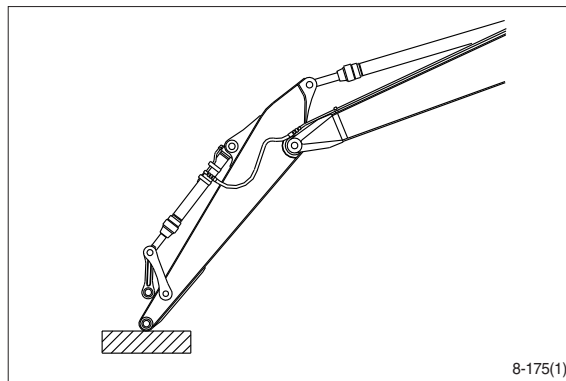
④ For details, see removal of arm cylinder assembly.

Place a wooden block under the cylinder and bring the cylinder down to it.

⑤ Remove bolt (2), plate (3) and pull out the pin (4) then remove the arm assembly.

- Weight : 1360 kg (2998 lb)
- Tightening torque (2) : $29.7 \pm 45 \text{ kgf} \cdot \text{m}$
($215 \pm 32.5 \text{ lbf} \cdot \text{ft}$)

- ※ When lifting the arm assembly, always lift the center of gravity.



(2) Install

① Carry out installation in the reverse order to removal.

▲ When lifting the arm assembly, always lift the center of gravity.

- ※ Bleed the air from the cylinder.

